

ICVSS 2008  
Sampieri,  
Sicily

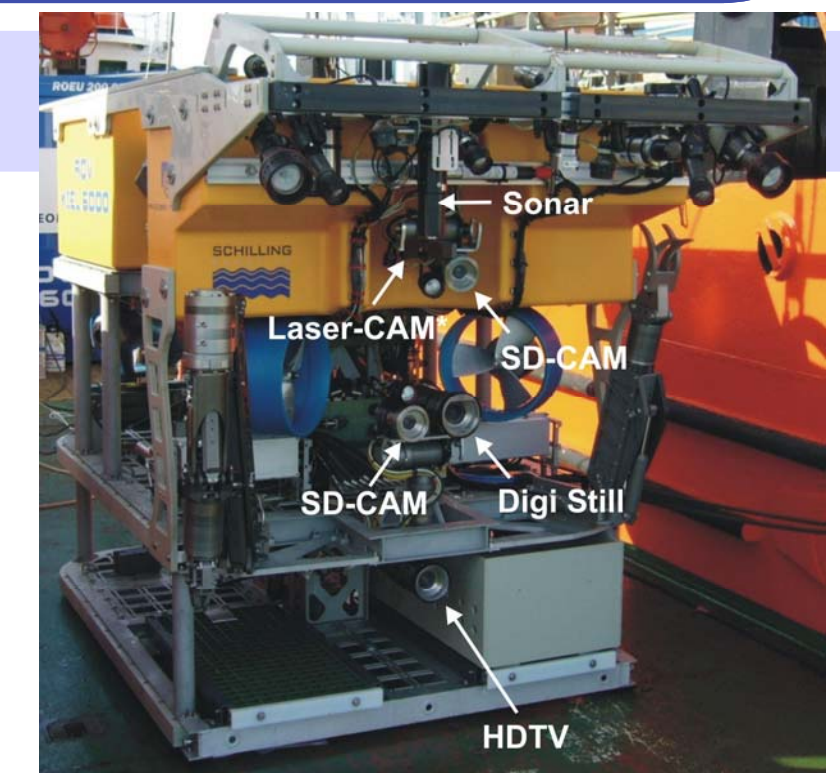
# 3D-Modeling of Seafloor Structures from ROV-based Video Data



Anne Sedlazeck and Reinhard Koch  
Multimedia Information Processing  
Christian-Albrechts-University of Kiel, Germany

## Motivation

- investigate feasibility and limitations of image processing and 3D Computer Vision techniques in deep sea underwater imaging environments (equipment: ROV Kiel 6000)
- reconstruction of 3D surface structures yields a seafloor map in 3D with accuracy for further volumetric analysis

