

# Coding order of luma and chroma intra prediction modes

**JCTVC-F094**

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# 1 Overview

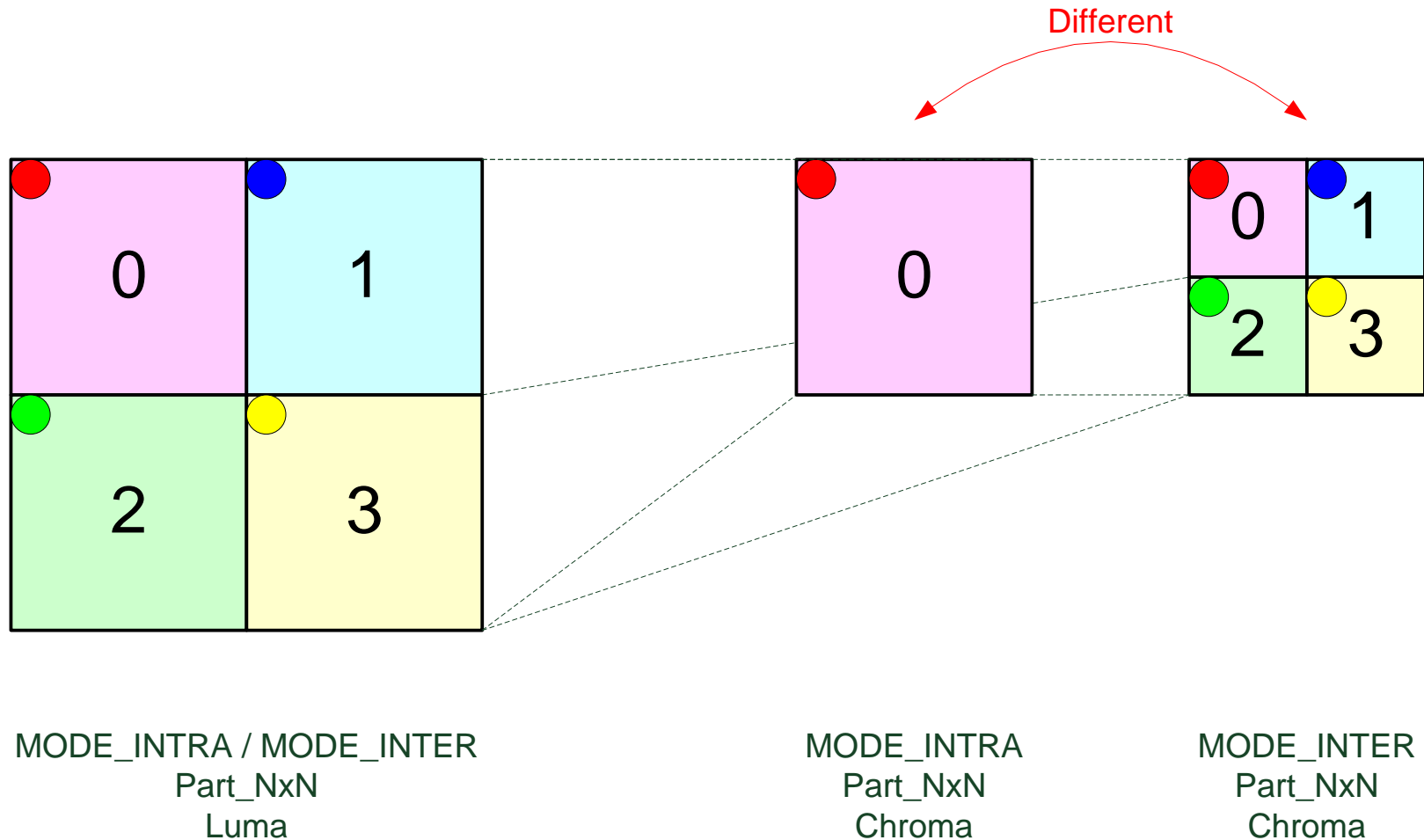
# Overview

- Current technique
  - Coding order of intra prediction mode syntax elements in HM3.0 and WD3
- Proposed technique
  - in 4:2:0 chroma sampling
  - in 4:2:2 and 4:4:4 chroma sampling
- Proposed Syntax
  - in 4:2:0 chroma sampling
  - in 4:2:2 and 4:4:4 chroma sampling
- Experiments
- Recommendations

