

Mistika workflows for Dolby Vision

Preliminary notes:

This document only explains the technical details in the “Mistika side” of the integration with Dolby Vision. It does not explain what is Dolby Vision or its components (Please check Dolby documentation for this)

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Introduction

For a first introduction we recommend watching this video:

https://www.youtube.com/watch?v=ReqMuN4_erU&feature=youtu.be&mc_cid=62726e417b&mc_eid=b9b0322ec7

Note: This document contain additional details not explained in the video.

The Mistika integration with Dolby Vision is based on these elements:

- **Dolby CMU** (Content Mapping Unit): It is a Dolby device that given HDR images graded for an HDR mastering display it will create automated versions for other target displays of inferior capabilities. (SDR displays or HDR displays with more limited nits)

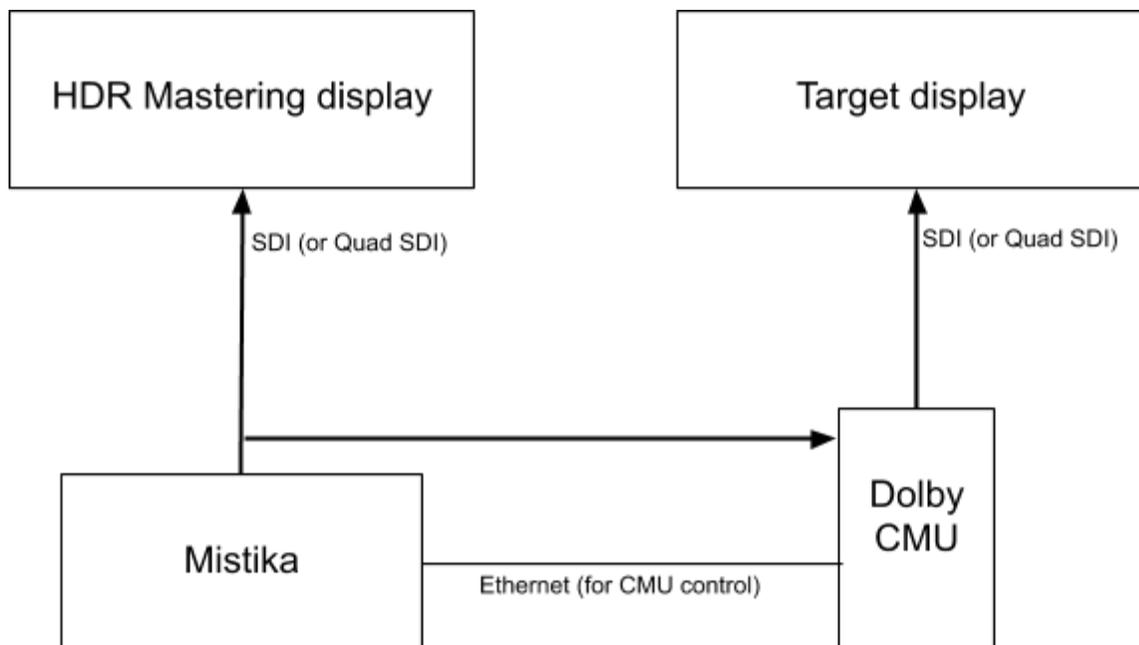
Please note that **the color grading version for the master monitor does not involve the usage of any Dolby Vision tools. Dolby Vision is only used to produce the other versions of inferior nits.**

The Dolby CMU was originally based on a dedicated external hardware unit known as “**eCMU**”, but it is also available as an internal software tool named “**iCMU**” integrated within Mistika. This document mainly describes the workflow for the hardware version, as the software version can be easily understood as a simplification of this document (if you plan to use the software version just skip the point about Hardware connections). The Dolby software itself comes integrated in Mistika (no additional plugins are required), but it requires a Dolby license to work. (otherwise some advanced features will not work, including the TRIM capabilities)

- **Ethernet connection between the Mistika system and the Dolby CMU.** This is used by Mistika to control the CMU behaviour. (Hardware CMU only).
- **SDI video signal from Mistika output to the CMU input.** This is the same signal that is sent to the HDR mastering monitor (that signal needs to be duplicated to give a duplicate to the CMU). (Hardware CMU only)
- **Mistika->Edit->Setup->Dolby Manager:** The Dolby Manager panel, to setup the CMU parameters (the CMU hardware/software mode, aspect ratio, master display, target display, etc).

