

Speedo V1.2 for Autodesk M&E Systems

Installation and User Guide

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1. Introduction

Speedo is a radical development of the well established Slo-Mo retiming plug-in from the Monsters suite using sophisticated optical flow algorithms and offering greater user control. Features include fixed and varispeed retiming and optional high quality motion blur.

2. Speedo Plug-in Installation

Having downloaded the 32 bit or 64 bit install package as required from <ftp://ftp.speedsix.com/Raptors/discreet/Speedo/>:

1. become 'su'
2. unzip the downloaded file. e.g. `gzip -d filename`
3. unpack the unzipped file e.g. `tar -xvf filename`
4. change directory to that the files are unpacked into
5. run the installation script: `./install_s6`

The plug-in **6-Speedo** will be in the sparks directory in **SpeedSix_v1.2_Raptors**.

3. Licensing

Speedo does not require a license to operate but the output will be watermarked without a licence.

Your Speedo license is tied to your system id (the Host ID for Irix or the Ethernet/MAC address for Linux) so you will need to provide this to your reseller or SpeedSix in order for the license to be generated. To find the system id:

1. If **Speedo** or SpeedSix Monsters have been installed: open a shell window and type:
`>/usr/local/SpeedSix/dl/bin/ssid`
2. **Irix:** If **Speedo** or SpeedSix Monsters have not already been installed: open a shell window and type:
`>sysinfo`
Linux: If **Speedo** or SpeedSix Monsters have not already been installed: open a shell window and type:
`>/sbin/ifconfig eth0 | grep HWaddr`
Look at the "number" following **HWaddr** with colons.

When the licence is returned by email:

1. Save the attachment as a file. This is the license file - do not edit the file in any way and KEEP A COPY IN A SAFE PLACE.
2. Copy it to the following directory on the machine to be licensed:
`/usr/local/SpeedSix/Licenses`

4. Getting Started

Having successfully installed and licensed Speedo become familiar with how to retime clips. The examples given below assume you will use the default options. Each of the controls and options available are discussed in more detail in the **Speedo Controls Guide** section.

Extending the length of a sequence

1. Load **6-Speedo** into a 'spark' button.
2. Click on **6-Speedo** and select the clip you wish to retime.
3. Make sure **PROCESS NOW** is switched off
4. If your input clip is field based then select the appropriate option from the 'Image' dropdown list

5. Select the '**Method**' you want to use. Each option gives you specific controls to express the time change. e.g. '**Method->Times Longer**' gives you a slider to set how many times longer you wish to make it.
6. The '**Expected Output Length**' is updated to tell you how many output frames will be created.
7. Extend the sequence length to this number of frames.
8. The '**Tuning Preset**' control selects the output quality required. This can be further tuned by using the '**Tuning**' page. For now just use the default
9. Ignore the '**Tuning**' and '**Motion**' pages for the moment.
10. Switch on **PROCESS NOW**. This must be turned on to activate the processing but it is advisable to turn it off again when you have completed rendering and evaluating the result. Always make sure it is off before changing any of the settings
11. Process the clip using the hosts '**Process**' button.
12. Exit from **Speedo** and replay the clip to see the results.

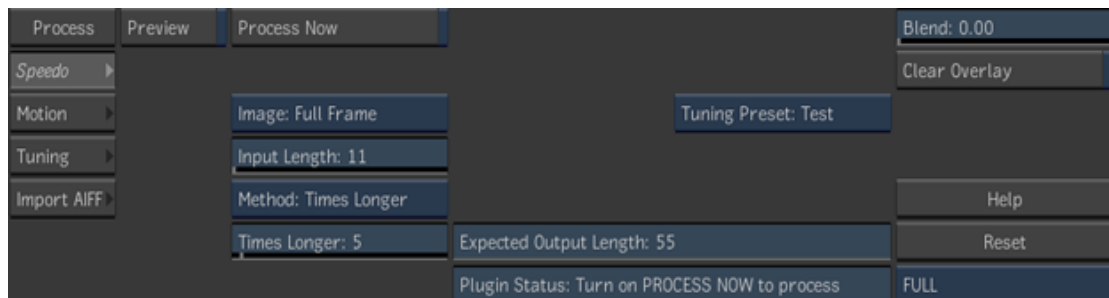
5. Speedo Controls Guide

This section describes the controls available in Speedo. The available functionality is divided into three main areas – each on its own control page.

