

JVET-L0393

CE11-related: Improvement of Extended Deblocking Filter

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■ Problem statement

- Various long-tap deblocking filters are now studied in CE11.1.
- Proposal is modifying the extended deblocking filter (CE11.1.2) to improve subjective quality.

■ Proposal

1. Luma

- Block size thresholds are switched by Bs in decision process
- Few additional conditions check

2. Chroma

- Block size thresholds are switched by Bs in decision process
- Applying luma strong deblocking filter to chroma

■ Subjective quality is improved with keeping

- objective quality and
- low complexity

- The extended deblocking filter is tested in CE11.1.2.
 - The filter is applied to a large ($16 \geq \text{width/height}$) block boundary
 - The filter is applied to only $Bs = 2$ boundary and only for luma.

- Problem
 - To improve subjective quality, with keeping objective quality and low complexity
 - Complexity means number of operation for filtering and decision (add, mult, comp, shift)

Proposal 1: Decision process for luma

■ Decision process

● Size check

Block size thresholds are switched by Bs value

- If Bs == 2 : Th = 16
- else if Bs == 1 : Th = 32

● Activity check

Only following four conditions are checked

$$|p_{7_0} - p_{0_0}| + |q_{7_0} - q_{0_0}| < \frac{\beta}{8} \quad (1)$$

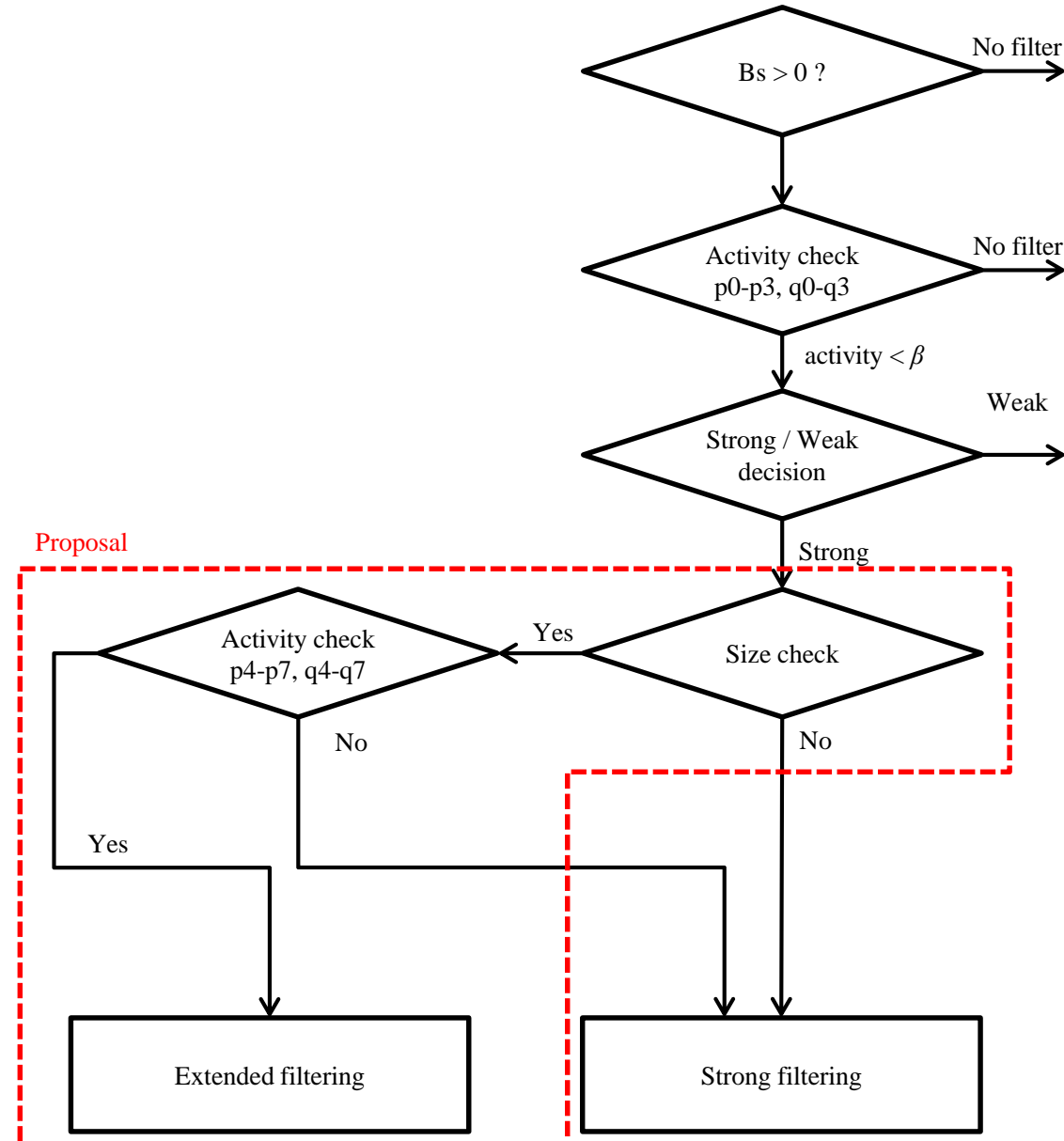
$$|p_{7_3} - p_{0_3}| + |q_{7_3} - q_{0_3}| < \frac{\beta}{8} \quad (2)$$

