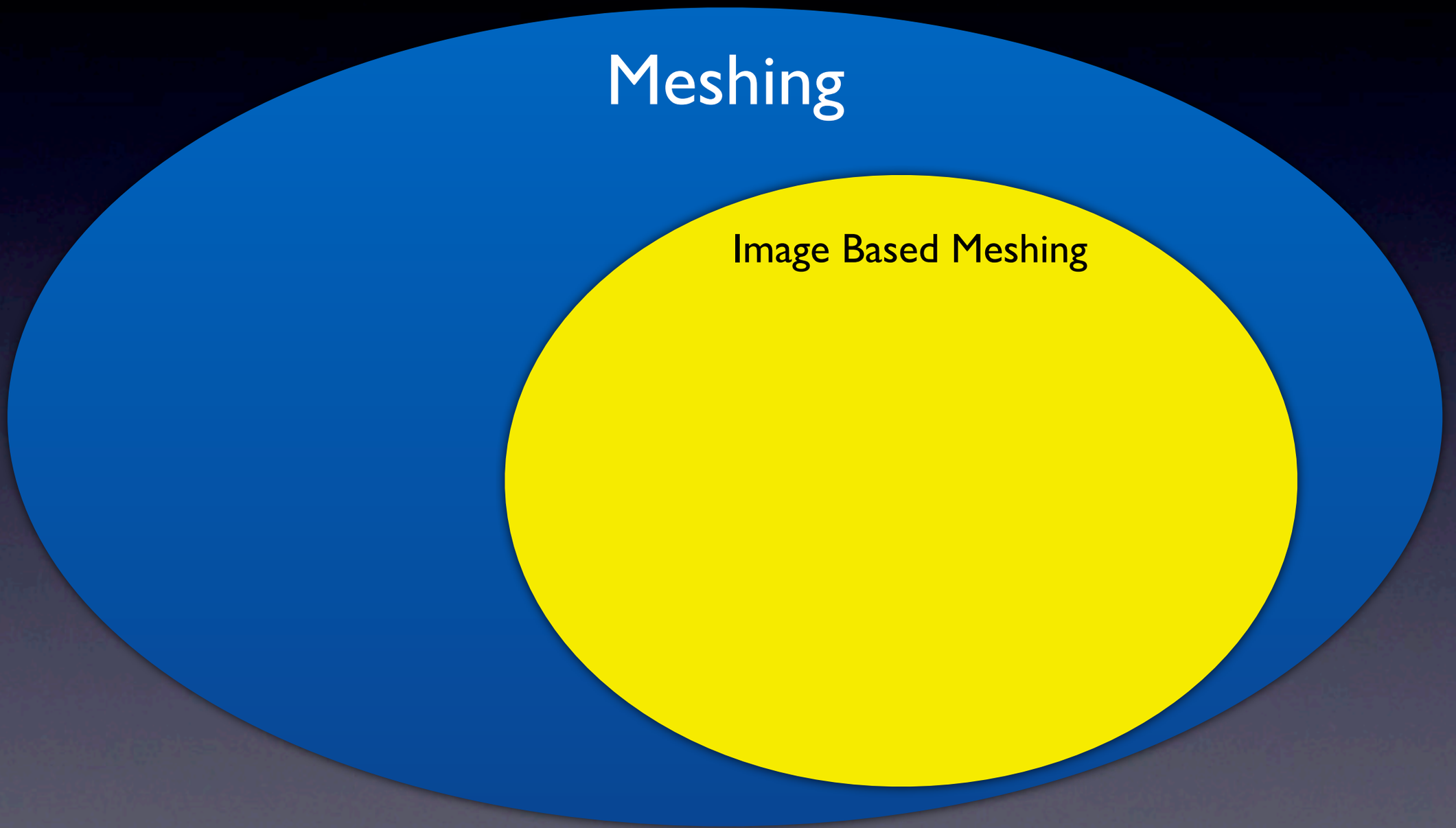
Biomesh3D - Demo

Darrell Swenson, Joshua Levine, Jess Tate, Ross Whitaker, Rob MacLeod

University of Utah
Department of Biomedical Engineering
Scientific Computing and Imaging Institute

When To Use BM3D



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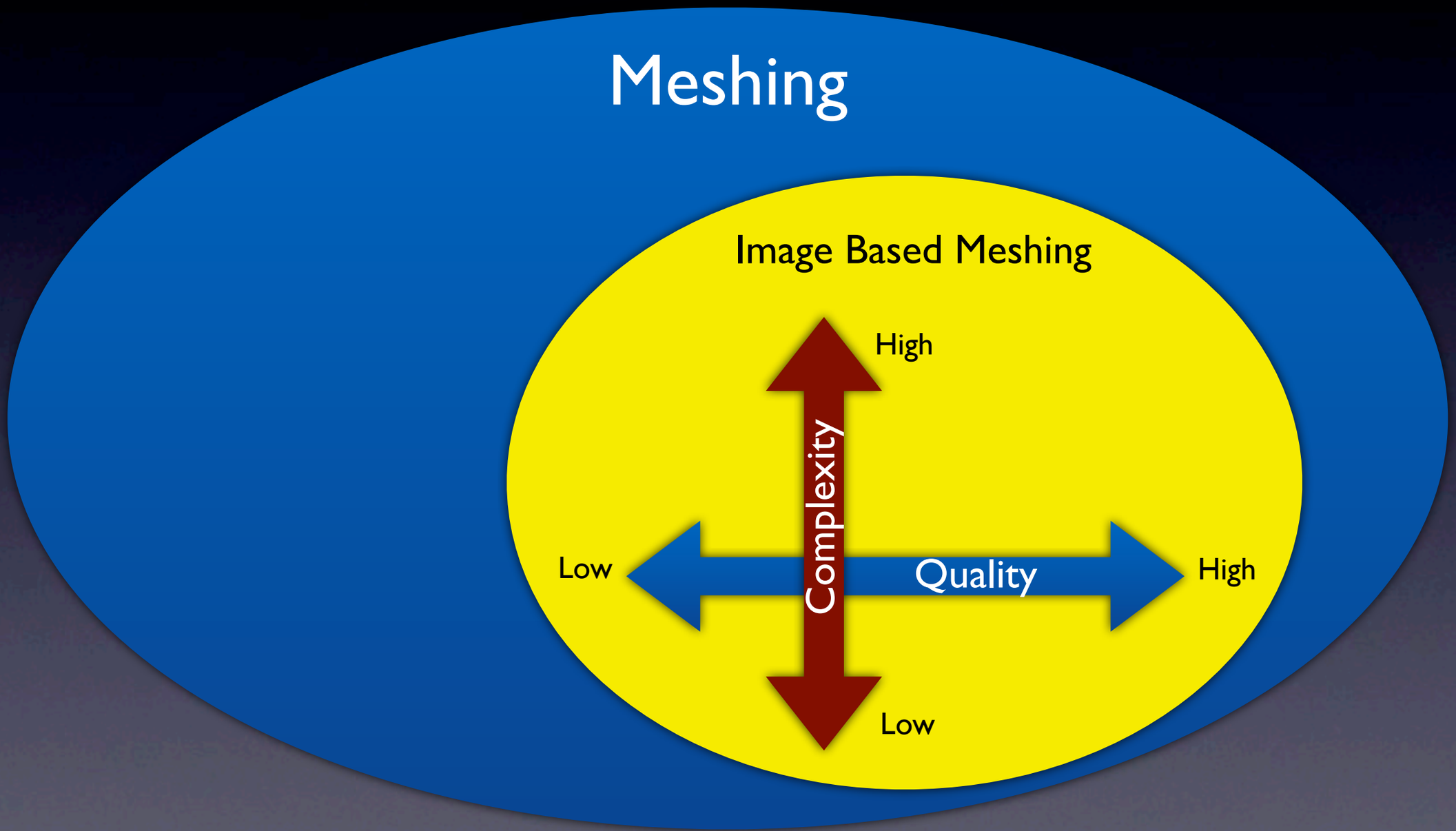

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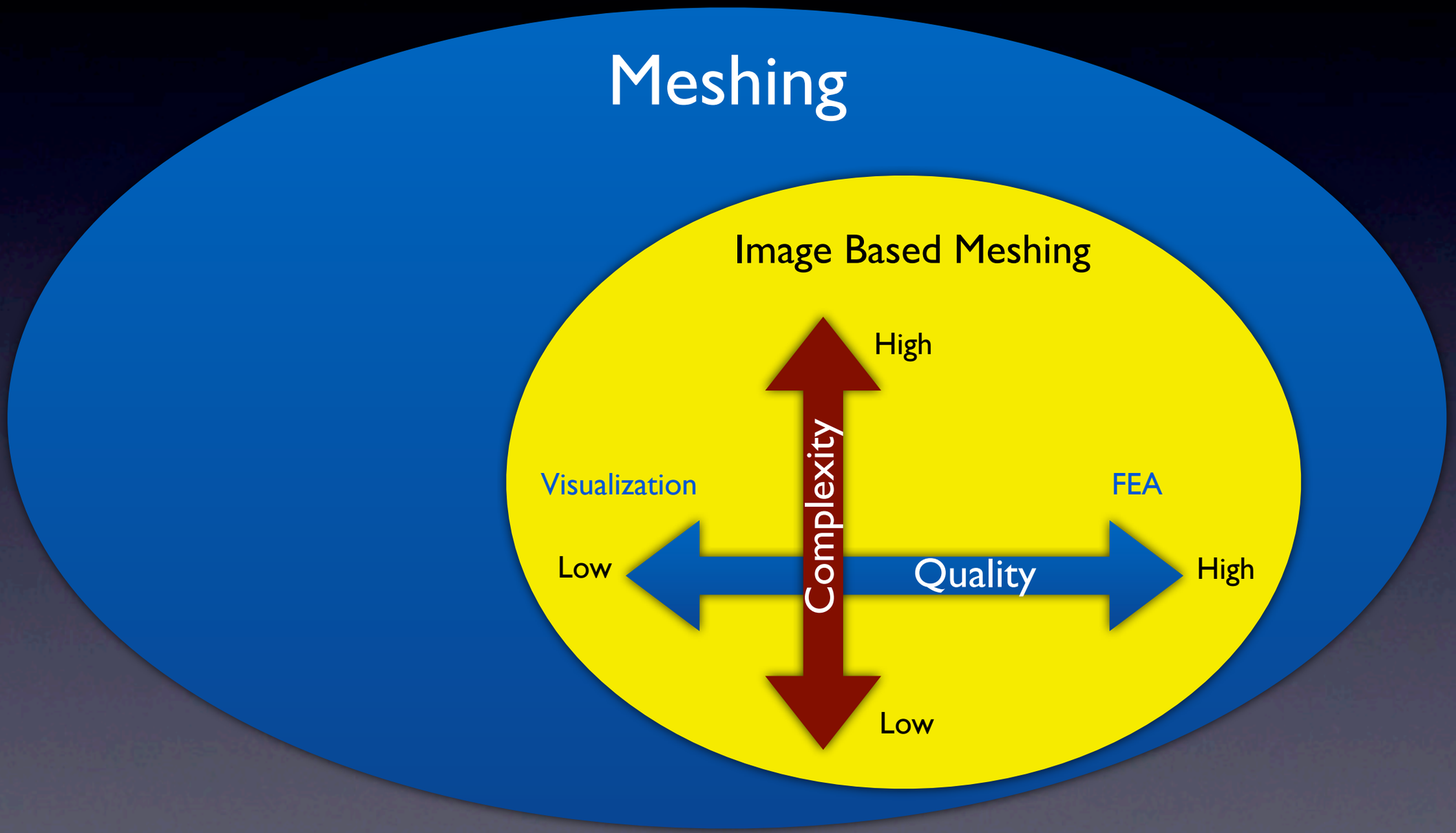

