

Interactive Visualization to Support Quantitative Analysis of Bone Biopsies

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SPACE MEDICINE
DOWN TO THE EARTH

The logo features a blue arc with a small globe of the Earth at its base. Below the arc, the text 'SPACE MEDICINE DOWN TO THE EARTH' is written in a bold, blue, sans-serif font. A faint, stylized 'Copyright' watermark is visible across the center of the slide.

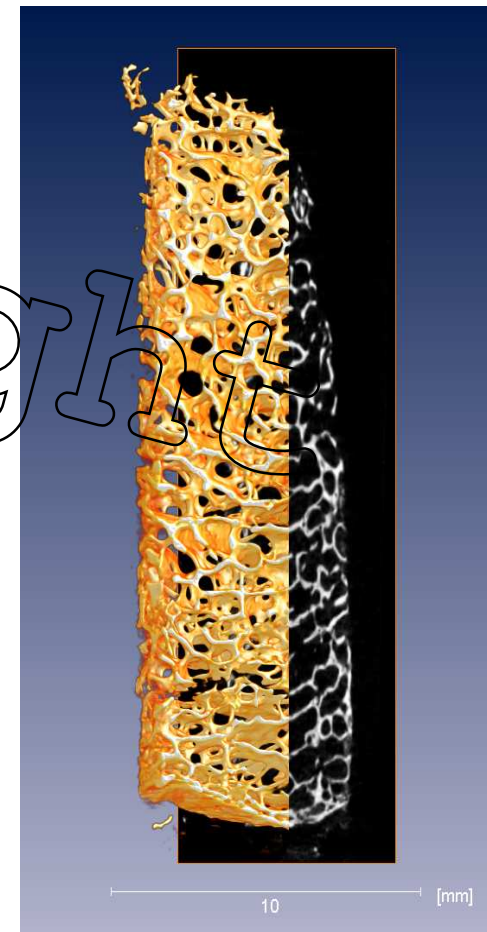
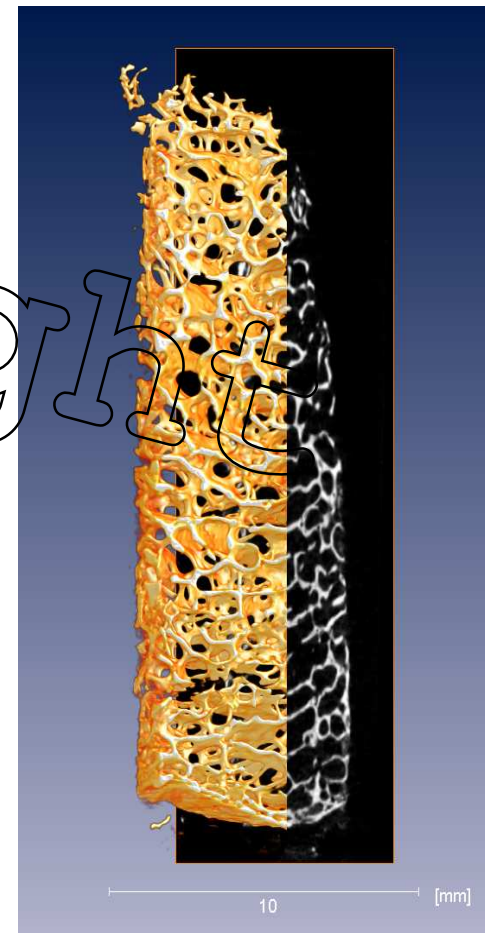


Image Data

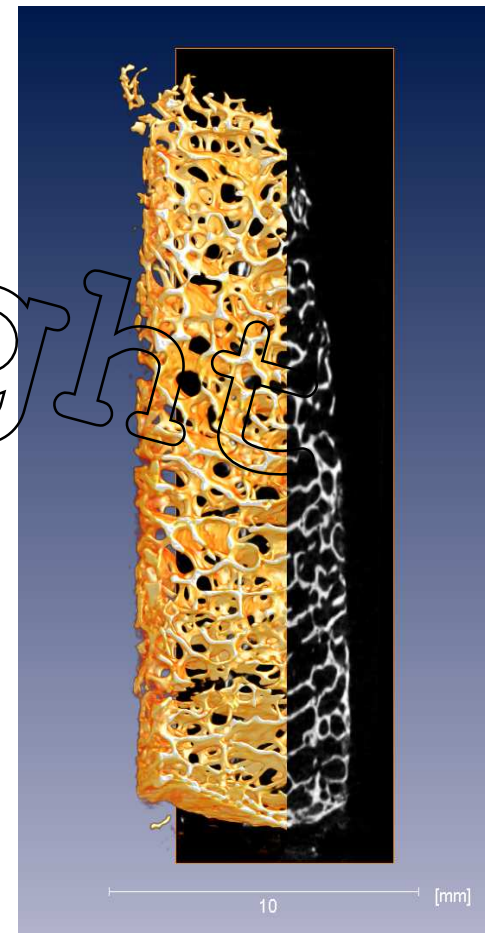
- micro-CT
 - Voxelsize down to 5μ
 - Matrixsize up to 1024^3

