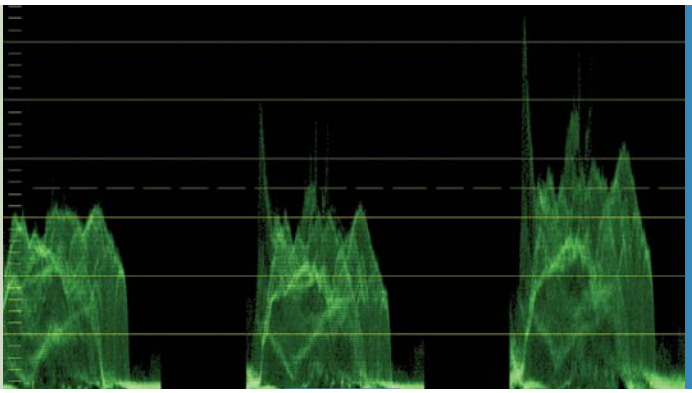

The Benefits of External Waveform Monitors in Color Correction for Video

Application Note

Tektronix®

Figure 1. Tektronix external waveform monitors provide many advantages over internal, software-based waveform monitors.

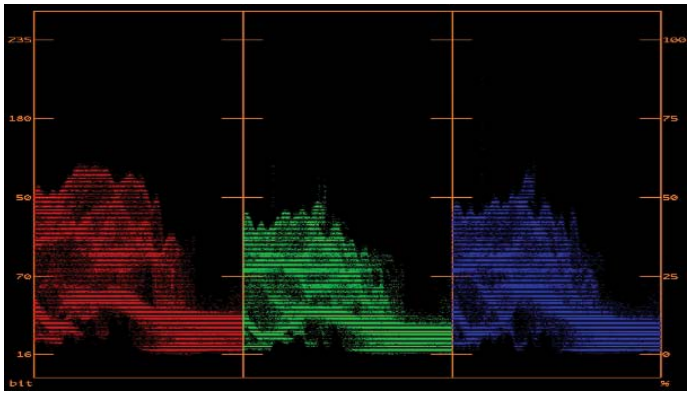

Figure 2. This is a screenshot from Avid's built in RGB Parade waveform monitor.

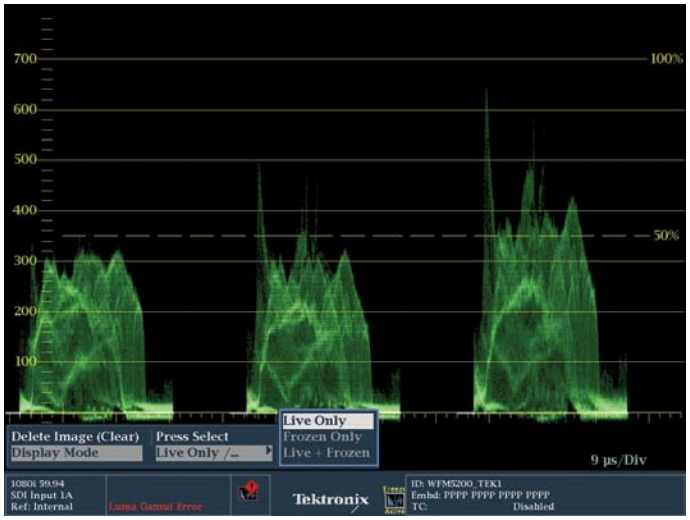

Figure 3. This is the same image displayed on the Tektronix WFM 5200.

One of the key aspects of doing good color correction is being able to analyze your image, and one of the most important ways to analyze your image is with a good external waveform monitor or rasterizer (Figure 1).

Many people have access to software-based "internal" waveform monitors in their non-linear editing systems or desktop color correction software (Figure 2). There are a couple of issues with using built in software Waveform Monitors to do color grading. This document will address the four main reasons for using external Waveform Monitors, such as the Tektronix WFM5200.

