

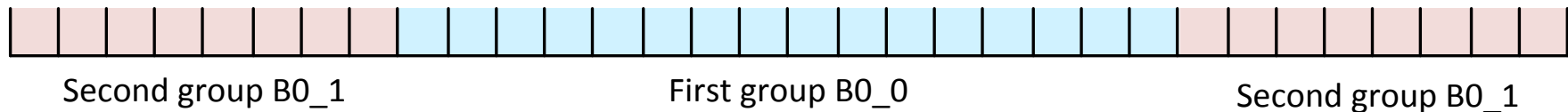
JCTVC-G246: On additional SAO Band Offset classifications

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Introduction

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



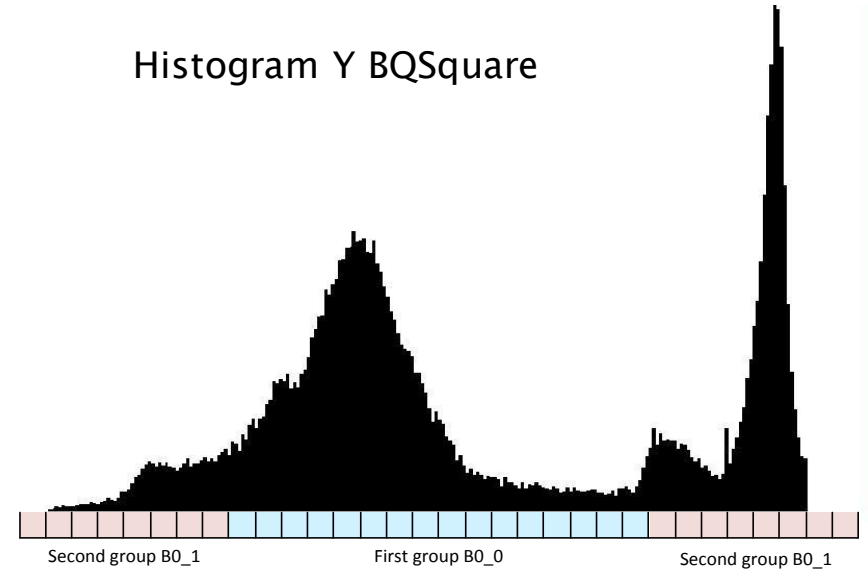
- SAO BO classification is restrictive to a kind of pixel values repartition and can't match compact pixel values repartition (as Chroma components)
- **Proposal: use additional classifications in order to be more adaptive to the pixel values repartition.**

SAO band offset: analysis

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



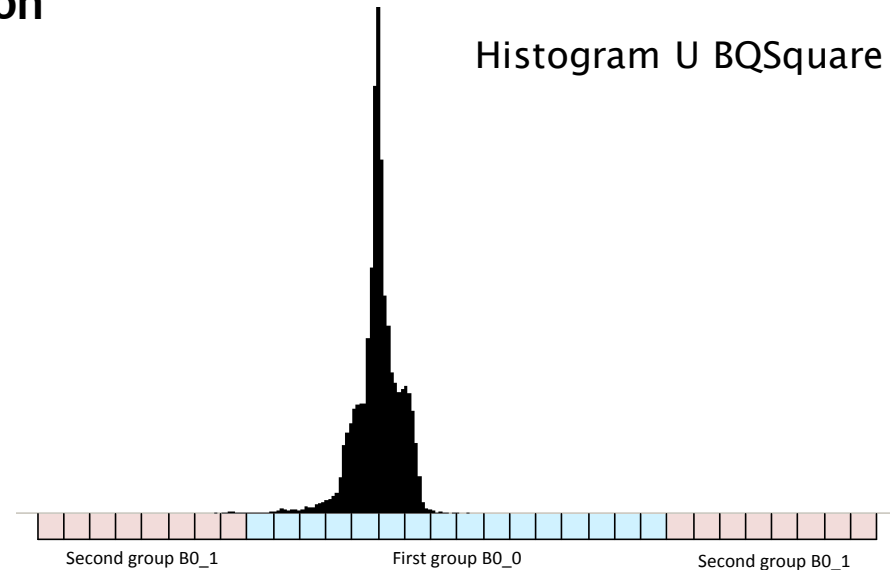
Histogram Y BQSquare



- 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 offset is the offset value

- **Proposed modification:**

$$\left(\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \quad \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \quad \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \right)$$

