HOW TO QC HDR DOLBY VISION FILES, HOW TO APPLY TRIM PASS – Updated 11 July 2023

Including Tektronix 8300 and Sony BVM X300 Monitor set up in MFR 08 /09.

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1. We need to make sure that the file we are working on has the Dolby Vision (DoVi) XML Metadata document present.
2. **We refer if no DoVi XML Metadata document present**.

3. **File Metadata matches the xml Dolby Vision metadata check.**
   We check that the values present in the file metadata need to be consistent with the values in the Dolby Vision xml Metadata doc.
   (for example: MaxCLL & Max Fall – sometimes added in the xml as 0 but on the base file as 997 MaxCLL & 400 MaxFALL)
   If the values are not consistent, the file should be failed.

4. **Our first picture Pass** is the **File Pass** without the xml metadata.
   This can be with the DoVi XML doc added but HDR simulation on the Iris set to off (or without the xml doc added.)
   Load the file into the Iris, and load the XML metadata doc into the Iris after you put the file in.
   Orange dots will show below the video window of the Iris.
5. Turn the **HDR Simulation OFF** in the Options menu in Iris – Split screen box un- ticked.
   Turn off HDR Simulation in the dropdown menu of the Iris video window.
6. **Then do your QC.** (So, your first pass will be with the DoVi XML metadata loaded into the Iris but with the HDR simulation off - showing you the native HDR image)

   The Trim Pass
   The Trim pass is to check that the sync timings of the edits in the Metadata match the edits in the video.
   If there are any timing errors, they would appear like a mistimed grading error with the luminance level changing at a point other than a cut.
   This is like a Bright up grading Change. If you spot these, please log and fail. We can also see faults like pixel dropouts more clearly.
   There is a test file with a 5-frame offset error. Location: LON_DL3_fs04> snfs06> QC> HDR_Test_files> DoVi_Timing_ TestClip_5fr_Early.

7. **Our second picture Pass (Trim Pass)** is with the Dolby Vision Trim pass applied - with the xml doc added.
   We can do this full Screen: The content will look oversaturated and bright.
   This will allow us to see the mistimed grading / bright up errors and faults like pixel dropouts.
8. **We turn on HDR simulation** / Options menu in Iris and ensure the Split screen box unticked.
   And we turn on the HDR simulation in the dropdown of the Iris.
9. It is recommended to use the 100-nit trim pass as this will give the greatest change in light level to the native level.
10. This will make the most obvious difference in the light levels.
11. **Trim Pass Spot check:** If the Client is not paying for Trim pass runtime, we will do a Spot Check of the Trim Pass
    (Start / Middle End to check sync timing – Run for 30 sec each / or over two shot edits).

The HDR metadata is used to control how the video is viewed on monitors / TV's which can't display the full HDR light levels and so doesn't affect the original HDR grade. So it's possible, and valid, to create both HDR10 and Dolby Vision metadata to be used on the same native HDR image after it's been graded. There are various ways of creating the DoVi metadata, from an automated process via Transkoder to manual manipulation of the values on a shot by shot basis. Again, any way is valid although they may produce different results as an 'eyes-on' review of each shot with the trim passes applied is the recommended way as it can then be confirmed that the results are as intended. However, there isn't any way we can tell how the Dolby Vision metadata has been created; all we can do is check and confirm it is technically valid.

The Color Encoding primaries refer to the color space of the file. It can be either Rec.2020 or P3 and it should match the metadata of the file itself so if they don't match it should be flagged. For example, if the color encoding primaries for the file are P3, whereas the XML metadata shows them as being Rec.2020 this is incorrect so it's an issue.

(NB - For Disney, the Colour Primaries should always be Rec.2020)

The Mastering Display information shows how the file was graded and can be either Rec.2020 or P3; it doesn't have to match the Color Encoding primaries.

You will usually see the following combinations:

Color Encoding Rec.2020
Mastering Rec.2020

Color Encoding Rec.2020
Mastering P3

Color Encoding P3
Mastering P3

Although less common, it's also valid to see:

Color Encoding P3
Mastering Rec.2020

It's therefore not an issue if the file metadata & Color Encoding primaries don't match the Mastering Display.

So, check that the Color Primaries for the file:

```
<ColorEncoding>
  <Primaries>
    <Red>0.708 0.292</Red>
    <Green>0.17 0.797</Green>
    <Blue>0.131 0.046</Blue>
  </Primaries>
```

Match the file metadata:

Color primaries: BT.2020
Transfer characteristics: PQ
Matrix coefficients: BT.2020 non-constant

(NB – For Disney, these should both show Rec.2020 as in this example.)

