

ITEM Status ASC Level 2 Milestone

Steve Owen, Ted Blacker

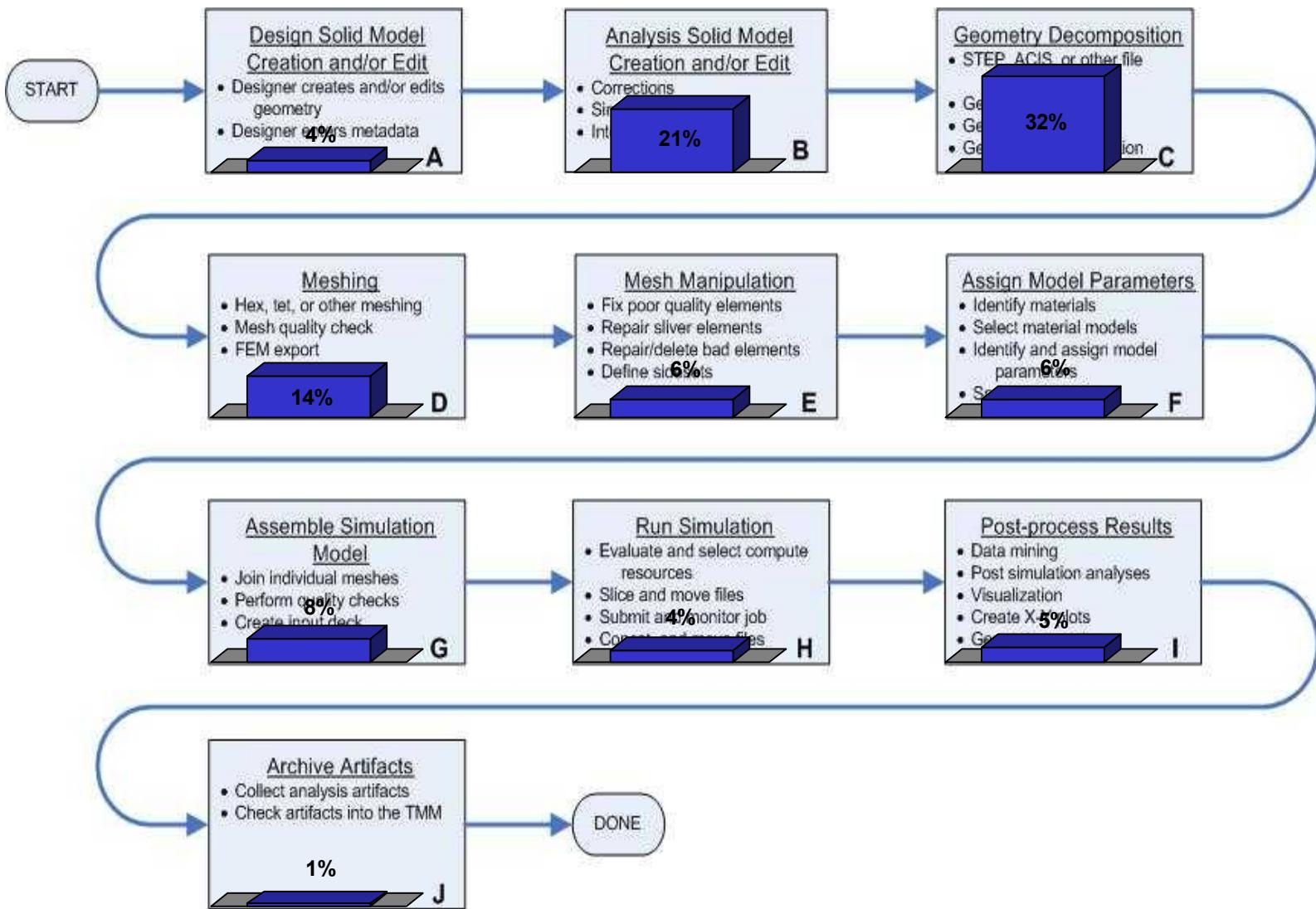
**JOWOG
May 2 2007
LANL**

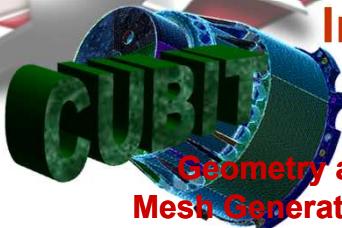
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DTA Process Map

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Geometry and
Mesh Generation
Toolkit

Immersive Topology Environment for Meshing (ITEM)



