

Solutions for Immersive 3D Video Communication

iMinds, Ghent, Belgium, 16th December 2010



Dr. Oliver Schreer
Nicole Atzpadin
Wolfgang Waizenegger
Ingo Feldmann



- State of the art in telepresence systems and 3D videoconferencing
- Existing drawbacks of current systems
- Virtual view rendering
- Conclusion

SoA of Telepresence Systems

Image Processing



telepresence system by CISCO



HP Halo telepresence system



Polycom TPX system

SoA of 3D Videoconferencing

Image Processing



Coliseum by
HP, Palo Alto, CA, 2003



VIRTUE System by FP5-IST-VIRTUE, 2003



MultiView by Univ. of California, Berkeley, 2004



im.point by Fraunhofer HHI, 2004

State of the art in telepresence systems and 3D
videoconferencing

Existing drawbacks of current systems

Virtual view rendering

Conclusion

Misleading gesture representation in multi-point setups (who is pointing at whom?)

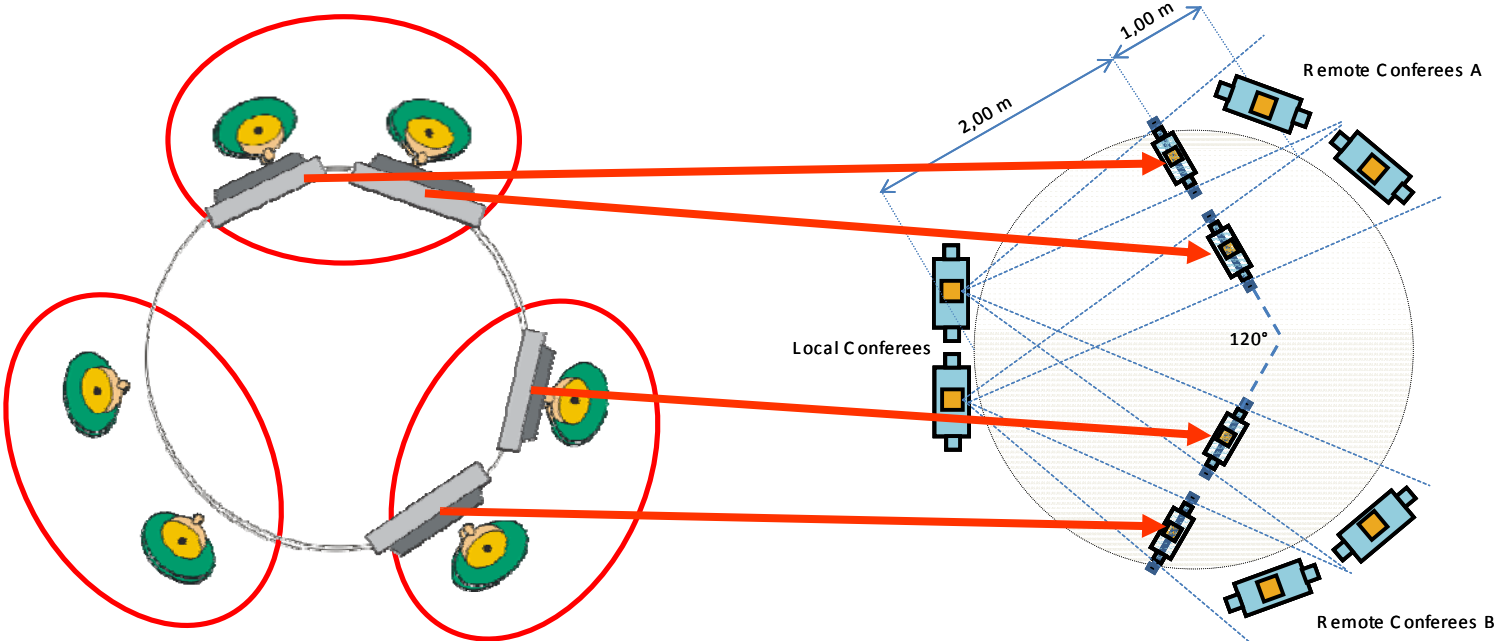


