



# **JCTVC-G246: On additional SAO Band Offset classifications**

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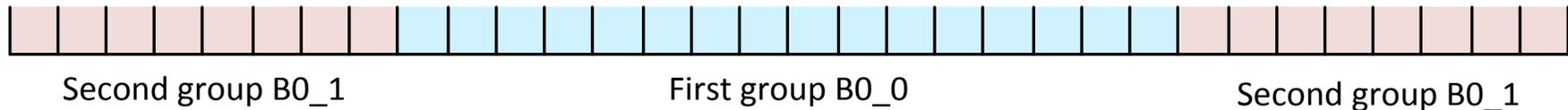
JCT-VC 7<sup>th</sup> Meeting, Geneva 21<sup>st</sup>-30<sup>th</sup> November, 2011



**Canon**

# Introduction

- The current SAO Band offset is used for both Luma and Chroma components
  - 2 classifications corresponding to 2 groups of ranges



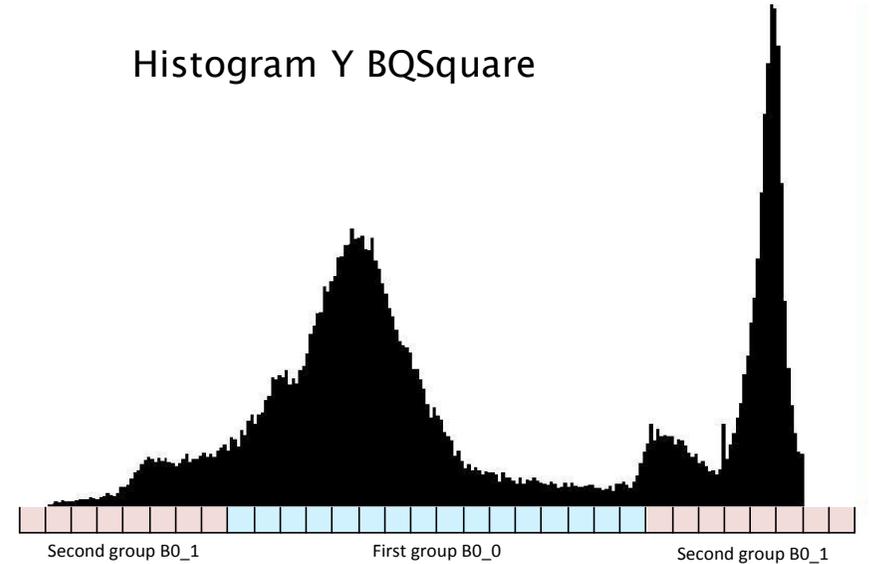
- SAO BO classification is restrictive to a kind of pixel values repartition and can't match compact pixel values repartition (as Chroma components)
- **Proposal: use additional classifications in order to be more adaptive to the pixel values repartition.**

# SAO band offset: analysis

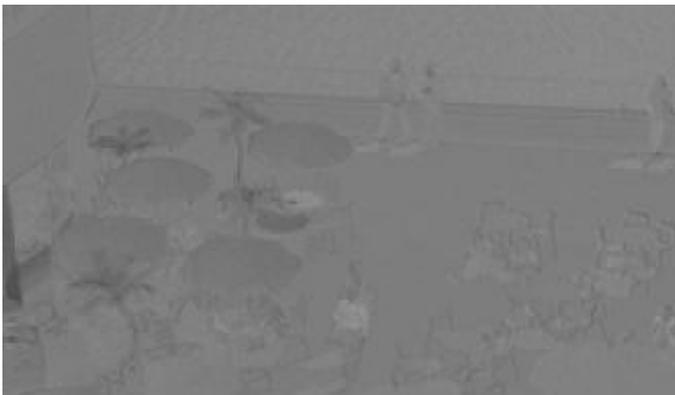
- Useful when the pixel values repartition covers all the intensity range of pixels



