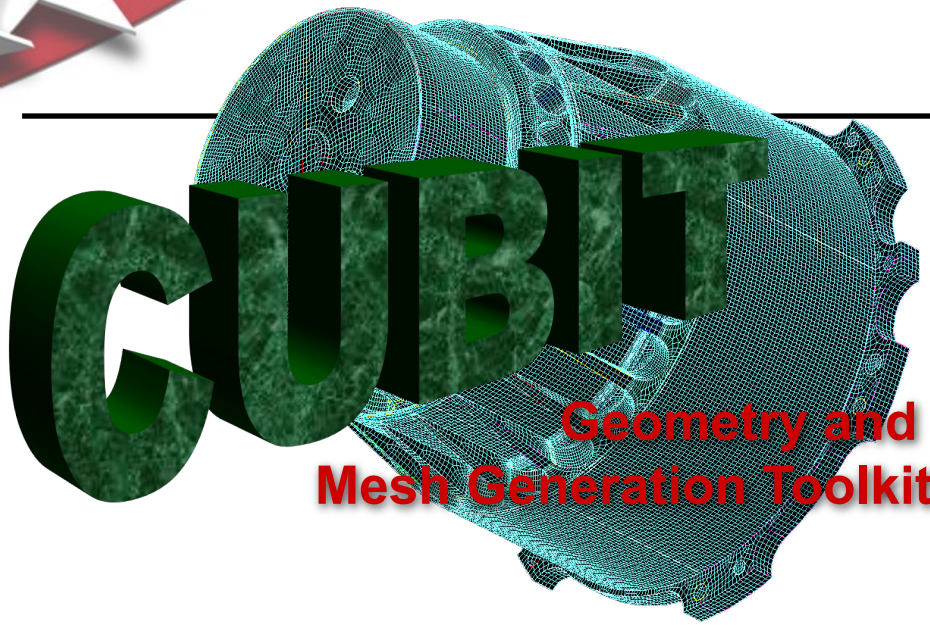


Simulation Modeling Sciences

CUBIT Fast-Start Tutorial

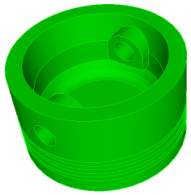
10. Geometry for Sweeping

Sandia National Laboratories is a multi-mission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC., a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

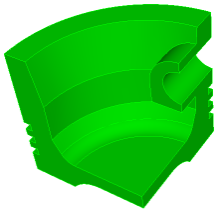
Sandia National Laboratories

The Basic CUBIT Process

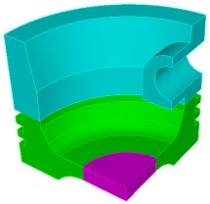
Simulation Modeling Sciences



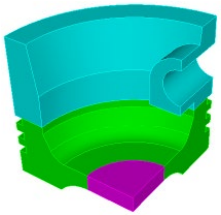
1 Import Solid Model



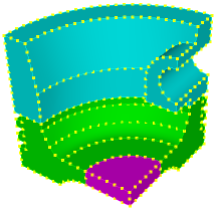
2 Simplify Geometry



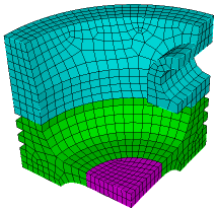
3 Decompose Geometry



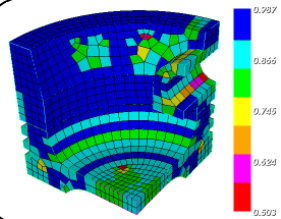
4 Imprint & Merge



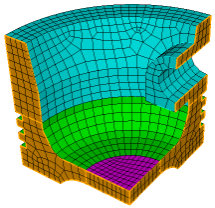
5 Set Schemes & Intervals



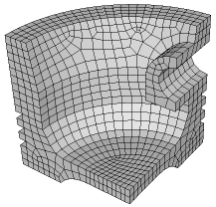
6 Mesh



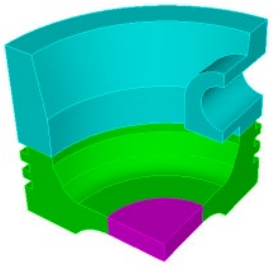
7 Check Quality



8 Apply B.C.s



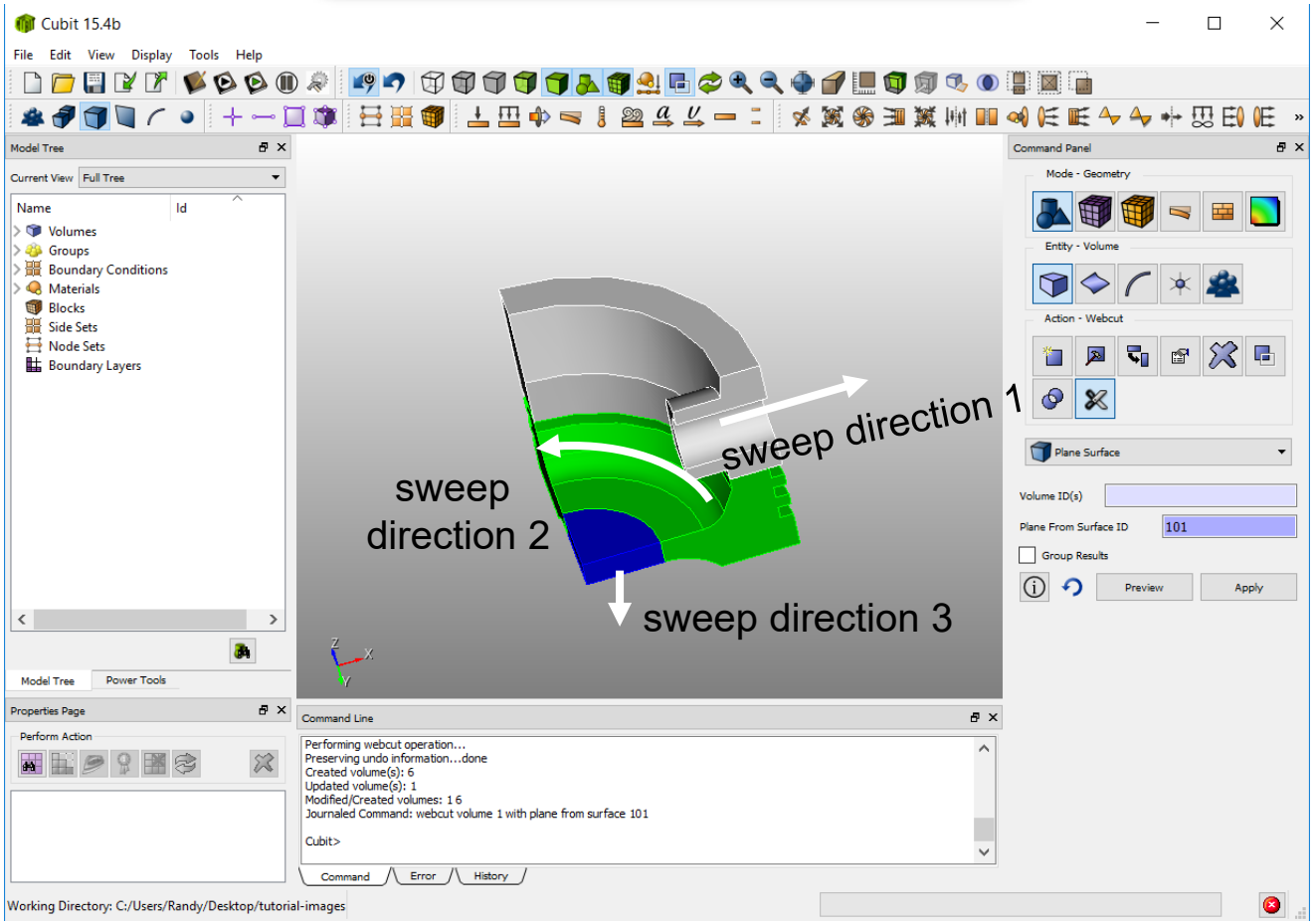
9 Export Mesh



3

Decompose Geometry

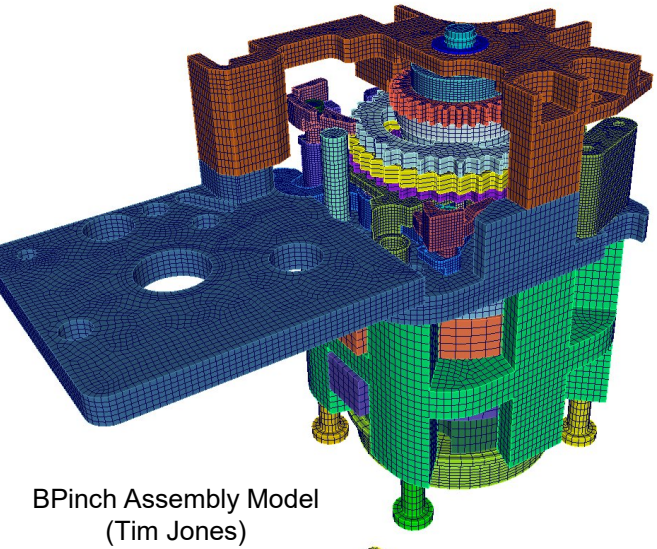
Cut the model into sweepable volumes



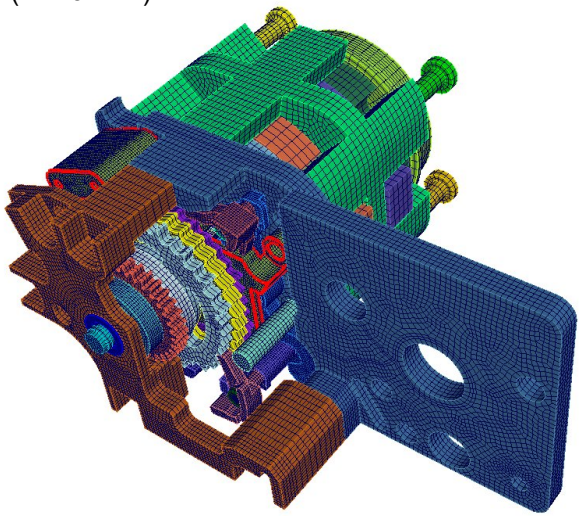
Volumes are now individually sweepable

Sandia National Laboratories

Decomposition for Sweeping



BPinch Assembly Model
(Tim Jones)



Most geometry will require partitioning into smaller volumes before it is capable of being meshed with a quality hex mesh.

