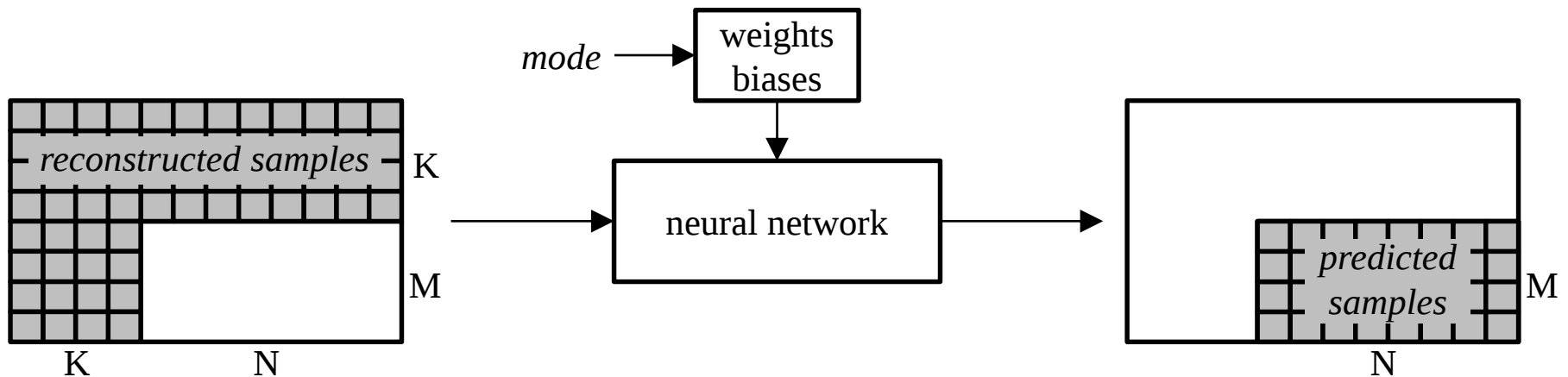


JVET-J0037

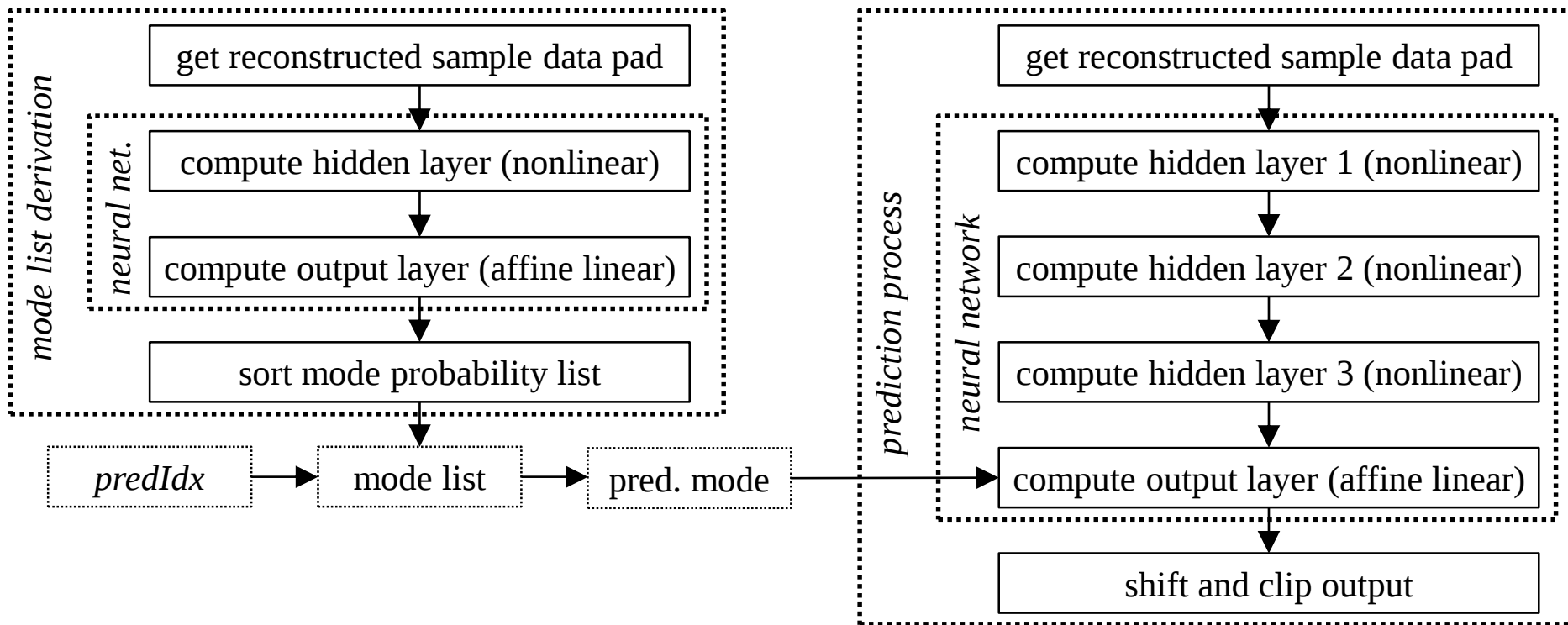
Intra prediction based on neural networks

