

# **Non-EE2: Low-Complexity Improvements of Intra Coding for Screen Content**

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# Introduction

- Two low complexity methods for screen content coding are proposed:
  - A component sign prediction of the IBC BVD
  - A MRL modification
- On top of ECM-2.0, the test results report gains:
  - BVD Sign prediction: Class F: BD-rate YUV: **-0.09%, -0.08%, -0.08%**, EncT: **101%**; DecT: **100%**
    - Class TGM: BD-rate YUV: **-0.21%, -0.20%, -0.20%**, EncT: **100%**; DecT: **99%**
  - MRL modification: Class F: BD-rate YUV: **-0.06%, -0.11%, -0.04%**, EncT: **99%**; DecT: **101%**
  - Join BVD Sign prediction and MRL modification:
    - Class F: **-0.15%, -0.13%, -0.22%**, EncT: **98%**; DecT: **100%**
    - Class TGM: **-0.24%, -0.23%, -0.20%**, EncT: **101%**; DecT: **99%**

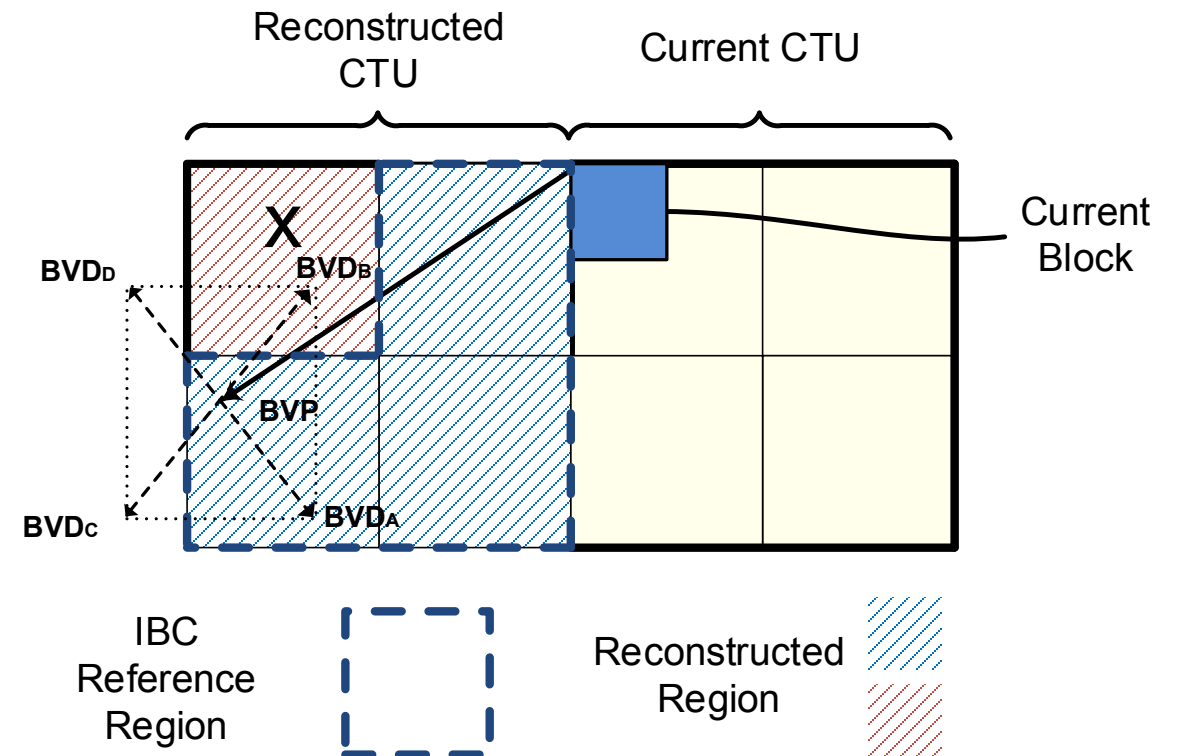
# Introduction

- BVD sign prediction:

- This tool exploits the IBC reference region constraints to determine the BVD sign in the decoder side without explicit signaling when certain conditions are met.

