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ISO/IEC JTC1/SC29/WG11  
CODING OF MOVING PICTURES AND AUDIO**

**ISO/IEC JTC1/SC29/WG11 MPEG2019/M53910  
April 2020, Alpbach, Austria**

**Source** Poznań University of Technology (PUT), Poznań, Poland  
**Status** Input  
**Title** [MPEG-I Visual] Impact of HEVC profile on TMIV performance  
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## 1 Introduction

In m53427, the results of application of HEVC-SCC for atlas coding were presented. Results from m53427 were obtained for TMIV2. At AhG Call on 2020-04-14 we were requested to repeat the experiment for TMIV4. Moreover, at the Call also the impact of different bit depth was considered.

This document presents an influence of different HEVC profiles on TMIV4 performance. HEVC Main10 (anchor), Main and Screen-Extended Main were compared.

## 2 Overview of the experiment

The experiment followed Common Test Conditions [N18997]. Two tested encoders require 8bps input data, so bit depth of all the atlases was changed before and after HEVC coding:

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input 10bps	=> TMIV encoder	atlases 10bps	=>	atlases 8bps	=> HEVC	atlases 8bps	=>	atlases 10bps	=> TMIV decoder	output 10bps
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The configuration of all tested video encoders was identical (excluding SCC-specific parameters). Configuration files are attached to this document.

All the experiments were performed for “rf” configuration (17 frames).

Versions of HM used:

- HM 16.16 (HEVC Main10, HEVC Main), as in CTC,
- HM 16.16 SCM 8.6 (HEVC Screen-Extended Main).

### 3 Experimental results

#### 3.1 HEVC Main vs. HEVC Screen-Extended Main

Test class	Sequence	Anchor (rf)	High-BR	Low-BR	Max	High-BR	Low-BR	High-BR	Low-BR	Pixel
			BD rate	BD rate		BD rate	BD rate	BD rate	BD rate	
			Y-PSNR	Y-PSNR	Y-PSNR	VMAF	VMAF	IV-PSNR	IV-PSNR	ratio
CG	ClassroomVideo	AA17 (MIV)	-16.9%	-20.7%	3.34	-14.0%	-21.1%	-12.7%	-20.0%	0.59
	TechnicolorMuseum	BA17 (MIV)	-5.6%	-7.7%	16.84	-8.4%	-9.0%	-5.2%	-6.4%	0.59
	InterdigitalHijack	CA17 (MIV)	-19.6%	-20.3%	13.40	-19.4%	-18.9%	-15.2%	-16.4%	0.59
	OrangeKitchen	JA17 (MIV)	-14.9%	-18.1%	14.17	-18.1%	-20.4%	-12.9%	-15.6%	0.70
	NokiaChess (*)	NA17 (MIV)	-14.9%	-18.8%	20.16	-5.6%	-23.0%	-9.6%	-12.2%	0.59
		MIV		-14.2%	-16.7%	16.84	-15.0%	-17.4%	-11.5%	-14.6%
NC	TechnicolorPainter	DA17 (MIV)	-8.5%	-9.7%	8.14	-8.3%	-9.4%	-8.4%	-9.4%	0.71
	IntelFrog	EA17 (MIV)	-5.1%	-8.7%	12.35	-6.0%	-8.9%	-4.0%	-7.2%	0.70
	PoznanFencing	LA17 (MIV)	-11.5%	-13.5%	13.99	-12.3%	-13.7%	-9.9%	-12.9%	0.49
	PoznanCarpark (*)	PA17 (MIV)	-10.2%	-12.0%	12.29	-10.1%	-12.1%	-9.9%	-12.5%	0.49
	PoznanHall (*)	TA17 (MIV)	-12.2%	-13.0%	16.95	-12.3%	-13.3%	-8.9%	-10.9%	0.49
	PoznanStreet (*)	UA17 (MIV)	-7.5%	-8.7%	10.95	-7.3%	-8.1%	-5.4%	-8.5%	0.49
	MIV		-8.4%	-10.6%	13.99	-8.9%	-10.6%	-7.5%	-9.8%	
Test class	Sequence	Anchor (rf)	High-BR	Low-BR	Max	High-BR	Low-BR	High-BR	Low-BR	Pixel
All			BD rate	BD rate	delta	BD rate	BD rate	BD rate	BD rate	rate
		MIV	Y-PSNR	Y-PSNR	Y-PSNR	VMAF	VMAF	IV-PSNR	IV-PSNR	ratio
			-11.7%	-14.1%	11.75	-12.4%	-14.5%	-9.8%	-12.5%	