The primary reason is resolution. The software Waveform Monitors built in to desktop editing and color correction applications get the left-overs when it comes to computing power. Apple and DaVinci and Avid are much more concerned with giving their users a great user experience, with no lag in response times or processing, so they devote most of the computing power in their app to the actual DOING of the color correction. So, to lower the drain on the rest of the application, the Waveform Monitors are usually only a quarter resolution at best. Sometimes the Waveform Monitors in the applications only sample every EIGHTH line of video!

When color correcting, you need high quality definition and resolution. Look at the difference between the Avid Waveform Monitor and the Tektronix Waveform Monitors (Figures 2 and 3).

Especially with small specular highlights, you could easily lose them with the internal Waveform Monitors. Tektronix Waveform Monitors look great. Even the lower cost ones, like the WFM5200, have the same high quality.

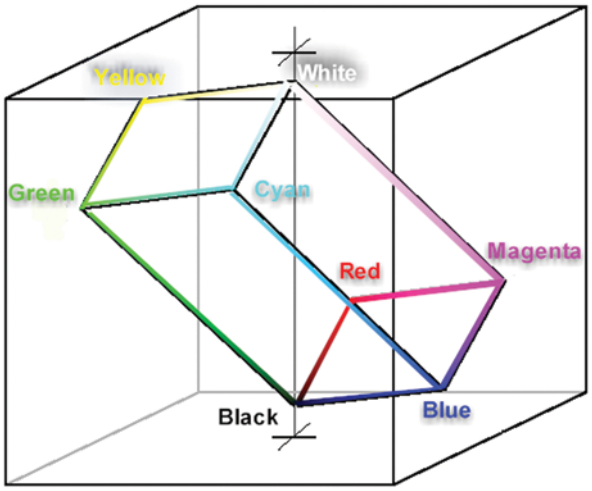

Figure 4. This is a representation of the YPbPr Color Space.

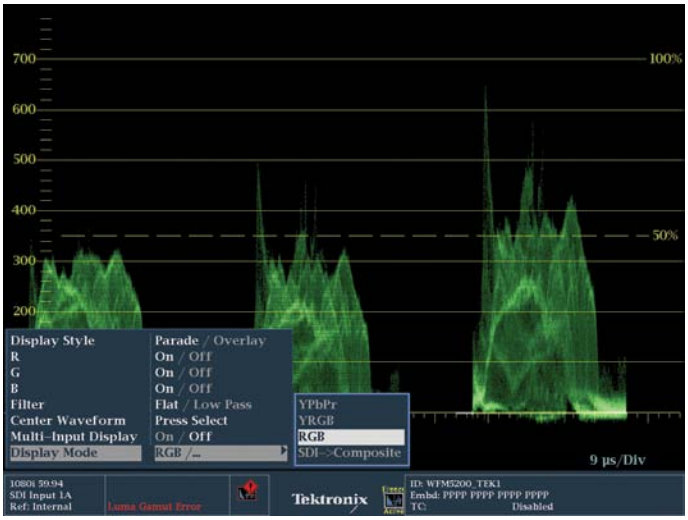

Figure 6. Tektronix waveform monitors are highly customizable with easy-to-navigate menus and direct access through buttons and controls.

Figure 5. Tektronix monitors can show multiple displays of information in completely customizable configurations for maximum efficiency.

Another important argument for using external waveform monitors is that the internal Waveform Monitors are just showing you what the hypothetical output of the signal will be coming out of your computer. The Tektronix Waveform Monitors have the advantage of actually being on the other side of your video card, showing you the actual output. These cards put out video in the format appropriate for the distribution method and the color space of the final screen. For example, for HDTV, video is in a YCbCr format with a rec. 709 color space which is how it will be distributed and viewed versus a simulation of this format within the editing platform (Figure 4).

Another critical advantage of Tektronix Waveform Monitors is that they're easily configured and can show you the exact display or combination of displays that you want at the touch of a button (Figure 5). These types of waveform monitors allow you to customize the displays in infinite ways and save them to presets that can be recalled and changed very quickly. That's important when you are trying to get through 1000 grades in a day. You can't waste time scrolling through menus on a screen (Figure 6).

