

ITEM Status ASC Level 2 Milestone

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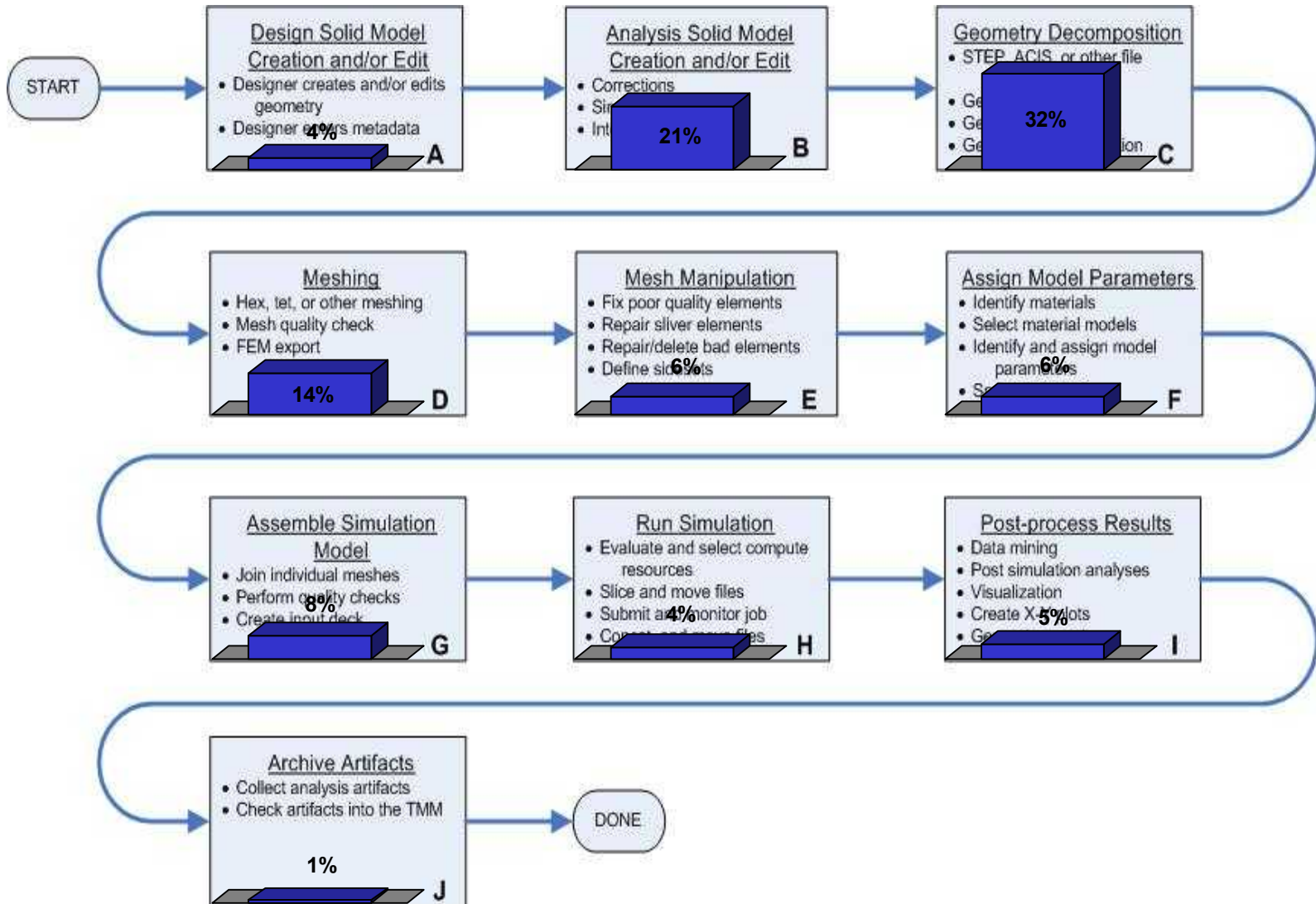
**JOWOG
May 2 2007
LANL**

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DTA Process Map



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Immersive Topology Environment for Meshing (ITEM)