#### 3.2 HEVC Main10 vs. HEVC Main

Test class	Sequence	Anchor (rf)	High-BR	Low-BR	Max	High-BR	Low-BR	High-BR	Low-BR	Pixel
			BD rate	BD rate		BD rate	BD rate	BD rate	BD rate	
			Y-PSNR	Y-PSNR	Y-PSNR	VMAF	VMAF	IV-PSNR	IV-PSNR	ratio
CG	ClassroomVideo	AA17 (MIV)	11.1%	4.6%	3.34	18.8%	5.3%	9.2%	6.4%	0.59
	TechnicolorMuseum	BA17 (MIV)	0.0%	217.8%	16.82	0.0%	123.1%	10.5%	5.0%	0.59
	InterdigitalHijack	CA17 (MIV)	55.5%	22.1%	13.29	41.1%	16.9%	-0.4%	-1.5%	0.59
	OrangeKitchen	JA17 (MIV)	15.8%	7.0%	14.15	30.3%	10.5%	2.7%	0.3%	0.70
	NokiaChess (*)	NA17 (MIV)	69.5%	46.2%	19.93	58.0%	49.6%	14.1%	8.9%	0.59
		MIV		20.6%	62.9%	16.82	22.6%	39.0%	5.5%	2.5%
NC	TechnicolorPainter	DA17 (MIV)	12.0%	5.1%	8.13	12.6%	5.0%	7.8%	2.8%	0.71
	IntelFrog	EA17 (MIV)	-3.6%	-3.5%	12.37	-5.7%	-1.6%	5.9%	2.9%	0.70
	PoznanFencing	LA17 (MIV)	5.3%	2.1%	14.00	4.0%	0.9%	7.6%	2.8%	0.49
	PoznanCarpark (*)	PA17 (MIV)	17.4%	8.2%	12.29	26.2%	10.9%	9.6%	4.2%	0.49
	PoznanHall (*)	TA17 (MIV)	11.6%	5.7%	16.92	10.8%	5.9%	7.2%	3.0%	0.49
	PoznanStreet (*)	UA17 (MIV)	17.1%	9.0%	10.96	20.3%	9.4%	10.0%	4.9%	0.49
	MIV		4.6%	1.2%	14.00	3.6%	1.4%	7.1%	2.8%	
Test class	Sequence	Anchor (rf)	High-BR	Low-BR	Max	High-BR	Low-BR	High-BR	Low-BR	Pixel
All			BD rate	BD rate	delta	BD rate	BD rate	BD rate	BD rate	rate
		MIV	Y-PSNR	Y-PSNR	Y-PSNR	VMAF	VMAF	IV-PSNR	IV-PSNR	ratio
			13.7%	36.5%	11.73	14.4%	22.9%	6.2%	2.6%	

Note: Value 0.0% for SB means non-overlapping curves (Main10 is much higher than Main).

