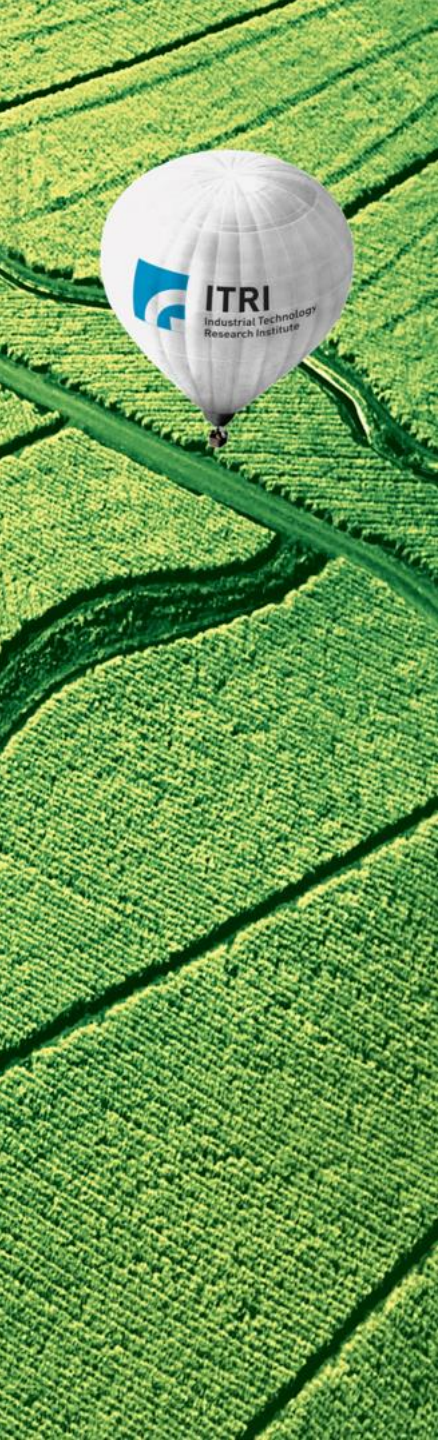
ITRI
Industrial Technology
Research Institute

