FieldsKit™ Users' Manual.

FieldsKit V2 currently consists of 3 plugins:

- FieldsKit Deinterlacer
- FieldsKit Reinterlacer
- FieldsKit PullDown

What is FieldsKit™?

FieldsKit is a complete plugin toolkit to manipulate video fields with higher quality and more flexibility than current applications generally allow. We hope this will be useful to effects people,who generally need full frames and not interlaced video to do their work, and video editors alike.

FieldsKit Deinterlacer uses adaptive motion techniques and clever models for deinterlacing. FieldsKit Deinterlacer builds full frames of much higher quality from video fields. **FieldsKit Reinterlace** and **FieldsKit Pulldown** allow much more flexible interlacing and pulldown removal/addition than most applications provide.

FieldsKit is a great companion to other **RE:Vision Effects** modules such as **Twixtor** and **ReelSmart Motion Blur**.

FieldsKit works in Adobe's **After Effects,** Apple's **Final Cut Pro,** Eyeon **Fusion,** Adobe's **Premiere,** discreet's **combustion** and other programs that support After Effects compatible plugins**.** See our website for full and current compatibility.

Important Notes:

- **Frame Rate Conversion**: Frame rate conversion (the menu items labeled "fps") will only work in **Combustion 2.1** and later and **After Effects** because these applications support different frame rate per second in the same project.
- **FCP:** You cannot animate a menu so you will not be able to animate the Pulldown removal phase.
- **Premiere Pro**: FieldsKit will not work correctly in Premiere 6.0, 6.5 and Premiere Pro 1.0 unless you work in a Premiere project with a project setting of progressive (that is, no interlacing). However, FieldsKit now works properly in Premiere Pro 1.5 (and later) projects with either fields (interlacing) or progressive settings.

- **Digital Fusion**: FieldsKit plugins show up in the AE plugin menu. To use FieldsKit in DF, you must not only set the Main Input but also set the "Source Layer" input. Usually this means you will need to double-connect the input to FieldsKit node. This is true of any plugin in Fusion that runs via the AE adapter and requests frames at other then current time.
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New in V2:

New in FieldsKit version 2 is a motion estimated-based frame blending mode in the Deinterlacer, and a mode in the Reinterlacer plugin that adds fields to progressive footage using motion estimation

What are fields

1) Simply put, an interlaced video frame consists of 2 fields. One field consists of all "even" lines of a frame, and the other field consist of "odd" lines. A traditional video device (monitor, TV, etc) has a beam that traces, or draws, one field, then goes back to the top of the frame and draws the other.

Example of an interlaced picture. Note how the action is broken down into two.
The person is moving. On the video display one field is displayed, then the other at half a frame time later.

2) You have two fields. One field is displayed first in time, and then the other. If the top scan line is part of the field that is displayed first (that is, the field of odd scan lines is displayed first) then we say that the video is "Upper Field First." If the second-to-top scan line is part of the field that is displayed first (that is, the field of even scan lines is displayed first) then we say that the is "Lower Field First ".

The rule of thumb when specifying "field first" for your footage: if you choose lower or upper field first and you double the duration (to see all fields deinterlaced) and the plugin produces material that is overly jittery, or jumps back and forth, then you probably chose the incorrect order option.

Note that you cannot assume all of your source material will have the same field first-ness. For example DV PAL is lower first fields and NTSC HD might be upper field first, even if earlier in video technology industry we assumed PAL to be upper field first and NTSC to be lower field first.

Usage Notes:

Important: Before you start, make sure you understand how your application deals with **field display** The document **"How to set up host applications for RE:Vision Effects plugins that work with fields"** describes what you need to do in the host application in order to use FieldsKit. (http://www.revisionfx.com/auxdocs/TurnFieldsOff.htm)

FYI, some interlaced video has an odd number of fields. In this case the two fields won't be of the same height. The FieldsKit handles this case by duplicating a line during the deinterlacing process.

Note that in the retiming mode naming we use the symbols **< , = , >** in the option labels as a mnemonic, to imply that fewer frames, the same number of frames, or more frames are created as a result of applying the plugin.

Please refer to the Application Note "**How to setup a RE:Vision Effects plugin that makes a sequence longer**" if you are not familiar with the art of dealing with sequences whose outputs are longer then inputs. (http://www.revisionfx.com/auxdocs/ExtendDuration.htm)

Important: Please note that some options of each plugin (the ones that **change the frame rate**) only work in a same project within After Effects and combustion. . The option labels for the settings that change frame rate will have "2X FPS" or "half frame rate", etc. in their names.

IMPORTANT NOTE for FINAL CUT PRO 3.0 users (this does not apply to prior versions of FCP and has been fixed in FCP 4 and up): If you apply two or more filters that have clips as inputs, then the program goes into an infinite loop and crashes. Both our deinterlacer and reinterlacer take clips as inputs as well as most of our products (Twixtor, ReelSmart Motion Blur...). Apple has been notified (quite a while ago actually) and we hope they'll fix this problem in a future release.

Note that we will use the term "combs" to refer to areas where there is significant motion in a frame with fields, because the resulting areas look "combed."

Two areas with "combs" are shown.

Related RE:Vision Effects Modules:

FieldsKit is a perfect companion to **Twixtor**:

- In general you will obtain better results with Twixtor by first restoring better full frames using FieldsKit's deinterlacer first (creating a frame for *each* field, so that you start with twice as many frames as your original footage), then using Twixtor to retime the whole-frame footage. This is because Twixtor's internal deinterlacer simply does "standard" deinterlacing (that is, blends scanlines). We preferred to put the more sophisticated deinterlacing controls in FieldsKit because you are then provided an option of a simple self-contained deinterlacer. By providing a separate deinterlacer that has its own options, Twixtor becomes be easier to understand and eliminates the need for Twixtor to have the extra controls you might never need and at a price point you cannot afford.
- Because Twixtor needs to take control of field handling, it forces people to split their rendering in two passes if they want to add 3:2 pulldown for example. Having the whole field handling chain as filters as opposed to IO attributes, allow users of applications that do not support frame rate conversion (for example, going from 24 FPS to 30 FPS) the flexibility to better streamline handling of field-based material.