# 2 Current Techniques

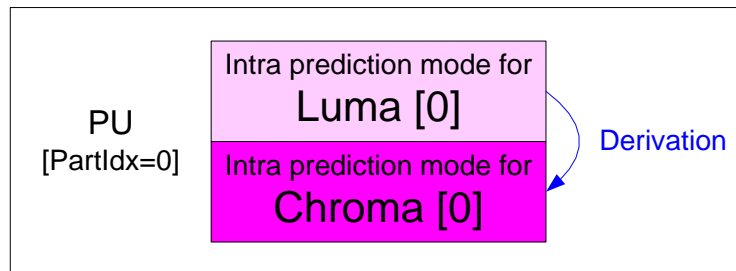
- HM3.0
- WD3

# Intra and inter NxN PU structure in a coding unit in 4:2:0 chroma sampling

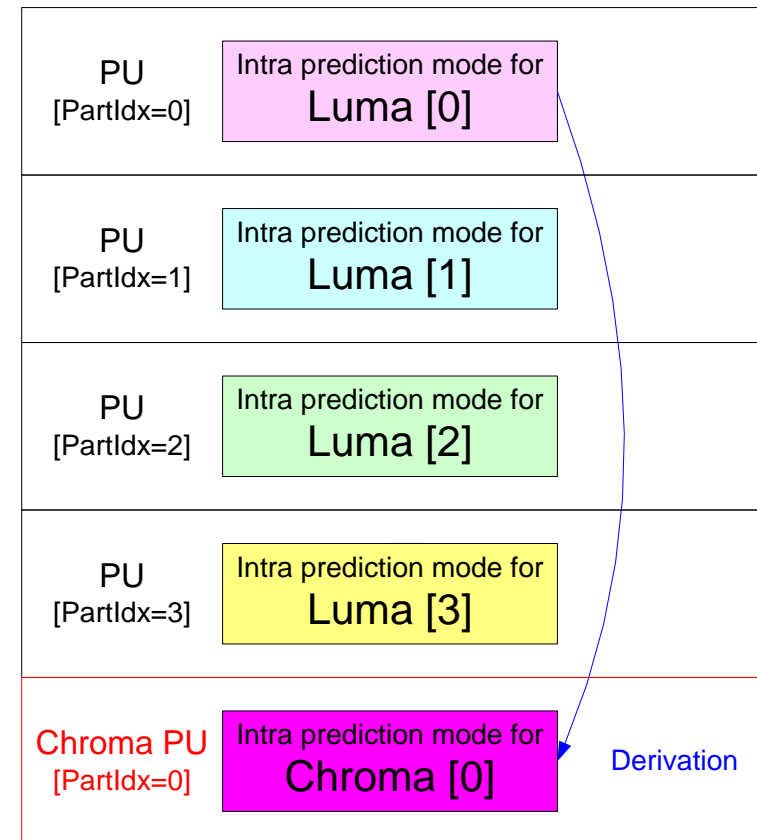


# Coding order of intra prediction mode syntax elements in HM3.0

## MODE\_INTRA Part\_2Nx2N



## MODE\_INTRA Part\_NxN

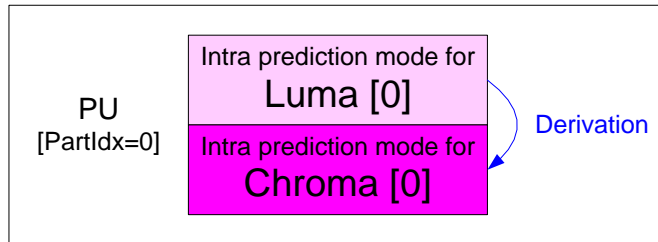


It is not sure how the PU structure is defined in HM 3.