There are at least 2 strategies to decompose your model for sweeping.

1) Using CUBIT Web Cutting and geometry tools (typical)

2) Using CAD package (i.e. Pro/E, Solidworks) Standard to create cut features.

Always look for a similar example on how to define the cut.

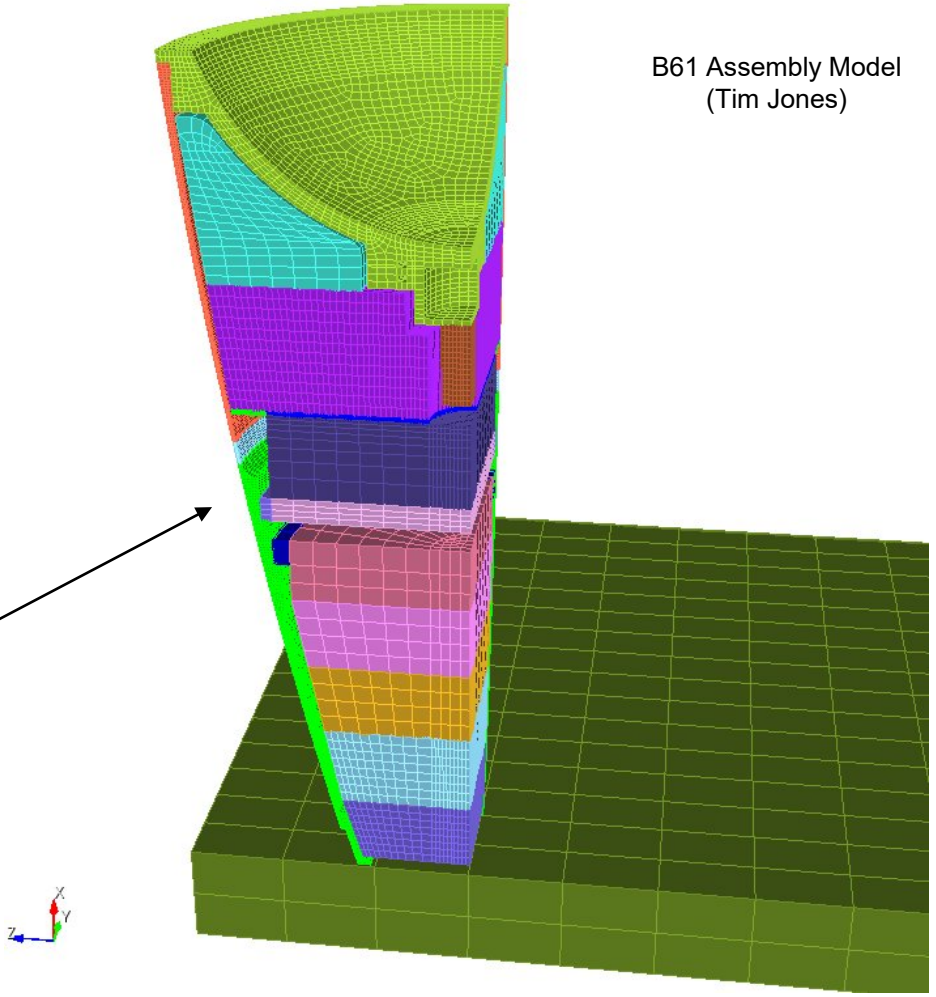
The hardest part of hex meshing is figuring out how to decompose the volume.

Decomposition for Sweeping

Depending on your geometry you may want to use both CUBIT and CAD tool for partitioning (web cutting)

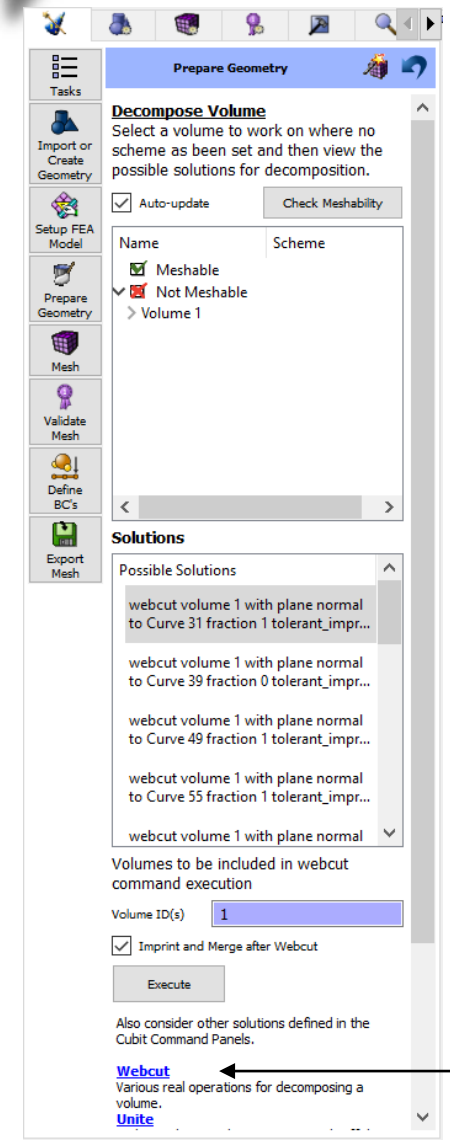
Many web cutting and Boolean operations are available in CUBIT.

Most partitioning (web cutting) can be done from within CUBIT



B61 Assembly Model
(Tim Jones)

Web Cutting



ITEM Decompose Volume panel

1. Checks meshability of each volume
2. Displays/Previews various webcut alternatives
3. Executes the webcut
4. Imprints and merges new volumes
5. Recomputes meshability

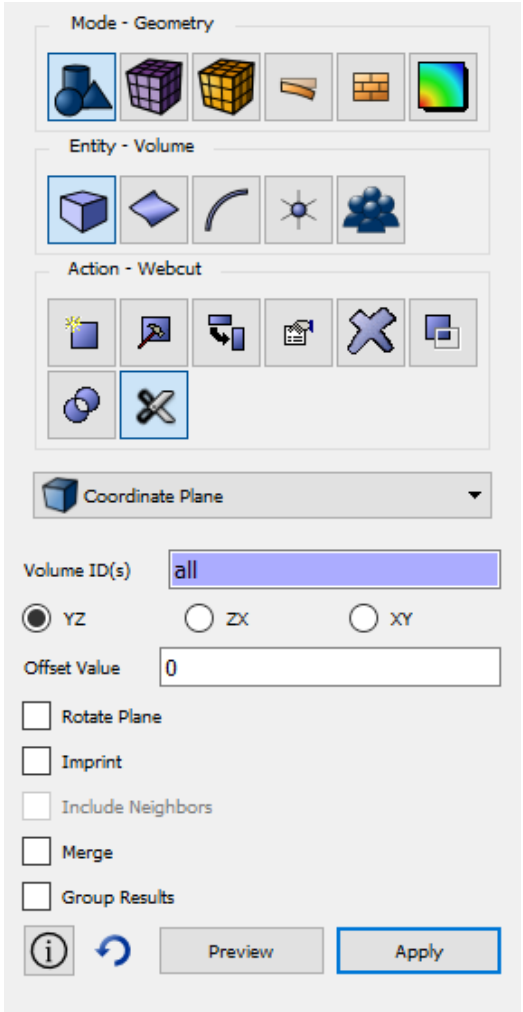
ITEM not guaranteed to suggest the best webcut

May require webcutting using the command panels

When using command panels, remember to imprint and merge!

Shortcut to webcut panels

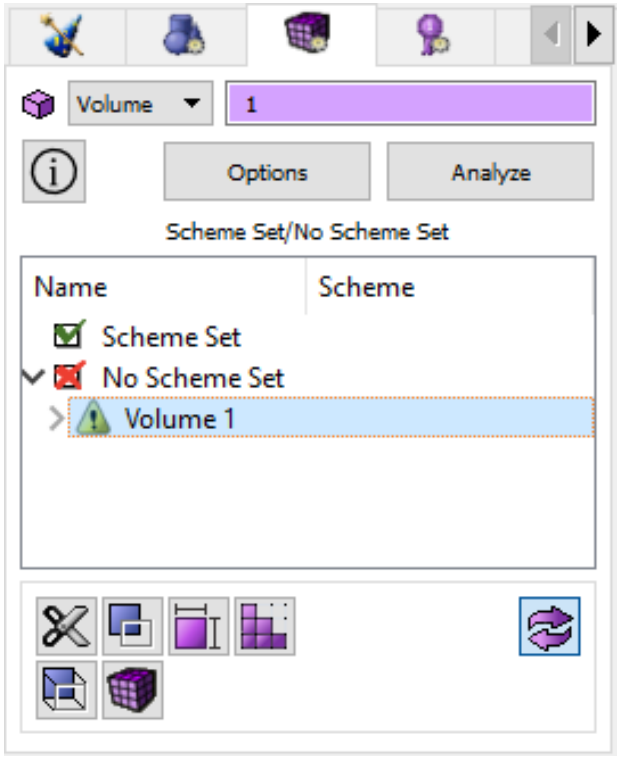
Web Cutting



Webcut Command Panel

Webcut panels offer a variety of different tools for decomposing your model for sweeping

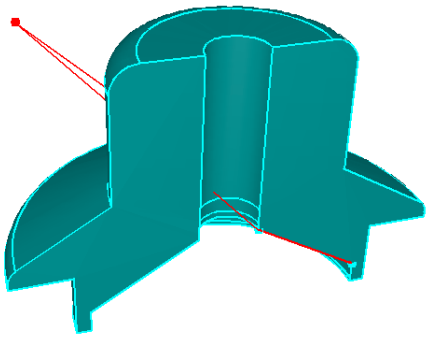
Use webcutting in conjunction with ITEM decompose Volume Panel or Meshing Power Tool