ReelSmart Motion Blur can be used as a post-process after Deinterlacing with FieldsKit, to simulate the true effect of a shutter if you use it simply to go from 30 FPS interlaced to 30 FPS progressive. Using ReelSmart Motion Blur can sometimes also help deal with some crawling that persist after defielding your movie with FieldsKit.

FieldsKit Deinterlacer

Overview:

The Deinterlacer creates a frame from individual fields. In the simple case the plugin throws out every other scanline, then create new scanlines by interpolating the remaining scanlines.

| Original material | Every other scanline thrown out | Thrown out scanlines filled with interpola pixels. |

"But wait!" you say. The tea kettle isn't moving, why are we throwing away every other scanline there? Rest assured that Deinterlacer includes some tools to mask out where pixels are thrown out, and subsequently, where pixel interpolation takes place.

The options, described step by step:

1) Select the Source Layer to Deinterlace
Source Layer :
The current layer to which the filter is applied will be deinterlaced. Disclaimer: A plugin cannot by itself extend the duration of a clip. It needs help from the user and the usage of an external layer. Make sure to read the application note on how to extend the duration when applying a RE:VIsion Effects plugin.

Note: In After Effects, before release 7.0, if there are any filters applied to the source footage, then "Source Layer" should be a pre-composition, otherwise filters applied to the source layer will not be visible. In After Effects 7 you need to set the Source Layer to NONE in order to see the previously applied effects be reflected in the deinterlaced output. Other applications may require you to put your source in containers in order to see other applied filters.

2) Select the timing mode. Do you want to make a frame from the first field of each frame, or do you want to make a frame frome each field of each frame (which creates 2 times as many frames as the original)?

Timing Mode:

- = 1 Frame Per Frame
  This mode makes an output frame from the first field (in time) of each input frame. Said another way, we "throw out" the other field... then we create new information from the thrown-out scanlines using the first field.

- >2x Duration,1 Frame Per Field
  This mode creates a frame for each field of the input. As such you end up with a sequence that is twice as long as the input. After processing and editing the extended sequence, FieldsKit Reinterlacer can then be used to reinterlace the footage back together for you if needed.

- >2x FPS,1 Frame Per Field
  This option creates a frame for each field of the input as well... creating twice as many frames. However, it is expected you set your destination composition to double the frame rate of the source. For example, if you are processing a 29.97 fps movie, then it is assumed that the destination composition is set to 59.94 fps. You get twice as many frames, but the processed footage remains the same duration. For example, in After Effects you can set your Render Settings to 29.97 with fields and each of the rendered field will be the frames of the 59.94 fps progressive footage created. **This option has only been tested to work in After Effects, combustion 2.1 or later and Commotion 3.1 or later.**

- = Field Blending,1 Frame Per Frame
  This mode deinterlaces both fields and blends the resulting frames 50% each. That is, this option is the same as setting up the deinterlacer with =1 Frame Per Frame using the Upper Field and =1 Frame Per Frame using Lower Field first and then blending the two results at 50%) This is often useful when you want the deinterlaced result to capture motion from both fields; e.g., when deinterlacing fast-moving material, like sport material, this option will capture more of the motion in the source material.

- = Motion Estimated Blend,1 Frame Per Frame
  This mode deinterlaces both fields and then warps the other field to the current one using motion estimation and then blend the resulting frames 50% each. This can give you a cleaner result although can produce softer results. It is particularly useful on shots that display diagonal, "moire" effects. Please note that this mode is much more compute-intensive, so it is not necessarily advised for long format processing. Some tracking errors might show up on fast action material, such as extreme sport material and on footage where many objects cross each other in the scene. Note in applications that allow you to animate a menu, you can simply

switch per shot from 1 Frame Per Frame, Field Blending and Motion Estimated Blend.

3) What is the field order of your source material?
Field Order:

- Upper First: The field containing topmost scanline line and all odd scanlines should be displayed first in time for the source footage, then the other field.
- Lower First: The field containing second-to-top scanline and all even scanlines should be displayed first in time for the source footage, then the other field.

- Note to users of Premiere Pro: you will see a second set of Field Order options for use within **Premiere Pro 1.5**. This option does nothing in Premiere Pro 2.0 and is there still to support loading old projects. It turns out Premiere had a timing bug in terms of what it reported to the plugin when the source material was a DV codec.
  - Upper First (VFW,Fields Project): Use this setting if you have upper fields first source material inside Premiere Pro 1.5 fields-based project and the project's Editing Mode is set to "Video For Windows." – now called Desktop. This setting is not needed for newly created projects in Premiere Pro 2.0 and up, and should not be used by projects that were not first created in Premiere Pro 1.0 or 1.5Lower First (VFW,Fields Project): Use this setting if you have upper fields first source material inside Premiere Pro 1.5 fields-based project and the project's Editing Mode is set to "Video For Windows." – now called Desktop. This setting is not needed for newly created projects in Premiere Pro 2.0 and up, and should not be used by projects that were not first created in Premiere Pro 1.0 or 1.5
  - Use Upper First and Lower First (the first two settings, without "VFW, Fields Project" in the name) for all other Premiere projects.

4) Choose a method to interpolate pixels
Fill Method:
We provide various methods to spatially interpolate/create pixels in the non-exisiting field scanline when making a full frame for it.

- None: this mode does nothing and allows you to see the raw fields. The raw mode could also allow you to see both fields if you are working in an application like After Effects that does not provide an interlaced viewing option. So this option provides a way to make showing the original interlaced frames (which can be very useful when previewing using a frame buffer that is attached to a monitor with interlacing).
- Duplicate: duplicate each line twice
- Blend: create in-between scanline pixels by mixing the pixels above and below.

