Setup and Workflows

Chapter 3

Managing Projects and Databases

This chapter covers how to use the Project Manager to organize the projects you're working on in DaVinci Resolve, as well as how to deal with managing the databases that serve as the organizational foundation of the Project Manager. You'll also see how to export and import projects, and how to archive a project and its media for long-term storage.

Contents

Using the Project Manager

Ordinarily, the Project Manager is the first window you'll see when DaVinci Resolve starts up. It's a convenient, centralized browser for creating, organizing, and managing all of your projects. Unlike other applications that rely on your file manager for organizing projects, DaVinci Resolve requires you to do most project organization in the Project Manager.
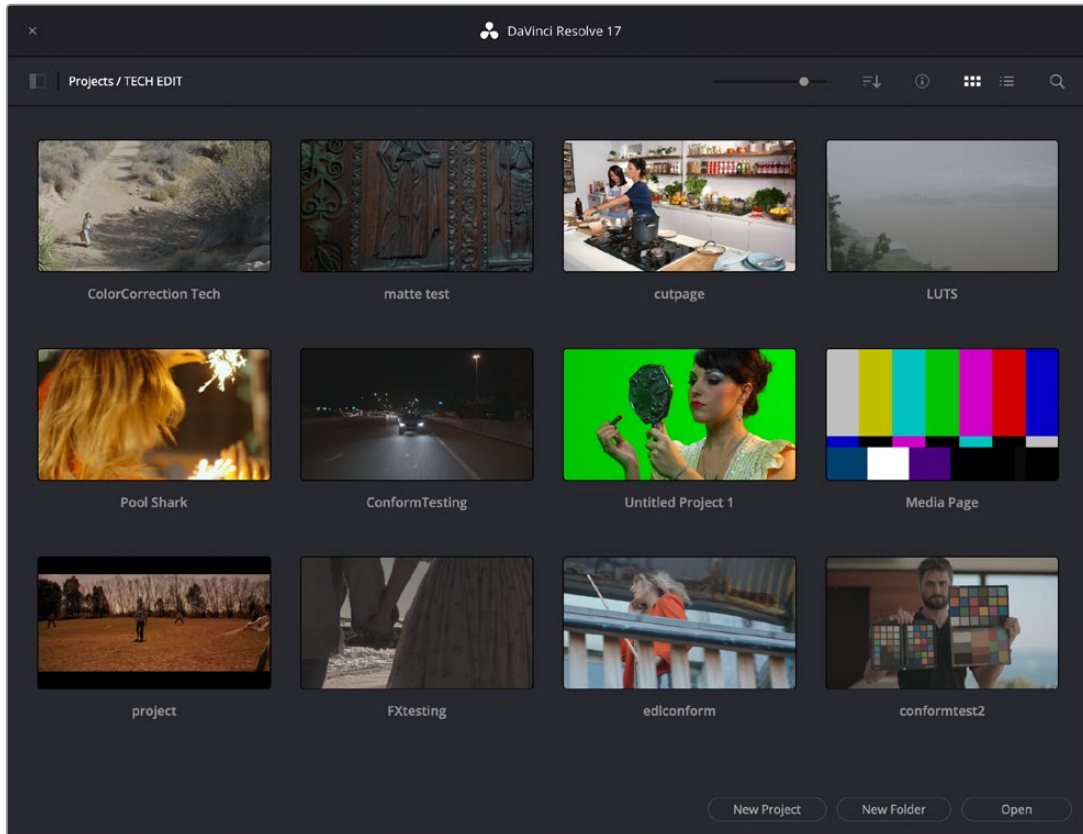
Project Manager

If you've already opened a project, you can reopen the Project Manager at any time by clicking the Home button at the bottom right-hand corner of the DaVinci Resolve window, in the Page Navigation bar. If you've hidden the Page Navigation bar at the bottom of the DaVinci Resolve window, you can open the Project Manager by choosing File > Project Manager.

The Project Manager button at the bottom right corner of the DaVinci Resolve interface

Launching DaVinci Resolve for the First Time?

If you've just installed DaVinci Resolve and have opened it for the first time, it's time to set the preferences in order to specify your language, scratch disk volume, and hardware configuration for video and audio I/O and control panels (if you have one). For more information about setting the preferences in DaVinci Resolve, see Chapter 4, "System and User Preferences."

Project Management

The Project Manager provides an in-application interface for creating, renaming, and deleting projects. Many of these commands exist within the contextual menu that appears when you right-click the background of the Project Manager.

Methods of project management:

– **To create a new project:** Double-click the Default Project icon, or click the New Project button at the bottom of the window. A new project is created, and DaVinci Resolve opens up the Media page. Once a project is open, you can alter its project settings by clicking the gear icon.

– **To open a previously saved project:** Double-click any Project icon, or Item if you're in List view. You can also select a project and click the Open button.

– **To open a project in Read-Only Mode:** Right-click a Project icon or Item, and choose Open in Read Only Mode. This lets you open a project without danger of altering it. If you make changes, you can use the Save As command to save a new copy of the project with a new name.

– **To rename a project:** Right-click a Project icon or Item, choose Rename, and type a new name in the dialog that appears, clicking OK when you're finished.

– **To load project settings from another project to the currently open project:** Right-click a Project icon or Item (other than the currently open project), and choose "Load Project Settings to Current Project." This lets you change a project's settings prior to opening it in cases where the project settings are causing some kind of problem that prevents you from opening the project.

– **To update the thumbnails of a project in the Project Manager:** Right-click any project, and choose "Update Thumbnails."

– **To delete a project:** Select one or more projects, then either press the Backspace key, or right-click one of the selected projects and choose Delete. Click OK when a dialog asks you to confirm the operation.

> **NOTE:** You cannot move or delete the currently open or loaded project.

Importing DaVinci Resolve Projects (.DRP Files)

DaVinci Resolve projects are saved with the file extension .drp and enable you to exchange files with other DaVinci Resolve users. If you double-click a DaVinci Resolve .drp file in the Windows or macOS file system, this will automatically open DaVinci Resolve, import that project into the Project Manager regardless of what kind of database you're using, and open that project so that you're ready to work.

Importing and Exporting Projects in Disk Databases

If you're using Disk Databases to manage your projects, you can copy and import projects using the project folders in the file manager of either macOS or Windows. This method does not work for DaVinci Resolve on Linux.

Moving projects from one disk database into another using macOS or Windows:

1   Locate the disk database directory in which the project you want to copy is stored. If you don't know where the designated disk database directory is, you can open DaVinci Resolve and check the directory path for the current disk database in the Databases sidebar.

2   Copy the project folder from the source workstation to the designated disk database directory on the destination workstation. If you don't know where the designated disk database directory is, you can open DaVinci Resolve on the workstation you're copying the project to and check the directory path for the current disk database in the Databases sidebar.

3   Once you've copied the project folder into the correct location, you'll need to quit and reopen DaVinci Resolve. Afterwards, the imported project should appear in the Project Manager.

Importing and Exporting Projects in PostgreSQL Databases

If you're using a PostgreSQL database, another set of commands let you import and export projects using the .drp file format. You can also export .drp files from Disk Databases if you want to export a more self-contained item to transport.

To import a .drp project file, do one of the following:

– Drag the .drp file you want to import from your file system and drop it anywhere into the Project Manager window.

– Right-click any empty area of the Project Manager and choose Import, then find and select a .drp project file using the Import Project File dialog, and click Open.

To import a .drp project file and reconfigure the gallery path at the same time:

– Hold the Option key down while right-clicking any empty area of the Project Manager, and choose Import+, then find and select a .drp project file, and click Open. Upon opening, the gallery path will automatically be updated to that of your workstation.

To export the currently open project as a .drp file:

– Choose File > Export Project, and when the Save dialog appears, choose a location, enter a name, and click Save. The result is a self-contained file with a .drp file suffix saved at the location you chose.

To export a .drp project file from the Project Manager:

1   Right-click a Project icon or Item in the Project Manager, then choose one of the following commands:

– **Export:** Exports project data, with no LUTs and no stills. Best when you need to export the smallest possible file.

– **Export With Stills and LUTs:** Exports the project including both still frames in the Gallery and LUTs used in grades. Best when you want to export the most self-contained file and you can't guarantee the recipient will have the same LUTs you do.

2   When the Save dialog appears, choose a location, enter a name, and click Save. The result is a self-contained file with a .drp file suffix saved at the location you chose.

Project Manager View Options

Four buttons at the top right let you control how projects are viewed in the Project Manager.
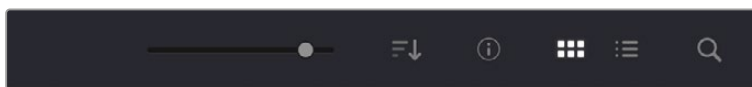
Select Thumbnail or List View

– **Zoom slider:** (Only appears in Thumbnail view) Lets you adjust the size of the thumbnails in Thumbnail view.

– **Project Sort Order drop-down:** (Only appears in Thumbnail view) Lets you choose the sort order of projects in Thumbnail view.

– **Information:** (Only appears in Thumbnail view) Lets you show or hide additional project information displayed underneath each project's thumbnail, including the frame size, number of timelines within, and when that project was last modified.

– **Thumbnail view:** Each project is represented by a large image that can be hover-scrubbed to reveal five representative images from that project.
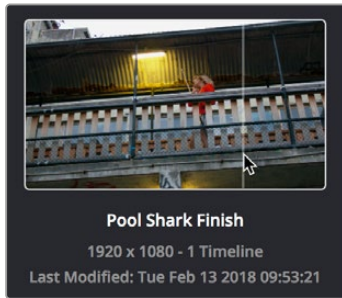
Hover-scrub over Project
icon; information is enabled

– **List view:** Every project appears as an item in a list that has seven columns: Name, Last Modified, Timelines, Format, Frame Rate, Date Created, and Note. You can click any column header to sort the contents of the Project Manager by that criteria; clicking the header a second time toggles that column between ascending and descending sorting.

Project List view

Searching for Projects

Clicking the magnifying glass button at the upper right-hand corner of the Project Manager exposes the Search Options, which can be used to locate one or more projects based on the metadata that's selected in the Filter By drop-down menu to the right of it.
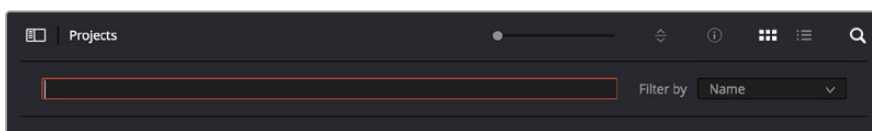
Search field open with Filter by search criteria selected

Using the drop-down menu, you can choose to search by name, or by project format. Once you've chosen a criteria, begin typing into the search field, and the Project Manager will immediately and dynamically begin to be filtered by your search text.

Organizing Projects in Folders

If you're organizing a lot of projects, you can create folders to put them into.

A folder in the Project Manager

Methods of working with project folders:

– **To create a folder:** Click the New Folder button, then enter a name into the Create New Folder dialog and click Create.

– **To delete a folder:** Right-click a folder, choose Delete, and click Yes when prompted. All projects inside a deleted folder will be deleted as well.

– **To rename a folder:** Right-click a folder, choose Rename, then enter a new name and click OK.

– **To open a folder:** Double-click a folder to open it and view its contents. At the upper left-hand corner of the Project Manager, a folder path view shows you which folder is open, as well as where you are within a nested series of folders if that's what you've set up.

– **To exit a folder:** Use the path control at the bottom left of the Project Manager.

– **To move a project into a folder:** Drag the project onto a folder icon, and drop it to place it inside the folder.

– **To move a project out of a folder:** Open a folder, select one or more projects you want to move, then right-click the selection and choose Cut from the contextual menu. Then, navigate to the next place in the Project manager where you want to place the cut projects, right-click the background of the Project Manager, and choose Paste. The projects should appear in the new location.

Managing Databases with the Databases Sidebar

Unlike other applications which save self-contained project files to user-specified locations wherever you like in your file system, DaVinci Resolve takes a more centrally organized approach to project management, using databases. By default, DaVinci Resolve uses a disk database to keep track of every project you create. The Database sidebar lets you manage the projects found within this database, which are saved to a specific directory on your system (particular to that database). The default location of this disk database depends on the operating system you use.

However, you can create additional databases with which to store other projects, if you like. For example, you might create one database each for each year in which you work. If you work on series television, you could create multiple databases for each program you work on. Or, you could create separate databases for each client you do work for. There's no hard and fast rule; ultimately how you use databases is entirely up to you and your individual organizational preferences.

> **TIP:** However you elect to organize your databases, keep in mind that projects saved within smaller databases with less project data will load and save faster.

Opening the Databases Sidebar

If you already have multiple databases, then clicking the button at the upper-left hand corner of the Projects Browser reveals a sidebar at the left of the Project Manager that lists every database on your workstation, with various options for managing these databases and for browsing the projects found within them.
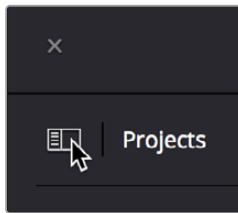
Databases Sidebar button

You can use this sidebar to open different databases and browse the projects found inside.
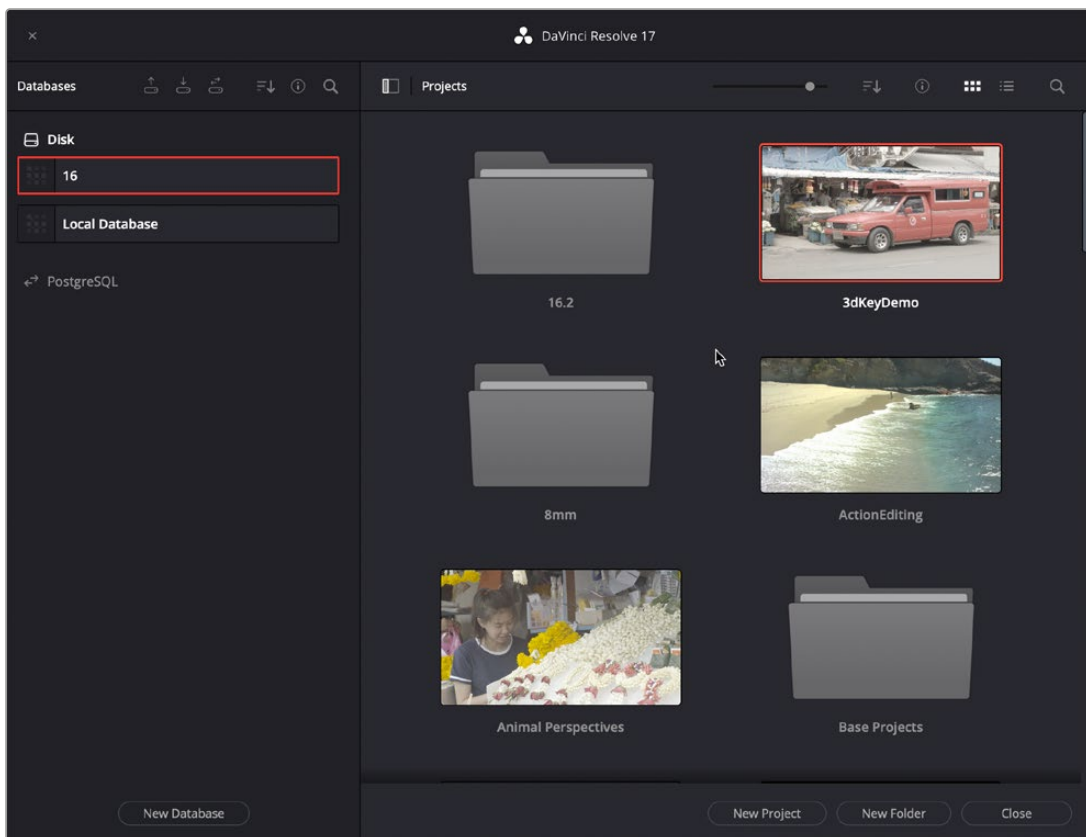
Project Manager with Databases sidebar displayed

Moving Projects From One Database to Another on the Same Workstation

If you've used multiple databases to organize your projects, you can browse the contents of each database to search for what you're looking for, and then copy one or more projects from one database to another if you need to rearrange how they're organized.

To view the contents of a database:

1 Click the button at the upper-left hand corner of the Projects window to open the Databases sidebar.

2 Click to select a database in the sidebar, and an orange highlight will appear

If you had a project already open, you'll be asked if you want to save it before closing, because all open projects must be closed prior to viewing the contents of another database. Then, the projects corresponding to that user within the selected database appear in the Project Manager window.

To import a project from another database using the Databases sidebar:

1 Click the button at the upper-left hand corner of the Projects window to open the Databases sidebar.

2 Click to select a database in the sidebar, and if necessary use the drop-down menu at the right of the database listing to choose a specific user. The projects corresponding to that user within the selected database appear in the Project Manager window.

3 Select a project you want to import, and press Command-C to copy it.

4 Click to select the current database again (the database you want to work within).

5 Press Command-V to paste the project you copied. A copy appears in the current database.

> **NOTE:** For more detail on shared database setup and operation, see Chapter 193, "Managing Databases and Project Servers."

To import Project Settings from another project using the Databases sidebar:

1 Click the button at the upper-left hand corner of the Projects window to open the Databases sidebar.

2 Select a project you want to import Project Settings to so that it's highlighted.

3 If necessary, click to select another database in the sidebar, and optionally use the drop-down menu at the right of the database listing to choose a specific user. The projects corresponding to that user within the selected database appear in the Project Manager window.

4 Right-click any project and choose "Load Project Settings to Current Project." That project's settings will be copied to the project you selected in step 2.

Managing Databases in the Databases Sidebar

Controls within the Databases sidebar make it easy to create new databases (via the button at the bottom), upgrade databases that have been flagged (via circular badges), import and export databases (via buttons at the top), and reveal additional information about each database (via buttons at the top of this sidebar).
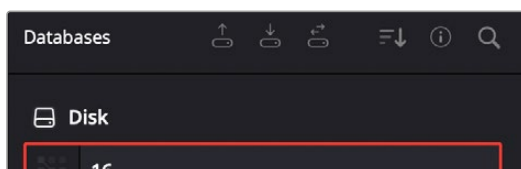
Databases sidebar controls

The five controls at the top of the Databases sidebar have the following functions:

– **Backup Database:** You can back up databases just like any other file. This provides added protection should your system drive fail, but a database backup can also be used to move multiple projects between systems (particularly if you're using PostgreSQL). Clicking this button exports the currently selected database, with all enclosed projects, to a self contained .resolve.backup file.

– **Import Database:** Imports .resolve.backup files to restore a backed up database.

– **Connect Database:** Allows connection to an existing database, either on a local disk or on a PostgreSQL server.

– **Sort Order drop-down menu:** This menu lets you choose how to sort the various Disk and PostgreSQL databases displayed in the sidebar. You can sort by Database Name, Schema (by date), Status, or Location in Ascending or Descending order.

– **Display Database Info toggle:** Turning this control on shows additional information underneath each database in the sidebar. What information depends on the type of database. Disk databases display their status (compatible/incompatible) and location (directory path). PostgreSQL databases display their schema (a date), their status (compatible/incompatible), their IP location, and any remarks that were appended when that database was updated.

– **Show Search Field:** Displays a search field and search criteria drop-down that lets you search for databases in the side bar by Name, Schema, Status, or Location.

Disk Vs. PostgreSQL Databases

When you first install DaVinci Resolve on a workstation it's never been installed on before, you are set up to use a Disk database by default, which saves user-accessible project files to a disk location of your choosing.

In many respects, Disk databases are simple to use. They're easier to back up, as they're located in an easily found directory, and in fact you can create Disk databases in custom locations, if you like. Disk databases avoid the need to know or care which version of PostgreSQL is installed on your machine, as PostgreSQL isn't used. Furthermore, projects in Disk databases don't need to go through an explicit "upgrade" process when you upgrade significant versions of DaVinci Resolve, as the project is automatically upgraded when you open it (the upgraded project can be saved independently from the original project using the Save As command if you want to leave the un-upgraded version intact).

However, many users prefer to use PostgreSQL database project management, particularly for situations where you want to use a shared database server so multiple rooms can access the same project files, and for collaborative workflow, where multiple editors, colorists, and audio professionals can work within the same project file.

Fortunately, it's easy to create and use either type of project database for maximum flexibility in organizing your projects. Then, using the Databases sidebar, it's easy to go back and forth between the two types of database management simply by creating the type of database you need and then switching over to it using the sidebar.

Creating New Disk and PostgreSQL Databases

You can use Disk databases and PostgreSQL databases side by side for switching to the use of one or the other, depending on your needs.

To create a new Disk database:

1 Click the button at the upper-left hand corner of the Projects window to open the Databases sidebar.

2 Click the New Database button at the bottom of the sidebar.

3 Leave Type set to Disk. The New Database window should look like the following screenshot:
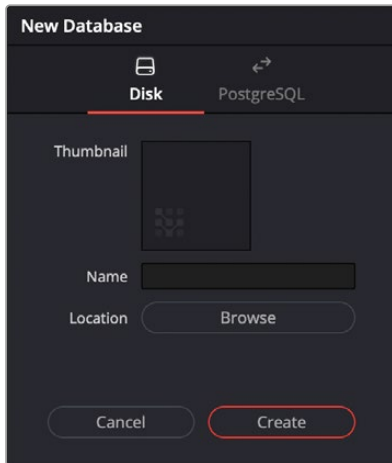
Creating a Disk database

4 In the remaining fields, do the following:

    a Type a name for the new database into the Name field

    b Click within the Location field and use the Filesystem navigation dialog to choose where to put the directory that will contain all of the DaVinci Resolve project directories

3 Click Create, and the new disk database will appear in the Disk database section of the Databases sidebar.

To create a new PostgreSQL database:

1 Click the button at the upper-left hand corner of the Projects window to open the Databases sidebar.

2 Click the New Database button at the bottom of the sidebar.

3 Change Type to PostgreSQL, and different options will appear at the bottom of the New Database dialog. The New Database window should look like the following screenshot:
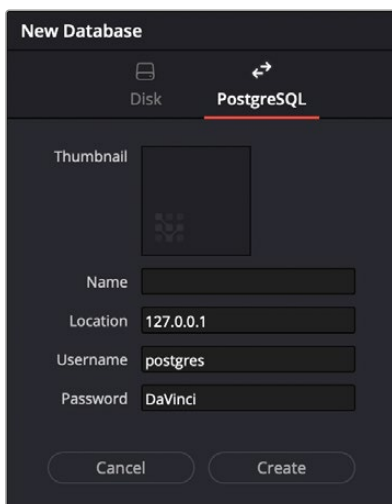
Creating a PostgreSQL database

4 Type a name for the new database into the Name field. Because all projects in a PostgreSQL database are saved internally within the PostgreSQL database, no other changes are necessary.

5 Click Create, and the new disk database will appear in the PostgreSQL database section of the Databases sidebar.

Backing Up and Restoring Databases

You can also back up databases by exporting them, and then reimport them later.

To backup/export a database:

1   Click the button at the upper-left hand corner of the Projects window to open the
Databases sidebar.

2   Select the database you want to back up.

3   Click the Backup button at the top of the Databases sidebar.

The Backup
Database button

4   Choose a location to which to save the backup in the Backup Database dialog, and click Save.

To import a database:

1   Click the button at the upper-left hand corner of the Projects window to open the
Databases sidebar.

2   Click the Import Database button at the top of the Databases sidebar.

The Import
Database button

3   Find the database you need to import using the file import dialog, and click Open.

Upgrading Databases

Databases display an upgrade badge (circular arrows) only when you've installed a new version of
DaVinci Resolve and you have databases that were created in older versions of DaVinci Resolve that
need upgrading.

icehouse2018

UpgradeDatabase

A badge at the right of a database indicates that database needs to be upgraded

It's generally a good idea to back up a database prior to upgrading it, in case something goes wrong.
In general, upgrading from a whole version release to the next whole version release of
DaVinci Resolve usually requires an upgrade, while upgrading to a dot release of the same version
may or may not. If the currently used database requires an update, you'll be told on application startup.

To upgrade a database from an old version of DaVinci Resolve:

–   Right-click a database that needs updating, and choose Upgrade from the contextual menu.
A dialog appears to confirm if you really want to upgrade that database. Click Upgrade to proceed.

Disconnecting and Deleting Databases

You cannot actually delete databases in DaVinci Resolve; you can only disconnect them so they don't appear in the Database list. However, disconnected databases can still be reconnected if you remember their name. The only way to completely delete a database entry in PostgreSQL is to do so from the command line, or to use the PGAdmin III application that accompanies the PostgreSQL installation that's part of the DaVinci Resolve installation process.

To disconnect a database you no longer need:

– Right-click a database that is not currently selected, and choose Disconnect from the contextual menu. A dialog appears to confirm if you really want to disconnect that database. Click Disconnect to proceed.

Locating Disk Database Directories in Your File System

Because Disk databases have a link to a specific directory in your file system, there's a way of locating that directory.

To locate a database on your system:

– Right-click any Disk database, and choose "Reveal in Finder." A file system window opens up showing you the location of that Disk database, inside which are all of its projects.

Optimizing Databases

Only available for PostgreSQL databases. Sometimes, databases in DaVinci Resolve can become so large that the size affects performance. In these cases you may need to optimize them to improve access speed by "vacuuming" the database of unnecessary spaces and reindexing it. Using the Optimize command can also be a valuable troubleshooting step in certain cases where you're having problems opening, importing, or otherwise using projects saved within PostgreSQL databases.

To optimize a database:

– Right-click a database, and choose Optimize from the contextual menu. A dialog appears to confirm if you really want to optimize that database. Click Optimize to proceed.

Legacy User Organization in the Databases Sidebar

DaVinci Resolve was originally designed as a multi-user application for use in commercial suites. While DaVinci Resolve is still very much used in that capacity in high-end facilities around the world, starting in DaVinci Resolve 14 the interface that was previously used to create and manage multiple users on a single workstation has been eliminated in favor of a simpler method of managing multiple databases right in the Project Manager, via the Databases sidebar. However, if you've upgraded databases that were previously organized using multiple users, the Database > User > Project structure of older databases is maintained via a drop-down menu to the right of that database's name in the Databases sidebar.
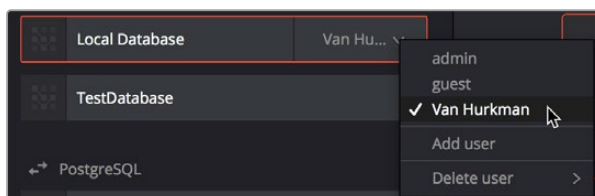
Legacy users in a database

Saving Projects

Once you've created and opened a project, you want to make sure that you regularly save your work.

Methods of saving projects:

– Choose File > Save Project (Command-S).

– Push the SAVE button on the DaVinci control panel.

– To save the current state of your project as a copy with a new name, choose File > Save Project As (Command-Shift-S), then enter a name into the Save Current Project window and click Save.

To revert to the last saved state of a project:

– To save the current state of your project as a copy with a new name, choose File > Save Project As (Command-Shift-S), then enter a name into the Save Current Project window and click Save. If you chose to save as the same name as an existing project, a dialog box will appear allowing you to confirm if you want to overwrite the existing project or to cancel out and choose another name.

As you work on your project, the word "Edited" appears to the right of the project name at the top of the DaVinci Resolve UI to let you know that you have unsaved changes. If you don't save in over 15 minutes, the word "Edited" turns yellow, and if you still don't save in over 30 minutes, it turns red to let you know that you probably should save. If you move the pointer over the word "Edited," a tooltip appears letting you know when the last save was performed.
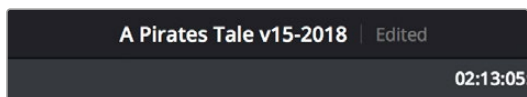
The word "Edited" to the right of the project name
lets you know you have unsaved changes

DaVinci Resolve also has two auto save mechanisms that you can enable in the Save Settings group of controls, called Live Save and Project Backups.
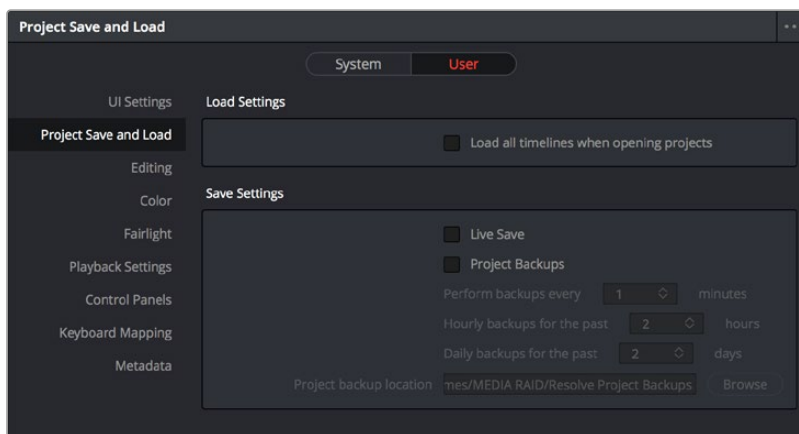
Auto Save controls in the User Preferences

Live Save

Enabling Live Save sets DaVinci Resolve to incrementally save changes as you make changes to your project, with no user intervention required. Disabling Live Save puts DaVinci Resolve back into a state where you have to manually save by pressing Command-S (this can be useful when doing demos when you don't want to save your changes to a project). Using Live Save is turned on by default and highly recommended to prevent the loss of work in the event you have a problem. It even works for previously unsaved projects that you've forgotten to save if anything goes wrong.

> **NOTE:** When you use Collaborative Workflow to enable multiple artists to work together in the same project, Live Save is automatically turned on and cannot be disabled.

Project Backups

Turning on the Project Backups checkbox in the Project Save and Load panel of the User Preferences enables DaVinci Resolve to save multiple backup project files at periodic intervals, using a method that's analogous to a GFS (grandfather father son) backup scheme. This can be done regardless of whether or not Live Save is turned on. Each project backup that's saved is a complete project file, excluding stills and LUTs, which are omitted in order to save storage space.

Once you've enabled Project Backups for a long enough time, whatever saved project backups have been created are retrievable in the Project Manager via the contextual menu that appears when you right-click a project, by choosing Project Backups to open the backups list dialog. The backups list dialog shows you all backups that are available for a particular project, and has controls for sorting the list via different columns, deleting some or all of the backups in the list, and loading backups that you want to retrieve. Opening a project backup does not overwrite the original project; project backups are always opened as independent projects.
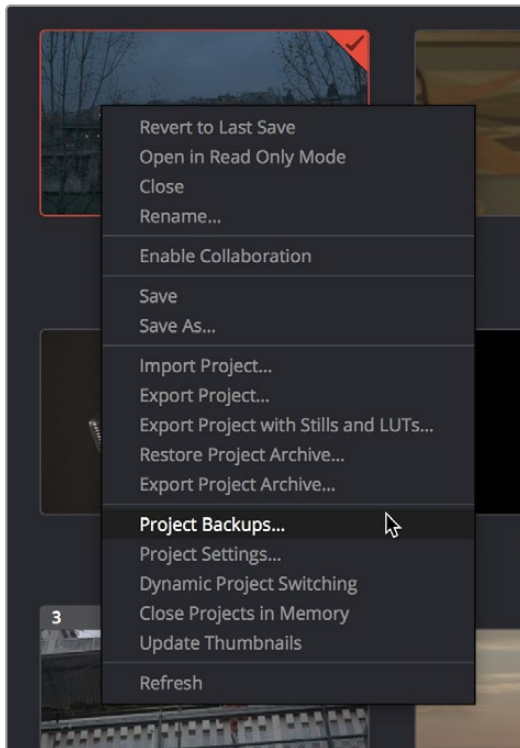
To enable Project Backups:

1   Choose DaVinci Resolve > Preferences, and open the Project Save and Load panel.

2   Turn on the Project Backups checkbox.

3   Choose the settings that determine how many Project Backups will be maintained. Project Backups are saved on a first in, first out basis. Three fields let you specify how often to save new backups and how many backups to maintain, while the fourth lets you choose where the backups will be saved.

— **Perform backups every X minutes:** The first field specifies how often to save a new backup within the last hour you've worked. By default, a new backup is saved every 10 minutes, resulting in six backups within the last hour. Once an hour of working has passed, an hourly backup is saved and the per-minute backups begin to be discarded on a "first in, first out" basis." By default, this means that you'll only ever have six backups at a time that represent the last hour's worth of work.

— **Hourly backups for the past X hours:** The second field specifies how many hourly backups you want to save. By default, 8 hourly backups will be saved for the current day you're working, which assumes you're working an eight hour day (wouldn't that be nice). Past that number, hourly backups will begin to be discarded on a "first in, first out" basis.

— **Daily backups for the past X days:** The third field specifies for how many days you want to save backups. The very last project backup saved on any given day is preserved as the daily backup for that day, and by default daily backups are only saved for five days (these are not necessarily consecutive if you take some days off from editing for part of the week). Past that number, daily backups will begin to be discarded on a "first in, first out" basis. If you're working on a project over a longer stretch of time, you can always raise this number.

— **Project backup location:** Click the Browse button to choose a location for these project backups to be saved. By default they're saved to a "ProjectBackup" directory on your scratch disk, although you could change this to a volume that better fits into your data backup methodology.

4   Click Save to confirm your change, and then close the Preferences window.

> **NOTE:** When using this feature, the very first backup that's saved for a given day may be a bit slow, but all subsequent backups should be unnoticeable.

Once one or more Project Backups have been saved, you can access them in the Project Browser.

To open a Project Backup that's been saved:

1 Open the Project Manager.

2 Right-click a project, and choose Project Backups from the contextual menu.

Restoring a project backup in the Project Browser

3 Select a backup that you want to restore from the Auto Backups list. If you don't see the particular backup you want, you can click the Refresh button to update the list, or you can try sorting by one of the columns (Auto Backup, Date Modified, Width, Height) to better navigate the list.
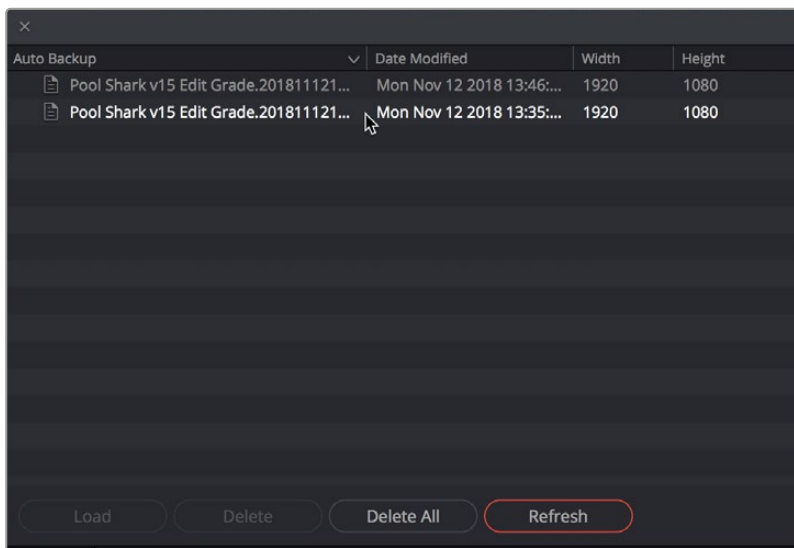
Selecting a backup that you want to restore

4 Once you've selected the backup you want to restore, you can click Load to open that backup as a new project. If the project it was saved from is already open, it won't be overwritten.

Project Notes

Each DaVinci Resolve project now provides access to Project Notes, which is a simple "scratch pad" for keeping track of text notes associated with each project. These notes can be accessed using the File > Project Notes command, and there's also a Project Notes command in the contextual menu for project icons in the Project Manager, which makes these notes accessible to everyone who's connected to that database.

Dynamic Project Switching

Dynamic Project Switching is an option in the Project Manager contextual menu that lets you open multiple projects into RAM simultaneously, so you can quickly switch between projects when you want to copy and paste clips, timelines, and node settings back and forth. If you plan on opening many projects, or even just a few very large projects, you should be sure your workstation has an appropriate amount of RAM installed or you could experience a slowdown in performance.

Methods of using Dynamic Project Switching:

– **To enable Dynamic Project Switching:** Open the Project Manager, right-click anywhere within the Project Manager and choose Dynamic Project Switching so that it's checked. Dynamic Project Switching will remain enabled until you turn it off.

– **To open multiple projects in RAM:** Open any project, then reopen the Project Manager and open any other project. All projects you open are kept available in RAM.

– **To switch among open projects:** Choose File > Switch Project and select the project you want to switch to from the submenu. You can also choose other projects that have been opened into RAM from the drop-down menu that appears to the right of the project name at the top center of the DaVinci Resolve user interface.

– **To close a specific project:** Choose File > Close Project and select the project you want to close from the submenu. You may be prompted to save, after which the project closes.

– **To close all other open projects:** Open the Project Manager. All open projects appear with a check mark in the upper right-hand corner; the currently open project has an orange corner mark, while other projects open in memory have a gray corner mark. Right-click anywhere within the Project Manager, and choose Close Projects in Memory to close all projects other than the current one.
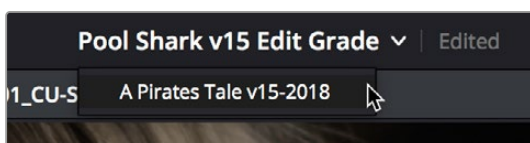
Switching among open projects using the Project Title
drop-down at the top of the DaVinci Resolve UI

Using dynamic project switching, you can do the following:

– Copy and paste clips from the Media Pool of one project into another.

– Copy and paste timelines from the Media Pool of one project into another. When you paste a timeline from another project, all of the clips used in that timeline will be pasted to the same location as well.

– Copy and paste clips from a timeline in one project to a timeline in another.

– Copy a node's settings from one project and paste them to a node in another project.

You can also copy and paste clips, timelines, and node settings from one project to another without using dynamic project switching, but using switching makes this process faster.

Archiving and Restoring Projects

DaVinci Resolve has a convenient feature for quickly archiving every single media file used by a project, including subtitle files, along with the project itself, to a single location. This can be done to hand a project off to another DaVinci Resolve user, or to bundle a project and its media up for either short- or long-term archiving using the backup methodology of your choice. The process is simple.

To Archive a project:

1   Open the Project Manager.

2   Locate and right-click the project you want to archive, and choose Archive.
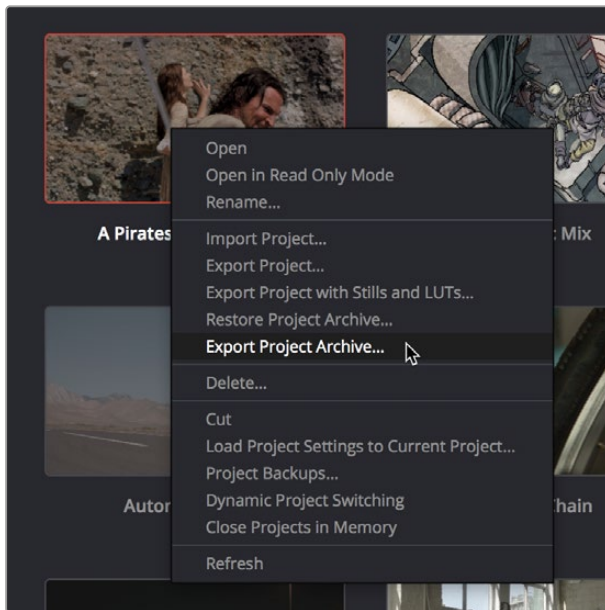
The contextual menu command for archiving projects

3   When the Archive Project window appears, choose a location to save the archive. Make sure you choose a volume that's large enough to accommodate the size of all the media from the project you're archiving, and click Save.

4   When the Archive dialog appears, verify the location the archive will be saved to, and choose which optional media you want to save within the archive. You can optionally save Optimized media and/or Render Cache media associated with a project.
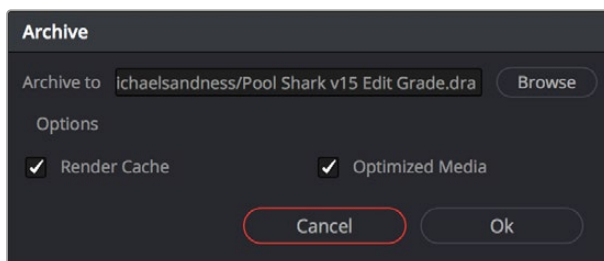
A dialog letting you choose whether to save Optimized and/or Render Cache media

5   Click Ok, and a dialog with a progress bar will show you how long the archive operation will take to finish. If any errors come up, resulting from missing or offline media, they'll be presented at the end of the process.

The resulting archive that is written is a directory with the .dra file extension. Inside this folder are a series of subdirectories containing all of the media that's used by the archived project. Each directory of media files used is saved within a directory path that mirrors the exact path it came from, so you have a reference for where each clip came from originally.

To restore an Archived project:

1   Copy the .dra archive directory you want to restore to the volume where you want those media files to be. Restoring doesn't move this directory, it only adds the project file within to the Project Manager, so you should make sure the .dra archive directory is located on a storage volume with suitable performance for you to work.

2   Open the Project Manager, right-click anywhere, and choose Restore from the contextual menu.

3   Choose the .dra archive directory you just copied, and click Open.

4   At the prompt, enter a unique project name for the restored project, and click OK. The project is restored to the Project Manager, and remains linked to the media located inside the .dra archive.

If, after restoring an archive, you want to move its media to another location, you can use Media Management to do a move operation for all clips in that project. For more information on Media Management, See Chapter 45, "Media Management."

Chapter 4

System and User Preferences

This chapter covers the settings used for customizing the DaVinci Resolve environment. System Preferences govern setup options that control the hardware and software environment, while User Preferences control various user controls within the software.

Contents

DaVinci Resolve Preferences

The DaVinci Resolve Preferences window contains workstation-specific settings for customizing how DaVinci Resolve works, divided into System and User panes, selectable via buttons at the top of this window.

To open the Project Settings window, do one of the following:

– Choose DaVinci Resolve > Preferences.

– Press Command-Comma.

> **TIP:** You can open the preferences while the Project Manager is open when you first run DaVinci Resolve by pressing Command-Comma.
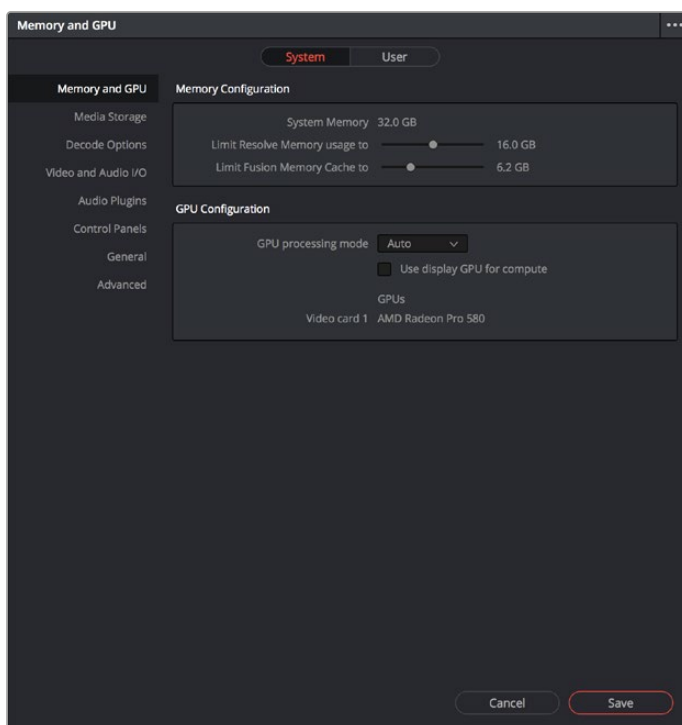
System Settings of the Preferences window

Adjusting Preferences

The System and User panes are each divided into a series of panels which can be selected from a sidebar at the left. Each panel contains a collection of related settings that affects some category of DaVinci Resolve functionality.

To alter any preference setting:

1   Click on the name of any group of settings in the sidebar at the left to open that panel.

2   Change whatever settings you need to change.

3   Click Save to apply the changes you've made and close the Preferences window.

If you've updated certain System Preferences, you'll be prompted to restart DaVinci Resolve, but if you've updated the User Preferences, this will probably be unnecessary.

Individual Preferences and Settings Based on Login

As of DaVinci Resolve 16, there are individual preferences and settings for each login account on a given computer. This means that multiple artists can each have their own operating system login, and DaVinci Resolve will maintain separate workspace layouts and preference states for each artist, depending on who's logged in.

Resetting Preferences

Resetting all preferences to their defaults is simple. Click the Option menu at the upper right corner of the Preferences window and choose Reset System Preferences.

System

The System pane of the Preferences window consists of a series of panels that configure the computer and other hardware that comprises your DaVinci Resolve workstation.

Memory and GPU

The top section of this panel provides Memory Configuration options, while the bottom section of this panel provides controls over how GPU processing is handled.

Memory Configuration

This section has the following preference settings handling memory usage.

–   **System Memory:** The total available RAM on your workstation is listed here.

–   **Limit Resolve Memory Usage to:** This preference limits the total amount of system memory that Resolve uses, keeping memory available for other applications. The maximum and default setting for this preference is 75 percent of your system's RAM.

–   **Limit Fusion Memory Cache to:** Lets you limit how much RAM the playback cache on the Fusion page is allowed to use. Depending on the length of clips you're working on in the Fusion page, the playback cache can occupy a considerable amount of available memory. The amount you allocate here is taken from the total amount of memory allocated by the "Limit Resolve Memory Usage to" setting.

GPU Configuration

This section lets you choose how GPU processing should be handled.
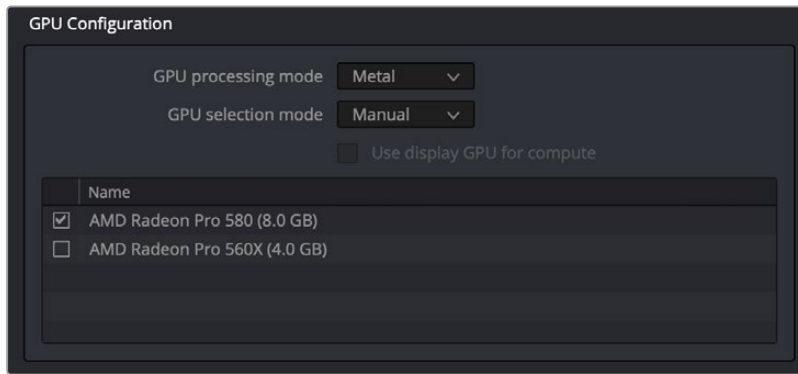
Options for configuring the GPUs on your workstation

– **GPU processing mode:** Lets you set DaVinci Resolve to use the OpenCL, CUDA, or Metal GPU computing APIs for doing effects processing. Which is best depends on the GPUs that are installed in your computer. Most users can leave this set to Auto to let DaVinci Resolve choose what's appropriate. Otherwise, here are specific recommendations. If you have a macOS system, you should use Metal. Linux and Windows users with AMD GPUs should use OpenCL. Linux and Windows users with Nvidia GPUs should use CUDA, but make sure you have the correct drivers for your system, and that you have the latest update to CUDA installed. Additionally, when you manually choose an option from this drop-down menu, the GPU selection mode drop-down also appears.

– **GPU selection mode:** Lets you choose between Auto, which lets DaVinci Resolve choose which of the available GPUs on your computer to use for processing, and Manual, which lets you choose which GPUs to enable or disable for processing from a list that appears below. This can be useful in instances where you have multiple GPUs installed on a machine and you want to choose only the most powerful GPUs for processing. This can also be useful in instances where an external eGPU is connected to a laptop or all-in-one with a weaker GPU, so you can choose the more powerful eGPU for processing.

– **Use Display GPU For Compute:** By default, a single GPU system uses the same GPU for the DaVinci user interface and also for image processing. As greater processing speeds are achievable with two or more GPUs, if two GPUs are installed for image processing, this checkbox enables the shared use of the display GPU instead of dedicating it to just the DaVinci user interface. Users of the non-studio version of DaVinci Resolve are restricted to the use of a single GPU, unless DaVinci Resolve is installed on a 2013 or later Mac Pro, in which case both installed GPUs will be used.

– **GPU selection list:** This list only appears when GPU processing mode is set to either OpenCL, CUDA, or Metal, and when GPU selection mode is set to Manual. A list of every GPU installed in your computer appears, and you can use checkboxes to the left of each GPU to enable or disable specific GPUs from being used for processing.

– **Optimized Viewer Updates:** This only appears on multi-GPU macOS and Windows systems or on single- and multi-GPU Linux systems; enables faster viewer update performance.

Media Storage

This panel lets you define the scratch disk and other media storage locations used by DaVinci Resolve, as well as the default cache directories locations to be used when creating new projects.

– **Media Storage Locations:** This list lets you define the scratch disk of the system. The first volume in this list is where Gallery stills and cache files are stored, so you want to make sure that you choose the fastest storage volume to which you have access.

– **Mapped Mount:** This column allows you to specify translatable media path mapping between Mac, Linux, and Windows file system conventions.

– **Direct I/O:** This Linux-only option allows DaVinci Resolve to write directly to the drive using the kernel buffers, bypassing the normal storage cache in RAM. This allows access to the full performance of the drive.

– **Automatically display attached local and network storage locations:** This checkbox lets DaVinci Resolve access media on all temporarily and permanently mounted volumes, including SATA and eSATA, SAS, USB, FireWire, Thunderbolt, Gigabit Ethernet (GbE or GigE), Fibre Channel, and otherwise connected hard drives, without having to add them to this list. This is on by default.

If you're using the Apple App store version of DaVinci Resolve, turning on "Automatically display attached local and network storage locations" automatically prompts you via a dialog to add "Macintosh HD" as a storage location. Clicking Add Location prompts you to select the Macintosh HD volume with another dialog, and clicking Open then adds that volume to the Media Storage Volumes list. After you click Save to close the Preference windows, Resolve should now auto-mount any volumes attached to your computer in the Media Storage browser of the Media page. Don't do this until after you've added a fast storage volume to the Media Storage Locations list, because you don't want Macintosh HD as the first volume in this list – the very first volume in this list should always be reserved for your fast scratch volume.

Adding Storage Locations Manually

Some versions of DaVinci Resolve do not allow automatic display of attached volumes. In this case, you can right-click anywhere in the background of the Media Storage panel's volumes list on the Media page and choose "Add New Location" to open a dialog you can use to choose a volume you want to add.

Manually adding a volume to the
Media Storage panel's volumes list

Using Path Mapping to Access Volumes From Other Operating Systems

Shared media path mapping support for Mac, Linux and Windows makes it easier for multi-system shops to share Resolve projects among different platforms that use different file path conventions.

To add a mapped mount string:

1 Open the Media Storage panel of the Resolve Preferences window.

2 Add the volume you want to map to the Scratch Disks list.

3 Double-click the Mapped Mount column of the drive you added to edit it.

4 Enter the alternate file path you want that volume to have. For example, if you're on a Windows workstation and you want to access a Linux volume, type the Linux file path into the Mapped Mount column.

> **NOTE:** If the volume you've selected to use for the cache becomes unavailable, DaVinci Resolve will warn you with a dialog.

Decode Options

This panel contains all options available for using the GPU to accelerate the decoding and debayering of various formats.

– **Use GPU for Blackmagic RAW decode:** Lets you use your GPU to accelerate the decoding of Blackmagic RAW (BRAW) media.

– **Decode H.264/HEVC using hardware acceleration:** Allows the use of hardware acceleration for H.264 or HEVC playback, if available on the computer you're using.

– **Use easyDCP decoder:** Since DaVinci Resolve has its own DCP encoder and decoder built in, this checkbox lets you switch over to using easyDCP to do DCP decoding, if you have a license installed on your workstation.

– **Automatically refresh growing files in the media pool:** If you're using a third-party application that records live to a growing video file, you can now begin to edit that file while it's still recording. Simply import the growing file into the Media Pool, and when this box is checked, DaVinci Resolve will continuously refresh to determine if the file has changed, and automatically update its attributes in the Media Pool.

– **Use GPU for RED Debayer:** Lets you use your GPU to accelerate debayering of R3D media. The latest RED API enables accelerated 8K debayering using either Metal or Cuda. There are three options:

  – None

  – Debayer

  – Decompression and Debayer

– **Use Red Rocket if available:** (Only appears if a RED ROCKET-X or RED ROCKET is installed.) This checkbox lets you disable Red Rocket support if you need to force DaVinci Resolve to use standard RED software CPU debayering to accommodate your specific workflow or when troubleshooting. If you are required to debayer R3D media using your CPU, turn this checkbox off. Additional options appear letting you choose decompression and debayer settings.

Video & Audio I/O

The preferences in this panel let you choose video and audio interfaces on your workstation.

Video I/O

This section lets you choose which Blackmagic Design video interfaces you want to use for monitoring, capture, playback, and Resolve Live, assuming you have any connected to your workstation. If you have more than one Blackmagic Design video device connected to your computer, you can independently configure them for playback and capture. If no interfaces are connected, no options will be available.

– **Capture Device:** If you have a compatible video capture card for video input, you should choose from the card options that appear here. This setting also sets the selected input device for use in Resolve Live, allowing you to monitor and color correct a live video signal. Any changes to this setting require a restart of the program.

– **Monitor Device:** If you have a compatible video output card, you should choose from the card options that appear here. Leaving this set to "None" disables external video output. Disabling video output can improve real time performance when external monitoring and output is not a priority. You can also choose "None" when you're using DaVInci Resolve with another application open at the same time that's using your workstation's video output interface. When you've quit the other application, you can reselect the video output interface for use by DaVinci Resolve. Any changes to this setting require a restart of the program.

– **Release video device when not in focus:** When turned on, DaVinci Resolve releases control of the video output device whenever you switch to another application.

– **Enable discrete audio output:** This enables sending audio to individual outputs per channel from your designated device.

– **Audio monitoring delay:** Allows you to adjust any latency between the video images and the audio monitoring.

Audio I/O

This section lets you define the audio hardware and different sets of speakers with which to monitor audio playback. To access more than the default stereo system output that most workstations default to, you must use whatever software is available for your operating system to choose the desired audio hardware you want to use, and define how many audio outputs are required for the type of monitoring you want to do (stereo, immersive, and so on). For example, on macOS you'll use the Audio Midi Setup utility to choose output hardware and select a speaker configuration to be made available on your system.

– **I/O Engine:** Lets you choose the audio hardware that DaVinci Resolve uses to process audio. Choices include System Audio, Desktop Video, Fairlight Audio Accelerator, and ASIO (Windows only).

– **System Audio:** System Audio interfaces with your computer's native audio hardware and enables the following parameters.

   – **Playback processing buffer size:** Lets you determine the size of the Playback buffer; to the right a latency display indicates the approximate latency of your choice in milliseconds.

   – **Record buffer size:** Lets you determine the size of the Record buffer; to the right a latency display indicates the approximate latency of your choice in milliseconds.

   – **Input Device:** Lets you chose the audio input device from the hardware attached to your system.

   – **Output Device:** Lets you chose the audio output device from the hardware attached to your system.

   – **Automatic speaker configuration:** Checking this box sets DaVinci Resolve to output audio via your workstation's built-in audio output, even if a compatible video I/O interface is enabled for capture and playback or for Resolve Live. Unchecking this box exposes additional controls with which you can define your own speaker setup.
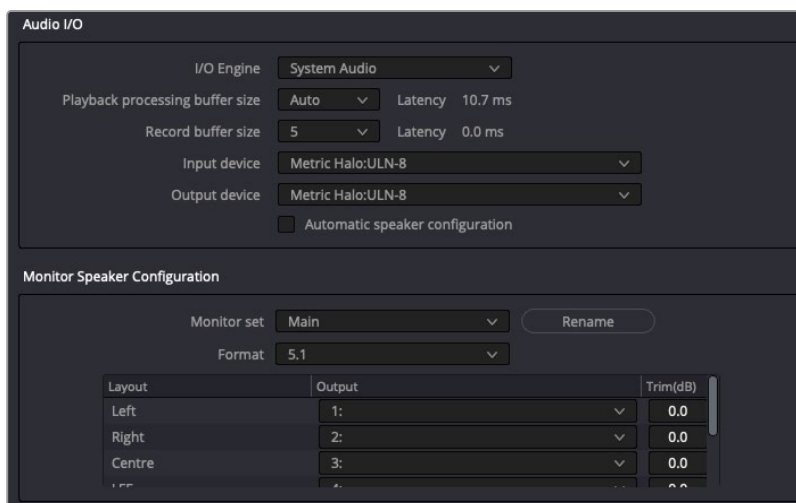
Assigning different audio I/O devices and required buffer adjustments

About Audio Monitoring and Audio Input

The audio processing throughout DaVinci Resolve, including on the Fairlight page and audio processing using Fairlight FX plug-ins, is equally compatible with all platforms that DaVinci Resolve runs on, including macOS, Windows, and Linux. In particular, DaVinci Resolve supports audio monitoring and audio input using (i) the audio of a supported Blackmagic Design I/O device such as an UltraStudio or Decklink, (ii) your macOS, Windows, or Linux workstation's on-board audio, (iii) any Core Audio-compatible, Windows-compatible, ASIO, or Advanced Linux Sound Architecture (ALSA)-supported third party audio interface.

Alternately, you can monitor audio with the optional Fairlight Audio Accelerator, which is a PCI card that's designed to handle even more channels of audio I/O monitoring and recording, and that's also capable of accelerating audio processing operations to provide better performance for audio operations.

NOTE: ASIO is a trademark and software of Steinberg Media Technologies GmbH.

Monitor Speaker Configuration

When the Automatic Speaker Configuration box is unchecked it reveals another panel in the Video and Audio I/O Preferences. Here you can assign your monitors to the default Main or Near sets, and you can also create an additional 15 monitor sets specific to your needs.

- **Monitor Set:** Choose the default Main or Near or create up to 15 other user-definable configurations.

- **Rename:** This button allows you to rename any of the monitor sets to something more meaningful for your individual needs.

- **Format:** A drop-down menu allows you to choose the desired format type from Mono up to Dolby Atmos 9.1.6. Below the Format type there are three windows to create the Monitor Set:

  - **Layout:** Breaks out the channels that correspond to the chosen format.

  - **Output:** Where you can assign the Output channels to your system.

  - **Trim:** Where you can reduce each individual level by up to -24dB of gain or add up to +10dB of gain for fine tuning the speaker calibration required for your particular playback space.

Monitor System External Inputs

You can create multiple sets of monitoring with up to 16 user-definable setups from the Control Room and Studio tabs in this panel. This allows flexibility to have different combinations of monitoring speakers that you can switch among for checking, reviewing, and creating different mixes.

- **External Monitor Source:** Chose None or up to 16 definable configurations.

- **Format:** When a Format is chosen, a drop-down menu appears allowing you to choose the desired format type from Mono up to Dolby Atmos 9.1.6. Once a format has been chosen, three more windows appear:

  - **Layout:** Which breaks out the channels that correspond to the chosen format.

  - **Source:** Where you can assign either Input Destination or Audio Repro.

  - **Input:** Where you can assign an individual track when in Audio Repro, or assign the specific channel when in Input Destination.

- **Rename:** This button allows you to rename any of the numerically labeled monitor sets to something more meaningful for your individual needs.
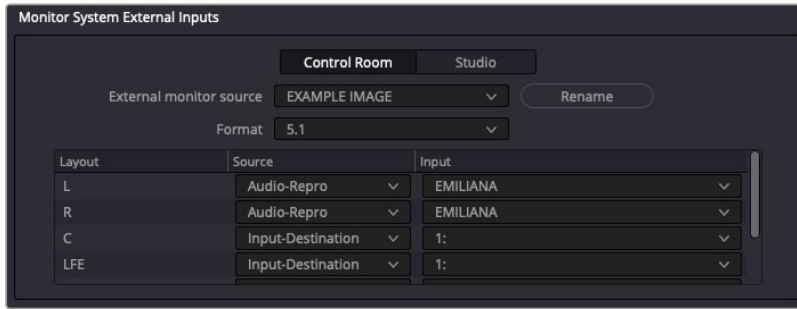
Patching and renaming different external inputs in Preferences

Immersive Audio Controls

These two Preference panels allow you to configure for the type of Immersive Audio that you want to have available in your project and also for linking to a Dolby RMU for doing Dolby Atmos mixing.

– **Immersive Audio:** This panel allows you to enable the various types of Immersive Audio offered within DaVinci Resolve. Those formats are: Auro-3D, Dolby Atmos, MPEG-H Audio, SMPTE ST 2098, and 22.2 Surround.

– **Dolby Atmos:** Checking this box allows the use of an external Dolby Atmos Renderer. Once checked you can enter the IP address of the RMU and choose the base audio output.
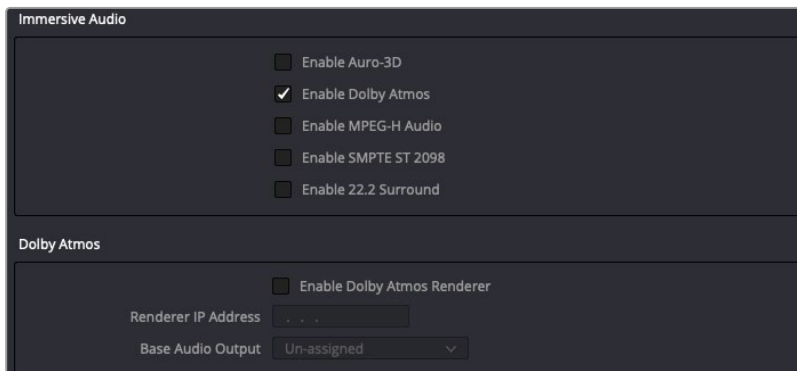
Video Plug-ins

You can selectively enable and disable specific Open FX plug-ins on startup. You can use this function to streamline and organize the Open FX list to just the plug-ins you commonly use, or to exclude a problematic plug-in that causes instability in the system. Additionally, DaVinci Resolve automatically checks the last plug-in loading result on startup, and skips any plug-ins that previously caused a crash or hang.

Individual Open FX plug-ins can be manually enabled and disabled in the Video Plugins panel by checking or unchecking the boxes corresponding to the plug-ins.
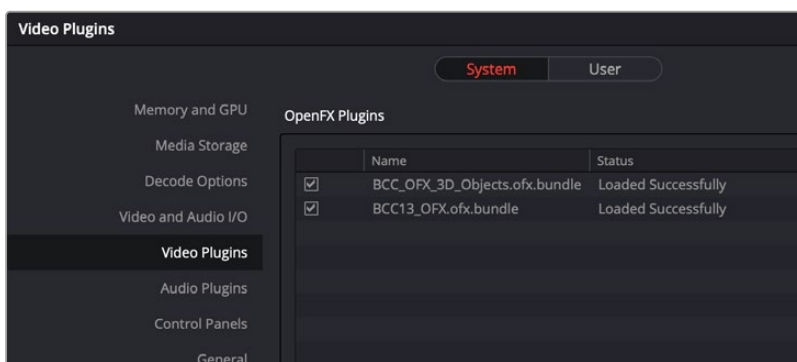
The Video Plugins panel allows you to enable or disable specific Open FX plug-ins at startup.

Audio Plug-ins

Three sections of parameters let you manage VST Effects, enabled plug-ins, and external audio processes.

– **VST Effects:** A list at top lets you manually add and remove VST plug-in effects directories, if necessary. VST effects aren't installed in a standard location, so it may sometimes be necessary to add a newly installed directory of VST plug-ins that you've just installed on your system.

– **Available Plug-ins:** Once you've added one or more VST directories to the list, a second list underneath shows all audio plug-ins that are available within these directories. Each plug-in on the list has a checkbox that shows whether or not it's currently enabled. Any VST plug-ins that cause DaVinci Resolve to crash while loading them during startup will be automatically disabled. You can use this list to see which plug-ins have been disabled, for troubleshooting purposes, and to reenable such "blacklisted" plug-ins by turning their checkboxes back on.

– **Setup External Audio Processes:** While working in the Fairlight page, you have the ability to process an audio file using a third-party application, if necessary, in the event you need to use another application's capabilities to create an effect or solve an issue that can't be accomplished in the Fairlight page itself. To do this, you must first add one or more applications to the External Audio Process list in the Audio Plug-ins panel of the System Preferences.

> **NOTE:** VST is a trademark of Steinberg Media Technologies GmbH.

To add an External Audio Process:

1   Click the Add button.

2   Double-click the text in the Name column and change the name to that of the application or process you're going to link to.

3   Click once in the Path column, and then use the file dialog to locate and select the application or script you want to use as the external audio process.

4   Open the drop-down menu in the Type column, and choose how you want the selected audio process to work: Reveal (open the application), Command Line (use from Terminal), or Clipboard (copy the audio clip file path to the clipboard to paste into the open command of an application or utility).

5   When you're done, click Save, and restart DaVinci Resolve if you're prompted to.

Control Panels

Two sections let you specify which Color Grading Panel and Audio Console is connected to your workstation.

– **Color Grading Panel:** A menu lets you choose which color grading panel you have connected to your workstation. Some panels expose additional controls.

If you have a DaVinci Resolve Mini or Micro Panel, leave this setting set to None and these panels will be auto-detected by Resolve when you plug them in.

If you have a control panel that connects via USB, choose your panel from the list.

If you have a DaVinci Resolve Mini Panel connected over Ethernet, choose "DaVinci Resolve Mini Panel (Ethernet)" and then choose your panel from the drop-down that appears.

If you're using a JLCooper Eclipse, choose "JLCooper Eclipse CX" and then enter the IP and Port number into the fields that appear.

– **Use MIDI Audio Console:** A checkbox lets you enable the use of a third-party audio console that's connected to your workstation. Turning this on exposes three additional menus.

– **MIDI Protocol:** Lets you choose either the HUI or MCU protocol, whichever is compatible with the audio console you want to use.

– **MIDI Input:** Lets you choose the MIDI input used to connect your console.

– **MIDI Output:** Lets you choose the MIDI output used to connect your console.

General

This panel provides various options for scripting, audio processing, monitoring, and sending problem reports.

– **External Scripting Using:** (Resolve Studio only) Options include None, Local, and Network. When set to None, only scripting in the Console window is allowed. When set to Local, external scripts and applications on the same computer can control DaVinci Resolve. When set to Network, external scripts and applications from other computers on the network (or via the internet) can control DaVinci Resolve.

– **Audio Processing Block Size:** Lets you increase the sample block size to add processing headroom to the system, at the expense of adding latency to audio playback. The default value is Auto, which automatically chooses a suitable setting for the audio I/O device you're using.

For those who have specific needs and are interested in setting this manually, here are some examples of use. In a first example, when a system is under a heavy load (there are many plug-ins being used on many tracks), then increasing the block size to add processing headroom will result in a longer delay every time your audio hardware requests samples to feed the speakers. If you're only mixing, the resultant latency may not be a problem, so this gives you the option to add headroom so your system can run a few more plug-ins or tracks.

On the other hand, this increased delay in the processed audio running through the mixer is a much bigger problem if you're recording an artist in an ADR session, where they need to hear themselves in the headphones, or when you're recording foley or voice over and there's an increased delay between what you see and what you're recording, so in this case sticking with the default value (or smaller) will sacrifice processing headroom for diminished latency.

> **TIP:** A common strategy when you need to force more cooperation from a particular combination of workstation and audio interface is to reduce Audio Processing Block Size when you're about to do a recording session, when track and plug-in use is lower. Later, when you start mixing in earnest and adding plug-ins, you can increase Audio Processing Block Size to give you better performance once you're finished recording.

– **Use 10-bit precision in viewers if available:** This checkbox only appears on Mac OS X 10.11 (El Capitan) and higher installations of DaVinci Resolve. Turning this checkbox on lets DaVinci Resolve display 10-bit images in the Viewer.

– **Use Mac Display Color Profile for viewers:** If you're using DaVinci Resolve on macOS, this checkbox enables all viewers in DaVinci Resolve to use whatever display profile is selected in the Displays panel of the System Preferences. This lets DaVinci Resolve use ColorSync on macOS so your Viewer image should better match your output display.

– **Automatically Tag Rec.709 Scene Clips as Rec.709-A:** Turn this checkbox on to automatically tag any Rec. 709 QuickTime files for Rec. 709-A playback. This setting is useful if your final QuickTime video does not match what you see in the Resolve viewers (gamma shift), and you wish to export for the web rather than broadcast.

– **Automatically Scan other databases for remote rendering jobs:** Turn this checkbox on to scan all connected databases, rather than just the current database for possible remote rendering jobs.

– **Automatically Check for Updates:** Turn this checkbox on to make it easier to ensure you're using the latest version of DaVinci Resolve. You can also choose DaVinci Resolve > Check For Updates to notify you of new versions and download them when available.

– **Automatically opt-in for new beta program notifications:** Lets you know when public beta versions of DaVinci Resolve become available, in case you're interested in living on the edge.

– **Send report when application quits unexpectedly:** When this checkbox is turned on, this setting enables DaVinci Resolve to automatically prepare a problem report whenever DaVinci Resolve unexpectedly quits. You get to fill out some information (please be as specific as you can about what you were doing when DaVinci Resolve had its issue) and click a button to send the report.

– **Automatically send problem reports:** When this checkbox is turned on, problem reports are automatically sent, with no user intervention. You have the option of adding your name and email address to be automatically included, but this information is optional.

Internet Accounts

DaVinci Resolve has tight integration with YouTube, Vimeo, Twitter, Dropbox, and Frame.io that allows you to render and upload directly to each service. This panel provides buttons that let you sign into your YouTube, Vimeo, Twitter, Dropbox, and Frame.io accounts, as well as specify a local cache location for media being synced with Frame.io.

For each service you sign into, a floating window presents the interface in which you'll need to enter your login name and password to enable integration, followed by whatever two-factor identification and other required steps are necessary. Once entered, DaVinci Resolve will sign in to each of these services automatically when DaVinci Resolve opens.
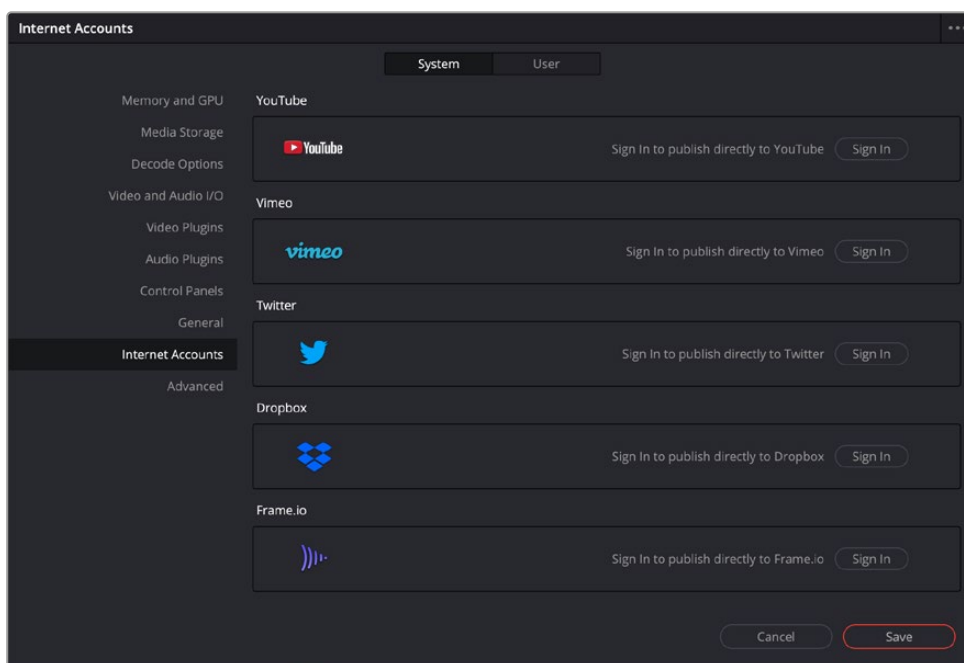
The Internet Accounts panel of the System tab of the DaVinci Resolve Preferences window

NOTE: For Frame.io, the local cache location is used to store clips you import into a DaVinci Resolve project from the Frame.io volume in the Media Storage panel of the Media page.

Advanced

This tab is used for special Resolve configurations and SAN parameters that are applicable to older file systems.

User

This panel lets you choose user preferences, specific to your workstation, that govern such things as UI behaviors and appearance, auto save settings, editing and color defaults, control panel action, and keyboard shortcut mappings.

> **TIP:** Many of the settings in the User panel used to be found in the Project Settings window prior to version 14, but they were moved here to accommodate collaborative workflows with each user having their own independent general, editing, and color settings, as well as their own keyboard shortcuts.

