



Flicker Free Manual

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Introduction: Flicker Free and the Angry Lights

Flicker Free allows you to easily remove flicker from video footage. But what is flicker and what causes it?

Flicker is the perceived change in the luminance (or brightness) of the individual frames (or parts of the frame) as they are played back. This creates a strobing effect which is distracting and can cause epileptic seizures in small children. (ok, we're not sure about children, but we have seen this happen with over caffeinated clients in an editing bay. Very similar to children in many respects.)

Flicker Free was originally designed to fix the flicker caused by varying exposures in time lapse videography. However, once we developed it, we discovered there are many reasons for flicker and that Flicker Free does a great job on most of them. The list below is probably not exhaustive. We keep finding other reasons that flicker happens, so it's simply what we're aware of at the time of this writing.



In the above image you can see the variation in brightness of three frames from a time lapse sequence. Frame 2 is noticeably brighter than Frame 1 and 3. This can be seen in the lighter areas of the image, like the clouds. It's not as apparent in the shadow areas. When played back, Frame 2 results in a flash of brightness that is distracting.

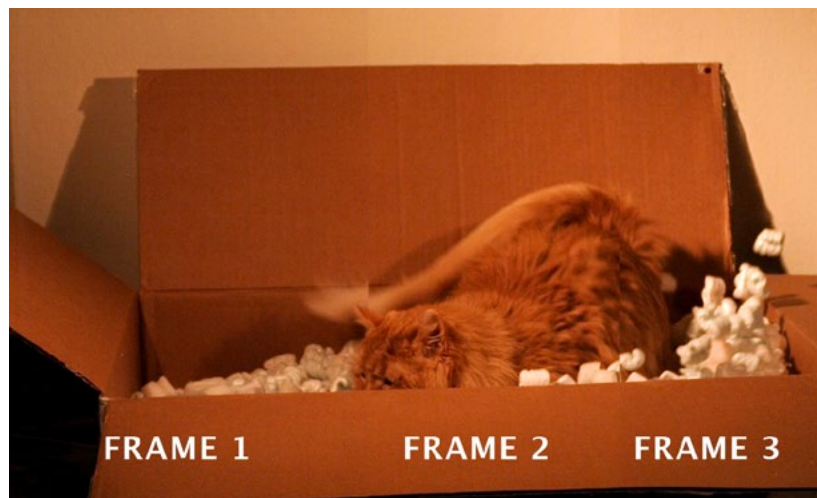
There's six main problems that cause flicker:

- 1: Flickering lights in a normal scene, shot at 24 - 30 frames per second
- 2: Flickering lights in a slow motion scene captured at 120 frames per second (or MUCH faster).
- 3: Exposure variation in a time lapse shot
- 4: Archival or old footage where either the film degraded or the older camera was not capable of a consistent exposure because it was hand cranked (or some such problem).
- 5: Rolling horizontal bands that move vertically through the footage caused by LED lights, computer monitors, and TVs
- 6: Electrical interference where the video camera is close to other electronics, like in an iPhone.

Flickering Lights and Slow Motion

Flickering lights are a somewhat rare problem in normal speed footage shot in the modern era. It can happen with situations where there are LED lights in the scene or lights that can't be controlled. Even then, with normal lights you'd have to have a defective bulb or electrical problem. It is more common with archival footage and older, more primitive lights. LED lights are also big problem, so below for more details.

It can be a HUGE problem for slow motion footage however. Electricity cycles at 50-60 times per second. This can cause the brightness of a light to vary as the electricity flows through the ballast of the light. High quality lights will probably not have this problem, but normal lights may and low quality lights almost certainly will have the issue. While shooting at normal speeds (24-30 fps), the camera is capturing slower than variation in electricity, so it's not a problem. However...



Digital Anarchy executive, Fierce Peanut, vs. packing peanuts and brightness variations thereof.

With high frame rate footage, the camera is shooting faster than the lighting fluctuations. Sometimes much, much faster. In such a case, the flicker becomes noticeable. At extremely slow speeds (say, 2500 fps), it's possible that the luminance change can happen over 30 or more frames. Usually the flicker just happens over a few frames though. This is pretty easy to correct and is one of the things Flicker Free is designed for.

So if you're on a budget, you can use lower quality lights, we've even used tungsten shop lights from Home Depot, to shoot your slow motion shots. Of course, you can purchase non-flickering lights or 2K/5K lights (which are so bright the fluctuations aren't noticeable) and solve the problem altogether.

