

Non-CE8: Palette mode and prediction mode signaling

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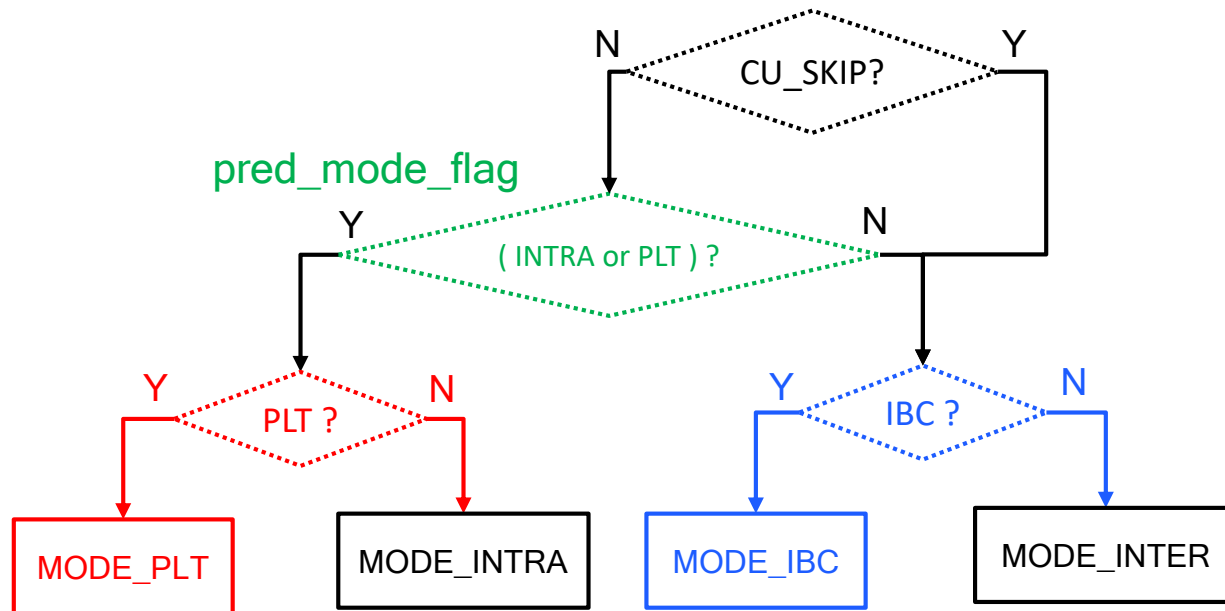
Introduction

- Current mode signaling in VTM6.0:
 - Conditions of palette mode, IBC mode, and prediction mode signaling are different for I slice/non-I slice, and IBC enabled/disabled
- Proposed simplification:
 - Unify the signaling condition for different config setting
 - The simplification shows minor impact on BD rate:
 - YUV4:4:4 - DualTree OFF
 - IBC ON: 0.08 % AI, -0.06 % RA, 0.08 % LB
 - IBC OFF: 0.00 % AI, -0.01 % RA, -0.06 % LB
 - YUV4:2:0
 - Overall: 0.00 % AI, 0.00 % RA, -0.01 % LB

