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**ISO/IEC JTC1/SC29/WG11  
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**Title** Results of Exploration Experiments in 3D Video Coding, described in w10360, for Alt Moabit sequence.  
**Sub group** Video  
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## **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.

| <b>Data set</b> | <b>OL-OR</b> | <b>NL-NR</b> |
|-----------------|--------------|--------------|
| Alt-Moabit      | 8-9          | 7-10         |

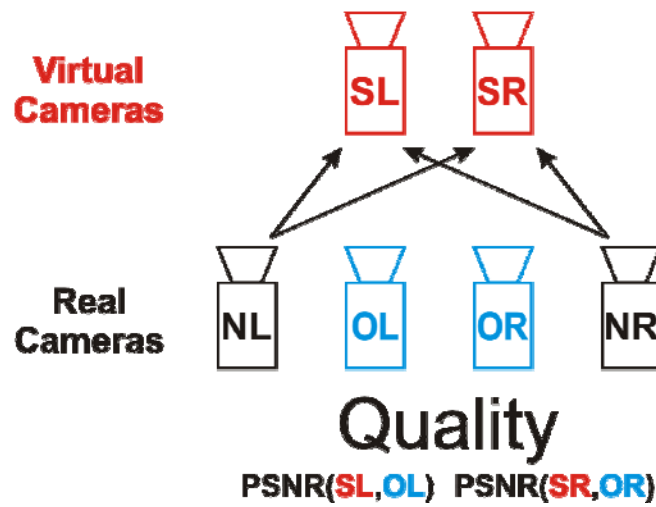


Figure 1. Setup of experiments for depth-estimation/view-synthesis software evaluation.

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

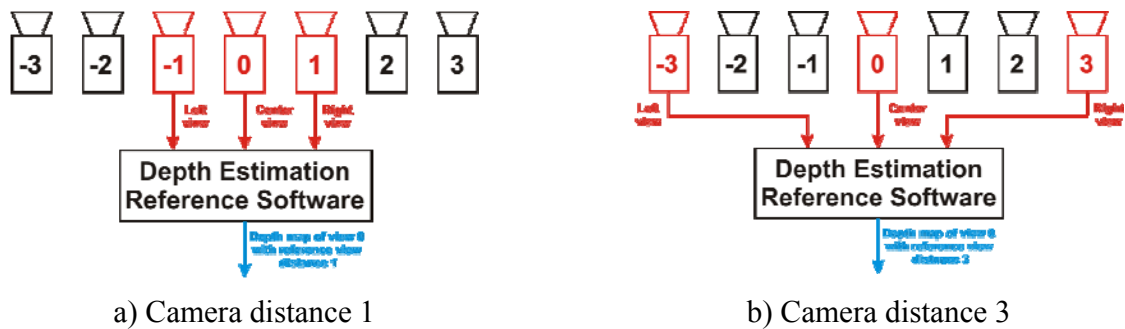


Figure 2. Setup of experiments for depth-estimation/view-synthesis software evaluation.

### 3 Results –EE1 – Depth Estimation improvement

#### 3.1. 1x1 pixel matching

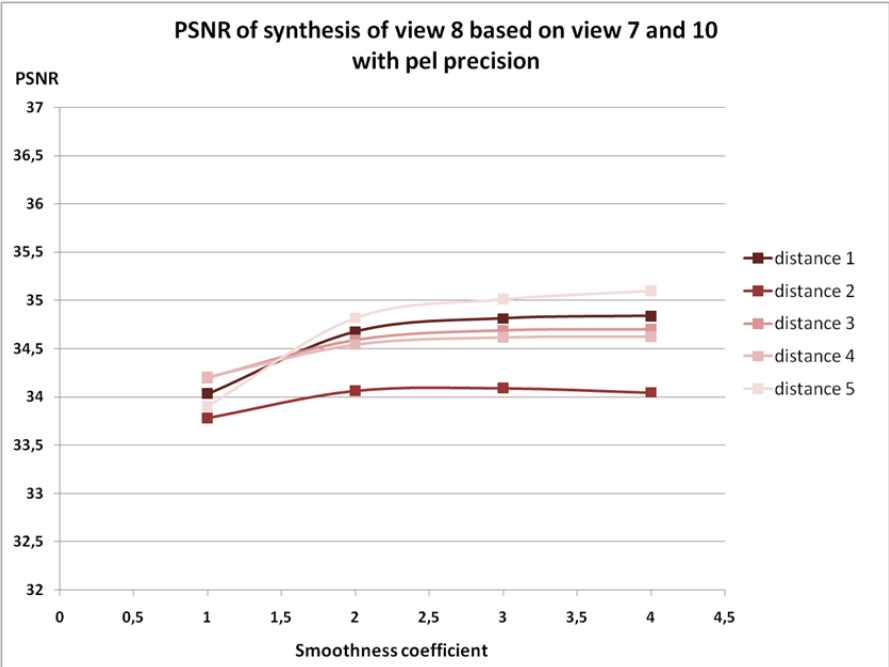


Figure 3. EE1 results - DERS3.0 + VSR3.0, pixel precision, view 8, 1x1 pixel matching.

