



HDR & Dolby Vision Workflow and Setup

← Streambox Chroma Encoder ⇒

Streambox Media Player (iPad Pro, Apple TV 4K, macOS)

Streambox Chroma+ and Halo Decoders
with Blackmagic Design DaVinci Resolve

Revision 4a

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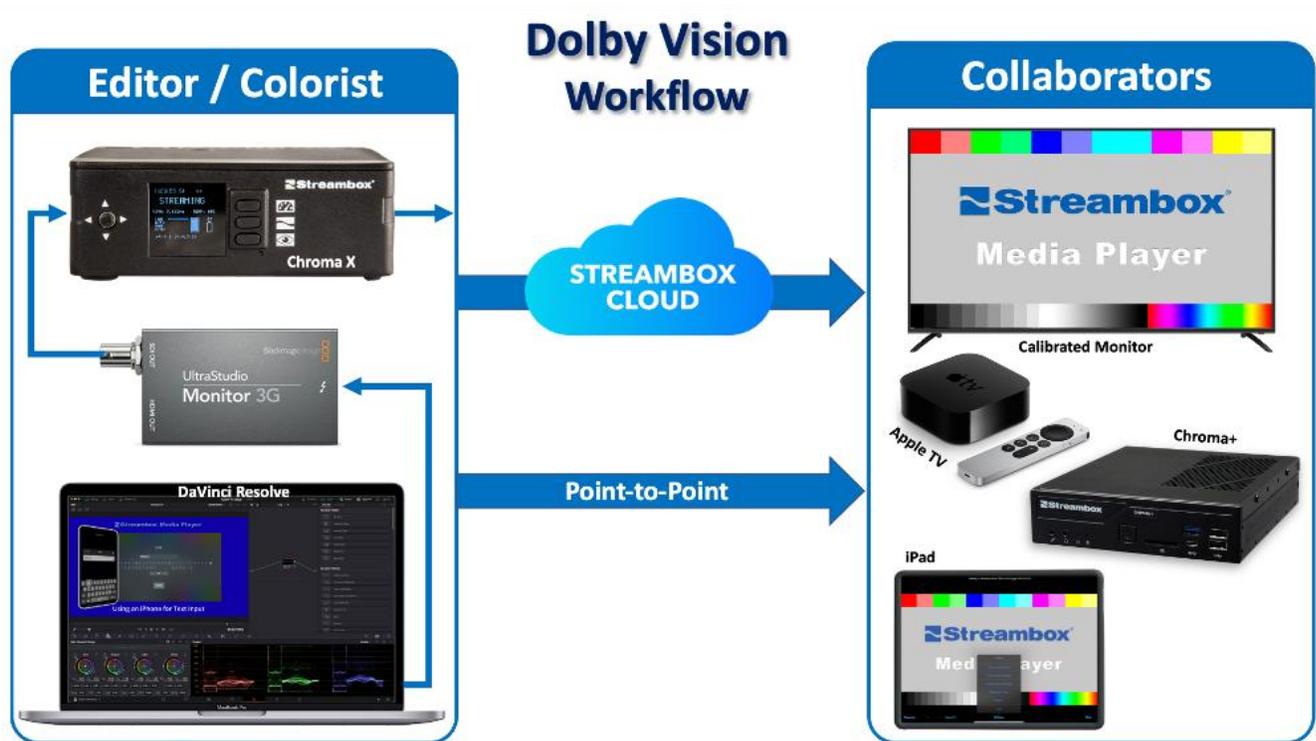
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Introduction

Streambox Chroma Encoders and Decoders allows editors and colorists the ability to share their work, in real-time, with other stakeholders near and far. With support for Dolby Vision, this collaboration is extended to a new level. Here we will introduce the implementation of Dolby Vision workflow using Blackmagic DaVinci Resolve as a source for streams from Streambox Encoders¹, over IP, to Streambox Decoders.

Overview



1. The editor or colorist sets up *Blackmagic DaVinci Resolve* to output to *UltraStudio Monitor 3G* which communicates the stream to the *Streambox ChromaX encoder*. The stream can then be transmitted over IP via the Streambox Cloud or directly, point-to-point, to a receiving decoder. The stream can be encrypted end-to-end without affecting latency. When properly configured, and with adequate bandwidth, most streams can be delivered within a second or less.

2. You need to use HDR enabled hardware – like Apple TV 4K (tvOS 14.6 or greater) or the Streambox Chroma+ (latest version) connected to a Monitor/TV that supports Dolby Vision. You can also use the latest generation iPad Pro (2021). The stream can be sent point-to-point using an IPv4 public address or via the Streambox Cloud using a Session ID to simultaneously share with up to 8 collaborators.