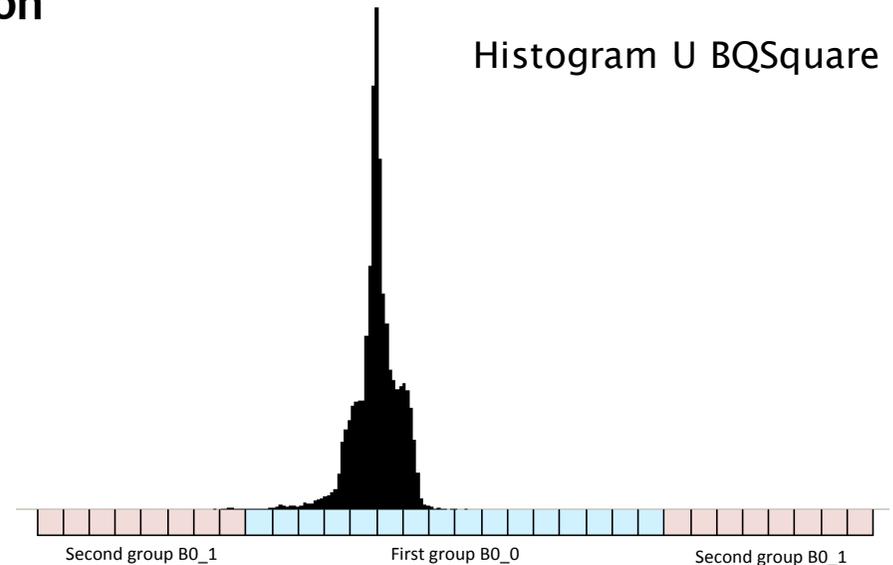
Histogram Y BQSquare



- Not adapted to compact pixel values repartition



Histogram U BQSquare



# Proposal: additional Band offset classifications

- **8 additional SAO Band classifications**
  - 3 smaller sizes of groups
  - Higher granularity of band classifications
  - Signalization of the center of new classifications
- **+ 1 RDO selection for all SAO classifications**
  
- **Aim to be more adaptable to the input signal**
  - Chroma signal where the pixel repartition is more compact
  - Small area filtered by SAO

# RD Selection

- HM4.0: RD cost for class number  $i$ , in:

where  $o$  is the offset value

- Proposed modification:

$$\left( \left( \right) \left( \right) \left( \right) \right)$$

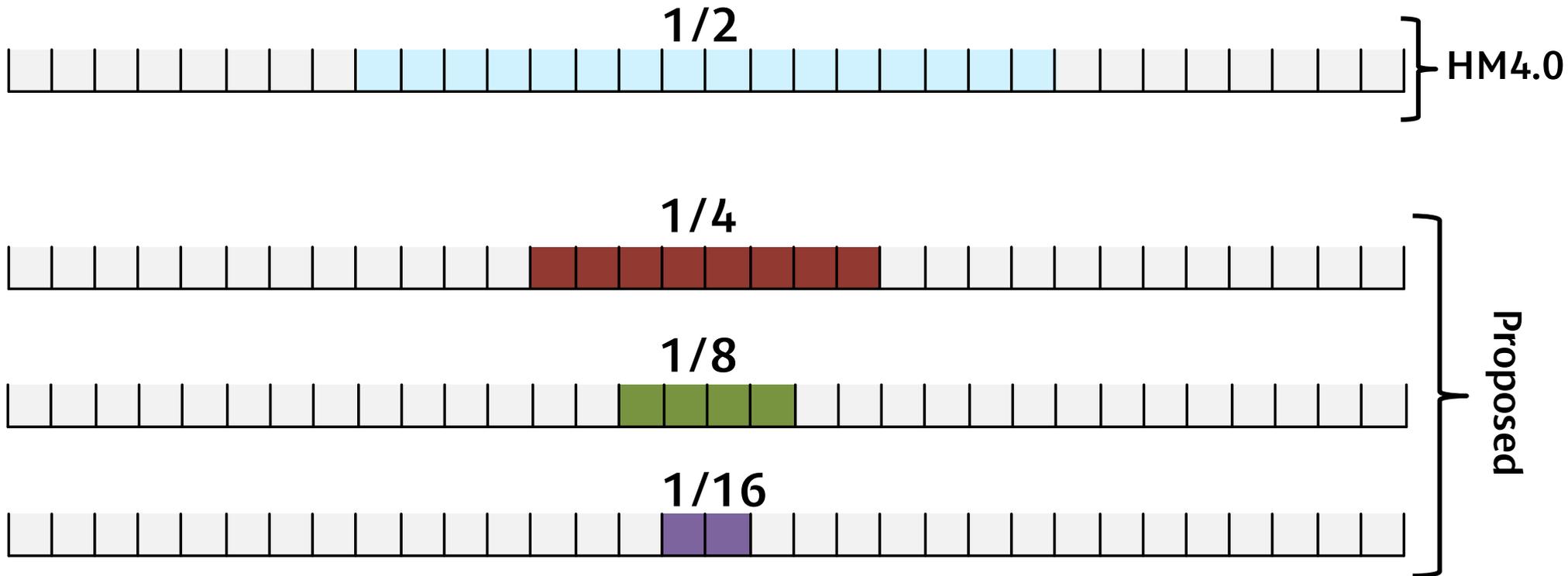
- The offset value  $o$  is set to zero if the RD cost of zero offset is lower than the RD cost of the determined  $o$ .

