PART 14

Advanced Workflows

Chapter 170

Frame.io Integration

DaVinci Resolve has sophisticated integration with Frame.io, a video review and collaboration service designed specifically for the postproduction industry. This integration consists of the ability to render and upload directly to Frame.io, maintain sync between Frame.io comments and timeline markers, and import media from Frame.io directly into the Media Pool.

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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.
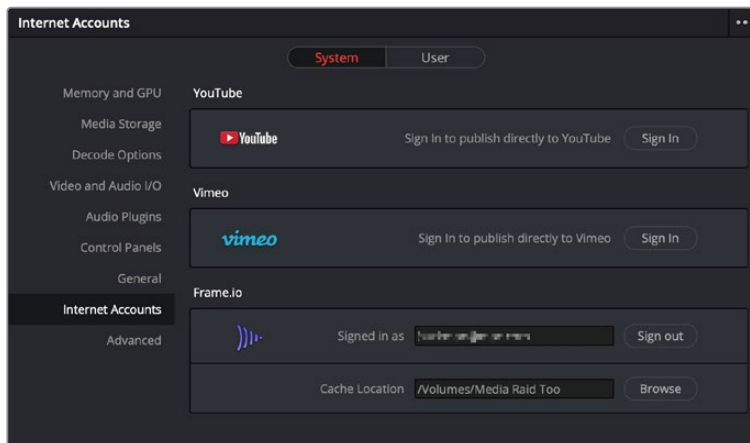

The Internet Accounts panel of the System tab of the DaVinci Resolve Preferences window (login deliberately obscured)

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.
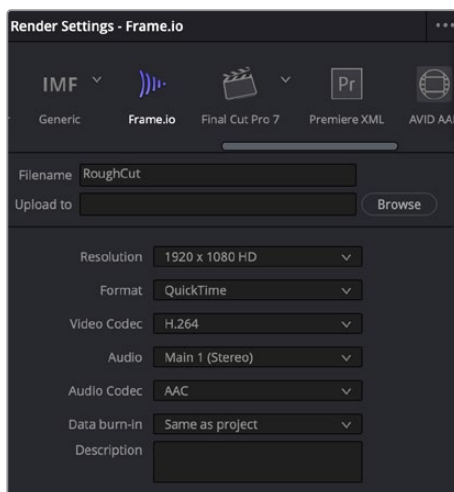

Choosing the Frame.io preset

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.
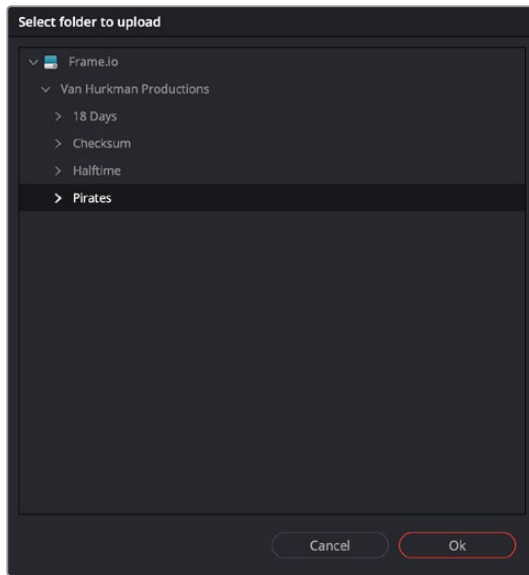
Choosing a Frame.io account to deliver a program to

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."
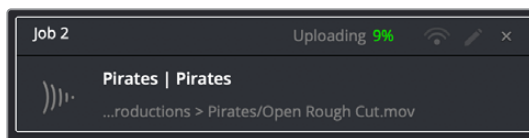

The job in the Render Queue shows you the percentage the file has uploaded so far

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.
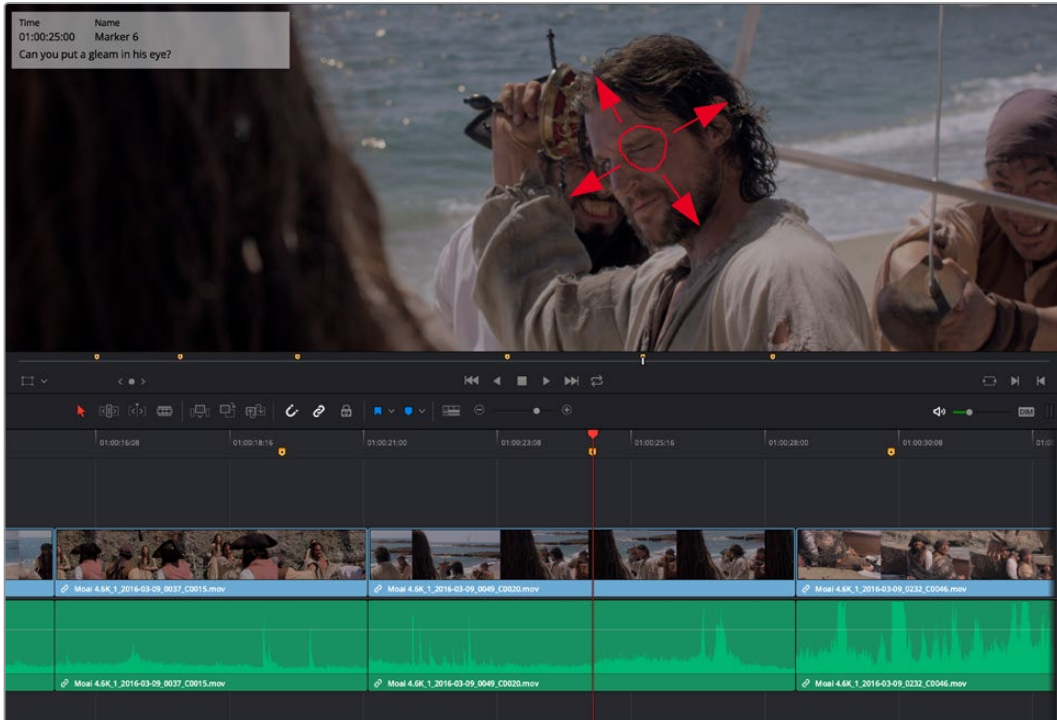
Comments and graphical annotations from Frame.io appear as markers with their corresponding overlays in your DaVinci Resolve Timeline

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.
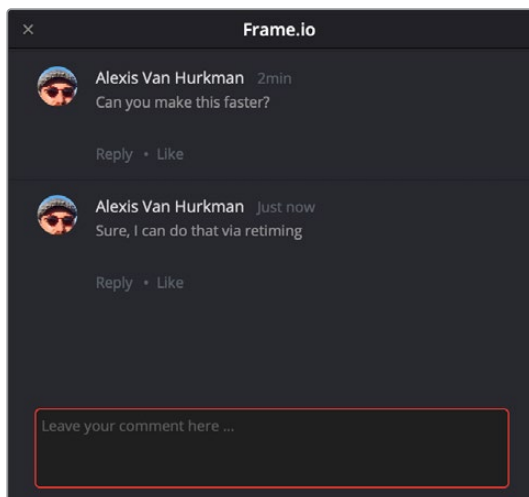
The editor talking to himself using the Frame.io comment dialog that appears when you open a Frame.io marker

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.

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.
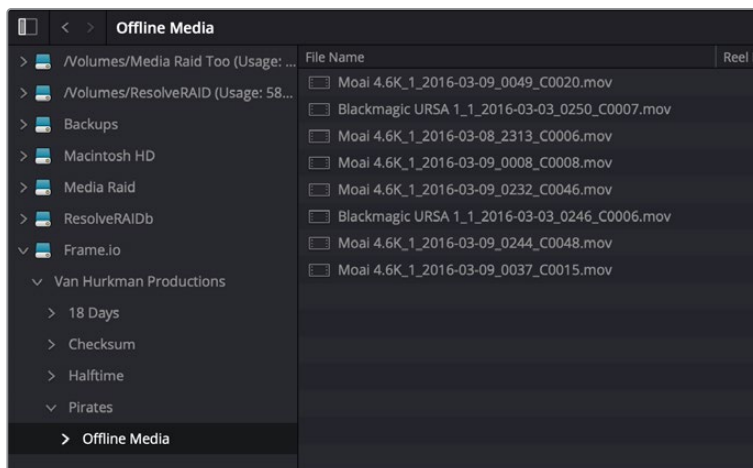

Accessing the directories of a Frame.io account from the Media Storage browser

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.
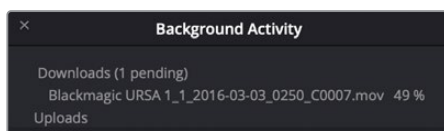
The Background Activity window lets you see what's happening in the background while you work

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.

Chapter 171

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 capture and playback, and one for Resolve Live input. If you only have a single video interface, you can only do one or the other. If you have two interfaces, then you can use these options to use one interface for playback, and the other interface for Resolve Live.
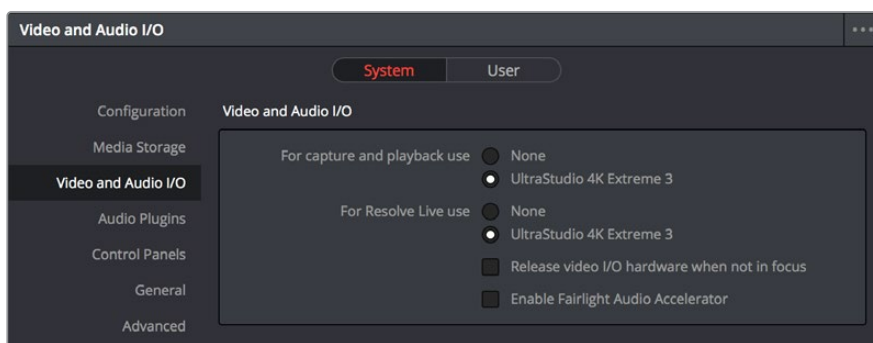
Video input/output options in the System Preferences

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.
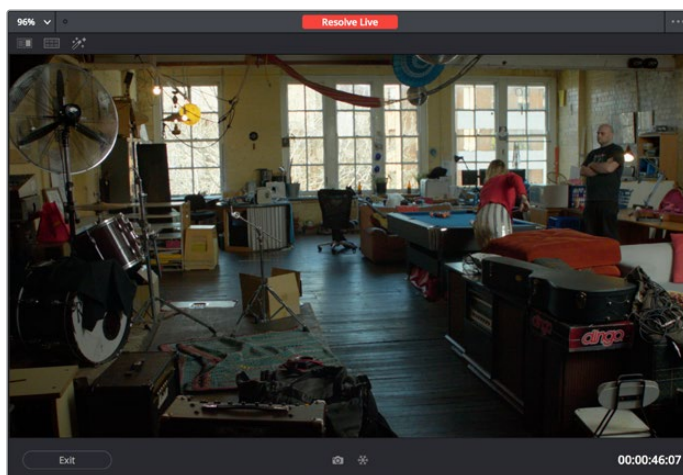
A red badge shows that Resolve Live is active and showing incoming video from the camera

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).
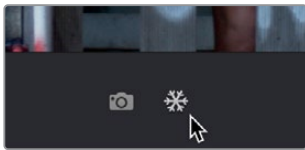
The snowflake button freezes the image so you can grade a particular frame

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).
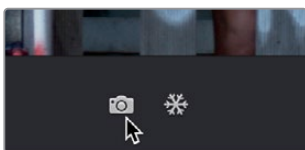
The snapshot button saves a frame and the grade for future use

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 129, "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 123, "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 172

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.
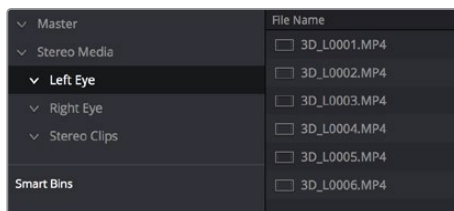
How to organize media for working in stereo 3D

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.
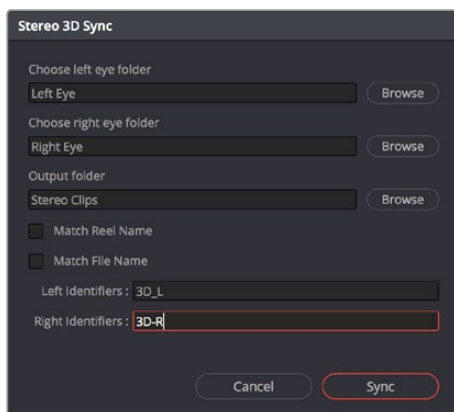
The Stereo Media Sync window

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.
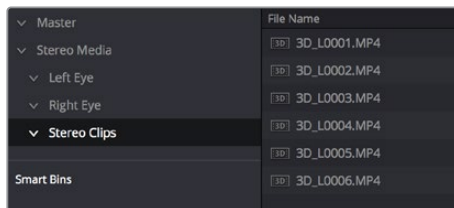
Final stereo clips, ready to be edited and graded

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.