MPEG國際會議分享



ITRI ICL V200
Ching-Chieh Lin

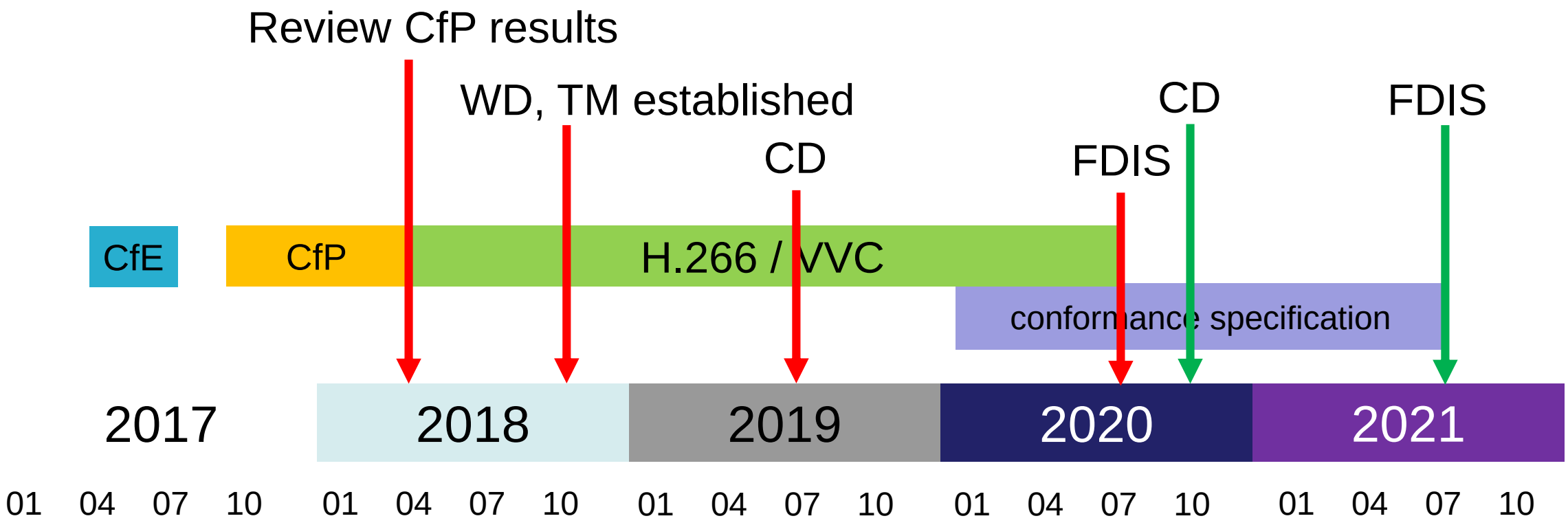
25th September 2020

Outline

- Joint Video Expert Team(VVC/H.266)
  - Timeline and status
  - Verifications and possible future works
  - Performance
- Schedule of future meetings

Joint Video Expert Team

H.266 Timeline



*WD : Working Draft
*TM : Test Model
*CD : Committee Draft
*FDIS: Final Draft International Standard

Status of VVC(1/3)

- VVC spec is in FDIS
  - ITU-T H.266 (08/2020) | ISO/IEC 23090-3 Versatile Video Coding (N19470 | JVET-S2001 + N19478 DoCR)
  - Description of bitstream syntax and semantics, processes for core decoding and high-level syntax necessary for decoding
- Versatile SEI messages for coded video bitstreams
  - ITU-T H.274 (08/2020) | ISO/IEC 23002-7 Supplemental enhancement information messages for coded video bitstreams (N19472 | JVET-S2007 + N19479 DoCR)
  - Independent SEI messages and VUI, specification not needed for core decoding process, could be used with VVC or other video standards

ITRI Industrial Technology Research Institute

Status of VVC(2/3)

- Test Model 10 of Versatile Video Coding (VTM 10) (N19471 | JVET-R2002)
  - Encoder and algorithm description
  - Has corresponding software implementation, to become CD next meeting
- Working Draft 2 of VVC conformance testing (N19474 | JVET-S2008)
  - Including almost complete list of bitstreams, to become CD next meeting
  - Low-level tools and HLS (including corner cases), profile/level limits

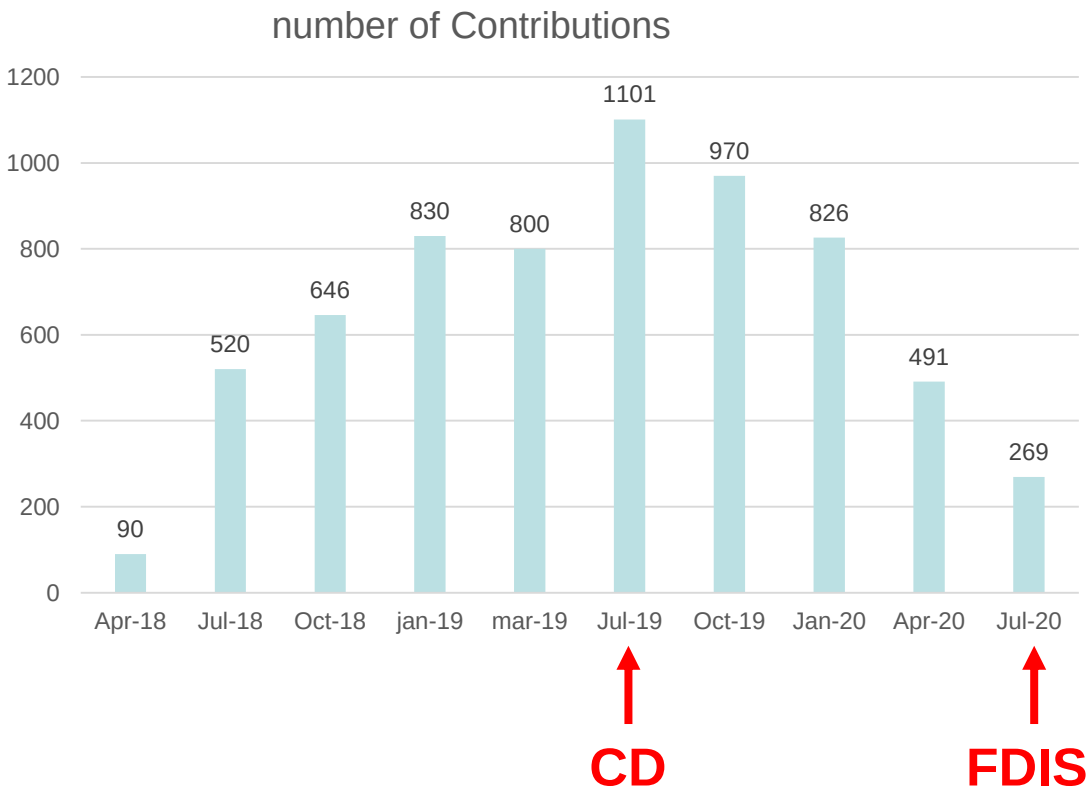
ITRI Industrial Technology Research Institute