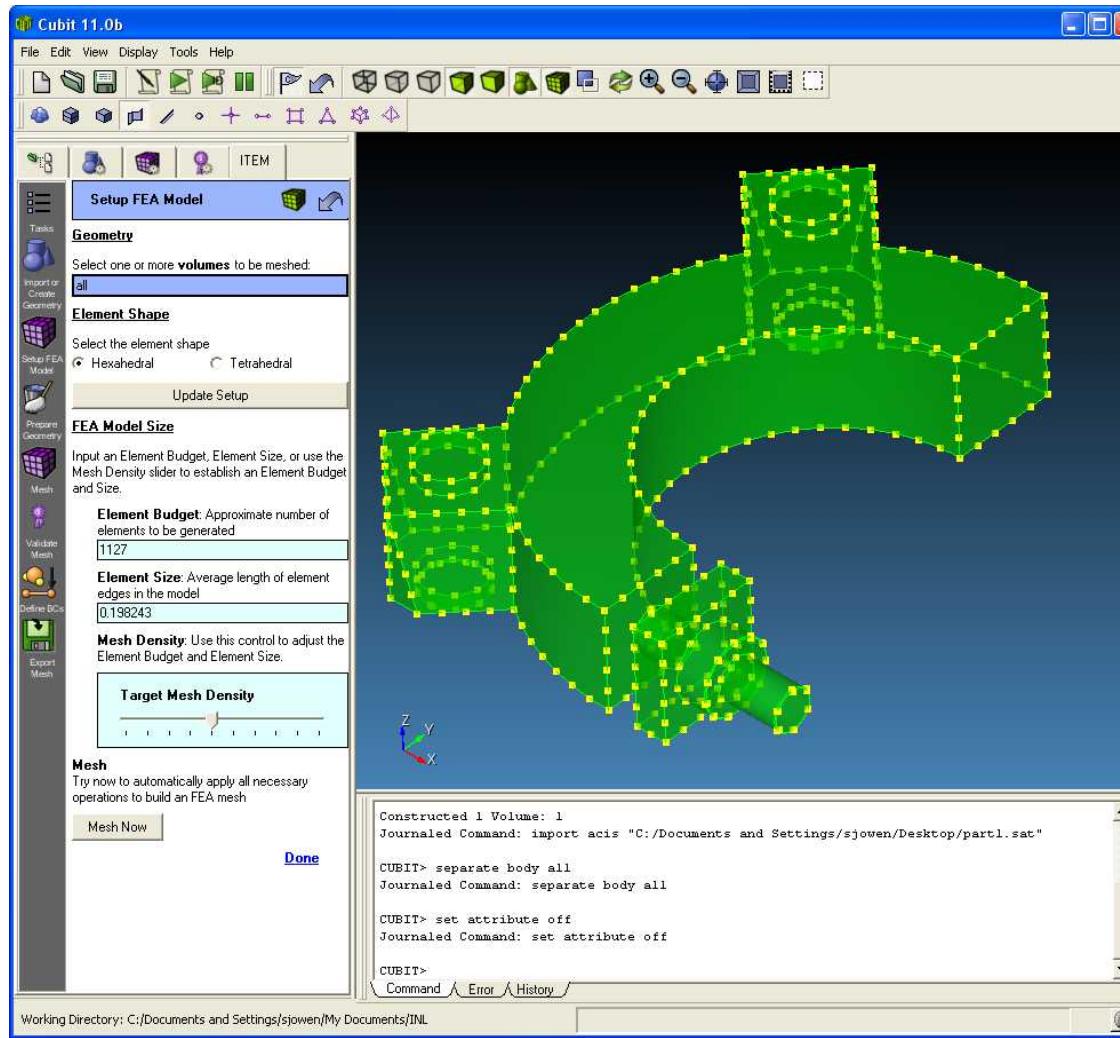
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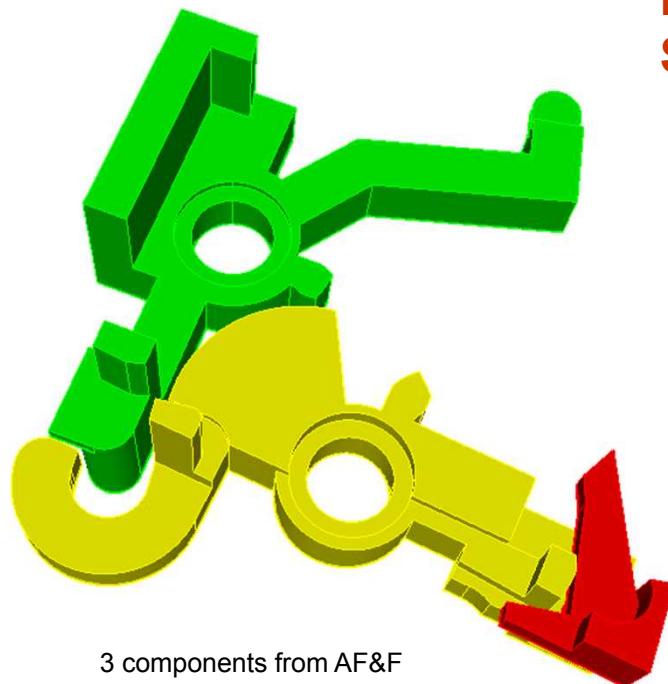
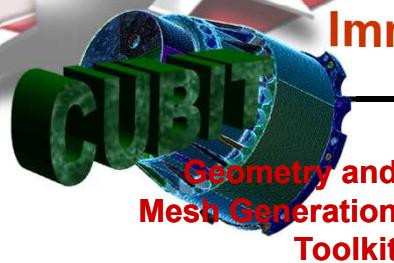


