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JVET-O0271

CE2-related: Chroma scaling for CIIP

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Overall Summary

- In CE2-1, all of the tests do not consider that CIIP is a combination of intra mode and inter mode
  - Option 1: CIIP mode is considered as normal inter mode (only use the predictor from inter part)
  - Option 2: CIIP mode is considered as intra mode
- Another aspect is to derive the chroma scaling factor at VPDU level
- All of the test result in minor BD-rate changes

Introduction

- In VTM-5.0, the inverse scale value is derived using the prediction samples of the **entire** collocated luma TB
- **In the worst case, the delay is the processing time of generating 64x64 luma prediction samples**
- JVET-O0087, JVET-O0098 and JVET-O0102 present different methods to reduce the latency
  - JVET-O0087 and JVET-O0102 only target intra blocks
  - JVET-O0098 targets all blocks
- JVET-O0087, JVET-O0098 and JVET-O0102 do not consider that CIIP is a combination of intra mode and inter mode

Method 1 and Method 2

- Method 1: Based on CE2-1.2+ CE2-1.3
- Method 2: Based on CE2-1.2+ CE2-1.4

- Option 1: Consider CIIP mode as inter mode
  - Use the top-left prediction sample from **inter part only**
  - In CE2-1.2: CIIP mode is considered as inter mode, use the top-left **combined prediction samples**
- Option 2: Consider CIIP mode as intra mode
  - If follow CE2-1.3, use the top-left **reconstructed sample** as the reference luma sample
  - If follow CE2-1.4, use the top-left **reference sample** as the reference luma sample

Results

- Method 1: Based on CE2-1.2+ CE2-1.3

	Intra	Inter	CIIP		Y	U	V
Option 1	rec	pred	pred (inter)	RA	0.01%	-0.05%	-0.05%
				LB	-0.01%	0.04%	-0.12%
Option 2	rec	pred	rec	RA	0.00%	-0.02%	-0.11%
				LB	0.02%	0.06%	0.01%

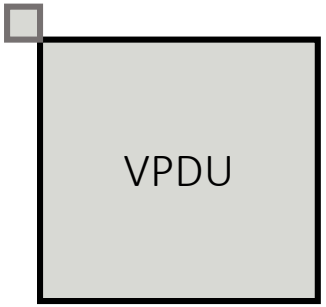
- Method 2: Based on CE2-1.2+ CE2-1.4

	Intra	Inter	CIIP		Y	U	V
Option 1	ref	pred	pred (inter)	RA	0.01%	-0.05%	-0.03%
				LB	0.03%	-0.05%	0.02%
Option 2	ref	pred	ref	RA	0.00%	-0.03%	-0.07%
				LB	0.01%	0.08%	-0.16%

Method 3 and Method 4 – derive chroma scale factor at VPDU level

- The latency between luma reconstruction and chroma reconstruction still exists in inter blocks
- The chroma scaling factor is derived for each TB
- Propose to further simplify the chroma scaling
  - Always use the top-left reconstructed sample as the reference luma sample
  - The chroma scale factor of the first TB in a VPDU is shared in the whole VPDU

→No additional latency between luma and chroma reconstruction



Results

	Intra	Inter	CIIP	Level	Dual Tree		Y	U	V
Method 3	rec	rec	rec	VPDU	X	RA	-0.01%	0.10%	0.08%
						LB	0.00%	0.09%	-0.11%
Method 4	rec	rec	rec	VPDU	O	AI	0.03%	-0.37%	-0.51%
						RA	0.02%	-0.39%	-0.41%
						LB	0.04%	-0.12%	-0.47%

Conclusion

- Propose to consider that CIIP is as inter mode or intra mode
  - Option 1: CIIP mode is considered as normal inter mode (only use the predictor from inter part)
  - Option 2: CIIP mode is considered as intra mode
- Another aspect is to derive the chroma scaling factor at VPDU level
- All of the test result in minor BD-rate changes
- Thank Kwai for cross-checking!

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Thank you!