### 3.3 HEVC Main 10 vs. HEVC Screen-Extended Main

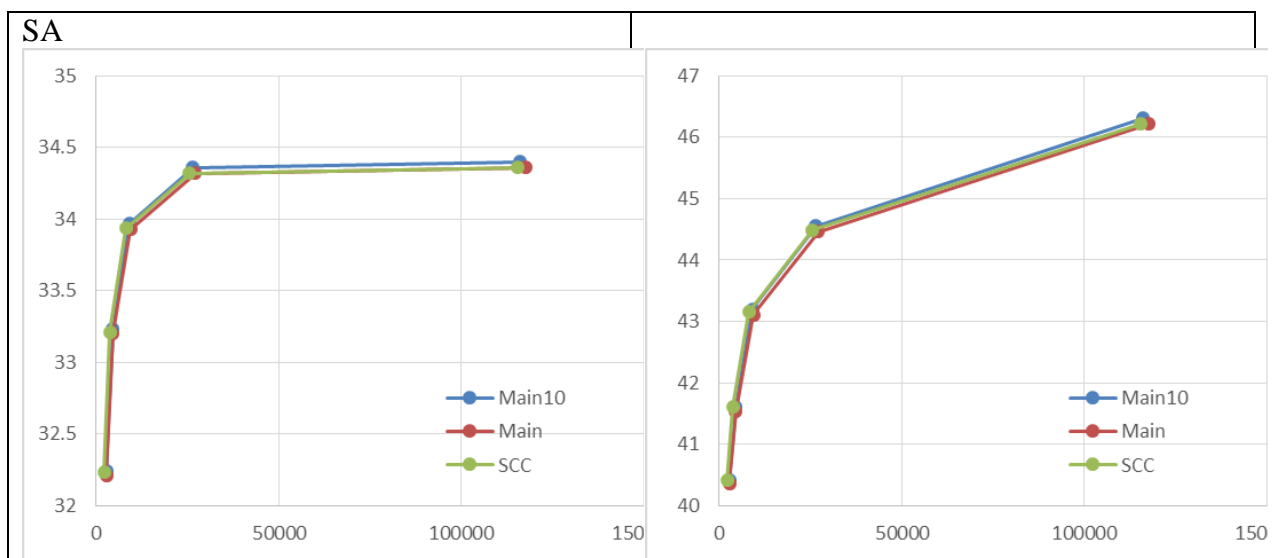
Test class	Sequence	Anchor (rf)	High-BR	Low-BR	Max	High-BR	Low-BR	High-BR	Low-BR	Pixel
			BD rate	BD rate		BD rate	BD rate	BD rate	BD rate	
			Y-PSNR	Y-PSNR	Y-PSNR	VMAF	VMAF	IV-PSNR	IV-PSNR	ratio
CG	ClassroomVideo	AA17 (MIV)	-6.2%	-14.9%	3.34	3.9%	-14.5%	-3.7%	-13.1%	0.59
	TechnicolorMuseum	BA17 (MIV)	0.0%	200.4%	16.84	0.0%	105.3%	5.5%	-0.8%	0.59
	InterdigitalHijack	CA17 (MIV)	28.6%	0.1%	13.40	19.0%	-2.9%	-14.4%	-16.1%	0.59
	OrangeKitchen	JA17 (MIV)	0.1%	-10.2%	14.17	8.7%	-9.7%	-9.3%	-13.5%	0.70
	NokiaChess (*)	NA17 (MIV)	49.4%	21.6%	20.16	109.6%	13.5%	3.7%	-2.7%	0.59
		MIV	5.6%	43.8%	16.84	7.9%	19.6%	-5.5%	-10.9%	
NC	TechnicolorPainter	DA17 (MIV)	3.2%	-4.2%	8.14	3.9%	-3.9%	-0.7%	-6.0%	0.71
	IntelFrog	EA17 (MIV)	-8.4%	-11.8%	12.35	-11.4%	-10.2%	1.8%	-4.2%	0.70
	PoznanFencing	LA17 (MIV)	-6.4%	-11.0%	13.99	-8.4%	-12.3%	-2.6%	-9.8%	0.49
	PoznanCarpark (*)	PA17 (MIV)	5.9%	-4.5%	12.29	14.1%	-2.1%	-1.2%	-8.5%	0.49
	PoznanHall (*)	TA17 (MIV)	-1.6%	-7.6%	16.95	-2.4%	-7.9%	-2.0%	-7.9%	0.49
	PoznanStreet (*)	UA17 (MIV)	8.7%	0.0%	10.95	11.9%	1.2%	3.9%	-3.7%	0.49
	MIV	-3.9%	-9.0%	13.99	-5.3%	-8.8%	-0.5%	-6.7%		
Test class	Sequence	Anchor (rf)	High-BR	Low-BR	Max	High-BR	Low-BR	High-BR	Low-BR	
All		MIV	1.5%	21.2%	11.75	2.2%	7.4%	-3.3%	-9.1%	

