

Overview of Centralized Color-Depth Packing Formats

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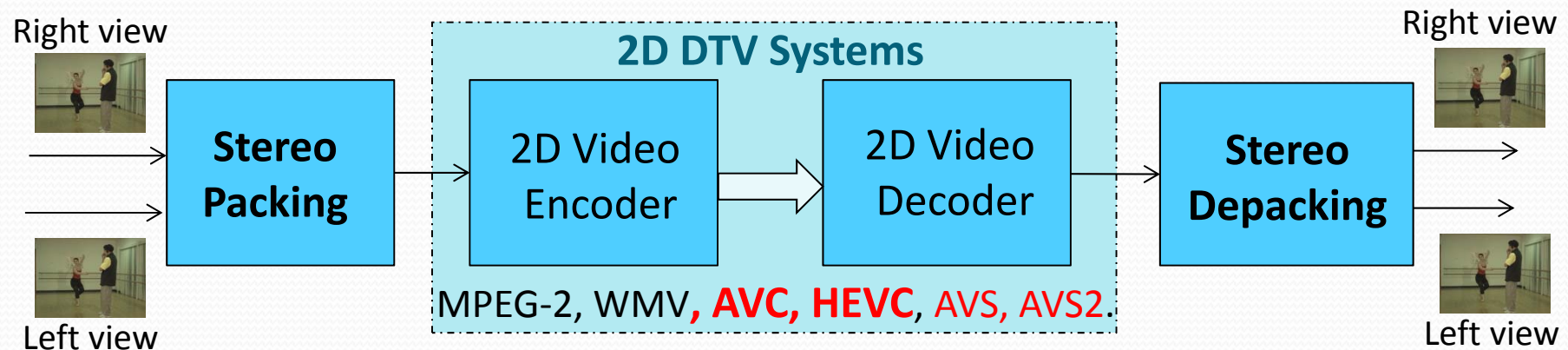
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- Overview
- Centralized Color-Depth Packing (CCDP)
- Experimental Results
- Conclusions

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.



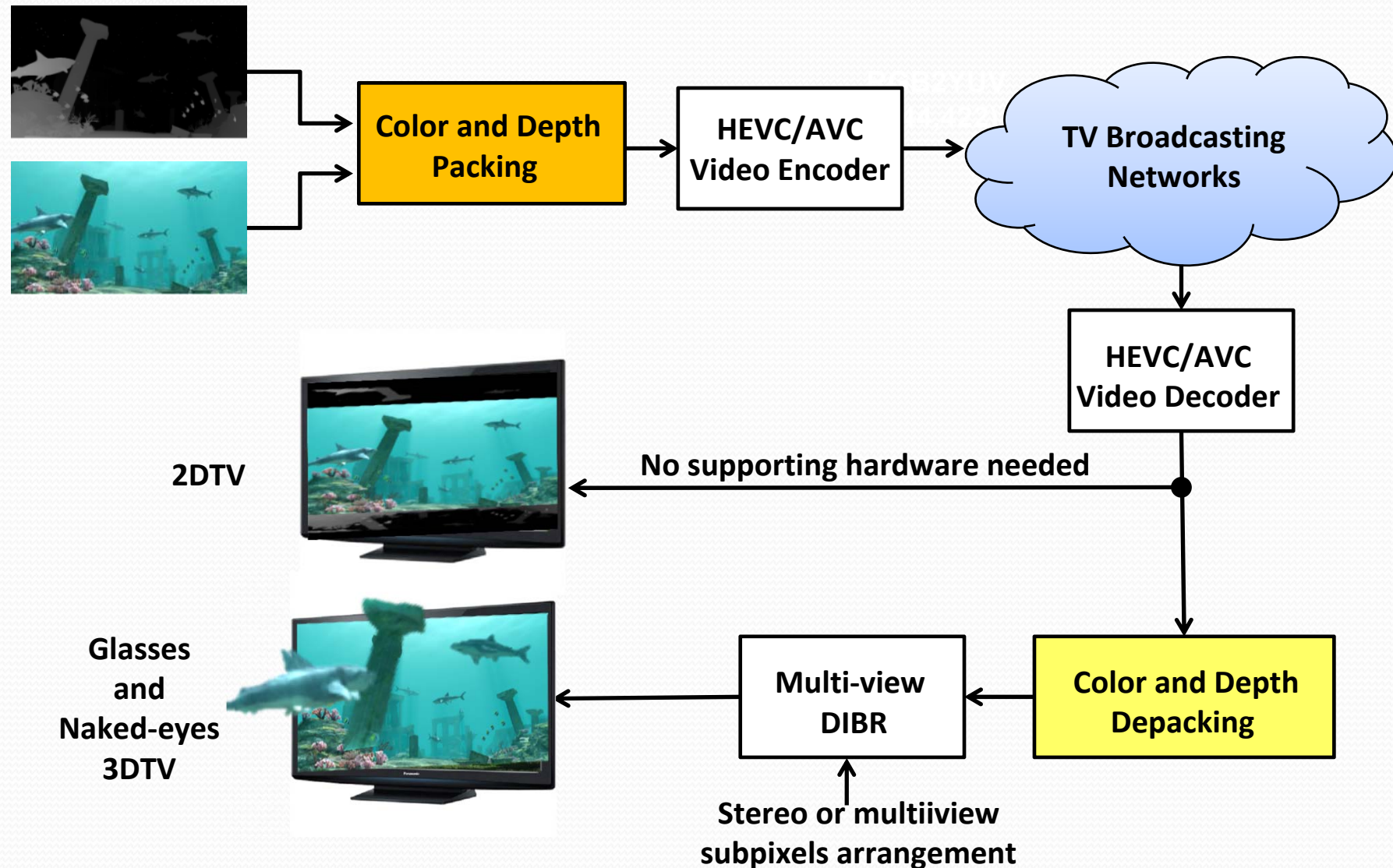
- For 2DTV displays, the users will suffer from very **uncomfortable viewing experiences** for most stereo packing videos.
- For naked-eye 3DTV displays, it also hard to convert stereo videos to multiview videos