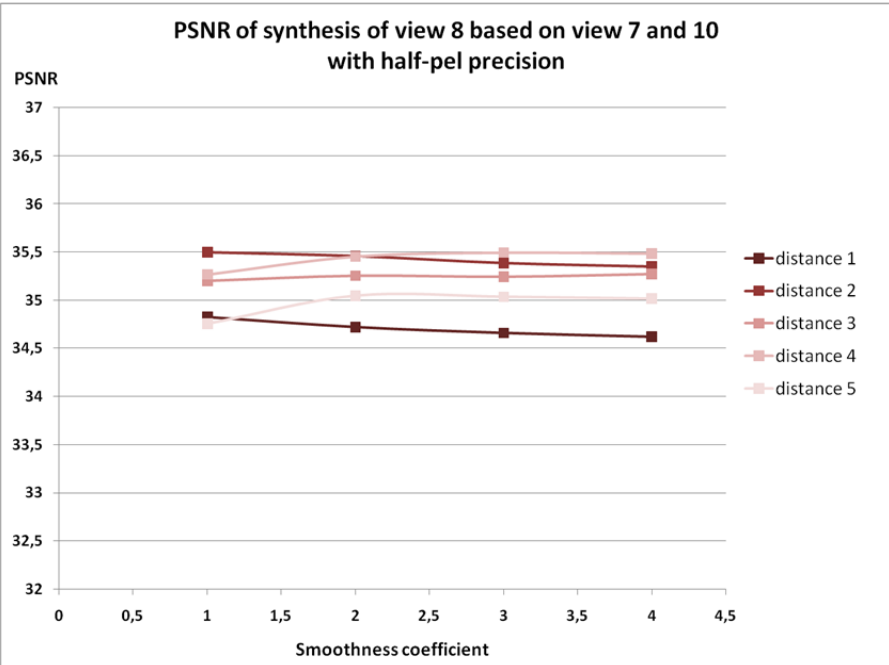


Figure 4. EE1 results - DERS3.0 + VSR3.0, half-pixel precision, view 8, 1x1 pixel matching.

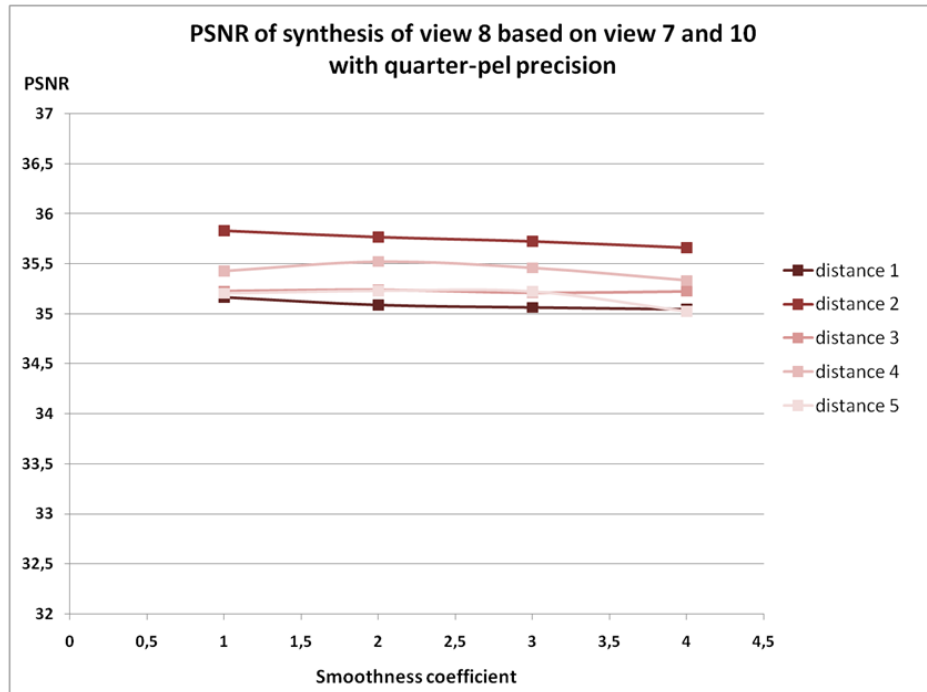


Figure 5. EE1 results - DERS3.0 + VSRS3.0, quarter-pixel precision, view 8, 1x1 pixel matching.

