

JCTVC-R0032

**SCCE2: Summary Report of HEVC Screen
Content Coding Core Experiment 2 on
Line-based Intra Copy**

Chun-Chi Chen, Xiaozhong Xu, Li Zhang

Sapporo, Japan, 2014

* 3 tests conducted, 1 withdrawn

- JCTVC-R0132
- **Test B:** 2-D BV + PU-level Splitting (NCTU/ITRI)
- **Test C:** 2-D BV + CU-level Splitting (NCTU/ITRI, Tongji)
- **Test D:** Test C + BV Merging for Lines (NCTU/ITRI)

* Similar performance results observed in all tests

- **AI:** (G/Y) 2.3-7.1%, (Enc.) 114%, (Dec.) 101%
- **RA:**(G/Y) 1.4-4.1%, (Enc.) 103%, (Dec.) 102%
- **LB:** (G/Y) 0.6-2.6%, (Enc.) 103%, (Dec.) 102%

* 2 Non-CE contributions

- JCTVC-R0132, JCTVC-R0281

3

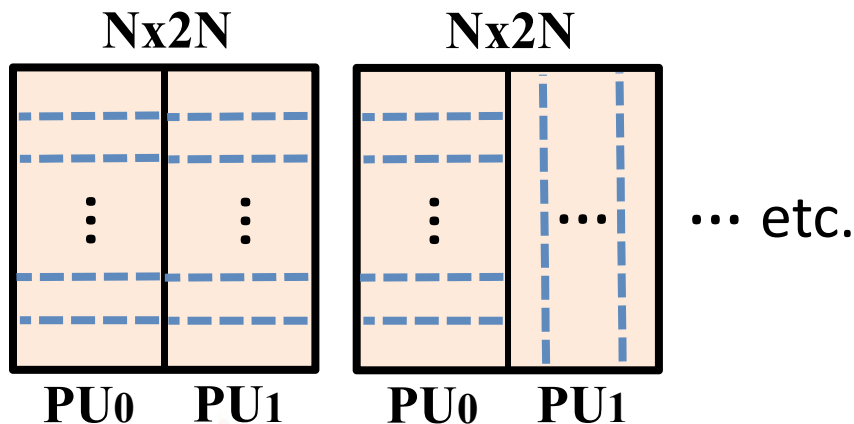
- * Split a PU into 1-pixel-wide lines (rows or columns)
- * Perform line intra copying horizontally or vertically
- * Predict BV's x or y component from last decoded BV



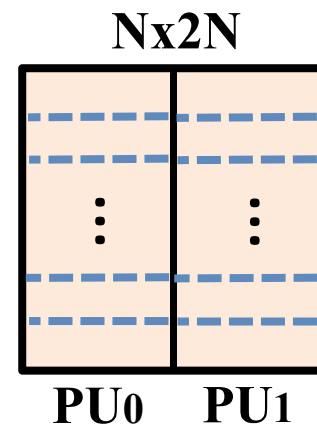
* Anchor: HM-14.0+RExt-7.0+SCM-1.0

	Splitting	BV Merging	Search Range
Test B	PU	No	* 8x8 CU * 2 CTUs (Encoder-only)
Test C	CU	No	
Test D	CU	Yes	

[PU-level Splitting]



[CU-level Splitting]



