

COMBINED TESTS OF JVET-L0046 AND JVET-L0047 (JVET-K0048)



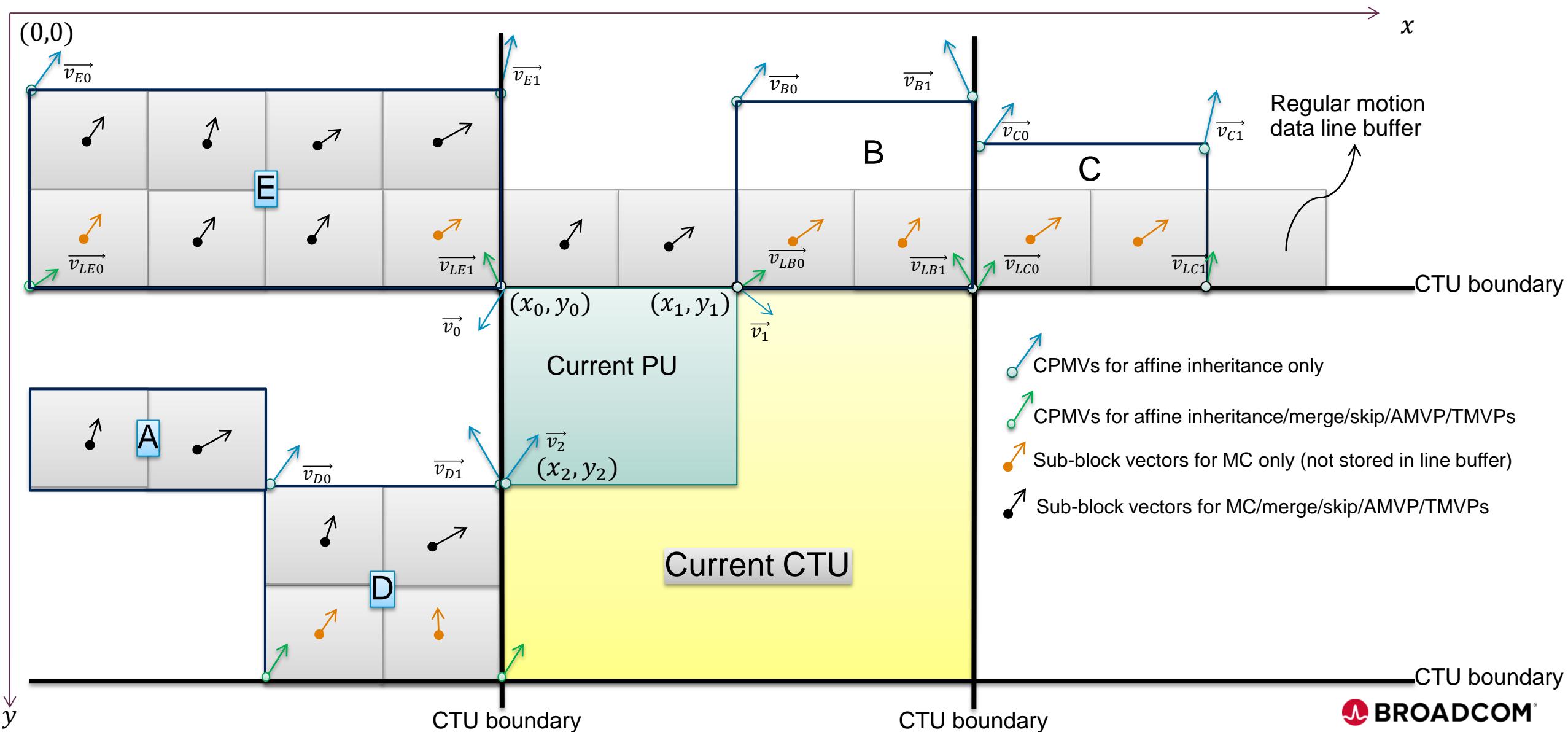
Minhua Zhou

Broadcom Inc.

