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CE9: Summary Report of Core Experiment on MV Coding and Skip/Merge Operations

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Overall Summary

- 5 categories, 46 experiments

- Unification of AMVP and Merge candidate lists
  - UNI01 – UNI03

- Simplification of MVP list construction
  - SP01 – SP14, SP06S1 and SP06S2

- Optimization of MV prediction
  - OPT01 – OPT03

- Evaluation of partial Merge
  - PART01 – PART18

- Robust AMVP/Merge parsing
  - ROB01 – ROB06

- As in the Geneva meeting, suggest to establish a BoG

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UNI01 (Samsung, JCTVC-F380)

- 4 candidates for both AMVP and Merge : {1, 2/2', 3/3', 4(T) }

- For Merge, when the reference index of the MVP is nonzero, the MVP is considered as "not available"
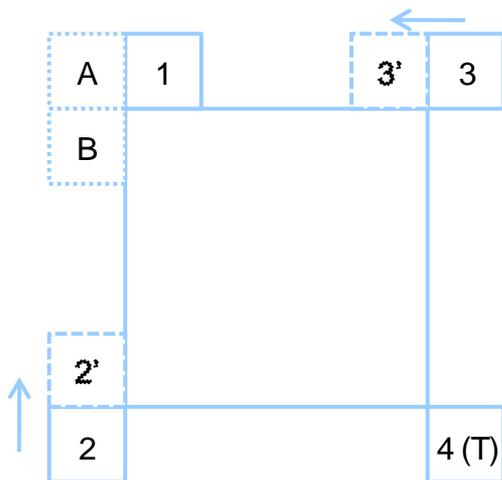
	Random access HE			Random access LC		
	Y	U	V	Y	U	V
Class A	0.0	-0.1	0.0	0.2	0.1	0.3
Class B	0.1	0.1	0.1	0.2	0.2	0.2
Class C	0.0	0.1	0.0	0.0	0.1	0.0
Class D	0.1	0.0	-0.1	0.0	-0.1	0.1
Class E						
Overall	**0.1**	**0.0**	**0.0**	**0.1**	**0.1**	**0.2**
Enc Time[%]	100%			100%		
Dec Time[%]	99%			99%		

	Low delay (B) HE			Low delay (B) LC		
	Y	U	V	Y	U	V
Class A						
Class B	0.2	0.4	0.3	0.3	0.3	0.2
Class C	0.1	0.3	0.2	0.1	0.2	-0.1
Class D	0.1	0.3	0.2	0.1	0.1	0.1
Class E	0.4	0.4	0.2	0.1	0.0	-0.4
Overall	**0.2**	**0.4**	**0.2**	**0.2**	**0.1**	**0.0**
Enc Time[%]	100%			100%		
Dec Time[%]	99%			100%		

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UNI03 (Qualcomm, JCTVC-F297)

- AMVP unchanged

- Merge mode
  - 5 candidates
  - Check L and BL
  - Check A and RA
  - If either the candidate at L or BL is invalid, use the candidate at LA (if valid) to replace the invalid one (L has higher priority than BL for being replaced if both are invalid)
  - If LA is not used in the previous step and if either the candidate at A or RA is invalid, use the candidate at LA (if valid) to replace the invalid one (A has higher priority than RA for being replaced if both are invalid)

- In CAVLC, merge index coding is based on PU shape and index

- Suggest to study UNI03 in the BoG

From collocated picture
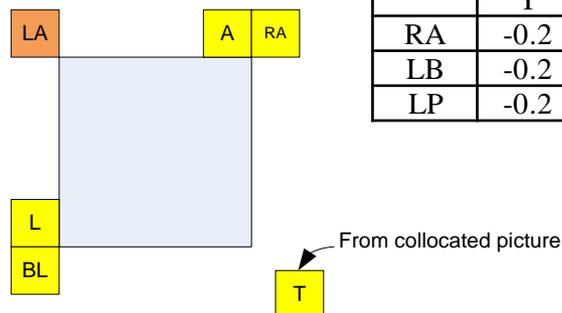
	HE			LC		
	Y	U	V	Y	U	V
RA	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
LB	-0.2	-0.3	-0.2	-0.2	-0.1	0.0
LP	-0.2	-0.3	0.0	-0.2	-0.2	-0.1

SP01, SP02, SP03, SP14 (TI, JCTVC-F084)

- SP01: disable spatial MVP scaling for 4x4 PUs

- SP02: disable spatial MVP scaling for 8x8, 8x4, 4x8, 4x4 PUs

- SP03: fix ref_idx to 0 for temporal MVP derivation of Skip

- SP14: disable temporal MVP in Merge but use it in Skip

- Suggest to put SP01 into the BoG starting point

Tests	RA-HE (%)	RA-LC (%)	LB-HE (%)	LB-LC (%)
SP01	0.0	0.0	0.0	0.0
SP02	0.1	0.1	0.0	0.0
SP03	0.0	0.0	0.2	0.3
SP14	0.3	0.2	0.5	0.5

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SP04 (MediaTek, JCTVC-F050)