- Results for the 8 configurations:

	Y	U	V
Average	0.0%	-0.2%	-0.3%

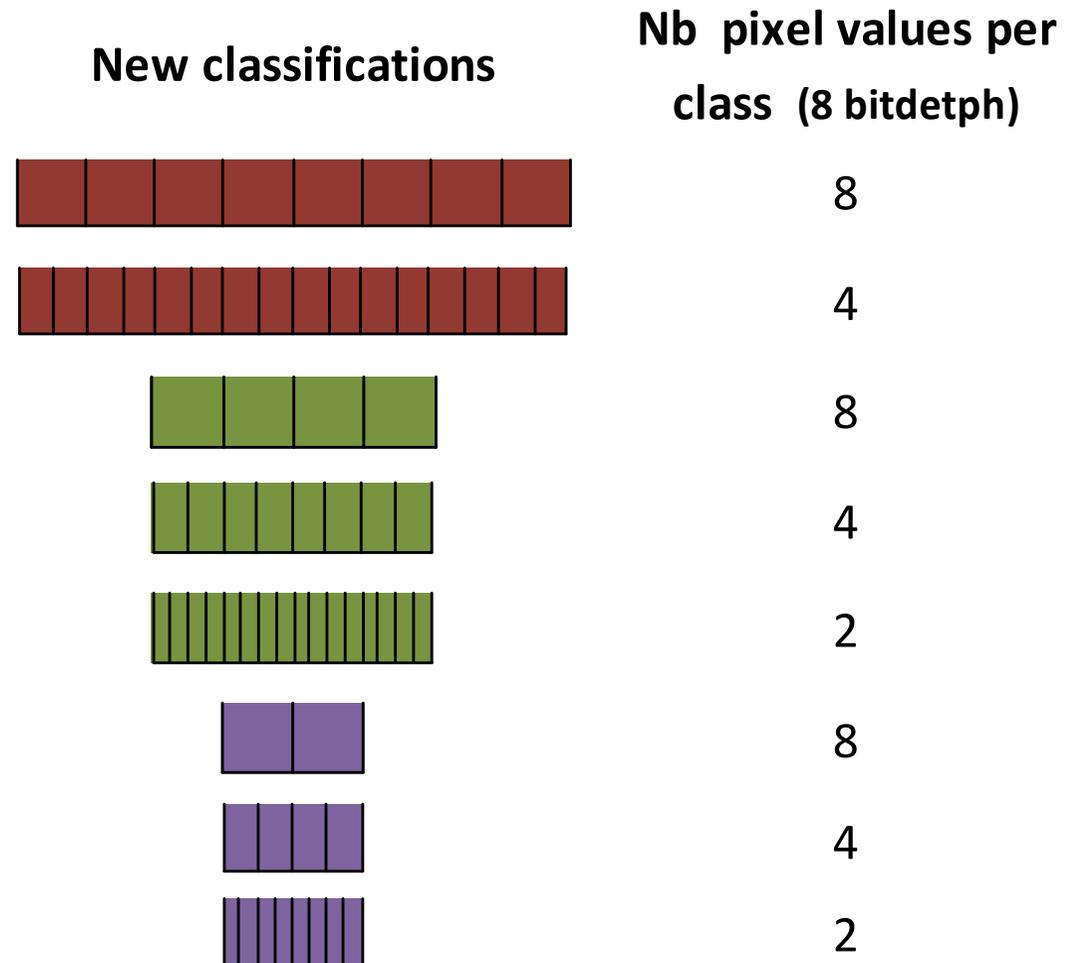
# Additional group sizes

- 3 additional intensity range subdivisions based on the first SAO BO group
  - $1/4^{\text{th}}$ ,  $1/8^{\text{th}}$  and  $1/16^{\text{th}}$  of the full intensity range.
  - HM4.0 :  $1/2$  of the full intensity range.