Time Lapse

A time lapse video requires taking a photo every 1 second or 1 hour and combining them to make the video. This can result in beautiful videos, but the problem is that the lighting changes and causes flicker.

You can shoot time lapse one of two ways: 1) Set the camera to manual mode and lock down both the shutter speed and aperture or 2) lock down the aperture and let the camera vary the shutter speed.

Setting the camera to manual mode results in less flicker IF there's no changes in lighting. If the sun is moving in and out of clouds you'll have flicker. I rarely use this mode for shooting time lapse, unless I have complete control over the lighting over the entire length of the shot (which usually means it's in a studio). For nature shots, the problem is that the correct exposure for noon is not going to work for 2pm. So it's problematic.

Locking down just the aperture allows the camera to adjust to changes in lighting conditions so you can shoot over a longer period of time. This will keep the luminance approximately the same throughout the entire video. However, this ALWAYS flickers. The camera's judgement of how bright a scene is varies slightly, so it will fluctuate the shutter speed slightly from frame to frame. This is another thing that Flicker Free was designed to do.

Archival Footage

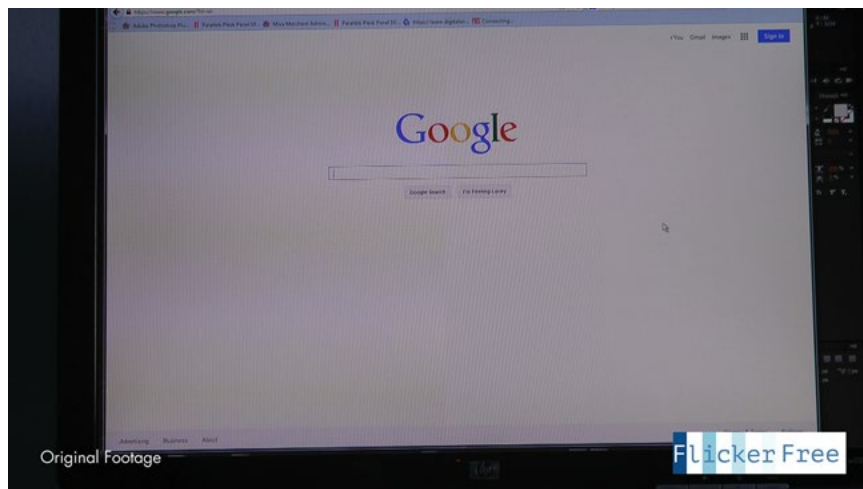
If you're restoring older footage, flicker comes from a few sources. 1) The film may have degraded over time, 2) The camera was hand cranked making it difficult to maintain a consistent exposure over the course of the shot, and 3) older lights were more prone to flickering.

If the problem comes from Exposure, then it's a similar problem to time lapse, in that it affects the whole frame, and should be easy for Flicker Free to fix. There may be some other issues like a lot of grain which goes beyond Flicker Free's capabilities.

If it's due to image degradation, the issue may be more complex as it's possible only parts of a frame will be affected. In which case Flicker Free may or may not be able to fix it.

'Rolling Bands' Flicker

This usually is caused by the camera shutter speed being out of sync with some light source. You can see it commonly happen when you capture a computer monitor or TV on video. The monitor or TV (the light source) refreshes 60 - 120 times per second. If the camera shutter speed doesn't divide evenly into the refresh rate (TV at 60hz, Camera at 1/30), they will be out of sync and you'll get the bands.



You can see there's severe banding on the left, and almost none on the right. To see the video footage, go to:
<https://www.youtube.com/watch?v=ILfV3E9rHC0>

This can also be caused by LED lights. These have a refresh rate similar to a monitor or TV! So you need to know what the refresh rate is and adjust the camera accordingly.

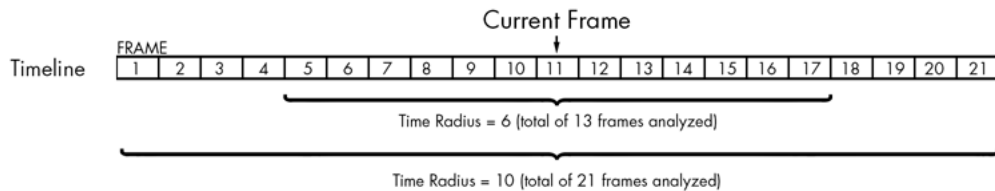
Electrical interference is another source of this problem. If the camera is too close to other electrical components, an iPhone camera or a GoPro on a drone, etc, you may also get the rolling bands.