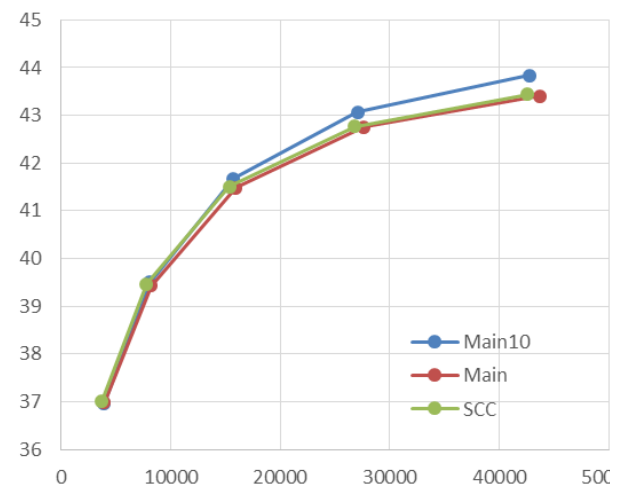
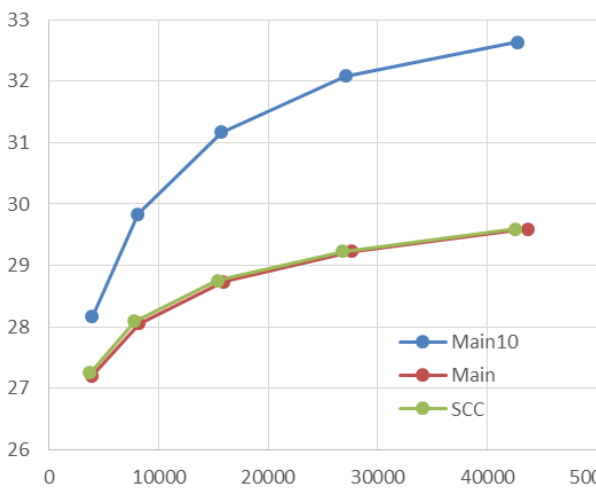
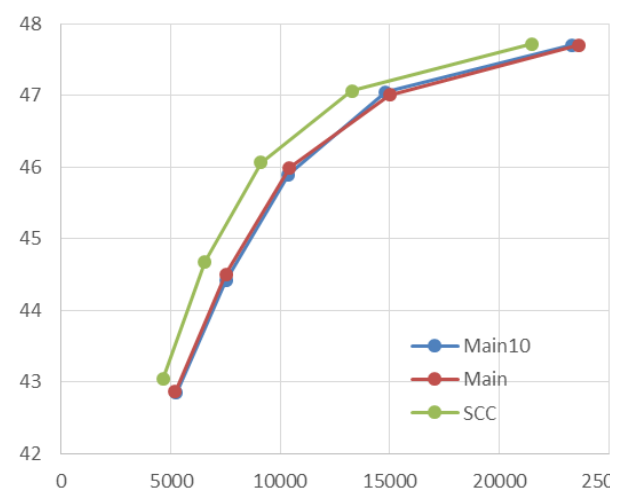
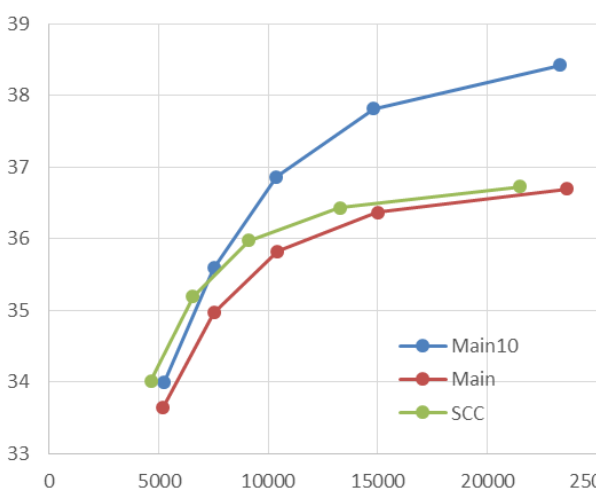
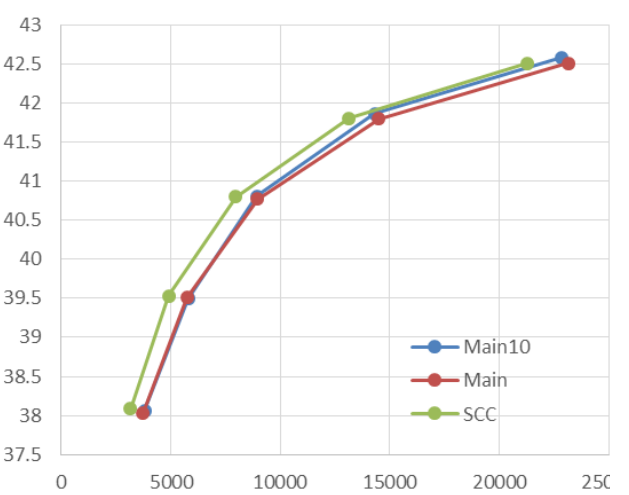
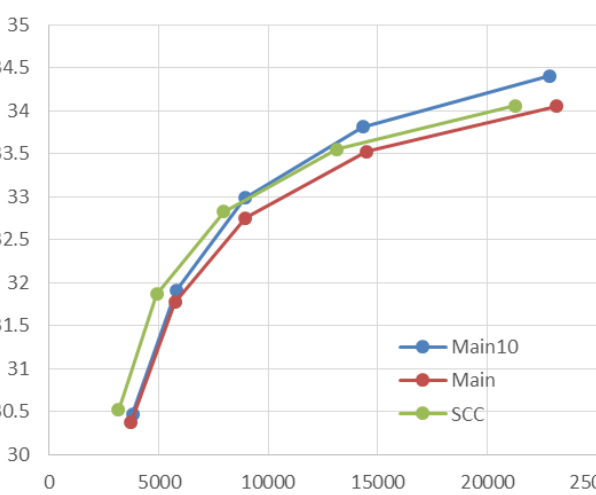
### 3.4 Comparison of 3 profiles