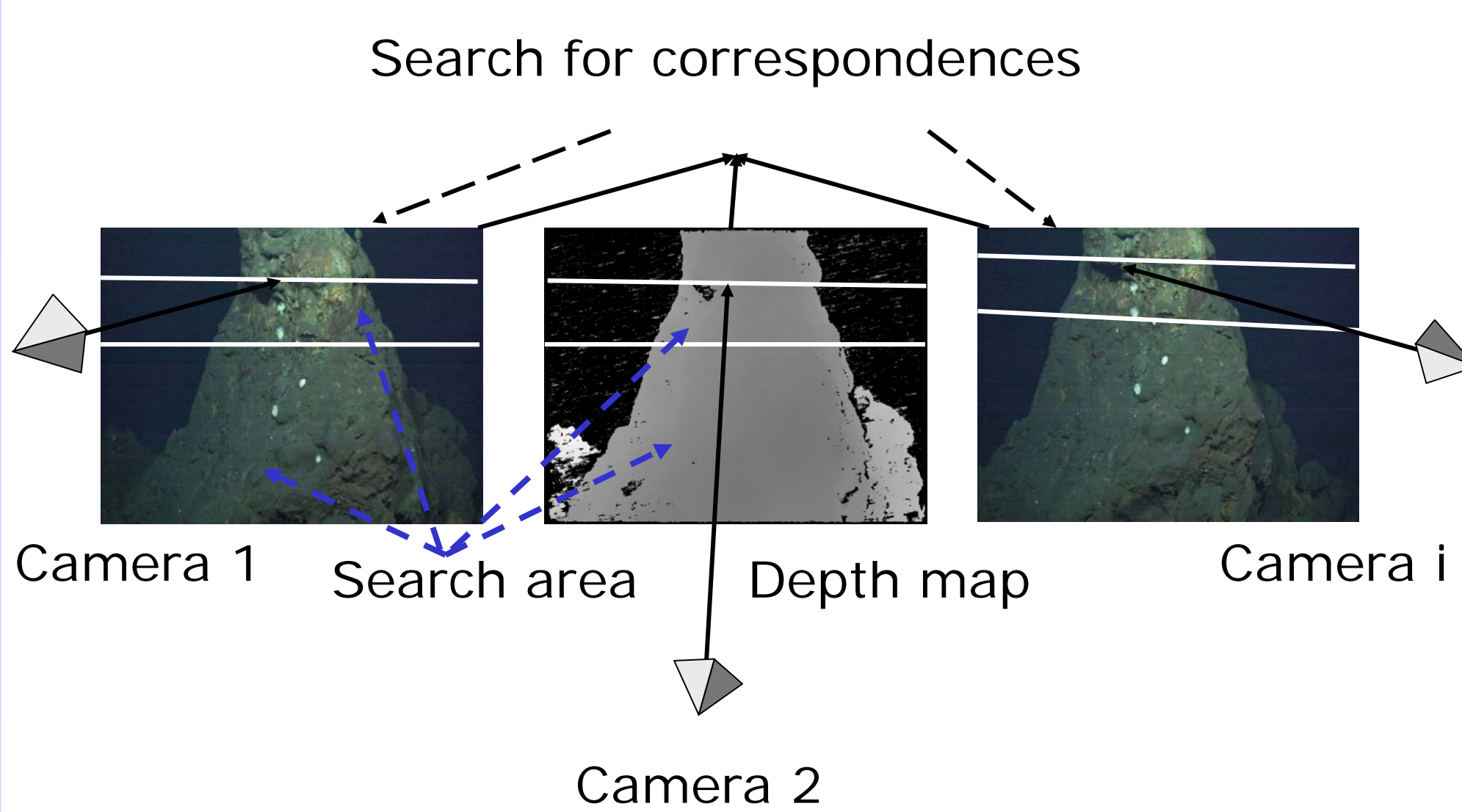