- Method:

- Build 4 BV candidates
- Check the BV candidate's validity in the normative IBC buffer
- Predict the BVD components sign based on the valid candidates (next table)



# Introduction

- BVD sign prediction:

"0": Invalid BV candidate

"1": Valid BV candidate

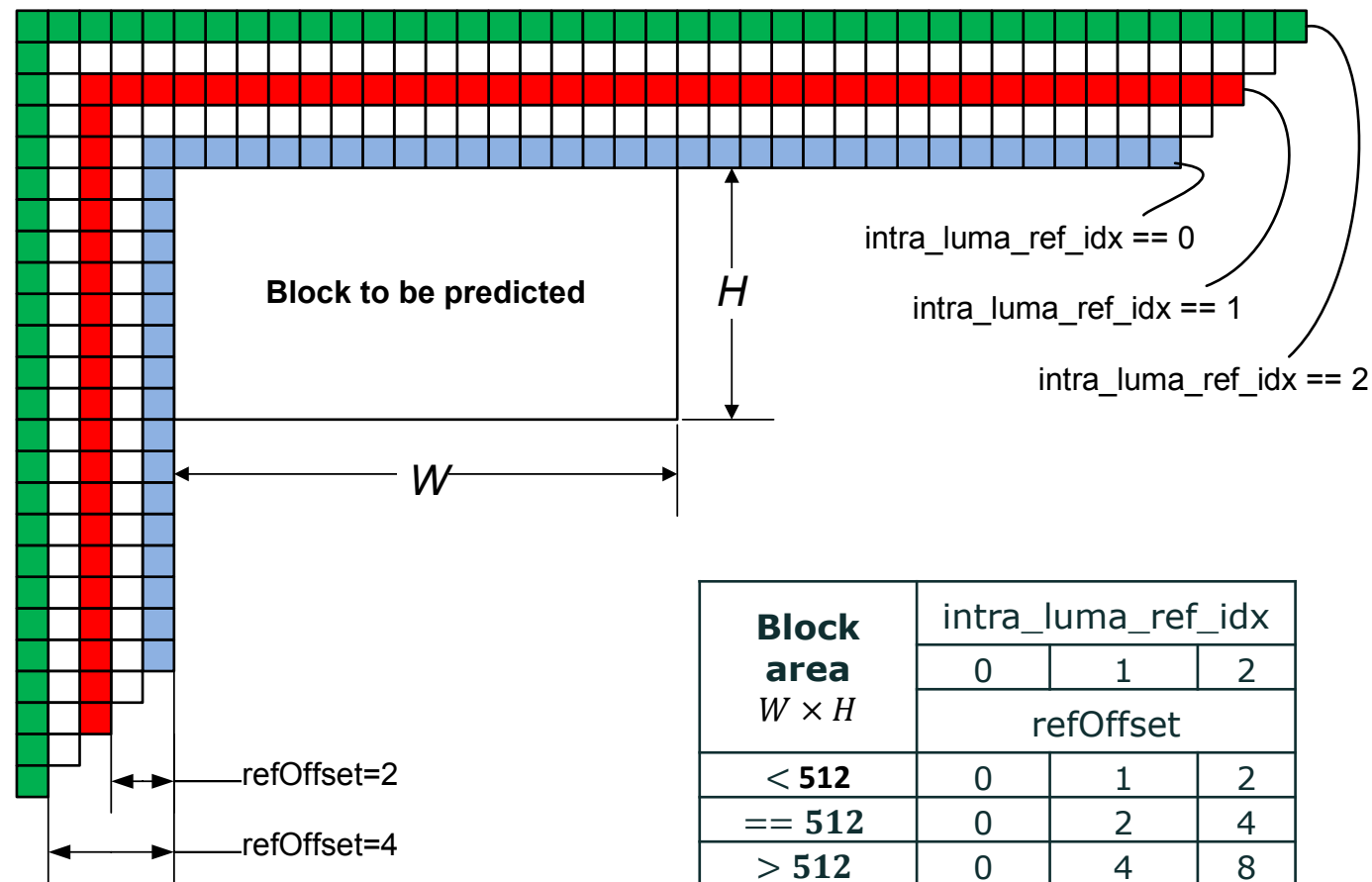
"+" and "-": sign is predicted

"X": sign is signaled

Idx	$BV_A = BVP + BVD(+,+)$	$BV_B = BVP + BVD(+,-)$	$BV_C = BVP + BVD(-,+)$	$BV_D = BVP + BVD(-,-)$	$xSign$	$ySign$
1	0	0	0	1	-	-
2	0	0	1	0	-	+
3	0	0	1	1	-	X
4	0	1	0	0	+	-
5	0	1	0	1	X	-
6	0	1	1	0	X	$ySign = Inv(xSign)$
7	0	1	1	1	X	If $xSign == (+)$ $ySign = (-)$ else X
8	1	0	0	0	+	+
9	1	0	0	1	X	$ySign = xSign$
10	1	0	1	0	X	+
11	1	0	1	1	X	If $xSign == (+)$ $ySign = (+)$ else X
12	1	1	0	0	+	X
13	1	1	0	1	X	If $xSign == (-)$ $ySign = (-)$ else X
14	1	1	1	0	X	If $xSign == (-)$ $ySign = (+)$ else X
15	1	1	1	1	X	X

# Introduction

- MRL modification:
  - This tool proposes to adjust offsets between reference lines subject to block size.
  - The number of reference lines and the syntax are kept unchanged.
  - Just the semantics and reference sample processing were modified to enable these offsets between reference lines.



# Results

- On top of ECM-2.0:

Table 1. BD-rate performance results on BVD sign prediction proposal

	All Intra Main10				
	Over ECM-2.0				
	Y	U	V	EncT	DecT
BasketballDrillText	-0.04%	-0.04%	-0.04%	101%	102%
ArenaOfValor	-0.01%	-0.01%	-0.01%	100%	100%
SlideEditing	-0.23%	-0.22%	-0.22%	101%	100%
SlideShow	-0.07%	-0.07%	-0.07%	102%	99%
FlyingGraphic	-0.18%	-0.17%	-0.17%	100%	99%
Desktop	-0.26%	-0.24%	-0.24%	100%	99%
Console	-0.23%	-0.22%	-0.22%	100%	98%
ChineseEditing	-0.18%	-0.18%	-0.18%	100%	101%
