



Cleaver

A tetrahedral meshing tool.



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Multimaterial
Volume



Cleaver



Conforming
Tetrahedral
Mesh

Input Representation

- Two material interfaces:
 - Isosurface: level set of a continuous scalar function in 3D
- Multi-material interfaces:
 - ??
- Indicator functions
 - One indicator function for each material
 - Scalar value indicates strength/contribution of material
 - Examples:
 - Distance Transforms
 - Partial Mixture Models

Input Format

Teem's Nearly Rasterized Raw Data format (NRRD)

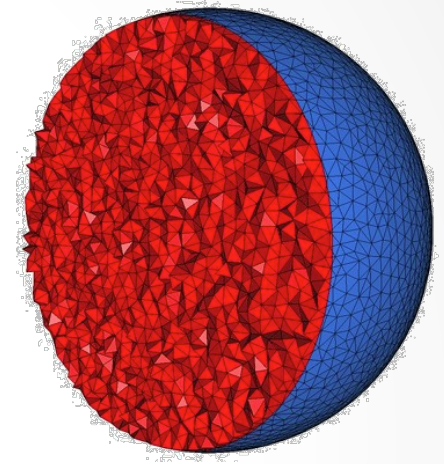
- Seg3D Compatible
- Human Readable Headers



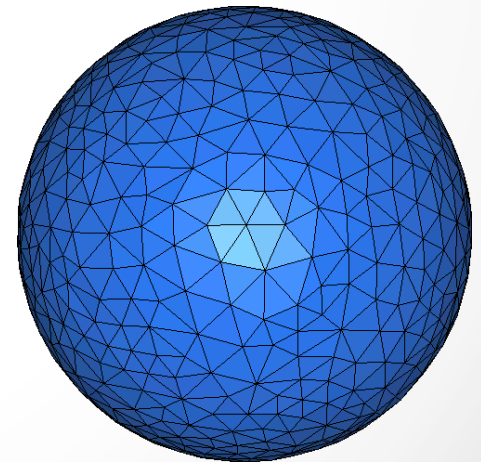
<http://teem.sourceforge.net/nrrd/index.html>

Output Formats

- Tetrahedral Meshes
 - TetGen format (*.node, *.ele) - ASCII
 - Matlab format (*.mat) - Binary



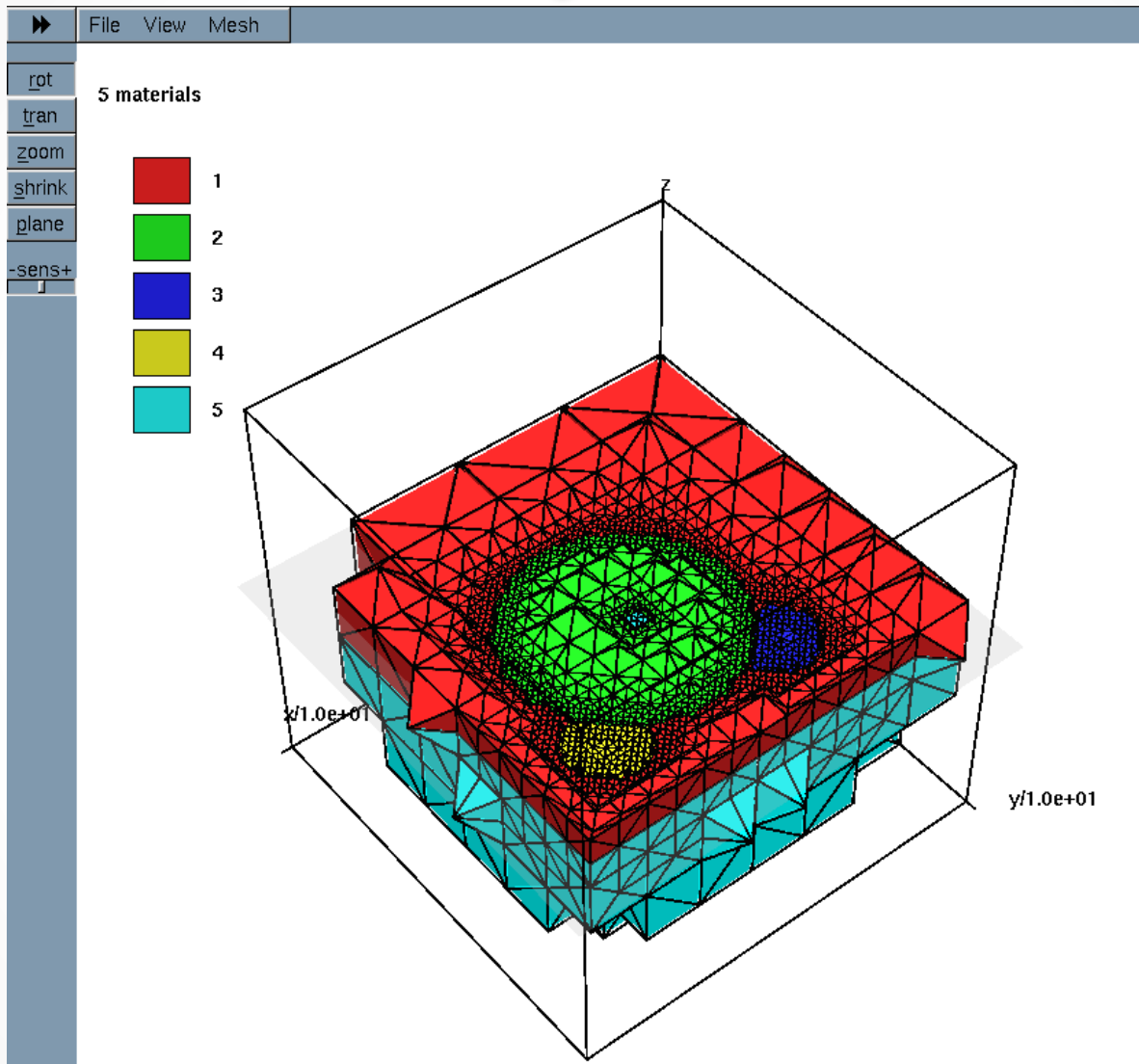
- Triangle Surface Meshes
 - PLY format – Stanford Triangle Format - ASCII



