Camera Training Center Breda The Netherlands

Febr 2016

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Jan Paul Campman

- **Your Host for this session**
- *Training Manager*
- *Trainer*
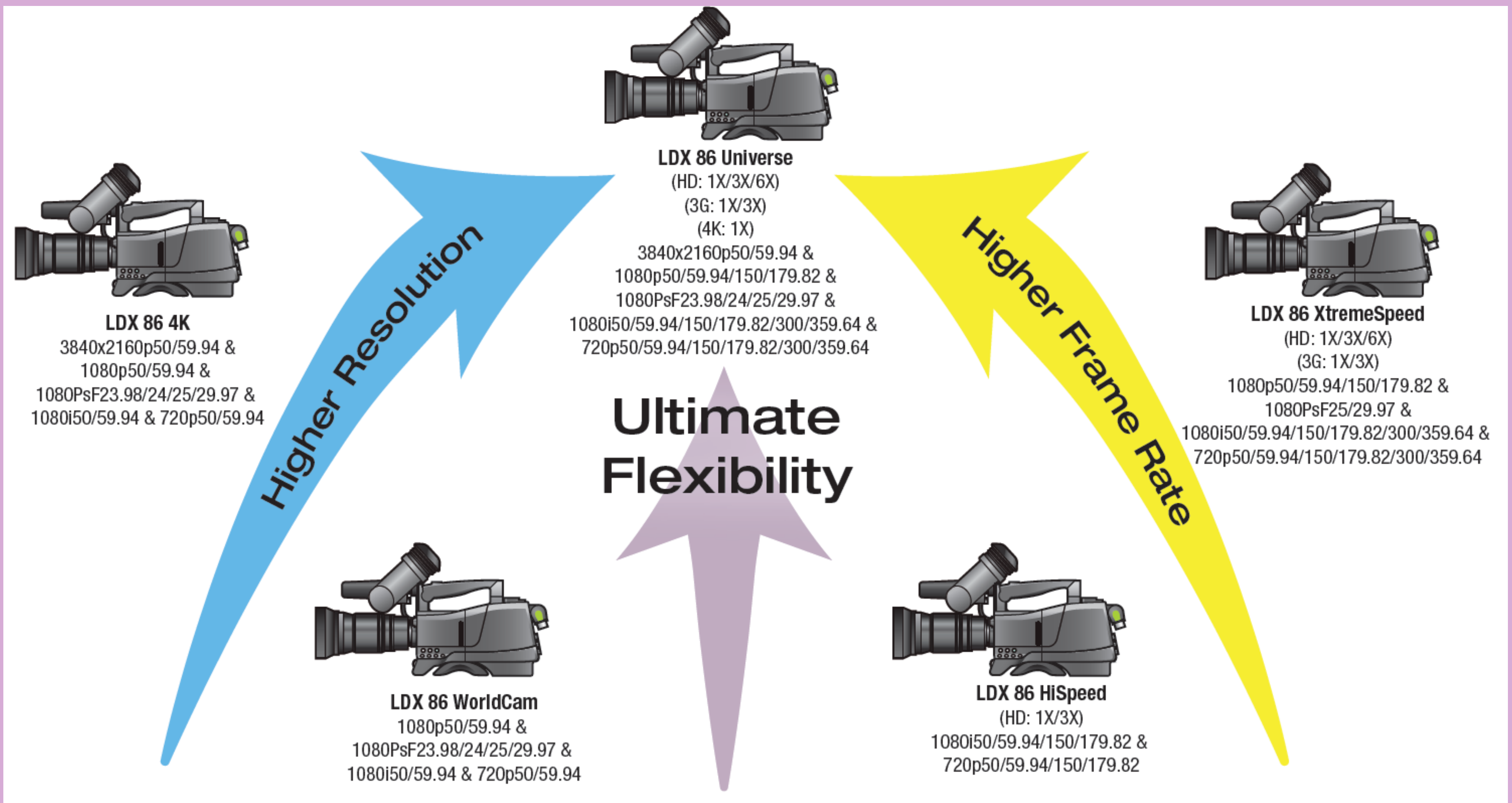- *Acceptance Engineer*
- *Demo specialist*
- *Web master*

- your guide for this __INTERACTIVE__ session.
- **Welcome to the LDX Series WEB-Training**

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LDX 86 series

LDX86 HD/4K XS

LDX 86 Universe
(HD: 1X/3X/6X)
(3G: 1X/3X)
(4K: 1X)
3840x2160p50/59.94 &
1080p50/59.94/150/179.82 &
1080PsF23.98/24/25/29.97 &
1080i50/59.94/150/179.82/300/359.64 &
720p50/59.94/150/179.82/300/359.64

LDX 86 4K
3840x2160p50/59.94 &
1080p50/59.94 &
1080PsF23.98/24/25/29.97 &
1080i50/59.94 & 720p50/59.94

Higher Resolution

Ultimate Flexibility

Higher Frame Rate

LDX 86 XtremeSpeed
(HD: 1X/3X/6X)
(3G: 1X/3X)
1080p50/59.94/150/179.82 &
1080PsF25/29.97 &
1080i50/59.94/150/179.82/300/359.64 &
720p50/59.94/150/179.82/300/359.64

LDX 86 WorldCam
1080p50/59.94 &
1080PsF23.98/24/25/29.97 &
1080i50/59.94 & 720p50/59.94

LDX 86 HiSpeed
(HD: 1X/3X)
1080i50/59.94/150/179.82 &
720p50/59.94/150/179.82

LDX XtremeSpeed series

This part gives you some more details about the Basics and Service from the LDX HighSpeed line
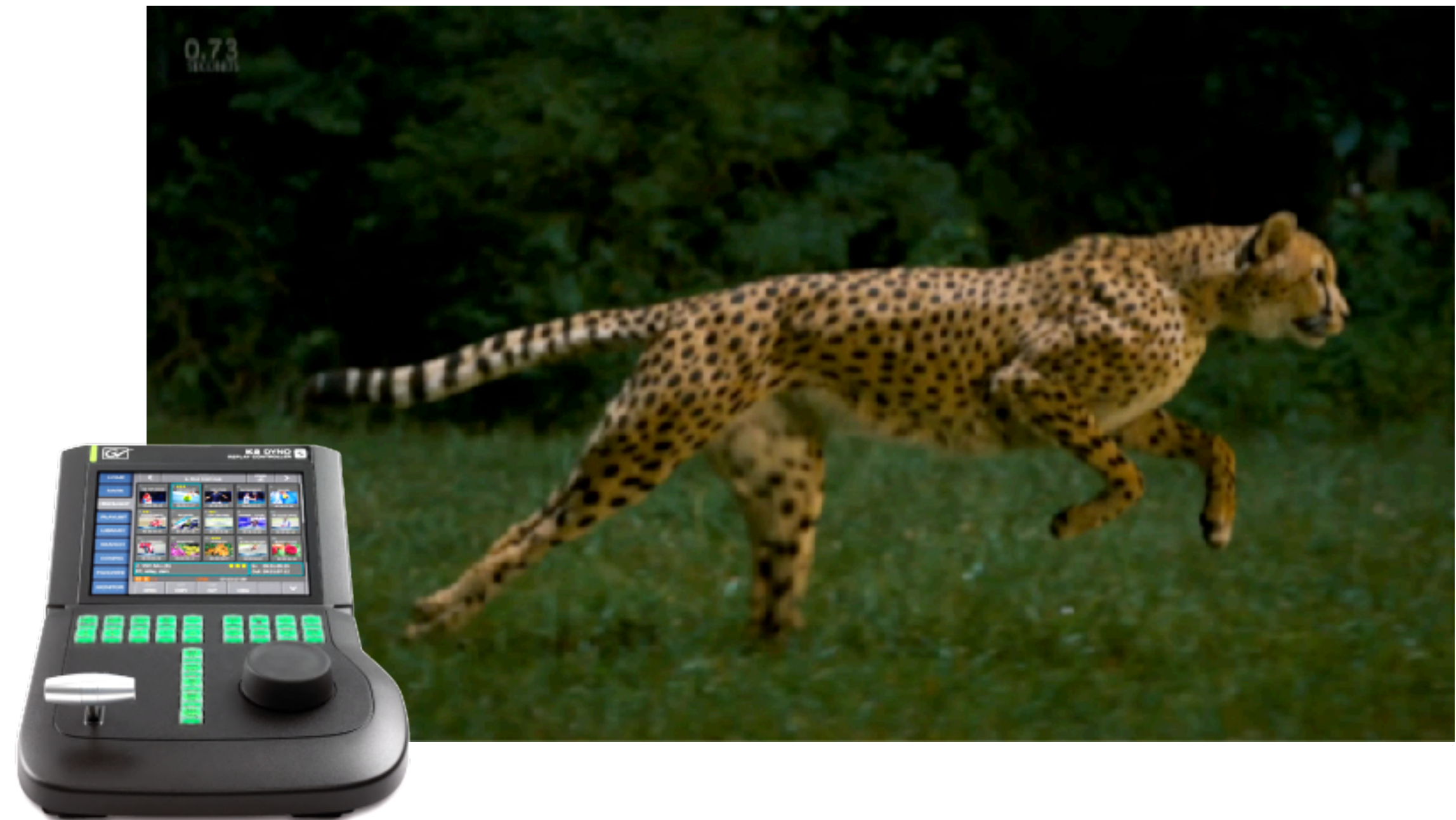
In this session:

✦ Introduction LDX XtremeSpeed

✦ **LDX 86 4K , XDR, CG explained**

✦ **Technical inside LDX XtremeSpeed**

✦ *Basic Service and Diagnostics (session 7)*

✦ **Looking inside (Head,Adaptor,XCU)**

✦ *Basics Dyno and Summit (session 9)*

LDX XtremeSpeed series

The Next Step In SlowMotion
Truly speeding up the HighSpeed workflow

History

1998 ; LDK23
- ✦ (1st SD Super Slow Motion Camera)

2000 ; LDK23MKII
- ✦ Including Flicker compensation
- ✦ Set the defacto standard for Super Slow Motion

2004 ; LDK6200
- ✦ 1st HD Slow Motion Camera

2008 ; LDK8300
- ✦ 1st HD Super Slow Motion Camera
- ✦ Set the defacto standard for Super Slow Motion

2014 ; LDX86
- ✦ 1st HD Extreme Motion Camera

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Sport Applications – The Speed Definitions

LDX HighSpeed

1x   2x   **3x**

Super Slow Motion

Straight-Forward workflow

Interviews with customers

Statements from customers using today's Ultra Motion cameras

☑ "3x speed cameras (SSM) are rented every soccer weekend"

☑ "Cost to rent Ultra Motion cameras must not exceed 2x the rental cost for 3x speed cameras" (1.900,- Euro/day)

☑ High cost for Ultra Motion are mainly due to high cost for EVS XT3

☑ "Light conditions in each stadium determine the max frame rate…….
     300fps is pretty normal."

☑ Large depth-of-field is required to make sure the slomo-replay is always in focus….!

☑ "Ultra Motion cameras are too complex to offer them on a Dry Hire basis"

☑ "Ultra Motion cameras, need experienced Ultra Motion operators"

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Our offering ; Customer Benefits

1st Ultra motion camera with straight-forward workflow

☑ Instant replay (never miss a moment)

☑ You're not limited by the internal camera memory size (banks)

Setting a new standard for Ultra Motion acquisition

☑ Perfect matching other LDX series cameras

☑ High Sensitive Imagers (LDX series)

☑ "AnylightXtreme" (artificial light compensation)

1st handheld Ultra Motion camera

☑ Get closer to the action. Unique shots with ENG lenses

☑ Mobile Ultra Motion cameraman. Move where the action is

LDX XtremeSpeed = the Sports Director's choice

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Our offering ; Customer Benefits (more)

Continuous recording on server

✦ Never miss a spectacular moment due to playing back a previous stunning replay

Full compatibility with standard XCU cradles

✦ Convert any camera position to an XtremeSpeed position with the XCU XtremeSpeed

✦ Cradle connections remain the same for I-com, audio, control, returns, etc.

Maximum Utilization

✦ HQ "Live"-output enables to go live-on-air, so not only use as XtremeSpeed camera

✦ Single Speed mode offers flexibility to use the XtremSpeed camera also as single speed

High Quality infrastructure

✦ XtremeSpeed uses standard LDX accessories like ViewFinders, SXP's and OCP's

✦ No lens-converters needed

Our offering ; **Server Integration**

- ☑ 1x speed, 1080i, 720p and 1080p at equal sensitivity
- ☑ 3x speed, 1080i150/180 output XCU, full-res captured (LDK8300 modes)
- ☑ 3x speed, 720p150/180output XCU, full-res captured (LDK8300 modes)
- ☑ 3x speed, 1080p150/180 output XCU, full-res captured
- ☑ 6x speed, 1080i300/360 output XCU, full-res captured
- ☑ 6x speed, 720p300/360output XCU, full-res captured
- ☑ 'combined' signal for all modes, for truly-matched Live usage

3G Coax 3x phases

3G Coax 1x Live

XT·3

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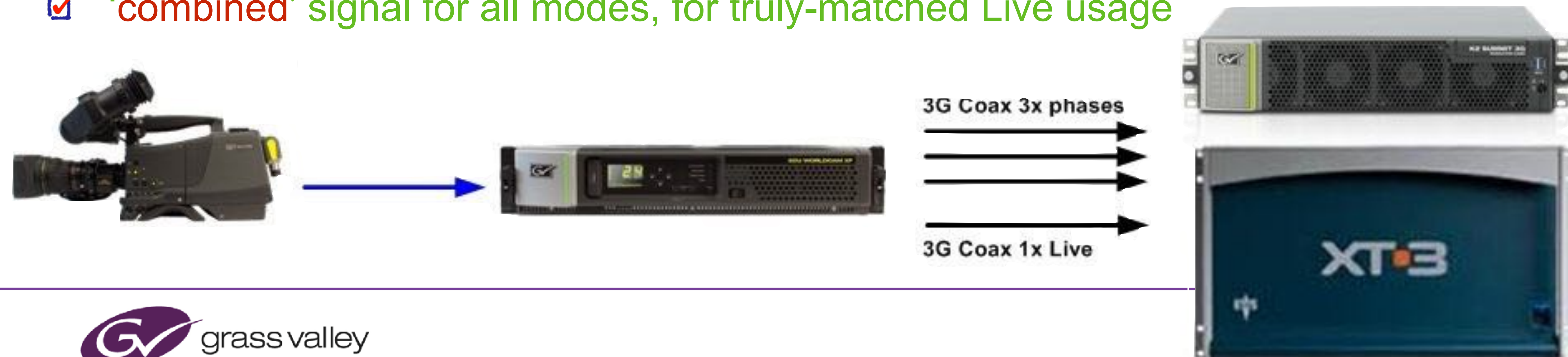
Our offering ; New Transmission

XF Transmission

- ☑ New **transmission** system between Camera Adapter and XCU
- ☑ **10Gb Fiber** only transmission, using standard SMPTE cables
- ☑ **X**treme **F**lexible transmission offers required bandwidth for high frame rates
- ☑ Direct Frame Transmission from Camera head to XCU outputs
  NO frame storage in camera head needed
- ☑ "Future-proof" transmission system ; Support of different protocols

XF Fiber Adapter

✦ **3G (4,5Gb) format**
✦ **10G HDSDI/SDSDI over IP**
  - Supporting SMPTE 2022-6
  based on standard protocol
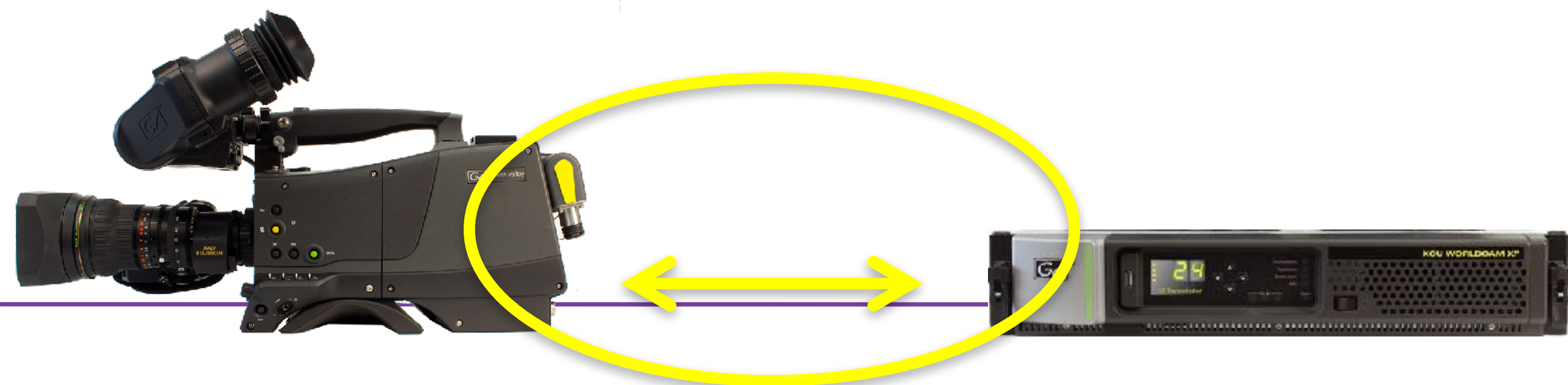
Our offering ; New Transmission

XF Transmission

10Gb Fiber only transmission, using standard SMPTE cables

- **Supporting SMPTE 2022-6**

Transport of High Bit Rate Media Signals over IP Networks (HBRMT)

Scope

This standard defines a unidirectional IP-based protocol for the transport of real-time video, audio, and ancillary signals. In particular this standard defines a method for the encapsulation of the payloads of a variety of existing SMPTE serial digital video standards.

The term High Bit Rate is used herein to distinguish from other Media-over-IP applications in which compressed signals are transported.
The uncompressed signals in this document
 are at rates of 270 Mbits/sec and higher.
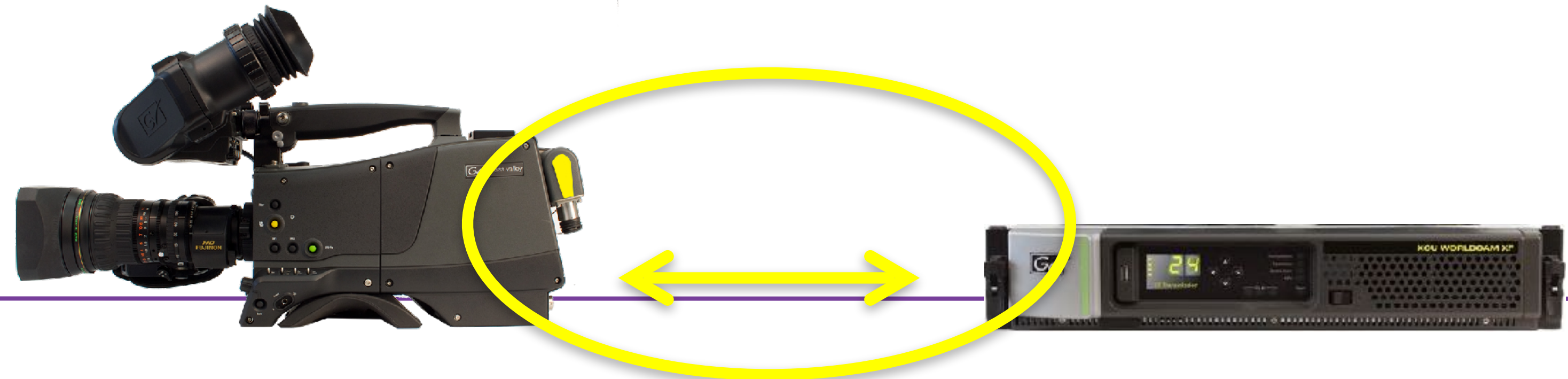
Our Partnerships

The LDX XtremeSpeed camera is supported by the two main Live replay server brands (Grass Valley and EVS)

Both supporting 3x1080p, 6x1080i and 6x720p

Summit 3G + Dyno-S

## EVS XT3 + LSM

LDX86 HD/4K XS (AnyLight™)

Artificial Light Flickering During Replay

- No artificial light flickering occurs during replays of 1x and 2x speed recordings
- Artificial light introduces flickering between frames when 3x speed recordings are played back at normal speed (see drawings 1x, 2x and 3x)
- "AnyLight™" has proven its value in the market for LDK8300 replays
- "AnyLight™" : NO Flickering under "any" light condition

1x

2x

3x
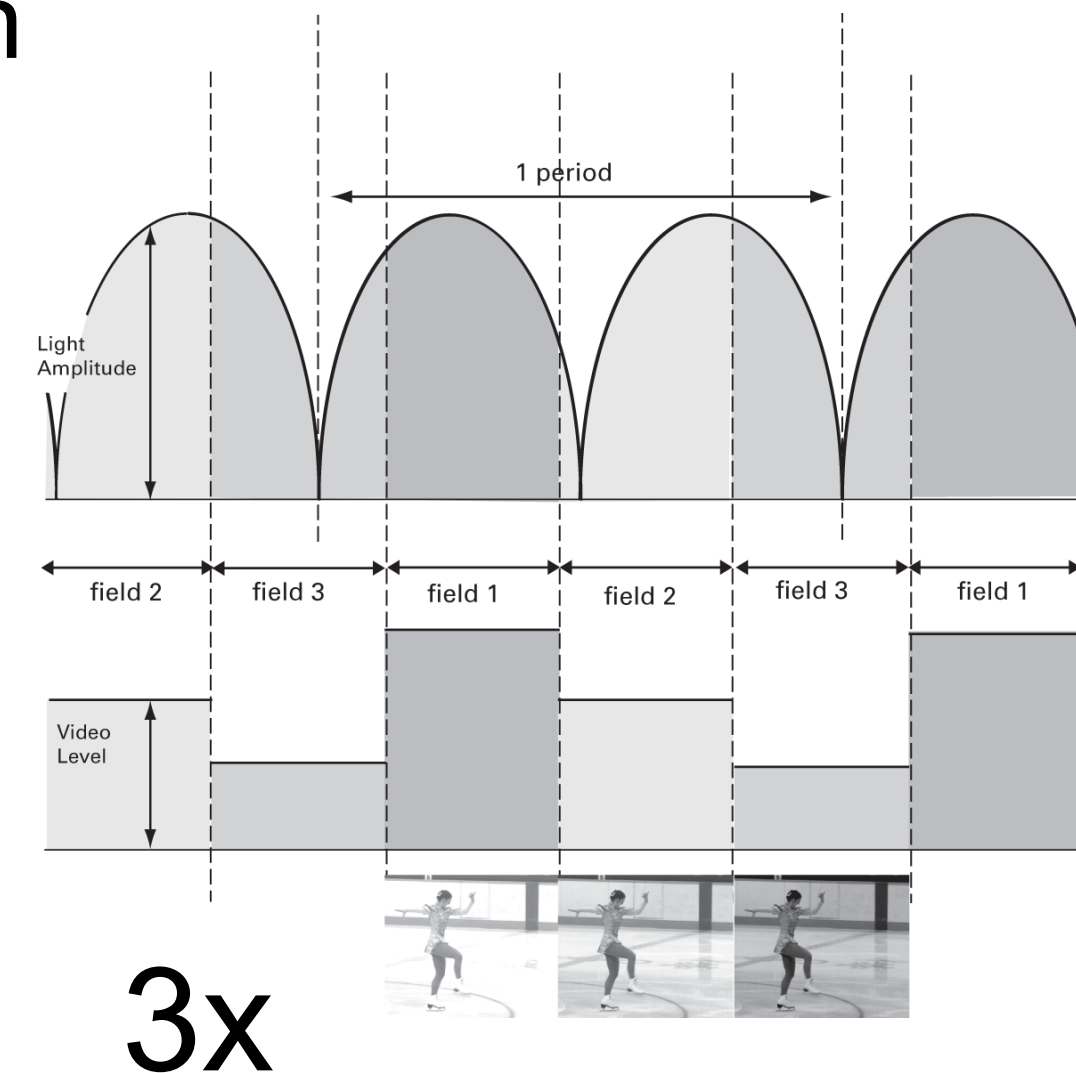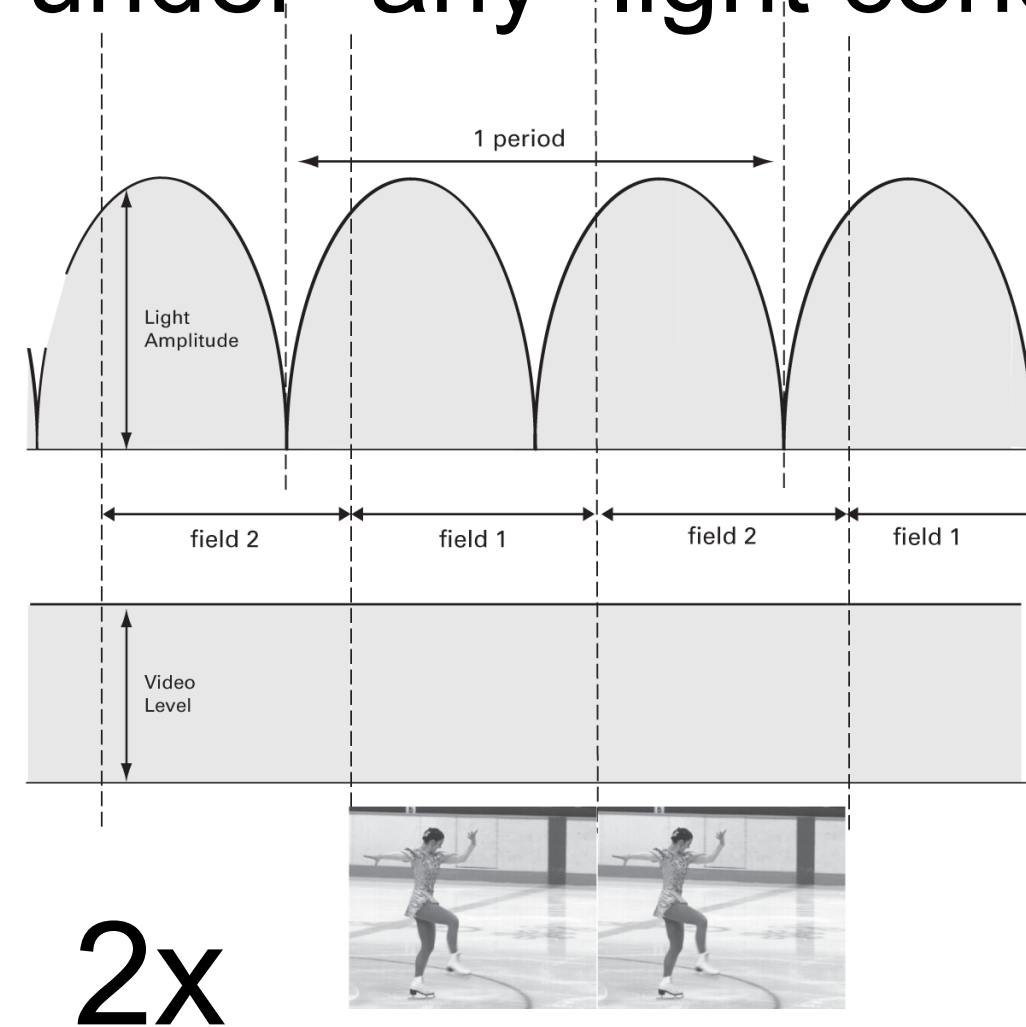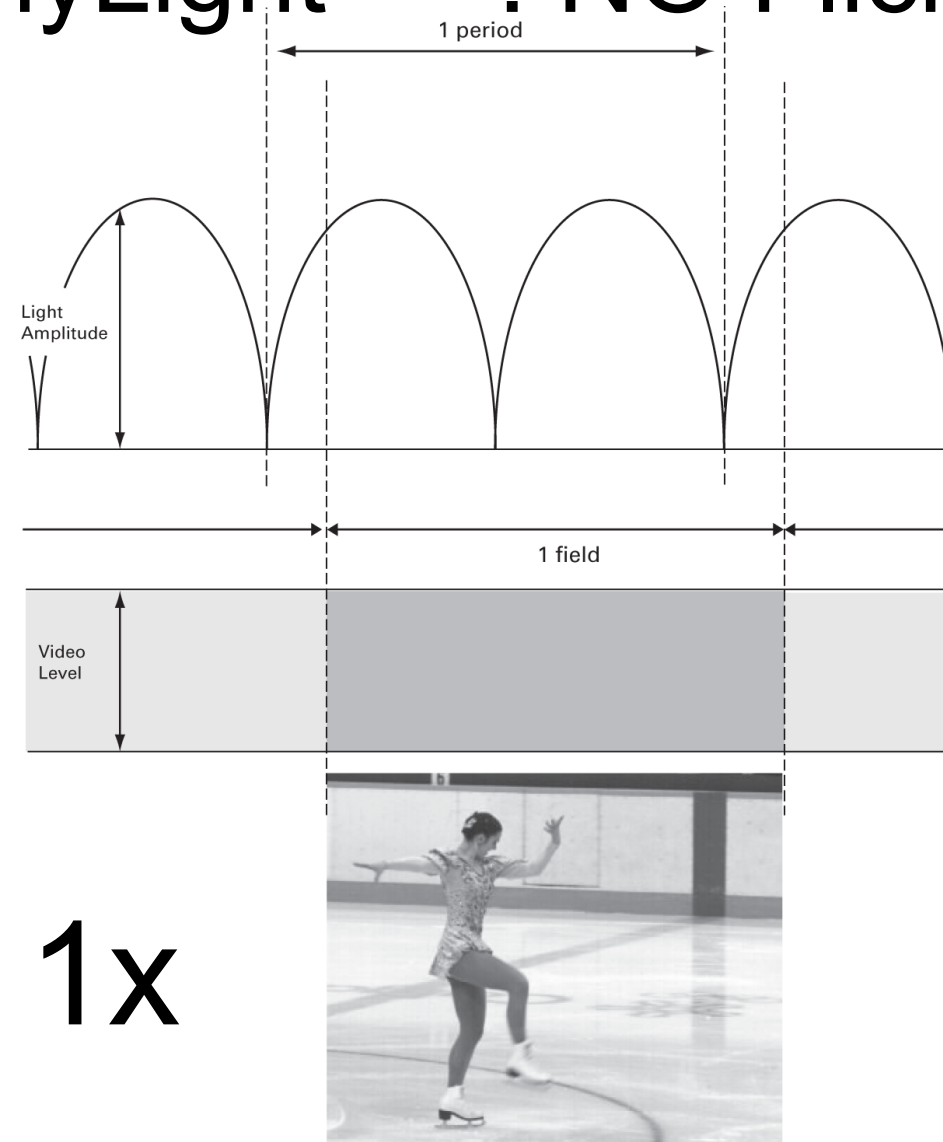
LDX86 HD/4K XS (AnyLight™)

