

# Overview of Centralized Texture-Depth Packing Formats

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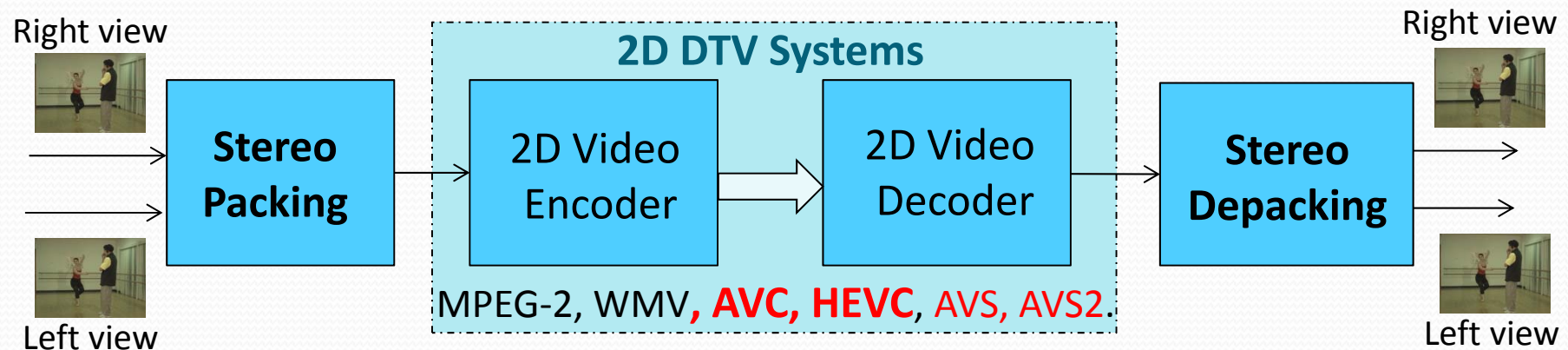
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- Overview
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- Conclusions

## Pros and Cons of Stereo Packing

### Simplest Stereo 3D - Deliverable in 2D DTV Systems:

- To deliver 3D TV services, one simple way is to combine both left and right view frames into single frame by **a stereo packing** such that the traditional TV broadcasting systems can transmit them easily.



- For 2DTV displays, the users will suffer from very **uncomfortable viewing experiences** for most stereo packing videos.
- For naked-eye 3DTV displays, it also hard to convert stereo videos to multiview videos

