



JCTVC-D127

Syntax for Leaf CU Aligned Slices

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Overall Summary

- A syntax design that can support both LCU-aligned and leaf-CU-aligned slices is proposed
 - When supporting LCU-aligned slices, the coding performance is similar to the LCU-aligned slices designed by slice AHG
 - When supporting leaf-CU-aligned slices, it can have more accurate rate control
 - When 1500 bytes per slice is considered
 - bitrate inaccuracies of LCU-aligned slices are 5%-14%
 - bitrate inaccuracies of leaf-CU-aligned slices are only 1%-3%
 - Our syntax design
 - Use hierarchical method to specify the start address of slice
 - Use hierarchical method to denote the termination of slices when CABAC is considered
- A software supporting this syntax design is verified and available

Outlines

- Introduction
- Proposed slice
- Simulation results
- Conclusions

Introduction: Problem Definitions

- In HM, only one slice per picture can be supported
 - Necessary to add the feature of multiple slices per picture
- In HEVC WD, slices can only be partitioned on LCU resolution
 - Should allow slice partitioning with smaller units
 - Better for rate control applications such as “near-fixed number of bits per slice”
- So we implement a software based on TMuC0.9 that can support both LCU aligned and leaf CU aligned slices

Proposed Slice Categories

- `lcu_aligned_slice_flag` is added to SPS
- `entropy_coding_mode_flag` is signaled at slice header
- 4 cases depend on whether slice boundaries are LCU aligned and whether CABAC is used

Case	1	2	3	4
LCU Aligned (True: <code>lcu_aligned_slice_flag = 1</code>)	True	True	False	False
CABAC (True: <code>entropy_coding_mode_flag = 1</code>)	False	True	False	True

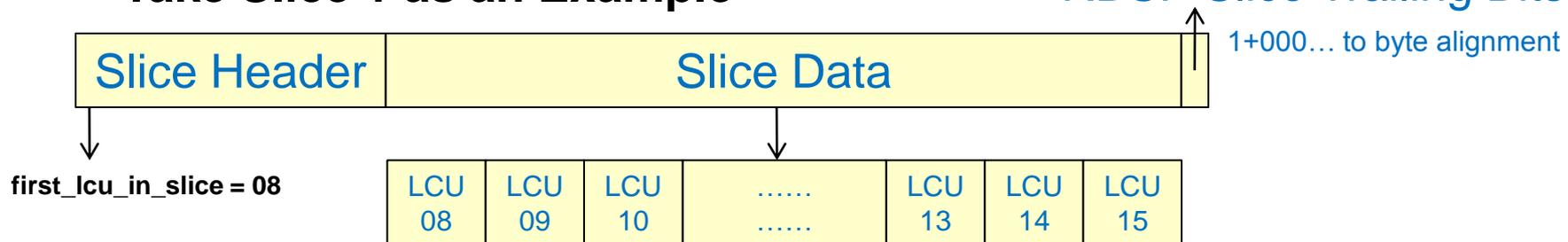
Case 1: LCU-Aligned, LCEC (Slice AHG Syntax)

LCU00	LCU01	LCU02	LCU03	LCU04	LCU05
LCU06	LCU07	LCU08	LCU09	LCU10	LCU11
LCU12	LCU13	LCU14	LCU15	LCU16	LCU17
LCU18	LCU19	LCU20	LCU21	LCU22	LCU23

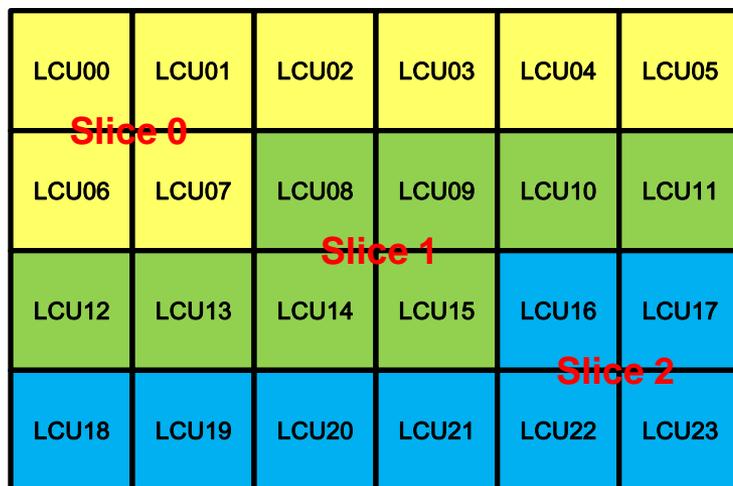
Diagram illustrating LCU alignment and slice extraction. The grid shows LCUs 00-23. Slice 0 (yellow) covers LCU00-05. Slice 1 (green) covers LCU06-11. Slice 2 (blue) covers LCU12-17. The text "Take Slice 1 as an Example" is positioned below the grid.