Current mode signaling in VTM6.0

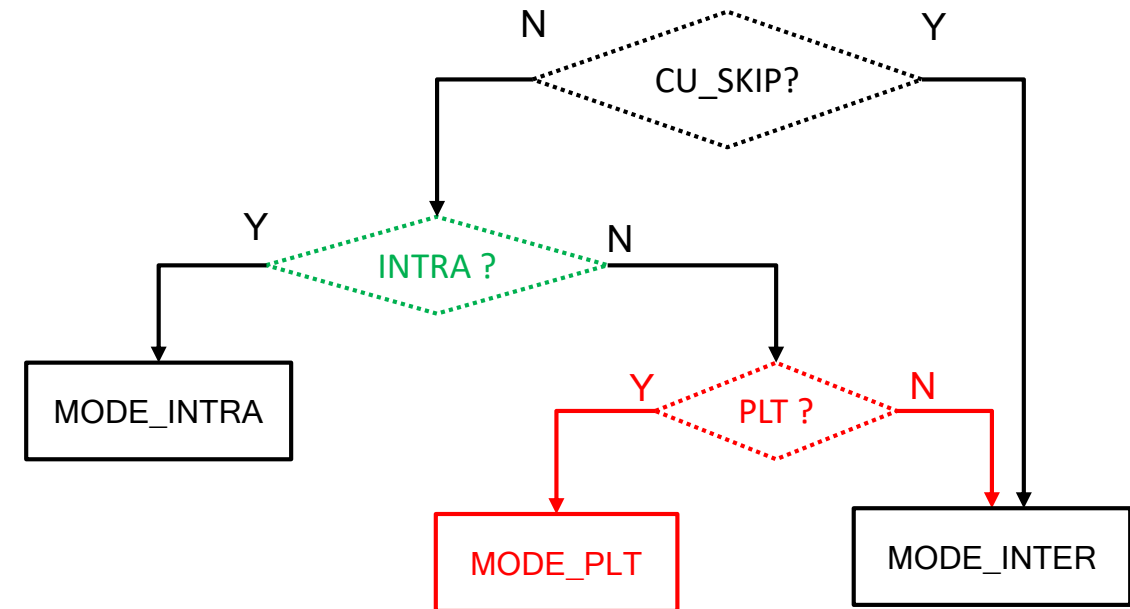
- Problem 1: palette mode signaling

IBC enabled in SPS



Palette mode signaled in INTRA path

IBC disabled in SPS

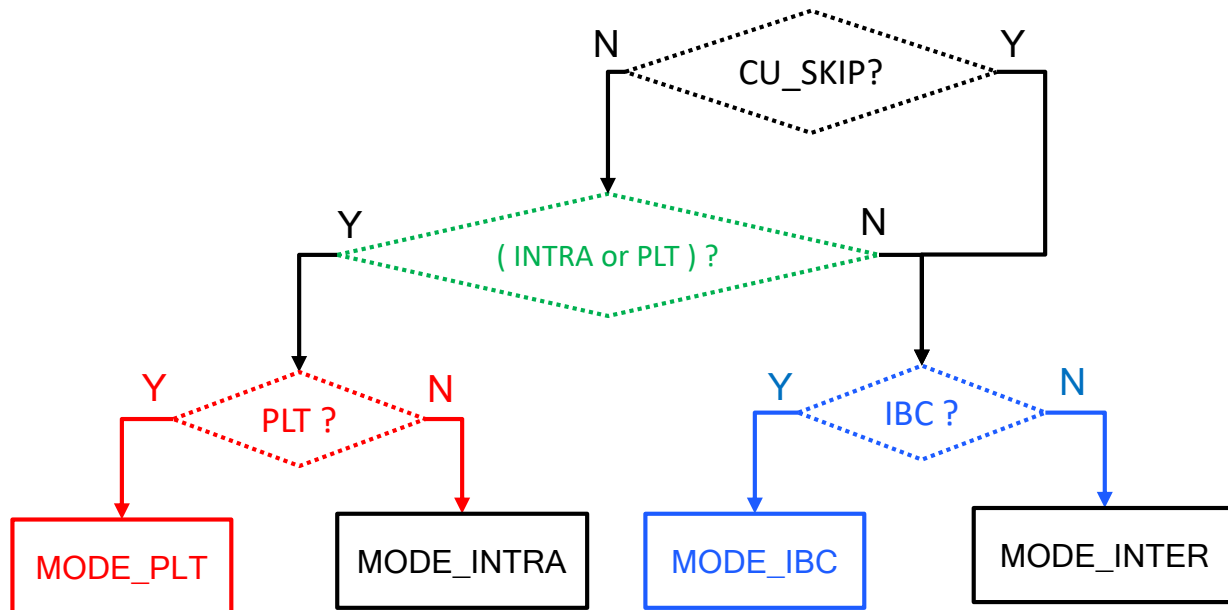


Palette mode signaled in INTER path

Current mode signaling in VTM6.0

- Problem 2: IBC mode and prediction mode signaling

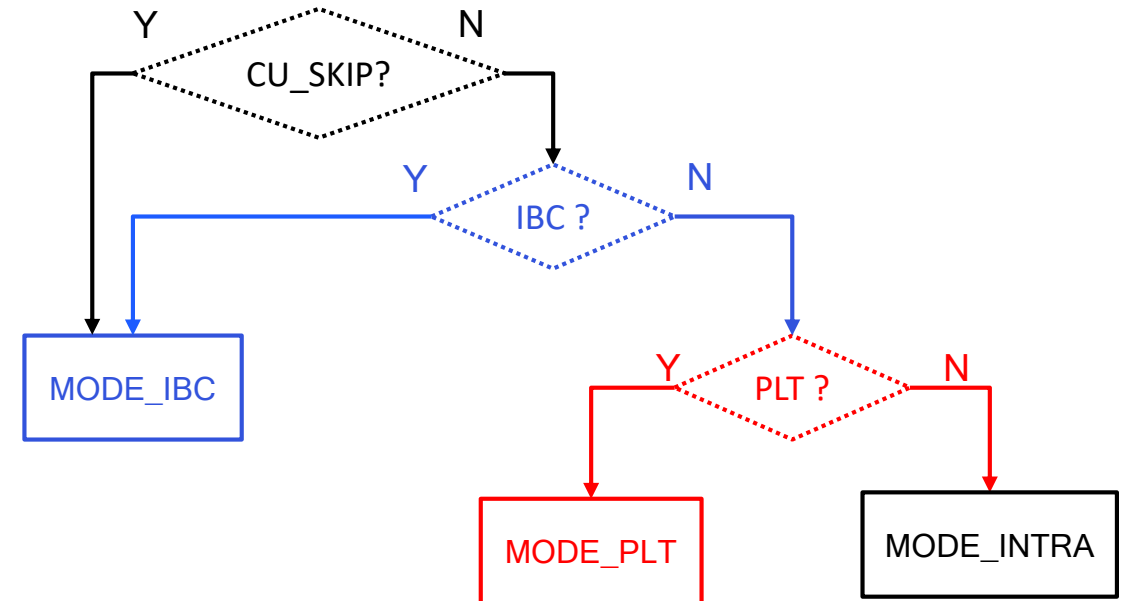
P/B slice



Prediction mode signaled if CU_SKIP is False