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Process reconstructed samples by a neural network to obtain a prediction signal on a rectangular block.

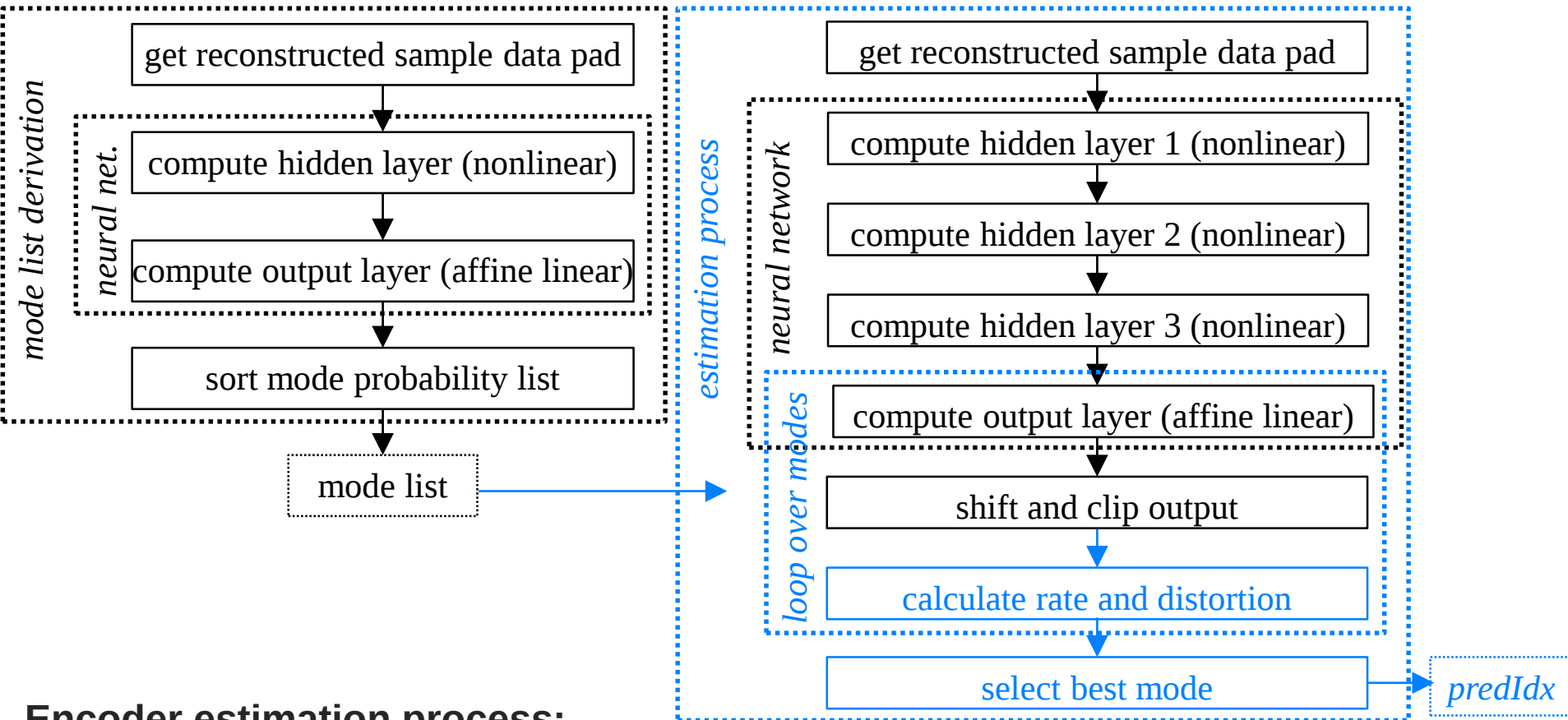


- *mode*: Derived from an index using conditional probability distribution represented by a second neural network.
- *weights/biases*: Parameters of the neural network, depending on mode.