- Remove the redundancy check during the derivation of the top MVP
  - The maximum number of spatial MVP scaling processes for each PU is reduced from 4 to 2.
  - The three MVPs (left, top, temporal) can be derived in parallel.
  - Suggest to study SP04 in the BoG

	HE-RA			LC-RA		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	0.0	0.2	0.0	0.0	0.1	0.0
Class B	0.0	-0.1	0.0	0.0	0.0	0.0
Class C	0.0	0.0	0.1	0.0	0.0	0.1
Class D	0.0	0.1	0.0	0.0	-0.1	-0.1
Class E						
All	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Enc Time[%]	99%			99%		
Dec Time[%]	99%			100%		

	HE-LD			LC-LD		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	0.0	0.2	-0.3	0.0	-0.1	-0.1
Class C	0.0	0.0	-0.1	0.0	-0.1	-0.1
Class D	-0.1	0.0	0.1	-0.1	-0.7	-0.4
Class E	0.0	0.3	0.2	0.0	0.0	0.4
All	**0.0**	**0.1**	**0.0**	**0.0**	**-0.2**	**-0.1**
Enc Time[%]	100%			99%		
Dec Time[%]	99%			99%		

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SP05 (Mitsubishi Electric, JCTVC-F168)

- For the left MVP, the first available inter PU is searched among left-neighboring PUs from bottom-left to top-left (same as HM-2.0)

- If the available PU contains an MV for target RefPicList having the same ref_idx as that of current PU, the MV is added in the candidate list.

- If no MV is added in the candidate list, the MV of the first inter PU in a left-neighboring PU is scaled and added to the candidate list.

- The top MVP is derived in a similar fashion as the left MVP.

- The third MVP is derived from the co-located PU

	HE			LC		
	Y	**U**	**V**	**Y**	**U**	**V**
RA	0.1	0.2	0.1	0.2	0.2	0.2
LB	0.0	0.0	-0.1	0.0	0.0	-0.1

SP06 (Mitsubishi Electric and LGE, JCTVC-F113)

- Step 1. Check A0 with condition 1

- Step 2. Check A1 with condition 1

- Step 3. Check A0 with condition 2

- Step 4. Check A1 with condition 2

- Step 5. Check A0 with condition 3 (MVP scaling)

- Step 6. Check A0 with condition 4 (MVP scaling)

- Step 7. Check A1 with condition 3 (MVP scaling)

- Step 8. Check A1 with condition 4 (MVP scaling)

	HE			LC		
	Y	**U**	**V**	**Y**	**U**	**V**
RA	0.0	0.0	0.0	0.0	0.0	0.0
LB	0.0	0.1	0.0	0.0	0.0	-0.1

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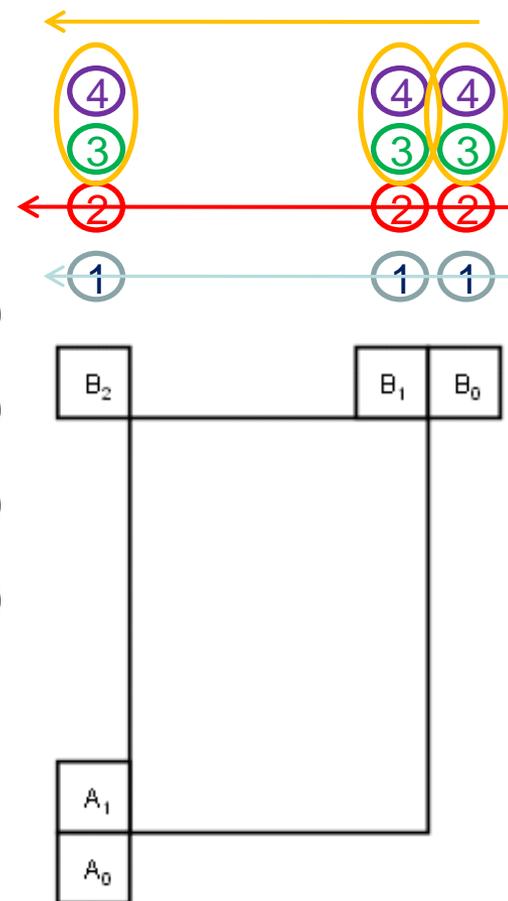
SP06S1, SP06S2 (TI & LG, JCTVC-F088)

- SP06S1: MVPs of same reference picture (con1 and con2) are scanned together, followed by the MVPs of different reference pictures (con3, con4).

