Real-Time Pointcloud Fusion and Mesh Generation

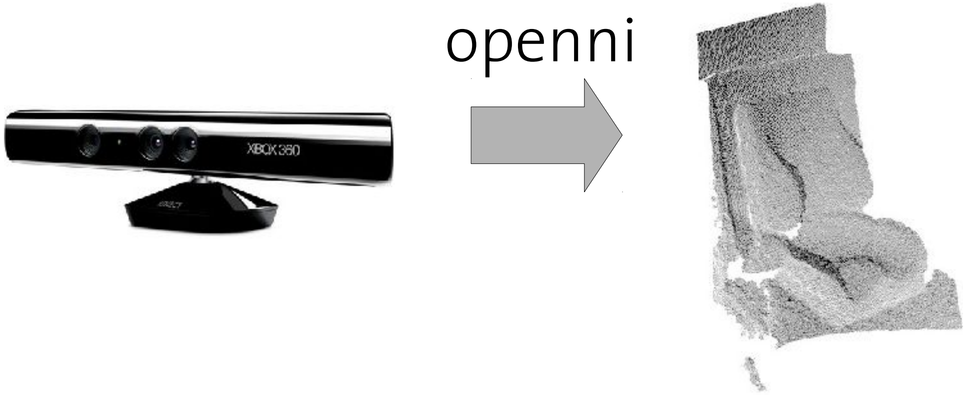
Remo Meyer & Jan Rüegg

CVG

Computer Vision and Geometry Lab

Pipeline

Pipeline



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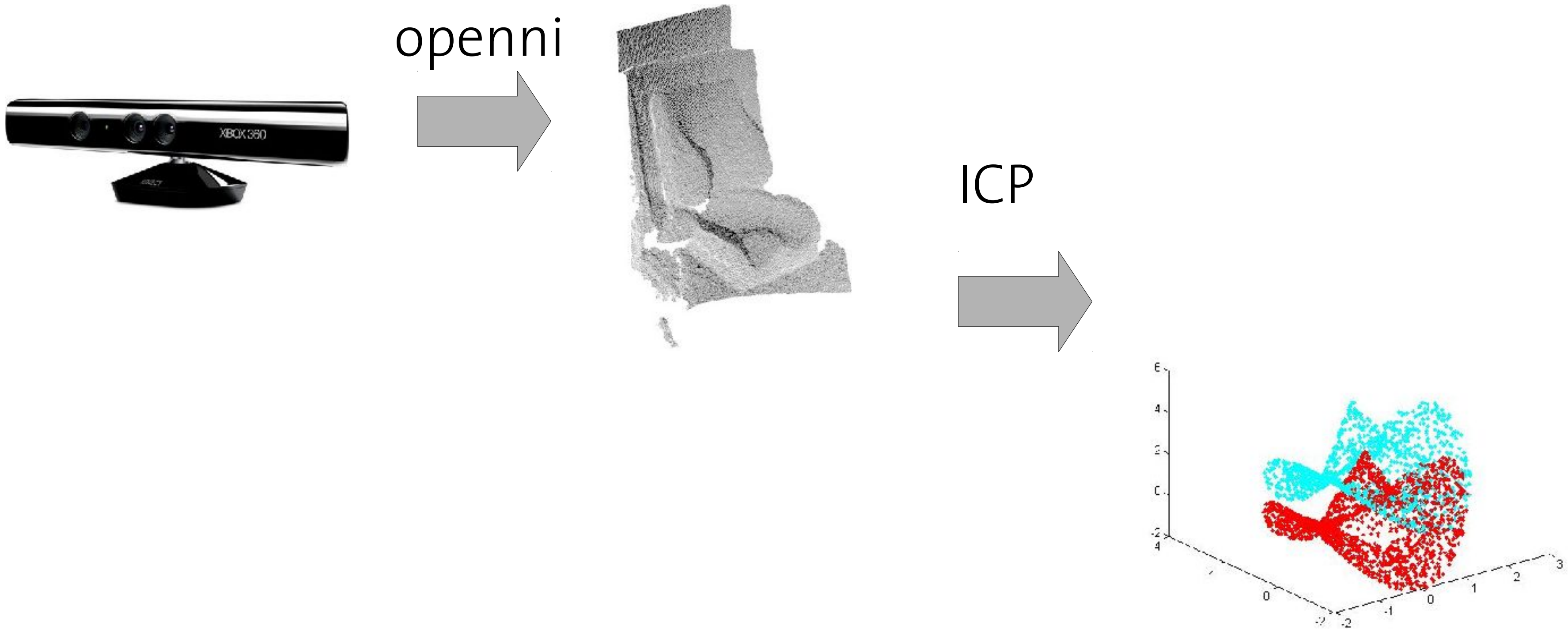
Pipeline