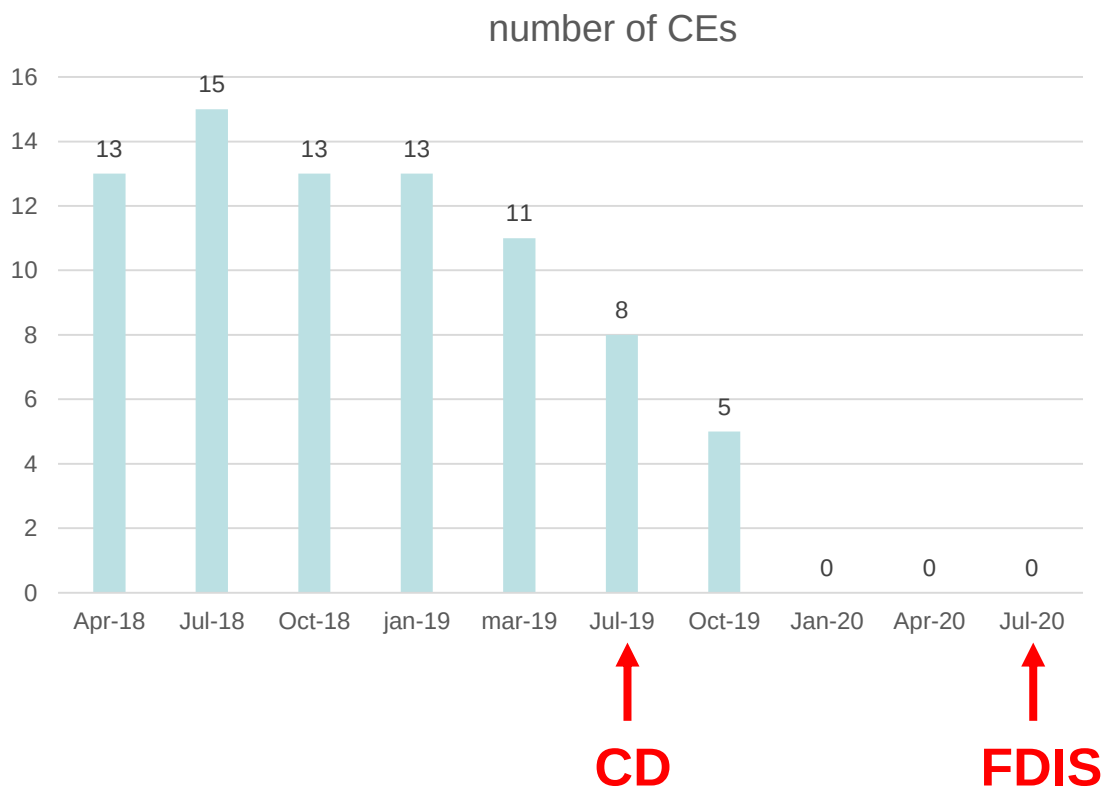
Status of VVC(3/3)

- Current Common Test Conditions(CTC)
  - 360
  - HDR/WCG (JVET#19)
  - non-420 / SCC (JVET#18)
  - lossless, near lossless, and mixed lossy/lossless
  - SDR
  - reference picture resampling
- Profiles for Version 1 (6 profiles)
  - “Main 10 Still Picture” profile and “Main 10 4:4:4 Still Picture” profile
  - “Main 10” and “Multilayer Main 10”
  - “Main 10 4:4:4” and “Multilayer Main 10 4:4:4”

