

# **Simplification of temporal motion vector (TMVP) candidate derivation for Merge and AMVP(JCTVC-G552)**

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# #1: Upper-left position for Merge and AMVP

- ❖ In HM-4.0, **two** separate positions are used to get a temporal motion vector predictor (TMVP) candidate both **for Merge and AMVP**.
  - **Right-bottom (RB) position** is examined first. If Prediction Unit (PU) of RB position is available, motion information of the PU is used to get TMVP candidate.
  - When the PU of RB position is not available, **center position** is examined next for TMVP candidate selection. Offset to get the center position is calculated as follows.
- ❖ **ruiPartIdxCenter** =  $g\_auiRasterToZscan[ g\_auiZscanToRaster[ ruiPartIdxCenter ]$
- ❖  $+ ( iPartHeight/m\_pcPic->getMinCUHeight() - 1 )/2 * m\_pcPic->getNumPartInWidth()$
- ❖  $+ ( iPartWidth/m\_pcPic->getMinCUWidth() - 1 )/2];$
- To get the offset,
  - 2 divisions, 1 multiplication, 2 additions and 2 subtractions.
  - Mappings should be done two times with two separate memory arrays,  $g\_auiRasterToZscan$  and  $g\_auiZscanToRaster$ .

# #1: Upper-left position for Merge and AMVP

## ❖ Proposed simplification

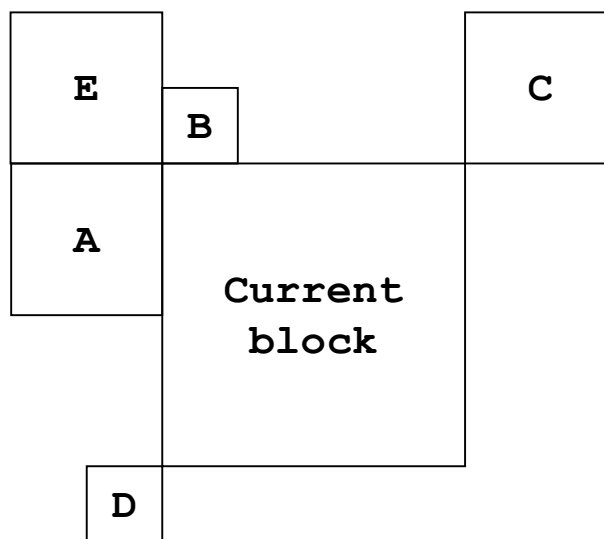
- Utilization of **upper-left position** instead of center position.
  - No additional calculation is required to get the specific position since it is easy to find upper-left position which is starting point of PU (starting position is always specified in WD and HM).

```
Void TComDataCU::xDeriveCenterIdx( PartSize eCUMode, UInt uiPartIdx, UInt& ruiPartIdxCenter )
{
    UInt uiPartAddr;
    Int iPartWidth;
    Int iPartHeight;
    getPartIndexAndSize( uiPartIdx, uiPartAddr, iPartWidth, iPartHeight);

    ruiPartIdxCenter = m_uiAbsIdxInLCU+uiPartAddr; // partition origin.
    #if !TCTR_AMVP_MRG_OFF
        ruiPartIdxCenter = g_auiRasterToZscan[ g_auiZscanToRaster[ ruiPartIdxCenter ]
            + ( iPartHeight/m_pcPic->getMinCUHeight() -1 )/2*m_pcPic-
            >getNumPartInWidth()
            + ( iPartWidth/m_pcPic->getMinCUWidth() -1 )/2];
    #endif
}
```

## #2: Zero reference index for Merge

- ❖ Reference index of TMVP candidate of **Merge** in HM-4.0
  - The reference index of TMVP is set as the value which has **majority occurrence** among neighbouring PU A, B and C.
  - If PU C is not available, PU D or E is used.
  - Positions used for reference index derivations are **different** from the positions used for other prediction candidates of Merge and AMVP.



## #2: Zero reference index for Merge

### ❖ Proposed simplification

- **Set zero for reference index for TMVP candidate of Merge**
- Implementation
  - MRG\_TMVP\_REFIDX macro in HM-4.0 is set 0.

