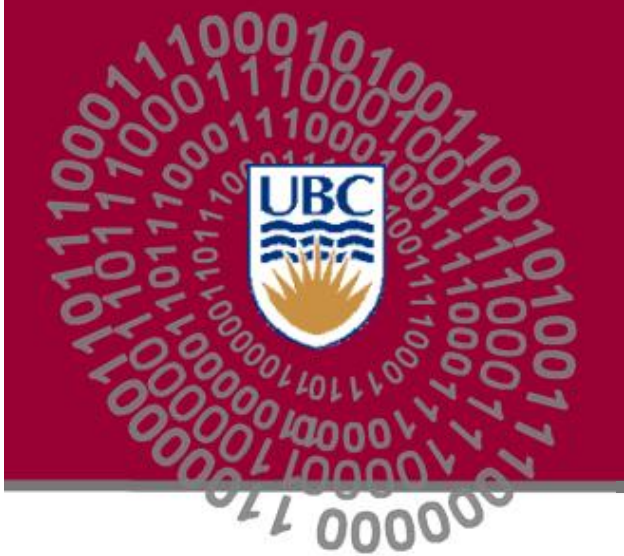
U N I V E R S I T Y O F B R I T I S H C O L U M B I A



Evaluation of Chroma Subsampling for High Dynamic Range Video Compression

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Overview

- **Chroma Subsampling**
- Chroma Subsampling and Compression Efficiency
- Conclusion

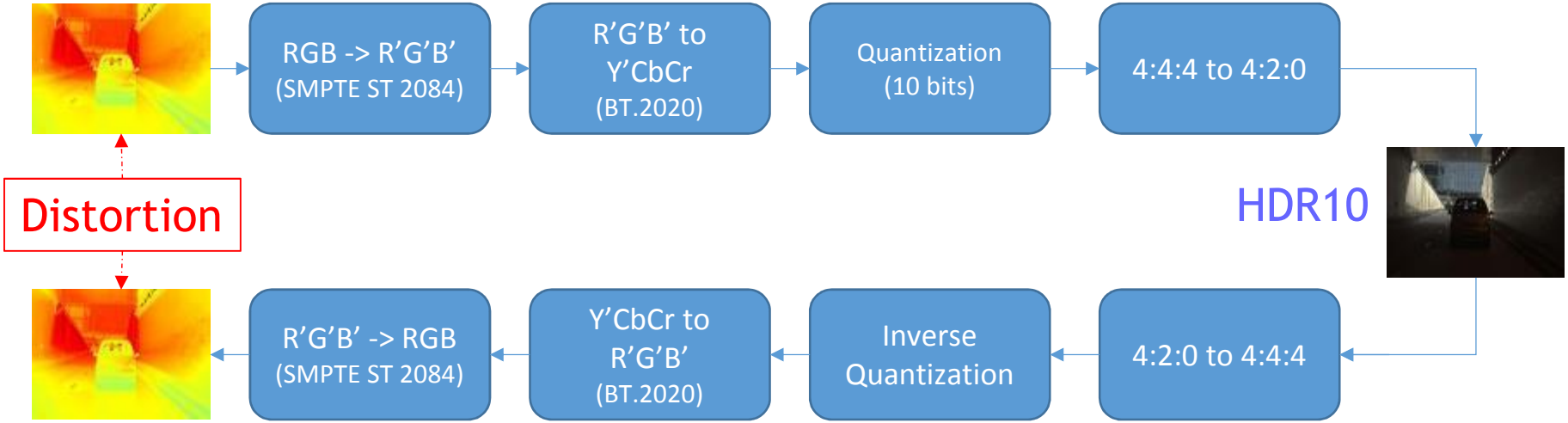
Chroma Subsampling

- Objective: assess the impact of chroma subsampling in the HDR10 distribution pipeline

- Sampling considered:
  - 4:4:4 full chroma sampling
  - 4:2:0 MPEG CTC filter (correspond to anchor V1)
  - 4:2:0 Lanczos3 (6-tap)

Chroma Subsampling

- Influence without compression



Chroma Subsampling

- Influence without compression

tPSNR-Y in dB			
Sequence	4:4:4	4:2:0 Lanczos	4:2:0 MPEG
FireEater2	69.33	65.15	64.38
Market3	69.56	62.52	62.07
BalloonFestival	67.94	62.35	62.12
Tibul2	68.53	60.66	60.00
Overall	68.84	62.67	62.1425

PSNR-DE0100 in dB			
Sequence	4:4:4	4:2:0 Lanczos	4:2:0 MPEG
FireEater2	52.32	48.80	48.42
Market3	42.11	36.88	36.76
BalloonFestival	45.36	40.46	40.62
Tibul2	49.66	45.92	45.61
Overall	47.36	43.01	42.85