¹ [Streambox Spectra \(software encoder\) setup for Dolby Vision](#) is covered in detail in a separate document.

The Components

1. [Streambox Chroma](#) Encoders and Decoders support High Dynamic Range (HDR), including Dolby Vision (DV):

Encoders – 4K Rackmount, ChromaX, Spectra (software encoder) ²

Media Players – for iPad Pro, macOS, and Apple TV 4K (2nd Generation)

Decoders – [Chroma+](#), [ChromaX](#), and [Halo](#)

2. [Dolby Vision](#) is an HDR (High Dynamic Range) format with support for wide color gamuts (P3 D65, and Rec.2020) that can support up to a 12-bit color depth and 10K nit³ brightness.
3. [Blackmagic DaVinci Resolve](#) is a video/color/graphics editor that supports Dolby Vision. DaVinci Resolve can stream a Clean Feed to a Streambox Chroma Encoder via a hardware interface like Blackmagic UltraStudio Monitor 3G. In the setup below, we use a [Blackmagic UltraStudio Monitor 3G](#) to facilitate video output over SDI to the [Streambox Chroma-X Encoder](#).

Streambox Encoder Setup

This setup is most ideal for color grading with focus on Dolby Vision support on Blackmagic DaVinci Resolve and Streambox Spectra. These instructions assume you are familiar with both DaVinci Resolve and Streambox products.

Note 1: When streaming Dolby Vision content via Streambox, setup in DaVinci Resolve supports both iCMU (internal - with pre-applied tone mapping - used when streaming to the iPad, macOS, Apple TV, Chroma +, Chroma X, and Halo) and eCMU (external - with metadata for endpoint tone mapping - used when streaming to Chroma+). By default, DaVinci Resolve output uses Internal CMU.

Note 2: iCMU workflow is primary for Color Correction/Grading. Davinci Resolve produces video that is tone mapped using Dolby Vision imaging which allows for direct viewing on professional monitors. Therefore, with iCMU the video is already tone mapped and should not be further modified by the display device. To achieve this, Streambox provides 'Pure PQ'⁴ mode for Apple devices and 'Absolute' mode for Dolby Vision TV's to mimic professional monitors.

² [Streambox Spectra \(software encoder\) setup for Dolby Vision](#) is covered in detail in a separate document.

³ 10,000 cd/m²

⁴ PQ (Perceptual Quantizer) format is a SMPTE ST 2084 standard. It is a gamma transformation.

SDI Connection

First, let's discuss the SDI connection. Any Blackmagic playback device will do. In this case, we used an UltraStudio Monitor 3G connected to the SDI input of a Streambox Chroma-X Encoder. Below are the settings from the 'Desktop Video Setup' app for the Monitor 3G.

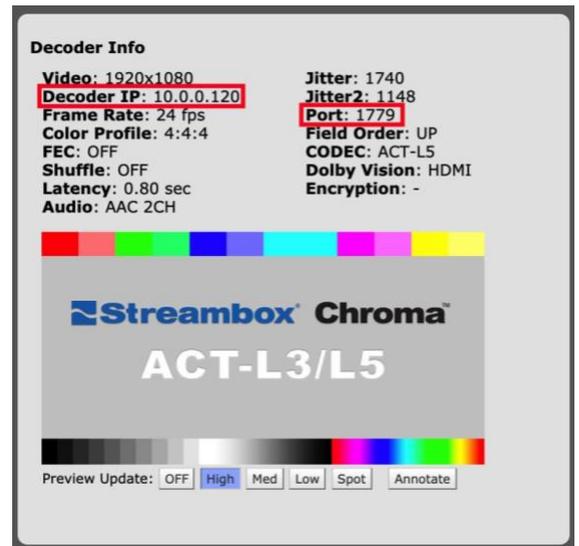


Streambox Chroma-X Encoder Setup

The Chroma-X Encoder can be set up to stream one-to-many using [Streambox Sessions](#) or one-to-one with point-to-point IP setup. In this example we will use point-to-point where the 'Target Decoder Destination IP' and 'Destination Port' are set on the Network page.

1. Determine the decoder IP and Port from the [Decoder Info](#) section of the 'Network' page of the Chroma Decoder (see image on right).

The Decoder IP is listed in the left column and the Decoder Port in the right column. While you are here, this is a good place to see the stats for the incoming stream; e.g., Color Profile, Audio, CODEC, and Dolby Vision.



