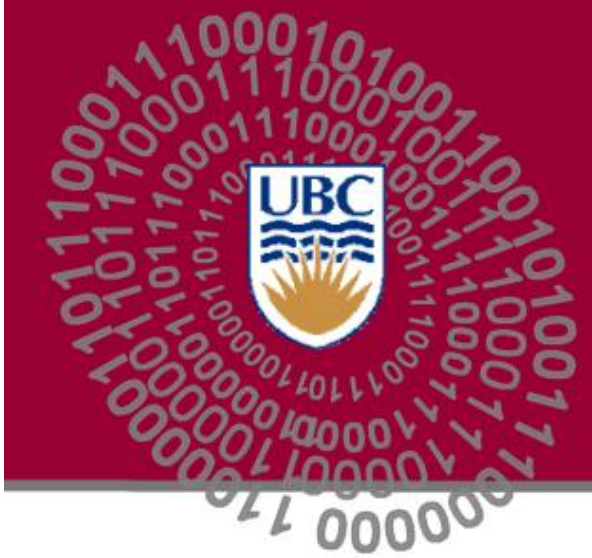
UNIVERSITY OF BRITISH COLUMBIA




# Evaluation of Scalable versus Single Layer Compression on Consumer HDR Displays

Ronan Boitard[1], Maryam Azimi[1], Mahsa T. Pourazad[1,2], and Panos Nasiopoulos[1]

[1]University of British Columbia, Vancouver, Canada

[2]TELUS Communications Inc., Canada

# Overview

- **Single Layer vs Scalable**
- Proposed Test
- Results
- Conclusion

# Single Layer vs Scalable

- Scalable scheme: bit-rate overhead:
  - Resolution: 20% to 30%
  - SNR Scalability: 21% (http://iphome.hhi.de/wiegand/assets/pdfs/DIC_SVC_07.pdf)
- HDR and WCG introduce new type of scalability:
  - Dynamic range: ?
- We propose to assess the scalability overhead using the Call for Evidence (CfE) conditions and subjective evaluation suggestions.

# Overview

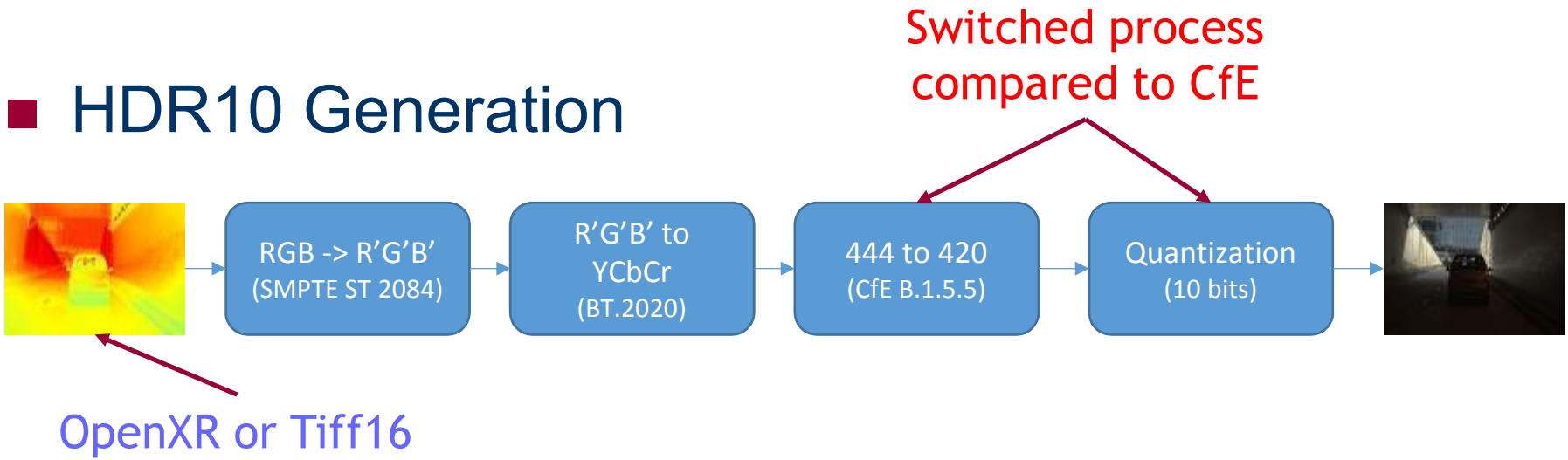
- Single Layer vs Scalable
- **Proposed Test**
- Results
- Conclusion

# Proposed Test

- Source test sequences:

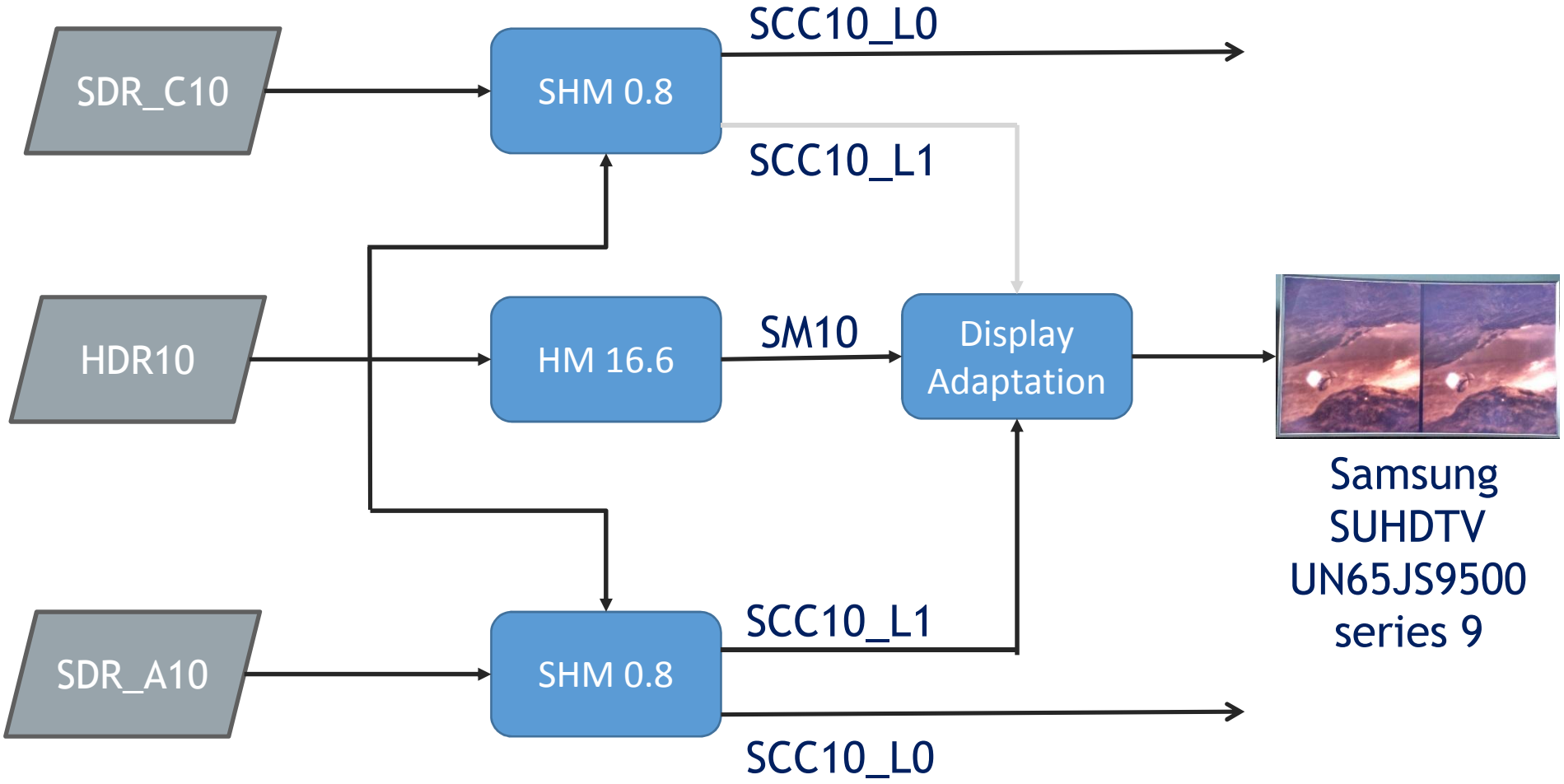
| Sequence | HDR10 | SDR_A10 (Class – Seq.) | SDR_C10 (Class – Seq.) |
|---|---|---|---|
| FireEater2 | Generated | AA – SA00 | AA – SC00 |
| Tibul2 | Generated | AA – SA01 | AA – SC01 |
| AutoWelding | Generated | N/A | AA – SC03 |
| BikeSparklers | Generated | N/A | AA – SC04 |
| BalloonFestival | Generated | AA – SA08 | AA – SC08 |

- HDR10 Generation



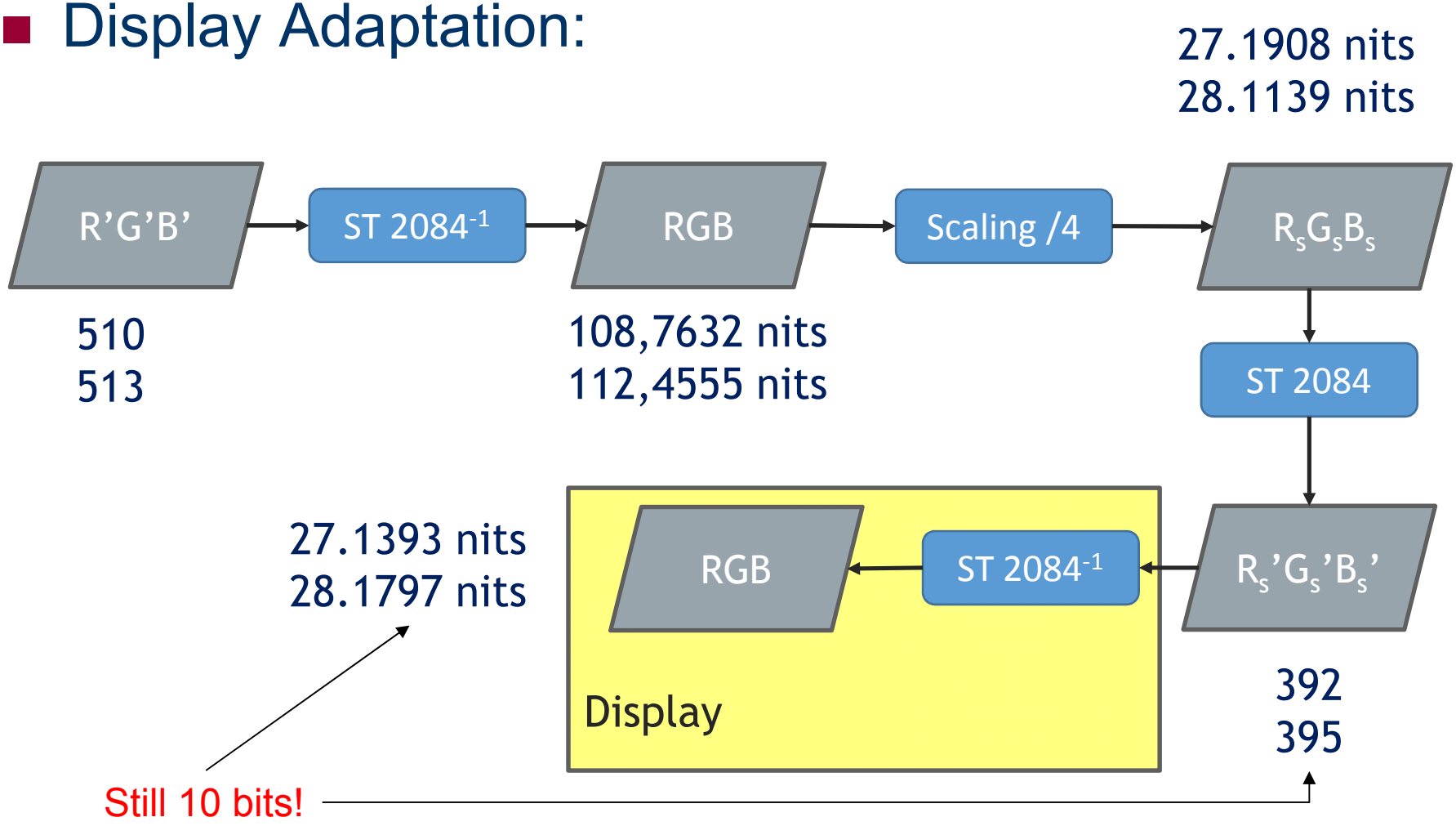
# Proposed Test

- Test Architecture:



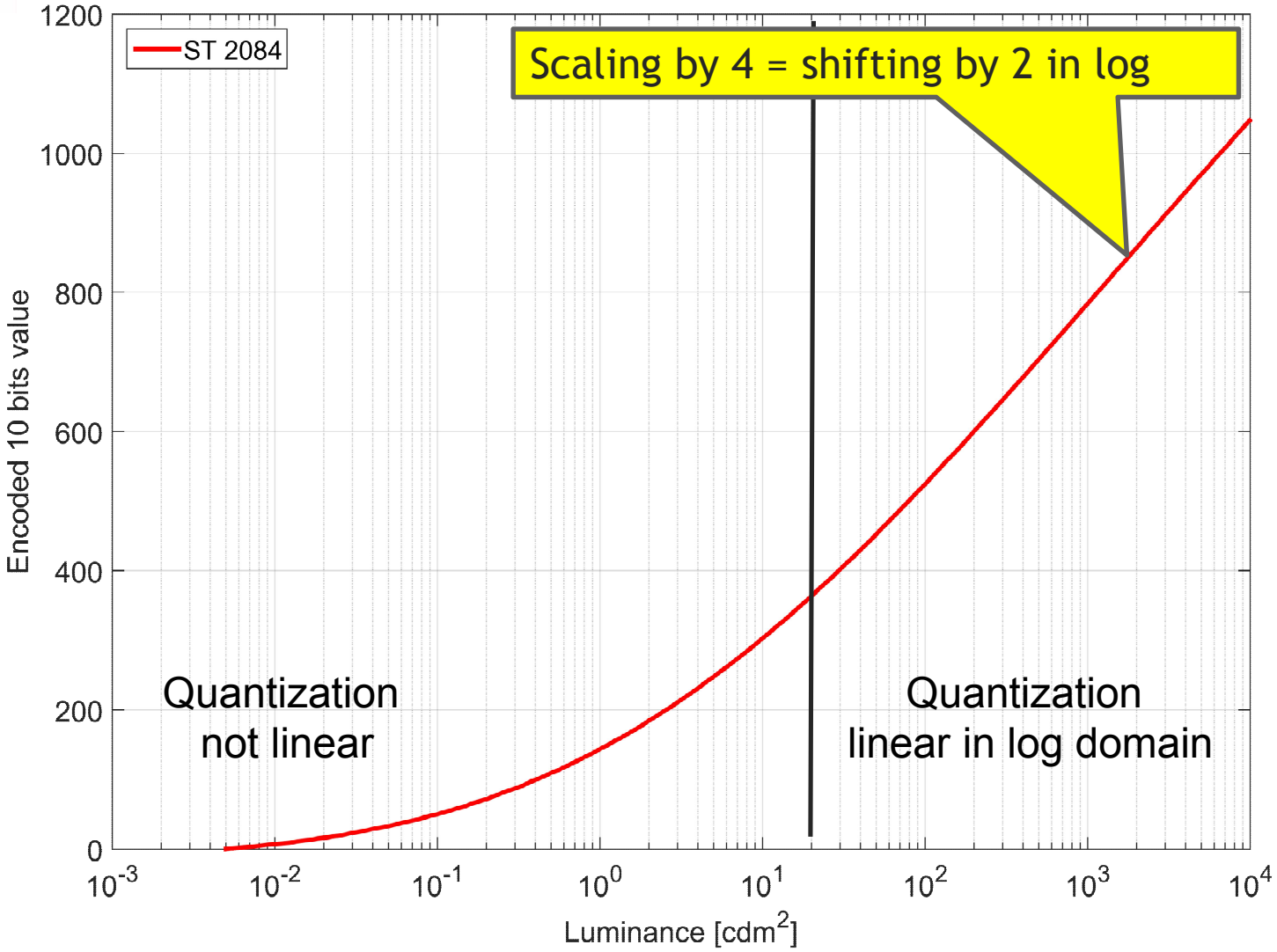
# Proposed Test

- Display Adaptation:



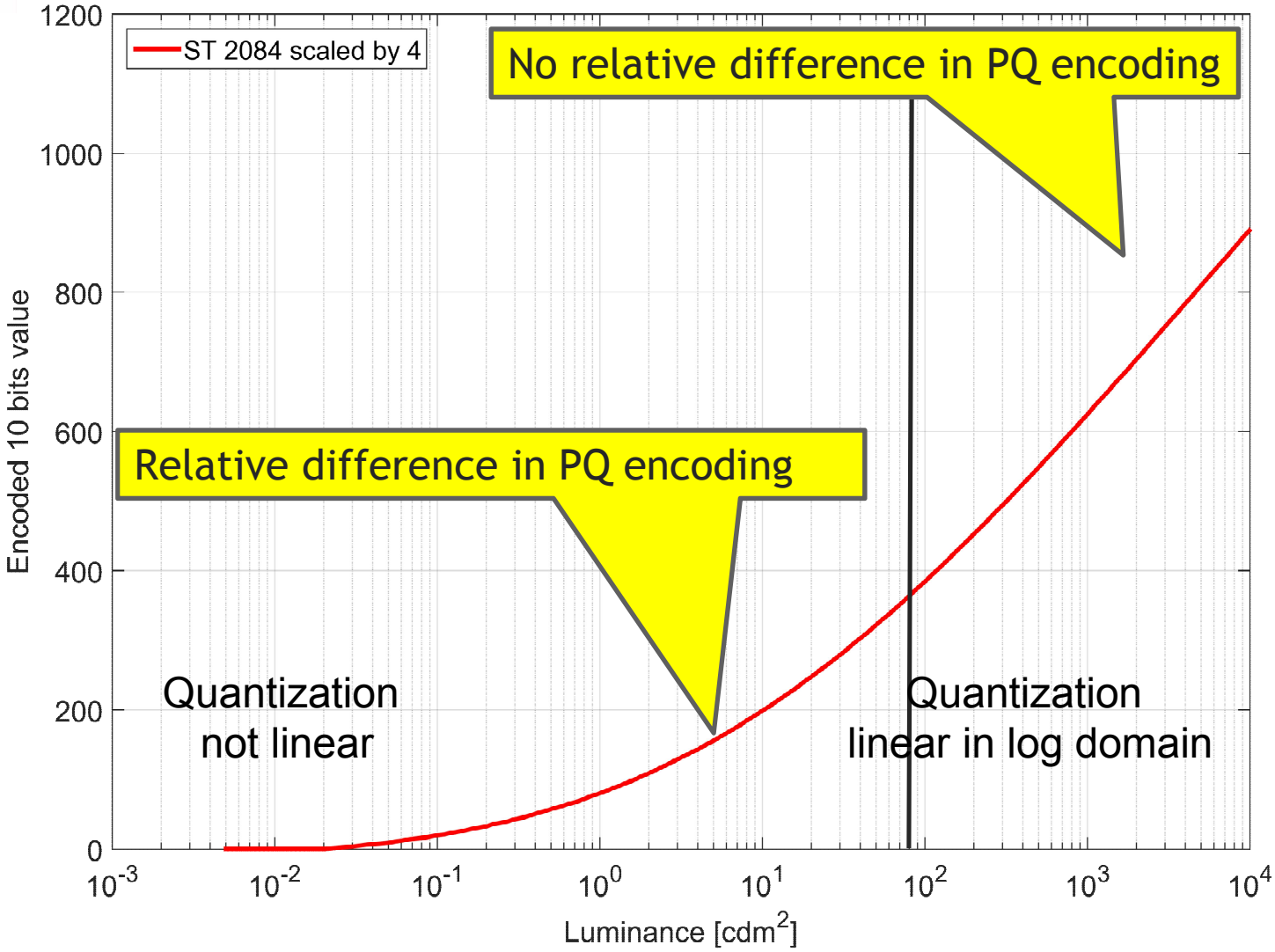
# Proposed Test

- PQ:



# Proposed Test

- PQ:



# Proposed Test

- Scaling-Pros:
  - Minimal loss of information in bright areas => coherent with PQ CSF (log-shift),
  - Preservation of spatio-temporal coherency of the video,
  - Coherent relative contrast,
  - No clipping in highlights,

- Scaling-Cons
  - Loss of colorfullness (Hunt's effect),
  - Overall brightness shifted (absolute contrast),
  - Quantization loss in dark areas (when luminance is lower than ~= 40 nits),

# Proposed Test

- Test characteristics:
  - Two side-by-side cropped Full HD (original versus Tested)
  - R'G'B' in BT.2020 container 10 bits
  - Scratch player for 10 bits driving
- Display characteristics:
  - Peak luminance: 1,000 nits
  - Color gamut: P3
  - Diagonal: 65"
  - Bit-depth: 10 bits
- Experiment
  - 20 subjects with 5 outliers

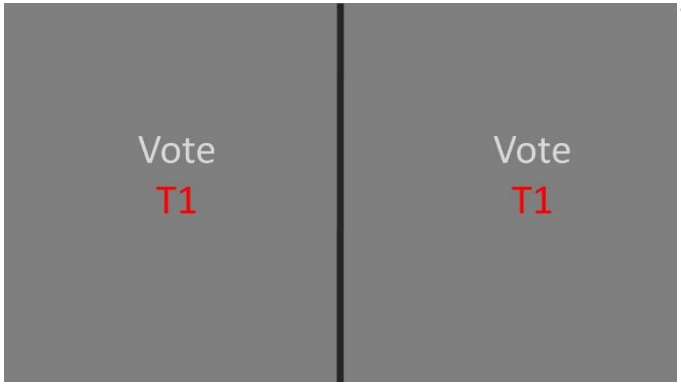
# Proposed Test

- Test procedure:

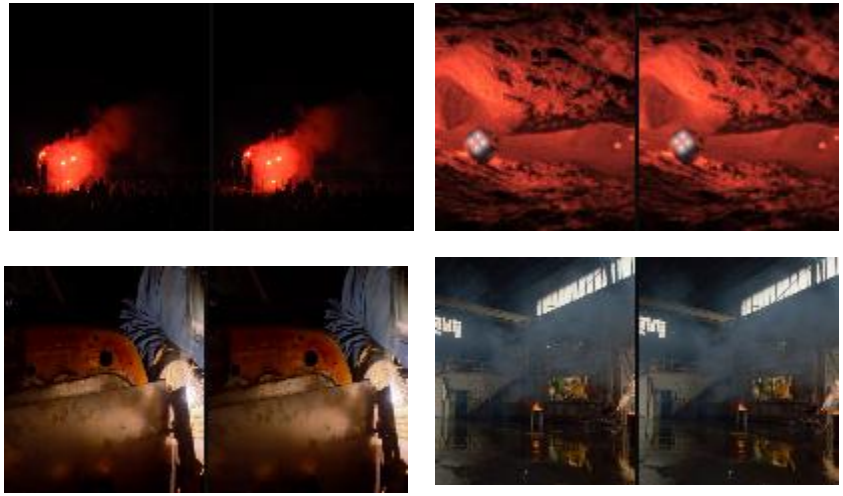
2 s.


Video

3 s.




