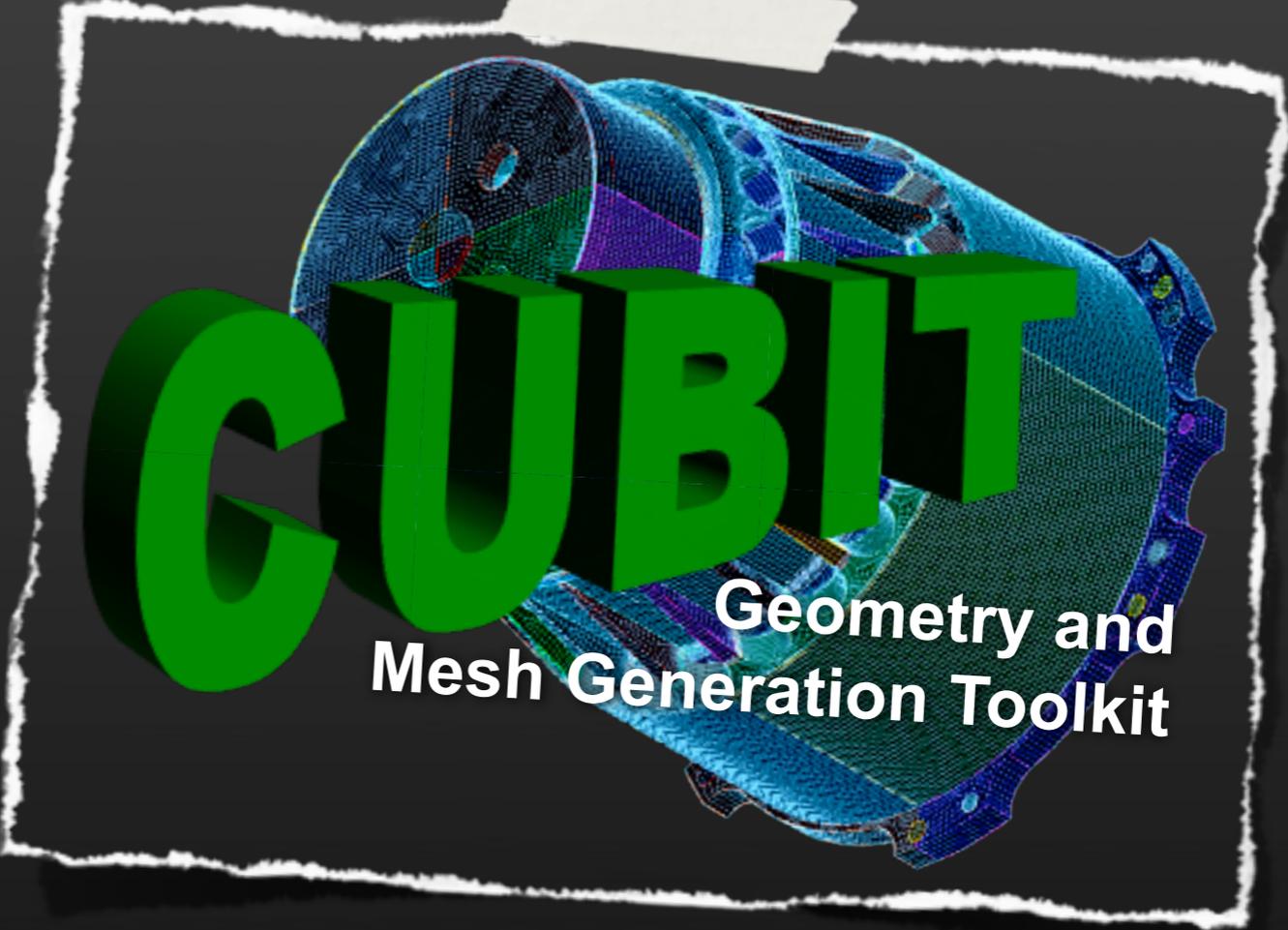


Emanuele Casarotti



CUBIT

Geometry and
Mesh Generation Toolkit

A ^{very} fast-start introduction for geophysicists



Istituto Nazionale di
Geofisica e Vulcanologia

Computational Infrastructure for
Geodynamics



SUMMARY

- 1) CUBIT introduction
- 2) HOW-TO: subduction zone
- 3) HOW-TO: volcano
- 4) HOW-TO: python scripting
- 5) CAVEAT: geometry engine