Artificial Light Flickering During Replay
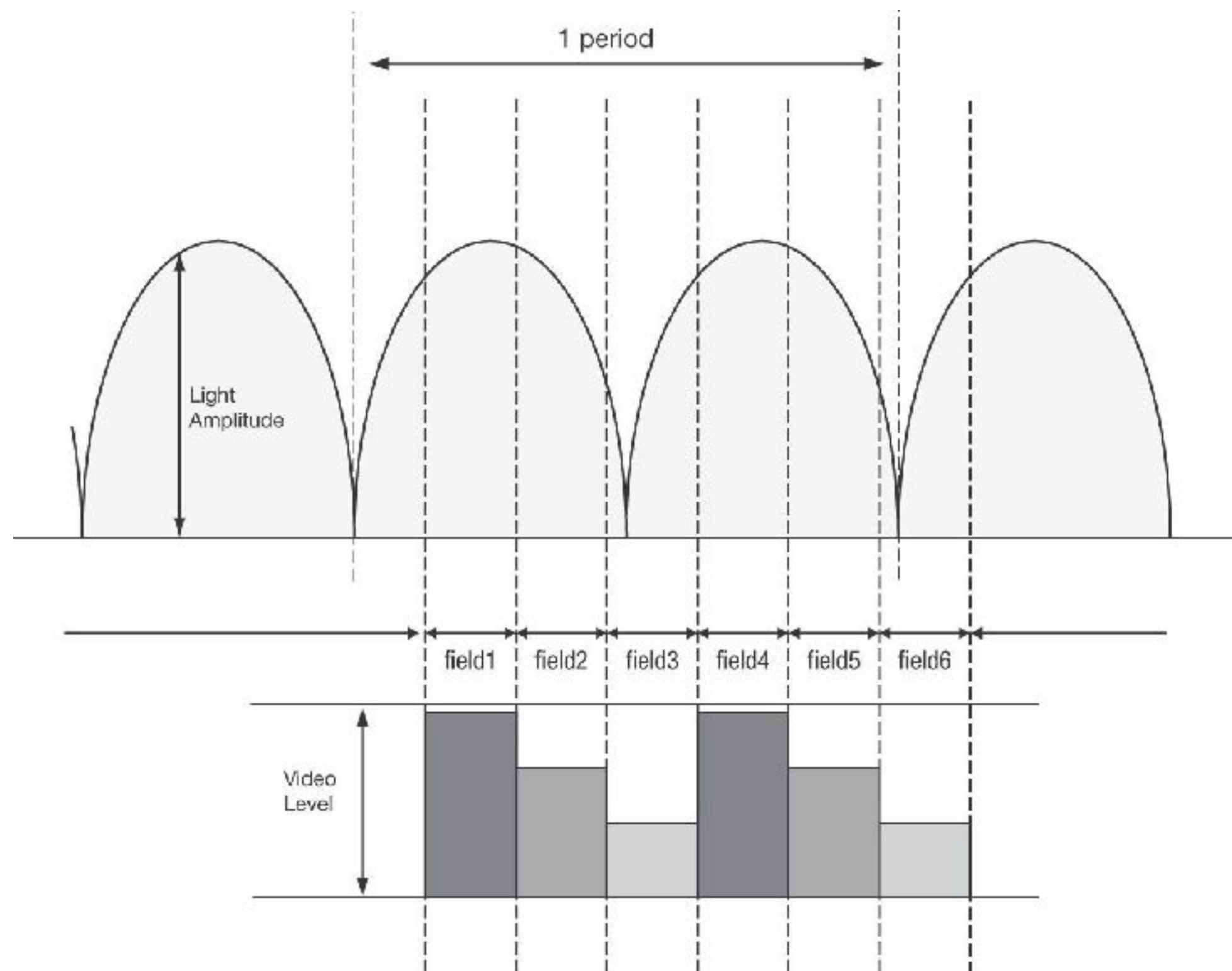
LDX XtremeSpeed captures video frames upto 6x faster as the light-cycle frequency.

"AnyLightXtreme" is the further improved LDK8300 "AnyLight" compensation !

"AnyLightXtreme^{tm}" is developed for upto 6x speed capturing, showing NO Atificial Light Flickering during the replays.

• 5 selectable levels to match light conditions

Competition:
Basic Reduction(AGC; Automatic Gain Control)
Flickering remains visible during replays

LDX XtremeSpeed series

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✦ **Technical inside LDX XtremeSpeed**

✦ *Basic Service and Diagnostics (session 7)*

✦ **Looking inside (Head,Adaptor,XCU)**

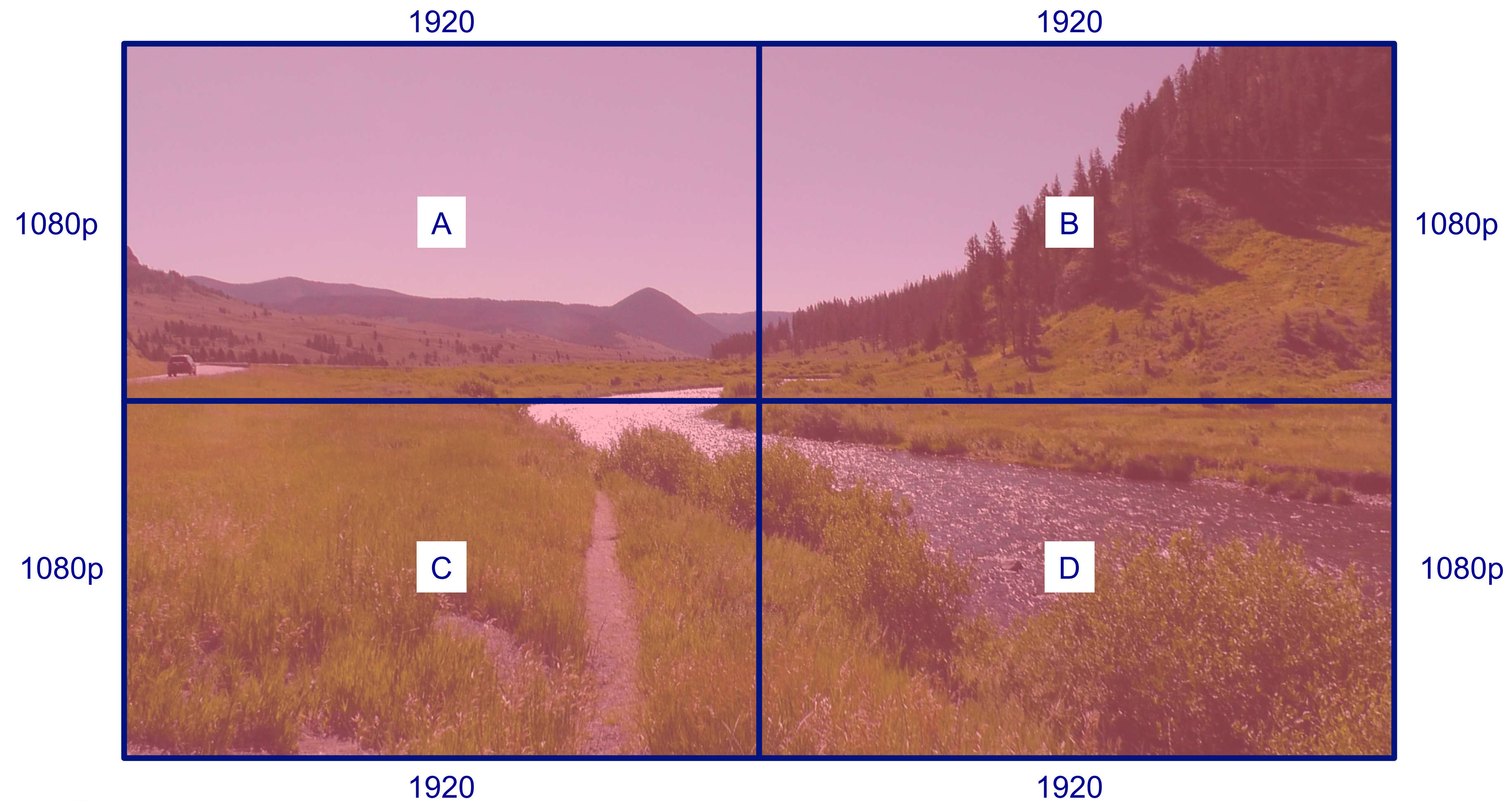✦ *Basics Dyno and Summit (session 9)*

LDX86 HD/4K XS

- What is the 4K standard?

- What is UHD?

- 4096 x 2160 or 3840 x 2160?
  => 4K as used in a switcher is 3840 x 2160

- Transmission can be either:
  a. Quad Link - 4 quadrants – simultaneously
    i.e. 4 - IP streams or 4-HDSDI signals at 1080p
  b. Dual Pixel Interleave
    1,1,2,2,1,1,2,2 and 3,3,4,4,3,3,4,4 on 2 simultaneous streams
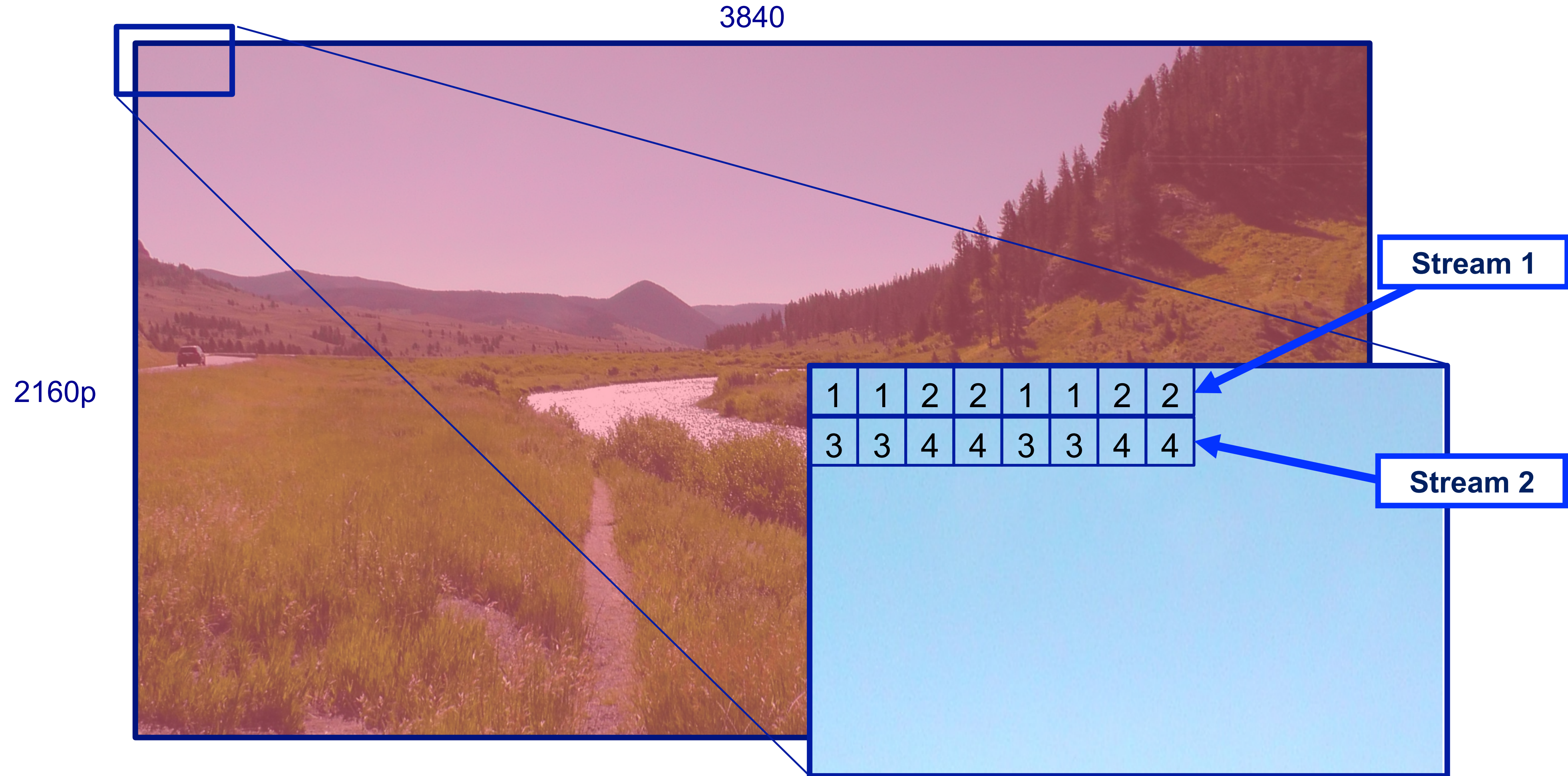 c. Compression - TICO (Tiny Codec) 4k in a 3Gb signal (4:1 compression)

LDX86 HD/4K XS
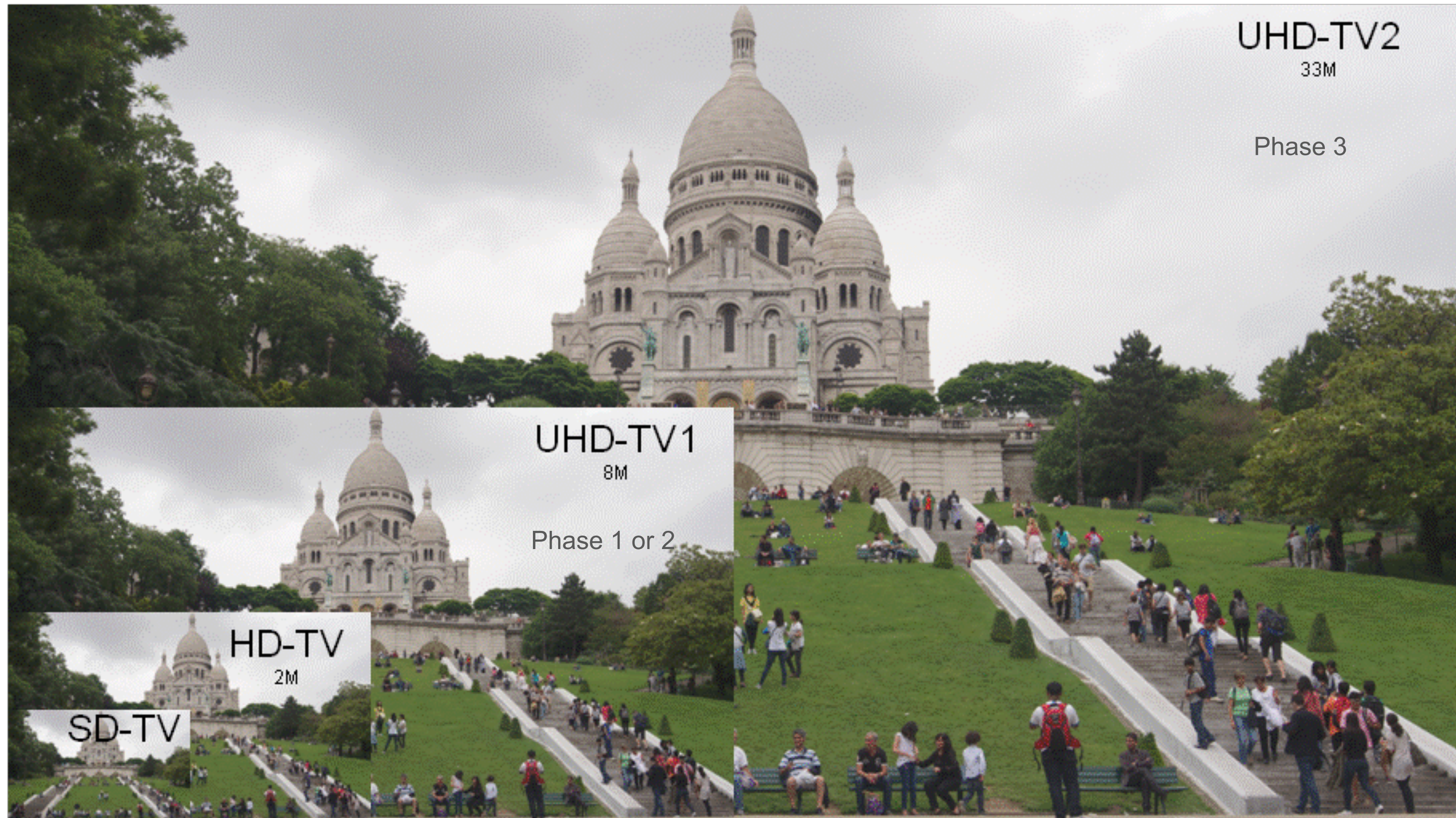
LDX86 HD/4K XS (modes)

4K Quadrants = (3840 x 2160) **Quad link**

1920

1920

1080p

A

B

1080p

1080p

C

D

1080p

1920

1920

Square Division Quad Split
 - Each link contains
   one quarter of the original image

Quad Link 2 Sample Interleave (2SI)
 - Each link contains a full image
   at 1/4 resolution.
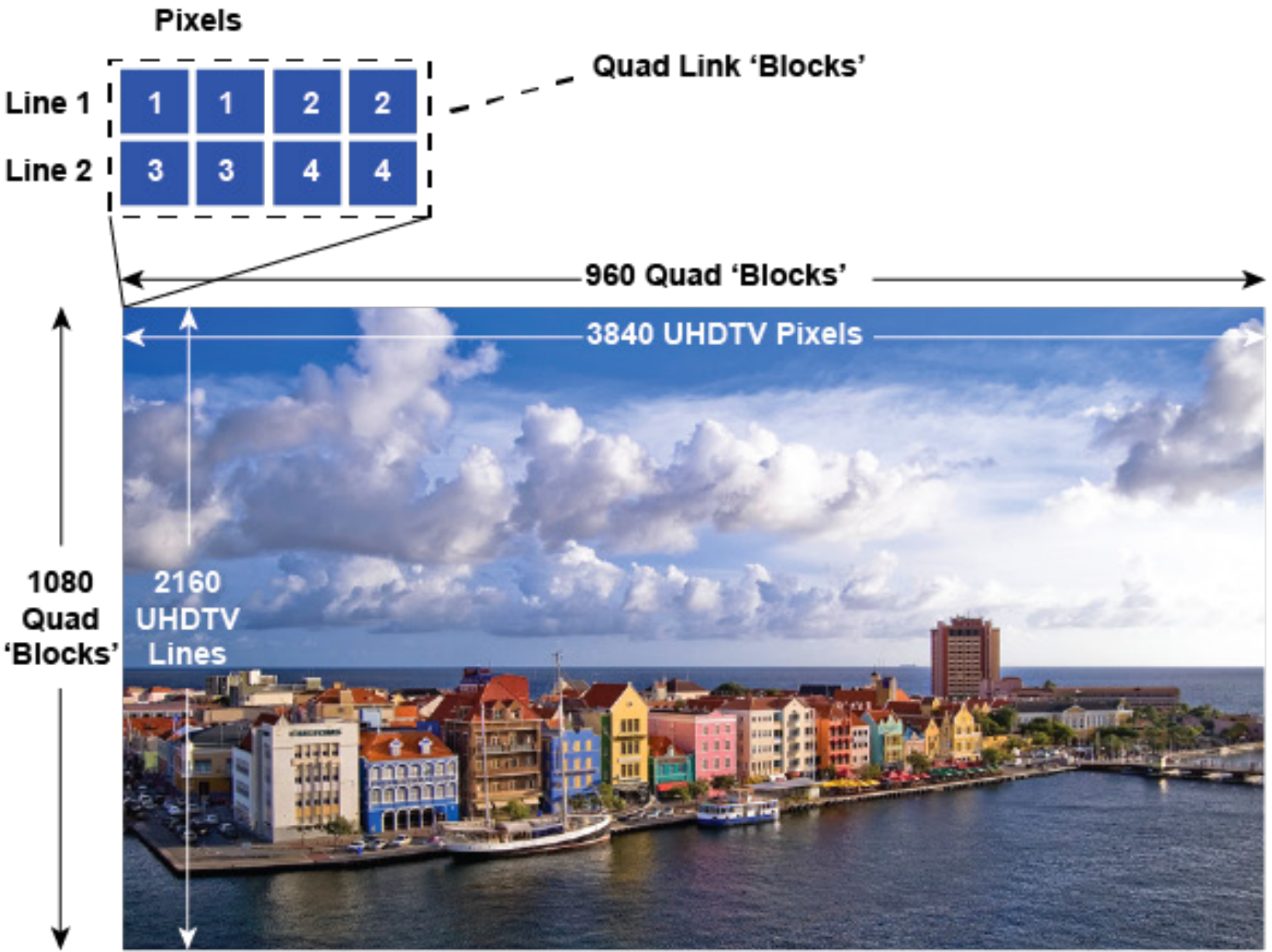
UHD/4K - How to watch 4K

- 4K images need a much shorter viewing distance
  - At today's screen sizes,
    the typical viewing distance does not allow viewers to see the full 4K resolution

or

- 4K needs much larger
  screen sizes

or

- 4K alone will miss
  the "WOW factor"

Image Diagonal	Minimum Viewing Distance for Full Resolution in cm				
Inch	SD	720p	1080p	4K	8K
32	232	186	124	62	31
37	268	215	143	72	36
40	290	232	155	77	39
42	305	244	163	81	41
47	341	273	182	91	45
50	363	290	193	97	48
55	399	319	213	106	53

UHD/4K - The (Production) market „Believe" in 4K

Production company survey

If you were to build a new production truck three years from now, which format do you think you would build it with?