$$|p_{7_0} - p_{4_0}| + |p_{7_3} - p_{4_3}| < \frac{\beta}{8} \quad (3)$$

$$|q_{7_0} - q_{4_0}| + |q_{7_3} - q_{4_3}| < \frac{\beta}{8} \quad (4)$$

■ Filtering Process

The kernel is same as CE11.1.2 (JVET-L0380)



Proposal 2 : Exploit extended filter for chroma

■ Decision process

● Size check

Block size thresholds are switched by Bs value (same as for luma)

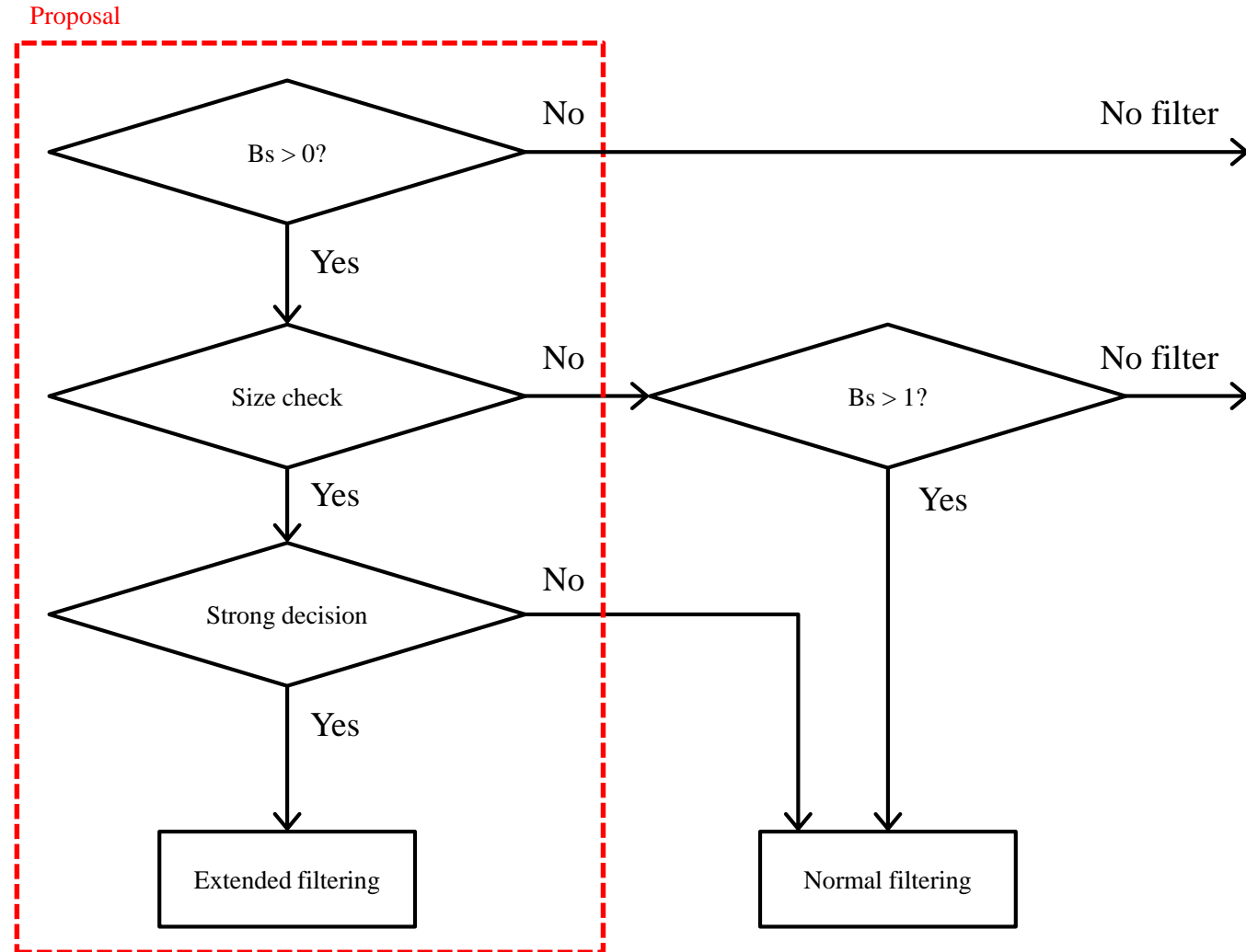
- If $Bs == 2$: $Th = 8$ (= 16 for luma)
- else if $Bs == 1$: $Th = 32$ (= 64 for luma)

