

# UHD Single-Master HDR-SDR Production

**Reading Video Scopes: Professional Reference**

# UHD HDR-SDR Single-Master Live Production Method

This eBook will evolve as we document the complete workflow.

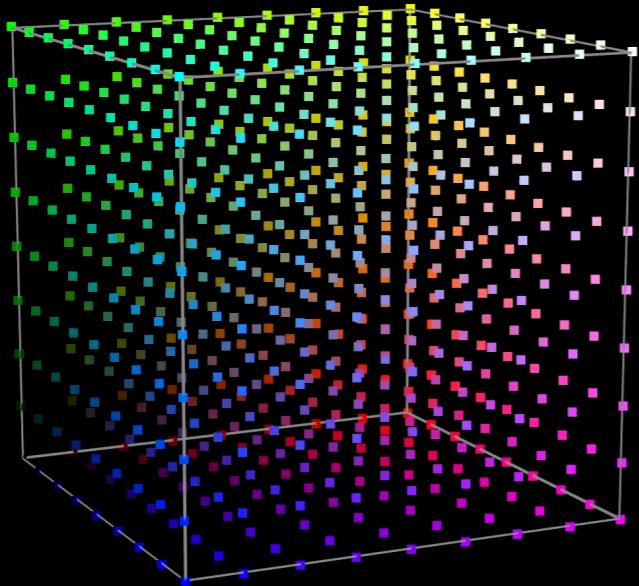
Lesson One will review reading video scopes.

It is provided as a reference for production teams.

Apple Book Store Link is here:

<https://books.apple.com/us/book/id6443385525>

# Lesson 1



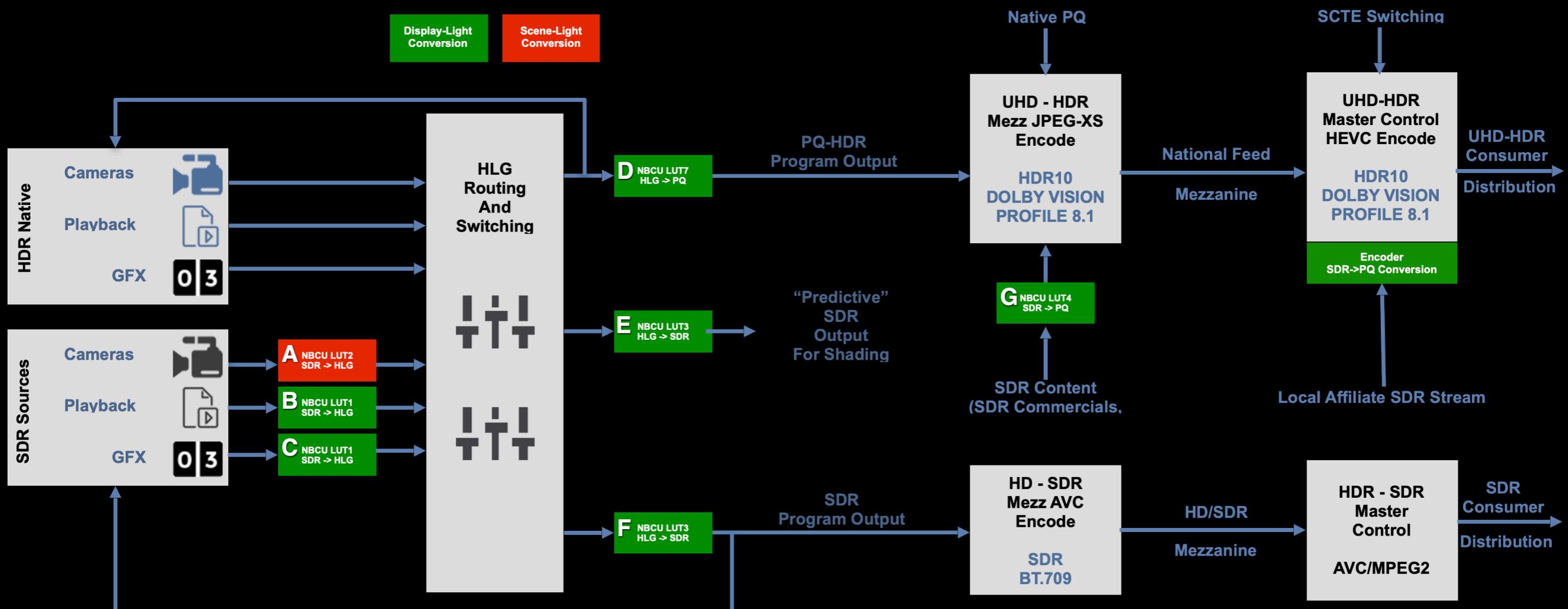
## Video Scopes **HLG AND SDR REFERENCE FOR PROFESSIONALS**

What do the waveform and vector scopes look like before and after conversion in HLG, PQ and SDR  
Using NBCUniversal LUTs 1 & 3

# UHD Single-Master HDR-Signal Path

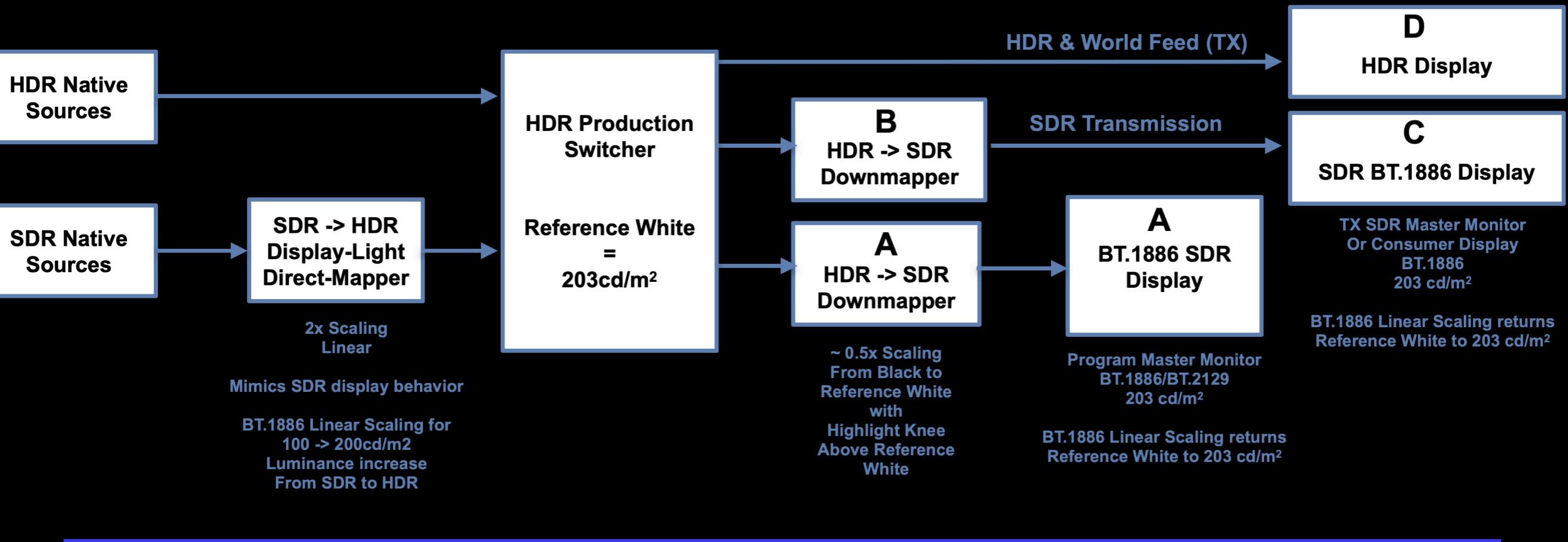
## Live Production HLG

## Transmission PQ/HDR10/DolbyVision



# UHD Single-Master - Optimal Gain Staging

Gain-Staging is ideal and preserves shadows-midtones,reference white from HDR into final SDR delivery and in roundtrip



