Fraunhofer

IIS

easyDCP Plus

easyDCP Creator+

User manual

Version
4.2

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Contents

1   Welcome

Thank you for purchasing easyDCP Creator software.

With the easyDCP Creator software you are now able to create DCPs in a fast and easy way. In the easyDCP Creator you are able to create stereoscopic and encrypted DCPs.

With easyDCP Creator it is possible to create SMPTE compliant DCPs or J2K Interop DCPs. This software solution needs only a standard PC/Mac to make either 2k or 4k content ready for the distribution to a digital movie theater. There is no special or additional hardware necessary.

2   Feature Overview

The feature of easyDCP Creator+ are:

Feature	easyDCP Creator+ Demo	easyDCP Creator+
SMPTE and Interop compliant DCP creation	✔	✔
Stereo, 5.1 and 7.1 Surround Audio	✔	✔
DPX, TIFF and JPEG 2000 Input	✔	✔
Automatic Gamut Transformation from ITU709 to XYZ	✔	✔
SMPTE & Interop compliant Subtitles	✔	✔
Metadata adjustment (e.g. Offset, Entry Point, Duration, Content Titles, Content Types, Annotation Texts)	✔	✔
Graphical User Interface with Drag and Drop	✔	✔
Windows and Mac OS Version	✔	✔
Dolby Atmos (packaging only)	✔	✔
QuickTime Input	✔	✔
Loading DCPs	✔	✔
3D-Support	✔	✔
Encryption and Signature	X	✔
Scriptable	✔	✔
Supplemental DCPs (DCPs with referenced MXF tracks)	✔	✔
Loading Key Delivery Messages (KDMs)	X	✔

Available for 64 bit Windows 10	✔	✔
Available for 64 bit Mac OS X (10.14-10.15)	✔	✔

easyDCP Creator User Manual

3 Licensing

3.1 License Activation and Certification

Download easyDCP Creator+ at www.easydcp.com.

3.1.1 Offline workflow

After installing and starting easyDCP Creator+ the following dialog appears:
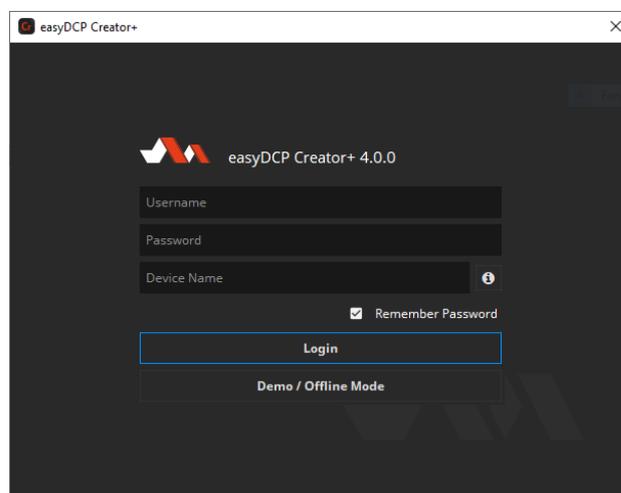
Click "Demo / Offline Mode" to start a free version of easyDCP Creator which is subjected to the demo mode restrictions. After startup has finished, open the options dialog, select "Activation Status" and press "Request License & Certificate". Fill in the licensee's name, the URL that shall be stated in the custom server certificates and a password that is used to protect access to the certificates. If the computer is connected to the Internet, click the "submit" button. The default web-browser will open www.easydcp.com, where further instructions will guide you through the purchase process.

After the purchase, a link to the zip file with the License & Certificate will be available for download within your user account at www.easydcp.com. The zip file can be dragged & dropped into easyDCP Player+ installation to unlock it.

The procedure is also described in a screen cast at www.easydcp.com.

Please be aware that this workflow only works with permanent licenses. For subscriptions you have to follow Online workflow.

3.1.2 Online workflow

Purchase one of the available subscription plans at www.easydcp.com. After the purchase, a license and the necessary certificate for easyDCP Creator+ is linked to your easyDCP account.
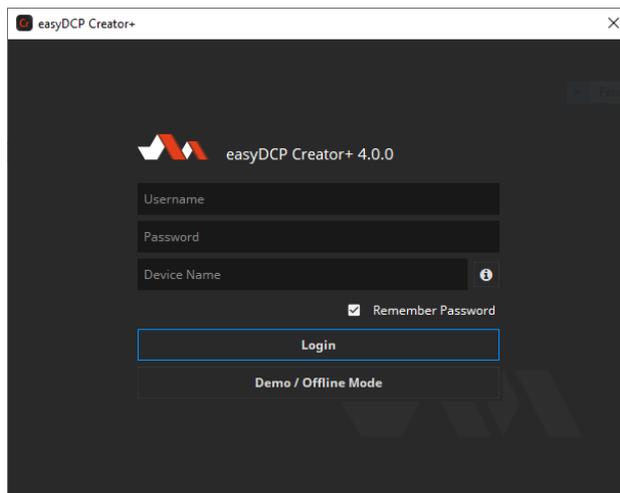
Install and start easyDCP Creator+ and fill in the username and password you've used for your easyDCP account. After clicking "Login", easyDCP Creator+ will automatically download the linked license and certificate from www.easydcp.com and activate your instance.

The "Device Name" field is prefilled with the name of the machine you use easyDCP Creator on. You can change the name freely. The name will be send to easyDCP.com and is used for convenient device identification only.

Please be aware that a permanent internet connection is required. As soon as easyDCP Creator+ detects a connection loss, the graphical user interface will be locked until the internet connection has been re-established.

With the online licensing workflow it's possible to run easyDCP Creator+ on different systems with the same license. Please be aware that multiple subscriptions are necessary to run easyDCP Creator+ instances at the same time on different machines.

Please be aware that for each computer a server certificate will be generated. Example: If you login on system 1 and afterwards on system 2, there will be two server certificates linked to your easyDCP account.

3.2 View current license status

To view the license details with an offline license, go to "menu bar -> File -> Settings -> Activation Status" and select Details next to the "Licensee" entry.

3.3 Application Data and Settings

easyDCP Creator automatically creates an application data folder. It contains the settings file as well as a folder where the server certificates are stored and a repository for color transform files.

The folder is located at
`<User Application Data>/Fraunhofer IIS/easyDCP Creator+/`

Additionally, all easyDCP applications share a folder with additional files such as color space descriptions. It is located at
`<User Application Data>/Fraunhofer IIS/easyDCP Shared/`

The user application data folder on Windows is located in
`C:/Documents and Settings/<username>/Application Data/`

A shortcut is to just enter `%APPDATA%` into the address bar.

On Mac OS X, the user application data folder is at
`/Users/<username>/Library/Application Support/`

3.4 Software Update

Please make sure you leave the automatic check-for-updates enabled, so that you get informed immediately when new versions are available for download.

Multiple versions of easyDCP Creator can be installed side-by-side, so there is no need to uninstall the old version before installing a new one.

With an active subscription it is possible to just login in the new version without further action required.

A new license file is only required for major updates, e.g. version 4.0 to version 4.1, and can be purchased at www.easydcp.com. Point releases do not require a new license, e.g. 4.0.0 to 4.0.1.

The update procedure is as follows

Point Release (only the last version number changes, e.g. 4.0.0 to 4.0.1)

1. Log into your account at www.easydcp.com

2. Download the new installer file and install it

3. **Offline licensing workflow:** The new easyDCP Creator+ version will automatically detect your existing license file and is good to go.

4. **Online licensing workflow:** easyDCP Creator+ will automatically download the necessary license and certificate information from www.easyDCP.com as described in 3.1.2. There is nothing else you have to do.

Major Release (first or second version number changes, e.g. 4.0.x to 4.1.x)

Offline licensing workflow

1. Log into your account at www.easydcp.com and purchase the license for the new version. The installer is then available for download. Download and install it.

2. Open the new easyDCP Creator+ version and proceed with the steps described in 3.1.1

   a. If you have already used easyDCP Creator+ before, you likely already have personalized server certificates. easyDCP Creator + will prompt you for the password. If the password can be verified, the new version of easyDCP Creator + will continue to use your existing server certificates and only request a new license file (the next step will prompt for a server certificate URL and password anyway, but the inputs are ignored then).

Online licensing workflow

If you have a valid subscription plan the installer of the new version can be downloaded at www.easydcp.com. All further steps are described in 3.1.2.

4   Getting Started

4.1   Project Configuration

At the start of easyDCP Creator or when creating a new project, the "Create New Project" dialog pops up. It is used to set the initial configuration of your project.
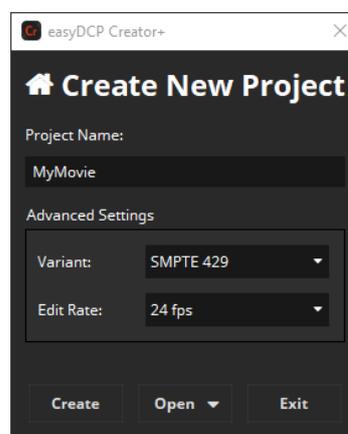
Project Name – Name of the project that will be used as title of the package and the first composition. The project name can be changed later on.

> The Project Name is limited to 14 characters and may not contain any spaces or underscores to be compatible with the *ISDCF Digital Naming Convention* used by easyDCP Creator.

Variant – The variant defines the specification the DCP shall meet. Now *InterOp*, *SMPTE 429* and *SMPTE RDD 52 (Bv2.1 Application Profile)* are supported. We recommend either *SMPTE RDD 52* or *SMPTE 429*. This can be changed later.

Edit Rate – Should match your input material's native edit rate as easyDCP Creator will not adjust your input material to the selected edit rate. There is only an edit rate conversion for the audio files if your input material has a different edit rate. The edit rate cannot be changed after the project was created.

> Since version 4.1 easyDCP Creator supports mixed 2K/4K and 2D/3D DCP. Therefore, *Project Type* selection to choose between 2K/4K/3D project type was removed. The type is now set directly per *Picture Track*.

Click *Create* to create the project. To access the project configuration after the project was created, select "`File -> Project Configuration…`" from the menu.

4.1.1 Digital Cinema Naming Convention

In digital cinema, it is common practice to follow a certain naming convention. The most important attributes such as the resolution, language, audio layout and so on are coded into the title so that a projectionist can later see them at first glance. This technique is called Digital Cinema Naming Convention.

easyDCP Creator+ provides an editor that helps you put together a proper title. The title will be used both for the project and also for the DCP and its Composition Playlist. Please note that it's not mandatory to fill in all fields.
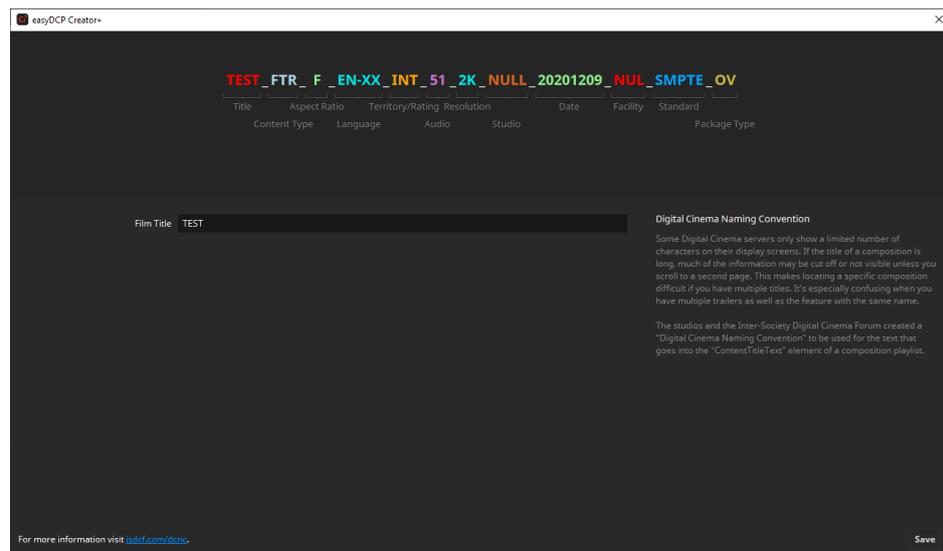
To change different properties you can select them at the top by clicking on the entry. This will open the edits for the selected group.

This dialog tries to fill out as many entries as possible automatically. Values like Content Type, Standard and Package Type are derived from the current project, but can be overridden manually.

All values are compliant to the Digital Cinema Naming Convention, Version V.9 (see http://www.digitalcinemanamingconvention.com).

4.2   The Main Window

After creating a new easyDCP Creator project, the start-up screen comes up:

Main Menu

Composition and
Reel
Manager/Timeline

Track Manager

Track/Reel Preview

Metadata Window
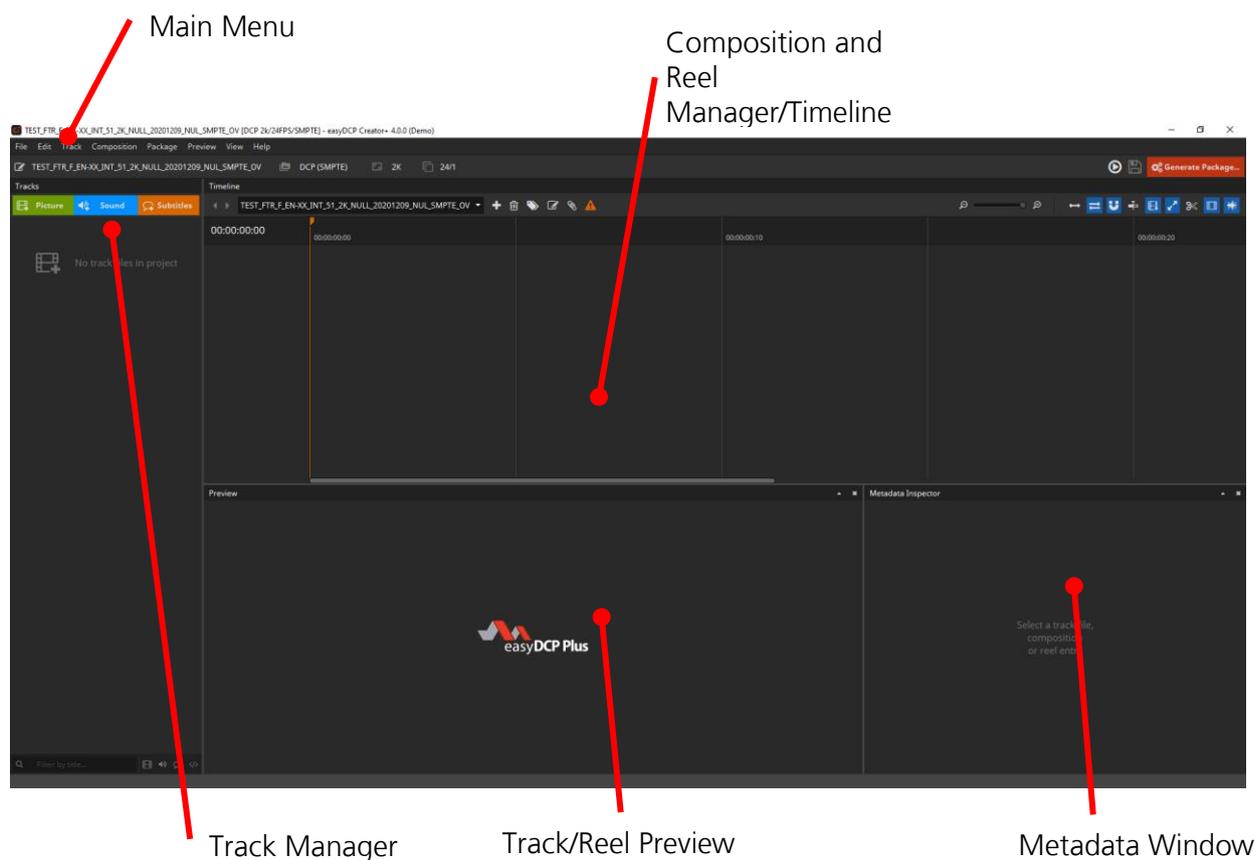
The main window is divided into several sub windows like a Track Manager and a Reel or timeline window. The following sections explain how to use the windows and features.

Per default the reel view is used, but it can be switched to timeline in the settings (New Project Defaults => Uncheck "Use Reel View for DCP").

4.3   Packing List (PKL) Parameters

Each DCP has a packing list (PKL) that lists all files contained in the DCP as well as some top-level metadata such as the creator, issuer and annotation text. The PKL's annotation text can be regarded as the DCP title.

To edit the packing list parameters, click the edit-icon in the main tool-bar below the menu bar:
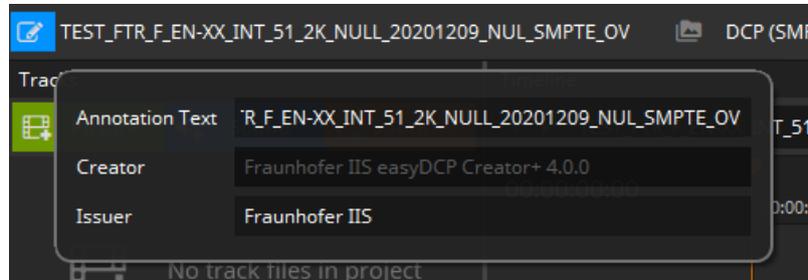
4.3.1.1 Annotation Text

The Annotation Text appears on the screen if a volume (e.g. USB-Drive, Hard disc Drive) is connected to a digital cinema system before ingest. This annotation text can be regarded as the DCP title. For DCPs that only contain a single Composition, it is common to use the same title for both the PKL and CPL. The title should follow the digital cinema naming convention. For more details, please refer to chapter 4.1.1.

The symbol next to the line edit to enter the name allows synchronizing the package title with the composition. If the chain is connected, updates will also update the name of the first composition. The same vice versa happens when updating the composition content title.
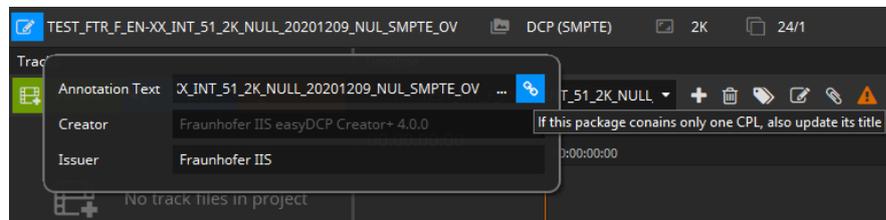
This synchronization mechanism is also available for Tracks to have a consistent annotation text and also for Creator and Issuer of PKL and CPL.

4.3.1.2 Creator

Commonly, the application that was used to create the DCP is stated here. This field is informational only and may be displayed by several D-Cinema servers.

The Creator is automatically filled with the easyDCP Creator version used for generation.

4.3.1.3 Issuer

State your company name here. This field is informational only and may be displayed by several D-Cinema servers.

4.4 Settings

With the settings you are able to set up default values for new projects, image processing and file naming options.

To set up settings, got to "`File -> Options`"

A new dialog will appear to set up the options described in the following chapters:

4.4.1 New Project Defaults

Default project settings are automatically applied when creating a new project. You can set your own company name as the issuer or a default Composition Playlist (CPL) content kind (e.g. feature, trailer etc.). It's also possible to change the default project type from SMPTE to InterOp.

The Use Reel View for DCP options defines the default view to be used when starting easyDCP Creator. When checked it will use the reel view that has always been present in easyDCP Creator. When unchecked the timeline view introduced in easyDCP Creator 3.5 will be used.

No matter of the default setting, the view in use can be toggled at any time during the workflow using the View menu in the menu bar and toggling the Timeline entry or by pressing Ctrl + T.
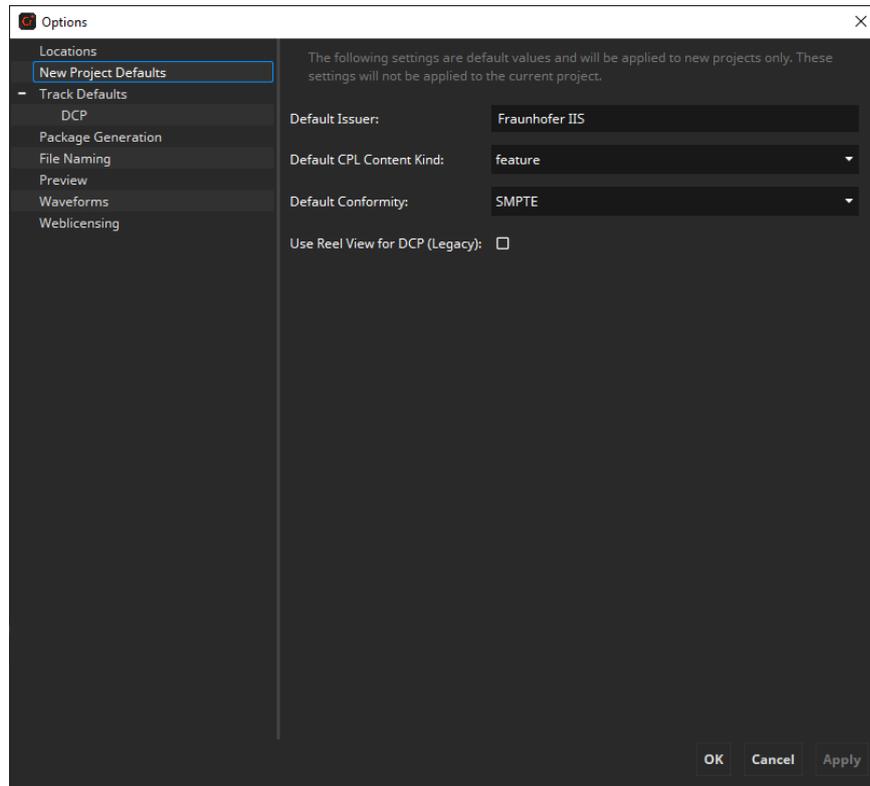
These settings are default values that will be applied to new projects only. They will not be applied to the current project.
Exception is the "Use Reel View for DCP" option which just requires a restart of the easyDCP Creator to take effect. To switch between timeline/reel view during runtime check the info box above.

4.4.2 Track Defaults

Default Track settings are automatically applied when adding new Tracks to a project.
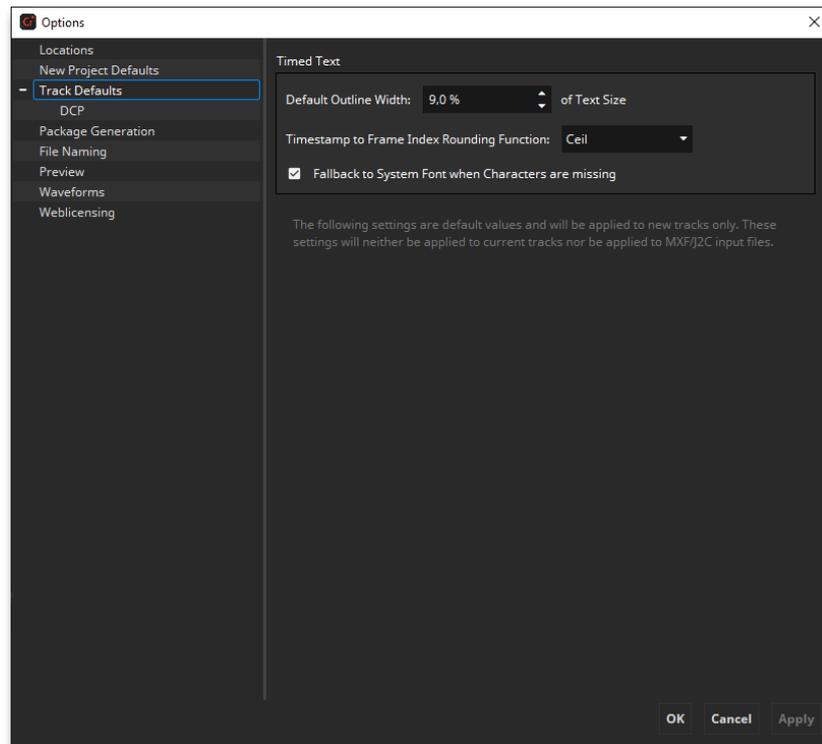
4.4.2.1 Common Defaults

Default Outline Width

The outline thickness for timed text is not defined in the specifications. With this setting, the default outline thickness can be configured and will be applied to new Timed Text Tracks.

> This setting only affects the way timed text is rendered in easyDCP Creator. Unless timed text is burnt into the images, this setting will not affect how a cinema server renders the outlines.

Timestamp to Frame Index Rounding Function

The rounding mode influences in some cases at which exact frame index a subtitle appears or disappears.

> This setting only affects the way timed text is rendered in easyDCP Creator. Unless timed text is burnt into the images, this setting will not affect how a cinema server renders the timed text.

Fallback to System Font when Characters are missing

If characters are missing in the loaded font and this option is enabled, missing characters will be replaced with characters from a similar font.

> This setting only affects the way timed text is rendered in easyDCP Creator. Unless timed text is burnt into the images, this setting will not affect how a cinema server renders the outlines.

> These settings are default values and will be applied to new Tracks only. They will not be applied to already present Tracks.

4.4.2.2 DCP

Default Color Transformation

Specify here which default source color space or color transform should be assumed for new Picture Tracks. The destination color space when selecting "Color Spaces" always is XYZ.