- <u>Best 3 Neighbors:</u> This expands the traditional Blend mode by looking at the left and right neighbors of scanlines to determine which neighbor should be considered in the blending process.
- <u>Best 5 Neighbors:</u> This extends the above logic by looking at 5 pixel neighbors on each scanline, but can produce artefacts on moving elements. Your mileage may vary on moving elements.

Note: <u>Best 3 Neighbors</u> and <u>Best 5 Neighbors</u> tries to give better results on diagonal lines.

| <u>Fill Method</u>: None | <u>Fill Method</u>: Duplicate | <u>Fill Method</u>: Blend |

| <u>Fill Method</u>: Best 3 Neighbors | <u>Fill Method</u>: Best 5 Neighbors |

Creating a mask, based on motion, where pixels are "thrown out" and then interpolated from non-thrown out scanlines.

The remaining steps, except for the last two, allow you to set up a region where the interpolation of scanlines is to take place. Why would you want to do this? Well, for example, if the camera is still and only a foreground object is moving then you really only want to "throw out" scanlines and interpolate pixels where the object is moving. The following 7 options allow you to specify where interpolation should occur.

IMPORTANT: If you specify that you want to use a motion detection scheme, a frame is created from a field by interpolating the field's scanlines only where there is motion. Otherwise, the pixels are obtained by the **other** field of the same frame. Using the options that follow, you implicitly create a "motion mask" that specifies where pixels are to be interpolated. You can even view this motion mask to determine if your settings are appropriate.

IMPORTANT: You want to set the "motion mask" to be on everywhere where you see combed behavior in the images (that is, where there is significant motion!). You can alternate the view mode in order to see where the motion mask is turned on.

View Motion Mask:
This allow you to display the motion mask (areas where to interpolate scanlines). The areas where pixels will be interpolated are displayed in Red. The objective is to make sure that you see that all "combs" are covered by red. Make sure you don't leave the Deinterlacer in this mode before you launch a render. Please note that when using multiple frame comparison you need to be on another frame then first and last of your sequence. HINT: The motion mask created in the Deinterlacer is stored in the RED channel. You may want to use the red channel as a mask to run alternative processes other than those included in the deinterlacer.

The picture examples for the motion settings are shown with the View Motion Mask option on.

5) Do you want to want to interpolate pixels only where there is motion?
Detect Motion:

- No Motion Mask: This tells FieldsKit Deinterlacer to interpolate pixels everywhere to make a frame from a field. You should use this option if the camera is moving or every pixel in the frame exhibits noticeable movement. This effectively tells Deinterlacer to interpolate all pixels of the thrown out scanlines.
- 2 Frames Compare: This detects motion by looking one frame away.
- 3 Frames Compare: This option detects motion by looking one frame forward and one frame backward.

Note, the choice for Detect Motion is important. Using 3 Frames Compare will most often create a larger area of detected motion).

| 2 Frames Compare
Note: noise in the tea kettle shows up as motion. | 3 Frames Compare.
Note that more motion is captured.
Note: noise in the tea kettle shows up as motion. |

6) If you decided to interpolate pixels only where there is motion, then how do you want to perform the inter frame comparison?

Motion Diff Method:

This setting specifies how a comparison of two frames should be done in order to determine where there is motion. When <u>Point Difference</u> is selected, corresponding pixels at two different times are differenced. If the difference of the two pixels is greater than the threshold (specified in the <u>Motion Tolerance</u> setting, described next), then the motion mask is turned on at that pixel. Small Area Difference uses a slightly larger region, which will help in reducing problems where video noise shows up as motion in the motion mask (but will also make areas of motion slightly smaller).. Large Area Difference searches an even larger area at each pixel.

- <u>Point Difference:</u> Looks at the difference with the next frame corresponding pixel
- <u>Small Area Difference:</u> At each pixel, this method looks at a small neighborhood of pixels in order to reduce problems where the motion mask is turned on due to noisy images.
- <u>Large Area Difference:</u> Similar to Small Area Difference, but looks at a larger neighborhood of pixels.
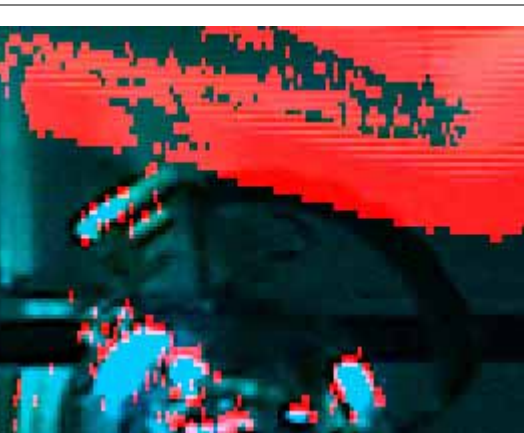
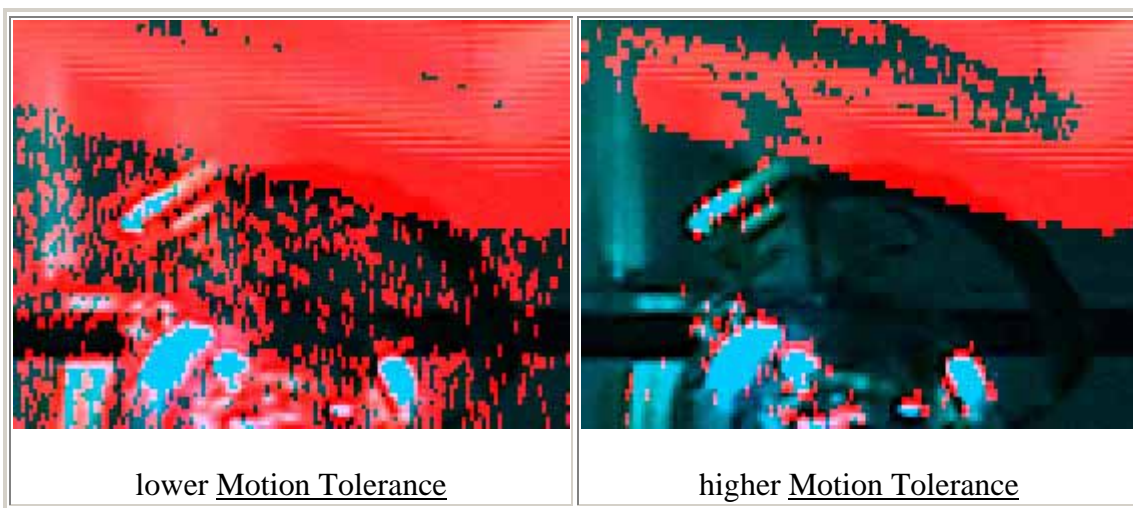|		
<u>Motion Diff Method</u>: Point Difference	<u>Motion Diff Method</u>: Small Area Difference	<u>Motion Diff Method</u>: Lare Area Differen

