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CODING OF MOVING PICTURES AND AUDIO**

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**Updated Version (06/2017)**

**- Added 'Carousel Teaser' clip back in.**

**- Changed download location.**

**Source** Stuttgart Media University (HdM)  
**Status** Input Document  
**Title** Description of HDR and WCG Test Sequences Proposed by Stuttgart Media University  
**Authors** Jan Froehlich, Stefan Grandinetti, Bernd Eberhardt, Peng Yin, Taoran Lu, Robin Atkins.

## **Abstract**

Four HDR and WCG sequences are proposed by the Stuttgart Media University for testing purposes within MPEG. A short description for each sequence is provided in this contribution. A license agreement form is also attached to the contribution.

## **1 Introduction**

To support MPEG Adhoc group activity for HDR and WCG, four HDR and WCG sequences are proposed by the Stuttgart Media University for video compression testing and evaluation, as shown in Table 1. The sequences were shown in MPEG meetings in July [3].

**Table 1: Brief Description of Test Sequences**

<b>Num</b>	<b>Resolution</b>	<b>TF</b>	<b>Sequence</b>	<b>Fps</b>	<b>Frames</b>
01	1920x1080 RGB 4:4:4  P3D65 in ct2020	PQ	BeerFestTeaserClip4000_1920x1080p_25_12_P3_ct2020_444i_xxx.tif	25	0-328
02		12b	FireplaceTeaserClip4000_1920x1080p_24_12_P3_ct2020_444i_xxx.tif	24	0-239
03			ShowGirl2TeaserClip4000_1920x1080p_24_12_P3_ct2020_444i_xxx.tif	25	0-338
04			CarouselTeaserClip4000_1920x1080p_24_12_P3_ct2020_444i_xxx.tif	25	0-257

Those sequences were professionally color graded for high dynamic range and mastered as wide color gamut content using the P3-D65 color space and exported in 16-bit TIFF files encoded with PQ EOTF[4]. The test sequences aim at covering various characteristics of HDR/WCG content, such as wider color gamut, maximum luminance, speculars, highlight details, black feeling, shadow details, skin tones, local contrast etc.

A license agreement form is attached to the input document. The license agreement allows the use of the content for standardization purposes and any papers or presentations resulting thereof.

## 2 Description of Pulsar Reference Display

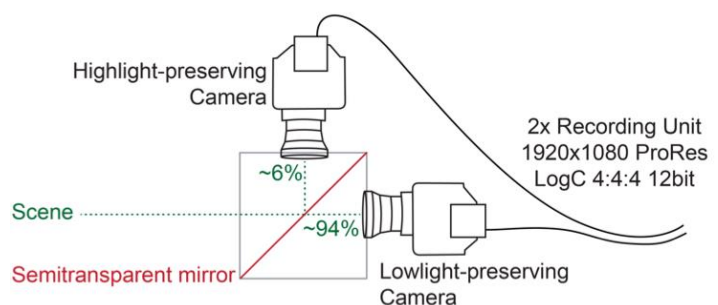
The sequences are primarily color graded on Pulsar display. The main characteristics of the display are described in Table 2.

**Table 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 colours	12 bits per component
Number of LED	6000
Brightness	Peak luminance at 4000 cd/m <sup>2</sup>
Contrast	sequential contrast: 800,000:1
	Corner Box Contrast: 370,000:1
White point	D65
Color gamut	DCI-P3

## 3 Description of Proposed Test Sequences

The sequences were captured using a dual camera rig as shown in figure 1. The mirror rig was populated with two 'ARRI Alexa M' cameras. A semitransparent mirror with a reflection to transmission ratio of about 1:16 was used to split the scene radiance between both cameras resulting in different exposures but exactly the same integration time, and depth of field.



**Figure 1: Image acquisition system**

For reasons of time and cost, both camera streams were recorded using visually lossless Apple ProRes 444 12bit 330Mbit/s compression in ARRI LogC AlexaWideGamut color space. As illustrated in Figure 2 the highlight preserving image was rectified to exactly match the geometry of the lowlight preserving image. The Highlights were then added to the Lowlight preserving image.