You can then check the Mastering Display information which will show how the file was graded, in this case, in P3:

```
<MasteringDisplay>
  <ID>20</ID>
  <Name>1000-nit, P3, D65, ST.2084, Full</Name>
  <Primaries>
    <Red>0.68 0.32</Red>
    <Green>0.265 0.69</Green>
    <Blue>0.15 0.06</Blue>
  </Primaries>
```

In a file / XML like the example above, this is showing the video was graded in P3 but is contained within a Rec.2020 color space on the file. This is valid, and arguably the normal for most productions, and so is correct and doesn't need to be flagged.

However, it's possible that the export has been done without applying a P3 to Rec.2020 color space conversion.
If you see the Max Gamut on the Histogram at over 100% then this is a possibility, and it should be checked further in Transkoder.

MaxFALL / Max CLL values are different between the xml and histogram.

With the MaxFALL & MaxCLL, although the values are different and if it's only very slight and they are in the same ball park so we don't need to flag. If they were way out, we would flag, but what we're seeing maybe just the difference between it being run on TKD versus being run through Dolby Tools. I believe that when using Dolby Tools, which is used to do the grading too, there are more fine controls over the parameters for the measurement so that's probably the difference we're seeing.

DoVi Trim Passes

Trim passes are available in both P3 and Rec.2020 color spaces and a range of target nit values, predominantly 600-nits, 1000-nits and 2000-nits. The trim pass name also references ST.2084; each of these elements is referring to different things:

BT.2084 is essentially another way of referring to the PQ transfer characteristic as it defines the PQ Transfer Function for translating 10 or 12-bit values into a brightness range of 0.0001 to 10,000-nit along with the requirement for Static or Dynamic metadata. So, as the 600-nit and 1000-nit trim passes are still using the PQ transfer characteristics that is OK.
Color Space. Trim passes can either use the Rec.2020 color space, or the P3 color space; both are valid. If the trim pass uses a different color space to the Mastering Display, then a color conversion is performed to ensure the colours are correct.

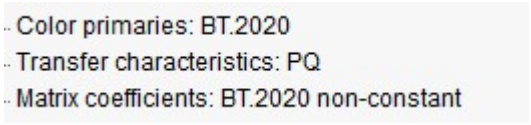
File and it's related xml Metadata Checks

We don't need to worry about the Target Display, the things that need to be checked are the Colour Space of the file vs the xml Metadata document and then potentially the Mastering Display values & MaxCLL & MaxFALL.
Essentially, any of these values present in the file need to be consistent with the values in the metadata or the file should be failed.
(For example: MaxCLL & Max Fall – sometimes added in the xml as 0 but on the base file as 997 MaxCLL & 400 MaxFALL).

Colour Space

The first thing you need to do is check that:
The Color Space in the file is the same in the DoVi metadata xml that is related to the file.

So, **in the file** it's in the usual place:



On the **xml metadata** it is under '**Color Encoding'** and you're checking to see if the Primaries are showing Rec.2020 or P3 values:

Rec.2020 =

```
<ColorEncoding>
    <Primaries>
      <Red>0.708 0.292</Red>
      <Green>0.17 0.797</Green>
      <Blue>0.131 0.046</Blue>
    </Primaries>
    <WhitePoint>0.3127 0.329</WhitePoint>
    <PeakBrightness>10000</PeakBrightness>
    <MinimumBrightness>0</MinimumBrightness>
    <Encoding>pq</Encoding>
    <ColorSpace>rgb</ColorSpace>
    <SignalRange>computer</SignalRange>
  </ColorEncoding
```

P3 =

```
<ColorEncoding>
  <Primaries>
    <Red>0.68 0.32</Red>
    <Green>0.265 0.69</Green>
    <Blue>0.15 0.06</Blue>
  </Primaries>
  <WhitePoint>0.3127 0.329</WhitePoint>
  <PeakBrightness>10000</PeakBrightness>
  <MinimumBrightness>0</MinimumBrightness>
  <Encoding>pq</Encoding>
  <ColorSpace>rgb</ColorSpace>
  <SignalRange>computer</SignalRange>
</ColorEncoding>
```

Mastering Display Information

The next thing you need to check is the Mastering Display Information **if it's present in the file** to see that that matches the metadata.
So if it's present:

```
Mastering display luminance: min: 0.0001 cd/m2, max: 1000 cd/m2
```

Then on the **xml metadata**, check under '**Mastering Display**' that the values match:

```
<MasteringDisplay>
  <ID>7</ID>
  <Name>4000-nit, P3, D65, ST.2084, Full</Name>
  <Primaries>
    <Red>0.68 0.32</Red>
    <Green>0.265 0.69</Green>
    <Blue>0.15 0.06</Blue>
  </Primaries>
  <WhitePoint>0.3127 0.329</WhitePoint>
  <PeakBrightness>4000</PeakBrightness>
  <MinimumBrightness>0.005</MinimumBrightness>
  <DiagonalSize>42</DiagonalSize>
</MasteringDisplay>
```