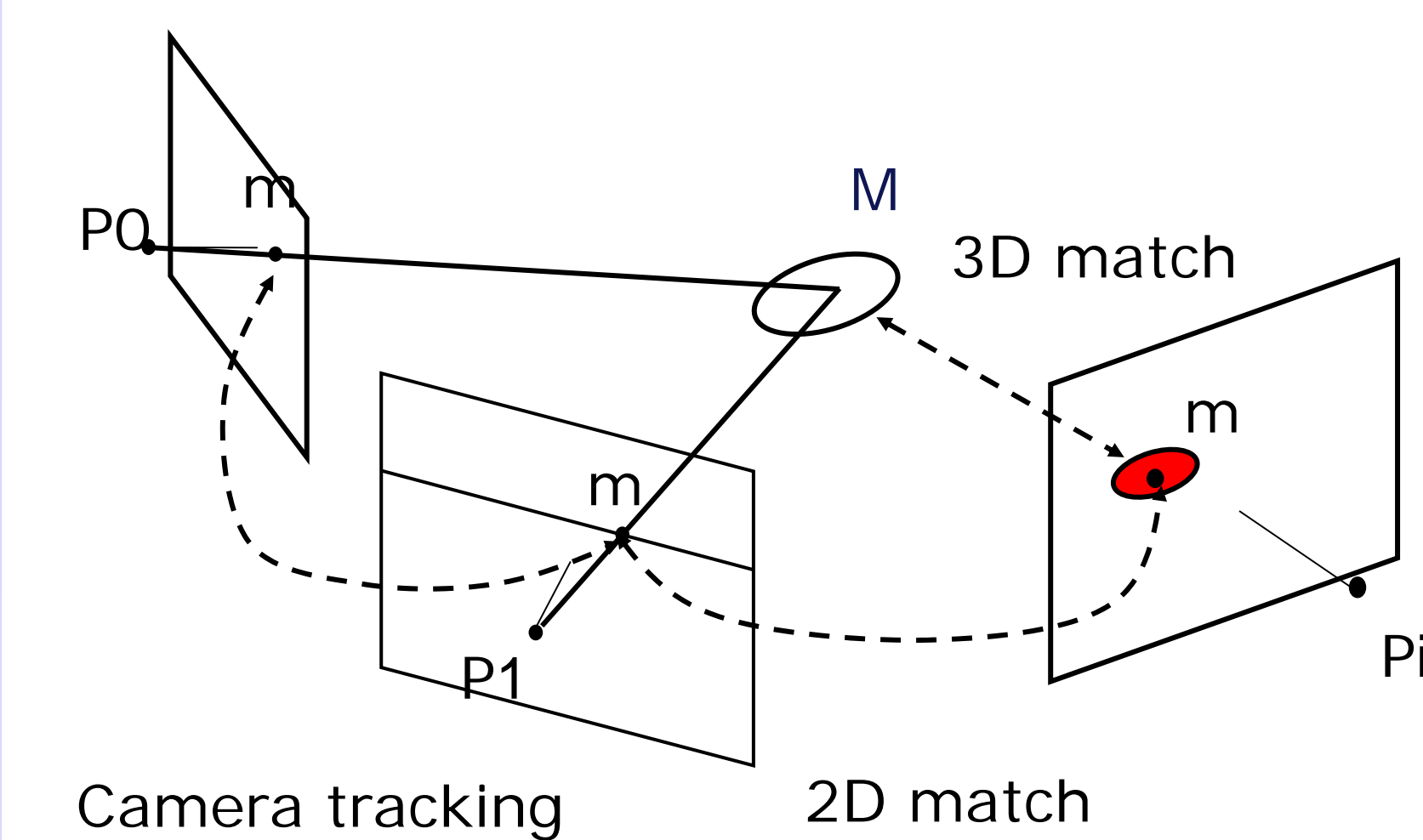