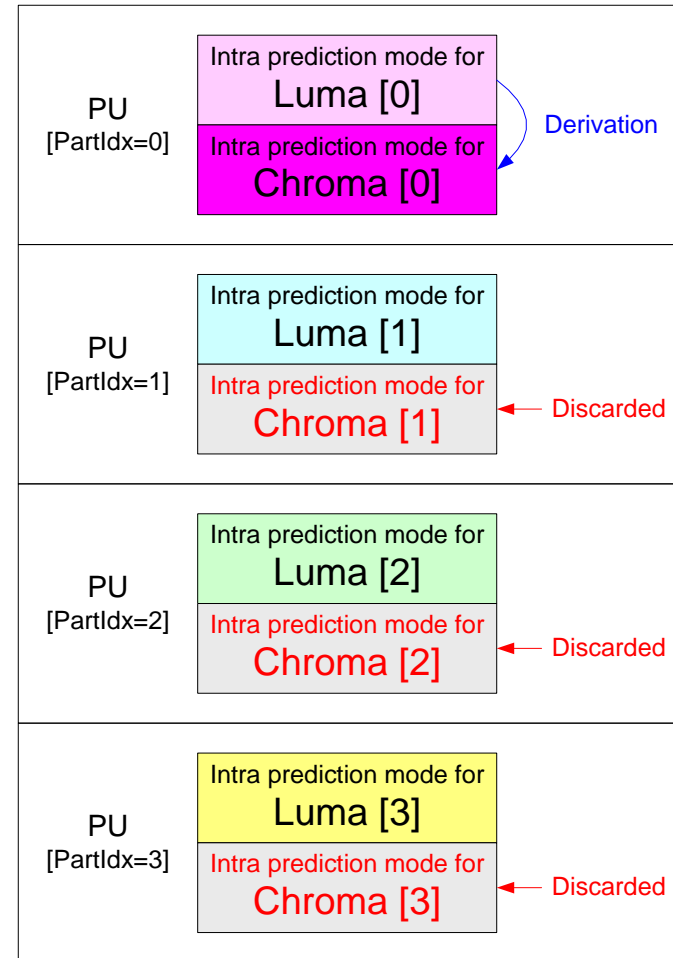
It seems that the chroma PU defined  
as the special case of MODE\_INTRA Part\_NxN.

# Coding order of intra prediction mode syntax elements in **WD3**

MODE\_INTRA  
Part\_2Nx2N



MODE\_INTRA  
Part\_NxN



It seems that  
discarded syntax elements are coded in WD3.

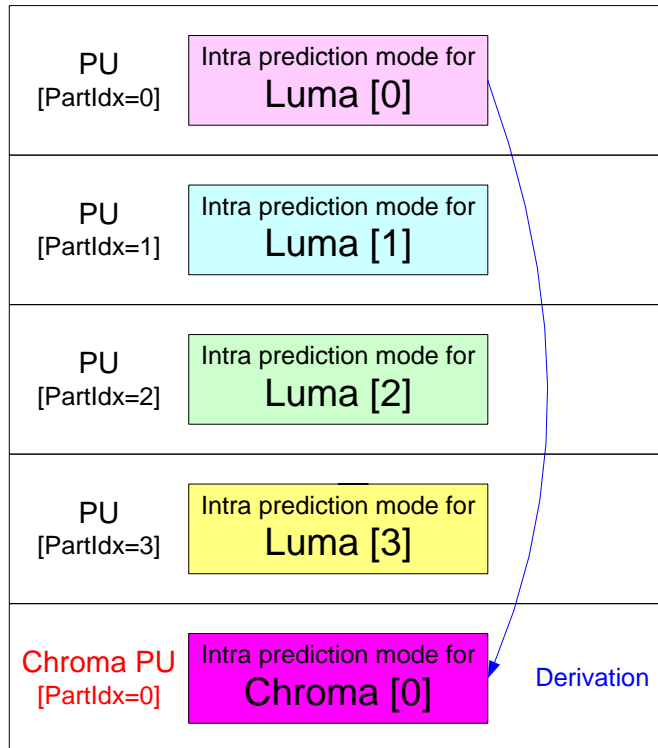
# Coding order of intra prediction mode syntax elements in **HM3.0** and **WD3**

