

Modification of mv memory compression & temporal mv predictor

(JCTVC-E059)

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Introduction

- **Temporal MV memory compression**
 - Reduction of storage for temporal motion vectors
 - 0.4% ~ 0.7% coding loss
 - **Centered temporal MV predictor**
 - Position change of temporal MV predictor changed to the center of the block
 - About 1% coding gain
 - **Proposals (4 modifications)**
 - Reference index buffer compression
 - Changing the position of representative mv
 - Replacing zero mv by neighbor inter blk
 - Changing the position of centered temporal predictor
- } *MV memory compression*
- } *Centered temporal MV predictor*

Modification of mv memory compression

- **Temporal motion vector memory compression**

- All blocks share same mv within a predefined region
- No change in reference index memory
- Inconsistency between mv and reference index → Improper scaling for temporal mv predictor

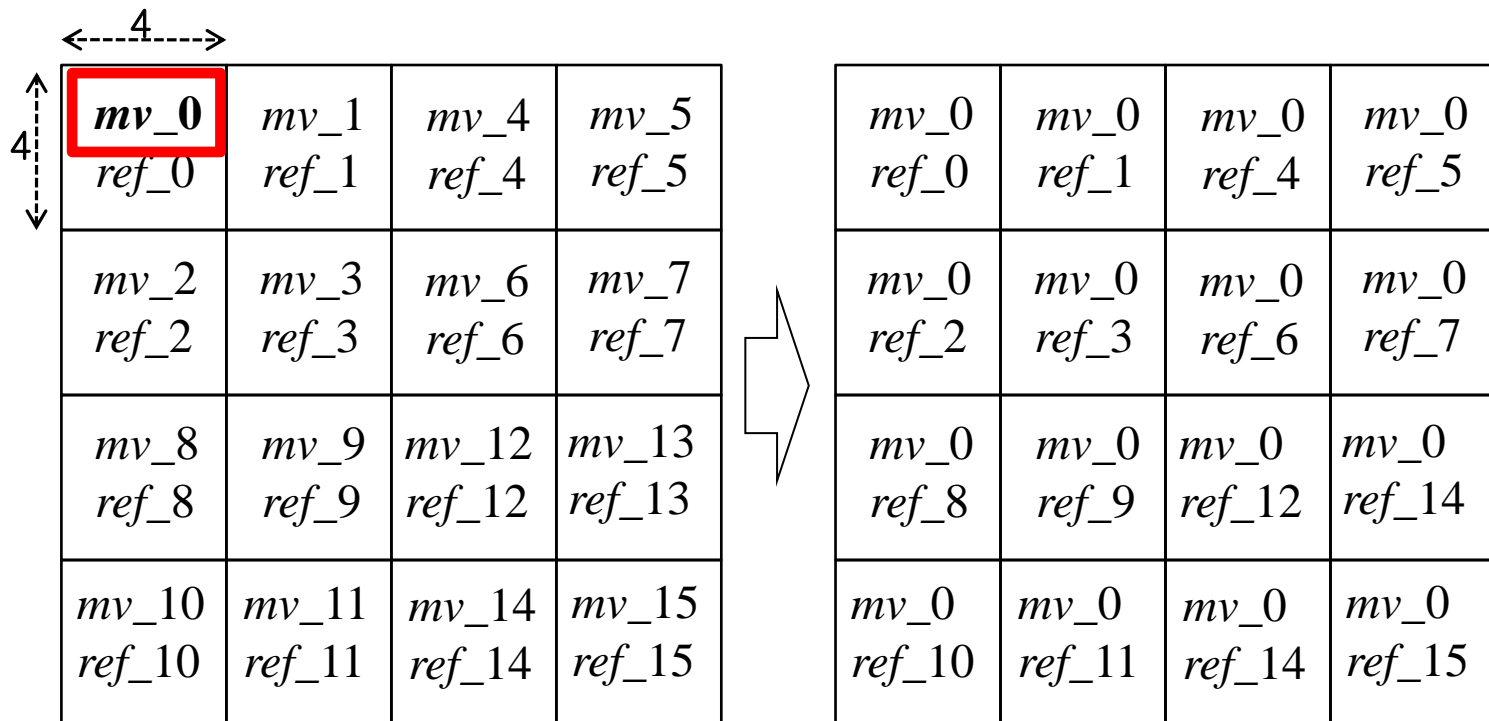


Figure 1. Temporal mv memory compression (e.g. motion_vector_buffer_comp_ratio = 4)

