JCTVC–Y0032
AHG 7: On Content Colour Volume SEI message

Oct. 2016

Dolby Laboratories

Outline

- Background

- Our proposal
  - Aiming at providing a minimum set of metadata
  - Other metadata are extensions

- Syntax and Semantics

# Overview of Proposals in June Meeting

- JCTVC-X0040, JCTVC-X0052, and JCTVC-X0069 were proposed on how to represent content colour volume.

	JCTVC-X0040	JCTVC-X0052	JCTVC-X0069
Proposal	2D Colour Gamut	multiple primary expressions and spatial regions	colour gamut primaries and luminance slice based colour primaries

- Questions:
    - which information is most important in the display adaptation for the optimal picture quality;
    - Minimum set of metadata that the bitstream should carry;
    - Complexity of generating and using those metadata.

Discussion

- Which metadata is must to have in order to represent a colour volume?

- A colour volume can be simply constructed by
  - colour primaries (indicating largest 2D colour gamut projected from 3D colour volume)
  - white point chromaticity: reasonable to assume same as container.
  - maximum luminance and minimum luminance.

- Issue:
  - A particular content might only cover partial of this "largest" colour volume
  - How to precisely describe a source colour volume?
    - Need to limit amount of metadata
      - Bit rate overhead
      - To preserve temporal stability, metadata is often consistent with a scene
    - Desirable to avoid unnecessary and impractical representation of content colour volume
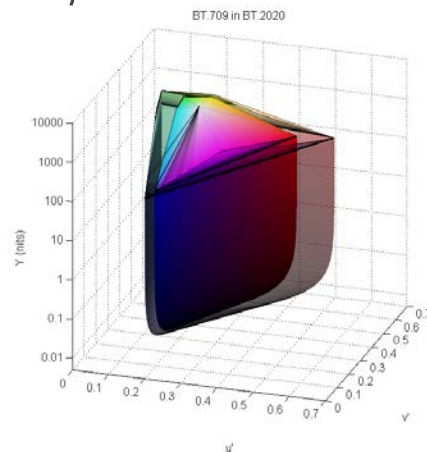
Some Background

- A simplified diagram on colour volume mapping (ST 2094-1)
  - Gamut mapping (shaping) => colour primaries
  - Tone mapping => max, min, average/mid-point luminance
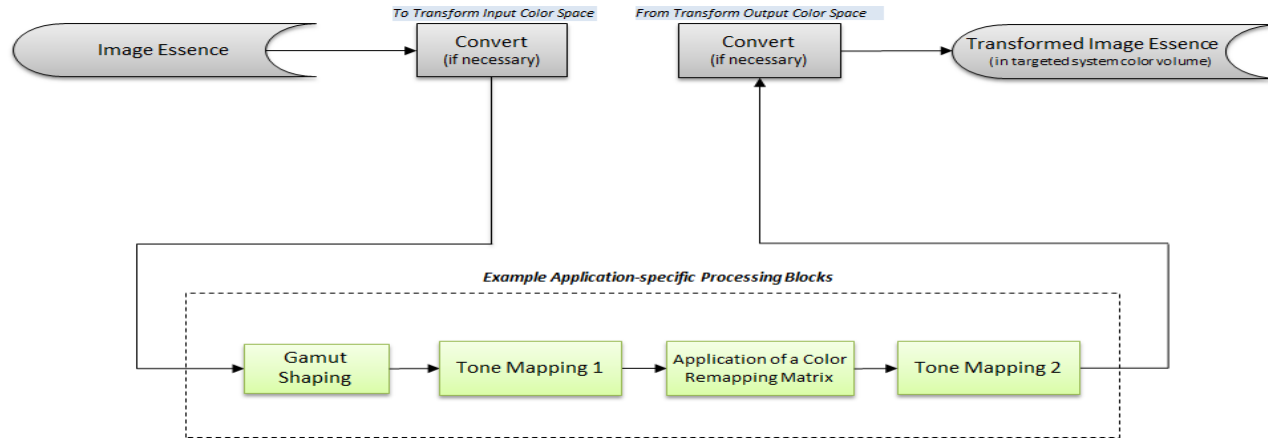
ST 2094-1 Processing blocks of the generalized Colour Volume Transform Model.
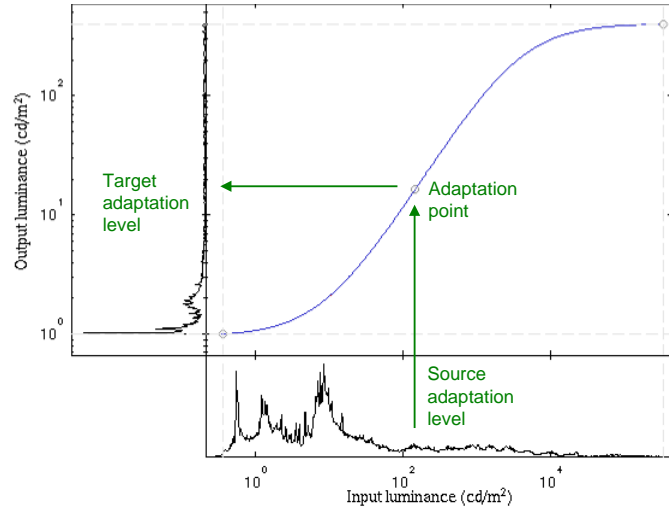
Gamut Mapping (Shaping): Example