HM3.0

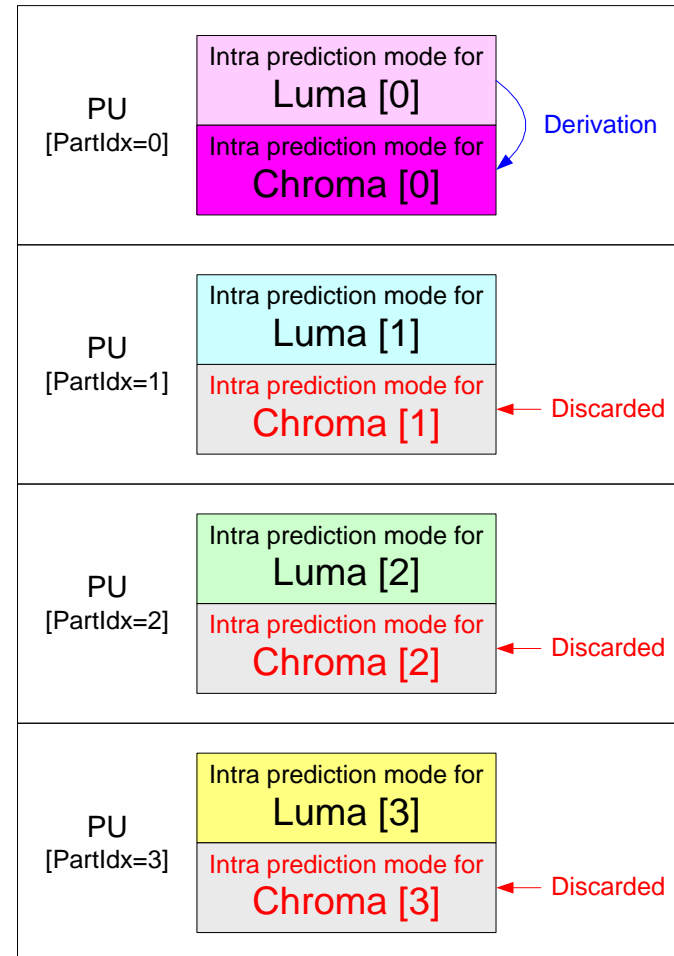
Discrepancy

WD3

MODE\_INTRA  
Part\_NxN



MODE\_INTRA  
Part\_NxN

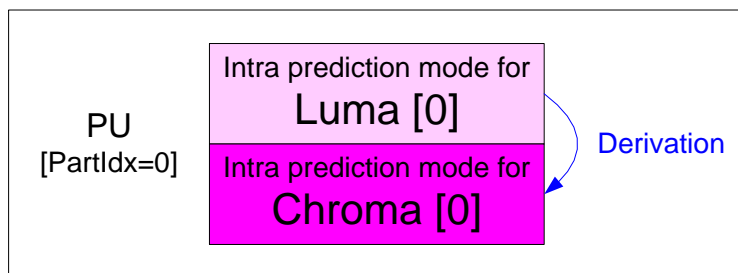




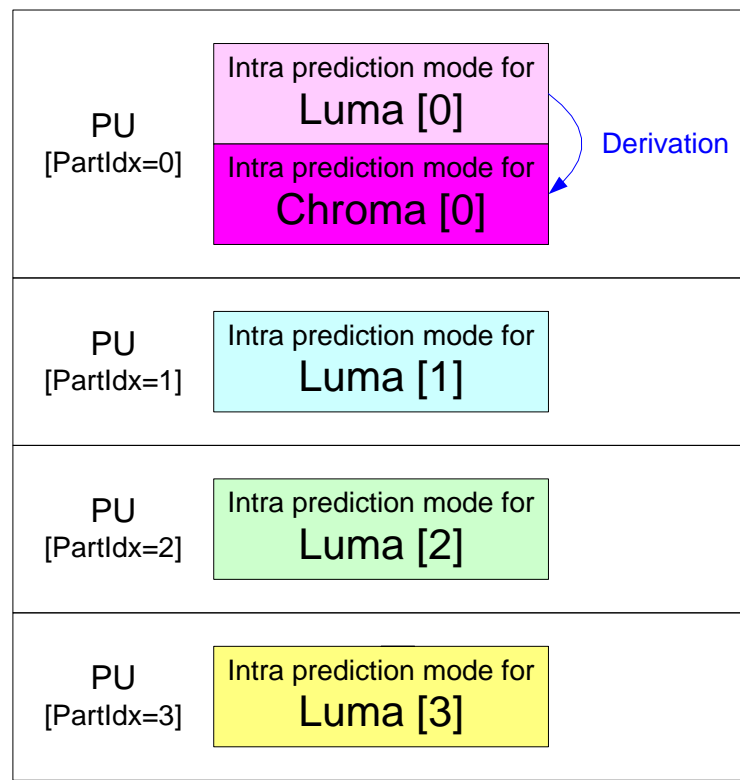
# 3 Proposed Techniques

# Proposed coding order of intra prediction mode in 4:2:0 chroma sampling

MODE\_INTRA  