Current Side-by-Side Stereo Packing

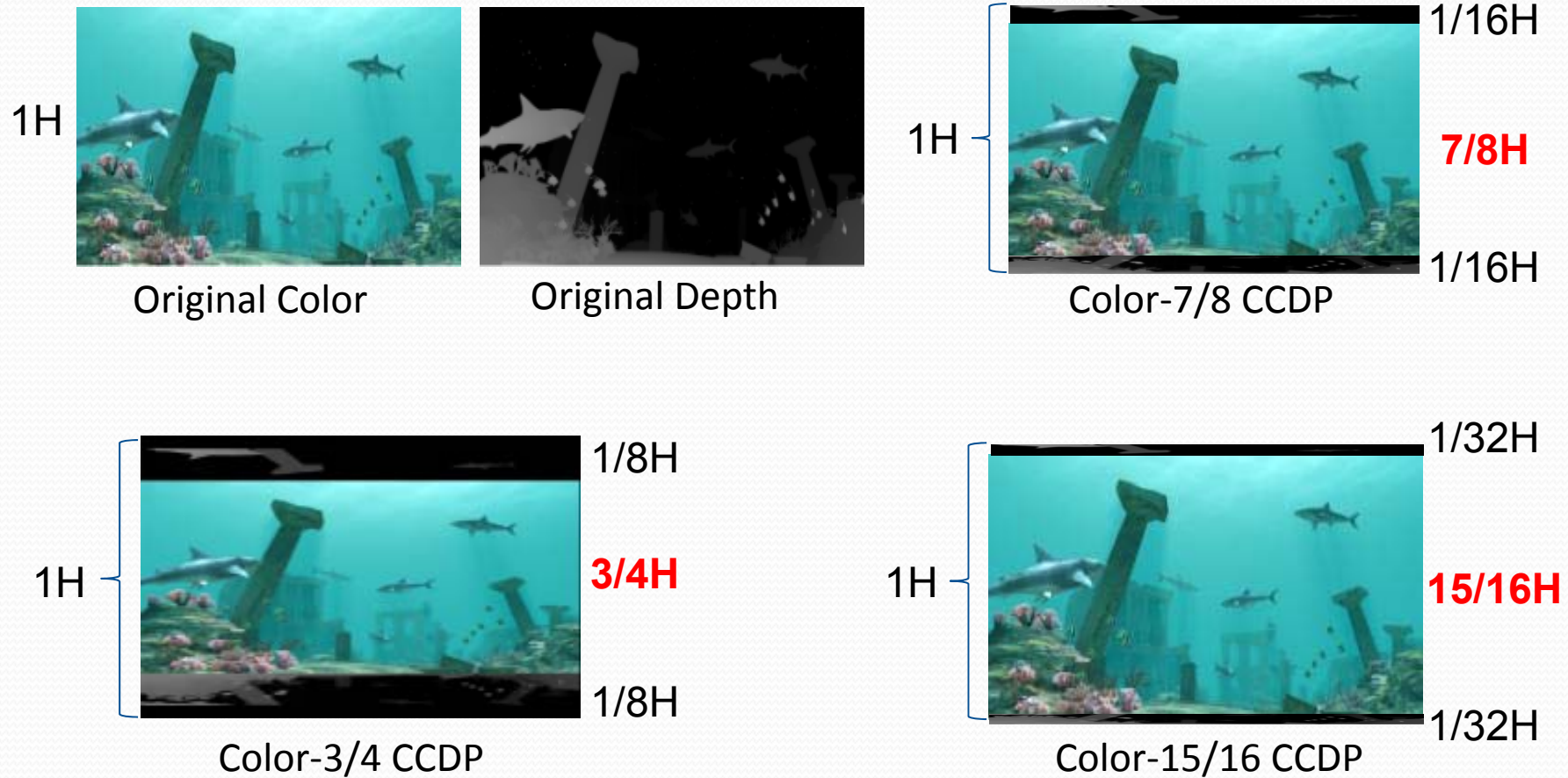


Frame Compatible Centralized Color-Depth Packing (CCDP)

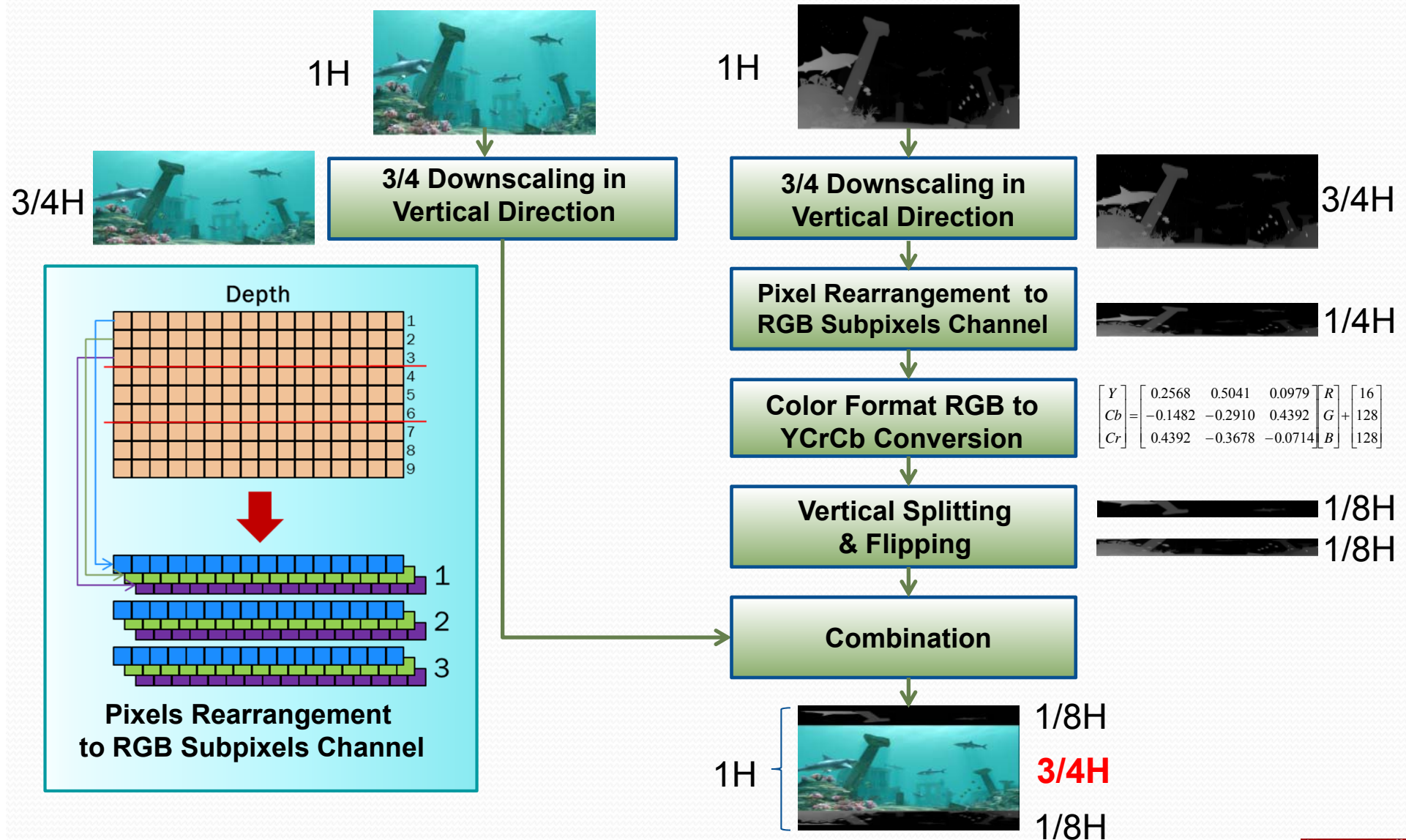
3D Broadcasting System with DCCP Format



Outlooks of CCDPs (color 3/4, 7/8, 15/16)