Decoder parsing and reconstruction process:

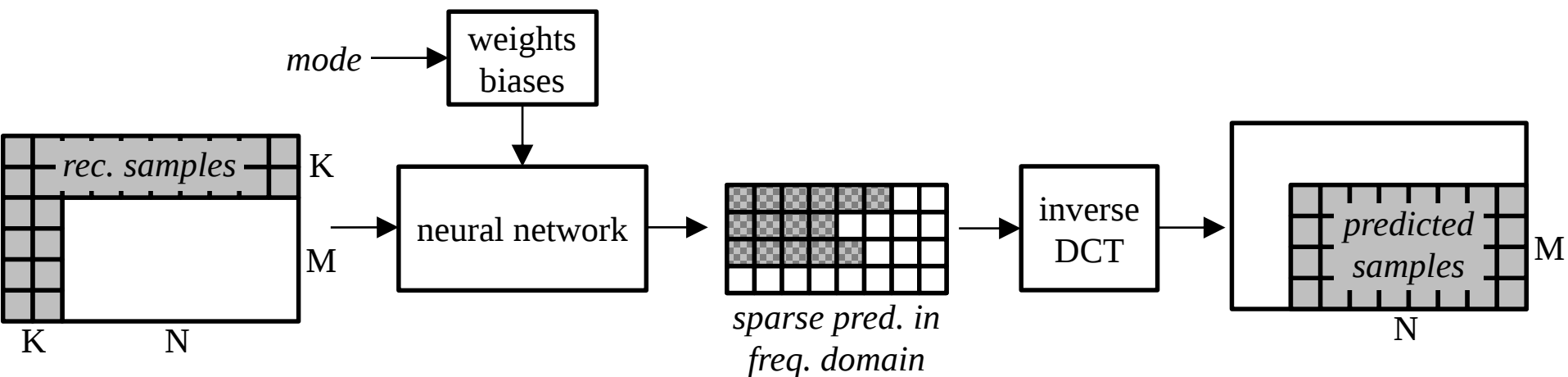
1. Parse index **predIdx** using a variable length code.
2. Reconstruct actual mode from index using reconstructed samples.
3. Generate prediction signal corresponding to that mode.



Encoder estimation process:

1. Loop over all modes, RD-comparison using Hadamard-Fast-Search.
2. All proposed predictions for a given block share all but the last layer.
Thus: Encoder needs to carry out corresponding computations only once.

Simplification: Predict into DCT-domain to obtain sparse prediction signal.



A lot of frequency components are constrained to a constant value.
Thus: Less multiplications needed in last layer of neural network.

Additional transforms:

For each proposed mode, four additional transforms were trained. Secondary transforms for large blocks. Thus: Five transforms to code prediction residual.

<i>trafoIdx</i>	$W \times H \leq 8 \times 8$	$W \times H > 8 \times 8$	
	<i>primary</i>	<i>primary</i>	<i>secondary</i>
0	DCT-II	DCT-II	
1	$\text{TNST}_{mode,1}$	DCT-II	$\text{TNST}_{mode,1}$
2	$\text{TNST}_{mode,2}$	DCT-II	$\text{TNST}_{mode,2}$
3	$\text{TNST}_{mode,3}$	DCT-II	$\text{TNST}_{mode,3}$
4	$\text{TNST}_{mode,4}$	DCT-II	$\text{TNST}_{mode,4}$

(TNST = trained non-separable transform)

Overall results: (CfP sequences – QPs 27, 32, 37, 42, QT+BTS as in JVET 0035)

Intra Only	Anchor HM+QT+BTS	Simplification DCT pred.	Num. TNST	Y	Cb	Cr	EncT	DecT
	✓		0	-2.89%	-0.42%	0.02%	298%	269%
	✓	✓	0	-2.39%	-0.52%	-0.34%	177%	141%
	✓		4	-6.26%	-0.82%	-0.21%	441%	297%
	✓	✓	4	-5.22%	-0.99%	-0.52%	269%	158%
	+SOT	✓	4	-2.16%	-0.41%	-0.24%	231%	133%

Random Access	Anchor HM+QT+BTS	Simplification DCT pred.	Num. TNST	Y	Cb	Cr	EncT	DecT
	✓		0	-1.83%	1.23%	1.55%	170%	125%
	✓	✓	0	-1.52%	0.56%	0.91%	125%	103%
	✓		4	-3.52%	1.30%	1.91%	211%	128%
	✓	✓	4	-2.88%	0.78%	1.20%	151%	116%
	+SOT	✓	4	-1.40%	0.57%	0.98%	143%	107%

Summary:

- We propose to generate intra prediction signals by applying a fully connected neural network with several layers to the reference samples.
- The proposed intra prediction modes lead to coding gains over state of the art video coding techniques.
- Non-separable transforms for each proposed mode further improve the compression efficiency.
- If the proposed modes predict into the frequency domain and sparsity constraints are applied, their complexity can be significantly reduced while most of the gain can be kept.