MaxFALL & MaxCLL

Finally, if the file shows the MaxFALL & MaxCLL, then these will need to be checked against the metadata too.
So **on the file** it shows:

```
Maximum Content Light Level: 496 cd/m2
Maximum Frame-Average Light Level: 45 cd/m2
```

On the xml metadata it shows:

```
<MaxCLL>0</MaxCLL>
<MaxFALL>0</MaxFALL>
```

Note: It's not necessarily an issue that the file shows **'0'** as that is often done intentionally, but then we'd expect the file to be the same.
(Disney spec for example expect these to be **'0'** on the xml)

See below for RGB primaries numbers for P3 or BT/Rec 2020

XML example given below: P3

```
- <MasteringDisplay>
    <ID>7</ID>
    <Name>4000-nit, P3, D65, ST.2084, Full</Name>
  - <Primaries>
      <Red>0.68 0.32</Red>
      <Green>0.265 0.69</Green>
      <Blue>0.15 0.06</Blue>
    </Primaries>
    <WhitePoint>0.3127 0.329</WhitePoint>
    <PeakBrightness>4000</PeakBrightness>
    <MinimumBrightness>0.005</MinimumBrightness>
    <DiagonalSize>42</DiagonalSize>
  </MasteringDisplay>
- <TargetDisplay>
    <ID>1</ID>
    <Name>100-nit, BT.709, BT.1886, Full (HOME)</Name>
  - <Primaries>
      <Red>0.64 0.33</Red>
      <Green>0.3 0.6</Green>
      <Blue>0.15 0.06</Blue>
    </Primaries>
    <WhitePoint>0.3127 0.329</WhitePoint>
    <PeakBrightness>100</PeakBrightness>
    <MinimumBrightness>0.005</MinimumBrightness>
    <EOTF>gamma_bt1886</EOTF>
    <DiagonalSize>42</DiagonalSize>
```

XML examples given below: BT/Rec - 2020

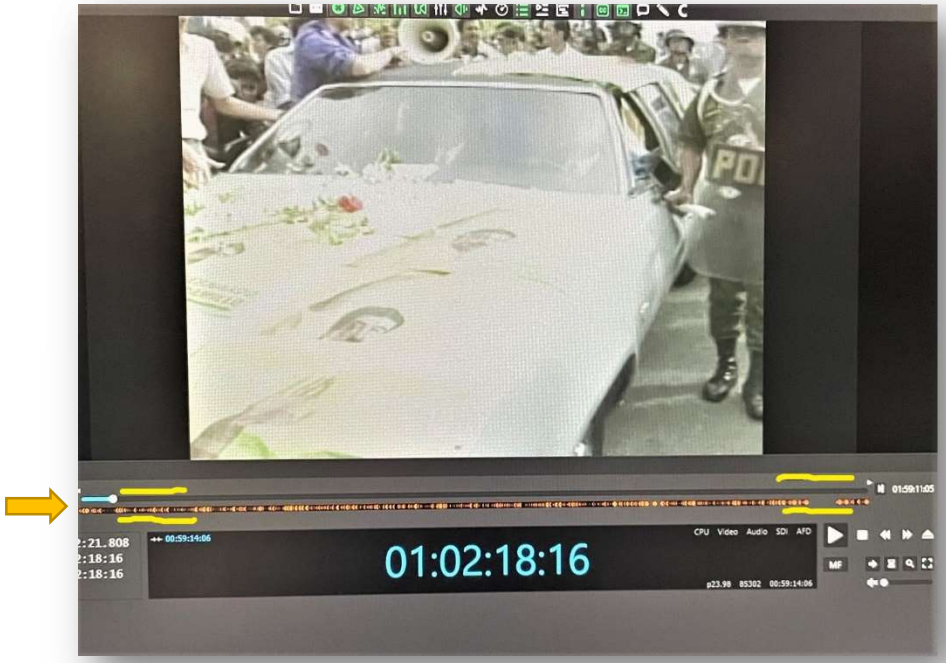
```
- <MasteringDisplay name="1000-nit, BT.2020, D65, ST.2084, Full" id="21">
    <ID>21</ID>
    <Name>1000-nit, BT.2020, D65, ST.2084, Full</Name>
  - <Primaries>
      <Red>0.708,0.292</Red>
      <Green>0.17,0.797</Green>
      <Blue>0.131,0.046</Blue>
    </Primaries>
    <WhitePoint>0.3127,0.329</WhitePoint>
    <MinimumBrightness>0.0001</MinimumBrightness>
    <PeakBrightness>1000</PeakBrightness>
    <Encoding>pq</Encoding>
    <ColorSpace>rgb</ColorSpace>
    <SignalRange>computer</SignalRange>
    <DiagonalSize>42</DiagonalSize>
    <BitDepth>16</BitDepth>
    <ChromaFormat>444</ChromaFormat>
  </MasteringDisplay>
- <TargetDisplay name="100-nit, BT.709, BT.1886, Full (HOME)" id="1">
    <ID>1</ID>
    <Name>100-nit, BT.709, BT.1886, Full (HOME)</Name>
  - <Primaries>
      <Red>0.64,0.33</Red>
      <Green>0.3,0.6</Green>
      <Blue>0.15,0.06</Blue>
    </Primaries>
    <WhitePoint>0.3127,0.329</WhitePoint>
    <MinimumBrightness>0.005</MinimumBrightness>
    <PeakBrightness>100</PeakBrightness>
```