Large main memory needed
or out-of-core processing



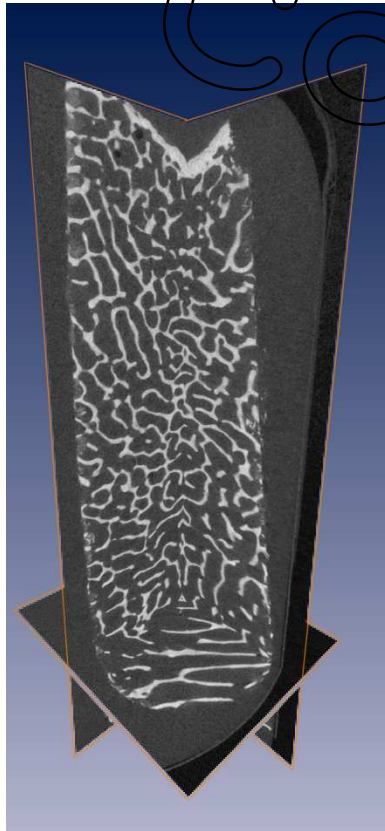
Tasks

- Quantitative analysis, e.g.
 - BV/TV
 - Mean grey value
 - Local thickness
 - More advanced measures
- **Visualization**
 - Interactive frame rates
 - Overall structure
 - Measures