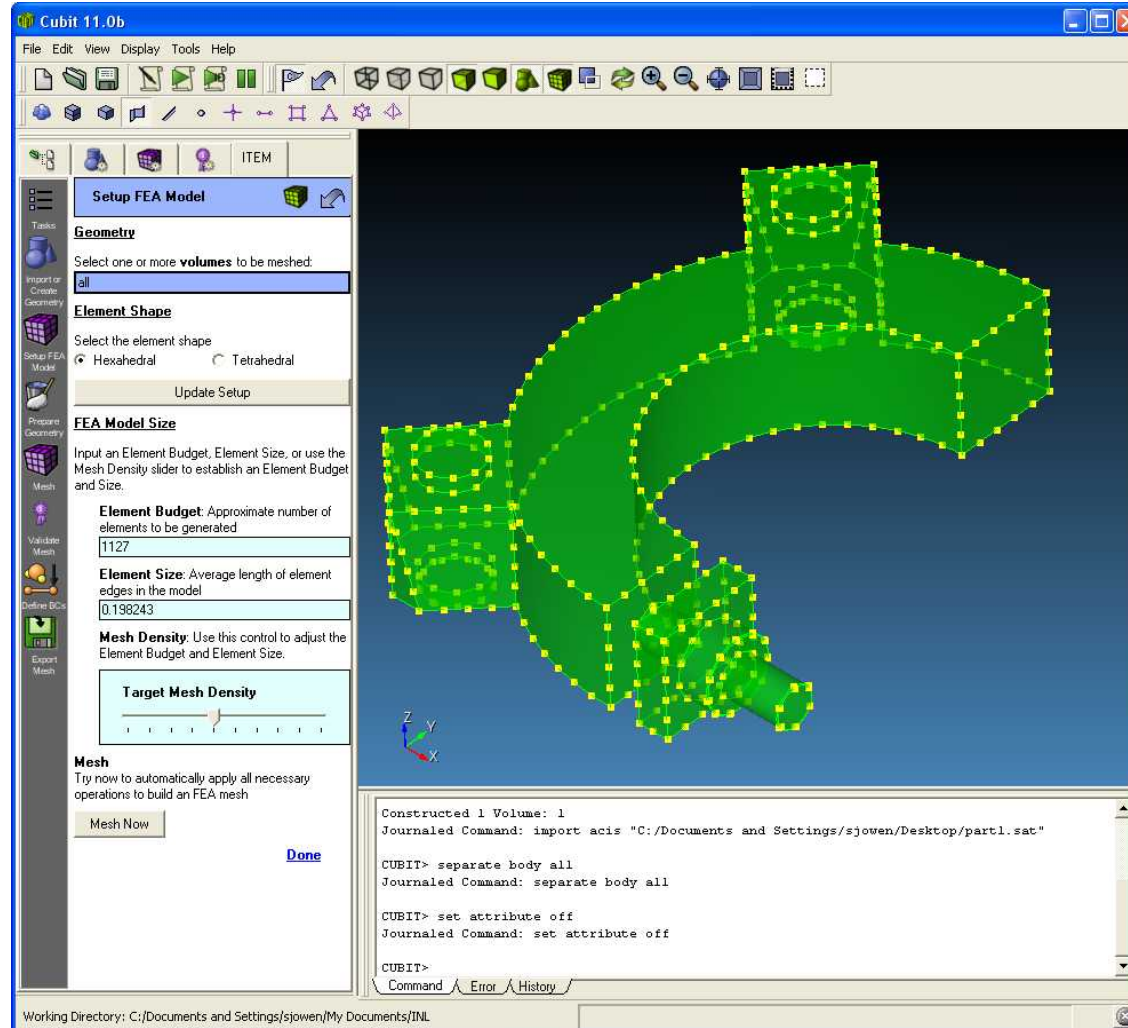
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2.1.1
Wizard
Workflow



