

HDR-TV

Agenda

HDR-TV Introduction

HDR-TV in SDI & ST2110

HDR-TV Live Production

The background features a soft, abstract gradient of colors, primarily in shades of blue and purple, with a white background. The colors blend smoothly, creating a sense of depth and movement. The text is centered in the middle of the frame.

HDR-TV Introduction

HDR-TV

- More Pixels: similar to migration from SD to HD
- More Frames: known from slow motion applications
- High Dynamic Range (HDR) & Wide Color Gamut (WCG): big challenge!
 - Human vision system is non-linear to brightness and color
 - One SDR format, multiple HDR formats (PQ, HLG, Dolby Vision, HDR10, HDR+, ...)

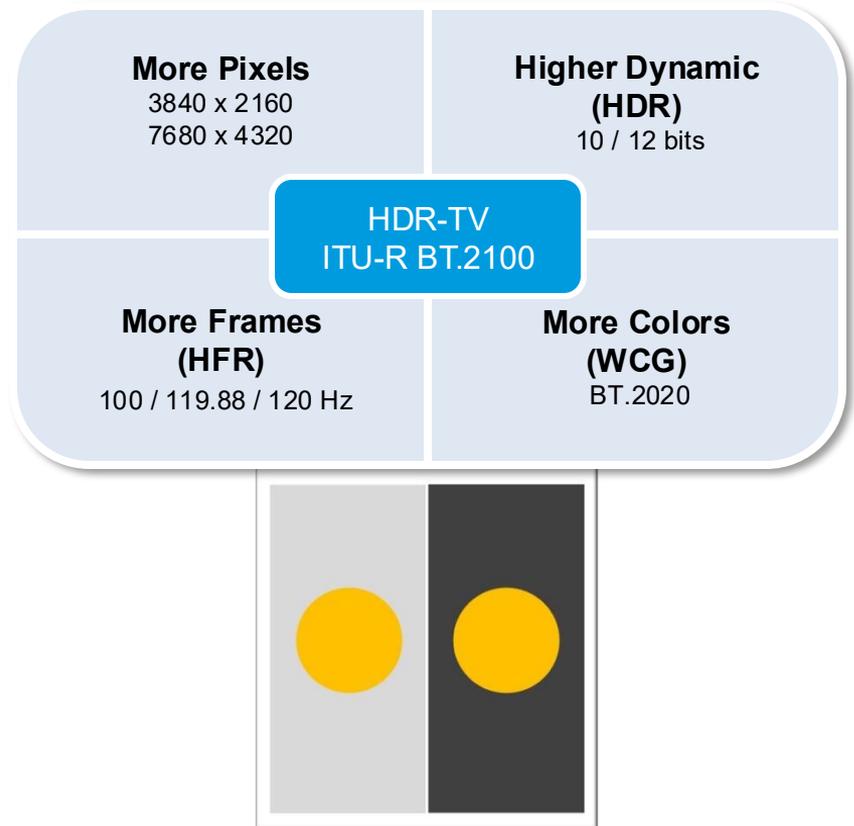
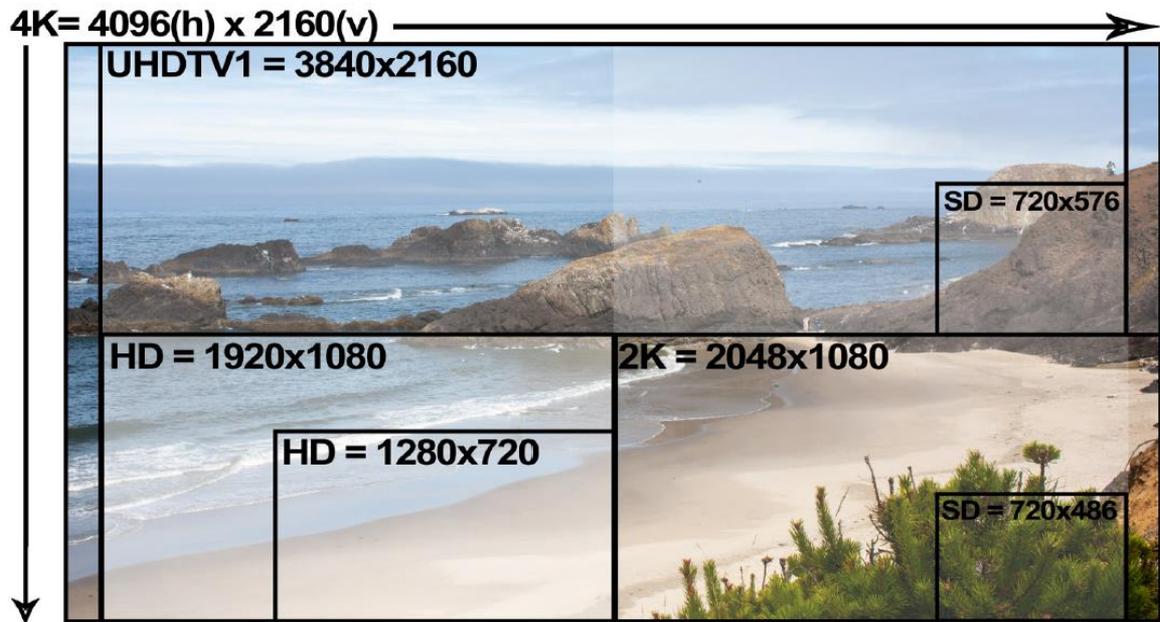


Image Size Comparison



Format	Aspect Ratio	H Pixels	V Lines
SD	4:3	720	486
SD	4:3	720	576
HD	16:9	1280	720
HD	16:9	1920	1080
2K	1.896:1	2048	1080
UHDTV 1	16:9	3840	2160
4K	1.896:1	4096	2160

Understanding HDR-TV

Sky Light: >500K nits

*Looking at the sun > 1 billion nits
(don't look at it)*



Lap top or TV: 100 to 200 nits
(hard to see in bright daylight)

Shadows: .1 to 10 nits

With day adapted eye shadows can be 10 nits.
In living room, less than 0.1 nits

Total Visual Dynamic Range

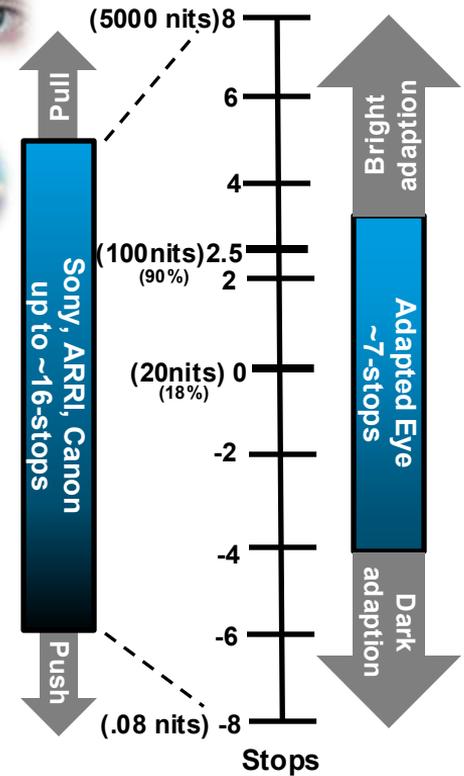
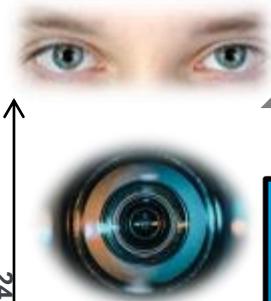
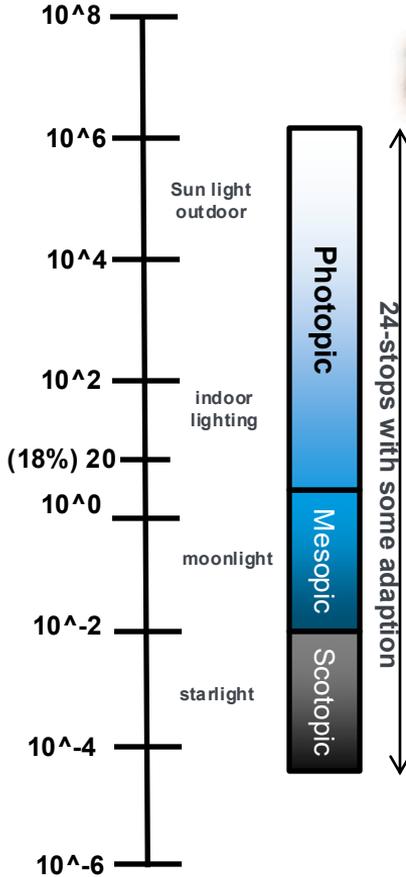


Sunlight
outdoor

Indoor
Lighting

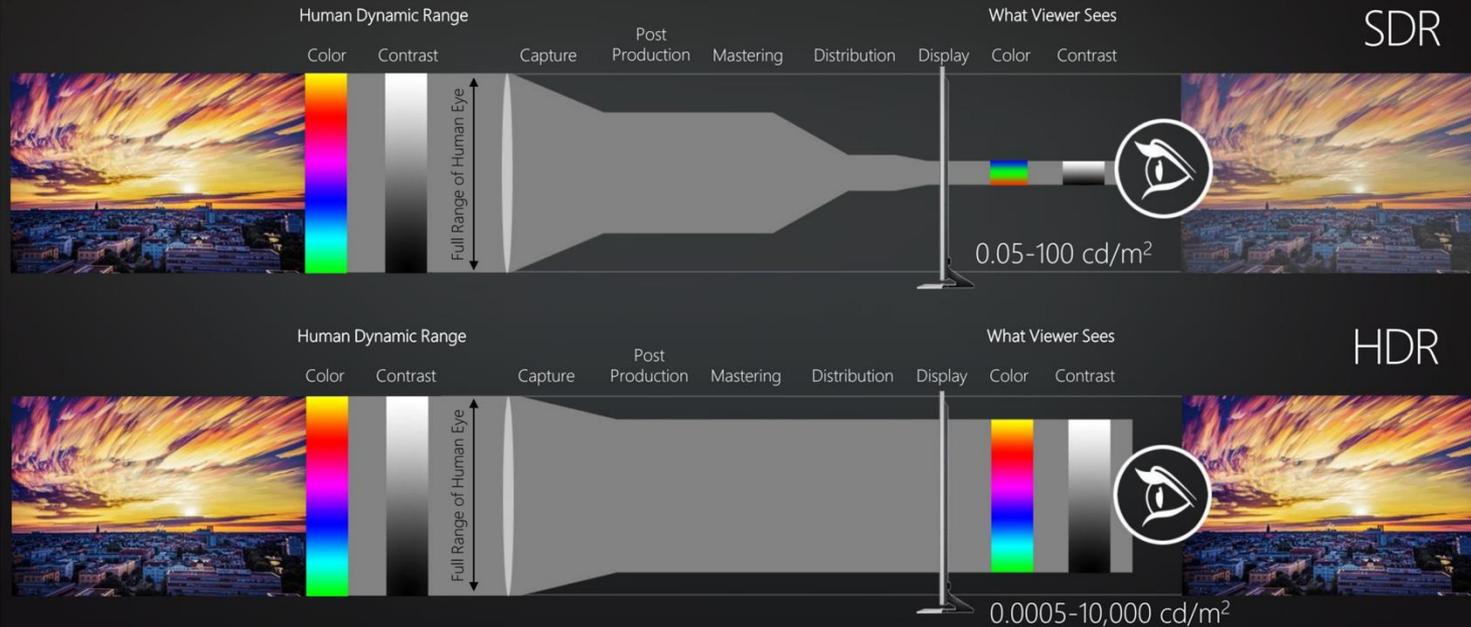
Moonlight

Starlight



SDR & 709 colors versus HDR & WCG

Chasing the human vision system



RTG Technology Summit. Under embargo until December 8, 2015, 9 a.m. EST.

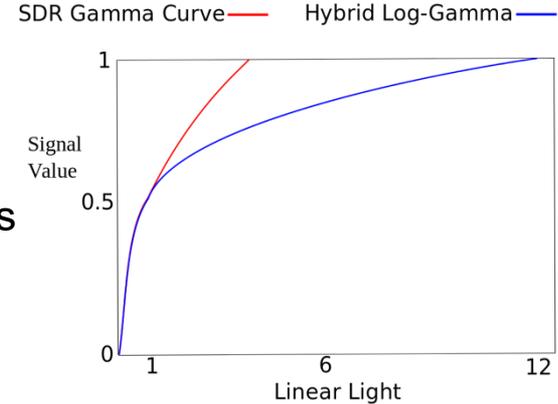
<https://www.tweaktown.com/articles/7467/amd-talks-rtg-visual-technologies-roadmap-2016/index3.html>

The background features a soft, abstract gradient of colors, primarily in shades of blue and purple, with a white background. The colors blend smoothly, creating a sense of depth and movement. The text is centered in the middle of the image.

HDR & WCG Basics

HLG – Hybrid Log Gamma (HDR format)

- “Scene-referred system”
 - Reproduces the relative light level from the recorded scene
 - Works independently from the display brightness
 - Compatibility to “SDR” displays for non-critical monitoring
 - Gamma curve in SDR region is close enough to SDR gamma
 - Just increase brightness of picture monitor
- Works better for Live / Traditional broadcast system
 - For various display types and environments (e.g. at home)
 - Use SDR display as multi viewer



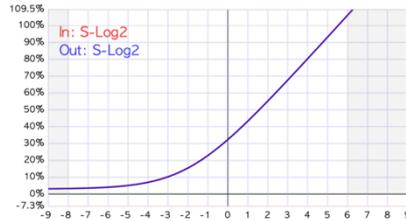
PQ – Perceptual Quantizer (HDR format)

- Display-referred system”
 - Define brightness on the display
 - Editors have greater control over the look
 - Wide dynamic range up to 10,000 nits (cd/m²)
 - 25% of code value remain unused for a production with a peak brightness of 1000 nits
 - Full range, 12bits coding (0~4095) is preferred
- Works for OTT and Package media
 - Requires controlled viewing environment including the display
 - Mastering display metadata (ST2086) to help display mapping to viewers environment

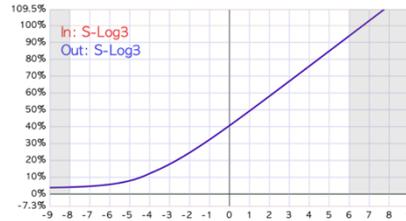


 **DOLBY**®

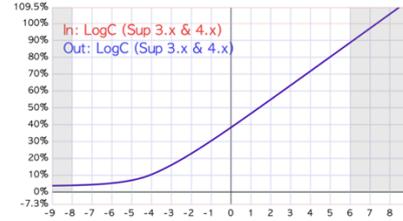
Gamma Curves - comparisons



Sony S-Log2



Sony S-Log3



ARRI



Canon C-log



Camera Gamma Curves



PQ SMPTE ST
2084



HLG ARIB STD
B67

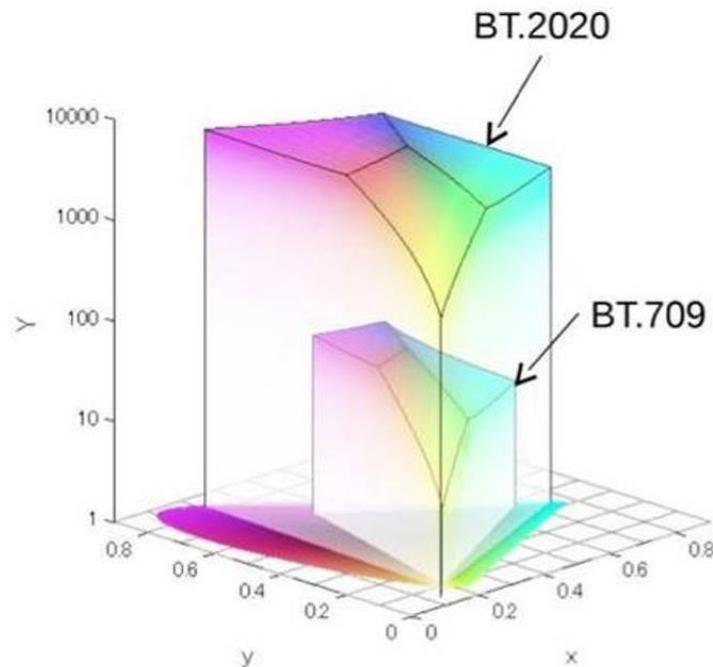
Display Gamma Curves

[Ben Turley LUT Calc](#)

