



Dolby Vision Professional Tools

User Manual

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ilmBase 2.1.0: <http://www.openexr.com>

OpenEXR 2.2.0 <http://www.openexr.com>

zlib 1.2.8: zlib.net

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1 Introduction

The Dolby Vision Professional Tools are a set of command line tools you use to create and manage a Dolby Vision master and mezzanine deliverable. Additionally, use these tools to extract and update the Dolby Vision metadata from a Dolby Vision deliverable.

Dolby Vision Professional Tools include:

- `cm_offline` - Renders, with color mapping, a Dolby Vision Master to a specified target display
- `mezzinator` - Creates a Dolby Vision mezzanine MXF deliverable
- `metafier` - Dolby Vision metadata utility and validation tool (formerly `extract_metadata` and `upgrade_metadata`)
- `cm_analyze` - Generates Dolby Vision XML Metadata with Global and L1 Analysis Metadata to convert existing HDR10 content to Dolby Vision content
- `md_conform` - Conforms L1 metadata in Dolby Vision bitstreams to reduce artifacts for certain Dolby Vision TVs

These tools are delivered as executables and designed to run on Linux, Mac OS X, or Windows systems. Choose the appropriate package for your operating system.

NOTE: ProRes is only supported on Linux and MacOS

For support and questions, send a detailed email to: dolbyvisionmastering@dolby.com

2 Installing and using the tools

2.1 Installation

The Dolby Vision Professional Tools are available for Linux, MacOS, and Windows and are provided in a separate installer package. Use the appropriate Professional Tools installer package for your operating system and follow the installation prompts.

By default, the installer packages will install the Professional Tools in the following locations:

Linux

```
/current_folder/
```

MacOS

Command Line Tools:

```
/usr/local/bin/dolby_vision_professional_tools/
```

User Manual :

```
/usr/local/share/doc/dolby/dolby_vision_professional_tools/
```

Windows

```
C:\Program Files\Dolby Vision Professional Tools v2.6.1\
```

2.2 Using the tools

Use the built-in help function to view a list of each tool's options and their descriptions. At the command line, use `-h`, `--help`, `--help-advanced` or `-?` to access help. Each tool has a unique set of options and arguments. We recommend that you refer to the options list for each tool and use this document for informational purposes.

To use each command line tool, enter the tool name at the command line. These tools do not require any additional programs to run.

3 CM_offline

This tool maps a Dolby Vision Master to a specified target display and outputs the appropriate derivative standalone image sequence.

If CUDA is supported on the platform, the `cm_analyze` tool defaults to using CUDA for processing because this is usually faster processing than using the CPU. For CUDA support, the machine requires to have a NVIDIA graphics card. CUDA acceleration only supports a single card. If there are multiple GPUs on the machine, this tool will determine the fastest single GPU card and use its available cores for processing. Multiple GPU cards is not currently supported. To force the system to use CPU processing, use the `--cpu-only` option in the command line.

3.1 Usage

3.1.1 Command line syntax

Basic usage

```
./cm_offline [-m <arg>] [--reel <arg>] [-f] [-r <arg>] [--targ <arg>]
[--targ-info <arg>] [--frame-offset <arg>] [--output-format <arg>] [--
show-targets] [--j2k-profile <arg>] [--quicktime-codec <arg>] [--help-
format] [--help-advanced] [-h] [-v] <source> <output>
```

Advanced usage

```
./cm_offline [-m <arg>] [--reel <arg>] [-f] [-r <arg>] [--input-crop
<arg1> <arg2> <arg3> <arg4>] [--resize-filter <arg>] [--resize <arg1>
<arg2>] [--output-letterbox <arg1> <arg2> <arg3> <arg4>] [--output-
image-ar <arg>] [--output-canvas-ar <arg>] [--targ <arg>] [--targ-info
<arg>] [--frame-offset <arg>] [--source-format <arg>] [--output-format
<arg>] [--show-targets] [--echo-metadata] [-t <arg>] [--j2k-profile
<arg>] [--quicktime-codec <arg>] [--help-format] [--help-advanced] [-
h] [-v] [--disable-font-color] [--cpu-only] [--cuda-device] <source>
<output>
```

Common examples

To deliver a standalone deliverable that is derived from the Dolby Vision Master or Mezzanine, i.e. standalone mapped SDR:

```
./cm_offline -m <metadata.xml> --targ 1
<input_image_sequence_#####.tif> <output_image_sequence_#####.tif>
./cm_offline --targ 1 <input.mxf> <output_image_sequence_#####.ext>
```

When metadata frame start is not aligned with image frame start:

```
./cm_offline -m <metadata.xml> --targ <arg> --frame-offset <-86400>
<input_image_sequence_#####.tif> <output_image_sequence_#####.tif>
```

To deliver specific frame ranges from the Dolby Vision Master:

```
./cm_offline -m <metadata.xml> --targ <arg>
<input_image_sequence_#####.tif> <output_image_sequence_#####.tif>
-f 86400-86500,95000-95100,100000-100100
```

To output a 1920x1080 SDR from a 3840x2160 master:

```
./cm_offline -m <metadata.xml> --targ 1
<input_image_sequence_#####.tif> <output_image_sequence_#####.tif> -
-output-format "1920x1080"
```

NOTE: For more information on resizing, refer to [Using the crop, resize and letterbox options](#)

To deliver a 1k-nit Rec.2020 from a 4k-nit P3D65 Master with P3 Trims:

```
./cm_offline -m <metadata.xml> --targ 48
<input_image_sequence_#####.tif> <output_image_sequence_#####.tif>
--output-format "pq bt2020"
```

3.1.2 Command line help

View basic options by entering:

```
./cm_offline -h | -? | --help
```

View the advanced options by entering:

```
./cm_offline --help-advanced
```

3.1.3 Compatible image formats

The `cm_offline` tool is compatible with multiple image formats. To output a selected image format, use one of the available image format extensions at the end of the output filename.

By default, the output format is the same bit-depth as the source format. The `cm_offline` tool also has the capability to change the output image formats and resolution.

- MXF (.mxf)
- TIFF (.tif)
- OpenEXR (.exr)
- JPEG 2000 (.j2c/.j2k)
- DPX (.dpx)
- ProRes (.mov)

To output the images in the desired image format in the same bit-depth as the input, specify one of the compatible image formats in the output file name and the tool outputs the correct image.

The `cm_offline` tools support many image manipulation operations such as image format conversion, image resizing, packing, sampling and encoding.

When specifying combined options with space delimited values, use quotes (“”) at the beginning and end of the specified string.

See [Advanced Image Format Strings](#) for a list all available functions, which are described in the output of the `./cm_offline --help-format` option.

See [Appendix D: Common input and output image format examples](#) for common image format examples.