2.1.2
Geometric
Reasoning





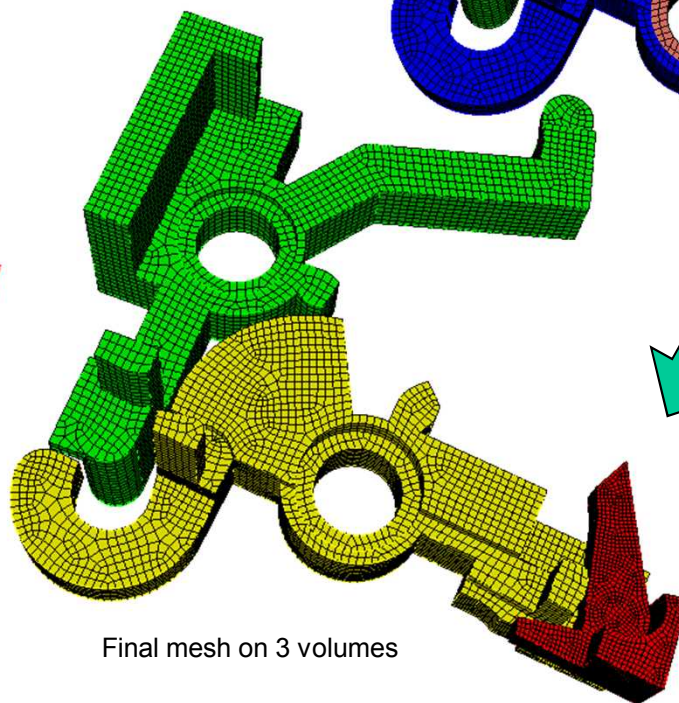
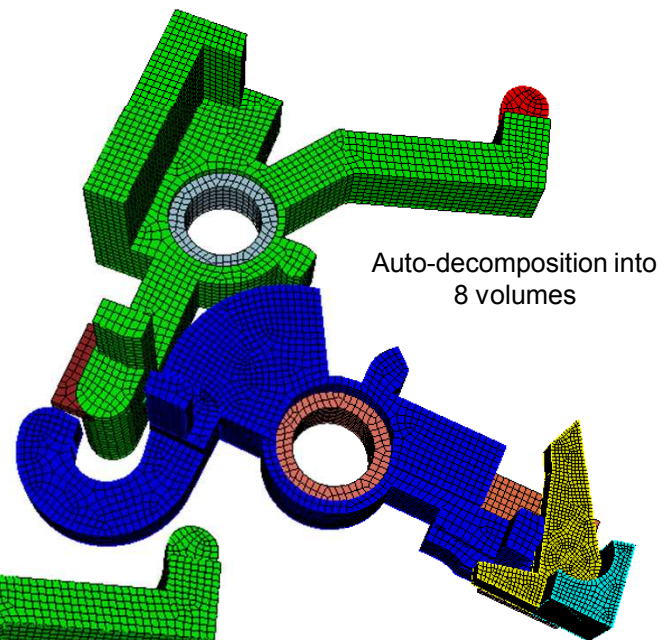
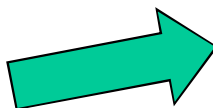
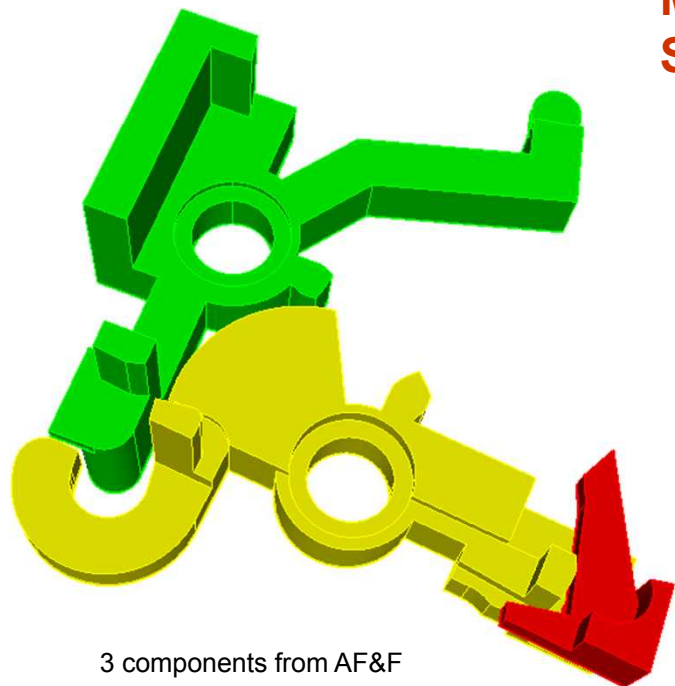
Geometry and
Mesh Generation
Toolkit

