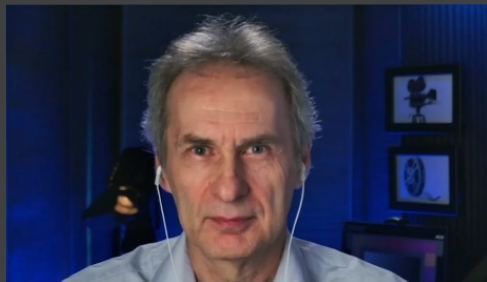
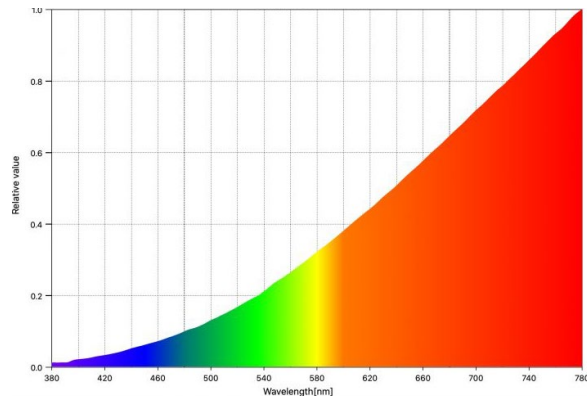




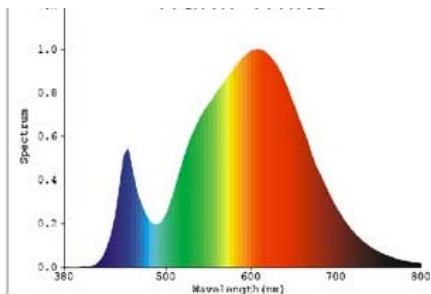
Using a Camera's Chroma Signal To evaluate and calibrate LED lighting and Video Walls



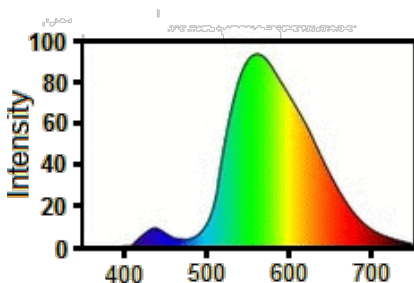
Brad Dickson Former Senior Lighting Director
/ Technical Instructor at the Canadian
Broadcasting Corporation



Tungsten



LED

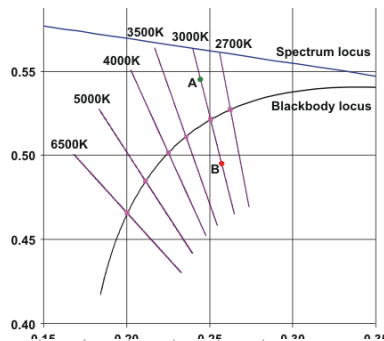
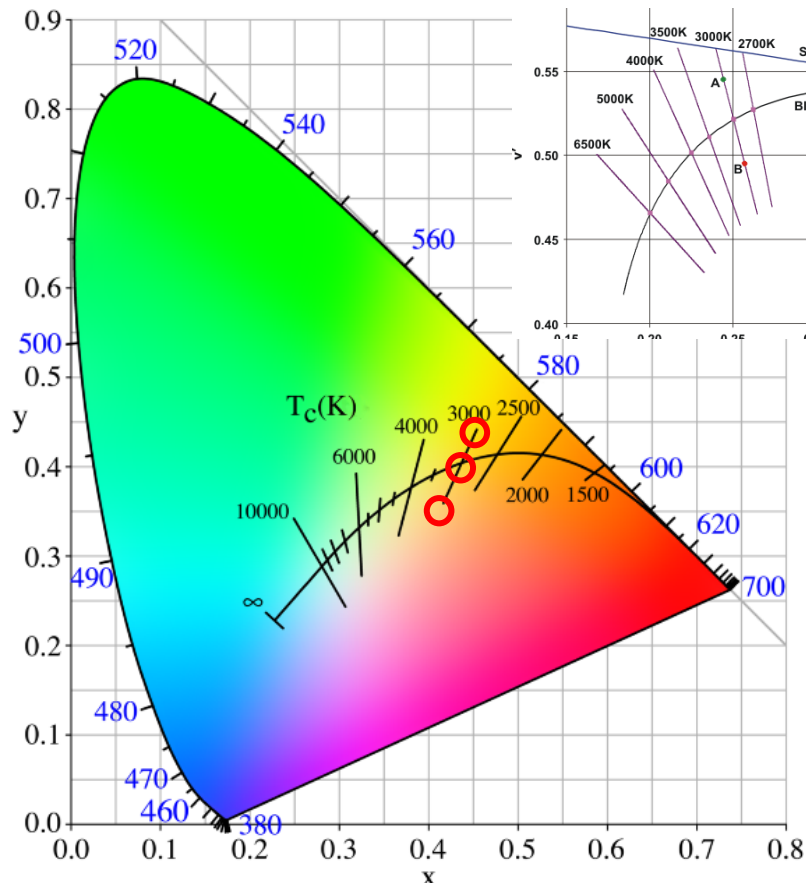


Lighting Measurements

Spectral Power Distribution (SPD)

The Top SPD graph shows the spectral output of a tungsten light source.

The bottom two SPDs show two LED light sources that are supposedly equivalent to the tungsten light source.



Lighting Measurements

Kelvin Vs. Correlated Color Temperature

Kelvin (K) temperature refers to colors of light emitted by a black body heated to a specific temperature.

Correlated Color Temperature (CCT) is the apparent color emitted by a light source created by other than heat. However, it can be above or below the black body curve and still be assigned the same Kelvin CCT equivalent value.

Lighting Measurements

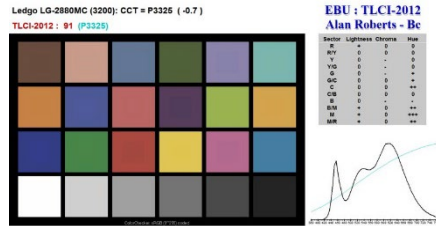
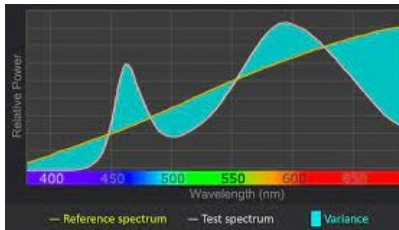
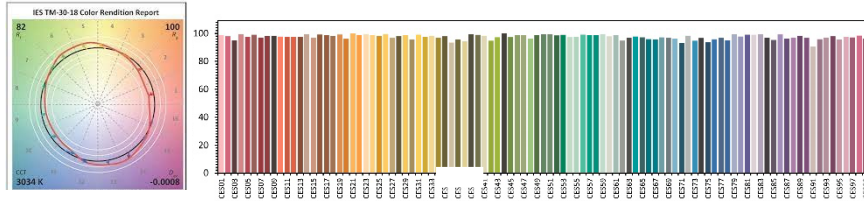
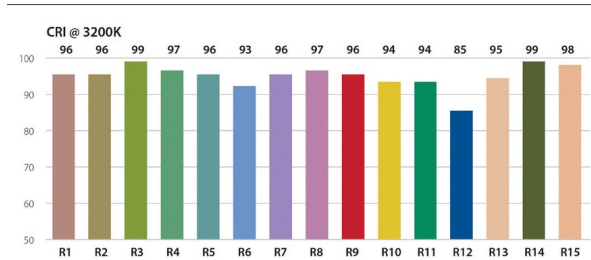
CRI TM-30-18 SSI TLCI