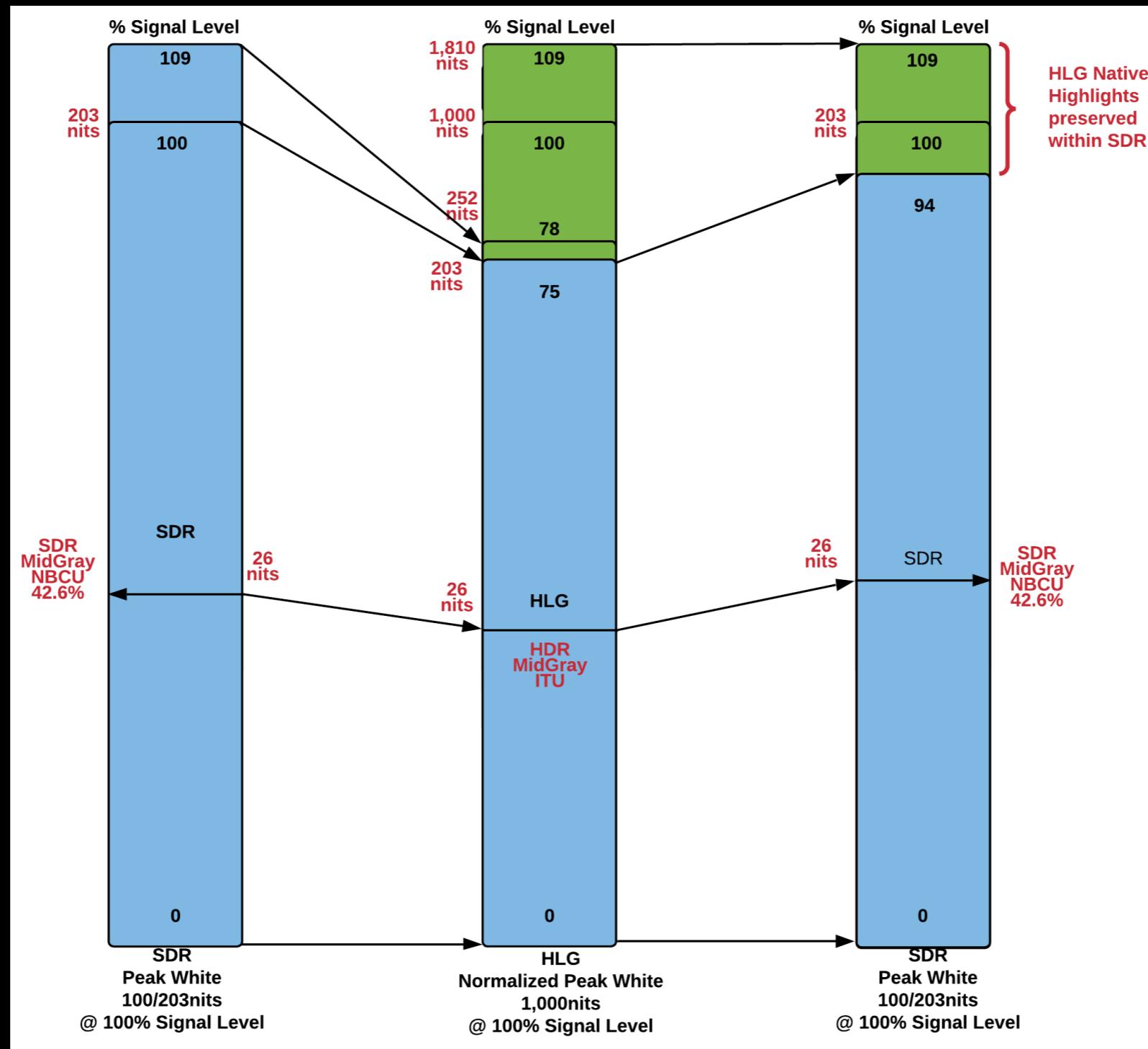
Optimal gain-staging starts with shading SDR at 203nits which is closer to what todays consumer displays use.

When the SDR shading display is set to 203nits, SDR peak-white is equal to HDR graphic white. This allows the two displays to be placed side-by-side.

SDR downmapping, applies a linear mapping so that the upmapping for a roundtrip is removed from HDR black to reference white. A knee is applied above HDR reference white so that some level of HDR highlights are preserved in SDR.

A consumer display typically rescales the video closer to 203nits providing optimal gain staging from source-to-consumer.

