RIT MAGIC DCP Exhibition

SOFA Tier 2 Screenings

Technical Policy

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Prepared For
SOFA Faculty & Students

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I. Introduction

SOFA Tier 2 screenings require two different deliverables: a Digital Cinema Package (DCP) deliverable for exhibition in the MAGIC Wegmans Theater, and a video deliverable for the SOFA screenings sign-up/SOFATube archive. In order to ensure that your film will playback properly on the Digital Cinema equipment in the theater, the guidelines in this document ***must*** be followed. It is the responsibility of the filmmaker to verify that their export settings match the requirements detailed below. The SOFA FVASA technical director and those that run screenings will not be held responsible for films that fail to playback due to incorrect export settings.

Tier 2 is designed to work appropriately with the Digital Cinema equipment located in the theater and allows for more professional exhibition abilities and qualities. It offers filmmakers the ability to screen a higher quality film and introduces workflows that enable new screening formats. Tier 2 exhibition comes with constraints that follow DCI (Digital Cinema Initiatives) specifications for Digital Cinema distribution and exhibition. This does add some complexity, but Tier 2 provides great benefits over Tier 1 exhibition.

NOTE: It is important for Tier 2 productions, like any productions, to take the details of your exhibition format into account in order to make technical decisions (i.e. shooting format) during pre-production and production.

Tier 2 DCP Screenings Limitations

Resolution	1998x1080 (DCI 2K Flat) 2048x858 (DCI 2K Scope) 3996x2160 (DCI 4K Flat) 4096x1716 (DCI 4K Scope)
Aspect Ratio[1]	1.85 (Flat) or 2.39 (Scope)
Frame Rate	24, 25, 30, 48, 50, 60 *No Drop Frame*
Sound	Stereo, 5.1 or 7.1, Uncompressed 24Bit/48kHz
Format	Digital Cinema Package (DCP)
Color Bit Depth, Chroma Subsampling	12 bit, None
Display Gamma, ColorSpace[2]	2.6, X'Y'Z'
WhitePoint, Luminance[2]	D65, 48 nits

*[1] If you would like to finish in a custom aspect ratio other than 1.85 or 2.39, please contact the FVASA technical director at **fvasa@rit.edu** to discuss options.*

[2] This will differ with future HDR and Wide Color Gamut options.

A Note on Digital Cinema Color

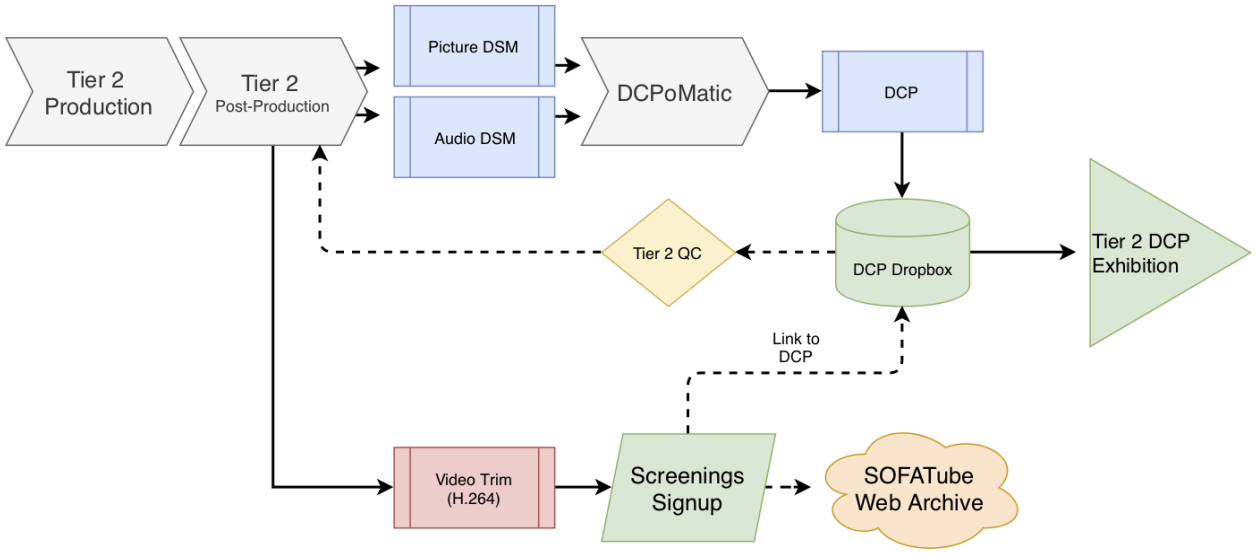
Digital Cinema exhibition is roughly half as bright as a typical Rec709 calibrated computer monitor. The difference in brightness will have color appearance consequences as colors will appear different in a dark Digital Cinema environment. Please be aware of this. Consider color correcting/grading in the MSS Color Correction Theater for an accurate digital cinema environment setup *(subject to availability and room access permission)*. If you would like to preview how your film looks before submission, or while you are in post production, please contact ***fvasa@rit.edu*** to make arrangements.