IBC signaled if (INTRA or PLT) is False

I slice

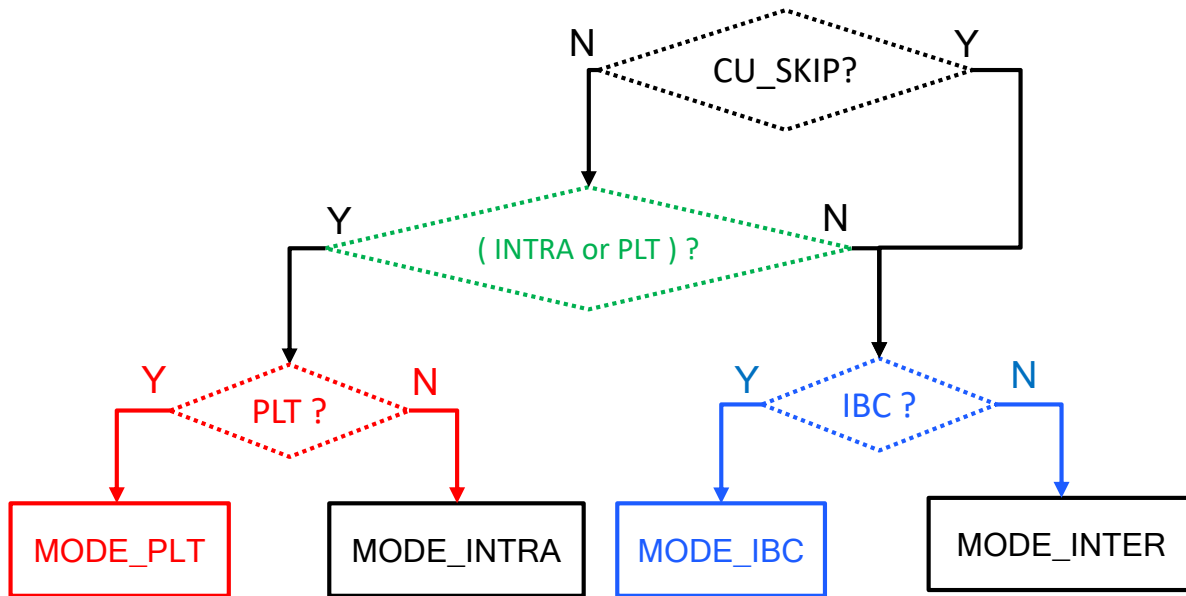


IBC signaled if CU_SKIP is False

Prediction mode not signaled

Proposed mode signaling

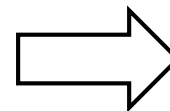
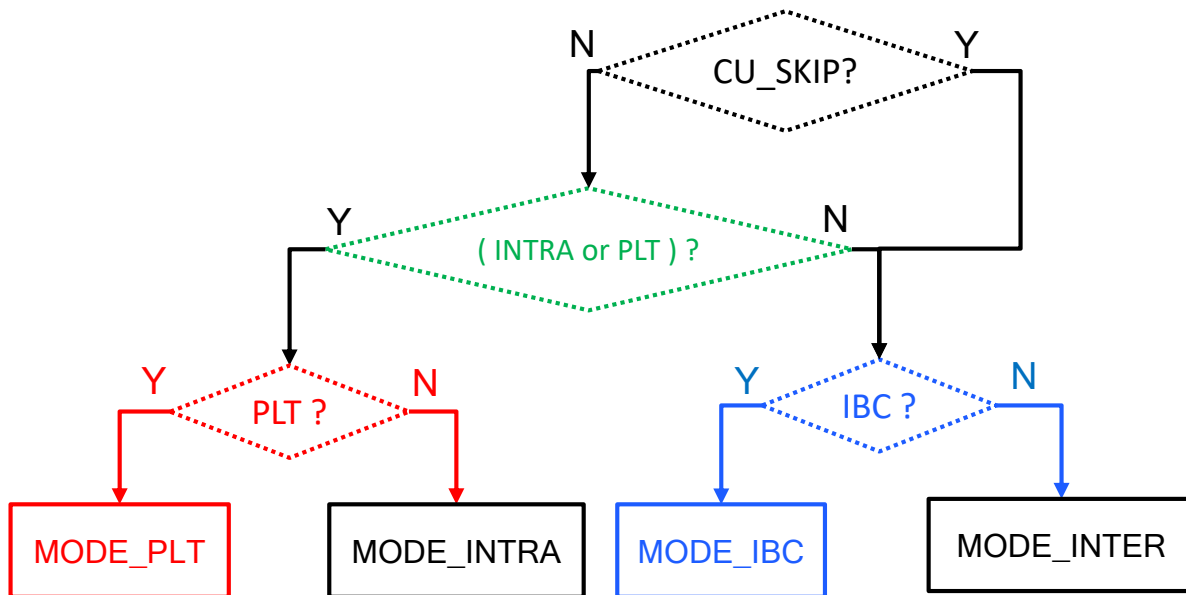
- Unified signaling:
 - Prediction mode signaling after cu skip = FALSE
 - Palette mode signaling after (INTRA or PLT) = TRUE
 - IBC mode signaling after (INTRA or PLT) = FALSE