# SDR to HLG to SDR Signal Relationships

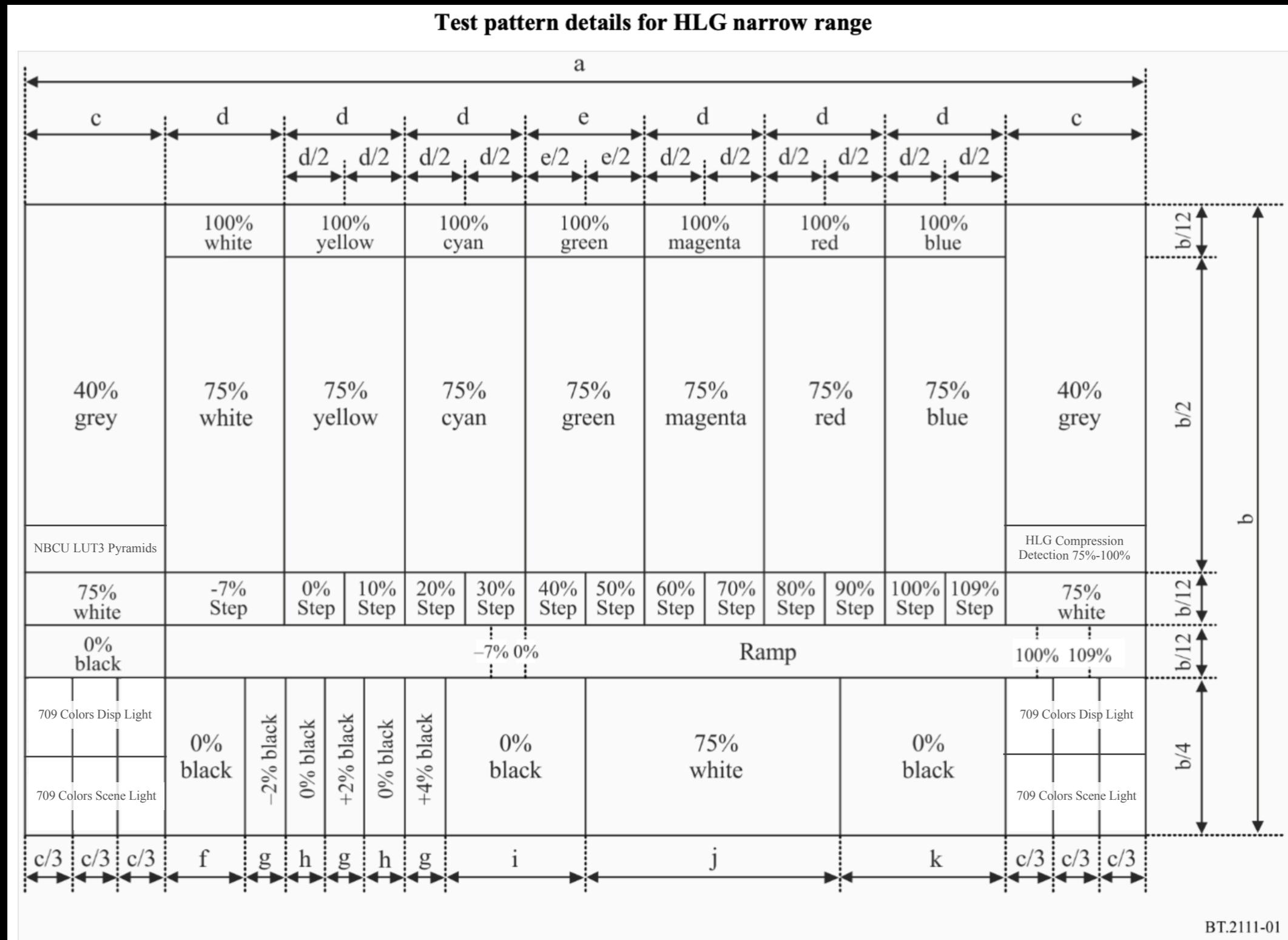


# HLG BT.2100 Color Bars (Fancy)



Since this HLG image is viewed in SDR-BT.709 it will not look quite correct

# HLG BT.2100 Color Bars (Fancy)



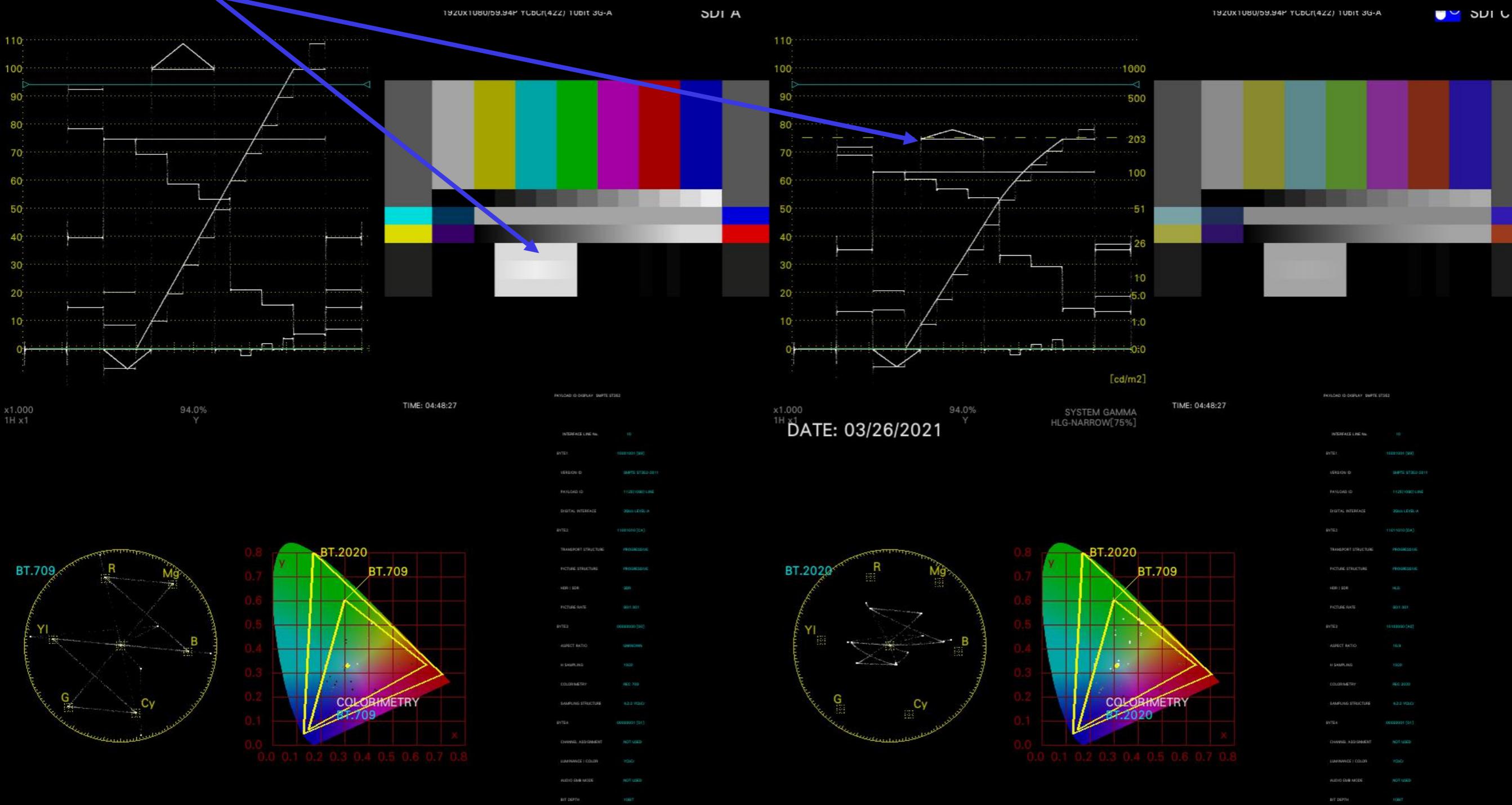
# SDR BT.709 Color Bars



Added: SDR grayscale ladder, linear ramp and patterns closer to BT.2111 color bars