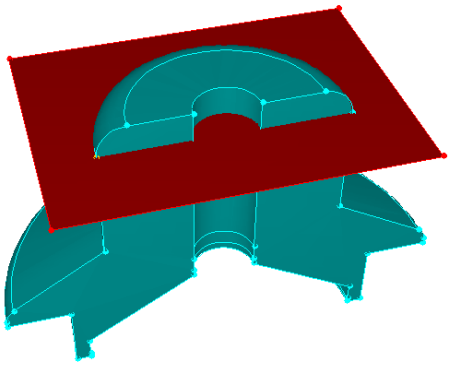
Meshing Power Tool

Web Cutting

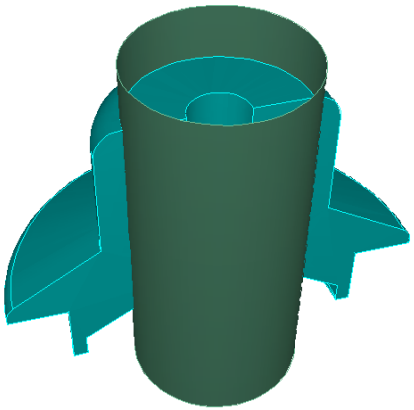
Plane from vertices:



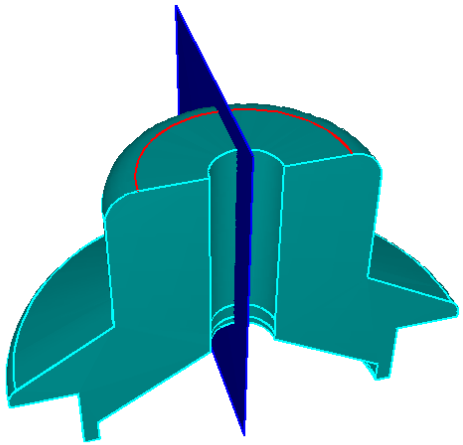
Coordinate plane:



Cylindrical surface:

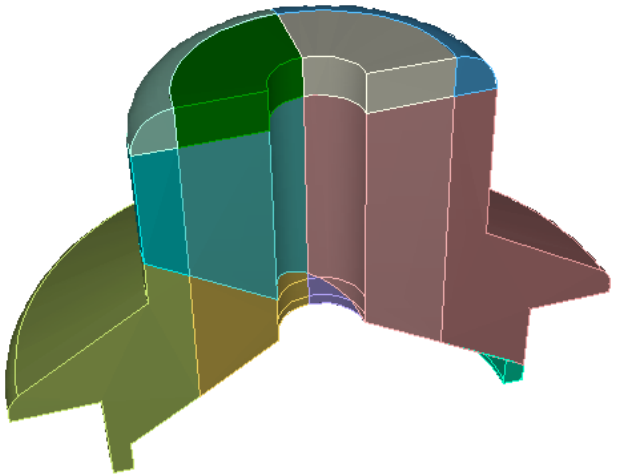


Plane normal to curve:



Example Webcuts

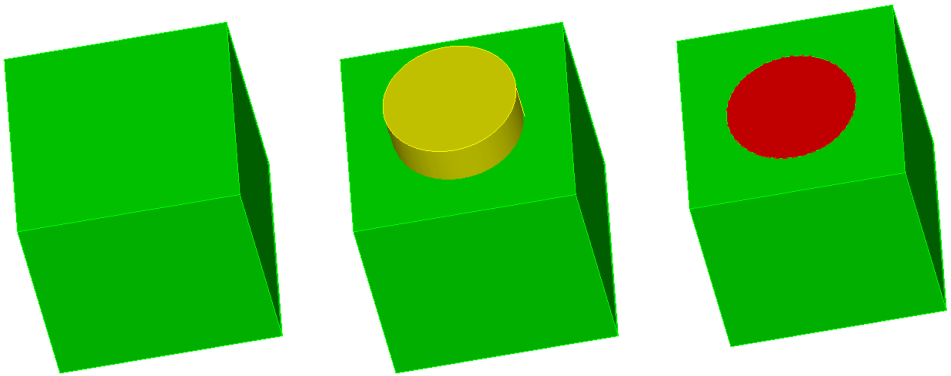
Result:

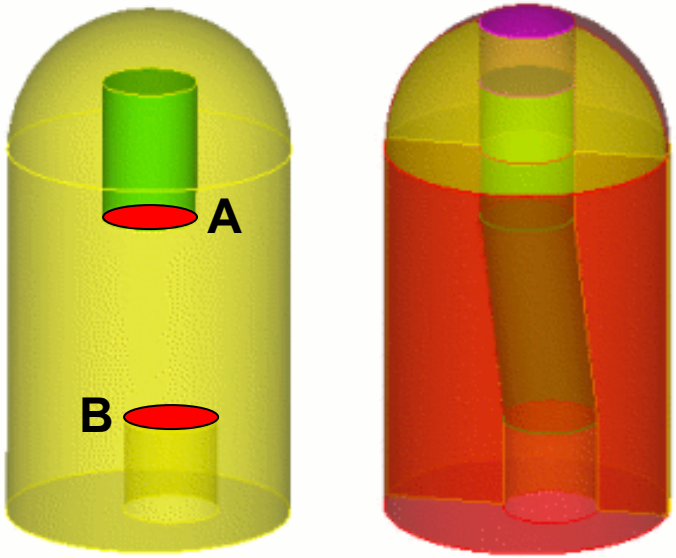


Web Cutting

Decomposition may require creation of a temporary tool volume to aid in cutting the geometry

A **Tool** volume is first created and used to webcut the volume

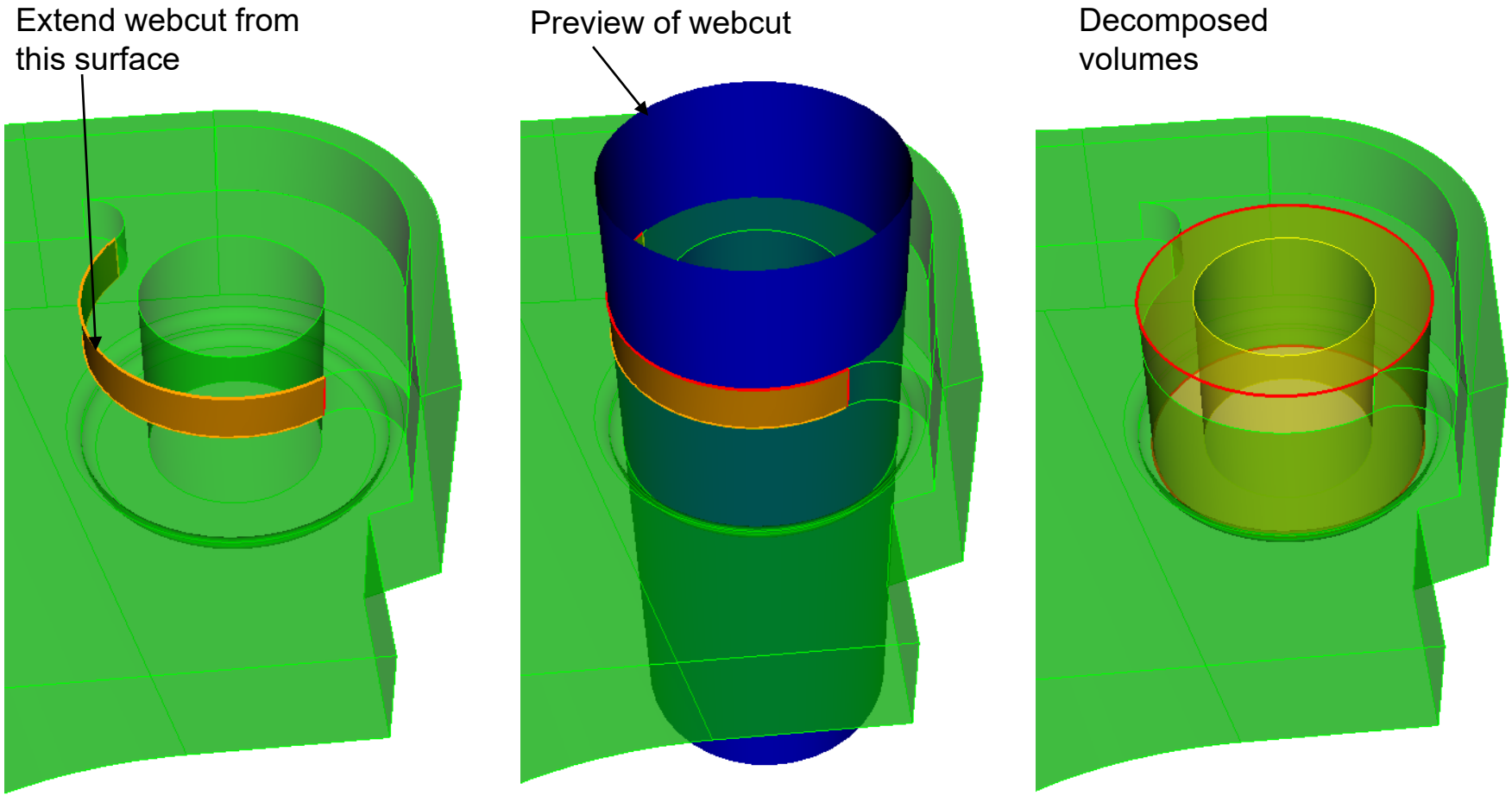




A lofted volume is first created between surface **A** and **B** and used as a Tool to cut the volume