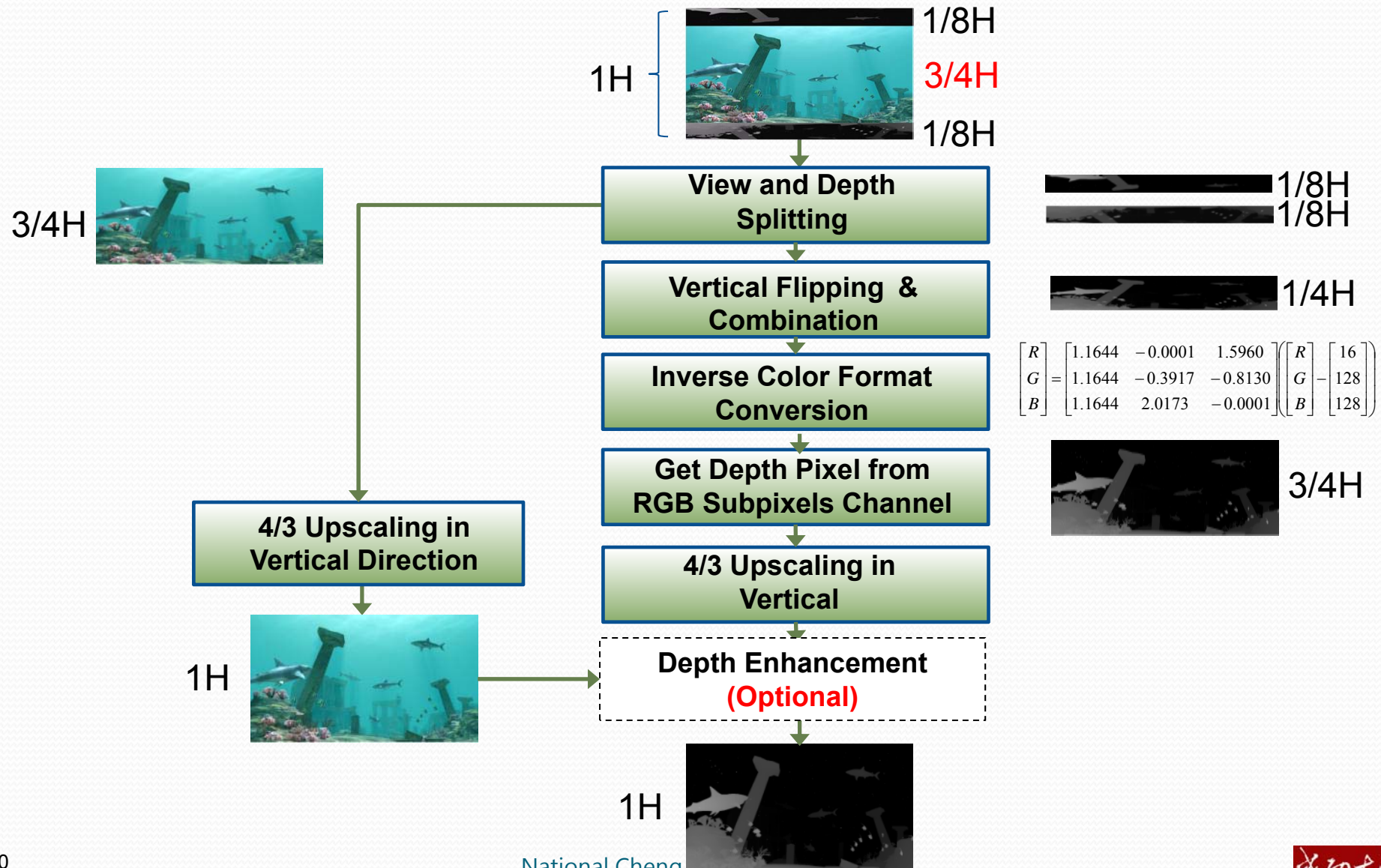
Color 3/4-CCDP Packing Procedure



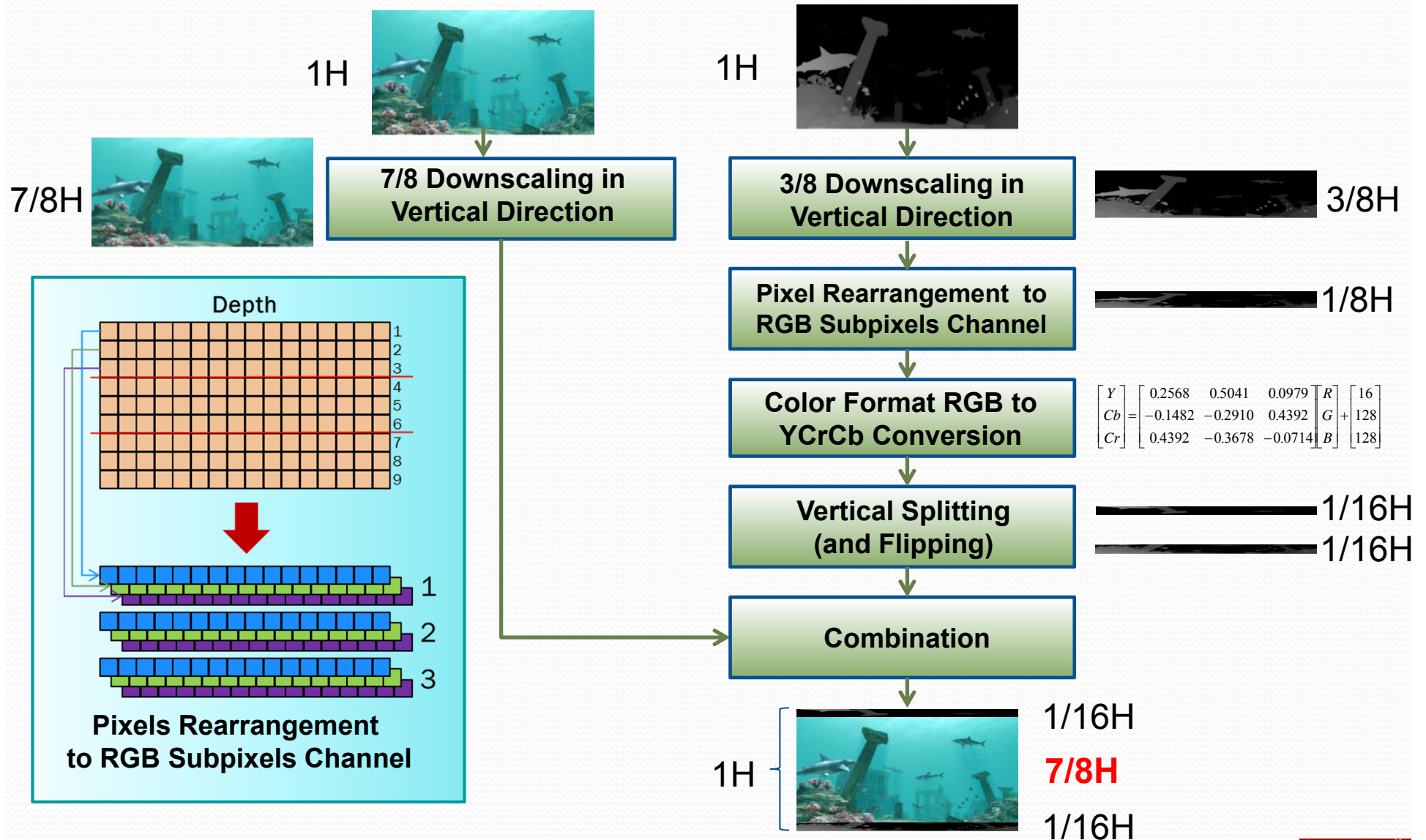
Packed Frame with Color-3/4 CCDP Format



Color 3/4-CCDP Depacking Procedure



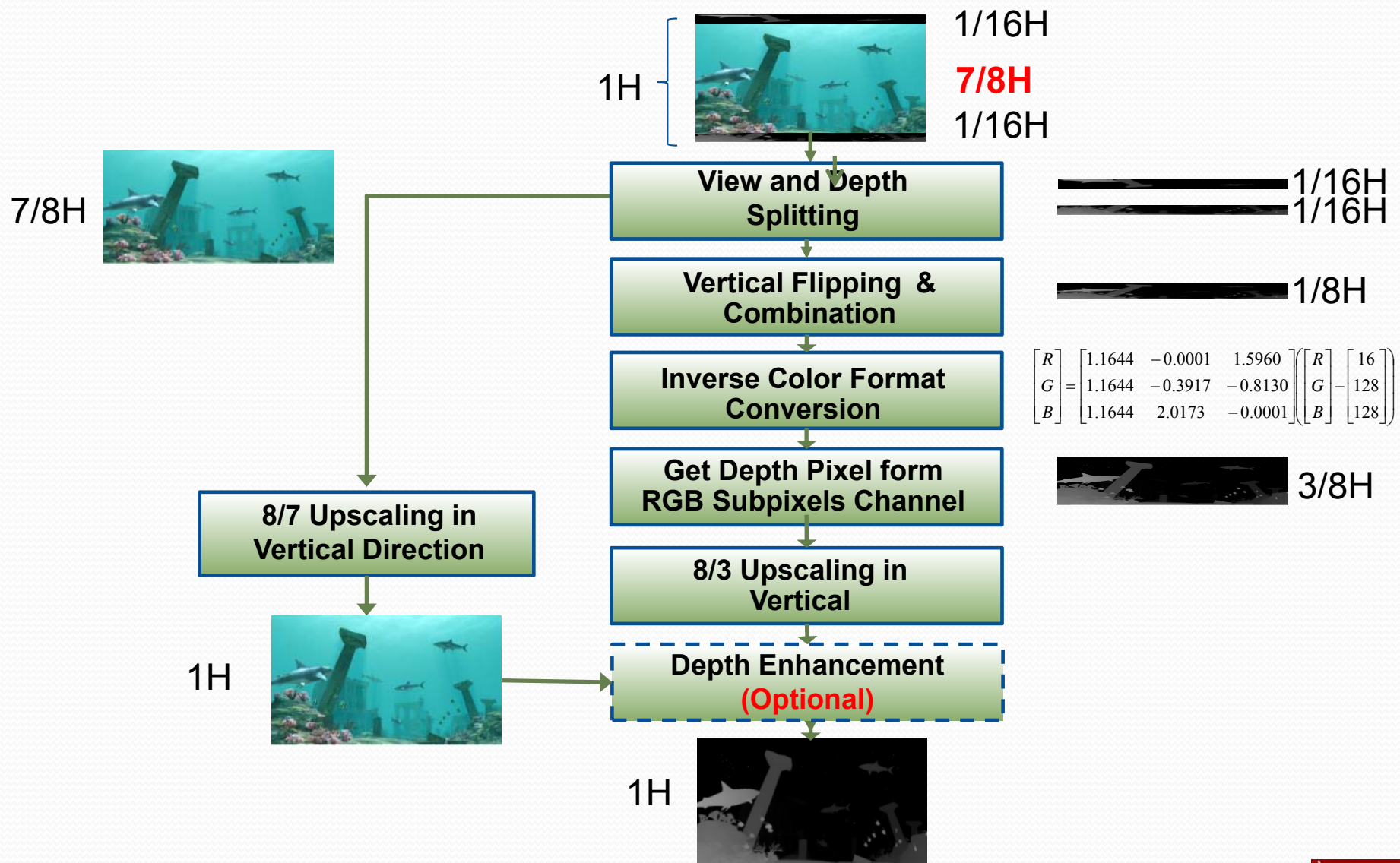
