

The Viper Exposed

Whitepaper

A Guide to Camera Operation Using FilmStream

With the Viper FilmStream™ camera it is inevitable that there will be comparisons between film and electronic capture. In fact film and CCDs are completely different and this paper has been written to help understand the behavior of the CCD sensors used in the Viper camera.

Comparing Film and CCD Imagers

- Grains in a film are equivalent to pixels in a CCD, they are the smallest individual areas that can interpret the light falling on them.
- Grain is randomly distributed within each frame and is therefore random from frame to frame, while pixels are in the same position in each frame. This means that there is no visible aliasing or fixed pattern with film, while there can be with CCDs.
- Sensitivity is based on the number of photons required to cause a reaction. It needs four photons to tag a grain, it needs two to three photons to start generating charge in a pixel.
- Film grains vary in size over a wide range, with low light the larger ones will be tagged first giving the characteristic sensitivity curve of film. Pixels are all the same size giving a linear response.
- Film continues to respond to light in the overexposure region (the shoulder) but once saturation is reached in a sensor there is no further change.
- CCDs have essentially the same MTF for red, green and blue, while with film it is significantly different for each layer.

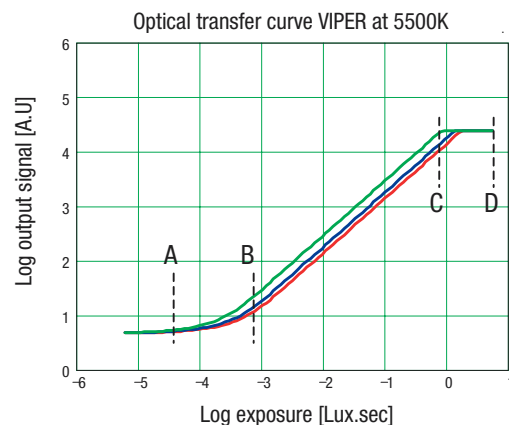
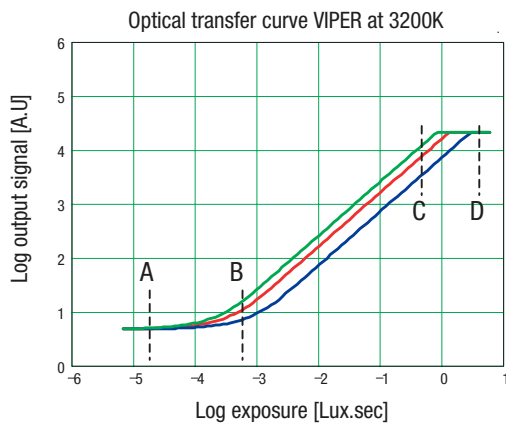
Exposing the Viper

In FilmStream operation, the output from the Viper camera is a direct representation of the light falling on the CCD Sensors. No internal gain or color balance controls are used.

The following show the transfer curves at 3200K and 5500K

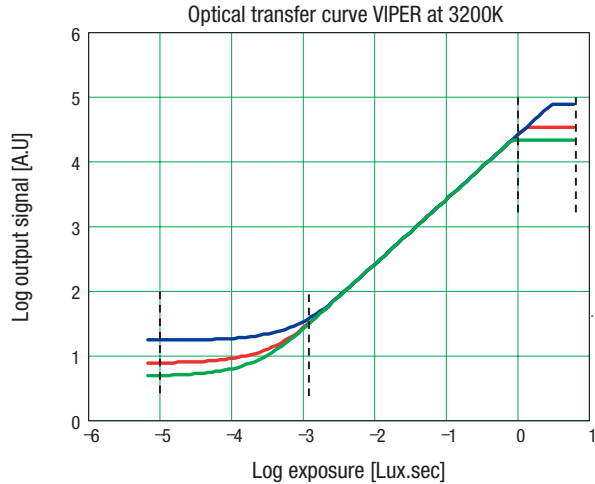
In both cases we see three areas:

- A-B** Nonlinear response where sensor noise offsets the response curve.
- B-C** The linear portion covering a wide exposure range of about 10 f-stops.
- C-D** Saturation region, where green saturates first.