Flicker Free can usually fix the rolling bands problem, but not always. The tighter and more well defined the bands are, the less likely it is that Flicker Free will work. If the bands are larger and softer, FF seems to work extremely well.

How Flicker Free Works

Flicker Free tries to remove flicker by analyzing a number of frames around the current frame, and figuring out what the brightness or luminance value should be for the current frame. By doing this for each frame, it can smooth out the changes in any given frame resulting in smooth lighting throughout the footage.

How many frames it looks at is set by Time Radius. The higher the value the more frames FF will look at. More frames usually means better results but slower renders. For example, if you have Time Radius set to 8, FF is looking at 17 frames: The current frame and 8 frames before and after it.



That's a lot of frames! So it's good to apply FF first before applying other effects. If you have a bunch of other effects applied, the host app or video card may run out of memory trying to render 17 frames to give to FF. This is especially true if you're using GPU accelerated effects. It's even better to apply Flicker Free in a pre-comp (or Compound Clip if you're in FCP) and then apply other effects to the pre-comp.

If you're on the first frame or the last frame (or around there), Flicker Free will use as many frames as it can. Obviously if you're at the last frame there's no frames beyond that to use, so FF will only use the frames prior to it.

Applying Flicker Free

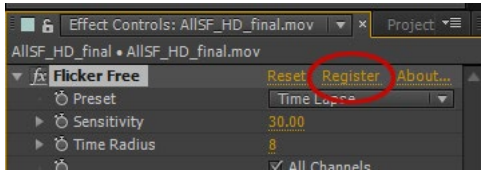
Flicker Free works like any other plugin or filter... select the footage in your host application, locate the Digital Anarchy sub-menu, and apply Flicker Free. This varies from host application to host application. If you're not sure how to do it, please consult the manual for your host application on how to apply video effects/filters. Usually there's an Effects menu or control panel where you'll see a Digital Anarchy menu item. Flicker Free will be in the Digital Anarchy menu or folder.

We have video tutorials on our website for most of the host applications we support. It's usually easier to show how to apply the filter with a quick video than screenshots in a manual. Please go here for the tutorials:

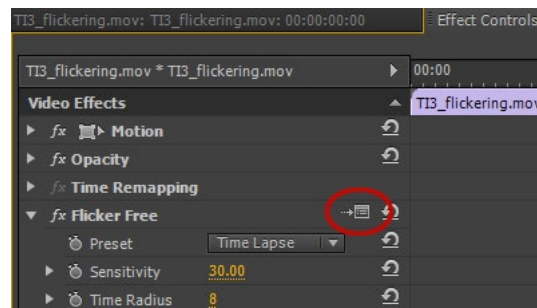
<http://www.digitalanarchy.com/Flicker/tutes.html>

Registering Flicker Free

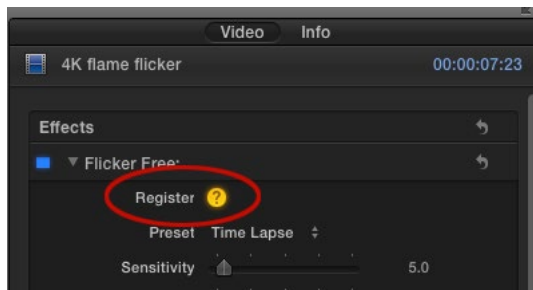
Once Flicker Free is applied you'll need to register it. In some host apps a dialog pops up as soon you apply it. This doesn't happen in most apps, so... at the top of the parameter list you'll see a Register button. Click on that to bring the dialog box up. Here's where to look in various host apps:



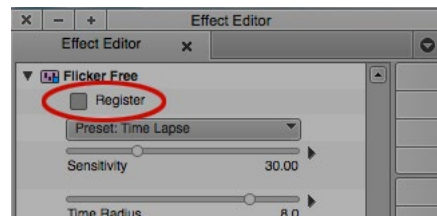
Register After Effects



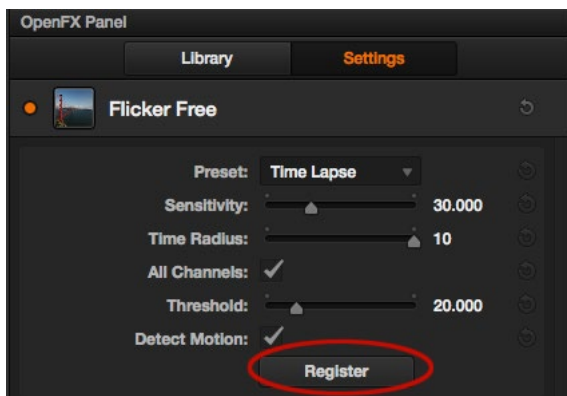
Register Premiere Pro



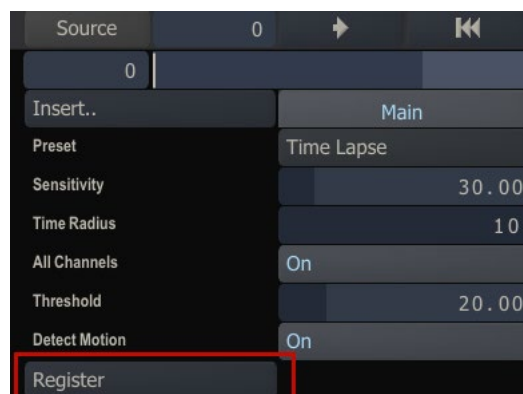
Register Final Cut Pro X



Register Avid

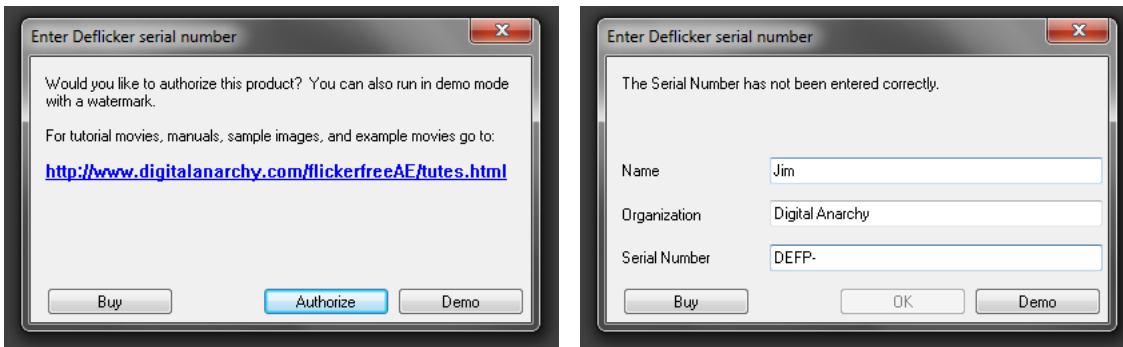


Register Davinci Resolve



Register Assimilate Scratch

In the dialog box, enter your name and serial number, which you should have received from sales@digitalanarchy.com when you purchased it. The plugin will then try to activate the serial number via the internet. It doesn't pass along any info to our servers, it just checks to see if the serial number is valid. If it is, you're good to go!



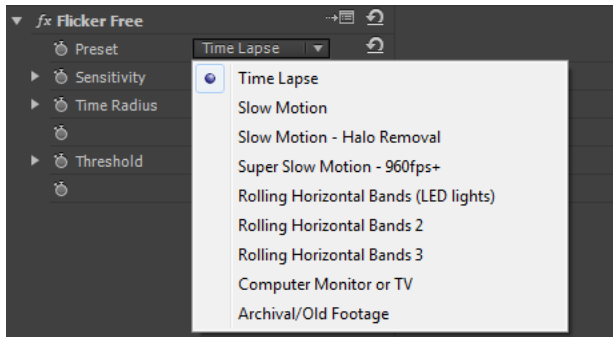
IF YOU DO NOT HAVE AN INTERNET CONNECTION: That's ok! The registration will fail, but it should show you a dialog box with your Hardware ID. Please email that Hardware ID to sales@digitalanarchy.com and we will issue you an activation key that is locked to your machine and doesn't require internet authorization.

Using Flicker Free

Quickstart Guide

Presets

There are several presets for different types of footage. These are settings we've found to work well in our tests. At best, they'll instantly solve your flicker problems! (this happens a lot... so try one of the presets, it may be all you need to do) Otherwise, they provide a good starting point and you shouldn't need to make too many tweaks.