Wide Color Gamut (WCG)

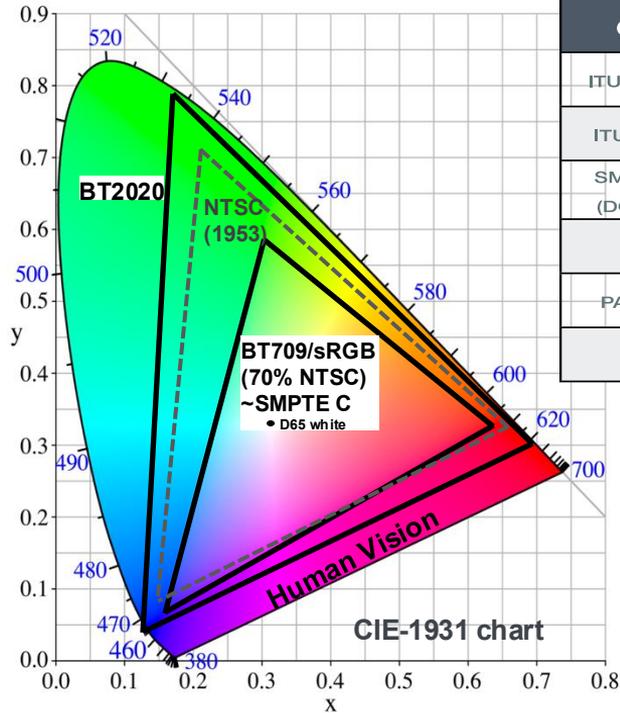
ITU-R BT.2020 versus ITU-R BT.709

- BT.2020 provides more than twice the color coverage on the CIE1931 color space
- The combination of HDR and BT.2020 makes the 3D cube bigger
- No display can show the complete ITU-R BT2020 color space today



Source: AWS_Elemental_High_Dynamic_Range_Video_White_Paper.pdf

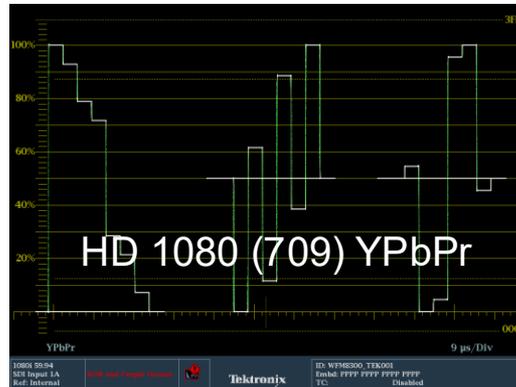
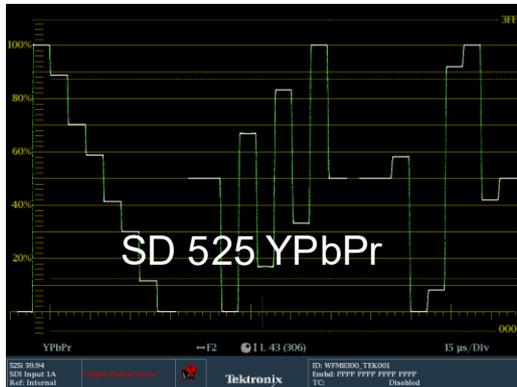
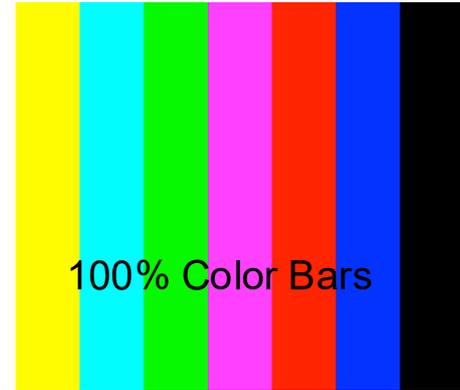
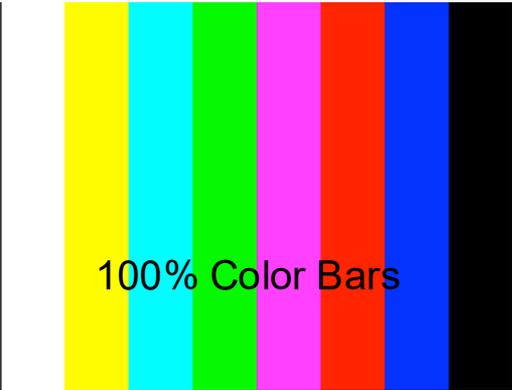
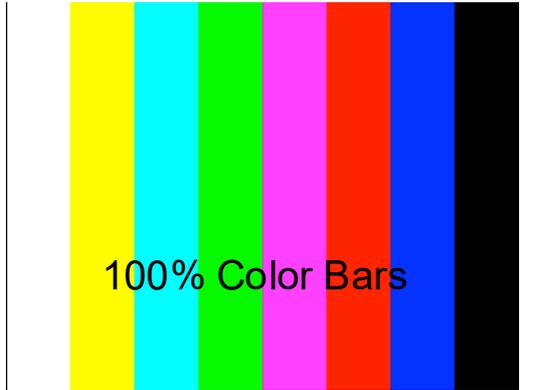
Wide(er) Color Gamut Percentage



Gamut	Illuminant	Red	Green	Blue
ITU-R BT. 2020	D ₆₅	x=0.708 y= 0.292	0.170 y= 0.797	x = 0.131 y = 0.046
ITU-R BT. 709	D ₆₅	x = 0.640 y = 0.330	x = 0.300 y = 0.600	x = 0.150 y = 0.060
SMPTE 431-2 (DCI-P3) XYZ		x = 0.680 y= 0.320	x = 0.265 y= 0.690	x = 0.150 y = 0.060
SMPTE	D ₆₅	x = 0.630 y = 0.340	x = 0.310 y = 0.595	x = 0.155 y = 0.070
PAL/SECAM	D ₆₅	x = 0.640 y = 0.330	x = 0.290 y = 0.600	x = 0.150 y = 0.060
NTSC	C	x = 0.670 y = 0.330	x = 0.210 y = 0.710	x = 0.140 y = 0.080

- 709 occupies 33.5% of CIE chart
- DCI-P3 occupies 44.5% of CIE Chart
- NTSC occupies 47.3% of CIE Chart
- 2020 occupies 63.3% of CIE Chart

Video Levels for Chromaticity Standards



The background features a soft, abstract gradient of colors, transitioning from a light blue on the left to a pale purple on the right, with a darker blue band curving across the middle. The overall effect is clean and modern.

HDR & WCG Standards

SMPTE Standards

- ST 2086
 - Specifies the metadata items to specify the color volume (the color primaries, white point, and luminance range) of the display that was used in mastering video content. The metadata is specified as a set of values independent of any specific digital representation.
- ST 2094
 - Specifies the content-dependent Color Volume Transform metadata for a set of applications, a specialized model of the color volume transform defined by the core components document SMPTE ST 2094-1.
 - Standardized “applications”
 - 10: Dolby
 - 20: Philips
 - 30: Technicolor
 - 40 Samsung (HDR 10+)

ITU-R Standards

- Report ITU-R BT.2408-1 (04/2018)

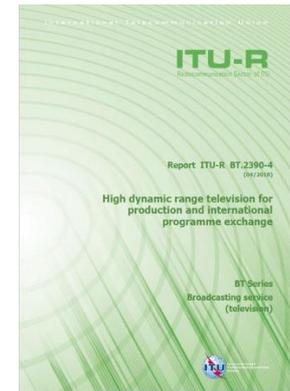
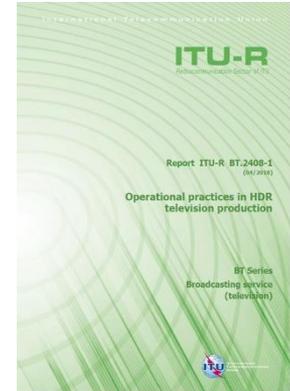
Operational practices in HDR television production

- A practical guide for those transitioning from standard dynamic range (SDR) to high dynamic range (HDR) production.

- Report ITU-R BT.2390-4 (04/2018)

High dynamic range television for production and international program exchange

- Background information on HDR in general, and for the PQ and HLG HDR signal parameters specified in the Recommendation BT.2100.



HDR Key Numbers to Remember

- HDR Display – BT.2100
 - Max brightness (for HLG and PQ) : 1000nits
 - Minimum luminance (Black level, for PQ) : ≤ 0.005 nits
- Reference Levels – BT.2408
 - 100% Diffuse white / Graphics white : 203nits
 - 100% Diffuse white in SDR : 100nits (BT.1886)
 - 18% Gray Card : 26nits
 - Typical Object (in nits)

132 nits	92 nits	70 nits	48 nits	42 nits	38 nits	33 nits	12 nits	8 nits
Light skin tone							65 – 110	
Medium skin tone							40 – 85	
Dark skin tone							10 – 40	
Grass							30 – 65	

datacolor
SpyderCUBE



18% Gray



The background features a large, abstract, curved shape that transitions from a deep blue on the left to a lighter, almost white blue on the right. The shape has a soft, ethereal quality with some purple and pinkish hues, suggesting a light leak or a stylized lens flare. The overall composition is clean and modern.

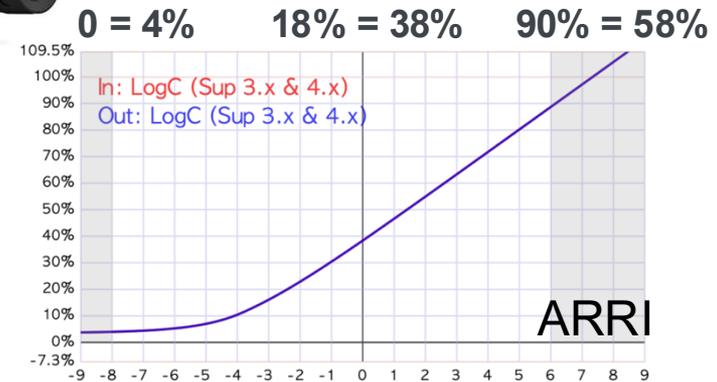
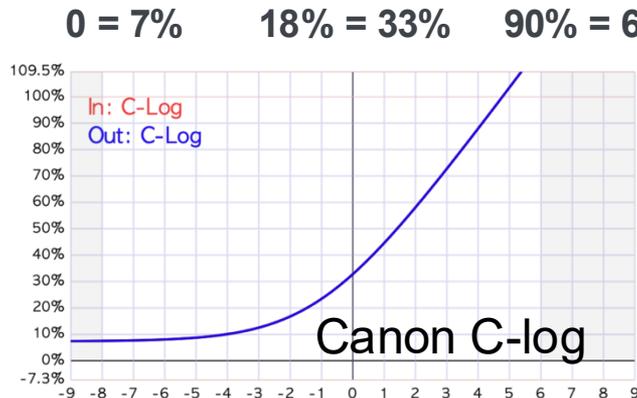
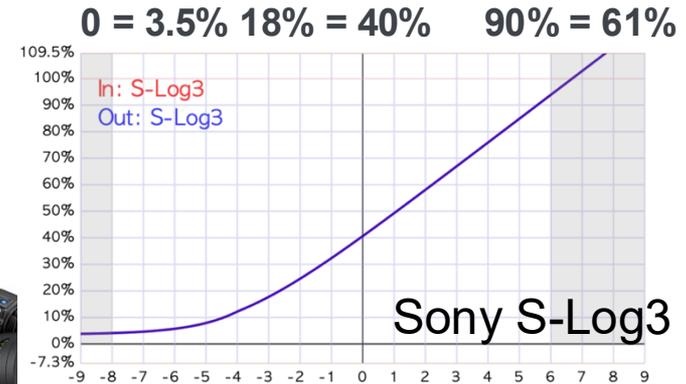
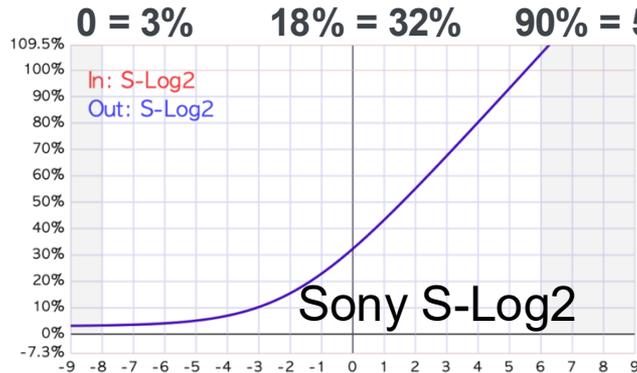
Camera Logs

Proprietary Camera

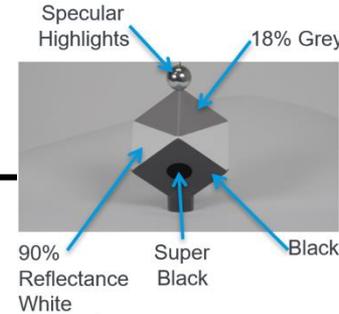
- Camera Logs allow you to shoot with a high dynamic range, taking the best out of the camera's sensor.
- Variety of different camera logs are available, and are non-standardized.
 - Sony (S-log, S-log2, S-log3), Canon (C-log), Panasonic (V-log), Arri (Log C), ...
- White papers describe Metadata, including SDI embedded Metadata LUT.
- **Camera logs not part of SMPTE ST 352 VPID.**