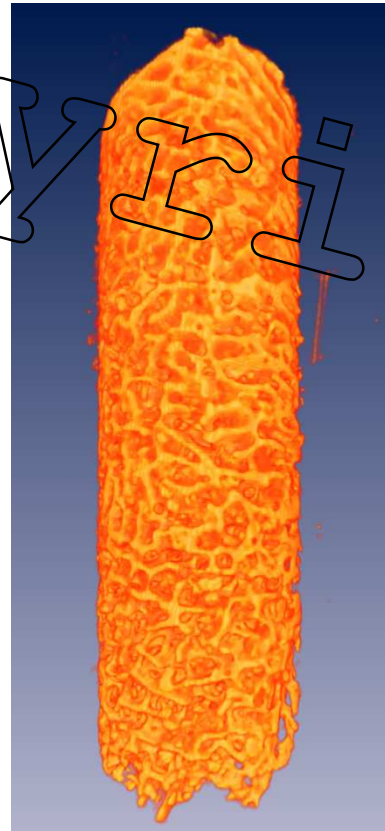


Basic Visualization

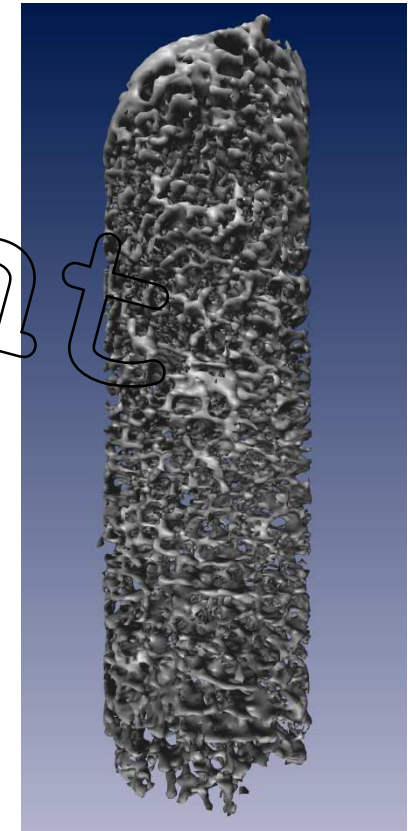
Slicing



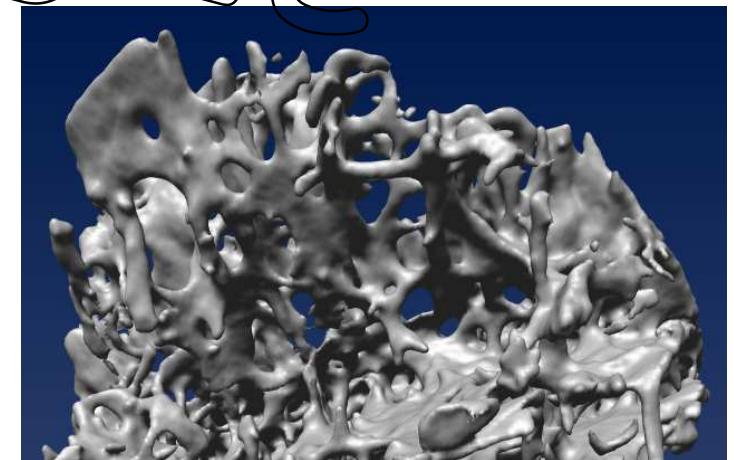
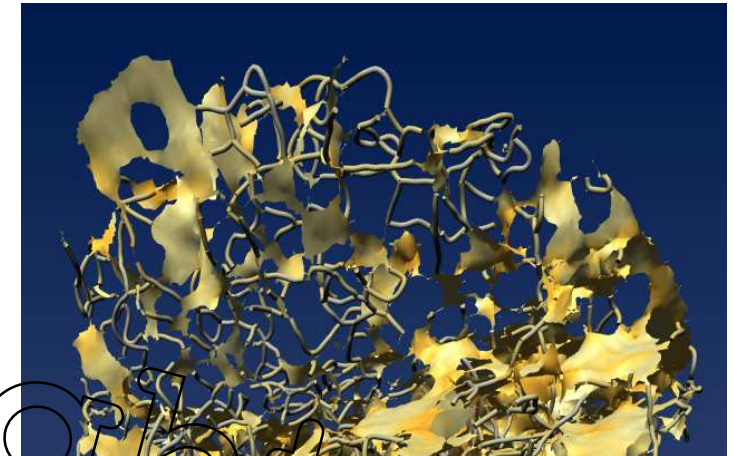
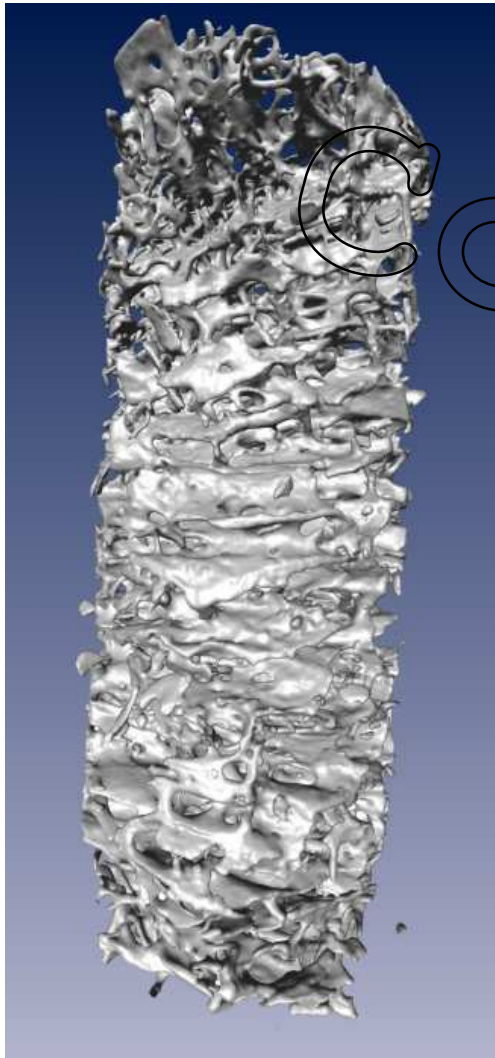
Volume rendering