II. Expected Users

The Tier 2 Workflow is designed for, but not limited to, upperclassman filmmakers in workshop classes, thesis films and independent studies who want to exhibit films in more professional formats. Users who follow the Tier 2 requirements are expected to have the skill and knowledge to handle multiple multi-format deliverables in order to take advantage of the digital cinema features. The workflow is designed to allow for wide aspect ratios, high fidelity color, and surround-sound audio formats that are not possible with the traditional Tier 1 video workflow. Tier 2 also allows for future films to incorporate High Dynamic Range, Wide Color Gamut, or High Frame Rate media. Please contact ***fvasa@rit.edu*** with questions regarding these capabilities.

III. Overview

The diagram below provides a brief graphical overview of the workflow. These are the steps you will have to follow for Tier 2 Screenings. The following sections describe each process in detail.



IV. Picture DSM

DSM Stands for "Digital Source Master" - This is the final export from your NLE, color correction, or conform program that will be used to make the DCP in step VI.

The encoding settings defined in this section reflect a variety of different deliverable options suited for styles of projects students may encounter. The options given represent a range of complexity/quality based on the type of project that you are going to screen, so read carefully to decide which is best for yours. Contact ***fvasa@rit.edu*** for assistance in choosing the appropriate export if necessary.

A. Conform

Depending on the chosen exhibition format, you will need to make sure that you adhere to the following DCI specifications for your DSM export in order for the DCP to be correct.

Frame Rate: 24.00 fps / 30.00 fps (& other accepted)

If showcasing in 24.00, it's best for source footage to be shot and kept in 24.00 fps throughout the entire production. If this is not the case, conform your NLE timeline to

24.00 fps and continue through post-production at 24.00 fps. Digital Cinema does NOT support 23.98 or 29.976 FPS. This applies to all other accepted framerates.

Resolution: Your timeline and export resolutions should conform to one of the four (4) DCI specified containers.

DCI 2K Flat: 1998 x 1080 (1.85:1)
DCI 2K Scope: 2048 x 858 (2.39:1)

DCI 4K Flat: 3996 x 2160 (1.85:1)
DCI 4K Scope: 4096 x 1716 (2.39:1)

*If you want your film to be in a different aspect ratio (4:3 etc), you must pad your DSM deliverable with black to reach one of the four DCI container resolutions for proper DCP creation. Contact **fvasa@rit.edu** with questions regarding this.*

B. Export

Options for export format/encoding exist based on your workflow needs and technical savvy. Note that these settings may be achieved differently depending on your NLE/conform program. All are possible from Adobe, AVID Media Composer, DaVinci Resolve, and Baselight. Contact ***fvasa@rit.edu*** if you need help determining which is best to use and how.