SUMMARY

1) CUBIT introduction

Disclaimer:

I am not employed by SANDIA national lab
I am not part of CUBIT developing team

4) HOW-TO: python scripting

5) CAVEAT: geometry engine

CUBIT introduction



The screenshot shows a web browser window with the URL <http://www.cubit.sandia.gov/>. The page features a large 3D model of a mechanical part with the word "CUBIT" overlaid in green. Below the model, the text "Geometry and Mesh Generation Toolkit" is displayed. A navigation menu includes links for Home, Licensing, Tutorials, Documentation, Support, Downloads, and Links. A "CUBIT News" section highlights a "110 CUBIT" update from November 20, 2007, and mentions other tools like DART, ITEM, and Python for CUBIT. The main content area is titled "The CUBIT Tool Suite" and lists sub-modules: CUBIT, CGM, VERDICT, CAMAL, CLARO, and MOAB. A detailed paragraph describes the software's history and research efforts at Sandia National Laboratories. A list of links at the bottom provides access to various toolkits and modules.

CUBIT
Geometry and Mesh Generation Toolkit

Home | [Licensing](#) | [Tutorials](#) | [Documentation](#) | [Support](#) | [Downloads](#) | [Links](#)

CUBIT News

110 CUBIT
November 20, 2007

DART
Metadata

ITEM
Immersive Topology Environment for Meshing
[View Video](#)

Python for CUBIT

The CUBIT Tool Suite
[CUBIT](#) | [CGM](#) | [VERDICT](#) | [CAMAL](#) | [CLARO](#) | [MOAB](#)

For more than a decade, CUBIT has been the focus of a broad research and development effort in mesh generation and geometry preparation at Sandia National Laboratories. The primary recipient and stakeholder for this effort has been Sandia and its sister laboratories within the USA, supporting computational field simulations for a variety of physics codes. In recent years CUBIT has also become more significant in academia and industry now supporting hundreds of active users world-wide. In addition to its role as a software provider, CUBIT encompasses ongoing research efforts to improve and discover new mesh generation algorithms, develop new tools for geometry cleanup and simplification and handle ever more complex preprocessing tasks for computational simulations. In developing the infrastructure and algorithms for such a comprehensive application, it was soon recognized that solutions developed for CUBIT were very similar to solutions needed within other applications at the Laboratory. As a result, significant effort in the past few years has been devoted to separating components of the CUBIT infrastructure or developing new tools as modules that can be used both as components of CUBIT as well as third party libraries callable from other applications. Click on a link to get more information about CUBIT and its related components:

- [CUBIT Geometry and Mesh Generation Toolkit](#)
- [Common Geometry Module \(CGM\)](#)
- [Mesh Verification with VERDICT](#)
- [Cubit Adaptive Mesh Generation Library \(CAMAL\)](#)
- [Graphical User Interfaces with CLARO](#)
- [a Mesh Oriented datABase \(MOAB\)](#)

[Back to top of page](#)

www.cubit.sandia.gov



2D/3D solid-modeler mesher:

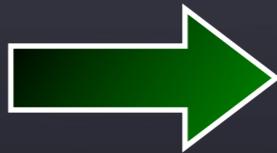
- Geometry preparation
- Automatic meshing algorithms
- Smoothing
- Quality analysis
- Hexahedra/Tetrahedra

FREE for academic
(300\$ distribution fee for institution, you can share with your colleagues inside the institution, fairly)