Color 7/8-CCDP Packing Procedure



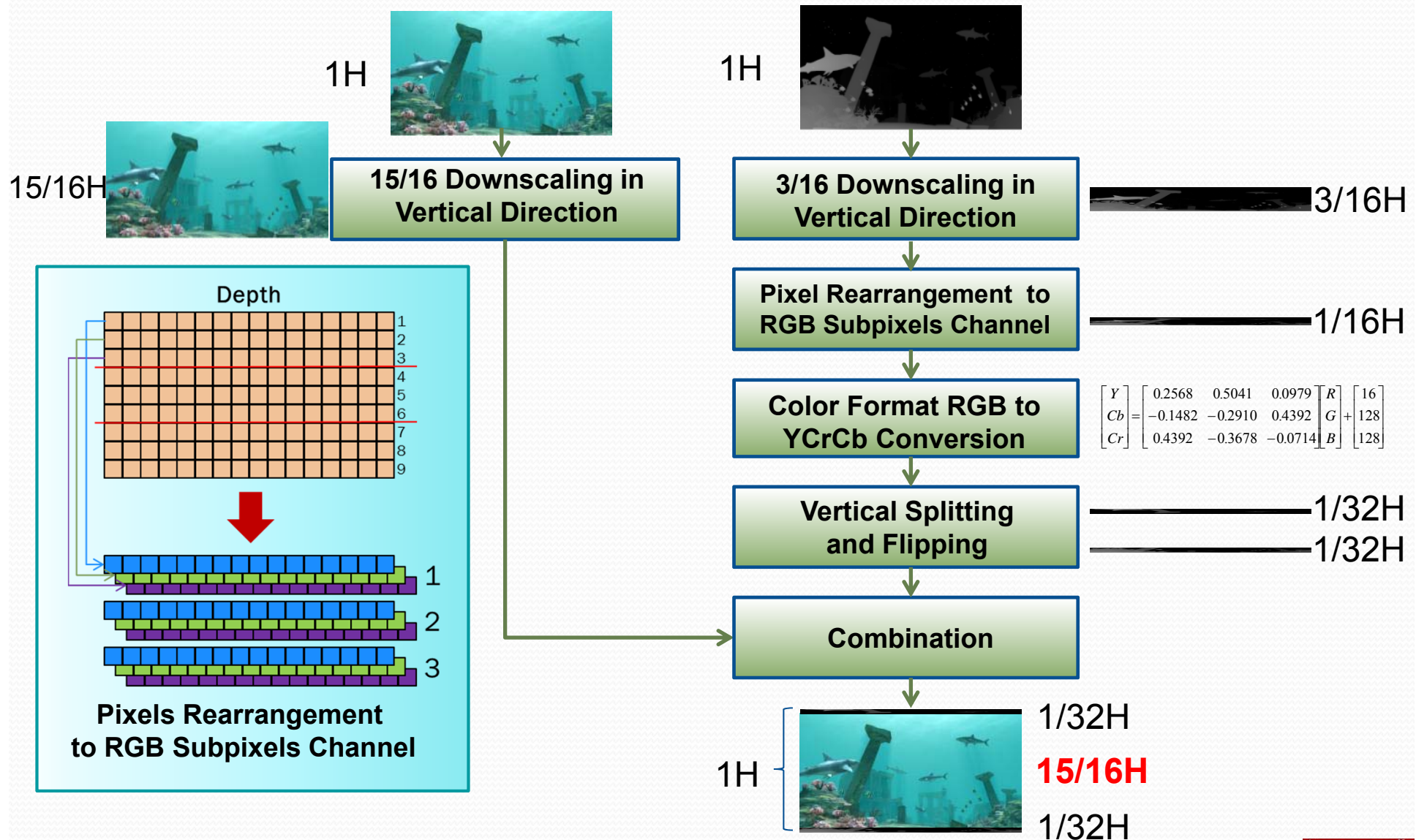
Packed Frame with Color-7/8 Format



Color 7/8-CCDP Depacking Procedure



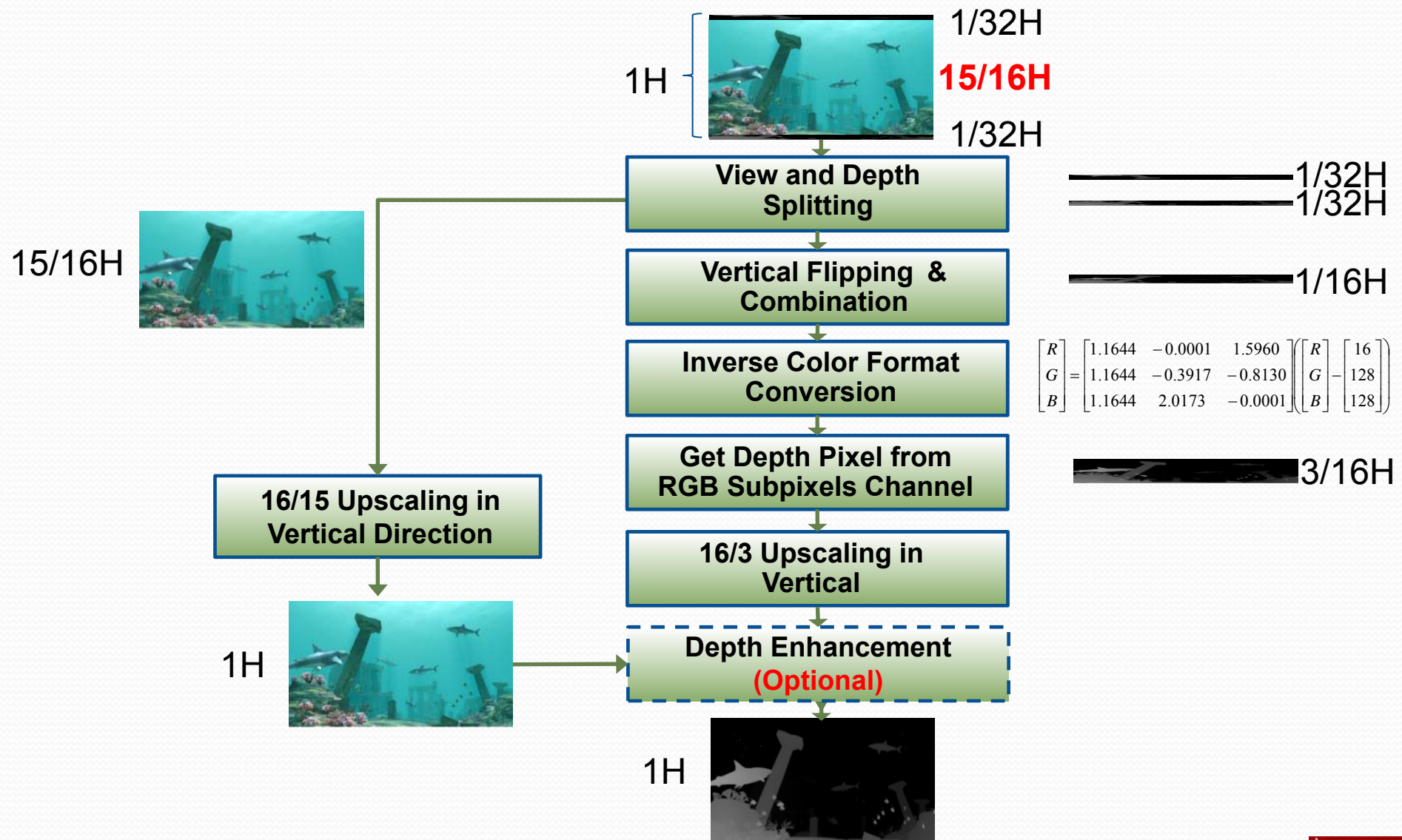
Color 15/16-CCDP Packing Procedure



Packed Frame with Color-15/16 CCDP Format



Color 15/16-CCDP Depacking Procedure



Experimental Results

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

Environment Setting

Test sequences (Nature)