ITRI
Industrial Technology Research Institute

Number of JVET contributions and CEs





ITRI Industrial Technology Research Institute

Important aspects

- Low level coding tools
  - Various cleanups, text/software alignments, bug fixes
    - many of these issues were found due to intense activity in conformance development
  - No changes of block level design unless for solving problems
    - most of them only for corner cases
  - Improved coding gain is not of importance
    - Highest priority: Stabilization of design, identify bugs and inconsistencies text/software
- High level syntax
  - No new concepts
    - required clarification and cleanup, implementation of originally existing intent
  - Software implementation of HLS

ITRI
Industrial Technology Research Institute

VVC verification

- Testing VVC VTM vs. HEVC HM
- First priority
  - SDR HD, SDR UHD、HDR HD, HDR UHD、360° (extracted viewports)
  - Plan to conduct final test for SDR-UHD until next meeting
- Secondary priority
  - Screen content (perhaps with 2 HEVC anchors – Main 10 and SCC profiles) 、Scalability 、4:4:4 content
- Test sequences not included in CTC

ITRI Industrial Technology Research Institute

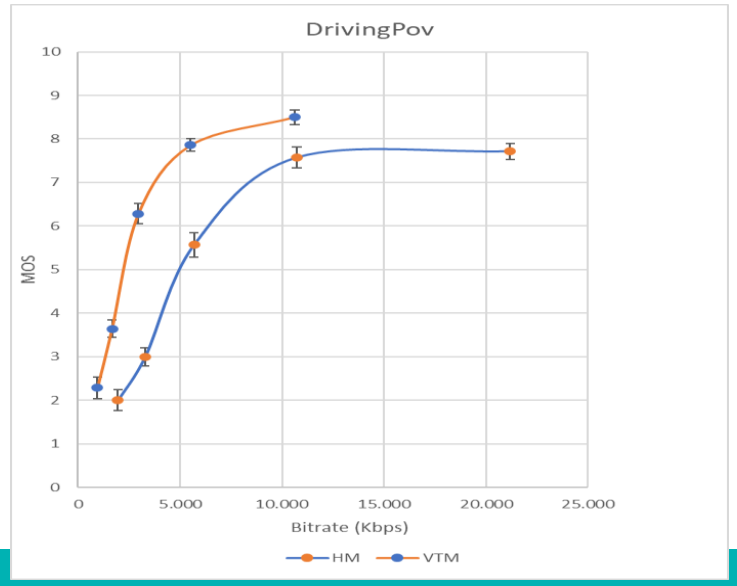
Test Sequence for Verification

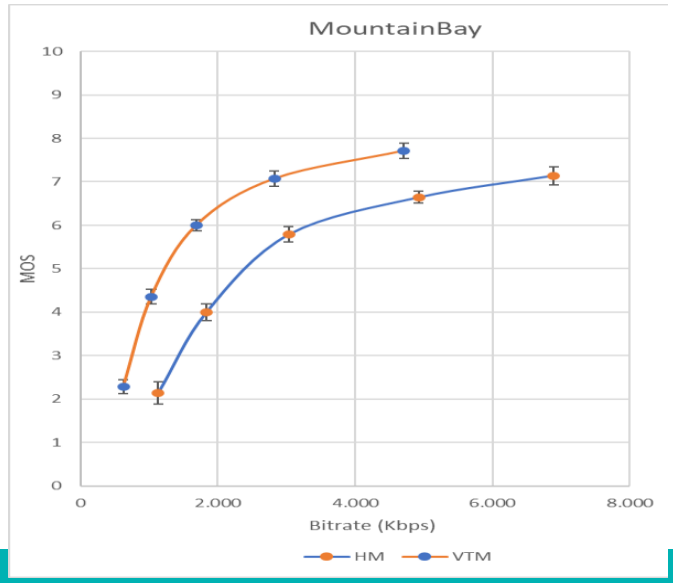
No.	Test sequence	HM QPs	VTM QPs
01	Marathon_3840x2160_30fps_8bit_420pf	46, 40, 36, 32	46, 42, 38, 34
02	MountainBay2_3840x2160_30fps_420_10bit	41, 37, 33, 29	42, 38, 34, 30
03	Netflix_DrivingPOV_4096x2160_60fps_10bit_420	40, 36, 32, 28	42, 38, 34, 30
04	Runners_3840x2160_30fps_8bit_420pf	45, 41, 37, 33	46, 42, 38, 34
05	TallBuildings_3840x2160_30fps_8bit_420pf	45, 41, 37, 33	46, 42, 38, 34
09	NeptuneFountain3_3840x2160_60fps_420_10bit	40, 36, 33, 28	42, 38, 34, 30
12	SubwayTree_3840x2160_60fps_420_10bit	45, 41, 37, 33	46, 42, 38, 34
13	TiergartenParkway_3840x2160_60fps_420_10bit	45, 41, 37, 33	46, 42, 38, 34