- SP06S2: the maximum number spatial MVP scaling processes is reduced to 1, i.e. for each PU, once the spatial MVP scaling is applied, it will no longer be used

- Suggest to study SP06S1 and SP06S2 in the BoG
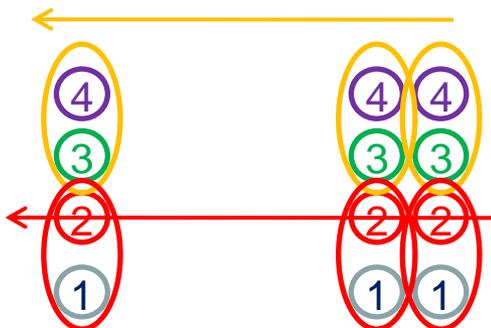
Tests	RA-HE (%)	RA-LC (%)	LB-HE (%)	LB-LC (%)
SP06S1	0.0	0.0	0.0	0.0
SP06S2	0.0	0.0	0.0	0.0

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Reducing TMVP Usage (Mitsubishi Electric and JVC)

- SP07, SP09, SP12 (MERL, JCTVC-F169)

- SP08, SP10, SP11 (JVC, JCTVC-F338)
  - SP10, SP11: encoding time is 106-109%

- Suggest to put SP07 into the BoG starting point

Tests	RA-HE (%)	RA-LC (%)	LB-HE (%)	LB-LC (%)
SP07	0.0	0.0	0.0	0.0
SP08	0.0	0.0	0.1	0.1
SP09	0.4	0.3	0.8	0.7
SP10	0.0	0.0	0.0	0.0
SP11	0.0	0.0	0.1	0.1
SP12	0.5	0.3	0.7	0.6

	4x4	8x4/4x8	8x8	16x8/8x16	16x16	32x16/16x32	32x32	64x32/32x64	64x64
SP07	×	○	○	○	○	○	○	○	○
SP08	×	×	○	○	○	○	○	○	○
SP09	×	×	×	○	○	○	○	○	○
SP10	△	○	○	○	○	○	○	○	○
SP11	△	△	○	○	○	○	○	○	○
SP12	△	△	△	○	○	○	○	○	○

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SP13 (IIR, JCTVC-F424)

- The Skip candidate set is reduced to two MVPs (top and left). If the Skip mode is not used and a 2Nx2N PU-Merge mode using the top or left candidate is subsequently signaled, the QT-Root flag is inferred to be 1 and not decoded.

	HE			LC		
	Y	U	V	Y	U	V
RA	0.1	0.2	0.2	0.1	0.0	0.0
LB	0.1	0.3	0.3	0.1	-0.5	-0.3

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OPT01, (Fujitsu, JCTVC-F144)

- Up to 8 candidates can be searched for one position

Reference index of predicting MV

L0 `| 0 | 1 | 2 | 3 |` Reference index
POC 6 4 2 0

L1 `| 0 | 1 | 2 | 3 |` Reference index
POC 8 6 4 2

Closest L1 reference picture to L0[0]

Reference picture list of the procssing picture

Priority

High	0	MV of L0[1]
	1	MV of L0[0]
	2	MV of L0[2]
	3	MV of L0[3]
	4	MV of L1[2]
	5	MV of L1[1]
	6	MV of L1[3]
Low	7	MV of L1[0]

Priority of MV according to its reference index/direction
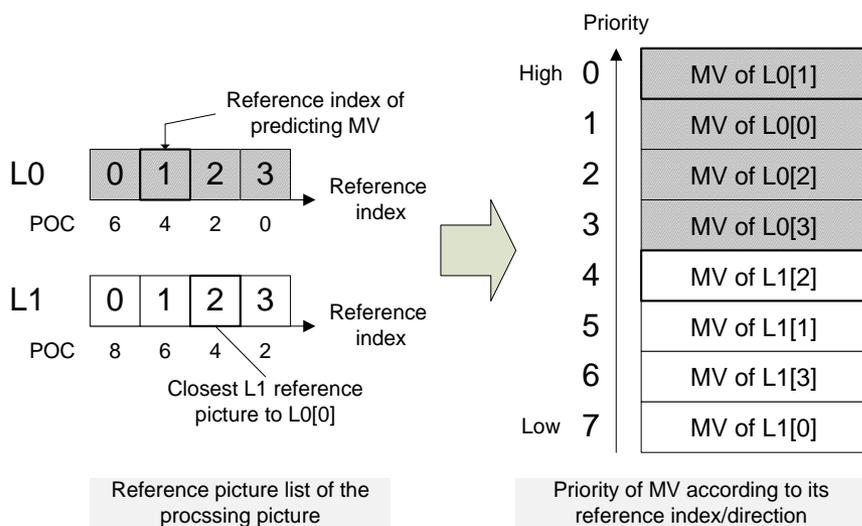
	Random Access HE			Random Access LC		
	Y	U	V	Y	U	V
Class A	0.0	0.2	0.0	0.1	0.0	0.0
Class B	0.0	0.0	0.0	0.1	0.1	0.0
Class C	0.1	0.1	0.1	0.1	0.1	0.2
Class D	0.1	0.1	0.1	0.1	0.0	0.0
Class E						
Overall	**0.0**	**0.1**	**0.0**	**0.1**	**0.0**	**0.0**
Enc Time[%]	101%			104%		
Dec Time[%]	100%			98%		

