



***Fast* VDO**  
*like it's meant to be...*

FastVDO Response  
HDR Category  
JVET-G0021

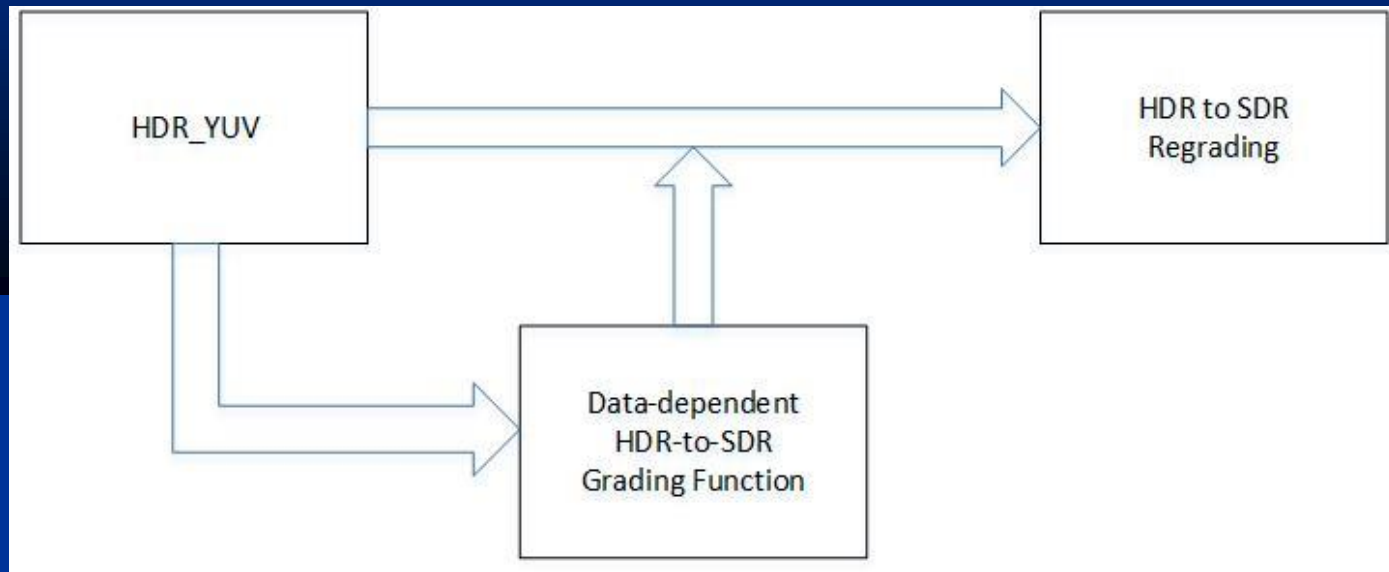
Pankaj Topiwala



# FastVDO Response to CFE (HDR Category) – G0021

- ❖ HDR/WCG extends the dynamic range of ordinary (SDR) video in two directions
  - Intensity (brightness), 100 nits -> 1K+
  - Color space, BT.709 -> BT.2020
- ❖ Introduce single tool: dynamic range adjustment
  - Dynamic range variation -> dynamic adjustment
  - Automatic adjustment triggered at frame level
- ❖ JEM 6.0 base codec

# Approach Overview



- ❖ Develop data-dependent grading function
  - Revert to linear light
  - Apply tunable, parametric model, using max, mean luminosity

# FastVDO PQ (FVPQ)

$Y_{OETF} = \text{powf}(((c2 * \text{powf}(Y, m1) + c1) / (1.0 + c3 * \text{powf}(Y, m1))), m2)$  where

