BBC Research & Development

W3C WORKSHOP ON WCG AND HDR FOR THE WEB

Hybrid Log-Gamma HDR-
Part 2 - Format Conversion and Compositing

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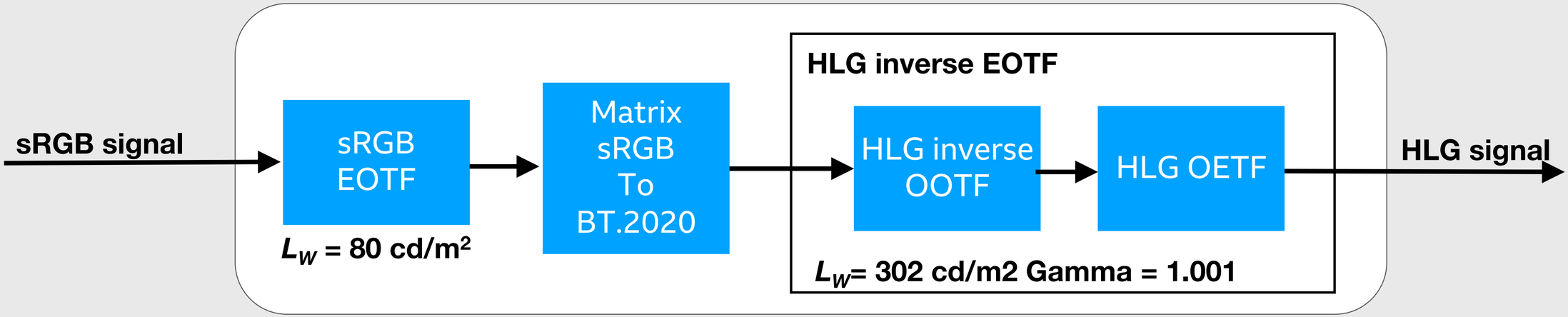
Overview – Part 2

- **Format conversion and compositing**
  - Composition of sRGB into HLG
  - Composition of HLG into sRGB
  - Compatibility with SDR displays
- **Summary**

- Part 1, Mixed display and viewing environments

Relative light allows easy “direct-mapping” of sRGB into HLG for compositing



- sRGB nominal peak white = 80 cd/m²
- HDR Reference White = 75% HLG signal (ITU-R BT.2408)
  - **sRGB nominal peak white => HDR Reference White**

➢ HLG EOTF^{-1} L_W chosen so that 80 cd/m² > 75% HLG

➢ **L_W= 302 cd/m² Gamma = 1.001**

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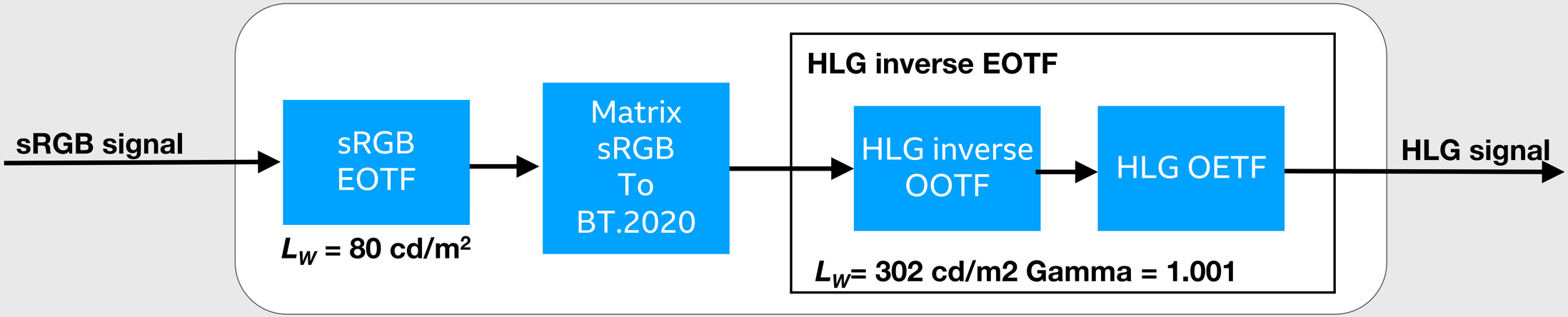

