

Overview



More than 60 tools and counting...

- Conversion
- Filtering and Morphology
- Mathematical Transformation
- Combination
- Segmentation
- Geometric Transformation
- Level Set Processing
- Bitwise Boolean Operations
- Bitwise Morphology Operations
- Sparsity Management and Compression

Conversion

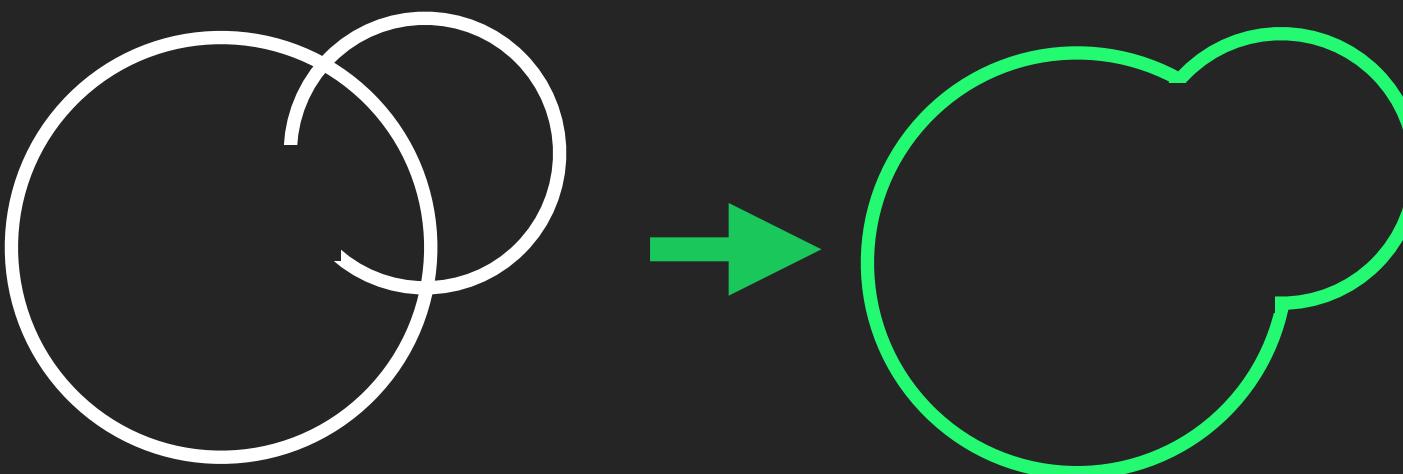
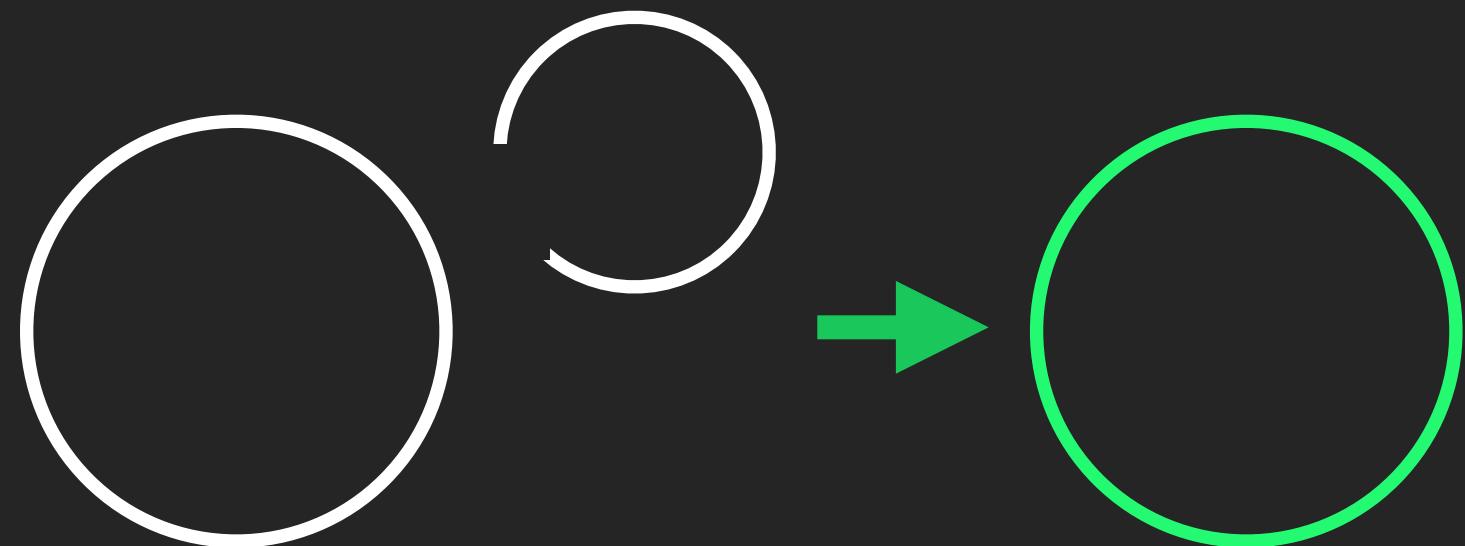


From Polygons

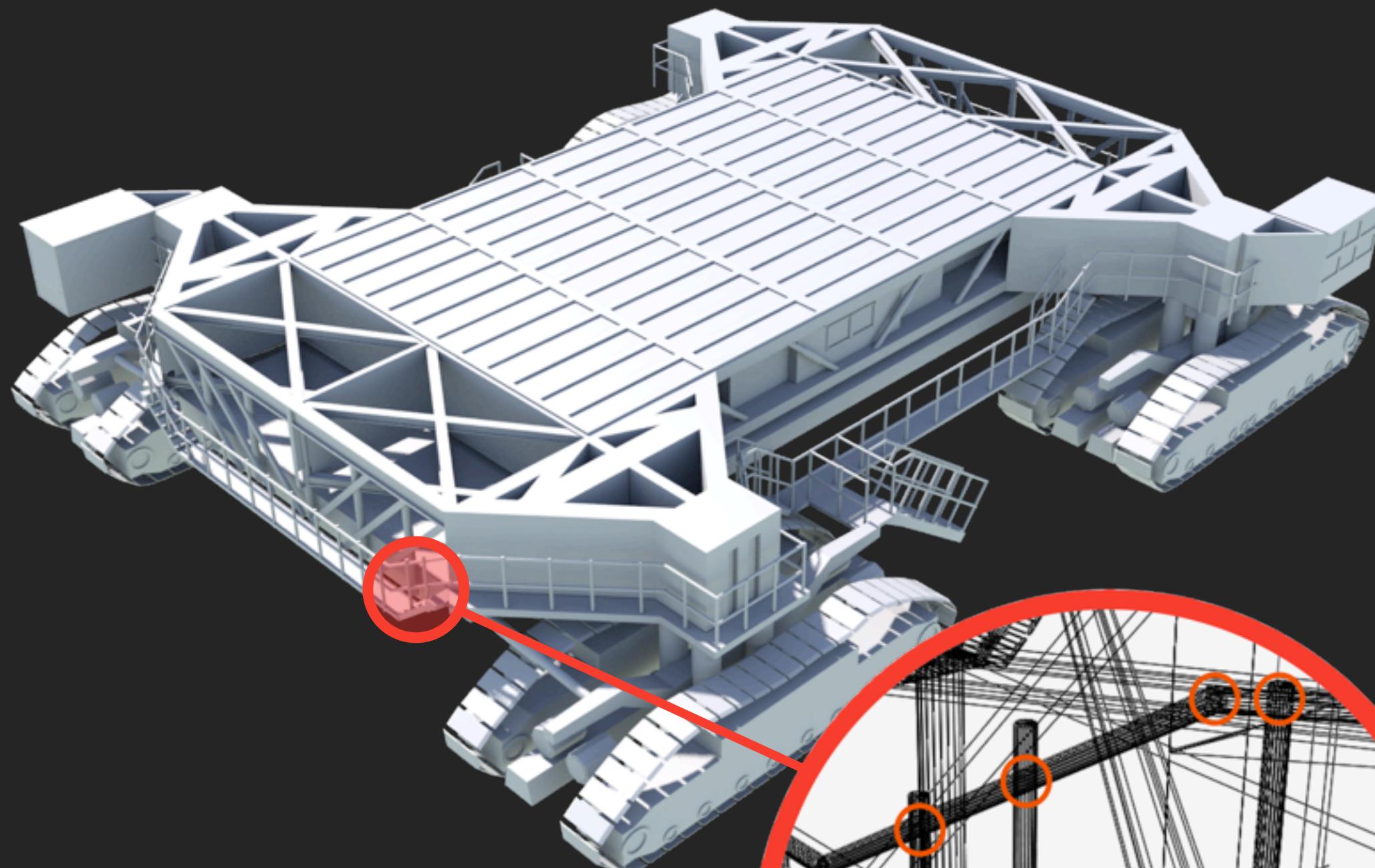
tools::MeshToVolume

- IN: Polygonal models (quads & triangles)
- OUT: Produces level set (SDF) or unsigned distance field
- Robust to non-manifold surfaces with internal self-intersections
- Requires closed (watertight) model for level set