3.1.4 Basic option information

Option Command	Description	Default
<code>-m --metadata <arg></code>	Input XML Metadata filename	
<code>--reel <arg></code>	Input Reel TXT information filename	
<code>-f --frames <arg1-arg2>, <arg3-arg4>...</code>	Specifies the frame ranges to process. For multiple frame ranges, use <code><frame_start#-frame_end#></code> , <code><frame_start#-frame_end#></code>	all
<code>-r --frame-rate <arg></code>	Sets the frame rate tag for the XML or MXF (24, 23, 24000/1001...)	input
<code>--targ <arg></code>	Specifies the output target to emulate (ID or name from <code>--show-targets</code>)	1
<code>--targ-info <arg></code>	Displays the detailed information for the specified output target ID	false
<code>--frame-offset <arg></code>	Offsets the metadata start frame number by this frame count to match the start image frame number. Use <code>auto</code> to guess the frame offset. Use <code>trim</code> to guess the frame offset and trim the head.	0
<code>--output-format <arg></code>	Optionally specifies a custom format for the output images.	input
<code>--show-targets</code>	Displays a list of all the available target profiles.	false
<code>--j2k-profile <arg></code>	Sets the JPEG 2000 encoding profile for MXF output (bcp5, bcp7, dci, imf_ml3, imf_ml6, imf_ml7, imf_ml8, imf_lossy_ml3, imf_lossy_ml6, imf_lossy_ml7, imf_lossy_ml8) NOTE: The default is bcp5 for bit depth between 8 and 12-bits or imf_ml6 for 16-bits	
<code>--quicktime-codec <arg></code>	Sets the Codec for Quicktime MOV output (prores 422 hq, prores 422, prores 422 lt,	ProRes 4444XQ

	prores_422_proxy, prores_4444, prores_4444_xq,)	
--help-format	Displays extended help on specifying image format strings for source, target and color encoding.	
--help-advanced	Displays advanced application arguments and usage.	
-h -? --help	Displays basic application arguments and usage.	
-v --version	Displays program version.	

3.1.5 Advanced option information

Option Command	Description	Default
--input-crop <arg1> <arg2> <arg3> <arg4>	Crops the original frame before processing (4 integers: left right top bottom).	
--resize <arg1> <arg2>	Resizes the output to the specified image resolution (2 integers: width height).	
--resize-filter <arg>	Specifies the resize filter (mitchell, lanczos7, lanczos5, lanczos3, lanczos2, gaussian, triangle, box, dirac).	mitchell
--output-letterbox <arg1> <arg2> <arg3> <arg4>	Sets the active image aspect ratio using a letterbox instead of a ratio (4 integers: left right top bottom) and pads if necessary with black color.	
--output-image-ar <arg>	Sets the active image aspect ratio for the output image after resizing.	
--output-canvas-ar <arg>	Sets the output canvas image aspect ratio for the output image after resizing.	
--echo-metadata	Displays metadata values on-screen as the image is processed.	
--source-format <arg>	Optionally specifies the source image format (use --help-formats for detailed information).	

<code>-t --threads <arg></code>	Specifies the number of CPU threads to use (-1 indicates all available cores).	-1
<code>--cpu-only</code>	Forces CPU processing only when CUDA is available (default: CUDA if available)	
<code>--cuda-device</code>	Uses the best available single GPU device	default
<code>--disable-font-color</code>	Disable Log Font Color	false

3.1.6 Input and output image sequence syntax

When specifying the image sequence for the input and output, replace the sequence number with the pound sign (#), as shown in the following example:

```
/path/name_#####.ext
```

If the image frame sequence number has varying length, you can use `*#`

```
/path/name_*.ext
```

Note: Do not use a space character.

3.1.7 Preset targets

For convenience, the `cm_offline` tool has a set of commonly used targets (as seen in `--show-targets`). To use these presets, use the `--targ <arg>` argument. See [Appendix A: Target displays for cm_offline](#) for details, or enter:

```
./cm_offline --show-targets
```

3.1.8 Specifying frame ranges to process

Single or multiple groups of frame ranges to be processed are supported by using the `-f --frames` option. Groups of frame ranges can be specified as:

```
-f <frame_start#-frame_end#>,<frame_start#-frame_end#>...
```

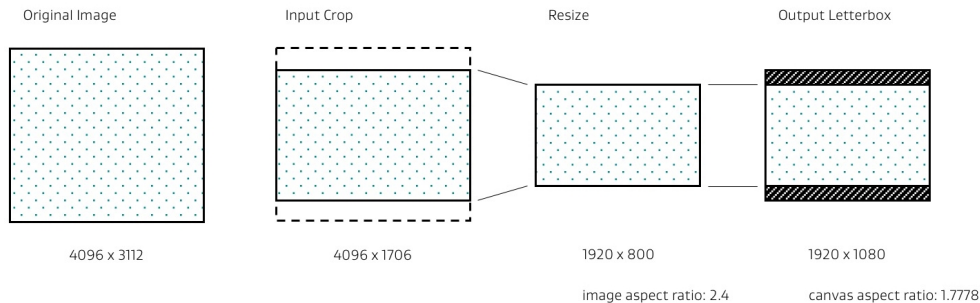
3.1.9 Using the crop, resize and letterbox options

The order of operations for scaling the output image is fixed as: Crop → Resize → Pad. This occurs regardless of the written order in the command line.

For automatic image scaling, use the `--output-format "<horizontal>x<vertical>x3"` option. Using the `output-format` option will automatically perform the crop, resize and pad based on the input resolution and the specified output resolution.

For advanced control over scaling, crop, resize and pad can be specified manually as shown below. When using the advanced controls, `crop`, `resize` and `letterbox` must all be specified in the command line. Specifying only one function will not work.

For help with this function, use `./cm_offline --help-advanced`



To specify Crop:

```
--input-crop <left_column> <right_column> <top_row> <bottom_row>
```

To specify Resize:

```
--resize <width> <height>
```

You can optionally apply resizing filters while resizing the output image:

```
--resize-filter <filter_name>
```

To specify Output letterbox:

```
--output-letterbox <left_column> <right_column> <top_row>  
<bottom_row>
```

3.1.10 Metadata Validation

When creating a driver deliverable with `cm_offline`, the metadata is automatically checked. If the metadata contains errors, the errors are displayed and the images will not be created. The metadata will need to be fixed before `cm_offline` continues to process.

Metadata can be fixed either manually and/or with the `metafier` tool.

Refer to [Validating Metadata](#) section in this document.

4 Mezzinator

This tool creates a type of Dolby Vision Mezzanine MXF deliverable that contains the video essence with the interleaved Dolby Vision Metadata track or a MXF with sidecar XML metadata file. This tool does not support any other mezzanine output.

4.1 Usage

4.1.1 Command line syntax

Basic usage

```
./mezzinator [-m <arg>] [--reel <arg>] [--frame-offset <arg>] [--frame-align <arg>] [--uuid <arg>] [--j2k-profile <arg>] [-r <arg>] [-f] [-b] [--target-bit-depth <arg>] [--disable-passthrough] [--sidecar-xml <arg>] [--help-format] [--help-advanced] [-h] [-v] <input> <output>
```

Advanced usage

```
./mezzinator [-m <arg>] [--reel <arg>] [--frame-offset <arg>] [--frame-align <arg>] [--uuid <arg>] [--j2k-profile <arg>] [-r <arg>] [--source-format <arg>] [-f] [-t <arg>] [-b] [--target-bit-depth <arg>] [--disable-passthrough] [--sidecar-xml <arg>] [--disable-font-color] [--help-format] [--help-advanced] [-h] [-v] <input> <output>
```

Common examples

Create a standard Dolby Vision MXF from a Dolby Vision Master:

```
./mezzinator -m <metadata.xml> <input_image_sequence_#####.ext> <output.mxf>
```

Create a standard MXF with sidecar XML metadata file:

```
./mezzinator -m <metadata.xml> <input_image_sequence_#####.tif> <output.mxf> --sidecar-xml <output.xml>
```

Create a longplay MXF from multiple reels:

```
./mezzinator --reel <reel.txt> <playlist.play> <output.mxf>
```

NOTE: For more information on creating a reel and playlist file, refer to [Appendix B: Creating a longplay deliverable from multiple sources](#) and [Appendix C: Creating a playlist file](#)

4.1.2 Command line help

View basic options by entering:

```
./mezzinator -h | -? | --help
```

View the advanced options by entering:

```
./mezzinator --help-advanced
```

4.1.3 Compatible input image formats

The mezzinator tool is compatible with the following image formats. To output a selected image format, use one of the available image format extensions at the end of the output filename.