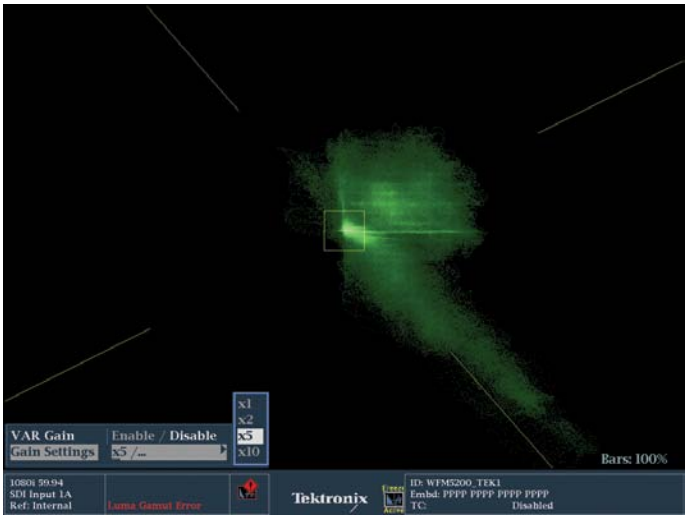

Figure 7. Tektronix waveform monitors can easily and quickly display zoomed, gained or magnified images of various waveform displays, like this 5x zoom of a vectorscope.

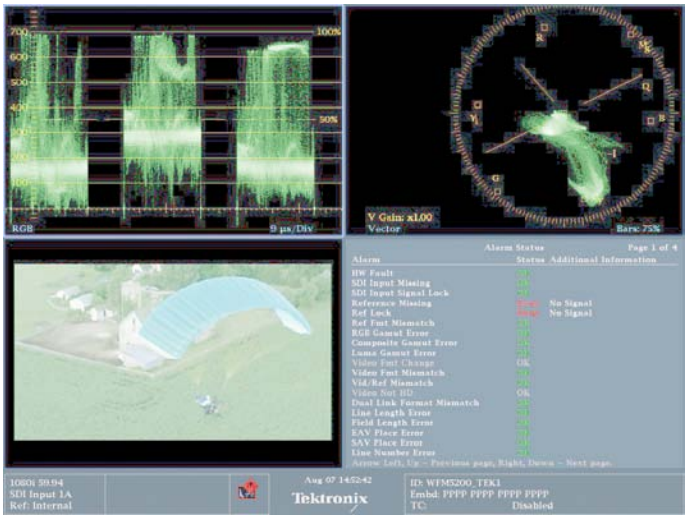

Figure 8. This is a fairly common and useful combination of an RGB Parade waveform monitor with a vectorscope.

Figure 9. Spearhead and Vectorscope are great complementary displays.

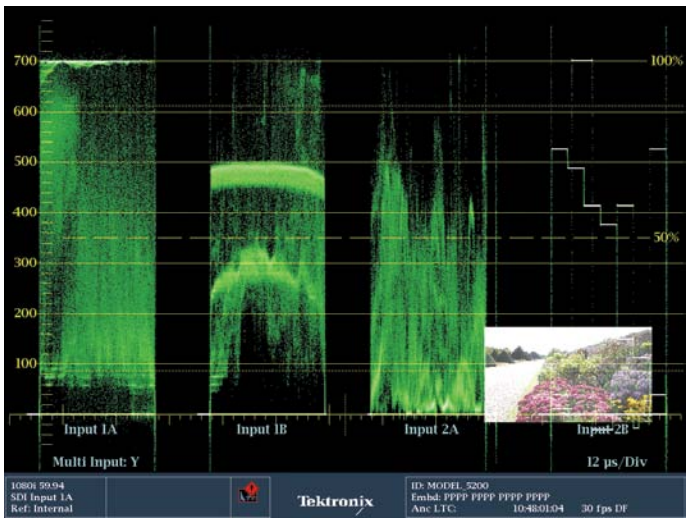

Figure 10. Tektronix series 7000 and 8000 can display up to four different trace-based displays at once.

