

# TU level limits on context-coded bins for coefficient coding (JVET-N0106)

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# Introduction

- Introduce TU level limits on context-coded bins for coefficient coding rather than more strict CG level limits
- Current limits: 32 bins for 16 coefficient CGs, 8 bins for 4 coefficient CGs
- Transform skip residual coding uses TU-level bin context-coded limits

# Proposal

- Introduce TU level limit that is equal to number of coded CGs times the current CG limit.
- Last position determines the initial total bin limit
$$lastPosSubblock = (scanPosLast \gg \log2CGSize) + 1$$
$$regBinTULimit = lastPosSubblock * (\log2CGSize == 2 ? 8 : 32)$$
- For every non coded CG, reduce the remaining bin count by
$$regBinTULimit -= (\log2CGSize == 2 ? 8 : 32)$$

# Results (VTM-4.0 anchor)

2 bin/coeff	All Intra				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1	-0.05%	-0.10%	-0.12%	102%	104%
Class A2	-0.08%	-0.01%	-0.08%	102%	103%
Class B	-0.04%	-0.06%	-0.04%	101%	101%
Class C	-0.03%	-0.05%	-0.12%	101%	99%
Class E	-0.04%	-0.10%	-0.12%	101%	100%
Overall	-0.05%	-0.06%	-0.09%	101%	101%
Class D	0.00%	-0.11%	-0.36%	102%	100%
Class F	-0.12%	-0.18%	-0.25%	101%	98%

	Random Access				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1	-0.04%	-0.06%	-0.05%	104%	103%
Class A2	-0.03%	-0.10%	-0.04%	102%	103%
Class B	-0.03%	-0.13%	-0.11%	101%	101%
Class C	-0.02%	-0.10%	-0.22%	101%	100%
Class E					
Overall	-0.03%	-0.10%	-0.11%	102%	101%
Class D	-0.03%	-0.52%	-0.02%	101%	100%
Class F	-0.12%	-0.30%	-0.48%	101%	102%

	Low Delay B				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	-0.02%	-0.16%	0.02%	101%	101%
Class C	-0.05%	0.23%	-0.13%	101%	101%
Class E	-0.05%	0.39%	0.38%	101%	100%
Overall	-0.04%	0.11%	0.06%	101%	101%
Class D	-0.01%	0.44%	0.01%	101%	100%
Class F	-0.26%	-0.57%	-0.28%	102%	101%

32bin/CG factor

1.75bin/coeff	All Intra				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1	-0.05%	-0.10%	-0.12%	102%	104%
Class A2	-0.08%	-0.01%	-0.08%	102%	103%
Class B	-0.04%	-0.06%	-0.04%	101%	101%
Class C	-0.03%	-0.05%	-0.12%	101%	99%
Class E	-0.04%	-0.10%	-0.12%	101%	100%
Overall	-0.05%	-0.06%	-0.09%	101%	101%
Class D	0.00%	-0.11%	-0.36%	102%	100%
Class F	-0.12%	-0.18%	-0.25%	101%	98%

	Random Access				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1	-0.04%	-0.06%	-0.05%	104%	103%
Class A2	-0.03%	-0.10%	-0.04%	102%	103%
Class B	-0.03%	-0.13%	-0.11%	101%	101%
Class C	-0.02%	-0.10%	-0.22%	101%	100%
Class E					
Overall	-0.03%	-0.10%	-0.11%	102%	101%
Class D	-0.03%	-0.52%	-0.02%	101%	100%
Class F	-0.12%	-0.30%	-0.48%	101%	102%

	Low Delay B				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	-0.02%	-0.16%	0.02%	101%	101%
Class C	-0.05%	0.23%	-0.13%	101%	101%
Class E	-0.05%	0.39%	0.38%	101%	100%
Overall	-0.04%	0.11%	0.06%	101%	101%
Class D	-0.01%	0.44%	0.01%	101%	100%
Class F	-0.26%	-0.57%	-0.28%	102%	101%

28bin/CG factor

1.58bin/coeff	All Intra				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
Class A2	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
Class B	-0.02%	-0.03%	-0.03%	80%	94%
Class C	0.01%	-0.08%	0.05%	79%	95%
Class E	-0.03%	-0.03%	-0.02%	81%	95%
Overall	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
Class D	-0.01%	0.07%	-0.01%	83%	98%
Class F	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!

	Random Access				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
Class A2	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
Class B	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
Class C	0.00%	-0.13%	-0.25%	82%	97%
Class E					
Overall	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
Class D	-0.01%	-0.07%	-0.04%	82%	94%
Class F	-0.01%	-0.09%	-0.12%	84%	98%

	Low Delay B				
	Over VTM-4.0				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
Class C	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
Class E	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
Overall	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
Class D	-0.04%	0.57%	-0.42%	82%	91%
Class F	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!

(28,20) bin/ CG Factor Lum,Chr

# Conclusion

- Alternative scheme to limit context-coded bin count at TU level
- Reduction of worst case context-coded bin count to HEVC levels
- Propose CE study

- Thanks Mediatek & HHI for crosschecking