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| *Title:* | **CICP: Appendix to Tag Common Industry In-Use Combinations of Video Stream Properties** | | |
| *Status:* | Input Document to JCT-VC/MPEG | | |
| *Purpose:* | Proposal | | |
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# Abstract

The Coding-Independent Code Points (CICP) document(s) (23091) defines code points and fields that establish presentation properties of a video or audio stream that are independent of the coded video layer stream aspects such as tools, levels, and bit rate. These properties, usually expressed in "metadata", can exist across the production and distribution workflows and knowledge of these properties has value as content gets processed in the E2E [End-to-End] production to distribution workflow chain. Tables with a broad gamut of values are defined for each separate property. The combinations of properties and the permutation of all values being considered can reach hundreds of choices to describe a stream. Many of these combinations (such as PQ with BT.601 primaries) will not be defined anywhere: only a small subset of these combinations (such as BT.2100 PQ and HLG) is actually used in practice.

This contribution recommends adding an appendix to the CICP-Video document (23091-2) to describe industry in-use combinations of video presentation properties of a stream. This contribution will further define category tags to support these different types of combinations. This initial proposal suggests the following category tags: 1) VideoColourVolumeTag, 2) MasteringDisplayTag, and 3) CameraLogGammaTag.

The benefits of defining these tags across production and distribution workflows is that different types of content processing toolsets can be used in an interoperable automated manner. Additionally, the tags will provide a means to avoid common content processing mistakes due to assumptions made of these properties in the authoring of source content. With HDR and the increased use of LUTs, these mistakes will increasingly become magnified. A further advantage is it will allow simplification of toolset development by avoiding complicated tailoring of the tool to specific areas of the workflow and allow repurposing tools to different parts of the workflow.

# Introduction & Problem Statement

In different parts of the workflow and in different toolsets, the same color volume description (e.g. HD/UHD/8K narrow Dynamic Range, WCG)) label can be applicable to **more than one combination** of video properties. Depending on where in the workflow and type of carriage, the same video properties can be labeled in **more than one way** (e.g. OETF in HEVC and MXF). (See Fig 1 & 2).

A video content processing tool handles this situation by designing the tool for a specific part of the workflow. It reduces the number of variations of combinations by either making assumptions on the input content or by analysing the input source content. Tools reduces the number of ways it needs to look for the same parameter by recognizing what part of the workflow the tool operates in and where to look for carriage of that information. With the advent of HDR, WCG, and LUTs in the workflow, the number of similarly labeled variations increases as well as the number of labels for the same function. This increases the chances of being processed wrongly. Also, toolsets may be too restricted to specific parts of the workflow simply because of specialized design of the inputs to the specific workflow.

From a different perspective, the toolset may suffer in complexity if it needs to accommodate content processing of video streams in all combinations of video properties including combinations that should not appear at all (e.g. HDR w/ Rec 709).



Figure 1 Colour tags for HEVC and QT



Figure 2 Colour Tags for MXF

# Suggestions

This contribution suggests that an appendix be created in the video properties portion of the Coding Independent Code Points document. This section will describe an extensible subset of permutations of properties of the video stream that are being used by industries today. This should help simplify development of toolsets and potential expand tools for use beyond a portion of the video workflow.

Additionally, the contribution proposes the creation of initial three category tags that capture logical combinations of video properties.

Add to CICP- Video Document in a new Appendix section

Appendix I. – Common Combinations of Video Signal Properties

AI.1- Video Category Tags

A Video Category Tag groups a related subset of video signal properties into a single representable tag. The following Video Category Tags have been defined:

AI.11 [VideoColourVolumeTag] Category Tag

This tag contains the combinations of the following subset of properties of the Video Stream related to colour volume. The tag contains the following video stream properties:

* Colour Primaries (from Table 2)

This parameter captures information to indicate source colour primaries information that correspond to a particular chromaticity for example BT.709-6 or BT.2020-2

* Transfer Functions (from Table 3)

This parameter captures information to indicate source transfer characteristics information that correspond to EOTF of the source signal for example PQ or HLG.

* Matrix Coefficients (from Table 4)

This parameter captures information to indicate matrix coefficients information that correspond to colorspaces of the source signal for example RGB or YCbCr or ICpCt.

* Bitdepth (from XXX)

This parameter indicates the BitDepth of source content pixel luma or chroma values. This can correspond to values for examples of 8, 10, 12, 16 bits

* Chroma SubSampling (from XXX)

This parameter indicates the chroma subsampling of the source content video signal. Values of this can be for example 4:4:4, 4:2:2, or 4:2:0.