One of the things you'll want to do when you're grading is add gain, or zoom in to a particular part of a scope, like the middle of the vectorscope or the highlights of a waveform (Figure 7).

Most software Waveform Monitors can't do this at all. The ones that don't are completely worthless. With a Tektronix scope the functionality is not only there, but it's easy to access. With the WFM5200 you can save two complementary traces displays, like an RGB Parade and a vectorscope (Figure 8) or a Vectorscope and a Spearhead display (Figure 9).

With other Tektronix Waveform Monitors, like the 7000 or 8000 series, you can have four trace displays up (Figure 10). Choose which displays and views you use in certain situations and save them as presets that you can recall with two quick taps. This is so important that I did a whole video about presets in this series.

Figure 11. The LQV on the left is showing shadows. The LQV on the right is showing highlights. Notice the blue numerical "High" and "Low" readouts in the upper left corner of each display. This shows the tonal range that each LQV is set to display.

Figure 12. This shows the customization menu for setting the tonal range that the LQV will display. In this case, the LQV will show shadows from below 0mv up through 79.91 mv.

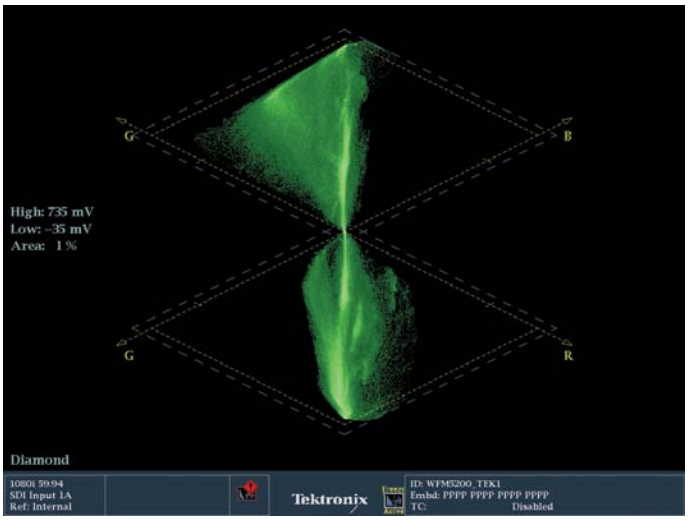

Figure 13. This is the Diamond Display. Because the diamonds are directly above each other in this display, it's easy to see the vertical orientation maintained in the trace between the two diamonds.

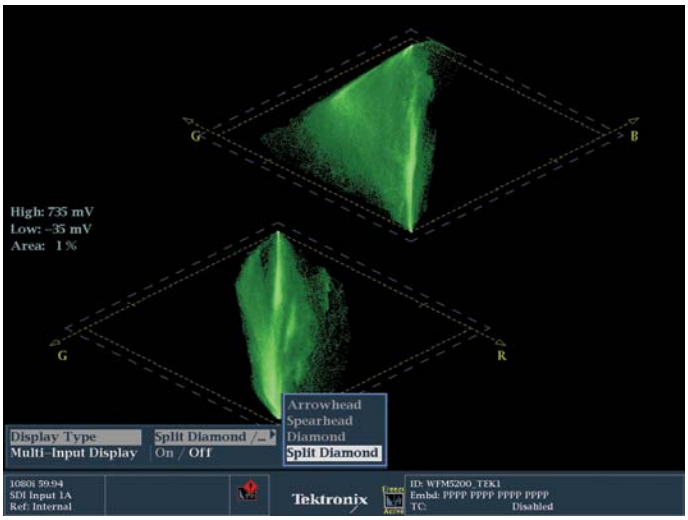

Figure 14. This is the Split Diamond Display. Because the diamonds are separated from each other, it is easier to distinguish the blacks at the bottom of the top diamond from the blacks in the top of the bottom diamond.

The final critical element is that Tektronix has patented several gamut displays and other features that simply aren't available on other internal OR external Waveform Monitors.