- **Mistika->FX->Dolby Vision:** The Dolby Vision effect, containing the analysis tools and all the TRIM parameters than can be adjusted to produce the target display versions.
- **Mistika->Output->Render->Dolby MXF->Dolby Mezzanine J2K.** The official format to render a Dolby Vision master
- **Mistika->Edit->Macros->Dolby Export:** To export a Dolby XML file with all the necessary metadata of the selected shots

Hardware connections between Mistika and Dolby eCMU (hardware mode)



Ethernet connection

In the CMU, set an ip address in the same network domain as your Mistika system and reboot the CMU.

Once this is done, in the Mistika system open an internet browser and put the ip address of the CMU. This will permit to test that the network connection is working (the CMU GUI should appear immediately) and the CMU GUI will let you to setup other CMU settings (check Dolby documentation in case of any doubt).

Note: Mistika will discover the CMU automatically. There is no need to indicate the CMU ip address in any Mistika setting, just have it in the same network. In case of problems use fixed addresses rather than DHCP. (If it does not solve the issue at least it will simplify diagnostics).

SDI connection

Regarding the SDI cabling we will need to create three different paths: one for the HDR mastering monitor, one for the target display and one between Mistika and the Dolby CMU.

The connection for the master HDR display needs to be an SDI connection between Mistika workstation (output 1) and the HDR Mastering display.

At the date of this document the Dolby Vision workflow only supports RGB signals. Please **make sure that the video parameters at mConfig->MasterFormats are set to RGB**

The connection for the target display needs to be an SDI connection from the CMU output to the target display.

The third one is the SDI connection between Mistika (output-1) and the CMU (input-1) and this is what can complicate things a little bit. This signal needs to go from the Mistika system both to the HDR mastering monitor and to the Dolby CMU so it needs to be duplicated. This depends on the capabilities of your video hardware but typical methods are:

- By using an SDI splitter or SDI router
- By using the monitor loop through, if available
- By using the Mistika dual link output, plus a Stereo3D effect to differentiate both output paths. (This method is normally possible in HD, as all SDI boards can provide two outputs, but in the case of UHD you need a video board model with 2 x Quad SDI, like the Aja Corvid88.

Once the SDI connections between Mistika and the CMU are in place, open an internet browser and put the ip address of the CMU to access its GUI interface. Check that it has detected a valid video signal and adjust settings as necessary for your case. If the SDI signal is not detected then **check that the video parameters at mConfig->MasterFormats are set to RGB and not YUV**

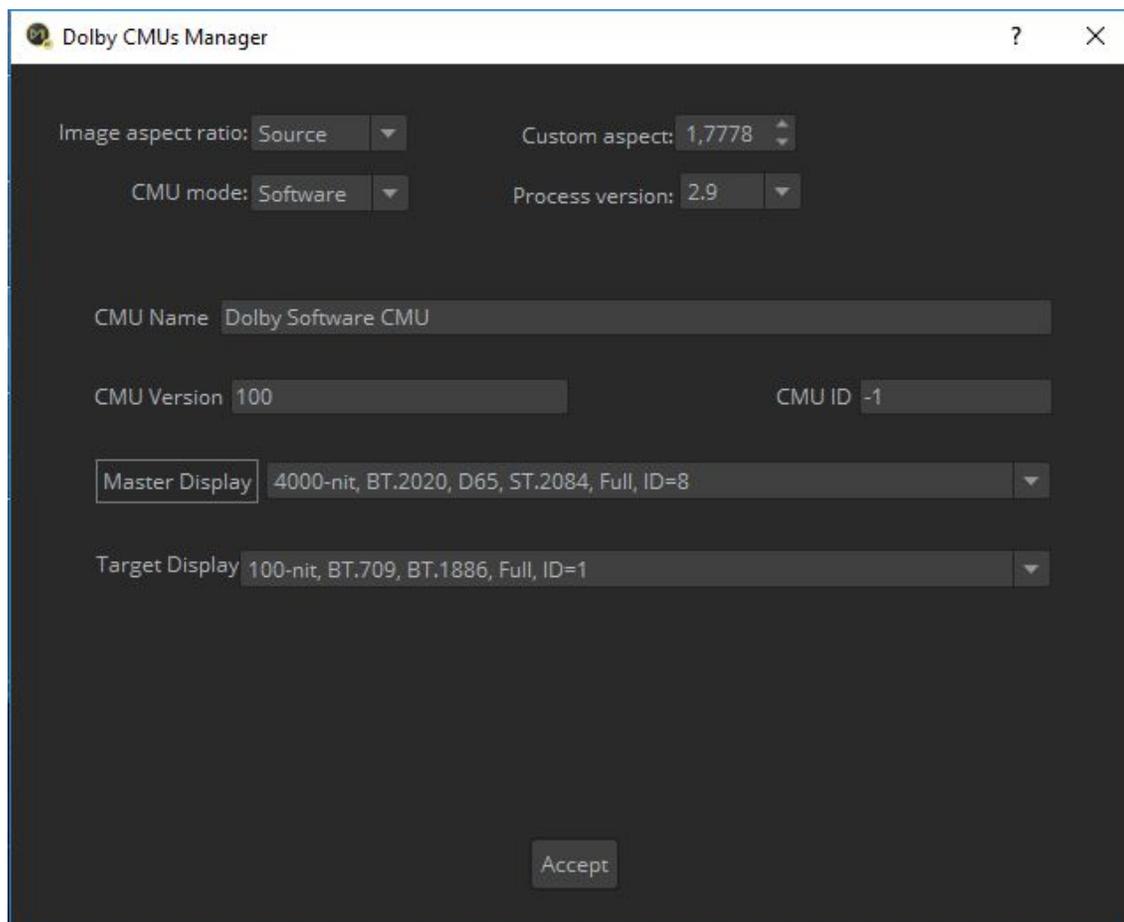
Note: Both Mistika and Dolby CMU support HD, 2K, and UHD. The UHD modes require Quad SDI connections.