### 3.2. 3x3 block matching

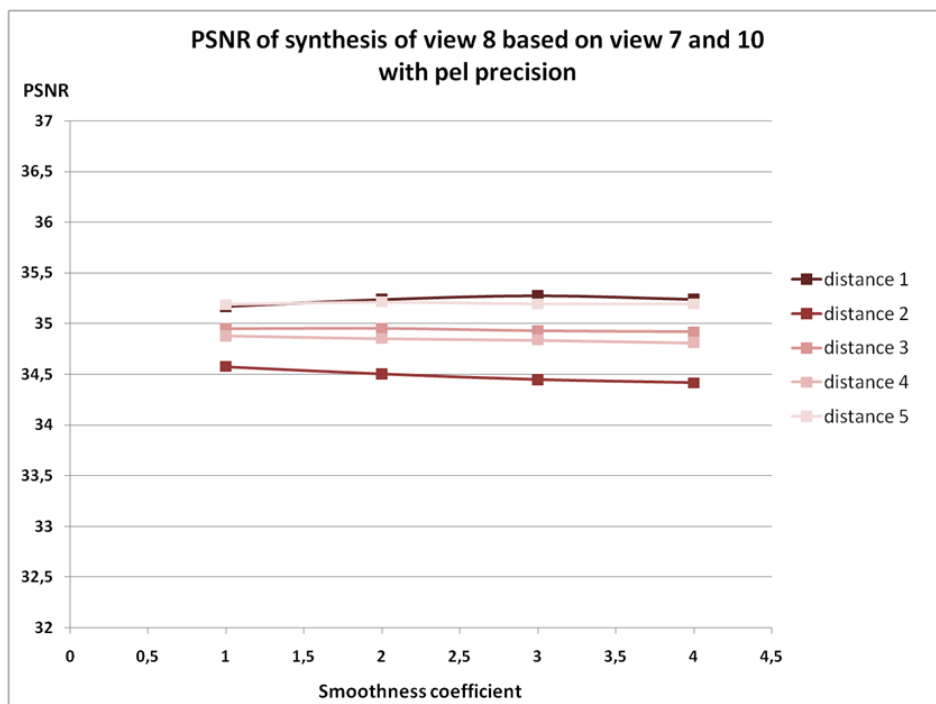


Figure 6. EE1 results - DERS3.0 + VSRS3.0, pixel precision, view 8, 3x3 block matching.

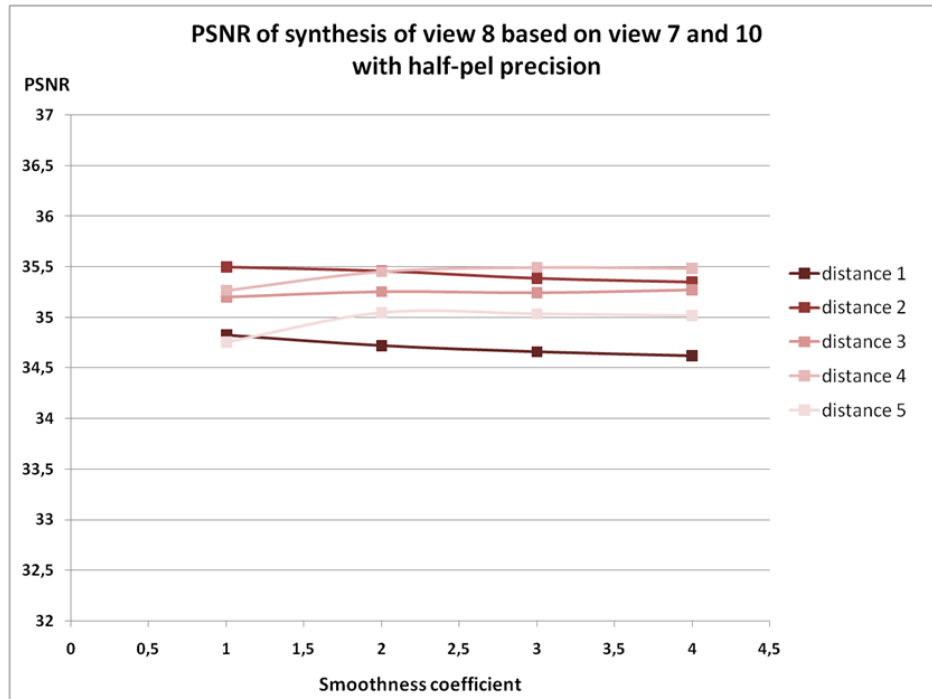


Figure 7. EE1 results - DERS3.0 + VSRS3.0, half-pixel precision, view 8, 3x3 block matching.