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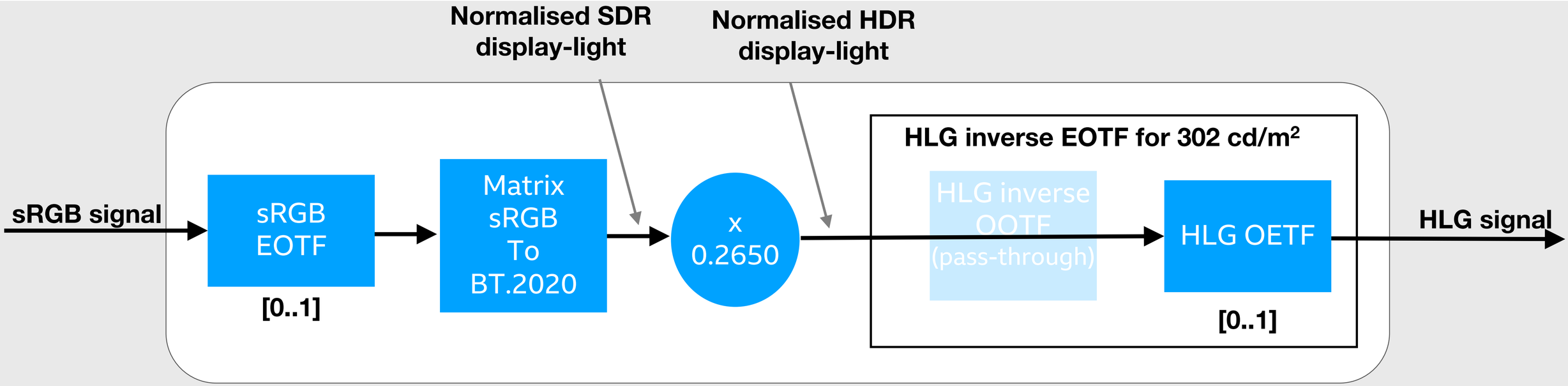
TABLE 1

Nominal levels for PQ and HLG production

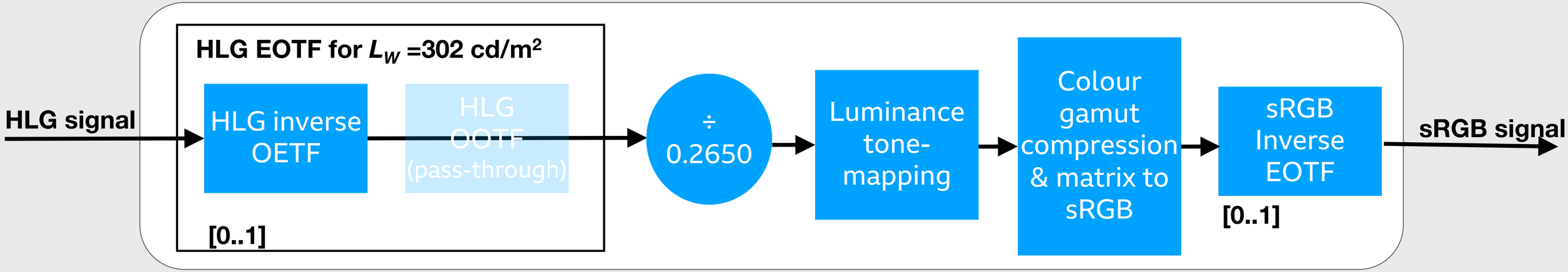
Reflectance object or reference (luminance factor, %)[3]	Nominal luminance, cd/m² (for a PQ reference display, or a 1 000 cd/m² HLG display)	Nominal signal level	
		%PQ	%HLG
Grey Card (18%)	26	38	38
Greyscale Chart Max (83%)	162	56	71
Greyscale Chart Max (90%)	179	57	73
Reference Level: HDR Reference White (100%) also diffuse white and Graphics White	203	58	75

In practice requires 2x 1D-LUT and a multiplier



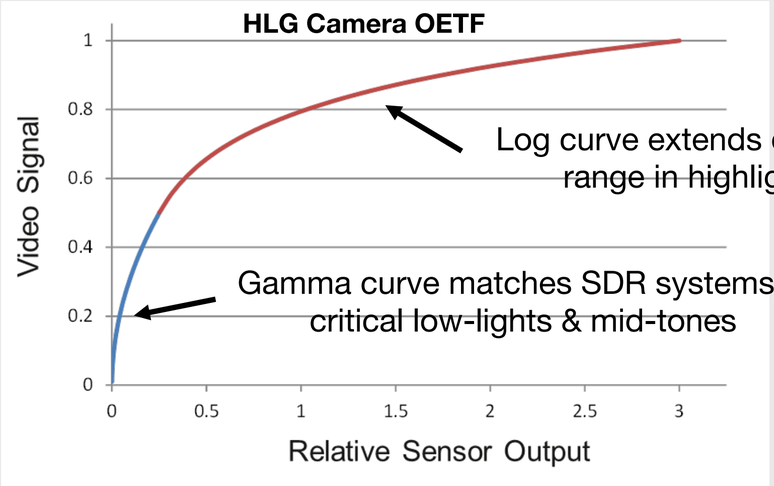
- As OOTF gamma ~1.0, inverse OOTF has no effect and becomes a “pass-through”
- Figure shows normalised signals [0..1], hence additional SDR > HDR scaling

