

JVET 12<sup>th</sup> Meeting

# **JVET-L0051 – CE1-related: Partitioning Clean-ups**

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Minsoo Park, Min Woo Park, Kiho Choi



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# Introduction

## ❖ In this proposal, two clean-ups for partitioning are proposed

- Clean-up 1: Removal of adaptive Max BT size signaling
- Clean-up 2: Set Max BT/TT sizes to possible Max BT/TT sizes by default

## ❖ Max size for Quad-tree, Binary-tree, and Ternary-tree

- Discrepancy of Max size between intra & inter slices, and between Luma & Chroma
- For BT, Luma and Chroma in intra slice have different Max size
- For TT, Intra and Inter slices have different Max size

	Intra slice		Inter slice
	Luma	Chroma	Luma & Chroma
QT	128	128	128
BT	32	64	128
TT	32	32	64

Current Max size in VVC

## ❖ Slice level adaptive Max BT size signaling

- The Max BT size is signaled based on statistics of previous frames (average CU size)
- If previous frame has an large block size, binary tree is allowed at the large block

# Proposed Methods

## ❖ Clean-up 1: Removal of adaptive Max BT size signalling

- **Test 1:** Removal of adaptive Max BT size signalling

- RA: -0.08% w/ 107% EncT
- LD: -0.09% w/ 108% EncT

slice_header() {	Descriptor
<b>slice_pic_parameter_set_id</b>	ue(v)
<b>slice_address</b>	u(v)
<b>slice_type</b>	ue(v)
<del>if( slice_type != I)</del>	
<del>    log2_diff_ctu_max_bt_size</del>	<del>ue(v)</del>
<b>dep_quant_enabled_flag</b>	u(1)
if( !dep_quant_enabled_flag )	
<b>sign_data_hiding_enabled_flag</b>	u(1)
byte_alignment( )	
}	

- **Test 2:** Test 1 with applying encoder optimization only

- **No loss, Same encoding time**
- RA: 0.02% w/ 99% EncT
- LD: 0.03% w/ 99% EncT

# Proposed Methods

## ❖ Clean-up 2: Default Maximum BT and TT sizes

- **Test 3:** Set the maximum sizes to the possible maximum sizes
  - AI: -0.57% w/ 140% EncT, RA: -0.12% w/ 105% EncT, LD: -0.04% w/ 98% EncT

	Intra slice		Inter slice
	Luma	Chroma	Luma & Chroma
Quad tree	128	128	128
Binary tree	32 → 64	64	128
Ternary tree	32 → 64	32 → 64	64

- **Test 4:** Test 3 with encoder optimization
  - AI: -0.05% w/102% EncT, RA: -0.01% w/ 101% EncT, LD: 0.00% w/ 98% EncT

	Default maximum size			Allowed maximum size in encoder		
	Intra slice		Inter slice	Intra slice		Inter slice
	Luma	Chroma	Luma & Chroma	Luma	Chroma	Luma & Chroma
Quad tree	128	128	128	128	128	128
Binary tree	64	64	128	32	64	128
Ternary tree	64	64	64	32	64	64

## ❖ Clean-up 1 & 2 w/ encoder optimization

- **Test 5:** Clean-up 1 & Clean-up 2 with encoder optimizations
  - AI: -0.05%/-0.87%/-0.86 w/ 102% EncT,
  - RA: 0.02%/-0.37%/-0.33% w/ 99% EncT,
  - LD: 0.03%/0.01%/-0.23% w/ 98% EncT

# Simulation Results

- ❖ Implemented on top of VTM-2.0.1
- ❖ Tests conducted based on JVET CTC
- ❖ Summary of results

	Test	BD-Rate (Y)	BD-Rate (U)	BD-Rate (V)	EncT	DecT
AI	Test1: clean-up 1	0.00%	0.00%	0.00%	99%	95%
	Test2: clean-up 1 w/ enc. opt.	0.00%	0.00%	0.00%	99%	97%
	Test3: clean-up 2	-0.57%	-1.30%	-1.37%	140%	96%
	Test4: clean-up 2 w/ enc. opt	-0.05%	-0.87%	-0.86%	102%	98%
	Test5: clean-up 1&2 w/ enc. opt.	-0.05%	-0.87%	-0.86%	102%	97%
RA	Test1: clean-up 1	-0.08%	-0.11%	-0.12%	107%	98%
	Test2: clean-up 1 w/ enc. opt.	0.02%	0.06%	0.01%	99%	95%
	Test3: clean-up 2	-0.12%	-0.54%	-0.43%	105%	99%
	Test4: clean-up 2 w/ enc. opt	-0.01%	-0.39%	-0.35%	101%	99%
	Test5: clean-up 1&2 w/ enc. opt.	0.02%	-0.37%	-0.33%	99%	95%
LDB	Test1: clean-up 1	-0.09%	-0.28%	-0.12%	108%	93%
	Test2: clean-up 1 w/ enc. opt.	0.04%	0.05%	-0.04%	99%	95%
	Test3: clean-up 2	-0.04%	-0.36%	-0.26%	98%	93%
	Test4: clean-up 2 w/ enc. opt	0.00%	-0.02%	-0.05%	98%	94%
	Test5: clean-up 1&2 w/ enc. opt.	0.03%	0.01%	-0.23%	98%	95%

