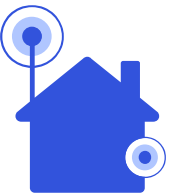


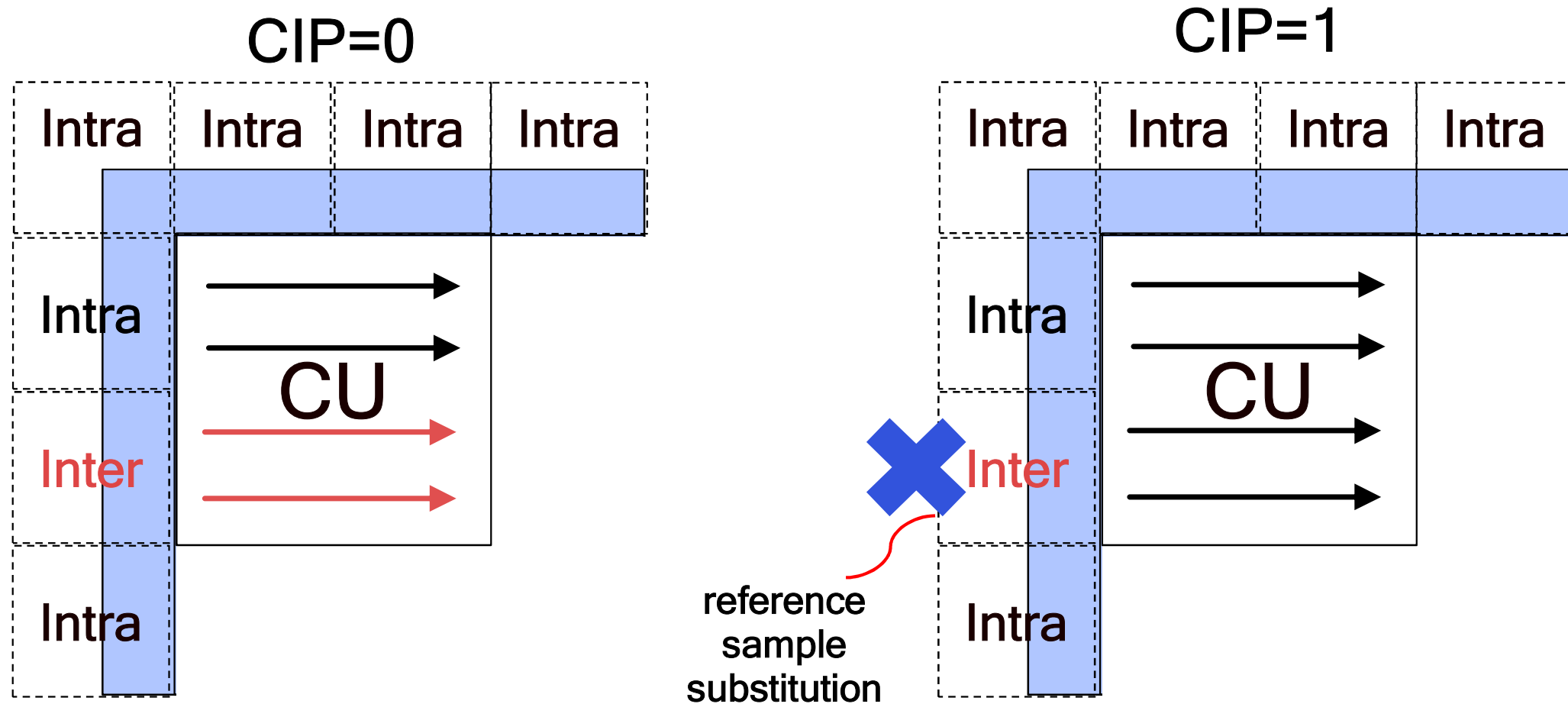
# Removal of CIP from Multi-hypothesis Intra Prediction

