The Latest on UHD*

*A.K.A Ultra HD, 4K, UHD-4K, Quad HD, UHDTV

More

Resolution

Frame Rates

Cameras

Colour Gamut

Codecs

DNxHR
XAVC
H.265 VP9

Workflows

DATA

Masters

Consumer devices

UHD Resolution Comparison

720x576
0.4Mpx
SD

1920x1080
2.1Mpx
HD

3840x2160
8.3Mpx

20xSD
4xHD
UHD

7680x4320
33.2Mpx
8K

UHD-1 "4K" HD 2160P
Resolution: 3840 x 2160 pixel
Scanning format: progressive only
Bit depth: 10 – 12 bit
Frame rate: like HD, 100 and 120 fps
Colour: Recommendation BT.2020
Sampling: 4:2:0 distribution, 4:2:2, 4:4:4 production
Aspect Ratio: 16x9

UHD-2 "8K" HD 4320P
Resolution: 7680 x 4320 pixel
Scanning format: progressive
Bit depth: 10 – 12 bit
Frame rate: like HD, 100 und 120 fps
Colour: Recommendation BT.2020
Sampling: 4:2:0 (distribution), 4:2:2, 4:4:4 production
Aspect Ratio: 16x9

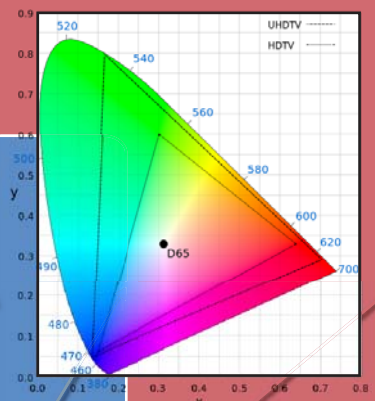
UHD-2 "8K" 7620x4320

Resolution vs Field of View

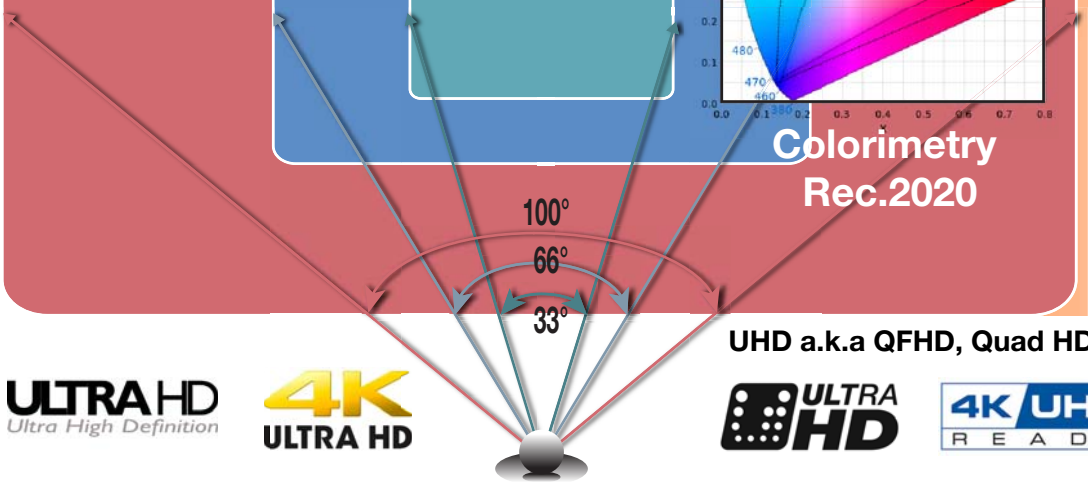
Completely filling the field of view to increase sense of being there

