



Cinnafilm[®]
Every Frame Matters

Welcome to the new Tachyon Settings Guide!

Previously, a web-based dropdown list of source/target frame rates with options for different video source types was provided. While we liked the interactive nature of the guide, the guide was unnecessarily complex given the intelligence in Tachyon.

Tachyon has always had intelligent analysis that will accurately extract the progressive source video essence for conversion. Respecting this intelligent design, we have modified the Tachyon user settings guide to simplify the user experience by providing settings that will work for 95% of all conversions that are presented to Tachyon.

Should you encounter issues with the conversion after applying these settings, please contact support@cinnafilm.com

The table in the next 3 pages will guide you through the settings for every possible frame rate conversion. For an explanation of how/why Tachyon needs these settings, please see the pages that follow the table.

Sincerely,

The Team at Cinnafilm

Source Rate	Target Frame Rate	Analysis Options	Motion Comp Settings	Filmic Preservation Options	Notes
23.976 / 24.0 p	25p, 29.97p		AUTO		
	25i		AUTO	Allow 2:2	Will motion comp to 25p and then output as 25i PSF
	29.97i		None, but can be in AUTO	Allow 2:3	
	50.0p		AUTO	Allow Double Frames	Will motion comp to 25p and double frames to achieve 50p
	59.94p		None, but can be in AUTO	Allow 4:6	
25 p	23.976, 24.0, 29.97p		AUTO		
	25i		None, but can be in AUTO	Allow 2:2	Output will be 25i PSF
	29.97i		Auto	Allow 2:3	Will motion comp to 23.976 then apply telecine
	50.0p		None, but can be in AUTO	Allow Frame Double	
	59.94p		AUTO	Allow 4:6	Will motion comp to 23.976 then apply 4:6
29.97 p	23.976, 24, 25p	Allow Telecine Removal	AUTO		If the source is captured at 23.976, duplicating every 4th frame will achieve 29.97p and therefore needs removal.
	25i	Allow Telecine Removal	AUTO	Allow 2:2	Will motion comp to 25p and then output as 25i PSF
	29.97i	Allow Telecine Removal	AUTO	Allow 2:2 Allow 2:3	If source is 23.976 that has a pulldown pattern, it will remove the pattern then apply 2:3 insertion
	50p	Allow Telecine Removal	AUTO	Allow Frame Double	Will motion comp to 25p and double frames to achieve 50p
	59.94p	Allow Telecine Removal	AUTO	Allow Frame Double Allow 4:6	If the source is captured at 23.976, duplicating every 4th frame will achieve 29.97p and therefore needs removal. Then 4:6 will be applied to achieve 59.94p.

Source Rate	Target Frame Rate	Analysis Options	Motion Comp Settings	Filmic Preservation Options	Notes
25i	23.976, 24, 25p	Allow Telecine Removal	AUTO		For true 50 fields, Motion Blur will automatically be calculated if the Motion Blur setting is set to AUTO. This is because the conversion is going from a video rate to a filmic rate and needs motion blur to play smoothly.
	29.97p	Allow Telecine Removal	AUTO		
	50p	Allow Telecine Removal	AUTO	Allow Frame Double	Allow Frame Double will only be invoked if 25i PSF is encountered.
	59.94p	Allow Telecine Removal	AUTO	Allow 4:6	Allow 4:6 will only be invoked if 25i PSF is encountered.
29.97i	23.976, 24, 25p	Allow Telecine Removal	AUTO		
	25i	Allow Telecine Removal	AUTO	Allow 2:2	Allow 2:2 will only be invoked if telecine'd 23.976 or 29.97psf is encountered.
	29.97p	Allow Telecine Removal	AUTO		
	50p	Allow Telecine Removal	AUTO	Allow Frame Double	Allow Frame Double will only be invoked if telecine'd 23.976 or 29.97psf is encountered.
	59.94p	Allow Telecine Removal	AUTO	Allow 4:6 Allow Frame Double	Allow 4:6 will only be invoked if telecine'd 23.976 is encountered. Allow Frame Double will only be invoked if 29.97 PSF is encountered.
50p	23.976, 24, 25p, 29.97p	Allow Telecine Removal	AUTO		Pattern removal will only occur when frame doubled 25p is encountered.
	25i	Allow Telecine Removal	AUTO		
	59.94p	Allow Telecine Removal	AUTO		