One key consideration in production was to create images with a signal to noise ratio that could be representative for future single sensor acquisition devices. Thus, to keep the signal to noise ratio above 30db for the top 11 stops, the exposure offset of the two cameras was limited to four stops. Figure 2b shows the simulated and measured Peak Signal to Noise Ratio (simulated: black line, measured: red, green blue dots).

Image processing pipeline (Postproduction)

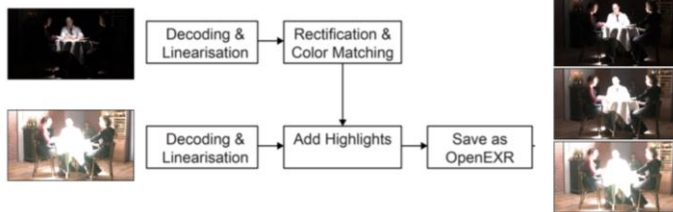


Figure 2a: Image processing Pipeline (Postproduction)

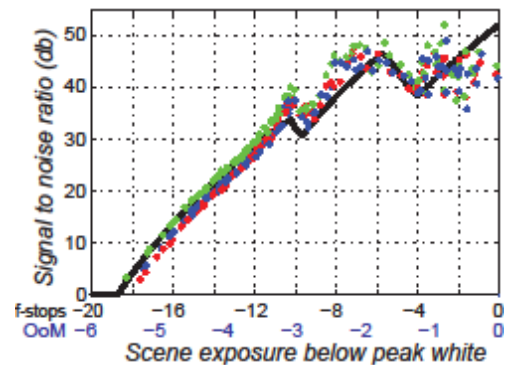


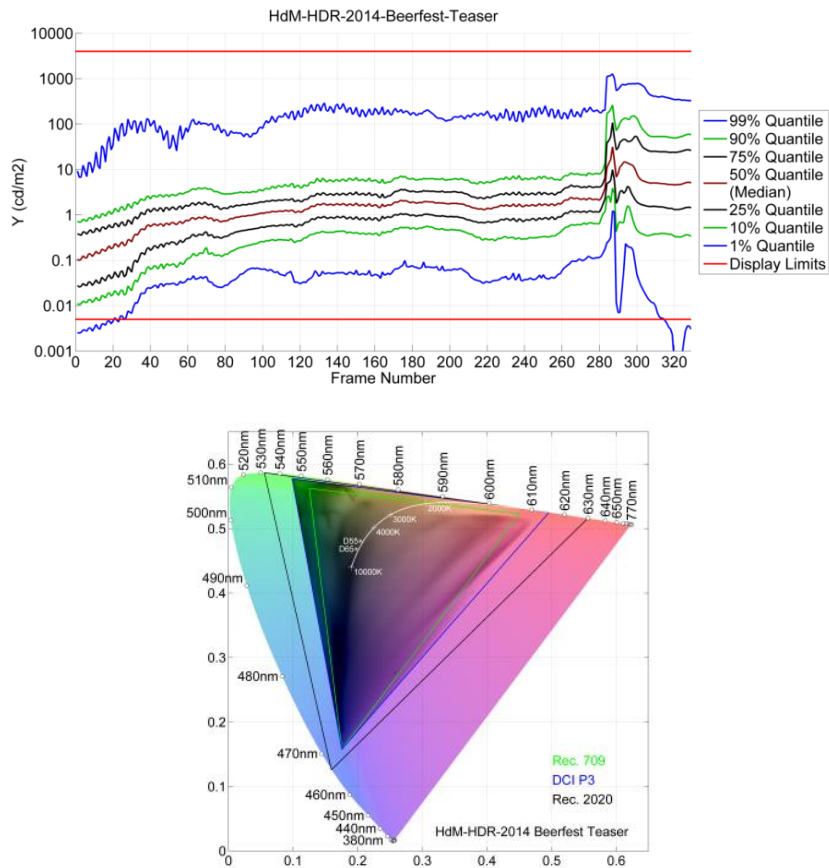
Figure 2b: Simulated vs. measured PSNR

Because the mechanical alignment of the two cameras only works within tolerances, spatial headroom was needed for reconstruction. To prevent a scaling operation for the lowlight preserving camera, the images are blanked with a 10 pixel boundary. This boundary should be treated like letterbox / pillarbox when calculating image statistics.