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ICP

Pipeline

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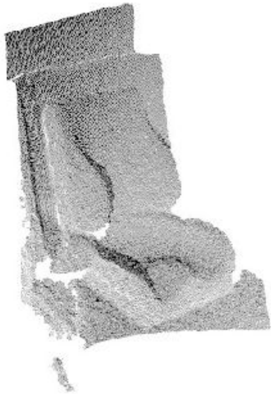

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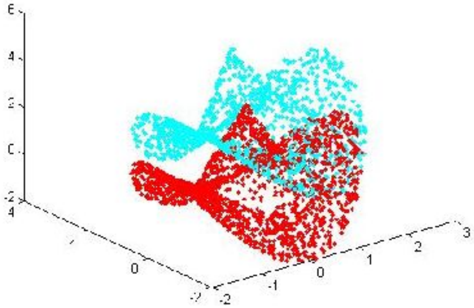
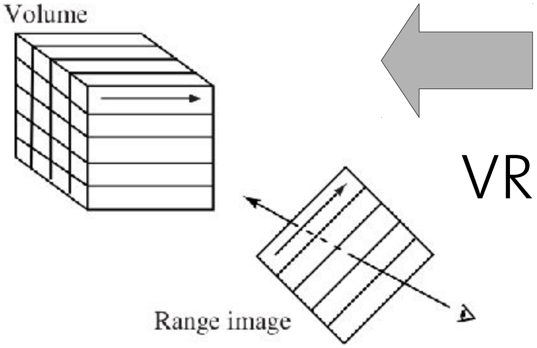
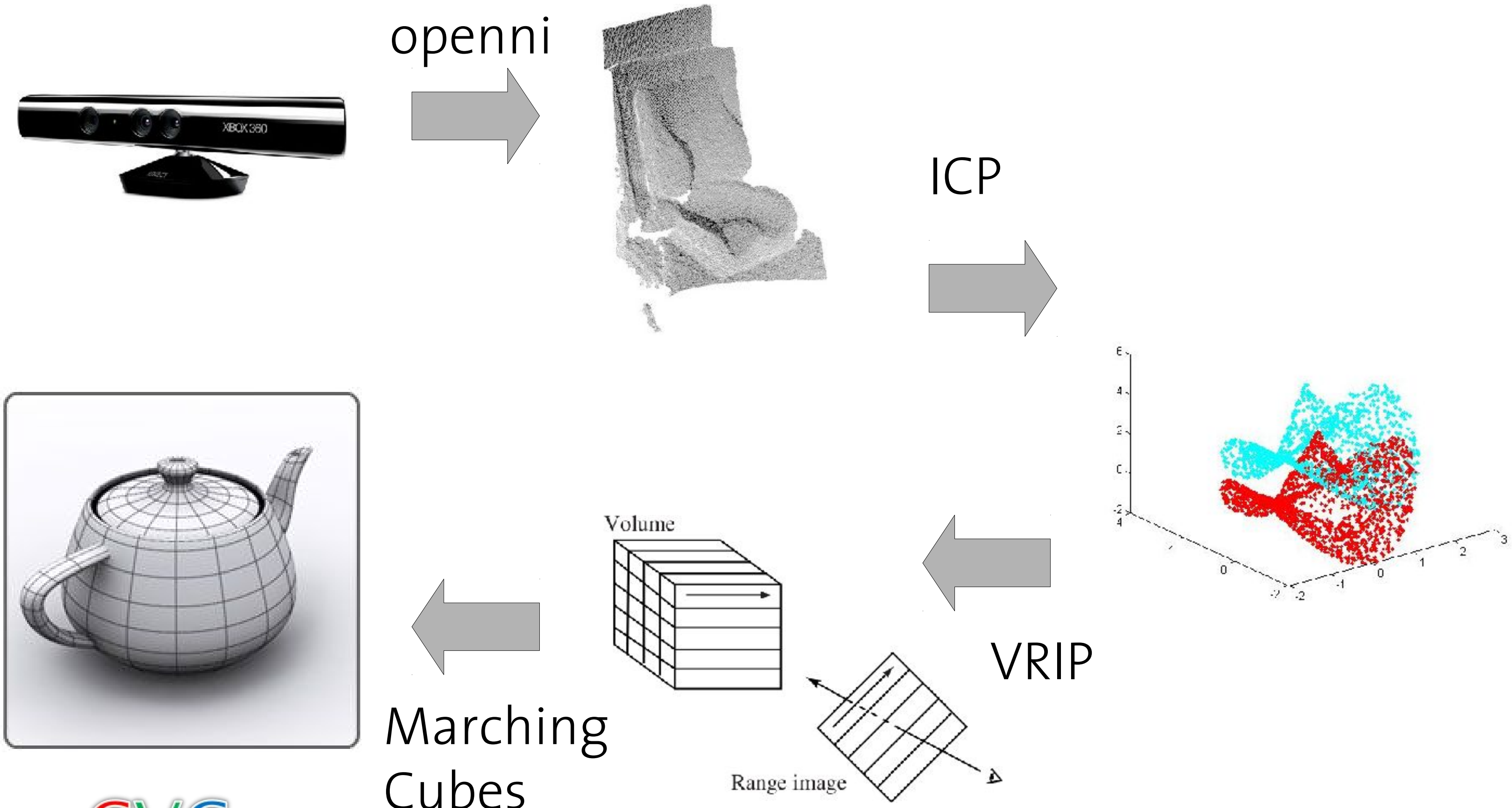


