HDTV Status Report

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EBU Abbreviations: 720p/50, 1080i/25, 1080p/25, 1080p/50
vertical_resolution_Scanning/Frame Rate

Agenda

- Milestones
- Basics on HDTV
- European situation overview – Consumer, Broadcast, Production
- EBU activities and open issues
- Some demos
- Sum up

Milestones HDTV

UK: John Logie Baird
240p Zeilen mech.
System
"High Definition"

NHK Start HD Activities

~1970

Japan: Attempt Standard
1920x1035i? Denied:
- political reasons
- non-square Pixel

US: HD Start Activities

1986

Motivation:
Protect spectrum

Japan - HiVision

1991

8 Std. Program

SDTV

Grand Alliance
- SMPTE Standards
- 240/260M 1125i/25

US

~1996

- ATSC DTV Standard
- 18 Formats (SD, ED, HD)

1920x1080i/p

square

Japan - HiVision

2000

- Hi-Vision digital
- square pixel

Japan - US

~2000

ant Standards
709-x; BT. 1543
4M, SMPTE 296M

Europe

2000

-EBU Activities

Europe

2004

-Euro1080

Europa

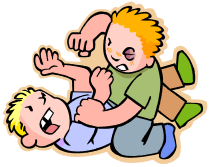
2003

- EBU TQE

Europe

2004

- 720p/1080i ?
- EBU Position



Europe

2005

-NMC Seminar

720p History

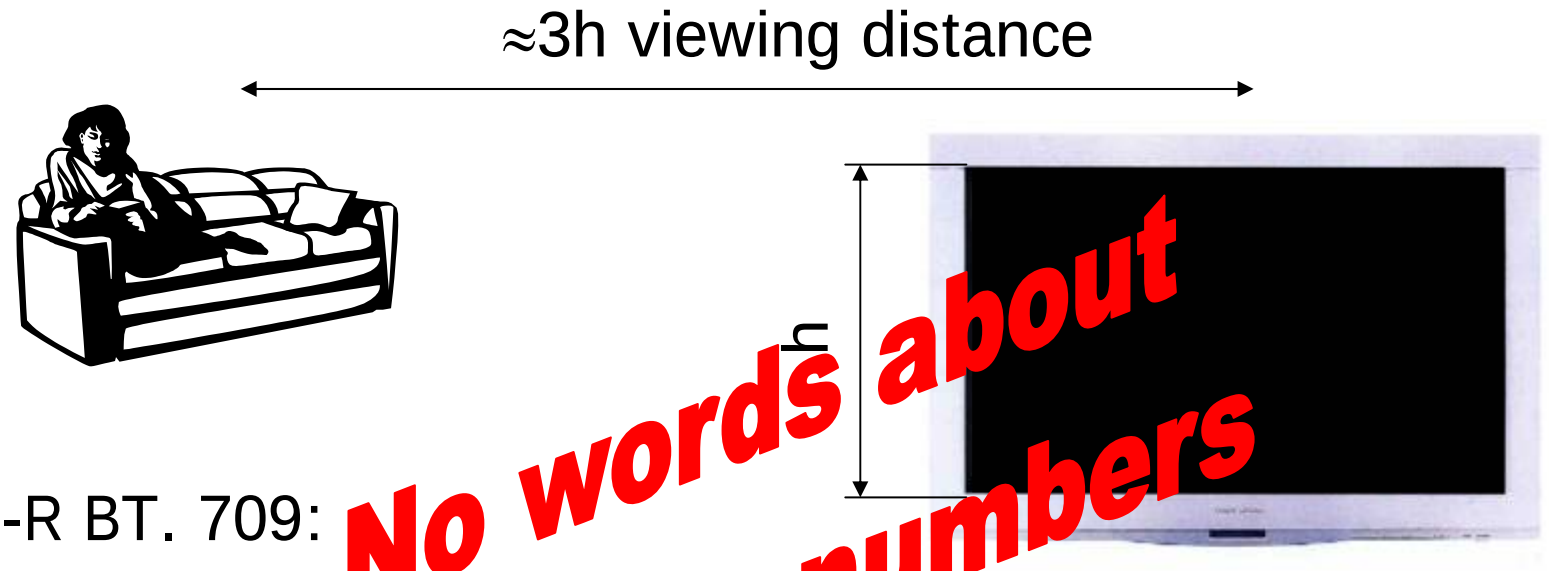
- ~1988: 3 x NTSC 1575i
- 1990: Zenith, AT&T, MIT: 787,5p
- 1994/95: SMPTE 296M (720p)
- 2001: SMPTE 296M (with 50p)
- ITU-R BT. 1543 (60p)
- ITU – October 2005 Initiative???

