INTERNATIONAL ORGANISATION FOR STANDARDISATION
ORGANISATION INTERNATIONALE DE NORMALISATION
ISO/IEC JTC1/SC29/WG11
CODING OF MOVING PICTURES AND AUDIO

ISO/IEC JTC1/SC29/WG11
MPEG/M16328
April 2009, Maui, Hawaii

Title	**Results of Exploration Experiments in 3D Video Coding, described in w10360, for Alt Moabit sequence.**
Sub group	**Video**
Authors	**Olgierd Stankiewicz** (ostank@multimedia.edu.pl), **Krzysztof Wegner** (kwegner@multimedia.edu.pl) and **Krzysztof Klimaszewski** (kklima@et.put.poznan.pl) Poznań University of Technology, Chair of Multimedia Telecommunications and Microelectronics, Poznań, Poland

1 Introduction

This document presents results of Exploration Experiments (EE1,EE2) performed on "Alt Moabit" sequence [2] and is in response to w10360 "Description of Exploration Experiments in 3D Video Coding" [1].

2 Experiments conditions

Experiments were performed basing on w10360 [1] guidelines (Figure 1):

- **Select stereo pair** from data set, i.e. an original left view OL and an original right view OR (OL=8, OR=9)
- **Estimate depth** corresponding to neighboring original views NL (left) and NR (right) (NL=7, NR=10), using any available camera
- **Synthesize views** (synthesized left SL and synthesized right SR) at positions of OL and OR from NL+D and NR+D
- Bring synthesized video to the meeting
- **Compare OL-OR with SL-SR** subjectively

The test were performed on 'Alt Moabit' [2] sequence with following views selected as OL-OR and NL-NR.

Table 1. The specification of view for EE experiment.

Data set	OL-OR	NL-NR
Alt-Moabit	8-9	7-10

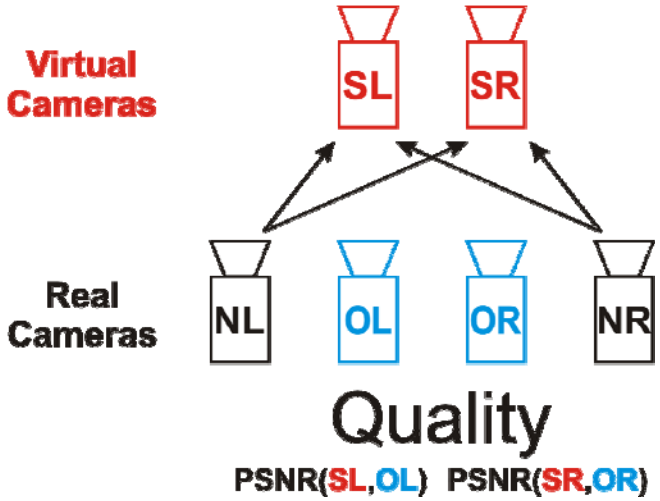
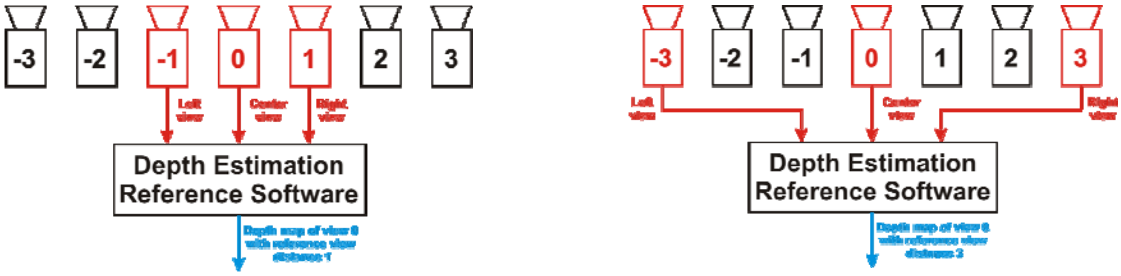


Figure 1. Setup of experiments for depth-estimation/view-synthesis software evaluation.

The depth estimation was performed with various Camera Distance (Figure 2) parameters– from distance 1 to distance 5.



a) Camera distance 1 b) Camera distance 3

Figure 2. Setup of experiments for depth-estimation/view-synthesis software evaluation.