2.1.1 Wizard Workflow

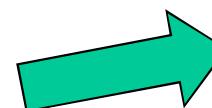


2.1.2 Geometric Reasoning

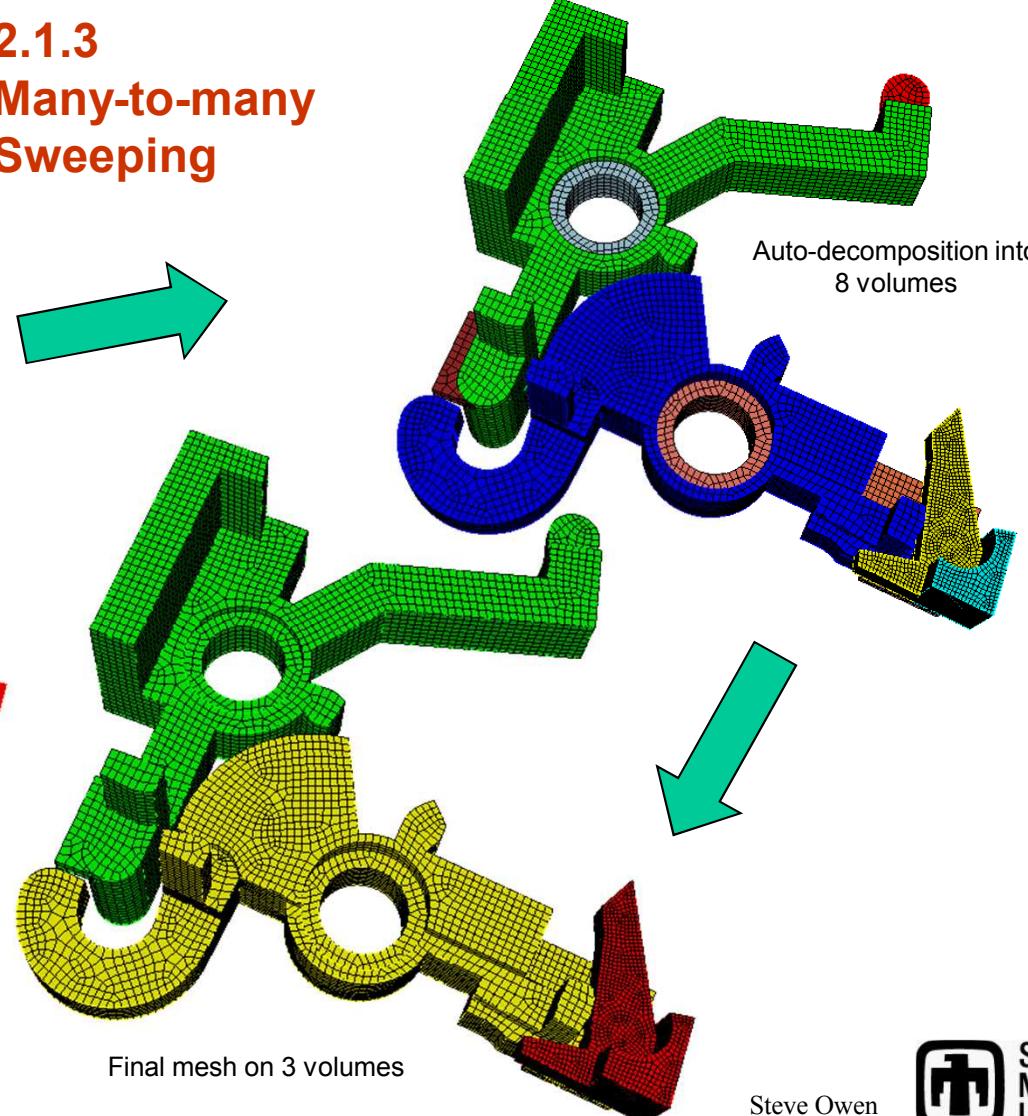




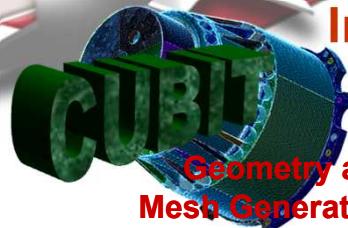