# SDR to HLG Direct Upmapping- NBCU LUT1

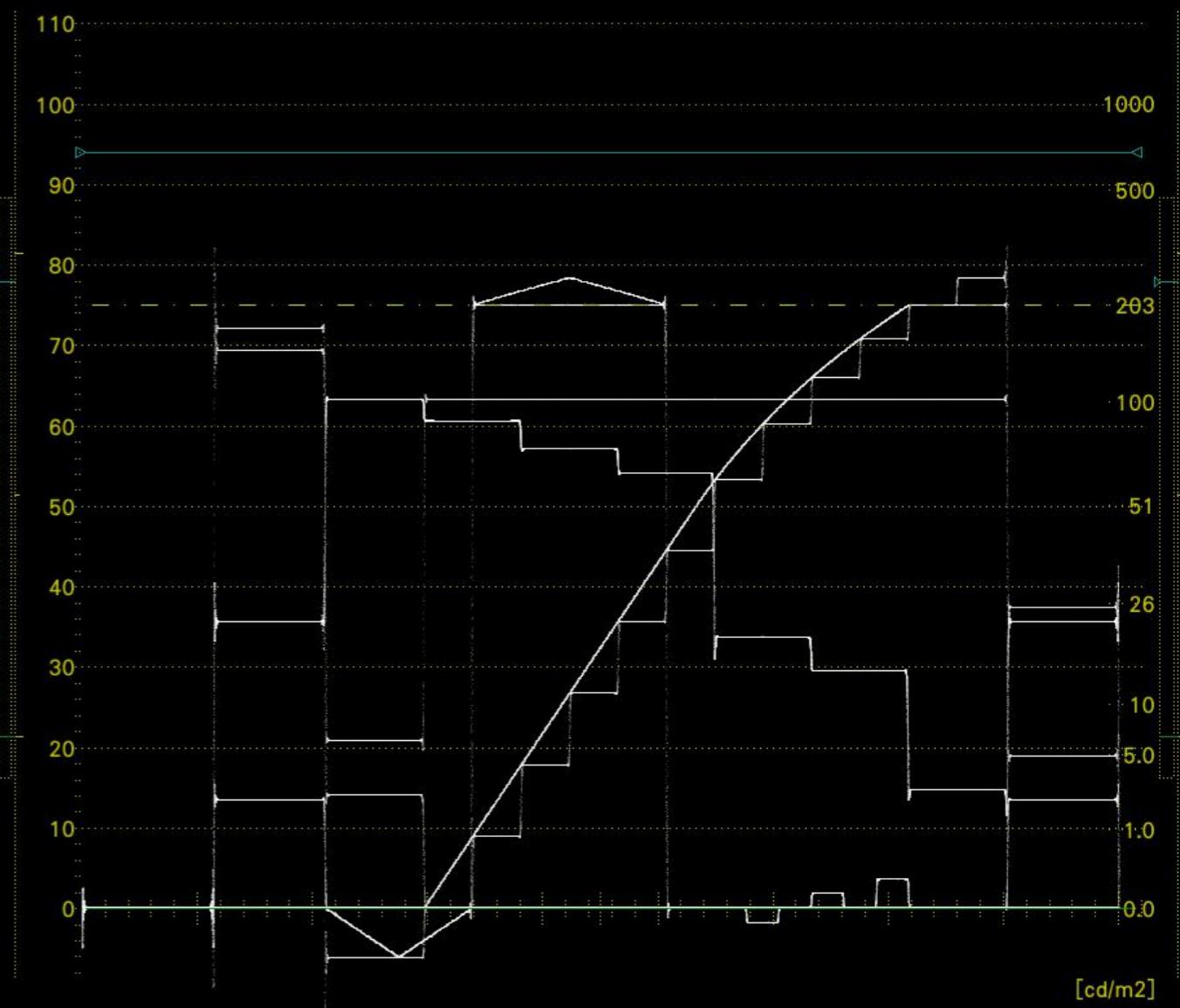
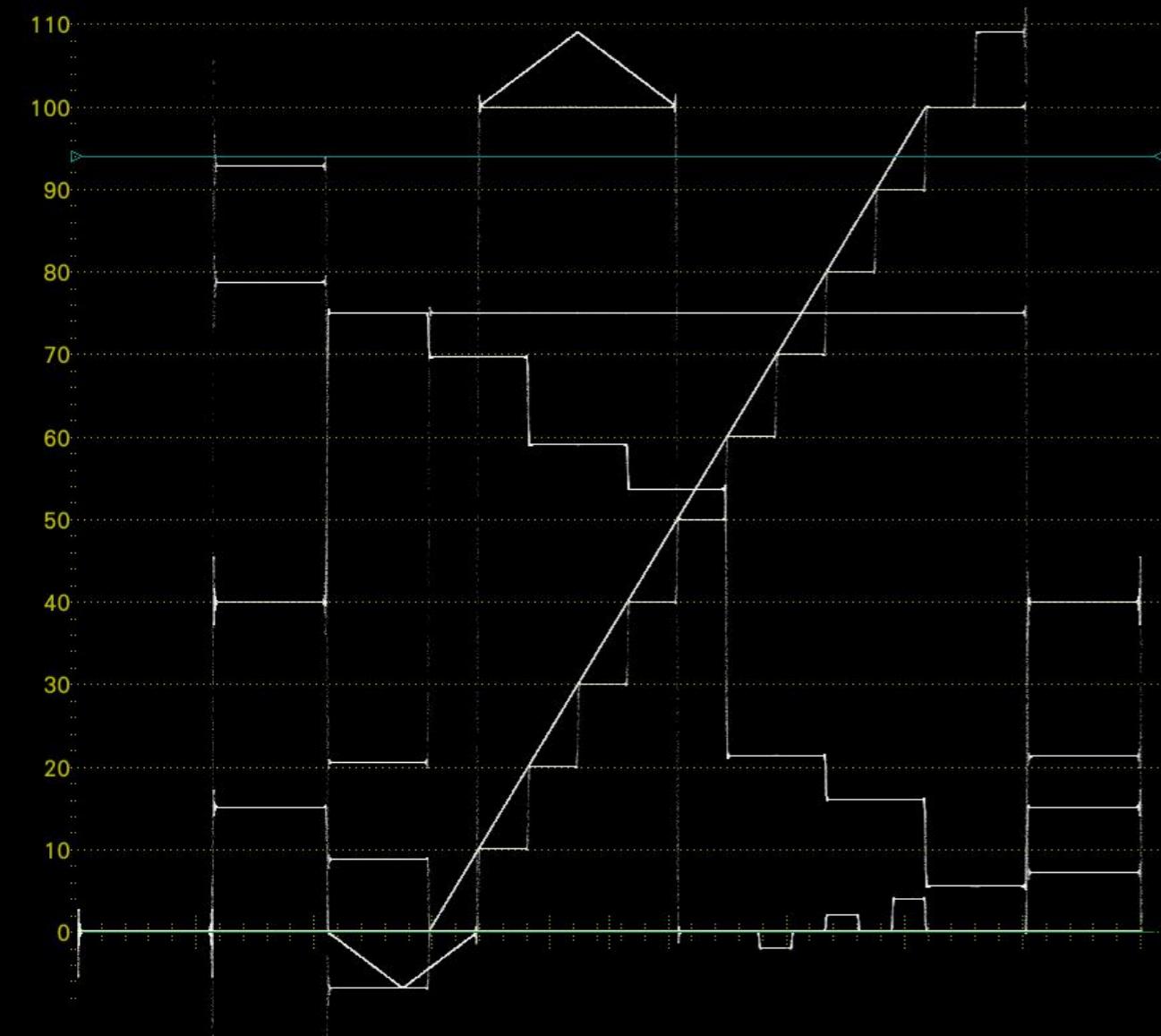
Conversion SDR to HLG  
 SDR Peak White (100% Signal Level)  
 to  
 HLG Graphic White (75%=203nits)  
 HLG Normalized @ 1,000nit peak @ 100%