> The "Overrides auto-detected color spaces" option disables auto-detection of color spaces and will always use the configured Source Color Space. When disabled the selected Source Color Space is chosen when the color space can't be determined automatically.

Default Letterboxing

Specify here which letterboxing mode, if any, should be used for new Picture Tracks. If "Automatic" is chosen, easyDCP Creator will choose a best fit for the project type and the input material.

> These settings are default values and will be applied to new Tracks only. They will not be applied to already present Tracks.

Sign Language Code

Specify here which language the default for the sign language tracks shall be. This settings effects only sound tracks containing sign language.

Default language empty subtitle

Specify the default language being used for new empty subtitles. It is possible to specify the language separately for InterOp and SMPTE subtitles.

Burn-in subtitle color space

Specify the default color space used for subtitles that get burned-in. They will be converted from the source color space to XYZ during burn-in.

> These settings are default values and will be applied to new Tracks only. They will not be applied to already present Tracks.
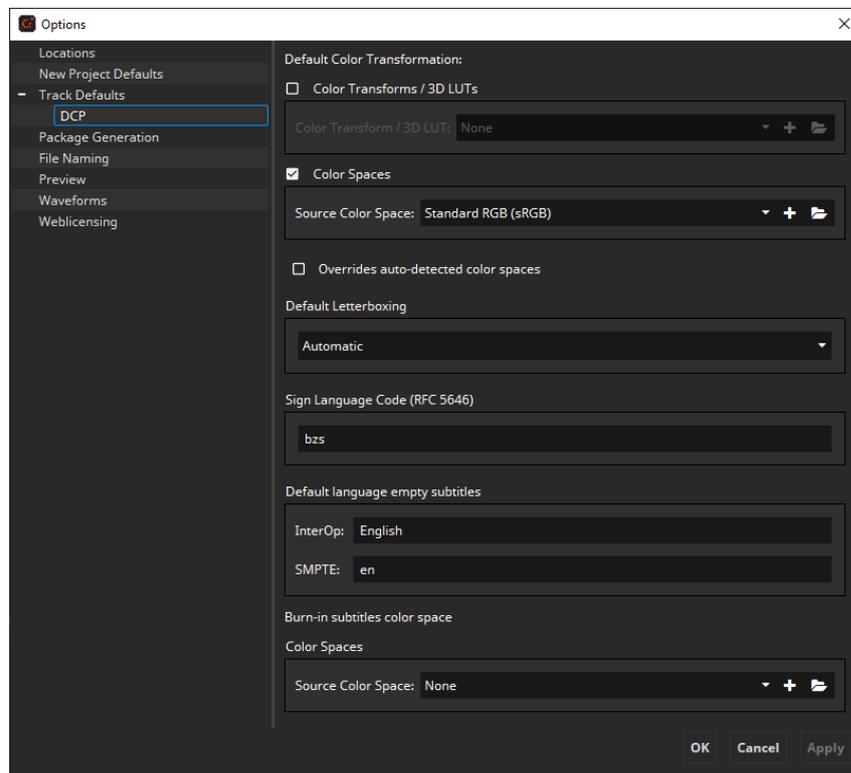
4.4.3 Package Generation

With the package generation options you are able to modify the way images will be processed during DCP generation.
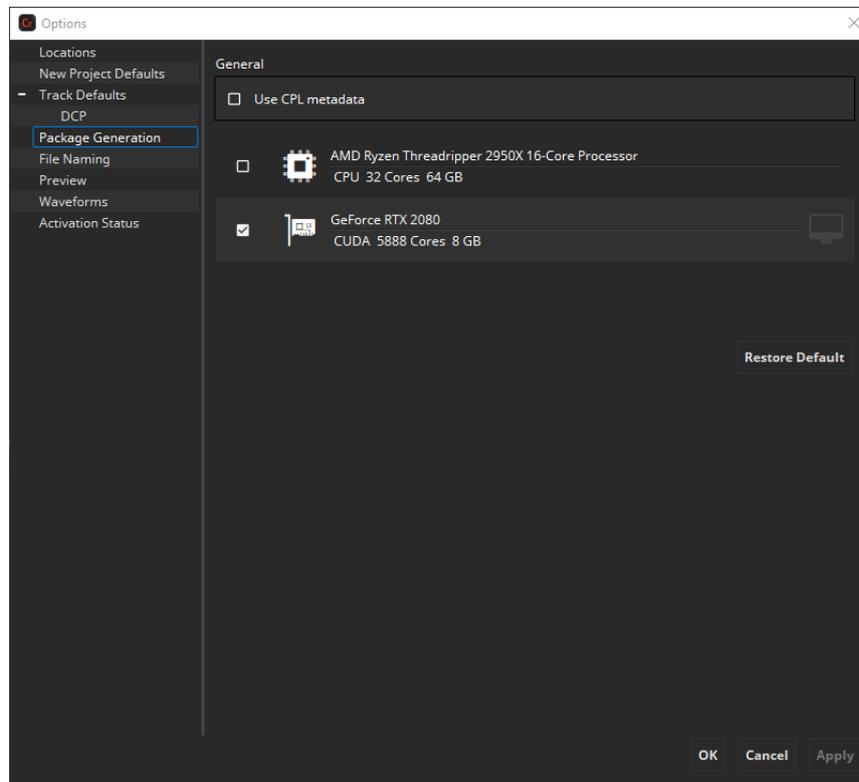
Use CPL metadata

SMPTE DCPs can contain additional metadata in the CPL. Enabling this option will add these information some servers might show then.

CPU/GPU Encoding

Choose whether you want to use the CPU or GPU for encoding of the JPEG 2000 images.

GPU encoding is only available on Windows.

4.4.4   File Naming

In the File Naming pane, you may specify how the files of a generated DCP shall be named. When ingesting a DCP into a cinema server, the file names are often not even displayed, but only the Composition Content Title. Adjusting the naming scheme is optional.

There are two presets available, but it's also possible to define your own file naming presets.

UUID – By default, the names of all generated files (except VOLINDEX and ASSETMAP) are composed of its UUID and default suffix, e. g. "CPL_feae1e80-0760-4c0f-a806-53414bcc8dab.xml" or "2a3d577d-0ace-482a-bb60-61b5ebbd5ba4_j2c.mxf".

Content Title – The names of all generated files (except VOLINDEX and ASSETMAP) are composed of its Content Title, Reel number, UUID and default suffix, e. g. "CPL_MovieTitle_TRL1_3D_48_F133_OV_feae1e80-0760-4c.xml" or "MovieTitle_TRL1_3D_48_F133_OV_Reel1_2a3d577d-0ace-48_j2c.mxf".

Custom – When this preset is selected, you can customize your own file naming via the placeholders shown in the usage.
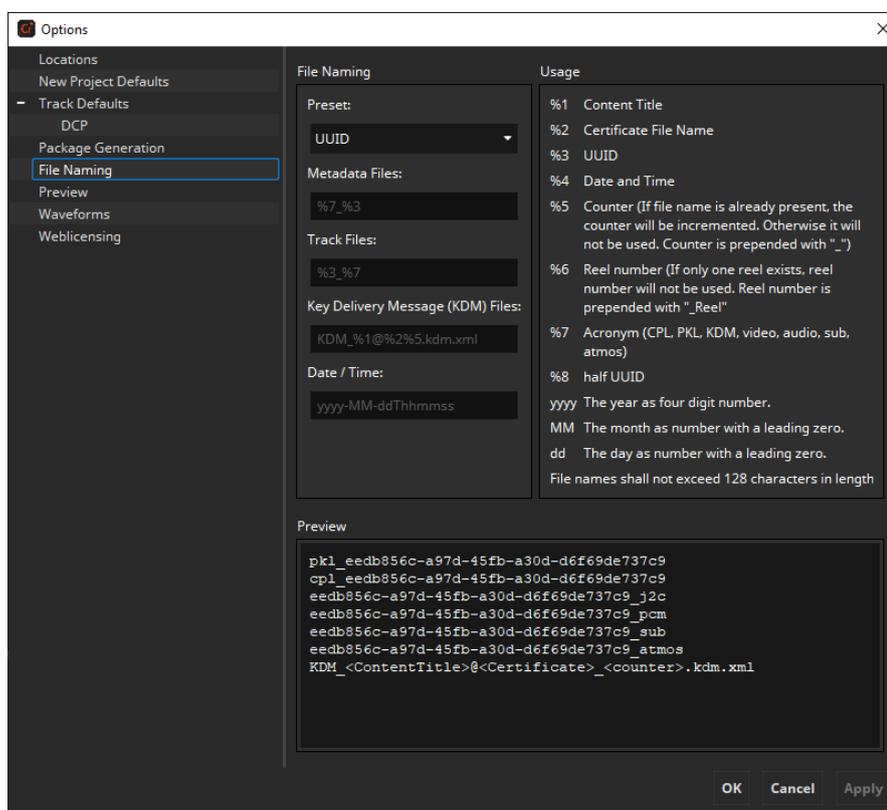
4.4.5 Preview

In the Preview pane you can select the Color Space that will be used for the thumbnails in the timeline as well as the preview. If a color transform isn't available from the source to the timeline color space, the source color space will be shown.
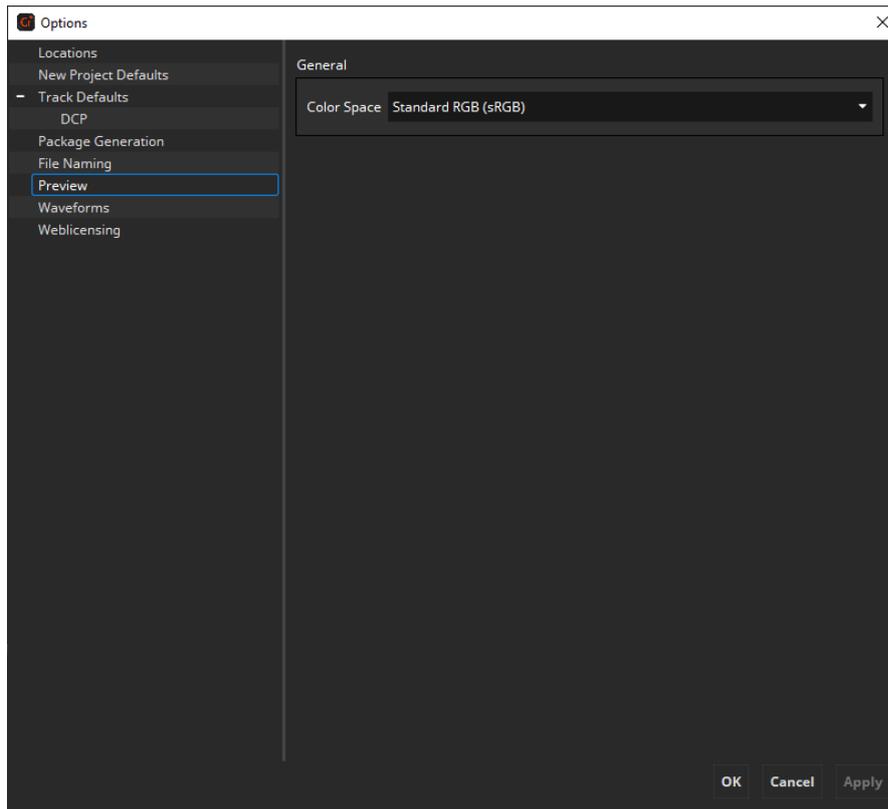
4.4.6 Activation Status

In the Activation Status pane you see all your license and certificate information. You can see the Licensee and the certificates in the upper area and show the details by clicking the "Details…" button next to them.

A new license or certificates can be requested and imported using the "Request License & Certificates" and "Import License & Certificates" buttons.

> Activation Status in only available in Demo mode and when importing an offline license.
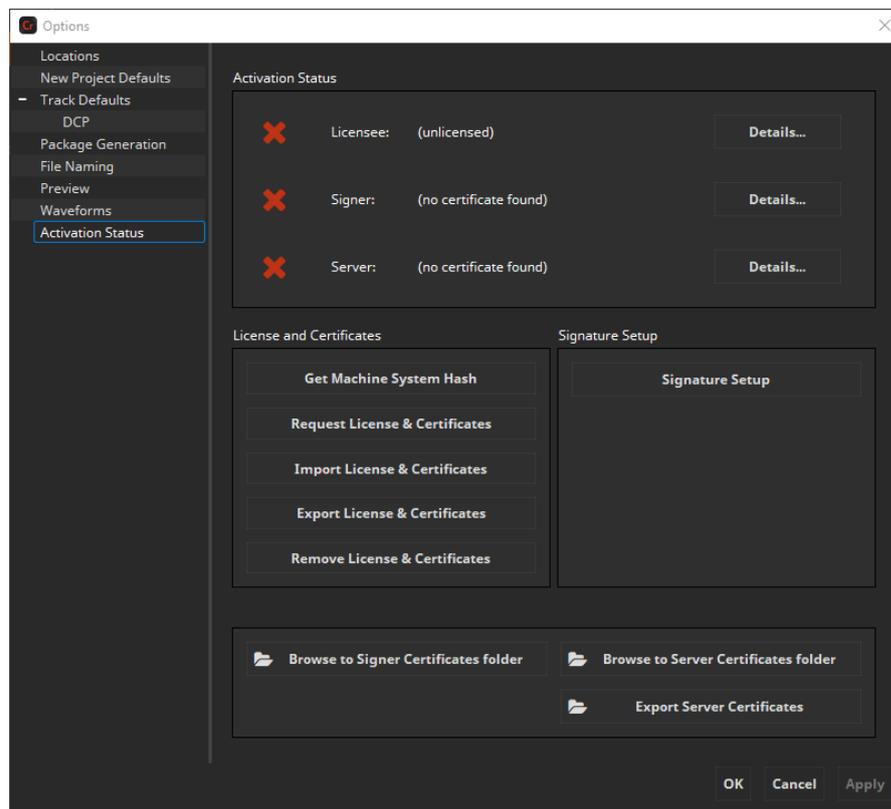
4.4.7 Weblicensing

In the Weblicensing pane signature can be set up and server certificates can be exported.

Weblicensing in only available in online mode.
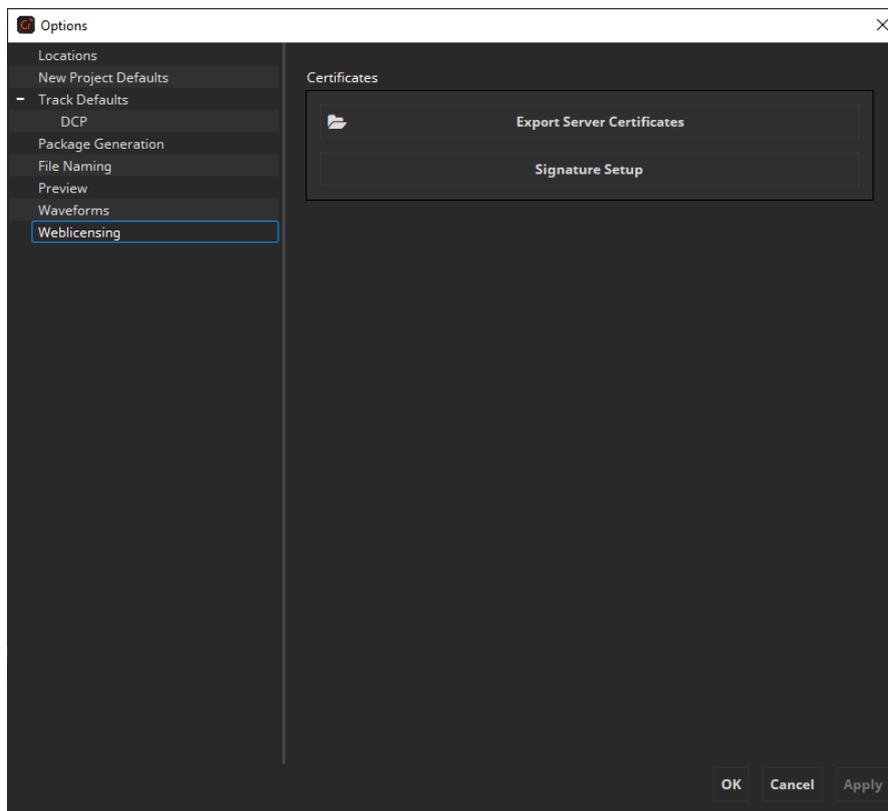
4.5 Undo/Redo functionality

Starting with easyDCP Creator 3.8 it is possible to revert/redo changes done to the project. Undo is triggered with Ctrl/Cmd + Z, redo with Ctrl/Cmd + Y. It's also possible to use the UI for it. There you find the option in the Edit menu. That will also show you which action will be reverted/redone.

Below you can find lists of covered and uncovered features.

Covered functionality:

- Changing PKL/CPL title

- Changing issuer

- Changing issuer language

- Changing CPL content kind

- Timeline

    o Adding clips

    o Removing clips

    o Moving clips

    o Split

    o Insert

    o Add Silence Sound Track

    o Add Empty Subtitle

    o Pre-/append Black Frames

    o Switching composition

    o Adding/removing compositions

- Track Manager

    o Adding/removing tracks to/from the track manager

    o Changing track annotation text

    o Changing letterboxing

    o Changing color space/transform

- o Changing supplemental state

- o Changing encryption

- o Changing subtitle burn-in state

- o Changing subtitle display type

- o Changing sign language

- o Changing audio configuration

- Compositor

  - o Adding/removing tracks

  - o Moving reels

  - o Adding/removing reels

  - o Adding/removing compositions

  - o Duplicate Reel

Uncovered functionality:

- Compositor

  - o Changing offset/duration of tracks

5   Track Manager

On the left side of the main window you can find the Track Manager. Content, which should be part of a package, must be added to this Track Manager first in form of Tracks.

A Track is the smallest building block of a DCP and represents either

- an image sequence

- an image still picture (which gets internally multiplied for a given duration)

- a sound Track comprised of either a multi-channel audio file or a multiple mono-sound files (or a combination thereof)

- or timed text (Open/Closed Subtitles/Captions).
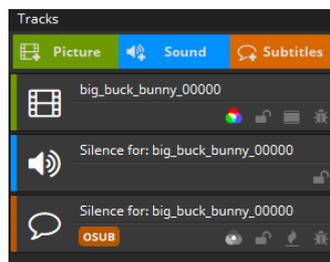
Tracks are just references, "pointing" at the original source files. Do not move or rename the source files after you have imported them. Each Track that is used in at least one Reel will become a single file in the created DCP. Tracks may have a description (i.e. Annotation Text) and a specific encryption key.

Tracks that are not used anywhere will automatically be omitted.

When you have a DCP with many Tracks, it is convenient to search for a Track by title or by type using the bar at the bottom:
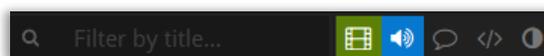
5.1 Picture Tracks

5.1.1 Add Picture Track

To add a picture sequence to the Track Manager, just click the "Picture" button at the top of the Track Manager or simply drag and drop files onto the Track Manager or directly into a Composition. You can also add a picture track using the main menu navigating through "`Track -> Add Picture Track…`".

Depending on the amount of image files in the selected directory, both browsing and opening an image file sequence may take some time.

easyDCP Creator will take the selected picture file as the first frame for the Picture Track and will also pick all subsequent images (of this format) in the same folder which belong to the sequence. If the fifth picture file (e.g. big_buck_bunny_00004.j2c) of this image sequence is selected, the imported Picture Track will start at this fifth picture and the first four pictures will be ignored.

According to the DCI standards, the duration of a DCP has to be at least one second. The amount of frames varies, depending on the current project's frame rate (e.g. 24 frames for 24 fps). If you open an image file sequence with duration less than one second, an error will be shown for the reel and before generation.

Furthermore, each picture in a sequence is required to have the same resolution.

5.1.2 Add Stereoscopic Picture Track

To add a Stereoscopic Picture Track select "`Track -> Add Stereoscopic Picture Track…`" in the main menu. The following dialog will open:
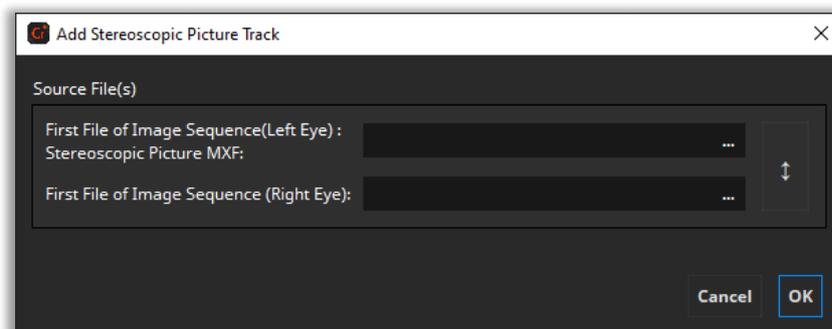
To add a stereoscopic picture Track to the Track Manager, just choose separate file sequences for each eye, i.e. one file sequence for the left eye and one file sequence for the right eye. Both file sequences are required to have the same number of files, resolution and format. Usually, these file sequences should be in different folders. If you want to load a stereoscopic MXF file, load it in the left-eye-field and leave the one for the right eye empty.

If a Picture Track is stereoscopic is signaled by the 3D indicator of the Picture Track.
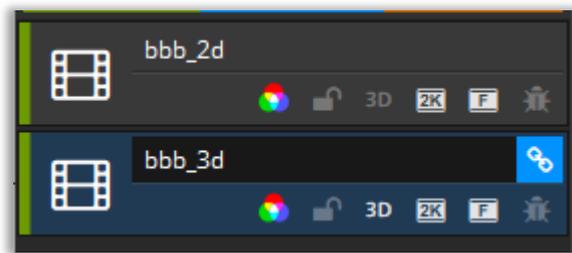
5.1.3   Numbering of input image file sequences

To represent an image sequence, the image files shall be numbered with or without leading zeroes (see Examples 1 and 2). Additionally, the prefix may also contain digits (see Example 3).

Example 1 (with leading zeroes)

```
Img_0000001.DPX
Img_0000002.DPX
Img_0000003.DPX
Img_0000004.DPX
…
```

Example 2 (without leading zeroes)

```
Pic_998.J2C
Pic_999.J2C
Pic_1000.J2C
Pic_1001.J2C
…
```

Example 3 (with numbers in filename)

```
Pic2001_998.TIF
Pic2001_999.TIF
Pic2001_1000.TIF
Pic2001_1001.TIF
…
```

5.1.4 Add Still Picture Track

A Still Picture Track is a convenient way to show small local advertisements.
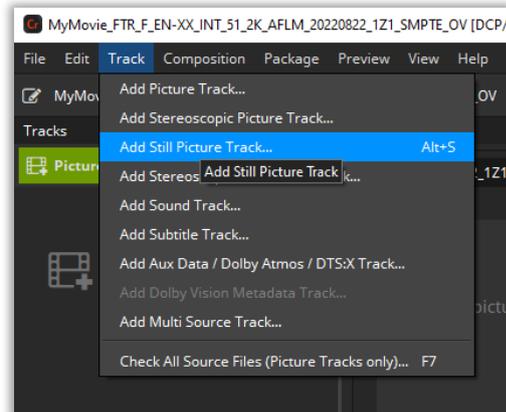
To add a Still Picture Track or Stereoscopic Still Picture Track to the Track Manager, select either "`Track -> Add Still Picture Track…`" or "`Track -> Add Stereoscopic Still Picture Track…`" in the main menu.

The following dialog will appear. For the stereoscopic case a similar dialog will appear with an additional input for the right eye still image.
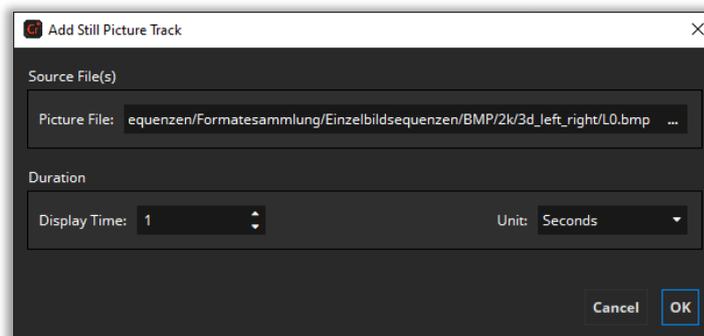
Now you can choose a picture file and a display time in seconds that defines how long the picture will be displayed on screen.

After pressing „OK", the still picture will be added to the Track Manager. The frame count of the still picture will be calculated automatically, depending on the current project's frame rate.

5.1.5 Supported Image File Resolutions

A DCP typically has one of three aspect ratios:

Aspect Ratio	2K	4K
Full Container	2048 x 1080	4096 x 2160
Scope (2.39:1)	2048 x 858	4096 x 1716
Flat (1:85:1)	1998 x 1080	3996 x 2160

In theory, other resolutions are valid as well. The DCI specifications state that at least one side must fill out the full container. However, for best interoperability you are recommended to stick to one of the above aspect ratios.

If your input images do not already have any of the above resolutions, they can be scaled and/or black bars can be added at the sides. The next chapter describes the various options in more detail.

5.1.6 2K/4K Container Resolution

The Container Resolution property defines the full container resolution of the Picture Track that is used as target for Letterboxing & Scaling. To create a 2K DCP the Container Resolution must be set to 2K for all Picture Tracks used in the DCP.

The Container Resolution of all Picture Tracks in a Composition must be set to the same Container Resolution. A DCP can be composed of multiple Compositions with different Container Resolutions (2K/4K).