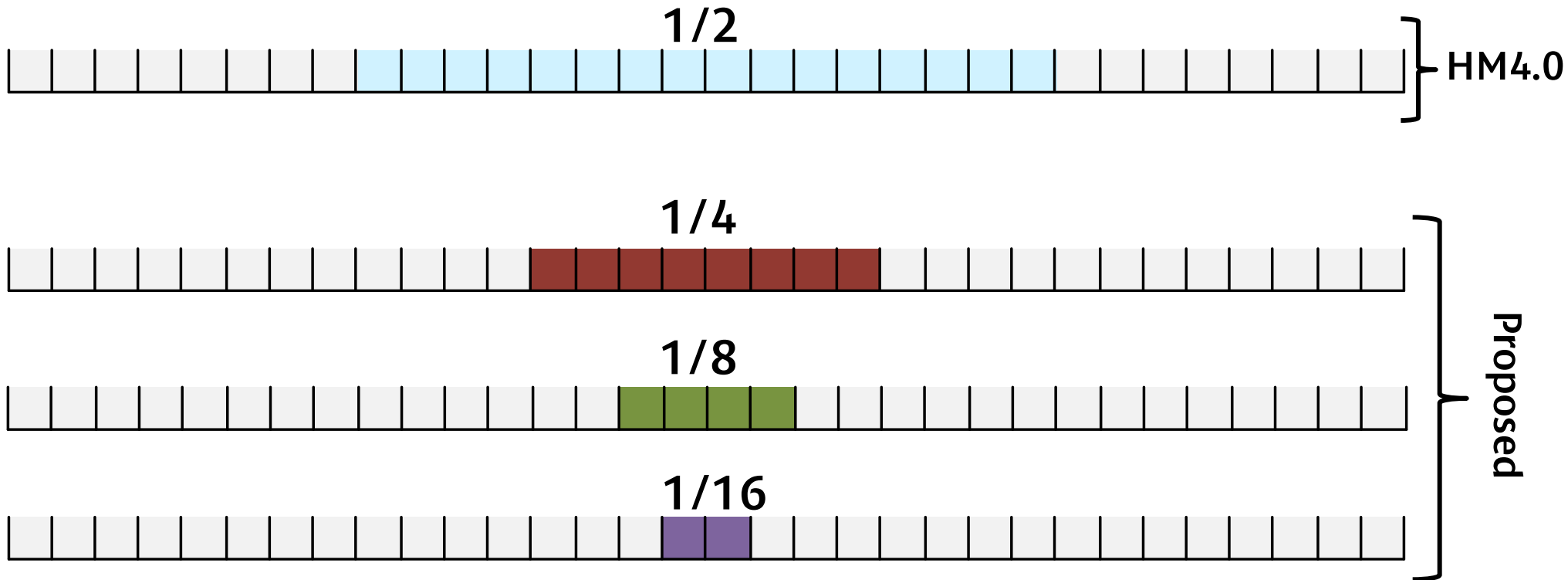
- The offset value is set to zero if the RD cost of zero offset is lower than the RD cost of the determined .