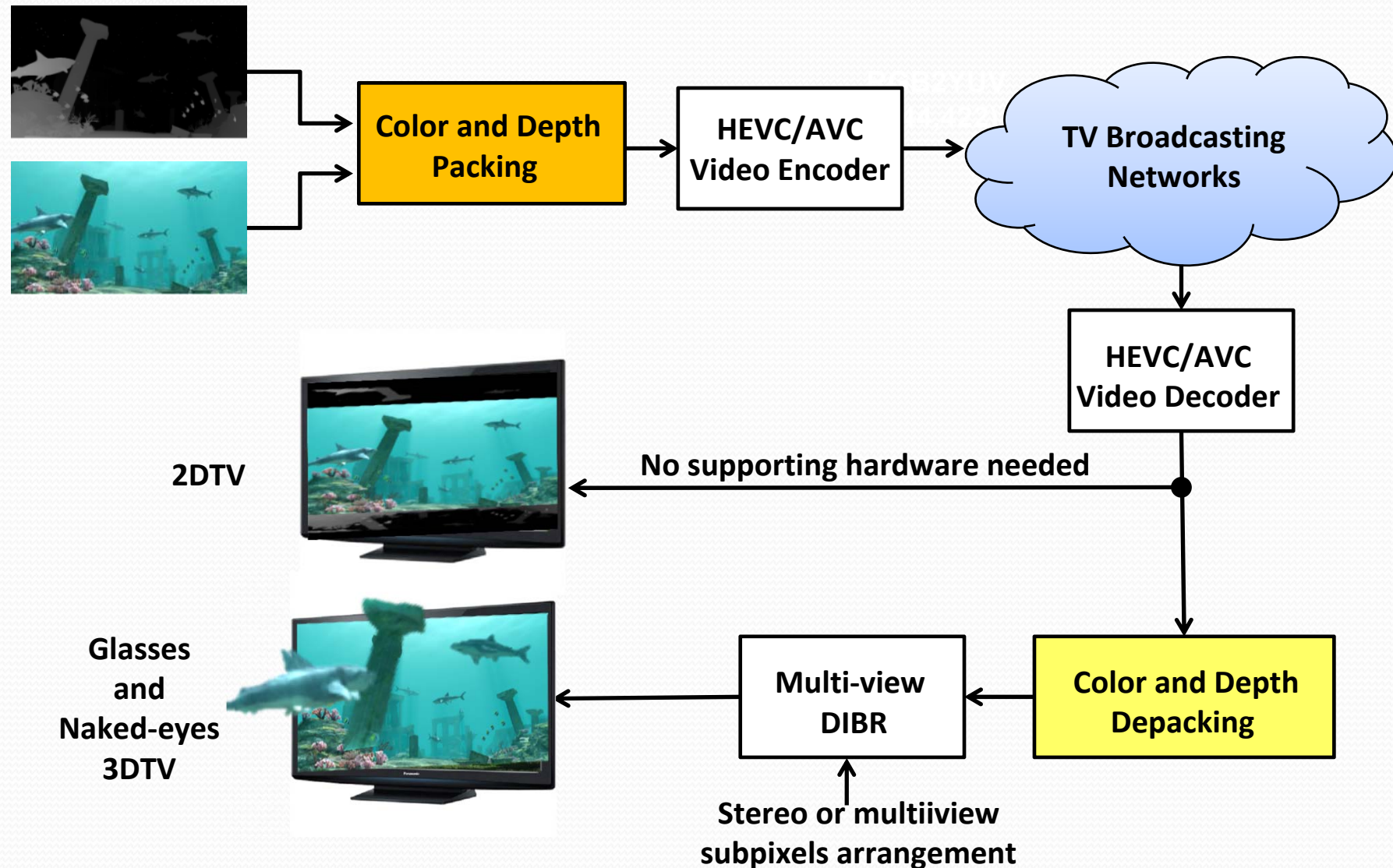


## Current Side-by-Side Stereo Packing



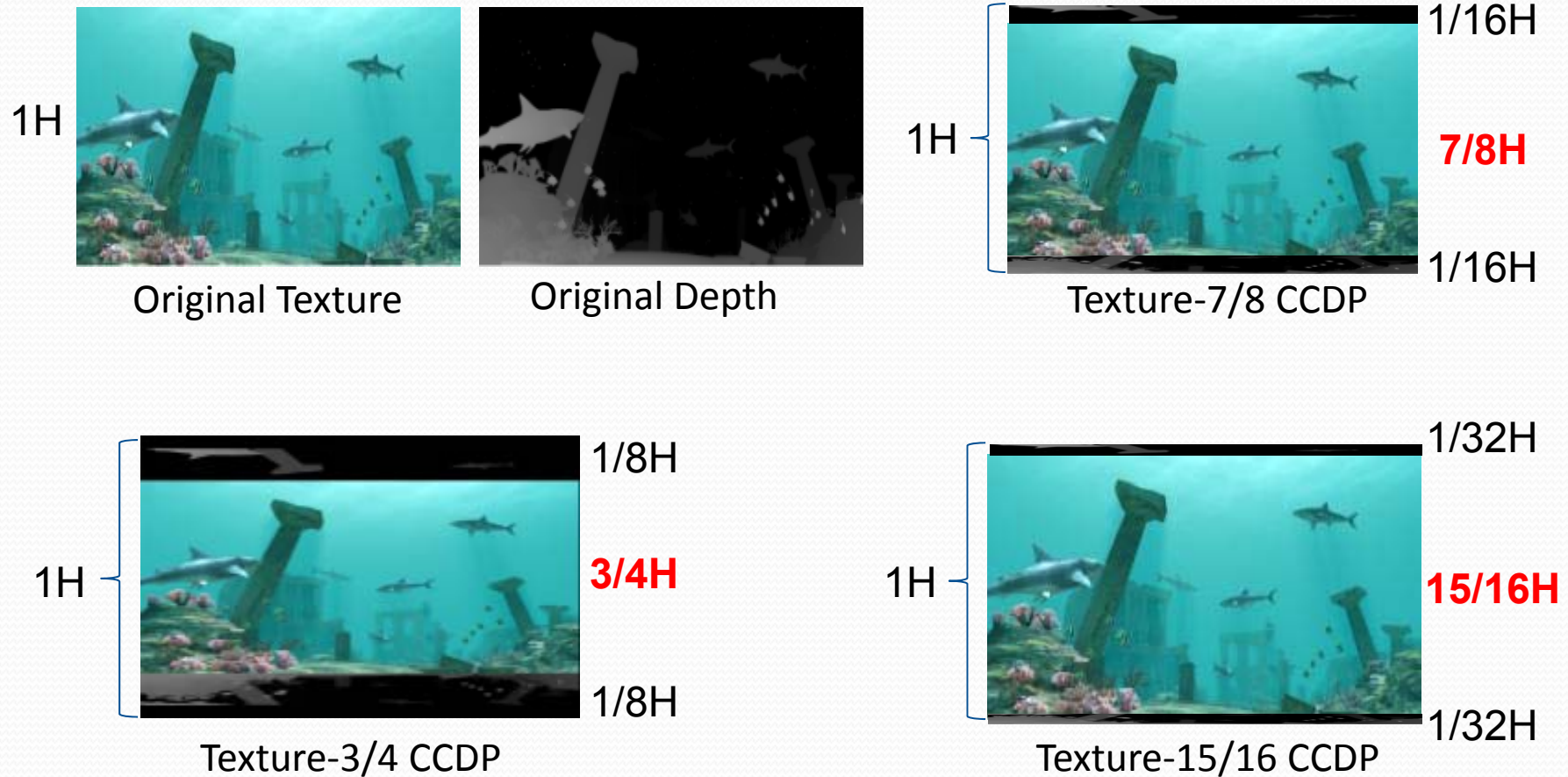
# Frame Compatible Centralized Texture-Depth Packing (CTDP)