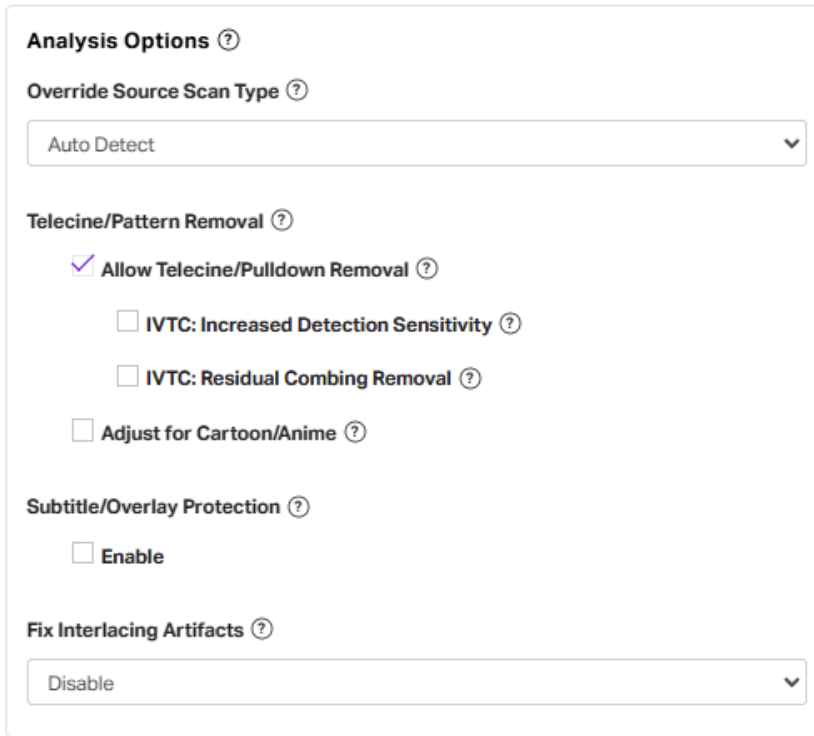
Source Rate	Target Frame Rate	Analysis Options	Motion Comp Settings	Filmic Preservation Options	Notes
59.94p	23.976, 24, 25p, 29.97p	Allow Telecine Removal	AUTO		Motion Blur will be inserted for 23.976, 24, 25p when Motion Blur is set to AUTO.
	25i	Allow Telecine Removal	AUTO	Allow 2:2	Allow 2:2 will only be invoked if 4:6 23.976 is detected in the source file.
	29.97i	Allow Telecine Removal	AUTO	Allow 2:3	Allow 2:3 will only be invoked if 4:6 23.976 is detected in the source file.
	50p	Allow Telecine Removal	AUTO	Allow Frame Double	Allow Frame Double will only be invoked if 4:6 23.976 is detected in the source file.

4 Key Concepts for a Proper Understanding of Tachyon:

1. Tachyon will only motion compensate progressive video; therefore, Tachyon will analyze and extract the progressive video essence from the source file on a scene-by-scene basis.
2. Multiple video essences may be present in a single file, and each essence must be treated in a unique manner, given the target frame rate. There are 3 situations in which Tachyon will determine video essence on a scene-by-scene basis:
 - a. **Interlaced content.** Tachyon will deinterlace true 5994i or 50i field content to 5994p or 50p (respectively).
 - b. **Telecine/Pulldown patterned content.** Tachyon will remove telecine or other pulldown patterns from low frame rate captured content. Patterns are typically applied for 29.97i broadcast.
 - c. **Progressive content.** Tachyon will identify when frames are already progressive and are simply placed in an interlaced container. This is known as PSF (Progressive Segmented Frames).
3. If the word "Allow" is used in a setting name, the user is "allowing" Tachyon to use an algorithm if the metrics deem it necessary. It does not mean the algorithm will be used, it is just an option for Tachyon should it encounter the right situation to use it.
4. Tachyon maintains the look/feel of the original content and has options that ensure this. Cinnafilm strongly believes that altering the playback experience is not something that should be done while transforming content for new distribution channels. The primary patterns are:
 - a. **Allow 2:2 Insertion**, aka PSF. This places progressive content into an interlaced container. The purpose of this is to maintain the original filmic look of the content **shot at low frame rates while being delivered at a higher, broadcast rate.**
 - b. **Allow 2:3 Insertion**, aka Telecine. This places progressive content into an interlaced container with a 5:4 ratio pattern applied so it can be broadcast in 29.97i systems. The result is a repeating pattern of 2 progressive frames followed by 2 interlaced frames followed by 1 progressive frame.
 - c. **Allow Double Frames** will double the frames to fill a container that is exactly 2x the progressive source frame rate.
 - d. **Allow 4:6 Insertion** is essentially telecine of 23.976 for 59.94p video containers. It is commonly used.