The presets generally match up to the types of problems we discussed in the intro. Every piece of footage is different, of course, but the types of flicker tend to be the same. So the presets usually work quite well.

So, after you apply the filter to your footage, start off with the Preset that most closely matches your footage. The presets make excellent starting points and is often all you need to do.

Render out a portion of your footage to see what it looks like. You usually don't have to render out the entire video clip to see how well Flicker Free is working. While there are many different types of flicker, flicker will be pretty much the same through any given piece of footage. So if Flicker Free works on a couple seconds of your footage, it'll work on the rest of it.

If one of the presets works, great! You're done. :-)

If not, why isn't it working? If you're seeing halos, ghosting, or blurring, make sure Detect Motion is turned ON. You can also set Time Radius to a lower value like 4 or 6.

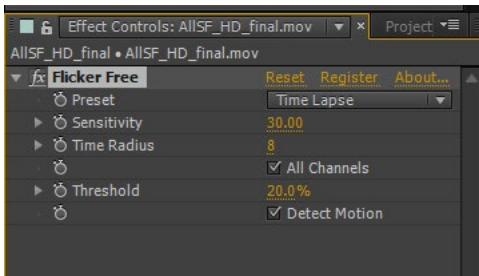
If there aren't any artifacts, but you're still seeing flickering, try turning Detect Motion to OFF. (as you might have noticed, Detect Motion is the first thing to fiddle with)

Next, adjust Sensitivity to somewhere between 5 and 50. Odds are that at least one of the presets showed some improvement, so Sensitivity will have been set to 10 or 30 depending on the preset. Try adjusting that value by +/- 10.

Finish by adjusting Threshold to between 5 and 20. For very extreme flickering, a high value like 50 or 100 might be in order.

Flicker Free is a pretty awesome solution but it's not perfect. There will be instances where it can't remove the flicker completely or sometimes it will get rid of the flicker but there's halos or ghosting. Meaning there's a tradeoff in getting rid of the flicker vs. ghosting. Often the halos are much less noticeable to the viewer than the flicker. Especially if Time Radius is set to 6 and Threshold to 10, as that will minimize the artifacts.

Parameters



Sensitivity

This affects how the flicker is removed. Not all flicker is created equal.

Some flicker affects the entire frame, for example Time Lapse shots have flicker because of the camera changing exposure. The change in exposure affects the entire frame.

Some flicker affects just certain areas. Say, an LED light that was used in a fixture at a wedding. That will cause just the area around the light to flicker and the rest of the frame will be fine.

The general rule of thumb is that flicker affecting the entire frame requires large Sensitivity values (like 30-ish) and regional flicker is better served by smaller values (10-ish). However, there are many exceptions to the rule, so it's just a guideline. For example, slow motion footage almost always looks better with a lower value, even if the flicker seems to affect the entire frame. Why? Possibly because even though the lights are affecting the frame, some parts of the subject being shot receives more light than other parts. But to be honest, I have no idea. Lower values just work better. :-)

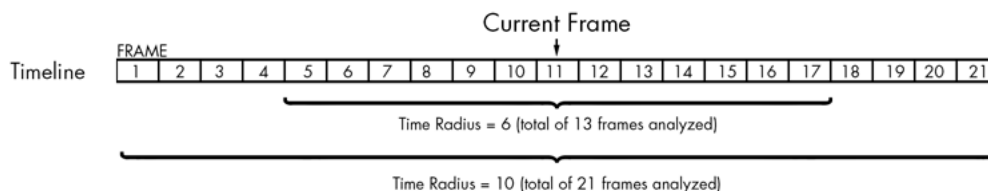
Actually, time lapse footage is the only footage that we've found so far that responds better to higher values.

Time Radius

As noted in the 'How Flicker Free Works' section, FF analyzes a number of frames before and after the current frame. Time Radius sets how many frames it analyzes. The maximum is 10. If you have Time Radius set to 10, FF will analyze 21 frames. This *usually* works better. However, it can sometimes cause artifacts or blurring, in which case a setting of 6-8 works better. Also, larger values may cause the host application to run out of memory, especially if it's trying to load all those frames into the memory of a graphics card, like Davinci Resolve.

Realistically the minimum setting for this is 3 or 4. FF won't have enough frames to analyze otherwise.