Modification of mv memory compression

- Reference index memory compression (**Modification 1**)
 - Following the same manner of mv memory compression
 - No syntax and semantics change
 - Same solution by JCTVC-E221, E147, E211 and E307

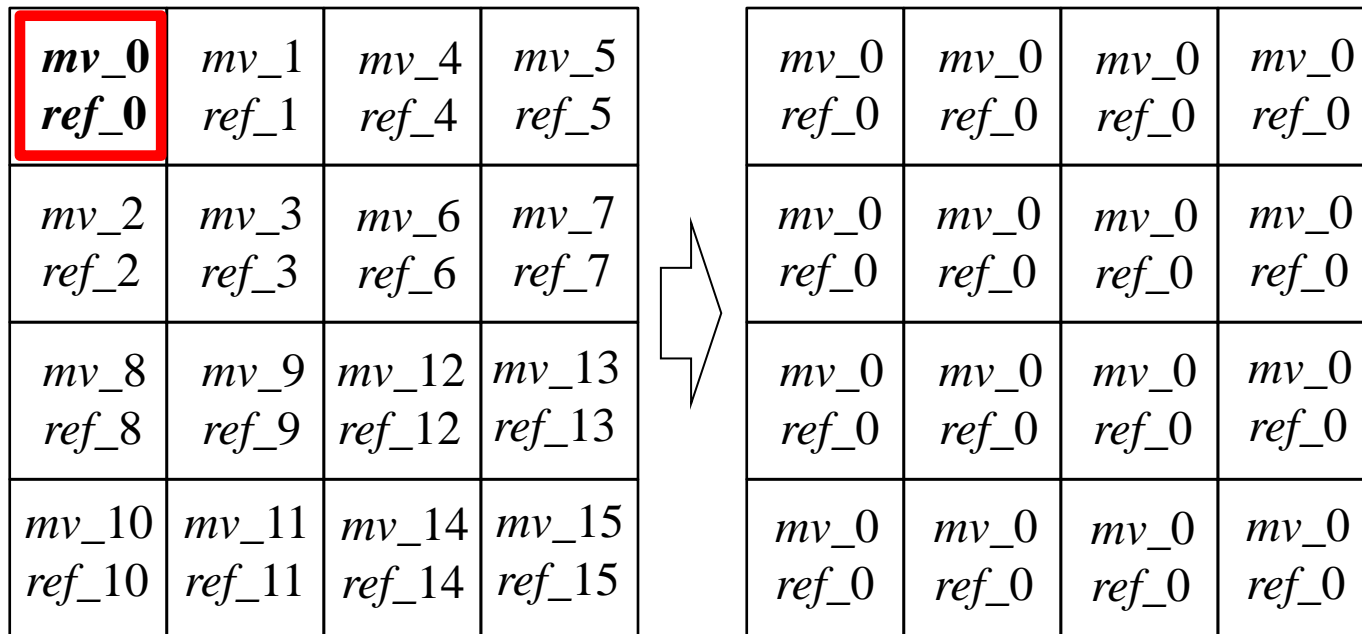


Figure 2. Reference index memory compression

Modification of mv memory compression

- Changing the position of representative mv (*Modification 2*)
 - Upper-left corner block used as a representative mv
 - Centered temporal mv predictor provides better coding performance
 - Applying the same concept into mv memory compression scheme