* Full/Narrow Scale (from XXX)

This parameter indicates the range types of values used in the bitdepth values. Values to describe this are full scale or narrow (legal) scale.

AI.12 [MasteringDisplayTag] Category Tag

This tag contains the combinations of the following subset of properties of the Video Stream related to capturing the Mastering Display Information used in creating the source video content stream. The tag contains the following video stream properties:

* MDPrimaries (from XXX)

This parameters indicates the range of values in the colorspace used to color correct the content video source stream and can be adjusted to gamma sensitivity. Values for these parameters are for examples 709Gamma2.2, 2020, and P3.

* MDWhitePoint (From XXX)

This parameter indicates the brightness level of what is considered “white” that is used to color correct the content video source stream. Typical values for this parameter is for example D65.

* MDMaxLuminance (From UHDA?)

This parameter indicates the maximum brightness level used to color correct the content video source stream. Typical maximum brightness values are 4000 cd/m2, 1000 cd/m2, or 100 cd/m2.

* MDMinLuminance From UHDA?)

This parameter indicates the minimum brightness level used to color correct the video source stream. Typical minimum brightness values are 0.05 cd/m2 (LED profile), or 0.0005 cd/m2 (OLED profile). This parameter correlates to the amount of details in the blacks of the scene.

AI.13 [CameraLogGammaTag] Category Tag

This captures the camera log gamma characteristics of the camera capturing the content for the video source stream. It indicates the types of transformation curves used to convert linear light levels captured out of camera photosensors to brightness values aligned to human visual systems. Often LUTs can be used to convert these values to PQ or HLG types of curves. Examples for these are Slog3 or CLog3.

**AI.2 Declared Category Tag Combinations For SDR and HDR Video Stream: -[VideoColourVolumeTag] [MasteringDisplayTag] [CameraLogGammaTag]**

This section of the appendix describes Industry in-use combinations for each category tag describes in section 1 of the appendix. These sections are divided into tables for each type of used SDR and HDR content.

**AI.2.1 SD/HD-SDR Content Types**

The following tables describe each video category tag corresponding to SD-HD SDR content and reflect combinations in use in the Industry for producing video streams that transverse through a production to distribution workflow. Tags that are not present reflect non-declared properties of the video stream.

Table 1- [VideoColourVolumeTag] Combinations for SD/HD – SDR Content

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Value** | Colour Primaries | Transfer Functions | Matrix Coefficients | BitDepth | Chroma SubSampling | Full/ Narrow Scale | Informative Remarks |
| **1** | 1 | 1 | 1 | 8 | 4:2:0 | FS |  |
| **2** | 1 | 1 | 1 | 8 | 4:2:0 | NS |  |
| **3** | 1 | 1 | 0 | 8 | 4:2:0 | FS |  |
| **4** | 1 | 1 | 0 | 8 | 4:2:0 | NS |  |
| **reserve-255** |  |  |  |  |  |  |  |



[MasteringDisplayTag]

Table 2- [MasteringDisplayTag] Combinations for SD/HD – SDR Content

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Value** | MDPrimaries | MDWhitePoint | MDMax Luminance | MDMin Luminance | Informative Remarks |
| **1** | 709Gamma2.4 | D65 | 100 | CRT |  |
| **reserve-255** |  |  |  |  |  |

[CameraLogGammaTag]

Table 3- [CameraLogGammaTag] Combinations for SD/HD – SDR Content

|  |  |  |
| --- | --- | --- |
| **Value** | Camera LogGamma Format | Informative Remarks |
| **1** | Slog3 |  |
|  | TBD |  |
| **reserve-255** |  |  |

**AI-2.2 HD/UHD/8K-SDR-WCG Content Types**

The following tables describe each video category tag corresponding to HD/UHD8K SDR-WCG content and reflect combinations in use in the Industry for producing video streams that transverse through a production to distribution workflow. Tags that are not present reflect non-declared properties of the video stream.