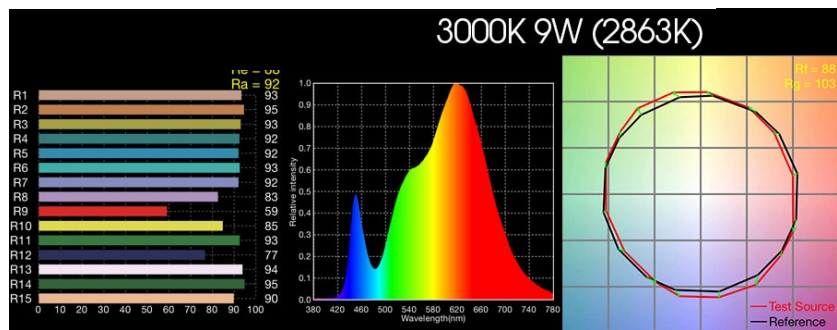
CRI - Color Rendering Index. Based on the eye's perception, but has a limited number of color reference points.

TM-30-18 - Expands reference colours in its readings.

SSI - Spectral Similarity Index values are based on how close a source SPD is to the reference SPD you are trying to match.

TLCI - Television Lighting Color Index, based on 3-chip prism cameras and not single-chip, Bayer-filter cameras. Based on a virtual camera's response.



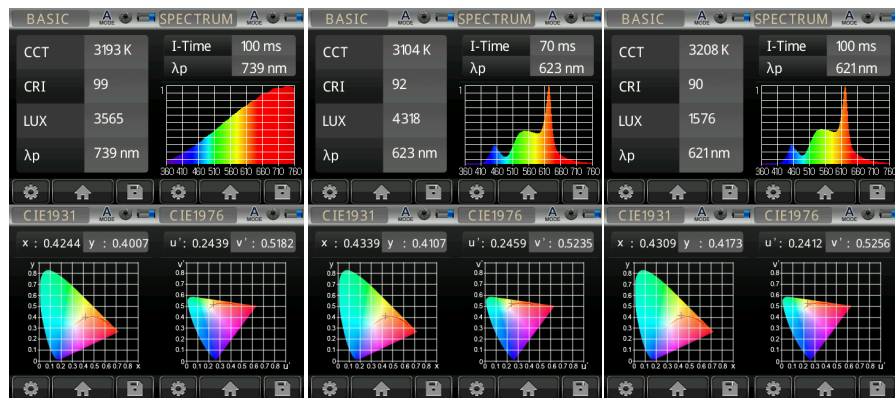


Lighting Measurements

Color Meter Reading

While color meters can provide you with a variety of measurements, can they predict a camera's response to different light sources?

Are their readings accurate enough for adjusting and matching multiple, different light sources on-camera?

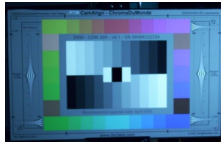
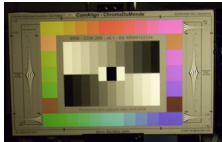
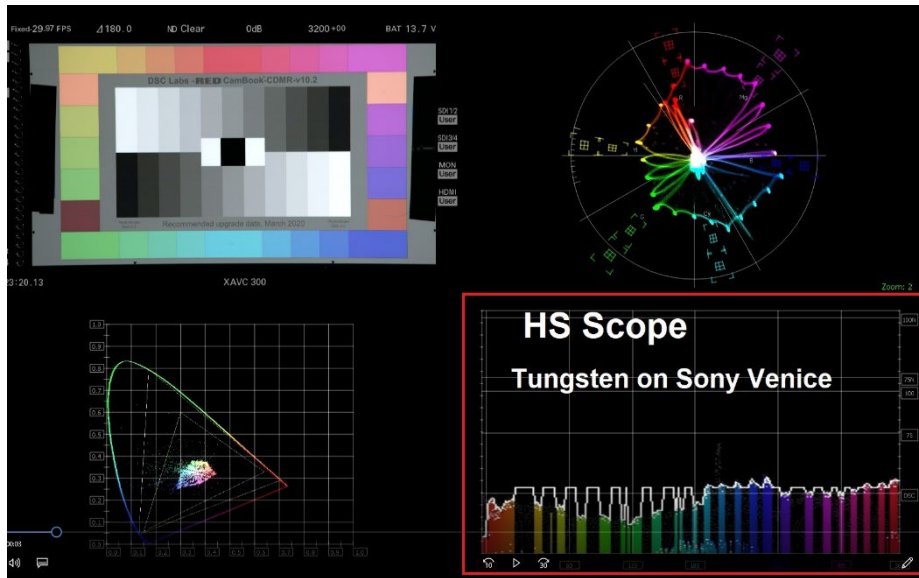


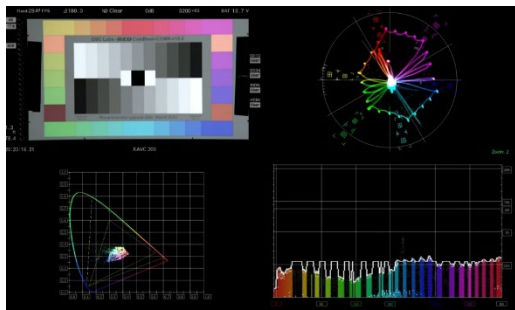
Lighting Measurements

Chroma Signal Reading with HS Scope

My methodology for evaluation and calibration is to use the camera's electronic chroma signal as a reference to predict how a camera responds to a given light source, in effect making the camera my metering tool.

I co-created the HS Scope to present the chroma signal in a unique display and facilitate the evaluation and calibration of different LED light sources for cameras.

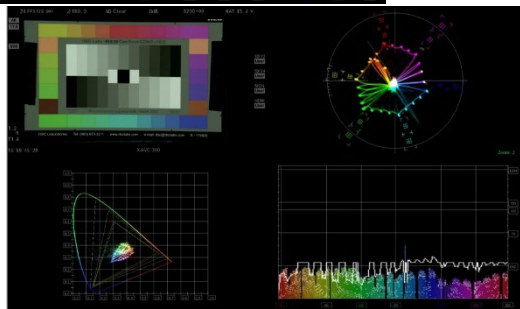




1

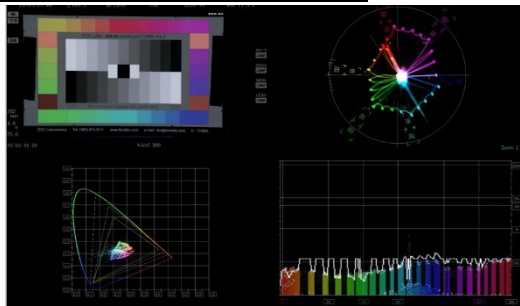
Lighting Measurements

Using HS Scope to match sources



2

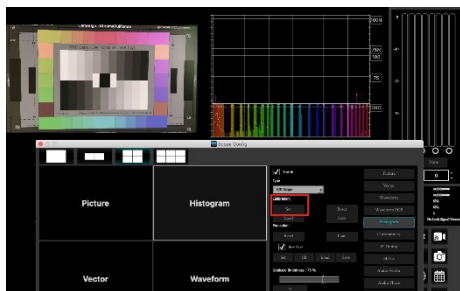
Frame 1: A tungsten **3200K** reference light source lights a DSC chart. HS Scope creates a reference guide line, shown as a white line, which is stored in the HS Scope reading on a Sony Venice camera.