Post Production Color Balance

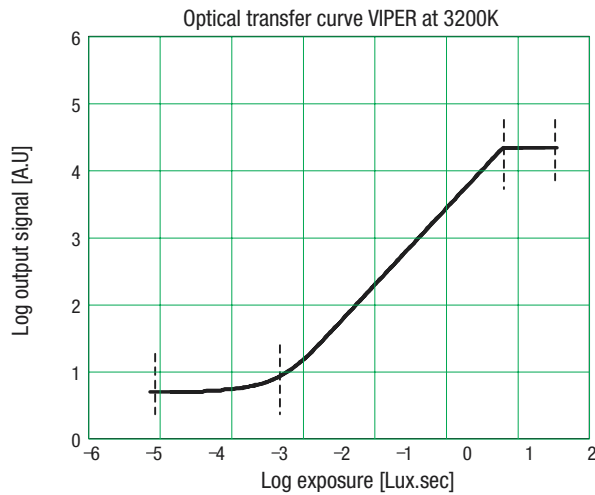
If color balance is applied electronically in post production by simply adjusting the gains to balance over the linear portion, we achieve a wide exposure range where the balance is correct. However, the bottom part of the curve shows the different noise levels in the colors, the (extreme) highlight portion shows a coloration towards magenta.



Optical Color Balance

An alternative approach is to color balance before the CCDs, i.e., using optical filters. If this is done, the color balance is achieved over the whole transfer curve and an additional 1 to 2 stop exposure range can be used.

NB: See separate documents for more information on the FilmStream signal and its implications in post production.



Choosing Electronic or Optical Balance

Optical color balance gives a wider exposure range and improved signal to noise, but since this is achieved by reducing the two higher level color signals, it is at the expense of sensitivity. Filters can be selected according to color temperature according to the following table:

Color Temp (K)	Color Filter	Sensitivity Loss
3200	None	0
3200	CC60M + CC80C	2.9 stops
5600	None	0
5600	CC60M + CC81B	2.2 stops

Effective Sensitivity of Viper

Because of the wide latitude the Viper camera could be regarded as having a very wide range of sensitivity ratings.

When shooting 1080p@24fps with 1800 shutter angle we recommend the following settings which will give approximately +4.5 stops and -5.5 stops latitude with respect to 18% grey.

Without optical color correction: 320 ASA

With color correction to 56000: 80 ASA

When using 2.37:1 aspect ratio the ASA rating is slightly higher at 400 ASA.

Note: The shutter angle referred to above is the effective shutter angle which is adjusted in the Viper camera by the variable exposure control. This is varying the exposure time electronically while the camera's mechanical shutter remains fixed. The total adjustment range available is approximately 50 to 3200.

Use of the Viewing Output

Because the FilmStream output appears flat and is usually of a green hue, it is often desirable to use the viewing output to gain an impression of the finished result. This output is gamma corrected and can be color balanced as required. Changes made on this output will not affect the FilmStream output in any way, however it is important to understand the implications of its use.

By changing the gain of the viewing channel the *appearance* is of having changed the sensitivity: if 18% grey is adjusted for the same correct appearance in each case the results are as follows:

-6 dB: 160 ASA, less noise, more latitude in lower part, less in upper part

0 dB: 320 ASA, standard setting (no optical color balance)

+6 dB: 640 ASA, less latitude in lower part, more in upper part

+12 dB: 1280 ASA, less latitude in lower part, more in upper part

Use of the Viewfinder Zebra

This feature can be used to give an accurate indication of areas of the picture where CCD saturation is being reached, or approached, warning that once the CCD has saturated no more information can be resolved.

Under normal lighting conditions we suggest that the viewfinder channel be set to monitor green. If the zebra is set for 100% this will give an indication as saturation is reached. By setting it to 98% it will indicate just before saturation occurs.

Zebra and viewfinder signal levels are not affected by changes made to the viewing channel gain.

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