Appendix: Detailed Results

Results for intra predictors without simplifications, Intra Only:

Intra Only										
	QP values 22, 27, 32, 37					QP values 27, 32, 37, 42				
	Y	Cb	Cr	EncT	DecT	Y	Cb	Cr	EncT	DecT
JVET A1	-3,07%	-1,22%	-1,38%	278%	270%	-3,11%	-0,74%	-0,58%	296%	303%
JVET A2	-3,03%	-1,36%	-1,36%	286%	250%	-2,99%	-0,67%	-0,60%	304%	285%
JVET B	-2,97%	-1,28%	-0,97%	265%	236%	-3,06%	-0,93%	-0,53%	288%	266%
JVET C	-1,54%	-0,01%	0,28%	225%	164%	-1,70%	0,79%	0,95%	240%	184%
JVET D	-2,14%	-0,89%	-0,13%	220%	148%	-2,27%	-0,94%	0,04%	237%	163%
JVET E	-4,26%	-1,45%	-2,33%	273%	221%	-4,16%	-0,28%	-1,70%	293%	248%
JVET F	-0,85%	0,17%	-0,09%	265%	153%	-1,02%	0,53%	-0,05%	270%	159%
CfP 360	-3,49%	-1,55%	-1,25%	327%	257%	-3,35%	-0,95%	-0,52%	361%	279%
CfP SDR-A	-2,78%	-1,26%	-1,34%	266%	239%	-2,75%	-0,78%	-0,82%	281%	274%
CfP SDR-B	-3,05%	-1,14%	-0,53%	268%	239%	-3,13%	-0,65%	0,32%	291%	268%
CfP HDR-A	-3,87%	-2,17%	-1,94%	292%	286%	-3,84%	-1,76%	-1,39%	321%	317%
CfP HDR-B	-2,17%	0,57%	1,58%	248%	205%	-1,74%	1,53%	1,92%	254%	230%
JVET all	-2,51%	-0,86%	-0,81%	257%	201%	-2,58%	-0,34%	-0,31%	274%	223%
CfP all	-3,00%	-1,02%	-0,59%	278%	240%	-2,89%	-0,42%	0,02%	298%	269%
JVET + CfP	-2,81%	-0,99%	-0,75%	268%	218%	-2,81%	-0,44%	-0,22%	286%	241%

Anchor: HM+QTGBS

Results for intra predictors without simplifications, Random Access:

Random Access										
	QP values 22, 27, 32, 37					QP values 27, 32, 37, 42				
	Y	Cb	Cr	EncT	DecT	Y	Cb	Cr	EncT	DecT
JVET A1	-2,04%	2,82%	1,18%	180%	153%	-1,86%	3,52%	2,50%	175%	148%
JVET A2	-1,63%	0,86%	0,90%	161%	117%	-1,65%	1,10%	1,03%	160%	117%
JVET B	-1,76%	0,35%	-0,04%	167%	123%	-1,96%	0,27%	0,20%	172%	128%
JVET C	-1,22%	0,41%	0,80%	165%	123%	-1,37%	0,81%	1,65%	166%	121%
JVET D	-1,30%	-0,14%	0,41%	158%	117%	-1,39%	-0,19%	1,92%	162%	120%
JVET E	-2,85%	-0,24%	-0,74%	160%	114%	-3,24%	0,17%	0,73%	160%	114%
JVET F	-0,68%	0,01%	0,19%	184%	118%	-0,78%	0,55%	-0,25%	184%	119%
CfP 360	-2,42%	0,63%	1,26%	174%	120%	-2,50%	1,12%	2,15%	183%	123%
CfP SDR-A	-1,37%	0,55%	0,36%	164%	125%	-1,34%	0,77%	0,64%	162%	124%
CfP SDR-B	-1,88%	0,97%	0,62%	164%	125%	-1,87%	1,32%	1,36%	164%	128%
CfP HDR-A	-2,22%	0,32%	1,17%	167%	128%	-2,28%	0,79%	2,34%	166%	126%
CfP HDR-B	-1,51%	1,57%	2,01%	171%	122%	-1,33%	1,98%	1,58%	177%	125%
JVET all	-1,60%	0,60%	0,41%	168%	123%	-1,70%	0,89%	1,09%	169%	124%
CfP all	-1,85%	0,85%	1,08%	168%	124%	-1,83%	1,23%	1,55%	170%	125%
JVET + CfP	-1,75%	0,64%	0,71%	168%	124%	-1,81%	1,02%	1,33%	170%	125%

