



Dolby Vision

Overview of Key Features & Workflows

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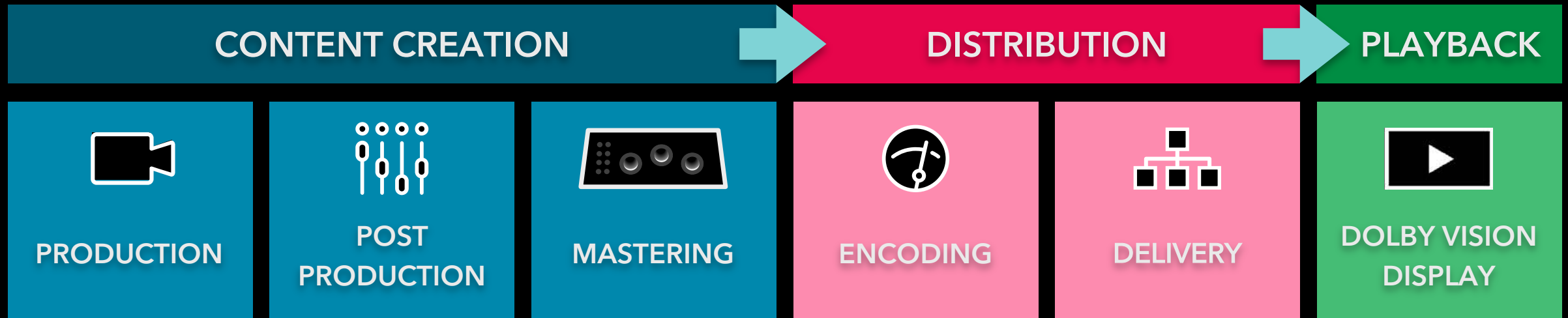
SAN FRANCISCO, CA

Introduction

- Dolby developed PQ as efficient signal non-linearity for HDR applications
- PQ is now a foundation of HDR imaging
- Dolby Vision uses PQ, but goes far beyond
- It is an **imaging ecosystem** designed to capture, produce, deliver and display consistent image quality from start to end



Dolby Vision End-to-End Ecosystem



INTRODUCTION

2022



Selected AV partnerships

Studios



Create



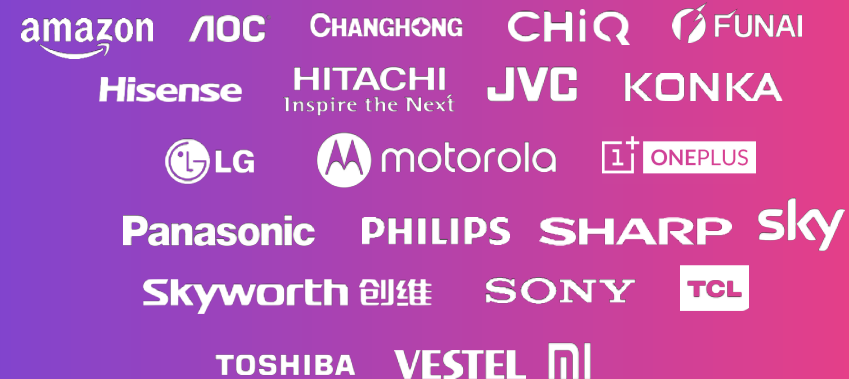
Operators & Broadcasters



Distribute



TVs



Experience

Retail DMAs



SOCs

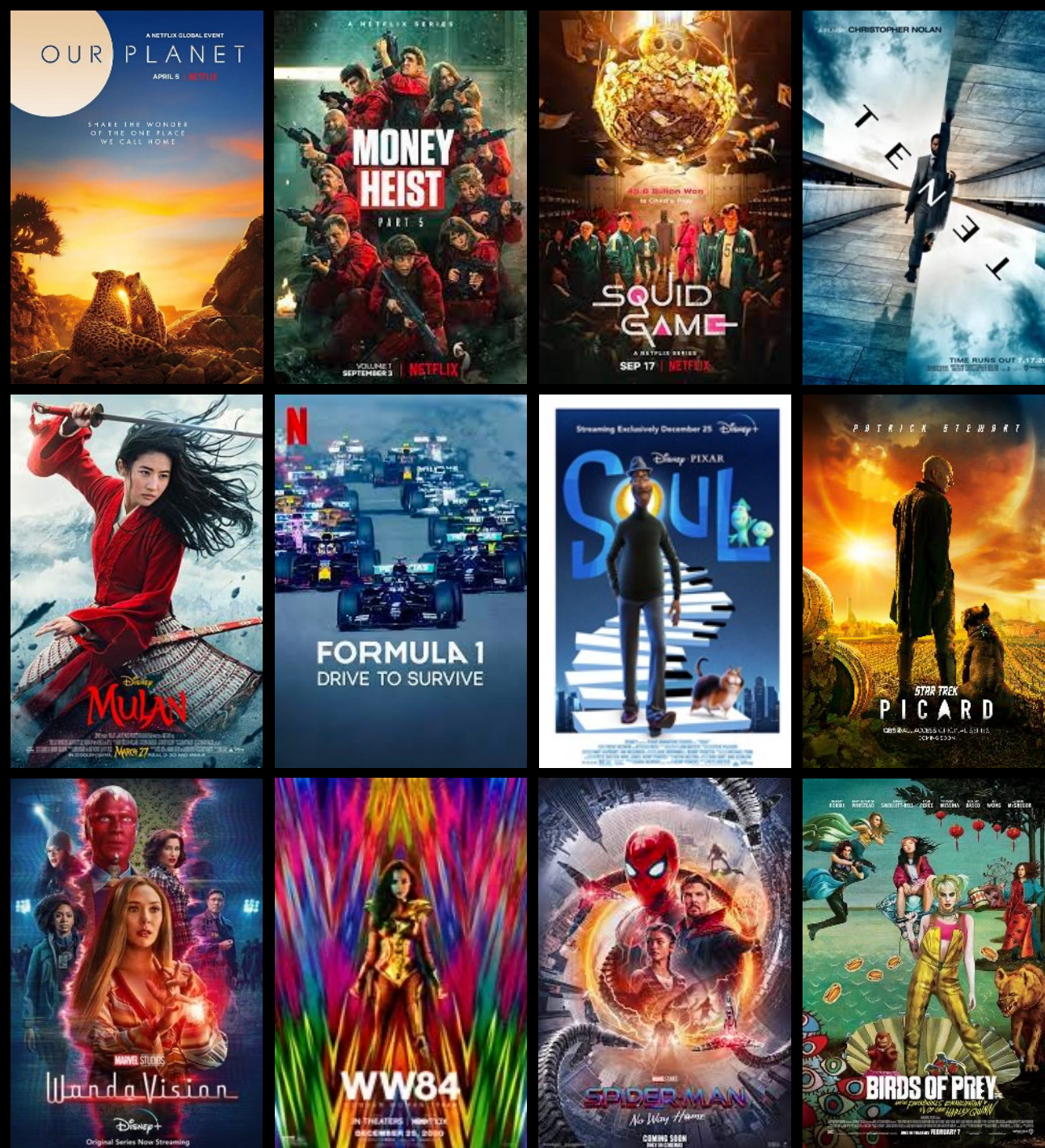


Service Provider STBs



Games





Dolby Vision

410+ Theatrical features
 1,560+ Movies
 6,260+ TV episodes

Overview

1. **Key features introduced by Dolby Vision**
and their benefits to image fidelity
2. How are these features facilitated through
Dolby Vision tools & workflows

Key Features

1. Comprehensive Ecosystem

- **Tools:** Provide tools, SDKs and APIs to support the whole imaging pipeline
- **Synchronized feature support:** From capture via production and deployment to display

2. Dynamic Metadata

- **Frame level accuracy:** Guide color transformations based on content, not container
- **Metadata Levels:** facilitate extensive set of features related to mapping, interoperability, efficiency and calibration
- **Trim Passes:** Enable creative input guiding content appearance for varying display capabilities

3. Dedicated Content Mapping Engine

- **Color Volume Mapping:** Reduce color volume to fit target display w/o introduction of artifacts
- **Effective Use of Metadata:** Factor in source content metadata as well target display properties
- **Automatic Ambient Light Compensation:** Optimize content appearance including viewing environment
- **Creative Intent Preservation:** Retain intent independent of display capabilities

A large, vibrant fire explosion is shown on a television screen. The fire is bright orange and yellow, with a lot of detail in the flames. In the bottom left corner of the screen, a person's head is visible, looking up at the fire. The background is dark, making the fire stand out. The text "1. DOLBY VISION FEATURES" is overlaid on the bottom right of the screen.