2.1.3 Many-to-many Sweeping



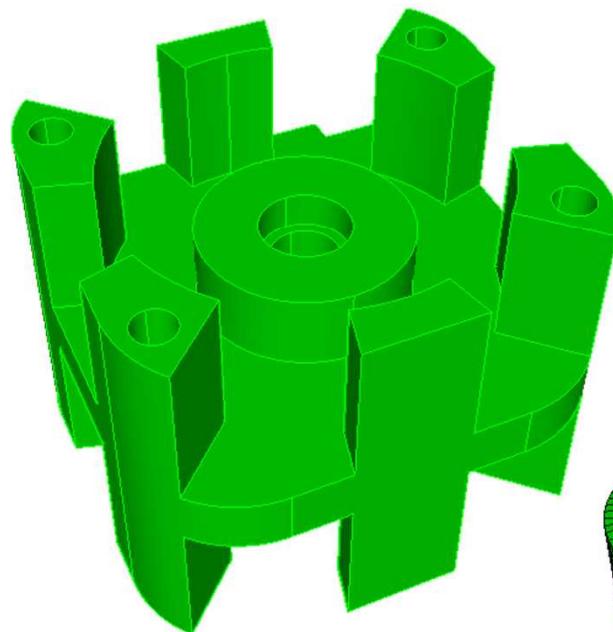
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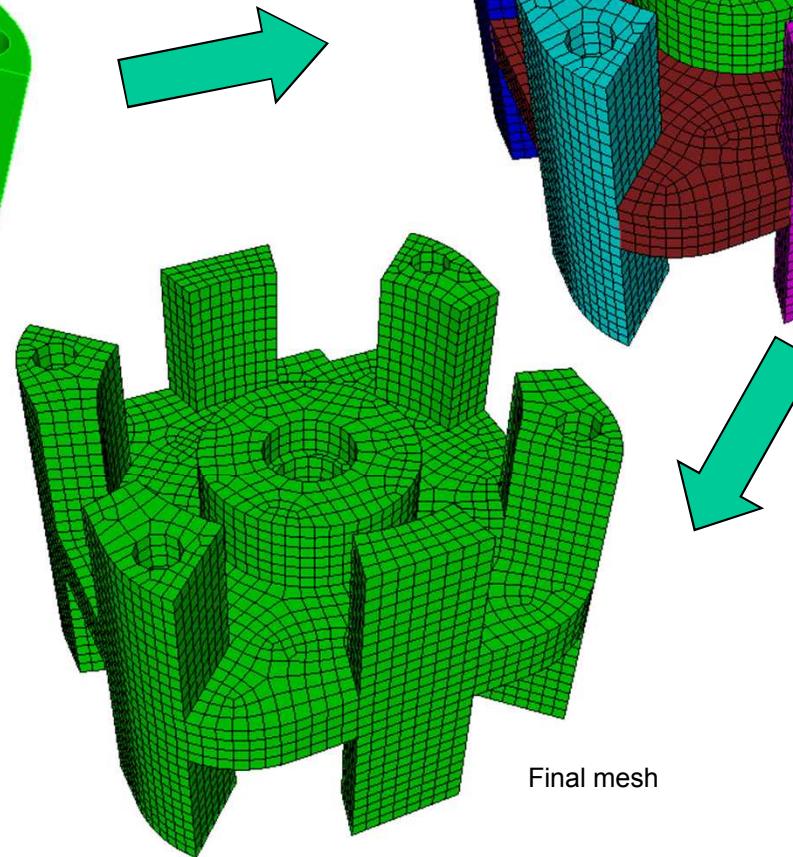