- **Results for the 8 configurations:**

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

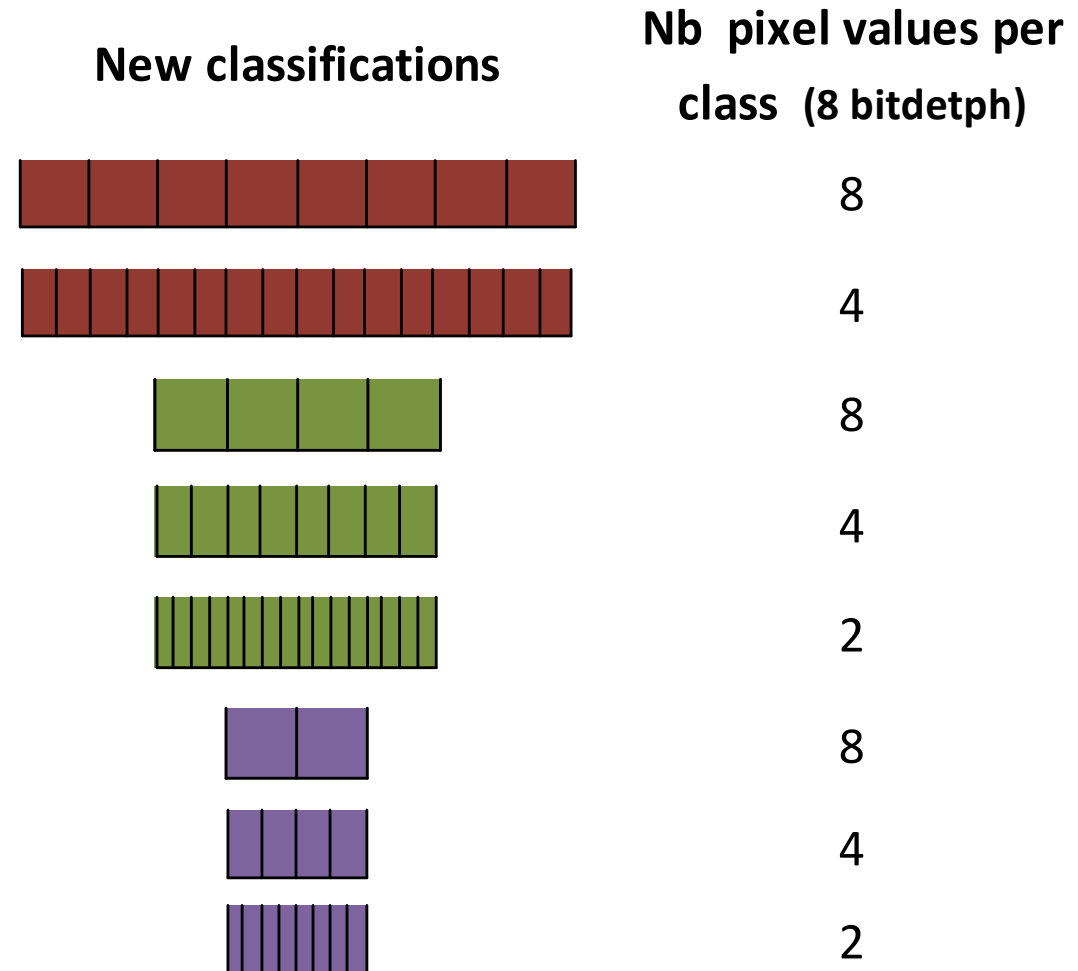
Additional group sizes

- 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.



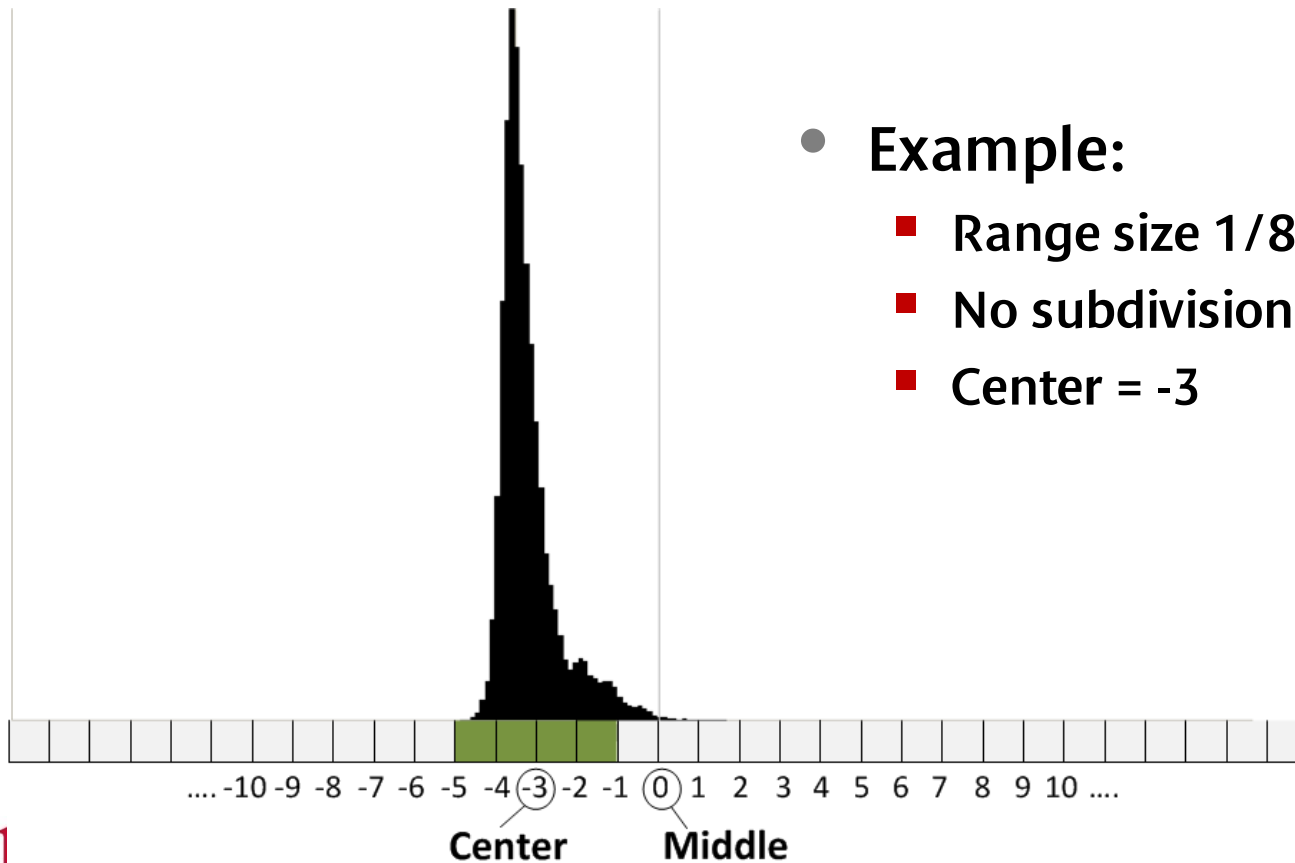
Additional class sizes

- 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%
Average	-0.1%	-1.7%	-2.0%	-0.4%	101.2%	99.1%

* 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 $PSNR_{AV}$