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- **Chroma Subsampling and Compression Efficiency**
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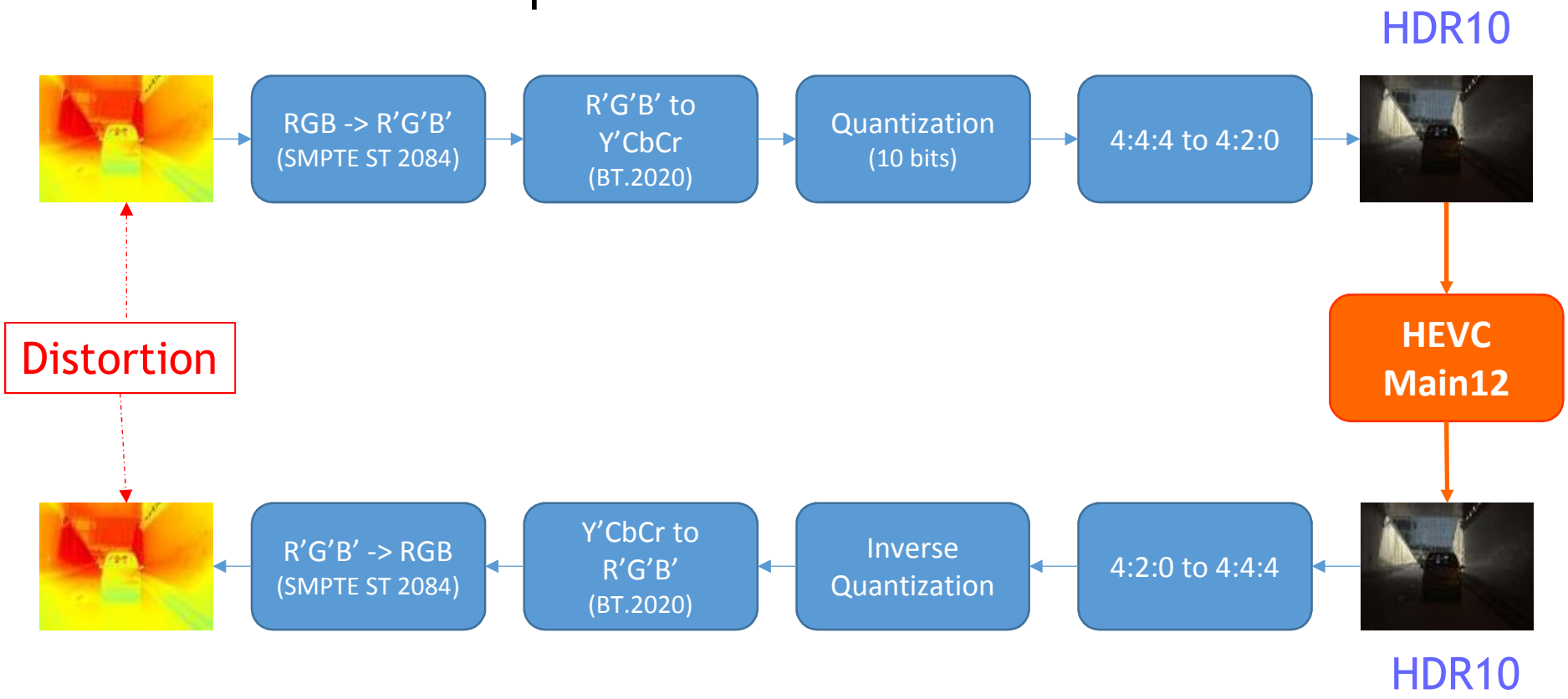
Chroma Subsampling

- Influence with compression



Proposed Test

- Source test sequences:

Sequence	Class	Frame Range
FireEater2	A	0-199
Market3	A	0-299
Sunrise	A	0-239
BalloonFestival	G	0-199
Starting	H	0-499
Hurdles	H	0-499