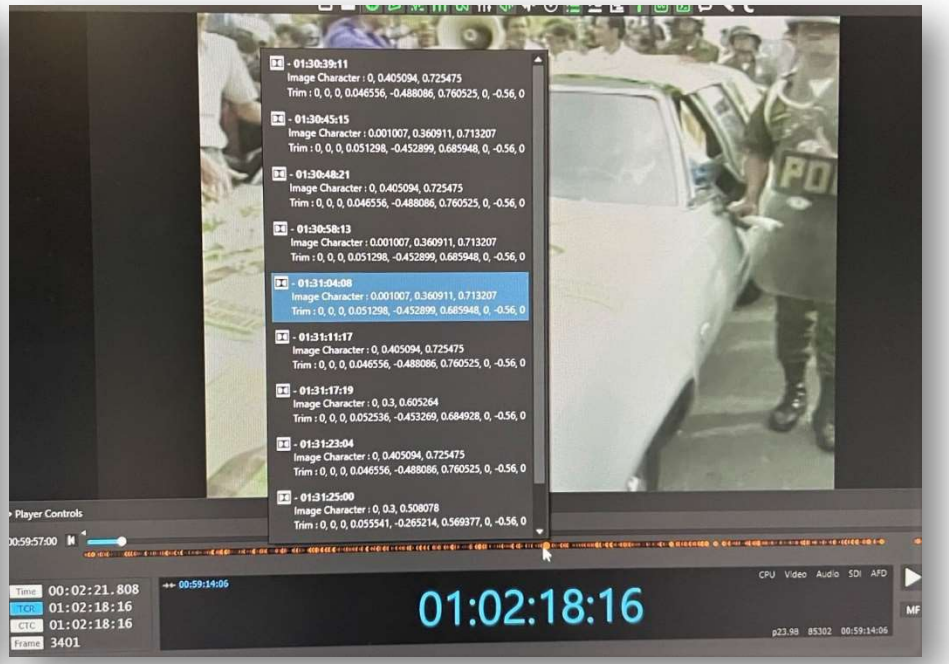
HOW TO ON IRIS.

Open the mov as usual.
Drag & drop the XML onto the Iris video window.

The DoVi timing data then appears above the timeline:

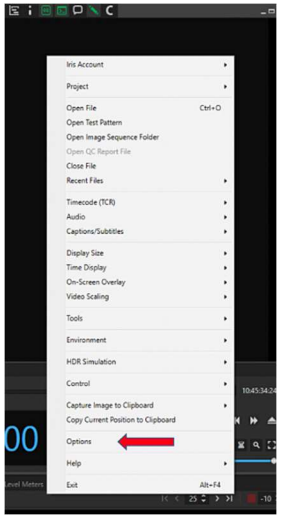
When you hover over the dots with the cursor, the sync timings of the edits in the Metadata are visible.





FOR FIRST PICTURE QC PASS (without TRIM PASS).

This can be done with or without the xml metadata document added.



First, right click on the Iris video window for the Options tab in the dropdown menu:

Select: Options

In Iris Options menu: Select **HDR** - Turn the **HDR Simulation** **OFF** **(tick Off box)**