View from left local to right remote



View from right local to right remote

The Principle of the Shared Table



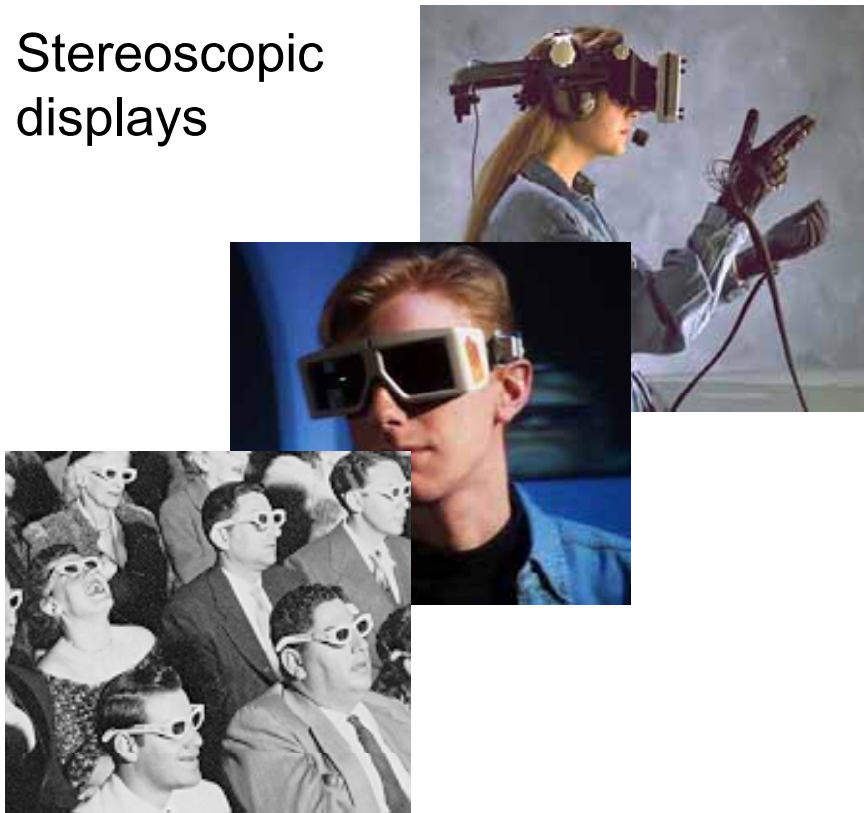
Misleading gesture representation in multi-point setups (who is pointing at whom?)

- shared table principle
- correct camera mounting

No stereoscopic viewing

Which Display Technologies for 3D?

Stereoscopic displays



Autostereoscopic flat displays

The Answer is Given by Our Chancellor

Image Processing



Misleading gesture representation in multi-point setups (who is pointing at whom?)

- shared table principle
- correct camera mounting

No stereoscopic viewing

- auto-stereoscopic displays

No multi-perspective viewing for multiple users at one site

- novel multi-perspective 3D display by Philips (see talk by Harm, Belt from Philips)



Misleading gesture representation in multi-point setups (who is pointing at whom?)