Format	Percentage
3G/1080p	36.8%
4K	30.8%
1080i	21.2%
8K	4.4%
720p	2.5%
IP	2.5%
3D	1.6%
SD-SDI	0.3%

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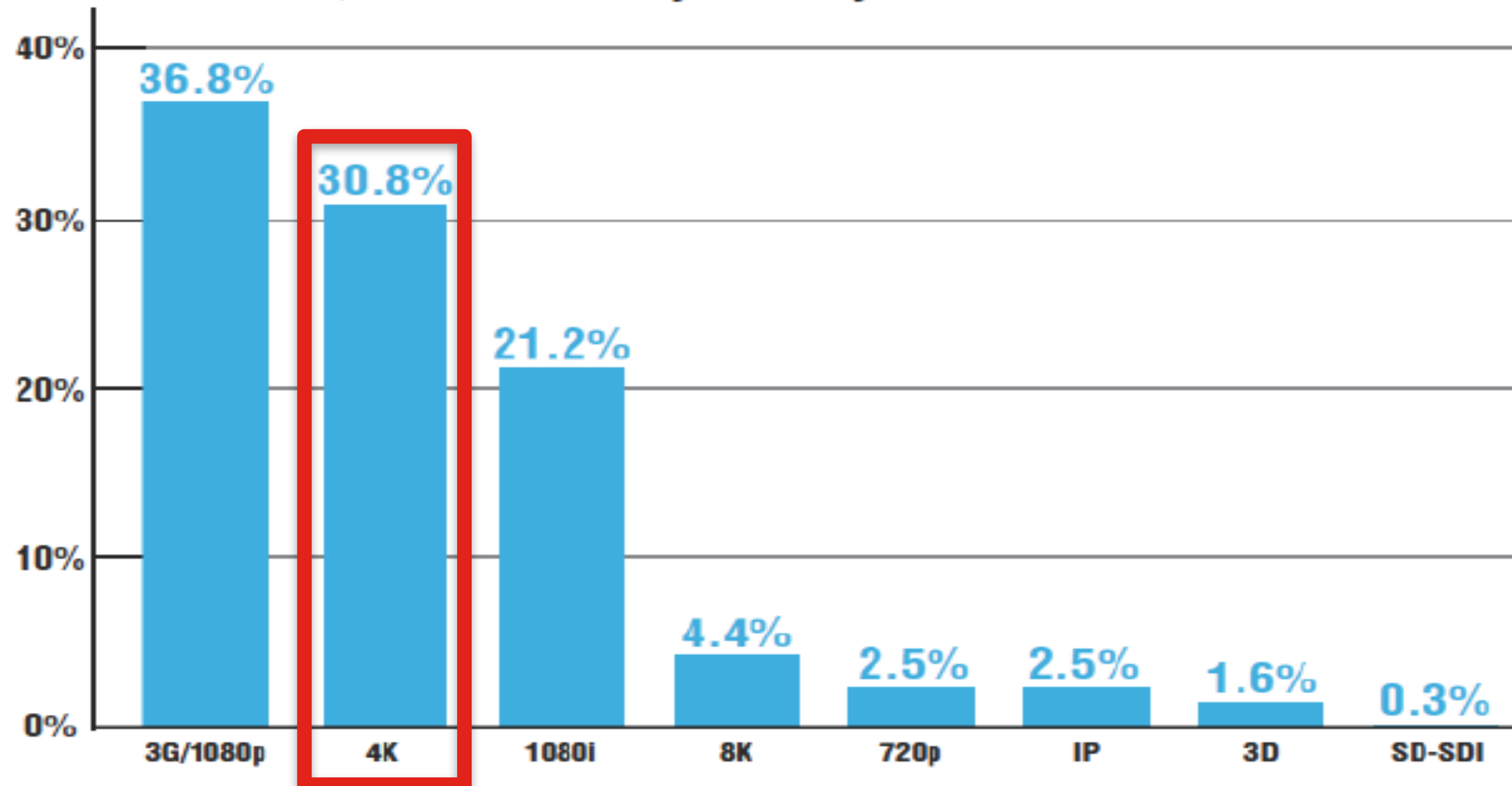
Many broadcasters think a 4x higher

count won't deliver the **"w**

needed from a new broadca

WOW!

HDR opens up the potential for more engaging, more beautiful content, as well as future proofing **XDR** is new feature in GV Cameras (Ready for 2K and 4K)

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Why HDR - For most natural images

High scene contrasts can be found in many typical pictures

A unit of measurement of luminance, or the intensity of visible light, where one nit is equal to one candela per square meter.
Nits are used to describe the brightness of displays, such as LCD and CRT monitors.

(1 nit = 1 cd/m2).

200 - 300 nits   for Standard monitor
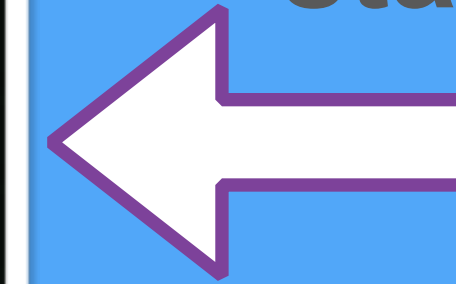**800 - 4000 nits for HDR monitor** more in the future
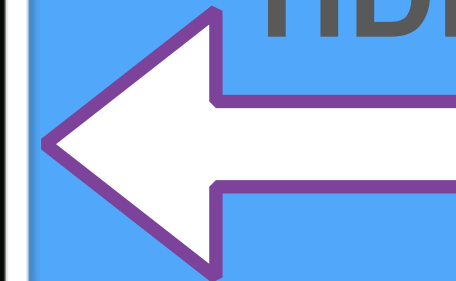
100 Watts bulb emits 18000 nits
sunny day up to 50000 nits
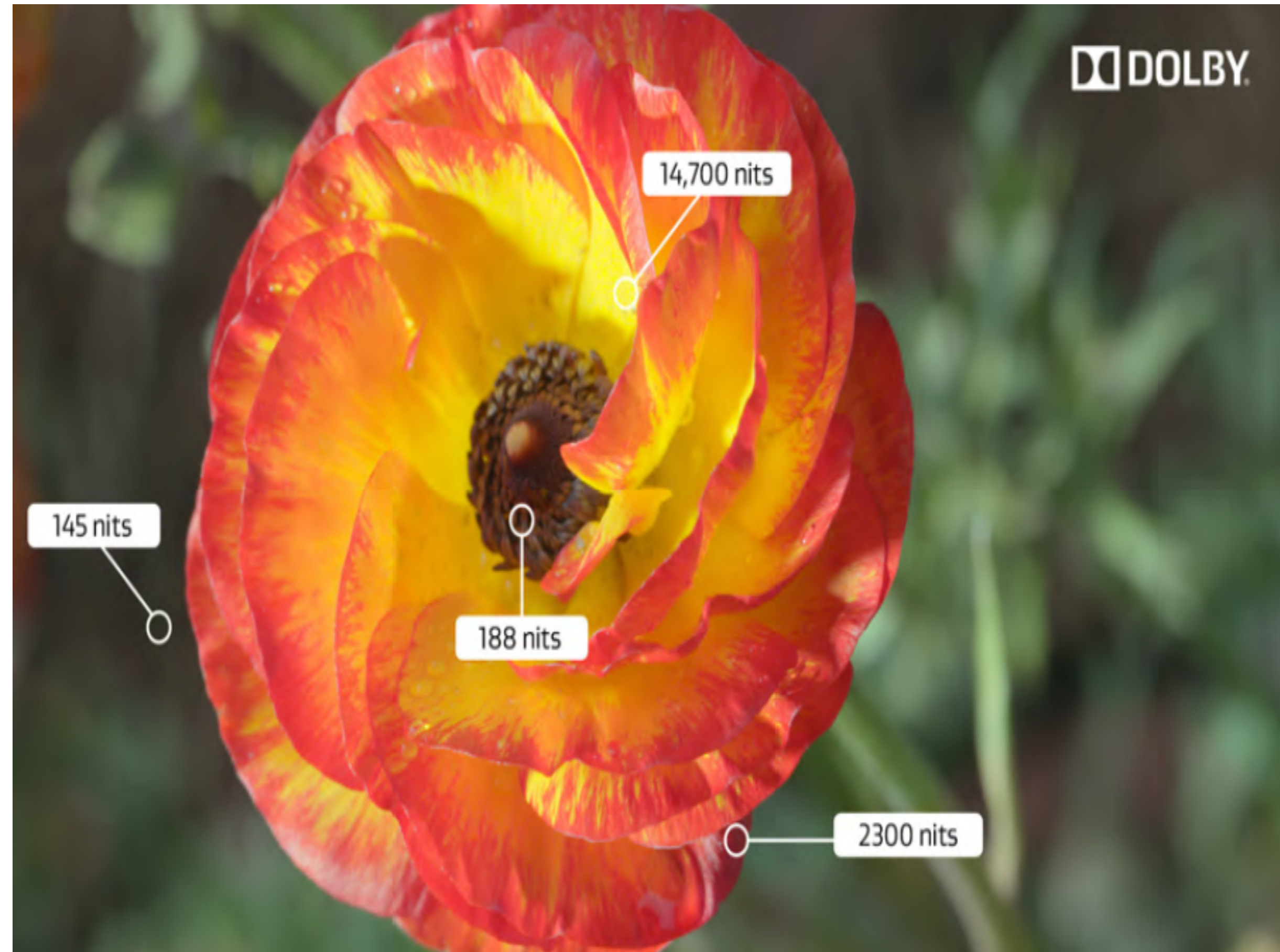
Why HDR - For most natural images
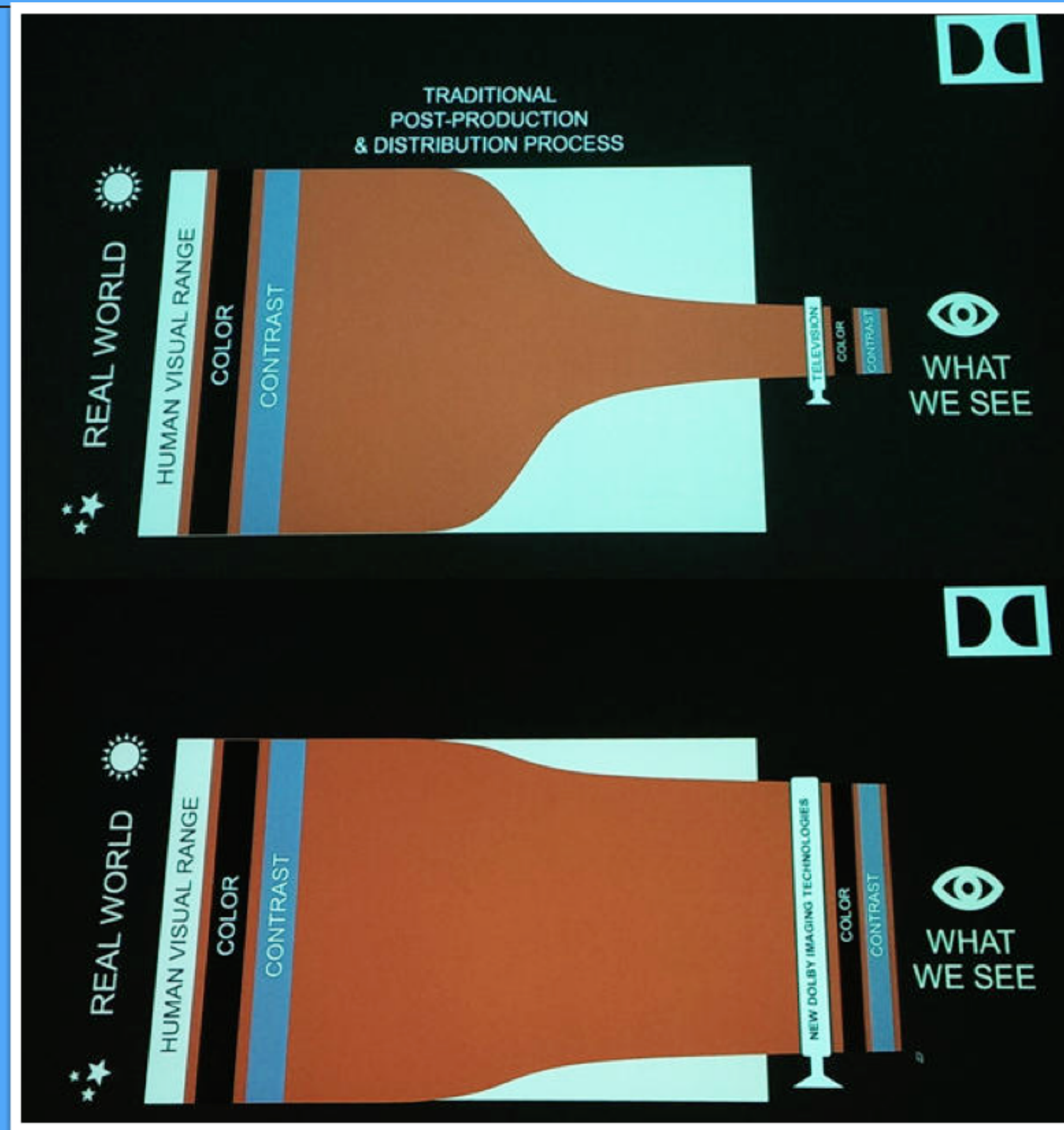
Looking to a standard monitor
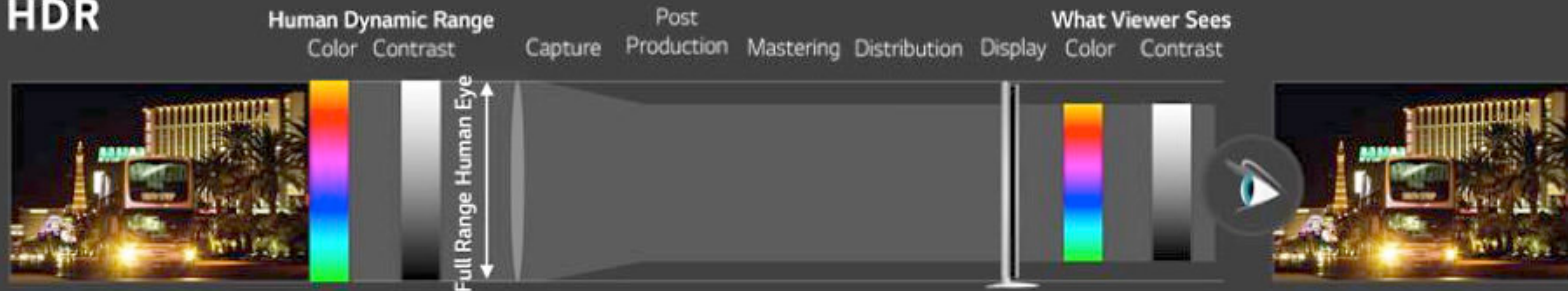
Looking to a HDR monitor

Dynamic Range in Television

SDR

Human Dynamic Range — Color · Contrast

Capture · Post Production · Mastering · Distribution · Display

What Viewer Sees — Color · Contrast

Full Range Human Eye

HDR

Human Dynamic Range — Color · Contrast

Capture · Post Production · Mastering · Distribution · Display

What Viewer Sees — Color · Contrast

Full Range Human Eye

Why HDR - For challenging lighting conditions

✦ High scene contrasts are most challenging in live broadcast applications

■ Lighting conditions are typically not under control

■ Pictures must be perfect at any time, and can't be fixed in post

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Why HDR - For challenging lighting conditions

HDR can be used to avoid washed out highlights

Note: For the sake of clarity, the gamma correction is not included in the graphs
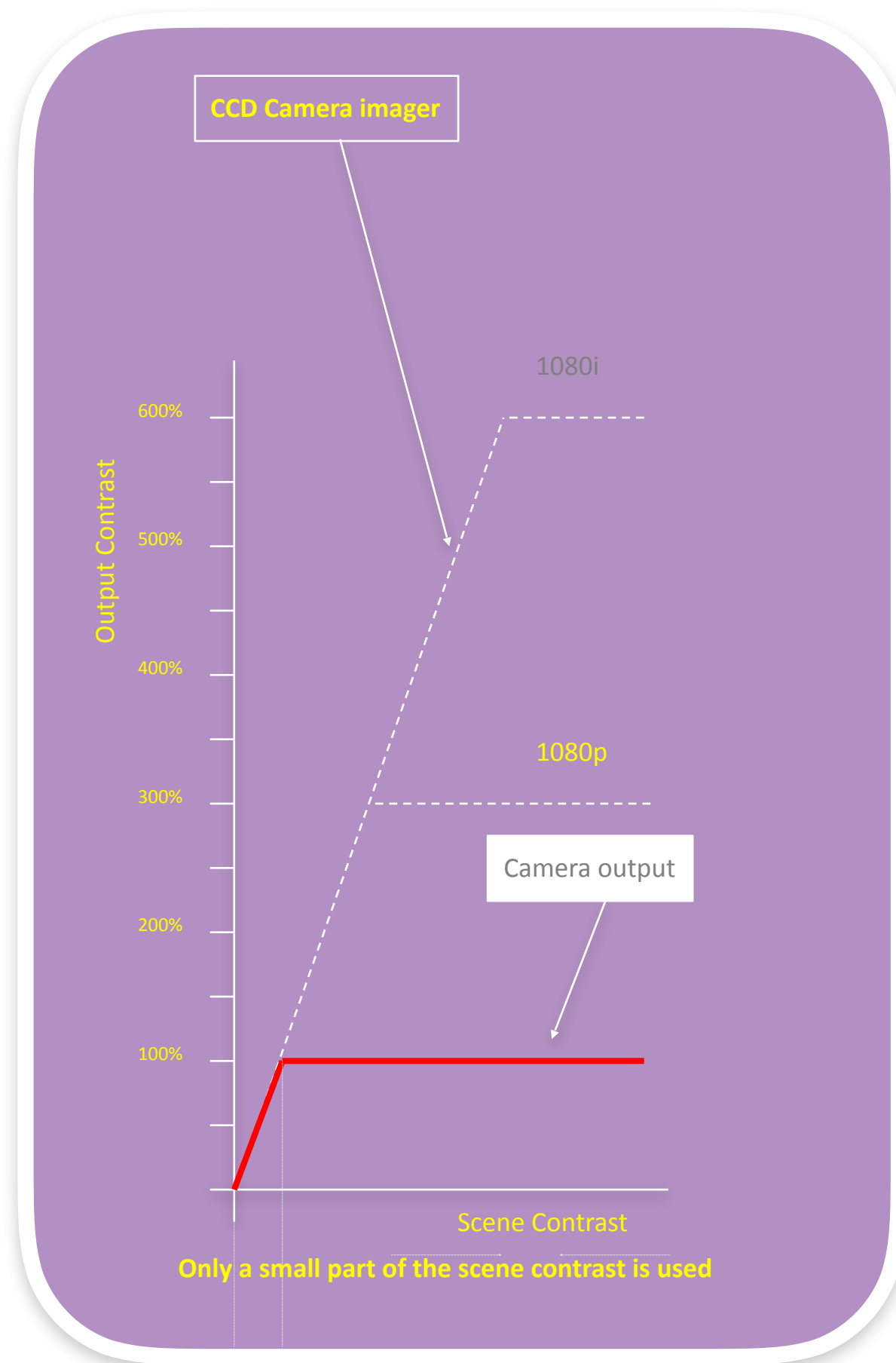
How HDR is generated – What is required?

- **An imaging technology delivering highest dynamic range**
  - ☑ CMOS delivers highest dynamic range in all formats, including progressive

- **Highest performance pixels**
  - ☑ "Large" pixel for 15 F-stops of live dynamic range without calculations
  - ☑ 5T pixel for global shutter operation

- **A camera solution able to deliver HDR signals**
  - ☑ Supporting the requested "HDR mappings"
  - ☑ True parallel processing of HDR and SDR signals
  - ☑ Easy control of both signals at the same time
  - ☑ Supporting 1080i/p, 720p, 4K (both 50 or 59Hz)

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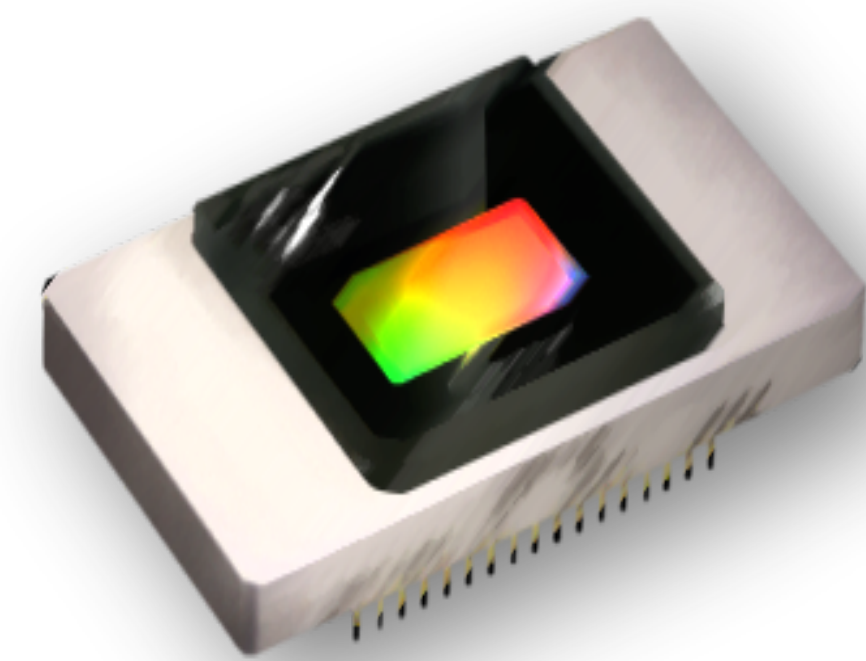
How HDR is generated – What is required?

- Display with a higher contrast range (higher peak white)
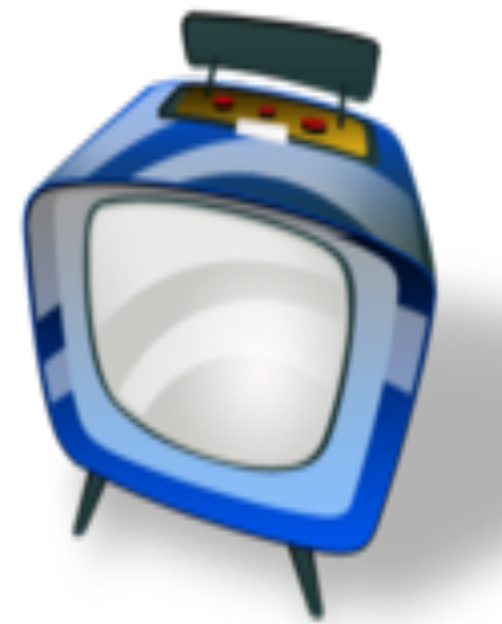
SDR Display
300 nits