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 7, "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.
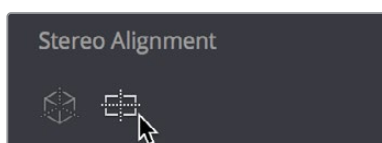

Controls for aligning the left- and right-eye media

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.
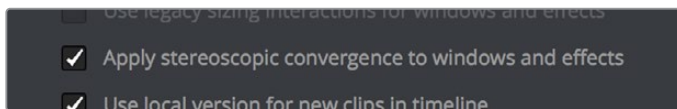
You must turn on a checkbox in the Project Settings
to enable stereo convergence for windows

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.
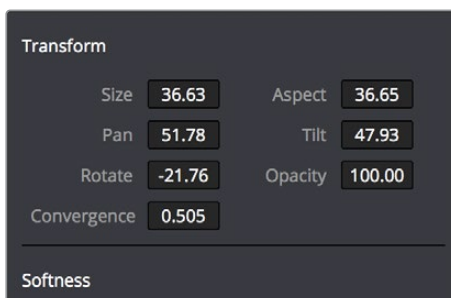
The Convergence control in the Transform
section of the Window palette

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.
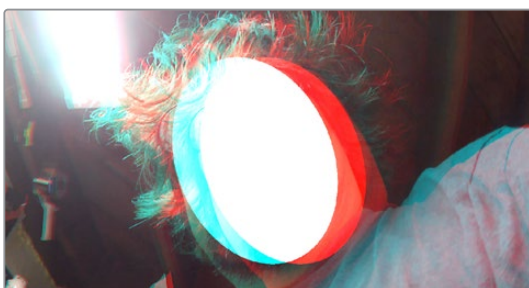
A convergence-adjusted window in stereo

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.
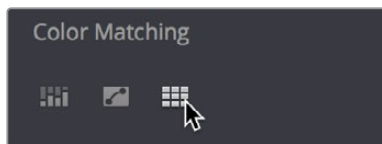
Controls for matching the grade of the left and right eye media

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.
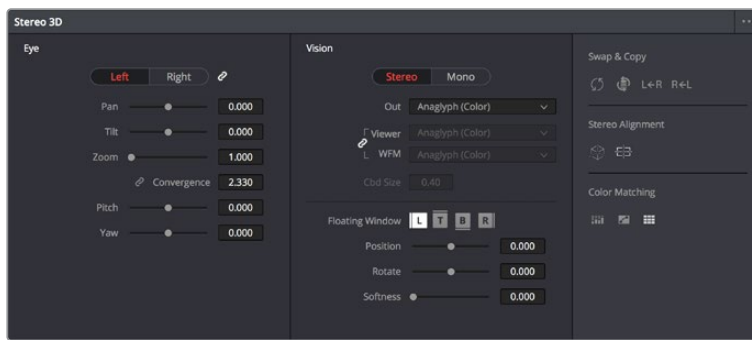
Stereoscopic 3D palette

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.
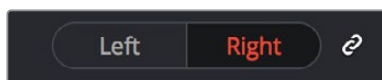
The Left eye is master and ganged with the Right

- **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.
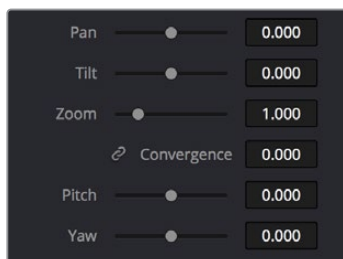
Stereoscopic 3D Geometry controls

- **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.
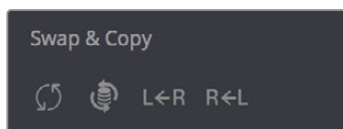
Swap and Copy grades between eyes

- **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.
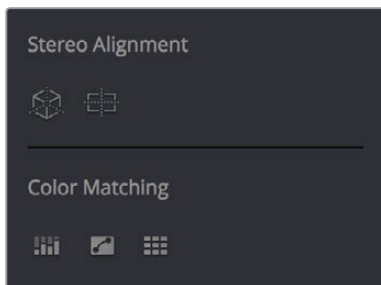
Auto align and color match buttons

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.
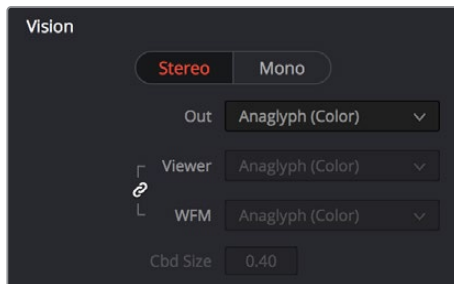
Monitoring controls for Stereo 3D

- **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.
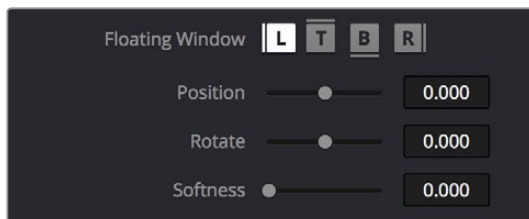
Floating Window controls

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 128, "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.
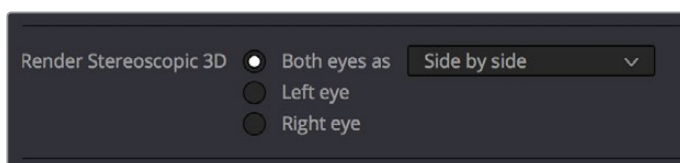
Stereoscopic 3D mesh render options on the Deliver page

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 173

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.
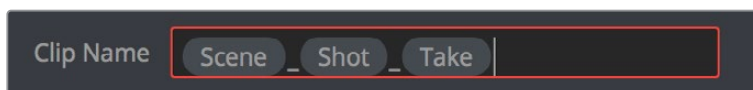
Variables and text characters entered to create
a display name based on a clip's metadata

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.
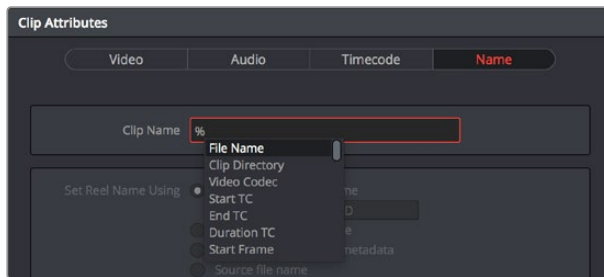
The variable list that appears when you type the % character

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

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.
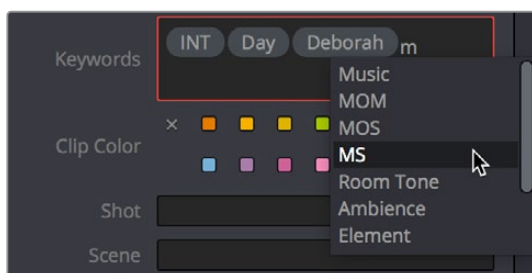
The keyword list that appears when you type within the Keyword field

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.

Chapter 174

Creating DCTL LUTs

This chapter describes how to create DCTL LUTs to perform your own custom mathematical transformations in DaVinci Resolve.

Contents

About DCTL

DCTL files are actually color transformation scripts that DaVinci Resolve sees and applies just like any other LUT. Unlike other LUTs, which are 1D or 3D lookup tables of values that approximate image transformations using interpolation, DCTL files are actually comprised of computer code that directly transforms images using combinations of math functions that you devise. Additionally, DCTL files run natively on the GPU of your workstation, so they can be fast.

Anyone with the mathematical know-how can make and install a DCTL. Simply enter your transformation code, using a syntax that's similar to C (described in more detail below), into any text editor capable of saving a plain ASCII text file, and make sure its name ends with the ".dctl" (DaVinci Color Transform Language) file extension. Once that's done, move the file to the LUT directory of your workstation. Where that is depends on which OS you're using:

- **On Mac OS X:** Library/Application Support/Blackmagic Design/DaVinci Resolve/LUT/
- **On Windows:** C:\ProgramData\Blackmagic Design\DaVinci Resolve\Support\LUT
- **On Linux:** /home/resolve/LUT

When DaVinci Resolve starts up, assuming the syntax of your .dctl is correct, they appear in the Color page Node contextual menu within the DaVinci CTL submenu.

DCTL Syntax

Users need to put __DEVICE__ in front of each function they write. For example:

```
__DEVICE__ float2 DoSomething()
```

The main entry function (transform) should come after all other functions, with the following format argument:

```
__DEVICE__ float3 transform(float p_R, float p_G, float p_B)
```

The main entry function must also have a float3 return value.

For the following floating point math functions, please use the described syntax:

```
float _fabs(float)                    // Absolute Value

float _powf(float x, float y          // Compute x to the power of y

float _logf(float)                    // Natural logarithm

float _log2f(float)                   // Base 2 logarithm

float _log10f(float)                  // Base 10 logarithm

float _exp2f(float)                   // Exponential base 2

float _expf(float)                    // Exponential base E

float _copysignf(float x, float y)    // Return x with sign changed to sign y

float _fmaxf(float x, float y)        // Return y if x < y

float _fminf(float x, float y)        // Return y if x > y

float _saturatef(float x, float minVal, // Return min(max(x, minVal), maxVal)
float maxVal)
```

```
float _sqrtf(float)                   // Square root

int   _ceil(float                     // Round to integer toward + infinity

int   _floor(float)                   // Round to integer toward - infinity

float _fmod(float x, float y)         // Modulus. Returns x — y * trunc(x /
                                      // y)

float _fremainder(float x, float y)   // Floating point remainder

int   _round(float x)                 // Integral value nearest to x rounding

float _hypotf(float x, float y)       // Square root of (x^2 + y^2)

float _atan2f(float x)                // Arc tangent of (y / x)

float _sinf(float x)                  // Sine

float _cosf(float x)                  // Cosine

float _acosf(float x)                 // Arc cosine

float _asinf(float x)                 // Arc sine

float _fdivide(float x, float y)      // Return (x / y)

float _frecip(float x)                // Return (1 / x)
```

The following functions support integer type:

```
min, max, abs, rotate
```

Other supported C Math functions include:

```
acosh, acospi, asinh, asinpi, atan, atanh, atanpi, atan2pi, cbrt, cosh, cospi,
exp10, expm1, trunc, fdim, fma, lgamma, log1p, logb, rint, round, rsqrt,
sincos, sinh, sinpi, tan, tanh, tanpi, tgamma
```

Vector types float2, float3, and float4 are supported. The data fields are:

```
float x
```

```
float y
```

```
float z
```

```
float w
```

To generate a vector value, use make_floatN() where N = 2, 3, or 4.

Users can define their own structure using "typedef struct." For example:

```
typedef struct

    {

        float c00, c01, c02;

        float c10, c11, c12;

    } Matrix;
```

To declare constant memory, use __CONSTANT__. For example:

```
__CONSTANT__ float NORM[] = {1.0f / 3.0f, 1.0f / 3.0f, 1.0f / 3.0f};
```

To pass the constant memory as a function argument, use the __CONSTANTREF__ qualifier, e.g.:

```
__DEVICE__ float DoSomething(__CONSTANTREF__ float* p_Params)
```

A float value must have the 'f' character at the end (e.g. 1.2f).

A Simple DCT LUT Example

The following code shows an example of how to create a simple color gain transformation using the DCT LUT syntax.

```
// Example to demonstrate simple color gain transformation

__DEVICE__ float3 transform(float p_R, float p_G, float p_B)

{

    const float r = p_R * 1.2f;

    const float g = p_G * 1.1f;

    const float b = p_B * 1.2f;

    return make_float3(r, g, b);

}
```

A Matrix DCT LUT Example

The following code shows an example of creating a matrix transform using the DCT LUT syntax.

// Example to demonstrate the usage of user defined matrix type to transform RGB to YUV
in Rec. 709

```
__CONSTANT__ float RGBToYUVMat[9] = { 0.2126f ,  0.7152f , 0.0722f,

                                     -0.09991f, -0.33609f, 0.436f,

                                      0.615f  , -0.55861f, -0.05639f };


__DEVICE__ float3 transform(int p_Width, int p_Height, int p_X, int p_Y,
float p_R, float p_G, float p_B)

{

    float3 result;


    result.x = RGBToYUVMat[0] * p_R + RGBToYUVMat[1] * p_G + RGBToYUVMat[2] *
p_B;

    result.y = RGBToYUVMat[3] * p_R + RGBToYUVMat[4] * p_G + RGBToYUVMat[5] *
p_B;

    result.z = RGBToYUVMat[6] * p_R + RGBToYUVMat[7] * p_G + RGBToYUVMat[8] *
p_B;


    return result;

}
```

A More Complex DCT LUT Example

The following code shows an example of creating a mirror effect, illustrating how you can access pixels spatially.

```
// Example of spatial access for mirror effect


__DEVICE__ float3 transform(int p_Width, int p_Height, int p_X, int p_Y, __
TEXTURE__ p_TexR, __TEXTURE__ p_TexG, __TEXTURE__ p_TexB)

{

    const bool isMirror = (p_X < (p_Width / 2));

    const float r = (isMirror) ? _tex2D(p_TexR, p_X, p_Y) : _tex2D(p_TexR, p_
Width - 1 - p_X, p_Y);

    const float g = (isMirror) ? _tex2D(p_TexG, p_X, p_Y) : _tex2D(p_TexG, p_
Width - 1 - p_X, p_Y);

    const float b = (isMirror) ? _tex2D(p_TexB, p_X, p_Y) : _tex2D(p_TexB, p_
Width - 1 - p_X, p_Y);

    return make_float3(r, g, b);

}
```

TCP Protocol for DaVinci Resolve Transport Control

This chapter describes how to create third-party utilities that use Transport Control with DaVinci Resolve.