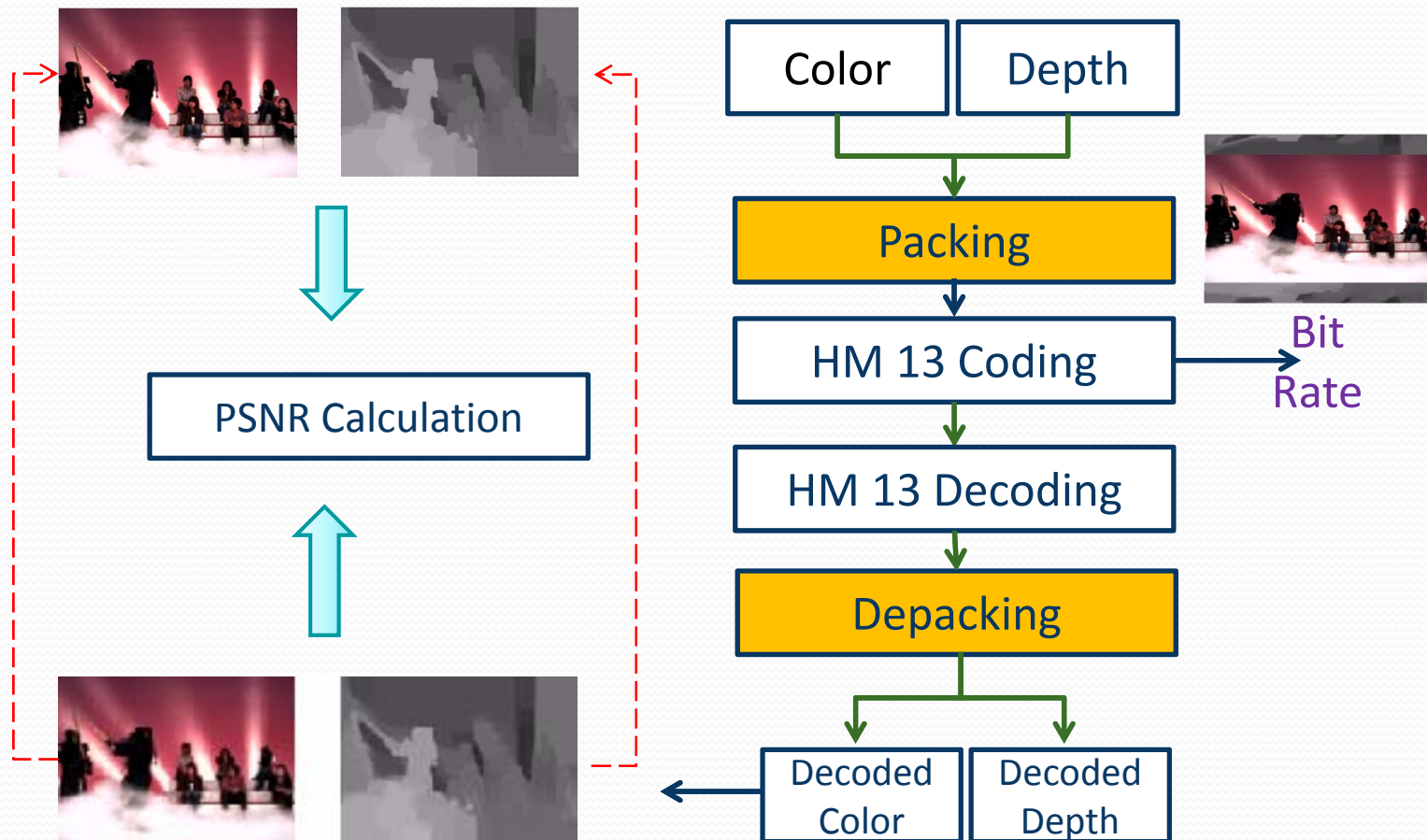
No.	Sequence	Size	Frames	Fps
S01	Poznan Hall	1920*1088	200	25
S02	Poznan Street	1920*1088	250	25
S05	Kendo	1024*768	300	30
S06	Balloons	1024*768	300	30
S08	Newspaper	1024*768	300	30



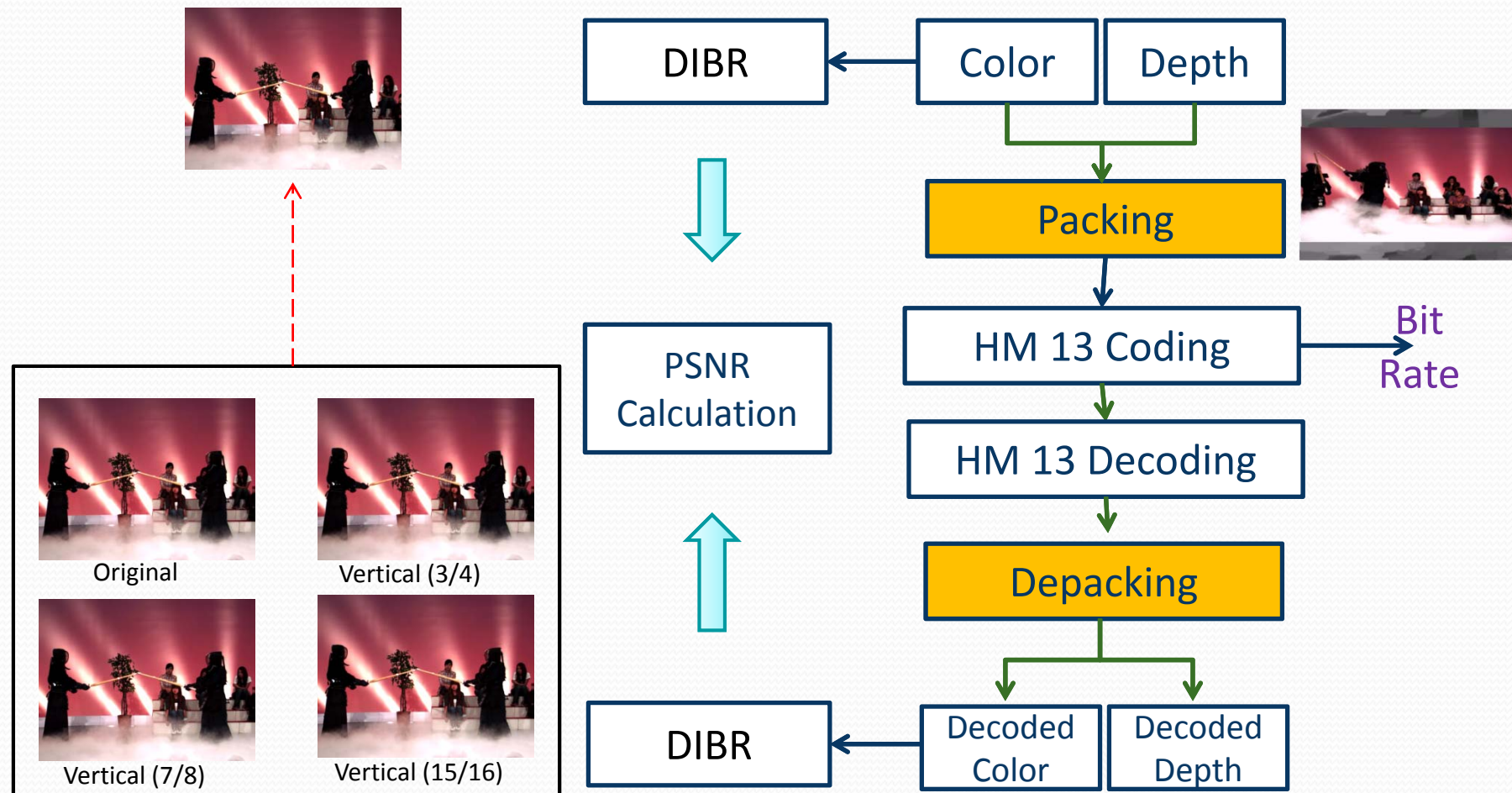
Experimental Setting

- 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

Comparisons over Color & Depth



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 Color and Depth Coding						Comparisons after DIBR		
	Color			Depth			Virtual View (color)		
	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	2.8724	-1.9139	-4.2890	-6.5804	1.5625	0.7346	-0.2847