52 tests



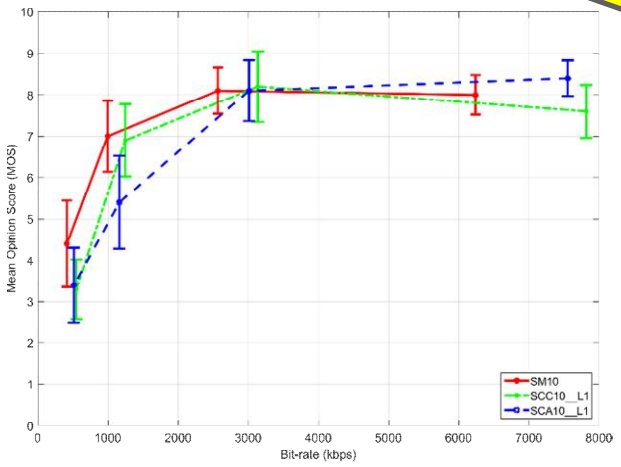
# Overview

- Single Layer vs Scalable
- Proposed Test
- **Results**
- Conclusion

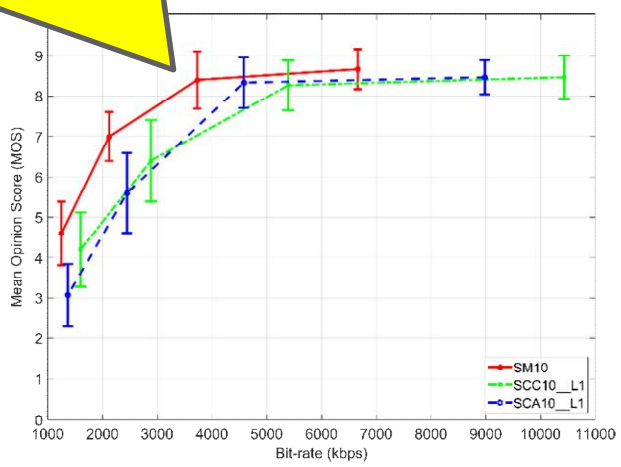
# Results

- General trend:
  - SM10: HDR10 compressed using HEVC (HM 16.6),
  - SCC10_L1: HDR10 and SDR_C10 sources using HEVC (SHM 0.8),
  - SCA10_L1: HDR10 and SDR_A10 sources using HEVC (SHM 0.8),

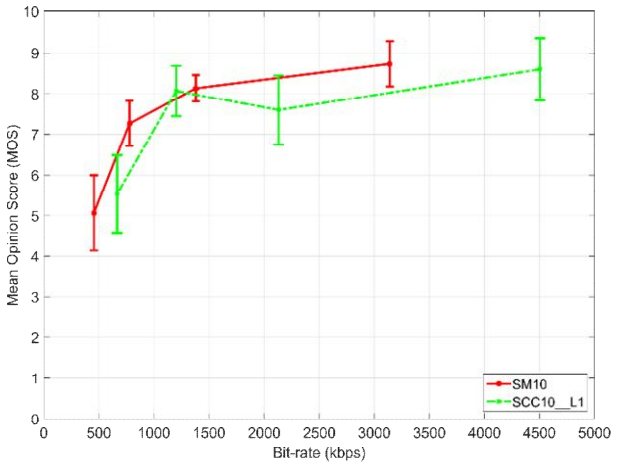
SM10 tends to outperform scalable techniques for 3 out of 5 sequences




Tibul2




BalloonFestival

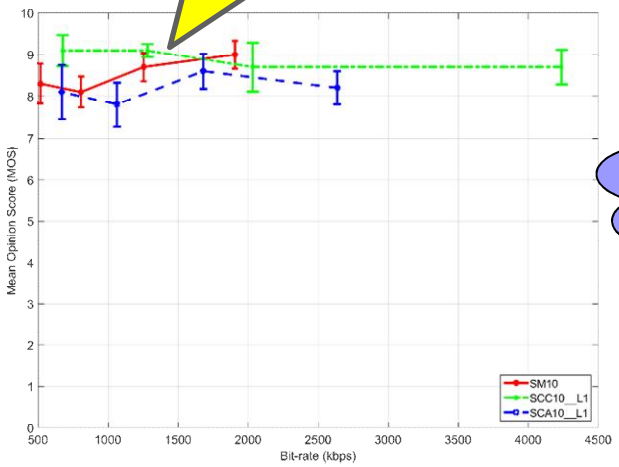



AutoWelding

# Results

- General trend:
  - SM10: HDR10 compressed using HEVC (HM 16.6),
  - SCC10_L1: HDR10 and SDR_C10 sources using HEVC (SHM 0.8),
  - SCA10_L1: HDR10 and SDR_A10 sources using HEVC (SHM 0.8),

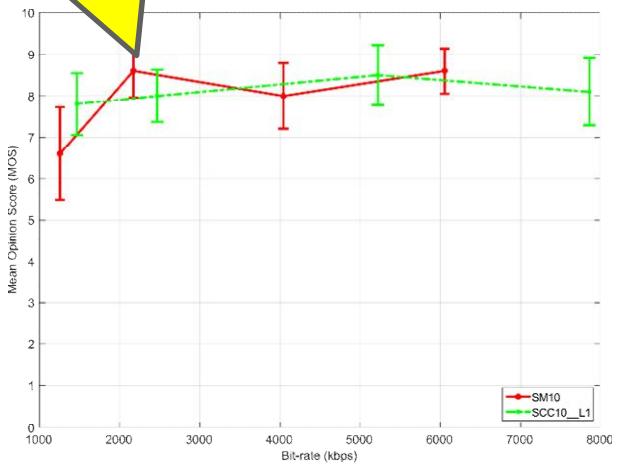
Quality similar for all bit-rates




FireEater2

Need of lower bit-rates (Higher QPs)