Saving User Preference Presets

It's possible to save multiple presets for instant recall of different User Preference settings, using the Option menu in the UI Settings window.
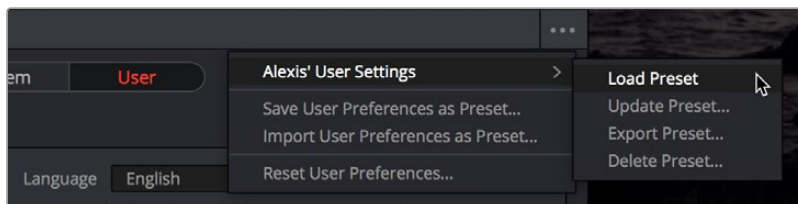
The commands for managing User Preference presets in the Option menu of the UI Settings window

Methods of managing User Preference presets:

– **To save a preset:** Choose whatever settings you want to use, then click the UI Settings window Option menu, and choose Save User Preferences as Preset. Enter a name into the dialog, and click OK. That preset will now appear at the top of the Option menu.

– **To load a preset:** Click the UI Settings window Option menu, and choose Load Preset from the submenu of the preset you want to load.

– **To update a preset:** Load a preset you want to edit, then change whatever settings you need to, and choose Update Preset from the submenu of that preset in the Option menu.

– **To export a preset:** Choose Export Preset from the submenu of any preset in the Option menu. A file with the .userprefs extension is saved at the location you chose.

– **To import a preset:** Choose Import User Preferences as Preset in the Option menu, use the dialog to find the exported .userprefs preset file you want to import, and click Open.

– **To delete a preset:** Choose Delete Preset from the submenu of any preset in the Option menu.

– **To reset all presets:** Choose Reset User Preferences from the Option menu to restore all User Preferences to their default settings.

UI Settings

A collection of operational preferences.

– **Language:** A Language drop-down at the top lets you specify which language the DaVinci Resolve user interface displays. DaVinci Resolve currently supports English, Chinese, Japanese, Spanish, Portuguese, French, Russian, Thai, and Vietnamese.

– **Reload last working project when logging in:** Automatically reopens the last project a user had open whenever that user logs back into DaVinci Resolve. This checkbox can only be enabled when editing a preset configuration in the Presets panel, so that it's always on no matter which project you open as long as you're using that particular preset. Ideally, enable it for your User config (if you're using a multi-user configuration of DaVinci Resolve) or your Guest Default config (if you're using a single-user configuration).

– **Show focus indicators in the User Interface:** Lets you enable or disable a red line at the top of each panel that indicates which panel currently has focus.

– **Use gray background for user interface:** By default, DaVinci Resolve uses a blue-gray UI background, intended to provide a more attractive experience for users focused on the less color-critical aspects of DaVinci Resolve, namely editing. Turning this checkbox on switches DaVinci Resolve to a totally neutral, desaturated gray UI, which can be valuable as a point of reference for colorists concerned about the blue-gray UI's potential to bias the eye in the dark environment of the grading suite.

– **Use gray background in viewers:** When turned on, sets the background of all viewers to gray, making it easier to evaluate image blanking or minor sizing adjustments than with the default dark background.

– **Resize image in viewer to square pixels:** This control will select between using a square or non-square pixel aspect ratio within the Viewer. This is important when working with SD images which do not have a square pixel aspect ratio.

– **Delay viewer display by X frames:** When turned on, you can enter a number of frames to delay DaVinci Resolve Viewers as they appear on your computer displays so that the image on your computer display better syncs up with the same image shown on external displays that are delayed due to various signal processing processes.

– **Output single field when paused:** This setting will reduce flicker when grading using a computer monitor or when working with interlaced material. Ordinarily, when viewing interlaced material in Stop or Pause mode, field one is displayed followed by field two. Depending on the image, this can result in a flicker on the display. When this option is enabled, only field one will be shown on the monitor when playback is paused; however both fields will be shown when the clips are played.

– **Stop playback when a dropped frame is detected:** When enabled, sets DaVinci Resolve to stop playback whenever a frame is dropped on output, to warn you that there are performance issues on your workstation. This is particularly useful when you're outputting to tape.

– **Stop renders when a frame or clip cannot be processed:** When enabled, this will halt a render if DaVinci Resolve detects an error in the encoding, rather than continue to try to process it.

– **Timeline sort order:** A user setting that allows you to determine the default sort order of the Timelines that appear in the Viewer drop-down menus throughout DaVinci Resolve.

  – **Alphabetic:** Sorts Timelines alphabetically A-Z.

  – **Creation Date:** Sorts Timelines by oldest creation date first.

  – **Recently Used (default):** Sorts Timelines by the last actively used Timeline first.

Project Save and Load

The Project Save and Load panel lets you control how projects are opened, and how they're saved.

Load Settings

The Load Settings preference lets you control a key aspect of project opening performance, namely whether or not all timelines within a given project are loaded into memory at the time of opening.

– **Load all timelines when opening projects:** To improve the performance of longer projects with multiple timelines, the "Load all timelines when opening projects" checkbox in the Project Save and Load panel of the User Preferences defaults to off.

– When this checkbox is off, opening a project only results in the last timeline you worked on being opened into memory; all other timelines are not loaded into RAM. This speeds up the opening of large projects. However, you may experience brief pauses when you open other timelines within that project, as each new timeline must be loaded into RAM as you open it. If you open a particularly gigantic timeline, a progress bar will appear letting you know how long it will take to load. Another advantage of this is the reduction of each project's memory footprint, which is particularly valuable when working among multiple projects using Dynamic Project Switching.

– If you turn this on, all timelines will be loaded into RAM, and you'll experience no pauses when opening timelines you haven't opened already. However, projects with many timelines may take longer to open and save.

Save Settings

The Save settings allow you to control how DaVinci Resolve handles automated saving and project backups. These features can save you from the heartache of lost work resulting from an unexpected problem.

– **Live Save:** Enabled by default, Live Save is a progressive, fast, always-on autosave mechanism that "saves as you go." All changes in the Cut, Edit, and Fairlight pages are saved as you make them. All changes in the Fusion and Color pages are automatically saved when you switch to another clip, and also periodically and invisibly in the background while you work to ensure that your work is saved even if you haven't switched clips in a while.

– **Project Backups:** Turning on the Project Backups checkbox in the Project Save and Load panel of the User Preferences enables DaVinci Resolve to save multiple backup project files at periodic intervals, using a method that's analogous to a GFS (grandfather father son) backup scheme. This can be done regardless of whether or not Live Save is turned on. Each project backup is a complete project file, excluding stills and LUTs.

Once you've enabled Project Backups for a long enough time, whatever saved project backups have been created are retrievable in the Project Manager via the contextual menu that appears when you right-click a project, by choosing Project Backups. Opening a project backup does not overwrite the original project; project backups are always opened as independent projects.
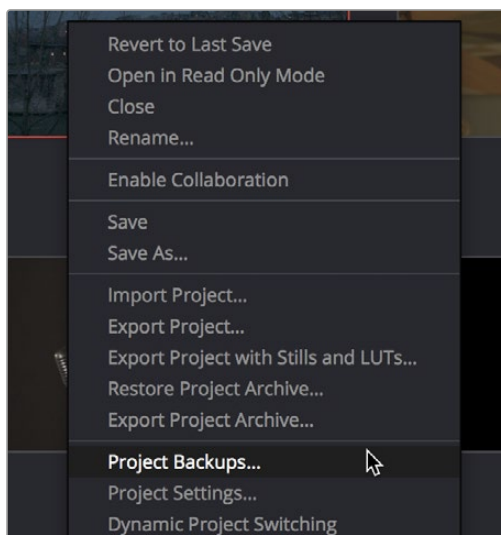
Restoring a project backup in the Project Browser

Project backups are only saved when changes have been made to a project. If DaVinci Resolve sits idle for any period of time, such as when your smart watch tells you to go outside and walk around the block, no additional project backups are saved, preventing DaVinci Resolve from overwriting useful backups with unnecessary ones.

Three fields let you specify how often to save a new project backup, while the fourth lets you choose where the backups will be saved.

– **Perform backups every X minutes:** The first field specifies how often to save a new backup within the last hour you've worked. By default, a new backup is saved every 10 minutes, resulting in six backups within the last hour. Once an hour of working has passed, an hourly backup is saved and the per-minute backups begin to be discarded on a first in, first out basis. By default, this means that you'll only ever have six backups at a time that represent the last hour's worth of work.

– **Hourly backups for the past X hours:** The second field specifies how many hourly project backups you want to save. By default, 8 hourly backups will be saved for the current day you're working, which assumes you're working an eight hour day (wouldn't that be nice). Past that number, hourly backups will begin to be discarded on a first in, first out basis.

– **Daily backups for the past X days:** The third field specifies for how many days you want to save backups. The very last project backup saved on any given day is preserved as the daily backup for that day, and by default daily backups are only saved for five days (these are not necessarily consecutive if you take some days off of editing for part of the week). Past that number, daily backups will begin to be discarded on a first in, first out basis. If you're working on a project over a longer stretch of time, you can always raise this number.

– **Project backup location:** Click the Browse button to choose a location for these project backups to be saved. By default they're saved to a "ProjectBackup" directory on your scratch disk, although you could change this to a volume that better fits into your data backup methodology.

> **NOTE:** When using this feature, the very first project backup that's saved for a given day may be a bit slow, but all subsequent backups should be unnoticeable.

Editing

The settings in this panel affect new timeline settings, editorial default values, trim behaviors, timeline UI appearance, and frame interpolation settings.

New Timeline Settings

These settings define the presets that populate the New Timeline Options window whenever you create a new timeline.

– **Start Timecode:** You can change the Start Timecode if a specific start time is required.

– **No. of Video Tracks:** Enter how many video tracks you want to have. You can also drag within this field to adjust the number of video tracks with a virtual slider.

– **No. of Audio Tracks:** Enter how many audio tracks you want to have. You can also drag within this field to adjust the number of audio tracks with a virtual slider.

– **Audio Track Type:** Choose the channel mapping you want the new audio tracks to use.

Automatic Smart Bins

These settings let DaVinci Resolve automatically create Smart Bins whenever clips with relevant metadata appear in the Media Pool, or whenever such metadata is added to clips that are already in the Media Pool. You can choose which Smart Bins are automatically created via a series of checkboxes.

General Settings

These settings define the timing of resolve-generated effects and editing operations.

– **Standard generator duration:** Defines the default duration of generators you edit into the Timeline, in Seconds or Frames. The default value is 5 seconds.

– **Standard transition duration:** Defines the duration of transitions, in Seconds or Frames, that you add to an edit point in DaVinci Resolve. The default value is 1 second.

– **Standard still duration:** Defines the duration of stills that you import such as TIFF, PNG and other supported graphic file formats, in Seconds or Frames. The default value is 5 seconds.

– **Pre-roll time:** Determines how much of the Timeline before the current position of the playhead to play when using the Play Around command.

– **Post-roll time:** Determines how much of the Timeline after the current position of the playhead to play when using the Play Around command.

– **Default handles length:** The value used when creating a timeline with handles. The default is one second worth of frames.

– **Default fast nudge length:** The number of frames that are nudged when you use the Shift-Comma (,) and Shift-Period (.) keyboard shortcuts.

– **Pre-playhead shadow length:** The number of frames in the Timeline prior to the playhead covered by the Playhead Shadow, if enabled by choosing View > Show Playhead Shadow.

– **Post-playhead shadow length:** The number of frames in the Timeline after the playhead covered by the Playhead Shadow, if enabled by choosing View > Show Playhead Shadow.

– **Timeline overlay retains the last performed action:** Turn this checkbox on if you want DaVinci Resolve to always remember the last edit type you used in the Timeline Viewer Overlay, and highlight it on this Overlay whenever you drag another clip over the Timeline Viewer to let you know that the last edit you performed is the new default edit if you drop clips to the left of the overlay.

– **Always highlight current clip in the media pool:** When turned on, any clips at the position of the playhead on the Edit or Color pages will be automatically highlighted in the Media Pool.

– **Sync the Master Timeline to the current frame:** If you turned on "Automatically match master timeline with media pool" in the Color settings, then this option lets you make sure that whenever you open the Master Timeline, the playhead is at the same clip and frame that it was in the previous Timeline you were working on.

– **Show offline reference for timeline gaps:** If there's a missing clip in a conformed timeline that results in a gap in the Timeline Editor, turning this option on sets DaVinci Resolve to show the corresponding frames of an "offline reference movie," if one has been assigned to that timeline, instead of black. This can be helpful in emergency situations when you're missing timeline clips right before a screening or review session; this feature lets you play or output the missing frames using the corresponding media from the offline reference movie, instead of outputting black. For more information on using and assigning Offline Reference Movies, see Chapter 55, "Preparing Timelines for Import and Comparison."

– **Show offline reference for non-conformed edits:** If there's missing media in a project that results in an unlinked clip in the Timeline Editor (represented by a red exclamation point overlay on that clip), turning this option on sets DaVinci Resolve to show the corresponding frames of an "offline reference movie," if one has been assigned to that timeline, instead of black. This can be helpful in emergency situations when you're missing source media right before a screening or review session; this feature lets you play or output the missing frames using the corresponding media from the offline reference movie, instead of outputting black. For more information on using and assigning Offline Reference Movies, see Chapter 55, "Preparing Timelines for Import and Comparison."

– **Use custom safe area overlays:** When turned on, displays Action Area and Title Area fields that let you set a custom percentage for each. The default values are 93% for Action Area and 90% for Title Area.

– **Align audio edits to frame boundaries:** When turned on, the In and Out points of audio clips always align themselves with whole frame boundaries, just like video clips. When turned off, you can perform subframe audio edits to audio-only clips, or to linked audio when you've suspended linked selection.

– **Limit media pool audio sync to first timecode match:** When two or more audio clips overlap timecode with a video clip, the default behavior is to sync all overlapping audio clips by making as many new tracks as necessary. Checking this box replaces this behavior by having DaVinci Resolve choose what it thinks is the most likely single audio track, and sync just that single audio clip, ignoring the others.

> **NOTE:** Even when Align audio edits to frame boundaries is turned off, if linked selection is on, you'll be unable to make subframe edits while you're resizing both the audio and video of linked clips.

Color

The settings in this panel govern different behaviors in the Color page.

General Settings

Affect a variety of behaviors while working in the Color page.

– **Master reset maintains RGB balance:** Defines how the DaVinci control panel trackball/ring reset buttons reset primary color adjustments. When this option is turned off (the default), pressing the ALL Reset button returns the primary correction values to their default values. When this checkbox is turned on, then pressing the ALL Reset button (a) resets the YRGB values so that the overall values are kept and the ratio of YRGB to each other is maintained, and (b) pressing the RGB Reset button sets the three color channels to the average of what they were previously set to.

– **Wipe wraps when viewing reference stills:** Turning this on (the default) lets stills wrap around the edge of the screen while you're adjusting the wipe using the mouse, rather than stopping at the screen's edge. If you find this behavior awkward when trying to quickly create full-frame comparisons with stills to flip on and off, it can be disabled.

– **High-Visibility Power Window Outlines:** Turning this on sets Power Window outlines to be drawn as green (for the center shape) and yellow (for the softness shapes), to make these windows easier to see in certain circumstances, instead of the default white and gray.

– **Mattes display high contrast black and white:** When enabled, the HILITE command, which displays the current key, shows a black and white matte (i.e., high contrast) rather than the standard gray matte. For more information on this setting, and on use of the HILITE command, see Chapter 133, "Secondary Qualifiers."

– **Next scene switches to visible track:** When grading a project with multiple tracks, you can use this option to alter the "next scene" command to work better in projects with multi-clip composites. With this option turned off, pressing NEXT SCENE on the DaVinci control panel, or using the Down Arrow keyboard shortcut, moves the playhead to the very next clip in the Thumbnail timeline, regardless of whether it's in front of or behind another clip. Turning this option on causes the NEXT SCENE command to move the playhead to the clip in the highest track if the next clip is part of a multi-clip composite with multiple clips stacked over one another.

– **Previous or Next node navigates only to correctors:** Node navigation only selects corrector nodes and bypasses mixer, splitter and combiner nodes, etc.

– **Preserve node numbers when adding nodes:** Checking this box increments the node numbering by the order in which they are created, regardless of its position in the node tree. Unchecked reflows the node numbering automatically based on the node's position in the tree.

– **Always perform copy and paste on selected nodes:** Bypasses the interface focus-based selection for copying and pasting full grades vs. individual nodes. When checked, DaVinci Resolve will only copy and paste between selected nodes regardless of the interface focus.

– **Use Legacy Auto Color:** As of DaVinci Resolve 16, the A button in the Color Wheels palette and the Shot Match command available from the Thumbnail Timeline contextual menu both now use advanced algorithms, based on the DaVinci Neural Engine, to provide superior results when automatically adjusting color balance and contrast. This checkbox lets you set the A button to use the older algorithm instead.

– **Use Legacy Shot Match:** As of DaVinci Resolve 16, the Shot Match command available from the Thumbnail Timeline contextual menu uses an advanced algorithm, based on the DaVinci Neural Engine, to provide superior results when automatically adjusting color balance and contrast. This checkbox lets you set the Shot Match command to use the older algorithm instead.

– **Histogram Background on Grading Tools:** This drop-down menu lets you turn the histogram that appears in the background of the Curves palette either Off, On based on the node's Input (changes made to the curve do not affect the background histogram), or On based on the node's Output (changes made to the curve do affect the background histogram).

– **Automatically cue x frames into timeline clips:** This setting affects the operation of the NEXT SCENE and PREV SCENE commands in the Color page. The default cue point when moving from one clip to the next is the first frame of each clip. Entering a value, in frames, in this field sets the default cue point to the specified number of frames after the first frame of each clip you move the playhead to. This can be convenient if the source material has black or camera rollup flashes at the beginning of every clip while you're trying to grade dailies.

– **Neighboring Clips in Split Screen:** Lets you choose how many neighboring clips next to the current clips are shown in a grid in the Color page Viewer when you turn on the Neighbor Clips option of the Split-Screen shot comparison control.

– **Switching clips:** (this setting can also be changed from the Option menu in the Node Editor) When switching clips, DaVinci Resolve can switch to the same or another node in the node graph. The four options below determine which node is selected:

  – **Selects last adjusted node:** The default setting, where each clip in the Timeline retains its own independent node selection that's remembered whenever you move back to that clip.

  – **Selects first node:** The first node is always selected when you move to another clip.

  – **Selects last node:** The last node is always selected when you move to another clip.

  – **Selects same node:** If the clip you've moved to has as many or more nodes as the last clip, the node of the same number will be selected. If the clip you've moved to has fewer nodes than the last clip, the next highest node will be selected.

- **Color picker:** Changes the way that colors are selected when using the Secondary color correction controls. DaVinci Resolve is the normal and modern mode, however some colorists who are familiar with the legacy 2K prefer the DaVinci 2K mode.

Ripple Mode

This setting determines the behavior of the Ripple command that's initiated when using the RIPPLE VALUE button on the DaVinci Advanced control panel.

- **Target clips are set to:** The Ripple mode that's used when you press the RIPPLE VALUE button on the DaVinci control panel. For more information on using this function, see Chapter 138, "Grade Management."

  - **Exact values changed:** Changes made to the current clip are rippled to the specified clips using the exact parameters that were changed. For example, if the Master Gain level in the current clip is changed to 0.75 of its range, each clip you ripple will have a Master Gain level of 0.75. Only parameters you adjust are rippled.

  - **Percent value changed:** Changes made to the current clip are rippled to the specified clips by the percentage of change you made to the altered parameters. For example, if the current clip has a Master Gain level of 1.00 and is changed to 0.90 units, then the Master Gain level of each clip you ripple will have a relative reduction of 10% relative to its previous value.

  - **Unit values changed:** Changes made to the current clip are rippled to the specified clips by the same delta of change, using whichever units make sense for the affected parameter. For example, if the current clip had a Master Gain of 0.80 and you increased it to 0.90, each rippled scene's Master Gain level increases by 0.10.

  - **All values are copied:** The current clip's grade is rippled to the specified clips in its entirety. No comparison is made with the original clip's parameters, and all memory parameters are rippled.

Printer Light Step Calibration

For film projects, when you have tight integration with a film lab, it is possible to adjust the printer light calibration sets to match the lab you are using. You should work with your lab technician to set up the Lab Aim settings, the Steps adjustments, which is an incremental value, and the Density Increment adjustment, which is the amount of correction applied within each step. Usually, the Step and Density values will be identical, but this will be up to your lab and your preference.

Fairlight

Video I/O Offset

The two preferences found in this section let you offset overall video playback up to 7 frames earlier than your audio playback, to account for situations where image processing applied to your video output is causing delays that make the video out of sync with your audio. For example, let's say your video output is going through a video convertor that adds a 1 frame delay, and then connects to a video projector that adds another 1 frame of delay. You can set your Video Monitor Offset to 2 frames to compensate, so the audio/video sync is solid.

- **Video Monitor Offset:** This drop-down menu lets you choose an offset from 0 to 7 frames.

- **Apply Offset during Jog and Shuttle:** Turning this checkbox on ensures that the offset you choose is also applied when you use Jog and Shuttle to move through your program.

General Settings

The two preferences found in the General Settings section both let you customize the Loop Jog behavior that's currently available only on the Fairlight page. Choosing Timeline > Loop Jog enables a brief sample preview to be heard while scrubbing the playhead through the Timeline. This can make it easier to recognize bits of dialog or music as you're quickly scrubbing through tracks, in situations where you're trying to locate specific lines or music cues. It also enables this brief sample preview to

loop endlessly when you hold the playhead on a frame, so you can pause while scrubbing and hear (by default) the current 80 ms prior to the playhead as it loops. A pair of settings let you customize this behavior.

- **Loop Jog Alignment:** Three options let you choose whether you loop audio Pre the position of the playhead, Centered on the playhead, or Post the position of the playhead.

- **Loop Jog Width:** A field lets you choose how many milliseconds of audio to loop when Loop Jog is enabled. How many milliseconds of audio corresponds to one frame depends on the frame rate of the video. For example, at a frame rate of 25 fps, there are 1000/25 = 40 ms per frame, so the default value of 80 ms equals two frames of looping.

Playback Settings

These preferences let you improve realtime performance in DaVinci Resolve by disabling specific UI features and optimizing the quality of some operations.

- **Hide UI overlays:** When using a single GPU for both display and CUDA, OpenCL, or Metal processing, or if your display GPU is underpowered, or if you lack the PCIe bandwidth required for the currently specified resolution or frame rate, you may be able to improve real time performance by turning this option on. When enabled, onscreen controls such as the cursor, Power Window outlines, and split-screen views are disabled and hidden during playback. When playback is paused, all onscreen controls reappear.

- **Minimize interface updates during playback:** When enabled, gives priority to real time performance during playback by reducing user-interface updates. This is helpful when you're creating complex grades on systems with low processing power, or when working on projects at high resolutions.

- **Performance Mode Automatic/Manual:** A trio of radio buttons let you choose between Automatic (default) and Manual (user selectable) behaviors when you turn on Performance Mode in DaVinci Resolve, or you can turn Performance Mode Off altogether. Set to Automatic, Performance mode automatically optimizes a variety of operations in a bid to balance performance with the necessary level of image quality, for fast onscreen performance while always maintaining the highest level of quality for video output. Set to Manual, there are three different settings you can choose to disable for instances where a particular performance tradeoff Resolve is making results in an undesirably noticeable reduction in image quality in Performance Mode:

  - **ptimized Sizing:** Relates to how image resizing is handled.

  - **Optimized Decode Quality:** Relates to how clip resolution vs. timeline resolution is handled.

  - **Optimized Image Processing:** Relates to how image processing operations are handled.

Control Panels

The parameters in this panel let you customize the functionality of the DaVinci Control panel. Some, but not all, of these settings apply to third party panels.

Panel Sensitivity

Lets you choose the orientation of red on the trackballs, how sensitive trackballs and rings are, and how sensitive the qualifier knobs are.

- **Classic DaVinci trackball alignment:** When enabled, this checkbox sets all color balance controls in DaVinci Resolve to the traditional orientation they've always used, which is close to, but not exactly the same as, the vectorscope alignment of hues. When disabled, the alignment of color balance controls is exactly the same as the vectorscope alignment of hues, which is similar to how other color grading applications work. You should choose the mode you're most familiar with.

– **Grading style:** Controls the orientation of the trackballs relative to the corrections they make. There are two options:

  – **DaVinci:** Most users will be familiar with the standard DaVinci controls as this mimics the vectorscope (how closely depends on the Classic DaVinci trackball alignment setting).

  – **Rank:** The Rank settings are somewhat different, so this option is for users who are familiar with color controls that the Rank control system offered. In this mode, the orientation of red and green are reversed.

– **Lift RGB balance:** Controls how quickly adjustments made to the Lift trackball (on the left) will adjust the Lift Color Balance parameters in the Color page. This setting affects third-party panels.

– **Lift master:** Controls how quickly adjustments made to the Lift ring (surrounding the leftmost trackball) will adjust the Lift Contrast parameter in the Color page. This setting affects third-party panels.

– **Gamma RGB balance:** Controls how quickly adjustments made to the Gamma trackball (second from the left) will adjust the Gamma Color Balance parameters in the Color page. This setting affects third-party panels.

– **Gamma master:** Controls how quickly adjustments made to the Gamma ring (surrounding the second trackball from the left) adjust the Gamma parameter in the Color page. This setting affects third-party panels.

– **Gain RGB balance:** Controls how quickly adjustments made to the Gain trackball (third from the left) will adjust the Gain Color Balance parameters in the Color page. This setting affects third-party panels.

– **Gain master:** Controls how quickly adjustments made to the Gain ring (surrounding the third trackball from the left) will adjust the Gain Contrast parameter in the Color page. This setting affects third-party panels.

– **Cursor offset:** Controls how quickly adjustments made to the fourth trackball affect the cursor, window position, log-mode offset, and other controls that can be manipulated via this trackball.

– **Cursor master:** Controls how quickly adjustments made to the fourth ring affect log-mode master offset, and other controls that can be manipulated via this ring.

– **Hue/Saturation/Luminance qualifier:** Controls the sensitivity of the HSL panel control knobs.

– **Jog:** Controls the sensitivity of the jog wheel.

– **Shuttle:** Controls the sensitivity of the shuttle dial.

Display Settings

Lets you adjust the display of your Blackmagic Design control panels.

– **LCD brightness:** Controls the overall brightness of the DaVinci control panel displays.

– **Key backlighting:** Depending on which control panel you have selected, two controls let you choose LCD Brightness and Key backlighting of the DaVinci Resolve Mini panel, or three controls let you adjust the color balance of the lit buttons of the DaVinci Resolve Advanced control panel (the default is red).

Metadata

The metadata panel lets you create custom sets of metadata parameters that will be exposed in the Metadata Editor. For more information on using this panel, see Chapter 19, "Using Clip Metadata."

Keyboard Customization

Choosing DaVinci Resolve > Keyboard Customization opens the standalone Keyboard Customization window. This window lets you choose which set of keyboard shortcuts you want to use, discover which keyboard shortcuts are available, or create your own custom keyboard mappings that more closely adhere to the way you like to work, in whichever pages you find yourself working.

The Keyboard Customization window

Choosing Keyboard Shortcut Emulation Presets

Using a drop-down at the top right of this menu, you can choose the default DaVinci Resolve set or any one of the other sets that attempt to mimic other NLEs you might be more familiar with. Please note that keyboard shortcuts can only be remapped to commands that functionally exist within DaVinci Resolve, so if a specific feature of another NLE does not have an equivalent in DaVinci Resolve, that key shortcut may not be mapped in the same way. Fortunately, the editorial feature set of DaVinci Resolve broadly overlaps with common features in other NLEs, so you should find that most features you're used to have a functional equivalent.

You can choose one of the preset keyboard mappings to emulate another NLE you're familiar with or the default DaVinci Resolve keyboard mapping.

You also have the ability to create your own custom sets of keyboard shortcuts. The Commands list below shows a hierarchical list of commands organized by the menu they appear within. This list lets you select individual commands to remap and can be searched if you're having a hard time finding what you're looking for. This is described in more detail later in this section.

Viewing Commands Assigned to Specific Key Combinations

To see what command a particular key of the keyboard is mapped to, you can click any combination of modifier and other keys on the virtual keyboard at the top of this window. The currently selected keys reveal how they're mapped in the "Active Key" list below.
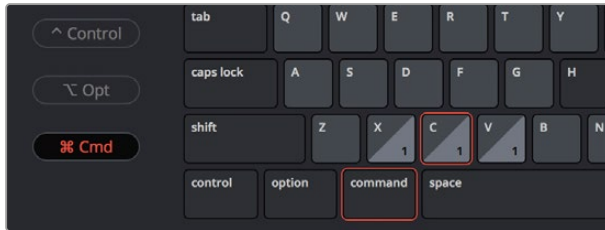

Selecting keys and modifiers on the virtual keyboard
displays their command mapping below

> **TIP:** Starting in DaVinci Resolve 15.2, commands can have multiple keys or key combinations assigned to them, and number keys on the numeric keypad of an extended keyboard can be assigned independently from keys at the top of a keyboard.

Panel-Specific Keyboard Mappings

When customizing keyboard shortcuts, they can be assigned to the "Application" so that shortcut works identically within every part of the DaVinci Resolve UI that's applicable, or you can map a particular keyboard shortcut to do a particular command within a specific panel.

Panel-specific keyboard shortcuts let you use a single key to do different things depending on which panel has focus; for example, one key can do different things in the Media Pool, the Edit Timeline, the Metadata Editor, and the Sound Library, to give a few Edit Page examples. This provides enormous flexibility, but if you go this route, you need to be aware of which panel has focus. Fortunately, starting in DaVinci Resolve 15.2, focus is indicated by a colored highlight at the top of each panel.
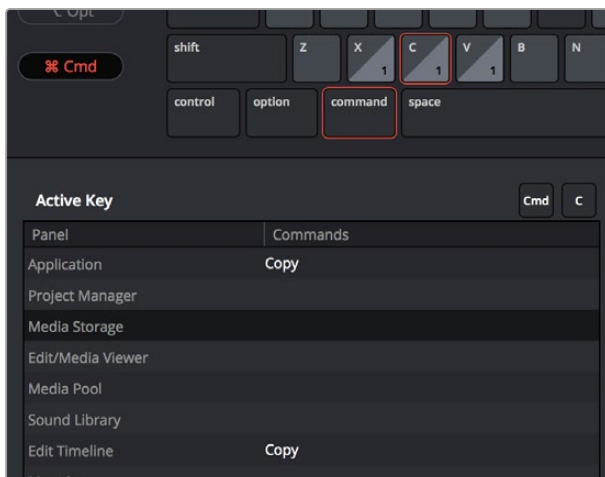
Keyboard shortcuts can now be mapped to specific panels so that different
panels can use the same shortcut to accomplish different things

Searching for Keyboard Shortcuts

Whether you're looking to see what keyboard shortcuts are available or looking for a particular command you want to customize, a Search field above the Commands list is available for searching whichever group of commands you want (including All Commands).

To search for specific keyboard shortcuts:

1 Choose DaVinci Resolve > Keyboard Customization.

2 Choose a command group from the Commands list to search within. If you want to search all of DaVinci Resolve, choose "All Commands."

3 Type a term into the Search field, and the Command/Keystroke list will update to show whatever commands match the search criteria you've entered.
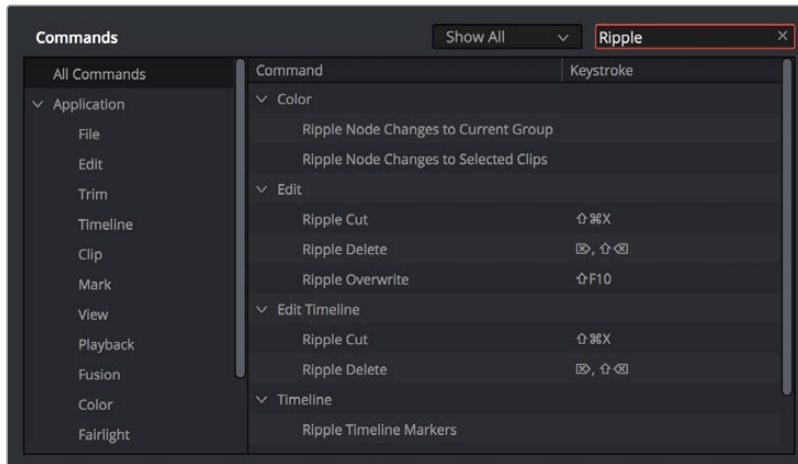
Selecting "All Commands" and searching for every keyboard shortcut corresponding to the word "ripple"

Managing Keyboard Mappings

DaVinci Resolve provides the following methods for creating and managing keyboard mappings in the Option menu of the Keyboard Customization menu:
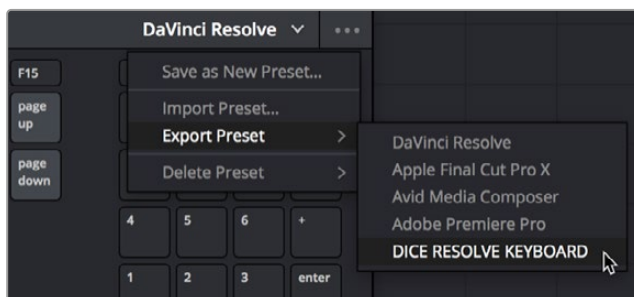
The Option menu of the Keyboard Customization window lets you export, import, and delete keyboard mappings

– **To create a new keyboard mapping:** Choose a keyboard mapping from the drop-down to use as your starting point, choose Save As New Preset from the Keyboard Customization Option menu, then enter a preset name in the dialog, and click OK. That preset will now appear in the preset drop-down menu.

– **To export a keyboard shortcut file for use by another DaVinci Resolve workstation:** Choose a preset from the Export Preset submenu of the Keyboard Customization Option menu, then choose a name and a location for the new file, and click Save.

– **To import a keyboard shortcut file:** Choose Import Preset from the Keyboard Customization Option menu, choose a DaVinci Resolve keyboard shortcut file, and click Open.

– **To delete a keyboard mapping:** Choose a keyboard mapping preset you want to delete, then click the trash can button.

Remapping a Command to One or More Keys

Changing the keyboard mapping for any given command is easy. You can even map a single command to multiple keys, if necessary.

To change the keyboard shortcut for a particular command:

1 Find the command you want to remap in the Commands list by selecting a category. If necessary, use the Search field. Whether a command is mapped generally to the entire application or specifically to a particular panel depends on what you've selected from the list.

a. If you want the keyboard character you plan to map to work application-wide, choose a menu name from underneath the Application category of the Commands list. Each menu shows all commands associated with it and can be individually searched.

b. If you want the keyboard character you plan to map to this command to be specific to a particular panel, then choose one from the Panels category underneath. Each panel shows all commands associated with it and can be individually searched.

2 Click within the Keystroke column of the list, to the right of the command, and when a selection appears type a new character using any combination of modifier keys you like.
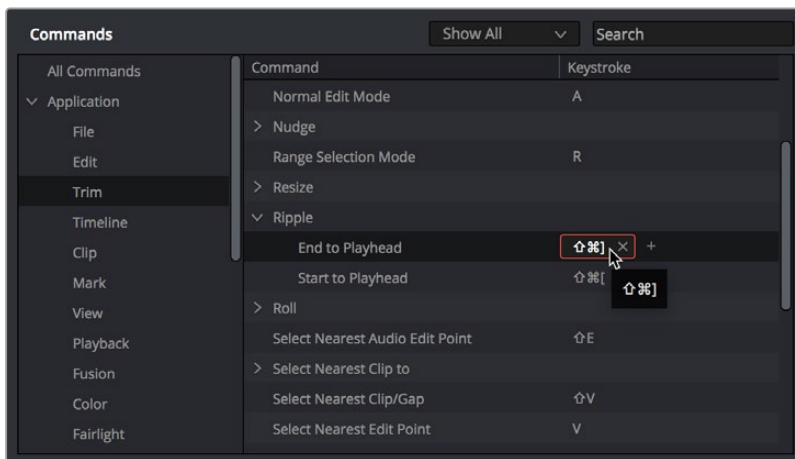
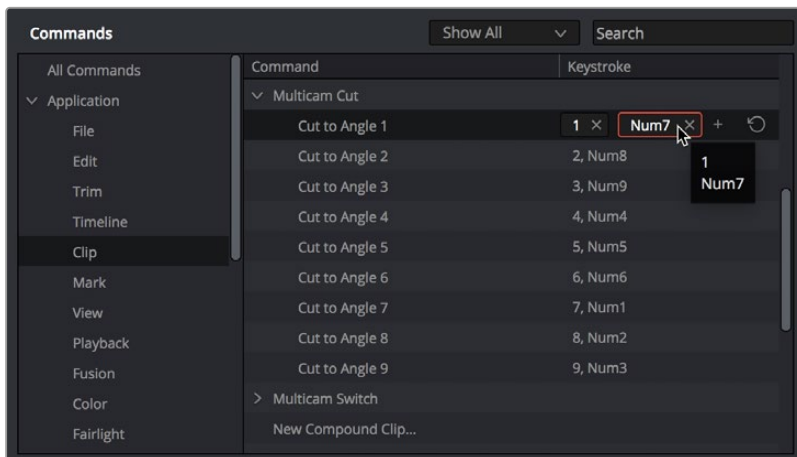Clicking to select a keyboard shortcut you want to modify

Please note that if you remap a key that was already assigned to another command, you'll see a warning that the key you're about to remap is already assigned to another command, giving you a chance to cancel and change key assignments if you like.
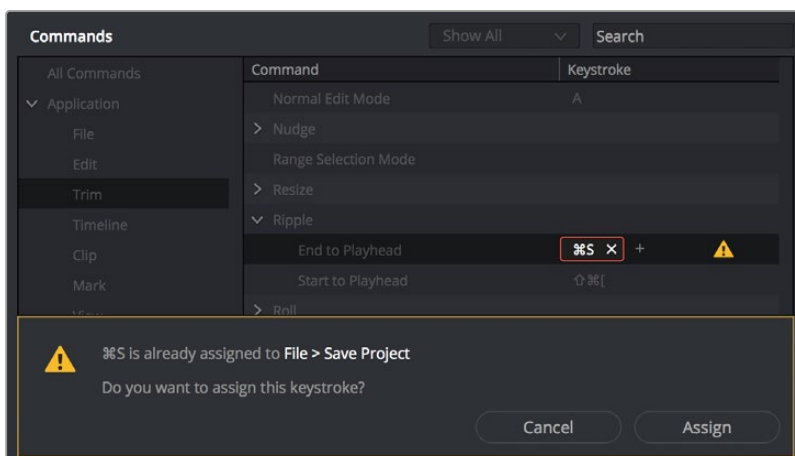
The warning you see if you try to map the same key to multiple commands

You can override the warning and make the assignment, but having the same character or combination applied to multiple commands can cause problems, so a warning badge appears next to affected commands, making it easy to see where the duplicate is, so you can remap one or the other command as necessary.

3   (Optional) You also have the option of assigning multiple keyboard shortcuts to a single command. For example, if you want to use keys on the numeric keypad of an extended keyboard in addition to other keys for a particular command, you can now set this up by clicking the "plus" button to the right of a currently assigned keyboard shortcut. This makes another highlight appear, within which you can type any secondary character or combination you like to make the additional assignment. You can do this as many times as you like. When you're done, all keyboard shortcuts applied to that command appear, separated by commas.

You can map multiple keys to the same command, if necessary

4   When you're finished changing keyboard shortcuts, click the Save button at the bottom right of the Keyboard Mapping list, and then click Cancel to close the window.

Chapter 5

DaVinci Control Panels Setup

There are several hardware control interfaces that are dedicated to more efficient workflows for specific pages in DaVinci Resolve. The DaVinci Control Panels Setup app is where you connect and configure these hardware interfaces.

Contents

DaVinci Control Panels Setup

DaVinci Resolve has many different hardware interfaces designed to increase your efficiency when working within certain pages. Specialized keyboards, color control surfaces, and audio mixing panels can be connected to your system, and the DaVinci Control Panels Setup is where you configure these devices.

The DaVinci Control Panels Setup utility is a separate application automatically installed alongside DaVinci Resolve. You can access this program directly from within DaVinci Resolve by choosing Help > DaVinci Control Panels Setup, or you can launch the program from the DaVinci Resolve folder in your OS.

Make sure your hardware is connected and powered on before launching the application.
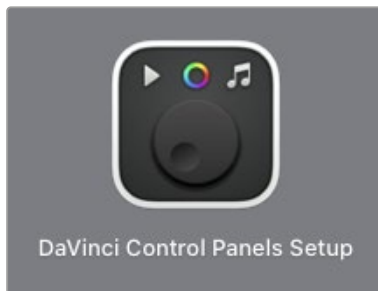
The DaVinci Control Panels Setup icon

DaVinci Control Panels Setup Layout

When you launch DaVinci Control Panels Setup, you will be presented with an interface showing you the detected hardware device on your system. If you have multiple hardware devices, you can scroll through them by clicking on the Left and Right Arrows on the sides of the window. If no devices are detected, the interface will tell you "No DaVinci control panels found."
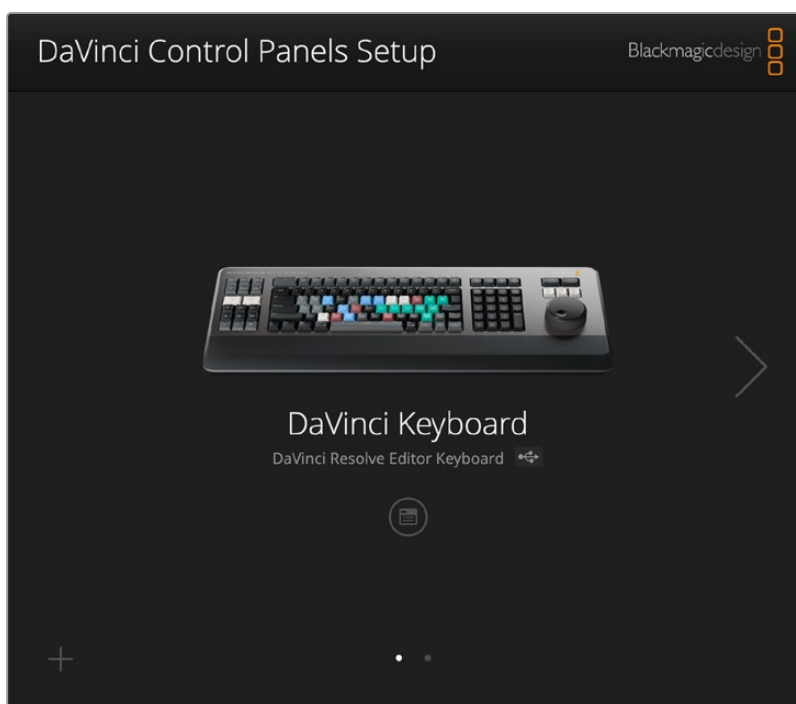
The DaVinci Control Panels Setup window showing a DaVinci Editor Keyboard attached.
The two dots below and the triangle to the right show another device connected as well.
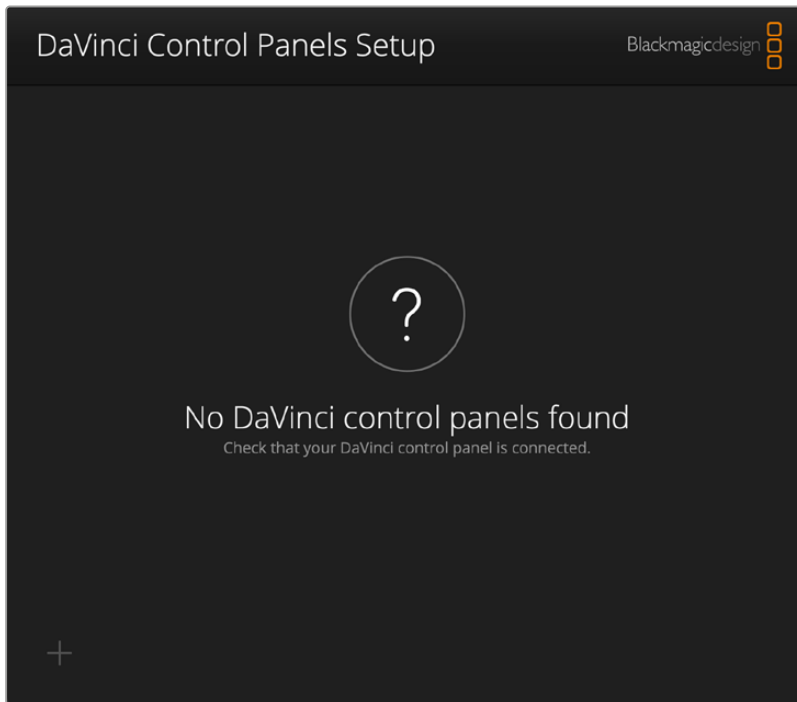
The DaVinci Control Panels Setup showing no detected hardware

Using DaVinci Control Panels Setup

The DaVinci Control Panels Setup presents a simple interface to connect to your devices, update their firmware, and modify their settings.
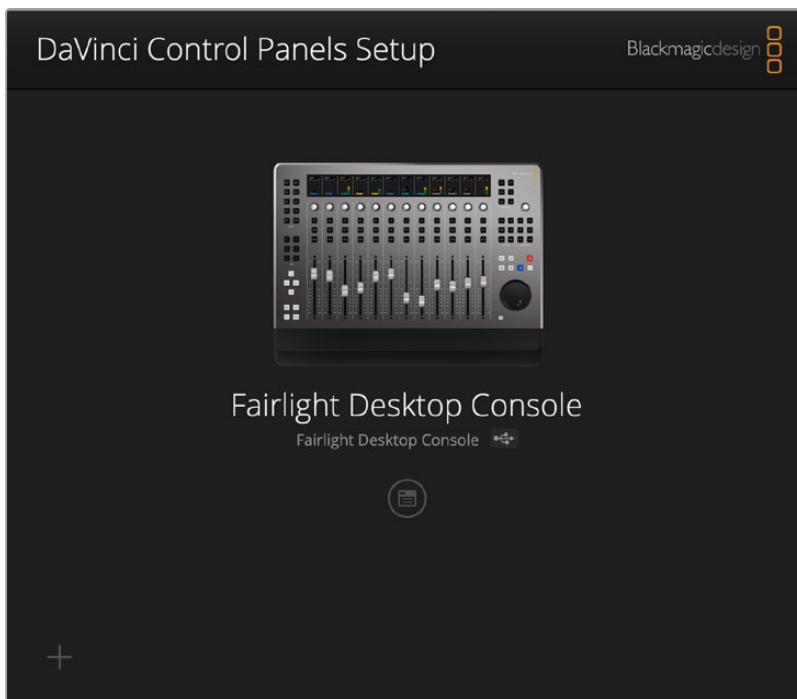
The DaVinci Control Panels Setup showing the Fairlight Desktop Console attached

Firmware

On startup, the DaVinci Control Panels Setup application will automatically check for any possible firmware updates for your device from the Blackmagic Design servers. If the application finds a newer firmware version it will ask you if you wish to update your device, or cancel and remain on your current firmware version. When updating, it's important not to unplug or power-down the device during the process as that can cause firmware corruption. Firmware updates include bug fixes and are required, in some cases, to use your device with new features in DaVinci Resolve. It is recommended to always update your device to the latest firmware unless you have a specific reason not to.
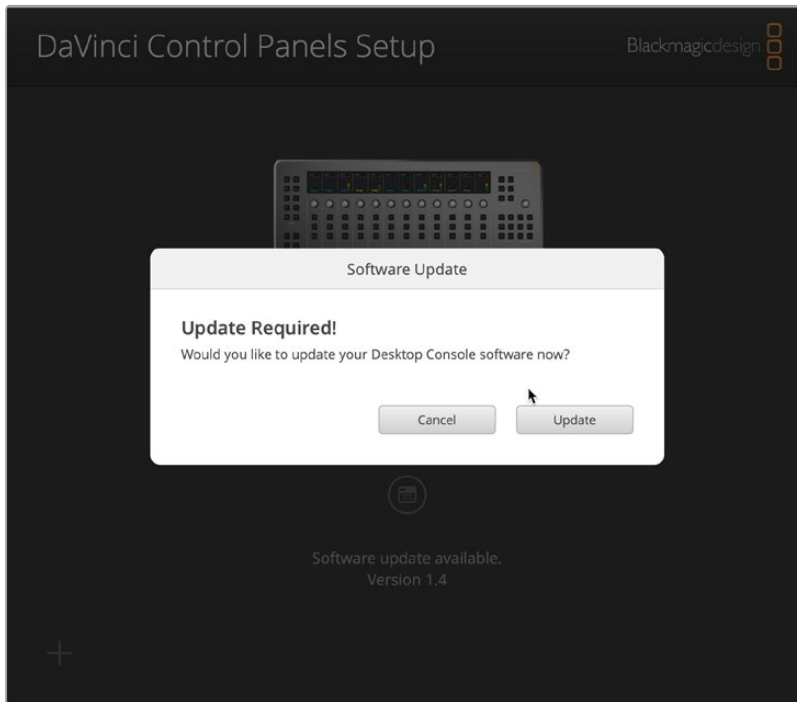
The firmware update dialog box
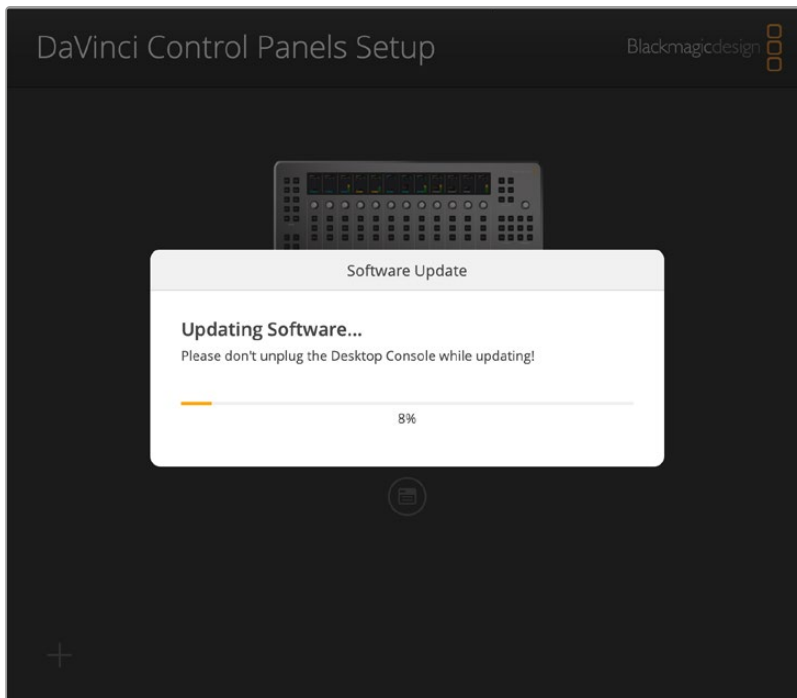
The firmware updating

Ethernet Connection

If you are connecting your device via Ethernet, you may need to enter its IP address before it can be configured in DaVinci Control Panels Setup. To do so, click on the "+" icon in the lower left corner of the interface. An Add DaVinci Control Panel window will appear, allowing you to type in the device's IP address. The device must be on the same Ethernet network as the computer you're connecting it to.
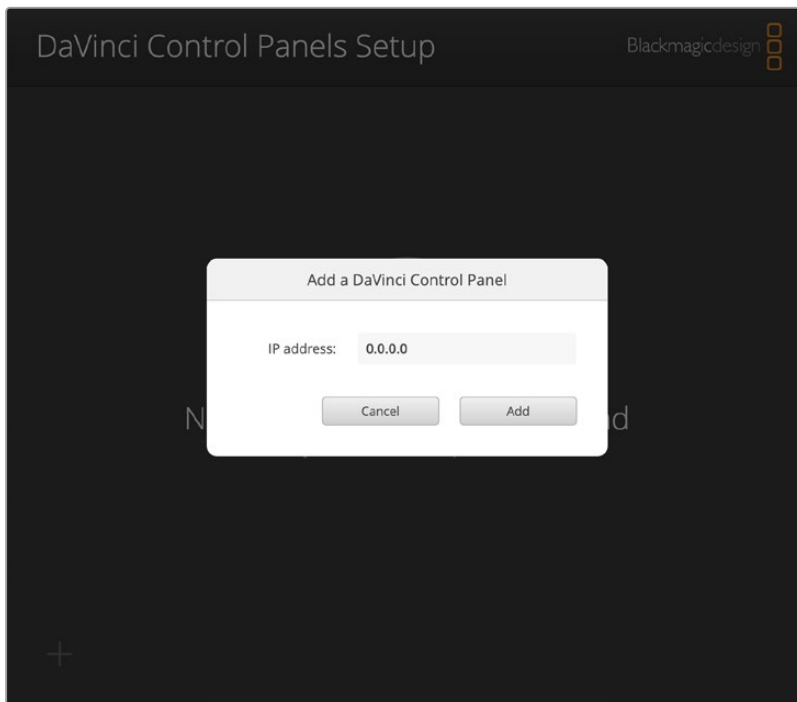
You can manually add an ethernet connected device by typing in its IP address.

Settings

You can access your device's settings by clicking on the setup icon directly below your device. Different hardware devices will have different settings, but generally they will be broken down into the following categories:

Setup

- **Name:** You can set a specific name for your hardware device to differentiate it in the interface and bluetooth selection preferences.

- **Software:** The current firmware version of the device.

Network

If your device has an ethernet connection, you can set up its networking settings. If you are new to networking, it is suggested that you leave the Protocol setting to DHCP, and let the computer figure it out. If you are part of a larger facility, you may want to consult with your IT department for the appropriate manual settings instead.

- **Protocol:** Choose whether you want the device's IP address to be set automatically by DHCP or to provide your own manual static IP address below.

- **IP Address:** You can manually assign the IP address for the device.

- **Subnet Mask:** You can manually assign the Subnet Mask for the device.

- **Gateway:** You can manually assign the Gateway address for the device.

Reset

– **Factory Reset:** Resets your device back to the factory defaults. This maybe useful in some troubleshooting situations.
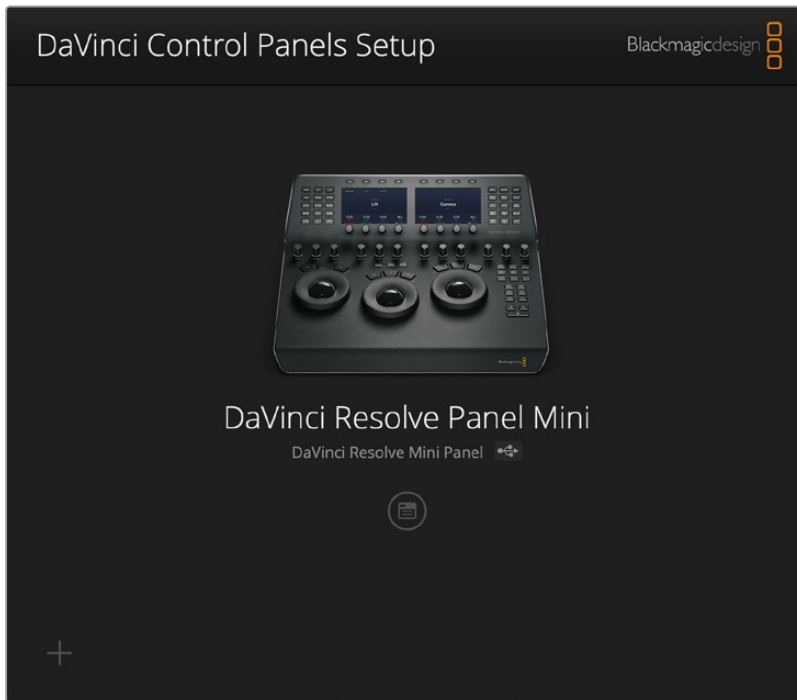
The DaVinci Control Panels Setup showing the DaVinci Resolve Mini Panel attached
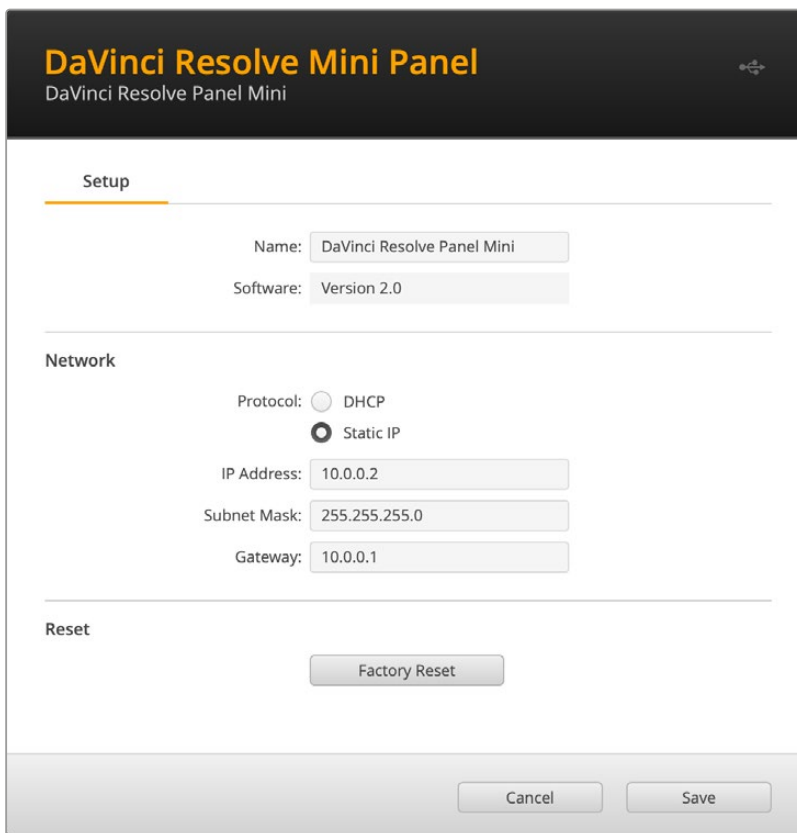
The Settings for the DaVinci Resolve Mini Panel

Chapter 6

Project Settings

This chapter covers the settings used for defining the properties of each individual project. It's a good idea to familiarize yourself with the information in this chapter prior to setting up your first project.

Contents

What Are the Project Settings?

The Project Settings window contains all project-specific parameters that are saved along with that project. These include essential project properties such as the timeline format, video monitoring settings, how to optimize media, and where to save cache files. It also includes image scaling properties, color management settings, and many other properties that affect projects in fundamental ways.

Opening and Editing Project Settings

All of these project-specific settings are easily accessed from anywhere in DaVinci Resolve by clicking the gear button at the bottom right of the page bar.

Project Manager and Project Settings buttons

The Project Settings window opens in the middle of the screen.
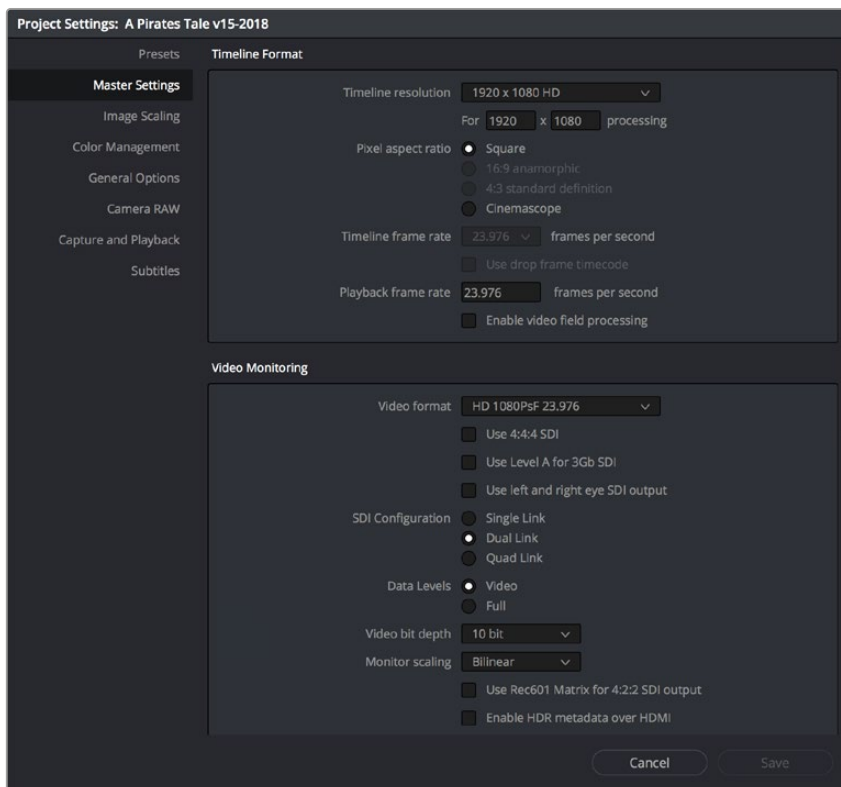
Project Settings window

The Project Settings window is divided into a series of panels which can be selected from a sidebar at the left. Each panel contains a collection of related settings that affects some category of DaVinci Resolve functionality.

To alter project settings:

1   Click on the name of any group of settings in the sidebar at the left to open that panel.

2   Change whatever settings you need to change.

3   Do one of the following to apply your changes:

– Click Save to apply the changes you've made and close the Project Settings.

– Option-click Save to apply the changes you've made and keep the Project Settings window open, so you can make other changes. This option is available because it's sometimes necessary to keep the Project Settings window open as you continue making changes that may visibly affect the clips and timelines in your project.

Presets

The Presets panel lets you save customized collections of Project Settings for future recall. Presets can save the state of nearly every parameter and setting in every panel of the Project Settings window, and make it easy to switch among different setups for different tasks, or to accommodate different types of projects.

There are three default items in the Presets list:

– **Current Project:** The current project's settings. If you load a preset, the current project becomes selected, showing that the preset you loaded has been applied to the current project.

– **System Config:** The System Config contains the default Project Settings that are used for all new projects that you create, and consists of the installed defaults that accompanied DaVinci Resolve. This config is uneditable, but you can use the Save As button to duplicate it as the basis for a new preset.

– **Guest default config:** This setting is a holdover from previous versions of DaVinci Resolve that had multi-user support. The default configuration for all new projects created by the currently logged in user. The actual name of this config reflects the current user name. This config can no longer be altered.

If you like, you can create your own presets, adding as many as you need to accommodate the types of projects you work on.

To create a new preset:

1   Do one of the following:

– Right-click a project in the Project Manager, and choose Project Settings from the contextual menu.

– Open any project, then open the Project Settings, and select the Presets panel.

2   Select any config in the Presets list that you want to use as the starting point of a new project preset, and click Save As.

3   Enter a name for the new preset you're creating into the Preset Name dialog, and click OK. A new preset should now appear in the Presets list.

4   Select the new preset you've just created.

5   Now, use the different panels of the Project Settings window to alter whichever settings you need to. There's no need to save your changes as you go, you'll save them all at once later.

6   When you're finished customizing the Project Settings, reopen the Presets panel and click Save. Your new preset is updated with the new settings you've chosen.

Once you've created one or more custom presets, you can load them into a project at any time.

To load a preset's settings into a project:

1 Open a project with a preset you want to update.

2 Click an item in the Presets list.

3 Click Load.

If a dialog appears saying either "Do you want to replace current project's config with this selected Preset" or "Apply Current Configuration to System?", click Yes.

4 If there's a custom preset that you've created that has outlasted its usefulness, you can delete it.

To delete a custom preset:

1 Do one of the following:

– Right-click a project in the Project Manager, and choose Project Settings from the contextual menu.

– Open any project, then open the Project Settings, and select the Presets panel.

2 Click an item in the Presets list to select it.

3 Click Delete.

4 When the Confirm Delete dialog appears, click Yes.

Master Settings

This panel is project specific and lets you set up and adjust the most essential properties of the timelines in your project, including the timeline format, video monitoring method, and conform options. In many workflows, you'll want to adjust these settings before getting started with your project.

By default, all timelines use these project-wide settings. However, beginning with DaVinci Resolve 16, you can optionally create timelines with individual Format, Monitoring, and Output Sizing settings. However, if you change a timeline to use "Basic Settings," then that timeline will mirror the project-wide options that are selected in the Project Settings.

Timeline Format

This group of settings affects the geometry and image processing of the current project.

– **Timeline resolution:** A drop-down menu that lets you choose a frame resolution preset to use for image processing while grading. DaVinci Resolve is resolution independent, so you can change the resolution at any time and all windows, tracks, sizing changes, and keyframe data will be automatically recalculated to fit the new size. For example, you can work on a 4K project while monitoring at HD resolutions if your room is only set up with an HD monitor, and then render the finished project at 4K resolution for final delivery. Alternately, you can downsize an HD project to an SD resolution to create another set of deliverables. For more information on Resolve's resolution independence, see Chapter 149, "Sizing and Image Stabilization."

– **Frame size (Labeled "For X x Y processing"):** Lets you set resolutions not found in the "Timeline resolution" drop-down menu.

– **Pixel aspect ratio:** Used to select PAR settings for image formats that don't use the default square pixel format. You can apply a 16:9 anamorphic PAR, a 4:3 PAR for SD projects, or a Cinemascope ratio.

– **Timeline frame rate:** Determines the primary frame rate used by the project. A variety of standard and high frame rate (HFR) settings are available. If you're importing an AAF or XML file, this setting is automatically set via an option in the Project Import dialog. Ideally, you should choose a frame rate before importing media into the Media Pool. However, the first time you import media into an empty Media Pool, you're prompted if the incoming media frame rate doesn't match the Timeline

frame rate set here, and you have the option of automatically updating this setting to match that of the media you're importing. Once one or more files have been added to the Media Pool, this setting cannot be changed.

- **Use drop frame timecode:** Enables or disables drop frame timecode for the current project. Off by default.

- **Enable interlace processing:** Interlaced media is supported throughout DaVinci Resolve. The "Enable interlace processing" checkbox forces DaVinci Resolve to process all operations internally using separated fields, in order to properly maintain the field integrity of interlaced clips in your program. In addition, each clip in the Media Pool has a Field Dominance drop-down menu in the Video panel of the Clip Attributes window that lets you specify whether clips are upper- or lower-field dominant; an Auto setting makes this choice by default.

  There is also a corresponding checkbox in the Render Settings panel of the Deliver page, named "Field rendering," that lets you enable and disable field rendering when you're rendering file-based output.

  There are two instances where you want to leave this setting turned off:

  - If you're working with progressive-frame media, it is not necessary to turn this checkbox on. Doing so will unnecessarily increase processing time.

  - If you're using interlaced clips in a progressive-frame project and you're intending to deinterlace those clips using the Enable Deinterlacing checkbox in the Clip Attributes window, then you must keep "Enable video field processing" off. Otherwise, the Enable Deinterlacing checkbox will be disabled for all clips. For more information about deinterlacing clips, see Chapter 22, "Modifying Clips and Clip Attributes."

  If you're working on a project with interlaced media that you intend to keep interlaced, then whether or not it's necessary to turn field processing on depends on what types of corrections you're applying to your clips. If you're mastering your program to an interlaced format, and you're applying any adjustments that would cause pixels from one field to move or bleed into adjacent fields, then field processing should be enabled; effects requiring field processing include filtering operations such as blur, sharpen, and OpenFX operations, as well as sizing transforms that include pan, tilt, zoom, rotate, pitch, and yaw.

  On the other hand, regardless of whether you're outputting interlaced or progressive-frame media, if you're not filtering or resizing your clips, and you're only applying adjustments to color and contrast, it's not necessary to turn on field processing for interlaced material, and in fact, leaving it off may somewhat shorten your project's rendering time.

- **Playback frame rate:** Usually mirrors the frame rate selected in the "Video format" setting (in the Video Monitoring section below), which is typically based on the frame rate of the external display that's connected to your video interface, given the "Timeline Frame Rate" setting. For example, a 50Hz monitor requires a 25 fps playback frame rate for synchronous display without dropped frames. If you want to monitor playback at a slower frame rate, type the frame rate of your choice in this field and DaVinci Resolve will make the appropriate calculations to drop or repeat frames as necessary to match it. This can be useful for temporarily seeing how clips look in slow motion.

Video Monitoring

The settings available in this group control the signal that's output by the video output interface that's connected to your workstation, and let you specify what standard of signal is output, and via which signal path.

By default the frame size and frame rate match those in the Timeline resolution and Playback frame rate options. However, if necessary you can change these settings to match those of the external display you're using to monitor your work. For example, if you're working with 2K files for 2K output, but you're color correcting using a high definition monitor set to 1080 resolution, you can select the appropriate HD standard for that monitor without changing the Timeline Resolution settings.

– **Video format:** Lets you choose a video standard combination of frame size and frame rate to be output via your connected video output interface.

– **Video connection checkboxes:** Lets you choose the signal standard to output from your connected video output interface to the video monitor. Make sure to choose a standard that's supported by both your video interface and your monitor. The options are:

  – **Use 4:4:4 SDI:** A signal path for monitoring image data to monitors that supports 4:4:4 chroma sampling, typically over SDI connections.

  – **Use Level A for 3Gb SDI output:** A signal path for monitoring image data via a single 3 Gb/s SDI connection.

  – **Use dual outputs on SDI output:** All DaVinci Resolve systems can generate a side-by-side display that can be sent to a Stereoscopic monitor via the HD-SDI output of an UltraStudio 4K or DeckLink card. When dual SDI 3D monitoring is enabled, each eye is output separately at full resolution. In this mode, split-screen wipes and cursors will not be visible on the grading monitor.

– **SDI Configuration:** Lets you choose from among Single Link, Dual Link, and Quad Link SDI, depending on what your display supports.

– **Data Levels:** This setting only affects the data levels being output via the video interface that connects the DaVinci Resolve workstation to your external display. It has no effect on the data that's processed internally by DaVinci Resolve, or on the files written when you render in the Deliver page. It is imperative that the option you choose in DaVinci Resolve matches the data range to which your external display is set. Otherwise, the video signal will appear to be incorrect, even though the internal data is being processed accurately by DaVinci Resolve. There are two options:

  – **Video:** This is the correct option to use when using a broadcast display set to the Rec. 709 video standard.

  – **Full:** If your monitor or projector is capable of displaying "full range" video signals, and you wish to monitor the full 10-bit data range (0–1023) while you work, this is the correct option to use.

  For more information about data levels, see Chapter 9, "Data Levels, Color Management, and ACES."

– **Retain sub-black and super-white data:** Turning this checkbox on lets DaVinci Resolve output the undershoots (sub-black) and overshoots (super-white) within the headroom of video encoded data levels to video. When this is turned off, these out-of-bounds values are clipped in video output.

– **Video bit depth:** Choose the bit depth that corresponds to the capability of your display. You can choose between 8-bit and 10-bit. Monitoring in 10-bit is more processor intensive, but preferable to avoid the appearance of banding that may not in fact be in the image data being processed by DaVinci Resolve.

– **Monitor scaling:** Defaults to basic, and is only enabled to smooth the edges of video being viewed on a projector with very large screens. These settings minimize high frequency artifacts that may be seen. This may also be noticeable if you have a 2K or HD project but are monitoring on an SD monitor. The other option, Bilinear, has different effects on the monitored image depending on your display device, so you may need to check to verify that it's appropriate for your environment.

– **Use Rec601 Matrix for 4:2:2 SDI output:** Don't use this checkbox unless you know what it does. You know who you are.

– **Enable HDR metadata over HDMI:** (only available in Studio version) Turning on this checkbox outputs the metadata necessary to send High Dynamic Range signals over HDMI 2.0a and have it be correctly decoded by an HDR-aware video display. When this checkbox is enabled, it's recommended to also enable the "HDR mastering is for X nits" checkbox in the Color Management page, and set the "nit" level (slang for cd/m2) to whatever peak luminance level your HDMI connected HDR display is capable of.

Optimized Media and Render Cache

These settings govern the resolution and codec of optimized media that DaVinci Resolve can generate in order to facilitate greater real time performance, as well as cached media that's generated by the Smart and User Cache.

– **Proxy media resolution:** A drop-down list lets you choose whether to generate proxy media at each clip's Original size, or at Half, Quarter, One-Eighth, or One-Sixteenth the resolution of the original media, or allow DaVinci Resolve to choose this automatically for you based on your timeline settings.

– **Proxy media format:** Specifies the format in which proxy media files will be written. You can choose from among a variety of Uncompressed, ProRes, and DNxHD formats, depending on your requirements.

– **Optimized media resolution:** A drop-down list lets you choose whether to generate optimized media at each clip's Original size, or at Half, Quarter, One-Eighth, or One-Sixteenth the resolution of the original media, or allow DaVinci Resolve to choose this automatically for you based on your timeline settings.

– **Optimized media format:** Specifies the format in which optimized media files will be written. You can choose from among a variety of Uncompressed, ProRes, and DNxHD formats, depending on your requirements.