1. DOLBY VISION FEATURES

Display Color Volume

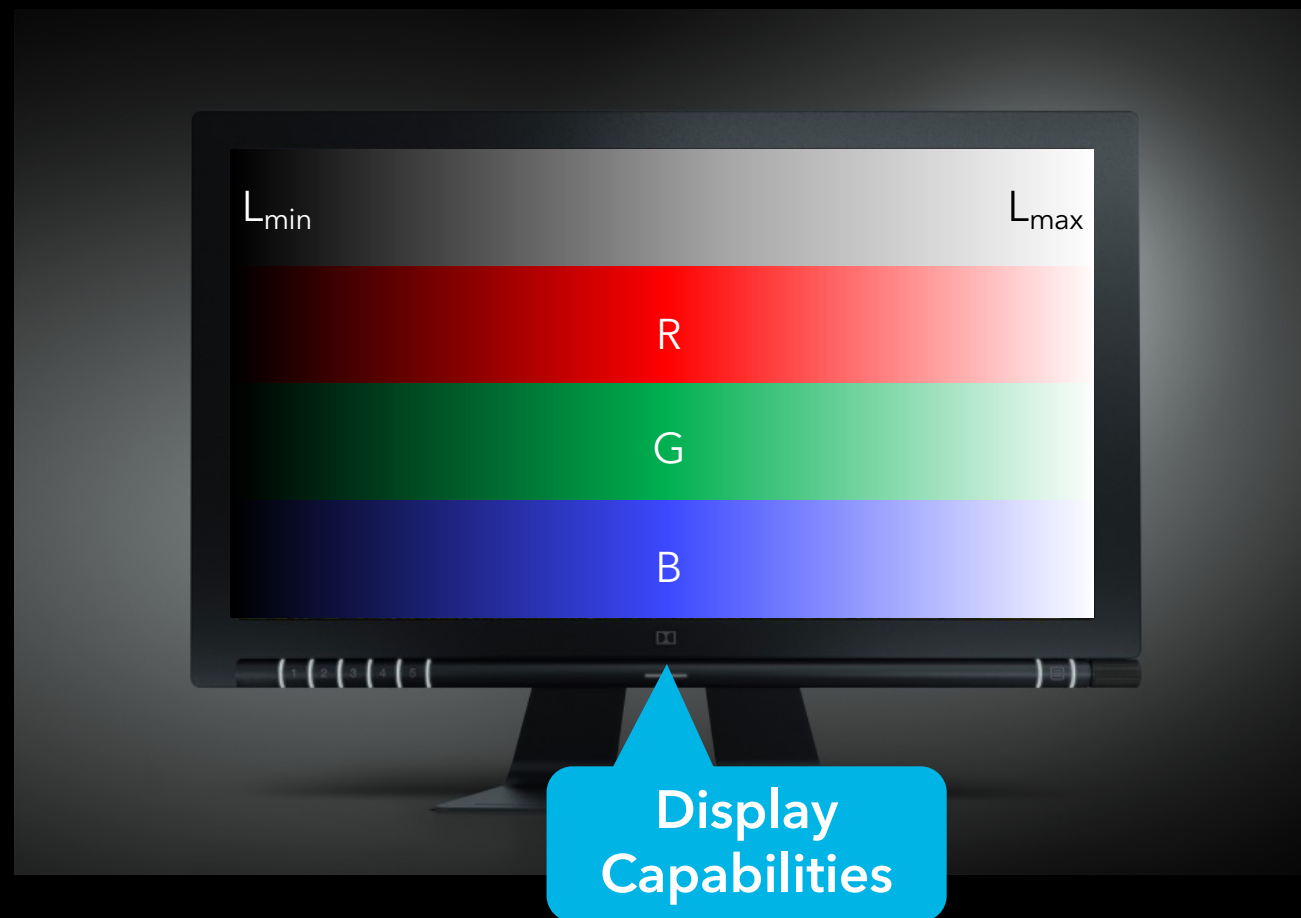
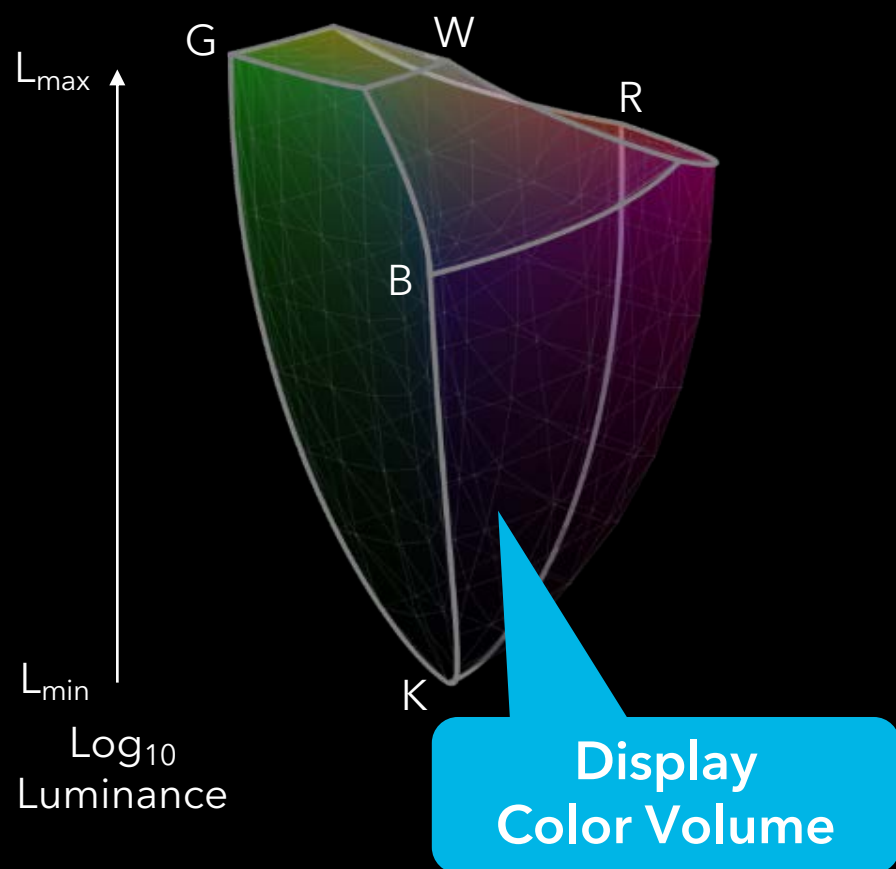
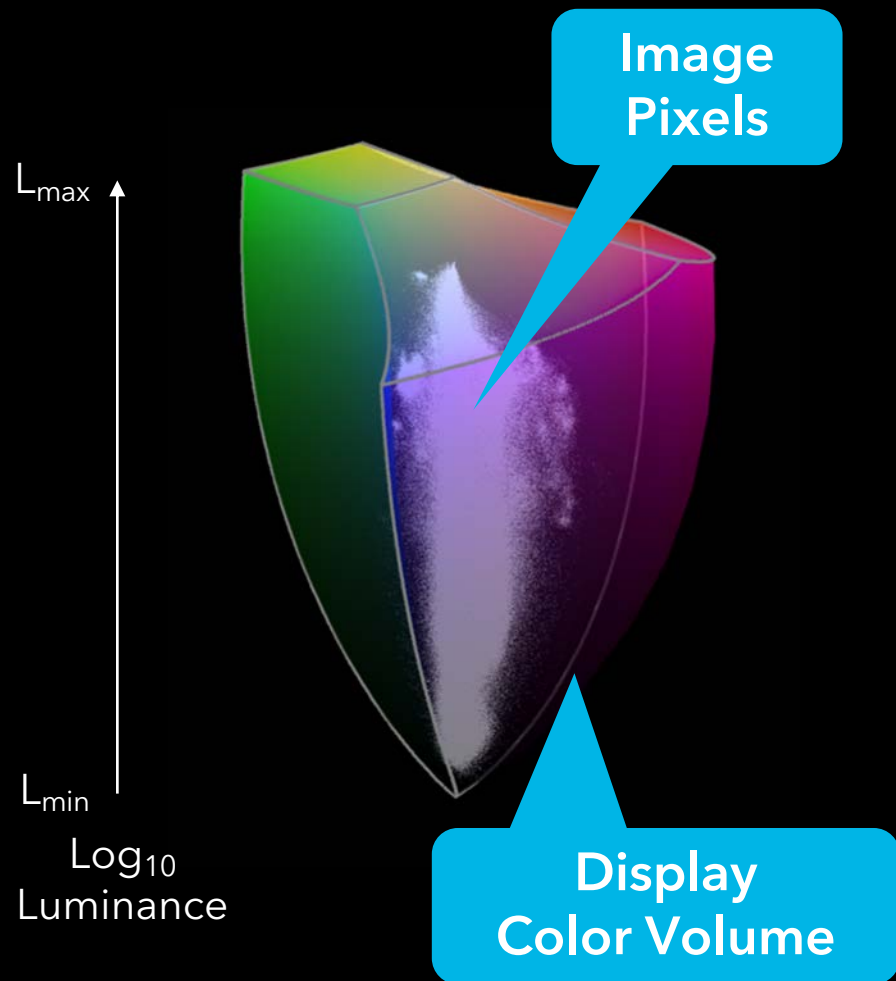
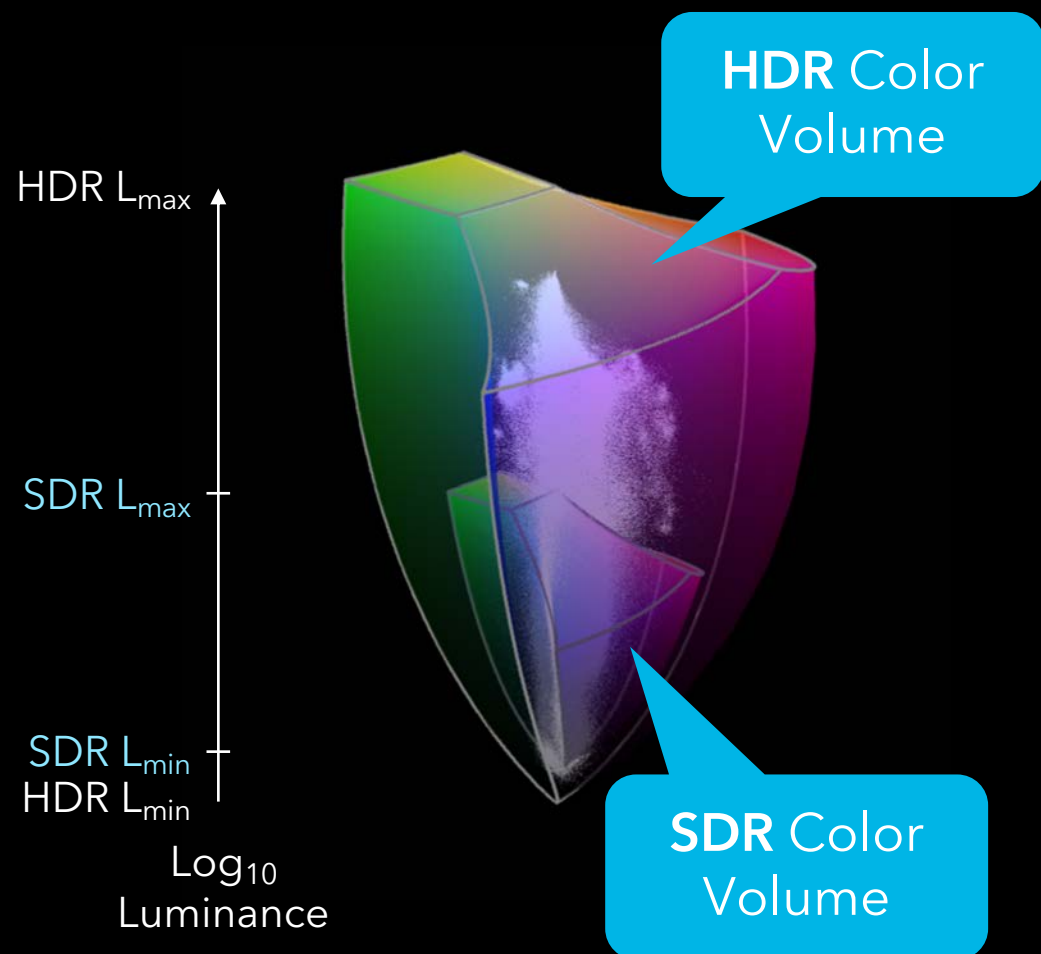