7) Set the Motion Tolerance so that the motion mask is covers the area where there is motion.

<u>Motion Tolerance:</u> 0-1: After the difference operation is run, this slider allows to tweak the region that is turned on in the motion mask.

|	
lower <u>Motion Tolerance</u>	higher <u>Motion Tolerance</u>

After you set up the motion mask region, there are a few operators that you can apply to grow and shrink the regions in the motion mask, along with some noise suppression that can be performed.

HINT: It helps to set the <u>View Motion Mask</u> to on then move the Motion Tolerance slider until the motion mask, drawn in the red channel, covers the area of motion.

8) Add some noise suppression to the motion detection
<u>Mask Suppression</u>: <0-5>

This option allows you to delete regions in the motion mask that are generally the result of video noise. A setting of 0 deletes no regions. A setting of 1 deletes regions that approximately 1 pixel in size. A setting of 5 deletes the largest regions. The job of this control to remove all the little spurious dots that are interpreted as motion even though they are just some form of noise. Adjust this control until you see no more stand alone dots where the image is not moving.
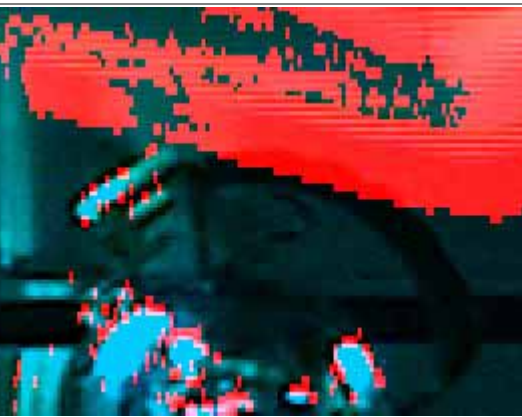
| Mask Suppress set to 0 | Mask Suppress set to 1 | Mask Suppress set to 4 |

### 9) Regrow the valid areas to cover the edges of objects
Mask Grow: <0-5>
After noise suppression is done, this option grows the motion mask by the specified number of pixels. This can be useful when setting the threshhold lower includes too many regions, but you'd still like to grow the motion mask. When you look in close up at the motion mask image concentrate mostly on the edges of the motion mask and make sure that you do not perceive "combs" outside of the motion mask. If you use 1 Frame Detect most probably you will want to make this value at least the same as the Suppression Window size.

| Mask Grow set to 0 | Mask Grow set to 3 |

10) Do you what a soft motion mask?
Mask Feather: <0-5>
This parameter create a smooth motion mask by feathering the edges by the number of pixels specified. Feathering can allow you to include a smoother transition between areas where there is motion detected and areas where there is no motion detected.


| Mask Feather set to 0 | Mask Feather set to 3 |
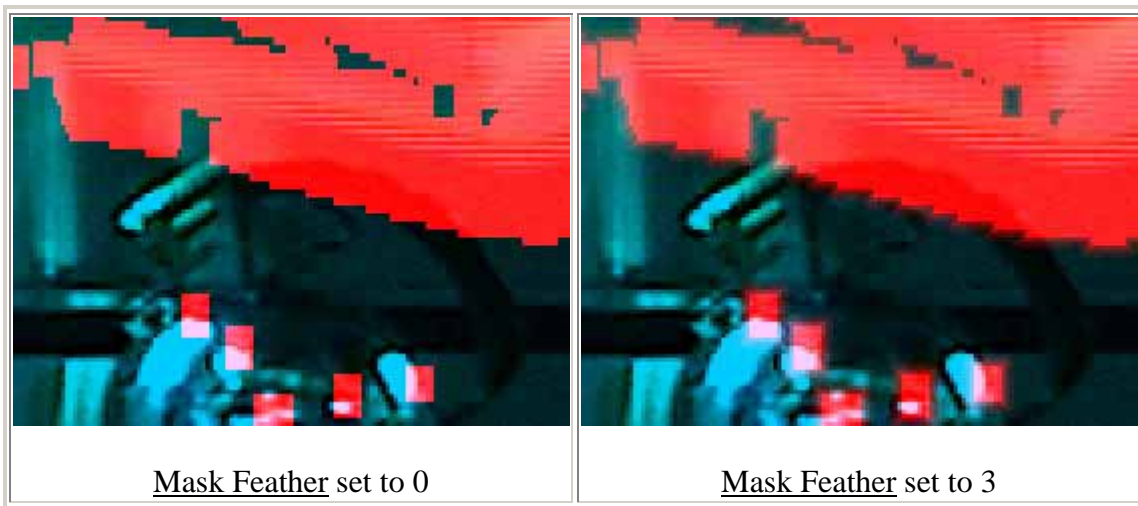
11) Now do you want to smooth the areas within the motion mask?
Smooth vertically: <slider: 0 to 2.0>
When setting this to a value greater than zero, a vertical smoothing filter will be applied to the interpolated pixels in the areas of the motion mask AFTER the fields have been interpolated. You should know that our vertical smoothing filter is smart and only filters

where there is high contrast (that is, it tries not to make smooth areas more smooth). Note, if you use motion detection then the vertical smoothing filter will only be applied inside the motion mask.