For more information on the creation of the HdM-HDR-2014 dataset please refer to [1] and [2].

The contribution consists of four scenes as described in the following:





**Figure 3: Beerfest Teaser Percentiles and CIE1976 u'v' Chromaticity Diagram**

**‘Beerfest Teaser’** is an excerpt from the ‘Beerfest Lightshow’ sequence. It is filmed on location in a moody, smoky beer-hall while a lightshow is performed. This lightshow includes various kinds of fast switched and moving lights that send out bright and colorful light beams. Additionally, a mirror bowl reflects neutral colored light beams. Laser beams flash up and strobe- lights as well as blinder-lights brighten up the scenery temporarily. The cameras were exposed to capture a compromise between lowlight detail and highlights. As a result, some highlights are clipped.



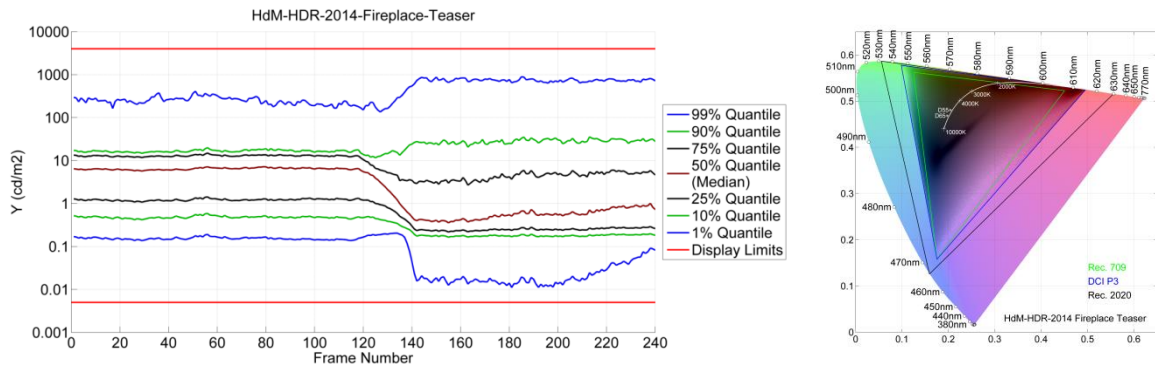


Figure 4: Fireplace Teaser snapshot(#76), Percentiles and CIE1976 u'v' Chromaticity Diagram

The **'Fireplace Teaser'** sequence is an excerpt from the 'Fireplace' scene. It offers a flickering light source with fast moving flames in front of a dim surrounding at dawn. The warm light of the campfire illuminates the persons that are surrounded by snowy scenery. The fire provides a strong color contrast to the bluish ambient light at dawn. Moving torchlights and flying sparks against the dark background at night provide high contrasts combined with fast movements.