3 Results –EE1 – Depth Estimation improvement

3.1. 1x1 pixel matching

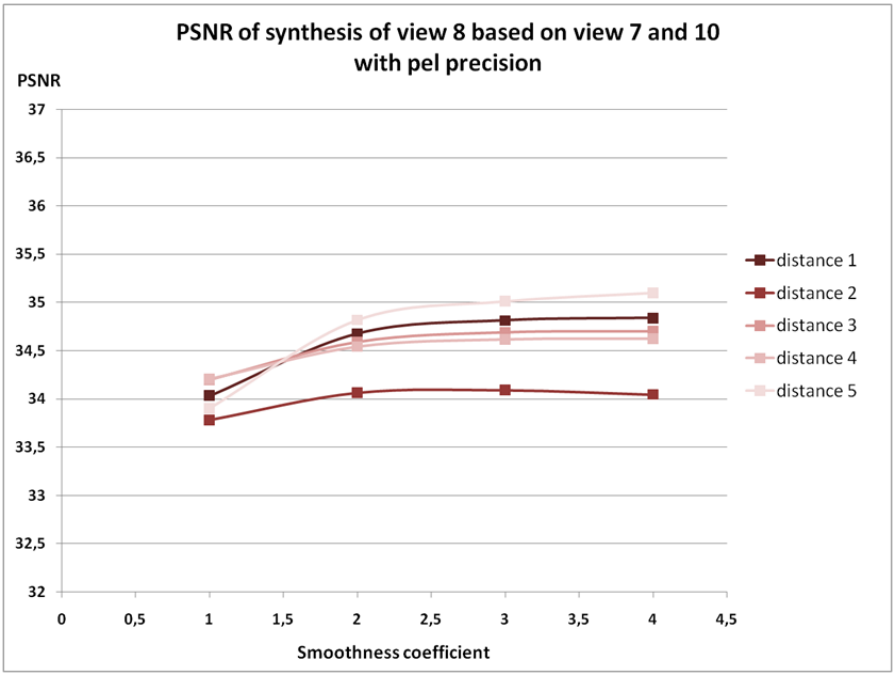


Figure 3. EE1 results - DERS3.0 + VSRS3.0, pixel precision, view 8, 1x1 pixel matching.

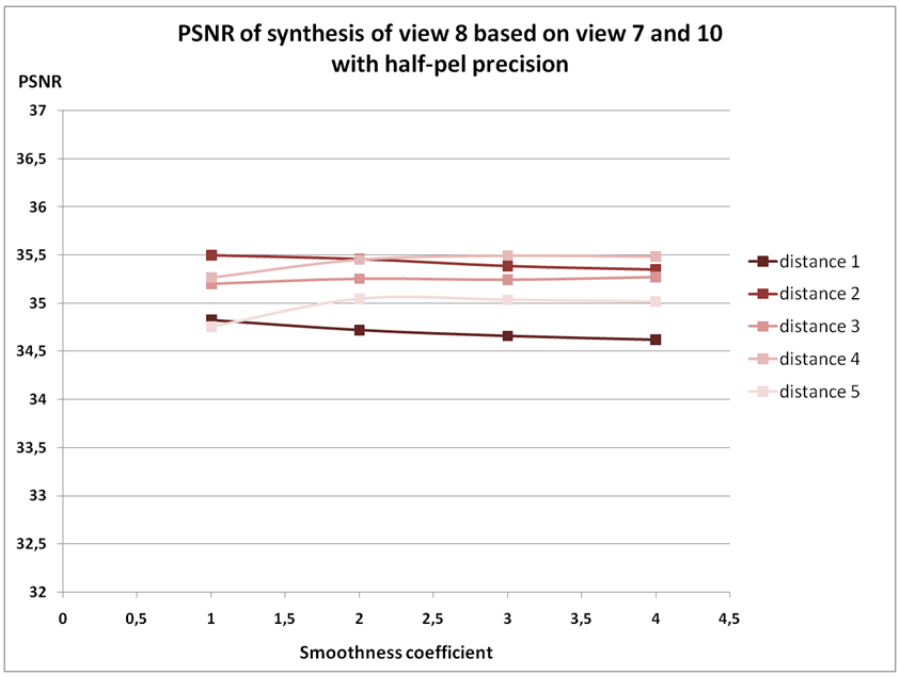


Figure 4. EE1 results - DERS3.0 + VSRS3.0, half-pixel precision, view 8, 1x1 pixel matching.

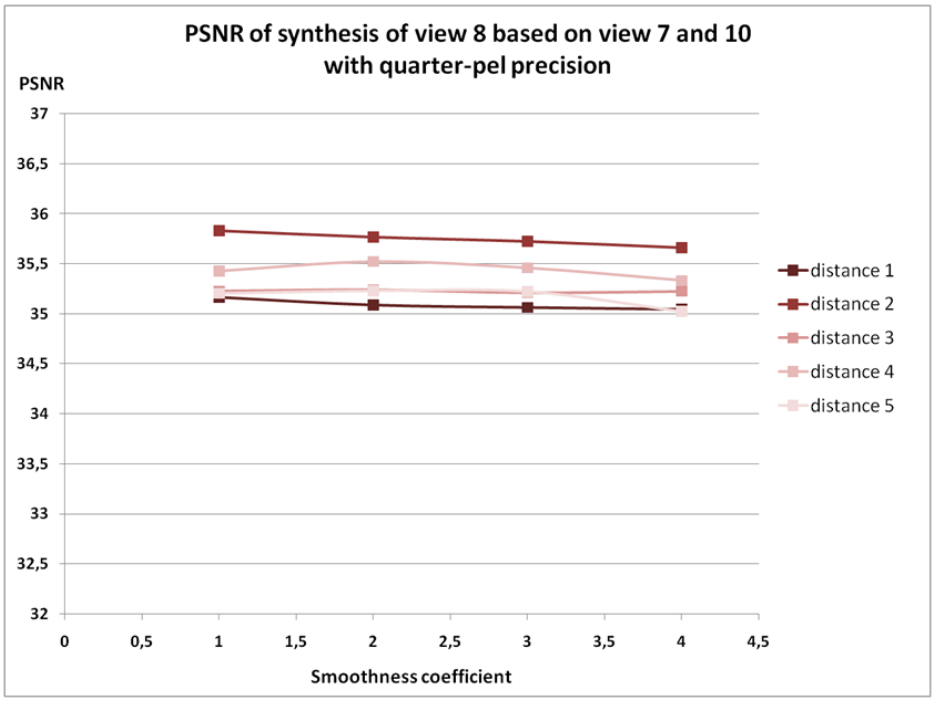


Figure 5. EE1 results - DERS3.0 + VSRS3.0, quarter-pixel precision, view 8, 1x1 pixel matching.

