



## Secondary Grading Controls

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# Secondary Grading Controls

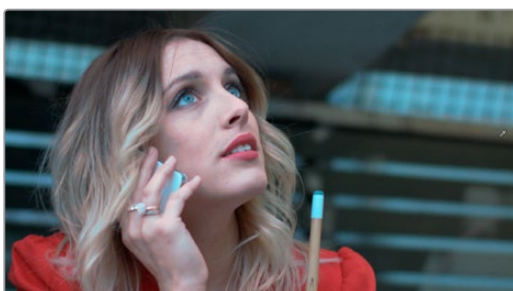
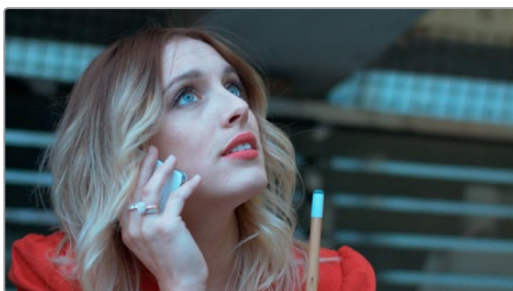
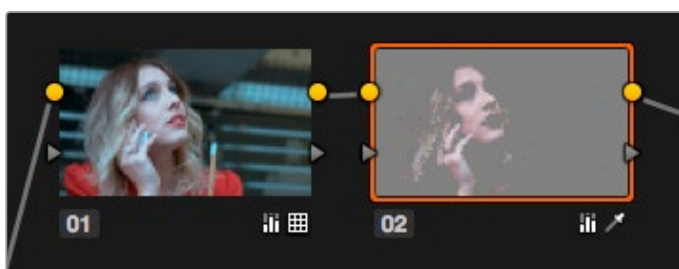
Secondary correction describes isolating a specific part of the image, or a specific subject, using a key. Keys in Resolve are grayscale images that define which areas of the picture you want to alter (in white) and which parts of the picture you want to leave alone (in black). Keys are generated either using the controls in the Qualifier palette, by using a Power Window, or by importing an external matte (for more information on how to use external mattes, see Chapter 30, “Working in the Node Editor”). Qualifiers let you key a range of color values (similarly to doing a green screen key) in order to create a matte. Power Windows let you use a shape to do the same thing. In addition to describing these two methods of working, this chapter also shows how you can combine the two, and how you can use motion tracking to make Power Windows follow along with the motion of subjects and the camera.

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## Secondary Qualifiers

This section covers the use of the Qualifier palette, which lets you pull a 3D, HSL, RGB, or Luma key, with which to isolate the correction you need. The Qualifier controls are fast and flexible when you need to isolate an irregularly shaped subject with a distinct range of color or lightness. Since you're generating a key by sampling the image, there's no need for tracking or keyframing, so in the right situation Qualifiers can be your fastest solution. In the following example, the client likes the slightly cool treatment overall, but wishes that the skin tones were a little more vibrant. This is exactly the sort of situation where Qualifiers can help out. Adding a second node, and using the 3D or HSL Qualifier to isolate the face makes it relatively simple to add color exactly where you want it.



(Top) Adding a second node and using HSL Qualification to isolate the skin tones.  
(Middle) The image with a simple primary correction. (Bottom) The final adjusted image.

Just about every control in the Color page can be limited using the the Qualifier modes available in Resolve. This makes the Qualifier palette a jack-of-all-trades tool with 101 uses. A few practical examples include keying a red element that's too intense for broadcast, in order to darken it or desaturate it; keying a range of green foliage, so you can shift its hue to a more attractive color; keying an actor's skin tone in a commercial, to apply some selective softening to it; or keying a range of sky, in which to to add blue.

## Adding a Secondary Operation to the Node Editor

Any node can be switched between functioning as a primary correction, where the adjustments you make affect the entire image, and a secondary correction, where you're adjusting a specific element in the scene. The only difference is that nodes being used for secondary corrections are limited using a Qualifier, Power Windows, or an external matte.

If you're planning to add a secondary operation to the current grade, you'll need to first add another node in the Node Editor. When pulling a key to qualify part of the image, it's important to understand that you'll be sampling the YRGB values being fed to that node from any previous nodes in the tree. That means that the state of the image being fed to a node you're qualifying affects the key you're pulling.

For example, if the image coming out of Node 1 is well saturated and has a neutral color balance with a wide range of colors, but the image coming out of Node 2 applies a low saturation, monochromatically orange color wash, you may find it more difficult to pull a detailed key from Node 2 than you would from Node 1.

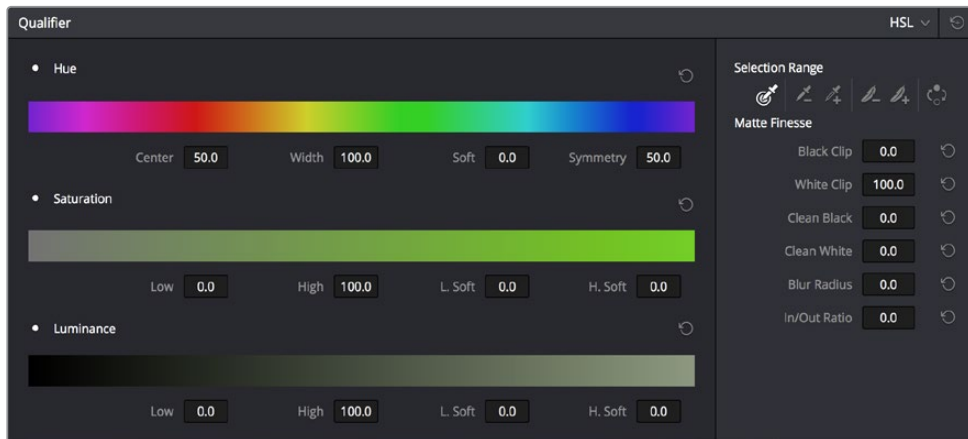


Choosing your battles—the image coming out of Node 1 will be easier to key than the highly stylized image coming out of Node 2

This is important because you have the flexibility of determining from what image you want to try pulling a qualified key. By connecting the node that's outputting the best YRGB image for the key you're trying to create to the node you're qualifying, you can control what you're keying. For more information about choosing which node to use for setting up a qualifier, see “Manipulating and Combining Keys” in Chapter 30, “Working in the Node Editor.”

## The Qualifier Interfaces

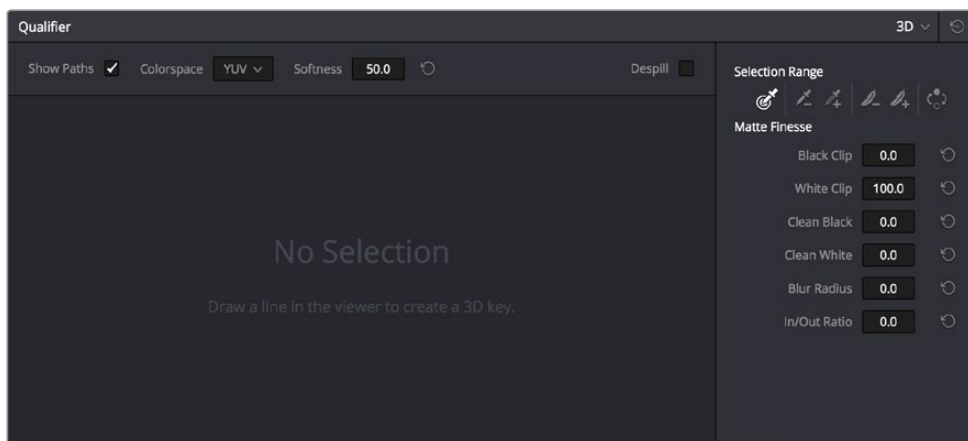
The DaVinci Resolve Qualifier palette interface is straightforward. To the left, graphical controls above numeric parameters let you manually adjust what ranges of each color component contributes to the key you're creating. To the right, Selection Range tools below lets you define a key by sampling pixels of the image, either using the pointer, or by using the fourth trackball of a DaVinci control panel, while below a set of Matte Finesse parameters let you alter the shape of the key that's been pulled.



Qualifier palette with HSL controls selected

The default qualification mode is the HSL Qualifier, which uses three color components, hue, saturation, and luma, to define a key. However, you can also use the RGB or LUM (Luma) qualification modes to pull keys using other combinations of color components. The LUM qualifier mode, in particular, lets you make targeted adjustments to specific ranges of image lightness. This is a technique employed by many colorists to alter color temperature within a specific range of image highlights or shadows.

Alternately, you can use the 3D qualifier introduced in DaVinci Resolve 12 to quickly and easily pull well-refined keys by drawing lines to sample colors from the image that correspond to volumes of color within a three-dimensional gamut. While the underlying technology is sophisticated, all you have to do is to draw blue lines to sample colors you want to isolate, or red lines to sample colors you want to subtract from the isolation you're creating, all of which automatically generate a high-quality key. Each line you draw adds a sample to the selection list; you can turn each sample off and on to evaluate its contribution to the resulting key, or delete samples that don't make a positive contribution.



The 3D qualifier

No matter which qualifier mode you use, the Matte Finesse controls make it easy to refine the resulting key to be even cleaner and more usable. In some instances, you can even take a marginal key that would otherwise be unusable, and squeeze it into something useful using the Clean Black, Clean White, and Blur Radius controls.

## Which Qualifier Do I Use?

The Qualifier palette's four modes offer you the flexibility to use the best keyer for the job when it comes to isolating a range of color or brightness values. In some cases, keys that are difficult to pull using some modes are easier to pull using others. Here's a brief summary:

- **3D:** The 3D keyer is a good one to start with if you're trying to isolate a range of color such as a blue shirt, a cyan sky, a performer's skin tone, or the orange leaves of a tree in autumn. Its interface of drawing lines over the part of the image you want to isolate, coupled with its high quality and extreme specificity, make it a fast and accurate tool to use in a variety of circumstances. However, the 3D keyer always samples every color component of the image; it's not useful when you want to isolate specific color components, such as luma only, or hue and saturation without luma. The 3D keyer's greatest strength, the speed with which you can sample areas of the picture to include (or exclude) from the final key, is also occasionally a weakness with images where your initial samples aren't giving you satisfactory results, because there aren't many ways to fine tune the key as it's being generated (although you can manipulate the result). On the other hand, for most images you would want to qualify, two or three samples is all you need, in conjunction with using the Matte Finesse controls to adjust the resulting key. If you need to do some compositing in the Color page, the 3D keyer also does an excellent job doing blue and green screen keying to create transparency, and has a built-in Despill control as well.
- **HSL:** In many instances, the HSL keyer is not as immediately accurate as the 3D keyer, and will include a broader portion of the image for any given sample. On the other hand, if the 3D keyer is not giving you satisfactory results for a particular shot, the HSL keyer can sometimes do a better job. Because of its interface, the HSL keyer makes it easier to "fine-tune" the range and softness of each individual color component that's sampled, in order to improve the result. The HSL keyer also gives you the option of disabling color components that you don't want to contribute to the final key, so that you can pull a saturation-only key, or a hue-only key, for instances where that may solve the issue at hand.
- **RGB:** The RGB keyer shares many of the limitations and advantages of the HSL keyer, but since you're sampling and adjusting red, green, and blue color components, the specificity with which you can fine-tune the resulting key works much differently.
- **LUM:** The LUM keyer works specifically to isolate parts of the image based on image tonality, lightness or darkness. This is the perfect tool when you're trying to isolate highlights or shadows in the image, which let you solve a multitude of different creative and technical issues. The LUM keyer is identical to using the HSL keyer with the Hue and Saturation qualifier controls turned off.

The following two sections provide an overview of how to use the 3D and HSL keyer modes in Resolve.

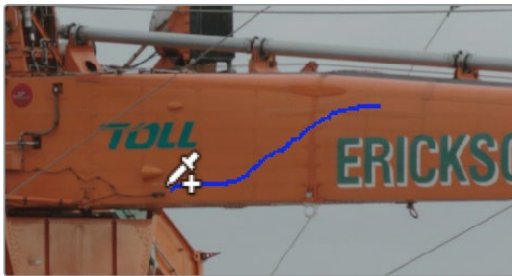
# Basic Qualification Using the 3D Keyer

The 3D qualifier mode offers a fast, simple way of pulling a key to isolate a range of color in the image, by drawing lines over the parts of the image you want to key. Each line you draw over the image adds to or subtracts from the cloud of values you're carving out of a three-dimensional representation of all available colors; you don't see this representation, but this "under the hood" functionality is what gives the 3D keyer its name.

The 3D keyer is a general-purpose keyer, letting you isolate any color you like. However, the 3D keyer is not good at pulling luma-only keys. If you're looking to isolate a range of luma values in the image, you should use the LUM mode.

### To use the 3D mode to isolate a subject in the Viewer:

- 1 Open the Qualifier palette, choose 3D from the mode pop-up, and click the eyedropper.
- 2 Click and drag across the part of the image you want to isolate to draw a line. Lines that add to the key are colored blue.



Drawing a line to create a key using the 3D qualifier

- 3 To see the key you're creating as you work, click the Highlight button in the Viewer Options toolbar at the top of the Viewer.

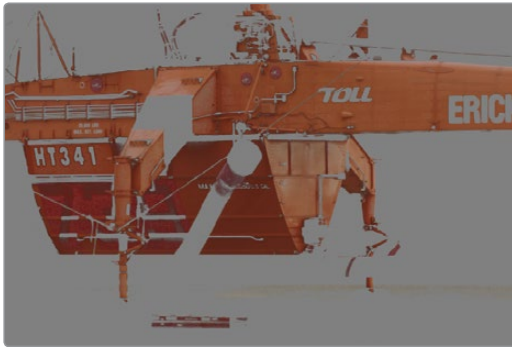


Viewing the key using the Highlight button

With the Highlight turned on, the lines you draw become invisible. They'll reappear whenever you turn the Highlight off.



- 4 If necessary, draw additional lines to add more of the image to the key you're creating. Ordinarily, it's a good idea to not to draw more than two or three lines to sample the part of the image you're trying to isolate. Ideally, you want the key you're pulling to have a somewhat soft edge, which makes it easier to use the Matte Finesse controls to fine-tune your result later on. If you draw too many lines to sample the image, the result can be a key with hard, jagged edges that can sometimes be more difficult to adjust later on.



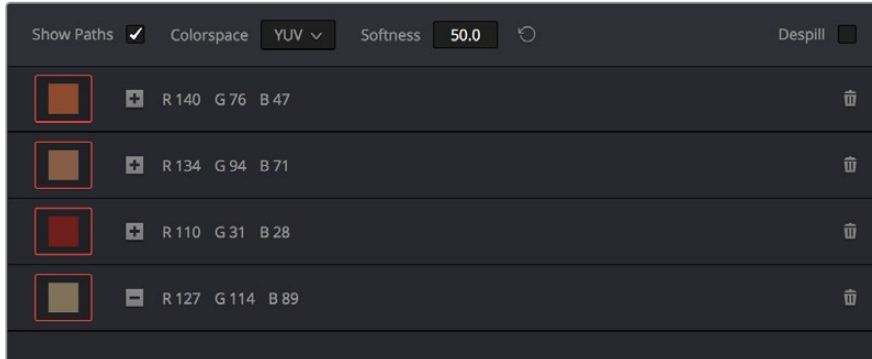
A hard-edged key created with three samples

- 5 Alternately, if there are parts of the image that are included in the key that you want to omit, hold the Option key down and draw a line over these areas. When you turn the Highlight button off, you can see that Option-drawn lines are red, and these subtract areas from the key you're creating. Again, try not to overdo drawing subtractive red lines, as you can end up with an overly hard-edged key that's difficult to adjust using other controls in the next few steps.



Blue lines add to the key, a red lines subtracts the grass from the key, as seen with the highlight turned off

- 6 If you find yourself wondering whether a particular sample in the list at left is doing any good, you can click the color patch at the left of any entry in the list to toggle that sample off and on. If you decide you don't need a particular sample, click the trash can button at the right to delete it.



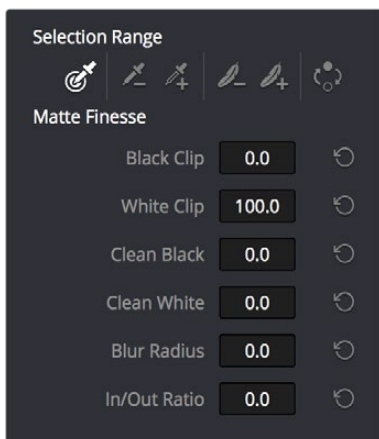
Controls for toggling samples off and on, and deleting them from the list

- 7 When you're satisfied that the key is good enough to start fine-tuning, stop drawing lines. It's all right if there's a bit of noise, speckling, or if there are small holes in the key you're creating, because you can take care of these using the Matte Finesse controls.



A sampled key that's ready for further refinement

Nearly every key you pull will benefit from some further “post-key” refinement. What this means is that, once you've created the best key you can procedurally through sampling the image, you can now adjust the resulting key itself, which is just a gray-scale image, to improve the isolated result. This is what the Matte Finesse controls are for.



Matte Finesse controls

- 8 The three most common methods of key refinement using the Matte Finesse controls are to increase Clean Black to fill in “holes” in the parts of the image you’re omitting (the background), increase Clean White to close holes in the part of the image you’re isolating (the foreground), and then use Blur Radius and In/Out Ratio controls to blur the edge of the key and push it in and out. Using these controls, you can vastly improve nearly any key without the need to endlessly readjust the Qualifier controls.

More information about using the Matte Finesse controls appears later in this chapter.

- 9 When you’re finished, click the Highlight control to turn the highlight off, and make whatever adjustment you need. In this example, the orange of the helicopter will be adjusted using the Hue control to make it blue instead.