Geometry and
Mesh Generation
Toolkit

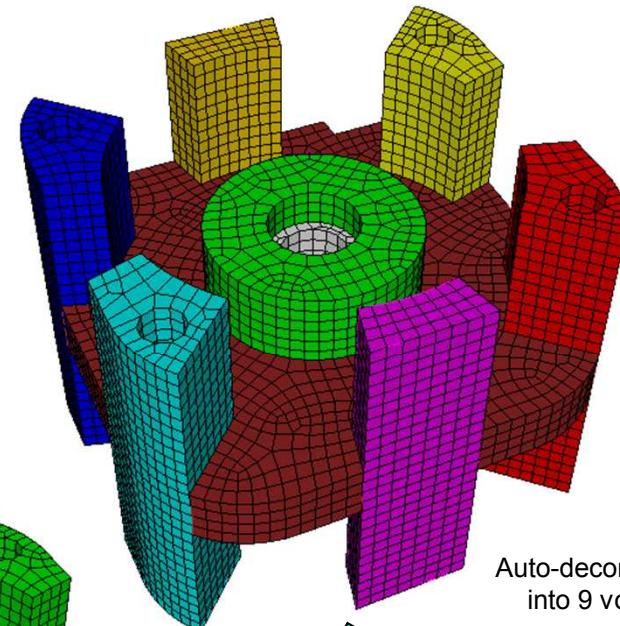


Component from AF&F

2.1.3 Many-to-many Sweeping



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Auto-decomposition
into 9 volumes

Final mesh

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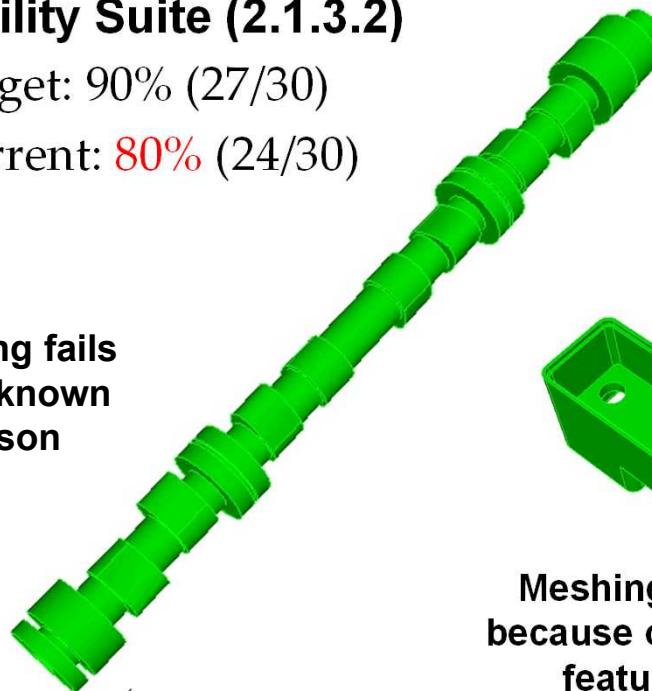
2.1.3 Many-to-many Sweeping Status

- **Regression Tests (2.1.3.2)**

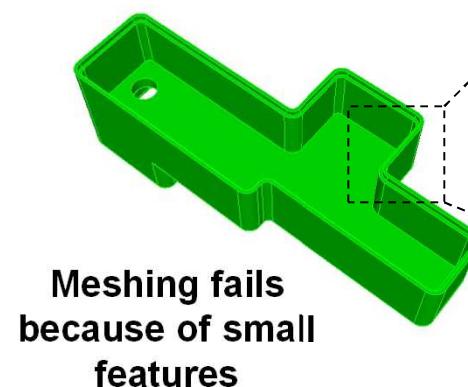
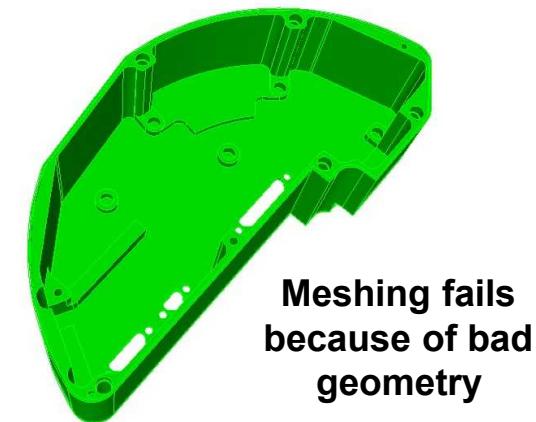
- Target: Maintain capability-100%
 - Current: **77%**