RD-curves for Y-WSPSNR and IVPSNR are presented in figures below (left column: Y-WSPSNR, right column: IVPSNR).

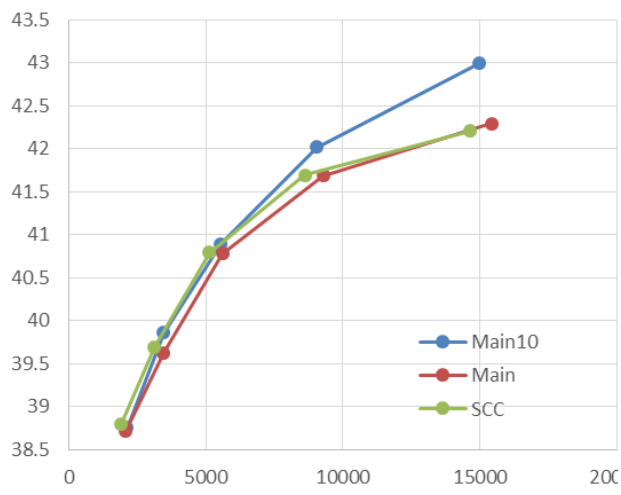
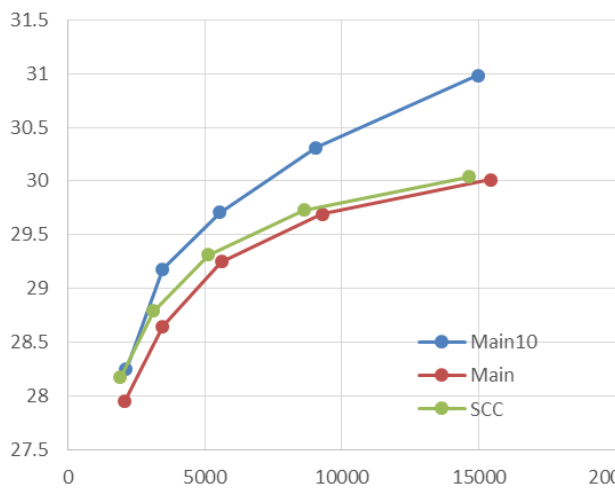
General observations may be done:

1. HEVC Screen-Extended Main is always better than HEVC Main.
2. HEVC Main10 is almost always better than HEVC Main (greater differences for CG).
3. HEVC Screen-Extended Main performs worse than HEVC Main10 for higher bitrates.
4. HEVC Screen-Extended Main performs better than HEVC Main 10 for lower bitrates:
  - a. in terms of IVPSNR: for all sequences,
  - b. in terms of Y-WSPSNR: for all NC sequences (and some CG ones).

