3D Video Coding

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Outline

- **Stereo Video Coding**
  - Stereo High Profile of H.264/AVC
  - Stereo SEI Message
- **Multi-view Video Coding**
  - Standardized MVC
  - Why depth is necessary for autostereoscopic displays?
- **Depth-Enhanced Stereo**
  - Depth coding using MVC
  - Depth coding using Platelets

Stereo Video


anaglyph

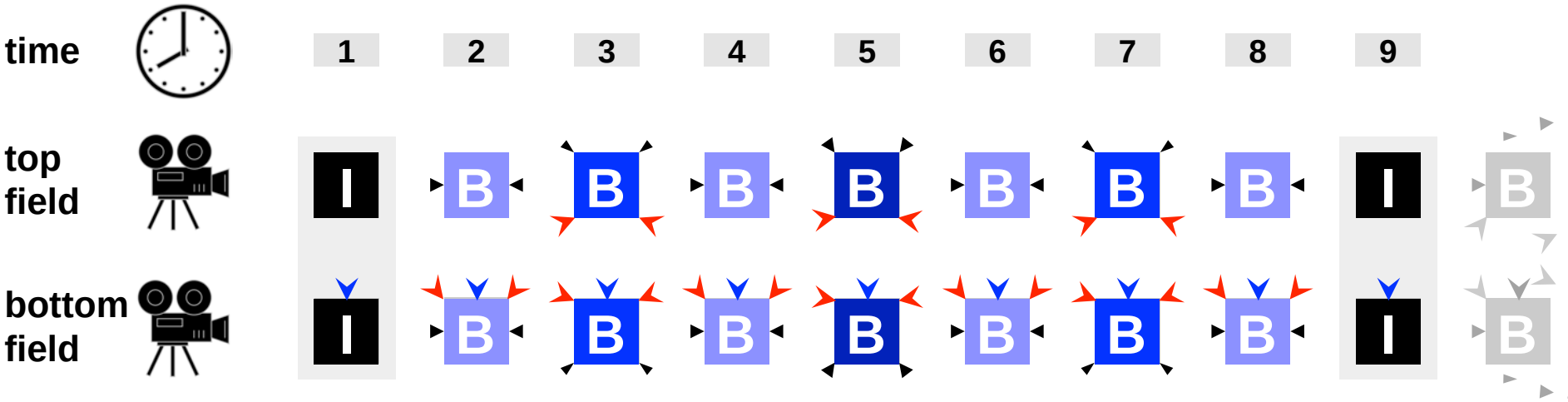

polarized


shutter

- Standard format for 3D Cinema and consumer displays
- Only color pixel video data are involved, but no scene geometry information

Coding of Stereo Video

- Simulcast
- Multi-View Video Coding
  (Stereo High Profile H.264/AVC -> Blu-Ray)
- Stereo SEI Message in H.264/AVC
  (not backward compatible)



Coding Results – Dog: 1.7 dB Gain

high

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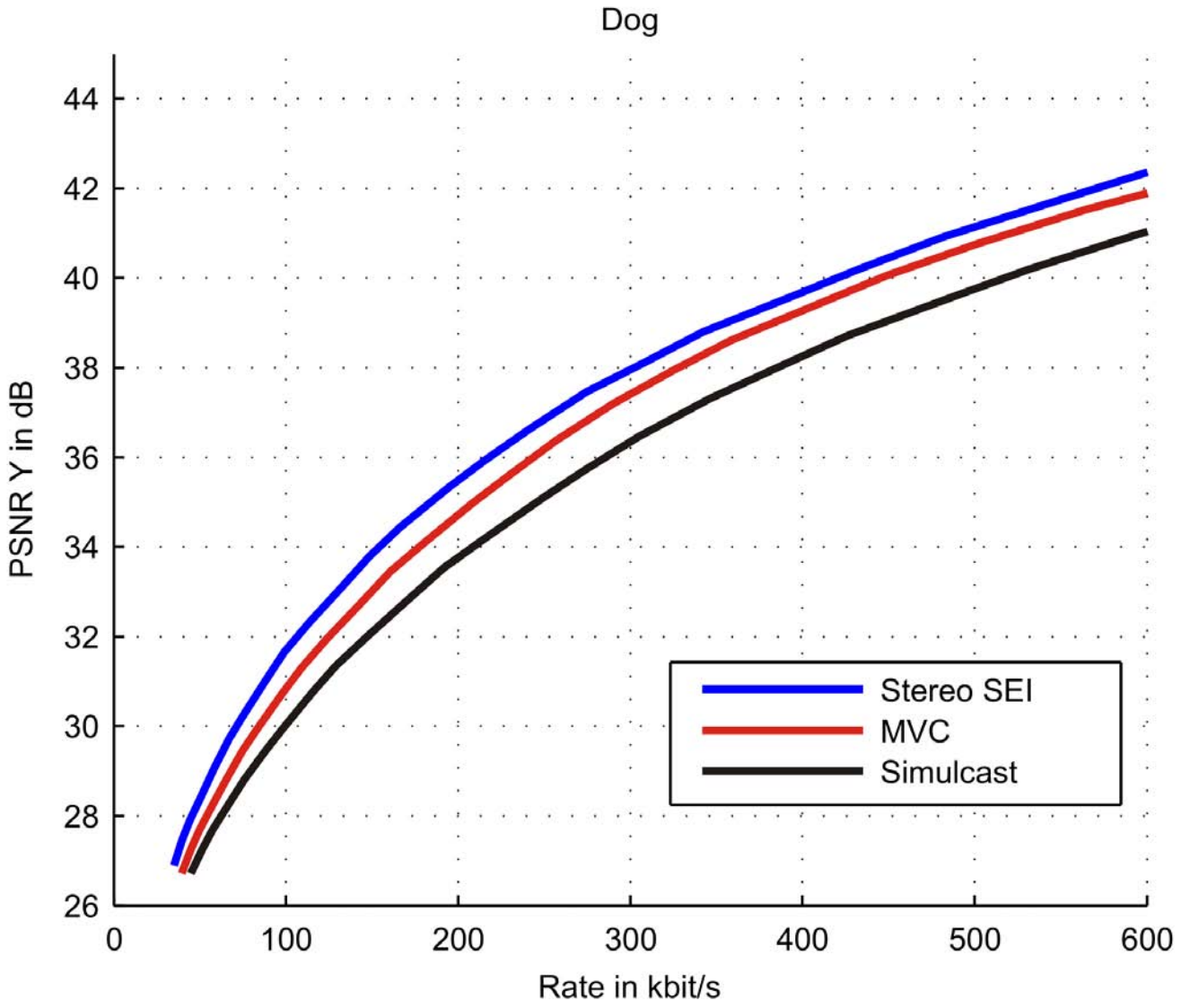
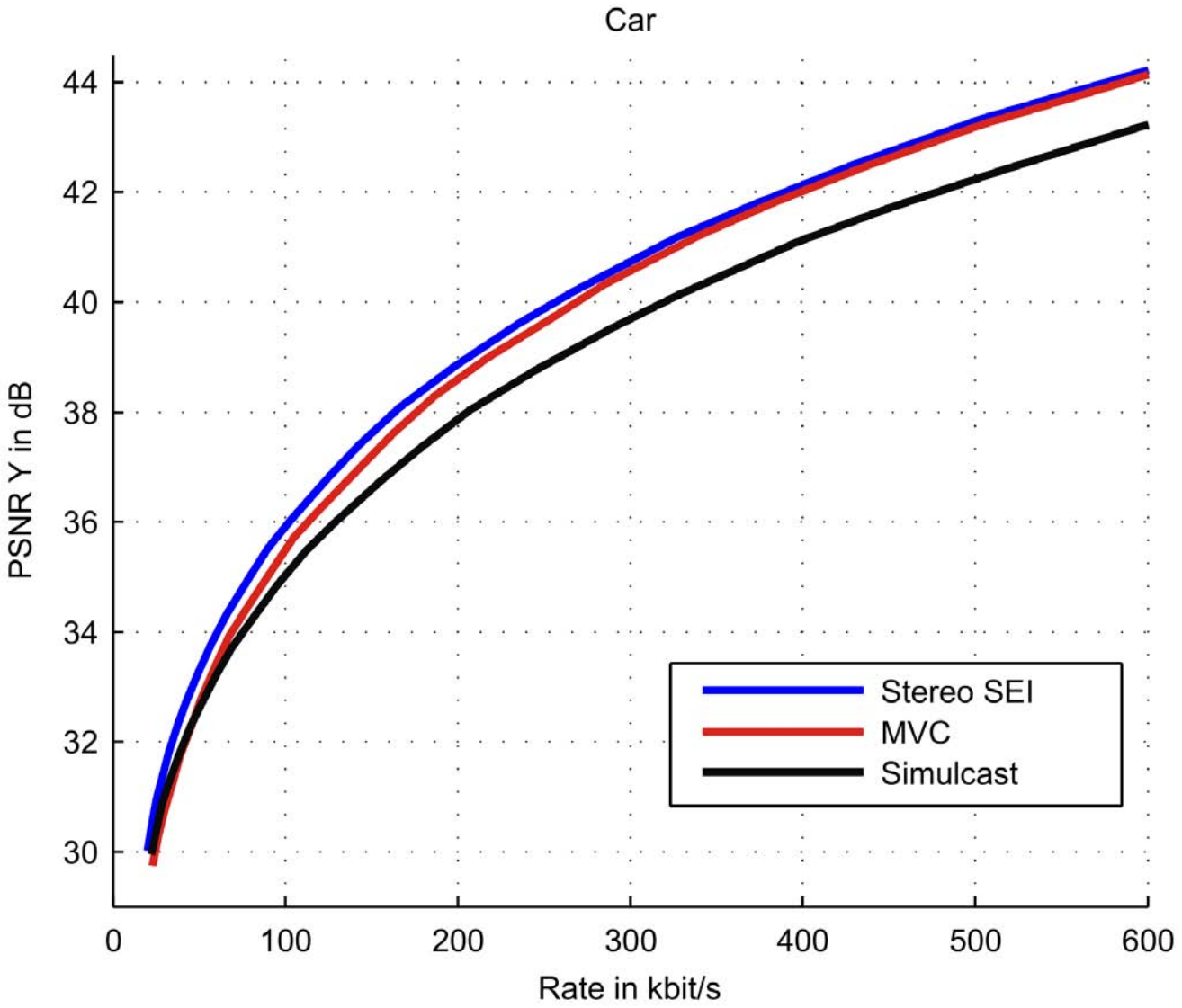
Quality