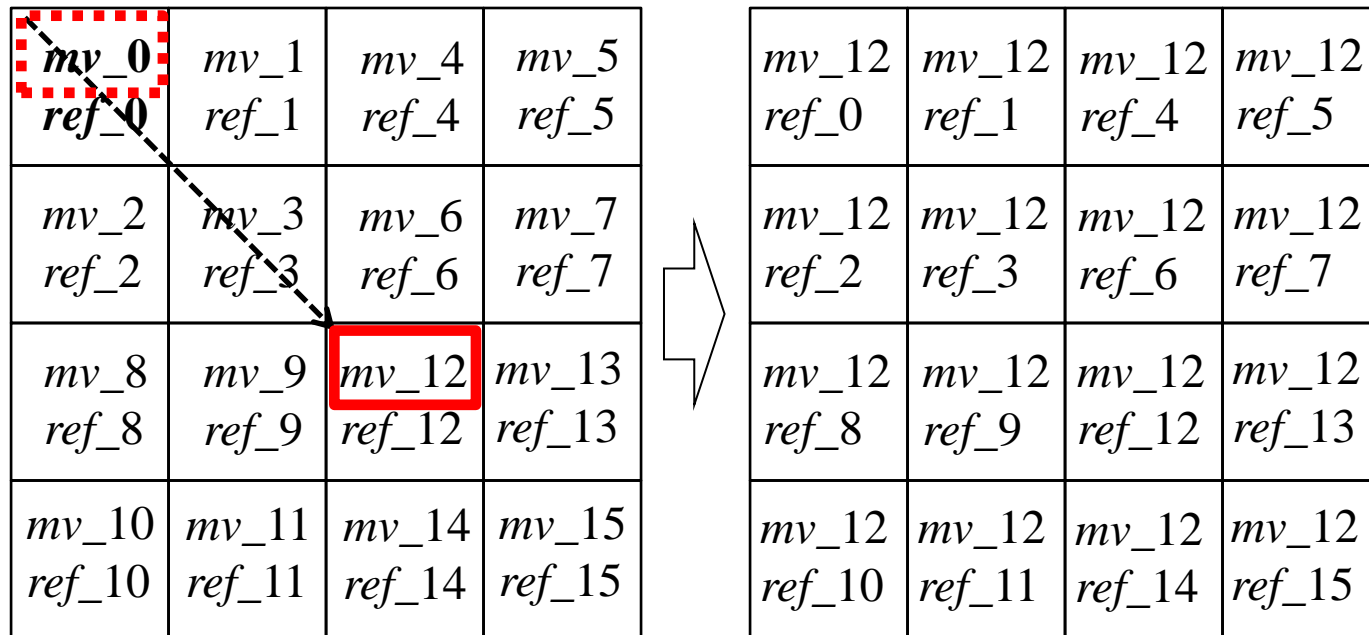


Figure 3. Position change of representative block (option 1)

Modification of mv memory compression

- Changing the position of representative mv (**Modification 2**)
 - Option 2: using right-bottom block as a representative block
 - Same performance in option 1 and option 2 with a combination of modification 1
 - Same solution by JCTVC-E221, E147, E211, E092 and E307

