

Towards an HDR-capable ICC PCS

ICC HDR meeting, 30 June 2020

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Slides accompany this paper

Need for HDR

Consumer WCG, HDR films, series, news, sports (BT.2100
PQ, HLG)

Consumer WCG, HDR-ready TVs commonplace

Consumer WCG (P3) laptops, tablets, phones; HDR coming

WCG, HDR still images coming (AVIF)

BT.2100: HLG & PQ

Hybrid Log Gamma

Perceptual Quantizer

- Scene-referred, relative luminance
- Diffuse white at 0.75
- 3.5 stops highlights
- Range of viewing environments (dim to bright)
- “Brighter displays for more luminance”
- Reference display referred, absolute luminance
 - Diffuse white varies (0.54, 0.58, 0.66)?
 - 5.5 stops highlights
 - Dim viewing environment
 - “Brighter displays for more luminance”

Extending or replacing Lab?

Fairchild HDR-Lab extends Lightness to 400

Exaggeration of large Chroma remains

Blue hue non-linearity (curve to purple)

Increasingly complex metrics: $\Delta E76$, $\Delta E_{CMC}(2:1)$ and
 $\Delta E2000$

JazzbZ (Safdar 2017)

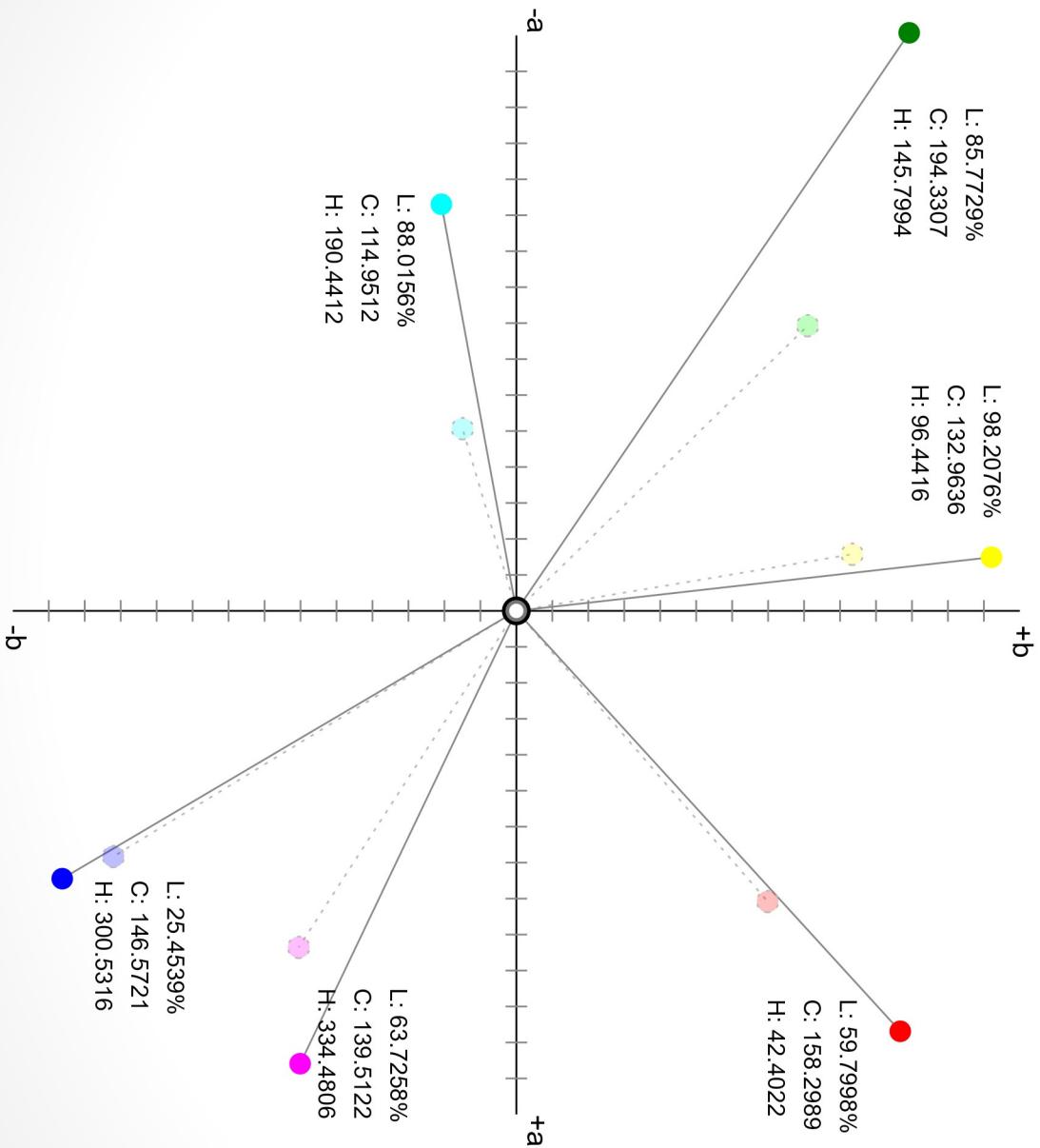
Correction term for blue non-linearity

Starts with absolute D65 XYZ, 0 to 10,000 cd/m²

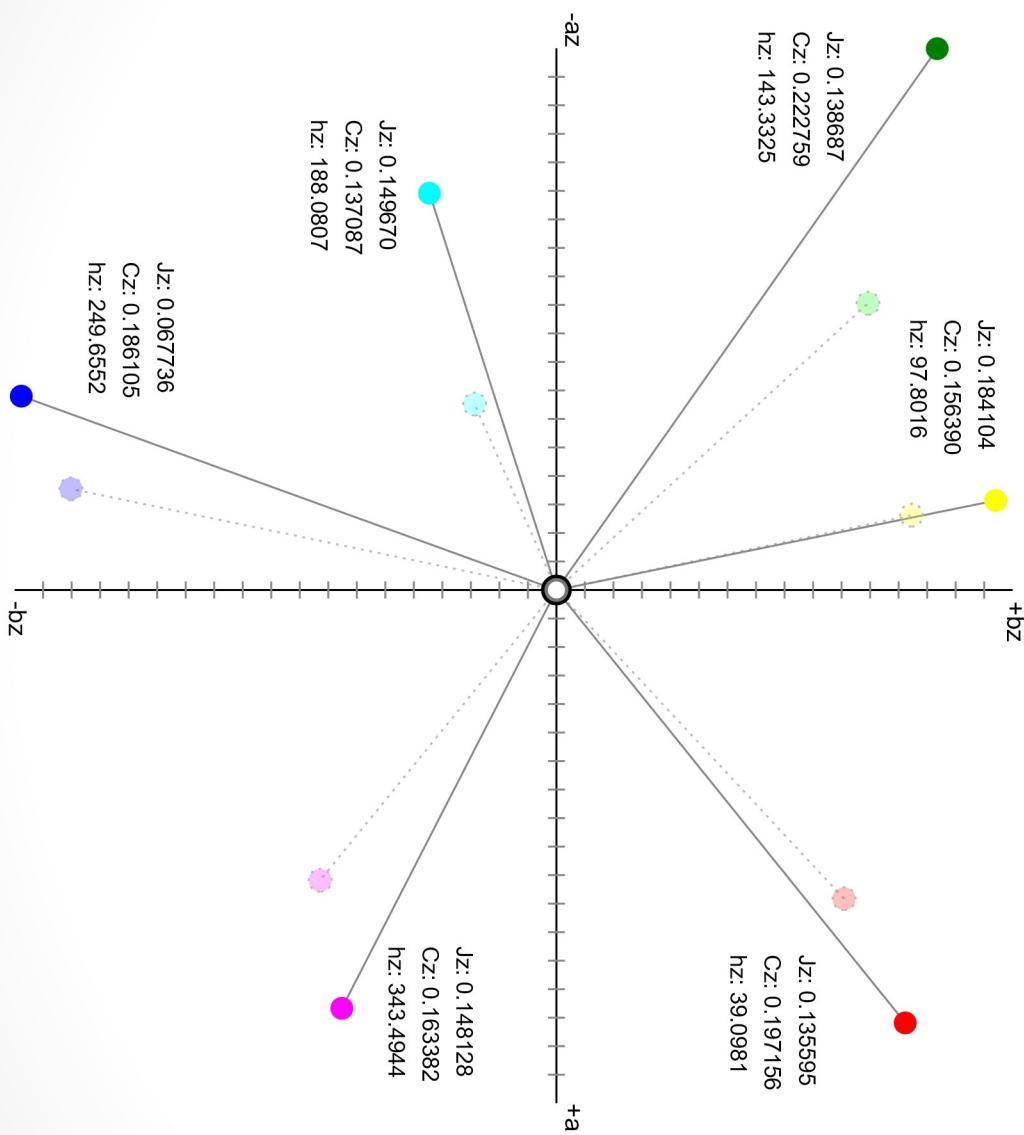
Transform to sharpened LMS domain

BT.2100 PQ transfer function

CIE Lab



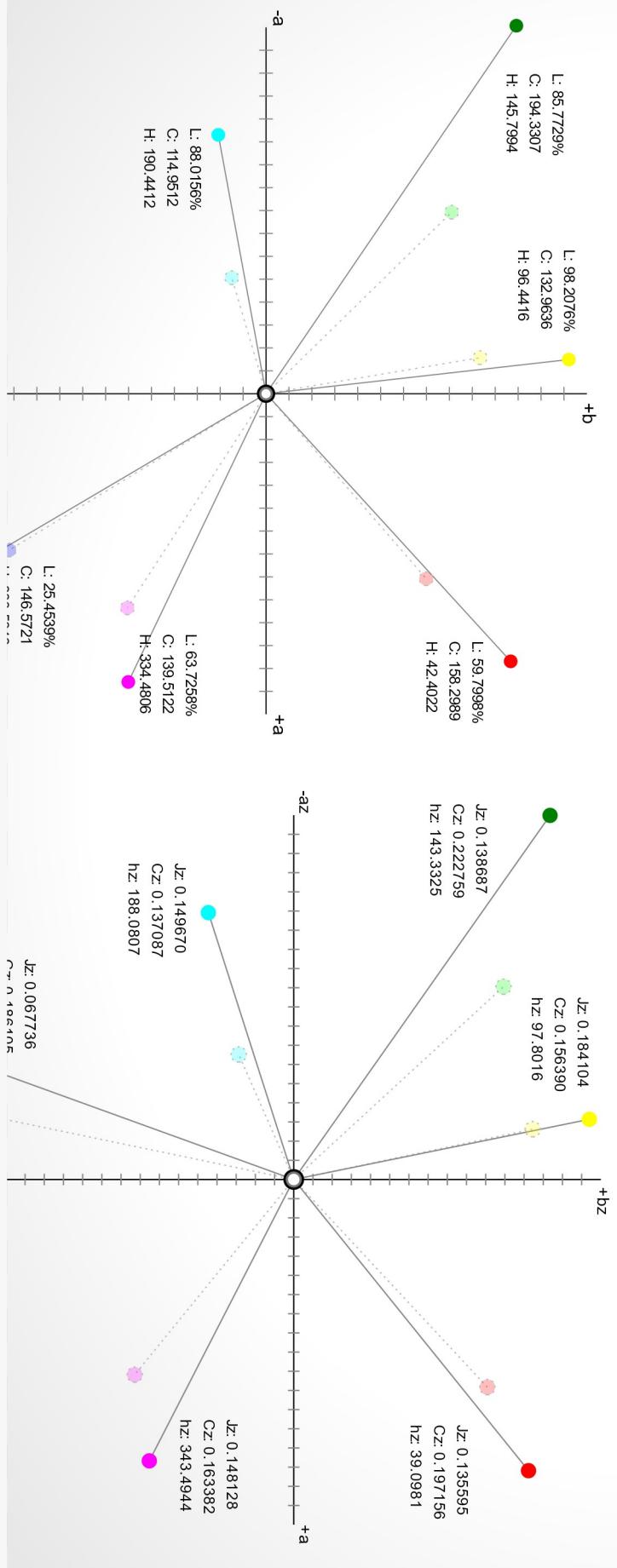
Jzazbz



Comparison

CIE Lab

Jzazz



Delta E Jz

$$\Delta E_{Jz} = \sqrt{(\Delta J_z^2 + \Delta C_z^2 + \Delta H_z^2)}$$

$\Delta H_z = 2 \times \sqrt{(C_z1 \times C_z2) \times \sin(\Delta h)}$, Δh in radians

