

JCTVC-F325

# Modified temporal MV derivation process for merge/skip mode

*Taichiro Shiodera*

*Akiyuki Tanizawa*

*Takeshi Chujoh*

*Tomoo Yamakage*

**TOSHIBA**

Leading Innovation >>>

# Summary

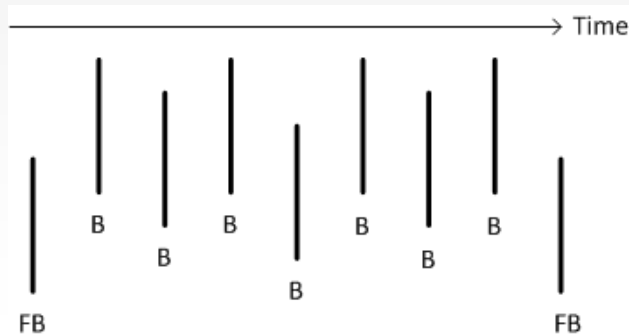
- Problem:
  - Same motion information can be set to list 0 and 1 in forward B-slice → Redundancy of motion compensation
- Modified temporal MV derivation for merge/skip
  - Proposal 1: Change uni-prediction from bi-prediction  
→ reduce computational complexity of redundant motion compensation process
  - Proposal 2: Modify MV derivation of bi-prediction for list 1  
→ improve coding efficiency

LB-LC	Proposal 1	Proposal 2	Proposal 1&2
Y BD-Rate	0.0%	-0.3%	-0.3%
Enc Time	99%	100%	99%
Dec Time	94%	100%	96%

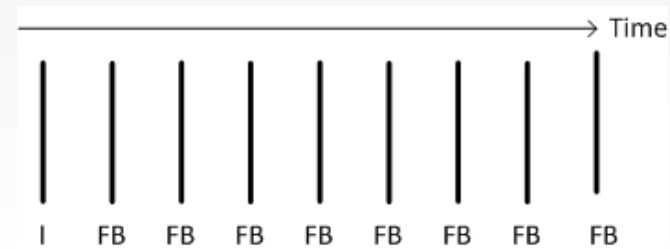
LB-HE	Proposal 1	Proposal 2	Proposal 1&2
Y BD-Rate	0.0%	-0.2%	-0.2%
Enc Time	99%	100%	99%
Dec Time	96%	100%	98%

# Introduction

- Forward B-Slice (FB-slice)
  - Use forward bi-prediction with reference list 0 and 1
  - Use same reference picture list for list 0 and 1
    - RefPicList0 is equal to RefPicList1.



RA case



LB case

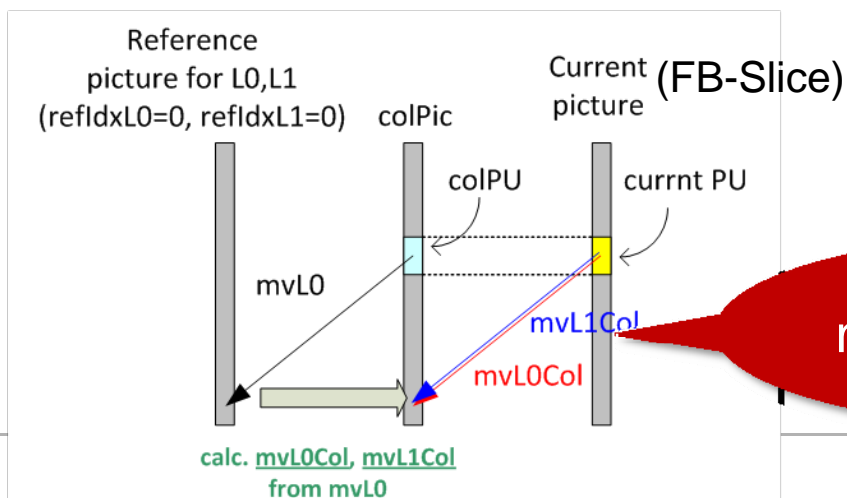
- Temporal Merge/Skip mode
  - Reuse temporal motion information of reference picture (colPic).
  - Motion information (MV and refIdx) are not signaled.
- There are some redundancies to be modified for temporal merge/skip mode in FB-Slices.