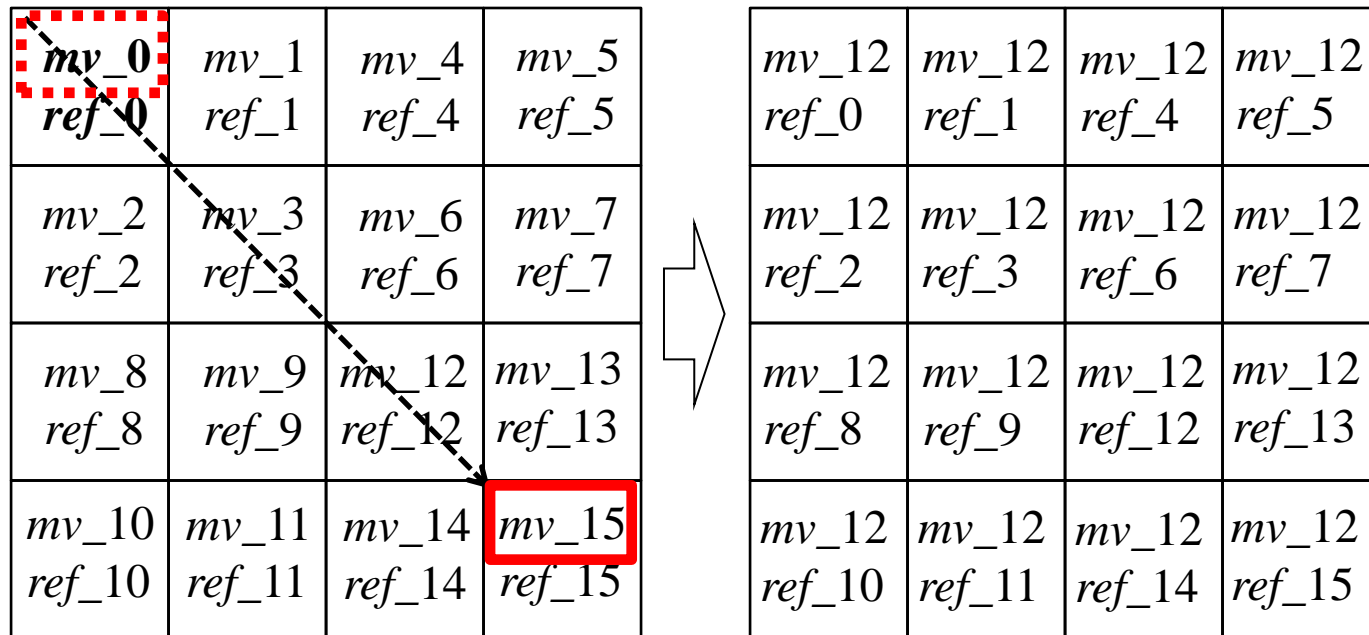


Figure 3. Position change of representative block (option 2)

Modification of mv memory compression

- **Replacing zero mv of intra blk by neighbor inter blk (*Modification 3*)**
 - If a representative blk coded as Intra, all blocks will have zero-mv neglecting neighbor inter blocks
 - Using mv of neighbor Inter block instead of zero-mv of Intra block

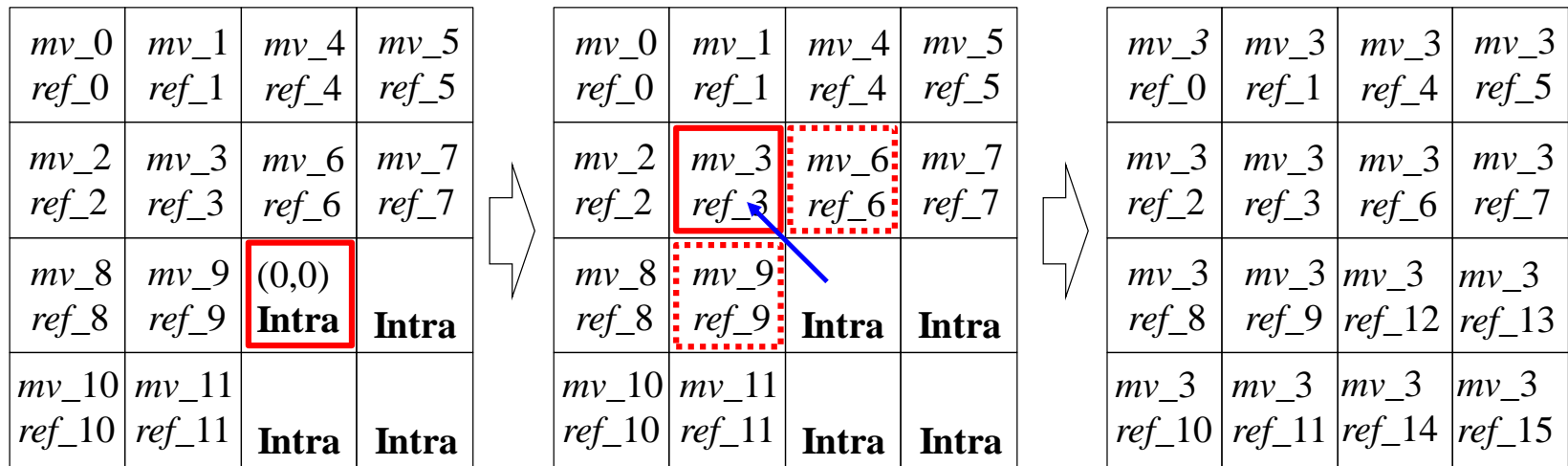


Figure 3. Replacing zero mv by mv of inter blk

Modification of temporal mv predictor

- **Changing position of centered temporal predictor (*Modification 4*)**
 - Currently, left top of center position is used as centered temporal predictor.
 - Better position of temporal predictor is right bottom blk of center position.