# 3D Broadcasting System with CTDP Format

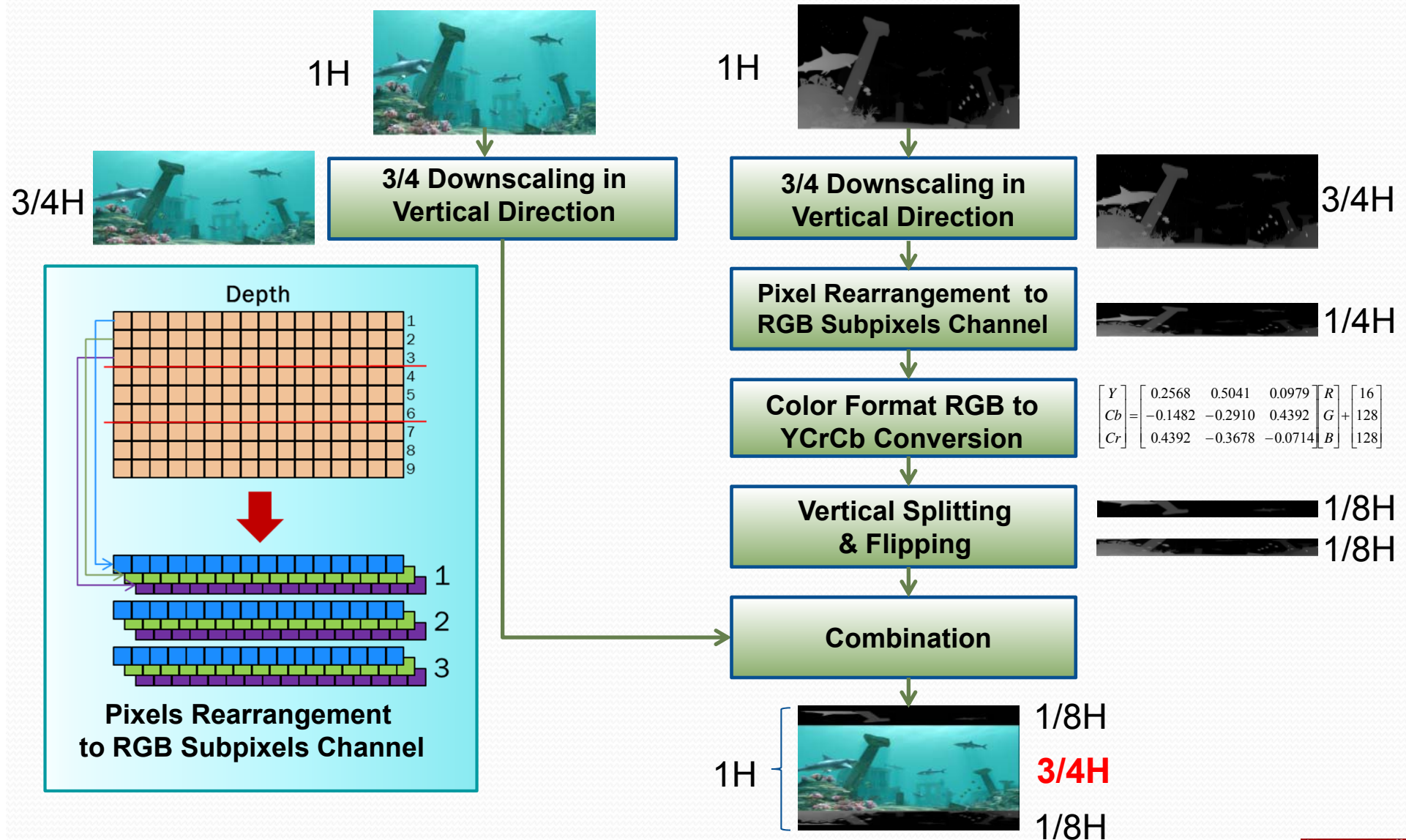




# Outlooks of CTDPs (texture 3/4, 7/8, 15/16)



# Texture-3/4 CTDP Packing Procedure

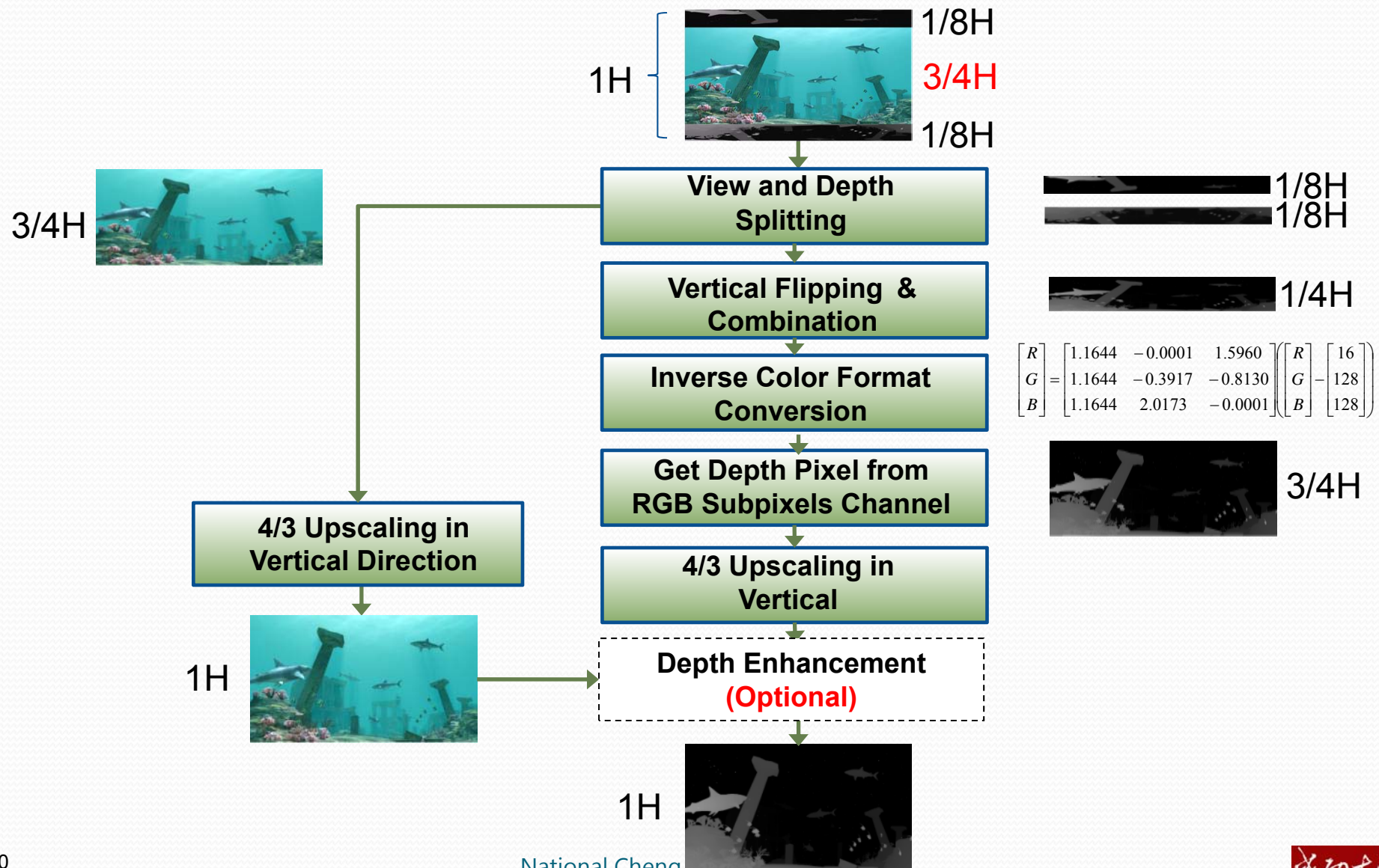




# Packed Frame with Texture-3/4 CTDP Format



# Texture-3/4 CTDP Depacking Procedure





# Packed Frame with Texture-7/8 CTDP Format





# Packed Frame with Texture-15/16 CTDP Format



# Experimental Results

1. Environment Setting
2. Coding performance comparison in HM 13.0

# Environment Setting



## Test sequences (Nature)

No.	Sequence	Size	Frames	Fps
S01	Poznan Hall	1920*1088	200	25
S02	Poznan Street	1920*1088	250	25
S05	Kendo	1024*768	300	30
S06	Balloons	1024*768	300	30
S08	Newspaper	1024*768	300	30