BDBR (%)									
	Comparisons of Color and Depth Coding						Comparisons after DIBR		
	Color			Depth			Virtual View (Color)		
	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	-59.7903	107.01	498.9833	77960.67	-49.113	-25.2343	32.331

Experimental results

(with respect to color-depth SbS packing format)

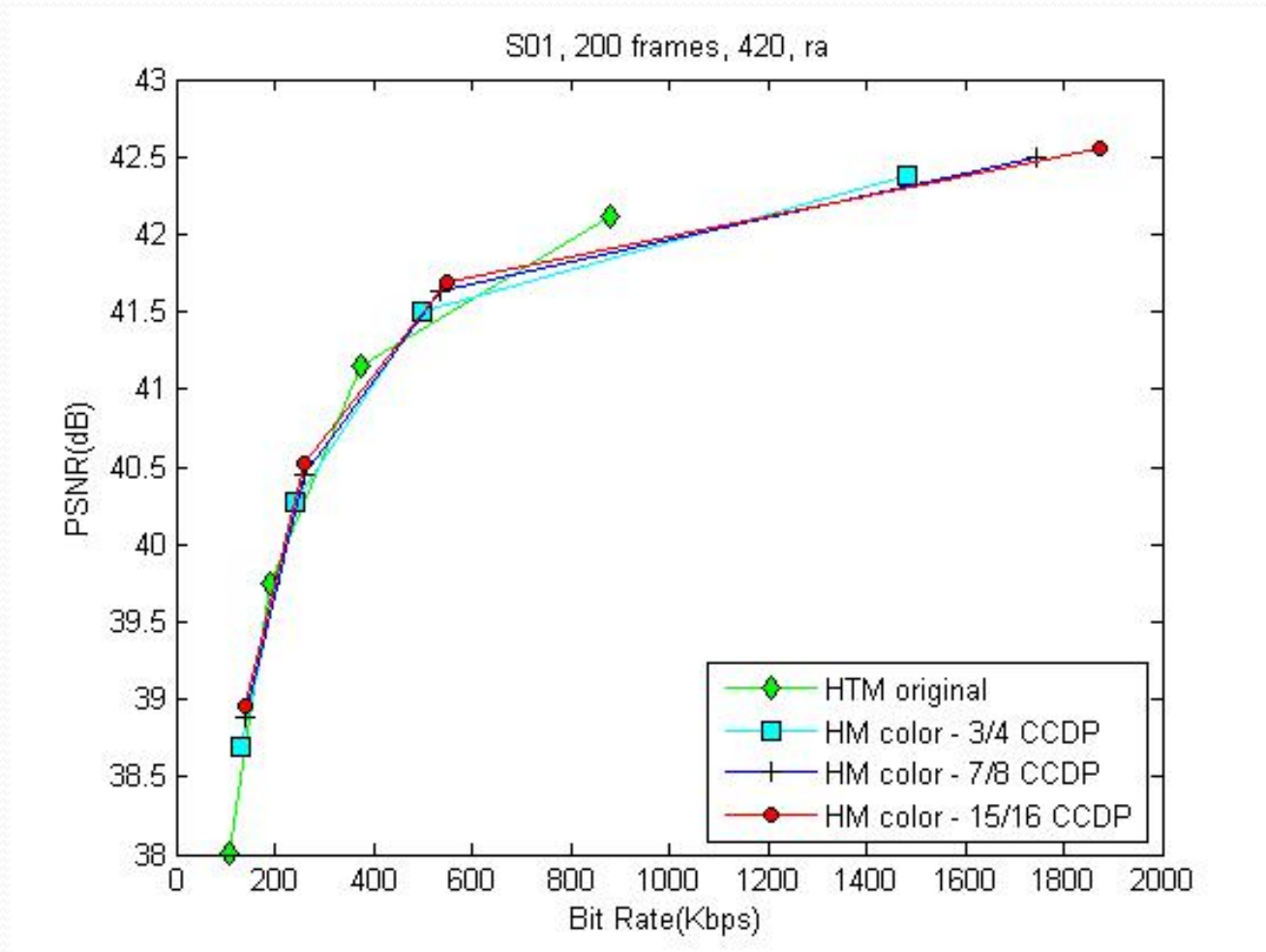
- AVC (No Depth Enhancement)

BDPSNR (dB)									
	Comparisons of Color and Depth Coding						Comparisons after DIBR		
	Color			Depth			Virtual View (Color)		
	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	2.4797	-2.5643	-5.0172	-7.2578	1.2142	0.4117	-0.6219

BDBR (%)									
	Comparisons of Color and Depth Coding						Comparisons after DIBR		
	Color			Depth			Virtual View (Color)		
	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	-48.5052	150.0696	2646.5610	217249.591	-35.9374	-8.5931	57.9645