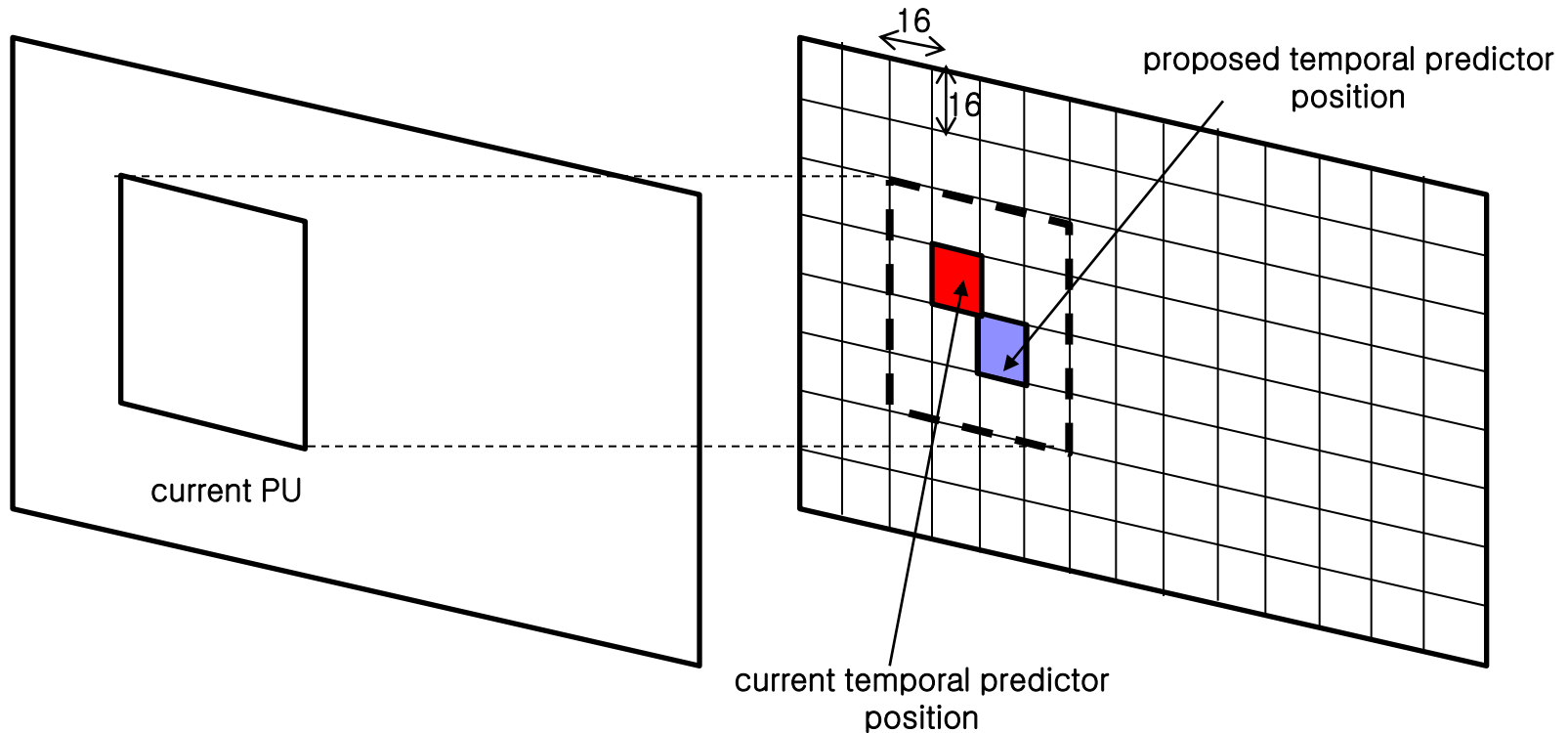


Figure 4. Position change of centered temporal mv predictor

Test conditions

- **Anchor : HM 2.0**
- **Common test condition (JCTVC-D600)**
- **Thank TI & MediaTek for cross-checking**

Result 1 : Tool 1 (Reference index buffer compression)

	Random access			Random access LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	0.0	0.1	-0.1	0.0	0.0	0.0
Class B	0.0	0.0	0.0	0.0	0.0	0.0
Class C	-0.1	0.0	0.0	0.0	0.0	0.0
Class D	-0.1	0.0	-0.1	-0.1	-0.1	-0.2
Class E						
All	0.0	0.0	-0.1	0.0	0.0	0.0
Enc Time[%]	100%			100%		
Dec Time[%]	101%			100%		

	Low delay			Low delay LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	0.0	0.1	0.2	-0.1	0.0	0.1
Class C	-0.1	0.1	0.0	-0.2	-0.1	-0.2
Class D	-0.2	-0.2	-0.3	-0.1	-0.4	-0.1
Class E	-0.1	-0.5	0.2	0.1	-0.3	-0.2
All	-0.1	-0.1	0.0	-0.1	-0.2	-0.1
Enc Time[%]	100%			100%		
Dec Time[%]	101%			101%		