Part\_2Nx2N

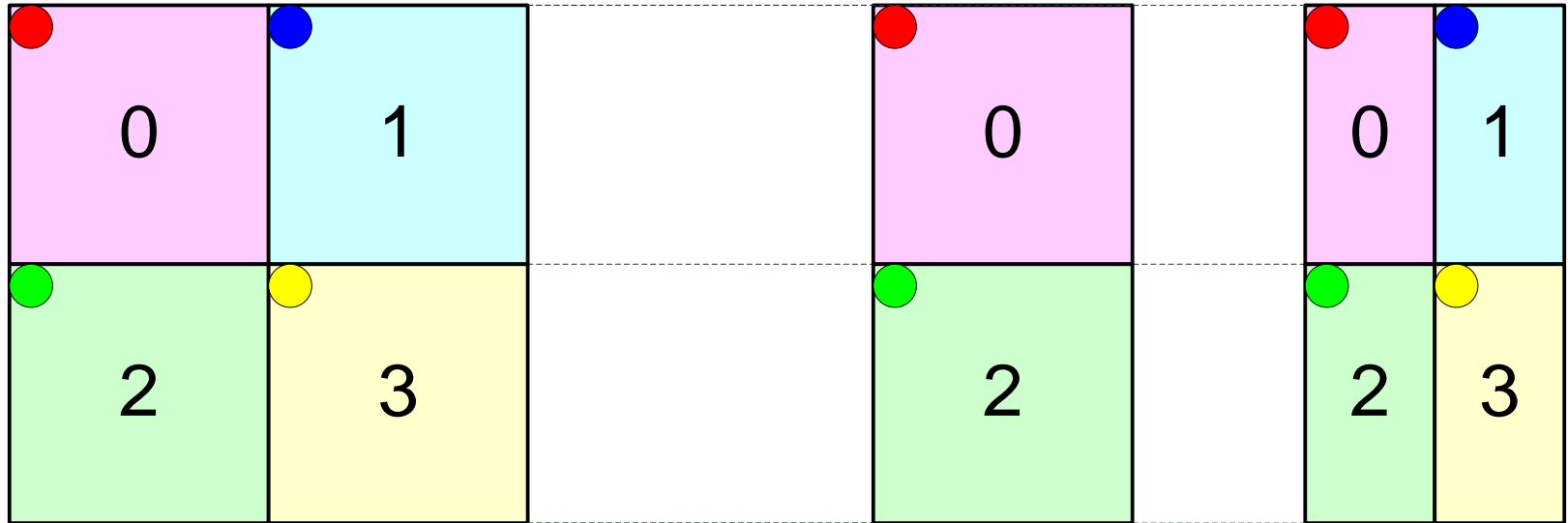


MODE\_INTRA  
Part\_NxN



- The chroma intra prediction mode is
- coded after the luma intra prediction modes located at the same position in the same PU.
  - derived using luma intra prediction mode in the same PU.