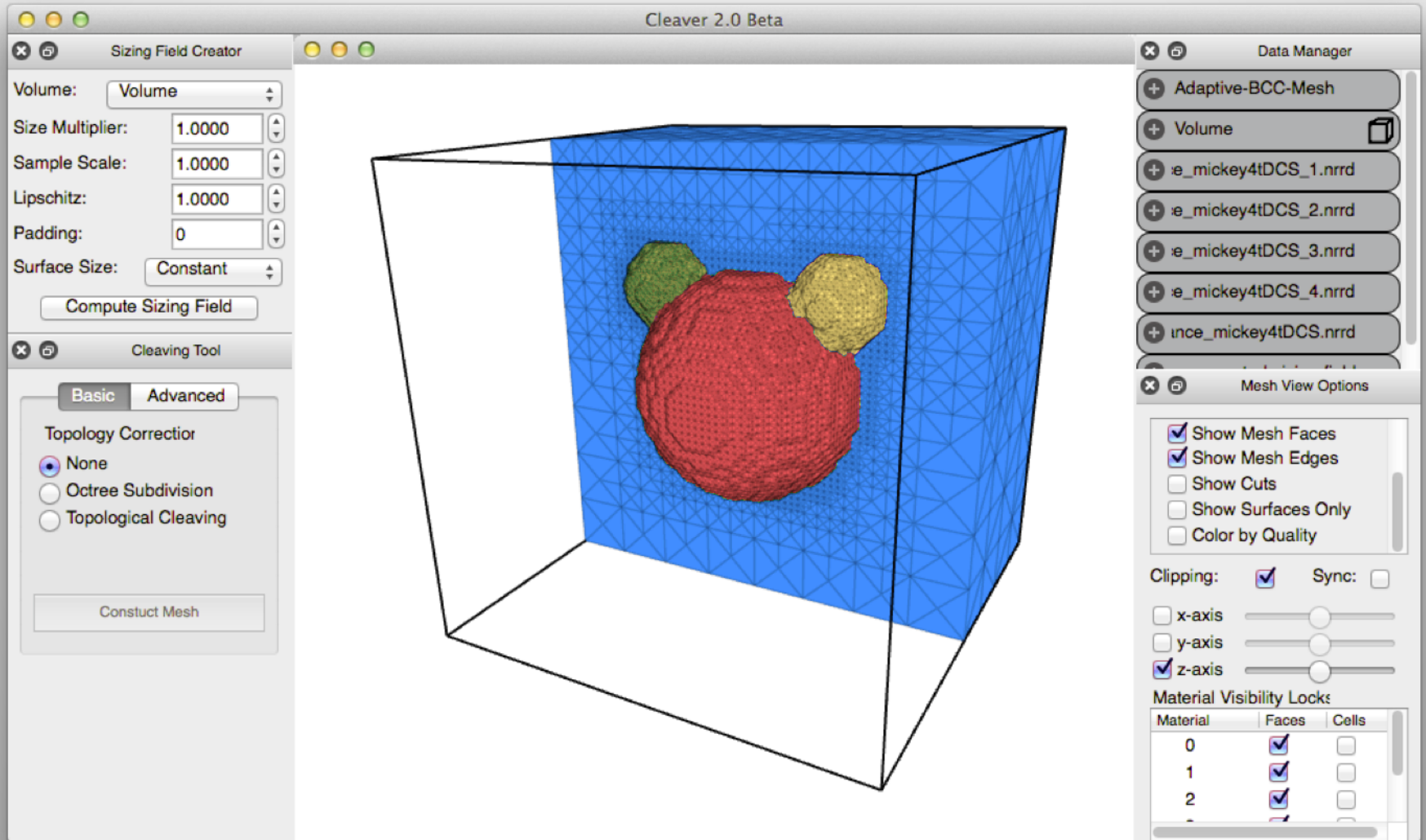
Cleaver 1

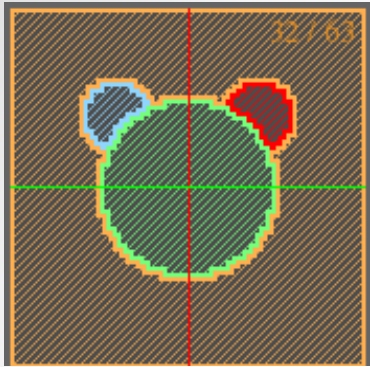
```
> ./cleaver -i material1.nrrd material2.nrrd material3.nrrd material4.nrrd material5.nrrd
Reading File: material1.nrrd
Reading File: material2.nrrd
Reading File: material3.nrrd
Reading File: material4.nrrd
Reading File: material5.nrrd
Input Dimensions: 63 x 63 x 63
Creating Mesh with Volume Size [63, 63, 63]
Cuts Computed
Triples Computed
Quads Computed
Tets Generalized
Phase 1 Complete
Phase 2 Complete
Phase 3 Complete
Stenciling Complete
Mesh Construction Complete
Total Time: 1.8 s
Worst Angles:
min: 18.0615081787
max: 148.886779785
Writing settings file: output.info
Writing mesh node file: output.node
Writing mesh ele file: output.ele
Writing mesh ply file: output.ply
Cleaning up.
Done.
```