When adding a Picture Track, easyDCP Creator will automatically preselect 2K for all sources with a resolution smaller or equal 2K. For sources with greater resolutions 4K will be preselected.

The Container Resolution can be changed via the property menu. Changing the Container Resolution may also be required to create a 2K DCP from a 4K source or vice versa.
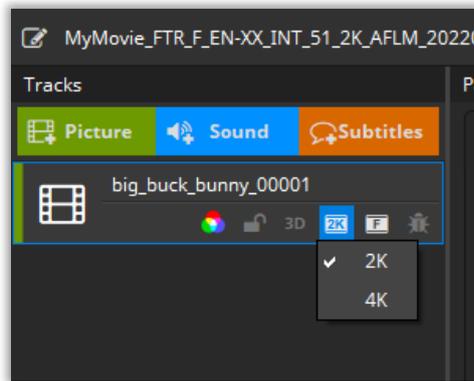
5.1.7 Letterboxing & Scaling

Pillarboxing is the process of adding black bars ("pillars") at the left and right sides.

Letterboxing is the process of adding black bars on the top and bottom.

By default, all input images will be pillar- or letterboxed to Flat, Scope or Full container, whichever is the closest match.

Example: if the source material were in HD (1920x1080), narrow black bars (each 39 pixels wide) would then be added to the left and right so that the DCP's aspect ratio becomes "Flat" (1998x1080).

This ensures that all sequences within a multi-Reel Composition will have identical resolutions and that the Composition has a DCI-compliant aspect ratio that will playback as expected on a D-cinema server. Many servers only have presets for "Flat", "Scope" and "Full". Selecting the correct preset is often required in order for the timed text to be properly positioned and for the curtains to be aligned exactly at the image's left and right edges.

Of course you may manually override the automatic mode and pick any other strategy.
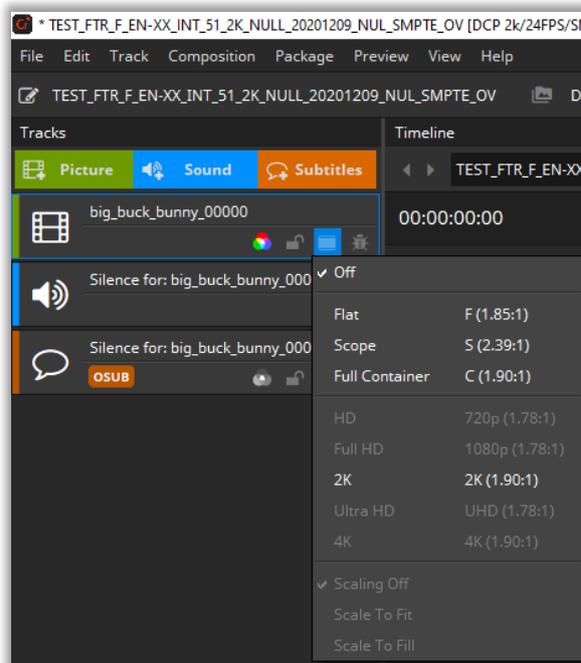
If scaling is set to **Scaling Off**, no scaling will be applied.

Scale To Fit will scale the image so that it completely fits the target resolution, but without any cropping. Black bars will probably have to be added to reach the target resolution. The aspect ratio of the input image will not be changed.

Scale To Fill will scale the image until the target resolution is reached in both width and height. No black bars will be added. In case the scaled width or height then stretches beyond the target resolution, parts of the input image will then have to get cropped. The aspect ratio of the input image will not be changed.

Regardless which combination of boxing or scaling options is selected, the input image sequences' native aspect ratio will always be maintained so that images will never get disproportionally distorted.

5.1.8 Color Processing

In a DCP, all images are required to be in the "XYZ (DCI)" color space with a gamma of 2.6. Since the input material imported into easyDCP Creator is typically not in this color space, but often in RGB, all images have to be color processed. In case the imported image sequences are in the right color space, e.g. when you are importing JPEG2000 codestream files (*.j2c) from an existing DCP, color processing can be bypassed by setting the source color space to

"XYZ (DCI)". This will also have a positive impact on the DCP render performance.

In easyDCP Creator, color processing can be done via selection of

- a color transformation XML file preset (*.xml),

- a user generated 3D lookup table file (*.3dl) or

- source and destination color spaces XML file presets (*.xml),

If color processing is activated, you see a small icon on the track. If color transformation is bypassed, the color processing icon is absent.

In easyDCP Creator the color processing is specified individually for each picture Track. To do so, right click on a picture Track and select "Color Processing" or simply click the picture Track's color space button:
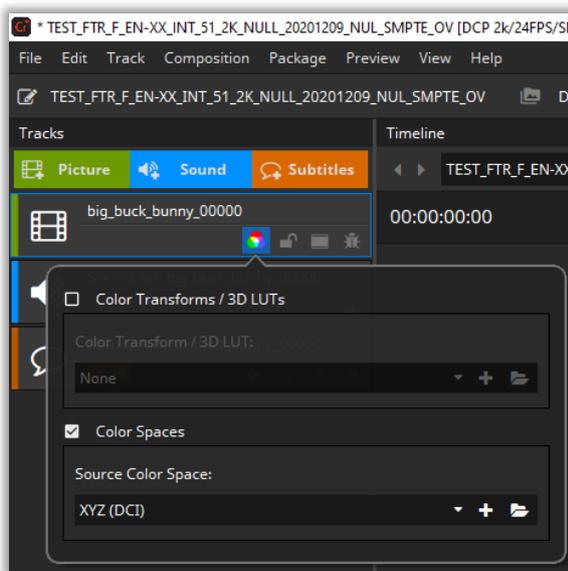
Color Transform Presets

In versions prior to 3.3.2, color transforms were of the form "*source space -> target space*". Each transform is represented by a file in the color transform repository. They use a proprietary XML format. The files can be edited and new ones can be added. These types of color transforms are still available for backwards compatibility. In the screenshot above, select the "Color Transforms / 3D LUTs" group box. The repository can be opened by clicking the folder icon. New files or 3D LUTs (*.3dl) can be added with the plus icon.

5.1.8.1 ITU 709 to XYZ Color Transformation (default)

Using this chain assures a DCI compliant processing of the input images. easyDCP Creator takes care about the color transformation and JPEG 2000 encoding. EasyDCP Creator expects RGB images with a sRGB/709 color gamut. Use this chain if you don't want to take care about color spaces and format conversions.

Note: The color transformation from linear RGB to linear XYZ uses the matrix defined in SMPTE RP177 Annex B.3, as sRGB/709 has other primaries and white points than the reference projector.

Input values:

The ranges of values describing the white level and the black level of the ITU 709 standard are not utilized. This means that black is represented by a value of 0 by each component. On the other hand white is represented by the maximum value of the file format.

Example 1:   TIFF files with 8 bits => Maximum value = $2^8 - 1 = 255$
Range [0..255]

Example 2:   DPX files with 10 bits => Maximum value = $2^{10} - 1 = 1023$
Range [0..1023]

Normalization and Degamma:

Using the given input values easyDCP Creator normalizes the input values and applies a de-gamma of 2.2

Color Transformation:

The ITU 709 color values will be converted to XYZ color space using the primaries shown in the following table.

D65 – ITU 709/sRGB		x	y
	R	0,6400	0,3300
	G	0,3000	0,6000
	B	0,1500	0,0600
	W	0,3127	0,3290

Gamma and De-normalization:

In this step a fixed gamma of 2.6 will be applied on the normalized XYZ values. Afterwards a de-normalization step will map the bit-range to 12 bit output values which is necessary for the correct JPEG 2000 encoding.

What input data characteristics should the R'G'B' pixels have?

easyDCP Creator uses full input range, means e.g. for 10 Bit 0..1023 code values (black is 0, white is 1023).

R'G'B' means a gamma of 2.2 is applied to the linear RGB values.

The color gamut of the RGB values should be sRGB/ITU 709 with D65 white point.
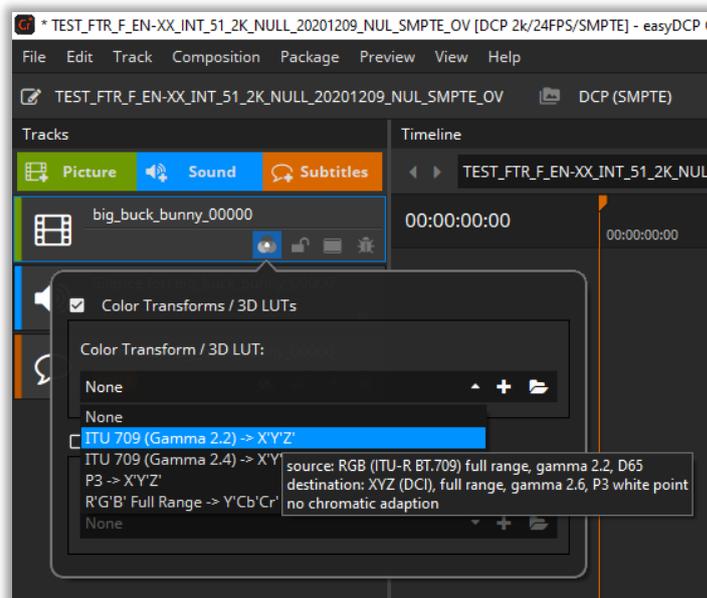
5.1.8.2 3D Lookup Table (3D LUT)

3d lookup tables can combine complex image processing steps, hence speeding up image processing.

To choose a 3d lookup table for a specific Picture Track, right-click on the Picture Track and choose "`Color Processing -> 3D Lookup Table…`":

To ensure that lookup tables have the correct file format, check the example 3d lookup tables, delivered with this software in the folder „Example Lookup Tables".

5.1.8.2.1 Supported 3D Lookup Table File Formats

Unfortunately there are no established standards for lookup tables. easyDCP Creator will read the most popular „3dl" files. The supported file formats are:

```
ASCII File Format
Bit Depth: 1..16
Supporting Points: 2..128
```

XML file format as well as floating point values are not yet supported.

5.1.8.3 Bypass Color Processing

Bypassed color processing is used if the source image files already are in the right color gamut.

To bypass color processing for a specific Picture Track, right-click on the Picture Track and choose "`Color Processing -> XYZ`":

Color Transformation has to be bypassed if you want use direct copying of the source image files into the final DCP without re-encoding. For proper metadata you sometimes need to select and identity color transformation by selecting the same source and destination color space.

5.1.9 Export Frames to JPEG 2000 Codestream (J2C) Files

To export the source image files of a specific Picture Track, right-click on the Picture Track and choose "`Export Frames…`":
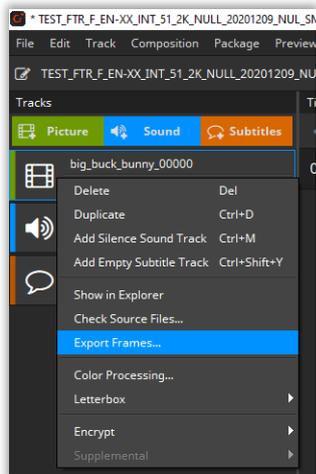
After pressing „`Export Frames…`", the easyDCP Standalone JPEG 2000 Transcoder comes up:
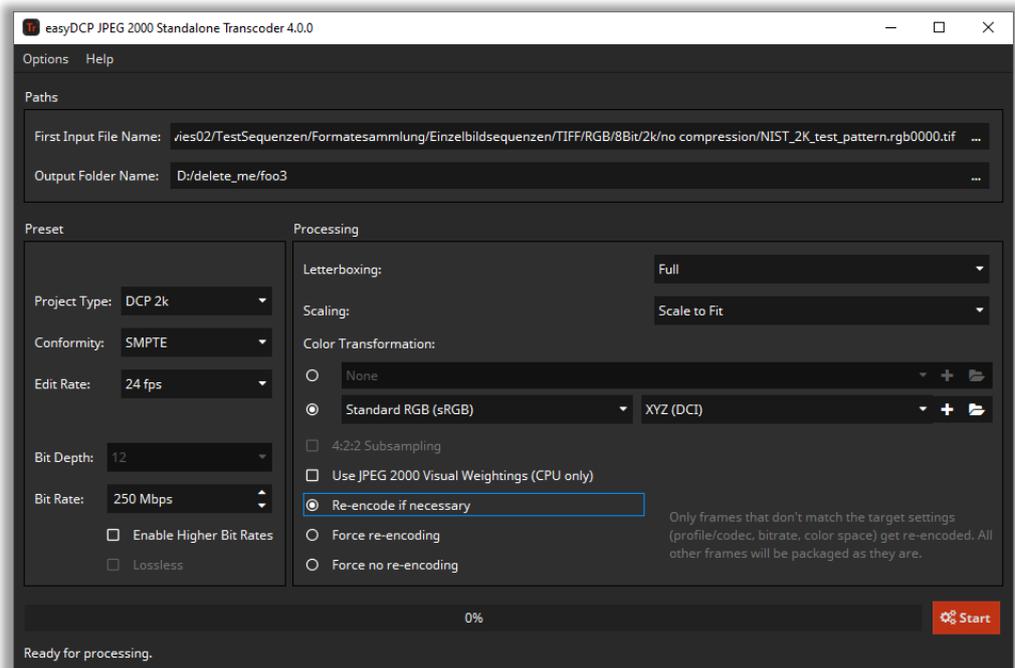
Several settings are obtained from the current easyDCP Creator project (e.g., resolution, stereoscopic or not, InterOp or SMPTE, framerate, color processing, pillar-/letterboxing, scaling, bitrate).

Choose an output folder where the processed image files will be stored. Press Start to start the processing.

5.2 Sound Tracks

The audio format of a DCP is specified to be:

- uncompressed

- 24 bits per sample

- Sampling rate of 48 KHz (or 96 KHz)

- Up to 16 Channels

easyDCP Creator will automatically convert any supported input (see 5.2.6 Supported Sound File Formats) to match the specification.

5.2.1 Add Sound Track

To add sound material to the Track Manager, click the "Sound"-button on the top of the Track Manager or use the main menu "Track -> Add Sound Track…".

The following dialog will appear where you can load one or more single- or Multi-channel files that will be combined into a sound Track.
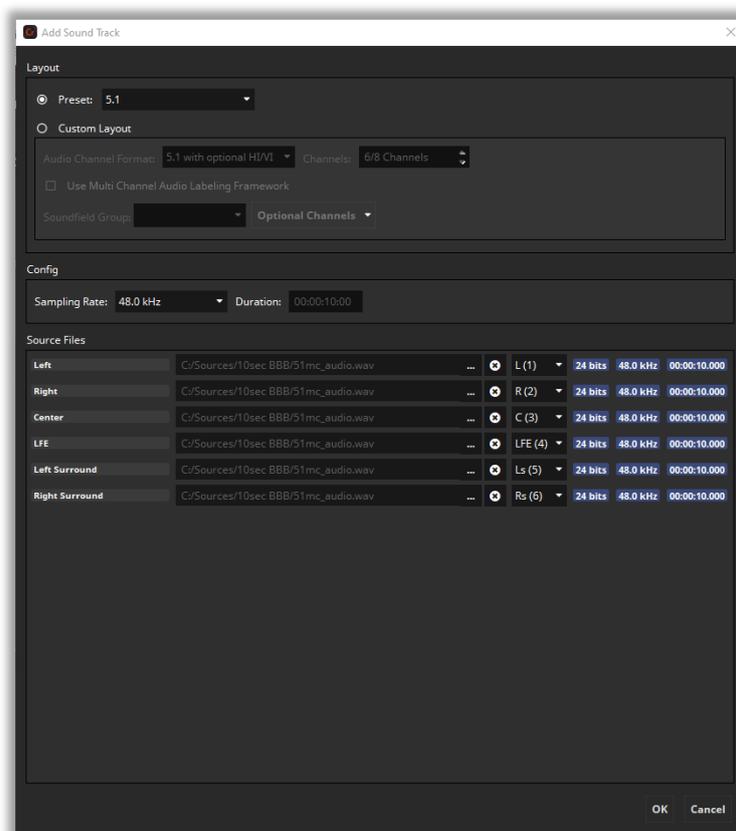
5.2.1.1 Layout

The *Add Sound Track* dialog offers two modes to set the channel layout of the Sound Track.

Preset – In this mode a layout can be chosen from a predefined set of configurations. The values in the custom layout section will be updated according to the selected preset.

Custom Layout – This mode gives more control over the layout configuration. Depending on the variant set in the project configuration it allows to set the *Audio Channel Format* and channel count or a *Multi Channel Audio Framework* labeling.

InterOp and SMPTE Audio Channel Format *Wild Track Format* do not define a channel layout. In this case easyDCP Creator will fall back to and display the default layout defined in *ISDCF Document 4 – Audio Channel Assignments*.

5.2.1.2 Config

The Config section can be used to set additional parameters of the Sound Track that are not part of the channel layout.

Sampling Rate – The target audio sampling rate of the Sound Track in the DCP. Supported options are 48 kHz and 96 kHz.

Sources with different sampling rate will be converted to the selected target sample rate.

Duration – If any source is present, this will display the duration of the Sound Track and edit will not be possible. In case no source is present the duration of the then silent Sound Track can be set.

5.2.1.3 Source Files

In the Source Files section one or multiple source files can be added either via drag & drop or a file browse dialog. If a file contains multiple channels, all sources for the following channels will be auto filled. Channels with existing sources will be skipped.

The first column shows the channel layout of the Sound Track as configured in the Layout section. The drop down on the right-hand side shows the detected layout of the source channels and the channel number.

The mapping of the source channels to the layout can be changed by rearranging the channels via drag & drop or by selecting the source channel via the drop-down source channel selector. If easyDCP Creator detects any channel labeling in the source, the channels will be labeled accordingly in the source channel selector.

For each channel with a source file the source metadata will be displayed. This includes sample rate, sampling depth and duration.

Channels with no source set will be filled with silence. A silence Sound Track can be created by leaving all channels empty and setting the desired duration in the Config section.

5.2.2 Multi-Channel Audio Labeling Framework

With Multi Channel Audio Labeling Framework (MCA) every used (, non-silent) channel is labeled with a specific Audio Channel Label that represents the type of the channel. Multiple channels can be grouped together by a Soundfield Group like 5.1.

Sound Tracks of SMPTE 429 DCPs may be labeled with the MCA Framework. This can be done either by selecting a MCA preset or by using the *Custom Layout* mode. With SMPTE 429 DCP the use of MCA in easyDCP Creator is currently limited to one Soundfield Group and its associated Audio Channel Labels.

Sound Tracks of RDD 52 DCPs shall be labeled with the MCA Framework. MCA is required and any preset will use MCA. Furthermore MCA cannot be disabled in the *Custom Layout* mode.

5.2.2.1 Optional Channels (RDD 52)

With RDD 52 the following optional special use-case channels exists:

Channel No.	Use Case
7	Hearing Impaired
8	Visually Impaired-Narrative
13	Motion Data
15	Sign Language Video Stream

These channels do not belong to the Soundfield Group and have to be explicitly labeled. This can be done by setting the layout mode to *Custom Layout* and switching the required Audio Channel Label on or off via the *Option Channels* menu.

5.2.3 Add Sound Track for Dolby Atmos

In case of RDD 52 the *Immersive Audio (Atmos)* preset should be used.

If a reel contains a Dolby Atmos track, the Main Sound Track has to provide a sync signal that is automatically generated on channel 14. Select one of the Dolby Atmos presets from the "Add Sound Track" dialog and mark unused channels, plus the actual sync channel 14, as silent by leaving their field empty:
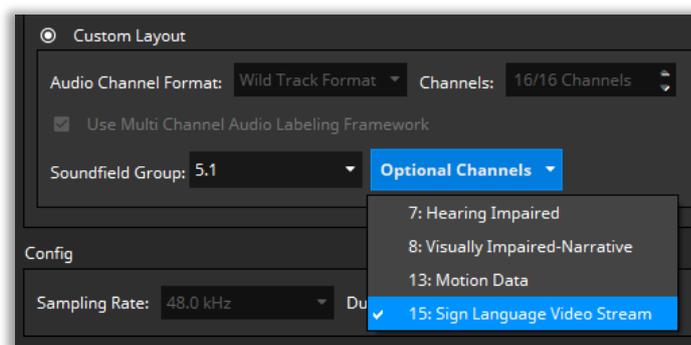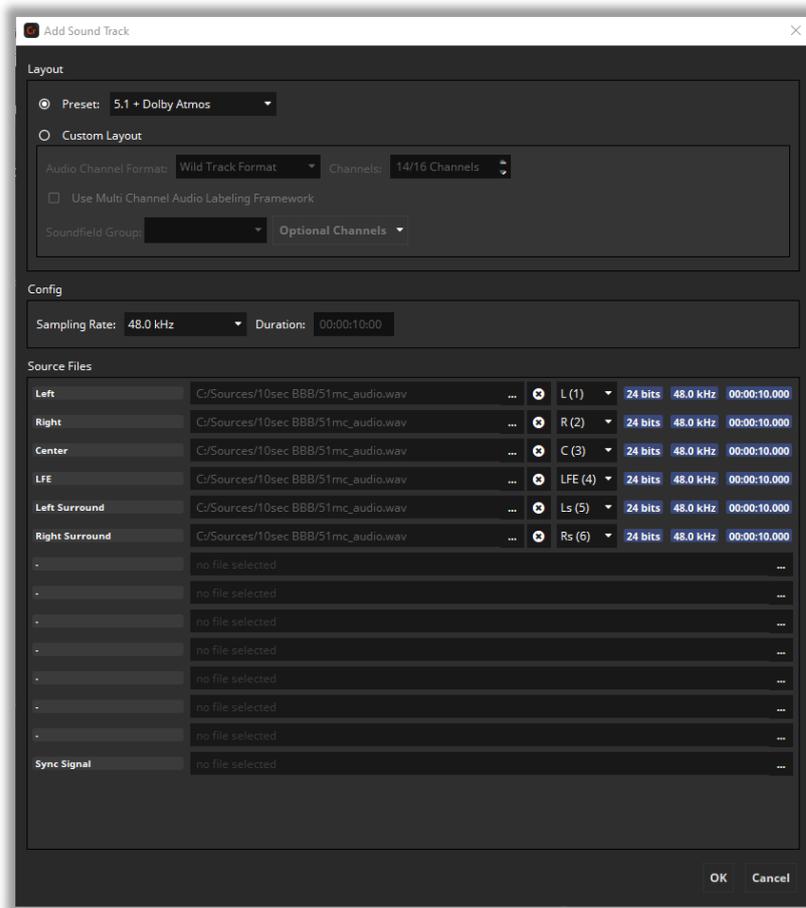
A 14 channel Sound Track will be added to the Track Manager. The synchronization signal will automatically be generated on channel 14.

5.2.4 Add Sign Language Track

> In case of RDD 52 the Sign Language Video Stream Audio Channel Label has to be explicitly set (see 5.2.2.1 Optional Channels (RDD 52)).

Brazilian Sing Language is wrapped in channel 15 of the corresponding sound track. To set it up in easyDCP Creator select the 16 Channels WTF preset from the "Add Sound Track" dialog and leave unused channels empty to mark them as silent, but put your sign language video In channel 15:
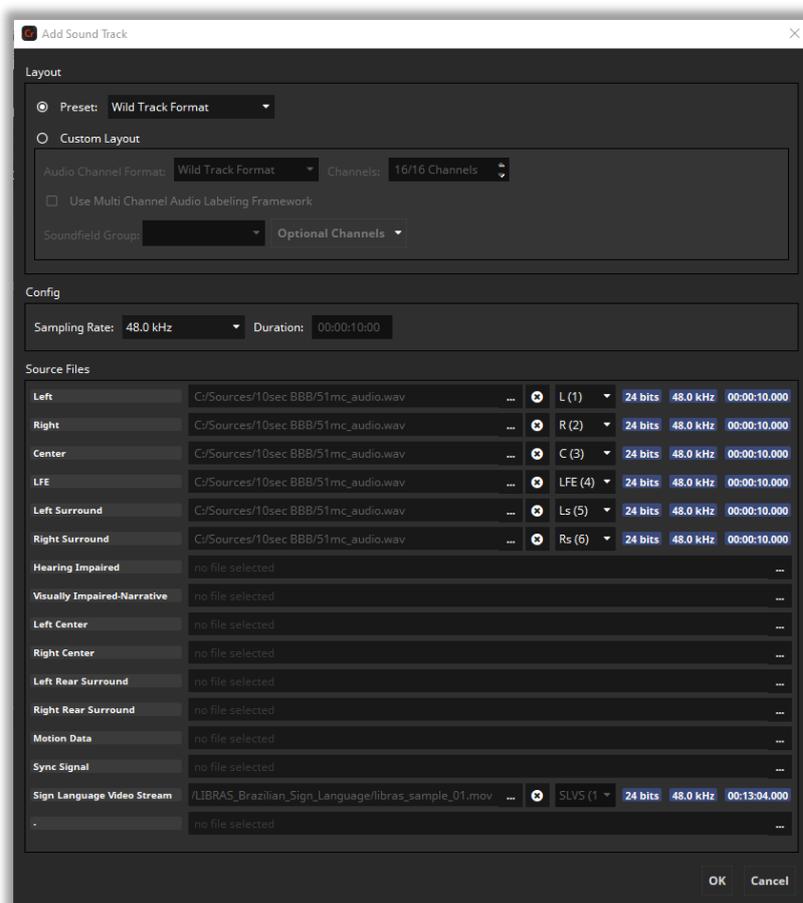
> Supported input formats for sign language video are WAV and H264 encoded videos. The resolution has to be 480x640 with 24 fps.
>
> For details check ISDCF Document 13.