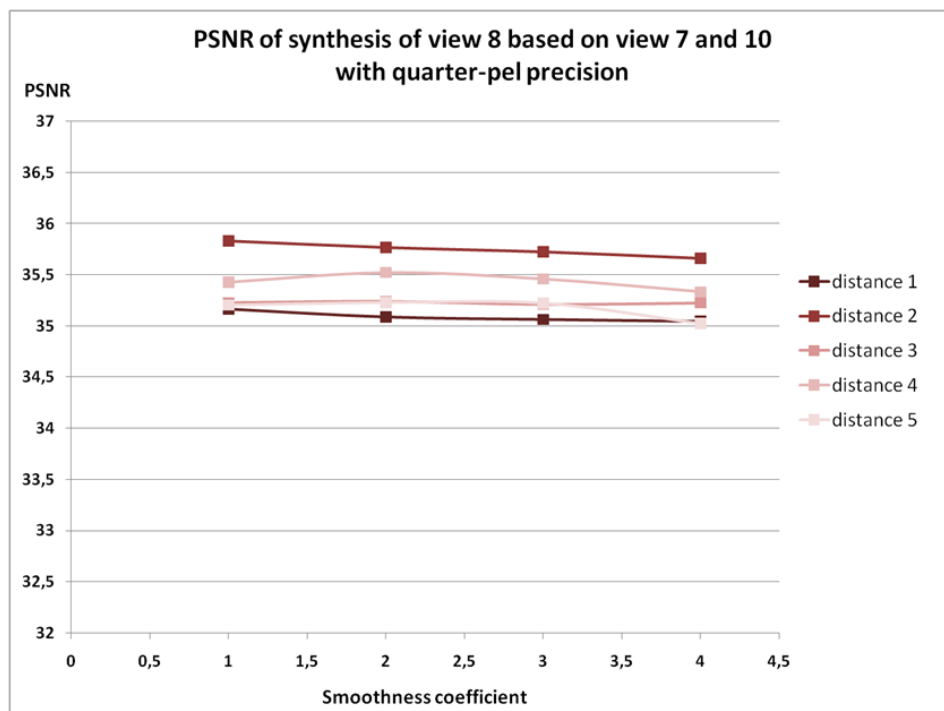


Figure 8. EE1 results - DERS3.0 + VSRS3.0, quarter-pixel precision, view 8, 3x3 block matching.

4 Results – EE2 – View Synthesis

4.1. 1x1 pixel matching

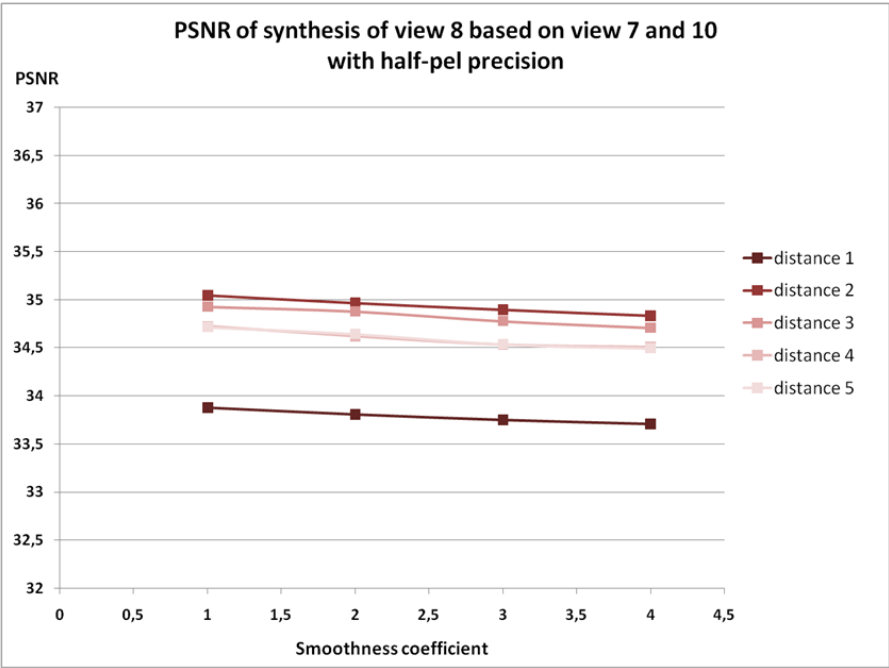


Figure 9. EE2 results – VSRS3.0, pixel precision, 1x1 pixel matching, view 8, synthesis with boundary noise removal.