- **Capability Suite (2.1.3.2)**

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



Meshing fails
for unknown
reason





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

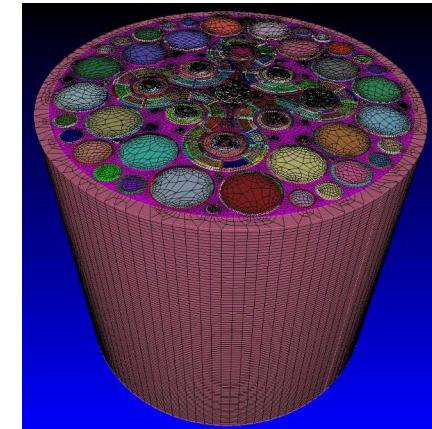
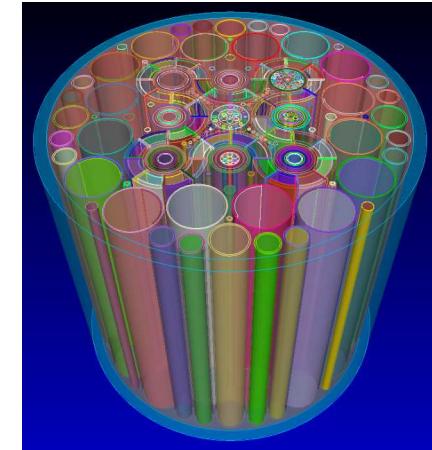
- Generate 1 volume mesh per processor

2.1.4.5 Combined Meshes

- Optionally combine meshes into a single mesh

2.1.4.6 Load Balancing

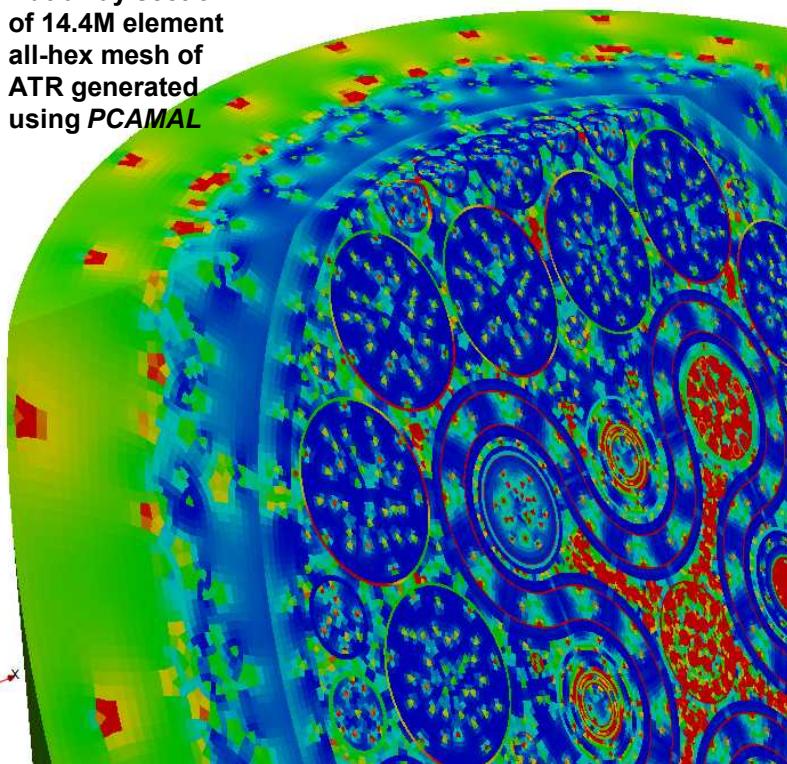
- User specified number of processors





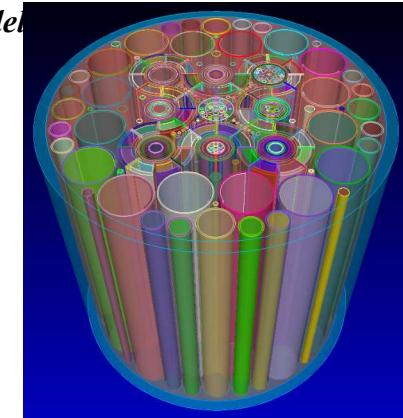
Geometry and
Mesh Generation
Toolkit

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