- Reference: Gamut Mapping for Digital Cinema
  - by Jan Fröhlich, Andreas Schilling, Bernd Eberhardt
  - SMPTE 2013 Annual Technical Conference, Los Angeles, October 2013
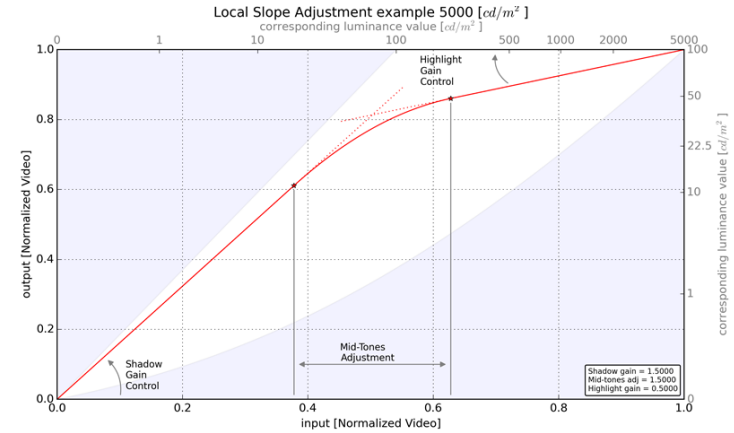
- 2D colour gamut info. is generally useful.
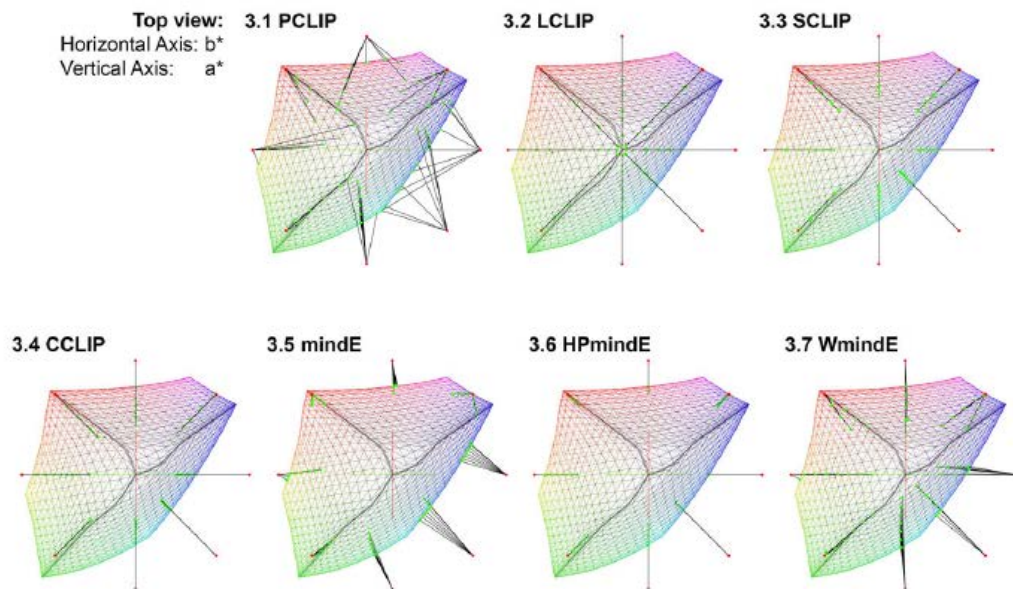
Different types of Gamut mapping methods (projection of La*b* on 2D a*b* plane)

Tone Mapping: Example Curve

ST 2094-10

ST 2094-20

ST 2094 Application #1, #2 and #4: use average/mid-point luminance information in some variance.
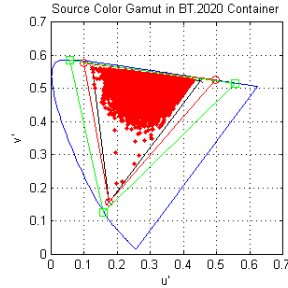
Our Proposal

- Proposes to include the following metadata in the colour volume SEI message:
  - the colour primaries (source colour gamut)
  - the maximum, minimum and average luminance values
  - if applicable, colour gamut for those three luminance values, (or more luminance slices or more spatial partitions).