- shared table principle
- correct camera mounting

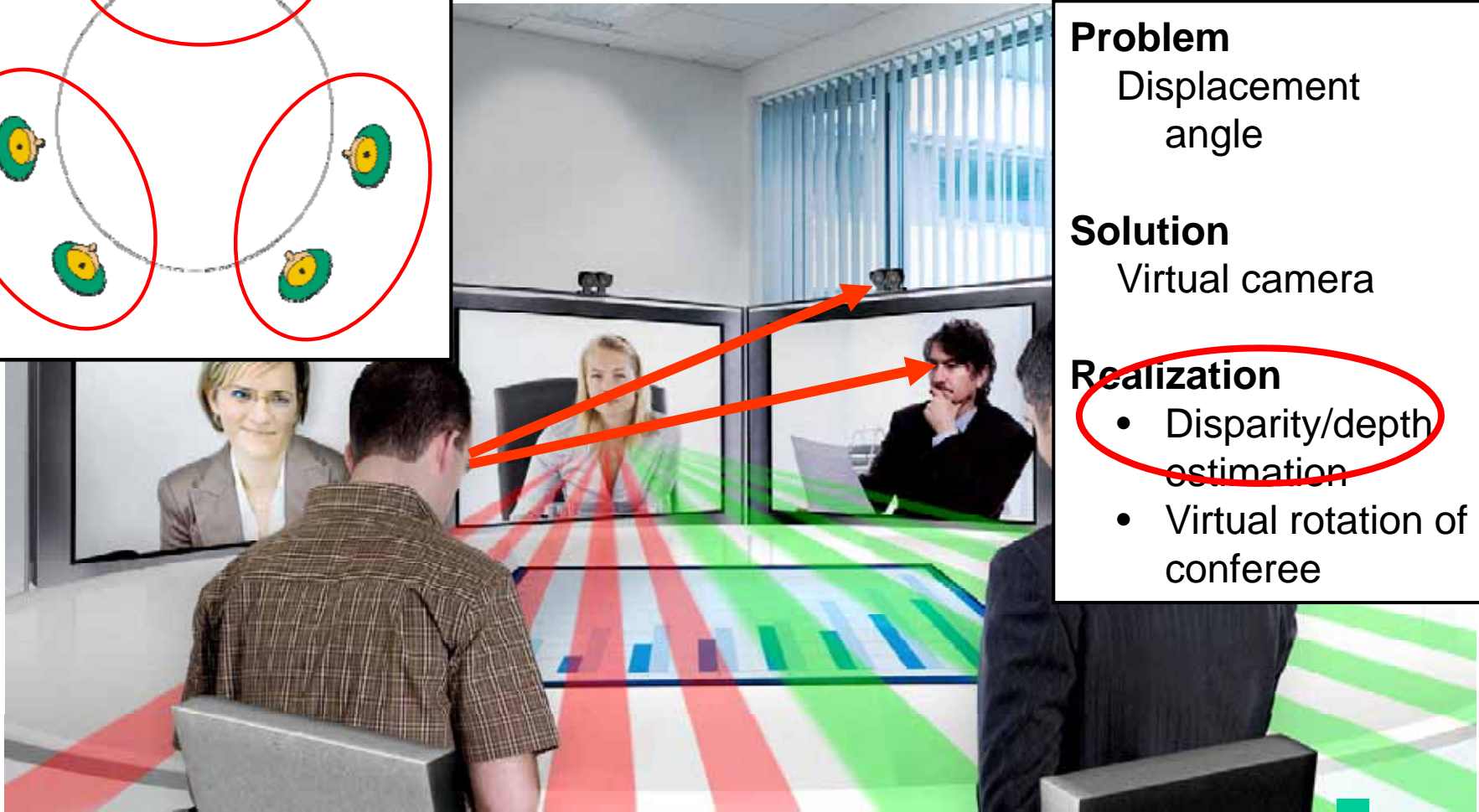
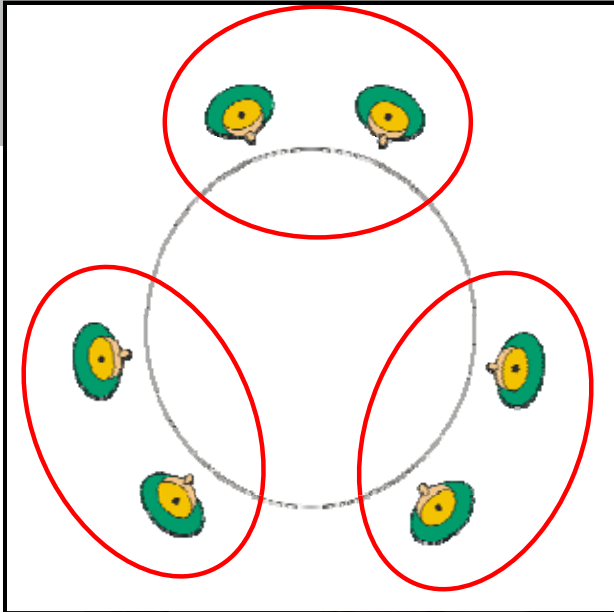
No stereoscopic viewing

- auto-stereoscopic displays

No multi-perspective viewing for multiple users at one site

- novel multi-perspective 3D display by Philips (see talk by Harm, Belt from Philips)

Lack of eye contact



Problem
Displacement
angle

Solution
Virtual camera

Realization

- Disparity/depth estimation
- Virtual rotation of conferee



Misleading gesture representation in multi-point setups (who is pointing at whom?)