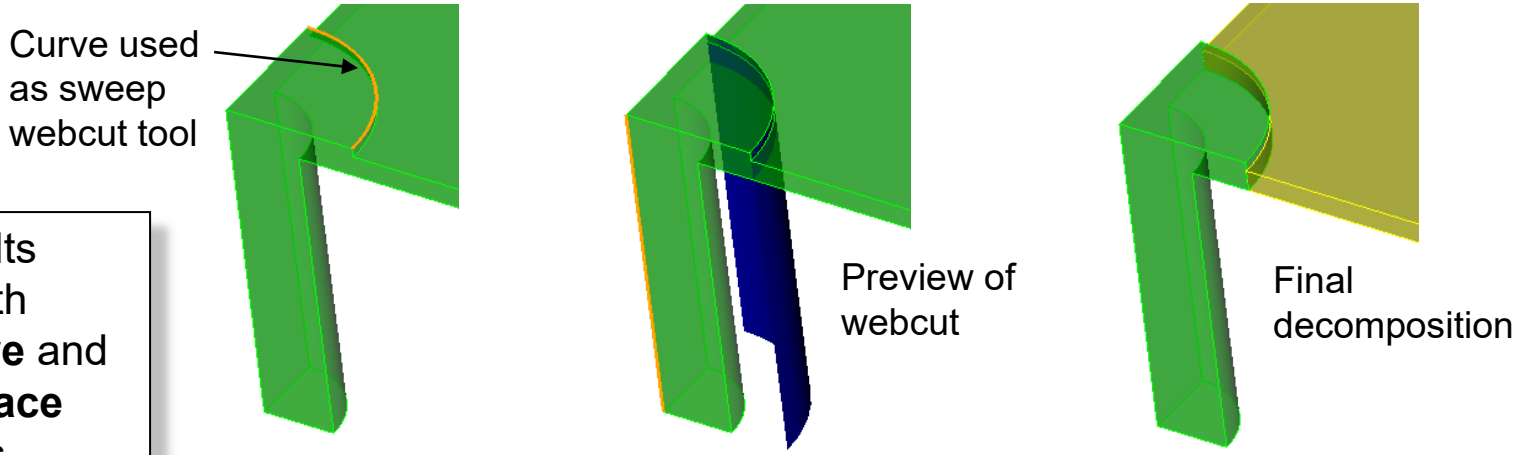
Web Cutting

Webcutting by extending a selected surface. Surface can be non-planar

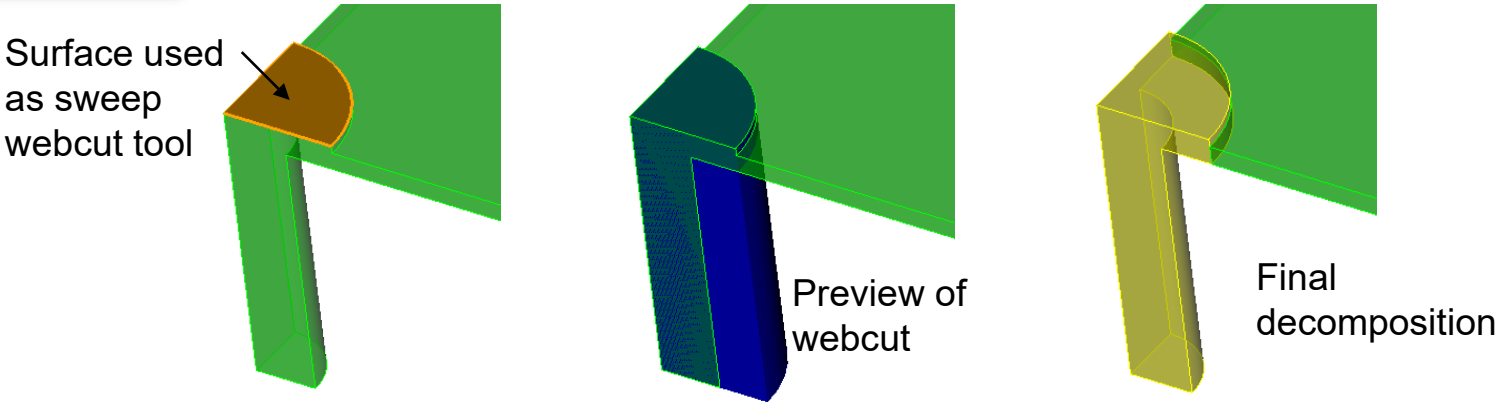


Web Cutting

Webcuts can be made by extruding a surface or curve through the volume along a path

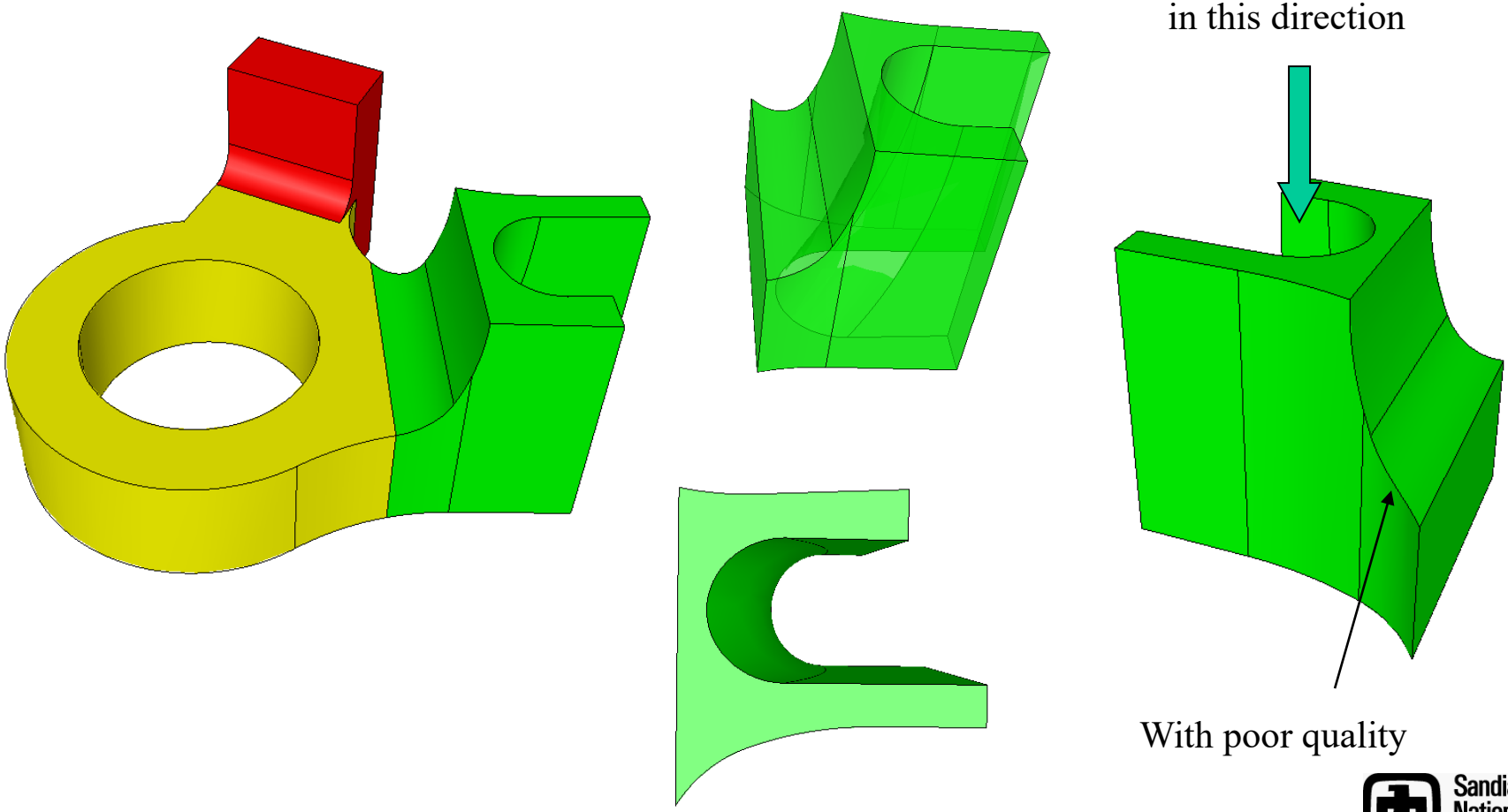


Similar results achieved with **sweep curve** and **sweep surface** webcut tools



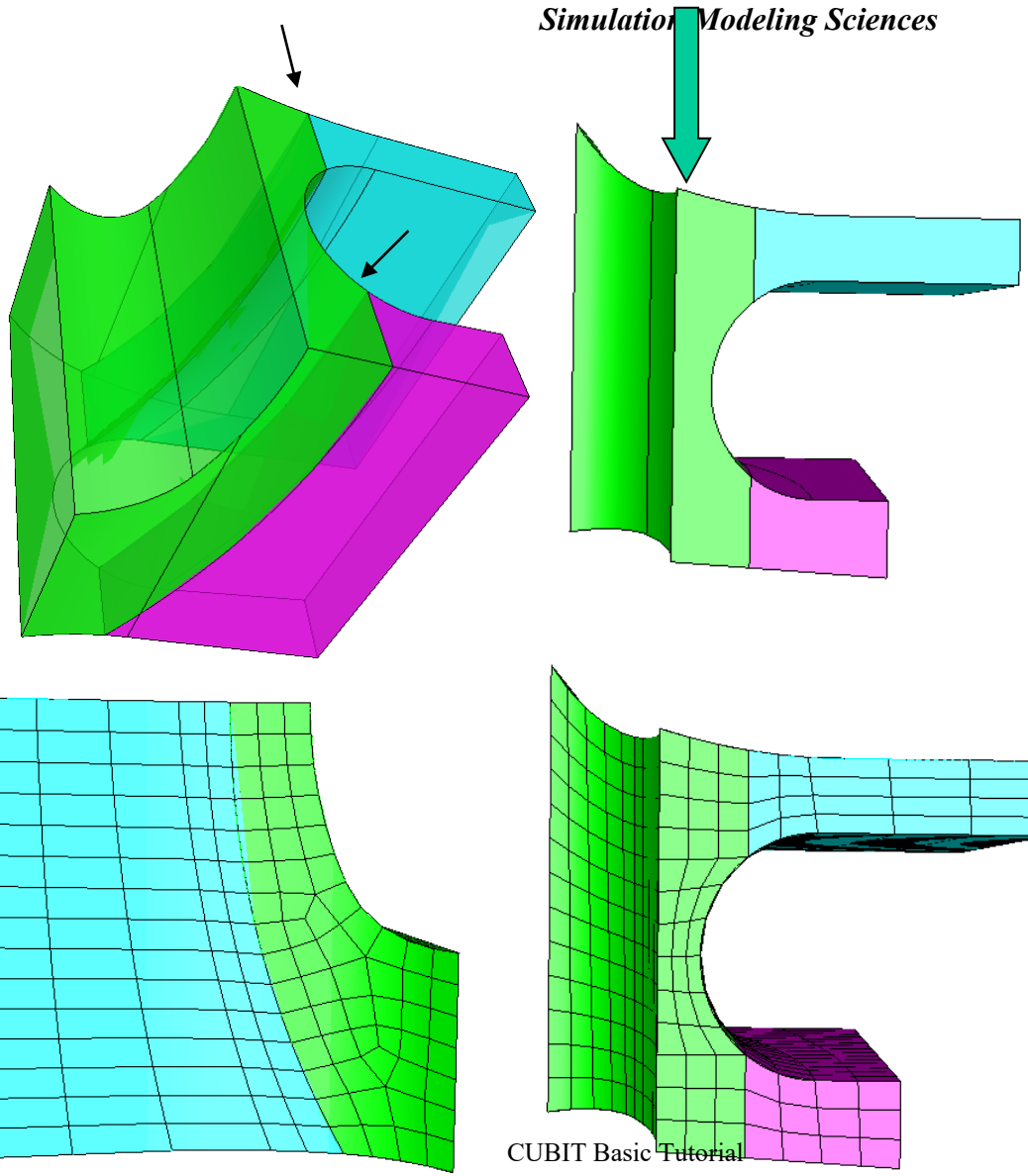
Web Cut Examples

Regardless of where you intend to cut your model if you are having difficultly determining where to cut a model a good place to start is the center of any fillets.