Anchor: HM+QTGBS

Results for intra predictors with simplifications, Intra Only:

Intra Only										
	QP values 22, 27, 32, 37					QP values 27, 32, 37, 42				
	Y	Cb	Cr	EncT	DecT	Y	Cb	Cr	EncT	DecT
JVET A1	-2,27%	-0,93%	-0,98%	176%	144%	-2,41%	-0,81%	-0,58%	178%	150%
JVET A2	-2,23%	-0,90%	-1,03%	179%	136%	-2,30%	-0,60%	-0,76%	181%	142%
JVET B	-2,41%	-0,96%	-0,81%	167%	136%	-2,51%	-0,81%	-0,64%	174%	143%
JVET C	-1,42%	-0,16%	0,03%	162%	123%	-1,58%	0,32%	0,53%	163%	129%
JVET D	-1,76%	-0,91%	-0,46%	157%	119%	-1,97%	-1,08%	0,05%	165%	127%
JVET E	-3,80%	-2,12%	-2,68%	167%	133%	-3,80%	-1,47%	-2,20%	172%	140%
JVET F	-0,87%	-0,10%	-0,11%	166%	113%	-1,02%	-0,25%	-0,16%	170%	118%
CfP 360	-3,03%	-1,51%	-1,46%	193%	145%	-2,96%	-1,10%	-0,99%	202%	148%
CfP SDR-A	-1,77%	-0,77%	-0,82%	166%	130%	-1,99%	-0,61%	-0,62%	169%	137%
CfP SDR-B	-2,45%	-0,82%	-0,74%	168%	132%	-2,54%	-0,57%	-0,38%	174%	139%
CfP HDR-A	-2,83%	-1,52%	-1,24%	179%	140%	-2,96%	-1,30%	-0,76%	186%	150%
CfP HDR-B	-2,06%	-0,07%	0,29%	161%	127%	-1,75%	0,65%	0,88%	161%	132%
JVET all	-2,06%	-0,83%	-0,80%	168%	129%	-2,18%	-0,65%	-0,48%	172%	135%
CfP all	-2,39%	-0,89%	-0,76%	172%	134%	-2,39%	-0,52%	-0,34%	177%	141%
JVET + CfP	-2,26%	-0,92%	-0,83%	170%	131%	-2,35%	-0,67%	-0,47%	174%	138%

Anchor: HM+QTGBS

Results for intra predictors with simplifications, Random Access:

Random Access										
	QP values 22, 27, 32, 37					QP values 27, 32, 37, 42				
	Y	Cb	Cr	EncT	DecT	Y	Cb	Cr	EncT	DecT
JVET A1	-1,42%	2,20%	0,85%	131%	111%	-1,30%	2,50%	1,92%	129%	109%
JVET A2	-1,06%	0,47%	0,67%	122%	98%	-1,20%	0,71%	0,75%	120%	98%
JVET B	-1,36%	0,14%	0,06%	124%	102%	-1,57%	0,10%	0,17%	125%	105%
JVET C	-1,01%	0,38%	0,40%	129%	108%	-1,03%	0,22%	1,20%	126%	103%
JVET D	-1,09%	0,70%	-0,31%	125%	108%	-1,15%	1,50%	0,73%	124%	107%
JVET E	-2,31%	-0,40%	-0,57%	122%	104%	-2,67%	0,54%	-0,08%	122%	105%
JVET F	-0,58%	0,29%	-0,03%	133%	105%	-0,73%	0,48%	0,48%	134%	107%
CfP 360	-2,09%	0,07%	0,59%	126%	101%	-2,22%	0,58%	0,94%	130%	102%
CfP SDR-A	-0,83%	0,13%	0,37%	123%	102%	-0,88%	0,26%	0,61%	121%	102%
CfP SDR-B	-1,39%	0,43%	0,41%	124%	103%	-1,49%	0,82%	1,14%	123%	105%
CfP HDR-A	-1,57%	0,01%	0,75%	125%	105%	-1,71%	0,39%	1,75%	124%	104%
CfP HDR-B	-1,38%	0,49%	1,17%	125%	103%	-1,37%	0,67%	0,45%	127%	105%
JVET all	-1,23%	0,56%	0,17%	127%	105%	-1,34%	0,85%	0,75%	126%	105%
CfP all	-1,44%	0,24%	0,65%	125%	102%	-1,52%	0,56%	0,91%	125%	103%
JVET + CfP	-1,36%	0,39%	0,35%	126%	104%	-1,46%	0,73%	0,82%	126%	104%