PLEASE NOTE: none of the controls in Speedo can have their values animated except where this is explicitly specified.

S6 Speedo Page

This page is where you make the settings that will determine how Speedo will change the speed of the input footage and make other important choices that will affect the appearance of the result.



Image

List control

This specifies whether the images in the input sequence are frame based or fields based. If they are fields based (interlaced), it also specifies the field order (based on the TV system type). Output images will be frame or field based to match the input image type as selected here.

- **Full Frame**
Images are not interlaced. This is the case with film and progressive video formats (and is of course, the One True and Proper Way).
- **NTSC Fields**
Images are interlaced, with fields in the normal order for the NTSC television standard.

- *NTSC Fields (Rev)*
Images are interlaced, with fields the other way around from the normal order for the NTSC television standard.
- *PAL Fields*
Images are interlaced, with fields in the normal order for the PAL television standard.
- *PAL Fields (Rev)*
Images are interlaced, with fields the other way around from the normal order for the PAL television standard.

“PAL” and “NTSC” don't necessarily imply anything about the image resolution in this case.

Speedo V1.2 will not correct for footage with 3:2 pulldown. This should be removed before processing with Speedo, as it is likely to interfere with the motion analysis.

Input Length

Integer number. Minimum: 1 Maximum: 10000 Default: 25

This specifies the length of the input sequence you want to process. It can be less than or equal to the actual full length of the input sequence **minus 1**.

Method

List control.

This controls how you want to map output time to input time, and this is perhaps the most important decision you need to make when using Speedo. Depending on which of the options you choose, other numeric controls are presented that are appropriate to that option. The controls that will appear are shown and described with each option. Note that “the length of the output” discussed below is measured in frames and will be rounded down in practise to an integer number of frames (for obvious reasons!). Another thing to note is that *sequence lengths* are, of course, how many frames are in the sequence. *Frame numbers* within a sequence, however, start at zero and go up to the sequence length minus one. This is relevant particularly to *VariSpeed*.

- *Times Longer*
The output is to be a simple integer multiple of the length of the input e.g. 5 times longer.
 - Times Longer
Integer number. Minimum: 1 Maximum: 100 Default: 5
How many times longer than the input the output is to be.
- *Times Shorter*
The output is to be 1 / n times the length of the input, where n is an integer. This is simply decimation – taking every nth frame. Except when motion blur is also applied.
 - Times Shorter
Integer number. Minimum: 1 Maximum: 100 Default: 5
How many times shorter than the input the output is to be.
- *Percent Longer*
The output is to be this percent longer than the input. Note: 0% longer is the same length ... The output will be (control + 100.0) / 100.0 as long as the input.
 - Percent Longer
Float number. Minimum: 0.0 Maximum: 10000.0 Default: 0.0
The percent value for *Percent Longer*.
- *Percent Shorter*
The output is to be this percent shorter than the input. Note: 0% shorter is the same length ... The output will be 100.0 / (control + 100.0) as long as the input.
 - Percent Shorter
Float number. Minimum: 0.0 Maximum: 10000.0 Default: 0.0
The percent value for *Percent Shorter*.