	Low delay B HE			Low delay B LC		
	Y	U	V	Y	U	V
Class A						
Class B	0.0	0.0	-0.1	0.0	-0.1	0.1
Class C	0.0	0.1	0.0	0.0	0.1	0.0
Class D	-0.1	-0.2	0.0	0.0	-0.4	0.0
Class E	-0.1	0.6	0.2	0.0	-0.1	0.2
Overall	**0.0**	**0.1**	**0.0**	**0.0**	**-0.1**	**0.0**
Enc Time[%]	101%			99%		
Dec Time[%]	101%			100%		

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PART01

Exp.	Which PU is restricted	CU level	Inferred / Encoder-only
Anchor	1st 2NxN PU, 1st Nx2N PU	16x16 and larger CU sizes	Inferred
PART01	1st 2NxN PU, 1st Nx2N PU	All CU sizes	Inferred

	Random access			Random access LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	-0.1	0.2	0.2	0.0	0.2	0.0
Class B	0.0	0.0	0.0	0.1	0.1	0.1
Class C	0.2	0.2	0.3	0.3	0.3	0.3
Class D	0.5	0.5	0.5	0.4	0.3	0.3
Class E						
All	0.2	0.2	0.2	0.2	0.2	0.2
Enc Time[%]	94%			92%		
Dec Time[%]	100%			100%		

	Low delay			Low delay LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	0.0	0.1	-0.3	0.0	-0.1	-0.1
Class C	0.1	0.3	0.3	0.1	0.0	0.0
Class D	0.2	-0.1	0.4	0.3	0.0	0.0
Class E	-0.2	-0.7	0.0	-0.2	-0.1	0.2
All	0.0	0.0	0.0	0.0	0.0	0.0
Enc Time[%]	93%			91%		
Dec Time[%]	100%			100%		

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PART02

Exp.	Which PU is restricted	CU level	Inferred / Encoder-only
Anchor	1st 2NxN PU, 1st Nx2N PU	16x16 and larger CU sizes	Inferred
PART02	1st 2NxN PU, 1st Nx2N PU	16x16 and larger CU sizes	Encoder-only

	Random access			Random access LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	0.20	0.31	0.18	0.29	0.21	0.18
Class B	0.18	0.19	0.11	0.25	0.19	0.17
Class C	0.22	0.25	0.32	0.22	0.16	0.23
Class D	0.27	0.20	0.16	0.18	0.06	0.08
Class E						
All	0.22	0.23	0.19	0.24	0.16	0.17
Enc Time[%]	99%			100%		
Dec Time[%]	100%			100%		

	Low delay			Low delay LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	0.25	0.38	0.19	0.34	0.24	0.29
Class C	0.25	0.26	0.31	0.18	0.28	0.10
Class D	0.13	0.42	0.75	0.20	0.06	0.34
Class E	0.50	0.53	0.68	0.58	0.40	1.12
All	0.27	0.39	0.45	0.31	0.23	0.41
Enc Time[%]	100%			100%		
Dec Time[%]	100%			100%		

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PART03

JCTVC-F029

Exp.	Which PU is restricted	CU level	Inferred / Encoder-only
Anchor	1st 2NxN PU, 1st Nx2N PU	16x16 and larger CU sizes	Inferred
PART03	1st 2NxN PU, 1st Nx2N PU	All CU sizes	Encoder-only

	Random access			Random access LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	0.4	0.6	0.4	0.5	0.4	0.3
Class B	0.4	0.4	0.3	0.4	0.3	0.3
Class C	0.7	0.7	0.8	0.7	0.6	0.7
Class D	1.0	1.0	0.9	0.8	0.6	0.6
Class E						
All	0.6	0.6	0.6	0.6	0.5	0.5
Enc Time[%]	94%			91%		
Dec Time[%]	100%			100%		

	Low delay			Low delay LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	0.3	0.5	0.3	0.5	0.4	0.4
Class C	0.6	0.6	0.7	0.6	0.5	0.4
Class D	0.8	0.7	1.3	0.9	0.8	0.5
Class E	0.6	0.5	0.9	0.8	0.2	0.7
All	0.6	0.6	0.8	0.7	0.5	0.5
Enc Time[%]	93%			91%		
Dec Time[%]	101%			100%		

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PART04

Exp.	Which PU is restricted	CU level	Inferred / Encoder-only
Anchor	1st 2NxN PU, 1st Nx2N PU	16x16 and larger CU sizes	Inferred
PART04	Both two 2NxN PUs, both two Nx2N PUs	16x16 and larger CU sizes	Inferred

	Random access			Random access LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	0.39	0.65	0.47	0.51	0.48	0.35
Class B	0.46	0.44	0.44	0.55	0.44	0.45
Class C	0.51	0.59	0.65	0.57	0.54	0.55
Class D	0.47	0.50	0.41	0.41	0.22	0.19
Class E						
All	0.45	0.54	0.49	0.51	0.42	0.39
Enc Time[%]	89%			85%		
Dec Time[%]	100%			101%		