- shared table principle
- correct camera mounting

No stereoscopic viewing

- auto-stereoscopic displays

No multi-perspective viewing for multiple users at one site

- novel multi-perspective 3D display

Lack of eye contact

Real-time 3D video processing is required for

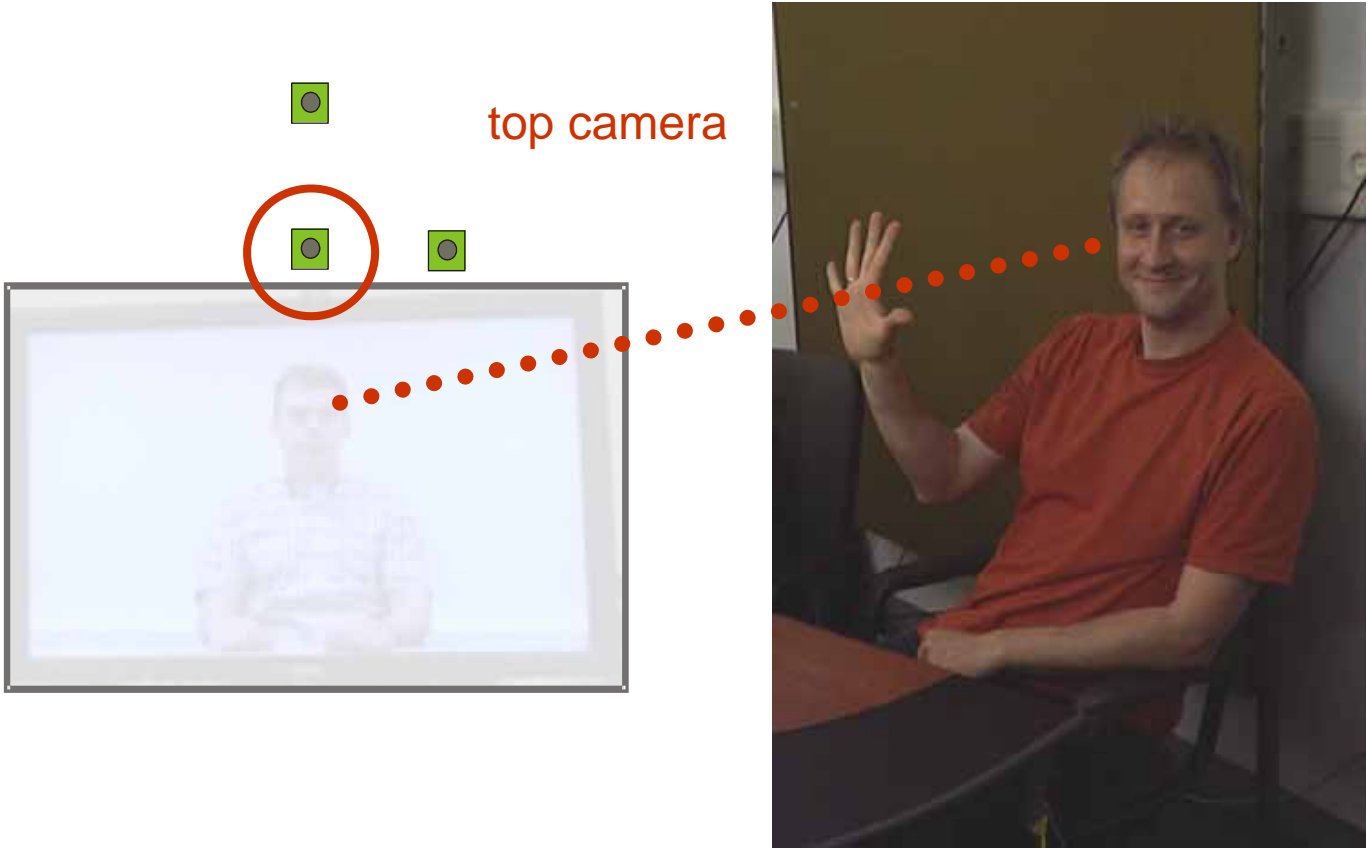
- **support of multi-view 3D displays**
- **provision of eye contact by virtual view rendering**