# SDR to HLG Direct Upmapping- NBCU LUT1

SDR

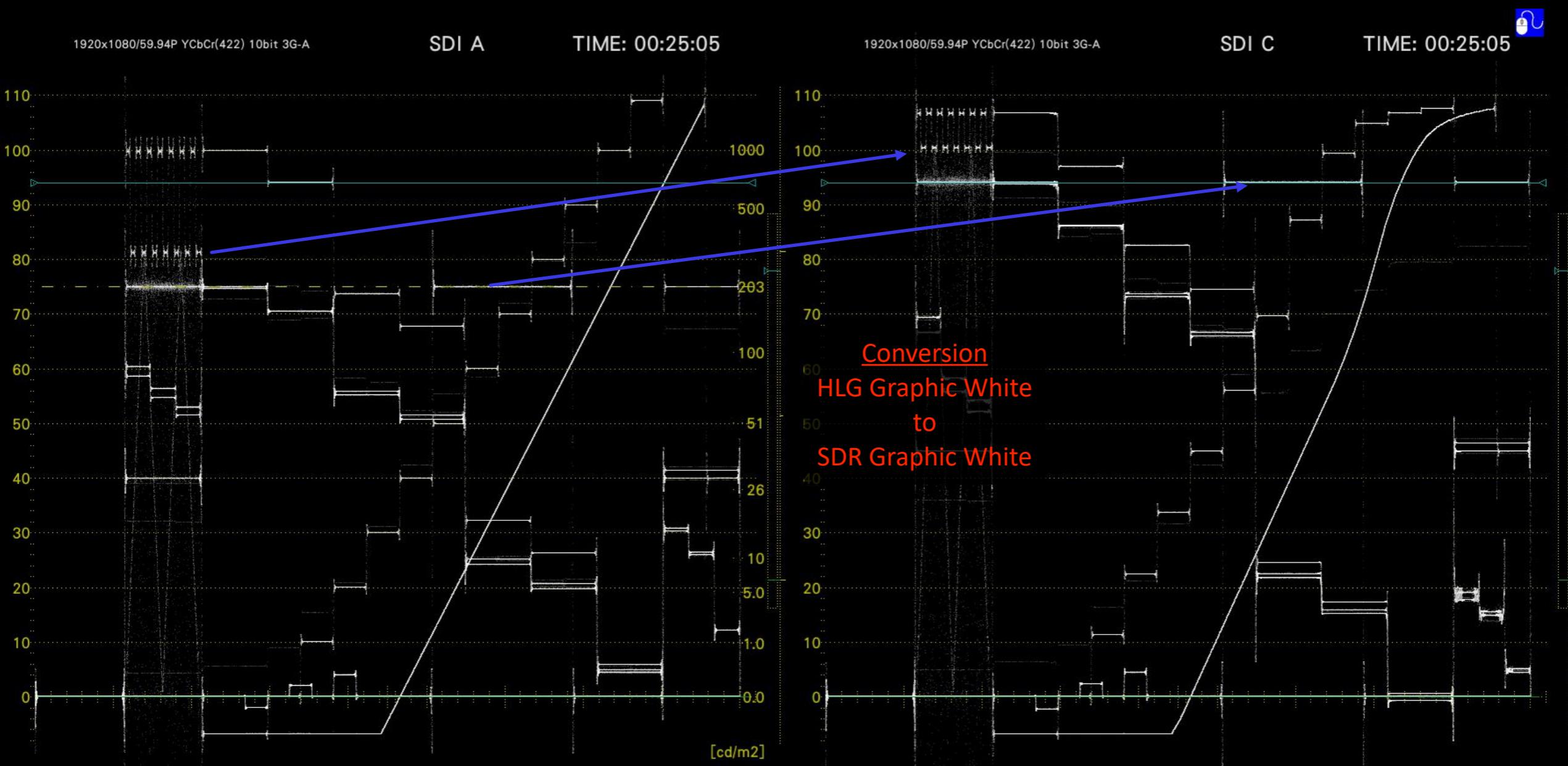
Converted HLG



# HLG to SDR Conversion: NCU - LUT3

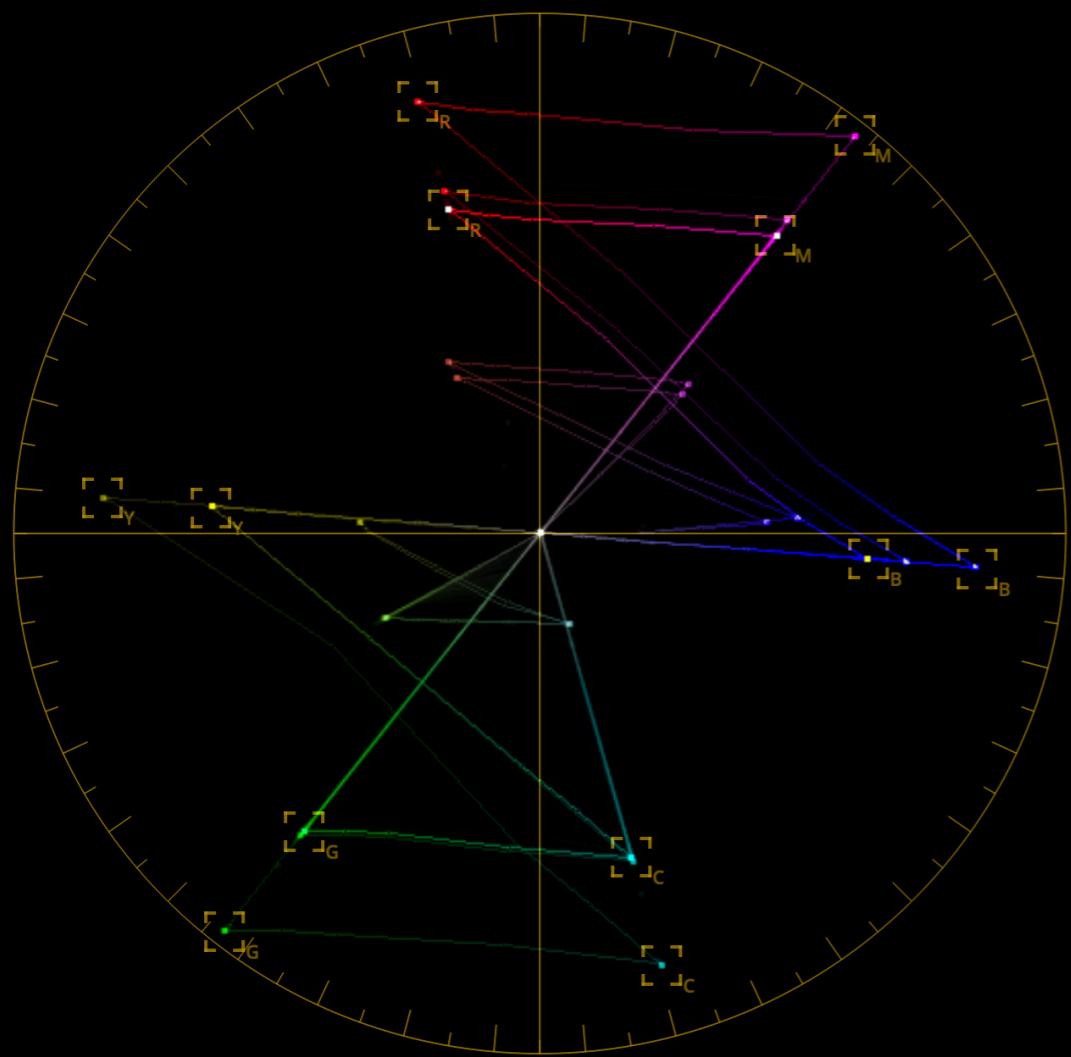
HLG Native Bars

SDR

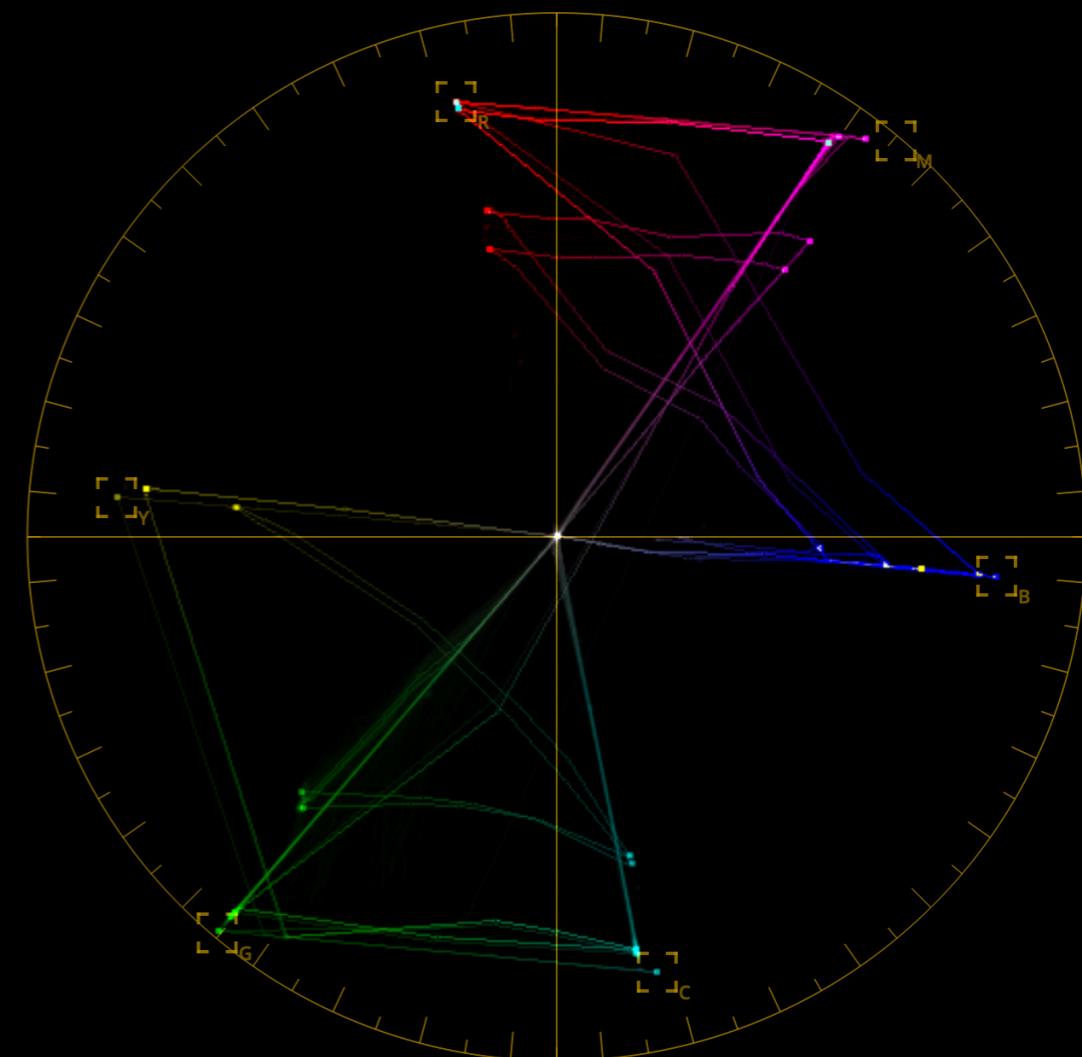


# HLG to SDR Conversion: NBCU - LUT3

HLG 100/75%

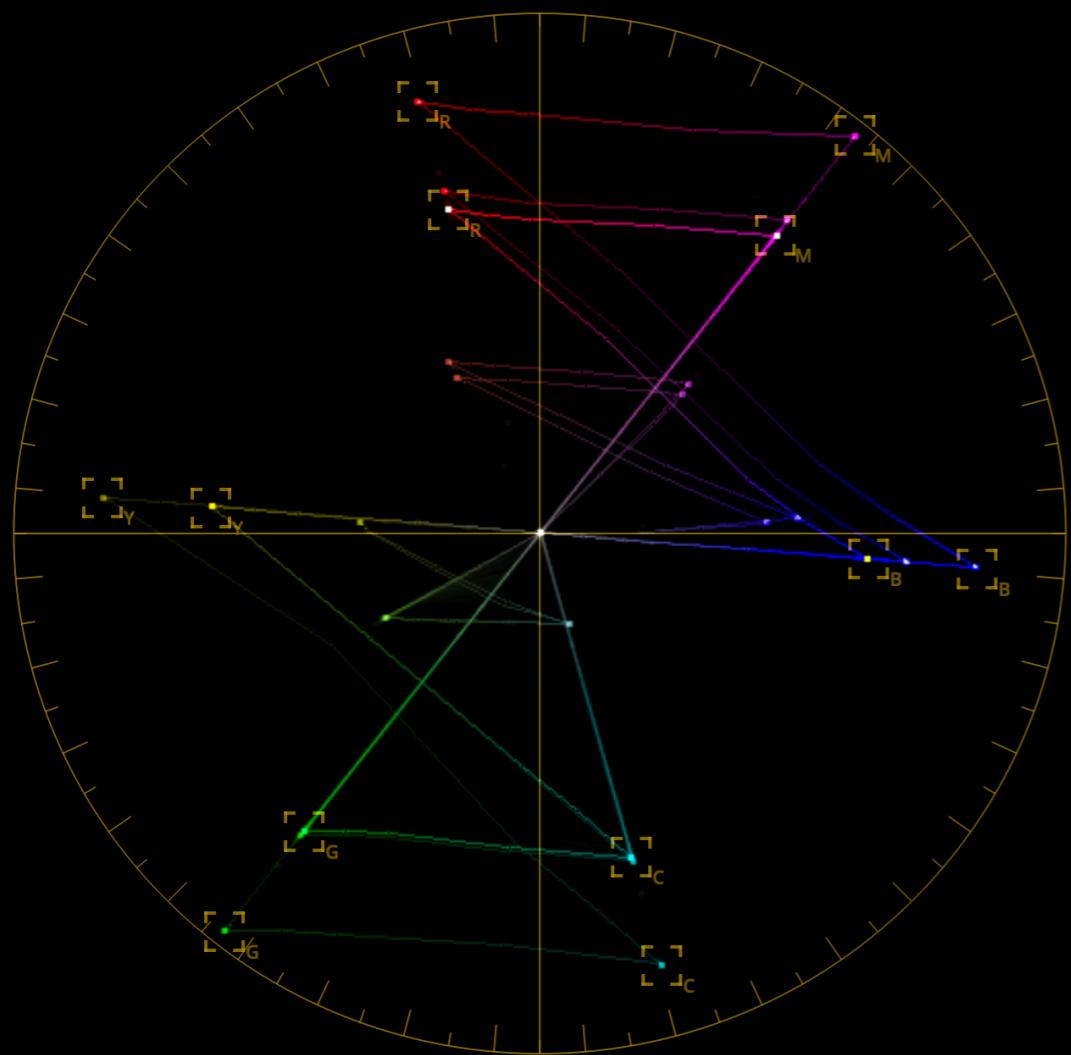


SDR 100%

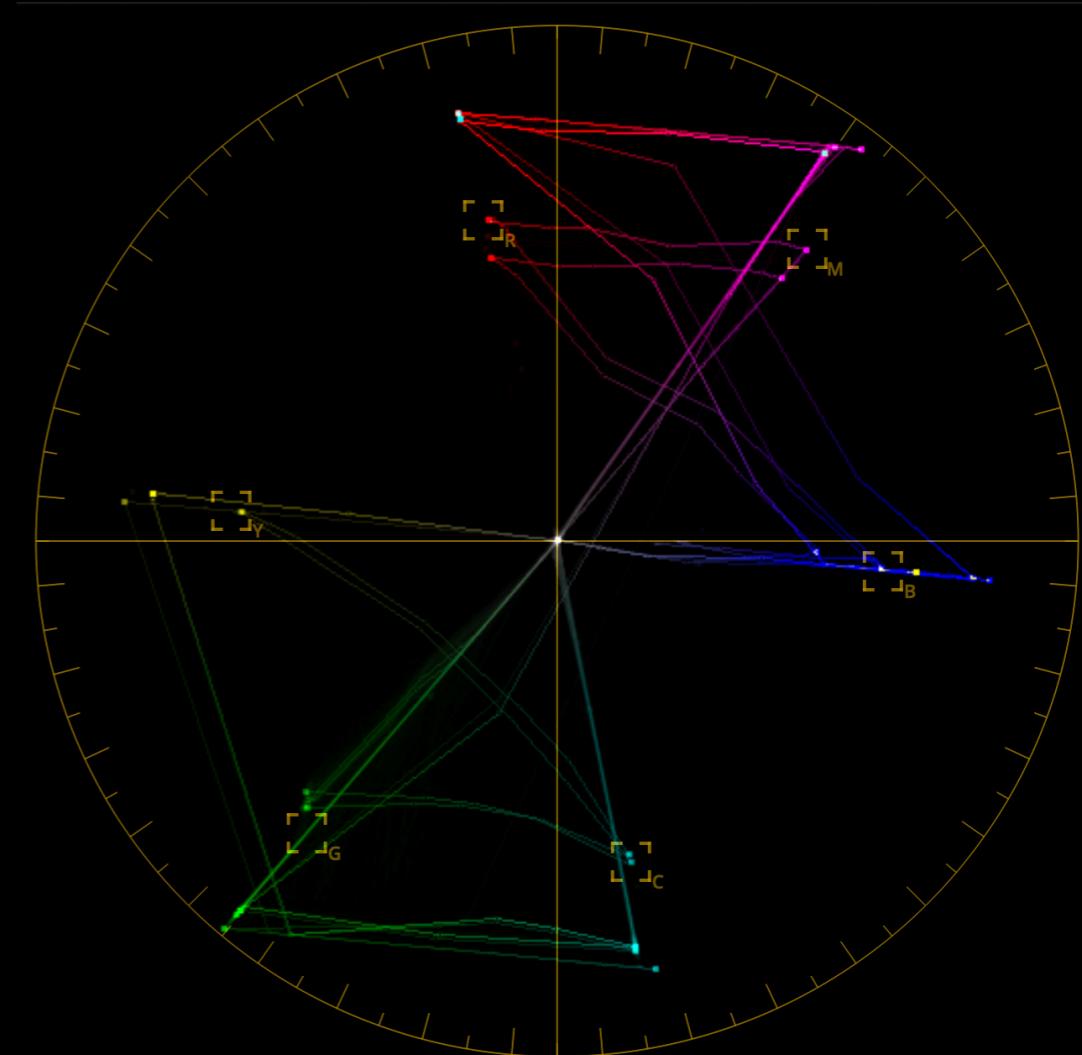


# HLG to SDR Conversion: NBCU - LUT3

HLG 100/75%