- On the Encoder's 'Network' page, make sure the Destination IP and Port match that from the Decoder (see image on right). This is an example of point-to-point setup on the same network. *Remember to 'Apply Changes'.*

Target Decoder

Name: (current)

Destination IP: 10.0.0.120

Destination Port: 1779 UDP (default: 1770)

IP Packet Size: 1392 bytes (default: 1392)

Note 1: Point-to-point setup over the internet requires that the local IPv4 address of the decoder is used and that port-forwarding is set up for the decoder if a firewall is in place.

Note 2: If you want to stream one-to-many, we suggest using Streambox Sessions (see top of this section).

- On the Encoder's 'Config' tab you will want to set the following values:

Video Resolution: HD Full

Color Profile: 4:4:4

Bit Depth: 10 or 12

Color Space: DCI/ICT RGB

Remember to 'Apply Changes'

Video Settings

Video Resolution: HD Full

Color Profile: 4:4:4 (default: 4:2:2)

Frame-rate: Full (default: Full)

Key Frames: 100 frames (default: 300 frames)

Advanced profile: Off (Default: Off)

Bit depth: 10 (Default: 10-bit)

Color Space: DCI/ICT RGB For RGB 4:4:4 only

Dynamic res: Off Quality: 0

Dynamic Status: Off (Default: Off)

Watermark: Off (Default: Off) (PNG file)

Note: Once you have everything set up, you can save all the settings as a Preset on this page.

- On the Encoder's System page, make sure the Codec is ACT-L5. If it is not, click the 'ACT-L5' button, then click the 'Restart Encoder' button.
- One last step. You must decide whether your target decoder requires Dolby Vision metadata (eCMU) or has internal tone mapping (iCMU).

- ON = Capture, process, and transmit Dolby Vision metadata (for streaming to Chroma+ or a Chroma decoder that is connected to a CMU adapter)

DolbyVision Metadata Capture Mode

- OFF = Do not capture Dolby Vision metadata. When using Internal CMU for delivery to iOS, Apple TV, or HDR10 devices
- RAW = Capture and transmit Dolby Vision metadata without processing (for future compatibility if Dolby changes metadata usage - only to be used with Chroma units connected to a CMU adapter)

Note: By default, DaVinci Resolve output uses Internal CMU. You can change to External CMU for Chroma+ by checking “Use external CMU” under Color Management on the Project Settings page (Dolby Vision license required). Thus, you must decide which decoder types you want to use for any one session (Apple TV and iPad or Chroma+) and set up DaVinci Resolve accordingly.

The Chroma Encoder is now ready to stream point-to-point to the Chroma Decoder. To start the stream, from the ‘Info’ tab, click on the START Streaming button. But first we need to set up a Chroma Decoder.

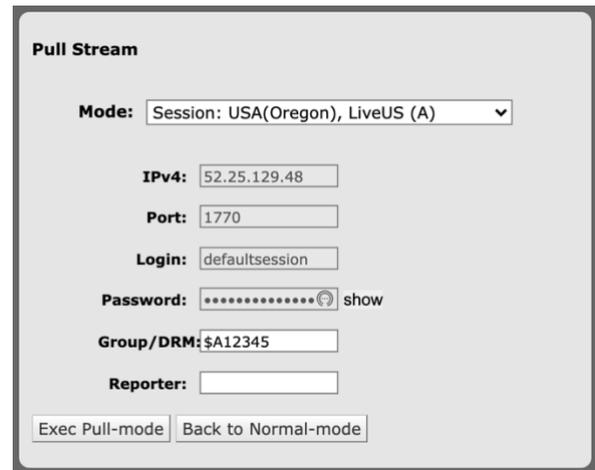
Streambox Hardware Decoder Setup

Decoder Network Setup

In this workflow we will review the Chroma+, Halo, and Chroma X, but any Chroma decoder will work nicely, and the setup is nearly identical.

First – On the ‘Network’ page, click the ‘Back to Normal-mode’ button to ensure that the decoder is in the Unicast (receive) mode. A confirmation message will appear - click ‘OK’.

Second – While on the Network tab, you can setup the Session ID (see image on right). Select the Mode/Server for the Session (that is associated with the Session ID). In this example, the Session ID starts with \$A, so from the Mode dropdown, you can see that it is associated with the ‘Session; USA(Oregon)’ server. Enter the Session ID in the Group field.



Network Page

Note 1: After everything else is setup (see below) you can click the ‘Exec Pull-mode’ button and within a minute the Session should start. The Session won’t be seen on the decoder side until the stream is started in Spectra.

Note 2: Jump to the section below based on the Chroma decoder you are setting up.