3.2. 3x3 block matching

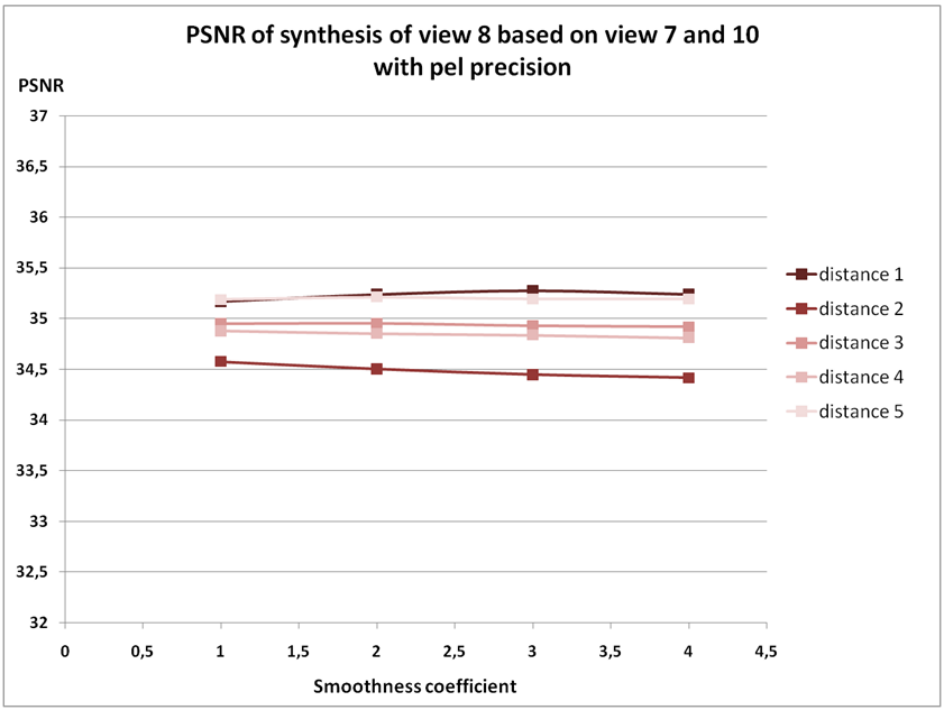


Figure 6. EE1 results - DERS3.0 + VSRS3.0, pixel precision, view 8, 3x3 block matching.

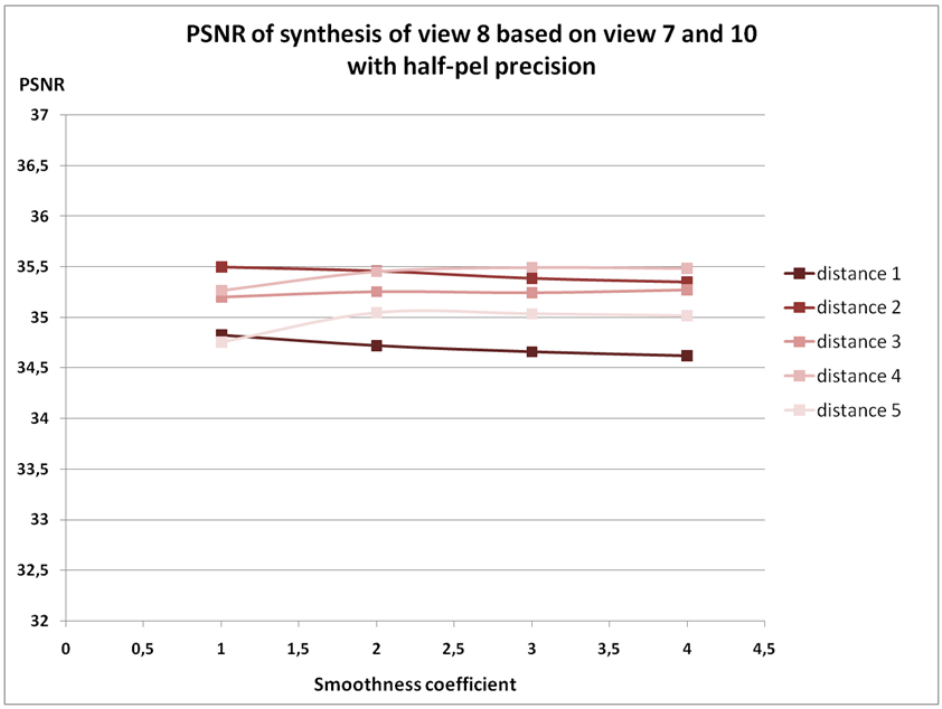


Figure 7. EE1 results - DERS3.0 + VSRS3.0, half-pixel precision, view 8, 3x3 block matching.