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2.1.3 Many-to-many Sweeping





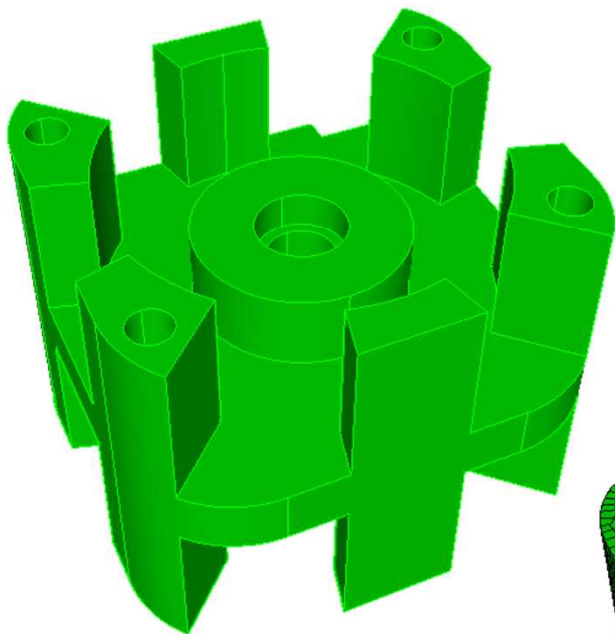
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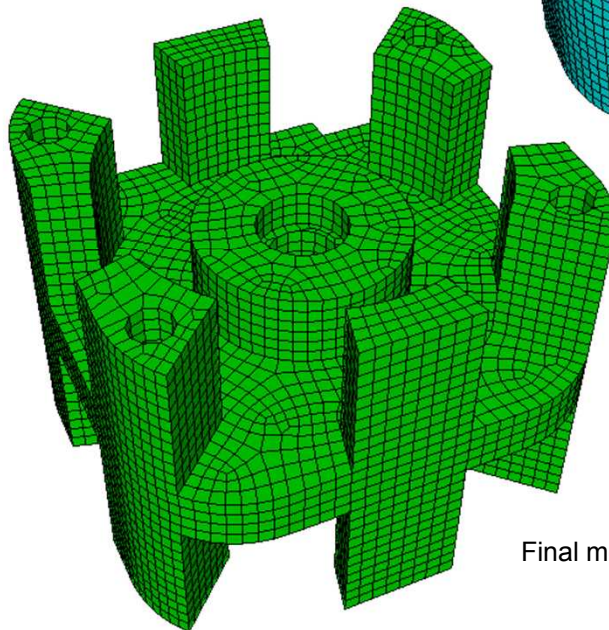
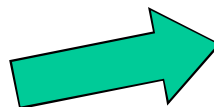


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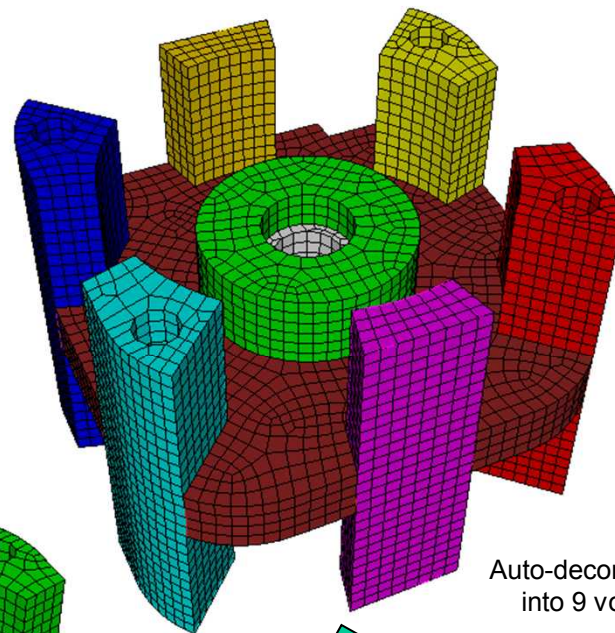
2.1.3 Many-to-many Sweeping



Component from AF&F



Final mesh



Auto-decomposition
into 9 volumes





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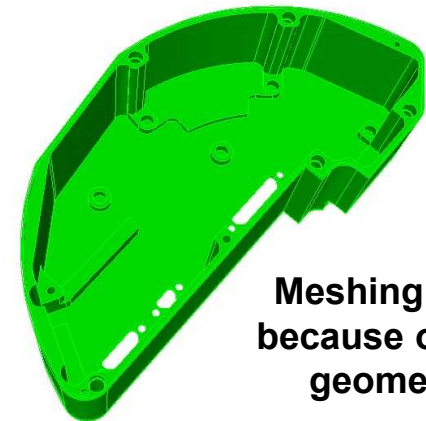
2.1.3 Many-to-many Sweeping Status