Performance Summary

Lossy (G/Y BD-rate)	All Intra			Random Access			Low Delay B		
	Test B	Test C	Test D	Test B	Test C	Test D	Test B	Test C	Test D
RGB, text & graphics w/ motion, 1080p	-7.1%	-7.0%	-6.9%	-4.1%	-4.1%	-3.9%	-2.6%	-2.5%	-2.3%
RGB, text & graphics w/ motion, 720p	-3.2%	-3.2%	-3.2%	-2.4%	-2.3%	-2.4%	-1.5%	-1.5%	-1.6%
RGB, mixed content, 1440p	-2.9%	-2.8%	-2.7%	-2.2%	-2.1%	-1.9%	-1.3%	-1.1%	-1.1%
RGB, mixed content, 1080p	-3.6%	-3.7%	-3.6%	-2.6%	-2.6%	-2.6%	-1.2%	-1.3%	-1.2%
YUV, text & graphics w/ motion, 1080p	-6.7%	-6.6%	-6.6%	-3.7%	-3.6%	-3.6%	-2.2%	-2.2%	-2.1%
YUV, text & graphics w/ motion, 720p	-2.6%	-2.5%	-2.7%	-2.0%	-2.1%	-2.0%	-0.7%	-0.9%	-0.8%
YUV, mixed content, 1440p	-2.3%	-2.2%	-2.1%	-1.4%	-1.3%	-1.3%	-0.6%	-0.7%	-0.6%
YUV, mixed content, 1080p	-3.2%	-3.2%	-3.0%	-2.4%	-2.4%	-2.3%	-0.7%	-0.5%	-0.6%
Enc Time[%]	115%	113%	115%	103%	103%	104%	103%	103%	102%
Dec Time[%]	101%	101%	103%	102%	104%	101%	102%	102%	101%

Lossless (Average Bitrate Saving)	All Intra			Random Access			Low Delay B		
	Test B	Test C	Test D	Test B	Test C	Test D	Test B	Test C	Test D
RGB, text & graphics w/ motion, 1080p	6.6%	6.5%	7.3%	4.1%	4.0%	4.6%	3.0%	3.0%	3.4%
RGB, text & graphics w/ motion, 720p	1.8%	1.7%	2.0%	1.0%	1.0%	1.2%	0.7%	0.7%	0.8%
RGB, mixed content, 1440p	1.0%	1.0%	1.1%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
RGB, mixed content, 1080p	1.3%	1.3%	1.4%	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%
YUV, text & graphics w/ motion, 1080p	6.6%	6.5%	7.4%	4.2%	4.1%	4.7%	3.1%	3.1%	3.6%
YUV, text & graphics w/ motion, 720p	2.1%	2.1%	2.4%	1.3%	1.3%	1.5%	0.9%	0.9%	1.0%
YUV, mixed content, 1440p	1.0%	1.0%	1.1%	0.2%	0.2%	0.2%	0.1%	0.2%	0.2%
YUV, mixed content, 1080p	1.3%	1.3%	1.4%	0.2%	0.2%	0.3%	0.1%	0.1%	0.1%
Enc Time[%]	122%	121%	117%	103%	104%	102%	102%	102%	101%
Dec Time[%]	102%	99%	98%	102%	104%	102%	101%	102%	102%

- * All tests reports similar performance and runtime results
- * Test C impacts less on the current syntax
- * Recommend to
 - 1) Further study the technique in Test C
 - 2) Present the Non-CE contributions JCTVC-R0132 and JCTVC-R0281 which provide more results for Test C and Test D, respectively

Appendix: Full Results

Lossy	Test B			Test C			Test D		
	G/Y	B/U	R/V	G/Y	B/U	R/V	G/Y	B/U	R/V
RGB, text & graphics w/ motion, 1080p	-7.1%	-7.1%	-7.1%	-7.0%	-7.0%	-6.9%	-6.9%	-6.9%	-6.9%
RGB, text & graphics w/ motion,720p	-3.2%	-3.1%	-3.1%	-3.2%	-3.2%	-3.2%	-3.2%	-3.2%	-3.3%
RGB, mixed content, 1440p	-2.9%	-2.9%	-2.9%	-2.8%	-2.7%	-2.8%	-2.7%	-2.6%	-2.7%
RGB, mixed content, 1080p	-3.6%	-3.8%	-3.9%	-3.7%	-3.8%	-3.8%	-3.6%	-3.6%	-3.7%
RGB, Animation, 720p	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%
YUV, text & graphics w/ motion, 1080p	-6.7%	-6.6%	-6.6%	-6.6%	-6.5%	-6.5%	-6.6%	-6.6%	-6.5%
YUV, text & graphics w/ motion,720p	-2.6%	-2.9%	-3.4%	-2.5%	-3.0%	-3.3%	-2.7%	-3.0%	-3.3%
YUV, mixed content, 1440p	-2.3%	-2.7%	-2.9%	-2.2%	-2.7%	-2.9%	-2.1%	-2.6%	-2.8%
YUV, mixed content, 1080p	-3.2%	-3.9%	-3.7%	-3.2%	-3.9%	-3.7%	-3.0%	-3.7%	-3.6%
YUV, Animation, 720p	0.0%	-0.1%	-0.1%	0.0%	-0.1%	-0.1%	-0.1%	-0.2%	-0.2%
Enc Time[%]	115%			113%			115%		
Dec Time[%]	101%			101%			103%		