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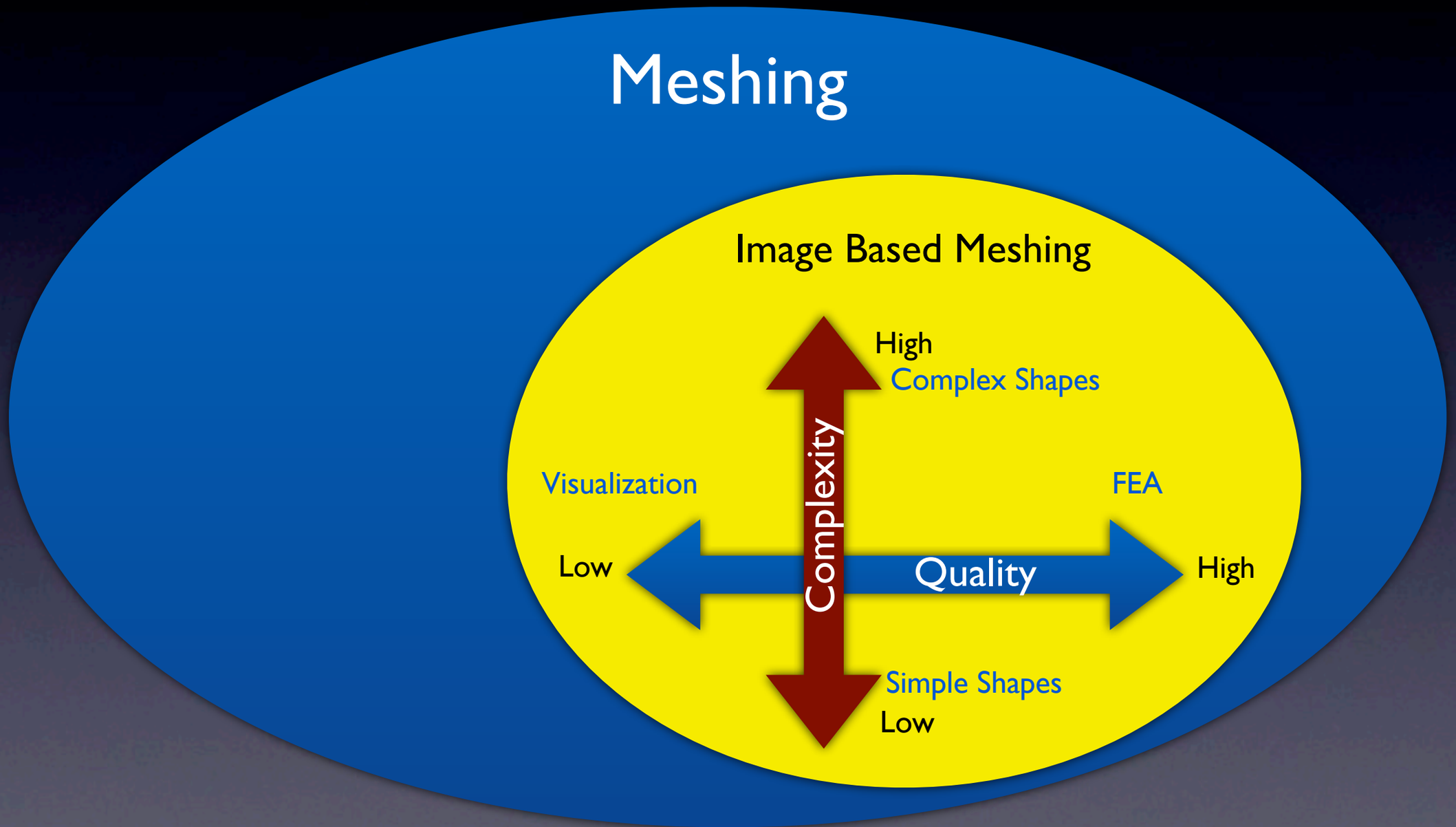

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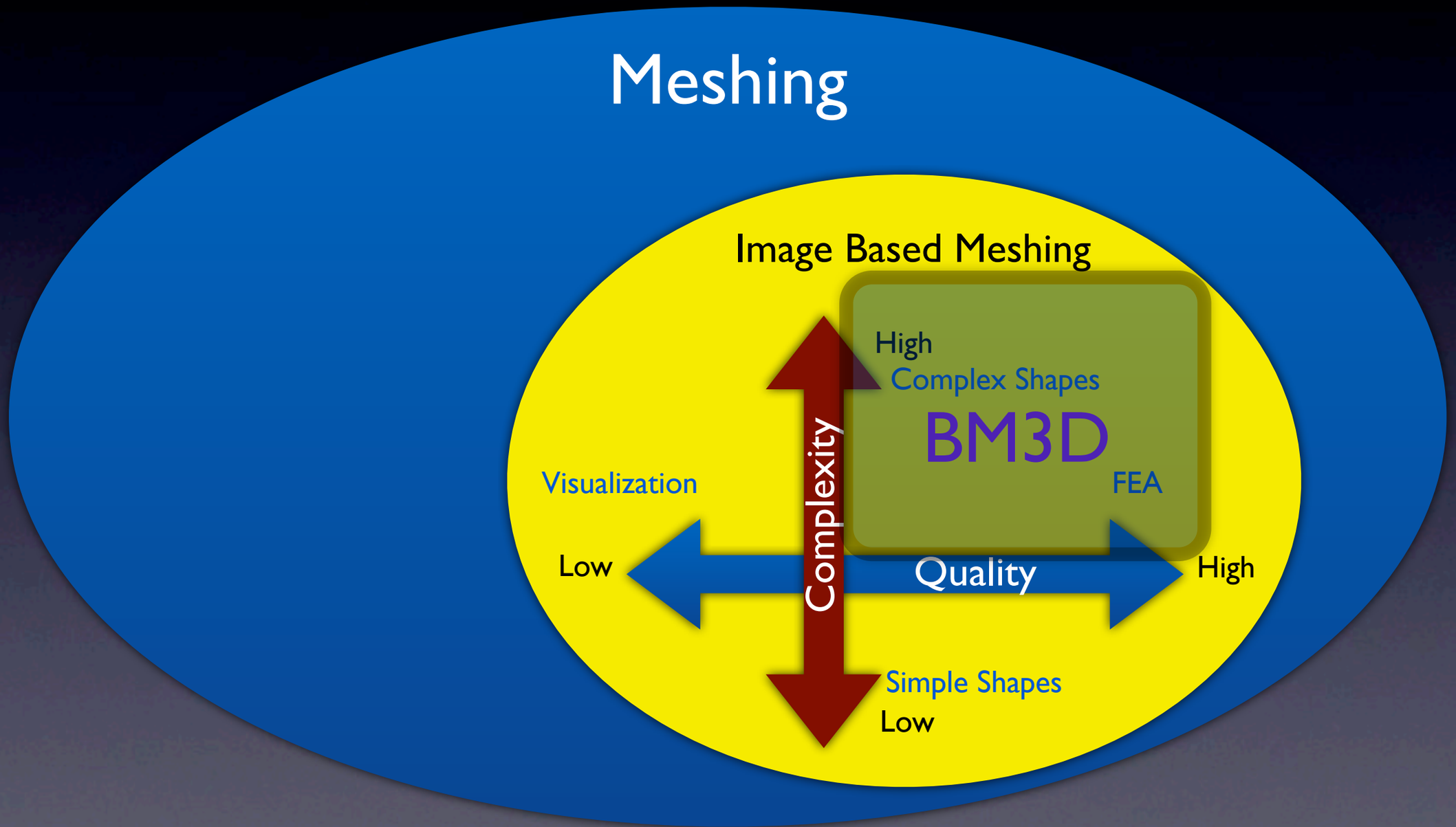
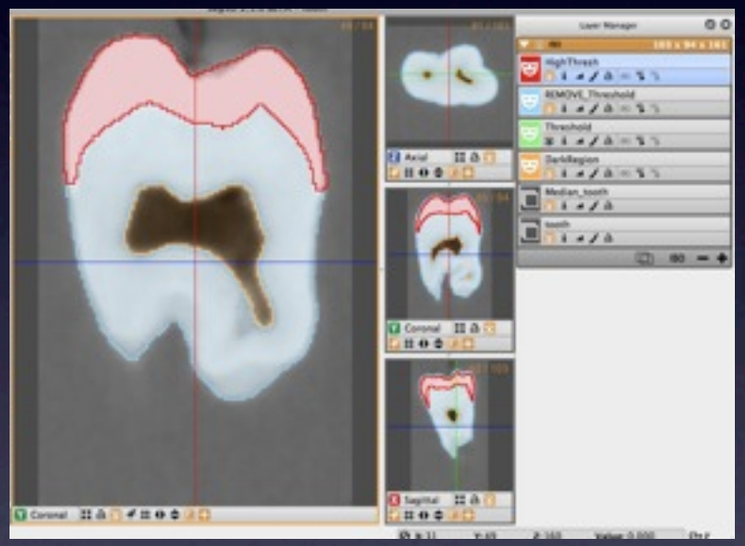
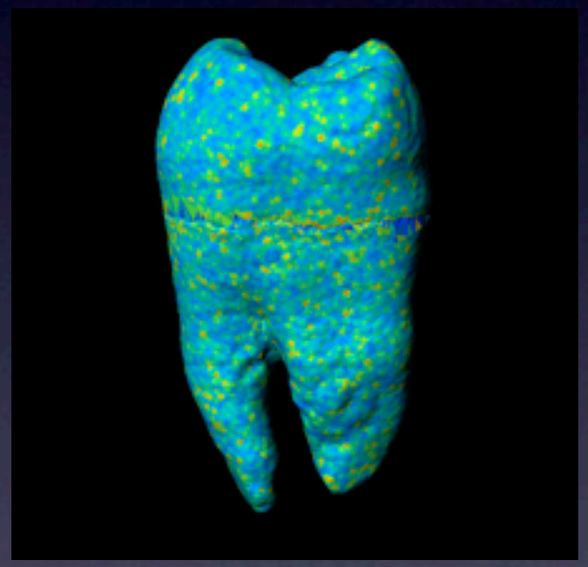


Biomesh3D

Segmentation



Tetrahedral Mesh



Biomesh3D

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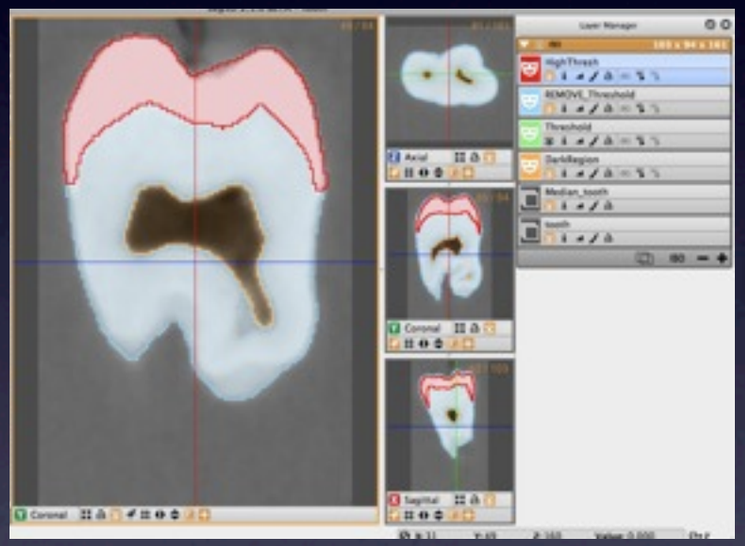

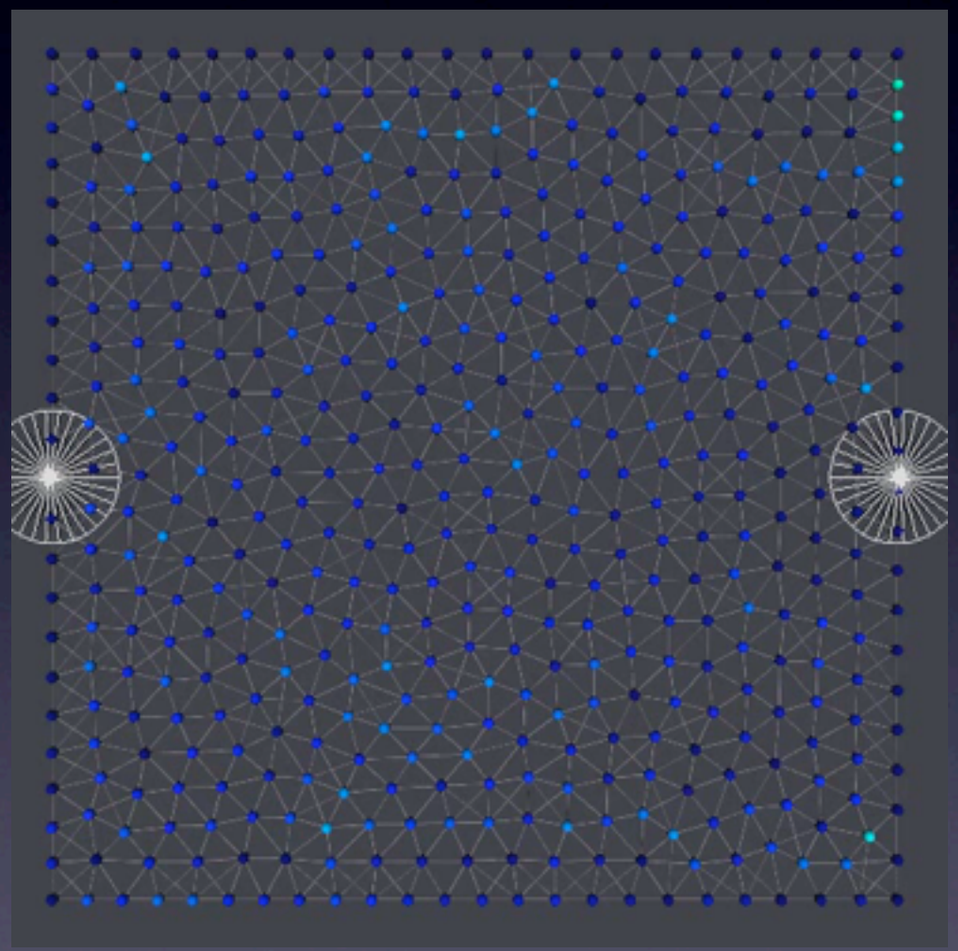

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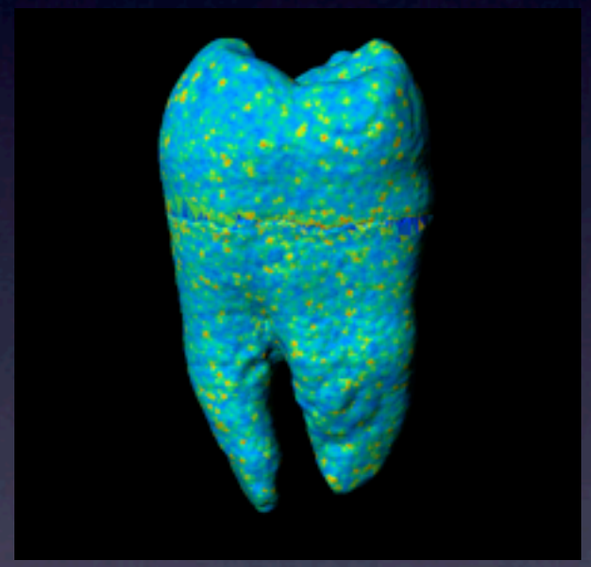