## Derivation process for temporal Merge/Skip mode in HM3

- When co-located partition (colPU) of current PU is coded using list 0 uni-prediction, list 0 MV predictor of colPU is set to not only list 0 MV predictor but also list 1 MV predictor.
- In FB-slices, motion information which includes (MV, refIdx) of list 0 is often identical with one of list 1.



- In the case of merge/skip mode, since mvd and refIdx are not signaled, reference blocks of list 0 and list 1 are same position  
→ **Predicted values of uni-prediction are identical to ones of bi-prediction**



$$mvL0Col = mvL1Col$$

# Proposal 1: change to uni-prediction from bi-prediction

- If reference blocks of list 0 and 1 are same, the inter prediction mode of current PU is changed to uni-prediction from bi-prediction
  - Need both refIdx (POC number) and MV information for this decision at the end of MV derivation process.
- Objective -- reduce computational complexity of redundant motion compensation process

Inter prediction mode	Bi-prediction	
MV	MvL0	MvL1
RefIdx	RefIdxL0	RefIdxL1

Complexity of Motion compensation	(Uni-pred) x 2 + Averaging
-----------------------------------	----------------------------

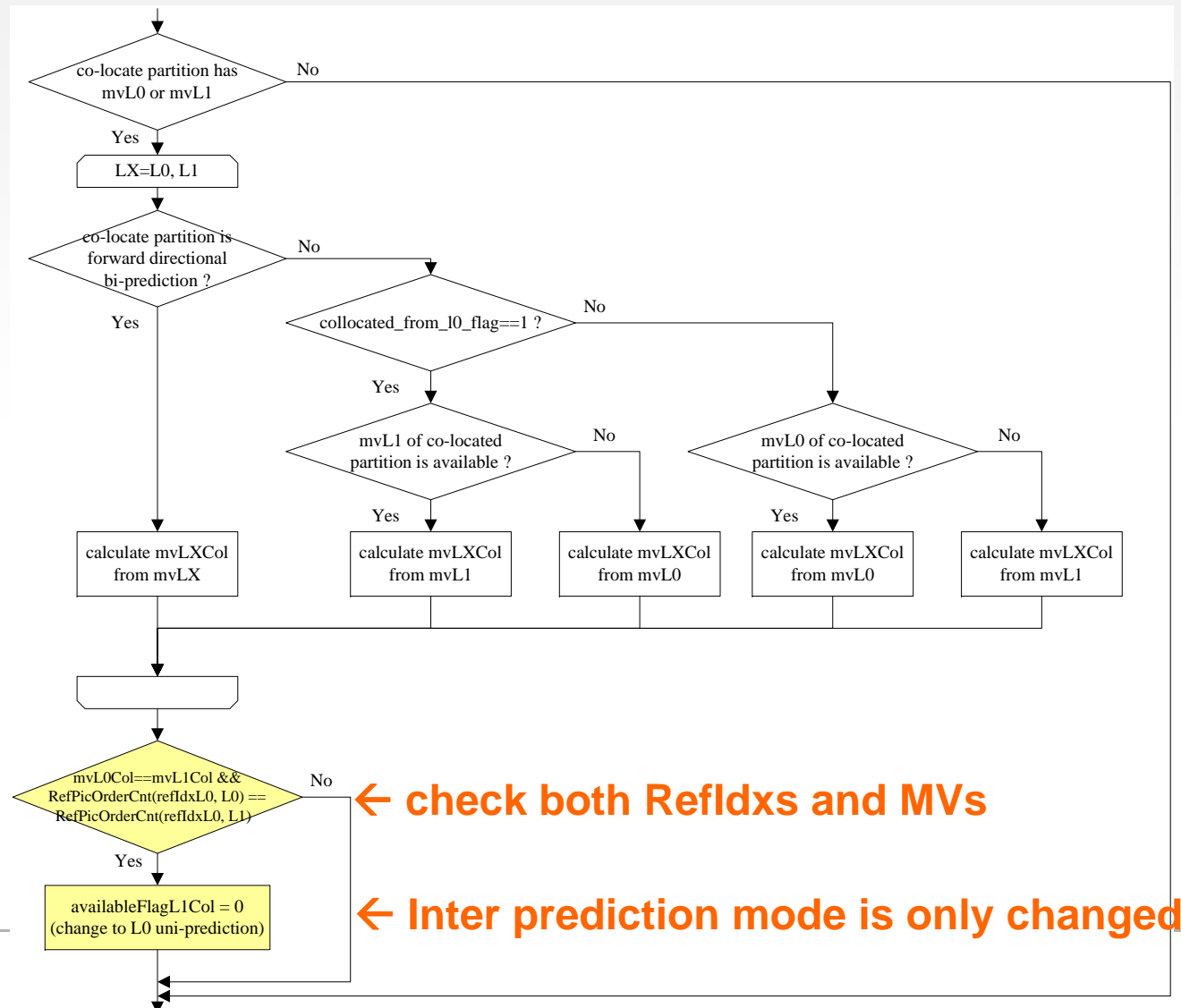


Uni-prediction	
MvL0	--
RefIdxL0	--

Uni-pred
----------

# Flowchart of Proposal 1

- Non-highlighted blocks are same as current derivation process in HM3.0.
- Yellow highlighted blocks are newly added in this proposal 1.



# Results of Proposal 1

## • Experimental results

- Performance compared with JCTVC-E700

(Anchor: HM3.0)

	LB-HE			LB-LC			RA-HE			RA-LC		
	Y	U	V	Y	U	V	Y	U	V	Y	U	V
Class A							0.0	0.0	0.3	0.0	0.0	0.1
Class B	-0.1	0.0	0.1	0.0	-0.1	-0.4	0.0	-0.1	0.0	0.0	0.0	0.0
Class C	-0.1	-0.1	-0.1	0.0	-0.1	-0.1	0.0	0.1	0.0	0.0	-0.1	-0.1
Class D	-0.1	0.1	0.1	0.0	0.2	0.1	0.0	-0.1	-0.1	0.0	0.0	0.0
Class E	0.0	0.3	-0.3	-0.1	-0.2	-0.4						
All	0.0	0.1	0.0	0.0	0.0	-0.2	0.0	0.0	0.0	0.0	0.0	0.0
Enc Time[%]	99%			99%			100%			100%		
Dec Time[%]	96%			94%			99%			99%		

### ■ Low delay B

- Complexity: decoding time reduction of 4 % (HE) and 6 % (LC)
- BD-Rate: negligible change

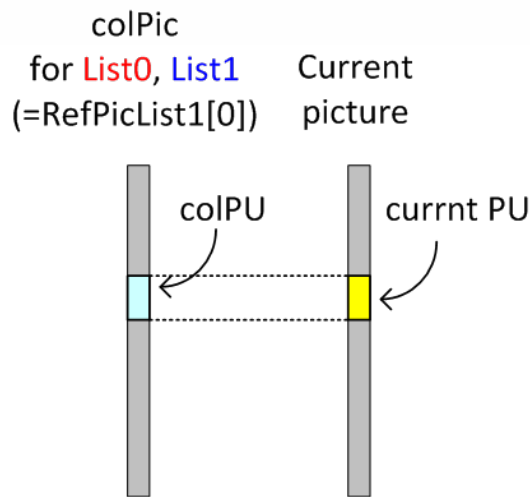
### ■ Random Access

- Complexity: decoding time reduction of 1 % (HE and LC)
- BD-Rate: negligible change

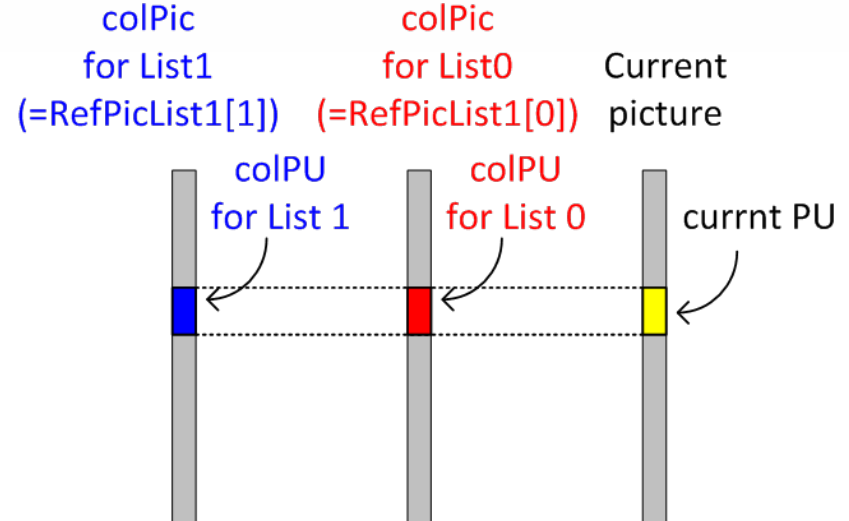
## Proposal 2: modify MV derivation for list 1 of bi-prediction