# Conclusions

- ❖ **We proposed partitioning clean-ups to less restrictions and cleaner design.**
  - Almost no change in coding gain and encoding complexity.
    - AI: -0.05%, 102% EncT
    - RA: 0.02%, 99% EncT
    - LD: 0.03%, 98% EncT
- ❖ **We suggest to adopt proposed clean-ups into the next VVC WD**

Thanks **HHI** for crosschecking our proposal

# Thank you



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# Test Results

## Test 1: Removal of adaptive Max BT size signalling

### Results

- AI
  - 0.00%, 100% EncT
- RA
  - -0.08%, 107% EncT
- LD
  - -0.09%, 108% EncT

	All Intra Main10				
	Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class A1	0.00%	0.00%	0.00%	99%	94%
Class A2	0.00%	0.00%	0.00%	99%	91%
Class B	0.00%	0.00%	0.00%	99%	92%
Class C	0.00%	0.00%	0.00%	99%	100%
Class E	0.00%	0.00%	0.00%	99%	98%
Overall	0.00%	0.00%	0.00%	99%	95%
Class D	0.00%	0.00%	0.00%	98%	95%
Class F (optional)	0.00%	0.00%	0.00%	100%	101%

	Random Access Main 10				
	Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class A1	-0.03%	-0.09%	-0.03%	108%	97%
Class A2	-0.09%	-0.13%	-0.15%	106%	96%
Class B	-0.12%	-0.14%	-0.18%	106%	100%
Class C	-0.07%	-0.06%	-0.10%	109%	99%
Class E					
Overall	-0.08%	-0.11%	-0.12%	107%	98%
Class D	-0.08%	-0.07%	-0.09%	116%	106%
Class F (optional)	-0.05%	-0.07%	-0.09%	104%	95%

	Low delay B Main10				
	Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	-0.10%	-0.39%	-0.35%	106%	93%
Class C	-0.10%	-0.23%	-0.11%	117%	92%
Class E	-0.07%	-0.16%	0.26%	100%	95%
Overall	-0.09%	-0.28%	-0.12%	108%	93%
Class D	-0.16%	0.26%	-0.09%	159%	99%
Class F (optional)	-0.13%	0.05%	0.16%	107%	97%



# Test Results

## Test 2: Test 1 with Encoder optimization

### Results

- AI
  - 0.00%, 100% EncT
- RA
  - 0.02%, 99% EncT
- LD
  - 0.03%, 99% EncT

	All Intra Main10				
	Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class A1	0.00%	0.00%	0.00%	99%	94%
Class A2	0.00%	0.00%	0.00%	99%	91%
Class B	0.00%	0.00%	0.00%	99%	92%
Class C	0.00%	0.00%	0.00%	99%	100%
Class E	0.00%	0.00%	0.00%	99%	98%
Overall	0.00%	0.00%	0.00%	99%	95%
Class D	0.00%	0.00%	0.00%	98%	95%
Class F (optional)	0.00%	0.00%	0.00%	100%	101%

	Random Access Main 10				
	Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class A1	0.00%	0.07%	0.05%	99%	95%
Class A2	0.02%	0.02%	-0.06%	100%	95%
Class B	0.02%	0.06%	0.05%	100%	98%
Class C	0.03%	0.08%	-0.02%	96%	91%
Class E					
Overall	0.02%	0.06%	0.01%	99%	95%
Class D	0.05%	0.08%	0.05%	97%	99%
Class F (optional)	0.02%	0.00%	0.01%	97%	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%	-0.08%	98%	94%
Class C	0.08%	-0.03%	0.03%	101%	95%
Class E	-0.03%	0.28%	-0.09%	98%	97%
Overall	0.04%	0.05%	-0.04%	99%	95%
Class D	0.03%	0.06%	-0.05%	100%	109%
Class F (optional)	-0.10%	0.50%	0.20%	97%	99%

# Test Results

## Test 3: Set the maximum sizes to the possible maximum sizes

### Results

- AI
  - 0.57%, 140% EncT
- RA
  - 0.12%, 105% EncT
- LD
  - 0.04%, 98% EncT

	All Intra Main10				
	Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class A1	-1.20%	-2.03%	-2.36%	173%	96%
Class A2	-0.59%	-1.52%	-1.15%	145%	91%
Class B	-0.51%	-1.38%	-1.59%	140%	93%
Class C	-0.15%	-0.42%	-0.39%	118%	100%
Class E	-0.61%	-1.40%	-1.52%	138%	100%
Overall	-0.57%	-1.30%	-1.37%	140%	96%
Class D	-0.10%	-0.18%	-0.49%	121%	94%
Class F (optional)	-0.23%	-0.63%	-0.42%	122%	98%