- **Percent Input**
The output length is to be this percentage longer than the input i.e. a straightforward scaling factor. Note: 100% is the same length as the input, 200% is twice as long, 50% is half as long.
 - Percent Input Speed
Float number. Minimum: 1.0 Maximum: 10000.0 Default: 100.0
The percent value for *Percent of In*.
- **FPS Ratio**
You specify the frame rate of the input and the frame rate of the output. Together with the input length – which you always specify – this determines the output length. I.e. there will be $(FPS_{out} / FPS_{in}) * InputLength$ frames in the output.
 - Input FPS
Integer number. Minimum: 1 Maximum: 1000 Default: 25
The frame rate of the input sequence.
 - Output FPS
Integer number. Minimum: 1 Maximum: 1000 Default: 25
The frame rate of the output sequence.
- **Output Length**
You specify the desired length of the output sequence in frames.
 - Output Length
Integer number. Minimum: 1 Maximum: 10000 Default: 25
How many frames are to be in the output sequence.
- **VariSpeed**
You use the keyframe editor (animated numeric value facility) of the host system to draw a graph (curve). The X axis of the graph is the output frame number. For any output frame number, the Y value at which a line normal to the X axis at the output frame number intersects the curve is used as the input frame number – which will generally be a number with a fractional part. *If that sounds complicated, it isn't really!* All you are doing is using a curve – any curve you can draw with the keyframer – to say where you want to be in the input for every output frame. This lets you do “ease-ins” and “ease-outs”, to both speed up and slow down at different places in the input, and to go backwards, if you want.
 - Vari Speed Curve (animatable)
Float number. Minimum: 0.0 Maximum: 10000.0 Default: 1.0
The input frame number, to be keyframed against output frame number to create a curve (a lookup table, if you want to think of it that way).
 - VariSpeed Length
Integer number. Minimum: 1 Maximum: 10000 Default: 25
Enter the required number of frames. Speedo will create this number of output frames, looking up the corresponding input frame position for each. If the input frame from the curve at any output frame is less than 0, it will be clamped to zero. If the input frame is ever greater than the highest input frame number (input length – 1), it will be clamped to that value.

Expected Output Length

Read-only Text

This shows you how many output frames you can expect to get from the settings you make in Method and its subsidiary controls. It is useful to know this value – apart from the obvious reason, you may need to explicitly set this value.

Tuning Preset

List control

This lets you choose the internal parameters used by Speedo's motion estimation algorithm in a very simple way. The motion estimator is subtle and sophisticated and its control parameters affect the results in ways that are often not obvious. This control lets you select sets of parameters that we have found are useful. In general, if the output is unsatisfactory with one of the choices you make here, try using a "higher" option from this list. You can also adjust the internal parameters themselves using the other controls on the **Tuning Page** if you wish. The values of the controls associated with each of the presets is shown with the option.

- **Test**

Use this only for testing. It may not be satisfactory for final output. But you may be lucky and it looks reasonable it is worth trying the 'better' but slower settings.!

Flow resolution = Quarter

Iterations = 8

Stages = 2

Fix brightness shift = No

Process RGB = No

- **Fast**

Good for many sequences.

Flow resolution = Half

Iterations = 30

Stages = 5

Fix brightness shift = No

Process RGB = No

- **Good**

More compute intensive, but should be good for most sequences.

Flow resolution = Half

Iterations = 60

Stages = 16

Fix brightness shift = No

Process RGB = No

- **Best**

Very compute intensive. Best reserved for "difficult cases"

Flow resolution = Half

Iterations = 100

Stages = 24

Fix brightness shift = No

Process RGB = No

Note that '**Best**' still only sets Flow resolution to '**Half**', Fix brightness shift to '**No**' and Process RGB to '**No**'. If you have a very difficult case select '**Best**' and then go to the **Tuning Page** and set as required. This can greatly increase the processing time required.

Plugin Status

Read only text control

This gives you information on what Speedo is doing, and displays error messages if appropriate.

Motion Page

This page lets you add (or potentially add more) motion blur when calculating the output frames. If you have perfectly sharp (as far as motion induced blur is concerned) input material, this can be used to add motion blur to those objects that move between frames. “Perfectly sharp” input material often comes from image synthesis systems, but is rarely (or never) produced by real cameras.

You can use Speedo’s motion blur feature to do “motion blur as a post process” for synthetic imagery without retiming them by simply setting ‘**Times Longer**’ to 1 on the **Method** control. However, the motion estimation process requires texture – it is unlikely to work well with very smooth, or, especially, “featureless” (e.g. constant shaded) objects. The resulting motion blur will be that appropriate to the distances that objects in the scene have moved from one output frame to the next.

Please note that adding motion blur is not the same as creating motion trails. Motion blur is due to the motion of objects in a single output frame time – in fact only during the fraction of the output frame period when the shutter is open. It is often quite a subtle effect. The effect of adding motion blur to an input sequence that already has motion blur will be to increase the amount to some extent. The increase may or may not be significant, however.