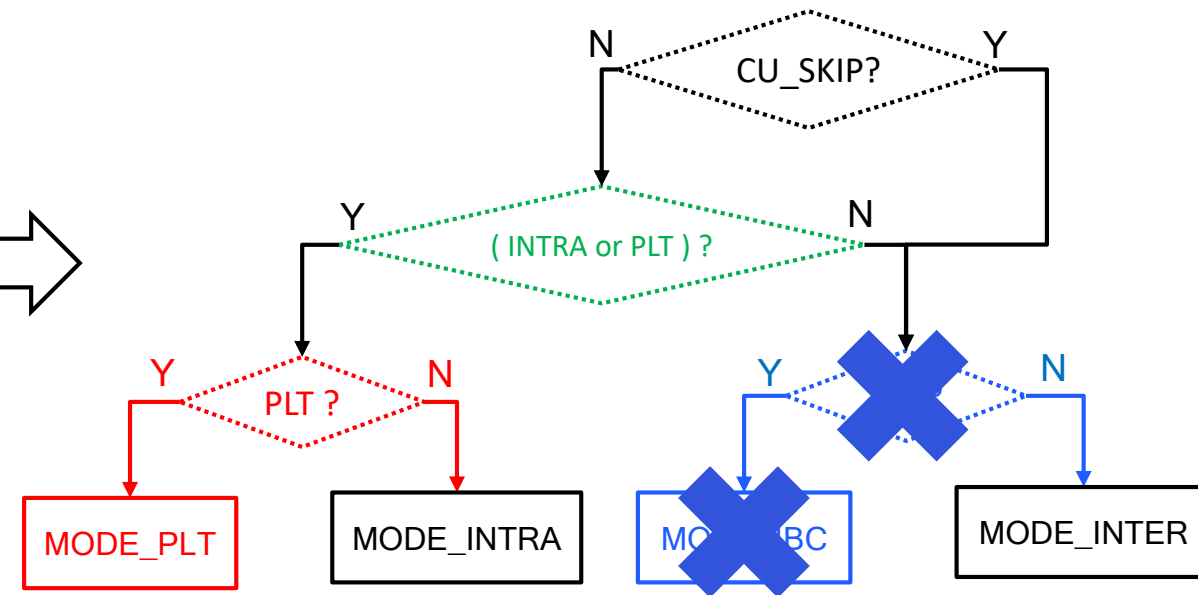
Proposed mode signaling

- For problem 1: palette mode signaled in INTRA path

IBC enabled in SPS

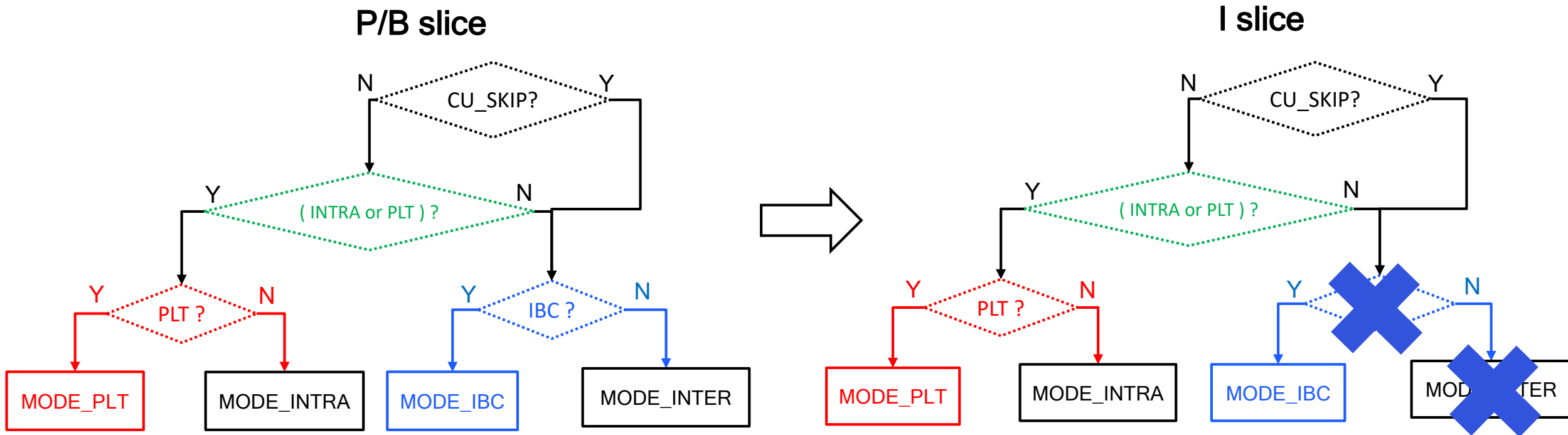


IBC disabled in SPS



Proposed mode signaling

- For problem 2: prediction mode is signaled after $\text{CU_skip} = 0$



Results - YUV4:4:4

Simulation setting: PLT=1, BDPCM=1, HashME=1, **DualTree = 0**

- IBC enabled

	All Intra Main10				
	Over VTM-6.0_PLT1_IBC1_DT0				
	Y	U	V	EncT	DecT
TGM 1080p	0.07%	0.00%	0.02%	100%	96%
TGM 720p	0.19%	0.01%	0.02%	100%	100%
Animation	0.00%	0.01%	0.01%	99%	101%
Mixed content	0.04%	-0.09%	-0.03%	99%	98%
Camera-Captured content	0.01%	-0.07%	0.02%	100%	102%
Overall	0.08%	-0.02%	0.01%	100%	99%