HDR Display
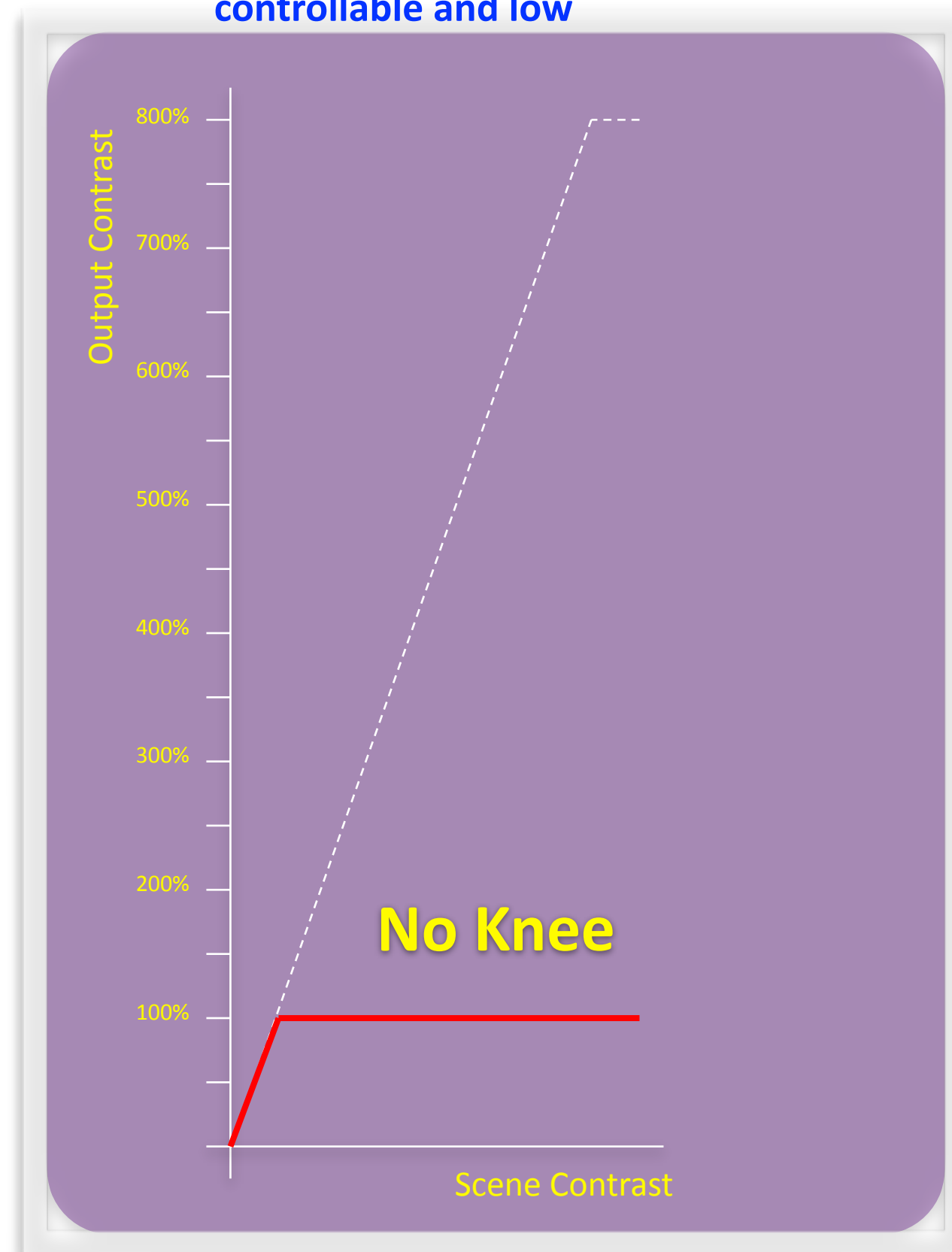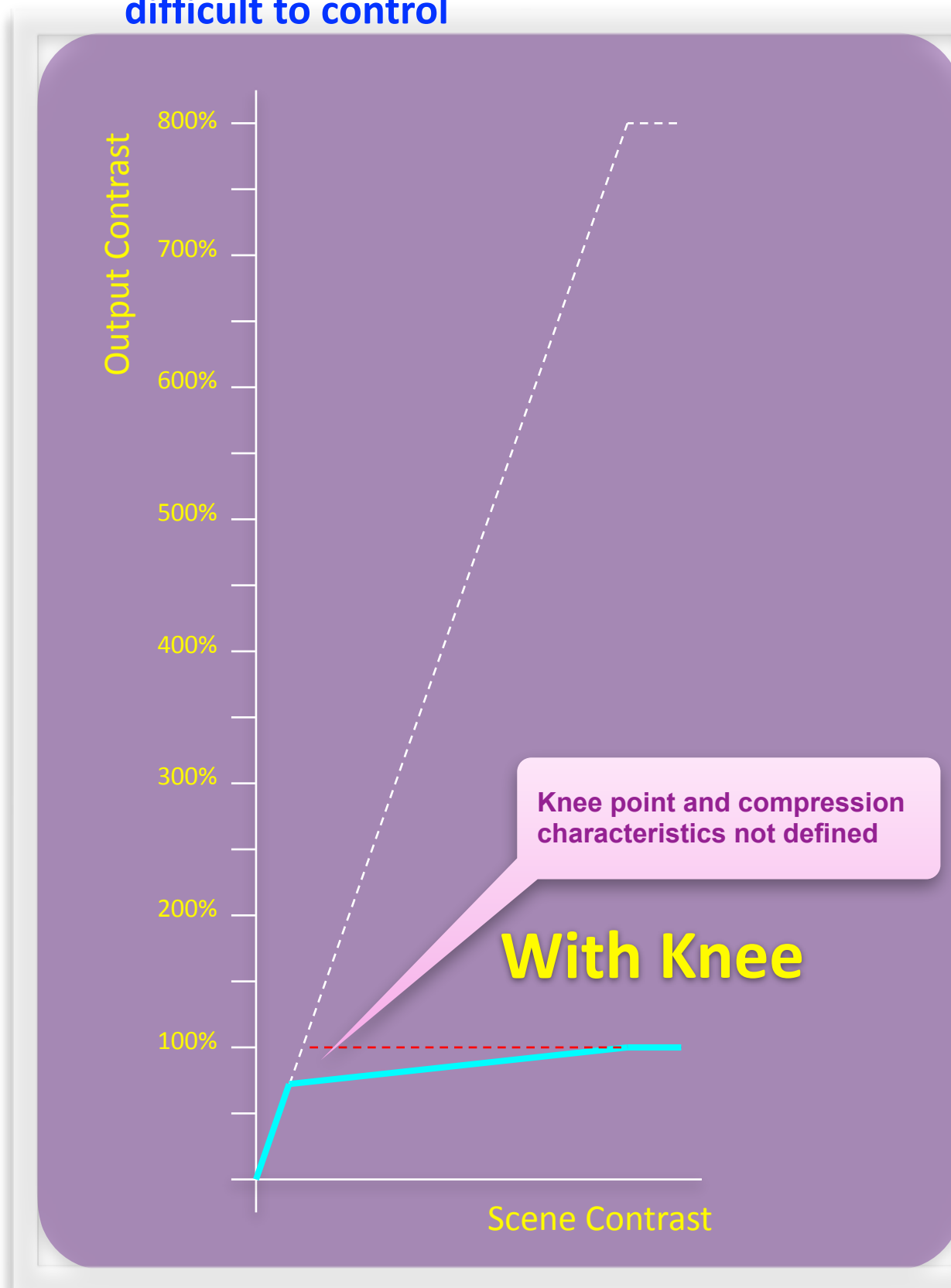1.000 – 10.000 nits

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How HDR is generated – Signal mapping

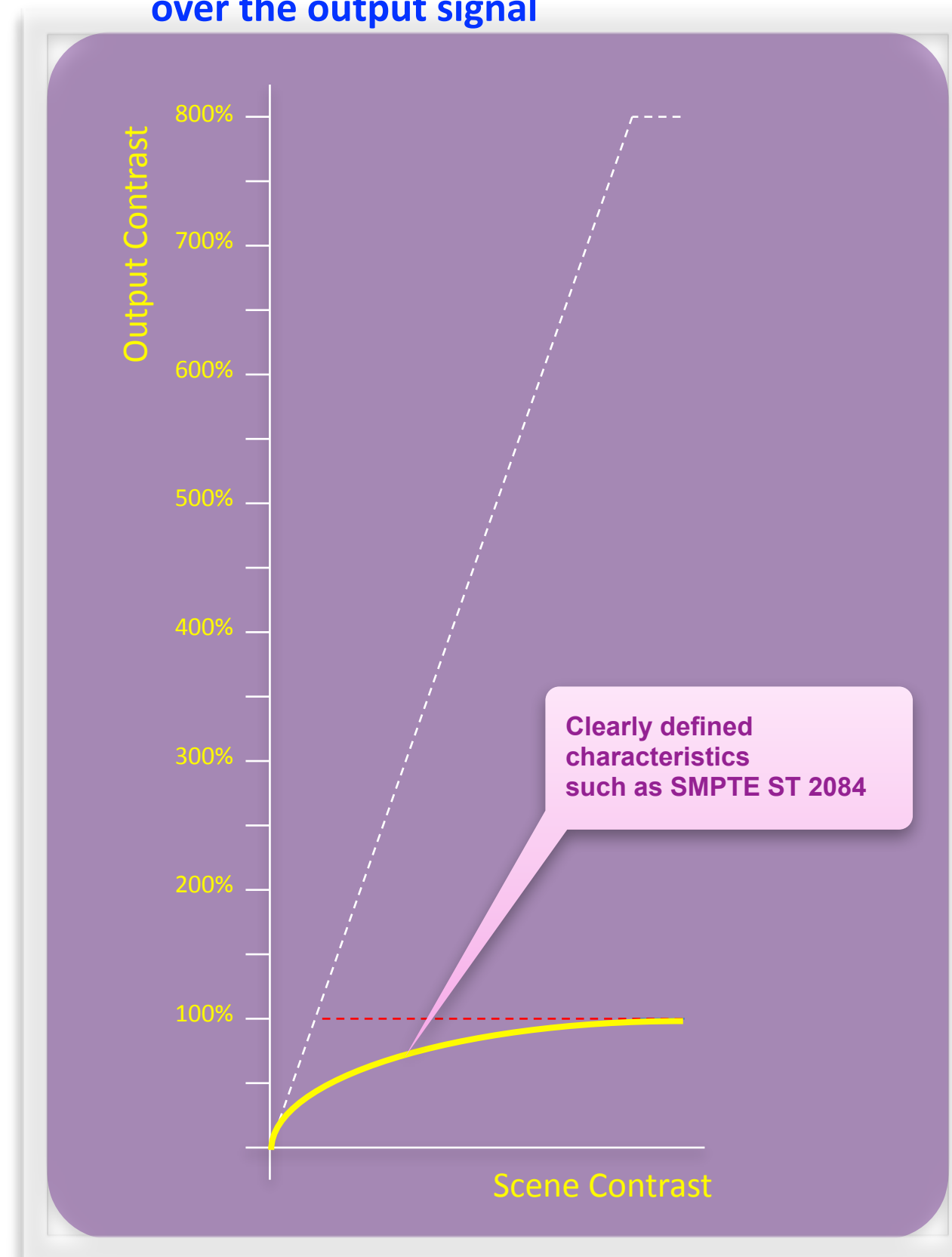- HDR needs a different signal mapping compared to SDR

**Signal processing with linear output
Only useable if scene contrast is
controllable and low**

**Signal processing with knee compression
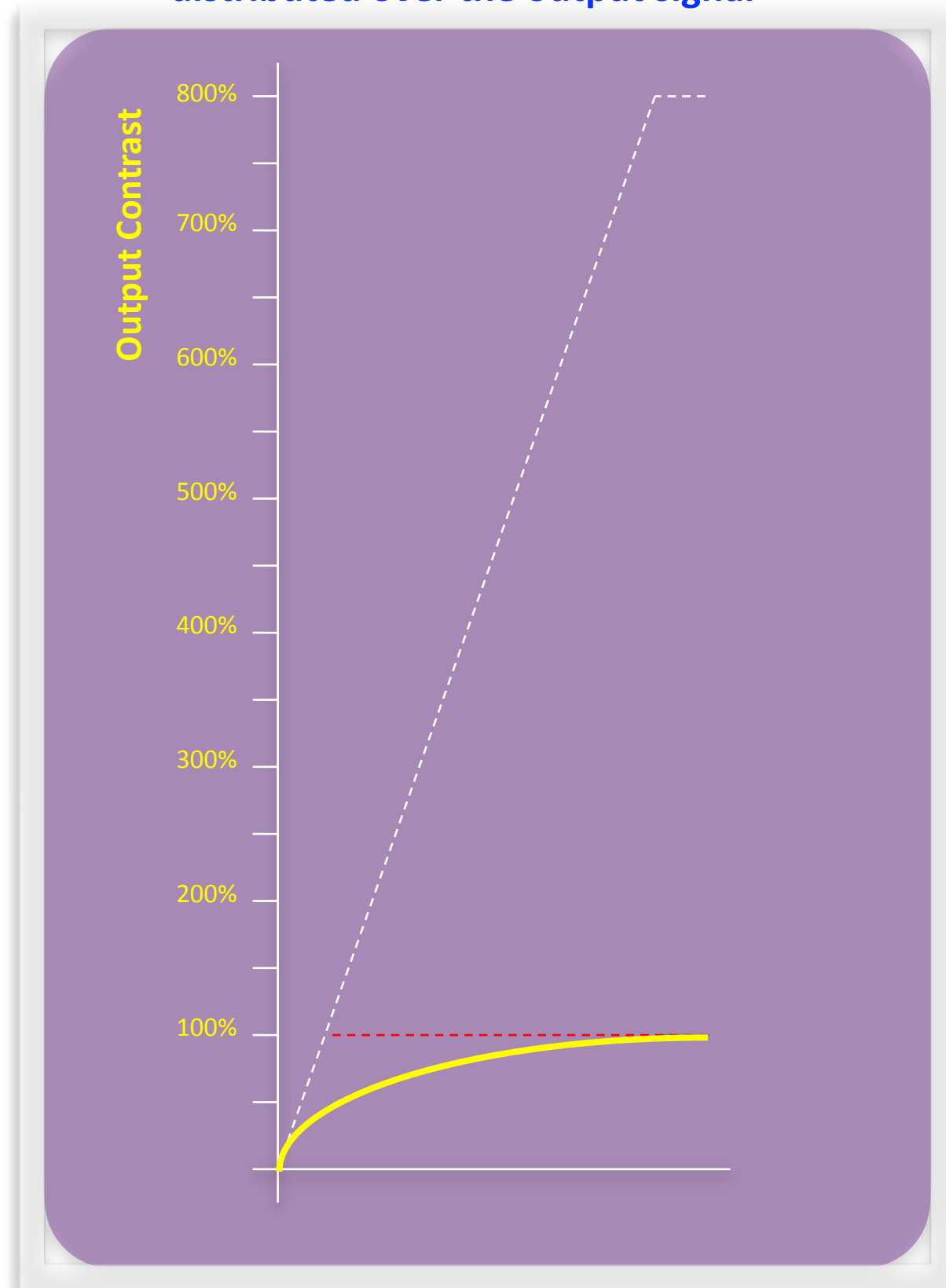Highlights are heavily compressed,
difficult to control**

**Signal processing for HDR operation
Scene contrast more even distributed
over the output signal**

No Knee

Knee point and compression characteristics not defined

With Knee

Clearly defined characteristics such as SMPTE ST 2084

Note: For the sake of clarity, the gamma correction is not included in the graphs
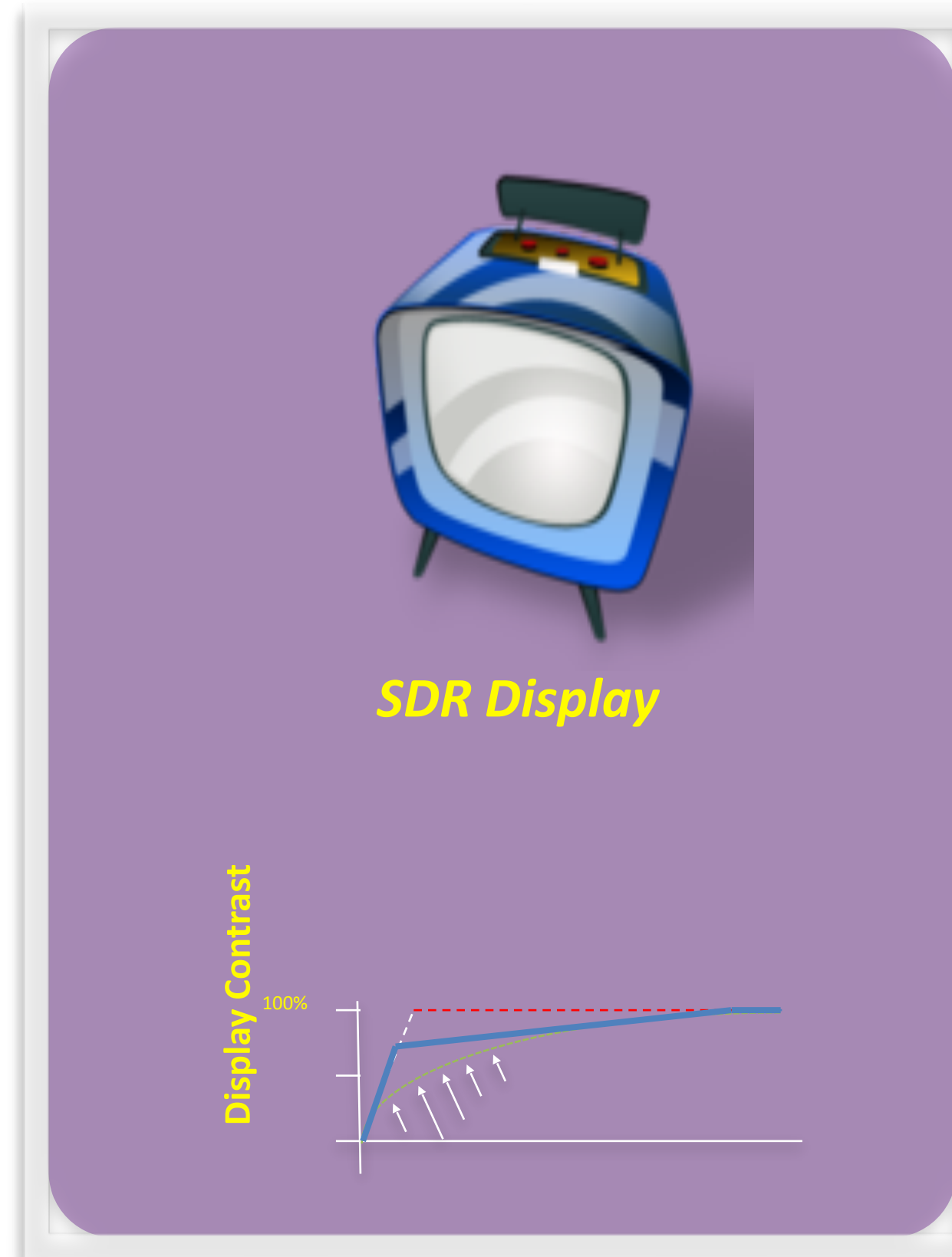
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How HDR is generated – Signal mapping
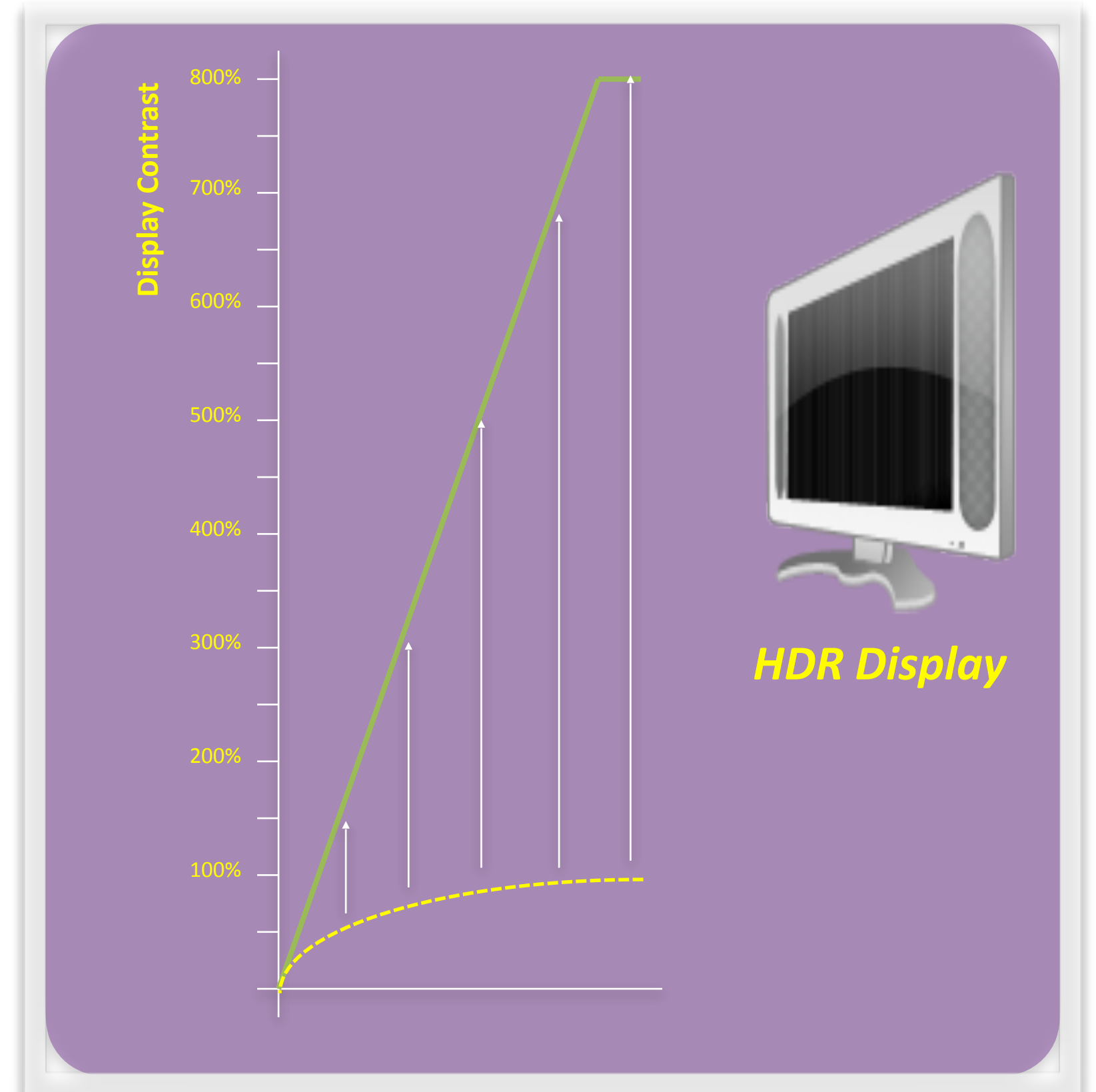
HDR signals can be re-mapped for simultaneous SDR operation

Signal processing for HDR operation
Scene contrast is more even
distributed over the output signal

Re-mapping of the HDR signal for SDR use

SDR Display

Re-mapping of the HDR signal for HDR use

HDR Display

Note: For the sake of clarity, the gamma correction is not included in the graphs
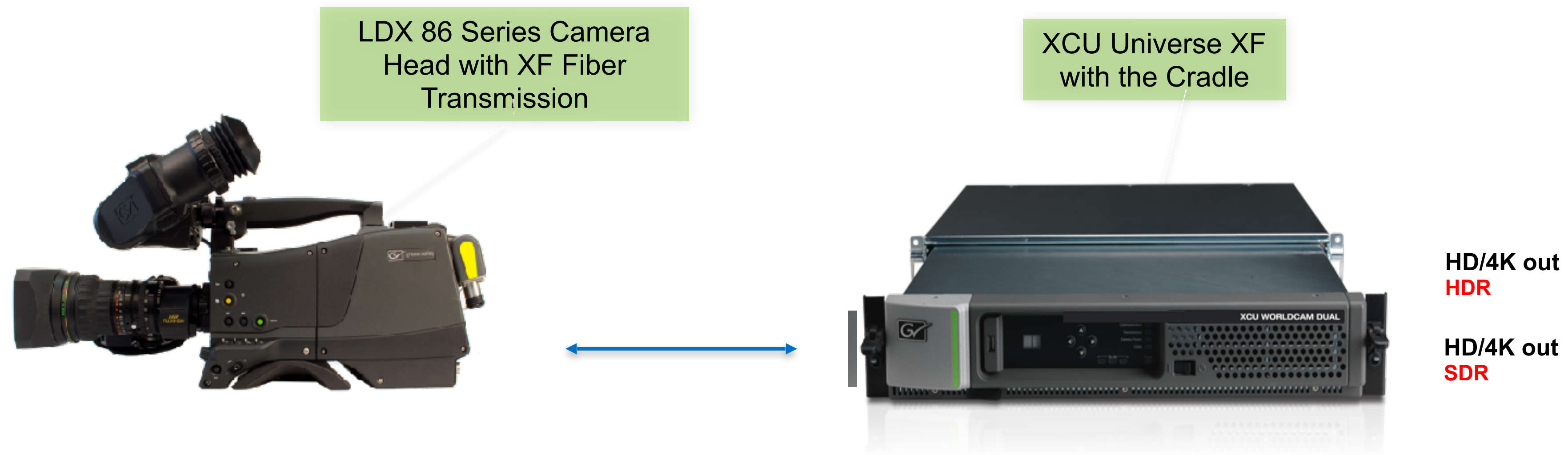
HDR Explained

- HDR offer a very clear improvement of the viewing experience
  - ☑ Not resolution dependent
  - ☑ Visible from all distances and on all screen sizes
- There several competing system proposals
  - ☑ From Dolby, BBC, Technicolor, Philips, NHK
- They are not compatible to each other
  - ☐ Will there be one system for all markets, countries, etc.?
  - ☐ If not will one system be convertible into another?

HDR Explained

- High dynamic range operation is easy to realize with CMOS imagers
  - The latest FT-CMOS cameras offer a dynamic range of up to 15 F-stops
  - In regular operation with a linear exposure and readout of the imager
- CMOS imagers can offer a further extended dynamic range
  - By using a multiple readout of the pixels during one exposure cycle
  - Because of the non- destructive readout
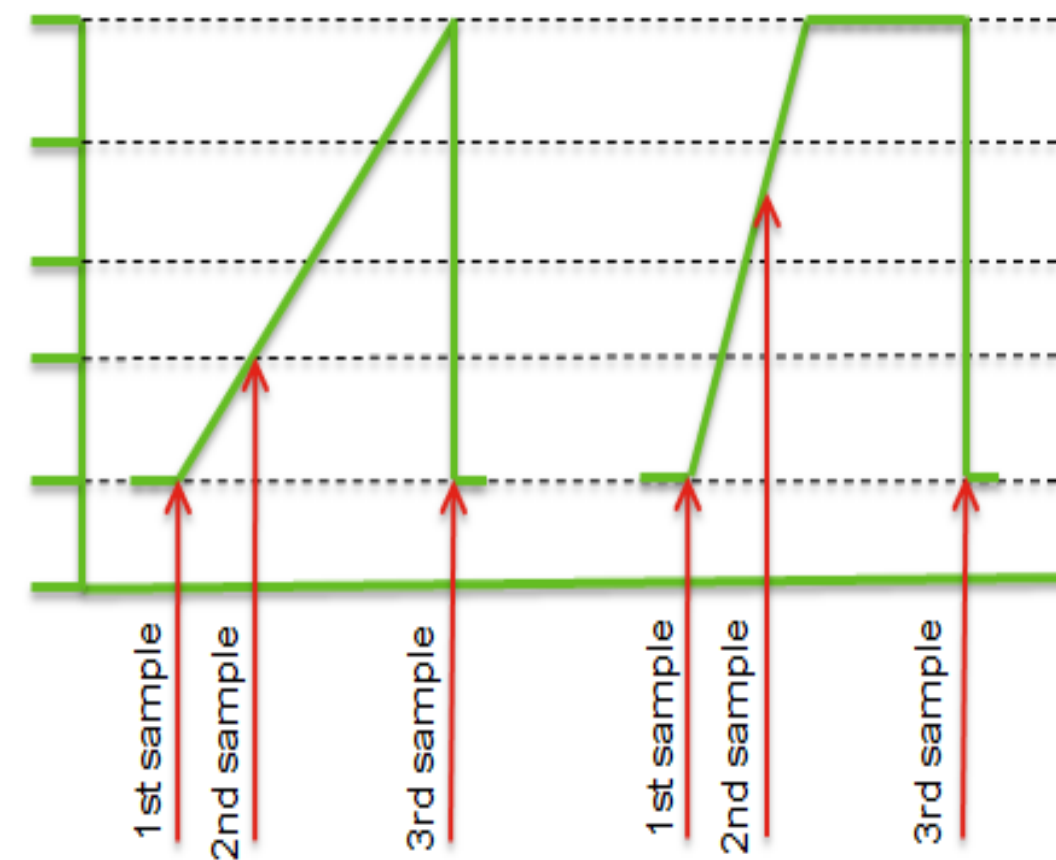
- Delivering the full dynamic range of 15 F-stops
- ☑ Enough for all HDR displays in the foreseeable future
- Parallel HDR and SDR outputs for highest flexibility
- ☑ Dual control mode of the camera control panels for best results in both outputs

LDX 86 Series Camera Head with XF Fiber Transmission

XCU Universe XF with the Cradle

HD/4K out
HDR

HD/4K out
SDR

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Why called XDR - Extended Dynamic Range?