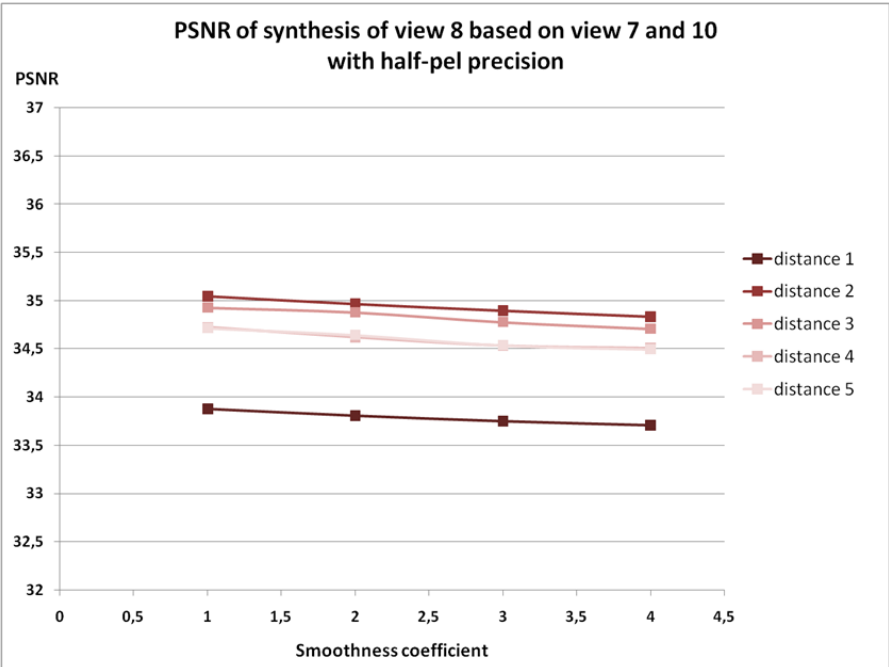


Figure 10. EE2 results – VSRS3.0, half-pixel precision, 1x1 pixel matching, view 8, synthesis with boundary noise removal.

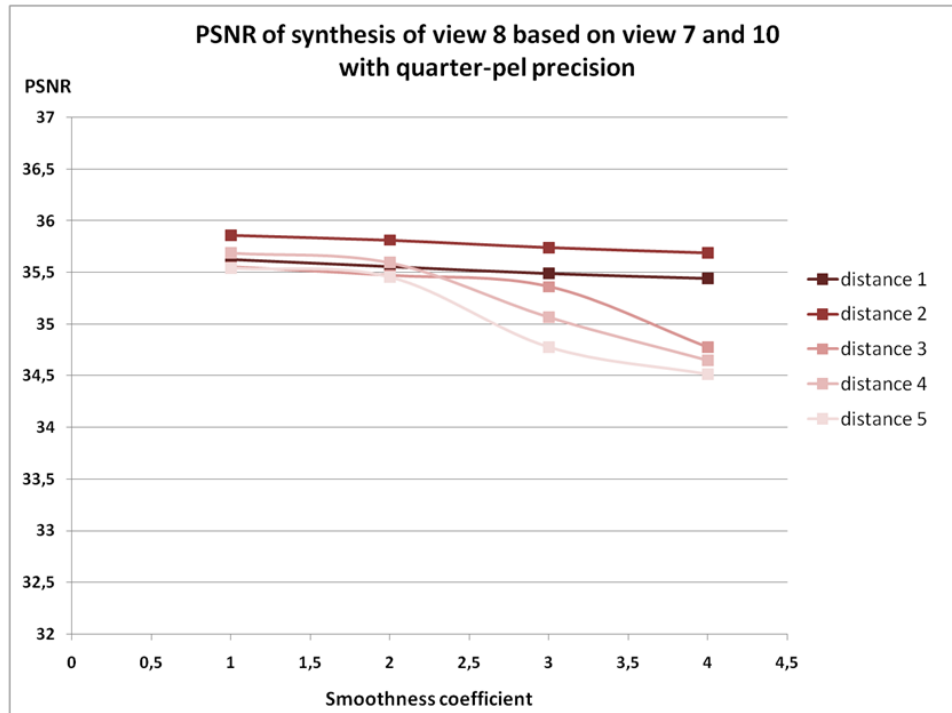


Figure 11. EE2 results – VSRS3.0, quarter-pixel precision, 1x1 pixel matching, view 8, synthesis with boundary noise removal.