– **Render cache format:** Specifies the format in which render cache files will be written. You can choose from among a variety of Uncompressed, ProRes, and DNxHD formats, depending on your requirements.

– **Enable background caching after X seconds:** Specifies the duration of inactivity after which automatic background caching will begin.

A series of checkboxes let you force specific types of effects to be cached when you use the User Cache, which is a more selective manner of caching than the Smart Cache. These include:

– **Automatically cache transitions in User Mode:** If you're using User mode and you find that your workstation does not have adequate performance to play transition effects in real time, you can force these categories of effects to be automatically included in the Sequence Cache and cached when you're using the User mode of caching.

– **Automatically cache composites in User Mode:** If you're using User mode and you find that your workstation does not have adequate performance to play composite mode or opacity effects in real time, you can force these categories of effects to be automatically included in the Sequence Cache and cached when you're using the User Mode of caching.

– **Automatically cache Fusion Effects in User Mode:** If you've created effects for a clip in the Fusion page and you find that your workstation does not have adequate performance to play that clip in real time, you can force these categories of effects to be automatically included in the Sequence Cache and cached when you're using the User Mode of caching.

Working Folders

These fields let you specify to which folders cache and gallery files are written.

– **Proxy generation location:** All proxy media files that you create are saved in the directory path specified by this field.

– **Cache files location:** All render cache files that you create are saved in the directory path specified by this field. This path defaults to a hidden "CacheClip" directory that's created at the location of the first Media Storage Volume you specify in the DaVinci Resolve Preferences window.

– **Gallery stills location:** By default, all stills you save are saved in the DPX format, and are placed in the directory path specified by this field. This path defaults to a hidden ".gallery" directory that's created at the location of the first Media Storage Volume you specify in the DaVinci Resolve Preferences window.

Frame Interpolation

These settings determine the default state for all retiming and speed change effects, including when clips are in mixed frame rate timelines.

— **Retime Process:** This drop-down menu lets you choose a default method of processing clips that don't match the project frame rate in mixed frame rate timelines and clips with speed effects (fast forward or slow motion) applied to them, throughout the project. Since each clip in every timeline defaults to "Project Settings," changing this setting will change the way most mixed frame rate and speed effected clips will be processed, except for those with custom settings selected. There are three options:

— **Nearest:** The most processor efficient and least sophisticated method of processing; frames are either dropped for fast motion, or duplicated for slow motion.

— **Frame Blend:** Also processor efficient, but can produce smoother results; adjacent duplicated frames are dissolved together to smooth out slow or fast motion effects. This option can provide better results when Optical Flow displays unwanted artifacts.

— **Optical Flow:** The most processor intensive, but highest quality method of speed effect processing. Using motion estimation, new frames are generated from the original source frames to create slow or fast motion effects. The result can be exceptionally smooth when motion in a clip is linear. However, two moving elements crossing in different directions or unpredictable camera movement can cause unwanted artifacts.

— **Motion estimation mode:** When using mixed frame rate clips in a timeline that has Optical Flow retiming enabled, when using Optical Flow to process speed change effects, or when using Image Stabilization or Temporal Noise Reduction controls in the Color page, the Motion Estimation drop-down of the Master Settings (in the Project Settings window) lets you choose options that control the trade-off between speed and quality.

There are additional "Enhanced" Optical Flow settings available in the "Motion estimation mode" drop-down in the Master Settings panel of the Project Settings. The "Standard Faster" and "Standard Better" settings are the same options that have been available in previous versions of DaVinci Resolve. They're more processor-efficient and yield good quality that are suitable for most situations. However, "Enhanced Faster" and "Enhanced Better" should yield superior results in nearly every case where the standard options exhibit artifacts, at the expense of being more computationally intensive, and thus slower on most systems.
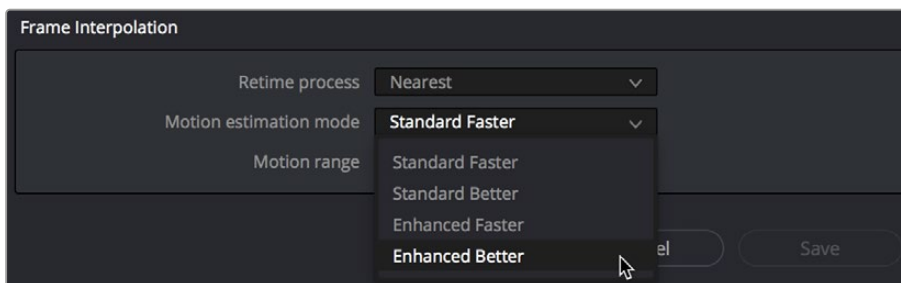
New improved Motion estimation mode settings in the Master Settings panel of the Project Settings

— **Motion range:** When using mixed frame rate clips in a timeline that has Optical Flow retiming selected, or when using Optical Flow to process speed change effects, this drop-down menu lets you choose the default setting to use, small, medium or large motion, for all speed and motion related calculations so you can try and improve the result by matching the type of motion in the source media. This setting can also be changed on a clip by clip basis in the Edit page Inspector.

Image Scaling

The Image Scaling panel contains settings that determine how and when clips are resized for various reasons.

Image Scaling

These settings affect the methods used to resize clips in various situations.

– **Resize Filter:** The first group of settings lets you choose the filter method used to interpolate image pixels when resizing clips:

  – **Smoother:** May provide higher quality for projects using clips that must be scaled down to fit an SD resolution frame size.

  – **Bicubic:** While the Sharper and Smoother options are slightly higher quality, Bicubic is still an exceptionally good resizing filter and is less processor intensive than either of those options.

  – **Bilinear:** A lower quality setting that is less processor intensive. Useful for previewing your work on a low-performance computer before rendering, when you can switch to one of the higher quality options.

  – **Sharper:** Usually provides the best quality in projects using clips that must be scaled up to fill a larger frame size or scaled down to HD resolutions.

  – **Custom:** This setting lets you take control of the exact algorithm used in all resizing operations. The custom Resize Filter options available are: Bessel, Box, Catmul-Rom, Cubic, Gaussian, Lanczos, Mitchell, Nearest Neighbor, Quadratic, and Sinc. In practice, the difference between these methods can be quite subjective. However, if you need to match a specific resizing method used from another application, you can do it here. For everyday use, the normal resizing filters in DaVinci Resolve should be sufficient.

– **Override input scaling:** Checking this box lets you choose an Input Sizing preset to apply to the project.

– **Override output scaling:** Checking this box lets you choose an Output Sizing preset to apply to the project.

– **Anti-alias edges:** A second group of settings lets you choose how to handle edge anti-aliasing for source blanking.

  – **Auto:** Adds anti-aliasing when any of the Sizing controls are used to transform the image. Otherwise, anti-aliasing is disabled.

  – **On:** Forces anti-aliasing on at all times.

  – **Off:** Disables anti-aliasing. It might be necessary to turn anti-aliasing off if you notice black blurring at the edges of blanking being applied to an image.

– **Deinterlace quality:** (only available in Studio version) A fourth group of settings lets you choose the quality/processing time tradeoff when deinterlacing Media Pool clips using the Enable Deinterlacing checkbox in the Clip Attributes window. There are two settings:

  – **Normal:** A high-quality deinterlacing method that is suitable for most clips. For many clips, Normal is indistinguishable from High. Normal is always used automatically during playback in Resolve.

  – **High:** A more processor-intensive method that can sometimes yield better results, depending on the footage, at the expense of slower rendering times.

  – **DaVinci Neural Engine:** This option uses the advanced machine learning algorithms of the DaVinci Neural Engine to analyze motion between the fields of interlaced material and reconstructs them into a single frame. This option is very computationally intensive but, ideally, will deliver an even more aesthetically pleasing result than the "high" setting.

Input Scaling

Contains one setting, Mismatched resolution files, that lets you choose how clips that don't match the current project resolution are handled. There are four options:

- **Center crop with no resizing:** Clips of differing resolution are not scaled at all. Clips that are smaller than the current frame size are surrounded by blanking, and clips that are larger than the current frame size are cropped.

- **Scale full frame with crop:** Clips of differing resolution are scaled so that the clip's shortest dimension is fit to match the frame. Excess pixels are cropped.

- **Scale entire image to fit:** The default setting. Clips of differing resolution are scaled so that the clip's longest dimension is fit to match the frame. The shorter dimension has blanking inserted (letterboxing or pillarboxing).

- **Stretch frame to all corners:** Useful for projects using anamorphic media. Clips of differing resolutions are squished or stretched to match the frame size in all dimensions. This way, anamorphic media can be stretched to match full raster, or full raster media can be squished to fit into an anamorphic frame. An added benefit of this setting is that it makes it easy to mix anamorphic and non-anamorphic clips in the same project.

Output Scaling

These settings let you optionally choose a different resolution to be output via your video output interface, for monitoring, outputting to tape, or rendering. In particular, if you set the resolution in the Render Settings list of the Deliver page to something other than the Timeline Resolution, these settings are used to make the change (for example, if you're rendering a downconversion of the current timeline). This can be used in situations where you're working on a high resolution 4K project, but you want to monitor using an HD display and output HD resolution media for approval.

- **Match timeline settings:** Turned on by default, so that these settings mirror the Timeline Resolution, Image Scaling, and Input Image Scaling settings described above. Turning this checkbox off lets you choose different settings for monitoring, outputting to tape, or rendering, using the other settings in this group.

- **Output resolution:** Lets you choose an alternate resolution.

- **For:** Lets you specify a different custom alternate resolution.

- **Pixel aspect ratio:** Lets you specify an alternate pixel aspect ratio to match the alternate timeline format.

- **Mismatched resolution files:** Lets you choose an alternate way of handling mismatched resolution files given the alternate resolution you've chosen. These options work identically to those of the "Input Image Scaling" group.

- **Super Scale:** Sets a very processor-intensive and high quality upscaling algorithm that actually creates new pixels for the resized image. The possible values are: None, 2x, 3x, 4x, and Auto. For more information on Super Scale, see Chapter 11, "Image Sizing and Resolution Independence."

Color Management

The various options found in the Color Management panel let you configure DaVinci Color Management (RCM) or ACES if you have either enabled, and they also allow you to pre- or post-process the DaVinci Resolve image processing pipeline using LUTs and Broadcast Safe settings, in order to accommodate a wide range of different color workflows.

Color Space and Transforms

If you choose DaVinci YRGB Color Managed or ACES in the Color Science menu at the top, then the other drop-down menus in this section become enabled. For more information about DaVinci Resolve Color Management and ACES, see Chapter 9, "Data Levels, Color Management, and ACES." If you're new to color or color management, you're strongly recommended to read this chapter.

If you choose to use Resolve Color Management (RCM), ACEScc, or ACEScct, the settings in this panel give you extensive control over how color is transformed, starting with choosing the default color settings for the source media in your project (via the Input Color Space), through choosing how you want your grading controls in DaVinci Resolve to behave (via the Timeline Color Space), and then specifying how the final color will look on your monitor and output device (via the Output Color Space).

– **Color science:** There are four options that let you choose whether to work with manual or automated color management.

  – **DaVinci YRGB color science:** DaVinci Resolve's original color science, in which you manage all and any color transforms from one color space to another manually, using either LUTs or manual adjustments.

  – **DaVinci YRGB Color Managed:** Enables the Resolve color-managed workflow (RCM) for grading.

  – **DaVinci ACEScc or ACEScct:** Both of these are standardized color management schemes that are available for facilities using ACES workflows. Of the available settings, ACEScct is the most intuitive way of working for most colorists, as it handles the lifting of shadows in a creatively useful way. For more information about Color Management and ACES, see Chapter 9, "Data Levels, Color Management, and ACES."

– **ACES version:** This drop-down only appears if you choose one of the DaVinci ACES options from the Color science drop-down menu. Lets you switch between different versions of the ACES specification. This lets you choose the appropriate older version of ACES whenever you open an older project. As of DaVinci Resolve 14, ACES 1.0.3 is the minimum supported version. In version 16, DaVinci Resolve also supports ACES 1.1.

– **Use Separate Color Space and Gamma:** If this checkbox is turned off (the default), the Color Management panel of the Project Settings exposes one drop-down each for the Input, Timeline, and Output Color Space settings, and each setting simultaneously transforms the gamut and gamma, depending on which option you choose. If you turn this checkbox on, then the Color Management panel changes so that the Input, Timeline, and Output Color Space settings each display two pop-ups. The first drop-down lets you explicitly set the gamut, while the second drop-down lets you explicitly set the gamma.

  To provide more detailed information, the simple and advanced global controls available for Resolve Color Management (RCM) are covered in a dedicated chapter. For more information, see Chapter 9, "Data Levels, Color Management, and ACES."

Dolby Vision™

DaVinci Resolve includes a GPU-accelerated software version of the Dolby Vision CMU (Content Mapping Unit) for doing Dolby Vision grading and finishing workflows right in either the free version of DaVinci Resolve or in DaVinci Resolve Studio. This is enabled and set up in the Color Management panel of the Project Settings with the Enable Dolby Vision checkbox.
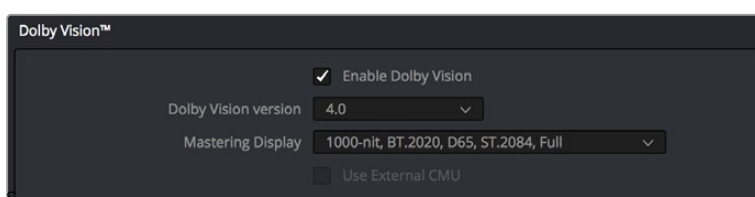
Dolby Vision settings in the Color Management panel of the Project Settings

There are five controls available:

- **Enable Dolby Vision:** Turns Dolby Vision on and off. When on, this checkbox enables the Dolby Vision palette in the Color page.

- **Dolby Vision version drop-down:** Lets you choose which version of the Dolby Vision algorithms to use. Options at the time of this writing include 2.9 and 4.0.

- **Master Display drop-down:** Lets you choose the nit level and gamut of the master HDR display you're grading on.

- **Use External CMU:** A checkbox lets you choose whether to use the built-in software CMU or a hardware CMU that you have connected to your DaVinci Resolve workstation.

> **NOTE:** Dolby Vision controls are available to all DaVinci Resolve users for monitoring and automatically generating Dolby Vision metadata for creating other HDR and SDR deliverables from the HDR grade you've made. However, if you want to be able to make manual trims on top of this automatic analysis, you must email dolbyvisionmastering@dolby.com for more information on obtaining a license.

HDR10+

DaVinci Resolve supports the new HDR10+ HDR format by Samsung. Please note that this support is a work in progress as this is a new standard. When enabled, an HDR10+ palette exposes trimming parameters that let you trim an automated downconversion of HDR to SDR, creating metadata to control how HDR-strength highlights look on a variety of supported televisions and displays. This is enabled and set up in the Color Management panel of the Project Settings with the Enable HDR10+ checkbox. Turning HDR10+ on enables the Dolby Vision palette in the Color page.
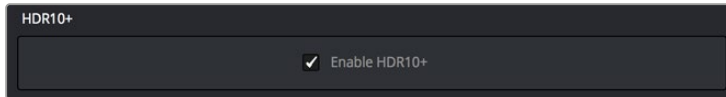
HDR10+ settings in the Color Management panel of the Project Settings

Lookup Tables

This group of controls lets you add LUTs to the Resolve image processing pipeline that affect every timeline in the entire project all at once. These LUTs can be used for a wide variety of functions, such as to trim Timeline grades, apply Log to Linear conversions, simulate film output, and limit the signal to accommodate Broadcast Safe requirements. Different options let you insert image processing to different stages of the pipeline as seen in the following diagram:
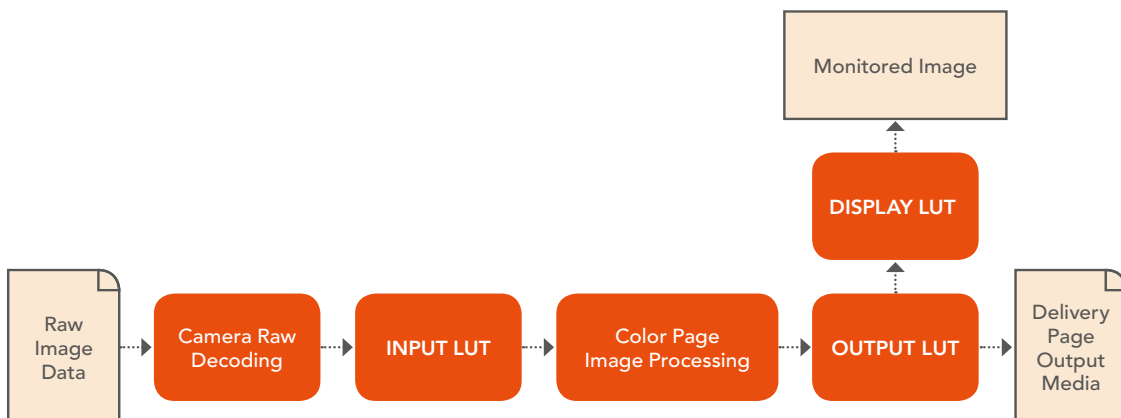
Keep in mind that since you can apply both 1D and 3D LUTs simultaneously, 1D LUTs at each step are always applied before 3D LUTs.

– **Input Lookup Table:** Two drop-down menus let you add 1D and/or 3D LUTs that process the current Timeline before every other image processing operation in DaVinci Resolve.

– **Output Lookup Table:** Two drop-down menus let you add 1D and/or 3D LUTs that process the current Timeline after the operations applied in the Color page, but before the temporarily applied Display LUT.

– **Video Monitor Lookup Table:** Two drop-down menus let you add 1D and/or 3D LUTs that process the current Timeline after every other image processing operation in DaVinci Resolve. However, Display LUTs are only temporarily applied for purposes of monitoring; they're never applied to rendered media, or to the signal that is output to tape using the controls in the Deliver page. Display LUTs are particularly valuable for applying a film print emulation LUT in a Log workflow, or for applying a monitor calibration LUT if you're outputting to a single display and you don't have dedicated outboard calibration hardware.

Here's an example. It's common, when grading for film output using a Log workflow, that you'll use the Display LUT drop-down menu to apply a film emulation LUT that simulates the image as it will be output from the film recorder, taking into account the film lab and print stock used, in order to make sure that the image you're grading will appear as close as possible to what the eventual release print will look like in the cinema.

– **Color Viewer Lookup Table:** Two drop-down menus let you add 1D and/or 3D LUTs that process the image shown in the Viewer on your computer display, independently of the Display LUT that's used to output to your broadcast display. By default, this follows the Video Monitor LUT setting, but you can also use this option to apply a specific calibration transform for your computer monitor. Alternately, you could use it to desaturate the GUI Viewer to be able to specifically evaluate image contrast, or if you don't want to have to argue with your client over which display looks correct.

– **Scopes Lookup Table:** Ordinarily, DaVinci Resolve's internal software video scopes provide an unbiased analysis of the actual video data levels within the Resolve image processing pipeline. However, you can choose to have the software scopes use the Video Monitor LUT selection, or any other LUT installed on your system, to transform this analysis to reflect the monitored output.

– **3D Lookup Table Interpolation:** Lets you choose the processing quality of both LUT and DCTL operations in DaVinci Resolve. 3D Lookup tables (LUTs) are 3D tables of red, green, and blue values that specify an output color value for each input color value, thereby providing a method of making color transformations using pre-calculated data. While powerful, 3D LUTs have finite detail; for example, one might have a 17x17x17 LUT that specifies 4913 individual color transforms. When applied to a floating point image that contains more data than the LUT specifies transforms for, color values falling between the 17x17x17 color transforms specified by the LUT need to be interpolated. You can choose from two methods that trade off processing efficiency for higher quality:

  – **Trilinear:** (Default) Trilinear is backward compatible with grades that use LUTs from previous versions of DaVinci Resolve and matches the look of LUTs being applied in other applications.

  – **Tetrahedral:** Tetrahedral is slightly more processor-intensive, but results in higher image quality LUT and DCTL processing, with reduced color-banding. Tetrahedral is recommended for projects that don't need backward compatibility with previous versions of DaVinci Resolve or LUTs created in other applications.

– **Update Lists button:** Refreshes the LUT drop-down menus if you've added new LUTs to your system since DaVinci Resolve has been opened.

– **Open LUT Folder button:** This selection opens the master folder in your file system, as described in the list of DaVinci Resolve LUT paths shown above.

Adding Lookup Tables to Your DaVinci Resolve Installation

The drop-down menus in the Color Management panel include a series of factory preset LUTs that were installed with DaVinci Resolve, along with any LUTs that have been generated by DaVinci Resolve, or that you've imported into the proper directory for your operating system.

On macOS: Library/Application Support/Blackmagic Design/DaVinci Resolve/LUT/

On Windows: C:\ProgramData\Blackmagic Design\DaVinci Resolve\Support\LUT

On Linux: /opt/resolve/LUT

If you downloaded the non-studio version of DaVinci Resolve from the Apple App Store, LUTs are saved in a different location in order for DaVinci Resolve to remain totally self-contained. In this case, you can click the "Open LUT Folder" button in the Lookup Tables panel of the Project Settings, to open up a Finder window at the location these LUTs are stored. You can use this window to copy LUTs that you want Resolve to have access to, or delete LUTs that you no longer need.

If you add a LUT to one of these directories after DaVinci Resolve has been opened, you can click the Update Lists button to refresh the contents of the drop-down menus.

DaVinci Resolve uses both 1D and 3D LUTs. 3D LUTs that are created by DaVinci Resolve are in the .cube format, configured as 33x33x33 cubes with 32-bit floating point processing. DaVinci Resolve can also read and use LUTs in the Shaperlut format.

Broadcast Safe

Broadcast Safe settings can be enabled while you grade to limit both the luma and chroma of the video signal to one of three levels of acceptable overshoots and undershoots.

– **Broadcast safe IRE (mV) levels:** A drop-down menu for choosing one of three levels of aggressiveness when limiting the signal. Choose the range that corresponds to your QC requirements.

– **Make Broadcast Safe:** A checkbox that turns broadcast safe limiting on and off.

> **NOTE:** The clipping imposed by Broadcast Safe itself does not have an inherently soft roll-off. For best results, Broadcast Safe should be used in conjunction with the Soft Clip controls in the Color page.

General Options

This panel presents a selection of general preferences that affect the interface and operation of DaVinci Resolve.

Conform Options

The settings in this group determine how clips are conformed to match imported project files with source media on disk by extracting timecode, reel names, file names, file paths, and so on. For more information on conforming and relinking, see Chapter 58, "Conforming and Relinking Clips."

– **Use Timecode:** Determines how DaVinci Resolve extracts timecode from referenced media files. There are two options:

  – **Embedded in the source clip:** The preferred setting for most projects to conform automatically and apply grades to the resulting clips. As long as DaVinci Resolve can reference the timecode in either a media file's timecode track, or in the header metadata of the frames in a DPX sequence, you can use timecode to reconform clips, or even completely change the media file to which a clip refers.

  – **From the source clip frame count:** This setting is useful if the source media lacks timecode metadata, and all that's available is a frame count that identifies frames via sequentially numbered integer values.

– **Conform partial clips with black gaps:** Inserts black frames whenever you conform a clip that doesn't contain all the required frames. When this option is selected, partial clips are flagged in the Edit page with a P in the thumbnail of the clip that it is lacking frames.

– **Automatically conform missing clips added to Media Pool:** Enabled by default, must be disabled to use collaborative workflow. When this checkbox is turned on, DaVinci Resolve maintains a dynamic relationship between clips in the Media Pool and those in a project's various timelines. When this checkbox is on and you import clips with matching timecode/file names/reel names to clips in a timeline, DaVinci Resolve will automatically reconform all matching missing clips, and all other timeline clips that have force conform turned off.

– **Assist using reel names from the:** When this checkbox is turned on, DaVinci Resolve uses reel numbers when conforming clips to match any imported project. This setting must also be turned on if you want to choose different reel name extraction methods for individually selected clips using the Clip Attributes window. Turning this checkbox off forces DaVinci Resolve to identify clips using file names when conforming XML and AAF projects. File names can only be used for conforming XML or AAF files, or when importing a DaVinci Resolve project.

  There are four options:

  – **Source clip file pathname:** Obtains the reel number by extracting it from each media file's path. This makes it possible to extract a reel number from all or part of the file name, or from all or part of the name of any folder in the path that encloses that file. This extraction is defined using the Pattern field.

  – **Pattern:** A code that defines how a reel number should be extracted from the source clip path name. For more information about creating patterns, see "Using the Pattern Field" in Chapter 58, "Conforming and Relinking Clips."

  – **Media Pool folder name:** The reel number is obtained from the name of the bin in the Media Pool that encloses that clip. This option is often used for stereo projects, deriving the reel number from "Left" and "Right" named directories. It's also useful for projects that are inheriting new VFX clips on a daily basis.

  – **Embedding in source clip file:** Useful for file formats where the reel number is embedded within the media file itself. QuickTime files created by Final Cut Pro, DPX frame files, and CinemaDNG files are all formats that are capable of containing reel number header data.

  – **Source clip filename:** If there is no defined reel number, often it's easy to just use the source clip filename. This is a safe option to use in situations where you want to manually choose different reel name extraction methods for individual clips using the Clip Attributes window.

– **Limit reel name matching to X characters:** For situations where you've been provided with media files with extra characters in the reel name that don't correspond to the names used in the project file you've been given, "Limit reel name matching to X characters" lets you omit a specific number of characters from the end of a reel name. This works in conjunction with the following setting.

– **Ignore the first X characters of the reel name:** For situations where you've been provided with media files with extra characters in the reel name that don't correspond to the names used in the project file you've been given, "Ignore the first X characters of the reel name" lets you omit a specific number of characters from the beginning of the reel name. Combined with the previous setting, you can trim any reel name to a conformable subset of characters.

– **Extract reel names from EDL comments:** Media file formats such as R3D have reel names, obtained from the file names, that are longer than the eight characters that are allowable in a standard EDL. This option allows DaVinci Resolve to extract reel names from appropriately formatted EDL comments, such as those output from Final Cut Pro 7.

– **Sort timeline using reel number and timecode:** Lets you change the behavior of C mode sorting in the Timeline. With this checkbox turned on (the default), all clips in the Timeline are sorted by reel number first, and then by source timecode. This way, clips with similar timecode from the same reel will appear next to one another in C mode. If you turn this checkbox off, reel number is ignored, and all clips in the Timeline are sorted only by source timecode. This may result in clips from multiple sources being mixed together, but it is useful in specific situations.

– **Mixed frame rate format:** (Only available prior to importing media into a project) This drop-down menu lets you choose the method used to conform mixed frame rates for rendering and playback. Which option you choose dictates the accuracy with which retimed clips in DaVinci Resolve match the same clips that were retimed in other editing applications when you import those timelines into DaVinci Resolve via XML or AAF. This drop-down menu also appears in the Load AAF or XML dialogs.

  – **If you're editing from scratch in DaVinci Resolve:** You should leave this setting set to "Resolve."

  – **When importing timelines via XML from Apple software:** Choose the "Final Cut Pro 7" or "Final Cut Pro X" methods of conform.

  – **When importing timelines via XML or AAF from Premiere Pro, Media Composer, Smoke, or other NLEs:** You should choose "Resolve."

  – **When none is selected:** DaVinci Resolve conforms and processes all clips in the Timeline to play at the frame rate that's selected in the "Timeline frame rate" drop-down menu. For example, 23.98, 29.97, 30, 50, 59.94 and 60 fps clips will all play at 24 fps if that's what "Timeline frame rate" is set to in the Master Project Settings, and clips will play slower or faster accordingly.

How clips in mixed frame rate timelines are rendered out depends on whether the Render Settings are set to render individual source clips or one single clip. When you render the Timeline as individual source clips, all clips are rendered individually at their original frame rate. If you select "single clip," all clips are converted to the "Timeline frame rate" frame rate and rendered as a single media file.

Color

These settings affect clip versions and timeline interactions when working in the Color page.

– **Automatically label gallery stills using:** When enabled, DaVinci Resolve automatically generates labels for all gallery stills you take based on the following controls:

  – **Naming drop-down:** Lets you choose what name to use for new stills. Options include: Clip Name, Clip Version Name, Source Timecode, Timeline Timecode, Timeline Name, Display LUT Name, Custom Label Using Tags (using metadata variables).

  – **Append still number on export checkbox:** When enabled, each new still has an appended still number. Where the number appears depends on the following radio buttons.

  – **As Suffix/As Prefix buttons:** Lets you choose to place still numbers at the end of an auto generated gallery label or at the beginning.

– **Luminance mixer defaults to zero:** Selecting this option sets the Y channel of the YRGB parameters for all grades to zero. This is required to be able to export a compliant ASC-CDL, and will impact all grades that use the Lum Mix control.

– **Use legacy Log grading ranges and curve:** DaVinci Resolve 12.5 introduced a modification to the Log grading controls that provides smoother, more pleasing results using the same controls. To maintain backward compatibility with older projects, a "Use legacy Log grading ranges and curve" checkbox in the Color panel of the Project Settings lets you switch your project between the older Log control behavior and the newer one. Older projects that are opened in DaVinci Resolve have this checkbox turned on by default, while new projects have this turned off by default.

– **Use S-curve for contrast:** On by default, this checkbox sets the contrast control in the Color Wheels palette to apply an "S-curve" to the image, such that the shadows and highlights of a signal will not be clipped when you increase the value. If you would prefer for these contrast adjustments to be made linearly, and for the signal to be allowed to clip when you reach the upper and lower boundaries of the video signal, you can turn this checkbox off.

– **Use legacy sizing interactions for windows and effects:** DaVinci Resolve 14.1.1 improved how window tracking applies transformations, to correctly handle things like pixel aspect ratio (par). New projects should leave this setting disabled, however older projects should leave this checkbox enabled to ensure tracking and transforms remain applied the way they were before.

– **Apply stereoscopic convergence to windows and effects:** When enabled, DaVinci Resolve correctly maintains the position of a window that's been properly placed over each eye as convergence is adjusted in the 3D palette. Enabling this checkbox also enables an additional Convergence parameter in the Window palette that lets you create properly aligned convergence for a window that's placed onto a stereoscopic 3D clip, as seen in the following screenshot.
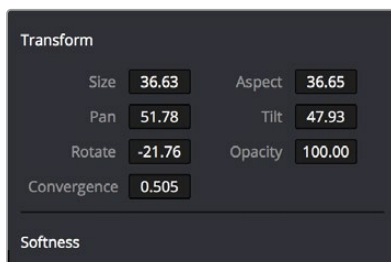
The Convergence control in the Transform section of the Window palette appears when you enable "Apply stereoscopic convergence to windows and effects"

– **Use local version for new clips in timeline:** Automatically sets all new clips that are added to existing timelines, or all clips that are added to new timelines that are imported via AAF, EDL, or XML, to use local grades by default. If you want all clips added to new timelines to use remote grades instead, as with DaVinci Resolve version 9 and earlier, you can turn this checkbox off.

– **Automatically match master timeline with media pool:** If you turn on this option before importing any media into the Media Pool, or importing any timelines that will in turn import media into the Media Pool, you can create projects with a Master Timeline. When enabled, clips are added to and removed from the Master Timeline as they're added to and removed from the Media Pool, so that the Master Timeline always contains all media in the Media Pool. Once media has been imported into a project, this setting cannot be changed.

– **Save timeline thumbnails with project:** To minimize project size, and maximize the speed of saving and loading projects, you should leave this checkbox unchecked. If you select the checkbox, all of your Timeline thumbnails will be stored inside every project, instead of in the default directory that's ordinarily dedicated to stills, during both Save and Auto Save operations. This provides a good history of the project but takes much longer to complete and uses more hard disk space.

- **Use BGR pixel order for DPX v2:** Lets you choose a different pixel order for projects using DPX version 2 media.

- **Embed timecode in audio output:** When turned on, directs DaVinci Resolve to output LTC timecode that's embedded in channel 16 of the SDI stream and channel 2 of the analog audio output from your video interface.

- **Use Timelines Bin:** This option is only available to be changed before you add clips to the Media Pool; after you've added clips, it's no longer available. Turning Use Timelines Bin on creates a dedicated Timelines bin in the Media Pool, at the top of the Bin List. When enabled, the Timelines bin contains all timelines in a project, and you're prevented from putting timelines into any other bin in the Media Pool. Whenever you create or import a new timeline, it automatically appears in the Timelines bin. You can add subfolders to the Timelines bin for more specific organization.

Dynamics Profile

Defines the default transition from one dynamic keyframe to the next for keyframed effects in the Color page. By default this transition is linear, with the "Dynamic profile start" and "Dynamic profile end" parameters set to 1. However, if you need to alter the acceleration of the interpolation of values from one dynamic keyframe to the next, then you can change that keyframe's Dissolve Type in order to "ease" the effect transition you're creating. The values in these settings correspond to the graph curves found in the Dynamic Attributes dialog when editing keyframes in the Color page. For more information, see "Changing Dynamic Attributes" in Chapter 144, "Keyframing in the Color Page."

Versions

Ten text fields provide a way for you to designate automatic names for the versions of grades that you select in the Color page. To the right of each text field, a drop-down menu lets you add a name from a handy list of predefined terms that's been provided. Alternately, you can simply click any field and type your own custom name.

When you change the name of a version in the Color page, the names you define in this list are available from a drop-down menu in the Version Name dialog.
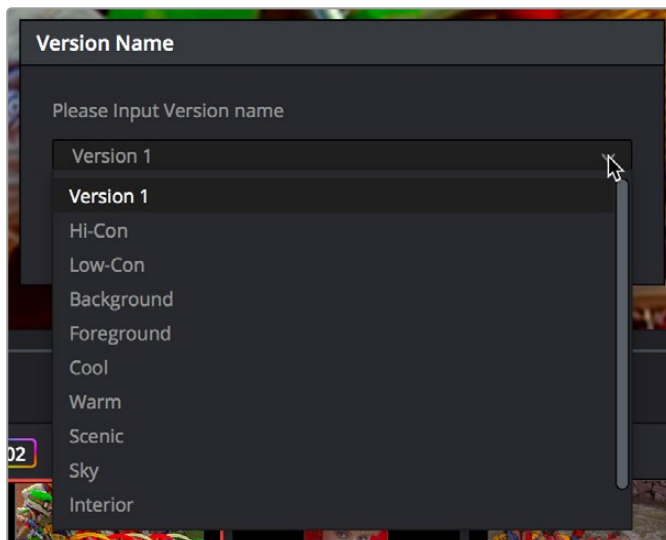
Using the named drop-down when editing the name of a version

Using a predefined list of names for your different versions avoids typos that can later create folder naming issues when you use the "Commercial Workflow" options for rendering your media in the Deliver page.

Camera Raw

This panel contains groups of parameters that correspond to every camera raw media format that's supported by DaVinci Resolve. Using these parameters in the Camera Raw panel, you can override the original camera metadata that was written at the time of recording, and make simultaneous adjustments to all camera raw clips using the "project" raw settings.

To provide more detail, these settings are covered in detail in a dedicated chapter. For more information, see Chapter 127, "Camera Raw Palette."

Capture and Playback

All settings in this panel let you define the functionality of capture and playout to tape using device controlled VTRs connected to your Resolve workstation via the connected video capture and output interface. For more information on deck capture, see Chapter 24, "Ingesting from Tape." For more information on video output to tape, see Chapter 188, "Delivering to Tape."

Deck Settings

These settings affect both capture and playback when using the tape ingest options of the Media page, or the tape output options of the Deliver page.

– **Video capture and playback:** You can choose the video format (frame size and frame rate) with which to output to tape from this drop-down menu. HD timelines can be downconverted to SD, and SD timelines can be upconverted to HD using the format conversion of your DeckLink card.

– **Use left and right eye SDI:** A checkbox that enables supported video interfaces to ingest and output muxed stereoscopic video when used with supported VTRs, such as HDCAM SR decks with 4:2:2 x 2 mode. (When muxed stereoscopic signals are ingested, each eye is separated into individual left-eye and right-eye image files.) This parameter only appears when your hardware is set up appropriately.

– **Video connection operates as:** Selects between the available signal options: Use 4:4:4 SDI and Enable Single Link. Which options are available depend on which video capture card you are using.

– **Data Levels:** Lets you specify the data range (normally Video or Full) that's used when ingesting from or outputting to tape. This option switches the data range of the signal output by your video capture card, but only during capture from tape in the Media page, or output to tape in the Deliver page. When capture or output is not currently occurring, your video capture card goes back to using the identically named data range setting in the Master Project Settings pane, which governs how you monitor the signal being output on an external broadcast display or projector.

– **Video bit depth:** Choose the bit depth that corresponds to the capability of your deck. Depending on your workstation's configuration, you can choose between 8-bit and 10-bit. Outputting to 10-bit is more processor intensive, but higher quality for compatible devices, and is the default setting.

– **Use deck autoedit:** If supported by your video deck, this is the best method to record video to the deck, as it enables the deck to roll the edit using the specified preroll, and control the edits via serial device control. If this checkbox is turned off, a basic edit On/Off mode is used by the deck, with the potential for frame inaccuracies if the "Non auto edit timing" setting is not properly adjusted.

– **Non auto edit timing:** Adjusts the edit synchronization of the connected deck when auto edit is turned off.

– **Deck preroll:** Sets the number of seconds for preroll. How much is appropriate depends on the performance of your deck.

– **Video output sync source:** When using a DeckLink card this is set to Auto. Other capture cards may require you to set the sync source to "Reference" for playout and "Input" for ingest. This setting is only available if you have a DVS card installed on your system.

– **Add 3:2 pulldown:** Inserts or removes the 3:2 pulldown required to record or play 23.98 fps media to or from a 29.97 tape format.

Capture

These settings are used when you use the Capture mode in the Media page to capture clips from tape into the Media Pool.

– **Capture:** Lets you choose whether to capture both Video and Audio, or Video Only.

– **Video Format:** The format that scanned film frames are saved as. When capturing from tape, the available options are DPX and QuickTime. When capturing from the Cintel film scanner, this is restricted to Cintel Raw Image (CRI), which is a raw data format that DaVinci Resolve automatically debayers as a Cineon log-encoded image for grading.

– **Codec:** The codec used to write captured media. When capturing from tape, these include the various type of Apple ProRes, 8- and 10-bit YUV 422, 10-bit RGB, and the various types of DNxHD. Cintel Raw Image files default to rgb.

– **Save clips to:** A field that displays the directory path to which media files captured from tape are written. You want to choose a volume that's fast enough to accommodate the data rate of the media format you're capturing.

– **Browse:** Click this button to choose a directory to write captured media to. The directory you choose appears in the field above.

– **Save in this folder path:** A series of checkboxes let you specify what other information to use to define the directory hierarchy that will hold the captured media. Every checkbox you turn on adds an additional directory with a name defined by that checkbox's metadata. You can choose any or all of the following: Program name, Clip number, Reel number, and Roll/Card.

– **Apply reel number to:** Lets you choose how to write the reel name. Two checkboxes let you write the reel number to the file's name, and/or to the Header data.

– **Use prefix:** A field lets you type in a prefix to be used in the media file's name. This lets you add text identification that will make the media more easily identifiable and searchable.

– **Apply prefix to:** Two checkboxes let you choose to use the prefix you typed in the file name, and/or in the folder name.

– **Use frame number with:** When capturing to image sequences, you can choose how many digits to use when writing the frame number into the name of each frame file.

– **Set batch ingest handles to:** When capturing to image sequences from a batch list, defines how many frames of additional handles to ingest along with each logged clip.

– **Input:** Lets you choose how many tracks of audio to capture, from 2 to 16.

Playout

These settings only affect the video signal that's output when you use the Edit to Tape mode of the Deliver page.

– **Output:** Lets you choose whether to output both Video and Audio, Video Only, or Audio Only if you're doing an audio layback.

– **Output Source Timecode:** Turn this checkbox on to output each individual clip's source timecode. This option is only applicable when assemble editing to tape.

– **Output LTC:** With a Blackmagic Design DeckLink or UltraStudio device using HD-SDI, longitudinal timecode (LTC) is available on track 16 of the HD-SDI video signal, making it easy to use a Mini Converter de-embedder to extract this analog timecode audio signal and feed it directly to a recording device. This is particularly helpful if you have outboard video processing equipment such as a noise reducer or format converter that passes through the VITC timecode.

– **Delay LTC by x frames:** When outputting LTC to bypass outboard processing gear, such as a noise reducer or format converter, you can compensate for the processing delay by delaying the timecode by a matter of frames to ensure that the processed image and timecode reach the deck at the same time. With a DVS card there is a separate timecode output.

– **Offset audio by x frames:** Lets you specify an offset between the audio track and video to achieve proper A/V sync in cases where the video is being delayed by outboard processing hardware.

– **Output x channels of audio:** Choose the number of audio tracks to output to tape.

– **Set batch playout head handle to x seconds:** When batch outputting multiple clips, you can specify a number of frames before the In point of each clip to be output as well.

– **Set batch playout tail handle to x seconds:** When batch outputting multiple clips, you can specify a number of frames after the Out point of each clip to be output as well.

Subtitles

The Subtitles panel lets you adjust presets that govern subtitles being created in subtitle tracks of the timeline.

– **Max Character Per Line:** Defaults to 60. Lets you choose the maximum number of characters allowed on one line in a subtitle.

– **Minimum Caption Duration:** Defaults to 3 seconds. Lets you choose the minimum duration allowed for subtitles in the timeline.

– **Maximum Characters Per Second:** Defaults to 30. Automatically calculates the maximum allowable characters per second based on a subtitle clip's duration.

Fairlight

The Fairlight panel lets you set up your project's audio sample rate, as well as setting up various audio-specific tools in the Fairlight page.

Timeline Sample Rate

This setting can only be changed prior to creation of your first timeline. Once one or more timelines have been created in a project, the Audio Sample Rate is locked to whatever was chosen.

The Audio Sample Rate, measured in kilohertz, is the number of samples per second used for audio processing in DaVinci Resolve. This setting defaults to 48000 (or 48 kHz), which is typical for broadcast and cinema work. However, you can change this to 96000 or 192000 if you want to mix and process audio at higher precision. Be aware that using a higher sample rate, such as 96 kHz instead of 48 kHz, will use twice as much processing power and result in media that's twice the size.

> **NOTE:** Regardless of the Timeline Sample Rate you select, when you import audio files at different sample rates, they will be automatically re-sampled to the Timeline Sample Rate so they play correctly.

Audio Metering

Two options in the General Options of the Project Settings let you customize the Loudness Meters on the Fairlight page, while the others affect all other audio meters in DaVinci Resolve.

– **Target Loudness level:** Lets you set the LUFS value that's used as a reference level for loudness metering. Defaults to –23 LUFS, which conveniently makes the display of these meters scale similarly to traditional audio meters that you're already used to.

– **Loudness Scale:** Lets you choose which scale you want to use with which to measure the meters. Options currently include the default of EBU +9 Scale (–18 to +9), and EBU +18 Scale (–36 to +18).

– **Bus Meter Alignment Level:** Sets the peak of the bus meter.

– **Bus Meter High Level:** Sets the dB level at which the meter starts showing red.

– **Bus Meter Low Level:** Sets the dB level at which the meter starts showing yellow.

– **Track Meters:** Lets you choose how meters in the Fairlight page display their audio analysis. There are two options:

  – **Post Fader:** Meters always display the level of each clip's signal after whatever fader adjustments have taken place. Fading a track's level down diminishes the visible level of that audio signal in the meter. This setting is good if you prefer a visual indication of the relative levels you've set your various audio tracks to, which is a very NLE-oriented behavior.

  – **Track Source:** Meters always use the volume levels of the audio clips in that track, even if you've lowered the level using the sliders. If you've keyframed a clip's volume, that change will be reflected by the audio meters, even though fader changes are not. Viewing meters this way means you can always see how much level is available to clips in your mix regardless of what the current fader levels are set to, in the event you want to keep track of audio you want to bring back into the mix later on. This is a very DAW-oriented behavior.

Immersive Audio

You can enable these audio surround formats in the Fairlight panel of the Project Settings. Once enabled, all supported channel configurations of each format become available for timeline track mappings, clip attributes channel mappings, Fairlight bus mappings, and output settings.

For more information, see Chapter 179, "Immersive Audio Workflows."

Chapter 7

Camera Raw Settings

This chapter discusses in detail each of the settings available for every camera raw format that is supported in DaVinci Resolve. These settings are available in the Camera Raw panel of the Project Settings, via a contextual menu command in the Media Pool that exposes a floating window, or in the Camera Raw palette of the Color page.

Contents

Camera Raw Decoding Explained

Camera raw media formats are so named because they capture raw color space data directly from the sensor of whatever digital cinema camera did the recording. Raw image data is not human readable, and must be debayered or demosaiced to convert the original raw data into image data that can be handed off to DaVinci Resolve's image processing pipeline.
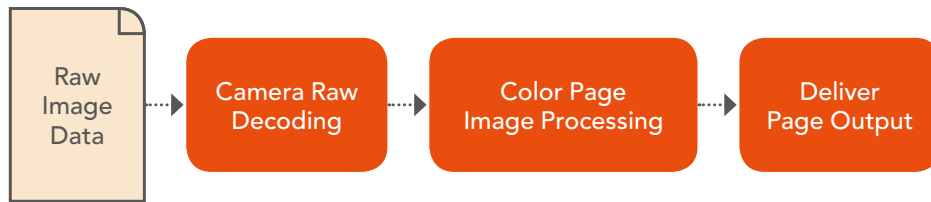
Raw decoding is the very first image processing operation that takes place, and it takes place before all other operations in the Color page, before even the Source bar in the Node Editor. For this reason, it's important to understand that the ideal transformation of raw image data to DaVinci Resolve-friendly image data is one that preserves the maximum amount of image data for continued processing. Since the 32-bit floating point accuracy of DaVinci Resolve's image processing pipeline preserves all transformed raw data with exceptional fidelity, the Camera Raw parameters are primarily useful for making whatever initial adjustments will produce the most optimum starting point for grading.

Each group of Camera Raw settings is available from the Raw Profile menu. This description covers the settings that are available for each of the camera raw media formats supported by DaVinci Resolve.

Camera Raw Project Settings

The Camera Raw panel of the Project Settings contain groups of parameters that correspond to every camera raw media format that's supported by DaVinci Resolve. Using these parameters in the Camera Raw panel, you can override the original camera metadata that was written at the time of recording, and make simultaneous adjustments to all camera raw media throughout your project.
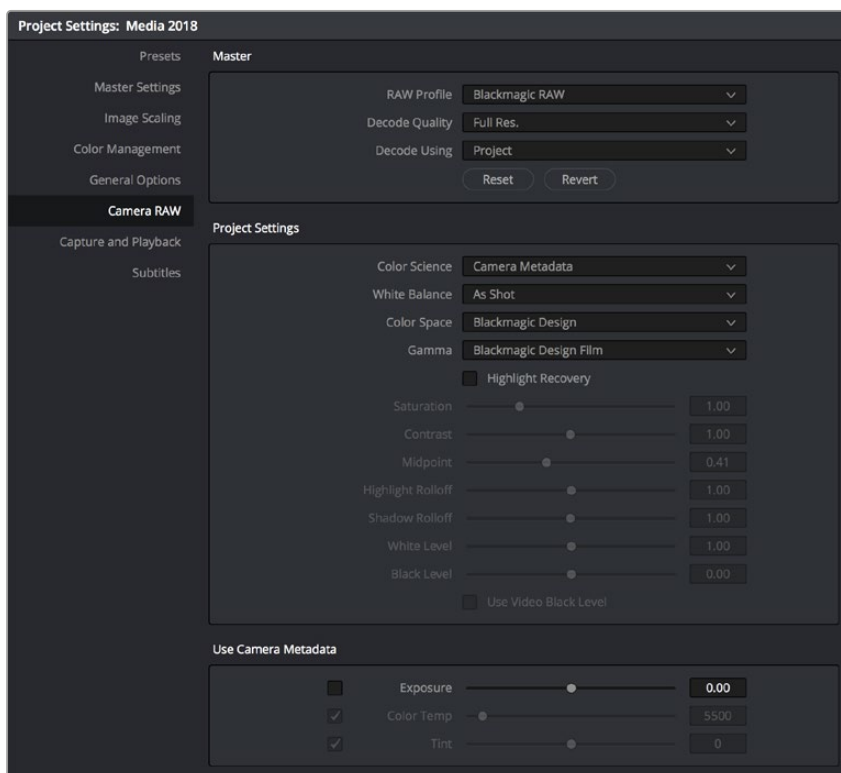
Camera Raw project settings

Each supported camera format has different controls that are specific to that format. These controls are also mirrored in the Camera Raw palette in the Color page, which lets you individually adjust the Camera Raw parameters for individual clips in a Timeline when you set Decode Using to Clip.
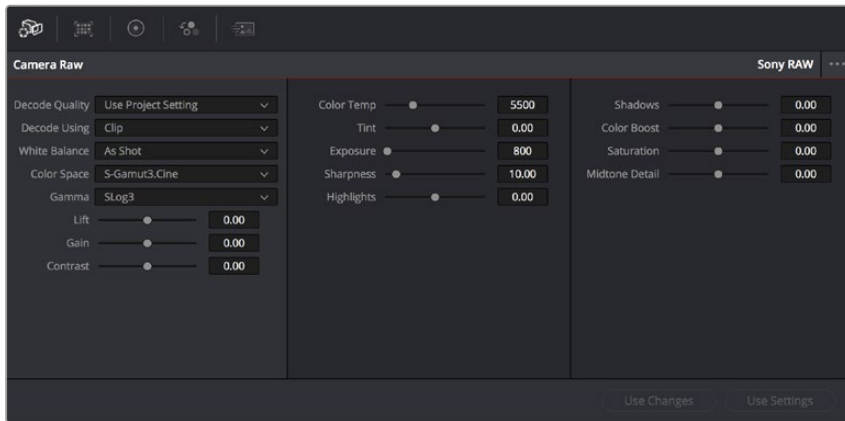
Camera Raw project palette in the Color page

Camera Raw Image Inspector

The Image panel in the Inspector exposes the Camera Raw parameters. If the video clip is in a Raw format, the specific camera's Raw controls will be exposed for user manipulation. Raw still images from Nikon (NEF) and Canon (CR2) cameras can also be adjusted in this panel.
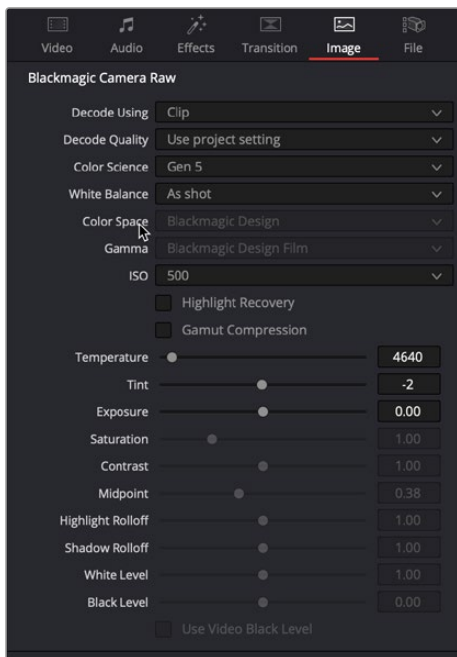
The Image Inspector for a Blackmagic RAW file

ARRI ALEXA

The ARRI ALEXA can record ProRes, DNxHD, or raw image data. When shooting raw, image data is recorded straight from the Bayer sensor, and must be debayered by DaVinci Resolve.

Master Settings

ARRI ALEXA media is extremely simple to debayer. There are only three Master settings.

– **Decode Quality:** Lets you debayer ARRI ALEXA raw files at Full, Half, or Quarter resolution to improve performance on slower systems. Lower resolution media is lower quality, but faster to work with and process. If necessary, you can choose a lower resolution setting that provides better real time playback on systems with limited performance while you work, and then switch to a higher quality when rendering the final output. A "Force debayer res to highest quality" checkbox in the Render Settings list of the Deliver page makes it easy to follow this workflow.

– **Decode Using:** The option you select determines whether all ARRI ALEXA media throughout the project is decoded using the original Camera Metadata settings (the default selection), using Project settings in which you choose custom settings to be applied to all clips, or using the ARRI default settings.

– **Import Media at Open Gate Resolution:** Enables DaVinci Resolve to access the "open gate" area of clips from ALEXA cameras capable of shooting in this mode, which produces a 3.4K image with extra area for stabilization and repositioning.

Project Settings

The following decoder settings let you adjust the color and exposure of ALEXA clips.

– **Lift:** Adjusts the black point of the media, raising it or lowering it while scaling all midtone values between it and the white point. Regardless of how you adjust this control, all image data is preserved and can be retrieved in subsequent adjustments. The range is –100 to +100.

– **Gain:** Adjusts the white point of the media, raising or lowering it while scaling all midtone values between it and the black point. Regardless of how you adjust this control, all image data is preserved and can be retrieved in subsequent adjustments. 0 is unity. The range is –100 to +100.

– **Contrast:** Raising contrast reduces shadows and raises highlights, while leaving midtones at 50 percent unaffected. Regardless of how you adjust this control, all image data is preserved and can be retrieved in subsequent adjustments. 0 is unity. The range is –100 to +100.

– **Tint:** Adjusts color balance to push the image between magenta and green; useful for balancing images with a green or magenta color cast, such as fluorescent or sodium vapor bulbs. 0 is unity. The range is –150 to +150.

– **Sharpness:** A debayer-specific sharpness filter applied to provide the appearance of enhanced image detail. 0 is unity, and 10 is the default. The range is 0 to 100.

– **Highlights:** Makes it easy to selectively retrieve blown-out highlight detail in high-dynamic-range media by lowering this parameter, and achieves a smooth blend between the retrieved highlights and the unadjusted midtones for a naturalistic result. 0 is unity. The range is –100 (minimum) through +100 (maximum).

– **Shadows:** Lets you selectively lighten or darken shadow detail. Raising this value retrieves shadow detail recorded below 0 percent, while leaving the midtones alone. 0 is unity. The range is –100 (minimum) through +100 (very high).

– **Color Boost:** Lets you naturalistically raise the saturation of regions of low saturation, sometimes referred to as a vibrance operation. Can be used also to lower the saturation of regions of low saturation. 0 is unity. The range is –100 (minimum) through +100 (very high).

– **Saturation:** Adjusts the color intensity of the image. 0 is unity. The range is –100 (minimum) through +100 (very high).

 – **Midtone Detail:** When this parameter is raised, the contrast of regions of the image with high edge detail is raised to increase the perception of image sharpness, sometimes referred to as definition. When this parameter is lowered to a negative value, regions of the image with low amounts of detail are softened while areas of high detail are left alone. 0 is unity. The range is –100 (minimum) through +100 (very high).

Use Camera Metadata

The most elemental camera metadata settings for exposure and color that are available.

 – **Color Temp:** Adjusts color balance to alter the "warmth" of the image. Adjustable in Kelvin. Lower values correct for "warmer" lighting, while higher values correct for "cool" lighting. +2000 is unity. The range is +2000 to +11,000.

 – **Tint:** Only available when White Balance is set to something other than As Shot. Designed to alter the green to magenta balance of the image, for images with fluorescent tinting. Lower values add green to compensate for magenta lighting, while higher values add magenta to compensate for green lighting. 0 is unity. The range is –12 to +12.

 – **Exposure:** Increases or lowers image lightness in units relative to ASA values. If your intended exposure adjustment lifts image data above the maximum white level, don't worry; all image data is preserved and can be retrieved in subsequent adjustments. 160 is unity. The range is +160 to +3200.

 – **Finetune Red:** Advanced debayer setting.

 – **Finetune Green:** Advanced debayer setting.

 – **Finetune Blue:** Advanced debayer setting.

ARRI Media and Log-C

ALEXA media is usually recorded using Log-C gamma and color processing, which is very similar to the Cineon Log gamma curve, developed by Kodak to produce flat-contrast, wide-gamut image data that preserves image detail with a wide latitude for adjustment. There is no ALEXA raw parameter to adjust this, so for Rec. 709 monitoring and deliverables you need to "normalize" Log-C clips in one of three ways.

You can use Resolve Color Management (RCM) to automatically normalize log-encoded media according to the type of media it is.

You can create your own adjustment to normalize Log-C clips as part of the grading process, using the parameters of the Color page. This approach gives you the most flexibility, as you'll be making custom settings that maximize the image data that's available in every scene.

Alternately, you can use a LUT to normalize Log-C clips to obtain a fast starting point for additional grading. Used in this way, LUTs can be applied either as an output LUT, if the entire Timeline is nothing but ALEXA raw media, or as a LUT that's applied to an individual node of a grade, if you're mixing ALEXA raw media with other formats. This provides a fast and easy solution to linearizing ALEXA media that can be useful for creating dailies for offline editing. However, one LUT may not be suitable for all clips. If you're applying individual LUTs to each clip, you can create multiple LUTs, each with differing contrast settings, in order to gain the speed benefits of using LUTs, while taking into account the individual differences among clips.

ARRI has a LUT generator available online that you can use to create custom LUTs for use with a variety of color correction applications at: www.arri.com/camera/alexa/tools/lut_generator.html

Blackmagic RAW

A raw format developed by Blackmagic Design and used by a variety of Blackmagic cameras. This format relies on the increased processing capabilities of modern cameras to perform a certain amount of in-camera pre-processing (including noise management, sensor profiling, and edge reconstruction) to partially de-mosaic the image and then re-encode the result, factoring in the characteristics of the originating image sensor. The image is encoded in such a way as to later enable typical raw controls but with efficiently compressed files (using a custom non-linear 12-bit space) that are not computationally challenging to decode and use. BRAW media can be encoded at either a Constant Bitrate (with variable compression of 3:1, 5:1, 8:1, and 12:1) or at Constant Quality (with a variable bitrate).

BRAW Sidecar Metadata Files

BRAW files have been designed to accommodate descriptive metadata that enables look management from on-set through post. This metadata is both embedded in the .braw files and included within .sidecar files that are saved alongside the media. Metadata .sidecar files that are present always takes precedence over the embedded metadata for purposes of decoding. However, if there's no .sidecar file, decoding of the .braw file falls back on the embedded metadata.

Modifying Sidecar Files

You can use the Camera Raw palette of the Color page to Update a BRAW clip's sidecar file with changes made to the Camera Raw settings. Click Update Sidecar to save changes, and click Export Frame to export a one-frame image for reference.

Master Settings

These parameters let you choose the decode quality and method that raw clips will be transformed to use when debayered.

– **Decode Quality:** Lets you debayer .braw files at Full, Half, Quarter, or Eighth resolution to improve performance on slower systems. Lower resolution media is lower quality but faster to work with and process. If necessary, you can choose a lower resolution setting that provides better real time playback on systems with limited performance while you work, and then switch to a higher quality when rendering the final output. A "Force debayer res to highest quality" checkbox in the Render Settings list of the Deliver page makes it easy to follow this workflow.

– **Decode Using:** The option you select determines whether all .braw media throughout the project is decoded using the original Camera Metadata settings (the default selection), using Project settings in which you choose custom settings to be applied to all clips, or using the Blackmagic Raw default settings.

Project Settings

These parameters let you choose the color science, white balance color space, gamma, and other visual settings guiding how the image will be transformed to suit your program and RCM.

– **Color Science:** Lets you choose what version of camera color science you want to use to decode .braw media.

  – **Camera Metadata:** Chooses whichever version of color science was selected by the camera at the time of shooting.

  – **Gen 4:** The original version of color science available for recording and decoding .braw media.

  – **Gen 5:** A newer more film-like curve designed for better skin tones and high contrast/saturation color response.

– **White Balance:** The first seven options offer White Balance presets, which automatically adjust the Color Temp and Tint parameters. These options include: Daylight, Cloudy, Shade, Tungsten, Fluorescent, and Flash. An eighth option, Custom, makes the Color Temp and Tint parameters user-adjustable. The default is As Shot.

– **Color Space:** Debayering .braw data requires choosing a color space to convert the raw signal into. Bear in mind that the color space you choose is merely a starting point for further correction. There is no requirement that you choose one or the other color space for any given workflow, and all settings will yield high-quality image data suitable for further color correction. You should choose the color space that provides the most pleasing starting point for your particular project.

  – **Blackmagic Design:** A wide gamut color space designed for digital cinema workflows on Blackmagic Design cameras.

  – **Rec. 709:** Decodes into the standard color space specified by the Rec. 709 standard for high definition video. While you may find this option useful as a starting point, it is not required for programs being output to video.

  – **Rec. 2020:** Decodes into the standard color space specified by the Rec. 2020 standard for high definition video, UHD video, and beyond. While you may find this option useful as a starting point, it is not required for programs being output to video.

  – **DCI-P3 D65:** Decodes RGB-encoded image data with a D65 white point, intended for monitoring with a P3-compatible display.

  – **DCI-P3 Theater:** A setting designed for adaptive viewing of DCI-P3 in a theater with a projector using a D60 white point.

  – **CIE 1931 XYZ D65:** A specialty setting for outputting to an XYZ color space with a D65 adaptive white point.

  – **CIE 1931 XYZ D50 (PCS):** A specialty setting for outputting to an XYZ color space with a D50 adaptive white point, as used by the profile connection space of the DNG image format.

– **Gamma:** There are several options available for choosing a gamma profile to be used when debayering .braw media. Which one is best really depends on how you like to work, as all will yield high-quality image data without clipping the signal internally within DaVinci Resolve's image processing pipeline. Even though some of these options will produce a range of image data that will clip on output, all of that image data is preserved "under the hood" and can be used and retrieved in your grade.

  – **Blackmagic Design Film:** A log-encoded "film workflow" oriented option that's specifically designed for version 4 of the Blackmagic Design color science. This option is designed to fit the maximum amount of information from wide latitude BMD cameras into the data range of 0–1023. Using this setting provides all the dynamic range from the source media into a signal that can be transcoded to other formats with no compromise. However, this is not a viewable image and requires grading to normalize it into an image that can be delivered to audiences.

  – **Blackmagic Design Video:** The standardized gamma curve for standard-dynamic-range HD and UHD display. For wide-latitude images, highlights will be clipped, but all image data will be preserved internally for retrieval via grading as necessary.

  – **Blackmagic Design Extended Video:** An SDR-compatible gamma curve similar to the above but with compressed highlights that preserve more highlight detail in the visible range of the image. Intended to be a fast starting point for grading SDR images. Fewer highlights are clipped, but nonetheless all image data is preserved internally for retrieval via grading as necessary.

  – **Blackmagic Design Custom:** For specialty workflows.

- **Linear:** A scene linear setting, suitable for visual effects and specialty workflows.
- **Rec. 2100 Hybrid Log Gamma:** The standardized gamma curve for the HLG standard of high-dynamic-range (HDR) video jointly developed by the BBC and NHK.
- **Rec. 2100 ST2084 (PQ):** The standardized gamma curve for high-dynamic-range (HDR) video as encoded by Dolby Vision and HDR10+. Also referred to as the PQ curve.

- **Highlight Recovery:** A checkbox that lets you include additional highlight sensor data that's usually clipped by the standard decoding matrix. In cases where you have extremely clipped peak highlights, you may obtain additional image detail this way, although it may contain unusual color artifacts.

- **Gamut compression:** Prevents monochromatic highly saturated light sources (LEDs, neon signs, etc.) from clipping the gamut.

- **Apply LUT:** Applies color metadata to the BRAW file from the selected LUT source.

- **LUT source:** Choose the color metadata from the sidecar file, or the metadata embedded in the clip.

- **Saturation:** Adjusts the color intensity of the image. 1 is unity. The range is 0 (desaturated) through +4 (extremely high).

- **Contrast:** Increases contrast by raising the top of the signal and lowering the bottom of the signal about the Midpoint slider (described below). Raising this value increases contrast, while lowering this value lowers contrast. 1 is unity. The range is 0 (minimum contrast) to +2 (maximum contrast).

- **Midpoint:** The level about which contrast is either expanded or contracted. 0.41 is unity. The range is 0 (black) to +1 (maximum white).

- **Highlight Rolloff:** Makes it easy to selectively retrieve blown-out highlight detail in high-dynamic-range media by lowering this parameter and achieves a smooth blend between the retrieved highlights and the unadjusted midtones for a naturalistic result. 1 is unity. The range is 0 (minimum) through +2 (maximum).

- **Shadow Rolloff:** Lets you selectively lighten or darken shadow detail. Raising this value retrieves shadow detail recorded below 0 percent while leaving the midtones alone. 1 is unity. The range is 0 (minimum) through +2 (very high).

- **White Level:** A gain setting for adjusting the highlights.

- **Black Level:** A lift setting for adjusting the shadows.

- **Use Video Black Level:** A legacy video setting that adds pedestal to the video signal. For people using video equipment dating from when shoulder pads were cool.

Use Camera Metadata

The most elemental camera metadata settings for exposure and color that are available. Deselect the Use Camera Metadata checkboxes to activate the controls.

- **Exposure:** Increases or lowers image lightness in units relative to *f*-stops. If your intended exposure adjustment lifts image data above the maximum white level, don't worry; all image data is preserved and can be retrieved in subsequent adjustments. 0 is unity. The range is −5 to +5.

- **Color Temp:** Only available when White Balance is set to something other than As Shot. Designed to alter the "warmth" of the image. Adjustable in Kelvin. Lower values correct for "warmer" lighting, while higher values correct for "cool" lighting. +5500 is unity. The range is +2000 to +50,000.

- **Tint:** Only available when White Balance is set to something other than As Shot. Designed to alter the green to magenta balance of the image, for images with fluorescent tinting. Lower values add green to compensate for magenta lighting, while higher values add magenta to compensate for green lighting. 0 is unity. The range is −150 to +150.

> ### BRAW Files and Blackmagic Design Film
>
> Blackmagic Design's logarithmically encoded Blackmagic Design Film gamma setting, which produces flat-contrast, wide-gamut image data that preserves image detail with a wide latitude for adjustment, is a modified version of the standard Cineon curve. However, the modifications are designed to emphasize the strengths of the sensors used by the Blackmagic Design cameras. Similarly to working with clips using Cineon, the ARRI ALEXA's Log-C gamma, or Sony's proprietary S-Log or S-Log2 formats, you need to normalize clips using Blackmagic Design Film by using Resolve Color Management (RCM), by making a manual adjustment to color and contrast, or by applying a LUT, using techniques discussed previously.

Canon RAW

Canon RAW (CRW) is produced by a variety of Canon cameras.

Master Settings

These parameters let you choose the decode quality and method that raw clips will be transformed to use when debayered.

– **Decode Quality:** Lets you debayer Canon RAW files at Full, Half, or Quarter resolution to improve performance on slower systems. Lower resolution media is lower quality but faster to work with and process. If necessary, you can choose a lower resolution setting that provides better real time playback on systems with limited performance while you work, and then switch to a higher quality when rendering the final output. A "Force debayer res to highest quality" checkbox in the Render Settings list of the Deliver page makes it easy to follow this workflow.

– **Decode Using:** The option you select determines whether all Canon RAW media throughout the project is decoded using the original Camera Metadata settings (the default selection), using Project settings in which you choose custom settings to be applied to all clips, or using the Canon RAW default settings.

Project Settings

Canon RAW has a variety of settings that can be adjusted to alter the image quality of the debayered result. The Color Temp and Tint parameters are only available if the White Balance drop-down menu is set to Custom.

– **White Balance:** The first seven options offer White Balance presets, which automatically adjust the Color Temp and Tint parameters. These options include Daylight, Cloudy, Shade, Tungsten, Fluorescent, and Flash. An eighth option, Custom, makes the Color Temp and Tint parameters user-adjustable.

– **Color Space:** No color spaces are selectable at the time of this writing.

– **Gamma:** No gamma settings are selectable at the time of this writing.

– **Tint:** Color balance correction for images with a green or magenta color cast, such as fluorescent or sodium vapor bulbs. 0 is unity. The range is –150 to +150.

– **Sharpness:** A debayer-specific sharpness filter applied to provide the appearance of enhanced image detail. 20 is unity. The range is 0 to 100.

– **Highlights:** Makes it easy to selectively retrieve blown-out highlight detail in high-dynamic-range media by lowering this parameter and achieves a smooth blend between the retrieved highlights and the unadjusted midtones for a naturalistic result. 0 is unity. The range is –100 (minimum) through +100 (maximum).

– **Shadows:** Lets you selectively lighten or darken shadow detail. Raising this value retrieves shadow detail recorded below 0 percent, while leaving the midtones alone. 0 is unity. The range is –100 (minimum) through +100 (very high).

– **Color Boost:** Lets you naturalistically raise the saturation of regions of low saturation, sometimes referred to as a vibrance operation. Can be used also to lower the saturation of regions of low saturation. 0 is unity. The range is –100 (minimum) through +100 (very high).

– **Saturation:** Adjusts the color intensity of the image. 0 is unity. The range is –100 (minimum) through +100 (very high).

– **Midtone Detail:** When this parameter is raised, the contrast of regions of the image with high edge detail is raised to increase the perception of image sharpness, sometimes referred to as definition. When this parameter is lowered to a negative value, regions of the image with low amounts of detail are softened while areas of high detail are left alone. 0 is unity. The range is –100 (minimum) through +100 (very high).

– **Lift:** Adjusts the black point of the media, raising it or lowering it while scaling all midtone values between it and the white point. Regardless of how you adjust this control, all image data is preserved and can be retrieved in subsequent adjustments. The range is –100 to +100.

– **Gain:** Adjusts the white point of the media, raising or lowering it while scaling all midtone values between it and the black point. Regardless of how you adjust this control, all image data is preserved and can be retrieved in subsequent adjustments. 0 is unity. The range is –100 to +100.

– **Contrast:** Raising contrast reduces shadows and raises highlights, while leaving midtones at 50 percent unaffected. Regardless of how you adjust this control, all image data is preserved and can be retrieved in subsequent adjustments. 0 is unity. The range is –100 to +100.

Use Camera Metadata

The most elemental camera metadata settings for exposure and color that are available.

– **Exposure:** Increases or lowers image lightness in units relative to ƒ-stops. If your intended exposure adjustment lifts image data above the maximum white level, don't worry; all image data is preserved and can be retrieved in subsequent adjustments. 0 is unity. The range is –5 to +5.

– **Color Temp:** Only available when White Balance is set to something other than As Shot. Designed to alter the "warmth" of the image. Adjustable in Kelvin. Lower values correct for "warmer" lighting, while higher values correct for "cool" lighting. +6500 is unity. The range is +2000 to +50,000.

– **Tint:** Only available when White Balance is set to something other than As Shot. Designed to alter the green to magenta balance of the image, for images with fluorescent tinting. Lower values add green to compensate for magenta lighting, while higher values add magenta to compensate for green lighting. 0 is unity. The range is –150 to +150.

CinemaDNG

CinemaDNG is an open format capable of high-resolution raw image data with a wide dynamic range and is one of the formats recorded by the Blackmagic Design Camera when you shoot in raw mode. CinemaDNG images are decoded with full dynamic range when the Highlight Recovery checkbox is selected.

DaVinci Resolve version 11.2.1 introduced improved debayering for raw CinemaDNG media acquired using any of the Blackmagic Design cameras. The "Apply Pre Tone Curve" setting controls whether you're using the older debayering method (when turned on) or the newer, visually improved debayering method (when turned off).

Master Settings

These parameters let you choose the decode quality, white balance, color space, and gamma that raw CinemaDNG clips will be transformed to use when debayered.

– **Decode Quality:** Lets you debayer CinemaDNG raw files at Full, Half, or Quarter resolution to improve performance on slower systems. Lower resolution media is lower quality but faster to work with and process. If necessary, you can choose a lower resolution setting that provides better real time playback on systems with limited performance while you work, and then switch to a higher quality when rendering the final output. A "Force debayer res to highest quality" checkbox in the Render Settings list of the Deliver page makes it easy to follow this workflow.

– **Decode Using:** The option you select determines whether all CinemaDNG media throughout the project is decoded using the original Camera Metadata settings (the default selection), using Project settings in which you choose custom settings to be applied to all clips, or using the CinemaDNG default settings.

– **Apply Pre Tone Curve:** When this checkbox is turned off (the default for new projects created in DaVinci Resolve 11.2.1 or later), DaVinci Resolve debayers CinemaDNG raw media using an improved method that delivers better-looking results, specifically for media acquired using any of the Blackmagic Design cameras. When this checkbox is turned on (the default for projects created in earlier versions of DaVinci Resolve), the older debayering method is reenabled for backward compatibility. However, turning Pre Tone Curve on may also provide better results for CinemaDNG raw files coming from other sources. If you're importing .dng media from cameras other than those from Blackmagic Design, you should try both settings to see which type of debayering you prefer.

– **Apply Soft Clip:** This checkbox is only available when Apply Pre Tone Curve is turned off. When turned on, high dynamic range parts of the signal (super-white highlights) are brought back into the picture as visible image detail you can adjust, similar to using the Highlights control to retrieve these otherwise clipped parts of the signal.