	Low delay			Low delay LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	0.33	0.40	0.22	0.49	0.36	0.33
Class C	0.43	0.46	0.56	0.46	0.32	0.25
Class D	0.35	0.75	0.88	0.46	0.16	0.30
Class E	0.44	1.04	0.68	0.56	0.32	0.70
All	0.38	0.62	0.56	0.49	0.29	0.37
Enc Time[%]	88%			84%		
Dec Time[%]	100%			101%		

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PART05

Exp.	Which PU is restricted	CU level	Inferred / Encoder-only
Anchor	1st 2NxN PU, 1st Nx2N PU	16x16 and larger CU sizes	Inferred
PART05	Both two 2NxN PUs, both two Nx2N PUs	All CU sizes	Inferred

	Random access			Random access LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	0.5	1.2	0.9	0.7	0.8	0.5
Class B	0.6	0.6	0.6	0.8	0.7	0.7
Class C	1.1	1.2	1.4	1.3	1.2	1.4
Class D	1.5	1.5	1.7	1.5	1.3	1.3
Class E						
All	0.9	1.1	1.1	1.0	1.0	1.0
Enc Time[%]	74%			67%		
Dec Time[%]	101%			101%		

	Low delay			Low delay LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	0.4	0.5	0.4	0.6	0.3	0.4
Class C	0.9	0.9	1.1	1.0	0.8	0.8
Class D	1.1	1.1	1.6	1.2	1.2	0.7
Class E	0.2	0.4	0.3	0.3	0.4	0.3
All	0.6	0.7	0.9	0.8	0.7	0.6
Enc Time[%]	71%			64%		
Dec Time[%]	101%			101%		

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PART06

Exp.	Which PU is restricted	CU level	Inferred / Encoder-only
Anchor	1st 2NxN PU, 1st Nx2N PU	16x16 and larger CU sizes	Inferred
PART06	Both two 2NxN PUs, both two Nx2N PUs	16x16 and larger CU sizes	Encoder-only

	Random access			Random access LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	0.57	0.87	0.70	0.79	0.71	0.56
Class B	0.61	0.62	0.63	0.84	0.66	0.65
Class C	0.68	0.76	0.80	0.81	0.66	0.86
Class D	0.67	0.69	0.56	0.59	0.44	0.52
Class E						
All	0.63	0.73	0.67	0.76	0.62	0.65
Enc Time[%]	89%			85%		
Dec Time[%]	101%			101%		

	Low delay			Low delay LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	0.59	0.90	1.06	0.97	0.56	0.61
Class C	0.65	1.02	0.93	0.72	0.49	0.55
Class D	0.57	0.42	1.27	0.67	0.64	0.51
Class E	0.99	1.93	1.29	1.57	1.20	1.60
All	0.68	1.00	1.12	0.95	0.68	0.75
Enc Time[%]	87%			84%		
Dec Time[%]	100%			101%		

PART12

Exp.	Which PU is restricted	CU level	Inferred / Encoder-only
Anchor	1st 2NxN PU, 1st Nx2N PU	16x16 and larger CU sizes	Inferred
PART12	None (PU merge)	N/A	N/A

	Random access			Random access LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	-0.61	-1.11	-0.98	-0.69	-0.74	-0.66
Class B	-0.40	-0.50	-0.49	-0.44	-0.32	-0.30
Class C	-0.62	-0.64	-0.76	-0.65	-0.62	-0.63
Class D	-0.48	-0.46	-0.51	-0.53	-0.62	-0.61
Class E						
All	-0.52	-0.67	-0.67	-0.57	-0.56	-0.54
Enc Time[%]	110%			116%		
Dec Time[%]	100%			100%		

	Low delay			Low delay LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	-0.19	-0.31	-0.56	-0.26	-0.17	-0.18
Class C	-0.35	-0.43	-0.58	-0.49	-0.26	-0.41
Class D	-0.39	-0.44	0.22	-0.31	-0.18	-0.25
Class E	-0.10	0.22	-0.06	-0.15	0.48	0.41
All	-0.27	-0.28	-0.27	-0.31	-0.07	-0.14
Enc Time[%]	112%			116%		
Dec Time[%]	100%			100%		

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PART13

Exp.	Which PU is restricted	CU level	Inferred / Encoder-only
Anchor	1st 2NxN PU, 1st Nx2N PU	16x16 and larger CU sizes	Inferred
PART13	1st only	16x16 and greater	Encoder-only (with RCME)

	Random access			Random access LC		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	-0.2	-0.2	-0.1	-0.1	0.2	0.1
Class B	-0.1	-0.1	-0.1	-0.1	0.0	0.1
Class C	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1
Class D	-0.1	-0.1	-0.1	-0.2	-0.3	-0.3
Class E						
All	-0.1	-0.2	-0.1	-0.1	0.0	-0.1
Enc Time[%]	107%			108%		
Dec Time[%]	102%			99%		

	Low delay			Low delay LC		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	0.0	0.0	-0.1	0.0	0.0	0.2
Class C	-0.1	0.1	-0.2	-0.2	-0.1	-0.1
Class D	-0.2	-0.3	0.6	-0.2	-0.4	-0.3
Class E	-0.1	-0.4	-0.2	0.0	0.6	0.6
All	-0.1	-0.1	0.1	-0.1	0.0	0.1
Enc Time[%]	106%			107%		
Dec Time[%]	100%			99%		