˅

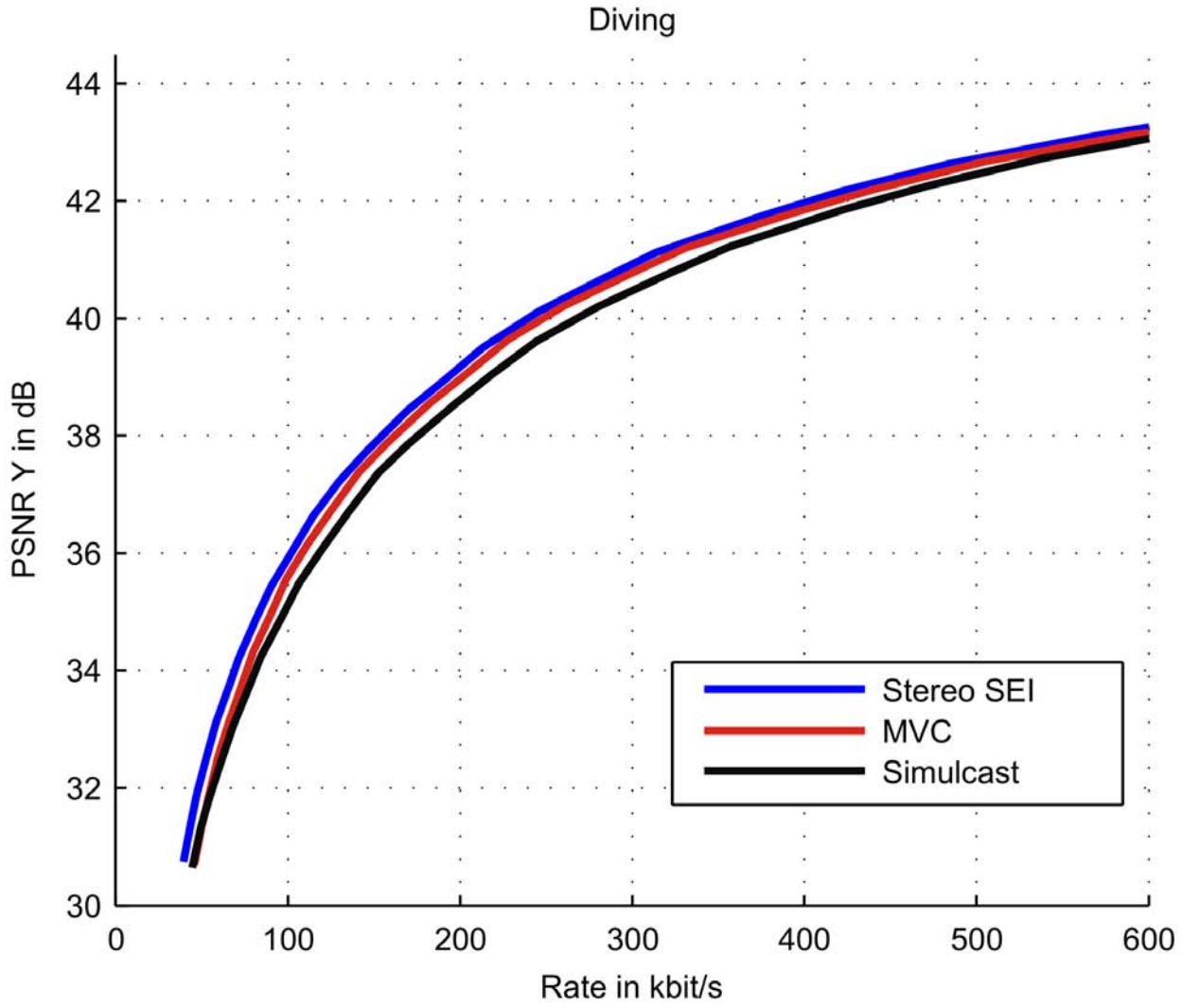
low



Coding Results – Car: 1 dB Gain



Coding Results – Diving: 0.5 dB Gain

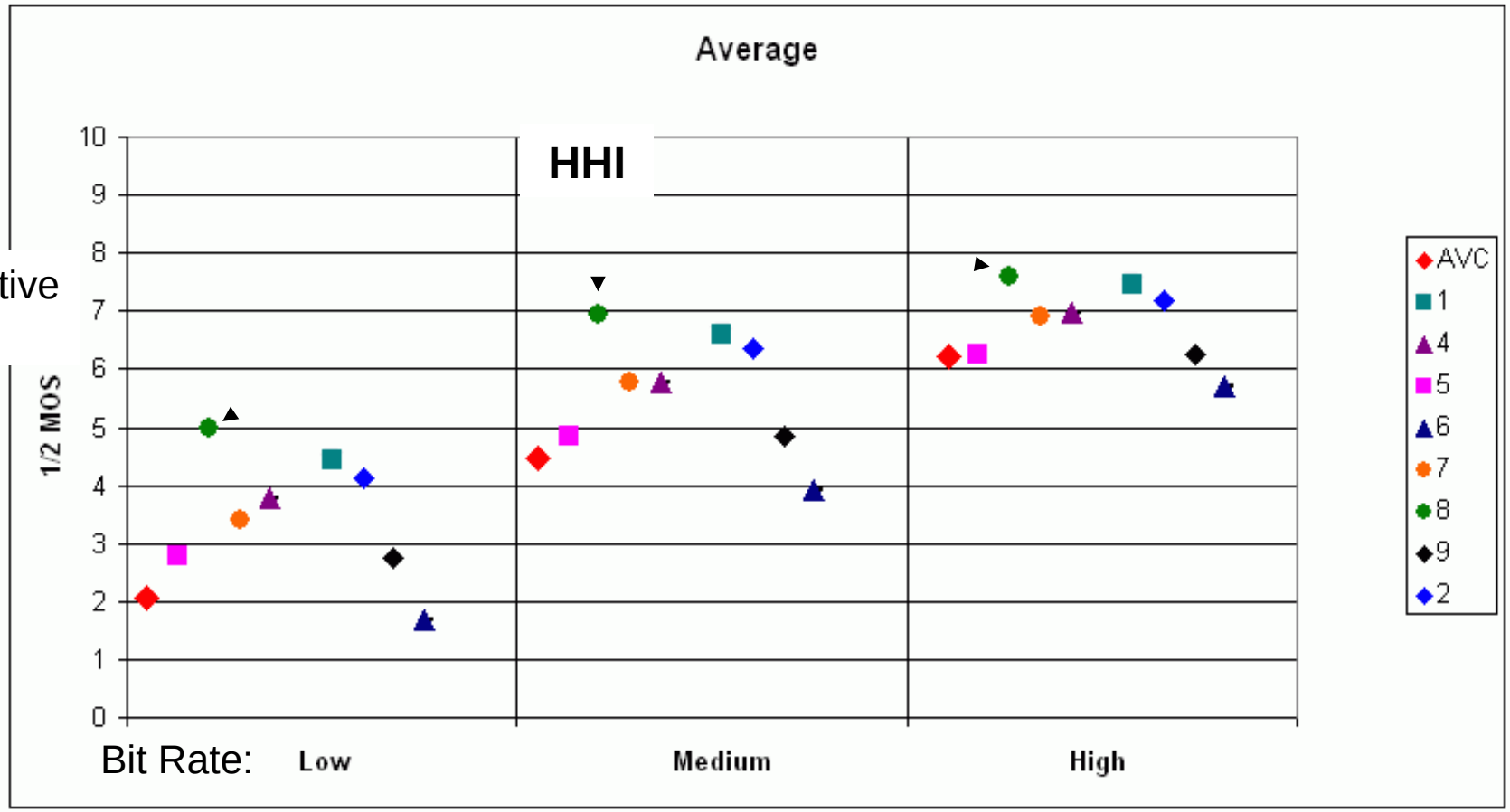


3DTV with Eye Glasses

Multi-View Video (MVV)

- Call for MVC in MPEG and JVT
- 8 responses to the Call for Proposals on MVC had been received:
  - 5 from industry(-cooperations),