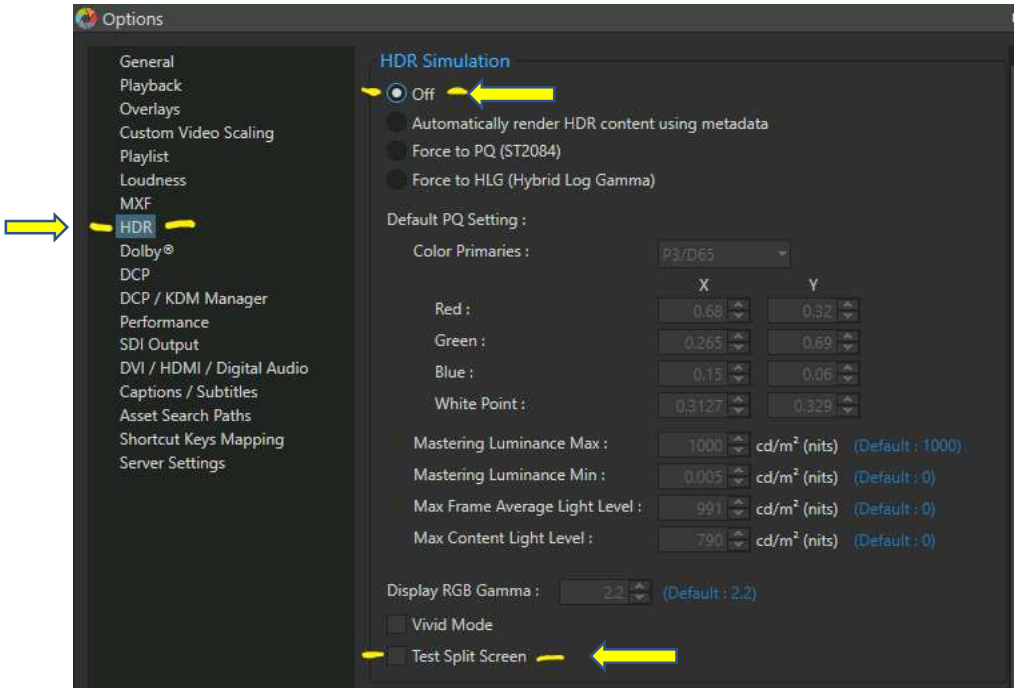
UN-TICK Test Split screen box.

In Iris video window: Right click for dropdown menu. HDR Simulation box ticked **Off.**

On Options Menu:

HDR Simulation OFF.

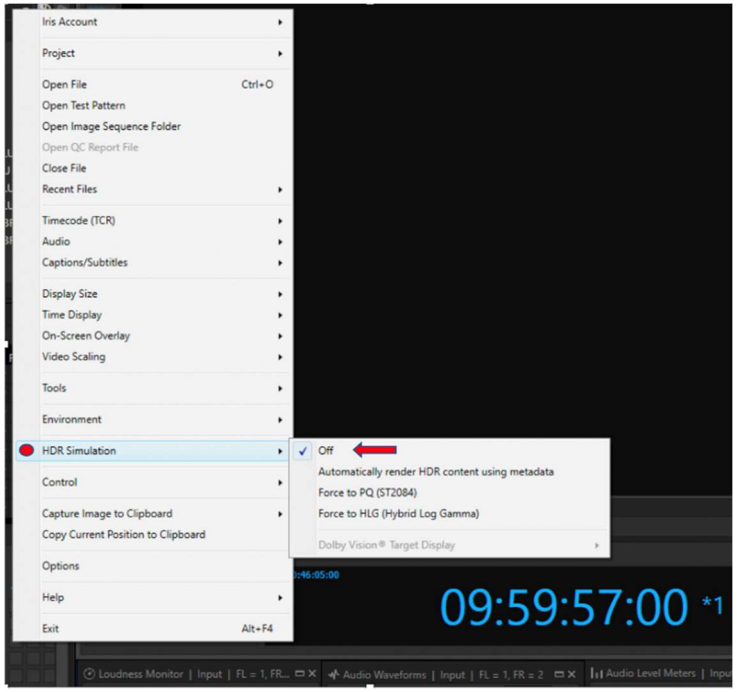
Test Split Screen UN-TICKED



Video Window on Iris:

Right click on Video Window for menu

HDR Simulation Off.



FOR SECOND PICTURE QC PASS (with TRIM PASS).

FOR TRIM PASS:

In Iris Options menu: Select **HDR** - HDR Simulation - **Make sure the box 'Automatically render HDR content using metadata' is selected (This pass can be done full screen without 'Test Split screen' selected)**