Result 2 : Tool 2 (Position change of representative mv)

	Random access			Random access LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	-0.3	-0.2	-0.3	-0.4	-0.4	-0.3
Class B	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1
Class C	-0.3	-0.3	-0.4	-0.3	-0.2	-0.3
Class D	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Class E						
All	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3
Enc Time[%]	100%			99%		
Dec Time[%]	101%			100%		

	Low delay			Low delay LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	-0.3	0.0	-0.2	-0.2	-0.2	0.3
Class C	-0.5	-0.3	-0.4	-0.5	-0.6	-0.8
Class D	-0.6	-0.7	-0.5	-0.5	-0.9	-0.9
Class E	-0.4	-0.2	-0.3	-0.5	-0.6	-0.2
All	-0.4	-0.3	-0.4	-0.4	-0.6	-0.4
Enc Time[%]	100%			100%		
Dec Time[%]	101%			101%		

Result 3 : Tool 2 + Tool 3 (Replacing zero mv by Inter blk)

	Random access			Random access LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	-0.4	-0.3	-0.7	-0.4	-0.3	-0.3
Class B	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1
Class C	-0.4	-0.3	-0.4	-0.4	-0.4	-0.4
Class D	-0.5	-0.5	-0.5	-0.6	-0.6	-0.6
Class E						
All	-0.4	-0.3	-0.4	-0.4	-0.3	-0.3
Enc Time[%]	100%			100%		
Dec Time[%]	100%			100%		

	Low delay			Low delay LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	-0.3	-0.2	-0.6	-0.2	-0.3	-0.2
Class C	-0.6	-0.4	-0.6	-0.6	-0.7	-0.7
Class D	-0.6	-0.4	-0.8	-0.6	-0.8	-0.5
Class E	-0.7	-1.1	-0.2	-0.4	-0.4	-0.5
All	-0.5	-0.4	-0.5	-0.5	-0.5	-0.5
Enc Time[%]	99%			99%		
Dec Time[%]	100%			100%		

Result 4 : Tool 1+ Tool 2 + Tool 3

	Random access			Random access LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	-0.4	-0.3	-0.6	-0.5	-0.4	-0.4
Class B	-0.3	-0.3	-0.2	-0.3	-0.1	-0.2
Class C	-0.6	-0.5	-0.5	-0.6	-0.5	-0.5
Class D	-0.8	-0.8	-0.7	-0.9	-0.9	-0.9
Class E						
All	-0.5	-0.4	-0.5	-0.5	-0.5	-0.5
Enc Time[%]	100%			99%		
Dec Time[%]	100%			100%		

