Versatile Video Coding (VVC)

on the final stretch

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July 30, 2019 – Mile High Video, Denver, CO, US

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Versatile Video Coding (VVC)

Joint ITU-T (VCEG) and ISO/IEC (MPEG) project

Coding Efficiency

50% over H.265/HEVC

HD / UHD / 8K resolutions

10bit / HDR

Versatility

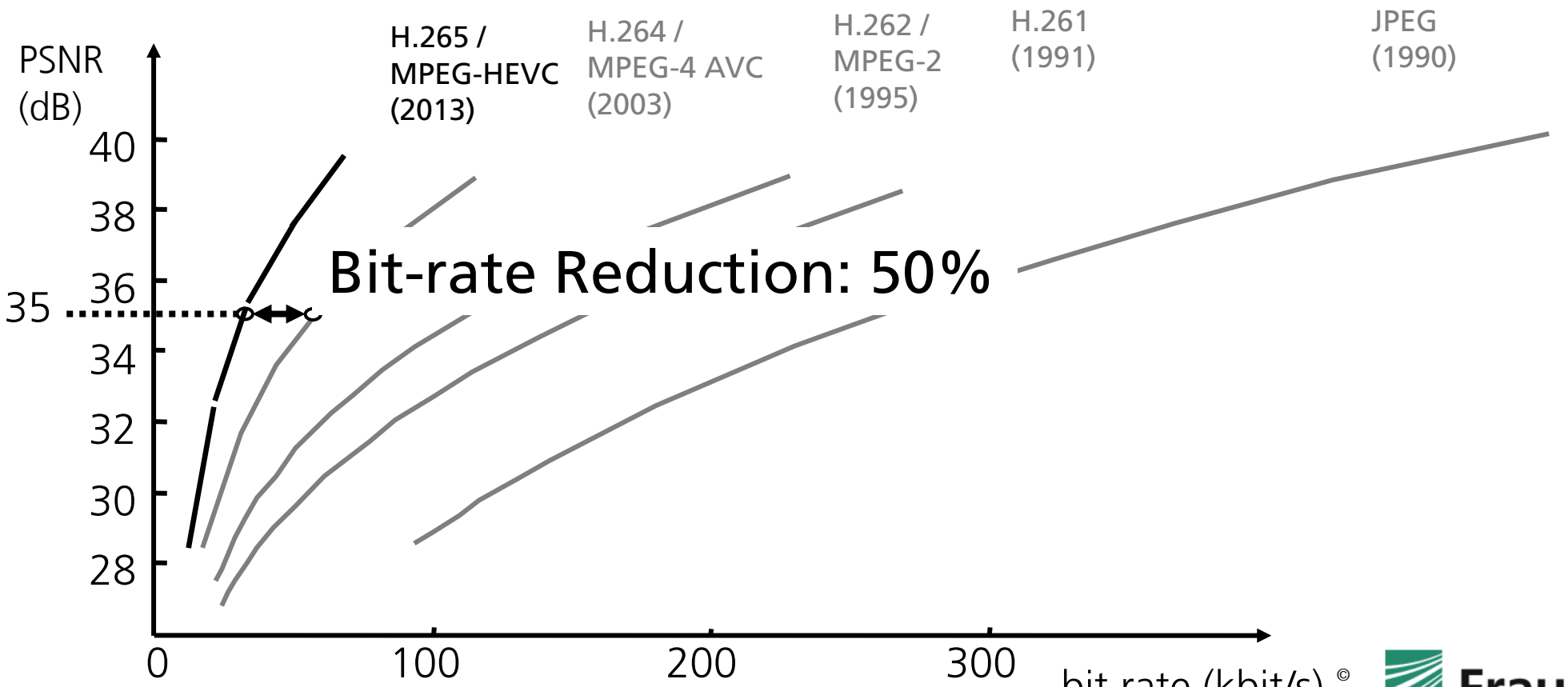
Screen content

Adaptive resolution change

Independent sub-pictures

VVC – Coding Efficiency

History of Video Coding Standards



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VVC – Coding Efficiency

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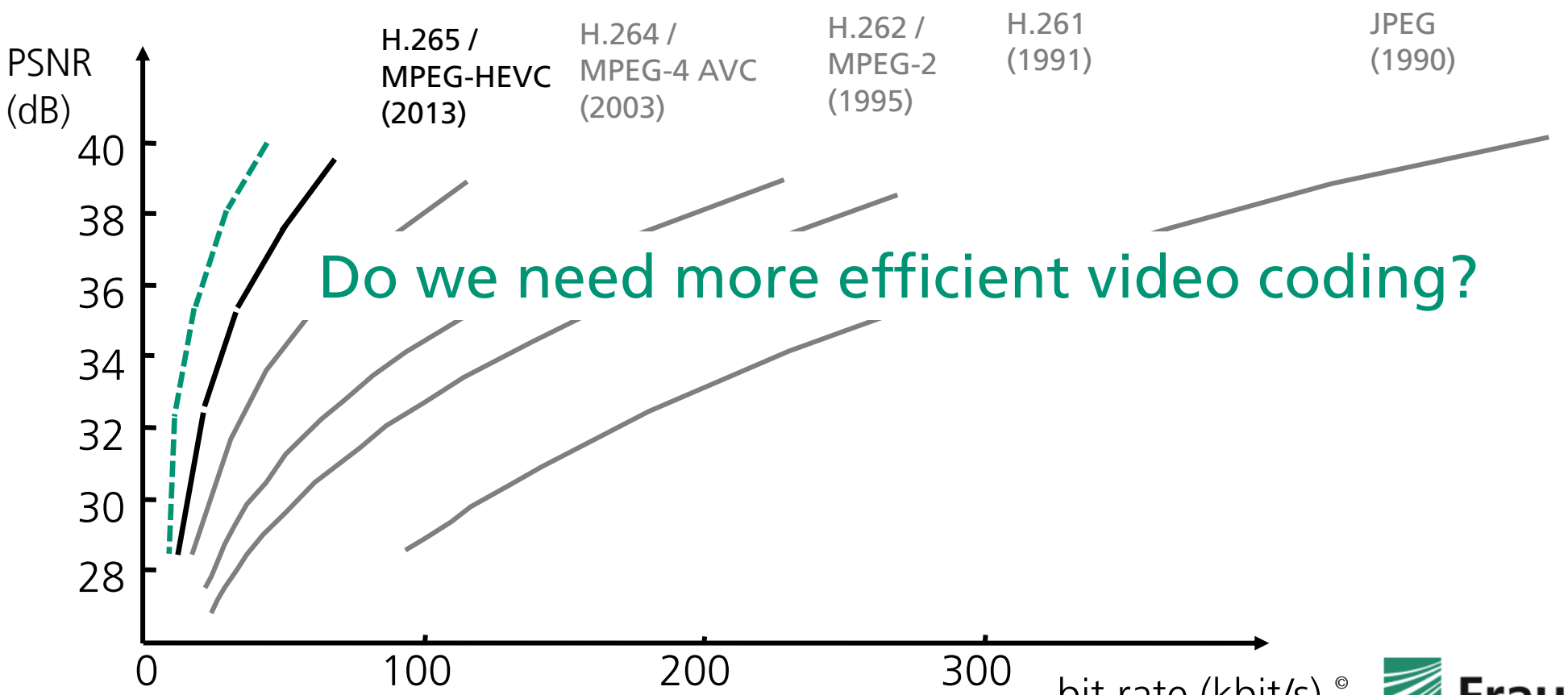