One of the most recent Tektronix innovations is the Luma Qualified Vectorscope display (Figure 11). This is an exclusive Tektronix display commonly referred to as LQV. You can find this in the settings for the Vectorscope display (Figure 12). It allows you to display a specific tonal range in the vectorscope, for example to see JUST the highlights or JUST the shadows. This makes it much easier to find a good white or black point, or to match what's happening with your high, middle and shadow trackballs with what's happening on the Luma Qualified Vectorscope.

The other important displays that only Tektronix has are gamut displays. The diamond (Figure 13) and split diamond (Figure 14) displays may look a little foreign, but these are gaining greater acceptance for balancing footage in color correction and camera set-up. These are powerful displays that are very useful and you can't get them anywhere else. The basics of the diamond are that the blacks are in the middle of the display, where the diamonds join. Whites are at the other ends of the diamonds. If the image is balanced, it basically runs right up the middle of the diamonds. When you get the hang of this, balancing is as easy as drawing a straight line!

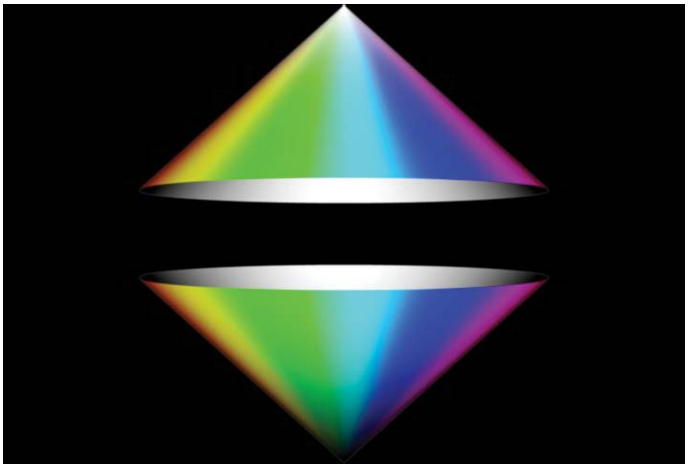

Figure 15. Imagine the RGB color space as two cones.

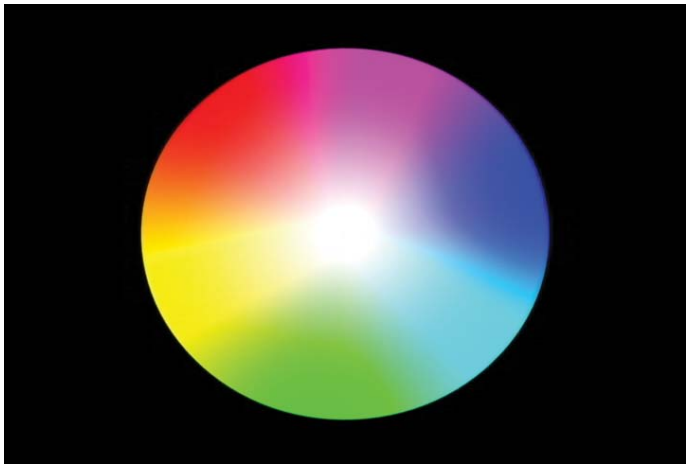

Figure 16. RGB color space viewed from the top.

The spearhead display is another gamut display that helps with compliance to broadcast specs AND with creative color correction. The spearhead is a great complement to the vectorscope. Imagine color space described as two cones, brightness to the top of one cone, darkness to the bottom of the other (Figure 15). This is what the HSL color space looks like in three dimensions.

More saturated towards the edges. Less saturated in the middle. Hues around the edges. Look at the cones like this, from the top, and you have a vectorscope (Figure 16).