Contents

About the TCP Protocol Version 1.2

This protocol defines the communication standard between third-party applications ("Client") and DaVinci Resolve ("Server") using the TCP protocol.

Port number 9060 will be used by the server. SSL will not be used in this protocol. Communication takes the form of request-response messages, where the Client initiates a command, and the Server responds appropriately.

To use this protocol, you must first type the following string into the Advanced panel of the DaVinci Resolve System Preferences:

```
System.Remote.Control = 1
```

Data Types

The following data types are used in this protocol:

- **float (f):** A 4-byte IEEE 754 single precision float
- **int (i):** A 4-bytes signed int
- **unsigned char (uc):** A 1-byte unsigned char (0–255)
- **string (s):** A UTF-8 encoded string. No terminator is specified. The string is a composite type, transmitted as a single int (i) specifying the number of characters in the string (N), followed by N unsigned chars (uc) containing the letters of the string.

> **NOTE:** The bytes of the float and int types are transmitted in little endian order.

Command Format

Commands are transmitted as a single string (using characters a–z (0x61 – 0x7A) only), followed by any additional payload required by the command in the definition.

Response Format

The response to any command is composed of a status byte (unsigned char), followed by any additional payload required by the response.

Communication Delays

Once the first byte of the command string is sent, the rest of the command string and the payload data must follow without delay. At the end of COMMAND, the server must respond immediately. If there is a delay of more than 5 seconds during this process, the party waiting for data may drop the connection assuming that the peer has become unresponsive.

There is currently no limit on the delay between two consecutive commands. (NOTE: Alternatively, a maximum allowable delay may be defined, in which case, the client may issue periodic 'connect' commands to keep the connection alive.)

Status Response Values

The meaning of the status values are as follows:

- **0x00:** Command was executed successfully. Any additional payload is sent as expected.
- **0xFF:** Command could not be executed successfully. No additional payload will follow.

TCP Protocol Stream

The following commands can be sent over the protocol stream.

connect

The client initiates the stream by sending a connect command string. There is no payload. The server responds with a status value of 0x00.

goto

The client sends a goto command string followed by four unsigned chars representing the hour, minute, second, and frame of the timecode.

The server responds with an appropriate status byte based on the execution of the command.

play

The client sends a play command string followed by a floating point value. Play in real-time is 1.0, stop is 0.0, reverse is -1.0, 2x is 2.0, etc.

The server responds with an appropriate status byte based on the execution of the command.

gettc

The client sends a gettc command string.

The server responds with an appropriate status byte (status byte may be 0xFF if no timeline exists, for instance). If the status byte is 0x00, it is followed by four unsigned chars representing the hour, minute, second, and frame of the timecode.

getframerate

The client sends a getframerate command string.

The server responds with an appropriate status byte. If the status byte is 0x00, it is followed by a floating point value for the frame rate.

Sample Code

The following C sample program sets up the connection to Resolve, and returns the timeline timecode to the client:

```
#include <stdio.h>
#include <sys/socket.h>
#include <arpa/inet.h>
#include <unistd.h>
#include <string.h>
#include <stdio.h>
#define PORT 9060

int main(int argc, char const *argv[])
{
    int sock = 0, valread;
    struct sockaddr_in serv_addr;
    if ((sock = socket(AF_INET, SOCK_STREAM, 0)) < 0)
```

```
    {
        printf("\n Socket creation error \n");
        return -1;
    }

    serv_addr.sin_family = AF_INET;
    serv_addr.sin_port = htons(PORT);

    // Convert IPv4 and IPv6 addresses from text to binary form
    if(inet_pton(AF_INET, "127.0.0.1", &serv_addr.sin_addr)<=0)
    {
        printf("\nInvalid address/ Address not supported \n");
        return -1;
    }

    if (connect(sock, (struct sockaddr *)&serv_addr, sizeof(serv_addr)) < 0)
    {
        printf("\nConnection Failed \n");
        return -1;
    }

    char* connectStr = "connect";
    int length = strlen(connectStr);

    send(sock , &length , sizeof(int) , 0 );
    send(sock , connectStr , strlen(connectStr) , 0 );

    char responseBuffer[1024] = {0};
    valread = read( sock , responseBuffer, 1024);
    printf(" %s sent, response = %x\n", connectStr, responseBuffer[0] );


    char* gettcStr = "gettc";
    length = strlen(gettcStr);
    send(sock , &length , sizeof(int) , 0 );
    send(sock , gettcStr , strlen(connectStr) , 0 );


    valread = read( sock , responseBuffer, 1024);
    printf(" %s sent, response = %x timecode(%d:%d:%d:%d)\n", gettcStr,
responseBuffer[0], responseBuffer[1], responseBuffer[2], responseBuffer[3],
responseBuffer[4] );

    return 0;
}
```

Chapter 176

Immersive Audio Workflows

DaVinci Resolve 16 introduced support for additional object and channel-based surround or immersive audio formats. This chapter describes how to set up and mix with these formats when mixing in the Fairlight page.

Contents

About Immersive Audio Formats

Immersive audio formats use multiple channels of audio to position audio around an audience, to add a specially creative dimension to sound design. At their simplest, formats such as 5.1 and 7.1 surround allow the mixer to send varying amounts of any given track to the combination of speakers that makes audio sound centered in front, ambient from the rear, or weighted towards the left or right of an auditorium or living room. More sophisticated "object-based" formats such as Dolby Atmos define a virtual soundstage on which you can actually position tracks in 3D space, and the resulting positional audio is rendered by specialized encoder/decoders to however many speakers in whichever configuration a venue happens to have.

Immersive Format Configuration

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.
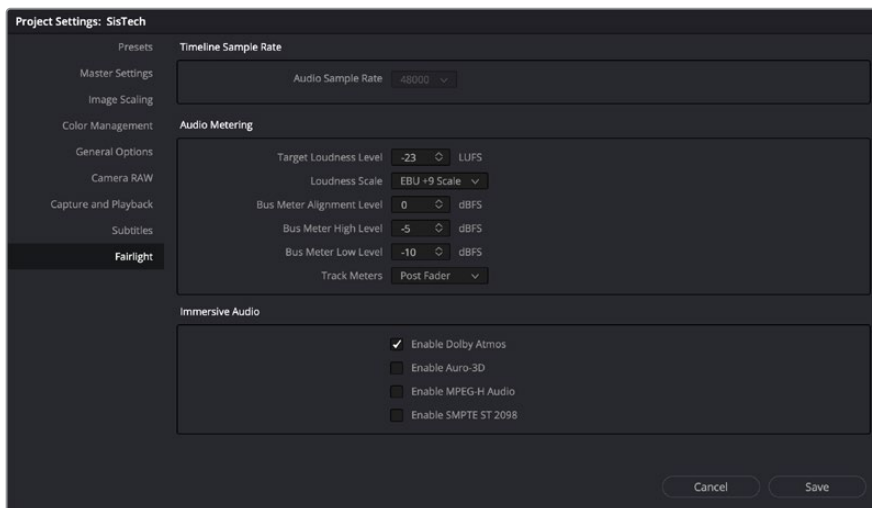
Controls for enabling various surround sound formats in the Fairlight panel of the Project Settings

Object-Based Format Support (Studio Only)

Dolby Atmos with support for 7.1.2 and 7.1.4

MPEG-H with support for 5.1.4, 7.1.4, and 7.2.3

SMPTE ST.2098 with support for 9.1 OH, 9.1 HT, 11.1 HT, 13.1 HT, and 15.1 HT

Auro-3D Support (Studio Only)

Auro-3D with support for 9.1, 10.1, 11.1 (7+4), 13.1

Dolby Atmos Configuration Controls

The Video and Audio I/O panel of the Resolve System Preferences lets you enable and configure the use of a Dolby RMU for doing Dolby Atmos mixing. You can enter the IP address of the RMU, and choose the base audio output.
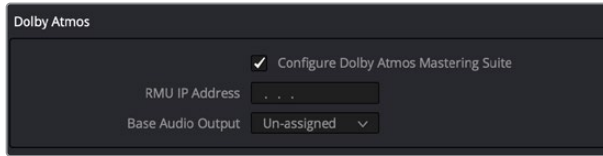
Configuring Dolby Atmos in the Resolve System Preferences

MPEG-H Authoring

DaVinci Resolve enables MPEG-H authoring. This includes Native MPEG-H track and bus formats and monitoring, including the ability to define basic track-level meta-data for export into an MPEG- H scene, and export of a MPEG-H Master file. Once enabled, the formats become available for selection as a bus, track, or monitoring format, in the Bus Format window.
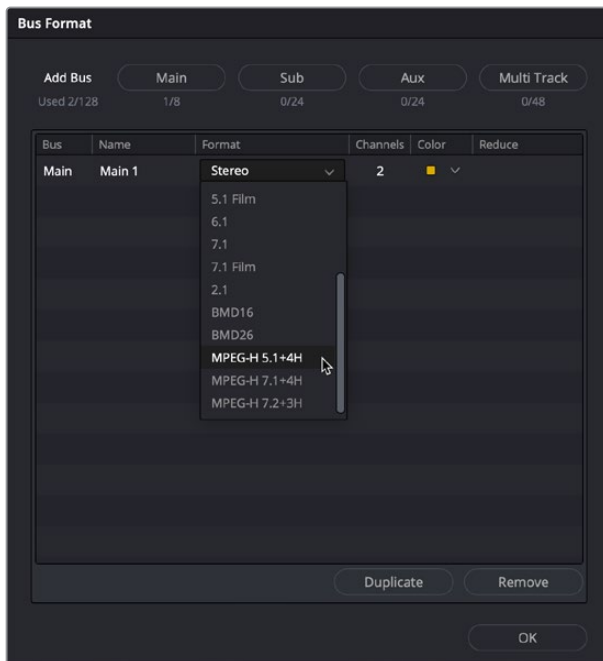
The MPEG-H format options in the Bus Format window

These formats also become available for multi-channel track assignment.
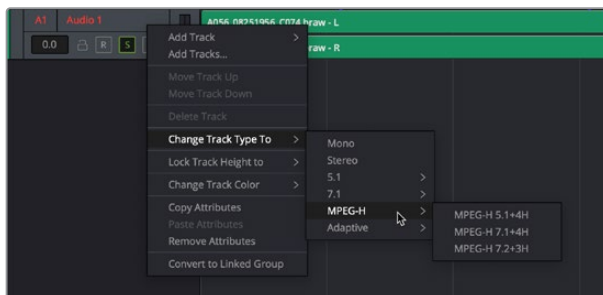
The MPEG-H format options in the Track Format submenu

Tracks are mixed natively in a similar manner to most immersive content, with the creation of a bed mix consisting of a set of immersive object tracks that use dynamic panning. These are combined onto the main bus to form the immersive mix.

Track Configuration

In addition to this process, once the format is enabled, a set of MPEG-H meta-data columns become enabled in the DaVinci Resolve Track index, including Track Type, Kind, Language, SW Group, and Preset. For more information about these columns and how to configure them, see Chapter 149, "Using the Fairlight Page."

When MPEG-H is enabled in the Project Settings, the Tracks panel shows additional columns of information for defining each track in the Timeline

Export

Once everything is configured, and your project is mixed, you export a master file. In order to do this, you must select a range In and Out point on the Timeline to define an export range. Additionally, you must define whichever busses are designated for rendering by defining their Kind, and you can select tracks you want to export additionally.
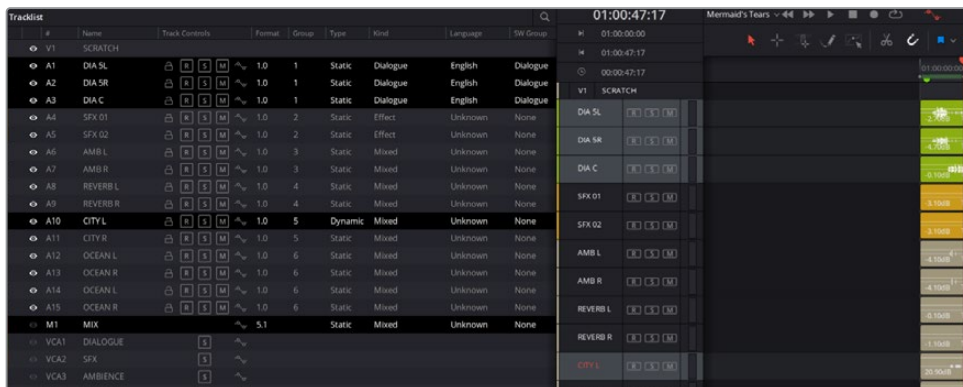
Selecting tracks and busses to export

> **NOTE:** An MPEG-H master file can only contain a maximum of fifteen channels total. If the selected track and bus stems exceeds this, then the export will fail, issuing a warning. The same will occur if a range is not selected.

To export an MPEG-H mix:

1   Choose Fairlight > Immersive > Generate MPEG-H Audio File.

2   Choose a save location and name, and click Save.

At this point, all defined busses are rendered. Then, track loudness is measured for compliance. Lastly, the source audio is exported and the metadata embedded into the deliverable MPEG-H wav file.