# Summary results

## ❖ Results

	Y BD-rate	Encoding time	Decoding time
Upper-left position for TMVP of Merge and AMVP	0.0%	100%	101%
Zero reference index for TMVP of Merge	0.0%	100%	101%
Combination of upper-left position and zero reference index for TMVP	0.0%	100%	99%

# Test Results (1)

❖ **Upper-left position** is used instead of center position as one of TMVP candidate position

- Test results under common test condition (JCTVC-F900)
  - Anchor software: HM-4.0
- **No loss is observed**

	Random Access HE			Random Access LC		
	Y	U	V	Y	U	V
Class A	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%
Class B	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%
Class C	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Class D	0.0%	-0.1%	0.0%	0.0%	0.1%	0.0%
Class E						
<b>Overall</b>	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Enc Time[%]	100%			100%		
Dec Time[%]	100%			101%		

	Low delay B HE			Low delay B LC		
	Y	U	V	Y	U	V
Class A						
Class B	0.0%	-0.1%	0.0%	0.0%	-0.1%	0.2%
Class C	0.0%	-0.1%	-0.1%	0.0%	0.2%	-0.2%
Class D	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%
Class E	0.0%	0.4%	0.5%	0.1%	-0.1%	0.3%
<b>Overall</b>	0.0%	0.0%	0.1%	0.0%	0.0%	0.1%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Enc Time[%]	100%			100%		
Dec Time[%]	101%			101%		

**cross-checked by Sony  
(JCTVC-G515)**

# Test Results (2)

## ❖ Zero reference index of TMVP of Merge

- Test results under common test condition (JCTVC-F900)
  - Anchor software: HM-4.0
- **Average 0.0% loss for four configurations**
  - **0.1% loss for LD, LDLC**

	Random Access HE			Random Access LC		
	Y	U	V	Y	U	V
Class A	-0.1%	0.0%	0.0%	0.0%	0.0%	-0.1%
Class B	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%
Class C	0.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
Class D	0.0%	0.0%	-0.1%	0.0%	0.0%	-0.1%
Class E						
<b>Overall</b>	0.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Enc Time[%]	100%			99%		
Dec Time[%]	100%			99%		

	Low delay B HE			Low delay B LC		
	Y	U	V	Y	U	V
Class A						
Class B	0.1%	0.3%	0.6%	0.1%	0.7%	0.8%
Class C	0.0%	0.1%	0.2%	0.0%	0.4%	0.3%
Class D	0.3%	0.8%	0.4%	0.2%	0.8%	0.3%
Class E	0.0%	0.1%	0.5%	0.1%	1.0%	0.6%
<b>Overall</b>	0.1%	0.3%	0.4%	0.1%	0.7%	0.5%
	0.1%	0.3%	0.4%	0.1%	0.7%	0.6%
Enc Time[%]	100%			100%		
Dec Time[%]	99%			101%		

**cross-checked by JVCKenwood  
(JCTVC-G227)**

# Test Results (3)

## ❖ Combined results

- Test results under common test condition (JCTVC-F900)
  - Anchor software: HM-4.0
- **Average 0.0% loss for four configurations**
  - **0.1% loss for LD, LDLC**

	Random Access HE			Random Access LC		
	Y	U	V	Y	U	V
Class A	0.0%	-0.1%	-0.1%	0.0%	-0.1%	-0.1%
Class B	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Class C	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%
Class D	0.0%	-0.1%	0.0%	0.0%	0.0%	-0.1%
Class E						
<b>Overall</b>	0.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
	0.0%	-0.1%	0.0%	0.0%	0.0%	-0.1%
Enc Time[%]	100%			99%		
Dec Time[%]	101%			99%		

	Low delay B HE			Low delay B LC		
	Y	U	V	Y	U	V
Class A						
Class B	0.1%	0.2%	0.4%	0.1%	0.6%	1.0%
Class C	0.0%	0.1%	0.0%	0.0%	0.3%	0.1%
Class D	0.2%	0.7%	0.6%	0.3%	0.5%	0.8%
Class E	0.0%	0.0%	0.6%	0.0%	0.9%	0.9%
<b>Overall</b>	0.1%	0.3%	0.4%	0.1%	0.6%	0.7%
	0.1%	0.2%	0.3%	0.1%	0.6%	0.7%
Enc Time[%]	100%			100%		
Dec Time[%]	99%			96%		

**cross-checked by JVCKenwood  
(JCTVC-G227)**

# Conclusions

- ❖ It is proposed to simplify the derivation process of TMVP candidate for Merge and AMVP.
  - 1) **upper-left position** is used instead of center position as one of TMVP candidate position
  - 2) reference index of TMVP of Merge set by **zero**.
  - When the both simplification is combined, the **average loss is 0.0%** with 100% and 99% encoding and decoding time, respectively.
- ❖ Based on these experimental results, it is recommended to adopt these two simplifications on Merge and AMVP.
- ❖ Similar simplifications of #2 are proposed in JCTVC-G163(LG), JCTVC-G217(JVCKenwood), JCTVC-G592(Nokia).