State of the art in telepresence systems and 3D
videoconferencing

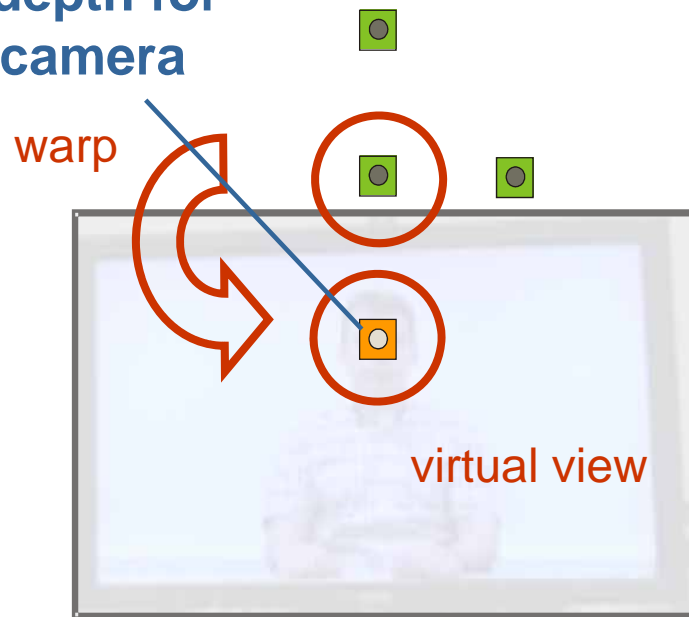
Existing drawbacks of current systems

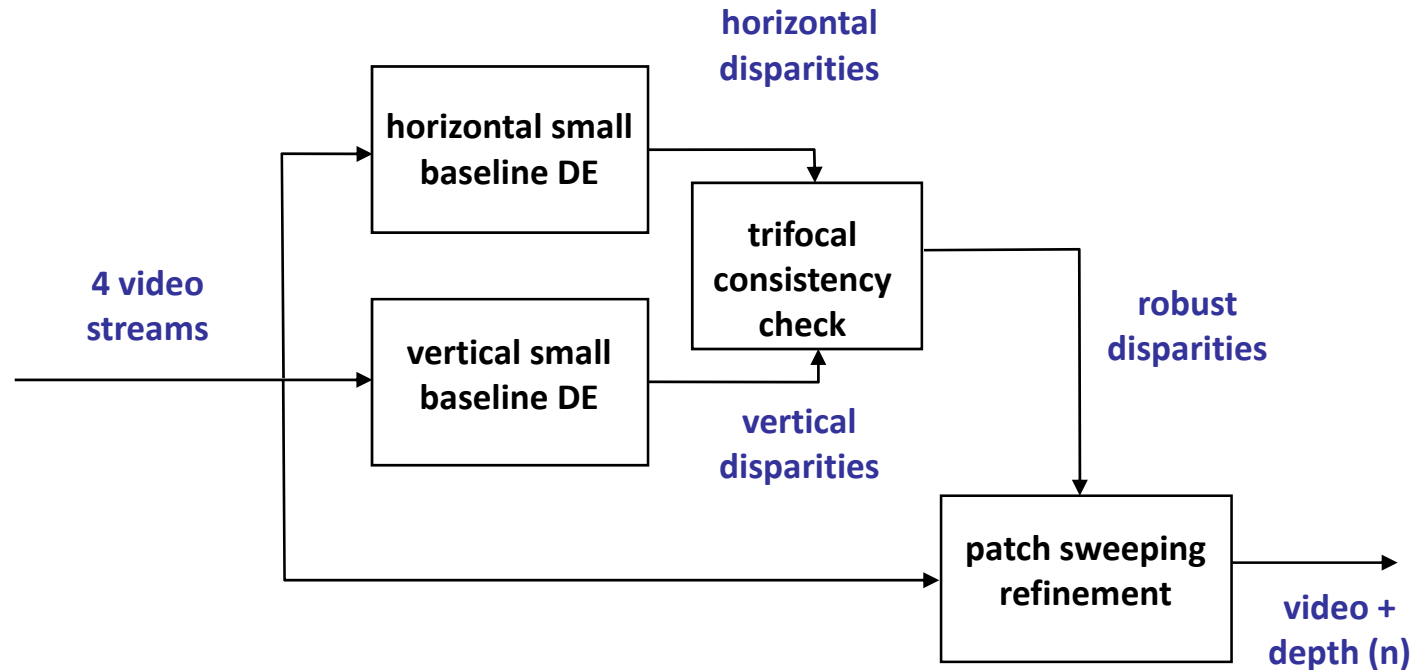
Virtual view rendering

Conclusion



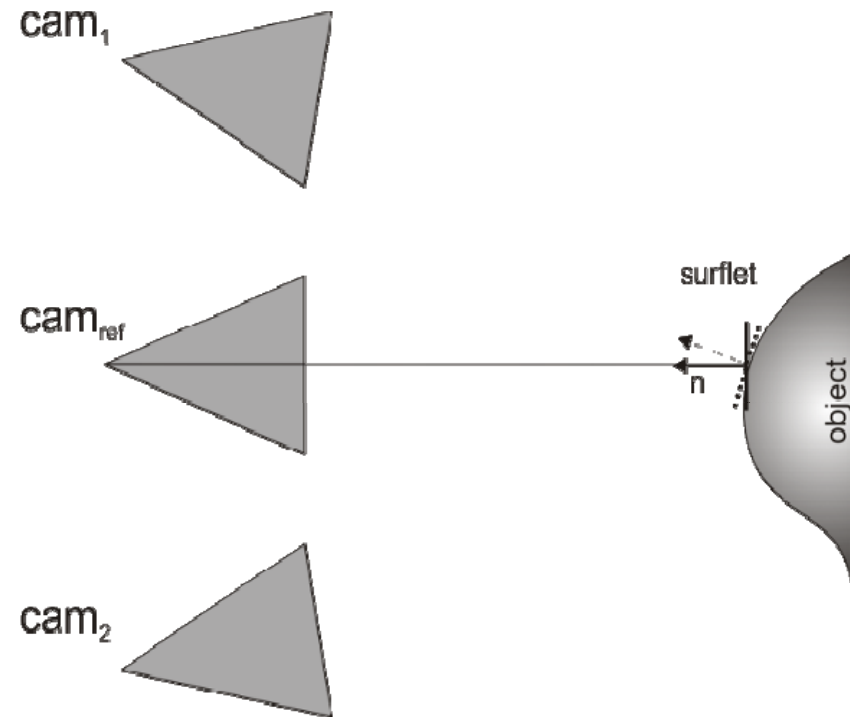
video + depth for
virtual camera

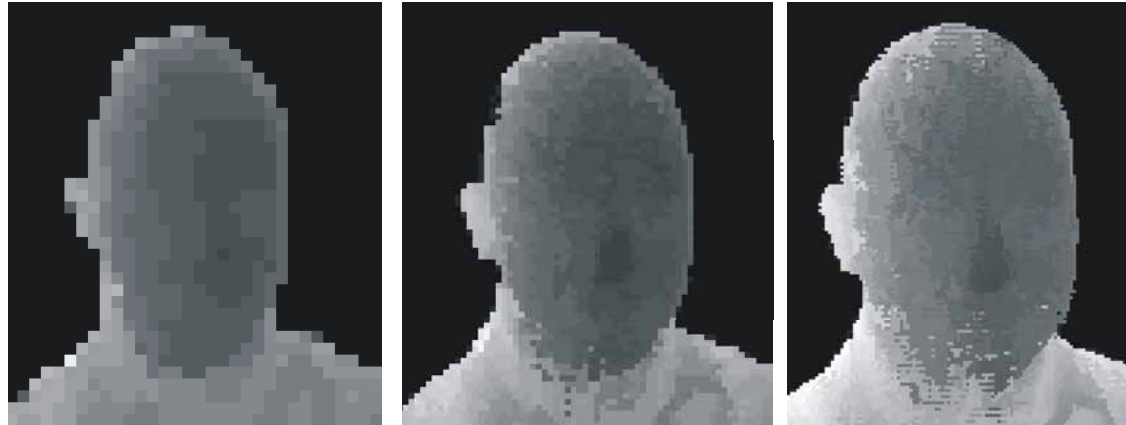




- Initial disparity/depth estimation based on hybrid-recursive matching (HRM)
- Robust disparities after trifocal consistency check
- GPU based patch sweeping for refinement in depth

- Change of orientation of a surflet in the reference camera to match best neighbour cameras
- User defined depth resolution possible
- High parallelization possible
- Well suited for graphic card implementation