Note: The Dolby workflows are always RGB “Full Range” (RGB in data levels, not video levels). Any element (images or displays) that are not in this format need to be separated from the Dolby Vision workflow and converted to Data levels first (**RGB Levels** effect)

Please note that all source images need to be already in RGB data levels before passing them to Dolby Vision effect, but it is equally wrong to apply a video to data levels conversion to images that were already in data levels (as that will produce a double range expansion, sending values below 0% and over 100%). If you are not sure check where are the black and white points in the Vectorscope tool before applying any conversion ...)

Mistika operation for Dolby Vision workflows

Dolby Manager settings



Open the **Edit->Setup->Dolby Manager** window. Here you can select the CMU mode, aspect ratio and the Dolby process version.

The **Process version** will determine the metadata controls of the Dolby Vision effect and the XML fields that will be exported. It is important to check which version is compatible with the needs of your client (The Dolby Xml files will be different) and also check that your Dolby CMU supports that version.

At the date of this document, if you are not sure about this parameter we recommend to use version 2.9, as it should provide maximum compatibility.

The Master Display and Target Display selection lists will also appear after a valid **CMU mode** has been selected (Hardware/Software).

Use the **Edit->Setup->Dolby Manager** window to select the **Master Display** and **Target Display**.

Master Display: Select your reference monitor (the one for which you have color graded the images).

Target Display: These are the monitors with inferior number of nits for which you want to produce other versions. Please note that if you plan to make specific adjustments for several target displays you can choose other displays later. For the first pass you will need to start with the target display of the lowest number of nits (**100 nits**). This is necessary for the correct interpolation of intermediate nit formats. In that way there is a good chance that the automatic interpolation is already valid for many of the shots when switching to other intermediate displays, thus avoiding the need for extra manual adjustments.

Footage preparation

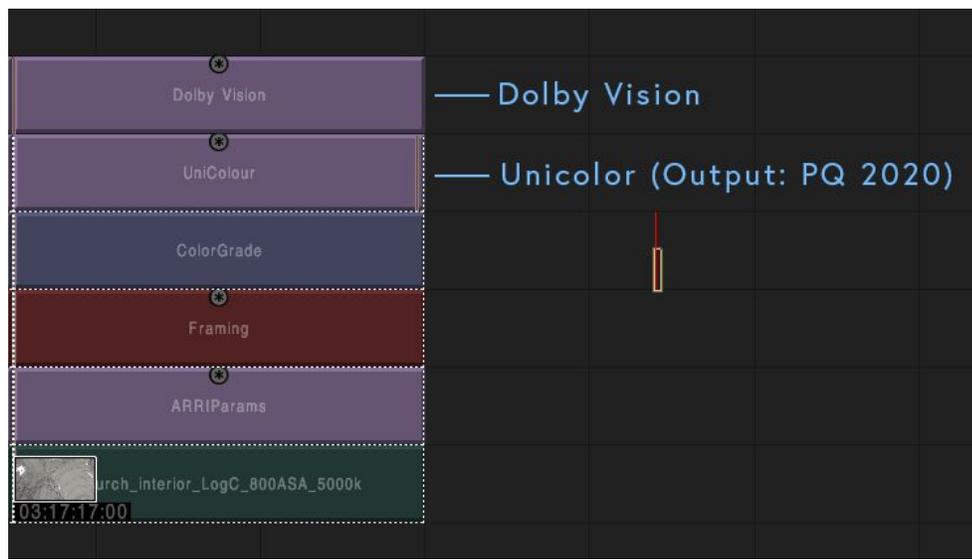
Dolby Vision requires to receive the input images in a very specific format:

- Gamut: P3D65 or Rec 2020.
- Gamma: PQ EOTF
- RGB Data Levels (also known as “Full Range”)

Then, if your footage is in RGB video levels you will need to apply **Fx->RGBLevels->DataLevels** to convert to data levels.

Once you are in data levels: If your footage is not P3-PQ you will need to apply **Fx->Unicolour** to convert it to P3-PQ.

If any of those steps are needed, always do it **BEFORE** applying the Dolby Vision effect. **Do not apply any subsequent effects or display filters that could alter the image content after the Dolby Vision effect** otherwise the output images, SDI signals and Xml metadata will be invalid for Dolby Vision workflow. **The Dolby Vision effect MUST always be the LAST colour transformation.**

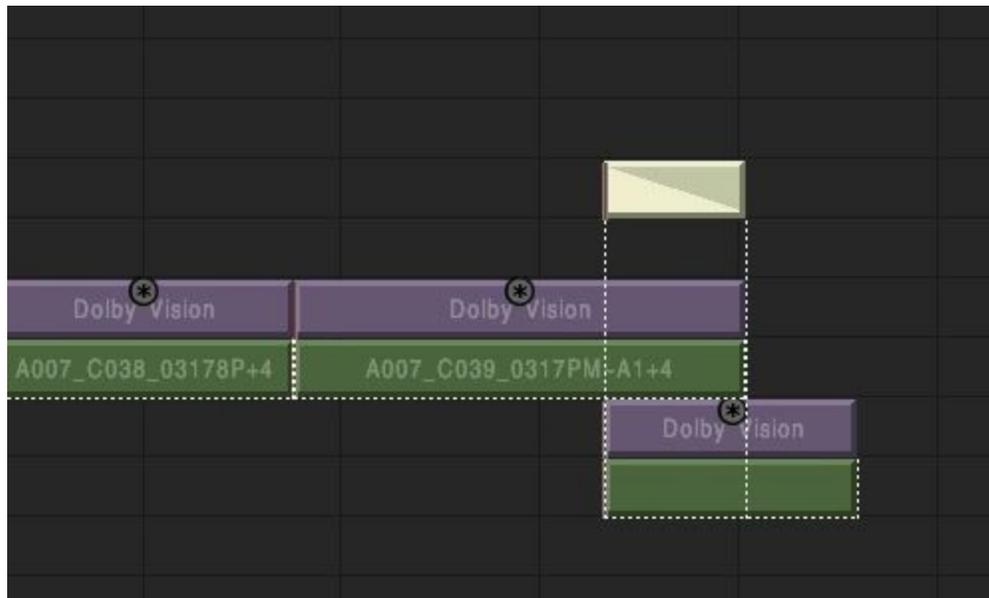


The same can be said about framing effects. The **Edit->Setup->Dolby Manager** tool provides its own settings to define the image aspect ratio and no framing operations should happen after the **Dolby Vision** effect. Any subsequent cropping of parts of the image would invalidate important calculations like the *Average Brightness* and others.

Obviously, all colour grading effects also need to be applied before the **Dolby Vision** effect.

Please note that the Dolby Vision effect is only needed to produce alternative versions for other target displays, not for the HDR mastering display. If you want to colour grade with the two displays (master and target) at the same time then you will need the Dolby Vision effect (and CMU) since the beginning. Otherwise you could let the whole Dolby Vision workflow for a later stage after grading for the HDR mastering display, but only as long as you have designed your effect stack to accommodate the Dolby Vision effect at the end of the chain (no display filters in use...).

If there are cross fade effects, make sure that each clip has its own Dolby Vision effect applied, then just apply the Mix on top as usual, and Mistika will automatically produce the correct interpolation between both Dolby Vision effects. Do not apply a Dolby Vision effect to the Mix effect.