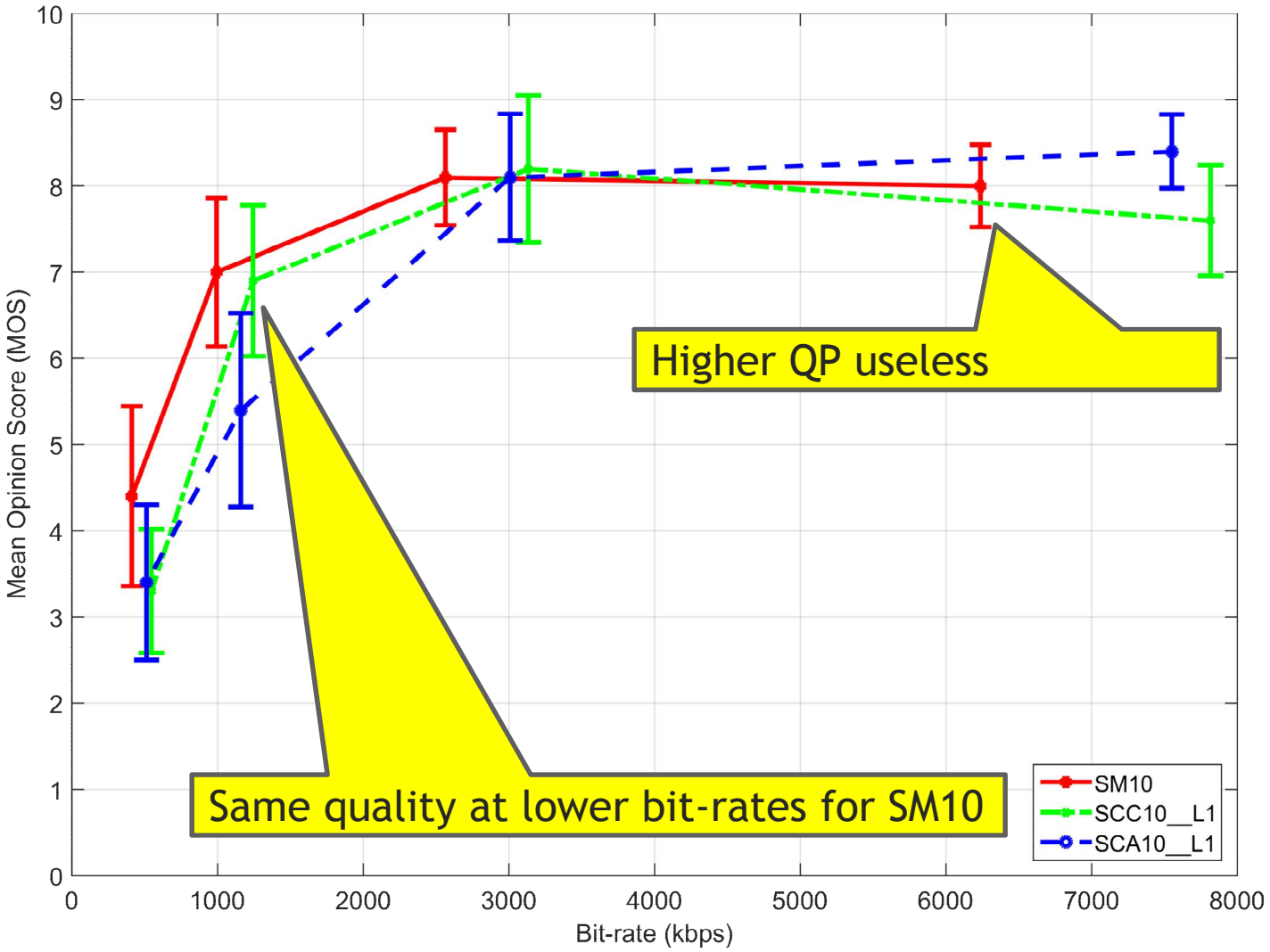
Quality similar for all bit-rates




BikeSparklers

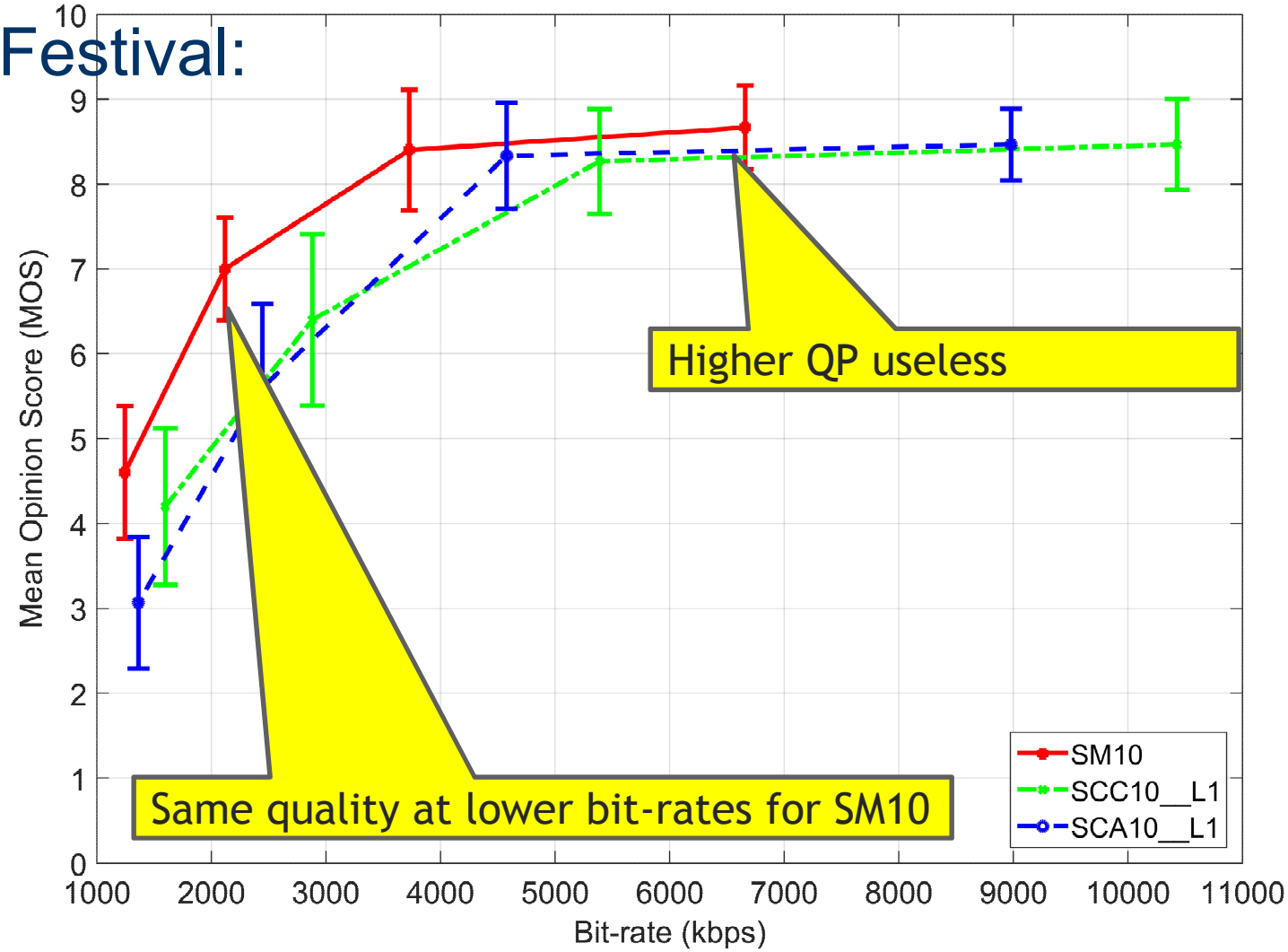
# Results

- Tibul2:



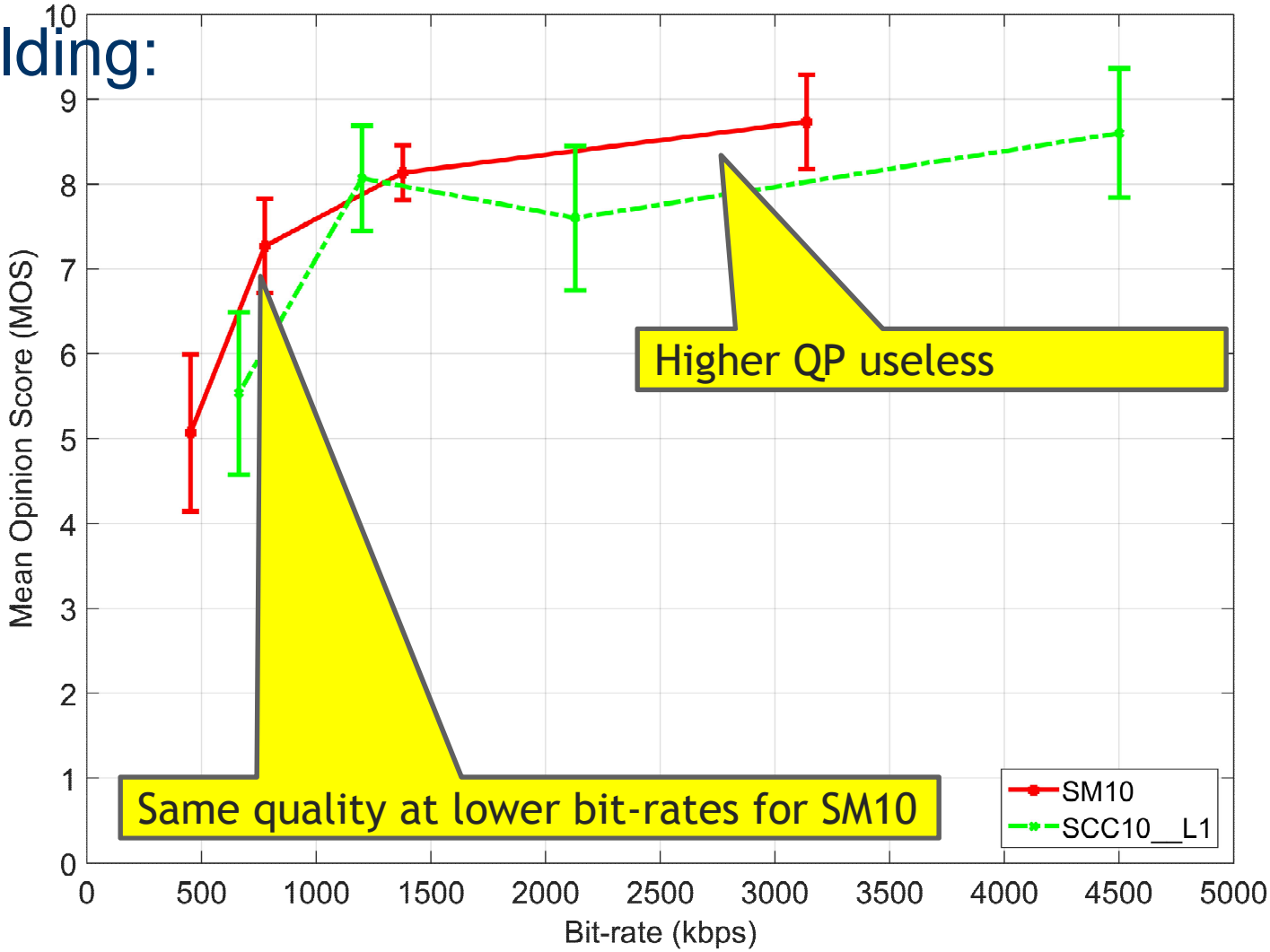
# Results

- BalloonFestival:



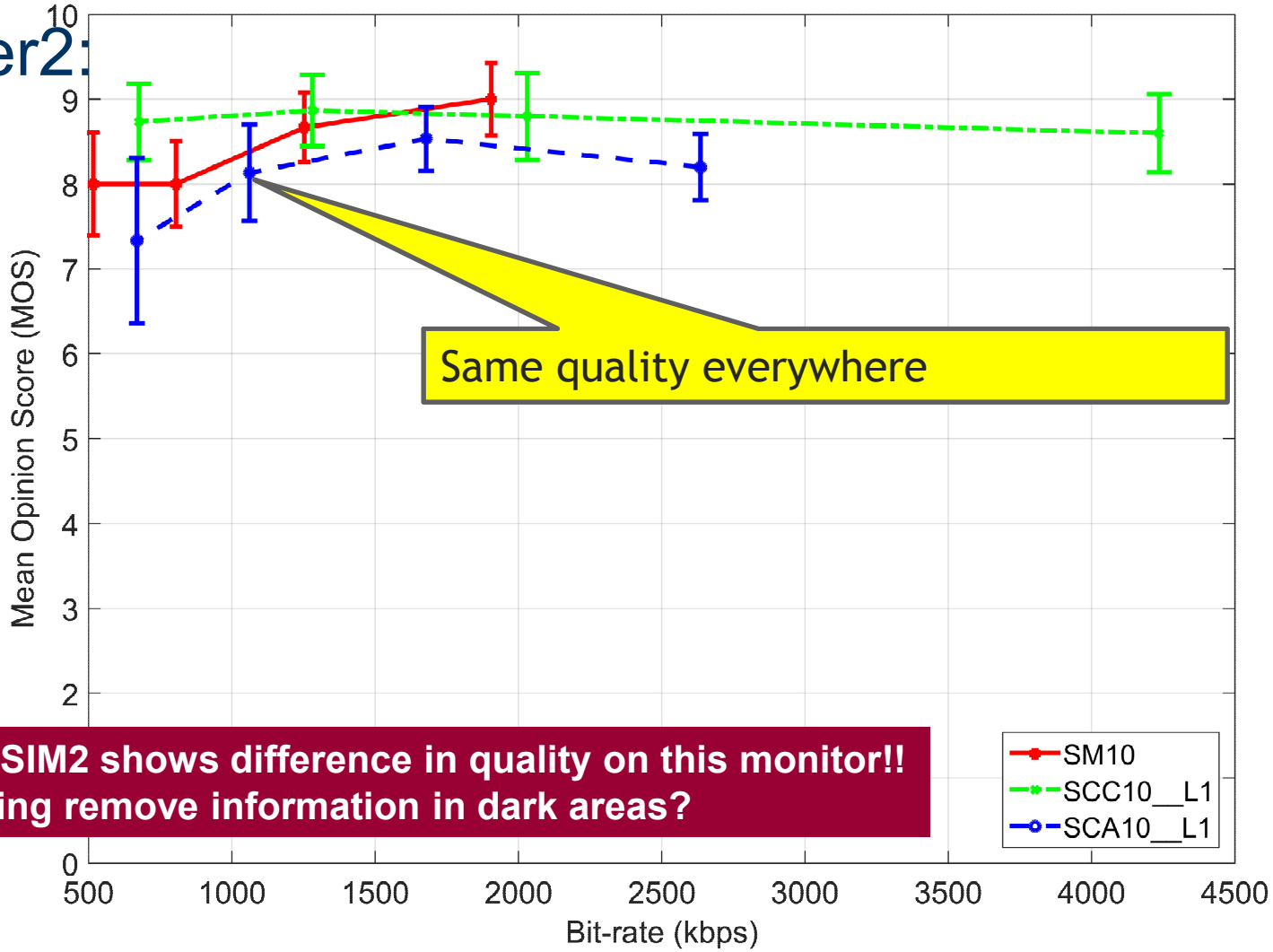
# Results

- AutoWelding:



# Results

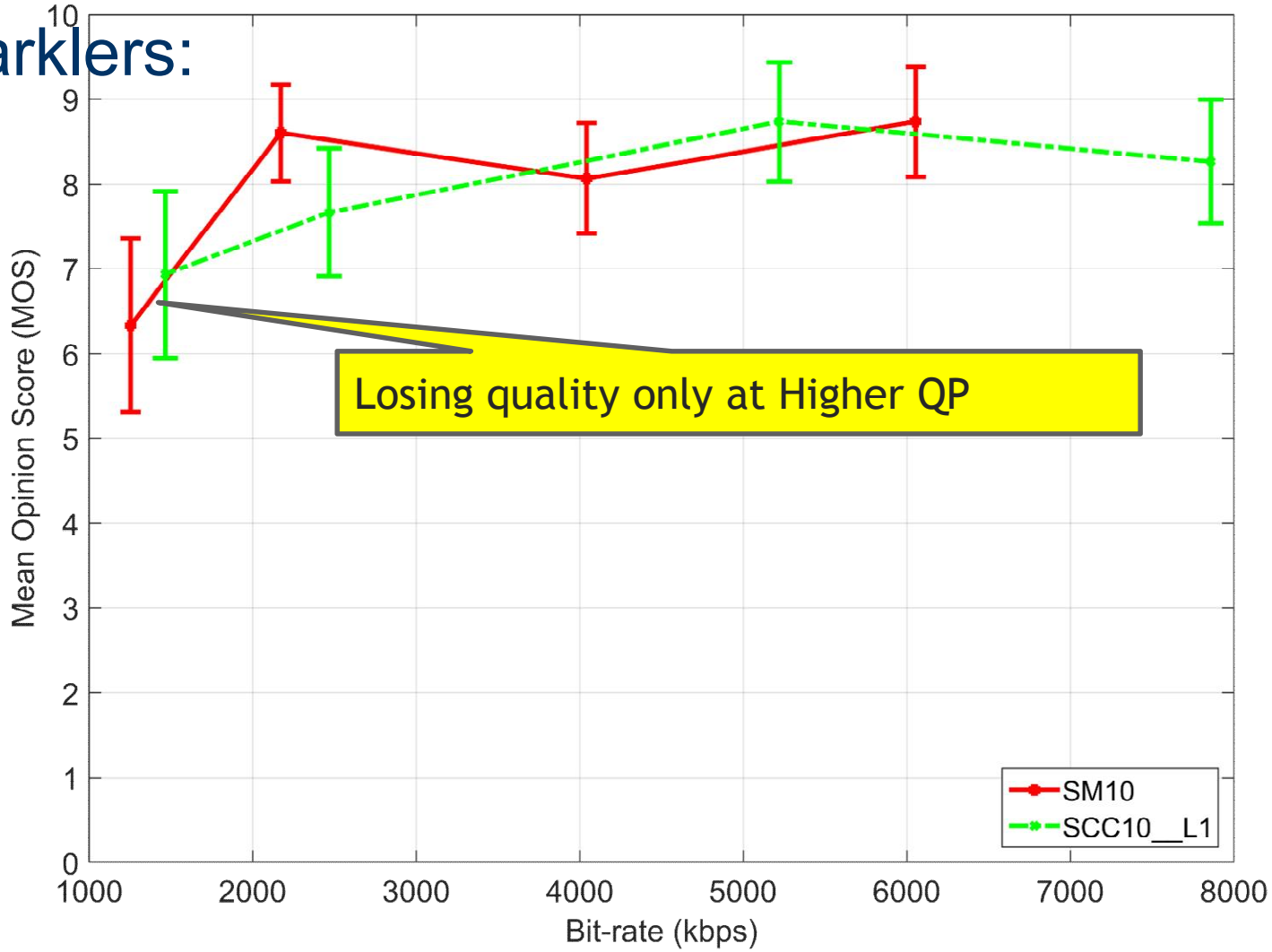
- FireEater2:




**Experiments on SIM2 shows difference in quality on this monitor!!**
**Scaling remove information in dark areas?**

# Results

- BikeSparklers:



# Overview

- Single Layer vs Scalable
- Proposed Test
- Results
- **Conclusion**

# Conclusion

- Single layer seems to outperform scalable
- Results are different depending to the display used

# Recommendations

- Change QP setting to have same bit-rates between scalable and single layer
- Higher QP for most sequences should be considered
- Graded content for a display should always be tested on this display and optionally on others

# Contact Information

## Contact Us

**Mailing Address :**

Digital Multimedia Lab
Department of Electrical and Computer Engineering
The University of British Columbia
ICICS/CS Building x310, 2366 Main Mall
Vancouver, BC V6T 1Z4
Canada

http://dml.ece.ubc.ca

**Phone Number :**

(604) 827-4878

**Lab Location :**

x310, ICICS/CS Building, UBC


THANK
YOU