Chroma+ Decoder

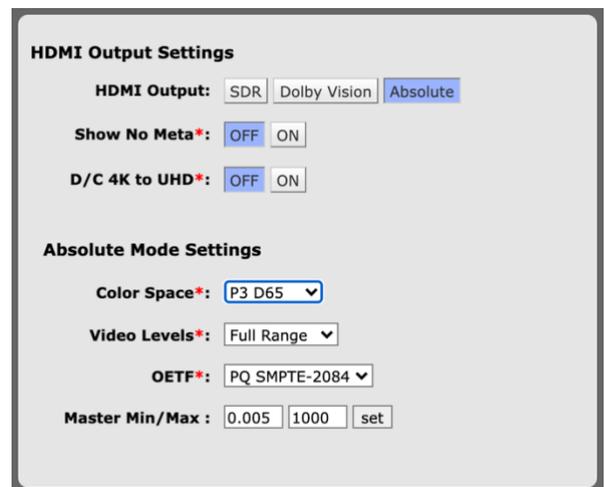
Streambox Chroma+ is a Chroma Decoder with HDMI output and support for Dolby Vision eCMU and iCMU for Dolby Vision enabled TV's. However, for color grading reviews, iCMU mode is most commonly used.

1. Turn to the 'Output' tab (see second image on right). The settings provided here are a good starting point for iCMU.

Note: Set the Video Levels to Full Range unless Legal Range was used in Spectra.

2. On the Decoder's System page, make sure the Codec is ACT-L5. If it is not, click the 'ACT-L5' button, then click the 'OK' button in the Restart dialog box.

Note: When connected, for example, to a Dolby Vision enabled consumer TV, Chroma + can receive either eCMU or iCMU streams. If receiving an iCMU stream (DaVinci Resolve default), make sure 'HDMI Output' is set to Absolute so there is no additional tone mapping applied. If receiving an eCMU stream, make sure 'HDMI Output' is set to Dolby Vision. When Dolby Vision is set, tone mapping metadata is passed through and applied by the displaying monitor.



Chroma+ Decoder

Halo Decoder

Streambox Halo is a Chroma Decoder with SDI output and support for Dolby Vision eCMU and iCMU.

1. Turn to the 'Output' tab (see image on right, next page). The settings provided here are a good starting point for iCMU.

Note: Set the Video Levels to Full Range unless Legal Range was used in Spectra.



2. On the Decoder's System page, make sure the Codec is ACT-L5. If it is not, click the 'ACT-L5' button, then click the 'OK' button in the Restart dialog box.

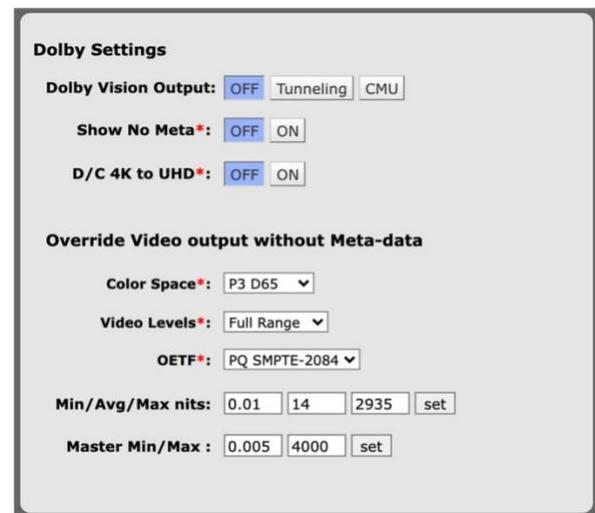


Halo Decoder

Chroma X Encoder/Decoder

Streambox Chroma X is a Chroma Encoder and Decoder with SDI input/output and support for Dolby Vision eCMU and iCMU.

1. Make sure Chroma X is in the Decoder mode. If not, go to the System tab and click the 'Switch to Decoder' button (it will restart in Decoder mode).
2. On the Decoder's System page, make sure the Codec is ACT-L5. If it is not, click the 'ACT-L5' button, then click the 'OK' button in the Restart dialog box.
3. Turn to the 'Output' tab (see image on right). The settings provided here are a good starting point for iCMU.



Chroma X

Note 1: Set the Video Levels to Full Range unless Legal Range was used in Spectra.

Note 2: For iCMU streams, ensure that 'Dolby Vision Output' is set to OFF, since tone mapping is already applied, and connected to a monitor where tone mapping is disabled (e.g., Sony X300).

