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<JCTVC-I0415> Mode-dependent DCT/DST for chroma

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Background

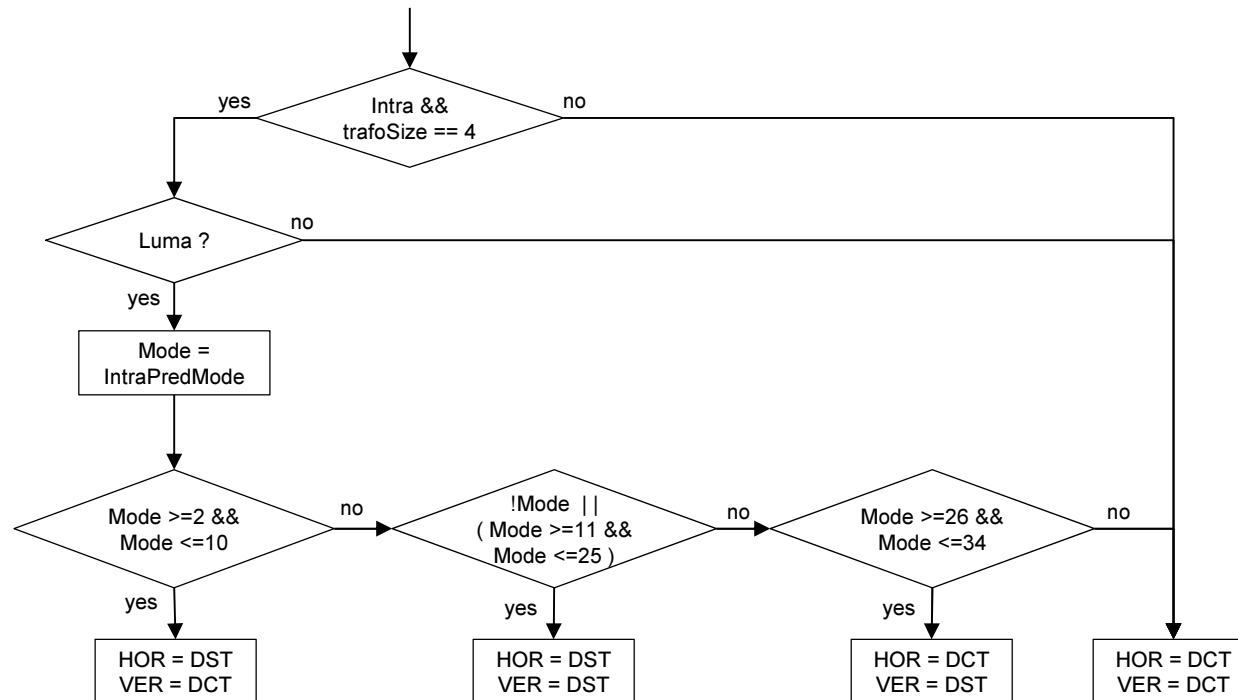
❑ Current HM

- ❖ Intra prediction mode dependent DCT/DST is used for:
 - 4x4 Luma transform blocks
- ❖ Not applied to 4x4 chroma blocks.

Table 8-11 – Specification of `horizTrType` and `vertTrType`

<code>IntraPredMode</code>	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
<code>vertTrType</code>	1	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
<code>horizTrType</code>	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

<code>IntraPredMode</code>	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
<code>vertTrType</code>	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<code>horizTrType</code>	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0