There are several error conditions, which are deleted during the export process, that will all cause the export to fail. For example, all tracks must contain audio. Audio within switch groups must be within a specific loudness tolerance of one another. If any of these conditions occur, a dialog will appear.
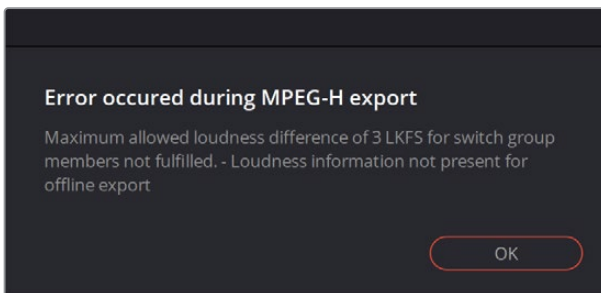
Warning dialog during MPEG-H export

Quality Control

You can do a quality control check of the final audio export using a Fraunhofer MHAPI tool which can open up the exported content. This includes compliancy tests, and visualization of the contained metadata. It can also render and monitor the content, but this aspect of the tool is basic, and only works with external audio that's linked to the metadata. In other words, you must manually link the components back to the source audio files.
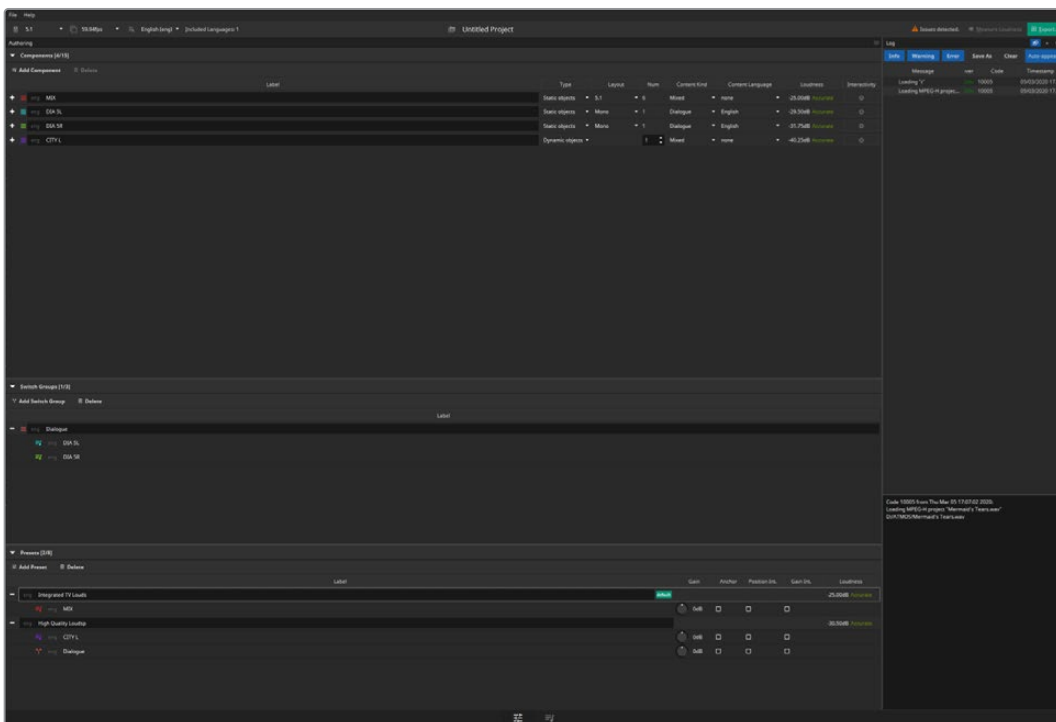
Quality control using the Fraunhofer MHAPI tool

B-Chain Support for Audio Monitoring (Studio Only)

Choosing Fairlight > Immersive > B-Chain Control opens the B-Chain Control window. Using traditional cinema audio postproduction terminology, the "A-Chain" is all of the bussing and signal processing that happens within the mix (in our case using the Fairlight page) and the "B-Chain" is the signal processing, amplification and speaker system that takes the sound from your workstation's output and gets it "into your ears." This typically includes all necessary signal decoding or pre-processing hardware, amplification systems, and speaker setups for most professional and commercial listening environments, especially for immersive audio or surround sound formats. These options are complex and have many variables in terms of speaker configuration, selection, and placement, output channel timing, attenuation, and phase, and a host of other considerations.

In DaVinci Resolve, these B-Chain controls affect how the channels of audio being output by the Main you're mixing is mapped to the actual audio signals being output from your workstation into the amplification and speaker system of the current viewing environment. The extensive level of control the B-Chain presets offer is most useful in situations such as surround-sound configured grading and mixing theaters, to define how the immersive audio standard you're mixing is mapped to the speaker setup of your particular application, and to fine-tune the channels being output to each speaker specifically for your environment. In simpler monitoring situations, the B-Chain controls can be useful for configuring the standard you're mixing with to play out of a non-standard speaker setup in your room.

Ultimately, the B-Chain controls are designed and intended for users who need to create custom, fine-tuned settings for their specific monitoring situation. For this reason, pretty much every real-world use of these B-Chain controls will require custom configuration for your unique environment.

Overview of Setting Up a B-Chain Configuration

Setting up a B-Chain configuration takes some doing, but once set up, you have a preset that's easy to reopen at any time. In the following example, a B-Chain preset will be configured to convert a 5.1 surround output to a 3-channel left-center-right room speaker setup.

To set up a B-Chain:

1 Choose Fairlight > Immersive > B-Chain Control to open the B-Chain Control dialog. This exposes the monitoring controls but not the configuration controls.

2 Click the Option menu in this window and choose Setup B-Chain Presets. The B-Chain Setup window appears.

3 Click the New button to create a new B-Chain preset, then enter a name in the dialog and click OK. In this example we'll use the name "5.1 to LCR." The Name you enter here is the name of the saved setting data.

Additional buttons let you Delete, Rename, or Duplicate presets that you've already created once you choose them from the Setting pop-up.

4 Enter a label in the Name field (this is the name that appears in the preset menu). The name you enter here is the name that appears in whatever pop-up menus you select these options from.

5 Choose Input Mode > Fixed Format, and Input > 5.1 from the pop-up menus. These define the signal coming out of your mix. (Input Mode > Monitor Feed sets the B-Chain to listen to the selected monitor source, while Input Mode > Custom Format lets you choose an arbitrary number of channels.)

6 Choose an Output Mode > Fixed Format, and Output > LCR from the next set of pop-up menus. These define the speaker setup you'll be playing the mix out of. In this example, we've chosen LCR, which stands for Left, Center, Right.

At this point, you can see that once you've defined the Input and Output channels, the "Inputs/Outputs" table of cells becomes populated:

– At the left of this table, each channel of your selected Input occupies a vertical column. In this example, the Input columns are labeled L, R, C, LFE, Ls, Rs, corresponding to the 5.1 channels you've selected to be output. It's possible to specify setups with many more channels, in which case the left half of the table becomes scrollable.

– At the right of this table, each channel of your selected Output occupies a horizontal row that intersects the Input columns. In this example, the rows are labeled Left, Center, Right.

In this way, every Input column intersects with each Output row, making it possible for you to assign how much of each Input is fed to each Output by entering values into each intersecting cell.
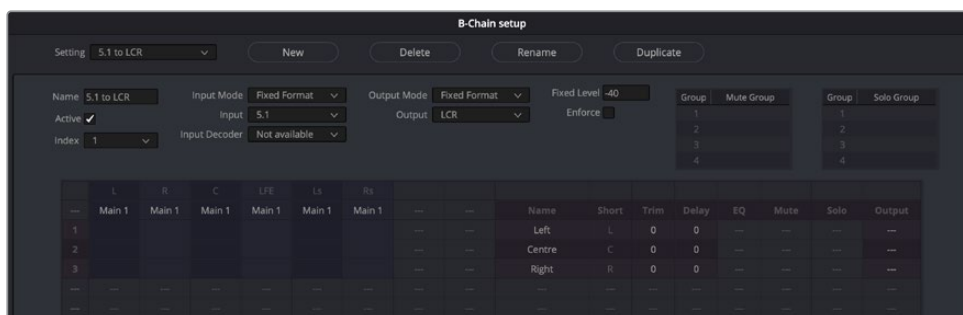
The Inputs/Outputs Table of the B-Chain preset window

7 To assign Input channels to Output channels, double-click the field where the desired Input intersects the desired Output, and type a value to set how much level from the Input to assign to the Output. Typing 0 assigns Input to Output at "unity" gain (0dB). Numbers you type here specify tenths of a dB. Typing -3 assigns half of the level from Input to Output. Typing -100 mutes that Input to that Output completely. Blank cells with no value make no assignment. In this example, we're typing:

a. 0 into cell L-1 to assign all of the Left source to the Left output

b. 0 into R-3 to assign all of the Right source to the Right output

c. 0 into C-2 to assign all of the Center source to the Center output

d. -6 into Ls-1 to assign a fraction of Left surround to the Left output

e. -6 into Rs-3 to assign a fraction of Right surround to the Right output

f. -8 into LFE-1 to assign a smaller fraction of LFE to the Left output (LFE is not directional)

g. -8 into LFE-3 to assign a smaller fraction of LFE to the Right output as well (LFE is not directional)

At this point, we've fully defined how much of which Input channels go to which Output channels. In the process, you can see that this table interface makes it possible to assign the full levels of Input channels to Output channels, to assign partial levels of Input channels to Output channels, and to assign fractions of Input channels to multiple Output channels.

	L	R	C	LFE	Ls	Rs			Name	Short	Trim	Delay	EQ	Mute	Solo	Output
—	Main 1	Main 1	Main 1	Main 1	Main 1	Main 1	—	—	Name	Short	Trim	Delay	EQ	Mute	Solo	Output
1	0			-8	-6		—	—	Left	L	0	0	—	—	—	—
2		0					—	—	Centre	C	0	0	—	—	—	—
3		0		-8		-6	—	—	Right	R	0	0	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

The Inputs/Outputs Table of the B-Chain preset window fully populated to assign inputs to outputs

8   At this point, you should notice there are additional columns to the right of the Output channels that provide various options that let you fine-tune each channel's output in order to optimize the acoustics and layout of your room:

   – Trim each channel (in tenths of a dB)

   – Add a Delay (in milliseconds)

   – Add specific EQ (None, LFE Only, Surr Mode)

   – Mute or Solo groups.

9   The last thing you need to do is to right-click each Output channel row's right-most Output column, and choose the hardware output of your audio or video+audio interface that you want that channel to go to. See one of the following I/O Setup procedure for how to rename these options to make this easier.

|	Name	Short	Trim	Delay	EQ	Mute	Solo	Output
	Left	L	0	0	—	—	—	1: Decklink
	Centre	C	0	0	—	—	—	2: Decklink
	Right	R	0	0	—	—	—	3: Decklink
	—	—	—	—	—	—	—	—

Assigning I/O channels to output to

10   Once you've finished setting up your B-Chain preset, click OK, and that preset will be saved and available for use.

To choose a B-Chain preset to use and enable B-Chain:

1   Choose Fairlight > Immersive > B-Chain Control to open the B-Chain Control dialog.

2   Turn on the toggle at the upper left-hand corner of the window to enable B-Chain, and choose a preset from the pop-up menu.

3   Choose the Input you want to assign that B-Chain preset to.

4   A set of Solo and Mute buttons lets you selectively choose sets of channels you want to listen to in isolation, or mute from the whole, in order to better evaluate selected portions of your mix.

5   A Fixed Level button lets you fix the output level in the DaVinci Resolve UI to a single value. With this enabled, you cannot drag the level slider to change the monitoring volume.

6   When you're finished using B-Chain for monitoring, turn off the toggle at the upper left-hand corner.

> **NOTE:** While the B-Chain is enabled, the Speaker Setup controls in the Video and Audio I/O panel of the Resolve System Preferences is disabled.
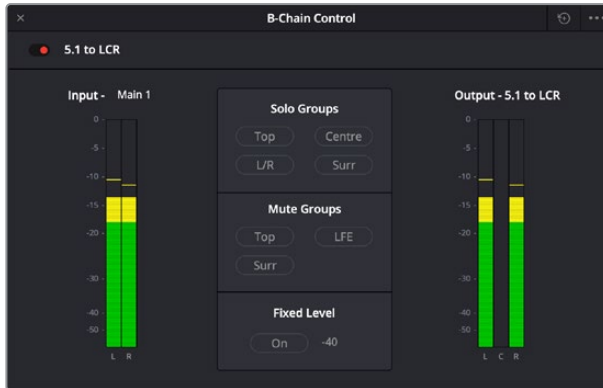

The B-Chain Control Window where you can choose and enable a B-Chain preset to affect the output

To name the various outputs of your system's channels for easy assignment:

1 Choose Fairlight > Immersive > B-Chain Control to open the B-Chain Control dialog.

2 Click the Option menu in this window and choose Setup I/O Names. The I/O setup window appears, showing every single audio input and output on every audio interface that's connected to and recognized by your system.