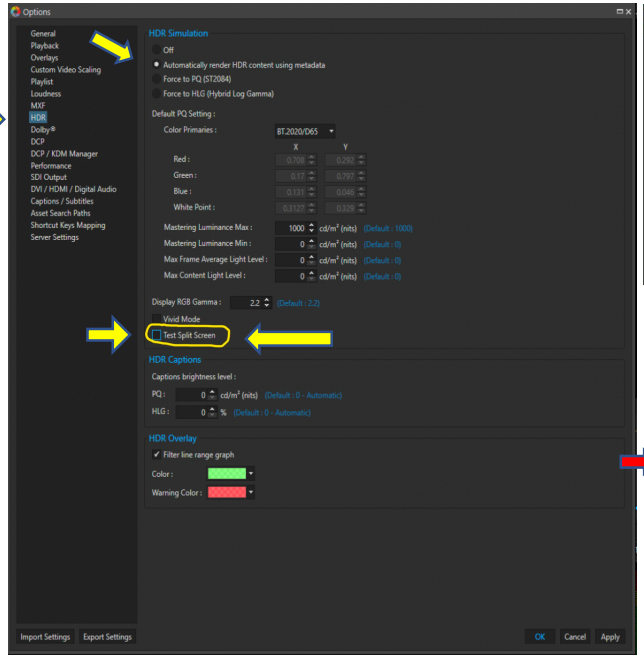
In Iris video window:

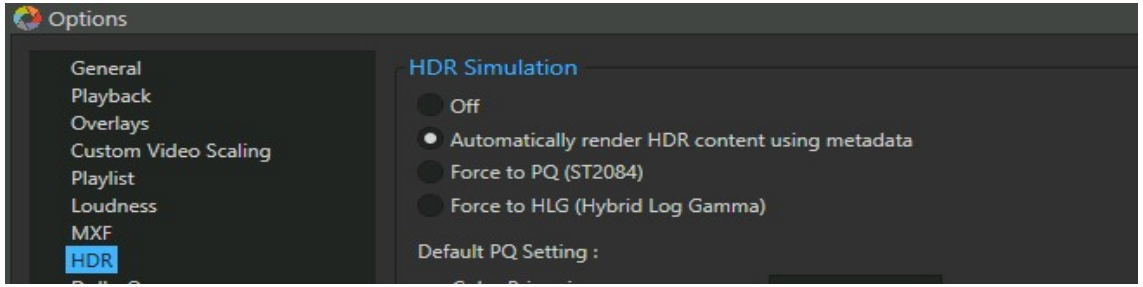
Right click for dropdown menu - Select **HDR Simulation**:

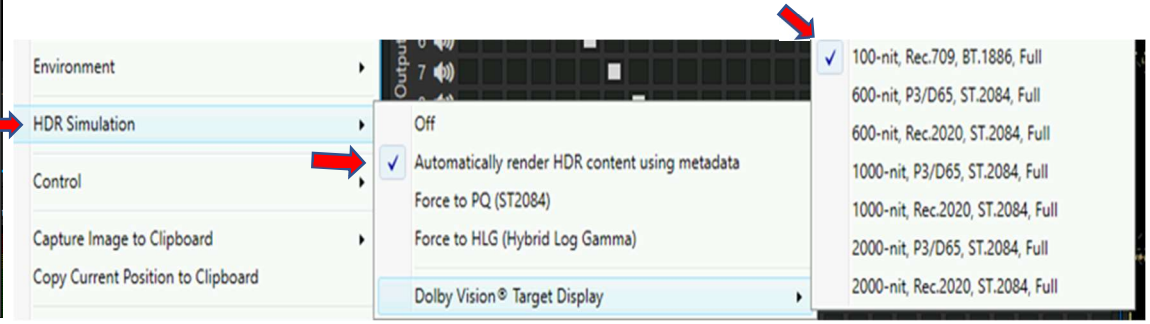
Select: **Automatically render HDR content using metadata.**

Select: **Dolby Vision Target Display**: 100-nit, Rec 709 BT 1886, full

(Or you can then select the trim pass you need to use if the QC requests a specific one to be used.)