    2 from research institutions,
    1 from a university
  - 2 from Korea, 2 from Japan,
    2 from USA, 2 from Germany

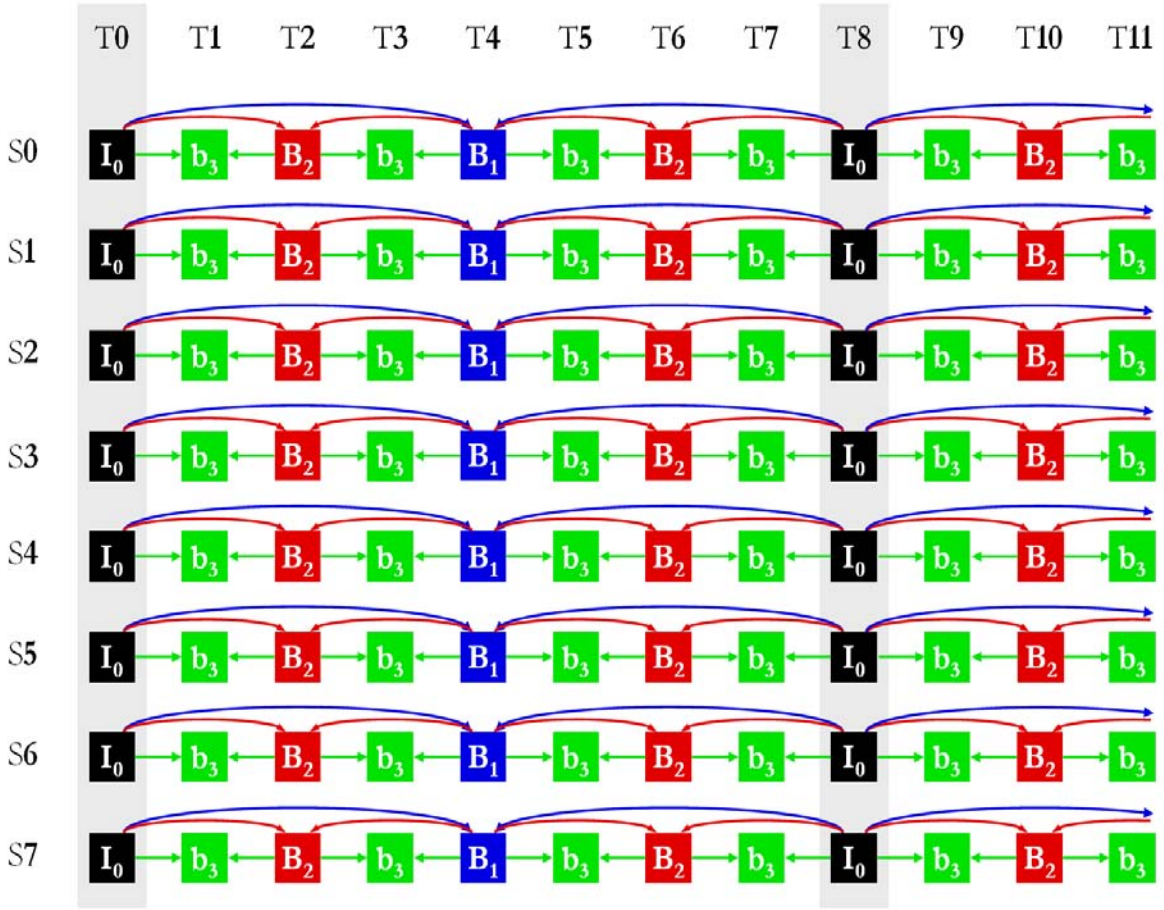
MVC Coding Results Summary



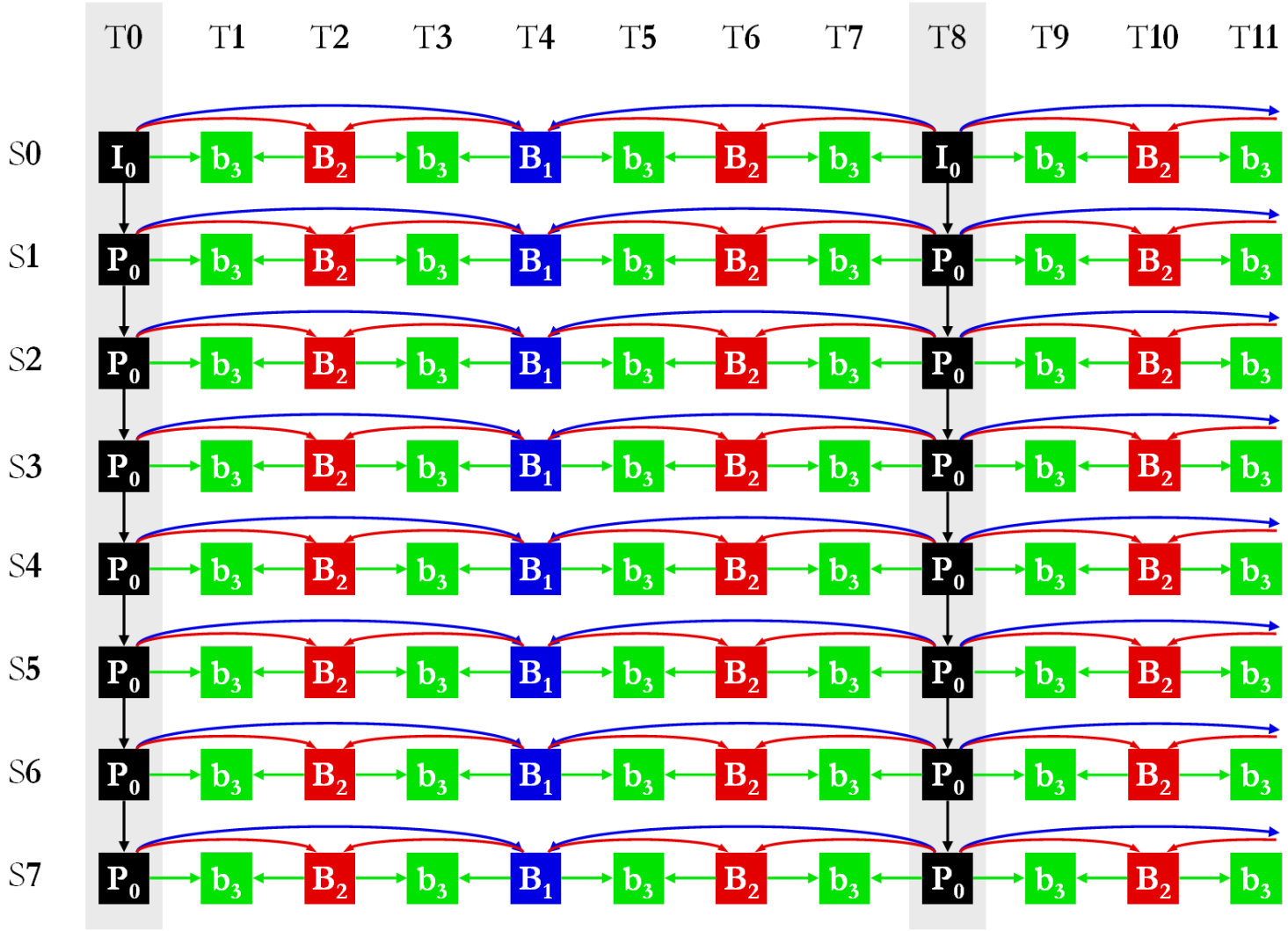
H.264-based solution by HHI gave best performance – All proposed improvements performed worse