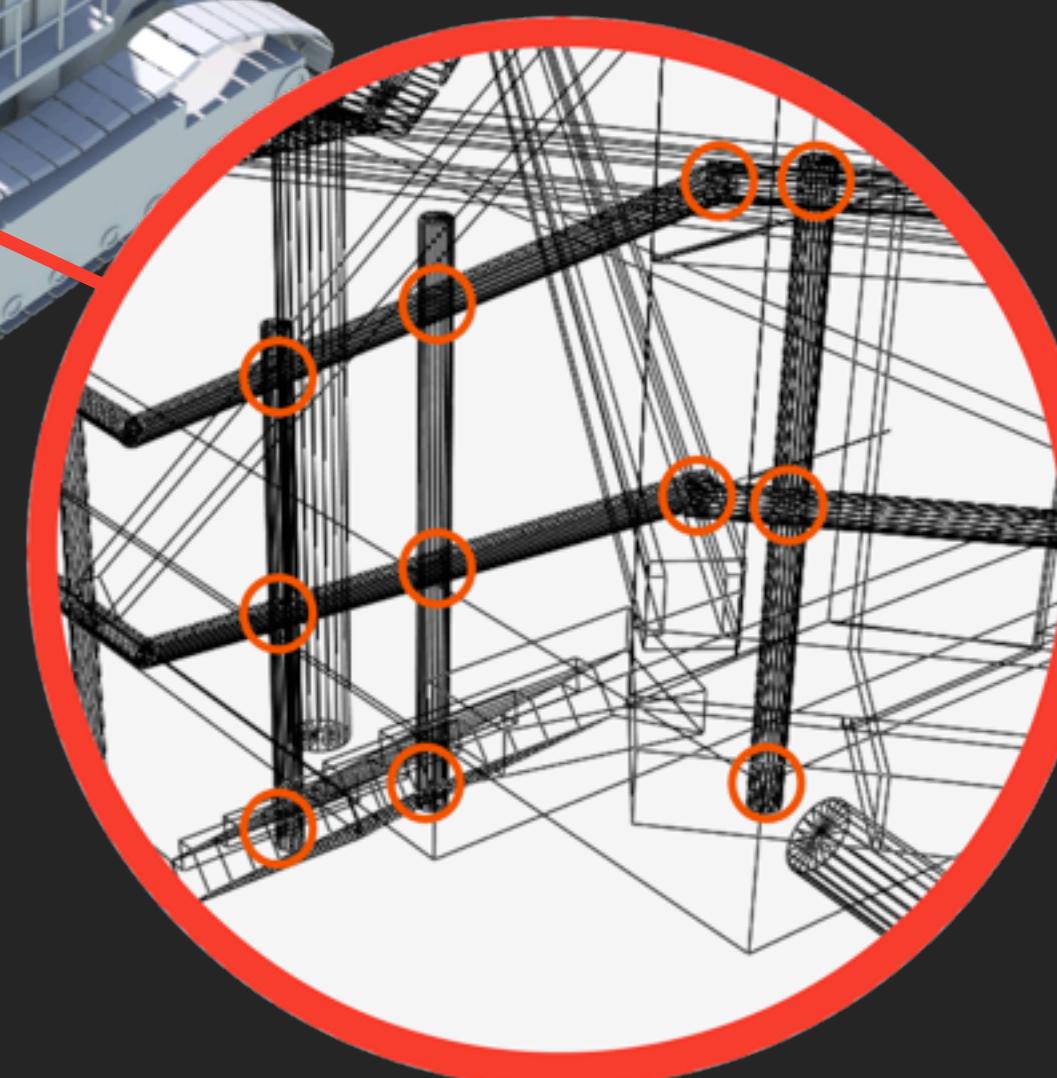
Level Set Conversion



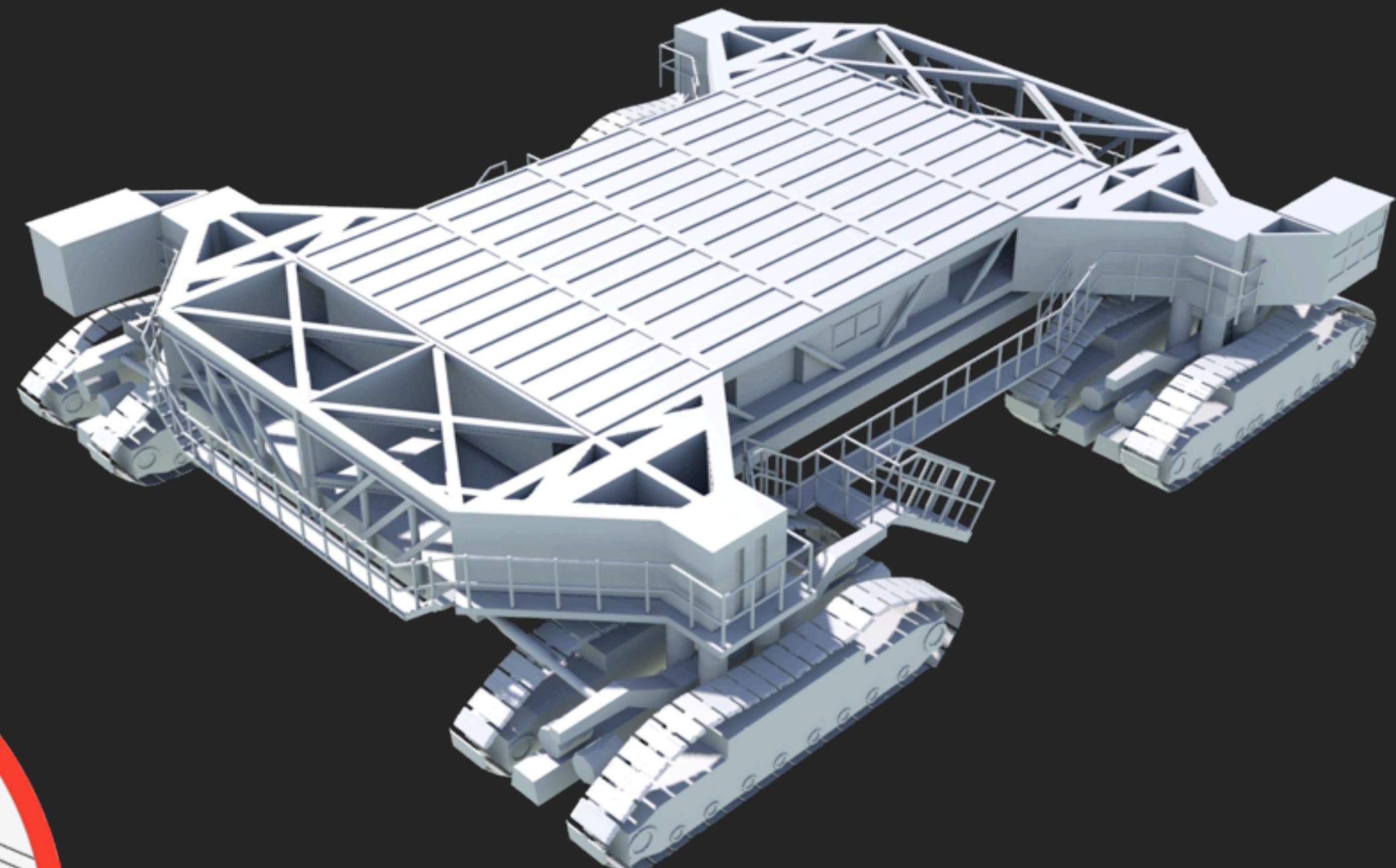
Conversion



Polygonal Model



internal self-intersections



Level Set

Resolution: $1051 \times 208 \times 863$

Active Voxels: 8.9M (188.7M dense)

Memory: 172 MB

Conversion Time 2.7s

Threaded – very fast

Conversion



To Polygons

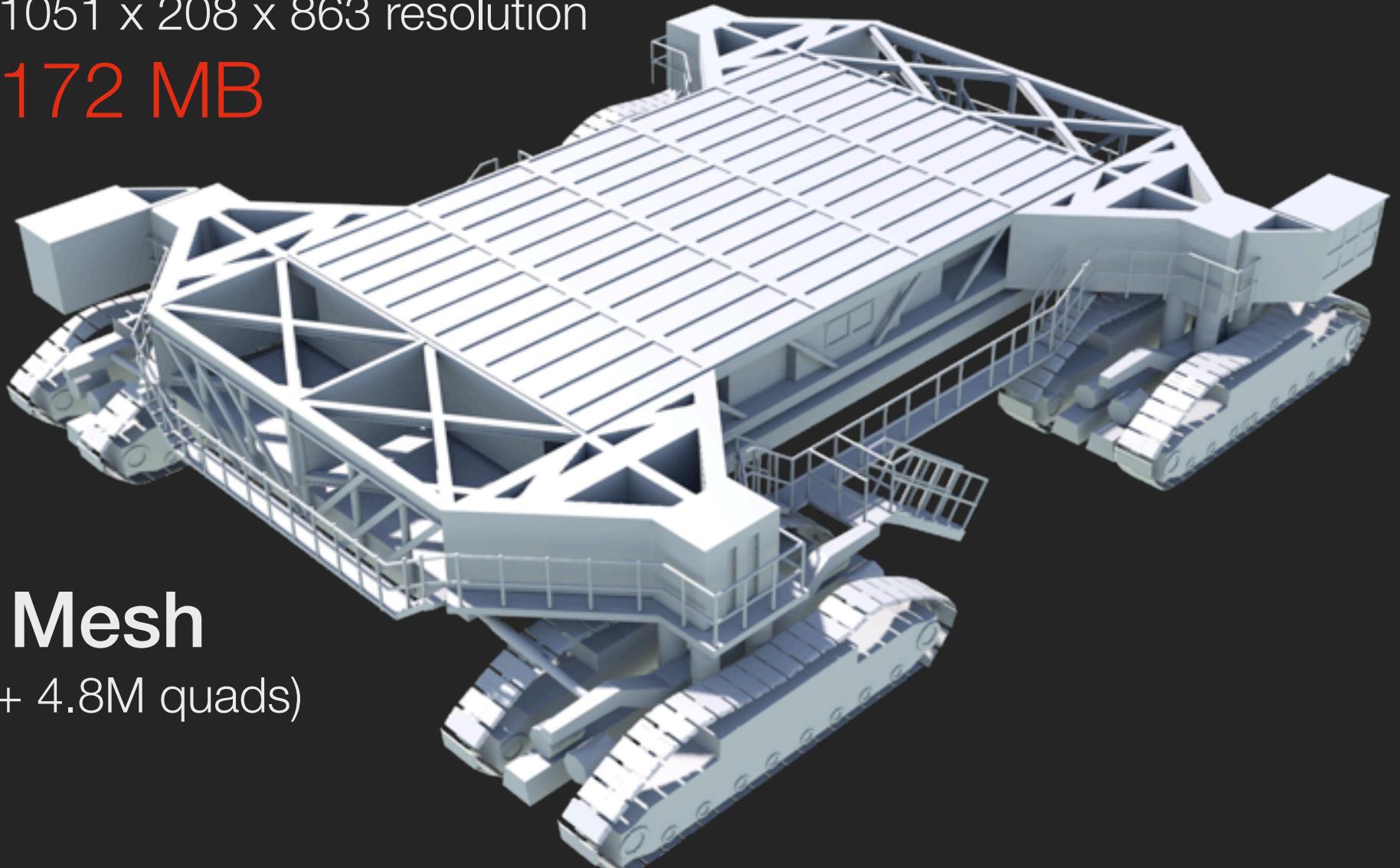
tools::VolumeToMesh

- Mesh any scalar field that has a continuous isosurface
- Threaded dual contouring scheme
- Adaptive, using local curvature
- Supports region masking and adaptivity field

Level Set

1051 x 208 x 863 resolution

172 MB



Uniform Mesh

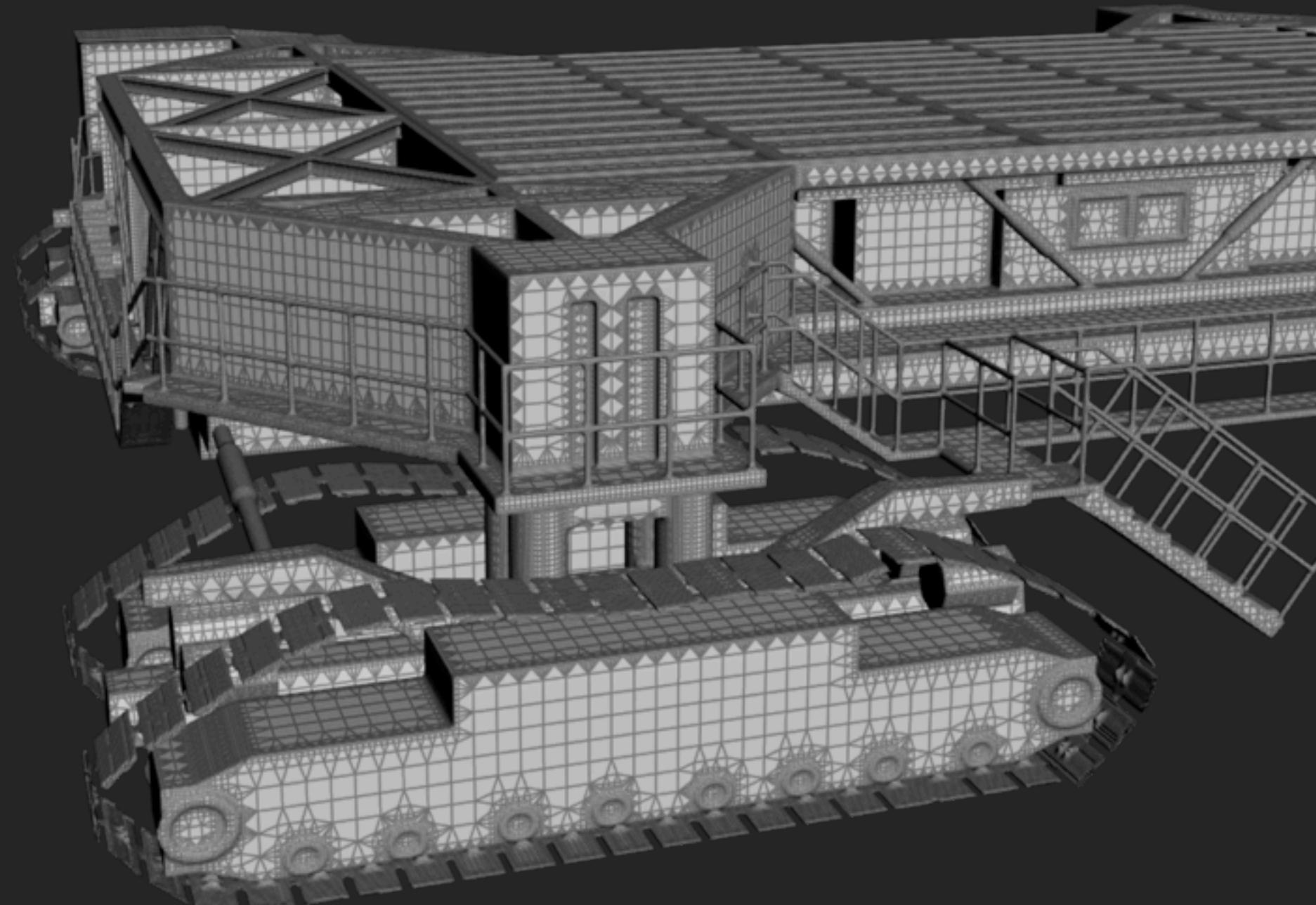
(4.8M points + 4.8M quads)