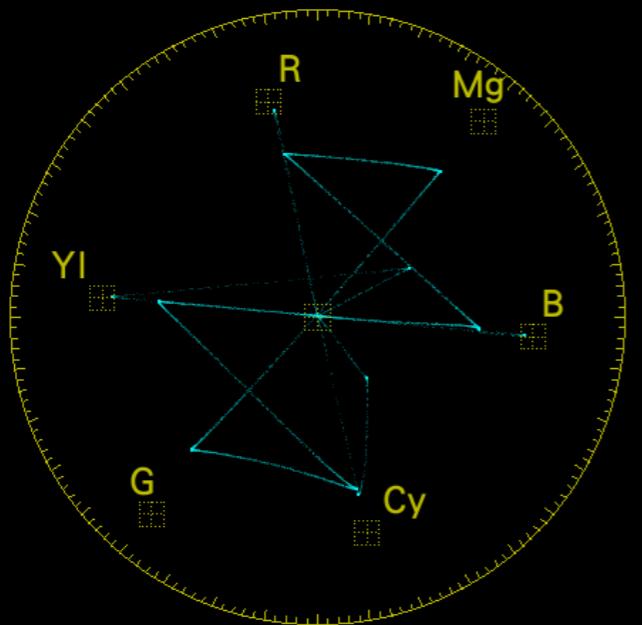
SDR 75%



# Roundtripped SDR -> HLG -> SDR

1920x1080/50I YCbCr(422) 10bit HD

COLORIMETRY  
BT.709



GAIN x1.000

COMPONENT

## STATUS

	Signal	Format	Freq.	Cable	Embedded Audio
A CH	DETECT	1920x1080/50I HD	-8.1ppm	< 10m	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16

## ERROR

SDI	A CH	ANC	A CH
CRC	1	Check Sum	0
TRS Position	1	Parity	0
TRS Code	1		
Illegal Code	1		