Temporal Coding Structure (Simulcast)

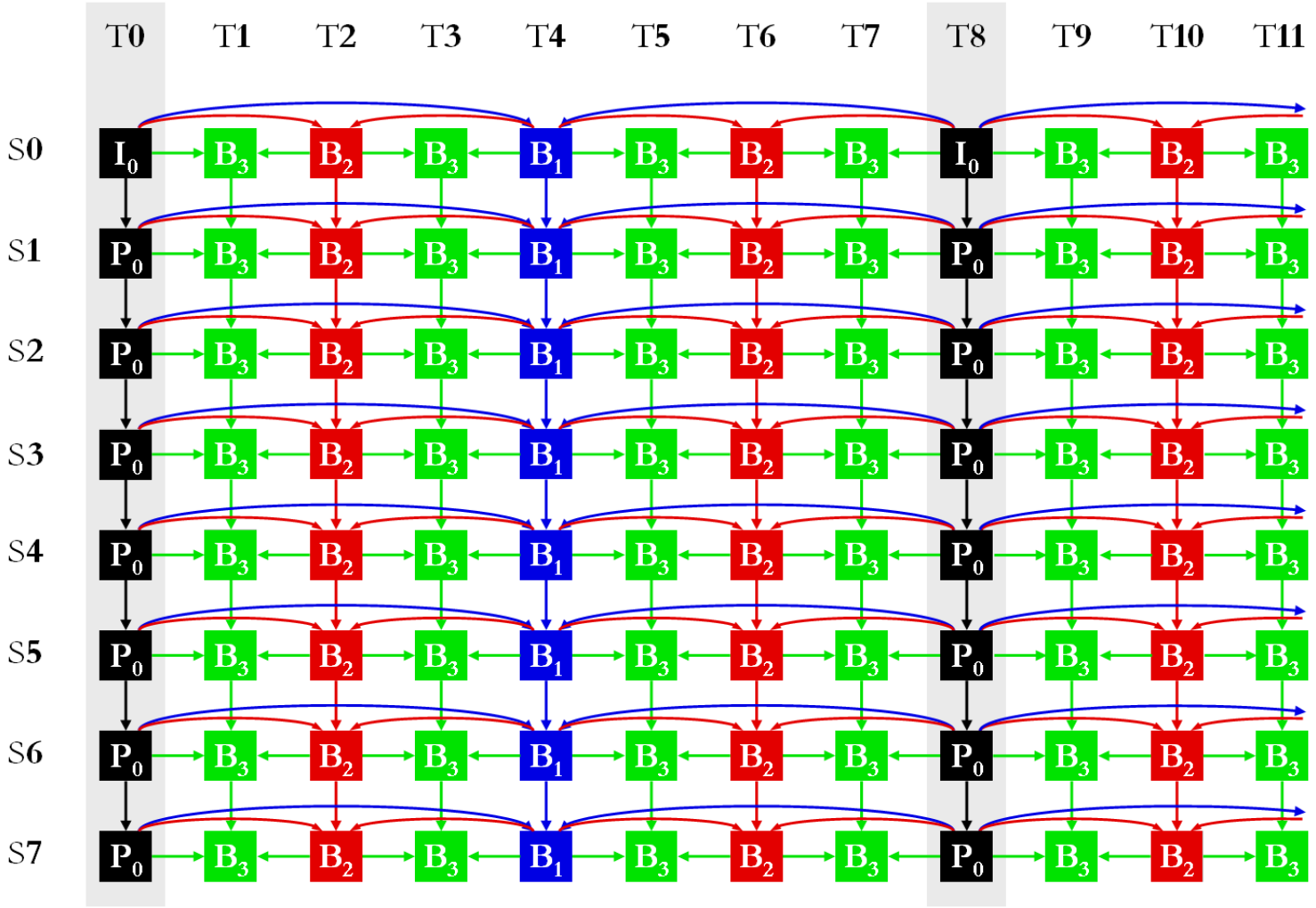
Temporal prediction using hierarchical B pictures