3rd Party Viewer



Cleaver 2

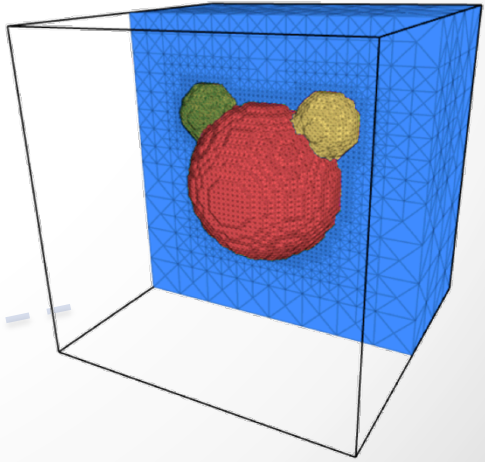




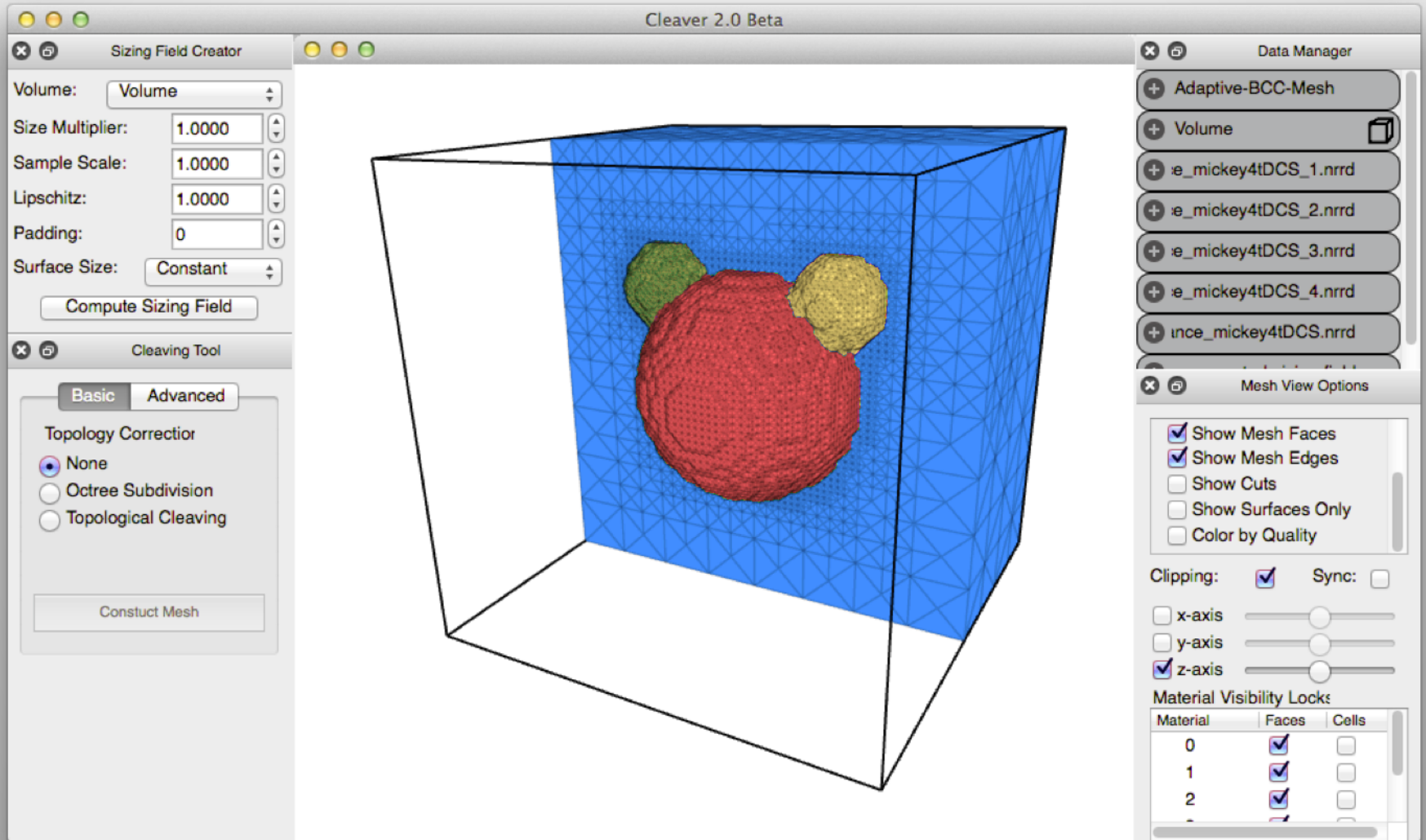
Generate Indicator Functions

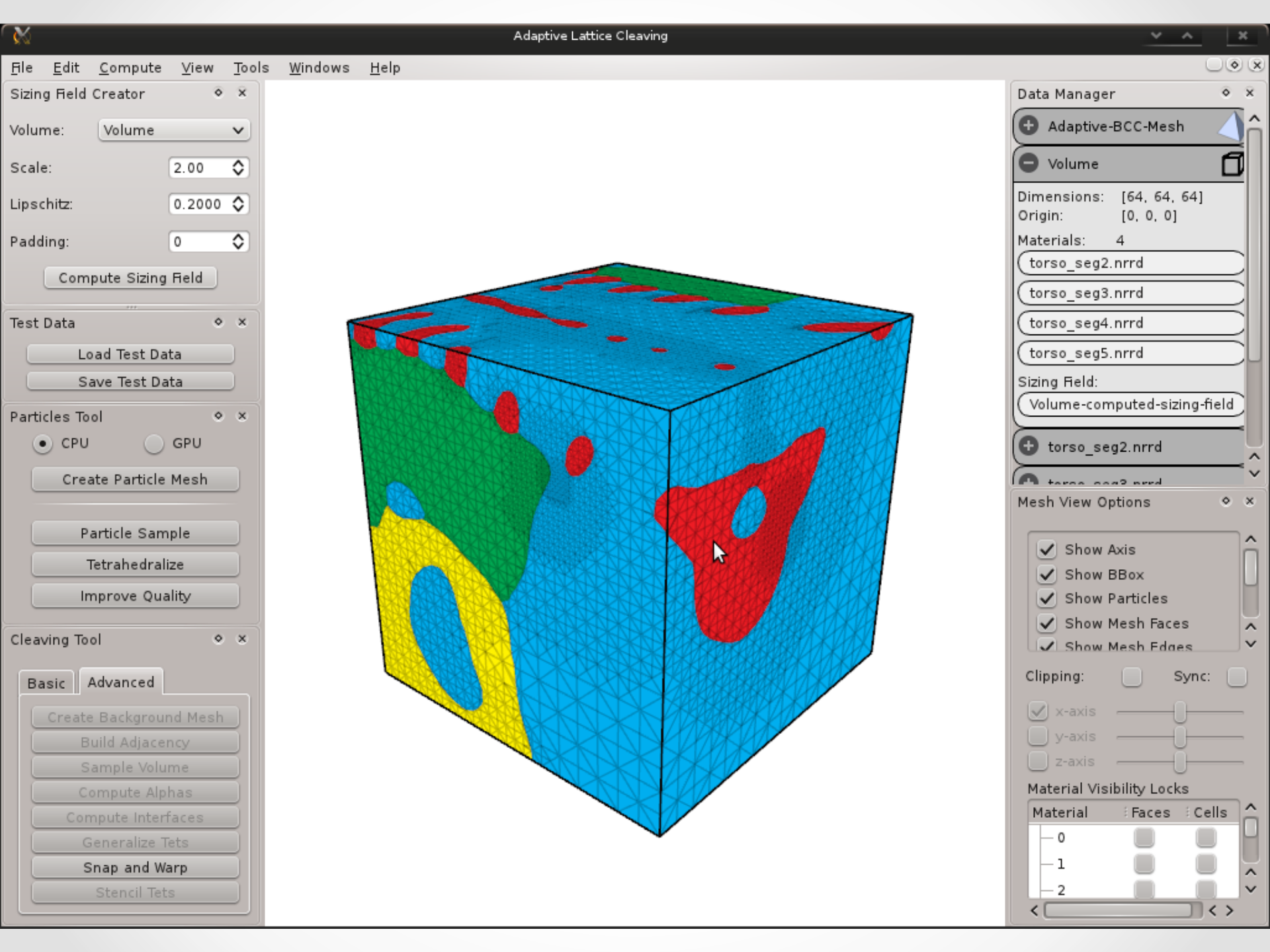
Compute Sizing Field

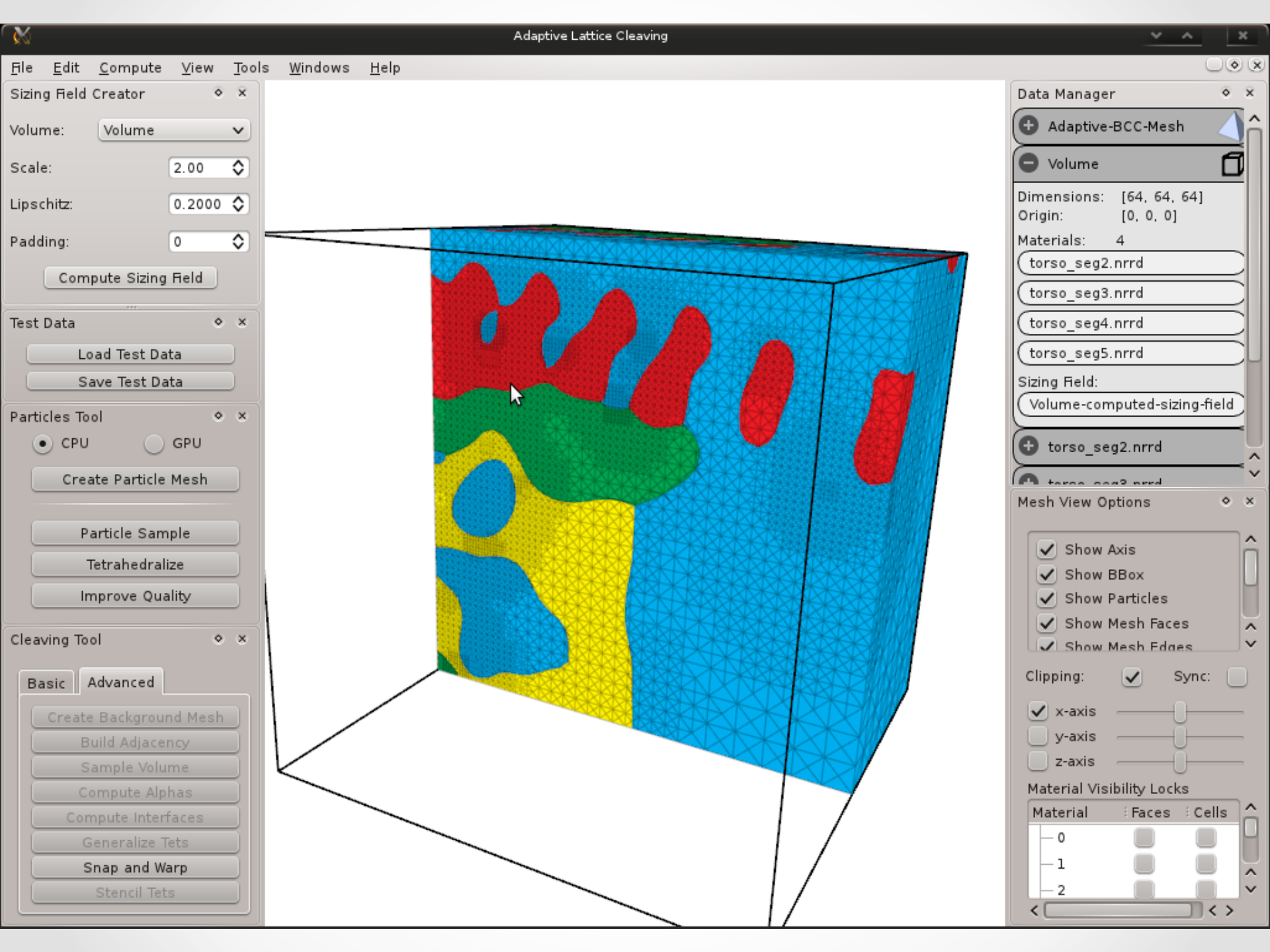
Generate Mesh