1995

HDTV – Milestone Categories

	Consumer	Emission	Production (mainstream)
2000 1st Gen. HDTV	**CRT based**	**MPEG-2 MP@HL (720p&1080i) DVB**	**CCD Cameras VTR DCT-based comp. 100-220Mbit/s HD-SDI interf.**
2005/6 2nd Gen. HDTV	**CRT and Non-CRT SVGA to W-XGA LCD,PDP,LcOS,DLP**	**Advanced Coding I (720p&1080i) DVB-S2**	**CMOS/CCD≤1920x1080p VTR and Server based; 100-220-800 Mbit/s Comp. DCT, MPEG-4 HD-SDI**
2008++ 3rd Gen. HDTV	**Non-CRT W-XGA, U-WXGA O-LCD, LCD, PDP, LcOS, DLP, Nano-tubes, etc.**	**Advanced Coding II - scalable (1080p/50) DVB-S2, DVB-T**	**CMOS/CCD ≥ 1920x1080p, 50Hz++frame rate; IT based; new mezzanine Compression; scaleab. Comp. New Gbit interfaces**

Definition HDTV



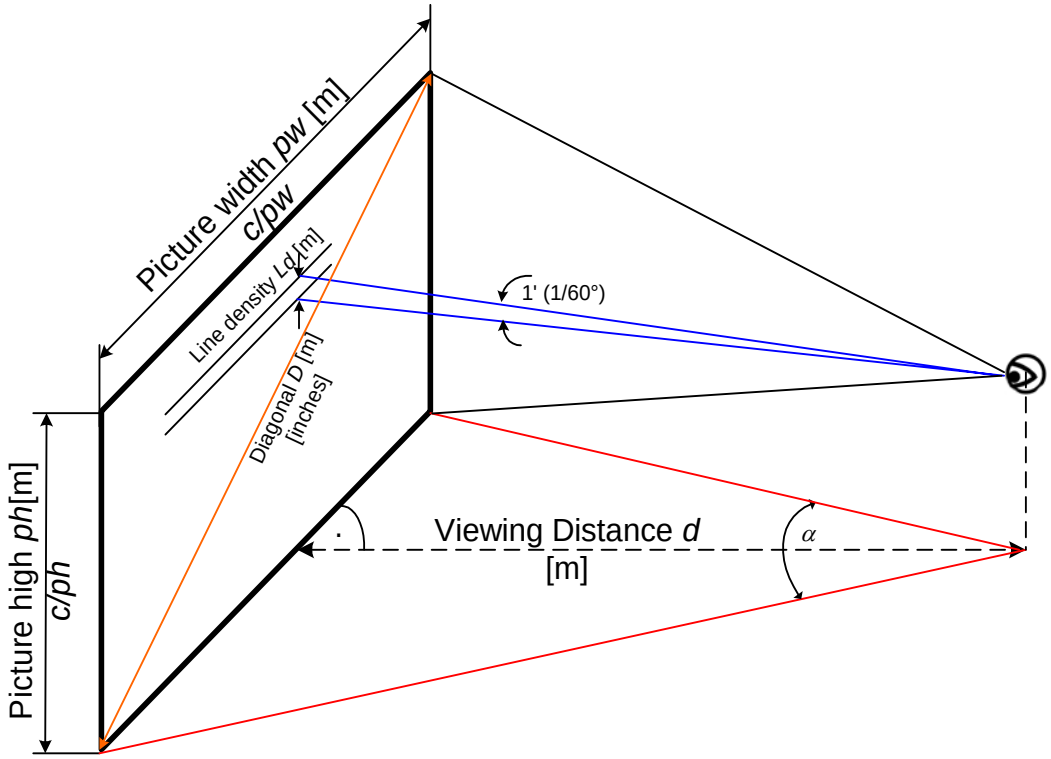
No words about I/P or line numbers

ITU-R BT. 709:

„ A high definition system is a system designed to allow viewing at about three times the picture height, such that the system is virtually, or nearly, transparent to the quality or portrayal that would have been perceived in the original scene or performance by a discerning viewer with normal visual acuity.“