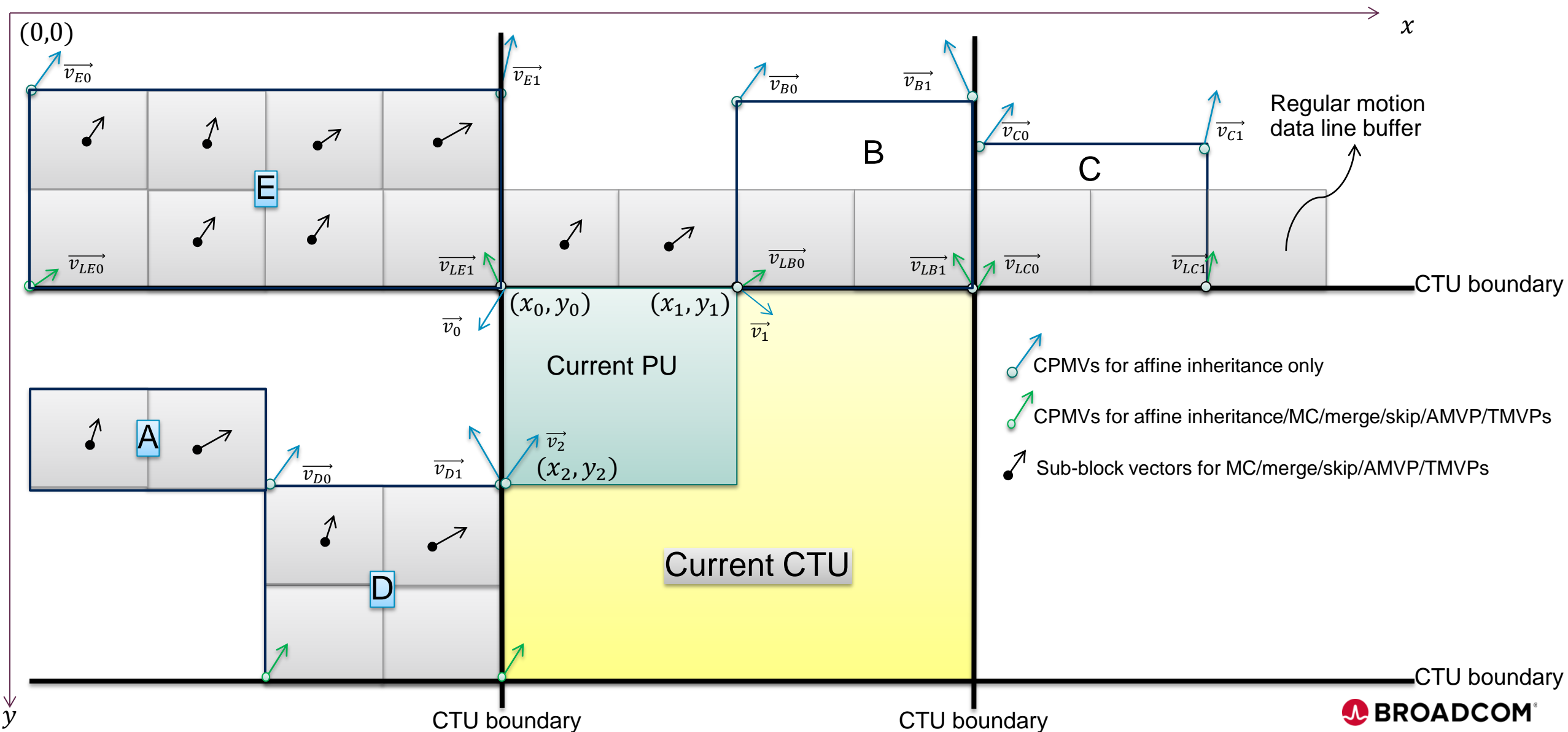
Combined Tests

- Combined tests integrate the line buffer reduction algorithm of JVET-L0046 and the clean-up algorithms of JVET-L0047 together
 - 1) **Combined test 1:** combines the line buffer reduction method described in JVET-L0046 and clean-up method 1 described in JVET-L0047. For a PU coded in affine mode and located at the top CTU boundary, the bottom-left and bottom-right CPMVs are used for the affine inheritance, merge/skip/AMVP list derivation and storage of TMVPs, **but sub-block vectors are used for motion compensation.**
 - 2) **Combined test 2:** combines the line buffer reduction method described in JVET-L0046 and clean-up method 1 described in JVET-L0047. For a PU coded in affine mode and located at the top CTU boundary, the bottom-left and bottom-right CPMVs are used for the affine inheritance, merge/skip/AMVP list derivation and storage of TMVPs, **as well as for motion compensation.**
 - 3) **Combined test 3:** combines the line buffer reduction method described in JVET-L0046 and clean-up method 2 described in JVET-L0047. In all the cases the CPMVs, including the bottom-left and bottom-right CPMVs stored in the motion data line buffer, are used for the affine inheritance, merge/skip/AMVP list derivation and storage of TMVPs, as well as for motion compensation of corner sub-blocks.