Selection of Camera Curves



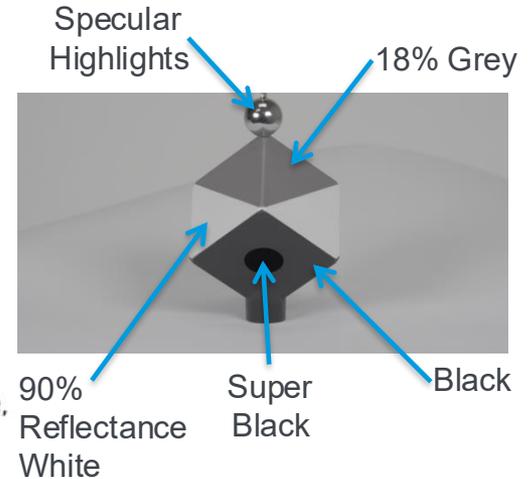
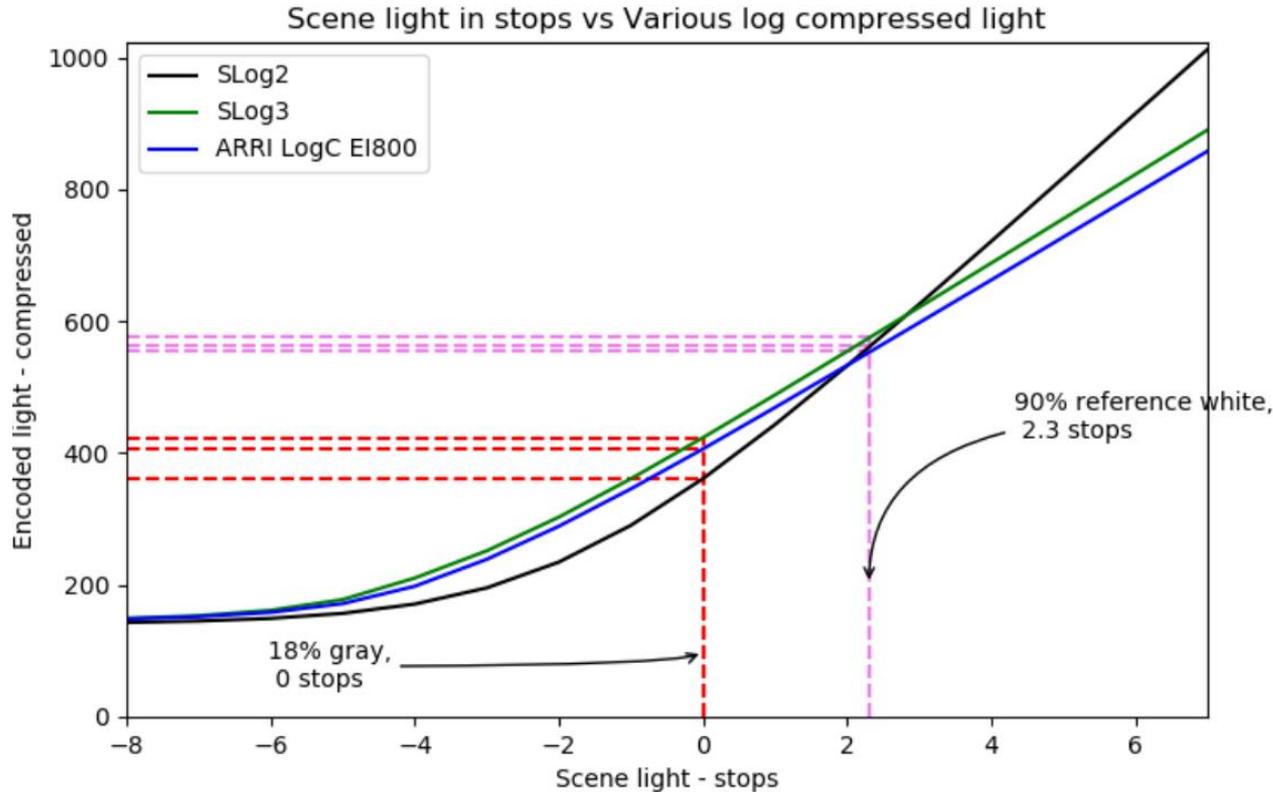
Capturing a Camera RAW image



Gamma	0% Black 10-bit Code- Value	%	18% Grey (20 nits illumination) 10-bit Code- Value	%	90% Reflectance 10-bit Code- Value	%
S Log 1	90	3	394	37.7	636	65
S Log 2	90	3	347	32.3	582	59
S Log 3	95	3.5	420	40.6	598	61
Log C	134	3.5	400	38.4	569	58
C-Log	128	7.3	351	32.8	614	63
V-Log		7.0		42.0		61
BT.709	64	0	423	41.0	940	100
ST2084 PQ (N)	64	0	377	36	509	51
REC2100 HLG	64	0	539	38	700	73



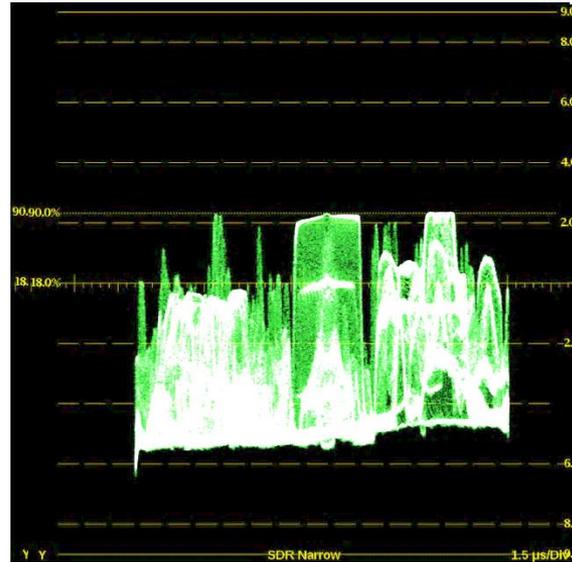
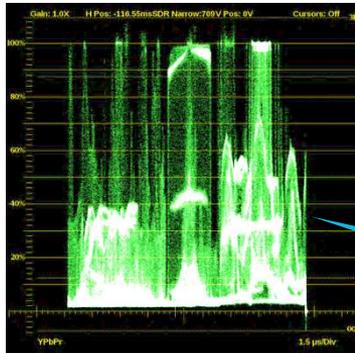
Proprietary Camera Logs



Explanation of STOP Display

*Reverse
Calculation*

SDR Gamma

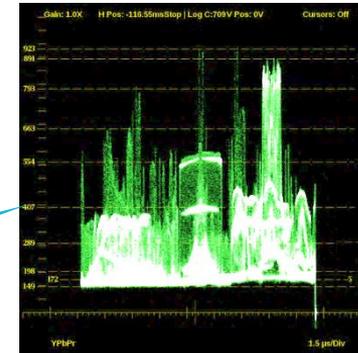


SDR

Different
look!!

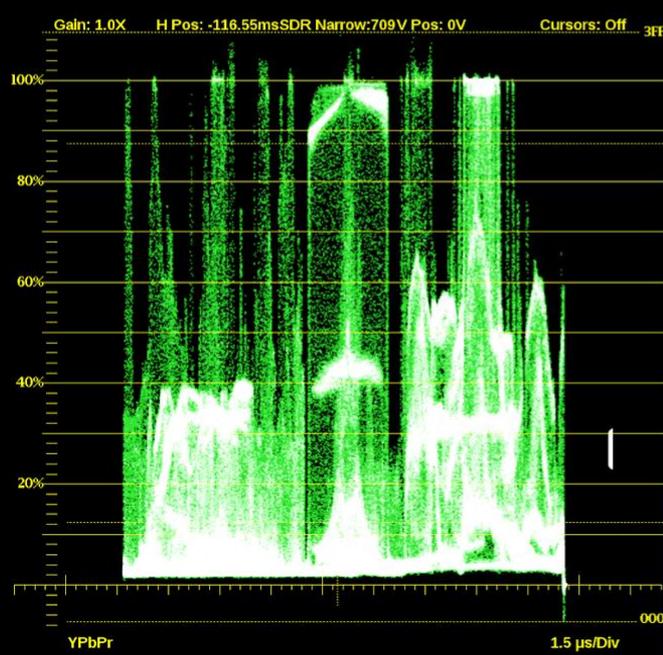
*Reverse
Calculation*

HDR Gamma

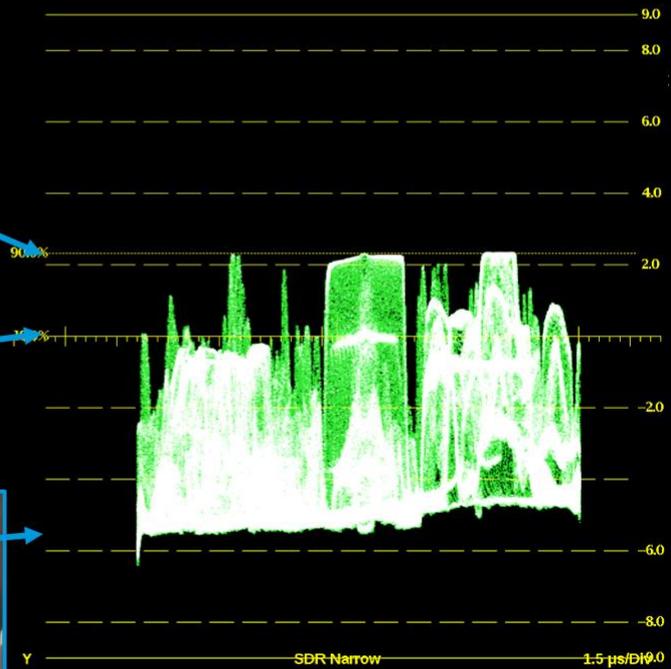


STOP Display (SDR)

WFM-Display (SDR)



STOP-Display (SDR)

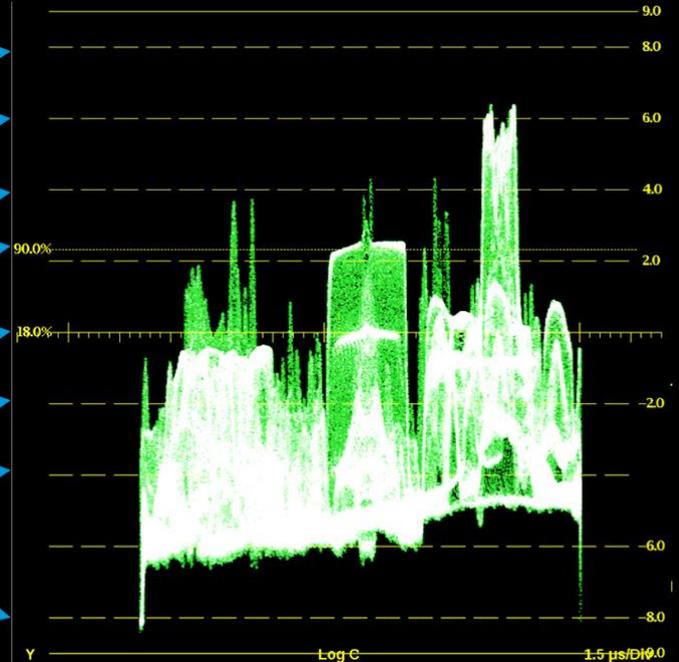
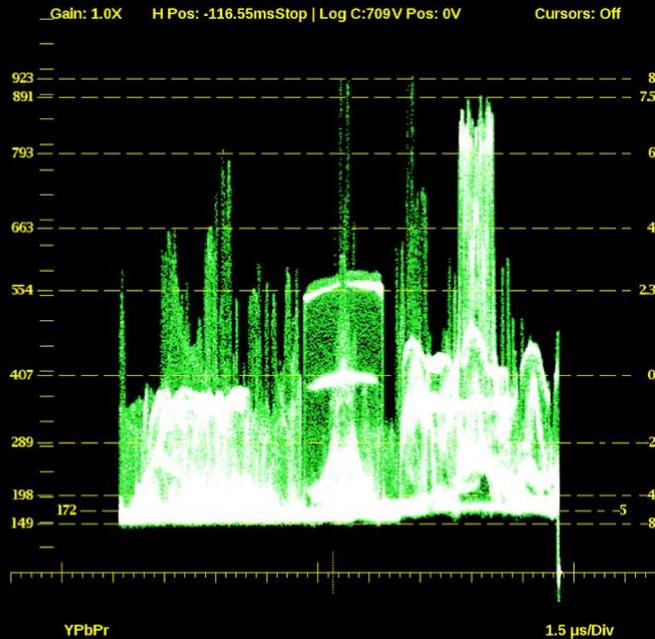




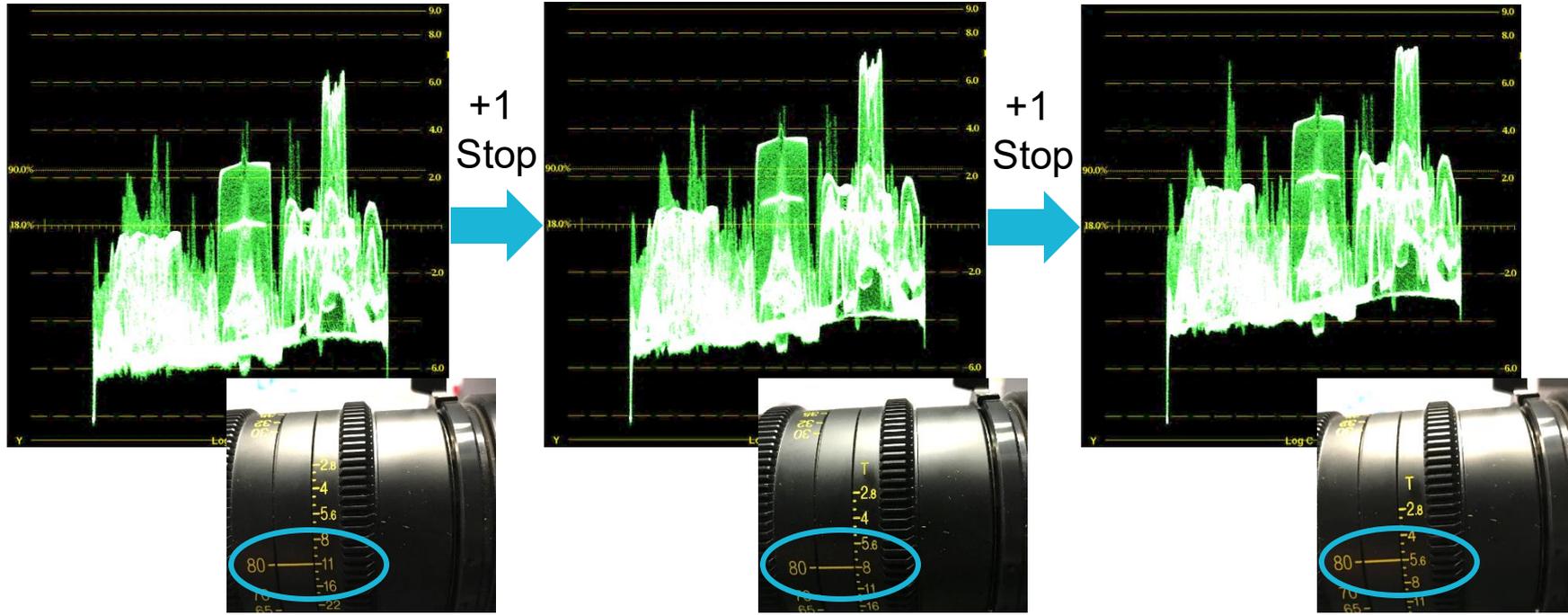
STOP Display (Log C)

WFM-Display (LogC)