Lossless	Test B			Test C			Test D		
	Avg.	Min	Max	Avg.	Min	Max	Avg.	Min	Max
RGB, text & graphics w/ motion, 1080p	6.6%	4.3%	10.4%	6.5%	4.3%	10.2%	7.3%	4.9%	11.2%
RGB, text & graphics w/ motion,720p	1.8%	0.5%	3.3%	1.7%	0.5%	3.2%	2.0%	0.5%	3.8%
RGB, mixed content, 1440p	1.0%	0.6%	1.4%	1.0%	0.6%	1.4%	1.1%	0.6%	1.6%
RGB, mixed content, 1080p	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.4%	1.4%	1.4%
RGB, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, text & graphics w/ motion, 1080p	6.6%	4.3%	10.3%	6.5%	4.3%	9.9%	7.4%	5.0%	11.1%
YUV, text & graphics w/ motion,720p	2.1%	0.4%	4.8%	2.1%	0.4%	4.6%	2.4%	0.5%	5.5%
YUV, mixed content, 1440p	1.0%	0.5%	1.4%	1.0%	0.5%	1.4%	1.1%	0.5%	1.6%
YUV, mixed content, 1080p	1.3%	1.3%	1.3%	1.3%	1.3%	1.3%	1.4%	1.4%	1.4%
YUV, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Enc Time[%]	122%			121%			117%		
Dec Time[%]	102%			99%			98%		

Lossy	Test B			Test C			Test D		
	G/Y	B/U	R/V	G/Y	B/U	R/V	G/Y	B/U	R/V
RGB, text & graphics w/ motion, 1080p	-4.1%	-4.1%	-4.2%	-4.1%	-4.0%	-4.0%	-3.9%	-3.9%	-3.9%
RGB, text & graphics w/ motion,720p	-2.4%	-2.2%	-2.4%	-2.3%	-2.2%	-2.4%	-2.4%	-2.3%	-2.3%
RGB, mixed content, 1440p	-2.2%	-2.0%	-2.1%	-2.1%	-1.9%	-1.9%	-1.9%	-1.8%	-1.9%
RGB, mixed content, 1080p	-2.6%	-2.8%	-2.7%	-2.6%	-2.7%	-2.7%	-2.6%	-2.6%	-2.7%
RGB, Animation, 720p	0.0%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%
YUV, text & graphics w/ motion, 1080p	-3.7%	-4.0%	-3.9%	-3.6%	-3.9%	-3.9%	-3.6%	-3.8%	-3.8%
YUV, text & graphics w/ motion,720p	-2.0%	-2.3%	-2.5%	-2.1%	-2.6%	-2.6%	-2.0%	-2.4%	-2.5%
YUV, mixed content, 1440p	-1.4%	-2.1%	-2.3%	-1.3%	-2.4%	-2.1%	-1.3%	-2.1%	-2.2%
YUV, mixed content, 1080p	-2.4%	-3.4%	-3.1%	-2.4%	-3.1%	-3.0%	-2.3%	-3.1%	-3.1%
YUV, Animation, 720p	0.0%	-0.2%	0.0%	-0.1%	-0.2%	0.0%	0.0%	-0.2%	0.1%
Enc Time[%]	103%			103%			104%		
Dec Time[%]	102%			104%			101%		

