

# › POLYPHASE SUBSAMPLING APPLIED TO 360-DEGREE VIDEO SEQUENCES

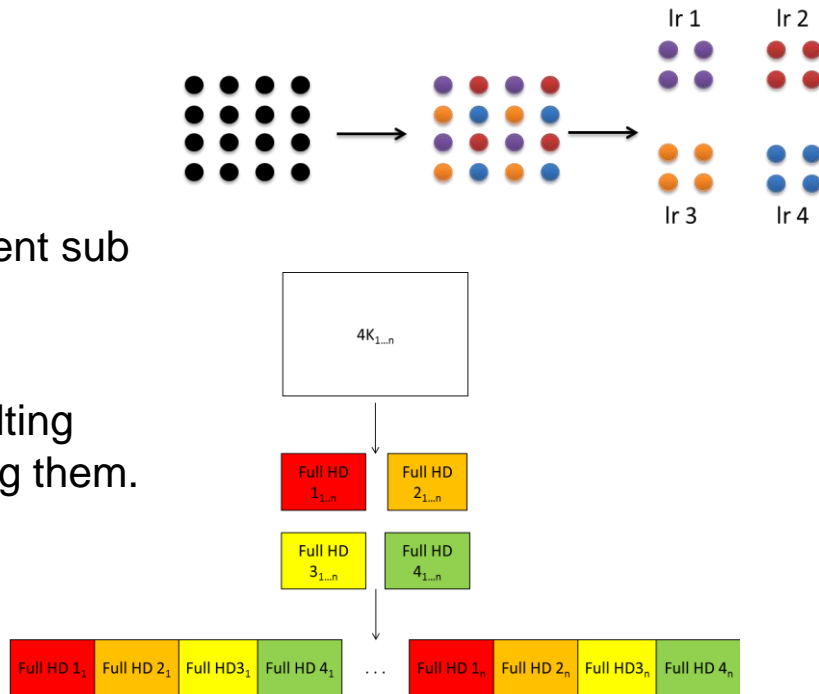
Submitted by

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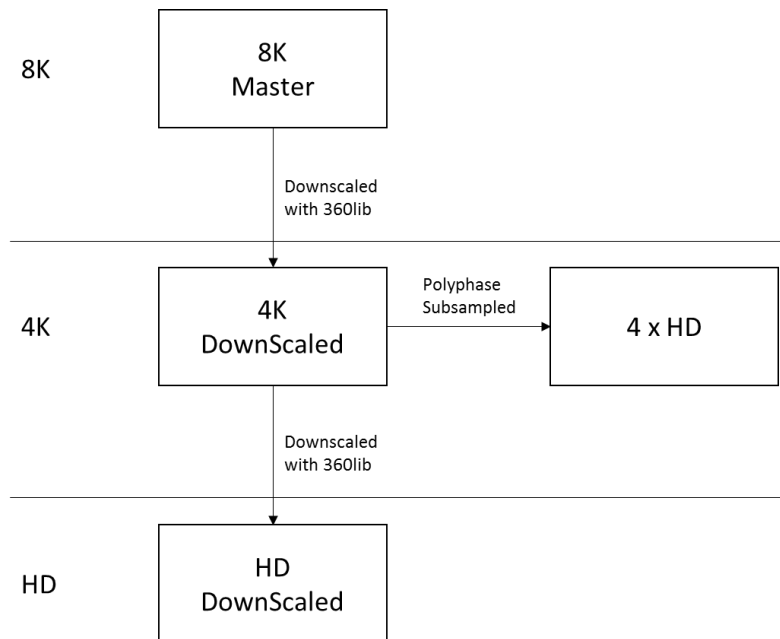
# POLYPHASE DECOMPOSITION OVERVIEW

- › More information (from JVET-B0043)
- › Each frame is subsampled producing 4 different sub frames.
- › A new frame sequence is made with the resulting subsampled frames by temporally multiplexing them.
- › The processed sequence has:
  - ›  $\frac{1}{4}$  of the resolution (4K – HD)
  - › 4x the frame rate



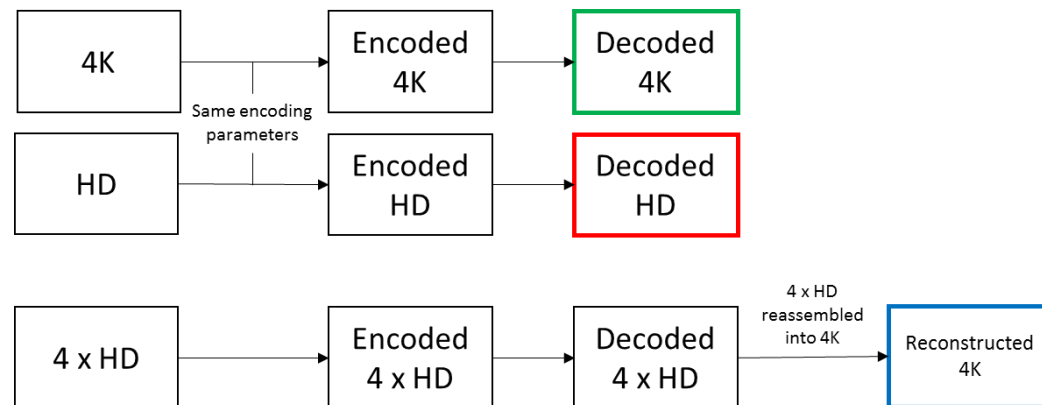
# CONTENT PREPARATION FOR EXPERIMENT

- › 8K master was downsampled with the 360lib
- › 4K downsampled was
  - › Downsampled again to HD, and
  - › Polyphase subsampled
- › HD downsampled will be used for simulcast comparison