- MXF (.mxf)
- TIFF (.tif)
- OpenEXR (.exr)
- JPEG 2000 (.j2c/.j2k)
- DPX (.dpx)
- ProRes (.mov)

When specifying combined options with space delimited values, use quotes (“”) at the beginning and end of the specified string.

See [Advanced Image Format Strings](#) for a list of all available functions, which are described in the output of the `./mezzinator --help-format` option.

See [Appendix D: Common input and output image format examples](#) for common image format examples.

4.1.4 Compatible output image formats

By default, the output format complies with IMF Application #2 Extended and output 12-bit J2C video essence, with the added Dolby Vision metadata as another track within the MXF.

You can select the JPEG 2000 compression profile and select whether to convert the image essence to BT.2020 color space.

If the input is already a MXF with JPEG 2000 images essence, then the mezzinator just passes the image essence through without applying any processing on the images.

4.1.5 Basic option information

Option Command	Description	Default
<code>-m --metadata <arg></code>	Specifies the input XML Metadata filename	
<code>--reel <arg></code>	Specifies a reel file as the input source (.txt, .reel)	
<code>--frame-offset <arg></code>	Offsets the metadata start frame number by this frame count to match the start image frame number Use <code>auto</code> to guess the frame offset. Use <code>trim</code> to guess the frame offset and trim the head.	0
<code>--frame-align <arg></code>	Aligns the metadata to the specified image frame number in the sequence, such as 86400.	0
<code>--uuid <arg></code>	Sets the MXF Asset UUID. The UUID string to set MXF UUID or write in form of: 81a82fd2-d1b7-11e4-8acc-002590ec378e This field is either manually set with the input option or randomly generated based on input such as time of day or system information.	random
<code>--j2k-profile <arg></code>	Sets the JPEG 2000 encoding profile for MXF output (bcp5, bcp7, dci, imf_ml3, imf_ml6, imf_ml7, imf_ml8, imf_lossy_ml3, imf_lossy_ml6, imf_lossy_ml7, imf_lossy_ml8) Note: The default is bcp5 for bit depth between 8 and 12-bits or imf_ml6 for 16-bits	bcp5/imf
<code>-r --frame-rate <arg></code>	Sets the frame rate tag for the XML or MXF (24, 23, 24000/1001...)	Input frame rate
<code>-f --frames <arg1-arg2>,<arg3-arg4>...</code>	Specifies the frame range(s) to process. For multiple frame ranges, use <frame_start#-frame_end#>,<frame_start#-frame_end#>	all
<code>--b --bt2020</code>	Converts image encoding primaries and white point from P3D65 or supplied source format to BT2020	
<code>--target-bit-depth <arg></code>	Converts image to specified bit depth (8, 10, 12, 16)	12-bit

<code>--disable-passthrough</code>	Pass-through mode is only used when going from JPEG 2000 (.j2c or .j2k) to MXF (.mxf) or MXF to MXF	
<code>--sidecar <arg></code>	Saves a sidecar XML file when creating a MXF with embedded metadata	false
<code>--help-format</code>	Displays extended help on specifying image format strings for source, target and color encoding	
<code>--help-advanced</code>	Displays advanced application arguments and usage	
<code>-h -? --help</code>	Displays basic application arguments and usage	
<code>-v --version</code>	Displays program version	

4.1.6 Advanced option information

Option Command	Description	Default
<code>--source-format <arg></code>	Optionally specify the source image format (use <code>-help-formats</code> for detailed information)	
<code>--disable-font-color</code>	Disable Logging Font Color	false

4.1.7 Input image sequence syntax

When specifying the image sequence for the input and output, replace the sequence number with the pound sign (#), as shown in the following example:

```
/path/name_#####.ext
```

If the image frame sequence number has varying length, you can use `*#`

```
/path/name_*.ext
```

Note: Do not use a space character.

4.1.8 Metadata and image sequence alignment

When using the mezzinator tool, make sure the metadata in the XML is aligned with the frame sequence. There are multiple ways to align the metadata with the image sequence.

- Option 1: aligning metadata to image frame number
 - Use the `--frame-align` method to align the metadata to the specified image sequence start frame number that is used in the image filename, i.e. 86400.

- Option 2: using a frame offset number to align metadata to image sequence
 - Calculate the difference between the metadata start frame number and the image start frame number and use that number in the `--frame-offset` function.
- Option 3: attempt auto alignment of metadata and image sequence
 - Use the `--frame-offset auto` feature to attempt to automatically align the metadata to the image sequence.

See [Appendix E: Metadata alignment examples](#) for further information.

4.1.9 Trimming and alignment

To trim the head/tail of the image sequence, there are multiple methods that will trim, depending on your needs.

If you are combining multiple reels and each reel contains a head and tail, the easiest method is to create a reel and playlist file and use those as the input to `cm_offline`. For more information on creating a reel and playlist, refer to [Appendix B: Creating a custom reel.txt file from multiple sources](#) and [Appendix C: Creating a playlist file](#).

To automatically align and trim the head for a single reel, use the `--frame-offset trim` function to automatically align and trim the head. Here, you do not need to specify a frame number or offset. The trim function will automatically trim the head with the best-guess frame offset.

To manually trim a single reel, you can use the `--frame-offset` with the `--f <arg1-arg2>` functions. When specifying the frames, `'-f'`, this is always specified as the image sequence frame numbers.

4.1.10 Metadata Validation

When creating a Dolby Vision MXF, the metadata is automatically checked. If the metadata contains errors, the errors will be displayed and the MXF will not be created. The metadata will need to be fixed before a MXF can be created.

Metadata can be fixed either manually and/or with the metafier tool.

Refer to [Validating Metadata](#) section in this document.

5 Metafier

Metafier is a metadata utility tool that works with Dolby Vision XML metadata and with the Dolby Vision Mezzanine MXF file. Metafier supports extracting, upgrading, checking, validating metadata and other useful functions and displaying information.