Proposal 1

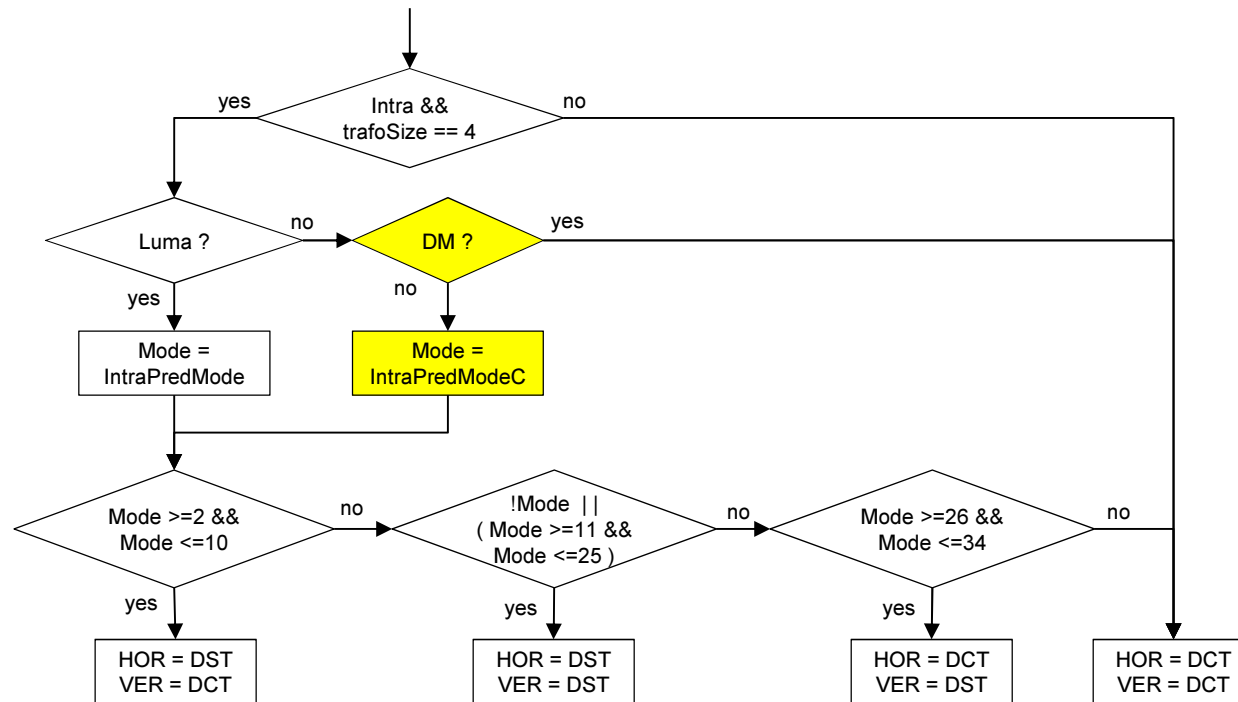
□ Apply DCT/DST to Chroma **EM** modes

intra_chroma _pred_mode	IntraPredMode[xB][yB]					
	0	26	10	1	X (0 ≤ X < 35)	
0	34	0	0	0	0 (Planar)	EM
1	26	34	26	26	26 (Vert.)	
2	10	10	34	10	10 (Hor.)	
3	1	1	1	34	1 (DC)	
4	LM	LM	LM	LM	LM	LM
5	0	26	10	1	X	DM

Table 8-11 – Specification of **horizTrType** and **vertTrType**

intraPredMode	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
vertTrType	1	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
horizTrType	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

intraPredMode	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
vertTrType	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
horizTrType	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0