Adjusting the orange color of the helicopter to be Blue instead

## Basic Qualification Using the HSL Keyer

The HSL qualifier is one of the most flexible tools in Resolve. Using any combination of sampled hue, saturation, and luma, you can isolate different ranges of color and contrast for specific adjustment. HSL is a general-purpose keyer, meaning you can key any color you like; it’s not restricted to blue or green.

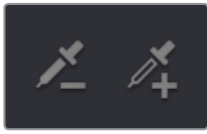
The most straightforward way to use any qualifier is to sample the image in the Viewer. A set of four controls let you sample pixels within the image in different ways. When you sample one or more pixels, the Hue, Saturation, and Luma values are analyzed, and set different ranges in each of the Hue, Saturation, and Luma qualifier controls. There are a number of different eyedropper controls available to control how you sample color in the image.

- **Sample Eyedropper:** The first control you use whenever sampling the image. It defines the initial range of the qualification; you must use this tool before any of the others. Clicking once with this tool selects a single pixel value, while clicking and dragging selects a range of image values that add together.



Color Picker button

- **Add/Subtract Color Range:** These two controls let you add areas of the image to, or subtract them from, the currently selected inner range of values that define the core of the key. As with the eyedropper, you can click on single pixels, or drag over a range of color.



Add and Subtract color buttons

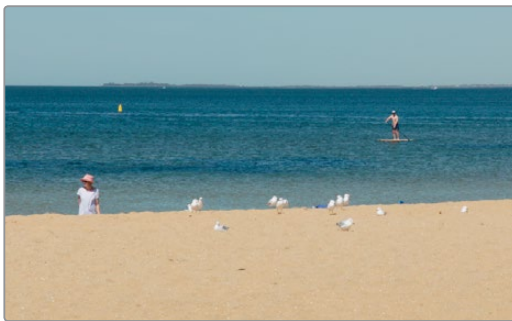
- **Add/Subtract Softness:** These two controls let you redefine the softness that transitions from the inner range of the key, falling off towards the outer edge of the key. Just like the other controls, you can click on single pixels, or drag over a range of color.



Add and Subtract qualifier softness

**NOTE:** When you select one of the sampling controls, it remains selected until you select another sampling control. If you select another clip in the Timeline, then click in the Viewer to sample a key and nothing happens, make sure that you select the Eyedropper control in the Qualifier palette.

If you're working with the Resolve on-screen interface, the easiest way to qualify a subject is to use the pointer in conjunction with the sampling controls.



Example image to qualify

To use the HSL Qualifier mode to isolate a subject in the Viewer:

- 1 Open the Qualifier palette, choose HSL from the mode pop-up, and click the eyedropper.
- 2 Either click a pixel of the part of the image you want to isolate, or click and drag across a range of pixels within that subject.



Picking to qualify the ocean

- 3 To see the key you're creating as you work, click the Highlight button in the Viewer Options toolbar at the top of the Viewer.

By default, the area of the image you're isolating appears in color, while the area of the image being excluded appears solid gray.

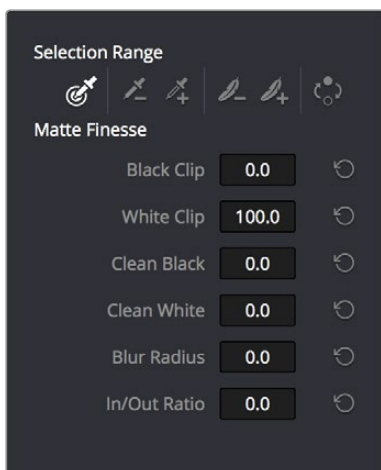


Viewer image with highlight turned on, isolated region appears in color, omitted region appears gray

Even though the highlight obscures the rest of the image, this doesn't prevent you from using the sampling tools to select pixels you can't see.

- 4 To subtract from the inner range of the key you're creating, click the minus Color Range control, and click or drag across the portion of the keyed image that you'd like to exclude.
- 5 To add softness to the outer range of the key you're creating, click the plus Softness control and then click or drag across the portion of the image you'd like to include as a soft edge.

Once you've finished using the range and softness sampling controls to refine the key you're using to isolate the subject, nearly every key you pull will benefit from some further "post-key" refinement. What this means is that, once you've created the best key you can procedurally through sampling the image, you can now adjust the resulting key itself, which is just a gray-scale image, to improve the isolated result. This is what the Matte Finesse controls are for.



Matte Finesse controls

- 6 The three most common methods of key refinement using the Matte Finesse controls are to increase Clean Black to fill in “holes” in the parts of the image you’re omitting (the background), increase Clean White to close holes in the part of the image you’re isolating (the foreground), and then use Blur Radius and In/Out Ratio controls to blur the edge of the key and push it in and out. Using these controls, you can vastly improve nearly any key without the need to endlessly readjust the Qualifier controls.

More information about using the Matte Finesse controls appears later in this chapter.

- 7 When you’re finished, click the Highlight control to turn the highlight off, and make whatever adjustment you need. In this example, the saturation has been raised and the color balance changed to make the adjustment obvious.



Altered color balance of the ocean and sky

If you have a DaVinci control panel, you can use the fourth trackball to sample the image, referring to either the Viewer or the display connected to the video output of your DaVinci workstation.

#### To sample a subject using the DaVinci control panel:

- 1 Press VECTORS on the T-bar panel to open the Qualifier palette, which defaults to the HSL Qualifier controls.
- 2 Press CURSOR (the third button above the fourth trackball) on the Center panel, to display the small cursor crosshairs in both the Viewer and the video output display.
- 3 Use the fourth trackball to position the cursor over the subject you want to sample, and press the leftmost of the three buttons appearing underneath the fourth trackball to sample the image.
- 4 Press HILITE on the Transport panel to turn on the highlight so you can see the key you’re creating, and then use the knobs at the top of the Center panel to adjust the range and softness parameters to obtain the most accurate key for your purposes.

## HSL Qualifier Presets

There is a set of HSL Qualifier presets, or Six Vector presets, that you can use to isolate automatically a predefined wedge of color (green, blue, red, magenta, yellow, or cyan) or chroma intensity (chroma light, chroma dark, or both). These presets are available either from the Color > Presets menu, or from the DaVinci control panel.

Selecting one of these presets automatically sets the HSL Qualifier to the corresponding range or color or lightness. Afterwards you can continue modifying the HSL Qualifier to suit your purpose.

To choose a Six Vector preset from the DaVinci control panel:

- 1 Press the PRESETS soft key on the Center panel. The Center panel's soft keys update with all the available lightness and color presets.
- 2 Press the soft key corresponding to the preset you want to use. The HSL Qualifier updates with the new settings, and the Center panel goes back to the main page of soft key controls.

## Using Highlight to See What You're Isolating

The Highlight control at the top of the Viewer (revealed by turning on Viewer Options in the Viewer's Option menu) lets you overlay a representation of the key you're creating over the current image in the Viewer. Overlays are also mirrored to your video output, so they'll show up on an external display as well, in the event that you're hiding the on-screen Viewer.

There are two types of highlights with which you can evaluate a qualification you're creating. Each is useful for different tasks.

- **Flat-Gray:** The default highlight that Resolve uses shows the selected portion of the image with the original colors, and the unselected portion of the image with a flat gray. It is useful for seeing the subject you're isolating even while you're adjusting the Qualifier controls, which lets you also see the color or contrast adjustments you're applying at the same time.



Oranges qualified and highlighted

- **High-Contrast:** Pressing Option-Shift-H, you can show what's called a "high-contrast" highlight, which should be familiar to you if you've used other color correction applications and plug-ins; it's a more typical display wherein the selected portion of the image is white, and the unselected portion of the image is black. The high-contrast highlight is useful in situations where you need to eliminate holes in a key, or evaluate how "chatter" a key is since irregularities are easier to spot when divorced from the original image.



Hi-Contrast B&W highlighting

**To enable or disable a highlight, do one of the following:**

In the Viewer Options toolbar at the top of the Viewer, click the Highlight control, and choose the type of highlight you want from the buttons that

- Choose an option from the View > Highlight submenu; a regular Highlight is Shift-H.
- On the T-bar panel of the DaVinci control panel, press HILITE.

**To enable or disable a high-contrast highlight, do one of the following:**

- Choose View > Highlight > Highlight BW (Option-Shift-H).
- On the T-bar panel of the DaVinci control panel, press SHIFT DOWN and then press HILITE.

**To make high-contrast black and white the default highlight:**

- 1 Open the Settings window.
- 2 Open the General Options and turn on “Mattes display high contrast black and white.”
- 3 Click Save.

The next time you click the Highlight control in the Qualifier palette, or press HILITE on the DaVinci control panel, the high-contrast highlight will display.

## Using Highlight to Solo Nodes

There's one other use of the Highlight control, and that's to solo individual nodes in the Viewer and video out, rather than outputting the sum of the entire node tree. For example, if you're trying to adjust a stack of nodes attached to a Parallel or Layer Mixer node, it's difficult to see what you're doing while adjusting one of the stack of nodes, because only the final result is being output.

However, if you turn on Highlight while you're selecting a node with no key, then only the currently selected node is output, making it easy to view just one node as you adjust it. Just make sure you turn Highlight off before moving on, or you may confuse yourself.

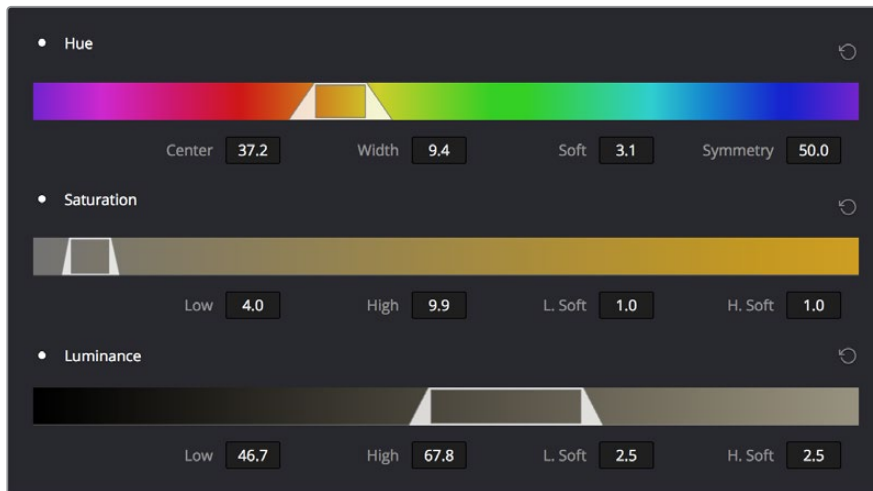
## Qualifier Parameters

Each of the Qualifier modes has parameters that correspond to the relevant color components for that mode, with which you can identify a range and softness, similar to using the sample tools. These parameters can be edited as virtual sliders using the pointer, or you can modify them using the knobs of the DaVinci control panel.

### HSL Qualification Controls

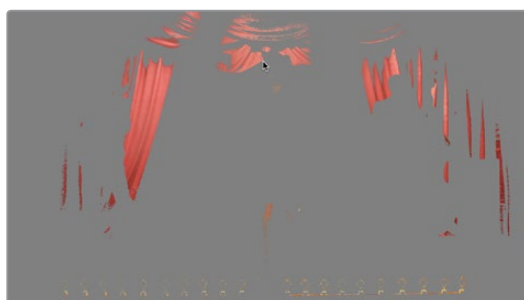
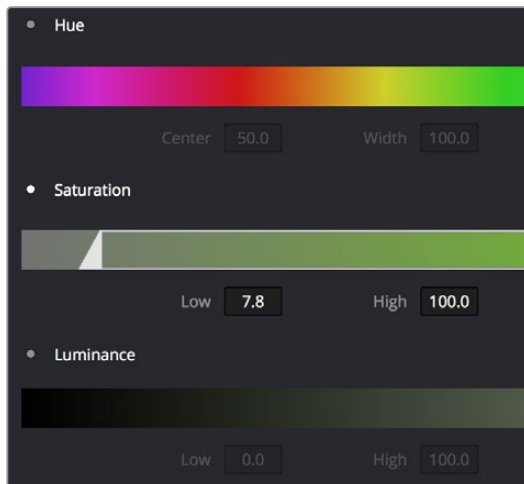
The HSL Qualifier is by far the most versatile mode of the Qualifier palette. It's also the qualifier that's easiest to understand, and the easiest to adjust by hand if you don't feel the need to sample the image. By selecting range and softness for each of three different color components, hue, saturation, and luma, you can isolate a wide variety of colorful subjects, or ranges of image lightness and saturation.





The HSL Qualifier controls in close up

One of the HSL Qualifier's key strengths, and one of its most underutilized features, is that you can enable or disable each of the three HSL components using the Hue, Sat, and Lum buttons, found at the upper left of each Qualifier range control. This lets you ignore specific color components, while focusing on others that are more important. For example, if you're trying to isolate the saturated parts of an image, regardless of the hue or brightness, you can turn off the Hue and Lum qualifiers so that only Sat is used to sample the image.



Qualification with saturation only to isolate the most saturated portion of the picture

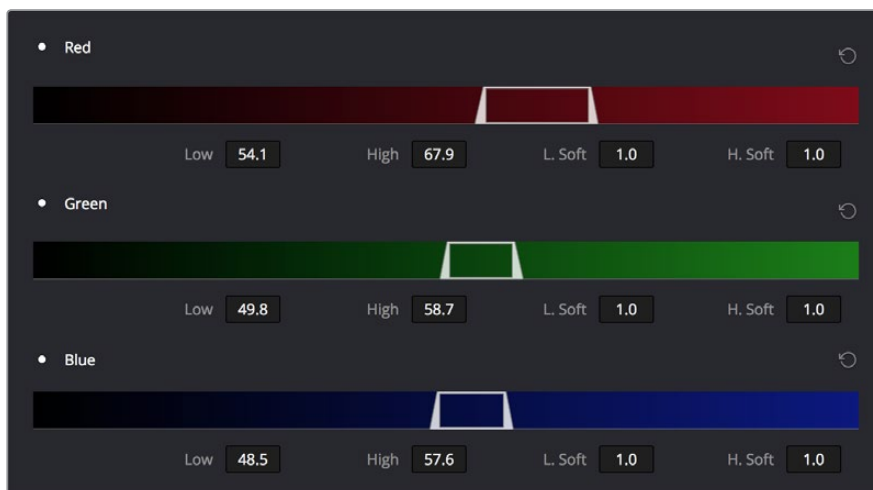
### The HSL parameters include:

- **Hue Center:** Defines the center of the range of Hue being isolated.
- **Hue Width:** Defines the width of the range of hue being isolated. Widening or narrowing this parameter widens and narrows the range of hue about the current Hue Center.
- **Hue Soft:** Widens or narrows the falloff at both sides of the currently selected range of hue.
- **Hue Symmetry:** Lets you selectively alter the angle of Hue Soft falloff at either the right or left side. Lowering this parameter makes the softness to the right of the hue range grow steeper. Raising this parameter makes the softness to the left of the hue range grow steeper.
- **Sat Low/High:** Two parameters let you define the upper and lower range of saturation being isolated.
- **Sat Low Soft/High Soft:** Two parameters let you define the upper and lower softness falling off outside the current range of saturation.
- **Lum Low/High:** Two parameters let you define the upper and lower range of luma being isolated.
- **Lum Low Soft/High Soft:** Two parameters let you define the upper and lower softness falling off outside the current range of luma.

## RGB Qualification Controls

The RGB Qualifier mode lets you isolate range and softness in the Red, Green, and Blue channels of an image. While this is not necessarily an intuitive way of manually creating a qualification from scratch, it can provide a different way of isolating potentially trickier ranges of the RGB color space.

If you start by sampling the image, then you can widen and narrow each color channel's isolated range of values. In some cases, you may find it's faster to isolate a specific range of continuous color by adjusting these controls.



RGB qualification controls

### The RGB parameters include:

- **Red Low/High:** Two parameters let you define the upper and lower range of the Red channel being isolated.
- **Red Low Soft/High Soft:** Two parameters let you define the upper and lower softness falling off outside the current range of red.
- **Blue Low/High:** Two parameters let you define the upper and lower range of the Blue channel being isolated.
- **Blue Low Soft/High Soft:** Two parameters let you define the upper and lower softness falling off outside the current range of blue.
- **Green Low/High:** Two parameters let you define the upper and lower range of the Green channel being isolated.
- **Green Low Soft/High Soft:** Two parameters let you define the upper and lower softness falling off outside the current range of green.

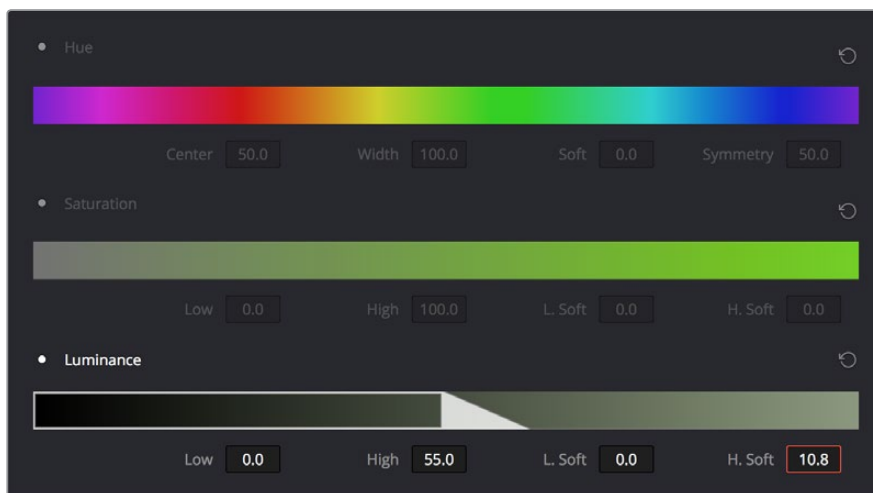
## Luma Qualification Controls

The Luma Qualifier mode simply pulls a key from the Luma channel all by itself. It's identical to the HSL qualifier with H and S turned off. This single-component keyer is more useful than you might think; it's a common technique to isolate a range of highlights, midtones, or shadows throughout the image to alter the color temperature selectively.