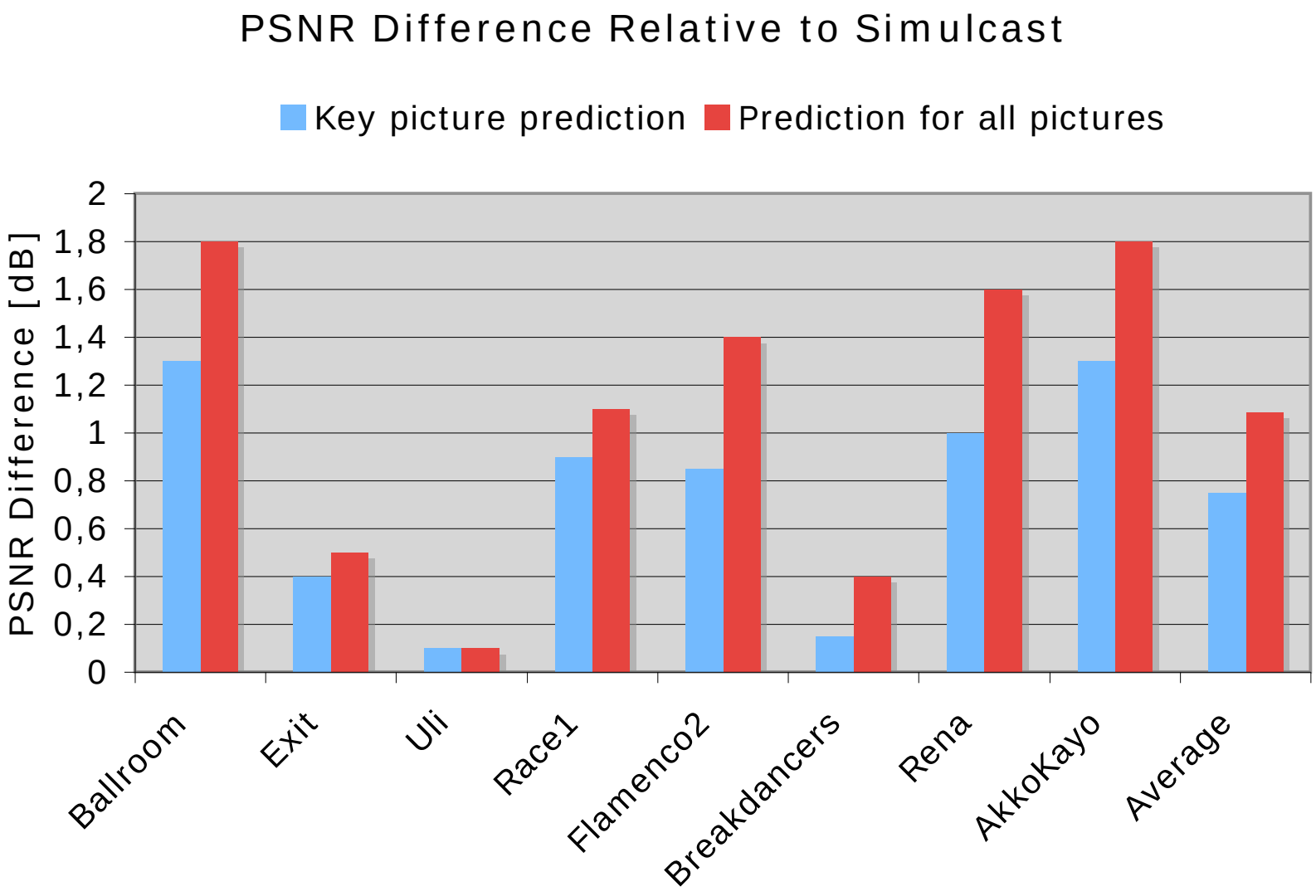
Inter-view Prediction for Key Pictures



Inter-view Prediction for All Pictures

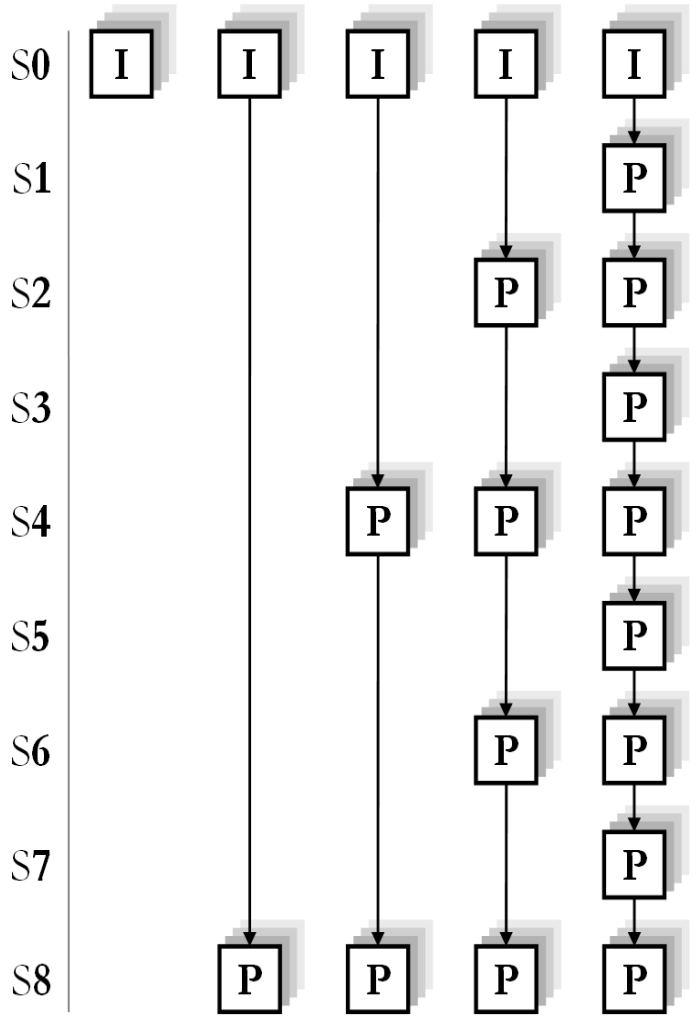


Results for all Test Sequences



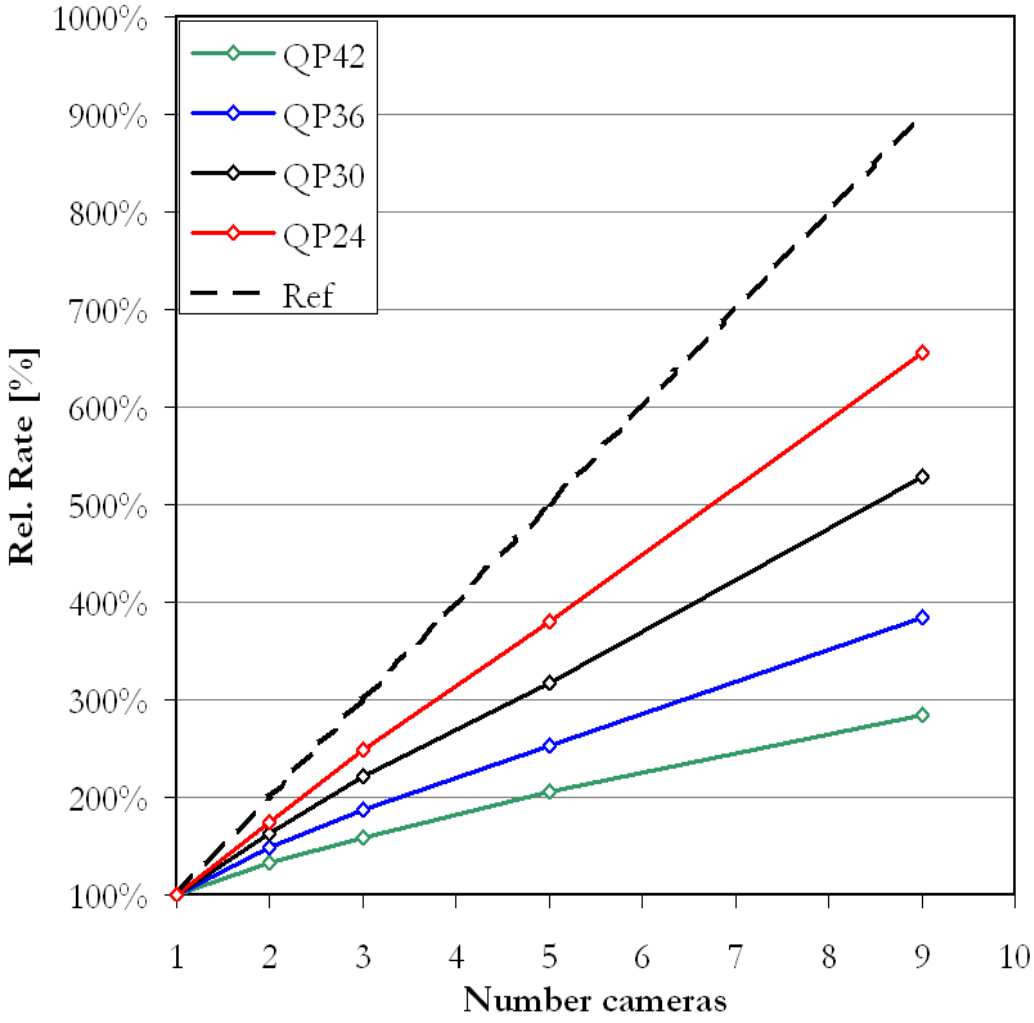
View Distance Variation Experiment

- Experiment for Rena sequence
- Linear camera setup, parallel view axis
- 13 cameras
- Inter-view prediction with different camera distances
- Realization by omitting original views



Bit Rate Reduction Results

- **Bit rate reduction for inter-view prediction**
- **Higher reduction for:**
  - Smaller camera distances
  - Lower reconstruction quality
- **Linear dependency!**
- **Reduce number of views as much as possible**



