

**JCT3V-F0153: CE5: Test results on simplification  
on DMM1 pattern generation mechanism**

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# Summary

- Motivation

- ◆ Simplify DMM1 pattern generation
- ◆ Reduce the number of DMM1 patterns
- ◆ Reduce encoding time

- Experimental results

- ◆ All-intra: -0.1% / 0.1% impact on video / synthesized view with 8% encoding time reduction
- ◆ CTC: -0.1% / 0.0% gain on video / synthesized view with 5% encoding time reduction

- Cross-check: JCT3V-F0236 by Qualcomm

# Shortcomings of current DMM1 pattern generation method

- DMM1 patterns are generated by the all possible combinations of the start and end points located at two image block boundaries. The number of patterns and the storage cost is huge

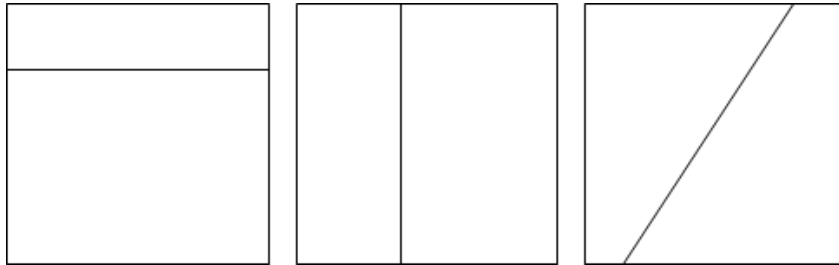
	4 x 4	8 x 8	16 x 16	32 x 32
Num. of patterns	86	782	1394	1503
Length of signalling bits	7	10	11	11

- The number of patterns doesn't reach the maximum allowed number for the signalling bits at each block-size
- The redundant generated patterns need to be checked and removed at pattern initialization process that complicate the pattern generation mechanism

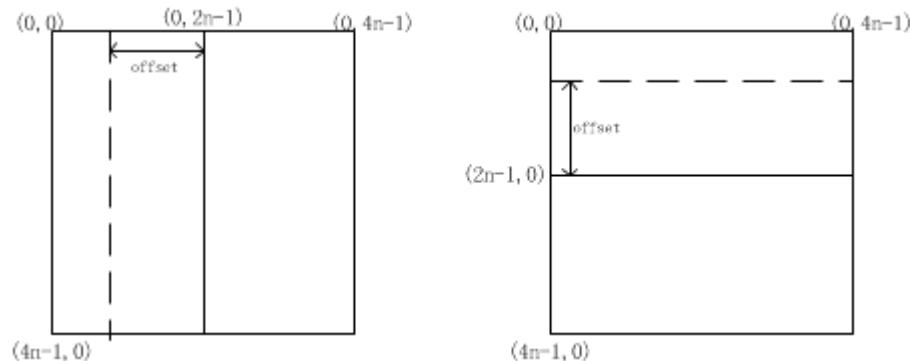
# Proposed simplification method

- Basic concept

- ◆ Categorize and signal the pattern partition according to pattern's geometry properties
- ◆ Three main categories are signaled by the syntax *partition\_type*

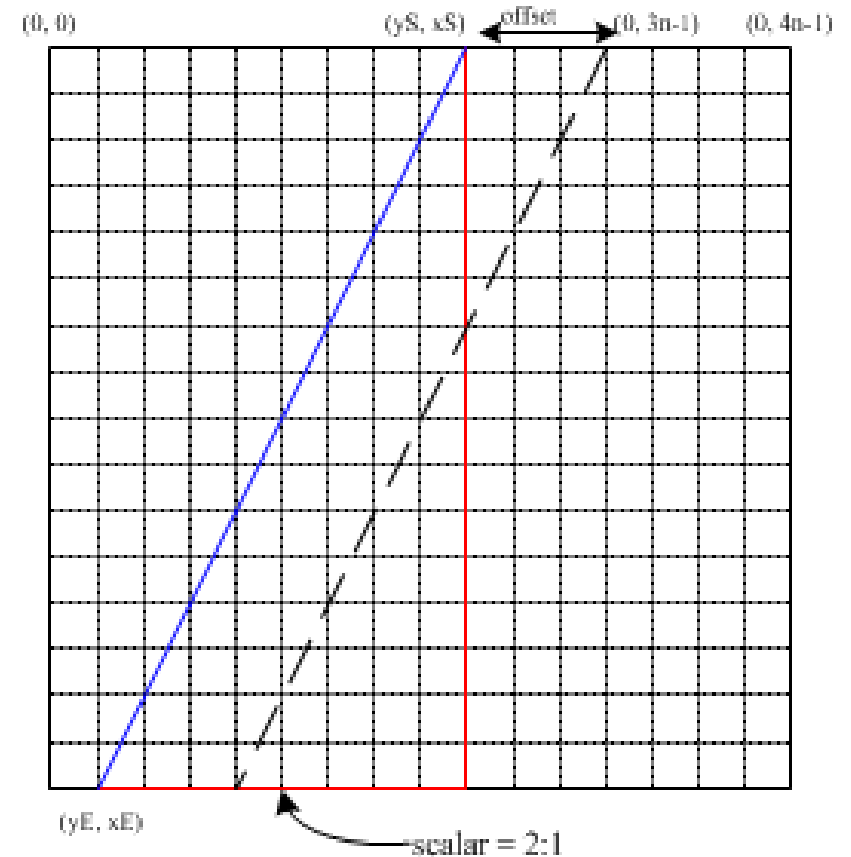


- The location of pattern partition line of horizontal and vertical rectangle partition is signaled by the *offset* parameter