- If reference pictures of list 0 and 1 are same, the co-located picture (colPic) position that contains the co-located partition (colPU) for only list 1 is changed to RefPicListX[1] from RefPicListX[0].
  - Need only refIdx (POC number) information for this decision.
- Objective -- improve coding efficiency

### ■ When colocated\_from\_l0\_flag = 1



(a) HM3



(b) proposal 2



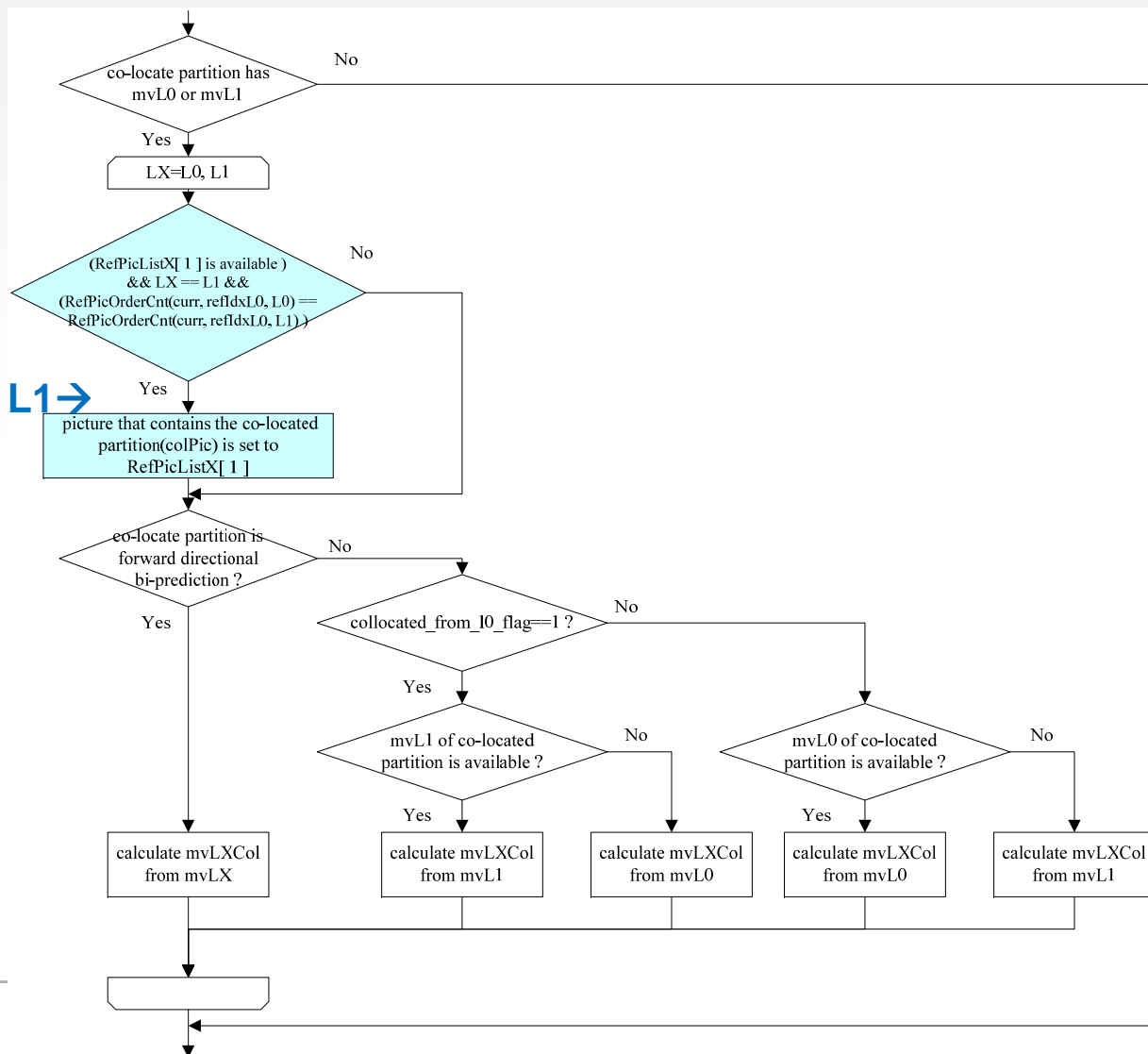
# Flowchart of Proposal 2

- Non-highlighted blocks are same as original HM3 process.
- Blue highlighted blocks are newly added in this proposal 2.

Refldxs are already known →

check only Refldxs →

change colPic position for only L1 →



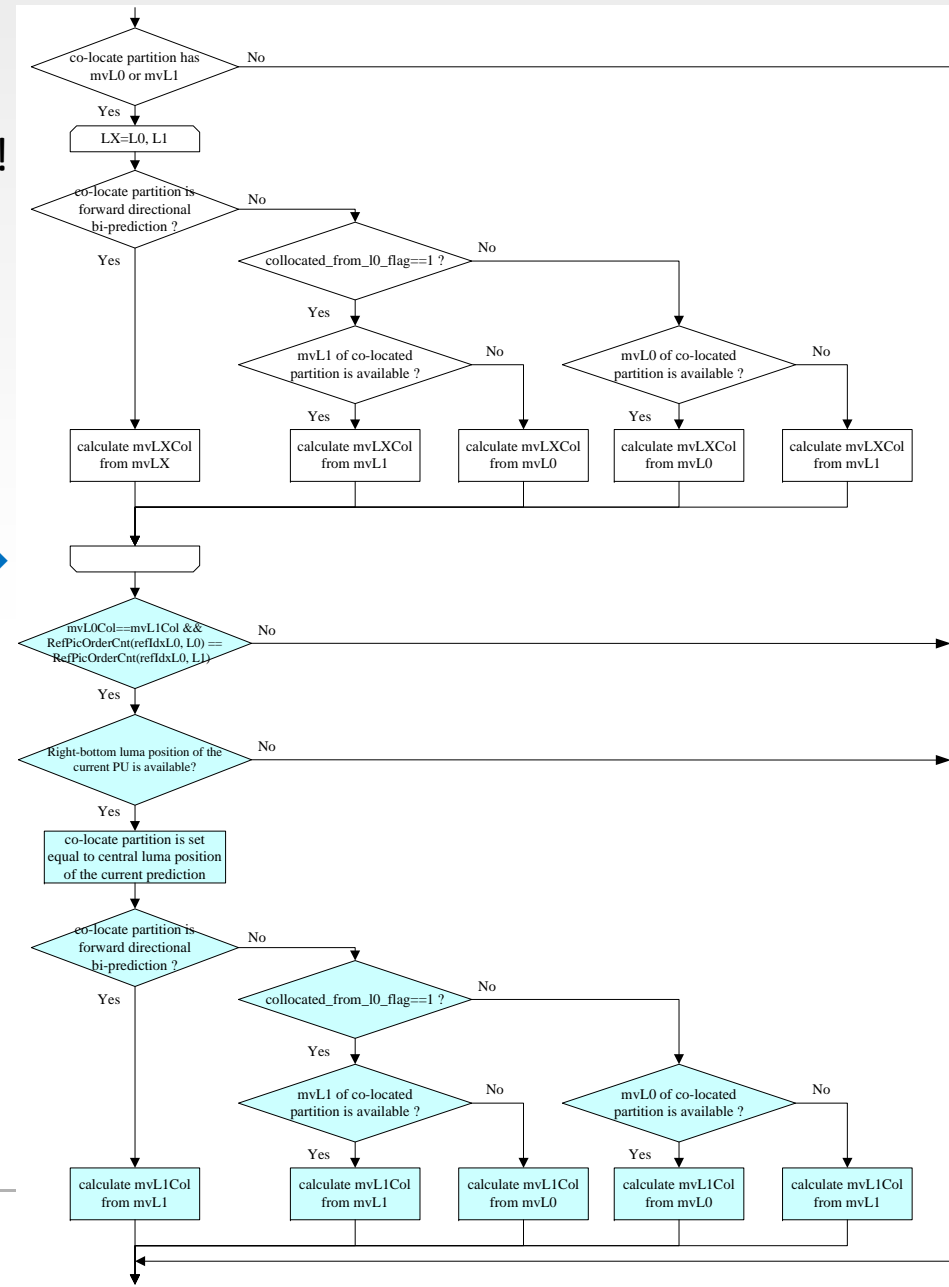
# If both refIdx and MV information are checked for proposal 2