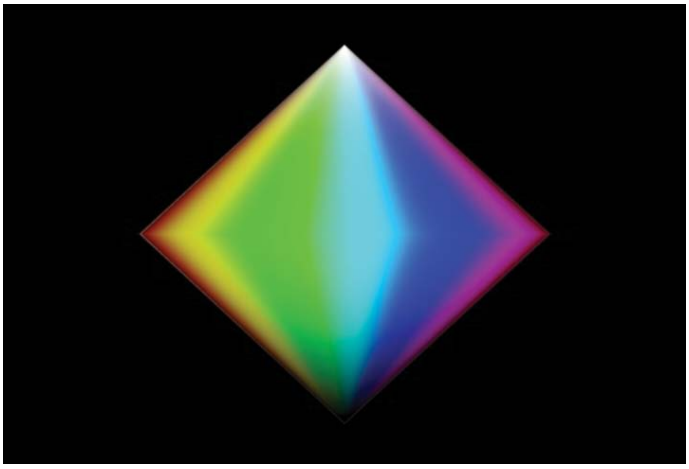

Figure 17. RGB color space as viewed from the side.

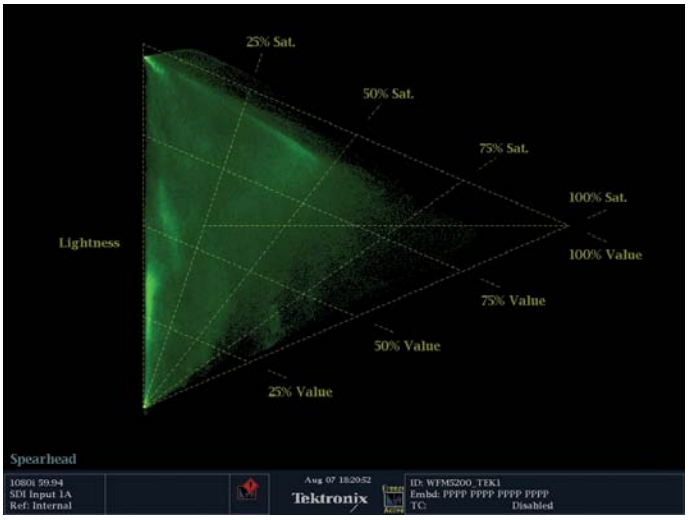

Figure 18. Tektronix's exclusive Spearhead display shows Lightness, Value and Saturation. It's a great companion view to the vectorscope.

Turn them like this, with black at the bottom and white and the top, saturation to the edges and you've basically got the spearhead (Figure 17). The spearhead takes hue from two dimensions to one, though.

So the spearhead and vectorscope combined provide a great three dimensional view of the color space. It's important to see these side by side because a vectorscope doesn't really show saturation in isolation. The excursion of the trace on the vectorscope - how far towards the edge it is - can be driven by saturation OR value OR both. The spearhead shows you the difference that the vectorscope alone can't (Figure 18).

On the WFM 5200, make a preset with these side by side, or download the presets from the Tektronix website and experiment with them. You'll find that these unique gamut displays are very useful in doing good, efficient color correction.

To learn more, visit our Learning Library at www.tektronix.com/5200learn.

Contact Tektronix:

ASEAN / Australasia (65) 6356 3900
Austria* 00800 2255 4835
Balkans, Israel, South Africa and other ISE Countries +41 52 675 3777
Belgium* 00800 2255 4835
Brazil +55 (11) 3759 7627
Canada 1 (800) 833-9200
Central East Europe and the Baltics +41 52 675 3777
Central Europe & Greece +41 52 675 3777
Denmark +45 80 88 1401
Finland +41 52 675 3777
France* 00800 2255 4835
Germany* 00800 2255 4835
Hong Kong 400-820-5835
India 000-800-650-1835
Italy* 00800 2255 4835
Japan 81 (3) 6714-3010
Luxembourg +41 52 675 3777
Mexico, Central/South America & Caribbean 52 (55) 56 04 50 90
Middle East, Asia and North Africa +41 52 675 3777
The Netherlands* 00800 2255 4835
Norway 800 16098
People's Republic of China 400-820-5835
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Russia & CIS +7 (495) 7484900
South Africa +27 11 206 8360
Spain* 00800 2255 4835
Sweden* 00800 2255 4835
Switzerland* 00800 2255 4835
Taiwan 886 (2) 2722-9622
United Kingdom & Ireland* 00800 2255 4835
USA 1 (800) 833-9200

*** If the European phone number above is not accessible, please call +41 52 675 3777**

Contact List Updated 10 February 2011

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