



JVCVC-H0132

On Adaptation Parameter Signaling

Yan Ye, Eun S. Ryu
InterDigital Communications, LLC

- APS or Adaptation Parameter Set is
 - Convenient way to share some picture-level parameters among multiple slices, esp. SAO and ALF
 - No need to repeat parameters in slice_header()
 - Use aps_id in slice_header() to identify APS
- Currently APS carries
 - quantization scaling matrices
 - SAO parameters
 - ALF parameters
 - Deblocking filter parameters
- Separate NAL unit: **nal_unit_type = 13**
- Problem: if APS lost, correctly received slices can not be fully reconstructed



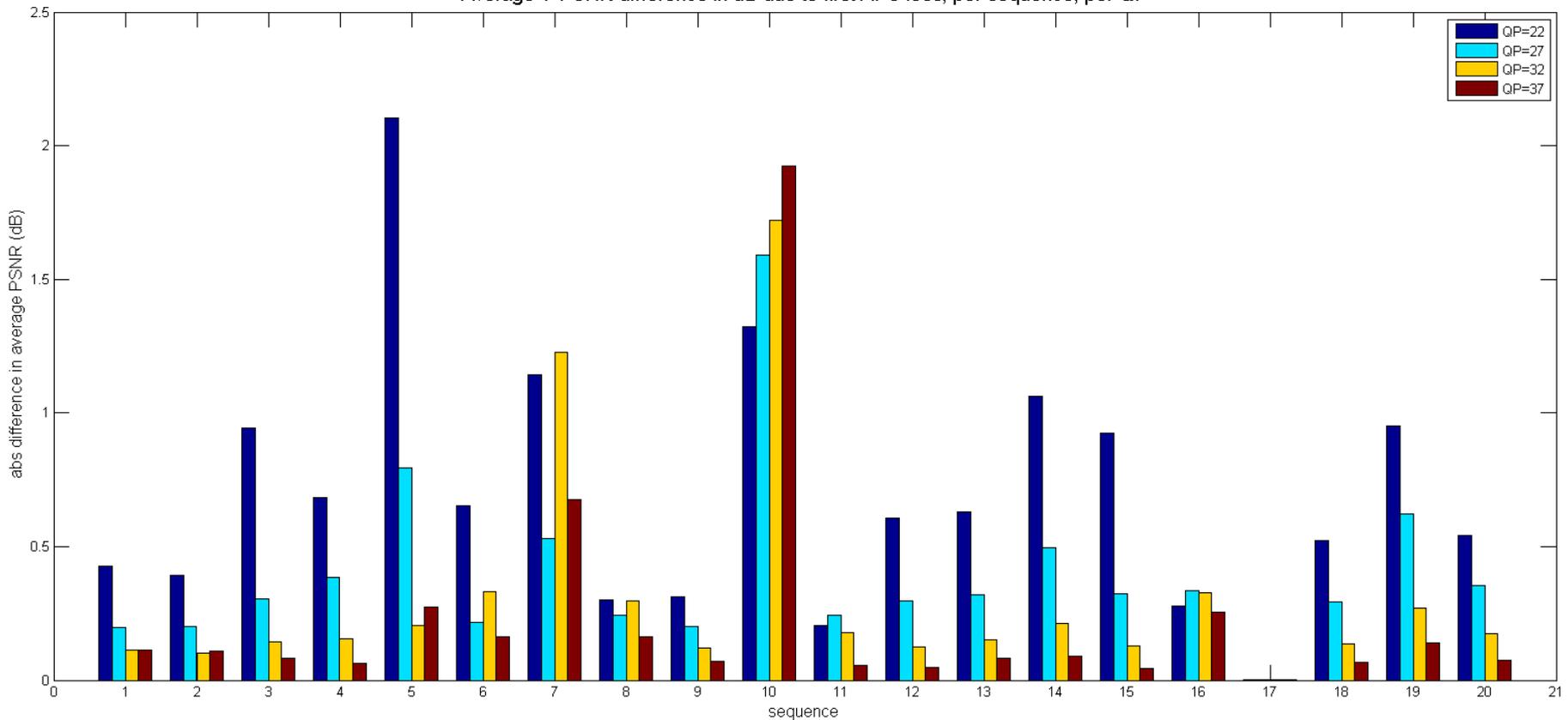
- Focus: to study the effect of error propagation due to loss of ALF/SAO parameters carried in APS
- Use LDB-HE setting (maximum error propagation):
 - “Fake” ALF/SAO parameter loss by forcing the following for the first I frame
 - `sample_adaptive_offset_flag = 0`
 - `adaptive_loop_filter_flag = 0`
- Both objective (PSNR degradation) and subjective (visual quality degradation) tests were performed