UHD-1 "4K" 3840x2160

HD 1920x1080



Colorimetry Rec.2020



UHD vs DCP vs DCI

UHD-1 "4K"	3840x2160
4K DCP	4096x2160
4K DI	4096x3112

10 or 12 bits RGB/YCbCr
4:4:4, 4:2:2 or 4:2:0
chroma subsampling

Progressive Only

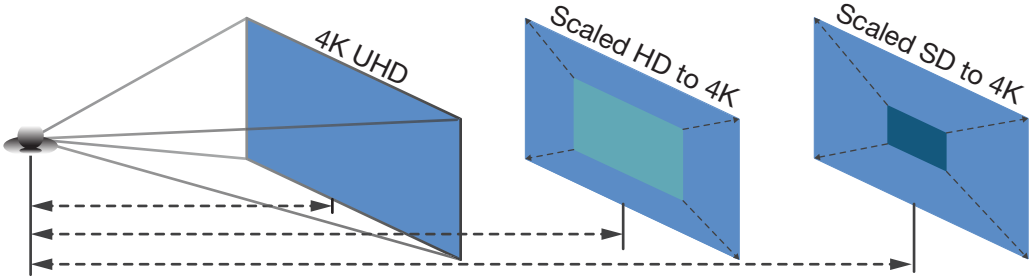
120p, 119.88p,100p,
60p, 59.94p, 50p,
30p, 29.97p, 25p,
24p, 23.976p

UHD a.k.a QFHD, Quad HD, Ultra HD, UltraHD and UHDTV

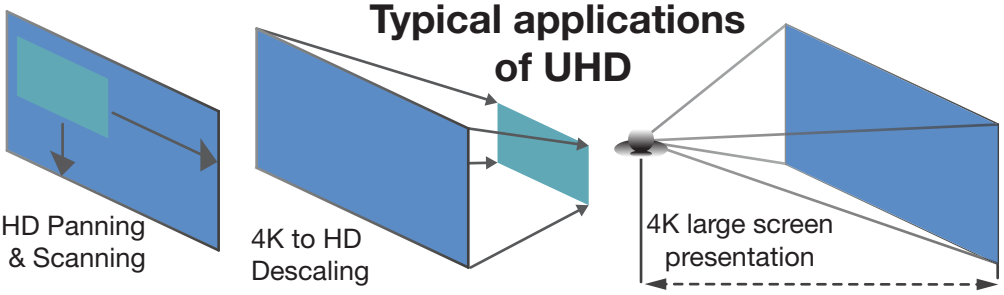
ULTRA HD Ultra High Definition
4K ULTRA HD
ULTRA HD
4K UHD READY
UHD ready 2160p
UHD ready 4320p

Visual Acuity* vs Resolution (Fixed screen size)

*Visual acuity (VA) is acuteness or clearness of vision. It depends on optical and neural factors, i.e., (i) the sharpness of the retinal focus within the eye, (ii) the intactness and functioning of the retina, and (iii) the sensitivity of the interpretative faculty of the brain



Typical applications of UHD



Acquisition

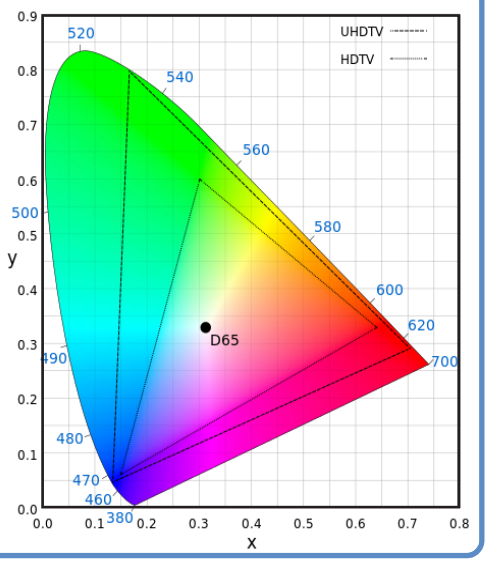
Go-Pro Hero 4- 4K30p
Blackmagic Production Camera 4K
JVC-GY-HMQ10
Sony AX1 4K
Canon EOS-C500
Sony PMW-F5
Red Scarlet-X
ARRI AMIRA

Rec. 2020

ITU-R Recommendation BT.2020

Colorimetry

630 nm red primary colour
532 nm green primary colour
467 nm blue primary colour



Two resolutions of 3840 × 2160 and 7680 × 4320, both 16:9 & square pixels.
Frame rates: 120p, 119.88p, 100p, 60p, 59.94p, 50p, 30p, 29.97p, 25p, 24p, 23.976p.
Bit depth of either 10-bits per sample or 12-bits per sample.