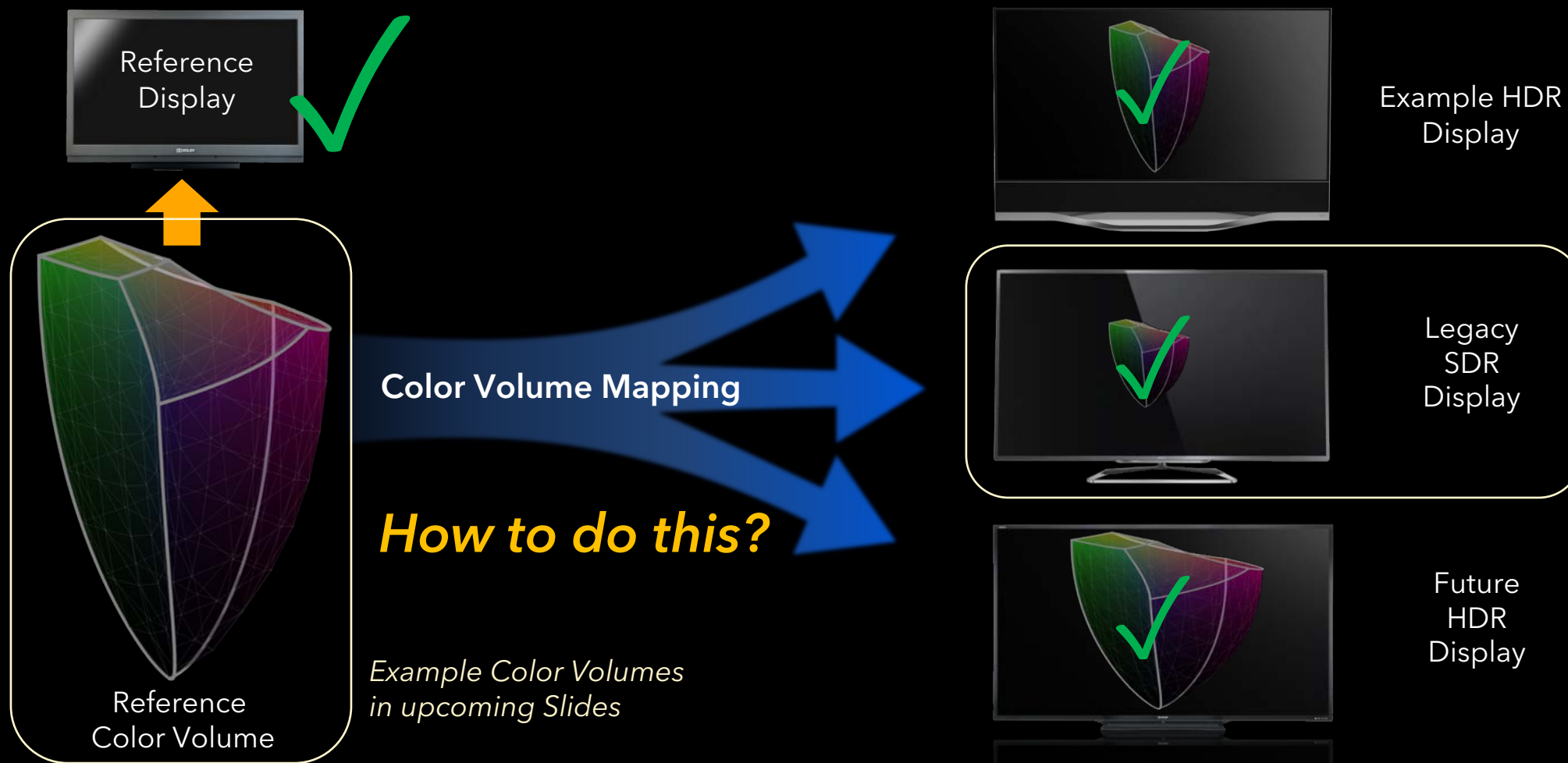
Image Pixels



HDR & SDR Color Volumes

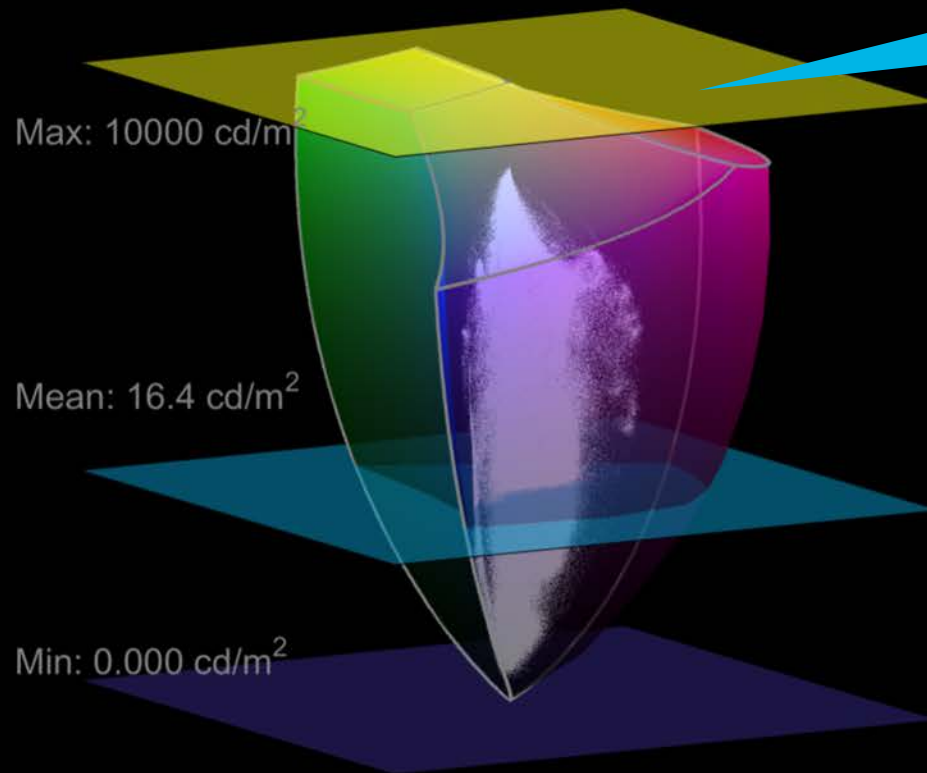


The Challenge: Delivering the Potential

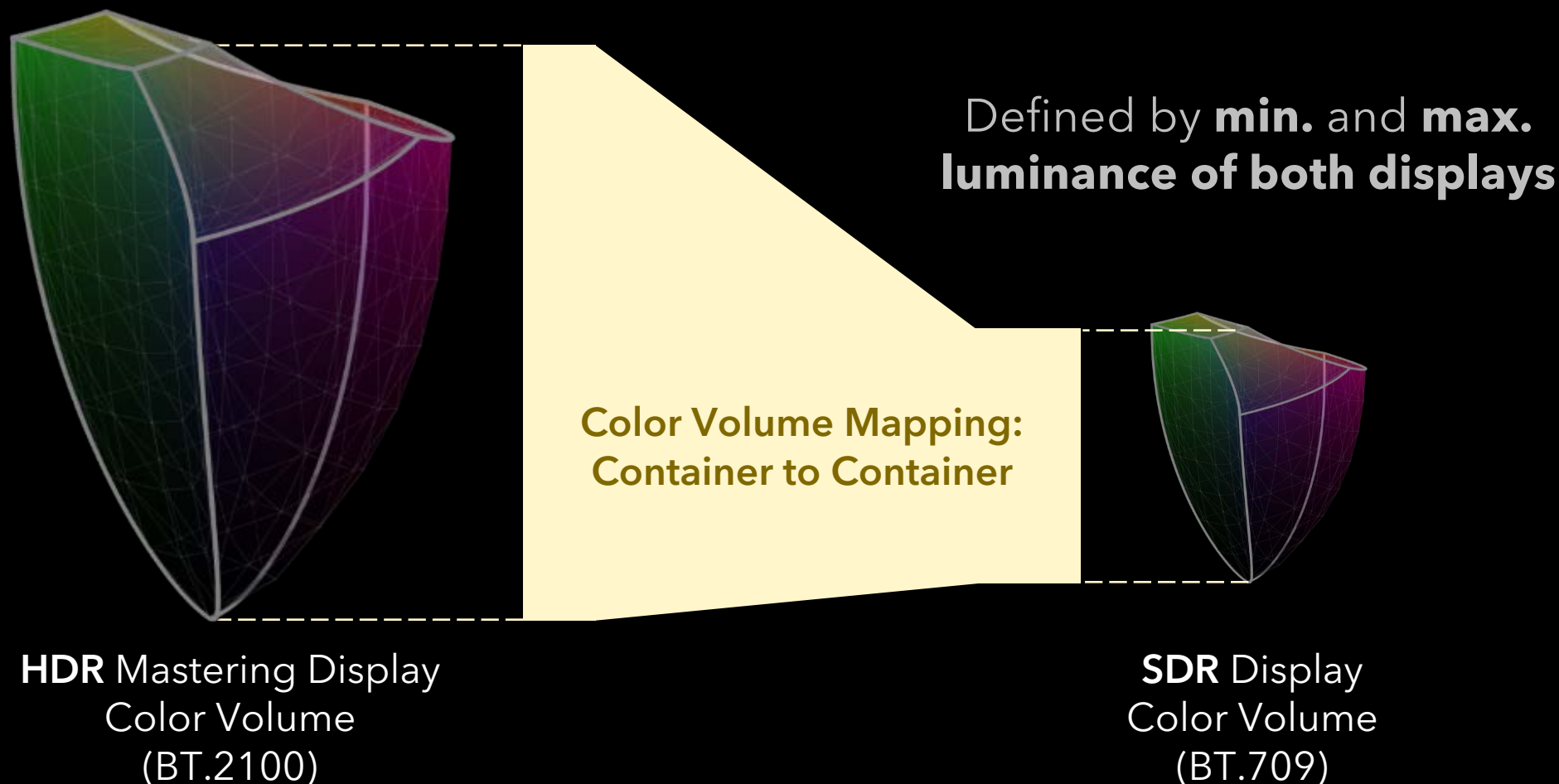


Option 1: Static Container Mapping (via Static Metadata)