Kiel 6000 with its cameras

Captured image sequence of black smoker at  $4^{\circ} 48' S$  and  $12^{\circ} 23' W$  (Atlantic Ocean), depth: 3039m



## Traditional SfM Approach



## Identified Problems in Underwater Environment

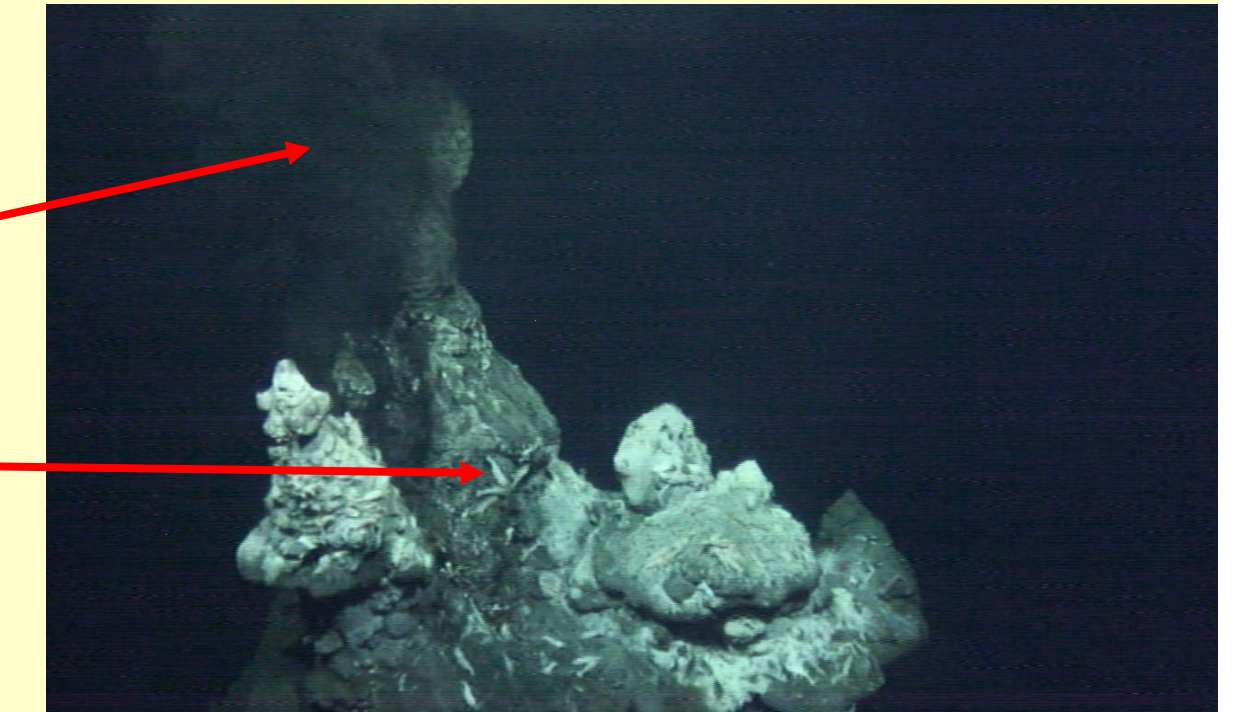
### Underwater Radiative Transfer

- special underwater imaging conditions (scattering and absorption)
- light source moves rigidly with camera (unstable lighting conditions)
- varying signal-to-noise ratio