Streambox Media Players for Apple Devices

Streambox Media Players provides a 'Pure PQ' mode where Apple tone mapping is disabled and a 'Native PQ' mode where Apple tone mapping is enabled. The PQ mode can be toggled when in landscape orientation. You can also adjust the image brightness with the + and – buttons (and keyboard equivalents – see [Media Player for Apple iPad® Pro](#) section below).

Note: Pure PQ mode mimics the behavior found in professional monitors. When Pure PQ mode is used for HDR profiles, Streambox Media Player will maintain true signal brightness regardless of the iPad brightness settings. If current screen brightness settings are above or below signal levels, Pure PQ mode will “hard cut” to the nearest available levels.

Media Player for Apple iPad® Pro

Streambox Media Player for iPad and iOS provides support for Dolby Vision iCMU workflows/streams.

Note: Screen brightness (nits) varies by generation:

2021- iPad Pro Liquid Retina XDR (supports up to 1000 nits)

2019/2018 - Retina iPad Pro 12” (supports up to 600 nits)

*Streambox does not recommend older iPads for Dolby Vision color grading

1. From the 'Settings' menu, select 'Color Space Settings'.
From that menu, select '(HDR) P3 D65 PQ Full'.

Note: Select 'Full' unless 'Legal' range was used in Spectra, then select '(HDR) P3 D65 PQ Legal'.

2. The Pure PQ / Native PQ switch is available in the landscape orientation along with a + and – buttons to adjust screen brightness (see red arrow, image below).
You will want to select Pure PQ mode for iCMU streams to disable additional tone mapping.
- 3.
4. You can setup up a Session to select from the Channels menu, or in portrait orientation, you can enter the Session ID directly and click 'Go'.

Note 1: On iPads with keyboards

'Space' (or screen tap in landscape orientation) will Show/Hide bottom menu

'P' will toggle between Pure PQ and Native PQ modes

'+' will increase screen brightness by 1 step

'↑' will increase screen brightness by 10 steps

- ‘←’ will decrease screen brightness by 1 step
- ‘↓’ will decrease screen brightness by 10 steps

Note 2: In landscape mode, tap the screen to show/hide color space and Pure PQ information (see



top of screen in image above).

Media Player for Apple TV® 4K

Apple TV (2nd Generation) supports iCMU streams on TV's/monitors that support HDR. Streambox Media Player for Apple TV can be downloaded/installed from the Apple Store.



1. From the 'Settings' menu, select 'Color Space Settings'.
From that menu, select '(HDR) P3 D65 PQ Full'.

Note: Select 'Full' unless 'Legal' range was used in Spectra, then select '(HDR) P3 D65 PQ Legal'.

2. Setup up the Session to pull. From the main menu select 'Open Session' and enter the Session ID provided by the host (which matches the Session addressed in Spectra)

Note 1: Apple TV HDMI outputs/converts video to Rec.2020 for attached monitors. If you are streaming with an iCMU workflow, it is important that a Professional Monitor is set to Rec.2020 (BT.2100: Rec2020 +PQ). This does not apply to the Media Player which should be set to P3 D65 PQ.

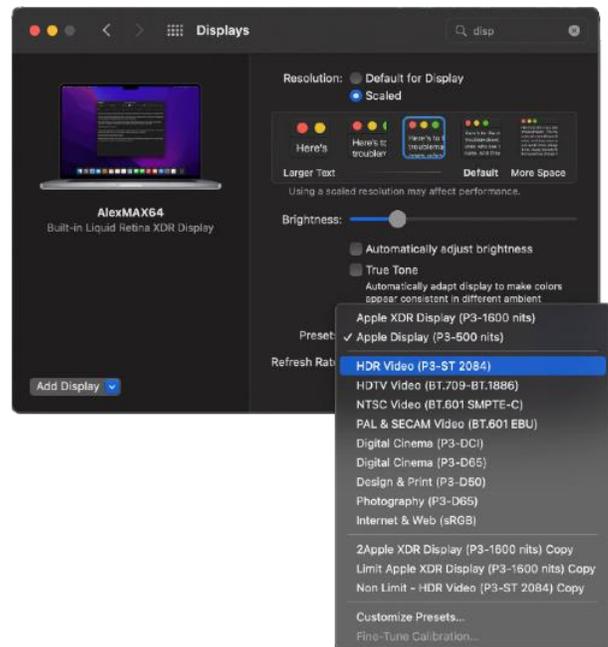
Note 2: It is advised that you review the Streambox Setup Guide for Media Player for Apple TV. Both Apple TV and the TV/monitor require some up-front setup for proper playback.

Note 3: Streambox Media Player for Apple TV does not apply tone mapping, but many HDR/Dolby Vision enabled televisions do. If you are streaming with iCMU workflow, it is important to ensure that tone mapping for the TV/monitor is disabled.