VRIP



Pipeline



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ICP

VRIP

Marching Cubes

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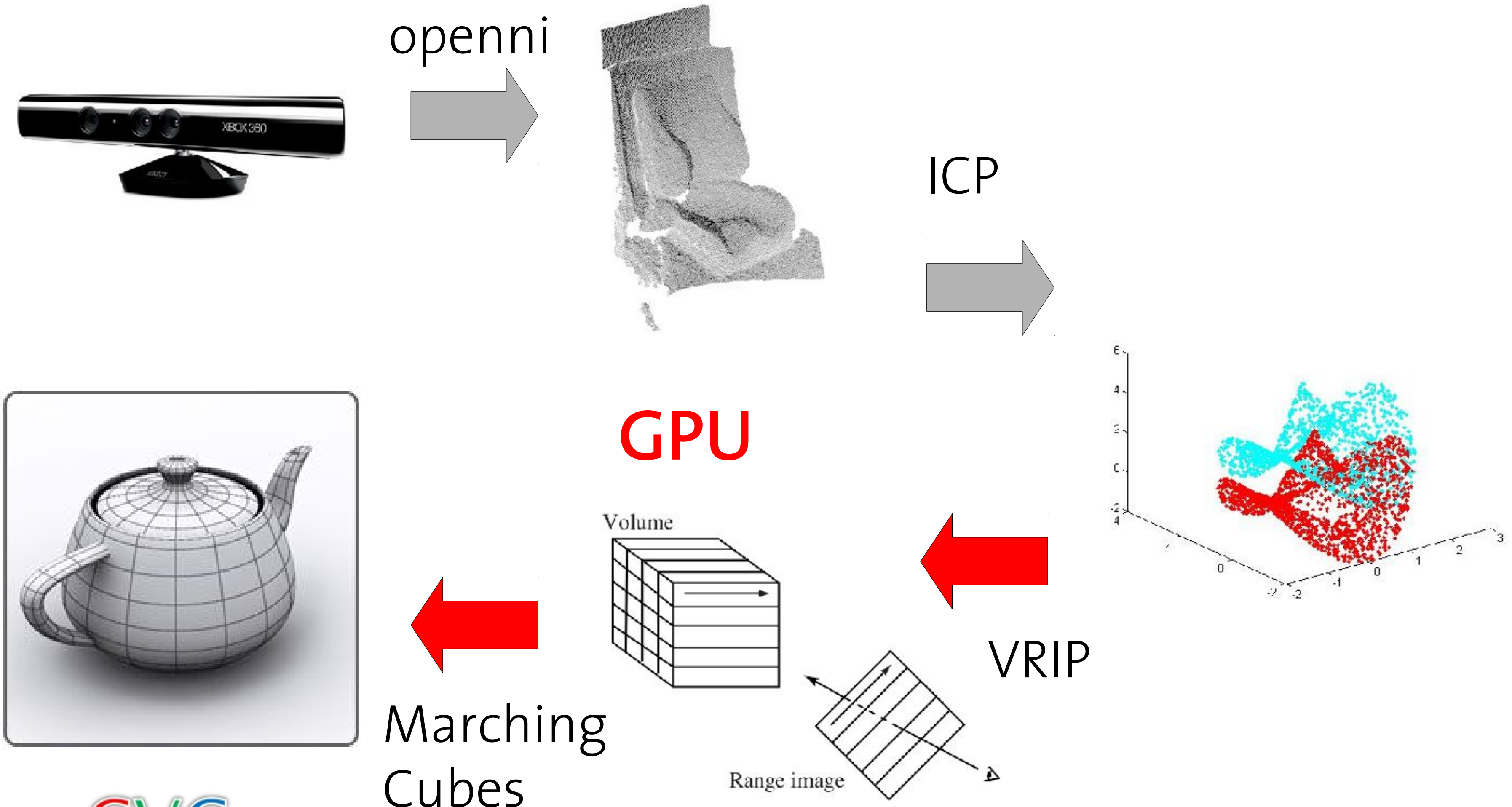
Pipeline