CUBIT introduction

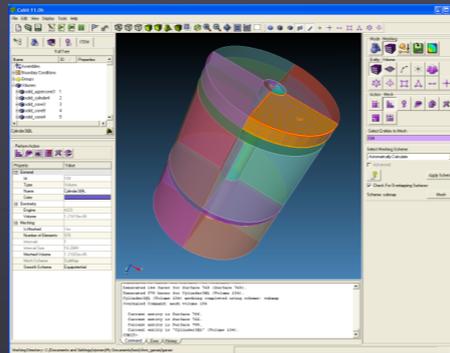
CAD

- ACIS (CUBIT, Autocad)
- STEP
- IGES (Rhinoceros)
- Pro/E
- Facets (GOCAD)
- STL
- Exodus II

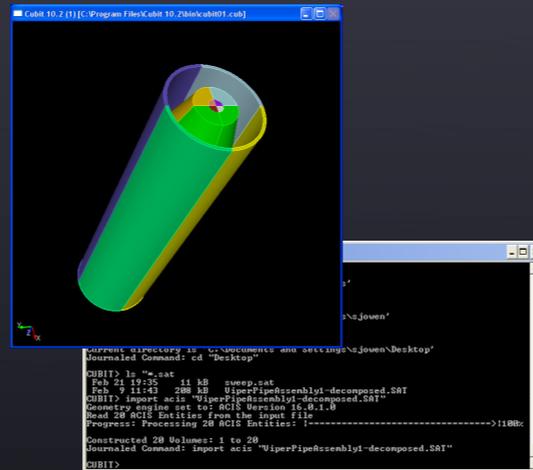


CUBIT

Graphical Interface



Command line

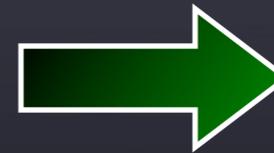


Python API



MESH

- Exodus II (NETCDF)
- Abaqus (ASCII)
- IDEAS-Universal
- NASTRAN-BDF
- Patran
- LS-Dyna



CUBIT introduction

The screenshot displays the CUBIT 11.0b software interface. The central 3D view shows a green rectangular volume with a red and yellow swept volume cut through it. The interface includes a 'Full Tree' on the left, a 'Perform Action' panel, and a 'Webcut' configuration panel on the right. The 'Webcut' panel is set to 'Sweep Surface' mode with 'Volume ID(s) 1' and 'Sweep Surface ID 7'. The 'Sweep Direction' is set to 'Vector' with coordinates X: 0, Y: 0, Z: -1. The 'Project' checkbox is checked, and 'Through All' is selected. The 'Apply' button is highlighted.

Full Tree

- Assemblies
- Boundary Conditions
- Groups
- Volumes
- Sheet Bodies

Perform Action

Property	Value

Mode - Geometry

Entity - Volume

Action - Webcut

Sweep Surface

Webcut Target

Volume ID(s) 1

Sweep Surface ID 7

Sweep Direction

- Vector
- Perpendicular
- Along Curve
- Rotate About Axis

X 0

Y 0

Z -1

Distance

Inward Outward

Project

- Through All
- Through Next
- To Surface

Group Results

Preview Apply

Creating the new (webcut) volumes...
Created volume(s): 3
Updated volume(s): 1
Modified/Created volumes: 1 3
Journalled Command: webcut volume 1 sweep surface 7 vector 0 0 -1 through_all