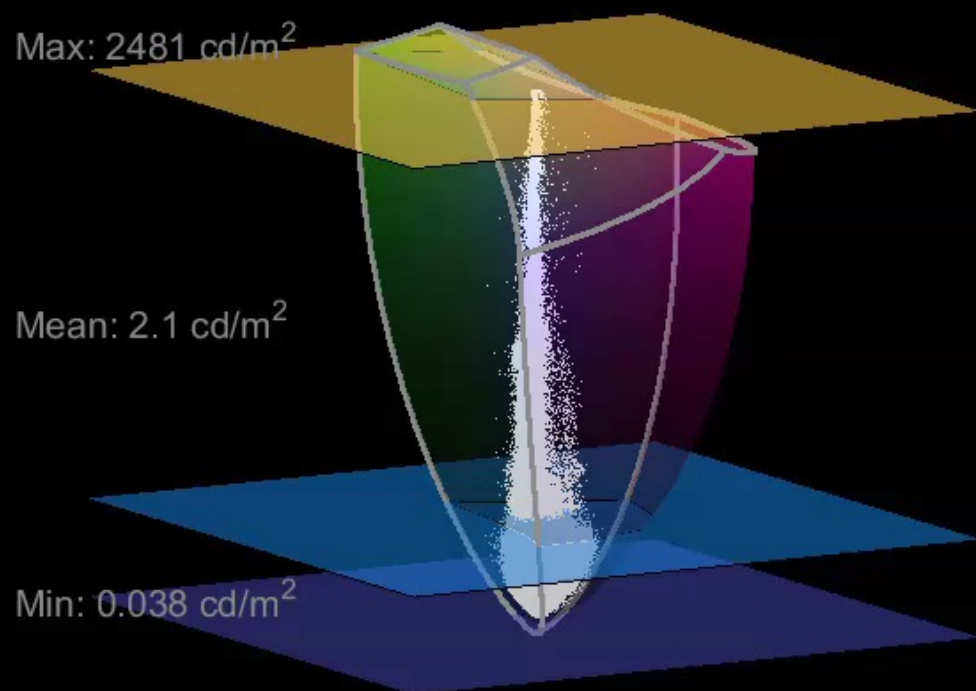
Maps mastering color volume **container** to single ('global') rendering color volume **container**



Option 1: Static Container Mapping (via Static Metadata)



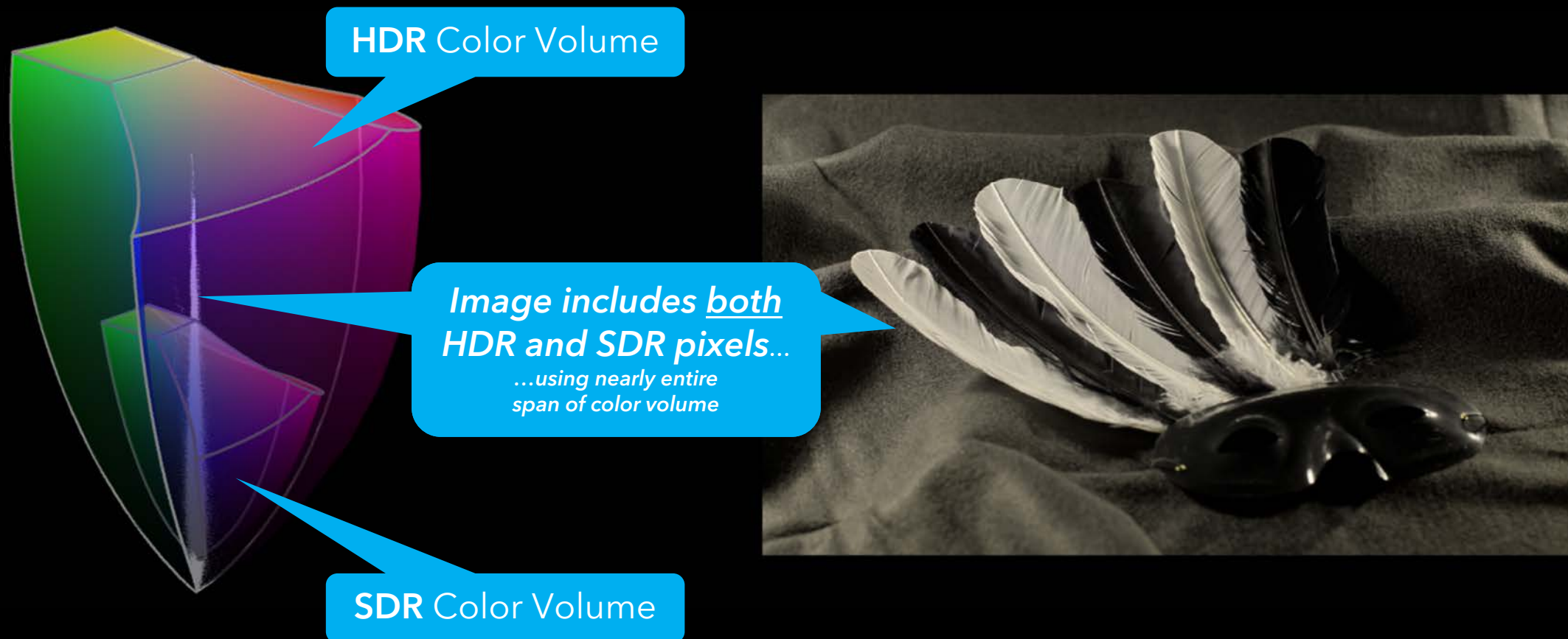
Option 2: Dynamic Content Mapping (via Dynamic Metadata)



