

# JVET-N0484

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# Problem statement

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- DMVR and BDOF are expensive process for decoder
- DMVR and BDOF are **BOTH** applied to a CU when
  - CU height  $> 4$
  - CU size  $\geq 64$
  - Merge mode but not MMVD, sub-block or triangle partition mode
  - Bi-prediction with equal distance from current picture to two reference pictures

Sequentially applying both tools is expensive for hardware implementation

➡ It is proposed to apply only one of DMVR and BDOF to a CU



# Method 1: Shape restriction

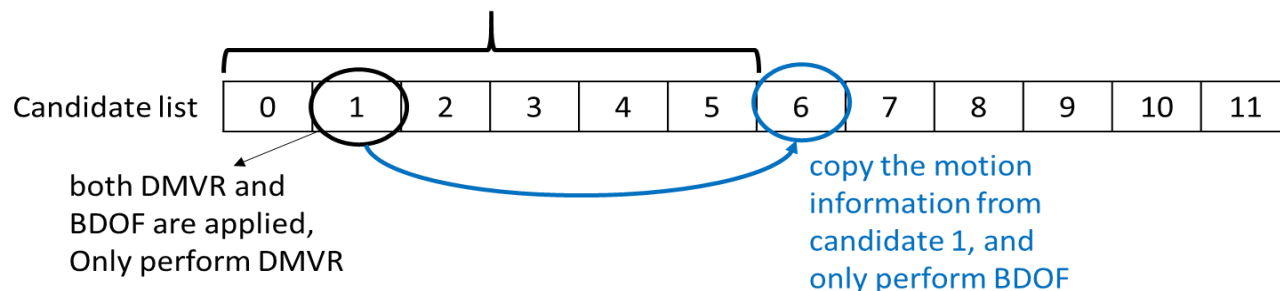
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- Disabling DMVR for a narrow-and-tall or wide-and-flat CU
  - When  $\max(\text{width} / \text{height}, \text{height} / \text{width}) > \text{threshold}$ , BDOF is applied
  - Otherwise, DMVR and BDOF are applied
  - Threshold is set to 4 or 8

# Method 2: Explicit signaling

- Using merge index to indicate which one is applied to a CU
  - Increasing 6 **virtual** merge candidates
  - Keeping **the same complexity** for merge list construction as VVC
  - Duplicating merge candidate when DMVR and BDOF are both performed;
    - The original merge candidate only perform DMVR
    - The duplicated merge candidate only perform BDOF

the same derivation process as VVC draft 4



# Simulation results (Method 1)

$\max(\text{width} / \text{height}, \text{height} / \text{width}) > 8$

		Random Access			
	Y	U	V	EncT	DecT
Class A1	0.00%	0.03%	-0.02%	102%	101%
Class A2	0.01%	0.06%	0.04%	102%	102%
Class B	0.00%	0.01%	-0.01%	101%	101%
Class C	0.00%	-0.06%	-0.06%	101%	101%
<b>Overall</b>	0.00%	0.01%	-0.02%	101%	101%
Class D	-0.01%	-0.01%	-0.01%	102%	102%
Class F	-0.01%	-0.01%	-0.04%	101%	101%

$\max(\text{width} / \text{height}, \text{height} / \text{width}) > 4$

		Random Access			
	Y	U	V	EncT	DecT
Class A1	0.02%	0.02%	0.03%	101%	102%
Class A2	0.03%	0.07%	0.07%	101%	102%
Class B	0.03%	0.02%	0.00%	100%	101%
Class C	0.03%	0.04%	-0.07%	100%	101%
<b>Overall</b>	0.03%	0.03%	0.00%	100%	101%
Class D	0.04%	-0.06%	-0.01%	101%	102%
Class F	0.00%	0.03%	-0.01%	100%	101%

# Simulation results (Method 2)

	Random Access				
	Y	U	V	EncT	DecT
Class A1	0.30%	0.19%	0.17%	101%	98%
Class A2	0.62%	0.30%	0.20%	101%	98%
Class B	0.41%	0.26%	0.22%	100%	96%
Class C	0.49%	0.37%	0.32%	101%	93%
<b>Overall</b>	0.45%	0.28%	0.23%	101%	96%
Class D	0.72%	0.38%	0.33%	101%	91%
Class F	0.19%	0.09%	0.08%	100%	95%



# Additional method

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- If DMVR and BDOF are implemented in different hardware stage, there is no need to mutually exclusive the combination of two tools
- However, DMVR is relatively expensive process
- We modify method 1 that always disable DMVR when  $\max(\text{width} / \text{height}, \text{height} / \text{width}) > 4$



# Additional results

## On top of VTM-4.0

	Random Access				
	Y	U	V	EncT	DecT
Class A1	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
Class A2	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
Class B	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
Class C	0.04%	0.07%	0.04%	99%	98%
<b>Overall</b>	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
Class D	0.03%	-0.02%	0.05%	99%	99%
Class F	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!

## On top of CE9-1.1.a

	Random Access				
	Y	U	V	EncT	DecT
Class A1	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
Class A2	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
Class B	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
Class C	0.01%	0.01%	0.03%	#NUM!	#NUM!
<b>Overall</b>	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!
Class D	0.00%	0.02%	0.07%	#NUM!	#NUM!
Class F	#VALUE!	#VALUE!	#VALUE!	#NUM!	#NUM!



# Conclusion

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- Two methods to solve sequentially process of DMVR and BDOF
- Suggest to disable DMVR for narrow-and-tall or wide-and-flat CUs
- Thanks to Kwai for cross-checking



# Text

## 8.5.1 General decoding process for coding units coded in inter prediction mode

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- When all of the following conditions are true, dmvrFlag is set equal to 1:
  - sps\_dmvr\_enabled\_flag is equal to 1
  - merge\_flag[ xCb ][ yCb ] is equal to 1
  - both predFlagL0[ 0 ][ 0 ] and predFlagL1[ 0 ][ 0 ] are equal to 1
  - mmvd\_flag[ xCb ][ yCb ] is equal to 0
  - DiffPicOrderCnt( currPic, RefPicList[ 0 ][ refIdxL0 ]) is equal to DiffPicOrderCnt( RefPicList[ 1 ][ refIdxL1 ], currPic )
  - cbWidth is greater than or equal to 8
  - cbHeight is greater than or equal to 8
  - cbHeight\*cbWidth is greater than or equal to ~~64~~128
  - $\text{Max}( \text{cbWidth}, \text{cbHeight} ) / \text{Min}( \text{cbWidth}, \text{cbHeight} ) \leq 4$