- **Regression Tests (2.1.3.2)**

- Target: Maintain capability-100%
- Current: 77%

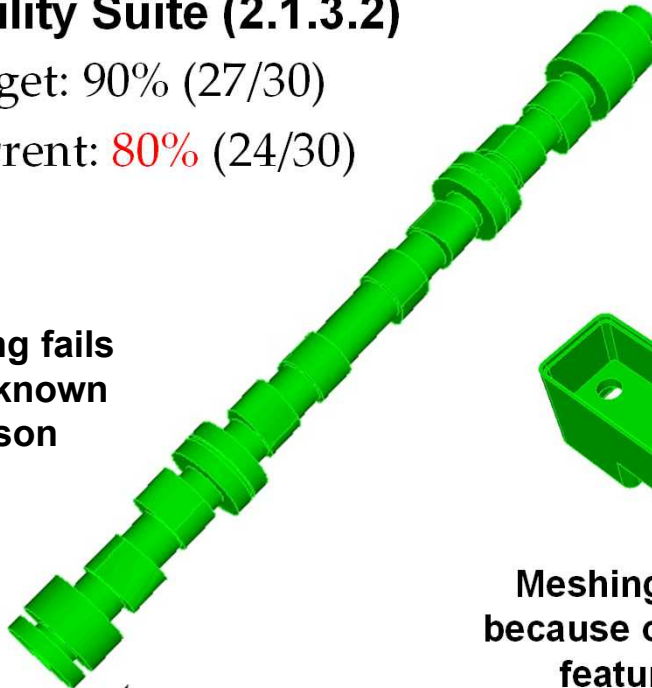
- **Capability Suite (2.1.3.2)**

- Target: 90% (27/30)
- Current: 80% (24/30)

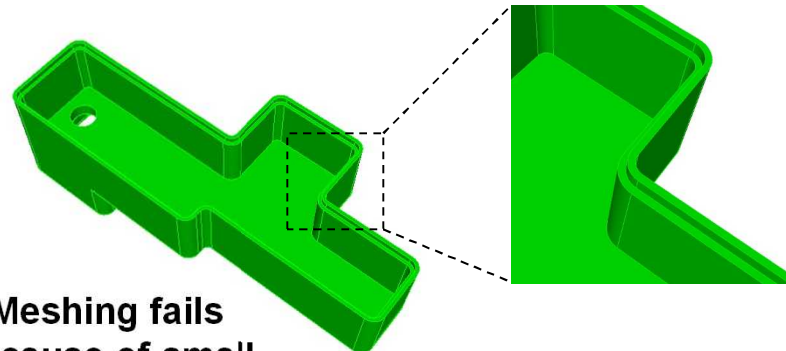


Meshing fails
because of bad
geometry

Meshing fails
for unknown
reason



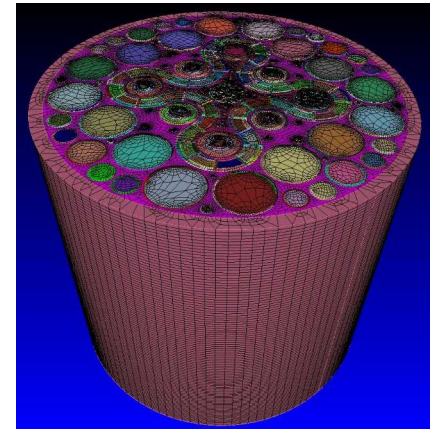
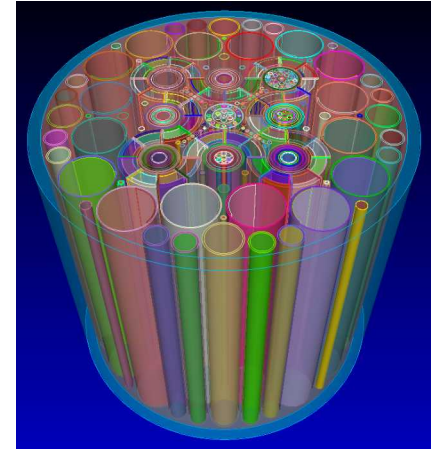
Meshing fails
because of small
features





