

Compression and Image Formats

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HDTV - Quo vadis ?

- the HDTV quality we provide to the consumer has to be **significant** better than SDTV
 - the end-to-end chain needs careful planning
- current HDTV formats are at least 10-15 years old
- in Europe we need to ask whether there was no further development between the invention of 1080i and today
- are there any alternative, better HDTV formats available that suit economic needs and visual quality and are future proof?

SDTV and HDTV standards world wide – quality view point

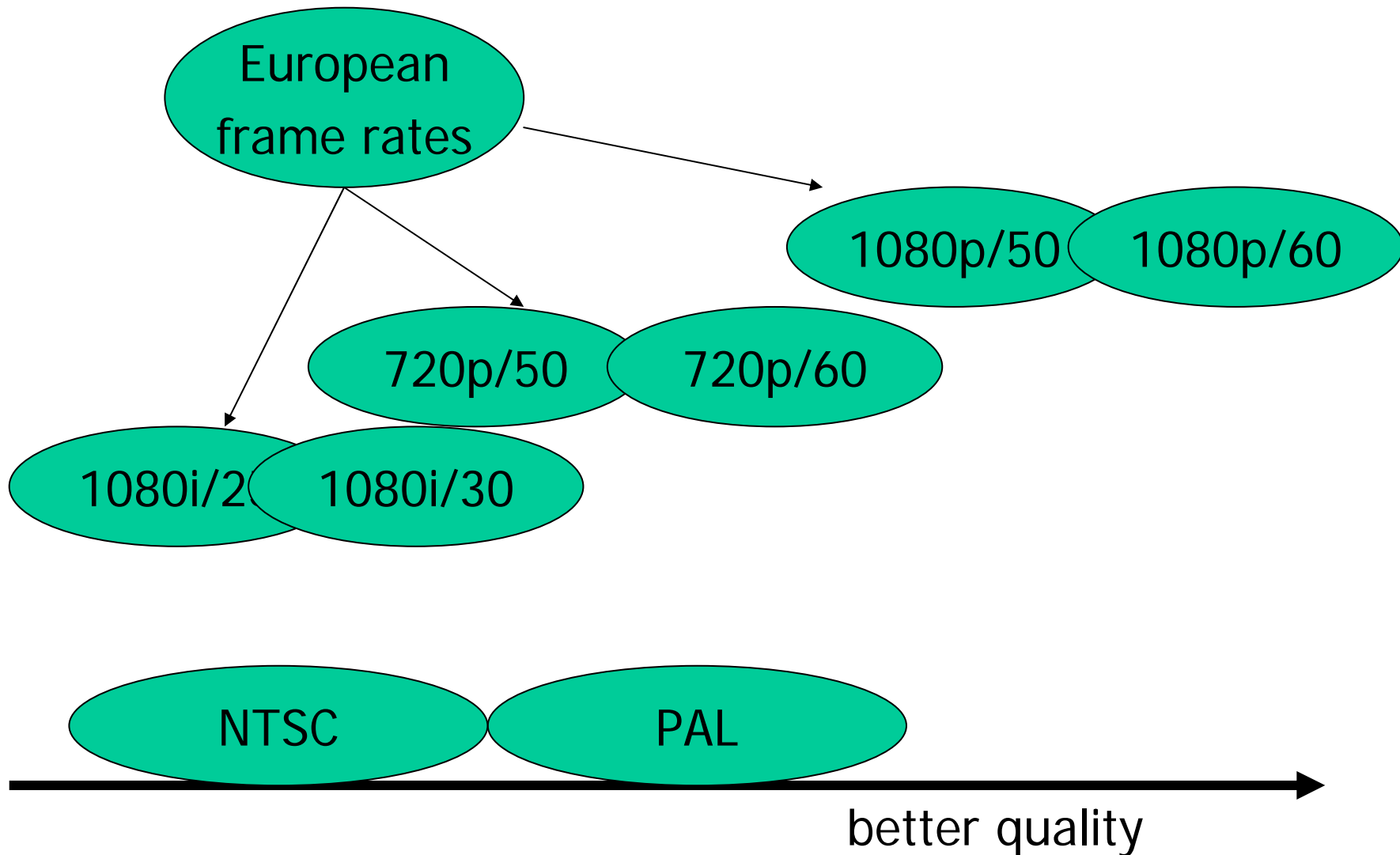
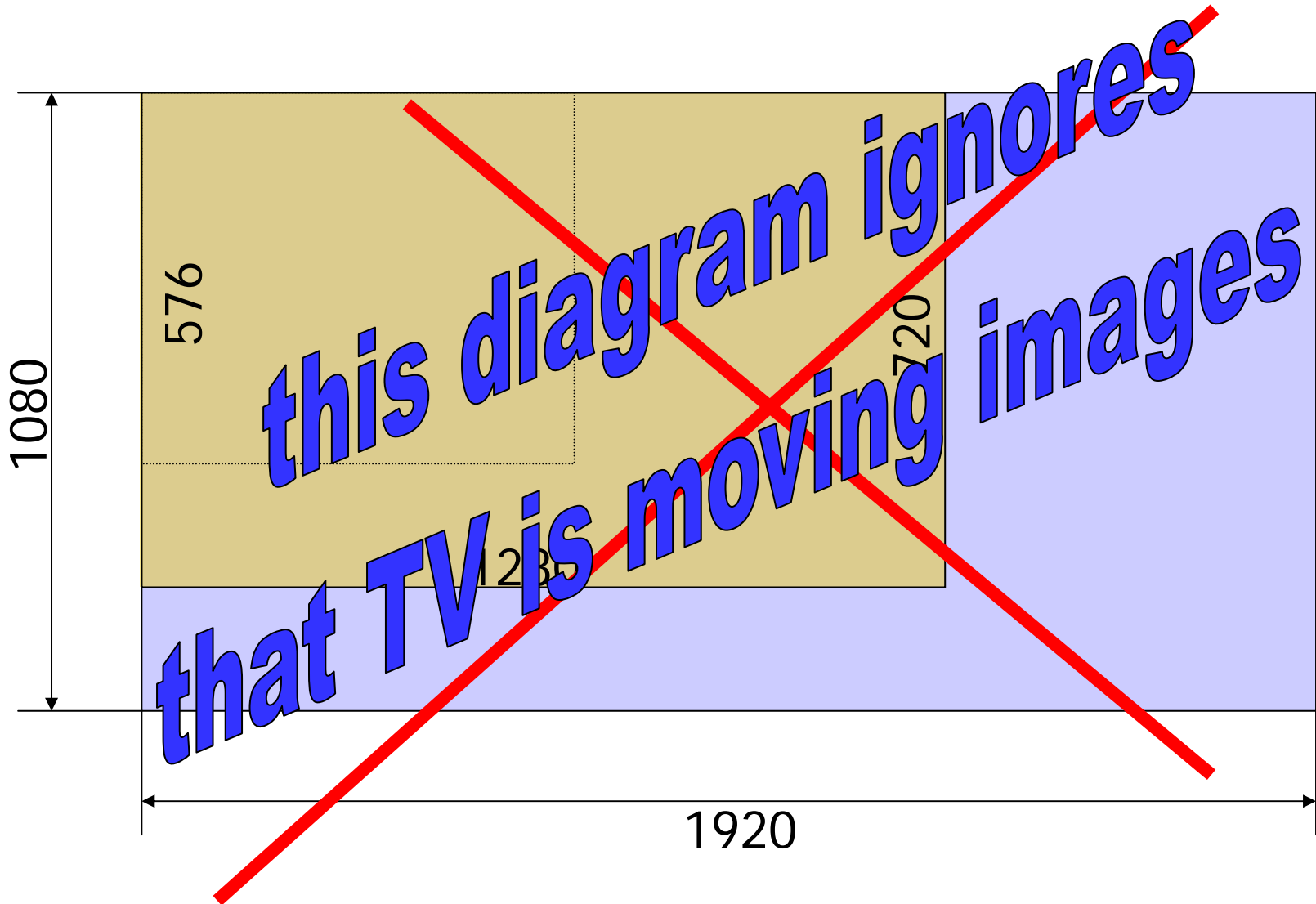