High-Definition Television

- HDTV = large 16x9 Displays
- PVD = Distance when line/pixel structure not longer visible



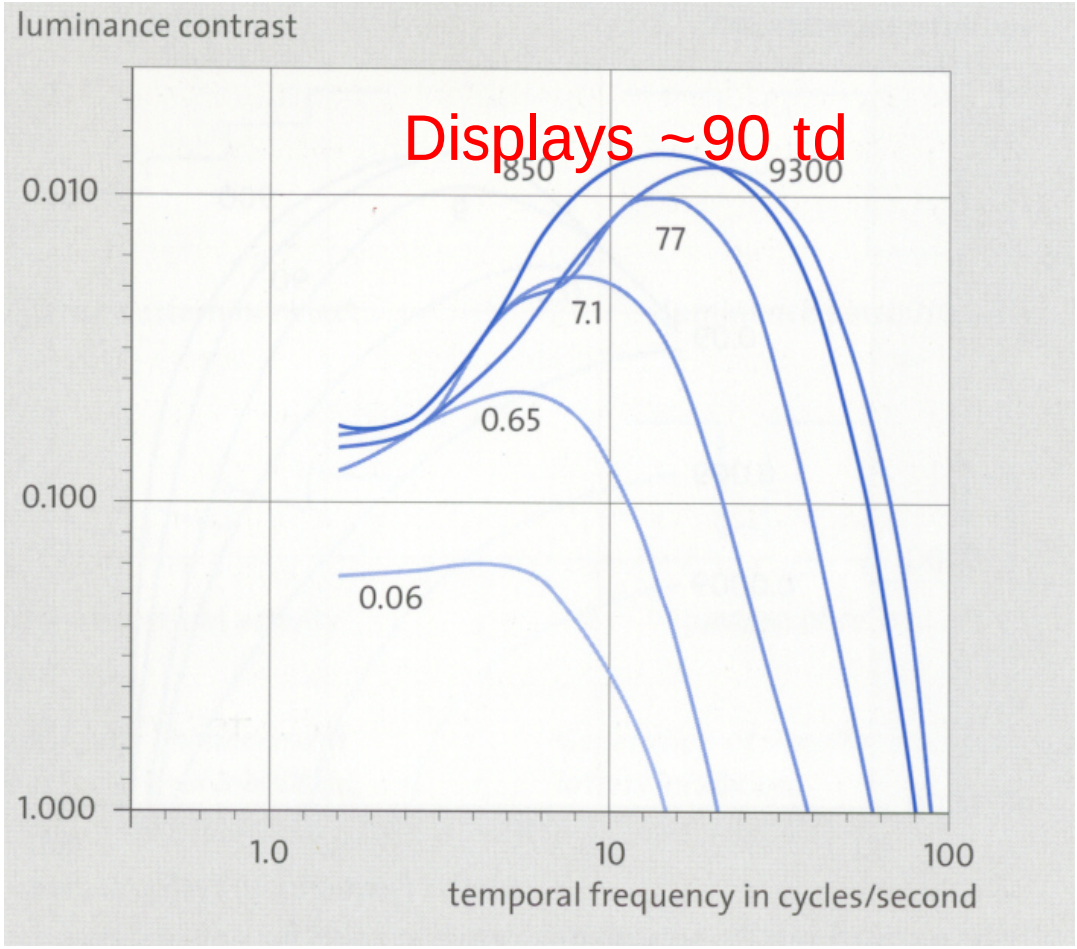
HVS:

- Resolution 1/60°
- PVD = 2,7m with D = 50 inch (BBC white paper)

Video signal:

- min. 1280 x 720p
- about 5% Over-sampling is useful (evidence?)

High-Definition Television



(Lang: Color and its reproduction)