5.2.5   Edit Sound Track

easyDCP Creator allows to edit the configuration of existing Sound Tracks added by the user or loaded from an existing DCP. Editing can be accessed by `"Edit Audio Sources"` from the Sound Track context menu.
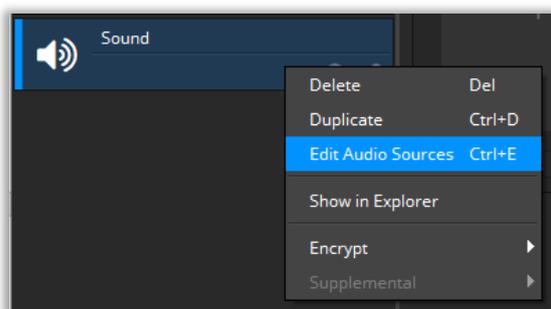
This will open the Add Sountrack Dialog. *OK* to apply or *Cancel* to revert any changes.

> The layout mode will be automatically set to *Custom Layout* if the Sound Track was loaded from a DCP or the *Variant* of the DCP was changed via the *Project Configuration*.

5.2.6   Supported Sound File Formats

easyDCP Creator supports the following audio codecs and file formats:

Uncompressed PCM	*.wav, *.wave, *.mov, *.mp4, *.mxf
Advanced Audio Coding	*.aac, *.mov, *.mp4
MPEG-1/2 Audio Layer III	*.mp3, *.mov, *.mp4
Audio Interchange	*.aiff, *.aif
Broadcast Wave Format	*.bwf

5.3 Subtitle Tracks

5.3.1 Add Subtitle Track

To add timed text to the Track Manager, click the quick button "Subtitle" on the top of the Track list. The word "subtitle" is used here as a synonym for **timed text**.

Subtitle is only one example of timed text. The other example is **Captions**. Both subtitles and captions can be either **Open** or **Close**. This yields four combinations:

- Open Subtitles

- Closed Subtitles

- Open Captions

- Closed Captions

Open subtitles or captions will be displayed on the main screen and be visible to everyone in the audience, while *Closed* subtitles or captions are meant to be displayed on secondary screens available on demand.

Subtitles usually translate only the spoken words, while *Captions* are meant to aid deaf and hearing-impaired audiences and often also describe background sounds ("classical music is playing in the radio").

While a DCP with *InterOp* conformity only supports Open Subtitles, a SMPTE DCP allows all four combinations.

5.3.2 Supported Subtitle File Formats

Currently easyDCP Creator does not support converting between timed text formats.

When creating a DCP with InterOp conformity, the source is required to be in the *Texas Instruments CineCanvas* format, which is based on XML.

When creating a DCP with SMPTE conformity, the source is required to be in the *SMPTE 428-7 D-Cinema Distribution Master – Subtitle* format, which is also based on XML. Both formats are explained in more detail in the next two chapters.

5.3.2.1 Texas Instruments CineCanvas (InterOp)

Interop compliant subtitles are based on the "Subtitle Specification for DLP Cinema™ Projection Technology" published by Texas Instruments. The default file extension is „.xml". The XML root node is "DCSubtitle".

An Interop compliant subtitle XML file should look like the following example:

```xml
<?xml version="1.0" encoding="UTF-8" ?>
 <DCSubtitle Version="1.0">
   <SubtitleID>97fd79ed-b2ff-468c-b11f-1a3792fc90dc</SubtitleID>
   <MovieTitle>Example Movie Title</MovieTitle>
   <ReelNumber>1</ReelNumber>
   <Language>English</Language>
   <!-- For testing this subtitle example, you need to copy a font file (e.g.
"arial.ttf") right next to this XML file. -->
   <LoadFont Id="arial" URI="arial.ttf" />
   <Font Id="arial" Color="FFFFFFFF" Effect="shadow" EffectColor="FF000000"
Size="42">
    <Subtitle SpotNumber="1" TimeIn="00:00:02:000" TimeOut="00:00:07:000"
FadeUpTime="2" FadeDownTime="2">
     <Text HAlign="center" VAlign="bottom" VPosition="10.00">Example Subtitle Text
One with LoadFont.</Text>
    </Subtitle>
    <Subtitle SpotNumber="2" TimeIn="00:00:08:000" TimeOut="00:00:12:000"
FadeUpTime="2" FadeDownTime="2">
     <Text HAlign="center" VAlign="bottom" VPosition="10.00">Example Subtitle Text
Two with Loadfont.</Text>
    </Subtitle>
   </Font>
</DCSubtitle>
```

```
<DCSubtitle Version="1.0">
```

The DCSubtitle tag indicates the root of the XML subtitle file. It includes the attribute version. The version is an optional attribute. If not specified, the projector will assume the latest version.

`<SubtitleID>`

> The value of the SubtitleID tag is a hexadecimal Universally Unique Identifier (UUID). To generate a UUID there are several UUID generators available. easyDCP Creator will generate a new random UUID during packaging.

`<MovieTitle>`

> The MovieTitle tag contains the name the title of the movie in which the subtitle shall be embedded.

`<ReelNumber>`

> The value of the ReelNumber tag indicates the Reel that subtitle was generated for.

`<Language>`

> The value of the Language tag indicates the subtitle language.

`<LoadFont>`

> This field is optional. If present, easyDCP Creator will try to find the font file and packs it into the DCP. The font file must not be larger than 640kB.

`<Subtitle SpotNumber="1" TimeIn="00:00:01:000" TimeOut="00:00:05:000" FadeUpTime="20" FadeDownTime="20">`

> The Subtitle tag indicates the beginning of a specific subtitle. The tag contains the following attributes and attribute-values:

`SpotNumber`

> The SpotNumber identifies a particular subtitle location. The number is user definable.

`TimeIn`

> The value of the TimeIn attribute indicates the first appearance of the subtitle. The formatting is HH:MM:SS:TTT (H=hours, M=minutes, S=seconds, T=ticks). The ticks can take the values 0-249, where one tick equals 4msec.

`TimeOut`

> The value of the TimeOut attribute indicates the complete disappearance of the subtitle. The formatting is HH:MM:SS:TTT (H=hours, M=minutes, S=seconds, T=ticks). The ticks can take the values 0-249, where one tick equals 4msec.

`FadeUpTime`

> The value of the FadeUpTime attribute defines the duration of the subtitle fade in. The formatting is TTT (T=ticks). The ticks can take the values 0-249, where one tick equals 4msec.

`FadeDownTime`

> The value of the FadeDownTime attribute defines the duration of the subtitle fade out. The formatting is TTT (T=ticks). The ticks can take the values 0-249, where one tick equals 4msec.

```
<Text Direction="horizontal" HAlign="center" HPosition="0" VAlign="bottom"
VPosition="10.00">
```

The value of the text tag is the actual subtitle text which appears on screen. The tag may contain the following attributes and attribute-values:

`Direction`

The value of this attribute indicates the direction of the rendered subtitle text. Valid values are horizontal and vertical. Default direction is horizontal.

`HAlign`

The value of this attribute indicates the horizontal alignment. Valid values are left, right and center. Default horizontal alignment is center.

`HPosition`

The value of the HPosition attribute indicates the horizontal position of the subtitle relative to the alignment value. The HPosition value is expressed as a percentage of the picture width from the edge or center according to the HAlign attribute. For example, HPosition="9.5" in conjunction with HAlign="left" implies that the text starts at a position 9.5% of the picture width from the left edge of the image. To center the text, choose HAlign="center" and HPosition="0". Default horizontal position is 0.

`VAlign`

The value of this attribute indicates the vertical alignment. Valid values are top, bottom and center. Default vertical alignment is center.

`VPosition`

The value of the VPosition attribute indicates the vertical position of the subtitle relative to the alignment value. The VPosition value is expressed as a percentage of the picture height from the edge or center according to the VAlign attribute. For example, VPosition="10" in conjunction with VAlign="bottom" implies that the text starts at a vertical position 10% of the picture height from the lower edge of the image. The vertical position specified is the baseline on which the text is drawn. Default vertical position is 0.

5.3.2.2 SMPTE Subtitle

SMPTE compliant subtitles are based on the specification "428-7 D-Cinema Distribution Master – Subtitle" published by the SMPTE for XML files or "429-5 D-Cinema Packaging – Timed Text Track" for mxf files. The xml is the raw format before packaging, while the mxf is the distribution format for unencrypted and encrypted subtitles.

A SMPTE compliant subtitle XML file should look like the following example:

```xml
<?xml version="1.0" encoding="UTF-8" ?>
<SubtitleReel xmlns="http://www.smpte-ra.org/schemas/428-7/2010/DCST">
 <Id>urn:uuid:94d3a710-b4b5-4b28-a020-eafb2f24c75d</Id>
 <ContentTitleText>Example Content Title</ContentTitleText>
 <AnnotationText>Example Annotation Text</AnnotationText>
 <IssueDate>2012-05-02T12:59:04+02:00</IssueDate>
 <ReelNumber>1</ReelNumber>
 <Language>en</Language>
 <EditRate>24 1</EditRate>
 <TimeCodeRate>24</TimeCodeRate>
 <StartTime>00:00:00:00</StartTime>
 <!-- For testing this subtitle example, you need to rename a font file (e.g.
"arial.ttf") to "5b0283b9-3c28-42a6-86ad-c22acb431665" and copy it right next to
this XML file. -->
 <LoadFont ID="Arial">urn:uuid:5b0283b9-3c28-42a6-86ad-c22acb431665</LoadFont>
 <SubtitleList>
  <Font ID="Arial" Color="FFFFFFFF" Weight="normal" Size="40">
   <Subtitle SpotNumber="1" TimeIn="00:00:02:00" TimeOut="00:00:07:00">
    <Text Valign="top" Vposition="10.00">Example Subtitle Text One with
LoadFont.</Text>
   </Subtitle>
   <Subtitle SpotNumber="2" TimeIn="00:00:08:00" TimeOut="00:00:12:00">
    <Text Valign="top" Vposition="30.00">Example Subtitle Text Two with
LoadFont.</Text>
   </Subtitle>
  </Font>
 </SubtitleList>
</SubtitleReel>
```

`<Id>`

The value of the tag "Id" is a hexadecimal Universally Unique Identifier (UUID). To generate a UUID there are several UUID generators available. easyDCP Creator will not generate a new random UUID during packaging.

`<ReelNumber>`

The ReelNumber tag denotes the ordered placement of this file in a set of DCDM Subtitle files. The value shall only be used for informative purposes and shall not influence the reproduction of the subtitle instances. The value is a positive integer in the range 1 .. n, where n is the total number of Reels in a Composition.

`<LoadFont>`

The LoadFont tag is used to declare an OpenType [ISO/IEC 14496, Part 18] font resource for use within the DCDM Subtitle file. The font is identified by a

urn:uuid in the tag's body. easyDCP Creator expects the entire external font filename to match the value of the urn:uuid (without any file extensions like „.ttf" or „.otf"). The font file must be located in the same folder as the subtitle XML file. At least one LoadFont element shall be present.

5.4 Add Auxiliary Data (Dolby Atmos) Track

To add a Dolby Atmos MXF file to the Track Manager, hit "`Add Aux Data / Dolby Atmos Track`":
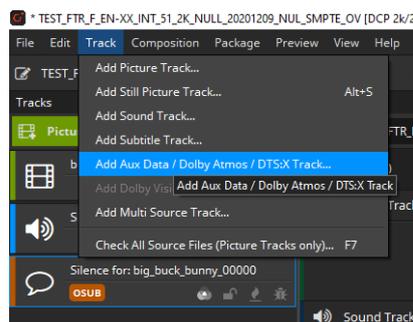
After choosing the Auxiliary Data MXF file, it will appear as a purple sound track in the Track Manager.
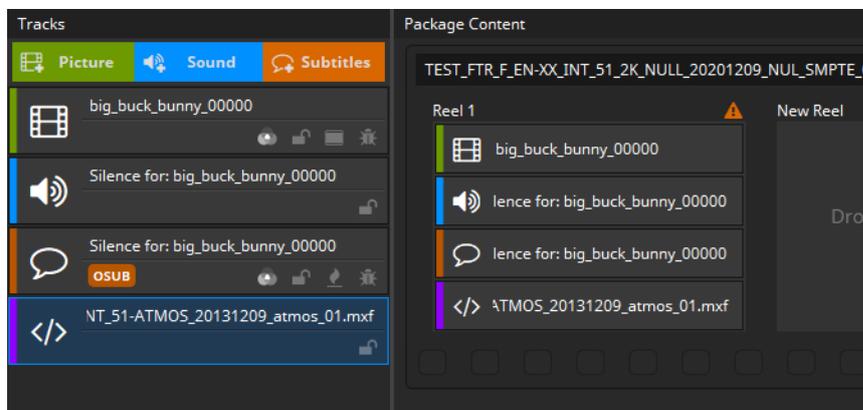
A Dolby Atmos track must be paired with a 14 channel Main Sound Track, containing a synchronization signal on channel 14. If a Dolby Atmos track is present in a reel, the synchronization signal will automatically be generated into channel 14 of the reel's Main Sound Track.

5.5 Add multi source track

If you need to combine multiple separate files into one mxf you can use this option. The order of files determines the order they are shown, from top to down. Adding a file sequence the whole sequence counts not just the selected frame.
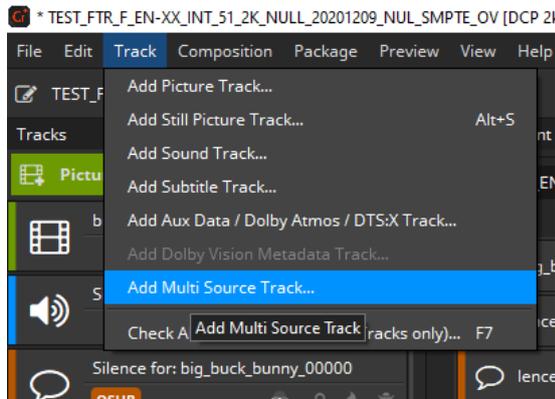
With the "+" und "-" button you can add and remove files. With "Arrow up" and "Arrow down" buttons you can change the order.
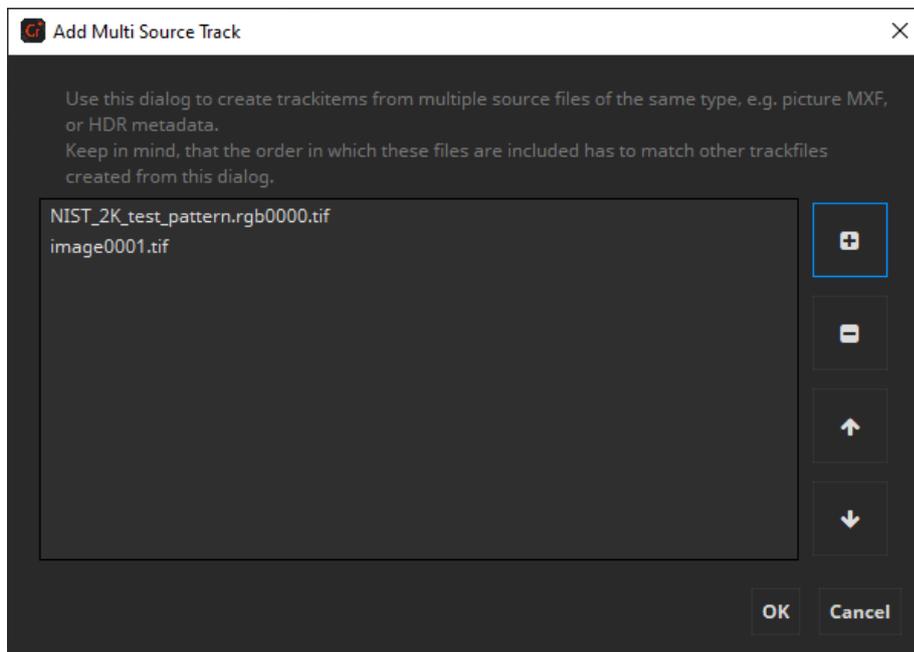
> The formats and properties of the files have to match to be used together, e.g. same resolution and same file format.

5.6   Check Source Files

To check only the source files of a single Track, right-click on a Track and choose "Check Source Files…":
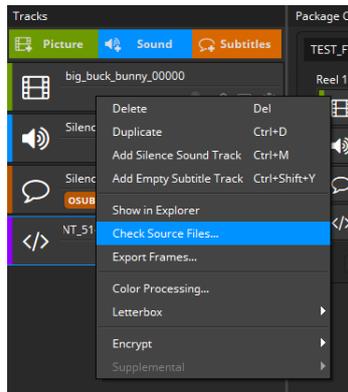
The following dialog will appear:
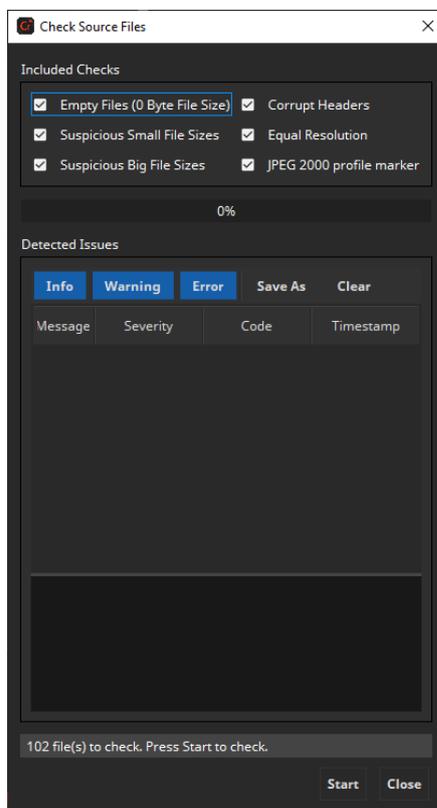
By default all checks are included (recommended). Checking for headers may slow down the checking progress, so if this will take too long you can disable this option.

Error Messages are displayed. If errors occurs during check, for example is a file is zero in size, read the warnings carefully and try to fix the problem. Then try again until no problems occur anymore.

5.6.1 Check All Source Files

To check all source files, choose the menu entry "`Track -> Check All Source Files…`" or simply press `F7` (see screenshot below).
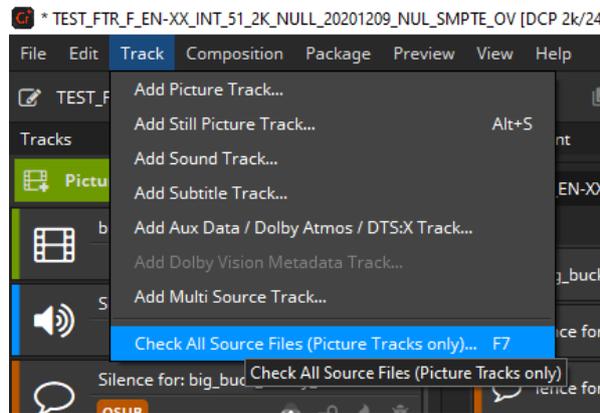
5.7 Remove / Delete Tracks

To remove an item from the Track Manager, mark it and press the "Delete" key. Alternatively right-click the Track to open its context menu and select "Delete". The Track will be removed from the list. This action will not physically delete any source files.
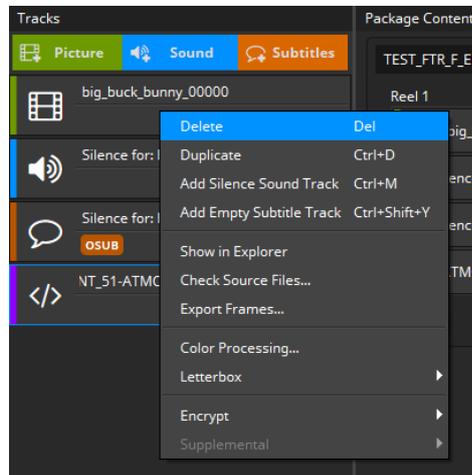
If the Track has already been added to one or more Reels, these references will be removed as well.

6 Composition Manager

The "Package Content" window is where you compose your package by creating Composition Playlists (CPL). When starting off with a new project, you can already see the first CPL with an empty Reel.

A CPL is comprised of one or more Reels that will be seamlessly played back-to-back, i.e. when played there are no gaps in-between Reels. There is no preference to a multi-Reel CPL over a single-Reel CPL. Use whatever option is more convenient to you.

6.1 Add Composition

If you want to place more than one composition in your package, you can create additional compositions. To achieve this, just click the "+" ("Add Composition") button on the right side of the composition.
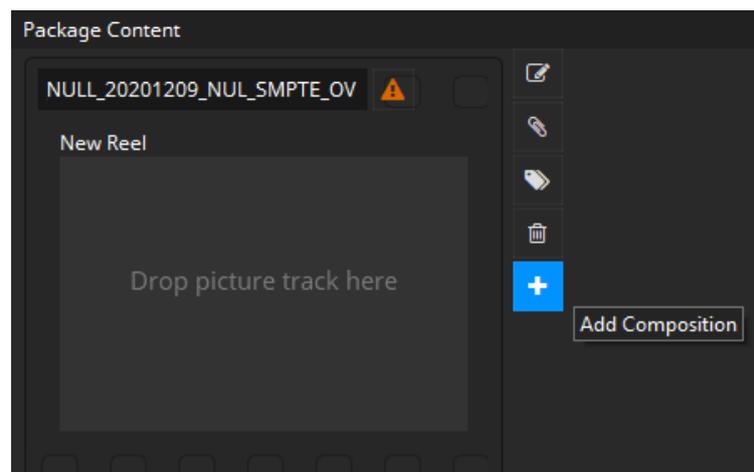
easyDCP Creator will create a new composition in the Reel Window.

6.2 Add Tracks to Composition

To add a Track to a Reel, simply drag & drop the Track from the Track manager into the desired Reel. All Tracks within a Reel will be played in parallel to each other.

Each Reel needs to contain at least a picture Track, but typically it will also contain an audio Track. A Reel may have zero, one or more timed text Tracks, provided they all use distinct display type (Open/Closed Subtitles/Caption). For

instance, a single Reel may contain an Open Subtitle Track and a Closed Caption Track. It may not contain more than one Open Subtitle Track.

The first Track that is added to an empty Reel needs to be a Picture Track. If you try to place a Sound or timed text Track into an empty Reel, the action will be ignored.

When adding a Track to a Reel that already contains a Track of the same type, the existing Track will be replaced with the new one.

After placing a media Track in an empty Reel, a new empty Reel placeholder is
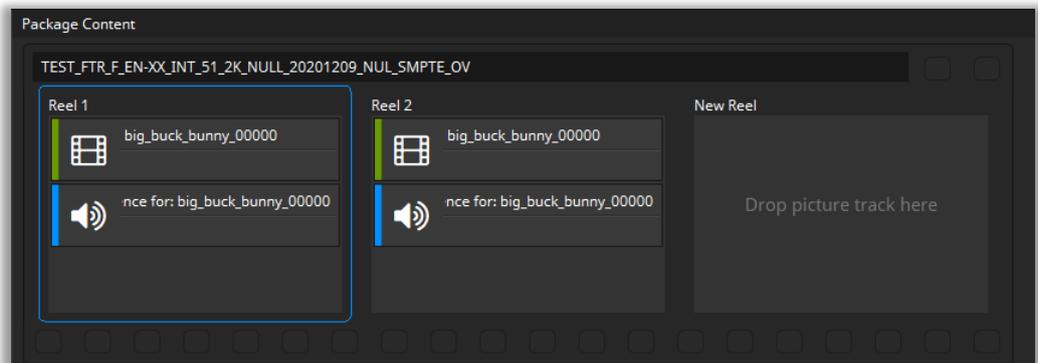
automatically appended at the end of the CPL. As long as there is no content in the Reel, it is called "New Reel" and it will not end up in the rendered DCP. You can place additional media Tracks in the new Reel. All Reels will be combined into a Composition in the package later.

6.3 Change Offset (EntryPoint) and Duration

In some cases you may want to crop the beginning and/or end of a Track. Double-click a Track within a Reel to change its offset or duration:
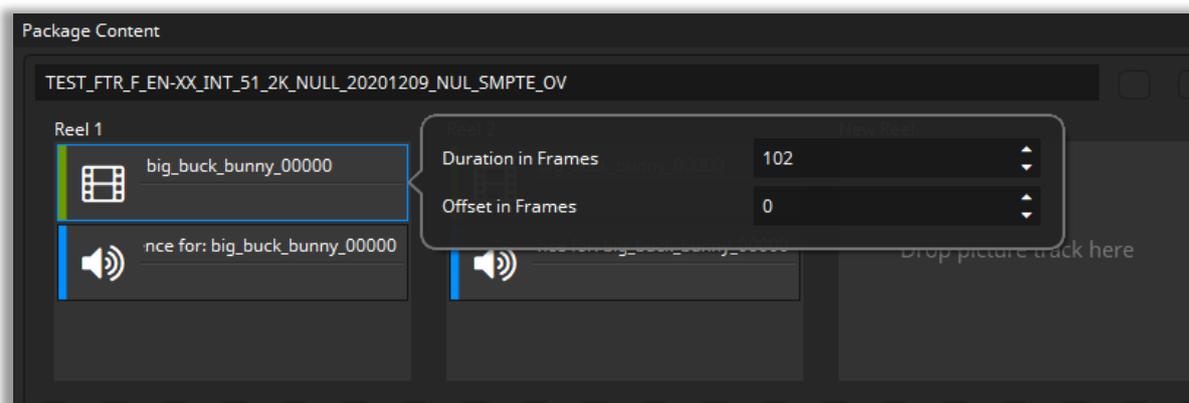
Skipping frames at the beginning can be done by changing the offset to a value (in frames) larger than zero. If you want to hide the first two seconds of a Track with an edit rate of 24 fps, set the offset to 48.