5.1 Usage

5.1.1 Command line syntax

Basic usage

```
./metafier [-o <arg>] [-e <arg>] [--shot-list <arg>] [--shot-list-duration <arg>] [--show-info <arg>] [--show-uuid <arg>] [--reset-displays] [--show-mastering-displays] [--mastering-display <arg>] [--color-encoding <arg>] [--max-fall-cll <arg1> <arg2>] [--aspect-ratios <arg1> <arg2>] [-r <arg>] [--trim-head <arg>] [--trim-tail <arg>] [--insert-black-head <arg>] [--insert-black-tail <arg>] [--start <arg>] [--algorithm-version <arg1> <arg2>] [--validate] [--with-l2-lift] [--save-version <arg>] [-v] [--help-format] [--help-advanced] [-h] <input>
```

Advanced usage

```
./metafier [-o <arg>] [-e <arg>] [--force-invalid] [--shot-list <arg>] [--shot-list-duration <arg>] [--show-info <arg>] [--show-uuid <arg>] [--reset-displays] [--show-mastering-displays] [--mastering-display <arg>] [--color-encoding <arg>] [--max-fall-cll <arg1> <arg2>] [--aspect-ratios <arg1> <arg2>] [-r <arg>] [--trim-head <arg>] [--trim-tail <arg>] [--insert-black-head <arg>] [--insert-black-tail <arg>] [--start <arg>] [--remove-trim <arg1> <arg2>] [--algorithm-version <arg1> <arg2>] [--validate] [--fix-dissolves] [--remove-duplicates] [--save-version <arg>] [--swap-gain-gamma] [-v] [--help-format] [--disable-font-color] [--help-advanced] [-h] <input>
```

Common examples

Extracting a XML metadata file from an MXF:

```
./metafier -e <metadata.xml> <input.mxf>
```

Validating XML metadata or metadata in a MXF:

```
./metafier --validate <input.xml> or <input.mxf>
```

```
./metafier --validate -o <output_log.txt> <input.xml>
```

```
./metafier --validate --with-l2-lift <input.xml>
```

Upgrading an older version of XML metadata to the current version:

```
./metafier -o <new_metadata.xml> --save-version latest
```

Display the shot list from a XML or MXF:

```
./metafier --shot-list - <input.xml> or <input.mxf>  
./metafier --shot-list <shotlist.txt> <input.xml> or <input.mxf>
```

Display the shot list with shot duration from a XML or MXF:

```
./metafier --shot-list-duration - <input.xml> or <input.mxf>  
./metafier --shot-list-duration <shotlist.txt> <input.xml> or  
<input.mxf>
```

Using metafier to fix simple overlapping shots:

```
./metafier --fix-dissolves <input.xml>
```

NOTE: Using metafier does not fix all cases with overlapping shots, but is worth trying before manually fixing the shots with overlapping metadata.

5.1.2 Command line help

View command options by entering:

```
./metafier -h, or -help
```

View the advanced options by entering:

```
./mezzinator --help-advanced
```

5.1.3 Basic option information

Option Command	Description	Default
<code>-o --output <arg></code>	Output filename (.xml, .mxf, .txt, .sl)	
<code>-e --extract <arg></code>	Specifies the XML filename of the extracted metadata from a MXF	
<code>--shot-list <arg></code>	Creates a shot list and saves it to a .sl or .txt file	
<code>--shot-list-duration <arg></code>	Creates a shot list with duration and saves it to a .sl or .txt file	
<code>--show-info <arg></code>	Displays frame size, frame duration and frame rate of the input MXF. Use the dash (-) for stdout.	false
<code>--show-uuid <arg></code>	Displays the UUID of the input MXF. Use the dash (-) for stdout.	false
<code>--reset-displays</code>	Resets Mastering and Target displays specified in the metadata to default values. If it cannot identify the original Mastering Display, it will set it to: 'Dolby Pulsar 4000-nit,P3/D65,ST.2084,Full'	false
<code>--show-mastering-displays</code>	Displays a list of supported mastering displays	false
<code>--mastering-display <arg></code>	Sets the Mastering Display by ID when using the '--reset-displays' flag (Overwrites any default behavior)	
<code>--color-encoding <arg></code>	Sets the color encoding information	input
<code>--max-fall-cll <arg1> <arg2></code>	Sets the specified MaxFALL and MaxCLL values (does not calculate values)	0 0
<code>--aspect-ratios <arg1> <arg2></code>	Sets the aspect ratios (Canvas, Image)	input
<code>-r --frame-rate <arg></code>	Sets the frame rate tag for the XML or MXF (24, 23, 24000/1001...)	input
<code>--trim-head <arg></code>	Trims the head of the metadata up to the specified frame number (default: 0)	0

<code>--trim-tail <arg></code>	Trims the tail of the metadata by the number of specified number of frames	0
<code>--insert-black-head <arg></code>	Inserts the specified number of black frame metadata for the header	0
<code>--insert-black-tail <arg></code>	Inserts the specified number of black frame metadata for the tail	0
<code>--start <arg></code>	Specifies the starting metadata frame number (only works with XML Metadata and not with MXF)	0
<code>--algorithm-version <arg1> <arg2></code>	Set the Algorithm Version (L1 Version, L2 Version)	empty
<code>--validate</code>	Validates the XML or MXF metadata and displays the results	false
<code>--with-l2-lift</code>	Adds additional check for positive L2 lift values when used with <code>--validate</code> for letterbox content	
<code>--save-version <arg></code>	Specifies the output Metadata version (default: input XML/MXF). Options: 2.0.4, 2.0.5, latest (2.0.5)	input
<code>-v --version</code>	Displays program version	
<code>--help-format</code>	Show extended help on specifying image format strings	
<code>--help-advanced</code>	Displays advanced application arguments and usage	
<code>-h -? --help</code>	Displays basic application arguments and usage	

5.1.4 Advanced option information

Option Command	Description	Default
<code>--remove-trim <arg1> <arg2></code>	Remove a trim from the Metadata (Trim Level, Target ID) Options for Trim Level: L2	false

<code>--fix-dissolves</code>	Attempts to introduce dissolves to fix overlapping shots	false
<code>--remove-duplicates</code>	Attempts to remove any duplicate trim levels found in the metadata	false
<code>--swap-gain-gamma</code>	Swaps the gain and gamma values for old baselight 2.x metadata files (this will also update the metadata to the current version supported by this application)	false
<code>--force-invalid</code>	In case of invalid metadata, ignores the errors and continues anyway	false
<code>--disable-font-color</code>	Disable Logging Font Color	false

5.1.5 Validating Metadata

The metafier tool has a feature that can perform basic metadata testing for validating Dolby Vision metadata in XML or MXF. To use the validation feature, use the `--validate` argument with metafier followed by the file.

```
./metafier --validate <md_file.xml>|<file.mxf>
./metafier --validate <reel.txt>
./metafier --validate </fullpath/>
```

The metafier tool checks the metadata for the following information:

- Mastering monitor
 - A single mastering monitor is listed in the metadata
 - The mastering monitor has valid specifications in the metadata
- Target displays
 - Target displays in the metadata are valid
- Color encoding
 - If present, the color encoding information is sanity checked and displayed
- Checks for overlapping shots and will display the shots that have overlap
- Checks for any gaps in metadata and will display the pair of shots that has the gap
- Checks each shot for negative duration
- Validity checks for L1 and L2 are valid ranges (-1,1)
- L1 values are compliant with: $\text{min} \leq \text{mid} \leq \text{max}$
- Checks for same L1 values across consecutive shots and will output a warning

- Valid L6 metadata: (when maxFall/maxCLL values are zero, this check is skipped)
 - maxFall < maxCLL
 - sanity check between maxCLL and Dolby Vision L1 values and will display a warning if they are greatly mismatched
- Outputs the following useful information:
 - Frame Range
 - Aspect Ratio
 - XML Version number
 - Number of shots in the XML
 - Frame Range of entire XML
 - TargetID with trim count
 - Color Encoding values in XML
- Checks for trims with positive L2 lift values when:
 - --validate --with-l2-lift will check and report shots that contain lift-trim values greater than zero if the aspect ratio, canvas \neq image. If the canvas=image, then using --with-l2-lift will not perform the check

When using the metafier tool to validate a reel file, the metafier tool will validate each XML as described above as well as cross compare each XML file specified in the reel file. If metadata mismatches one or more specified XML files, then the metafier tool will summarize what is mismatching per XML file. Cross-comparing XML files is only performed when using a reel file as the input.