Media Player for macOS (MacBook Pro, XDR 2021+)

Streambox Media Player for macOS (1.2.6 or higher) provides support for Dolby Vision iCMU streams.

1. First, configure your MacBook display for Dolby Vision / HDR. Open the 'Displays' page from the 'System Preferences' dialog (see image on right), Select the 'HDR Video (P3-ST 2084)' reference profile.⁵
2. Now on Media Player, from the 'Settings' menu, select 'Color Space Settings'. From that menu, select '(HDR) P3 D65 PQ Full'.



Note: Select 'Full' unless 'Legal' range was used in Spectra, then select '(HDR) P3 D65 PQ Legal'.

3. Setup up the Session to pull. In portrait orientation, you can enter the Session ID and click 'Go' (see red arrow, image on right).

⁵ Used for 4K or ultra-high-definition video production workflows up to 1000 nits. This profile uses the wide color P3 primaries and the high-dynamic-range SMPTE ST-2084.

4. The Pure PQ / Native PQ switch is available in the landscape orientation (as shown above in the [iPad](#) section) by resizing or maximizing the Media Players window.

Note 1: When HDR Video reference profile is selected, macOS disables brightness control. However, in 1600 and 500nits profiles, it is possible to adjust brightness with Mac Book Pro keyboard. Only brightness in the 100% to 75% range is supported. When brightness is below this value "increase brightness" message is displayed.

Note 2: You will want to select Pure PQ mode for iCMU streams. For macOS 12.1 and for HDR Video reference profile, both Pure PQ and Native PQ are identical. Other profiles will require Pure PQ mode.

Note 3: On MacBooks

- 'Space' will Show/Hide bottom menu
- 'P' will toggle between Pure PQ and Native PQ modes
- Click on screen to show/hide color space and PQ status

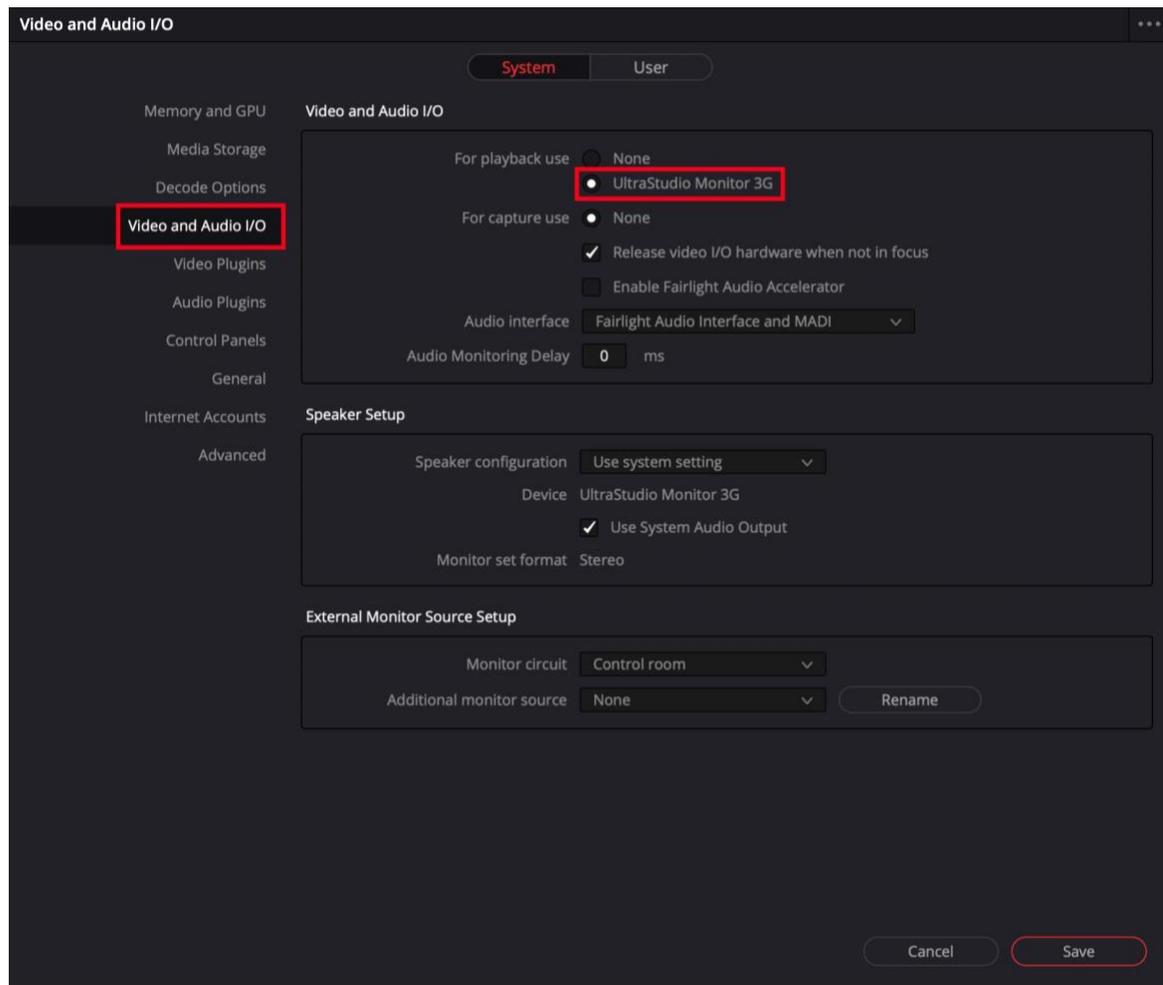
Note 4: MacBooks (latest generation, 2021+) support stream tone mapped with Dolby Vision iCMU up to 1000 nits.