If you want to truncate the Track, decrease the duration. Example:
Your Track has an intrinsic duration of 100 frames. You want to hide the first 10 and last 20 frames. Then you would set the offset to 10 and the duration to 70 (100-10-20=70).

The In- and Out-markers as defined by the offset and duration are displayed in the Preview Window's timeline when a single Track within a Reel is selected:
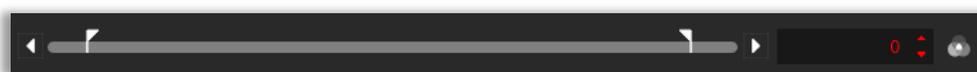
There are various further use cases where the offset and duration properties might be convenient.

Use case: Cut Scene

You can even use this option to cut a scene from a Track. To do that add the same Track to two consecutive Reels. Set up the duration of the Track in the first Reel, so that it stops just before the scene that you want to cut out starts. In the second Reel, set the offset of the Track so that it starts just after the scene is over.

Use case: Insert scene

Also, you can add an insert. Assume you have a Track that contains the entire movie, but you want to add a pause in the middle and show a message, you could create a JPEG with the message and create a new still-picture Track from that JPEG. Put the main movie Track in the first Reel, the pause Track in the second Reel and again, the main movie track in the third Reel. Assuming your main audio and picture Tracks are each 90 minutes long, they have an intrinsic duration of 129600 frames given an edit rate of 24 fps (90x60x24=129600). In the first Reel, decrease the duration to 64800 (129600/2=64800) and in third Reel, set the offsets to 64800.

Use case: shift audio and video relative to each other

Assume your picture Track has a film leader showing a count-down with a duration of a 100 frames, but your audio Track's leader only has a duration of 80 frames. In this case, you can set the picture Track's offset to 100 and your audio Track's offset to 80. Now you have shifted the two Tracks relative to each other and they will be in sync.

6.4   Move Content within Compositions and to other Compositions

You can easily move Reels within a Composition using drag & drop. Just click on a Reel with the left mouse button and hold the button down. Then move with the mouse to the new position for the Reel and release the mouse button. The positions where you can place the Reel are getting highlighted with a green bar when moving over with the mouse.
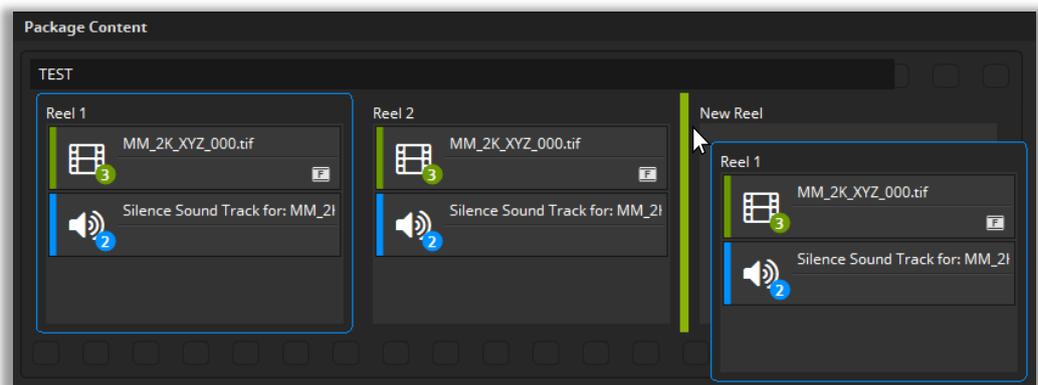
6.5   Delete Reel

Choose the Reel you want to remove from the Composition and click the trash can symbol button in the Reel's tool bar. You can also select a Reel and hit the shortcut "Del". The selected Reel is indicated by a blue border:
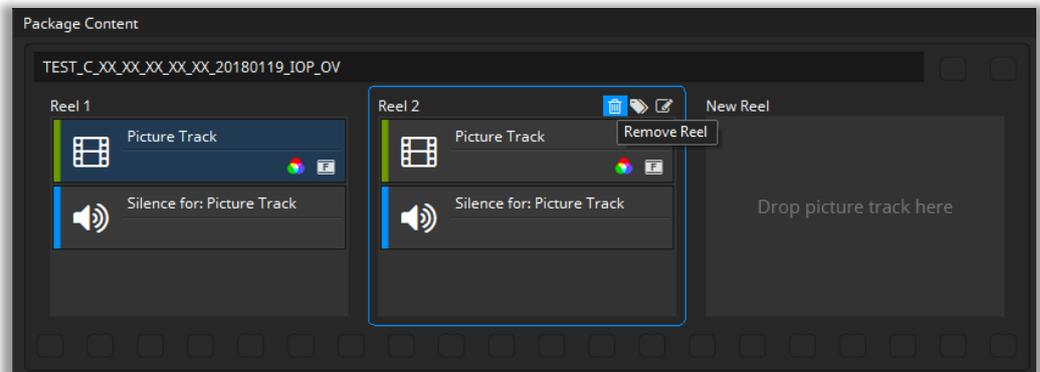
6.6 Editing Composition Properties

You can easily edit the properties of your Composition by double clicking it or
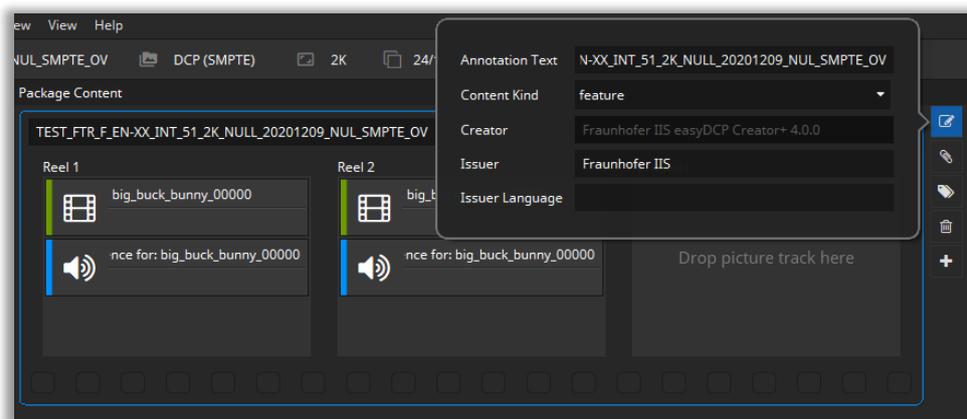
by clicking the Edit-icon on the right of the CPL.

6.6.1 Content Kind of a Composition

The content kind is informational only. It defines the kind of material referred to by the Composition playlist. The content shall match one of the values listed in the table below. This kind may be displayed to the operator in the cinema server. Some servers sort their DCPs and playlists by content kind so that the projectionist can easily find trailers, advertisements or feature films.

Kind	Description
`feature`	A theatrical feature.

trailer	Short (2 to 3 minutes) content promoting an upcoming theatrical feature.
test	Content used to test, calibrate or setup D-Cinema exhibition equipment.
teaser	Very short (typically less than 1 minute) content promoting an upcoming theatrical feature.
rating	Slate/still picture indicating the recommended age group permitted to view the content to follow. This rating is generally unique per country.
advertisement	Content promoting a product or service other than an upcoming feature.
short	Non advertising/promotional content (3 to 15 minutes) typically before a theatrical feature.
transitional	Extremely short content (1 to 15 seconds) separating unrelated Compositions.
psa	Public service announcement.
policy	Content defining the code of conduct for patrons.

To edit the content kind of a Composition, double click or click the "Edit Composition Parameters" button and select a kind from the dropdown list.
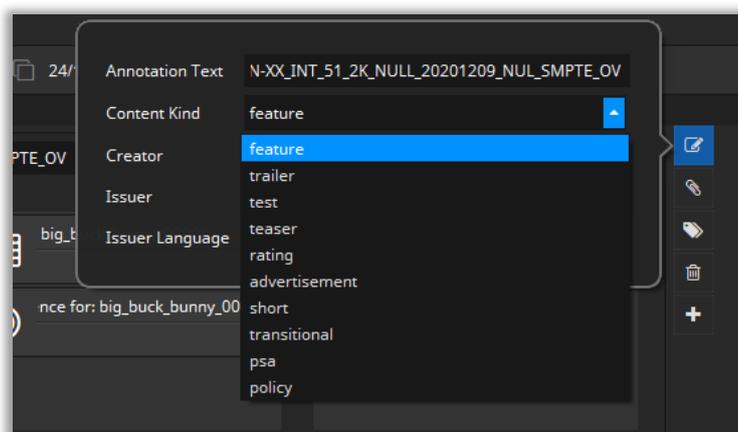
If you typically create DCPs of the same content kind, it is convenient to change the Default CPL Content Kind in the Options dialog.

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6.6.2 Content Title

The Content Title appears on the screen if a volume (e.g. USB-Drive, Hard disc Drive) is connected to a digital cinema system before ingest. This annotation text describes the whole DCP. In contrast to the Annotation Text of the Composition (CPL Annotation Text) it describes the whole DCP.

Some Digital Cinema servers only show a limited number of characters on their display screens. If the title of a composition is long, much of the information may be cut off or not visible unless you scroll to a second page. This makes locating a specific composition difficult if you have multiple titles. It's especially confusing when you have multiple trailers as well as the feature with the same name. You should follow the Digital Cinema Naming Convention at http://www.digitalcinemanamingconvention.com/

6.6.3 Conformity: InterOp or SMPTE

You already selected the conformity of your DCP project in the "New Project Settings" windows. In the Compose view you can optionally change this setting via the main menu bar:
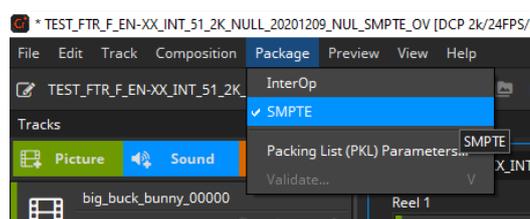
Neither an InterOp nor SMPTE DCP will work in a so called "E-Cinema" system.

If you do not have a tangible reason to switch to Interop conformity, we recommend using SMPTE as conformity mode.

6.7 Delete Composition

Deleting a composition is as quite as easy as creating one. Just choose the composition you want to remove from the DCP and hit the "Delete Composition" button in the tool bar. A composition is selected if there is a tiny blue frame around the composition. The following screen shot will show how a selected composition looks like:
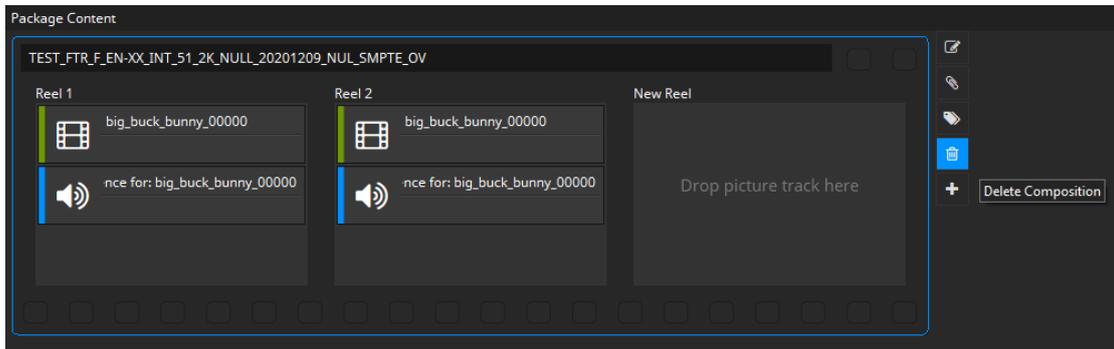
6.8   Composition Metadata

SMPTE DCPs support composition metadata which is used on some cinema servers to display informations. CPL metadata can be edited by clicking the icon in the composition manager and timeline.
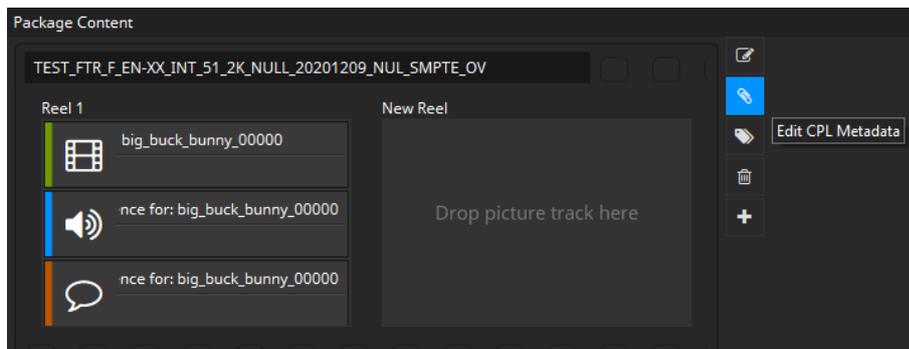
After clicking the CPL metadata dialog appears. Metadata that can be derived from the CPL will be filled in automatically. This affects e.g. edit rate and intrinsic duration. Other data has to be entered manually and so can be changed.

For certain features like Sign Language and Eclair color special extensions are provided. It is also possible to add arbitrary new extensions as key value pairs.
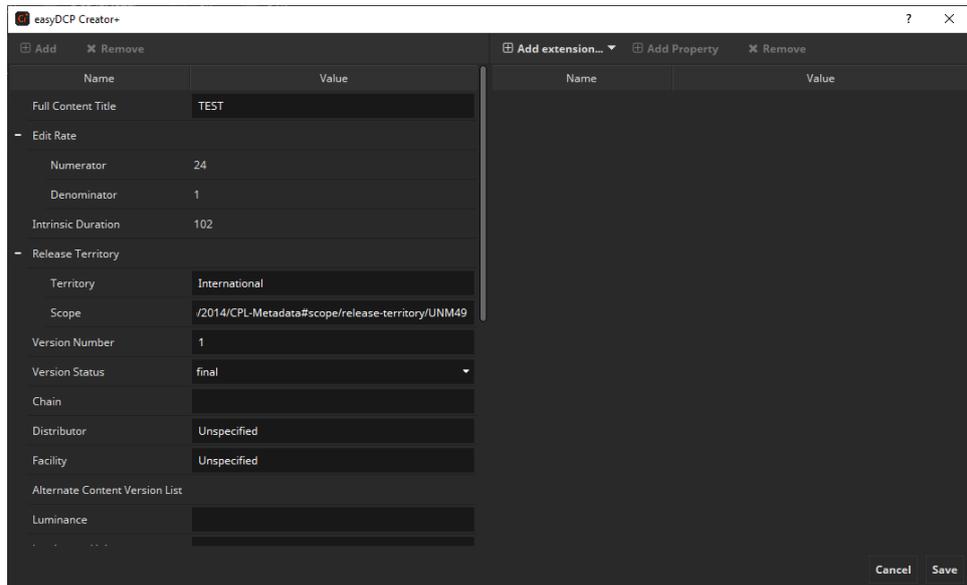
6.9 Preview package

Before starting package generation, it is possible to preview the entire project in easyDCP Player. If you have installed easyDCP Player, just click on the "Play Preview" button in the upper right corner:
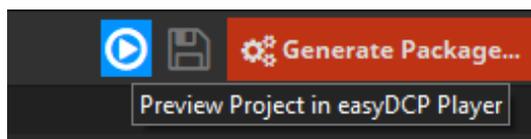
The easyDCP Player can directly play back project files (*.dcpproj) containing source files (e.g. DPX, WAV and Subtitle XML files), so it is possible to check e.g. audio and video synchronization before generating the package.

7 Timeline

The Timeline was introduced in easyDCP Creator 3.5.0 with a first set of features. You are able to preview your compositions and edit offsets and durations. It can display picture, audio and timed text tracks. Audio tracks can be shown both as combined waveform and with the channels split up.

For DCP packages you can decide whether to use the Composition Manager or the Timeline.
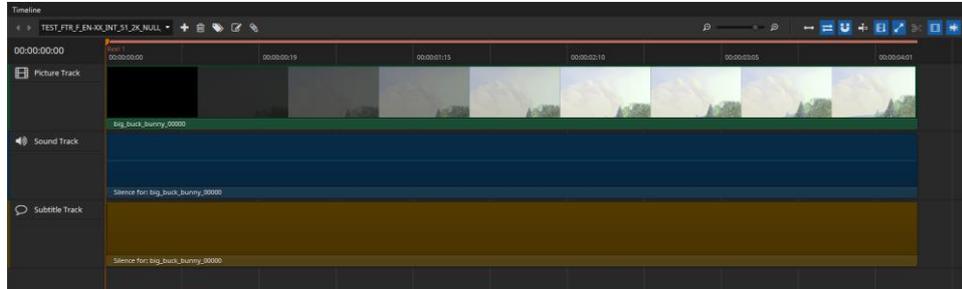
7.1   Timeline Controls

Time Code Edit

The time code on the left side of the timeline is clickable and allows to jump directly to a specific time code. When it is selected it becomes blue and accepts all keys from 0 to 9. Pressing enter will accept the input and jump to the position in the timeline. It is also possible to start the editing via Ctrl + G after clicking the timeline once.

Composition List

With the box on the upper left of the Timeline you can choose the composition to be previewed in the Timeline. You can either select it using the combo box or navigate through them with the arrows on the left.
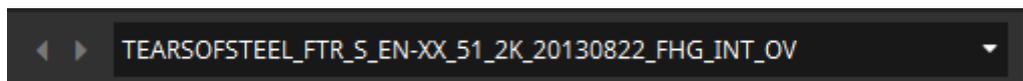
⬚ Add Composition
Adds a new composition.

⬚ Delete Composition
Deletes the composition that is currently selected for preview in the timeline.

⬚ Duplicate Composition
Clicking this button duplicates the current composition. In the popup you have the possibility to reference the same track files as in the original or to duplicate them.

⬚ Editing Composition Properties
See 6.6.

f e Zoom

Use the slider to define the zoom level of the timeline. You can also zoom using "CTRL + mouse wheel" while the mouse is over the timeline.

⬚ Zoom to fit

Shows the entire timeline in respect to the available space in the user interface.

⬚ Ripple edits for later items

Moves later items together with the currently selected clip.

⬚ Snap to clip borders

Helps to properly align different tracks in the timeline. If it is necessary to align the duration of a video clip to the shorter duration of a given audio track, you can simply reduce the length of the video track by clicking on the right edge of the longer track file and moving the mouse to the left. Once the mouse pointer gets close to the end of the shorter track, the size of the current track will snap to the same length if snap to clip borders is activated. Once triggered, the snap feature will also show a red vertical line at the boundary of the tracks it is currently aligning.
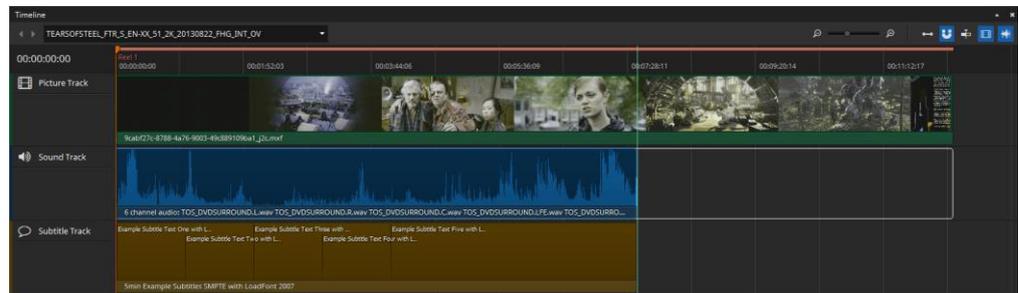
J Center view on play head

Auto-aligns the timeline so that the play head is placed in the center.

⬚ Split sequence

Splits the sequence containing the playhead marker at the playhead marker position into two reels and adjusts their offsets and duration to fit the original length. Only selected clips that contain the playhead are split, so it's possible to split just picture while keeping sound one clip.

j Render reels

In order to know where you're reels/segments will be split you can toggle rendering of reels on. This will display the reel markers in ascending order on top of the timeline with slightly alternating colors.

L Render thumbnails

If active, thumbnails will be rendered for all video tracks in the timeline.

K Render waveforms

If active, a visual representation of each audio track will be displayed in the timeline. Depending on the length of the audio tracks the rendering of the waveform for the first time can take a while.

Navigation

Using arrow key left and right allows for frame wise stepping in the timeline. With arrow up and down it is possible to jump to the next/previous clip in the timeline.

Switching between time codes and frames

With a right-click into the empty space of the timeline a context menu opens. There you can switch between the time code representation in the timeline and frames.
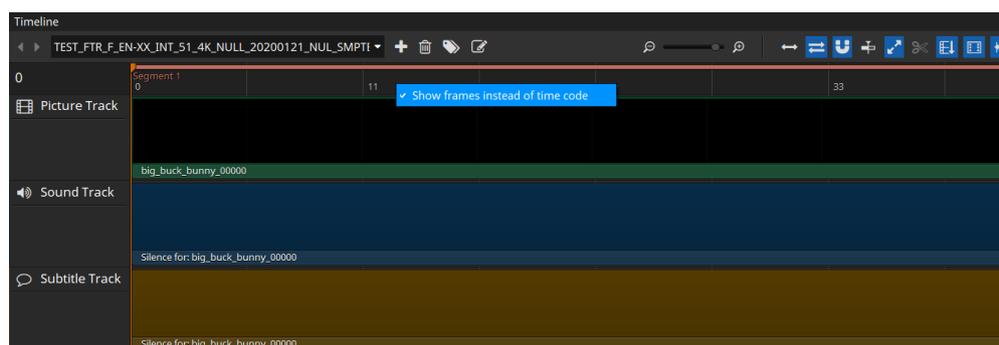
7.2   Editing in the Timeline

The Timeline supports editing of offsets and durations of the Tracks, rearranging sequences, drag & drop of tracks and files and functionality to split sequences and insert tracks in between.

To edit the offset (entry point) of a track, just drag the left border of it. The offset is directly updated in the Metadata Window. Dragging to the left reduces the offset (if not already at 0), while dragging to the right will increase the offset as long as possible.
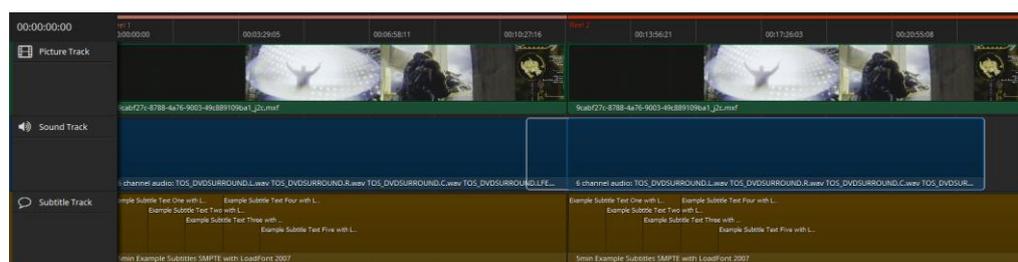
To change the duration of a track, drag the right border. Dragging to the right will increase the duration while dragging to the left will shorten the track.

Both offset and duration are directly updated in the Metadata Window. The maximum offset/duration depends on the tracks and the project type (DCP 1 second).

To add new tracks to the timeline it is possible to drag a track from the track manager directly on the timeline. The track can be inserted in between two existing sequences. To make an insert in an existing reel/segment for creating supplemental DCPs drop at the position on select "Insert" in the context menu. This will split the existing clip in the timeline at the mouse position and insert the new clip resulting in a total of three clips instead of the previous one with all offsets and durations being automatically adjusted.

Rearranging clips is also possible. Clips in the timeline can't overlap and will automatically be reset to their origin position when dragging started. But when dragging a clip in between two others everything left will be moved left (when coming from the left side) or right (when coming from the right side).