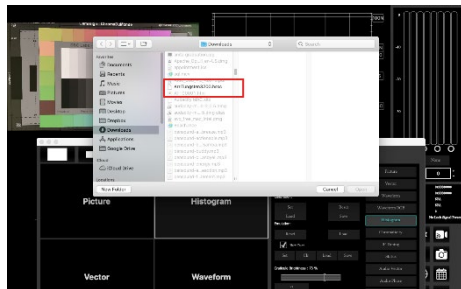
3

Frame 3: By adjusting the RGB values of the separate LED sources in the fixture, we obtain an optimal match to the reference tungsten source, using the Sony Venice's actual chroma signal.

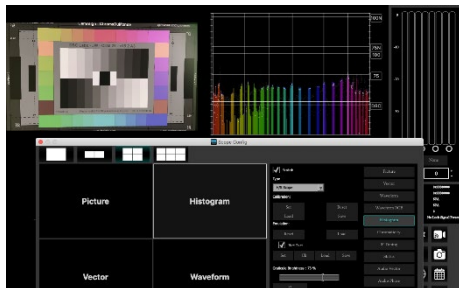
1



2



3



Lighting Measurements

HS Scope allows a webcam to emulate other camera's chroma response curves

Frame 1 : A Webcam chroma signal is calibrated to a zero point.

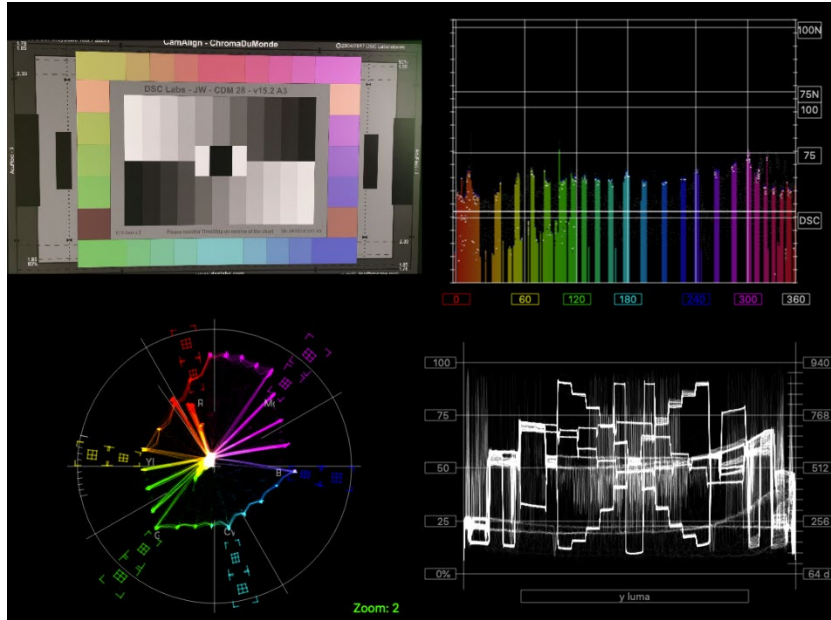
Frame 2 : A stored reference file, based on a chroma reading from the actual camera chosen, is then loaded for the webcam to emulate.

Frame 3 : The webcam now emulates the chroma response of the selected camera as selected in HS Scope.

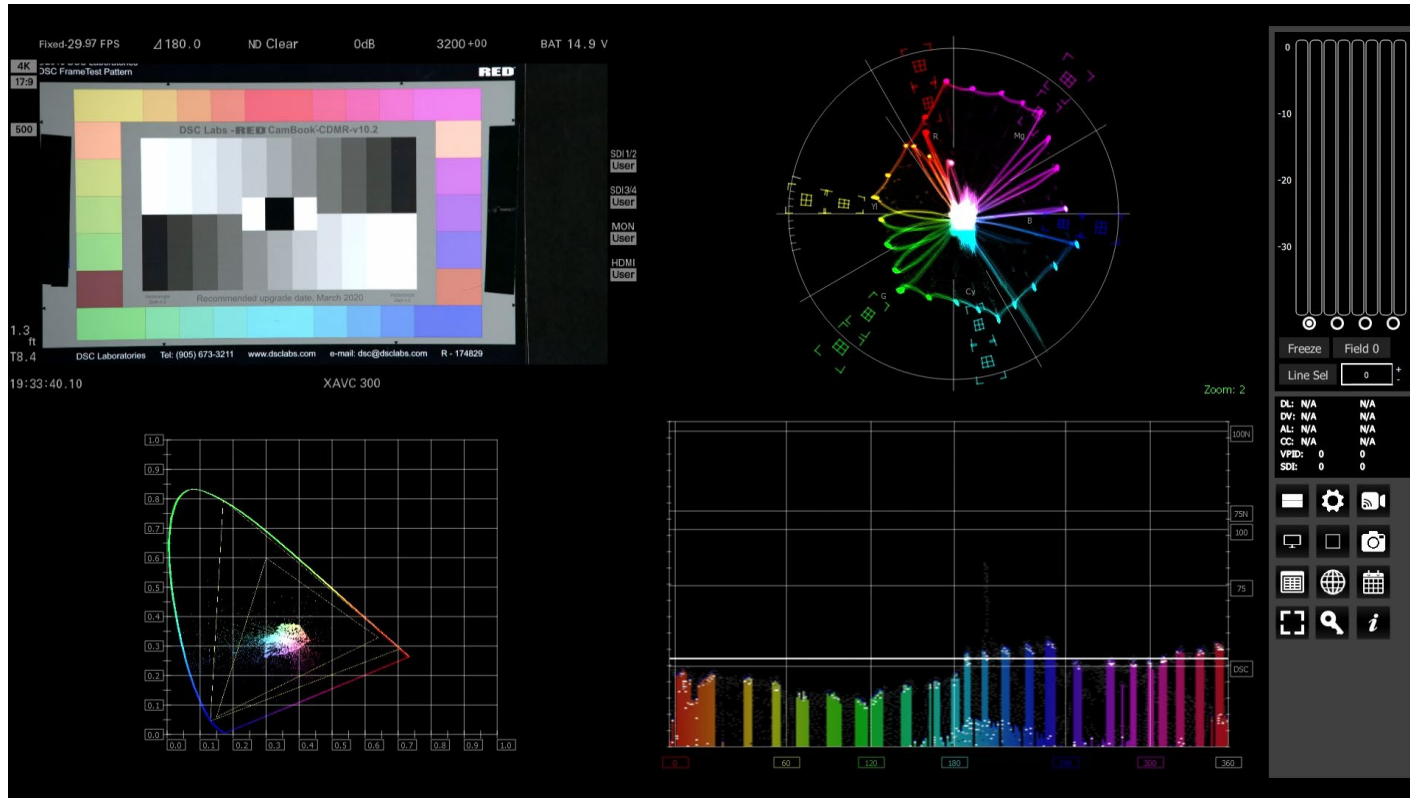
Lighting Measurements

HS Scope allows a webcam to emulate other camera's chroma response curves

This example show how HS Scope is used to adjust a Webcam to emulate the chroma response of an Arri Alexa Mini LF camera, based on a 3200K Tungsten reference light source with the camera preset to 3200K.