129 MB

Adaptive Mesh

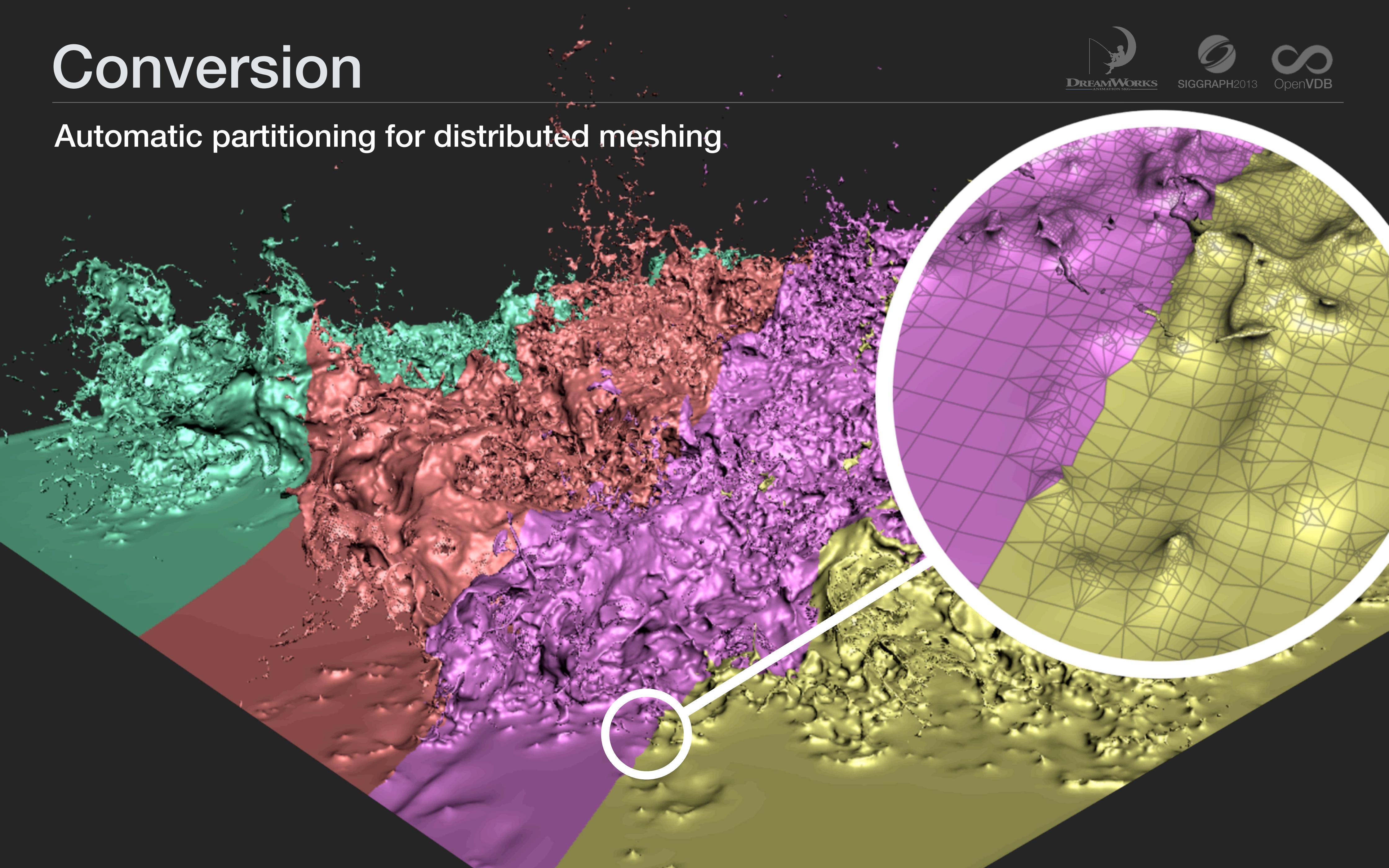
(1.7M points + 1.5M quads + 335K triangles)

46 MB



Conversion

Automatic partitioning for distributed meshing

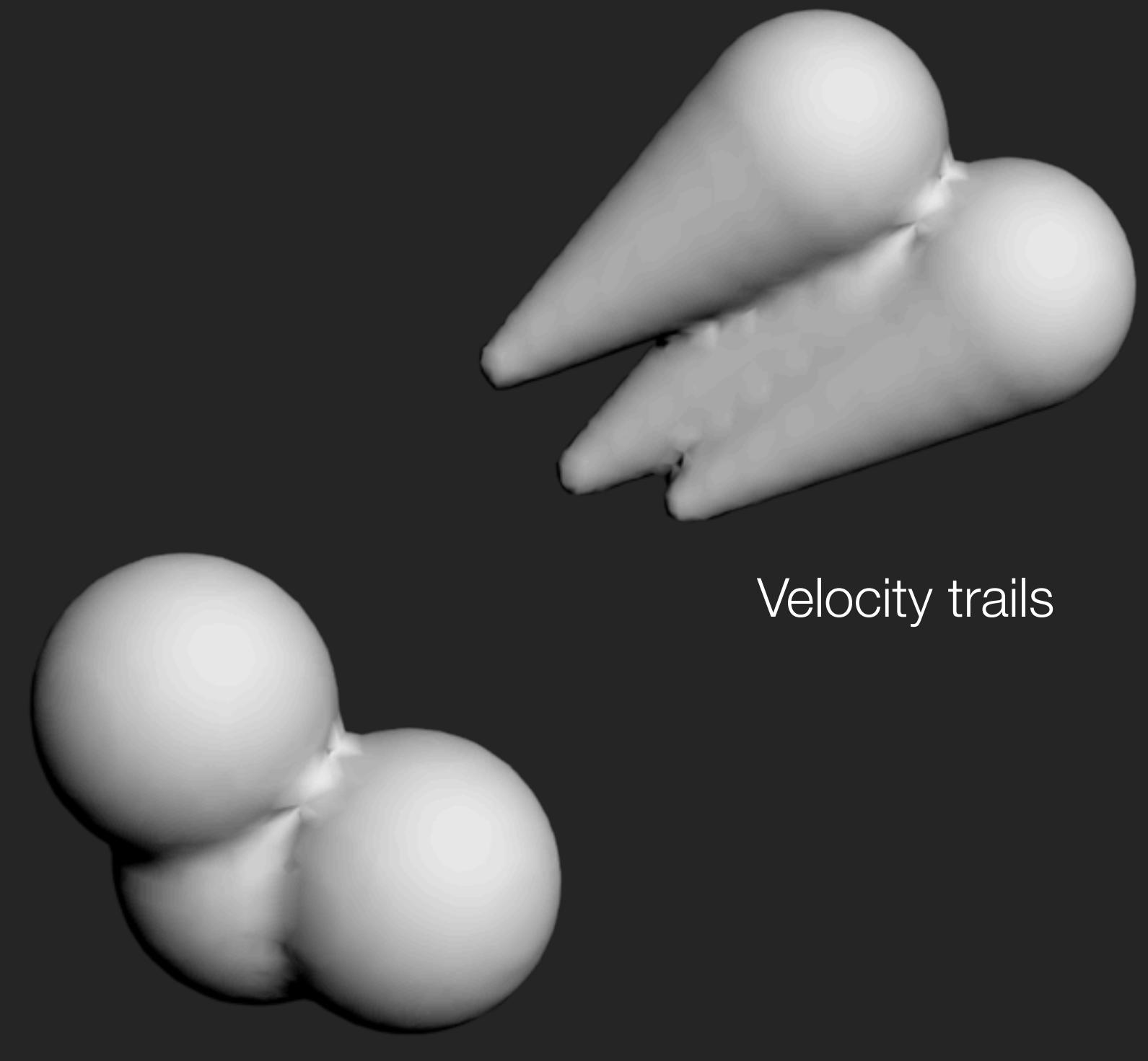
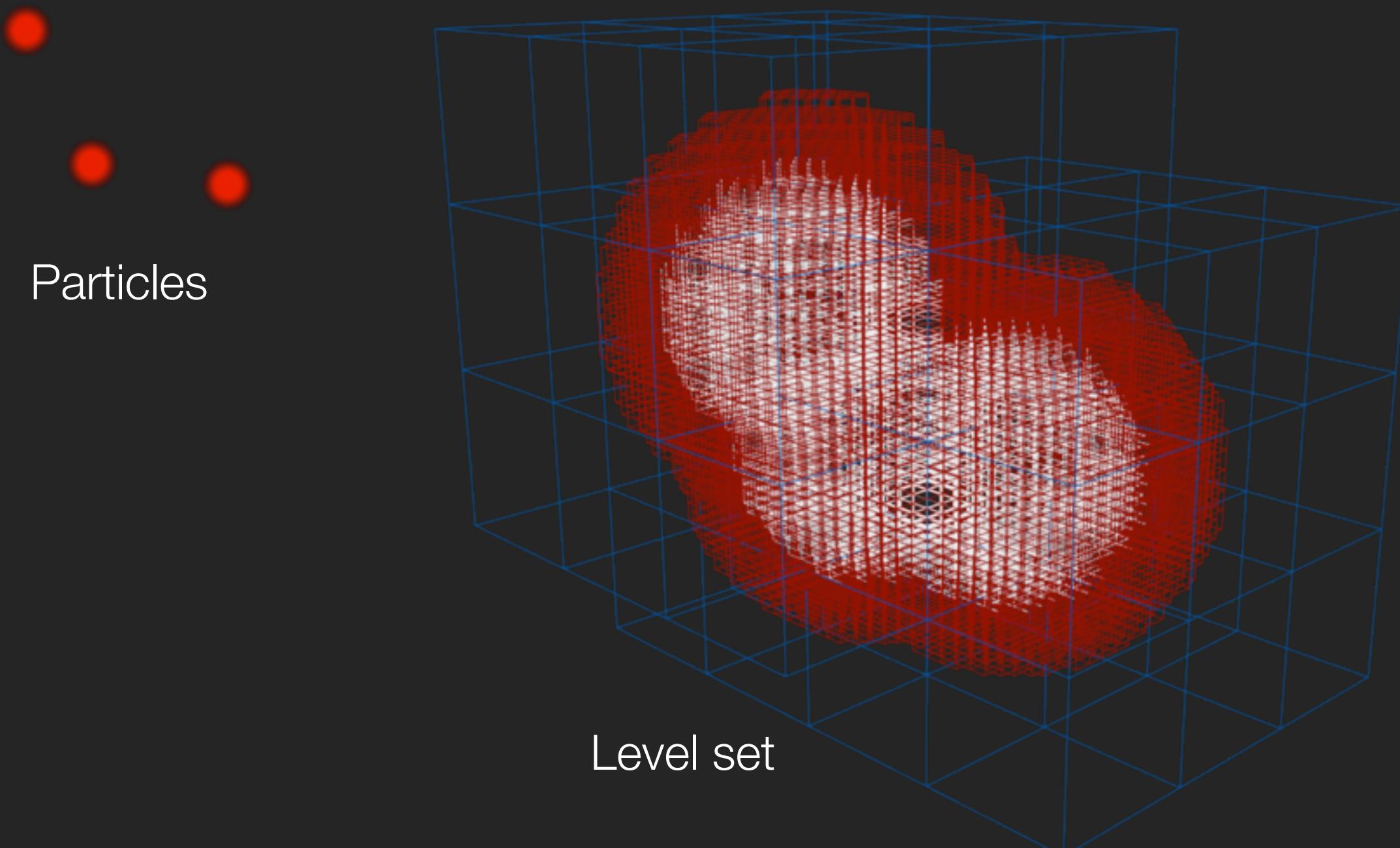


Conversion

From Particles

tools::ParticlesToLevelSet

- Creates a level set from a list of points with position & radius
- Threaded
- Custom attribute transfer
- Optional velocity trails



More Converters



From SDF to Fog Volume

`tools::sdfToFogVolume`

Rebuild Level Set

`tools::levelSetRebuild`

Dense Volume Converters

`tools::copyFromDense`

`tools::copyToDense`

Scatter Points

`tools::UniformPointScatter`

`tools::NonUniformPointScatter`

Filtering and Morphology



Gaussian

```
tools:::Filter:::gaussian  
tools:::LevelSetFilter:::gaussian
```

Offset / Morphological

```
tools:::Filter:::offset  
tools:::LevelSetFilter:::offset
```

Median

```
tools:::Filter:::median  
tools:::LevelSetFilter:::median
```

Normalize

```
tools:::normalize  
tools:::LevelSetFilter:::normalize
```

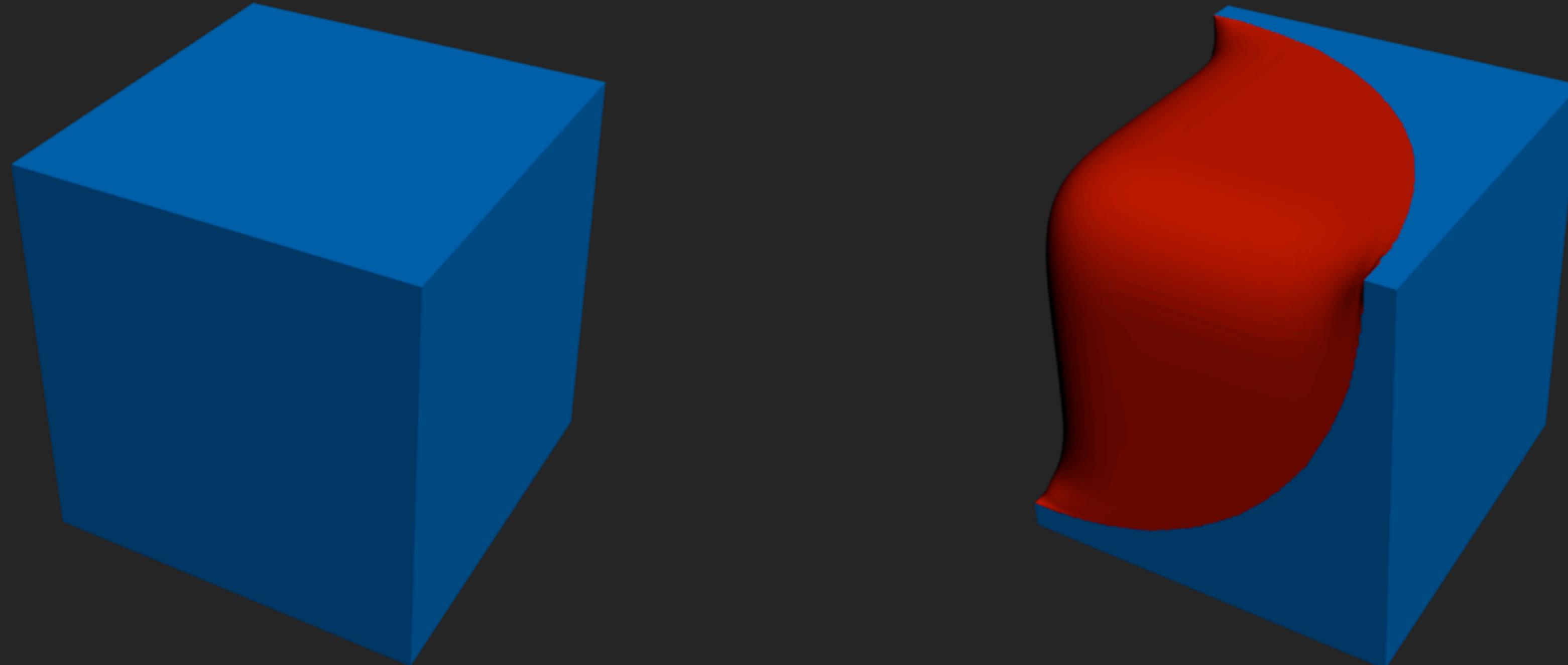
Mean

```
tools:::Filter:::mean  
tools:::LevelSetFilter:::mean
```