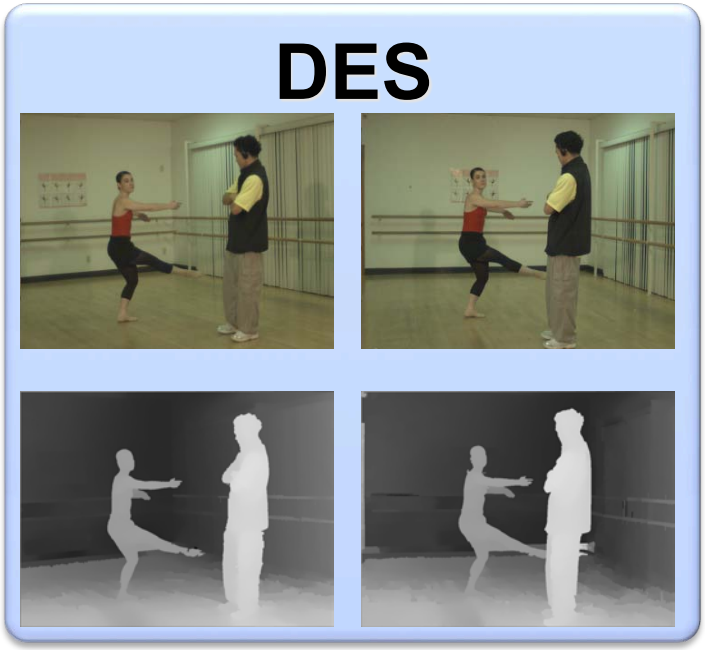
Interpolation Example: Varying Number of Views

- Linear camera setup, parallel view axis, 13 cameras
- No consideration of scene structure: bilinear view interpolation

7 views

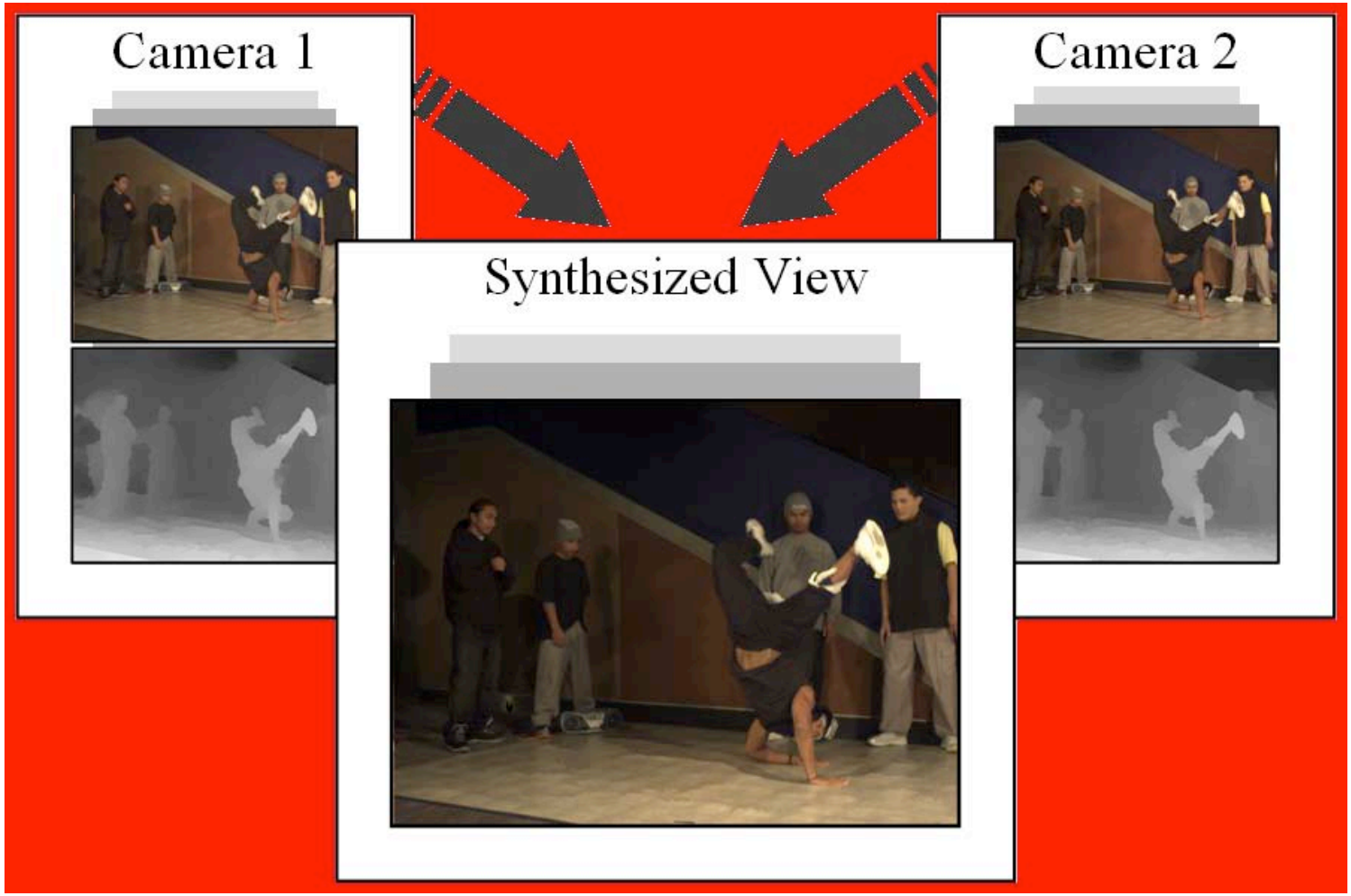
2 views

Depth-Enhanced Stereo (DES)



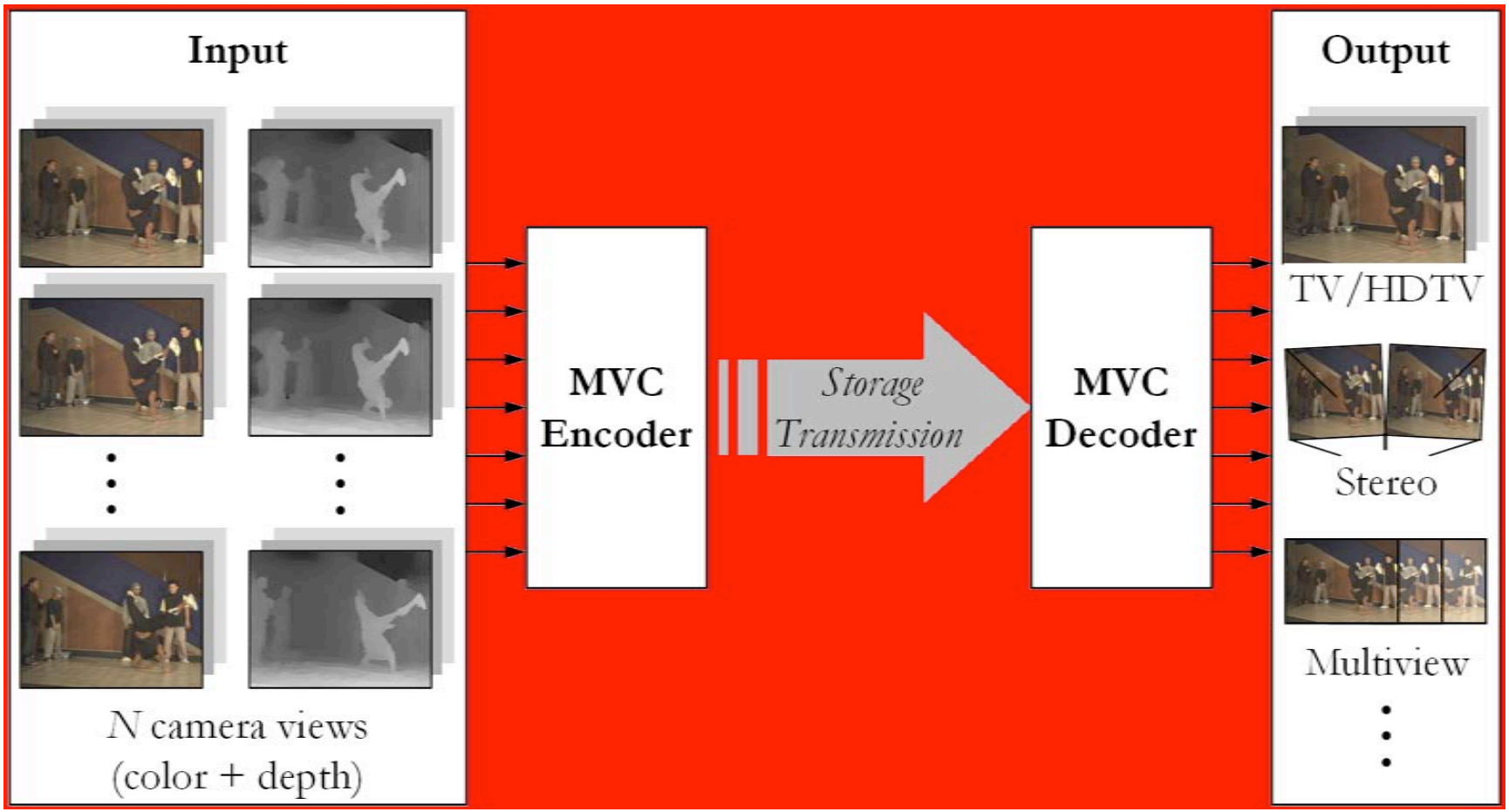
- Can be extended to Multi-view video plus depth (MVD)
- Can be condensed to Layered Depth Video (LDV)
- Logarithmical depth quantization between z_{near} and z_{far} clipping plane