	lab(73 25 -18)	36.8680	37.9233	27.1492	0.070663	28
lab(61 -5 29)	31.9100	34.4758	22.8977	0.054039	2	
lab(56 -27 -3)	30.2531	38.0618	31.9030	0.054381	2	
lab(58 24 15)	27.4089	33.3342	19.4535	0.048484	15	
.25 lab(84.46	3.1849	1.6364	1.6743	0.007603	3.	
8.88						
96.49)						

Gamut Mapping studies

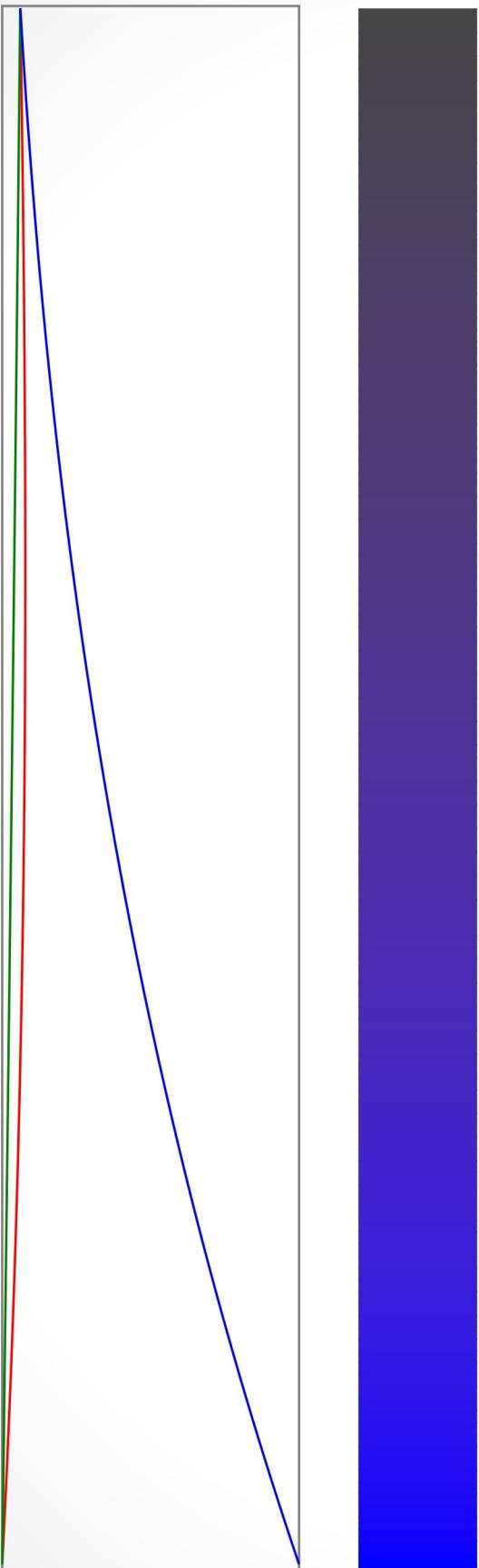
Xu studied CIE Lab, CAM02-UCS & Jzazbz

Six global & two spatial GMA including HPMINDE

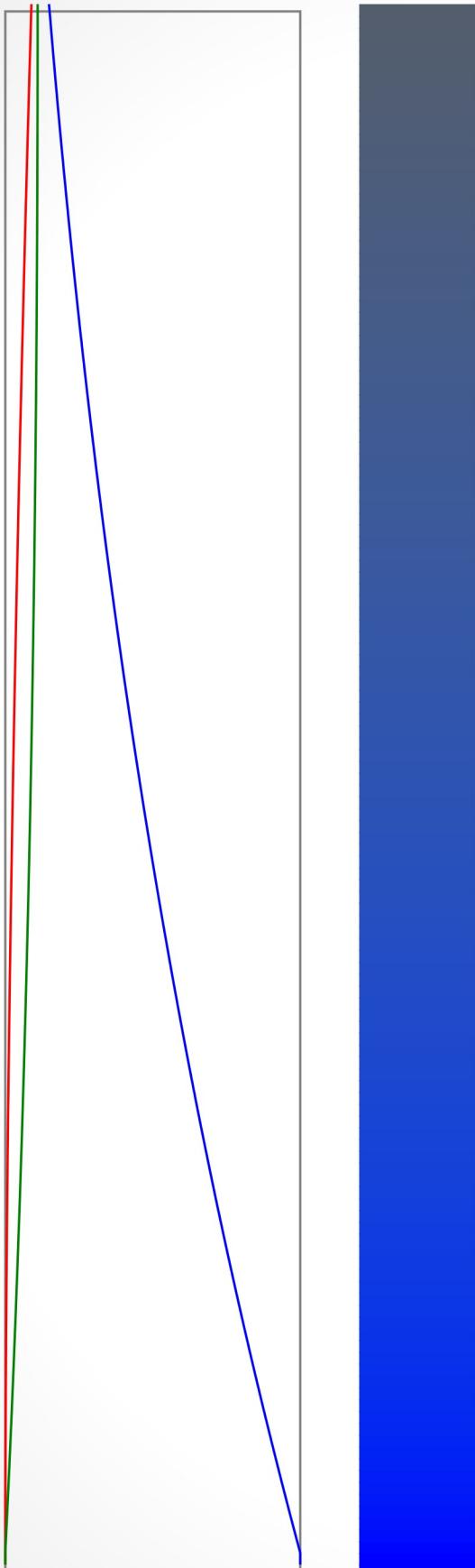
WCG only, not HDR

“Jzazbz is a promising UCS for gamut mapping”