Take Slice 1 as an Example

RBSP Slice Trailing Bits



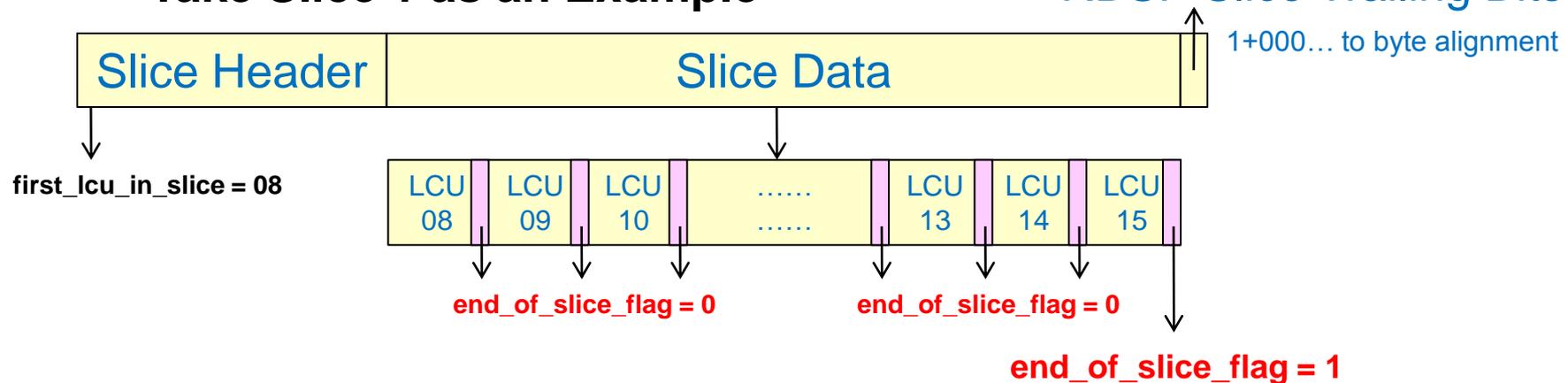
Case 2: LCU-Aligned, CABAC (Slice AHG Syntax)



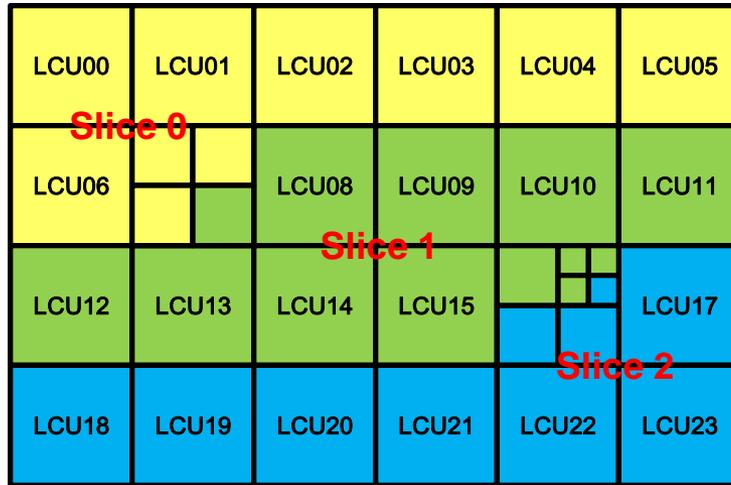
Take Slice 1 as an Example

RBSP Slice Trailing Bits

1+000... to byte alignment



Case 3: Leaf-CU-Aligned, LCEC



0	1	4	5	16	17	20	21
2	3	6	7	18	19	22	23
8	9	12	13	24	25	28	29
10	11	14	15	26	27	30	31
32	33	36	37	48	49	52	53
34	35	38	39	50	51	54	55
40	41	44	45	56	57	60	61
42	43	46	47	58	59	62	63