ITRI
Industrial Technology Research Institute

Dry run results

- The results of EVP suggests the suitability of the test sequences
- QP setting for some sequences are suggested to be adjusted for avoiding too close quality for the VTM
- Suggested to keep ALF on in further subjective assessments
- Suggested to consistently use 10 bit test sequences





Industrial Technology Research Institute

Future of VVC

- Possible items for version 2
  - Extend set of SEI messages
  - High bit depth, high bit rate, high frame rate coding
    - some aspects may require alignment of low-level tools
- Neural-network-based video coding
  - Potential extensions of VVC with NN-based coding tools
  - NN-based encoding optimization for VVC
  - To be coordinated with corresponding activities in parent bodies
    - DNNVC

ITRI
Industrial Technology Research Institute

AHGs for 19th JVET Meeting (1/2)

- Project Management (AHG1)
- Draft text and test model algorithm description editing (AHG2)
- Test model software development (AHG3)
- Test material and visual assessment (AHG4)
- Conformance testing (AHG5)
- 360° video coding tools, software and test conditions (AHG6)
- Coding of HDR/WCG material (AHG7)
- Layered coding and resolution adaptivity (AHG8)
- ~~High-level syntax (AHG9)~~
- SEI message studies (AHG9)
- Encoding algorithm optimizations (AHG10)
- ~~Screen content coding (AHG11)~~
- Neural-network-based video coding (AHG11)

ITRI Industrial Technology Research Institute

AHGs for 19th JVET Meeting (2/2)

- ~~High-level parallelism and coded picture regions (AHG12)~~
- High bit depth, high bit rate, and high frame rate coding (AHG12)
- Tool reporting procedure (AHG13)
- ~~Lossless and near-lossless coding (AHG14)~~
- ~~Quantization control (AHG15)~~
- ~~Implementation studies (AHG16)~~

ITRI
Industrial Technology Research Institute

Performance comparison (1/3)

- VTM 9.0 over HM 16.20

	All Intra Main10				
	Over HM 16.20				
	Y	U	V	EncT	DecT
Class A1	-29.10%	-32.37%	-34.36%	1630%	190%
Class A2	-29.29%	-23.97%	-21.08%	2626%	199%
Class B	-21.74%	-26.92%	-30.75%	2946%	198%
Class C	-22.54%	-18.92%	-22.71%	4046%	202%
Class E	-25.78%	-26.10%	-24.52%	2381%	187%
Overall	-25.08%	-25.42%	-26.91%	2712%	196%
Class D	-18.44%	-13.25%	-13.25%	4528%	204%
Class F	-39.39%	-39.90%	-42.49%	5346%	192%

	Random access Main10				
	Over HM 16.20				
	Y	U	V	EncT	DecT
Class A1	-38.74%	-37.19%	-44.34%	884%	186%
Class A2	-43.13%	-39.74%	-38.35%	999%	199%
Class B	-34.74%	-46.77%	-44.61%	935%	189%
Class C	-29.90%	-30.58%	-32.56%	1212%	199%
Class E					
Overall	-35.93%	-39.13%	-40.09%	1004%	193%
Class D	-27.64%	-26.48%	-26.11%	1326%	194%
Class F	-41.55%	-44.78%	-46.09%	689%	163%

	Low delay B Main10				
	Over HM 16.20				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	-30.78%	-37.52%	-35.44%	836%	171%
Class C	-29.11%	-22.39%	-22.49%	1006%	183%
Class E	-33.10%	-39.76%	-34.51%	420%	147%
Overall	-30.80%	-33.03%	-30.89%	749%	168%
Class D	-25.98%	-16.62%	-16.00%	1024%	182%
Class F	-42.77%	-44.36%	-44.85%	558%	145%