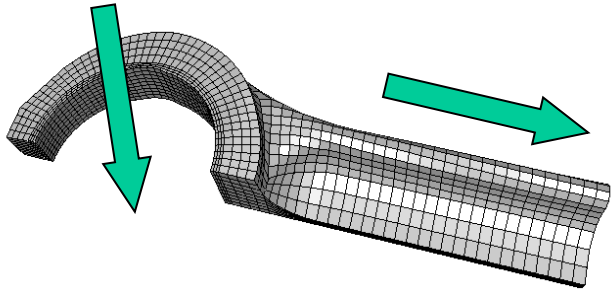
Web Cut Examples

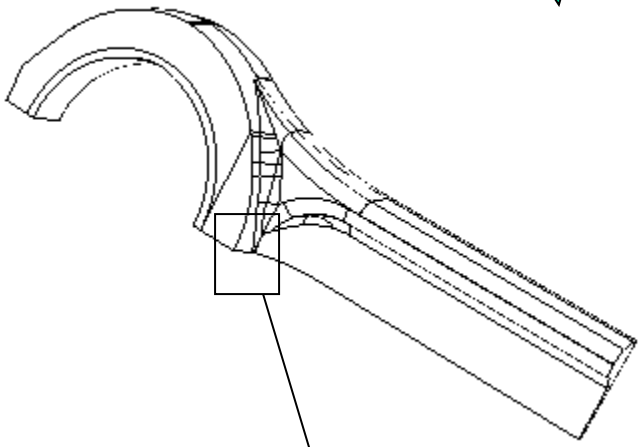
Cutting through centers of fillets gives added flexibility in sweeping and helps improve quality

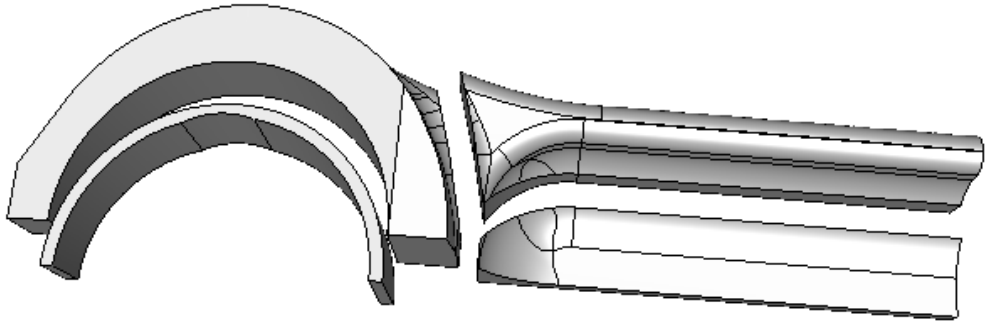


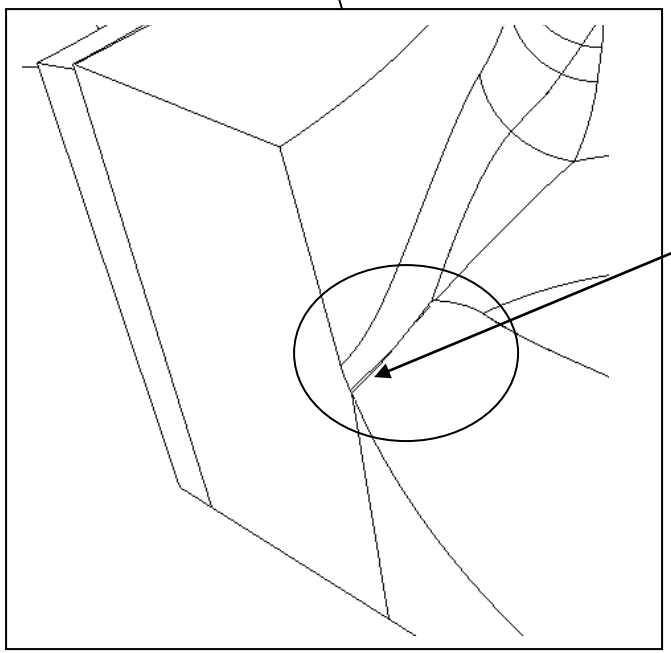
Web Cut Examples

Simulation Modeling Sciences



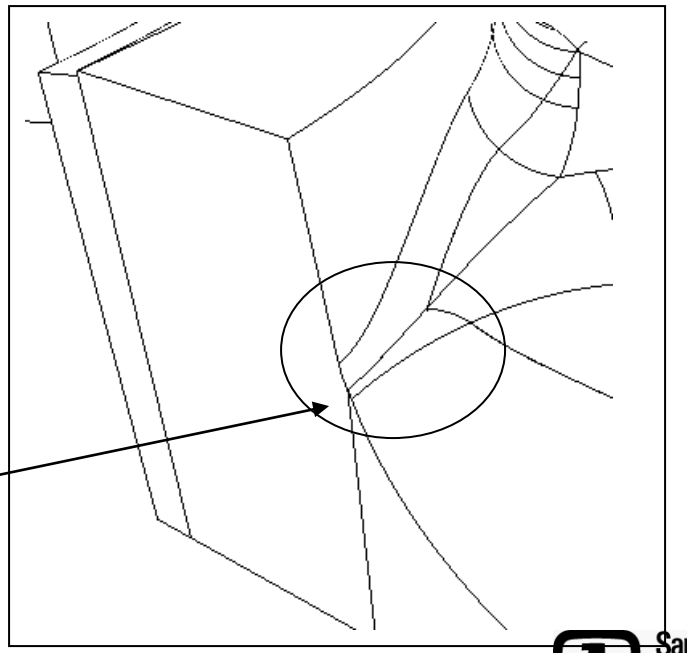




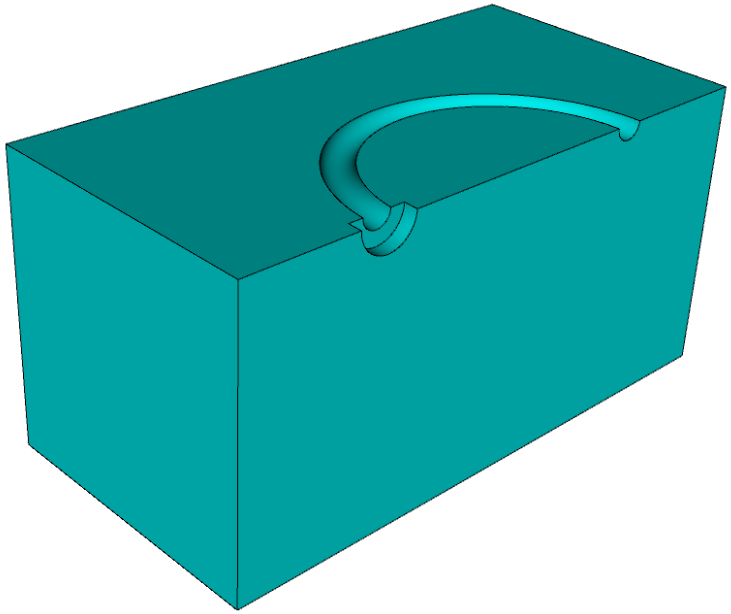


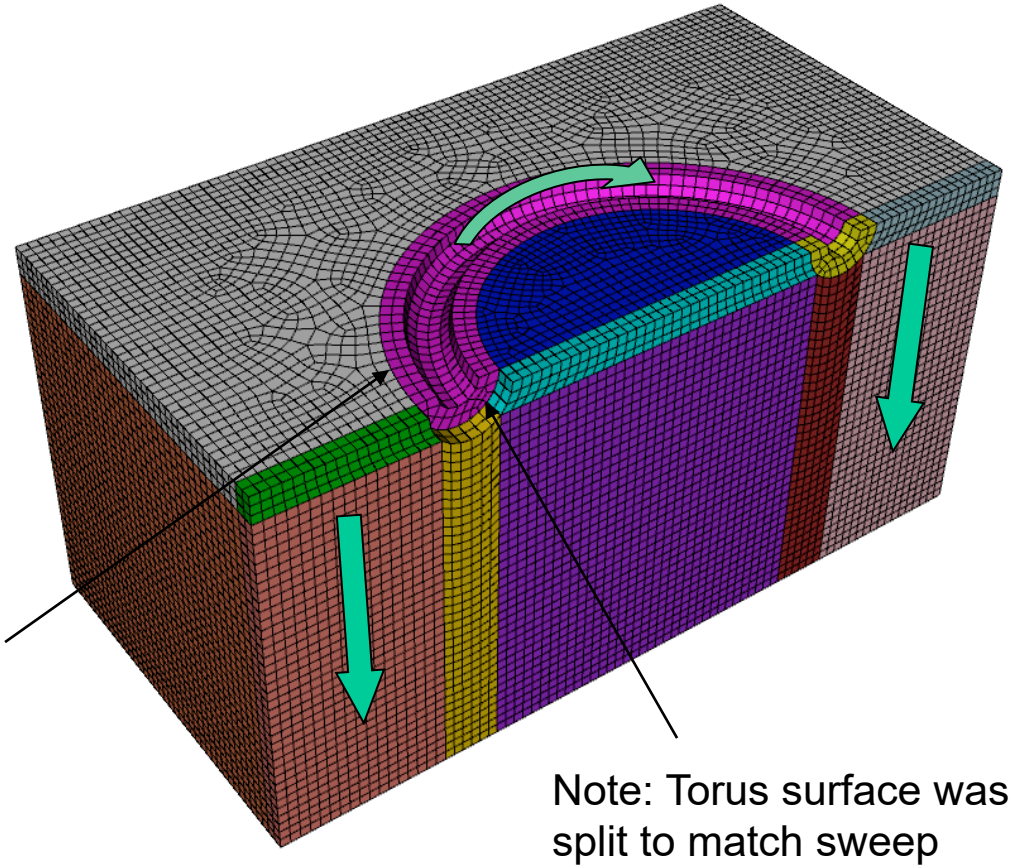
Avoid cuts which leave small sliver surfaces