Lossless	Test B			Test C			Test D		
	Avg.	Min	Max	Avg.	Min	Max	Avg.	Min	Max
RGB, text & graphics w/ motion, 1080p	4.1%	1.7%	7.6%	4.0%	1.7%	7.4%	4.6%	2.0%	8.3%
RGB, text & graphics w/ motion,720p	1.0%	0.3%	2.8%	1.0%	0.3%	2.7%	1.2%	0.3%	3.2%
RGB, mixed content, 1440p	0.2%	0.1%	0.3%	0.2%	0.1%	0.4%	0.2%	0.1%	0.3%
RGB, mixed content, 1080p	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
RGB, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, text & graphics w/ motion, 1080p	4.2%	2.0%	7.7%	4.1%	2.0%	7.5%	4.7%	2.3%	8.5%
YUV, text & graphics w/ motion,720p	1.3%	0.3%	4.1%	1.3%	0.3%	3.9%	1.5%	0.3%	4.7%
YUV, mixed content, 1440p	0.2%	0.1%	0.3%	0.2%	0.1%	0.3%	0.2%	0.1%	0.3%
YUV, mixed content, 1080p	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%	0.3%	0.3%
YUV, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Enc Time[%]	103%			104%			102%		
Dec Time[%]	102%			104%			102%		

Lossy	Test B			Test C			Test D		
	G/Y	B/U	R/V	G/Y	B/U	R/V	G/Y	B/U	R/V
RGB, text & graphics w/ motion, 1080p	-2.6%	-2.6%	-2.5%	-2.5%	-2.4%	-2.3%	-2.3%	-2.3%	-2.1%
RGB, text & graphics w/ motion,720p	-1.5%	-1.4%	-1.4%	-1.5%	-1.4%	-1.5%	-1.6%	-1.4%	-1.5%
RGB, mixed content, 1440p	-1.3%	-1.4%	-1.2%	-1.1%	-1.3%	-1.1%	-1.1%	-1.1%	-1.0%
RGB, mixed content, 1080p	-1.2%	-1.3%	-1.3%	-1.3%	-1.3%	-1.3%	-1.2%	-1.3%	-1.2%
RGB, Animation, 720p	-0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, text & graphics w/ motion, 1080p	-2.2%	-2.3%	-2.4%	-2.2%	-2.4%	-2.5%	-2.1%	-2.3%	-2.3%
YUV, text & graphics w/ motion,720p	-0.7%	-1.3%	-1.5%	-0.9%	-1.1%	-1.8%	-0.8%	-1.2%	-1.8%
YUV, mixed content, 1440p	-0.6%	-1.6%	-1.9%	-0.7%	-1.7%	-1.8%	-0.6%	-1.4%	-1.5%
YUV, mixed content, 1080p	-0.7%	-2.4%	-0.8%	-0.5%	-2.0%	-0.4%	-0.6%	-2.2%	-0.7%
YUV, Animation, 720p	0.0%	-0.4%	-0.1%	-0.1%	-0.5%	-0.2%	-0.1%	-0.4%	0.0%
Enc Time[%]	103%			103%			102%		
Dec Time[%]	102%			103%			101%		

Lossless	Test B			Test C			Test D		
	Avg.	Min	Max	Avg.	Min	Max	Avg.	Min	Max
RGB, text & graphics w/ motion, 1080p	3.0%	1.3%	5.0%	3.0%	1.3%	4.9%	3.4%	1.4%	5.6%
RGB, text & graphics w/ motion,720p	0.7%	0.2%	1.9%	0.7%	0.2%	1.8%	0.8%	0.3%	2.1%
RGB, mixed content, 1440p	0.2%	0.0%	0.3%	0.2%	0.0%	0.3%	0.2%	0.0%	0.3%
RGB, mixed content, 1080p	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
RGB, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, text & graphics w/ motion, 1080p	3.1%	1.5%	5.3%	3.1%	1.6%	5.1%	3.6%	1.8%	5.9%
YUV, text & graphics w/ motion,720p	0.9%	0.2%	2.7%	0.9%	0.2%	2.6%	1.0%	0.2%	2.9%
YUV, mixed content, 1440p	0.1%	0.0%	0.3%	0.2%	0.0%	0.3%	0.2%	0.0%	0.3%
YUV, mixed content, 1080p	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
YUV, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Enc Time[%]	102%			102%			101%		
Dec Time[%]	101%			102%			102%		