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CE1-related: Index map scan for 64x64 palette coding block

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Overview Summary

- Proposed to divide the 64x64 traverse scan into four 32x32 traverse scans to accommodate to the 32x32 block pipelining
  - In HEVC and its non-SCC extensions, hardware decoding is often pipelined with 32x32 processing units due to the maximum TU size
  - In SCM-3.0, a 64x64 traverse scan is utilized for 64x64 palette coded block that increases implementation cost and complexity
- BD-rate increases are 0-0.2% with average smaller than 0.1%

# Problem Definition

- In HEVC and its non-SCC extensions, hardware decoding is often pipelined with 32x32 processing units due to the maximum TU size equal to 32x32

  - The operations of inter prediction and SAO of a 64x64 block can be divided into four 32x32 blocks and processed in sequential

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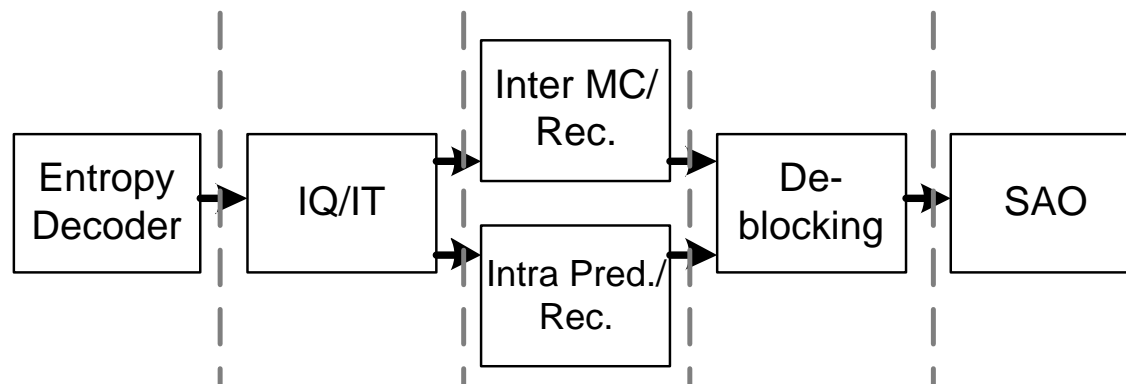
Problem Definition

- In SCM-3.0, a 64x64 traverse scan is utilized for 64x64 palette coded block
    - The 64x64 traverse scan cannot be divided into four 32x32 sub-scans
- A larger buffer (e.g. 64x64 buffer) is required to store the palette related information, and the processing unit of the palette reconstruction module is forced to be a 64x64 block
    - **The implementation cost and complexity are increased**

64
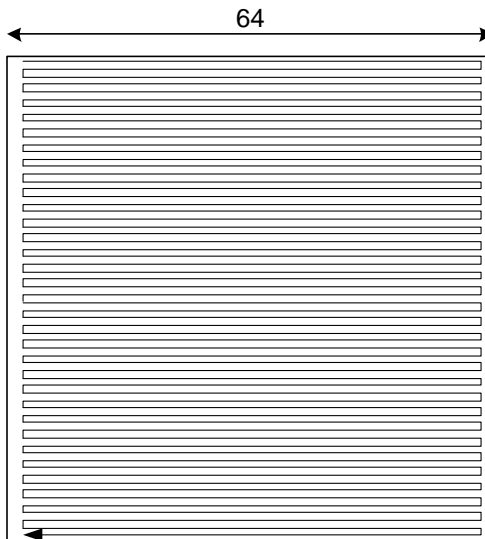
Method-1: Proposed Scan for 64x64 Palette Coded Block

- Proposed to divide the 64x64 traverse scan into four 32x32 traverse scans
    - Processing unit of the palette decoding/reconstruction module can be a 32x32 block to accommodate to the 32x32 block pipelining
    - **The implementation cost and complexity are reduced**
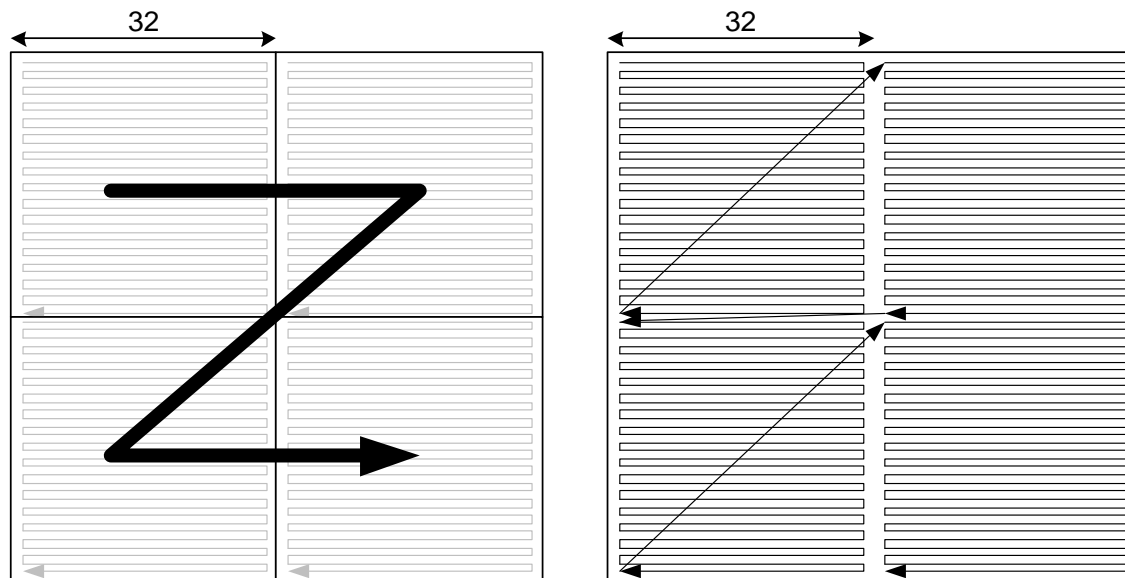
Method-2: Disable Palette Mode for 64x64 Blocks