Moving the cut only slightly will save trouble merging



Web Cut Examples



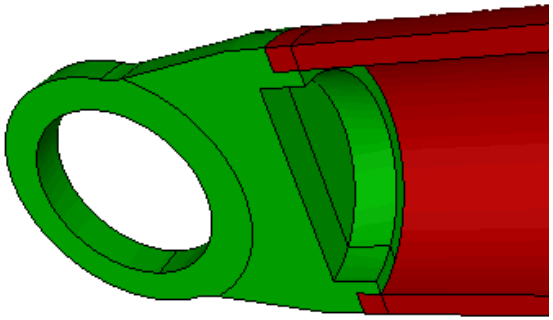


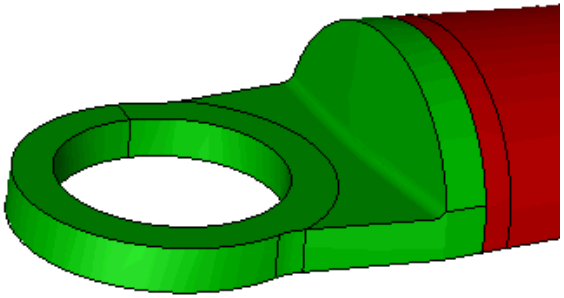
Note: Webcut using an offset surface from the torus – provides good quality elements

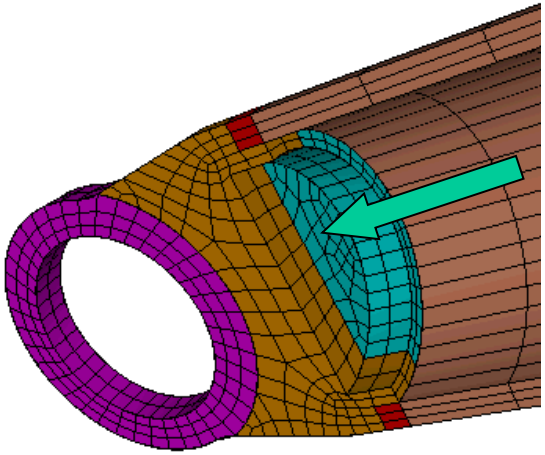
Note: Torus surface was split to match sweep direction