Seq. no	Seq. name	Resolution	Seq. no	Seq. name	Resolution
1	BasketballDrill	832x480	11	Kimono	1920x1080
2	BasketballDrillText	832x480	12	ParkScene	1920x1080
3	BasketballDrive	1920x1080	13	PartyScene	832x480
4	BasketballPass	416x240	14	RaceHorses	416x240
5	BlowingBubbles	416x240	15	RaceHorses	832x480
6	BQMall	832x480	16	SlideEditing	1280x720
7	BQSquare	416x240	17	SlideShow	1280x720
8	BQTerrace	1920x1080	18	Vidyo1	1280x720
9	Cactus	1920x1080	19	Vidyo3	1280x720
10	ChinaSpeed	1024x768	20	Vidyo4	1280x720

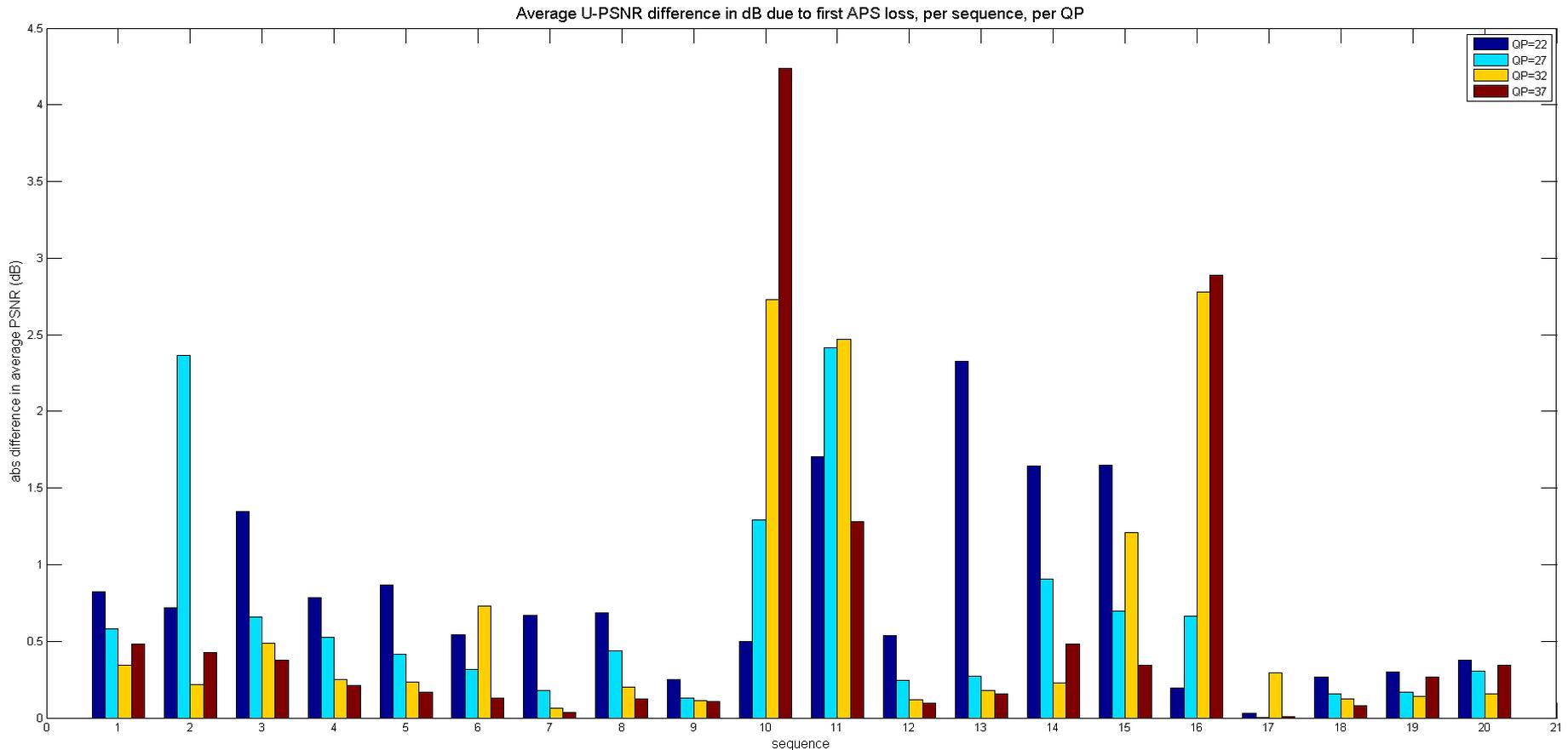


Average Y-PSNR difference in dB due to first APS loss, per sequence, per QP



- Y PSNR drop is between 0dB and ~2dB
- In general bigger drop for lower QP sequences