Proposal 2

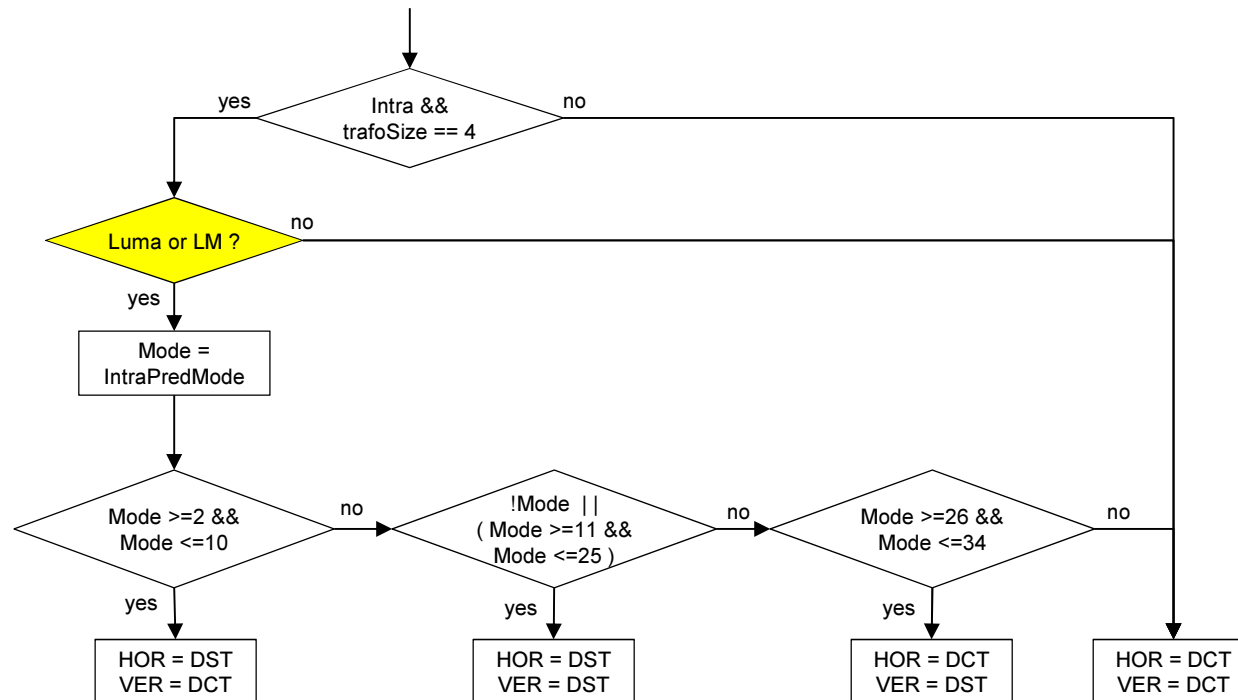
□ Apply DCT/DST to Chroma **LM** mode

intra_chroma _pred_mode	IntraPredMode[xB][yB]					
	0	26	10	1	X (0 ≤ X < 35)	
0	34	0	0	0	0 (Planar)	EM
1	26	34	26	26	26 (Vert.)	
2	10	10	34	10	10 (Hor.)	
3	1	1	1	34	1 (DC)	
4	LM	LM	LM	LM	LM	LM
5	0	26	10	1	X	DM

Table 8-11 – Specification of horizTrType and vertTrType.

IntraPredMode	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
vertTrType	1	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
horizTrType	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

IntraPredMode	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
vertTrType	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
horizTrType	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0



Proposal 3

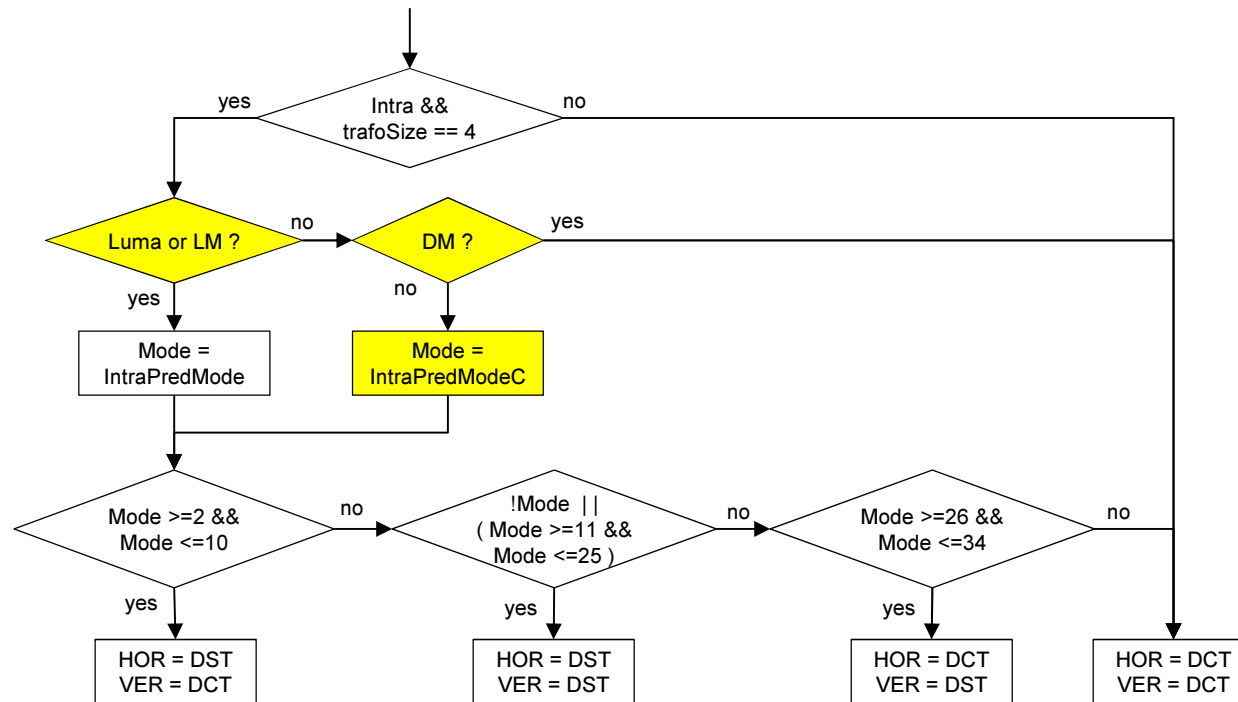
□ Apply DCT/DST to Chroma **EM** and **LM** modes

intra_chroma _pred_mode	IntraPredMode[xB][yB]					
	0	26	10	1	X (0 ≤ X < 35)	
0	34	0	0	0	0 (Planar)	EM
1	26	34	26	26	26 (Vert.)	
2	10	10	34	10	10 (Hor.)	
3	1	1	1	34	1 (DC)	
4	LM	LM	LM	LM	LM	LM
5	0	26	10	1	X	DM

Table 8-11 – Specification of horizTrType and vertTrType

■ IntraPredMode	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
■ vertTrType	1	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
■ horizTrType	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

■ IntraPredMode	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
■ vertTrType	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
■ horizTrType	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0



Results & Conclusion

❑ Experimental Results

- ❖ Consistent Chroma gain is observed over all cases
- ❖ Comparison between Proposal 1 and 3
 - Proposal 1 shows 0.2% larger average chroma gain @HE10
 - Proposal 3 shows 0.1% larger luma gain for class C and D @HE10
- ❖ Results confirmed by Samsung (JCTVC-I0444)

❑ Conclusion

- ❖ Recommend adopting Proposal 1 or 3 into the next version of the HM.