Image formats

- HDTV is designed for 3h viewing distance in the home!!!
- The HDTV image format needs to provide sufficient information so that viewer perceives the HDTV experience in the home
 - without requiring too much bit-rate in emission (and production)
 - we know today, that the image format (spatial and temporal resolution) has an immediate impact on the image quality and how much bits and £\$€ you have to spend in emission bandwidth
- If you sit at 5-7h don't care about HDTV image formats 1080i/25, 720p/50 or 1080p/50

„Marketing diagram.....“



Our research approach for HDTV in emission



- We believe only in subjective testing
- Traditional methods:
 - Double Stimulus Impairment Scale
 - Shortcomings:
 - we compare a reference against the impaired image of the same format
 - we can only determine the failure characteristics of each format individually
 - a comparison of the different HDTV formats is only indicative
- We had to develop a better subjective testing method

New method for picture quality assessment (TSCES)

- Upper anchor: 1080p/50 uncompressed
- Middle display: pictures under test in various bit rates and formats
- Lower anchor: SDTV with 3 Mbit/s H.264/AVC



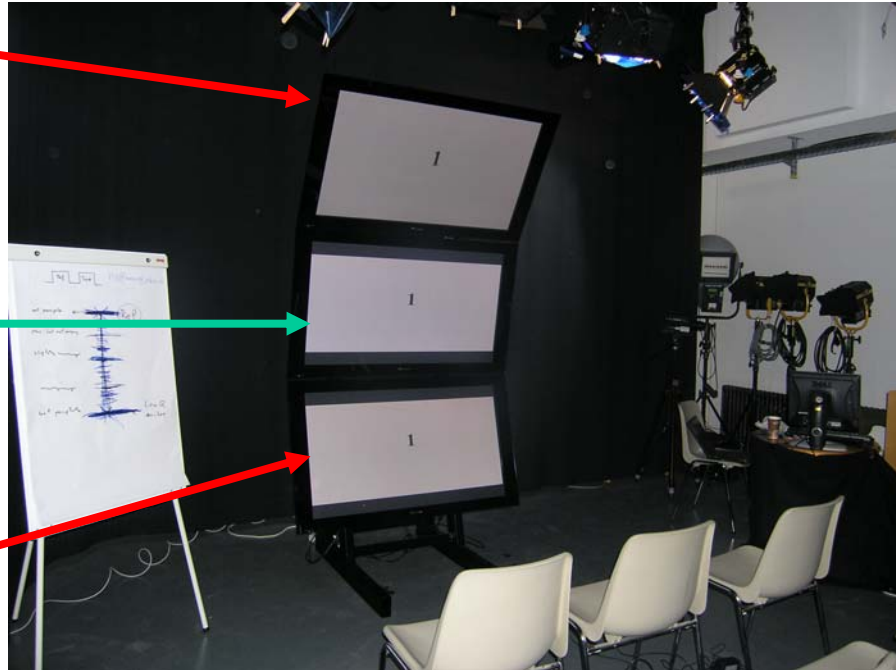
Voting procedure

100 = 1080p/50 not compressed

100

0

Example
voting
on paper



0 = SDTV 3Mbit/s (today's TV)