Note 5: MacBooks 2018-2021 can display up to 600 nits with Color LCD Profile and Pure PQ mode enabled and brightness set from 100% to 75%.



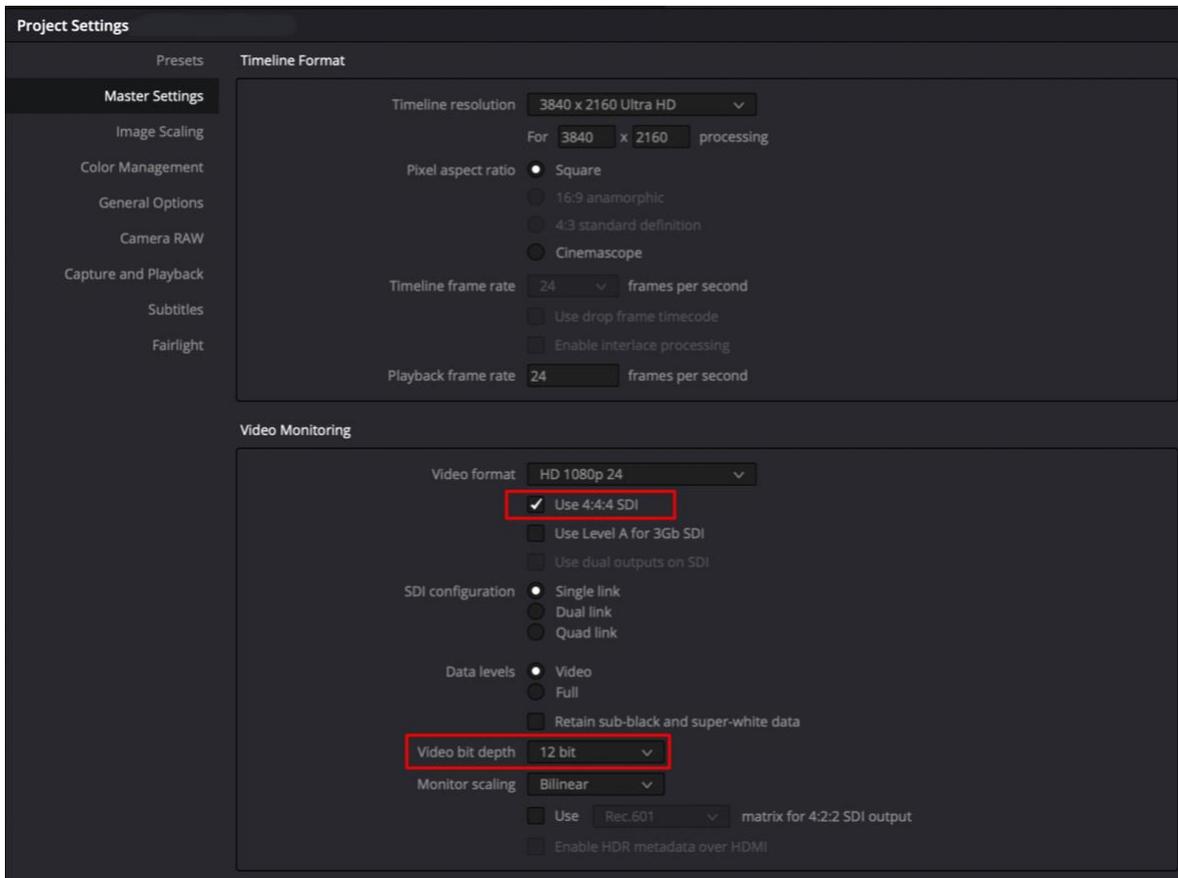
Setting up DaVinci Resolve

Basically, you need to tell DaVinci Resolve where to send the video stream. In this case, it is the UltraStudio Monitor 3G. Open the 'Preferences...' page and select the 'Video and Audio I/O' tab. Make sure that the UltraStudio Monitor 3G is first plugged in and is selected here. All other settings on this page have no impact on our mission here.