Option A - TIFF Image Sequence

The recommended option. TIFF sequence DSMs are common industry practice for DCP creation. A TIFF sequence preserves the quality level that is required to get the most out of the Digital Cinema projector. This is ideal for films that will screen using a DCI aspect ratio (1.85 or 2.39) and want to retain the *highest-quality* image pipeline (12 to 16 bit) with no compression. This is a sequence of image files (one per frame of video) and will be large. *This is the recommended format and works very well for Live Action students who shoot RAW or Animators who have a frame sequence.* Consult ***fvasa@rit.edu*** for help if needed.

Format: TIFF
Bit Depth: 16 Bit
Data Levels: Full Range

Note that Option A requires that sound be delivered separately to the DCP packaging step.

Option B - DNxHR

The DNxHR workflow is provided as an alternative to exporting and managing a large TIFF sequence. At the time of this writing there are support inconsistencies with DNxHR support between various programs. Thus, the quality level of DNxHR exports will differ from program to program. For students finishing from Adobe programs, it is recommended to use the TIFF option for DSMs as Adobe DNxHR exports are limited to 10 bit color. This is not ideal as it will not take advantage of the 12 bit color that Digital Cinema can offer. DNxHR is useful for films that only need minimal Tier 2 features (surround sound with standard image quality or widescreen standard image quality with stereo sound). *If you can export and handle storage of a TIFF sequence, that is the recommended DSM format.*

Format/Container: MOV/QuickTime
Codec: DNxHR HQX 10/12 bit (Premiere/Resolve)
Data Levels: Full Range

Note: Finishing your film in Tier 2 requires Audio and Video be brought separately to DCP packaging. Consult the documentation ***at fvasa.rit.edu/documentation*** *for help.*

If exporting your DSM out of Adobe Premiere Pro, Media Encoder or After Effects, presets for DSM exports have been created on every workstation with Adobe software. For detailed instructions on Picture DSM exports please refer to the document, ***MSS-2019-04W: Exporting Picture DSMs for Tier 2*****.**

V. Audio DSM

A. Conform

For a Pro Tools workflow, your session should be set to 48kHz/24bit. While it is possible to change your working bit-depth, it is **not** possible to change the sample rate once a session has been created.

If you are mixing for surround sound, verify that SMPTE channel order (L,R,C,Lfe,Lss,Rss,[Lrs,Rrs]) is selected within the I/O menu in Pro Tools. Pro Tools uses its own internal channel mapping (called FILM) and may default to also output Pro Tools channel order.

In order to avoid unsynchronized audio during mixing, it is important to communicate with the editor that they deliver the same frame rate that the final film will be exported at.

If you are finishing in 24fps, the editor was expected to conform their session to 24fps, so the audio timeline must do so as well.

B. Technical Requirements & Export

Before you bounce your final mix, verify that the cut of the video that you have includes the complete duration of the film from the RIT credit at the beginning to the last frame after the credits. In essence, the duration of the mix should be **exactly** the same length as that of the picture DSM. If it is not, then the film will not be in sync when packed as a DCP.

Ensure that the maximum peak does not exceed -3 dBFS and target integrated loudness of -27 LKFS/LUFS (+/-2 LU). These specifications can be monitored and verified using a variety of plugins within your DAW or NLE. For Pro Tools users, the author recommends *Izotope Insight (1 or 2)* for monitoring and analyzing program loudness and peak*, while Izotope Loudness Control* is suited for hard-conforming your final mix to the -27 LKFS/ -3 dBFS technical requirement. The availability of these plugins is dependent on what plugins are installed at your workstation. *Avid Pro Limiter Loudness Analyzer* is an option freely available on all Pro Tools systems. For those mastering their audio in Premiere Pro, *Loudness Radar* is recommended.