When working in software CMU mode you may want to have the two SDI outputs from the Mistika station (the Master display and the target display). To do this activate the mConfig->MasterFormats->Stereo3D Dual link and connect one HD/2K output to each monitor (or 2 x 4K QuadSDI in the case of Corvid88). Once in Mistika, make sure that the “eye” used to feed the Master display has the Dolby Vision effect muted. In this way you do not need a hardware CMU nor any extra hardware for Dolby Vision workflows, just the Mistika system.

Image analysis with the Dolby Vision effect

Please note that for the next points we will assume you have already finished your HDR grade for the HDR mastering display.

Now apply a **Dolby Vision** effect to each shot as the last effect in the stack (upper track).

Check that the **TargetID** field is set to the same **target display** that you have selected in **Edit->Setup->Dolby Manager**. (Both are set to **100nit-709** by default, which is the most typical case. But if you change it you need to change in both places).

In the **Dolby Vision** effect, set **Analysis->Analysis State** parameter to **Pending**. The image will change to shades of yellow. This is just to warn you that the Dolby Vision effect is already active, but the shot has not been analysed yet for the whole duration of the effect. The effect needs to calculate the maximum, minimum and average brightness of the shot for which **it needs to go through all the frames**. To do this just press **VisualEditor->Playback**. (or if you want to analyse many shots in one go, just press the Timeline playback and let it go through all shots one time).



When it finishes the **Analysis** parameter will automatically change to **“Completed”** state and the image output sent to the target display will be already calibrated. The above picture shows a Before (Analysis pending) / After analysis example.

At this point the output images in the target display should have changed noticeably. They should already look “technically correct” for that particular target display. They may still need some manual “trim” adjustments (which will be done in the next section) but the improvements in brightness should be already very noticeable.

Note: If nothing changes or if the overall brightness has not improved then check the steps in the previous sections, specifically that the Dolby Manager has the same target display as the TargetID of the effect.

In all the next steps of the workflow you will not need to repeat the analysis stage, as long as the input images to the Dolby Vision effect have not changed (otherwise you will need to repeat the analysis).

Manual adjustments with Dolby Vision effect (trim)

After the automatic analysis is done, now go to the **Trim1** parameters layer. With these parameters you can do additional subjective adjustments. In many shots you probably will not need to make any further modifications, but when you still appreciate noticeable differences between the target display and the master HDR display (apart from the differences purely related to the capabilities of each display) then you can use the trim parameters for fine tuning or to trade off and prioritize the most important subjective aspects. The objective here is to match the target display to the mastering display as much as possible. (Please check the **Dolby Vision** documentation for more information about each parameter).

Trim 1					
Target ID	100-nit, Re				
Lift	0.100	Gamma	0.200	Gain	0.100
Chroma Weight Of	0.000	Saturation Gain	0.000	Tone Detail Weigh	-0.750

Note: When using the eCMU **hardware mode** the images in the visual editor will not change. In this mode the changes are only shown in the target display. This is because the colour transformations are applied in the eCMU device and then sent to the target display from there. As a difference, in the **software mode** the changes are also shown in

the Visual Editor, as in this case the iCMU it is a software device in the local system receiving the images from Mistika and returning the output images to it.

Adjusting additional target displays

Dolby Vision capable displays provide automatic adjustments for any displays in the range between the target display and the HDR mastering display (they can read the Dolby metadata embedded in the images and interpret the images data accordingly) . However, if you want to make specific adjustments for specific intermediate displays that are especially important in your workflow then you can add more adjustment layers as follows:

Connect the target SDI signal to the new target display (if not done so already).

Select **Visual Editor->Layer->Add Layer**

A new trim layer will appear in the Dolby Vision effect. Set its **TargetID** to the new target display and also select it in **Edit->Setup->Dolby Manager** to switch the CMU to the new target. Then repeat the trim adjustments as necessary for the new target display.

Please note that even if the effect can store the transformations for multiple target displays the CMU can only produce one target display at a given time. For that reason, when the **Dolby Vision** effect is not set to the same target display as the **Dolby Manager** it will not show any changes (it will simply show the input images).

Also note that the Dolby Vision effect does not have any setting to choose which one is the active layer (active TargetID), because that is precisely what is decided in the **Edit->Setup->Dolby Manager** tool as explained.