   The I/O Setup window lets you rename the Inputs and Outputs associated with your workstation setup, to make it easier to configure Fairlight when you're managing hundreds of channels. The names you choose here are shown everywhere in DaVinci Resolve where channels are selectable and/or exposed.

3 To rename a channel, double-click that channel's field in the Name column, type a new name, and press Return.

4 To protect a channel, click the checkbox in the Protect column. Protected channels are prevented from being patched to. This is intended for potentially high-volume speaker outputs, to which it would be hazardous to accidentally connect the wrong input. Protected channels can be seen everywhere patches can be made, but they're grayed out. Protected channels can only be used in the Speaker Setup controls in the Video and Audio I/O panel of the Resolve System Preferences, and in the B-Chain Setup window.

5 When you're finished, close the window. The names and protected status of channels are a system-wide setup.
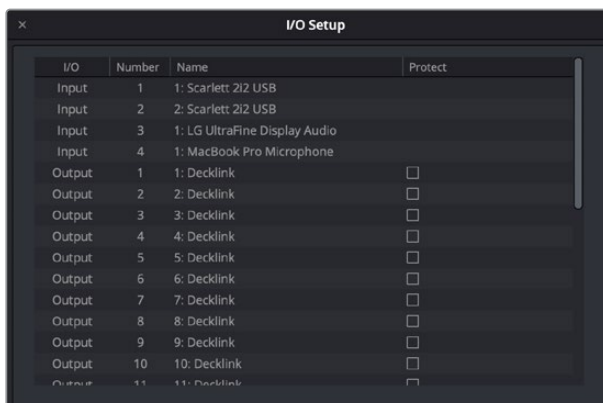
The I/O Setup window where you can rename your system's audio outputs and protect channels going to amplified speakers

Space View Channel Monitoring

Once you've configured your DaVinci Resolve workstation to mix audio via an Immersive format, you can use the Space View to facilitate surround sound mixing. Choose Fairlight > Immersive > Space View Scope to open the Space View window, which is a virtual representation of your control room with all defined source channels positioned in space according to the speaker that channel is intended to play out of. This view makes it easy to see which audio channels on which timeline tracks are playing out each speaker.
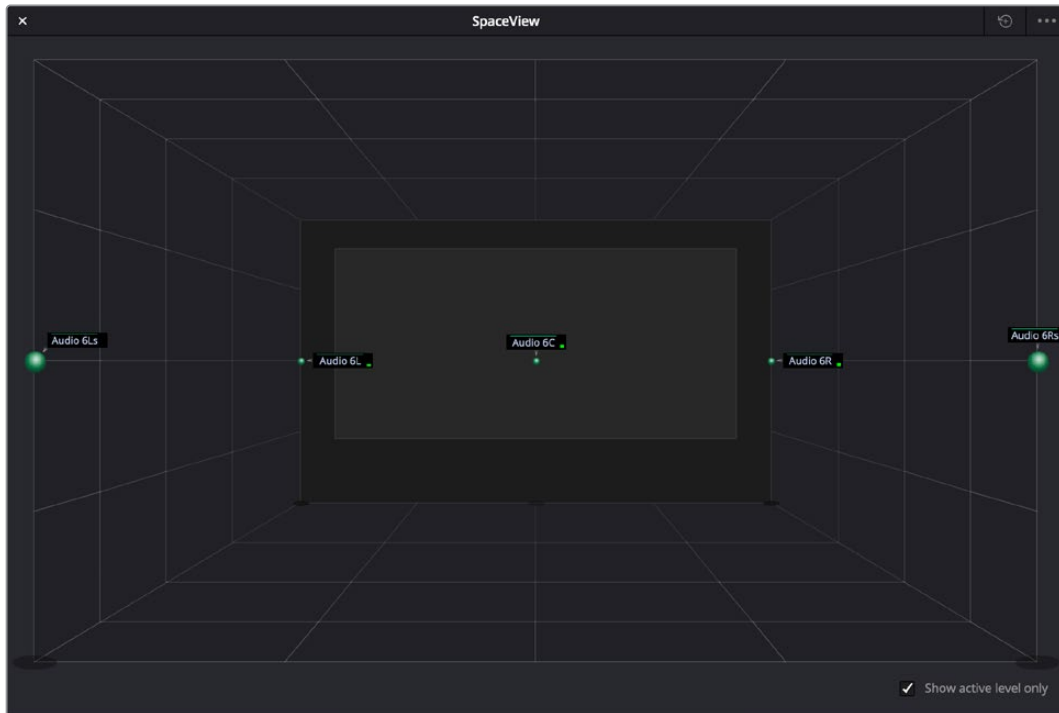
The Space View window gives you a spatial representation of what levels
are playing where; this example show the various stems of a 5.1 mix

Each channel shows a label and a meter that lets you see, at any given part of the mix, what audio levels are playing where, spatially. However, you only see channels that are unmuted and with a fader level of more than -70dB. A checkbox lets you choose whether to see labels for all track channels in your mix, or to only show labels for track channels with active levels that are currently playing. The Space View is also aware of the state of all Solo controls, allowing you to quickly focus on just what you hear.

PART 15

Project Databases, Collaborative, and Remote Workflows

Chapter 177

Managing Databases and Project Servers

This chapter describes how to set up and use databases in greater detail, giving you more control over how projects are saved and organized, including how to set up project servers you can use to administer DaVinci Resolve projects that are available to multiple DaVinci Resolve workstations on the same network.

Contents

Why Use a Project Server?

Multiple DaVinci Resolve workstations can access the same project when you set up a Project Server that shares one or more PostgreSQL databases over a local network. Once you've set this up, there are two ways of using a shared database.

Multiple Users Sharing Projects

The simplest case is for users to simply open up a project on the Project Server and work on it. Working this way, if you ever have to change rooms, or switch workstations, you can easily open that same project from any machine that's connected to the server on the same network without needing to export and import it first. For example, an assistant could be working with a colorist to prepare files for the next reel by conforming shots, managing VFX replacements, doing dust busting repairs, and so on in an unsupervised editing suite anywhere in the building, before saving their work and closing the project so the colorist can immediately open that same project in the grading theater across the hall.

Another way of taking advantage of shared Project Servers is to split large projects into sections, so multiple artists can work in parallel on different pieces of the whole in different suites, handing them off when necessary. For example, a feature film may be split into reels, or a film can be separated from the trailer and electronic press kit projects that it shares media with. In this case, each project can be edited, mixed, and graded by different people accessing the Project Server.

When a shared project is opened by someone else after it's already been opened, a dialog informs you that it's being opened in Read-only mode to prevent multiple users from accessing the project at the same time. If you load a Read-only project and decide you want to make changes anyway, you'll need to use the Save As command to create a duplicate project file using a new name in order to preserve your work.

Using Collaborative Workflow

Alternately, you can use the Collaborative Workflow features in DaVinci Resolve to enable multiple collaborators on multiple workstations in multiple rooms to open and work on the very same project at the same time. For example, an editor can be editing a project's main timeline in one room, while an assistant organizes media and adds metadata within the same project in another room, and a colorist grades dailies in that same project in yet another room, all accessing the same Project Server which allows them to work together in parallel. For more information, see Chapter 178, "Collaborative Workflow."

All participants in a Collaborative Workflow must have the Studio version of DaVinci Resolve, and they must be using a PostgreSQL database on a Project Server that's properly set up.

Know Which Version of PostgreSQL You're Using

Starting with DaVinci Resolve 12.5.4 on macOS, DaVinci Resolve requires PostgreSQL 9.5, which is necessary for compatibility with macOS versions above 10.12 Sierra. All previous versions of DaVinci Resolve on macOS use PostgreSQL 8.4, and you must upgrade PostgreSQL before upgrading to macOS 10.12 Sierra or later.

> **IMPORTANT** If you're upgrading from a previous version of DaVinci Resolve that uses 8.4 to a new version of DaVinci Resolve that uses 9.5, it's vital you read the instructions located in /Library/Application Support/Blackmagic Design/DaVinci Resolve/Upgrade PostgreSQL/ before you upgrade.

If you're unsure what version of PostgreSQL you're using, check to see what versions appear in the /Library/PostgreSQL/ directory.
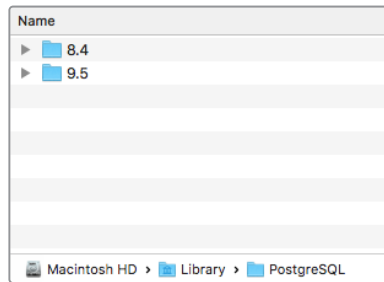

The /Library/PostgreSQL/ directory on macOS systems shows which versions of PostgreSQL you're using

Using the DaVinci Resolve Project Server Application

When you install DaVinci Resolve, an additional application is installed in the DaVinci Resolve application directory on macOS and Windows, called DaVinci Resolve Project Server. This is a stand-alone application that lets you create, manage, backup, restore, and most importantly share project databases on any workstation. Using this application, it's not necessary to launch DaVinci Resolve just to manage your databases, and it's no longer necessary to use Terminal to set up database sharing as before (although you still can if you want to).

The DaVinci Resolve Project Server Interface

The DaVinci Resolve Project Server interface greatly resembles the DaVinci Resolve Project Manager with the Databases sidebar open. However, a toolbar at the top exposes all of the database management tools that are available for creating and managing databases, including controls for sharing databases and creating access keys that are essential for quickly and easily creating and connecting to Project Servers.
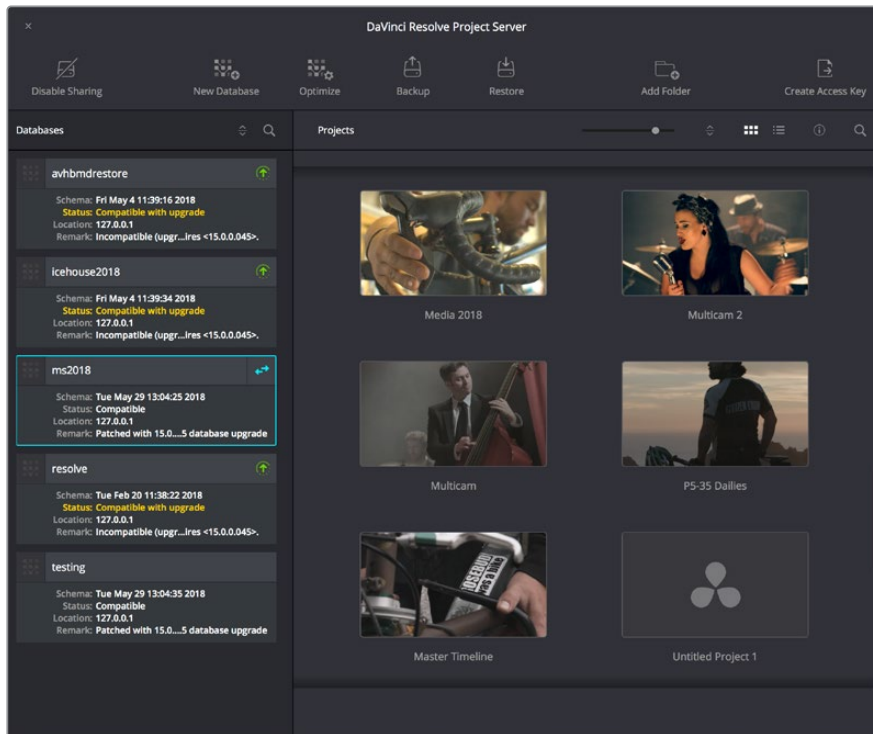
The DaVinci Resolve Project Server window

This window has three main UI areas:

- **Databases list:** Unlike the Databases sidebar in the Project Browser of DaVinci Resolve, in which you can disconnect databases you no longer want to use, the Databases list in the Project Server application shows every single DaVinci Resolve PostgreSQL database on your machine. This makes it easy to find databases you've disconnected that you want to reconnect.

- **Projects browser:** Shows all projects and folders within the currently selected database.

- **Toolbar:** A toolbar at the top of the window shows you all of the functions that are available for managing DaVinci Resolve databases on your workstation.

    - **Enable Sharing:** Selecting a database and clicking this button lets you turn the workstation you're on into a Project Server. When you select a database that's already shared, this button changes to Disconnect Database. This process is described in greater detail in the next section.

    - **New Database:** Lets you create new databases without needing to open Resolve.

    - **Optimize:** 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 it to improve access speed by "vacuuming" the database of unnecessary spaces and reindexing it. You can now also access the

Optimize Project command directly from the Project Manager window. Simply hover the mouse over your project in the Project Manager, hold down the Option key, and right-click. Then select Optimize Project in the menu.

– **Backup:** 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.

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

– **Add Folder:** Creates a project folder inside whatever database is currently selected.

– **Create Access Key:** Selecting a database and clicking this button exports an access key file that you can send to other users to quickly connect their workstation to a shared Project Server. This process is described in greater detail in the next section.

Using the Project Server Application to Manage Databases

The DaVinci Resolve Project Server utility is useful for accomplishing all kinds of administrative tasks.

Creating New PostgreSQL Databases

If necessary, you can create new PostgreSQL databases right within this utility.

To create a new PostgreSQL project database:

1   Click the New Database button in the toolbar.

2   When the New Database window appears, 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.

3   Click Create, and the new disk database will appear in the Databases list.

Backing Up and Restoring Databases

You can also back up and restore databases without needing to open Resolve. Furthermore, you can back up databases even if they're out of date, making it easy to back up databases for safety before you upgrade them.