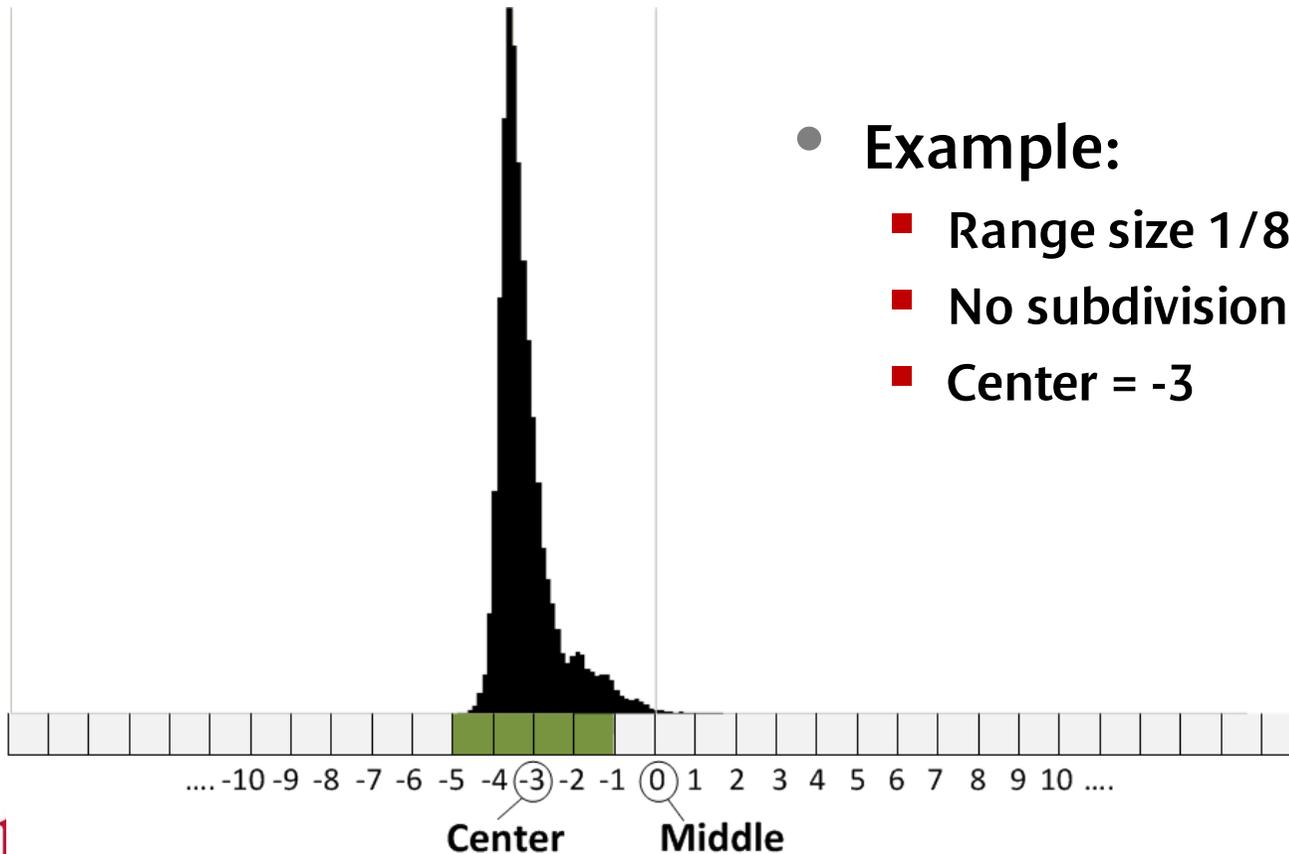
# Additional class sizes

- 3 Class sizes
- Including subdivision of class size
- Most significant bits used for classification:
  - 5, 6 or 7
- Max offset = 16
- No impact on worst case complexity:
  - Less complex than SAO Edge offset



# Center of additional classifications

- Signalization of the center of the new groups
  - Coded on a subdivision of 32 ranges of the intensity range.
  - Predicted by the middle of the intensity range



- Example:
  - Range size 1/8 th
  - No subdivision
  - Center = -3

# Experimental Results

	Y	U	V	YUV*	ENC time	DEC time
AIHE	0.0%	-1.3%	-1.6%	-0.2%	100.6%	98.8%
AILC	0.0%	-0.7%	-0.9%	-0.1%	101.6%	99.6%
RALC	0.0%	-0.8%	-0.9%	-0.1%	101.3%	101.9%
RAHE	-0.1%	-1.4%	-1.5%	-0.3%	100.5%	99.7%
LDHE	-0.1%	-2.0%	-2.3%	-0.5%	100.6%	100.5%
LDLC	-0.2%	-2.3%	-2.7%	-0.6%	100.7%	97.4%
LDPHE	-0.2%	-4.6%	-3.7%	-0.9%	101.8%	98.3%
LDPLC	-0.1%	-2.2%	-2.6%	-0.5%	102.2%	97.0%
<b>Average</b>	<b>-0.1%</b>	<b>-1.7%</b>	<b>-2.0%</b>	<b>-0.4%</b>	<b>101.2%</b>	<b>99.1%</b>

\* YUV BDR computed with  $PSNR_{AV}$



**1.7% and 2% gain for Chroma components**  
**0.4% gain on  $PSNR_{AV}$**

# Conclusion

- 8 additional SAO band classifications in order to be more adaptable to the input signal
  - 3 additional groups
  - 3 sizes of classes
  - Signalization of the center of this additional groups
- Complexity:
  - No impact on the worst case complexity
    - SAO Band offset is less complex than Edges offset
  - Decoding time reduction due to higher selection of Band offset.
- Results:
  - 1.7% and 2% gain for Chroma components
  - 0.4% gain on  $PSNR_{AV}$