NOTE: All user-interface pictures are from Tachyon in PixelStrings

Proper Tachyon Settings for Analysis of Source Video



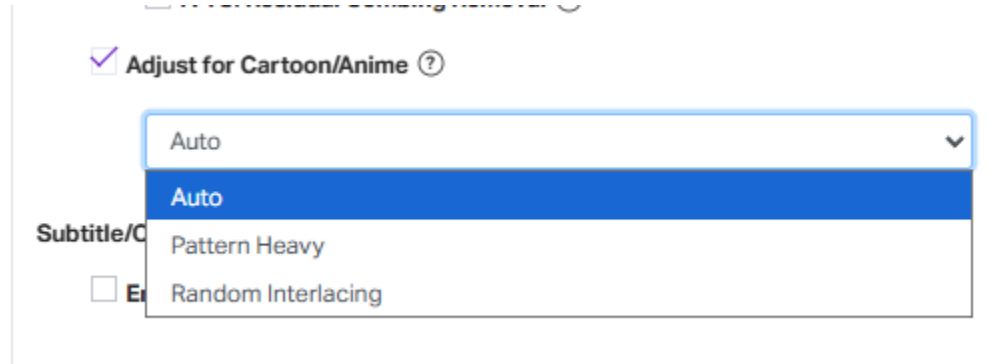
The screenshot shows a settings panel with the following sections:

- Analysis Options** (with a help icon):
 - Override Source Scan Type** (with a help icon): A dropdown menu set to "Auto Detect".
- Telecine/Pattern Removal** (with a help icon):
 - Allow Telecine/Pulldown Removal** (with a help icon)
 - IVTC: Increased Detection Sensitivity** (with a help icon)
 - IVTC: Residual Combing Removal** (with a help icon)
 - Adjust for Cartoon/Anime** (with a help icon)
- Subtitle/Overlay Protection** (with a help icon):
 - Enable**
- Fix Interlacing Artifacts** (with a help icon): A dropdown menu set to "Disable".

The above picture is an ideal setting for most video processing.

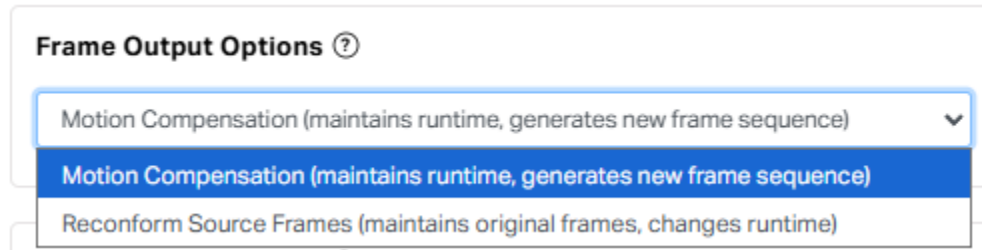
- **Override Source Scan Type**, might be worded differently in other UI's. Tachyon will analyze the field order at every scene cut when removing pulldown with this set to AUTO. Changing it to Lower/Upper Field First or Progressive will disable the field order detection and will apply the override to all analyses. Be sure of the field order in the source content before adjusting this setting from AUTO.
- **Allow Telecine/Pulldown Removal**. This box being turned on for all content is a safe option. On a scene-by-scene basis, Tachyon will inspect for repeated fields/frames and extract them from the stream if they are identified. It will not remove fields or repeated frames UNLESS it is detected. Broken patterns are also identified and correctly removed.
- Other Telecine Settings
 - **Increased Detection Sensitivity** reduces the frame analysis window and lowers the signal-to-noise ratio to account for long fades up/down in content. While this could be on for all content processing, it has the potential for false positives, so it should be used only when long fades are present or if Tachyon has missed identifying telecine with just the Allow Telecine/Pulldown Removal engaged.
 - **Residual Combing Removal** enables a de-interlace pass post Telecine/Pulldown removal. This feature is useful in removing combing that occurs when progressive lower thirds are overlaid onto telecine content, or there are composites in the content where the telecine pattern was not matched up prior to compositing.