7.3   Appending/prepending black frames

For some purposes it's necessary to add black frames before or after a reel/segment. To do so right-click the picture track file.
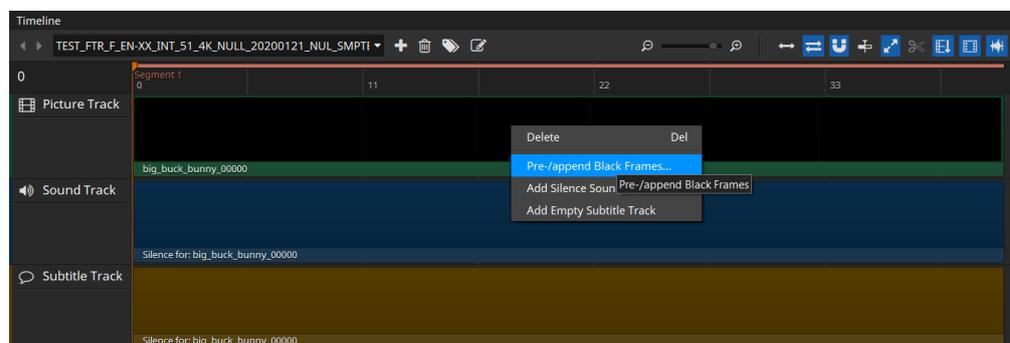
In the dialog that will open up next you can select whether you want to prepend or append to the reel you right clicked on. You can also select how many frames/seconds of black frames you want to prepend/append.
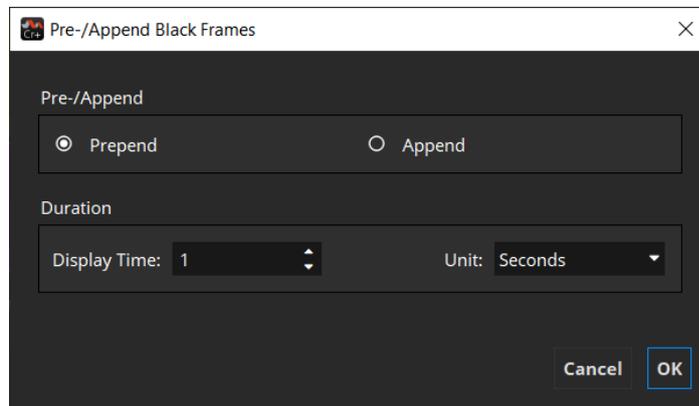
7.4   Adding Silence Sound

As in the compositor it's also possible to add silence sound in the timeline. When no clip is selected the silence track is added to the clip you right click on. If you have selected a clip or multiple ones, the silence sound track will span all of them. This will automatically be split up again into reels.
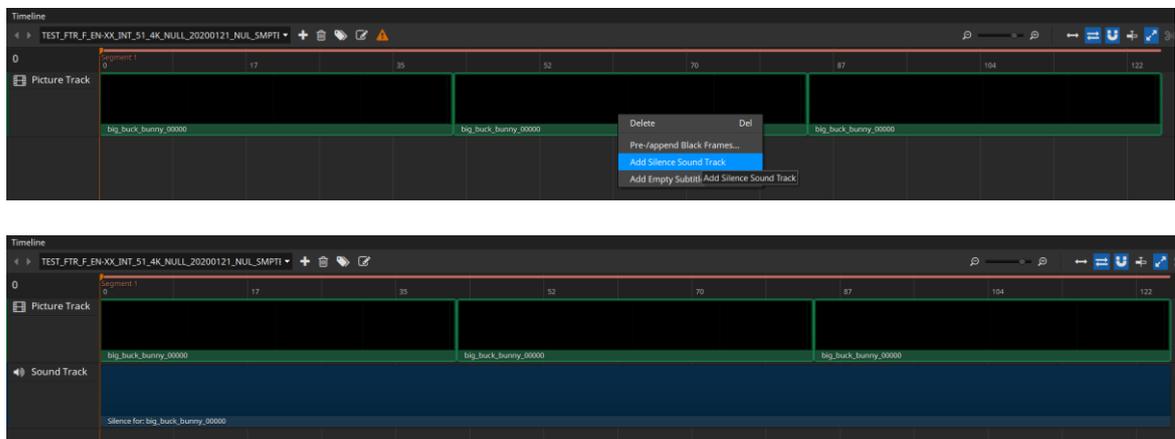
7.5   Timeline Validation

Every once in a while the current timeline is validated so you can see if your project is valid and can be generated. In case of errors or warnings, a warning symbol appears in the toolbar. Clicking it opens a popup containing detailed information about what's wrong.

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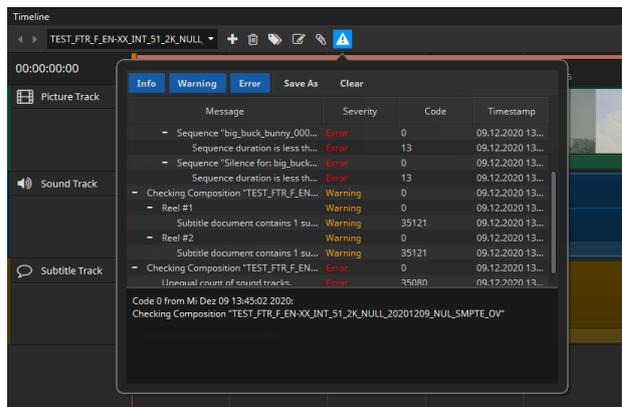
8   Composition Marker

Composition Marker are marker carried in the Marker Track contained in the Composition Playlist. They signal special events like the *First Frame of End Credits (FFEC)* and are used for purposes like to automatically dimm the light in theaters when the end credits roll.

A Composition Marker consists of a predefined Marker Label and Scope, an optional and custom Annotation Text and the relative offset from the start of the Marker Track the Marker is located in. This means in case of a Composition with multiple Reels the offset may not represent the absolute position of the Marker in the Composition.

Composition Duration: 200

Duration: 100	Duration: 100
Reel 1	Reel 2

LFOC (Last Frame of Composition)

Offset: 99
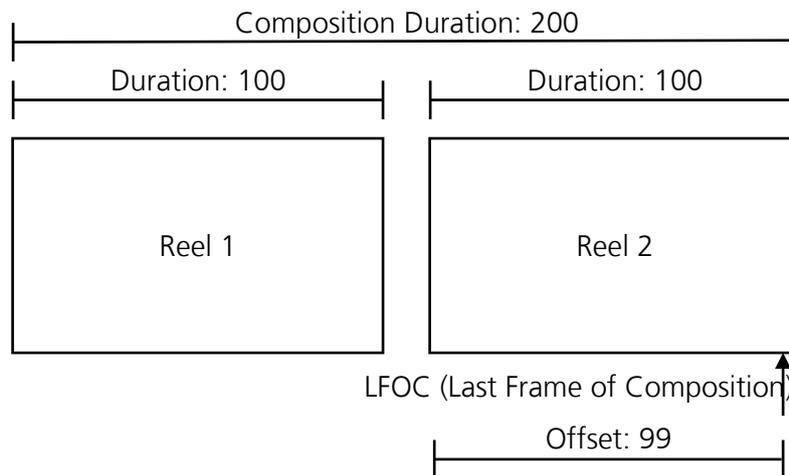
In this Illustration a Marker is located in the Marker Track of the second Reel. The Marker Track has no Entry Point or an Entry Point value of zero. In this case, as the start of the Marker Track and the Reel coincide, the absolute position of the Marker in the Composition is defined by the start of the Reel and the Offset of the Marker in the Marker Track. On the other hand, if a Marker Track has an Entry Point value other than zero, the absolute position of its Markers are further offset accordingly.

8.1 Overview

If a loaded DCP or project contains Compositions with Marker, easyDCP Creator will display the associated Marker Tracks. If the first Composition Marker is added to a Composition, easyDCP Creator will automatically insert the required Marker Tracks into the Composition. Likewise, if the last Composition Marker is removed, the associated Marker Tracks in the Composition will be removed as well.
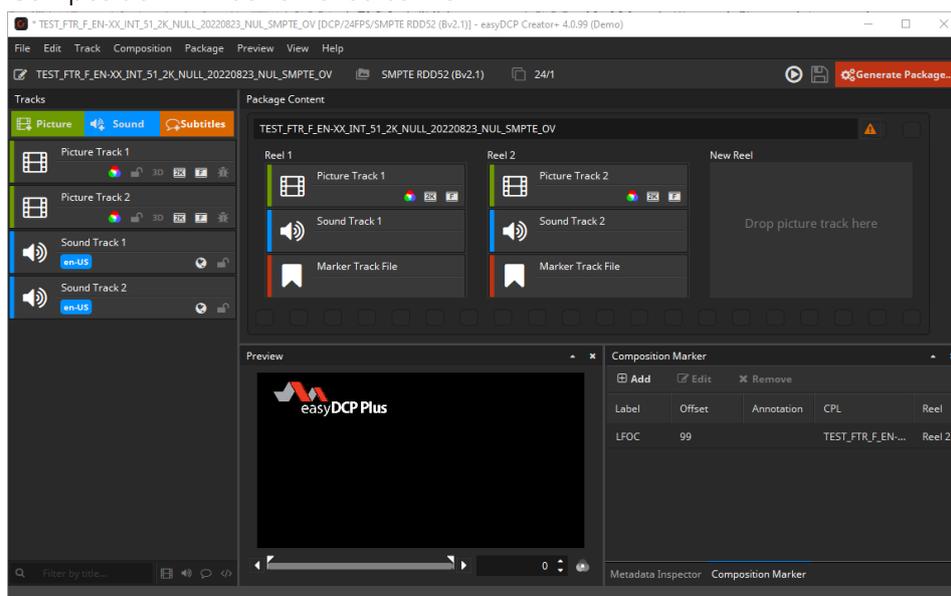
All existing Marker will also be listed in the *Composition Marker* tab next to the *Metadata Inspector* tab. This list is used for adding, editing or removing any Markers as well.

8.2 Editing

8.2.1 Adding a new Marker

To add a new Marker the Reel, or in the *Timeline View* the Picture Clip of the Reel, has to be selected the Marker shall be added to. By clicking *Add* in the
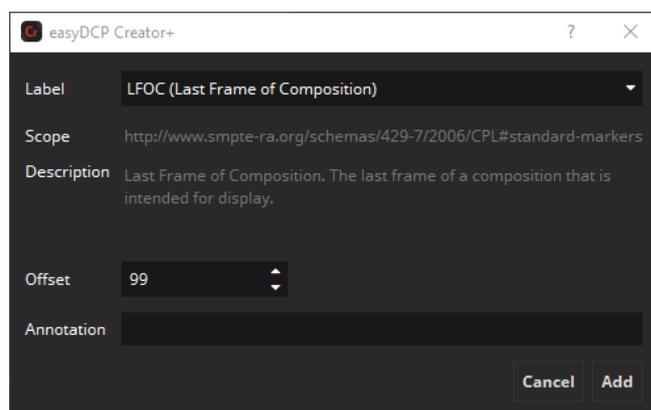
Composition Marker tab, next to the *Metadata Inspector* tab, the Composition Marker dialog will open.

In this dialog one of the predefined Marker Label, the Offset in the Marker Track and an optional Annotation can be set.

After confirming with *Add* easyDCP Creator will automatically create all the required Marker Tracks if they do not exist yet and will add the new Marker.

8.2.2   Edit a Marker

Markers can be edited by selecting the Marker to be edited in the *Composition Marker* tab and clicking *Edit*. This will bring up the same dialog as for adding Marker prefilled with the current values for the Marker. After modification the changes can be applied by clicking *Save*.

8.2.3   Remove a Marker

Markers can be removed by selecting the Marker to be removed and clicking *Remove*. If the last Marker in a Composition was removed, easyDCP Creator will also remove all remaining and now empty Marker Tracks from the Composition.

9   The Metadata Window

The metadata window shows the most important technical properties of whatever item is currently selected. It is merely a read-only element and cannot
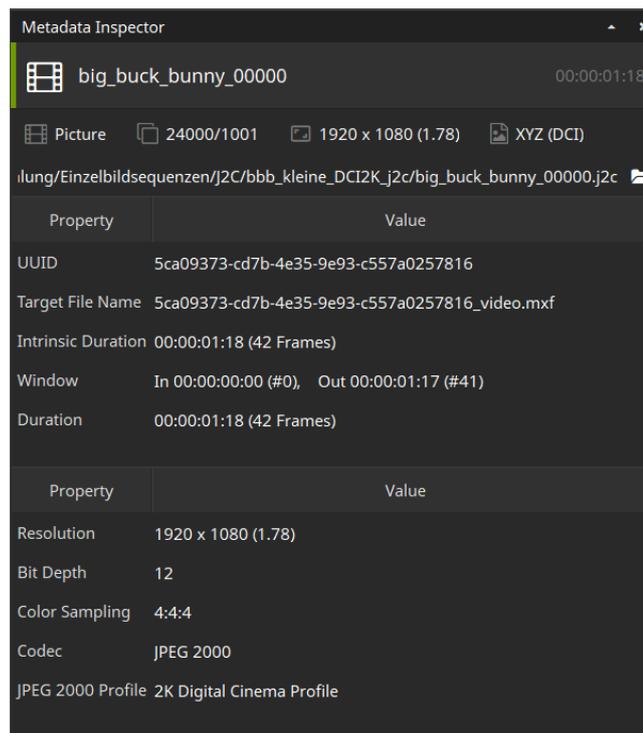
be used to change any of the properties.

The set of properties that are displayed depends on what item type was selected:

- Track (picture, sound or timed text)

- Track in Reel (picture, sound or timed text)

- Reel

- Composition

The Metadata and Preview windows always refer to the same item.

10   The Preview Window

In the preview window, you are able to take a look into each Picture and Subtitle Track.

The previewed frame number is shown in white letters in the box on the bottom right of the preview window (starting with 0). If you scroll to a position before offset or after duration, this number will turn red.

By default, color processing will not be shown. To activate the color processing preview, toggle the "`Preview color transform`" button next to the frame number:
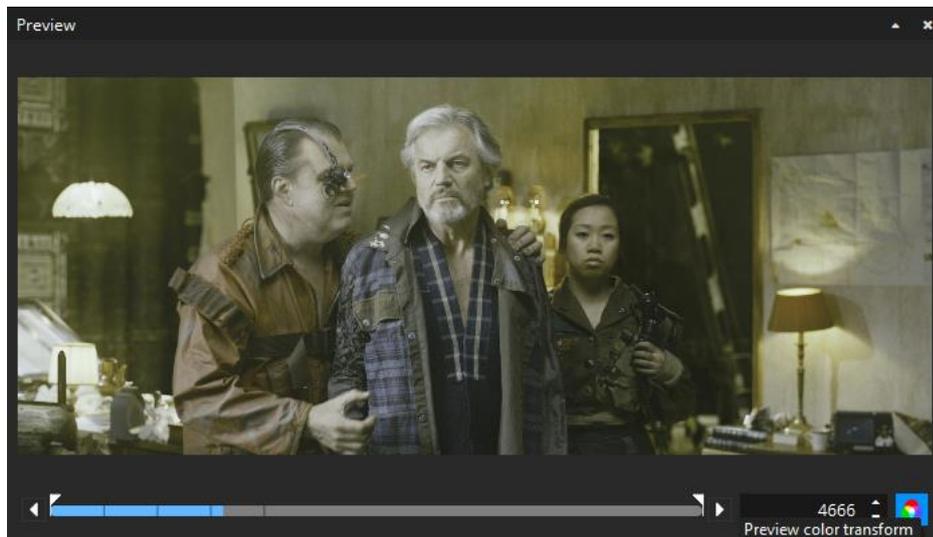
When color processing is disabled, the source color space will be previewed. When it is enabled, the configure Preview color space (see Settings => Preview) will be used.

Color processing won't affect subtitle preview.

Preview for audio tracks is not yet supported.

10.1   Safe Areas

Introduced in version 3.6.0, easyDCP Creator can overlay „Title Safe" and „Action Safe" areas as well as the DCI containers *Flat*, *Scope* and *Full*.
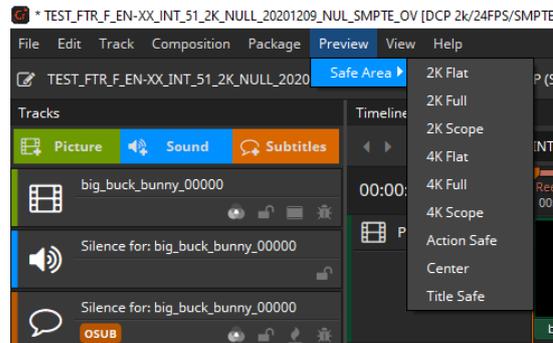
Each preset is based on an XML file that is located in a directory which can be opened by selecting "Open Repository". The "Title Safe", "Action Safe"and "Center" presets are defined by specifying coordinates relative to the image. The remaining presets, on the other hand, are defined based on absolute coordinates. Based on the presets it should be straight forward to add additional custom presets, when required. They can either be copied into the directory where they will be detected by easyDCP Creator after a restart or they can be imported by selecting the "Add new preset…" option. The colors or thickness can currently not be changed. The overlays cannot be burnt into the image when exporting the DCP package.
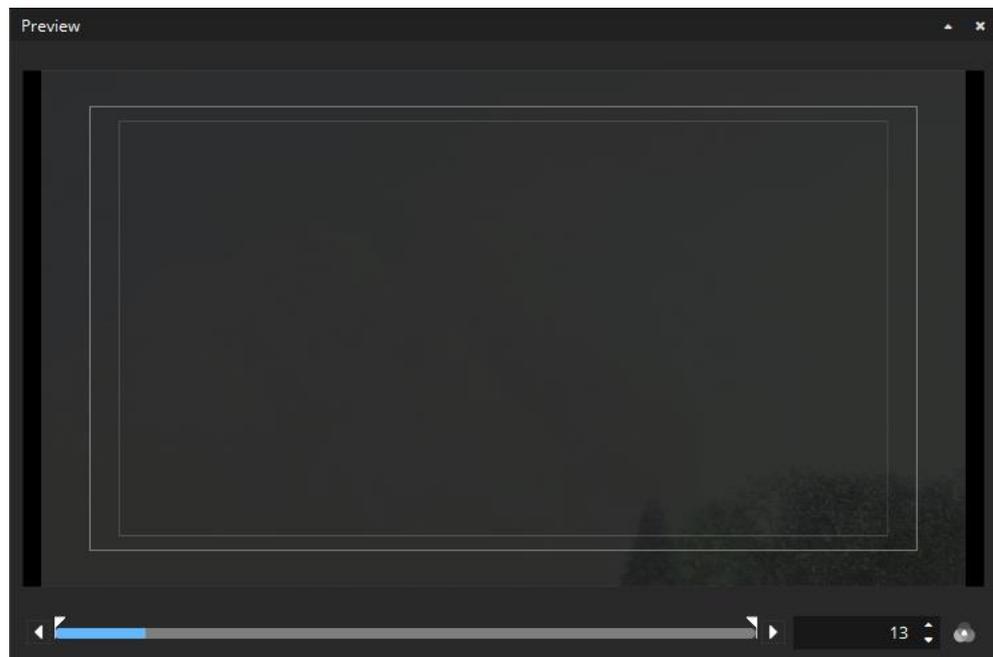
11   Generate a DCP

After adding content to compositions, press the "`Generate Package…`" button in the upper right corner of the main window.

A wizard dialog will appear to guide you through the generation process. The first page allows you to specify the destination folder for your package. It is recommended to name the folder with your package title and select a folder on an EXT-2 or EXT-3 formatted drive.
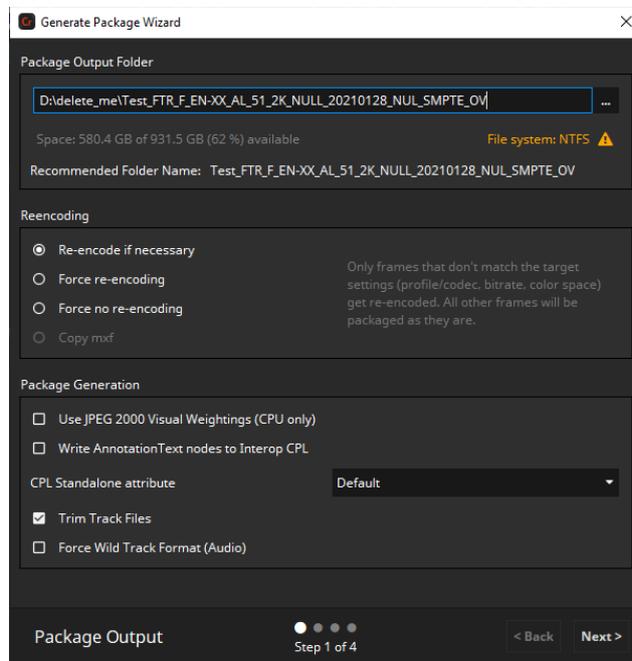
Re-encoding

For re-encoding a total of four options exist with different behaviors.

With the Force re-encoding option enabled, each source image file will be re-encoded, regardless if the source files are JPEG 2000 codestreams (*.j2c files and codestreams from MXF files) or not. This ensures that each final image will have the right format (i.e. the correct DCI compliant profile, bitrate, color gamut etc.).

Disabling force re-encoding option is only available in the full licensed version of easyDCP Creator, since the easyDCP logo will be burned into each picture frame at the top left. Thus, each picture has to be re-encoded.

The force no re-encoding option causes the codestreams to be packed directly into the final package. This may speed up the package generation process. The user has to make sure that the source files are already in the right format. No source file checks will be made, the source files will be copied directly into the package and just the mxf file will be written.

The copy mxf option is similar to force no re-encoding, but doesn't even unpack the codestreams and just copy the whole mxf file. In this case even the mxf metadata has to be correct.

Using force no re-encoding or copy source option you are responsible for compatibility of the data with the selected package type in regards of codec/profile, resolution, colors etc.

With the re-encode if necessary option selected easyDCP Creator doesn't check the input images if the input format is JPEG 2000 in terms of e.g. color space. easyDCP Creator checks image dimensions, bit depth, bitrate and wavelets only. Using this chain a user can create his own JPEG 2000 files in the post production and easyDCP Creator will just do the faster packaging. The advantage is that if any color processing is bypassed, packaging will be much faster.

To ensure that JPEG 2000 codestreams will be directly copied into the final package, the following settings must be done:

- All source files shall be DCI compliant JPEG 2000 codestreams.

- The JPEG 2000 codestream re-encoding shall be switched off.

- The pillar-/letterboxing & scaling shall be switched off (see 5.1.7 Letterboxing & Scaling).

- The source color space has to be XYZ.

Use JPEG 2000 Visual Weightings (CPU only)

Enable this option if you want to use visual weightings mechanisms in the JPEG 2000 encoding process. This settings only affects the package generation using CPU and improves the image quality at low bitrates.

Write AnnotationText nodes to Interop CPL

Some cinema projectors have problems when there's more than one AnnotationText in a CPL. For compatibility you can disable this option.

CPL Standalone attribute

Some cinema systems complain about standalone attribute in some metdata files of the DCP being set to "yes", but need to be "no". The "Default" behavior will add no standalone attribute at all, which is interpreted as "yes". If you need them to be set to "no" choose the "Force No" option.

Trim Track Files

Enabling this option causes unused frames being stripped from the mxf files. This happens as pre-processing step of the generation and can reduce generation time.

Example: Source sequence has 100000 frames, but just 1000 frames are used in the package. As a result just these 1000 frames are encoded while the remaining 99000 frames aren't touched.

Force Wild Track Format

Some cinema servers require audio to use the wild track channel format instead of the digitical cinema labels. While this can be already configured when adding audio to the project (see 5.2.1) you can enforce wild track format by checking this option. The configuration then will be overwritten to use wild track format no matter what has been configured originally.

The next page allows specifying the maximum bitrate of the generated DCP. 250 Mbit/sec is the maximum bitrate for DCPs.
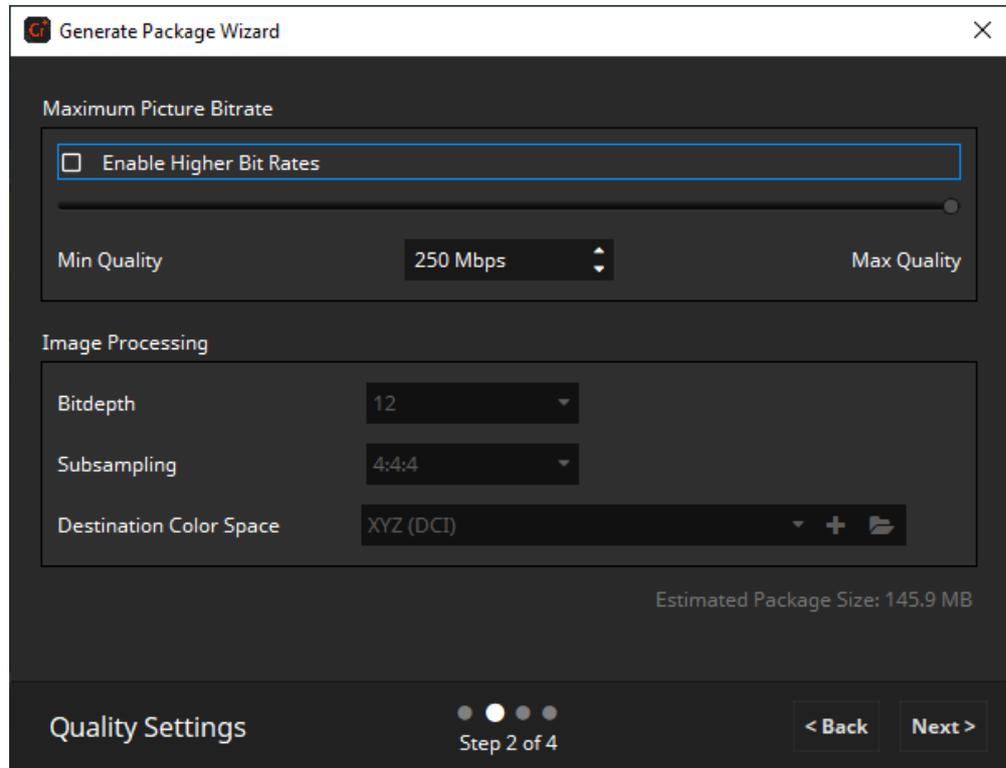
Keep in mind that a lower maximum bitrate can decrease the picture quality of the DCP.

If your package contains at least one encrypted Track, you can also choose a DCP Digest and a KDM server certificate. Digest generation won't be available when generating a supplemental DCP (see 11.2).