Many products claim HDR performance with limited 13-14 F-stops*[1] of dynamic range

*[1] Equal to 200 - 400% of a regular camera

**Grass Valley goes beyond this _full 15 F-stops*[2]_**

*[2] Equal to >800% of a regular camera

- **XensiumFT** imagers with
  15 F-stops of dynamic range
  - In regular operation with a linear exposure and readout of the imager

- **CMOS** imaging offers solutions
  for an even greater dynamic range
  - By using a multiple readout of the pixels during one exposure cycle
    - Because of the non-destructive readout

15 F-stops of dynamic range from Xensium FT imagers

XDR Solutions from LDX Series
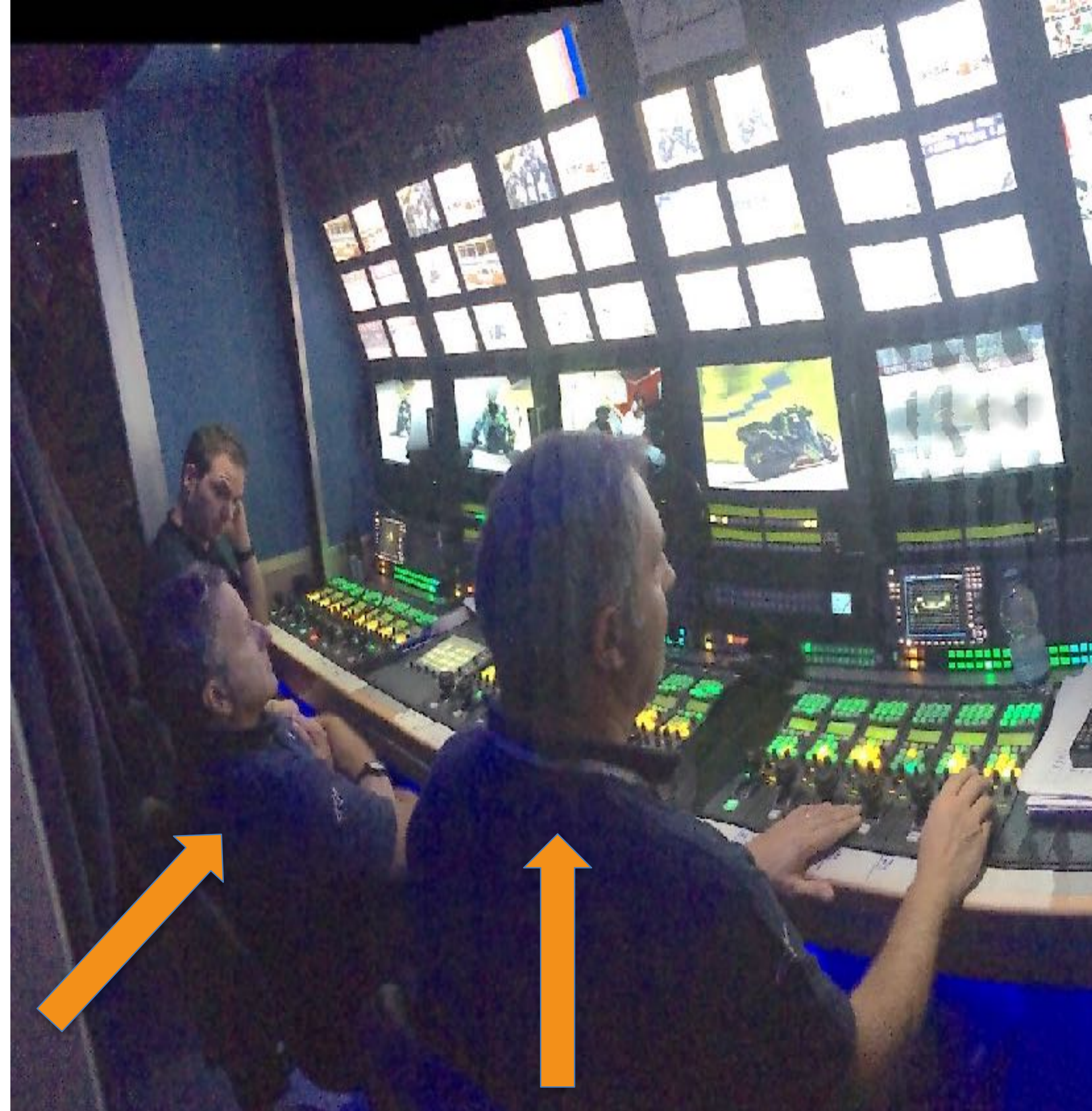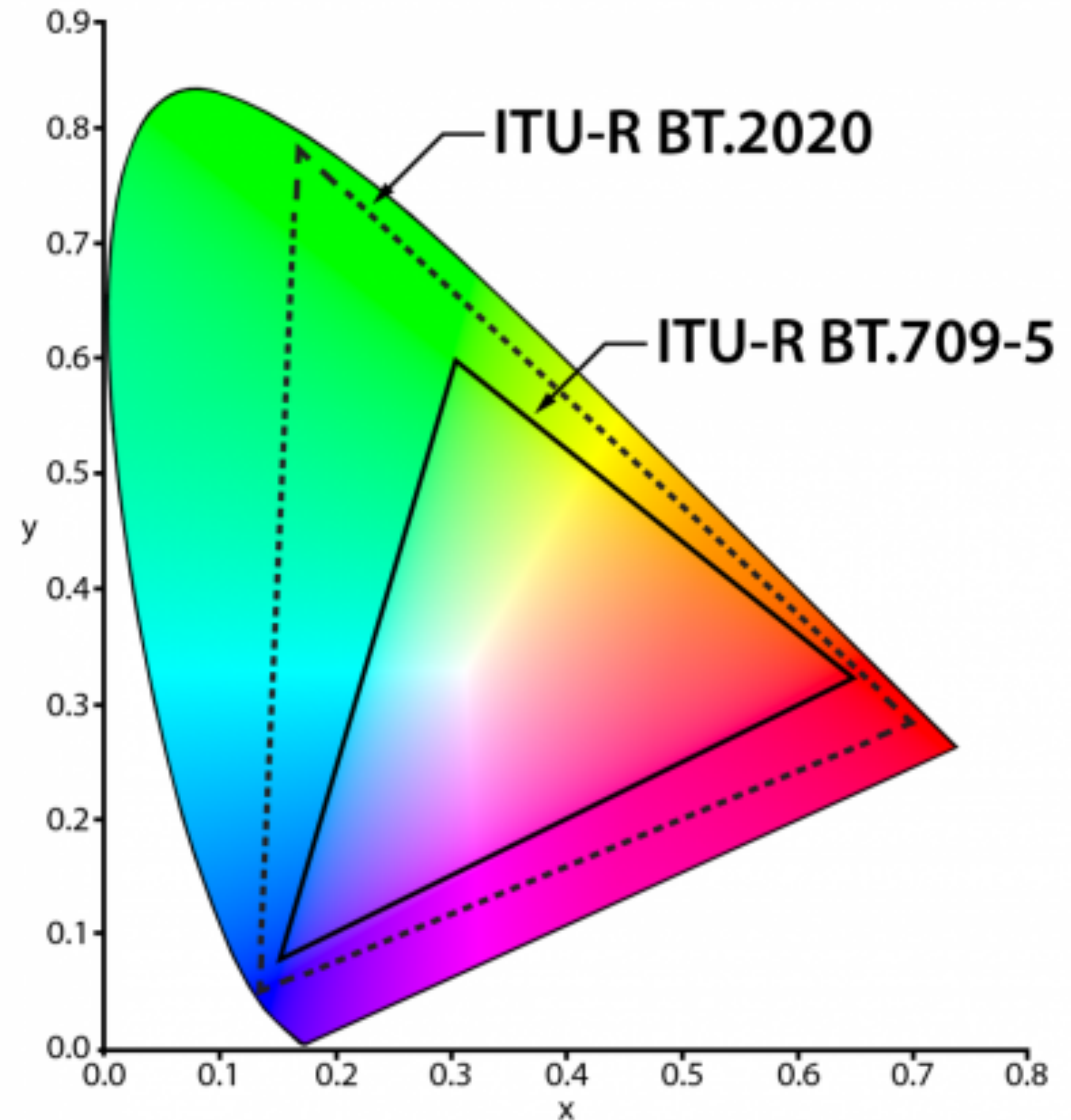

Shader HDR

Shader SDR

LDX86 HD Extended Color Gamut

Many 4K cameras still use the color gamut from HD as specified in the
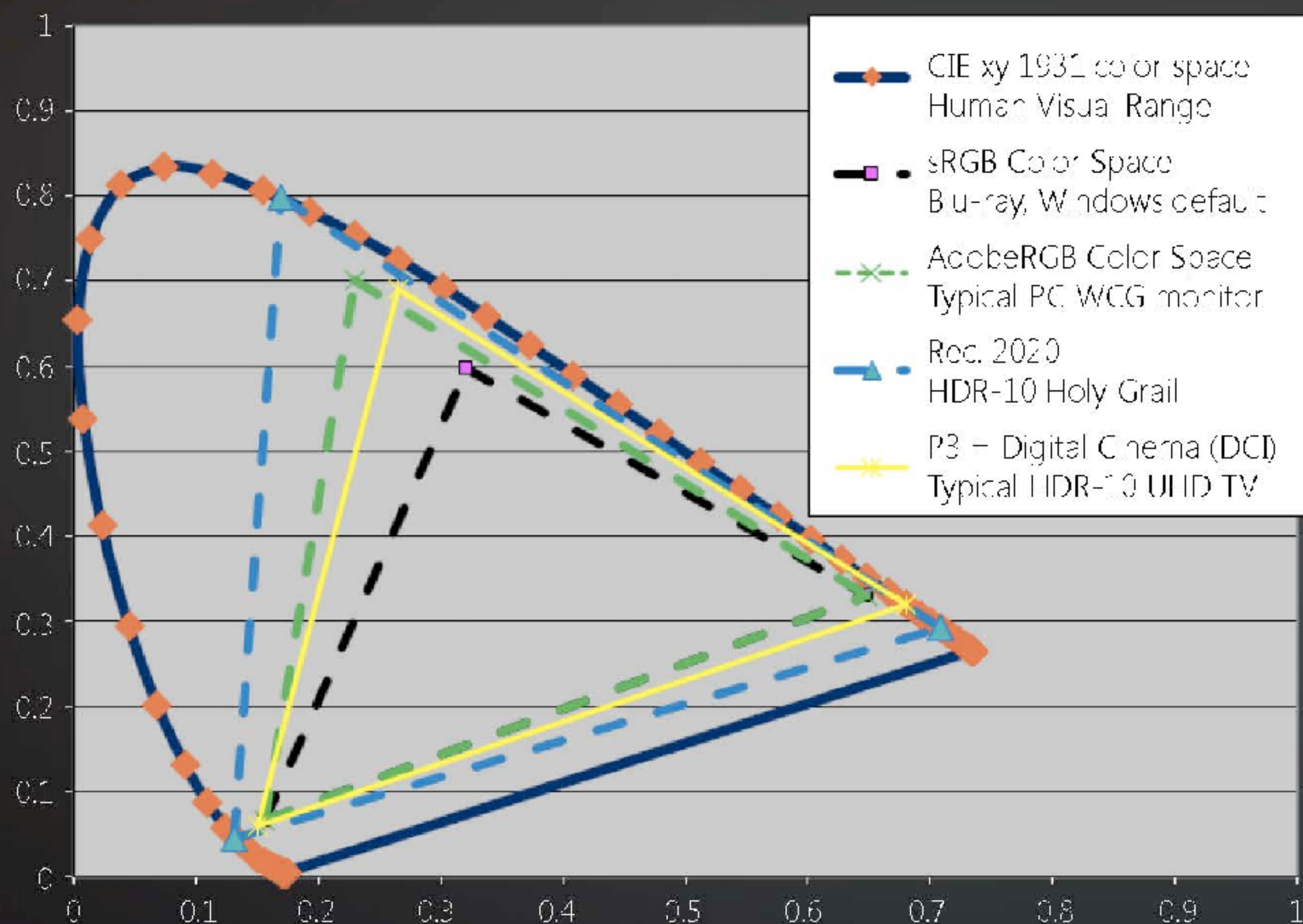
ITU-R BT.709

At the LDX 86 Series a wide color gamut can be selected as specified in the

ITU-R BT.2020

**Available in the next free of charge software package update**

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We Need More Color

Legend:
- CIE xy 1931 color space — Human Visual Range
- sRGB Color Space — Blu-ray, Windows default
- AdobeRGB Color Space — Typical PC WCG monitor
- Rec. 2020 — HDR-10 Holy Grail
- P3 – Digital Cinema (DCI) — Typical HDR-10 UHD TV

HDR-10 = BT.2020 primaries + SMPTE 2084 (PQ) =

0.0005 to 10,000 nits

Typical UHDTVs = 500 (OLED), 1K (LCD) nits

~ 2K (LCD) nits holiday '16

BT.2020

BT.709

- BT.709, sRGB, SMPTE 1886 (Gamma 2.4) = today's digital content
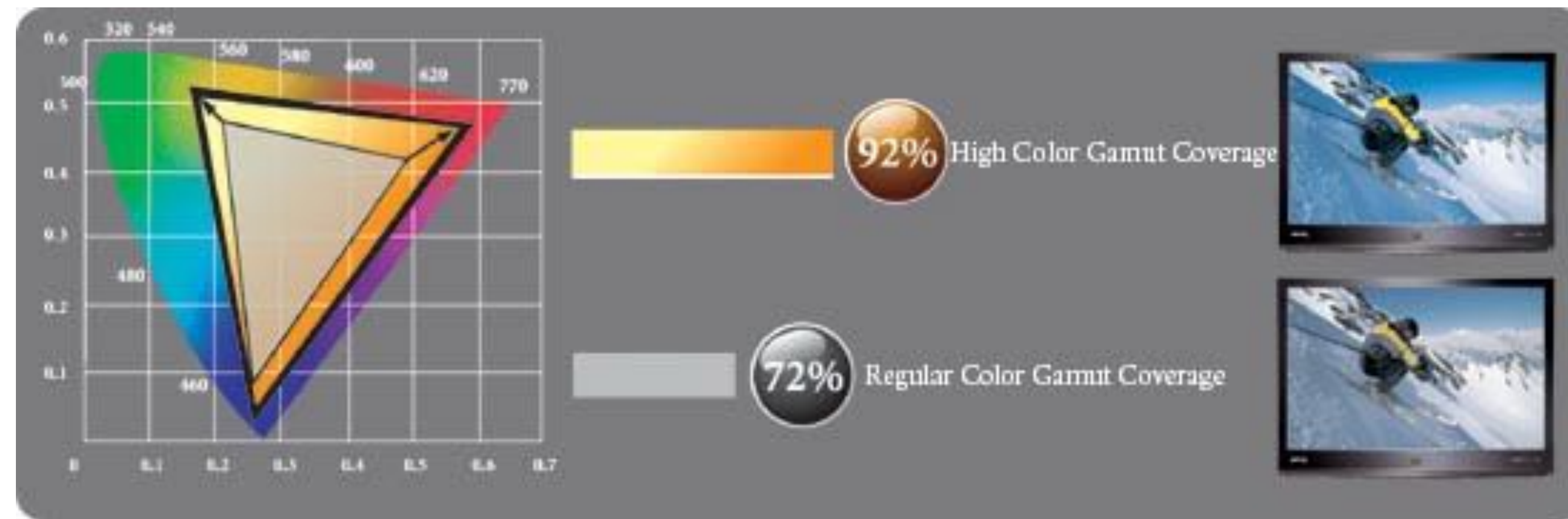- BT.2020, SMPTE 2084 (PQ) = HDR Content's color container
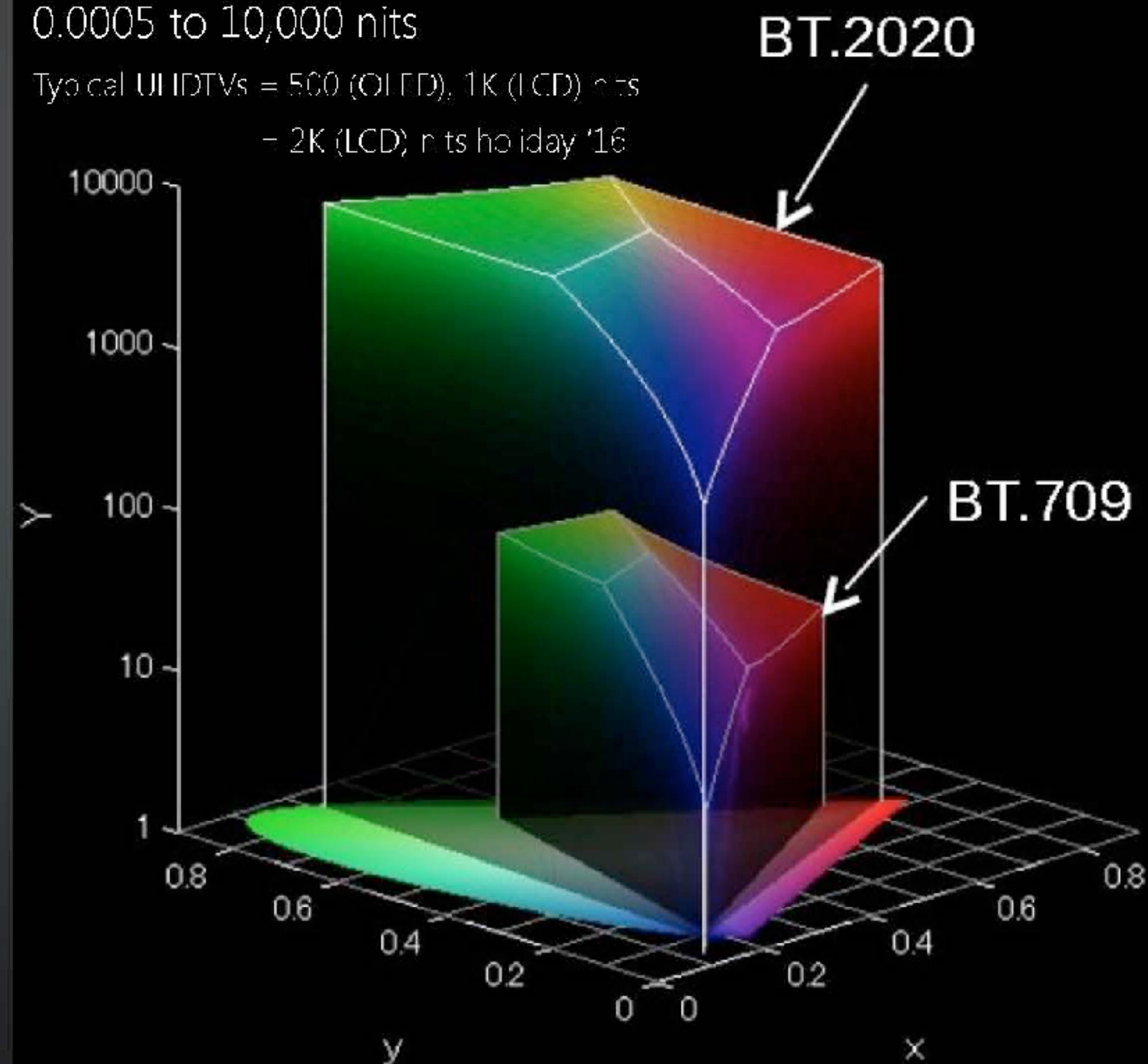
LDX86 HD Extended color Gamut
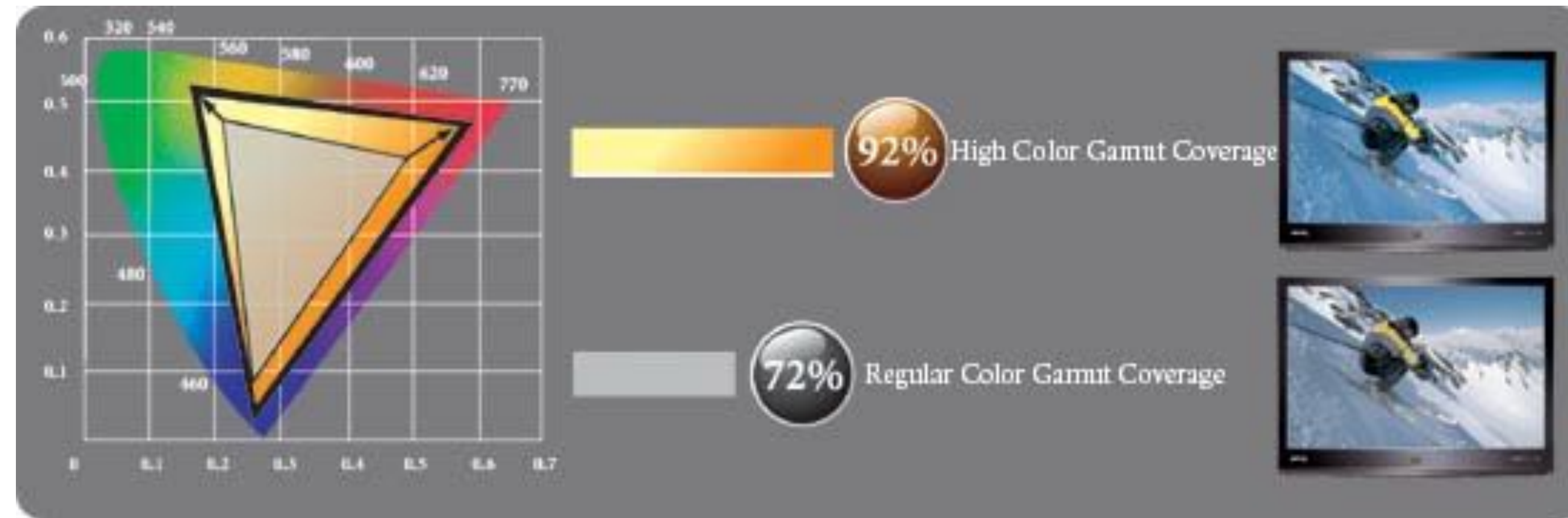
Wide Colour Gamut for true-to-life colours

LDX86 HD Extended color Gamut

When using Extended color Gamut
It is important also to set the display in this mode

Set both devices in
Extended color gamut

LDX XtremeSpeed series

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✦ Technical inside LDX XtremeSpeed

✦ *Basic Service and Diagnostics (session 7)*

✦ **Looking inside (Head,Adaptor,XCU)**

✦ *Basics Dyno and Summit (session 9)*

LDX XtremeSpeed series

Introduction LDX XtremeSpeed

Within the HighSpeed project a new high speed camera system is being developed based on the LDX camera head, the New Fiber adapter and the XCU base station.

The goal is to develop a camera platform that is basically identical to the Worldcam LDX camera system, and can be upgraded to a high-speed camera system by licensing.

LDX XtremeSpeed series

■ Introduction LDX XtremeSpeed

Sensor 3x

RightProc.

HDMI/Mic.

RightConn.

The most important issues are:

- **For the LDX-camera:**
  - ○ The new FT HS sensor (which will replace the current FT-Xensium sensor).
  - ○ The video processing (RP-board).
  - ○ The RC-board (improvements w.r.t audio and HDMI 1080P)
  - ○ The HDMI and Mic. board
- **For the Adapter:**
  - ○ The new transmission system (based on the newly developed fiber transmission board).
- **For the XCU:**
  - ○ Implementing the new transmission system
  - ○ Anylight algorithm (for 1080p 3-speed and 1080I / 720 P 6-speed)
  - ○ Fiber Interconnection to the server.

Fiber Trans.

Fiber Interc.

Fiber Trans.

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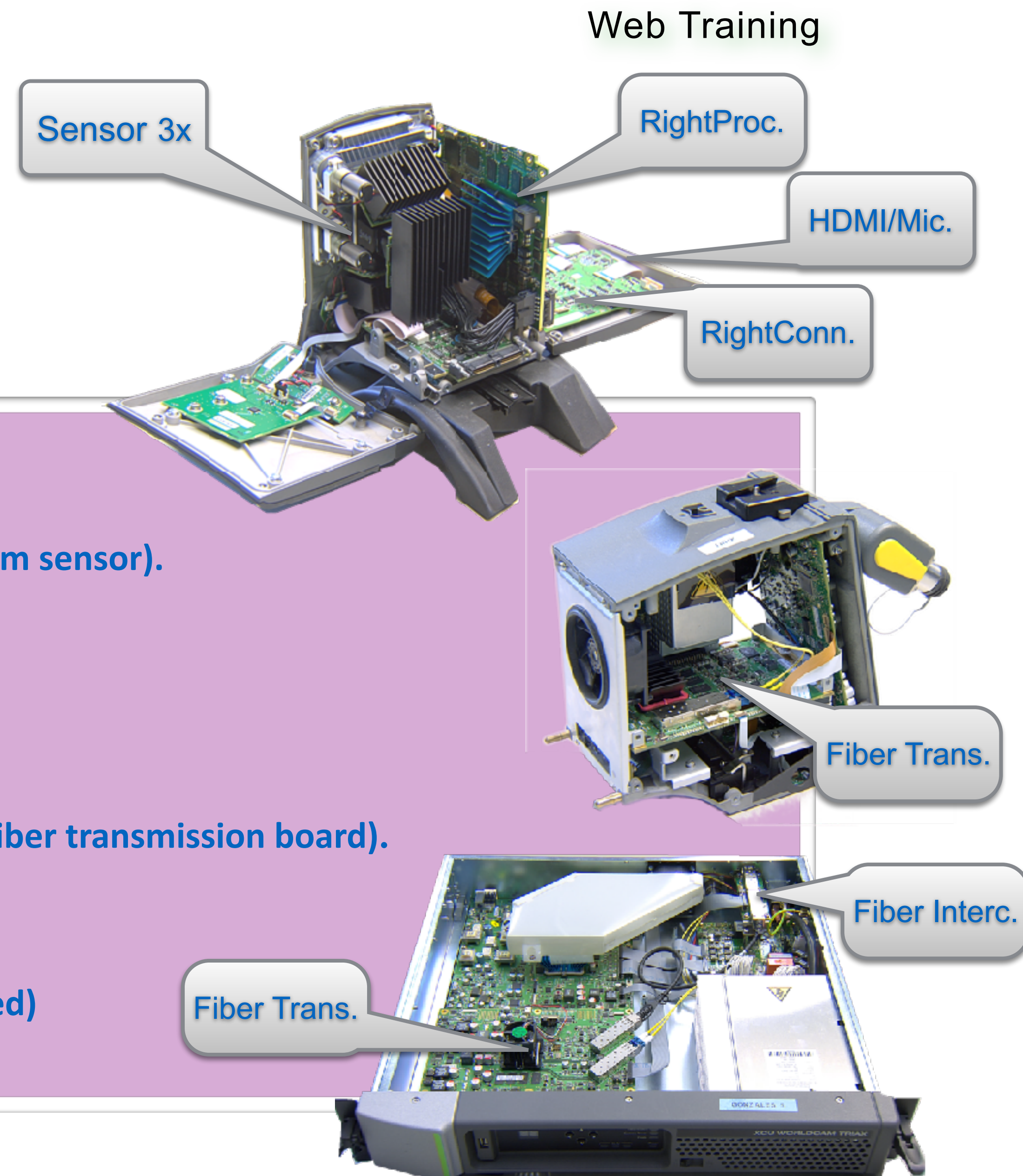
LDX XtremeSpeed series

▪ Introduction LDX XtremeSpeed

As these high-speed video frame rates (uncompressed) are rather new for the broadcast market, the interface to the storage/play-out equipment has to be communicated and agreed upon with the suppliers of the servers: both GrassValley (internally) and EVS.
3 Coaxes with 3 Gbit signals (1.5 Gbit for 1080i and 720P 3-speed) shall be used for the interface with the server in the first phase of the project.