Tests with TSCES Method

- 178 students at the Univ. Wiesbaden using a 50 inch Plasma Display Panel with 1920x1080 pixel (Full HD)
- About 150 people at the EBU headquarters using a 52 inch LCD with 1920x1080 pixel (Full HD)
- Test of seven different sequences with different criticalities
 - originated on a HDC1500 CCD camera (downconverted to 720p/50 and 1080i/25)
 - originated on film 65mm/50fps and scanned to 2160p/50 (downconverted to 1080p/50, 720p/50, 1080i/25)
- Data for 3h/4h viewing distance - outline of the results

Image formats and bit-rates under test (middle display)

- Software codec H.264/AVC (HHI Berlin)
- 720p/50, 1080i/25 and 1080p/50 at uncompressed, 18,16,13,10,8,6 Mbps.
- Hidden upper anchor (1080p/50 uncompressed)
- Hidden lower anchor (SDTV 3 Mbps)
- SDTV (4Mbps)

Sequences - overview



Crowd Run



Parkjoy



Dancer



Princess Run



Aloha



Ice-Dance

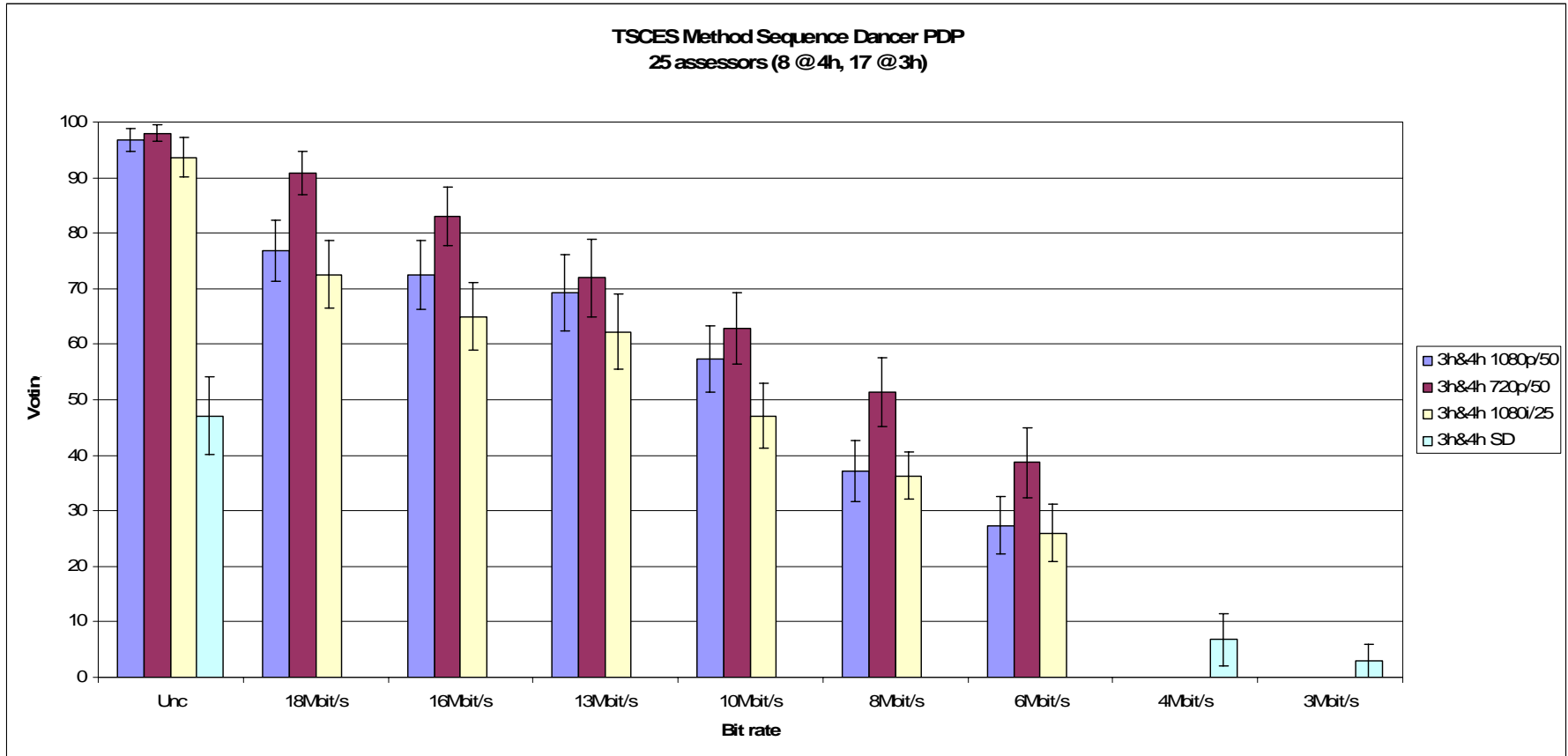


Police Boat

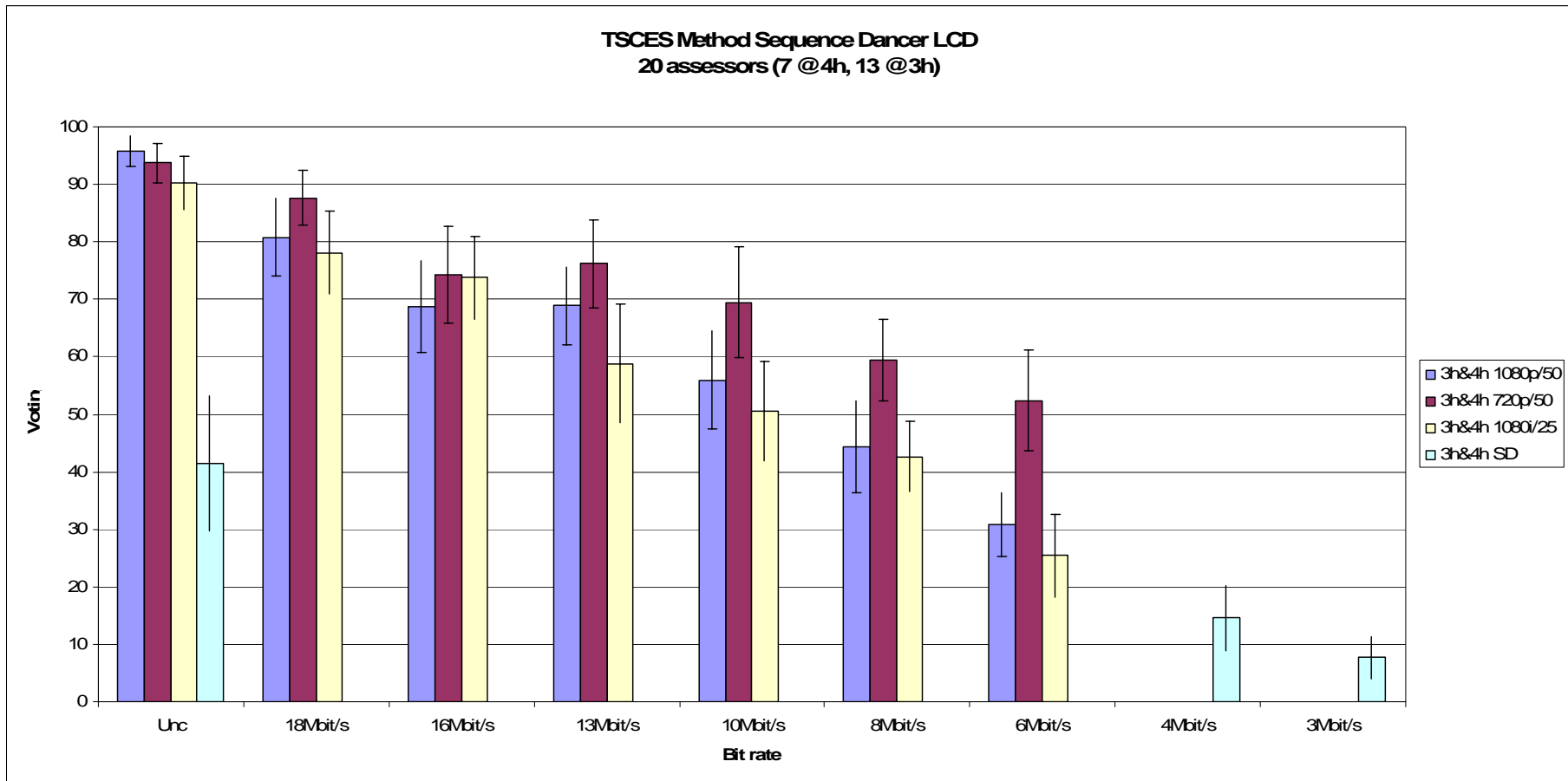
TSCES – Dancer



TSCES – Dancer - PDP



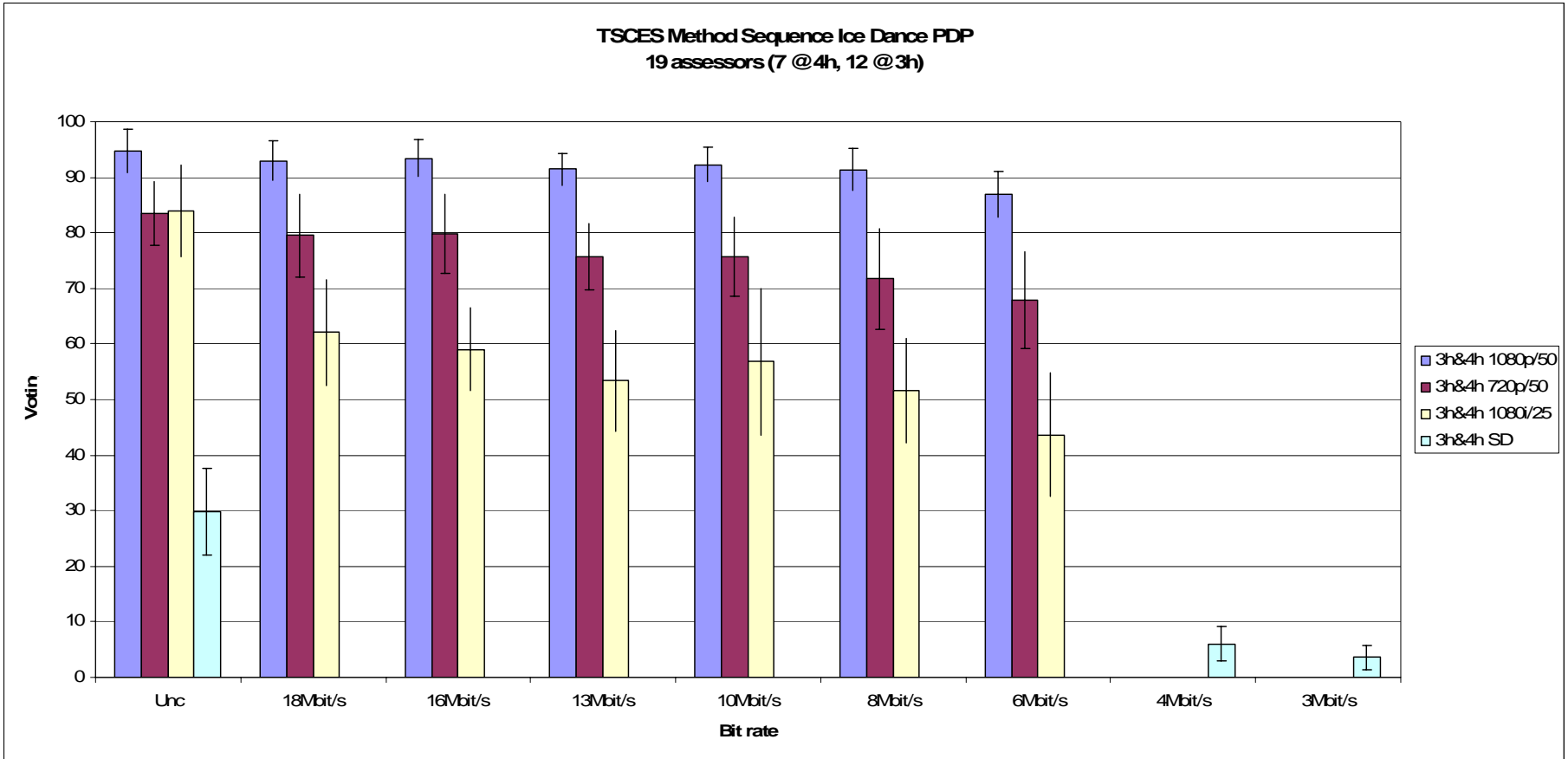