Calibration of a LED light source to match tungsten source



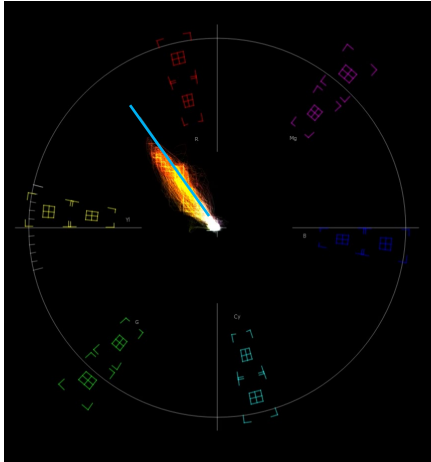
Lighting Measurements

Chroma Signal Shows Shifts

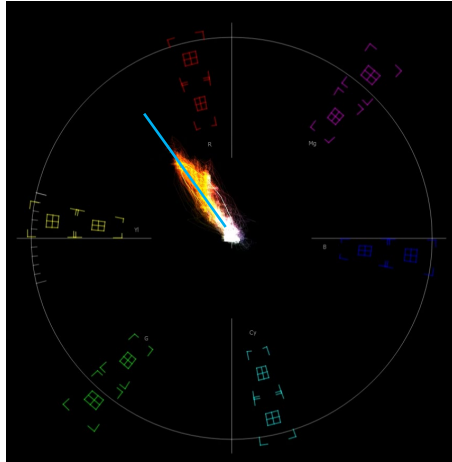
Frame 1: Camera preset to 3200K. 3200K tungsten source lighting skin tone.

Frame 2: An LED fixture, preset to factory 3200 CCT, lighting skin tone. We see a slight shift towards red, deviating from the desired original camera look.

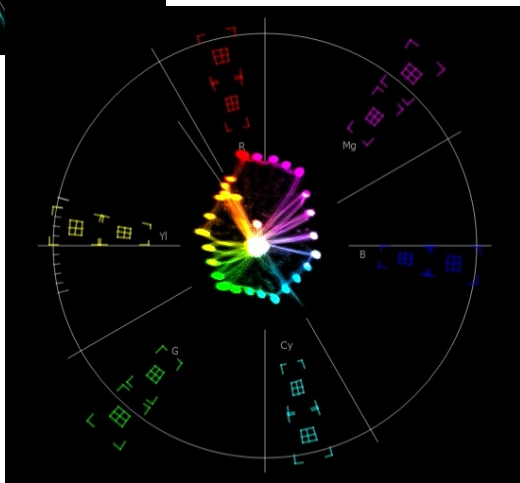
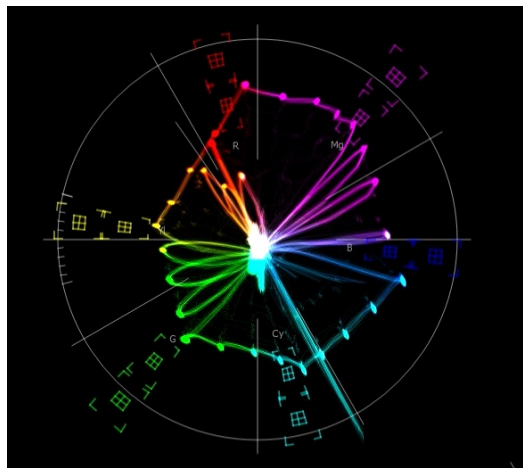
Multiple LED light sources can alter the original camera look.



1



2



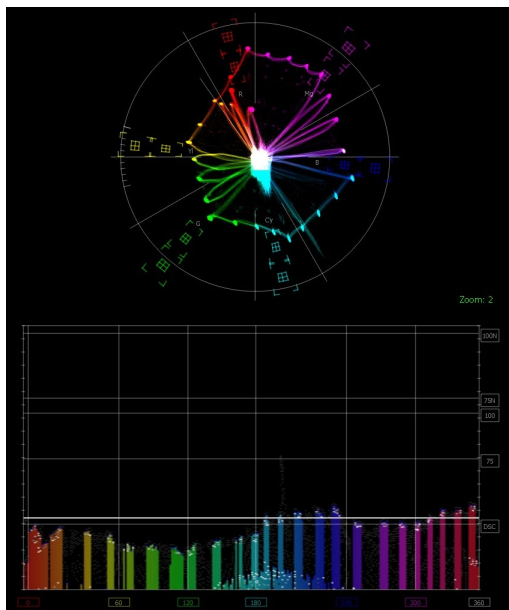
Lighting Measurements

Chroma Signal Shows Shift When Dimmed

The camera's chroma signal can show precise color point shifts that occur during the dimming process.

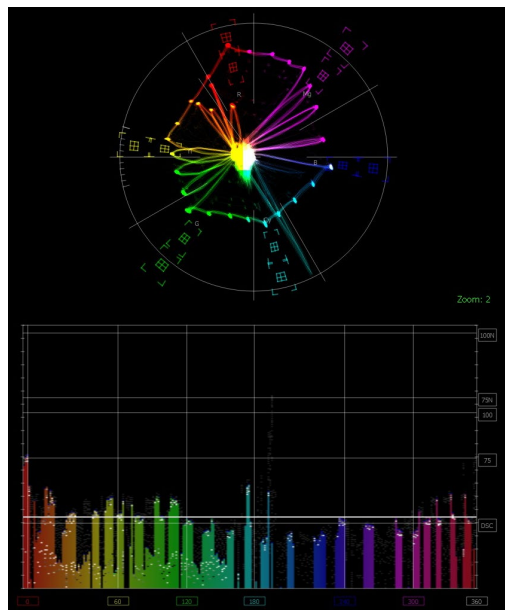
LED lighting manufacturers will claim that no color shifts occur while dimming, but the camera's chroma signal shows otherwise.