Level set specific

```
tools:::LevelSetFilter:::laplacian  
tools:::LevelSetFilter:::meanCurvature
```

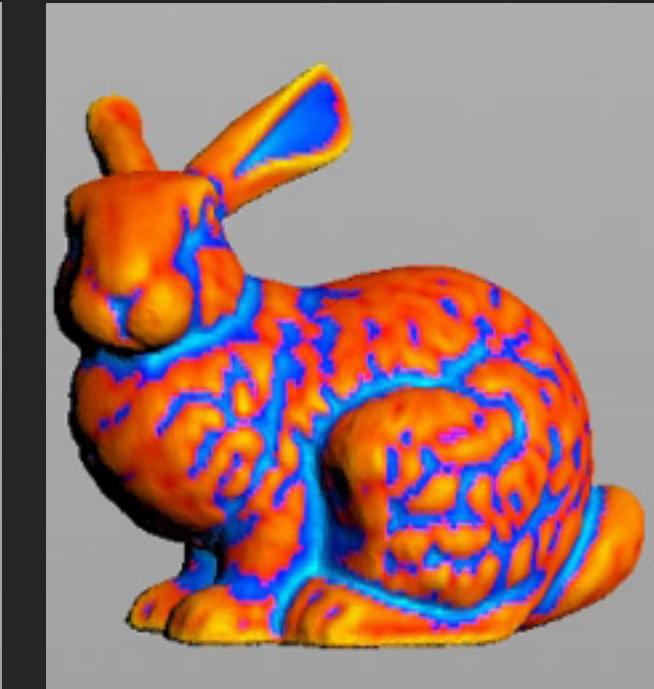
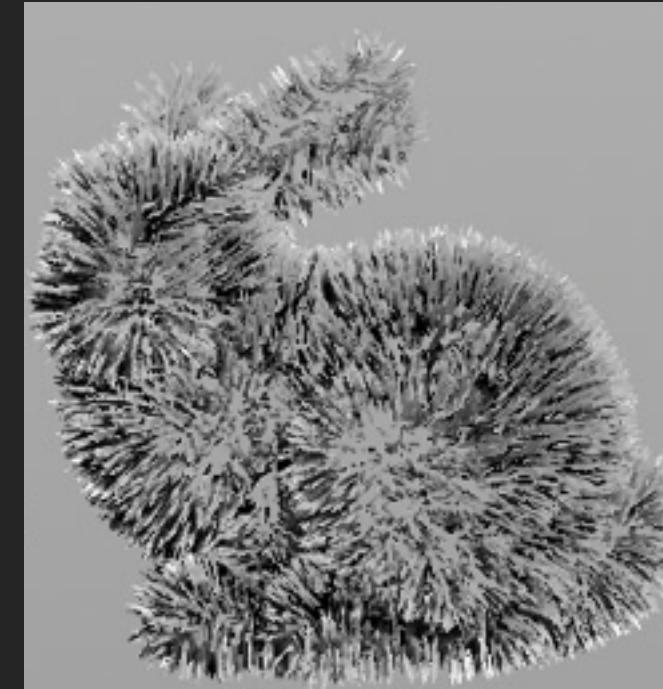
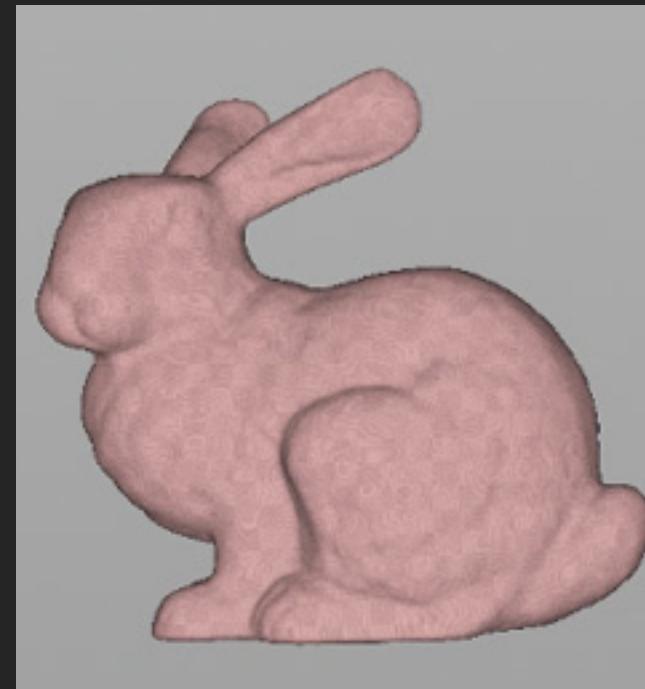
Gaussian Filter with Masking



Mathematical Transformation

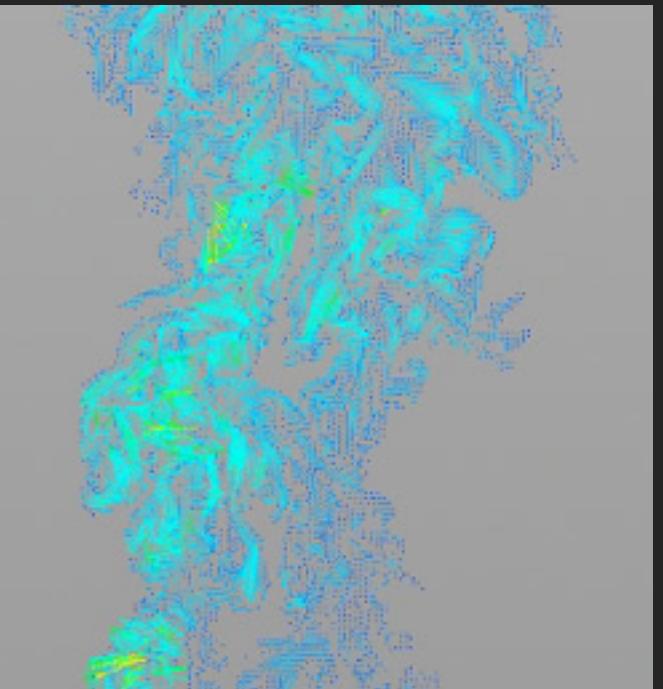
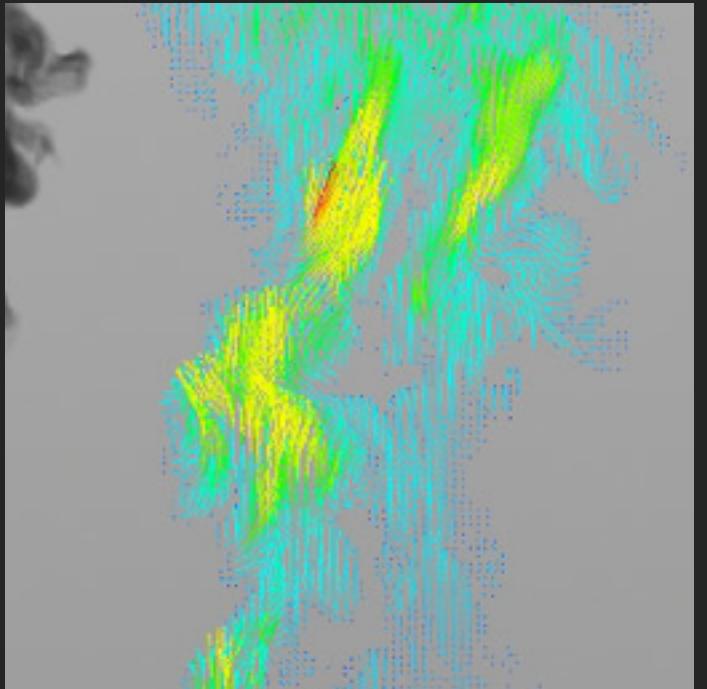
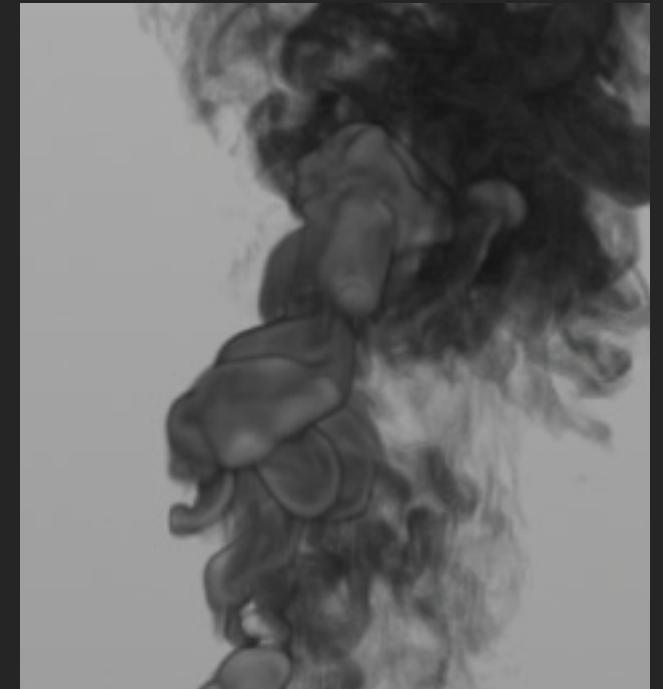


The implicit surface
(zero level set)