- **Adjust for Cartoon/Anime** is self-explanatory. Anime has special pulldown applied and gratuitous compositing. There are 2 choices when selecting this option:



- **Pattern Heavy** is for content where an underlying 2-3 Telecine Cadence can be seen, but it is broken by composites or other inserted frames that alter the PPPII pattern.
- **Random Interlacing** is for content where no discernible pattern can be identified.
- **Subtitle/Overlay Protection** should be invoked when a Motion Compensated frame rate conversion is expected. When removing Telecine from 29.97i to obtain 23.976 or if the content is subtitle/overlay free, this setting is NOT needed. But for any conversion that has subtitles/overlays/bugs and will be using Motion Compensation for frame rate conversion, we recommend enabling this setting.
- **Fix Interlacing Artifacts** is a setting used to correct camera aliasing after the content has been de-interlaced. Aliasing is common in older, interlaced content, so if aliasing is present after a Tachyon conversion of older media, enabling this setting could be of benefit.

Frame Rate Output Options



Reconform Source Frames

Tachyon in PixelStrings provides an option for a "fast NTSC" or "slow PAL" conversion of 23.976/24.0/25.0 progressive content. This option is currently not available in any other transcoding platform. To use this feature, select "Reconform Source Frames."

- Selecting Motion Compensation will enable the frame generation engine in Tachyon to recreate the image stream at the new frame rate without any alteration of run time.
- Selecting Reconform Source Frames will reuse the original frames, simply packaging them into a new frame rate container. The result will be a file that is shorter or longer than the source, depending on the source/target frame rate:
 - 23.976 reconformed to 25 will be 4.17% shorter
 - 25 reconformed to 23.976 will be 4.09% longer

Motion Compensation Settings

As mentioned above, Tachyon will only convert progressive video when using Motion Compensation. After Tachyon has extracted the progressive video essence, the extracted frames will be used for the conversion. For example, after proper Tachyon analysis/extraction:

- A 29.97i (true 59.94 fields) source will present a 59.94 progressive video essence for conversion.
- A 29.97i (via telecine) source will present a 23.976 progressive video essence for conversion.

Both of the above progressive video essences came from a 29.97i source, but during conversion, they are vastly dissimilar from a motion data perspective and must be treated differently.

When selecting AUTO in the Motion Compensating settings, Tachyon will apply the correct Motion Amount, Block Size, and Fallback Blend Area given the progressive video essence frame rate and the target frame rate. The AUTO settings have been determined by extensive experimentation with the Motion Compensation engine and are tuned specifically for the source video essence frame rate and the chosen target frame rate.

Motion Compensation ?

Motion Compensation ?

Normal Motion ?

Motion Compensation Amount ?

Auto ▼

Block Size ?

Auto ▼

Fallback Blend Area ?

Auto ▼

Extreme Motion ?

Motion Compensation Amount ?

Auto ▼

Block Size ?

Auto ▼

Fallback Blend Area ?

Auto ▼

Motion Blur ?

Auto ▼

Motion Levels

Tachyon has two motion compensation tiers: Normal and Extreme.

- Think of Normal as a scene with a slow pan and little object motion, or a table where people are seated and having a conversation.
- Extreme motion is anything with significant movement: A band playing, a sporting match, a fight scene, driving in a car - anything with a significant amount of camera or object motion.

Tachyon has thresholds programmed for Normal and Extreme motion based on the source progressive video essence and the target frame rate. AUTO will automatically invoke the correct settings on both the video essence/frame rate target relationship AND on a scene-by-scene basis and within the scene when the motion crosses the Extreme motion threshold.

Motion Compensation with Mixed Mode Media

In many interlaced files, there are 2, sometimes 3, video essences present that need to be extracted for conversion. When placed in AUTO, Tachyon will automatically change the Motion Compensation settings on a scene-by-scene basis to optimally convert to the target frame rate.

If any Motion Compensation setting other than AUTO is chosen, then that setting will be applied irrespective of the video essence frame rate that is encountered. This may cause artifacts as the motion comp settings for 59.94p are rarely the same as the motion comp settings for 23.976p.