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PART14

Exp.	Which PU is restricted	CU level	Inferred / Encoder-only
Anchor	1st 2NxN PU, 1st Nx2N PU	16x16 and larger CU sizes	Inferred
PART14	1st 2NxN PU, 1st Nx2N PU, all four NxN PUs	16x16 and larger CU sizes for 2NxN and Nx2N, 8x8 for NxN	Inferred

	Random access			Random access LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	0.0	0.0	0.0	0.0	0.1	0.0
Class B	0.0	-0.1	-0.1	0.0	0.0	0.0
Class C	0.0	0.1	0.0	0.1	0.2	0.3
Class D	0.2	0.3	0.2	0.2	0.2	0.2
Class E						
All	0.0	0.0	0.0	0.1	0.1	0.1
Enc Time[%]	91%			89%		
Dec Time[%]	100%			100%		

	Low delay			Low delay LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	0.0	0.0	-0.1	0.0	-0.2	-0.2
Class C	0.0	0.1	0.0	0.0	0.0	-0.1
Class D	0.0	-0.1	0.7	0.1	0.1	0.0
Class E	0.0	0.2	0.2	-0.2	-0.3	0.6
All	0.0	0.0	0.2	0.0	-0.1	0.0
Enc Time[%]	90%			87%		
Dec Time[%]	100%			100%		

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PART15

Exp.	Which PU is restricted	CU level	Inferred / Encoder-only
Anchor	1st 2NxN PU, 1st Nx2N PU	16x16 and larger CU sizes	Inferred
PART15	1st 2NxN PU, 1st Nx2N PU, all four NxN PUs	16x16 and larger CU sizes for 2NxN and Nx2N, 8x8 for NxN	Encoder-only

	Random access			Random access LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	0.21	0.30	0.06	0.28	0.21	0.04
Class B	0.22	0.22	0.15	0.32	0.24	0.28
Class C	0.34	0.41	0.48	0.46	0.41	0.50
Class D	0.49	0.40	0.41	0.51	0.45	0.44
Class E						
All	0.31	0.33	0.27	0.39	0.32	0.31
Enc Time[%]	91%			89%		
Dec Time[%]	100%			100%		

	Low delay			Low delay LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	0.26	0.40	0.02	0.40	0.29	0.47
Class C	0.34	0.51	0.37	0.43	0.44	0.33
Class D	0.42	0.46	1.17	0.57	0.69	0.79
Class E	0.71	1.29	0.43	0.67	0.59	1.09
All	0.40	0.61	0.47	0.50	0.48	0.63
Enc Time[%]	91%			88%		
Dec Time[%]	100%			100%		

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PART16

Exp.	Which PU is restricted	CU level	Inferred / Encoder-only
Anchor	1st 2NxN PU, 1st Nx2N PU	16x16 and larger CU sizes	Inferred
PART16	All four NxN PUs	8x8 for NxN	Inferred

	Random access			Random access LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	-0.6	-0.8	-1.0	-0.7	-0.7	-0.7
Class B	-0.4	-0.5	-0.5	-0.4	-0.3	-0.3
Class C	-0.6	-0.6	-0.6	-0.5	-0.4	-0.3
Class D	-0.4	-0.4	-0.4	-0.3	-0.2	-0.5
Class E						
All	-0.5	-0.6	-0.6	-0.5	-0.4	-0.4
Enc Time[%]	102%			104%		
Dec Time[%]	100%			100%		

	Low delay			Low delay LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	-0.2	-0.5	-0.4	-0.3	-0.2	-0.1
Class C	-0.3	-0.4	-0.4	-0.5	-0.4	-0.4
Class D	-0.3	-0.3	0.3	-0.2	-0.1	-0.2
Class E	-0.1	0.2	-0.4	-0.3	0.2	0.4
All	-0.2	-0.3	-0.2	-0.3	-0.2	-0.1
Enc Time[%]	102%			103%		
Dec Time[%]	100%			100%		

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PART17

Exp.	Which PU is restricted	CU level	Inferred / Encoder-only
Anchor	1st 2NxN PU, 1st Nx2N PU	16x16 and larger CU sizes	Inferred
PART17	1st 2NxN PU, 1stNx2N PU, all four NxN PUs	All CU sizes for 2NxN and Nx2N, 8x8 for NxN	Inferred

	Random access			Random access LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	0.0	0.4	0.2	0.1	0.4	0.2
Class B	0.1	0.1	0.1	0.2	0.2	0.2
Class C	0.5	0.5	0.7	0.7	0.7	0.9
Class D	0.9	1.1	1.2	1.1	1.2	1.3
Class E						
All	0.3	0.5	0.5	0.5	0.6	0.6
Enc Time[%]	85%			81%		
Dec Time[%]	100%			101%		