2.1.4 Parallel Hex Meshing

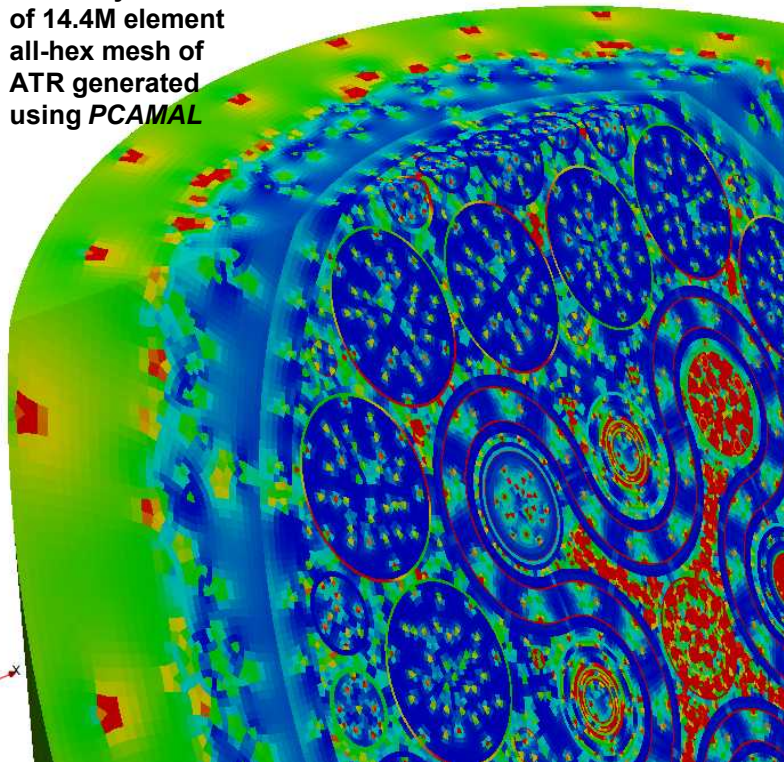
- ✓ **2.1.4.1 Parallel Meshing Scheme**
 - Meshing scheme in Cubit to generate boundary mesh only
- ✓ **2.1.4.2 Cubit Export**
 - Export boundary mesh only from Cubit
- ✓ **2.1.4.3 pCAMAL**
 - New parallel meshing application that accepts boundary mesh
- ✓ **2.1.4.4 Exodus Mesh**
 - Generate 1 volume mesh per processor
- ✓ **2.1.4.5 Combined Meshes**
 - Optionally combine meshes into a single mesh
- ✗ **2.1.4.6 Load Balancing**
 - User specified number of processors





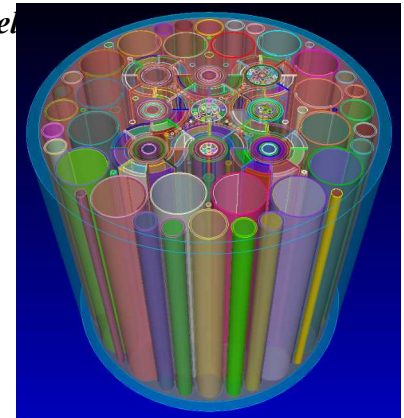
2.1.4 Parallel Hex Meshing

Cut-away section of 14.4M element all-hex mesh of ATR generated using PCAMAL



Elements colored by distortion metric using Paraview

Computational Model



Example:
Advanced Test Reactor
Idaho National Lab

Process	Approx. Time
Geometry Cleanup Small feature removal, simplification	1.5 days user time
Surface Meshing Mapping and paving, interval assignment	3.0 days user time
Volume Meshing Parallel sweeping algorithm *	4 minutes CPU time

*944 volumes meshed using PCAMAL

Processors: 34 on Catalyst

Number Nodes: 19,026,060

Number of Hexes: 14,412,594

Mesh quality (Shape): min= 0.036845 mean= 0.856212



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2.1.5 Throughput Measurement

- Created a testing plan to reduce familiarity, user competence, and model complexity in measuring CUBIT's improvements
- Added capability to log time and errors
- Scripts to separate user from machine time and count errors
- Algorithm to quantify CUBIT's improvements from the collected data