TSCES – Dancer - LCD



TSCES – Ice Dance



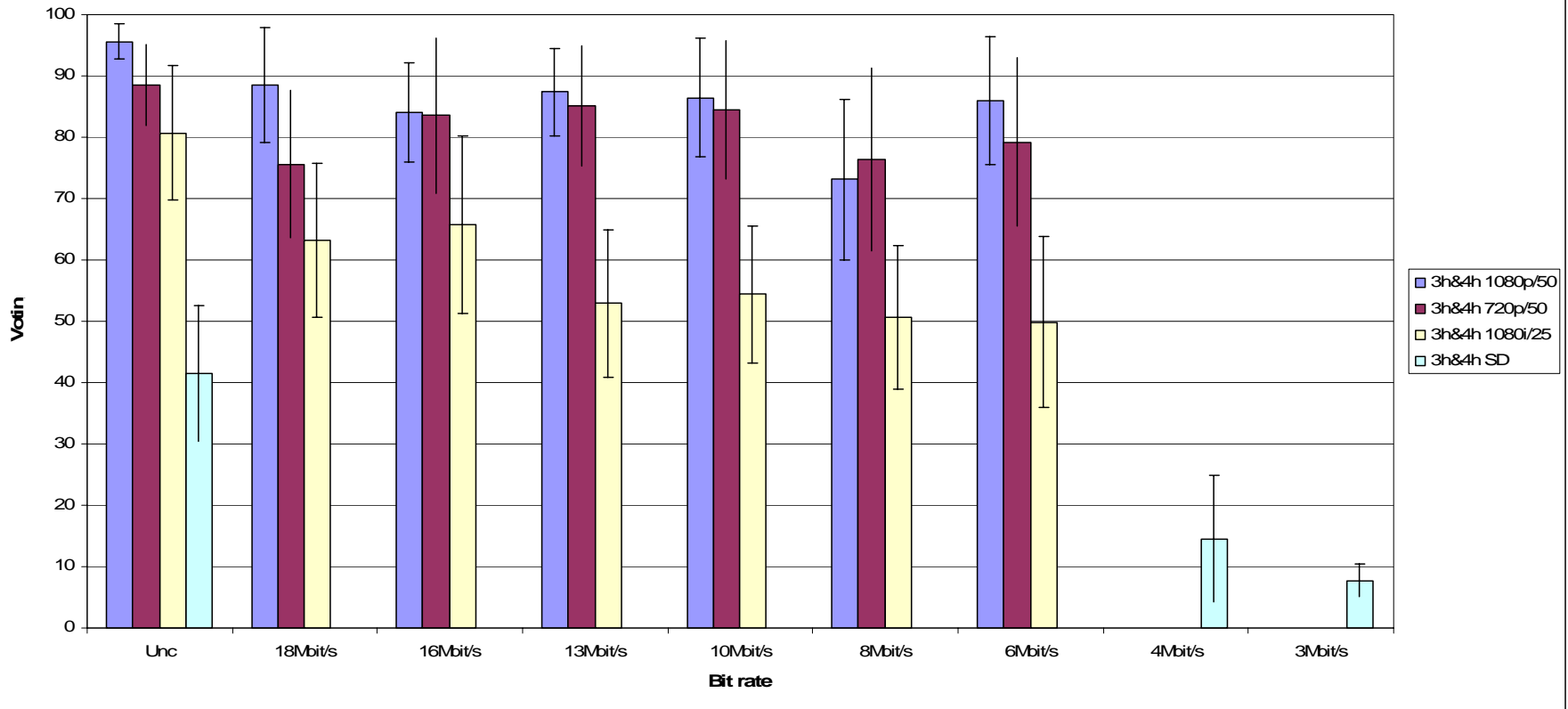
TSCES – Ice Dance PDP



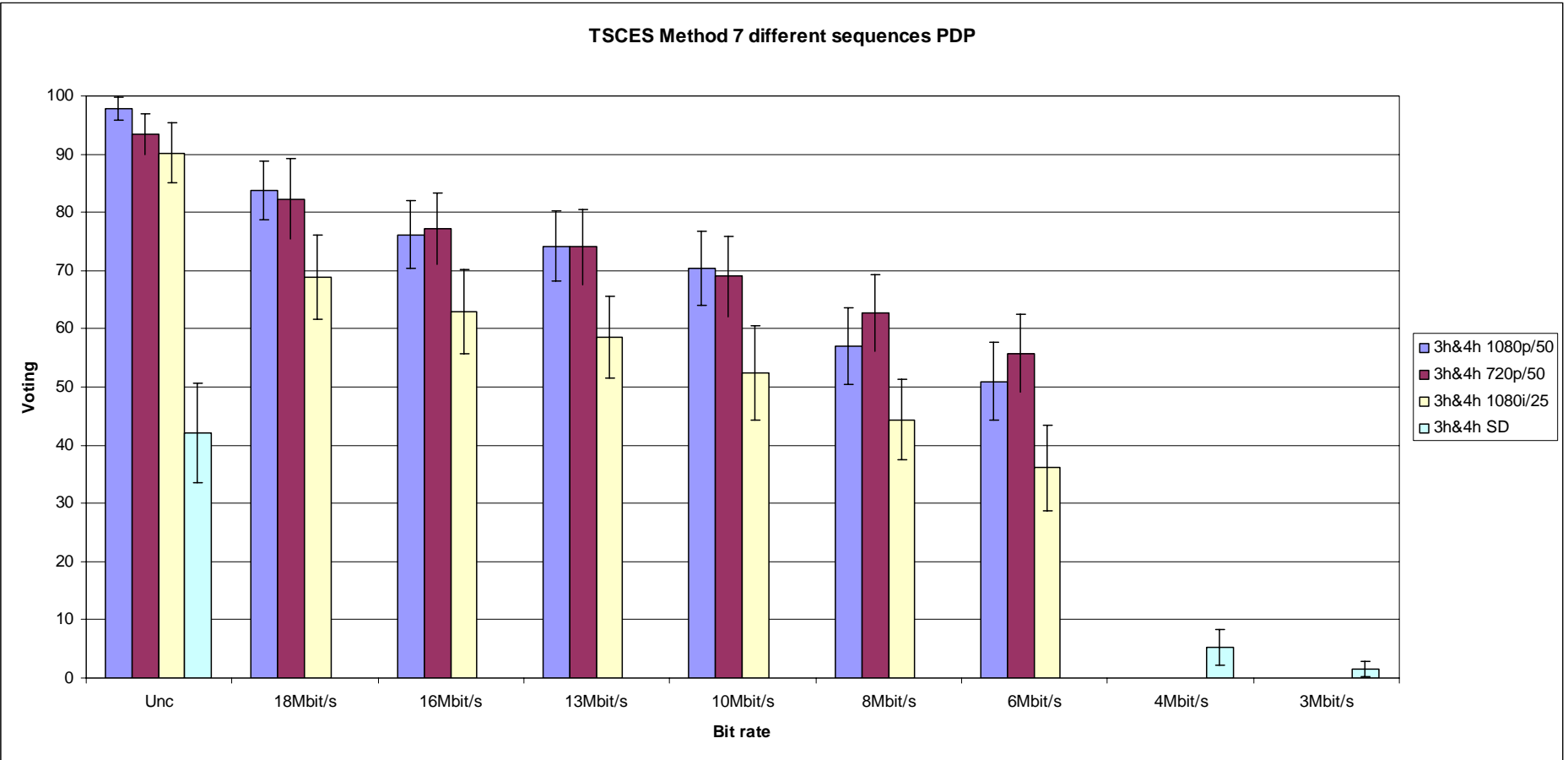
Please note how good 1080p/50 is rated with a non-critical sequence

TSCES – Ice Dance LCD

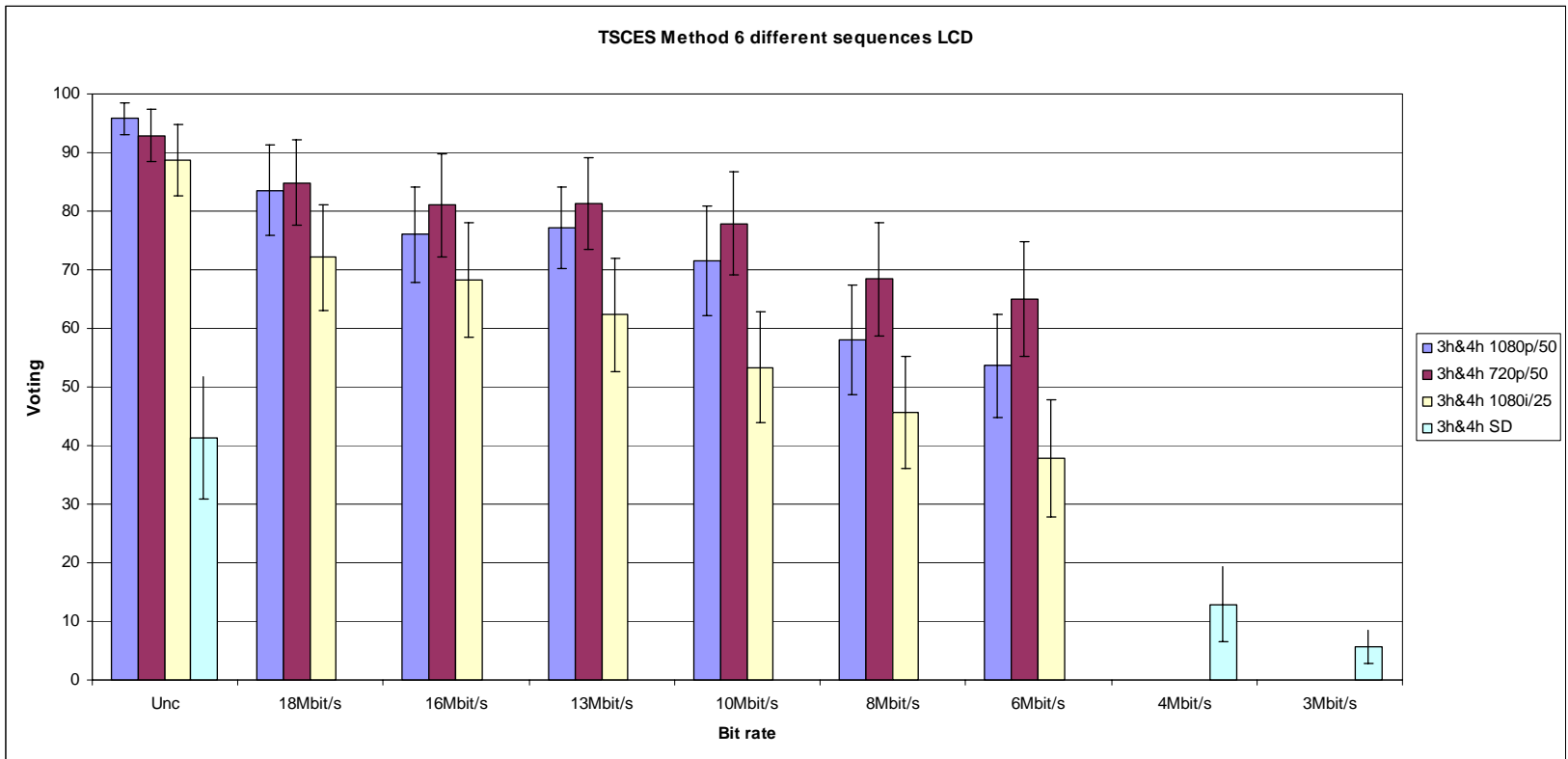
TSCES Method Sequence Ice Dance LCD
11 assessors (4 @4h, 7 @3h)