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ICP

VRIP

GPU

Marching Cubes

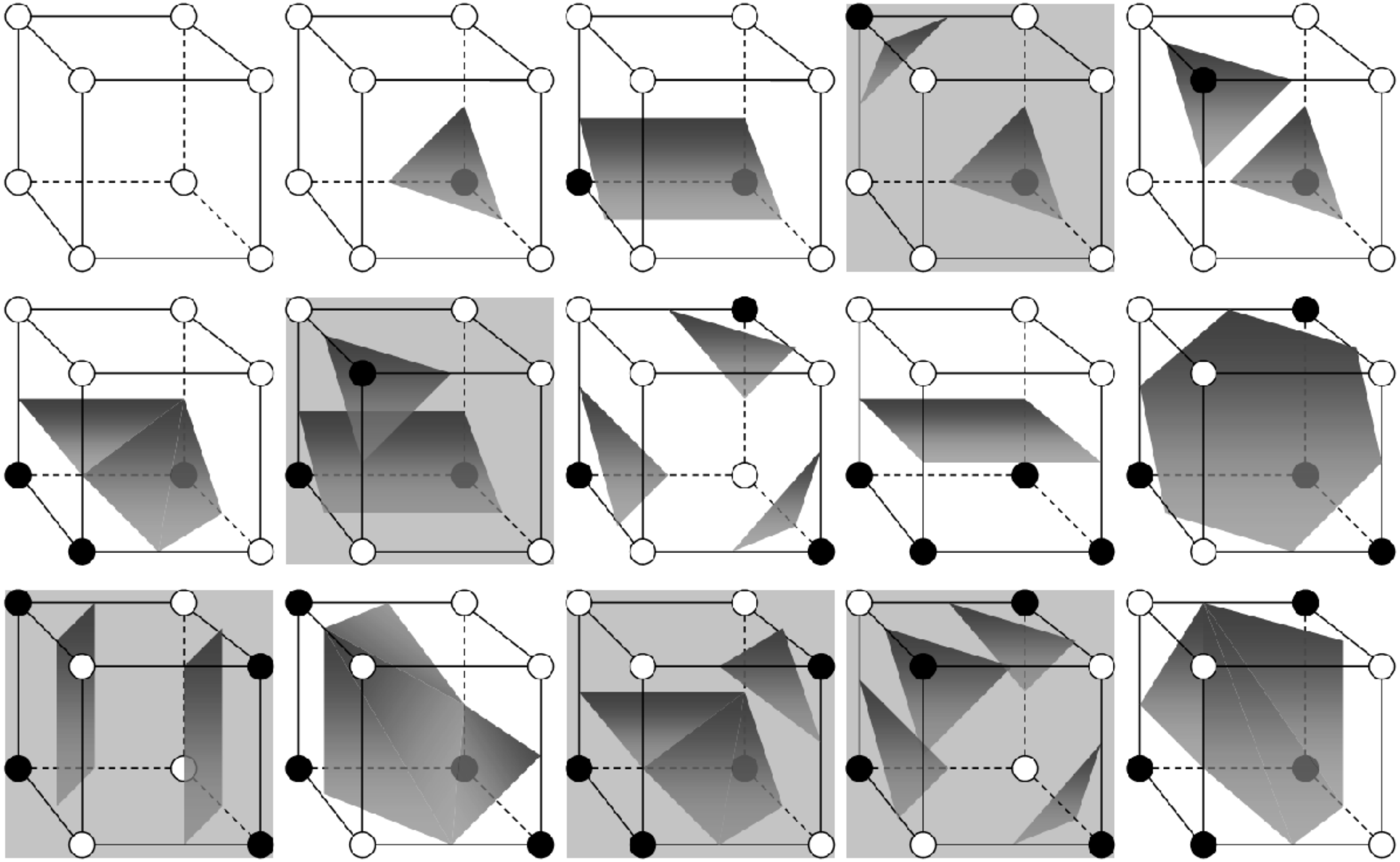
Part 1: ICP

- 3D – Photography Course
- Reading Kinect Data
- 6-Step ICP Pipeline
- Robot Operating System

Part 2: VRIP

- *A Volumetric Method for Building Complex Models from Range Images*
- Brian Curless & Marc Levoy, Stanford University, SIGGRAPH '96
- *From Scratch* Implementation

Marching Cubes



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Marching Cubes

- Reference Implementation
  - http://www.thebigblob.com/tag/marching-cubes/
- Ported to OpenCL
- Prefix-sum to decrease memory requirement