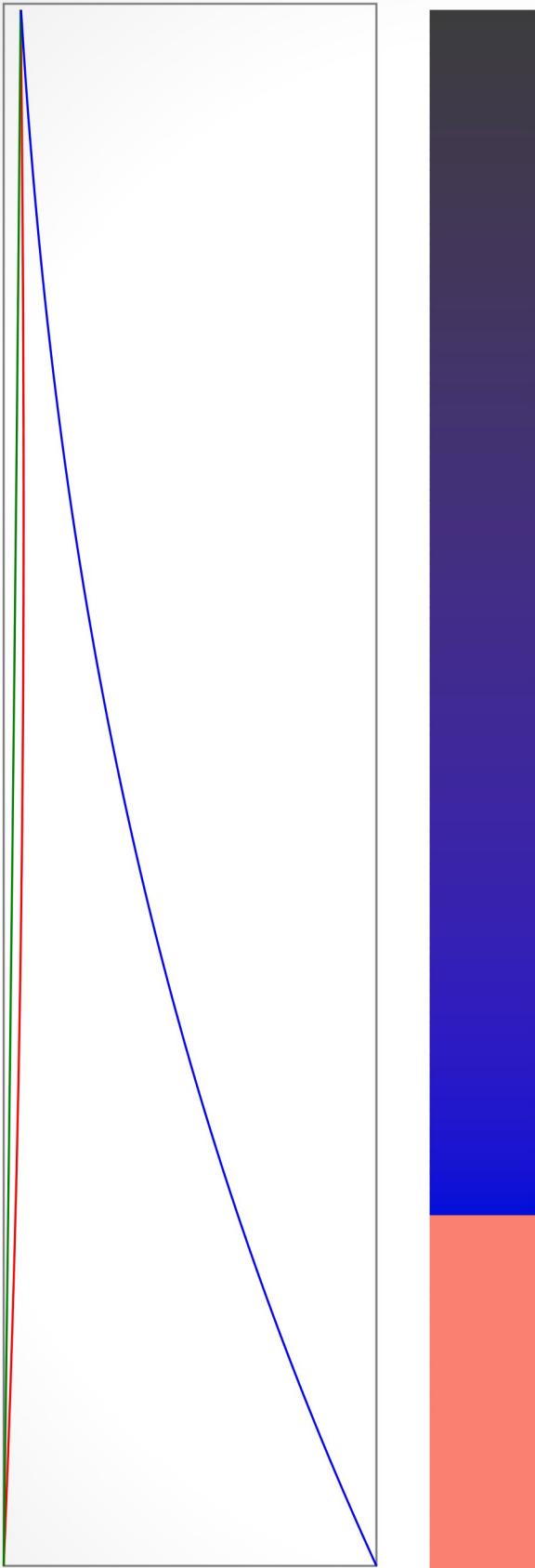
sRGB blue, LCH chroma
reduced



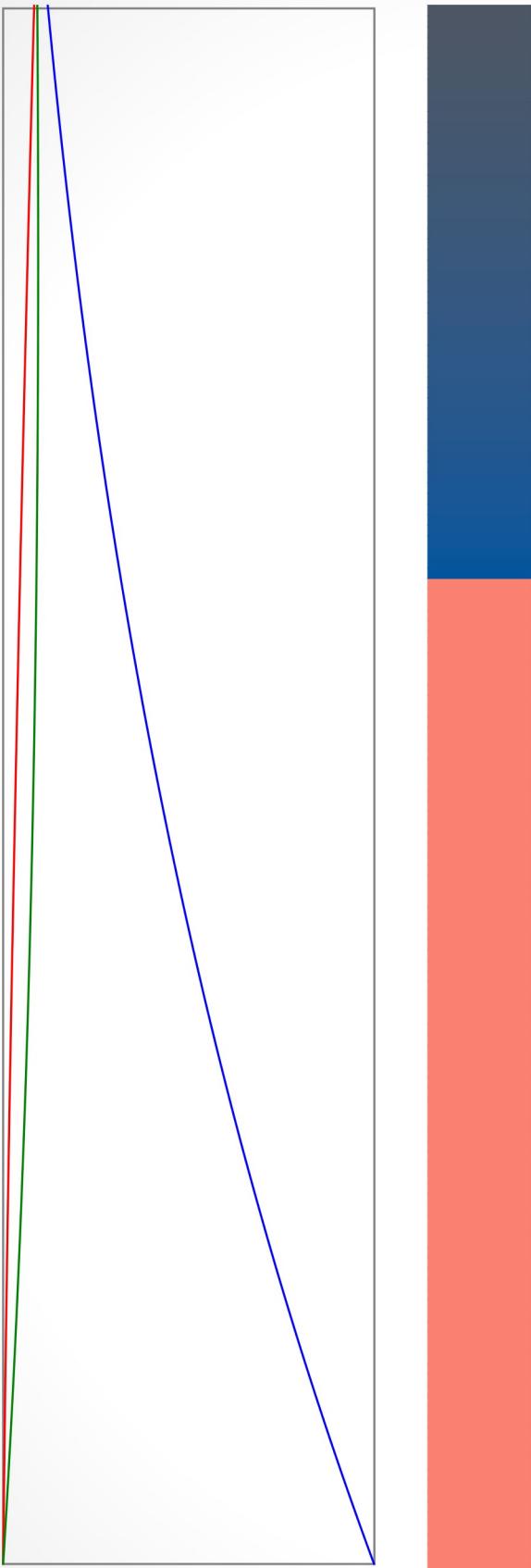
**sRGB blue, JzCzhz chroma
reduced**



**B.T.2020 blue, LCH chroma
reduced**



BT.2020 blue, JzCzhz chroma
reduced



Not my conclusion

Trying to use CIECAM02 within an ICC framework is not as simple as switching from XYZ to CIELAB. It requires careful thought about the goals that one hopes to achieve, careful selection of the CIECAM02 input parameters and management of the expectations. It is not the answer to all the problems and it also produces new problems that have to be dealt with in an appropriate way.

Tentative conclusions

HDR aspect of J_{zazbz} little explored

A UCS with HLG might apply to more viewing conditions,
without re-rendering

Hue linearity of J_{zazbz} needs to be further investigated

The tiny values are awkward for comparison &
communication

Thank you!