



New in ICC

HDR content management

Luke Wallis - ICC Experts Day - 21st September 2026 - Gjøvik, Norway

History Line

2019:

- Dolby and BBC give a presentation on PQ and HLG video to ICC
- Lars Borg creates the first "HDR" PQ and HLG ICC profiles
- ICC HDR Working Group is created. Charter: To promote the use of ICC color management in High Dynamic Range (HDR) imaging

2020:

- Coding-independent code points (CICP) tag proposal
- ISO TC-42 Technical Specification 22028-5 (HDR metadata)

2021:

- CICP tag is approved

2022

- ISO TC-42 Technical Specification 21496-1 (Gain Maps): image-specific tone mapping, a concept of headroom

2023

- Apple demonstrates to ICC an image-specific Adaptive Gain Curve based on the image Gain Map
- Apple and Google join forces to propose the same idea to SMPTE for HDR video management

2025

- ISO 22028-5 Metadata added to ICC Metadata Registry
- SMPTE initiates the "Dynamic Metadata System for Color Volume Transform" project, labeled ST 2094-50, developed through a partnership between Apple, Google, and NBCUniversal.
- ICC Adaptive Gain Curve tag is approved, but held back from publication pending compatibility with the in-development SMPTE ST 2094-50

2026

- SMPTE ST 2094-50 published
- Headroom Adaptive Gain Curve (HAGC) ICC tag proposed, supersedes the Adaptive Gain Curve tag (awaiting ballot)
- HDR Profile definition (awaiting ballot)
- CICP tag amendment (awaiting ballot)

Headroom Adaptive Gain Curve recap

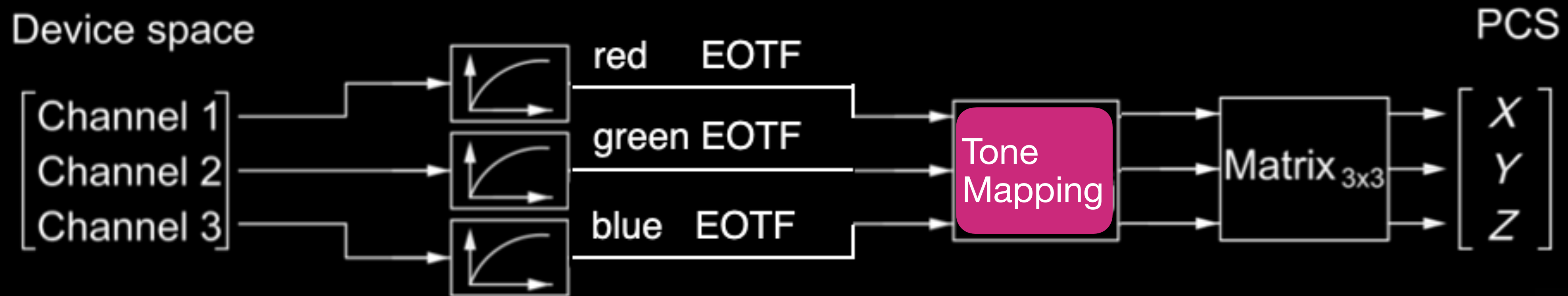
- Gain-based global tone-mapping curve, adaptive to target headroom
- Gives the image creator the ability to predict how the image will be reproduced
- Encodes SMPTE ST 2094-50 dynamic metadata
- Up to four alternate gain curve functions per tag
- Supports HDR→SDR, SDR→HDR, and HDR→HDR tone mapping
- Supersedes the April 2025 ADGC tag, realigned to the revised SMPTE spec

HDR Profile Definition

- Need for an unambiguous definition in the ICC specification
- An HDR profile could be:
 - HDR content (image) characterization
 - HDR device (display, camera) characterization
- Focus:
 - HDR content characterization + tone mapping prediction (HAGC)
 - Clearly defined processing model
- PCSXYZ clarification
 - Currently scattered information about PCSXYZ causes confusion about its ability to carry an HDR signal

HDR Profile Definition (2 of 5)

- Sub-class of ColorSpace profiles
- New processing model (similar to TRC/Matrix model)



*HDR EOTF → display-linear RGB → **tone mapping** (headroom-adapted) → color matrix → PCSXYZ*

HDR Profile Definition (3 of 5)

What's new required vs. new optional for HDR

Status	Tag(s)
Mandatory	<code>cicpTag</code> (TransferCharacteristics = PQ, HLG, or Linear only) — the only source of transfer function and primaries a ColorSpace profile can carry
Mandatory	<code>AToB0Tag</code> + <code>BToA0Tag</code> — required of every ColorSpace profile — here constrained to carry HDR→SDR and SDR→HDR fallback rendering
Optional	Headroom Adaptive Gain Curve (HAGC) tag — HDR image metadata (bit-by-bit compatible with SMPTE ST 2094-50 metadata) — carries tone-mapping intended by creator

HDR Profile Definition (4 of 5)

Why ColorSpace, not just Display or Input class?

- Yes, many Display profiles (e.g. sRGB) are used to define content but don't carry image-specific metadata, and can still be used as a substitute for a true device profile
- A ColorSpace profile never defines redTRCTag/greenTRCTag/blueTRCTag or matrix column tags — so there is nothing for cicpTag to disagree with
- This also draws the scope line on purpose: an HDR content profile (an encoding), not an HDR display profile (a measured device) — display characterization stays out of scope, for future work

HDR Profile Definition (5 of 5)

What is required about AToB0Tag and BToA0Tag?

- Essential to provide backward compatibility for non-HDR-aware CMMs
 - AToB0Tag provides tone mapping from HDR → SDR
 - BToA0Tag provides tone mapping from SDR → HDR
- More on that later ...

CICP Tag Amendment

Self-contained extension to carry custom primaries

- `cicpTag.ColourPrimaries = 2` ("Unspecified/determined by the application")
 - no defined recovery mechanism in ICC.1:2022
- Current proposal: `ColourPrimaries = 2` may carry the primaries directly — 8 `s15Fixed16Number` values (R/G/B/white chromaticities) embedded in `cicpType` itself, mirrors HAGC's own custom-primaries mechanism
- Extension to permit `cicpTag` in the HDR ColorSpace sub-class

Questions?