When validating all the XML files in a folder, the metafier tool will validate each XML individually and display the validation report.

Passing metadata file example

```
$ metafier --validate Bright_LTRBX_A_DoVi_mastering.xml
12/16/2016/10:17:53.363708036 metadata: INFO Validation Summary:
=====
Metadata version: "2.0.5"
Mastering Monitor: "Dolby Pulsar 4000-nit,P3/D65,ST.2084,Full (ID 7): display
7 ('Dolby Pulsar 4000-nit,P3/D65,ST.2084,Full'): bits 16 diagonal 42 color:
pq rgb computer p3d65"
Mastering Monitor Validation Test: PASS
Target Displays Validation Test: PASS
Color Encoding: "pq rgb computer p3d65"
Color Encoding Validation Test: PASS
Overlapping Shots Validation Test: PASS
Gap between Shots Validation Test: PASS
Negative Shot duration Validation Test: PASS
L1 Metadata Validation Test: PASS
L2 Metadata Validation Test: PASS
L6 Metadata Validation Test: PASS
=====
12/16/2016/10:17:53.364416997 metafier: INFO No issues found in the Metadata
```

Metadata file that has a gap between shots example

```
12/16/2016/12:06:47.879302843 metadata: ERROR Gap between Shots:  
UUID = b850de18-92c0-4be7-9049-49ac722203bb @ {86441+29@24/1}  
UUID = c139651d-e544-47c8-a443-a071f7a24e2f @ {86471+19@24/1}  
  
UUID = b14bb736-6d8d-4345-8669-2db52a11260f @ {86610+18@24/1}  
UUID = 6abdd0b0-e3ab-410d-890b-6f32878b35a4 @ {86629+38@24/1}  
  
12/16/2016/12:06:47.879564730 metafier: ERROR Invalid Metadata
```

If shots are not contiguous or overlapping, the pair of shots, or multiple shots with errors, will be displayed that contains the error.

6 CM_analyze

The `cm_analyze` tool is primarily used to convert existing HDR10 content to Dolby Vision content by automatically generating Dolby Vision L1 Analysis metadata for the HDR10 source. This metadata and original HDR10 source is then used to create a Dolby Vision Mezzanine deliverable to be encoded and distributed.

This tool is not intended for generating a backward-compatible SDR version. `cm_analyze` maintains high quality and artistic intent by enabling playback through Dolby Vision enabled playback devices.

If CUDA is supported on the platform, the `cm_analyze` tool defaults to using CUDA for processing because this is usually faster processing than using the CPU. For CUDA support, the machine requires to have a NVIDIA graphics card. CUDA acceleration only supports a single card. If there are multiple GPUs on the machine, this tool will determine the fastest single GPU card and use its available cores for processing. Multiple GPU cards is not currently supported. To force the system to use CPU processing, use the `--cpu-only` option in the command line.

The `cm_analyze` tool is compatible with the following image formats. To output a selected image format, use one of the available image format extensions at the end of the output filename.

- MXF (.mxf)
- TIFF (.tif)
- OpenEXR (.exr)
- JPEG 2000 (.j2c/.j2k)
- DPX (.dpx)
- ProRes (.mov)

6.1 Required information and files

- Conformed HDR10 image sequence that is encoded in SMPTE ST.2084 (PQ)
- Shot list with shot type for the entire sequence (.txt, .sl, .edl). Also works with a Dolby Vision XML
 - If the shot list is not available, use the optional "live mode" to generate frame-by-frame metadata
- Aspect ratios for the sequence

6.2 Usage

Cm_analyze requires the following information to be specified. Color Encoding metadata will be set based on the mastering display used.

- Source Format
- Mastering Display ID
- Aspect Ratio or Letterbox Information
- Frame Rate

6.2.1 Command line syntax

Basic Usage

```
./cm_analyze [-s <arg>] [-m <arg>] [--frame-offset <arg>] [-f] [-r <arg>] [--letterbox <arg1> <arg2> <arg3> <arg4>] [--aspect-ratios <arg1> <arg2>] [-b] [--source-format <arg>] [--show-mastering-displays] [--help-format] [--help-advanced] [-h] [-v] <input> <output XML>
```

Advanced Usage

```
./cm_analyze [-s <arg>] [-m <arg>] [--frame-offset <arg>] [-f] [-r <arg>] [--letterbox <arg1> <arg2> <arg3> <arg4>] [--aspect-ratios <arg1> <arg2>] [-b] [--source-format <arg>] [--show-mastering-displays] [-t <arg>] [--help-format] [--help-advanced] [-h] [-v] [--disable-font-color] [--cpu-only] [--cuda-device] <input> <output XML>
```

6.2.2 Command line help

Basic usage

```
./cm_analyze -h, or -help.
```

Advanced usage

```
./cm_analyze --help-advanced
```

Common example

```
./cm_analyze -s <shotlist.txt> -m 7 -r 23 --source-format "u16 i444 tight computer bt2020" --aspect-ratios 1.77778 1.77778 <input_hdr10_image_sequence_#####.tif> <output_dolby_vision_metadata.xml>
```

6.2.3 Basic usage option information

Option Command	Description	Default
<code>-s --shot-list <arg></code>	Specifies input shot list filename (.edl, .txt, .sl, .xml)	
<code>-m --mastering-display <arg></code>	Sets the Mastering Display by ID when using the '--reset-displays' flag (Overwrites any default behavior).	
<code>--frame-offset <arg></code>	Offsets the metadata start frame number by this frame count to match the start image frame number	0
<code>-f --frames</code>	Specifies the frame range(s) to process. For multiple frame ranges, use <frame_start#-frame_end#,frame_start#-frame_end#,single_frame,...> or <frame_start#> <frame_end#>	
<code>-r --frame-rate <arg></code>	Sets the frame rate tag for the XML or MXF (24, 23, 24000/1001...).	input
<code>--letterbox <arg1> <arg2> <arg3> <arg4></code>	Specifies the area to ignore for processing (left right top bottom).	0 0 0 0
<code>--aspect-ratios <arg1> <arg2></code>	Sets the aspect ratios (Canvas, Image).	input
<code>-b --bda</code>	Computes MaxFALL, MaxCLL as per the Blu-ray Disc document and records the values in the output XML.	false
<code>-l --live-mode</code>	Use to replicate live broadcast with frame-based metadata	false
<code>--source-format <arg></code>	Optionally specifies the source image format (use --help-formats for detailed information).	input
<code>--show-mastering-displays</code>	Displays a list of supported mastering displays.	false
<code>--help-format</code>	Displays extended help on specifying image format strings for source, target and color encoding.	
<code>--help-advanced</code>	Displays advanced application arguments and usage.	

<code>-h -? --help</code>	Displays basic application arguments and usage.	
<code>-v --version</code>	Displays the program version.	