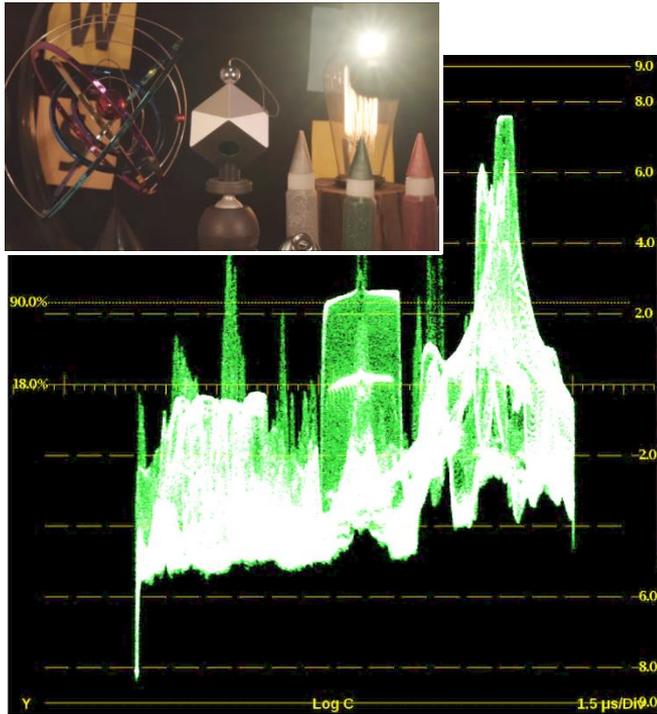
STOP-Display (LogC)



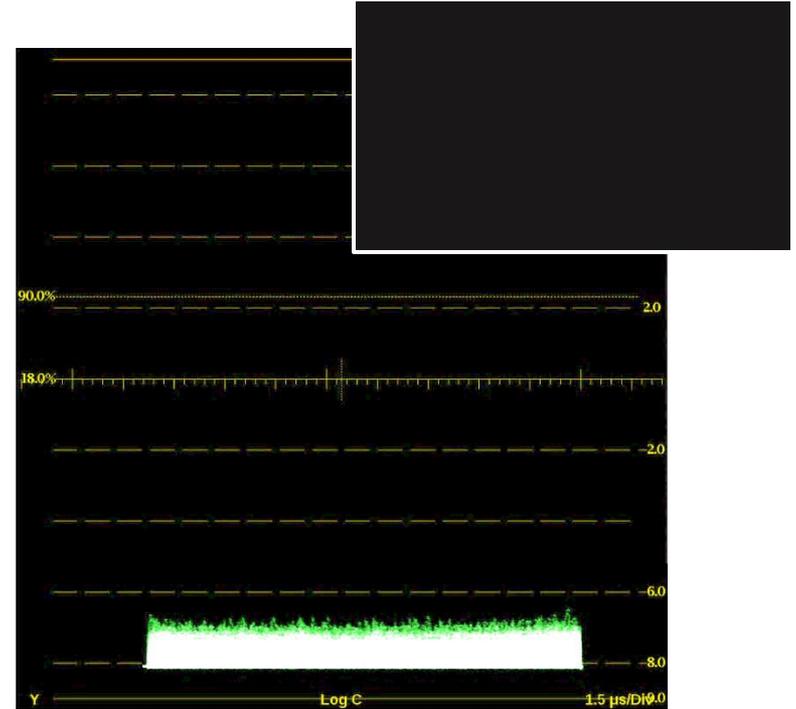
STOP Display – “Linear to Light”



STOP Display – Camera Dynamic Measurement



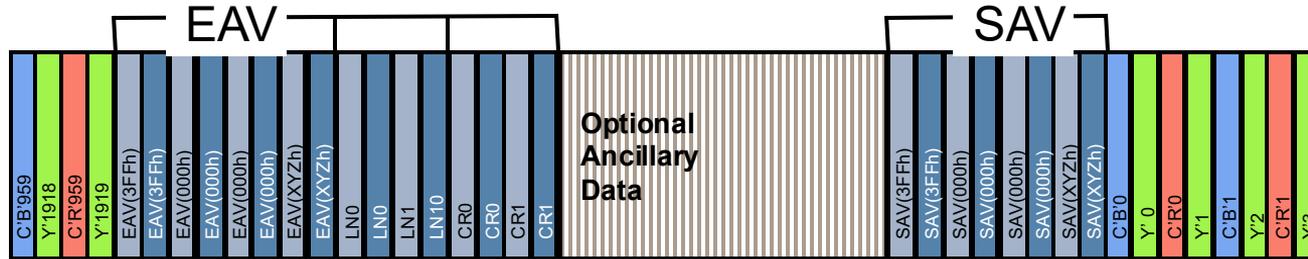
14.5 Stops





HDR-TV in SDI & ST2110

Evolution of SDI



- SMPTE ST 292: Bit-Serial Interfaces at 1.5 Gb/s
- SMPTE ST 424: 3 Gb/s Signal/Data Serial Interface
- SMPTE ST 425: Source Image Format and Ancillary Data Mapping for the 3 Gb/s Serial Interface
- SMPTE ST 2081: 6G-SDI Bit-Serial Interfaces
- SMPTE ST 2082: 12G-SDI Bit-Serial Interfaces

HDR Signaling in SDI

Video Payload Identifier (VPID)

- ANC data packet with 4 UDWs (user data words) to assist a device in quickly decoding the correct video format.
- UDW1 points to other standards that should be taken into account for correct ANC data packet interpretation.

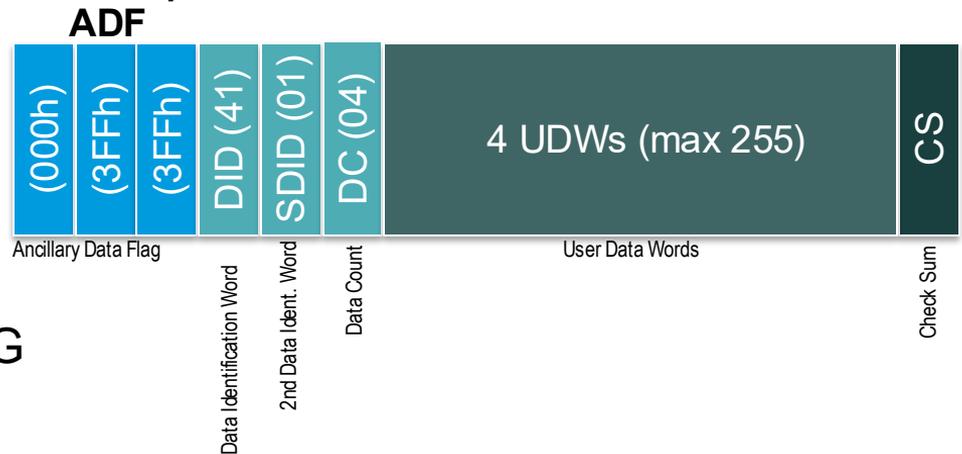
SMPTE ST 259 for SD

SMPTE ST 292-1 for HD

SMPTE ST 425-1 for 3G

SMPTE ST 2081-10 for 6G

SMPTE ST 2082-10 for 12G



SMPTE ST 425-1:2017

- Transfer characteristics for
 - SDR-TV (0h)
 - HLG (1h)
 - PQ (2h)
 - Unspecified (3h)
- Colorimetry
 - Rec 709 (0h)
 - Reserved (1h)
 - UHDTV (2h)
 - Unknown (3h)
- Bit depth
 - Narrow Range (10/12 bit)
 - Full Range (10/12 bit)

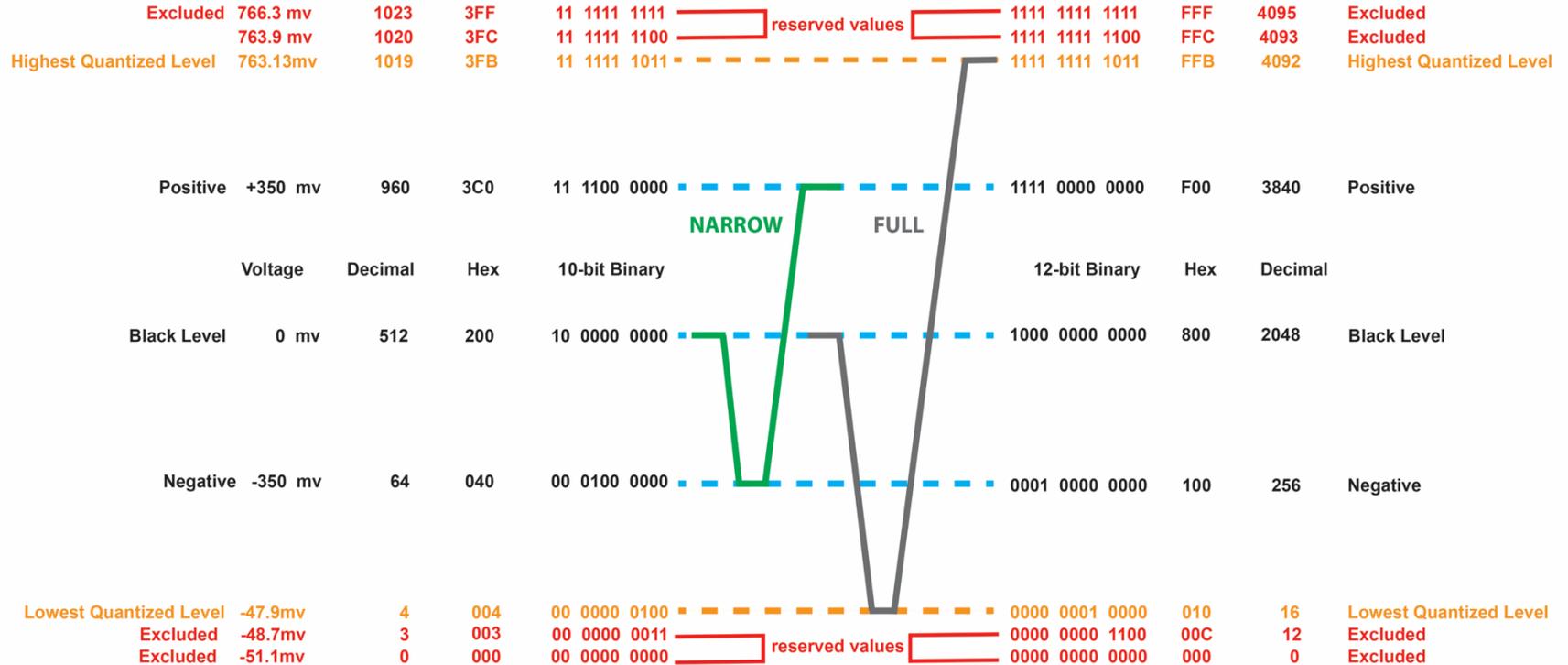
Table 5 – Payload Identifier Definitions, Bytes 2 to 4

Bits	Byte 2	Byte 3	Byte 4
Bit 7	Interlaced (0) or Progressive (1) transport	Aspect ratio 16:9 (1), unknown (0)	Reserved
Bit 6	Interlaced (0) or Progressive (1) picture	Horizontal Pixel Array Size 1920 (0) or 2048 (1)	Reserved
Bit 5	Transfer characteristics	Colorimetry	Reserved
Bit 4	SDR-TV (0h) HLG (1h) PQ (2h) Unspecified (3h)	Rec 709 ^{*1} (0h) Reserved (1h) UHDTV ^{*2} (2h) Unknown (3h)	Luminance and color difference signal Y'C _B C _R ' (0) I _{C_TC_P} ' (1)
Bit 3	Picture Rate (Refer to SMPTE ST 352 Table 2)	Sampling structure (Refer to Table 5a)	Reserved
Bit 2			Reserved
Bit 1			Bit depth 10-bit Full Range (0h), 10-bit (1h), 12-bit (2h), 12-bit Full Range (3h)
Bit 0			

^{*1} Rec 709 indicates Conventional System Colorimetry as defined in Recommendation ITU-R BT.709 and referenced in SMPTE ST 274.

^{*2} UHDTV indicates Recommendation ITU-R BT.2020 Reference Primaries and reference white as referenced in Recommendation ITU-R BT.2100

Narrow and Full range (10-bit representation)



PRISM VPID decoding

Video Session

Run Time: 0d, 00:00:00



Stopped



Input: SDI - SDI-In 1

1080p 50 - YCbCr 422 10b - 425M-A 2.970 Gbps

SDI FORMAT	VPID 352	BIT LEVEL	CRC STATUS
Link A1	89h D9h A0h 1h	BYTE 1 10001001	SMPTE 425.1 Lvl A (1125)
		BYTE 2 11011001	Transport progressive
			Picture progressive
			Transfer HLG
			Picture Rate 50.00
		BYTE 3 10100000	Aspect Ratio 16x9
			H Pixel 1920
			Color Rec. 2100
			Sampling Structure YCbCr 4:2:2
		BYTE 4 00000001	Luma Color Difference YCbCr
			Bit Depth 10-bit

HDR Signaling in SMPTE 2110

SDP

(Session Description Protocol)

- Describes the stream in a small text file
- Sent from sender to the receiver
- [SDP white paper](#) (Embrionix)

```
EMB_192-168-206-37_VidSender_000.sdp X
1 v=0
2 o=- 1443716955 1443716955 IN IP4 192.168.206.37
3 s=st2110 0-0-0
4 t=0 0
5 a=group:DUP primary secondary
6 m=video 43602 RTP/AVP 96
7 c=IN IP4 239.22.37.1/64
8 a=source-filter: incl IN IP4 239.22.37.1 192.168.206.37
9 a=rtpmap:96 raw/90000
10 a=fmtp:96 sampling=YCbCr-4:2:2; width=1920; height=1080;
    exactframerate=25; depth=10; TCS=SDR; colorimetry=BT709;
    PM=2110GPM; SSN=ST2110-20:2017; TP=2110TPN; interlace;
11 a=mediaclock:direct=0
12 a=ts-refclk:ptp=IEEE1588-2008:ec-46-70-ff-fe-00-60-00:0
13 a=mid:primary
14 m=video 29309 RTP/AVP 96
15 c=IN IP4 239.122.37.1/64
16 a=source-filter: incl IN IP4 239.122.37.1 192.168.206.37
17 a=rtpmap:96 raw/90000
18 a=fmtp:96 sampling=YCbCr-4:2:2; width=1920; height=1080;
    exactframerate=25; depth=10; TCS=SDR; colorimetry=BT709;
    PM=2110GPM; SSN=ST2110-20:2017; TP=2110TPN; interlace;
19 a=mediaclock:direct=0
20 a=ts-refclk:ptp=IEEE1588-2008:ec-46-70-ff-fe-00-60-00:0
21 a=mid:secondary
```