## Experimental Setting

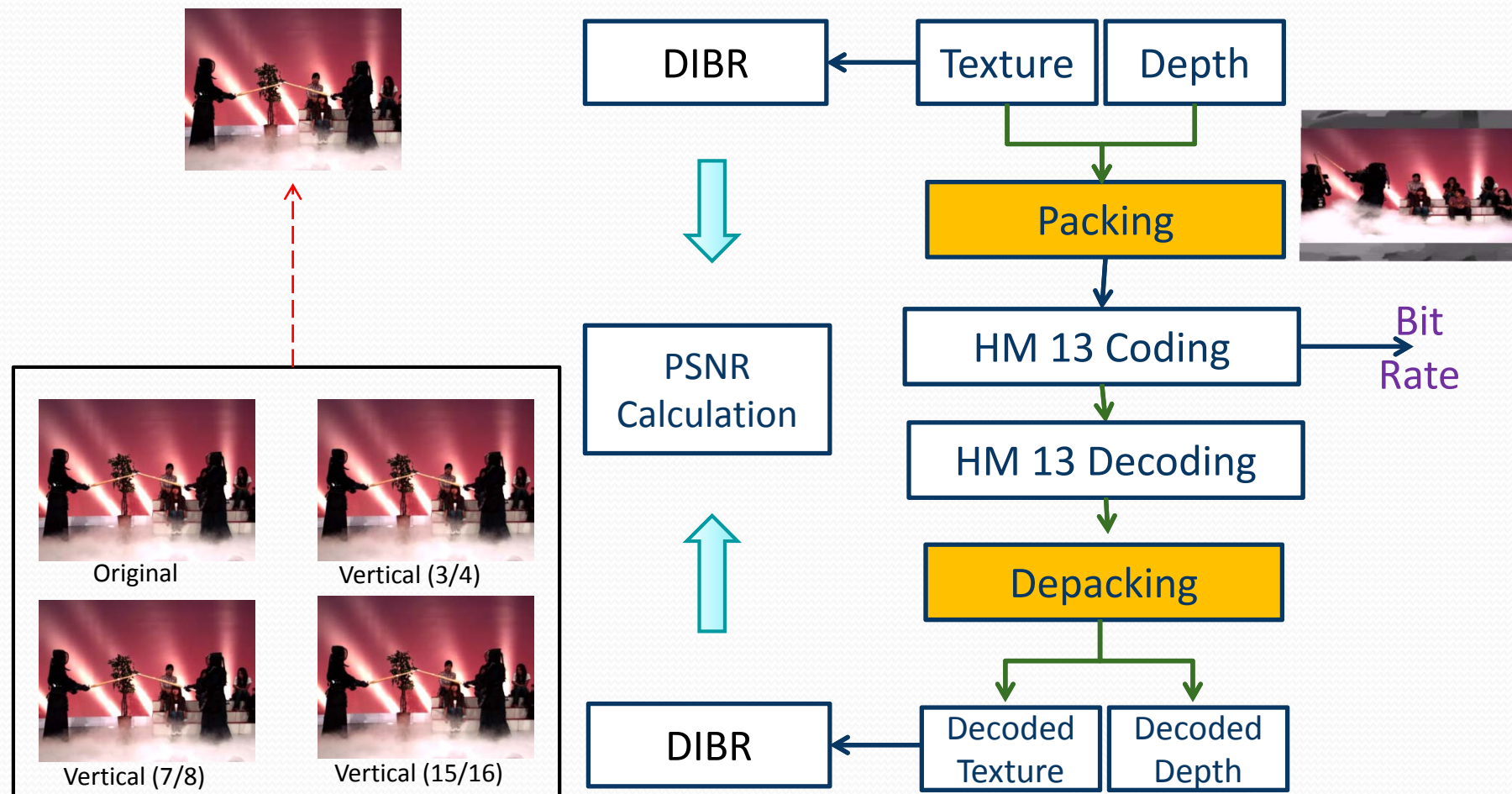
- Encoding Mode
  - All Intra (ai) 、 Low delay (ld) 、 Random access (ra)
- QP
  - 22,27,32,37
- Image Resizing (Open issue)
  - Bilateral
- Planar format Conversion(Open issue)
  - Nearest



The diagram illustrates the video processing pipeline for PSNR calculation. The pipeline starts with 'Texture' and 'Depth' inputs, which are packed and then encoded using 'HM 13 Coding'. The 'Bit Rate' is output from the coding stage. The encoded data is then decoded using 'HM 13 Decoding' and unpacked into 'Decoded Texture' and 'Decoded Depth'. The original and decoded images are compared using 'PSNR Calculation'.



# Comparisons of Virtual View After DIBR



# Coding Performance Comparisons (HM v13.0)

# Experimental results

(with respect to color-depth SbS packing format)

- HEVC (No Depth Enhancement)

BDPSNR (dB)									
	Comparisons of Texture and Depth Coding						Comparisons after DIBR		
	Texture			Depth			Virtual View (Texture)		
	3/4	7/8	15/16	3/4	7/8	15/16	3/4	7/8	15/16
ai	2.3789	2.5594	2.6396	-2.161	-4.8921	-7.2828	1.3823	0.5166	-0.4782
ldp	2.5583	2.8770	3.0298	-1.7413	-3.9545	-6.2577	1.5837	0.874	-0.1387
ra	2.5524	2.8218	2.9479	-1.8395	-4.0206	-6.2007	1.7216	0.8133	-0.2372
Ave	2.4965	2.7527	<b>2.8724</b>	-1.9139	-4.2890	-6.5804	<b>1.5625</b>	0.7346	-0.2847

BDBR (%)									
	Comparisons of Texture and Depth Coding						Comparisons after DIBR		
	Texture			Depth			Virtual View (Texture)		
	3/4	7/8	15/16	3/4	7/8	15/16	3/4	7/8	15/16
ai	-47.149	-50.283	-51.643	116.25	576.67	146346	-41.778	-14.213	44.504
ldp	-57.072	-61.617	-63.554	100.48	457.51	13020	-50.764	-30.584	22.943
ra	-58.065	-62.309	-64.174	104.3	462.77	74516	-54.797	-30.906	29.546
Ave	-54.0953	-58.0697	<b>-59.7903</b>	107.01	498.9833	77960.67	<b>-49.113</b>	-25.2343	32.331



# Experimental results

(with respect to texture-depth SbS packing format)