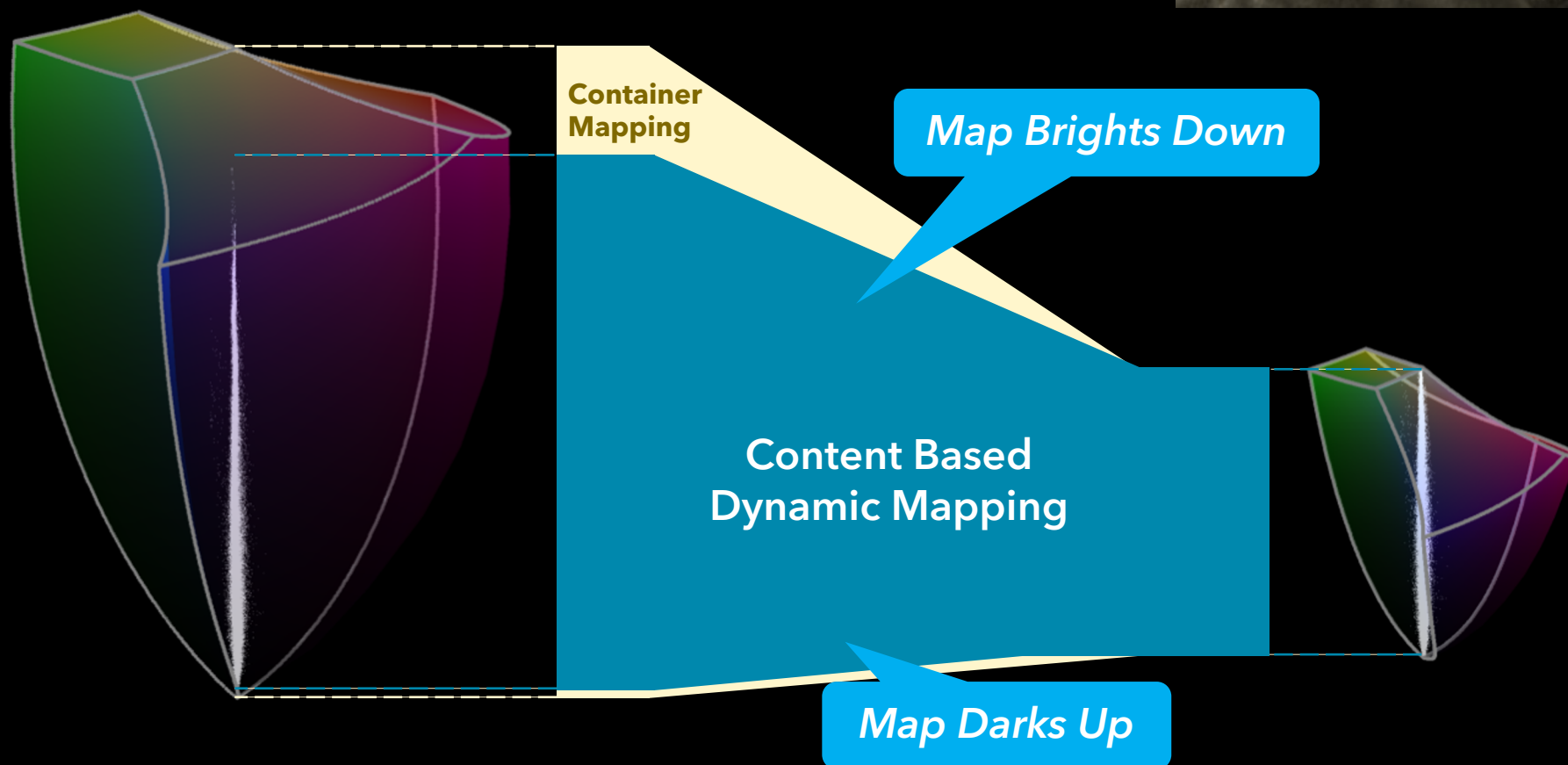
Animation: Robin Atkins, Dolby

Defined by **content image statistics**,
source & target display capabilities

Example 1: Both Bright and Dark Colors



Example 1: Mapping HDR to SDR



Example 1: HDR to SDR Mapping Comparison

Static Container Mapping



Dynamic Content Mapping

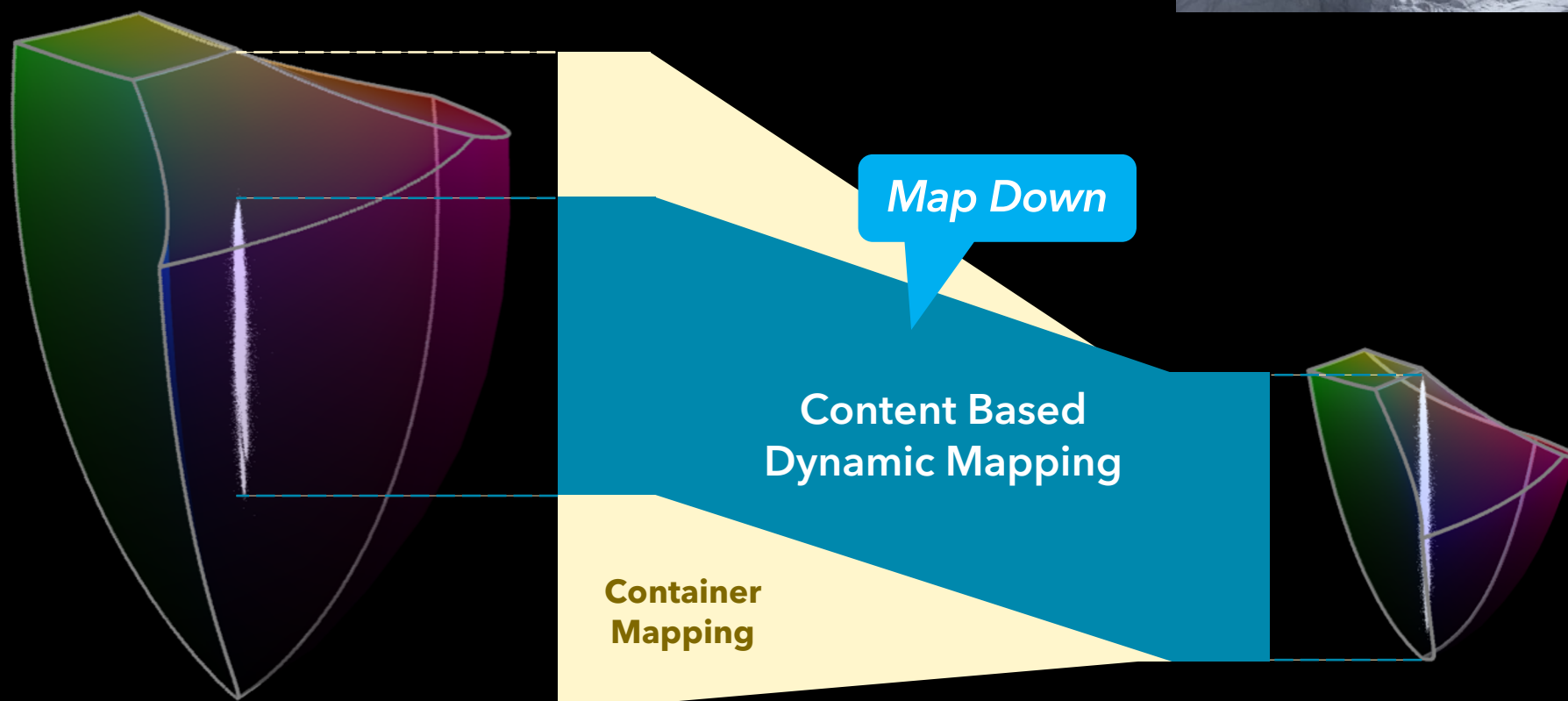


Similar Appearance after Mapping
Still: CONTAINER mapping != CONTENT mapping

Example 2: Only Bright HDR Colors



Example 2: Mapping HDR to SDR



Example 2: HDR to SDR Mapping Comparison

Static Container Mapping



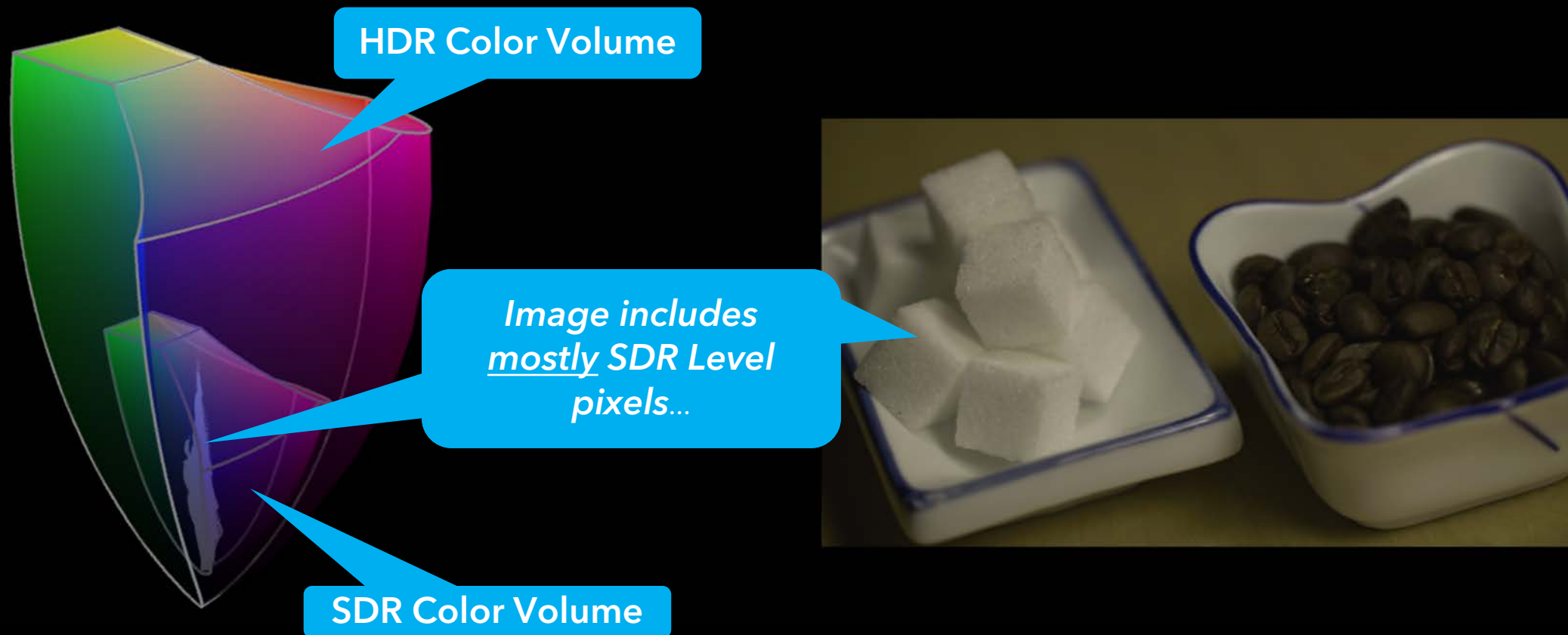
Excessive compression of highlights - loss of detail