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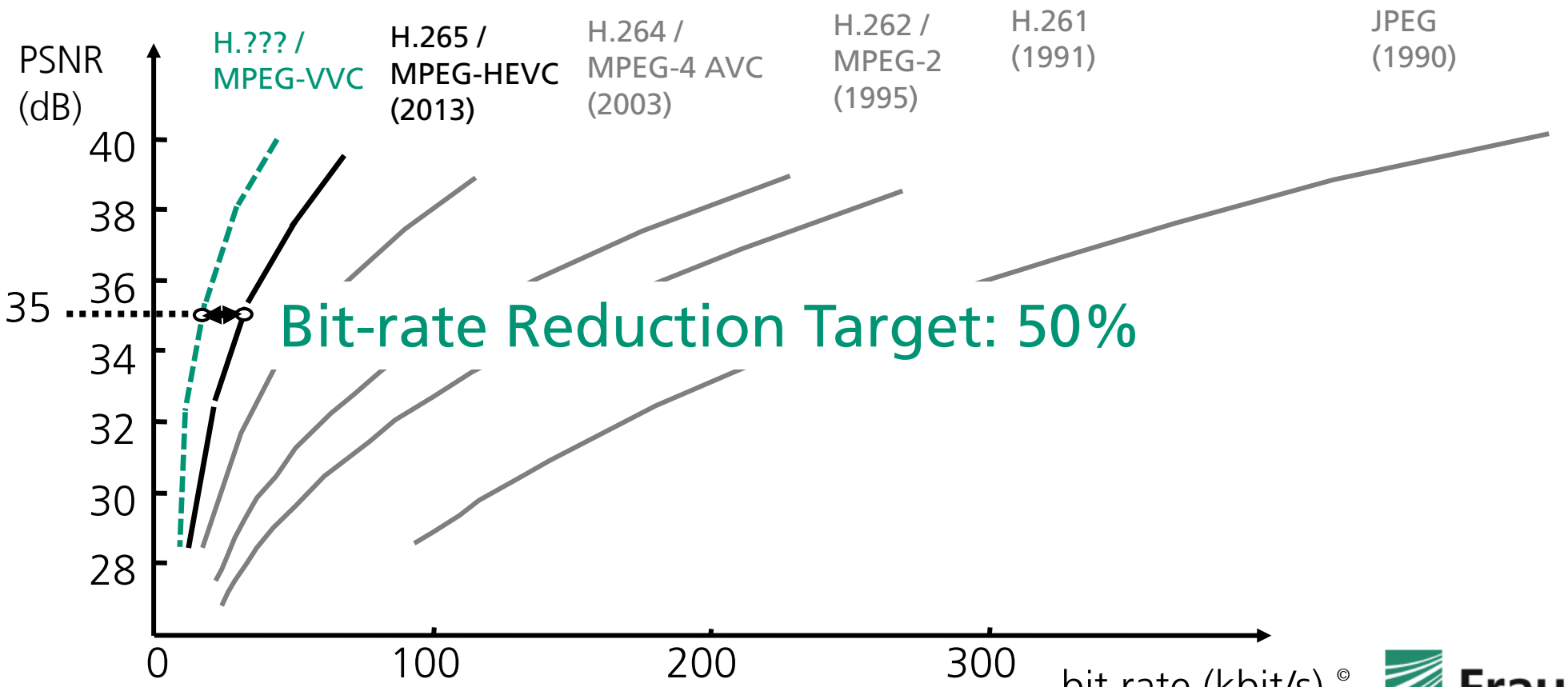
VVC – Coding Efficiency

Jevons Paradox

"The efficiency with which a resource is used tends to increase (rather than decrease) the rate of consumption of that resource."

VVC – Coding Efficiency

Target for the final VVC standard



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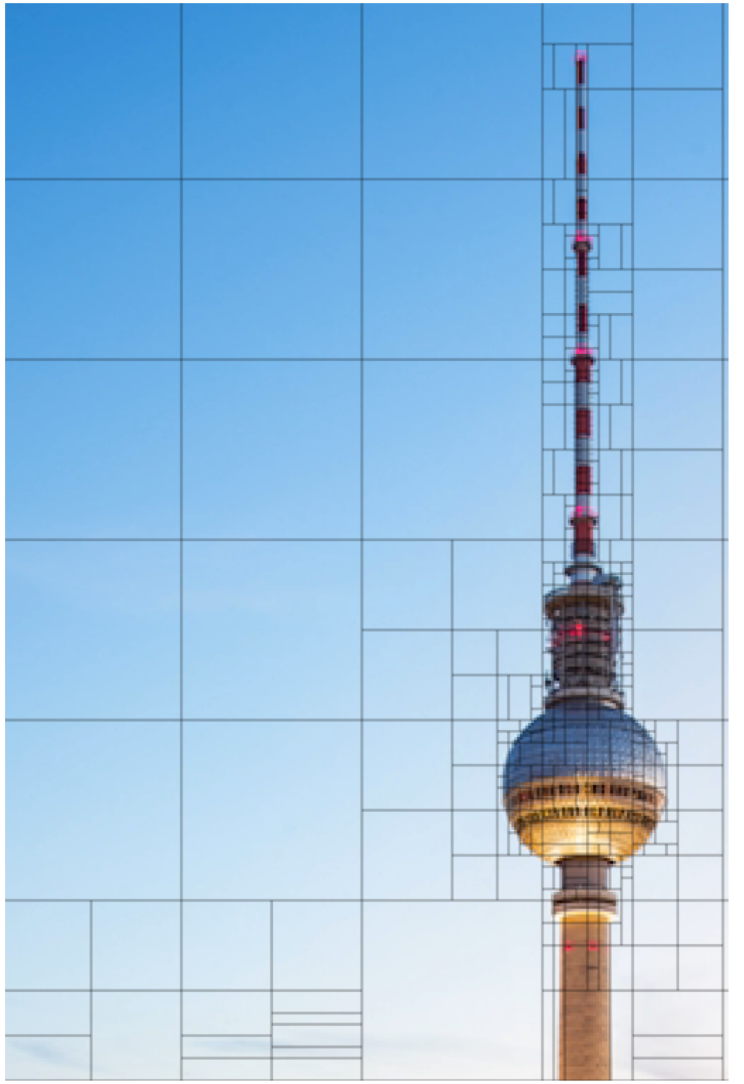
VVC – Coding Efficiency