Steps of BM3D

1. Preprocess Segmentation
2. Tighten or smooth
3. Medial Axis
4. Sizing Field
5. Seed Surface
6. Particle System
7. Generate Surfaces
8. Generate Volume Mesh

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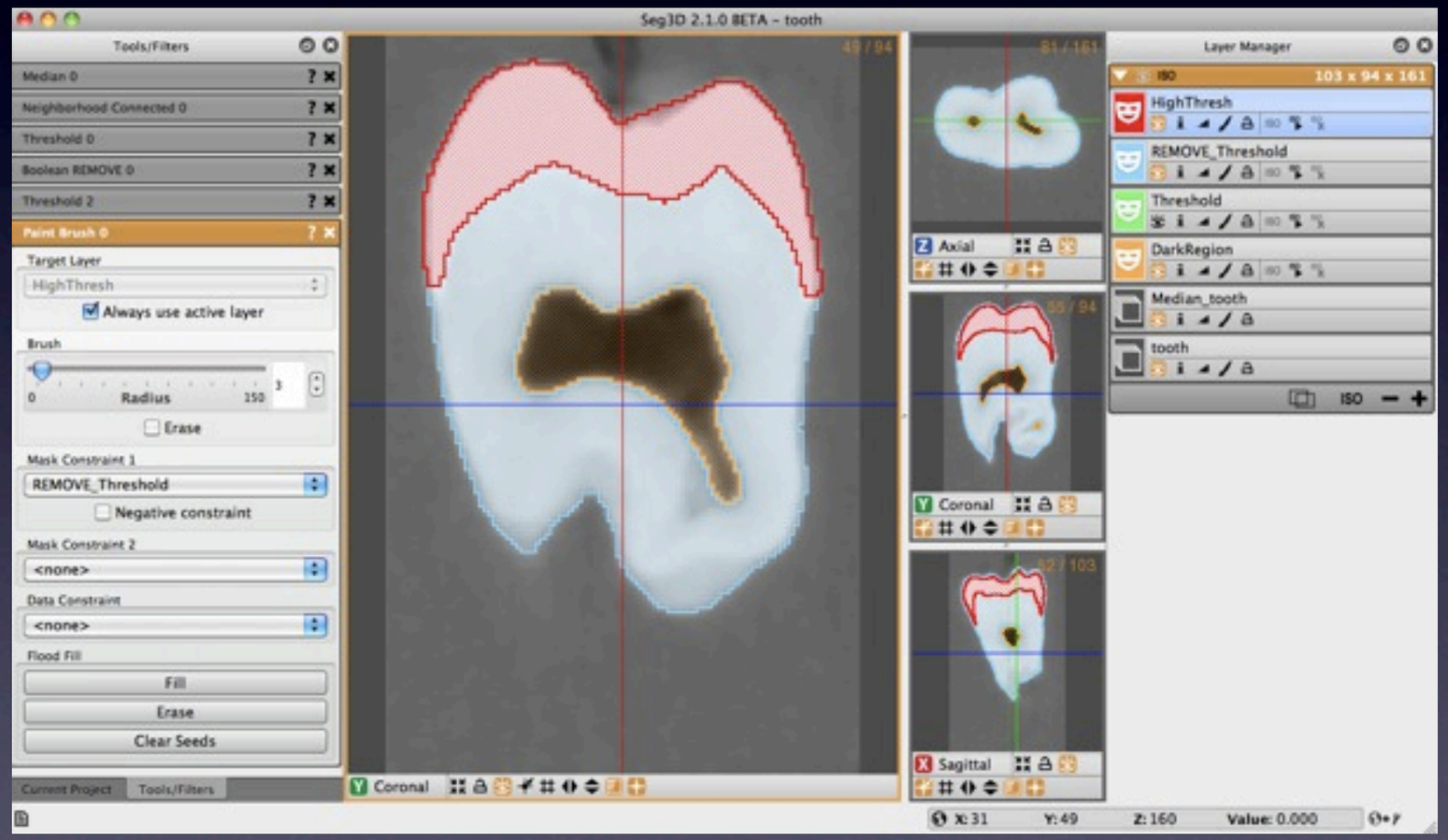
- Reads a .nrrd from Seg3D
- Each Label is a different material



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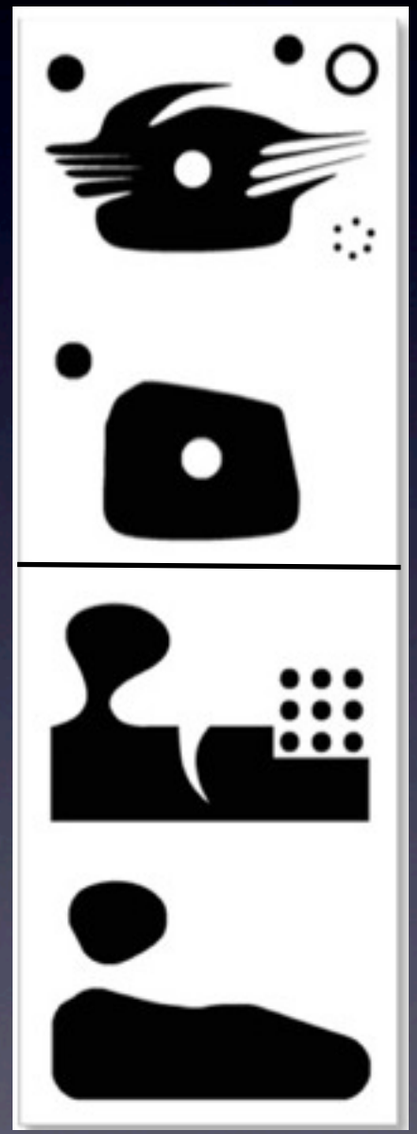
Curvature limiting geometric simplification



A. Chica, J. Williams, et. al. Pressing: Smooth isosurfaces with flats from binary grids. *Computer Graphics Forum* 27(1), 2007.
J. Williams. Relative convexity and the medial cover. *Fall Workshop on Computational Geometry*, 2008.

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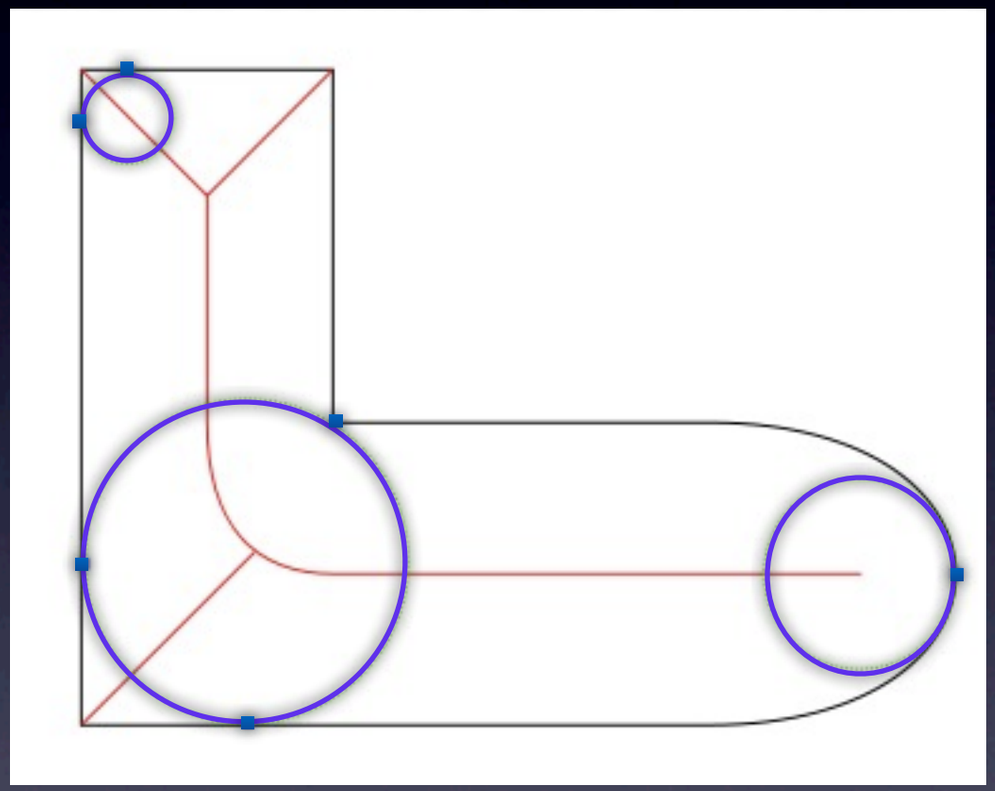
Identifies corners and thin features



By Pblanke (Own work) [Public domain], via Wikimedia Commons

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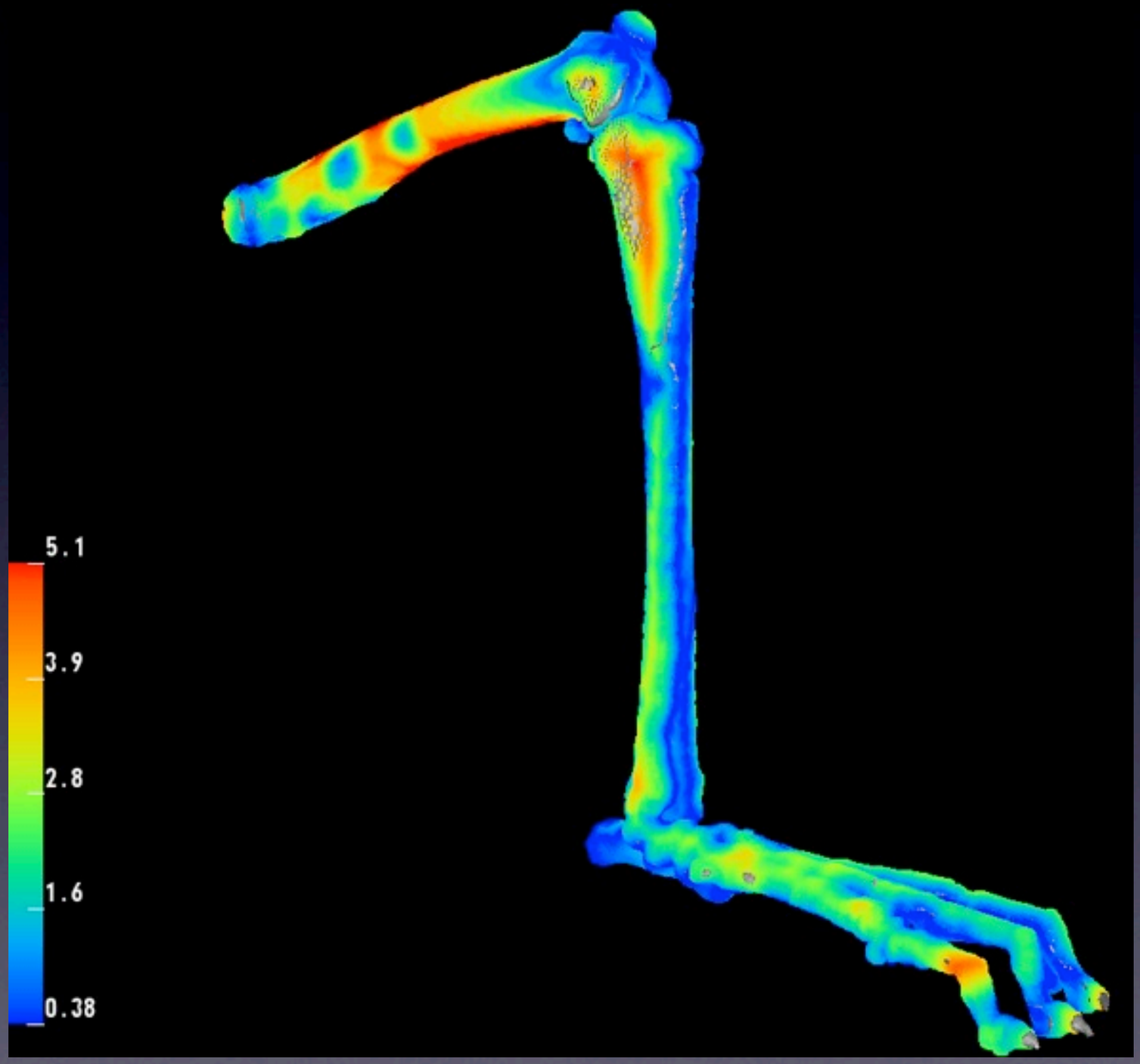