#### 4.2. 3x3 block matching

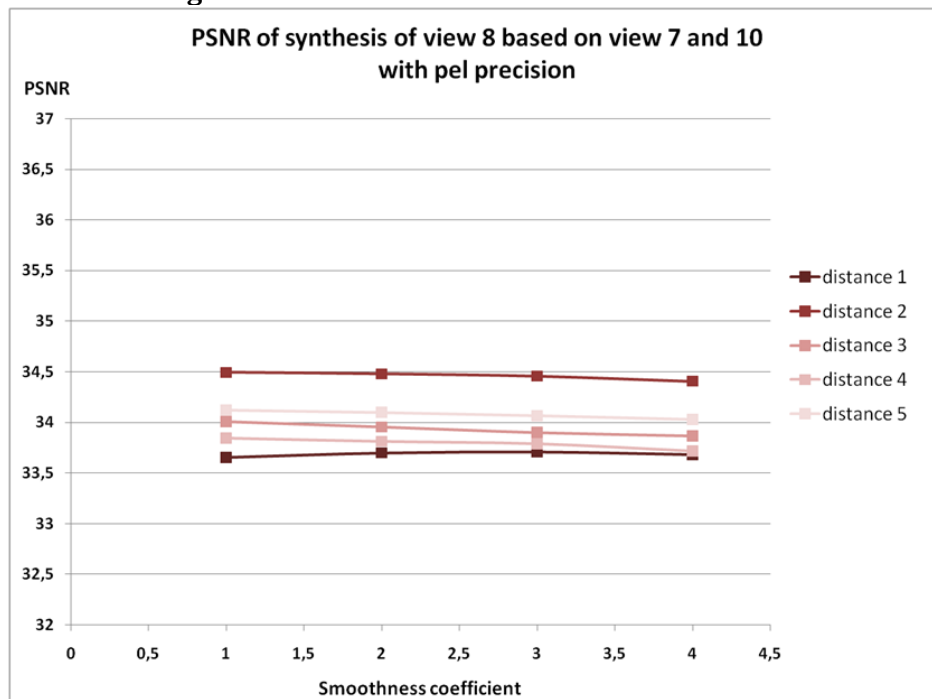


Figure 12. EE2 results – VSRS3.0, pixel precision, 3x3 block matching, view 8, synthesis with boundary noise removal.

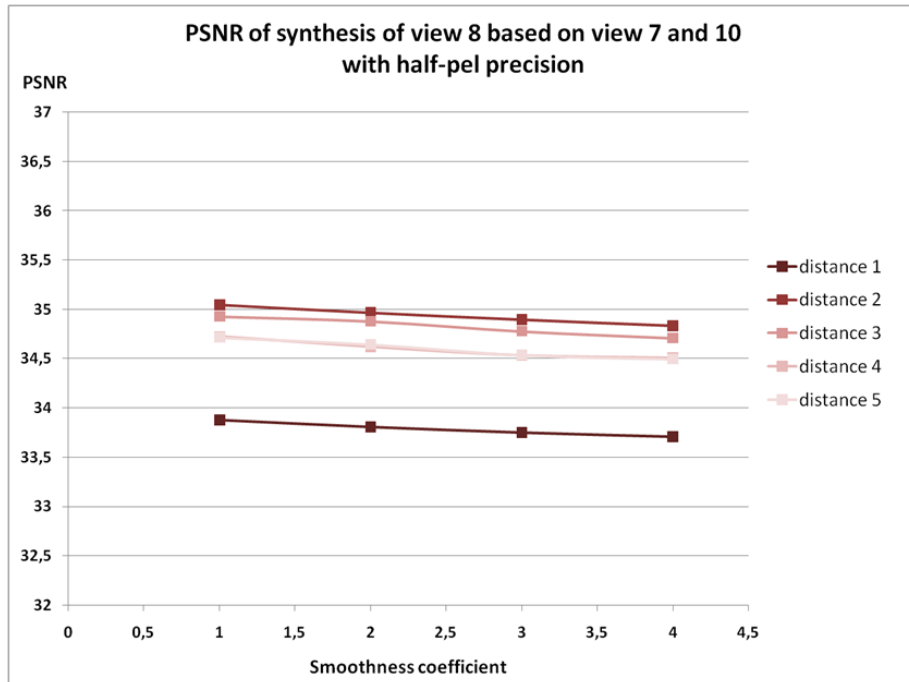


Figure 13. EE2 results - VSRS3.0, half-pixel precision, 3x3 block matching, view 8, synthesis with boundary noise removal.

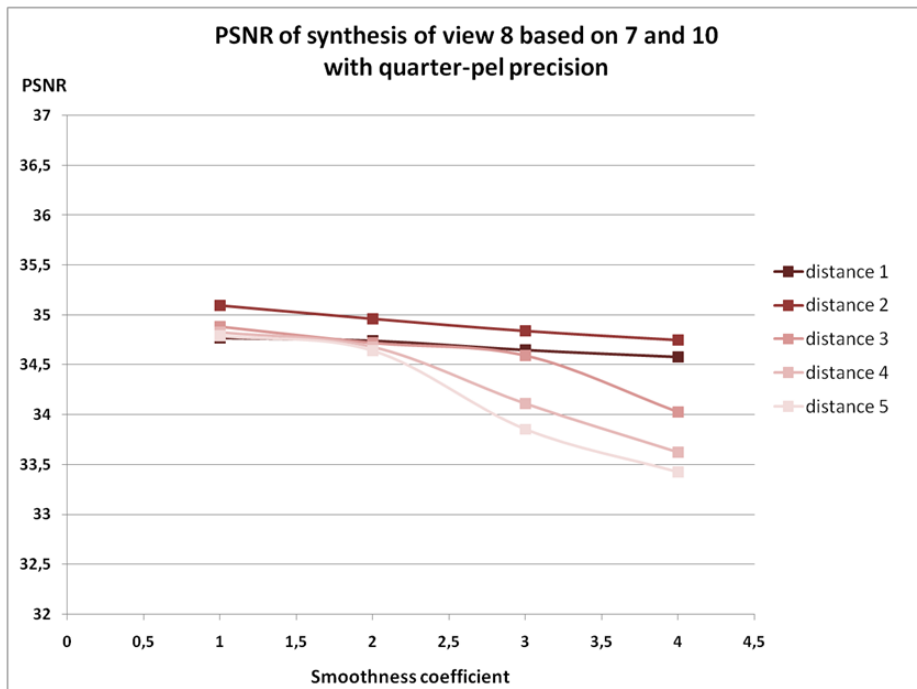


Figure 14. EE2 results – VSRS3.0, quarter-pixel precision, 3x3 block matching, view 8, synthesis with boundary noise removal.