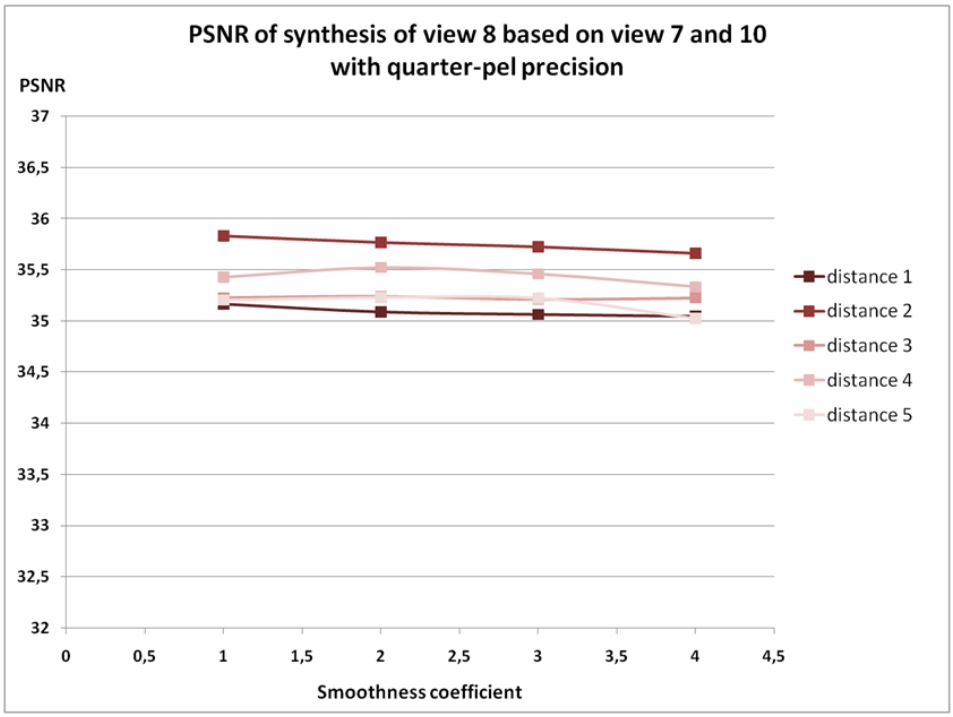


Figure 8. EE1 results - DERS3.0 + VSRS3.0, quarter-pixel precision, view 8, 3x3 block matching.

4 Results – EE2 – View Synthesis

4.1. 1x1 pixel matching

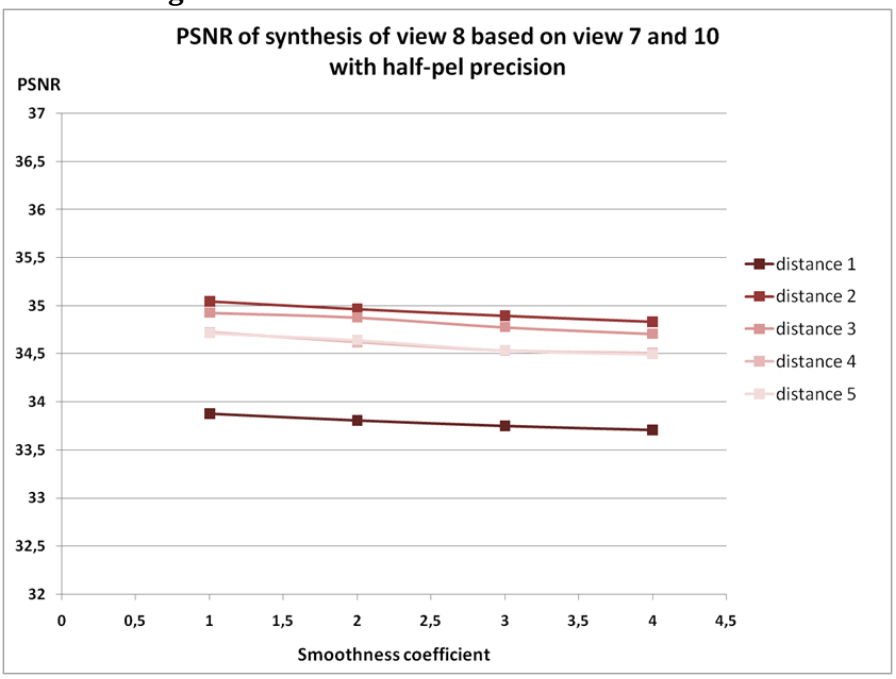


Figure 9. EE2 results – VSRS3.0, pixel precision, 1x1 pixel matching, view 8, synthesis with boundary noise removal.