# Proposed simplification method (2)

- Non-rectangle pattern partition is signaled by *scalar*, *ori*, *offset*
  - ◆ *scalar*: the slope of the pattern partition line
    - 1:1, 2:1, 1:2, 4:1 and 1:4 scalars are provided
  - ◆ *ori*: the left-up to right-down or left-down to right-up partition line orientation
  - ◆ *offset*: the location of the partition line



# Proposed simplification method (3)

- Change to DMM3

- ◆ At the first version of CE results, DMM3 use same signaling method as DMM1, and cause some signaling redundant
- ◆ DMM3 is removed from the second version of CE results. Test results show no impact on coding performance

# Benefits

- The total amount for DMM1 patterns is significantly reduced
  - ◆ The cost of memory storage for the patterns is reduced compared to the current DMM1 design
  - ◆ The signaling bits for pattern index is also shorten

	4 x 4		8 x 8		16 x 16		32 x 32	
	current	proposed	current	proposed	current	proposed	current	proposed
<b>Num. of patterns</b>	86	32	782	100	1394	212	1503	436
<b>Length of signalling bits</b>	7	4~7	10	5~8	11	6~9	11	7~10

- The pattern generation method is easier than current design
  - ◆ Removal of the redundant patterns checking process
  - ◆ The pattern generation process is simplified

# Experimental results

## ● AI (with removal of DMM3)

	video 0	video 1	video 2	video PSNR / video bitrate	video PSNR / total bitrate	synth PSNR / total bitrate	enc time	dec time	ren time
Balloons	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	92.1%	98.7%	99.9%
Kendo	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	91.8%	94.8%	98.9%
Newspaper_CC	0.0%	0.0%	0.0%	0.0%	-0.1%	0.3%	89.5%	93.0%	96.0%
GT_Fly	0.0%	0.0%	0.0%	0.0%	-0.1%	0.2%	92.4%	96.2%	96.0%
Poznan_Hall2	0.0%	0.0%	0.0%	0.0%	-0.1%	-0.1%	93.3%	100.5%	96.9%
Poznan_Street	0.0%	0.0%	0.0%	0.0%	-0.1%	0.1%	93.0%	99.0%	99.6%
Undo_Dancer	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	92.7%	93.7%	92.5%
1024x768	0.0%	0.0%	0.0%	0.0%	-0.1%	0.1%	91.1%	95.5%	98.3%
1920x1088	0.0%	0.0%	0.0%	0.0%	-0.1%	0.1%	92.8%	97.3%	96.2%
average	0.0%	0.0%	0.0%	0.0%	-0.1%	0.1%	92.1%	96.6%	97.1%
Shark	0.0%	0.0%	0.0%	0.0%	-0.1%	0.9%	93.8%	100.2%	102.4%

# Experimental results (2)

## ● CTC (with removal of DMM3)

	video 0	video 1	video 2	video PSNR / video bitrate	video PSNR / total bitrate	synth PSNR / total bitrate	enc time	dec time	ren time
Balloons	0.0%	-0.1%	0.0%	0.0%	-0.1%	0.0%	99.0%	97.4%	98.8%
Kendo	0.0%	0.1%	0.0%	0.0%	-0.1%	-0.1%	99.1%	96.9%	98.2%
Newspaper_CC	0.0%	0.1%	0.1%	0.0%	-0.2%	0.1%	99.9%	98.0%	103.6%
GT_Fly	0.0%	0.1%	0.1%	0.0%	-0.1%	0.1%	92.7%	100.4%	104.3%
Poznan_Hall2	0.0%	0.0%	-0.1%	0.0%	-0.1%	-0.4%	91.2%	99.5%	97.3%
Poznan_Street	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	93.3%	101.1%	99.0%
Undo_Dancer	0.0%	0.1%	0.0%	0.0%	0.0%	0.1%	90.2%	101.0%	99.3%
1024x768	0.0%	0.1%	0.0%	0.0%	-0.1%	0.0%	99.3%	97.4%	100.2%
1920x1088	0.0%	0.1%	0.0%	0.0%	-0.1%	0.0%	91.8%	100.5%	100.0%
average	0.0%	0.1%	0.0%	0.0%	-0.1%	0.0%	95.0%	99.2%	100.1%
Shark	0.0%	0.0%	0.2%	0.0%	0.0%	0.4%	101.9%	102.8%	104.3%

# Conclusions

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- Suggest adopting the simplified DMM1 pattern generation mechanism due to the reduction of pattern number, the reduction of encoding time and the simplification of pattern generation process



# Thank you!

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