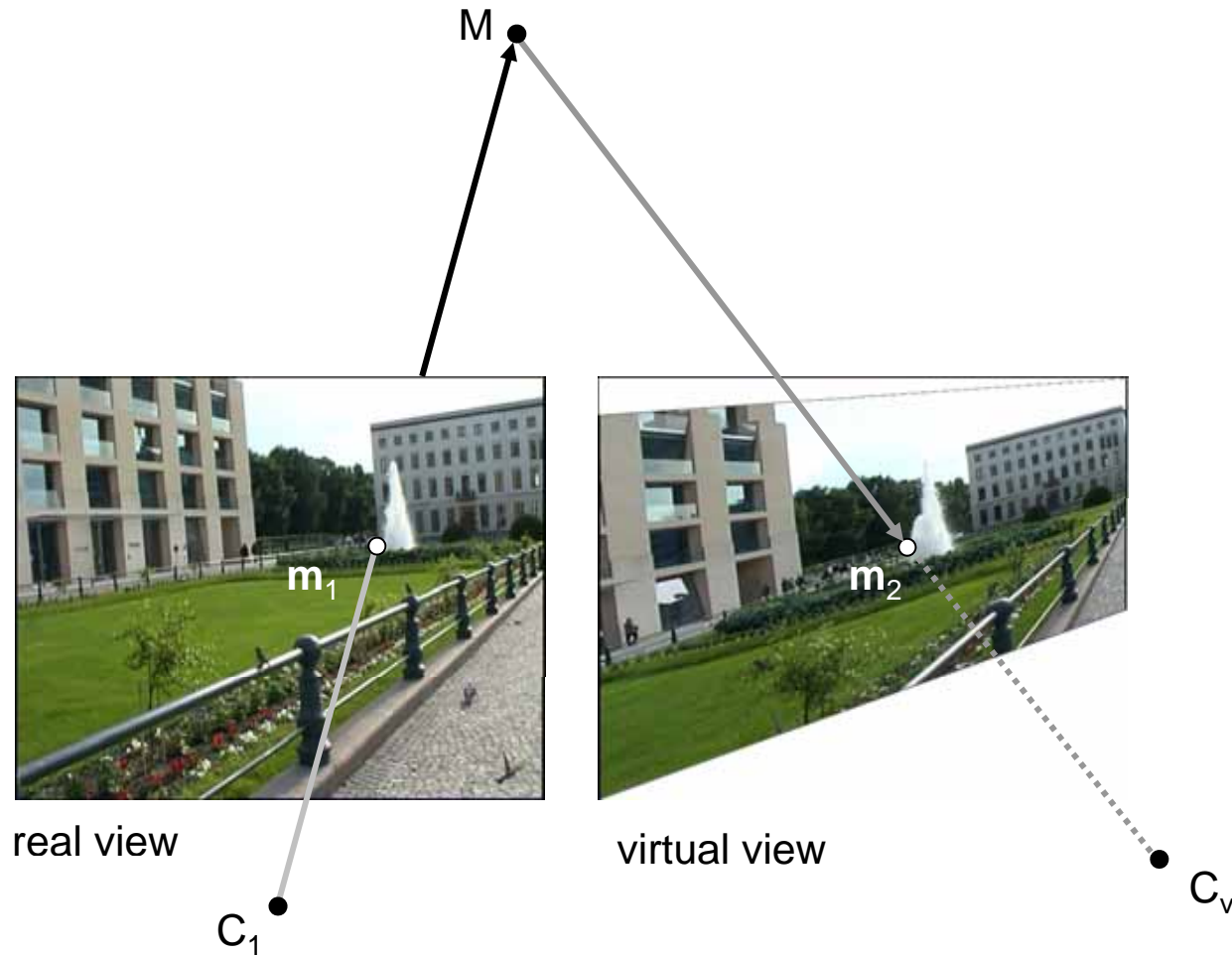




HRM result for pixel accuracy, sub-pel accuracy of factor 2, sub-pel accuracy of factor 4



Patch sweeping result: original view (left), synthesized view (middle), depth map (right)