| Smooth Vertically set to 0 | Smooth Vertically set to 1.2 |
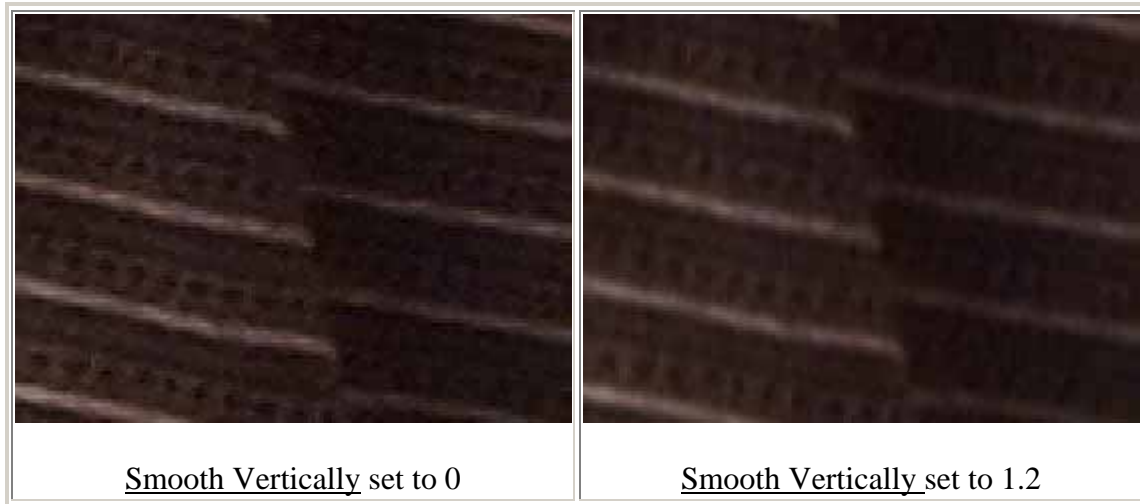
12) Finally you have the option of sharpening up lost details
Sharpen: <slider: 0 to 1.0>
This function is conceptually the opposite of the Smooth Vertically function. This option allows you to specify how much of a sharpening filter is applied. Sharpening happens after the full frame is created. Note that because interpolated pixels are the result of blending other pixels, these interpolated pixels will often be smoother than necessary. So this post-process sharpening filter can be very useful. Hint: as a rule of thumb you might consider setting this control to half the Smooth Vertically value you have selected..

| Sharpen set to 0 | Sharpen set to 0.5 |
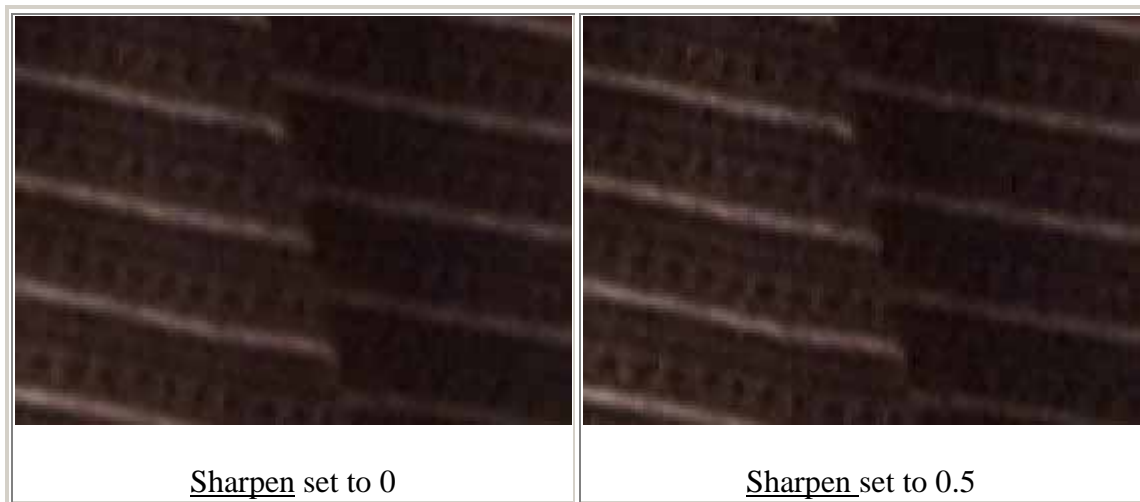
FieldsKit Reinterlacer

Interlacing is the process of taking two pictures half a frame apart and interleaving them on a scanline basis, meaning you create a single frame from two, talking half the scanlines from one and half from the other. The Reinterlacer is provided as a convenient tool to interlace frames at differing places in your workflow.

Field Order:

- <u>Upper First</u>: The field containing topmost scanline line and all odd scanlines should be displayed first in time for the source footage, then the other field.
- <u>Lower First:</u> The field containing second-to-top scanline and all even scanlines should be displayed first in time for the source footage, then the other field.

- Note to users of Premiere Pro: you will see a second set of Field Order options for use within **Premiere Pro 1.5**.
  - o <u>Upper First (VFW,Fields Project)</u>: Use this setting if you have upper fields first source material inside Premiere Pro 1.5 fields-based project and the project's Editing Mode is set to "Video For Windows."
  - o <u>Lower First (VFW,Fields Project)</u>: Use this setting if you have upper fields first source material inside Premiere Pro 1.5 fields-based project and the project's Editing Mode is set to "Video For Windows."
  - o Use <u>Upper First</u> and <u>Lower First</u> (the first two settings, without "VFW, Fields Project" in the name) for all other Premiere projects.