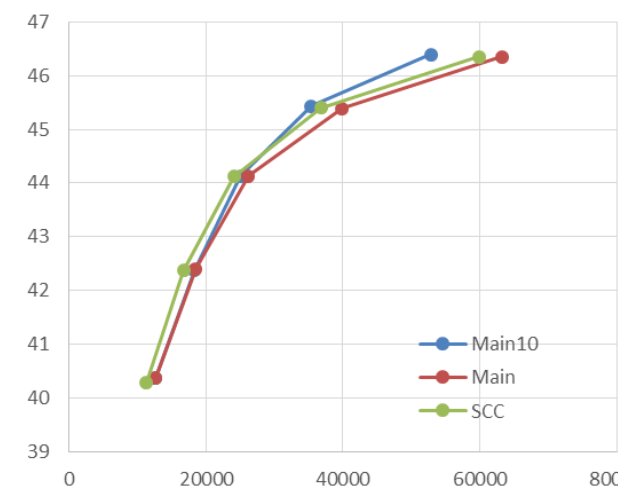
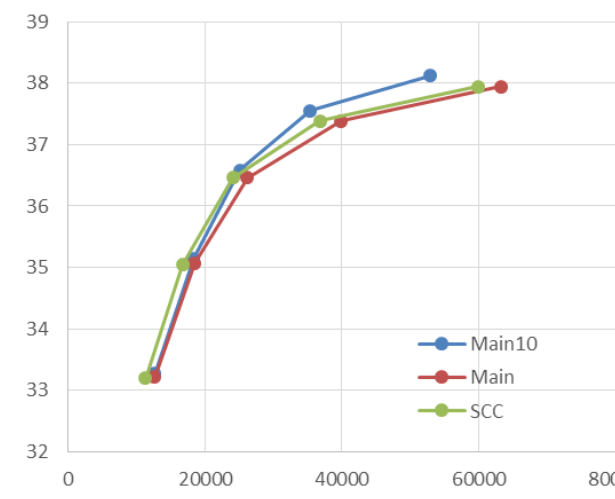


**SB****SC****SJ**

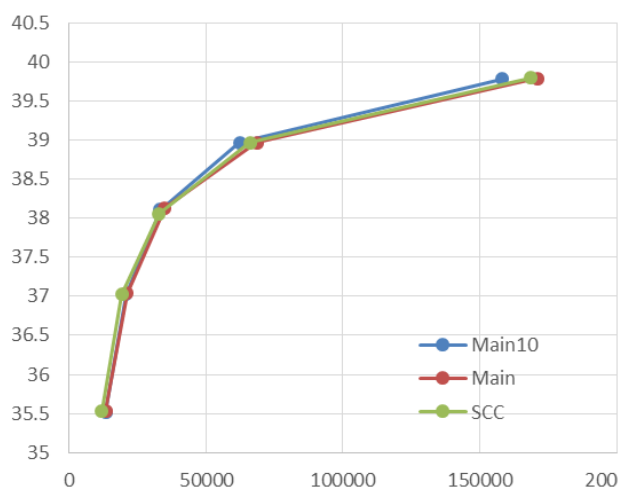
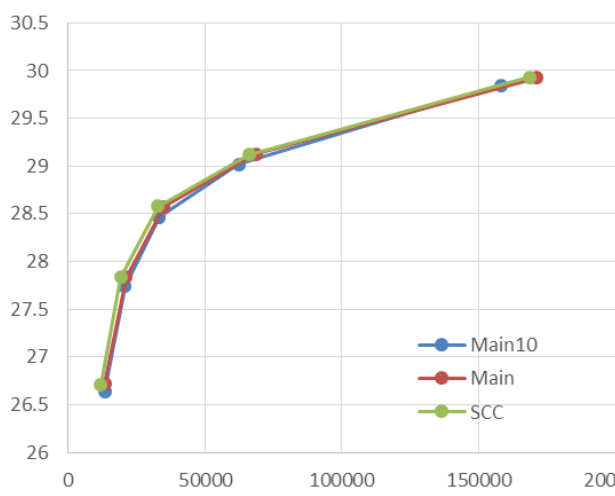
**SN**