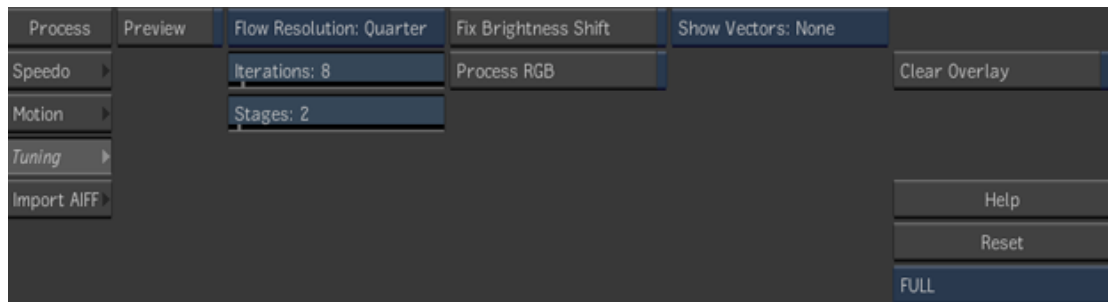
Add Motion Blur Checkbox control

Three controls are relevant to motion blur and will appear when Add Motion Blur is selected

- **Shutter Angle**
Float number. Minimum: 0.0 Maximum: 360.0 Default: 0.0
We use the way film motion picture cameras work as the model for how we specify motion blur. These cameras have a disk which rotates 360 degrees in each frame period. The disk is placed so that it prevents light from reaching the film. A sector is cut from this disk. The size of this sector is measured in the number of degrees (angle) of circle that it uncovers. A 360 degree opening would be equivalent to having the shutter open for the whole frame period (this isn’t possible in a real film camera – there has to be some time where the light is cut off in which to move the film to the next frame). A 0 degree opening would let no light through at all! In Speedo, though, 0 degrees is equivalent to no motion blur – a single sample is taken. Typical real world camera shutter angles are around 130 degrees. In a real camera, the shutter angle changes the film exposure as well as the amount of motion blur. Speedo does not simulate this, of course.
- **Shutter Phase**
Float number. Minimum: 0.0 Maximum: 360.0 Default: 0.0
This controls when the shutter opens relative to the start of the frame period. It is also measured in degrees, as you’d expect. You can move the shutter opening partially into what would be the next frame period in Speedo, which though harmless here, would not be possible in a real camera.
- **Motion Samples**
Integer number. Minimum: 4 Maximum: 256 Default: 16
This is the number of samples taken while the shutter is open. If you have large shutter angles, you may want to increase this number from its default value. If you have small shutter angles, you may want to decrease it. (More samples means more computation, hence more time to calculate a result frame).

Tuning Page

The controls on this page give you direct control over the parameters Speedo will use for motion estimation. The motion estimation algorithm is complex and subtle – it isn't possible to give definitive statements about what will happen when these controls are adjusted.



Flow Resolution

List control.

- *Quarter*
Use quarter resolution as the top level of the motion estimation pyramid.
- *Half*
Use half resolution.
- *Full*
Use full resolution. This is very time consuming.

Iterations

Integer number. Minimum: 2 Maximum: 100 Default: 8

(Also set indirectly whenever the Tuning Preset control is changed.)

The number of minimization iterations to do at each stage.

Stages

Integer number. Minimum: 1 Maximum: 24 Default: 2

(Also set indirectly whenever the Tuning Preset control is changed.)

The number of stages over which to carry out the global minimization.

Fix Brightness Shift

Checkbox control. Default: No

(Also set indirectly whenever the Tuning Preset control is changed.)

Try to compensate for overall brightness changes between successive frames.

Process RGB

Checkbox control. Default: No

(Also set indirectly whenever the Tuning Preset control is changed.)

Do motion estimation using all three colour channels rather than a single luminance channel.

Show Vectors

List control

Draw the motion estimate vectors in the display overlay as flow fields are calculated or read.

This can't "replay" the vectors as an animated display, unfortunately. It can only show the flow field that was last computed or read.

- *None*: Don't show vectors. Vectors obscure the image to some extent, so this is usually the option you want.
- *Forward*: Show the forward motion estimate (from the earlier image to the later).
- *Backward*: Show the backward motion estimate (from the later image to the earlier).
- *Both*: Show both estimates (Speedo always calculates both).