- Where to generate metadata:
  - Colour volume might be modified after chroma subsampling, bitdepth reduction or other processing.
  - To maximize usage of colour volume SEI, it should describe colour volume of source in its original form.
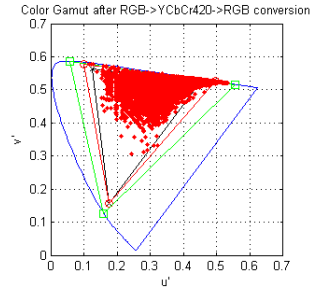 - Therefore, naming SEI as Source Colour Volume SEI
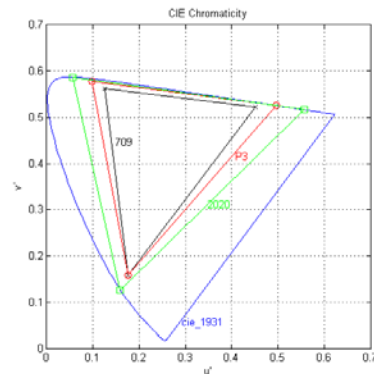
Colour Volume Modification: Example 1

Sourece RGB in BT.2020

Source Color Gamut in BT.2020 Container
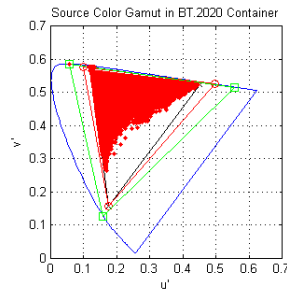
Converted RGB (from YCbCr420) in BT.2020

Color Gamut after RGB->YCbCr420->RGB conversion

Source content gamut:
BT. 709

After RGB->YCbCr420_10bit->RGB
Content gamut spread out to
container gamut (BT. 2020)

Example 2

Sourece RGB in BT.2020

Source Color Gamut in BT.2020 Container

Converted RGB (from YCbCr420) in BT.2020

Color Gamut after RGB->YCbCr420->RGB conversion

Source content gamut:
BT. 709

After RGB->YCbCr420_10bit->RGB
Content gamut spread out to
container gamut (BT. 2020)

Example 3

Sourece RGB in BT.2020

Source Color Gamut in BT.2020 Container

Source content gamut:
P3D65

Converted RGB (from YCbCr420) in BT.2020

Color Gamut after RGB->YCbCr420->RGB conversion

After RGB->YCbCr420_10bit->RGB
Content gamut spread out to
container gamut (BT. 2020)

Example 4
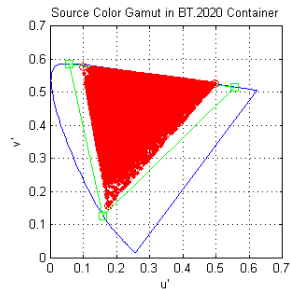

Sourece RGB in BT.2020

Source Color Gamut in BT.2020 Container
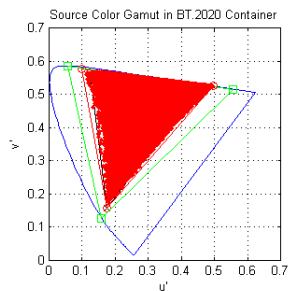
Source content gamut:
P3D65

Converted RGB (from YCbCr420) in BT.2020

Color Gamut after RGB->YCbCr420->RGB conversion

After RGB->YCbCr420_10bit->RGB
Content gamut spread out to
container gamut (BT. 2020)

Proposed syntax

source_colour_volume(payloadSize) {	Descriptor
source_colour_volume_id	ue(v)
source_colour_volume_cancel_flag	u(1)
if(!source_colour_volume_cancel_flag) {	
srouce_colour_volume_persistence_flag	u(1)
source_colour_primaries	u(8)
if(source_colour_primaries == 2) {	
for(c = 0; c < 3; c++) {	
source_primaries_x[c]	u(16)
source_primaries_y[c]	u(16)
}	
}	
max_source_luminance	u(32)
min_source_luminance	u(32)
avg_source_luminance	u(32)
luminance_colour_primaries_info_present_flag	u(1)
if(luminance_colour_primaries_info_present_flag) {	
for(i = 0; i <= 3; i++) {	
for(c = 0; c < 3; c++) {	
luminance_primaries_x[i][c]	u(16)
luminance_primaries_y[i][c]	u(16)
}	
}	
}	
}	
}	

Colour Gamut Info.

Key Luminance Info.

Additional Info.

Conclusion

- Proposes a source colour volume SEI
  - Aiming at providing a compact set of "essential" metadata,
  - Important for optimal signal adaptation on target displays and meanwhile is minimal in terms of data size and complexity.

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