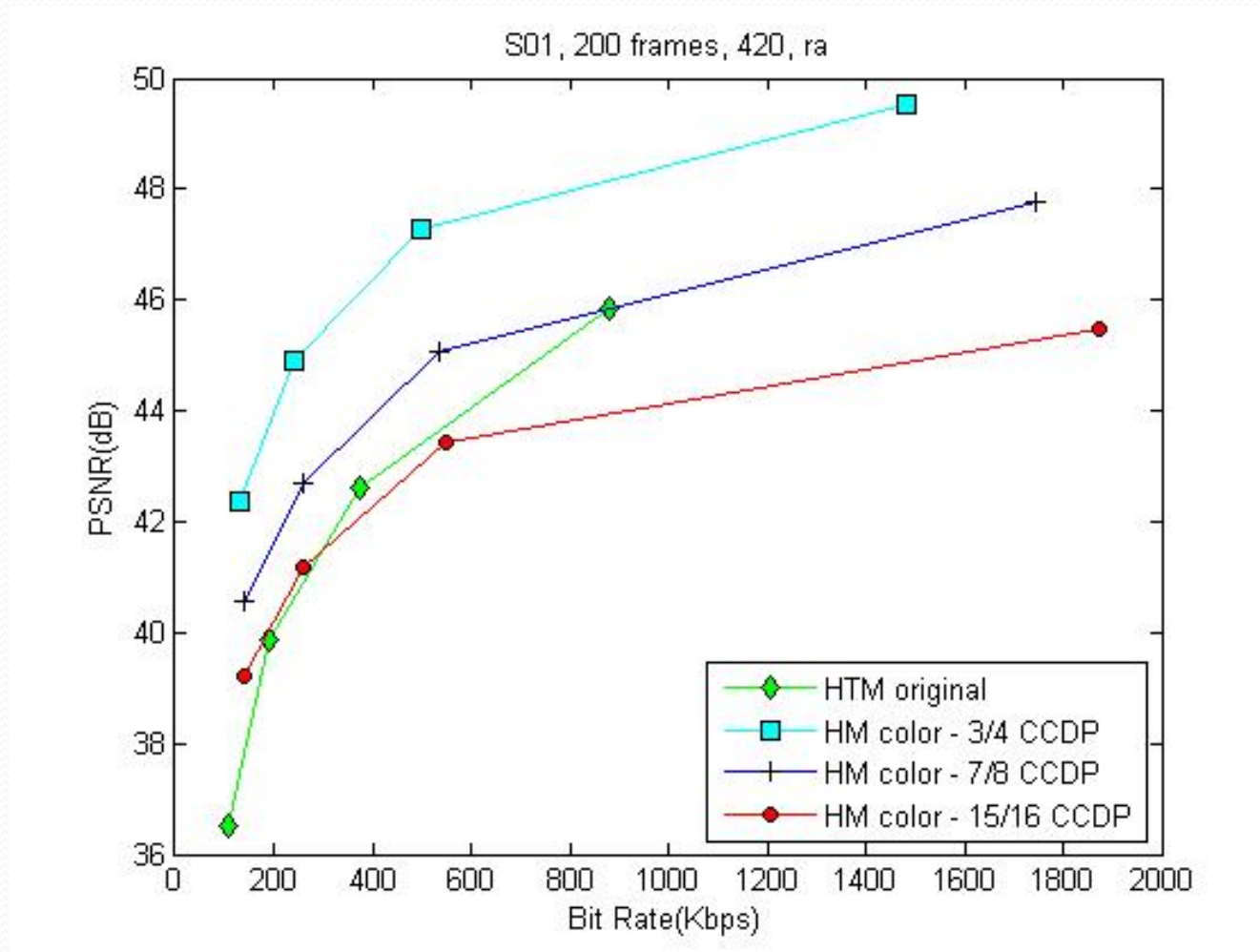
CCDP with HEVC HM 13.0 versus Color and Depth with 3D-HEVC 8.0

Color RD Curves (without DIBR)



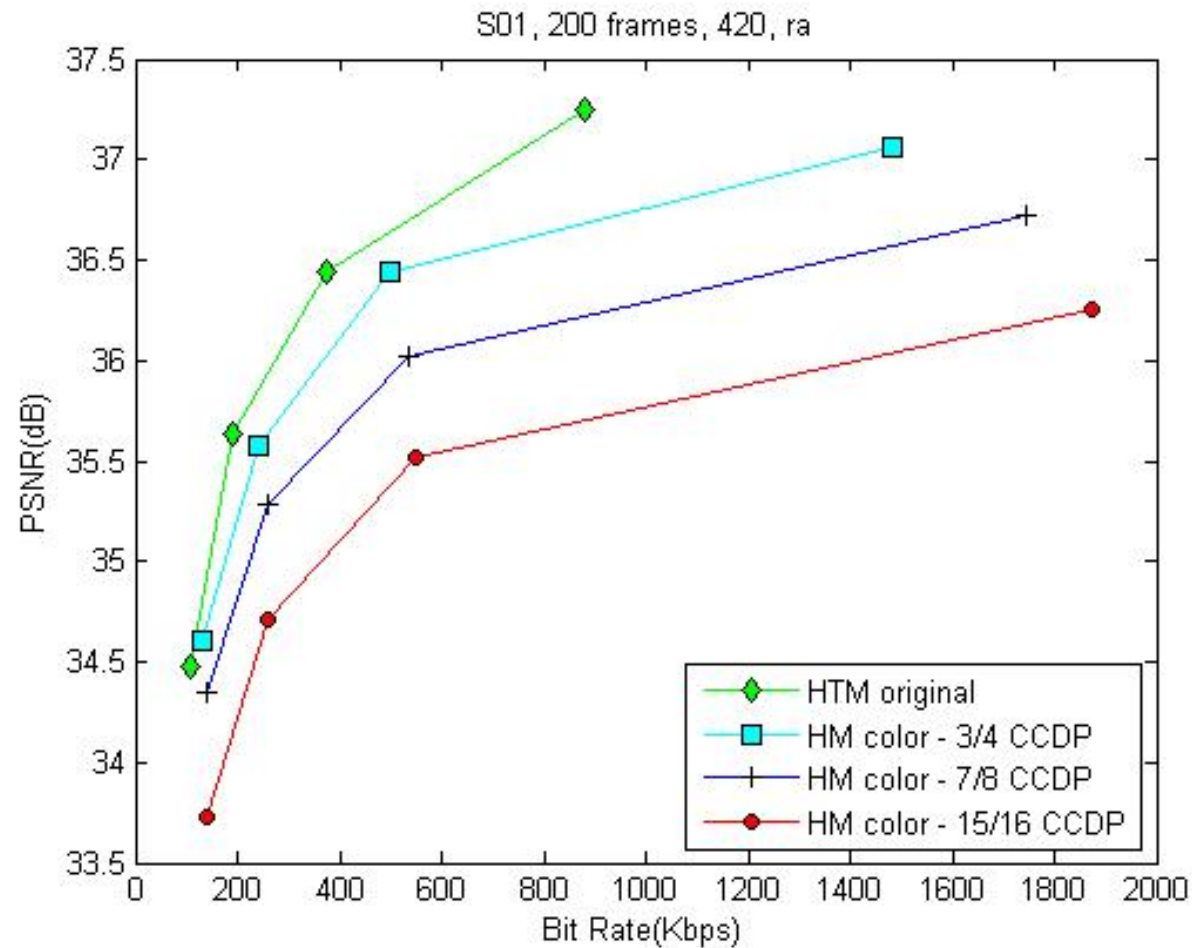
Color Y

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 Color and Depth Coding						Comparisons after DIBR		
	Color			Depth			Virtual View (Color)		
	3/4	7/8	15/16	3/4	7/8	15/16	3/4	7/8	15/16
ra	0.3761	0.6536	0.7888	3.5058	1.2856	-0.9024	-0.2287	-0.9874	-2.0703

Average BDBR (dB) results for different sequences

BDBR (%)									
	Comparisons of Color and Depth Coding						Comparisons after DIBR		
	Color			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	-15.5193	-59.5028	-26.5578	26.6362	15.1971	70.7927	258.2328

Conclusions

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

Thanks for your kind attention
Q&A