Also, keep in mind that the luma component is the sharpest keyable component when you're working with heavily compressed video. Keys that are noisy or chunky with HSL qualification may be sharper if you just use the Luma Qualifier, although you won't be able to be chromatically specific.

### The Luma Qualifier has four parameters:

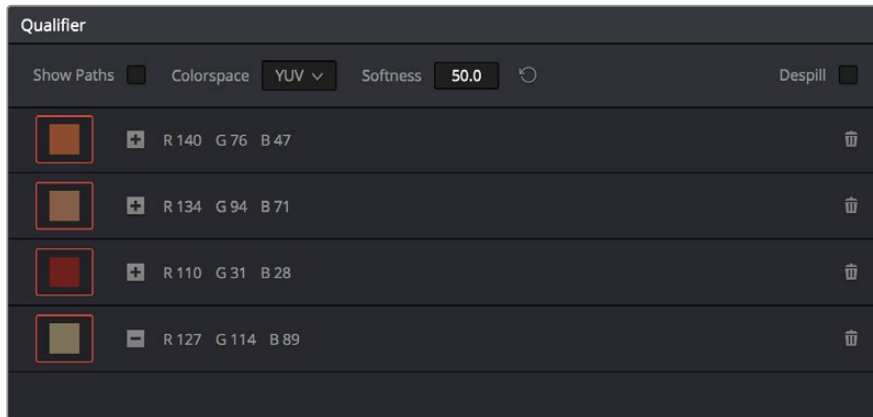
- **Lum Low/High:** Two parameters let you define the upper and lower range of the luma component being isolated.
- **Lum Low Soft/High Soft:** Two parameters let you define the upper and lower softness falling off outside the current range of luma.



The Luma Keyer mode automatically disables the Hue and Saturation controls

## 3D Keyer Controls

As discussed earlier in this chapter, the 3D Keyer works much differently than the other qualifiers in Resolve. In this mode, drawing lines over parts of the image you want to isolate adds samples to the Sample list, some of which add to the key (when you drag with the pointer) and some of which subtract from the key (when you Option-drag with the pointer). While this functionality is very simple to use, there are other controls that are available.



The 3D Qualifier mode

### The 3D parameters include:

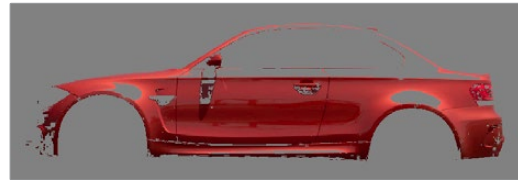
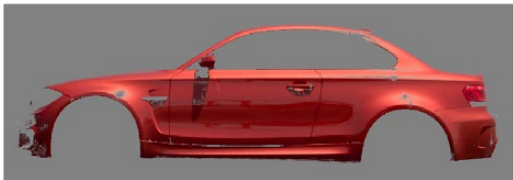
- **Show Paths:** A checkbox that lets you turn the visibility of the lines you're drawing to sample the image on and off. Turning lines off does not affect the key in any way.
- **Colorspace:** A pop-up menu that lets you choose whether you're sampling colors in YUV colorspace or HSL colorspace. YUV is the default, but if you find you're not getting satisfactory results, you can reset the Qualifier palette and switch to HSL to see if that works any better.
- **Softness:** A single parameter lets you adjust the overall softness of the key you're creating. The default value is 50. Raising this value increases key softness, lowering it decreases key softness.
- **Despill:** If you're using the 3D keyer to pull a blue or green screen key to create transparency in conjunction with the optional Alpha Output in the Node Editor, this checkbox lets you turn on an automatic color correction that eliminates blue or green spill from the image, while retaining the image's original color.
- **Sample list:** A list shows each line you drew as a sampled entry. A color patch at the left shows you the average color you sampled, clicking the color patch turns lets you temporarily turn any color sample off to evaluate its contribution to the overall key. A plus or minus icon shows you whether that patch is adding to or subtracting from the key. The average red, green, and blue color values are shown next, and a trash can icon at the right lets you delete any sample from the list.

## Matte Finesse Controls

After you've used the sample controls and Qualifier parameters to create the most useful key for your purposes, you may find that it has problems that cannot be overcome easily by the available adjustments. Issues such as chattery edges, holes, or noisy bits can sometimes be easily fixed using the Matte Finesse controls. These controls filter the output of the Qualifier controls and are adjustments that are made to the matte itself, so they may work well in some instances, and poorly in others, depending on what you're trying to do.

### Black Clip

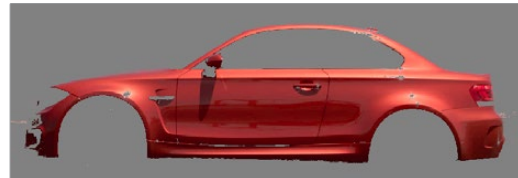
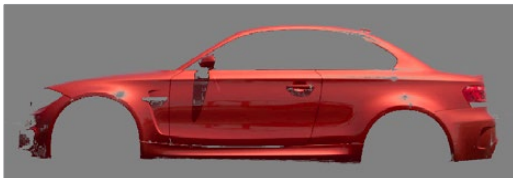
Raising Black Clip applies a "lift" adjustment such that translucent areas of the matte (gray areas when viewing a high-contrast highlight) are pushed towards black. The range is 0 to 100, with 0 being the default setting."



Before/After raising Black Clip

### White Clip

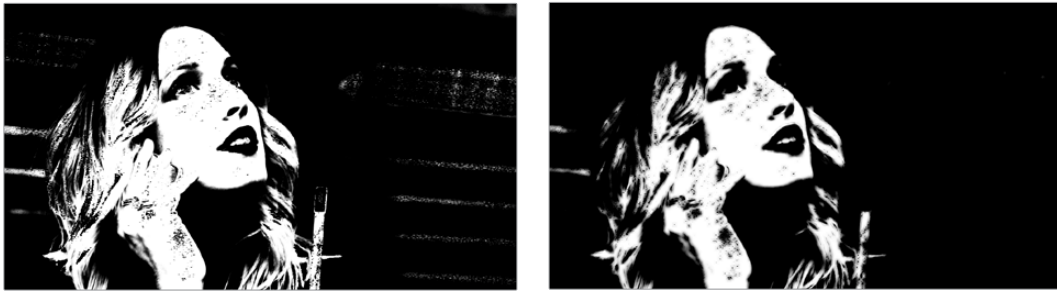
Lowering White Clip applies a "gain" adjustment such that translucent areas of the matte (gray areas when viewing a high-contrast highlight) are pushed towards white. The range is 0 to 100, with 100 being the default setting.



Before/After lowering White Clip

## Clean Black

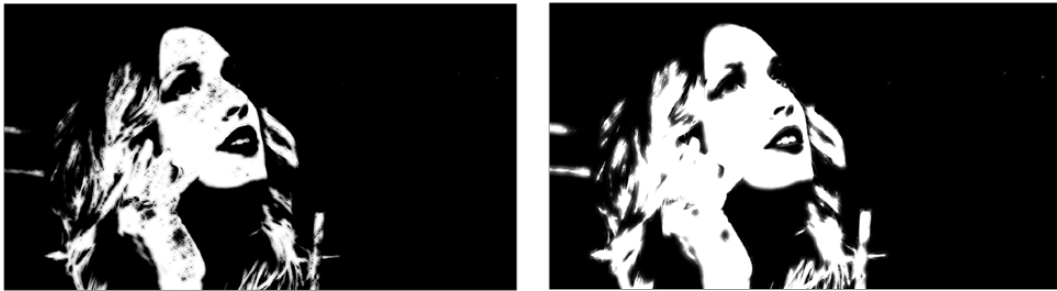
Clean Black is a specialized operation that eliminates noise (seen as white speckling when viewing a high-contrast highlight) in the black area of a key that omits the regions of the image you don't want to isolate, and shrinks the key by making the dark parts of a key darker the higher you raise this parameter, pushing dark gray areas of the key towards black. The practical result is that raising Clean Black lets you “fill holes” in the background portion of a key, and erode translucent edges.



Before/After raising Clean Black, viewing the high contrast matte

## Clean White

Clean White is another specialized operation that eliminates noise (seen as black speckling when viewing a high-contrast highlight) in the white portion of a key that include areas of the image you're isolating, and expands the key by making light parts of a key lighter the higher you raise this parameter, pushing light gray areas of the key towards white. The practical result is that raising Clean White lets you “fill holes” in the foreground portion of a key, and grow translucent edges.

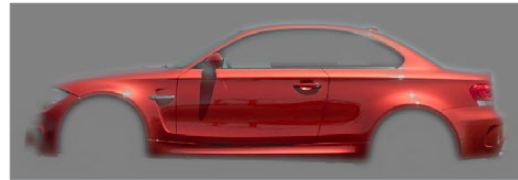
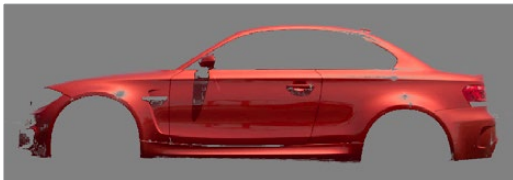


Before/After raising Clean White, viewing the high-contrast matte

## Blur Radius

In small amounts, blurring a key does well to take the edge off problem edges. However, blurring a key can also feather the edges of a key past the border of the subject you're keying, with the result being a visible "halo" around your subject depending on the adjustment you're making. The range is 0 to 2000, with 0 being the default. With such a large maximum blur radius, combined with the capabilities that the In/Out Ratio provides in customizing the direction of spread, you can turn some pretty precarious mattes into surprisingly smooth and useful results.

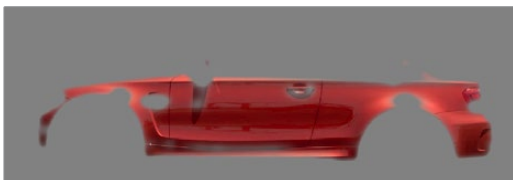
**TIP:** If haloing is a problem, you can try adjusting the In/Out Ratio parameter, or you may want to consider using the Qualifier Softness parameters to feather the edges of the key, instead.



Using the blur parameters to soften the edges of a key

## In/Out Ratio

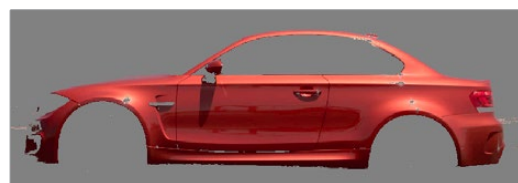
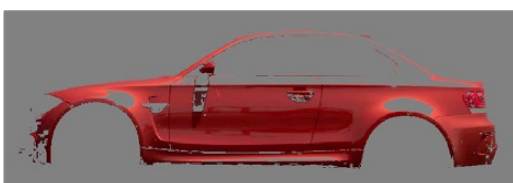
Controls whether the "Blur Radius" is applied equally to the inside and outside of the edge of the matte (zero), applied only within the matte (negative values), or applied only outside the matte (positive values). Using In/Out Ratio can help eliminate fringing when using the Blur Radius parameter.



(Left) In/Out Ratio lowered so blurring ends at the edge of the matte and feathers inward.

(Right) In/Out Ratio raised so that blurring starts at the edge of the matte and feathers outward

However, you can also use In/Out Ratio even in situations where no Blur Radius is applied at all. Raising In/Out Ratio will fill in small black holes in the matte, while lowering In/Out Ratio below 0 will eliminate speckling by pushing small white bits of the matte towards black.



(Left) In/Out Ratio controls lowered to expand holes in the matte,

(Right) In/Out Ratio controls raised to fill in small black holes in the matte

## The Many Ways to Invert a Key

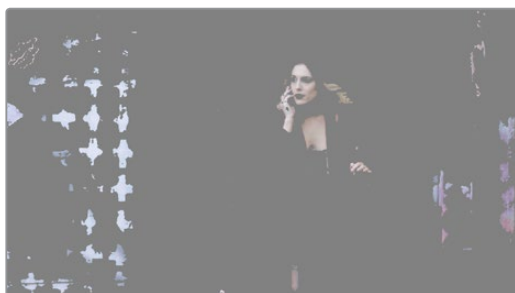
Sometimes, you'll need to isolate a subject or range of values in an image, and then make a change to everything else. One way to do this is to add an Outside node after the node in which you've created the key. This lets you make one set of adjustments to what you've keyed, and another set of adjustments to everything outside the key.

If you just need to make a simple adjustment, you can invert the key from within the Qualifier palette. However, there are three other ways to invert a key.

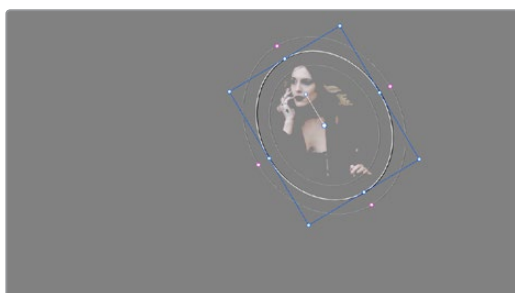
- **The Qualifier Invert button:** Clicking this control simply inverts the key being generated by all of the controls within the Qualifier palette.
- **Key Palette Qualifier Invert:** The Qualifier Invert control within the Key palette provides another control with which you can invert the key that's generated by the Qualifier palette.
- **Key Palette Output Invert:** The Output Invert control within the Key palette is notable because it inverts the sum of all keys applied within that node. For example, if you're using a Qualifier in conjunction with a Window, the two invert controls mentioned previously will only invert the Qualifier key; the Window key remains unaffected. However, using the Output Invert control inverts the overall combination of the Qualifier key and the Window, all together.

## Combining Qualifiers and Windows

This is covered in more detail in a subsequent section, but if you create a key using one of the Qualifier modes, and you then add a Window, the final key that's output by that node is limited to the intersection of the Qualifier key and the Window. This makes it easy to use a Window to "garbage matte" out bits of a key that you don't want, that can't be eliminated by further adjustment of the Qualifier controls.



The woman's skin tone is too close to other elements in the scene.

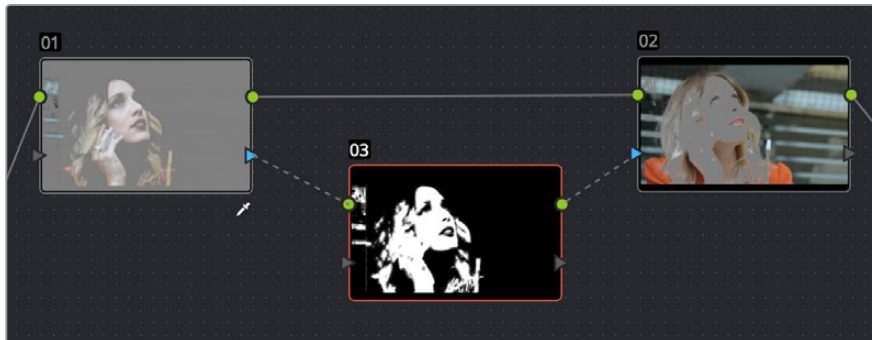


A Circular Power Window is used to further isolate the woman being isolated.



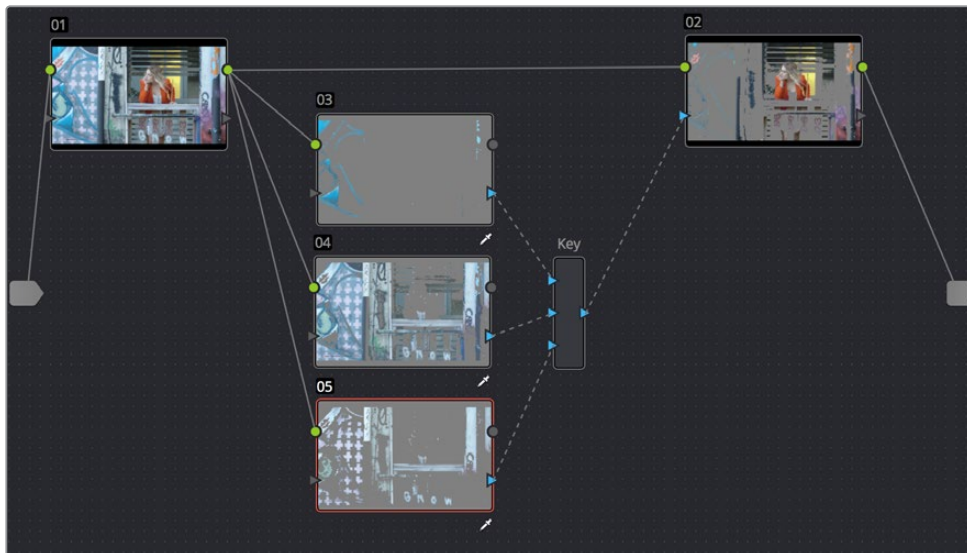
## Manipulating Keys Using Additional Nodes

If you need to make more adjustments to a qualified key than the Matte Finesse controls will allow, you can use the Node Editor to feed the KEY output of one node to the RGB input of another, at which point you can use all of the second node's color adjustment controls to manipulate the grayscale image that constitutes that key, to improve it.



Connecting a KEY output to an RGB input, and then connecting the RGB output back to the next node's KEY input again

You can also use the Key Mixer node to combine multiple keys in several different ways, adding keys together, or subtracting them from one another, in order to create exactly the key you need.



Adding multiple keys together using a Key Mixer

For more information about these techniques, see Chapter 30, “Working in the Node Editor.”

# Power Windows

Power Windows are another way of making secondary correction, being essentially shapes you can use to isolate regions of the image. Different controls let you use oval, rectangular, polygonal, or custom curved shapes. Because you can isolate regions of the image by drawing, Power Windows produce exceptionally clean results, with edges that can be precisely positioned and feathered to achieve a variety of effects.