[VideoColourVolumeTag]

Table 4- [VideoColourVolumeTag] Combinations for **HD/UHD/8K-SDR-WCG Content**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Value** | Colour Primaries | Transfer Functions | Matrix Coefficients | BitDepth | Chroma SubSampling | Full/ Narrow Scale | Informative Remarks |
| **5** | 9 | 1 | 9 | 10 | 4:2:0 | NS |  |
| **6** | 9 | 1 | 0 | 10 | 4:2:0 | NS |  |
| **reserve-255** |  |  |  |  |  |  |  |

[MasteringDisplayTag]

Table 5- [MasteringDisplayTag] Combinations for **HD/UHD/8K-SDR-WCG Content**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Value** | MDPrimaries | MDWhitePoint | MDMax Luminance | MDMin Luminance | Informative Remarks |
| **2** | P3 | D65 | 100 | CRT |  |
| **3** | BT2020 | D65 | 100 | CRT |  |
| **reserve-255** |  |  |  |  |  |

[CameraLogGammaTag]

Table 6- [CameraLogGammaTag] Combinations for SD/HD – SDR Content

|  |  |  |
| --- | --- | --- |
| **Value** | Camera LogGamma Format | Informative Remarks |
| **1** | Slog3 |  |
|  | TBD |  |
| **reserve-255** |  |  |

**AI.2.3 HD/UHD/8K-HDR-WCG Content Types**

The following tables describe each video category tag corresponding to HD/UHD/8K HDR-WCG content and reflect combinations in use in the Industry for producing video streams that transverse through a production to distribution workflow. Tags that are not present reflect non-declared properties of the video stream.

[VideoColourVolumeTag]

Table 7- [VideoColourVolumeTag] Combinations for **HD/UHD/8K-HDR-WCG Content**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Value** | Colour Primaries | Transfer Functions | Matrix Coefficients | BitDepth | Chroma SubSampling | Full/ Narrow Scale | Informative Remarks |
| **7** | 9 | 16 | 9 | 10 | 4:2:0 | NS |  |
| **8** | 9 | 18 | 9 | 10 | 4:2:0 | NS |  |
| **9** | 9 | 16 | 14 | 10 | 4:2:0 | NS |  |
| **10** | 9 | 18 | 14 | 10 | 4:2:0 | NS |  |
| **11** | 9 | 16 | 0 | 10 | 4:2:0 | NS |  |
| **12** | 9 | 18 | 0 | 10 | 4:2:0 | NS |  |
| **13** | 9 | 16 | 9 | 10 | 4:2:0 | FS |  |
| **14** | 9 | 16 | 9 | 10 | 4:2:0 | FS |  |
| **15** | 9 | 16 | 14 | 10 | 4:2:0 | FS |  |
| **16** | 9 | 18 | 14 | 10 | 4:2:0 | FS |  |
| **17** | 9 | 16 | 0 | 10 | 4:2:0 | FS |  |
| **18** | 9 | 18 | 0 | 10 | 4:2:0 | FS |  |
| **reserve-255** |  |  |  |  |  |  |  |

[MasteringDisplayTag]

Table 8- [MasteringDisplayTag] Combinations for **HD/UHD/8K-HDR-WCG Content**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Value** | MDPrimaries | MDWhitePoint | MDMax Luminance | MDMin Luminance | Informative Remarks |
| **4** | P3 | D65 | 1000 | LCD |  |
| **5** | BT2020 | D65 | 1000 | LCD |  |
| **6** | P3 | D65 | 4000 | LCD |  |
| **7** | BT2020 | D65 | 4000 | LCD |  |
| **8** | P3 | D65 | 1000 | LED |  |
| **9** | BT2020 | D65 | 1000 | LED |  |
| **10** | P3 | D65 | 4000 | LED |  |
| **11** | BT2020 | D65 | 4000 | LED |  |
| **reserve** |  |  |  |  |  |

[CameraLogGammaTag]

Table 9- [CameraLogGammaTag] Combinations for **HD/UHD/8K-HDR-WCG Content**

|  |  |  |
| --- | --- | --- |
| **Value** | Camera LogGamma Format | Informative Remarks |
| **1** | Slog3 |  |
|  | TBD |  |
| **reserve** |  |  |

# Additional References

* W16694 Geneva Jan 2017- **23091-2** Information technology – Coding-independent code points – Part 2: Video
* [**ISO/IEC 23001-8:2016(E): Part 8 Coding-independent code points**](https://www.iso.org/obp/ui/)
* [**SMPTE 2067-21:2016 Application #2E**](http://ieeexplore.ieee.org/document/7560818/): **: Extends 2067-20 Application #2 with MXF support for BT.2020, ST.2084 HDR Transfer Functions, ST.2086 HDR Mastering Display Metadata**
* [**Apple QuickTime™ Video Color Management in AV Foundation**](https://developer.apple.com/library/content/technotes/tn2227/_index.html)
* [**Apple ProRes™ SMPTE RDD Draft for MXF**](https://kws.smpte.org/kws/public/projects/project/details?project_id=278)

# Patent rights declaration(s)

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