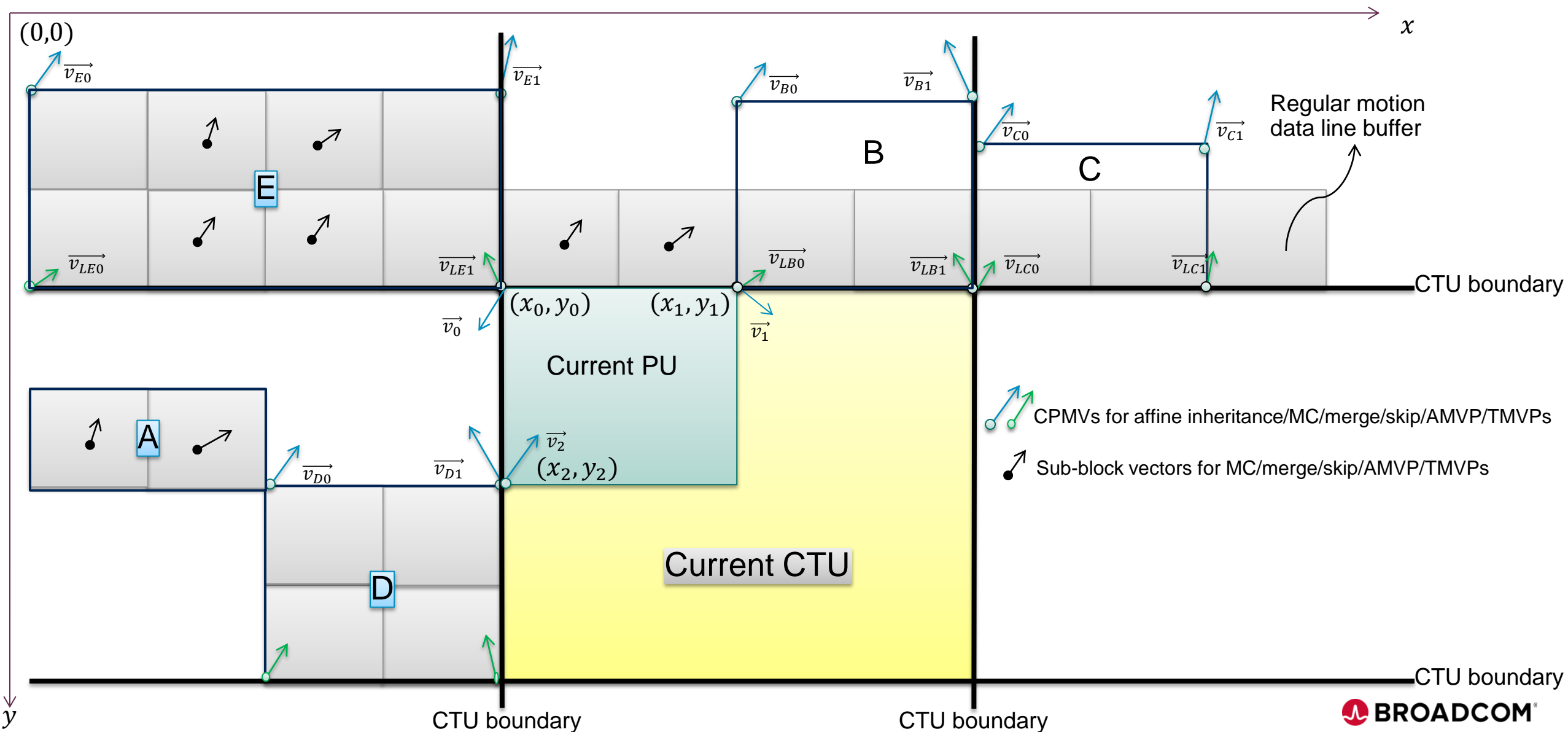
Motion Vector Usage in Combined Test 1



Motion Vector Usage in Combined Test 2



Motion Vector Usage in Combined Test 3



Memory Buffer Reduction Analysis

- About 9 K bytes line buffer reduction for 4K video (common to all the three tests)
- Local CPMV/sub-block MV buffer reduction (see JVET-L0047)
 - Combined tests 1 and test 2: 1,536 bytes
 - Combined test 3: 1536 + 768 bytes

Luma picture width = 4096		line buffer for merge/skip and AMVP mode		line buffer for affine mode in VTM2.0.1		line buffer for affine mode after simplification	
	Bits/unit	Number of units per 4 luma samples	list0 & list1 line buffer size (bytes)	Number of units per 8 luma samples	list0 & list1 line buffer size (bytes)	Number of units per 8 luma samples	list0 & list1 line buffer size (bytes)
sub-block MVs/CPMVs	32	2	8192	4	8192	0	0
Reference index	4	2	1024	2	512	0	0
PU width	4	0	0	1	256	1	256
PU height	4	0	0	1	256	0	0
Total (bytes)			9216		9216		256

Experimental Results (VTM2.0.1 code base)

- Left – Combined test 1 (peak loss 0.13% in RA) and Right - Combined test 2 (peak loss 0.11% in RA)