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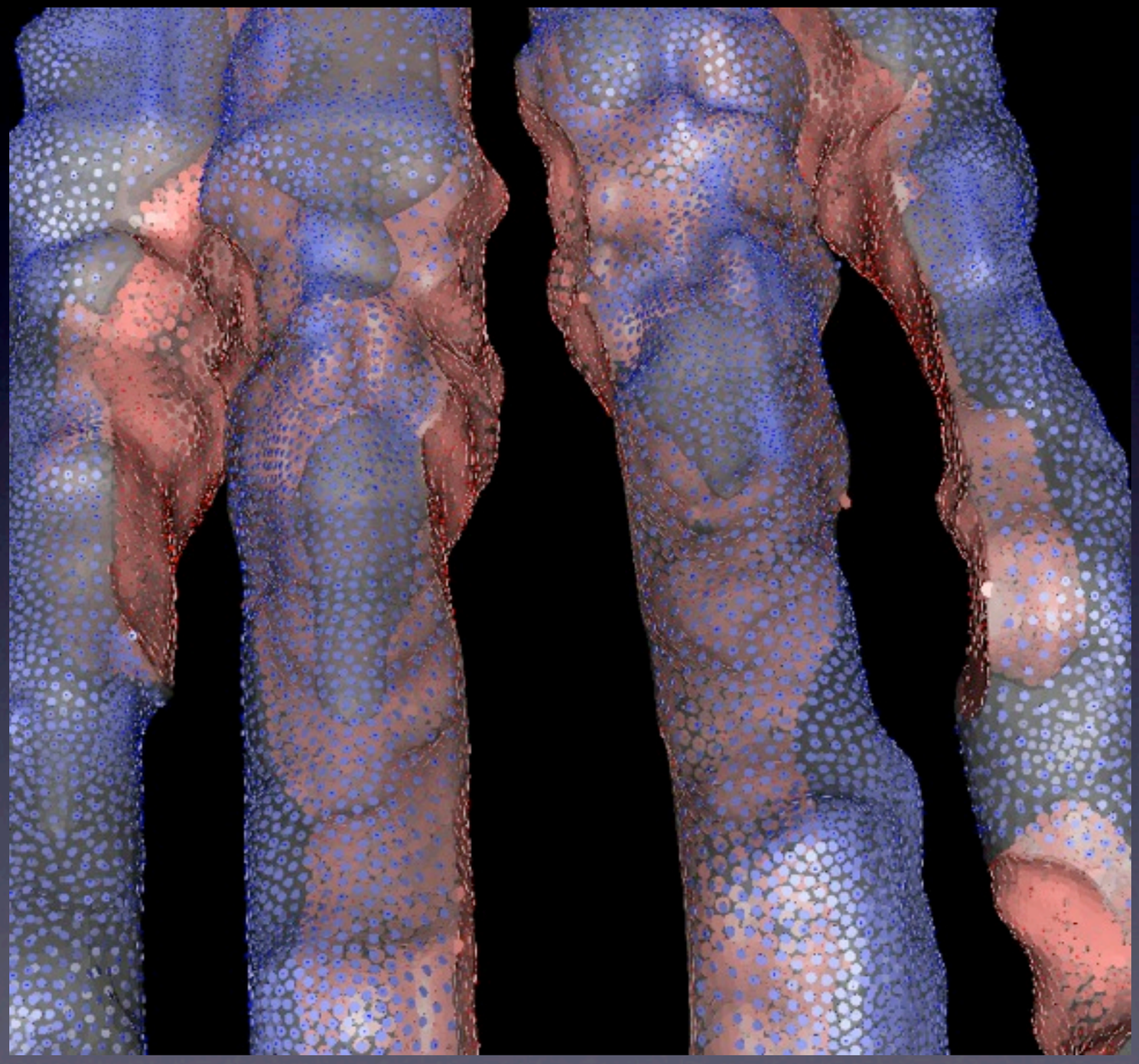

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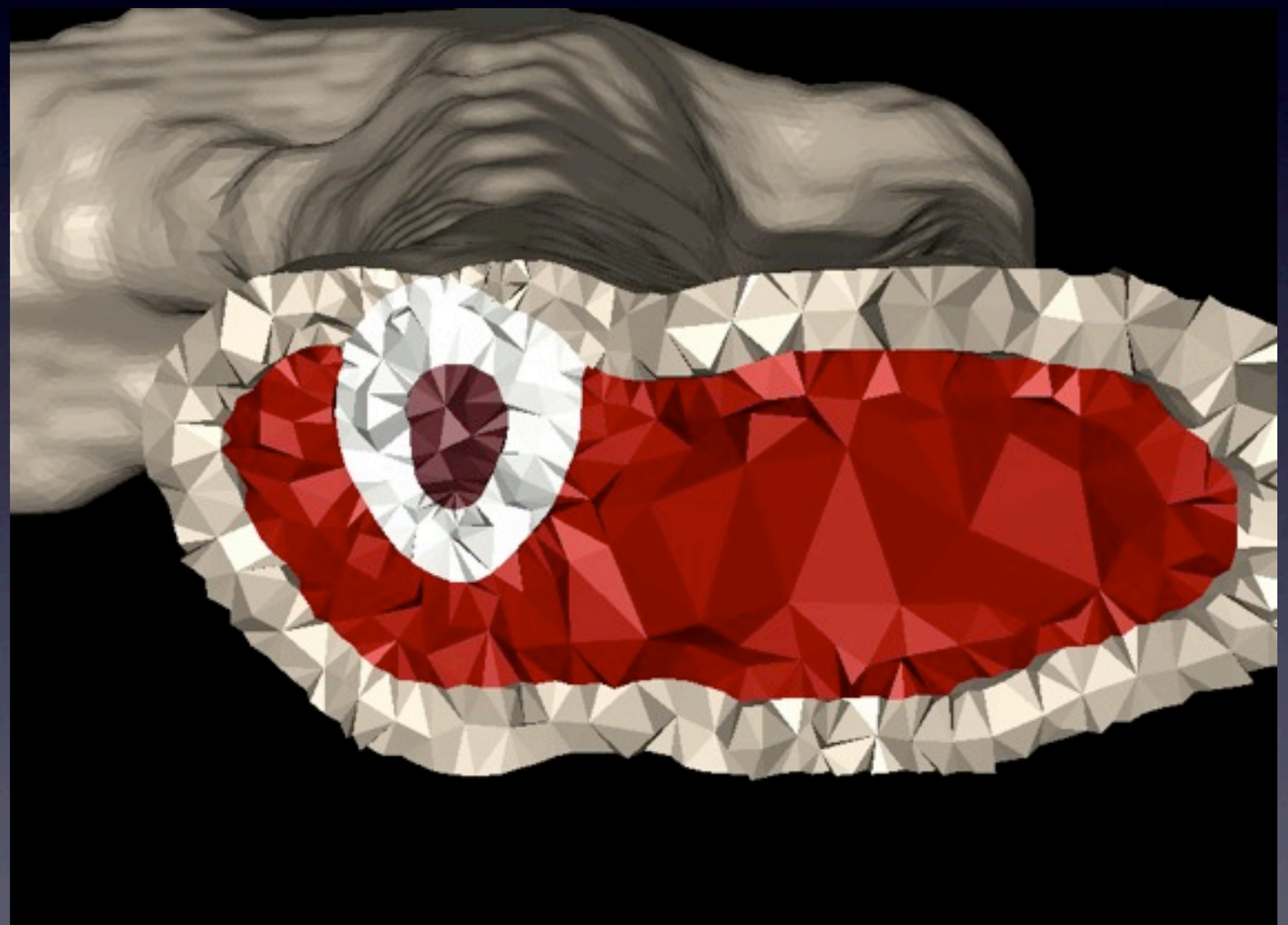
Tetgen for volume meshing