Isosurface

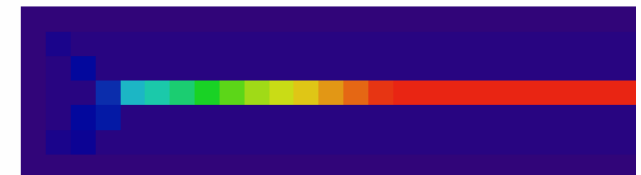
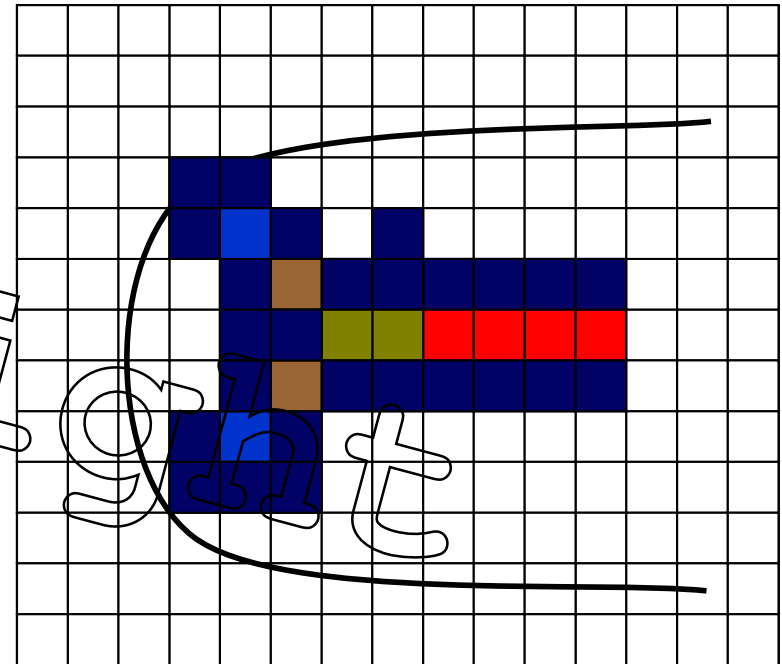


Advanced Vis, Skeleton



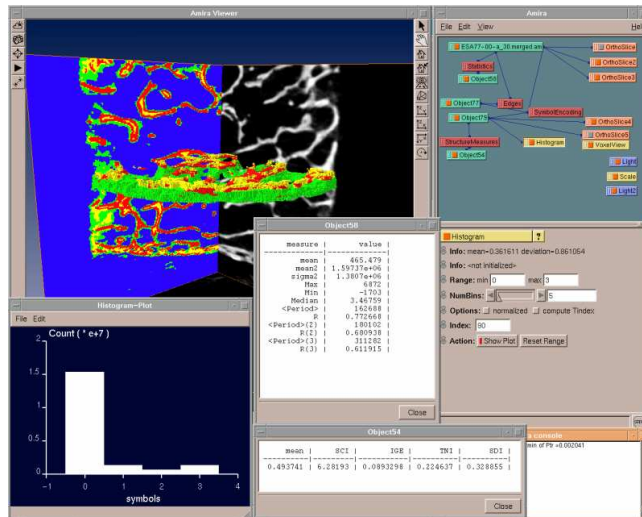
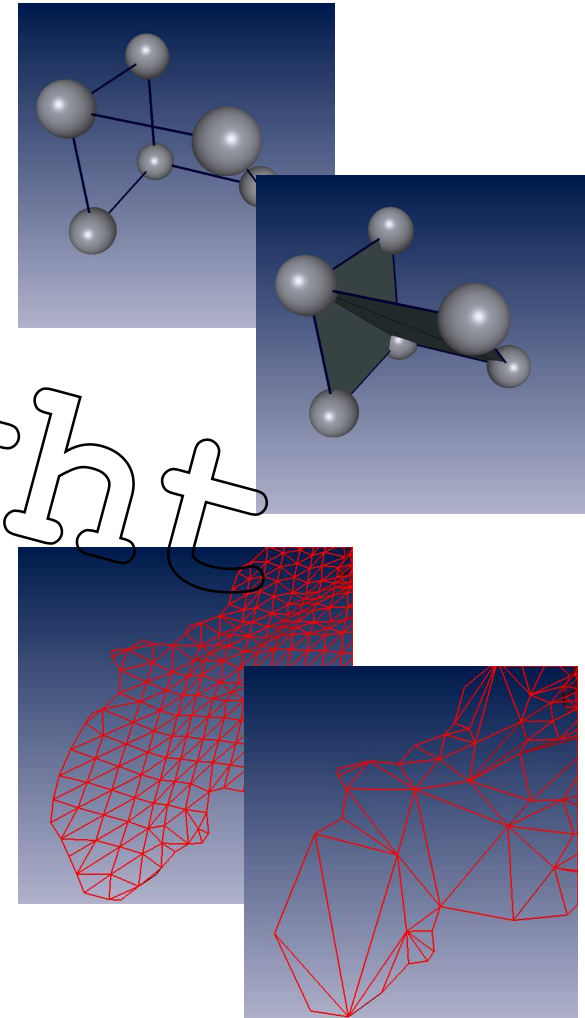
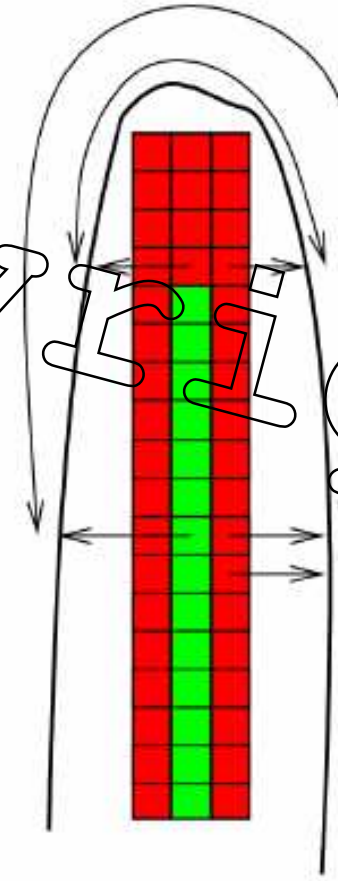
Skletonization Measure