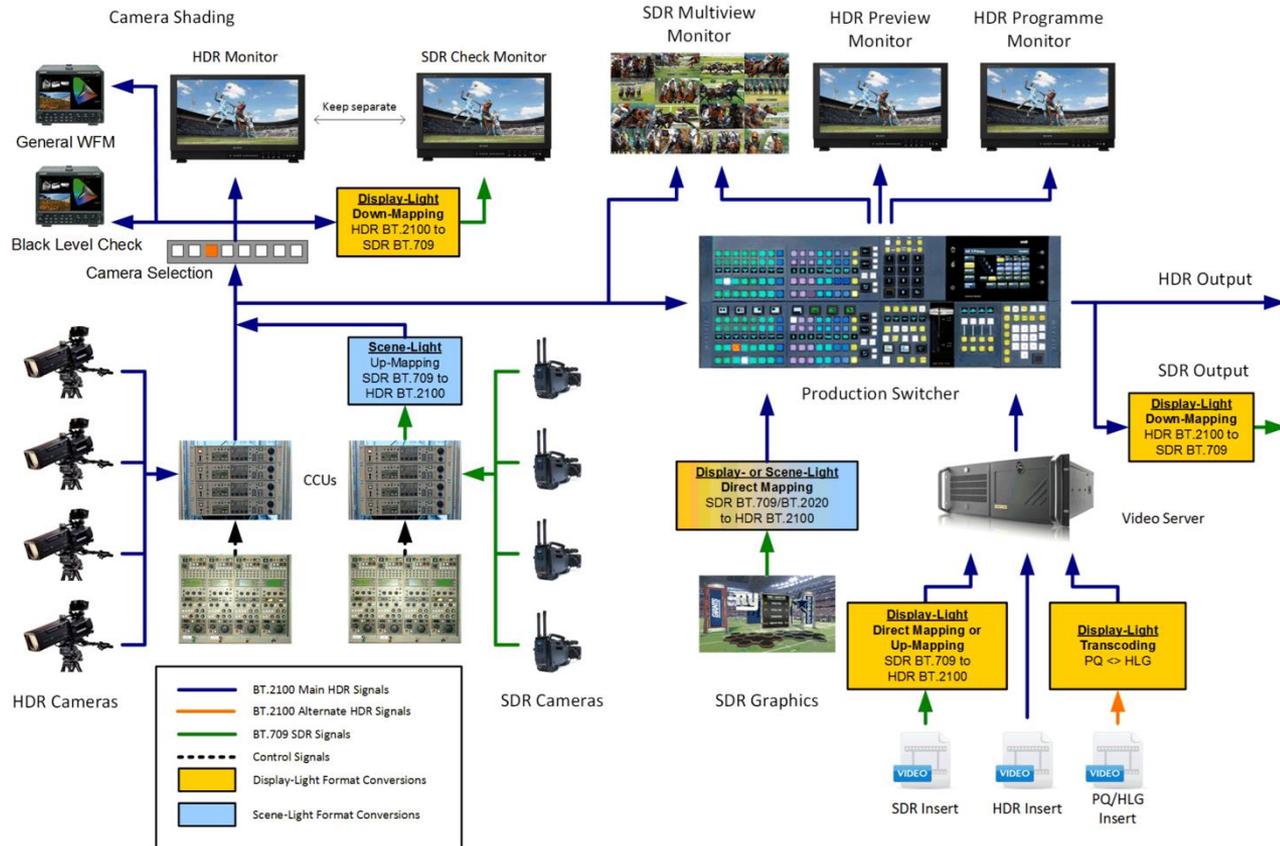
HDR-TV
Live Production

Live Production – IRIS Adjustment in SDR / HDR

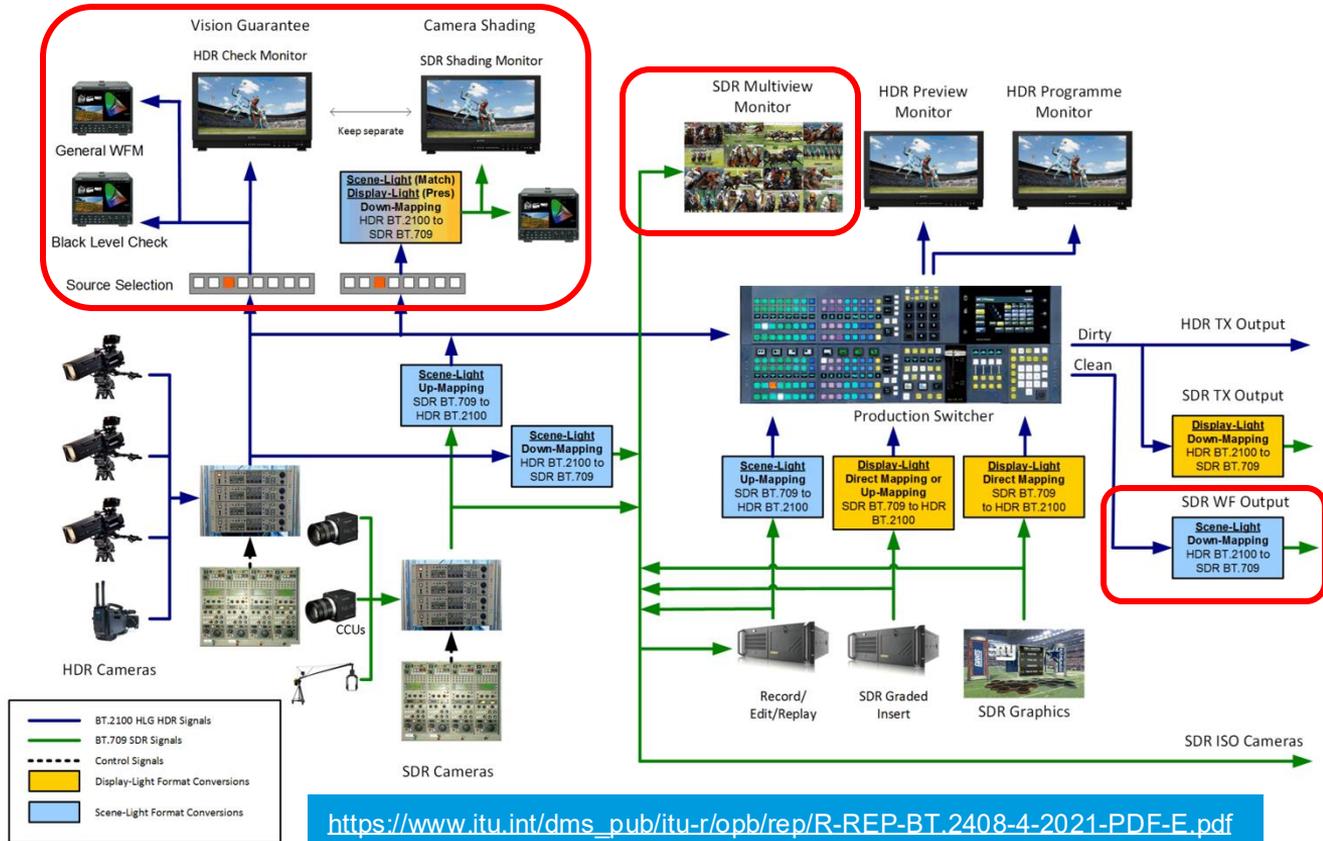


- SDR – More iris adjustment – Current user experience
- HDR – Less iris adjustment – *Better user experience*

HDR Live Production with SDR derived by down-mapping



BBC SDR focused HLG Live Production

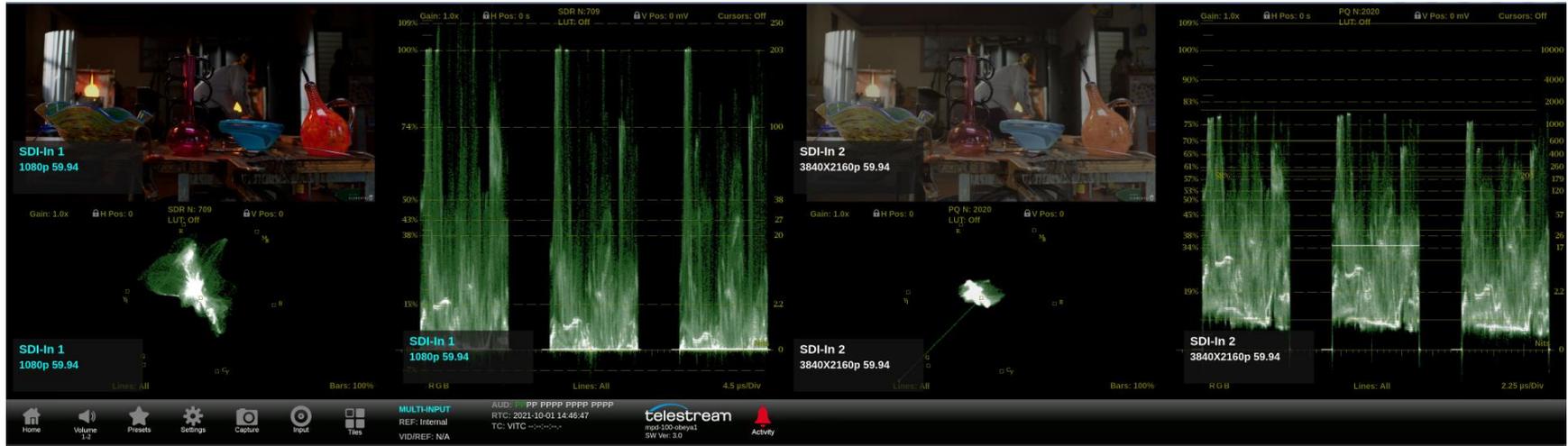


https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-BT.2408-4-2021-PDF-E.pdf

Compare SDR / HDR

SDR/709 1080p59

PQ/2020 2160p59



↑
Vector

↑
Waveform

↑
Vector

↑
Waveform

SDR / HDR side by side in Dual display, but....

Compare SDR / HDR

SDR/709 1080p59

Desaturated picture

PQ/2020 2160p59



Different RGB primary,
Gamma

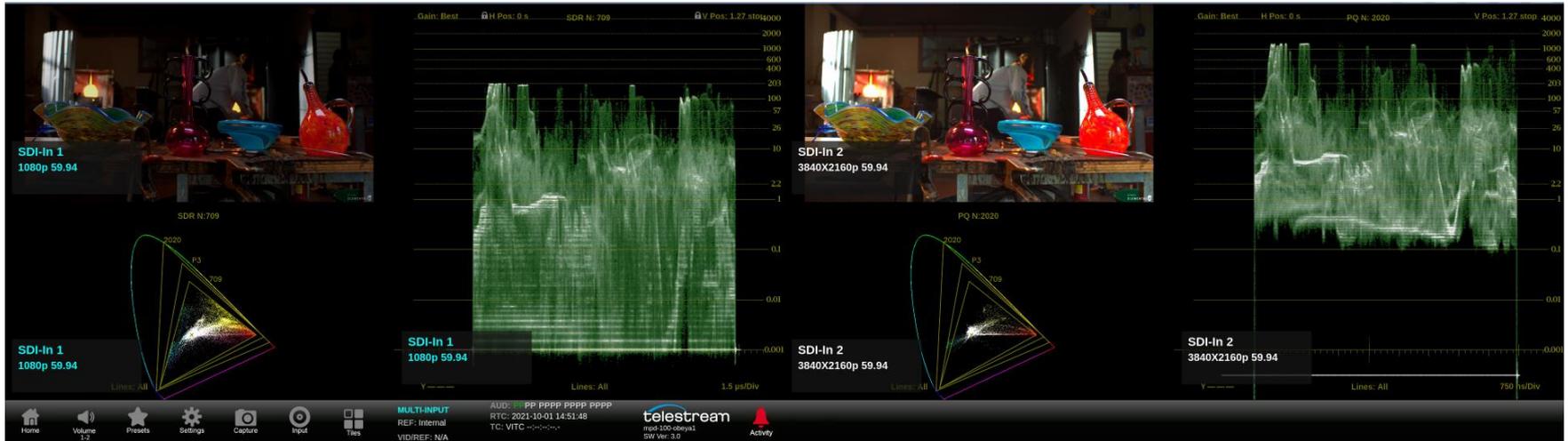
Not easy to compare...

Different scale

Compare SDR / HDR

SDR/709 1080p59

PQ/2020 2160p59



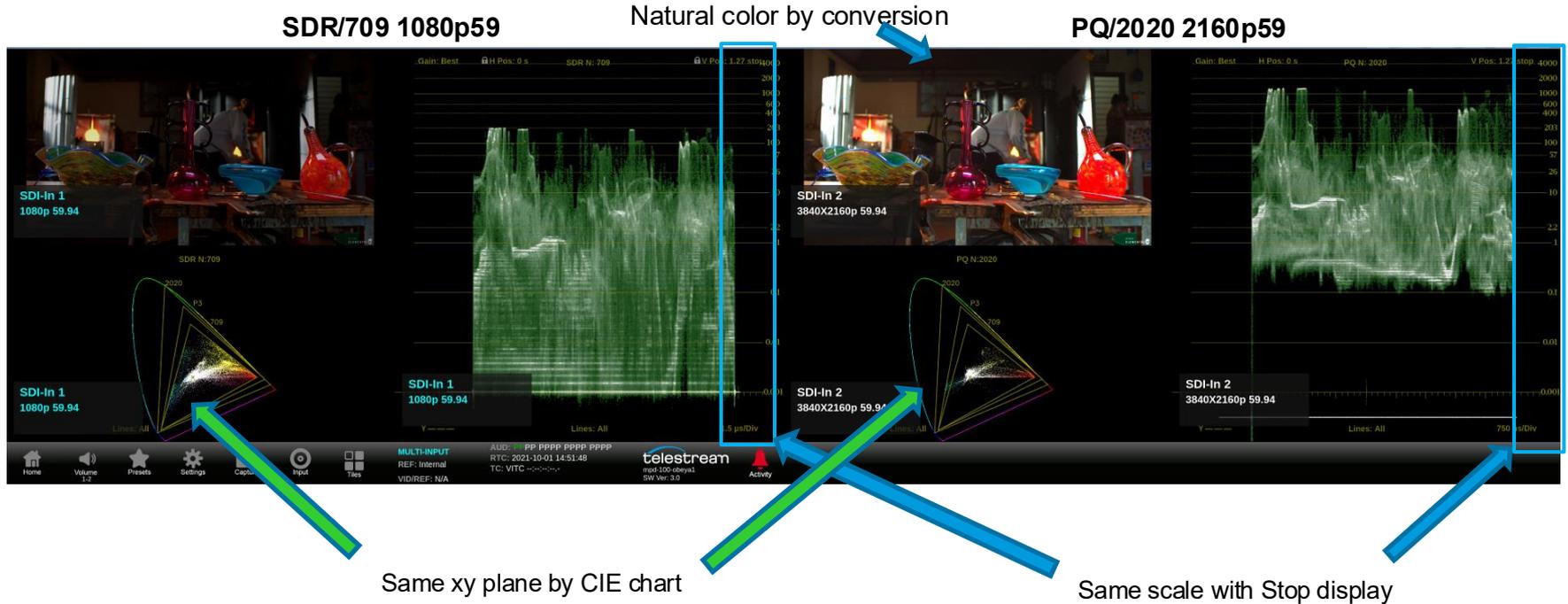
↑
CIE

↑
Stop

↑
CIE

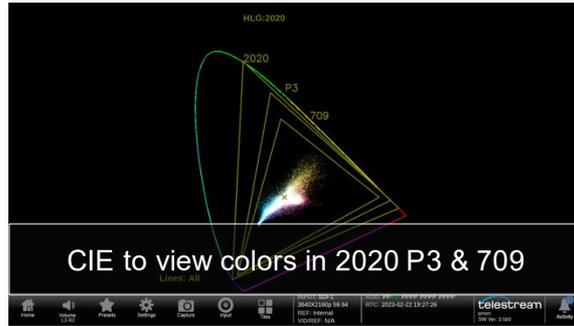
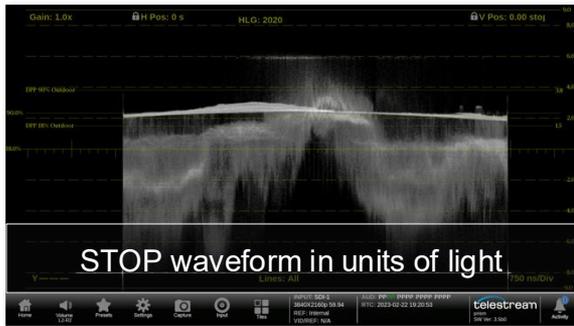
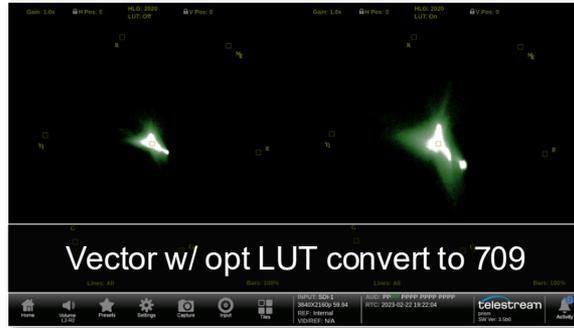
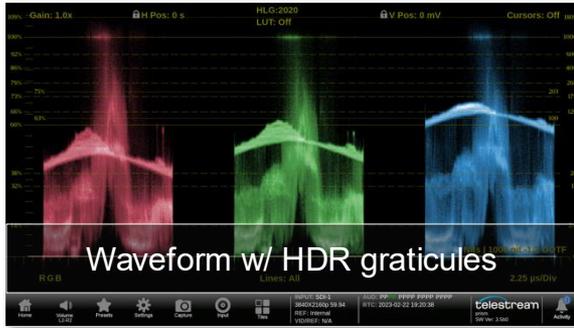
↑
Stop