Chun-Chi Chen, Wei-Jung Chien, Marta Karczewicz



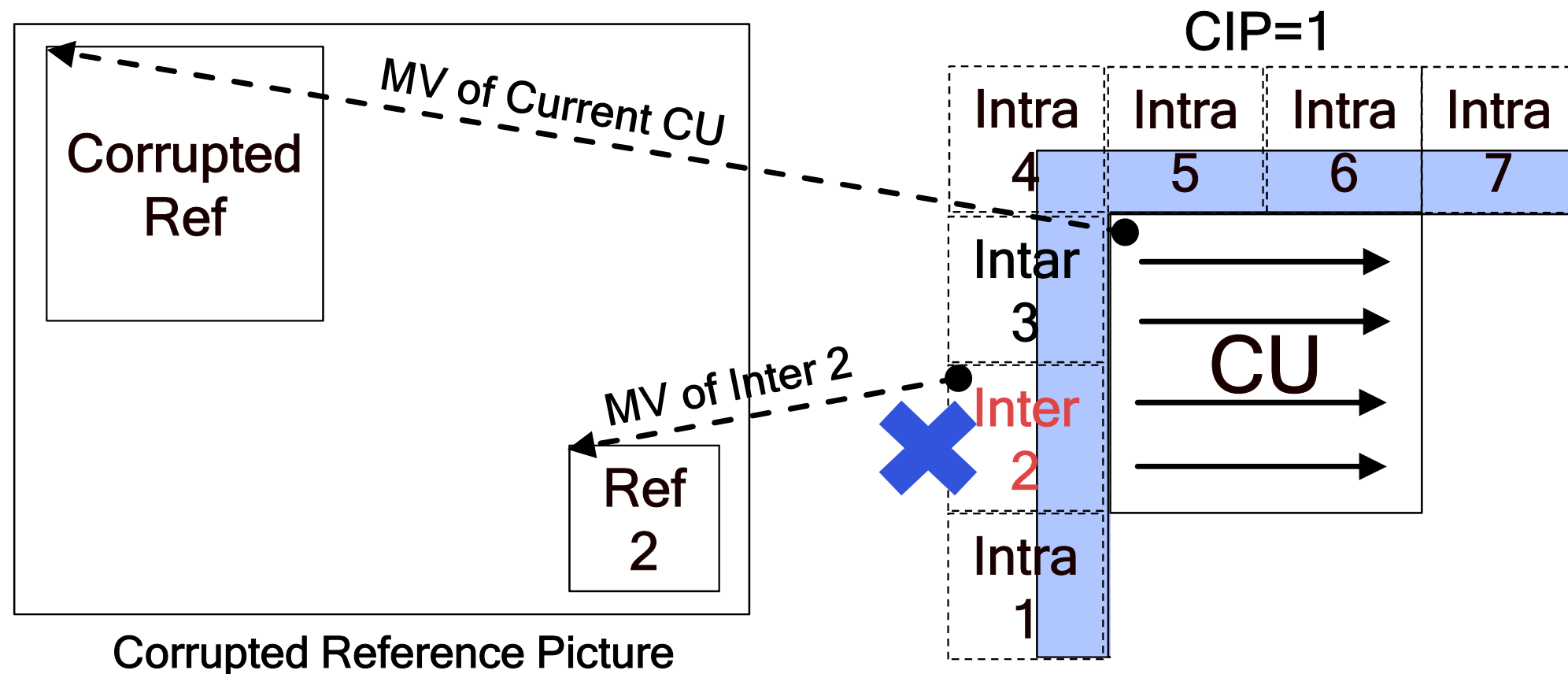
# Introduction

- Propose to bypass the functionality of constrained intra prediction (CIP) from multi-hypothesis intra prediction (MHIntra a.k.a. Combined Inter and Intra Prediction)