Rec. 2020 covers 75.8% CIE 1931 colour space
In comparison to digital cinema reference 53.6%,
Adobe RGB colour space 52.1% and
Rec 709 colour space 35.9%

75.8%

RGB and YCbCr signal formats with 4:4:4, 4:2:2, and 4:2:0 chroma subsampling

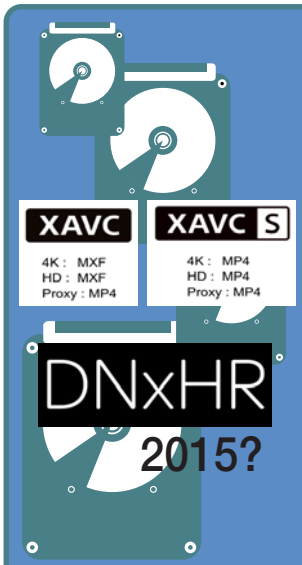
SMPTE

6 Gb/s

12 Gb/s

Standard	Name	Introduced	Bitrates	Example video formats
SMPTE 424M	3G-SDI	2006	2.970 Gbit/s, and 2.970/1.001 Gbit/s	1080p
SMPTE ST-2081*	6G UHD-SDI	?	6 Gbit/s	4Kp30
SMPTE ST-2082*	12G UHD-SDI	?	12 Gbit/s	4Kp60

SMPTE 2036-1 (2009) Ultra High Definition Television — Image Parameter Values for Program Production
SMPTE 2036-2 (2008) Ultra High Definition Television — Audio Characteristics and Audio Channel Mapping for Program Production
SMPTE 2036-3 (2010) Ultra High Definition Television — Mapping into Single-link or Multi-link 10 Gb/s Serial Signal/Data Interface



UHD *	Frame Rate	Colour Space	Transfer Gb/s **	*60 minutes of Storage*		
				Raw (TB) **	XAVC-HD (GB) **	XAVC-4K (GB) **
2160P	24	YUV 10-Bit	4.2	1.91	40.15	112.15
2160P	25	YUV 10-Bit	4.4	2.00	41.65	116.65
2160P	29.97	YUV 10-Bit	5.3	2.39	49.1	137.5
2160P	30	YUV 10-Bit	5.3	2.39	49.15	137.5
2160P	48	YUV 10-Bit	8.5	3.83	76.15	225
2160P	50	YUV 10-Bit	8.8	3.99	79.15	225
2160P	59.94	YUV 10-Bit	10.6	4.78	94.063	275
2160P	60	YUV 10-Bit	10.6	4.79	94.15	275
2160P	96	YUV 10-Bit	17	7.65	150	437.5
2160P	120	YUV 10-Bit	21.2	9.56	187.5	550

* Includes Audio, 8 Channels, 48KHz, 24-bit ** Values derived from AJA DataCalc app