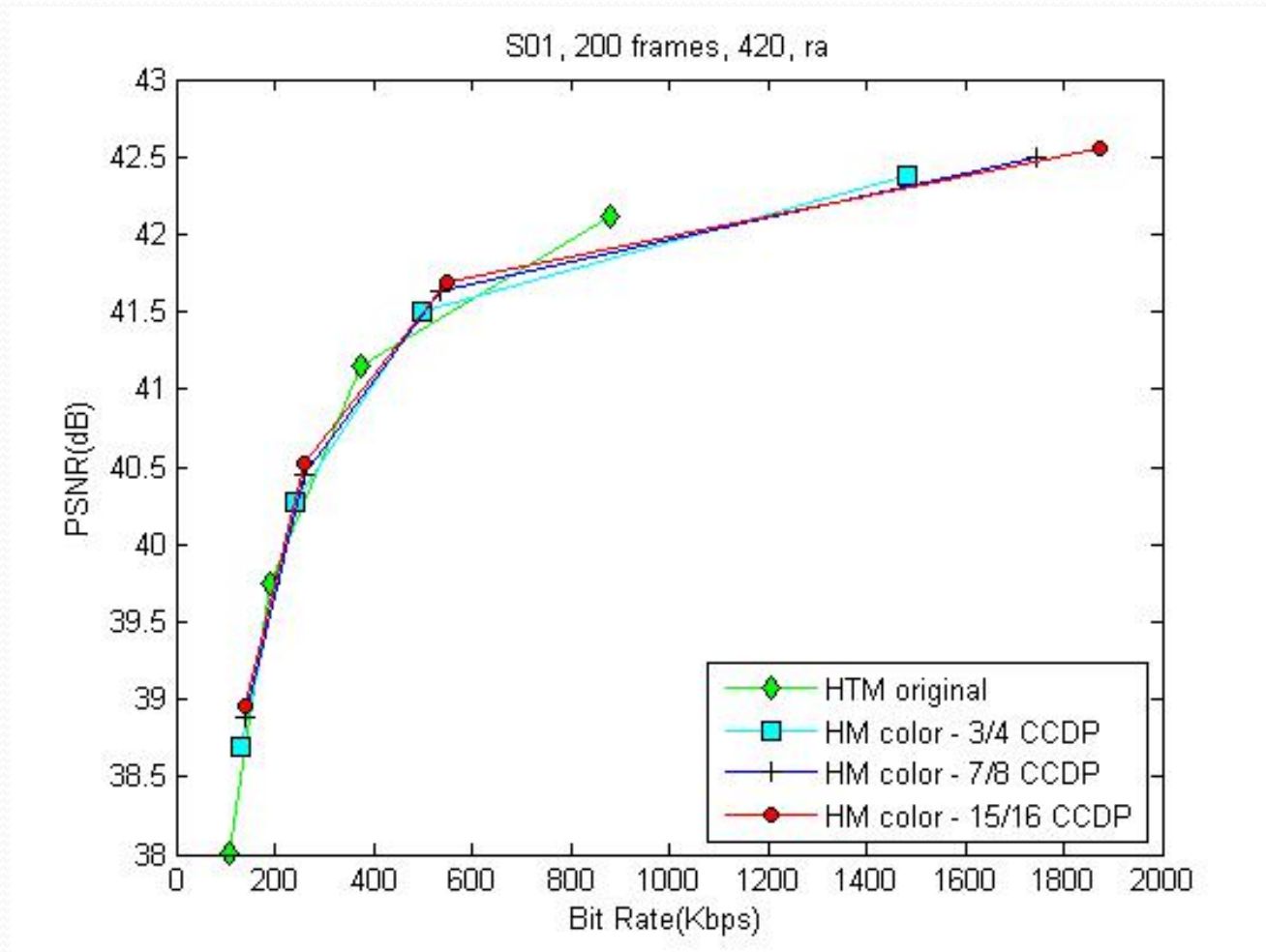
- AVC (No Depth Enhancement)

BDPSNR (dB)									
	Comparisons of Texture and Depth Coding						Comparisons after DIBR		
	Texture			Depth			Virtual View (Texture)		
	3/4	7/8	15/16	3/4	7/8	15/16	3/4	7/8	15/16
ai	2.09762	2.21558	2.26182	-2.78262	-5.34102	-7.89658	1.15348	0.25352	-0.8396
ldp	2.3364	2.5545	2.6701	-2.5931	-4.8405	-7.3083	1.2773	0.4754	-0.5360
ra	2.2205	2.4456	2.5071	-2.3171	-4.8702	-6.5684	1.2118	0.5062	-0.4901
Ave	2.2182	2.4052	<b>2.4797</b>	<b>-2.5643</b>	-5.0172	-7.2578	<b>1.2142</b>	0.4117	-0.6219

BDBR (%)									
	Comparisons of Color and Depth Coding						Comparisons after DIBR		
	Texture			Depth			Virtual View (Texture)		
	3/4	7/8	15/16	3/4	7/8	15/16	3/4	7/8	15/16
ai	-41.6430	-43.8998	-44.8542	165.1893	682.8496	115900.179	-35.7985	-2.9077	68.7556
ldp	-48.2654	-51.2992	-53.3529	172.3632	895.7649	528563.445	-38.3992	-11.8080	58.6390
ra	-44.0361	-46.5163	-47.3085	112.6562	6361.0685	7285.1491	-33.6147	-11.0636	46.4990
Ave	-44.6482	-47.2384	<b>-48.5052</b>	<b>150.0696</b>	2646.5610	217249.591	<b>-35.9374</b>	-8.5931	57.9645