	Low delay P Main10				
	Over HM 16.20				
	Y	U	V	EncT	DecT
Class A1					
Class A2					
Class B	-35.12%	-40.02%	-37.82%	751%	174%
Class C	-30.84%	-22.48%	-22.76%	898%	191%
Class E	-35.79%	-43.00%	-37.53%	402%	155%
Overall	-33.86%	-34.92%	-32.73%	682%	174%
Class D	-27.43%	-15.80%	-15.13%	916%	184%
Class F	-42.33%	-43.52%	-43.97%	581%	151%

ITRI
Industrial Technology Research Institute

Performance comparison(2/3)

- PSNR-based Common Test Conditions BD-Rate savings relative to HEVC reference software (10 bit)

vs HM	AI			RA			LDB			LDP		
	gain	Enc.	Dec.	gain	Enc.	Dec.	gain	Enc.	Dec.	gain	Enc.	Dec.
VTM 1.0	4%	9.6X	1.1X	8%	2.2X	0.8X	8%	1.6X	0.8X	9%	1.5X	0.9X
VTM 2.0	18%	18X	1.6X	23%	3.7X	1.3X	18%	3.2X	1.3X	22%	2.9X	1.3X
VTM 3.0	19%	19X	1.6X	27%	5.3X	1.3X	21%	4.4X	1.2X	24%	3.7X	1.2X
VTM 4.0	21%	22X	1.7X	32%	8X	1.5X	23%	6.6X	1.4X	27%	5.8X	1.5X
VTM 5.0	23%	34X	1.9X	33%	10X	1.9X	25%	7.4X	1.5X	28%	6.9X	1.6X
VTM 6.0	24%	27X	2.0X	35%	10X	1.9X	25%	7.7X	1.7X	29%	7.4X	1.8X
VTM 7.0	24%	27X	1.8X	35%	9.5X	1.8X	29%	6.9X	1.7X	33%	6.4X	1.8X
VTM 8.0	24%	31X	2.2X	35%	10.7X	2X	30%	7.7X	1.7X	33%	7.0X	1.8X
VTM 9.0	25%	27X	2.0X	36%	10X	1.9X	31%	7.5X	1.7X	34%	6.8X	1.7X

ITRI Industrial Technology Research Institute

Performance comparison (3/3)

- PSNR-based Common Test Conditions BD-Rate savings relative to VTM reference software (10 bit)

	AI			RA			LDB			LDP		
	gain	Enc.	Dec.	gain	Enc.	Dec.	gain	Enc.	Dec.	gain	Enc.	Dec.
VTM 2.0 vs. VTM 1.0	14.5%	1.9X	1.5X	16.1%	1.7X	1.5X	10.8%	2.0X	1.5X	14.1%	1.9X	1.4X
VTM 3.0 vs. VTM 2.0	1.6%	1X	1X	5.8%	1.4X	1X	3.4%	1.4X	0.9X	3.3%	1.2X	0.9X
VTM 4.0 vs. VTM 3.0	2.4%	1.1X	1X	5.5%	1.5X	1.2X	3.6%	1.5X	1.1X	3.6%	1.6X	1.1X
VTM 5.0 vs. VTM 4.2	2.5%	1.6X	1X	2.4%	1.3X	1.1X	1.2%	1.1X	1.1X	1.5%	1.2X	1.1X
VTM 6.0 vs. VTM 5.2	1.4%	0.8X	1X	2.3%	0.9X	1X	0.7%	1.1X	1.1X	1.5%	1.1X	1.1X
VTM 7.0 vs. VTM 6.2	0.2%	1X	1X	-0.1%	1X	1.1X	5.2%	0.9X	1.2X	5.1%	0.9X	1.2X
VTM 8.0 vs. VTM 7.0	-0.4%	1.1X	1.3X	0.2%	1.1X	1.1X	0.9%	1.1X	1.0X	0.2%	1.1X	1.0X
VTM 9.0 vs. VTM 8.1	1.2%	1X	1X	1.7%	1X	1X	1.1%	1.0X	1.1X	1.1%	1.0X	1.0X