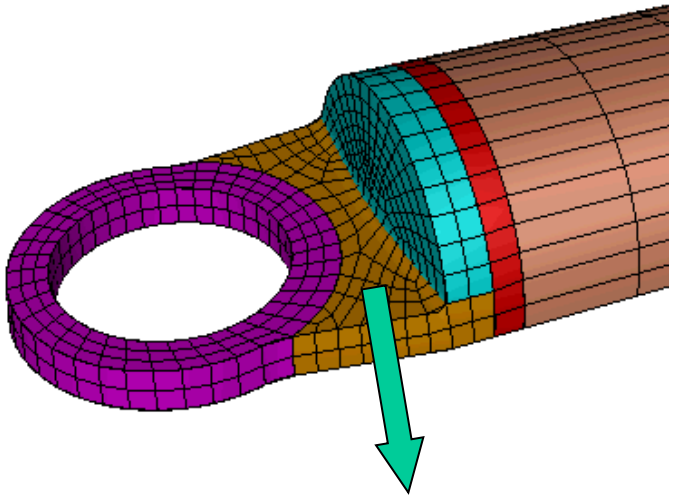
Web Cut Examples





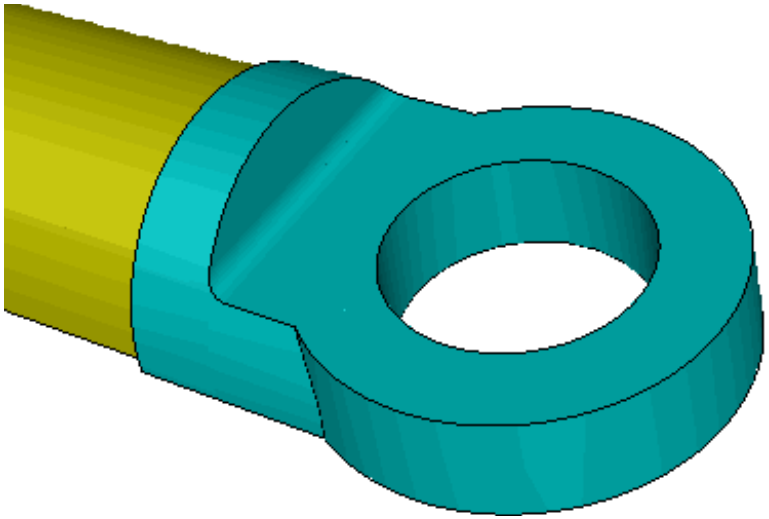


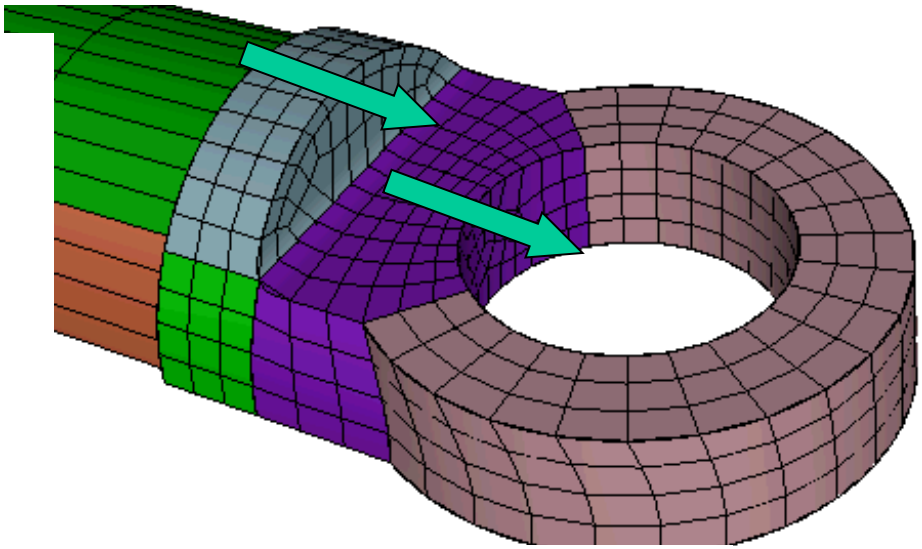


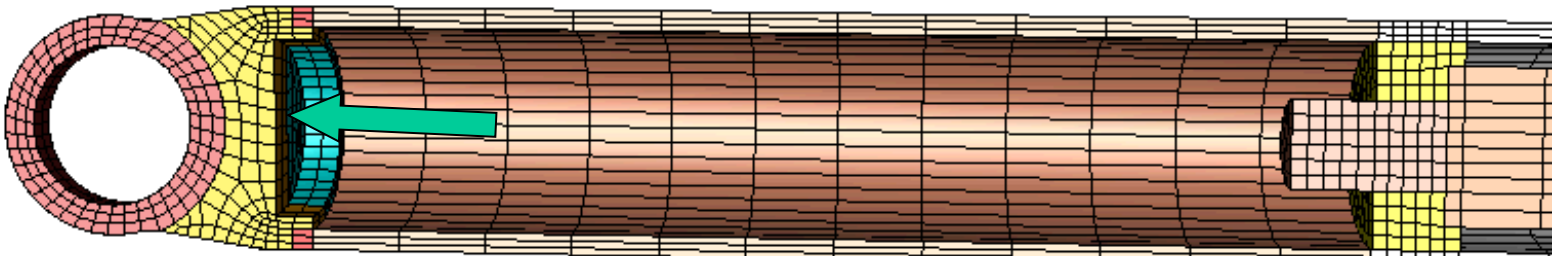


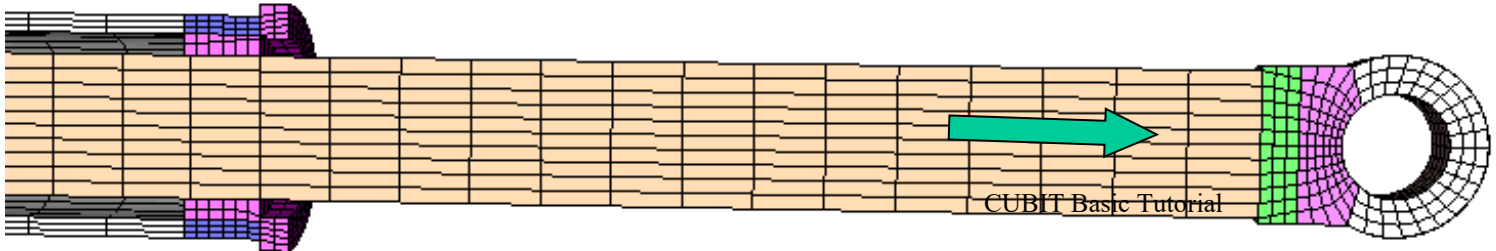
Web Cut Examples



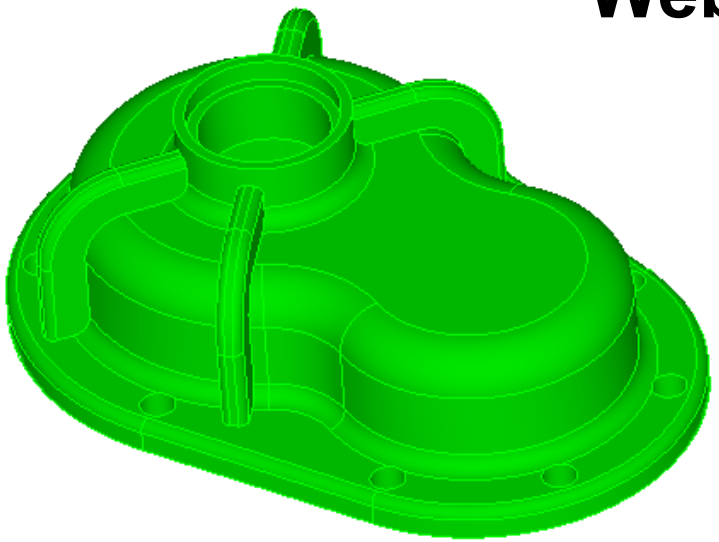


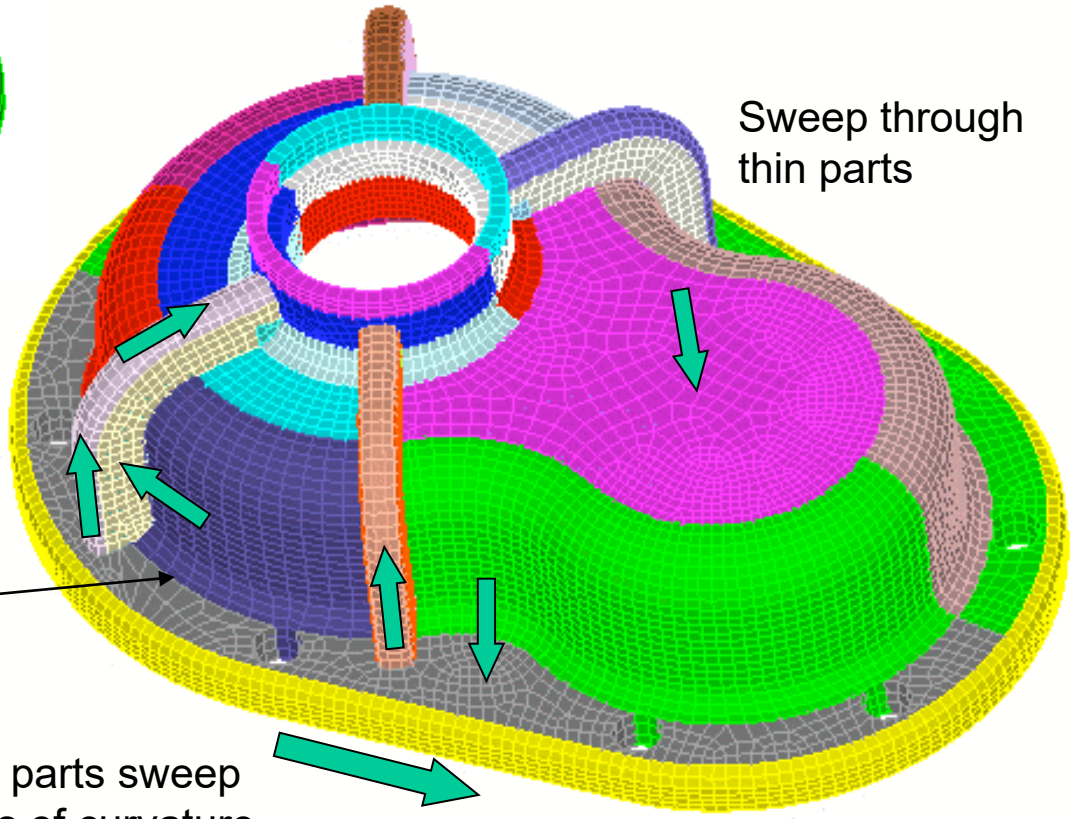




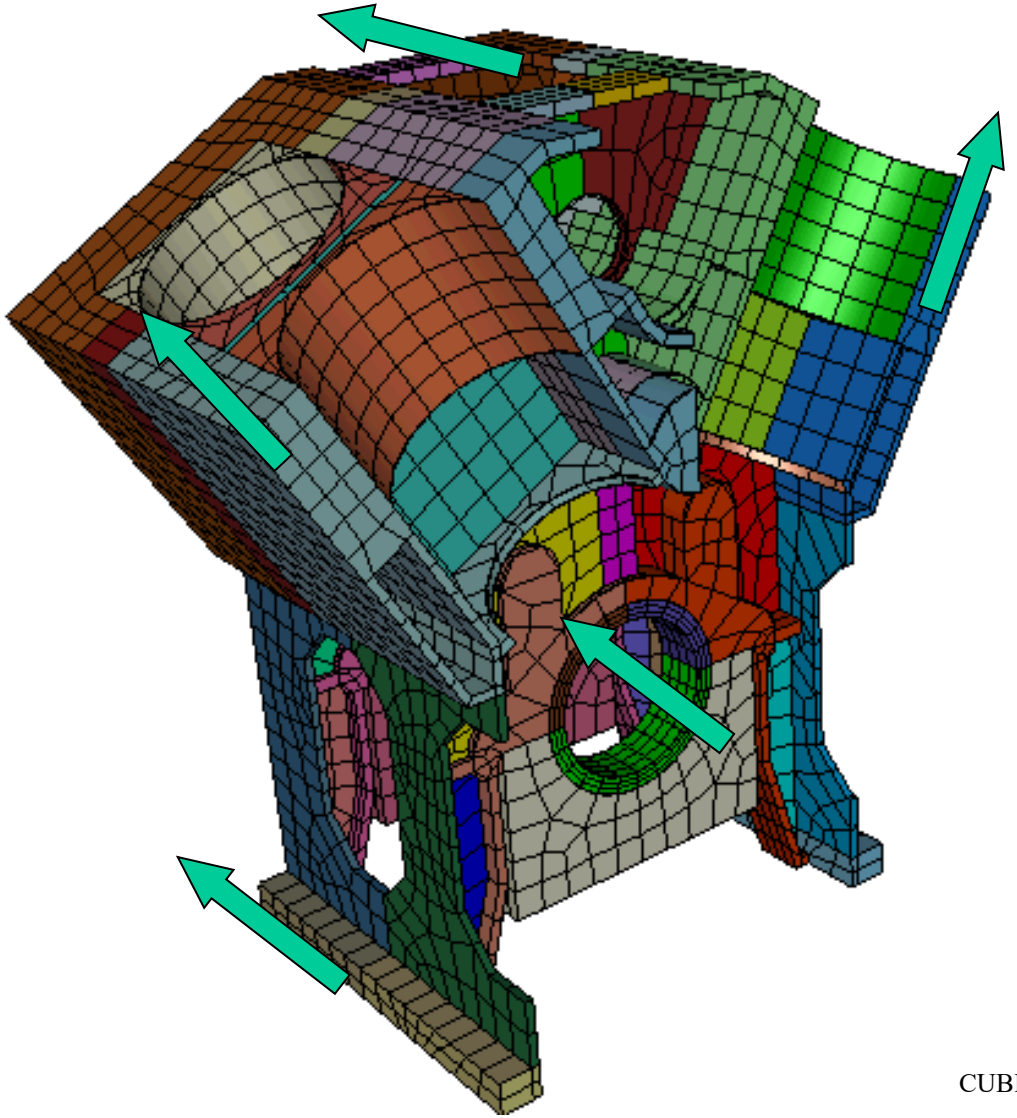


Web Cut Examples

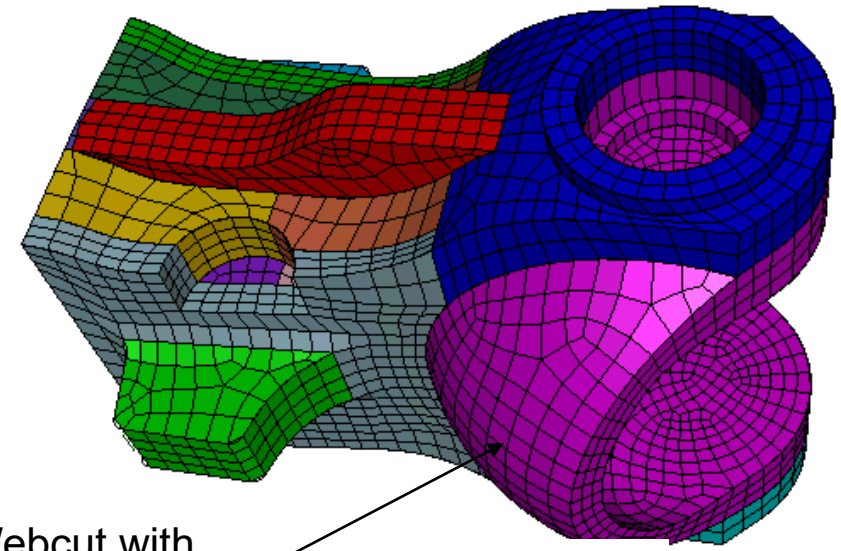




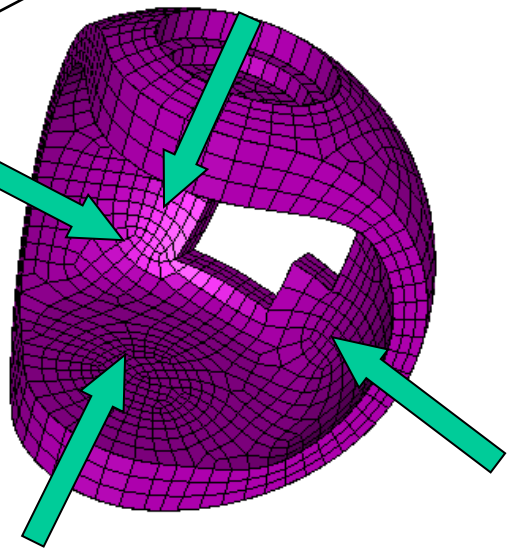
Web Cut Examples

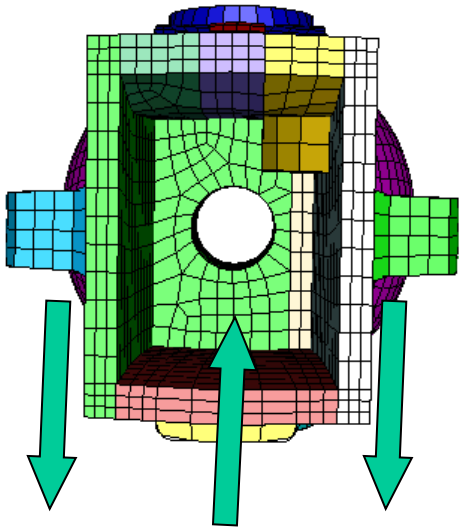


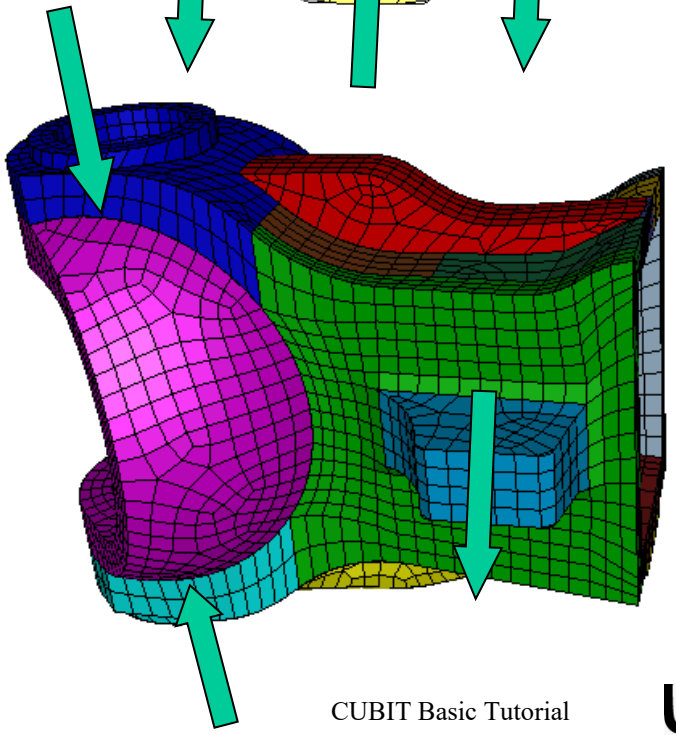
Web Cut Examples



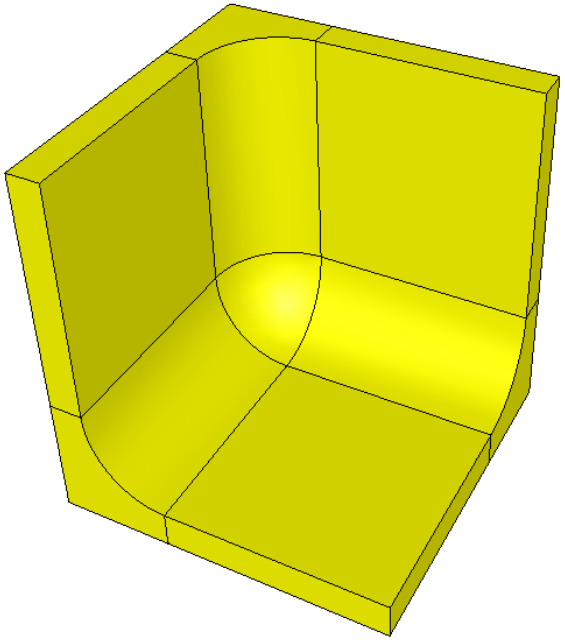
Webcut with extended surface to create this volume

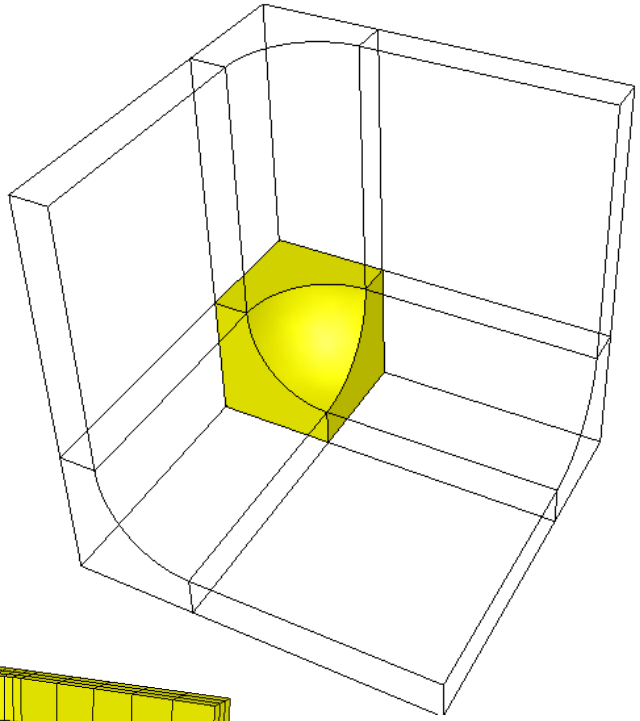




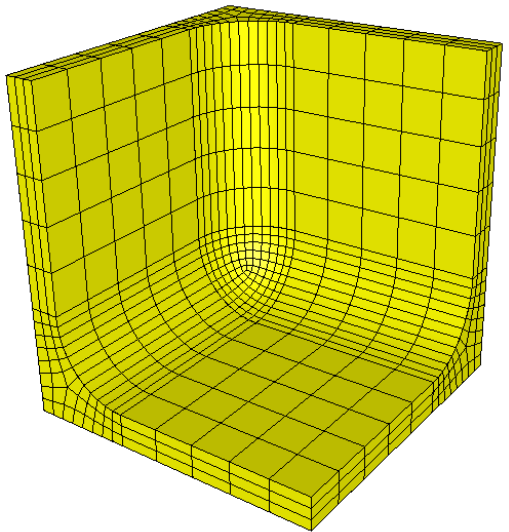


Web Cut Examples

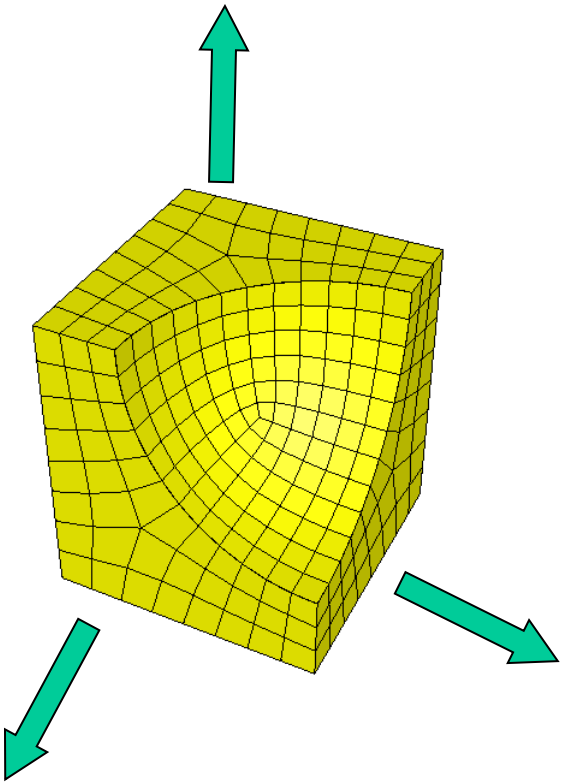




New sweep directions



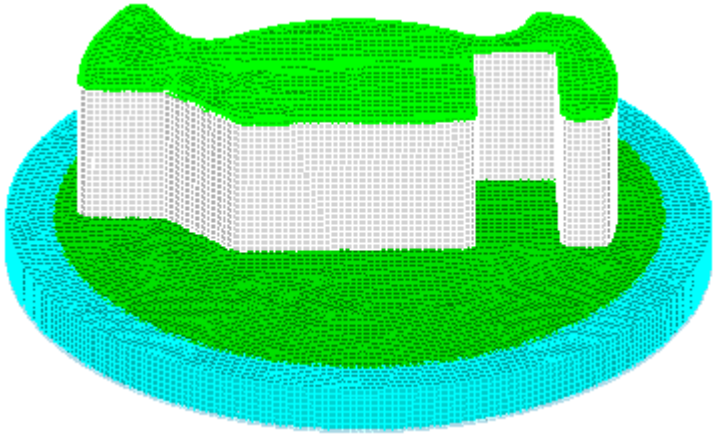
Polyhedron volume mesh scheme



Exercise 1

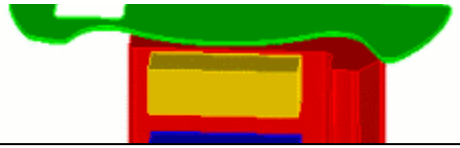