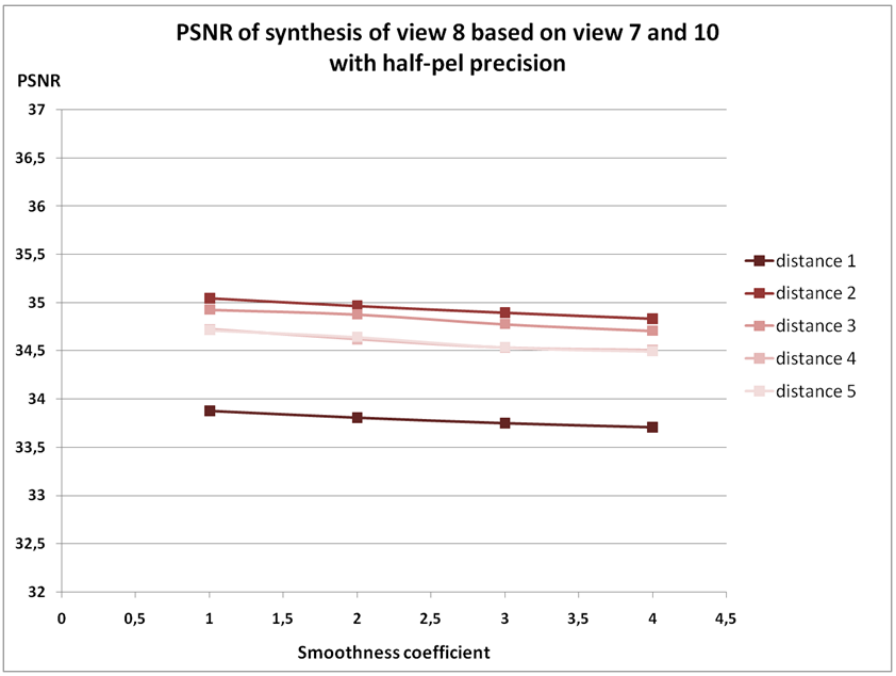


Figure 10. EE2 results – VSRS3.0, half-pixel precision, 1x1 pixel matching, view 8, synthesis with boundary noise removal.

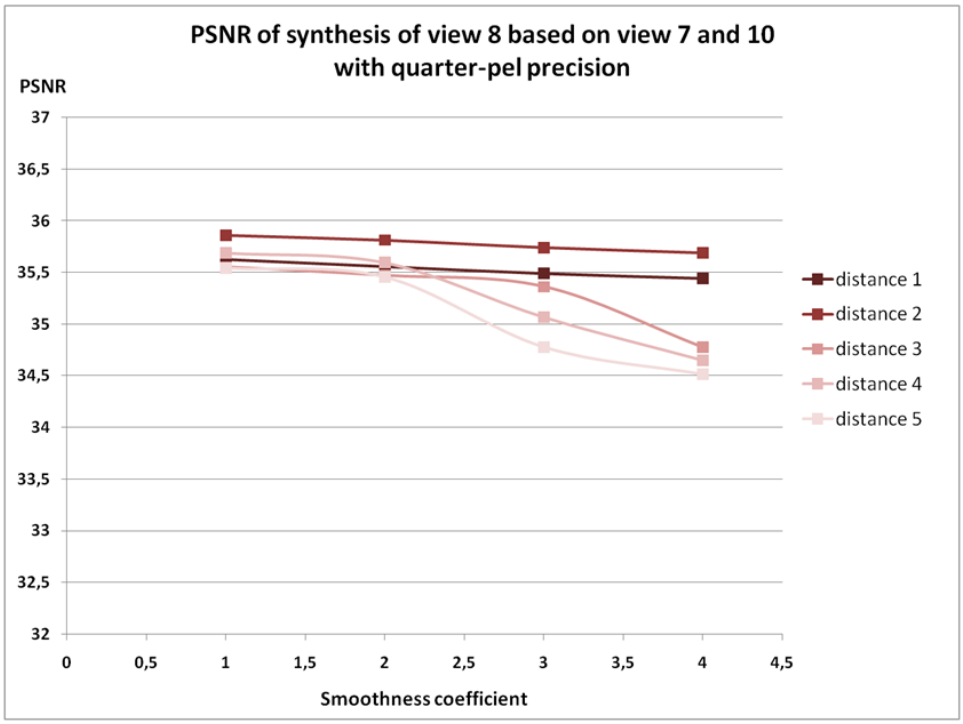


Figure 11. EE2 results – VSRS3.0, quarter-pixel precision, 1x1 pixel matching, view 8, synthesis with boundary noise removal.