Cleaver 2







Sizing Field Creator

Volume: Volume

Scale: 2.00

Lipschitz: 0.2000

Padding: 0

Compute Sizing Field

Test Data

Load Test Data

Save Test Data

Particles Tool

CPU GPU

Create Particle Mesh

Particle Sample

Tetrahedralize

Improve Quality

Cleaving Tool

Basic Advanced

Create Background Mesh

Build Adjacency

Sample Volume

Compute Alphas

Compute Interfaces

Generalize Tets

Snap and Warp

Stencil Tets

Data Manager

Adaptive-BCC-Mesh

Volume

Dimensions: [64, 64, 64]

Origin: [0, 0, 0]

Materials: 4

torso_seg2.nrrd

torso_seg3.nrrd

torso_seg4.nrrd

torso_seg5.nrrd

Sizing Field:

Volume-computed-sizing-field

torso_seg2.nrrd

Mesh View Options

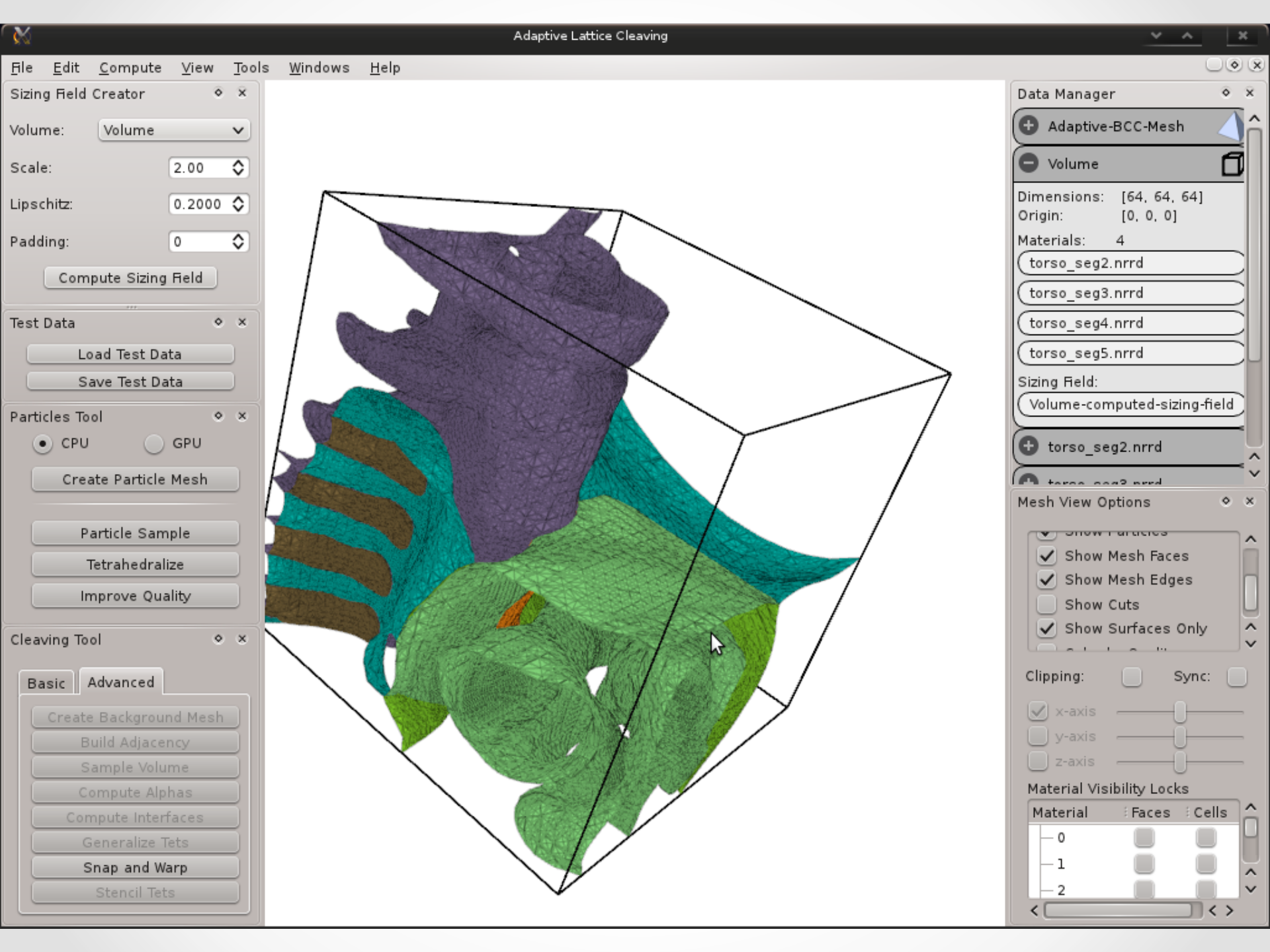
- Show Axis
- Show BBox
- Show Particles
- Show Mesh Faces
- Show Mesh Edges