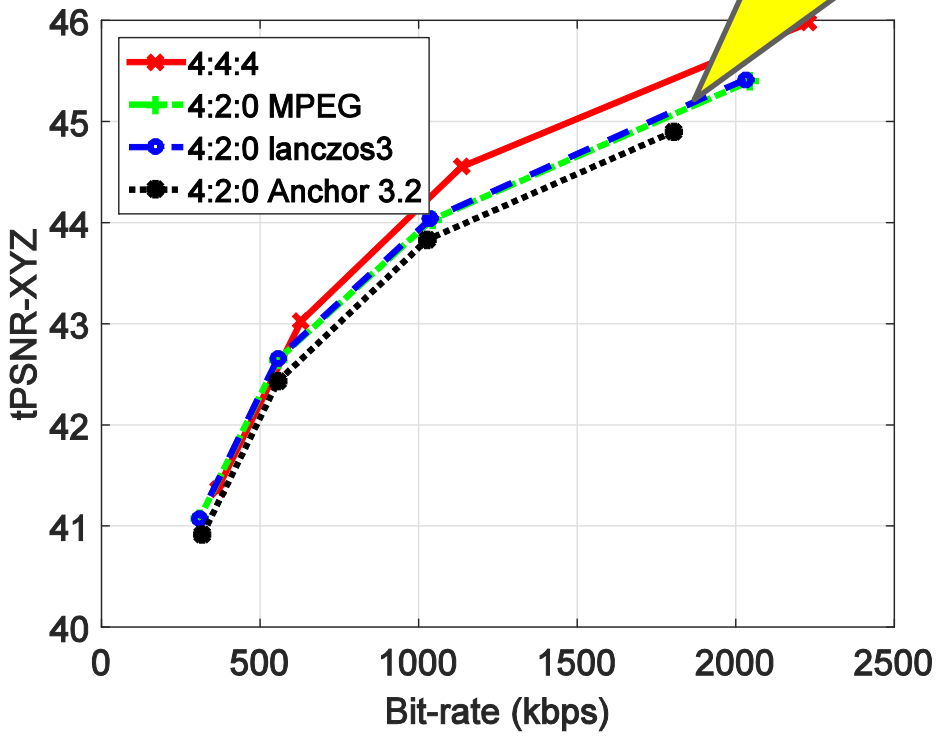
Script error

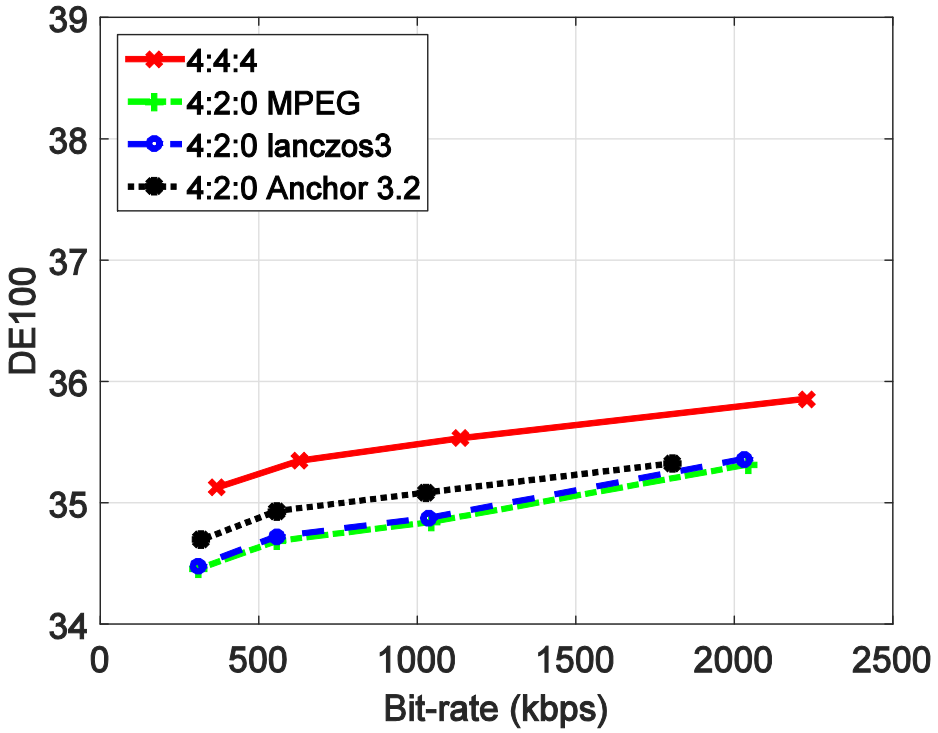
- SuperAnchor 3.2 has been added to the plot:
  - Different profile main10 versus main12
  - Different generation of HDR10 (luma adjustment)
  - Different tools (CbCr QP offset, delta luma adaptive, etc.)
  - Comparison is not fair

Results

- SunRise:

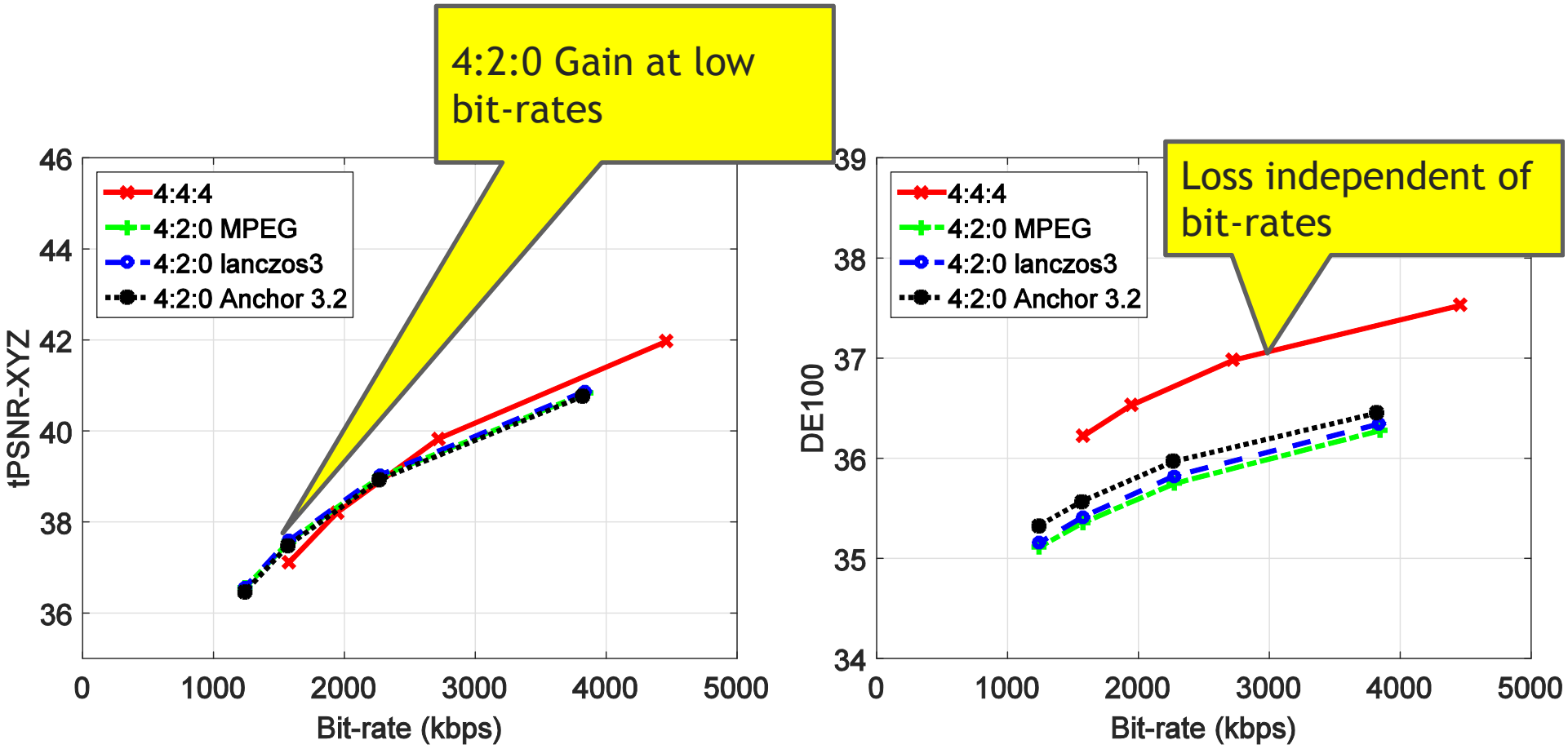
Subjective evaluation complicated due to difference in bit-rates