- Need derivation process of mvLXCol twice.
- ➔ Cause computational complexity increase !

MVs (mvLXCols) are known at this point ➔  
check both RefIdxs and MVs ➔

change colPic position ➔

re-calculation of mvL1Col



# Results of Proposal 2

## • Experimental results

- Performance compared with JCTVC-E700

(Anchor: HM3.0)

	LB-HE			LB-LC			RA-HE			RA-LC		
	Y	U	V	Y	U	V	Y	U	V	Y	U	V
Class A							0.0	-0.1	0.0	0.0	0.0	0.1
Class B	-0.2	-0.3	-0.1	-0.4	-0.6	-0.5	0.0	0.0	0.1	0.0	0.0	0.0
Class C	-0.1	-0.3	-0.2	-0.2	-0.3	-0.3	0.0	0.1	0.0	0.0	0.0	0.0
Class D	-0.1	-0.5	-0.2	-0.1	-0.1	-0.3	0.0	-0.1	-0.1	0.1	0.0	-0.1
Class E	-0.1	-0.6	0.0	-0.5	-0.9	-0.7						
All	-0.2	-0.4	-0.1	-0.3	-0.5	-0.4	0.0	0.0	0.0	0.0	0.0	0.0
Enc Time[%]	100%			100%			100%			100%		
Dec Time[%]	100%			100%			100%			100%		