Destination Color Space

Select the color space your package shall be encoded to. For DCP that's always XYZ, so the option can't be changed.
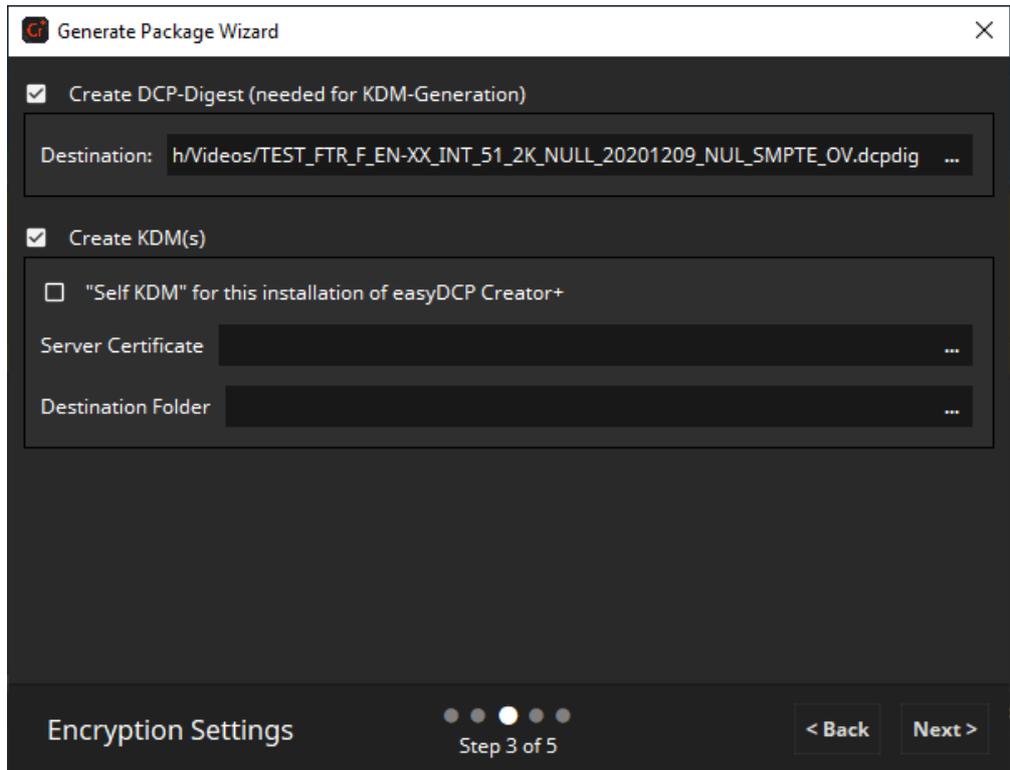
The next page will show a summary of your project configuration.
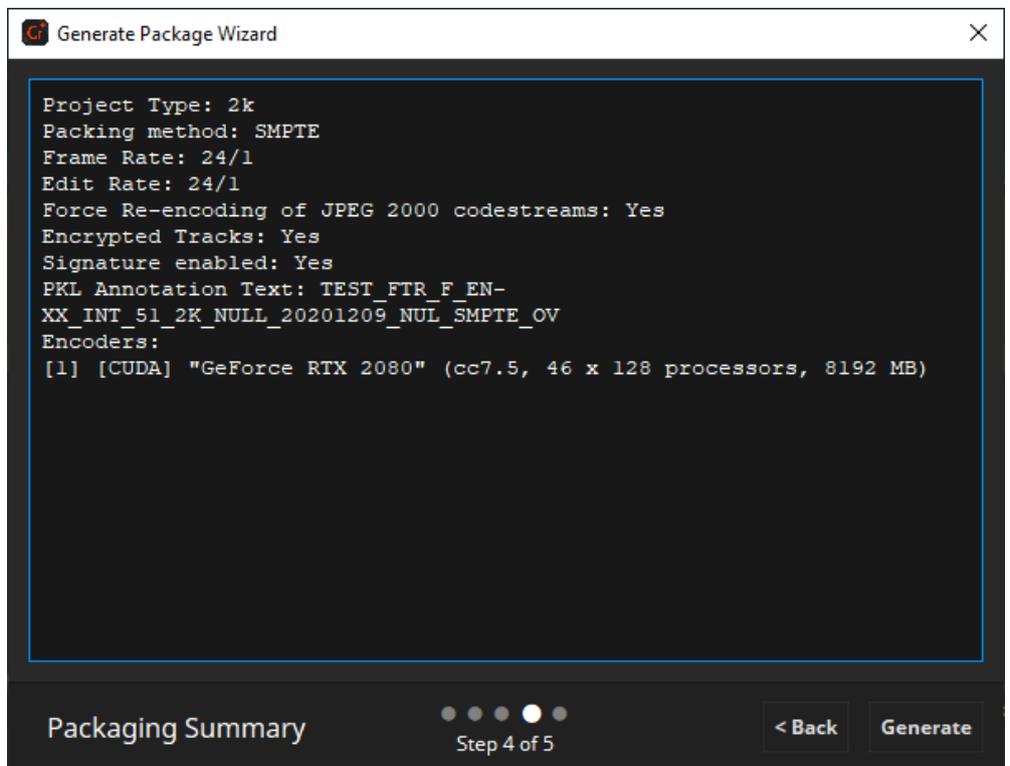
During the render process some statistics will be shown, like "Estimated Time Left" or the current rendering throughput.

After the rendering process has finished the result will be shown on the last page of the generation wizard. Please have a careful look if there were any issues detected during the rendering process.

Here you also have the option to validate your project (see 14.5), open it for a
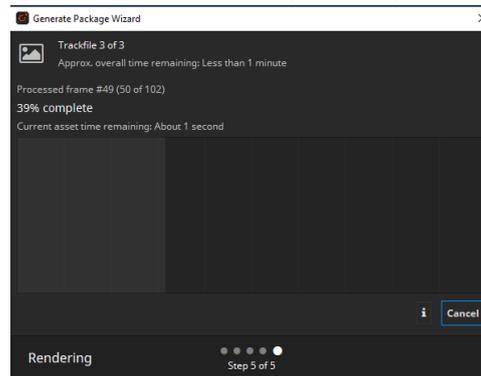
preview in easyDCP Player or browse the folder containing the package.
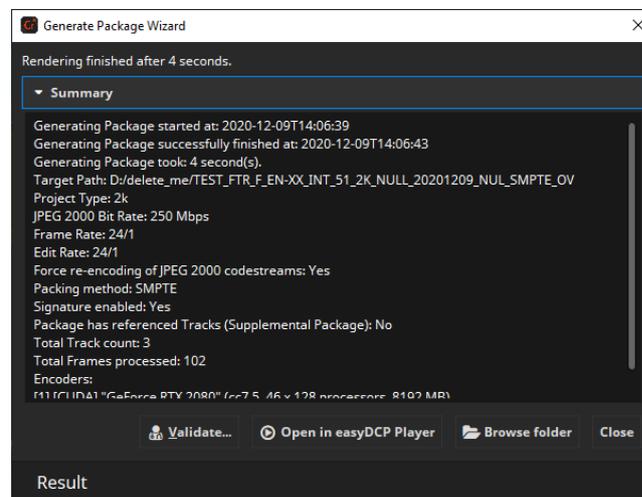
11.1 Why does easyDCP Creator generate KDMs since version 2.1?

Beginning with version 2.1, easyDCP Creator is capable of opening encrypted DCPs and using these DCPs as basis for new DCPs. There are basically two ways of providing the keys in order to allow easyDCP Creator to decrypt the content for the preview and for generating a new DCP.

If keys are provided by means of a proprietary Fraunhofer Digest file (*.dcpdig), you can generate and also save the package. In both cases a new digest valid for the generated/saved package is created.

Open DCP

Provide Digest

Alter DCP

Generate DCP & Save Package

Open DCP

Provide (D)KDM

Alter DCP

Generate DCP & ~~Save Package~~
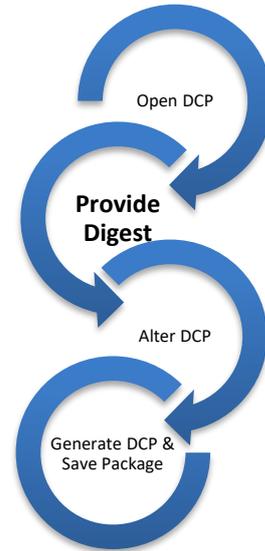
If one provides the keys by means of Distribution KDM (or KDM), easyDCP Creator does not allow to save the package as this would invalidate existing KDMs. In every case you need to generate a new package which will create a new (D)KDM and digest for the new package.
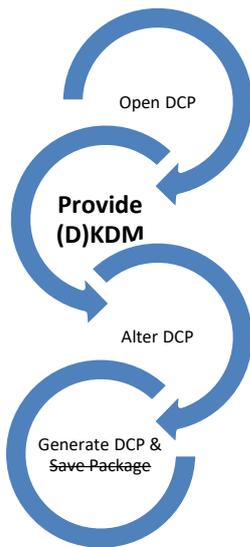
Using easyDCP Creator version 2.1 or higher you can generate a (D)KDM directly from within easyDCP Creator. The "Generate DCP…" dialog was extended to offer you to generate KDMs. By design, one (D)KDM will be generated for easyDCP Creator itself in order to make sure that one can open the DCP on the same computer using easyDCP Creator later. A second (D)KDM can be generated for another software being able to open (D)KDMs, including easyDCP KDM Generator+ and many other 3rd party hard-/and software tools.

11.2 Why can I not generate a Fraunhofer Digest file when generating DCP?

Since version 2.1 of easyDCP Creator it is possible to open encrypted DCPs and to use these DCPs as a basis for new DCPs. There are basically two ways of providing the keys in order to allow easyDCP Creator to decrypt the content for the preview and before generating a new DCP.

If one provides the keys by a Fraunhofer Digest, we assume that the user generated the content and that he is in charge of the source content used for the first DCP generation. In such a case you can do everything in easyDCP Creator, including the deactivation of the encryption and the generation of a new Digest when generating a new DCP.

If one provides the keys by a Distribution KDM (or KDM), easyDCP Creator does not allow to generate the Fraunhofer Digest in case the source package is a supplemental DCP. In order to understand this behavior we have to explain that the Fraunhofer Digest stores the encryption key as plain text on the hard drive. Without disabling the Digest-option one could easily open an encrypted DCP together with a (D)KDM, generate a new encrypted DCP and store the encryption keys in plaintext. Since content-owners are very diligent with their content, Fraunhofer IIS decided to disable the option since version 2.1.

11.3   Why can I generate a KDM with easyDCP Creator? Do I still need the easyDCP KDM Generator?

Please study the answer to the question "Why does easyDCP Creator generate KDMs since version 2.1?" in order to learn, why easyDCP Creator (version 2.1 or higher) allows for the generation of (D)KDMs. Please notice that one can only generate one (D)KDM when generating a new DCP. For the generation of many KDMs, easyDCP KDM Generator is still the software of your choice allowing you to generate unlimited KDMs with a simple click.

12 Encrypting DCPs

Encrypted DCPs make sure that your content can only be played back on specific servers. No one will be able to read the unencrypted data.

Every single Track (i.e. picture, sound or subtitle) can either be encrypted or unencrypted. So you have the ability to only encrypt the pictures, while the sound is unencrypted or vice versa. Another possibility is that you encrypt all reels of a single composition except the first reel so that the first reel (e.g. a trailer or advertisement) can be played back on every d-cinema server while the rest of the composition can only be played back with the right KDM.

Subtitle encryption is only supported in SMPTE mode.

12.1 Encrypting Tracks

To encrypt your DCP, just do the following steps:

Step 1: After loading the image Tracks, you can switch the encryption on or off by clicking the right mouse button, when rolling over the Track and selecting the menu item "Encryption" on or off. A lock appears on the Track, when encryption is activated:
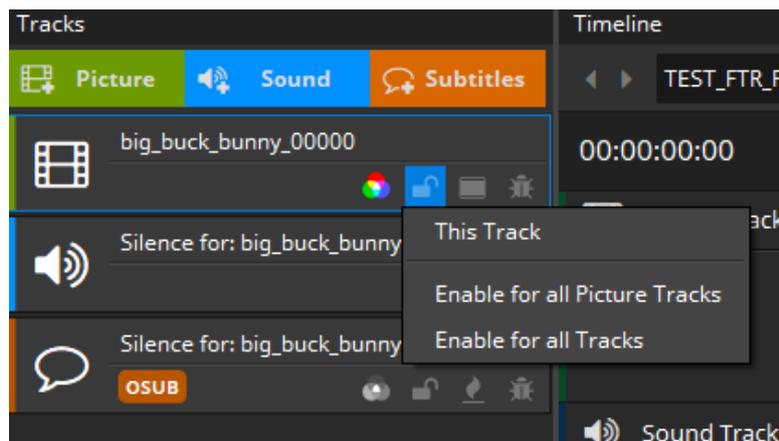
Step 2: When switching encryption on, easyDCP Creator generates automatically a random AES128 key.

Step 3: After pressing the "Generate Package…"button, a menu appears. Here you should create a DCP Digest file (*.dcpdig) selecting the checkbox and

choosing a folder). The DCP Digest is an XML file, which contains the AES keys for further KDM generation. Now the encrypted DCP can be generated.

> **WARNING: Do not deliver this DCP Digest file to any exhibitions because the DCP Digest contains all the keys in plain text needed to decrypt your DCP.**

Step 4: For the creation of KDMs we will deliver a separate KDM-Generation tool. This tool will read the DCP Digest file with the AES keys create KDMs for the specified player systems.

12.2   Server Certificates

easyDCP Creator allows loading encrypted content. Each Digital Cinema play-out system or mastering station has its own private and public key, and so does each easyDCP Creator installation. The private key is known only to the play-out system, whereas the public key is contained in a public server certificate and may be distributed to content providers. When content providers choose to encrypt a DCP, they need to somehow provide the decryption keys (there is one key for every encrypted track file) to the play-out system. To ensure that no one else is able to read these sensitive decryption keys, they are themselves encrypted in a way that only the targeted play-out system is able to decrypt them. To do this, the content provider will need the play-out system's public server certificate. This encrypted message is called a Key Delivery Message (KDM). easyDCP Creator will not keep its ingested KDMs in a repository, so that encrypted DCPs can only be viewed multiple times while having to re-ingest the keys each time. An expired KDM will no longer grant access to the DCP.

When easyDCP Creator is first started, it does not yet have a server certificate set. The demo edition does not allow unlocking of encrypted content. Only in the commercial edition, server certificates can be requested from Fraunhofer support by clicking "menu bar -> File -> Settings -> Activation Status -> Request License & Certificates". The process is described in a screen cast at www.easydcp.com.

Unique private and public keys will be generated and provided to you online. The received license and certificate set (a Zip file) can be imported via drag & drop (or with „ menu bar -> File -> Settings -> Activation Status -> Import License & Certificates".

The certificates are created and signed by Fraunhofer IIS. Fraunhofer IIS will delete the private key immediately, and keep the public leaf certificate in a database. The certificate is digitally signed by a chain of Fraunhofer certificates. These certificates are referred to as a certificate chain and this certificate chain, even though already included in the public server certificate, is additionally saved in a separate file. These certificates are meant for commercial use as they state the licensee's URL and have a unique serial number that links the certificates to the license. These server certificates are tied to the licensee's

computer, using the easyDCP system hash. If the license should need to be migrated to another system, a new certificate set will have to be requested. A migration is possible in the user account at www.easydcp.com. Since the private key is very sensitive, it is asynchronously encrypted using a combination of easyDCP Creator internal keys and a password selected by the user during the License & Certificates request. Likewise, if the user chooses to store their password, it is first asynchronously encrypted. The user password needs to have 6 to 20 letters and **cannot be changed after it was created**.

All mentioned files are stored in the user application data folder's certificates subfolder. Hence, the OS user management can be used to maintain multiple sets of certificates simultaneously. In order to easily determine which files belong together, they are each identified by a unique ID. The ID of the set that is currently used by easyDCP Creator is also listed in the "About" dialog (hit 'F6').

- easydcpcreator_<ID>.privkey.pem contains the encrypted private key

- easydcpcreator _<ID>.cert.sha256.crt is the public server certificate

- easydcpcreator _<ID>.chain.sha256.pem contains the certificate chain

- easydcpcreator _<ID>.privkey.passwd contains the encrypted user password

When easyDCP Creator is uninstalled, none of these files will be removed. If the user password file (*.passwd) is manually deleted, the user will simply be prompted for the password again the next time a KDM is ingested or an encrypted DCP is opened.

12.3   Export Server Certificates

The content decryption context menu is only available in the easyDCP Creator edition.

The option "File -> Content Decryption -> Export Public Server Certificate" will copy both the public leaf certificate (easydcpcreator_<id>.cert.sha256.crt) and the signature chain (easydcpcreator _<id>.chain.sha256.pem) to the selected folder. The signature chain contains the leaf certificate as well as intermediate certificates and the root certificate. You may safely distribute these certificates to content providers who want to issue a Distribution KDM to your easyDCP Creator installation. When issuing (D)KDMs with easyDCP KDM Generator, place only the leaf certificate file (*.crt) into the server certificate's folder or just drag and drop it into the corresponding input form.

13   Signing DCPs

easyDCP Creator allows you to sign the package with your own digital certificates. Note: If you generate DCPs with one or more encrypted Tracks, the package shall be signed.

13.1   Signing a DCP

To sign a package, open the Signature dialog by choosing "menu bar -> File -> Settings -> Activation Status -> Signature Setup". The following dialog box should appear:
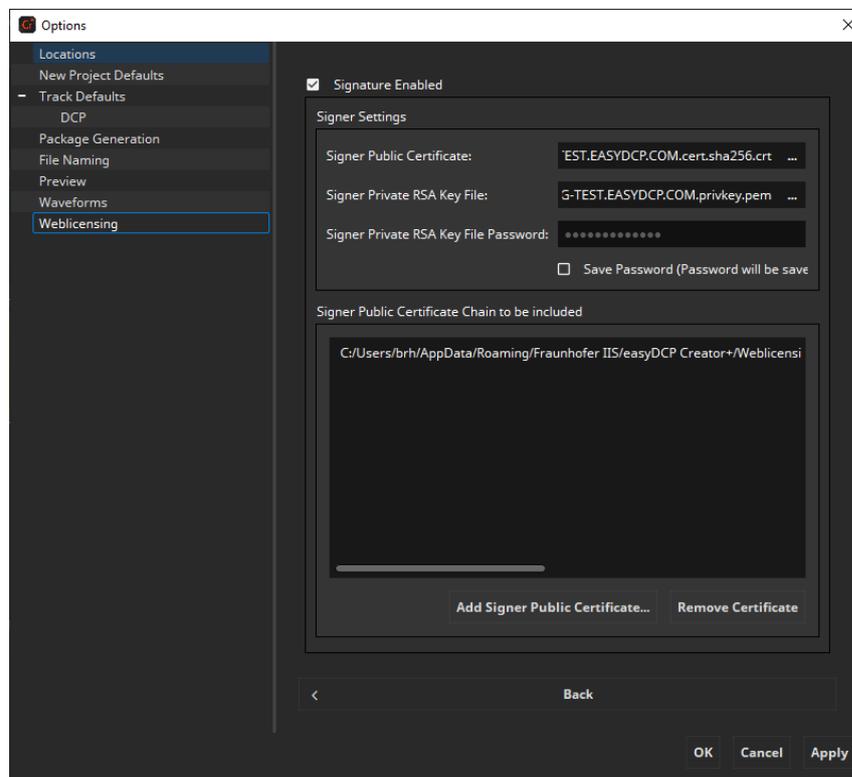
This dialog will automatically be filled with demo signer certificates during the first startup. If you purchase a license, you will receive your own signer certificates, containing your company's URL.

Custom signer certificates can also be used. Check the Checkbox "Signature Enabled" and fill out the window "Certificate Chain to be included" with the entire certificate chain of your own signer certificate (including the self-signed root certificate). There should be a minimum of 3 certificates in the certificate chain. The signer certificate (leaf certificate) should not be included here. Enter a Signer Certificate File with your own private RSA key file. If your private key

file itself is encrypted (which is strongly recommended), enter the password for this key file, otherwise leave this field empty.

To make sure all certificates and the certificate chain is valid please refer to the documents "SMPTE 430-2 D-Cinema Operations: Digital Certificate" and "Compliance Test Plan", which you can find at http://www.dcimovies.com/. It is very important to fulfill these specifications, otherwise problems may occur during ingest or playback of the package.

14   Opening DCPs

With the function for opening packages the easyDCP Creator provides a powerful feature to apply changes to existing DCPs fast and easily. With this function you are able to open your own DCPs or third party DCPs and deploy any changes e.g. adding subtitles, adding sound tracks, adding and rearranging reels and so forth.
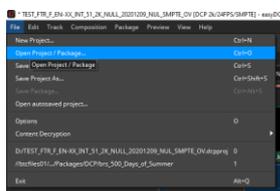
14.1   Editing an opened DCP

An opened unencrypted DCP can be edited just like a DCP that is built from scratch. Some restrictions apply on encrypted DCPs (see below). It is also possible to save the opened DCP and the deployed changes as a Project (*.dcpproj) in the easyDCP Creator. From the edited DCP, you can then generate a new DCP or a supplemental DCP.

14.2   Saving an opened package

When you have opened a package and just make changes on the metadata of the package, you don't have to generate a new package, you can also just save your changes to the existing one. Changes of the metadata include the offset, duration and annotation text of reels, rearranging, deleting and adding reels, renaming, deleting and adding compositions. To save the changes, choose "Save Package" in the file menu. If saving is not possible and re-encoding of the whole DCP is necessary, an error message will appear.

When saving the DCP, new UUIDs for all compositions and reels and the packing list will be generated. Thus, the saved DCP will be distinguished from the original by D-Cinema servers. If you saved an encrypted DCP, the DCP-Digest (*.dcpdig) file will be overwritten. Old KDMs for this DCP won't work anymore, new KDMs need to be generated.

If you change the Tracks of the package, e. g. applying a color transformation or add new Tracks, you have to generate a new DCP or a supplemental DCP using the button "Generate Package…".

14.3   Supplemental DCPs

Generating a feature movie is a time expensive procedure. If you're just adding subtitles or an additional sound track to an existing movie, easyDCP Creator provides a solution saving you a lot of time. You can generate a supplemental DCP. A supplemental DCP is a DCP, which enhances or modifies an existing DCP by providing just the changes and using the Tracks of the original DCP as references. Hence you don't have to build a whole DCP when just adding material to an existing one. Because a supplemental DCP amends an existing DCP, both the original DCP and the supplemental DCP have to be ingested on a D-Cinema Server to playback the compositions of the supplemental DCP.

To generate a supplemental DCP with easyDCP Creator you have to open a DCP and mark the original track and subtitle files as references (supplemental). For that, you have to click with the right mouse button on the Track and select "Supplemental -> This Track" in the displayed menu:
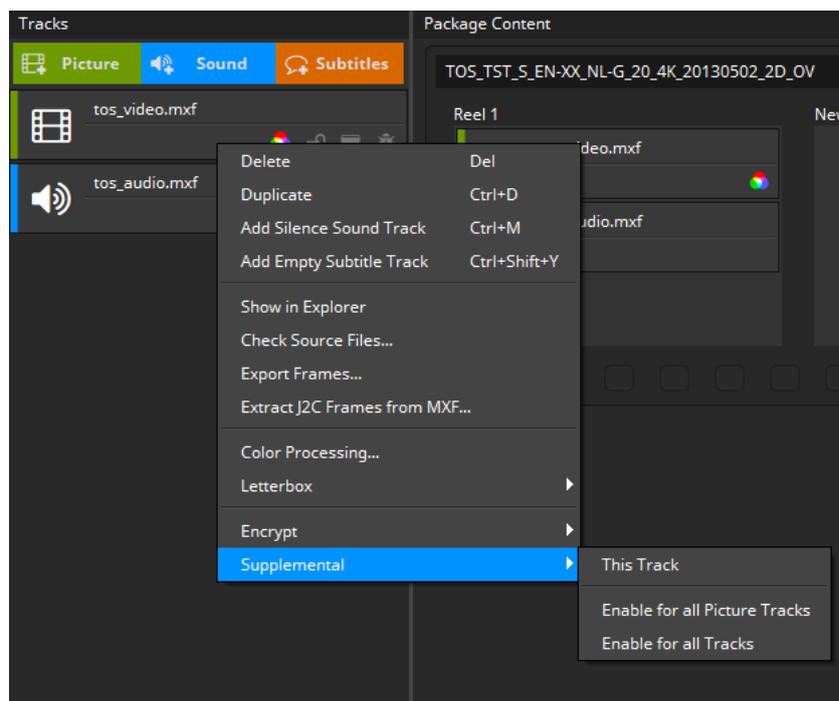
Then new compositions and new Tracks can be added and changes at existing compositions can be applied.

By clicking on the "Generate Package..." button the supplemental DCP will be generated. The difference to a normal DCP is, all Tracks marked as reference are not packed into the supplemental DCP, they are only referenced by CPL(s). This saves disk space and time during the generation process of the DCP. With the easyDCP Creator it is even possible to open and edit supplemental DCPs and generate further supplemental DCPs to them.