Simulation Results on Virtual View Synthesis

Image Processing

top camera



ground truth camera



Simulation Results on Virtual View Synthesis

Image Processing

top camera



interpolated view





Camera 1:
original video
and depth



Camera 2:
original video
and depth

Original Views and Target Ground Truth Camera

Image Processing



original view



target view

Target View and Synthesized View



target view



synthesized view

target
view

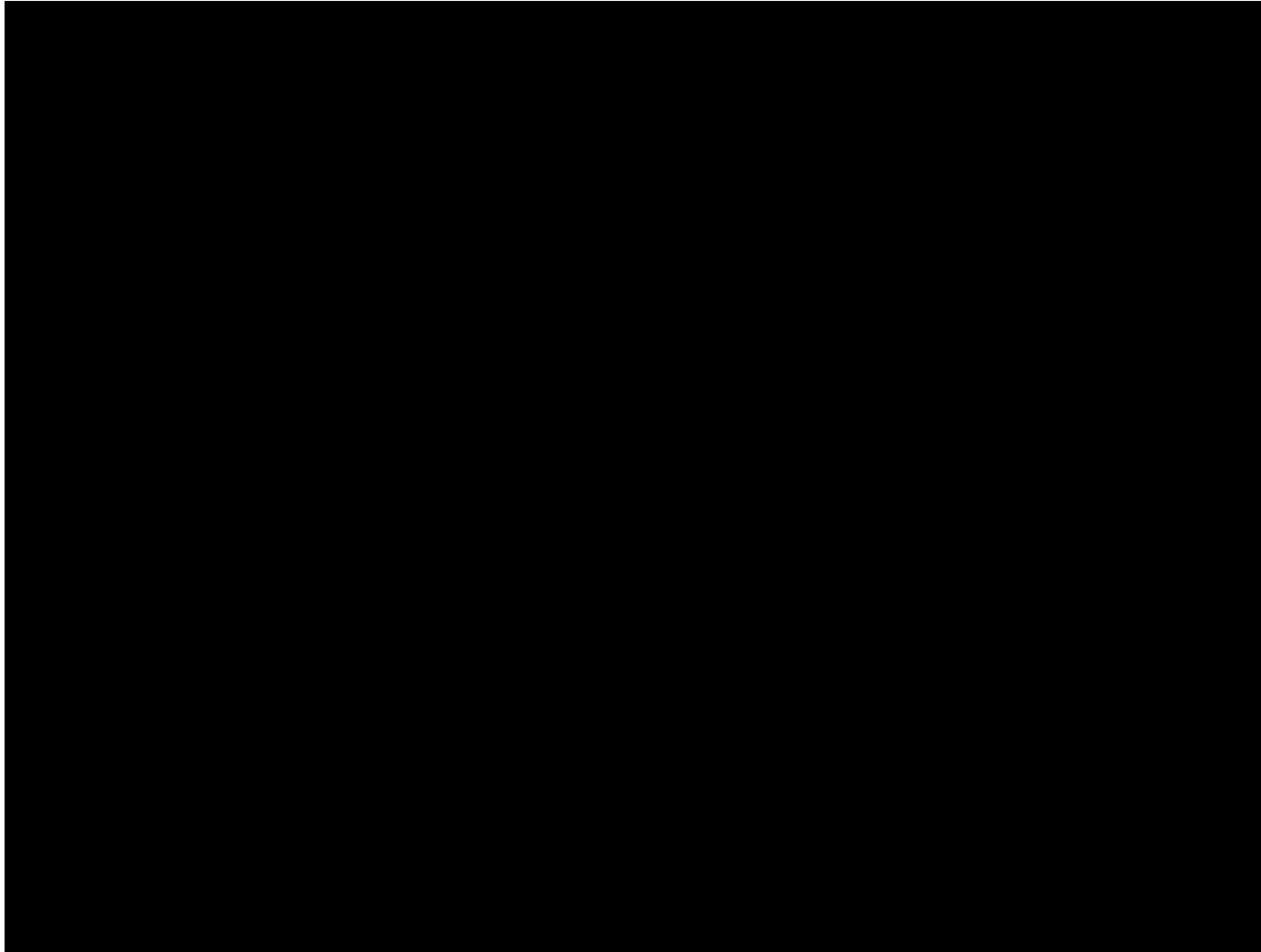
synthesized
view

The Virtual Eye Contact Engine

Image Processing



First demonstration to the public at 3D Stereo Media,
Liège, 8.-10. December 2010!!



- Commercial video communication systems still lack with respect to true tele-immersion
 - Limited gesture awareness
 - No eye contact
- Solutions for direct eye contact on prototype level available
 - Combined approach of multi-view stereo and patch sweeping
 - Exploitation of graphic cards
 - High-resolution, high quality rendering achieved

**Thank you for
your attention!**

Contact: Oliver.Schreer@hhi.fraunhofer.de