Proposal 1 (EM)	All Intra Main			All Intra HE10		
	Y	U	V	Y	U	V
Class A	0.0%	-0.7%	-0.7%	0.0%	-0.3%	-0.5%
Class B	0.1%	-1.1%	-1.2%	0.0%	-0.6%	-0.6%
Class C	0.0%	-1.6%	-1.9%	0.0%	-0.9%	-1.0%
Class D	0.0%	-1.9%	-2.2%	0.0%	-1.2%	-1.6%
Class E	0.0%	-1.3%	-1.7%	-0.1%	-0.2%	-0.9%
Overall	0.0%	-1.3%	-1.5%	0.0%	-0.7%	-0.9%
	0.0%	-1.3%	-1.5%	0.0%	-0.7%	-0.9%
Class F	0.0%	-1.0%	-1.2%	0.0%	-0.6%	-0.8%
Enc Time[%]	96%			104%		
Dec Time[%]	100%			100%		

Proposal 2 (LM)	All Intra Main			All Intra HE10		
	Y	U	V	Y	U	V
Class A	Identical to the Anchor			0.0%	-0.1%	-0.2%
Class B				0.0%	-0.2%	-0.1%
Class C				-0.1%	0.0%	0.1%
Class D				-0.1%	-0.4%	-0.3%
Class E				0.0%	-0.2%	-0.3%
Overall				0.0%	-0.2%	-0.2%
				0.0%	-0.2%	-0.2%
Class F				0.0%	0.2%	0.3%
Enc Time[%]				99%		
Dec Time[%]				101%		

Proposal 3 (EM+LM)	All Intra Main			All Intra HE10		
	Y	U	V	Y	U	V
Class A	Identical to Proposal1			0.0%	-0.3%	-0.5%
Class B				0.0%	-0.5%	-0.5%
Class C				-0.1%	-0.5%	-0.6%
Class D				-0.1%	-1.1%	-1.3%
Class E				-0.1%	-0.2%	-0.9%
Overall				0.0%	-0.5%	-0.7%
				0.0%	-0.5%	-0.7%
Class F				-0.1%	-0.2%	-0.4%
Enc Time[%]				100%		
Dec Time[%]				100%		

Combination with I0103

❑ Combined Experiment

- ❖ JCTVC-I0415 Mode dependent DCT/DST for Chroma
 - Proposal 1 (EM)
 - Proposal 3 (EM+LM)
- ❖ JCTVC-I0103 Mode dependent coefficient scanning for Chroma

❑ Results

- ❖ 0.1% additive gain is observed in both cases.
- ❖ “Proposal 1 + I0103” provides 0.2% more chroma gain @HE10
- ❖ “Proposal 3 + I0103” provides 0.1% more luma gain @HE10

Proposal 1 + I0103	All Intra Main			All Intra HE10		
	Y	U	V	Y	U	V
Class A	0.0%	-0.7%	-0.7%	0.0%	-0.5%	-0.5%
Class B	0.1%	-1.1%	-1.2%	0.0%	-0.7%	-0.8%
Class C	0.0%	-1.6%	-1.9%	0.0%	-1.0%	-1.2%
Class D	0.0%	-1.9%	-2.2%	0.0%	-1.4%	-1.7%
Class E	0.0%	-1.3%	-1.7%	0.0%	-0.2%	-0.9%
Overall	0.0%	-1.3%	-1.5%	0.0%	-0.8%	-1.0%
	0.0%	-1.3%	-1.5%	0.0%	-0.8%	-1.0%
Class F	0.0%	-1.0%	-1.2%	-0.1%	-0.9%	-0.9%
Enc Time[%]	96%			99%		
Dec Time[%]	100%			#NUM!		

Proposal 3 + I0103	All Intra Main			All Intra HE10		
	Y	U	V	Y	U	V
Class A	Identical to Proposal1 + I0103			0.0%	-0.3%	-0.5%
Class B				0.0%	-0.6%	-0.6%
Class C				-0.1%	-0.6%	-0.6%
Class D				-0.1%	-1.2%	-1.4%
Class E				-0.1%	-0.2%	-0.9%
Overall				-0.1%	-0.6%	-0.8%
				-0.1%	-0.6%	-0.8%
Class F				-0.1%	-0.3%	-0.4%
Enc Time[%]				100%		
Dec Time[%]				#NUM!		

❑ Conclusion

- ❖ Recommend adopting “Proposal 3 + I0103” for the next version of HM.



Thank You Very Much !

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