$m1 = (2610.0 \quad) / (4096.0 * 4.0),$

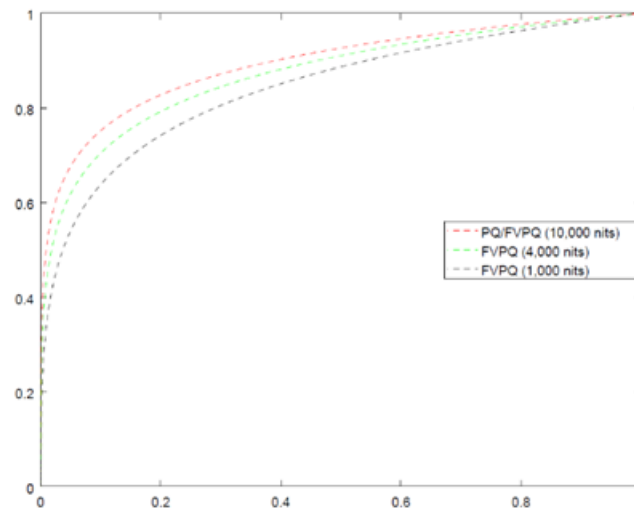
$m2 = (((2523.0 * 128.0)) / 4096) * (1 + 0.25 * \log(10000 / \text{InputPeakBrightness})),$

$c1 = (3424.0 \quad) / 4096.0,$

$c2 = (2413.0 * 32.0) / 4096.0,$

$c3 = (2392.0 * 32.0) / 4096.0$

Here,  $\text{powf}(a, b) = a^b$ , and *InputPeakBrightness* is new parameter, indicative of the peak brightness of the data. When the parameter equals 10,000, this reduces to the usual PQ function.



VDO

# Objective Results

Table 1. details the objective metrics obtained for the experiment vs JEM 6.0; Table 2 vs HM.

Table 1.

	Y	DE100	PSNRL100	wPSNR Y	wPSNR U	wPSNR V	PSNR Y	PSNR U	PSNR V
Market3Clip4000r2	5.9%	-10.3%	-0.9%	-1.6%	-39.7%	-43.4%	8.0%	-15.1%	-20.8%
ShowGirl	7.1%	-10.8%	0.0%	0.1%	-21.4%	-22.4%	-9.5%	-53.8%	-68.9%
EBU_04_Hurdles	-11.9%	-23.7%	-16.0%	-11.6%	33.7%	39.3%	-3.8%	60.9%	53.2%
EBU_06_Starting	10.3%	-13.6%	6.0%	-0.9%	-2.9%	-10.6%	-8.1%	-6.4%	-34.9%
Cosmos 1	2.6%	-5.4%	-6.1%	-2.6%	37.2%	56.6%	14.2%	70.8%	61.5%
Overall	2.8%	-12.7%	-3.4%	-3.3%	1.4%	3.9%	0.2%	11.3%	-2.0%

Table 2.

		Y	DE100	PSNRL100	wPSNR Y	wPSNR U	wPSNR V	PSNR Y	PSNR U	PSNR V
class A	Market3Clip4000r2	-19.5%	-44.0%	-25.8%	-27.8%	-67.6%	-68.9%	-17.9%	-48.2%	-38.3%
	ShowGirl	-19.7%	-32.6%	-26.1%	-26.8%	-67.6%	-28.6%	-31.8%	0.0%	-73.6%
	EBU_04_Hurdles	-37.3%	-53.3%	-41.5%	-39.1%	-44.7%	-31.0%	-33.1%	-28.0%	-18.9%
class B	EBU_06_Starting	-22.3%	-41.8%	-27.4%	-29.5%	-33.6%	-36.0%	-34.2%	-37.2%	-46.3%
	Cosmos1	-21.3%	-34.8%	-29.0%	-26.6%	-58.3%	-50.6%	-12.0%	-40.8%	-62.2%
	Overall	-24.0%	-41.3%	-30.0%	-30.0%	-54.4%	-43.0%	-25.8%	-30.8%	-47.9%



# Visual Gains

- ❖ Objective metrics are not reliable in HDR coding
- ❖ Limited testing indicates some visual gains

# Conclusion

- ❖ JEM 6.0 vs HM already shows substantial gains
- ❖ Tested simple tool, which appears to provide some further visual benefit
- ❖ In any case, we believe CfP is merited