SONY VENICE / Metered CCT Kelvin VS HS Scope



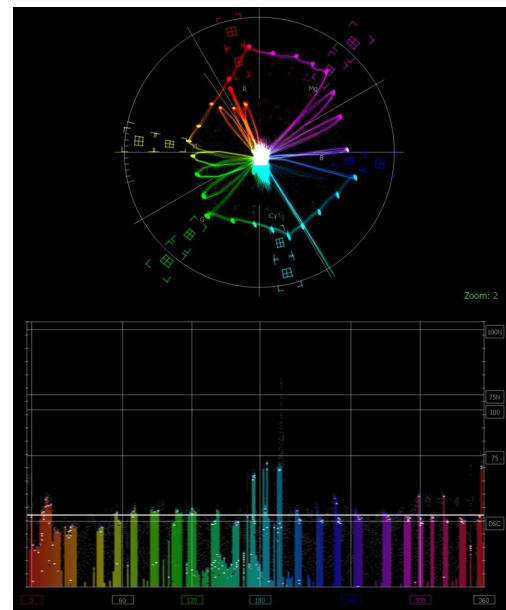
3200K Tungsten

1



2970 CCT LED Metered

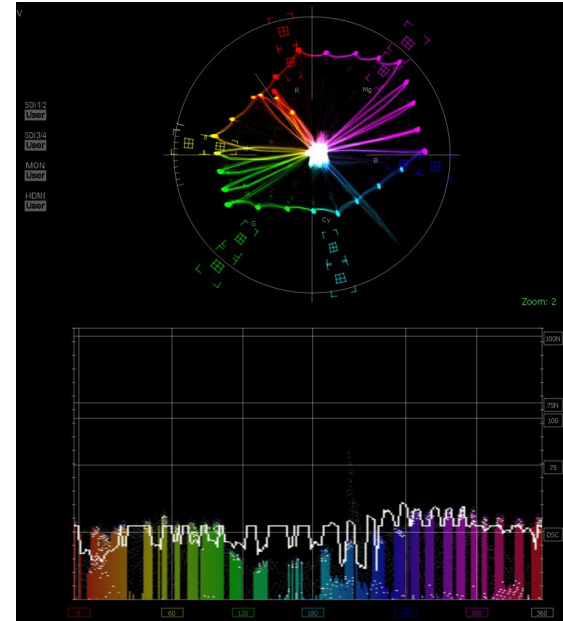
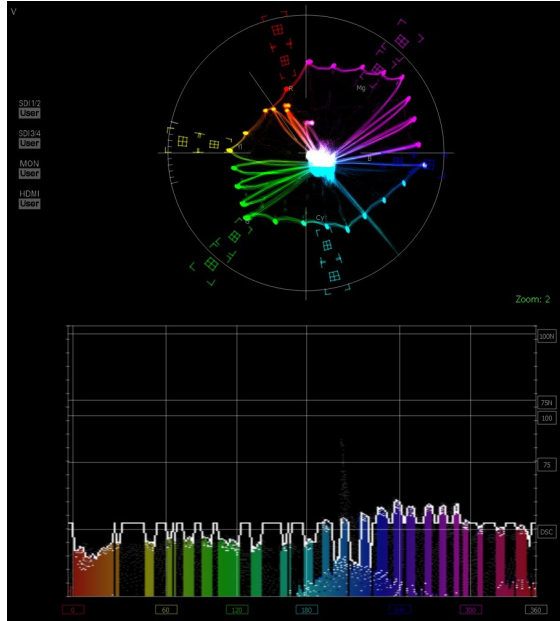
2



3196 CCT LED Metered

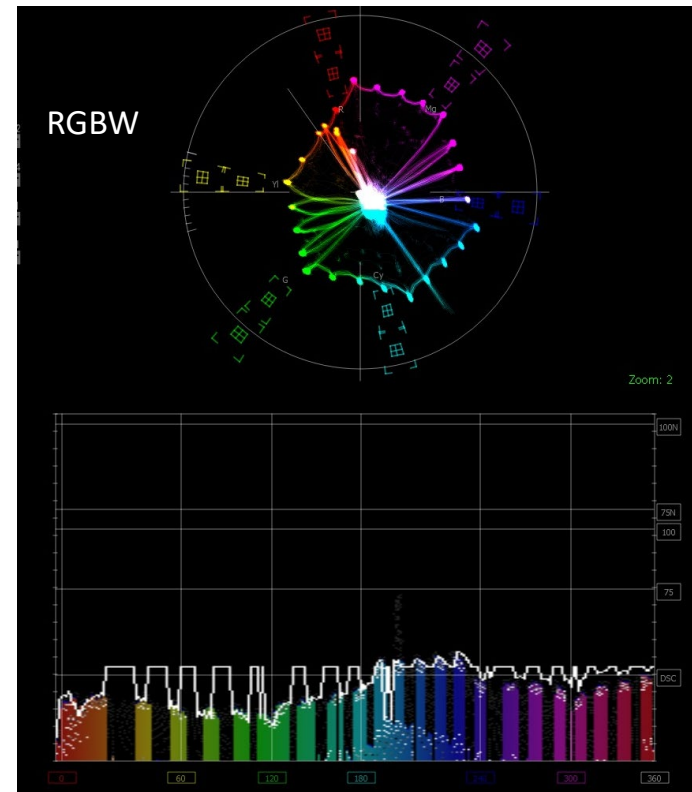
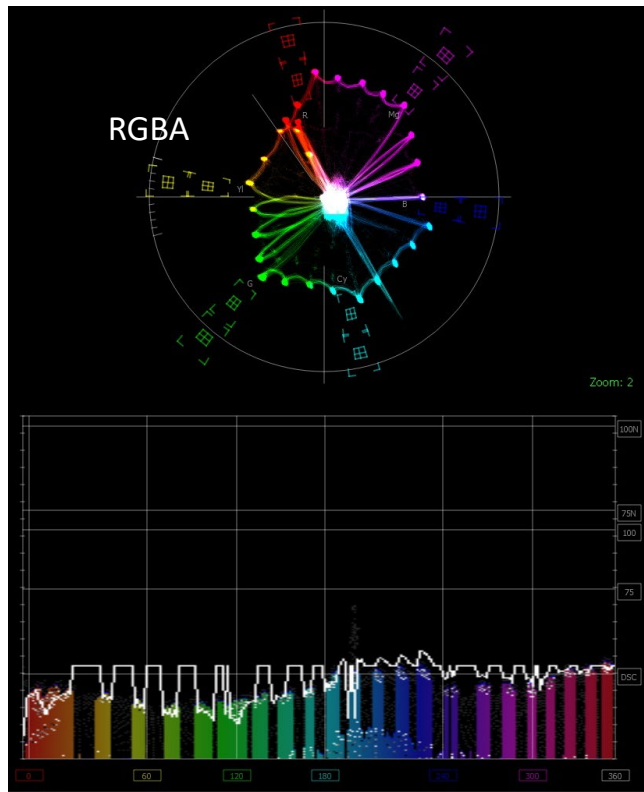
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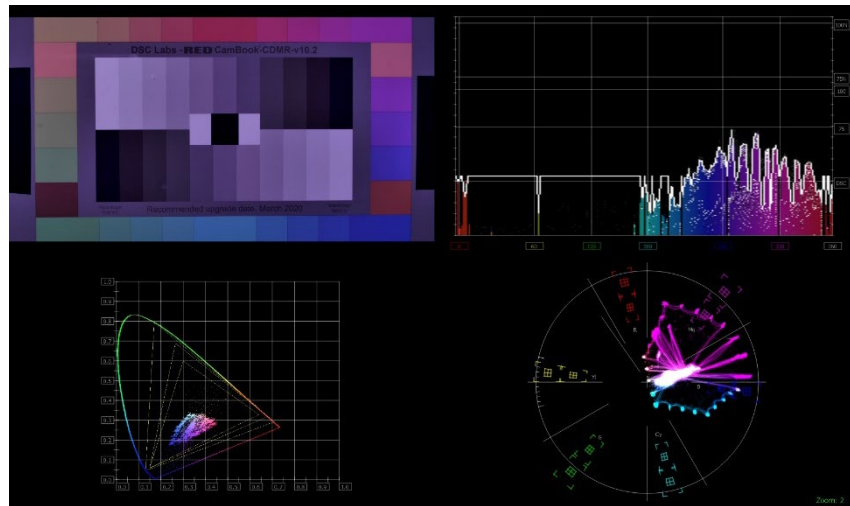
SONY VENICE 5500K Preset LED to HMI reference
Minus green adjustment is off the scale in TM-30-18;
however, it was good on a SONY VENICE



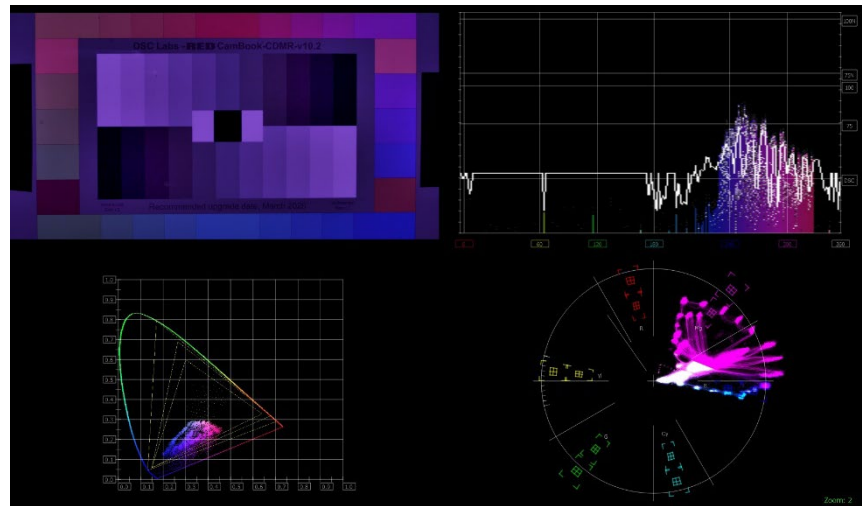
LED to HMI reference
- green off the scale in TM-30-18