model_config.py

```
model_input_file="/Users/wmartin/workspace/meshing/test_utils/square/square.nrrd"

model_output_path="/Users/wmartin/workspace/meshing/test_utils/square/square-test"

mats = (0, 1)

mat_names = ('air', 'box')

mat_radii = 0.8

refinement_levels=4

max_procs=2

MAX_SIZING_FIELD = 5.0
SIZING_SCALE_VAR = 2.0

tetgen_joined_vol_flags = "pYzgA"

num_particle_iters = 500
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Smoothing Step - may lose thin structures

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More refinement for thin structures

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Cap the sizing field
Higher number less resolution



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Volume Meshing Parameters



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```
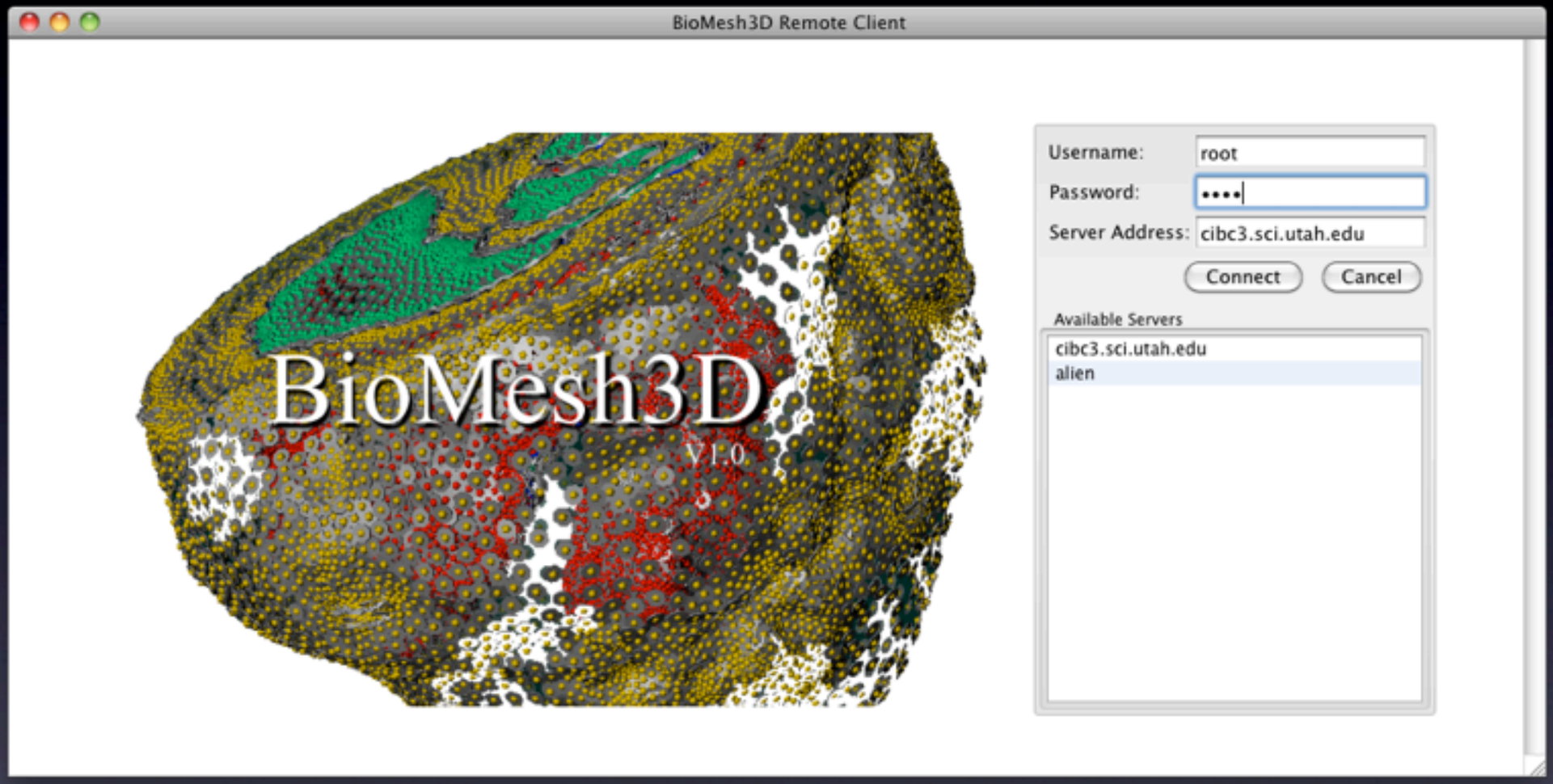
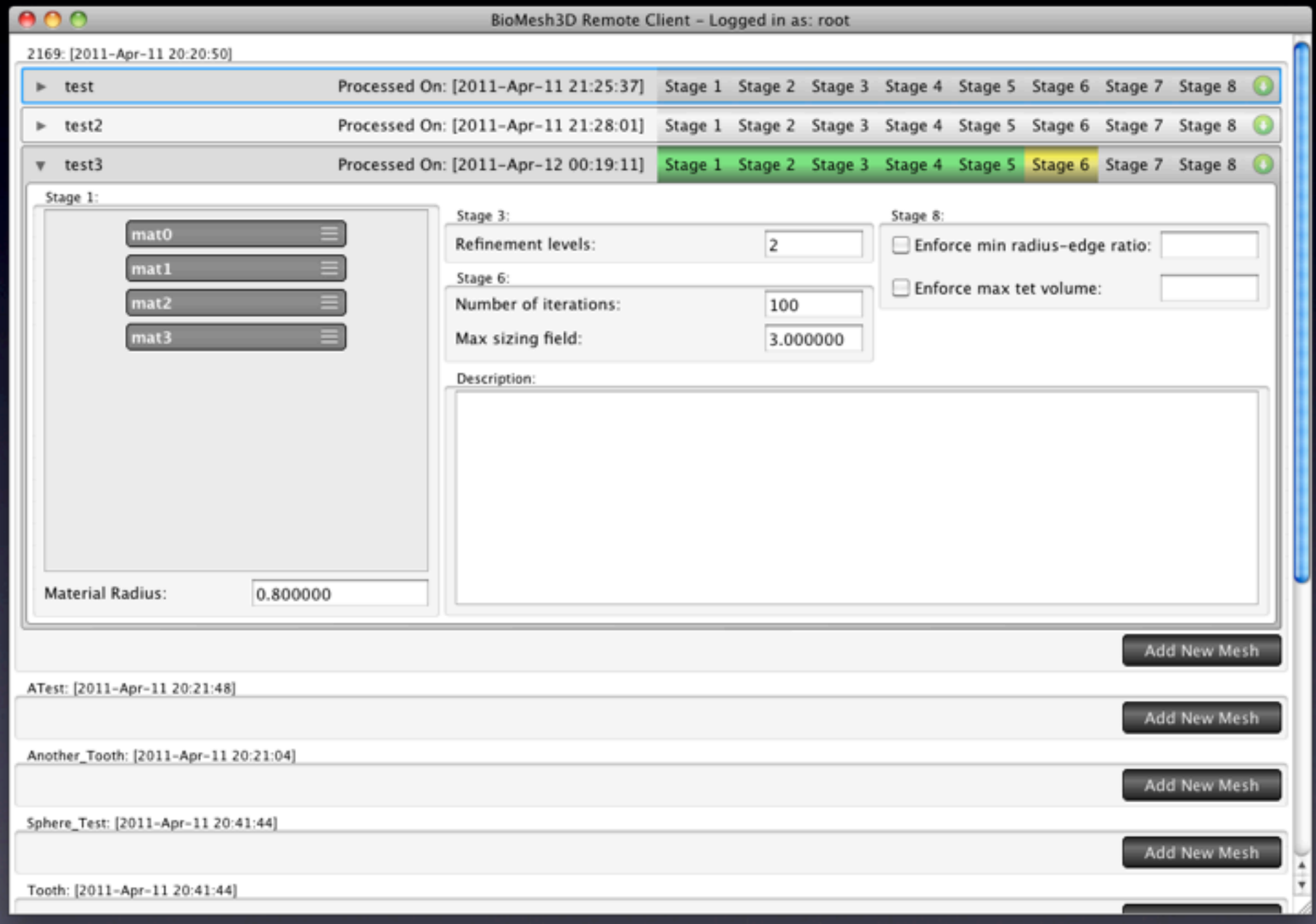

More iterations for better distribution



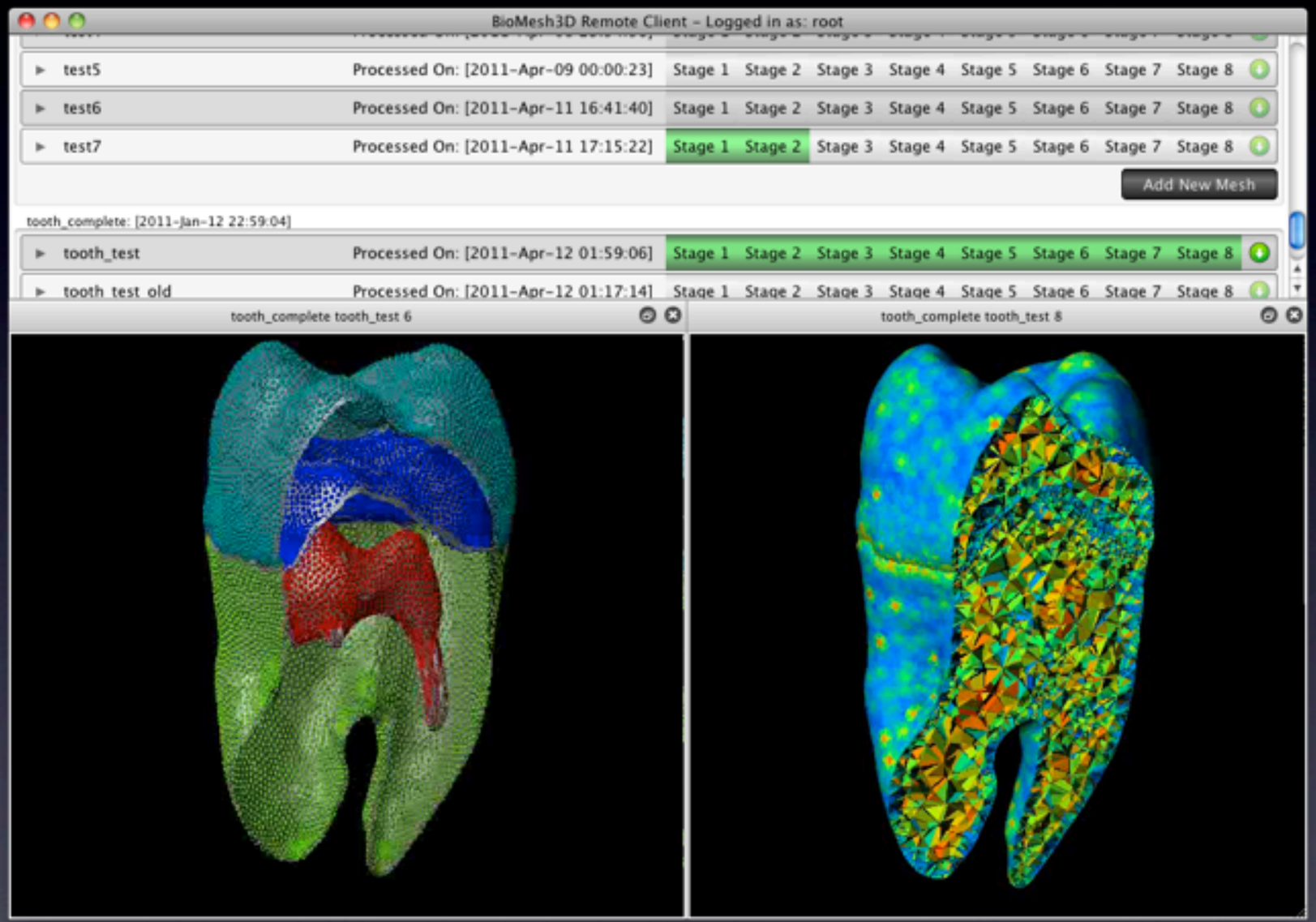
Client/Server



Mesh Configuration

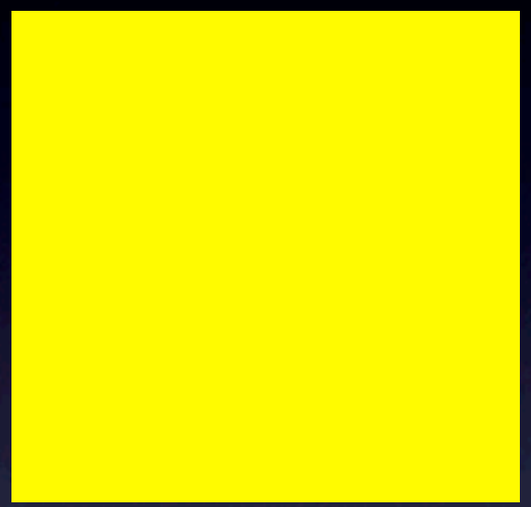


Visualizing Stages



Demo

Meshing In Biology



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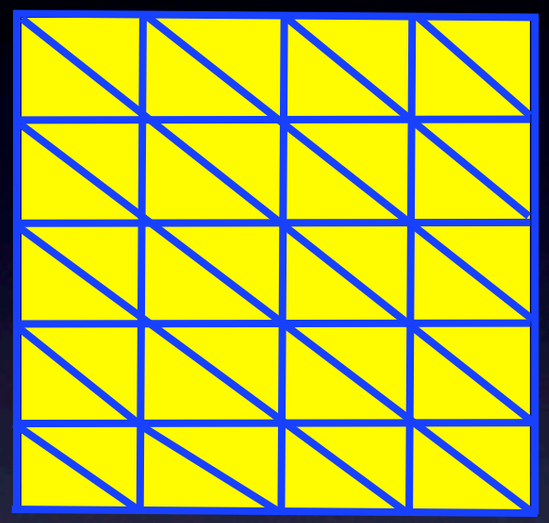

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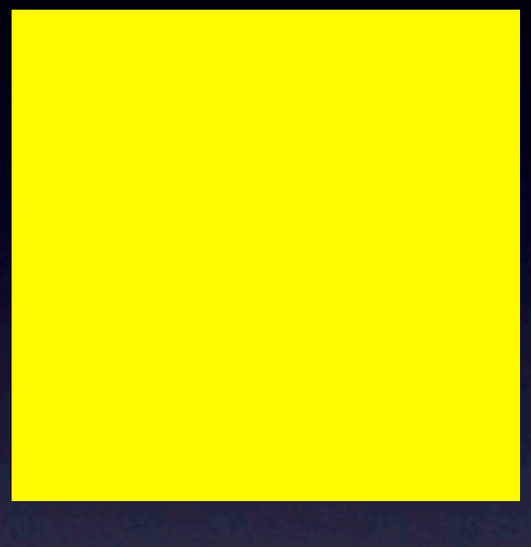

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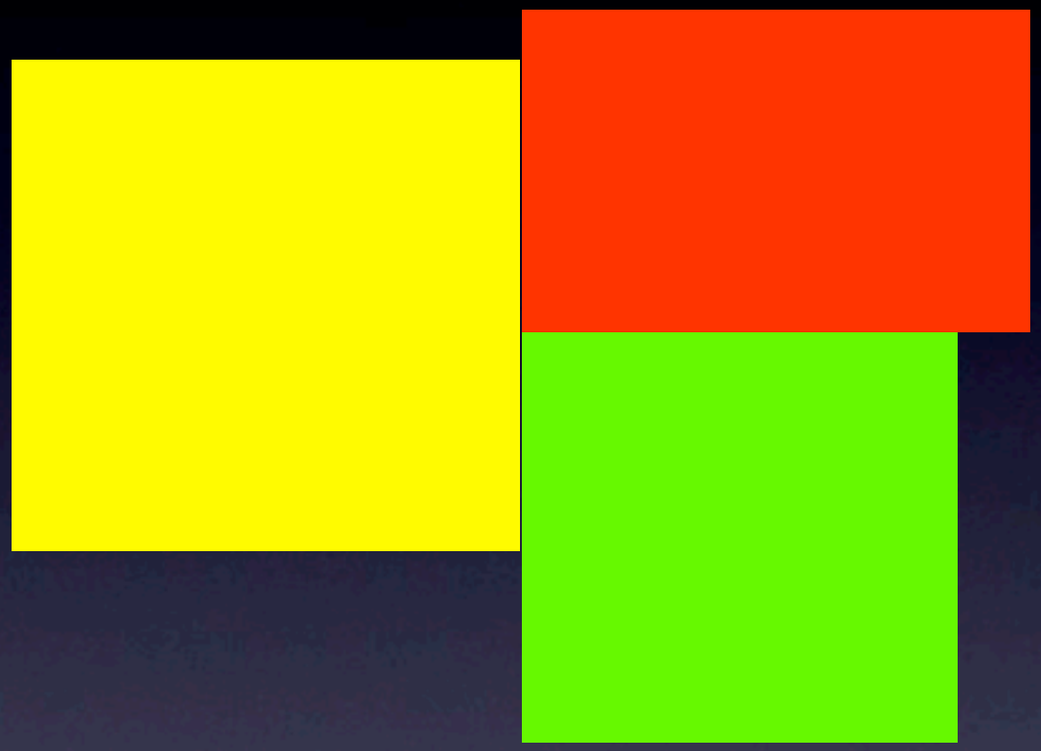