Anchor: HM+QTGBS

Results for intra predictors without simplifications and with four additional transforms per proposed mode, Intra Only:

Intra Only										
	QP values 22, 27, 32, 37					QP values 27, 32, 37, 42				
	Y	Cb	Cr	EncT	DecT	Y	Cb	Cr	EncT	DecT
JVET A1	-7,06%	-2,89%	-2,98%	442%	306%	-6,86%	-2,17%	-1,91%	436%	333%
JVET A2	-7,38%	-2,90%	-2,86%	440%	295%	-6,70%	-2,14%	-1,93%	430%	324%
JVET B	-6,53%	-2,73%	-2,47%	439%	267%	-6,64%	-1,99%	-1,59%	440%	291%
JVET C	-4,09%	0,35%	0,37%	414%	191%	-4,36%	2,25%	2,05%	410%	208%
JVET D	-4,93%	-1,16%	-0,80%	356%	156%	-5,26%	-0,68%	0,49%	360%	170%
JVET E	-8,09%	-3,18%	-3,90%	412%	237%	-7,40%	-1,36%	-2,47%	412%	264%
JVET F	-2,09%	0,47%	0,09%	394%	163%	-2,47%	1,05%	0,52%	399%	175%
CfP 360	-7,77%	-2,70%	-1,95%	553%	301%	-7,22%	-1,32%	-0,17%	568%	318%
CfP SDR-A	-6,07%	-2,49%	-2,54%	408%	273%	-5,78%	-1,90%	-1,93%	398%	300%
CfP SDR-B	-6,84%	-2,40%	-1,85%	427%	265%	-6,68%	-1,16%	-0,39%	428%	288%
CfP HDR-A	-8,21%	-4,11%	-3,63%	476%	327%	-7,41%	-2,86%	-2,12%	487%	350%
CfP HDR-B	-5,42%	0,99%	2,71%	386%	233%	-4,67%	2,30%	2,80%	367%	257%
JVET all	-5,68%	-1,70%	-1,74%	414%	224%	-5,64%	-0,74%	-0,66%	413%	245%
CfP all	-6,74%	-1,97%	-1,26%	444%	274%	-6,26%	-0,82%	-0,21%	441%	297%
JVET + CfP	-6,28%	-1,93%	-1,59%	430%	246%	-6,05%	-0,86%	-0,49%	428%	266%

Anchor: HM+QTGBS

Results for intra predictors without simplifications and with four additional transforms per proposed mode, Random Access:

Random Access										
	QP values 22, 27, 32, 37					QP values 27, 32, 37, 42				
	Y	Cb	Cr	EncT	DecT	Y	Cb	Cr	EncT	DecT
JVET A1	-2,67%	2,61%	1,19%	212%	156%	-2,57%	4,03%	2,97%	210%	150%
JVET A2	-3,38%	0,89%	0,85%	193%	121%	-3,47%	1,10%	0,94%	189%	120%
JVET B	-3,14%	-0,37%	-0,37%	202%	126%	-3,73%	-0,16%	-0,05%	211%	131%
JVET C	-1,95%	0,86%	0,76%	193%	125%	-2,26%	1,65%	1,73%	197%	124%
JVET D	-1,95%	0,01%	0,39%	214%	128%	-2,19%	0,06%	1,26%	197%	121%
JVET E	-5,48%	-0,63%	-1,50%	194%	114%	-5,63%	0,77%	-0,93%	196%	116%
JVET F	-1,35%	0,42%	0,22%	233%	116%	-1,65%	0,73%	0,44%	236%	121%
CfP 360	-5,06%	0,08%	1,24%	231%	123%	-5,23%	1,18%	2,85%	241%	124%
CfP SDR-A	-2,13%	0,62%	0,39%	197%	129%	-2,25%	0,82%	0,64%	194%	127%
CfP SDR-B	-2,96%	0,40%	0,43%	194%	128%	-3,26%	1,26%	1,71%	198%	130%
CfP HDR-A	-4,05%	-0,25%	0,63%	204%	133%	-3,98%	0,61%	2,19%	205%	132%
CfP HDR-B	-3,32%	2,04%	2,74%	213%	123%	-3,08%	2,37%	2,29%	219%	127%
JVET all	-2,76%	0,55%	0,26%	206%	127%	-3,00%	1,14%	0,94%	205%	126%
CfP all	-3,46%	0,65%	1,13%	208%	127%	-3,52%	1,30%	1,91%	211%	128%
JVET + CfP	-3,16%	0,52%	0,63%	208%	127%	-3,30%	1,19%	1,40%	209%	127%