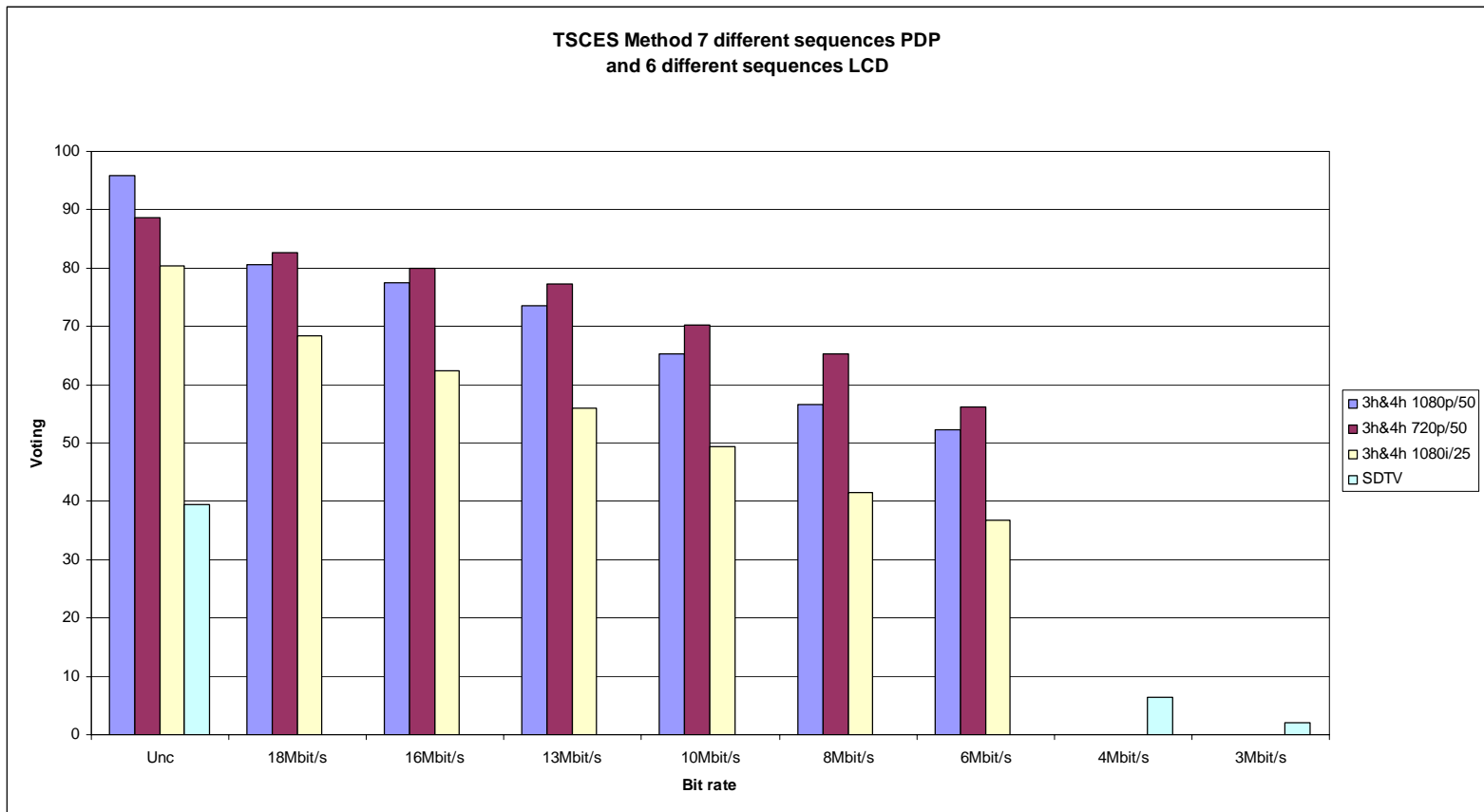
Over all 7 sequences shown on PDP



Over all 6 sequences shown on LCD

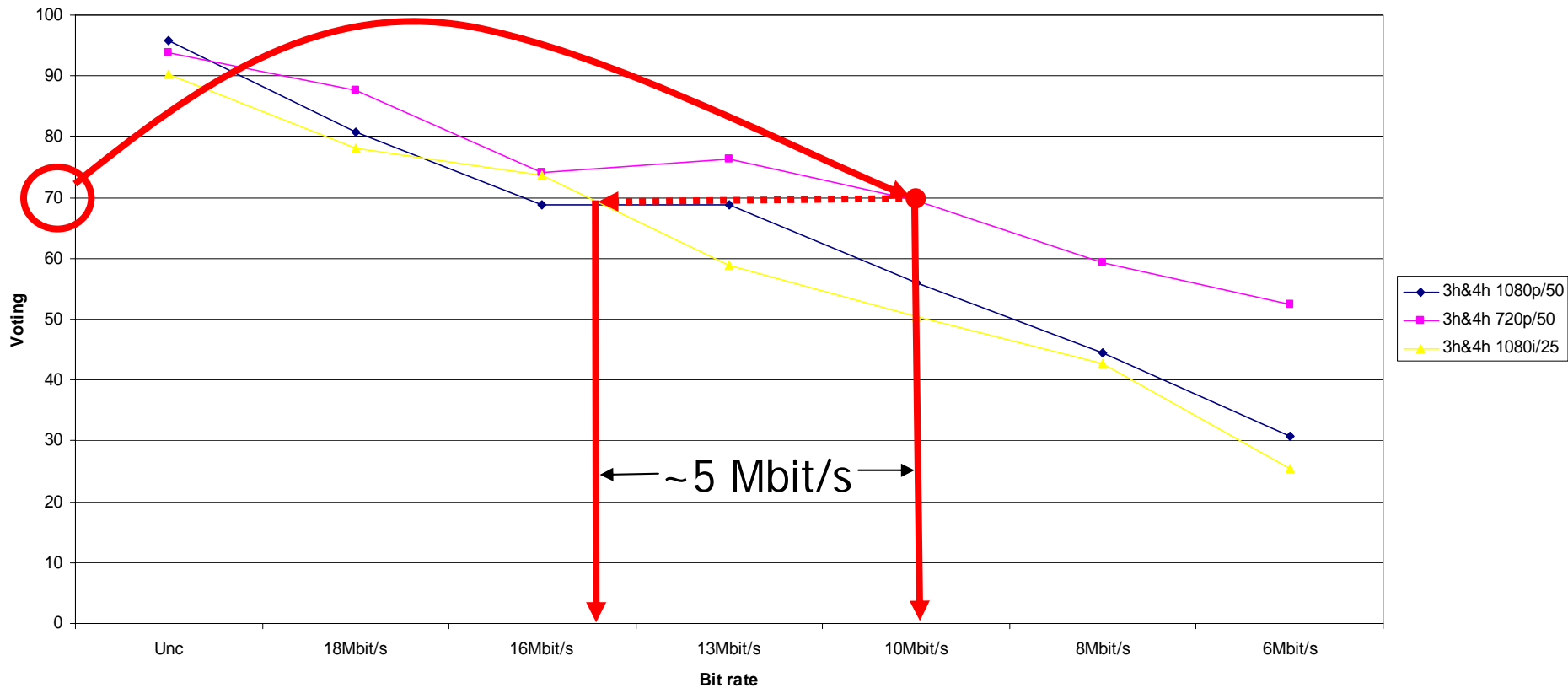


Over all result for PDP and LCD



The economy of bandwidth and quality (example)

TSCES Method Sequence Dancer LCD
20 assessors (7 @ 4h, 13 @ 3h)



Test conclusions (I)

- We should avoid interlaced in production and emission for HDTV
- Maximum benefit of progressive in emission requires progressive scan in production
- Today, 720p/50 in emission provides the best bandwidth-quality trade-off and for displays up to ~50" (target size for public?)
- If you need a slogan: „full motion HD“

Test conclusions (II)

- The Future 1080p/50 ?
 - With lower content criticality, we found that 1080p/50 can provide the best quality
 - More work is required on the 1080p/50 coding - there is potential for the future!
 - Don't expect a „low cost“ 1080p/50 full chain solution within the next 3 years
 - It will first come in production, then (perhaps) in emission, if we take the appropriate actions!
- EBU activities will continue towards 1080p/50
 - what are the bit-rate requirements in the studio (archive) with an open compression standard and what is the impact to emission?
 - watch out for IBC2007!!!

Other EBU activities on HDTV

- Investigate the image quality of
 - Legacy: HDCAM, HDCAM-SR, DVCPRO100
 - Sony Long_GOP @ 35 and 50 Mbit/s
 - Panasonic AVC-I @ 50 and 100 Mbit/s
 - GVG/Thomson J2k @ 75 and 100 Mbit/s
 - AVID DNxHD
- Multigeneration with/without pixel shift and with/without GOP alignment
- Broadcast encoder testing
- Results: IBC 2007
- Displays (session tomorrow)

- 720p/50, 1080i/25 and 1080p/50 in uncompressed form from a DVS server
- Projector (this is not representative for home environments): 1920x1080
- Remember HDTV is viewing at 3h = 4th row here in the audience
- Parkjoy sequence at 6 Mbit/s for 1080i/25, 720p/50 and 1080p/50
- Uncompressed and encoded with H.264/AVC at 18, 16, 13, 10, 8, 6 Mbps
- Further demos later after session on request and please come forward to 3h

Thank You !

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