Line Number	1		
Embedded Audio	A CH	Video Quality	A CH
BCH	0	Freeze	
Parity	0	Black	
DBN	0	Gamut	
Inhibit	0	Cmp. Gamut	
Audio Sample	1	Level Y	
		Level C	

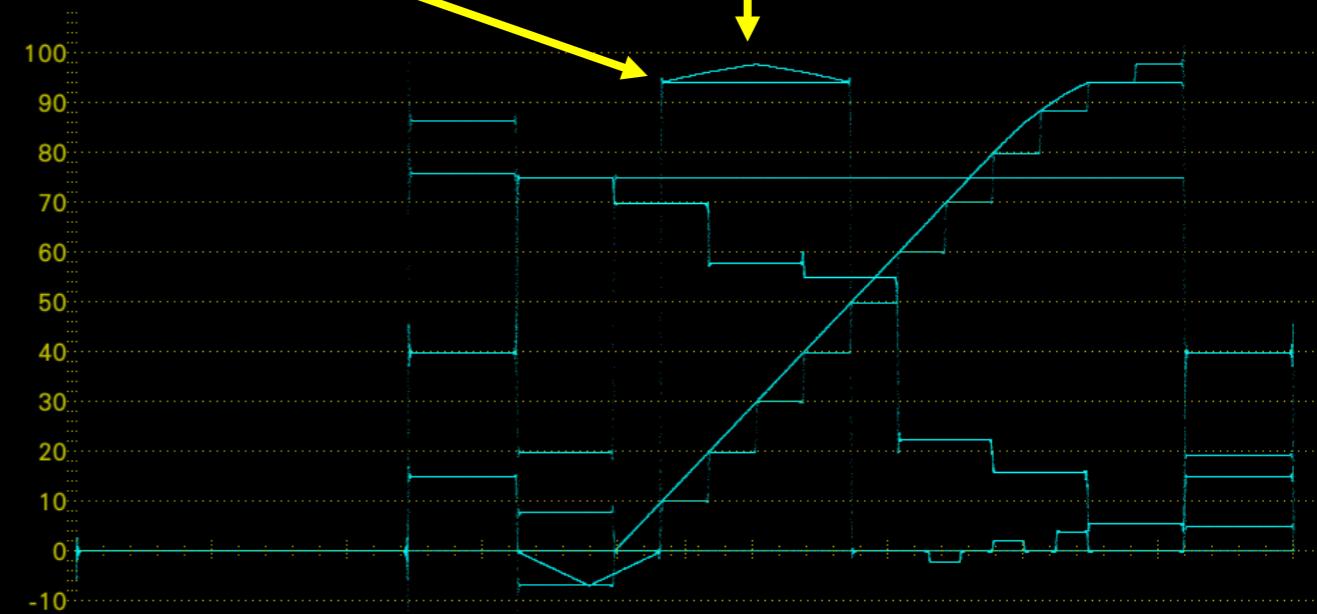
SinceReset 01:14:51

Roundtripped  
Graphics

SDI A

Roundtripped  
Tent  
(Check)

TIME: 08:06:18



# Roundtripped SDR -> HLG -> SDR

There is a slight reduction in level during a round trip which reserves a range for HDR down mapped highlights