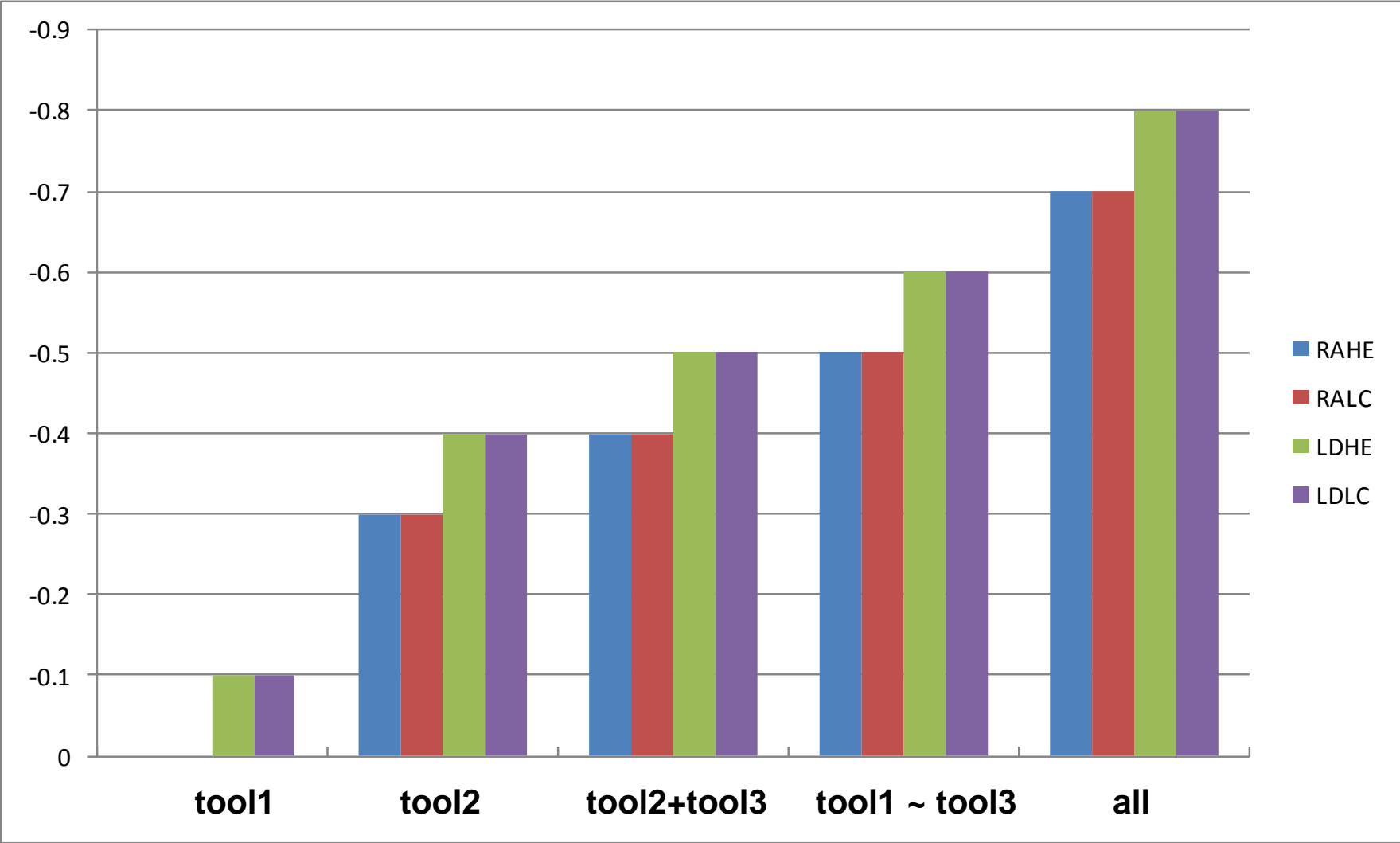
	Low delay			Low delay LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	-0.4	-0.2	-0.5	-0.4	-0.5	-0.3
Class C	-0.7	-0.6	-0.5	-0.9	-1.0	-1.0
Class D	-0.9	-0.8	-1.0	-0.8	-1.1	-0.7
Class E	-0.6	-0.8	-0.6	-0.4	-0.9	-0.5
All	-0.6	-0.6	-0.6	-0.6	-0.8	-0.6
Enc Time[%]	99%			97%		
Dec Time[%]	100%			100%		

Result 5 : Tool 1 ~ Tool 4(changing position of temporal predictor)

	Random access			Random access LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	-0.6	-0.5	-0.7	-0.7	-0.7	-0.7
Class B	-0.4	-0.4	-0.3	-0.4	-0.3	-0.3
Class C	-0.7	-0.6	-0.7	-0.7	-0.6	-0.7
Class D	-1.0	-0.9	-1.0	-1.0	-0.9	-0.9
Class E						
All	-0.7	-0.6	-0.7	-0.7	-0.6	-0.6
Enc Time[%]	100%			99%		
Dec Time[%]	101%			101%		

	Low delay			Low delay LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	-0.5	-0.4	-0.6	-0.6	-0.6	-0.4
Class C	-0.8	-0.7	-0.9	-1.0	-1.1	-1.2
Class D	-0.9	-0.3	-0.7	-0.9	-0.9	-0.6
Class E	-0.9	-1.0	-0.9	-0.7	-0.5	-0.8
All	-0.8	-0.6	-0.7	-0.8	-0.8	-0.7
Enc Time[%]	99%			99%		
Dec Time[%]	101%			101%		

Overall gains



Conclusion

- **Proposed four modifications**
 - Reference index buffer compression
 - Changing the position of representative mv
 - Replacing zero mv by neighbor inter blk
 - Changing the position of centered temporal predictor
- **Avg 0.8% BD-rate saving with reference index buffer compression (no complexity impact)**
- **Suggest inclusion of all modifications in the HM design**

Annex