# CCDP with HEVC HM 13.0 versus Color and Depth with 3D-HEVC 8.0

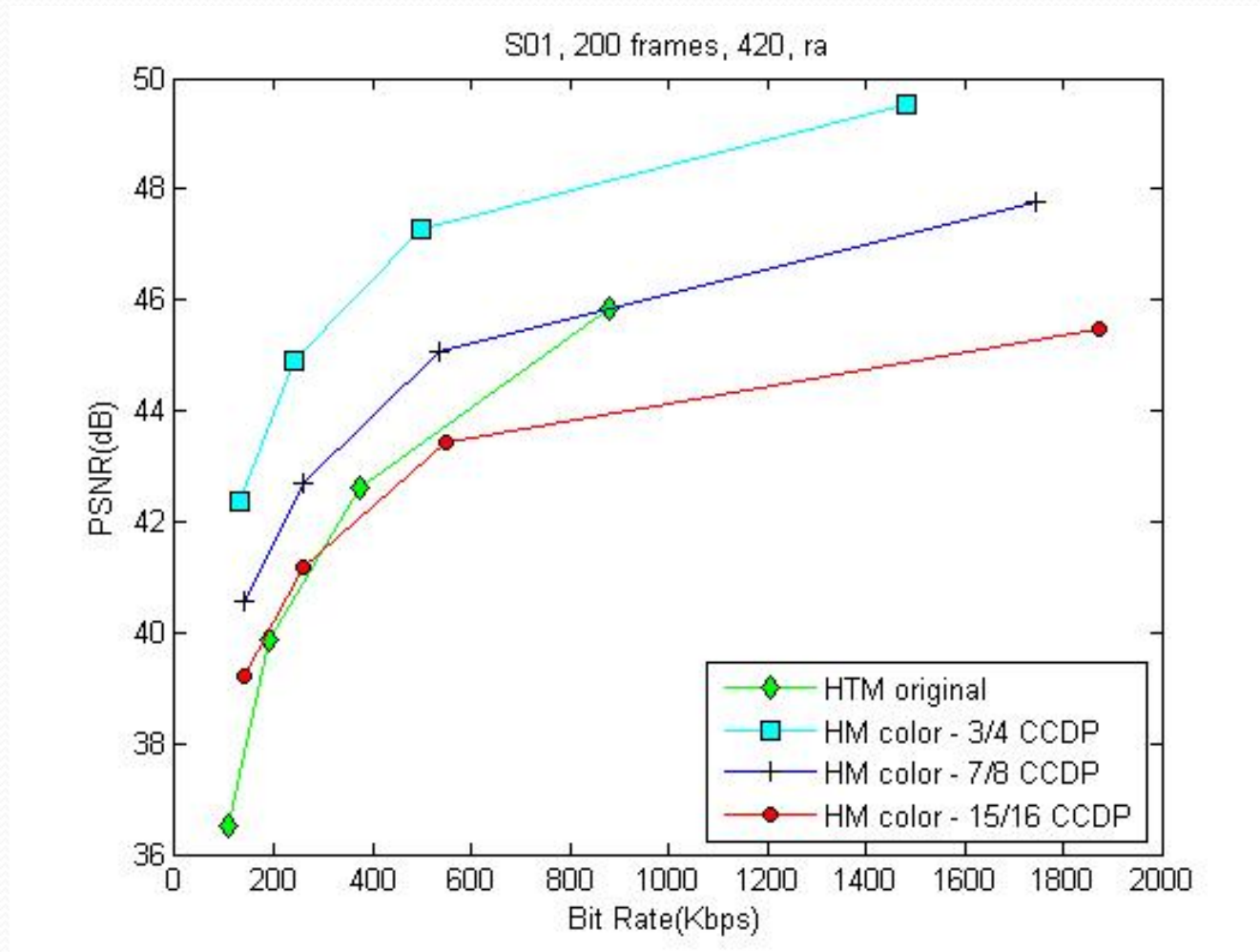
# Color RD Curves (without DIBR)



Color Y

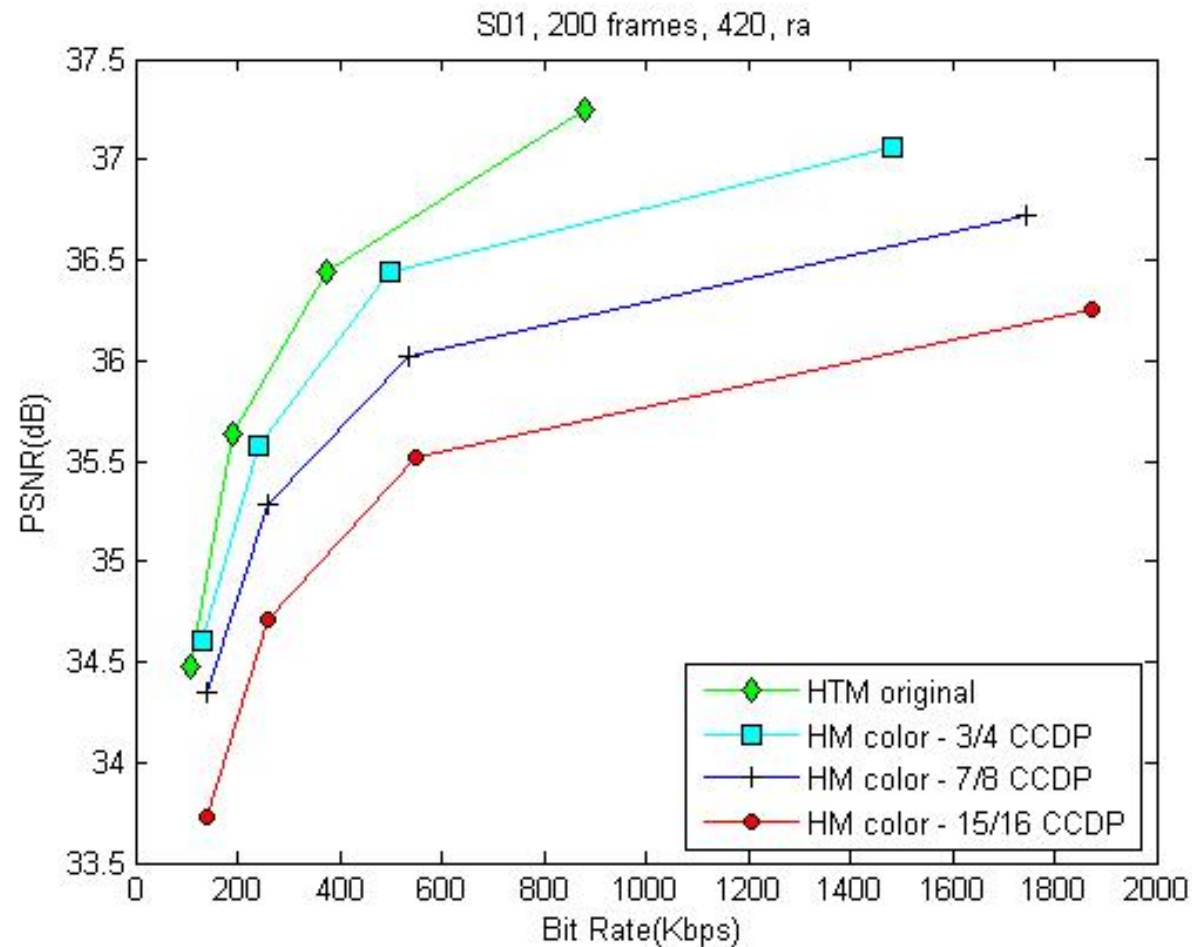


# Depth RD Curves (without DIBR)



Depth Y

# Virtual View RD Curves (with DIBR)



Virtual View (Color)

# Experimental results

(with respect to color-depth 3D-HEVC coding)

Average BDPSNR (dB) results for different sequences

BDPSNR (dB)									
	Comparisons of Textrue and Depth Coding						Comparisons after DIBR		
	Texture			Depth			Virtual View (Texture)		
	3/4	7/8	15/16	3/4	7/8	15/16	3/4	7/8	15/16
ra	0.3761	0.6536	<b>0.7888</b>	3.5058	1.2856	-0.9024	<b>-0.2287</b>	-0.9874	-2.0703