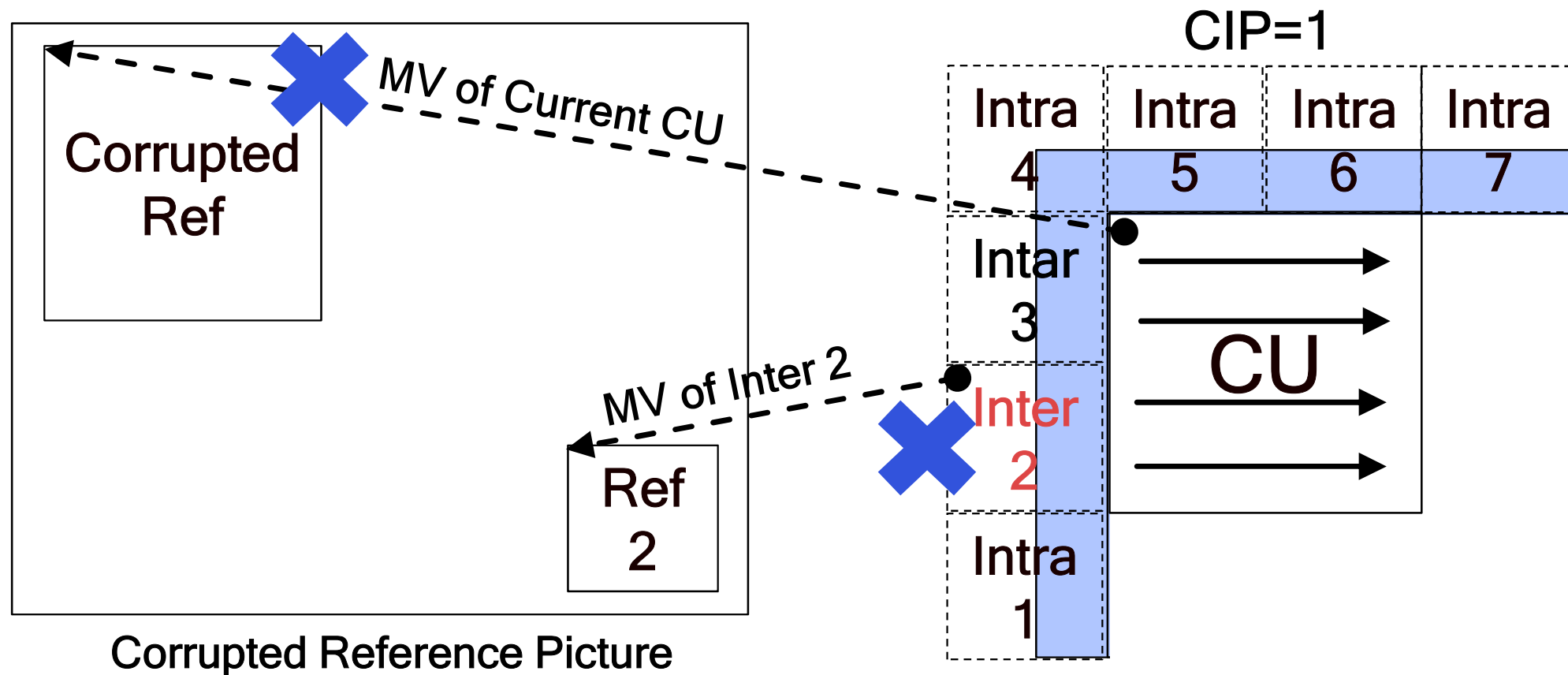
# Problem Statement

- MHItra is a prediction technique that combines prediction signals from both Merge mode and Intra prediction mode in a weighted average manner
- Even though CIP=1, potential error propagation into prediction signals is still unavoidable