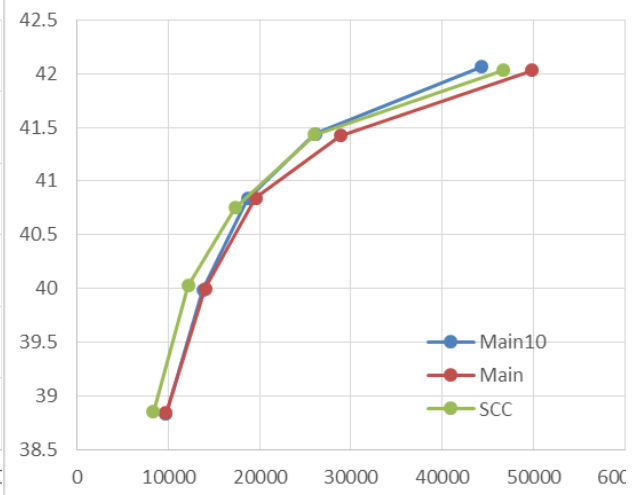
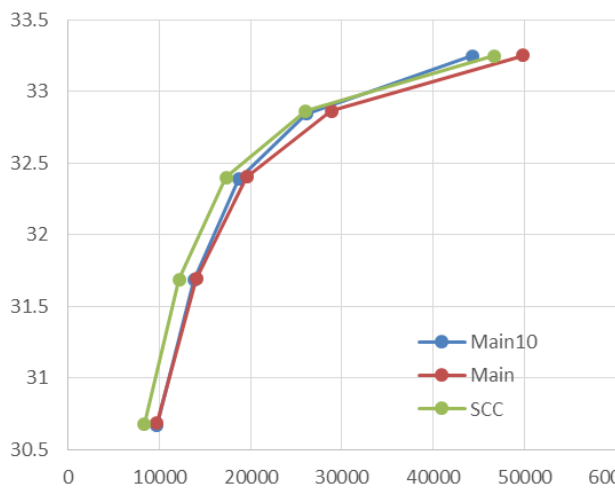
**SD**



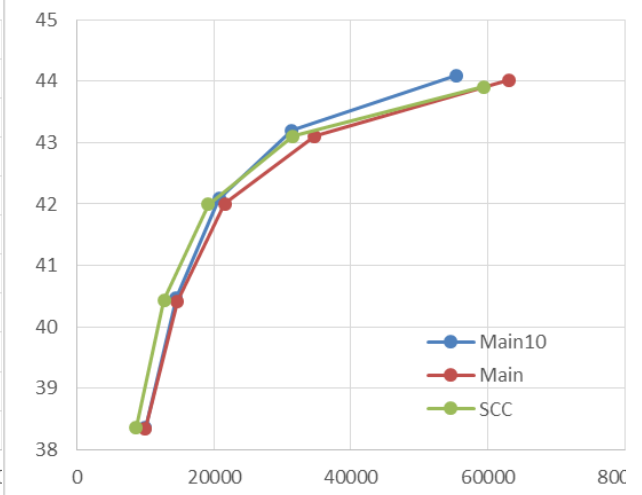
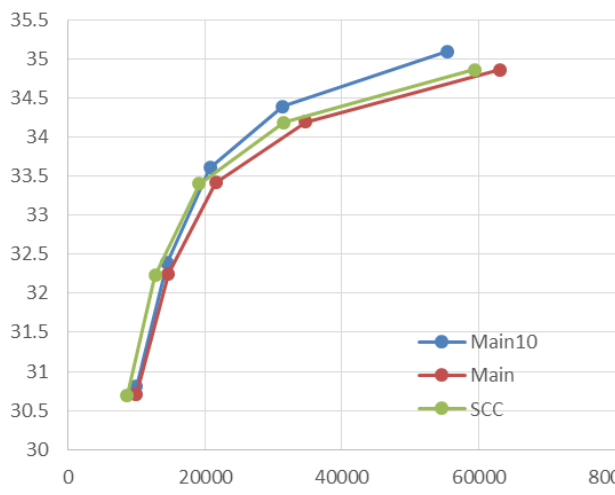
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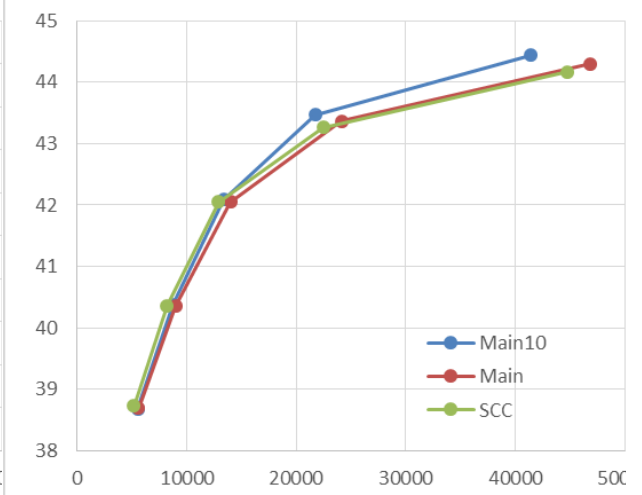
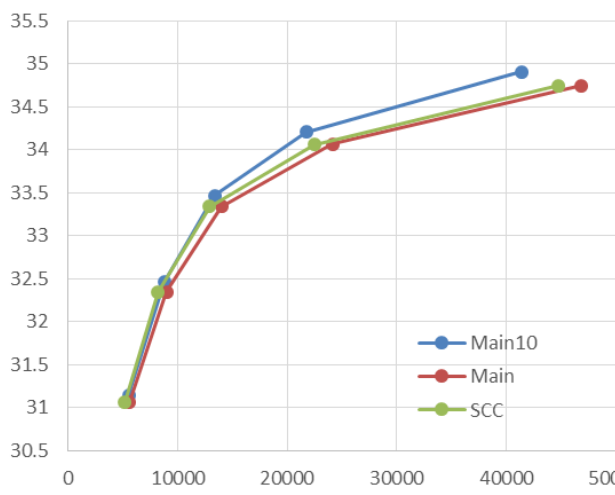
### SL