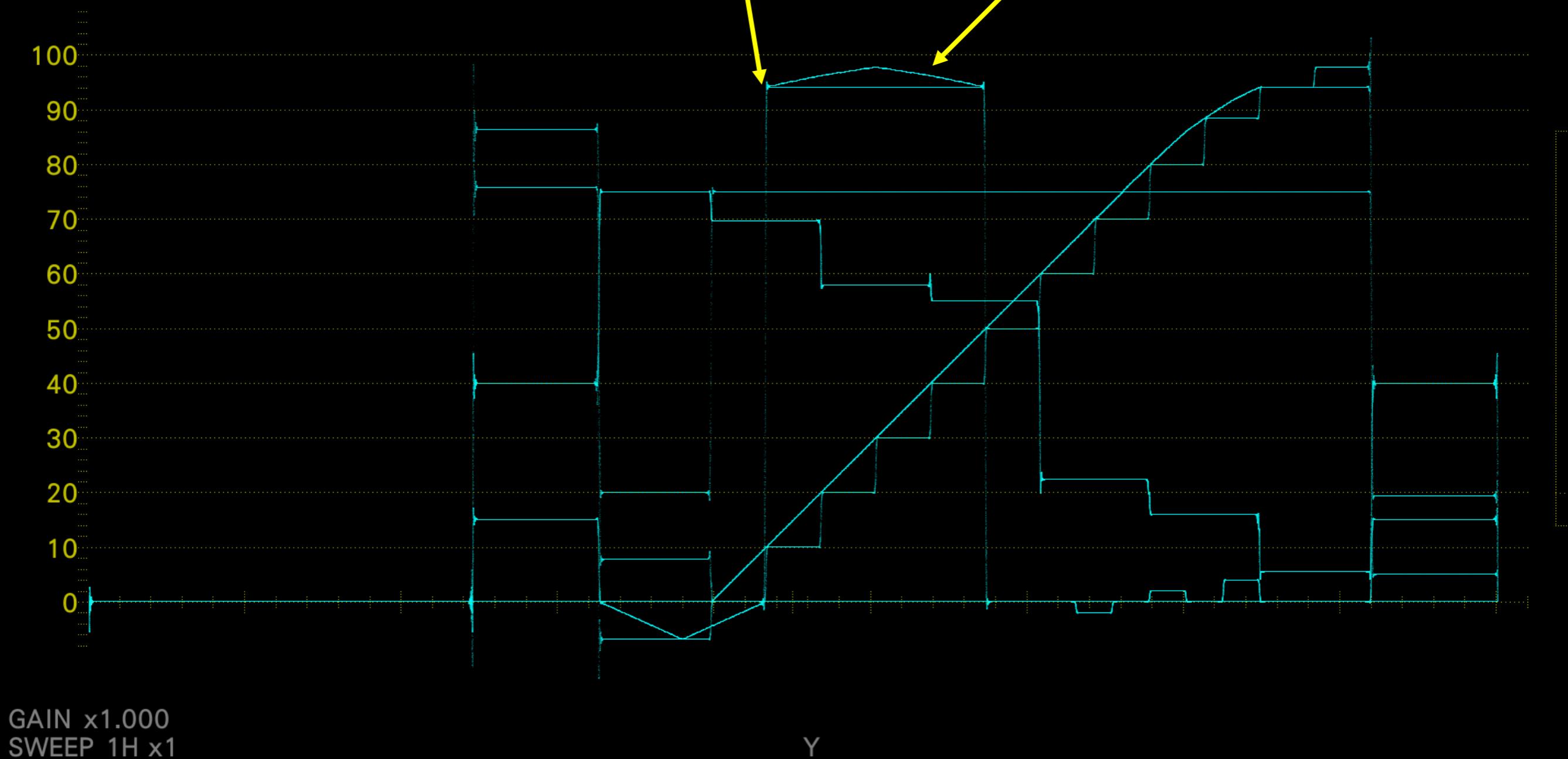
1920x1080/50I YCbCr(422) 10bit HD

Roundtripped  
Graphics White 95%

SDI A

Roundtripped  
Tent (check clipping)

TIME: 08:06:49



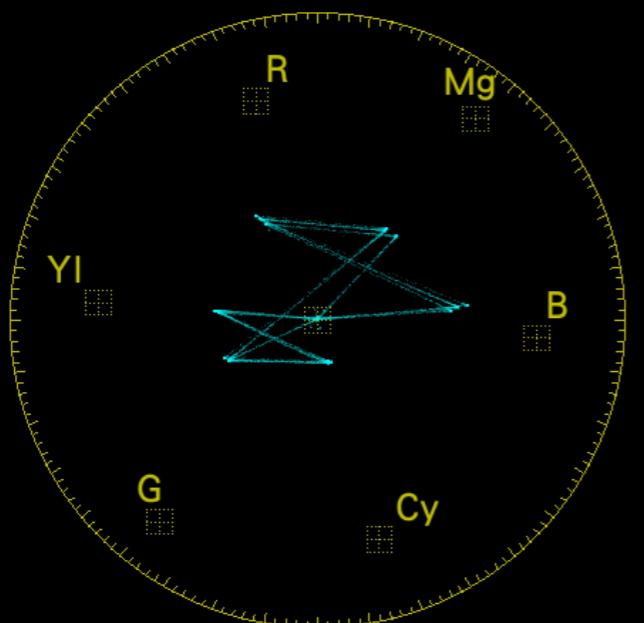
GAIN x1.000  
SWEEP 1H x1

# Roundtripped HLG -> SDR -> HLG

AVOID DOING THIS !!! REFER TO ORIGINAL HLG SOURCE

1920x1080/50P YCbCr(422) 10bit 3G-A

COLORIMETRY  
BT.2020



GAIN x1.000

COMPONENT

STATUS					
	Signal	Format	Freq.	Cable	Embedded Audio
A CH	DETECT	1920x1080/50P 3G-A	-8.1ppm	< 10m	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16

ERROR		
SDI	A CH	ANC
CRC	1	Check Sum
TRS Position	1	Parity
TRS Code	1	
Illegal Code	1	
Line Number	1	
Embedded Audio	A CH	Video Quality
BCH	0	Freeze
Parity	0	Black
DBN	0	Gamut
Inhibit	0	Cmp. Gamut
Audio Sample	1	Level Y
		Level C

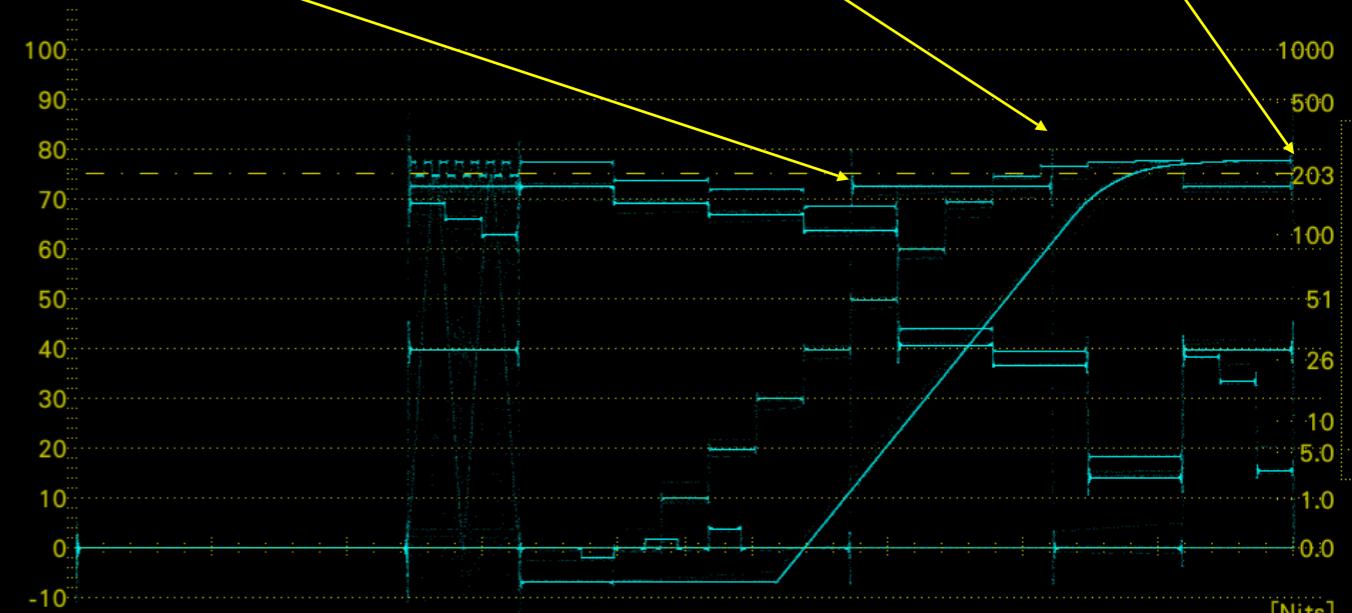
Roundtripped  
Graphics White

SDI A

Roundtripped  
Highlights

Nits

TIME: 08:07:49



GAIN x1.000  
SWEEP 1H x1

SYSTEM GAMMA  
HLG-NARROW[75%]



# Roundtripped HLG -> SDR -> HLG

AVOID DOING THIS !!! REFER TO ORIGINAL HLG SOURCE