Compare SDR / HDR



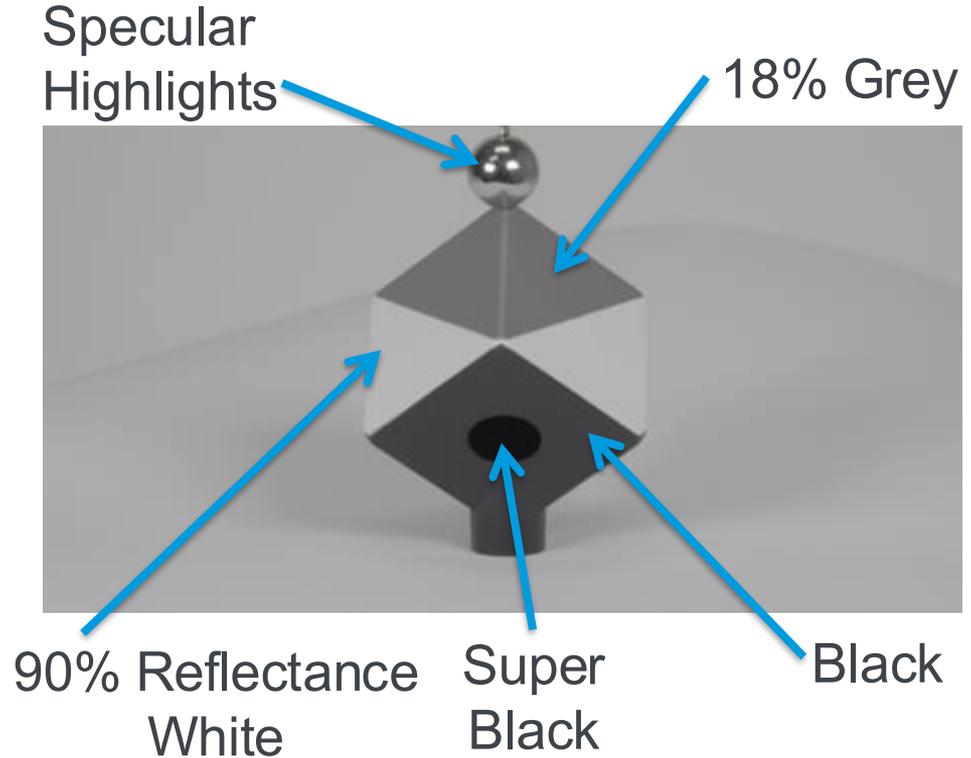
Ideal setup with MPD models for SDR/HDR comparison

HDR is creating the need for new tools



Capturing Camera RAW Footage

- Setup your test chart within the scene
- Adjust the lighting to evenly illuminate the chart
- Adjust the camera controls to set the levels
 - ISO/Gain, Iris, Shutter, White Balance



The background features a soft, abstract gradient of light blue and lavender. A prominent, dark blue, curved shape, resembling a stylized arrow or a swoosh, sweeps across the frame from the bottom left towards the top right. The text 'LUT (Lookup Table)' is centered within this dark blue shape.

LUT (Lookup Table)

HDR Workflow – Transfer Functions

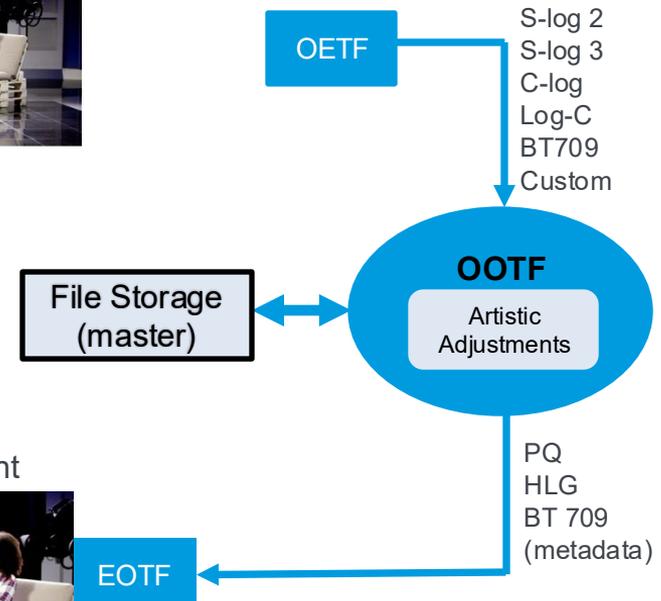
OETF: Opto-Electro Transfer Function

OOTF: Opto-Optical Transfer Function

EOTF: Electro-Optical Transfer Function

Look Up Tables (LUTs) can be used to

- change from one specific dynamic range to another
- change from one color space to another
- create a creative look (color grading)



Look Up Table (LUT)

- LUT provide a transform for from one set of digital values to another set of digital values
- Can be 1D (1024, 4096, 16384) or 3D (17x17x17, 33x33x33 65x65x65) matrices.

Use cases:

Create "The Look" of a scene or movie.

Convert from one ETF to another one, i.e.

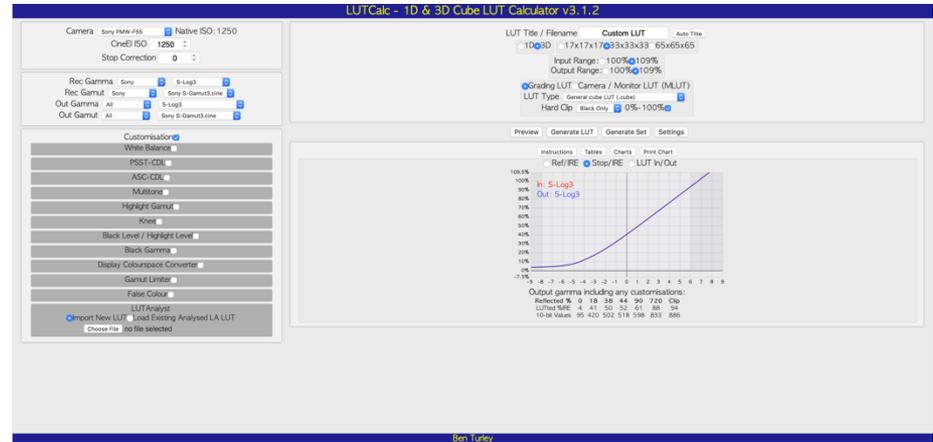
SDR & BT.709 → HLG / PQ & BT.2020

HLG / PQ & BT.2020 → SDR & BT.709

Slog-3 & S-Gamut3 → HLG & BT.2020

HLG Look-Up Tables from BBC

http://downloads.bbc.co.uk/rd/pubs/papers/HDR/BBC_HDRTV_HLG_LUT_Licensing.pdf

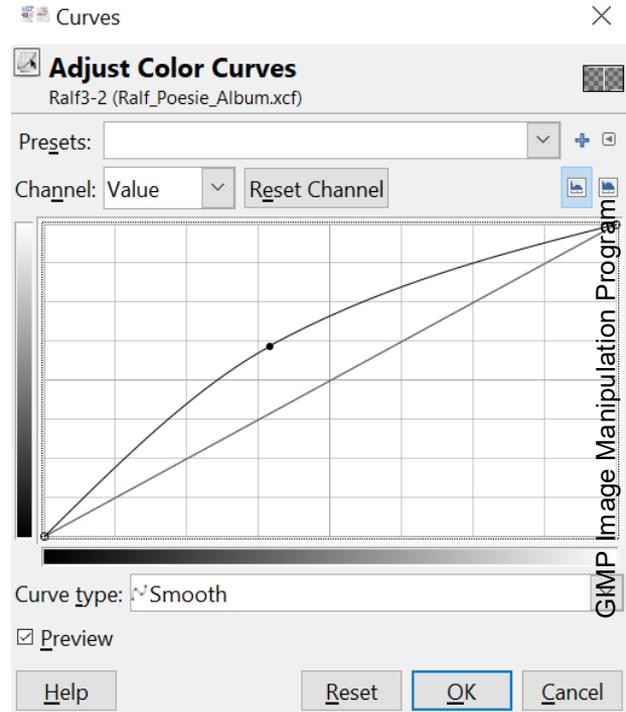


[Ben Turley LUT Calc](#)

Lookup Table (LUT)

■ 1D LUT

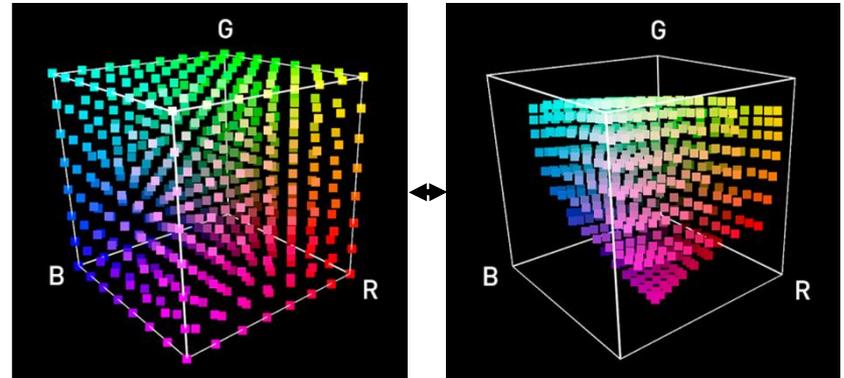
- Separate processing for RGB (3x 1D LUT) or Y only (1x 1D LUT)
- One input value → one output value
- Typical LUT sizes for video applications:
1024 (2^{10}), 4096 (2^{12})
- Typical file endings:
.lut, .ilut, .spi1d



Lookup Table (LUT)

■ 3D LUT

- Parallel processing of RGB
- Matrix: 3 input vales → 3 output values
- Typical 3D LUT sizes:
17x17x17, 33x33x33,
65x65x65
→ Too much computing with 1024x1024x1024!
- Interpolation is used to avoid banding
- Typical file endings:
*.cube, *.3dl, *.spi3d



8x8x8 3D LUT <https://www.inventome.com/blog/the-truth-about-luts>

```
[TITLE "Custom LUT"  
LUT_3D_SIZE 33  
# S-Log3/Sony S-Gamut3.cine -> S-Log3/Sony S-Gamut3.cine, CineEI Shift 0.00,  
Black Level 3.54% IRE, Input 109% -> Output 109% - Created with LUTcalc  
v3.1.2 by Ben Turley, September 2017  
0.062561 0.062561 0.062561  
0.062561 0.062561 0.062561  
0.062561 0.062561 0.062561  
0.093750 0.062561 0.062561  
0.125000 0.062561 0.062561  
0.156250 0.062561 0.062561  
0.187500 0.062561 0.062561  
0.218750 0.062561 0.062561  
0.250000 0.062561 0.062561  
0.281250 0.062561 0.062561  
0.312500 0.062561 0.062561  
0.343750 0.062561 0.062561  
0.375000 0.062561 0.062561  
0.406250 0.062561 0.062561  
0.437500 0.062561 0.062561
```

Look Up Table (LUT)



Base sRGB image
Hue circle, hue circle
+/-2 stops, ramps from
0 to 1.



Fuji Emulation LUT
Converts from Cineon to
Fuji style colors



Fuji Emulation LUT
without interpolation.
Visible banding

<https://www.inventome.com/blog/the-truth-about-luts>

Choosing Format Conversion LUTs

- Video Range
- Color Compensation
- Scene-Referred vs Display Referred
- Direct-Mapping vs Up Mapping (SDR→HDR)
- Harsh vs. Normal (HDR→SDR)
- Strict LUT



Does the content make a “round-trip”?

Posted by Simon Thompson <https://www.bbc.co.uk/rd/blog/2020-06-lut-format-conversion-hdr-video-production>

Choosing Format Conversion LUTs

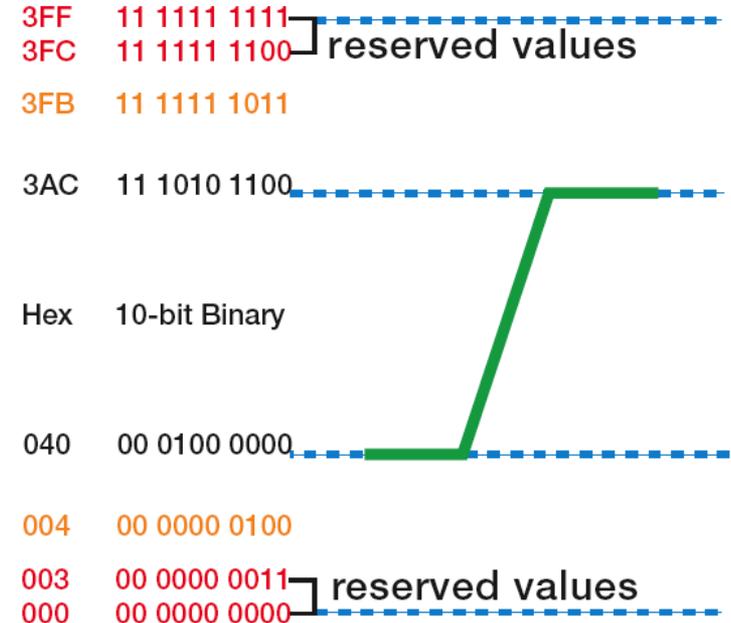
■ Video Range

- **Narrow range**

Luma Y 64d –940d for 10-bit
Chroma Cb/Cr 64d – 960d for 10-bit

- **Full range**

Luma Y 0d –1023d for 10-bit
Chroma Cb/Cr 0d –1023 for 10-bit



Posted by Simon Thompson <https://www.bbc.co.uk/rd/blog/2020-06-lut-format-conversion-hdr-video-production>

What is the Right LUT?