4.2. 3x3 block matching

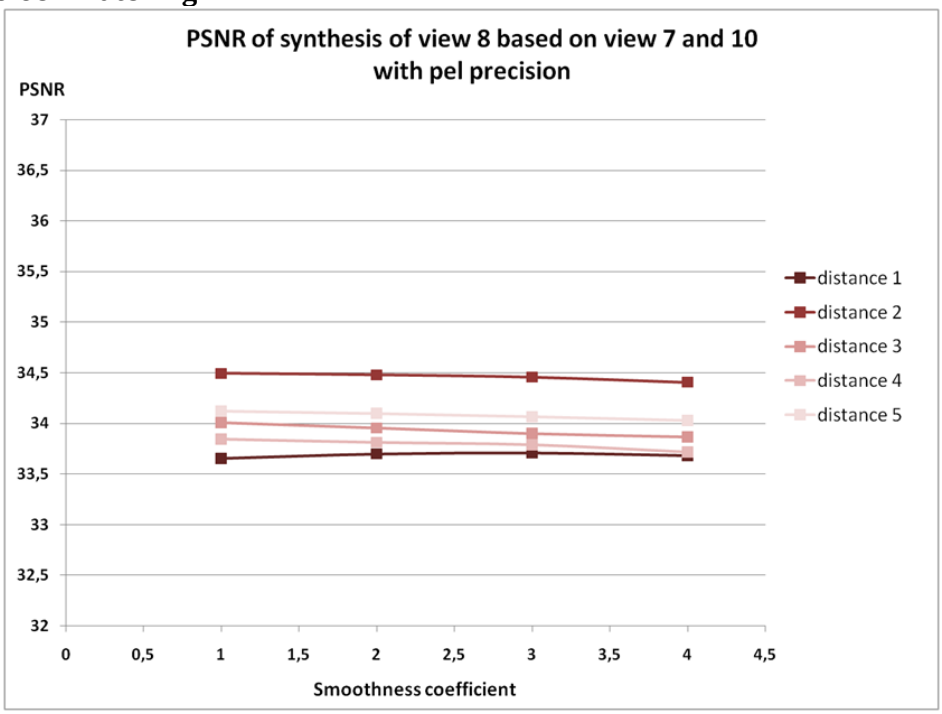


Figure 12. EE2 results – VSRS3.0, pixel precision, 3x3 block matching, view 8, synthesis with boundary noise removal.

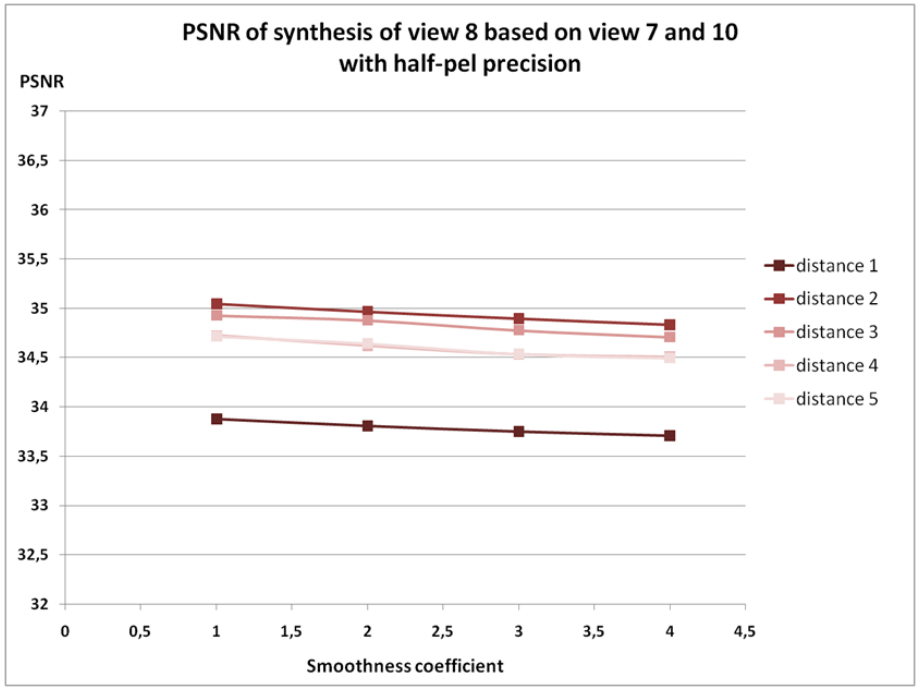


Figure 13. EE2 results - VSRS3.0, half-pixel precision, 3x3 block matching, view 8, synthesis with boundary noise removal.

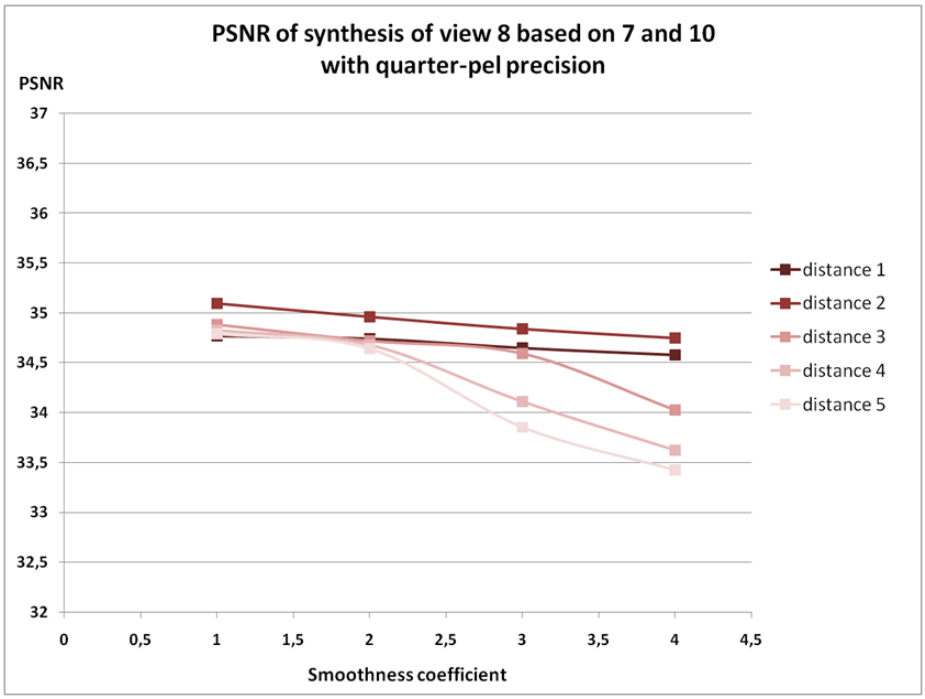


Figure 14. EE2 results – VSRS3.0, quarter-pixel precision, 3x3 block matching, view 8, synthesis with boundary noise removal.