To back up a database for safekeeping:

1   Select the database you want to back up in the Databases list.
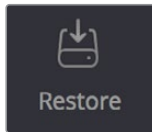
2   Click the Backup button in the toolbar.

The Backup Database button in the toolbar

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

To restore a database you've backed up previously:

1   Click the Restore button in the toolbar.

The Import Database button

2   Find the database you need to import using the file import dialog, and click Open. The database you've restored should now appear in the Databases list.

Upgrading Databases

From time to time, new versions of DaVinci Resolve require changes to the way projects are created, which requires databases created with older versions of DaVinci Resolve to be upgraded before you can access the projects within. Fortunately, this is a simple process.

To upgrade a database made or used with an older version of DaVinci Resolve:

Right-click any database with an upgrade badge to the right of the database name, and choose Upgrade from the contextual menu.

Reconnecting Databases You Previously Disconnected

Unlike the Project Manager in DaVinci Resolve, the DaVinci Resolve Project Server application shows you every single DaVinci Resolve database on your computer, whether it's connected to Resolve or not. For this reason, it's a good way to find the names of databases that have been disconnected, either deliberately or accidentally, in order to reconnect them.

To reconnect any database on your workstation:

1   Open the DaVinci Resolve Project Server application.

2   Find the database you want to reconnect in the Databases list at the left.

3   Open DaVinci Resolve.

4   When the Project Manager window appears, open the Databases sidebar, and then drag the database you want to reconnect from the DaVinci Resolve Project Server window to the Database list of the Project Manager. That database is reconnected and appears in the Database list.

Sharing Databases to Create a Project Server

You can also use the DaVinci Resolve Project Server to easily set up a shared Project Server on your local network. However, for this to work, you need to adhere to the following requirements:

- All workstations need to be connected to the Project Server on a local network.
- All network connections should be reasonably fast (preferably Gigabit Ethernet or faster).
- The computer functioning as the Project Server should be reasonably fast, but it doesn't need fast GPU processing.
- The Project Server should have DaVinci Resolve installed, but it doesn't need a dongle or serial number, nor need it be the Studio version.

The following procedures describe how to set up a shared Project Server, and how to export an access key with which to easily set up other workstations to connect to it.

To set up a workstation as a DaVinci Resolve Project Server:

1   Open the DaVinci Resolve Project Server application, found in the DaVinci Resolve application folder.

2   Select or create a DaVinci Resolve project database you want to share, and click the Enable Sharing button.

3   When a dialog appears asking if you want to authorize the configuration of your PostgreSQL server. Click Authorize. That database can now be shared among other Resolve workstations on the same network.

Once you've set up a Project Server, it's easy to connect other machines to that server using access keys that you can create using the DaVinci Resolve Project Server application.

To create an access key to enable easy connection to a Project Server:

1   With the DaVinci Resolve Project Server application open, select a database that you've set up to share, and click the Create Access Key button to the right in the toolbar.

2   Choose a location via the Create Access Key dialog, and click Save. An access key file is saved to the location you chose with the file extension .resolvedbkey.

3   Copy the .resolvedbkey file to the workstation you want to connect to the shared database.

4   Open Resolve, and when the Project Manager appears, open the Databases sidebar, and then drag the .resolvedbkey file and drop it anywhere within the Project Manager. The shared database should now appear in the Databases sidebar, and if you select it, you'll see all of the projects that are located in that database on the Project Server.

If necessary, you can also disable sharing for any database, preventing remote access to it from other workstations on the network.

To disable sharing:

1   With the DaVinci Resolve Project Server application open, select a database you enabled sharing for, and click the Disable Sharing button to the left in the toolbar.

2   When a dialog appears asking if you want to authorize the configuration of your PostgreSQL server. Click Authorize. That database will no longer be shared.

IMPORTANT: If you enable sharing on a computer that is later moved to another network (for example, if you set up Project Server sharing on a laptop), you'll need to disable sharing and then re-enable it before you create access key files that will successfully connect to the new network location.

Manually Setting Up a Linux Project Server

These instructions are only appropriate for systems created with the DaVinci Resolve CentOS 6.x/7.3 build image ISO. The default PostgreSQL install is set up to only allow connections to the database from the local host IP address. Remote systems will not be able to access the database. To change this, you need to modify the "pg_hba.conf" file as detailed below.

 Open a shell on the desktop and type:

> **su<ENTER>**

You'll be prompted for the password. The password will be "DaVinci" for DaVinci Resolve Legacy CentOS 6.x installs. For CentOS 7.3 installs, the password is whatever root password you chose.

Based on which install you have, type either of the following:

> For legacy DaVinci Resolve installs:

> **cd /db/PostgreSQL/8.4/data<ENTER>**

> For CentOS 7.3 standalone DaVinci Resolve installs:

> **cd /db/PostgreSQL/9.2/data<ENTER>**

This puts you into the directory with the "pg_hba.conf" file.

Next, type:

> **ls<ENTER>**

This lists the files in the directory. Make sure you see the pg_hba.conf file. If you do not, type pwd<ENTER> to make sure you are really in the proper directory.

Next, type:

> **cp pg_hba.conf pg_hba.conf.bk<ENTER>**

This makes a backup copy of "pg_hba.conf" in case something goes wrong.

Next, use a text editor such as vi or nano to edit the "pg_hba.conf" file. Once you have the file open in a suitable editor, go to the bottom of the file and add the following line:

> **host all all 192.168.1.88/24 md5**

Use the tab key to format the text to match the line above, just to keep things tidy. More importantly, the "192.168.1.88" IP address used above should be replaced by the IP address of your actual server; this will allow any other computer on the 192.168.1.x subnet (or whatever YOUR actual subnet is) to access the database. Note that there is no space after the 88 and before the /24.

Once you have added the line above, save the changes and exit the editor. As a sanity check, you can type:

> **cat pg_hba.conf<ENTER>**

This shows the contents of the file and verifies that your change at the end of the file is correct.

Lastly, enter the following:

> **service postgresql restart<ENTER>**

This restarts the PostgreSQL server, which will now use the new "pg_hba.conf" information. After the restart, other DaVinci Resolve systems on the same network subnet should be able to create and connect to databases on this server.

Chapter 178

Collaborative Workflow

Multi-user collaborative workflow has been significantly altered after DaVinci Resolve 14, using "bin locking" to manage who has access to what when multiple collaborators open the same project. However, collaborative workflow also allows multiple artists to do simultaneous editing, compositing, grading, and metadata entry to clips on the same timeline within a single project for which Collaboration has been enabled. Multiple users can simultaneously access the same timeline within the same project to edit, composite, and grade at the same time, while other editors and assistants can open different bins containing different timelines within the same project to do editorial and media management. This chapter describes how to set up multiple DaVinci Resolve workstations to collaborate, and how to use bin locking to work together.

Contents

Introduction to Collaborative Workflow

Multi-user collaborative workflow allows simultaneous editing, compositing, grading, and Media Pool clip management by multiple people within a single project that has been enabled for collaboration. Collaboration takes three different forms:

- Using bin locking, multiple editors can simultaneously edit different timelines in different bins of the same project, while assistant editors can reorganize clips and edit the metadata in other bins within the same project. Bins are automatically locked when selected by a particular user and unlocked when deselected by that same user, or they can be manually set to be either locked or unlocked as circumstances require.

- Using clip locking, multiple colorists and compositing artists can work together in the same timeline, in either the Color page or Fusion page, without fear of overwriting one another's work. A clip is locked automatically when a user selects that clip to work on, and is unlocked (with the work checked in) when that same user selects a different clip. Clip locking in the Fusion page is maintained separately from clip locking on the Color page, so a compositing artist and colorist can work together on the same shot.

- One editor, one compositing artist, and one colorist can work together on the same clip in the same Timeline of the same project without conflict.

Overall, working in DaVinci Resolve in Collaborative Workflow mode is identical to working in non-collaborative mode. However, there are a few collaborative capabilities that are worth knowing about.

Collaborative Render Cache Support

Each collaborator on a project can have individualized render cache settings on their machine, enabling everyone to cache to a format that their workstation can best handle and that meets their needs.

Collaborative Support for Individual Monitoring

If necessary, each collaborator on a project can override the output and monitoring settings of a project on their particular workstation. When a project is set to use Collaborative Workflow, a "Use Local Overrides" checkbox appears in the Video Monitoring group of the Project Settings that lets you choose how to monitor on your particular workstation.

Collaborative Marker, Flag, and Clip Color Support

Collaborative workflow supports the modification of markers, flags, clip metadata, and clip color from the Color page. Additionally, FrameIO comment markers are supported by collaborative workflow.

Read Only Mode

Users can load collaborative projects in Read Only Mode.

Collaborative Support for HDR

Starting with DaVinci Resolve 16, there is support for Dolby Vision and HDR10+ in collaborative workflows.

Requirements for Collaboration

In order to use collaborative workflow:

- All users must be using the paid Studio version of DaVinci Resolve.
- All users must be working on a project that's been saved on a properly configured Remote Database Server. This Remote Database Server can be on one of the actively used DaVinci Resolve workstations, or it can be another computer on your network that simply hosts shared projects, but it should be on a computer that is never shut down or put to sleep, to prevent projects suddenly becoming unavailable.
- All machines participating in a collaborative workflow must be networked. They can be on the same local area network (LAN), but you can also connect computers on different subnets.
- Shared projects should ideally use media on some type of fast storage area network (SAN), with each collaborator connected to that SAN so that every workstation that's connected to the project being collaborated on has direct access to the same media. In a pinch, shared volumes over a network will work, but proper SANs will provide significant performance benefits. Facilities using multiple computer platforms (macOS, Windows, and Linux) together can use the Mapped Mount option of the Media Storage Locations list, found in the DaVinci Resolve System Preferences, to facilitate cross platform drive connection.

For more information on setting up a Database Server, see Chapter 177, "Managing Databases and Project Servers."

Enabling Project Collaboration

Starting with DaVinci Resolve 14, the process of initiating a collaborative workflow has been vastly simplified over previous versions.

To open a project and initiate a collaborative workflow:

1. Open DaVinci Resolve on a computer that's connected to a Remote Database Server.

2. Open any project on the remote database DaVinci Resolve is connected to using the Project Manager.

3. When the project is open, choose File > Enable Collaboration.

   Once collaboration is enabled, two additional buttons appear at the lower right-hand corner of the DaVinci Resolve interface, next to the Project Manager and Project Setting buttons. These are the Collaboration Chat and Collaboration buttons.


The Collaboration Chat button (far left) and the Collaboration button (second from left)

> **NOTE:** When you enable collaboration, the "Auto conform missing clips as media is added to Media Pool" option in the General Options panel of the Project Settings is automatically disabled, as it interferes with collaborative workflow. Also, Live Save is automatically turned on in the Auto Save panel of the User Preferences, to ensure that all collaborators' work is saved regularly to avoid conflicts between collaborators.
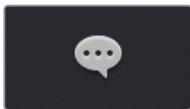
Opening Projects to Collaborate

Projects that have Collaboration enabled appear with a badge below their thumbnail in the Project Manager to let you know that project is available for collaboration.
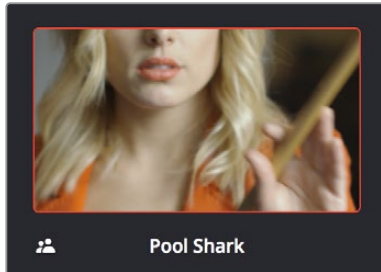

An icon indicates that a project in the Project Manager is available for collaboration

At this point, anyone else who has access to this Remote Database Server can simply open this project up and work collaboratively with you. Whenever a collaborator opens the same project you're working in, the Collaboration Chat button at the bottom of the DaVinci Resolve UI highlights to let you know you have a message.

The Collaboration Chat button highlights to let you know you have a message

Opening the Collaboration Chat window shows who's collaborating with you.
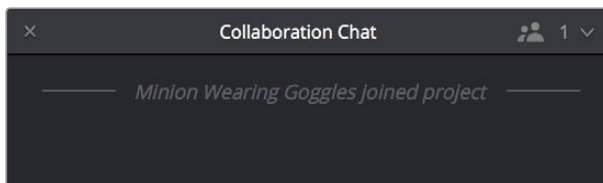
A new message in the Collaboration Chat window lets you know who else has opened the project you're working on

Customizing Your Collaborator Identification

Once you've set up a project for collaboration, you want to make sure it's easy to tell all your collaborators apart. Clicking the Collaboration button opens a list of all collaborators, or project members, working in that project.
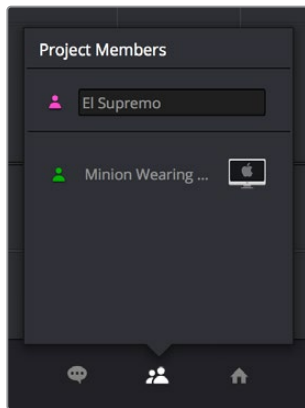
Opening the Collaboration list shows all
the current project members

The top member is you, and you can change the name you use by editing the text field.
Additionally, you can click the icon to the left and choose a new color for yourself from the icons
in the pop-up menu below. All the badges that indicate who has a lock on which folders,
timelines, and shots are color-coded, so it's a good idea for everyone to choose their own
custom color so you can tell who's doing what.
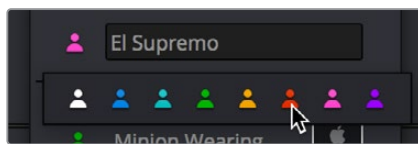
There are eight custom colors for
collaborators to choose from

How Collaboration Works

At its simplest, collaborative workflow uses a "first come, first served" model to manage who
has can make changes to what. Essentially, the first collaborator to select a bin in the Media
Pool, open a timeline, or select a clip in the Fusion page or Color page gets a "lock" on that
item. Once an item is locked (indicated by a colored collaborator badge), other collaborators
can look at it, but they cannot make changes. This prevents versioning conflicts from occurring.