Project Settings

CinemaDNG has a variety of settings that can be adjusted to alter the image quality of the debayered result. The Color Temp and Tint parameters are only available if the White Balance drop-down menu is set to Custom.

– **Color Science:** Lets you choose what version of camera color science you want to use to decode CinemaDNG media.

– **Camera Metadata:** Chooses whichever version of color science was selected by the camera at the time of shooting.

– **Gen 4:** The original version of color science available for recording and decoding CinemaDNG media.

– **White Balance:** The first seven options offer White Balance presets, which automatically adjust the Color Temp and Tint parameters. These options include: Daylight, Cloudy, Shade, Tungsten, Fluorescent, and Flash. An eighth option, Custom, makes the Color Temp and Tint parameters user-adjustable.

– **Color Space:** Multiple color spaces are adjustable, depending on your intended workflow:

– **Rec. 709:** Decodes into the standard color space specified by the Rec. 709 standard for high definition video.

– **P3 D60:** Decodes into the standard P3 color space specified by the DCI standard for digital cinema projection.

– **Blackmagic Design:** Decodes into a log-encoded color space that remaps the raw data into an approximation of the Log-C standard. Choosing Blackmagic Design Film also forces the Gamma setting to Blackmagic Design Film. This setting produces flat-contrast image data that preserves image detail with a wide latitude for adjustment, which is suitable as a starting point for detailed grading and is also compatible with log workflows intended for film output.

- **Gamma:** Five gamma settings are available, depending on what starting point you want to use for further grading.

    - **2.4:** A simple power-function gamma setting commonly used for broadcast.

    - **2.6:** A simple power-function gamma setting commonly used for digital cinema projection.

    - **Rec. 709:** A gamma of 2.35, with a linear segment near black, approximating the EBU recommended gamma for broadcast.

    - **sRGB:** A gamma of 2.2, with a linear segment near black, intended for reproduction on computer displays alongside the sRGB color space.

    - **Linear:** A simple linear gamma setting.

    - **Blackmagic Design Film:** A log-encoded gamma setting that approximates Cineon encoding, the main difference being that more data is encoded in the darkest portion of the Blackmagic Design Film signal. When you choose this setting, the appropriate variation of gamma will be applied based on your particular sensor, be it 4K or 4.6K.

    - **Blackmagic Design Video:** A normalized gamma setting that provides a fast starting point for grading if you don't want to begin with a log-encoded image.

- **Highlight Recovery:** A checkbox that lets you include additional highlight sensor data that's usually clipped by the standard decoding matrix. In cases where you have extremely clipped highlights, you may obtain additional image detail this way, although it may contain unusual color artifacts.

- **Sharpness:** A debayer-specific sharpness filter applied to provide the appearance of enhanced image detail. 20 is unity. The range is 0 to 100.

- **Highlights:** Makes it easy to selectively retrieve blown-out highlight detail in high-dynamic-range media by lowering this parameter and achieves a smooth blend between the retrieved highlights and the unadjusted midtones for a naturalistic result. 0 is unity. The range is –100 (minimum) through +100 (maximum).

- **Shadows:** Lets you selectively lighten or darken shadow detail. Raising this value retrieves shadow detail recorded below 0 percent, while leaving the midtones alone. 0 is unity. The range is –100 (minimum) through +100 (very high).

- **Color Boost:** Lets you naturalistically raise the saturation of regions of low saturation, sometimes referred to as a vibrance operation. Can be used also to lower the saturation of regions of low saturation. 0 is unity. The range is –100 (minimum) through +100 (very high).

- **Saturation:** Adjusts the color intensity of the image. 0 is unity. The range is –100 (minimum) through +100 (very high).

- **Midtone Detail:** When this parameter is raised, the contrast of regions of the image with high edge detail is raised to increase the perception of image sharpness, sometimes referred to as definition. When this parameter is lowered to a negative value, regions of the image with low amounts of detail are softened while areas of high-detail are left alone. 0 is unity. The range is –100 (minimum) through +100 (very high).

- **Lift:** Adjusts the black point of the media, raising it or lowering it while scaling all midtone values between it and the white point. Regardless of how you adjust this control, all image data is preserved and can be retrieved in subsequent adjustments. The range is –100 to +100.

- **Gain:** Adjusts the white point of the media, raising or lowering it while scaling all midtone values between it and the black point. Regardless of how you adjust this control, all image data is preserved and can be retrieved in subsequent adjustments. 0 is unity. The range is –100 to +100.

- **Contrast:** Raising contrast reduces shadows and raises highlights, while leaving midtones at 50 percent unaffected. Regardless of how you adjust this control, all image data is preserved and can be retrieved in subsequent adjustments. 0 is unity. The range is –100 to +100.

Use Camera Metadata

The most elemental camera metadata settings for exposure and color that are available.

– **Exposure:** Increases or lowers image lightness in units relative to *f*-stops. If your intended exposure adjustment lifts image data above the maximum white level, don't worry; all image data is preserved and can be retrieved in subsequent adjustments. 0 is unity. The range is −5 to +5.

– **Color Temp:** Only available when White Balance is set to something other than As Shot. Designed to alter the "warmth" of the image. Adjustable in Kelvin. Lower values correct for "warmer" lighting, while higher values correct for "cool" lighting. +6500 is unity. The range is +2000 to +50,000.

– **Tint:** Only available when White Balance is set to something other than As Shot. Designed to alter the green to magenta balance of the image, for images with fluorescent tinting. Lower values add green to compensate for magenta lighting, while higher values add magenta to compensate for green lighting. 0 is unity. The range is −150 to +150.

> ### CinemaDNG Files and Blackmagic Design Film
>
> Blackmagic Design's logarithmically encoded Blackmagic Design Film gamma setting, which produces flat-contrast, wide-gamut image data that preserves image detail with a wide latitude for adjustment, is a modified version of the standard Cineon curve. However, the modifications are designed to emphasize the strengths of the sensors used by the Blackmagic Design cameras. Similarly to working with clips using Cineon, the ARRI ALEXA's Log-C gamma, or Sony's proprietary S-Log or S-Log2 formats, you need to normalize clips using Blackmagic Design Film by using Resolve Color Management (RCM), by making a manual adjustment to color and contrast, or by applying a LUT, using the same techniques discussed previously.

Panasonic Varicam RAW

Panasonic Varicam RAW (CRW) is produced by a variety of Panasonic cameras (such as the VariCam 35 and VariCam Pure 4K) recording to Codex VRAW recorders.

Master Settings

These parameters let you choose the decode quality, white balance, color space, and gamma that raw clips will be transformed to use when debayered.

– **Decode Quality:** Lets you debayer Varicam RAW files at Full, Half, or Quarter resolution to improve performance on slower systems. Lower resolution media is lower quality but faster to work with and process. If necessary, you can choose a lower resolution setting that provides better real time playback on systems with limited performance while you work, and then switch to a higher quality when rendering the final output. A "Force debayer res to highest quality" checkbox in the Render Settings list of the Deliver page makes it easy to follow this workflow.

– **Decode Using:** The option you select determines whether all Varicam RAW media throughout the project is decoded using the original Camera Metadata settings (the default selection), using Project settings in which you choose custom settings to be applied to all clips, or using the Varicam RAW default settings.

Project Settings

Panasonic Varicam RAW has a variety of settings that can be adjusted to alter the image quality of the debayered result. The Color Temp and Tint parameters are only available if the White Balance drop-down menu is set to Custom.

- **White Balance:** The first seven options offer White Balance presets, which automatically adjust the Color Temp and Tint parameters. These options include: Daylight, Cloudy, Shade, Tungsten, Fluorescent, and Flash. An eighth option, Custom, makes the Color Temp and Tint parameters user-adjustable.

- **Sharpness:** A debayer-specific sharpness filter applied to provide the appearance of enhanced image detail. 20 is unity. The range is 0 to 100.

- **Highlights:** Makes it easy to selectively retrieve blown-out highlight detail in high-dynamic-range media by lowering this parameter and achieves a smooth blend between the retrieved highlights and the unadjusted midtones for a naturalistic result. 0 is unity. The range is –100 (minimum) through +100 (maximum).

- **Shadows:** Lets you selectively lighten or darken shadow detail. Raising this value retrieves shadow detail recorded below 0 percent, while leaving the midtones alone. 0 is unity. The range is –100 (minimum) through +100 (very high).

- **Color Boost:** Lets you naturalistically raise the saturation of regions of low saturation, sometimes referred to as a vibrance operation. Can be used also to lower the saturation of regions of low saturation. 0 is unity. The range is –100 (minimum) through +100 (very high).

- **Saturation:** Adjusts the color intensity of the image. 0 is unity. The range is –100 (minimum) through +100 (very high).

- **Midtone Detail:** When this parameter is raised, the contrast of regions of the image with high edge detail is raised to increase the perception of image sharpness, sometimes referred to as definition. When this parameter is lowered to a negative value, regions of the image with low amounts of detail are softened while areas of high-detail are left alone. 0 is unity. The range is –100 (minimum) through +100 (very high).

- **Lift:** Adjusts the black point of the media, raising it or lowering it while scaling all midtone values between it and the white point. Regardless of how you adjust this control, all image data is preserved and can be retrieved in subsequent adjustments. The range is –100 to +100.

- **Gain:** Adjusts the white point of the media, raising or lowering it while scaling all midtone values between it and the black point. Regardless of how you adjust this control, all image data is preserved and can be retrieved in subsequent adjustments. 0 is unity. The range is –100 to +100.

- **Contrast:** Raising contrast reduces shadows and raises highlights, while leaving midtones at 50 percent unaffected. Regardless of how you adjust this control, all image data is preserved and can be retrieved in subsequent adjustments. 0 is unity. The range is –100 to +100.

Use Camera Metadata

The most elemental camera metadata settings for exposure and color that are available.

- **Color Temp:** Only available when White Balance is set to something other than As Shot. Designed to alter the "warmth" of the image. Adjustable in Kelvin. Lower values correct for "warmer" lighting, while higher values correct for "cool" lighting. +6500 is unity. The range is +2000 to +50,000.

- **Tint:** Only available when White Balance is set to something other than As Shot. Designed to alter the green to magenta balance of the image, for images with fluorescent tinting. Lower values add green to compensate for magenta lighting, while higher values add magenta to compensate for green lighting. 0 is unity. The range is –150 to +150.

Phantom Cine

The Phantom line of high-speed digital cinema cameras record wide latitude, high-gamut media using the Cine Raw format.

Master Settings

These parameters let you choose the decode quality, white balance, color space, and gamma that raw Phantom Cine clips will be transformed to use when debayered.

– **Decode Using:** The option you select determines whether all Phantom Cine media throughout the project is decoded using the original Camera Metadata settings (the default selection), using Project settings in which you choose custom settings to be applied to all clips, or using the Cine default settings.

– **Timecode:** There are four types of timecode that Phantom Cine files can be set to use:

  – **Set to zero:** Camera timecode is ignored, instead using a simple frame count with the first frame considered 0.

  – **Time of day (Local):** Time of day timecode recording.

  – **Time of day (GMT):** Time of day timecode recording based on Greenwich Mean Time.

  – **SMPTE:** Standard SMPTE timecode.

Project Settings

The following settings for exposure, color, and sharpness are available.

– **Gamma:** Three options are available for setting the gamma of the debayered output:

  – Rec. 709

  – Log 1

  – Log 2

– **Lift:** Adjusts the black point of the media, raising it or lowering it while scaling all midtone values between it and the white point. Regardless of how you adjust this control, all image data is preserved and can be retrieved in subsequent adjustments. The range is –100 to +100.

– **Gain:** Adjusts the white point of the media, raising or lowing it while scaling all midtone values between it and the black point. Regardless of how you adjust this control, all image data is preserved and can be retrieved in subsequent adjustments. 0 is unity. The range is –100 to +100.

– **Contrast:** Raising contrast reduces shadows and raises highlights, while leaving midtones at 50 percent unaffected. Regardless of how you adjust this control, all image data is preserved and can be retrieved in subsequent adjustments. 0 is unity. The range is –100 to +100.

– **Sharpness:** A debayer-specific sharpness filter applied to provide the appearance of enhanced image detail. 20 is unity. The range is 0 to 100.

– **Highlights:** Makes it easy to selectively retrieve blown-out highlight detail in high-dynamic-range media by lowering this parameter and achieves a smooth blend between the retrieved highlights and the unadjusted midtones for a naturalistic result. 0 is unity. The range is –100 (minimum) through +100 (maximum).

– **Shadows:** Lets you selectively lighten or darken shadow detail. Raising this value retrieves shadow detail recorded below 0 percent, while leaving the midtones alone. 0 is unity. The range is –100 (minimum) through +100 (very high).

– **Color Boost:** Lets you naturalistically raise the saturation of regions of low saturation, sometimes referred to as a vibrance operation. Can be used also to lower the saturation of regions of low saturation. 0 is unity. The range is –100 (minimum) through +100 (very high).

– **Saturation:** Adjusts the color intensity of the image. 0 is unity. The range is –100 (minimum) through +100 (very high).

– **Midtone Detail:** When this parameter is raised, the contrast of regions of the image with high edge detail is raised to increase the perception of image sharpness, sometimes referred to as definition. When this parameter is lowered to a negative value, regions of the image with low amounts of detail are softened while areas of high detail are left alone. 0 is unity. The range is –100 (minimum) through +100 (very high).

RED

R3D source media, recorded by the various models of RED DIGITAL CINEMA cameras, contains one of the most elaborate sets of raw parameters of any of the camera formats. These settings are divided into four different groups.

Master RED Settings

The Master RED settings are the most important, handling decode quality and the control governing whether the original camera metadata is used, or if you're overriding the camera metadata project-wide with custom settings.

These settings also contain the drop-down menus that let you choose the color space and gamma curve used to transform the raw image data into image data for processing in DaVinci Resolve when debayering R3D clips. Which Color Space and Gamma Curve settings you use are solely a matter of preference; there is no absolute requirement to use one or the other for any given type of workflow. You're simply looking for settings that provide the best starting point for the media you have, given the type of grading you're looking to do.

For example, in many cases combining the REDcolor3 Color Space setting and REDlog Film gamma curve will offer a starting point that retains the most image detail with the greatest latitude for adjustment. On the other hand, if you're working in a hurry, for example to generate dailies for offline editing, using one of the REDcolor Color Space settings with one of the REDgamma settings can offer an image that's more immediately pleasing and that requires fewer adjustments to achieve an acceptable result. These are not recommendations, they're only examples. As always, the ideal settings for your project depend heavily on the quality of the source media, so you should experiment with media from your own projects to find the most suitable results to your eye.

Master

These top settings determine the image quality that you're choosing to extract from the R3D source media. The tradeoff is that higher quality media at higher resolution will be more processor-intensive to debayer, depending on your workstation's capabilities.

– **Decode Quality:** Determines the image quality of the decoded R3D data that's handed off to the DaVinci Resolve image processing pipeline. The Decode Quality you select has a direct impact on real time performance. Decoding performance depends entirely on the hardware capabilities of your system.

On the most modern systems, R3D files can be decoded using accelerated GPU-based debayering if you set the Use GPU for R3D drop-down menu to Debayer in the Decode Options panel of the DaVinci Resolve System Settings. DaVinci Resolve 16.1.2 introduced the latest RED API-enabling 8K-accelerated debayering using Cuda. Otherwise, R3D files can be decoded with high performance using multi-core CPU processing if your workstation has fast enough CPUs.

If necessary, you can also choose a lower quality setting that provides better real time playback on systems with limited performance while you work, and then switch to a higher quality when rendering the final output. A "Force debayer res to highest quality" checkbox in the Render Settings list of the Deliver page makes it easy to follow this workflow.

- **Bit Depth:** DaVinci Resolve can decode R3D files with 8-, 10-, or 16-bit image data for processing. Choosing 16-bit for maximum quality may impact playback performance on some hardware.

- **Timecode:** The timecode recorded for R3D media depends on the camera setting in use when it was shot. There are three choices:

  - **Camera:** This setting automatically selects between Absolute and Edge depending on what was chosen as the default timecode mode on the camera. This setting needs to be selected before you add R3D media to the Media Pool. If you're browsing R3D media when you change this setting, you should refresh the folder in the Library of the Media Pool before adding media to the Media Pool.

  - **Absolute:** The default. Records "time of day" timecode. If an external timecode source was connected and the camera was put into Jam Sync mode, the external timecode would have been recorded instead.

  - **Edge:** The first recorded clip for each magazine starts at 01:00:00:00, and the timecode of each subsequent clip is recorded sequentially and continuously.

- **Decode Using:** The option you select determines whether all R3D media throughout the project is decoded using the original Camera Metadata settings (the default selection), using Project settings in which you choose custom settings to be applied to all clips, or using the RED default settings.

Project Settings

These settings control the fundamental methods used to debayer R3D media. The selections you make to these settings determine the basic color and contrast that you're choosing to extract from the camera raw image data.

- **Color Science:** The options are Original, which was the color science used by early builds of the REDone camera, Version 2, and IPP2, which is the current version of color science used by the entire RED camera line. Unless you need to match the look of older projects using the older color science, the newest color science is generally preferable.

- **Color Space:** Because RED cameras record R3D data which uses a raw color space, debayering the native R3D data requires choosing a color space to convert the raw signal into. Bear in mind that the color space you choose is merely a starting point for further correction. There is no requirement that you choose one or the other color space for any given workflow. You should choose the color space that provides the most pleasing starting point for your particular project.

  - **DragonColor2:** A further optimized version of DragonColor that is especially recommended for underwater footage.

  - **REDcolor4:** A further optimized version of REDcolor3 that is especially recommended for underwater footage.

  - **REDWideGamutRGB:** Part of RED's IPP2 (image processing pipeline 2) initiative; this is a camera color space designed to encompass all colors that can be recorded by RED cameras without clipping, and is meant to provide a single common starting point for all models of RED cameras, for convenient grading to HDR or SDR workflows.

  - **Rec. 2020:** Decodes into the standard color space specified by the Rec. 2020 standard for high definition video, UHD video, and beyond. While you may find this option useful, it is not required for programs being output to video.

  - **Rec. 709:** Decodes into the standard color space specified by the Rec. 709 standard for high definition video. While you may find this option useful, it is not required for programs being output to video.

  - **sRGB:** Decodes into the standard color space defined by the sRGB standard, typically used for computer display.

  - **Adobe1998:** Decodes into Adobe's unique version of the sRGB standard.

– **DCI-P3:** Decodes to an RGB-encoded image data with a D61 white point, intended for use when outputting media for DCI mastering.

– **DCI-P3 D65:** Decodes RGB-encoded image data with a D65 white point, intended for monitoring with a P3-compatible display.

– **ProPhoto RGB:** A color space developed by Kodak that offers a large gamut intended for photography. An idiosyncrasy of this color space is that the green and blue primary points are outside the boundaries of visible color, meaning this gamut encompasses "imaginary" colors in order to achieve an extremely large gamut.

– **CameraRGB:** Outputs the original, unmodified sensor data. Not a recommended setting.

– **REDspace:** Fits the raw R3D image data into a color space that's larger than that of Rec. 709. Appropriate for digital cinema mastering and film output. REDspace was the predecessor to the REDcolor setting.

– **REDcolor:** A color space that's similar to the Rec. 709 option, but modified to balance accuracy with pleasing color rendition, emphasizing accurate skin tones.

– **REDcolor2:** Similar, but less saturated than, REDcolor.

– **REDcolor3:** Similar saturation to REDcolor, but with additional modifications to improve the color rendition of skin tone. Introduced as the optimum color space for Epic cameras, but also appropriate for previous generations of RED cameras.

– **DragonColor:** A color space optimized for cameras with the RED Dragon sensor, although this color space can be used for previous generations of RED cameras as well.

– **Gamma Curve:** There are several options available for choosing a gamma profile to be used when debayering the raw R3D data:

  – **REDgamma4:** The latest iteration of the REDgamma curve, designed to give a good in-camera look without the need for grading, while retaining great dynamic range and highlight handling. REDgamma4 is suitable for all RED cameras.

  – **REDlog Film:** An improved logarithmic gamma setting that's designed to remap the original 12-bit R3D data to the standard Cineon gamma curve. This setting produces flat-contrast image data that preserves image detail with a wide latitude for adjustment, and is compatible with log workflows, including those intended for film output.

  – **Linear:** No gamma adjustment is made, this is a linear-to-light representation of data from the RED camera's sensor.

  – **Rec. 709:** A gamma curve typical for Rec. 709 display. Does not provide an abundance of latitude for grading.

  – **Gamma 2.4:** A simple power-function gamma setting commonly used for broadcast.

  – **Gamma 2.6:** A simple power-function gamma setting commonly used for digital cinema projection.

  – **sRGB:** Similar gamma setting to that employed by Rec. 709.

  – **HDR ST.2084:** The standardized gamma curve for high-dynamic-range (HDR) video. Also referred to as the PQ curve.

  – **Hybrid Log Gamma:** The standardized gamma curve for the HLG standard of high-dynamic-range (HDR) video jointly developed by the BBC and NHK.

  – **BT.1886:** The standardized gamma curve for standard-dynamic-range HD and UHD display. Does not provide an abundance of latitude for grading.

- **Log3G12:** An expanded option for RED's IPP2 (image processing pipeline 2) initiative, this is a wide dynamic range log space designed to encode camera data from all RED models to a common starting point in RWG color space for convenient grading to HDR or SDR workflows. Log3G12 provides 12 stops of dynamic range above mid gray, 2 more stops than Log3G10. However, this is at the expense of a slight loss of precision.

- **Log3G10:** Part of RED's IPP2 (image processing pipeline 2) initiative, this is a wide dynamic range log space designed to encode camera data from all RED models to a common starting point in RWG color space for convenient grading to HDR or SDR workflows. 3G represents the mapping of 18% mid gray to 1/3, and 10 represents the 10 stops of dynamic range above mid gray this supports.

- **PDlog 685:** A logarithmic gamma setting that maps the native 12-bit RED image data into the linear portion of a Cineon or film transfer curve.

- **PDlog 985:** A logarithmic gamma setting with different mappings.

- **Custom PDlog:** A logarithmic gamma setting that exposes user adjustable Black Point, White Point, and Gamma PDlog parameters so you can customize your own log gamma curve.

- **REDspace:** Similar to Rec. 709, but slightly altered to be more appealing, primarily through higher contrast and lighter midtones. The predecessor to the REDgamma curve.

- **REDlog:** A logarithmic gamma setting that maps the original 12-bit R3D image data to a 10-bit curve. The blacks and midtones occupying the lowest 8 bits of the video signal maintain the same precision as in the original 12-bit data, while the highlights that occupy the highest 4 bits are compressed. While reducing the precision of highlight detail, the tradeoff is that there's an abundance of precision throughout the rest of the signal. This is a good setting for maintaining maximum latitude.

- **REDgamma:** An improved gamma curve designed to be perceptually appealing on displays calibrated for Rec. 709, with an improved soft roll-off in the highlights to maintain highlight detail while grading.

- **REDgamma2:** Similar to REDgamma, with higher contrast.

- **REDgamma3:** The most recent iteration of the REDgamma curve. Based on a log starting point, but with a pleasing "ready to view" contrast curve applied, designed to be a visually pleasing starting point that maintains excellent dynamic range. REDgamma3 is also designed to work with REDcolor3.

- **Blend Type:** Works to control how RED HDRX media is used. When using either Simple or Magic Motion to blend HDRX exposures, there's no need to use the second output in the Node Editor. You can choose from three options:

  - **None:** Only the regular exposure is used.

  - **Simple:** Blends the two HDRX exposures to achieve a pleasing middle ground.

  - **Magic Motion:** Uses a proprietary algorithm to combine the dual exposures to combine overexposed and well-exposed regions of the picture in a more targeted fashion, while blending the sharpness of the regularly exposed source with the motion blur of the underexposed source.

- **Blend Bias:** Lets you adjust how much of the regular exposure and how much of the underexposure are combined.

- **Apply Metadata Curves:** If the R3D media files were preprocessed in REDCINE X Pro, and saved with color curve metadata, you can use this setting to either use or discard that metadata.

- **D.E.B. (Dragon Enhanced Blacks):** A checkbox that enables the elimination of red noise in RED cameras using the Dragon sensor.

- **Embedded Audio:** Enables embedded audio in R3D media.

Decoder Settings

This second group of settings contains additional controls for finessing the debayering of RED raw image data. Which controls are exposed depends on which Color Science setting is selected above. Many of the settings in this group are color correction adjustments, some of which resemble analogous controls in the Color page. However, the FLUT and DRX controls manage the exposure of the debayered media being fed to the DaVinci Resolve image processing pipeline, and so can be used to retrieve image detail from R3D source media in cases where the default settings are clipping or crushing detail in the highlights or shadows that would be unavailable to DaVinci Resolve as a result.

- **De-noise:** Applies image-wide noise reduction. There are seven settings available, from mild to maximum, that you can use to balance noise reduction against any possible image degradation.

- **OLPF Compensation:** (color science versions 1 and 2) OLPF compensation applies a low pass filter to reduce color moiré. There are four options: Off (the default), Low, Medium, and High.

- **Image Detail:** (color science versions 1 and 2) Controls the demosaicing algorithm that's used for the software decoding of R3D media. You can choose a level of sensor detail extraction: Low, Medium, and High (recommended). If you're using a RED ROCKET card, this setting is ignored as there is a fixed algorithm that's used.

- **FLUT:** (color science versions 1 and 2) A gain operation that lets you boost or attenuate the ISO in smaller increments. 0 is unity. The range is –8 to +8.

- **Contrast:** Raising contrast reduces shadows and raises highlights, while leaving midtones at 50 percent unaffected. The image is compressed rather than clipped at the limits of 100 and 0 percent. 0 is unity. The range is –1 to +1.

- **Saturation:** (color science versions 1 and 2) Adjusts the color intensity of the image. 1 is unity. The range is 0 (minimum) through 5.0 (very high).

- **DRX:** (color science versions 1 and 2) A Dynamic Range control (X) that lets you recover highlights while taking into account Color Temperature (degrees Kelvin) and Tint. 0 is unity, and 1.0 is the maximum value.

- **Shadow:** (color science version 1 and 2) Provides control over the toe (low range) of the FLUT adjustment. 0 is unity. The range is –2 to +2.

- **Brightness:** Adjusts image lightness. Image data is compressed rather then clipped at 100 and 0 percent. 0 is unity. The range is –10 to +10.

- **Flashing pixel adjust:** A setting to apply noise reduction for removing or minimizing any flashing pixels recorded from the sensor. Levels are: None, Low, Medium, and High.

Three additional parameters are available for IPP2 workflows, but they only function when DaVinci Resolve is set to use DaVinci YRGB Color Managed color science and the Timeline to Output Gamut Mapping in the Color Management panel of the Project Settings is set to RED IPP2 Gamut Mapping. These controls (which are also mirrored in the Color Management panel when enabled) are designed to let you tone map wide gamut media that's being graded to a smaller gamut, such as Rec. 709.
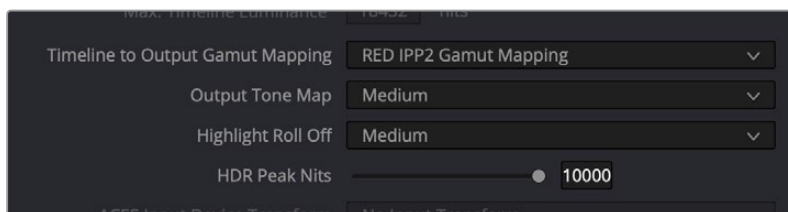
The RED IPP2 Gamut Mapping controls that appear
in the Color Management tab of the Project Settings

– **Output Tone Map:** (color science IPP2) Provides an easy setting for setting the resulting contract when tone mapping wide dynamic range images to standard dynamic range (SDR) output. Settings are: None, Low, Medium, and High. Low results in less contrast; High results in more contrast.

– **Highlight Roll Off:** (color science IPP2) Five settings let you adjust how much to roll off the highlights to fit within the current gamut. These are: None, Hard, Medium, Soft, and Very Soft. Hard provides a minimum of roll-off; Very Soft provides a maximum of roll-off. This setting interacts with the HDR Peak Nits slider below.

– **HDR Peak Nits:** (color science IPP2) Adjusts the amount of highlight compression that's done by Highlight Roll Off.

Use Camera Metadata

The most elemental camera metadata settings for exposure and color that are available.

– **ISO:** A gain operation that keeps the black point at 0 while raising or lowering the white point of the image, linearly scaling everything in between. Raising the ISO results only in boosted highlights being more compressed; no clipping will occur. 320 is unity. The range is 50–6400.

– **Exposure Adjust:** Increases or lowers image lightness in units relative to *f*-stops. Using exposure to boost the image beyond 100 or to lower it below 0 will clip, not compress, the image data that's passed along to the DaVinci Resolve image processing pipeline. 0 is unity. The range is –7 to +7.

– **Color Temp:** Designed to alter the "warmth" of the image while keeping white elements of the scene looking neutral. Adjustable in degrees Kelvin. Lower values correct for "warmer" lighting, while higher values correct for "cool" lighting. This parameter is designed specifically to adjust RED linear light image data to make the most photometrically accurate correction. 5600 is unity. The range is 1700 to 10,000.

– **Tint:** Color balance correction for images with a green or magenta color cast, such as fluorescent or sodium vapor bulbs. This parameter is designed specifically to adjust RED linear light image data to make the most photometrically accurate correction. 0 is unity. The range is –100 to +100.

Sony RAW

Sony makes several digital cinema cameras, such as the F65 and F55, that record wide latitude, high-gamut media either using Sony's 12-bit SR codec, or as 16-bit raw media files. Since Sony's cameras do not use a traditional Bayer pattern, special debayering is necessary when working with F65 raw media, and the image data is demosaiced using the following raw controls and parameters.

Master Settings

These parameters let you choose the decode quality, white balance, color space, and gamma that Sony raw clips will be transformed to use when debayered.

– **Decode Quality:** Determines the image quality of the decoded Sony raw data that's handed off to the DaVinci Resolve image processing pipeline regardless of the Play Quality setting. The Decode Resolution you select has a direct impact on real time performance, and decoding performance depends entirely on the hardware capabilities of your system.

   If necessary, you can choose a lower resolution setting that provides better real time playback on systems with limited performance while you work, and then switch to a higher quality when rendering the final output. A "Force debayer res to highest quality" checkbox in the Render Settings list of the Deliver page makes it easy to follow this workflow.

– **Decode Using:** The option you select determines whether all F65 media throughout the project is decoded using the original Camera Metadata settings (the default selection), using Project settings in which you choose custom settings to be applied to all clips, or using the Sony default settings.

Project Settings

These settings control the fundamental methods used to debayer Sony raw media. The selections you make to these settings determine the basic color and contrast that you're choosing to extract from the camera raw image data.

- **White Balance:** The first seven options offer White Balance presets, which automatically adjust the Color Temp and Tint parameters. These options include: Daylight, Cloudy, Shade, Tungsten, Fluorescent, and Flash. An eighth option, Custom, makes the Color Temp and Tint parameters user-adjustable.

- **Color Space:** Multiple color spaces are adjustable, depending on your intended workflow:

  - **Rec. 709:** Decodes into the standard color space specified by the Rec. 709 standard for high definition video.

  - **P3 D60:** Decodes RGB-encoded image data with a D60 white point, intended for monitoring with a P3-compatible display.

  - **SGamut:** Decodes into Sony's wider S-gamut color space, designed to provide the widest range of image data for adjustment.

  - **SGamut3:** The gamut is identical to SGamut, but color reproduction is more accurate, according to Sony's "Technical Summary for S-Gamut3Cine/S-Log3 and S-Gamut3/S-Log3" whitepaper.

  - **SGamut3.Cine:** According to Sony's "Technical Summary for S-Gamut3Cine/S-Log3 and S-Gamut3/S-Log3" whitepaper, S-Gamut3.Cine is designed to provide a more traditionally log-encoded workflow with color reproduction that is slightly wider than the P3 gamut.

  - **P3:** Decodes to an RGB-encoded image data with a D61 white point, intended for use when outputting media for DCI mastering.

  - **ACES:** Decodes to image data that maps to the ACES profile for the camera that was used.

- **Gamma:** Five gamma settings are available, depending on what starting point you want to use for further grading.

  - **Gamma 2.4:** A simple power-function gamma setting commonly used for broadcast.

  - **Gamma 2.6:** A simple power-function gamma setting commonly used for digital cinema projection.

  - **Rec. 709:** A gamma curve typical for Rec. 709 display.

  - **SLog:** Not designed for viewing, Sony's SLog gammas are designed to provide a wide latitude for grading; 14-stops according to Sony. 18% gray is at 38%.

  - **SLog2:** This version has a half stop offset from SLog to allow for a higher dynamic range. 18% gray is at 32%.

  - **SLog3:** An "easier to grade" version of SLog. 18% gray is at 40%. According to Sony's "Technical Summary for S-Gamut3Cine/S-Log3 and S-Gamut3/S-Log3," SLog3 is designed to provide a more traditionally log-encoded workflow, with a gamma curve that is similar, but not identical, to Cineon workflows.

  - **Linear:** A simple linear gamma setting.

- **Lift:** Adjusts the black point of the media, raising it or lowering it while scaling all midtone values between it and the white point. Regardless of how you adjust this control, all image data is preserved and can be retrieved in subsequent adjustments. The range is –100 to +100.

- **Gain:** Adjusts the white point of the media, raising or lowering it while scaling all midtone values between it and the black point. Regardless of how you adjust this control, all image data is preserved and can be retrieved in subsequent adjustments. 0 is unity. The range is –100 to +100.

- **Contrast:** Raising contrast reduces shadows and raises highlights, while leaving midtones at 50 percent unaffected. Regardless of how you adjust this control, all image data is preserved and can be retrieved in subsequent adjustments. 0 is unity. The range is –100 to +100.

- **Sharpness:** A debayer-specific sharpness filter applied to provide the appearance of enhanced image detail. 20 is unity. The range is 0 to 100.

- **Highlights:** Makes it easy to selectively retrieve blown-out highlight detail in high-dynamic-range media by lowering this parameter, and achieves a smooth blend between the retrieved highlights and the unadjusted midtones for a naturalistic result. 0 is unity. The range is –100 (minimum) through +100 (maximum).

- **Shadows:** Lets you selectively lighten or darken shadow detail. Raising this value retrieves shadow detail recorded below 0 percent, while leaving the midtones alone. 0 is unity. The range is –100 (minimum) through +100 (very high).

- **Color Boost:** Lets you naturalistically raise the saturation of regions of low saturation, sometimes referred to as a vibrance operation. Can be used also to lower the saturation of regions of low saturation. 0 is unity. The range is –100 (minimum) through +100 (very high).

- **Saturation:** Adjusts the color intensity of the image. 0 is unity. The range is –100 (minimum) through +100 (very high).

- **Midtone Detail:** When this parameter is raised, the contrast of regions of the image with high edge detail is raised to increase the perception of image sharpness, sometimes referred to as definition. When this parameter is lowered to a negative value, regions of the image with low amounts of detail are softened while areas of high-detail are left alone. 0 is unity. The range is –100 (minimum) through +100 (very high).

Use Camera Metadata

The most elemental camera metadata settings for exposure and color that are available.

- **Exposure:** Increases or lowers image lightness in units relative to ASA values. If your intended exposure adjustment lifts image data above the maximum white level, don't worry; all image data is preserved and can be retrieved in subsequent adjustments. +800 is unity. The range is +1 to +65,535.

- **Color Temp:** Designed to alter the "warmth" of the image. Adjustable in degrees Kelvin. Lower values correct for "warmer" lighting, while higher values correct for "cool" lighting. +6500 is unity. The range is +2000 to +50,000.

- **Tint:** Only available when White Balance is set to something other than As Shot. Designed to alter the green to magenta balance of the image, for images with fluorescent tinting. Lower values add green to compensate for magenta lighting, while higher values add magenta to compensate for green lighting. 0 is unity. The range is –150 to +150.

Sony Media and SLog

Sony's proprietary SLog gamma setting, which produces flat-contrast, wide-gamut image data that preserves image detail with a wide latitude for adjustment, is also available on some other Sony cameras. Similarly to working with clips using the ARRI ALEXA's Log-C gamma, you need to normalize SLog clips by using Resolve Color Management (RCM), by making a manual adjustment to color and contrast, or by applying a LUT, using the same techniques discussed previously.

When applying a LUT, there are two methods that Sony recommends. A 1D LUT can be used to transform SLog clips into the standard Cineon (or Log-C) curve if your ultimate goal is to output Log media for film printing. If you're planning to output to a normalized format, you can use a dedicated LUT to make this transformation.

For more information, search the web for Sony's document "SLog: A new LUT for digital production mastering and interchange applications."

Chapter 8

Improving Performance, Proxies, and the Render Cache

DaVinci Resolve is a high-performance piece of software designed to enable real time effects on a variety of workstations. This section describes the various ways you can monitor your performance to make sure you're maintaining real time playback, along with different methods of optimizing real time performance, including using on-the-fly proxies and the background Render Cache.

Contents

Understanding the GPU Status Display

Every viewer in DaVInci Resolve exposes a GPU status indicator and a frame-per-second (FPS) meter, which appears in the Viewer's title bar, which shows you your workstation's performance whenever playback is initiated. Since DaVinci Resolve uses one or more GPUs (graphics processing units) to handle all image processing and effects, the GPU status display shows you how much processing power is being used by whichever clip is playing.
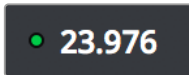
Frame rate and GPU
indication, green is good

A green status indicator shows there is plenty of GPU processing headroom available. As the GPU resources is increasingly taxed, this green graph eventually turns red to show that the available GPU power is insufficient for consistent real time playback.

Red indicates that playback
is at slower than real time

Eventually, as you add more and more effects and corrections, you'll reach the limits of available performance, forcing DaVinci Resolve to either drop frames, or play video at a slower speed in order to maintain high image quality, shown by the red FPS indicator.

When real time performance falls short, DaVinci Resolve provides a variety of controls and options that let you enhance real time playback and effects. Each is useful for different situations, and all can work together so you can choose the best trade-off between image quality and performance while you work. All of these methods can be set up to have no effect on your delivered output.

Prioritizing Audio or Video Playback in the Edit Page

When available processing power is insufficient to play the clip or clips at the position of the playhead due to the grade, transforms, or effects that are applied at that moment in the Timeline, you have the ability to choose exactly how performance in DaVinci Resolve degrades, by turning the "Show All Video Frames" on or off in the Option menu of the Edit page Viewers.

– **Show All Video Frames off:** The default setting, ideal for video editing. Prioritizes audio playback at the expense of dropping video frames when processing power is tight, resulting in a more conventional playback experience.

– **Show All Video Frames on:** An alternate setting that's ideal when you're doing effects work, for which you need to see every single frame play back, sequentially. Audio quality is compromised while every frame of video plays in slower-than-real-time, if necessary, to maintain playback.

Keep in mind that this setting only affects playback when GPU performance is lacking. In areas of the Timeline where performance is adequate, playback remains uncompromised.

Performance Mode Improves Overall Performance

Performance Mode, which is found in the Playback Settings of the User Preferences, analyzes your computer's configuration, the CPU, GPU, connected video interface, and so on, and automatically tunes DaVinci Resolve's under-the-hood image processing settings to provide the best interactivity on your machine. It's set to Automatic by default, although you can choose to adjust its effect manually, or disable it altogether. When enabled, Performance Mode dramatically improves the experience of editing, mixing, and grading on less powerful computers.

While Performance Mode is turned on, DaVinci Resolve still outputs to video, renders in the Delivery page, and processes via the Media Management command at the highest quality. As a result, using Performance Mode makes no compromise in the quality of your output, so creative editors and audio mixers can leave this setting on always.

Finishing editors and colorists might notice subtle differences between the image on your computer monitor on less powerful computers when Performance Mode is on versus when it's off, which is why this setting can be disabled, either entirely or in part using checkboxes in the Playback Settings panel of the User Preferences for instances where GUI interactivity is less important than your onscreen display.

Adjusting Performance Mode

A pair of radio buttons in the Playback Settings panel of the User Preferences let you choose between Automatic (default) and Manual behaviors when you turn on Performance Mode in DaVinci Resolve. Set to Automatic, Performance mode automatically optimizes a variety of operations in a bid to balance performance with the necessary level of image quality, for fast onscreen performance while always maintaining the highest level of quality for video output.

Set to Manual, there are three different settings you can choose to disable for instances where a particular performance tradeoff results in an undesirably noticeable reduction in image quality in Performance Mode:

– **Optimized Sizing:** Relates to how image resizing is handled.

– **Optimized Decode Quality:** Relates to how clip resolution vs. timeline resolution is handled.

– **Optimized Image Processing:** Relates to how image processing operations are handled.

Timeline Proxy Mode Improves Effects Performance

If you don't want to either drop frames or play at slower than real time speed whenever the GPU Status indicator is in the red, an immediate way of improving performance is to turn on the Use Timeline Proxies option in the Playback menu. Using timeline proxies reduces processing demands by taking advantage of the resolution independence of DaVinci Resolve to lower the resolution of your clips on-the-fly, thereby increasing real time playback performance without the need to spend time caching part or all of the timeline, or create optimized media (both discussed later).

To turn Use Timeline Proxies on and off, do one of the following:

– Choose Playback > Timeline Proxy Mode > Half Resolution, Quarter Resolution, or None.

– Press PROXY ON/OFF on the T-bar panel of the DaVinci control panel (Defaults to the last proxy resolution you selected from the menu. Half is the default if you haven't selected a resolution yet.).

Turning on one of the proxy resolutions reduces the working resolution by either half or a quarter of whatever the current Timeline resolution is for your project. Working at a temporarily reduced resolution increases your workstation's real time performance, while the resolution independence of Resolve guarantees that every window you draw and sizing operation you make scales correctly to the actual resolution of your project.

Proxy Resolution	Width	Height
Full 8K UHD	7680	4320
Full UHD/Half 8K UHD	3840	2160
Full-HD/Half UHD/Quarter 8K UHD	1920	1080
Half-HD/Quarter UHD/Eighth 8K UHD	960	540
Quarter-HD/Eighth UHD/Sixteenth 8K UHD	480	270

Table of half and quarter proxy resolutions for different television frame sizes

> **Important**
>
> Timeline Proxy Mode is entirely different and independent of the creation of Proxy Media as described later in this chapter. The two functions, Timeline Proxy Mode and Proxy Media, have no relation to each other.

Reducing Decode Quality Improves Raw Media Performance

The Use Proxy command will improve performance when grades and effects are responsible for your project's slower than real time playback, but Use Proxy won't help when real time performance is being used up by the need to debayer raw media. While you could improve playback performance by taking the time to either generate optimized media (see below) or render to the Fusion Output Cache by enabling the Smart Cache (see later in this chapter), the fastest solution is to open the Camera Raw panel of the Project Settings and reduce the Decode Quality of the raw media formats you're using:

– **Decode Quality:** Camera raw formats such as R3D and F65 can be debayered at different levels of quality. For higher real time performance, you can choose a lower quality setting while you work, and then switch to a higher quality when rendering the final output.

Options for reducing resolution vary by each raw format's differing capabilities, but at the very least include full, half, and quarter resolution (R3D and Sony Raw have options for full, half, quarter, eighth, and sixteenth). Exceptions include the Canon RAW, Panasonic Varicam RAW, and Phantom Cine formats, which only decode to full resolution.

If you reduce the decode quality of raw media formats in your project to improve performance, you can use the "Force debayer res to highest quality" checkbox in the Render Settings list of the Deliver page to ensure that DaVinci Resolve renders all raw formats at the highest quality available, so you don't have to worry about forgetting to change the decode quality back when it's time to render your deliverables.

Optimized Media Improves Overall Performance

If you're editing processor-intensive source formats such as camera raw, H.264, or 8K media, and your computer isn't fast enough to work with it easily in real time, you can create pre-rendered, low-overhead duplicate media to use instead, that's automatically managed alongside the original media. This is called "Optimized Media." Optimized Media lets you work more quickly by allowing you to edit with a more processor-efficient media format and resolution, while providing the ability to easily switch your project back to the original source media whenever you want. So, you can use Optimized media to edit, and switch back to the original source media when it's time to finish and output. Switching is as easy as choosing Playback > Use Optimized Media if Available to toggle Optimized media on and off.

The advantage of using optimized media to help you work faster is that it's pre-generated, meaning you can render it once and then use the files for the duration of your work in that project (unless you change the debayering settings of the raw media). Also, optimized media improves the playback performance of clips throughout DaVinci Resolve, including in the Media page and in the Media Pool and Source Viewer of the Edit page, whereas the similar but different Fusion Output Cache component of the Smart Cache only improves the performance of clips that are already in the Timeline by caching them at the Timeline resolution. This makes optimized media ideal for editing workflows of all kinds.

Choosing the Appropriate Optimized Media Format for Your Project

You have the option of choosing the Format of the optimized media you create, using controls in the Master Settings panel of the Project Settings. Be aware that the format you choose via the "Optimized Media Format" menu will determine whether out-of-bounds image data (also known as "overshoots") and Alpha Channels are preserved when the clip is cached.

– **Preventing Clipping:** You should use 16-bit float, ProRes 4444, ProRes 4444 XQ, or DNxHR 444 if you plan on grading using optimized media. This is particularly true for HDR grading.

– **Preserving Alpha Channels:** Also be aware that the format you choose will determine whether Alpha Channels will be preserved if they're present in the clips being optimized. Currently, the Uncompressed 10-bit, Uncompressed 16-bit Float, ProRes 4444, ProRes 4444 XQ, and DNxHR 444 formats preserve alpha channels.

Creating Optimized Media

Creating optimized media to work with is easy. Resolve automatically manages the relationship between source clips and the optimized media you create, so all you need to do is choose which clips to make optimized media for. You can manually choose which clips to optimize, or you can use a Smart Bin to collect all of the media corresponding to one or more formats you need to optimize to gather it procedurally. In either case, this gives you the option of only optimizing clips in formats that require optimization, saving you time.

For example, if you're editing a project that consists half of camera raw media, and half of DNxHD media, you probably only need to optimize the camera raw media, so you can create a Smart Bin that gathers all of it, based on Resolution, Codec, File Name, or whatever other metadata is appropriate. Once gathered, it's an easy thing to select all of these clips in preparation for the next step.

To create optimized media for one or more selected clips:

– Right-click one of the selected clips, and choose Generate Optimized Media from the contextual menu.

All optimized media is written to the same directory as the Cache files are written, which defaults to the first scratch disk listed in the Preference dialog's Media Storage panel. The location of Cache and Optimized files is also selectable via the "Cache files location" setting in the Master Settings panel of the Project Settings.

Optimized Media for Raw Source Clips

In general, once you create optimized media, DaVinci Resolve keeps track of it and continues using it regardless of whatever changes you make to your project, including changing the Timeline resolution. However, any change to the camera raw settings of optimized clips will automatically discard the optimized media, requiring you to re-generate optimized media for them.

Customizing the Type of Optimized Media You Create

The Master Settings panel of the Project Settings has a set of controls that govern what kind of media files are created when you create optimized media.
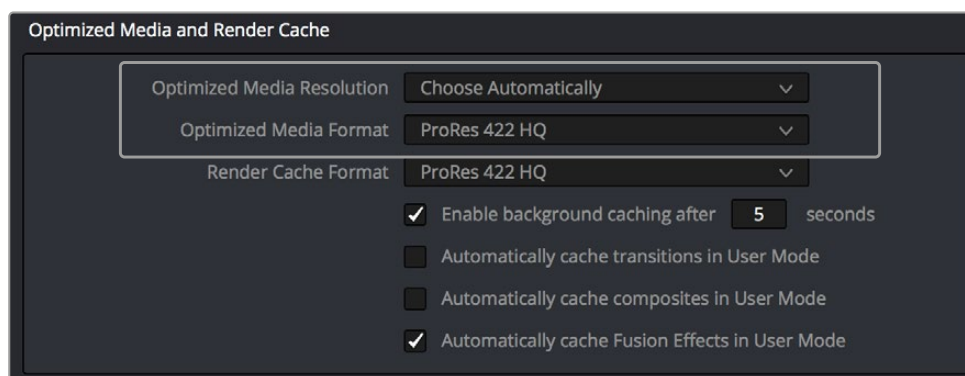
Options available for creating optimized media in the Master Settings panel of the Project Settings

There are two settings affecting Optimized Media in the Optimized Media and Render Cache section:

– **Resolution:** Lets you choose whether to create optimized media at the same size as your original media files (by choosing Original), or to reduce the bandwidth of your optimized media further by reducing its resolution by a Half, Quarter, Eighth, or Sixteenth. The "Choose automatically" option tries to balance visual quality with efficiency by only reducing the resolution of media files that are larger than the currently selected Timeline resolution, using whatever reduction ratio best matches the Timeline resolution.

– **Optimized Media Format:** Lets you choose the format and codec with which to generate optimized media. Options include Uncompressed 10-bit, and Uncompressed 16-bit float for maximum quality. Other options include ProRes Proxy through 4444 XQ, and DNxHR LB through 444. All options will store image data in the optimized and proprietary .dvcc image format. While smaller formats take less room on your scratch disk, there are two good reasons to use higher-quality formats for creating Optimized Media.

  – **Preventing Clipping:** Be aware that the format you choose will determine whether out-of-bounds image data is preserved when the signal is optimized. If you find that image data (typically super-white levels) are clipped after optimization, you should switch to 16-bit float, ProRes 4444, or ProRes 4444 XQ; in particular, any of these three codecs are appropriate optimized formats for HDR grading.

  – **Preserving Alpha Channels:** Also be aware that the format you choose will determine whether Alpha Channels will be preserved, if they're present in the clips being Optimized. Currently, the Uncompressed 10-bit, Uncompressed 16-bit Float, ProRes 4444, ProRes 4444 XQ, and DNxHR 444 formats preserve alpha channels.

Choosing Resolution Automatically

The "Choose automatically" option of the Resolution setting bears a bit more explanation. When selected, only source media with a higher resolution than the selected Timeline resolution will generate downsized optimized media. How much each clip will be downsized depends on how much larger each clip is than the Timeline resolution. For example, if you're working within a 1080 resolution project, then 8K clips will generate quarter-resolution optimized media, and 4K clips will generate half-resolution optimized media, such that all optimized media is somewhere around 1080 resolution. All clips that are 1080 and smaller generate optimized media at the same resolution as the source clips.

In the example of a 4K project, 8K clips will generate half-resolution optimized media, and all other clips that are 4K and smaller will generate optimized media at the same resolution as the source clips.

Proxy Resolution	Width	Height
Full 8K UHD	7680	4320
Full UHD/Half 8K UHD	3840	2160
Full-HD/Half UHD/Quarter 8K UHD	1920	1080
Half-HD/Quarter UHD/Eighth 8K UHD	960	540
Quarter-HD/Eighth UHD/Sixteenth 8K UHD	480	270
Eighth-HD/Sixteenth UHD	240	135

Table of optimized resolutions for different television frame sizes

Switching Between Optimized and Original Media

Choosing whether or not you're using optimized media is easy. Simply choose Playback > Use Optimized Media if Available to switch your entire project between using optimized media (if it's been generated), or the original media. Furthermore, a checkbox in the Render Settings of the Deliver page lets you choose whether you want to use optimized media to speed up rendering, or render using the original media only.

> **NOTE:** Optimized media is not included in Media Management operations, nor is it included as part of Archive operations in the Project Manager.

Sharing Optimized Media Between Projects

Optimized Media is shared across projects in the same database (previously optimized media was confined to a single project). This means that if you create optimized media for a clip in one project, that same optimized media will be used for that clip in any other project that's in the same database. This happens automatically and requires no user input. This will dramatically cut down the space requirements for working with the same media across different projects.

Rediscovering Lost Optimized Media

It's difficult, but it is possible to lose track of optimized media you've generated in certain rare circumstances. For example, if you generate optimized media on another workstation, but failed to save the project, DaVinci Resolve may lose the relationship between the clips in the Media Pool and the optimized media files you created. In these cases, it's possible to rediscover the optimized media so you don't have to regenerate it.

To rediscover lost optimized media:
Select the clips in the Media Pool for which you know you have optimized media, then right-click one of the selected clips and choose Rediscover Optimized Media from the contextual menu.

Deleting Optimized Media

The optimized media you generate within a project is persistent; it's saved for future use even when the project is closed and later reopened. If you need to delete optimized media to free up space on your scratch volume (or wherever you've decided to locate your project's cache files), you must delete the optimized media manually in your OS. By default, the Optimized Media is stored in the first volume in the Media Storage tab of the System Preferences.

Using Optimized Media for Delivery

An option in the More options section of the Render Settings in the Deliver page, "Use Optimized Media," lets you output using Optimized Media, rather than the original media, in order to save rendering time. If you're planning on using this option, it's advisable to set the Optimized media format to a suitably high-quality HDR-capable format to guarantee the best results.

Using the Smart or User Cache Improves Effects Performance

Another option for achieving real time performance when the GPU Status indicator is in the red due either to Timeline effects, Color page grading, or processor-intensive media in the Timeline, is to use the Smart Cache or User Cache modes of the Render Cache. What DaVinci Resolve calls "caching" is sometimes referred to by other applications as "rendering." Both terms refer to the behind-the-scenes creation of new media, with all effects "baked in," which DaVinci Resolve plays back in real time in place of the original source media containing processor-intensive effects at the same time. This results in smooth playback without the risk of dropped frames.

The DaVinci Resolve Smart Cache and User Cache automatically render and cache clips, including simple video clips, compound clips, Fusion clips, and nested timelines that have processor-intensive grades and effects applied to them, or that you manually flag for caching by right-clicking any clip in the Color page or Edit page timeline and enabling the Render Cache Clip Output option. When the Smart or User Caches are enabled, frames of each automatically or manually flagged clip are cached either during playback in the Timeline, or automatically whenever you pause work, to the "Cache files location" specified in the Master Settings panel of the Project Settings.
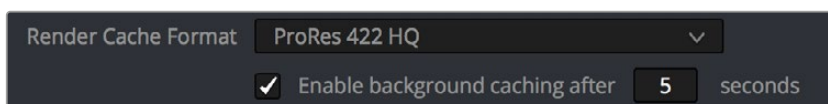
The settings governing caching in the Master Settings panel of the Project Settings

Once you've cached clips in the Timeline, they play back in real time until they're modified, which automatically flushes the now out-of-date cache files for those modified clips and triggers the need to re-cache.

To use clip caching on any page, do one of the following:

– Choose Playback > Render Cache > Smart to set DaVinci Resolve to automatically cache computationally intensive effects and timeline clips in formats judged too processor-intensive to play in real time.

– Choose Playback > Render Cache > User to set DaVinci Resolve to cache clips and effects that you manually choose to cache, as well as automatically caching processor-intensive effects (transitions, composites, and Fusion Effects) you specify in the Master Settings of the Project Settings.

– Choose Playback > Render Cache > Off to disable all render caching.

– In the Color and Edit pages, press Option-R to cycle among Off, Smart, and User.

– Press CACHE MODE on the T-bar panel of the DaVinci control panel to toggle among the available options.

Choosing the Appropriate Cache Media Format for Your Project

You have the option of choosing the Format of the cached media you create, using controls in the Master Settings panel of the Project Settings. Be aware that the format you choose via the "Render Cache Format" menu will determine whether out-of-bounds image data (also known as "overshoots") and Alpha Channels are preserved when the clip is cached.

– **Preventing Clipping:** You should use 16-bit float, ProRes 4444, ProRes 4444 XQ, or DNxHR 444 if you plan on grading using cached media. This is particularly true for HDR grading.

– **Preserving Alpha Channels:** Also be aware that the format you choose will determine whether Alpha Channels will be preserved, if they're present in the clips being cached. Currently, the Uncompressed 10-bit, Uncompressed 16-bit Float, ProRes 4444, ProRes 4444 XQ, and DNxHR 444 formats preserve alpha channels.

How Cached Media Is Organized

The cache mechanism in DaVinci Resolve actually comprises three independently managed media caches that interact with one another. This is done to keep you working quickly by ensuring that changes you make to your timeline don't require a grade to be re-cached, and that changes you make to a grade don't require the timeline to be re-cached. The three levels of caching are:

First, Fusion Output Caching

Formerly called the "Source Cache" in previous versions of DaVinci Resolve. When enabled by turning on the Smart Cache, by individually turning on Render Cache Fusion Output for a particular clip, or by enabling the automatic caching of clips with Fusion Effects applied in the Project Settings, this caches the portion of each source media file that appears in the Timeline in its pre-graded state for clips that have the following characteristics:

– Clips in media formats DaVinci Resolve considers to be processor-intensive to decode, such as H.264, HEVC, and various raw camera formats

– Clips with Speed or Retime effects

– Clips with Fusion Effects that have been added in the Fusion page

– Titles and Generators that are processor intensive

Effectively, this is a "pre-Color page" cache. By caching all processor-intensive clips in the Timeline, you'll experience vastly improved trimming and grading performance. However, you also have the option to turn the Fusion Output Cache on or off for individual clips, or for multiple selected clips all at once. This lets you switch between using the native source of each clip with live effects, or the cached clip in the cache format you've chosen.

The advantage of the Fusion Output Cache over Optimized Media is that you only cache clips that are used in a timeline, which is ideal for finishing workflows. However, the Smart and User caches aren't useful for speeding up work done with source media in the Media Pool and Source Viewer when you're at the very beginning of an edit; that's what Optimized Media is for (as described in the previous section).

If Optimized media exists for a given clip, and "Use Optimized Media if available" is turned on, then Optimized media will be used instead of the Fusion Output Cache if there are no Speed effects or Fusion Effects applied to a particular clip.

Second, Node Caching

The Node Cache, which is a separate level of caching from the Fusion Output Cache, can be triggered in several different ways, corresponding to the three different purposes it serves.

– When enabled by turning on the Smart Cache, nodes with processor-intensive operations (along with all nodes appearing upstream in that grade's node tree) are automatically cached, meaning that, for example, if Nodes 1 and 2 are cached, you can continue adjusting Nodes 3, 4, and 5 to your heart's content without needing to re-render your grade to the cache. Operations that trigger caching include Noise Reduction, Motion Blur, and any Resolve FX or OFX plug-in that's added to a node. If you've added a Resolve FX to a node that's capable of playing in real time but that node is being flagged for caching anyway, you can force caching off for that node by right-clicking it and choosing Node Cache > Off from the contextual menu.

– You can manually force any node to cache if it and its upstream nodes are compromising performance but somehow not being automatically flagged, by right-clicking a node and choosing Node Cache > On from the contextual menu.

– You can also turn on the "Render Cache Color Output" option for a clip in the Timeline of either the Edit or Color pages. This forces that clip's entire grade to be cached via the Node Cache, all the way through the Node tree's output. This can result in higher real time performance in the Edit page, at the expense of needing to completely re-cache that clip whenever you adjust any part of its grade.

– If you apply Resolve FX or OFX filters to clips in the Edit page, these will also be cached via the Node Cache. If necessary, you can choose which OFX to cache via the Render Cache OFX Filter submenu in the contextual menu for clips in the Timeline. This is useful when you have a combination of realtime and non-realtime filters applied to a clip; caching the non-realtime filters only enables you to continue adjusting realtime filters without the need to re-cache. However, be aware that making changes to a filter being cached in the Edit page timeline will force that clip's grade to be re-cached in the Color page, and vice versa.

If multiple nodes are flagged for caching in a particular node tree, then each node will be individually cached. That way, you can turn a cached node off and on to get a before-and-after look without needing to re-cache the entire node tree. If a clip is part of a group in the Color page, you can enable a Group Cache in the Group Pre-Clip and Group Post-Clip Node Editor modes, which cache these parts of a group grade as part of the Node Cache.

Third, the Sequence Cache

The Sequence Cache is a separate cache for effects that are specifically applied within the Timeline in the Edit page. These include transitions, opacity adjustments, and composite mode superimpositions. Sequence Cache effects can be auto-cached in both the Smart and User caches.

## Choosing a Cache Format and Location

The cache format is user selectable by opening the Master Settings panel of the Project Settings, and using the "Render Cache Format" drop-down menu to choose one of the ProRes, DNxHR, or uncompressed 10- or 16-bit float uncompressed .dvcc formats. Selecting a higher quality cache format guarantees high quality image playback, but makes more demands on the throughput and size of your available disk storage. On the other hand, choosing a more highly compressed cache format makes real time playback possible on less capable computers with slower and smaller storage, at the expense of slightly compromised image quality. Ideally, you should choose the highest quality cache format that your workstation's storage can accommodate.

The format you choose via the "Render Cache Format" menu will determine whether out-of-bounds image data (including "super white" or HDR strength highlights) is preserved when the signal is cached. Formats in this menu that end in "– HDR" preserve out-of-bounds image data, while formats that don't, wont. If you find that image data (typically bright highlights) is clipped after caching or optimizing, you should switch to 16-bit float, ProRes 4444, ProRes 4444 XQ, or DNxHR 444; in particular, any of these codecs are appropriate for HDR grading.

The Cache files location defaults to the first volume you add to the Scratch Disks list of the Media Storage panel of the System Preferences. If no scratch disk is specified, your System disk will be used, which may pose problems with capacity and/or performance depending on the size and type of System disk you're using, and on the media format you choose to cache to. For this reason, it's nearly always advisable to set your first scratch disk to the largest, fastest storage volume available to your workstation.

When Caching Happens

When caching is enabled, cache indicators along the bottom of the Timeline Ruler of the Edit page timeline shows the status of the cache. Red means "to be cached," while blue means "has been cached."
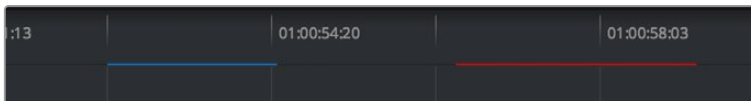
Source, Clip, and Sequence Cache bars seen in the Timeline of the Edit page; red bars show areas of the Timeline that need caching, blue shows areas that have been cached

In the Color page, cache indicators are node specific, showing the node in your grading node tree (including all upstream nodes) at which caching will take place.
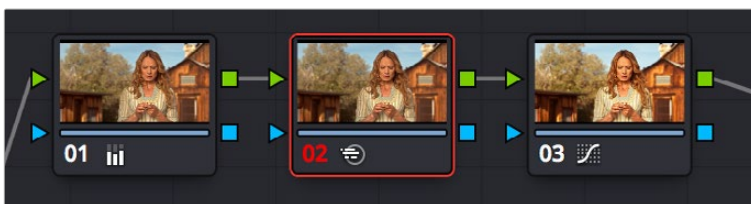
Node Cache indicator seen as a red colored node number on node two of the Node Editor of the Color page

Caching happens in two ways. First, when either Smart or User caching is enabled, caching always happens whenever you play clips with red caching indicators.

Second, if background caching is enabled in the Project settings (it's turned on by default), and you don't make any changes to your project for a user-definable number of seconds (this is adjustable in the Master Settings panel of the Project Settings), caching will automatically begin during periods of user inactivity. So feel free to use this as an excuse to take those coffee, mate, or tea breaks; DaVinci Resolve will keep on working for you.

The Difference Between the Smart Cache and User Cache Modes

The Smart Cache option of the Render Cache submenu provides the easiest user experience when you want to "set it and forget it." Choosing Smart triggers a variety of automatic caching behaviors designed to optimize playback in DaVinci Resolve by rendering clip formats, grading operations, and timeline effects that are known to be performance-intensive, while also letting you manually flag clips that you'd like to cache that the Smart Cache hasn't.

The User Cache, on the other hand, does not automatically cache clips in processor-intensive formats, so this is a good option to choose when your workstation is capable of playing all media formats you're using in real time. Ordinarily, the User cache relies on you to control what is cached and what is not by manually flagging specific clips and effects. However, the Master Settings panel of the Project Settings has three options you can enable for automatically caching transitions, composites, and Fusion Effects while in User Cache mode (these options are found in the Optimized Media and Render Cache group). Of these settings, only "Automatically cache Fusion Effects in User Mode" is turned on by default.

Here are the differences between the Smart and User cache modes for each type of caching DaVinci Resolve does.

Fusion Output Caching

- **In Smart mode:** For all clips with "Render Cache Fusion Output" set to either Auto (by default) or On, three types of effects are rendered. First, H.264, H.265, DCP, JPEG2K, or camera raw clips that have been edited into a timeline are cached. Camera Raw clips are cached using the currently selected project or clip debayer settings. Second, Speed effects are cached at the source level, which makes it possible to move cached speed effects clips on the Timeline without needing to re-cache them. Finally, Fusion Clips or clips with Fusion Effects applied to them are also cached, and manually flagged clips are also cached in Smart mode.

- **In User mode:** Clips with Render Cache Fusion Output set to On are cached, while clips set to Auto are ignored, except for clips with Fusion Effects, which are automatically cached in Auto mode when the "Automatically cache Fusion Effects in User Mode" Project Setting is on.

Caching Specific Nodes in the Color Page

- **In Smart mode:** DaVinci Resolve automatically caches all nodes that use Motion Blur, Noise Reduction, or Resolve FX and OFX plug-ins. Manually flagged nodes are also cached in Smart mode.

- **In User mode:** DaVinci Resolve only caches nodes that have been manually flagged by right-clicking them and choosing Node Cache > On to force that node to cache in User mode, along with all upstream nodes to the left of them.

Cache Color Output Is Actually Node Caching for the Whole Grade

- **In Smart mode:** Manually flagged clips with Render Cache Color Output turned on cache the entire output of the Color page node graph, effectively caching that clip's entire grade. This is most useful when you want to improve trimming and playback performance in the Edit page. Flagging a clip for caching also causes EVERY SINGLE VERSION associated with that clip to be cached as well.

- **In User mode:** Manually flagged clips with Render Cache Color Output turned on also cache the entire output of the Color page node graph.

Caching of Resolve FX and OFX in the Edit Page Is Also Node Caching

Caching of Resolve FX and OFX filters applied to clips in the Edit page can only be set manually, whether you're in Smart or User mode. Only filters that you have flagged to cache by right-clicking the clip they're applied to and choosing them in the Render Cache OFX Filter submenu are cached.

Sequence Caching

- **In Smart mode:** DaVinci Resolve automatically caches all superimposed clips that use composite modes other than "Normal," any clips with opacity or speed effects, and any transitions. Clips cannot be manually flagged for Sequence caching.

- **In User mode:** If you've enabled User mode and you find that your workstation does not have adequate performance to play composite and opacity effects in the Edit page, you can force these categories of effects to be automatically cached in User mode via a set checkboxes in the Optimized Media and Render Cache section of the Master Settings of the Project Settings. When these options are enabled, you also gain the ability to exclude specific tracks from being cached, by right-clicking the track header of any video track you want to exclude from caching, and choosing Exclude track from caching. Excluding an entire track from caching is a convenient way of keeping a track full of effects that are capable of playing in real time on your workstation, such as a track of titles, from wasting time and storage by being cached when it's not necessary.

Manually Controlling the Cache

This section describes how to manually control each type of caching that is manually controllable in DaVinci Resolve.

Controlling Fusion Output Caching

You can manually control which clips in the Timeline are cached, and which are not. You can select one or more clips in the Timeline of the Edit page, or in the Thumbnail Timeline of the Color page, right-click one of the selected clips or thumbnails, and choose an option from the Render Cache Fusion Output submenu. There are three options:

- **Auto:** The clip will only be cached in Smart mode if it's a format designated for caching or if there's a speed effect applied. The clip will only be cached in User Mode if "Automatically cache transitions in User Mode" is enabled.

- **On:** The clip will be cached in either Smart or User mode, no matter what format or effects are applied.

- **Off:** The clip will not be cached at all, in either Smart or User modes.

Controlling Node Caching

You can manually control which nodes in a grade are cached, and which are not. Right-click any node in a node tree, and choose an option from the Node Cache submenu. There are three options:

- **Auto:** The flagged node and all upstream nodes will only be cached in Smart mode if it contains an operation that's designated for caching.

- **On:** The node will always be cached in either Smart or User mode, no matter what operations it performs.

- **Off:** The node will not be cached, in either Smart or User modes. This lets you exclude nodes from caching in Smart mode if they're capable of real time operation on your system.

Controlling Color Output Caching

Each clip in the Timeline (including Adjustment clips) has a Color Output setting that you can turn on or off by right-clicking that clip in the Timeline of the Edit page, and choosing Render Cache Color Output from the contextual menu. A check mark indicates when this setting is turned on.

Controlling Edit Page Filter Caching

You can choose which of the Resolve FX or OFX filters applied to a particular clip should be cached by right-clicking that clip in the Timeline of the Edit page, and choosing which of the filters in the Render Cache OFX Filter submenu you want to cache.

Each filter applied to that clip appears in this submenu in the order in which it's applied to the clip, and you can turn the caching of specific filters on and off (selected filters appear with a check mark to the left of their menu item).

Clearing Cached Media

Each project's cache is persistent; the cache is saved for future use even when the project is closed and later reopened. If you need to delete a project's cache to free up space on a storage volume, there are three options in the Delete Render Cache submenu:

– **All:** You can delete all media in the cache to reset every single cached clip.

– **Unused:** You can choose to delete only Unused cache clips that no longer correspond to clips or effects in the Timeline.

– **Selected clips:** You can make a manual selection of clips in the Timeline, and delete the cache corresponding to just those clips.

To clear a project's cache:
Open the project, and choose Playback > Delete Render Cache > All, Unused, or Selected Clips.

Using Cached Media When Rendering in the Deliver Page

The "Use Render Cached Images" option in the "More options" section of the Video panel of the Render Settings in the Deliver page lets you write media directly from the cache, rather than re-rendering the effects from scratch, in order to save rendering time when you output your project. If you're planning on using this option, it's advisable to set the cache format to a suitably high-quality format to guarantee the best results.

Using Proxy Media

DaVinci Resolve includes a Proxy Media workflow to provide a playback optimization option that makes it easier to exchange projects online, work on projects remotely, and work with external media asset management systems. It creates a simple and flexible system for editing collaboration that can be custom configured to your specific requirements.

Creating and Using Proxy Media

Proxy Media is essentially more highly compressed (and potentially lower resolution) versions of your source media that are linked to your source media in DaVinci Resolve via metadata. This is done in such a way as to make it easy to switch back and forth between the original and proxy media as your needs require.

Typically, this lets you use lower bandwidth proxy media for increased real-time effects performance and full speed playback while editing, while easily reverting back to more bandwidth and processor-intensive source media for color correction, finishing, and final output. In addition to enabling better performance, these proxy files are fully portable, which lets you move your whole project easily from workstation to workstation, and even across the internet, accompanied by much more compact proxy media.

You set the resolution and format of your proxies in the Optimized Media and Render Cache section of the Master Settings panel in the Project Settings. There are two settings that control the actual media files created by the Generate Proxy Media command.

– **Proxy Media Resolution:** Choose "Original" to keep proxies the same resolution as the source media. If you prefer, reduce the resolution of the proxy media files by choosing Half, Quarter, Eighth, or Sixteenth to save bandwidth. The "Choose Automatically" option balances visual quality with efficiency by only reducing the resolution of media files that are larger than the currently selected Timeline resolution, using whatever reduction ratio best matches the Timeline resolution.

– **Proxy Media Format:** Lets you choose the specific QuickTime format and codec that the proxy files will be created with. There are several ProRes and DNxHR varieties to chose from, as well as H.264 and H.265 options. Which format you chose will be determined by the bandwidth and quality tradeoffs that you need for a particular project. For example, if you simply want better playback speed from RAW media while preserving image quality, you may want to pick a high-quality codec like ProRes 422 HQ, or DNxHR HQX. If your goal is to send your media across the internet to another editor, you may want to chose a more compressed format, such as ProRes Proxy, or even H.264 or H.265, to keep file sizes small.
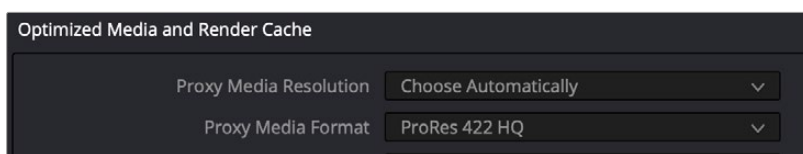
The Proxy Media Resolution and Format settings

To generate proxy media in DaVinci Resolve:

1 Select all of the clips you wish to generate proxies for in the Media Pool.

2 Right-Click any selected clip and choose "Generate Proxy Media" from the contextual menu.

DaVinci Resolve will display a progress bar and give you a time estimate for completion as it renders out your selected clips to the format and codec determined by the Proxy Media Resolution and Format settings.

> **NOTE:** If your source clip has a separate audio file synced to it in the Media Pool, any proxies generated from that clip will include the synced audio, but that audio will be embedded in the video clip instead of being created as a separate file.