- Requested to be tested during the meeting

- Just disable the palette mode for 64x64 blocks

Lossy Coding Result

- Anchor: SCM-3.0
- Test: Proposed scan for 64x64 palette coded block

	All Intra			Random Access			Low delay B		
	G/Y	B/U	R/V	G/Y	B/U	R/V	G/Y	B/U	R/V
RGB, text & graphics with motion, 1080p & 720p	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
RGB, mixed content, 1440p & 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.2%	-0.1%
RGB, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	-0.1%
RGB, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%
YUV, text & graphics with motion, 1080p & 720p	0.1%	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%
YUV, mixed content, 1440p & 1080p	0.0%	0.1%	0.1%	0.0%	0.2%	0.0%	0.1%	0.0%	0.0%
YUV, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	-0.1%	0.0%
YUV, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	-0.1%	0.1%	0.0%

Lossy Coding Result

- Anchor: SCM-3.0
- Test: Proposed scan for 64x64 palette coded block

	All Intra				Random Access				Low Delay B			
	Bit-rate change (Total)	Bit-rate change (Average)	Bit-rate change (Min)	Bit-rate change (Max)	Bit-rate change (Total)	Bit-rate change (Average)	Bit-rate change (Min)	Bit-rate change (Max)	Bit-rate change (Total)	Bit-rate change (Average)	Bit-rate change (Min)	Bit-rate change (Max)
RGB, text & graphics with motion, 1080p & 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB, mixed content, 1440p & 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p & 720p	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
YUV, mixed content, 1440p & 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Lossy Coding Result vs. CE1 Test A.1.5

- Anchor: CE1 Test A.1.5
- Test:
  - Method-1: Proposed scan for 64x64 palette coded block
  - Method-2: disabling palette mode for 64x64 blocks

Method-1

	All Intra			Random Access			Low delay B		
	G/Y	B/U	R/V	G/Y	B/U	R/V	G/Y	B/U	R/V
RGB, text & graphics with motion, 1080p & 720p	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%	0.1%	0.0%
RGB, mixed content, 1440p & 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%
RGB, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
RGB, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p & 720p	0.1%	0.1%	0.2%	0.1%	0.1%	0.1%	0.0%	0.1%	0.3%
YUV, mixed content, 1440p & 1080p	0.0%	0.1%	0.0%	0.0%	0.0%	-0.1%	0.1%	0.3%	0.1%
YUV, Animation, 720p	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	-0.1%	0.0%
YUV, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.0%

Method-2

	All Intra			Random Access			Low delay B		
	G/Y	B/U	R/V	G/Y	B/U	R/V	G/Y	B/U	R/V
RGB, text & graphics with motion, 1080p & 720p	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%	0.3%	0.2%
RGB, mixed content, 1440p & 1080p	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%	0.1%	0.1%	0.1%
RGB, Animation, 720p	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.0%	0.0%	0.1%
RGB, camera captured, 1080p	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
YUV, text & graphics with motion, 1080p & 720p	0.4%	0.4%	0.4%	0.2%	0.3%	0.3%	0.2%	0.4%	0.5%
YUV, mixed content, 1440p & 1080p	0.1%	0.2%	0.1%	0.1%	0.2%	0.0%	0.2%	0.5%	0.2%
YUV, Animation, 720p	0.0%	0.0%	0.0%	0.0%	-0.3%	0.0%	0.0%	0.3%	-0.1%
YUV, camera captured, 1080p	0.0%	0.0%	0.1%	0.0%	-0.1%	0.2%	0.0%	0.1%	-0.1%

Conclusion

- Proposed to divide the 64x64 traverse scan into four 32x32 traverse scans to accommodate to the 32x32 block pipelining
  - **The implementation cost and complexity of palette decoding/reconstruction module are reduced**

- BD-rate increases are 0-0.2% with average smaller than 0.1%