	Low delay			Low delay LoCo		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	0.0	0.0	-0.1	0.0	-0.1	-0.2
Class C	0.3	0.3	0.3	0.4	0.4	0.4
Class D	0.5	0.8	1.1	0.8	0.6	0.6
Class E	-0.2	-0.2	0.0	-0.2	-0.3	0.3
All	0.2	0.3	0.3	0.3	0.1	0.2
Enc Time[%]	83%			79%		
Dec Time[%]	101%			101%		

MEDIATEK

PART18

Exp.	Which PU is restricted	CU level	Inferred / Encoder-only
Anchor	1st 2NxN PU, 1st Nx2N PU	16x16 and larger CU sizes	Inferred
PART18	None	8x8 for NxN	Encoder-only

	Random access			Random access LC		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A	-0.5	-0.8	-0.9	-0.6	-0.5	-0.6
Class B	-0.3	-0.5	-0.5	-0.4	-0.3	-0.3
Class C	-0.5	-0.4	-0.5	-0.4	-0.2	-0.2
Class D	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1
Class E						
All	-0.4	-0.5	-0.5	-0.4	-0.3	-0.3
Enc Time[%]	101%			102%		
Dec Time[%]	101%			99%		

	Low delay			Low delay LC		
	Y BD-rate	U BD-rate	V BD-rate	Y BD-rate	U BD-rate	V BD-rate
Class A						
Class B	-0.1	-0.2	-0.6	-0.2	-0.1	-0.1
Class C	-0.2	0.0	-0.2	-0.2	0.0	-0.1
Class D	0.0	0.1	0.6	0.1	0.3	-0.1
Class E	-0.1	-0.4	-0.2	-0.2	0.2	0.3
All	-0.1	-0.1	-0.1	-0.1	0.1	0.0
Enc Time[%]	101%			102%		
Dec Time[%]	99%			99%		

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PART-Series

- Main participants are NTT DOCOMO, MediaTek, and TI in order to find better trade-off points between coding efficiency and encoding time

- Suggest to study PART12-18 in the BoG

- It may be better to discuss and decide the PART-series before the BoG in order to reduce the number of experiments to be conducted this week in the BoG.

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ROB01 (Canon, JCTVC-F474)

- Force the temporal MVP to be available

	Random Access HE			Random Access LC		
	Y	U	V	Y	U	V
Class A	0.8	0.7	0.5	0.9	0.9	0.5
Class B	1.0	0.7	0.5	1.1	0.8	0.7
Class C	1.1	1.0	0.9	1.1	0.9	1.0
Class D	1.1	0.9	0.9	1.1	0.6	0.7
Class E						
Overall	**1.0**	**0.8**	**0.7**	**1.1**	**0.8**	**0.7**
Enc Time[%]	100%			101%		
Dec Time[%]	99%			98%		

	Low delay B HE			Low delay B LC		
	Y	U	V	Y	U	V
Class A						
Class B	1.4	1.1	0.8	1.5	1.0	1.1
Class C	1.3	1.0	1.0	1.2	0.8	0.8
Class D	1.3	1.1	1.0	1.3	0.7	0.6
Class E	3.5	3.5	2.8	3.8	2.8	3.5
Overall	**1.7**	**1.5**	**1.3**	**1.8**	**1.2**	**1.3**
Overall wo CL E	**1.3**	**1.1**	**0.9**	**1.3**	**0.8**	**0.8**
Enc Time[%]	99%			100%		
Dec Time[%]	98%			98%		

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ROB02 (Canon, JCTVC-F474)

- Force the temporal MVP to be available + replace redundant spatial MVPs by substitutes

- Suggest to study ROB02 in the BoG

	Random Access HE			Random Access LC		
	Y	U	V	Y	U	V
Class A	0.4	0.3	0.5	0.2	0.4	0.2
Class B	0.6	0.5	0.4	0.5	0.6	0.5
Class C	0.7	0.8	0.8	0.4	0.5	0.5
Class D	0.6	0.7	0.6	0.3	0.3	0.3
Class E						
Overall	**0.6**	**0.6**	**0.6**	**0.4**	**0.4**	**0.4**
Enc Time[%]	102%			104%		
Dec Time[%]	96%			94%		

	Low delay B HE			Low delay B LC		
	Y	U	V	Y	U	V
Class A						
Class B	0.5	0.1	-0.4	0.1	0.2	0.5
Class C	0.5	0.4	0.2	0.2	0.1	0.3
Class D	0.5	0.1	1.0	0.4	-0.2	0.0
Class E	1.9	2.2	1.4	1.4	2.1	2.7
Overall	**0.8**	**0.6**	**0.4**	**0.4**	**0.4**	**0.7**
Overall wo CL E	**0.5**	**0.2**	**0.2**	**0.2**	**0.1**	**0.3**
Enc Time[%]	102%			104%		
Dec Time[%]	95%			94%		

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ROB03 (MediaTek, JCTVC-F051)

- Flags to control the usage of temporal MVPs

- Provide multiple trade-off points between coding efficiency and parsing robustness