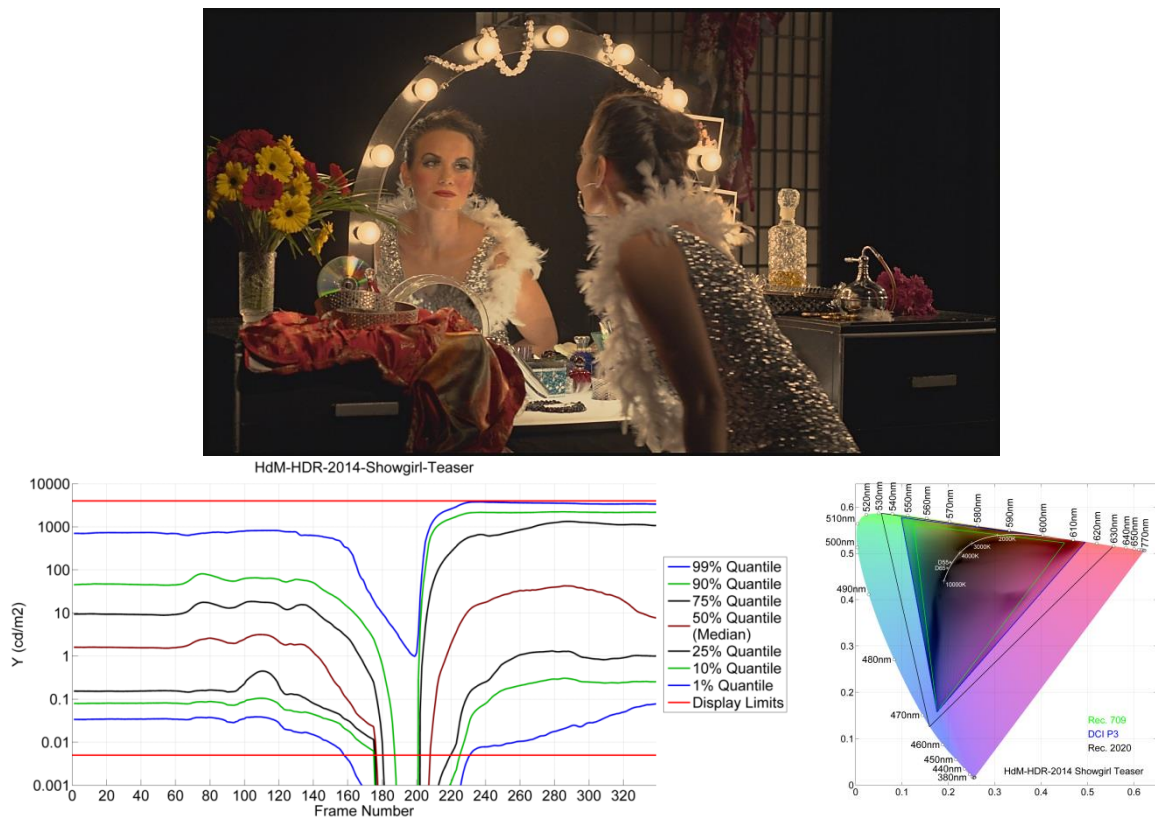
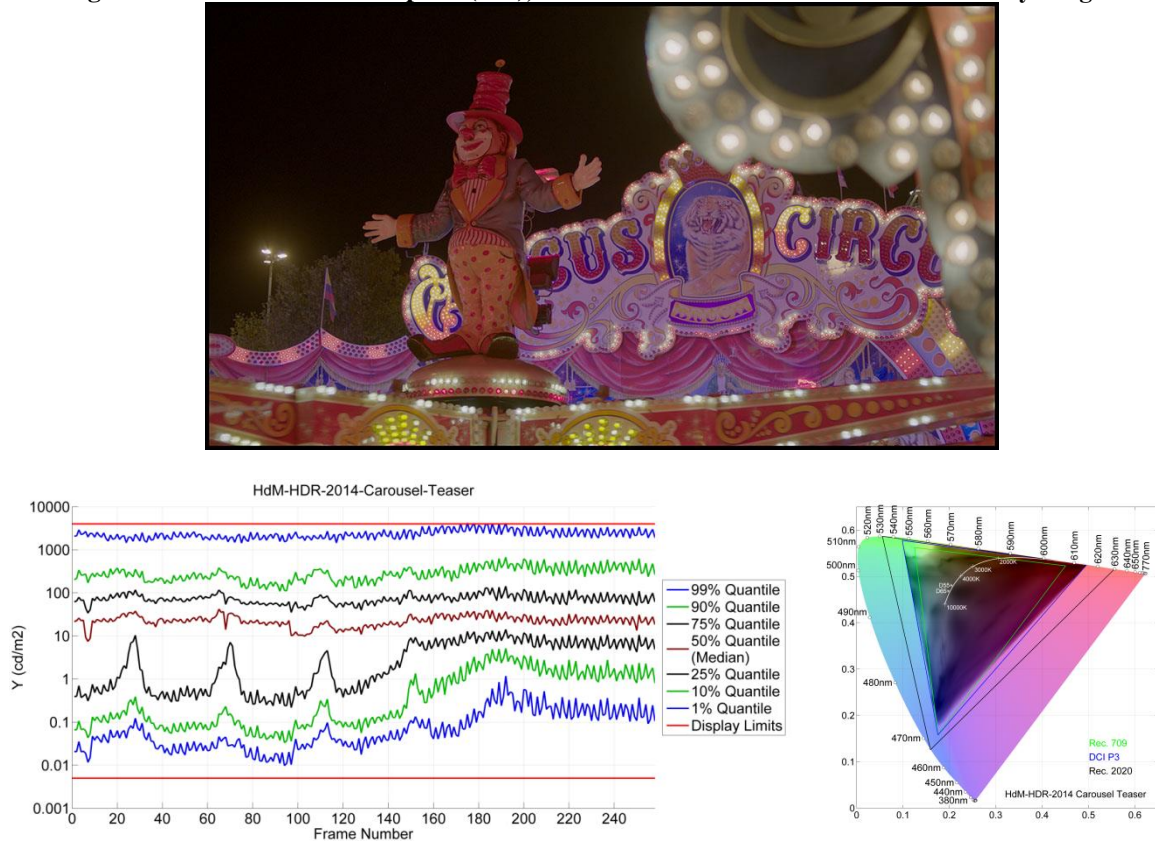