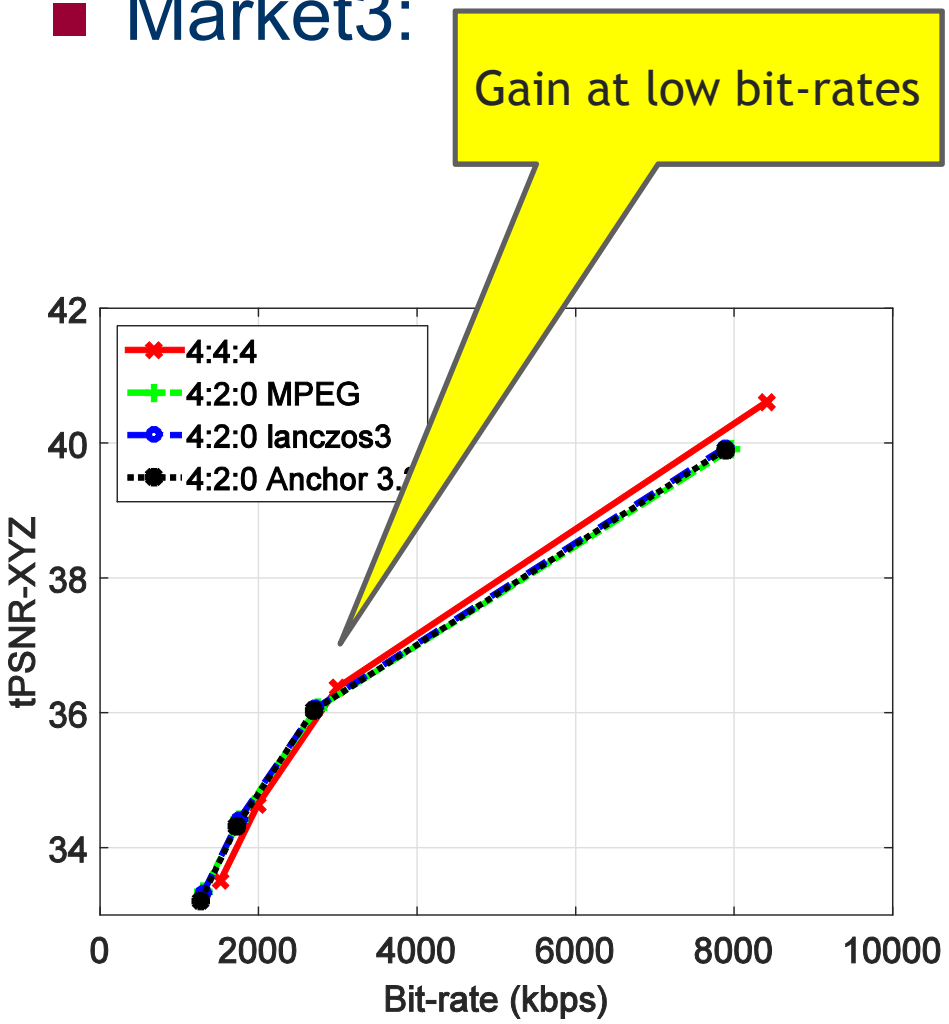
Results

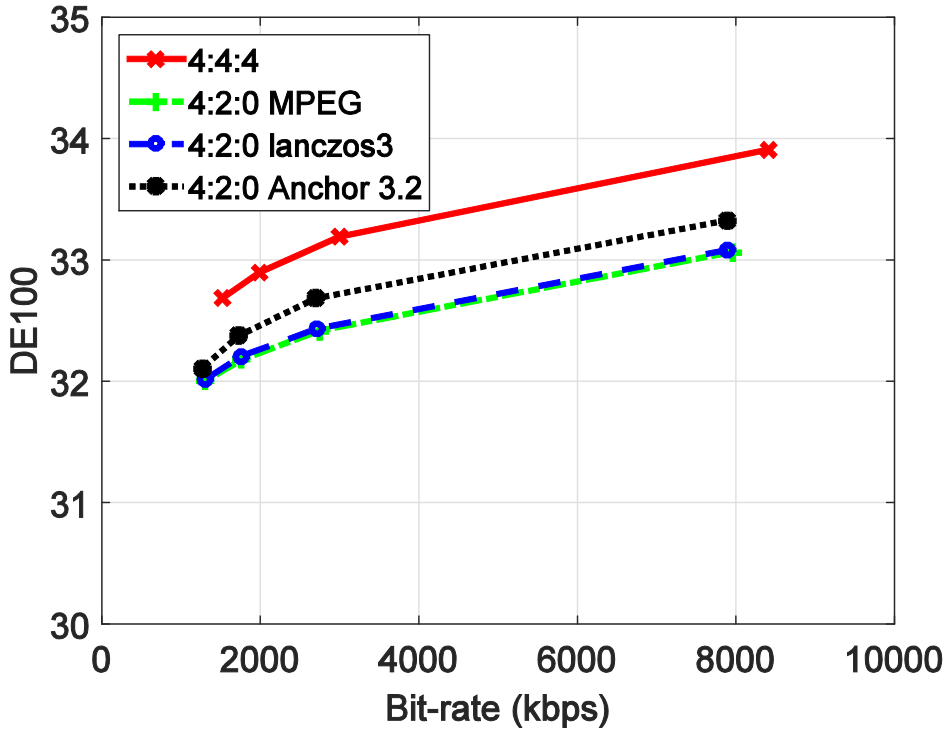
- BalloonFestival:



Results