Where is Proxy Media Saved?

Proxy media is created in the "Proxy generation location" destination, found in the Working Folders section of the Master Settings of the Project Settings. The proxies are further organized into subfolders by original source clip location. It is important to have enough free space on this drive to contain the proxies. Once created, these proxy files can then be moved to any other drive location on the system, if you wish, and then re-linked to their source files.

Generating Proxy Media in Other Applications

Proxy files can also be generated in applications outside of DaVinci Resolve, such as other NLEs or various media asset management systems. To properly link the proxy to its source media in DaVinci Resolve, the proxy file must meet the following criteria:

– Proxy files must have identical timecode to the source file.

– Proxy files must have the same file name as the source file (excluding extensions).

– Proxy files must have the same frame rate as the source file.

– The format and codec used for proxy files must be supported in DaVinci Resolve.

If your proxy file meets these criteria, you'll be able to manually link proxy media created in other applications to source clips in the Media Pool as described below.

Managing Proxy Media

You can check the status and location of all your proxy media in the List view of the Media Pool. Right-click on any column heading and click the checkboxes of "Proxy" and "Proxy Media Path."

– **Proxy:** This column shows the current proxy status.

– **None:** Indicates no proxy media has been created.

– **Offline:** Indicates a proxy has been created but cannot be found in the Proxy Media path.

– **(Resolution):** A number indicating the resolution of the created proxy and that it is online.

– **Proxy Media Path:** The location of where DaVinci Resolve is looking for the proxy file. If this location is incorrect, you can relink the proxy to a new path manually.

The proxy columns in List view, showing Proxy Media status and location

Linking Clips to Proxy Media

If you've created proxy media in another application, or moved the internally created proxy media out of its default location in "ProxyMedia," you'll need to manually link the proxies to their source media files in your Media Pool.

To link proxy media to a source clip:

1   Select one or more clips in the Media Pool you wish to link proxy media to.

2   Right-click one of the selected clips, and choose "Link Proxy Media" from the contextual menu.

3   Use the file browser to find the specific proxy file or directory (in the case of multiple clips) to set a new Proxy Media path, and click Open. If you select an incorrect file or directory, a warning dialog box will appear and no linking will occur.

To unlink proxy media from a source clip:

1   Select a clip or clips in the Media Pool you wish to unlink proxy media from.

2   Right-click on any clip and select "Unlink Proxy Media" from the contextual menu. This will remove the metadata link from proxy to source and will set the status in the Proxy column to "None."

> **NOTE:** Unlinking a proxy file does not delete it. The proxy file remains on the hard drive where it was created. As of this writing, proxy files must be deleted manually using your OS file system outside of DaVinci Resolve.

Re-generating Proxy Media

You can generate more than one proxy file per clip. This can be useful if you want to set multiple Camera Raw parameters and choose between them, or to create proxy files of different resolutions.

To generate a new proxy:

1   Make your desired changes to the current clip's settings.

2   Right-click on the same clip and select "Generate Proxy Media" from the contextual menu.

A new proxy file is created in the same directory as the previously linked proxy file, and its file name is appended with "_s00x" to differentiate it. The latest proxy generated is automatically linked to the source file, but previous proxy versions are retained on disk, so you can then manually relink the different versions as needed.

Switching Between Proxy Media and Source Media

You can switch between using your original source media and the proxy media for playback at any time by checking or unchecking Playback > Use Proxy Media If Available in the Menu bar.

Using Proxy Files for Delivery

By default, the Deliver page always reverts proxies to the original source media for final output to ensure the highest quality render. Checking the "Use proxy media" box in the Advanced Settings of the Video Render settings in the Deliver page overrides this so DaVinci Resolve uses proxy media for final output instead. This can be useful if you need to save rendering time while making dailies, or to quickly create outputs of your timeline for producers or audio engineers where master quality is not necessarily needed. You will also need to check the "Use proxy media" box if you are editing with proxies and do not have access to the original source media.

Moving Proxies Using a DaVinci Resolve Archive (.dra)

When moving proxies from one DaVinci Resolve system to another, it can be time consuming and problematic to manually copy many individual assets (proxies, graphics, source files, etc.) from different folders and locations. By far the easiest way to move complete projects from system to system is by letting DaVinci Resolve do all that file management for you, by creating a DaVinci Resolve Archive (.dra). An archive file contains not only your project, but all its media as well, maintaining the file paths and organization of the original project.

To create a DaVinci Resolve Archive file, right-click on any project in the Project Manager, and choose "Export Project Archive" from the drop-down menu. Within this mechanism, a new Archive setting in DaVinci Resolve makes working with proxies simple and elegant.

Creating a Proxy-Only Archive to Share

In the Archive Options dialog, if you check Proxy Media, and uncheck Media Files and Render Cache, DaVinci Resolve will make an Archive using only the proxy media. This allows you to create a compact and easily transported version of your project to either move to another computer, or to give to an editor working remotely. If proxy media is not available for a clip (say a graphic or a media file you didn't create a proxy for in the first place), the original media is automatically exported to ensure that nothing goes offline.
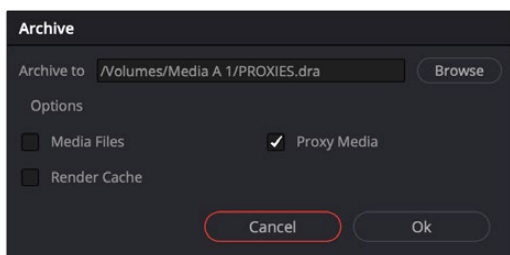
Archive Setting options for exporting only Proxy Media

The resulting .dra is a folder that is a fully self-contained version of your project and proxy media. This folder can easily be moved from drive to drive, or zipped up and sent across the internet.

Working Remotely Using Proxy Media

The proxy workflow in DaVinci Resolve opens up many new possibilities for editing collaboration and media management. For example, one common workflow is to use the RAW camera master source clips in the editing suite but to then generate low resolution proxies to take home to edit on a laptop.

To create a portable set of proxies for editing on a laptop:

1   Set up the Resolution and Format settings for the proxies in the Project Settings. In this case, you may want to use "Choose Automatically" and a low-bandwidth, easily editable codec like ProRes LT or DNxHR LB.

2   Select all source media in the Media Pool and Generate Proxy.

3   Export a DaVinci Resolve Archive (.dra) onto an external drive, with only Proxy Media checked.

4   Go away. Once at home, connect that drive to your home laptop, and use the Restore Project Archive command in the Project Manager to import the archive.

5   When you've finished working at home, export a timeline, bin, or project from your laptop when finished, and bring just that file back into the edit suite to continue working with the original source media.

Another common scenario might involve sending proxies over the internet to an editor in another city or country.

To send a project to another editor over the internet:

1   Set up the Resolution and Format settings for the proxies in the Project Settings. In this case, you may want to use a low resolution like "quarter" or "one-eighth," and a low-bandwidth, highly-compressed codec like H.265 for the smallest file sizes possible.

2   Select all of the source media in the Media Pool and Generate Proxy.

3   Export a DaVinci Resolve Archive (.dra), with only Proxy Media checked.

4   Using the file compression tools in your OS, zip the archive folder so it becomes one large file.

5   Upload the resulting .zip to the online file sharing service you prefer, and send the download link to the remote editor.

6   Once the other editor unzips and imports the archive, you and they can then simply send timelines, bins, and/or project files back and forth to collaborate. These files are small enough to transfer over email or an instant messaging service.

Additionally, you may have your editing computer connected via ethernet to a Media Asset Management system that can create its own proxies. In order to edit smoothly via the network, you need to use low bandwidth proxies instead of the source media.

To create proxy media externally to edit over a local network:

1   Import the original source media files to your Media Pool from the network storage system you're using.

2   Set up the proxy generation settings in your Media Asset Management software to accommodate the amount of network bandwidth you expect to have access to.

3   Make sure the timecode and frame rate of the proxies match the original source media, and render the proxies to a network location.

4   Select all of your original source media in the Media Pool, and choose "Link Proxy Media."

5   Choose the proxy media at the network location where they've been rendered.

Proxy Media vs. Other Playback Optimizations in DaVinci Resolve

There continue to be other methods of optimizing real time performance in DaVinci Resolve, so it's natural that one might wonder how this is different from Optimized media, Timeline Proxy Mode, and other performance optimization techniques available in DaVinci Resolve. The key aspect of proxy media that differentiates it is that proxy media is independent, portable, and can be created by applications outside of DaVinci Resolve, if desired.

Proxy Media vs. Timeline Proxy Mode

One of the oldest performance optimization options, originally named "Proxy Mode" in previous versions of DaVinci Resolve, has been renamed "Timeline Proxy Mode" in DaVinci Resolve 17 to differentiate it from Proxy Media. While the new Proxy Media feature creates actual media files on disk, "Timeline Proxy Mode" simply reduces the resolution of the timeline on-the-fly, allowing for increased real time playback performance. To be clear, Proxy Media and Timeline Proxy Mode are two entirely different features, which are wholly independent of one another.

Proxy Media vs. the Render Cache

Proxy Media is designed to create easy-to-edit primary source material on the Timeline, for improved performance before you start editing. The Render Cache is designed to improve the real time performance of clips that have enough computationally intensive effects (such as Resolve FX, color corrections, noise reduction, compound clips, fusion compositions, etc.) to slow playback, even at the current Timeline resolution. Proxy Media is independent and portable (you can move clips wherever you want; you just have to relink them afterward), while the Render Cache media is not designed to be moved or interacted with externally and only works with the project it was made for.

Proxy Media vs. Optimized Media

On the surface, Proxy Media and Optimized Media appear similar in function. Both options are designed to create lower bandwidth, easier to edit versions of source media. However, Optimized Media is managed internally by DaVinci Resolve, cannot be exported, and is not user accessible. In contrast, Proxy Media creates fully portable and independent media that can be easily managed by the user.

Using Optimized Media, Proxy Media, and Caching Together

How you use DaVinci Resolve's various performance-enhancing features together is entirely up to you, but you should know that they're not an either/or proposition. For example, you can create optimized media from the camera raw original clips in your project, then enable Timeline Proxy Mode playback to enhance the performance of your 4K timeline, and turn on Smart Cache to speed up your work in the Color page as you add Fusion effects, noise reduction, and Resolve FX or OFX to every clip. All of these optimization methods work happily and seamlessly together to improve your performance while keeping the image quality of your project as high as the Optimized, Proxy, and Cache formats you've selected in the Master Settings panel of the Project Settings.

Which Playback Optimization Method Should I Use?

DaVinci Resolve's various playback optimization features are designed to specifically increase performance to make up for hardware, storage, and bandwidth deficiencies, but knowing when to use each method is essential to proper functionality. Included below is a quick reference.

– **Timeline Proxy Mode:** My timeline is playing back, just a little bit too slowly.

– **Cache Clip:** I need help playing back a few clips in real time that have heavy effects applied.

– **Optimized Media:** I need help playing back all my source media in real time, and I will only be editing on this computer.

– **Proxy Media:** I need help playing back all my source media in real time, and I need to collaborate and share this media with other users, programs, or outside storage locations.

Other Project Settings That Improve Performance

In addition to working with proxies, using reduced raw decoding quality, generating optimized media, and enabling the Smart and User caches, there are five additional options in the Project Settings window and one setting in the UI Settings panel of the User Preferences that you can use to further improve real time performance if you're working on an underpowered computer, at the expense of lower image quality while you work. These settings can then be changed back to higher quality modes prior to rendering.

– **Set timeline resolution to:** (Master Project Settings, Timeline Format) DaVinci Resolve is resolution independent, so you can change the resolution at any time and all windows, tracks, sizing changes, and keyframe data will be automatically recalculated to fit the new size. Lowering the Timeline resolution while you're grading will improve real time performance by reducing the amount of data being processed, but you'll want to increase Timeline resolution to the desired size prior to rendering. This is effectively the same as using the Proxy command, but you get to choose exactly what resolution you want to work at.

– **Enable video field processing:** (Master Project Settings, Timeline Format) You can leave this option turned off even if you're working on interlaced material to improve real time performance. When you're finished, you can turn this setting back on prior to rendering. However, whether or not it's necessary to turn field processing on depends on what kinds of corrections you're making. If you're applying any filtering or sizing operations such as blur, sharpen, pan, tilt, zoom, or rotate, then field processing should be on for rendering. If you're only applying adjustments to color and contrast, field processing is not necessary.

– **Video bit depth:** (Master Project Settings, Video Monitoring) Monitoring at 8-bit improves real time performance, at the expense of possibly introducing banding to the monitored image.

– **Monitor scaling:** (Master Project Settings, Video Monitoring) Lets you choose which transform filter to use when scaling video to fit into the Video format resolution you've specified. Options are Bilinear and Basic.

– **Resize Filter:** (Image Scaling) A drop-down menu that lets you choose an alternate image transform filter (such as Bilinear) that is lower quality but less processor intensive. A "Force sizing highest quality" checkbox in the Render Settings list of the Deliver page helps make sure you don't accidentally render your final media at this lower quality setting, however.

– **Hide UI overlays:** (User Preferences, Playback Settings) Off by default. When using a single GPU for both display and CUDA or OpenCL processing, or if your display GPU is underpowered, or if you lack the PCIe bandwidth required for the currently specified resolution or frame rate, you may be able to improve real time performance by turning this option on. When enabled, onscreen controls such as the cursor, Power Window outlines, and split-screen views are disabled and hidden during playback. When playback is paused, all onscreen controls reappear.

– **Minimize interface updates during playback:** (User Preferences, Playback Settings) On by default. While enabled, this setting improves real time performance by hiding on-screen controls that appear in the Viewer, such as the cursor, Power Window outlines, and split-screen views during playback. When playback is stopped, onscreen controls reappear.

Chapter 9

Data Levels, Color Management, and ACES

This chapter covers operational details that affect how color is managed for media that is imported into and exported from DaVinci Resolve. If color accuracy is important to you, then it's a good idea to learn more about how Resolve handles the data levels of each clip, how DaVinci Resolve Color Management helps you to work with different formats, and how to use ACES.

Contents

Data Levels Settings and Conversions

Different media formats use different ranges of values to represent image data. Since these data formats often correspond to different output workflows (cinema vs. broadcast), it helps to know where your project's media files are coming from, and where they're going, in order to define the various data range settings in DaVinci Resolve and preserve your program's data integrity.

To generalize, with 10-bit image values (with a numeric range of 0–1023), there are two different data levels (or ranges) that can be used to store image data when writing to media file formats such as QuickTime, MXF, or DPX. These ranges are:

– **Video:** Typically used by Y'CBCR video data. All image data from 0 to 100 percent must fit into the numeric range of 64–940. Specifically, the Y' component's range is 64–940, while the numeric range of the CB and CR components is 64–960. The lower range of 4–63 is reserved for "blacker-than-black," and the higher ranges of 941/961–1019 are reserved for "super-white." These "out of bounds" ranges are recorded in source media as undershoots and overshoots, but they're not acceptable for broadcast output.

   – **Full:** Typical for RGB 444 data acquired from digital cinema cameras, or film scanned to DPX image sequences. All image data from 0 to 100 percent is simply fit into the full numeric range of 4 to 1023.

Keep in mind that every digital image, no matter what its format, has absolute minimum and maximum levels, referred to in this section as 0–100 percent. Whenever media using one data range is converted into another data range, each color component's minimum and maximum data levels are remapped so that the old minimum value is scaled to the new data level minimum, and the old maximum value is scaled to the new data level maximum:

   – (minimum Video Level) 64 = 4 (Data Level minimum)

   – (maximum Video Level) 940 or 960 = 1023 (Data Level maximum)

Converting Between Ranges and Clipping

Simply converting an image from one data range to another should result in a seamless change. All "legal" data from 0–100 percent is always preserved and is linearly scaled from the previous data range to fit into the new data range.

The exceptions to this are undershoots and overshoots that you've deliberately set, also referred to as out-of-bounds levels. The overshoots and undershoots that are allowable in "Video Levels" media (known as sub-black or super-black and super-white) are usually clipped when converted to full-range "Full Levels." However, DaVinci Resolve preserves this data internally, and these clipped pixels of detail in the undershoots and overshoots are still retrievable by making suitable adjustments in the Color page to bring them back into the "legal" range.

The out-of-bounds image data that's preserved within the headroom of Video Levels by DaVinci Resolve while working is usually clipped, however, when you either output to video or render your output. There are two settings that let you get around this for instances where you want to preserve these levels:

  – A checkbox in the Video Monitoring group of the Master settings, "Retain sub-black and super-white data," lets DaVinci Resolve output undershoots (sub-black) and overshoots (super-white) to video when Data Level is set to Video. When this is turned off, these out-of-bounds values are clipped on output.

  – A checkbox in the Advanced settings of the Render settings in the Deliver page, "Retain sub-black and super-white data," lets DaVinci Resolve render undershoots (sub-black) and overshoots (super-white) to exported media when Data Level is set to Video.

Internal Image Processing and Clip Data Levels

It's useful to know that, internally to DaVinci Resolve, all image data is processed as full range, uncompressed, 32-bit floating point data. What this means is that each clip in the Media Pool, whatever its original bit-depth or data range, is scaled into full-range 32-bit data. How each clip is scaled depends on its Levels setting in the Clip Attributes window, available from the Media Pool contextual menu.
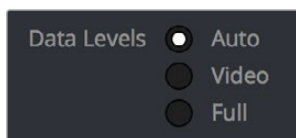
Selecting Auto, Video, or Full levels

By converting all clips to uncompressed, full-range, 32-bit floating point data, Resolve guarantees the highest quality image processing that's possible. As always, the quality of your output is dependent on the quality of the source media you're using, but you can be sure that Resolve is preserving all the data that was present in the original media.

Assigning Clip Levels in the Media Pool

When you first import media into the Media Pool, either manually in the Media page or automatically by importing an AAF or XML project in the Edit page, Resolve automatically assigns the "Auto" Levels setting. When a clip is set to Auto, the Levels setting used is determined based on the codec of the source media.

DaVinci Resolve generally does a good job of figuring out the appropriate Levels setting of each clip on its own. However, in certain circumstances, such as when you're working with media that was originated in one format but transcoded into another, you may find that you need to manually choose the appropriate settings so that the levels of each clip are interpreted correctly. This can be done using each clip's Levels setting in the Clip Attributes window, available from the Media Pool contextual menu in either the Media or Edit pages.

To change a clip's Data Level setting:

1   Open the Media or Edit page.

2   Select one or more clips, then right-click one of them and choose Clip Attributes.

3   Click the Levels ratio button corresponding to the data level setting you want to assign, then click OK.

> **TIP:** If you need to change the Levels setting of a range of clips that share a unique property such as reel name, resolution, frame rate, or file path, you can view the Media Pool by column, and sort by the particular column that will best isolate the range of media to which you need to make a data level assignment.

Once you change a clip's Levels setting, that clip will automatically be reconverted based on the new assignment. If it appears to be correct, then you're ready to work. If it doesn't, then you may want to reconsider the Levels assignment you've made, and you should check with the person who provided the media to find out how it was generated, captured, and exported.

So long as the Levels settings used by your clips are accurate, you should be ready to work. However, problems can still occur based on what external video hardware you're using with your workstation, and how you need to deliver the finished media to your client. For this reason, there are three additional data level settings that you can use to maintain data integrity, while at the same time seeing the proper image as you work.
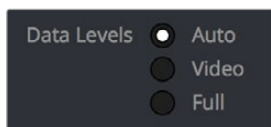
Video Monitoring Data Levels

Superficial problems may result if the settings used by your external display differ from the settings you're using to process data levels in Resolve. Accordingly, there is a Video/Full Level setting in the Master Settings panel of the Project Settings (in the Video Monitoring section).

When you change this setting, the image being output to your external display should change, but the image you see in your Viewer will not. That's because this setting only affects the data levels being output via the video interface connecting the Resolve workstation to your external display. It has no effect on the data that's processed internally by Resolve, or on the files written when you render in the Deliver page.

There are two options:

– **Video:** This is the correct option to use when using a broadcast display set to the Rec. 709 video standard (10-bit 64–940).

– **Full:** If your monitor or projector is capable of displaying "full range" video signals, and you wish to monitor the full 10-bit data range (4–1023) while you work, then this is the correct option to use.

It is imperative that the option you choose in DaVinci Resolve matches the data range the external display is set to. Otherwise, the video signal will appear to be incorrect, even though the internal data is being processed accurately by DaVinci Resolve.

Auto/Video/Full Level selection for monitoring

Deck Capture and Playback Data Level

There is a separate "Video/Data Level" setting that is specific to when you're capturing from or outputting to VTRs. This setting also affects the video signal that is output via the video interface connecting the Resolve workstation to your VTR (which is usually also in the signal chain used for monitoring). However, it only takes effect when you're capturing from tape in the Media page, or editing to tape in the Deliver page. If you never capture or output to tape, this setting will never take effect.

This setting is found in the Deck Capture and Playback panel of the Project Settings.

The reason for a separate option for tape capture and output is that often you'd want to monitor in one format (normally scaled Rec. 709), but output to tape in another (full range RGB 444). This way, you can set up Resolve to accommodate this workflow, and then not have to worry about manually switching your video interface back and forth.

There are two options:

– **Video:** This is the correct option to use when you want to output conventional
  Rec. 709 video to a compatible tape format.

– **Full:** This is the correct option to use when you want to output "full range" RGB 444 video
  to a compatible tape format.

Once tape ingest or output has finished, your video interface goes back to outputting using the setting specified by the "Colorspace conversion uses" setting in the Master Settings panel of the Project Settings (in the Video Monitoring section).

Output Data Level Settings in the Deliver Page

Finally, there's one last set of data level settings, available in the Render Settings list, within the Format group. It's the "Set to video or data level" drop-down menu. It's there to give you the ability to convert the data level of your rendered output, if necessary.

All media is output using a single data level, depending on your selection. There are three options:

– **Automatic:** The output data level of all clips is set automatically based on the codec you select to
  render to in the "Render to" drop-down menu.

– **Video:** All clips are rendered as normally scaled for video (10-bit 64–940).

– **Full:** All clips are rendered as full range (10-bit 4–1019).

For most projects, leaving this setting on "Automatic" will yield the appropriate results. However, if you're rendering media for use by another image processing application (such as a compositing application) that is capable of handling "full range" data, then full range output is preferable for media exchange as it provides the greatest data fidelity. For example, when outputting media for VFX work as a DPX image sequence, or as a ProRes 4444 encoded QuickTime file, choosing "Unscaled full range data" guarantees the maximum available image quality. However, it is essential that the application you use to process this media is set to read it as "full range" data, otherwise the images will not look correct.

So, What's the "Proper" Data Range for Output?

Strictly speaking, there is no absolutely "proper" data range to use when outputting image data. As long as the Levels setting of each clip in the Media Pool is set to reflect how each clip was created, your primary consideration is which data range is compatible with the media format or application you're delivering to. If the media format you're exporting to supports either normally scaled or full range, and the application that media will be imported into supports either normally scaled or full range, then it's really your choice, as long as everyone involved with the project understands how the data range of the media is meant to be interpreted once they receive it.

Outputting to hardware is a bit trickier, in that you need to make sure that the external display or VTR you're outputting to is set up to receive a signal using the data range you've chosen. If the device is limited to only one data range, then you need to be sure that you're outputting to it using that data range, or the levels of the image will appear to be incorrect, even though the image data being processed by Resolve is actually fine.

Introduction to DaVinci Resolve Color Management

How color is managed in DaVinci Resolve depends on the "Color Science" setting at the top of the Color Management panel of the Project Settings. There are four options: DaVinci YRGB, DaVinci YRGB Color Managed, DaVinci ACEScc, and DaVinci ACEScct. This section discusses the second setting, DaVinci YRGB Color Managed. ACEScc and ACEScct is discussed in the following section in this chapter.

Display Referred vs. Scene Referred Color Management

The default DaVinci YRGB color science setting, which is what DaVinci Resolve has always used, relies on what is called "Display Referred" color management. This means that Resolve has no information about how the source media used in the Timeline is supposed to look; you can only judge color accuracy via the calibrated broadcast display you're outputting to. Essentially, you are the color management, in conjunction with a trustworthy broadcast display that's been calibrated to ensure accuracy.

DaVinci Resolve 12 introduced a color science option called "DaVinci YRGB Color Managed," or more simply "Resolve Color Management" (RCM). This introduced a so-called "Scene Referred" color management scheme, in which you have the option of matching each type of media you've imported into your project with a color profile that informs DaVinci Resolve how to represent each specific color from each clip's native color space within the common working color space of the timeline in which you're editing, grading, and finishing.

This is important, because two clips that contain the same RGB value for a given pixel may in actuality be representing different colors at that pixel, depending on the color space that was originally associated with each captured clip. This is the case when you compare raw clips shot with different cameras made by different manufacturers, and it's especially true if you compare clips recorded using the differing log-encoded color spaces that are unique to each camera.

This Scene Referred component of color management via RCM doesn't do your grading for you, but it does try to ensure that the color and contrast from each different media format you've imported into your project are represented accurately in your timeline. For example, if you use two different manufacturer's cameras to shoot green trees, recording Blackmagic Film color space on one, and recording to the Sony SGamut3.Cine/SLog3 color space on the other, you can now use RCM to make sure that the green of the trees in one set of clips match the green of the trees in the other, within the shared color space of the Timeline.

It should be mentioned that this sort of thing can also be done manually in a more conventional Display Referred workflow, by assigning LUTs that are specific to each type of media, or using Color Space Transform Resolve FX in order to transform each clip from the source color space to the destination color space that you require. However, RCM's automation can make this process faster by freeing you from the need to locate and maintain a large number of LUTs to accommodate your various workflows. Also, the matrix math used by RCM (as well as the Color Space Transform operation) extracts high-precision, wide-latitude image data from each supported camera format, preserving high-quality image data from acquisition, through editing, color grading, and output. These are all advantages when compared to lookup tables, which can have plenty of precision, but can clip out-of-bounds image data and introduce issues when differing lookup table interpolation methods cause minor inconsistencies with color space transformations from application to application.

The preservation of wide-latitude image data deserves elaboration. LUTs clip image detail that goes outside of the numeric range they're designed to handle, so this often requires the colorist to make a pre-LUT adjustment to "pull back" image data in the highlights that you want to retrieve. Using RCM eliminates this two-step process, since the input color space matrix operations used to transform the source preserves all wide-latitude image data, making highlights easily retrievable without any extra steps.

Updated RCM In DaVinci Resolve 17

In version 17, DaVinci Resolve introduced the biggest improvements to Resolve Color Management (RCM) since it was originally introduced, adding numerous features to simplify setup, improve image quality, and make the "feel" of your grading controls more consistent. Specific improvements include improved metadata management for incoming media files that support color metadata, a new wide gamut color space suitable for using as your default Timeline working color space for any program, a new Input Tone Mapping option (Input DRT) that makes it easier to mix media formats for SDR and HDR grading, improved Timeline to Output Tone Mapping (Output DRT) that offers improved shadow and highlight handling, and select color space-aware grading palettes that make controls feel and perform well no matter what you're grading.

This updated Resolve Color Management has the same name as the previous version. However, older projects using the previous version of RCM will have Color science set to Legacy, to preserve the older color management settings and color transformations effect on your work. For more information on how the previous generation of RCM works, see the September 2020 version of the DaVinci Resolve 16 Manual.

How Is DaVinci Resolve Color Management Different from ACES?

This is a common question, but the answer is pretty simple. Resolve Color Management (RCM) and ACES are both Scene Referred color management schemes designed to solve the same problem. However, if you're not in a specific ACES-driven cinema workflow, DaVinci Resolve Color Management can be simpler to use, and will give you all of the benefits of color management, while approximating the "feel" that the DaVinci Resolve Color page controls have always had.

Resolve Color Management for Editors

RCM isn't just for Colorists. RCM can be easier for editors to use in situations where the source material is log-encoded. Log-encoded media preserves highlight and shadow detail, which is great for grading and finishing, but it looks flat and unpleasant, which is terrible for editing.

Even if you have no idea how to do color correction, it's simple to turn RCM on in the Color Management panel of the Project Settings, and then use the Media Pool to assign the particular Input Color Space that corresponds to the source clips from each camera. Once that's done, each log-

encoded clip is automatically normalized to the default Timeline Color Space of Rec. 709 Gamma 2.4. So, without even having to open the Color page, editors can be working with pleasantly normalized clips in the Edit page.

The Input, Timeline, and Output Color Space

The foundation of Resolve Color Management rests on three core settings. Not only do you have the ability to either automatically or manually identify the color science of each individual source clip (the Input Color Space), but you also have explicit control over the working color space within which all color adjustments and operations are made (the Timeline Color Space), and you have separate control over the Output Color Space that defines how your graded image will be monitored and output.

This means that, basically, Resolve Color Management consists of two color transforms working together, converting each source clip via its Input Color Space definition into the Timeline Color Space in which you work, and then converting the adjusted image from the Timeline Color Space to whatever Output Color Space you require to deliver the project.
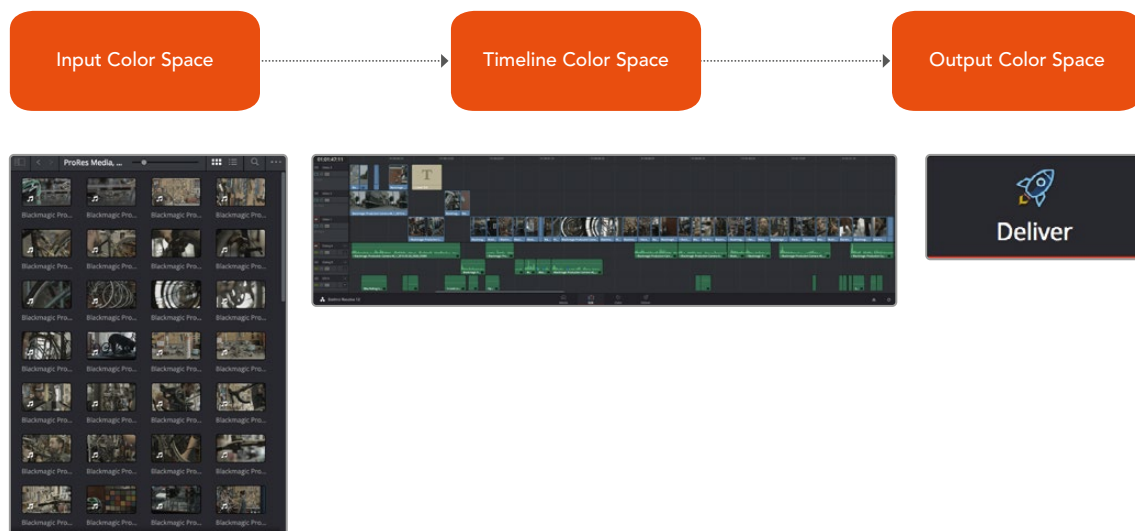
Resolve Color Management consists of three color transforms working together.

This means that, as a colorist, you can set the Timeline Color Space that you're working in to whatever you prefer. If you prefer grading wide-gamut log media because you like the way the grading controls behave in that color space, you can set the Timeline Color Space in the Color Management panel of the Project Settings to DaVinci Wide Gamut (more on this below), or any of the available log formats, including ARRI Log C, REDWideGamutRGB/Log3G10, and Cineon Film Log. If you instead prefer grading in the Rec. 709 color space because you're mastering a standard dynamic range (SDR) program to Rec. 709 and you're more comfortable with how the controls in DaVinci Resolve have always felt in that color space, you can choose that instead. Whatever Timeline Color Space you assign is what all source clips will be transformed to for purposes of making grading adjustments in the Color page, so you can make this choice using a single setting.

A key benefit of the color space conversions that RCM applies is that no image data is ever clipped during the Input to Timeline color space conversion. For example, even if your source is log-encoded or in a camera raw format, grading with a Rec. 709 Timeline Color Space does nothing to clip or otherwise limit the image data available to the RCM image processing pipeline. All image values greater than 1.0 or less than 0.0 are preserved and made available to the next stage of RCM processing, the Timeline to Output color space conversion.

Consequently, if you're grading in a color space other than the one you need to output to, you don't have to worry about data loss during the color transformation back to the color space you actually want to output to. The Output Color Space setting gives you the freedom to work using whatever Timeline Color Space you like while grading, with Resolve automatically converting your output to the specific color space you want to monitor with and deliver to. And thanks to the precision of the image

processing in DaVinci Resolve, you can convert from a larger color space to a smaller one and back again without clipping or a loss of quality. Of course, if you apply a LUT or use Soft Clip within a grade, then clipping will occur, but that's a consequence of using those particular operations.

> **TIP:** If you want to use Resolve Color Management, but you want the Input and Output Color Spaces to match whatever you set the Timeline Color Space to, you can choose "Bypass" in the "Input Colorspace" and "Output Colorspace" drop-down menus.

Finally, it is the Output Color Space that determines the final color space of your rendered result. While no image data is clipped during the Source to Timeline color space conversion, image data will be clipped during the Timeline to Output color space conversion in order for the final image to conform to the color space being rendered and output, unless you use the Gamut Mapping options to compress image data during the Timeline to Output Color Space conversion.

The RCM Image Processing Pipeline

The previous explanation is, of course, simplified. To clarify the inner workings of Resolve Color Management for advanced users, the following flowchart presents a rudimentary overview of how every parameter works together to automatically manage the color of clips in your program.
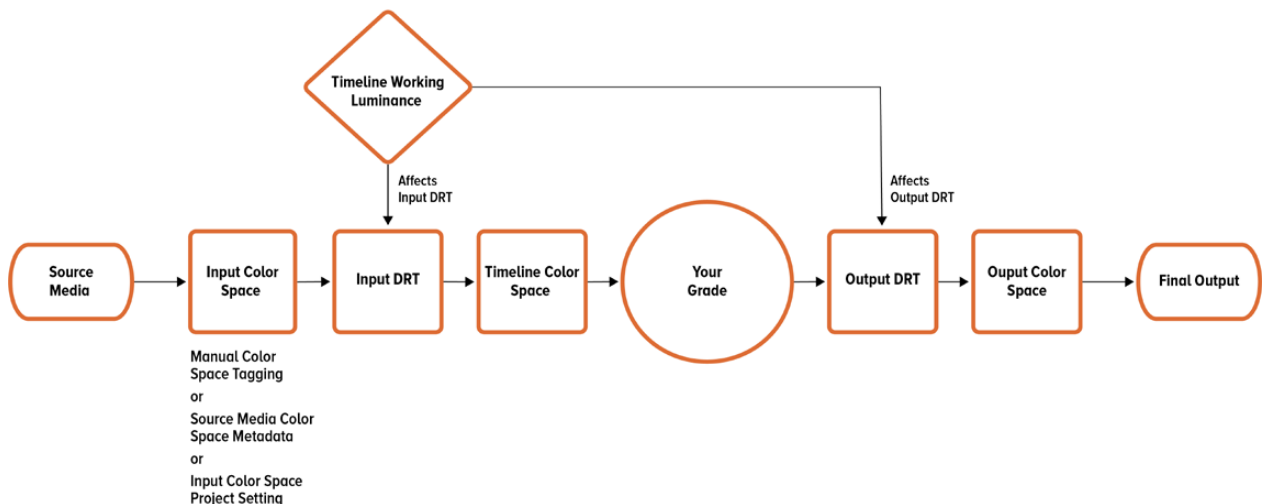
Resolve Color Management's image processing pipeline, illustrated

Identifying the Input Color Space of Different Clips

Central to the process of automated color management is knowing the color space and transfer function used by every clip of source media in your project. There are a variety of ways DaVinci Resolve can figure this out, in a cascading decision-tree that can be manually overridden if necessary. Deriving the Input Color Space involved the following stages of automated decision making:

1 If the source media is a camera raw format like .braw, .R3D, .ari, etc., DaVinci Resolve uses manufacturer-supplied colorimetry to automatically debayer the clip and identify its Input Color Space.

2 Otherwise, if the source media has embedded color space metadata (QuickTime or .MXF make this possible), then use that to identify the Input Color Space.

3 Otherwise, if there is no embedded color space metadata, use the default Input Color Space setting of the Project Settings to assign an Input Color Space to all otherwise unidentified clips.

4 If necessary, you can manually set the Input Color Space of clips in the Media Pool, which overrides both embedded color space metadata (in case it's wrong), or the default Input Color Space setting (if you're dealing with multiple color spaces). You cannot override the Input Color Space of camera raw media.

The following sections discuss each of these steps in more detail.

Using Camera Raw Formats

When you use RCM in a project that uses Camera Raw formats, color science data from each camera manufacturer is used to debayer each camera raw file to specific color primaries with linear gamma, so that all image data from the source is preserved and made available to DaVinci Resolve's color managed image processing pipeline. As a result, the Camera Raw project settings and Camera Raw palette of the Color page are disabled, because RCM now controls the debayering of all camera raw clips, and all image data from the raw file is available no matter which Timeline Color Space you choose to work within.

Using Source Media Color Space Metadata

When enabled, RCM automatically identifies the color space information of imported media that's been either transcoded or recorded directly to supported non-raw media formats, reading the NCLC metadata of QuickTime-wrapped files, the color space metadata of .mxf-wrapped files, and the XML sidecar files that track color management in ACES workflows. This behavior is automatic; there are no visible controls governing this behavior aside from the individual Input Color Space and Input Gamma settings associated with each clip in the Media Pool.

Color Space Metadata in QuickTime

DaVinci Resolve is capable of reading the NCLC metadata found within media files wrapped within a QuickTime container for proper color management. This metadata consists of three values formatted as (for example) 1-1-1. From left to right, these three digits specify the Color Primary (or color space), Transfer Function (or gamma), and Color Matrix used by that media file.

These values are standardized in the SMPTE Registered Disclosure Document RDD 36:2015. For your information, the different codes are listed in the following table. In the previous example, the code of 1-1-1 indicates a standard dynamic range clip that uses the BT.709 primaries, transfer function, and color matrix.

	Color Primary		Transfer Function		Color Matrix
0	Reserved	0	Reserved	0	GBR
1	ITU-R BT.709	1	ITU-R BT.709	1	BT709
2	Unspecified	2	Unspecified	2	Unspecified
3	Reserved	3	Reserved	3	Reserved
4	ITU-R BT.470M	4	Gamma 2.2 curve	4	FCC
5	ITU-R BT.470BG	5	Gamma 2.8 curve	5	BT470BG
6	SMPTE 170M	6	SMPTE 170M	6	SMPTE 170M
7	SMPTE 240M	7	SMPTE 240M	7	SMPTE 240M
8	FILM	8	Linear	8	YCOCG
9	ITU-R BT.2020	9	Log	9	BT2020 Non-constant Luminance
10	SMPTE ST 428-1	10	Log Sqrt	10	BT2020 Constant Luminance
11	DCI P3	11	IEC 61966-2-4	–	–

	Color Primary		Transfer Function		Color Matrix
12	P3 D65	12	ITU-R BT.1361 Extended Colour Gamut	–	–
–	–	13	IEC 61966-2-1	–	–
–	–	14	ITU-R BT.2020 10 bit	–	–
–	–	15	ITU-R BT.2020 12 bit	–	–
–	–	16	SMPTE ST 2084 (PQ)	–	–
–	–	17	SMPTE ST 428-1	–	–
–	–	18	ARIB STD-B67 (HLG)	–	–

The Default Input Color Space

The default Input Color Space can only be set if the "Resolve color management preset" drop-down menu is set to Custom. Otherwise, it defaults to "Rec. 709 Gamma 2.4" for all presets. Or else, this setting is the default color space that all otherwise unidentified clips in the Media Pool will default to.

Manually Tagging Clip Color Space

If necessary, you can manually identify the color space of one or more selected clips in the Media Pool by right-clicking them and choosing the Input Color Space (and optionally the Input Gamma) from the contextual menu.

Simple RCM Setup

When you first choose DaVinci YRGB Color Managed from the Color science drop-down menu of the Color Management panel in the Project Settings, you're presented with a simple pair of menus for setting up how you want to work with Resolve Color Management: the "Resolve color management preset," and the "Output Color Space."

Automatic Color Management

The first option when using RCM is to decide to use either Automatic Color Management or the Manual Presets. When the Automatic Color Management box is checked, DaVinci Resolve presents you with a simplified set of options for the most common use cases. For the Color Processing Mode, you choose SDR or HDR, and based on the file types and codecs in the Media Pool, DaVinci Resolve will automatically choose the appropriate input color space. Then, select from a list of common Output color spaces for delivery. If you want specific control of these parameters, uncheck Automatic Color Management box and select from the Color Management Presets below.
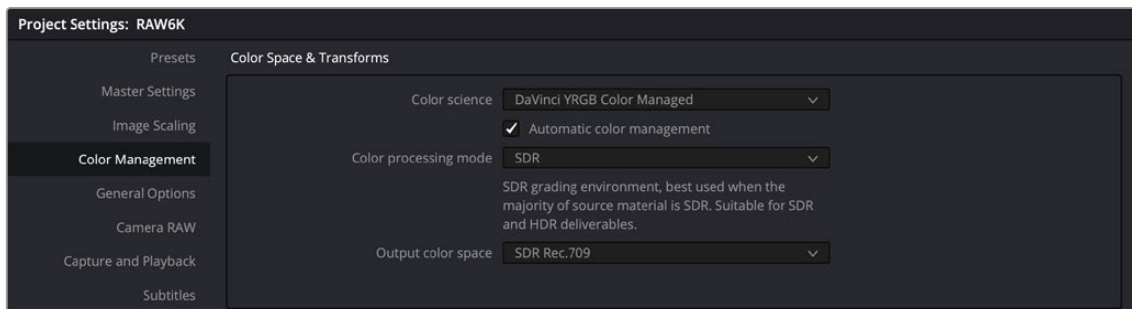
Automatic Color Management presets for fast, simple color management setup

Resolve Color Management Presets
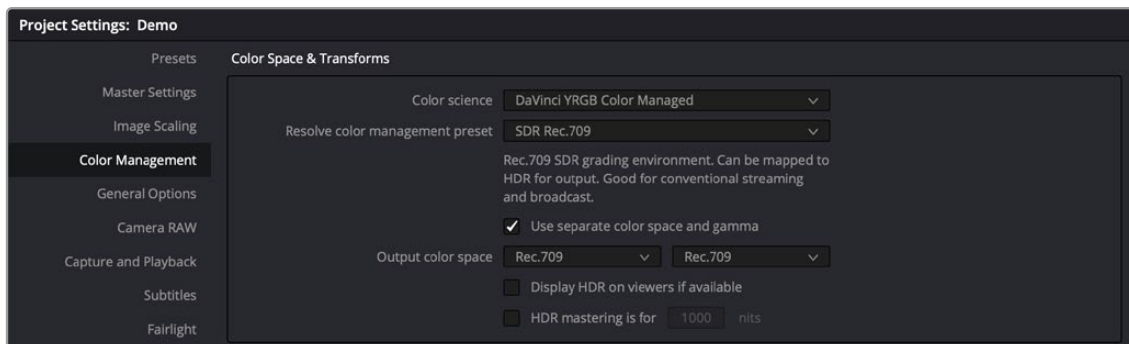
Resolve Color Management presets for manual color management setup

The Resolve Color Management preset menu lets you choose how you want to use RCM to grade your program. Each of these presets fully configures your project's use of color management, and the setting you select directly impacts how you'll grade your program. Because of this, once you choose a method of working and you grade every clip in your program, those grades rely on the preset you used being selected in order to appear as they should.

When it comes to choosing a preset, a good way to think about which to use is to choose an SDR or HDR preset that corresponds to the primary deliverable you plan on outputting. Both SDR and HDR presets have several variations that you can choose among.

While these presets correlate to how you plan on outputting your program, they don't lock you in, since you can always change the Output Color Space (described below). This makes it possible to export multiple versions of your program, each intended for different venues, no matter which color management preset you're using.

Whenever you choose a preset, a brief description explains the workflow that preset is intended to facilitate. Here's a list of the available presets, with slightly more detailed explanations.

– **SDR Rec.709:** (default) Sets up a Rec. 709 SDR grading environment. Your work can be converted to HDR on output, if specified, but is limited to a Rec. 709 gamut with out-of-bounds colors being clipped. Gamma 2.4 is not mentioned in the name because scene versus display OOTF is managed automatically. Suitable for conventional streaming and broadcast.

– **SDR P3 Broadcast:** Sets up a P3-D65 SDR grading environment. Your work can be mapped to HDR for output, if specified, but it is limited to a P3-D65 gamut with out-of-bounds colors being clipped. Gamma 2.4 is not mentioned in the name because scene versus display OOTF is managed automatically. Suitable for wider gamut streaming and broadcast at SDR levels.

– **SDR P3 Cinema:** Sets up a P3-D60 SDR grading environment. Your work can be mapped to HDR for output, if specified, but it is limited to a P3-D60 gamut with out-of-bounds colors being clipped. Suitable for conventional Cinema projection.

– **SDR Rec.2020:** Sets up a Rec. 2020 SDR grading environment. Your work can be mapped to HDR for output, if specified. Good for wide gamut streaming and broadcast.

– **DaVinci Wide Gamut:** Sets up an extra wide gamut grading environment that's suitable for grading either SDR or HDR. Capable of exporting with maximum image fidelity, preserving highlight details of up to 10,000 nits. This is a log-encoded grading space for colorists wishing to work that way. Suitable for creating mezzanine intermediates or final deliverables, or for grading HDR with high nit levels.

– **HDR P3 Broadcast:** Sets up a P3-D65 HDR grading environment. Output gamut is limited to P3-D65, with out-of-bounds colors being clipped. Suitable for grading wide gamut SDR or HDR up to 1000 nits.

- **HDR Rec.2020:** Sets up a Rec. 2020 HDR grading environment. Suitable for wide gamut SDR or HDR deliverables up to 1000 nits.

- **Custom:** If none of the available presets suits how you need to work, you can choose Custom, which exposes the full set of RCM settings for you to set up to suit your needs.

> **IMPORTANT**
>
> For all presets, importing media that's in an identical or smaller gamut maps the image data into the larger color space of the preset without transforming it. Importing media with a wider gamut than the color space of the preset remaps the image data to fit into the smaller color space, while preserving as much image detail as possible.

Output Color Space

For most DaVinci Resolve installations and projects, you'll set your Output Color Space to match the needs of your program, according to your display's capabilities (or the capabilities your display is set to use for the project at hand). You'll also typically use a Resolve Color Management preset that matches those capabilities.

However, RCM gives you the flexibility of grading in one color space and then outputting to others, when necessary. For example, it's easy to grade an SDR Rec. 709 version of a program for streaming or broadcast, and then switch the Output Color Space to SDR P3 Cinema to output an additional deliverable for theatrical exhibition.

To facilitate this, you can set the Output Color Space to any setting, independent of the Resolve Color Management preset you've selected, and DaVinci Resolve will automatically convert from your Color Management Preset to the Output Color Space of your choice. When you do so, here are the rules that govern the resulting image transform.

When going SDR to HDR:

- 0-50 nits (18% mid-gray) in your program is mapped to 0-50 nits on output (no change).

- Everything from 51-90 nits in your program is remapped from 51 to 100 nits (slightly expanded).

- Everything from 91-100 nits in your program is remapped from 101 to 1000 nits (greatly expanded).
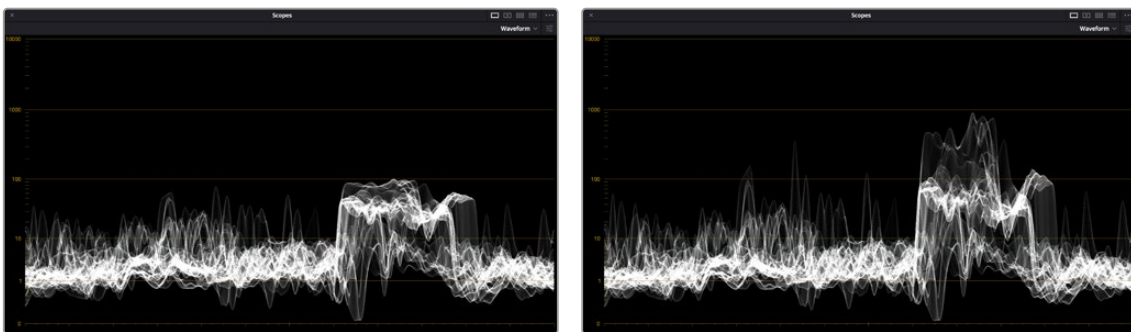
(Left) Original SDR grade seen within an HDR scale, (Right) After an automatic SDR to HDR conversion

When going from HDR to SDR, the reverse is done:
- 0-50 nits (18% mid-gray) in your program is mapped to 0-50 nits on output (no change).

- Everything from 51 to 100 nits in your program is remapped from 51-90 nits (slightly compressed).

- Everything from 101 to 1000 nits in your program is remapped from 91-100 nits (greatly compressed).

While these methods of converting between SDR and HDR provide an effective starting point for conversion, they're not meant to be an automatic solution. It's critical that you do a trim pass whenever outputting a deliverable in a new color space and EOTF, so you can check every clip and make adjustments to improve the result when necessary.

> **NOTE:** When converting SDR to HDR, this behavior may exaggerate noise in imported SDR media that happens to have large flat expanses of bright colors. If you see particular clips that show this issue, you can disable this behavior on a clip by clip basis in the Media Pool clip contextual menu, or the Thumbnail Timeline contextual menu in the Color page, by toggling "Inverse DRT for SDR to HDR Conversion."

Advanced RCM Setup

Advanced users who need more detailed control over every aspect of RCM can choose Custom from the Resolve Color Management preset menu. This exposes every control that's available, which opens a world of workflow possibilities for advanced users and post production facilities.

Because each of the settings encompasses a significant amount of functionality, the following sections cover each particular parameter in detail.
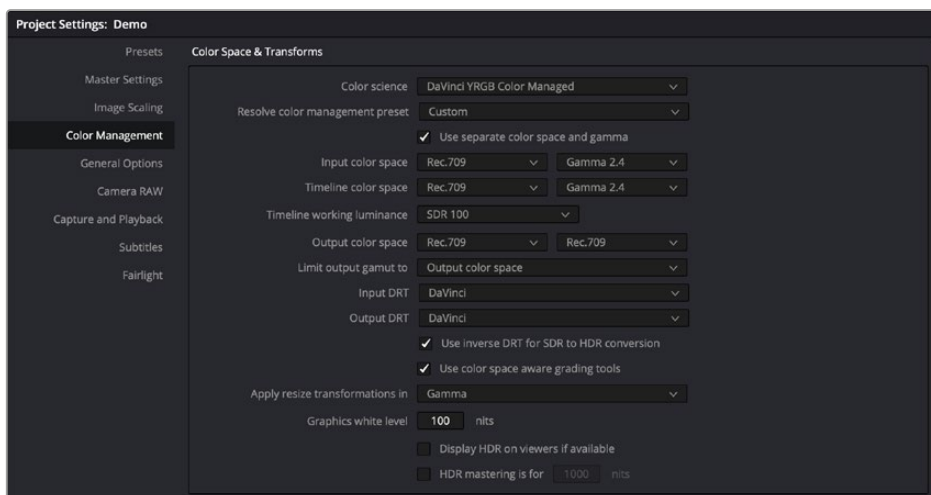
Custom Color Management settings of Resolve Color Management, as updated in DaVinci Resolve 17

> **NOTE:** Older projects using RCM will have Color science set to Legacy, to preserve the older color management settings and color transformations effect on your work. For more information on how the previous generation of RCM works, see the September 2020 version of the DaVinci Resolve 16 Manual.

Single Setting vs. Dual Setting RCM

There are two ways you can set up RCM. When the "Use Separate Color Space and Gamma" checkbox is turned off, the Color Management panel of the Project Settings exposes one drop-down each for the Input, Timeline, and Output Color Space settings. Each setting lets you simultaneously transform the gamut and gamma, depending on which option you choose. This makes it a bit simpler to set up the transform you need.
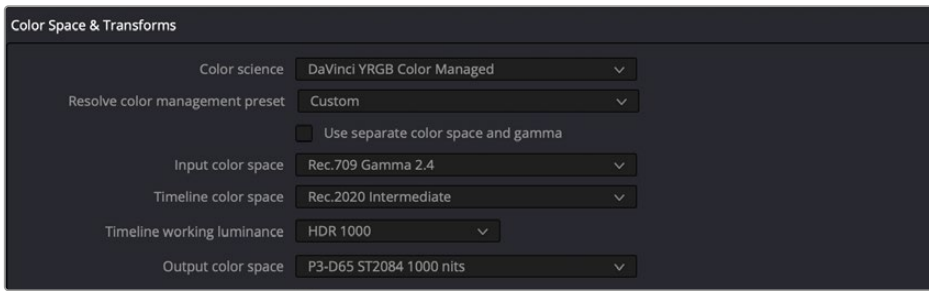
Single setting Resolve Color Management

If you turn the "Use Separate Color Space and Gamma" checkbox on, then the Color Management panel changes so that the Input, Timeline, and Output Color Space settings each display two pop-ups. The first drop-down lets you explicitly set the gamut, while the second drop-down lets you explicitly set the gamma. This makes it easier to see exactly which pair of transforms is being used at each stage of RCM.
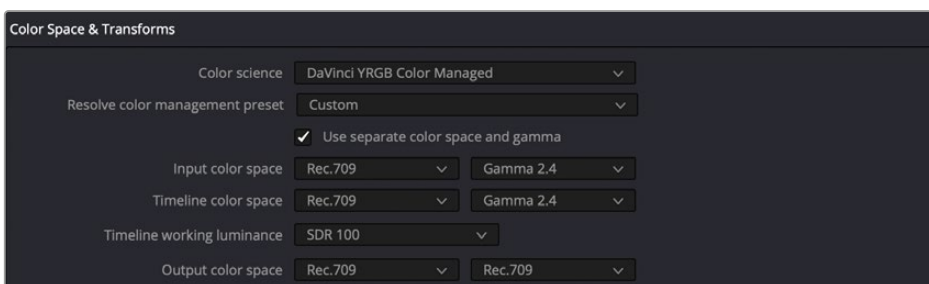
Dual setting Resolve Color Management

Additionally, Dual Setting RCM enables you to assign separate gamut and gamma transforms to clips in the Media Pool.

Dual setting Resolve Color Management assignments for Media Pool clips

Setting the Input Color Space

This setting is the default color space that all otherwise unidentified clips in the Media Pool will default to, unless you manually identify the color space of these clips by right-clicking them and choosing an Input Color Space (and optionally Input Gamma) from the contextual menu.

This setting does not affect media in camera raw formats, or media with embedded color space metadata.

Choosing a Timeline Color Space

The Timeline Color Space is the "working" color space that determines how each clip's contrast and color are mapped for adjustment, which in turn has an impact on how sensitive the effects and grading controls are as you work. Some colorists prefer to work in the classic "video" color space of Rec. 709, since the controls feel comfortable and familiar, particularly if you're mastering SDR content. On the other hand, colorists who are used to working with log-encoded media (likely using the Log controls) often prefer to work in a more film-oriented workflow using Cineon, LogC, or other wide gamut, logarithmically encoded formats.

If you're outputting an SDR deliverable, any color space that you're comfortable will produce good results. However, if you're outputting an HDR deliverable, it's in your best interest to choose a wide gamut Color Space (and Gamma) to obtain the best results on output. In this instance, DaVinci Wide Gamut is a great choice (see below for more information).

No matter which Timeline Color Space you choose to work in, all clips in an edit are transformed from the Input Color Space that's either automatically or manually assigned to them, to the Timeline Color Space setting to provide the final output. This is how you can grade within a Log-encoded timeline color space and yet view a normalized or de-logged image.

> **IMPORTANT**
>
> Once you choose a Timeline Color Space and begin grading, do not change your Timeline Color Space, or you'll end up changing all of the grades that are built using the mathematics it defines. You can always change the Output Color Space to create a new deliverable, but all of your grades depend on the Timeline Color Space to render correctly.

DaVinci Wide Gamut Color Space and DaVinci Intermediate Gamma

DaVinci Wide Gamut (DaVinci WG) and DaVinci Intermediate are Timeline Color Space and Gamma settings developed by Blackmagic Design that provide a reliable universal internal working color space, which encompasses a practical maximum of what image data any given camera can capture. The DaVinci Wide Gamut color space is greater than BT.2020, ARRI Wide Gamut, and even ACES, so you don't ever lose image data, no matter where your media is coming from.

Furthermore, the primary color values of the DaVinci WG color space are set such that the process of automatically mapping source media from different cameras into this gamut is extremely accurate as part of the Input to Timeline Color Space conversion, and tone and saturation mapping from one color space to another can be done more accurately in the Timeline to Output Color Space conversion. This also helps to produce greater consistency among media from different cameras when making manual grading adjustments (though some variations due to differences in camera and lens systems will remain).
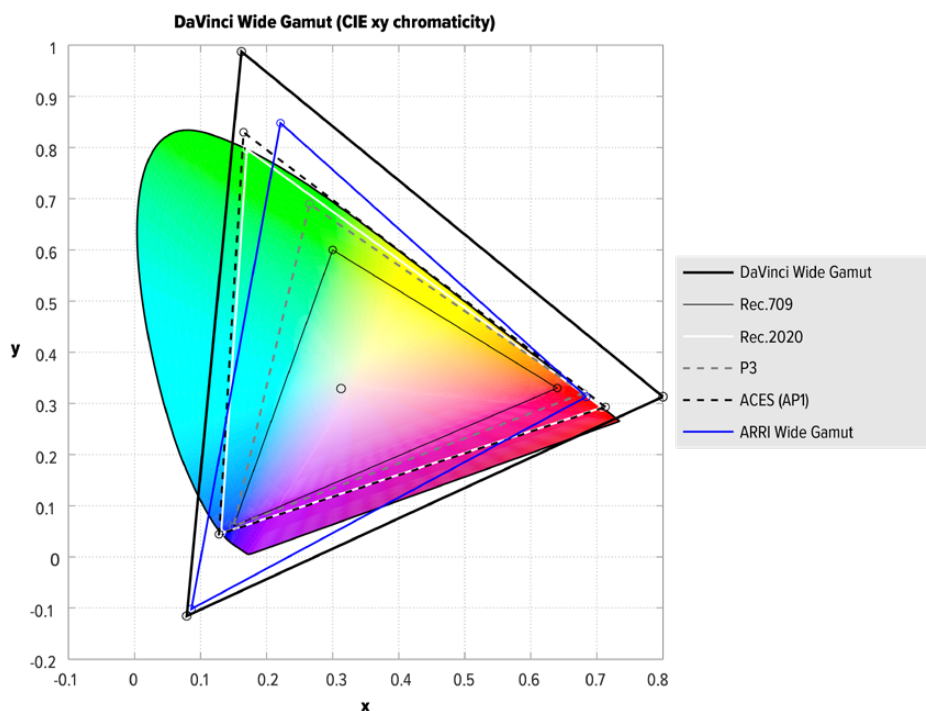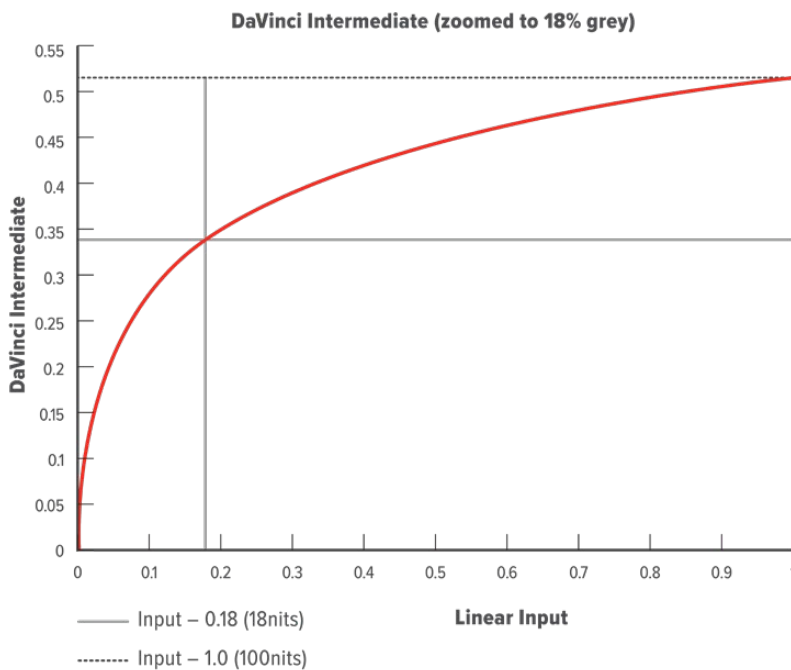

The DaVinci Wide Gamut color space

The DaVinci Intermediate OETF gamma setting has been designed to work with DaVinci Wide Gamut to provide a suitable internal luminance mapping of high precision image data, in preparation for mastering to either HDR or SDR standards, as your needs require, without losing image data.
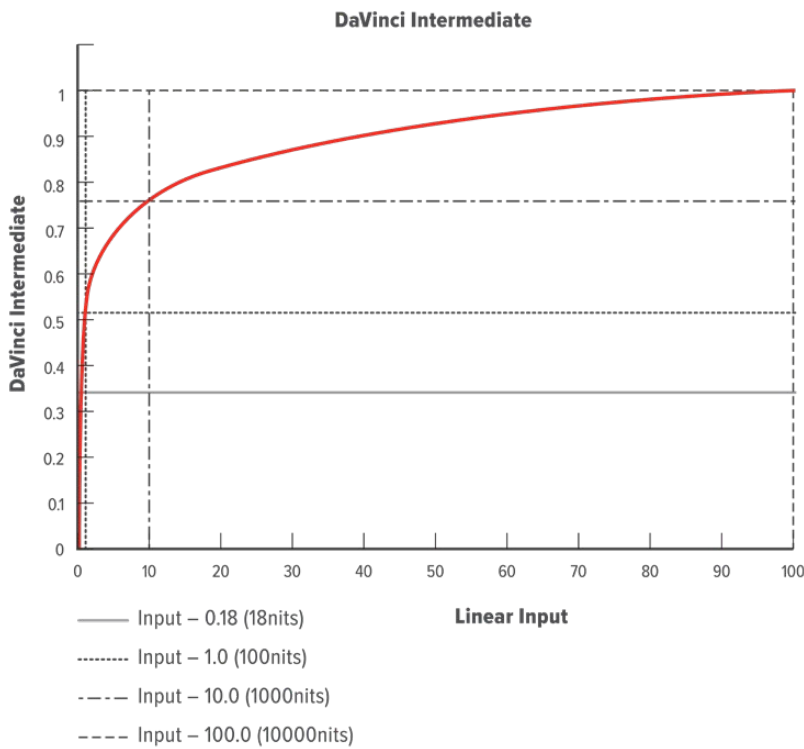
The DaVinci Intermediate OETF seen encoding HDR levels

The DaVinci Intermediate OETF encoding SDR levels

Resolve Color Management is extremely flexible, so you don't have to use DaVinci Wide Gamut/ DaVinci Intermediate as your Timeline color space if you don't want. However, it presents many advantages and is worth trying out to see if it can improve your workflow.

For more information, see the "DaVinci Resolve Wide Gamut Intermediate" document at https://www.blackmagicdesign.com/support/family/davinci-resolve-and-fusion.

Timeline Working Luminance

This control is only visible while the Resolve Color Management presets menu is set to Custom Settings. The Timeline Working Luminance drop-down menu lets you choose how the Input DRT (described below) maps the maximum level of a source image to the currently selected Timeline Color Space. This setting also defines the maximum highlight level that's possible to output into the currently selected Output Color Space using the Output DRT.

While it's typical to set this according to the mastering standard you're grading to via a collection of SDR and HDR labeled settings, there are additional settings available that make it possible to add more automatic compression of highlights as you grade.

– **SDR 100:** The conventional setting for grading SDR material with a maximum level of 100 nits.

– **HDR 500-4000:** Conventional settings for grading HDR material at a variety of maximum mastering levels. So long as output DRT isn't set to None, there will be some manner of rolloff in the highlights, unless inverse DRT is enabled, in which case there will be no rolloff.

– **SDR and HDR ER settings:** These "extended range" settings each specify two values and provide more headroom for aggressive grading of highlights by enabling DaVinci Resolve to compress a greater range of out-of-bounds image data without clipping, which can result in a smoother look.

> Here's how it works. Suppose you choose the setting "HDR ER 1000/2000." In this case, the Input DRT is used to map the maximum brightness of each source image to the range specified by the first value, which is 1000 nits. Then, when you grade, the signal isn't clipped until it reaches the maximum range specified by the second value, which is 2000 nits. This provides an additional 1000 nits of out-of-bounds headroom before the image data is hard clipped by RCM's image processing pipeline. The Output DRT is then used to map from the maximum brightness specified by the second number (2000 nits) to the output value defined by the currently selected Output Color Space, in the process compressing this out-of-bounds headroom to preserve as much highlight detail as is possible given the range you've selected.

– **Custom:** Exposes a field where you can enter a specific nit value.

203 Nit Support for SDR to HDR

This control is only visible while the Resolve Color Management presets menu is set to Custom Settings. Resolve Color Management has support for remapping SDR content to HDR by mapping 100 nits to 203 nits (defined as the diffuse white level) according to the BT.2100 recommendation. This enables the peak highlights of SDR material to compete more favorably against the significantly brighter highlights of HDR content in programs that combine both (such as documentaries), so that SDR whites continue to appear white, rather than gray, when compared to diffuse white in HDR.

The checkbox that enables this is hidden by default. Whenever you set the Output to an HDR standard while the Timeline is set to an SDR standard, the "Use 203 nits reference for Rec.2100 HDR" checkbox for remapping SDR highlights to HDR appears in both the RCM settings of the Color Management panel of the Project Settings and in the Color Space Transform Resolve FX plug-in.
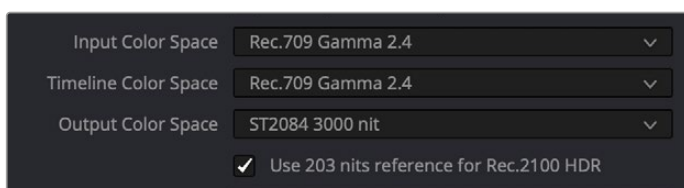

The "Use 203 nits reference for Rec.2100 HDR" checkbox in Resolve Color Management for scaling SDR levels appropriately into HDR color space

Gamut Limiting, Restricting Values Within a Larger Gamut

This control is only visible while the Resolve Color Management presets menu is set to Custom Settings. In the emerging world of larger gamuts for distribution, it's increasingly common for delivery specifications to specify output to a large gamut, such as Rec. 2020, yet require that image values be restricted to a smaller gamut, such as P3. This is to allow delivery to "future-proofed" delivery standards, while preventing saturation values that are too high to be displayed on consumer displays that aren't capable of implementing the full scope of those standards.

In this case, you'll choose a larger gamut in Output Color Space, but you'll then choose a smaller gamut in "Limit Output Gamut To." When you do this, all image values falling outside the "Limit Output Gamut To" standard specified will be hard clipped. This setting defaults to None.
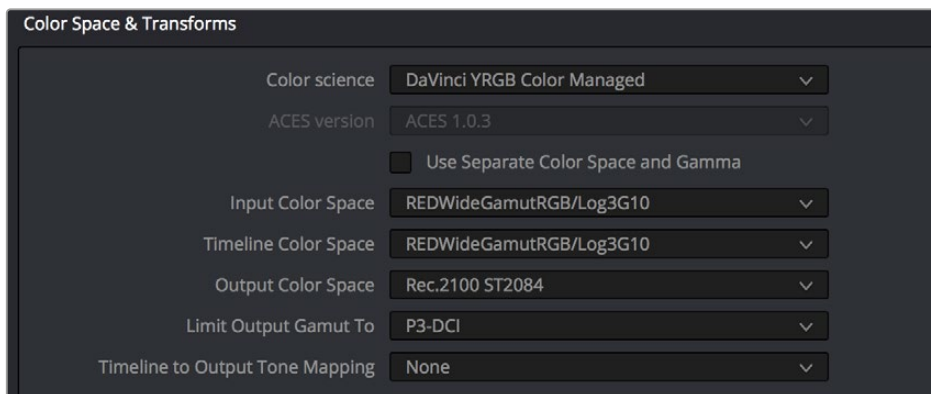
Choose a setting from the Limit Output Gamut To menu to limit image values within a larger gamut

Input DRT Tone Mapping

This control is only visible while the Resolve Color Management presets menu is set to Custom Settings. RCM has always transformed the color primaries of different media formats to match one another within the shared Timeline Color Space. In this updated version, the Input DRT (Display Rendering Transform) drop-down menu provides a variety of different options to enable DaVinci Resolve to automatically tone map the image data of SDR and HDR clips to better match one another when they're fit into the currently selected Timeline Color Space. While each option varies in the details, they are all automated input-to-timeline color transforms that do the following:

– Log-encoded media, or media using a 2.4 gamma transfer function, is mapped so the black point, midtones at 18% gray, and white levels match those of HDR media. Highlight data will be carefully stretched as necessary so that the highlights of all clips in the Timeline, whether SDR or HDR, are treated similarly.

– Raw formats such as BRAW, RED, and ARRI RAW, and media using HDR transfer functions are minimally mapped along an HDR range of tonality.

– All color transforms into the Timeline Color Space are done without clipping.

The idea is to distribute the image data of each clip in the Timeline, be it SDR or HDR media, along a similar histogram, with shadows, midtones, and highlights spread out in such a way as to create an easier starting point for grading. One result of this is that grades made for one type of media mostly work well with other types of media.

Different options are provided governing the details of how this Input to Timeline Color Space transform is achieved. They all do the same thing but have different advantages.

– **None:** This setting disables Input DRT Tone Mapping. No tone mapping is applied to the Input to Timeline Color Space conversion at all, resulting in a simple 1:1 mapping to the Timeline Color Space.

– **Simple:** A good mapping for color transforms from HDR to SDR.

– **Luminance Mapping:** Same as DaVinci, but more accurate when the Input Color Space of all your media is in a single standards-based color space, such as Rec. 709 or Rec. 2020.

– **DaVinci:** This option tone maps the transform with a smooth luminance roll-off in the shadows and highlights, and controlled desaturation of image values in the very brightest and darkest parts of the image. This setting is particularly useful for wide-gamut camera media and is a good setting to use when mixing media from different cameras.

– **Saturation Preserving:** This option has a smooth luminance roll-off in the shadows and highlights, but does so without desaturating dark shadows and bright highlights, so this is an effective option for colorists who like to push color harder. However, because over-saturation in the highlights of the image can look unnatural, two parameters are exposed to provide some user-adjustable automated desaturation.

– **Sat. Rolloff Start:** Lets you set a threshold, in nits (cd/m^2), at which saturation will roll off along with highlight luminance. Beginning of the rolloff.

– **Sat. Rolloff Limit:** Lets you set a threshold, in nits (cd/m^2), at which the image will be totally desaturated. End of the rolloff.

Output DRT Tone Mapping

This control is only visible while the Resolve Color Management presets menu is set to Custom Settings. To accommodate workflows where you need to transform one color space into another that has a dramatically larger or smaller gamut, an additional group of settings have been added that can help to automate the expansion or contraction of image data necessary to give a pleasing result.

Using the available options in the Output DRT drop-down menu will compress or expand your image data as necessary during the Timeline to Output Color Space transformation that RCM performs when monitoring or rendering a timeline, in order to make sure that the final result is either not clipping, or to ensure that it's taking better advantage of the new color space. This is not meant to provide your final grade. Rather, it's meant to give you a faster starting point, when you need it, for proceeding with your own more detailed grade of the result.

Here are some examples of what the Gamut Mapping controls of RCM can be used for:

1 If you're working with high-dynamic-range log-encoded media and you're outputting to Rec. 709 as you work, turning on Gamut Mapping lets RCM use saturation and tone mapping to give you a more immediately pleasing image with highlight detail that's not clipped.

2 If you're working with standard-dynamic-range log-encoded media and you're outputting to an HDR format as you work, turning on Gamut Mapping lets RCM use saturation and tone mapping to expand the highlights of the image to HDR strength to give you an image with more immediate visual impact on HDR screens.
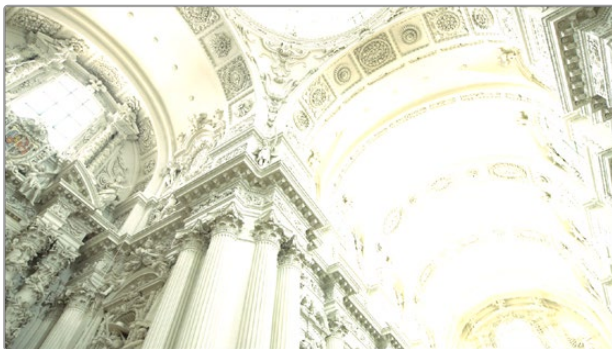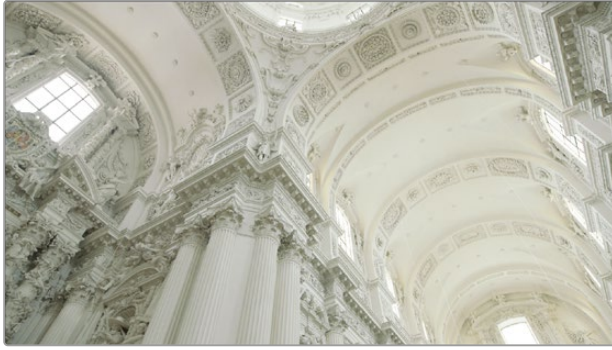
(Before/After) Gamut Mapping used to automatically fit
high-dynamic-range media into the Rec. 709 color space

The Output DRT (Display Rendering Transform) drop-down menu provides the following options.