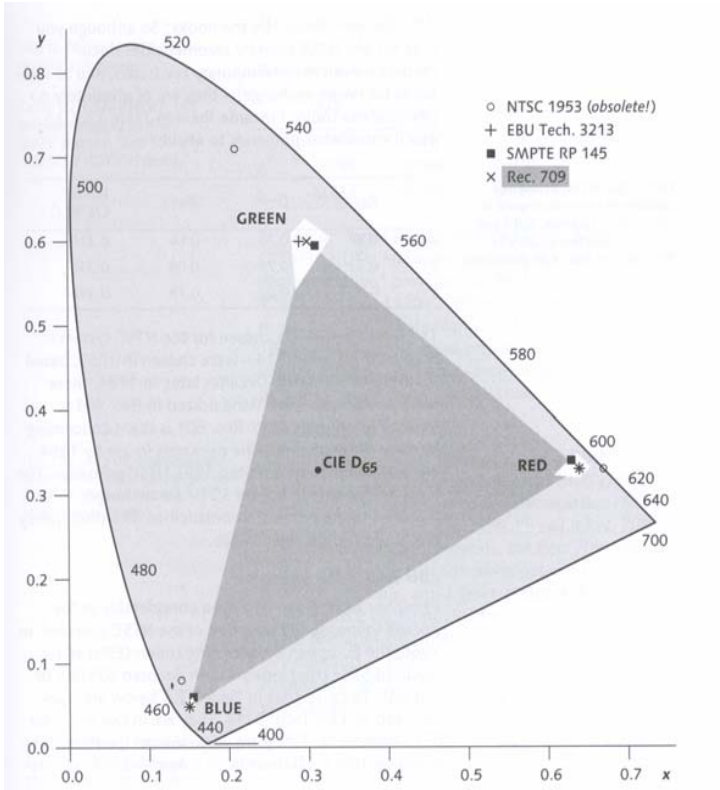
HVS:

- Luminanz/contrast sensitiv
- Flicker: 50Hz minimum

(some displays still convert to 60Hz)

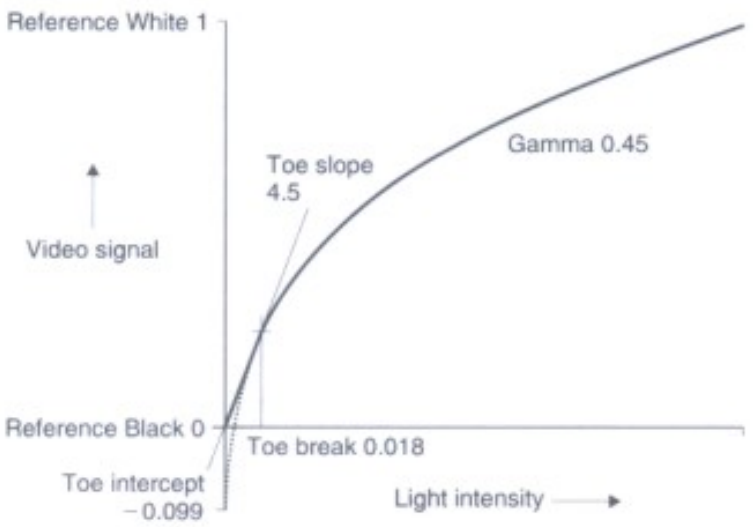
High-Definition Television

- Colorimetry: ITU-R BT.709



(Poynton)

- Gamma: ITU-R BT.709



(Poynton)

- Future: ITU 1361 ??
(extended, unified colour system), because of Display capabilities?

- Future: Gamma?

Bit-rate / Interfaces

	720p/50	1080i/25	1080p/25	1080p/50
Uncom. (4:2:2 10Bit)	0.980Gb	1.11Gb	1.11Gb	2.21Gb
Interface (HD-SDI with 1.485Gbit/s)	Y	Y	Y	N dual link HD-SDI or new development
4:1 compression (similar like 50Mbit/s policy for SDTV)	245Mb	277Mb	277Mb	552Mb

European Conditions for HD

- Consumer domain
- Distribution side
- Production Environment

Consumer domain I

- Increasing penetration of non-CRT displays
  - LCD, PDP, DLP, LcOS with usually non-CRT resolutions
  - Displays are progressive
  - Scaler adopt the video signal to spatial display resolution and (Low-Cost) De-interlacer are required for Interlaced video inputs
  - Have all different behaviors than CRT and to each other (e.g. colorimetry)
  - New display technologies will enter the market until HD wave starts in Europe

Displays

HD-Ready

Abbreviation	Spatial Resolution
VGA	640x480
SXGA	1024x768
WXGA	1366x768 (1280x720)
UXGA	1600x1200
WUXGA	1920x1080
QXSGA	2560x2048
More to come	