Output Type:

- <u>< Half Frame Rate</u>: This option takes each 2 pairs frames from the source and makes 1 frame by taking the field scanlines specified in <u>Fields Order</u> from the first frame of the pair, and the field to be displayed second from the second of the pair. This option assumes that your source material is at one rate (say 59.95 fps) and the destination is at half the frame rate (in this case, 29.94 fps).**This option only works in After Effects, Combustion 2.1 or later and Commotion 3.1 or later.**

- <u>< Keep Frame Rate</u>: This option takes each 2 pairs frames from the source and makes 1 frame by taking the field scanlines specified in <u>Fields Order</u> from the first frame of the pair, and the field to be displayed second from the second of the pair. However, this option makes the destination 1/2 the duration (so 4 seconds of input becomes 2 seconds of output).

- <u>= Field Blending</u> : Field Blending is mixing two fields from pairs of images in a sequence. This option neither creates nor destroys frames, but rahter, blends fields of adjoining pairs of frames in a way that may be less-flickery on an interlaced

monitor. This is a useful filter when your source material has small animated things (like stars) or horizontal lines that move about an image. Note this is a destructive process in the sense that you will not be able to deinterlace that render to recuperate the exact original source.

- = Combine: Say you have two sequences of whole frames aligned in time. One sequence if of whole frames that should represent the first field of the output and the other, the second field. Apply Reinterlacer to the sequence representing the first fields, set the source to the other sequence that is to make up the second fields of the output.

- = Create motion estimated fields: This option will convert progressive material to interlaced material using motion estimation to create new fields between each original frame. This mode looks at the current frame and the next frame and estimates a new field at the inbetween position. Looking at the current frame and the next frame can create some issues at a cut point in your sequence. In applications that supports animation of menu options, you might need set a keyframe at the beginning of a cut. This mode is helpful to get a consistent look when merging material without fields and material with fields (or simply generate a field based render in a progressive project…) .
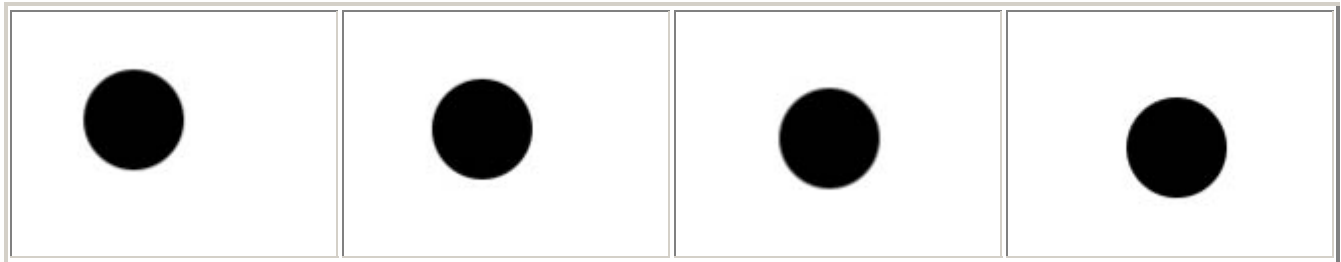
Original sequence of 4.
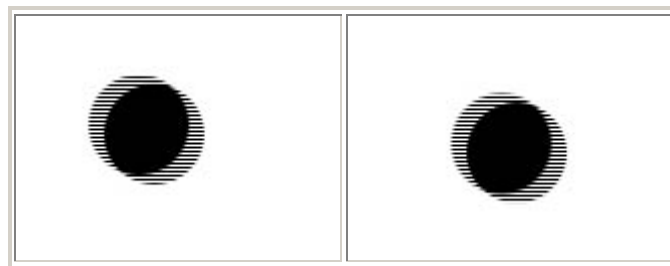
Interlaced set of 2 frames (the <Half Frame Rate or <Keep Frame Rate. options).
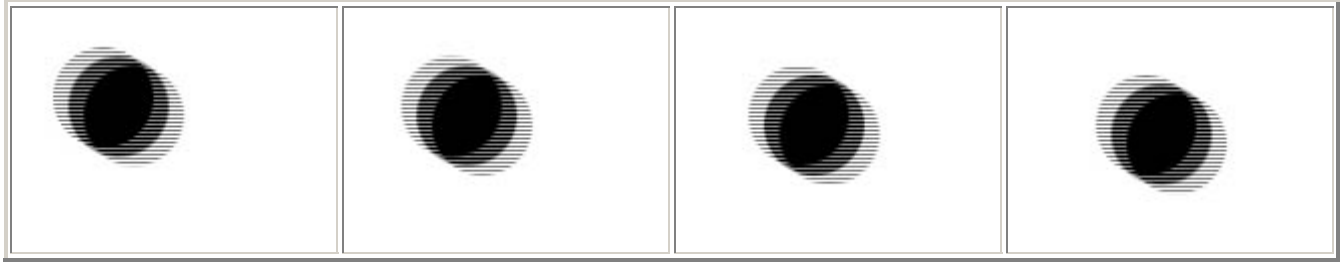
=Field Blending option used. Note the same number of frames in and out. This option blends frames across fields.

Source Layer :

Note: In After Effects before version 7, if there are any filters applied to the source footage, then "Source Layer" should be a pre-composition, otherwise filters applied to the source layer will not be visible. In version 7 you can set the Source Layer to None for in order to have the result of the Reinterlacer reflect any previously applied effects . Other applications may require you to put your source in containers in order to see other applied filters.

FieldsKit Pulldown

This is a very NTSC process. A pulldown is the traditional way a telecine (a device to transfer 24 FPS film to 30 FPS video) retimes the source material. The formula for a 3:2 pulldown turns 4 successive input frames into 5 output frames where 1 (so-called Pa for Progressive Advanced) or 2 (conventional telecine type) will be interlaced.