New coding tools

- Flexible Block Partitioning with Multi-type Tree (MTT)
- Separate Tree for Luma and Chroma (CST)
- Dependent Quantization (DQ)
- Joint coding of chrominance residuals (JCCR)
- Bi-prediction with CU weights (BCW)
- Decoder-side motion vector refinement (DMVR)
- Symmetric motion vector difference (SMVD)
- Sub-block transform (SBT)

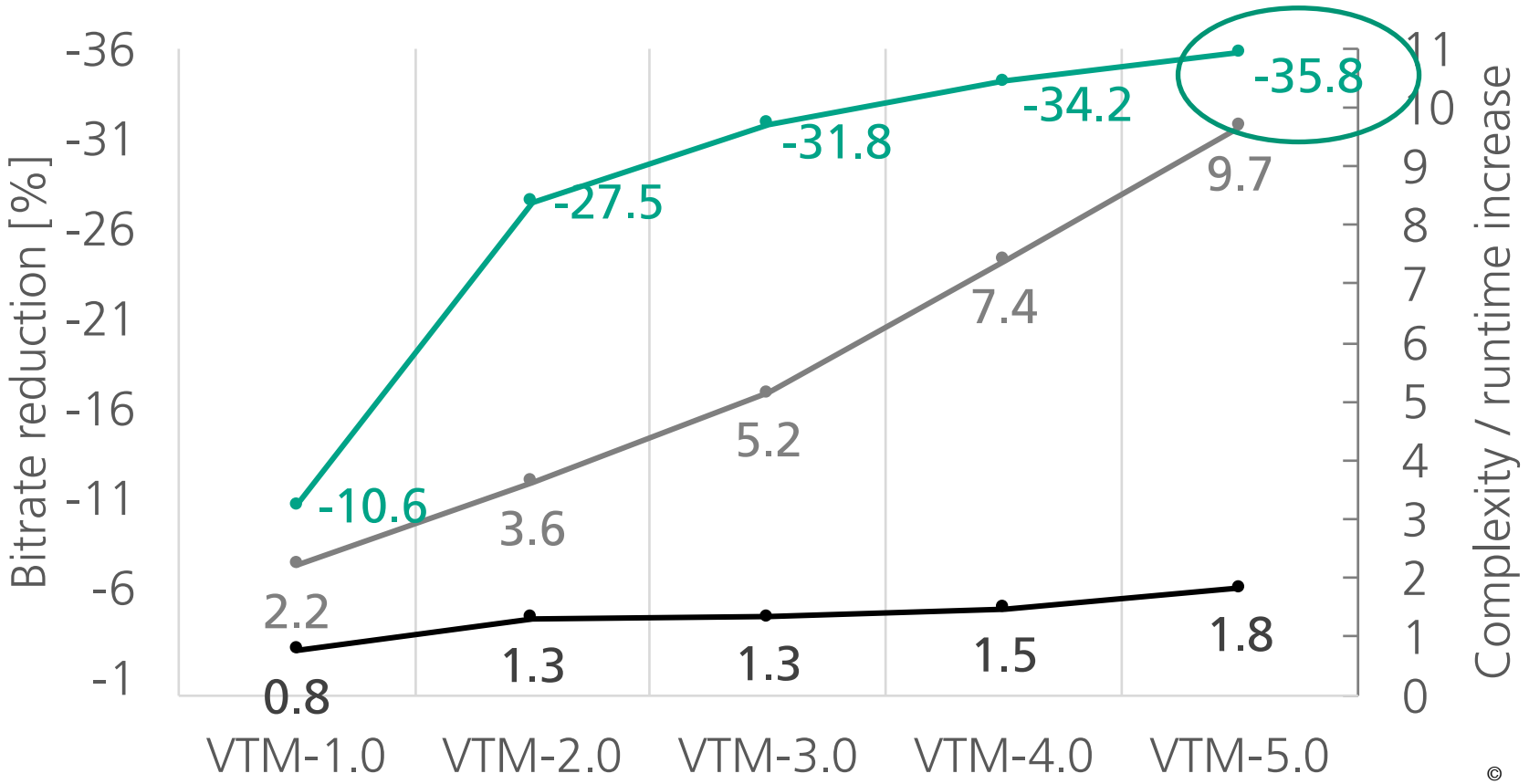
Many small improvements of classic hybrid video coding design