Before/After PowerCurve Power Window isolates the sky area for a targeted correction

Power Windows (also referred to as simply “windows”) are excellent when what you need to adjust can be encompassed within a clearly defined geometrical area. For example, the oval of a person’s face, the front of a car, or a wide expanse of sky are all good candidates for windowed adjustments. A drawback of windows can be that they must be animated to follow whatever subject they’re isolating. Fortunately, this is where DaVinci Resolve’s powerful tracker comes in, making it easy to track Power Windows quickly and accurately to follow along with the subject being isolated.



Circular Power Window to focus attention to the skin

DaVinci Resolve makes it easy to combine multiple Power Windows in different ways, to intersect with one another and create even more sophisticated shapes. For example, multiple windows can be added together, or one window can be used to cut out part of another window, which saves you from the need to make complicated keyframing operations to animate that window's shape.

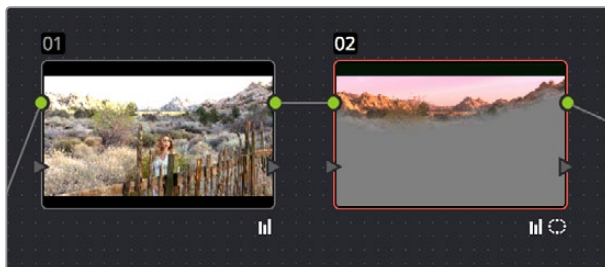


Multiple Windows combined to isolate and mask the image

This section covers the use of Power Windows, how to create and modify them, as well as how to combine multiple windows, and combine windows and qualifiers to create highly specific isolations.

## Adding Nodes with Windows

As with qualifiers, you must first add a node to a grade's node tree before you begin windowing a correction. This is because all of the windows within a particular node work together to limit that node's grade. As a reminder, any node can be changed from a primary operation that affects the entire image, to a more targeted secondary operation, simply by turning on a window, using a qualifier, or enabling an external matte.



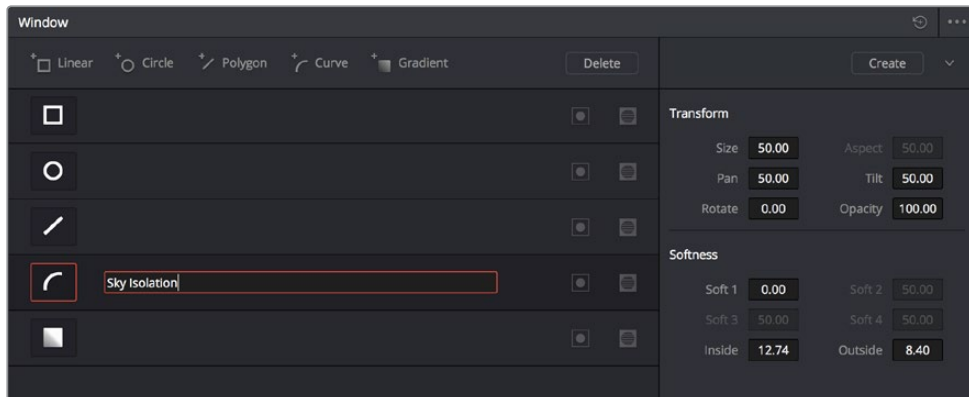
Serial nodes showing the window on Node 2

If you don't create a new node before creating a window, you'll discover you've inappropriately changed a primary correction into a secondary correction. If you create a new serial node, you'll then need to use the controls found within the Window palette to turn on a window to customize for your purposes. However, there are also a set of commands you can use to add serial nodes with a window already turned on, saving you a few clicks or button presses in the process.

### To add a new node with a window already turned on:

- Choose Nodes > Node + CPW (Option-C), or press the button of the same name on the T-bar panel of the DaVinci control panel to create a new serial node with a circular window.
- Choose Nodes > Node + LPW (Option-Q), or press the button of the same name on the T-bar panel of the DaVinci control panel to create a new serial node with a linear window.

- Choose Nodes > Node + PPW (Option-G), or press the button of the same name on the T-bar panel of the DaVinci control panel to create a new serial node with a polygonal window.
- Choose Nodes > Node + PCW (Option-B), or press the button of the same name on the T-bar panel of the DaVinci control panel to create a new serial node with a PowerCurve window.
- When you add a node with a Power Window, the Window palette automatically opens up, ready for editing WindowPaletteUI



The Window Palette

The Window palette is divided into three sets of controls: the Window list, the Presets, and the Transform and Softness controls.

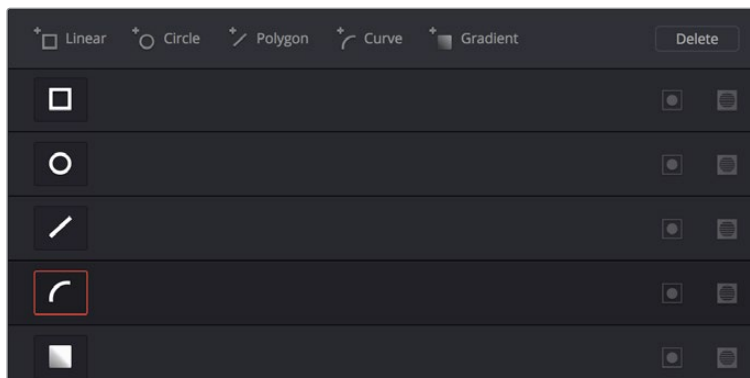
## The Window Palette Interface

Once you've created a node with which to apply a Power Window correction, you need to open the Window palette if it hasn't been opened already.

### To open the Window palette:

- Click the Window palette button.
- Press the WNDWS button on the T-bar panel of the DaVinci control panel.

The majority of the Window palette is occupied by the Window List, within which you can create as many windows as you need for the task at hand. There are five types of windows you can create, each of which has a different geometry. You can use these windows individually, or you can combine them to create even more complex shapes and interactions. The Window palette has four groups of controls that let you use these windows in different ways.



The Window palette with the Window list

- **Window List:** A row of buttons at the top of this list lets you add new windows, which you can then customize as necessary. Each window in the list exposes an On/Off button that shows the shape type, a Layer Name field you can use to identify what each window is for, an Invert button, and a Mask button that governs how that window interacts with the other windows that are currently enabled (adding to other windows by default, or subtracting from other windows in Mask mode).
- **Transform parameters:** Controls the overall size, aspect ratio, position, and rotation of the currently selected window.
- **Softness parameters:** Controls the edge softness of the currently selected window. Different window shapes have different softness options.
- **Window Preset browser:** A browser to which you can save presets of individual or multiple windows for easy recall later.
- **Option pop-up menu:** The Option pop-up menu has commands for resetting windows, deleting windows, saving and managing window presets, and copying and pasting track data.
- Using buttons along the top of the Window palette, there are five types of windows you can create:
  - **Linear:** A four-point shape that can be edited into any kind of rectangle or trapezoid you might need. In addition to the center and corner controls, you can also drag any of the four sides to change the shape.
  - **Circular:** An oval that can be shaped, sized, and feathered to solve an amazing number of problems.
  - **Polygonal:** A four-point shape that can be expanded with additional control points to create complex sharp-cornered polygonal shapes.
  - **PowerCurve:** A Bezier drawing tool that you can use to create any kind of shape, curved, polygonal, or mixed, that you require.
  - **Gradient:** A simple two-handled control for dividing the screen into two halves, with options for the center, angle, and feathering of the shape. Good for fast sky adjustments.

## Managing Windows

To manipulate a window, first you need to create the type of window you want to use, or if you've got a group of windows created already, you need to select the window you want to work on.

### Methods of creating and selecting windows:

- **To create a new window:** Click the Create Window button (at the bottom of the Window list) that corresponds to the window you want.
- **To create a new window using the DaVinci control panel:** Press WINDOWS on the T-bar panel, then use the UP and DOWN buttons on the Trackball panel to select the window type you want to apply, and press ADD.
- **To select a window using the on-screen controls:** Click anywhere within a window to select it in the Viewer.
- **To select a window from the Window list:** Click the Shape icon button corresponding to the window you want to select.

### To delete a window you no longer want:

- Select a window, then choose Delete Selected Window from the Option pop-up.

**To reset one or all windows:**

- **To reset one window to its default shape:** Select a window, then choose Reset Selected Window from the Option pop-up.
- **To reset all windows:** Choose Reset All Windows from the Options pop-up.

## Showing and Hiding On-Screen Window Controls

When you open the Window palette, the Viewer goes into Power Window mode. Enabling a window makes that window's on-screen controls appear within the Viewer, and are mirrored to video out so you can see the window controls on your external display. If you like, you can change how and where the on-screen controls appear.

**To choose whether on-screen controls are mirrored to video out, or disabled, do one of the following:**

Choose an option from the View > Window Outline submenu. There are three options:

- **Off:** Hides the window outline on both the external display and the Viewer.
- **On:** The default, shows the window outline on both the external display and the Viewer.
- **Only UI:** Hides the window outline on your external display, but leaves it in the Viewer.

Press Option-H to toggle among all three of the above modes.

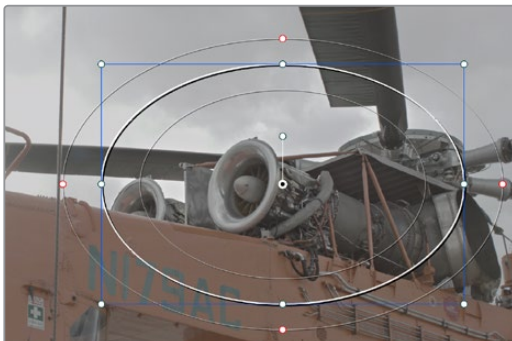
**To show or hide window on-screen controls using the DaVinci control panel:**

- Press SHIFT UP and then DISPLAY/CURSOR, above the fourth trackball on the Center panel.

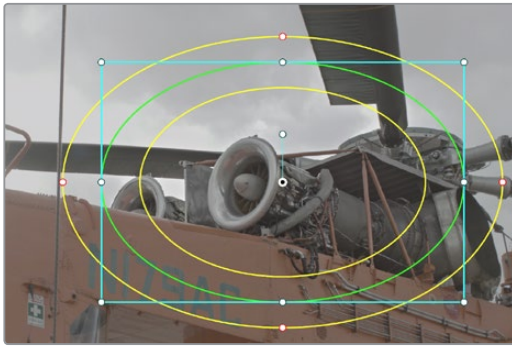
This command is a three-way toggle. The first use of this command hides the window outline on your external display, but leaves it in the Viewer. The second use of this command hides the window outline on both the external display and Viewer. The third use of this command shows the window outline on both the external display and Viewer.

## Using the High-Visibility Power Window Outline Option

Ordinarily, Power Window outlines are white (for the center shape) and gray (for the softness shapes). However, sometimes this color scheme can be difficult to see, so the Color panel of the Project Settings has an option in the General Settings section called "High visibility Power Window outlines." Turning this on sets power window outlines to be drawn as green (for the center shape) and yellow (for the softness shapes), to make these windows easier to see in certain circumstances.



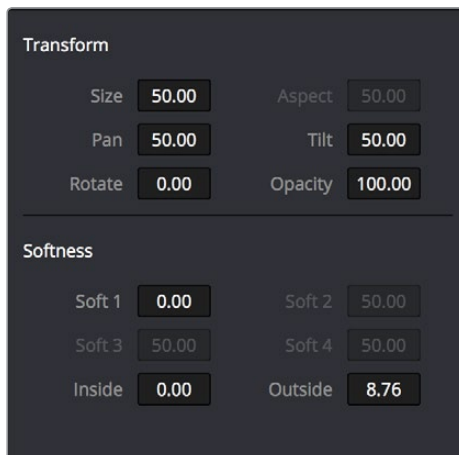
Default window outlines



High Visibility window outlines enabled in the Project Settings

## Window Transform Controls

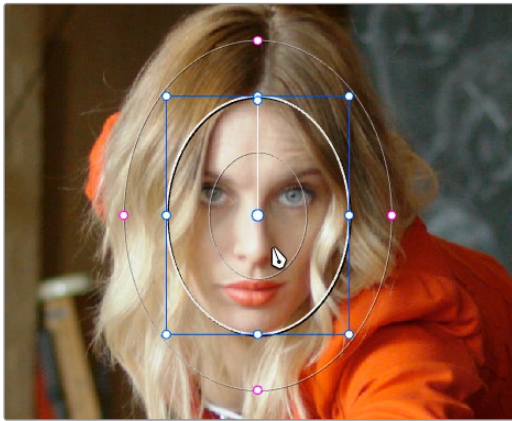
Windows have transform parameters that are similar to those found in the Sizing palette. These parameters let you alter the window, affecting all of its control points together.



Window transform controls

- **Size:** Scales the entire window up or down. 50.00 is the default size.
- **Aspect:** Alters the aspect ratio of the window. 50.00 is the default value, larger values make the window wider, and smaller values make the window taller.
- **Pan:** Repositions the window along the X axis. 50.00 is the default position, larger values move the window to the right, smaller values move the window to the left.
- **Tilt:** Repositions the window along the Y axis. 50.00 is the default position, larger values move the window up, smaller values move the window down.
- **Rotate:** The default value is 0. Increasing this parameter rotates the shape clockwise, decreasing this parameter rotates the shape counterclockwise.
- **Opacity:** Lets you vary the transparency of an individual window's contribution to a node's key.

The transform parameters also correspond to onscreen controls found in the Viewer, which can be manipulated directly using the pointer.



Manipulating the window position on the Viewer

While many of the on-screen controls correspond to parameters within the Window palette, some on-screen controls, such as the control points that govern reshaping linear, polygonal, and PowerCurve windows, are only adjustable via the pointer.

#### On-screen controls for window transforms:

- **To select a window:** Click on one of an arrangement of many windows to select it, making that window's controls active.
- **To reposition a window:** Drag anywhere within the window's onscreen control. Window position corresponds to the Window palette's Pan and Tilt parameters. For a Gradient window, drag the center control point.
- **To resize a window while locking its aspect ratio:** Drag one of the four blue corner points out to enlarge, or inwards to shrink. This corresponds to the Window palette's Size parameter.
- **To squish or stretch a window, altering its aspect ratio:** Drag one of the blue top, bottom, left, or right control points. These adjustments correspond to the Window palette's Aspect parameter.
- **To rotate a window:** Drag the top inner blue rotate handle, in the middle of the window. For a gradient, drag the bottom arrow handle.
- **To change a window's center of rotation:** Command-drag the bottom inner blue rotate handle to a new location.
- **To alter window softness:** Drag any one of the magenta softness handles. Different window shapes have different sets of handles, which correspond to the Softness parameters.
- **To reshape a linear window:** Drag any of the green corner handles to corner pin the window, or drag one of the green top, bottom, or side handles to move an entire side segment of the window around.
- **To reshape a polygonal window:** Turning on a polygonal window reveals a simple green rectangle with four corner control points. Click anywhere on the surface of the rectangle to add additional control points with which to reshape the polygon, and drag any green
- **To change the size and aspect of a PowerCurve or polygon:** Command-drag any control point to freely resize the PowerCurve about the center point.
- **To remove control points from polygonal or PowerCurve windows:** Middle-click the control point you want to remove.



**NOTE:** Removing a control point from a Polygonal window that's already been animated using the Keyframe Editor results in that point abruptly popping on and off at the keyframes creating the animation.

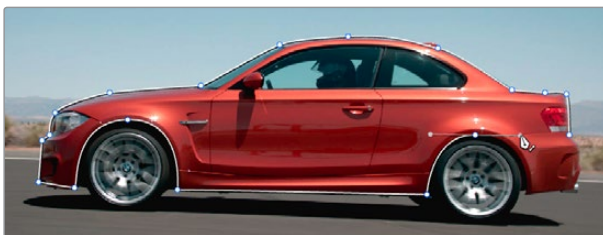
## Window Softness

Each type of window has different Softness parameters, depending on how adjustable that window is.

- **Circular:** A single parameter, Soft 1, lets you adjust the uniform softness of the oval's edge.
- **Linear:** Four parameters, Soft 1-4, let you adjust the softness of each of the four sides of the linear window independently. Magenta softness control points on the top, bottom, left, and right let you adjust the softness of each side of the linear shape independently.
- **Polygon:** Two parameters, Inside Softness and Outside Softness, let you adjust the overall softness of a polygonal window. There are no on-screen softness control points.
- **PowerCurve:** Two parameters, Inside Softness and Outside Softness, let you adjust the overall softness of a PowerCurve. Using the on-screen controls, you can adjust the magenta inside and outside softness control points independently, creating any softness shape you need.
- **Gradient:** A single parameter, Soft 1, lets you adjust the uniform softness of the gradient window's edge.

## Drawing a PowerCurve

The PowerCurve window is the only window that doesn't display any on-screen controls when it's first turned on. Instead, you must click within the Viewer to add control points, drawing your own custom shape to isolate whatever region you want.



PowerCurve window to isolate a car

**TIP:** Turning on the Viewer's full-screen mode can make it easier to draw detailed shapes. You can also zoom into and out of the Viewer while you're drawing, using either the scroll wheel of a mouse or by pressing Command-Plus or Command-Minus.

### To draw a PowerCurve:

- 1 Turn on the PowerCurve window style control.
- 2 Click anywhere in the Viewer to start adding control points and drawing the shape you need.
- 3 Click and drag to add and shape Bezier curves, or just click and release to add a hard angle.
- 4 To finish drawing and close the shape, click the first control point you created to create a corner, or click-and-drag on the first control point you created to create a Bezier curve.

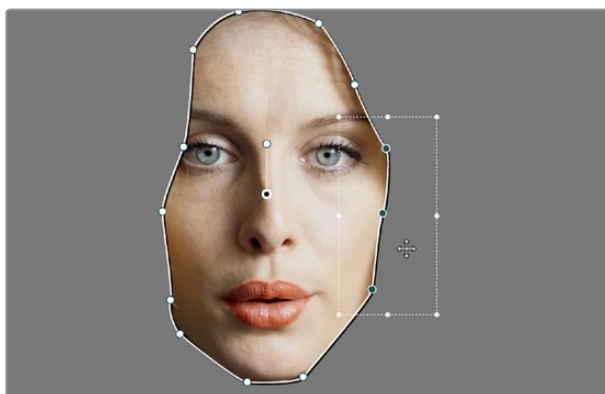
Once you've drawn a PowerCurve, there are many ways of manipulating it.