Plus: interface specifications

Drawback: no real spec. on the image quality

Consumer domain II

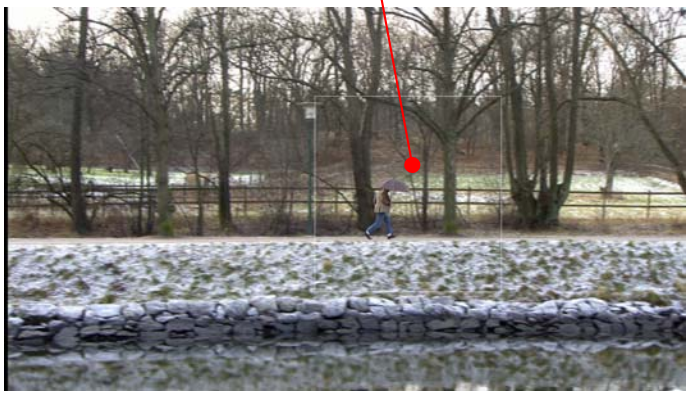
- Some miss-information on the market
  ("HD compatible" for 480p displays)
- Initiative to define a "HDTV Receiver Label"
- AVC is mandatory (H.264 or VC-1 proposed SMPTE 421)
- Trends which PB need to recognize:
  - Display penetration
  - HD-DVD will enter the market by 2006 and will raise consumer expectations
  - Play-Stations with HD-resolutions
  - Consumer camcorder with HDV etc.
  - "Variants of good and bad HD"
  - Acceptance of private Broadcasters with HDTV

Distribution/Broadcasting

- DVB-S2 will become “State of the Art”
- DVB-T role out very good under way for SDTV
  - Potential for HDTV depends on new compression algorithm
- Some Pay-TV offer services already (HD-1) or in 2006 (Premiere, BSkyB, TF-1, Canal+).
- First initial information's show that AVC hardware implementations still need optimization
- “Progressive” EBU position on HDTV emission:
  - 720p/50 as optimum solution now, and 1080p/50 as an attractive option for the future (EBU R112-2004)