6.2.4 Advanced option information

Option Command	Description	Default
<code>--analysis-version <arg></code>	Specifies the analysis algorithm version used to create L1 metadata. (use 2 for version 2.9, 4 for version 4.0)	Live mode = 4 Shot based = 2
<code>-t --threads <arg></code>	Specifies the number of CPU threads to use (-1 indicates all available cores)	-1
<code>--cpu-only</code>	Forces CPU processing only when CUDA is available (default: CUDA if available)	
<code>--cuda-device</code>	Uses the best available single GPU device	default
<code>--disable-font-color</code>	Disable Log Font Color	false

6.2.5 Compatible input image formats

The `cm_analyze` tool is compatible with these image formats and the format using `--source-format` should be specified for each file format used.

See [Advanced Image Format Strings](#) for a list of all available functions, which are described in the output of the `./cm_analyze --help-format` option.

See [Appendix D: Common input and output image format examples](#) for common image format examples.

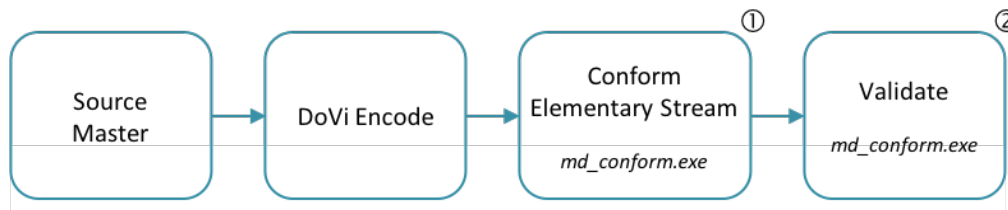
7 MD_conform

Md_conform is a bitstream metadata utility tool that works with Dolby Vision bitstream files. This tool conforms L1 Analysis Metadata in Dolby Vision bitstream files to address luminance irregularities during playback for certain Dolby Vision TVs. This tool does not require a re-encode of the content.

The md_conform tool is applied to bitstreams right after encoding.

7.1 Conformance Workflow

This is the workflow for conforming L1 metadata within the existing implementation of the Dolby Vision Encoder. In the future, the Dolby Vision Encoder will be updated, and this will no longer be required.



Example CLI:

① `./md_conform --conform-L1 <source_el_bitstream.265> <conformed_el_bitstream.265>`

② `./md_conform --validate <conformed_bitstream.265>`

NOTE: For BD Profile 7, conform L1 using the EL (Enhancement Layer)

7.2 Usage

7.2.1 Command line syntax

Basic usage

```
./md_conform [--validate] [--conform-L1] [-h|--help] [-v|--version] [-  
-disable-font-color] <source> <output>
```

Example

Conforming a bitstream file:

```
./md_conform --conform-L1 <source_bitstream.file>  
<conformed_bitstream.file>
```

7.2.2 Basic usage option information

Option Command	Description	Default
--validate	Checks the source file if conformance is required	
--conform-L1	Checks the source file and conforms L1 metadata	
--disable-font-color	Disable Log Font Color	
-v --version	Displays program version	
-h --help	Displays application arguments and usage	

8 Advanced color and image format strings (`--help-format`)

You can specify a space-separated string of the following tags to inform the sequence reader / writer about the images you are attempting to read or produce.

Option	Description and examples
Image size:	Specifies the size of the image. This is primarily for raw formats such as yuv in which there is no header. Usually it is read from the image file format header. The basic format is WIDTHxHEIGHT, with an optional number of image channels, 1920x1080 1920x1080x3
Raw image structure tags - Using these tags can to force the interpretation of the bits to a specific value if they cannot automatically be queried from the file itself. This is primarily for raw formats such as yuv.	
Image bit depth	u8 8bit 8bits u10 10bit 10bits u12 12bit 12bits u14 14bit 14bits u16 16bit 16bits u32 32bit 32bits f16 half f32 float f64 double
Orientation (pixels)	top_left top_right bottom_left bottom_right left_top right_top left_bottom right_bottom
Endianness	be (big endian) le (little endian) ne (native endian)
Layout	msb32 lsb32

	msb32_reverse msb32rev ** usually for new dpx where things are stored lsb32_reverse lsb32rev ** BGR (or component 2,1,0 for 4:2:2 YCbCr) msb16 lsb16 tight
Channel packing	planar interleaved
Sub-sampling	444 422 420
Color image state tags: These tags can be specified to define how the values in the image should be interpreted (such as color space)	
Encoding	All encodings allow specification of luminance range that defines scaling to nits except for absolute spaces such as PQ. Usage is: <encoding>(0.0,100.0) <encoding> is one of the following encoding names. The first argument is the minimum luminance; the second is the maximum luminance in nits. linear pq gamma_bt1886 gamma1886 gamma_bt709 gamma709 gamma_bt2020 gamma2020 gamma_srgb gammasrgb gamma_dci gammadci log slog slog2 logc aceslog

Colorspace	<p>Specifies the current color space of the image. Some of these values represent fixed transforms, from one back to RGB (or to one), such as ycbcr_bt709. Others imply a combination of a 3x3 matrix transforms to and from XYZ.</p> <p>rgb ycbcr_bt601 ycbcr601 ycbcr_bt709 ycbcr709 ycbcr_r709 ycbcr_rec709 ycbcr_bt2020 ycbcr2020 ycbcr_r2020 ycbcr_rec2020 xyz ictcp</p>
Signal range	<p>Specifies the range of values. Full range is considered unscaled, video is the typical 16 - 235 (when in 8-bits) values. Signal is the SDI 'valid' range of 4-1019 in 10-bits (and scaled, not inserted)</p> <p>signal sdi video legal narrow smpte computer full data plus smpteplus smpte_plus</p>
Chromaticities and Whitepoint	<p>Specifies the color coordinates represented by 0 - 1 in normalized values. These values automatically compute the 3x3 transforms between XYZ and RGB, for example.</p> <p>p3d65 bt709 r709 rec709 bt2020 r2020 rec2020 bt601ntsc ntsc bt601pal pal dci aces sgamut3 sgamut3cine sgamut3_cine custom (red.x, red.y, green.x, green.y, blue.x, blue.y, white.x, white.y)</p>
Framerates	<p>Specifies the frame rate of the material by having the frame rate followed immediately (no space) by fps, as shown in the following values.</p> <p>23.976fps 24fps 29.97fps 30fps 60fps</p>

<p>Frame range</p>	<p>Specifies the frame range of the sequence. If this is not specified, the sequence attempts to scan the directory and discover the frame range (or for yuv files, look at the file size and image size to compute the range). This allows the specification of a shorter range.</p> <p>0-100</p>
<p>Shortcuts</p>	<p>444p p444: 444 planar 422p p422: 422 planar 420p p420: 420 planar 444i i444: 444 interleaved 422i i422: 422 interleaved 420i i420: 420 interleaved</p>
<p>Presets</p>	<p>These simple tags imply a collection of the above color information tags.</p> <p>bt601_ntsc_ycber: gamma_bt709(0,100) ycber_bt601 video bt601ntsc bt601_pal_ycber: gamma_bt709(0,100) ycber_bt601 video bt601pal bt709_rgb: gamma_bt709(0,100) rgb video bt709 bt709_ycber: gamma_bt709(0,100) ycber_bt709 video bt709 bthdr: pq rgb video bt2020 bthdrfull: pq rgb computer bt2020 computer_srgb: gamma_srgb(0,100) rgb computer bt709 dcinema: gamma_dci(0.024,48) xyz computer dci exr_linear: linear(0,100) rgb computer bt709 jpeg: gamma_srgb(0,100) ycber_bt601 computer bt709 prm: pq rgb signal p3d65 pulsar: pq rgb computer p3d65 sony_cinema: slog3(0,48) rgb computer sgamut3_cine sony_video: slog3(0,100) rgb video sgamut3</p>

Appendix A: Mastering and target displays for cm_offline and/or cm_analyze

This appendix describes the available target displays for the cm_offline tool and mastering displays for the cm_analyze tool.