- Maximum of geodesic distance d of nearest boundary voxels
 - Propagation to calculate DM and boundary voxels
 - Propagation in boundary to calc. d
- Threshold controls sensitivity to noise and features



Skeletonization

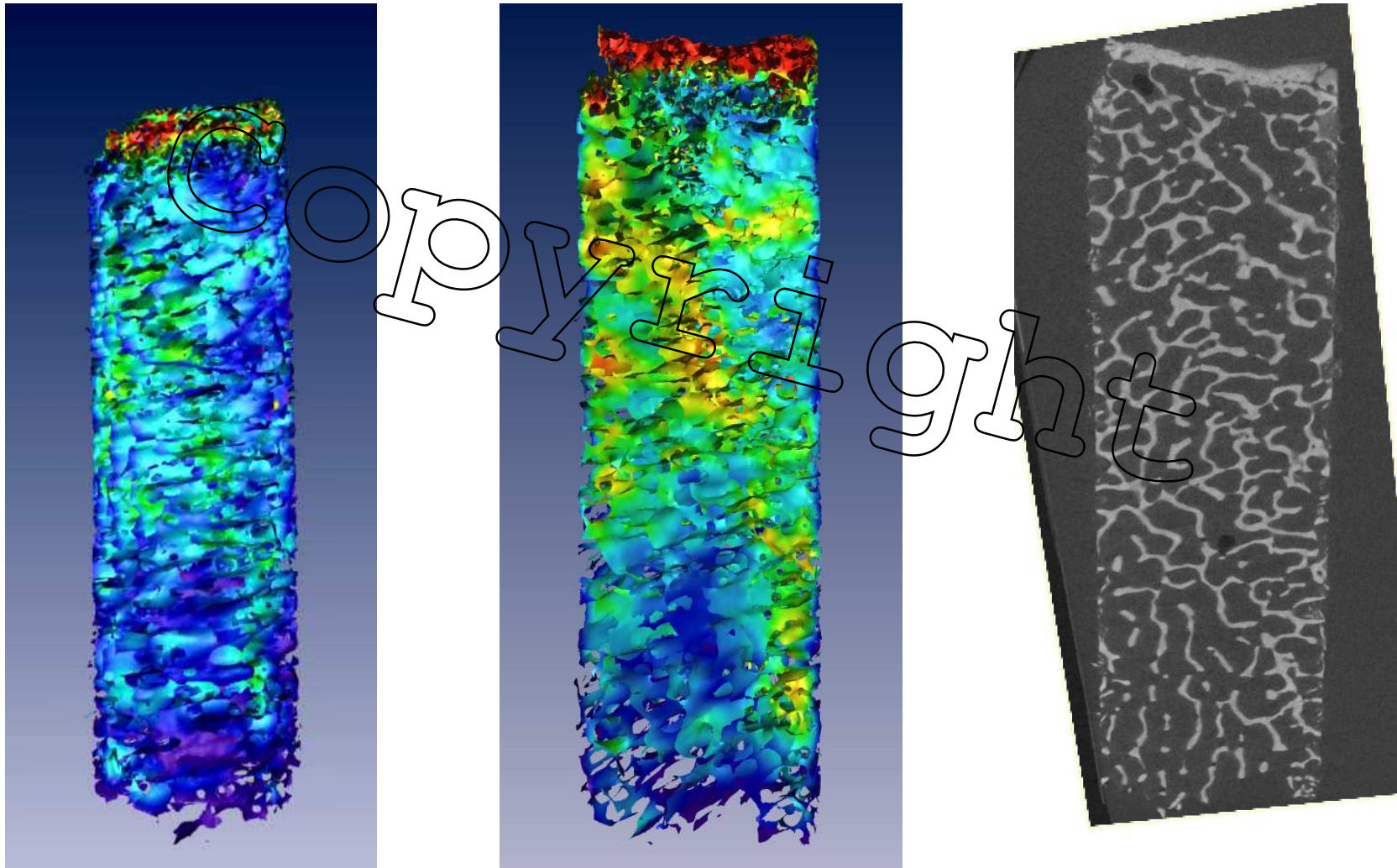
- Segmentation
- Voxel skeleton
- Triangulation
- Triangle reduction
- Integrated into Amira