5 Summary

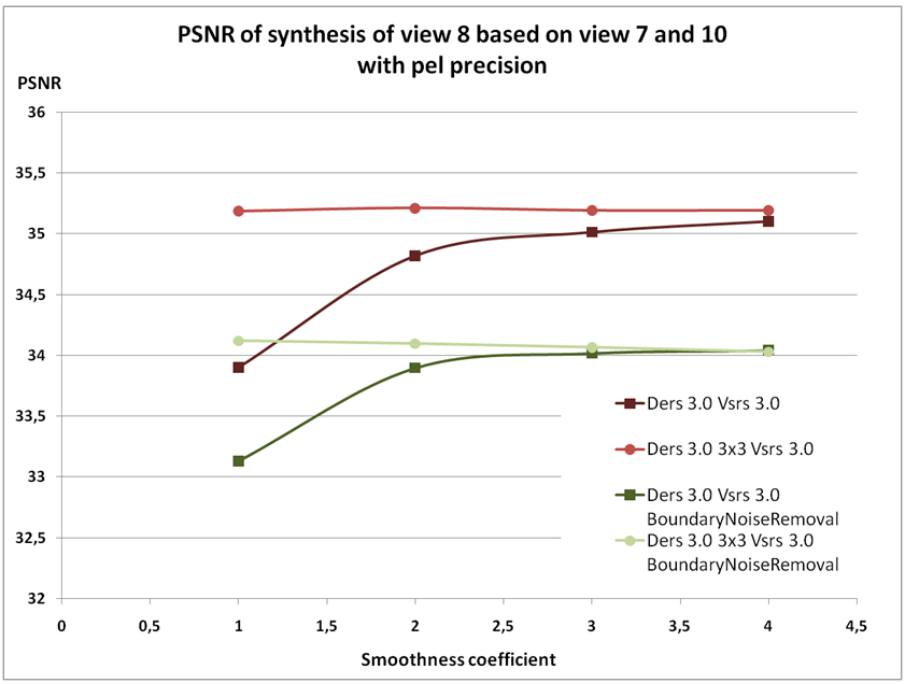


Figure 15. Summary of the best synthesis results (for the best camera distance), DERS 3.0, VSRS 3.0, pixel-precision, various options.

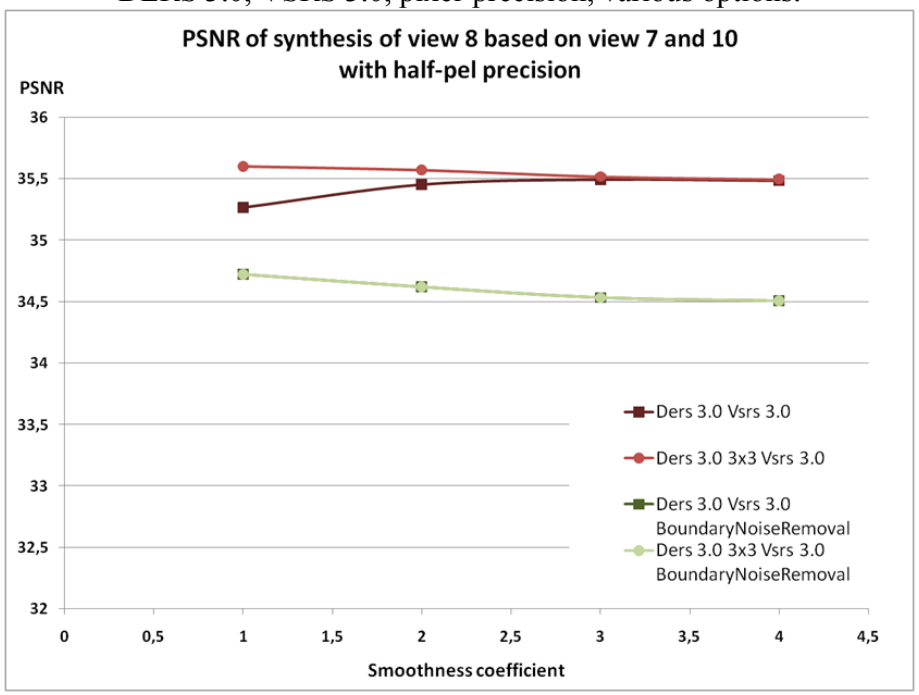


Figure 16. Summary of the best synthesis results (for the best camera distance), DERS 3.0, VSRS 3.0, half-pixel-precision, various options.