14.4 Opening encrypted DCPs

Opening encrypted DCPs is a feature of the easyDCP Creator only. When you open an encrypted DCP where you also have the corresponding Digest file (*.dcpdig), you can perform any changes you want on the DCP. This way you can open and modify encrypted DCPs you have built yourself. Without the Digest you can't change the DCP. If you have a KDM for the DCP you can view its content in the preview window. An opened encrypted DCP shows a closed lock on the encrypted Tracks, indicating that you have no access to this content.

If you have the DCP-Digest file (*.dcpdig) or a KDM for the DCP, you can either load it via the file menu or directly drop it onto the track manager to gain access to the encrypted content.

After you have loaded a KDM or Digest, an opened lock is shown with the Tracks denoting your access to its content. With a Digest file loaded, you can apply any changes on the DCP and save it or generate a new or supplemental DCP. Without a Digest, you can only generate supplemental DCPs.

> When generating a supplemental DCP from an encrypted DCP, new KDMs for the supplemental DCP have to be generated.

14.5 Validator

The package validation module was introduced with easyDCP Creator 3.4. It can be used to automatically search for a range of potential issues in a DCP. The validation is split up into many individual tests. Tests are executed one after the other. Some tests only take a split second (for instance: check if all files exist) while others may take a while (for instance: check if all JPEG 2000 images can be decoded).

Once a test was executed, it gives a result that is either **Success**, **Warning** or **Failed**. When selecting a test, more details can be found in the bottom section of the validation dialog. A tree of events will describe what the test has done and each entry in the tree can in turn be selected to see its details in the dark-grey text edit below. It is often not possible to foresee whether an issue will cause the DCP to be rejected by a cinema server or another tool in the production chain. For this reason we encourage the user to even take warnings seriously.
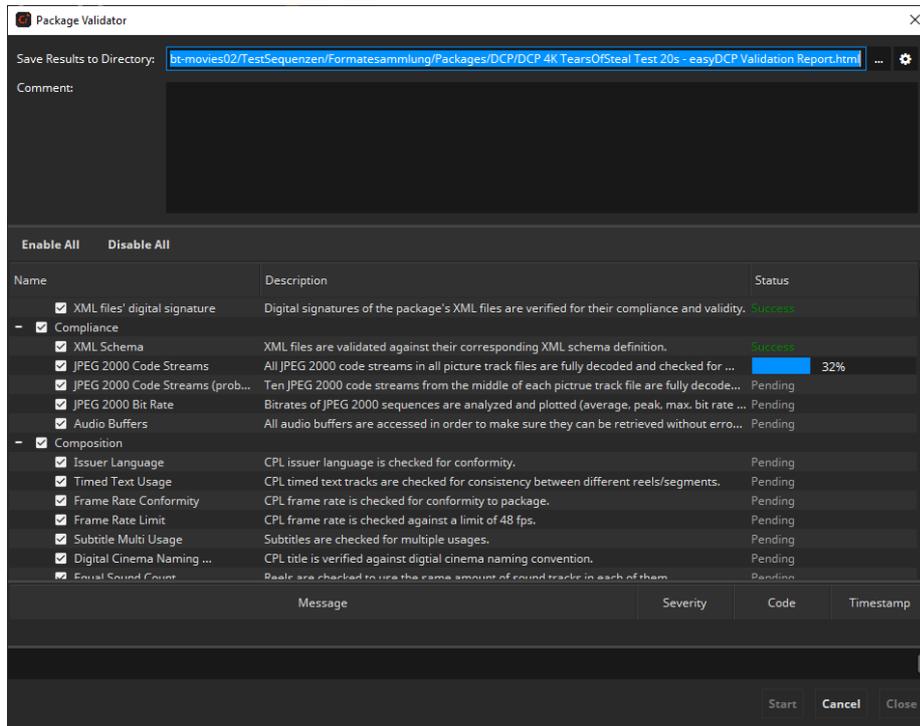
The result of a validation run is always stored as a report in HTML format. By default, the file will be named after the folder that contains the DCP and be located next to it. Also, the overall test result will be included in the file name:

```
DCP: C:\MyDcps\AliceWonder_FTR-1_S_EN-LAS_US-13_51_2K_DI_20060607_TDC_OV\
 Report: C:\MyDcps\AliceWonder_FTR-1_S_EN-LAS_US-13_51_2K_DI_20060607_TDC_OV -
          easyDCP Validation Report (Success).html
```

By clicking the cogwheel icon next to the "Save Results to Directory" field, the default behavior can be changed so that the file be located inside the DCP directory and/or that the overall validation result not be included in the filename.

```
DCP: C:\MyDcps\AliceWonder_FTR-1_S_EN-LAS_US-13_51_2K_DI_20060607_TDC_OV\
 Report: C:\MyDcps\AliceWonder_FTR-1_S_EN-LAS_US-13_51_2K_DI_20060607_TDC_OV\
          AliceWonder_FTR-1_S_EN-LAS_US-13_51_2K_DI_20060607_TDC_OV - easyDCP
          Validation Report.html
```

The validation report is separated into seven sections:

- **General Information** – contains top-level metadata on the package, the test result and the computer and easyDCP version where the validation was carried out. Custom annotations that the user entered into the validation dialog's "comment" field will also be added to this section.

- **Composition Playlists** – lists technical properties (such as duration, resolution, package type, JPEG 2000 profile, audio layout, etc.) individually for each composition.

- **Quality Report** – contains all the test results and details in an interactive view

- **Recommendations** – contains all the test results that are compliant to the standard but can cause issues in cinemas

- **JPEG 2000 Bitrate Analysis** – contains an interactive plot of the bitrate in Mbit/s over time for each CPL. Additionally, some statistics such as peak and average bitrate or the time code of the largest frame are stated.

- **Files** – lists the content of each XML file as well as the metadata of each MXF file in the package. If the package is a supplemental package (version file - VF) and the original version (OV) was also loaded, both packages' files are listed.

- **Directory Snapshot** – lists of all files (including those that don't belong to the package) within the folder or any subfolders of the package, including the file's size in Bytes and date of its last modification. Paths are stated relative to the package's root folder so that names of the user's local or network repository are not disclosed.

The **overall result** of the validation is

- **Failed** – if at least one test found an error

- **Warning**, if at least one test found a warning or has been deliberately disabled by the user (by clicking the check box next to the test in the validation dialog), and no test found an error

- **Success** – if all tests were executed and none of them found any potential issues (warnings or errors)

The quality report shows the results and details of all tests. When selecting a test, details are shown in the dark grey box on the bottom. In the below example, the test result is a warning, because the tests was deliberately disabled by the user by deselecting it before the start of the validation.

The **Bitrate Analysis** tab gives information on the JPEG 2000 bitrate. Every DCP or IMP is subject to a maximum bitrate that should never be exceeded. The maximum is typically 250 Mbit/s for DCPs, but can be higher for high-bitrate DCPs. The maximum bitrate is independent of the resolution or whether the movie is in 2D or 3D. easyDCP Creator will infer the maximum bitrate based on the package type and JPEG 2000 profile.

JPEG 2000 is a highly data-dependent image compression scheme, though. If a particular image is easy to compress, e.g. because there are not a lot of details in it, then the maximum bitrate will not be reached. Only images with many details (or a lot of noise) will have to be capped in order not to exceed the data rate. The bitrate computed by easyDCP is based only on the size of the decrypted JPEG 2000 file (i.e. without MXF overhead) and is converted from bits to Megabits using 10^3 (1000) as demanded by the specifications - and not 2^{10} (1024).

Starting with easyDCP 3.7.0 the bitrate analysis also shows the bitrates for each of the three components. For DCPs the component bitrate is limited at 200 Mbit/s. Since this can lead to issues on some cinema servers, the validation will show a warning between 190 to 200 Mbit/s for a component.

The diagram plots the bitrate over the time for each CPL. The plot is zoom-able via the mouse wheel and can be moved left or right by dragging it with the left mouse button pressed.
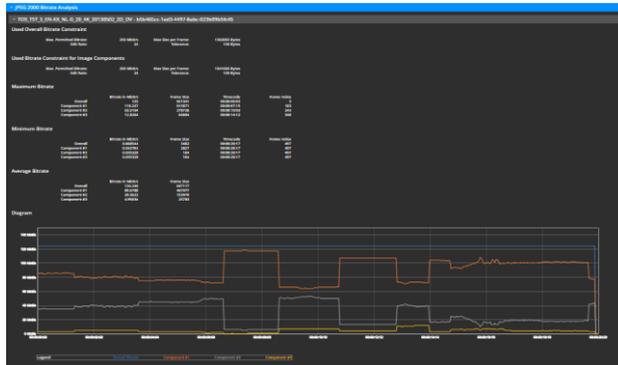
The validation can also be triggered from the command line. This way it is also easy to batch-validate an existing collection of DCPs.

Below is an example of Windows Batch file for validating all DCPs in a given folder:

```
@echo off
pushd \\networkstorage\MyDcpRepository
set EasyDcpBin=C:\Program Files\Fraunhofer IIS\easyDCP Creator+ 4.0.0\bin\easyDCP
  Creator+.com

for /f "tokens=*" %%D in ('dir /S /B /A:-D assetmap*') do (
  echo Validating %%D
  echo.
  "%EasyDcpBin%" "%%D" -validate -o C:\\Reports
  echo.
)
popd
```

For more details on how to use easyDCP Creator from the command line, please refer to chapter 15.

14.6   Merge CPLs

easyDCP Creator can merge CPLs from other DCPs or complete other DCPs into the currently opened project. Via Package => Merge CPLs the file, either the ASSETMAP or the CPL XML file, can be selected. The CPLs of the selected package will be added to the active project. In case of matching track files (e.g. when adding a VF to the OV) the track files are automatically reused.

There currently are some limitations for the import process:

- Project types have to match: you can't import an IMF package into easyDCP Creator

- Framerates of the packages have to match

15 Using Scripting Functionality

easyDCP Creator can be used with command line arguments. Using easyDCP Creator with command line arguments can be very useful for scripting purposes or in a scripting environment where many operations have to be executed automatically. For example this can be a weekly advertisement where the workflow is always the same. Or maybe you want to create a bunch of DCPs all with the same picture but with a somewhat different sound to find out which is the best.

15.1 On Windows

On Windows, the command prompt or a script (e.g. a batch file) would typically be used to pass command line parameters to easyDCP Creator. easyDCP Creator.exe / easyDCP Creator.exe were built using the Windows Subsystem and therefore their output is not visible in the command prompt. Instead, easyDCP Creator.com / easyDCP Creator.com should be used. Since the executable file contains a space, enclose any calls into "", e.g.

```
C:\>"Program Files\Fraunhofer IIS\easyDCP Creator+ 4.0.0\bin\easyDCP
Creator.com" -help
```

15.2 On Mac OS X

On Mac OS X, the terminal or a script (e.g. a shell script) would typically be used to pass command line parameters to easyDCP Creator. The easyDCP Creator application is in truth a directory called "easyDCP Creator+.app". The executable file which can be started and get passed parameters is "easyDCP Creator+.app/Contents/MacOS/easyDCP Creator". Since the executable file contains a space, enclose any calls into "", e.g.

```
Mymac:~ user$ "/Applications/easyDCP Creator+
4.0.0.app/Contents/MacOS/easyDCP Creator 3.7.0" -help
```

15.3 Using command line (CLI) arguments

For detailed descriptions of the available parameters, call the executable file with the parameter "–help".

```
C:\Program Files\Fraunhofer IIS\easyDCP Creator+ 4.0.0\bin>"easyDCP Creator+.com" -h

easyDCP Creator+ 4.0.0 rev.105190

Usage: " C:/Program Files/Fraunhofer IIS/easyDCP Creator+ 4.0.0/bin/easyDCP Creator+.exe"
<parameters> "

Optional parameters:

 -username              Login username - optional if already stored
```

```
 -password            Login password - optional if already stored
 -i                   <projectfile>
 -o                   <output directory>
 -mbits               <mbits> optional - set mbits per second for encoding.
                      Default: 250 mbits for DCP
 -d                   <digest filename>
 -p                   <password for signature certificate private key>
 -writeCplMetadata    Set CPL metadata writing enabled
                      This setting will be taken into account for SMPTE DCPs only
 -trimTrackFiles      Set Track File trimming enabled
                      This setting will cause mxf files to only contain used ranges of
frames
 -forceReencoding     Force re-encoding of sources
                      All frames get re-encoded
 -forceNoReencoding   Force no re-encoding, just re-wrapping
                      No frames will be re-encoded and the frames will be packed into a
new mxf file
                      You have to make sure that the content properties are valid for
the selected package type (profile/codec, bitrate, color space).
 -reencodeOnDemand    Re-encode if necessary
                      Only frames that don't match the target settings (profile/codec,
bitrate, color space) get re-encoded.
                      All other frames will be packaged as they are.
 -copySourceFiles     Copy mxf files to destination without touching sources
                      No frames will be re-encoded and the existing MXF files will be
copied to the destination folder.
                      You have to make sure that the content properties are valid for
the selected package type (profile/codec, bitrate, color space).
 -forceWildTrackFormat Enforce wild track format for the package (Audio)
                      No matter what the originally configured audio channel format is
wild track format will be used.
 -ph                  print system hash (required for requesting a license)
 -log                 <logfile>|CON|CONSOLE
                      enable log and write it to a file or the console
 -h                   print this help

Device management:
Select which devices should be used for generation
-deviceCpuOnly                Use only CPU for generation
-deviceGpuOnly                Use most powerful GPU for generation
-deviceId                     <device ID>
                              Use specific GPU, identified by device id

CUDA devices:
[1] [CUDA] "GeForce RTX 2080" (cc7.5, 46 x 128 processors, 8192 MB)

Example:
C:\Program Files\Fraunhofer IIS\easyDCP Creator+ 4.0.0\bin\easyDCP Creator+.exe -i
C:\myDCPprojs\test.dcpproj -o C:\myDCP\newDCP -d C:\MyDigests\newDigest.dcpdig


Validation parameters:

 -validate
   Performs a validation of the provided package.

[--reportFile|-o <report.html>]
    Sets the path for the output file of validation. The directory has to exist.

    If the path is a directory, the package's folder name will be used as file base name.

    This way, all reports for a validation batch job can be conveniently stored in a
single folder.

[--comment|-c <comment>]
    Write a custom comment to the quality report.

[--tests|-t <"1,2,3">]
    List of tests which should be executed. If no tests are selected, all available tests
will be executed.

    Mutually exclusive with -skipTests.

[--skipTests|-s <"1,2,3">]
    List of tests which should not be executed. All other tests will be enabled.

    Mutually exclusive with -tests.

    Available tests:
     Id Name
     1  File Sizes
```

```
 2  XML files' digital signature
 3  XML Schema
 9  File Hashes
10  File Hashes (small files only)
11  JPEG 2000 Code Streams
12  JPEG 2000 Code Streams (probe only)
13  JPEG 2000 Bit Rate
14  Audio Buffers
15  Digital Cinema Naming Convention
16  Package Title
17  Consistent Trackfiles
18  XML Format
19  Fonts/PNGs Listed in Package
20  Out of Bounds Timestamps
21  Characters Available
23  Fonts/PNGs Available
24  Order of Time-in Timestamps
25  Order of Timed Text Spot Numbers
26  Open Subtitles Language
27  Subtitle Burnin Overlap
28  Number of Compositions
29  Conformity
30  Output Profile List
31  Issuer Language
32  Timed Text Usage
33  Frame Rate Conformity
34  Frame Rate Limit
35  Subtitle Multi Usage
36  Digital Cinema Naming Convention
37  Audio Language Codes
38  Track Edit Rates
39  Track Frame Rates
40  Subtitle Display Type
41  Subtitle Language
42  Resolution
43  Image Subsampling
44  Source Colorspace
45  Audio Channel Configuration
46  Audio Sampling Rate
47  Audio Bits
48  JPEG 2000 Properties
50  Number of Sequences/Tracks
51  Sequence Durations
52  Sequence Edit Rates
53  Subtitle Burn-in
54  Subtitle Display Type
55  Subtitle Language
56  Subtitle Multi Usage
57  Dolby Atmos
58  Sequence Duration
59  Audio Sequence Duration with NTSC Frame Rates
60  Number of Entries
61  Sound Language Code
62  Intrinsic Duration
63  Frame and Edit Rate
64  Frame and Edit Rate Metadata
65  Picture Track Subsampling
66  Resolution
67  Track audio padding
68  Subtitle Track Source Document
69  Subtitle Track Conformity
70  Subtitle Track Schema Check
71  Subtitle Track Semantics Check
72  Subtitle Track Edit Rate
73  Subtitle Track Resource
74  Subtitle Track Encryption
75  Subtitle Entries After Picture
76  Frame Rate Conformity
77  Subsampling Resolution
78  Dolby Vision Metadata
79  Dolby Vision Metadata Supplemental
80  Equal Sound Count
81  CPL contains Reel
82  Contains CPLs
83  Parsing OPLs
84  Max Path Length of Package Files
85  Valid color processing configuration
86  Valid subsampling configuration
87  Check for valid CPL metadata
88  Check for CPL metadata extension sign language video
89  JPEG 2000 Component Bit Rate Recommendation
```

```
90 Subtitle Track ReelNumber
91 SMPTE Subtitle Namespace Prefix
```

15.4   Examples

`easyDCP_Creator "c:/myprojects/Africa.dcpproj"`

Starts easyDCP Creator and automatically opens the Project File
"c:/myprojects/Africa.dcpproj".

`easyDCP_Creator -i "c:\DCPproj\test.dcpproj" -o "c:\DCP"`
`-d "c:\digests\new.dcpdig"`

Creates a DCP into the folder "`c:\DCP`" using the Project File "`test.dcpproj`"
and generates the DCP Digest file "`new.dcpdig`".

15.5   Standalone Transcoder

The standalone transcoder application can be used in the same way as
described for easyDCP Creator above. Starting easyDCP Standalone Transcoder
with the parameter "–help" will display a list of available parameters.

```
C:\Program Files\Fraunhofer IIS\easyDCP Creator+ 4.0.0\bin>"easyDCP JPEG 2000 Standalone
Transcoder.com" -h

Usage:
C:\Program Files\Fraunhofer IIS\easyDCP Creator+ 4.0.0\bin\easyDCP JPEG 2000 Standalone
Transcoder.exe
    -input                  /-i   <input_file>
    [-start                 /-s   <start_frame>                ]
    [-end                   /-e   <end_frame>                  ]
    -output                 /-o   <output_folder>
        [-subfolder               /-sf                                       ]
    [-type                  /-t   <project_type>               ]
    [-fpsnum                /-f   <fps_numerator>              ]
    [-fpsdenom              /-d   <fps_denominator>            ]
    [-bitrate               /-b   <bitrate>                    ]
    [-letterboxing          /-p   <letterboxing>              ]
    [-scaling               /-sc  <scaling>                    ]
    [-colortransform        /-c   <color_transformation>       ]
    [-sourcecolorspace      /-ss  <source_color_space>         ]
    [-destinationcolorspace /-ds  <destination_color_space>    ]
    [-numthreads            /-n   <number_of_threads>          ]
    [-log                         <log_file_path>              ]
    [-gui                   /-g                                ]
    [-help                  /-h                                ]
        [-username                    <username>                      ]
        [-password                    <password>                      ]


<input_file>    First input image or the movie file.
<start_frame>   First frame which will be processed.
                (Default: 0)
<end_frame>     Last frame which will be processed.
                (Default: last frame)
<output_folder> Output folder.
-subfolder / -sf        Create subfolder with name based on the input file name.
                          (Default: Don't create subfolder)
<project_type>  Type of the project and images.
                Options: DCP2k, DCP2k3D, DCP4k, DCP4k3D, IAP2k, IAP4k, MAP
```

```
                 (Default: DCP2k)
<fps_numerator> Numerator of frames per second.
                 (Default: 24)
<fps_denominator> Denominator of frames per second.
                 (Default: 1)
<bitrate>        Bitrate for the JPEG 2000 compression in MBit/s or lossless:
                 60 - for 60MBit/s,
                 lossless - lossless compression
                 If project type is stereoscopic, the given value is
                 the overall bitrate for both eyes.
<letterboxing>   Letterboxing applied.
                 Options: full, flat, scope, automatic and off
                 (Default: automatic)
<scaling>        Scaling applied.
                 Options: off, fit, fill
                 (Default: off)
<color_transformation> Color transformation, name or filename.
                 (Default: None)
<source_color_space> Color space of source, name or filename.
                 (Default: None)
<destination_color_space> Color space of destination, name or filename.
                 (Default: None)
<number_of_threads> Number of threads used for the processing.
                 (Default: maximum)
<status_xml_output> Output will be send to a file or the serverport.
                 When given a path and file name, the status will be written to
                 that file. When given a server port number, the status will be
                 available at the given port.
<status_stylesheet_file> Path and file name of the stylesheet, used with the
                 status xml.
                 When using a xml file output, the path has to be given
                 relatively to the status xml file. When using the server output
                 the path has to be given relatively to this program.
<status_stylesheet_file> Path and file name of the stylesheet, used with the
                 status xml.
                 When using a xml file output, the path has to be given
                 relatively to the status xml file. When using the server output
                 the path has to be given relatively to this program.
<log_file_path> Path where log file shall be created ot "-"/"Con" for console logging
-gui/-g          Force start of gui.
<username>       Login username to connect to easyDcp license server
<password>       Login password to connect to easyDcp license server


Available color transforms:
ITU 709 (Gamma 2.2) -> X'Y'Z'
ITU 709 (Gamma 2.4) -> X'Y'Z'
P3 -> X'Y'Z'
R'G'B' Full Range -> Y'Cb'Cr' Legal Range (Rec BT.709)


Available color spaces:
Eclair Color
RGB (ITU-R BT.2020 / PQ)
RGB (ITU-R BT.2020 / PQ) - Full Range
RGB (ITU-R BT.709 Full-Range)
RGB (ITU-R BT.709)
RGB (ITU-R BT.709) Legal Range Gamma 2.0
RGB (ITU-R BT.709) Legal Range Gamma 2.2
RGB (ITU-R BT.709) Legal Range Gamma 2.3
RGB (ITU-R BT.709) Legal Range Gamma 2.6
RGB P3 (D65)
RGB P3 (D65) PQ
RGB P3 (DCI)
Standard RGB (sRGB)
XYZ (DCI)
YCbCr (ITU-R BT.709)
```

16 Tips and Tricks handling DCPs

16.1 Uploading DCPs and KDMs to FTP-Servers

Before up- or downloading DCPs or KDMs to or from FTP-Servers, the DCPs and KDMs should be zipped. During the upload or download process files which are stored in ASCII format – such as the XML files like Packing List (PKL), Composition Playlist (CPL) or Key Delivery Message (KDM) – are changed and errors may occur during DCP ingest or playback. Some FTP-Servers change line feeds or tabs resulting in bad signature hash values. Mac and Windows often use different line feed in text files. To prevent this source of errors before transferring such data all files should be zipped before transaction. You should zip files for E-Mailing, too.

A single DCP should consist of at least five files:

`VOLINDEX` or `VOLINDEX.xml` The volume index is important if you deliver your DCP over more than one volume.

`ASSETMAP` or `ASSETMAP.xml` The Assetmap contains a list with all of the files to find for the server.

`…_pkl.xml` A packing list (PKL) containing a list with all of the files to be ingested.

`…_cpl.xml` A composition playlist (CPL) containing information of a single composition.

`…_j2c.mxf` A Track containing JPEG 2000 pictures.

`…_pcm.mxf` A Track containing PCM waveform.

`…_sub.mxf` A Track containing timed text.

`…_kdm.xml` A KDM for a specific D-Cinema playback system.

There may be more files regarding to the complexity of your package.

Every single DCP shall be stored in its own directory. No more than one DCP shall be stored in one folder.

16.2 Opening XML files in text file editors

Opening XML-files of a DCP (e. g. PKL, CPL and KDM) in a text editor is a dangerous thing. After opening the files for viewing please make sure you do not save the files. Do not simply edit the XML-files. For example if you want to

change your company name or correct a typo error you have to recreate the whole DCP. One changed character is enough to fail the signature test and errors may occur during ingest or playback of the DCP on a D-Cinema Server.

Some editors are running in auto-save mode thus overwriting the original files (i.e. changing line delimiters due to the specific operating system) resulting in bad signature hash values. These corrupted signatures cannot be ingested on a D-Cinema playback system. So don't touch the files of a DCP. Do not rename any files of the DCP. Only store one DCP in its own folder. Two or more DCPs cannot be stored in the same folder, because the assetmap.xml and the volindex.xml will be overwritten.

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17   Limitations

17.1   DCPs

DCPs split across multiple volumes (VolIndex) are not supported.

"E-Cinema" DCPs with MPEG2 essence are not supported.

17.2   Timed Text

The timed text formats specified for InterOp DCPs and SMPTE DCPs are supported.

Only a subset of the elements defined in DLP Cinema^{TM} Projection Technology ("InterOp timed text") and SMPTE 428-7 ("SMPTE timed text"). This subset covers PNG as well as text subtitles or captions, rendered horizontally with or without custom fonts, outlines or shadows. A not exclusive list of ignored elements are ruby characters (Rt tag), attributes related to rotation, attributes related to scaling, attributes and related to stretching.

Stereo 3D subtitles are not supported.

18   Frequently Asked Questions (FAQs)

please refer to FAQs at www.easydcp.com

19   Contact

We appreciate very much to have your feedback and your annotations about easyDCP Creator+. In order to enhance the software and to optimize it for your applications, we are looking forward to your cooperation.

If you have any problems or questions, please contact us at the following addresses:

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