<http://amira.zib.de>

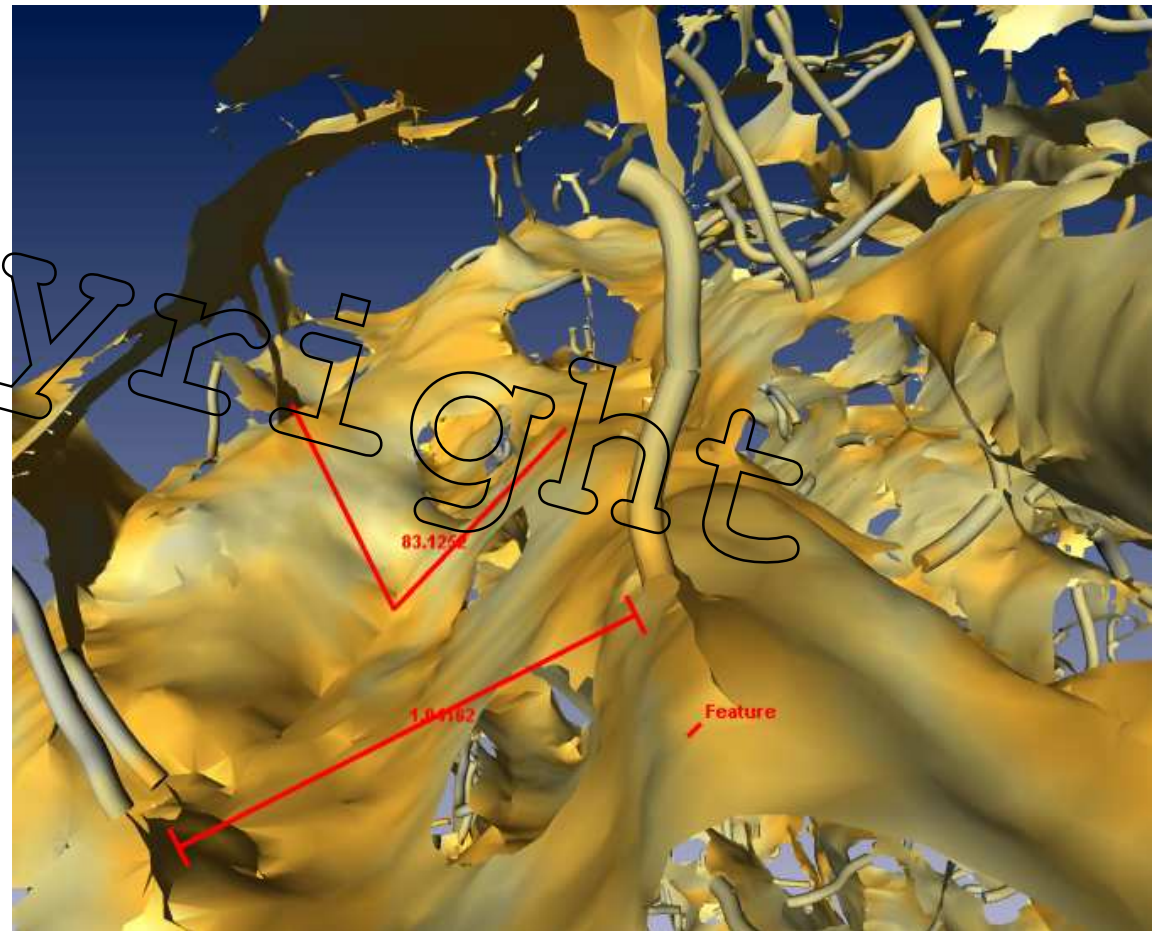
prohaska@zib.de, <http://bone3d.zib.de>

Colored by mean CT value



Interactive Measuring

- Distance
- Angle
- Annotation



Fly Through, Vol. Rendering



Fly Through, Skeleton



Summary

- Interactive visualization of high resolution images of bone biopsies is possible
- Slicing, Isosurface, Volume rendering
- Feature extraction → Skeleton
- Interactive Measuring

Acknowledgement

Visualization framework: Indeed – Visual Concepts, amira.zib.de

Funding: ESA, Scanco Medical

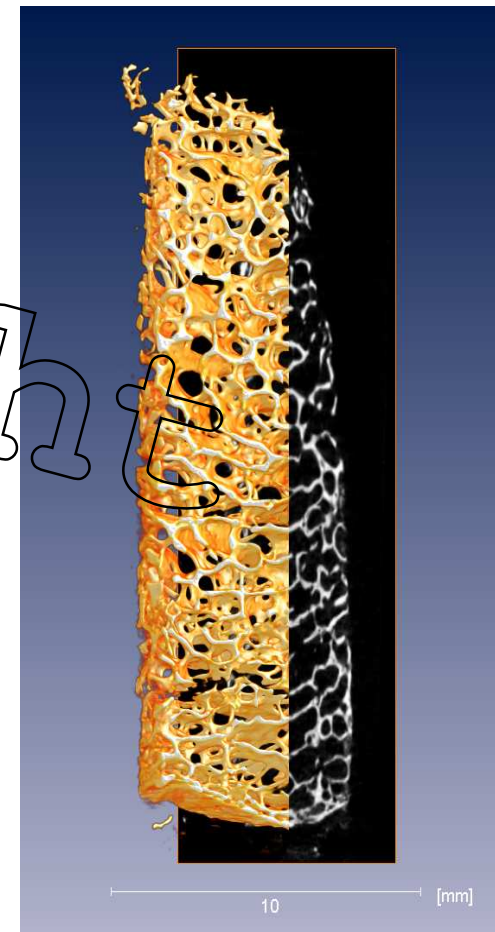