It is also important to **not apply any posterior modification to the image output** (image scalers, LUTS, etc), as the Dolby Vision metadata is encoded embedded within the image data using proprietary technology, and this metadata can be easily destroyed if the image is modified by non Dolby Vision aware processes.

Final render and Dolby XML export

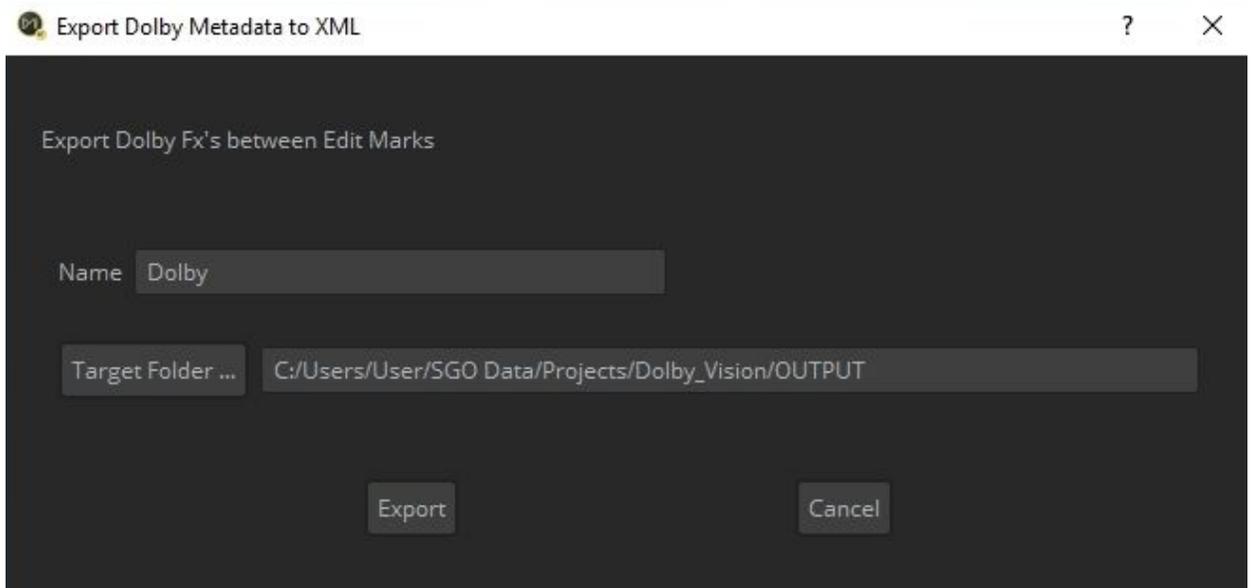
Before rendering, make sure that there are no empty areas in the timeline. The Dolby Xml export does not support this case. To cover an empty area you can use a Solid effect, then apply a Dolby Vision effect to it and analyze it (or copy it from elsewhere).

When rendering, select **Output->Render->Dolby MXF->Dolby Mezzanine J2K** as the render format and render your work. This is the official master format for Dolby Vision.

The render to Dolby Mezzanine already includes all the metadata produced by the Dolby Vision effect, but in most cases you will also want to export the Dolby Vision metadata to an XML file, as part of the master and for intermediate purposes. **A typical Dolby Vision master delivery will include both the rendered media and the Dolby XML file.**

You can also render to other formats that do not have embedded metadata and then deliver an XML file with them. In that way the Dolby Master can be produced later in other system. But if you use a different format (rather than **Dolby Mezzanine J2K**) make sure you select a render format with at least 12 bit per channel (EXR, Tiff16, etc). Otherwise it will not be Dolby Vision compliant.

To create the XML file, select all the shots that you want to include (all the Dolby Vision effects) and press **Mistika->Edit->Macros->Dolby Export**. This will create a Dolby XML file with the Dolby Vision metadata for all the selected shots. This file is placed in the OUTPUT folder of the project.



A single Dolby Vision XML file can contain as many shots as you want. In a certain sense, it is somewhat similar to an EDL but also containing all the HDR metadata.

Importing a Dolby XML file to Mistika

A Dolby Vision XML file can also be imported in a Mistika Timeline (just drag & drop the XML file to the timeline). When it is done, a collection of Dolby Vision effects will appear in the correct positions and durations of the Timeline (similar to an EDL) which can then be applied to the original shots.

But before importing it, it is recommended to configure the Dolby Manager setup to the same settings used to create the XML file. For example, using it with a different aspect ratio can lead to incorrect (variable) black levels in the letterbox area, as it would not be protected