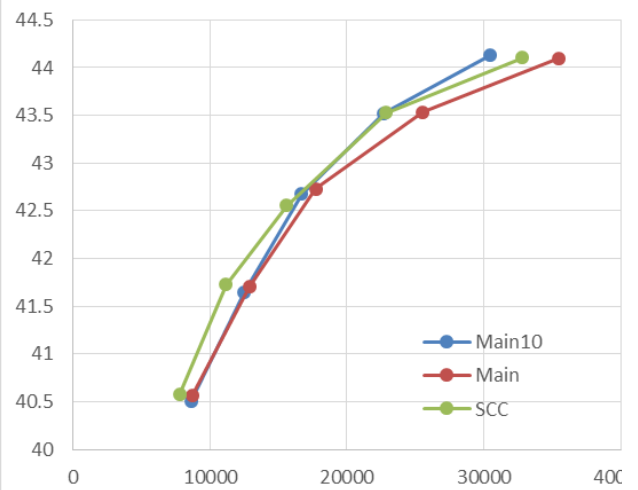
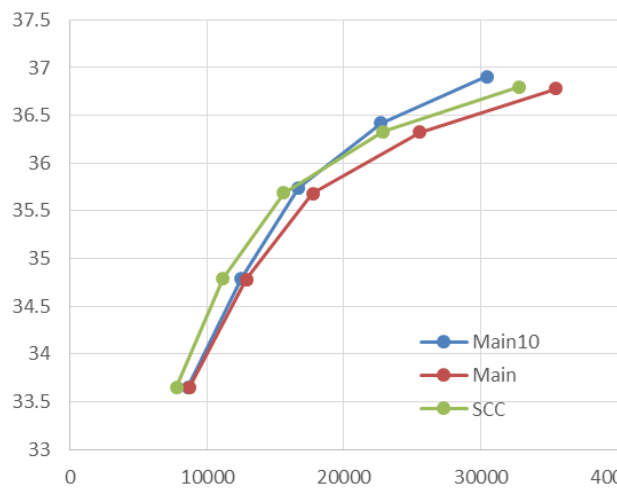
### SP



### SU



ST



## 4 Attachments

1. Reporting templates,
2. HEVC configuration files.

## 5 Acknowledgement

This work was supported by the Ministry of Science and Higher Education.

## 6 References

- [m53427] [MPEG-I Visual] HEVC-SCC in TMIV,  
J. Samelak, A. Dziembowski, D. Mieloch, M. Domański,  
ISO/IEC JTC1/SC29/WG11 MPEG/m53427, Alpbach, Austria, April 2020
- [N18997] Common Test Conditions for Immersive Video,  
ISO/IEC JTC1/SC29/WG11 MPEG/N18997, Brussels, Belgium, January 2020