# Intra and inter NxN PU structure in a coding unit in 4:2:2 chroma sampling

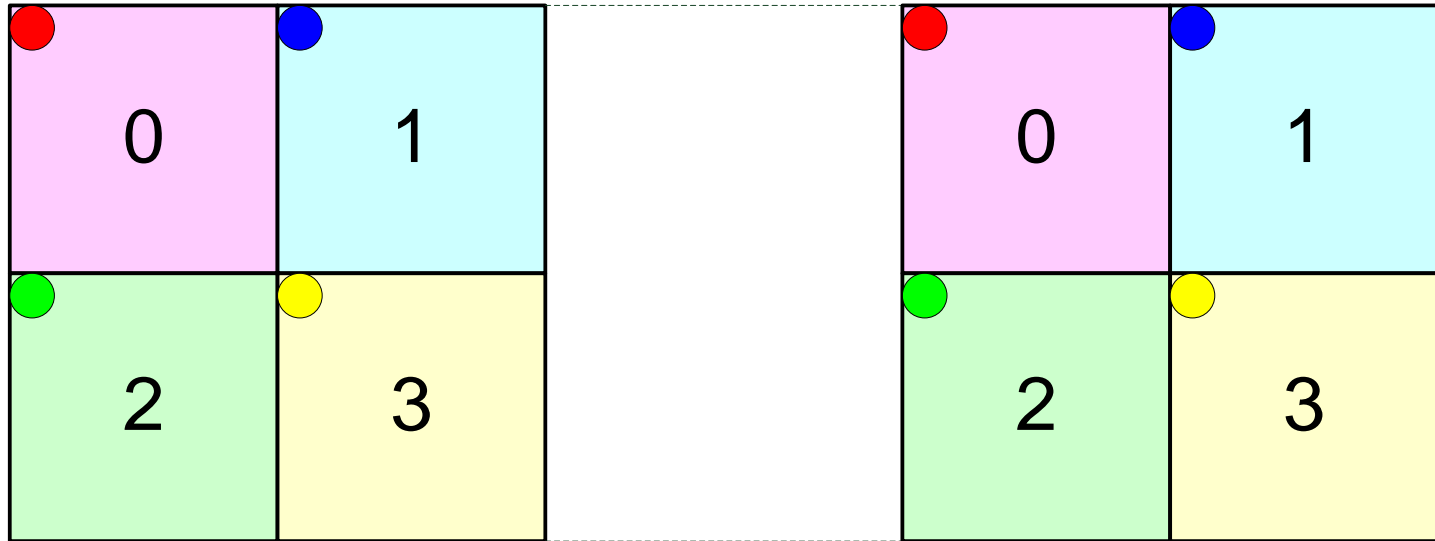


MODE\_INTRA / MODE\_INTER  
Part\_NxN  
Luma

MODE\_INTRA  
Part\_NxN  
Chroma

MODE\_INTER  
Part\_NxN  
Chroma

# Intra and inter NxN PU structure in a coding unit in 4:4:4 chroma sampling



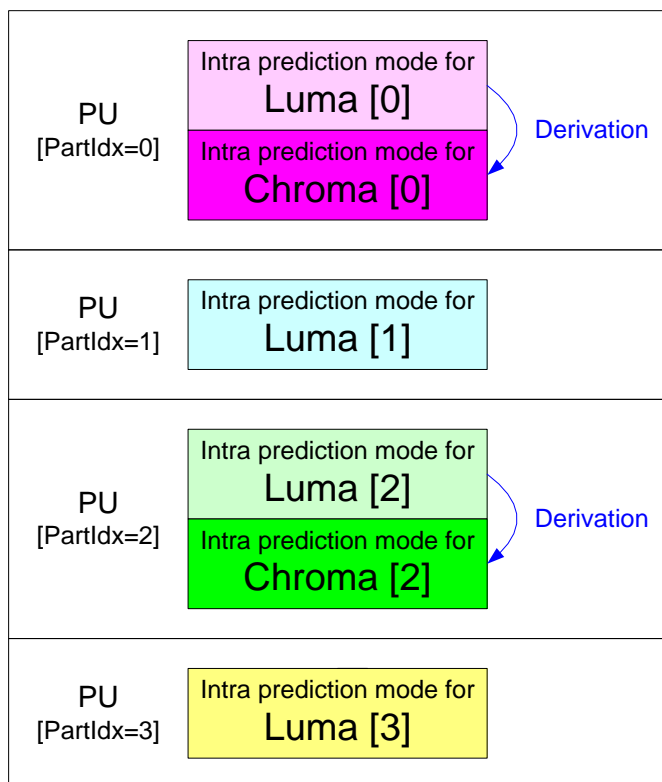
MODE\_INTRA / MODE\_INTER  
Part\_NxN  
Luma

MODE\_INTRA / MODE\_INTER  
Part\_NxN  
Chroma

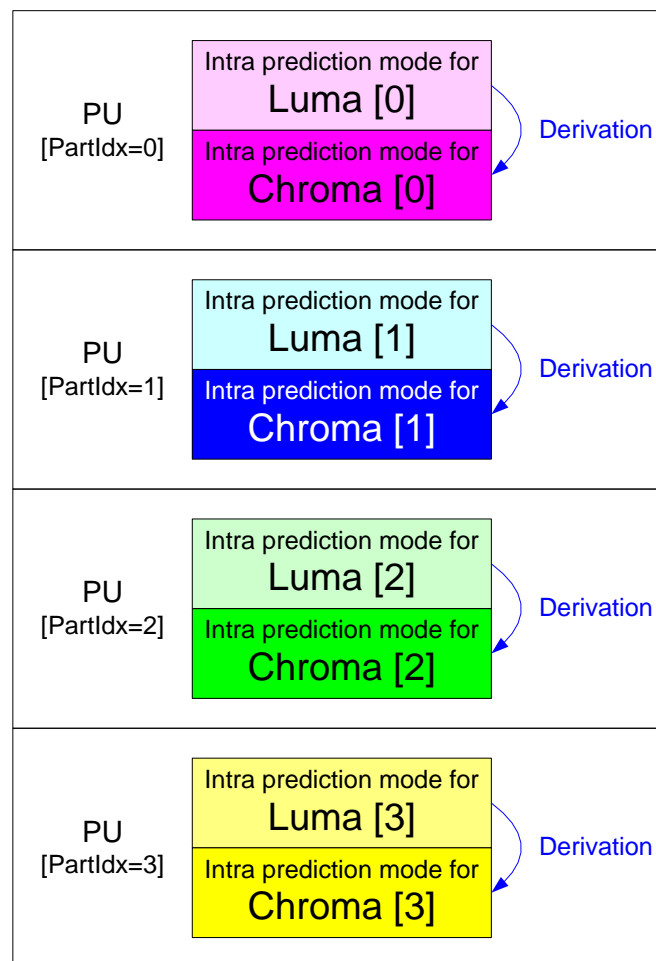
# Proposed coding order of luma and chroma intra prediction mode