Please note that as part of the telecine process there is a slowdown of 1000/1001 of the original 24fps to 23.976 before pulldown is added to give 29.97 fps. When we refer to 24fps and 30fps below, we really mean 23.976 and 29.97. So when adding pulldown, your original footage should be 23.976 (that is, the 1000/1001 slowdown has already taken place) and when removing pulldown from NTSC video, your 29.97fps footage will end up as 23.976 fps footage.

For example, in WSSWW, the first 4 frames are turned into 5 as shown by below:
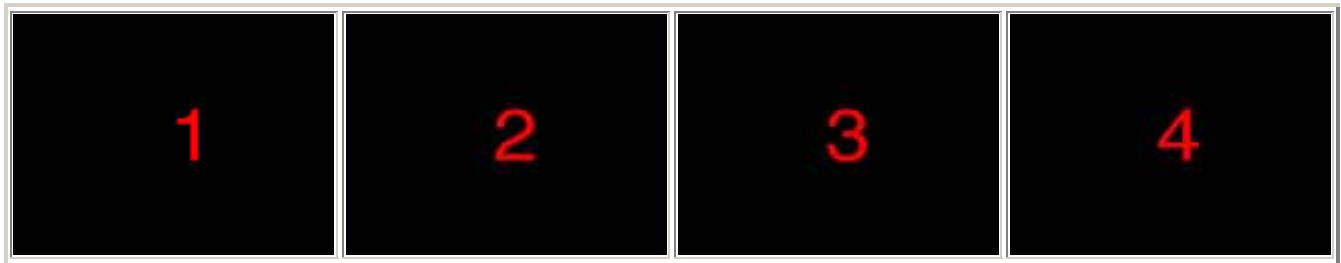
4 Input frames at 24 fps

5 Output frames at 30fps, converted from 24fps using 3:2 pulldown

Field Order:

- Upper First: The field containing topmost scanline line and all odd scanlines should be displayed first in time for the source footage, then the other field.
- Lower First: The field containing second-to-top scanline and all even scanlines should be displayed first in time for the source footage, then the other field.

- Note to users of Premiere Pro: you will see a second set of Field Order options for use within **Premiere Pro 1.5** (This has been fixed in Premiere 2.0 and is there for backward compatibility purposes). Although the menu says Video For Windows, it should really be saying DV codec.
    - Upper First (VFW,Fields Project): Use this setting if you have upper fields first source material inside Premiere Pro 1.5 fields-based project and the project's Editing Mode is set to "Video For Windows."
    - Lower First (VFW,Fields Project): Use this setting if you have upper fields first source material inside Premiere Pro 1.5 fields-based project and the project's Editing Mode is set to "Video For Windows."
    - Use Upper First and Lower First (the first two settings, without "VFW, Fields Project" in the name) for all other Premiere projects.

3:2 Pulldown Mode:

- \> Create: This option takes every 24 frames of a sequence and creates 30 frames by doing 3:2 pulldown. The phase of the 3:2 pulldown is specified in the Pulldown Phase menu. Both the input and output will be assumed to be 30 (or 29.97) fps. The resulting sequence will be longer (30/24 times longer), so please read "**How to setup a RE:Vision Effects plugin that makes a sequence longer**." (http://www.revisionfx.com/auxdocs/ExtendDuration.htm)
- \< Remove: This option takes every 30 frames of a sequence and removes 3:2 pulldown to make 24 frames. Again, the phase of the 3:2 pulldown is specified by Pulldown Phase menu. Both the input and output frames rates are assumed to be 30 (or 29.97), so the resulting sequence will be shorter (by 24/30).
- \> Create, 24 to 30fps: This option also takes every 24 frames of a sequence and creates 30 frames by doing 3:2 pulldown. The difference from the >Create option is that the source layer is assumed to be 24fps and the output will be 30fps (or, respectively 23.976 and 29.97fps). After you drop the 24fps footage into the 30fps track (but before application of the Pulldown plugin), the host application will create 30 frames out of 24 by duplicating frames every so often. Not to worry! Apply Pulldown to the sequence and set this menu option to create 3:2 pulldown.. This is useful when dropping 24fps footage into a 30fps system, or in After Effects, applying 3:2 pulldown to a 24fps composition inside of a 30fps composition. **This option only works in After Effects, Combustion 2.1 or later and Commotion 3.1 or later.**

- \< Remove 30 to 24 fps: This option takes every 30 frames and removes 3:2 pulldown to create 24 frames. The difference from the >Remove option is that the

source layer is assumed to be 30 (29.97) fps and the output layer will be 24 (23.976) fps. **This option only works in After Effects, Combustion 2.1 or later and Commotion 3.1 or later.**

Pulldown Phase:

The Pulldown Phase refer to the action taken on a 5 frames increment basis from the first frame. Here "W" means "whole frame" and "S" means split frame (an interlaced frame will be or was made from 2 successive frames).

The first set of menu choices is the original 3:2 pulldown (which has the cadence 3:2:3:2, that is, the first frame of the 24p footage is copied to the first 3 **fields** of the output interlaced footage, the second frame is copied to the next 2 fields of the output, the third frame is copied to the next 3 fields of the output and the fourth frame is copied to the next 2 fields of the output). As such, each 4 frames is copied to 10 fields, or 5 full frames, of interlaced footage. (that is frames A,B,C,D of the 24p footage get transfered to interlaced frames: AA AB BC CC DD. Note: frame "B" is spread across two frames of the output).

- WWSSW
- WSSWW
- SSWWW
- SWWWS
- WWWSS

We support 24Pa which uses a 2:3:3:2 cadence instead of 3:2:3:2. (Pa stands for Progressive Advanced). When adding pulldown, each 4 frames of the 24p footage is copied to 10 fields, or 5 full frames, of interlaced footage. That is frames A,B,C,D of the 24p footage get transfered to interlaced frames: AA BB BC CC DD. Note: to remove the pulldown all we have to do is drop the 3rd frame of the interlaced footage. So when 24p is transfered to 30fps interlaced footage with "Pullodown Advanced", to remove the pulldown, one out of every 5 frames can be simply dropped (so the 24Pa method is a bit easier to work with).