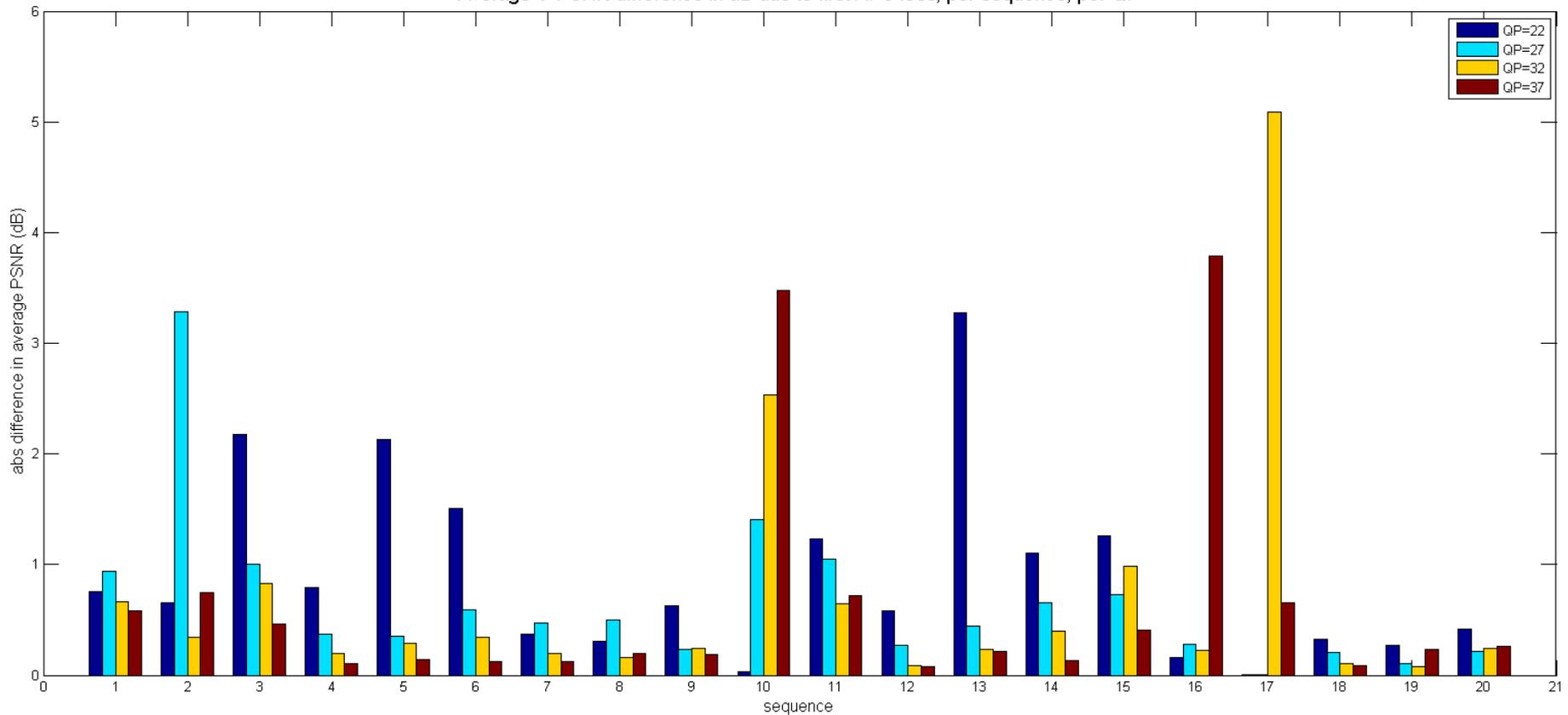




- U PSNR drop between 0dB and ~4dB
- Significance of PSNR drop is less correlated with QP