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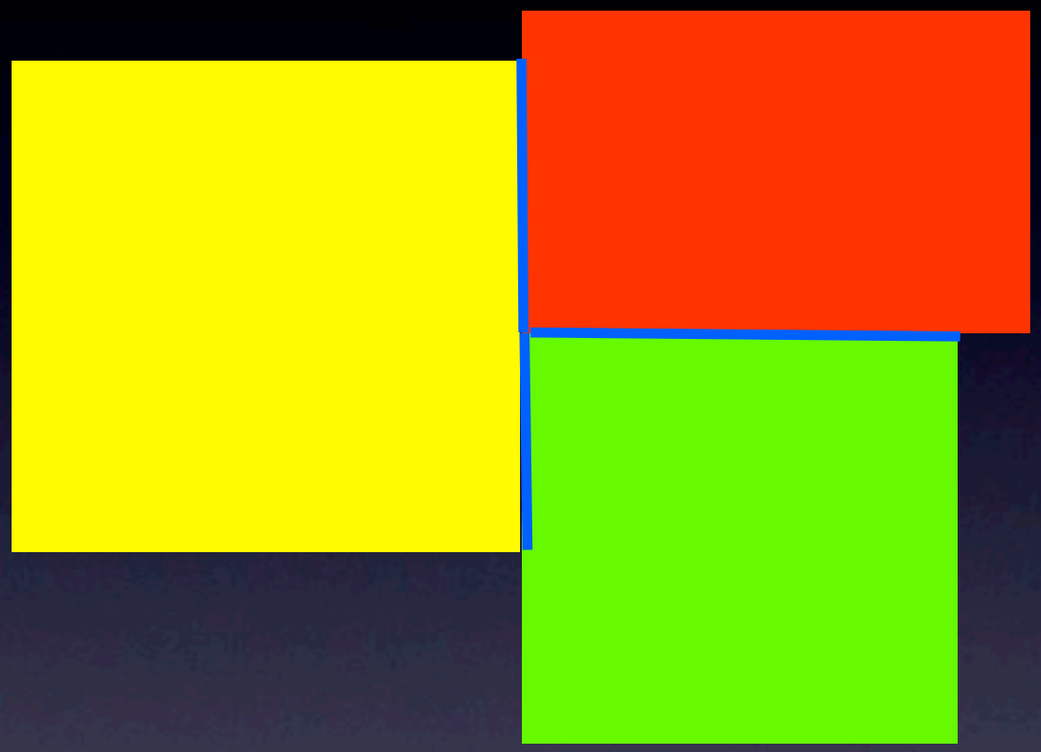

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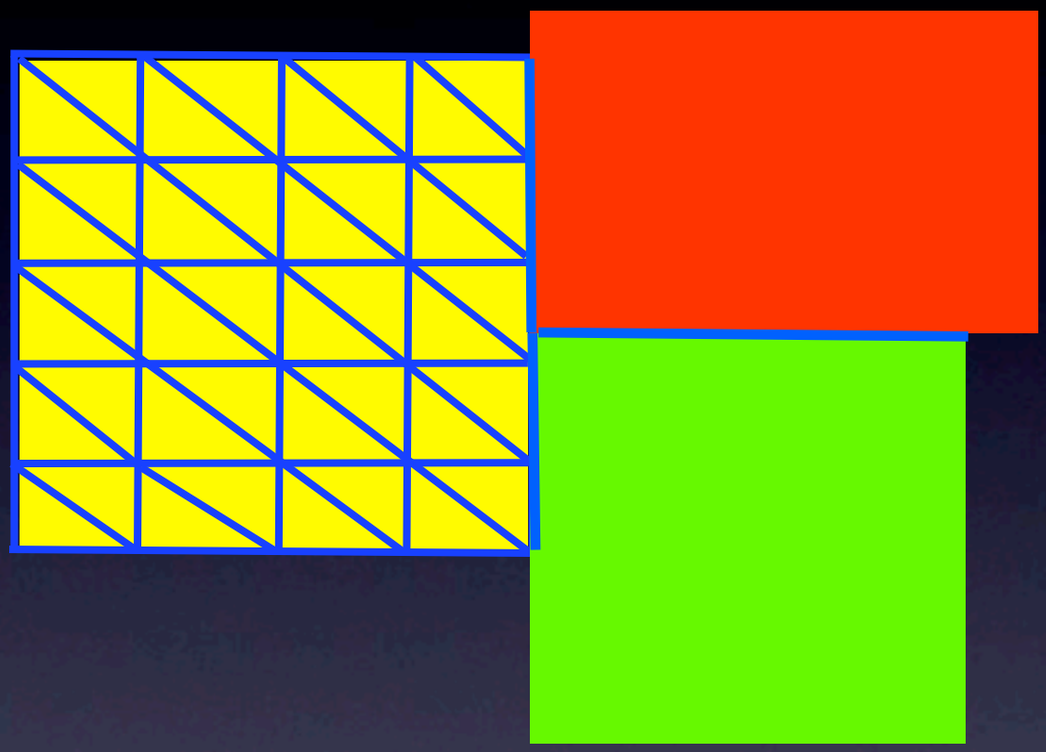

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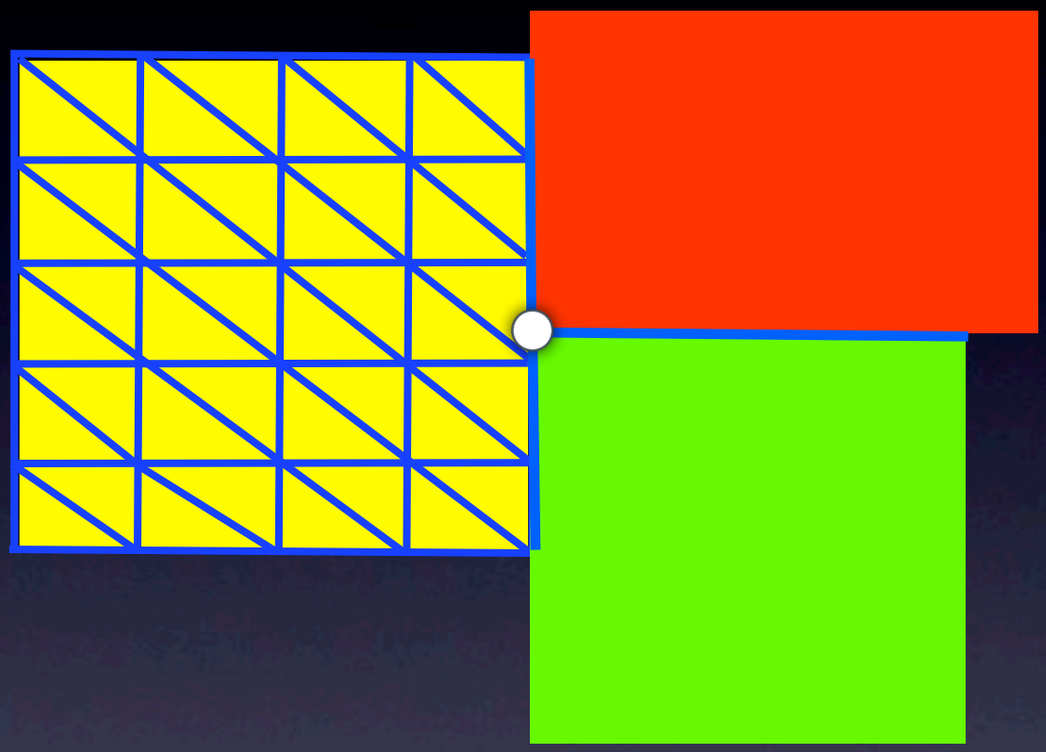

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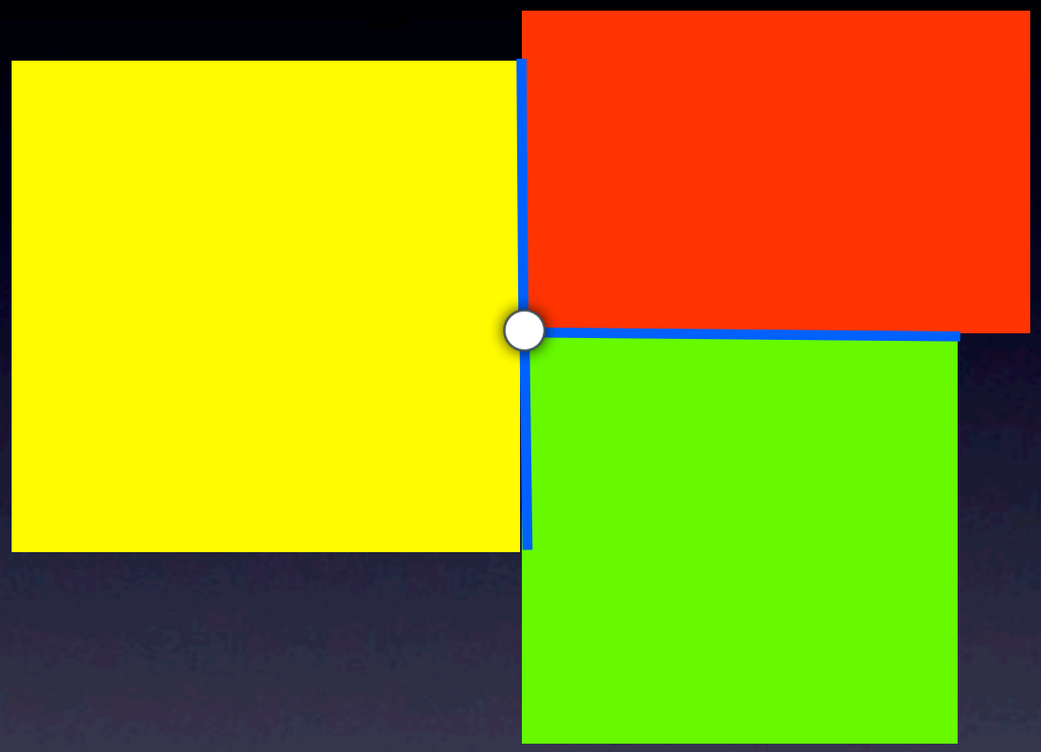
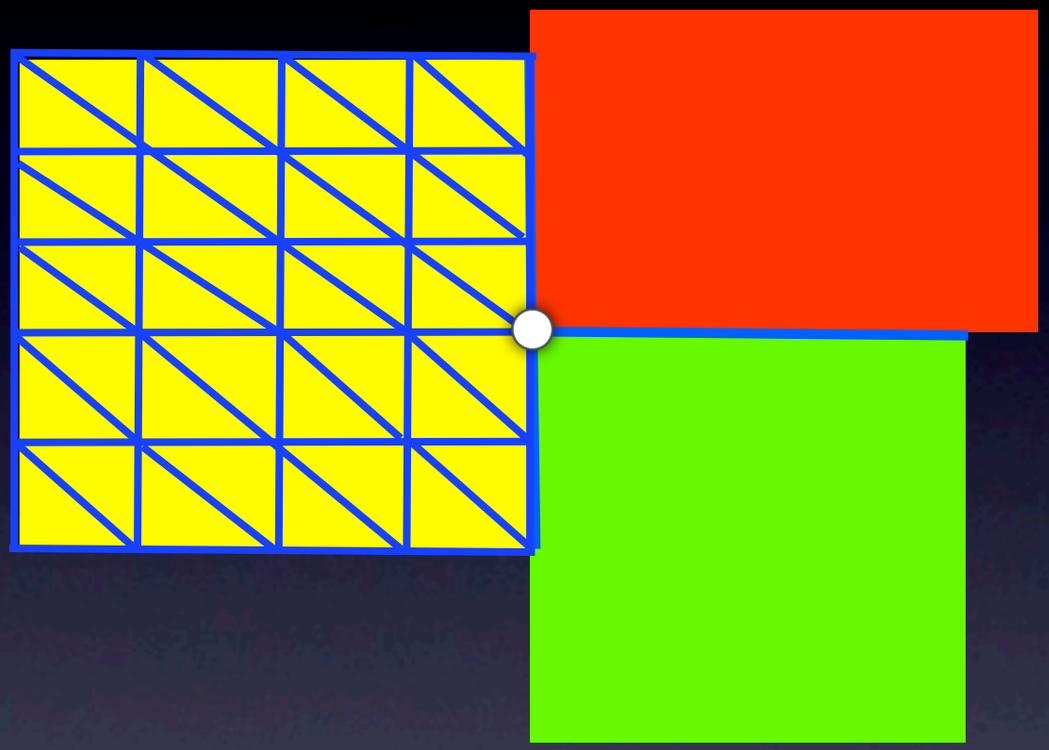


Meshing In Biology



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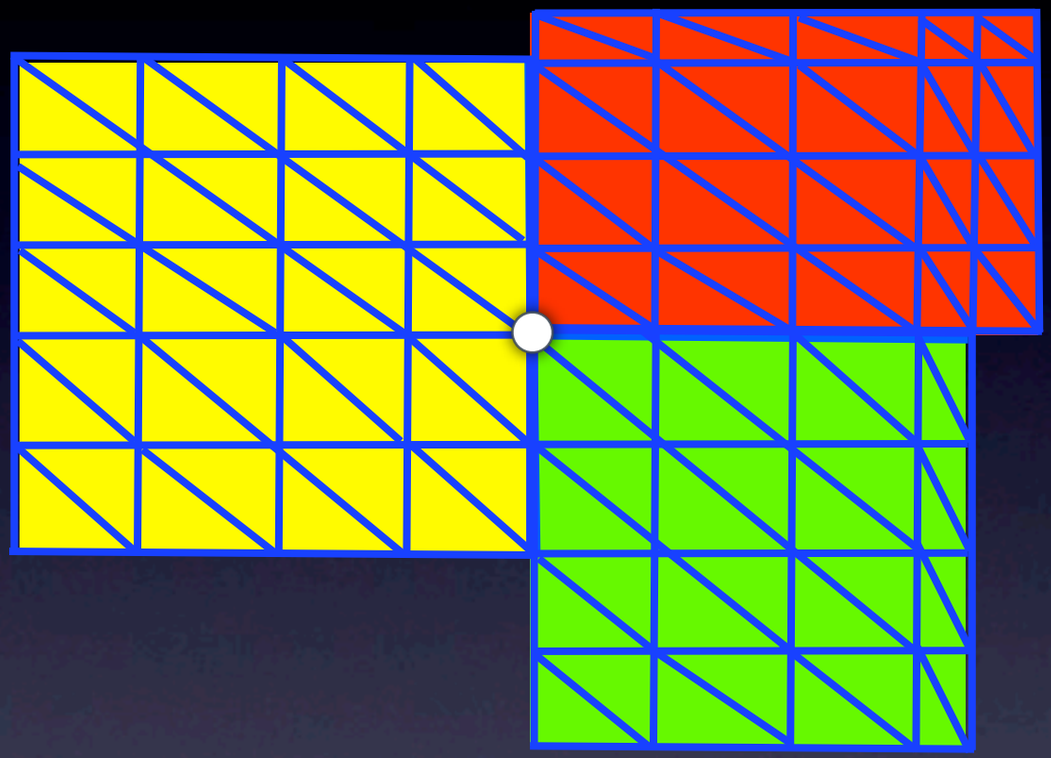

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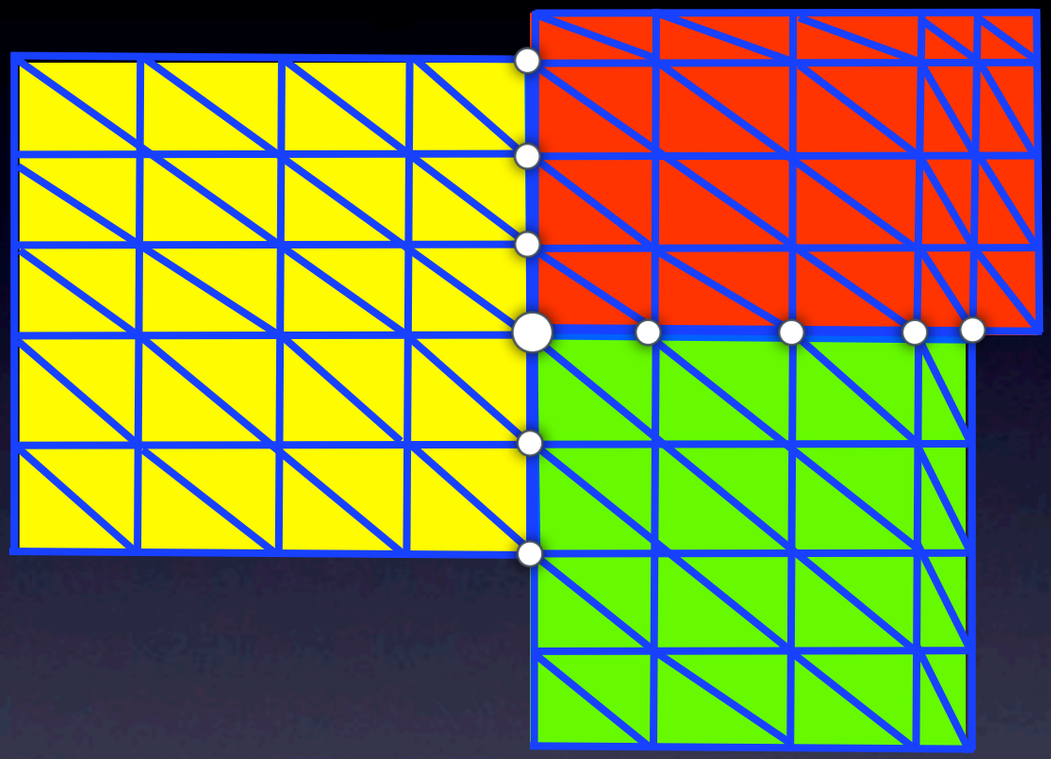