### Simple methods of modifying a PowerCurve:

- **To add points:** Click anywhere on a PowerCurve to add control points.
- **To reshape a PowerCurve:** Drag any control point to a new location.
- **To resize a PowerCurve:** Command-drag any control point to resize the whole shape. Vertical and horizontal sizing are not locked.
- **To move a PowerCurve:** Drag anywhere within or just outside a PowerCurve to move it.
- **To symmetrically alter a Bezier curve:** Drag any Bezier handle. The opposite handle automatically moves in the other direction.
- **To asymmetrically alter a Bezier curve:** Option-drag any Bezier handle. The opposite handle stays in place while you drag the current handle. Once you've created an asymmetric pair of Bezier handles, they move together as one if you simply drag a handle. You need to Option-drag to change the angle.
- **To change a curve into a corner:** Option-double-click any Bezier curve control point to change it to a sharp-angled corner point.
- **To change a corner into a curve:** Option-click any corner point and drag to pull out a Bezier handle, changing it to a curve.
- **To remove points:** Middle-click the control point you want to remove.

**NOTE:** Removing a control point from a Polygonal window that's already been animated using the Keyframe Editor results in that point abruptly popping on and off at the keyframes creating the animation.

You can also shift-drag a bounding box to select multiple control points on a PowerCurve to move, delete, or transform them all at once.



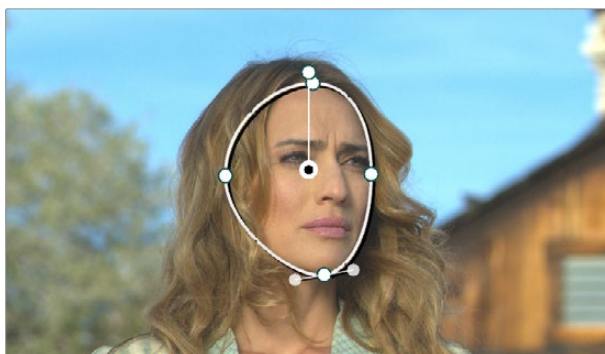
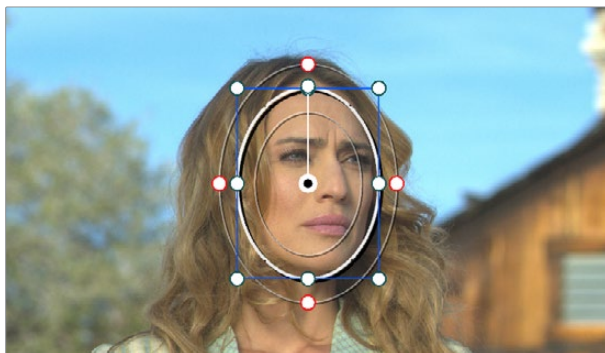
You can Shift-drag a bounding box over multiple control points to manipulate them all at once

### To select multiple control points on a PowerCurve:

- 1 Hold the Shift key down and drag a bounding box around the control points you want to manipulate or delete. All included control points will become highlighted.
- 2 Do one of the following:
  - **To move the control points:** Drag anywhere within the bounding box.
  - **To transform the control points:** Drag one of the outer corners to resize all control points symmetrically, drag the top, bottom, or side handles to squish or stretch the control points relative to one another, or move the pointer to one of the corners until the rotate cursor appears, and then drag to rotate the control points.
  - **To delete the control points:** Press the Backspace key.
- 3 When you're finished, press the Escape key to deselect the control points.

## Converting Linear, Circular, and Polygon Windows into Bezier PowerCurves

If you start out isolating a subject using one of the simple Linear, Circular, or Polygon shape windows and you realize that you need a more complex shape to accomplish the task at hand, you can easily convert them to a more complex Bezier PowerCurve by choosing Convert to Bezier from the Window palette Option menu.



Before and after converting a Circular window to a Bezier PowerCurve and adjusting the result, before adding softness to the edge

Once you've converted a simple shape to a Bezier window, you can add control points and manipulate the shape in any way you need to make it better conform to the subject, just as you would with any PowerCurve.

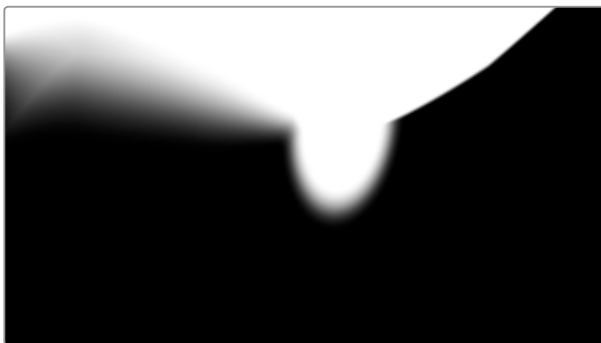
## Resetting the Window Palette

The entire Window palette can be reset using the Option menu's Reset command.

# Combining Power Windows With the Mask Control

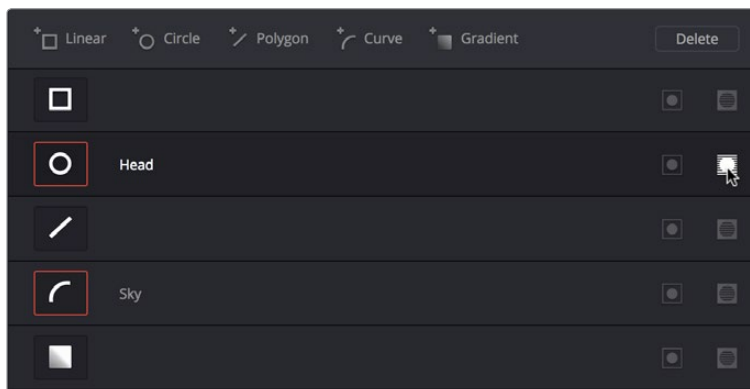
Adding multiple windows to a single node is an easy way to create composite keys. When combining windows, the Mask control defines whether one window adds to another window, or subtracts from that window.

In the following example, Circular and PowerCurve windows have both been created, and each window's Mask control is also turned on (by default), resulting in both masks being added together so that the sunset look correction affects both the sky and the woman's face.



The two images show the combination of the key mattes

By turning the Mask control of the Circular window off, the Circular window is subtracted from the PowerCurve.



Turning off the Mask control of the Circular window

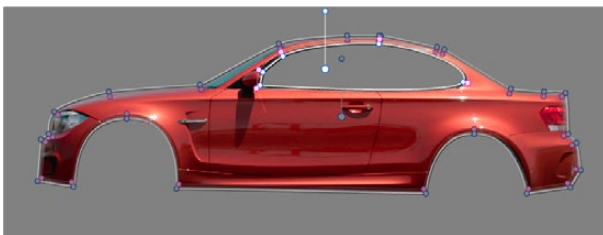
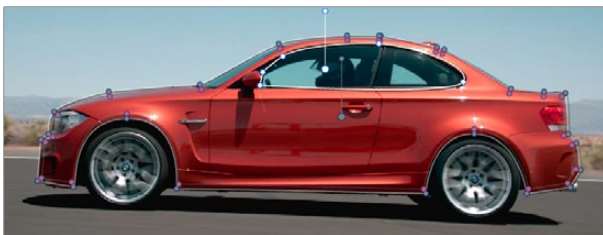
Now, the woman's face is being protected from the aggressive sky treatment.



The two images show the result of subtracting the circular window

Since windows can be individually tracked and keyframed, you can quickly set up complex interactions of windows to solve common problems you'll encounter. For example, when you're tracking a window to follow a moving subject that moves behind something in the frame, you can use a second window with Mask turned off to cover the object in front. Now, when the tracked window intersects the subtractive window, the correction will disappear along with the subject.

You can also use the Mask control to create more complex shapes than you can with a single window.



Mattes and mask used together to make complex shapes

Furthermore, once you reach the limits of what shapes you can create using the four available windows, you can combine multiple nodes containing multiple shapes and qualifiers using the Key Mixer.

## Copying and Pasting Windows

If there's a particular window you've created that you want to either duplicate within the current node, or apply to another node, you can copy and paste an individual window's shape from one item in the Window list to another.

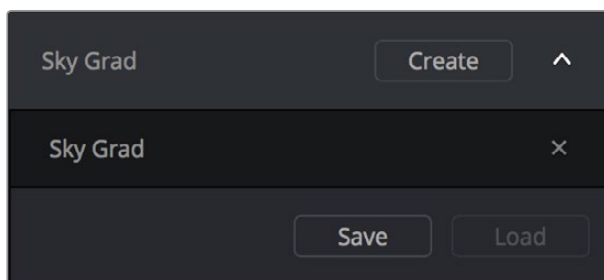
### Methods of copying and pasting Windows:

- **To copy a Window:** Click any enabled Window in the Window list, then click the Window palette option menu and choose Copy Window.
- **To duplicate a Window:** After copying a window, create another window of the same type that you copied, and then click the Window palette option menu and choose Paste Window.
- **To paste a Window to another node:** Double-click or otherwise select another node, open the Window palette, choose the same type of window that you copied in the Window list, and then click the Window palette option menu and choose Paste Window.

## Saving Window Presets

If you find there's a particular window shape or combination of windows that you use frequently, you can save one or more windows as a preset for easy recall whenever needed. For example, if you're working on a documentary within which you find you need to do a lot of face brightening, you can create preset face ovals for close-up, medium, and wide shots, to save you from having to customize a stock circular window for every single new shot. You can also save groups of windows together as a single preset, in order to reuse complicated multi-window shapes.

Window presets are available from a group of Presets controls in the upper right-hand corner of the Window palette.



Controls for saving, applying, and deleting window presets

### Methods of working with Power Window presets:

- **To save a window preset:** Once you've created one or more windows you want to save, click the Create button, type a name into the resulting dialog, and click OK. That preset is now available in the Preset pop-up.

- **To recall a window preset:** Click to open the Shape Preset Browser, choose a preset from the list, and click Load. Loaded window presets overwrite whatever other windows were set up in that node.
- **To update an already saved preset:** Recall a preset, change the resulting window(s), then click to open the Window Preset Browser, and click the Save button overwrite the current preset with the altered window arrangement.
- **To delete a window preset:** Click to open the Shape Preset Browser, choose a preset from the list, and click the x button to the left the the preset you want to delete.

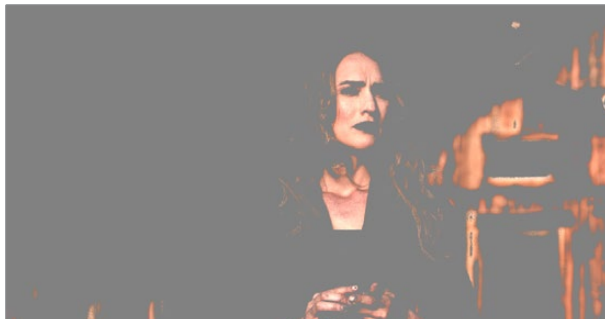
Once recalled, windows created by presets can be modified and tracked just like any other window.

## Using Windows and Qualifiers Together

Another use of windows is to act as a “garbage matte” when used together with a qualifier. By default, when you use a window and qualifier together, a key is only output where both the window and qualifier intersect. This makes it easy to exclude unwanted parts of a key that are too difficult to eliminate by further refinement of the qualifier controls.

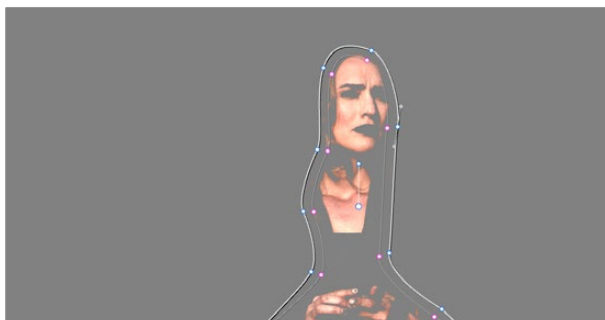
For example, the following qualification is intended to isolate the woman’s face, but some of the similarly colored wood and sky in the background is also included.

Instead of driving yourself crazy trying to eliminate the unwanted parts of the key by modifying the current qualification, which is doing a great job of isolating the skin tones, you could instead use a window to isolate her face, excluding everything outside the window, and simplifying your job considerably.



A qualified image with highlight on

If she moves, then you can simply track the window to follow. Simple tracking is covered later in this chapter.



Now with additional Power Window isolation

Furthermore, you can use the window's Invert control to do the reverse, excluding all qualified portions of the key inside the window, and including all qualified portions of the key outside the window.

If you need to build more complex qualifier/window combinations than this, you can add more windows, or you can use multiple qualifiers and windows with the Key Mixer node, which is discussed later in this chapter.

## Manipulating Windows Using a Control Panel

Window shape and position can also be manipulated using the DaVinci control panel. All Windows controls are located on the T-bar panel, except for the ADJ WINDOW button above the fourth trackball of the Center panel.

### To enable, mask, or disable a window:

- 1 Press WNDWS on the T-bar panel. The Window palette should appear.
- 2 Press the soft key that corresponds to the type of window you want to turn on, CPW (Circular Power Window), LPW (Linear Power Window), PPW (Polygonal Power Window), or PCW (PowerCurve window). The appropriate window controls should appear with an orange highlight.
- 3 Press the MATTE/MASK soft key to toggle among turning the window on, turning Mask on, and turning the window off.

### To reposition a window using the Pan and Tilt knobs:

- 1 Press the unlabeled soft key at the bottom-right of the T-bar panel to toggle between the current knob mappings on the T-bar panel, and the PAN and TILT mappings.
- 2 Use the Pan and Tilt knobs to adjust the window's position.

### To reposition a window using the fourth trackball:

- 1 If necessary, press WNDWS on the T-bar panel to open the Window palette.
- 2 Press ADJ WNDW, above the fourth trackball on the Center panel.
- 3 Use the fourth trackball to reposition the window.
- 4 When you're finished, press ADJ WNDW again to exit adjust window mode.

### To alter a window's Zoom, Aspect, or Rotation:

Use the ZOOM, ASPECT, and ROTATE knobs on the T-bar panel.

### To alter a window's softness, do one of the following:

- **For Circular and Linear windows:** use the SOFTNESS knob on the T-bar panel.
- **For Polygonal and PowerCurve windows:** press the unlabeled soft key at the bottom-right of the T-bar panel to toggle between the current knob mappings, and the PAN, TILT, INSIDE SOFT and OUTSIDE SOFT knob mappings.

### To invert a window:

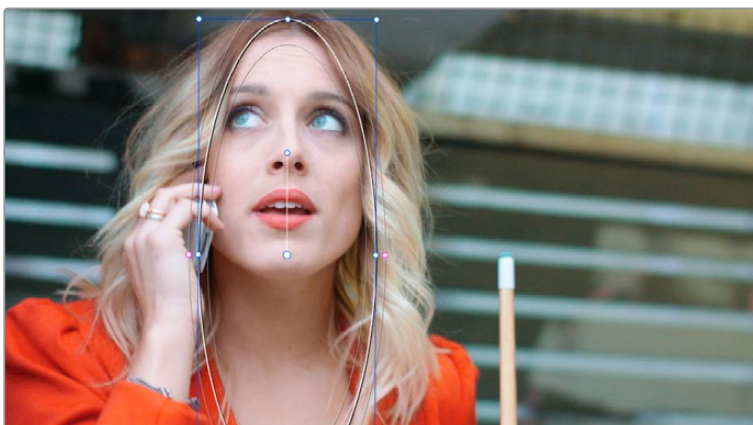
Press the INVERT soft key on the T-bar panel.



## Motion Tracking Windows

The Tracker palette has three modes, available from the Palette menu. In Window mode, the tracking controls let you match the motion of a window to that of a moving feature in the frame. In Stabilizer mode, the same underlying technology is used to smooth or stabilize the motion within the entire frame, while in FX mode a point tracker can be used to animate ResolveFX or OFX plug-ins with positioning controls (For more information about the FX and Stabilizer modes, see Chapter 29, “Color Page Effects”).

DaVinci Resolve has an incredibly simple, yet powerful, 3D cloud tracker that allows you to track quickly and accurately any Power Window (Circular, Linear, Polygonal, PowerCurve or Gradient) to follow any moving feature. This avoids the need to use dynamic keyframes to manually animate a window’s position.



A Power Window tracking a woman’s face; the motion path resulting from the track is shown as the wiggly white line

### Simple Tracking Using the Tracker Menu

The simplest way to track a feature using a Power Window is to use the commands found in the Playback menu. These commands include:

- **Track Forward (Command-T):** Tracks a window to a feature from the current position of the playhead forward, ending at the last frame of a clip.
- **Track Reverse (Option-T):** Tracks a window to a feature from the current position of the playhead backward, ending at the first frame of a clip.
- **Track Stop (Command-Option-T):** Interrupts any track. This is useful for letting you cancel a long track that goes wrong (the Stop button of a control panel stops tracking as well).

Most window tracks are easy to accomplish using these three commands.

