

Constructing M3D-C1 Meshes

M3D-C1 simulations are mostly applied to specific tokamak configurations

■ To effectively support M3D-C1 users there are three mesh generation options:

- Select from 4 standard configurations and provide a minimal set of mesh control parameters.
- Provide a set of loops and define the tokamak cross-section geometry by providing information on the loops used to define the desired model faces. Minimal mesh control parameters are associated with the loops and faces.
- Load the tokamak loop geometry into Simmetrix and interactively set mesh control information.

Note that the M3D-C1 adaptive mesh control procedures can then be applied to meshes made by any of these procedures.

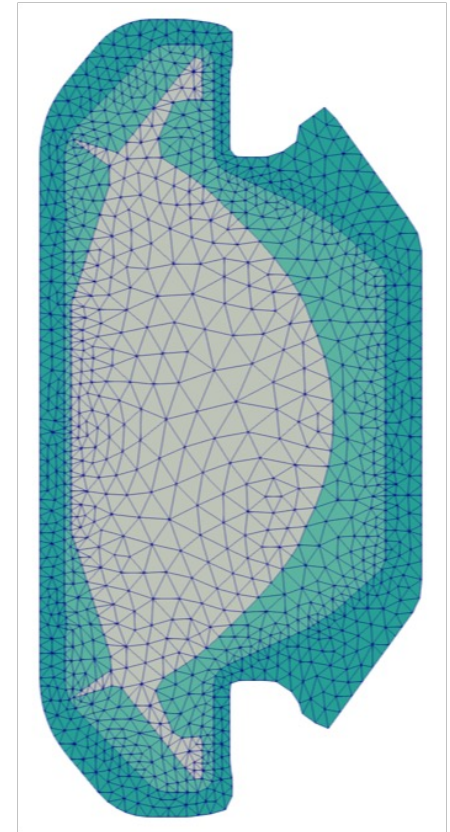
Multi-Face M3D-C1 Meshing Tool

User provides

- A set of mesh loop geometries with loop mesh control
- Definition of the required faces in terms of bounding loops and mesh control

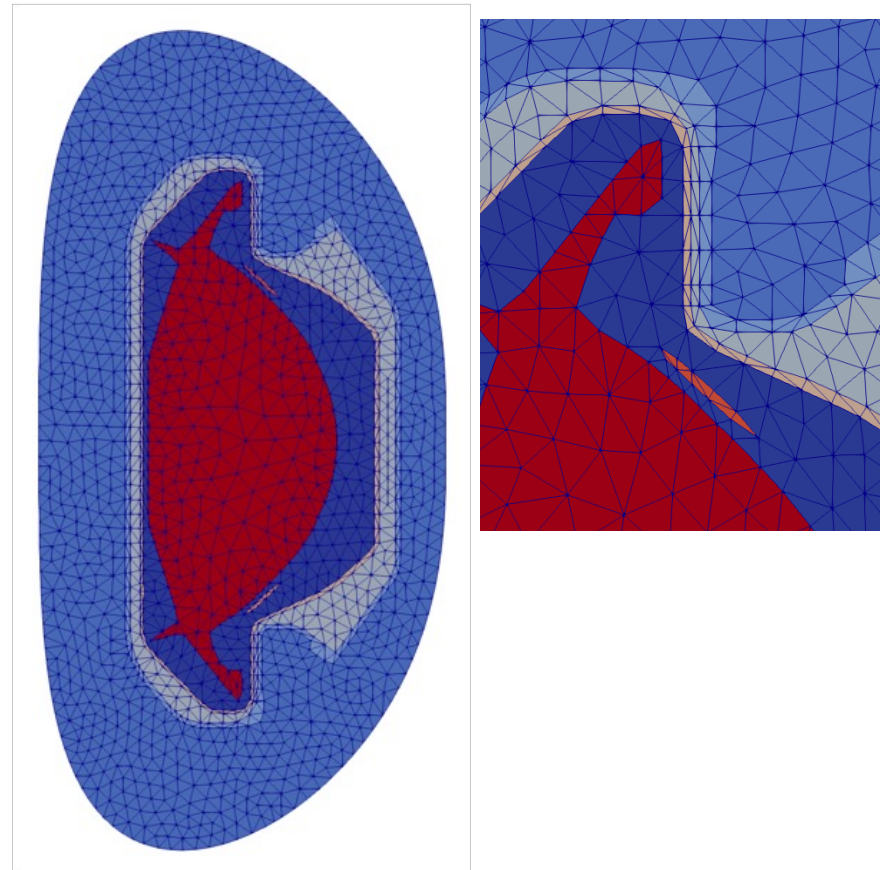
Loops geometry can be

- Provided in files of a set of discrete segments
- In terms of a parameterized outer vacuum vessel
- Defined as a finite thickness wall with mesh parameters for layered mesh if desired