Bin and clip locks are released when a collaborator selects a different bin or timeline in the
Media or Edit pages, or a different clip in the Fusion page or Color page. At that point, the
changes that have been made to the previously locked item are "checked in" and made
available to all collaborators once they refresh their project (by clicking a circular refresh icon
that appears to the right of bins in the Media Pool or in the corner of the Edit page Viewer).

All changes that collaborators make are automatically saved to the project as they're made, via
Live Save (which is always on in Collaborative mode), so no work will ever be lost as you
collaborate with your team. However, each collaborator gets to decide when they want to
update the bin, timeline, or clip they're currently working on to see the changes made by
everyone else, in order to prevent a kaleidoscope of constant alterations to compositions and
grades from being a distraction while you're working.

The following sections describe Bin and Timeline locking and Clip locking in more detail.

Automatic Bin and Timeline Locking

Whenever a collaborator opens a particular bin, that bin and its contents are locked, preventing any other collaborators who open that project from making alterations to anything inside that same bin. This prevents versioning conflicts while work is in progress. When a bin is locked, you can still view its contents, if for instance you just need to figure out where a particular clip has been put, but you can't make changes.

Furthermore, when a collaborator opens a timeline in either the Edit or Fairlight pages, whatever bin that timeline is in is locked as well, along with any other timelines or clips in that bin. Collaborators can open locked bins and see the contents for reference, but they cannot make any organizational or editorial changes. The only things that can be changed once a bin and its contents are locked are the creation or alterations of clip compositions in the Fusion page, and alterations to clip grades in the Color page.

You can always tell when a collaborator has a lock on a bin and its contents because a badge appears to the right of the bin in the Bin list, and in the corner of timeline thumbnails that are visible in the Media Pool browser area. Hovering the mouse over that badge in the Bin list reveals a tooltip with that collaborator's name.
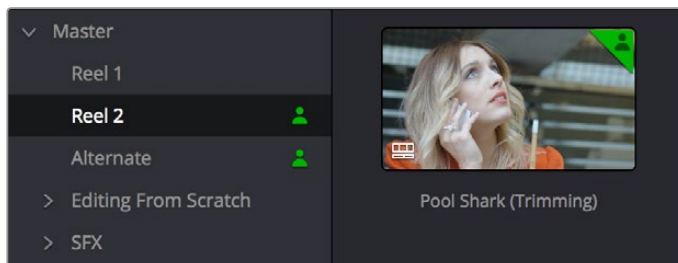
An icon indicates that another collaborator has a lock on the Reel 2 bin, the Pool Shark (Trimming) timeline, and the Alternate bin

Once a collaborator (someone other than you) makes changes to a bin's contents or to a timeline, you'll see a circular "refresh" badge appear by each affected bin in the Bin List of the Media Pool. Click these badges whenever you want to update your version of the shared project with all organizational and editorial changes made by others in that bin.
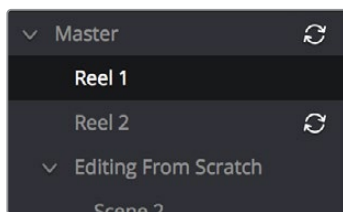
An icon indicates that another collaborator has made changes, clicking it refreshes your project to show those changes

To release a bin or timeline, simply select another bin or timeline. It's that simple.

Managing Bin Locks Manually

You can also manually control the locked state of bins, during instances where you want to keep bins locked for future use or prevent them from becoming locked when you only want to browse the contents.

Keeping Bins Locked

If you want to lock one or more bins that you know you're going to be switching among to either prevent other collaborators from making changes or so that nobody else inadvertently prevents you from having access, you can right-click one or more selected bins and choose Lock Bins to lock them. Bins locked in this way remain locked, even when you deselect them, until you right-click them again and choose Unlock Bins.

Manually locked bins stay locked
even when they're not selected

Keeping Bins Unlocked

Additionally, you can choose to keep bins unlocked when selected. For example, you may just want to examine the contents of a bin without keeping someone else from editing its contents. In this case, simply Option-click any bin to open that bin in read-only mode, which is indicated by an eyeball badge to the left of that bin in the Bin list. In this mode, any other collaborator can still lock that bin while you're examining its contents. Selecting any other bin will clear this read-only status.
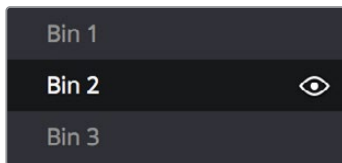
Selecting a bin in read only mode
allows collaborators to lock that
bin while you examine its contents

> **TIP:** While a bin is open but manually unlocked by you, you can still open clips into the Source Viewer and add markers to them, so long as another user doesn't select that same bin and lock you out.

Manually Unlocking Timelines

You can also manually manage the locking of timelines. Ordinarily, opening a timeline automatically locks other collaborators out of making changes to that timeline, and also locks the bin that timeline appears within. However, if you've finished making changes to a timeline and you want to release it to other collaborators for immediate work, you can unlock the currently open timeline.

To unlock a timeline to let other collaborators work on it:

1 Right-click that timeline in the Media Pool and choose Timelines > Unlock Timeline from the contextual menu.

2 Your collaborator will then need to right-click the Media Pool bin the timeline is in to be able to edit it.

Automatic Clip Locking

Clip locking in the Fusion and Color pages works similarly. As multiple compositing artists work in the Fusion page, and multiple colorists work in the Color page, the first compositing artist or colorist to select any given clip has an automatic lock on that clip. Other compositing artists or colorists will see a badge on that clip in the Thumbnail timeline showing that it's locked as well as letting them know who has the lock. In the following screenshot, a green badge at the corner of clip 12 in the Color page Thumbnail timeline indicates that clip is locked.
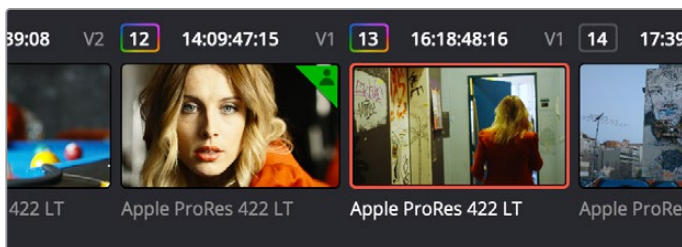
Badges in the Thumbnail timeline indicate which clips are
locked because a collaborator is grading them

Automatically Checking In Work When You Change Clips

When you're finished with the clip you're working on, you need only select another clip for the changes you made to the previously selected clip to be automatically saved and pushed to all other colorists who are working on that timeline in the Color page. No refresh is needed. This is the main difference between clip locking in the Color page and bin locking.

Compositing Artists and Colorists Can Work Together

The Fusion page and Color page each maintain separate clip locks. This means that for any given pool of compositing artists, only one will be able to work on a given clip at a time, while in the Color page only a single colorist will be able to work on a clip at a time.

However, because Fusion and Color page clip locking is maintained separately, that means that one compositing artist and one colorist can work on a single clip in the timeline simultaneously, even while an editor is working on that timeline.

Receiving Changes Made by Collaborators

As you work collaboratively, it will be common for groups of compositing artists to be executing multiple compositions at a time, while colorist and their assistants will be working on the grade, and an editor and their assistants will be refining the edit, all working together within the same project.

Receiving Changes On the Edit Page

While compositors are compositing and colorists are grading clips within the same timeline of the same project, each clip that's adjusted in the Fusion or Color page triggers a Refresh badge to appear in three areas of the Edit page, so the collaborating editor(s) can decide when to update their timeline to see the changes that have been made.

- At the upper right corner of the Timeline Viewer. Clicking this badge refreshes the composites and grades of all clips in the currently open Timeline.
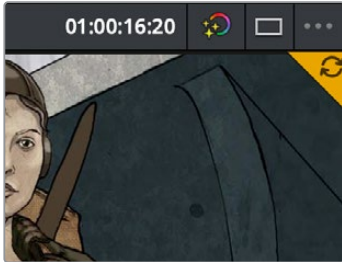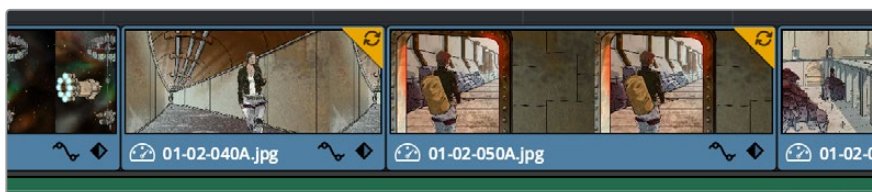

A clickable "update" badge appears in the corner of the Timeline Viewer for timelines with edits, grades, and composites that have been updated

- At the right of the bin containing the modified timeline in the Media Pool's bin list. Clicking this badge refreshes all clips in the Timeline within that bin.
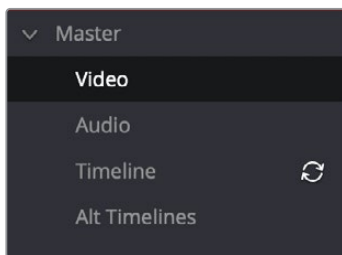
A clickable "update" badge appears over bins containing timelines in the Media Pool with edits, grades, and composites that have been updated

- At the upper-right hand corner of each modified clip in the Timeline.


A clickable "update" badge appears over clips in the Timeline with edits, grades, and composites that have been updated

## Receiving Changes On the Fusion and Color Pages

For collaborators working on the Fusion or Color pages, other badges indicate when editors have made changes to the Timeline, or when other compositing artists or colorists have made changes to other clips in that timeline.

- Timelines that you're locked out of because another collaborator has a lock on them are indicated by a badge at the upper right corner of the Viewer, while changes made to the Timeline by editors on the Edit page are indicated by a refresh badge in the same location. Clicking this badge refreshes all clips in the Timeline.
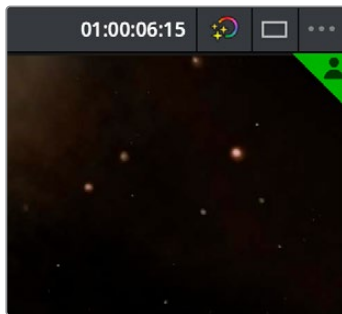

A badge in the Viewer shows that a viewer has a lock on this timeline

- If you open up the Media Pool, then a badge appears at the right of any bin in the Bin List that's been reorganized or that contains a modified timeline. Clicking this badge refreshes all clips in the Timeline within that bin.
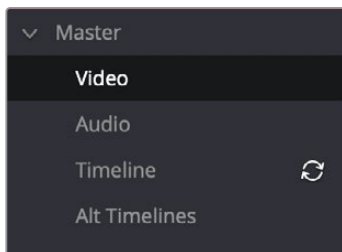
A badge appears to the right of bins in the Media Pool containing timelines that have been updated

- A badge appears at the upper-right hand corner of each clip in the Thumbnail timeline that's been modified by a fellow compositing artist or colorist. Clicking a single clip's badge updates that clip alone.
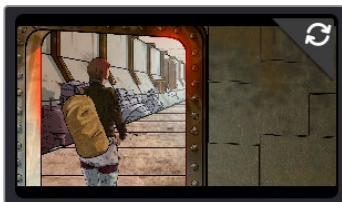
A badge appears over clips in the Timeline with grades that have been updated. Clicking this badge refreshes just that clip.

Examples of Collaborators Working Together

The first collaborator that opens a timeline is the only person that can make editorial changes to that timeline in the Edit or Fairlight pages. Other collaborators who open that project are "locked out" of making changes to the Edit or Fairlight pages, but they can see the Timeline, and they can make grading changes in the Fusion or Color pages. This means in situations where you want multiple editors to be working on a project, it can be ideal to organize your program into separate "reels," where each reel of a project is a separate timeline in a separate bin.

Multiple Editors Working Together

The first collaborator that opens a timeline is the only person that can make editorial changes to that timeline in the Edit or Fairlight pages. Other collaborators who open that project are "locked out" of making changes to the Edit or Fairlight pages, but they can see the Timeline, and they can make grading changes in the Fusion or Color pages. This means in situations where you want multiple editors to be working on a project, it can be ideal to organize your program into separate "reels," where each reel of a project is a separate timeline in a separate bin.

On the other hand, if two or more editors must both work on the same timeline, this can be accomplished using duplicate timelines and then merging the changes back together later on. For example, collaborating editor Anne can do the following to make changes to a timeline that editor Erin is already working on:

- First, Anne can duplicate the locked timeline into a separate bin from the one Erin has a lock on. Alternately, Erin could be proactive and duplicate the timeline into a separate bin in advance.