The Anylight algorithm has to be modified due to the fact that the 3-consequent frames will be available at the same time.

The next step will be to have one high-speed interconnection direct to the Network based environment.
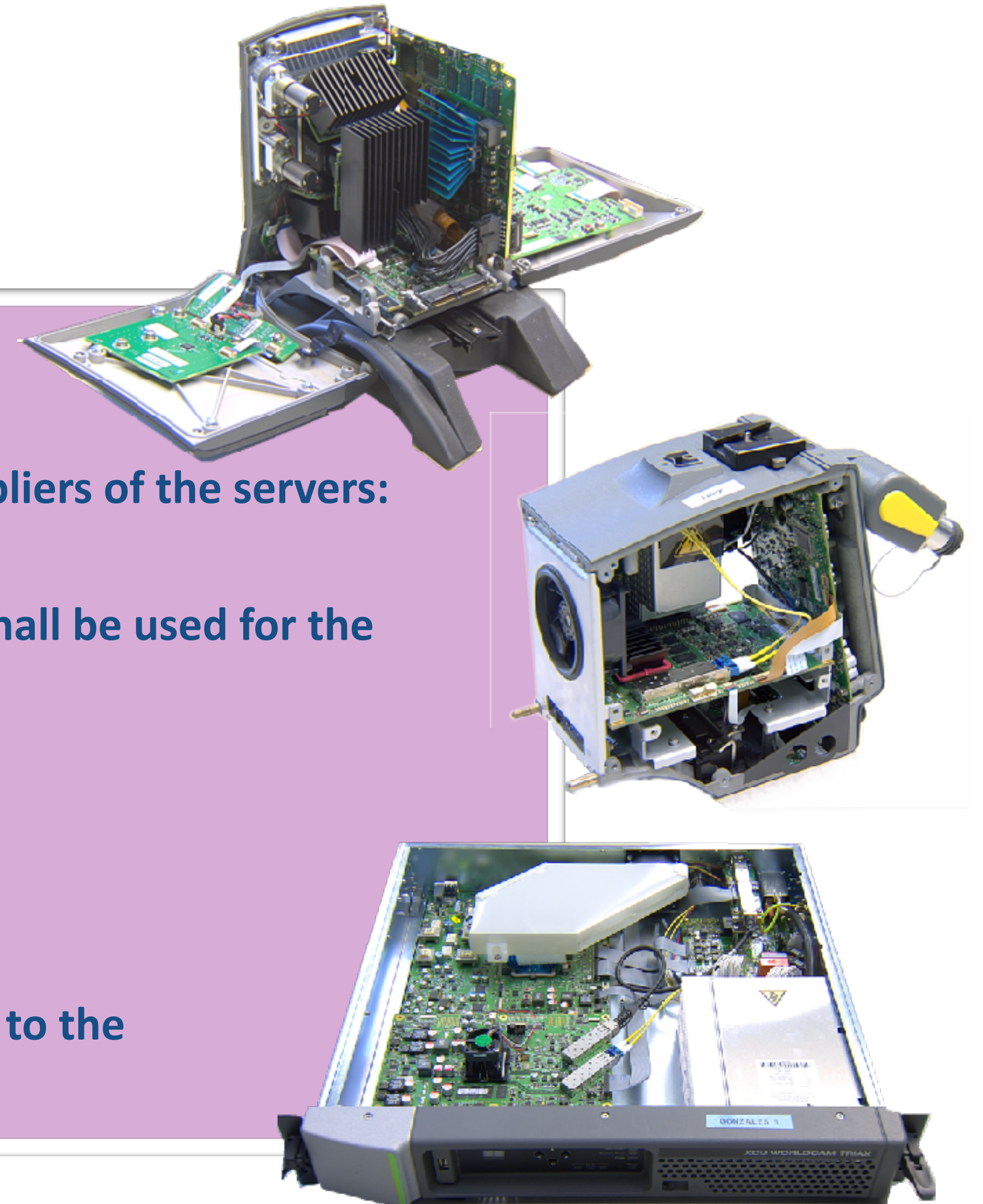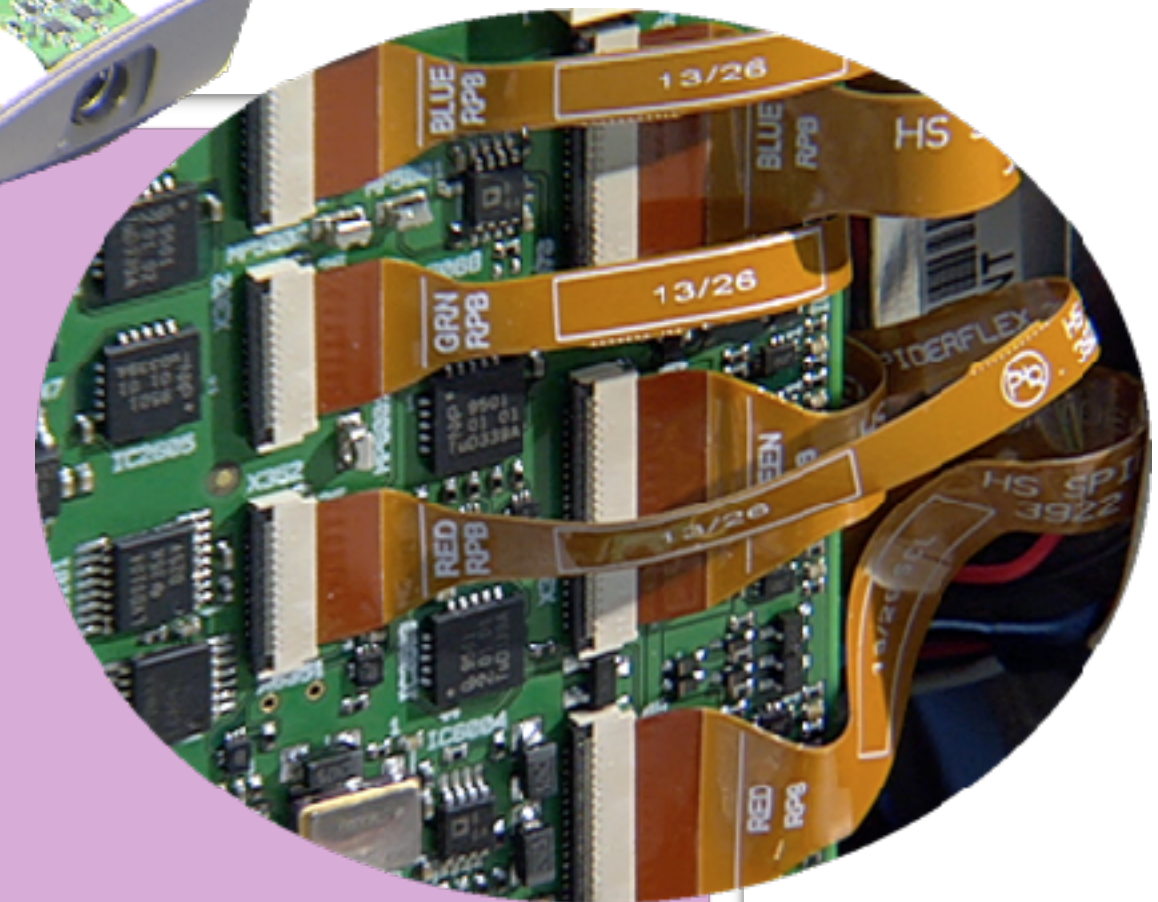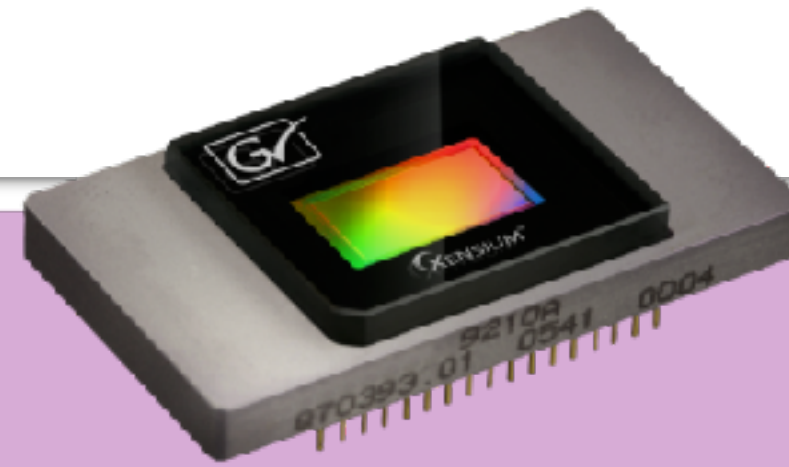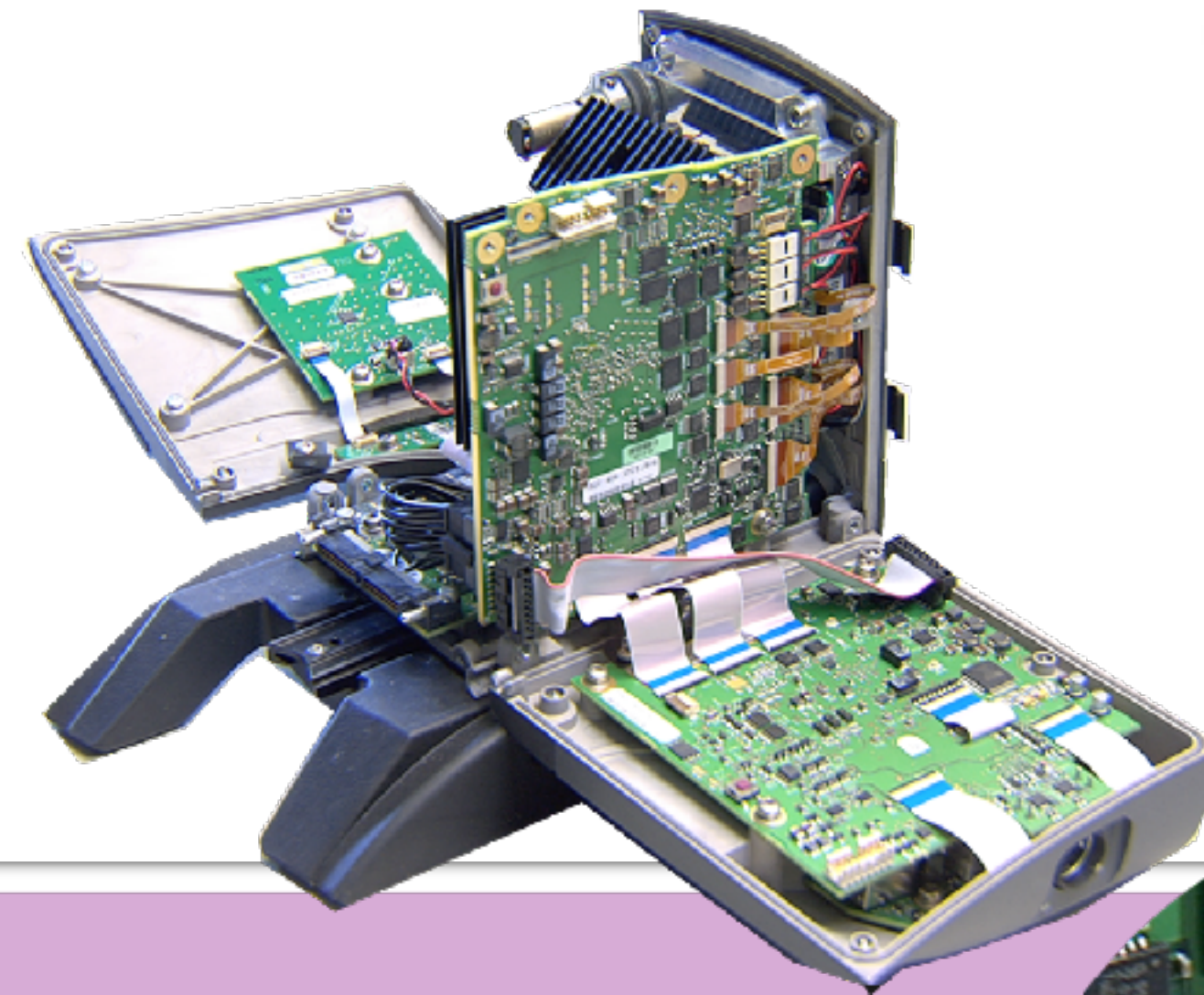
LDX XtremeSpeed series

- **Introduction LDX XtremeSpeed**

The Sensor (front)

A replacement for the current FT-Xensium is needed

to meet the speed which is necessary for the higher frame rates asked for in this project.

An extra connector at the sensor boards and the processing board will be added to

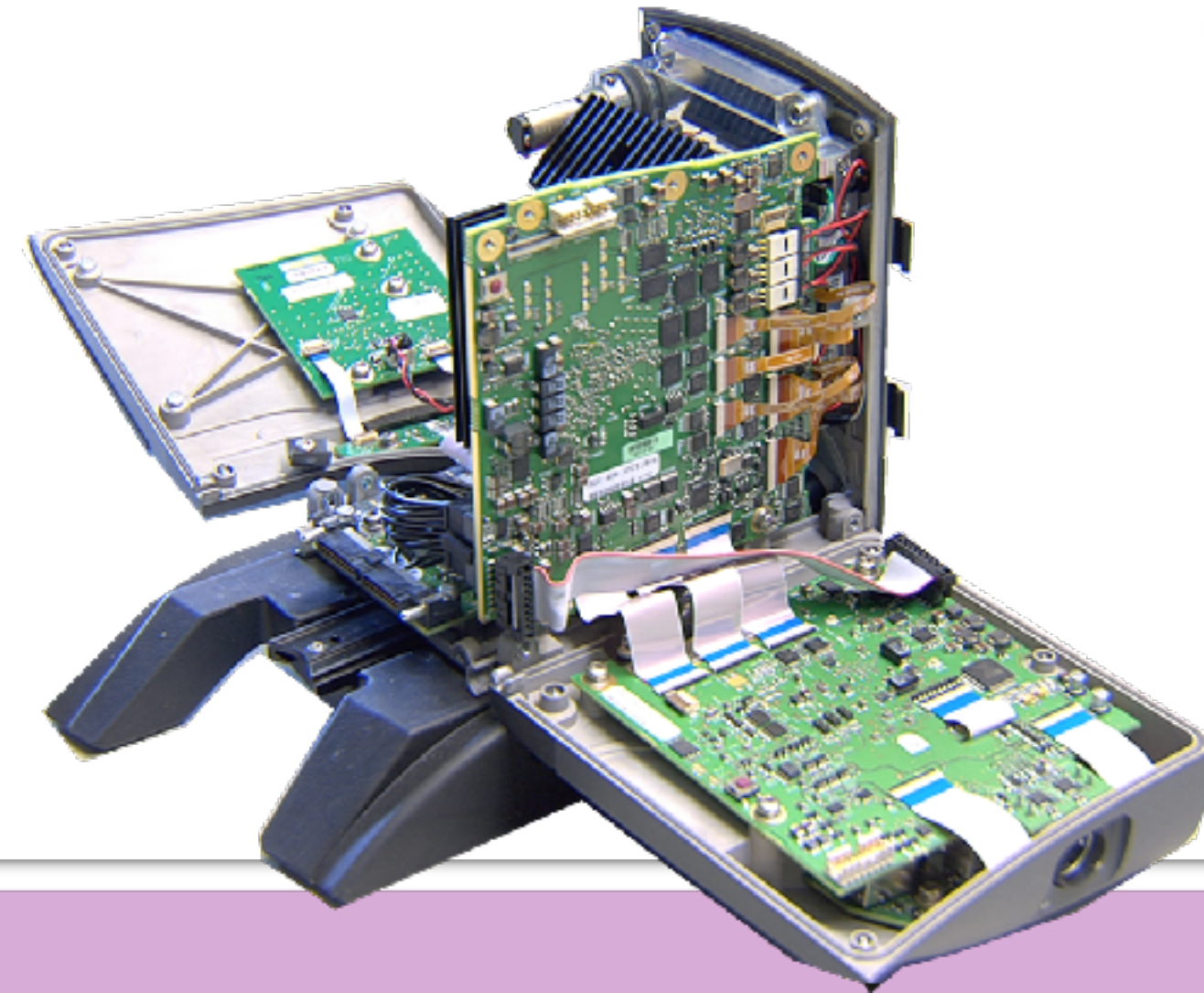transfer all the data from the sensor to the processing board.

This means that also the so-called spider flex has to be updated

LDX XtremeSpeed series

Introduction LDX XtremeSpeed

The Sensor (front)

As the new AD-converters from the sensor are designed to run at a maximum frequency of 225 MHz, the maximum speed with full resolution will be limited to

3 x 1080P or 6 times 1080i (processing speed is 450 Mhz).

(The sensor has four AD-converters and is read-out twice for each image, so the total frequency of the sensor output is 900 MHz).

The interlaced image (1080I) in 3-speed will be converted from the 1080p signal in the processing.

For 6-speed 1080I the image will be generated inside the sensor by adding two lines to keep the output sample rate limited to 900 Mhz.

LDX XtremeSpeed series

- **Introduction LDX XtremeSpeed**
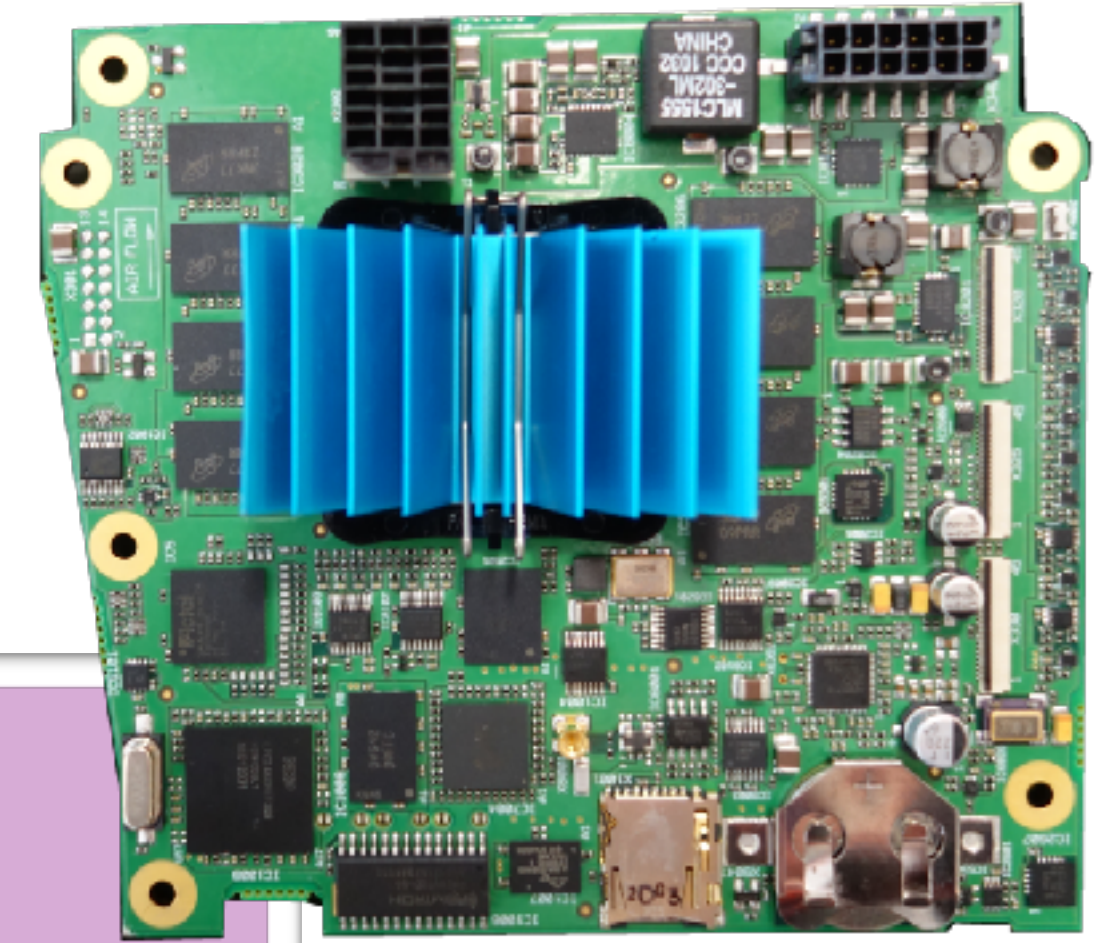

The Video processing (RP board)

3-Speed processing for the 1080P format or 6-speed processing for the 1080I or 720P format asks for a processing speed of 450 MHz.

As this will lead to a lot of timing errors in the FPGA-modules used for the processing, it is decided to do the processing in 3 parallel streams.

This will also lead to a more efficient use of bandwidth for the memories used for the input processing.

For 1080P three frames will be processed in parallel. The memories of the input processing will be used to create this parallel stream of three frames.

For all these new processing a new Right Processor board was developed.

LDX XtremeSpeed series

Introduction LDX XtremeSpeed

The Video processing (RP board)

Part of the processing of the signals in the single and triple speed modes for 1080I and 720P will be done in 1080P format.

This will cost some extra power, but it gives the possibility to combine and scale the VF-signal in a different way than the output signal.

operational video mode	VF-output
	- Adaptor HD BNC - VF connector
1080I50/59	1080I50/59
1080P50/59	1080I50/59
720P50/59	720P50/59
1080I150/179	1080I50/59 (combined)
1080P150/179	1080I50/59 (combined)
720P150/179	720P50/59 (combined)
1080I300/359	1080I50/59 (combined)
720P300/359	720P50/59 (combined)

LDX XtremeSpeed series

Introduction LDX XtremeSpeed

Right Cover and HDMI Mic board

With the current LDX it is not possible to have 1080P signals at the HDMI or VF connector.

These interfaces at the RC & HDMI Board have to be upgraded for these functions.

The VF and HDMI output are prepared for 3G HDSDI.

Also the audio input for the front microphone needs an update this to optimize the performance of the audio signal.

This means a gain controlled amplifier at the input, where now a fixed gain is implemented.