HLG/2020 → SDR/709

HLG/2020



SDR/709 LUT 1



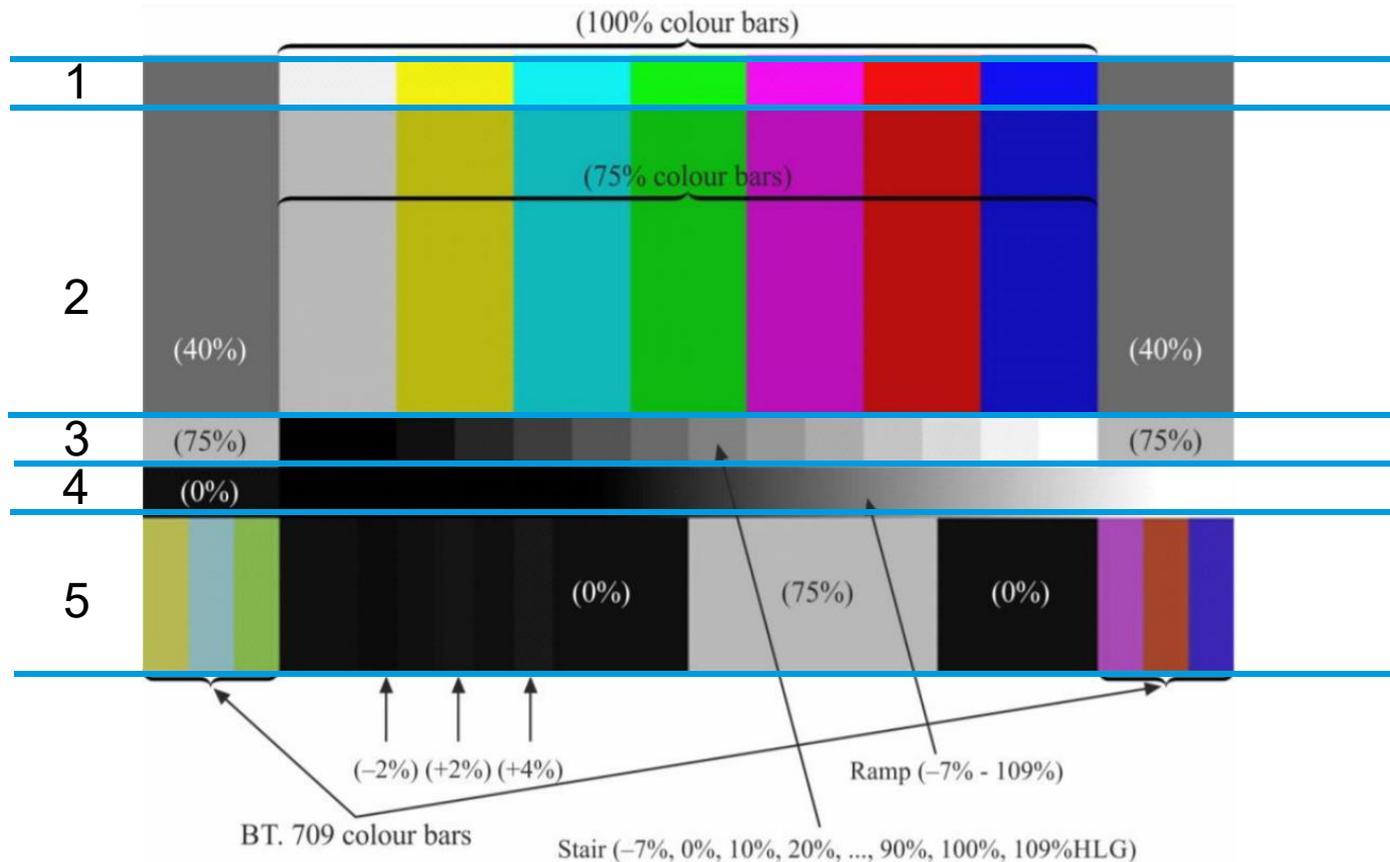
SDR/709 LUT 2



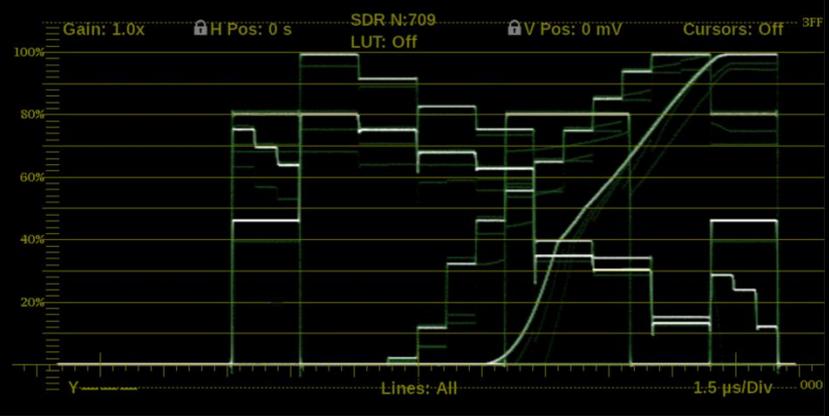
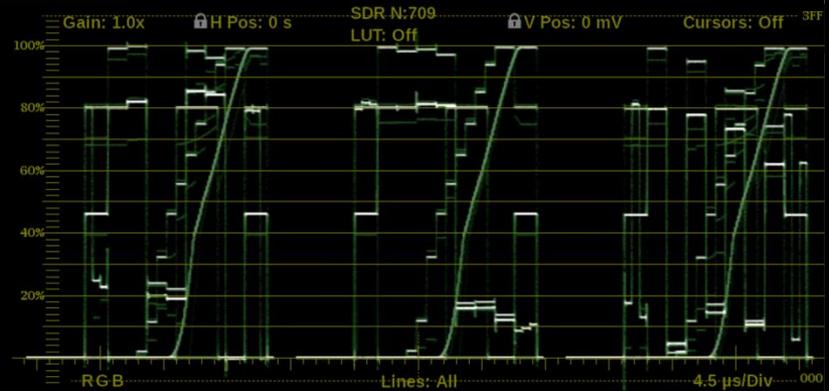
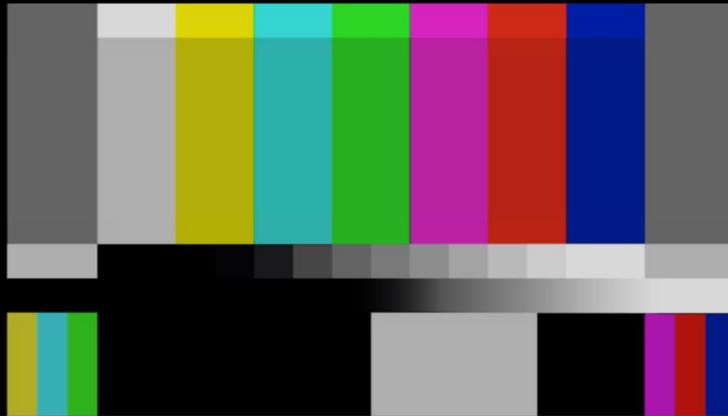
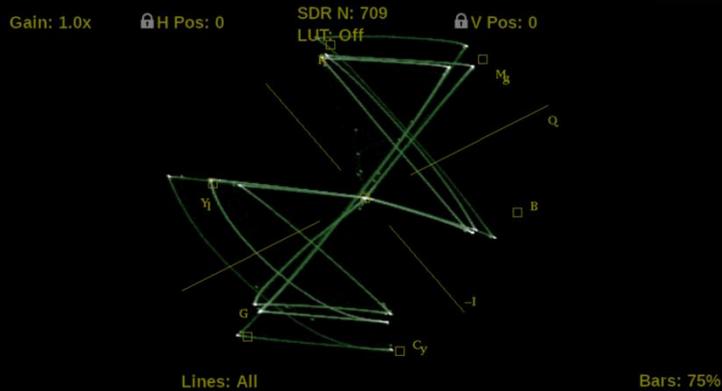
SDR/709 LUT 3



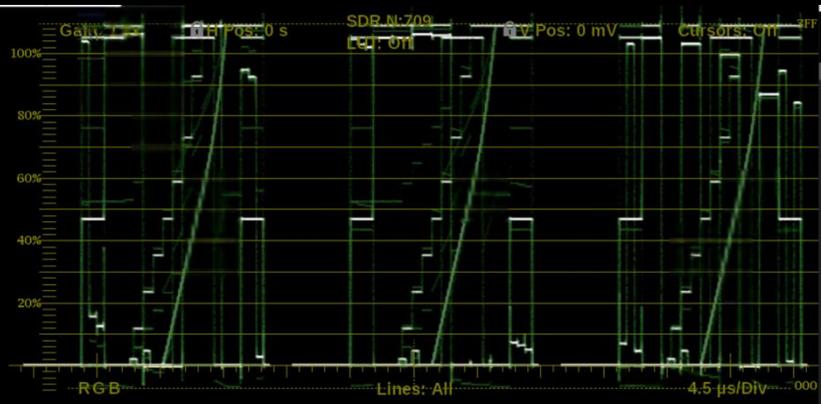
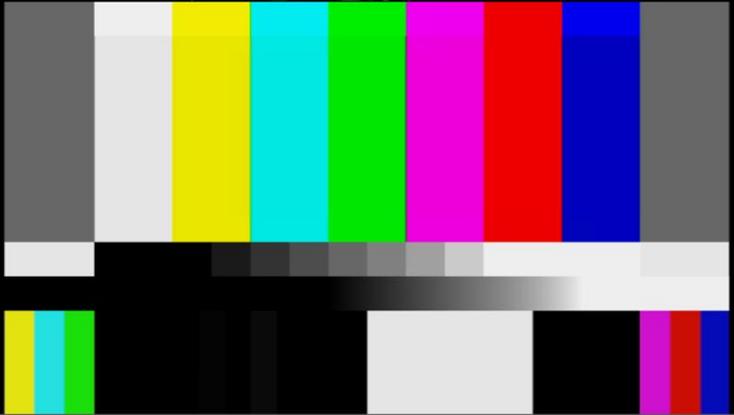
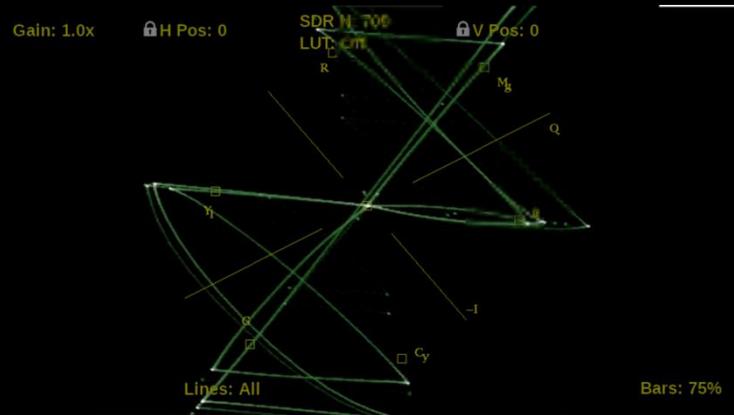
ITU-R BT.2111-2 HLG Bars



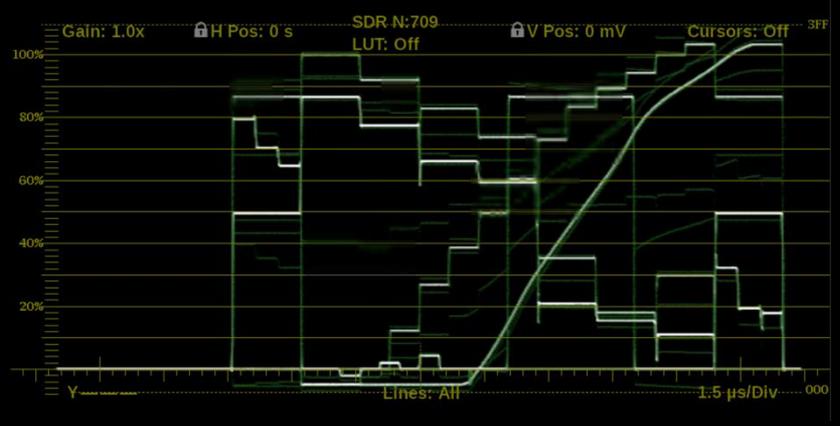
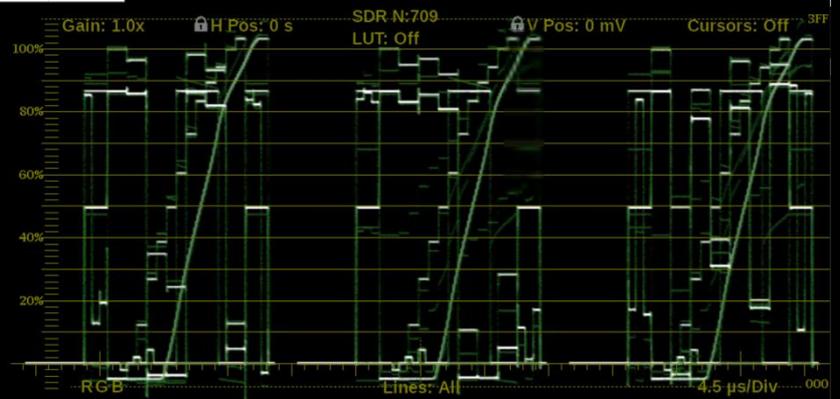
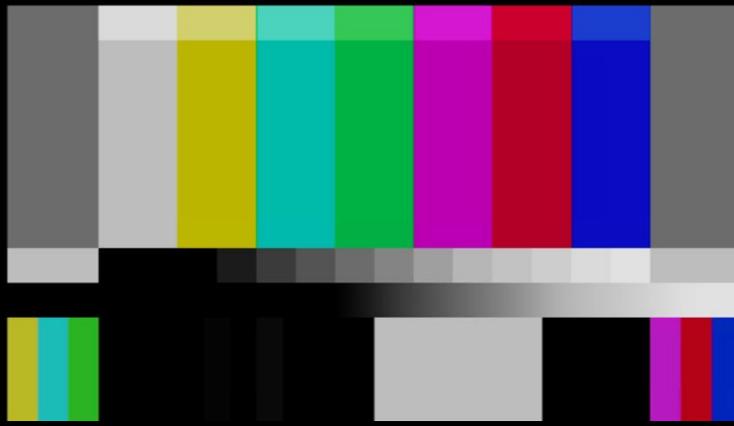
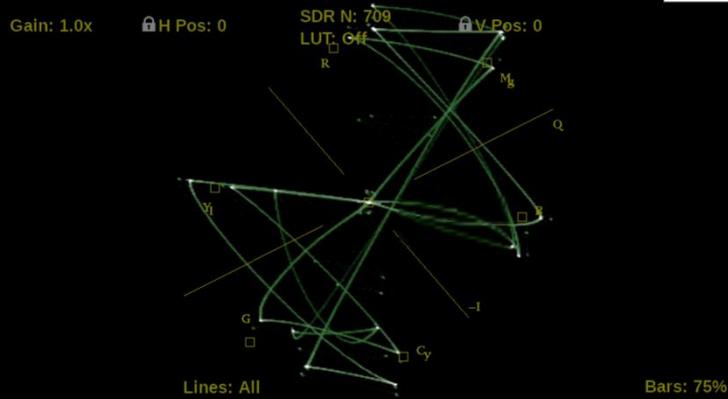
HLG Bars / 2020 → SDR / 709 LUT 1