- Second, Anne will re-edit the duplicate timeline to make whatever changes are necessary to a different scene than the one Erin is currently working on. Working on different scenes is the cleanest and easiest way of using this workflow.

- Third, Anne uses Collaborative Chat to notify Erin that the changes are finished.

- Fourth, Erin then refreshes the project to see Anne's updated duplicate timeline in the Media Pool, right-clicks it, and chooses Compare With Current Timeline from the contextual menu to show the Timeline Comparison window that makes it possible to merge the changed section of the duplicate timeline with the original timeline that Erin already has open.

In the following screenshot, Erin's highlighted changes (made while Anne was working) can be seen at the left, and Anne's highlighted changes can be seen at the right. Right-clicking within the right highlighted area reveals an Accept Change command that lets that scene's changes be merged from the duplicate timeline back to Erin's original timeline.
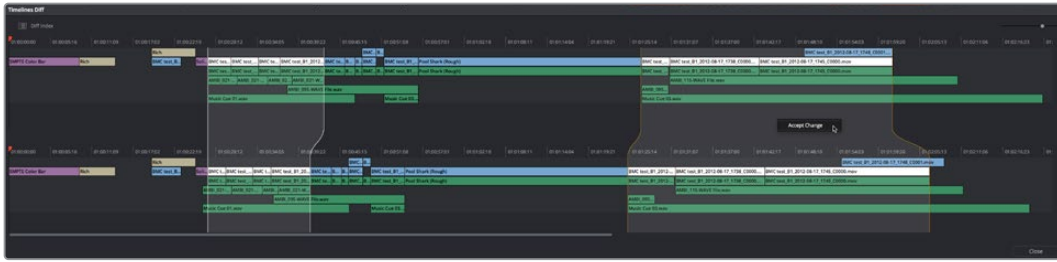
Using the Compare With Current Timeline command lets you see the differences between two differently edited versions of the same timeline, and merge a scene's worth of changes that a collaborator has made (at right) back to the original timeline

For more information on comparing timelines, see Chapter 26, "Creating and Working with Timelines."

Editors and Assistant Editors Working Together

Collaborators can edit metadata, create new bins, and reorganize clips within unlocked bins only. This means that your project should be organized so that an editor can lock the contents of the bins they need to work with at a given point in time, while the assistants can work on additional timelines and media within other bins in that project.

However, in addition to being able to copy timelines from a locked bin to a bin that you control, you can also copy clips from one timeline to another. In this way, if you absolutely need to make changes to source clips while the original source clips are locked, you can make your changes to copies of these clips.

## Editors and Compositing Artists Working Together

Editors and compositing artists can work together closely, since compositing artists can create compositions for one or more clips in a timeline while it's being edited, even though that timeline and the bin it's in are locked to other editors.

Here's an example of an editor working on a commercial spot with a lot of greenscreen material working together with one or more compositing artists.

- First, the editor cuts together each foreground clip with actors performing as a rough cut, and once that rough cut is assembled, they edit in the background clips that accompany each greenscreen clips to create a series of stack of clips.

- Second, the editor selects each stack of clips, one by one, and uses the New Fusion Clip command to create Fusion clips that the compositing artists can work on. By making each of these clips into Fusion clips, the editor is making it easy for the compositing artists to have access to all the clips necessary for each composition from within the Fusion page, collaboratively.

- At this point, the editor uses collaborative chat to notify the compositing artists that there are composites ready for them to work on, and the editor can then turn their attention back to refining the edit.

- Upon being notified that they can begin work, one or more compositing artists start working through the Fusion clip compositions while the editor is working, to create each multi-layered composite that's necessary. As each compositing artist finishes a clip and moves to a new clip to begin work, the editor sees a notification badge at the upper right corner of each clip in the Timeline that's been composited, as well as notification badges in the Bin List of the Media Pool, and at the upper right corner of the Timeline viewer. Clicking any of these badges will refresh one or more of these clips, so the editor can see the changes.

Multiple Compositing Artists Working Together

To prevent versioning issues, only one compositing artist can work on a particular clip at a particular time in the Fusion page, and the first compositing artist to select a clip puts a lock on that clip. Other collaborators looking at the Thumbnail timeline in the Fusion page will see a small icon that shows it's locked, letting them know they can't make any changes to it until whoever is working on that composition moves to another clip.
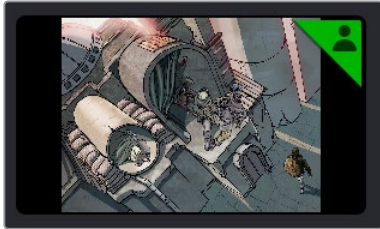
A small icon indicates that you're locked out because another compositing artist is working on that clip

This means that multiple compositing artists can't work on the same composition at the same time. However, an assisting compositing artist can do preparatory work on one composition, such as doing rotosocoping, paint, particle system design, or any other time-consuming task, while a lead compositing artist works on another shot in the meantime. Once the assisting compositor is done, they can select another clip to work on and use collaborative chat to let the other compositor know they're done and that clip is ready for more work.

In order to prevent half-finished work from being disseminated to other collaborators, a clip that's in the process of being worked on in the Fusion page isn't updated for anyone else who's working on that same timeline until the compositing artist who's working on it selects another clip. Immediately upon being deselected, all changes are automatically checked in and made available to all other collaborators, who see notification badges in the Fusion page and the Edit page to alert them that changes are available and that they can refresh their timeline to see the updates.

## Editors and Colorists Working Together

Colorists and editors can work together very closely in DaVinci Resolve, as colorists can grade the shots of a timeline that an editor is currently working on, even though that timeline and the bin it's in are locked to other editors.

From the colorist's point of view, whenever the editor makes an alteration to the Timeline, a badge appears at the upper right hand corner of the Color page Viewer to indicate that a change has been made to the timeline being graded. Clicking this badge updates the timeline the Colorist is working on.

In order to prevent half-finished work from being disseminated to the editor (or worse, being seen by the client), clips that are in the process of being graded aren't updated for other collaborators that are looking at that timeline until the colorist who's working on it "checks in" their work by selecting another clip. So, from the editor's point of view, whenever a colorist has finished grading a clip and has selected another clip to grade, a series of badges appear in the Edit page, one on the clip that's been graded, one on the Timeline Viewer and one on the bin in the Bin List that contains the Timeline. Clicking any of these badges updates the Timeline with the latest grades.

Multiple Colorists Working Together

Only one colorist can work on a particular clip at a particular time, and the first colorist to select a clip puts a lock on that clip. Other collaborators looking at the Thumbnail timeline in the Color page will see a small icon that shows it's locked, letting them know they can't make any changes to it until whoever is grading that clip moves to another clip.
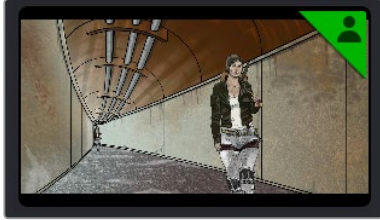
A small icon indicates that you're locked out because another colorist is grading that clip

In order to prevent half-finished work from being disseminated to other colorists or editors, a clip that's in the process of being graded isn't updated for other collaborators that are looking at that timeline until the colorist who's working on it selects another clip. These changes are then automatically made available to all other collaborators working in the Color page, who see badges appear in the Edit and Color pages to indicate which clips have updates available.

This makes it easy for multiple colorists to work together. For example, an assistant colorist can be notified via Collaborative Chat to draw a custom window that a senior colorist needs for a grade. The assistant opens that timeline in another suite, selects the appropriate clip, and draws the window. Once finished, the assistant simply selects a different clip, and the changes they've made are immediately available to the senior colorist, who sees a badge on that clip in the Thumbnail timeline and can click to update it.

Managing Notes Among Collaborators

If an editor wants to send a note to colorists or compositing artists, they can do one of the following:

- − They can add a marker with note text to the Timeline ruler (the marker appears in the marker submenu in the Color page Viewer option menu)
- − They can add a marker with note text to a clip (that marker appears in the mini-timeline of the Color page)
- − They can color code clips in different ways to get the colorist's attention (clip color coding appears as a dot in the Thumbnail timeline).
- − Of course, the editor and colorist can always interact via the collaborative chat window, as well.

Collaboration Chat

To facilitate communication among collaborators, DaVinci Resolve has built-in text chat, called Collaboration Chat. Simply click the Collaboration Chat button to open the chat window, and chat away.
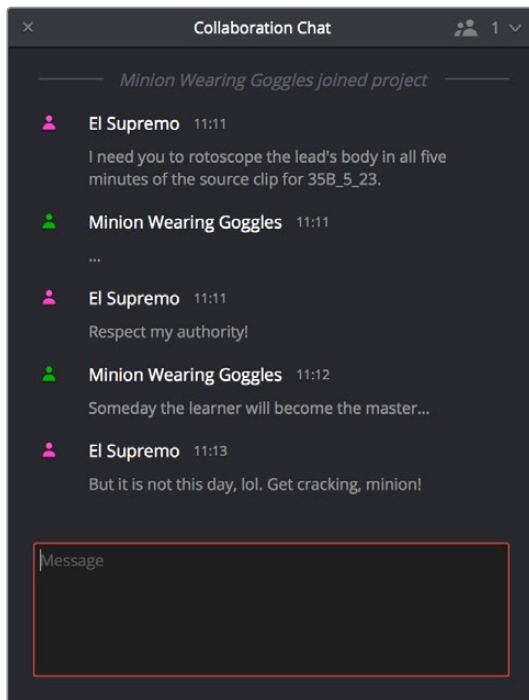
The Collaboration Chat window for communication among collaborators

The Collaboration Chat button at the bottom of the DaVinci Resolve interface highlights whenever someone texts while this window is closed, letting you know you have messages that are waiting.

The Collaboration Chat button highlights to let you know you have a message

Chapter 179

Remote Grading

This chapter describes how to set up and use two separate
DaVinci Resolve systems in different locations via the internet, to have one
system remotely control the other for color grading.

Contents

Introduction to Remote Grading

To enable colorists to work interactively with clients across the globe, DaVinci Resolve offers a remote grading option. It allows two matching DaVinci Resolve systems to be synchronized via an Internet connection such that changes made on the colorist's workstation are immediately applied on the remote client's workstation.

Cue commands are also synchronized to ensure that both systems are always on the same frame in the Timeline. Starting or stopping playback on the colorist's DaVinci Resolve also starts and stops the remote client system. While a remote grading session is in progress, input from the user at the remote client's DaVinci Resolve workstation is ignored.

Currently, the remote grading feature supports only color correction and does not allow editing or conforming during a session. The two colorist and remote DaVinci Resolve systems must have matching timelines and the number of clips, clip durations, and system resolutions must match. The requirements and limitations of a remote grading session are summarized below.

Requirements for Remote Grading

- The same version of DaVinci Resolve must be installed on both systems.
- The Timeline to be graded must be conformed on both machines prior to the start of the remote grading session.
- The number of clips on the Timeline and the duration of each clip must be identical.
- While grading, the active Timeline and versions on the remote client system are constantly updated. Creating, deleting, or switching the Timeline on the client's DaVinci Resolve is not allowed. Doing so will terminate the remote grading session immediately.
- You cannot make any grading adjustments on the remote client's DaVinci Resolve workstation until the remote grading session has ended.

> **NOTE:** Remote grading does not require a shared database.

Setting Up for Remote Grading

To start a remote grading session, the client's DaVinci Resolve must be able to connect to the colorist's system using TCP/IP.

1   Open DaVinci Resolve on the remote client's workstation (the one that's being remotely controlled), log in, and open the project that will be remotely graded.

2   Choose Workspace > Remote Grading (Ctrl-G) on the remote client's workstation. A window is displayed with text fields to enter the IP address and port number of the colorist's system.

3   Set the IP address field to the IP of the colorist's DaVinci Resolve workstation. If the colorist's system already has a public IP address, the port number can be left at its default value (15000). If the colorist's system is on a private network, the colorist or their network administrator should set the port number to one on the public IP router that is internally routed to port 15000 of the colorist's DaVinci Resolve.

4   Once the remote client clicks Connect, the client's DaVinci Resolve system will attempt to establish a connection with the remote colorist's workstation.

5   Once the connection is established, a pop-up appears on the colorist's screen asking for permission to accept a Remote Grading connection.

6   Click OK to accept, minimize the size of this dialog window, and continue grading normally.

The Remote Grading session will remain active until one of the users chooses to disconnect or an error occurs causing DaVinci Resolve to automatically terminate the session.

Remote Grading Restrictions

To allow operation over low bandwidth and a potentially long latency Internet connection there are some restrictions to remote operation.

- When playback is started, the playback speeds on the two DaVinci Resolve systems may differ. The frame positions are only guaranteed to be synchronized when playback is stopped.

- Input/output/display LUTs applied from the Config page on the colorist's DaVinci Resolve will not have any effect on the client system. LUTs selected on the client's DaVinci Resolve will be applied instead.

- Presets applied from the Config/Color pages on the colorist's system will not have any effect on the client's system. Presets selected on the client's DaVinci Resolve will be applied instead.