Technical Details

- ROS
- *OpenCL*
- Multiple *Threads*

  (1 for ICP, 1 for VRIP / Marching Cubes)
- Realtime
- Incremental

Setup

MacBook Pro 13“

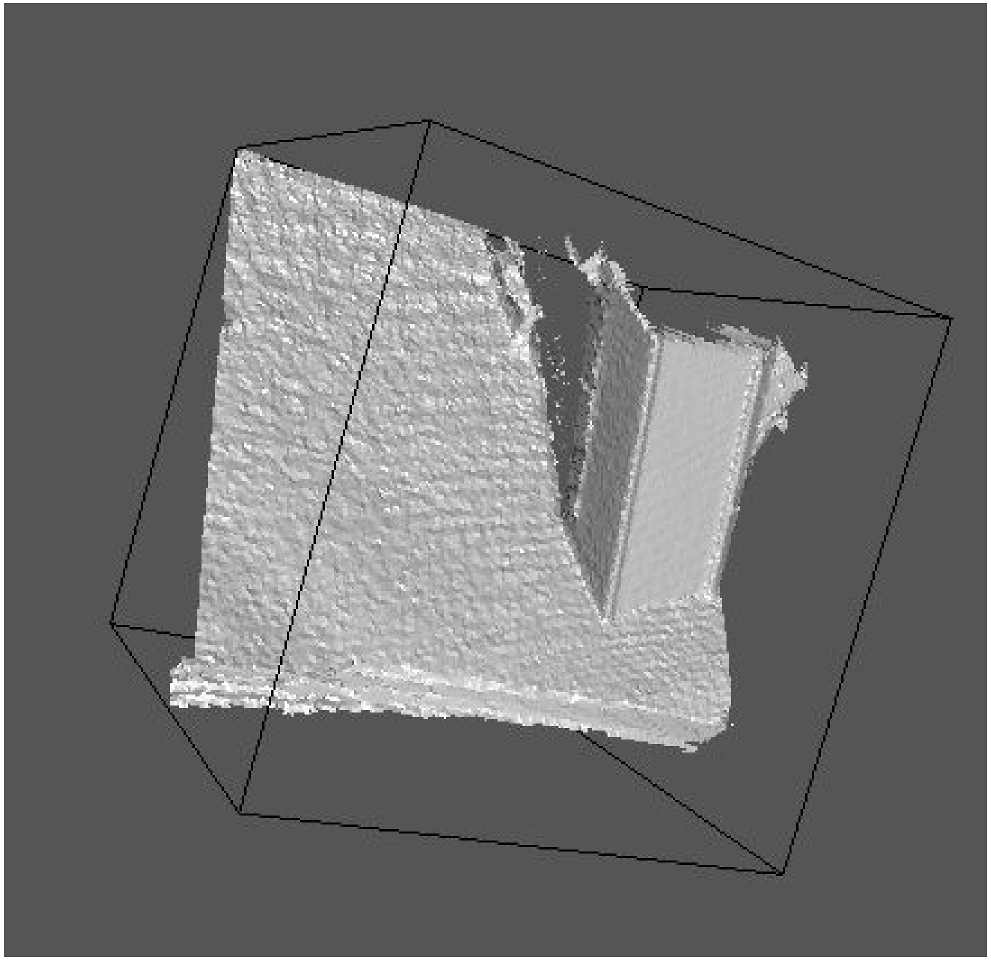
- *GPU*: Gforce 320M
- *CPU*: Core2 Duo @2.4GHz

- Grid Size: 128x128x128

Speedup

	Vrip	Marching Cubes
CPU	44.3 ms	126 ms
GPU	5.2 ms	91 ms
Speedup	8.5	1.38

Demo!



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Outlook

- Realtime Viewer
- More Memory Efficiency
- Finer Volumetric Grid

Our Repository

- *https://github.com/SgtPepper123/ICP_3dPhoto*
- *Important files in the project Folder (kinect_icp):*
  - *src/vrip.cpp: Vrip and Marching Cubes Subscriber*
  - *src/point_cloud_fusor.cpp: ROS interface*
  - *fuse.cl: Vrip and Marching Cubes OpenCL Kernel*
  - *ScanLargeArrays_Kernels.cl: PrefixSum kernel*

Our Contribution

- The PrefixSum kernel was the only thing not written by us. As we already did this task in the exercise, we did not port it to OpenCL, but used a reference implementation from the AMD SDK instead.

- Also, the files mentioned above are all written entirely for this lecture. The 3d - Photography work was done in the other files (like *icp_local.cpp, icp_core.cpp*...)