The following are the video essence frame rates possible for each listed source frame rate:

(Source rate, possible pattern/frame representation, possible progressive video essence)

- 29.97i = 59.94 fields, 29.97 psf, 29.97 telecine = 59.94p, 29.97p, 23.976
- 25.0i = 50 fields, 25 psf = 50p, 25p
- 50p = 25p doubled, 50p = 25p, 50p
- 59.94p = 23.976 with 4:6, 29.97p frame doubled, 59.94p = 23.976, 29.97p, 59.94p

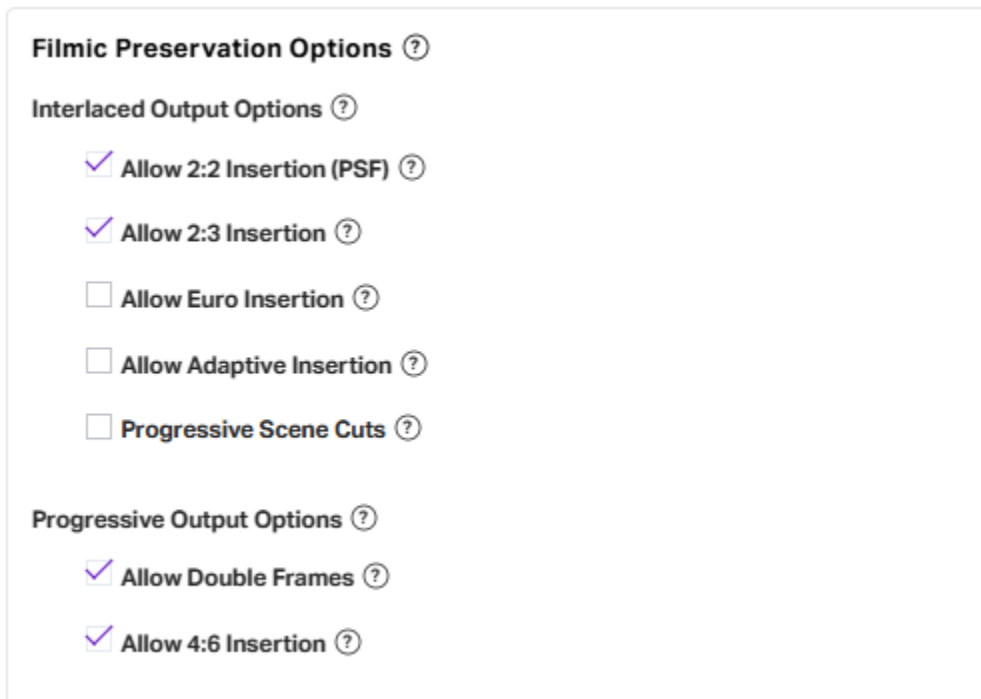
Preserving The Filmic Look

When converting from 23.976/24.0/25.0 frame rates (low, progressive video essences), the target frame rate settings must include Filmic Preservation Options that will ensure the look and feel of the original source material is not altered.

What is Meant by "Preserving the Filmic Look and Feel"

When taking a filmic rate and oversampling it to 50p or 59.94p, it will take the viewer out of cinematic viewing mode and place them in the reality TV mode. Upsampling filmic rates effectively destroys the cinematic experience, and there is not a director, cinematographer, or producer who would approve this type of conversion. Many televisions have a setting called "true motion" or "pure motion" that will turn on low frame rate upsampling and make some of the most beautifully shot films look like reality TV. Cinnafilm does not recommend upsampling filmic rates.

Also, in addition to the look being destroyed, there is a high propensity for artifacts when going from low frame rates to high frame rates. Motion Compensation, whether phase correlation or even AI-based is not fully accurate, and when pushed to extreme limits (like doubling the frame rate from low capture rates), it will generate artifacts.



It is worth pointing out one unique setting - Progressive Scene Cuts.

Progressive Scene Cuts will ensure that during interlaced outputs, the first and last frame of every scene is progressive. While this will not be temporally accurate, some clients just prefer clean scene transitions, and this feature ensures that every transition will have clean cuts.

As a default, the following "ALLOW" settings can always be enabled, irrespective of frame rate conversion:

- Allow 2:2
- Allow 2:3
- Allow Frame Double
- Allow 4:6

Tachyon's intelligence will know when to apply these settings and will only apply them in accordance with best practices for preservation of filmic looks and prevention of artifacts.