Backup

Results – Method 1.1

	Random access Main10				
	Over VTM-5.0				
	Y	U	V	EncT	DecT
Class A1	0.00%	-0.12%	-0.01%	145%	129%
Class A2	0.01%	-0.10%	0.00%	143%	127%
Class B	0.01%	-0.01%	-0.10%	142%	124%
Class C	0.01%	0.00%	-0.05%	142%	128%
Class E					
Overall	0.01%	-0.05%	-0.05%	143%	127%
Class D	-0.03%	0.08%	0.26%	142%	132%
Class F	-0.01%	0.04%	-0.03%	142%	121%

	Low delay B Main10				
	Over VTM-5.0				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	0.01%	-0.02%	-0.34%	137%	125%
Class C	-0.03%	0.15%	-0.02%	144%	135%
Class E	0.00%	0.00%	0.12%	138%	127%
Overall	-0.01%	0.04%	-0.12%	139%	129%
Class D	-0.02%	-0.05%	0.74%	142%	134%
Class F	0.00%	-0.01%	0.03%	131%	124%

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Results – Method 1.2

	Random access Main10				
	Over VTM-5.0				
	Y	U	V	EncT	DecT
Class A1	0.01%	0.00%	-0.03%	143%	127%
Class A2	0.01%	-0.09%	-0.06%	142%	127%
Class B	0.01%	-0.02%	-0.18%	142%	125%
Class C	-0.01%	0.01%	-0.12%	142%	127%
Class E					
Overall	0.00%	-0.02%	-0.11%	142%	127%
Class D	0.01%	0.09%	0.14%	141%	131%
Class F	0.00%	0.08%	-0.01%	142%	124%

	Low delay B Main10				
	Over VTM-5.0				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	-0.01%	0.15%	0.18%	136%	126%
Class C	0.00%	-0.15%	-0.07%	136%	128%
Class E	0.09%	0.17%	-0.15%	134%	126%
Overall	0.02%	0.06%	0.01%	136%	127%
Class D	-0.02%	-0.29%	1.01%	134%	130%
Class F	0.03%	0.07%	-0.06%	132%	124%

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Results – Method 2.1

	Random access Main10				
	Over VTM-5.0				
	Y	U	V	EncT	DecT
Class A1	0.01%	-0.19%	0.03%	100%	101%
Class A2	0.02%	-0.04%	-0.01%	100%	99%
Class B	0.02%	0.01%	-0.10%	100%	98%
Class C	-0.02%	-0.01%	0.00%	100%	98%
Class E					
Overall	0.01%	-0.05%	-0.03%	100%	99%
Class D	-0.01%	-0.03%	0.20%	100%	100%
Class F	0.01%	0.06%	0.00%	101%	99%

	Low delay B Main10				
	Over VTM-5.0				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	0.02%	0.06%	0.15%	100%	100%
Class C	0.03%	-0.12%	0.02%	102%	105%
Class E	0.03%	-0.15%	-0.18%	101%	99%
Overall	0.03%	-0.05%	0.02%	101%	101%
Class D	-0.04%	-0.32%	0.55%	98%	107%
Class F	-0.02%	0.05%	0.19%	98%	100%

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Results – Method 2.2

	Random access Main10				
	Over VTM-5.0				
	Y	U	V	EncT	DecT
Class A1	-0.02%	-0.08%	0.05%	100%	99%
Class A2	0.02%	-0.03%	-0.03%	100%	100%
Class B	0.02%	0.02%	-0.09%	100%	97%
Class C	-0.02%	-0.07%	-0.17%	100%	98%
Class E					
Overall	0.00%	-0.03%	-0.07%	100%	99%
Class D	0.03%	-0.12%	0.21%	99%	100%
Class F	0.01%	0.07%	0.03%	100%	97%

	Low delay B Main10				
	Over VTM-5.0				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	0.01%	0.04%	-0.04%	100%	100%
Class C	0.03%	0.03%	-0.20%	101%	102%
Class E	-0.02%	0.22%	-0.31%	100%	98%
Overall	0.01%	0.08%	-0.16%	100%	100%
Class D	-0.02%	-0.56%	0.50%	98%	102%
Class F	0.01%	0.07%	0.27%	98%	99%