## 5 Summary

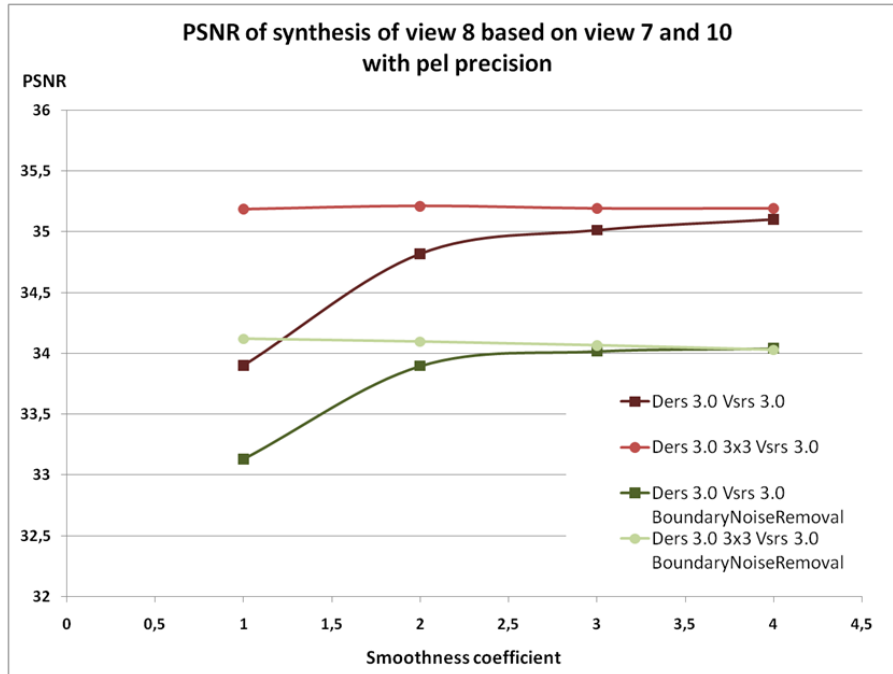


Figure 15. Summary of the best synthesis results (for the best camera distance), DERS 3.0, VSRS 3.0, pixel-precision, various options.

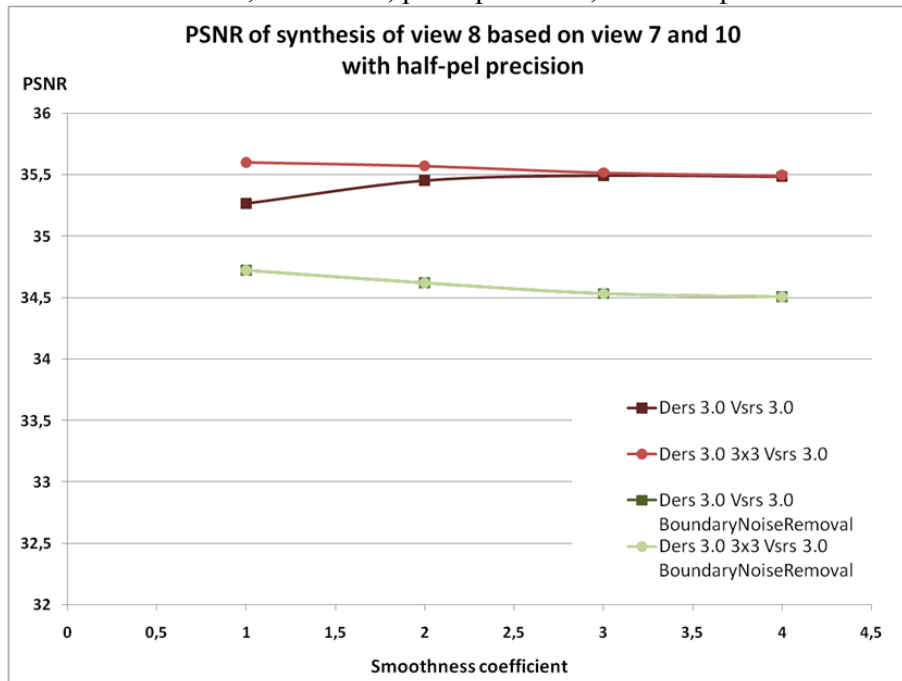


Figure 16. Summary of the best synthesis results (for the best camera distance), DERS 3.0, VSRS 3.0, half-pixel-precision, various options.