	Random access Main10				
	Over VTM-6.0_PLT1_IBC1_DT0				
	Y	U	V	EncT	DecT
TGM 1080p	-0.09%	-0.05%	0.04%	98%	100%
TGM 720p	-0.08%	0.02%	0.20%	100%	100%
Animation	0.01%	-0.03%	-0.09%	101%	102%
Mixed content	-0.10%	0.04%	-0.18%	99%	100%
Camera-Captured content	-0.02%	0.13%	-0.17%	100%	100%
Overall	-0.06%	0.01%	-0.01%	99%	100%

	Low delay B Main10				
	Over VTM-6.0_PLT1_IBC1_DT0				
	Y	U	V	EncT	DecT
TGM 1080p	0.02%	0.05%	0.10%	102%	100%
TGM 720p	0.22%	-0.09%	0.75%	102%	100%
Animation	0.09%	-0.02%	-0.08%	99%	93%
Mixed content	0.04%	0.67%	-0.21%	101%	102%
Camera-Captured content	-0.03%	0.05%	0.04%	100%	99%
Overall	0.08%	0.12%	0.16%	101%	99%

- IBC disabled

	All Intra Main10				
	Over VTM-6.0_PLT1_IBC0_DT0				
	Y	U	V	EncT	DecT
TGM 1080p	0.00%	0.00%	0.00%	100%	99%
TGM 720p	0.00%	0.00%	0.00%	101%	103%
Animation	0.00%	0.00%	0.00%	100%	101%
Mixed content	0.00%	0.00%	0.00%	100%	100%
Camera-Captured content	0.00%	0.00%	0.00%	99%	97%
Overall	0.00%	0.00%	0.00%	100%	100%

	Random access Main10				
	Over VTM-6.0_PLT1_IBC0_DT0				
	Y	U	V	EncT	DecT
TGM 1080p	0.00%	0.02%	0.03%	100%	100%
TGM 720p	-0.03%	0.00%	0.01%	100%	101%
Animation	0.07%	0.06%	0.08%	100%	101%
Mixed content	-0.01%	0.06%	0.06%	100%	100%
Camera-Captured content	-0.11%	0.05%	-0.05%	100%	101%
Overall	-0.01%	0.04%	0.03%	100%	100%

	Low delay B Main10				
	Over VTM-6.0_PLT1_IBC0_DT0				
	Y	U	V	EncT	DecT
TGM 1080p	-0.08%	0.07%	0.06%	101%	101%
TGM 720p	-0.13%	-0.03%	-0.08%	101%	98%
Animation	0.02%	-0.01%	0.09%	100%	99%
Mixed content	-0.02%	-0.21%	-0.11%	102%	100%
Camera-Captured content	-0.08%	0.03%	-0.06%	102%	101%
Overall	-0.06%	-0.03%	-0.02%	101%	100%

Results - YUV4:4:4

Simulation setting: PLT=1, BDPCM=1, HashME=1, **DualTree = 1**

- IBC enabled

	All Intra Main10				
	Over VTM-6.0_PLT1_IBC1_DT1				
	Y	U	V	EncT	DecT
TGM 1080p	0.00%	-0.02%	-0.01%	100%	101%
TGM 720p	0.02%	0.00%	0.08%	100%	101%
Animation	0.01%	0.00%	-0.02%	99%	97%
Mixed content	0.04%	0.09%	0.10%	101%	105%
Camera-Captured content	-0.03%	0.06%	0.01%	100%	100%
Overall	0.01%	0.02%	0.03%	100%	101%

	Random access Main10				
	Over VTM-6.0_PLT1_IBC1_DT1				
	Y	U	V	EncT	DecT
TGM 1080p	-0.03%	0.06%	0.00%	101%	101%
TGM 720p	0.01%	-0.02%	0.06%	100%	99%
Animation	0.15%	0.13%	0.11%	99%	98%
Mixed content	0.03%	-0.34%	-0.37%	99%	100%
Camera-Captured content	-0.03%	0.10%	-0.01%	99%	98%
Overall	0.02%	-0.02%	-0.03%	100%	99%

	Low delay B Main10				
	Over VTM-6.0_PLT1_IBC1_DT1				
	Y	U	V	EncT	DecT
TGM 1080p	0.14%	0.18%	0.22%	101%	101%
TGM 720p	0.26%	0.04%	0.30%	98%	98%
Animation	0.08%	0.18%	0.02%	98%	98%
Mixed content	-0.18%	0.20%	-0.17%	98%	99%
Camera-Captured content	-0.02%	0.04%	-0.19%	97%	93%
Overall	0.08%	0.13%	0.08%	99%	98%

- IBC disabled

	All Intra Main10				
	Over VTM-6.0_PLT1_IBC0_DT1				
	Y	U	V	EncT	DecT
TGM 1080p	0.00%	0.00%	0.00%	100%	103%
TGM 720p	0.00%	0.00%	0.00%	100%	103%
Animation	0.00%	0.00%	0.00%	101%	106%
Mixed content	0.00%	0.00%	0.00%	99%	99%
Camera-Captured content	0.00%	0.00%	0.00%	100%	99%
Overall	0.00%	0.00%	0.00%	100%	102%