Once the program picture lock has been confirmed and level specifications met, you can now bounce your mix. Your bounce settings should be:

Stereo Mixes:	**5.1 & 7.1 Surround Mixes:**
File Type: WAV	**File Type**: WAV
Formated: Interleaved	**Formated**: Multiple Mono
Bit Depth: 24 Bit	**Bit Depth**: 24 Bit
Sample Rate: 48 kHz	**Sample Rate**: 48 kHz

If you are mixing in surround sound, you are also required to bounce a stereo fold-down for the archival trim deliverable. This can be accomplished by using a downmixing plugin with Pro Tools and choosing the output of that stereo track as the Bounce Source. ***Make sure to check the level of the fold-down mix! Unless you specify within the downmixer to drop the level, it will be ~3dB louder.***

Once your mix is bounced, the audio DSM is ready to be sent to whoever will be packing the DCP, typically being the editor or colorist.

For a more detailed walkthrough of conforming and exporting Audio DSM, please refer to the document, MSS-2019-08W: Conforming and Exporting Audio for Tier 2

VI. DCP Requirements

Once your Picture DSM and Audio DSM files are created, you will use them to create the DCP that will screen. To do this, the open-source DCP packaging program DCP-o-matic 2 will be used. In order to ensure that your DCP is compatible and DCI compliant, there are a few requirements to note. The table below lists specifications that are required to ensure compatibility.

For instructions on creating the DCP, refer to document: **MSS-2019-07W: Using DCP-o-matic 2**

Resolution	DCI 2K or DCI 4K
Aspect Ratio	1.85 (Flat) or 2.39 (Scope)
Frame Rate	24, 25, 30, 48, 50, 60
Sound Format	2.0, 5.1, 7.1 (SMPTE order)
DCP Type	2D
DCP Name[1]	LastnameFilmTitle_%%%%%%%%%%
DCP Content Type	Short
Encryption	None
Standard	SMPTE
Reels	Single Reel
JPEG2000 Bandwidth	250 Mbps
Color Encoding & Luminance	2.6 X'Y'Z' 48 nit

[1]%%% indicates the ISDCF name created from DCP-o-matic 2

VII. Quality Control

By utilizing the Tier 2 workflow, you are allowed a Quality Control (QC) day for viewing your DCP in the theater. This is done because DCP's cannot accurately be viewed and verified on a computer. Students should utilize the QC process to ensure that their film meets the required specifications for proper playback.

VIsit fvasa.cad.rit.edu/documentation for QC information, or contact ***fvasa@rit.edu*** for details on QC availability.

NOTE: In order to take advantage of the QC process, you must adequately time manage your pre-production, production, and post-production. Students using Tier 2 are expected to have the production savvy to supply themselves with ample time to allow for QC. If you are improving the quality of your work, you must balance it with work ethic.

A. DCP Delivery

Your DCP is automatically delivered to the screenings admin when you package it using DCP-o-matic 2.

B. QC Playback

Please be sure to watch your film back to confirm that it was exported/packaged correctly! Audio and video should hit the specifications listed above without exception. Sound Mixers will have the option to set a custom volume Fader playback level, other than the default level of 5.5 that Tier 1 is constrained to. Please arrange for the sound mixer to be present so that they can set a Fader level that accurately respects their mixing intent. If you do not QC your film during this process your film will be played at fader level 5.0.

The FVASA Technical Director reserves the right to lower playback volume if a mix is harmfully loud or above spec, but will **not** increase it for Tier 2 films beyond the specified fader level set during the QC day. Those running screenings will not replace files that were delivered incorrectly after the submission deadline and QC day has passed, ***unless*** a formal technical amnesty has been granted. Please refer to the general SOFA screenings policy for more detail.

C. Final DCP

If you have QC'd your DCP and you are satisfied with the results, you must now follow the instructions in section VIII for creating the SOFATube Trim Deliverable.

If you were not satisfied with the quality of your QC's DCP, you must make any necessary changes in post production and re-render your DCP for another round of QC.

VIII. SOFATube Trim Deliverable

In addition to your DCP, you are required to submit a separate video trim deliverable. This version of your film should follow the Tier 1 screenings export requirements for delivering an H.264 version of your film. For reference the target specifications for picture are listed in the table below.

This **is not** the version that will show at any screenings. This **is** the version that will be stored on SOFATube and presented on the Honors Show DVD (refer to SOFA policy or ***fvasa@rit.edu*** for more on Honors Show).