Gradient
tools::gradient

Buoyant density in an incompressible fluid simulation



Curl
tools::curl

Closest-point transform
tools::cpt

Divergence
tools::divergence

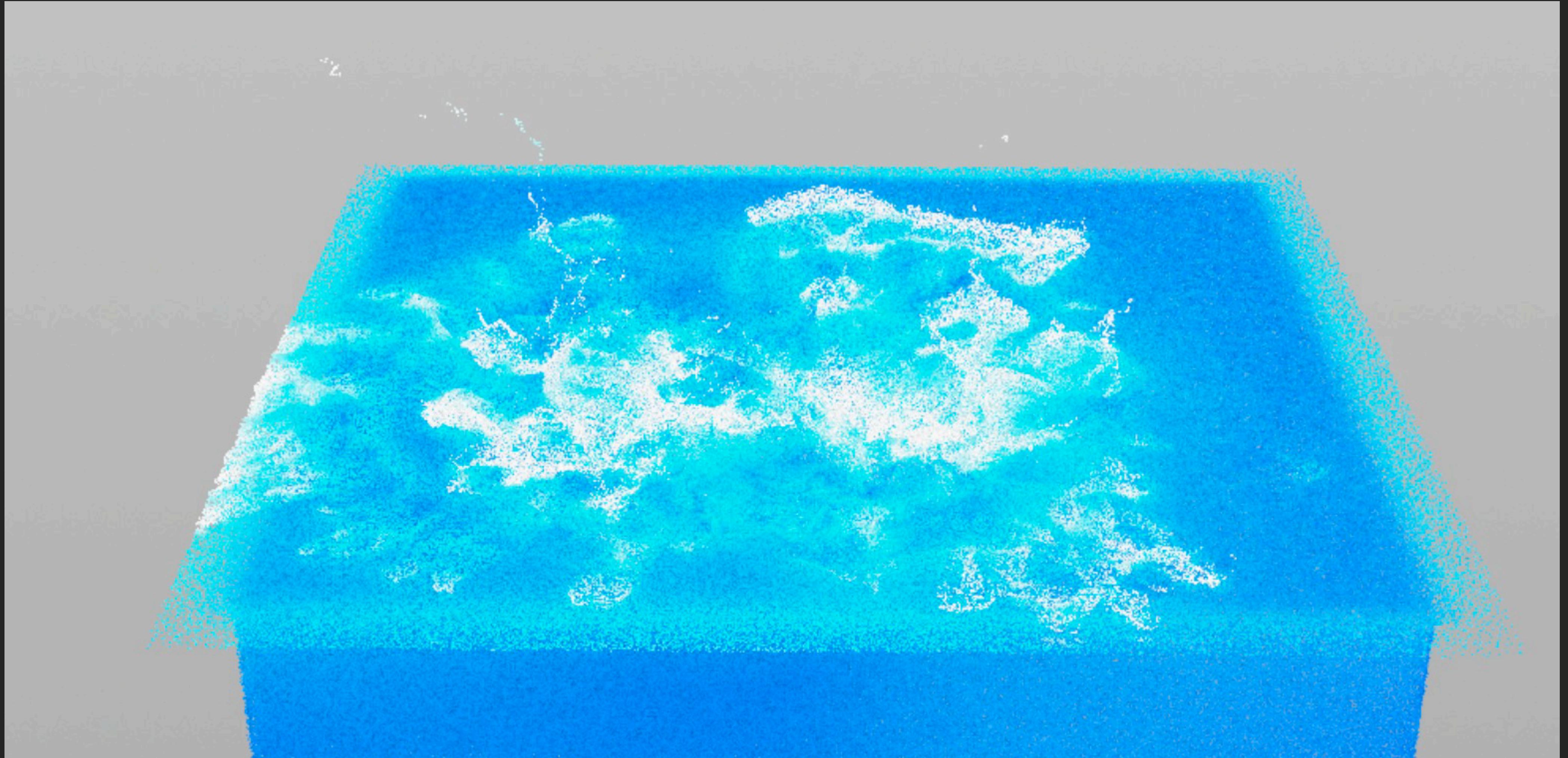
Laplacian
tools::laplacian

Mean curvature
tools::meanCurvature

Magnitude
tools::magnitude

Liquid Surfacing

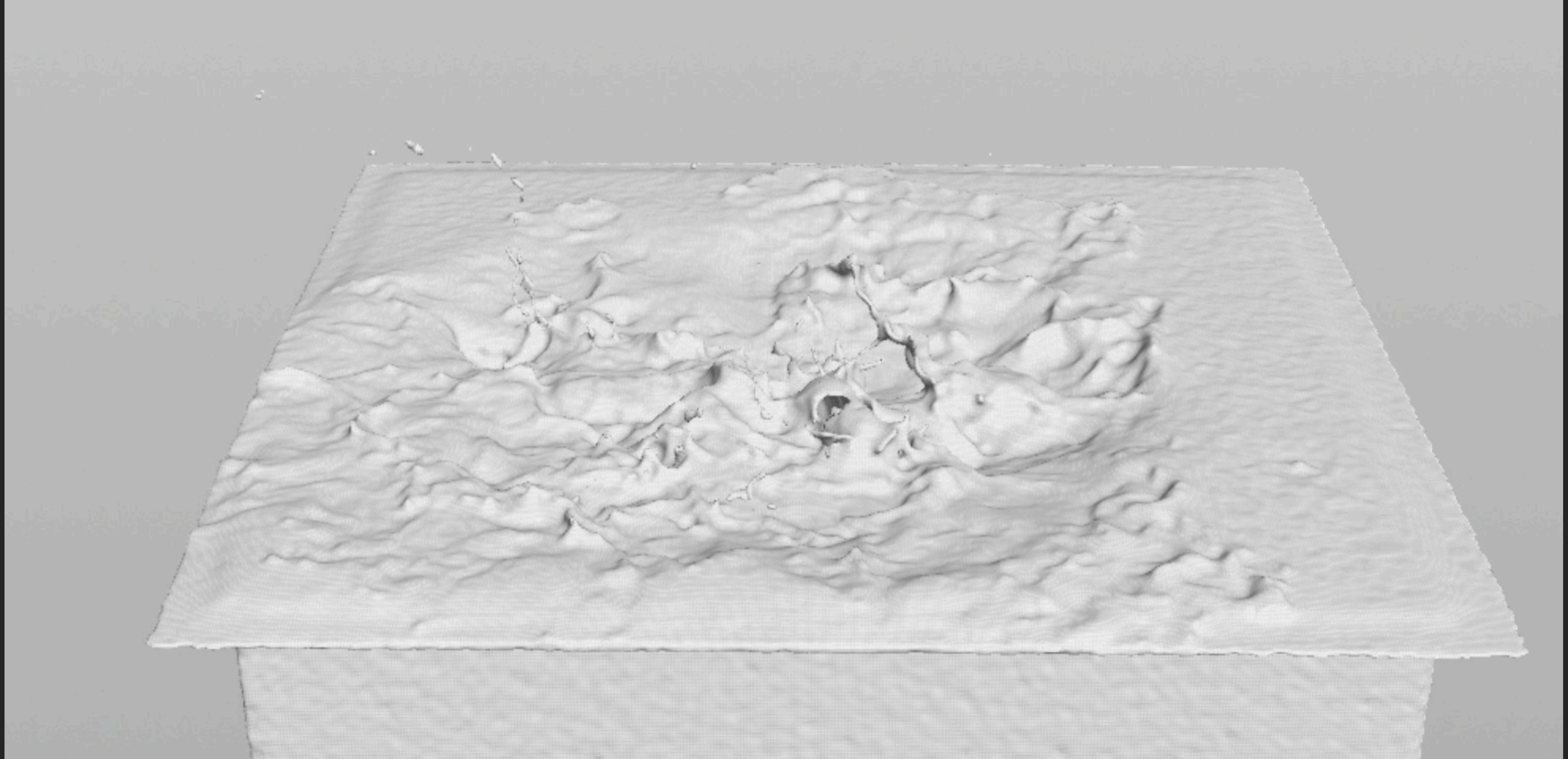
Particle Liquid Simulation



Liquid Surfacing



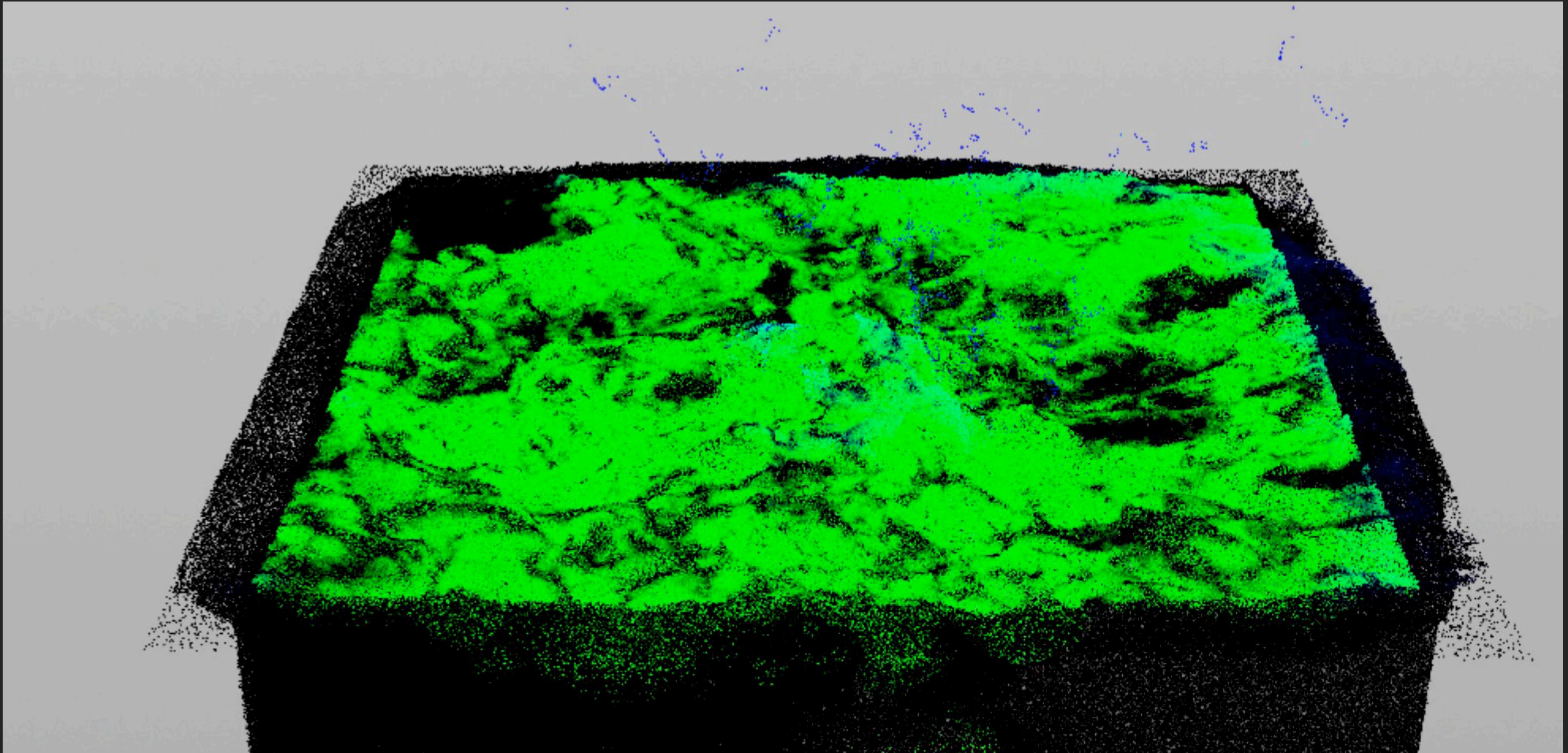
Fast initial surface (using only From Particles)



Liquid Surfacing



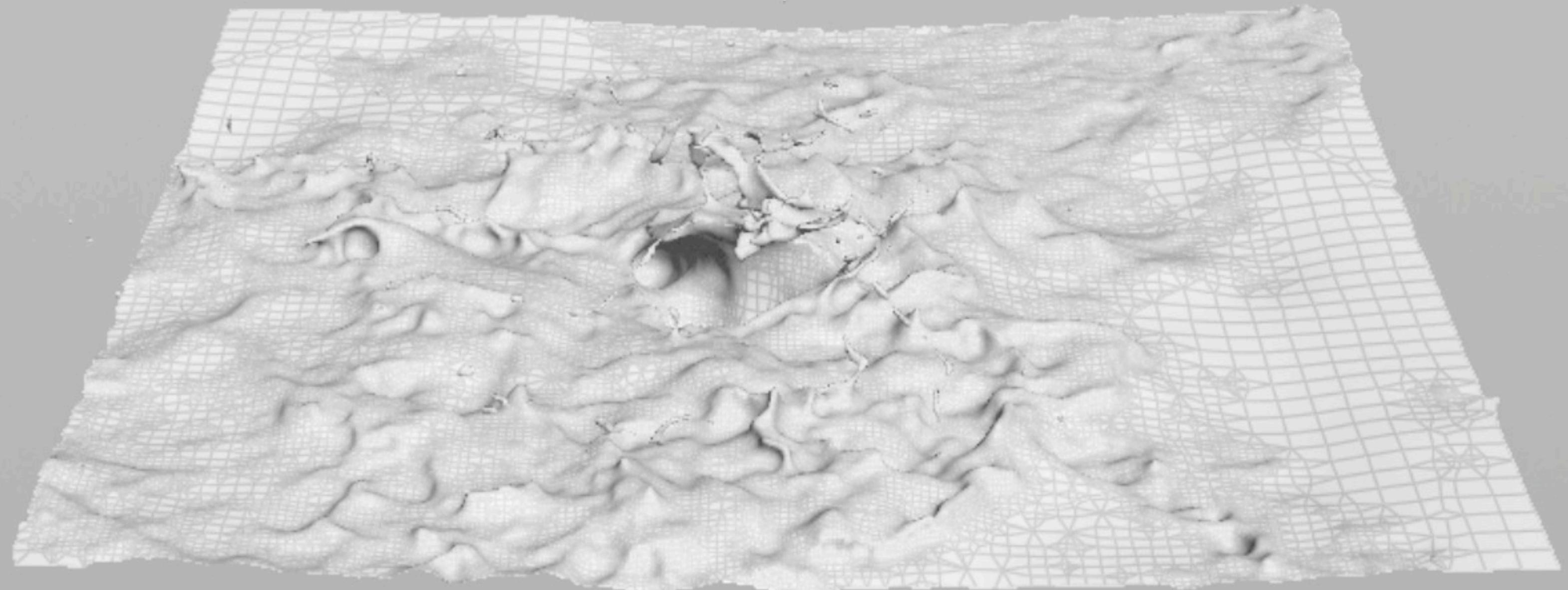
Vorticity Magnitude Mask (used for filtering)