	Random access Main10				
	Over VTM-6.0_PLT1_IBC0_DT1				
	Y	U	V	EncT	DecT
TGM 1080p	0.01%	0.02%	0.03%	100%	100%
TGM 720p	0.00%	-0.02%	0.00%	99%	99%
Animation	-0.03%	0.06%	-0.01%	101%	101%
Mixed content	-0.08%	-0.03%	-0.15%	101%	100%
Camera-Captured content	-0.11%	-0.02%	-0.02%	101%	101%
Overall	-0.03%	0.00%	-0.02%	100%	100%

	Low delay B Main10				
	Over VTM-6.0_PLT1_IBC0_DT1				
	Y	U	V	EncT	DecT
TGM 1080p	0.12%	0.21%	0.23%	101%	100%
TGM 720p	-0.02%	-0.10%	-0.07%	100%	98%
Animation	-0.10%	0.13%	0.05%	102%	103%
Mixed content	-0.03%	-0.04%	0.02%	100%	101%
Camera-Captured content	-0.03%	-0.03%	0.03%	100%	97%
Overall	0.00%	0.04%	0.06%	100%	100%

Results - YUV4:2:0

Simulation setting: CTC setting

	All Intra Main10				
	Over VTM-6.0, CTC				
	Y	U	V	EncT	DecT
Class A1	0.00%	0.00%	0.00%	98%	98%
Class A2	0.00%	0.00%	0.00%	100%	102%
Class B	0.00%	0.00%	0.00%	98%	97%
Class C	0.00%	0.00%	0.00%	99%	94%
Class E	0.00%	0.00%	0.00%	99%	91%
Overall	0.00%	0.00%	0.00%	99%	96%
Class D	0.00%	0.00%	0.00%	98%	97%
Class F	0.01%	0.06%	-0.08%	98%	98%
Class TGM	0.02%	0.02%	0.03%	99%	97%

	Random Access Main 10				
	Over VTM-6.0, CTC				
	Y	U	V	EncT	DecT
Class A1	-0.01%	-0.05%	-0.04%	100%	101%
Class A2	0.03%	0.09%	0.05%	98%	97%
Class B	-0.02%	0.10%	0.06%	99%	99%
Class C	0.01%	0.10%	-0.08%	100%	98%
Class E					
Overall	0.00%	0.07%	0.00%	99%	99%
Class D	-0.01%	-0.05%	0.02%	96%	93%
Class F	0.03%	-0.05%	0.00%	99%	99%
Class TGM	-0.01%	-0.02%	-0.03%	98%	99%

	Low delay B Main10				
	Over VTM-6.0, CTC				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	0.00%	0.09%	0.09%	98%	92%
Class C	-0.01%	0.18%	0.03%	97%	86%
Class E	-0.02%	0.35%	-0.09%	100%	99%
Overall	-0.01%	0.19%	0.02%	98%	92%
Class D	-0.03%	0.01%	0.25%	93%	88%
Class F	0.10%	-0.29%	0.66%	99%	95%
Class TGM	-0.21%	-0.08%	-0.12%	94%	87%

We thank InterDigital for crosschecking !!



Thank you!

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Current Spec in VTM6.0

coding_unit(x0, y0, cbWidth, cbHeight, cqtDepth, treeType, modeType) {	Descriptor
chType = treeType == DUAL_TREE_CHROMA? 1 : 0	
if(slice_type != I sps_ibc_enabled_flag sps_palette_enabled_flag) {	
if(treeType != DUAL_TREE_CHROMA && !((cbWidth == 4 && cbHeight == 4) modeType == MODE_TYPE_INTRA) && !sps_ibc_enabled_flag))	
cu_skip_flag[x0][y0]	ae(v)
if(cu_skip_flag[x0][y0] == 0 && slice_type != I && !(cbWidth == 4 && cbHeight == 4) && modeType == MODE_TYPE_ALL)	
pred_mode_flag	ae(v)
if(((slice_type == I && cu_skip_flag[x0][y0] == 0) (slice_type != I && (CuPredMode[chType][x0][y0] != MODE_INTRA (cbWidth == 4 && cbHeight == 4 && cu_skip_flag[x0][y0] == 0)))) && cbWidth <= 64 && cbHeight <= 64 && modeType != MODE_TYPE_INTER && sps_ibc_enabled_flag && treeType != DUAL_TREE_CHROMA)	
pred_mode_ibc_flag	ae(v)
if((((slice_type == I (cbWidth == 4 && cbHeight == 4) sps_ibc_enabled_flag) && CuPredMode[x0][y0] == MODE_INTRA) (slice_type != I && !(cbWidth == 4 && cbHeight == 4) && !sps_ibc_enabled_flag && CuPredMode[x0][y0] != MODE_INTRA)) && sps_palette_enabled_flag && cbWidth <= 64 && cbHeight <= 64 && cu_skip_flag[x0][y0] == 0 && modeType != MODE_INTER)	
pred_mode_plt_flag	ae(v)
}	