Next we need to open the 'Project Settings' page (Shift + 9, or click the cogwheel in the lower right hand corner).

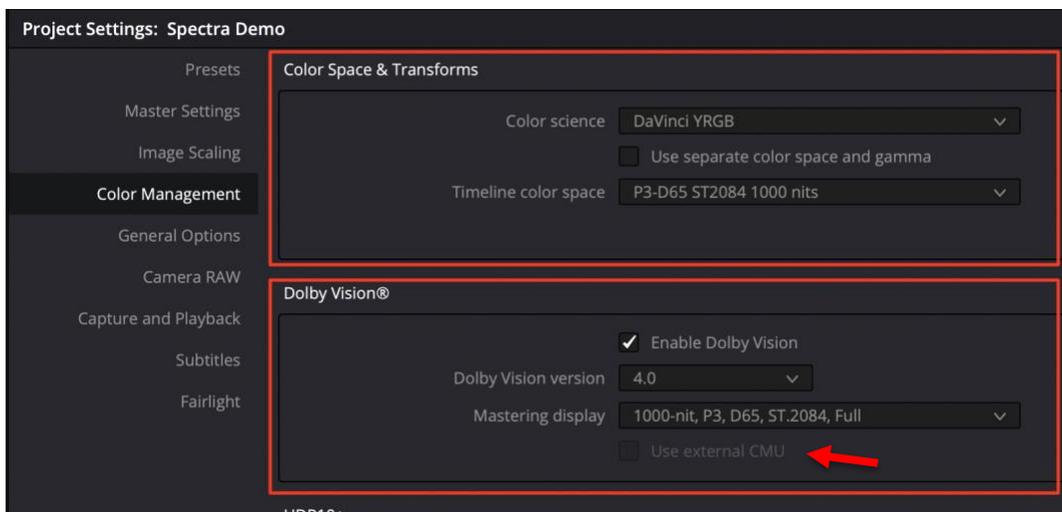
1. If you are streaming with Dolby Vision metadata (to Chroma+), you need to set Video Monitoring to 'Use 4:4:4 SDI' and 12-bit Video bit depth.



Next, we need to select 'Color Management' on the 'Project Settings' page (see image below).

2. Under the 'Color Space & Transforms' section set the following:

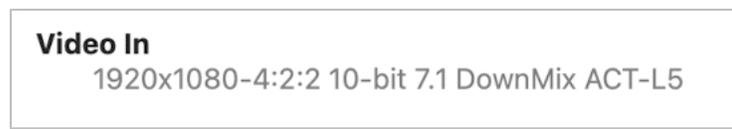
- Color science = 'DaVinci YRGB'
- Timeline color space = 'P3-D65 ST2048 1000 nits'



3. Under the 'Dolby Vision' section set the following:
 1. Check the 'Enable Dolby Vision' feature
 2. Dolby Vision version = '4.0' (for iCMU)
Dolby Vision version = '2.9' (for eCMU)
 3. Mastering display = '1000-nit, P3, D65, ST.2084, Full'
 4. Uncheck 'Use external CMU' to use Internal CMU to map Dolby Vision to HDR10 in Davinci Resolve for HDR streaming to iOS or Apple TV 4K (red arrow).
4. Save - click the Save button

Note 1: Once these changes have been made, you can do a simple scrub of the timeline to make sure the Streambox Encoder is receiving a representative image.

Note 2: You can confirm correct settings by streaming to a Media Player (directly or via the Streambox Cloud) and reviewing the 'Video In' readout (see image below). The example below shows that the video resolution is 1920x1080 (or HD), the chroma subsampling is 4:2:2, the color depth is 10-bit, there are 8 audio channels (that were downmixed to 2, stereo), and the codec is ACT-L5.



Conclusion

If all the above setup is implemented, and the Encoder is set to stream, you should now be streaming the DaVinci Resolve timeline from the Encoder to the Decoder.

If this is not the case, please go through the steps one more time. If that fails, please contact Support.

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