# ENCODING/DECODING PROCESS

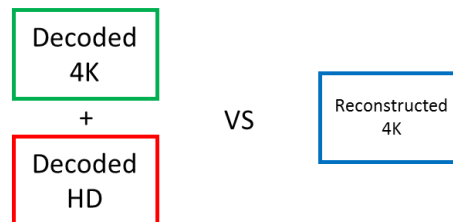
- › HM and JEM encoders were used to encode the sequences
- › The same encoding parameters were used between 4K and HD so that they would be comparable for simulcast situation
  - › QPs from CfE anchors
  - › Random access
- › The 4xHD were reconstructed after being decoded by the reverse process of the polyphase subsampling



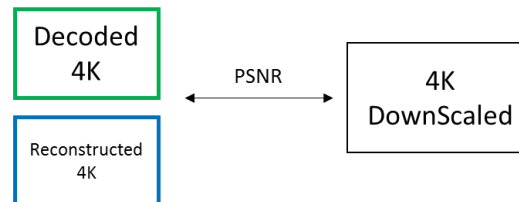
# BD RATE CALCULATION

- Calculations of BD rate were done with and without the addition of the Decoded HD (simulcast)

Bitrate domain



Quality parameters domain



## RESULTS VS HM 4K ANCHORS

Sequence	4K vs 4xHD			4K + HD vs 4xHD		
	PSNR <sub>Y</sub>	PSNR <sub>U</sub>	PSNR <sub>V</sub>	PSNR <sub>Y</sub>	PSNR <sub>U</sub>	PSNR <sub>V</sub>
Trolley	86.9%	49.8%	19.6%	31.30%	5.50%	-15.80%
Skateboarding_in_lot	-67.7%	-44.1%	-66.4%	-76.50%	-59.30%	-75.60%
Chairlift	-25.3%	-16.0%	-51.1%	-46.70%	-39.90%	-65.20%
KiteFlite	11.4%	28.7%	-4.9%	-21.50%	-9.30%	-33.10%
Harbor	66.1%	75.8%	14.6%	18.10%	25.00%	-18.50%
<b>Overall</b>	<b>14.3%</b>	<b>18.8%</b>	<b>-17.6%</b>	<b>-19.10%</b>	<b>-15.60%</b>	<b>-41.60%</b>

### › Positive

- › Skateboarding In Lot and Chairlift have gains
- › Simulcast scenario has 3 sequences with gains

### › Negative

- › The other sequences have noticeable losses

## RESULTS VS JEM 4K ANCHORS

Sequence	4K vs 4xHD			4K + HD vs 4xHD		
	PSNR <sub>Y</sub>	PSNR <sub>U</sub>	PSNR <sub>V</sub>	PSNR <sub>Y</sub>	PSNR <sub>U</sub>	PSNR <sub>V</sub>
Trolley	135.5%	13.7%	-19.3%	64.6%	-20.2%	-43.3%
Skateboarding_in_lot	-62.1%	-59.5%	-81.4%	-72.6%	-70.6%	-84.4%
Chairlift	-2.6%	-32.1%	-65.1%	-32.0%	-52.8%	-76.0%
KiteFlite	31.9%	3.3%	-63.7%	-7.8%	-27.8%	-74.7%
Harbor	81.7%	39.7%	-50.5%	28.2%	-1.5%	-64.9%
<b>Overall</b>	<b>36.9%</b>	<b>-7.0%</b>	<b>-56.0%</b>	<b>-3.9%</b>	<b>-34.6%</b>	<b>-68.67%</b>

### › Positive

- › Skateboarding In Lot (large) and Chairlift (quite small) have gains
- › Simulcast scenario has 3 sequences with gains

### › Negative

- › The other sequences have noticeable losses

# OBSERVATIONS

- › Results show large variance across sequences, average gain is not so relevant to consider.
- › Encoding time are shorter with subsampled sequences than for 4K sequences although the same data is encoded.
- › Compared to JVET CTC test sequence encoding (JVET-B0043), more sequences show gains. As suggested, the higher resolution the more gain seems to apply. This because of less damage done by the polyphase subsampling with higher resolution content.



# CONCLUSION

- › Gain in BD rate are obtained for Skateboarding in Lot and Chairlift in both HM and JEM by using common encoding configuration (no fine-tuning specific to the proposed technique)
- › The about 60% gain for Skateboarding in Lot shows potential for more sequences with a fine-tuned encoding configuration and/or improvement of the subsampling technique.
- › Furthermore, in simulcast comparison (4K+HD vs proposed solution) 3 sequences out of 5 show gains for both HM and JEM.