Unification for palette mode

coding_unit(x0, y0, cbWidth, cbHeight, cqtDepth, treeType, modeType) {	Descriptor
chType = treeType == DUAL_TREE_CHROMA? 1 : 0	
if(slice_type != I sps_IBC_enabled_flag sps_palette_enabled_flag) {	
if(treeType != DUAL_TREE_CHROMA && !((cbWidth == 4 && cbHeight == 4) modeType == MODE_TYPE_INTRA) && !sps_IBC_enabled_flag))	
cu_skip_flag[x0][y0]	ae(v)
if(cu_skip_flag[x0][y0] == 0 && slice_type != I && !(cbWidth == 4 && cbHeight == 4) && modeType == MODE_TYPE_ALL)	
pred_mode_flag	ae(v)
if(((slice_type == I && cu_skip_flag[x0][y0] == 0) (slice_type != I && (CuPredMode[chType][x0][y0] != MODE_INTRA (cbWidth == 4 && cbHeight == 4 && cu_skip_flag[x0][y0] == 0)))) && cbWidth <= 64 && cbHeight <= 64 && modeType != MODE_TYPE_INTER && sps_IBC_enabled_flag && treeType != DUAL_TREE_CHROMA)	
pred_mode_IBC_flag	ae(v)
if(CuPredMode[x0][y0] == MODE_INTRA && sps_palette_enabled_flag && cbWidth <= 64 && cbHeight <= 64 && cu_skip_flag[x0][y0] == 0 && modeType != MODE_INTER)	
pred_mode_plt_flag	ae(v)
}	

Unification for IBC and prediction mode

coding_unit(x0, y0, cbWidth, cbHeight, cqtDepth, treeType, modeType) {	Descriptor
chType = treeType == DUAL_TREE_CHROMA ? 1 : 0	
if(slice_type != I sps_ibc_enabled_flag sps_palette_enabled_flag) {	
if(treeType != DUAL_TREE_CHROMA && !((cbWidth == 4 && cbHeight == 4) modeType == MODE_TYPE_INTRA) && !sps_ibc_enabled_flag) {	
cu_skip_flag[x0][y0]	ae(v)
if(cu_skip_flag[x0][y0] == 0 && modeType != MODE_TYPE_INTER)	
pred_mode_flag ← If (INTER or IBC are enabled) and !(cu_skip or MODE_TYPE_INTER)	ae(v)
}	
if(slice_type != I && !(cbWidth == 4 && cbHeight == 4) && CuPredMode[chType][x0][y0] != MODE_INTRA && cbWidth <= 64 && cbHeight <= 64 && modeType == MODE_TYPE_ALL && sps_ibc_enabled_flag && treeType != DUAL_TREE_CHROMA)	
pred_mode_ibc_flag ← If (INTER and IBC are enabled) and !pred_mode_flag	ae(v)
if(CuPredMode[x0][y0] == MODE_INTRA && sps_palette_enabled_flag && cbWidth <= 64 && cbHeight <= 64 && cu_skip_flag[x0][y0] == 0 && modeType != MODE_INTER)	
pred_mode_plt_flag	ae(v)
}	

Context modeling unification

Table 9-83 – Specification of ctxInc using left and above syntax elements

Syntax element	condL	condA	ctxSetIdx
pred_mode_flag[x0][y0]	CuPredMode[chType][xNbL][yNbL] = = MODE_INTRA MODE_PLT	CuPredMode[chType][xNbA][yNbA] = = MODE_INTRA MODE_PLT	0

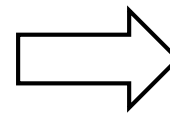
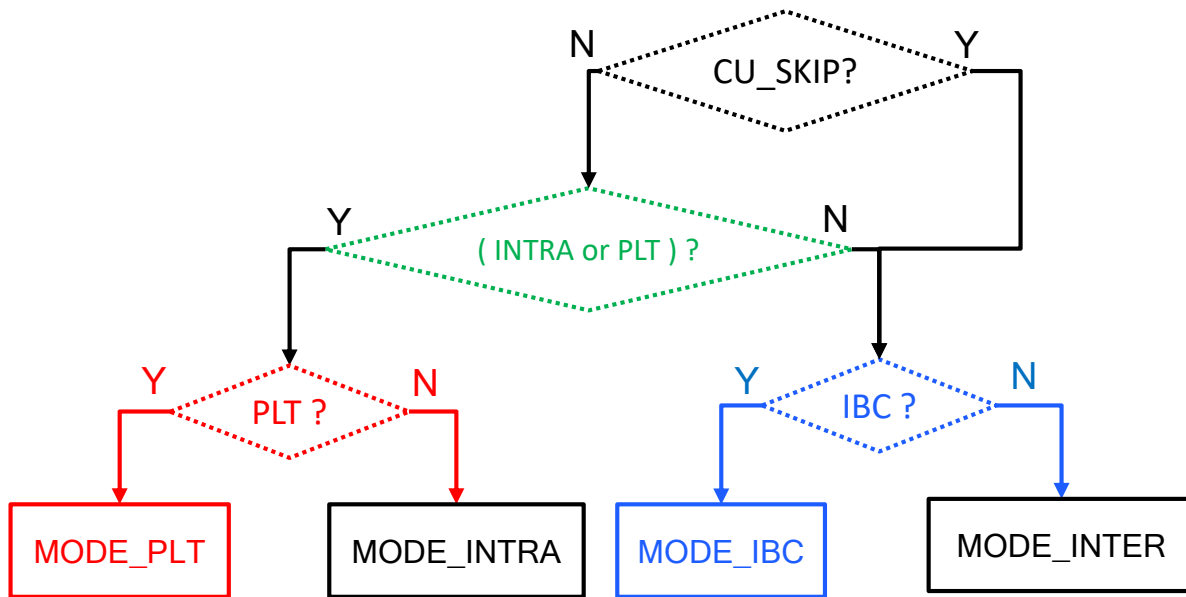
For YUV 4:2:0: same as VTM6.0