Liquid Surfacing



Putting it all together

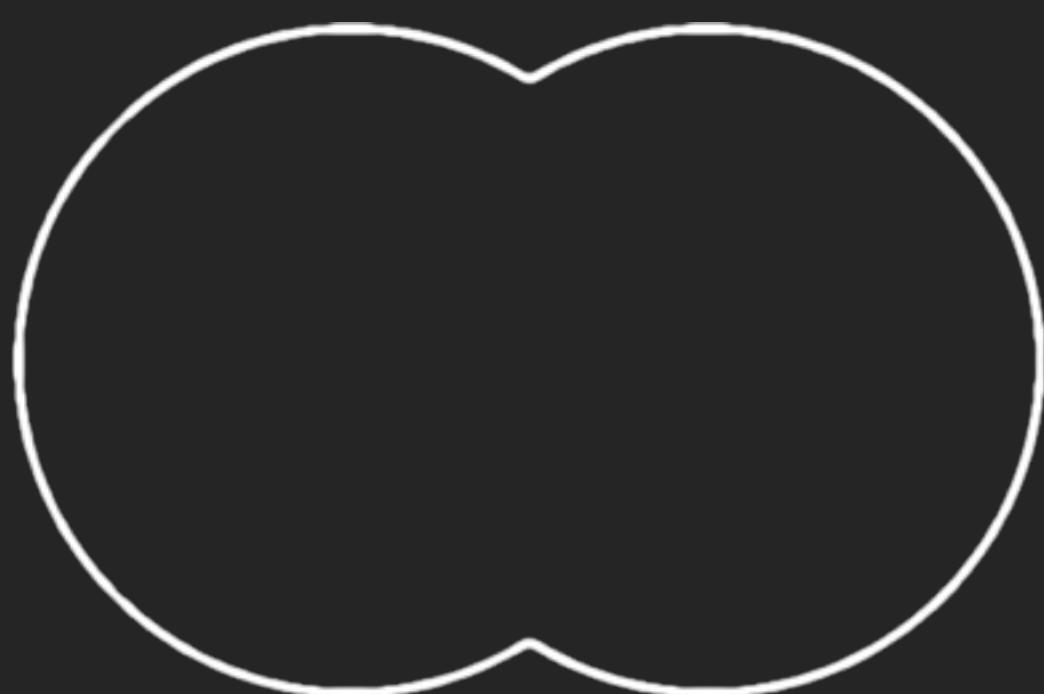
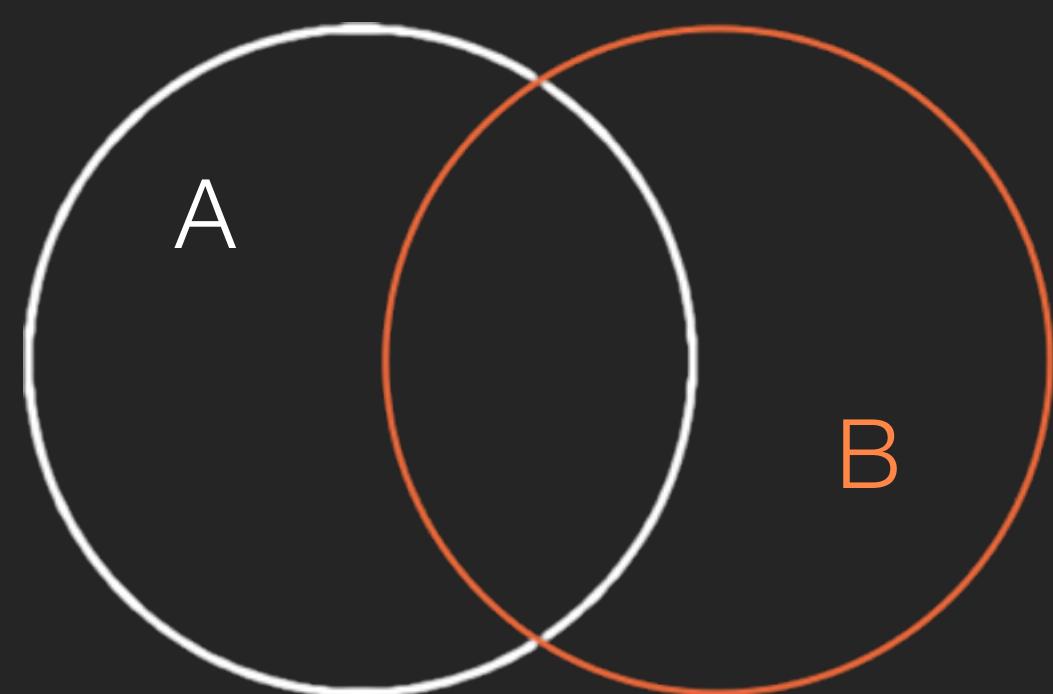


Combination



Constructive solid geometry

- Hierarchical
- Branch stealing – very fast



`tools::csgUnion`



`tools::csgIntersection`



`tools::csgDifference`

More Combination Tools



Pairwise Hierarchical Combination

Maximum
tools::compMax

Minimum
tools::compMin

Multiply
tools::compMul

Sum
tools::compSum

Replace
tools::compReplace

Merge
Grid::merge

Generic Hierarchical Algorithms

Combine
Tree::combine
Tree::combineExtended
Tree::combine2
Tree::combine2Extended

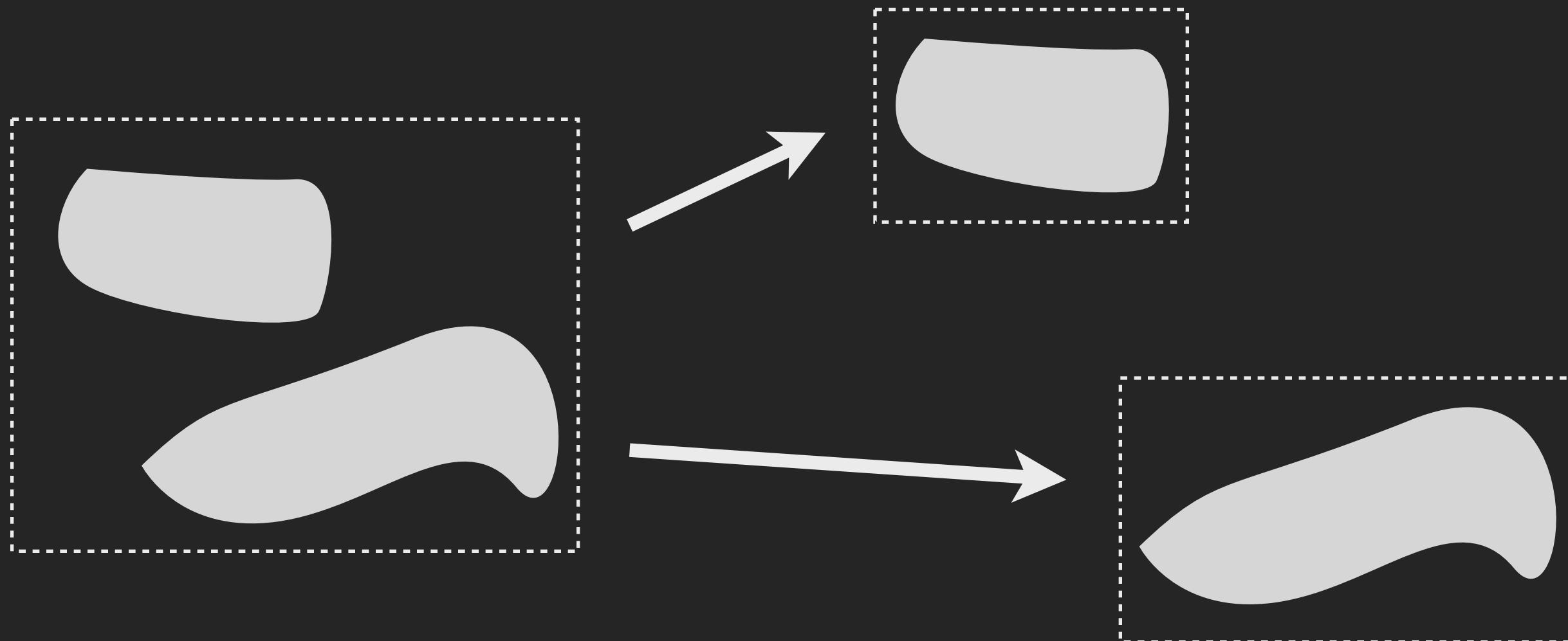
Visit
Tree::visitActiveBBox
Tree::visit
Tree::visit2