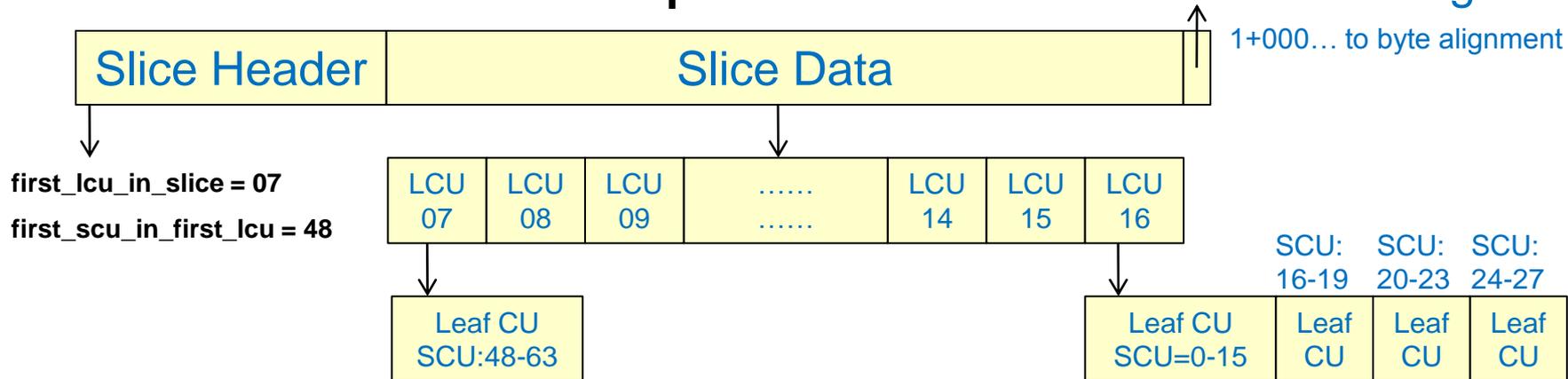
→ LCU

LCU size: 64x64
SCU size : 8x8

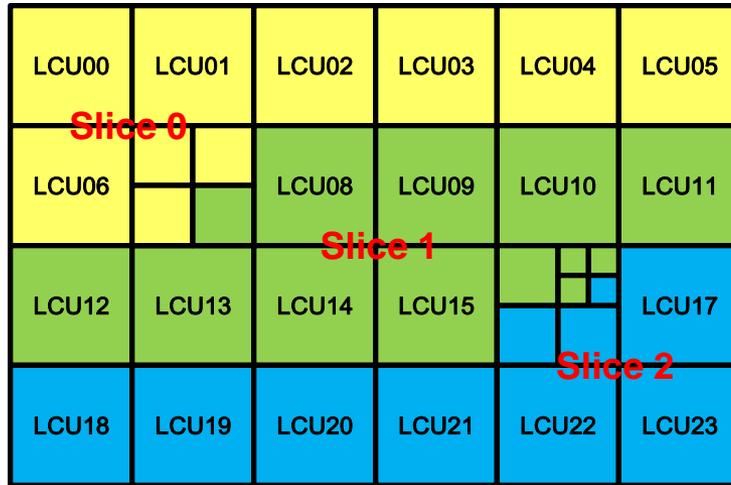
These numbers denote SCU indices.

Take Slice 1 as an Example

RBSP Slice Trailing Bits



Case 4: Leaf-CU-Aligned, CABAC



0	1	4	5	16	17	20	21
2	3	6	7	18	19	22	23
8	9	12	13	24	25	28	29
10	11	14	15	26	27	30	31
32	33	36	37	48	49	52	53
34	35	38	39	50	51	54	55
40	41	44	45	56	57	60	61
42	43	46	47	58	59	62	63