	Random Access HE			Random Access LC		
	Y	U	V	Y	U	V
Class A	0.8	0.6	0.8	0.8	0.5	0.6
Class B	0.1	0.1	0.2	0.1	0.1	0.2
Class C	0.1	0.1	0.2	0.1	0.1	0.2
Class D	0.3	0.3	0.2	0.3	0.1	0.2
Class E						
Overall	**0.3**	**0.3**	**0.3**	**0.3**	**0.2**	**0.3**
Enc Time[%]	99%			99%		
Dec Time[%]	99%			99%		

Disable TMVPs every 8 pictures

	Low delay B HE			Low delay B LC		
	Y	U	V	Y	U	V
Class A						
Class B	0.3	0.0	-0.5	0.4	0.1	0.2
Class C	0.4	0.3	0.3	0.4	0.3	0.2
Class D	0.3	0.0	0.8	0.4	0.0	0.0
Class E	0.5	0.3	0.4	0.4	-0.2	0.6
Overall	**0.4**	**0.1**	**0.2**	**0.4**	**0.0**	**0.3**
Enc Time[%]	99%			99%		
Dec Time[%]	96%			99%		

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ROB04 (MediaTek, JCTVC-F052)

- Replace redundant MVPs by substitutes, similar to ROB02

- Motion ID for removing redundancy
  - A unique motion ID is assigned for each Inter PU and conditionally assigned for a Skip/Merge PU that selects a temporal MVP
  - Motion IDs can be inherited through the Skip/Merge
  - For a current PU, an MVP with the same motion ID as another MVP can be removed.

	Random Access HE			Random Access LC		
	Y	U	V	Y	U	V
Class A	0.3	0.6	0.6	0.4	0.6	0.6
Class B	0.2	0.2	0.2	0.3	0.3	0.3
Class C	0.4	0.4	0.6	0.6	0.7	0.7
Class D	0.4	0.4	0.3	0.4	0.4	0.3
Class E						
Overall	**0.3**	**0.4**	**0.4**	**0.4**	**0.5**	**0.5**
Enc Time[%]	102%			102%		
Dec Time[%]	101%			102%		

	Low delay B HE			Low delay B LC		
	Y	U	V	Y	U	V
Class A						
Class B	0.2	-0.1	-0.2	0.3	0.1	0.1
Class C	0.3	0.1	0.1	0.4	0.4	0.3
Class D	0.2	-0.1	0.8	0.3	0.3	-0.2
Class E	0.8	1.0	-0.2	1.3	1.2	1.2
Overall	**0.3**	**0.2**	**0.1**	**0.5**	**0.4**	**0.3**
Enc Time[%]	103%			104%		
Dec Time[%]	102%			102%		

- Suggest to study ROB04 in the BoG

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ROB05 (TI, JCTVC-F083)

- ROB5: disable TMVP for Inter but use it as an initial candidate for motion estimation (ME)

- ROB05S1: disable TMVP for both Inter and ME

- ROB05S2: disable TMVP for Inter, Merge, Skip, and ME

Tests	RA-HE (%)	RA-LC (%)	LB-HE (%)	LB-LC (%)
ROB05	0.1	0.2	0.1	0.1
ROB05S1	0.2	0.2	0.1	0.1
ROB05S12	2.0	1.8	2.1	2.3

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ROB06, (Canon and MediaTek, JCTVC-F713)

- Combination of ROB02 and ROB04
  - Add the motion ID concept on top of ROB02

- Suggest to study ROB06 in the BoG

	Random Access HE			Random Access LC		
	Y	U	V	Y	U	V
Class A	0.1	0.1	0.0	0.1	0.2	-0.1
Class B	0.1	0.2	0.1	0.0	0.1	0.1
Class C	0.2	0.3	0.3	0.3	0.2	0.3
Class D	0.2	0.1	0.2	0.2	0.1	0.1
Class E						
Overall	**0.2**	**0.1**	**0.2**	**0.1**	**0.1**	**0.1**
Enc Time[%]	102%			103%		
Dec Time[%]	96%			97%		

	Low delay B HE			Low delay B LC		
	Y	U	V	Y	U	V
Class A						
Class B	0.0	-0.1	-0.3	-0.3	-0.2	0.1
Class C	0.1	0.2	0.0	0.1	0.0	0.0
Class D	0.1	-0.4	0.5	0.1	0.1	-0.1
Class E	0.5	1.0	0.6	0.8	0.8	1.0
Overall	**0.2**	**0.1**	**0.1**	**0.1**	**0.1**	**0.2**
Enc Time[%]	103%			104%		
Dec Time[%]	96%			97%		

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Conclusion

- Suggest to establish a BoG
  - Use SP01+SP07 as the BoG starting point
  - Study UNI03, SP04, SP06S1, SP06S2, PART12-18, ROB02, ROB04, ROB06, and possible combinations of the above on top of the BoG starting point
  - It may be better to present UNI03, SP04, SP06S1, SP06S2, ROB02, ROB04, and ROB06 before the BoG starts if time is allowed.
  - It may be better to discuss and decide the PART-series before the BoG in order to reduce the number of experiments to be conducted this week in the BoG.

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