Multi-Face Example with Input File

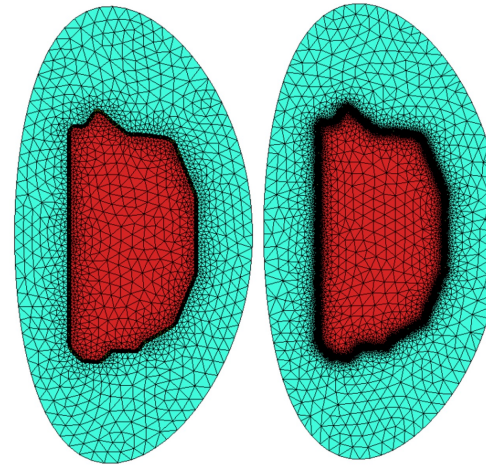
```
numBdry 7 number of boundary loop files
bdryFile loop1.dat 3 0.2 file name, loop label, mesh size
bdryFile loop2.dat 10 0.3
bdryFile loop3.dat 11 0.4
bdryFile loop4.dat 21 0.4
bdryFile loop5.dat 25 0.4
bdryFile loop6.dat 17 0.2
bdryFile loop7.dat 19 0.1
useVacuum 1 9 0.1 vacuum vessel loop, loop label, mesh size
vacuumParams 1.8 1.5 0.4 0.0 2.5 vacuum vessel pars.
numFace 8 number of model faces
faceBdry 1 3 0.2 core face has one loop, loop label, mesh size
faceBdry 1 10 0.3 'island face', one loop, loop label, mesh size
faceBdry 1 11 0.1 'island face', one loop, loop label, mesh size
faceBdry 2 21 25 0.2 two loop face, 2 loop labels, mesh size
faceBdry 2 25 17 0.09 two loop face, 2 loop labels, mesh size
faceBdry 2 17 19 0.1 two loop face, 2 loop labels, mesh size
faceBdry 2 19 9 0.1 two loop face, 2 loop labels, mesh size
faceBdry 4 3 10 11 21 0.11 four loop face, 4 loop labels (inner, outer, and to island holes), mesh size
outFile input7 mesh output file name
```



Anisotropic Layered Mesh for Finite Thickness Wall

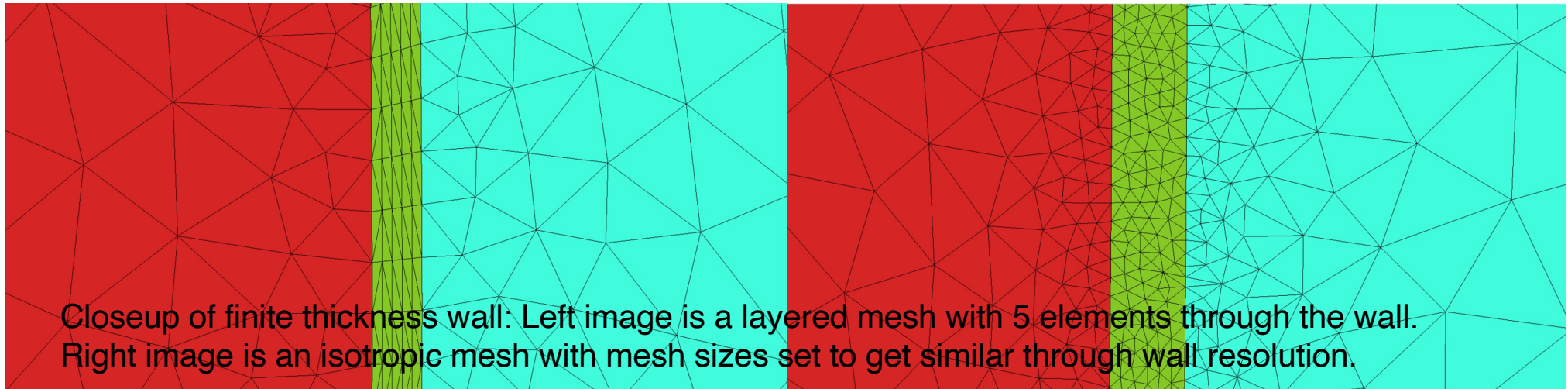
Want sufficient resolution through the wall thickness

- Isotropic mesh generation creates meshes with many more elements than desired.
- A layered anisotropic mesh provides the desired through the thickness resolution while allowing a coarser mesh in the rest of the domain still meets the desired mesh resolution there.



Left image is a layered mesh with 5 elements through wall. Mesh has 4.9K elements.

Right image is an isotropic mesh with mesh sizes set to get similar through thickness resolution. Mesh has 19K elements (4 times more).



Closeup of finite thickness wall: Left image is a layered mesh with 5 elements through the wall. Right image is an isotropic mesh with mesh sizes set to get similar through wall resolution.