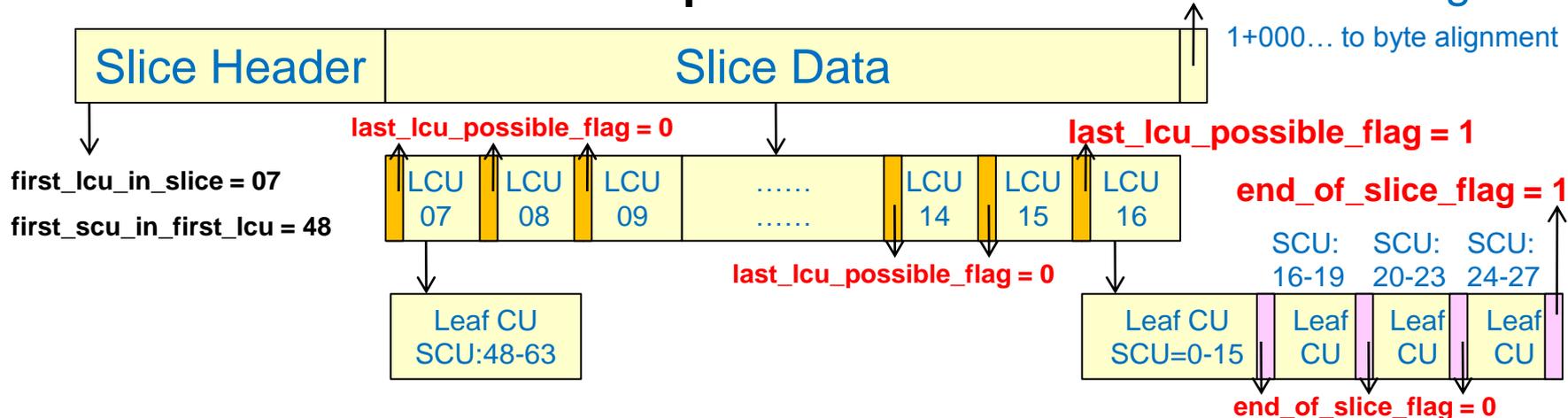
→ LCU

LCU size: 64x64
SCU size : 8x8

These numbers denote SCU indices.

Take Slice 1 as an Example

RBSP Slice Trailing Bits



Transmit one end_of_slice_flag for every leaf CU of the LCU with last_lcu_possible_flag=1.

Simulation Results

- To support fully independent or parallel decoding of multiple slices
 - Slice-independent DF and ALF are implemented
- The modified DF and ALF will suffer a little coding efficiency loss (0.1%-0.4%)
 - Since the ALF issue is not the focus of this proposal, ALF is turned off for all experiments
 - This will only affect the HE anchors because ALF is already off in LC configurations of JCTVC-C500

Fixed number of LCUs per slice

- Slice settings:
 - Slice mode: fixed LCU number
 - Number of LCUs per slice:
 - “the number of LCUs of the picture width plus one”
 - lcu_aligned_slice_flag: true
- Anchor: JCTVC-C500 (ALF off)



BD-rate (%)	HE-AI	LC-AI	HE-RA	LC-RA	HE-LD	LC-LD
Mediatek Slice	3.9	4.3	7.7	6.5	9.1	6.2
Slice AHG	3.5	4.0	7.3	6.3	8.7	6.2

Fixed number of bytes per slice

- Slice settings:
 - Slice mode: fixed number of bytes
 - Number of bytes per slice: 1500
 - Icu_aligned_slice_flag: true vs. false

- Performance matrix:
$$inaccuracy(\%) = \left| \frac{(\text{Real coded bytes} - \text{Target bytes})}{\text{Target bytes}} \times 100 \right|$$

inaccuracy (%)	HE-AI	LC-AI	HE-RA	LC-RA	HE-LD	LC-LD
LCU-aligned slice	13.56	14.48	8.75	8.90	6.06	4.98
Leaf CU-aligned slice	1.91	0.61	2.17	0.66	2.81	0.70

Cross Verification

- We thank Ericsson for crosschecking our proposal
 - JCTVC-D387
 - Our software can be compiled and ran without any problems
 - BD-rates data are confirmed

Conclusions

- A syntax design that can support both LCU-aligned and leaf-CU-aligned slices is proposed
 - The coding performance of LCU-aligned slice is similar to that of slice AHG
 - Our syntax design can have more accurate rate control
- It is proposed to adopt the flexible slice syntax design

MEDIA TEK

Thank you