### ■ Low delay B

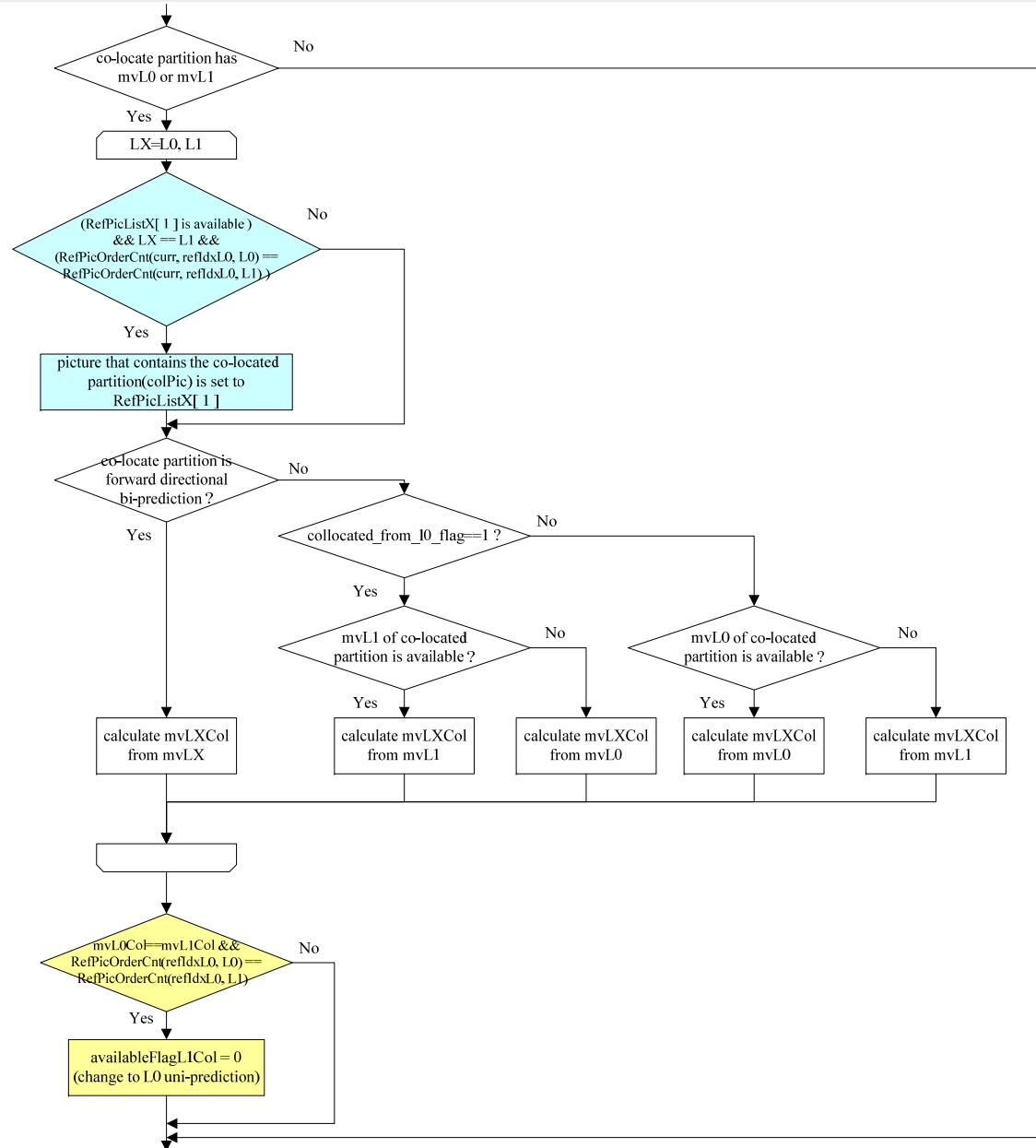
- Complexity: not change
- BD-Rate: **gain of 0.2 % (HE) and 0.3 % (LC)**

### ■ Random Access

- Complexity: not change
- BD-Rate: negligible change

# Combination of proposal 1 and 2

Proposal 2 →



Proposal 1 →

# Results of combination with Proposal 1 and 2

## • Experimental results

- Performance compared with JCTVC-E700

(Anchor: HM3.0)

	LB-HE			LB-LC			RA-HE			RA-LC		
	Y	U	V	Y	U	V	Y	U	V	Y	U	V
Class A							0.0	-0.1	-0.1	0.0	0.0	0.1
Class B	-0.3	-0.3	-0.7	-0.5	-0.6	-0.7	0.0	-0.1	0.1	0.0	0.0	0.0
Class C	-0.1	-0.2	-0.3	-0.2	-0.3	-0.5	0.0	0.0	0.0	0.0	0.0	-0.1
Class D	-0.1	0.1	0.0	-0.1	-0.1	-0.1	0.0	0.0	-0.1	0.1	0.0	0.0
Class E	-0.3	-0.5	-0.7	-0.5	-0.5	-0.8						
All	-0.2	-0.2	-0.4	-0.3	-0.4	-0.5	0.0	0.0	0.0	0.0	0.0	0.0
Enc Time[%]		100%			100%			100%			100%	
Dec Time[%]		98%			96%			100%			99%	

### ■ Low delay B

- Complexity: decoding time reduction of 2 % (HE) and 4% (LC)
- BD-Rate: gain of 0.2 % (HE) and 0.3 % (LC)

### ■ Random Access

- Complexity: not change
- BD-Rate: negligible change

# Conclusion

---

- **Modified Temporal MV derivation for merge/skip mode**
  - Proposal 1: Change to uni-prediction from bi-prediction
  - Proposal 2: Modify MV derivation of bi-prediction for list 1
- **Experimental results**
  - **Low delay B case**
    - Complexity: 2 % (HE) and 4% (LC) decoding time reduction
    - BD-Rate: 0.2 % (HE) and 0.3 % (LC) gain
  - **Random Access case**
    - Complexity: not change
    - BD-Rate: negligible change
- **Recommendation**
  - These proposals will be integrated to the next version of HM.

**TOSHIBA**  
**Leading Innovation >>>**