A new Right cover and HDMI Micr. board will be necessary to comply with the CRS
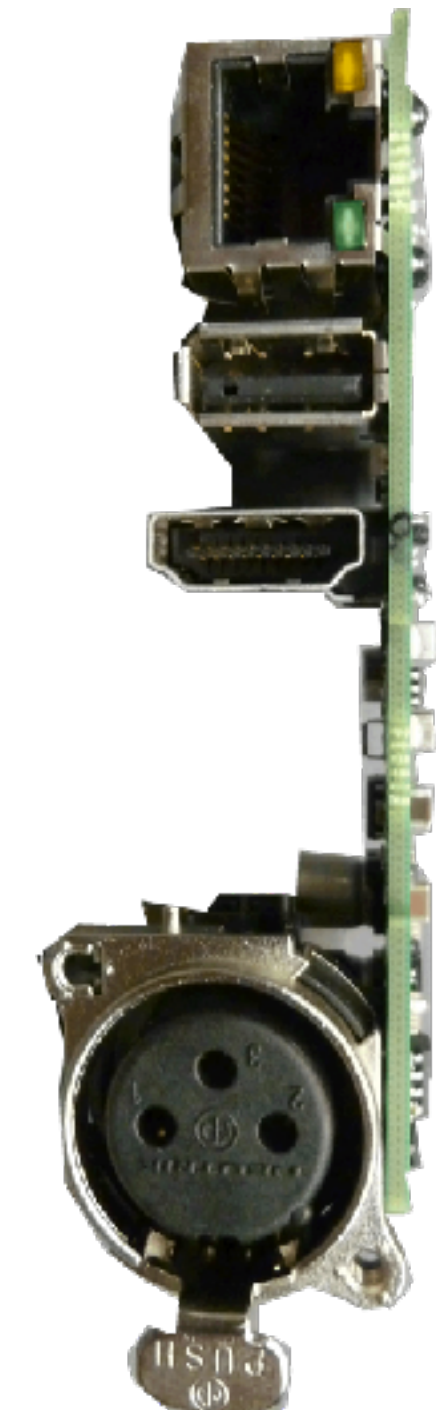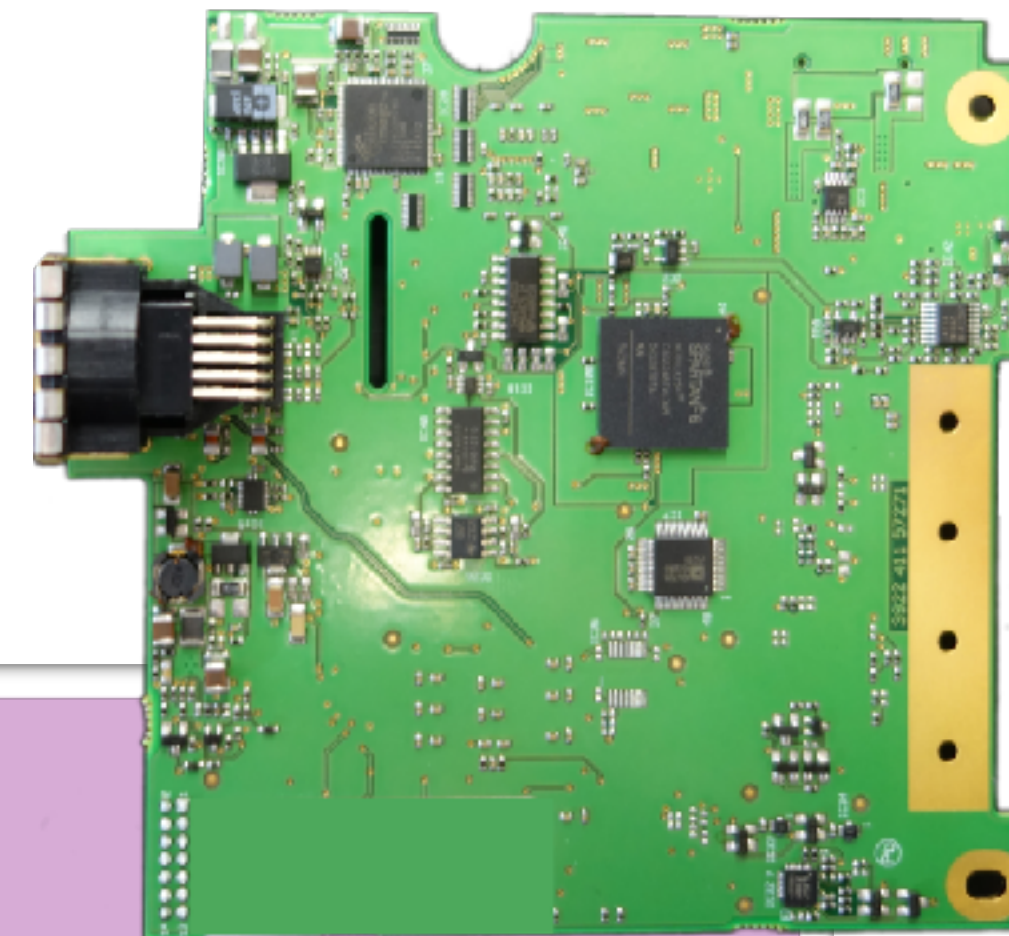
LDX XtremeSpeed series

- **Introduction LDX XtremeSpeed**

Synchronisation

As the camera head has to be combined with the current LDX-adapters and the new 3G Triax/Fiber adapter (for single speed only), it is necessary to use the same synchronization system as it is used in the current LDX camera.

This means that the synchronization is based on the (analogue) H-lock signal and a frame reset puls.

This is also the most cost-effective way of synchronizing for the 3G triax adapter.

Additionally it will be possible to synchronize the camera head with a 3-level sync-signal (future developments such as a compact adapter or wireless system) and through the HD-SDI-signal at the EXT-1 input.
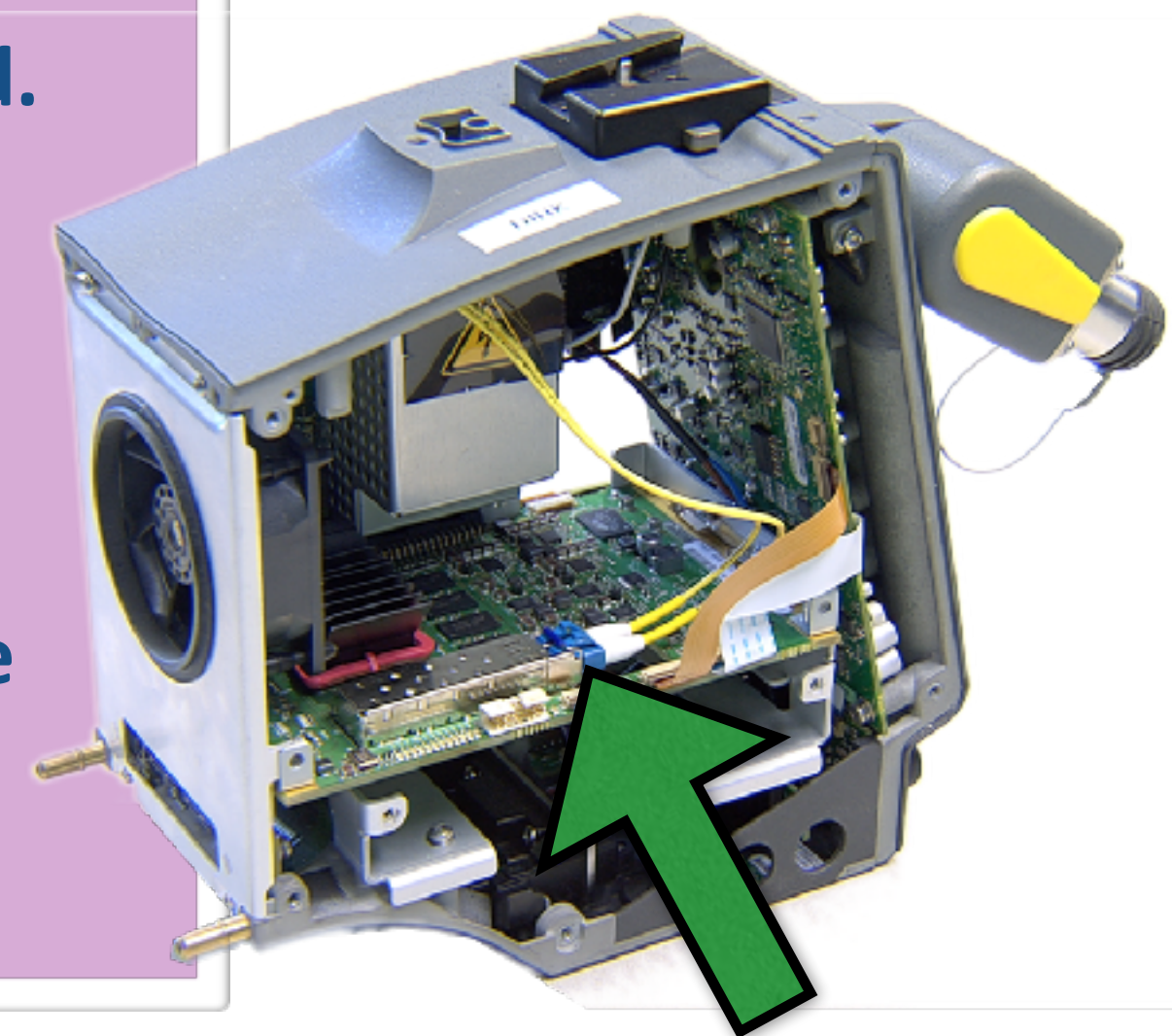
LDX XtremeSpeed series

- **Introduction LDX XtremeSpeed**

The Adaptor

The modifications from the LDX 5650(3G fiber) adaptor is limited to the transmission board.

The new fiber transmission board is now prepared for a 10 Gbit fiber transmission.

The rest of the adapter is generic and will not be influenced by this high speed mode.

The goal is to have an audible noise from the camera according the NR20 standard in single speed. For higher speed a higher noise level from the fan is acceptable. (max NR30)

LDX XtremeSpeed series

■ Introduction LDX XtremeSpeed

The Transmission   Camera to XCU

The following signals have to be transmitted from camera to XCU:

- 1, 3 or 6 speed video (1.5 to 9 Gbit/sec uncompressed video data)

- 4 audio channels (in total 6 Mbit/sec)

- 2 intercom channels (in total 3 Mbit/sec or less)

- control data (incl metadata) + private data (in total less than 1 Mbit/sec)

- 1 Gbit ethernet (for highspeed applications, this could be limited to 10 or 100 Mbit/sec)

LDX XtremeSpeed series

Introduction LDX XtremeSpeed

The Transmission XCU to Camera

The return signals will be identical for all speeds, as the return video signals are always normal speed signals (processing in the generic board of the XCU).

These signals are:

- 2 return video signals (2 x 1.5 Gbit/sec: 1080I or 720P)
- Teleprompter video (270 Mbit/sec)
- 3 intercom signals (Engineering and Production intercom and program audio)
- control data + private data
- 1 Gbit ethernet (for highspeed 10 or 100 Mbit/sec)

LDX XtremeSpeed series

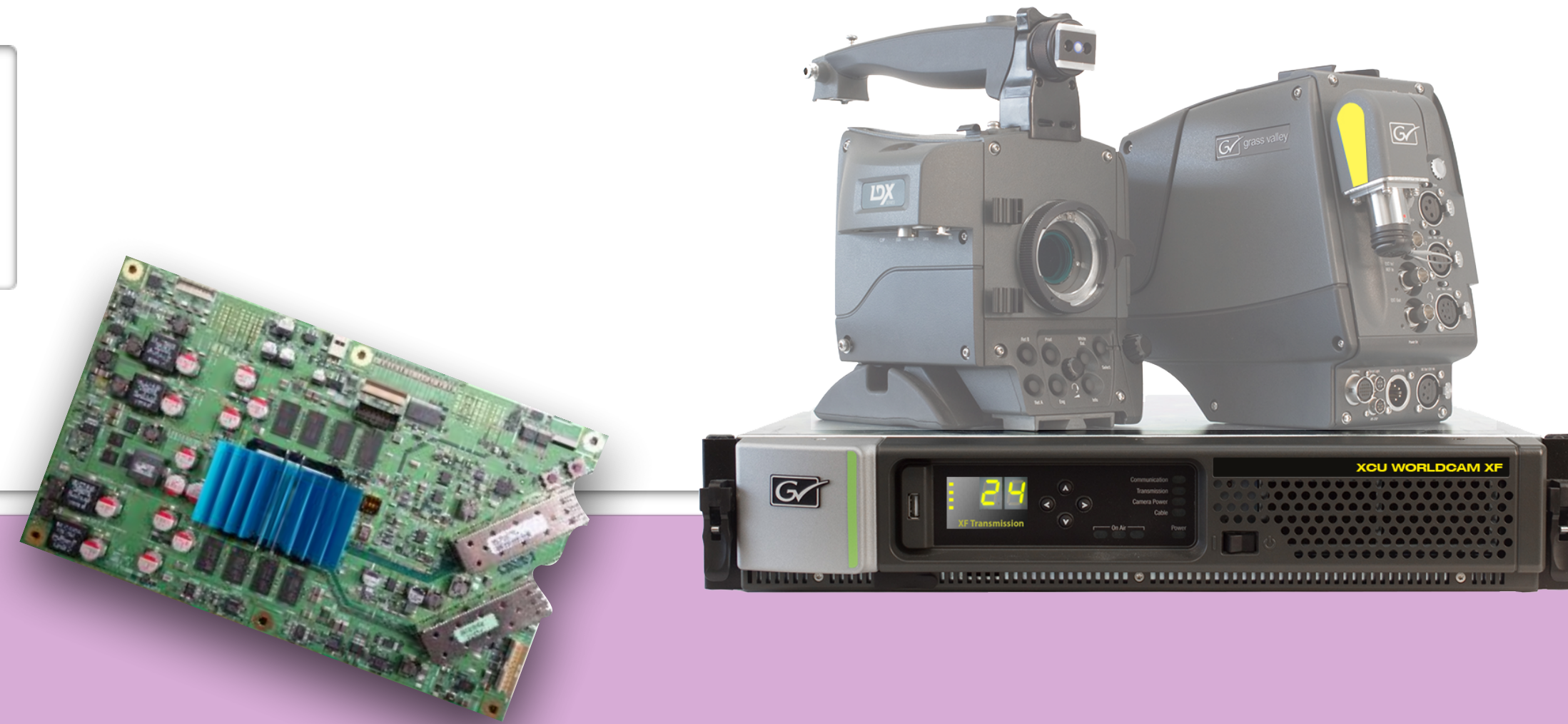- **Introduction LDX XtremeSpeed**

The Basestation (XCU)

The new transmission system will be implemented on a new pc-board in the XCU at the position of the 3G triax transmission board.

The current interconnection from this Transmission board to the Generic board is 2 x 3 Gbit/sec.

As the Live signal is also generated at the transmission board there is a need for four 3 Gbit video connections from transmission board to generic board.

The output of the video outputs on the CCU in the high-speed mode will be according the table on slide 41

LDX XtremeSpeed series

Introduction LDX XtremeSpeed

The Transmission board (XCU)

The Transmission board will be equipped with an SFP+ module for the interface to the camera.
For the location of the SFP-module at the board it is necessary to take the length of the fibers of the connector assembly into account.

A big FPGA (Xilinx) and enough memory will be necessary to handle the 10Gbit protocol with
the Forward Error Correction. Also the Any Light algorithm is implemented on this board.
The FEC error correction for the return channels can be limited to save bandwidth in the memories.

As the combined signal has to be generated before the Anylight algorithm, also the combined signal has to be generated
at the transmission board and send to the generic board.

This board must also be prepared for the (fiber) interface to IP based environment.
If this is a 10 Gbit interface, a second SFP+ module must be prepared (going to the interconnection at the backside of the XCU).

Fiber Trans.

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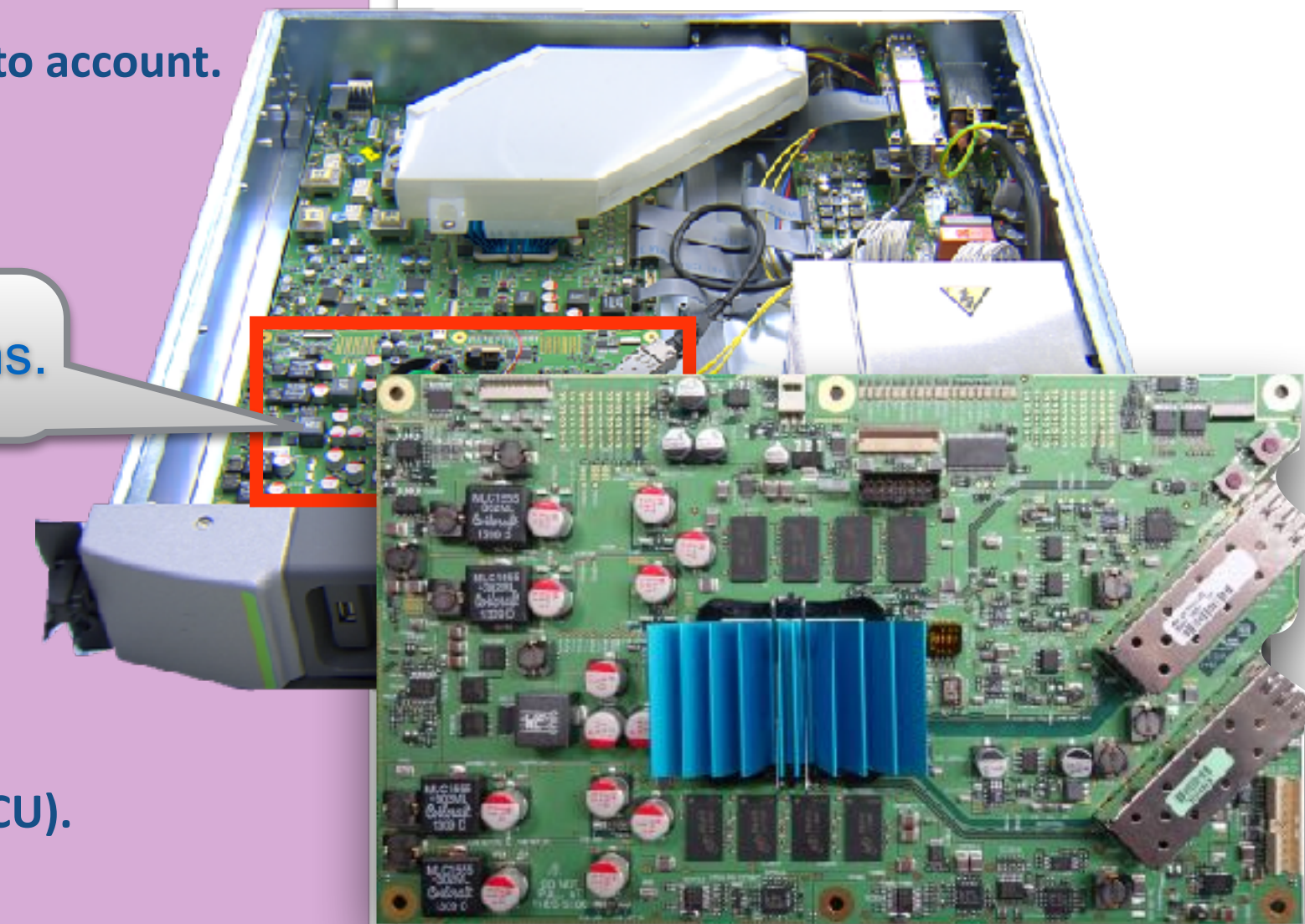
LDX XtremeSpeed series

■ Introduction LDX XtremeSpeed

The Generic board (XCU)

A new version of The Generic board is created for the extra input signals.

The redesign is mainly limited to the lay-out of the board, as the FPGA used on the current board can

handle these extra input signals (number of receivers).

The resources of the FPGA and the memory on the board are expected to be able to handle the signal routing and eventually down-converting the Live signal (in 1080P switchable between 1080i and 1080P).

This new Generic board can be the default board for all XCU's.

Some extra features have to be implemented with respect to the current XCU (also for the sheep adapter):

- The 1 Gbit (10, 100 Mb) ethernet trunk which is prepared, but not operational yet.
- Handling the EXT input signal from the camera (to Live/effect output) in single speed.
- The loop-through of the monitoring signal (selectable: input at EXT3)
- Extra ancillary data (meta data) embedding.
- Sending Metadata over the C2IP-link to the LDK connect Gateway.

The latency of the Live signal will be as short as possible as this signal will be used in the Live production.

Together with the monitoring and SDI output signals, this signal will be synchronized with the EXT reference input.

Generic

LDX86 HD/4K XS

New menu control with XCU display

Hold 2 seconds to enter menu
XF Fiber

Make selection:
▶ Change camera number
Menu (Monitoring)
Menu (XCU display)
◀ Back   Select ▶

XCU Menu control
▲
◀   ▶
▼
Hold ◀ to Exit

Root
▶ Menu off
Video
Monitoring
Audio/Intercom
◀   exec ▶

02
XF Fiber

Up
Hold
Down

XCU Type: XCU4280XF
XCU PID: 037W67

Package: OK
   12NC: 6455
Version: v02.00
02   Status

Extern 1:   No
Extern 2:   No
Extern 3:   No
TP: None
Reference: 1080i50
Gen Lock: Yes
02   Signals

Fiber A
  Cable   OK
  Signal   OK
Fiber B
  Cable   OK
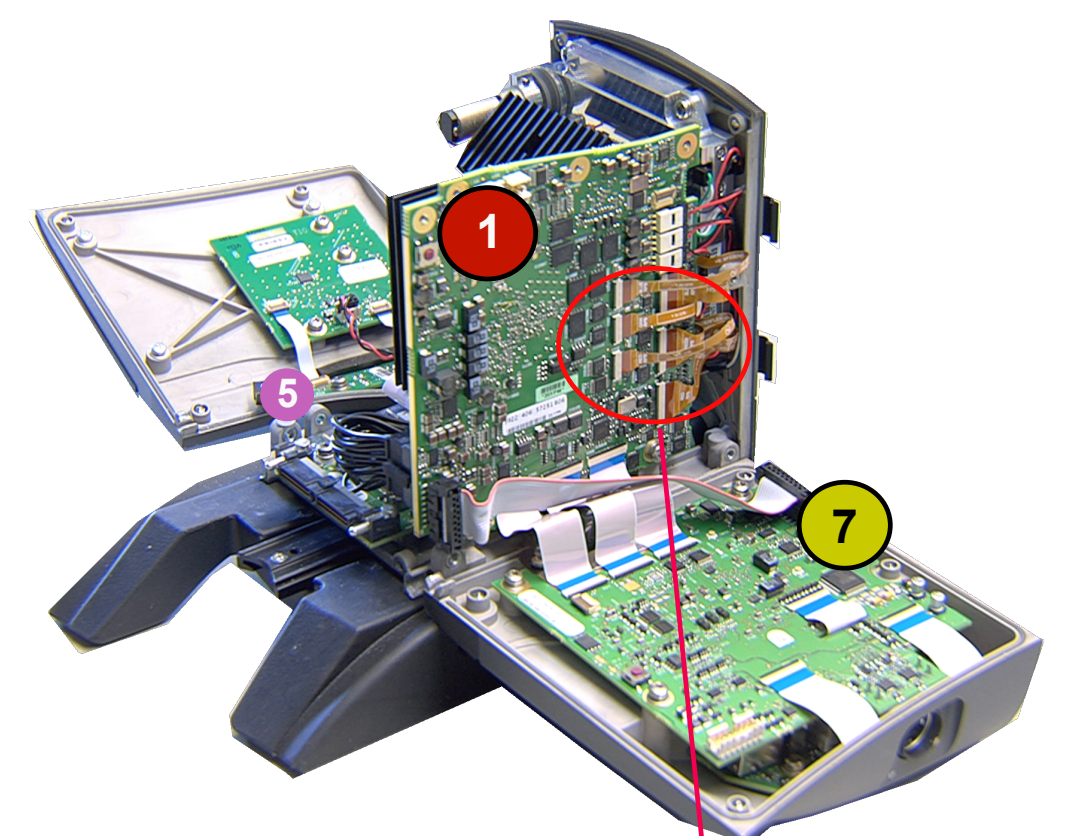 Signal   OK
02   Transmission

LDX86 HD/4K XS

XCU Outputs
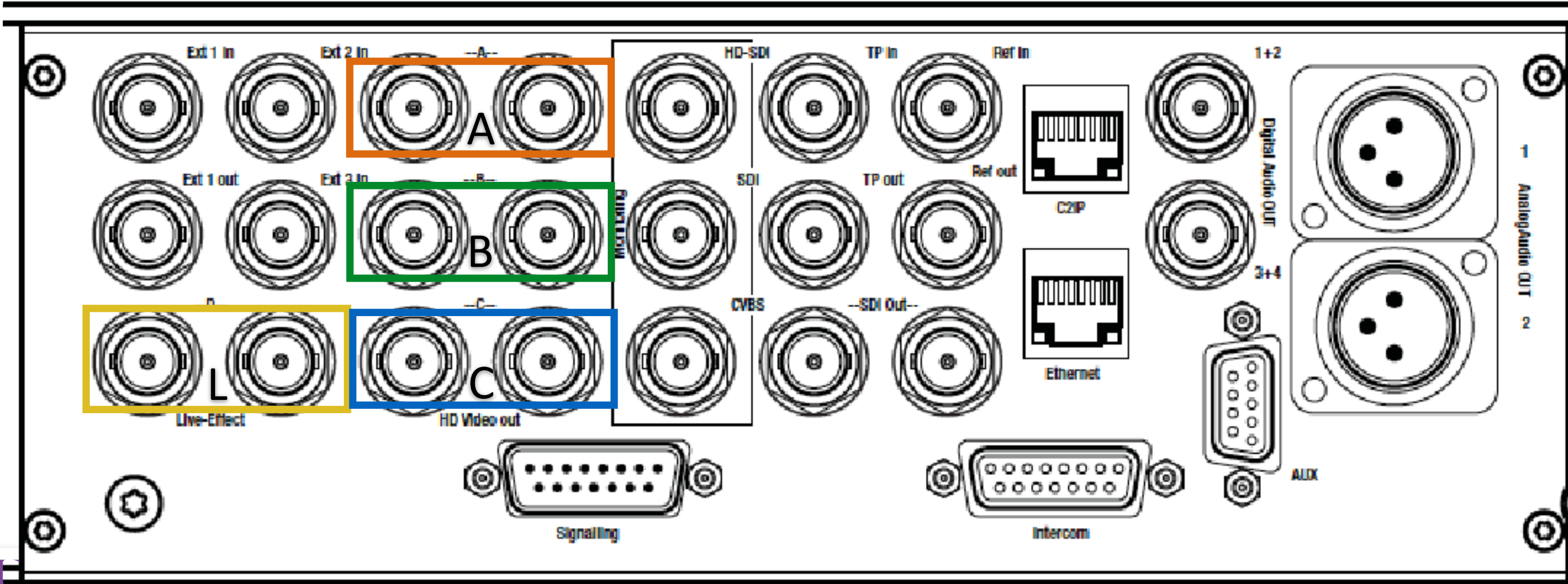
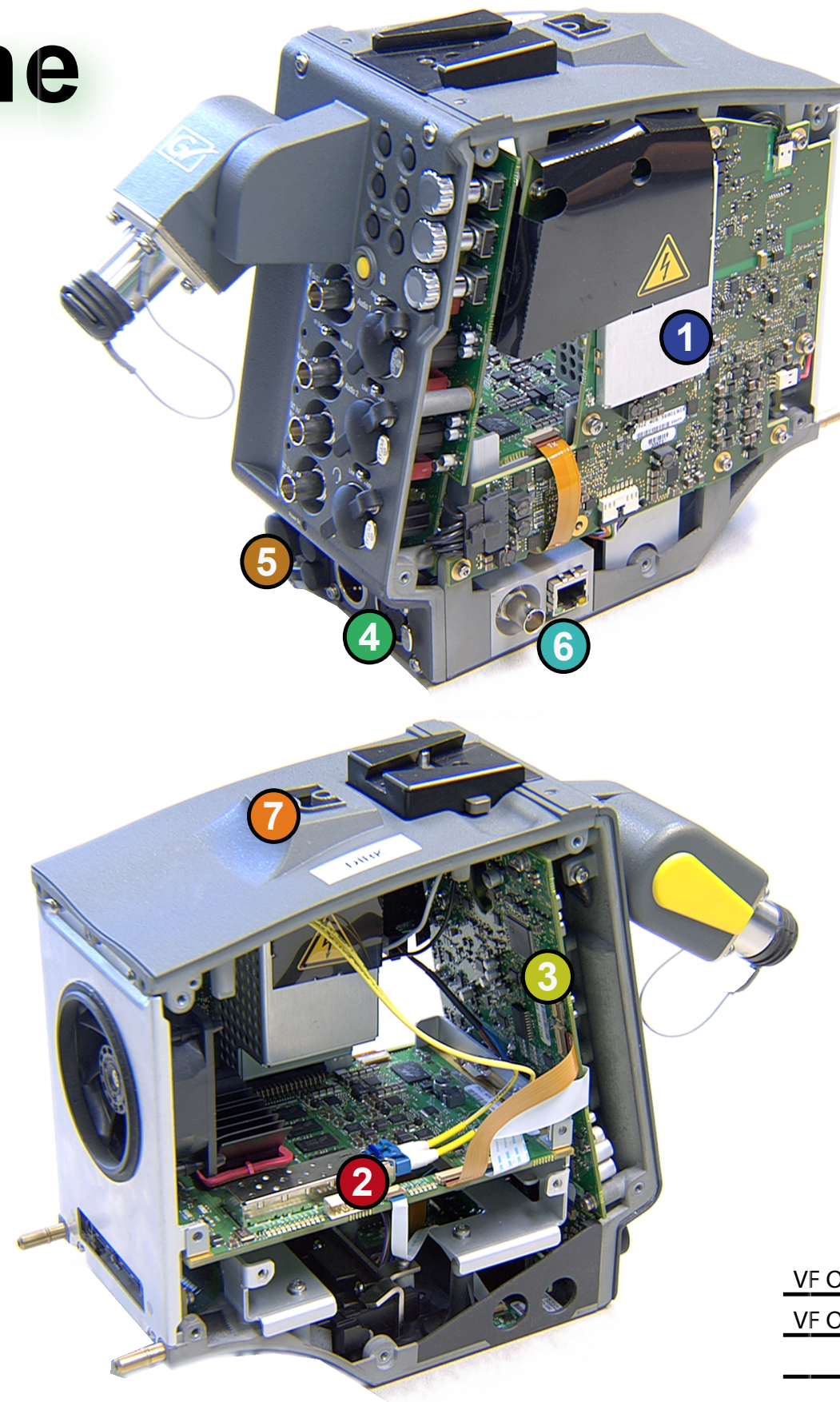| Video Format	Output A	Output B	Output C	Live-out	Monitoring
1080P150/179	Phase 1 (3Gb/s)	Phase 2 (3Gb/s)	Phase 3 (3Gb/s)	Live (3Gbit/s)	Live (1.5Gbit/
1080I150/179	Phase 1 (1.5Gb/s)	Phase 2 (1.5Gb/s)	Phase 3 (1.5Gb/s)	Live (1.5Gbit/	Live (1.5Gbit/
1080I300/359	Phase 1+2 (3Gb/s)	phase 3+4 (3Gb/s)	Phase 5+6 (3Gb/s)	Live (1.5 Gbit/	Live (1.5Gbit/
720P150/179	Phase 1 (1.5Gb/s)	Phase 2 (1.5Gb/s)	Phase 3 (1.5Gb/s)	Live (1.5Gbit/	Live (1.5Gbit/
720P300/359	Phase 1+2 (3Gb/s)	phase 3+4 (3Gb/s)	Phase 5+6 (3Gb/s)	Live (1.5 Gbit/	Live (1.5Gbit/
4K 50/59	Q1 (3Gb/s)	Q2 (3Gb/s)	Q3 (3Gb/s)	Q4 (3Gb/s)	Live (1.5Gbit/
XDR	XDR	XDR	XDR	XDR or SDR	SDR