SONY VENICE 3200K Preset RGBA LED vs. RGBW LED HS Scope to 3200K reference line





R52 Reference
Tungsten Source

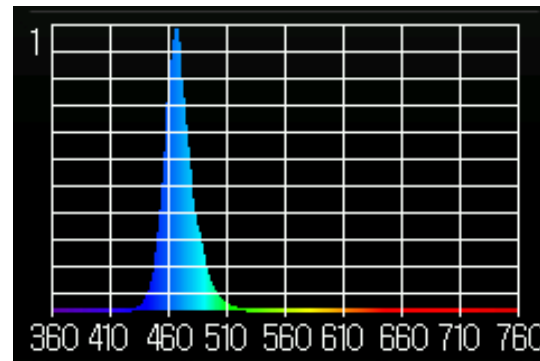
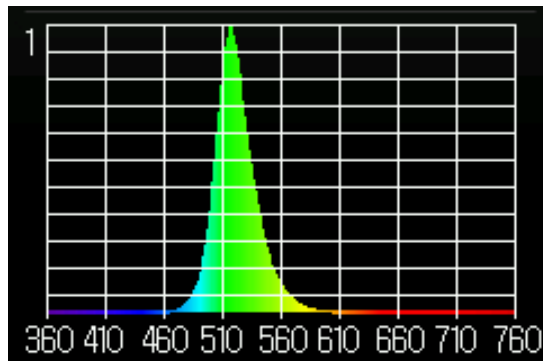
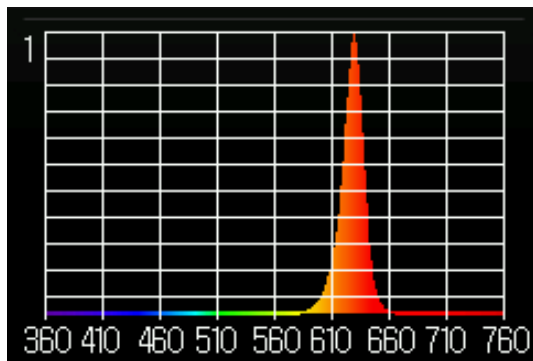


R52 Reference
LED Simulation

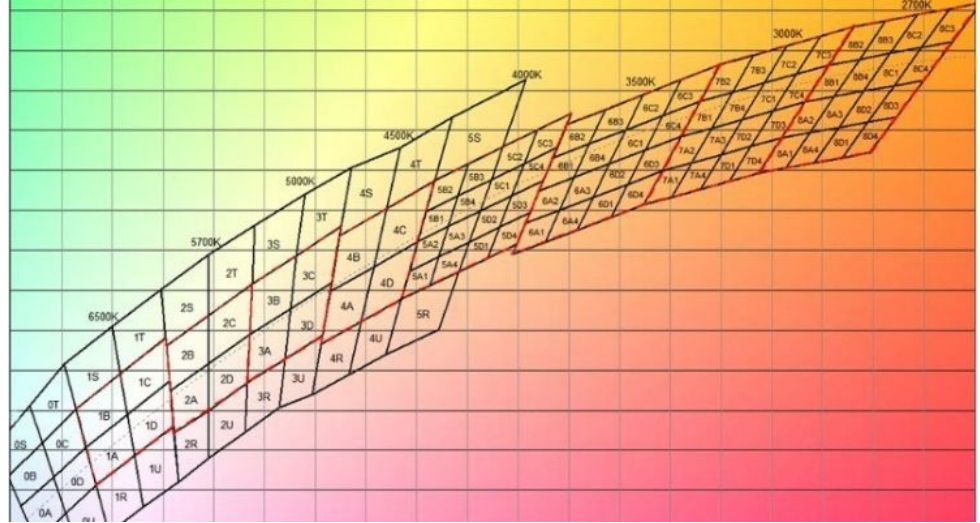
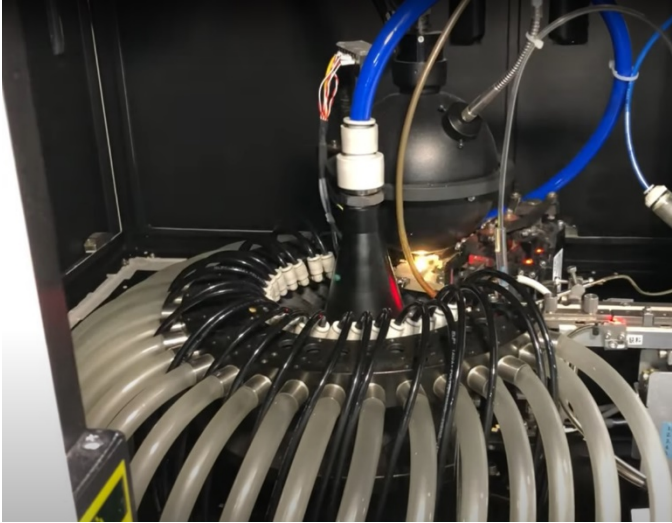
RGB In Video Walls