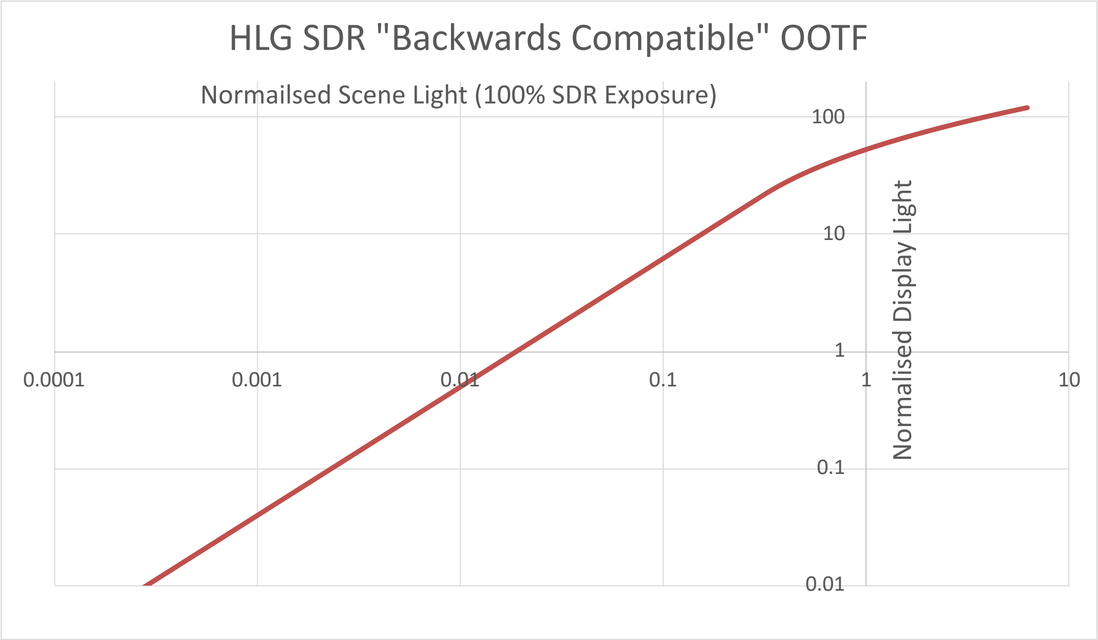
Example of high quality HLG to sRGB “down-mapper”



- “MaxRGB” based tone-mapping of luminance avoids hue shifts and ensures output within maximum signal range
  - Very bright colours may appear too saturated after conversion
- Colour gamut compression could be a simple clip of negative RGB values or more complex desaturation
  - Clipping may cause deep blues to look slightly purple
- ***Simpler approaches possible with HLG, exploiting its backwards compatibility with SDR displays***

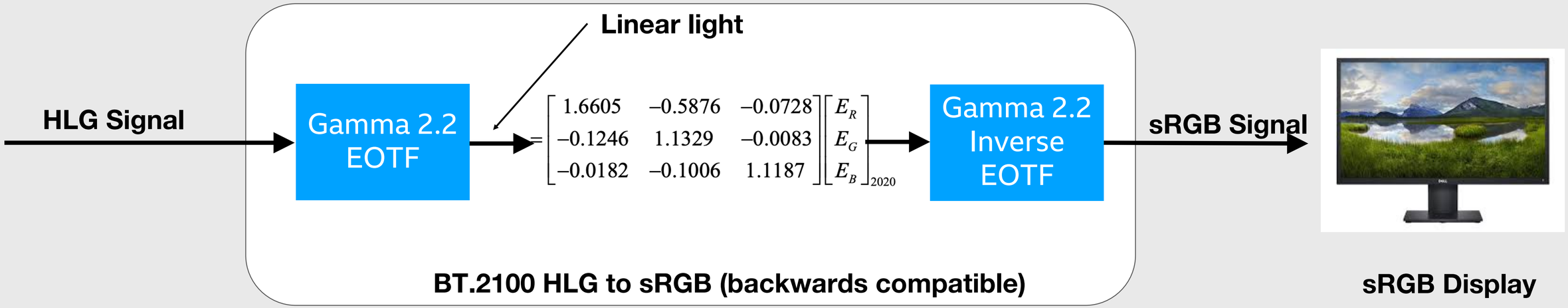
HLG's "backwards" compatibility may deliver all that's needed for an SDR display





- **Delivers a compatible image on SDR BT.2020 displays**
  - Best image on gamma = 2.2 CE displays
- **Achieved through "camera" OETF- similar to SDR Camera Curve With a "Knee"**

Simple colour conversion (with gamut clipping) for displays with other primaries



- Conversion should be performed in linear light
- Matrix coefficients to match display primaries (BT.709 shown)
- Less gamut clipping on wider (e.g. DCI-P3) displays
  - See ITU-R reports BT.2047 & BT.2390

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Summary – Part 2

- HLG’s basis of relative scene-light allows easy conversions to/from sRGB and BT.709
- Colour volume reduction can be as simple or complex as application requires
- HLG’s backwards compatibility, combined with any necessary colour conversion, delivers high quality SDR on a wide range of displays

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www.bbc.co.uk/rd/projects/high-dynamic-range