The cm_offline tool synchronizes targets with the latest software version of the Dolby Vision Content Mapping Unit (CMU).

For the list of the latest mastering and target displays, always refer to the target help or the help menu for the third-party tool that is connected to the CMU.

```
./cm_analyze --show-mastering-displays  
./cm_offline --show-targets
```

Mastering Displays

ID	Name
7	4000-nit,P3/D65,ST.2084,Full
8	4000-nit,Rec. 2020,ST.2084,Full
20	1000-nit,P3/D65,ST.2084,Full
21	1000-nit,Rec. 2020,ST.2084,Full
30	2000-nit,P3/D65,ST.2084,Full
31:	2000-nit,Rec. 2020,ST.2084,Full
Default (7)	4000-nit, P3/D65,ST.2084,Full

Target Displays

ID	Name
1	100-nit, Rec. 709, BT.1886, Full
27	600-nit, P3/D65, ST.2084, Full
37	2000-nit, P3/D65, ST.2084, Full
38	2000-nit, Rec. 2020, ST.2084, Full
48	1000-nit, P3/D65, ST.2084, Full
49	1000-nit, Rec. 2020, ST.2084, Full
Default (1)	100-nit, Rec. 709, BT.1886, Full

Appendix B: Creating a longplay deliverable from multiple sources

This function creates a single long play mezzanine or long play XML from multiple reels or multiple XMLs.

Warning: Do not use this function to cut a reel. For cutting reels, use the `[-f|--frames <arg1> <arg2>]` function available in the `cm_offline` and `mezzinator` tools.

When creating a custom `reel.txt` file, specify the XML associated with the image sequence and the frame-start and frame-end from the frame numbers specified in the XML.

Create a plain text, `reel.txt` file with the following information:

```
<metadata_file1.xml> <first_frame_sequence_#> <last_frame_sequence_#>
<metadata_file2.xml> <first_frame_ sequence_#> <last_frame_sequence_#>
```

Note: The last frame number is defined as `last_frame_start + last_shot_length - 1`

Finding frame numbers

When the `frame_start` number is not equal to zero, you must obtain the frame numbers from within the XML file as shown in the following example. To print shots in the XML, use the `curl` command in Terminal to easily find the frame starts and duration.

Curl Example

```
$ curl file:///<fullpath_filename.xml> | grep In
<Source> <ParentID>0</ParentID> <In>0</In> </Source>
<Record> <In>86400</In> <Duration>48</Duration> </Record>
<Source> <ParentID>0</ParentID> <In>0</In> </Source>
<Record> <In>86448</In> <Duration>72</Duration> </Record>
```

In this example, the first frame number is **86400** and the last frame number is **86448 + 72 - 1**

When `frame_start` number is zero, you can alternatively use the `metafier` tool on the XML file to extract the frame number of each shot contained in the XML, as shown in the following example:

```
./metafier --shot-list - <filename.xml>
```

Output:

```
Start frame of each shot
```

When using the mezzinator tool with a `reel.txt` file, the `--reel <arg>` replaces the `-m | --metadata <arg>` command. Generally, you use a `playlist.play` file as the input source. For more information, see [Appendix C: Creating a playlist file](#).

The following example shows using the mezzinator with reels to create a longplay MXF.

```
./mezzinator --reel <reel_filename.txt> <input_filename.play>
<output_filename.mxf>
```

Creating a longplay XML only

The following example shows using metafier to create a longplay XML using reels.

```
./metafier -o <output.xml> <reel_filename.txt>
```

Creating a longplay XML with additional black frame header and tails

To create a longplay XML in which the image sequence has black frame headers and tails that were added without metadata, use the `--insert-black-head <arg>` and `--insert-black-tail <arg>` function in the metafier tool. Specify the number of black frames to be captured in the metadata for head and tail.

The following example shows adding 24 black frames to the header and tail of the longplay image sequence:

```
./metafier -o <output.xml> <reel_filename.txt> --insert-black-
head 24 --insert-black-tail 24
```

Appendix C: Creating a playlist file

Use a playlist file in combination with the `reel.txt` file to create a single long play mezzanine from multiple reels.

A `playlist.play` file contains the input frame list from multiple sources or paths.

Create a plain text file that has the `.play` file extension (`<filename.play>`), and which contains the following information:

```
<image_file_#####.ext> <first_frame_sequence_#>-  
<last_frame_sequence_#> <format_preset string>
```

Note: For the playlist file, the frame sequence numbers are the numbers used in the image sequence filename.

For the `<format_preset_string>`, use the following presets or the customized values described in [Appendix D: Common input and output image formats examples](#).

```
bt601_ntsc_ycbcr | "gamma_bt709(0,100) ycbcr_bt601 video  
bt601ntsc"  
bt601_pal_ycbcr | "gamma_bt709(0,100) ycbcr_bt601 video bt601pal"  
bt709_rgb | "gamma_bt709(0,100) rgb video bt709"  
bt709_ycbcr | "gamma_bt709(0,100) ycbcr_bt709 video bt709"  
computer_srgb | "gamma_srgb(0,100) rgb computer bt709"  
dcinema | "gamma_dci(0.024,48) xyz computer dci"  
exr_linear | "linear(0,100) rgb computer bt709"  
jpeg | "gamma_srgb(0,100) ycbcr_bt601 computer bt709"  
prm | "pq(0.005,600) rgb signal p3d65"  
pulsar | "pq(0.005,4000) rgb signal p3d65"
```

The mezzinator tool can optionally use a `playlist.play` file as the input file instead of using the image sequence file.

The following example shows using the mezzinator tool with a playlist file.

```
./mezzinator --reel <reel_filename.txt> <input_playlist.play>  
<output_filename.mxf>
```

Appendix D: Common input and output image formats examples

By default, `cm_offline` and `mezzinator` tools check the image format header and the metadata file header for the color encoding space.

Note: The `--source-format` and `--output-format` functions do not need to be specified unless image conversion is required.

The general format string to specify the input and output format is:

```
"<horizontal_pixels>x<vertical_pixels> <bit_depth> <channel_packing>  
<color_subsampling> <endianness> <layout> <frame_rate> <orientation>  
<encoding(min_luminance, max_luminance)> <color_space> <value_range>  
<chromaticities_whitepoint>"
```

Note: When specifying combined options with space delimited values, use quotes (“ ”) at the beginning and the end of the specified string.

Generally, you do not specify the output image format unless you want to change the container or override the image.

If you want to override the output image, the `cm_offline` tool performs the conversion on the output image, therefore changing the output image to the format that you specified.

Additionally, you do not usually use the `<encoding>`, `<color_space>` and `<chromaticities_whitepoint>` arguments.