Segmentation



Segment

tools::segment



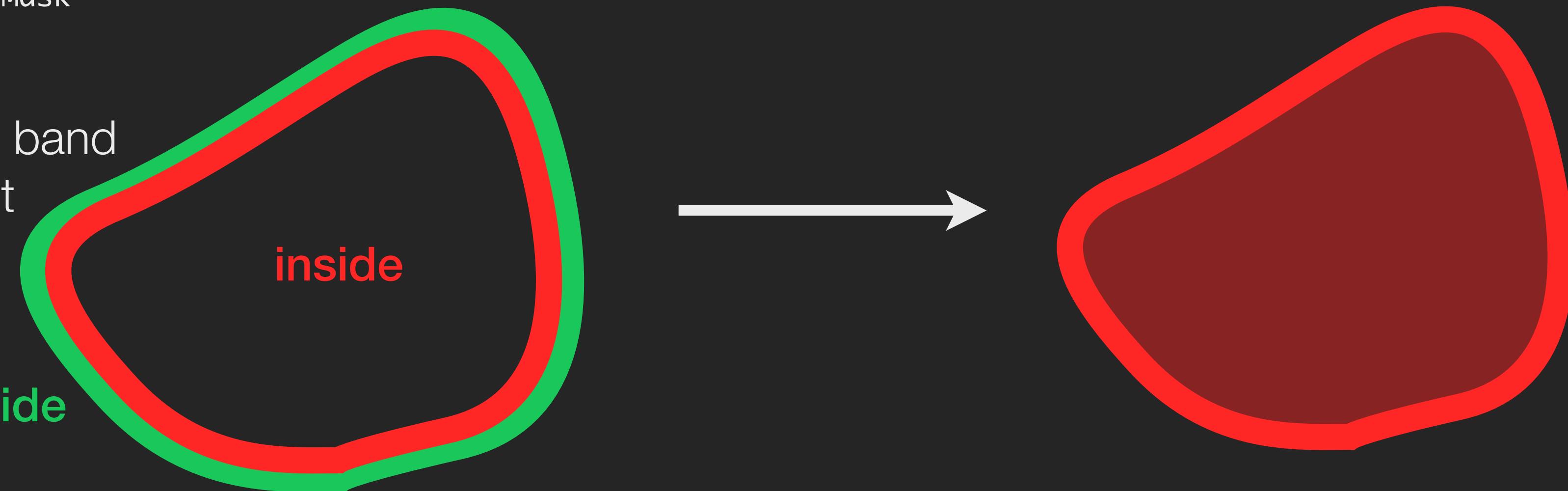
Interior mask

tools::sdfInteriorMask

Narrow band
level set

inside

outside



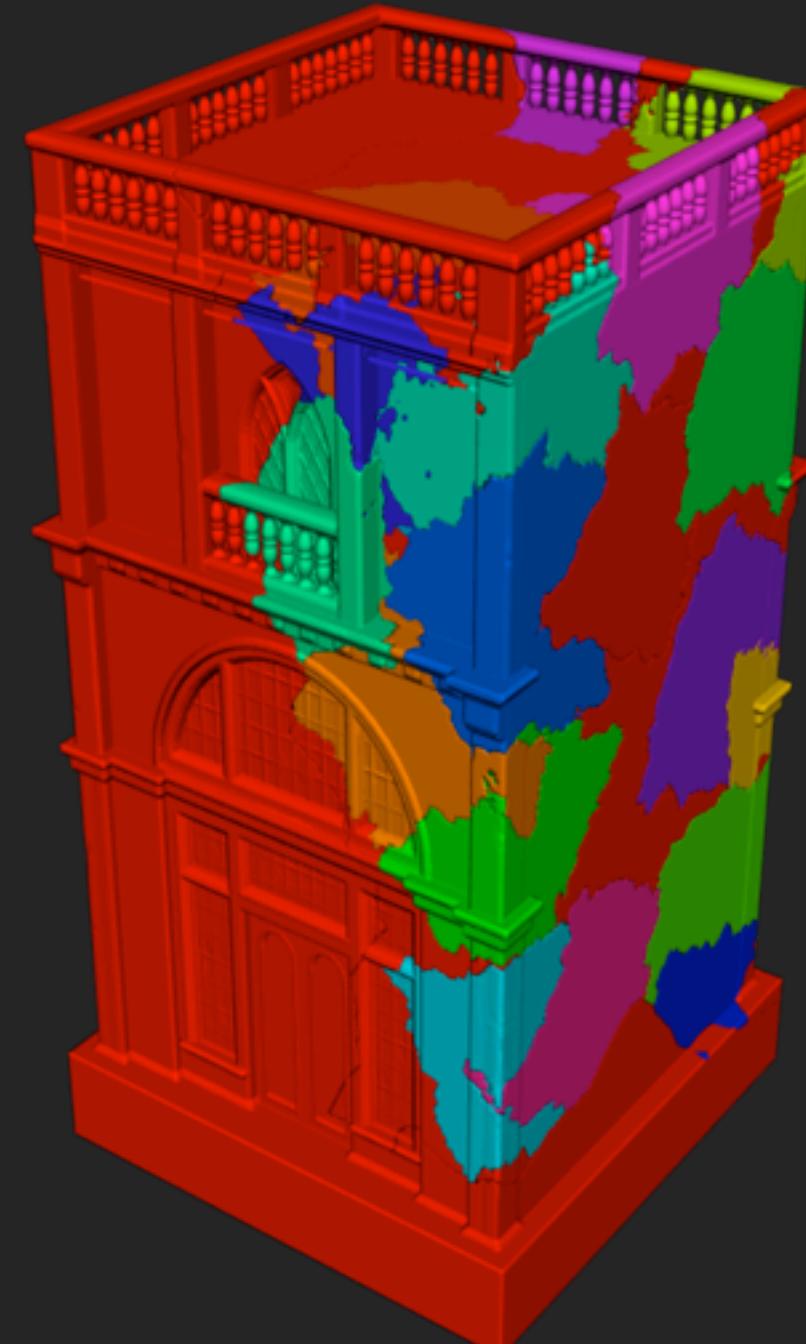
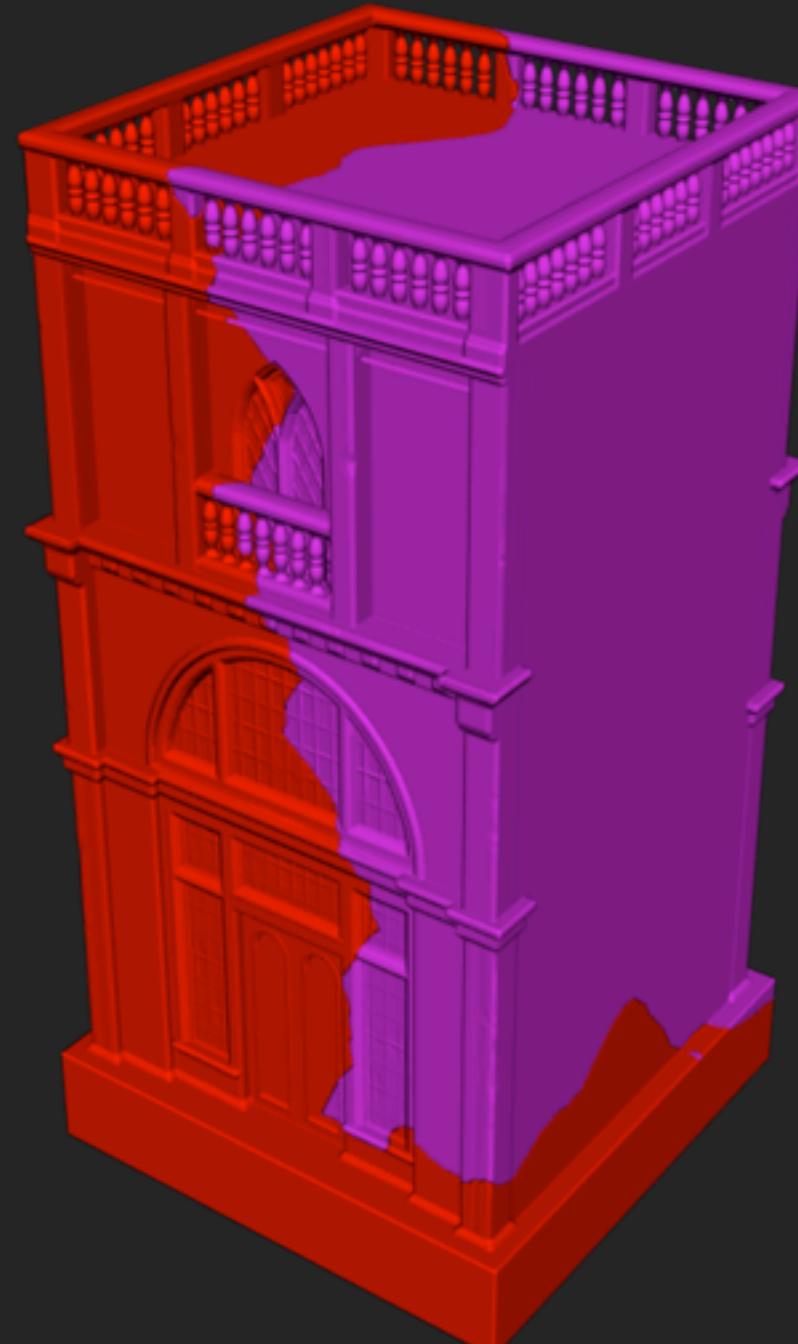
Level Set Fracture



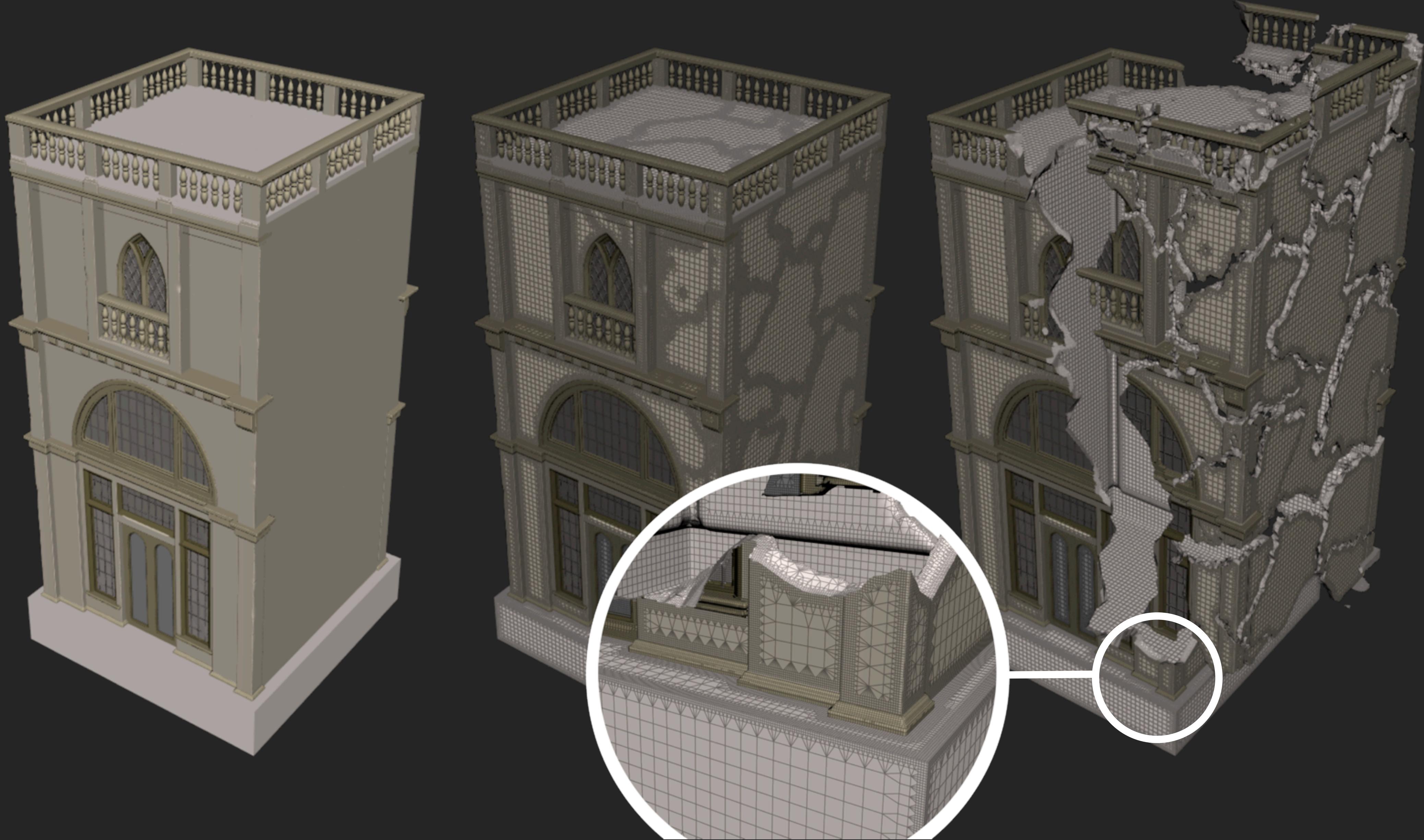
Level Set Conversion

Fracturing
tools::LevelSetFracture

Surfacing



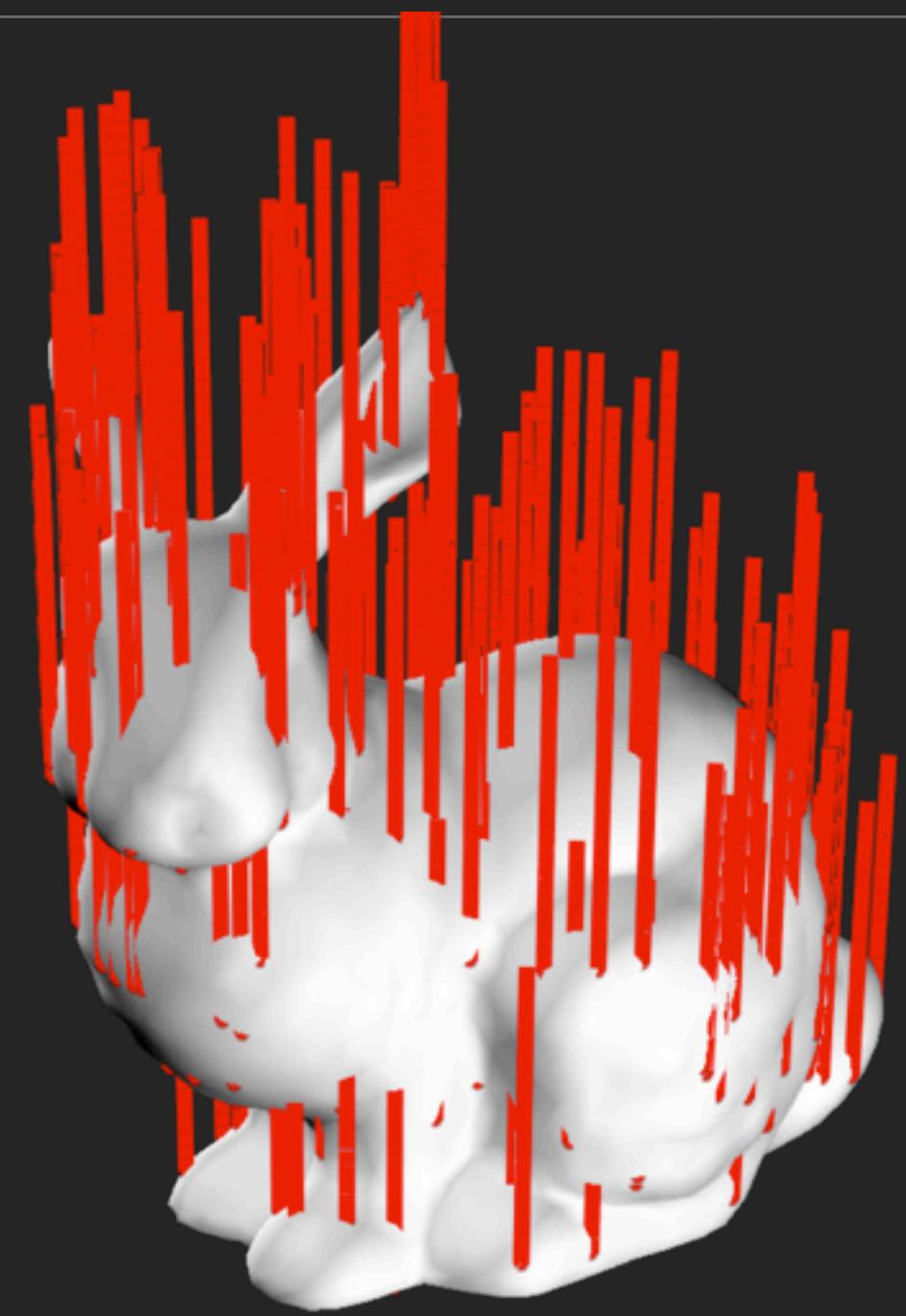
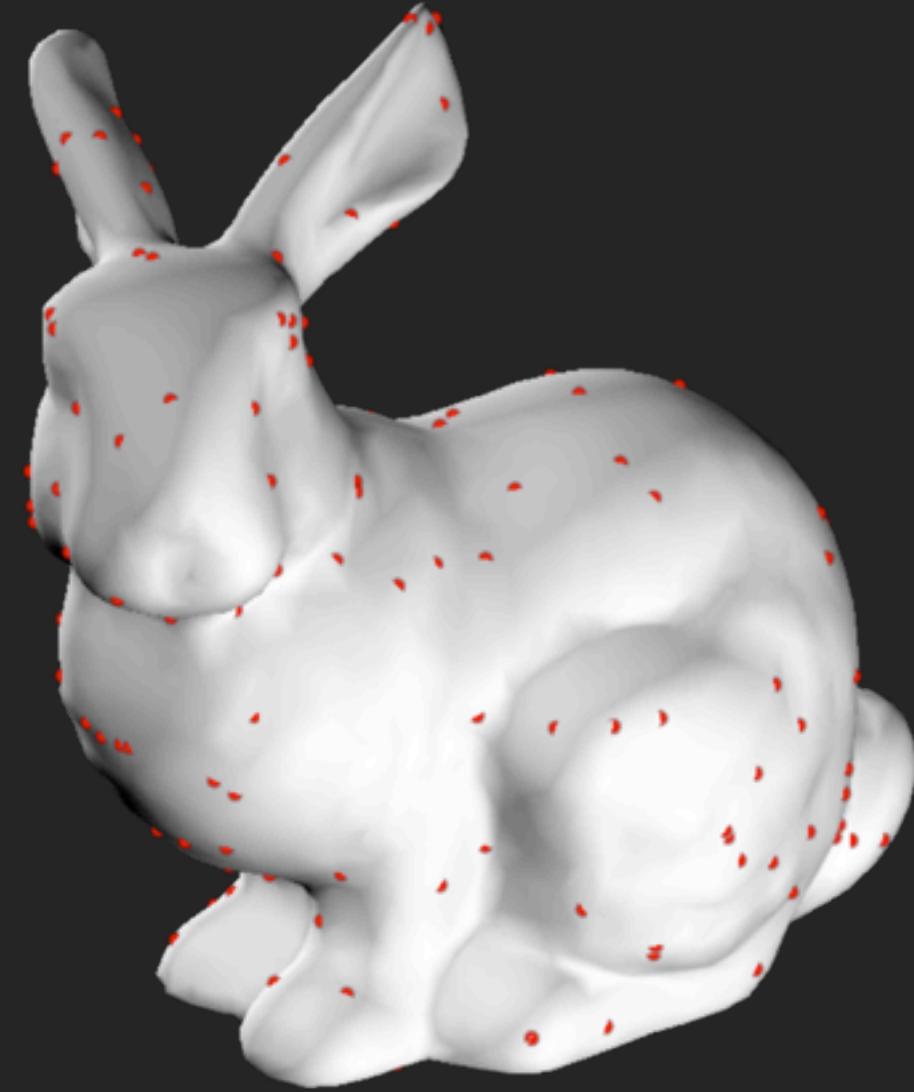
Level Set Fracture