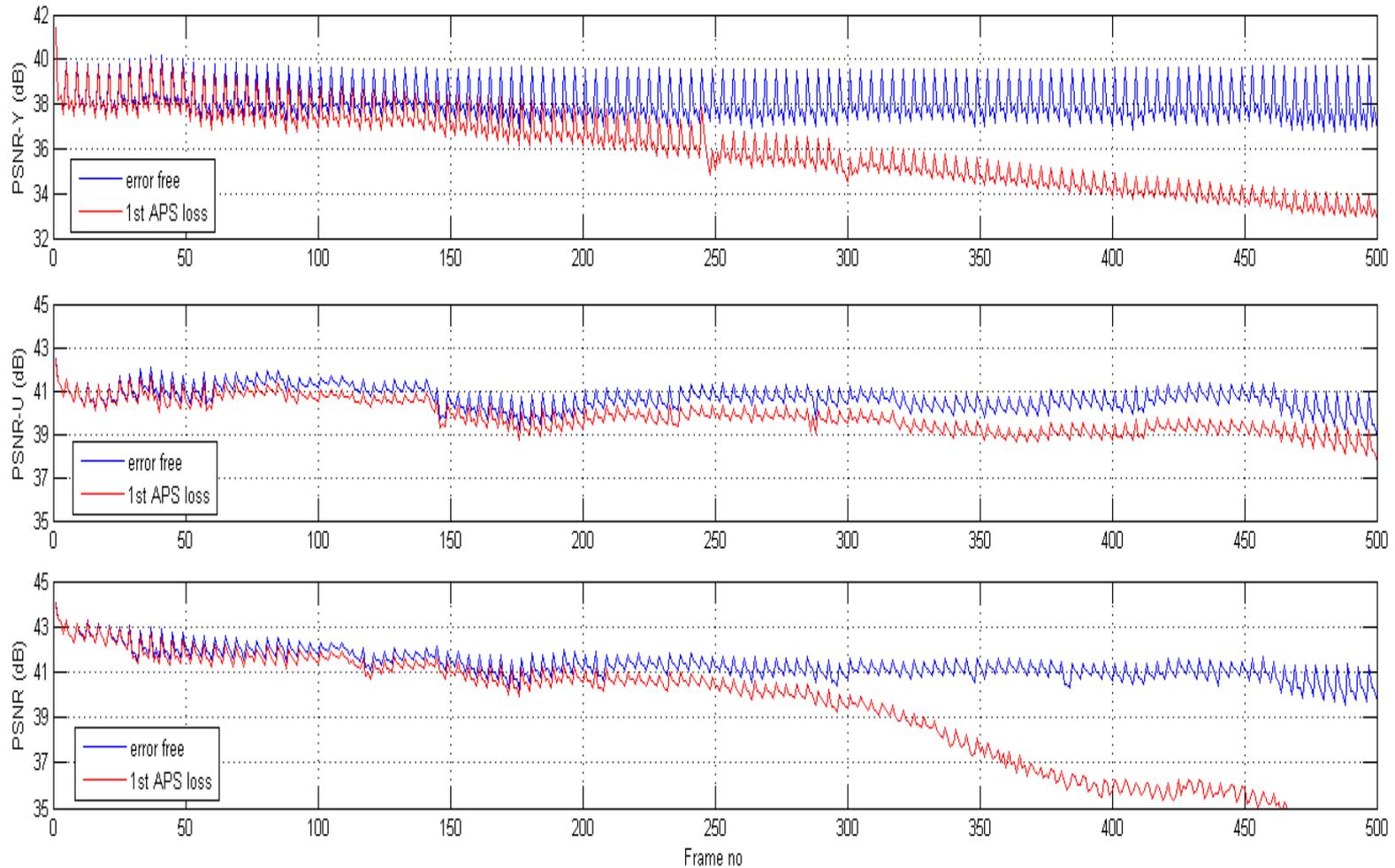
Average V-PSNR difference in dB due to first APS loss, per sequence, per QP