- Affine Motion Compensation
- Subblock-based Temporal Merging Candidates
- Adaptive motion vector resolution (AMVR)
- Triangular partition mode (TPM)
- Bi-directional optical flow (BDOF)
- Merge with MVD (MMVD)
- Intra sub-partitioning (ISP)
- Matrix based intra prediction (MIP)
- Cross-component Linear Model (CCLM)
- Luma mapping with chroma scaling (LMCS)
- Transform Skip Residual Coding (TSRC)
- Quantized residual DPCM …



VVC – Coding Efficiency

VVC reference software (VTM) vs. HEVC reference software (HM)



Same ball park as HEVC vs. AVC

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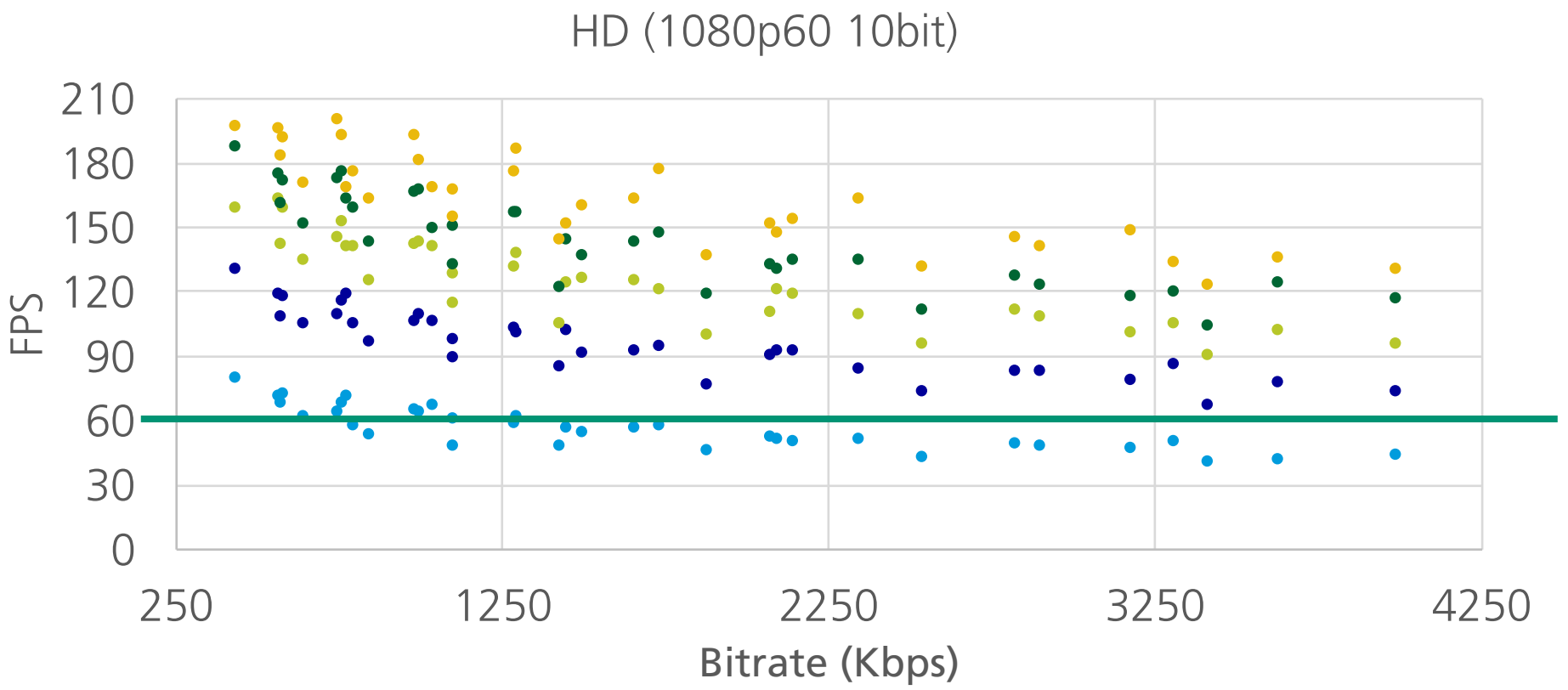
VVC – Coding Efficiency

Fraunhofer HHI live SW decoder on a laptop



Demo
@ IBC 2019
Fraunhofer
booth

>60 fps
2 threads

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Done!