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Results – Method 3

	Random access Main10				
	Over VTM-5.0				
	Y	U	V	EncT	DecT
Class A1	-0.01%	0.12%	0.20%	100%	99%
Class A2	0.02%	-0.02%	0.00%	100%	101%
Class B	0.00%	0.04%	-0.02%	100%	98%
Class C	-0.03%	0.24%	0.18%	99%	101%
Class E					
Overall	-0.01%	0.10%	0.08%	100%	99%
Class D	-0.02%	0.45%	0.57%	99%	100%
Class F	-0.01%	0.05%	0.03%	100%	100%

	Low delay B Main10				
	Over VTM-5.0				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	0.01%	-0.01%	0.08%	100%	100%
Class C	0.01%	0.23%	0.05%	100%	101%
Class E	-0.02%	0.07%	-0.64%	100%	100%
Overall	0.00%	0.09%	-0.11%	100%	101%
Class D	-0.04%	0.30%	1.02%	99%	102%
Class F	0.04%	-0.01%	0.02%	98%	97%

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Results – Method 4

	All Intra Main10				
	Over VTM-5.0				
	Y	U	V	EncT	DecT
Class A1	-0.10%	0.42%	0.23%	150%	128%
Class A2	-0.11%	0.91%	1.04%	151%	127%
Class B	0.04%	-0.34%	-0.45%	151%	125%
Class C	0.14%	-1.16%	-1.38%	152%	127%
Class E	0.13%	-1.44%	-1.77%	150%	126%
Overall	0.03%	-0.37%	-0.51%	151%	126%
Class D	0.07%	-0.50%	-0.73%	151%	132%
Class F	0.29%	-1.30%	-1.41%	147%	124%

	Random access Main10				
	Over VTM-5.0				
	Y	U	V	EncT	DecT
Class A1	-0.01%	0.12%	0.20%	142%	126%
Class A2	0.02%	-0.02%	0.00%	141%	128%
Class B	0.02%	-0.37%	-0.43%	143%	124%
Class C	0.05%	-1.08%	-1.16%	141%	125%
Overall	0.02%	-0.39%	-0.41%	142%	126%
Class D	0.02%	-0.26%	-0.41%	142%	130%
Class F	0.21%	-1.32%	-1.24%	142%	130%

	Low delay B Main10				
	Over VTM-5.0				
	Y	U	V	EncT	DecT
Class B	0.00%	0.09%	-0.20%	145%	133%
Class C	0.06%	0.45%	-0.08%	139%	131%
Class E	0.07%	-1.25%	-1.46%	142%	129%
Overall	0.04%	-0.12%	-0.47%	142%	132%
Class D	-0.09%	0.65%	0.91%	143%	135%
Class F	0.02%	-0.33%	-0.26%	135%	127%

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Summary

	Intra	Inter	CIIP	Level	Dual Tree		Y	U	V
Method 1.1	rec	pred	pred (inter)	TB	X	RA	0.01%	-0.05%	-0.05%
						LB	-0.01%	0.04%	-0.12%
Method 1.2	rec	pred	rec	TB	X	RA	0.00%	-0.02%	-0.11%
						LB	0.02%	0.06%	0.01%
Method 2.1	ref	pred	pred (inter)	TB	X	RA	0.01%	-0.05%	-0.03%
						LB	0.03%	-0.05%	0.02%
Method 2.2	ref	pred	ref	TB	X	RA	0.00%	-0.03%	-0.07%
						LB	0.01%	0.08%	-0.16%
Method 3	rec	rec	rec	VPDU	X	RA	-0.01%	0.10%	0.08%
						LB	0.00%	0.09%	-0.11%
Method 4	rec	rec	rec	VPDU	O	AI	0.03%	-0.37%	-0.51%
						RA	0.02%	-0.39%	-0.41%
						LB	0.04%	-0.12%	-0.47%