Average BDBR (dB) results for different sequences

BDBR (%)									
	Comparisons of Texture and Depth Coding						Comparisons after DIBR		
	Texture			Depth			Virtual View (Color)		
	3/4	7/8	15/16	3/4	7/8	15/16	3/4	7/8	15/16
ra	-5.7811	-12.5321	<b>-15.5193</b>	-59.5028	-26.5578	26.6362	<b>15.1971</b>	70.7927	258.2328



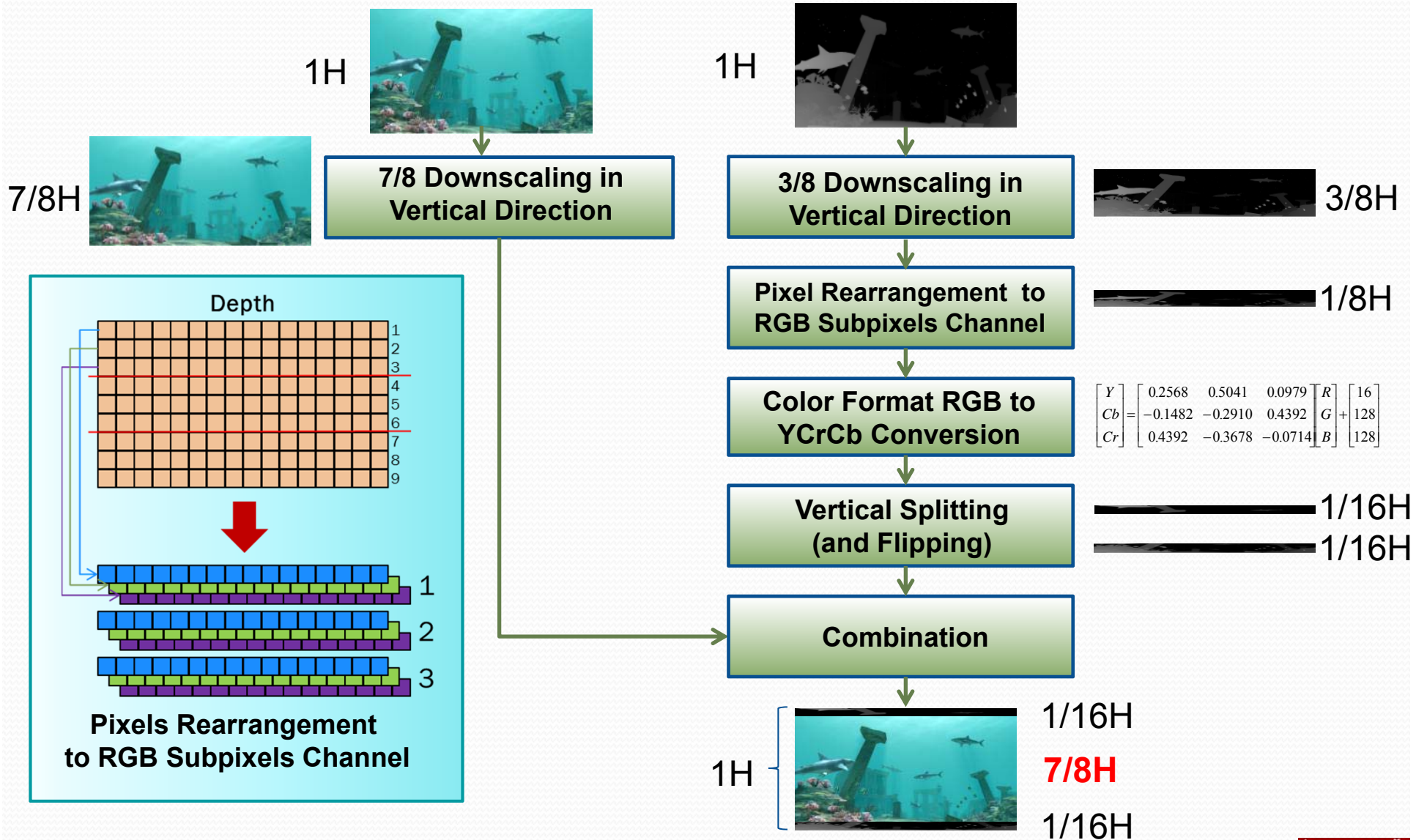
## Conclusions

- The detailed concept of centralized texture-depth packing formats is introduced. The packing and unpacking procedures for CTDP formats are overviewed.
- The objective quality measurements of texture-3/4, 7/8 and 15/16 CTDP formats based on texture depth packing SbS are presented.
- For color and depth quality measures, we found that texture-15/16 CTDP format achieves the best in color frames (best for 2D displays). In average, the texture-3/4 CTDP has best coding performance without any depth enhancement.
- Without any depth enhancement, we recommended adopting the proposed texture-3/4 CTDP format rather than the others since it can achieve the best 3D quality and similar 2D quality.
- Comparing to traditional frame compatible SbS packing format, the proposed CTDP formats attain better image quality for both 2D-TV or 3D-TV displays.