View Synthesis



Rendering arbitrary intermediate viewpoints of the scene

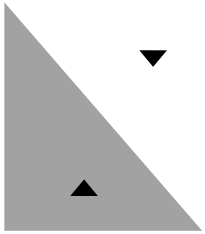
Multi-view or Stereo Plus Depth Coding



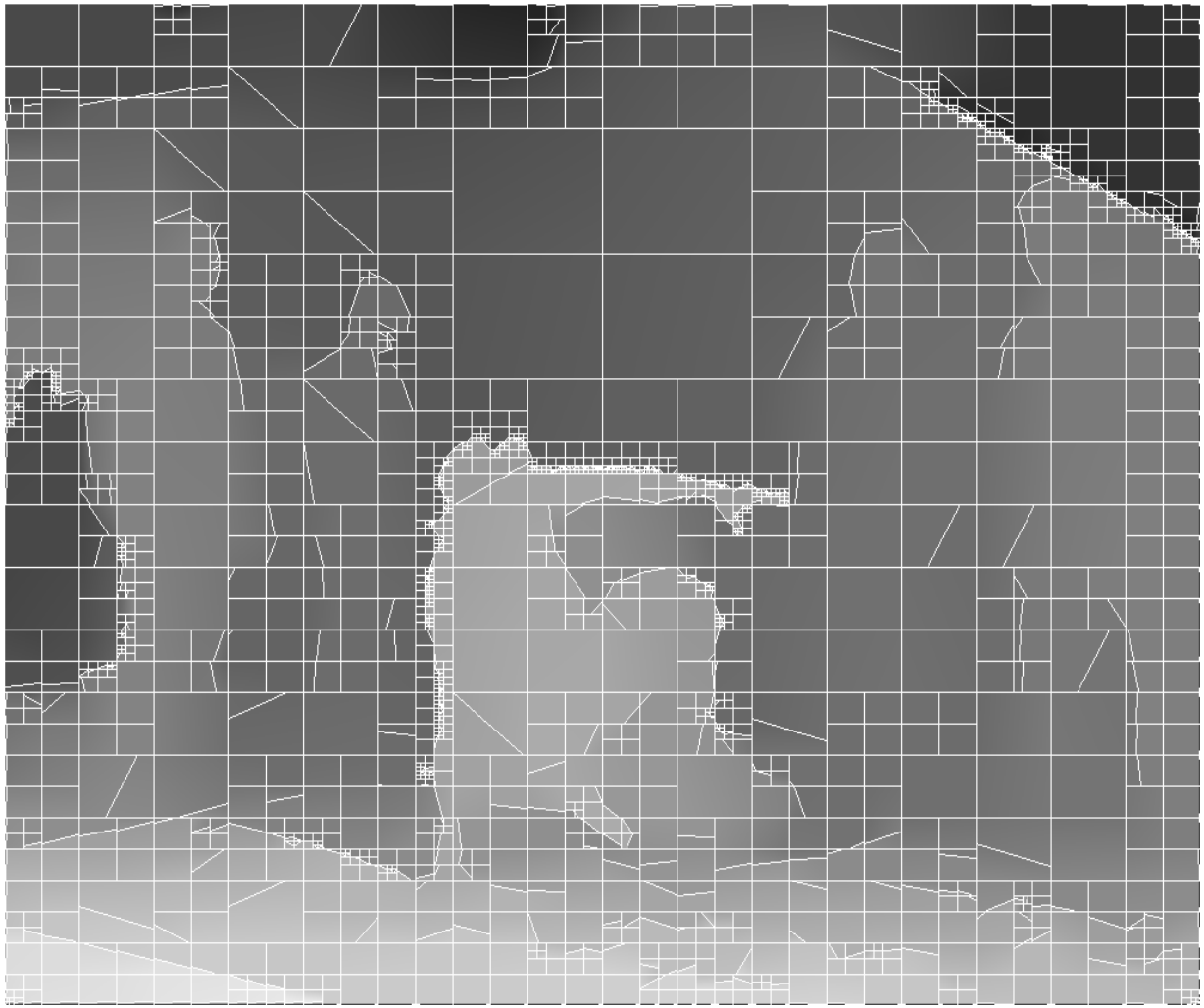
Depth-Map Coding Using MVC

Depth Coding using Platelets

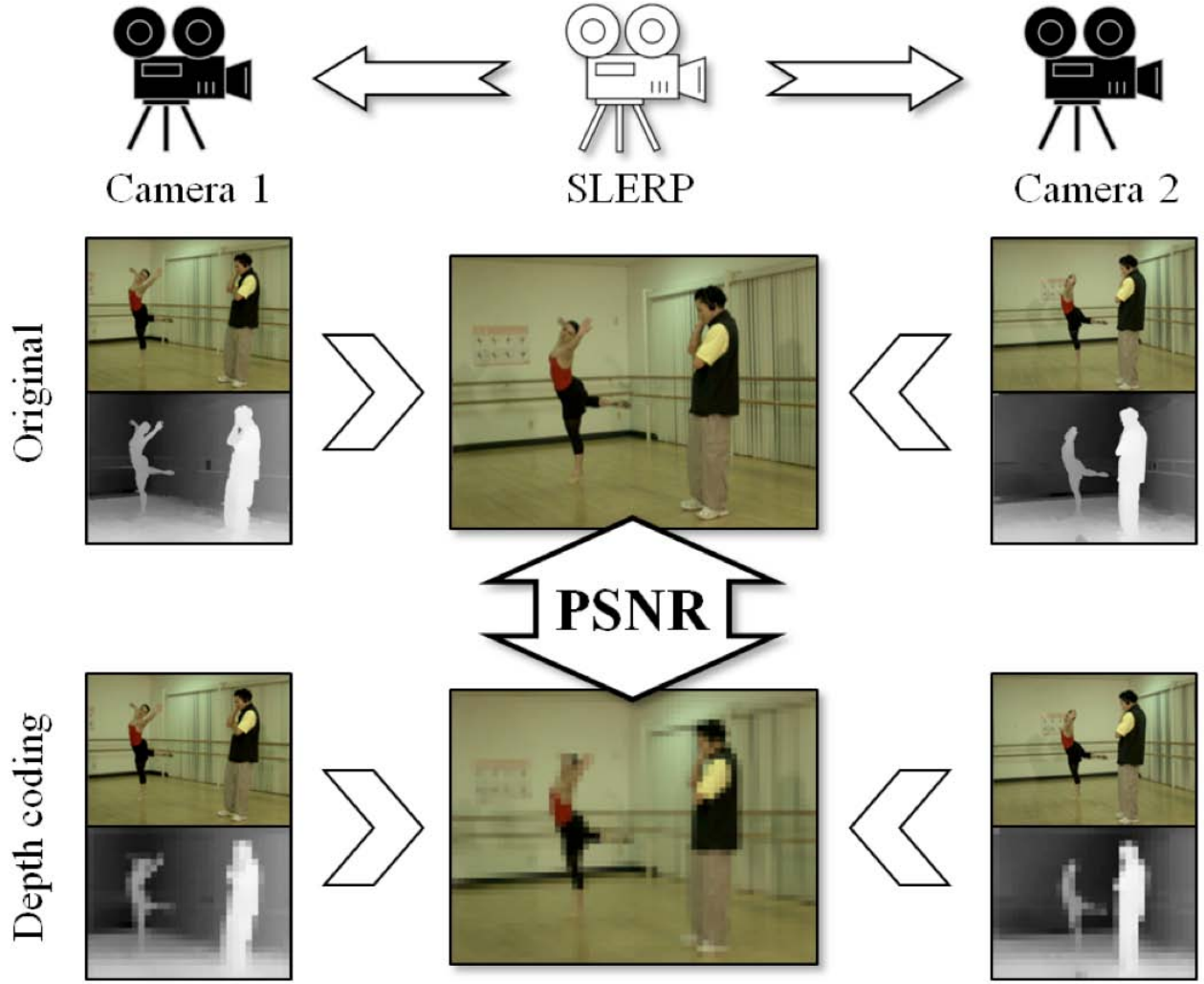
Depth 0



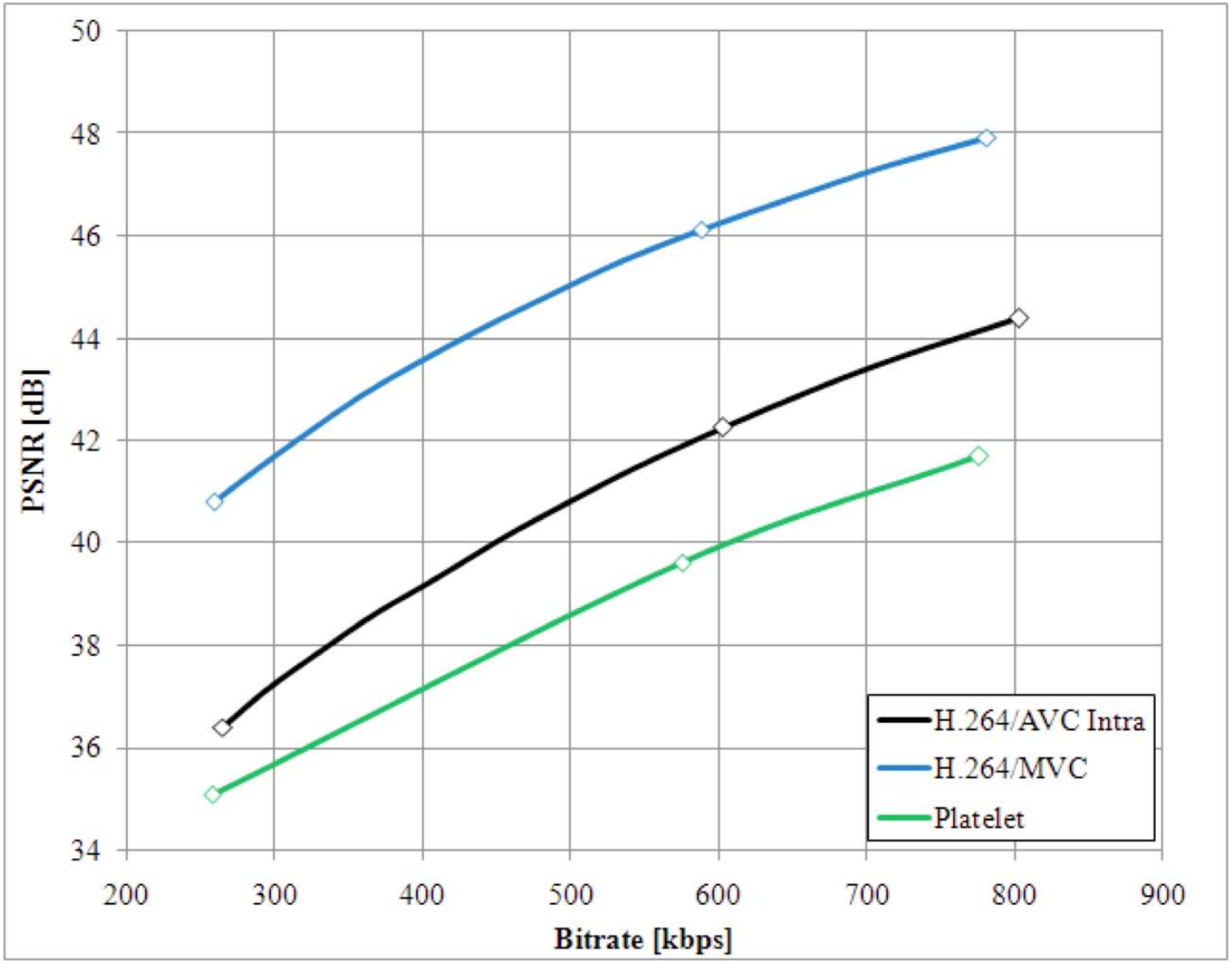
Depth 1



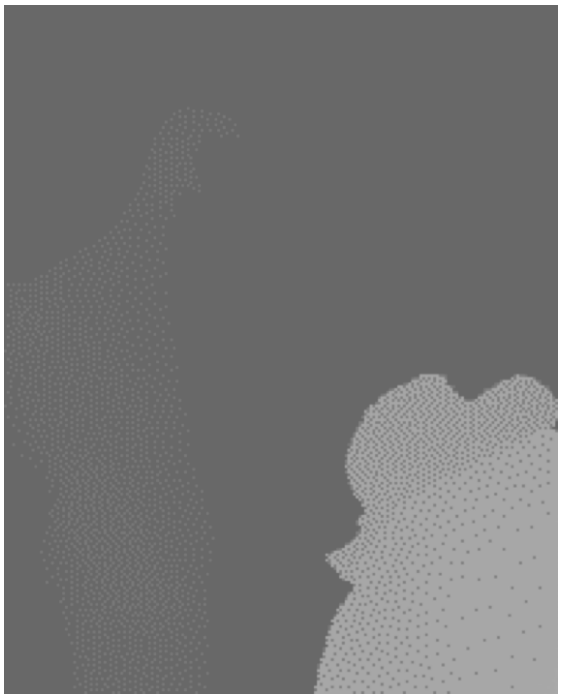
Quality Measurement



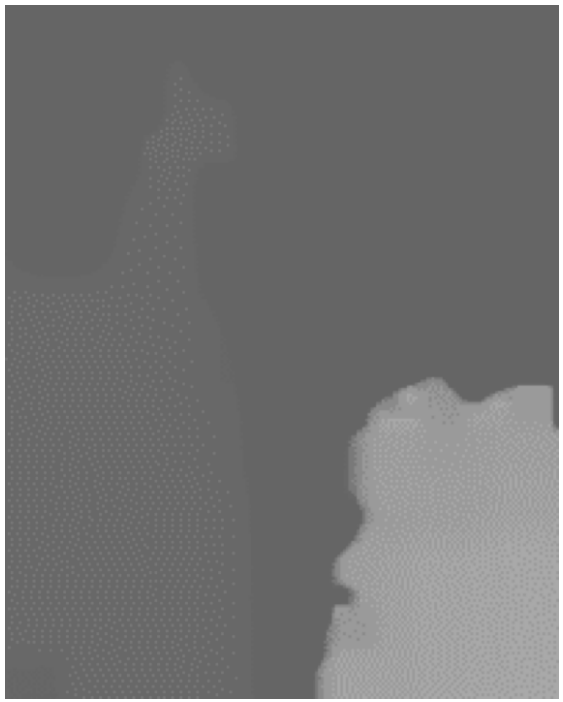
PSNR Results



Coding Results for Depth Maps



Original



MVC

Platelet

Subjective Quality

Original

MVC

Platelet

Summary

- Stereo video will be introduced using Stereo High Profile of H.264/AVC
- Backwards compatible with 2D H.264/AVC High Profile
- Stereo High is derived from Multi-View Coding (MVC originally proposed by HHI)
- Bit rate is linearly proportional to number of views
- Depth-Enhanced Stereo allows for view generation at the receiver using depth information
- Efficient compression of depth maps and DES is future challenge

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