Specimens are a courtesy of the Anatomical Institutes of the Humboldt University and the Free University Berlin.

Thank you...

... for your attention.

Questions?

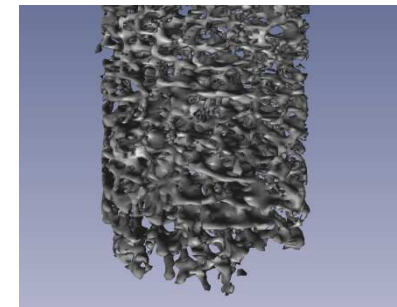
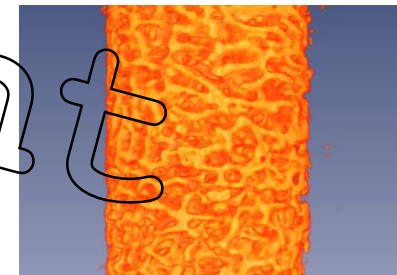
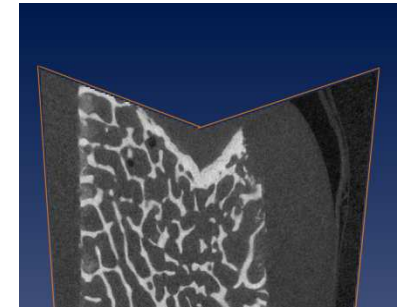
Copyright





Basic Visualization

- Slicing
 - Fast at full resolution
 - Hard to realize 3D structure
 - No preprocessing → reference
- Volume rendering
 - Downsampled (here $8 \times 8 \times 4 = 256$)
- Isosurface
 - 10.000.000 triangles at full resolution
 - Downsampled only



High resolution & 3D structure?

Colored by local thickness