1080icompr_10Mb_H264

720p_10Mb_H264



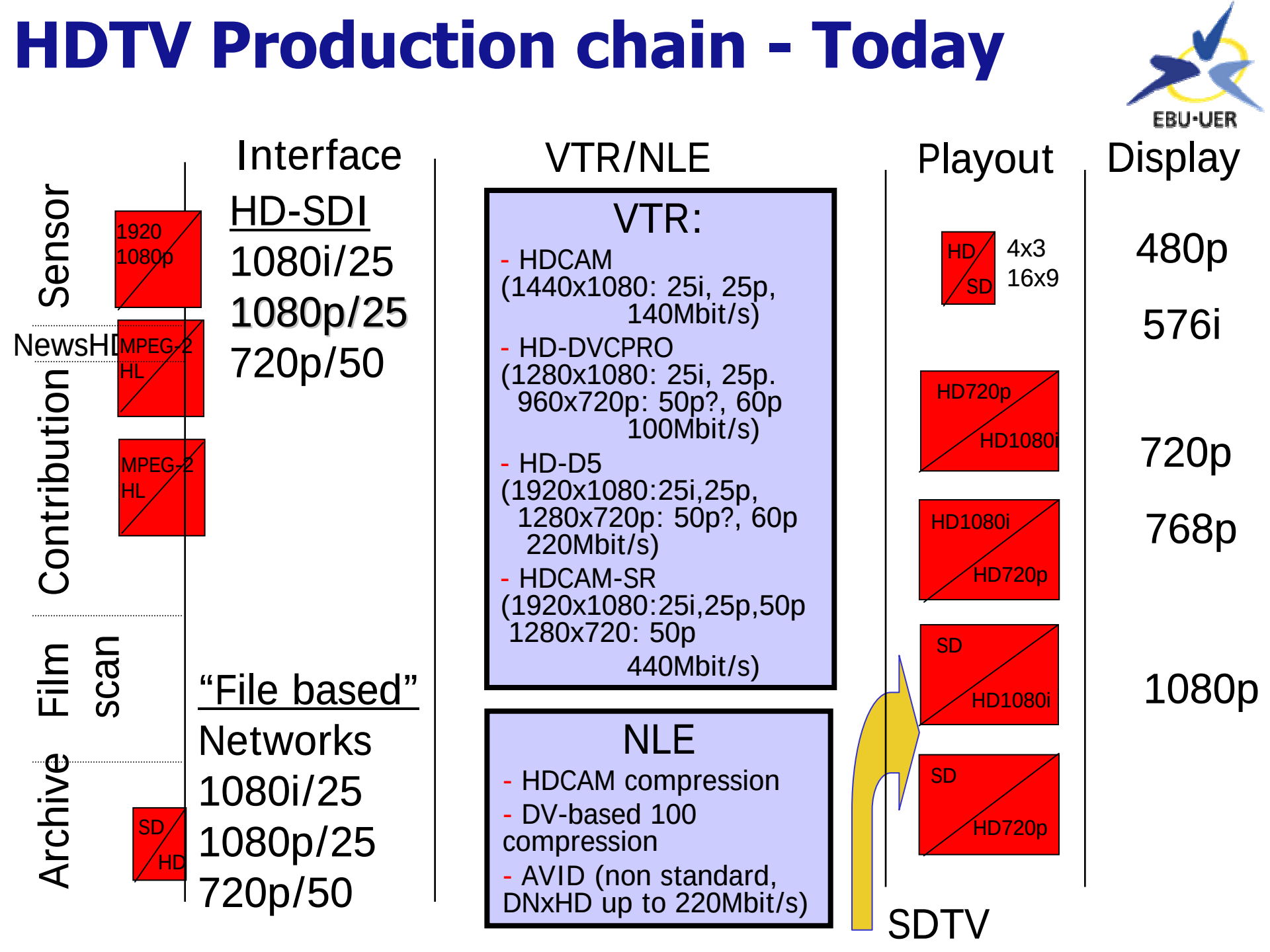
Summary on I and P

- “The difference appears after PP and emission”!
- Interlaced was the right choice in the past as a suitable data reduction method
- New compression systems work better than “I”.
- Interlaced footprint usually cannot be removed
- Avoid low-cost de-interlacer in the display: better to place one HQ De-Interlacer at playout.
- Progressive provides more efficient compression at low bit rates; about equal to interlaced at high bit rates
- Better motion portrayal (e.g. Sport-Genre)
- Compatible to the whole IT and Multimedia world.