	Random Access Main 10				
	Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class A1	-0.22%	-0.44%	-0.41%	109%	97%
Class A2	-0.20%	-0.81%	-0.53%	104%	96%
Class B	-0.11%	-0.81%	-0.76%	108%	102%
Class C	0.01%	-0.07%	0.05%	99%	99%
Class E					
Overall	-0.12%	-0.54%	-0.43%	105%	99%
Class D	0.02%	-0.24%	-0.18%	100%	105%
Class F (optional)	-0.09%	-0.11%	-0.23%	102%	95%

	Low delay B Main10				
	Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	0.01%	-0.17%	-0.48%	98%	95%
Class C	0.07%	-0.03%	-0.19%	98%	91%
Class E	-0.25%	-1.13%	0.01%	98%	94%
Overall	-0.04%	-0.36%	-0.26%	98%	93%
Class D	-0.02%	0.05%	-0.41%	98%	99%
Class F (optional)	-0.14%	0.30%	0.34%	98%	96%

# Test Results

## Test 4: Test 3 with Encoder optimization

### Results

- AI
  - 0.05%, 102% EncT
- RA
  - 0.01%, 101% EncT
- LD
  - 0.00%, 98% EncT

	All Intra Main10				
	Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class A1	-0.04%	-0.99%	-1.05%	101%	100%
Class A2	-0.08%	-1.01%	-0.75%	103%	94%
Class B	-0.04%	-0.96%	-1.10%	102%	95%
Class C	-0.07%	-0.38%	-0.31%	102%	102%
Class E	-0.05%	-1.10%	-1.09%	101%	102%
Overall	-0.05%	-0.87%	-0.86%	102%	98%
Class D	-0.02%	-0.18%	-0.41%	100%	95%
Class F (optional)	-0.05%	-0.46%	-0.30%	103%	102%

	Random Access Main 10				
	Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class A1	-0.04%	-0.27%	-0.19%	101%	97%
Class A2	-0.02%	-0.57%	-0.41%	97%	97%
Class B	0.00%	-0.61%	-0.55%	107%	102%
Class C	0.00%	-0.08%	-0.17%	98%	99%
Class E					
Overall	-0.01%	-0.39%	-0.35%	101%	99%
Class D	-0.01%	-0.18%	-0.28%	98%	106%
Class F (optional)	0.01%	-0.27%	-0.24%	98%	95%

	Low delay B Main10				
	Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	0.01%	0.02%	0.30%	98%	95%
Class C	0.04%	-0.09%	-0.07%	98%	91%
Class E	-0.05%	0.01%	-0.61%	97%	95%
Overall	0.00%	-0.02%	-0.05%	98%	94%
Class D	0.02%	0.14%	-0.17%	98%	100%
Class F (optional)	-0.14%	0.26%	-0.13%	98%	97%

# Test Results

## Test 5: Clean-up 1 & 2 with encoder optimizations

### Results

- AI
  - -0.05%, 102% EncT
- RA
  - 0.02%, 99% EncT
- LD
  - 0.03%, 98% EncT

	All Intra Main10				
	Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class A1	-0.04%	-0.99%	-1.05%	101%	97%
Class A2	-0.08%	-1.01%	-0.75%	103%	92%
Class B	-0.04%	-0.96%	-1.10%	102%	95%
Class C	-0.07%	-0.38%	-0.31%	102%	100%
Class E	-0.05%	-1.10%	-1.09%	101%	100%
Overall	-0.05%	-0.87%	-0.86%	102%	97%
Class D	-0.02%	-0.18%	-0.41%	101%	92%
Class F (optional)	-0.05%	-0.46%	-0.30%	102%	98%

	Random Access Main 10				
	Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class A1	-0.03%	-0.28%	-0.19%	99%	96%
Class A2	-0.01%	-0.48%	-0.42%	101%	95%
Class B	0.04%	-0.57%	-0.51%	99%	98%
Class C	0.04%	-0.10%	-0.14%	97%	91%
Class E					
Overall	0.02%	-0.37%	-0.33%	99%	95%
Class D	0.05%	-0.21%	-0.16%	97%	99%
Class F (optional)	0.04%	-0.23%	-0.20%	97%	90%

	Low delay B Main10				
	Over VTM-2.0.1				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	0.05%	0.16%	-0.14%	99%	94%
Class C	0.07%	-0.02%	0.11%	98%	94%
Class E	-0.04%	-0.19%	-0.82%	98%	98%
Overall	0.03%	0.01%	-0.23%	98%	95%
Class D	0.07%	-0.04%	-0.22%	107%	103%
Class F (optional)	0.00%	0.51%	0.23%	97%	98%