– **None:** No tone mapping is applied to the Timeline to Output Color Space conversion at all, resulting in a simple 1:1 output with no softness or rolloff applied. All image data outside of gamut will be clipped.

– **Simple:** A good mapping for color transforms from HDR to SDR.

– **Luminance Mapping:** Same as DaVinci, but more accurate when all your media is in a single standards-based color space, such as Rec. 709 or Rec. 2020, set to the Timeline and Output.

– **DaVinci:** This option tone maps your output with a smooth luminance roll-off in the shadows and highlights, and controlled desaturation of image values in the very brightest and darkest parts of the image. It's been designed to give smooth, naturalistic highlights and shadows as you push and pull the values of your images, without the need for additional settings. This setting is particularly useful for wide-gamut camera media and is a good setting to use when mixing media from different cameras.

– **Saturation Preserving:** This option has a smooth luminance roll-off in the shadows and highlights to prevent clipping. It does so without desaturating dark shadows and bright highlights, so this is an effective option for colorists who like to push color a bit harder. However, because over saturation in the highlights of the image can look unnatural, two parameters are exposed to provide some user-adjustable automated desaturation.

  – **Sat. Rolloff Start:** Lets you set a threshold, in nits (cd/m^2), at which saturation will roll off along with highlight luminance. Beginning of the rolloff.

  – **Sat. Rolloff Limit:** Lets you set a threshold, in nits (cd/m^2), at which the image will be totally desaturated. End of the rolloff.

– **RED IPP2:** This setting lets you use RED IPP2 tone mapping to output to an SDR format, such as Rec. 709; two settings are exposed with which to choose how your output will be shaped.

  – **Output Tone Map:** Lets you choose what kind of tone mapping you want to use for your output. Options include: None, Low, Medium, and High.

  – **Highlight Roll Off:** Lets you choose what kind of highlight rolloff you want to use to prevent clipping. Options include: None, Hard, Medium, Soft, and Very Soft.

  – **HDR peak nits:** A slider lets you choose the peak nit level you want to tone map to. Defaults to 10,000 nits.

Use Inverse DRT for SDR to HDR Conversion

This control is only visible while the Resolve Color Management presets menu is set to Custom Settings. A device rendering transform (DRT) is typically used when converting high dynamic range media to a lower dynamic range color space/mastering standard. Thus, setting up a color transform from SDR to HDR is an "inverse" operation to expand the dynamic range of SDR media to HDR

standards. The way this works is that levels at 100 nits are mapped to the maximum value set for the Timeline Working Luminance parameter, and all other image levels are strategically tone mapped in order to give yourself a good starting point for grading SDR media into an HDR program.

This setting also has a secondary use. With this setting turned on, you can output Rec. 709 clips with color that's identical to the input, with no compression in the highlights.

> **NOTE:** Turning on "Use Inverse DRT for SDR to HDR Conversion" may exaggerate noise in imported SDR media with large flat expanses of bright colors.

Use White Point Adaptation

This control applies a chromatic adaptation transform to account for different white points between color spaces.

– Uncheck this box if you simply want to view the input color space's white point unaltered in the output color space. For example, wanting to use a P3-D60 mastered clip inside a P3-D65 timeline for reference purposes.

– Check this box to apply the chromatic adaptation transform to convert the input white point to match the output color space's white point. For example, wanting a P3-D60 mastered clip to cut in with other clips mastered in a P3-D65 timeline.

> **NOTE:** This control is only visible while the Resolve Color Management presets menu is set to Custom Settings.

Color Space Aware Grading Tools

In DaVinci Resolve version 17, both Resolve Color Management and ACES enables "color space aware" palettes, such as the new HDR palette, to have controls that feel consistent, no matter what color space the original media is from, or what Timeline Color Space you're using.

Other palettes, such as the Qualifier and Curves palettes, become color space aware when you turn on the "Use Color Space Aware Grading Tools" checkbox in the Color Management panel of the Project Settings (this is turned on by default). When you're using color space aware grading tools, you should not turn on HDR Mode for the node you're working on.

– In the case of the Qualifier palette, this enables Qualifiers to create high-quality keys as you would expect, no matter what the color space of the original media is, or what Timeline Color Space you're using.

– In the case of the Curves palette, this makes the overall range of each curve better fit the overall data range of the current clip, making curves adjustments easier and more specific.

> **NOTE:** This control is only visible while the Resolve Color Management presets menu is set to Custom Settings.

Apply Resize Transformations In

When you're using Resolve Color Management, a new "Apply Resize Transformations In" Project Setting is available in the Color Management panel while the Resolve Color Management presets menu is set to Custom Settings. This setting lets you choose which color space is used for resizing

operations. Ordinarily, resizing is done in Linear, but certain specialty workflows benefit from doing resizing in other color spaces, so this option lets you choose which is best. The available options are:

– **Timeline:** Uses the Timeline Color Space to perform all resizing operations.

– **Log:** Uses a Log Color Space for resizing. Good for avoiding artifacts in certain high-contrast images, such as titles and star fields.

– **Linear:** Usually provides the best results with most SDR media.

– **Linear Mapped:** Usually provides the best results with most HDR media.

– **Gamma:** Provided in case you find a need for this option.

– **Gamma Mapped:** Usually provides best results when mixing SDR media with wide gamut and log-encoded media on the same timeline.

Graphics White Level

The "Graphics white level" setting lets you define a shared maximum level in nits (cd/m^2) for titles, generators, and selected effects that generate color. Changing this setting lets you change the maximum level of all DaVinci Resolve-generated titles, generator graphics, and effects at once to accommodate different mastering and output requirements.

Display HDR On Viewers If Available

Turn this checkbox on if your computer monitors and operating system are capable of accommodating HDR display. This allows the Viewers to show true HDR, according to the capabilities of your computer monitor.

HDR Mastering Is For (Studio Version Only)

If you have a DeckLink 4K Extreme 12G or an UltraStudio 4K Extreme video interface, then DaVinci Resolve 12.5 and above can output the metadata necessary to correctly display HDR video signals to display devices using HDMI 2.0a when you turn on the "Enable HDR metadata over HDMI" checkbox in the Master Project Settings.
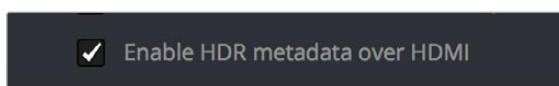
The Enable HDR metadata over HDMI option in the Master Project Settings lets you output HDR via HDMI 2.0a.

When you do so, a setting in the Color Management panel of the Project Settings, "HDR mastering is for X" lets you specify the output, in nits, to be inserted as metadata into the HDMI stream being output, so that the display you're connecting to correctly interprets it. The output you specify should match what your display is expecting.
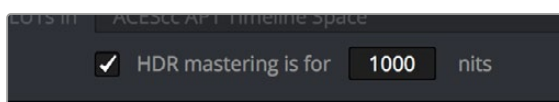
The "HDR mastering is for" setting lets you insert metadata for HDR output via HDMI 2.0a.

Resolve Color Management and the Fusion Page

Enabling RCM also allows the Fusion page to handle the color of clips automatically. Images output by MediaIn nodes are automatically converted to Linear color space, which is the preferred color space with which to perform high-quality compositing operations. Setting the LUT menu of each Viewer in

the Fusion page to Managed ensures that you're looking at the image in Rec. 709, so that the image looks correct to the artist even though they're really working in the Linear color space. Each MediaOut node then converts the image back to the timeline color space for handoff to the Color page.

With RCM off, you must manage color in the Fusion page manually, either using the Source Color Space and Source Gamma Space settings of each MediaIn node, or using the CineonLog or FileLUT nodes in your node tree.

For more information on how color management affects the Fusion page, and why the Linear color space is preferable for compositing, see Chapter 76, "Controlling Image Processing and Resolution."

Ability to Bypass Color Management Per Clip

When you right-click a clip in the Thumbnail Timeline of the Color page, a "Bypass Color Management" setting appears underneath the Input Color Space and Input Gamma submenus that let you identify a clip's color characteristics. Choosing this option so that it appears checked lets you exclude that clip from color management altogether, in the event you want to manually manage that clip using LUTs, the Color Space Transform node, or simply by doing manual grading.
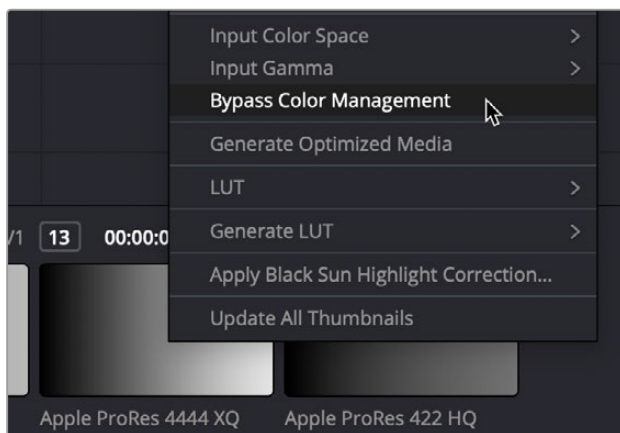
The Bypass Color Management option for clips in the contextual menu of the Thumbnail Timeline

Exporting Color Space Information to QuickTime Files

If you render QuickTime files from the Deliver page, then color space tags will be embedded into each file based on either the Timeline Color Space (if Resolve Color Management is disabled) or the Output Color Space (if Resolve Color Management is enabled). Two settings in the Advanced Settings of the Render Settings let you choose how color space metadata will be embedded into your output for supported media formats, "Color Space Tag," and "Gamma Tag." These default to "Same as Project," which will match the Output Color Space currently selected in the Project Settings.
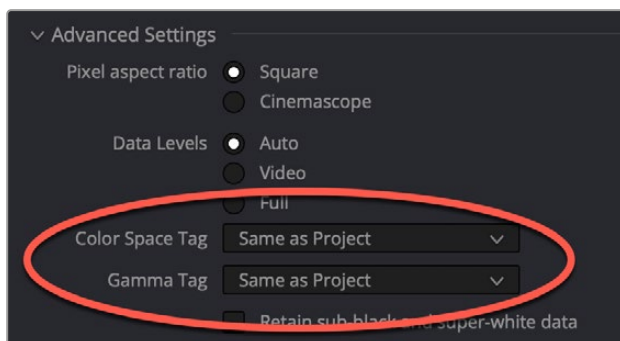

The Color Space Tag and Gamma Tag settings in the Render Settings

Color Management Using ACES

The ACES (Academy Color Encoding Specification) color space has been designed to make scene-referred color management a reality for high-end digital cinema workflows. ACES also makes it easier to extract high-precision, wide-latitude image data from raw camera formats, in order to preserve high-quality image data from acquisition through the color grading process, and to output high-quality data for broadcast viewing, film printing, or digital cinema encoding.

An oversimplification of the way ACES works is that every camera and acquisition device is characterized to create an IDT (Input Device Transform) that specifies how media from that device is converted into the ACES color space. The ACES gamut has been designed to be large enough to encompass all visible light, with more than 25 stops of exposure latitude. In this way ACES has been designed to be future-proof, taking into consideration advances in image capture and distribution.

Meanwhile, an RRT (Reference Rendering Transform) is used to transform the data provided by each image format's IDT into standardized, high-precision, wide-latitude image data that in turn is processed via an ODT (Output Device Transform). Different ODT settings correspond to each standard of monitoring and output, and describe how to accurately convert the data within the ACES color space into the gamut of that display in order to most accurately represent the image in every situation. The RRT and ODT always work together.
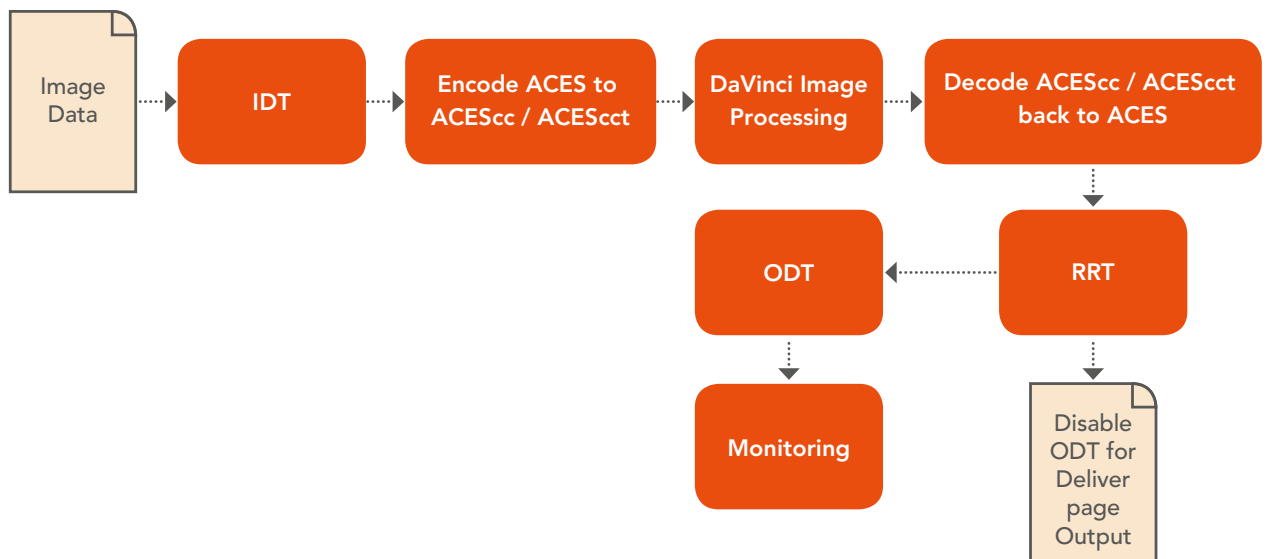
ACES signal and processing flow

By using the ACES color space and specifying an IDT and an ODT, you can ingest media from any capture device, grade it using a calibrated display, output it to any destination, and preserve the color fidelity of the graded image.

Setting Up ACES in the Project Settings Window

There are four parameters available in the Color Science drop-down of the Color Management panel of the Project Settings that let you set up DaVinci Resolve to use the ACES workflow:

– **Color science is:** Using this drop-down menu, you can choose either DaVinci ACES, or DaVinci ACEScc color science, which enables ACES processing throughout DaVinci Resolve.

   – **ACEScc:** Choose DaVinci ACEScc color science to apply a standard Cineon-style log encoding to the ACES data before it is processed by DaVinci Resolve. This well defined common encoding makes it possible for ASC CDL values to be used across systems using the same ACEScc encoding. After processing, a reverse encoding is applied in order to output ACES linear data.

- **ACEScct:** A variation of ACEScc that adds a roll-off at the toe of the image that's different from the encoding of ACEScc, in order to make color correction lift operations "feel" more like they do with film scans and LogC encoded images, which makes it easier to raise the darkest values of the image and get milky shadows, something that can be difficult with ACEScc. After processing, a reverse encoding is applied in order to output ACES linear data.

- **ACES Version:** When you've chosen one of the ACES color science options, this drop-down becomes available to let you choose which version of ACES you want to use. You can choose from ACES 1.0.3, ACES 1.1, ACES 1.2, or ACES 1.3 (the latest version).

- **ACES Input Device Transform:** This drop-down menu lets you choose which IDT (Input Device Transform) to use for the dominant media format in use. DaVinci Resolve currently supports the following IDTs:

  - **ACEScc/ACEScct/ACEScg:** Standardized transforms for each of these ACES standards.

  - **ADX (10 or 16):** 10-bit or 16-bit integer film-density encoding transforms meant for use if you're working with film scans that were initially encoded in an ACES workflow. This transform is designed to maintain the variation in look between different film stocks.

  - **ALEXA:** Color management settings for all ARRI ALEXA cameras.

  - **BMD Film/4K/4.6K:** Color management settings for Blackmagic Design cameras.

  - **Canon 1D/5D/7D/C200/C300/C300MkII/C500/C700:** Color management settings for Canon cameras.

  - **DCDM:** This IDT transforms X'Y'Z'-encoded media with a gamma of 2.6.

  - **DCDM (P3D65 Limited):** This IDT transforms X'Y'Z'-encoded media with a gamma of 2.6, specifically hard clipped to a P3 gamut with a D65 white point.

  - **DRAGONcolor/2 and REDgamma3/4/REDlogFilm combinations:** Different combinations of the DRAGONcolor, REDgamma, and REDlogFilm settings are provided for legacy RED workflows.

  - **P3-D60:** Transforms RGB-encoded image data with a D60 white point, intended for monitoring with a P3-compatible display using a D60 white point.

  - **P3-D65:** Transforms RGB-encoded image data with a D65 white point; intended for monitoring with a P3-compatible display using a D65 white point.

  - **P3-D65 (D60 sim.):** Transforms RGB-encoded image data with a D65 white point; intended to simulate monitoring with a P3-compatible display using a D60 white point on a display with D65.

  - **P3-D65 ST2084 (108/1000/2000/4000 nits):** Transforms an image that's compatible with the P3 color gamut, using the SMPTE standard PQ (ST.2084) tone curve for High Dynamic Range (HDR) post-production. Three settings for four different peak luminance ranges are provided; which one is appropriate to use depends on the maximum white level of the display used to create the media. Preliminary standards exist for HDR displays with peak luminance at 1000 nits, 2000 nits, and 4000 nits. A setting of 108 nits is provided for Kodak laser projection.

  - **P3-D65:** Transforms RGB-encoded image data with a D65 white point, intended for monitoring with a P3-compatible display using a D65 white point.

  - **P3-D65 ST2084 (1000/2000/4000 nits):** Transforms an image that's compatible with the P3 color gamut, using the SMPTE standard PQ (ST.2084) tone curve for High Dynamic Range (HDR) post-production. Three settings for three different peak luminance ranges are provided; which one is appropriate to use depends on the maximum white level of the display used to create the media. Preliminary standards exist for HDR displays with peak luminance at 1000 nits, 2000 nits, and 4000 nits.

  - **P3-DCI (D60 sim.):** Produces output that's specifically for output on a DCI projector with a D60 white point. This output may look magenta on other display devices that aren't set up for DCI display.

– **P3-DCI (D65 sim.):** Produces output that's specifically for output on a DCI projector with a D65 white point. This output may look magenta on other display devices that aren't set up for DCI display.

– **Panasonic V35:** Color management settings for each listed camera.

– **Rec.2020:** This IDT transforms media created with the wide-gamut standard for consumer and broadcast television.

– **Rec.2020 ST2084 (1000/2000/4000 nits):** This IDT transforms media created within the wide-gamut standard for consumer and broadcast television, using the SMPTE standard PQ (ST.2084) tone curve for High Dynamic Range (HDR) post-production. Three settings provided for HDR televisions with different peak luminance capabilities.

– **Rec.2020 HLG (1000 nits):** This IDT transforms media within the wide-gamut standard for consumer and broadcast television and uses the Hybrid Log-Gamma (HLG) standard tone curve for High Dynamic Range (HDR) post-production. A single setting is provided for HDR televisions with peak luminance at 1000 nits.

– **Rec.709 (Camera):** A deprecated legacy IDT for Rec. 709 that's included for backward compatibility. Converts the source data to linear based on Rec. 709 and transforms the result to ACES, but while this transformation is technically correct, it's not necessarily pleasing after conversion through the matching ODT. For this reason, the academy updated to the following Rec. 709 IDT, which is the inverse of the Rec. 709 ODT.

– **Rec.709:** A standard transform designed to move media in the Rec. 709 color space into the ACES color space. This option is used for any other file type that might be imported, such as ProRes from Final Cut Pro, DNxHD from Media Composer, and any media file captured from tape.

– **Rec.709 (D60 sim.):** A standard transform designed to move media in the Rec. 709 color space with a white point of D60 into the ACES color space.

– **REDColor2/3/4/REDGamma3/4/REDLogFilm combinations:** Different combinations of the REDcolor, REDgamma, and REDlogFilm settings are provided for legacy RED workflows.

– **RWGLog3G10:** The standardized RED IPP2 color pipeline transform for all RED camera media.

If you're working on a project that mixes media formats that require different IDTs, then you can assign different IDTs to clips using the Media Pool's contextual menu, or using the Clip Attributes window, which is also accessible via the Media Pool's contextual menu.

– **ACES Output Device Transform:** This drop-down menu lets you choose an ODT (Output Device Transform) with which to transform the image data for monitoring on your calibrated display, and when exporting a timeline in the Deliver page. You can choose from the following options:

– **ADX (10 and 16):** A standardized ODT designed for media destined for film output. Two settings accommodate 10-bit and 16-bit output. This ODT is not meant to be used for monitoring.

– **DCDM:** This ODT exports X'Y'Z'-encoded media with a gamma of 2.6 intended for handoff to applications that will be re-encoding this data to create a DCP (Digital Cinema Package) for digital cinema distribution. This can be displayed via an XYZ-capable projector.

– **DCDM (P3D60 Limited):** Outputs a P3 hard-limited signal with a D60 white point.

– **DCDM (P3D65 Limited):** Outputs a P3 hard-limited signal with a D65 white point.

– **P3 D60:** Outputs RGB-encoded image data with a D60 white point; intended for monitoring with a P3-compatible display using a D60 white point.

– **P3 D65:** Outputs RGB-encoded image data with a D66 white point; intended for monitoring with a P3-compatible display using a D66 white point.

– **P3 D65 (D60 sim.):** Outputs RGB-encoded image data to simulate monitoring with a P3-compatible display using a D60 white point on a display with a D65 white point.

- **P3 D65 (Rec.709 Limited):** Outputs RGB-encoded image data with a D65 white point within a P3 gamut that's hard-limited to the color range of Rec. 709.

- **P3 D65 ST2084 (108/1000/2000/4000 nits):** Outputs an image that's compatible with the P3 color gamut, using the SMPTE standard PQ tone curve for High Dynamic Range (HDR) post-production. Three settings for three different peak luminance ranges are provided; which one is appropriate to use depends on the maximum white level of your display. Preliminary standards exist for HDR displays with peak luminance at 1000 nits, 2000 nits, and 4000 nits. A setting of 108 nits is provided to simulate an HDR signal clipped to an SDR range.

- **P3 DCI (D60 sim.):** Outputs RGB-encoded P3 image data that appears as if with a D60 white point on a DCI projector with a DCI white point.

- **P3 DCI (D65 sim.):** Transforms RGB-encoded image data with a D61 white point (the DCI mastering standard) that appears as if with a D65 white point.

- **P3-D65 ST2084 (1000/2000/4000 nits):** Transforms an image that's compatible with the P3 color gamut, using the SMPTE standard PQ (ST.2084) tone curve for High Dynamic Range (HDR) post-production. Three settings for three different peak luminance ranges are provided; which one is appropriate to use depends on the maximum white level of the display used to create the media. Preliminary standards exist for HDR displays with peak luminance at 1000 nits, 2000 nits, and 4000 nits.

- **Rec.2020:** This ODT is for compatibility with the full range of this wide-gamut standard for consumer and broadcast television.

- **Rec.2020 (P3D65 Limited):** Outputs a P3D65 hard-limited signal within this wide-gamut standard for consumer and broadcast television.

- **Rec.2020 (Rec.709 Limited):** Outputs a Rec. 709 hard-limited signal within this wide-gamut standard for consumer and broadcast television.

- **Rec.2020 HLG:** Outputs the full Rec. 2020 gamut to the Hybrid Log-Gamma standard for HDR.

- **Rec.2020 HLG (1000 nits, P3D65 Limited):** Outputs a 1000 nit, P3D65 hard-limited signal within the Rec. 2020 gamut and the Hybrid Log-Gamma standard for HDR.

- **Rec.2020 ST2084 (1000/2000/4000 nits):** This ODT transforms media created within the wide-gamut standard for consumer and broadcast television, using the SMPTE standard PQ (ST.2084) tone curve for High Dynamic Range (HDR) postproduction. Three settings are provided for HDR televisions with different peak luminance capabilities.

- **Rec.2020 ST2084 (1000/2000/4000 nits, P3D65 Limited):** This ODT transforms media within the wide-gamut standard for consumer and broadcast television but with hard clipping at the boundary of the P3 gamut for televisions that are limited to the smaller P3 gamut for digital cinema; also uses the SMPTE standard PQ (ST.2084) tone curve for High Dynamic Range (HDR) post-production. Three settings are provided for HDR televisions with different peak luminance capabilities.

- **Rec.709:** This ODT is used for standard monitoring and deliverables for TV.

- **Rec.709 (D60 Sim):** A standard transform designed to move media in the Rec. 709 color space with a white point of D60 into the ACES color space.

- **sRGB:** A standardized transform designed for media created for computer display in a consumer environment.

- **sRGB (D60 Sim.):** A standardized ODT designed for media destined for computer display in a consumer environment. Suitable for monitoring when grading programs destined for the web.

- **ACEScc/ACEScct/ACEScg:** Standardized transforms for each of these ACES standards.

You must manually select an ODT that matches your workflow and room setup when working in ACES.

- **Process Node LUTs in:** This drop-down menu lets you choose how you want to process CLF LUTs that are added to nodes in your grades while working in ACES, such as Look LUTs in on-set or VFX workflows. There are two choices: ACEScc AP1 Timeline Space (the default), and ACES AP0 Linear.

  - **ACEScc AP1:** For LUTs that have been designed to take the specific range of ACEScc data using the AP1 primary coordinates.

  - **ACES AP0:** For LUTs that have been designed for normal ACES data from 65504 to -65504 floating point values.

> **NOTE:** ACES grades require CLF LUTs that have been specifically created for ACES workflows. If you want to apply a regular LUT within a grade, you must do a color space transform to convert the image from ACES to whatever space the LUT was designed to work within, and then another color space transform to convert the image back to ACES; however, this workflow does not alway provide ideal results.

The Initial State of Clips When Working in ACES

Don't worry if the initial state of each image file appears differently than what was monitored originally on set. What's important is that if the camera original media was well exposed, the IDT used in ACES mode will retain the maximum amount of image data, and provide the maximum available latitude for grading, regardless of how the image initially appears on the Timeline.

The Timeline Color Space in ACES Workflows is Fixed

When you're working in ACES, you do not get to change the Timeline Color Space as you do in Resolve Color Management. The ACES working color space is a log-encoded color space, which encourages a more traditional, film-oriented approach to grading.

Tips for Rendering Out of an ACES Project

When choosing an output format in the Deliver page, keep the following in mind:

- If you've delivering graded media for broadcast, set the ACES Output Device Transform to be Rec. 709, then you can output to whatever media format is convenient for your workflow.

- When you're delivering graded media files to another ACES-capable facility using the DCDM or ADX ODCs, you should choose the OpenEXR RGB Half (uncompressed) format in the Render Settings, and set the ACES Output Device Transform to "No Output Device Transform."

- When you're rendering media for long-term archival, you should choose the OpenEXR RGB Half (uncompressed) format in the Render Settings, and set the ACES Output Device Transform to "No Output Device Transform."

Chapter 10

HDR Setup and Grading

High Dynamic Range (HDR) grading for cinema, television, and streaming is the latest evolution of the consumer media experience. While HDR workflows in high-end cinema and television aren't new, this way of mastering media has been slow to expand to less expensive programming. However, new developments and an expanding array of affordable HDR-capable consumer devices are poised to make HDR mastering of visual content increasingly ubiquitous. This chapter describes what HDR is for the uninitiated and covers the operational details that will let you set up DaVinci Resolve to do HDR grading.

Contents

High Dynamic Range (HDR) Grading in DaVinci Resolve

The HDR features found in DaVinci Resolve are only available in DaVinci Resolve Studio.

High Dynamic Range (HDR) video describes an emerging family of video encoding and distribution technologies designed to enable a new generation of television displays to play video capable of intensely bright highlights and increased saturation. The general idea is that the majority of an HDR image will be graded similarly to how a Standard Dynamic Range (SDR) image is graded now, with the shadows and midtones being mostly the same between traditionally SDR and HDR-graded images. This is mostly because shadows are shadows and are meant to be dark; however this philosophy also maintains a comfortable viewing experience and easier backward compatibility when you need to master both SDR and HDR versions of a program. The difference is that HDR provides abundant additional headroom for very bright highlights and color saturation that far exceed what has been previously visible in SDR television and cinema. This enables the colorist to create more vivid and life-like highlights in images, such as sunsets, lit clouds, firelight, explosions, sparkles, and other intensely bright and colorful imagery. In short, you can now "open up" the highlights in an image just as you've always been able to open up, or expand, the detail of the shadows. This not only provides more life-like lighting intensity and saturation, but it also dramatically expands the contrast available in the scene. For example, a calibrated SDR display should have a peak luminance level of 100 nits (cd/m^2), but existing HDR displays can provide peak luminance levels of 700, 1000, or even 4000 nits.

However, because it's an evolving technology, the technical standards that have been developed far exceed what current consumer televisions, projectors, phones, and tablets are capable of. At the time of this writing, consumer televisions are capable of outputting 700 to 1600 nits. Furthermore,

consumer displays are often saddled with automatic brightness limiting (ABL) circuits that limit power consumption to acceptable levels for home use, which means that only a certain percentage of the picture may reach these peak values at any one time. This is fine, because the point of HDR is not that you're making the entire image brighter, it's that you have more headroom for specific bright highlights and additional saturation.

For all of these reasons, HDR standards focus on describing what displays should be capable of, not how these levels are to be used. That is a creative decision.

HDR Isn't Just for Televisions

Lest you think that living room televisions and projectors are the only way to watch HDR content, certain flagship iOS and Android phones and tablets have implemented HDR viewing capabilities that are capable of meeting or even exceeding the UltraHD requirements for HDR content on an OLED display. This makes HDR, surprisingly, a widely available mobile experience.

The Different Ways of Mastering HDR

While different HDR technologies use different methods to map the video levels of your program to an HDR display's capabilities, they all output a "near-logarithmically" encoded signal that requires a compatible television that's capable of correctly stretching this signal into its "normalized" form for viewing. This means if you look at an HDR signal that's output from the video interface of your grading workstation on an SDR display, it will look flat, desaturated, and unappealing until it's plugged into your HDR display of choice.
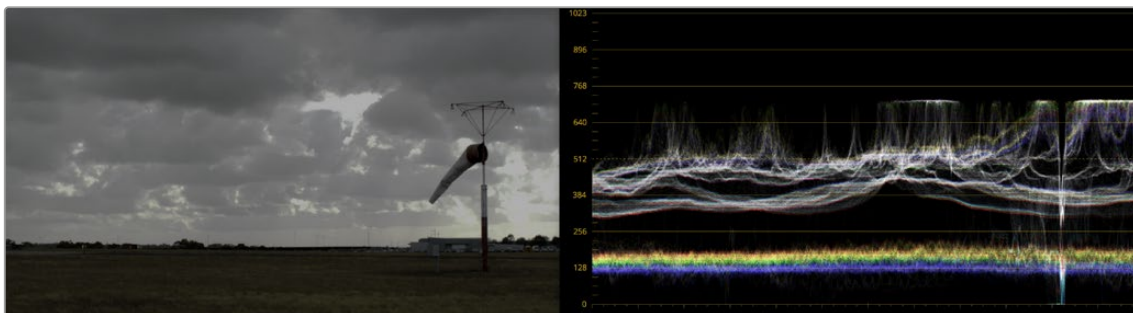
A graded HDR image being output looks similar to a log-encoded image

At the time of this writing, there are four principal approaches to mastering HDR that DaVinci Resolve is capable of supporting, including:

– Dolby Vision®

– HDR10

– HDR10+

– Hybrid Log-Gamma (HLG)

Each of these HDR standards define how an HDR signal is encoded for export and later mapped to the visible output of an HDR or SDR display. Grading to each of these standards requires some degree of color management, and DaVinci Resolve gives you three main ways to handle this:

– The easiest way is to enable Resolve Color Management (RCM) or ACES in the Color Management panel of the Project Settings, and use the Color Space conversion options that are available. There are options there for each supported type of HDR.

– The transforms that are available in RCM are also available as Resolve FX operations, if you want to organize your grading pipeline more manually using the Color Transform Resolve FX adjustment.

- LUTs are also available to accomplish each of these color space conversions if you want to develop your own specific image processing pipeline based on custom-made LUT or DCTL transforms.

Overall, Resolve Color Management and ACES are reliable and recommended approaches to handling HDR grading in DaVinci Resolve in most instances. For more information about Resolve Color Management, see Chapter 9, "Data Levels, Color Management, and ACES."

What Do I Do With HDR?

While these standards make HDR mastering and distribution possible, they have nothing to say about how these HDR-strength levels should be used creatively. That's up to you, because the question of how to utilize the expansive headroom for brightness and saturation that HDR enables is fully within the domain of the colorist, as a series of creative decisions that must be made regarding how to assign the range of highlights that are available in your source media to the above-100 nit HDR levels you're mastering to as you grade, given the peak luminance level that you're assigned to master with. Which HDR peak luminance level you use (1000 nit, 3000 nit, 4000 nit) probably depends on which display you have access to and who's distributing the resulting program.

Analyzing HDR Signals Using Video Scopes

When you're using waveform scopes of any kind, including parade and overlay scopes, the signal will fit within the 10-bit scale used to analyze the signal much differently owing to the way HDR is encoded. The following chart of values will make it easier to understand how each level in "nits" (i.e., cd/m^2) corresponds to a code value within the 10-bit image scale:

10-Bit Code	Nearest Value in cd/m^2	HDR Display Peak Luminance Capability
1019[†]	10,000	No commercially available display
920	4000	Dolby Pulsar
889	3000	Flanders Scientific XM310K w/L20 test pattern
844	2000	Dolby PRM 32FHD
767	1000	Sony BVM X300 w/L10 test pattern, EIZO Prominence CG3145, or Flanders Scientific XM311K
756	900	Flanders Scientific XM650U w/L20 test pattern
742	800	Panasonic TC-55FZ1000U w/L10 test pattern
728	700	Measured on an iPhone XS displaying 50% white
711	600	Canon V2411 (not in burst mode)
691	500	Minimum standard for an "UltraHD" OLED display
635	300	Flanders Scientific DM250 in "HDR preview mode" w/L40 pattern
593	203	BT.2408 recommendation for diffuse white of SDR content being intercut with 1000 nit max HDR content
528	108	Dolby Cinema projector
520	100	Standard peak luminance for SDR displays
447	48	Standard peak luminance for SDR DCI projection, Dolby Cinema 3D peak luminance
4[†]	0	Absolute black

[†] 0–3 and 1020–1023 are reserved values

While this table of values is useful for understanding where HDR nit levels fall on legacy external scopes, if you're monitoring with the built-in video scopes in DaVinci Resolve, you can turn on the "Enable HDR Scopes for ST.2084" checkbox in the Color panel of the User Preferences, which replaces the 10-bit scale of the video scopes with a scale based on nit values (or cd/m²) instead.
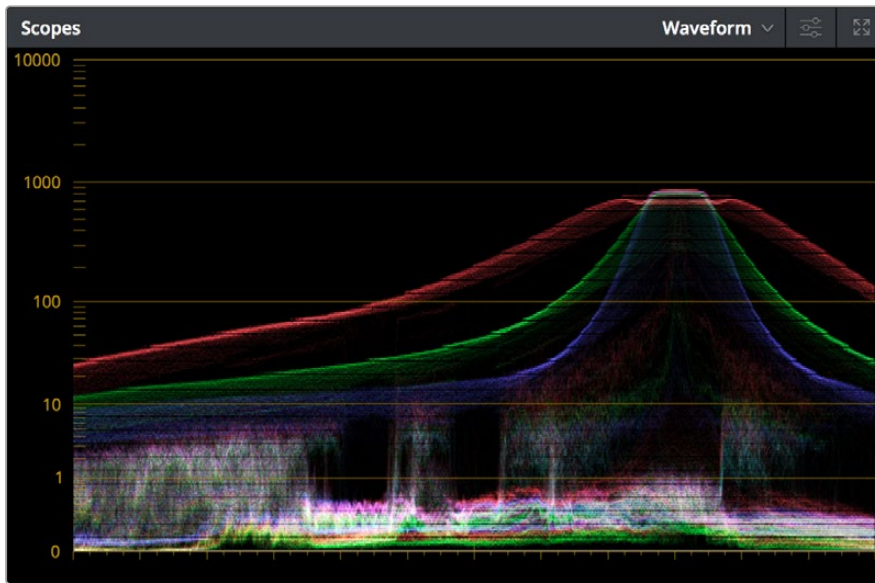
The video scopes with "Enable HDR Scopes for ST.2084" enabled in the Color panel of the User Preferences

TIP: If you're unsatisfied with the amount of detail you're seeing in the 0–519 range (0–100 nits) of the video scope graphs, then you can use the 3D Scopes Lookup Table setting in the Color Management panel of the Project Settings to assign the appropriate "HDR X nits to Gamma 2.4 LUT," with X being the peak nit level of the HDR display you're using. This converts the way the scopes are drawn so that the 0–100 nit range of the signal takes up the entire range of the scopes, from 0 through 1023. This will push the HDR-strength highlights up past the top of the visible area of the scopes, making them invisible, but it will make it easier to see detail in the midtones of the image.

Dolby Vision®

Long a pioneer and champion of HDR for enhancing the consumer video experience, Dolby Laboratories has developed a method for mastering and delivering HDR called Dolby Vision. As with most HDR standards discussed in this chapter, Dolby Vision uses the PQ (perceptual quantizer) electrical-optical transfer function (EOTF, which defines how an electronic video signal is presented on a display), which is defined by SMPTE ST.2084, along with a hierarchy of metadata that's embedded alongside the video stream. All metadata used by Dolby Vision is organized into levels, of which the following are important to the colorist:

– Level 0 metadata, which is global metadata that defines the Mastering Display (what the colorist is using), including aspect ratio, frame rate, color encoding and information on all the target displays that are used for the Level 2 and Level 8 trim metadata below.

– Level 1 metadata, which is the Dolby Vision v2.9 analysis metadata that's generated automatically when you use the Dolby Vision controls to analyze the clips in the timeline. The controls for automatically generating Level 1 metadata are available to all DaVinci Resolve Studio users.

– Level 2 metadata, which is the Dolby Vision v2.9 trimming metadata that's set by the colorist via the version 2.9 trim controls available in the Dolby Vision palette of the Color page. This trimming allows adjustment of how the Dolby Vision image is to be mapped to a target display (such as a 100 nit BT.709 display) that's different from the mastering display (such as a 1000 nit BT.2020 display). The purpose of this metadata is to maintain a program's artistic intent by providing guidance from the colorist over how the program's signal should be fit into the differing luminance ranges of a variety of displays with different peak luminance capabilities. Manually adjustable Level 2 metadata is only available to DaVinci Resolve Studio users via a license obtained from Dolby.

– Level 3 metadata, which is the offset for Dolby Vision v4.0 added to Level 1 metadata generated by the analyze buttons in the Dolby Vision controls. It also stores the mid tone offset data.

– Level 5 metadata, which provides information about the aspect ratio of the deliverable format, and the aspect ratio of the actual image within that format. This metadata is also applicable at the per clip level.

– Level 6 metadata, which stores the MaxCLL and MaxFALL levels required by the HDR10 mastering standard of HDR.

– Level 8 metadata, which is the updated Dolby Vision v4.0 trimming metadata that's set by the colorist via the v4.0 trim controls available in the Dolby Vision palette of the Color page. This evolved set of trimming commands allows more detailed adjustment of how the Dolby Vision image is to be mapped to a target display (such as a 100 nit BT.709 display) that's different from the mastering display (such as a 1000 nit BT.2020 display). Just like Level 2 metadata, the purpose of Level 8 metadata is to maintain a program's artistic intent by providing guidance from the colorist over how the program's signal should be fit into the differing luminance ranges of a variety of displays with different peak luminance capabilities. Manually adjustable Level 8 metadata is only available to DaVinci Resolve Studio users via a license obtained from Dolby. Whether you use Level 2 trim controls or Level 8 trim controls depends on the Dolby Vision version setting you choose in the Color Management panel of the Project Settings.

> **NOTE:** It's currently recommended for all users to choose Dolby Vision v4.0 for analysis and trimming, as it provides superior results. If you're required to deliver Dolby Vision v2.9 metadata when mastering for backwards compatibility, DaVinci Resolve can now export v2.9 metadata from projects using v4.0 workflows.
>
> The metadata levels described above are current of this writing. However Dolby Vision is a rapidly evolving technology, and as Dolby adds new features and metadata levels you should reference Dolby's website to keep track of the latest developments: https://professionalsupport.dolby.com/s/article/Dolby-Vision-Metadata-Levels?language=en_US

For the foreseeable future, the current consumer display landscape encompasses a wide variety of differently performing televisions and projectors that are guaranteed to improve year over year. This means that mastering for today's displays may render content less vibrant than content that emerges five years from now. This can be especially vexing for narrative content that will have a long lifespan on streaming services as new generations of viewers discover them. While one way of solving this would be to re-grade your program many times at a variety of nit levels to create deliverables suitable to a range of display capabilities, that's an enormous amount of work.

Dolby Vision offers a shortcut by using sophisticated algorithms to derive automatically analyzed metadata that intelligently guides how an image graded at one nit level (say 4000 nits) can be adjusted to be perceptually similar to viewers watching a 1000 nit display. Highlights and saturation that are too bright for a particular display will be adjusted to provide as close to the same experience without clipping or flattening image detail.

Furthermore, this automatic analysis can be manually trimmed by a colorist to account for the artistic intentions of the authors of a program, in cases where the automatic analysis doesn't do exactly what's wanted. This combination of auto-analysis and manual trimming is key to how Dolby Vision streamlines

the process of mastering programs to accommodate backward compatibility with SDR displays, as well as the varying peak luminance capabilities of different makes and models of HDR consumer displays, both now and in the future. You're only required to make a 100 nit trim pass to guide the HDR program's conversion all the way down to SDR, and the Dolby Vision system can use that information to guide how intermediate presentations (such as at 700 or 1200 nits) should be adjusted. You can even do multiple trim passes at specific nit levels, such as a 100 nit pass and a 1000 nit pass, to give the Dolby Vision system more information to accurately guide intermediate presentations on different displays. Additionally, you don't have to trim every clip. If the analysis is good, you can skip those clips and only trim clips that need it. The overall system has been created to make it as efficient as possible for colorists to ensure that the widest variety of viewers see the image as it's meant to be seen.

This, in a nutshell, is the advantage of the Dolby Vision system. You can grade a program on a more future-proofed 4000 nit display, and use auto-analysis plus one or two manual trim passes to make the program backward compatible with SDR televisions, and capable of intelligently scaling the HDR highlights to provide the best representation of the mastered image for whatever peak luminance and color volume a particular television is capable of. All of this is guided by decisions made by the colorist during the grade.

At the time of this writing, all seven major Hollywood studios are mastering in Dolby Vision for cinema. Studios that have pledged support to master content in Dolby Vision for home distribution include Universal, Warner Brothers, Sony Pictures, and MGM. Content providers that have agreed to distribute streaming Dolby Vision content include Netflix, Vudu, and Amazon. If you want to watch Dolby Vision content on television at home, consumer television manufacturers LG, TCL, Vizio, HiSense, Sony, Toshiba, and Bang & Olfusen have all shipped models with Dolby Vision support.

## Organizing Your Timeline for Dolby Vision Mastering

One of the first things you need to do before doing a Dolby Vision grade is to organize your timeline accordingly. Because each clip undergoes a visual analysis to facilitate the Dolby Vision workflow, there are specific limitations to how clips can appear in a timeline.

– All clips to be analyzed in a Dolby Vision workflow need to be on video track V1; clips on other tracks will be ignored.

– All clips that overlap one another as part of a composite must be turned into a single item in the timeline in order to be correctly analyzed. This means that each group of clips that create a composite in a timeline, be it multiple overlapping clips combined via keys or alpha channel transparency, multiple overlapping clips combined using composite or blend modes, or text generators appearing above one or more video clips, must be turned into a compound clip for Dolby Vision analysis to work correctly.

Letterboxing for Dolby Vision Mastering

The analysis of clips in a Dolby Vision workflow keeps track of the timeline aspect ratio, as well as the image aspect ratio of each clip in that timeline. Programs that mix different aspect ratios of letterboxing (or blanking) will be accommodated by the Dolby Vision analysis, however Dolby Vision does not support letterbox on two sides (both pillarbox and letterbox), only one at a time.

If you choose Show Blanking Clip Override in the Output Sizing mode of the Sizing palette, you have the option of overriding the overall Timeline Blanking settings with individual Clip Blanking settings. You can do this by choosing the Clip option and then turning off the Use Timeline Blanking checkbox. At this point, you can choose any letterboxing format you want, and the correct letterboxing ratio will be stored as part of the metadata.
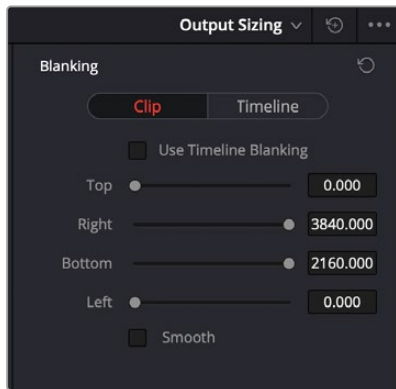
The Show Blanking Clip Override options with the Use Timeline Blanking box unchecked

Setting Up Color Management for Dolby Vision Mastering

For an HDR signal to look correct, you need to output your graded program using the right EOTF for the HDR standard you're mastering. The EOTF maps the different levels DaVinci Resolve outputs to your HDR display using the SMPTE ST.2084 PQ setting required for outputting Dolby Vision. You can set this up in one of three different ways, as:

– Output Color Space and Gamma settings in RCM or ACES

– Color Space and Gamma settings within a series of Resolve FX Color Transform plug-ins that can be used at the end of each grade or at the end of a Timeline grade

– 3D LUTs used for converting signals from one standard to another that can be used at the end of each grade or at the end of a Timeline grade

While Dolby Vision content is not limited to a particular color space, Resolve Color Management provides a P3 D65 setting that matches the capabilities of most mastering displays in use at the time of this writing.

Choosing Mastering Displays for Dolby Vision

To do HDR grading, you need a suitable HDR display. Technically any monitor that supports SMPTE ST.2084 (aka PQ) will work. Happily, a growing number of professional displays from Sony, Flanders Scientific, TV-Logic, Canon, and Eizo are suitable for use in HDR grading suites. EBU Tech 3320 specifies the requirements for a Grade 1 HDR mastering monitor. Dolby recommends the following minimum requirements for HDR monitors:

– A minimum Peak Luminance of 1000 nits

– A 200,000:1 contrast ratio

– Minimum black at 0.005 nits

– Capable of at least 99% of P3 gamut

For more information on Dolby best practices for color grading Dolby Vision, visit: https://www.dolby.com/us/en/technologies/dolby-vision/dolby-vision-for-creative-professionals.html.

Using the Dolby Vision Internal Content Mapping Unit (iCMU)

DaVinci Resolve has a GPU-accelerated "internal" software version of the Dolby Vision CMU (Content Mapping Unit) for previewing Dolby Vision mapping right in DaVinci Resolve. iCMU support can be enabled and set up in the Color Management panel of the Project Settings by turning on the Enable Dolby Vision checkbox. This is a DaVinci Resolve Studio-only feature.
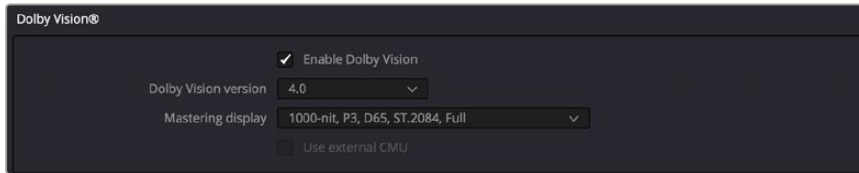
Dolby Vision settings in the Color Management panel of the Project Settings

The Dolby Vision group of settings also exposes menus for choosing the version of Dolby Vision you want to use, what kind of Master Display you're using, and whether or not to use an eCMU (assuming you possess the option). Finally, turning Dolby Vision on also enables the Dolby Vision palette and controls in the Color page, which are described in greater detail later in this chapter.

To master with Dolby Vision in DaVinci Resolve using the built-in iCMU, you still need a more specific hardware setup than the average grading and finishing workstation, consisting of the following equipment:

– Your DaVinci Resolve grading workstation, outputting via either a DeckLink 8K Pro or DeckLink 4K Extreme 12G video interface

– A mastering display capable of outputting HDR nit levels suitable for the deliverable you're required to produce

Simultaneous Master and Target Display Output for Dolby Vision

When mastering HDR and trimming versions for more limited displays, it's extremely useful to be able to evaluate your HDR grade and SDR trim pass side-by-side. It's possible to output both the Master Display output and the Target Display output simultaneously when you're grading with either Dolby Vision or HDR10+ enabled.

Necessary Hardware

To work in this manner, you must have the following equipment:

– Your DaVinci Resolve grading workstation must output via a DeckLink 8K Pro or DeckLink 4K Extreme 12G.

– Your Mastering Display must be capable of HDR nit levels suitable for the deliverable you're required to produce.

– A display that can be set to output calibrated SDR, probably using the BT.709 gamut

Enabling Simultaneous Monitoring

When you set up your display hardware, the HDR Master Display must be connected to output A, and the Target Display must be connected to output B of whichever BMD video output device you're using. Then, you need to turn on the "Use dual outputs on SDI" checkbox in the Master Settings of the Project Settings. At this point, assuming all of your connections are compatible with one another, you should see an HDR image output to your HDR display, and a trimmed image output to your SDR display.

External Content Mapping Unit (eCMU) for Dolby Vision

DaVinci Resolve supports the use of a Dolby External Content Mapping Unit (eCMU) for studios doing more intensive HDR mastering work, as it lets you monitor and adjust an HDR display simultaneously to an SDR display for side-by-side trimming at high resolutions via hardware. The eCMU also has the ability to preview Dolby Vision on a consumer display in real time via HDMI tunneling to view directly what the audience will see at home.

Auto Analysis is Available to All Studio Users

Resolve Studio enables either unlicensed or licensed users to automatically analyze the image and generate Dolby Vision analysis metadata. This metadata is used to deliver Dolby Vision content and to render other HDR and SDR deliverables from the HDR grade that you've made. This enables any DaVinci Resolve Studio user to create Dolby Vision deliverables with Level 1 metadata. However, manual trimming of the analysis metadata requires a license from Dolby.

The commands governing Dolby Vision auto-analysis, which are available to all Resolve Studio users, are available in the Color > Dolby Vision™ submenu, as well as the Dolby Vision palette, and consist of the following:

– **Analyze All Shots:** Automatically analyzes each clip in the Timeline and stores the results individually.

– **Analyze Selected Shot(s):** Only analyzes selected shots in the Timeline.

– **Analyze Selected And Blend:** Analyzes multiple selected shots as if they were a single sequence. The result is the same analysis being saved to each clip. Useful to save time when analyzing multiple clips that have identical content.

– **Analyze Current Frame:** A fast way to analyze clips where a single frame is representative of the entire shot.

Once you analyze a clip, the Min, Max, and Average fields automatically populate with the resulting L1 data; these fields are not editable.
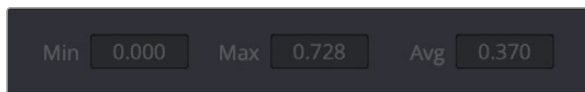
The metadata fields for each clip

Additionally, clips that have been analyzed show an HDR badge in the Thumbnail timeline, to help you keep track of which clips have been analyzed and which have yet to be.
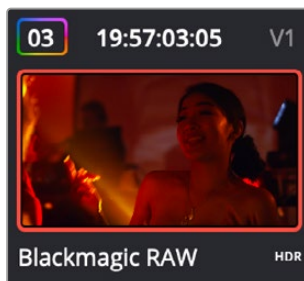
Analyzed clips have HDR
badges to identify them

Licensing DaVinci Resolve to Expose Dolby Vision Trim Controls

To expose the Dolby Vision controls in DaVinci Resolve Studio that let you make manual trims on top of the automatic analysis that any copy of DaVinci Resolve Studio can do, you must email dolbyvisionmastering@dolby.com to receive more information about obtaining a license.

Once you've obtained a license file from Dolby, you can import it by choosing File > Dolby Vision > Load License, and its successful installation will enable the Dolby Vision controls to be enabled in the Color page. You should also receive a display configuration file, which can be loaded via the File > Dolby Vision > Load Configuration command and lets you populate the Dolby Vision drop-down menus with the most up to date options.

Dolby Vision® Trim Controls in DaVinci Resolve

Once you've analyzed a clip, you're in a position to trim the result. The latest version of the Dolby Vision palette exposes four sets of controls. The first are the main controls:

- **Target Display Output:** This drop-down specifies what Dolby refers to as the Target Display, used to display the tone mapped image. This menu lets you choose specific display properties to obtain a preview of what the trimmed image will look like on different displays with different gamuts and peak luminance capabilities.

- **Trim Controls for:** Which Target Display you're currently trimming for. The default setting (100-nit, BT.709, BT.1886, Full) lets you monitor an SDR version of the HDR image, so you can see how the trim metadata tone maps the image on non-HDR televisions.

- **Analyze controls:** The commands governing Dolby Vision auto-analysis are available as buttons, which perform the same functions as their similarly named counterparts in the Color > Dolby Vision submenu. Please note that most trim controls are disabled until you perform an analysis, which is a necessary first step.

  - **All:** Automatically analyzes each clip in the current Timeline and stores the results individually.

  - **Selected:** Only analyzes selected shots in the Timeline.

  - **Blend:** Analyzes multiple selected shots as if they were a single sequence. The result is the same analysis being saved to each clip. You need to use the blend option when analyzing two clips that meet at a through edit separating otherwise contiguous frames. It's also typical to use the Blend option when analyzing a scene of clips that take place at the same location at the same time, to ensure that natural variations in lighting don't add unwanted variations between the analyses of clips that are supposed to already be balanced with one another. Blend also saves time when analyzing multiple clips that have identical content.

  - **Frame:** Useful in situations where part of a clip has an extreme level of color or lightness that's not typical of the rest of the clip, that incorrectly biases the analysis and produces a poor result. Placing the playhead on a frame that's representative of how the clip is supposed to look and using the Frame option bases the analysis on only that frame. This is also a fast way to analyze clips where a single frame is representative of the entire shot.

- **Enable Tone Mapping Preview:** Lets you see the target display output in the Color page Viewer and video output, so you can evaluate how the tone mapped version looks on your HDR display. This control is disabled when you enable "Use dual-outputs on SDI" in the Master Settings of the Project Settings, since the second output SDI now automatically displays the target display output.

- **Mid Tone Offset (CM v4.0 only):** This control is used to match the overall exposure between the tone mapped SDR signal to the HDR master. This offset is applied to the L1 Mid values, allowing the adjustment of mid tones without affecting the blacks and highlights. It can be used to shift overall L1 analysis to ensure the best preservation of artistic intent. This setting is shared among all trim passes you do at all nit levels, so if you've done two trim passes, one at 100 nits and another at 1000 nits, adjusting this setting always adjusts both trim passes at once. Changes made to this control are recorded to the L3 metadata for each clip.

The second are the Min, Mid, and Max metadata fields that are populated by the analyzed values of the current clip. These fields cannot be edited, although analysis metadata can be copied and pasted among clips. These values represent the L1 analysis and are used to calculate how the HDR image should be trimmed to fit into the video standard specified by the Target Display.

The third are the Primary Trims, which are only editable if you've performed an analysis and if you have a license from Dolby. Which controls are exposed depends on the version of Dolby Vision you've selected in the Color Management panel of the Project Settings.
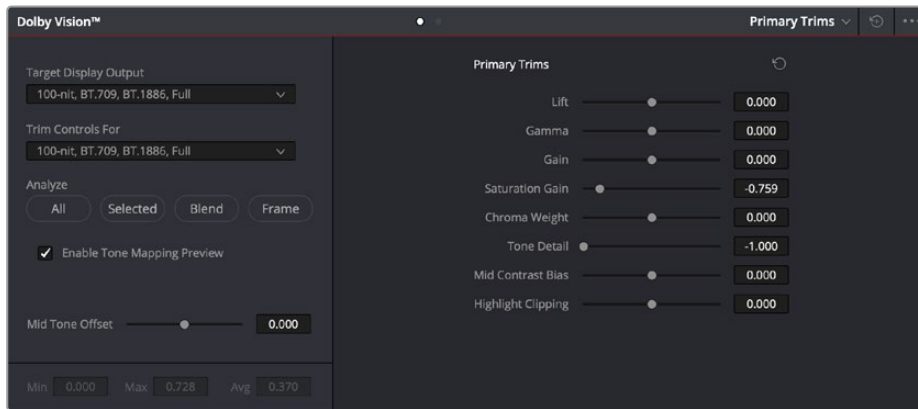
Dolby Vision CM v2.9 Controls

If you choose Dolby Vision 2.9 in the Color Management panel of the Project Settings, it activates the 2.9 version of Dolby's content mapping algorithm and exposes the original Dolby Vision trim controls. It is no longer suggested to use these, since you can do a Dolby Vision 4.0 analysis and trim, and still export converted 2.9 metadata for legacy workflows.

- **Lift/Gamma/Gain:** These controls function similarly to the Y-only Lift, Gamma, and Gain master wheels of the Color Wheels palette, to let you trim the overall contrast levels of the image. The Dolby Best Practices Guide recommends to limit positive Lift to no more than 0.025, and mostly restrict yourself to using Gamma and Gain if necessary to lighten the image.

- **Saturation Gain:** Lets you trim the saturation of the most highly saturated areas within a scene. Lesser saturated values will be less affected.

- **Chroma Weight:** Darkens saturated parts of the image to preserve colorfulness in areas of the image that are clipped by smaller gamuts that don't have enough headroom for saturation in the highlights.

- **Tone Detail:** Lets you preserve contrast detail in the highlights that might otherwise be lost when the highlights are mapped to lower dynamic ranges, usually due to clipping. Increasing Tone Detail Weight increases the amount of highlight detail that's preserved. When used, can have the effect of sharpening highlight detail.

Dolby Vision CM v4.0 Controls

If you choose Dolby Vision 4.0 in the Color Management panel of the Project Settings, it activates the 4.0 version of Dolby's content mapping algorithm, and exposes the following controls.

- **Lift/Gamma/Gain:** These controls function similarly to the Y-only Lift, Gamma, and Gain master wheels of the Color Wheels palette, to let you trim the overall contrast levels of the image. The Dolby Best Practices Guide recommends to limit positive Lift to no more than 0.025, and mostly restrict yourself to using Gamma and Gain if necessary to lighten the image.

- **Saturation Gain:** Lets you trim the saturation of the most highly saturated areas within a scene. Lesser saturated values will be less affected.

- **Chroma Weight:** Darkens saturated parts of the image to preserve colorfulness in areas of the image that are clipped by smaller gamuts that don't have enough headroom for saturation in the highlights.

- **Tone Detail:** Lets you preserve contrast detail in the highlights that might otherwise be lost when the highlights are mapped to lower dynamic ranges, usually due to clipping. Increasing Tone Detail Weight increases the amount of highlight detail that's preserved. When used, can have the effect of sharpening highlight detail.

- **Mid Contrast Bias:** Affects image contrast in the region around the computed average picture level. This lets you increase or decrease contrast in the midtones of the image.

- **Highlight Clipping:** Reduces details and affects the roll-off the brighter part of the image by clipping the highlights as required. This is useful when the tone mapped image is displaying unwanted details.

The Primary Trims controls that are found in the Dolby Vision palette are only enabled once you've authorized your system with a special license, available from Dolby.

The fourth set of controls is available via a second palette mode, the Secondary Trims. These are only editable if you've performed an analysis and if you have a license from Dolby.

– **Secondary Saturations:** A set of slider-based vector-style controls (similar to the Hue vs. Sat curve) lets you adjust the Saturation of Red, Yellow, Green, Cyan, Blue, and Magenta to help you selectively fine tune the results.

– **Secondary Hues:** Another set of slider-based vector-style controls (similar to the Hue vs. Hue controls) lets you adjust the Hue of Red, Yellow, Green, Cyan, Blue, and Magenta to help you fine tune the results.
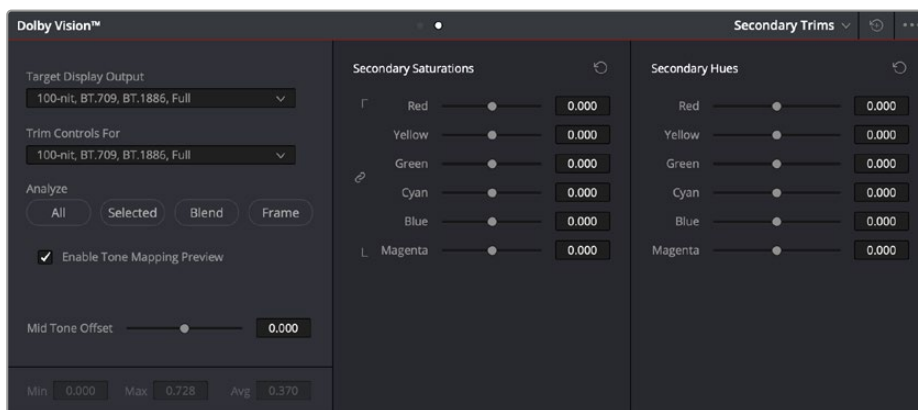
The Secondary Trims controls, as seen on a licensed Dolby Vision system

Together, all of this trimming metadata lets the colorist guide how the iCMU or eCMU transforms the image from the Mastering Display specified in the Project Settings to the Target Display specified in the Dolby Vision palette. This metadata is carried throughout the ecosystem so that your artistic intent is preserved on a variety of platforms and displays.

Previewing and Trimming At Different Levels

Additionally, the iCMU or eCMU can be used to preview 100 nit, 600 nit, 1000 nit, and 2000 nit versions of your program, with different gamuts, if you want to see how your master will scale to those combinations of peak luminance levels and standards. This, of course, requires your DaVinci Resolve workstation or eCMU to be connected to a display that's capable of being set to those peak luminance output levels.

Though it's not at all typical, you also have the option to set the "Trim Controls For" drop-down menu to different combinations of peak luminance, gamut, and color temperature, in order to visually trim the grades of your program at up to four different peak luminance levels, including 100 nit, 600 nit,

1000 nit, and 2000 nit reference points. Choosing a setting from the "Trim Controls For" drop-down menu sets you up to adjust trim metadata for that setting.

Choosing different settings from the "Trim Controls For" drop-down menu lets you can optimize a program's visuals for the peak luminance and color volume performance of many different televisions with a much finer degree of control. If you take this extra step of doing a complete trim pass of your program at multiple nit levels (using the Dolby Vision controls), the Level 2, or Level 8 metadata you generate in each trim pass ensures that the artistic intent is preserved as closely as possible across a wide variety of displays, in an attempt to provide the viewer with the best possible representation of the director's intent, no matter where it appears.

For example, if a program were graded relative to a 4000 nit display, along with a single 100 nit BT.709 trim pass, then a Dolby Vision-compatible television with 750 nit peak output will reference the 100 nit trim pass metadata in order to come up with the best way of "splitting the difference" to output the signal correctly. On the other hand, were the colorist to do three trim passes, the first at 100 nits, -cond at 600 nits, and a third at 1000 nits, then a 750 nit-capable Dolby Vision television would be able to use the 600 and 1000 nit trim metadata to output more accurately scaled color volume and HDR-strength highlights, relative to the colorist's adjustments, that take better advantage of the 750 nit output of that television.

Managing Dolby Vision Metadata

As you go through the process of analyzing and trimming the HDR grades displayed on your Master Display to look appropriate on your Target Display, you'll sometimes find it useful to copy and paste metadata from one clip to another. You can copy and paste Analysis Metadata separately from Trim Metadata and Mid Tone Offset, and you can choose to copy and paste metadata for all Target Displays when you're trimming multiple passes, or you can copy and paste metadata for only the current Target Display if you're trimming multiple passes and you only want to overwrite metadata for a single pass.

Methods of Copying and Pasting Dolby Vision Metadata:

– **To copy and paste Analysis Metadata:** Select a clip you want to copy from, choose Copy Analysis Metadata from the Dolby Vision palette option menu, then select a clip you want to paste to, and choose Paste Analysis Metadata from the Dolby Vision palette option menu.

– **To copy and paste Trim Metadata for all Target Displays:** Do one of the following:

  – Select a clip you want to copy from, choose Edit > Dolby Vision > Copy Trim Metadata, then select a clip you want to paste to, and choose Edit > Dolby Vision > Paste Trim Metadata.

  – Select a clip you want to copy from, choose Copy Trim Metadata from the Dolby Vision palette option menu, then select a clip you want to paste to, and choose Paste Trim Metadata from the Dolby Vision palette option menu.

  – Select a clip you want to paste to, then press and hold the Option-Shift keys, and middle-click the clip you want to copy from.

– **To copy and paste Trim Metadata for the current Target Display:** Do one of the following:

  – Select a clip you want to copy from, choose Copy Trim Metadata from the Dolby Vision palette option menu, then select a clip you want to paste to, and choose Paste Trim Metadata to Current from the Dolby Vision palette option menu.

  – Select a clip you want to paste to, then press and hold the Option key, and middle-click the clip you want to copy from.

– **To copy and paste Mid Tone Offset:** Select a clip you want to copy from, choose Copy Mid Tone Offset from the Dolby Vision palette option menu, then select a clip you want to paste to, and choose Paste Mid Tone Offset from the Dolby Vision palette option menu.

Setting Up Resolve Color Management for Grading HDR

Once the hardware is set up, setting up Resolve itself to output HDR for Dolby Vision mastering is easy using Resolve Color Management (RCM). This procedure is pretty much the same no matter which HDR mastering technology you're using; only specific Output Color Space settings will differ.

1   Set Color Science to DaVinci YRGB Color Managed in the Color Management panel of the Project Settings.

2   Then, open the Color Management panel, and set the Output Color Space drop-down to the ST.2084 setting that corresponds to the peak luminance, in nits, of the grading display you're using. For example, if you're grading with a Sony BVM X300, choose ST.2084 1000 nit, but if you're grading with a Flanders Scientific XM310K, choose ST.2084 3000 nit, in order to use the full capabilities of each display. Be aware that whichever HDR setting you choose will impose a hard clip at the maximum nit value supported by that setting. This is to prevent accidentally overdriving HDR displays for which there are negative consequences (not all HDR displays have this limitation).

    – ST.2084 300 nit

    – ST.2084 500 nit

    – ST.2084 800 nit

    – ST.2084 1000 nit

    – ST.2084 2000 nit

    – ST.2084 3000 nit

    – ST.2084 4000 nit

    This setting is only the output EOTF (a sort of gamma transform, if you will, using the terminology that DaVinci Resolve's UI has used up until now).

3   Next, choose a setting in the Timeline Color Space that corresponds to the gamut you want to use for grading, and that will be output. For example, if you want to grade the Timeline as a log-encoded signal and "normalize" it yourself, you can choose ARRI Log C or Cineon Film Log (this workflow is highly recommended for the best results). If you would rather save time by having DaVinci Resolve normalize the Timeline to P3-D65 and grade that way, you can choose that setting as well. In terms of defining the output gamut, the rule is that if "Use Separate Color Space and Gamma" is turned off, the Timeline Color Space setting will define your output gamut. If "Use Separate Color Space and Gamma" is turned on, then you can specify whatever gamut you want in the left Output Color Space drop-down menu, and choose the EOTF from the right drop-down menu (as described in step 2).

4   Be aware that, when it's being properly output, HDR ST.2084 signals appear very "log-like," in order to pack a wide dynamic range into the bandwidth of a standard video signal. It's the HDR display itself that "normalizes" this log-encoded image to look as it should. For this reason, the image you see in your Color page Viewer is going to appear flat and log-like, even though the image being displayed on your HDR reference display looks vivid and correct. If you're using a typical SDR computer display, and you want to make the image in the Color Page Viewer look "normalized" at the expense of clipping the HDR highlights (in the Viewer, not in the grade), you can use the 3D Color Viewer Lookup Table setting in the Color Management panel of the Project Settings to assign the appropriate ST.2084 setting with a peak nit level that corresponds to the HDR broadcast display you're outputting to.

5   Additionally, the "Timeline resolution" and "Pixel aspect ratio" (in the project settings) that your project is set to use is saved to the Dolby Vision metadata, so make sure your project is set to the final Timeline resolution and PAR before you begin grading.

DaVinci Resolve Grading Workflow For Dolby Vision

Once the hardware and software is all set up, you're ready to begin grading HDR. The workflow is fairly straightforward.

1 First, grade the HDR image on your HDR Monitor to look as you want it to. Dolby recommends starting by setting the look of the HDR image, to set the overall intention for the grade.

2 When using various grading controls in the Color page to grade HDR images, you may find it useful to enable the HDR Mode of the node you're working on by right-clicking that node in the Node Editor and choosing HDR Mode from the contextual menu. This setting adapts that node's controls to work within an expanded HDR range. Practically speaking, this makes controls that operate by letting you make adjustments at different tonal ranges, such as Custom Curves, Soft Clip, and so on, work more easily with wide-latitude signals.

3 When you're happy with the HDR grade, click the Analysis button in the Dolby Vision palette. This analyzes every pixel of every frame of the current shot, and performs and stores a statistical analysis that is sent to the iCMU or eCMU to guide its automatic conversion of the HDR signal to an SDR signal.

4 Choose "Target Display Output" and "Trim Controls For" settings that you want to trim to. By default, these are set to "100-nit, BT.709, BT.1886, Full," which is a typical SDR deliverable. However, other options are available if you want to do multiple trim passes to obtain a more accurate result. Whichever setting you choose from, "Trim Controls For" dictates which trim pass you're doing. You can do multiple trim passes by choosing another option from this menu.

5 If you're not happy with the automatic conversion, use the trim controls in the Dolby Vision palette to manually trim the result to the best possible BT.709 approximation of the HDR grade you created in step 1.

6 If you obtain a good result, then move on to the next shot and continue work. If you cannot obtain a good result, and worry that you may have gone too far with your HDR grade to derive an acceptable SDR tone mapping, you can always trim the HDR grade a bit, and then retrim the SDR grade to try and achieve a better tone mapping. Dolby recommends that if you make significant changes to the HDR master, particularly if you modify the blacks or the peak highlights, you should reanalyze the scene. However, if you only make small changes, then reanalyzing is not strictly required.

As you can see, the general idea promoted by Dolby is that a colorist will focus on grading the HDR picture relative to the 1000, 2000, 4000, or higher nit display that is being used, and will then rely on the colorist to use the Dolby Vision controls to "trim" this into a 100 nit SDR version. This metadata is saved as part of the mastered media, and it's used to more intelligently tone map the entire image to fit within any given display's parameters. The colorist's artistic intent is used to guide all dynamic adjustments to the content.

Delivering Dolby Vision

Once you're finished grading the HDR and trimming the SDR tone mapping, you need to output your program correctly in the Deliver page.

Rendering a Dolby Vision Master

To deliver a Dolby Vision master after you've finished grading, you want make sure that the Output Color Space of the Color Management panel of the Project Settings is set to the appropriate HDR ST.2084 setting based on the peak output you want to deliver (any values above will be clipped). Then, you want to set your render up to use one of the following Format/Codec combinations:

– TIFF, RGB 16-bit

– EXR, RBG-half (no compression)

When you render for tapeless delivery, all Dolby Vision metadata is recorded into a Dolby Vision XML and delivered along side either the Tiffs or EXR renders. To export a Dolby Vision XML file, select your timeline in the media pool and choose File > Export >Timeline. Navigate to where you want to save the file and select Dolby Vision v2.9 (or v4.0) MXF files from the file type selector and click save. These two sets of files are then delivered to a facility that's capable of creating the Dolby Vision deliverable file.

Rendering a Dolby Vision IMF

You can deliver directly to an IMF that includes an MXF with embedded Dolby Vision metadata in the package. To export a Dolby Vision IMF use the following Video settings in the Deliver page:

– **Format:** IMF

– **Codec:** Kakadu JPEG 2000

– **Type:** Dolby Vision (HD, 2K, UHD, or 4K) depending on your deliverable resolution.