Geometric Transformation



Advect points

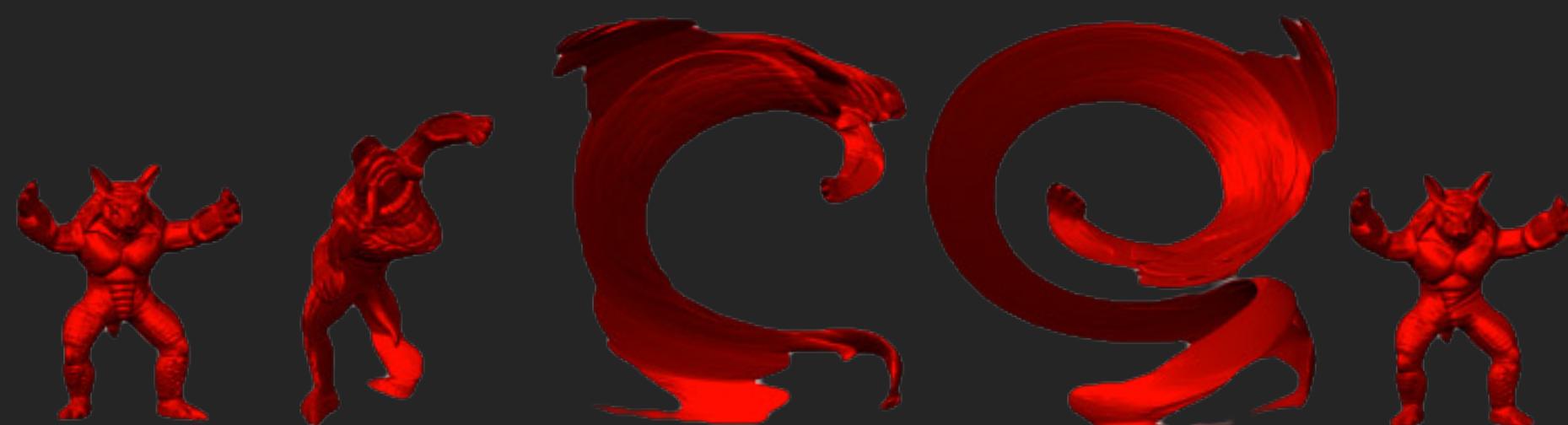


`tools::PointAdvect`



`tools::ConstrainedPointAdvect`

Advect level set
`tools::LevelSetAdvection`

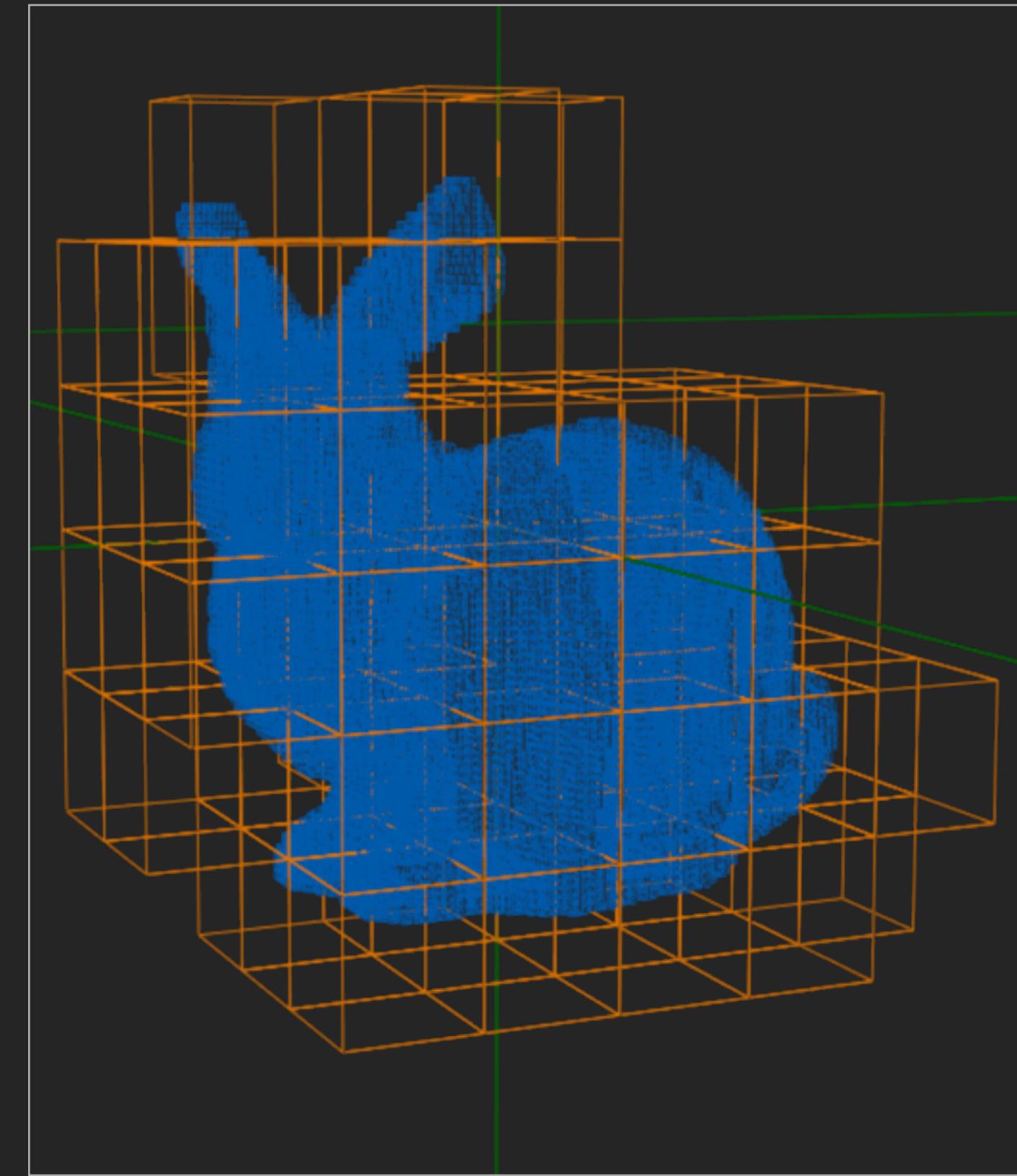
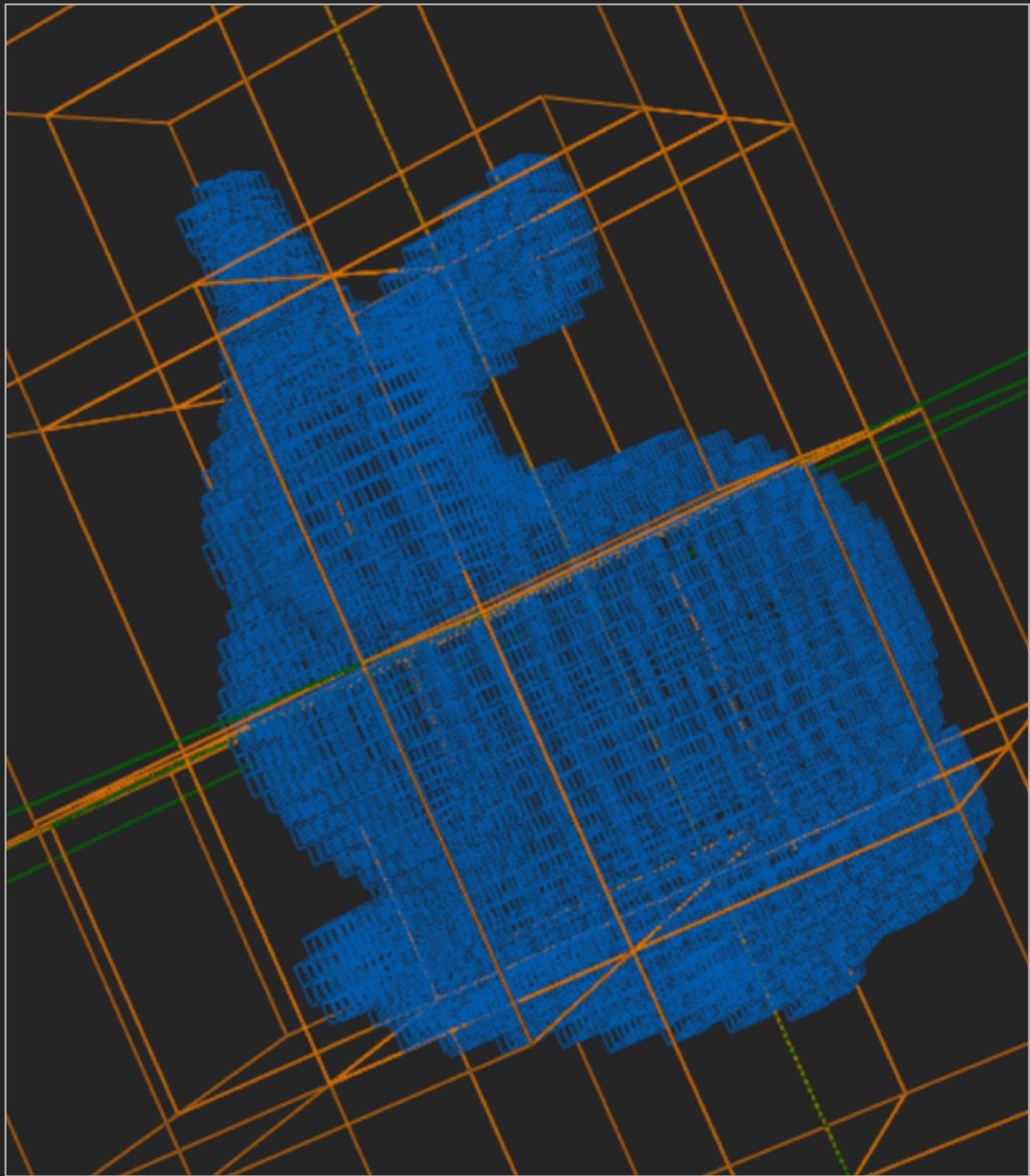


Geometric Transformation



Resample

tools:::GridTransformer
tools:::GridResampler
tools:::resampleToMatch



Level Set Processing



Advection

tools::LevelSetAdvection
tools::LevelSetFilter::track

Ray intersection

tools::LevelSetRayIntersector

Constructive solid geometry

tools::csgDifference
tools::csgIntersection
tools::csgUnion

Conversion

tools::ParticlesToLevelSet
tools::MeshToVolume
tools::VolumeToMesh
tools::sdfToFogVolume

Filtering

tools::LevelSetFilter::gaussian
tools::LevelSetFilter::laplacian
tools::LevelSetFilter::mean
tools::LevelSetFilter::meanCurvature
tools::LevelSetFilter::median

Morphology

tools::LevelSetFilter::offset

Normalize

tools::LevelSetFilter::normalize

Platonic primitives

tools::LevelSetSphere

Rebuild level set

tools::levelSetRebuild

Segmentation

tools::LevelSetFracture
tools::sdfInteriorMask
tools::internal::segment

Signed flood fill

Grid::signedFloodFill

Data Structure Manipulation



Bitwise Boolean Operations

Topology Difference

`LeafNode::topologyDifference`

Topology Intersection

`LeafNode::topologyIntersection`

Topology Union

`Grid::topologyUnion`

Topology Comparison

`Tree::hasSameTopology`

Bitwise Morphology Operations

Topology Dilate

`tools::dilateVoxels`

Topology Erode

`tools::erodeVoxels`

Sparsity Management and Compression

Grid::prune

Tree::pruneOp

Tree::pruneInactive

Tree::pruneLevelSet

Densify

`tree::Tree::voxelizeActiveTiles`

More information

Documentation

- FAQ
- Cookbook
- Doxygen

www.openvdb.org/documentation

Forum

www.openvdb.org/forum

E-mail

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