Mesh the geometry in the file **example01.sat** with a contiguous all-hex mesh.

Use a mesh size of 0.15

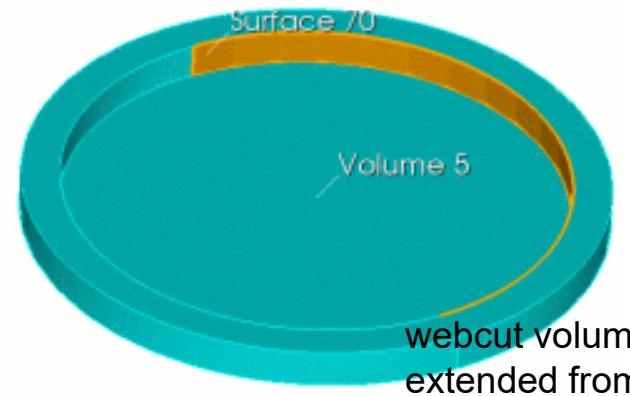


Hints

- Examine sweepability of all volumes. Is there a many-to-many sweep volume?
- Don't forget to imprint and merge
- This assembly can be meshed with as little as 1 webcut



CUBIT> webcut volume 5 with sheet extended from surface 70
CUBIT> imprint all
CUBIT> merge all
CUBIT> volume all size 0.15
CUBIT> volume all scheme auto



webcut volume 5 with sheet extended from surface 70

Exercise 2

Mesh the geometry in the file **example04.sat** with a contiguous all-hex mesh.

Use a mesh size of 0.15

Hints:

- Consider a coring approach: Sweep radially around the outside and top to bottom on the interior core.
- Consider creating a tool volume using the loft option for creating volumes to create the core
- Remember to delete the tool volume afterward webcutting
- Use a sweep surface webcut to extend the core to the top
- Split the volumes along a symmetry plane to permit the radial sweep.
- Remember to imprint and merge!