Configure the rest of the IMF settings as necessary for your project.

The Video Settings to use for creating a Dolby Vision IMF in the Deliver page

Rendering an Ordinary SDR Media File or Other Specific HDR Trim Pass

If you want to export the SDR trim pass, then you can choose Dolby Vision from the Tone Mapping drop-down menu in the Advanced Settings of the Render Settings list on the Deliver page, and choose the 100-nit, BT.709, BT.1886, Full setting below. With this enabled, you can output the SDR version of your program to any format you like.

You can also export the trims for other HDR nit levels for specific displays, at 600, 1000 or 2000 nits and in the either the BT.2020 or P3 gamuts.
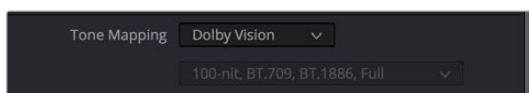
The Tone Mapping setting in the Advanced Settings of the Render Settings list

SMPTE ST.2084 and HDR10

Many display manufacturers who have no interest in licensing Dolby Vision for inclusion in their displays are instead going with the simpler method of engineering their displays to be compatible with SMPTE ST.2084. It requires only a single stream for distribution, there are no licensing fees, no special hardware is required to master for it (other than an HDR mastering display), and there's no special metadata to write or deal with.

Interestingly, SMPTE ST.2084 ratifies the "PQ" EOTF that was originally developed by Dolby, and which is used by Dolby Vision, into a general standard that accommodates encoding HDR at peak luminance values up to 10,000 cd/m^2. This standard requires at minimum a 10-bit signal for distribution, and the EOTF is mathematically described such that the video signal utilizes the available code values of a 10-bit signal as efficiently as possible, while allowing for such a wide range of luminance in the image.

SMPTE ST.2084 is also part of the "Ultra HD Premium" industry specification, which stipulates that televisions bearing the Ultra HD Premium logo have the following capabilities:

- A minimum UHD resolution of 3840 x 2160

- A minimum gamut of 90% of P3

- A minimum dynamic range of either 0.05 nits black to 1000 nits peak luminance (to accommodate LCD displays), or 0.0005 nits black to 540 nits peak luminance (to accommodate OLED displays)

- Compatibility with SMPTE ST.2084

Finally, ST.2084 has been included in the HDR 10 standard adopted by the Blu-ray Disc Association (BDA) that covers Ultra HD Blu-ray. HDR 10 stipulates that Ultra HD Blu-ray discs have the following characteristics:

- UHD resolution of 3840 x 2160

- Up to the Rec. 2020 gamut

- SMPTE ST.2084

- Mastered with a peak luminance of 1000 nits

The downside is that, by itself, an HDR10 mastered program is not backward compatible with BT.709 displays using BT.1886 (although the emerging HDR10+ standard described later addresses this). Furthermore, no provision is made to scale the above-100 nit portion of the image to accommodate different displays with differing peak luminance levels. For example, if you grade and master an image to have peak luminance of 4000 nits, and you play that signal on an HDR10-compatible television (using ST.2084) that's only capable of 800 nits, then everything above 800 nits will be clipped, while everything below 800 nits will look exactly as it should relative to your grade.

This is because ST.2084 is referenced to absolute luminance. If you grade an HDR image referencing a 1000 nit peak luminance display, as is recommended by HDR10, then any display using ST.2084 will respect and reproduce all levels from the HDR signal that it's capable of reproducing as you graded them, up to the maximum peak luminance level it can reproduce. For example, on an HDR10-compatible television capable of outputting 500 nits, all mastered levels from 501–1000 will be clipped, as seen in the screenshot below.
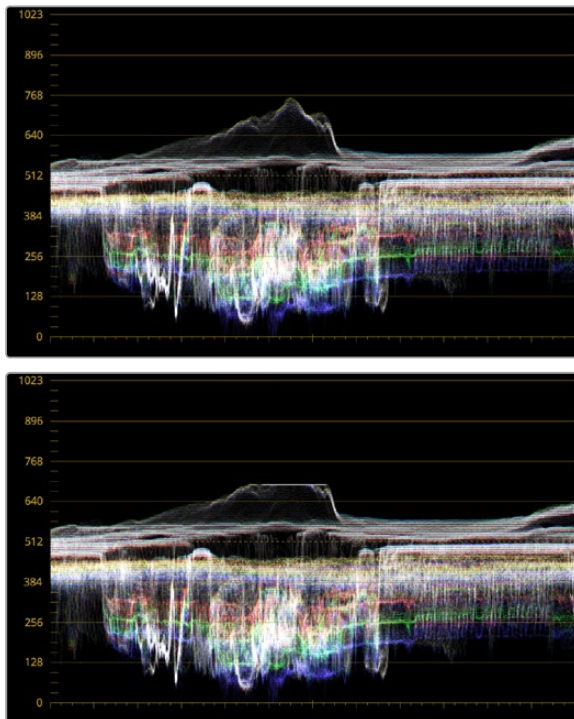
Comparing the original 1000 nit waveform representing the grading monitor to
a 500 nit clipped waveform representing the consumer television

How much of a problem this is really depends on how you choose to grade your HDR-strength highlights. If you're only raising the most extreme peak highlights to maximum HDR-strength levels, then it's entirely possible that the audience might not notice that the display is only outputting 800 nits worth of signal and clipping any image details from 801–1000 nits because there weren't that many details above 800 anyway. Or, if you're grading large explosive fireballs up above 800 nits in their entirety because it looks cool, then maybe the audience will notice. The bottom line is, when you're grading for displays that are only capable of ST.2084, you need to think about these sorts of things.

Monitoring and Grading to ST.2084 in DaVinci Resolve

Monitoring an ST.2084 image is as simple as obtaining a ST.2084-compatible HDR display and connecting it to the output of your DeckLink 8K, DeckLink 4K Extreme 12G, or UltraStudio 4K Extreme.

Setting up Resolve Color Management to grade for ST.2084 is identical to setting up to grade for Dolby Vision. You'll also monitor the video scopes identically, and output a master identically, given that both standards rely upon the same PQ curve.

> **TIP:** If you're monitoring with the built-in video scopes in DaVInci Resolve, you can turn on the "Enable HDR Scopes for ST.2084" checkbox in the Color panel of the User Preferences, which will replace the 10-bit scale of the video scopes with a scale based on nit values (cd/m^2) instead.

Connecting to HDR-Capable Displays using HDMI 2.0a

If you have a DeckLink 4K Extreme 12G or an UltraStudio 4K Extreme video interface, then DaVinci Resolve 12.5 and above can output the metadata necessary to correctly display HDR video signals to display devices using HDMI 2.0a when you turn on the "Enable HDR metadata over HDMI" checkbox in the Master Settings panel of the Project Settings.
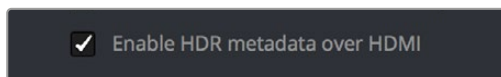
The Enable HDR metadata over HDMI option in the Master Settings panel of the Project Settings lets you output HDR via HDMI 2.0a

When you do so, a setting in the Color Management panel of the Project Settings, "HDR mastering is for X" lets you specify the output, in nits, to be inserted as metadata into the HDMI stream being output, so that the display you're connecting to correctly interprets it. The output you specify should match what your display is expecting.

The "HDR mastering is for" setting lets you insert metadata for HDR output via HDMI 2.0a

HDR10+™

DaVinci Resolve supports the new HDR10+ HDR format by Samsung. Please note that this support is a work in progress as this is a new standard. When enabled, an HDR10+ palette shows the results of the trimming analysis that make an automated downconversion of HDR to SDR, creating metadata to control how HDR-strength highlights look on a variety of supported televisions and displays. This is enabled and set up in the Color Management panel of the Project Settings with the Enable HDR10+ checkbox. Turning HDR10+ on enables the HDR 10+ palette in the Color page.
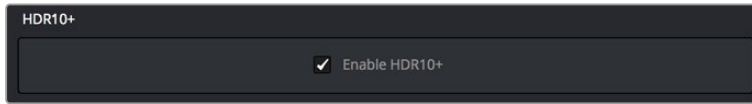
HDR 10+ settings in the Color Management panel of the Project Settings

Monitoring and Grading to ST.2084 for HDR10+

When you're grading a program for HDR10+ output, you'll need to monitor an ST.2084 image, which is as simple as obtaining a ST.2084-compatible HDR display and connecting it to the output of your DeckLink 8K, DeckLink 4K Extreme 12G, or UltraStudio 4K Extreme.

Setting up Resolve Color Management to grade for ST.2084 is identical to setting up to grade for Dolby Vision or regular HDR10. You'll also monitor the video scopes identically, and output a master identically, given that each of these standards rely upon the same PQ curve.

> **TIP:** If you're monitoring with the built-in video scopes in DaVinci Resolve, you can turn on the "Enable HDR Scopes for ST.2084" checkbox in the Color panel of the User Preferences, which will replace the 10-bit scale of the video scopes with a scale based on nit values (cd/m^2) instead.

HDR10+ Grading Workflow

The idea behind the HDR10+ workflow is that you'll grade the HDR version of each clip in your program first, and then use the automatic analysis to create a downconverted tone mapped version of each shot that's controlled by metadata. Once the HDR10+ trim pass is complete, you'll deliver the rendered HDR output along with a set of HDR10+ JSON metadata files to a facility for final mastering.

Simultaneous Master and Target Display Output for HDR10+

When mastering HDR and trimming versions for more limited displays, it's extremely useful to be able to evaluate your HDR grade and tone mapped trim pass side by side. Starting in DaVinci Resolve 15, it's possible to output both the Master Display output and the Target Display output simultaneously when you're grading with either Dolby Vision or HDR10+ enabled.

Necessary Hardware

To work in this manner, you must have the following equipment:

— Your DaVinci Resolve grading workstation must output via a DeckLink 8K, DeckLink 4K Extreme 12G, UltraStudio 4K Extreme video interface, or better.

— Your Mastering Display must be capable of HDR nit levels suitable for the deliverable you're required to produce.

— An HDR target display that can be set to the appropriate tone mapped output.

Enabling Simultaneous Monitoring

When you set up your display hardware, the HDR Master Display must be connected to output A, and the Target Display must be connected to output B of whichever BMD video output device you're using. Then, you need to turn on the "Use dual outputs on SDI" checkbox in the Master Settings of the Project Settings. At this point, assuming all of your connections are compatible with one another, you should see an HDR image output to your HDR display and a trimmed image output to your SDR display.

HDR10+ Auto Analysis Commands

After you've graded an HDR version of each clip in your program, a set of HDR10+ specific commands let you auto-analyze each clip to create custom HDR to SDR downconversion metadata that give you a starting point for the SDR trim pass you need to do. These commands are available in the Color > HDR10+ submenu:

– **Analyze All Shots:** Automatically analyzes each clip in the Timeline and stores the results individually.

– **Analyze Selected Shot(s):** Only analyzes selected shots in the Timeline.

– **Analyze Selected and Blend:** Analyzed multiple selected shots and averages the result, which is saved to each clip. Useful to save time when analyzing multiple clips that have identical content.

– **Analyze Current Frame:** A fast way to analyze clips where a single frame is representative of the entire shot.

The Enable Tone Mapping Preview checkbox lets you turn the tone mapping trim being applied off and on, so you can evaluate how the downconverted SDR version looks on your HDR display. This control is disabled when you enable "Use dual-outputs on SDI" in the Master Settings of the Project Settings, since the second output SDI now automatically displays the target display output.

Delivering HDR10+

Once you're finished grading the HDR and trimming the SDR downconversion, you need to output your program correctly in the Deliver page.

Rendering an HDR10+ Master

To deliver an HDR10+ master after you've finished grading, you want make sure that the Output Color Space of the Color Management panel of the Project Settings is set to the appropriate HDR ST.2084 setting based on the peak output you want to deliver (any values above will be clipped). Then, you want to set your render up to use the highest quality Format/Codec combination that can be delivered to whomever is doing the final mastering.

The HDR10+ analysis and manual trim metadata you generated while trimming is saved per clip, in a series of JSON sidecar files, which should then be exported by right-clicking that timeline in the Media Pool, and choosing Timelines > Export > HDR10+JSON.

These two sets of files are then delivered to a facility that's capable of creating an HDR10+ Mezzanine File (this cannot be done in DaVinci Resolve).

> **NOTE:** The HDR10+ mastering workflow is still a work in progress. More information will be provided as it becomes available.

Hybrid Log-Gamma (HLG)

The BBC and NHK jointly developed another method of encoding HDR video, referred to as Hybrid Log-Gamma (HLG). The goal of HLG was to develop a method of mastering HDR video that would support a range of displays of different peak luminance capabilities without additional metadata, that could be broadcast via a single stream of data, that would fit into a 10-bit signal, and that in the words of the ITU-R Draft Recommendation BT.HDR, "offers a degree of compatibility with legacy displays by more closely matching the previous established television transfer curves."

The basic idea is that the HLG EOTF functions very similarly to BT.1886 from 0 to 0.6 of the signal (with a typical 0–1 range), while 0.6 to 1.0 smoothly segues into logarithmic encoding for the highlights.

This means that, if you just send an HDR Hybrid Log-Gamma signal to an SDR display, you'd be able to see much of the image identically to the way it would appear on an HDR display, and the highlights would be compressed to present an acceptable amount of detail for SDR broadcast.

On a Hybrid Log-Gamma compatible HDR display, however, the log-like highlights of the image (not the BT.1886-like bottom portion of the signal, just the highlights) would be stretched back out, relative to whatever peak luminance level a given HDR television is capable of outputting, to return the image to its true HDR glory. This is different from the HDR10 method of distribution described previously, in which the graded signal is referenced to absolute luminance levels dictated by ST.2084, and levels that cannot be represented by a given display will be clipped.

And while this facility to support multiple HDR displays with differing peak luminance levels is somewhat analogous to Dolby Vision's ability to tailor HDR output to the unique peak luminance levels of any given Dolby Vision-compatible television, HLG requires no additional metadata to guide how the highlights are scaled, which depending on your point of view is either a benefit (less work), or a deficiency (no artistic guidance to make sure the highlights are being scaled in the best possible way).

As is true for most things, you don't get something for nothing. The BBC White Paper WHP 309 states that, for a 2000 cd/m^2 HDR display with a black level of 0.01 cd/m^2, up to 17.6 stops of dynamic range without visible quantization artifacts ("banding") is possible. BBC White Paper WHP 286 states that the proposed HLG EOTF should support displays up to about 5000 nits. So, partially, the backward compatibility that HLG makes possible is due in part to discarding long-term support for 10,000 nit displays. However, it's an open question whether or not over 5000 nits is even necessary for consumer enjoyment.

Sony, LG, Panasonic, JVC, Phillips, Hisense, Hitachi, and Toshiba have all either announced or are shipping consumer HDR televisions capable of displaying HLG encoded video, and of course DaVinci Resolve supports this standard through Resolve Color Management.

Grading Hybrid Log-Gamma in DaVinci Resolve

Monitoring an ST.2084 image is as simple as getting a Hybrid Log-Gamma-compatible HDR display, and connecting the output of your video interface to the input of the display.

Setting up Resolve Color Management to grade for HLG is identical to setting up to grade for Dolby Vision, except that there are four HLG settings to choose from for the Output Color Space:

– Rec.709 HLG ARIB STD-B67

– Rec.2020 HLG ARIB STD-B67

– Rec.2100 HLG

– Rec.2100 HLG (Scene)

Optionally, if you choose to enable "Use Separate Color Space and Gamma," you can choose either Rec. 2020 or Rec. 709 as your gamut, and Rec. 2100 HLG as your EOTF.

The levels you'll be monitoring in your scopes will be different from the table of data to nit values listed previously for grading to the PQ EOTF.

Ouputting Hybrid Log-Gamma

Once you've created an HLG grade for your program, you can output it to any high-quality 10-bit capable media format.

Chapter 11

Image Sizing and Resolution Independence

DaVinci Resolve is a resolution-independent application. This means that, whatever the resolution of your source media, it can be output at whatever other resolution you like, and just about every size-dependent effect in your project, text, windows of grades, edit and input clip scaling, and other effects will scale appropriately to match the new output resolution.

This also means that you can freely mix clips of any resolution, fitting 4K, HD, and SD clips into the same timeline, with each scaling to fit the project resolution as necessary.

Your project's resolution can be changed at any time, allowing you to work at one resolution, and then output at another resolution. This also makes it easy to output multiple versions of a program at different resolutions, for example, outputting 4K, HD, and SD sized versions of the same timeline.

Additionally, most controls that let you transform clips, either to push into a clip for creative intent, or to pan and scan media of one format to fit better into a different output format, are smart enough to always refer back to the source resolution when combining resizing operations to shrink, then enlarge an image for various reasons as you work in the Cut, Edit, Fusion, and Color pages.

This chapter covers the relationship among the different sizing and transform controls found in DaVinci Resolve, showing how they work together to intelligently manage the sizing of clips and effects as you work.

Contents

About Resolution Independence

If you only read one paragraph of this chapter, read this: Resolution Independence in DaVinci Resolve means you can add clips to a timeline in any combination of resolutions to fit the project resolution you've chosen to work at, and you can later output that timeline to as many other resolutions as necessary in order to create multiple deliverables. When you do so, all effects and transforms will automatically readjust themselves to match the sizing of each new timeline resolution, and most transforms are calculated and processed using the full native resolution of the source media you've linked to that clip.

In short, what this means is that you can create multiple deliverables in multiple resolutions by simply changing the timeline resolution or by using a lower resolution setting in the Deliver page compared to the timeline resolution when you create a new job to render out, and every effect will be the right size automatically.

Timeline Resolution

The timeline resolution is one of the most fundamental settings of your project, defining its frame size. It's found in the Master Settings panel of the Project Settings, where you can choose a predefined resolution from the "Timeline resolution" drop-down menu, or you can type a custom resolution into the X and Y fields below.
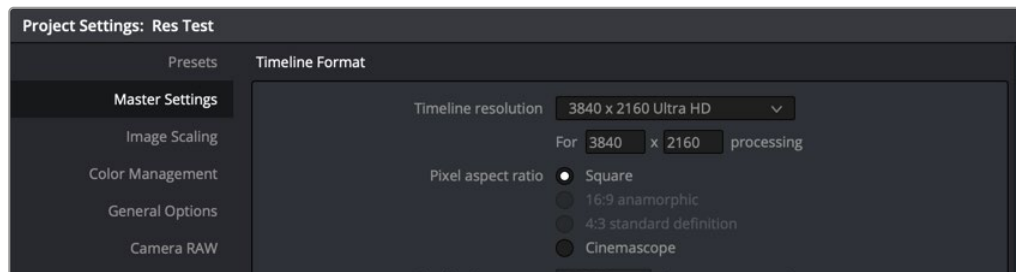
The project-wide Timeline Resolution parameters found in the Master Settings panel of the Project Settings window

Mixing Clip Resolutions

Media used in a project does not have to match the timeline resolution. In fact, it's extremely common to mix multiple resolutions within the same timeline. Clips that don't match the current resolution will be automatically resized according to the currently selected Image Scaling setting (described below).

Changing the Timeline Resolution

As mentioned earlier, you can change the timeline resolution whenever you like. When you do so, each Edit page transform, Fusion clip effects output, Color page Power Window, Input and Output Sizing adjustment, tracking path, spatial keyframing value, as well as any other other resolution-dependent Resolve FX effect or transform operation in DaVinci Resolve is automatically and accurately scaled to fit the new resolution.

You Can Use Separate Timelines to Output Different Resolutions

Beginning in DaVinci Resolve 16, you have the option of creating separate timelines with individual Format (including Input Scaling), Monitoring, and Output Sizing settings for situations where you need to set up multiple timelines to create multiple deliverables with different resolutions, pixel aspect ratios, frame rates, monitoring options, or output scaling options than the overall project, including "Mismatched Resolution Files" settings. For more information, see Chapter 34, "Creating and Working with Timelines."

You Don't Need Separate Timelines to Output Different Resolutions

Because of the way DaVinci Resolve works, it's not necessary to create separate timelines when all you need is to output the same timeline at multiple resolutions. Instead, you can focus on mastering a single timeline, which you can output to as many other resolutions as you need.

For example, with only a single timeline in a project set to 4096x2160 (4K DCI) resolution, you can easily output UHD, HD, center-cut SD, and center-cut Instagram sized deliverables in any format you need by simply changing the Resolution drop-down setting in the Deliver page Render Settings before you create a job to render. DaVinci Resolve takes care of the rest.
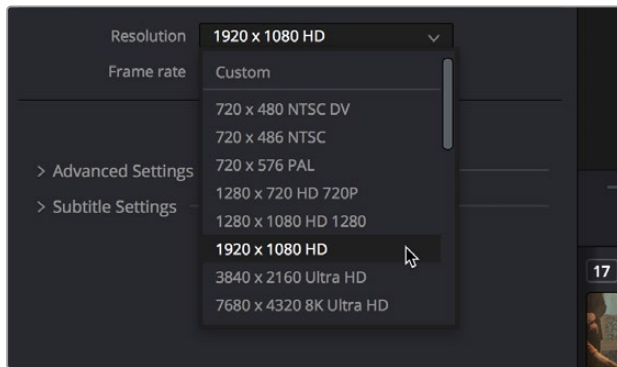
The Deliver page drop-down menu in the Render Settings panel lets you choose what resolution you want to output the current timeline using

Using High Resolution Media in Lower Resolution Projects

Every set of transform and sizing parameters and settings that resize clips is combined intelligently, so that the full resolution of a clip's source media is always used as the source for any transform. For example, if you're using 8K media within a 1920x1080 project, and you need to enlarge a clip using the Input Sizing palette's Zoom parameter to 200%, the image is scaled relative to the native 8K resolution of the source, and the result is fit into the current timeline resolution. This automatically guarantees the highest quality for any image transform you make so long as you don't zoom in past the native resolution of any given clip.

This also applies to situations where, for example, you shrink a clip in the Edit page using the Edit Sizing controls, only to re-enlarge the same clip in the Color page, using the Input Sizing controls. In this situation, DaVinci Resolve is smart enough to do the math combining the project resolution, the Edit Sizing, and the Input Sizing controls so that a single transform is applied to the native source resolution of that clip, giving you the best quality result.

> **NOTE:** This changes when you apply Fusion effects to any clip, as described later in this chapter.

Clip Source Resolution

Clip resolution in DaVinci Resolve is handled by the combination of Pixel Aspect Ratio and Resolution.

Pixel Aspect Ratio (PAR)

The Timeline Format settings, found in the Master Settings of the Project Settings, let you specify a Pixel Aspect Ratio for the project, in addition to the frame size. This setting defaults to Square Pixel, which is appropriate for high definition projects and most digital media. However, there are also options for 16:9 anamorphic, 4:3 standard definition, or Cinemascope. Which options are available depends on what timeline resolution you've selected.

In addition, each clip has individually adjustable PAR settings in the clip attributes, for situations where you're mixing multiple types of media within a single project. For example, if you're mixing SD clips with non-square pixels and HD clips with square pixels, you can sort out all of the SD clips in the Media Pool and assign them the appropriate NTSC or PAL non-square pixel ratio PAR setting. For more information, see Chapter 22, "Modifying Clips and Clip Attributes."

Clip Resolution

Ordinarily, the resolution of a clip is entirely dependent on the resolution that was selected when that media was shot, or rendered out of a compositing, VFX, or 3D application. Once a piece of media has been created, the native resolution of that media cannot be changed, and to maintain the ideal amount of sharpness for that clip, you need to make sure that whatever transforms you apply to resize a clip zoom into that clip no more than 10-20% over its native resolution (if even that), otherwise the image will visibly soften.

However, DaVinci Resolve provides advanced Super Scale image processing in the Clip Attributes of every video and image clip, that make it possible to resize clips beyond their native resolution while maintaining the perceptible sharpness of a clip that's still within it's native resolution. This is an illusion, but it's a convincing one.

The DaVinci Resolve Sizing Pipeline

This section discusses the various sizing controls that are available in DaVinci Resolve, and how they work together.

"Super Scale" High Quality Upscaling (Studio Version Only)

For instances when you need higher-quality upscaling than the standard Resize Filters allow, you can now enable one of three "Super Scale" options in the Video panel of the Clip Attributes window for one or more selected clips. Unlike using one of the numerous scaling options in the Edit, Fusion, or Color pages, Super Scale actually increases the source resolution of the clip being processed, which means that clip will have more pixels than it did before and will be more processor-intensive to work with than before, unless you optimize the clip (which bakes in the Super Scale effect into the optimized media) or cache the clip in some way.
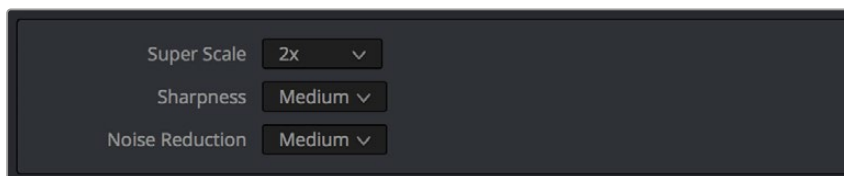
Super Scale options in the Video panel of the Clip Attributes

The Super Scale drop-down menu provides three options of 2x, 3x, and 4x, as well as Sharpness and Noise Reduction options to tune the quality of the scaled result. Note that all of the Super Scale parameters are in fixed increments; you cannot apply Super Scale in variable amounts. Selecting one of these options enables DaVinci Resolve to use advanced algorithms to improve the appearance of image detail when enlarging clips by a significant amount, such as when editing SD archival media into a UHD timeline, or when you find it necessary to enlarge a clip past its native resolution in order to create a closeup.

You may find that, depending on the source media you're working with, setting Sharpness to Medium yields a relatively subtle result that can be hard to notice, but setting Sharpness to high should be immediately more preferable, while also sharpening grain and noise in the image to an undesirable extent at the default settings. However, while raising Noise Reduction will ameliorate this effect, it will also diminish the gains you obtained by raising Sharpness. In these cases, it's worth experimenting with keeping Sharpness at Low or Medium so that Super Scale sharpens all aspects of a clip, but then using the Noise Reduction tools of the Color page (with their additional ability to be fine-tuned) to diminish the unwanted noise.

Fusion Effects and Resolution

All image processing by the Fusion page takes place before effects that are applied by the Edit page, with the sole exception of the Lens Correction effect. When it comes to sizing and image resolution, whether or not the Fusion page affects resolution depends on how you use it.

Fusion Effects Inherit the Source Resolution of a Clip

When you open a clip on the Timeline in the Fusion page, the Fusion page is set to the full source resolution of that clip, regardless of the Timeline resolution. This can be seen if you look at the resolution that's listed above the upper right-hand corner of the Viewer. This means that if you don't apply any operations that reduces the image resolution (described later), subsequent sizing adjustments in other pages will refer to the same resolution as the source clip.

The available resolution and bit depth of the currently selected clip is visible
above the upper right-hand corner of the Viewer, circled in red

Fusion Clips Inherit the Timeline Resolution

If you combine multiple clips on the Timeline into a Fusion clip, the Fusion page is set to the timeline resolution, regardless of the source resolution of the clip. The image is then output to the Edit page at this timeline resolution, and all subsequent sizing adjustments are performed relative to the timeline resolution, with no reference to the original resolution in the source clip.
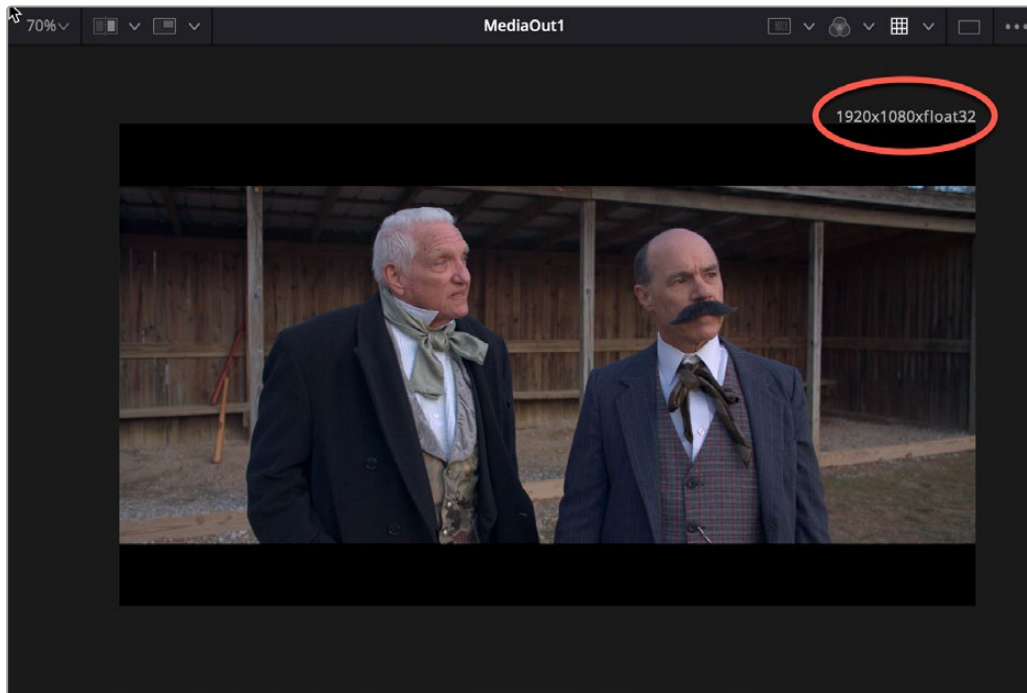
The available resolution and bit depth of a clip that's been turned into a
Fusion Clip, that's set to the timeline resolution of 1920x1080

Operations in the Fusion Page That Change Resolution

If you don't do anything to change the size of a clip in the Fusion page, then its resolution stays the
same and you'll effectively output the source resolution of that clip to the Edit page.

However, if you Merge the image with a second clip attached to the background which has a different
resolution, or if you use a Crop or Resize node to increase or decrease the resolution of the image,
then the new resolution will be passed to the Cut and Edit pages as the effective source resolution of
that clip.

In short, the Fusion page passes whatever resolution is output by the last node of your composition
back to the Edit page as the effective resolution of that clip in the DaVinci Resolve image
processing pipeline.

Fusion Page Transform Operations Are Resolution Independent

Within the Fusion page, multiple Transform nodes operate in a resolution independent manner relative
to the resolution of the source clip. This means that if you shrink an image to 20% with one Transform
node, and then enlarge it back up to 100% using a second Transform node, you end up with an image
that has all the resolution and sharpness of the input image.

Fusion Page Resize Operations Are Not

Within Fusion there are two kinds of transform effects, the Transform node and the Resize node. Which
of these nodes you use has a dramatic impact on resolution independence.

– The Transform node always refers back to the input resolution of the clip (as defined by the
  Clip Attributes) to enable resolution-independent sizing, such that multiple Transform nodes can
  scale the image down and up repeatedly within the Fusion page with no unnecessary loss of
  image resolution.

– The Resize node actually decreases image resolution when you shrink an image or increases
  image resolution (with filtering) when enlarging. This means that the Resize node will break
  resolution independence, and the resolution of the image will be fixed at whatever you specify
  from that point in your composite's node tree forward.

In most situations, you probably want to use the Transform node to maintain resolution independence relative to the source media, unless you specifically want to alter and perhaps reduce image resolution to create a specific special effect which purposefully degrades the image. For example, if you want a clip to be forced to a standard definition resolution in order to make it look like a low-resolution archival clip, the Resize node will accomplish this. Enlarging the result with a Transform node will then perform a filtered enlargement that will look like a real SD clip being enlarged.

Transforms from the Fusion Page to the Edit Page

All transform operations you apply on the Cut, Edit, and Color pages are resolution independent, referring to the original resolution of the source media, so long as you don't use the Fusion page. For example, if you shrink an image to 20% in the Edit page (using Edit sizing controls) and then enlarge it in the Color page back to 100% (using Input sizing controls), you end up with an image that has all the resolution and sharpness of the original media, because the final resolution is drawn from the original source media.

However, once you use the Fusion page to do anything to a clip, from adding a small effect to creating a complex composition, the resolution-independent relationship of the Edit and Color pages to the source media is broken, and whatever resolution is output from your Fusion composition is the new effective resolution of the clip that appears in the Timeline. This means if you shrink an image to 20% in the Fusion page (using a Transform node) and then enlarge it in the Color page by 150%, you end up with an image that isn't as sharp as the original because the downconverted image in the Fusion page is effectively the new source resolution of that clip.

Image Scaling

DaVinci Resolve has a dedicated mechanism for automatically managing the size of clips with resolutions that don't match the timeline resolution, and it's separate from the Zoom transform controls that are available for making creative adjustments to clips. This is called Image Scaling, and it's customizable in a few different areas.

Resize Filter Project Setting

The Resize Filter setting lets you choose the filter method that's used to interpolate image pixels when resizing clips:

– **Smoother:** May provide a more pleasing result for projects using clips that must be scaled down to standard definition as this filter exhibits fewer sharp edges at SD resolutions.

– **Bicubic:** While the sharper and smoother options are slightly higher quality, bicubic is still an exceptionally good resizing filter and is less processor-intensive than either of those options.

– **Blinear:** A lower quality setting that is less processor-intensive. Useful for previewing your work on a low-performance computer before rendering when you can switch to one of the higher quality options.

– **Sharper:** Usually provides the best quality for most projects, using an optical quality processing technique that's unique to DaVinci Resolve.

– **Custom:** This setting lets you take control of the exact algorithm used in all resizing operations. The custom Resize Filter options available are: Bessel, Box, Catmul-Rom, Cubic, Gaussian, Lanczos, Mitchell, Nearest Neighbor, Quadratic, and Sinc. In practice, the difference between these methods can be quite subjective. However, if you need to match a specific resizing method used from another application, you can do it here. For everyday use, the normal resizing filters in DaVinci Resolve should be sufficient.

– **Override Input scaling:** Checking this box lets you choose an Input Sizing preset to apply to the project.

– **Override Output scaling:** Checking this box lets you choose an Output Sizing preset to apply to the project.

– **Anti-alias edges:** A second group of settings lets you choose how to handle edge anti-aliasing for source blanking.

  – **Auto:** Adds anti-aliasing when any of the Sizing controls are used to transform the image. Otherwise, anti-aliasing is disabled.

  – **On:** Forces anti-aliasing on at all times.

  – **Off:** Disables anti-aliasing. It might be necessary to turn anti-aliasing off if you notice black blurring at the edges of blanking being applied to an image.

– **Deinterlace quality:** (only available in Studio version) A fourth group of settings lets you choose the quality/processing time tradeoff when deinterlacing Media Pool clips using the Enable Deinterlacing checkbox in the Clip Attributes window. There are two settings:

  – **Normal:** A high-quality deinterlacing method that is suitable for most clips. For many clips, Normal is indistinguishable from High. Normal is always used automatically during playback in DaVinci Resolve.

  – **High:** A more processor-intensive method that can sometimes yield better results, depending on the footage, at the expense of slower rendering times.

  – **DaVinci Neural Engine:** This option uses the advanced machine learning algorithms of the DaVinci Neural Engine to analyze motion between the fields of interlaced material and reconstructs them into a single frame. This option is very computationally intensive, but ideally will deliver an even more aesthetically pleasing result than the "high" setting.

Input Scaling Project Setting

If the native resolution of an imported clip doesn't match the timeline resolution, then the currently selected Input Scaling Preset in the Image Scaling panel of the Project Settings dictates how mismatched clips will be handled project-wide. The default setting is "Scale entire image to fit," which shrinks or enlarges the image to fit the current dimensions of the frame without cropping any part of the image, adding letterboxing or pillarboxing as necessary to fill the unused portion of the frame depending on whether the horizontal or vertical dimension of the image hits the edge of the frame first.

The Mismatched resolution files option let you choose how clips that don't match the current project resolution are handled. The illustrated examples below show an SD clip being fit into an HD project using each of the different options.

– **Center crop with no resizing:** Clips of differing resolution are not scaled at all. Clips that are smaller than the current frame size are surrounded by blanking, and clips that are larger than the current frame size are cropped. Keep in mind that this is a good setting to use if you're importing a timeline from another NLE in which clip resolution adjustments are imported as scaling adjustments. Choosing "Center Crop with no resizing" prevents DaVinci Resolve from "double scaling" clips in imported timelines.

– **Scale full frame with crop:** Clips of differing resolution are scaled so that the clip fills the frame with no blanking. Excess pixels are cropped. This is a good setting when you want clips that don't match the project resolution to automatically fill the frame, with no letterboxing or pillarboxing.

– **Scale entire image to fit:** The default setting. Clips of differing resolution are scaled so that each clip fills the frame without cropping. The dimension that falls short has blanking inserted (letterboxing or pillarboxing). This is a good setting when you want clips that don't match the project resolution to automatically fit into the frame without being cropped in any way, and you're fine with letterboxing or pillarboxing as a result. However, if you've imported a timeline from another NLE and there are clips that are twice as big as they should be, it's because this setting is on by default, and your imported timeline has imported scaling settings used to resize clips that didn't match the timeline resolution. If this happens, switch to "Center crop with no resizing" instead, and that will fix the problem.

– **Stretch frame to all corners:** Useful for projects using anamorphic media. Clips of differing resolutions are squished or stretched to match the frame size in all dimensions. This way, anamorphic media can be stretched to match full raster or full raster media can be squished to fit into an anamorphic frame. An added benefit of this setting is that it makes it easy to mix anamorphic and non-anamorphic clips in the same project.

Output Image Scaling Project Settings

Another group of settings found in the Image Scaling panel of the Project Settings lets you optionally choose a different resolution to be output, either via the Deliver page, or via your video output interface for monitoring or outputting to tape.

In particular, if you set the "Resolution" in the Render Settings panel of the Deliver page to something other than the timeline resolution, these settings are used to make the change. This is useful in situations where you're mastering a high resolution 4K project, but you want to monitor using an HD display, and you plan on eventually outputting HD resolution deliverables in addition to the 4K deliverables for which you want to use different Scaling and/or Resize Filter settings that work better at the lower resolution.

- **Match timeline settings:** This checkbox is turned on by default so that these settings mirror the Image Scaling and Input Scaling settings described above. Turning this checkbox off lets you choose different settings to be used when monitoring, outputting to tape, or rendering, using the other settings below.

- **Output resolution:** Lets you choose an alternate resolution for monitoring and delivery. You can also set this from the "Resolution" drop-down menu of the Video panel in the Render Settings of the Deliver page.

- **For "X x Y" processing:** Lets you specify a different custom alternate resolution.

- **Pixel aspect ratio:** Lets you specify an alternate pixel aspect ratio to match the alternate timeline format.

- **Mismatched resolution files:** Lets you choose an alternate way of handling mismatched resolution files that works better for the alternate resolution you've chosen. These options work similarly to those of the "Input Scaling" group. For example, for an HD or UHD resolution project you may have the Image Input Scaling set to "Scale Full Frame With Crop" so that all Standard Definition resolution files are center-cut to eliminate blanking. However, if you're using Output Image Scaling to create a Standard Definition deliverable, you may want to set the Output Image Scaling > Mismatched resolution files setting to "Scale entire image to fit" in order to letterbox all HD or UHD resolution clips, while preserving the original aspect ratio of the SD clips.

- **Super Scale:** Sets a very processor-intensive and high quality upscaling algorithm that actually creates new pixels for the resized image. The possible values are None, 2x, 3x, 4x, and Auto.

Clip-Specific Scaling Settings

There's an additional set of Scaling and Resize Filter settings, available in the Video Inspector for selected clips, that provide the same options as those found in the Project Settings window, except that they let you choose settings that will be specific to a particular clip. These are valuable for situations where the project-wide scaling setting is working for most clips, but you have a handful of specific clips that would benefit from individual settings.

Edit Sizing in the Cut and Edit pages

The Video Inspector contains a set of Transform parameters with which you can alter clips in the Timeline. These parameters operate independently of the Input Sizing controls found in the Color page. Separate Edit sizing controls serve a number of different functions:

- They're convenient for editors and are easily animated for creating motion graphics effects right on the Cut and Edit page timelines. They also keep editor transform adjustments separate from colorist transform adjustments, for a clear division of labor and responsibility.

- Edit sizing parameters also store incoming transform data from imported AAF and XML projects that come from other applications, so that imported transforms are kept separate from adjustments made by colorists and finishing artists.

The Transform parameters in the
Inspector of the Edit page

If, when importing an AAF or XML project file, you turned on the "Use sizing information" checkbox, then every clip that had position, scale, rotation, or crop settings applied in the originating NLE will have those adjustments applied to these transform parameters, which is convenient for keeping imported transform settings separate from other DaVinci Resolve-native transform settings.

Additionally, a set of Dynamic Zoom parameters also exists in the Video Inspector, which let you make quickly animated transforms using graphical controls that correspond to the start and end states of an animated transform. However, these transforms are lumped in with the other Edit page Transform parameters in terms of the order of sizing operations occurring throughout DaVinci Resolve.
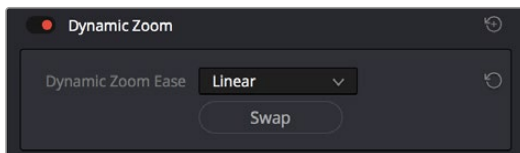
The Dynamic Zoom settings in the
Inspector of the Video Inspector

The transform that's made via the Edit Sizing controls refers back to either the source resolution of each clip, or the resolution output by the Fusion page if it's in use.

Image Stabilization

DaVinci Resolve provides Image Stabilization controls in the Cut, Edit, and Color pages that all control the same transform operation that happens between Edit sizing and Input Sizing in the image processing pipeline. The transform that's made via the Image Stabilization controls refers all the way back to either the source resolution of each clip, or the resolution output by the Fusion page if it's in use.

Input Sizing on the Color Page

The Sizing palette on the Color page has another dedicated set of keyframable transform parameters that work with the various DaVinci control panels to let the colorist apply pan and scan adjustments while working through a project. These parameters work independently of the Edit page Transform parameters, allowing you to keep imported transform settings separate from other transform settings that you apply. However, for convenience the Edit sizing controls are available in the Color page as well.

The transform that's made via the Input Sizing controls refers all the way back to either the source resolution of each clip, or the resolution output by the Fusion page if it's in use.

Node Sizing on the Color Page

Using Node Sizing, you can apply individual sizing adjustments to clips on a per-node basis within the Color page, which is similar in principal to using Transform nodes in the Fusion page. All Node Sizing adjustments within a grade are cumulative, and any keyframing done to Node Sizing parameters is stored in that node's Node Format keyframe track in the Keyframe Editor. Two good examples of Node Sizing include realigning color channels individually in conjunction with the Splitter/Combiner nodes or duplicating windowed regions of an image by moving them around the frame. Subsequent Node Sizing operations do not refer back to the source resolution of a clip, so using multiple Node Sizing operations to reduce and enlarge an image will reduce image resolution and sharpness.

Output Sizing on the Color Page

Output sizing is an additional transform that is applied after Edit sizing, Fusion sizing, Input sizing, and Node sizing. It's an overall adjustment that affects every clip at once, which is suitable for making last-minute format alterations that you want to affect the entire program. Technically, Output Sizing includes the Blanking controls, but those are important enough to discuss separately. Output Sizing also does not refer back to the source resolution of clips, so if you use Edit or Input Sizing to shrink a clip, and Output Sizing to enlarge it again, the final result will be somewhat softened as you're enlarging the lower resolution image output by Input Sizing.

Output Blanking

Output blanking is not a sizing operation, but it's often related and so worth mentioning here. Blanking is an adjustment you can use to add black areas to the top, bottom, left, or right of an image, in order to add "letterboxing" (black bars at the top and bottom of the image) or "pillarboxing" (black bars at the left and right of the image) that lets you fill in the unused parts of an image frame that's either shorter or thinner than the current output resolution.

Once all transforms, compositing operations, and color corrections have been applied by the DaVinci Resolve image processing pipeline, the very last operation to be performed is Output blanking, if it's enabled. This guarantees that overlapping images, grading, and other adjustments are properly "blacked out" no matter what you're doing to the program.

Output Blanking controls are found in the Timeline menu (as a series of aspect ratios) as well as in the Output Sizing parameters of the Color page Sizing palette (via Top, Right, Bottom, and Left controls).

> **TIP:** Text and graphics superimposed via the Data Burn-In window, if enabled, are the only effects that will appear in front of picture areas affected by blanking. This lets you add timecode and other information over letterboxed areas that you don't want to obscure the picture.

Format Resolution on the Delivery Page

By default, the Format Resolution setting in the Render Settings of the Deliver page matches the timeline resolution when "Match timeline settings" is enabled in the Output Scaling Preset in the Image Scaling panel of the Project Settings.

Choosing a new resolution from the "Set Resolution to" drop-down menu lets you override the current Format Resolution setting before rendering. Using this control, you can queue up multiple jobs, each set to a different resolution, to output multiple formats during a single render session.
For more information on rendering and setting up jobs for the Render Queue, see Chapter 185, "Using the Deliver Page."

Rendering Sizing Adjustments and Blanking

When rendering your final output, you have the option of choosing whether or not to "bake in" the sizing operations that have been performed. For example, you may have set up a whole set of specific sizing adjustments for the clips in a program, but then you're requested to render the project and its media as individual clips for round trip re-delivery to the editor for further work. In this case, you can choose to either render the sizing into the final media, or not.

Whether or not sizing is rendered into your final media depends on the "Disable edit and input sizing" checkbox in the Advanced Settings options of the Render Settings panel. You can disable sizing and blanking either when rendering the current timeline as a single clip, or when rendering individual clips.

– **If "Disable sizing and blanking output" is turned off:** Output Blanking, Cut and Edit page sizing adjustments, Color page Input and Output Sizing adjustments, and Image Stabilization are rendered into the final rendered media using the optical-quality sizing algorithms available to DaVinci Resolve. This is best if your sizing adjustments are approved and final, and you want to "bake" sizing adjustments into the final media you're delivering.

– **If "Disable sizing and blanking output" is turned on:** Output Blanking, Cut and Edit page sizing adjustments, Color page Input and Output Sizing adjustments, and Image Stabilization are not rendered, and each clip will be rendered either at the source resolution if "Render at source resolution" is enabled in individual clips mode, or to the currently specified resolution of the timeline or project. However, the sizing adjustments you've made will be exported as part of the XML or AAF file that you're exporting. This is best for workflows where the editor wants to continue adjusting sizing after you've handed off the graded project relative to the original size of the clips.

Keep in mind that if you want to render Input Sizing adjustments into the media you're outputting, the "Force sizing to highest quality" checkbox guarantees that DaVinci Resolve will use the highest-quality sizing setting, even if you've temporarily chosen a faster-processing option for a slower computer.

> **NOTE:** "Disable sizing and blanking output" does not disable any transform operations that happen within the Fusion page. Those will continue to be applied to the final output.

Chapter 12

Data Burn-In

This chapter covers how to use the Data Burn-In window that's available to every page in DaVinci Resolve.

Contents

Data Burn-In

The Data Burn-In window lets you display select metadata as a timeline-wide "window burn" that's superimposed over the image in the Viewer. This window burn is written into files that you render in the Deliver page, and it's also output to video, for viewing on your external display, or for outputting to tape.

The Burn-In window is available by choosing Workspace > Data Burn-In.
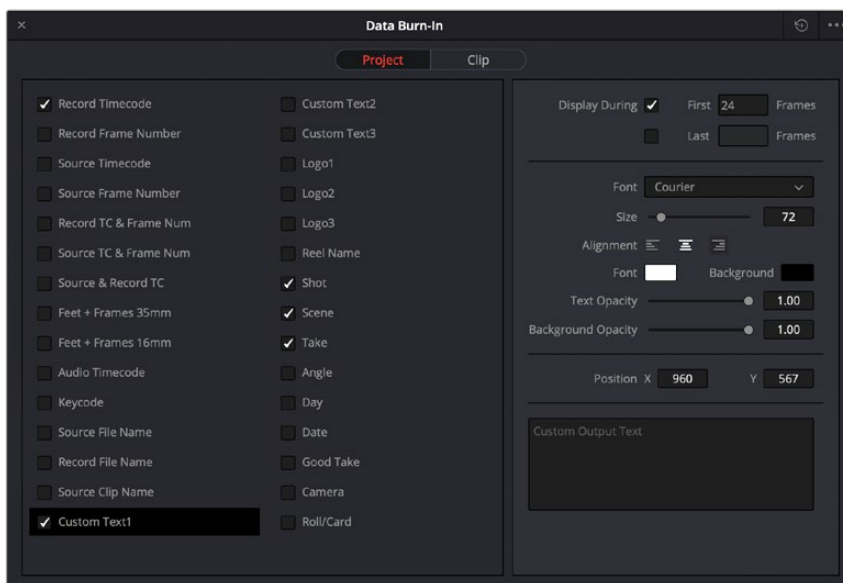
Data Burn-In window

Traditionally, window burns are useful as a reference when creating offline media that you need to keep track of later. However, the Data Burn window is extremely flexible. For example, it's also useful for watermarking review files that you don't want to be distributed accidentally with either custom text or graphics with alpha channels, for adding graphical logos or "bugs" to programs in preparation for broadcast (again, optionally using graphics with alpha channels), for superimposing custom reference guidelines of some sort over the images being monitored, or even just for temporarily displaying timecode or clip names to refer to on your monitor while editing, mixing, or reviewing graded dailies with a client.

Viewer displaying record timecode, source timecode, and source clip name

Project vs. Clip Mode

Two buttons at the top of the Data Burn window let you choose whether you want to edit one set of burned-in metadata that will be displayed for the entire duration of the Timeline, or edit burned-in metadata on a clip-by-clip basis. You can combine the two, having timeline-wide window burn settings and separate clip-specific window burn settings for a handful of clips in that timeline at the same time.

When rendering in the Delivery page, window burns are applied both when rendering timelines as individual source clips and when rendering as one single clip.
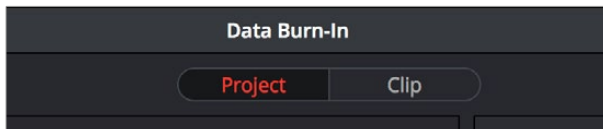
Two separate panels let you adjust project-wide
window burns vs. clip-specific window burns

Setting Up Burned-In Metadata

Setting up different clip and project metadata to output as a window burn is easy.

To set up a window burn:

1   Choose Workspace > Data Burn-In.

2   Click Project or Clip at the top of the Data Burn-In window.

3   Turn on the checkboxes of whatever items of metadata you want to display in the "Add to Video Output" column. More information about the available items appears later in this chapter.

The first item of metadata is centered near the bottom of the frame, above Action Safe. Each additional item of metadata you turn on for display is added above whichever items are already displayed, regardless of their position in the "Add to Video Output" list.

4   Click any currently enabled item of metadata from the list to highlight it in black, and edit that item's Custom Output parameters at the right. More information about the available parameters appears later in this chapter.

To reset the current window burn setup:

Click the Reset button next to the Option drop-down menu to reset the current mode of the Data Burn window.

Saving and Loading Burn-In Presets

If there are common sets of metadata that you regularly use and switch among, you can save each set up as a preset for future use.

To save a burn-in preset:

1   Click the Option menu and choose Save As New Preset.

2   Type a name into the Burn In Preset dialog that appears, and click OK. That preset is added to the list of saved presets in the Option menu.

To delete a burn-in preset:

1   Choose a preset from the Option menu.

2   Click the Option menu, and choose Delete.

3   A dialogue box appears asking you to confirm the deletion.

To modify a burn-in preset:

1   Choose a preset from the Option menu.

2   Edit it however you like.

3   Click the Option menu, and choose Update.

Data Burn-In Metadata

The leftmost column in the Data Burn-In window contains a list of all the options that you can add to the video output as a window burn. Each option has a checkbox that lets you turn it on or off. You can also select in the Option drop-down if you would like the item name rendered as a prefix to the burn-in data.

> **NOTE:** If two clips overlap in the Timeline, the metadata that matches the currently visible clip in the Viewer is what will be displayed in the window burn.

– **Record Timecode:** The timecode relative to the Timeline, as set in the Conform Options section of the General Options panel of the Project Settings.

– **Record Frame Number:** The number of frames from the first frame of the Timeline.

– **Source Timecode:** Each clip's individual timecode.

– **Source Frame Number:** The number of frames from the first frame of the clip.

– **Record TC & Frame Num:** Both metadata options combined in one line.

– **Source TC & Frame Num:** Both metadata options combined in one line.

– **Source & Record TC:** Both metadata options combined in one line.

– **Feet + Frames 35mm:** Displays a Feet + Frames conversion of the program's record timecode, calculated for 35mm film.

– **Feet + Frames 16mm:** Displays a Feet + Frames conversion of the program's record timecode, calculated for 16mm film.

– **Audio Timecode:** The timecode of audio that's been synced to a clip.

– **Keycode:** Also referred to as edge-code, the identification codes running along the edge of film stocks that provide an absolute reference for which digital frames correspond to which film frames.

– **Source File Name:** The full file path, including file name, of the media file that's linked to the current clip.

– **Record File Name:** The file name as defined in the Render Settings list of the Deliver page.

– **Source Clip Name:** The file name of the media file that's linked to the current clip, without the file path.

– **Custom Text1:** A line of text that you type into the Text field of the Custom Output parameters. You can use any characters you like. When editing any of the three custom text fields that are available, you can use "metadata variables" that you can add as graphical tags that let you display clip metadata. For example, you could add the corresponding metadata variable tags %scene_%shot_%take and the custom text would display "12_A_3" if "scene 12," "shot A," "take 3" were its metadata. For more information on the use of variables, as well as a list of all variables that are available in DaVinci Resolve, see Chapter 16, "Using Variables and Keywords."

– **Custom Text2:** A second line of text that you can customize.

– **Custom Text3:** A third line of text that you can customize.

– **Logo1:** Lets you superimpose a graphic over the image in a customizable location. Compatible graphics formats include PNG, TGA, TIF, BMP, and JPG. Alpha channels are supported for transparency in logos.

– **Logo2:** Lets you superimpose a second graphic.

– **Logo3:** Lets you superimpose a third graphic.

– **Reel Name:** The currently defined reel number for the current clip.

– **Shot:** Shot metadata, if it's been written to the file by a camera, or entered into the Metadata Editor on the Media page.

– **Scene:** Scene metadata, if it's been written to the file by a camera, or entered into the Metadata Editor on the Media page.

– **Take:** Take metadata, if it's been written to the file by a camera, or entered into the Metadata Editor on the Media page.

– **Angle:** Angle metadata, if it's been written to the file by a camera, or entered into the Metadata Editor on the Media page.

– **Day:** Day metadata, if it's been written to the file by a camera, or entered into the Metadata Editor on the Media page.

– **Date:** Date metadata, if it's been written to the file by a camera, or entered into the Metadata Editor on the Media page.

– **Good Take:** Corresponds to Good Take metadata, if it's been written to the file by a camera, or entered into the Metadata Editor on the Media page.

– **Camera:** Corresponds to the Camera metadata, if it's been written to the file by a camera, or entered into the Metadata Editor on the Media page.

– **Roll/Card:** Corresponds to the Roll/Card metadata, if it's been written to the file by a camera, or entered into the Metadata Editor on the Media page.

Custom Output Options

The parameters in the Custom Output panel let you modify the look, position, and in some cases content, of the selected metadata item. Pan and Tilt are individually customizable for each metadata item.

– **Display During First x frames:** Turning on this checkbox lets you specify a number of frames during which the current item of metadata will be displayed before dissolving away over one second. When enabled, the current item of metadata will cut onscreen with the beginning of each new clip, remain onscreen for the duration specified, and then dissolve away.

– **Display During Last x frames:** Turning on this checkbox lets you specify a number of frames before the end of each clip during which the current item of metadata will appear onscreen after fading up over one second, before cutting away with the end of the clip.

– **Font:** Defaults to Courier, but you can choose any font that's installed on your system.

– **Size:** Defaults to 48, but you can choose standard increments from 6 to 72.

– **Alignment:** Defaults to Center. The only other option is Left.

– **Font (color):** Defaults to white, but you can choose from a range of predefined colors in this drop-down menu.

– **Background:** Defaults to black, although the apparent color is influenced by the Opacity setting. For a more garish look, you can choose from a range of predefined colors in this drop-down menu.

- **Text Opacity:** Defaults to 1.00. Lets you define the transparency of the burned-in metadata's text.

- **Background Opacity:** Defaults to 1.00. Lets you define the transparency of the burned-in metadata's background color.

- **X-Y Position:** Lets you change the horizontal and vertical orientation of the current item of metadata. The default horizontal value is the center of the frame, relative to the current project's frame size. The first item of metadata is centered vertically near the bottom of the frame, above Action Safe. Each subsequent item of metadata you turn on is automatically placed above the previous item of metadata, regardless of its order in the "Add to Video Output" list.

- **Text:** (only if one of the Custom Text options is checked) A text field that lets you enter custom text to display as one of three possible custom text items.

- **Logo:** (only if one of the Logo options is checked) A field that displays the file path of any currently selected graphic that you're displaying as one of the three possible Logo graphics. Compatible graphics formats include PNG, TGA, TIF, BMP, and JPG. Alpha channels are supported for transparency in logos.

- **Import File button:** (only if one of the Logo options is checked) Lets you choose a graphics file to use as a logo.

Gang Rendered Text Styles

You have the option of independently styling each item of metadata, depending on whether the Gang Render Text Styles option is checked in the Data Burn-In window's Option menu. When turned on, all text metadata share the same font, size, color, background, justification, and opacity. When turned off, each item of metadata can have individual settings.

Prefix Render Text

Another option in the Data Burn-In window's Option menu lets you turn the prefixes, or headers, on or off for all metadata that's enabled to be burned in.

Chapter 13

Frame.io & Dropbox Replay Integration

DaVinci Resolve has sophisticated integrations with Frame.io, and Dropbox Replay video review and collaboration services designed specifically for the postproduction industry.

Contents

Enabling Frame.io Integration
in Preferences

An Internet Accounts panel in the System tab of the DaVinci Resolve Preferences lets you sign into your Frame.io account and specify a local cache location for media being synced with Frame.io. You'll need to enter your login name and password to enable Frame.io integration, but once entered, DaVinci Resolve will sign in automatically when DaVinci Resolve opens.
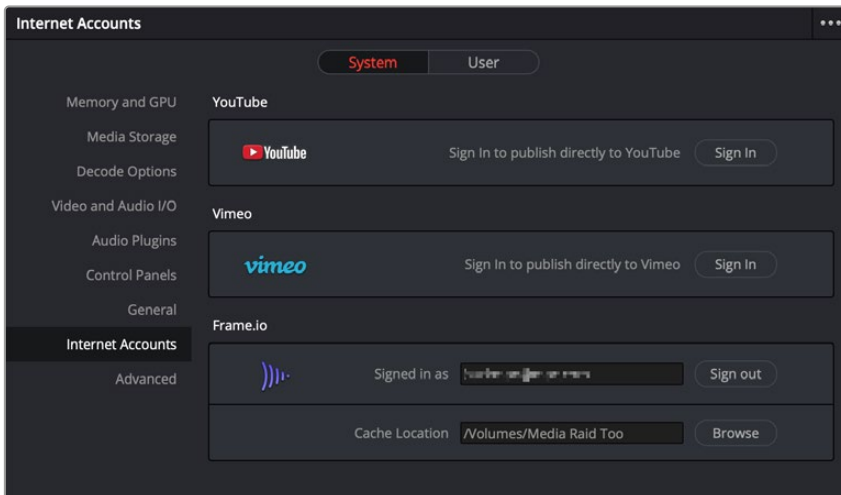
The Internet Accounts panel of the System tab of the
DaVinci Resolve Preferences window (login deliberately obscured)

The local cache location is used to store clips you import into a DaVinci Resolve project from the Frame.io volume in the Media Storage panel of the Media page.

Deliver and Upload to Frame.io

A Frame.io preset at the top of the Deliver page's Render Settings panel lets you render and upload a program for review. All options in the Render Settings panel update to present suitable controls for this process.
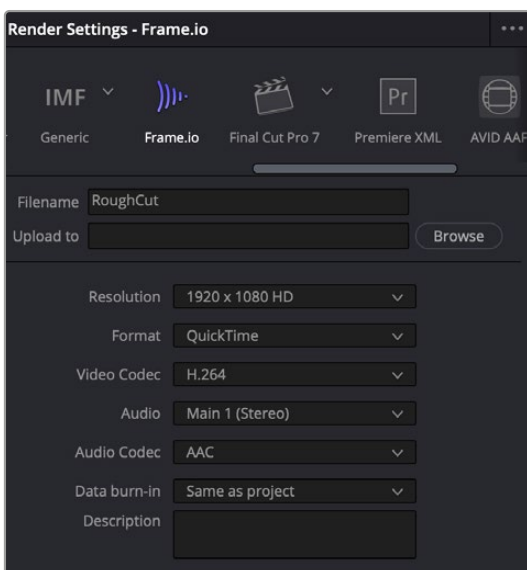
Choosing the Frame.io preset

When you choose the Frame.io preset, the Location field turns into an Upload To field, and the Browse button lets you choose a project and folder path to which to upload the exported result.
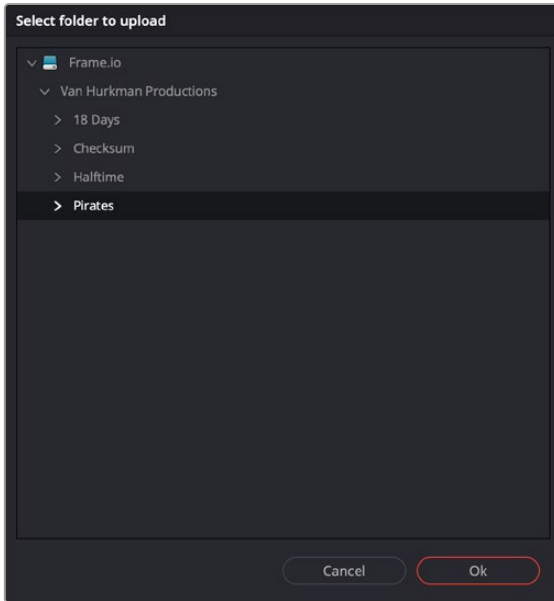
Choosing a Frame.io account to deliver a program to

When you export to Frame.io, the available choices in the Resolution, Format, Video Codec, and Type pop-up menus are limited to those that are most suitable for Frame.io file sharing. Choose the desired export options, then click the Add to Render Queue button to add this job to the Render Queue as you would with any other export. When that job is rendered, it automatically proceeds to upload to Frame. io, and an upload percentage indicator appears in the job listing to show how far along this upload is. When it's finished, the job displays the text "Upload completed."
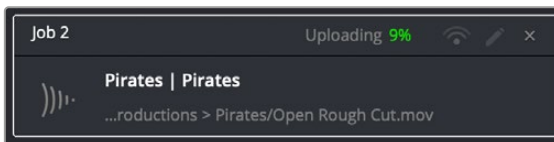
The job in the Render Queue shows you the percentage the file has uploaded so far

This upload is done in the background, so you can continue working on other things in DaVinci Resolve while the file uploads. If you want to see how long the upload will take on any other page, you can choose Workspace > Background Activity to see the Background Activity window.

Frame.io Comments Sync with Timeline Markers

When you render a timeline directly to Frame.io, that timeline is automatically linked to the movie that's been uploaded to Frame.io, and all comments, "Likes," and graphical annotations (drawings and arrows) from reviewers that are added online via the Frame.io interface are automatically synced to Frame.io markers on your timeline (so long as your computer has an active internet connection). Frame.io markers are distinct from all other markers and can be independently shown and hidden, or deleted. Drawings and arrows from Frame.io are converted into their equivalent DaVinci Resolve annotation graphics for visibility in DaVinci Resolve.
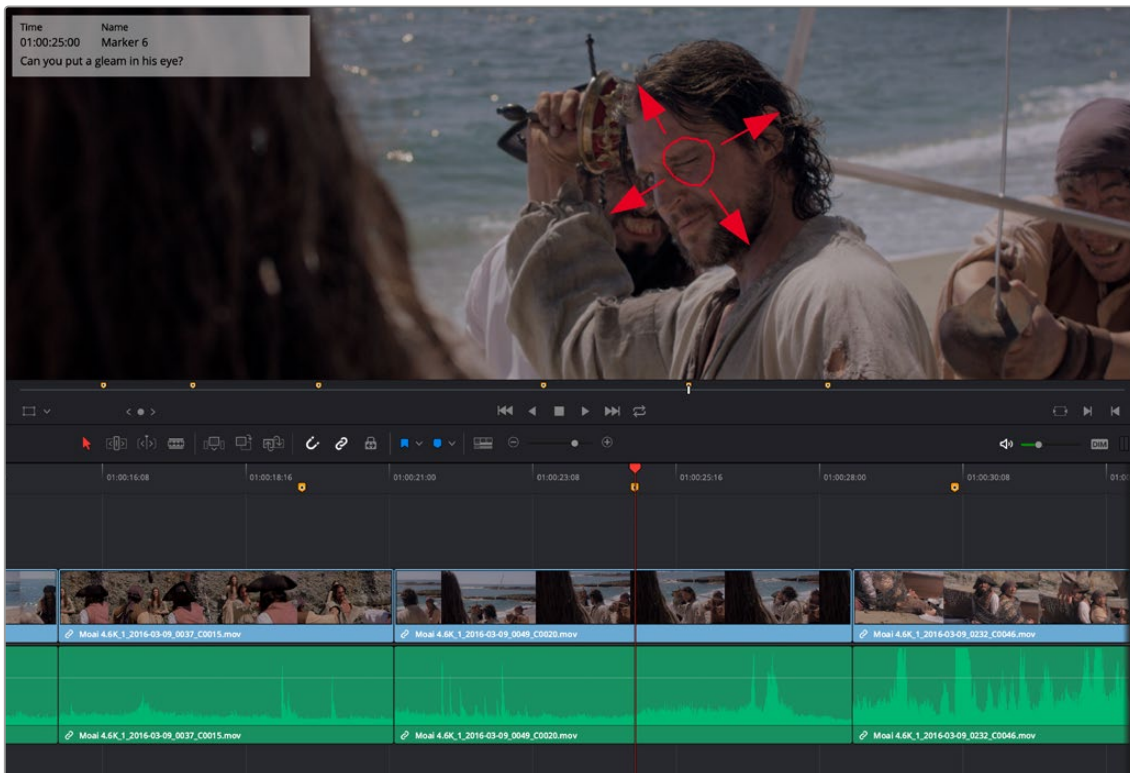
Comments and graphical annotations from Frame.io appear as markers
with their corresponding overlays in your DaVinci Resolve Timeline

Working With Frame.io Markers

Double-clicking any Frame.io marker in the Timeline opens a dialog that lets you send replies to
comments that appear on Frame.io, enabling editors to respond directly to commenters.
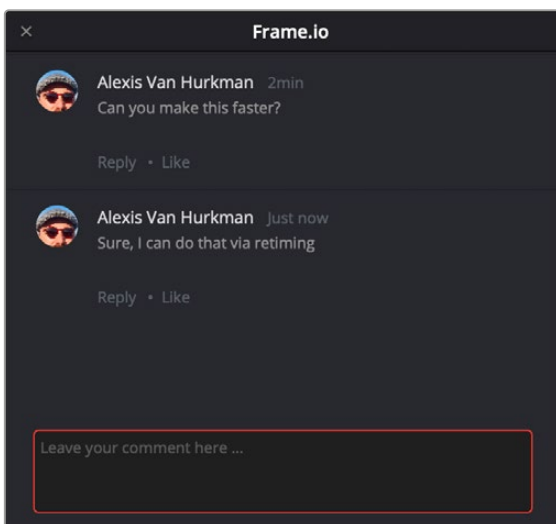
The editor talking to himself using the Frame.io comment
dialog that appears when you open a Frame.io marker

You can also place Frame.io markers on the Timeline to have them automatically sync back to Frame.
io, giving you the ability to send your own comments back to commenters (be kind).

If you delete one or more Frame.io markers on the DaVinci Resolve timeline, those markers will also be
deleted in Frame.io. This includes the Mark > Delete All Markers > Frame.io command. This is not
undoable.

Frame.io Marker Navigation

You can specifically navigate only the markers created in Frame.io while in the comment dialog of a Frame.io marker, using the Previous Marker (Shift-UpArrow) and Next Marker (Shift-DownArrow) commands. This allows you to skip directly from comment to comment in Frame.io without having to either navigate all markers in-between, or double-click each Frame.io marker individually to respond. Frame.io interoperability is a Studio Only feature.

Importing Media from Frame.io

A Frame.io volume appears in the Media Storage panel of the Media page that lets you access the media available from your Frame.io account. Within this Frame.io volume, a top-level directory represents your account directory, and within that each project you've created in Frame.io appears as a sub-directory.
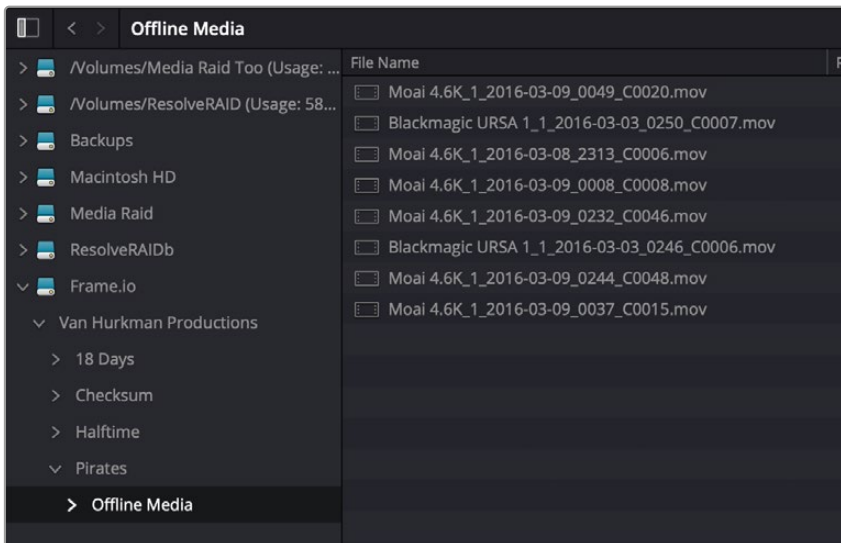
Accessing the directories of a Frame.io account from the Media Storage browser

Any media files that can be accessed in Media Storage can be imported into the Media Pool via the usual methods. Once added to the Media Pool, that media file downloads in the background to the specified local cache location, but it's immediately available via your internet link until the download is complete, so you can begin working immediately. If you want to see how long the download will take, you can choose Workspace > Background Activity to see the Background Activity window.
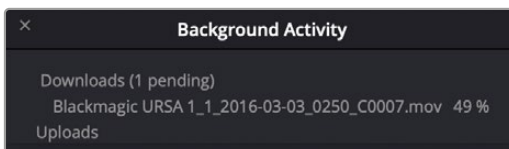
The Background Activity window lets you see
what's happening in the background while you work

Linking Media Pool Clips and Timelines with Frame.io Clips

You can also use Frame.io accessibility in the Media Storage panel of the Media page to link clips or timelines with media that's already uploaded to your Frame.io account. Just locate and select a Frame.

io clip in Media Storage, then right-click the clip or timeline you want to link it to in the Media Pool and choose Link to Frame.io Media from the contextual menu.

If you've linked a Frame.io clip to a timeline, comments made on that Frame.io clip appear on the linked timeline as Frame.io markers, just as if you'd exported that timeline directly to Frame.io.

Enabling Dropbox Replay Integration in Preferences

An Internet Accounts panel in the System tab of the DaVinci Resolve Preferences lets you sign into your Dropbox account. You'll need to enter your login name and password to enable Dropbox integration, but once entered, DaVinci Resolve will sign in automatically when DaVinci Resolve opens.
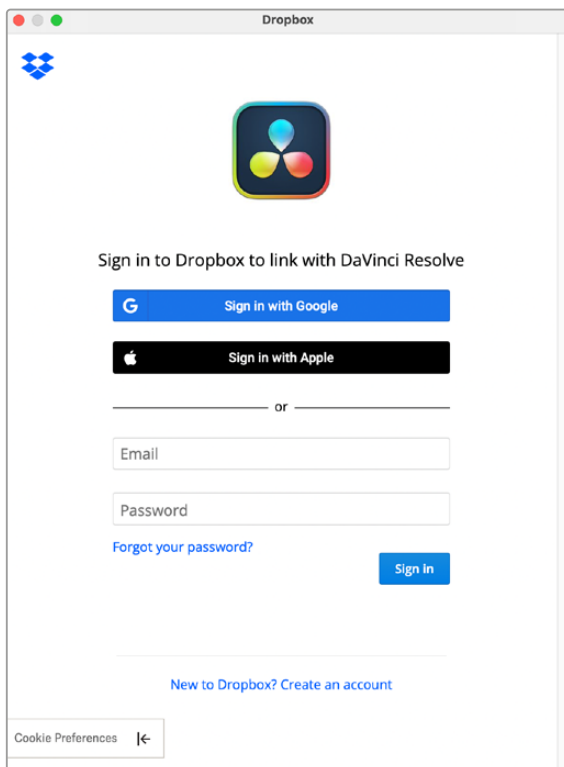
The Dropbox Login window in the Internet Accounts panel of the System tab of the DaVinci Resolve Preferences window.