	Random Access Main 10				
	Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class A1	-0.02%	0.10%	-0.08%	101%	99%
Class A2	0.08%	0.03%	0.00%	99%	102%
Class B	0.01%	0.00%	0.01%	98%	99%
Class C	0.03%	0.05%	0.05%	102%	108%
Class E					
Overall	0.02%	0.04%	0.00%	100%	102%
Class D	0.02%	-0.02%	0.04%	104%	110%
Class F (optional)	0.00%	-0.04%	-0.04%	97%	95%

	Low delay B Main10				
	Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	0.02%	0.01%	0.00%	95%	101%
Class C	0.01%	0.04%	-0.10%	89%	98%
Class E	-0.20%	0.04%	-0.69%	102%	112%
Overall	-0.04%	0.03%	-0.21%	95%	102%
Class D	0.01%	0.19%	-0.74%	99%	96%
Class F (optional)	-0.07%	0.35%	0.66%	104%	112%

	Low delay P Main10				
	Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	-0.01%	0.14%	0.31%	98%	101%
Class C	0.01%	-0.10%	0.03%	92%	91%
Class E	-0.01%	-0.17%	0.19%	89%	91%
Overall	0.00%	-0.02%	0.19%	94%	95%
Class D	0.04%	0.26%	-0.09%	98%	93%
Class F (optional)	0.09%	-0.36%	0.19%	98%	97%

	Random Access Main 10				
	Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class A1	0.01%	0.07%	-0.01%	101%	98%
Class A2	0.06%	0.07%	-0.01%	93%	95%
Class B	0.03%	0.02%	-0.09%	101%	103%
Class C	0.02%	0.14%	0.00%	102%	101%
Class E					
Overall	0.03%	0.07%	-0.04%	100%	100%
Class D	0.05%	0.10%	0.15%	99%	97%
Class F (optional)	0.01%	-0.06%	-0.04%	97%	100%

	Low delay B Main10				
	Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	0.03%	-0.03%	-0.23%	101%	108%
Class C	0.03%	-0.02%	-0.01%	87%	90%
Class E	-0.15%	0.03%	-0.35%	101%	101%
Overall	-0.01%	-0.01%	-0.19%	96%	100%
Class D	0.03%	0.68%	-0.14%	102%	103%
Class F (optional)	-0.12%	0.30%	0.55%	101%	104%

	Low delay P Main10				
	Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	-0.02%	0.16%	0.20%	97%	103%
Class C	0.00%	-0.04%	-0.13%	96%	101%
Class E	0.01%	-0.19%	0.29%	92%	96%
Overall	-0.01%	0.00%	0.11%	96%	100%
Class D	0.10%	0.07%	-0.69%	98%	100%
Class F (optional)	0.10%	-0.11%	0.34%	99%	96%

Experimental Results (VTM2.0.1 code base)- Cont.

- Combined test 3 (peak loss 0.39% in RA)

	Random Access Main 10				
	Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class A1	0.02%	0.06%	-0.03%	96%	93%
Class A2	0.14%	0.00%	0.02%	99%	99%
Class B	0.10%	0.08%	0.09%	94%	93%
Class C	0.07%	0.19%	0.05%	96%	95%
Class E					
Overall	0.08%	0.09%	0.04%	96%	95%
Class D	0.16%	0.08%	-0.02%	102%	100%
Class F (optional)	0.08%	0.06%	0.09%	93%	91%

	Low delay B Main10				
	Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	0.05%	0.02%	-0.15%	93%	97%
Class C	0.06%	-0.10%	0.14%	80%	80%
Class E	-0.09%	-0.21%	-0.53%	102%	102%
Overall	0.02%	-0.08%	-0.15%	91%	92%
Class D	0.11%	0.43%	-0.24%	104%	99%
Class F (optional)	0.07%	0.29%	0.79%	102%	110%

	Low delay P Main10				
	Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	0.02%	0.10%	0.21%	100%	101%
Class C	0.08%	-0.09%	0.02%	105%	99%
Class E	0.02%	0.21%	0.41%	88%	87%
Overall	0.04%	0.07%	0.20%	99%	97%
Class D	0.17%	0.49%	0.12%	102%	100%
Class F (optional)	0.24%	0.06%	0.51%	92%	90%

Recommendation

- Combined test 1 or test 2 is recommended for a more consistent and implementation friendly design of affine mode without comprising coding efficiency
 - 1) Memory buffer saving by ~10.5 Kbytes.
 - 2) Avoiding duplicated sub-block vector derivation.
 - 3) Less conditional checking in the merge/skip/AMVP/affine merge/affine AMVP list derivation of memory usage optimized decoder implementations.

Thanks to InterDigital for cross-check