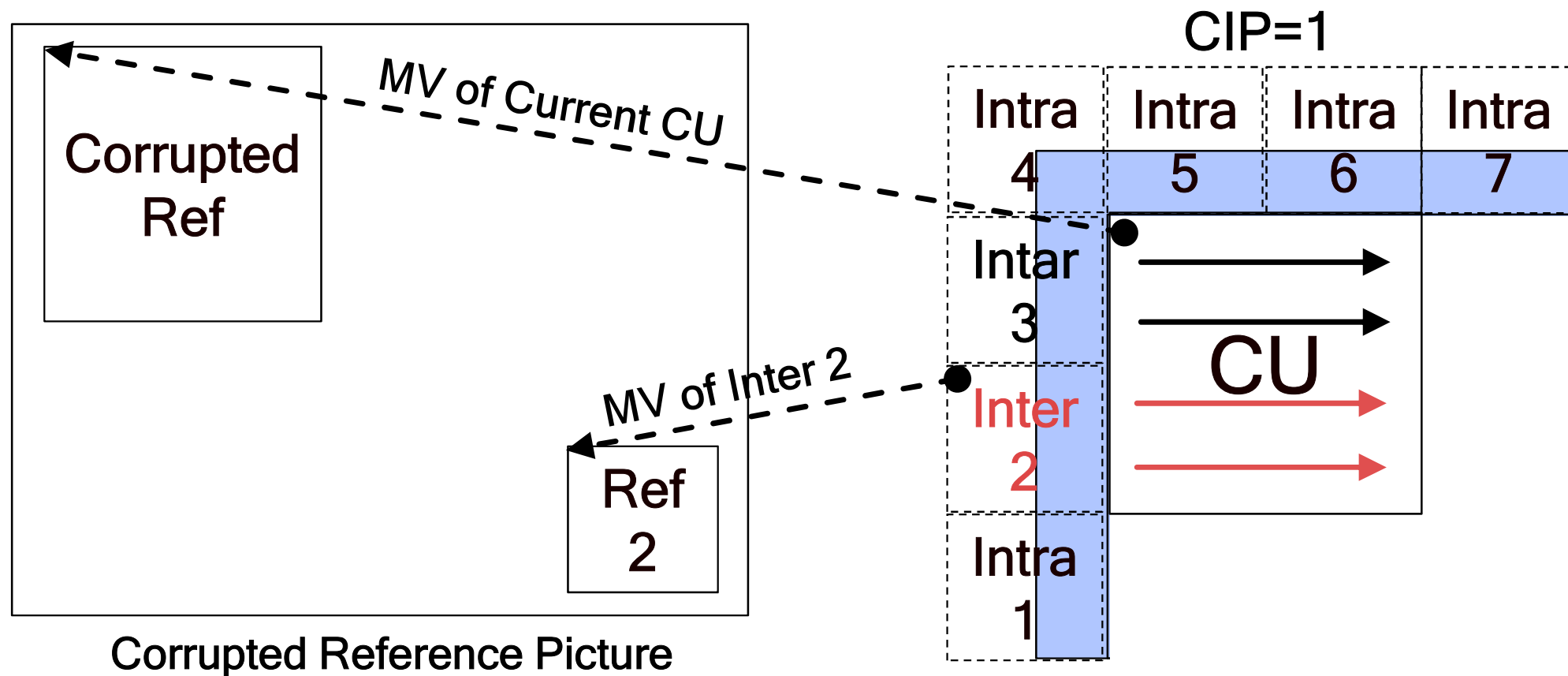
# Potential Solution 1

- Disable MHIntra completely when CIP=1
- Approach this solution by skipping sps\_mh\_intra\_enabled\_flag



# Potential Solution 2

- Ignore the effect of CIP on MHIntra when CIP=1
- Approach this solution by adding 1 CU-level comparison with MHIntra flag



# Solution 1 vs. Solution 2

## [Solution 1] Disable MHIntra mode completely when CIP=1

- Skip `sps_mh_intra_enabled_flag` and impact none on low-level design
- Expect potential performance impact on VTM w/ CIP=1

## [Solution 2] Ignore the effect of CIP on MHIntra when CIP=1

- Clean up ineffectual functionality in MHIntra and expect no negative performance impact
- Introduce 1 additional comparison for MHIntra flag at CU level

`cs.pps->getConstrainedIntraPred() & !cu.firstPU->mhIntraFlag`

We take Solution 2 as recommended solution.

# Experimental Results (Anchor: VTM-3.0 w/ CIP=0)

[ VTM-3.0 w/ CIP=1 ]

	Random Access Main 10				
	Y	U	V	EncT	DecT
Class A1	6.33%	16.99%	19.66%	99%	98%
Class A2	3.41%	7.96%	6.46%	99%	100%
Class B	4.22%	8.12%	9.23%	99%	98%
Class C	4.42%	7.45%	8.48%	100%	98%
<b>Overall</b>	4.53%	9.68%	10.56%	99%	99%
Class D	3.40%	6.17%	6.25%	96%	99%
Class F	3.16%	5.11%	4.94%	100%	100%
	Low Delay B Main 10				
	Y	U	V	EncT	DecT
Class B	3.20%	7.69%	9.11%	98%	97%
Class C	3.10%	6.95%	8.15%	101%	99%
Class E	0.81%	2.16%	2.12%	101%	99%
<b>Overall</b>	2.57%	6.06%	7.04%	100%	98%
Class D	2.17%	6.27%	6.66%	100%	97%
Class F	4.56%	8.38%	8.85%	97%	98%

[ VTM-3.0 w/ CIP=1 & Solution 2 ]

	Random Access Main 10				
	Y	U	V	EncT	DecT
Class A1	5.38%	17.23%	20.43%	99%	101%
Class A2	2.66%	7.00%	5.19%	100%	101%
Class B	3.26%	7.41%	8.60%	99%	99%
Class C	3.76%	7.20%	8.02%	98%	99%
<b>Overall</b>	3.70%	9.24%	10.13%	99%	100%
Class D	2.83%	6.16%	5.96%	99%	100%
Class F	2.76%	4.78%	4.48%	98%	100%
	Low Delay B Main 10				
	Y	U	V	EncT	DecT
Class B	1.94%	4.92%	6.28%	98%	97%
Class C	2.13%	5.33%	6.26%	101%	98%
Class E	0.49%	0.89%	0.98%	101%	99%
<b>Overall</b>	1.64%	4.05%	4.95%	100%	98%
Class D	1.47%	4.28%	4.37%	99%	98%
Class F	3.99%	7.47%	7.37%	97%	98%

# Conclusion

- Clean up ineffectual functionality in the prediction process of MHIntra caused by CIP
- Report less negative performance-wise impact from CIP when Solution 2 is applied

[Recommendation]

Adopt Solution 2 into the next release of VTM software and VVC Working Draft

Thank Panasonic (JVET-M0667) for crosscheck





# Thank you!

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