#### To track any Power Window to match a moving feature within the frame:

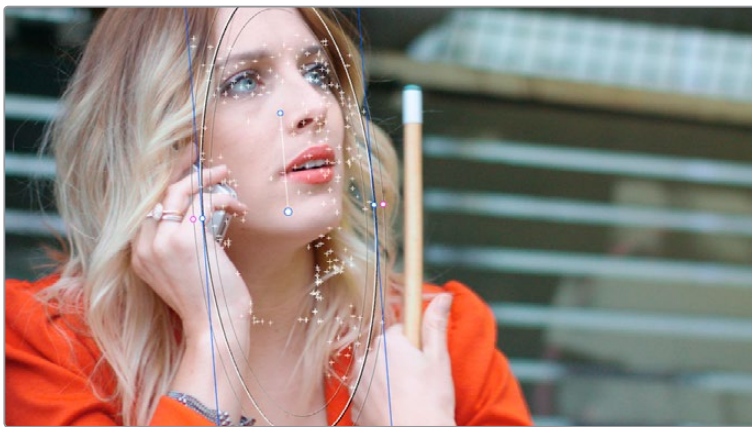
- 1 Move the playhead to the frame of the current shot where you want to begin (you don’t have to start tracking at the first frame of a shot).
- 2 Turn on any window, and adjust it to surround the feature you want to track.

Typically, you’ll have done this anyway, for example, framing someone’s moving face with a Circular Window to lighten their highlights.

- 3 To initiate tracking, do one of the following:
- Choose Color > Track Forward (press T)
  - Choose Color >Track Reverse (Option-T)
  - On the T-bar panel of the DaVinci control panel, press OBJECT TRACK MODE, and then press either the TRACK FWD or TRACK REV soft keys on the Center panel.

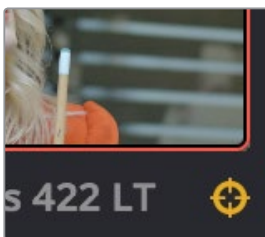
Resolve automatically opens the Viewer page, places a series of tracking points within the window you've created, and performs the track from the current frame; forward to the last frame or backward to the first frame.

Resolve analyzes a cloud of tracking points that follow the vectors of every trackable group of pixels within the window you've created, and the results are fast and accurate. After tracking, the window you've placed automatically moves, resizes, rotates, and skews to match the motion of the feature you're tracking.



Object tracking in progress. Tracking points are automatically placed over trackable features of the image

Once a clip has tracking data applied to one of its windows, a small tracking icon appears within that clip's icon in the Thumbnail timeline.



A tracking icon in the top left corner of the Thumbnail timeline shows that clip has been tracked

If the track you've performed is unsuitable, you can reposition the window to cover a different area of the subject you're trying to track, and initiate tracking again. New tracking data overwrites any previous tracking data applied to that window.

Once you're satisfied with your track, you can continue to resize, reposition, or reshape the window being tracked. Tracking data is separate from the window transform parameters (which can be keyframed), so changes you make to a window offset it from the originally tracked path.

## Tracking Windows When You'll Be Exporting Media With Handles

When you track windows to match moving features in a clip, the windows are only transformed on frames with tracking data. In Round Trip workflows where you add handles to the graded clips you render for editorial flexibility in the footage you deliver, you need to make sure that you track all windows from the beginning to the end of these handles to make sure that, if an editor actually trims any of the clips you give them to use the handles, all windows are doing what they should.

An easy way to do this is to choose View > Show Current Clips With Handles to display each clip you select in the Timeline with handles defined by the “Default handles length” setting in the Editing panel of the Project Settings. Make sure that the “Default handles length” is equal to the handles you export using the “Add X Frame handles” option in the Render Settings list of the Deliver page. With each clip’s handles made visible in this way, you can easily track windows along every frame you’ll be rendering.

## Simple Ways of Working With Existing Tracking Data

If there’s a portion of a shot that you haven’t tracked (for example, you started tracking at a later frame, or you ended tracking before the end of the shot), then the window you’re tracking remains wherever it was at the first or last frame that was tracked. If you want to fill in these gaps, you can always move the playhead to the first or last frame that was tracked, and then use the Track Backward or Track Forward command to track the rest of the frames in that shot.

## Tips For Better Tracking

In situations where a feature changes shape in such a way as to confuse the tracker, you can try tracking a smaller part of the feature by using a smaller window. Once you’ve achieved a successful track, you can resize the window as necessary, and it will have no effect on the track that’s already been made.

Also, if you’re tracking a feature that moves behind something onscreen and disappears for the rest of the shot, there’s an easy way to avoid having an awkward window sitting in the middle of the scene. You can use dynamic keyframes to animate the Key Output Gain parameter (in the Key tab of the Color page) to fade from the correction’s full strength of 1.0 down to 0, the value at which the correction disappears, along with the window itself.

## Tracking One Frame at a Time

You can click the “track one frame forward” or “track one frame backward” buttons in the Tracker palette to track a moving feature one frame at a time, making it easier to make adjustments to follow a difficult track when you’ve set tracking to Frame mode (by clicking the Frame button).

In Frame mode, you can keyframe window transformations to more faithfully conform to troublesome motion as you’re moving one frame at a time through the track; manual changes to a window’s position will be keyframed to create frame-specific transformations, rather than used to offset the entire tracked motion path as in Clip mode. When you add multiple keyframes in the Tracker graph, animation will be automatically interpolated from keyframe to keyframe.

## Copying and Pasting Tracking From One Window to Another

There will be plenty of times you'll apply multiple windows to a single moving subject, such as a car, when you can use a single motion track for all the windows. Commands in the Option menu let you copy and paste track data from one window to another within the same node, saving time when you want several windows tracking together as one.

**To copy track data from one window to another:**

- 1 Open the Window palette, then select a window that has tracking applied to it (indicated by a tracking badge in the corner of the shape icon), and choose Copy Track Data from the Option pop-up.
- 2 Select another window, and choose Paste Track Data from the Option pop-up.

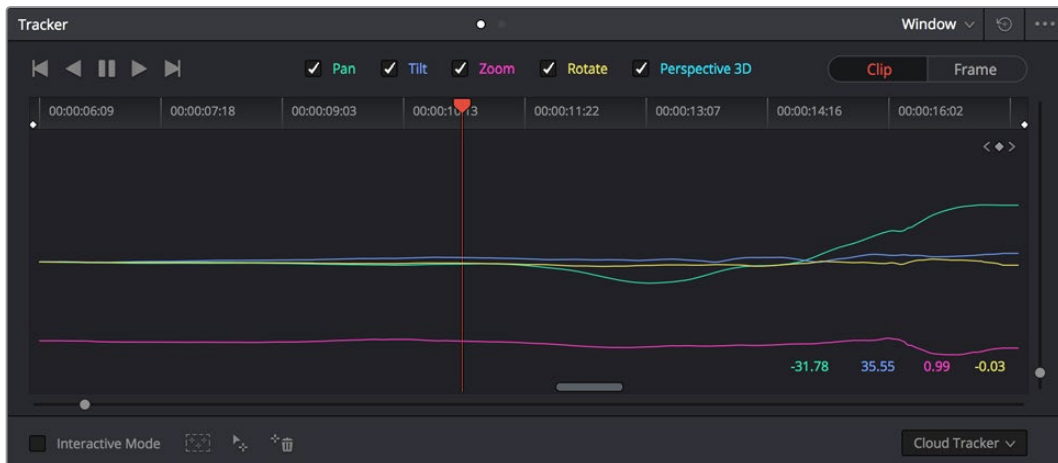
Once you've copied track data from one window, you can paste it to as many other windows as you like.

## Tracker Palette Controls in More Detail

You can easily combine object tracking and keyframing to animate windows. For example, you'll typically use object tracking to make a window follow the position and orientation of a moving feature, but you can add dynamic marks to the window track of the correction in the Color page with which to alter its size and shape to better conform to a feature's changing form.

### Controls in the Window Tracker Palette

Occasionally, you'll run into a shot that doesn't quite track well enough using the Tracker menu's simple controls. In these cases, the Viewer page provides the complete set of object tracking controls that can be used to modify tracking operations in different situations.



The Tracker palette

The Object Tracking Controls are divided into seven groups.

### Tracker Palette Modes

The Tracker palette's Option pop-up menu lets you choose between Window mode (for matching a window to the motion of a feature in the frame), and Stabilizer mode (for subduing unwanted camera motion. For more information on Stabilizer mode, see Chapter 29, "Color Page Effects.")

## Types of Tracking

A pop-up menu below the Tracker graph lets you choose whether to use the Cloud Tracker or the Point Tracker.



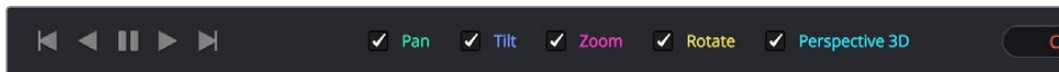
The tracker type pop-up

### There are two options:

- The Cloud Tracker automatically analyzes all parts of the image for trackable points, and uses these to automatically figure out the motion in the shot that you want to use to move a Power Window or stabilize a shot. This tracker type is great for quickly tracking a window to match the movement of almost any feature, with a minimum of work.
- The Point Tracker lets you create one or more tracker crosshairs that you can manually position in order to track specific features in the shot. The more crosshairs you create and position, the more accurate the track can be. The Point Tracker is incredibly useful in situations where you need to follow the motion of a very specific feature in the frame. It can also be useful in cases where you want to stabilize a shot that has many subjects moving in different directions, and it's difficult to obtain a good result with the Cloud Tracker.

## Object Tracking

The Object Tracking controls provide the most basic tracking functions, some of which are mirrored within the Tracker menu.



Choose which type of transform you want to track before tracking

A series of five checkboxes let you turn on and off which transforms you'd like motion tracking to apply automatically to the window. These checkboxes must be selected before you perform a track in order to restrict the transforms that are used.

- **Pan and Tilt:** Enables tracking of horizontal and vertical position, when you want to transform a window to follow the location of a tracked subject.
- **Zoom:** Enables tracking of size, when you want to transform a window to resize to follow a tracked subject.
- **Rotate:** Enables tracking of orientation, when you want to transform a window to rotate with a tracked subject.
- **Perspective 3D:** Enables tracking of pitch and yaw in 3D space, when you want a window to skew to follow the orientation of a tracked subject within the scene. Good when you want the window to “stick” to a surface.

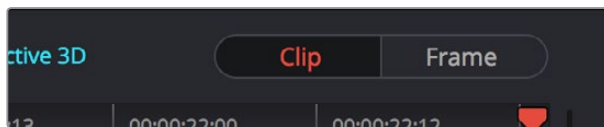
**NOTE:** Once tracking or stabilization has been done, disabling these checkboxes does nothing to alter the result. To make changes, you need to enable or disable the necessary checkboxes first, and then reanalyze the clip.

After you've defined the transforms you want to use for the track, the analyze controls let you proceed with the analysis of the subject being tracked.

- **Track One Frame Reverse button:** Motion tracks a single frame in reverse. Useful for slow tracking of difficult subjects that may require frequent correction.
- **Track Reverse button:** Initiates tracking from the current frame backward, ending at the first frame of the clip. Good for tracking backwards when your best starting point is somewhere within the middle of the shot.
- **Pause button:** Stops tracking (if you're fast enough to click this button before tracking is finished).
- **Track Forward button:** Initiates tracking from the current frame forward, ending at the last frame of the clip.
- **Track One Frame Forward button:** Motion tracks a single frame forward. Useful for slow tracking of difficult subjects that may require frequent correction.

## Clip/Frame Controls

Two buttons let you set how manual adjustments to the position of tracked windows affect the overall track.

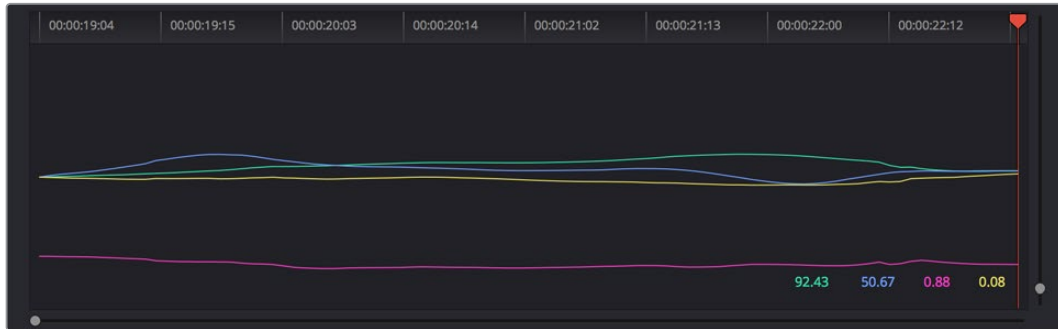


Selecting clip or frame to apply adjustments

- **Clip:** The default mode, in which changes you make to the position of a window are globally applied to the entire track. For example, if you track a feature, and then move the window, the window moves along a motion path that's consistently offset from the original track for the duration of the clip. Use this mode if you're happy with the track, but you want to modify the window's overall shape and position relative to the motion path it's following.
- **Frame:** In this mode, changes you make to the position or shape of a window create a keyframe at the frame at the position of the playhead. Multiple keyframes are interpolated to create animation with which you can manually transform a window to solve a variety of problems. This mode is useful for rotoscoping the shape and position of windows to match a subject that's tough to automatically track. Frame mode is also useful for making corrections to individual frames that were badly tracked, for animating windows to go all the way out of frame along with a subject, or for making manual, frame-by-frame adjustments to window position to cover untrackable sections.

## The Tracker Graph

The Tracker Graph provides a visual display of the tracking data that's being analyzed. Each of the transform controls that can be tracked has an individual curve, which lets you evaluate each tracked parameter on its own, and each curve is color-coded to match the corresponding label of the tracking transforms listed above.



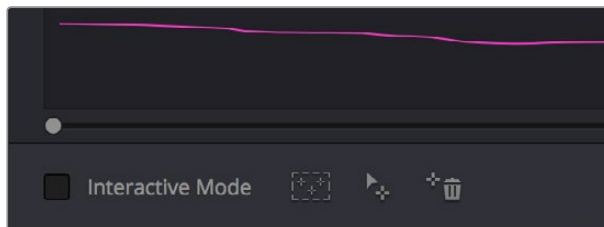
Add keyframe and Interpolate between

A vertical slider to the right of the Tracker graph lets you scale the height of the curve data within to make it easier to see it all within the graph. Above the Tracker graph, a Timeline ruler contains a playhead that's locked to the playheads in the Viewer and Keyframe Editor.

You can draw a bounding box in the Tracker graph with which to select a portion of one or more curves to delete sections of low-quality tracking data using the Clear Selected Keyframes command found in the Palette Options menu. To eliminate the current bounding box from the Tracker graph, click once anywhere within the graph.

### Interactive Mode Controls

The Interactive controls, at the bottom-left of the Tracker palette, let you make manual changes to the automatically generated tracking point cloud that Resolve creates when you're tracking with the Cloud Tracker, so you can try different ways of obtaining better tracking results in challenging situations.



Interactive mode controls

- **Interactive Mode checkbox:** Turns the Interactive tracking mode on and off. When you enter Interactive mode, you can manually alter the point cloud that Resolve uses to track the feature within the current window. You'll then make your track while in Interactive mode.
- **Insert:** Lets you add tracking points to whatever trackable features exist within a bounding box that you've drawn in the Viewer. Inserted tracking points are automatically placed based on trackable pixels in the image.
- **Set Point:** Lets you use the cursor (using the DaVinci Resolve control panel), to manually place individual tracking points, one by one, with which to track a feature. If there is no trackable pixel group at the coordinates where you placed the cursor, a tracking point will be placed at the nearest trackable pixel group.

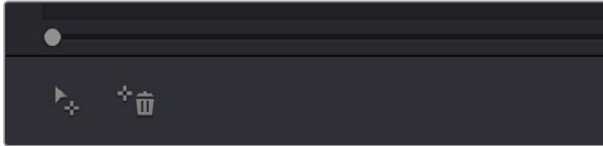
You must place at least two tracking points at different pixel groups to track rotation, and at least three to track zoom.

- **Delete:** Eliminates all tracking points within a bounding box that you've drawn in the Viewer.

For more information, see "Using the Interactive Tracking Controls" later in this section.

## Point Tracker Controls

If you're using the Point Tracker, then the Interactive Mode controls disappear, replaced by the two controls of the Point Tracker.



Point Tracker controls

- **Add Tracker:** Click to create a new tracker that's automatically positioned in the center of the frame. Once created, you can drag it using the pointer to line up with the feature you want to track. You can create as many trackers as you like. Multiple trackers are all tracked at once.
- **Delete Tracker:** Select any tracker (selected trackers are red, de-selected trackers are blue), and click this button to remove it.

## Additional Commands in the Tracker Palette Options Menu

There are some additional commands located in the Palette Options pop-up menu.

- **Reset Track Data on Active Window:** Lets you delete the tracking data corresponding to the currently selected window.
- **Clear Selected Track Data:** When you drag a bounding box over parts of one or more curves in the Tracker graph, this command lets you delete that part of the graph. This is useful when you want to eliminate sections of low-quality track data. Portions of curves that are cleared in this way have linear interpolation automatically applied to them, similar to if you used the Keyframes Interpolation controls.
- **Delete Keyframe:** Deletes tracker graph keyframes at the current position of the playhead.
- **Clear All Tracking Points:** Clears the tracking points in the Power Window at the frame you are on.
- **Show Track:** Turn this checkbox on to show the motion path produced by the tracking you've done.
- **Copy Track Data:** Lets you copy track data from the currently selected window. Windows can be selected directly in the Viewer while the Tracker palette is open.
- **Paste Track Data:** Pastes copied track data to the currently selected window. Windows can be selected directly in the Viewer while the Tracker palette is open.



# Cloud Tracker Workflows

The next few examples illustrate how to use the Tracker palette's controls in practical situations. In many circumstances, objects passing in front of a tracked subject, known as "occlusions," can cause problems. While the tracker in DaVinci Resolve is highly occlusion-resistant, the following sections show a variety of techniques you can use when an occlusion prevents you from getting a useful track.