Thanks for your kind attention  
Q&A

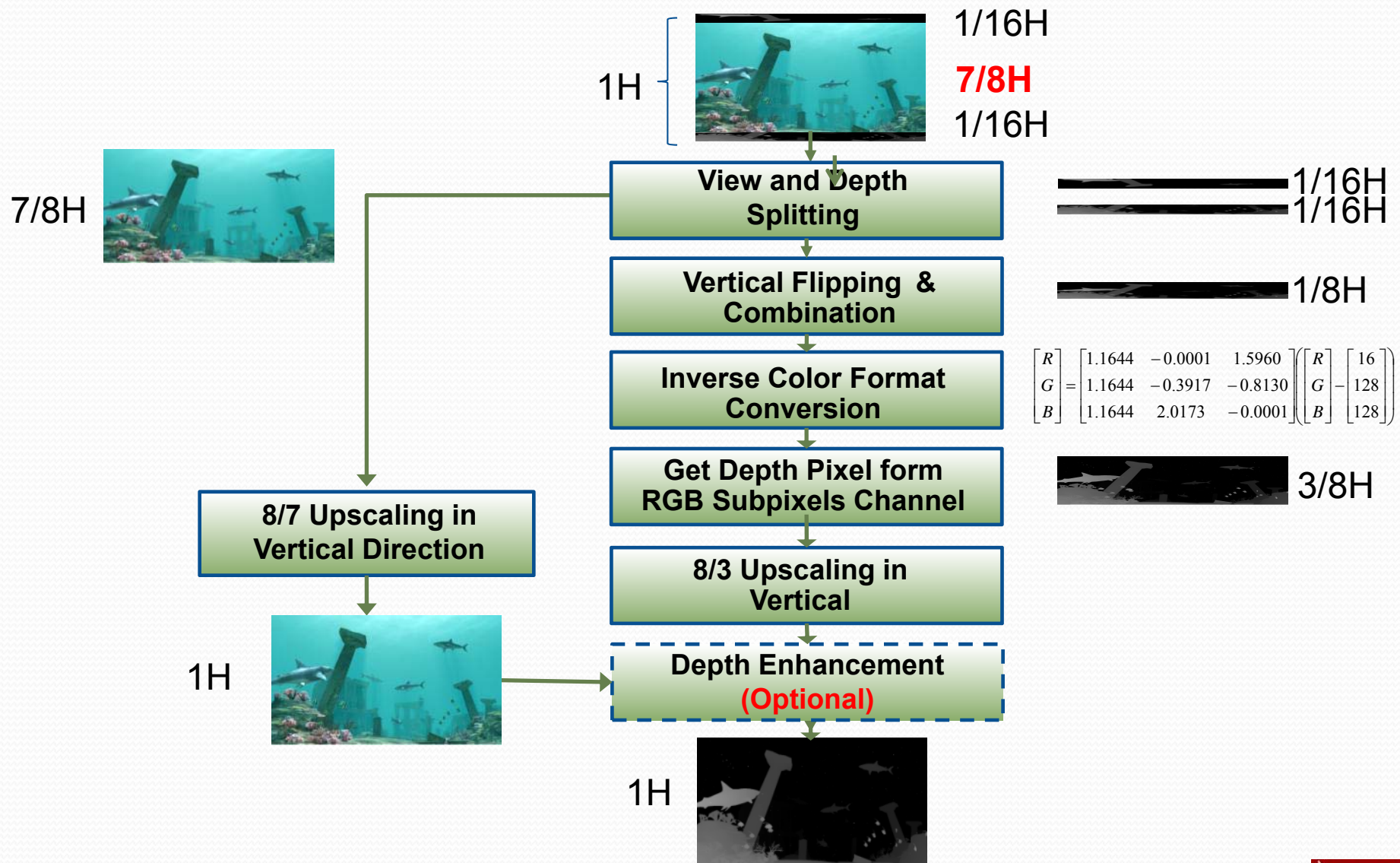


# Texture-7/8 CTDP Packing Procedure

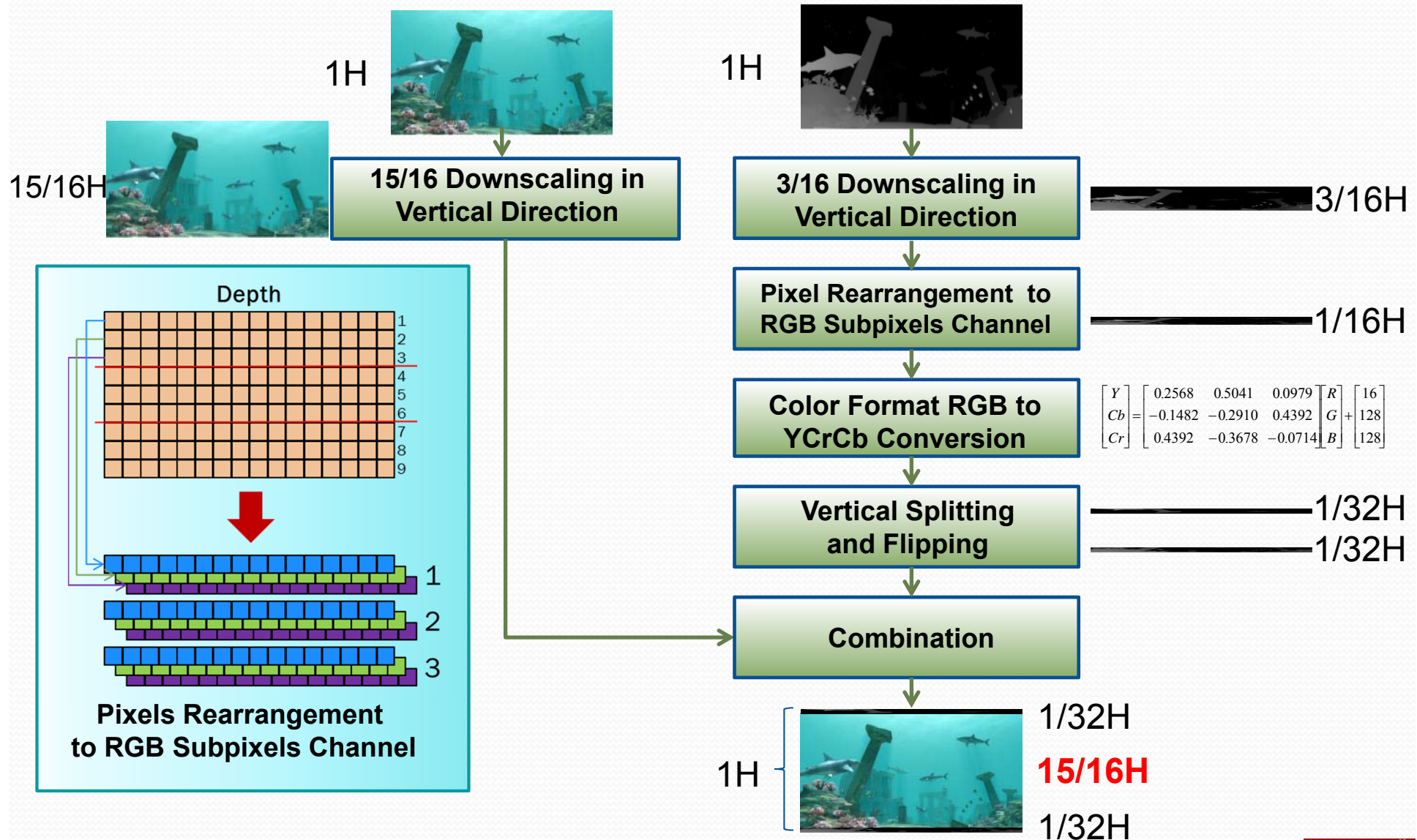




# Texture-7/8 CTDP Depacking Procedure



# Texture-15/16 CTDP Packing Procedure





# Texture-15/16 CTDP Depacking Procedure