HLGbars / 2020 → SDR / 709 LUT 2

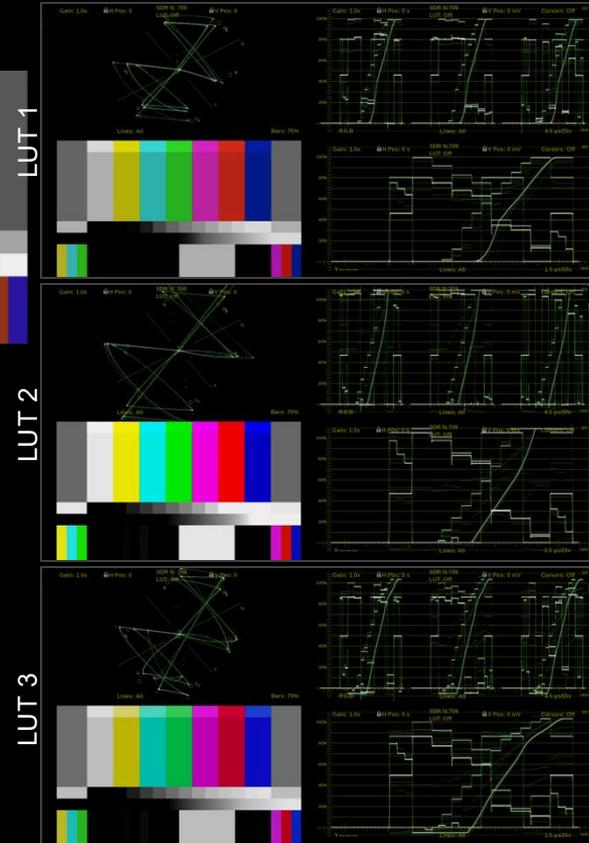
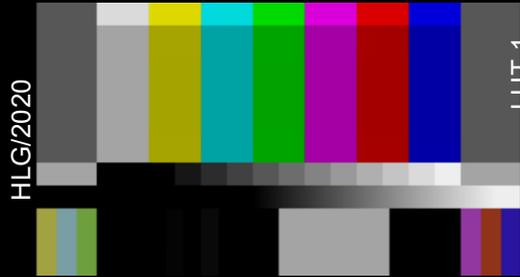


HLG Bars / 2020 → SDR / 709 LUT 3



Bars HLG / 2020 → SDR / 709 summary

- You cannot have everything
- Find the best compromise for your content and workflow:
 - dynamic
 - contrast
 - color saturation
 - accuracy of color shades
 - “round-trip” compatibility
- Use pre-defined LUTs as a starting point:
 - from grading system / processing device
 - BBC HLG Lookup Table package (licensed)
 - optimize from there

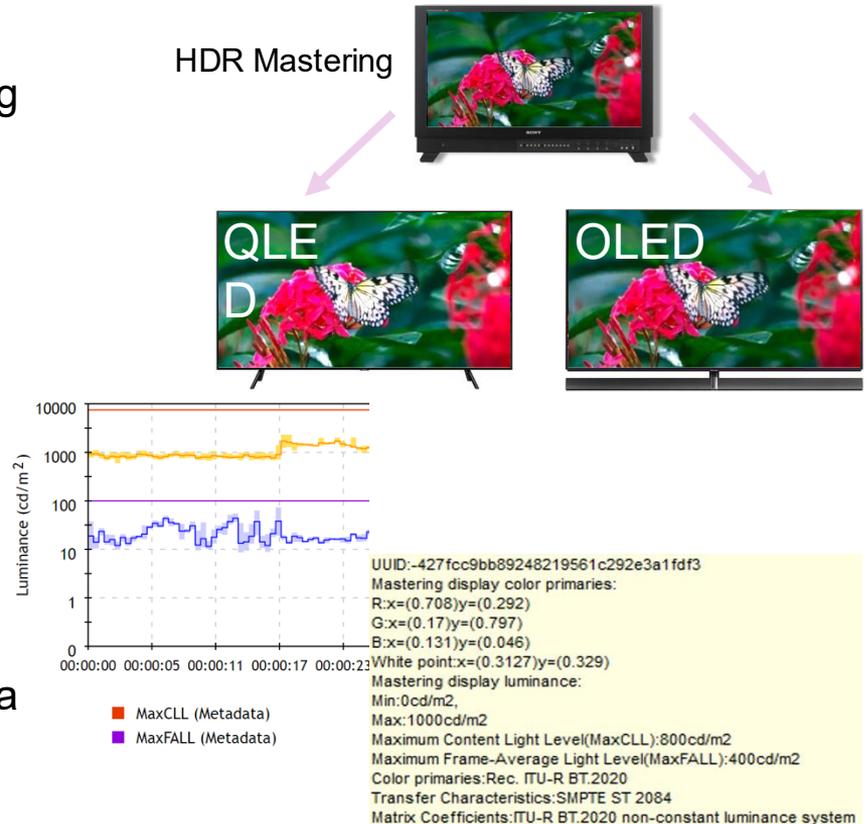


The background features a soft, abstract gradient of colors, transitioning from light blue and purple on the left to a pale, almost white glow on the right. The colors are blended and slightly blurred, creating a sense of depth and movement.

HDR Metadata

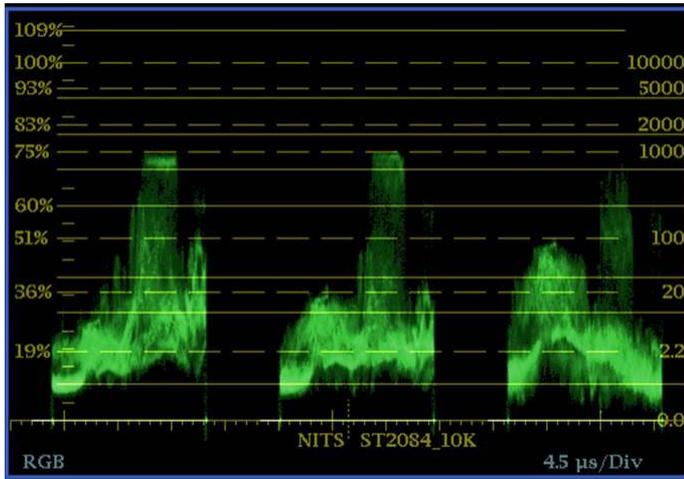
HDR Metadata

- Ensure that the content looks similar on various displays and future proving HDR
- Static Metadata for tone mapping
SMPTE ST 2086 Mastering Display Color Volume Metadata, MaxCLL (Content Light Level) , MaxFALL (Frame-Average Light Level)
- Dynamic Metadata for tone mapping
SMPTE ST 2094 Dynamic Metadata for Color Volume Transform
- HDR Metadata for SDI
SMPTE ST 2108 HDR/WCG Metadata Packing & Signaling in the Vertical Ancillary Data Space

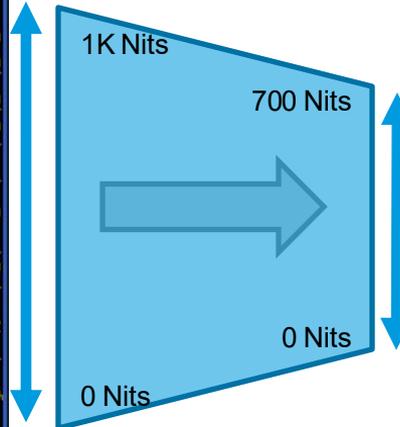


Static Tone Mapping

- Metadata is sent to the Monitor that shows the Grade of the entire file.
- If the file was a 1K Nit Grade but the Monitor can only do 700 Nits the monitor can adjust / Scale.



Fixed Grade at 1K nits in this case

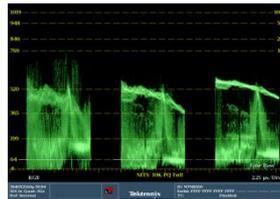
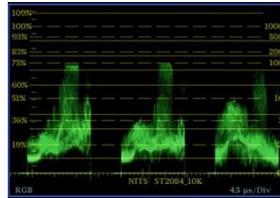
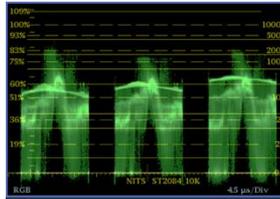


Monitor will Scale the input to its Nit range



Dynamic Tone Mapping

- Color transforms optimized for each monitor and each scene
- ST 2094
Standardizes HDR color transform from several companies (part -10, -20, -30, 40)



Mastering display color primaries:
 $R_x=(0.708)y=(0.292)$
 $G_x=(0.17)y=(0.797)$
 $B_x=(0.131)y=(0.046)$
White point: $x=(0.3127)y=(0.329)$
Mastering display luminance:
Min:0cd/m²
Max:1000cd/m²
Maximum Content Light Level(MaxCLL):800cd/m²
Maximum Frame-Average Light Level(MaxFALL):400cd/m²
Color primaries:Rec. ITU-R BT.2020
Transfer Characteristics:SMPT ST 2084
Matrix Coefficients:ITU-R BT.2020 non-constant luminance system

METADATA

Mastering display color primaries:
 $R_x=(0.708)y=(0.292)$
 $G_x=(0.17)y=(0.797)$
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Transfer Characteristics:SMPT ST 2084
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METADATA

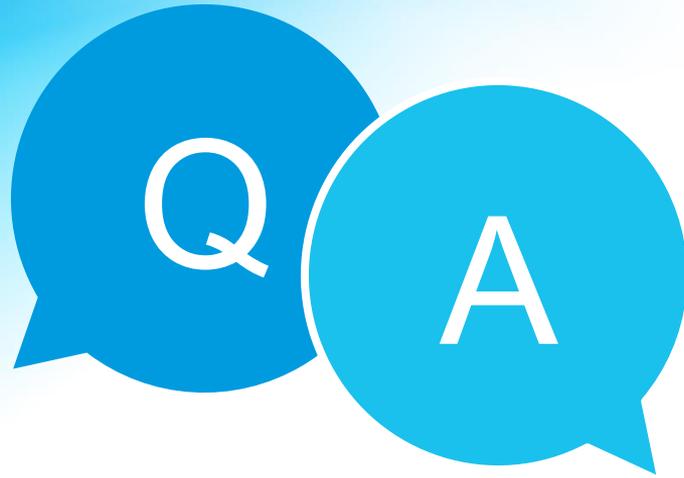


Format	Proposed By	Metadata	Transfer Function	Target(s)	Backwards Compatibility	Benefits	Challenges
Advanced HDR	Technicolor and Philips	Dynamic	HLG or PQ	Broadcast TV, Blu-ray, VOD	Yes, using certain modes	Complete end-to-end HDR ecosystem, SDR to/from HDR conversion focus Compatible with existing production infrastructure (no need for metadata to be carried through production)	Technicolor SDK required (pre-processing and decode)
Dolby Vision	Dolby Lab	Dynamic	PQ	Broadcast TV, Blu-ray, VOD, Digital Cinema <small>(sep. implementation)</small>	Yes, using certain modes	Complete end-to-end HDR ecosystem ICtP Color Space preserves color accuracy	Dolby SDK required (pre-processing). Separate workflow for SDR when using single layer option
HDR 10	Dolby, SMPTE ST-2084	Static	PQ	Broadcast TV, Blu-ray, VOD	No	SMPTE Standard	Requires separate workflow for SDR
HDR 10 w. dynamic metadata	SMPTE ST- 2094-x -10 = Dolby -20 = Philips -30 = Technicolor -40 = Samsung (HDR10+)	Dynamic	PQ	Broadcast TV, Blu-ray, VOD	No	Dynamic metadata added on top of HDR 10	HDR 10 with a choice of metadata types Relatively new, CE adoption will take time
HLG	BBC, NHK	None	HLG	Broadcast TV	Limited, only newer 10-bit SDR displays	Compatible with existing production infrastructure (no need for metadata to be carried through production)	Trageted primarily for live broadcasting No dynamic metadata option

The logo for Teletream features a blue arc above the word "teletream" in a black, lowercase, sans-serif font. The background consists of abstract, flowing shapes in shades of blue and purple.

teletream

Questions



The logo for Telestream, featuring a blue arc above the word "telestream" in a black, lowercase, sans-serif font. The background consists of abstract, flowing shapes in shades of blue and purple.

telestream



Telestream HDR-TV Products



HDR capabilities of Telestream's product portfolio

IQBU

Inspector Live: HDR metadata view, metadata missing / changing
Sentry: HDR format reporting (Program Status), alarming for HDR detected / not detected.



Program:	HDR-Red-Bull
Flow:	HDR-Red-Bull
Event Time:	May 12, 00:00:32
EOTF	PQ10
VUI Parameters	Present
Video Signal Type	Present
Video Format	Unspecified(5)
Video Full Range	No
Field Sequence Flag	Progressive(0)
Timing Information	No
Color Description	Not Present
Color Primaries	BT.2020(9)
Transfer Characteristics	SMPTE 2084(16)
Matrix Coefficients	BT.2020 Non-Constant Luma(9)

PID	Type
257	HEVC Video 3840x2160p, 4:2:0 25.00Hz 10bit 1:1 HDR10 PQ
258	AAC Audio 2.0, 48.0KHz, und

Creating Program Alerts

- 1 Select alert type:
- Generate alert when HDR metadata is Detected Not Detected

HDR capabilities of Telestream's product portfolio

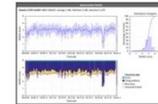
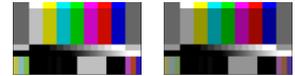
■ Monitoring and Measurement

- PRISM, WFM: HLG, PQ, Camera Log monitoring in SDI & IP
- SPG8000A: HLG and PQ test patterns in SDI (ITU BT.2111)



■ Transcoding & File Based QC

- Vantage: Generate Proxy/ HDR Editing video formats from HDR recordings incl. various camera logs, 3D LUT, metadata insertion & change
- Lightspeed Live Stream: HLG, HDR10, Dolby Vision support
- Vidchecker: HDR metadata change detection, HDR Measurement and metadata validation for HDR10, Dolby Vision & HLG formats for HEVC, J2K & ProRes (Aurora with graphing).



The background features a soft, abstract gradient of colors, transitioning from light blue and purple on the left to a bright white on the right. The colors are blended and slightly blurred, creating a sense of depth and movement.

HDR-TV Training Materials

Telestream Training Materials

- PDF documents
 - Telestream Whitepaper – A Video Engineering Guide to Color Space
<https://pages.telestream.net//693253/2019-06-03/28x1n>
 - Practical High Dynamic Range (HDR) Broadcast Workflows – Essential Guide
<https://pages.telestream.net//693253/2020-04-03/j5z76>
 - HDR For Cinematography – Essential Guide
<https://www.thebroadcastbridge.com/content/entry/15060/essential-guide-hdr-for-cinematography>
 - A Guide to 4K/UHD Monitoring and Measurement – Tektronix
<https://www.telestream.net/pdfs/technical/4KUHD-Content-Creation-eBook-25W604010.pdf>

Telestream Training Materials

- PDF documents (2)
 - Creating 4K/UHD Content Poster (Tektronix)
https://www.telestream.net/pdfs/technical/Creating-4K-UHD-Content-Poster_11W-60274-2-2.pdf
- Videos
 - HDR transcoding in Vantage
<https://www.youtube.com/watch?v=rnx35rJ2J70>
 - PRISM
 - High Dynamic Range <https://www.youtube.com/watch?v=zTRiQveYi5k>
 - Wide Color Gamut <https://www.youtube.com/watch?v=eq6j5fzkKsg>
 - HDR Monitoring False Color
<https://www.youtube.com/watch?v=fhr7FE5yAE0>