- V PSNR drop between 0dB and ~5dB
- Significance of PSNR drop is less correlated with QP



Frame-by-frame PSNR: BlowingBubbles, QP=22





BasketballDrive, frame 129



BlowingBubbles, frame 499 (error started appearing from frame 290)



Video Example: BQTerrace, frames 467-499

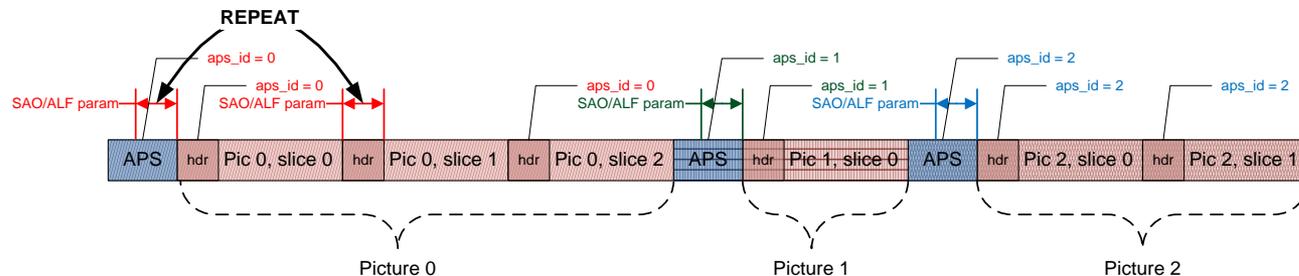


- Visual degradation is **content dependent**
 - *Unnoticeable* for some sequences to *significant* artifacts for others
- For those sequences where visual artifacts were observed
 - Some artifacts appear earlier while others appear later
 - For BasketballDrive, artifacts appeared **as early as at ~0.6 sec** (frames 32 and 33)
 - Some artifacts appear for very short duration, while other last for a long time
 - For PartyScene, color artifacts observed for **a long duration ~6.5 sec** (frames 180 – 499)
- The most visible artifacts appear as chroma shifts, such as unnatural and/or wrong colors
- Except class E (less rich in chroma), at least one sequence in each class suffered noticeable to significant artifacts



Improved Error Resilience for Adaptation Parameters

- Propose to add 1-bit flag in slice_header() to indicate whether parameters are sent in APS or in slice_header()
- Embed adaptation parameters in slice header to improve error resilience when:
 - The slice is likely to be used for temporal prediction (e.g., coded with lower QP)
 - The slice is likely to cause long temporal propagation (e.g., an I-slice used for intra refresh)
 - Error propagation is more likely to be visible (e.g., “richer” color content)
- “Hedge” against APS loss by repeating parameters in some slice headers



- Additional benefit:
 - More efficient signaling if SAO and ALF parameters are derived at slice level, instead of at picture level



Proposed Syntax Change

	Descriptor
slice_header() {	
entropy_slice_flag	u(1)
if(!entropy_slice_flag) {	
slice_type	ue(v)
pic_parameter_set_id	ue(v)
if(sample_adaptive_offset_enabled_flag adaptive_loop_filter_enabled_flag)	
{	
use_adapt_param_from_aps_flag	u(1)
if(use_sao_alf_param_in_aps_flag)	
aps_id	ue(v)
else	
{	
scaling_list_data_present_flag	u(1)
sample_adaptive_offset_flag	u(1)
adaptive_loop_filter_flag	u(1)
if(scaling_list_data_present_flag)	
scaling_list_param()	
if(sample_adaptive_offset_flag)	
sao_param()	
if(adaptive_loop_filter_flag) {	
alf_param()	
}	
... }	
... }	
}	