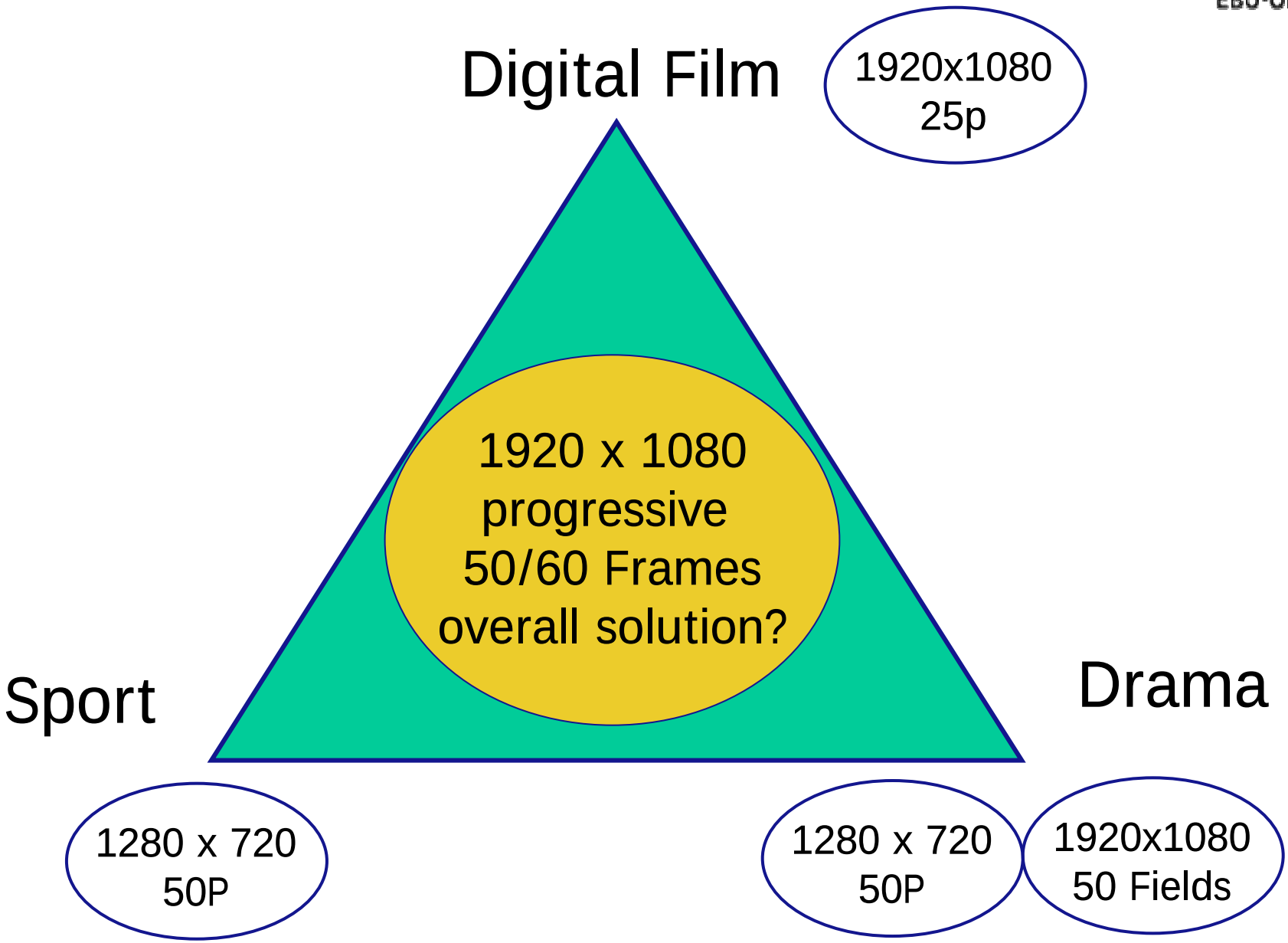
Production

- Increase of HDTV productions for selected events
- European studios are quite advanced in digital
  - fully IT network and server based in News and increasingly also for mainstream production
  - Backbone is based on Rec.601 with SDI environments
  - Costly to change “all of that”
- Awareness that international programme exchange requires increasingly HD
- EBU has stated in D97 the demand that equipment should include 720p/50 and calls for work on 1080p/50 in EBU R115
- EBU Tech 3299: HDTV specifications for production
  - 720p/50, 1080i/25, 1080p/25, 1080p/50