- WWSWW (24Pa)
- WSWWW (24Pa)
- SWWWW (24Pa)
- WWWWS (24Pa)
- WWWSW (24Pa)

Also from FK version 1.4, if there is a switch of phase (animation of the pulldown phase) and the phase falls on an half-frame (an "S" frame), the field will be deinterlaced rather then mixed with the previous frame.

Source Layer :

 Note: This option determines where the source material is located. If you are making a sequence longer, then you'll have to make a longer sequence, apply Pulldown to it, and point to the source material. (see "**How to setup a RE:Vision Effects plugin that makes**

a sequence longer"). Premiere Pro 1.0 users (Premiere Pro fixed this in version 1.5) you should avoid having this menu point to a nested sequence. It could create a memory leak and make you crash. (http://www.revisionfx.com/auxdocs/ExtendDuration.htm)

Moving Material around -- Pitfalls of FPS?

 Now fields are terribly sensitive for proper interpretation to the FPS settings. We discovered that some formats like OMF material, or outputs from Premiere for example will come out as 29.97002997002997… rather then 29.97. This although it appears a minute difference can completely screw up your footage. Editing applications (OMF, Premiere) seem to like to export 29.97002997002997 (a periodic number that corresponds to 30000/1001). It so turns out that if you sample at 29.97 a 29.97003 piece of footage, eventually the application can drop a field and display the wrong field because the time sampling between the two frame rates cause this to happen.   It's more dramatic than you might think: if you use field and don't conform the 29.970003 footage to 29.97, an application like After Effects can actually drop a field when you rerender! Thing to look for: your render, even without any plugins applied, looks all soft after you rerender with fields upon output...For example in After Effects if you make a comp from the footage you load it will it you look at the comp settings show as 29.970 (underneath it actually is storing 29.97003 as the fps)… You have to Interpret Footage conform to the rate 29.97 to get the proper result. So if you set FieldsKit Deinterlacer to double duration and it duplicates the same field, then that is most probably the issue.

Wait... But Why?

The most difficult thing to understand for someone who is new to this industry is why we still have fields, some applications even wrongly allow you to swap the fields spatially without regards to the fact that they represent different points in time.

So consider this: Fields is a concept inherited from television/video technology history. As progressive cameras become more standard this should become one less problem to worry about, however sports still like to shoot 59.94i (until 60P becomes a completely available option). The initial reason for fields was a technological difficulty. A clever kludge was devised, fields, to address two engineering issues. In a nutshell, the scan rate was decided to be made in phase to the power system frequency (60 MHZ for America and 50 for Europe), as it was evaluated that by using the ratio 1000/1001 AC line interference effects were minimized in the reproduced picture. The interlace scheme was selected as a fallback compromise because it was the only way to overcome the technical limitations of the forties (hello! this is year 2007). The writers of the initial television standard proposal actually proposed initially 44 full frames a second as minimum to avoid flickering problems and their proposal was rejected as too expensive for deployment of television in the 40s, so then came the *Fabulous Fields*... It is interesting to note that the first instance of interleaved video frames, fields, was actually developed for the Marconi stereo (3d) video system prior to the development of the current video standards still in current usage. (Ref: Book of Practical Television, G.V. Dowding, BBC Corporation, Amalgamated Press, London,1935).

Since then, many equipment manufacturers have invented all kinds of reasons to make us believe that such a thing is actually a good thing, including that 24P with Pulldown is a good thing. Bottom line, we are still stocked with fields 60 years or so later. One hope in this IPTV transition would be that scheme like fields and 3:2 pulldown etc are never in the media itself and if they persist become strictly handled by the display system.

Now, have you ever complained about strobing when watching a film transferred to video? Of course, not. So do we need so many frames per second? It depends. One functionality forgotten here is that the film camera (and more and more new video cameras) has also an additional attribute, a shutter. That is a shutter opening causes a motion blur in objects that move in effect reducing the required amount of frames required by our brain to achieve fusion ("critical flicker fusion"). There is no such concept in traditional analog video since by definition video requires to be timed to 1/60th (or 1/50) of a second per field. Note unless someone was devising a clever buffering technique of some sort, the laws of physics govern that you can't capture a 24P motion blur smearing at 60 samples per second. The only way to do shuttering in cameras then by dropping temporal or spatial resolution (for example dropping a field, duplicating frames so you actually shoot 24P on 60 samples per second media…).

Fields can really be a problem when doing visual effects. This is one reason why so much commercials are still shot with film or inceasingly with progressive high def video cameras can be useful. Fields are also bad to display on a computer monitor and as well are impossibly hard on compressors as they remove local structure in an image.

And as an additional informational note, within the standard video forms (ATSC), the current solution that creates the less post-production problems is 60 progressive FPS video. The reason is that at that frame rate "motion blur" starts to become a less important factor, because there are now enough frames per second to have your brain completely do the work. For example if you look at a frame of a Showscan film (captured at 60 FPS), you will see very sharp images with almost no blur. This is exactly why our computer display have 70-75 HZ (and not 24 for example). Also note that in a film theater, the same frame is actually projected twice (or maybe sometimes 3), that is there is actually a shuttering process in the film projection system itself, and in effect the projector's shutter is shut half the time (for one thing allowing film plane motion to the next frame).

In retrospect, the early 1990's arguments ABC had versus NBC and CBS when discussing early HDTV standards (eg 1080i vs 720P) might have been something that sumed up to: given the same amounts of pixels per second (aka stream rate), less frames without fields is better for movies and more frames with fields is better compromise for sports on current television delivery.

SO, bottom line, whether we like it or not, we have to deal with it. SO this tool is about opening another track to let you deal with fields in a manner where hopefully they come into place totally at the end of your creative thinking process, and help you squeeze out

the most quality out of your digital video camcorders.

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