Basic RGB LED Spectral Output With Narrow Spikes



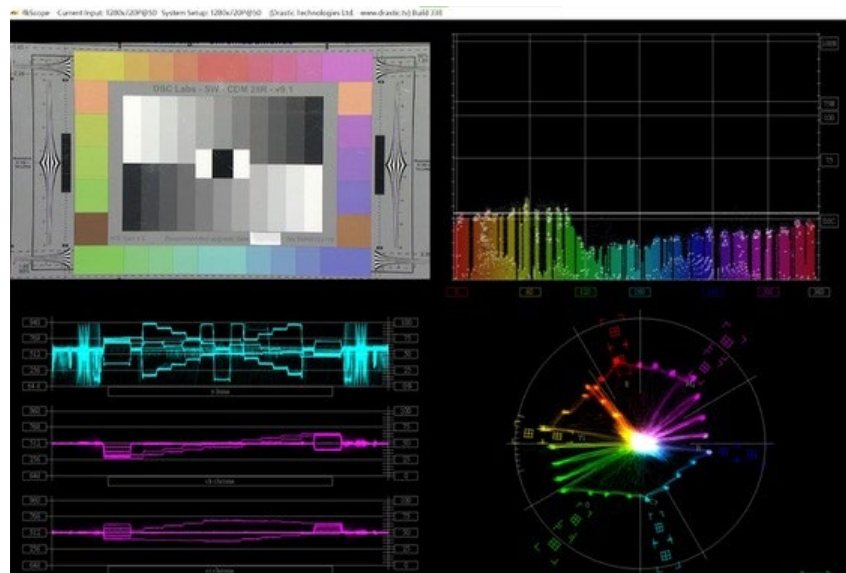
LED Binning



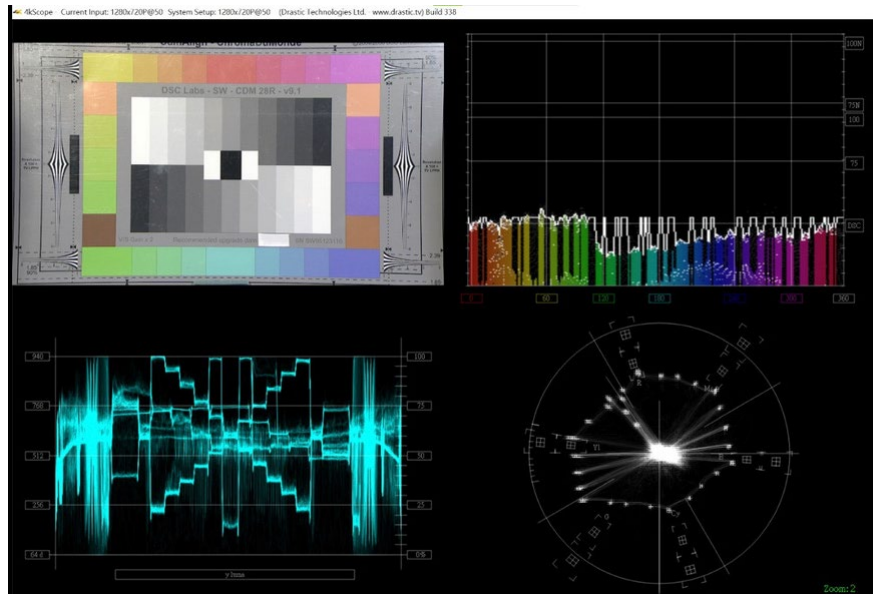
Tony Ngai
Hong Kong Society of Cinematographers
Honorary Technical advisor