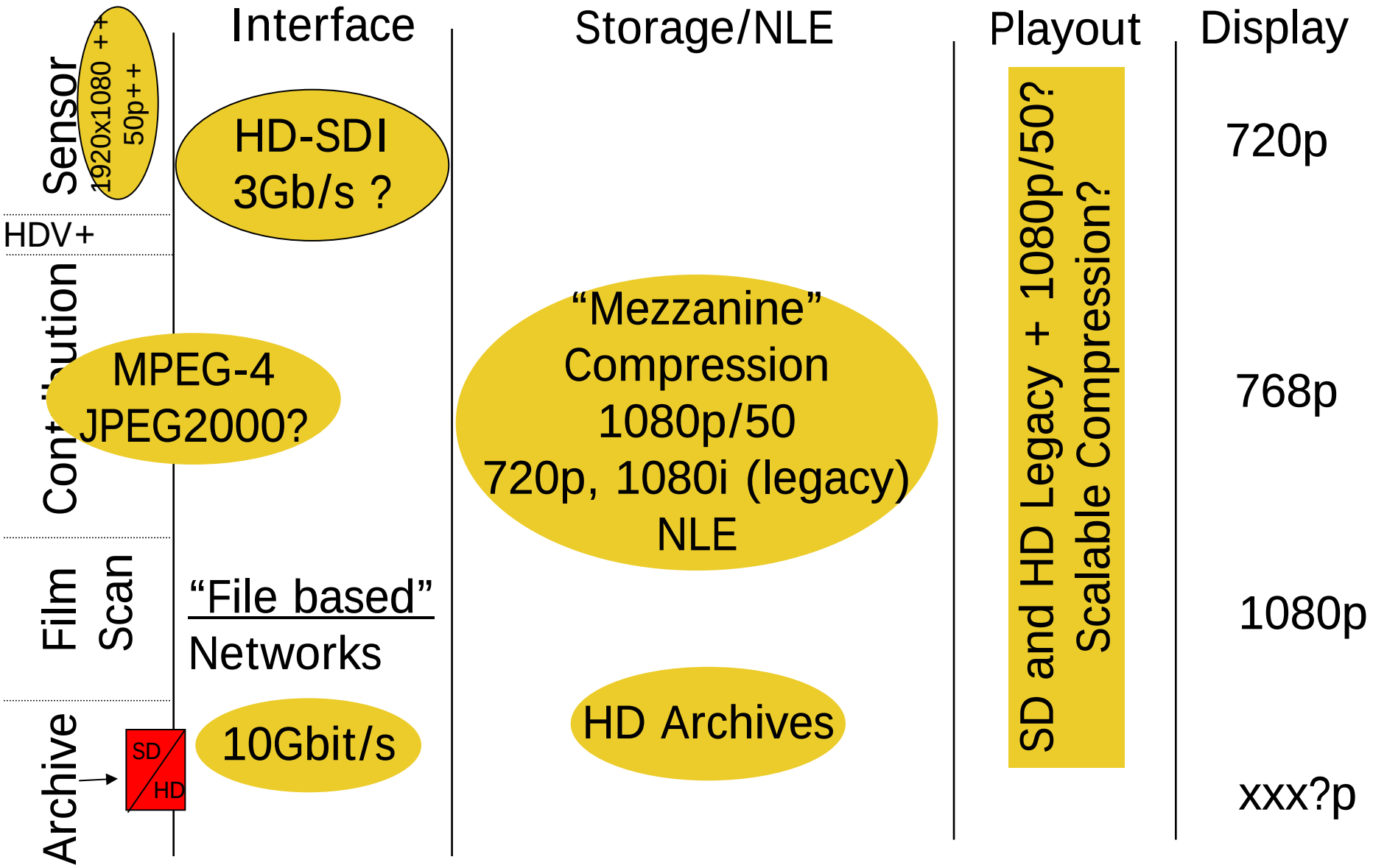
HDTV Production chain - Today



HD # HDTV ?


Digital Film
1920x1080
25p
1920 x 1080
progressive
50/60 Frames
overall solution?
Sport
Drama
1280 x 720
50P
1280 x 720
50P
1920x1080
50 Fields

HDTV Production chain – expected changes



EBU Activities

- HDTV System tests (P/HDTP)
  - HD Studio equipment
    - VTR
    - NLE
    - Compressions formats
    - Multi channel Audio
    - Big Problem: Reference displays
- Automate subjective tests
- HD Contribution (N/HD-NET)
    - Interoperability issues of Contribution codecs (ISOG)
- HD Emission and Displays (B/TQE)
    - Advanced Video Coding
    - Image quality versus required bit-rate
    - EBU Guidelines for HDTV Set Top Boxes
    - Need to think about Audio
- Provide a platform for national HD forums
  - (July 1st meeting)

EBU Library

- Set-up viewing room and of HDTV Test-Material Library
  - From EBU Members for EBU Members
  - 720p/50, 1080i/25 and 1080p/50
  - Test material selection by experts
- Use
  - scientific testing
    - compression formats in production / emission
    - HDTV Formats
  - “show difficulties with HDTV” and to visualize important changes in production
- Demos: “720p/50 uncompressed, 1.485 Gb, (RGB to Projector)”

- Summary current experiences from shootings
  - A lot needs to be done - Independent of the HDTV format discussion!!!
  - E.g. New production grammar
  - E.g. Knowledge on technology
  - E.g. Training, Training, Training

SMPTE, ITU-R, WBU

- SMPTE Study Group on high speed interfaces
  - User Requirements for new Studio interfaces
  - Proposal: HD-SDI 3 Gbit/s
  - “Other Interfaces”
- SMPTE Study Group on Displays
  - Non-CRT Displays in prof. use
  - “Measurement Specification” (www.VESA.org)?
- ITU-R
  - HD-SDI with 3Gbit/s
  - Perceptual-Lossless Compression for SDI/HD-SDI
- WBU
  - HDTV Contribution codec interoperability tests

Summary

- 2008 – 2010 - 2012: “Wave” of HD activities in Europe
- Industry will not sleep with new technology developments
- Number of R&D technology tasks for HDTV:
  - HVS and HDTV - Display issues
  - Compression system and interfaces in production
  - Compression in contribution and broadcasting
- Training, guidelines, migration strategies, etc.
- Avoid a “HD-light” version in Europe just because of adoption of legacy technology from NTSC-viewing environments which are migrating to HDTV

Three important points

- HDTV Production equipment of the 2nd generation for 50Hz is available, also in 720p/50 (latest from 2006 on), but industry will further develop (Displays, Production, etc.) until HD booms in Europe. We need to pay attention to these developments!
- Cost difference between local test productions, a simple demo sat. channel, and the migration of large European PB.
- Important that we recognise and pro-active use the “green field” opportunity in Europe, there is really a lot to be done!