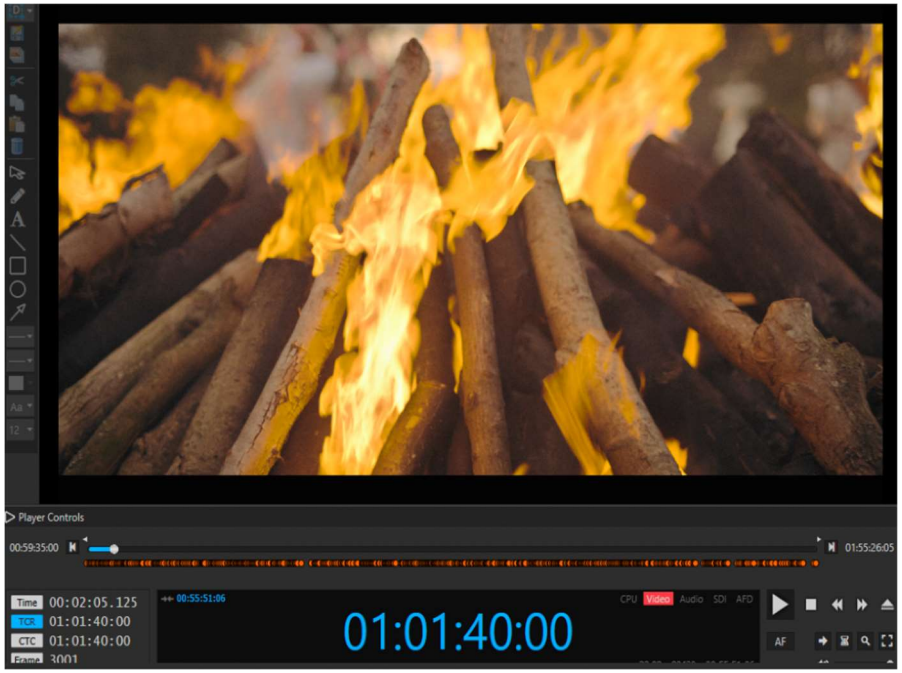




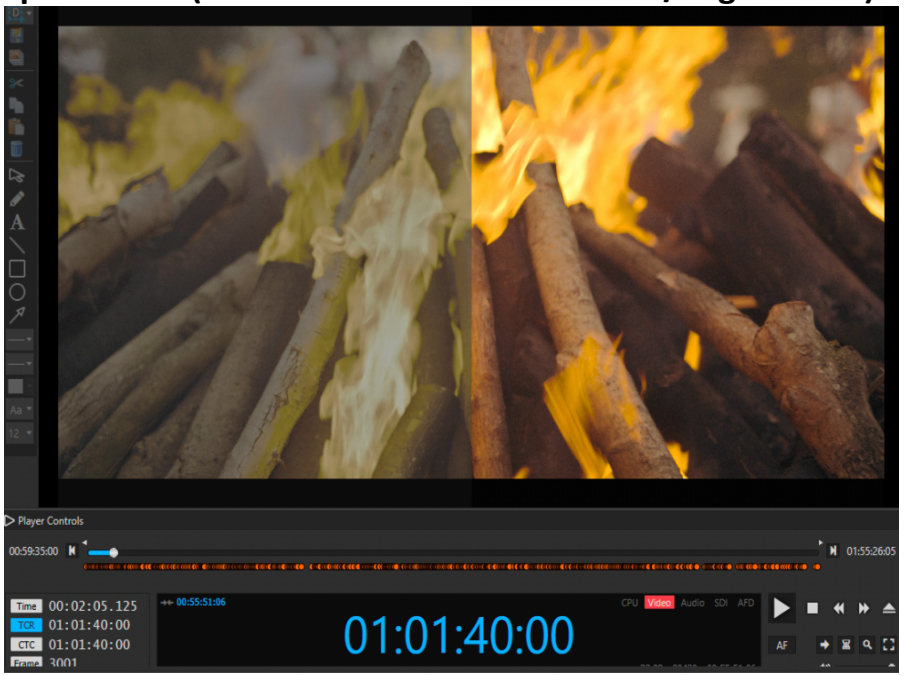
This is an example of what a Trim Pass Looks like on the Iris QC player.

(This should view the same on the Sony BVM X300 Monitor)

Full screen Trim Pass



Split screen (Left: without HDR Simulation / Right: With)



Notes on Colour Gamut details

While improved dynamic range is one key advantage of creating and delivering content in Dolby Vision (and HDR in general), the other key advantage is the ability to access a wider range of colours or wide colour gamut (WCG). While many home entertainment and broadcast use cases are built around the Rec. 2020 standard, no current display device is able to natively display the entirety of this colour gamut. The cinema-based DCI-P3 colour gamut (which most high quality HDR displays are able to reproduce 100% of) is often used as a reference gamut for studio content delivery specifications. Dolby Vision supports both DCI-P3 and Rec. 2020 colour gamuts, but because Rec. 2020 can not be accurately 100% reproduced by any display, many users opt into working with a DCI-P3 gamut inside of a Rec. 2020 container if their client's delivery specifications require 2020. It is important to consider whether or not the HDR display you may be evaluating supports your needed HDR colour gamut (or what percentage of the gamut is capable of being accurately reproduced).