- Market3:

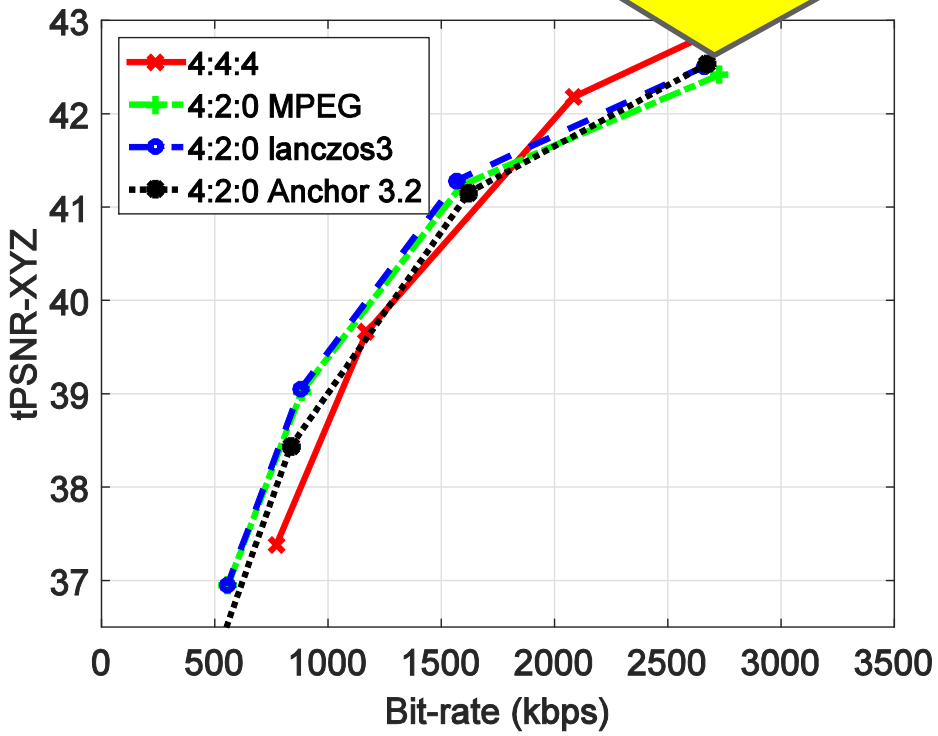


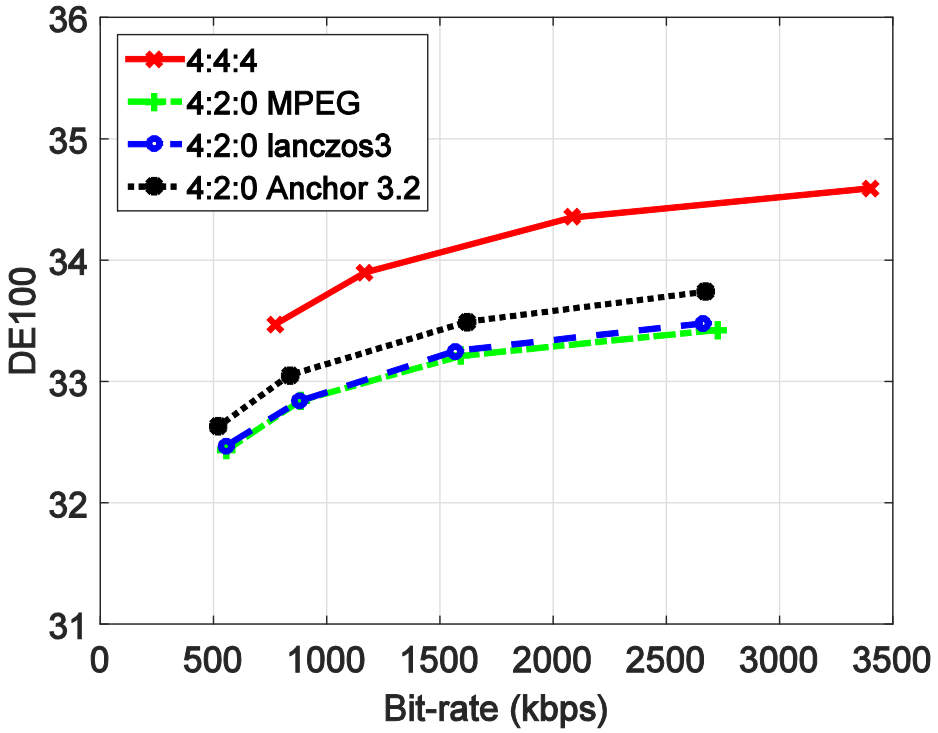


Results

- Starting:

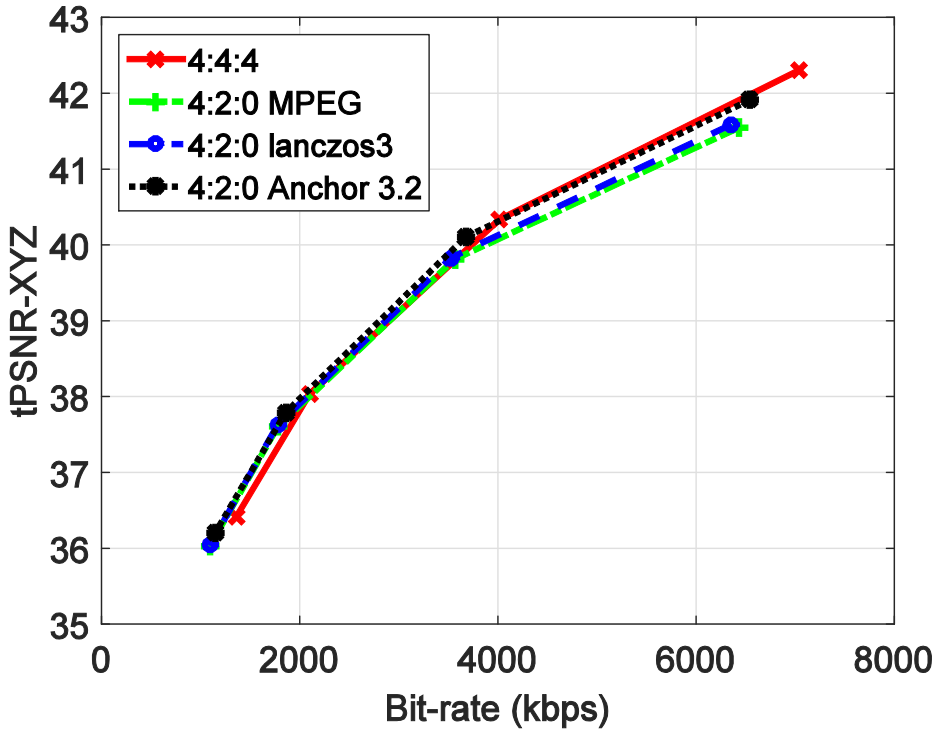
Anchor 3.2 equal or below in tPSNR XYZ

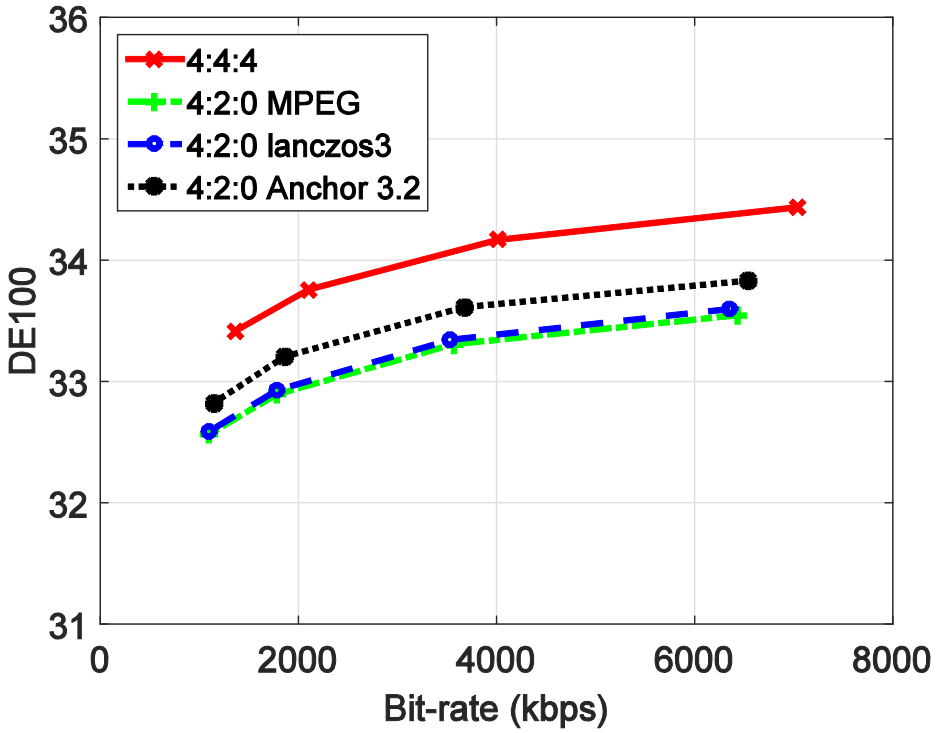




Results

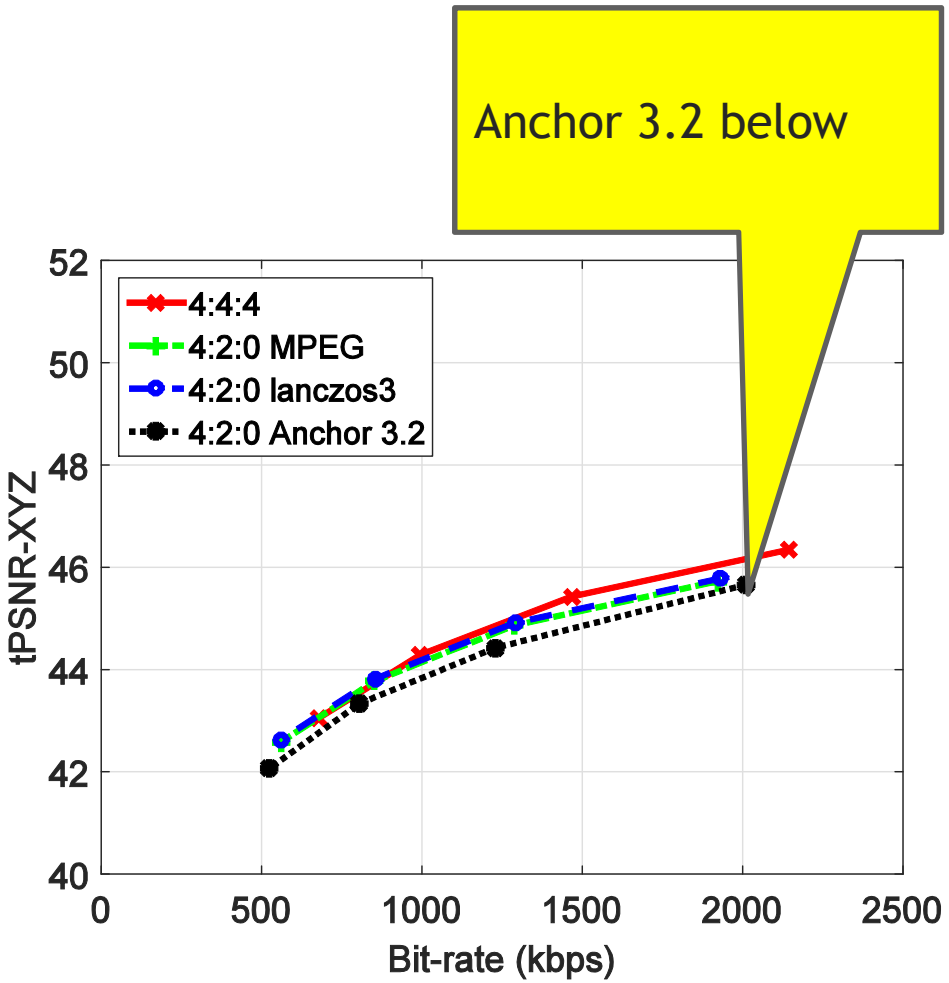
- Hurdles:

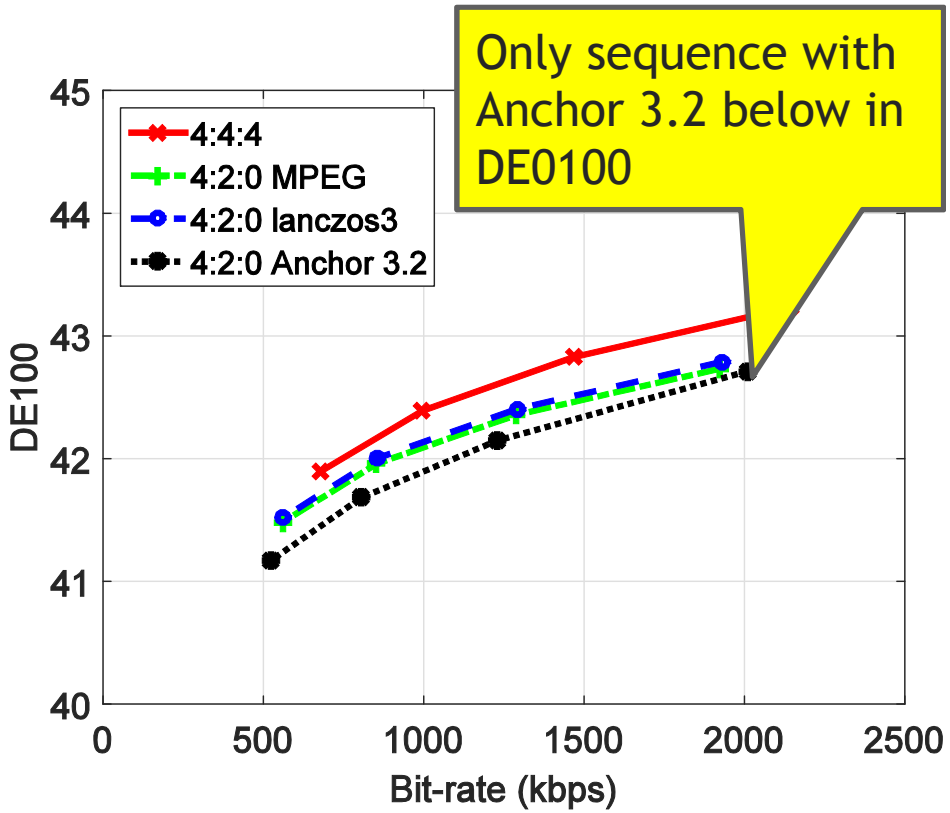




Results

- FireEater2:





Overview

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Conclusion

- Subsampling is more efficient (according to tPSNR-XYZ) at low bit-rates
- Anchor 3.2 is more efficient in term of color reproduction (QP chroma offset?)
- High bit-rates, 4:4:4: is more efficient (both metrics)
- 4:4:4 can solve chroma problems for processes at the decoding stage (see JCTVC-W0106).