CUBIT>

Script Command Error History

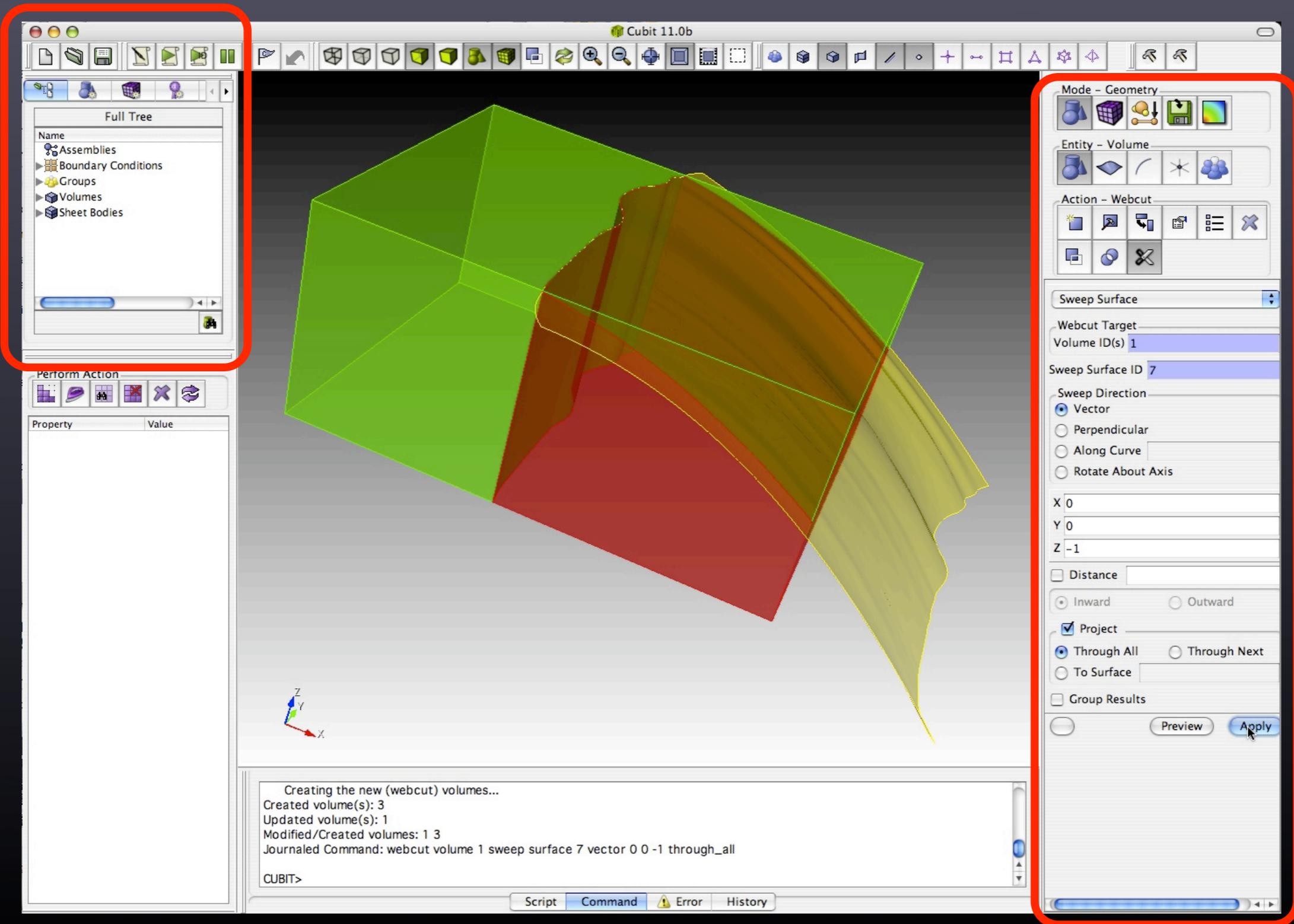
CUBIT introduction

The screenshot displays the CUBIT 11.0b software interface. The central 3D view shows a green cube with a red webcut surface applied to its top face, creating a new volume. The interface is divided into several panels:

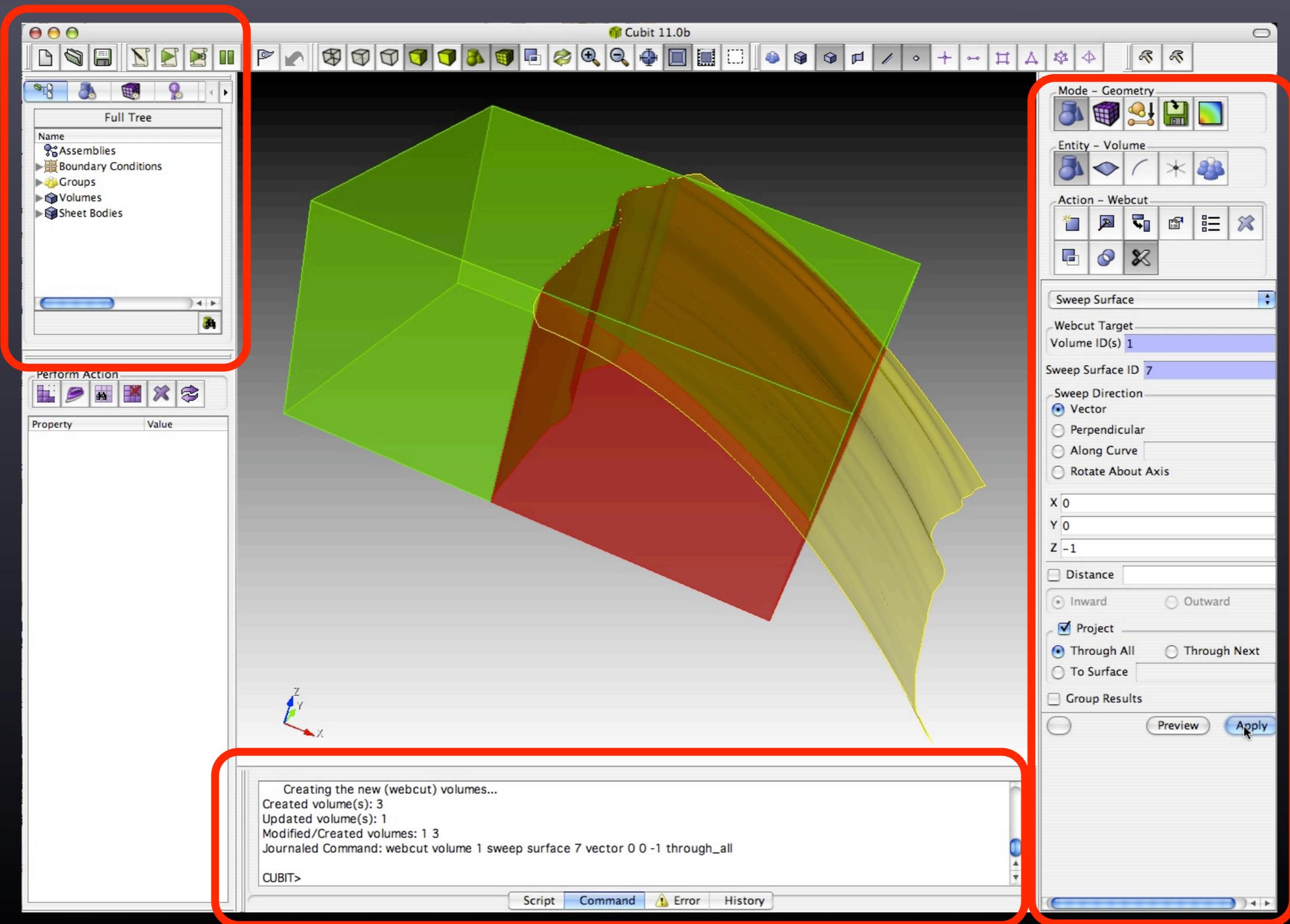
- Full Tree (Left):** A hierarchical tree view showing the model's structure, including Assemblies, Boundary Conditions, Groups, Volumes, and Sheet Bodies. This panel is highlighted with a red border.
- Perform Action (Bottom Left):** A panel with icons for various actions and a table for properties and values.
- Command Window (Bottom Center):** Displays the current command and its execution status:

```
Creating the new (webcut) volumes...
Created volume(s): 3
Updated volume(s): 1
Modified/Created volumes: 1 3
Journalled Command: webcut volume 1 sweep surface 7 vector 0 0 -1 through_all
CUBIT>
```
- Right Panel (Property Panel):** Shows the configuration for the 'Sweep Surface' operation. The 'Webcut Target' is set to 'Volume ID(s) 1' and the 'Sweep Surface ID' is '7'. The 'Sweep Direction' is set to 'Vector' with coordinates X: 0, Y: 0, Z: -1. The 'Project' checkbox is checked, and the 'Through All' radio button is selected. The 'Apply' button is highlighted.