<b>Overall</b>					
Class F	<b>-0.09%</b>	<b>-0.08%</b>	<b>-0.08%</b>	<b>101%</b>	<b>100%</b>
Class TGM	<b>-0.21%</b>	<b>-0.20%</b>	<b>-0.20%</b>	<b>100%</b>	<b>100%</b>

Table 2. BD-rate performance results on MRL modification proposal

	All Intra Main10				
	Over ECM-2.0				
	Y	U	V	EncT	DecT
BasketballDrillText	-0.06%	-0.06%	0.16%	98%	102%
ArenaOfValor	0.00%	-0.07%	0.06%	100%	100%
SlideEditing	-0.07%	-0.07%	-0.04%	98%	101%
SlideShow	-0.13%	-0.22%	-0.33%	98%	100%
FlyingGraphic					
Desktop					
Console					
ChineseEditing					
<b>Overall</b>					
Class F	<b>-0.06%</b>	<b>-0.04%</b>	<b>-0.14%</b>	<b>97%</b>	<b>100%</b>
Class TGM					

# Results

- On top of ECM-2.0:

Table 3. BD-rate performance results on joint BVD sign prediction and MRL modification proposals

	All Intra Main10				
	Over ECM-2.0				
	Y	U	V	EncT	DecT
BasketballDrillText	-0.10%	-0.15%	-0.08%	98%	101%
ArenaOfValor	-0.04%	0.01%	0.07%	100%	101%
SlideEditing	-0.22%	-0.17%	-0.36%	97%	100%
SlideShow	-0.21%	-0.19%	-0.52%	97%	97%
FlyingGraphic	-0.24%	-0.29%	-0.23%	102%	99%
Desktop	-0.26%	-0.21%	-0.20%	100%	99%
Console	-0.28%	-0.18%	-0.22%	100%	99%
ChineseEditing	-0.19%	-0.23%	-0.15%	100%	101%
<b>Overall</b>					
Class F	-0.15%	-0.13%	-0.22%	98%	100%
Class TGM	-0.24%	-0.23%	-0.20%	101%	99%

# Conclusion

- This contribution proposes a method for the sign prediction of the components of the IBC block vector difference, and an MRL modification for screen content coding.
- Simulation results report a coding gain on top of ECM-2.0 with negligible encoding and decoding complexity increase.
- Recommend to study both techniques in EE2.





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