### Feature Correspondences

- floating particles
- moving animals and smoke at the top of the black smoker

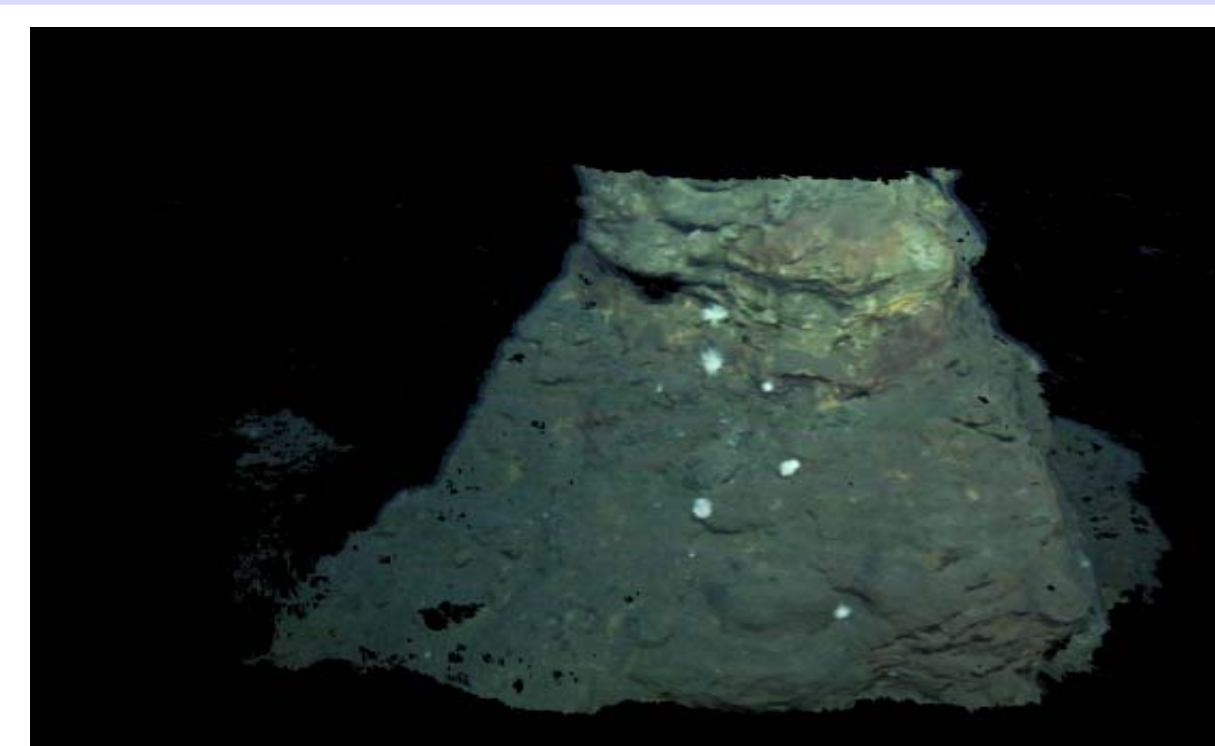
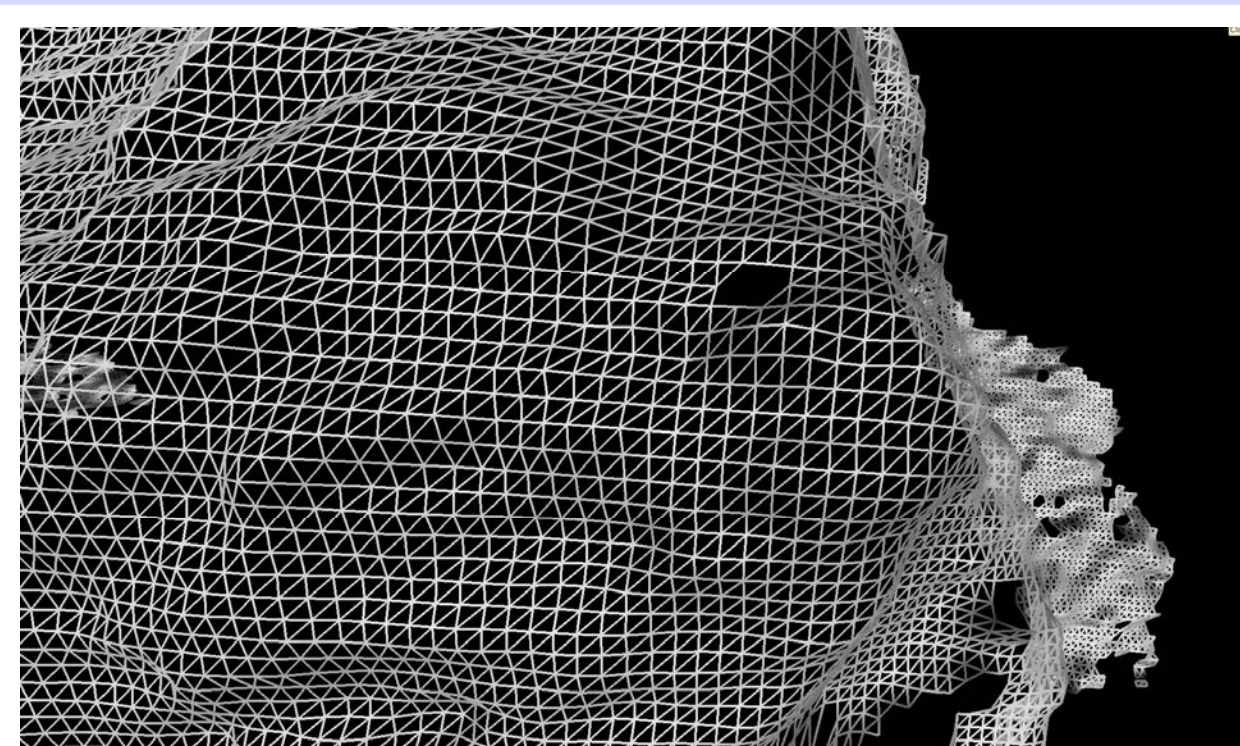
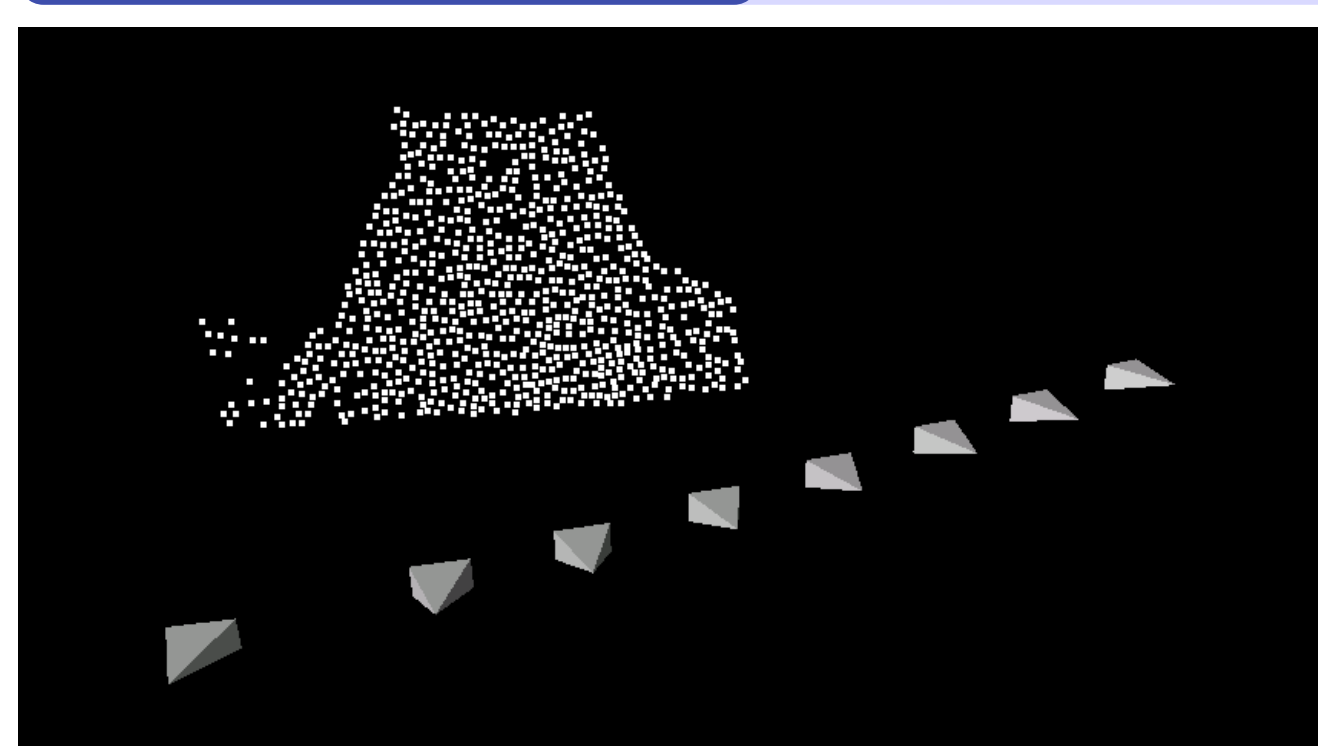


### Challenging Camera Calibration

- optical path/refraction depends on salinity, depth, temperature, zoom, etc.
- auto-calibration on-site required
- degenerate scene (dominant plane, structures cover small field of view)
- absolute scale to enable volumetric analysis



## First Results



From left to right:  
camera path,  
wireframe, and  
3D-model