Dynamic Content Mapping

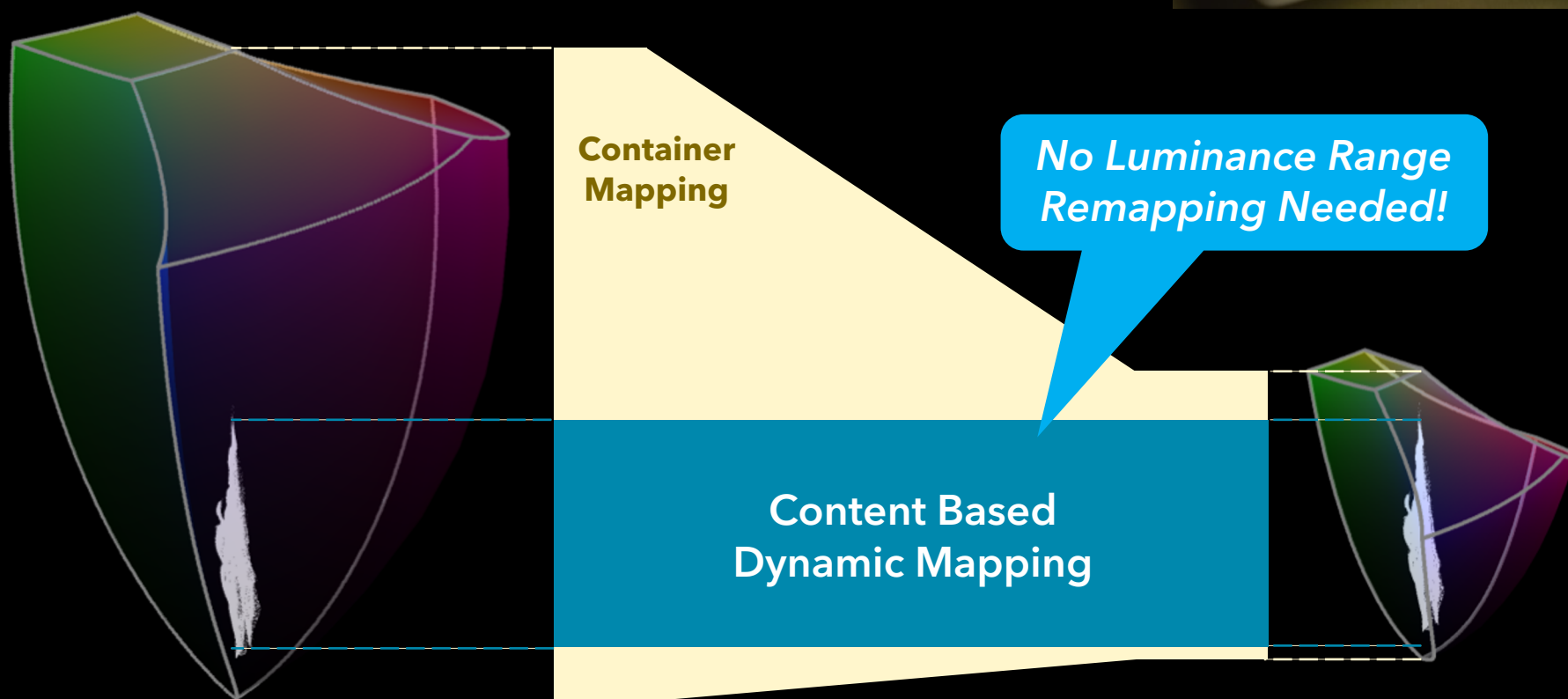


Less compression

Example 3: SDR Range Levels Only



Example 3: Mapping HDR to SDR



Example 3: HDR to SDR Mapping Comparison

Static Container Mapping



*Unnecessary scaling & compression
of image resulting in contrast loss*

Dynamic Content Mapping



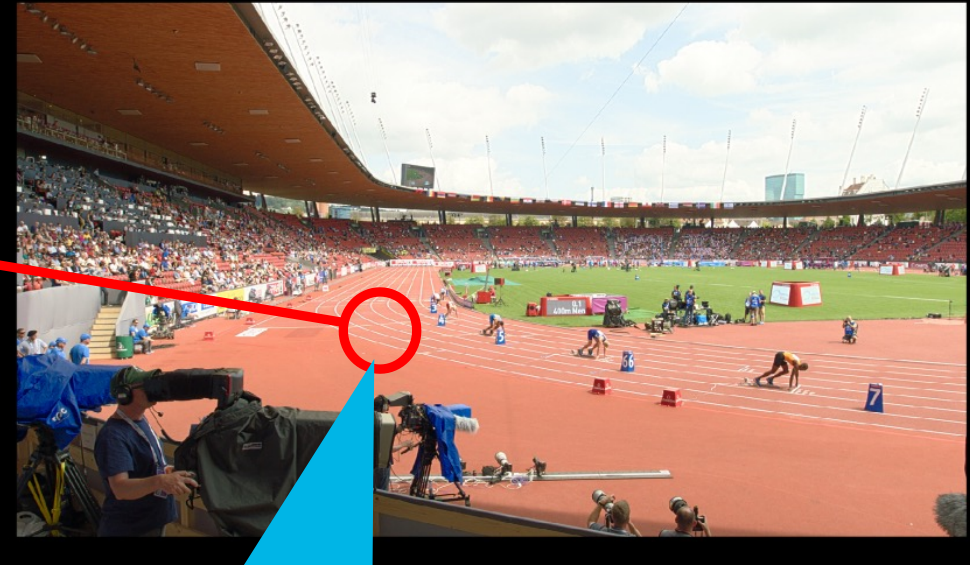
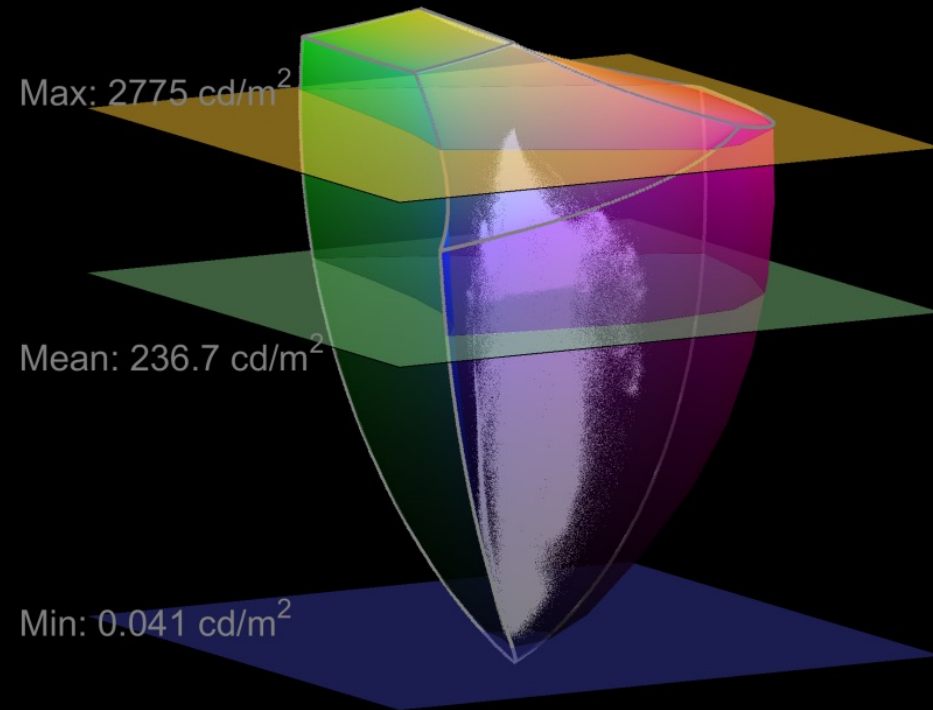
*Minimal mapping of image since
already in range*

Dynamic Mapping using Dynamic Metadata

- **Dynamic Metadata** is not the same as **Dynamic Mapping**
- The parameters for dynamic mapping can be **computed on the fly by target device**
 - Properties such as scene cuts must be identified in real time
 - Requires compute power and sufficiently large image buffers
 - Is not always accurate (e.g., can only 'look behind')
- There is significant benefit to **pre-analyze source content** and **provide it as dynamic metadata**
 - Enable a target display's dynamic color volume mapper to make more informed decision
 - E.g., metadata can provide a content 'look ahead' (in addition to 'look behind')
 - Significantly less compute power required to analyze image statistics
- **Dynamic Metadata & Dynamic Mapping approaches work well together**

Trim Passes: Creative Image Priority

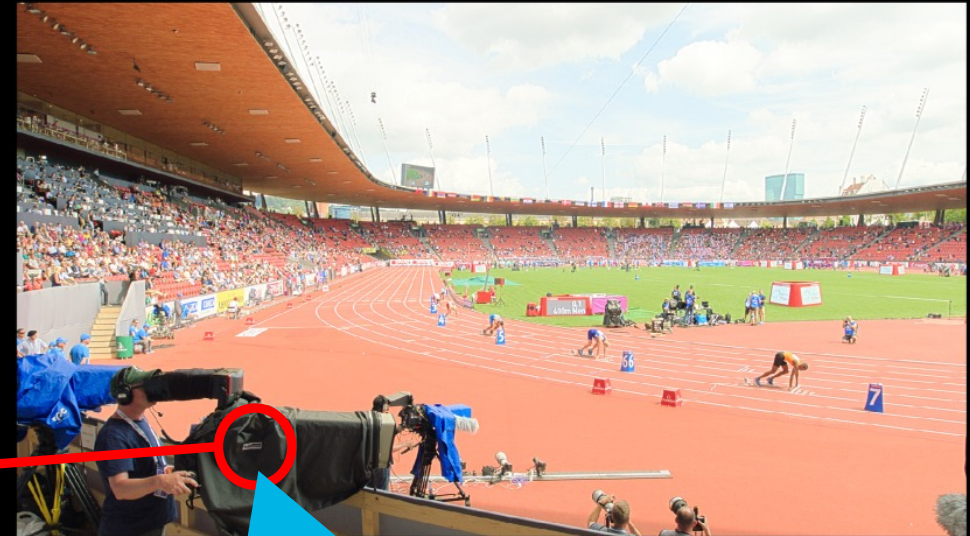
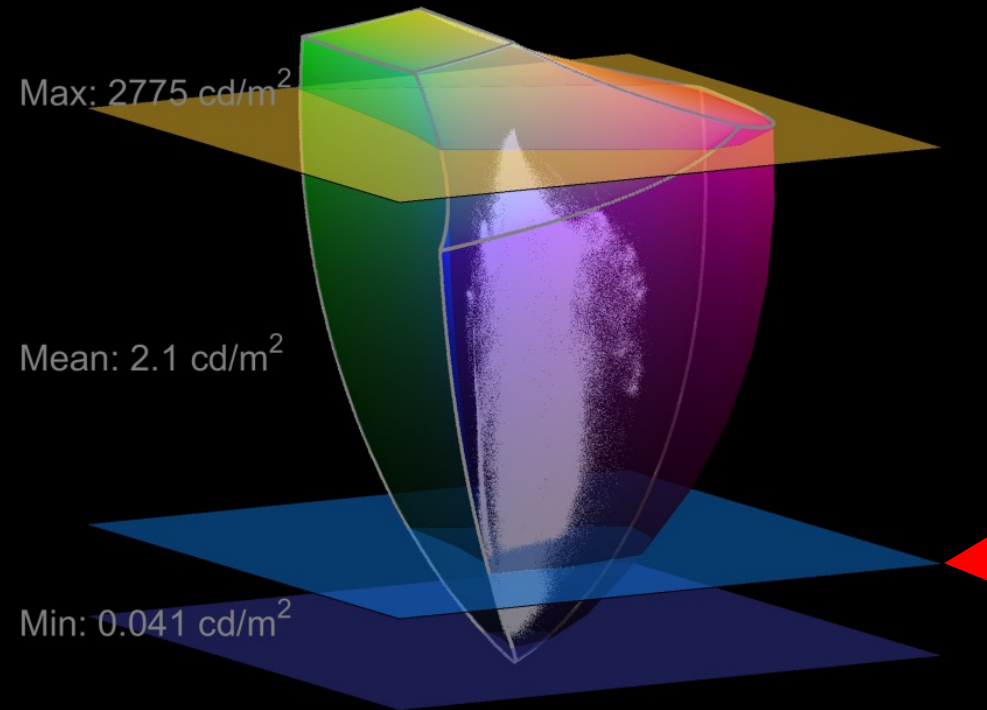
- **Image statistics** for Dolby Vision dynamic metadata **are computed automatically & reliably**
- Instances where a creative wants to introduce a **dedicated look** when **mapping to a particular display capability**
- This can be implemented via Dolby Vision **Trim Pass metadata**