Utilized the HS Scope for his video wall
panel testing and evaluation

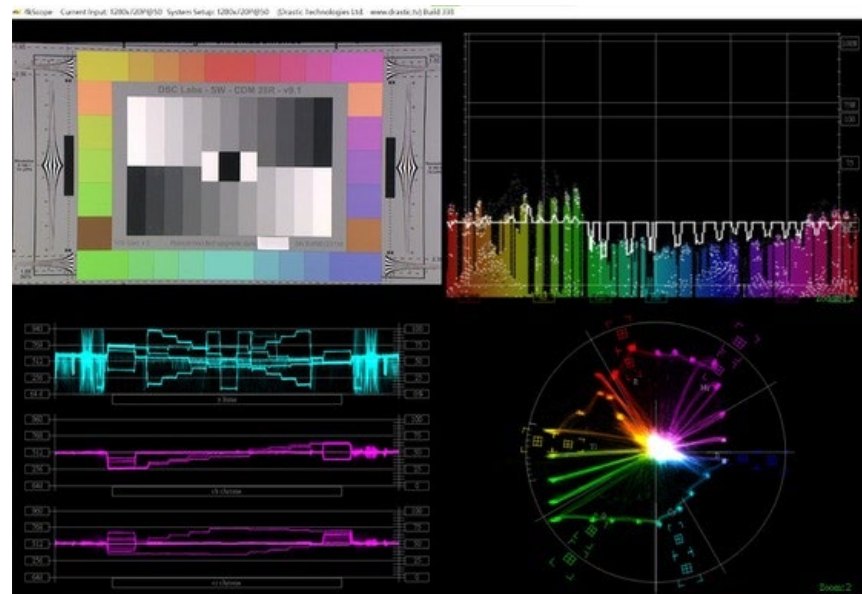
Establishing a reference source



Comparing A Reference Source To A Video Wall

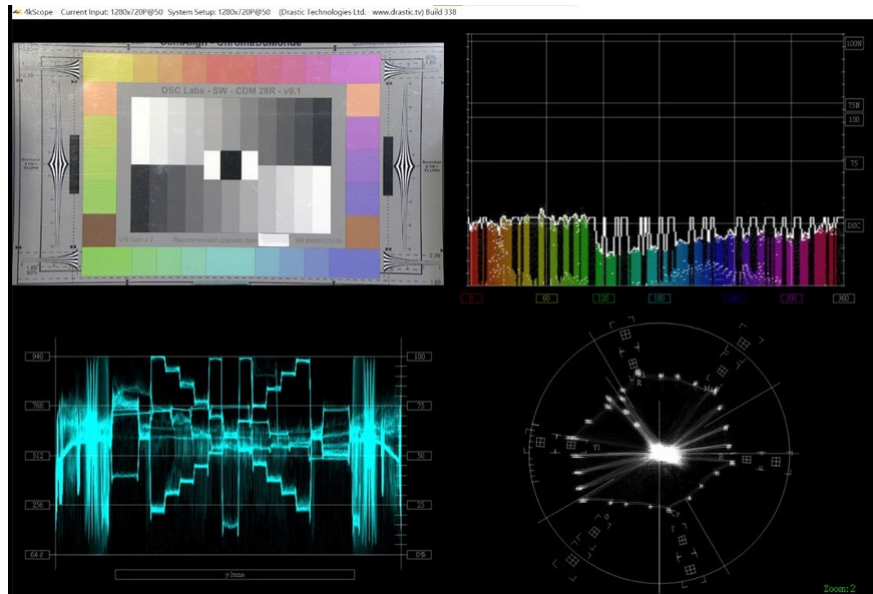


Reference 5600K chroma response

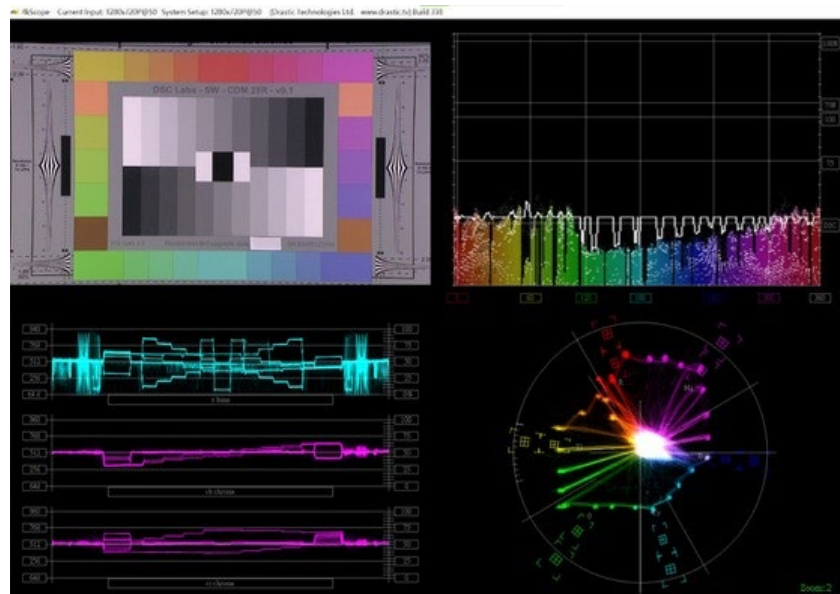


Video Wall 5600 CCT Inaccurate chroma response

Comparing A Reference Source To A Video Wall

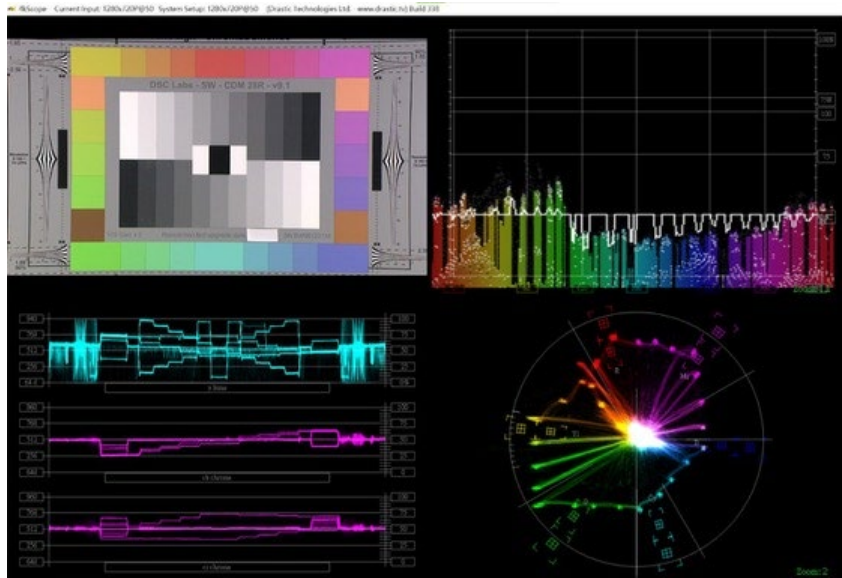


Reference 5600K chroma response

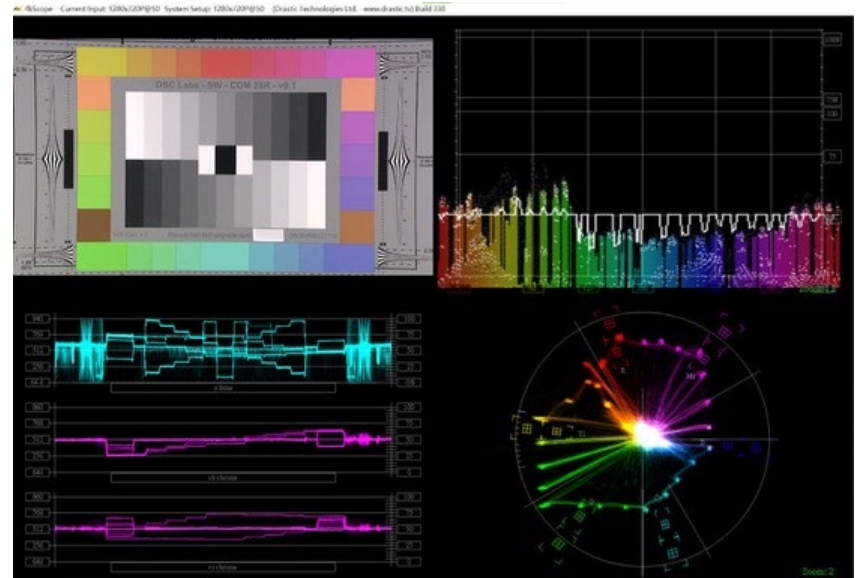


Video Wall 5600 CCT Adjusted chroma response

Video wall light output used as the reference to calibrate LED fixtures to match. This creates Harmony as seen by the camera



Video wall 5600 CCT chroma response



Calibrate LED fixtures to match Video Wall

XRs

Fluency in future-focused technologies has enabled XR Studios to redefine the limits

XR[®] xr.studios

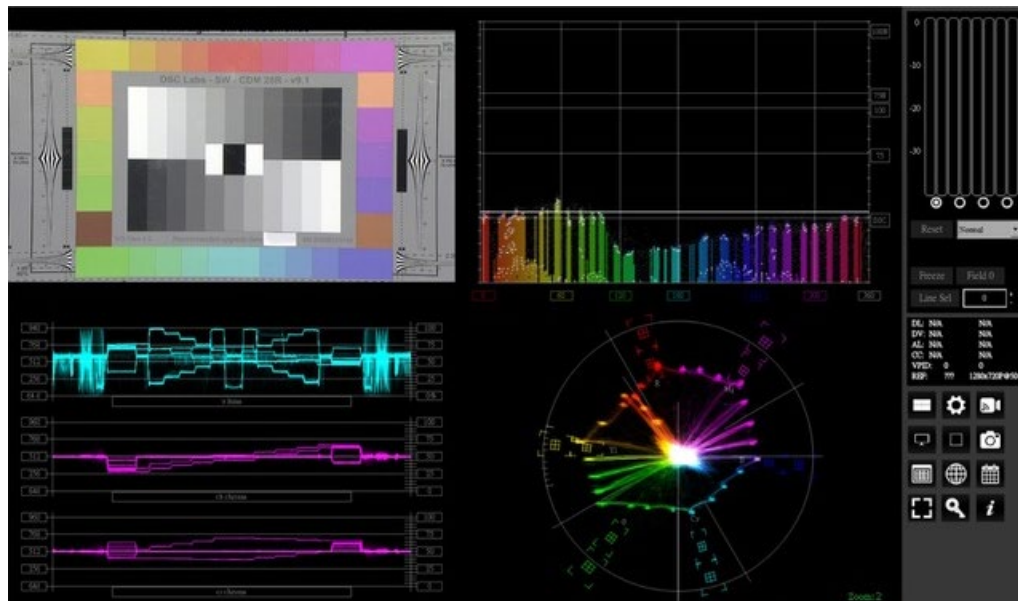
XR Studios have incorporated the HS Scope into their workflows and do LED calibrations based on camera chroma signals.

LED Fixture and Video Wall Variables

- LED Binning
- Dimming of LED light sources or an LED video wall may shift the color spectral response of both
- Are video wall CT presets accurate for cameras?
- Do you need to alter the video signal input to the video wall to get accurate calibration, i.e. using the videowall processor for calibration ?
- Does virtual software like Unreal give you extended color control?

LED Fixture and Video Wall Variables

Using the camera's chroma signal as a guide helps to define and alter variations in spectral response to meet the needs of the camera

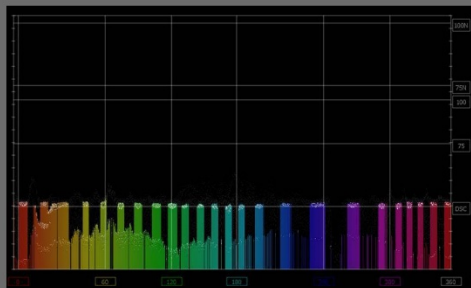


Comparing Sources with Chroma Signal

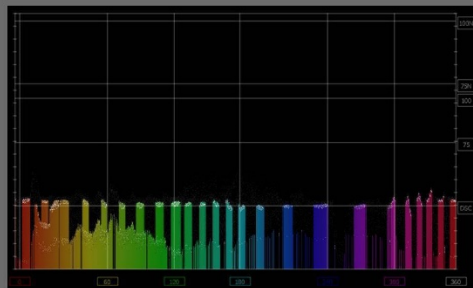
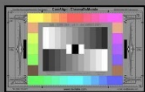
It is easy to evaluate a LED source when compared to a reference source by using side by side comparisons of the chroma signal

ARRI Alexa Mini preset to 3200K

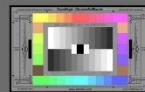
- Tungsten 3200K / DMG MIX 3200CCT / HS SCOPE readout



ARRI 3200K Preset / 3200K Light



ARRI 3200K Preset / 3200 CCT DMG MIX



Full Spectral Chroma Reading Is Possible

DSC Charts offer a full spectral chart to evaluate and calibrate LED lights and displays by using a camera's chroma signal