Perspectives

- Subjective evaluation is complicated due to the bit-rate difference
  - Rate-controlled might be considered
- Improving subsampling process to bridge gap between 4:4:4 and 4:2:0 in DE0100

Contact Information

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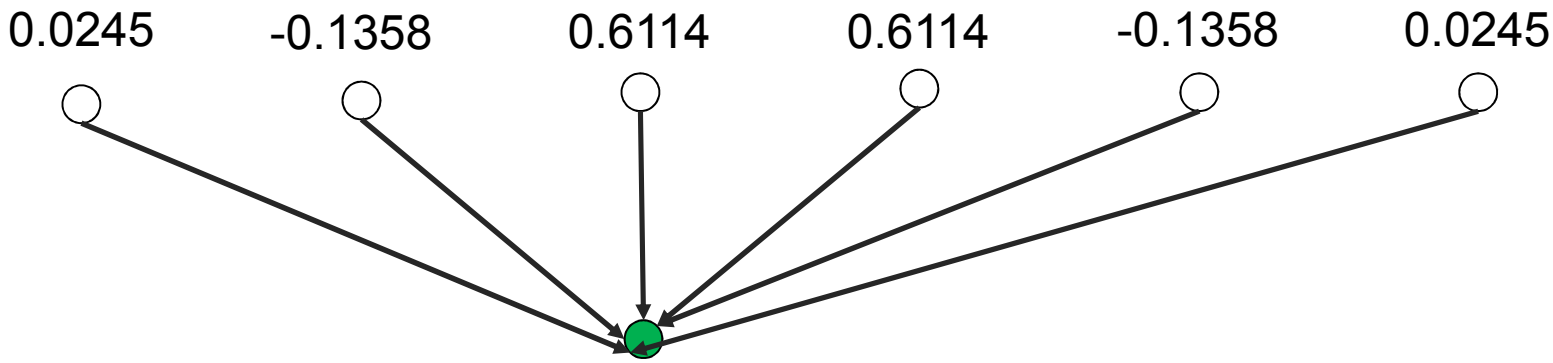
THANK
YOU

Chroma Subsampling

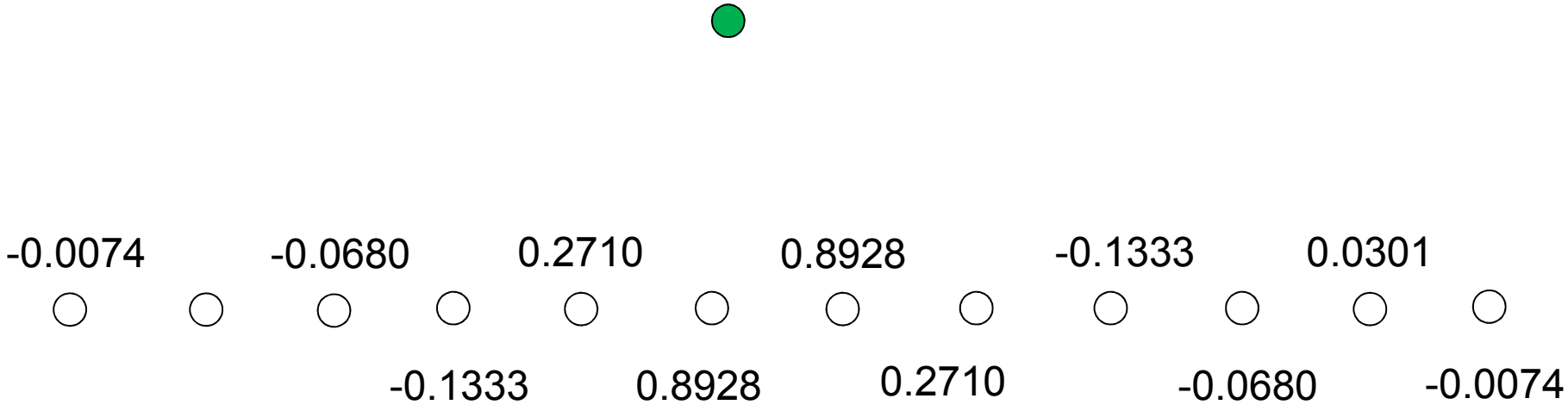
- 4:2:0 Lanczos3 (6-tap) downsampling (1D)



position	-2	-1	0	1	2	3
Coef.	0.0245	-0.1358	0.6114	0.6114	-0.1358	0.0245

Chroma Subsampling

- 4:2:0 Lanczos3 upsampling



position	- 5	-4	-3	-2	-1	0
Coef.	0.0074	0.0301	-0.0680	-0.1333	0.2710	0.8928

position	6	5	4	3	2	1
Coef.	0.0074	0.0301	-0.0680	-0.1333	0.2710	0.8928