LDX Extreme Head

LDX 86 Main Diagram (Xtreme)

Legend:
- **0** Front unit
- **1** Right Processor board
- **2** Interconnection board
- **3** Zoom Grip / Control Interface
- **4** Front Switch Panel
- **5** Left Switch Panel
- **6** Left Switch Rotary
- **7** Right Cover Panel
- **8** PCBA Lens board
- **9** PCBA HDMI and Micr board

Right Cover panel
3922 406 57271
- VF signals
- Lens Controls
- Ethernet driver
- USB Driver
- HDMI Driver
- Microphone input

Right Processor brd
3922 406 57251

Imager Video FPGA

Interconn. Power
3922 406 56001
- Power
- Interconnections
- Filterwheel contr.
- Left Switch panel
- Indent board

VF Out (A)
VF Out (D)
HSDI 1
HSDI 2
HSDI 3
EXT 1
EXT 2

Micr. input

PCBA HDMI and Mic. board — 5634
RJ45 / USB / HDMI / XLR (Audio)

Lens. conn.

PCBA Lens board — 5633

Zoom Control Interface — 5602
5030
Zoom Grip Switch

Focus Follow / Zoom Follow / IRIS Contr./ Follow / RS232 Dig Lens / Lens Switches

FocusZoom / IRIS / R.Ext

SEAL Glass

Filterwheel motor

Sensing boards

Filterwheel motor

LP Filter + Retardation plate

BLUE / CMOS / GRN / CMOS / RED / CMOS

IR Filter

Sensor board

Ident board

Power Switch

Left Switch Rotary — 5614

Left Switch Panel — 5599

Front Switch Panel — 5598

Open   Close

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LDX Extreme Adaptor

3922 406 56861
Tally light. brd

7

X113

1

3922 406 56901
PCBA Power board

3

3922 406 56911
PCBA Backpanel Audio

X116

X115

Fan

X117

X111

Not Used with Fiber (X112)

X211

X118

X114

X215

6

3922 406 56891
PCBA Right conn. brd

2

3922 406 57221
PCBA Fiber Transmission
10G adaptor

VF Out (A)

VF Out (D)

HSDI 1

HSDI 2

HSDI 3

EXT 1

EXT 2

X2

3922 406 56851
Samtec Flex

X1

8

BNC

UTP

X2

X212

X213

X214

Not Used

9

Hotshoe
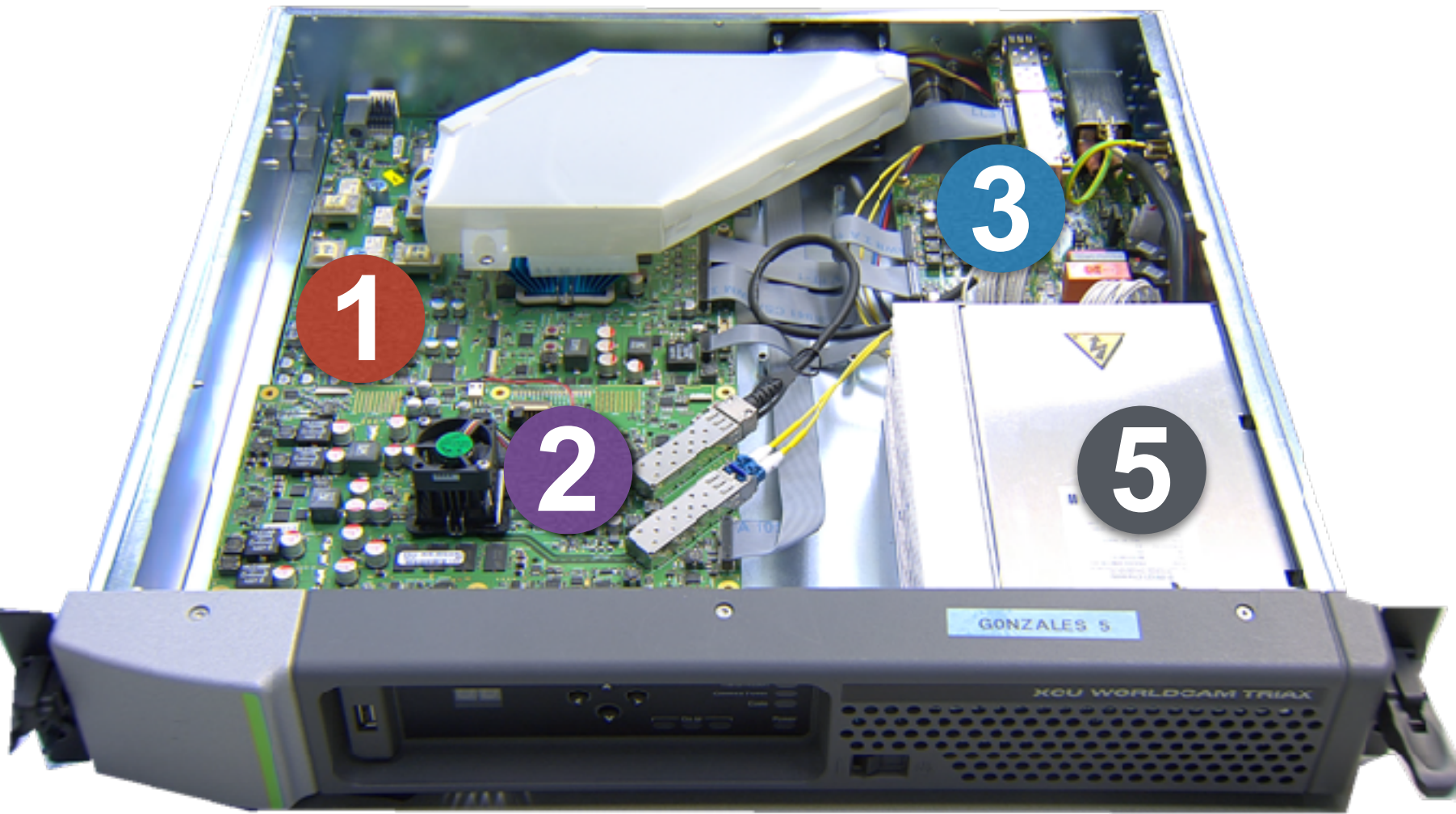
1 PCBA Power board

2 PCBA Fiber Trans. 10G adaptor

3 PCBA Backpanel Audio

4 PCBA Power conn.board

5 PCBA AUX conn. brd

6 PCBA Right conn. brd

7 Tally light board

8 SamTec Flex

9 Indentification board

LDX Fiber 10G adaptor

DC In
11-17V

DC Out
12V 4A

4

3922 406 56871
PCBA Power conn. brd

Auxiliary

Scriptlight

RS232

5

3922 406 56881
PCBA AUX conn. brd

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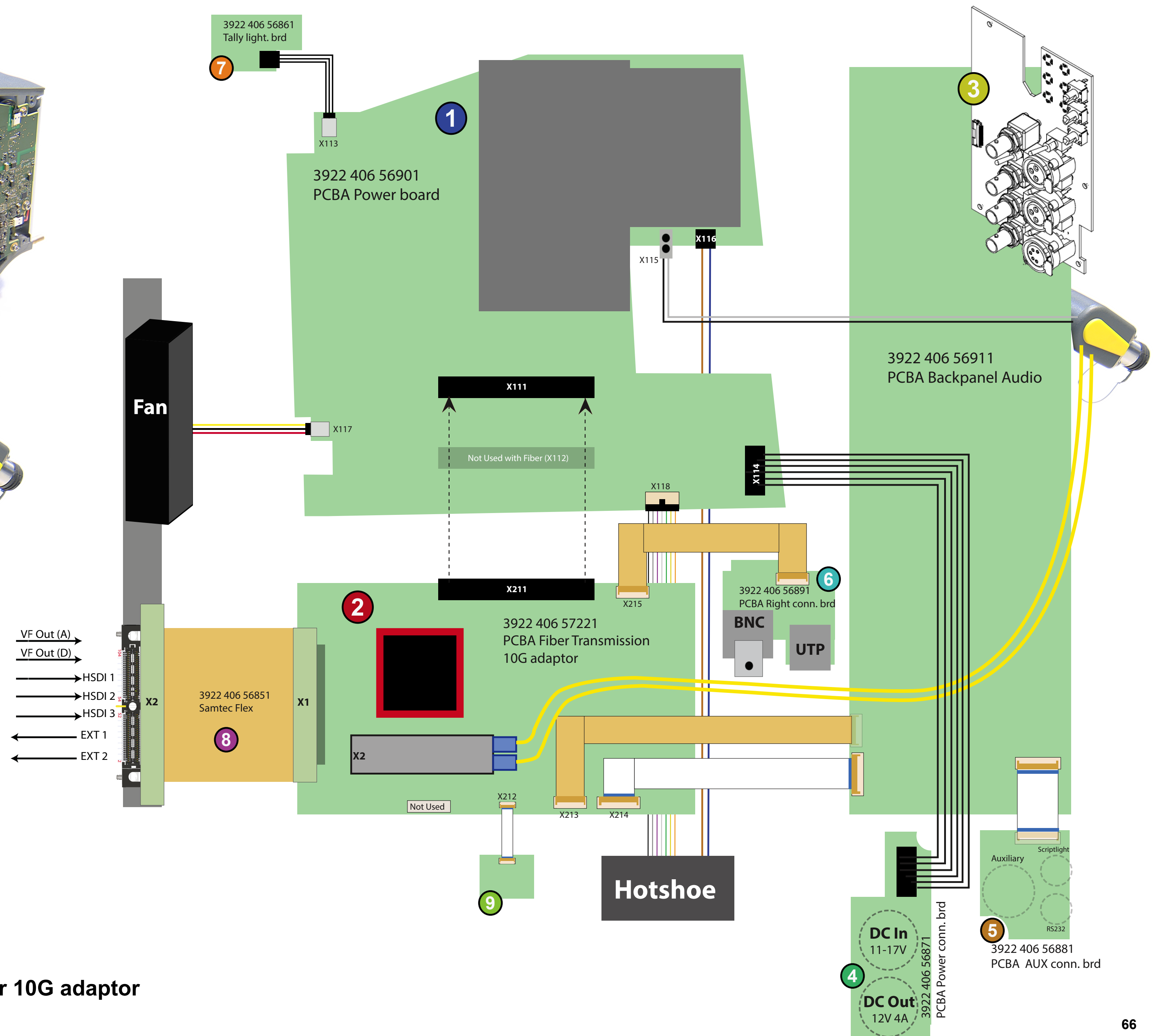
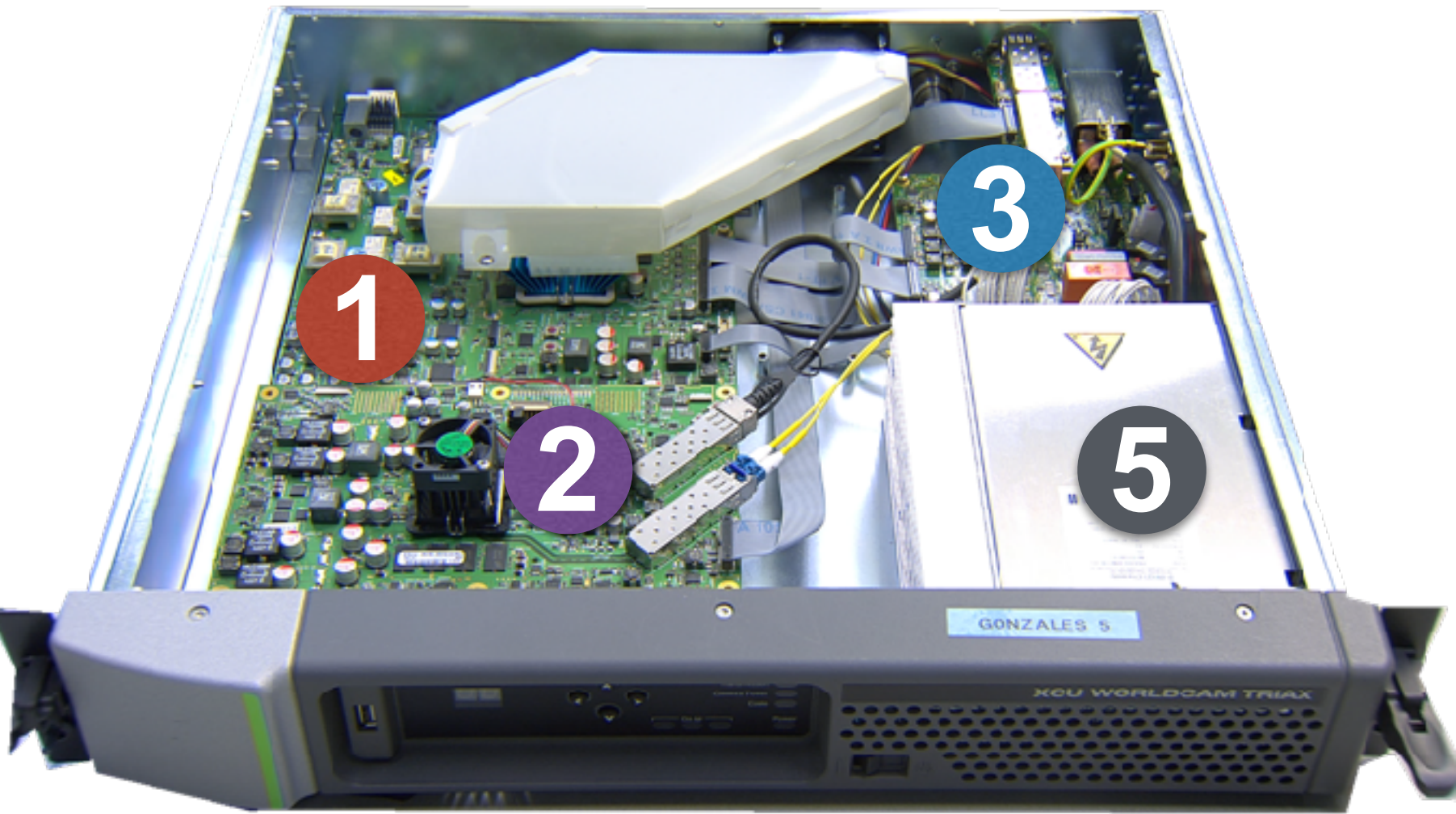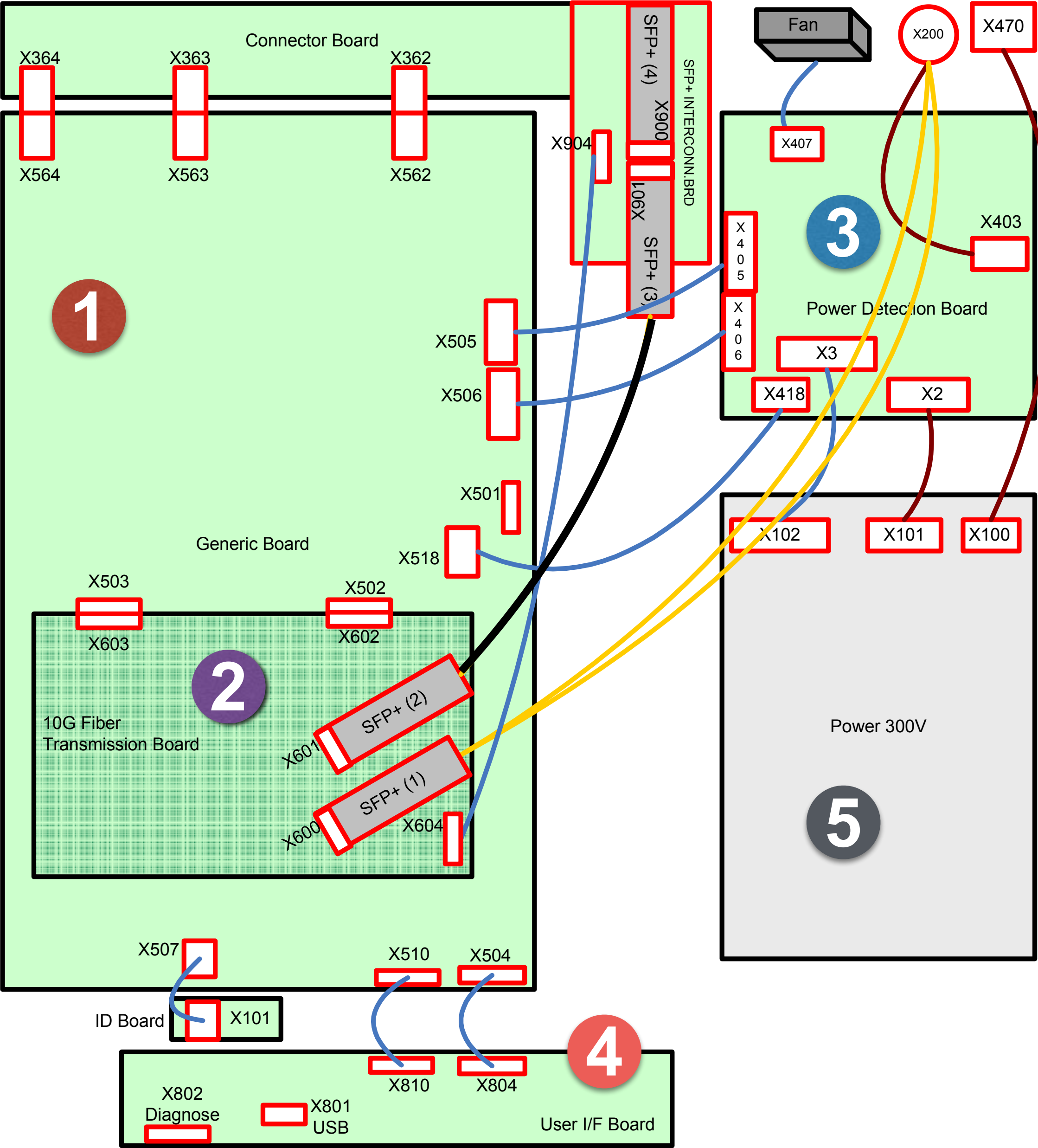# LDX Extreme XCU / 4K (BNC)

1: Generic board
2: Transmission board
3: Power detection board
4: User I/F board
5: Power 300V
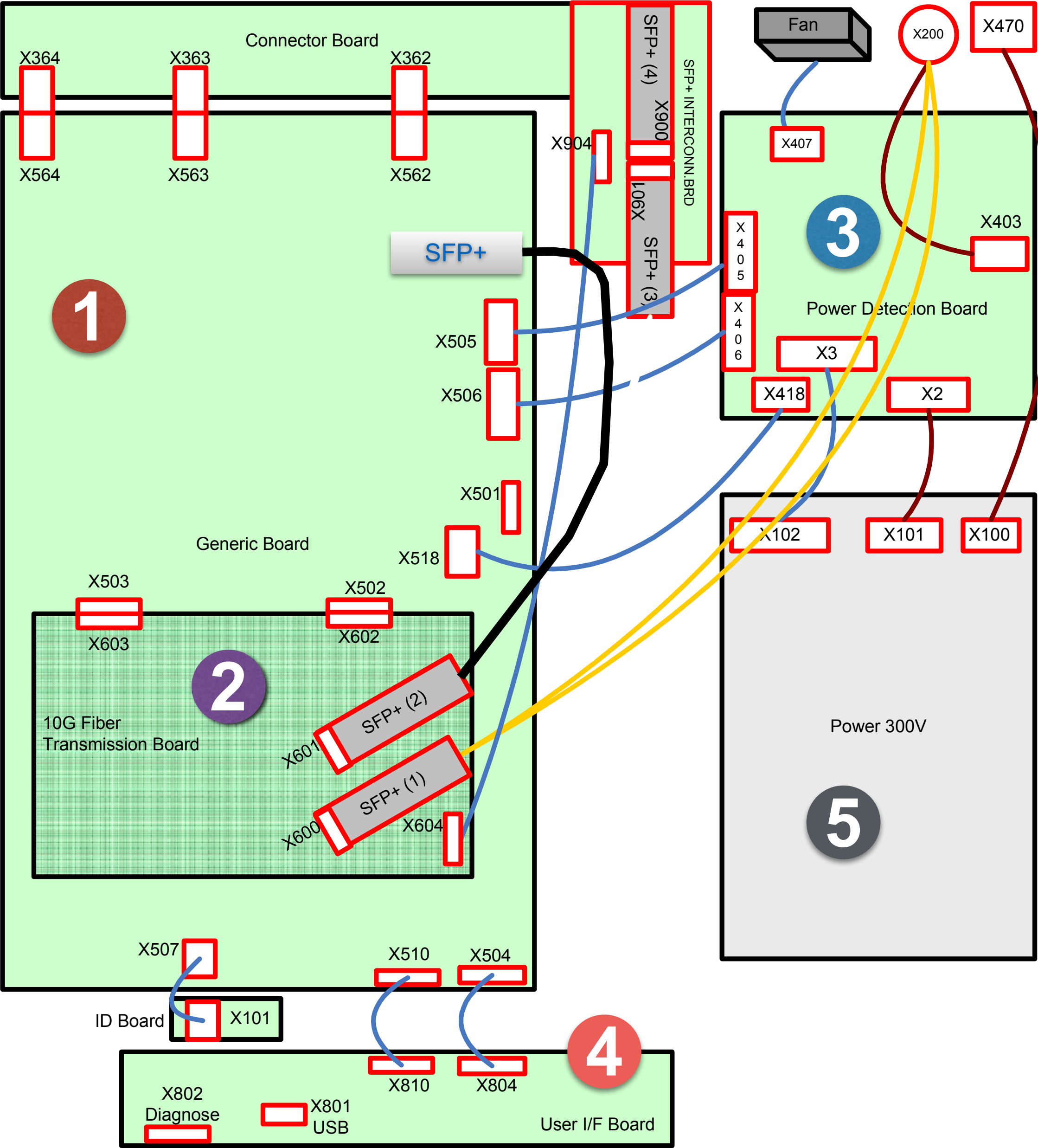
LDX IP XCU 4K over TICO

1: Generic board
2: Transmission board
3: Power detection board
4: User I/F board
5: Power 300V

LDX XtremeSpeed series

This part gives you some more details about the Basics and Service from the LDX HighSpeed line

In this session:

- ✦ **Introduction LDX XtremeSpeed**
- ✦ **LDX 86 4K , XDR, CG explained**
- ✦ **Technical inside LDX XtremeSpeed**
- ✦ *Basic Service and Diagnostics (session 7)*
- ✦ Looking inside (Head,Adaptor,XCU)
- ✦ *Basics Dyno and Summit (session 9)*

LDX 86/Adaptor/XCU

-> Disassemble

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