Deliver and Upload to Dropbox Replay

A Dropbox Replay preset at the top of the Deliver page's Render Settings panel lets you render and upload a program for review. All options in the Render Settings panel update to present suitable controls for this process.

NOTE: The Dropbox Replay Render settings are separate from the normal Dropbox Render settings, and you need to use this specific set of presets to integrate with Dropbox Replay.
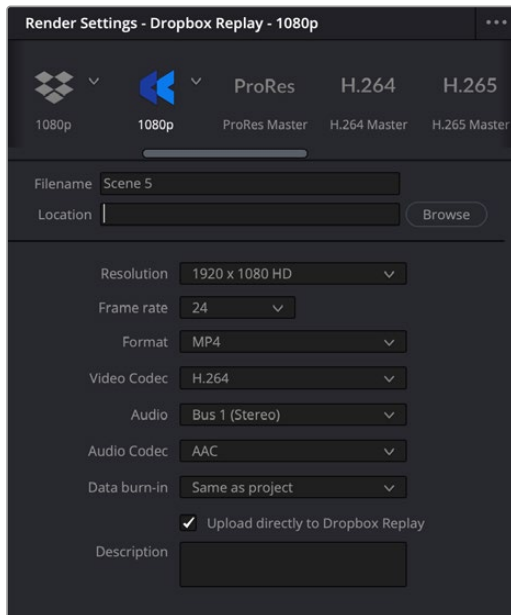
The Dropbox Replay Render settings (highlighted). Note they are different from the normal Dropbox Render settings to the left.

When you export to Dropbox Replay, the available choices in the Resolution, Format, Video Codec, and Audio pop-up menus are limited to those that are most suitable for Dropbox Replay. Choose the desired export options, then click the Add to Render Queue button to add this job to the Render Queue as you would with any other export. When that job is rendered, it automatically proceeds to upload to Dropbox Replay, and an upload percentage indicator appears in the job listing to show how far along this upload is. When it's finished, the job displays the text "Upload completed."
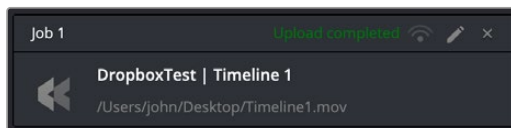
The job in the Render Queue shows you the percentage the file has uploaded, and lets you know when it's completed.

This upload is done in the background, so you can continue working on other things in DaVinci Resolve while the file uploads. If you want to see how long the upload will take on any other page, you can choose Workspace > Background Activity to see the Background Activity window.

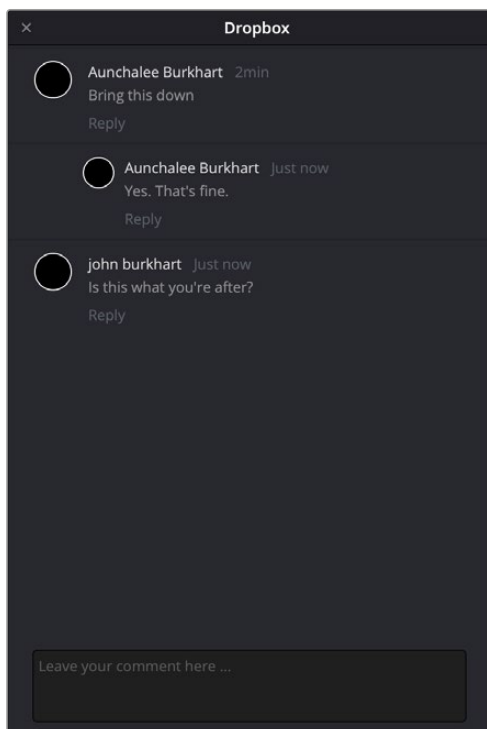# Dropbox Replay Comments Sync with Timeline Markers

When you render a timeline directly to Dropbox Replay, that timeline is automatically linked to the movie that's been uploaded to Dropbox Replay, and all comments, and graphical annotations (drawings and arrows) from reviewers that are added online via the Dropbox Replay interface are automatically synced to Dropbox markers on your timeline (so long as your computer has an active internet connection). Dropbox markers are distinct from all other markers and can be independently shown and hidden or deleted. Drawings and arrows from Dropbox Replay are converted into their equivalent DaVinci Resolve annotation graphics for visibility in DaVinci Resolve.
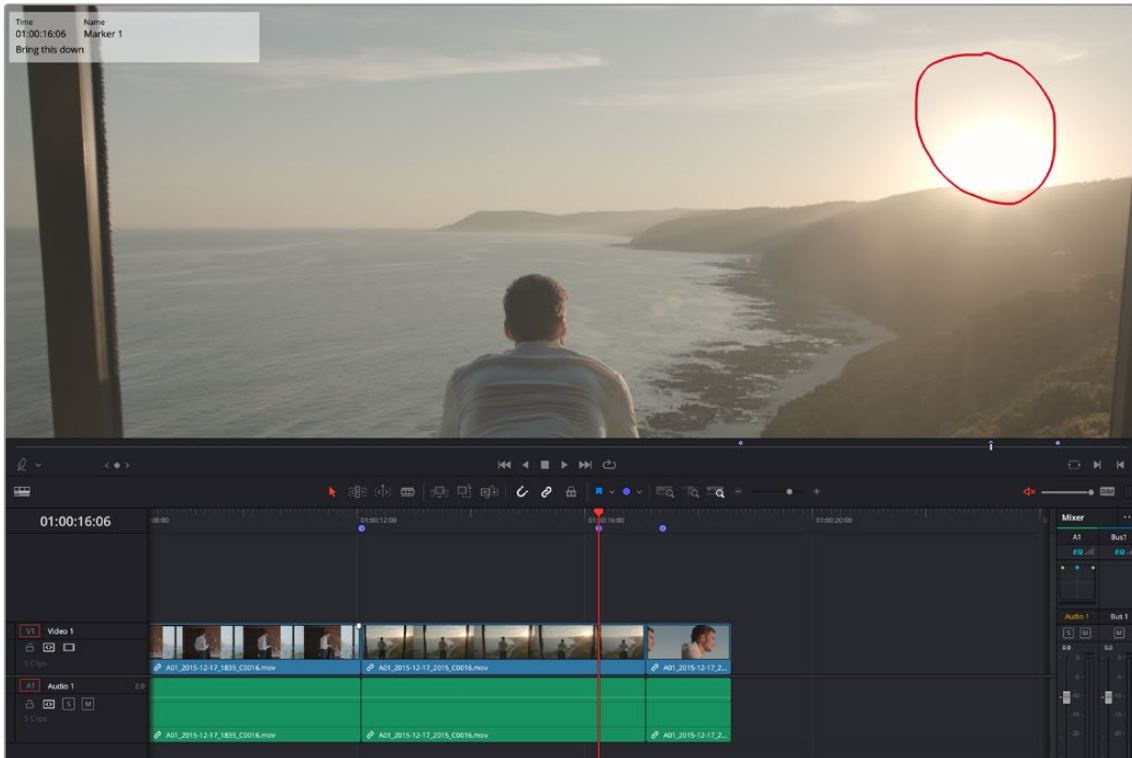
Comments and graphical annotations from Dropbox Replay appear as markers
with their corresponding overlays in your DaVinci Resolve timeline.

Working With Dropbox Markers

Double-clicking any Dropbox marker in the Timeline opens a dialog that lets you send replies to
comments that appear on Dropbox Replay, enabling editors to respond directly to commenters.

The Dropbox Replay comment dialog that
appears when you open a Dropbox marker

You can also place Dropbox markers on the Timeline to have them automatically sync back to Dropbox Replay, giving you the ability to send your own comments back to commenters (be kind). Dropbox markers on the Timeline show solid blue when they are created, and with a circle inside them once they are synced with Dropbox Replay.

If you delete one or more Dropbox markers on the DaVinci Resolve timeline, those markers will also be deleted in Dropbox Replay. This includes the Mark > Delete All Markers > Dropbox command. This is not undoable.

Dropbox Marker Navigation

You can specifically navigate only the markers created in Dropbox Replay while in the comment dialog of a Dropbox marker, using the Previous Marker (Shift-UpArrow) and Next Marker (Shift-DownArrow) commands. This allows you to skip directly from comment to comment in Dropbox Replay without having to either navigate all markers in-between, or double-click each Dropbox marker individually to respond.

Chapter 14

Resolve Live

The Color page has another mode available to aid you in using DaVinci Resolve in on-set grading workflows. Turning the Resolve Live option on puts DaVinci Resolve into a live grading mode, in which an incoming video signal from a camera can be monitored and graded during a shoot.

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More About Resolve Live

Resolve Live has been designed to let you use all of the features of DaVinci Resolve to grade these on-set video previews, in the process saving video snapshots that contain a captured image, your grade, and reference timecode from the camera. The idea is that, using Resolve Live, you can work with the cinematographer to develop looks and test lighting schemes on the footage being captured during the shoot, and then later you can use those looks to build dailies, and as a starting point for the final grade once the edit has been completed.

Additionally, you can use Resolve Live in conjunction with other Color page features such as the Alpha output to build test composites to check green screen shots, comparing them against imported background images in order to aid camera positioning and lighting adjustments. The built-in video scopes can also be used to monitor the signal levels of incoming video. Finally, you can use 1D and 3D LUTs to monitor and grade log-encoded media coming off the camera.

Configuring Your System for Resolve Live

Setting up Resolve Live is straightforward. Whether you're using a tower workstation or a laptop, any of the Blackmagic Design DeckLink or UltraStudio video interfaces can be used to connect your DaVinci Resolve workstation to a camera and external video display. The important thing to keep in mind is that, if you want to connect to a live incoming signal and output that signal for monitoring at the same time, you need to either use two separate DeckLink PCIe cards or UltraStudio Thunderbolt interfaces, or a single DeckLink Duo or DeckLink Studio card with multiple separate inputs and outputs on a single PCIe card.

The Video and Audio I/O panel of the System Preferences provides two sets of options for configuring video interfaces connected to your computer, one for playback, and one for capture. Resolve Live uses the capture input.
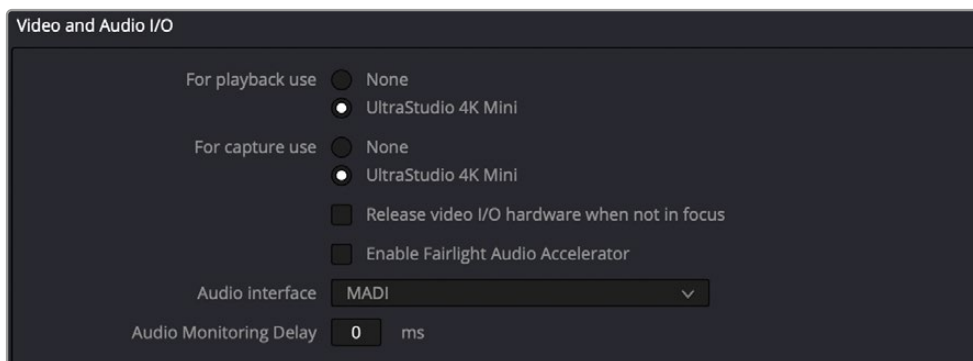
Video input/output options in the System Preferences

During the shoot, the digital cinema camera in use needs to be connected to your DaVinci Resolve workstation via HD-SDI, which must be configured to carry both the video image and timecode that mirrors the timecode being written to each recorded clip. Most cameras allow timecode output over HD-SDI, and both DeckLink and UltraStudio interfaces can pass this timecode to DaVinci Resolve. Without a proper timecode reference, you won't be able to take the shortcut of automatically syncing your saved Snapshots to recorded camera original media using ColorTrace, although you can always apply grades manually.

Grading Live

Once your camera and computer are appropriately connected and configured, using Resolve Live is straightforward. This section describes the live grading workflow as it was designed to be used. Once you're familiar with the capabilities of Resolve Live, you may find your own ways of working that are more in tune to the needs of your particular project.

Getting Started

When working with Resolve Live on a new shoot, you should begin with an empty project and a new empty timeline, since the live grading workflow involves capturing live graded snapshots to an otherwise unoccupied timeline. One recommended way of organizing the live grades of a shoot is to create one new project per day of shooting. This way, snapshots captured during shoots using all 24 hours of time-of-day timecode won't conflict with one another. Also, separate projects can make it easier to use ColorTrace to copy grades from your live grade snapshots to the camera original media you'll be creating dailies from, eventually.

> **TIP:** Having an empty Media Pool and timeline doesn't mean you can't install useful LUTs and pre-import reference stills and saved grades to the Gallery, as these can be valuable tools for expediting your on-set grading.

Once you've created your new project, you also need to choose the disk where all snapshots you take will be saved. By default, snapshots are saved on the scratch disk at the top of the Scratch Disks list in the Media Storage panel of the System Preferences. They're automatically saved in a folder named identically to the current project.
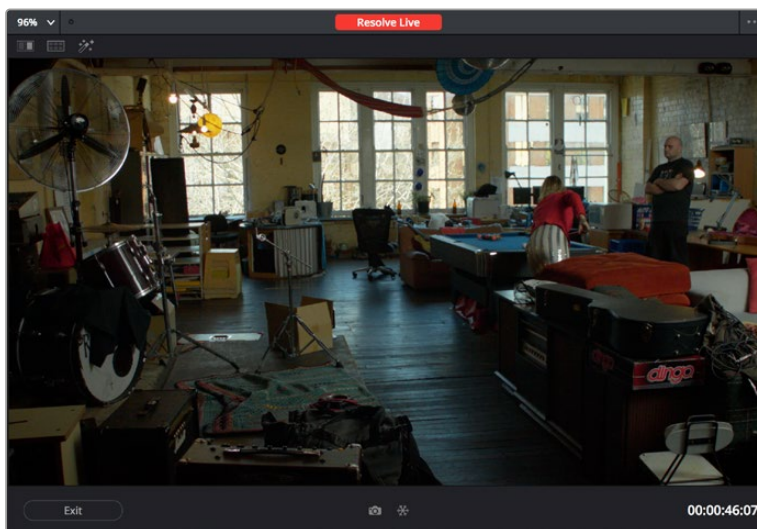
Going Live

Once you've created your day's project, you need to turn on Resolve Live to begin work.

To turn on Resolve Live:

1 Open the Color page.

2 Choose Color > Resolve Live (Command-R).

A red Resolve Live badge at the top of the Viewer indicates that Resolve Live is turned on, and the transport controls are replaced by the Freeze and Snapshot buttons.

A red badge shows that Resolve Live is active
and showing incoming video from the camera

At this point, the video from the connected camera should become visible within the Viewer, the camera timecode should be displayed in the Viewer's timecode window, and you can begin using all of the capabilities of the Color page to begin grading whatever is onscreen, including Gallery split-screens for matching and comparing. The current color adjustments in all palettes are automatically applied to both the image in the Viewer and the video output to an external display (if there is one).

While Resolve Live is on, much of DaVinci Resolve's non-grading functionality is disabled, so when you're finished, be sure to turn Resolve Live off.

To turn off Resolve Live, do one of the following:
– Click the Exit button at the bottom left-hand corner of the Viewer.
– Choose Color > Resolve Live (Command-R).

Using Freeze

In Resolve Live mode, the Freeze button (it looks like a snowflake) freezes the current incoming video frame, so you can grade it without being distracted by motion occurring during the shoot. When you've made the adjustment you need, you can unfreeze playback in preparation for grabbing a snapshot.

To freeze incoming video:
– Click the Freeze button (that looks like a snowflake).
– Choose Color > Resolve Live Freeze (Shift-Command-R).
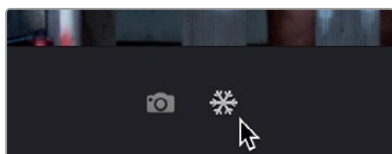
The snowflake button freezes the image so you can grade a particular frame

Using Snapshot

Once you're happy with a grade, clicking the Snapshot button saves a snapshot of the current still in the Viewer, the incoming timecode value, and your grade into the Timeline. Snapshots are simply one-frame clips. They use grades and versions just like any other clip. In fact, ultimately there's no difference between the timeline created by a Resolve Live session and any other timeline, other than that the Resolve Live timeline only has a series of one frame clips, which appear in the Timeline of the Edit page as a series of 1-frame stills.

To save a snapshot, do one of the following:
– Click the snapshot button (with a camera icon).
– Choose Color > Resolve Live Snapshot (Command-Option-R).

The snapshot button saves a frame and the grade for future use

For example, you may begin the process of building and refining a grade for a particular scene during an unrecorded run-through. Then, once shooting starts, you may take snapshots of each shot's slate, and then of significant takes that follow, tweaking where necessary and in conjunction with the DP's feedback once things get going. New camera setups may require further tweaks, which you'll save as snapshots for those shots, and as you work in this way you'll find yourself building up a timeline of snapshots that correspond to that day's shoot.

As you work, keep in mind that you must temporarily turn Resolve Live off in order to open a grade from a previous snapshot in the Timeline, in order to use it as a starting point for another shot. You can also save grades into the Gallery.

Using Resolve Live Grades Later

Since each Snapshot you capture during a Resolve Live session contains timecode that was captured from the camera, grades from snapshots with timecode that overlaps recorded camera original media can be synced using ColorTrace when the time comes to start making dailies.

Keep in mind that snapshot grades correspond to the monitored output of the camera during the shoot. If you shot using a raw format, you'll need to use whatever in-camera debayering settings were used for monitoring during the shoot if you want the grades from your snapshots to produce the same result.

For more information on using ColorTrace, see Chapter 145, "Copying and Importing Grades Using ColorTrace."

Using LUTs in Resolve Live Workflows

Many on-set workflows use Lookup Tables (LUTs) to calibrate displays, normalize log-encoded media for monitoring, and preview looks in the video village to test how the current lighting scheme will work with the intended grade. You can apply LUTs using the Lookup Tables section of the Project Setting's Color Management panel, or within a grade as part of a node tree.

However, you can also export LUTs, if necessary for monitor previewing, that you can apply by loading them into a compatible LUT box of some kind, connected in-between the camera's video output and a display, or using a display capable of loading LUTs internally.

If you're exporting LUTs using the Generate 3D LUT command of the Thumbnail timeline's contextual menu, you should limit yourself to using only Primaries palette and Custom Curves palette controls within a single node. These are the only grading controls that can be mathematically converted into a LUT.

When exporting a LUT, any nodes that use Windows or OpenFX will be ignored along with all corrections made within these nodes. All other nodes with Primaries palette and Custom Curves palette adjustments that can be translated into a LUT will have their combined result translated into a LUT. For any nodes that mix supported and unsupported adjustments for LUT export (such as sharpening or blur filtering operations), the unsupported adjustments will simply be ignored. For more information on exporting LUTs, see "Exporting Grades and LUTs" in Chapter 138, "Grade Management."

> **NOTE:** DaVinci Resolve exports LUTs in the .cube format, which is a DaVinci-developed LUT format, with no relation to the Adobe SpeedGrade.cube format.

Chapter 15

Stereoscopic Workflows

DaVinci Resolve has robust support for a wide variety of stereoscopic workflows. Using the built-in tools of the Studio version of DaVinci Resolve, you can edit using stereoscopic clips, grade the resulting program, adjust each clip's stereo-specific properties such as convergence and floating windows, and master stereoscopic output, all within DaVinci Resolve.

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Stereoscopic Workflows

Creating a stereo 3D project is a multi-step process that benefits from careful media organization. This chapter covers how to set up for working on stereoscopic projects, how to import stereoscopic projects, and how to export stereoscopic media.

First, stereoscopic pairs of clips, i.e., the individual left- and right-eye media files, are imported into the Media Pool, organized, and then linked together using the "Stereo 3D Sync" command to create a new set of linked stereo clips. Then, these clips stereo clips can be either edited or conformed to imported project data using a single Timeline. DaVinci Resolve lets you manage left- and right-eye grades and sizing in the Color page using the controls found in the shortcut menu of the Thumbnail timeline, and in the Stereo 3D palette.

If you're using stereoscopic CineForm media, which contains muxed left-eye and right-eye image data that can be decoded by DaVinci Resolve, you still need to go through this process, although you'll be using duplicate clips to populate Left and Right folders with matching sets of clips.

Hardware Requirements for Working in Stereo 3D

With DaVinci Resolve on Mac systems, dual 4:2:2 Y'CbCr stereoscopic video streams are output via SDI from a compatible Blackmagic Design video interface. You can select either Side-by-Side or Line Mesh output to be fed to your stereo 3D-capable display, depending on its compatibility. Alternately, if you turn on the "Enable Dual SDI 3D Monitoring" checkbox in the Video Monitoring group of the Master Settings panel of the Project Settings, your compatible Blackmagic Design video interface outputs full resolution 4:2:2 Y'CbCr for each eye to compatible displays.

When setting up a 3D-capable DaVinci Resolve workstation, keep in mind that the dual video streams of 3D projects make greater demands on disk bandwidth, media decoding via your workstation's CPU, and effects processing via your workstation's available GPU cards.

Setting Up to Display Stereo 3D via SDI

All DaVinci Resolve systems can output a side-by-side frame-compatible signal that can be viewed on a stereo 3D-capable display via a single SDI connection, output from a DeckLink HD Extreme card or better. For higher-quality monitoring, two SDI signals can be used to output the left-eye and right-eye images separately at full resolution using one of the following Blackmagic Design video interfaces:

– DeckLink HD Extreme 3D+

– DeckLink 4K Extreme

– DeckLink 4K Extreme 12G

– DeckLink 8K Pro

– UltraStudio 4K

– UltraStudio 4K Extreme

– UltraStudio 4K Extreme 3

Very old legacy systems accomplish this via NVIDIA dual SDI monitoring outputs.

> **NOTE:** If your stereo display is not capable of multiplexing the two incoming SDI signals by itself, you can accomplish this using an external device to multiplex both SDI signals into a single stereo 3G signal that will be compatible. Check with your display manufacturer in advance to see if this is necessary.

The following procedures describe how to set up stereo 3D monitoring in two different ways.

Monitoring via dual SDI to dual SDI:

1 Open the Master Settings panel of the Project Settings, then do the following:

– Make sure the Use 4:4:4 SDI checkbox is unchecked.

– Turn on the "Use dual outputs on SDI" checkbox.

2 Open the Stereo 3D palette in the Color page, and do the following:

– Set Vision to Stereo.

– Set the Out pop-up menu to None.

> **NOTE:** When "Enable dual SDI 3D monitoring" is turned on, split-screen wipes and cursors will not be visible on the grading monitor, nor will you be able to view image resizing.

Setting Up to Display Stereo 3D via HDMI

If your stereo-capable display only has HDMI input, you'll need to use the HDMI output of a compatible Blackmagic Design video interface that has HDMI 1.4 or better to output stereo 3D signals; see the documentation accompanying your video interface for more information.

Supported Stereo 3D Media

When importing stereo 3D media from other applications, there are two types of media that are compatible with DaVinci Resolve stereoscopic workflows.

Using Dual Sets of Media in Any Supported Format

When originally shot, the media corresponding to stereo 3D workflows consists of two directories, one for the left-eye media, and one for the right-eye media. For the most automated workflow possible, this media must be tightly organized. Each pair of left-eye and right-eye media files in both directories should have matching timecode, and reel numbers that clearly indicate which are the left-eye shots, and which are the right-eye shots. When organized in this way, it's relatively easy to use DaVinci Resolve to convert each matching pair of clips into the stereo 3D clips that you'll need to work in DaVinci Resolve. This process is covered in detail in a subsequent section.

Using Stereoscopic OpenEXR Media

DaVinci Resolve is compatible with stereo OpenEXR files to accommodate professional cinema and specialty workflows. Stereo OpenEXR clips include the media for both eyes stored as separate parts so that a single OpenEXR file may output either a single image or stereo 3D images when used with an application that supports it, such as DaVinci Resolve. This means you can edit stereo OpenEXR media, grade it, and make all of the stereoscopic adjustments that the Stereo palette of the Color page supports.

If you import stereo OpenEXR clips to the Media Pool, they will at first appear to be regular non-stereo clips that output a single image. However, these can easily be converted to stereo 3D clips using the following procedure.

To set stereo OpenEXR clips to be usable as stereo clips:

1 Import the OpenEXR media to the Media Pool as you would any other clips.

2 Select one or more OpenEXR clips, then right-click the selection and choose "Convert to Stereo" from the contextual menu. Those clips will now appear with a stereo 3D badge to indicate that they're stereo.

Using Stereoscopic CineForm Media

DaVinci Resolve is also compatible with CineForm stereo QuickTime files. CineForm clips encode the media corresponding to both eyes and mux (multiplex) it together in such a way so that CineForm files may output either a single frame of image data, if used in an application that is not capable of stereoscopic processing, or stereo 3D media when used with an application that is, such as DaVinci Resolve. This means that you can edit CineForm media using nearly any NLE, export a project via whatever workflow is convenient, and end up with a stereoscopic project that can be graded in DaVinci Resolve.

There are two ways of creating CineForm files. One is by using a camera or recording system that processes dual synchronized video signals to create a single set of CineForm media. The other is to use the CineForm conversion tools that come with GoPro CineForm Studio to reprocess dual sets of stereo 3D assets into the CineForm format.

The CineForm codec itself encodes full-frame image data using wavelet compression, at any resolution, at up to 12-bits, in a choice of RGB, Y'CbCr, or RAW color spaces. DaVinci Resolve is compatible with CineForm in a QuickTime wrapper using any supported color space, allowing access to the dual streams of image data that are provided.

When the time comes to output your program, keep in mind that while DaVinci Resolve can read CineForm files, CineForm files cannot be rendered out of DaVinci Resolve unless you've purchased an encoding license for OS X or Windows from GoPro. Furthermore, DaVinci Resolve cannot render Stereoscopic CineForm files.

If you import stereo CineForm clips to the Media Pool, they will at first appear to be regular non-stereo clips that output a single image. However, these can easily be converted to stereo 3D clips using the following procedure.

To set stereo CineForm clips to be usable as stereo clips:

1   Import the CineForm media to the Media Pool as you would any other clips.

2   Select the CineForm media you need to convert, then right-click the selection and choose "Convert to Stereo" from the contextual menu. Those clips will now appear with a stereo 3D badge to indicate that they're stereo.

Creating Stereo 3D Clips From Separate Files

If you're working with stereo media that was either captured or created as individual left- and right-eye files, then you need to convert each matching pair of clips into the stereo 3D clips that you'll need to work in DaVinci Resolve. This is a two-step procedure.

Step 1—Import and Organize Your Media

You need to import all of the left-eye and right-eye media into separate bins.

1   Open the Media page, and create three Media Pool bins named "Left," "Right," and "Stereo Clips." The exact names are not important, but the way the media is organized is.

2   Import all left-eye media into the "Left" bin, and all right-eye media into the "Right" bin. If you're importing stereoscopic Cineform media, you still need to create this kind of organization, which requires you to place duplicates of each clip into each of the "Left" and "Right" bins.

Step 2—Generate 3D Stereo Clips

Once you've organized your media appropriately, you're set up to synchronize the left- and right-eye clips using timecode.

1   Create a new bin in the Media Pool, and name it "Stereo Clips." This is the bin that will eventually contain the linked stereo clips you're about to create.
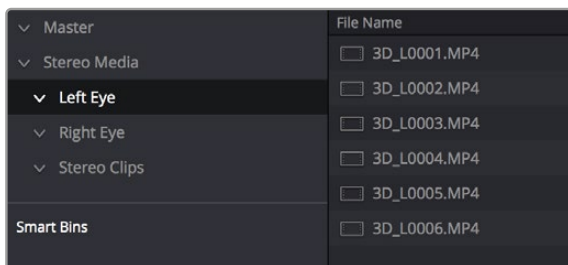
How to organize media for working in stereo 3D

2   Right-click anywhere within the Media Pool and choose Stereo 3D Sync.

The Stereo 3D Sync dialog appears, with buttons for choosing the left-eye folder, choosing the right-eye folder, choosing the output folder, and checkboxes for specifying whether to match reel names and file names, and additional fields for entering characters that identify left- and right-eye clips.
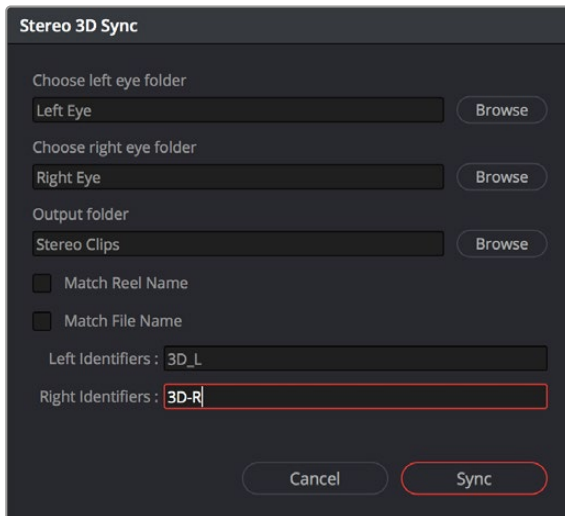
The Stereo Media Sync window

3   Click the Browse button corresponding to "Choose left eye folder" and then use the hierarchical list of bins that appears to choose the bin you named "Left." Follow the same procedure to choose the right-eye media.

4   Click the Browse button corresponding to "Output folder" and then use the hierarchical list of bins that appears to choose the bin you named "Stereo Clips."

5   Choose which matching criteria to use. Ideally, you only need to use whichever one of the three criteria that apply. The three options are:

   – **Match Reel Name:** If the reel names of the left- and right-eye media match, turn this checkbox on.

   – **Match File Name checkbox:** If the file names of the left- and right-eye media match, turn this checkbox on.

   – **Left Identifiers and Right Identifiers fields:** If the left- and right-eye clips are identified by a special subset of characters within the file name (for example, "3D_R" and "3D_L"), then you can type each into the appropriate field, and these characters will be used to match the left and right eyes together.

6   Click Sync.

The original clips in the Left and Right bins disappear, and a full set of Stereo 3D clips appear in the output bin you selected in step four.
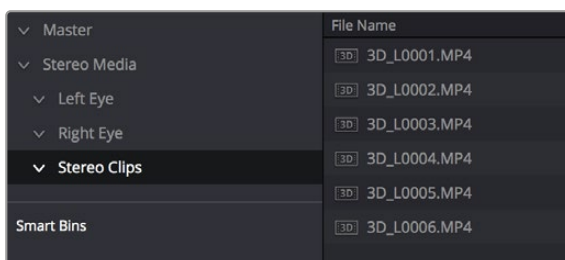
Final stereo clips, ready to be edited and graded

Step 3—(Optional) Create Optimized Media

If your stereo media is excessively large, you can create optimized media.

1   Select the stereo clips you've created.

2   Right-click one of the selected clips, and choose Generate Optimized Media from the contextual menu. A window appears showing you how long it will take to finish creating optimized media.

Monitoring Stereoscopic 3D in the Edit Page

You can now view a Stereoscopic 3D signal directly from the Edit page. Previously, the Edit page was restricted to left eye for both outputs. The Edit Page Viewer now displays Stereoscopic 3D identically to the Color page Viewer. The 3D palette in the Color page has the stereoscopic controls to select the stereo viewing options (Side by Side, Anaglyph, Line by Line, etc.), as well as adjusting the convergence and other stereoscopic parameters.

Converting Clips Between Stereo and Mono

You also have the option of converting clips between mono and stereo 3D using a pair of commands in the Media Pool.

Converting Stereo Clips Back to Mono

If necessary, you can split one or more stereo clips into mono clips using a single command.

To convert stereo clips into mono clips:

1   Select one or more stereo clips in the Media Pool.

2   Right-click one of the selected clips and choose Split Stereo 3D Clips from the contextual menu.

Afterwards, two new bins are created named Left and Right, containing the individual left- and right-eye clips that you've split apart.

Converting Mono Clips or an Entire Timeline to Stereo

Non-stereo clips (for which there are not separate left- and right-eye media files) can be converted into stereo clips either individually or throughout an entire timeline for one of two different reasons:

– You can convert non-stereo clips into stereo for use in a stereo project, so they output properly along with the rest of a stereo timeline, albeit without adjustable convergence or depth effects.

– If you want to grade an HDR and non-HDR version of your program at the same time, converting non-stereo clips to stereo makes it possible for you to a) manage two separate SDR and HDR grades for each clip in a timeline using the left- and right-eye channels, and b) output the SDR and HDR signals separately via your compatible Blackmagic Design interface's left- and right-eye SDI outputs when you turn on the "Use dual outputs on SDI" checkbox in the Video Monitoring section of the Master Settings panel of the Project Settings.

To convert mono clips into stereo clips:

1   Select one or more non-stereo clips in the Media Pool.

2   Right-click one of the selected clips and choose Convert to Stereo from the contextual menu.

Afterwards, that clip appears in the Media Pool as a Stereo 3D clip, and when edited into a timeline, can expose its controls in the 3D Stereo palette in the Color page.

If you have a timeline full of clips that you've just converted into stereo using the above procedure, you need to take the additional step of setting the Timeline to stereo in order to create stereo grades for each clip.

To convert a timeline to have stereo grades for simultaneous HDR/SDR output while grading:

– Right-click a timeline in the Media Pool and choose Timelines > Set Timeline to Stereo.

For more information about using stereo timeline workflows for simultaneous HDR and SDR grading, see Chapter 9, "Data Levels, Color Management, and ACES."

Attaching Mattes to Stereo 3D Clips

If you have left- and right-eye mattes that need to be attached to stereo clips, the process works identically to importing mattes for regular clips, except that when you've selected a stereo 3D clip in the Media Pool, you have two matte import commands, "Add As Left Eye Matte," and "Add As Right Eye Matte."

Organizing and Grading Stereo 3D Dailies

A common workflow is the creation of digital dailies within DaVinci Resolve before editing in an NLE. This provides the editors, director, and producers with the advantage of having more attractive media to work with, that's also more comfortable to view if handled with the automatic geometry and color-matching functions that match the media of each pair of shots together for a preliminary left- and right-eye balance. The resulting Timelines can then be output to whichever media format is most convenient to use.

Step 1—Create 3D Stereo Clips

The very first step in the process of creating dailies is to import all of the left-eye and right-eye media into individually organized bins, and to then link them together to create stereo 3D clips, as described in the previous section.

Step 2—Edit the New Stereo Clips Into One or More Timelines for Grading

Now that you've created a set of Stereo 3D clips, you're ready to edit them into one or more Timelines for grading. You can do this by simply creating a new Timeline and deselect the Empty Timeline checkbox. A new Timeline will be created with the stereo 3D clips you created.

Step 3—Align Your Media

For the stereoscopic effect to work without causing headaches, it's critical that both eyes are aligned. This can be tricky to adjust using manual controls, but is something that can be automatically analyzed. You can perform stereo 3D alignment to a single clip using the Stereo 3D Palette controls, or you can select a range of clips to align all of them automatically at once. There are two methods of alignment; which is more appropriate depends on the type of geometry issues you have to address.

– **Transform Alignment:** Analyzes the image and makes vertical and rotational adjustments to line up the left- and right-eye images as closely as possible.

– **Vertical Skew:** Analyzes the images and makes a vertical-only adjustment to line up the left- and right-eye images.

Controls for aligning the left- and right-eye media

Step 4—Grading Stereo Media

Grade the clips in the Timeline as you would any other digital dailies, with the sole addition of using the controls in the Stereo 3D palette to control monitoring and manage the adjustments made to each eye as necessary. As when creating any other kind of dailies, you can use LUTs, the Timeline Grade, and individual clip grading to make whatever adjustments are necessary to create useful media for editing.

Grading Windows

If you're using windows, The Color group of the General Options panel of the Project Settings has a checkbox called "Apply stereoscopic convergence to windows and effects" that correctly maintains the position of a window that's been properly placed over each eye when convergence is adjusted.
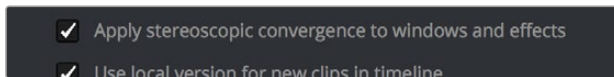

You must turn on a checkbox in the Project Settings to enable stereo convergence for windows

When this option is enabled, the Window palette displays an additional Transform parameter, "Convergence," that lets you create properly aligned convergence for a window placed onto a stereoscopic 3D clip.
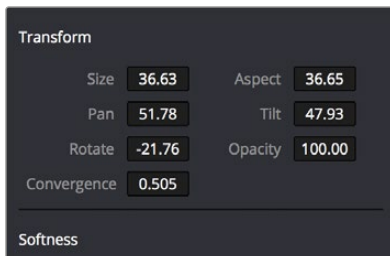
The Convergence control in the Transform section of the Window palette

After placing a window over a feature within the image while monitoring one eye, you can enable Stereo output in the Stereo 3D palette and use the Pan and Convergence controls to make sure that window is properly stereo-aligned over the same feature in both eyes. At that point, adjusting the Convergence control in the Stereo 3D palette correctly maintains the position of the window within the grade of each eye.
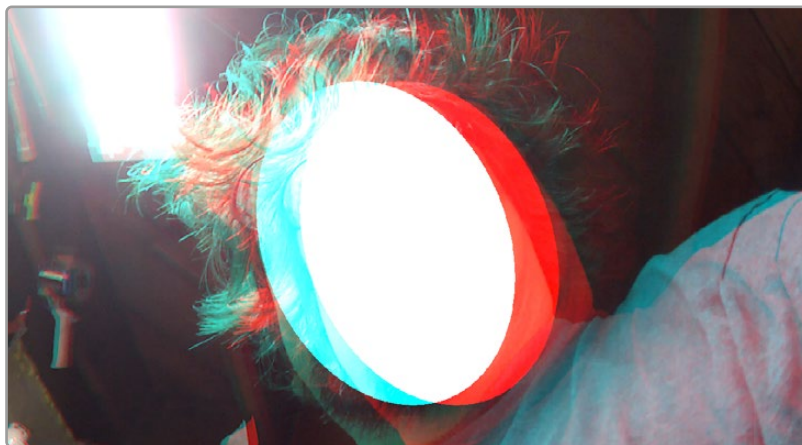
A convergence-adjusted window in stereo

Matching Media From Left and Right Eyes

To help you manage the visual differences between left- and right-eye clips, there are also three automatic color matching commands that can be used to batch process as many clips as you need to adjust at once.

– **Stereo Color Match (Primary Controls):** Uses the Lift/Gamma/Gain controls to match one eye to the other. The result is a simple adjustment that's easy to customize, but may not work as well as Custom Curves in some instances.

– **Stereo Color Match (Custom Curves):** Uses the Custom Curves to create a multipoint adjustment to match one eye to the other. Can be more effective with challenging shots.

– **Stereo Color Match (Dense Color Match):** Performs a pixel by pixel, frame by frame color match that is incredibly accurate. This operation is processor intensive, so if you're going to batch process many clips, or if you're matching long clips, you'll want to make sure you have adequate time. Because this is such a precise match, it's recommended to use Dense Color Match after you've used one of the stereo alignment commands.
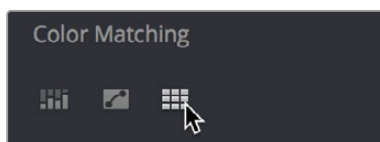
Controls for matching the grade of the left and right eye media

Step 5—Output Offline or Online Media for Editing

When you're done applying whatever grading is necessary to make the media suitable for editing, you'll need to export each clip as separate left- and right-eye clips using the controls of the Deliver page.

1   Open the Deliver page, and set up your render to output the format of media you require. Be sure to do the following:

– Set Render Timeline As to Individual source clips.

– Turn on the "Filename uses Source Name" checkbox.

– To render both eyes' worth of media, choose "Both eyes as" from the Render Stereoscopic 3D option, and choose Separate Files from the accompanying pop-up menu. Optionally, you could also choose to render only the left-eye or right-eye media.

2   Choose how much of the Timeline to render from the Render pop-up menu in the Timeline toolbar; to render everything, choose Entire Timeline.

3   Click "Add Job to Render Queue."

4   Click Start Render.

DaVinci Resolve will now render either two sets of left- and right-eye clips, or one set of media corresponding to the eye you chose.

To make sure that the resulting edited project conforms easily to the originating DaVinci Resolve project, it's important to be sure that you render individual source clips, and that you turn on the "Filename user Source Name" checkbox, in order to clone the timecode, reel numbers, and file names of the source media.

Conforming Projects to Stereo 3D Media

Since DaVinci Resolve manages stereo via a single set of specially created stereo 3D clips, you can use the same project import methods to import stereo 3D projects as you would for any other project. Only a single imported timeline is necessary.

This also means that you can edit stereo projects in NLEs that aren't otherwise stereo-aware, and finish them in full stereo 3D in DaVinci Resolve. To do this, you need to make sure that you edit the left-eye media in your NLE, and then export either an EDL or XML file to conform in DaVinci Resolve.

To conform an EDL to stereo 3D media:

1   Open the Media page, and create the necessary set of stereo 3D clips that will correspond to the project you're going to import, as described previously.

Open the Edit page, and then use the Import AAF/EDL/XML command to import your edit.

2   When the Load EDL/XML dialog appears, do the following:

– If importing an EDL, verify that the frame rate is correct, and click OK.

– If importing XML, make sure you turn off the "Automatically import source clips into Media Pool" checkbox, since you want to relink the imported project to the stereo 3D clips you created in step one.

The left-eye media timecode and reel information that's embedded within each stereo 3D clip will be used to conform the stereo 3D clips with the imported EDL, and you should be ready to work.

## Grading Mastered Stereoscopic Media From Tape

If you've been handed a stereo 3D muxed tape with a mastered program that needs to be graded, but you haven't been given a project file or EDL, you can ingest it as individual left- and right-eye media files with a supported VTR, such as HDCAM SR with 4:2:2 x 2 mode, by turning on the "Use left and right eye SDI" checkbox in the Capture and Playback panel of the Project Settings. When muxed stereoscopic signals are ingested, each eye is separated into individual left-eye and right-eye image files

Once ingested, you can use Scene Detection to split the left-eye media in one bin, and to create an EDL, you can use to split the right-eye media in the same way in another bin, so that you can create a sequential set of stereo clips for grading.

Adjusting Clips Using the Stereo 3D Palette

Once you've either created or imported a stereoscopic 3D-identified timeline, you're ready to begin grading. The left eye will be displayed in the Edit and Color pages by default; however, you can right-click on the Timeline and select Stereo 3D Mode to view the other eye. Most colorists work by grading one eye first (typically the left), and rippling their grades to the other eye, making separate adjustments to each eye's clips when necessary to match undesirable variation between cameras. DaVinci Resolve lets you do this automatically.

Setting up stereo 3D media enables the Stereo 3D palette on the Color page. This palette contains all the controls necessary for working on stereoscopic projects. It provides controls for choosing which eye to grade, adjusting convergence, swapping and copying grades and media between matching left- and right-eye clips, auto-processing the color and geometry of left- and right-eye clips to match, stereo 3D monitoring setup, and controls for floating windows.
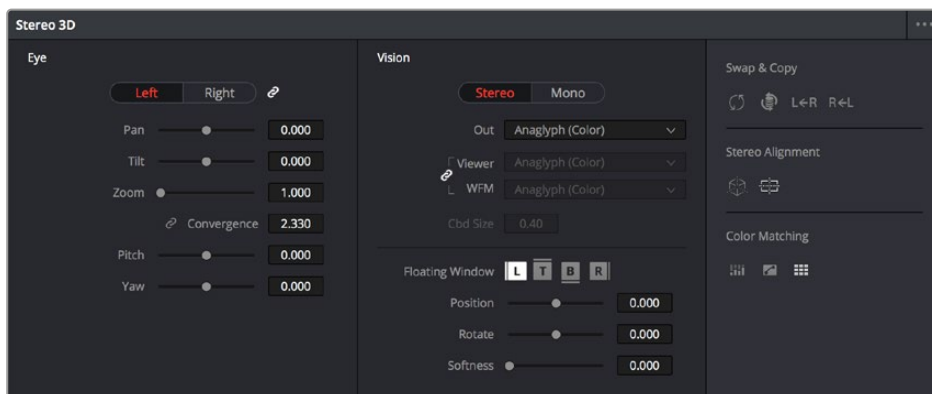

Stereoscopic 3D palette

Your project must contain stereo 3D clips in order to open this palette. For more information on setting up a stereo 3D project, see the "Creating Stereo 3D Clips" section of this chapter.

Stereo Eye Selection

Most colorists work by grading one eye first (typically the left), and rippling their grades to the other eye, making separate adjustments to each eye's clips when necessary to match undesirable variation between cameras.

The first three buttons in the Stereo 3D palette let you choose which eye to grade while you're working, as well as whether or not to ripple each clip's grade to the matching opposite-eye clip. Whenever you switch eyes, the 3D badge above each clip's thumbnail changes color (blue for right, red for left) and the thumbnails themselves update to show that eye's media.
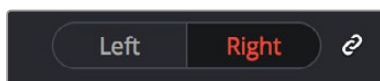
The Left eye is master and ganged with the Right

– **Left button:** Displays the left-eye image and grade.

– **Ripple Link button:** When enabled (orange), all changes you make to the grade of the currently selected eye are automatically copied to the correspondingly opposite eye. When disabled (gray), grades made to the currently selected eye are made independently.

– **Right button:** Displays the right-eye image and grade.

You can also choose which eye you're viewing and grading by right-clicking a clip's thumbnail and choosing Stereo 3D > Switch Eye or by choosing View > Switch Eye To > Left Eye or Right Eye.

Using Ripple Link When Grading Stereo 3D Clips

You would turn Ripple Link off to suspend rippling when you want to make an individual adjustment to the grade of one eye to obtain a better match between the two. When you're finished matching the two clips, you can turn it back on to resume automatic grade rippling.

Stereo 3D grade rippling is always relative, so differences between the grades that are applied to the left- and right-eye clips are preserved. In fact, when you add or remove nodes to or from one eye, the same nodes are automatically added to or removed from the corresponding clip it's paired with, regardless of whether or not Ripple Linked is enabled.

> **IMPORTANT**
>
> Regardless of whether or not Ripple Link is enabled, local versions created for one stereo 3D-identified clip are automatically available to the paired timeline.

Stereo 3D Geometry Controls

The next group of parameters lets you adjust the geometry of stereo 3D clips. The Pan, Tilt, and Zoom controls are provided as a convenience, and simply mirror the same parameters found in the Transform palette's Input mode, but made specific to the geometry of the left- and right-eye media. Convergence, Pitch, and Yaw are the three parameters that are unique to the Stereo 3D palette.
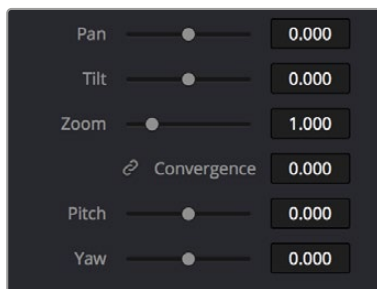
Stereoscopic 3D Geometry controls

– **Convergence:** Adjusts the disparity between the left and right eyes, to define the point of convergence (POC), or the region within the image where the left- and right-eye features are in perfect alignment. If necessary, Convergence can be animated using the Stereo Format parameter group in the Sizing track of the Keyframe Editor. If you want to adjust convergence in pixels, open the Stereo 3D palette option menu, and turn on "Show convergence in pixels."

Features that overlap perfectly in both right- and left-eye clips are at zero parallax, putting that feature's depth at the screen plane. Matching features that are divergent in the left- and right-eye clips have increasingly positive parallax, and appear to be farther away from the audience. Matching features that are divergent and reversed in the left- and right-eye clips have increasingly negative parallax, and appear to be closer to the audience than the screen plane.

– **Linked Zoom button:** When enabled (white), both the left- and right-eye clips are automatically zoomed whenever Convergence is adjusted so that both eyes always fill the screen. When disabled (gray), changes to Convergence will cause the opposing left and right edges of each eye's clip to have blanking intrude.

– **Pitch:** Pivots the image around the horizontal center plane of the frame.

– **Yaw:** Pivots the image around the vertical center plane of the frame.

Sizing Repositioning in Stereo 3D

Generally, you'll want to reposition stereo 3D clips with Ripple Link turned on, but you may occasionally find yourself needing to make a manual adjustment to one eye in particular with Ripple Link disabled. As with color adjustments, Sizing adjustments made with Ripple Link disabled are only applied to the clip in the current Timeline. When Ripple Link is turned on, all Sizing adjustments are automatically copied to the correspondingly numbered shot of the other stereo 3D timeline.

> **WARNING**
>
> It is not advisable to use the Rotate parameter when transforming stereo 3D clips. Geometrically, rotation tilts a stereo pair of clips inappropriately, and ruins the "side-by-side" convergence that's necessary to create the stereoscopic illusion.

Protecting Stereo Adjustments When Copying Grades

Each version of a grade has independent stereo adjustments stored along with the Sizing settings. To prevent accidental overwrite of convergence and alignment data when copying grades from one clip to another, you can right-click within the Gallery and choose one of the following options to turn them on:

– **Copy Grade:** Preserve Convergence

– **Copy Grade:** Preserve Floating Windows

– **Copy Grade:** Preserve Auto Align

When enabled, these options let you overwrite a clip's grade without overwriting specific Stereo 3D parameters.

> **TIP:** Stereo 3D and Sizing settings are processed before node-based corrections in the DaVinci Resolve image processing pipeline.

Swap and Copy Controls

Another set of controls at the right of the Stereo 3D palette lets you swap and copy grades, and swap clips, in situations where you need to reverse what's applied to a pair of left- and right-eye clips.
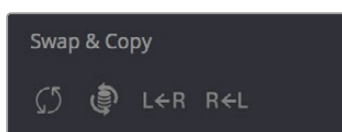
Swap and Copy grades between eyes

– **Swap Grade:** Exchanges the grades that are applied to the left- and right-eye clips.

– **Swap Shot:** A checkbox that, when enabled, switches the actual media used by two corresponding left- and right-eye clips. Useful in situations where the eyes of a stereo 3D clip were mislabeled, and you want to switch the clips without rebuilding both EDLs.

– **Copy Right to Left:** Copies the right-clip grade to the corresponding left-eye clip.

– **Copy Left to Right:** Copies the left-clip grade to the corresponding right-eye clip.

### Batch Grade Management for Stereo 3D Projects

There are also a series of batch-processing commands that are useful for stereoscopic grading that are available when you right-click one or more selected clips in the Thumbnail timeline:

– **Stereo 3D Batch Copy:** Copies every grade from the left-eye clips to the right-eye clips.

– **Stereo 3D Batch Sync:** Copies grades from one eye to the other only when their node graphs have the same number of nodes. This prevents you from accidentally overwriting a custom grade with a different node structure that was necessary to match two eyes for a problem shot.

The Copy Grade, Swap Grade, Swap Shots, Ripple Link, and Switch Eye commands are also available from the Stereo submenu of the Timeline contextual menu.

Automatic Image Processing for Stereo 3D

It's common during stereoscopic shoots for minor divergences in geometry and color to appear in the source footage. To make the process of grading stereo 3D media less onerous, DaVinci Resolve provides a set of auto-adjustment controls at the right of the Stereo 3D palette that gives you a starting point for matching left- and right-eye clips together.
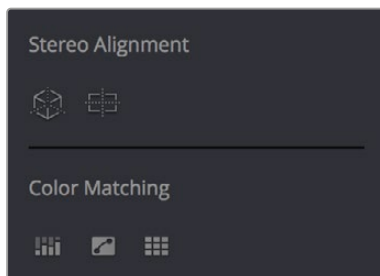
Auto align and color match buttons

Options for Auto Processing

You can choose which frame should be used to automatically analyze and process stereo clips using the Alignment and Matching controls from the Stereo 3D palette option menu. You can choose Auto Process > First or Middle, depending on what works best for your media.

Auto Process—Stereo Alignment

For the stereoscopic effect to work without causing headaches, it's critical that both eyes are aligned. This can be tricky to adjust using manual controls, but is something that can be automatically analyzed. You can perform stereo 3D alignment to a single clip, or you can select a range of clips to align all of them automatically at once. There are two options. Which is more appropriate depends on the type of geometry issues you're needing to address.

– **Transform Alignment:** Analyzes the image and makes vertical and rotational adjustments to line up the left- and right-eye images as closely as possible.

– **Vertical Skew:** Analyzes the images and makes a vertical-only adjustment to line up the left- and right-eye images.

To align one or more clips automatically:

1   Select one or more stereo clips in the Thumbnail timeline of the Color page.

2   Choose which frame of each clip you want to use for the analysis by opening the Stereo 3D palette, clicking the Option menu, and choosing Auto Process > First or Auto Process > Middle.

3   Click either of the Stereo Alignment buttons. The button to the left is for Automatic Transform, while the button to the right is for Automatic Vertical Skew.

If you selected multiple clips, then the Stereo Alignment window appears, and a progress bar shows the remaining time this operation will take.

Auto Process—Color Matching

Due to the design of different stereo 3D rigs, sometimes the color and contrast of one eye's media doesn't precisely match that of the corresponding eye. DaVinci Resolve provides two commands for quickly and automatically matching two eyes together.

– **Stereo Color Match (Primary Controls):** Uses the Lift/Gamma/Gain controls to match one eye to the other. The result is a simple adjustment that's easy to customize, but may not work as well as Custom Curves in some instances.

– **Stereo Color Match (Custom Curves):** Uses the Custom Curves to create a multipoint adjustment to match one eye to the other. The result can be more effective with challenging shots.

– **Stereo Color Match (Dense Color Match):** Performs a pixel by pixel, frame by frame color match that is incredibly accurate. This operation is processor intensive, so if you're going to batch process many clips, or if you're matching long clips, you'll want to make sure you have adequate time. Because this is so precise match, it's recommended to use Dense Color Match after you've used one of the stereo alignment commands.

> **TIP:** For the best results, it's recommended to use automatic color matching in a separate node, independent of other corrections.

Stereo 3D color match works differently depending on whether or not one of the stereo 3D-paired clips has already been graded. The following procedure shows how to match a pair of left- and right-eye clips before you make any manual adjustments of any kind.

To match a pair of left- and right-eye clips automatically:

1   Select one or more clips in the Thumbnail timeline of the Color page.

2   Open the Stereo 3D palette, and click one of the three Color Match controls.

The Color Matching window appears, and a progress bar shows the remaining time this operation will take. You can also use automatic color matching to match an ungraded clip to a paired clip that's already been graded. This only works for grades consisting of one or more primary corrections; secondary corrections cannot be auto-matched.

To match an ungraded clip automatically to a paired stereo clip that's graded:

1   To suspend stereo grade linking temporarily:

– Open the Stereo 3D palette, and turn off the Ripple Link button.

– Right-click the Thumbnail timeline, and choose Stereo 3D > Ripple Link > Solo.

2   Make a primary adjustment to a clip in the left-eye timeline to create a simple base grade. The left-eye clip now has a grade, and the right-eye clip does not.

3   Do one of the following to switch eyes:

– In the Stereo 3D palette, click Right.

– Right-click the Thumbnail timeline again, and choose Stereo 3D > Switch Eye.

This procedure only works when you use the Stereo Color Match commands on the ungraded clip of a left- and right-eye stereo pair, to match it to the graded clip.

4   To make the match, do the following:

– In the Stereo 3D palette, click one of the three color match controls.

Both clips should match one another very closely.

Stereo 3D Monitoring Controls

To output both eyes to a stereo 3D display, you need to click the Vision: Mono or Stereo button, and then choose a display mode from the Out pop-up menu.
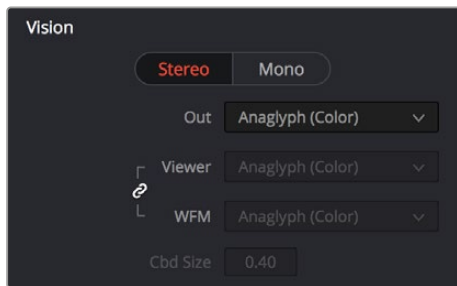
Monitoring controls for Stereo 3D

– **Vision:** Click a button to choose between Stereo, where both eyes can be displayed in the Viewer and output to video in a variety of different formats, and Mono, where only one eye is monitored in the Viewer and your video output interface.

– **Out:** A pop-up menu that provides different stereo viewing options for previewing stereo 3D signals in different ways. By default, this option is also linked to the Viewer display Internal Video Scope options. For detailed descriptions of each stereo 3D viewing mode, see the following section, "Stereo 3D Output Options."

– **Link button:** When enabled, the Viewer and internal video scopes both use the Out pop-up menu's option for stereo 3D viewing. When disabled, you can choose different stereo 3D viewing options for the Viewer and internal video scopes.

– **Viewer:** Lets you choose a stereo 3D viewing option for the Viewer.

– **WFM:** Lets you choose a stereo 3D viewing option for the internal video scopes.

– **Cbd Size:** If any stereo 3D viewing options are set to Checkerboard, this parameter becomes enabled, and lets you define the size of the checkerboard boxes, in pixels.

Dual 4:2:2 Y'CbCr stereoscopic video streams are output via HD-SDI on selected Blackmagic I/O devices when you turn on the "Use left and right eye SDI output" checkbox on the Master Settings panel of the Project Settings. You can select either Side-by-Side or Line-by-Line output to be fed to your stereo-capable display, depending on your display's compatibility.

Stereo 3D Output Options

Additionally, the Viewer and video scopes can be set to display both "eyes" in one of a variety of different modes.

– **Side by Side:** Displays both images side by side. Each eye is squeezed anamorphically to fit both eyes into the same resolution as the GUI viewer.

– **Top and Bottom:** Displays both images one over the other. Each eye is squeezed vertically to fit both eyes into the same resolution as the GUI viewer.

– **Line by Line (Even/Odd):** An interlaced mode where each eye is displayed on alternating lines. The thickness of the lines as seen in the Viewer depends on how zoomed in you are.

– **Checkerboard:** Displays both eyes via an alternating checkerboard pattern. This is an excellent mode for identifying regions of the image where there's variation in color or geometry between the two eyes.

– **Anaglyph (B/W):** Each eye is desaturated and superimposed via Red/Cyan anaglyph to show the disparity between both eyes in different regions of the image. Left-eye divergence is red, and right-eye divergence is cyan. Regions of alignment between both eyes appear grayscale.

Anaglyph modes are useful for evaluating the geometric differences between both eyes, as well as for identifying the point of convergence (where both eyes align most perfectly) that places a region of the image at the screen plane.

Red/cyan color coding also identifies the direction of parallax. For any given feature, disparity such that red is to the right and cyan is to the left indicates positive parallax (backward projection away from the audience). Red to the left and cyan to the right indicates negative parallax (forward projection towards the audience).

– **Anaglyph (Color):** Similar to Anaglyph (B/W), except that regions of close alignment are shown in full color. Incidentally, both anaglyph modes can be previewed on ordinary displays using old-fashioned red/cyan anaglyph glasses, enabling stereo 3D monitoring on non-stereo 3D-capable displays.

– **Difference:** Superimposes grayscale versions of both eyes using the difference composite mode. Corresponding left/right-eye pixels that are perfectly aligned appear black, while pixels with disparity appear white. This mode is extremely useful for evaluating geometric differences between both eyes, as well as for identifying the point of convergence, without the distraction of color that the anaglyph modes present.

> **NOTE:** Only displays the eye corresponding to the currently selected timeline in the Viewer. However, this option also works in conjunction with the "Use Dual Outputs on SDI" checkbox in the Master Settings of the Project Settings which, when turned on, outputs each eye to an individual HD-SDI output of your Blackmagic I/O card.


The Viewer set to display an anaglyph stereo image in color

Floating Windows

Floating Windows are meant to correct for "Window violations," where elements of the image with negative parallax, that project forward from the screen plane towards the audience, are cut off by the edge of the frame. In these instances, differences between the images being shown to the left and right eyes can result in a visual paradox that's difficult for viewers to reconcile. Specifically, when a forward-projecting element is cut off by the left or right edge of the frame, one eye sees things that the other eye does not.

If the subject is moving quickly, this may not be an issue, but if the cut off (or occluded) element lingers onscreen, it causes problems for viewers that defeat the stereo 3D illusion. The viewer's binocular vision (or stereopsis) is providing one depth cue, while occlusion is providing a completely different depth cue.

To fix this, you can use Floating Windows to crop the cut off object from the eye on the side of the object that's cut off, thus eliminating the portion of the stereo image that is unseen to the other eye that causes the problem.
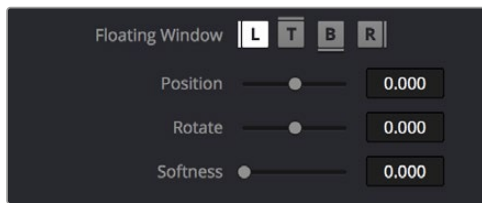
Floating Window controls

The objective of using Floating Windows is to manipulate the illusion of the viewer's "window into the scene." In addition to fixing Window violations, it has been proposed that Floating Windows can be used as a creative tool by manipulating the geometry of this Window to alter subtly the viewer's perception of the screen orientation.

– By cropping the right-hand side of the right-eye frame, you also create the illusion that the right edge of the "window into the image" is tilted farther forward toward the viewer.

– By cropping the left-hand side of the left-eye frame, you create the illusion that the left edge of the Window is tilted toward the viewer.

– If you crop both the left-hand side of the left-eye frame and the right-hand side of the right-eye frame, you create the illusion that the entire plane of the "virtual screen" is coming toward you.

– If you apply opposite-angled Windows to the left- and right-eye clips at one or both of the edges of the frame, it appears to "tilt" the screen toward or away from the viewer.

Animating Floating Windows

Floating Windows can be animated using the Float Window keyframing track, found within the Sizing track of the Keyframe Editor, to push the edge of the frame in as needed, and then pull it back out when the partially occluded subject has moved fully into the frame. For more information about animating keyframing tracks, see Chapter 144, "Keyframing in the Color Page."

Floating Windows have the following controls and parameters.

– **L/R/T/B buttons:** Lets you choose an edge to which to apply a Floating Window. Click the button corresponding to the edge you want to adjust. Each edge has its own position, rotate, and softness settings.

– **Position:** Adds masking to the currently selected edge.

– **Rotate:** Rotates the currently selected edge, letting you create an angled Window.

– **Softness:** Feathers the edge of the currently selected edge, letting you create a soft Window that can be less noticeable to viewers.

To add a Floating Window to fix a Window violation:

1   Choose to which eye you want to add the Floating Window.

– To apply a Floating Window to eliminate a Window violation on the right-hand side of the screen, click the right eye view.

– To apply a Floating Window to eliminate a Window violation on the left-hand side of the screen, click the left eye view.

2   Choose which edge you want to adjust by clicking the L or R buttons.

– To eliminate a Window violation on the right-hand side, click R.

– To eliminate a Window violation on the left-hand side, click L.

3 Adjust the Position parameter as necessary to crop the portion along the edge of the selected eye that's not visible in the other.

4 Optionally, if you feel that the Window adjustment you've just made is too obvious, increase the Softness parameter to make that edge less noticeable.

Stereo Controls on the DaVinci Control Panel

If you're doing convergence adjustments and stereographic work throughout a program, you can use many of the controls described in this section from the DaVinci control panel.

To show the Stereo transform controls page on the Transport panel:

1 Press the 3D soft key. The Transport panel's knobs and soft keys are remapped with all available Stereoscopic commands.

2 When you're finished, press MAIN.

**To show the Floating Windows controls on the Center panel:**

1 From the main page of the Center panel, press the 3D soft key. The Floating Windows, Auto Match, and Auto Align controls appear on the Center panel.

2 Press the 3D OVERLAY soft key to expose the Stereoscopic sizing controls on the Transport panel. Press 3D OVERLAY again to return to the ordinary sizing controls.

3 When you're finished, press the MAIN soft key to exit the 3D control page.

Outputting Stereo 3D Media in the Deliver Page

To render full frame media, you'll need to render each stereo 3D eye separately using the controls of the Deliver page, outputting whatever media format is required by the client.

Rendering Frame-Compatible Media

Frame-compatible media has both the left- and right-eye images squeezed anamorphically into a single media file. To create frame-compatible media, choose the "Both eyes as" option from the Render Stereoscopic 3D controls at the bottom of the File output options of the Deliver page, and then choose a method of output from the Mesh Options pop-up menu.
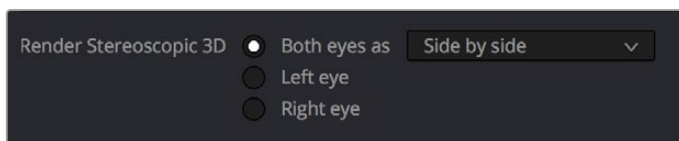
Stereoscopic 3D mesh render options on the Deliver page

You can choose Side-by-Side, Line-by-Line, or Top-Bottom. You can also choose Anaglyph if you want to output a traditional anaglyph red/cyan stereo 3D image for viewing on any display.

Rendering Individual Left- and Right-Eye Clips

If your workflow requires you to deliver separate sets of left- and right-eye media, this is easily accomplished by either setting up a render job with "Render Stereoscopic 3D" set to either "Right eye" or "Left eye," or selecting "Both eyes as" and choosing the "Separate files" option.

# Chapter 16

Using Variables and Keywords

This chapter describes how to use metadata variables and keywords to help you manage your clips.

Contents

Using Metadata Variables

If you're an enthusiastic user of clip metadata (and you should be), you can use "metadata variables" that you can add into supported text fields that let you reference other metadata for that clip. For example, you could add the combination of variables and text seen in the following screenshot. Variables, once they've been entered, are represented as graphical tags shown with a background, while regular text characters that you enter appear before and after these tags.
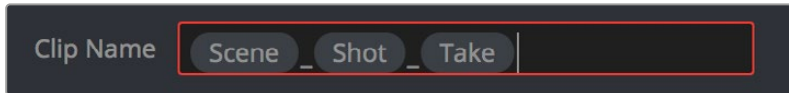
Variables and text characters entered to create a display name based on a clip's metadata

As a result, that clip would display "12_A_3" as its name if scene "12," shot "A," and take "3" were its metadata. When you do this, you can freely mix metadata variables with other characters (the underscore, as in the example above) to help format the metadata to make it even more readable.

Be aware that, for clips where a referenced metadata field is empty, no characters appear for that corresponding metadata variable's tag wherever it happens to be used.

Where Variables Can Be Used

Metadata variables are extremely flexible, and can be used to procedurally add metadata to several functions in DaVinci Resolve. Here's a partial list of where you can use variables.

– **Clip names:** You can use variables in the Clip Name column of the Media Pool in List view, or in the Clip Name field of the Clip Attributes window's Name panel, to use each clip's metadata to generate a more readable and useful display name.

– **Other metadata fields in the Metadata Editor:** You can use variables to reference metadata in other fields.

– **Automatic labeling of stills in the Gallery:** You can choose an option from the Color group in the General Options panel of the Project Settings to "Automatically label Gallery stills" in the Gallery, and you can use variables to do so.

– **Custom text in the Data Burn palette:** You can use variables to automatically populate metadata in different combinations as a window burn.

– **The Filename field of the Render Settings in the Deliver page:** Using variables, you can automatically set the name of rendered clips to follow any metadata that's associated with a timeline or individual clip. This is especially useful when you want to generate specific file names when rendering individual source clips.

How to Edit Metadata Variables

Every single item of metadata that's available in the Metadata Editor can be used as a variable, and several other clip and timeline properties such as the version name of a clip's grade, a clip's EDL event number, and that clip's timeline index number can be also referenced via variables.

To add a variable to a text field that supports the use of variables:

1 Type the percentage sign (%) and a scrolling list appears showing all variables that are available.

2 To find a specific variable quickly, start typing that variable's name and this list automatically filters itself to show only variables that contain the characters you've just typed.

3 Choose which variable you want to use using the Up and Down Arrow keys, and press Return to choose that variable to add.
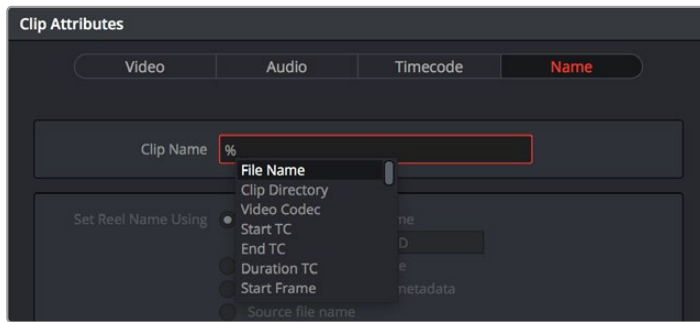
The variable list that appears when you type the % character

As soon as you add one or more metadata variables to a field and press Return, the string is replaced by its corresponding text. To re-edit the metadata string, simply click within that field to edit it, and the metadata variables will reappear as the graphical tags that they are.

To remove a metadata variable:

– Click within a field using variables to begin editing it, click a variable to select it, and press Delete.

Available Variables in DaVinci Resolve

The following list describes what metadata variables are available to add.

Clip Metadata

– File Name

– Clip Directory

– Video Codec

– Data Level

– KeyKode

Metadata Editor Metadata

– All Shot Scene metadata

– All Clip Details metadata (see Metadata Editor for more information)

– All Camera metadata (see Metadata Editor for more information)

– All Tech Details metadata (see Metadata Editor for more information)

– All Stereo 3D VFX metadata (see Metadata Editor for more information)

– All Audio metadata (see Metadata Editor for more information)

– All Audio Tracks metadata (see Metadata Editor for more information)

– All Production metadata (see Metadata Editor for more information)

– All Production Crew metadata (see Metadata Editor for more information)

– All Reviewed By metadata (see Metadata Editor for more information)

Media Pool Metadata

– File name

– Reel name

– File path

– Video Codec

– IDT

– Input LUT

– PAR

– Data Level

– Description

– Comments

– Keyword

– Shot

– Scene

– Take

– Roll/Card #

– Input Color Space

– Input Sizing Preset

– Start TC

– End TC

– Optimized Media

Timeline and Project Metadata

– Group

– Timeline Name

– Project Name

– Track Number

– Track Name

– Render Codec

Legacy Metadata

– **EDL Tape Number:** Tape number extracted from imported EDL

– **Render Resolution:** Resolution of the rendered file

– **EDL Event Number:** DaVinci Resolve-generated index number of the clip in the timeline

– **Version:** Version Name of the rendered file

– **Eye:** Stereo session, "Left" or "Right"

– **Reel Number:** Reel Name extracted by DaVinci Resolve from source filename or clip name

– **Timeline Index:** Event number from imported EDL

Using Keywords

While most metadata in the Metadata Editor is edited via text fields, checkboxes, or multiple button selections (such as Flags and Clip Color), the Keyword field is unique in that it uses a graphical "tag" based method of data entry. The purpose of this is to facilitate consistency with keyword spelling by making it easy to reference both a built-in list of standardized keywords, as well as other keywords that you've already entered to other clips.

Once added, keywords are incredibly useful for facilitating searching and sorting in the Media Pool, for creating Smart Bins in the Media and Edit pages, and for use in Smart Filters on the Color page. Reaping these benefits by adding and editing keywords is simple and works similarly to the method of entering metadata variables that's described above.

To add a keyword:

1   Select one or more clips, then click in the Keyword field of the Metadata Editor, and begin typing the keyword you want to use. As you begin typing, a scrolling list appears showing all keywords that are available using the string of characters you've just typed.

2   To find a specific keyword in the list, start typing that keyword's name and this list automatically filters itself to show only keywords that contain the characters you've just typed. Choose which keyword you want to use in the list using the Up and Down Arrow keys, and press Return to choose that keyword to add.

3   If you selected multiple clips, don't forget to click Save or you'll lose your changes. If you only selected a single clip, your changes will be saved automatically.
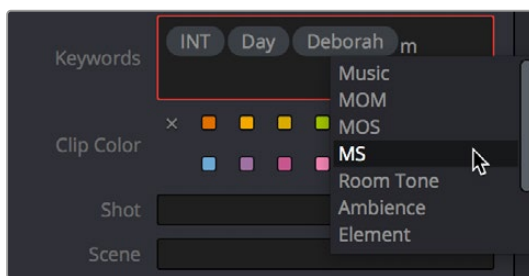
The keyword list that appears when you type within the Keyword field

As soon as you add one or more keywords, they appear as a graphical tag. To re-edit any keyword, simply click anywhere within the Keyword field to edit it.

To edit a keyword:

Double-click any keyword to make it editable, then edit it as you would any other piece of text, and press Return to make it a graphical keyword tag again.

To remove a keyword:

Click any keyword to select it, and press Delete.