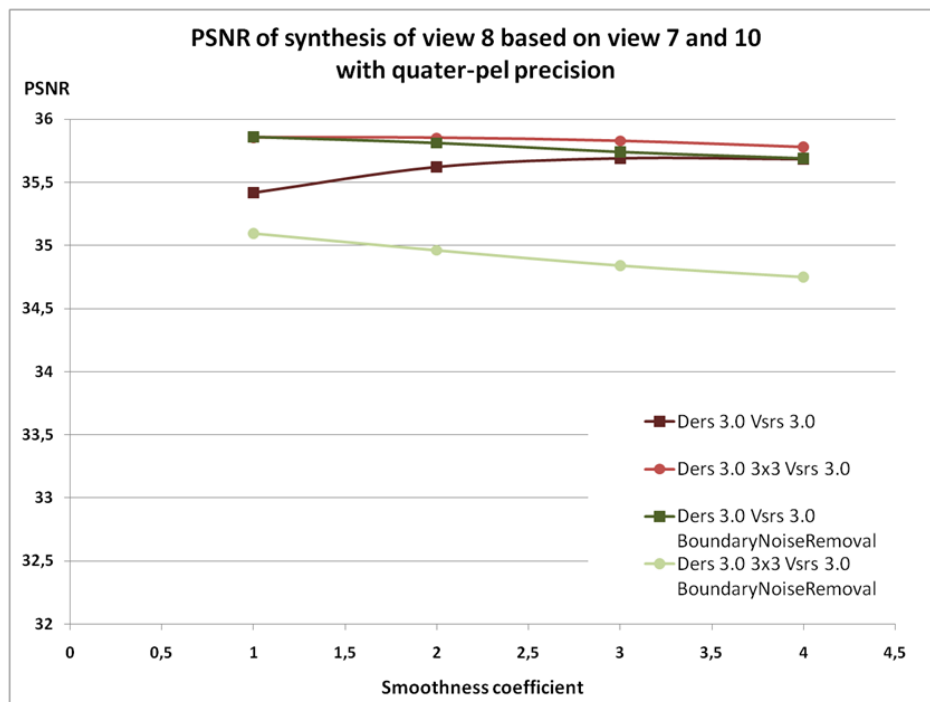


Figure 17. Summary of the best synthesis results (for the best camera distance), DERS 3.0, VSRS 3.0, quarter-pixel-precision, various options.

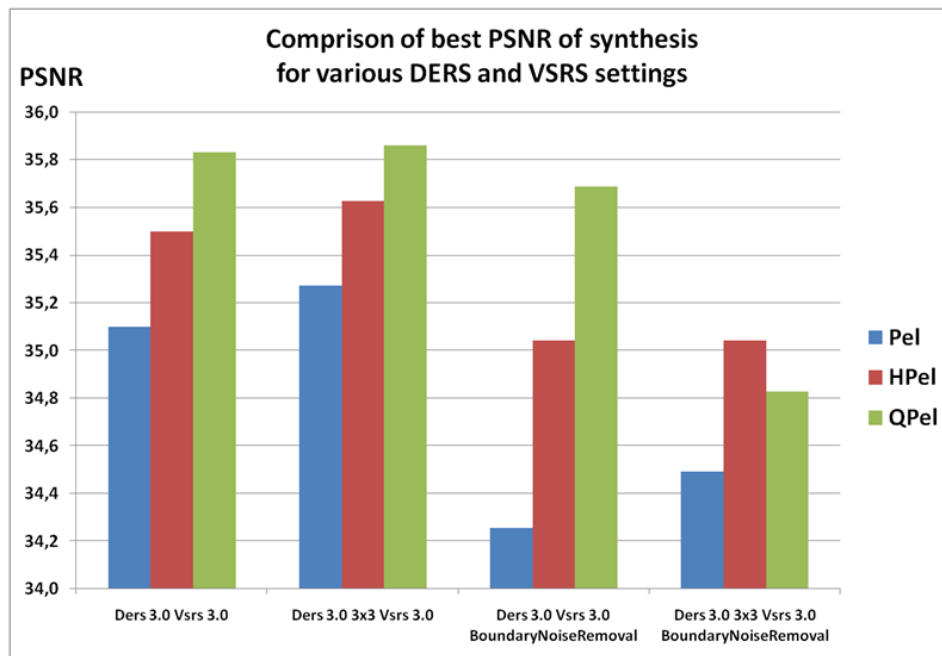


Figure 18. Summary of the best synthesis results, DERS 3.0, VSRS 3.0, various options.

## 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 results 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 than HPel (0.4-0.7dB), which is better than Pel (0.3-0.7dB) with exception to 3x3 matching with BNR enabled, where HPel is better than QPel for about 0.2dB
- There 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.