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| Joint Collaborative Team on Video Coding (JCT-VC)  of ITU-T SG 16 WP 3 and ISO/IEC JTC 1/SC 29/WG 11  23rd Meeting: San Diego, USA, 19–26 February 2016 | Document: JCTVC-W0087 |

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| *Title:* | **Description of Color Graded SDR content for HDR/WCG Test Sequences** | | |
| *Status:* | Input Document to JCT-VC | | |
| *Purpose:* | Information | | |
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| *Source:* | Dolby Laboratories, Inc. | | |

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# Abstract

To satisfy the need in testing SDR backward compatibility, Dolby has made available color graded SDR content for the corresponding HDR content inside MPEG HDR/WCG AHG activity. The SDR content is color graded by a professional colorist using DaVinci Resolve and professional reference displays. An onsite expert viewing session is planned to review the SDR versions on a PRM-4200 reference display during the La Jolla MPEG meeting.

# SDR Color Grading Process

To support MPEG adhoc group activity for HDR and WCG, four additional standard-dynamic range re-graded sequences are proposed corresponding to HDR content inside MPEG HDR/WCG AHG activity, as shown in [Table 1.1](#Table1).  This will create an equivalent set of content to match S10, S11, S12, and S13 HDR/WCG material respectively. These additional grades will complement the SDR grades already released for existing HDR test clips.

**Table 1.1: Test Sequences**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Num | Properties | Sequence | Fps | Frames |
| S10 | 1920x1080  YUV 4:2:0  Rec.709  10bit | EBU\_04\_Hurdles\_CG\_1920x1080p\_50\_10\_709\_420.yuv | 50 | 0-499 |
| S11 | EBU\_06\_Starting\_CG\_1920x1080p\_50\_10\_709\_420.yuv | 50 | 0-499 |
| S12 | SunriseClip4000r1\_CG\_1920x1080p\_24\_10\_709\_420.yuv | 24 | 0-199 |
| S13 | GarageExitClip4000\_CG\_1920x1080p\_24\_10\_709\_420.yuv | 24 | 0-287 |

The SDR regrading process followed the established theatrical-to-home content workflows. This process typically uses a procedure where an automatic conversion is employed in connection with one or more “trim passes” overseen by a colorist. In the current Blu-ray workflow, the content’s peak brightness is increased from 48 nits to 100 nits while the color gamut is decreased from P3 to BT.709. In the case of HDR to SDR conversions, a similar process is employed although both the brightness and the color volume are decreased from 4000 nit P3 to 100 nit BT.709. The colorist’s role is to identify and repair the inevitable incompatibilities from the automatic process and to make adjustments to the “look and feel” of the SDR content. This maintains the artistic intent in the reduced space while attempting to match the theatrical version.

For the purposes of creating MPEG HDR/WCG AHG SDR grades, the HDR content was presented to the colorist using a Pulsar (an HDR/WCG reference display) as a reference for the SDR content which was graded alongside on a PRM-4200. The colorist adjusted the SDR content to match the look and feel of HDR content as closely as possible – within the confines of the lower brightness and color volume. Once the colorist felt that it was a close match, other people were asked to review the content for the appropriate “look and feel” match. The reviewers included MPEG experts and local content experts.

[Figure 1.1](#Figure1) shows the setup of the color grading suite while the colorist is working on the SDR regrading of GarageExit. The left display is the Pulsar, showing the HDR reference for the content, and the right display is the PRM4200 (an SDR reference display, set to 100-nit peak and BT.709), showing the current “look” of the graded SDR in a real time fashion based on the colorist’s adjustment on DaVinci Resolve.

The SDR regrading process followed the same procedure as for Class D StEM content.



Figure 1.1: Colorist working on SDR color grading with DaVinci Resolve and Dolby Reference monitors

# Description of Reference Displays: PRM4200 and Pulsar

All the SDR sequences underwent regrading using a PRM4200 display as the primary grading monitor. The main characteristics of the display are described in [Table 2.1](#Table2).

**Table 2.1 Main Characteristics of PRM4200**

|  |  |
| --- | --- |
| Technology | LCD Display with individually controlled LED backlight modulation |
| Resolution | 1920 x 1080 pixels |
| Display size | 42” |
| Panel aspect ratio | 16:9 |
| Number of real colours | 12 bits per component |
| Number of LEDs | 1800 |
| Brightness | Peak luminance up to 600 cd/m2 (for SDR regrading, using 100 cd/m2) |
| Color gamut | up to DCI-P3 (for SDR regrading, using BT. 709) |
| Contrast | 120,000:1 (20,000:1) |
| White point | D65 |

The HDR/WCG material provided as reference during the regarding process was viewed on a Pulsar display. The main characteristics of the display are described in [Table 2.2](#Table2_2).

Table 2.2 Main Characteristics of Pulsar

|  |  |
| --- | --- |
| Technology | HDR LCD Display with individually controlled LED backlight modulation |
| Resolution | 1920 x 1080 pixels |
| Display size | 42” |
| Panel aspect ratio | 16:9 |
| Number of real colors | 12 bits per component |
| Number of LEDs | 6000 |
| Brightness | Peak luminance at 4000 cd/m2 |
| Black level | 0.005 cd/m2 |
| Contrast | Sequential Contrast: 800,000:1 |
| Corner Box Contrast: 370,000:1 |
| White point | D65 |
| Color gamut | DCI-P3 |

# Snapshots



Figure 3.1: EBU\_04\_Hurdles\_CG (frame 0), ©EBU



Figure 3.2: EBU\_06\_Starting\_CG (frame 0), ©EBU



Figure 3.3: SunriseClip4000r1\_CG (frame 0), ©Technicolor



Figure 3.4: GarageExitClip4000\_CG (frame 0), ©Dolby

# Content Availability

The distribution of the color graded SDR will be handled in the same fashion as the HDR/WCG counterpart for each clip.

* For GarageExit, the color graded SDR is distributed by the original owner (Dolby) to those who signed the license form.
* For Sunrise, EBU\_04\_Hurdles and EBU\_06\_Starting, the color graded SDR can be downloaded from the MPEG content site at <http://wg11.sc29.org/content/>

# About the Colorist

The color grading for the SDR content was performed by Shane Mario Ruggieri. Shane is a digital colorist and editor who has more than 15 years of experience in film and television post-production. His professional experiences can be found in [2].

# References

1. https://www.blackmagicdesign.com/products/davinciresolve
2. http://www.shanemario.com/Home/About.html, http://www.imdb.com/name/nm1847735/ and http://vimeo.com/channels/shanemario

# Patent rights declaration(s)

**Dolby Laboratories, Inc. may have current or pending patent rights relating to the technology described in this contribution and, conditioned on reciprocity, is prepared to grant licenses under reasonable and non-discriminatory terms as necessary for implementation of the resulting ITU-T Recommendation | ISO/IEC International Standard (per box 2 of the ITU-T/ITU-R/ISO/IEC patent statement and licensing declaration form).**