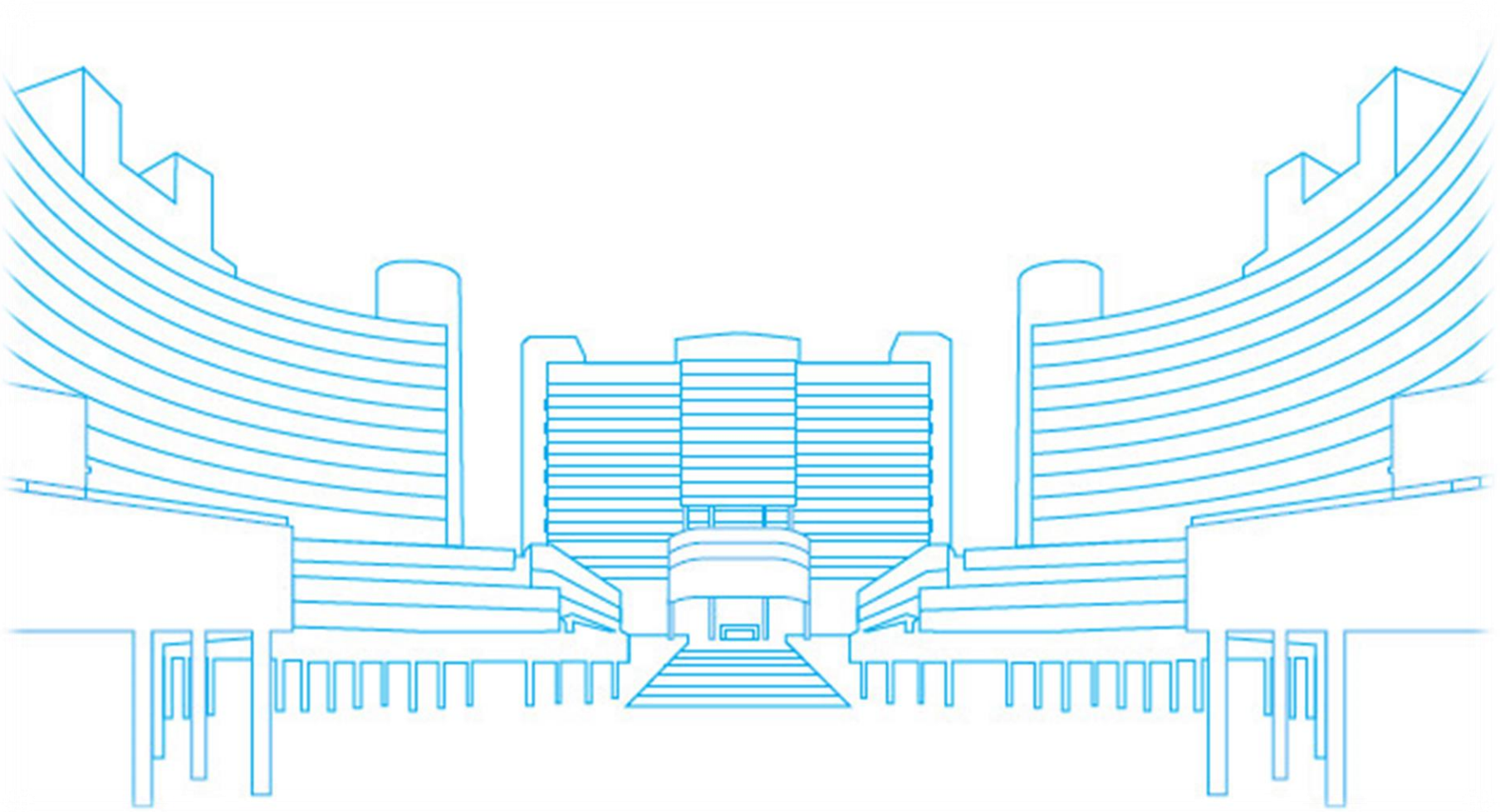
ITRI Industrial Technology Research Institute

Future meetings

#	City	Country	Year	Month
128	Geneva	CH	19	10
129	Brussels	BE	20	01
130	Alpbach	AT	20	04
131	Geneva	CH	20	07
132	Rennes	FR	20	10
133	Capetown	ZA	21	01
134	Geneva	CH	21	03
135	Prague	CZ	21	07
136	???	???	21	10
137	Geneva	CH	22	01

Virtual Meeting

ITRI Industrial Technology Research Institute



ITRI
Industrial Technology Research Institute