Here's a visual representation of what Time Radius does:



All Channels

This tells Flicker Free to analyze the Red, Green, and Blue channels independantly. If this is OFF it will analyze the combined channels. This should almost always be ON. The results are significantly better if so. There are some speed/memory benefits to it being off, but they're small. It's possible this parameter will disappear in the future but for version 1.0 it's included.

Threshold

Threshold looks at the amount of change in brightness that any given pixel will have. Usually a large change in brightness is not flicker, and is not something that needs to be 'fixed'. (e.g. someone with a white shirt moves to reveal a dark backgroud) So this is usually set quite low, below 20%. However, if you do have a situation where the flicker is extreme, you'll want to crank this up.

Generally flicker is visible but the change in brightness is very dramatic, maybe changing a shade of gray from 50% gray to 52 or 55%. That's still a very visible flicker when happening frame to frame, but in terms of a percentage it's rather low. Thus, a setting of 10-20 is usually appropriate for Threshold.

Fluorescent lights can be prone to more severe flickering. So you may need to increase this for footage affected by cheap fluorescent lights.

High values are more prone to artifacts and blurring, so use them with caution. However, we've seen some crazy types of flicker solved by setting this to 50 or 100. So if you filmed someone in front of a fire and you decided in post that you didn't want the firelight flickering on them, setting this to 50 might work out for you.

Detect Motion

With this turned on, Flicker Free will analyzes the footage for pixels that seem to be moving. This helps us prevent artifacts and 'halo-ing' which can sometimes occur with this off.

The downside is that the flicker removal may not be as good. So this is definitely something to try with and without. Different pieces of footage are subject to different problems as far as FF is concerned. So the settings that worked for one clip may not work for another. This is especially true with Detect Motion.

We recommend starting off with a preset that matches your footage and seeing how it works. If it works, great! You're good to go. If not, try switching the Detect Motion checkbox as the first thing you do.

Cache Frames

This only appears in the Final Cut Pro version of Flicker Free (for now). This should be turned on as it allows FF to cache the frames and drastically speeds up rendering. It's helpful not to have to ask for 21 frames on every frame. If they're cached then for each new frame we only need to ask for one additional frame to add to the cache. Some host apps (e.g. After Effects) already have good caching and don't require this. For others, we just haven't implemented it yet.

Flicker Free Problems: Artifacts, Shading, Ghosting, Black Frames and more.

Flicker Free usually works remarkably well and you should be happy with the results. Some customers are even ecstatic due to it saving shots, this is especially true for the 'rolling bands' type of flicker because they did not see it on the set.

HOWEVER... FF is not perfect and can cause problems. Here's what to look for:

Shading and Halos

This is probably the most common problem. FF is trying to blend multiple frames. If there are high contrast areas and the camera moves fast, you may see the lighter areas effected by the darker areas. Causing something that looks like a shadow or shading. Reducing the Time Radius will help significantly, as the main problem is that FF is trying to blend too many frames that vary a lot. Also, try adjusting the Threshold to a lower value. Having Detect Motion ON, will often solve the problem. However, this can cause less flicker reduction... in this case increasing the Threshold to 40 or 50 can be helpful.

Of course, it may not be that big of a deal. Play it back in realtime and see how it looks. Frequently the problem is only noticeable when you turn Flicker Free on and off in the host application and when played back normally it's not noticeable by the viewer.

For low contrast areas, Shading can also happen, but it looks more like a blur. For example, if someone moves their head very quickly, you may see some softness in areas like the eyes.

Ghosting

This is kind of rare but happens when you've got fast moving objects. Again, it's more of an issue with high contrast areas of the scene (e.g. a bright tennis ball moving across a black background). The object will appear in a frame with 'ghosts' or 'echoes' of itself at the positions it was at in prior frames. Reducing the Time Radius can help with this. Also try adjusting the Threshold to a lower value.

Black Frames / Render Errors

Keep in mind that FF is requesting a lot of frames from the host. If you have Time Radius set to 10, Flicker Free is asking the host app to render 21 frames so we can analyze them. You should apply FF BEFORE applying other effects. If you apply it afterwards, the host app or graphics card may run out of memory trying to render all those frames and won't render. In which case, you'll get a render error, black frames, or some other odd behavior. In some apps we do attempt to cache frames, which reduces the overhead needed but it still can be a problem.