Versatility

Screen content

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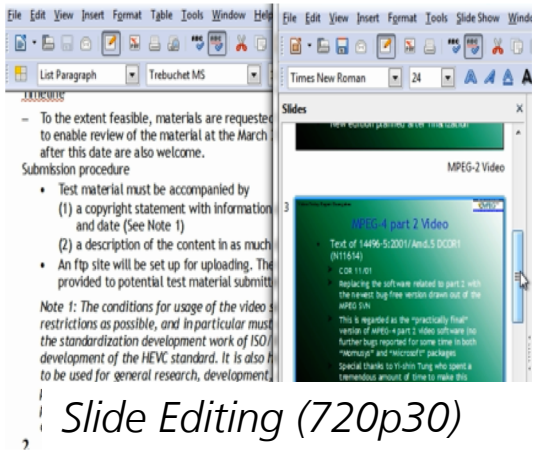
VVC – Versatility

Screen content coding (SCC)

- Application: new emerging content
  - Gaming
  - Screen sharing / remote desktop
  - …

Arena of Valor (1080p60)



Slide Editing (720p30)

- Problem: Video codecs typically optimized for natural video (different signal characteristic)
- Solution: Special screen content coding tools

  HEVC v4 SCC extensions -> not in main profile!

  VVC supports SCC already in v1

VVC – Versatility

Reference picture rescaling (RPR)

- Application: Adaptive streaming with resolution switching
- Problem: Pictures with different resolutions cannot reference each other in inter-picture prediction -> reduces coding efficiency
- Solution: Rescale reference picture in case of different resolutions

  VVC supports reference picture rescaling

  More efficient rescaling filters currently under investigation

  RPR as enabler for spatial scalability in VVC v1 (exact design under investigation)

VVC – Versatility

Independent sub-pictures

- Application: Tiled streaming of 360-degree videos

- Problem: Managing a decoder pixel budget dynamically post-encoding

  -> throwing 24K video (parts) at a 4K decoder

- Solution: More efficient coding of independent sub-pictures (in-picture padding)

  Flexible block addressing for easier extraction and merging of sub-pictures

  HLS design to avoid slice header rewriting

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Done!

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Versatility

Screen

Almost Done!

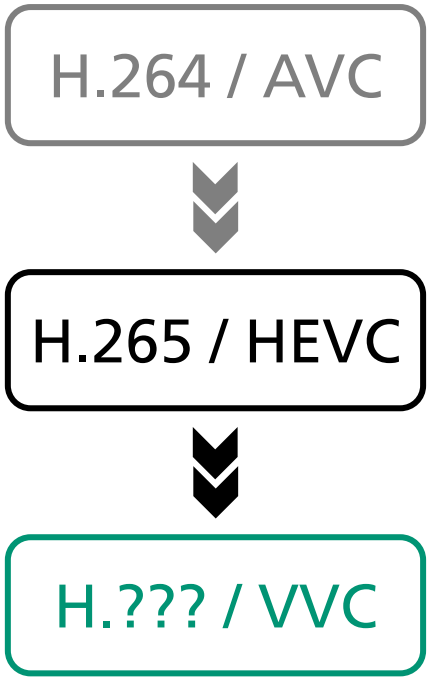
Adaptation change

Independent sub-pictures

Versatile Video Coding (VVC)

Summary

- Coding Efficiency – VVC Test Model 5.0 over HEVC (HM)
  - 36% bitrate reduction for HD and UHD
  - 9.7x encoder and 1.8x decoder runtime
- Versatility – enabled by:
  - Screen content coding tools (gaming, screen sharing,…)
  - Reference picture rescaling (adaptive streaming)
  - Spatial scalability using RPR scaling filters
  - Independent sub-pictures (360 video, ROI)
- Final Standard by July 2020



Thank you very much!

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