Content courtesy of the EBU

Trim Passes: Creative Image Priority

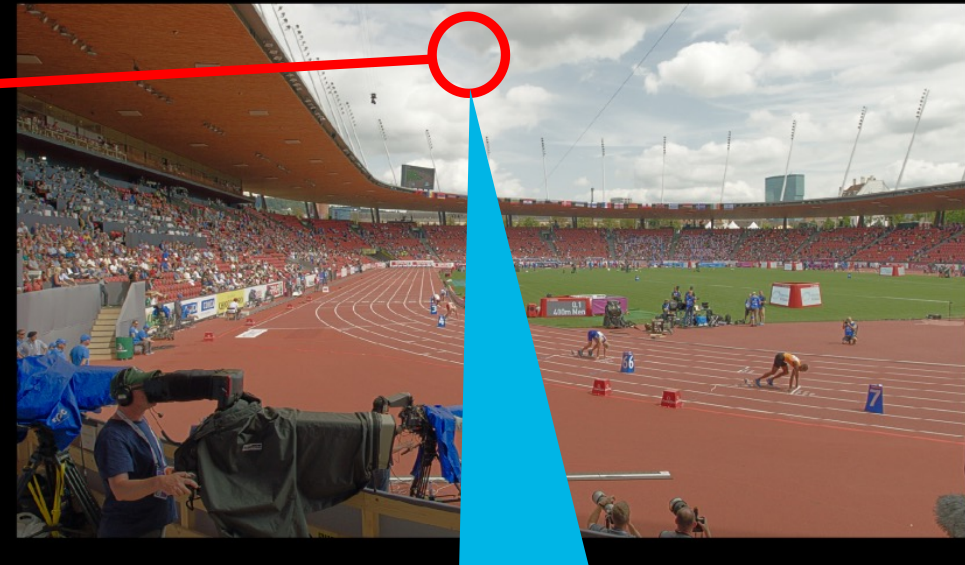
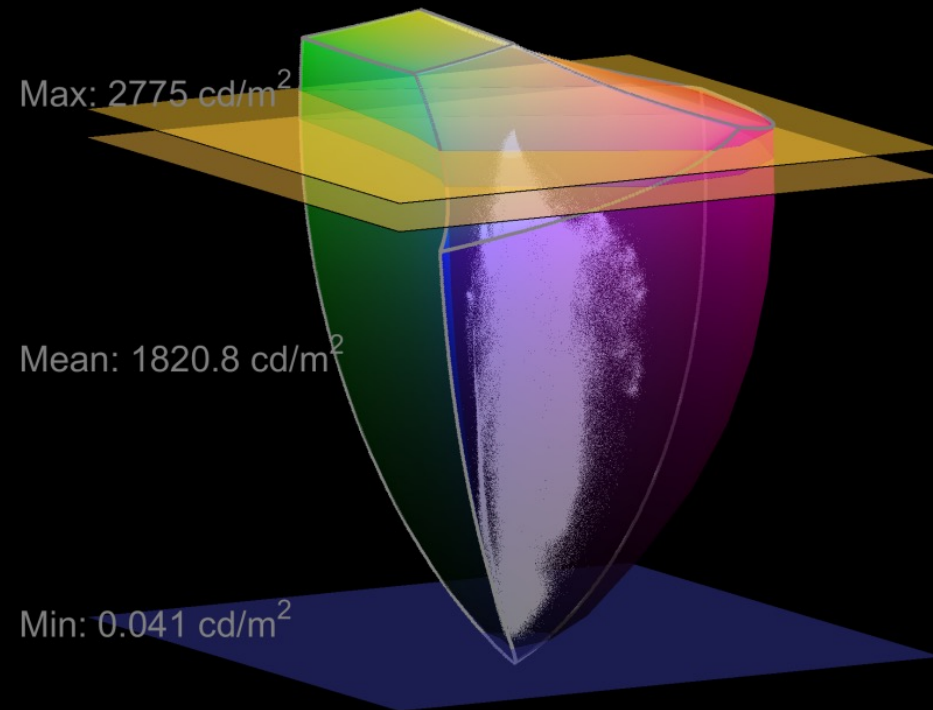
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Region of the Image
to Prioritize

Trim Passes: Creative Image Priority

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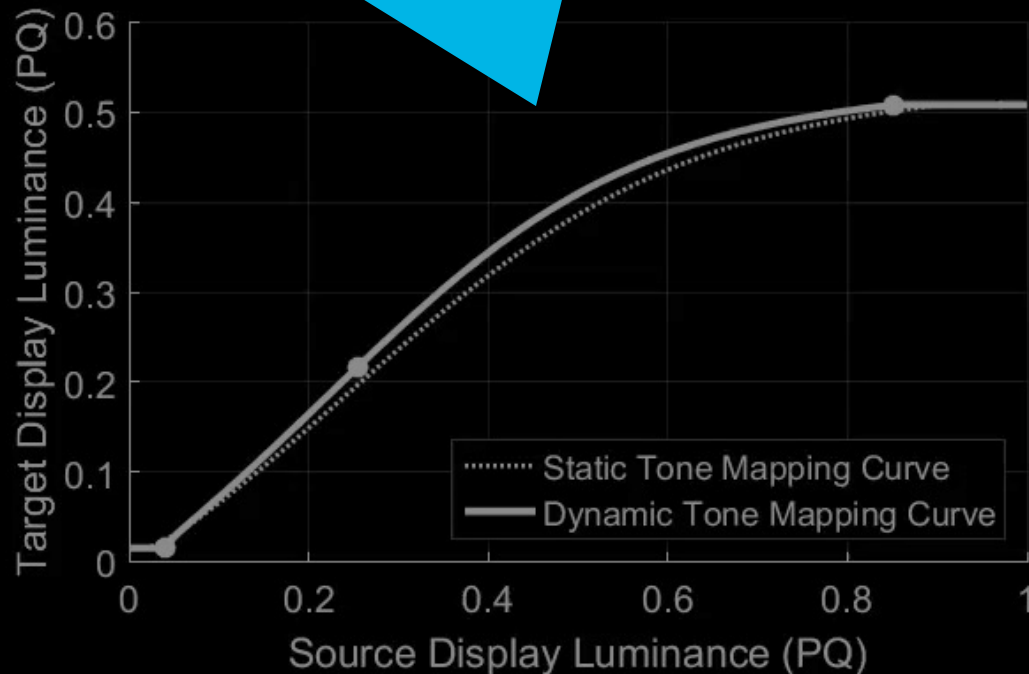


Content courtesy of the EBU

Content Mapping using Dynamic vs. Static Metadata

Dolby Vision Color Volume Mapping

- Use Dolby Vision Dynamic Metadata to guide Mapping
- Changes at scene cuts or by frame
- Follow Trim Passes Rules



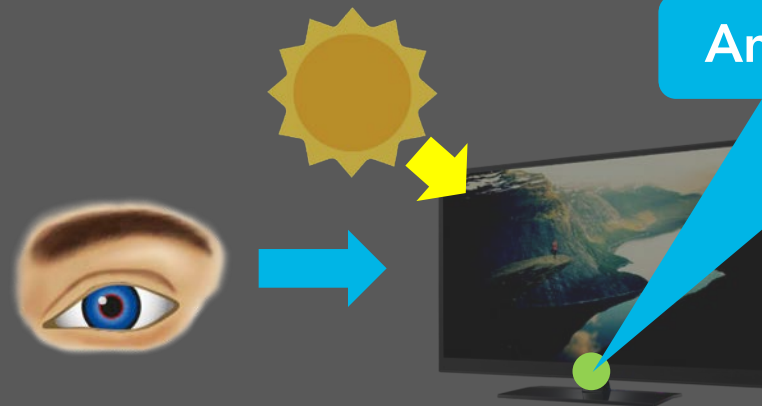
Impact of Ambient Light on Dark Tones

Low Ambient Light



- All tone values visible
- This includes deep blacks

High Ambient Light



Ambient Light Sensor

- Deep blacks and dark greys appear the same
- Lower tone values are clipped
- Overall image contrast is reduced

Automatic Brightness Control (ABC)

Step 1: Measure ambient illumination level

Step 2: Adjust Image Signal to retain image intent

Generic Solution

- Typically, relative offsets to dark tone values, not related to source content image statistics