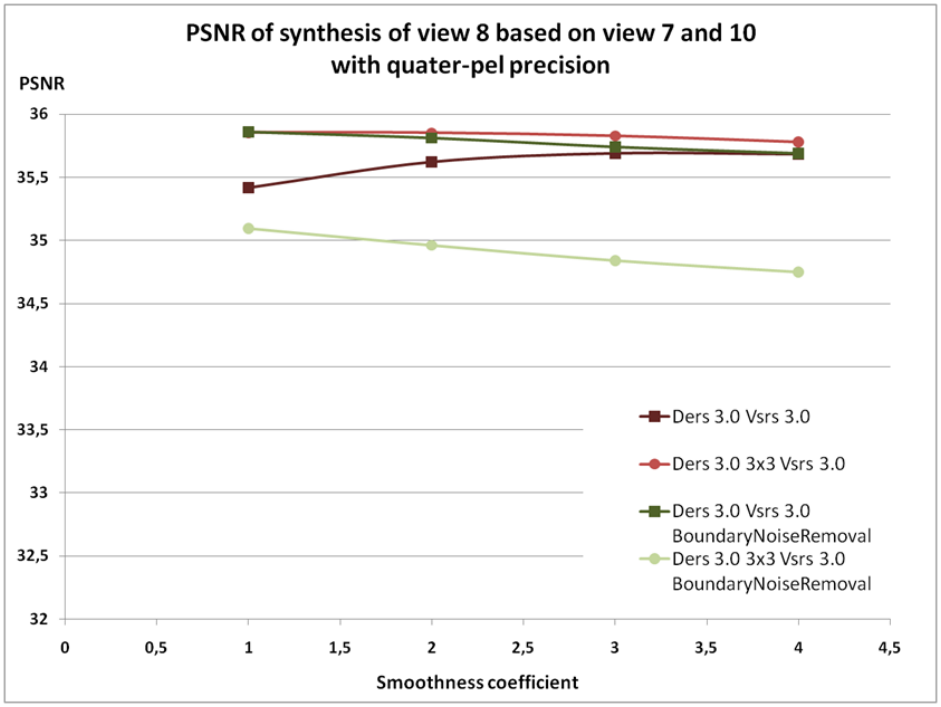


Figure 17. Summary of the best synthesis results (for the best camera distance), DERS 3.0, VSRS 3.0, quarter-pixel-precision, various options.

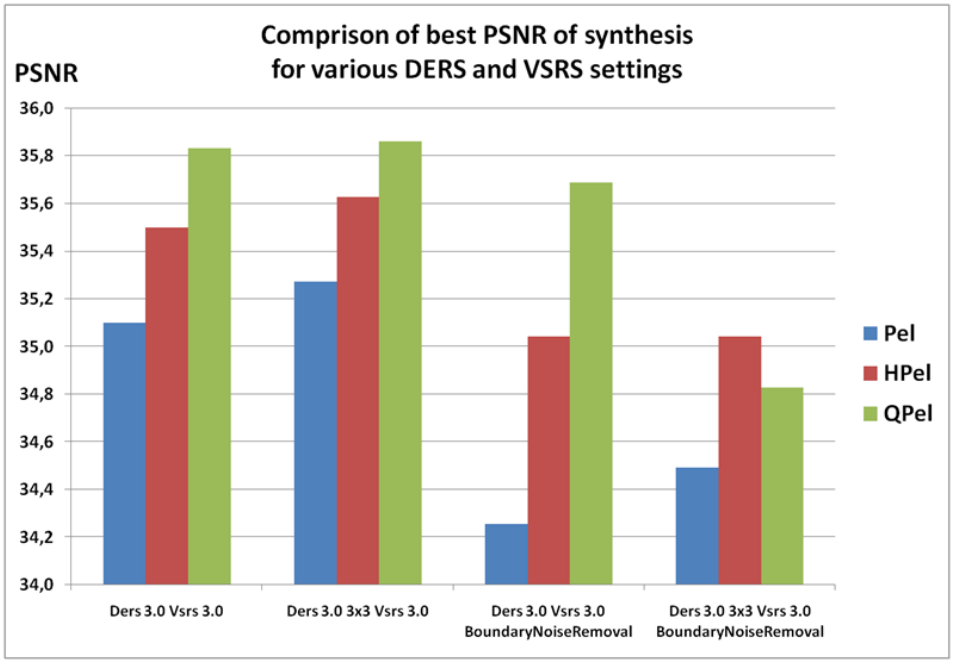


Figure 18. Summary of the best synthesis results, DERS 3.0, VSRS 3.0, various options.

6 Conclusions

EE1:

- 3x3 block matching in depth estimation gives a gain of about 0.2dB for pixel-precision (comparing to 1x1 pixel matching),
- The 3x3 block matching gain is lesser for higher precision modes (almost no gain for quarter-pel precision),
- No resuls of experiments with segmentation – not enough time, because the software is too slow,
- No experiments with semi-automatic depth estimation – no working software available yet.
- The results and conclusions for temporal consistency are the same as from previous EE [3]

EE2:

- Boundary Noise Removal (BNR) technique does not bring any gain to VSRS3.0 with respect to PSNR.
- BNR is worse from about 0.5dB (quarter-pixel precision) to about 1.0 dB (pixel-precision)
- In general, QPel is better that HPel (0.4-0.7dB), which is better that Pel (0.3-0.7dB) with exception to 3x3 matching with BNR enabled, where HPel is better than QPel for about 0.2dB
- These is no evidence that BNR brings subjective improvement.

7 References

[1] "Description of Exploration Experiments in 3D Video Coding" MPEG 2008/W10173, Busan, Korea, October 2008.

[2] Feldmann, M. Mueller, F. Zilly, R. Tanger, K. Mueller, A. Smolic, P. Kauff, T. Wiegand „HHI Test Material for 3D Video", MPEG 2008/M15413, Archamps, France, April 2008.

[3] O. Stankiewicz, K.Wegner, "Results of 3DV/FTV Exploration Experiments, described in w10173, or Alt Moabit sequence" MPEG 2008/M16026, Lausanne, Switzerland, February 2009.