## Using Interactive Mode to Manually Choose Tracking Features

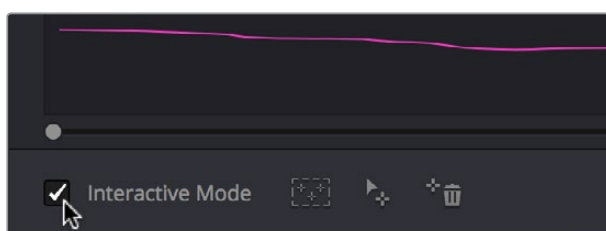
Interactive Mode lets you manually remove or add tracking points to improve tracking performance in situations where the automatic image analysis in Resolve provides unsatisfactory results.

For example, you can delete tracking points within a window that correspond to overlapping features you don't want to track. Suppose a car that you're tracking drives by a sign that partially obscures the car. Without intervention, the PowerCurve that's isolating the car will deform improperly when the car moves along and then away from the sign.

Using Interactive Mode, you can delete the tracking points that will overlap the sign you don't want to track, improving the result.

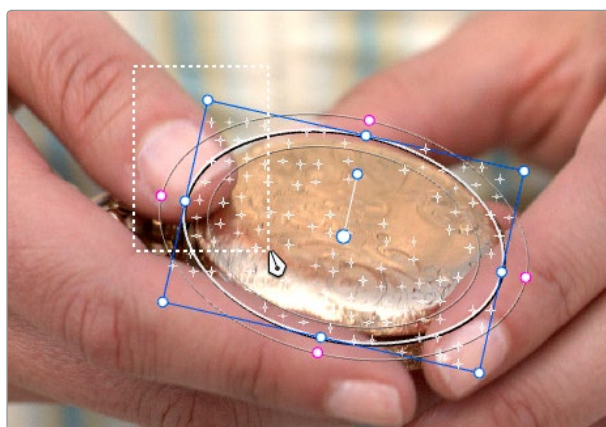
### To eliminate specific, unwanted tracking points from a track:

- 1 Open the Tracker palette.
- 2 Turn on the Interactive Mode checkbox.



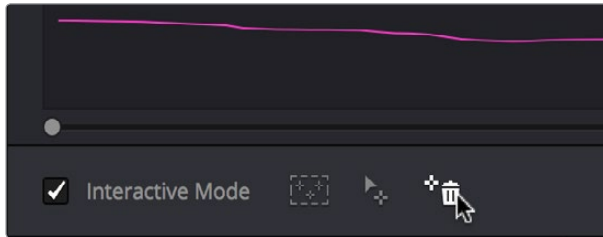
Selecting Interactive Mode

- 3 In the Viewer, drag a box around the tracking points you want to eliminate within the window, and click the Delete button. The points within the selection area are deleted.



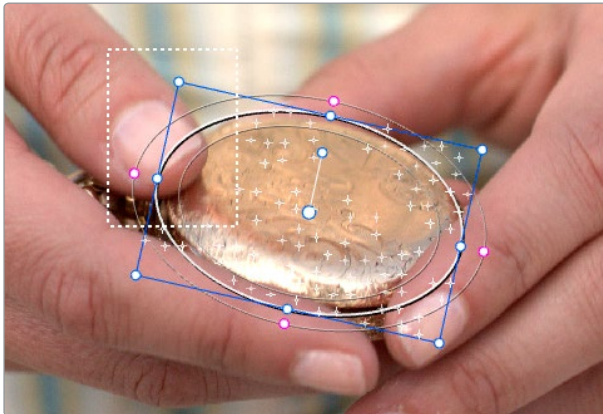
Dragging a box around tracking points that need to be deleted

- 4 Click the Delete button.



Deleting tracking points

The points within the selection area are deleted.



Remaining tracking points ready to be used

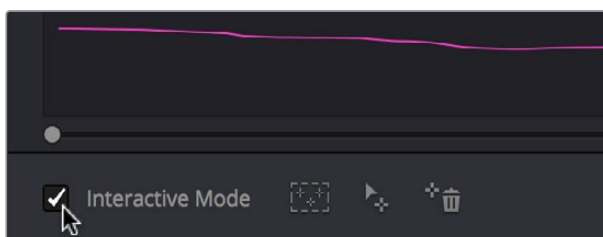
- 5 While Interactive Mode is still on, click Track Forward or Track Reverse to track the subject using the remaining tracking points.
- 6 When you're finished tracking, click the Exit Interactive button.

**NOTE:** If you delete tracking points and then disable Interactive Mode without performing a new track first, Resolve goes back to using automatically placed tracking points.

In another interactive tracking example, you may sometimes run into situations where you want to eliminate all automatically placed tracking points altogether, placing your own in specific regions of the image.

**To eliminate automatic tracking points, adding your own instead:**

- 1 Open the Tracker palette.
- 2 Turn on the Interactive Mode checkbox.



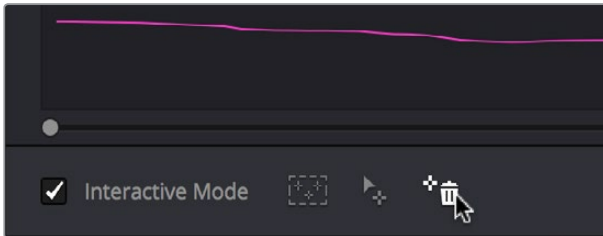
Selecting Interactive Mode

- 3 In the Viewer, drag a box around all the tracking points in the window, and click the Delete button to eliminate all tracking points from the image.



Selection box surrounding all tracking points

- 4 Click the Delete button to eliminate all tracking points from the image.



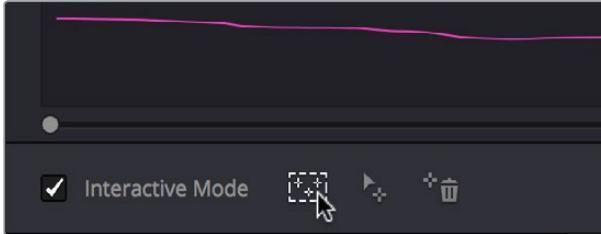
Deleting tracking points

- 5 Drag a box around the specific area where you'd like to add new tracking points. In this case, you only want to track the top half of the woman's face, since the bottom half is cut off by the fence posts.



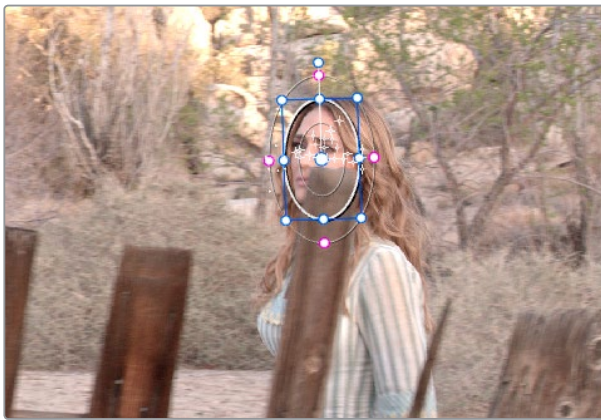
Placing the selection box over the top of the window

- 6 Now, click the Insert Track Points button.



The Insert button of Interactive Mode automatically adds tracking points within the current bounding box.

New tracking points are automatically added to whichever features are appropriate for tracking within the box you've drawn.



Tracking with the remaining tracking points

**NOTE:** If no appropriate tracking features can be found, no points will be added.

While in Interactive Object Tracking mode you may also choose to add tracking points one by one.

**To add a single tracking point:**

- 1 Open the Tracker palette.
- 2 Turn on the Interactive Mode checkbox.
- 3 Using the DaVinci control panel, press the CURSOR button above the fourth trackball of the Center panel, and move the onscreen cursor to the detail of the image that you want to add a tracking point to.
- 4 Click the Set Point button, within the Interactive Mode controls of the Tracker palette.  
This adds a tracking point corresponding to the feature of the image that you clicked, and you're ready to start tracking.

## Dealing With Occlusions When Tracking

Sometimes you'll find that you need to deal with a gap in the useful tracking data. For example, objects in the frame that pass in front of the feature you're trying to track cause gaps in the tracking information for a clip.

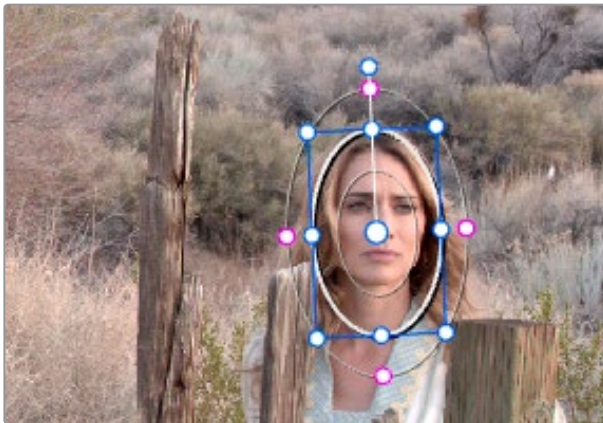
In situations where a subject being tracked becomes totally occluded by another object in the frame, there's an easy method of interpolating to cover holes in the available tracking data. In the following example, the woman walks behind another fence post, this time one that's taller than she is. The window tracking her face will become completely lost at this point, but interpolation will help to salvage this shot.



Original clip

### Interpolating between two sets of tracking data to track past an occlusion:

- 1 Move the playhead to the first trackable frame of the moving feature you're correcting, and create a Power Window that surrounds it.



Adding the Power Window

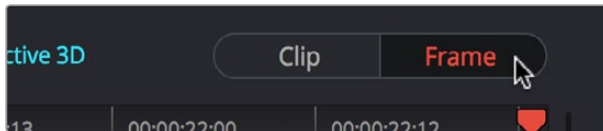
- 2 Use Track Forward to track the feature as far as you can before it becomes obscured behind something else in the frame.

- 3 When the Power Window stops tracking the feature reliably, stop the track.



The Power Window is obscured by the post

- 4 Open the Tracker palette.
- 5 Click the Frame radio button to put the Tracker controls into frame-by-frame adjustment mode. This is an important step.



Selecting Frame mode

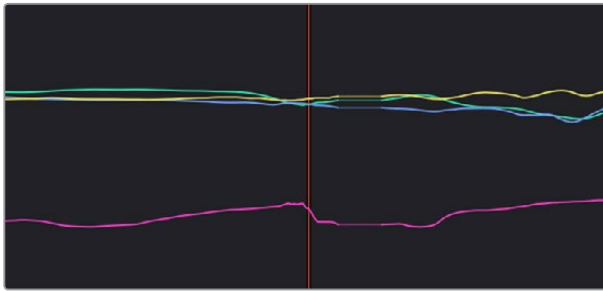
- 6 Move the playhead to the frame where the feature you're tracking reappears from behind the occlusion, then drag the window so that it again overlaps the feature.



Moving the playhead and position the window

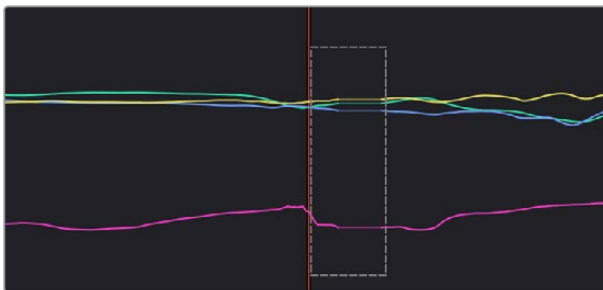
- 7 Use Track Forward to continue tracking the feature until the end of the clip. Alternately, you could have started from the end of the clip and used Track Reverse to track the feature as far as possible, if that's easier.

Now that you've identified the gap in reliable tracking data for this clip, it's time to set up the interpolation.

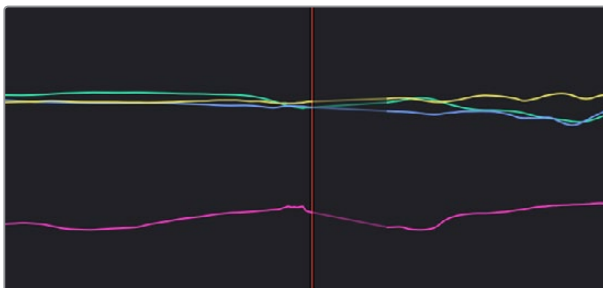


Notice the gap in the tracking data where the window was behind the post

- 8 Drag a bounding box over the portion of the curves in the Tracker graph that fall between the good tracking data at the beginning and end of the shot.



- 9 Click the Tracker palette option pop-up menu, and choose Clear Selected Track Data.



The portions of curves that you selected are deleted, and have linear interpolation automatically applied to them so that there's no hole in the track data or the motion of the window, which now moves smoothly from the last outgoing frame of reliable tracking data to the first incoming frame of new reliable tracking data.

## Point Tracker Workflows

As advanced as the Cloud Tracking that is the default in DaVinci Resolve is, there are times when it may be simpler to track using good old-fashioned crosshairs. The Point Tracker, introduced in Resolve 12.5, makes it easy to track very specific features of a subject with motion you need to follow. Unlike the Cloud Tracker, which automatically looks for all trackable points within a region of the image that you identify using a window, the Point Tracker lets you create one or more crosshairs that you must manually position to overlap with whatever high-contrast features you want to track. This section covers the three main workflows you need to know to use the Point Tracker.

## Tracking a Window Using the Point Tracker

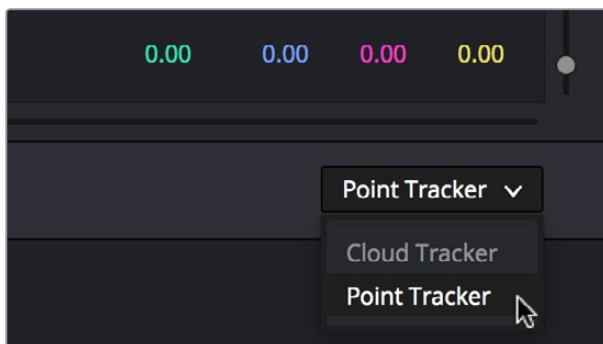
The following procedure describes, in a general way, how to use the Point Tracker to track a moving subject and apply that motion to a Power Window.

- 1 Move the playhead to the frame of the current shot where you want to begin (you don't have to start tracking at the first frame of a shot, since you can always track backwards).
- 2 Turn on any window, and adjust it to surround the feature you want to track. Typically, you'll have done this anyway, for example, framing someone's moving face with a Circular Window to lighten their highlights. You want to make sure that the window you want to apply the tracked motion to is selected before you begin tracking. In this example, we'll be tracking a circular window to follow the woman's face.



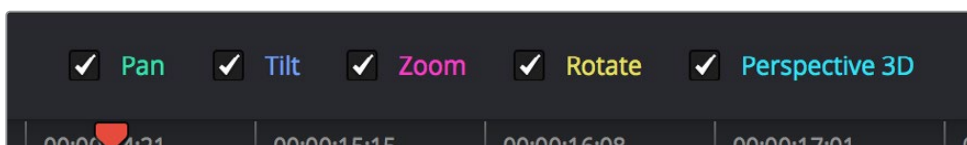
Setting up to track a window over a woman's face

- 3 Open the Tracker palette, and choose Point Tracker from the bottom right pop-up.



Choosing the Point Tracker

- 4 Before you start tracking, choose what types of motion you want to track and apply to the window you're working on. You can choose from among Pan, Tilt, Zoom, Rotate or Perspective 3D. Which methods of transformation can be applied depend on how many points you add to track.



Choosing what type of motion to analyze

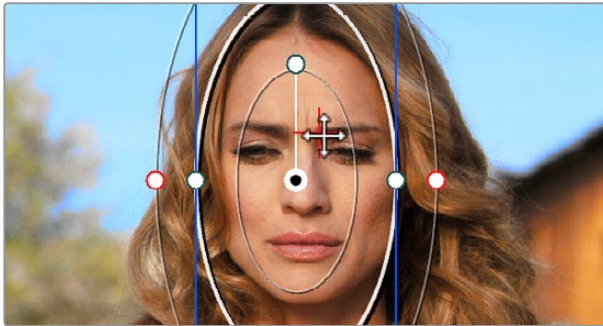


- 5 Click the Add Tracker button. A new tracker crosshairs appears in the Viewer in the center of the frame.



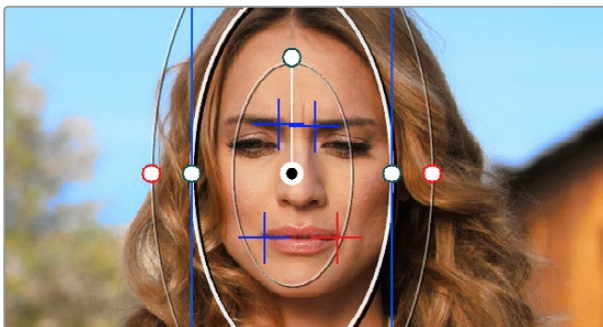
Clicking the Add Tracker button

- 6 Move the pointer directly over the tracker crosshairs, and when it turns into the move cursor, click and drag to move the crosshairs to line up on top of the feature you want to track. For the best results, this should be a high-contrast detail such as a corner, the end of a line, a small shape like a pebble, or a jagged detail. Unlike other point trackers, there is no inside or outside region to separately adjust, there's only the one crosshairs that you need to align. In this example, this first crosshairs is placed at the inside of her stage left eyebrow (the corner of her eye would introduce too much jitter as the tracker will pick up her blinks).



Lining up the tracker crosshairs with the feature you need to track

- 7 If you want to improve the accuracy of your track, you can create more tracker crosshairs and position them on top of other details within the subject you're tracking. For the best results, make sure that all crosshairs are placed onto details that are in the same plane of motion. In other words, don't put some crosshairs on a person's face in the foreground, and other crosshairs on a tree that's far in the background, since both these features will have very different vectors of motion. In this example, trackers are placed at her inside eyebrows and at the corner of her lips.



Setting up four trackers to follow the corners of her eyebrows and mouth

- When you're done placing crosshairs, click the Track Forward or Track Backward buttons to initiate tracking. The clip will be analyzed, and the Tracker graph will update with the tracking data, and the window you had selected automatically moves to match the motion of the feature you're tracking.