For YUV 4:4:4: pred_mode_flag = 1 for MODE_INTRA | | MODE_PLT

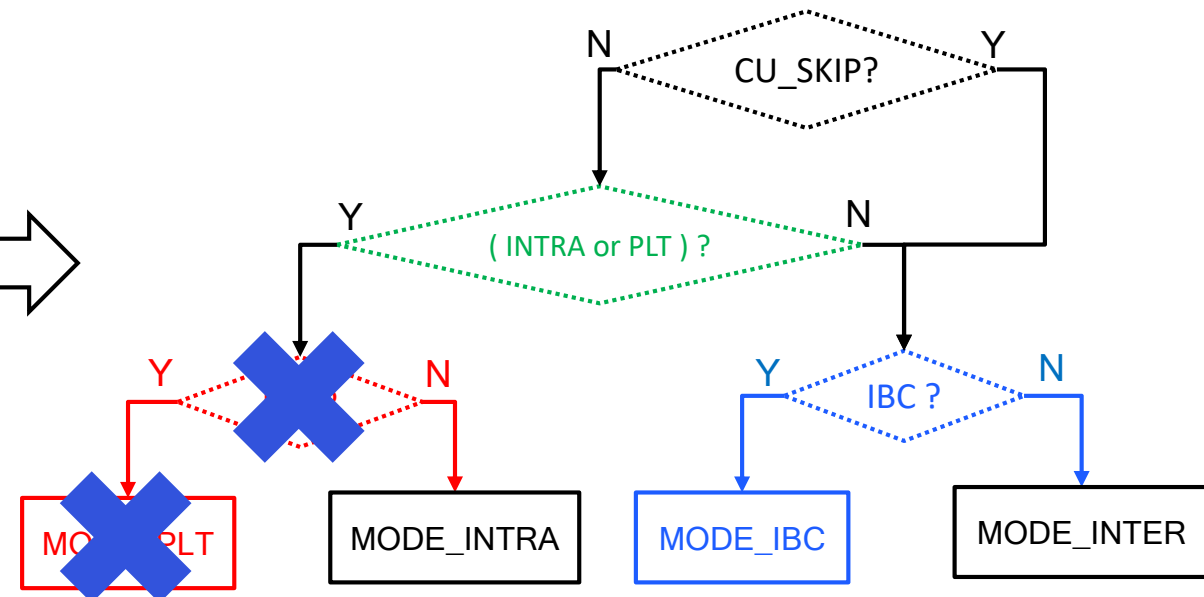
Proposed mode signaling

- PLT enabled/disabled

PLT enabled

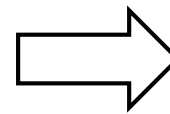
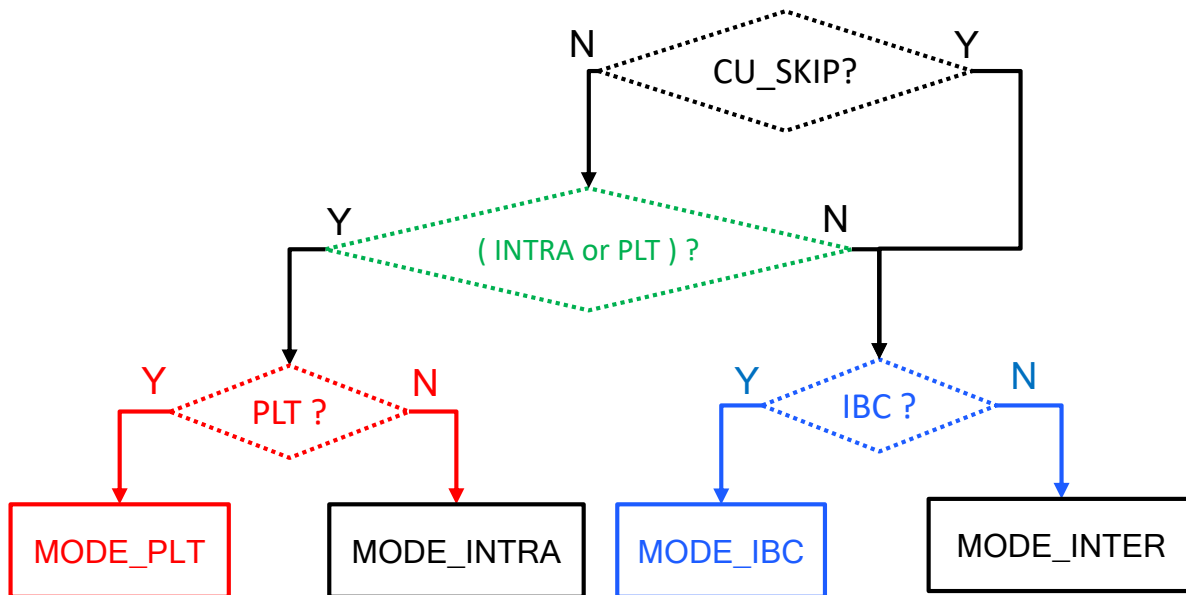


PLT disabled



Proposed mode signaling

- IBC and INTER enabled/disabled



IBC and INTER disabled