Dolby Vision Test file Demo

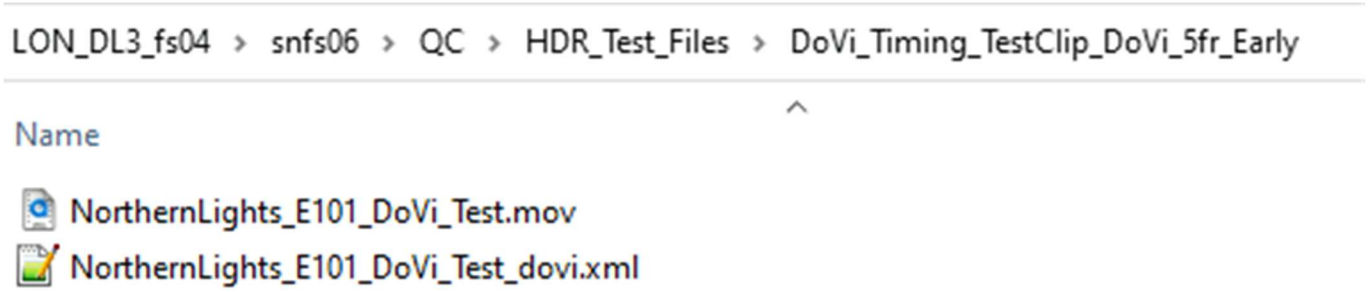
We have created a new test file which can demonstrate mistimed DoVi metadata.

On the files below, the metadata is 5 frames early, so you see a change in the levels 5 frames before each cut.

Depending on the trim pass values this may not always be obvious as cuts within the same scene may have similar values.
There are several shots where the mistimed metadata can be easily seen in this test.

Please load the mov file and the xml into the iris with HDR simulation on.
You can view this with Spit screen on and look at both left and right sides, and you can see this in full screen trim pass mode.

The files are here:



Sony BVM X300 Monitor & Tektronix Set up in MFR 08 & 9

The Sony BVM X300 monitors in MFR08 /09 have been calibrated and aligned to the below settings.
The path from to Iris to Tektronix to Monitor has also been checked.

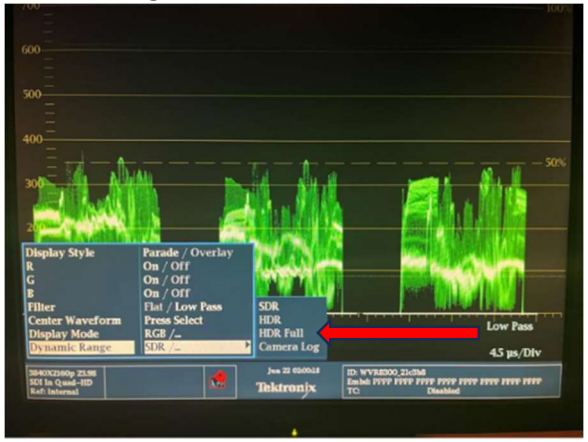
For HDR:
HDR Pass No Metadata - the Iris **HDR Simulation** must be set to **off. Test Split screen set to off.**
(The xml metadata doc can be loaded in the Iris – as long as the HDR Simulation is off.)
Trim Pass – load the xml metadata doc in the Iris video widow.
HDR Simulation set to ON & Test Split screen set to off.

For HDR:
Look at the Asset metadata of the base file on the Iris.
(Please note that the metadata on the file may not always be correct, so always double check if the rasteriser is set correctly).
Color Range - Full
Color Range - Limited

Set up Tektronix Rasteriser

If Color Range is Limited: Set Tektronix Rasteriser to HDR

If Color Range is Full: Set Tektronix Rasteriser to HDR Full



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FOR SDR: (Limited and Full) Please select and set to SDR.

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Sony BVM X300 Monitor set up MFR08 & 09

SDI – INPUT SETTINGS.

SDI 1 4K – PRESS UNTIL YOU REACH INPUT SETTING 1 – SELECT
If your HDR content is BT2020 – select input 1.
If your HDR content is P3 – select input 2.

FOR UHD SDR - select inputs 3 & 4
==========
SDI 1 2K - For HD.

SONY BVM-X300 INPUT SETTINGS

	Input Setting 1	*Input Setting 2*	*Input Setting 3*	*Input Setting 4*
USE FOR >	HDR, 2020, Full Range	HDR, P3, Full Range	SDR, REC709, Full Range	SDR, REC709, Head Range
Input:	Inputs 1,2,3&4	Inputs 1,2,3&4	Inputs 1,2,3&4	Inputs 1,2,3&4
Interface Format:	Quad-Link 3G/HD-SDI	Quad-Link 3G/HD-SDI	Quad-Link 3G/HD-SDI	Quad-Link 3G/HD-SDI
Image Division:	Auto	Auto	Auto	Auto
Signal Format:	Auto	Auto	Auto	Auto
RGB Range:	Full	Full	Full	Limited
Color Space:	ITU-R BT.2020	DCI-P3	ITU-R BT.709	ITU-R BT.709
****EOTF:*	SMPTE ST 2084 (HDR)	SMPTE ST 2084 (HDR)	2.4	2.4
Transfer Matrix:	ITU-R BT.2020	ITU-R BT.2020	ITU-R BT.709	ITU-R BT.709