The final track, accomplished with four point trackers, with the track path turned on

## Removing Trackers

If you find that a particular tracker is causing problems, you can remove it by selecting it in the Viewer, and clicking the Delete Tracker button, before retracking the subject.

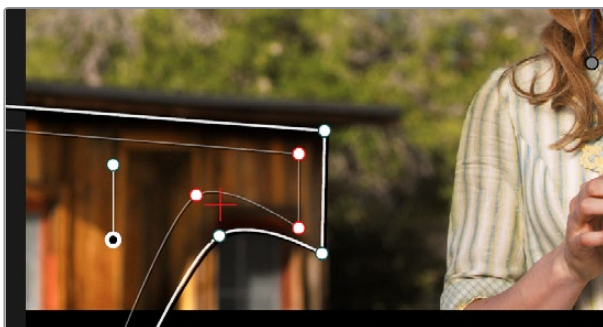


Clicking the Delete Tracker button

## Using Frame Mode to Offset Track

A common issue when point tracking is how to deal with occlusions and times when the tracked feature moves off screen. In Resolve, the solution is to use the Tracker Palette's Frame mode to move the tracker crosshairs onto another feature to track, while offsetting the resulting motion so that it continues to follow the original motion path.

- In this example, a point tracker crosshairs has been positioned at a corner of a window of a building that's being separately adjusted using a Power Window. The window is being used because, as the woman turns to leave, she covers up most of the other trackable outer edges of the building, which would ruin the track.



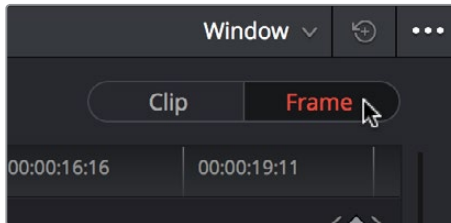
Setting up to track a building moving off screen

- 2 As the camera pans, the feature being tracked is about to go off frame, which is about to ruin the track. As this happens, click the Stop Track button.



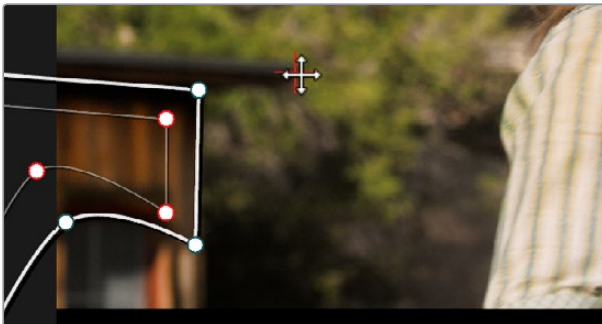
Stopping the track on the last good frame of the track, before the tracker goes off screen

- 3 Move the playhead back to the last good frame of tracking, and then click the Frame button in the Tracker palette to go into Frame mode.



Turning on Frame mode, to prepare to offset the track

- 4 In Frame mode, you can now drag the tracker to another feature of the building, this time the outer edge of the roof, that will be better to follow as the building goes out of frame to the left, since the Power Window will go out of frame before the right-most corner of the building's roof does.



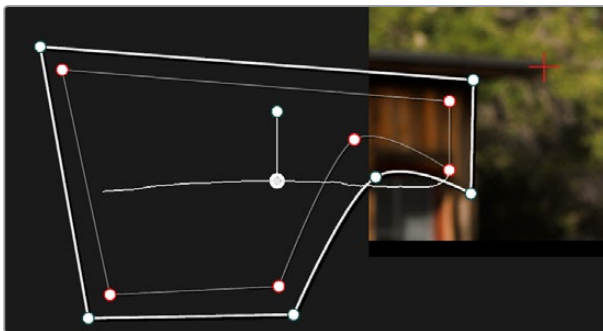
Dragging the tracker to another feature that's better to track

- 5 Now, click the Track Forward button again, and the crosshairs will begin tracking the new feature, but the motion will be offset, so the movement of the Power Window continues to follow the original motion path.



Tracking an offset feature lets the window go all the way off screen

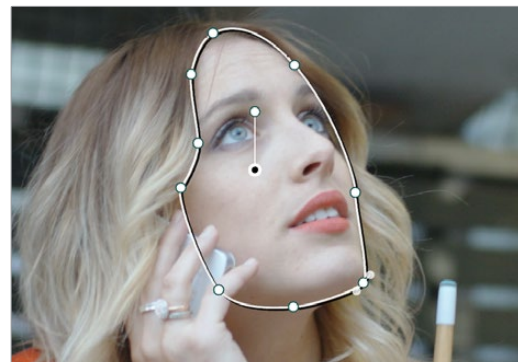
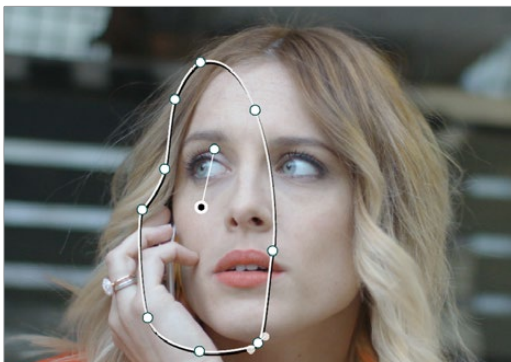
- 6 If you turn on the track path (in the Tracker palette Option menu), and move the playhead to the frame where you moved the tracker, you can see that the motion before you moved the tracker and the motion after continues smoothly along the same path, with no sudden breaks. When you're finished, click the Clip button to get out of Frame mode.



The tracker path before and after moving the tracker crosshairs in Frame mode is smooth and continuous

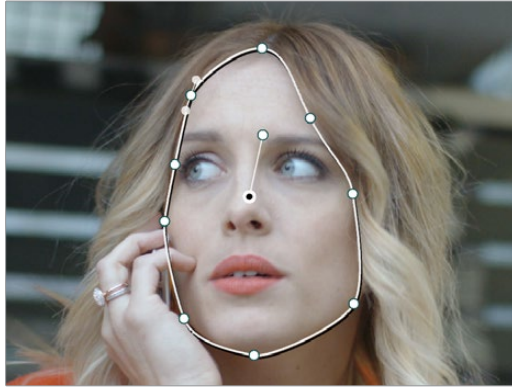
## Rotoscoping Window Shapes After Tracking

While the DaVinci Resolve trackers are pretty miraculous when it comes to making a window follow moving subjects, or elements within a moving scene, there will be plenty of times when the final track isn't quite perfect. For example, if you're trying to isolate someone's face with a very specific window, and the person turns their head, then the resulting change of shape is almost certainly going to require you to make animated adjustments to the window in order to continue making such a specific isolation.



Before and after a window tracking a turning head, the window doesn't quite follow the edge of the woman's face as her head turns

Fortunately, the Tracker palette's Frame mode makes it easy to animate shape changes you make to windows in order to better follow a moving subject, a task often referred to as rotoscoping. By following the motion of a moving subject, and making a series of automatically keyframed adjustments to the window at every point the subject changes speed or direction, you can make a window isolate a moving target with surprising precision.



Using Frame mode to rotoscope the window to better follow the edges of her face and the contours of the jaw

Furthermore, you can also use Frame mode to repair imprecise tracks where the window is veering off course because of quickly or irregularly moving features. In these cases, you have the option of manually tracking the window in Frame mode to fit the trajectory of the feature, frame by frame.

Lastly, you don't even have to have performed a track to use the Tracker graph in Frame mode to keyframe animated changes to a window. In fact, using the Tracker graph in Frame mode can sometimes be more convenient than using the Keyframe Editor in Auto Keyframe mode, depending on what you're doing.

## Rotoscoping Controls

The Clip/Frame buttons determine whether or not you're rotoscoping a shape.

- **In Clip mode:** Any changes you make to a window transform it over the entire duration of that clip. In other words, you can track a window to a moving feature, and in Clip mode any changes you make to the size, rotation, position, or shape of the window occur equally from the beginning to the end of that clip.
- **In Frame mode:** Changes you make to a window automatically create a keyframe at the bottom of the ruler in the Tracker graph. Making two or more changes to a window in Frame mode results in automatically interpolated animation from one keyframed window transformation to the next.

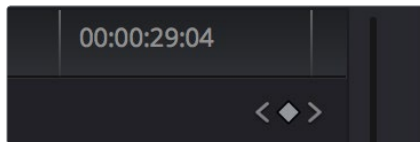
You can freely move back and forth between Clip to Frame modes to make changes to a window. Even if you've keyframed a window to change shape, you can turn on Clip mode and make an overall change to the window, enlarging it for example, that results in the window being equally enlarged at every keyframe.

## Keyframing in Frame Mode

Once you've added keyframes to the Tracker palette, there are a number of ways you can edit them.

### Methods of working with keyframes in the Tracker graph:

- **To add a keyframe:** Click the Add Keyframe button at the upper right-hand corner of the Tracker graph. It looks similar to the keyframe buttons found in the Edit page Inspector. This is useful for adding a keyframe to a frame where the window fits the subject well, prior to moving forward a few frames and making an alteration to the window to follow the subject that will generate another keyframe.
- **To move the playhead from one keyframe to another:** Click the Previous Keyframe and Next Keyframe buttons at the upper right-hand corner of the Tracker graph. These controls look similar to those found in the Edit page Inspector.
- **To delete a keyframe:** With the playhead on the same frame as the keyframe you want to delete, open the Tracker graph option menu, and choose Delete Keyframe.



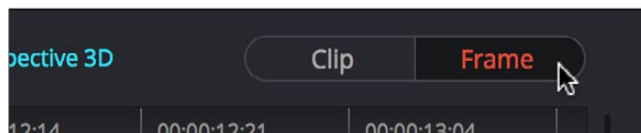
The Previous Keyframe, New Keyframe, and Next Keyframe buttons in the Tracker graph

## A Rotoscoping Workflow

The following procedure demonstrates how to use a window to rotoscope an on-screen feature that you want to isolate. In the process, it shows how to set up a window for rotoscoping using the Tracker palette, and discusses some best practices for rotoscoping efficiently.

To rotoscope or manually track a window using automatic keyframing:

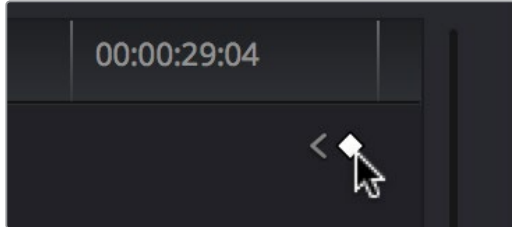
- 1 Create a window to isolate the feature you're wanting to adjust, and use the tracker to make it follow the motion of the subject. If the window doesn't follow the contours of the subject as precisely as you require, then you can begin manually keyframing its shape on top of the tracking you've done to rotoscope the subject.
- 2 With the Tracker palette open, click Frame to change the tracking mode.



Clicking the Frame button to begin keyframing your shape

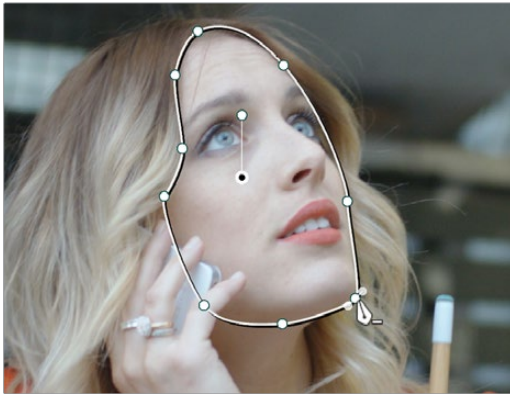
The best way to use Frame mode for tracking is to either start at the last successfully tracked frame and work your way forward, or start at the first successfully tracked frame and work your way backward. This takes the best advantage of the automatic keyframing and interpolation between keyframes to animate the window you're transforming smoothly.

- 3 With the playhead at either the first or last frame where the window fits the subject you're isolating, you can either click the Add Keyframe button at the upper right-hand corner of the Tracker graph, or wiggle any control point by a pixel or two, to add a keyframe at that frame.



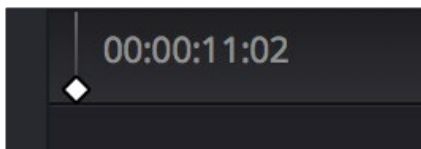
Clicking the Add Keyframe button in the Tracker graph

Adding a keyframe at the last frame where the window follows the subject's motion well means that any future animated changes you make interpolate from this frame forward, rather than from previous frames where there's no need for alterations.



Adjusting the Window in Frame mode adds a keyframe

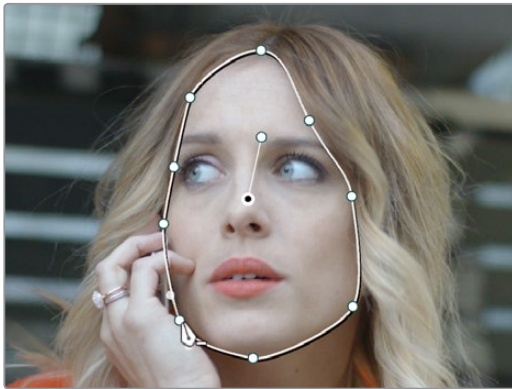
While you're in Frame mode, the changes you make to the window automatically generate a keyframe in the Tracker palette, which appears at the bottom of the Tracker graph's timeline.



Keyframes appear in the Tracker graph ruler

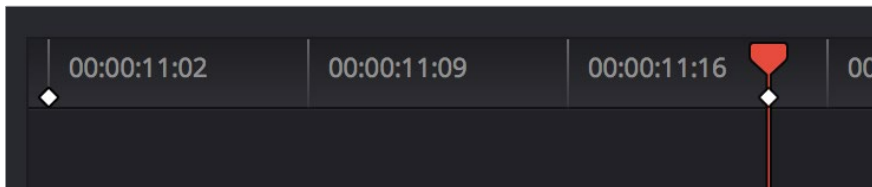
It's frequently essential to add a keyframe at the last frame where a window conforms well to the subject you're trying to isolate, in order to limit window animation from that frame to the next keyframed transformation, rather than accidentally animating from the beginning of the clip, or from the next or previous keyframe in the Tracker graph.

- 4 Next, move the playhead to the next frame where the window requires adjustment to better fit the moving subject, and adjust the position of the window, the control points of the window, or both to isolate the subject as necessary.



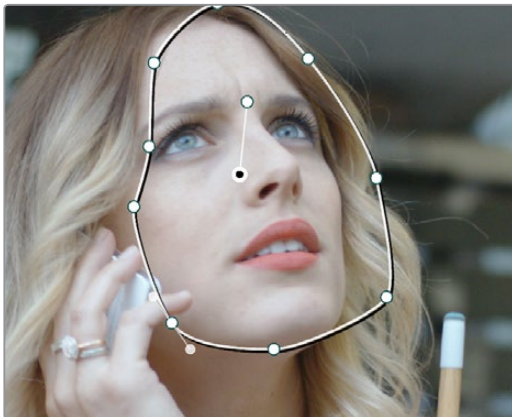
Readjusting the Window in Frame mode to follow the subject's motion

This results in a second keyframe being placed in the ruler of the Tracker graph.



Two keyframes creating roto-scoped animation in addition to any motion tracking that's applied

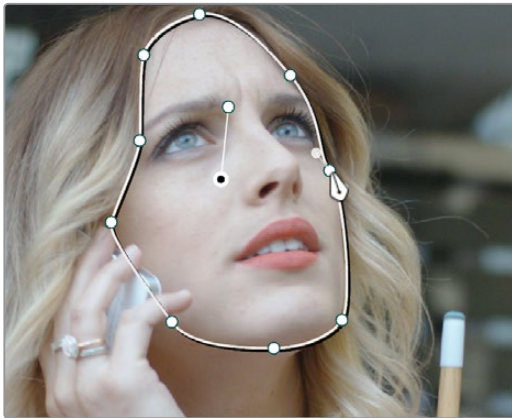
- 5 With your first two keyframes placed, scrub the playhead back and forth between them to evaluate how well the window's animation is automatically interpolating to fit the motion of the subject you're isolating. If the window doesn't follow the motion of your subject well enough, move the playhead to the frame where the window divergence is the most pronounced and make another adjustment to correct the shape.



A frame between the two keyframes you've roto-scoped that needs further adjustment

This creates create another keyframe.





After adjusting the in-between frame

- 6 When you're finished making adjustments between your first two keyframes, move the playhead farther along and add keyframes as necessary to make the window follow the motion of your subject.

In general, look for the frames where your subject's motion starts, stops, speeds up, slows down, or changes direction. As you work, it's good to try and add the fewest number of keyframes you can to ensure smooth motion from one to another. Too many keyframed adjustments made too close together for a smoothly moving subject risks adding jerky motion if you're not careful. On the other hand, if you have an erratically moving subject, you may have to add more keyframes, possibly frame by frame, to achieve the desired result.

**TIP:** If you're isolating a subject with a complex shape that moves quite a lot, you might consider using multiple simple overlapping shapes to track and rotoscope it, rather than a single complicated one, to make the task easier.

- 7 When you're finished rotoscoping the window, be sure to click the Clip button to switch back to Clip mode, so you can trim the Window's shape across every keyframe you've just created, if necessary. This will also prevent you from accidentally adding more keyframes if you select other shapes.

This technique requires a bit more work than simply using the Tracker, but it'll let you quickly adjust the animation of a window to more tightly conform to a moving subject when you need an adjustment to be specific to that subject alone. You can also use this technique to reposition specific motion path points in the middle of an otherwise successful track to make them fit better, or to add keyframes to the beginning or end of a track when the subject moves offscreen but the window does not.

## Viewing a Window's Motion Path

You can turn on the motion path of the window you're tracking by choosing Show Motion Track from the Tracker palette's Option menu, or by pressing the SHOW TRACK soft key on the Center panel of the DaVinci control panel when you're in OBJECT TRACK MODE.