SONY XAVC

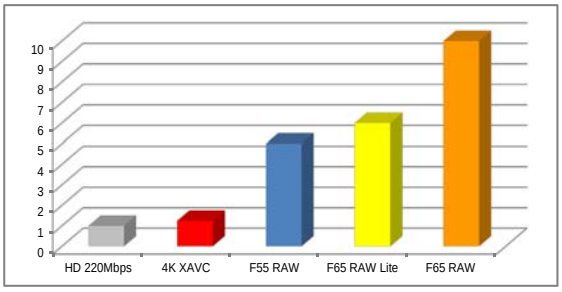


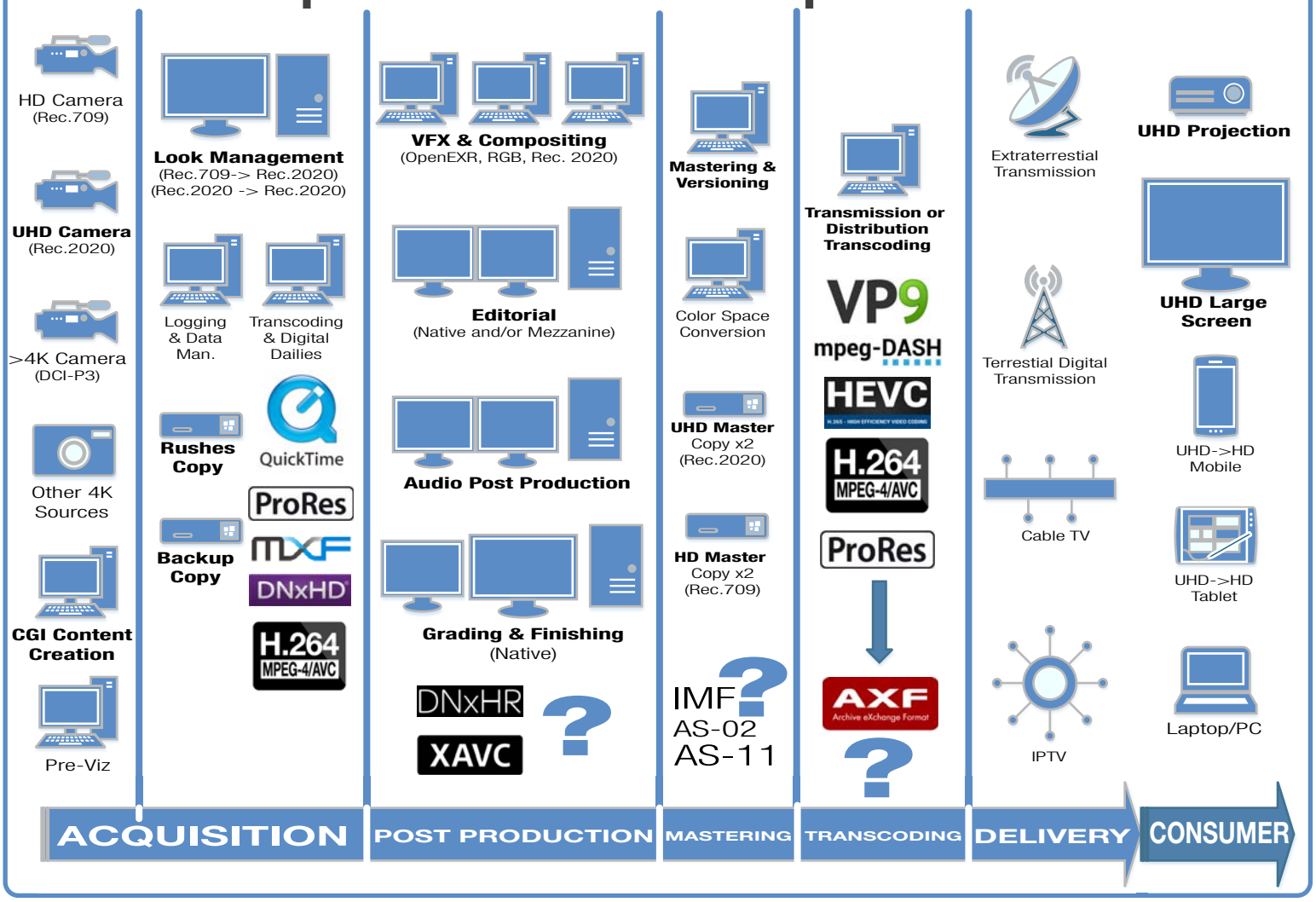
Image file size comparison: Unit Giga Byte / Frame

Range	Resolution	Frame Rate	Color	Max Bitrate	Intra/Long
4k	4096x2160	23.98p to 59.94p	4:2:0/8bit to 4:4:4/12bit	960Mbps	Intra/Long GOP
	3840x2160				
HD	2048x1080	23.98p to 59.94p 50i/59.94i	4:2:0/8bit to 4:4:4/12bit	440Mbps	Intra/Long GOP
	1920x1080				
	1440x1080				
	1280x720				
Proxy	1920x1080	23.98p to 59.94p	4:2:0/8bit	28Mbps	Long GOP
	1280x720				
	640x360				
	480x270				

MPEG-4
MXF OP1a

UHD Post Technology Vendors

UHD-1 Acquisition to Consumption



Recent & Future UHD-1 Broadcast & Distribution

Designed and Collated by Dair Design and Consulting Ltd. October 2014 www.bendair.co.uk