## in 4:2:2 and 4:4:4 chroma sampling

MODE\_INTRA  
Part\_NxN  
4:2:2



MODE\_INTRA  
Part\_NxN  
4:4:4



# 4 Proposed Syntax

# PU syntax of this proposal in 4:2:0 sampling

prediction_unit( x0, y0, log2PUWidth, log2PUHeight, PartIdx , InferredMergeFlag ) {	Descriptor
if( skip_flag[ x0 ][ y0 ] ) {	
.....	
} else if( PredMode == MODE_INTRA ) {	
.....	
if( pcm_flag ) {	
.....	
} else {	
<b>prev_intra_luma_pred_flag</b> [ x0 ][ y0 ]	u(1)   ae(v)
if( prev_intra_luma_pred_flag[ x0 ][ y0 ] )	
if( NumMPMCand > 1 )	
<b>mpm_idx</b> [ x0 ][ y0 ]	u(1)   ae(v)
else	
<b>rem_intra_luma_pred_mode</b> [ x0 ][ y0 ]	ce(v)   ae(v)
if( IntraPredMode[ x0 ][ y0 ] == 2 )	
<b>planar_flag_luma</b> [ x0 ][ y0 ]	u(1)   ae(v)
if( PartIdx == 0 ) /* Part 2Nx2N and PART NxN */	
<b>intra_chroma_pred_mode</b> [ x0 ][ y0 ]	ue(v)   ae(v)
SignaledAsChromaDC = ( chroma_pred_from_luma_enabled_flag ? intra_chroma_pred_mode[ x0 ][ y0 ] == 3 : intra_chroma_pred_mode[ x0 ][ y0 ] == 2 )	
if( IntraPredMode[ x0 ][ y0 ] != 2 && IntraPredMode[ x0 ][ y0 ] != 34 && SignaledAsChromaDC )	
<b>planar_flag_chroma</b> [ x0 ][ y0 ]	u(1)   ae(v)
}	
}	
} else { /* MODE_INTER */	
.....	
}	
}	

# PU syntax of this proposal

in monochrome, 4:2:0, 4:2:2, 4:4:4 sampling

prediction_unit( x0, y0, log2PUWidth, log2PUHeight, PartIdx , InferredMergeFlag ) {	Descriptor
if( skip_flag[ x0 ][ y0 ] ) {	
.....	
} else if( PredMode == MODE_INTRA ) {	
.....	
if( pcm_flag ) {	
.....	
} else {	
<b>prev_intra_luma_pred_flag</b> [ x0 ][ y0 ]	u(1)   ae(v)
if( prev_intra_luma_pred_flag[ x0 ][ y0 ] )	
if( NumMPMCand > 1 )	
<b>mpm_idx</b> [ x0 ][ y0 ]	u(1)   ae(v)
else	
<b>rem_intra_luma_pred_mode</b> [ x0 ][ y0 ]	ce(v)   ae(v)
if( IntraPredMode[ x0 ][ y0 ] == 2 )	
<b>planar_flag_luma</b> [ x0 ][ y0 ]	u(1)   ae(v)
if( ( ChromaArrayType != 0 && PartIdx == 0 )    ( ChromaArrayType == 2 && PartIdx == 2 )    ChromaArrayType == 3 )	
<b>intra_chroma_pred_mode</b> [ x0 ][ y0 ]	ue(v)   ae(v)
SignaledAsChromaDC = ( chroma_pred_from_luma_enabled_flag ? intra_chroma_pred_mode[ x0 ][ y0 ] == 3 : intra_chroma_pred_mode[ x0 ][ y0 ] == 2 )	
if( IntraPredMode[ x0 ][ y0 ] != 2 && IntraPredMode[ x0 ][ y0 ] != 34 && SignaledAsChromaDC	
)	
<b>planar_flag_chroma</b> [ x0 ][ y0 ]	u(1)   ae(v)
}	
}	
} else { /* MODE_INTER */	
.....	
}	
}	



# 5 Experiments

# Simulation results of Proposal 2 (MVP)

- Implementation software: HM3.0
- Simulation Condition: All Intra, Random Access, Low Delay (B)
- Cross Check: JCTVC-F098 by NTT