Anchor: HM+QTGBS

Results for intra predictors with simplifications and with four additional transforms per proposed mode, Intra Only:

Intra Only										
	QP values 22, 27, 32, 37					QP values 27, 32, 37, 42				
	Y	Cb	Cr	EncT	DecT	Y	Cb	Cr	EncT	DecT
JVET A1	-5,75%	-2,38%	-2,45%	285%	168%	-5,74%	-2,01%	-1,80%	264%	169%
JVET A2	-5,56%	-2,14%	-2,13%	277%	155%	-5,22%	-1,79%	-1,67%	251%	159%
JVET B	-5,50%	-2,18%	-1,90%	290%	157%	-5,72%	-1,87%	-1,60%	274%	160%
JVET C	-3,18%	0,20%	0,20%	287%	137%	-3,46%	1,54%	1,04%	266%	141%
JVET D	-3,66%	-0,32%	-0,19%	279%	127%	-4,01%	-0,14%	0,60%	275%	137%
JVET E	-6,44%	-2,78%	-3,43%	268%	142%	-6,10%	-1,49%	-2,78%	253%	147%
JVET F	-1,74%	0,15%	-0,38%	273%	121%	-2,16%	0,45%	-0,37%	263%	125%
CfP 360	-6,58%	-2,11%	-1,70%	358%	175%	-6,29%	-1,29%	-0,50%	342%	173%
CfP SDR-A	-4,35%	-1,87%	-1,92%	260%	147%	-4,50%	-1,73%	-1,79%	239%	153%
CfP SDR-B	-5,52%	-1,87%	-1,42%	282%	152%	-5,46%	-1,21%	-0,62%	265%	154%
CfP HDR-A	-6,34%	-2,89%	-2,62%	299%	167%	-5,99%	-2,19%	-1,52%	285%	171%
CfP HDR-B	-4,64%	0,02%	1,16%	262%	142%	-4,18%	0,99%	1,44%	235%	146%
JVET all	-4,51%	-1,33%	-1,41%	281%	144%	-4,62%	-0,77%	-0,90%	264%	148%
CfP all	-5,41%	-1,64%	-1,19%	289%	155%	-5,22%	-0,99%	-0,52%	269%	158%
JVET + CfP	-5,01%	-1,56%	-1,38%	286%	149%	-5,00%	-0,95%	-0,79%	268%	153%

Anchor: HM+QTGBS

Results for intra predictors with simplifications and with four additional transforms per proposed mode, Random Access:

Random Access										
	QP values 22, 27, 32, 37					QP values 27, 32, 37, 42				
	Y	Cb	Cr	EncT	DecT	Y	Cb	Cr	EncT	DecT
JVET A1	-1,98%	2,48%	0,97%	147%	115%	-1,95%	3,87%	2,50%	141%	113%
JVET A2	-2,28%	0,37%	0,71%	143%	102%	-2,49%	0,40%	0,79%	137%	101%
JVET B	-2,49%	-0,20%	-0,53%	149%	152%	-3,11%	-0,01%	-0,41%	152%	154%
JVET C	-1,48%	0,57%	0,23%	150%	111%	-1,71%	0,91%	0,72%	149%	108%
JVET D	-1,67%	-0,18%	0,17%	149%	109%	-1,85%	-0,49%	1,80%	148%	109%
JVET E	-4,05%	-1,47%	-2,20%	148%	107%	-4,42%	-0,75%	-1,39%	146%	108%
JVET F	-1,10%	0,14%	0,02%	171%	108%	-1,42%	0,31%	0,02%	169%	110%
CfP 360	-4,20%	-0,16%	0,61%	172%	108%	-4,49%	0,46%	1,62%	174%	108%
CfP SDR-A	-1,39%	0,31%	0,29%	141%	105%	-1,63%	0,23%	0,43%	136%	104%
CfP SDR-B	-2,20%	0,24%	0,18%	144%	128%	-2,52%	1,19%	1,25%	143%	128%
CfP HDR-A	-2,99%	-0,15%	0,81%	147%	108%	-3,06%	0,60%	1,90%	144%	107%
CfP HDR-B	-2,82%	0,86%	2,10%	162%	132%	-2,77%	1,33%	1,07%	160%	133%
JVET all	-2,09%	0,29%	-0,03%	151%	115%	-2,37%	0,63%	0,61%	149%	115%
CfP all	-2,70%	0,25%	0,80%	153%	116%	-2,88%	0,78%	1,20%	151%	116%
JVET + CfP	-2,44%	0,20%	0,31%	152%	115%	-2,66%	0,65%	0,88%	151%	115%