Clipping: Sync:

- x-axis
- y-axis
- z-axis

Material Visibility Locks

Material	Faces	Cells
0		
1		
2		



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Data Manager

Adaptive-BCC-Mesh

Volume

Dimensions: [64, 64, 64]

Origin: [0, 0, 0]

Materials: 4

torso_seg2.nrrd

torso_seg3.nrrd

torso_seg4.nrrd

torso_seg5.nrrd

Sizing Field:

Volume-computed-sizing-field

torso_seg2.nrrd

torso_seg3.nrrd

Mesh View Options

Show Mesh Faces

Show Mesh Edges

Show Cuts

Show Surfaces Only

Clipping: Sync:

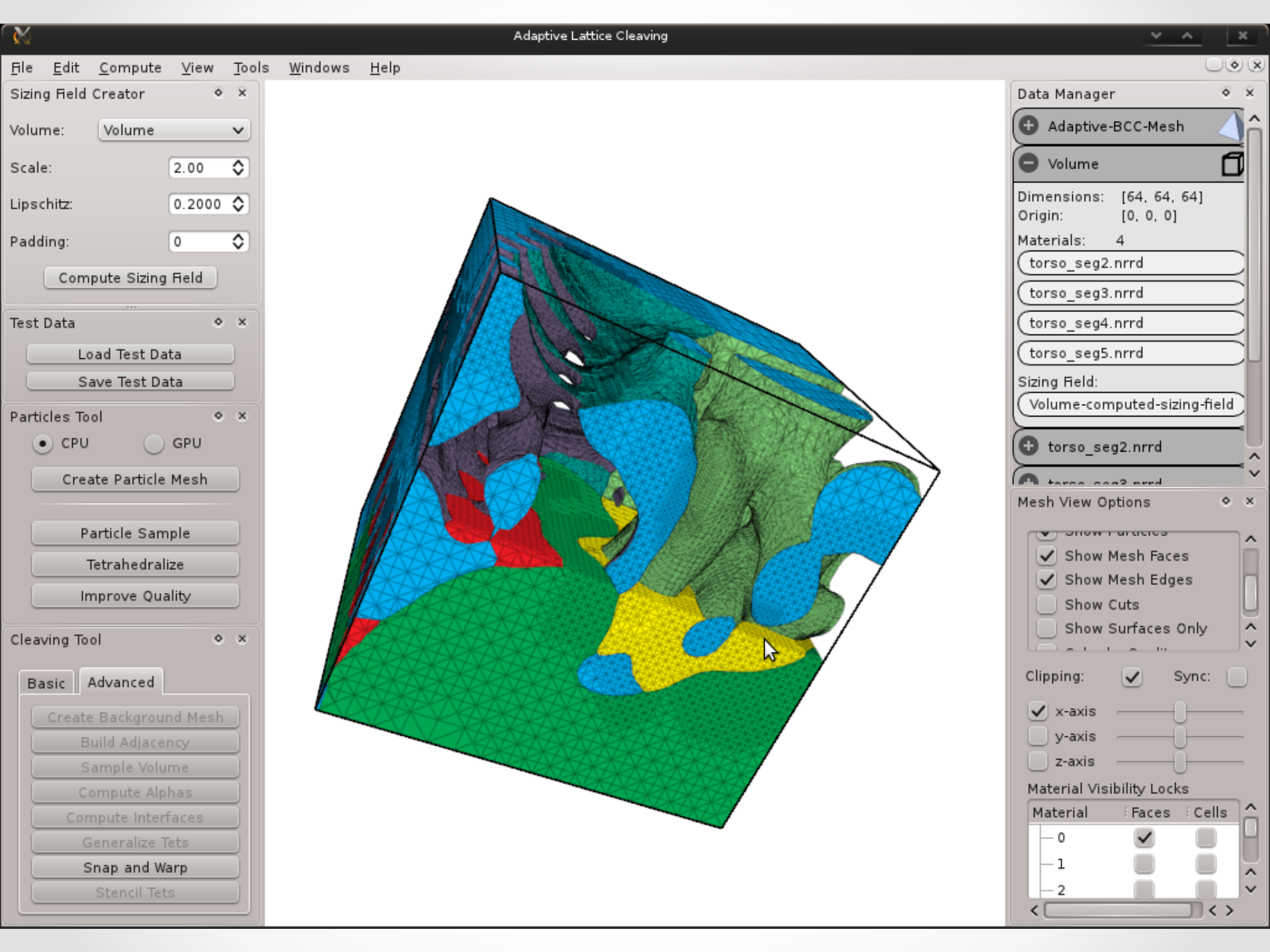
x-axis

y-axis

z-axis

Material Visibility Locks

Material	Faces	Cells
0	<input type="checkbox"/>	<input type="checkbox"/>
1	<input type="checkbox"/>	<input type="checkbox"/>
2	<input type="checkbox"/>	<input type="checkbox"/>