Resolution	Any DCI Native Resolution[1]
Aspect Ratio	Any DCI Native Aspect Ratio[1]
Frame Rate	23.98, 24, 25, 29.97, 30, 48, 50, 59.94, 60
Sound	Stereo, bitrate-limited (320 kbps)[2]
Compression	H.264, Interframe & Intraframe Compressed
Container	MP4
Color Bit Depth, Chroma Subsampling	8 bit, 4:2:0
Display Gamma, ColorSpace	2.4, Rec709
WhitePoint, Luminance[3]	D65, 100 nits

[1]You may export the same resolution/aspect ratio as your DCP deliverable. It is recommended that 4K content is downscaled to 2K varieties. Additionally, any of the DCI formats can be fit into a 16:9 container (i.e. 1080p HD) for better handling - the deliverable will export with black letterbox/pillarboxing.

[2]The trim deliverable should use a stereo fold down if surround sound mix was used in the DCP. This should be delivered by the sound mixer.

[3]The difference in luminance between DCPs and SOFAtube trim may require a separate pass in color grade on a standard sRGB monitor if you choose to have your trim deliverable look accurate to your cinema deliverable, otherwise they may look slightly different. For questions regarding this, contact the FVASA Technical Director at ***fvasa@rit.edu****.*

Presets for exporting your SOFATube trim deliverable have been created for Adobe Premiere Pro, Media Encoder and After Effects. You can find these along with your DSM Presets. For more detail on the trim presets please refer to document ***MSS-2019-04W: Exporting DSMs for Tier 2.***

If you are finishing out of Davinci Resolve, Avid Media Composer, Baselight or some other NLE, the general settings to use are listed below.

A. Picture

Format (Codec): H.264
Target Bitrate: up to 25 Mbps
Max Bitrate: up to 30 Mbps

Other NLE and video encoding programs may show different settings. In such cases, the most important settings to ensure compatibility are that you use an H.264 codec and have a bitrate between 25-30 Mbps.

B. Audio

Audio Codec: AAC
Sample Rate: 48000 Hz
Channels: Stereo
Bitrate Settings: 320 kbps
Bit Depth: 24

Other NLE and video encoding programs may show different settings. In other NLEs, ensure you use AAC, 48000 Hz, 320 kbps at 24bits.

C. Container

The container within which the H.264 should be wrapped as **MP4**. This is the default wrapper when using the H.264 format in Adobe programs, but you may need to specify the container and codec separately in other programs. If the program you are using does not allow for H.264 encoding to an MP4 file, please contact ***fvasa@rit.edu*** for assistance.

IX. Captioning/Subtitling

All accessibility procedures related to deaf and hard-of-hearing students cross-registered in RIT programs apply to those who have been admitted into SOFA. Students, whether deaf, hard of hearing, or hearing, will be responsible to manage the captioning of any short film to be submitted for screening at SOFA events, including the end-of-the-semester screenings. Refer to documentation on suggested workflows and include the addition of captions/subtitles to your quality control process prior to submitting for screenings. For more information review captioning tutorials here: https://fvasa.cad.rit.edu/documentation/captioning.

For Tier 2 delivery, captions/subtitles must be burned-in to the image for both the DCP and SOFATube Trim deliverables.

X. Screenings Sign Up

Having successfully created your SOFATube trim deliverable and DCP, you are still required to go through the standard screenings sign up process through FVASA. **When using the submission wizard to submit your trim deliverable, be sure to signify that you are a Tier 2 film in order for the system to link to the DCP, otherwise your trim deliverable will show at screenings.** After completing the Screenings submission wizard and receiving your screenings ticket, please show up to the FVASA sign up table to secure your time slot. If you successfully completed the QC day validation of your film, your DCP should already be ingested into the projection playback system and ready for screenings day. If you submitted another DCP version after your QC, please verify with the FVASA TD that your film has been ingested.

*Forward all questions regarding technical requirements to **fvasa@rit.edu***