Common format examples

Image format	Example
8-bit TIF/TIFF	"u8 interleaved tight" <output_filename.tif>
10-bit DPX	"1920x1080x3 u10 interleaved 444 ne msb32 " <output_filename.dpx> Note: The important arguments are marked in BOLD
12-DPX	"u12 interleaved lsb16" <output_filename.dpx>
12-bit MXF JPEG 2000 standalone, without metadata	"u12 interleaved lsb16" <output_filename.mxf>
12-bit JPEG 2000	"u12 interleaved lsb16" <output_filename,j2k[j2c]>
16-bit TIF/TIFF	"u16 i444 tight" <output_filename.tif[tiff]>
16-bit OpenEXR	"f16 tight" <output_filename.exr>
ProRes 4444/4444XQ*	"u16 i444 be rgb tight"
10-bit ProRes422*	"u10 i422 lsb32rev le ycbcr_bt2020 video"
8-bit ProRes 422*	"u8 i422 le tight ycbcr_rec709 video"

* ProRes is only supported on Linux and MacOS.

Appendix E: Metadata alignment examples

The metadata and image essence is always reset to zero when creating a MXF package.

Using the `--frame-offset` function to align metadata

The frame offset function uses the following equation:

$$\text{offset} = (0 - \text{start_frame_of_sequence})$$

To specify a frame range, it uses:

$$\text{offset} = (0 - \text{start_frame_of_range})$$

The following examples show the mezzinator tool's automatic alignment function.

Use Case 1

Aligned metadata [86400, 86500] and frame sequence [86400, 86500]

The metadata is realigned to zero, and becomes [0, 100]. The offset is estimated to be -86400.

$$f = 86400, \text{ we have } (f = 86400 - 86400); \text{ or } f = 0$$

$$f = 86500, \text{ we have } (f = 86500 - 86400); \text{ or } f = 100$$

Use Case 2

Unaligned metadata [300, 400] and frame sequence [86400, 86500]

The metadata is realigned to zero and becomes [0, 100]. The offset is estimated to be -86400.

$$f = 86400 \text{ we have } (f = 86400 - 86400); \text{ or } f = 0$$

$$f = 86500 \text{ we have } (f = 86500 - 86400); \text{ or } f = 100$$

Use Case 3

Unaligned metadata [90000, 90100] and frame sequence [300, 400]

The metadata is realigned to zero so becomes [0, 100] offset is estimated to be -300.

$$f = 300 \text{ we have } (f = 300 - 300); \text{ or } f = 0$$

$$f = 400 \text{ we have } (f = 400 - 300); \text{ or } f = 100$$

Use Case 4

Aligned case metadata [86400, 86500] and frame sequence [86400, 86500] with frame range [86450, 86455]

The metadata is realigned to zero and becomes [0, 100]. The offset is estimated to be -86450.

f = 86450 we have f = 86450 - 86450; or f = 0

f = 86455 we have f = 86455 - 86450; or f = 5

Note: This estimate is incorrect. In this case, you must impose an offset of -86400.

f = 86450 we have f = 86450 - 86400; or f = 50

f = 86455 we have f = 86455 - 86400; or f = 55

Using the `--frame-align` function to align metadata

Alternatively, the frame align function aligns the metadata to the specified frame number used in the image sequence filename and reset those to zero accordingly when creating the resulting MXF.

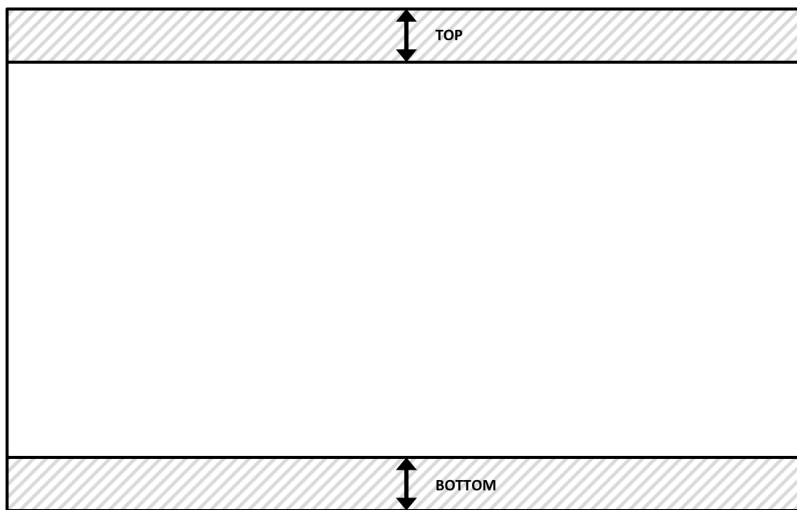
Appendix F: Specifying Letterbox

When specifying the letterbox area with `cm_offline` and `cm_analyze`, the size used for the letterbox command is the letterbox area and not the active image area as shown in the below diagram. The sequence for the letterbox values are left, right, top, bottom.

```
--output-letterbox <left > <right > <top > <bottom >
```

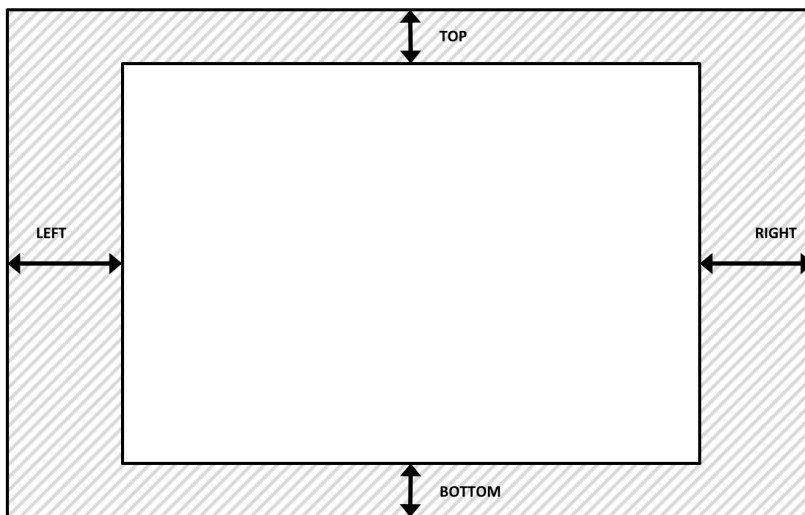
Example 1:

```
--output-letterbox 0 0 274 274
```



Example 2:

```
--output-letterbox 360 360 274 274
```



Appendix G: Operating system compatibility

This appendix describes the compatible operating systems on which the Dolby Vision Professional Tools have been tested. They may function on other operating systems that have not been tested by Dolby Laboratories. We recommend that you only run the tools on these supported operating system versions.

Compatible or tested operating system	Supported versions
Linux	CentOS Linux 6.5+, 7.x
Mac OS X*	Mac OS X 10.9.5+
Microsoft Windows	Windows 7.x, Windows 10 Note: Windows also requires Visual C++ Redistributable for Visual Studio 2012.
GPU Support	Most NVIDIA GPUs that support CUDA

*CUDA is only supported on Mac if the system is using the NVIDIA-published version of GPU drivers and the CUDA runtime. The standard Mac graphic drivers are not compatible.

Note: CUDA is only compatible with NVIDIA GPUs. Systems with other GPUs will only be able to use CPU processing.