Sizing Field Creator

Volume: Volume
Scale: 2.00
Lipschitz: 0.2000
Padding: 0
Compute Sizing Field

Test Data

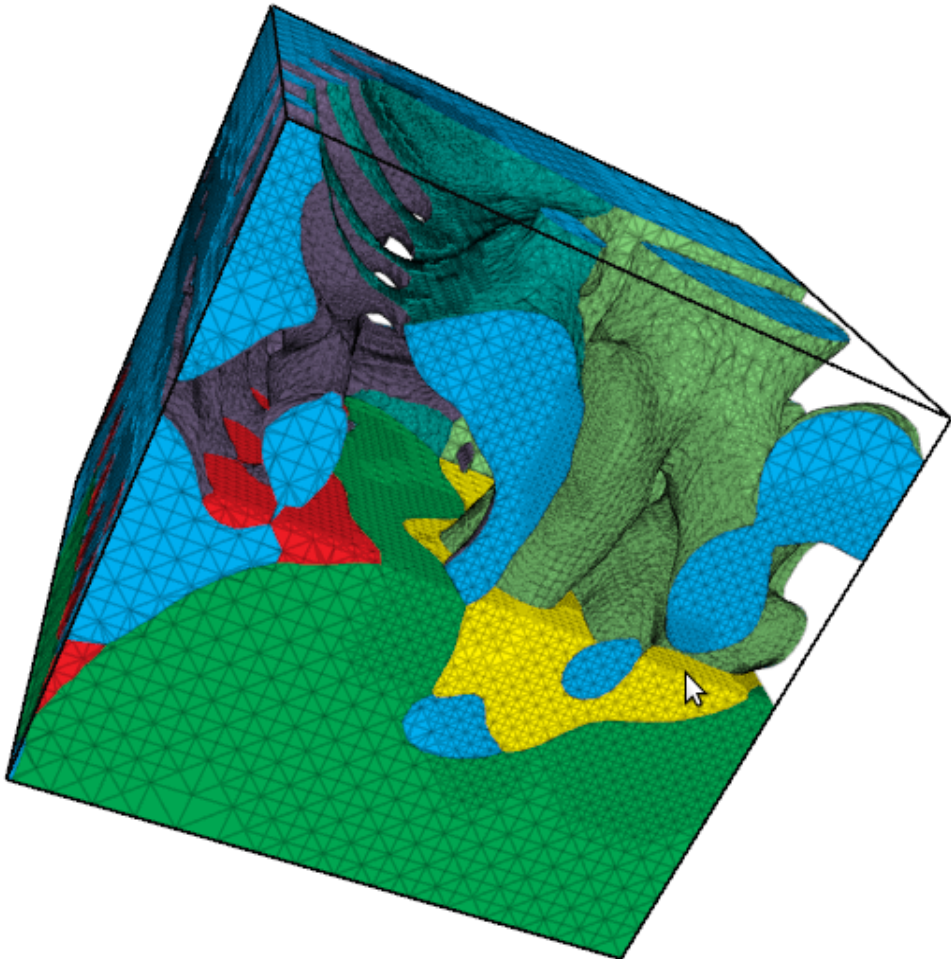
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Save Test Data

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Data Manager

Adaptive-BCC-Mesh
Volume
Dimensions: [64, 64, 64]
Origin: [0, 0, 0]
Materials: 4
torso_seg2.nrrd
torso_seg3.nrrd
torso_seg4.nrrd
torso_seg5.nrrd
Sizing Field:
Volume-computed-sizing-field

Mesh View Options

Show Mesh Faces (checked)
Show Mesh Edges (checked)
Show Cuts
Show Surfaces Only

Clipping: (checked) Sync: (unchecked)
x-axis (checked) [slider]
y-axis [slider]
z-axis [slider]

Material Visibility Locks

Material	Faces	Cells
0	(checked)	(unchecked)
1	(unchecked)	(unchecked)
2	(unchecked)	(unchecked)