Figure 5: Showgirl Teaser snapshot(#84), Percentiles and CIE1976 u'v' Chromaticity Diagram

The **"Showgirl Teaser"** sequence is an outtake from the 'Showgirl 02' scene. A light-change from tungsten light to bright stage-light from an HMI-lamp is executed to show the skin tone of an actress in two extreme lighting situations throughout one take. Her dull feather boa serves as a diffuse white reference, whereas the glistening of the costume and jewelry is brighter than diffuse white.

**Figure 6: Carousel Teaser snapshot(#84), Percentiles and CIE1976 u'v' Chromaticity Diagram**



‘Carousel Teaser’ is an outtake from the ‘Carousel Fireworks’ sequence of shots acquired under available light at an annual fair during the night. The distinction of this scenery is to present colorful self-illuminated objects and dark surroundings at the same time. Changing colored light sources illuminate the scenery including cloth and skin tones of the actors. The moving carriages of the carousel create blurred light sources that are both filmed in standard speed and slow-motion. The firework provides bright colored highlights glittering against a uniform black sky.

## 4 License Agreement

The license agreement for the proposed sequences is attached with this contribution. Please send a scan of the signed license agreement via email to [froehlichj@hdm-stuttgart.de](mailto:froehlichj@hdm-stuttgart.de). The clips can be downloaded here: <https://www.hdm-stuttgart.de/~froehlichj/hdm-hdr-2014-mpeg/>

## 5 Acknowledgement

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## 6 References

- [1] Jan Froehlich; Stefan Grandinetti; Bernd Eberhardt; Simon Walter; Andreas Schilling; Harald Brendel; “Creating cinematic wide gamut HDR-video for the evaluation of tone mapping operators and HDR-displays”. Proc. SPIE 9023, Digital Photography X, 90230X (March 7, 2014); doi:10.1117/12.2040003.
- [2] <http://www.hdm-stuttgart.de/~froehlichj/hdm-hdr-2014/>
- [3] Walt Husak, Suzanne Farrell, Jan Froehlich, Timo Kunkel, Robin Atkins, Scott Daly, Philip J. Warren, “HDR/WCG Test Sequences”, m34278, July 2014, Sapporo, Japan
- [4] SMPTE ST 2084:2014; “High Dynamic Range Electro-Optical Transfer Function of Mastering Reference Displays”