Dolby Vision IQ

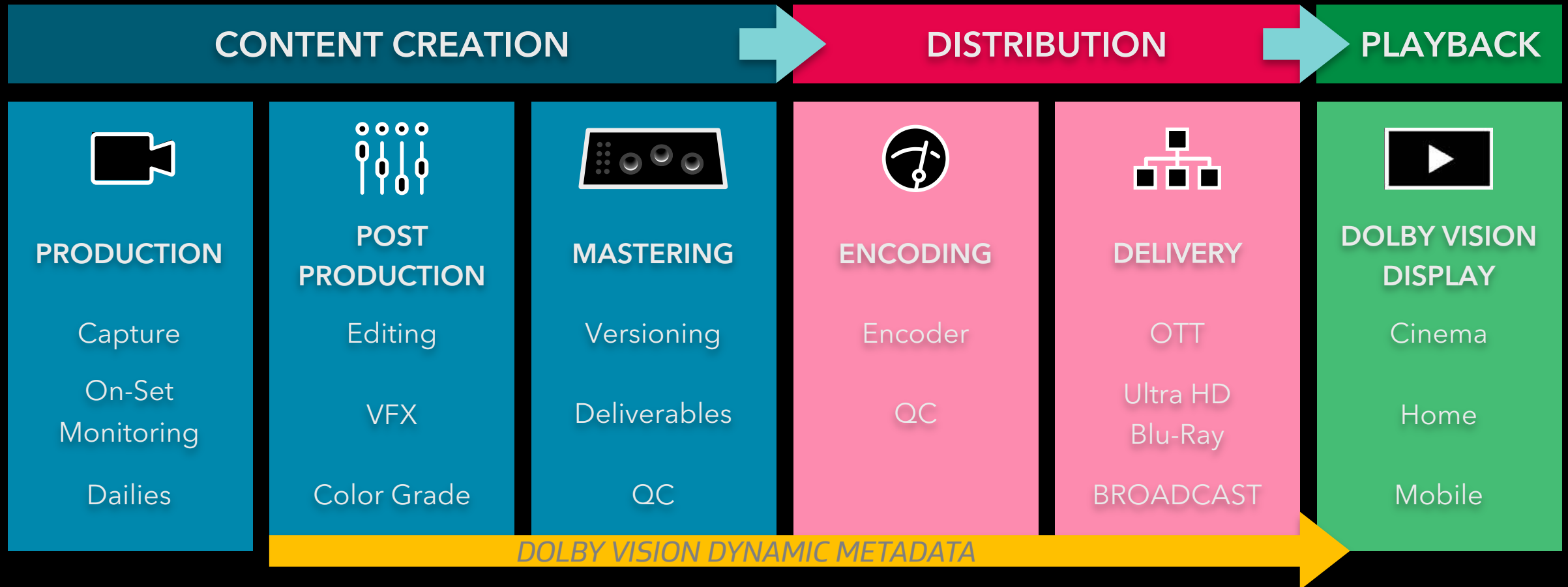
- Offsets based on measured absolute illuminance
- Computation using
 - Absolute linear light signal (from PQ)
 - Dolby Vision Source Content Metadata
- Part of Dolby Vision color volume mapping engine
- Can use existing sensors (if characterized) or additional ones



A man with glasses is sitting at a desk in a dark room, looking at a computer monitor. The monitor displays a vibrant, colorful image of a woman's face, possibly a pop art style. There are other monitors and a white mug on the desk. The scene is dimly lit, with the primary light source being the computer screens.

2. DOLBY VISION WORKFLOWS

Dolby Vision End-to-End Workflow



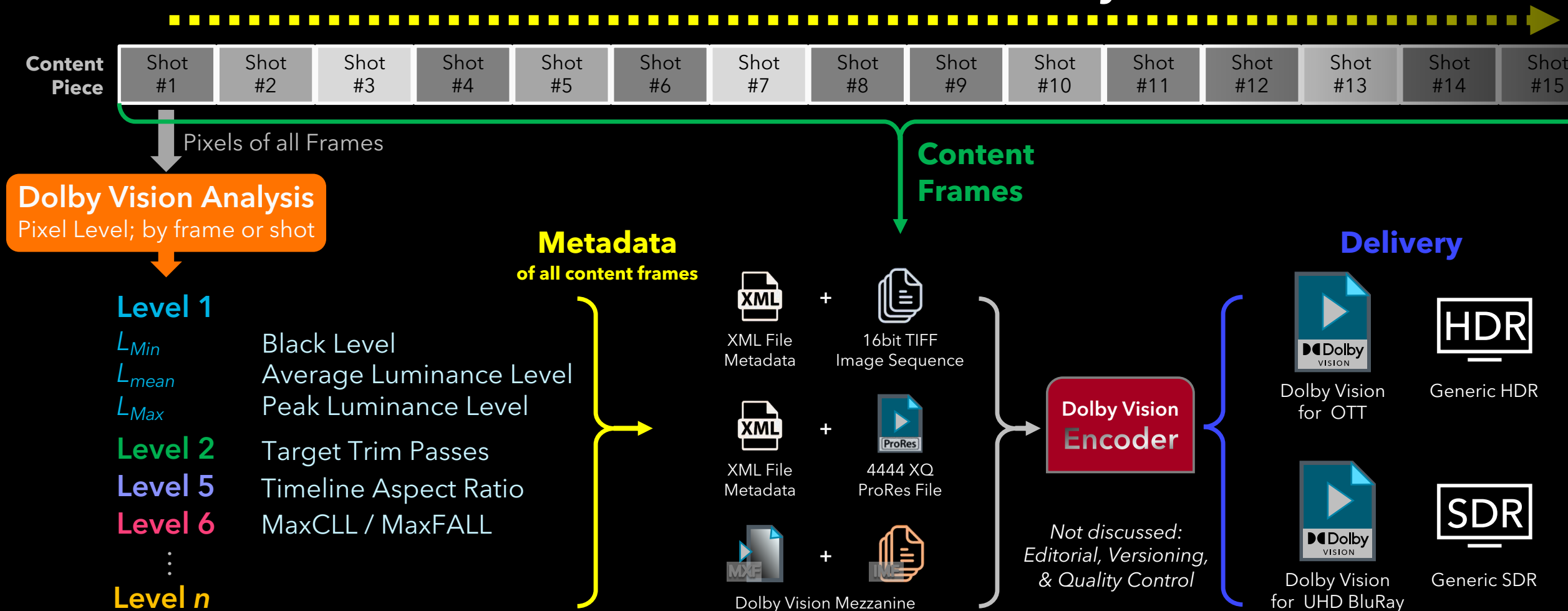
Conforming & Color Grading



1. Import the source material
2. Cut the timeline into shots (Conform)
3. Use PQ and a P3 color gamut (or Rec.2020)
4. Output PQ to the HDR display
5. **Fully utilize the extended dynamic range and wider color gamut** to create the best-looking images according to the creative intent
6. Use all the tools and features on the color correction system as required

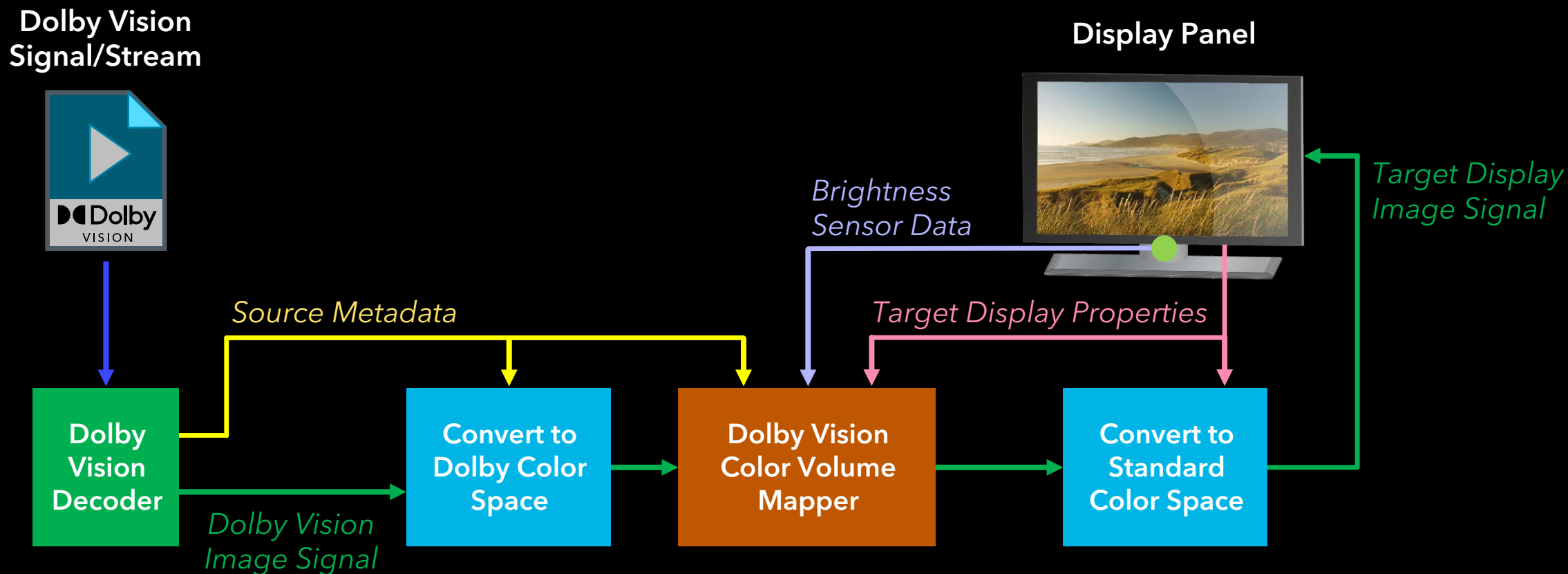


Metadata Generation & Content Delivery



Customization options for other content types: Live Sports, Gaming, User-Generated Content (UGC)

Display Mapping at Consumer Device*



* This is one possible approach...



SUMMARY

Summary

- **Key enabling Technologies & Concepts**
 - **Dynamic metadata** providing extensive details about the content
 - **Dedicated content mapping engine**
 - Optimization for **ambient** as well as **display technologies and capabilities**
 - Customization for other content types: Live Sports, Gaming, User-Generated Content
- Deployed in multiple services and platforms with hundreds of millions of devices globally across several industries
- **Future-proof** scalability and flexibility
- Dolby Vision provides a **holistic end-to-end system** enabling content to be rendered while **maintaining the artistic intent**



THANK YOU!

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