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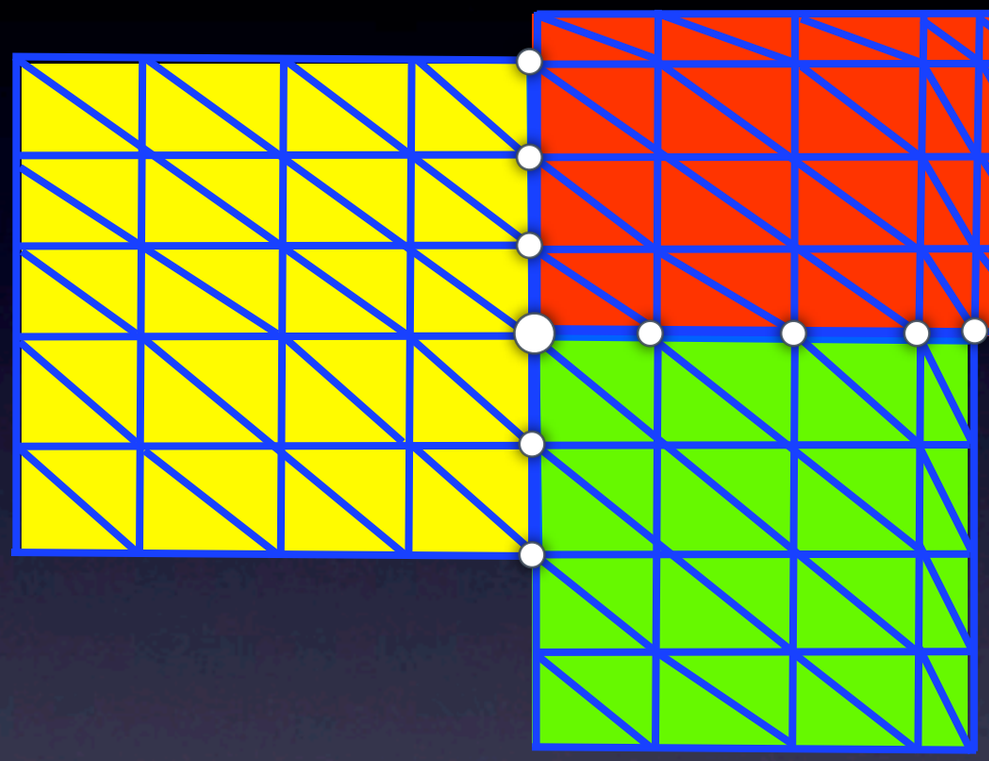

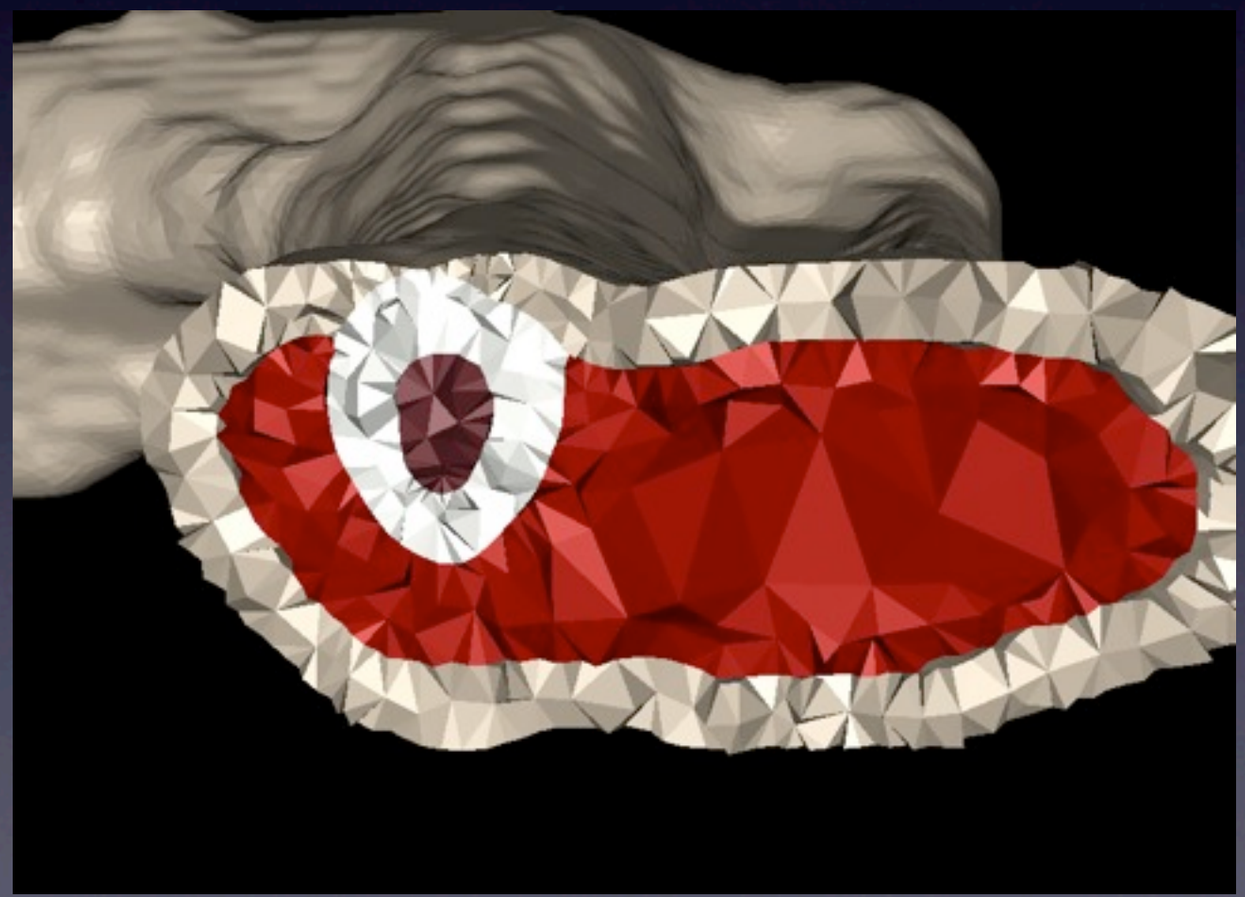

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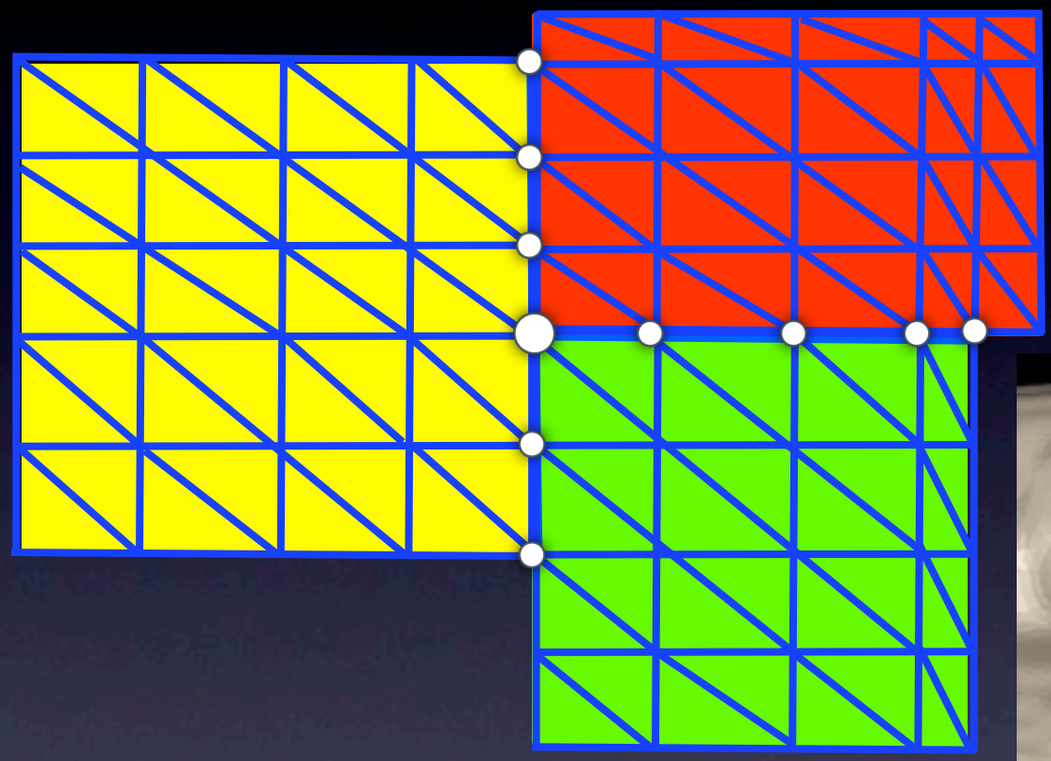

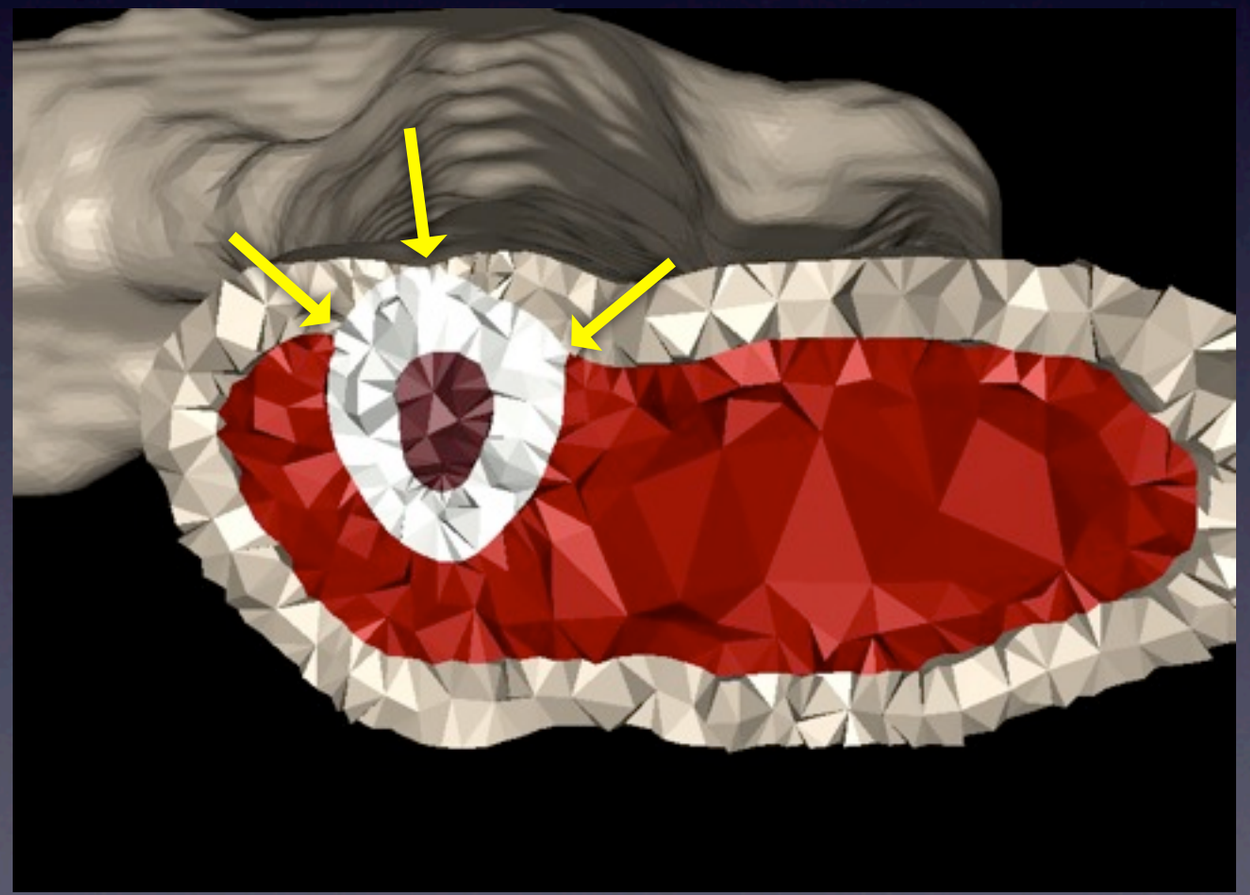

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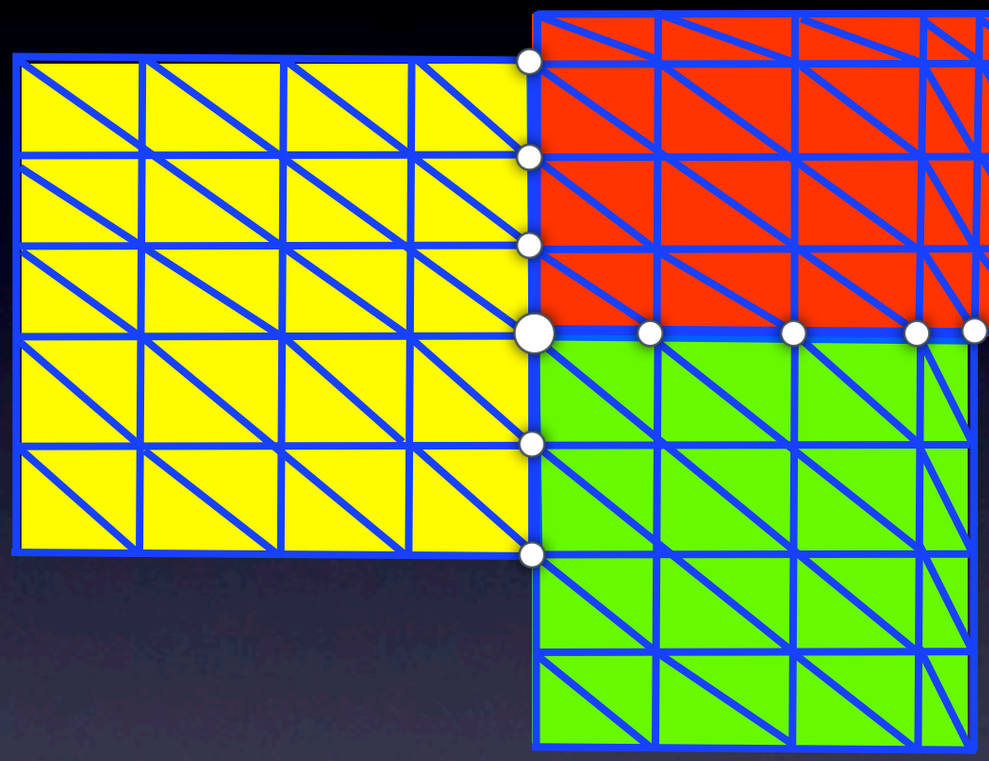
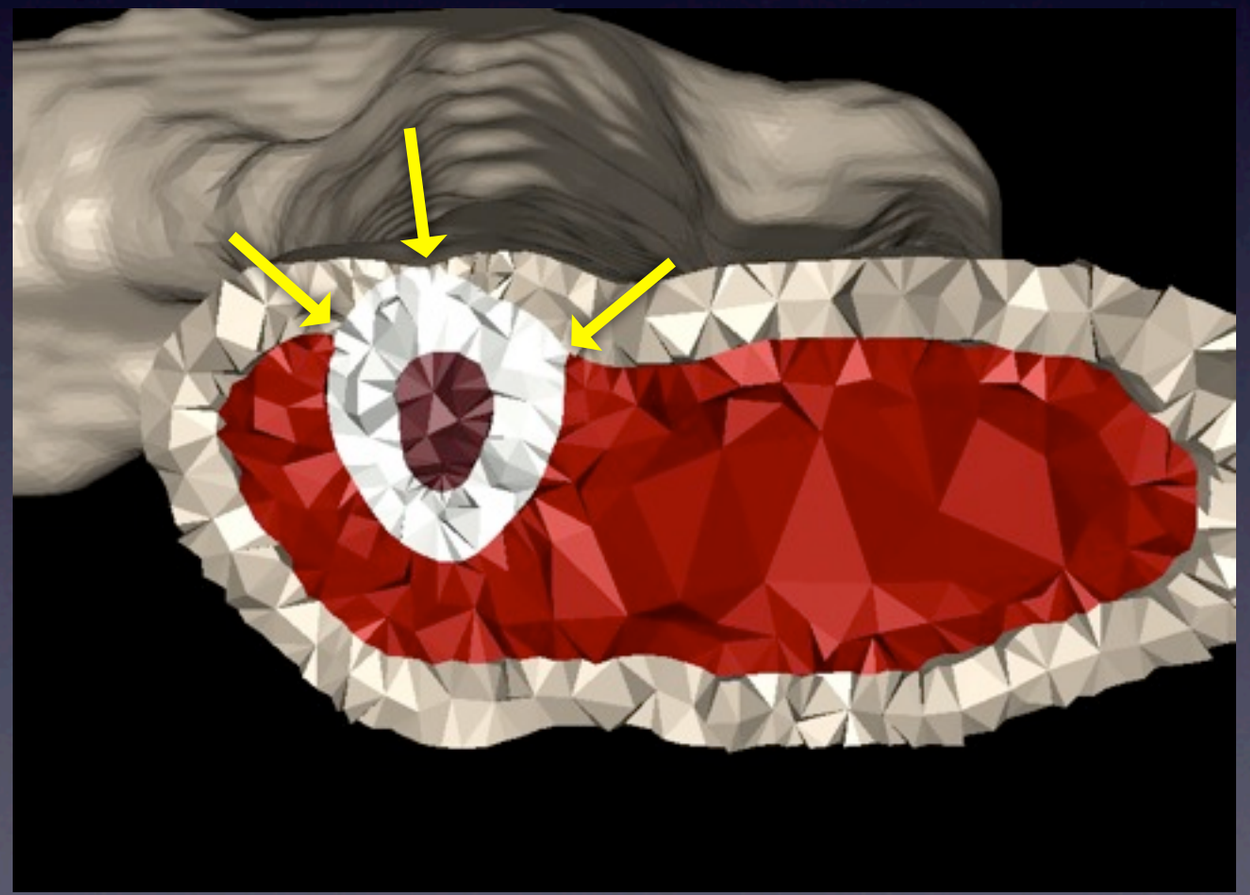
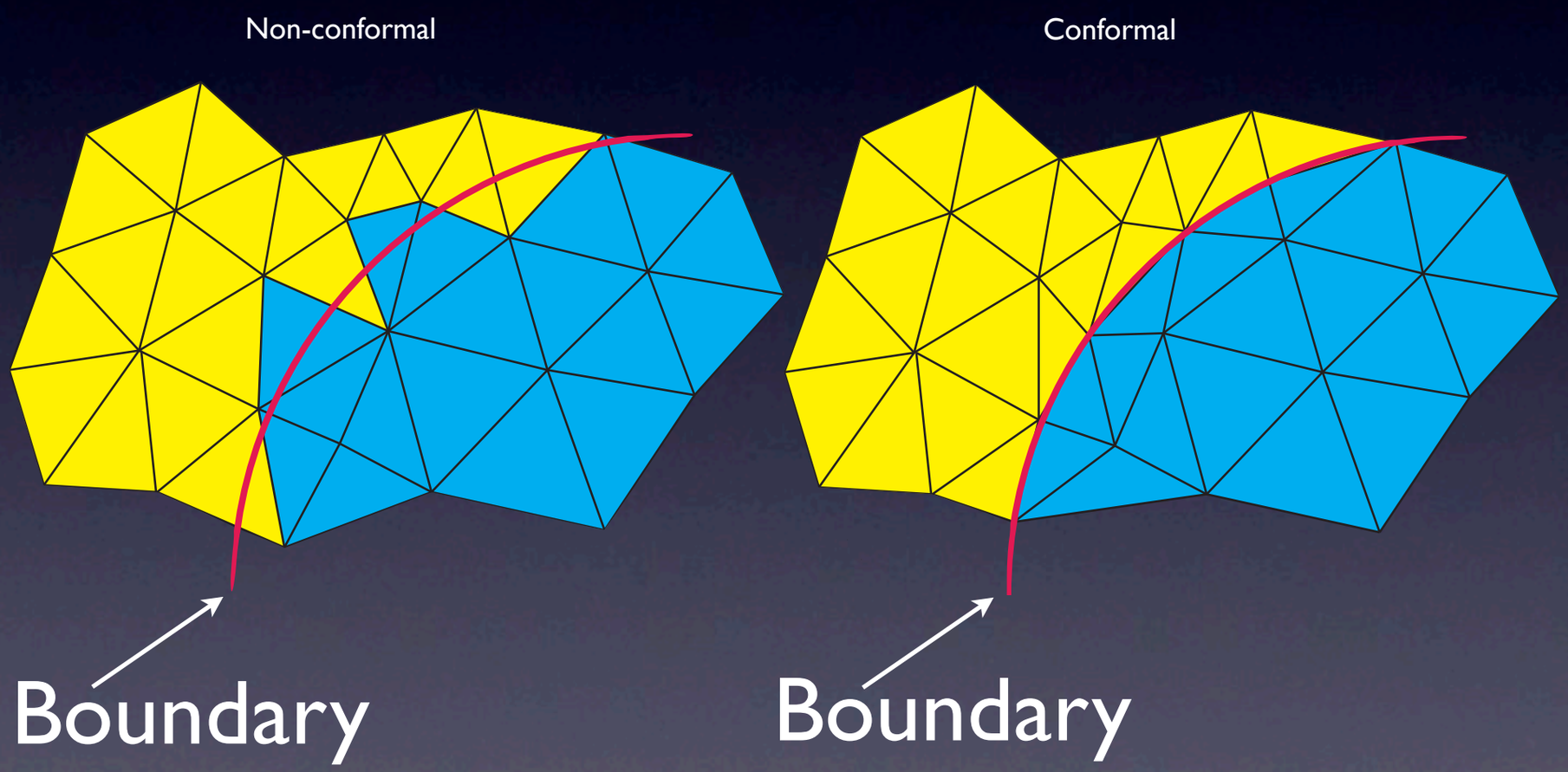




Biomesh3D
CGAL
DelPSC

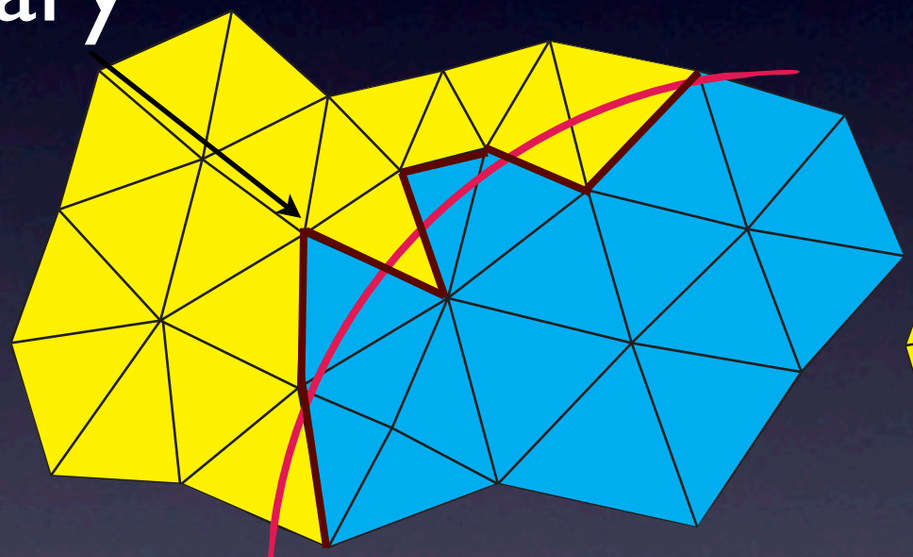
Non-Conformal vs Conformal



Non-Conformal vs Conformal

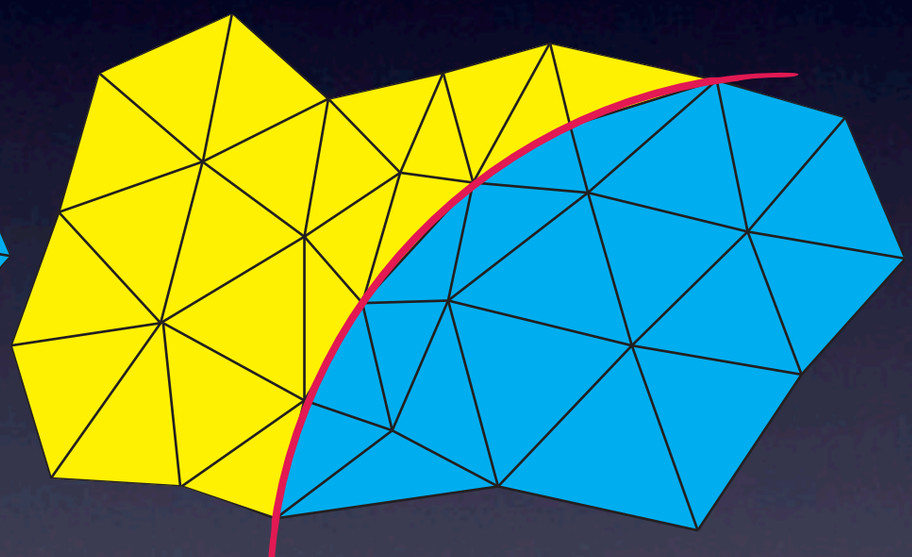
Replicated Boundary

Non-conformal



Boundary

Conformal



Boundary