● Strong decision

Exact same process as luma strong filtering decision on VTM

■ Filtering process

The kernel is same as luma strong filter on VTM



■ Objective evaluation (Anchor : VTM2.0.1) : **Loss of BD-rate almost does not exist**

Experimental results for Proposal 1 (luma)

Cond.	ALF	Y	U	V	EncT	DecT
AI	ON	-0.01%	0.00%	0.00%	100%	98%
RA	ON	-0.06%	0.03%	-0.02%	100%	101%
LDB	ON	0.03%	0.03%	-0.13%	100%	101%
LDP	ON	0.00%	0.09%	0.08%	100%	101%
AI	OFF	-0.01%	0.00%	0.00%	100%	99%
RA	OFF	-0.09%	-0.04%	-0.02%	100%	101%
LDB	OFF	0.07%	-0.01%	-0.02%	100%	101%
LDP	OFF	-0.10%	0.05%	-0.10%	100%	101%

Experimental results for Proposal 2 (chroma)

Cond.	ALF	Y	U	V	EncT	DecT
AI	ON	0.00%	-0.53%	-0.51%	100%	99%
RA	ON	-0.01%	-0.53%	-0.47%	100%	101%
LDB	ON	-0.03%	0.39%	-0.16%	100%	101%
LDP	ON	-0.03%	-0.04%	-0.32%	100%	101%
AI	OFF	0.00%	-0.70%	-0.62%	100%	99%
RA	OFF	-0.01%	-0.73%	-0.58%	100%	101%
LDB	OFF	0.03%	-0.20%	-0.32%	100%	102%
LDP	OFF	-0.03%	-0.71%	-0.88%	100%	102%

Experimental results for Proposal 1 (luma) and Proposal 2 (chroma)

Cond.	ALF	Y	U	V	EncT	DecT
AI	ON	-0.01%	-0.53%	-0.51%	100%	102%
RA	ON	-0.09%	-0.58%	-0.48%	100%	102%
LDB	ON	0.00%	0.30%	-0.03%	100%	102%
LDP	ON	-0.03%	-0.02%	-0.23%	100%	101%
AI	OFF	-0.02%	-0.70%	-0.62%	100%	102%
RA	OFF	-0.10%	-0.75%	-0.55%	100%	102%
LDB	OFF	0.00%	-0.28%	-0.46%	100%	102%
LDP	OFF	-0.10%	-0.80%	-0.95%	100%	102%

■ Subjective evaluation

block noises are well suppressed in case of using proposed method for both luma and chroma



(a) VTM 2.0.1



(b) Proposal 1 (luma)



(c) Proposal 1 & 2 (luma & chroma)

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■ Proposed filtering method is recommended to further study in CE11.

Appendix

	Luma complexity					Chroma complexity					Min unit size in luma samples that can be processed separately
	Samples from block boundary modified	Samples from block boundary for deblocking decision	Max number of operations for filtering per line (add/mult/compar/shift)	Max number of oper. for decision (add/mult/compar/shift)	Number of line buffers	samples from block boundary modified	samples from block boundary for deblocking decision	Max number of operations for filtering per line (add/mult/compar/shift)	Max number of oper. for decision (add/mult/compar/shift)	Number of line buffers	
CE11.1.2	7+7	7+7	246 (138, 12, 28, 68)	20(10,0,6,4) per 4 line segment	8	VTM	VTM	VTM	VTM	VTM	8x8
Proposal	7+7	7+7	246 (138, 12, 28, 68)	23 (12, 0, 7, 4) per 4 line segment	8	3+3	4+4	56 (28, 2, 12, 14)	40 (20, 1, 10, 9) per 4 line segment	4	8x8