	All Intra HE			All Intra LC		
	Y	U	V	Y	U	V
Class A	0.0	0.0	-0.1	0.0	0.0	0.0
Class B	0.0	0.0	0.0	0.0	0.0	0.0
Class C	0.0	0.0	0.0	0.0	0.0	0.0
Class D	0.0	-0.1	0.0	0.0	0.0	0.0
Class E	0.0	0.0	0.0	0.0	0.0	0.0
<b>Overall</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
Enc Time[%]	100%			100%		
Dec Time[%]	101%			100%		

# 6

## Conclusions

# Recommendations

- The syntax described in next WD should correspond to HM implementation in terms of coding of intra prediction mode.
- The chroma intra prediction mode should be coded just after the luma intra prediction mode located at the same position in the same PU.
- The conditional statement is applied into the PU syntax.
- When only 4:2:0 sampling is considered in next WD:

<code>if( PartIdx == 0 ) /* Part_2Nx2N and PART_NxN */</code>
<code>intra_chroma_pred_mode[ x0 ][ y0 ]</code>

- When monochrome, 4:2:0, 4:2:2 and 4:4:4 are considered:

<code>if( ( ChromaArrayType != 0 &amp;&amp; PartIdx == 0 )   </code>
<code>( ChromaArrayType == 2 &amp;&amp; PartIdx == 2 )   </code>
<code>ChromaArrayType == 3 )</code>
<code>intra_chroma_pred_mode[ x0 ][ y0 ]</code>

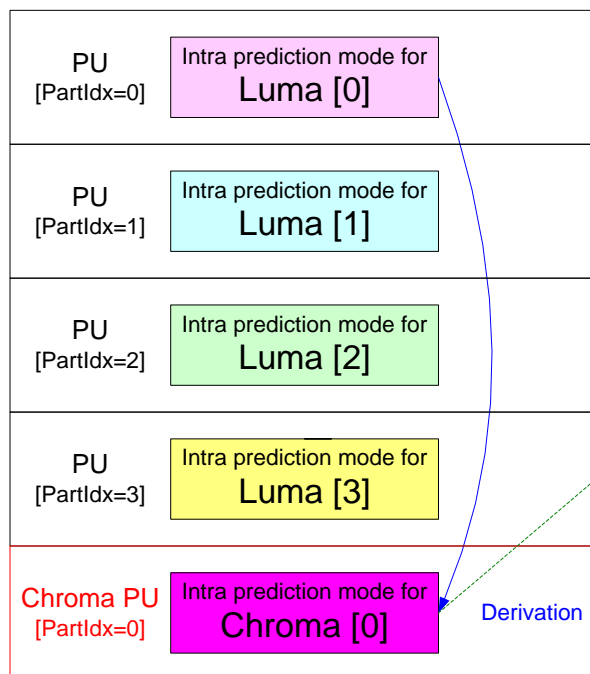
# Recommendations

- When only 4:2:0 sampling is considered in next WD:

<b>if( PartIdx == 0 ) /* Part_2Nx2N and PART_NxN */</b>
<b>intra_chroma_pred_mode[ x0 ][ y0 ]</b>

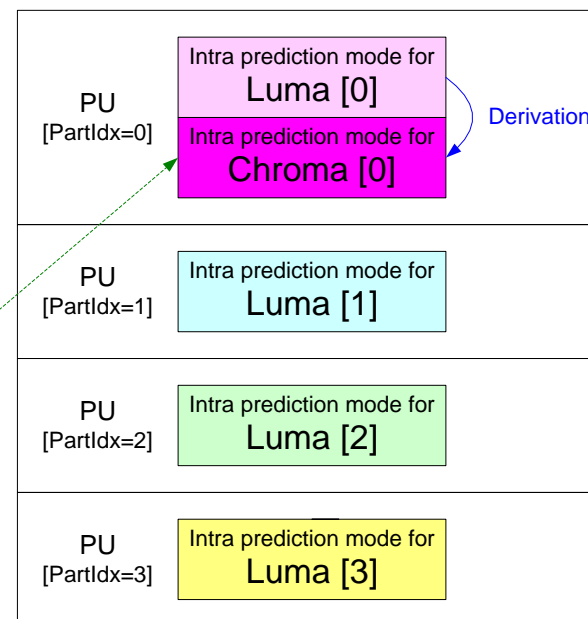
HM3.0

MODE\_INTRA  
Part\_NxN



Next HM

MODE\_INTRA  
Part\_NxN



**JVC KENWOOD**  
**HOLDINGS**

The logo graphic consists of two parallel, curved, grey swooshes that originate from the right side of the word 'HOLDINGS' and sweep upwards and to the right, ending near the top right of the frame.