Anchor: HM+QTGBS

Results for intra predictors with simplifications and with four additional transforms per proposed mode over SOT (extension of NSST and EMT), Intra Only:

Intra Only										
	QP values 22, 27, 32, 37					QP values 27, 32, 37, 42				
	Y	Cb	Cr	EncT	DecT	Y	Cb	Cr	EncT	DecT
JVET A1	-2,45%	-1,18%	-1,06%	224%	135%	-2,32%	-0,92%	-0,69%	229%	134%
JVET A2	-2,03%	-0,71%	-0,77%	232%	129%	-1,64%	-0,47%	-0,42%	235%	129%
JVET B	-2,66%	-1,15%	-0,90%	224%	137%	-2,55%	-0,99%	-0,84%	229%	137%
JVET C	-1,24%	-0,16%	-0,20%	237%	133%	-1,26%	0,26%	0,13%	252%	143%
JVET D	-1,63%	-0,31%	-0,39%	213%	120%	-1,73%	-0,22%	-0,09%	216%	122%
JVET E	-2,90%	-1,67%	-1,70%	220%	121%	-2,64%	-1,12%	-0,98%	238%	132%
JVET F	-0,88%	-0,21%	-0,31%	230%	113%	-1,03%	-0,08%	-0,40%	236%	117%
CfP 360	-3,11%	-1,49%	-1,14%	248%	145%	-2,82%	-1,10%	-0,60%	252%	143%
CfP SDR-A	-1,77%	-0,89%	-0,86%	221%	125%	-1,69%	-0,75%	-0,81%	223%	126%
CfP SDR-B	-2,45%	-0,77%	-0,53%	230%	134%	-2,25%	-0,45%	-0,21%	234%	136%
CfP HDR-A	-2,73%	-1,17%	-1,11%	208%	122%	-2,53%	-0,75%	-0,65%	214%	124%
CfP HDR-B	-2,11%	0,24%	0,53%	224%	128%	-1,65%	0,85%	0,90%	225%	131%
JVET all	-1,96%	-0,75%	-0,73%	226%	127%	-1,88%	-0,50%	-0,47%	233%	131%
CfP all	-2,41%	-0,79%	-0,58%	227%	131%	-2,16%	-0,41%	-0,24%	231%	133%
JVET + CfP	-2,21%	-0,82%	-0,71%	226%	129%	-2,07%	-0,51%	-0,40%	232%	132%

Results for intra predictors with simplifications and with four additional transforms per proposed mode over SOT (extension of NSST and EMT), Random Access:

Random Access										
	QP values 22, 27, 32, 37					QP values 27, 32, 37, 42				
	Y	Cb	Cr	EncT	DecT	Y	Cb	Cr	EncT	DecT
JVET A1	-1,55%	1,90%	0,99%	137%	112%	-1,39%	2,95%	2,35%	133%	108%
JVET A2	-0,83%	1,07%	0,82%	133%	104%	-0,80%	1,03%	0,85%	133%	104%
JVET B	-1,39%	-0,08%	0,08%	141%	110%	-1,55%	0,15%	0,49%	145%	111%
JVET C	-0,72%	-0,06%	-0,08%	131%	107%	-0,74%	0,61%	0,49%	133%	108%
JVET D	-0,65%	-0,76%	-0,16%	142%	107%	-0,84%	-1,00%	-0,10%	142%	107%
JVET E	-1,72%	-0,07%	0,28%	140%	106%	-1,94%	1,17%	0,59%	143%	106%
JVET F	-0,54%	-0,49%	-0,27%	154%	104%	-0,72%	-0,38%	-0,51%	155%	104%
CfP 360	-2,04%	-0,43%	0,57%	151%	108%	-2,10%	0,14%	1,53%	154%	106%
CfP SDR-A	-0,78%	0,50%	0,27%	132%	106%	-0,84%	0,54%	0,48%	130%	106%
CfP SDR-B	-1,30%	0,32%	0,46%	137%	110%	-1,30%	0,60%	0,88%	139%	110%
CfP HDR-A	-1,49%	0,24%	0,66%	137%	108%	-1,48%	0,62%	1,22%	137%	107%
CfP HDR-B	-1,38%	0,99%	1,69%	152%	109%	-1,29%	0,98%	0,89%	154%	107%
JVET all	-1,05%	0,22%	0,23%	140%	107%	-1,13%	0,61%	0,59%	140%	107%
CfP all	-1,39%	0,33%	0,74%	142%	108%	-1,40%	0,57%	0,98%	143%	107%
JVET + CfP	-1,23%	0,21%	0,41%	141%	108%	-1,28%	0,58%	0,72%	142%	107%