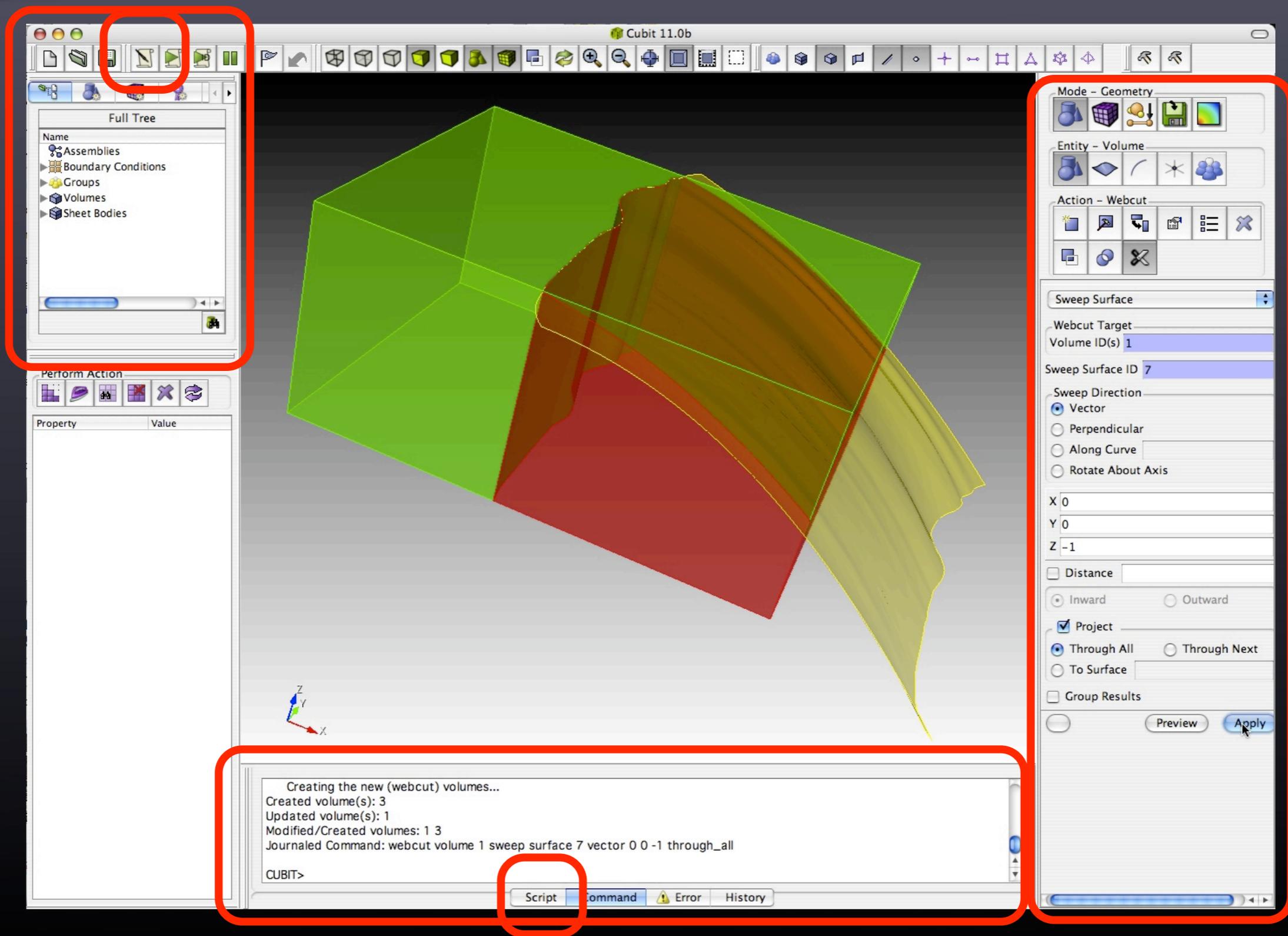
CUBIT introduction



CUBIT introduction



CUBIT introduction



CUBIT introduction

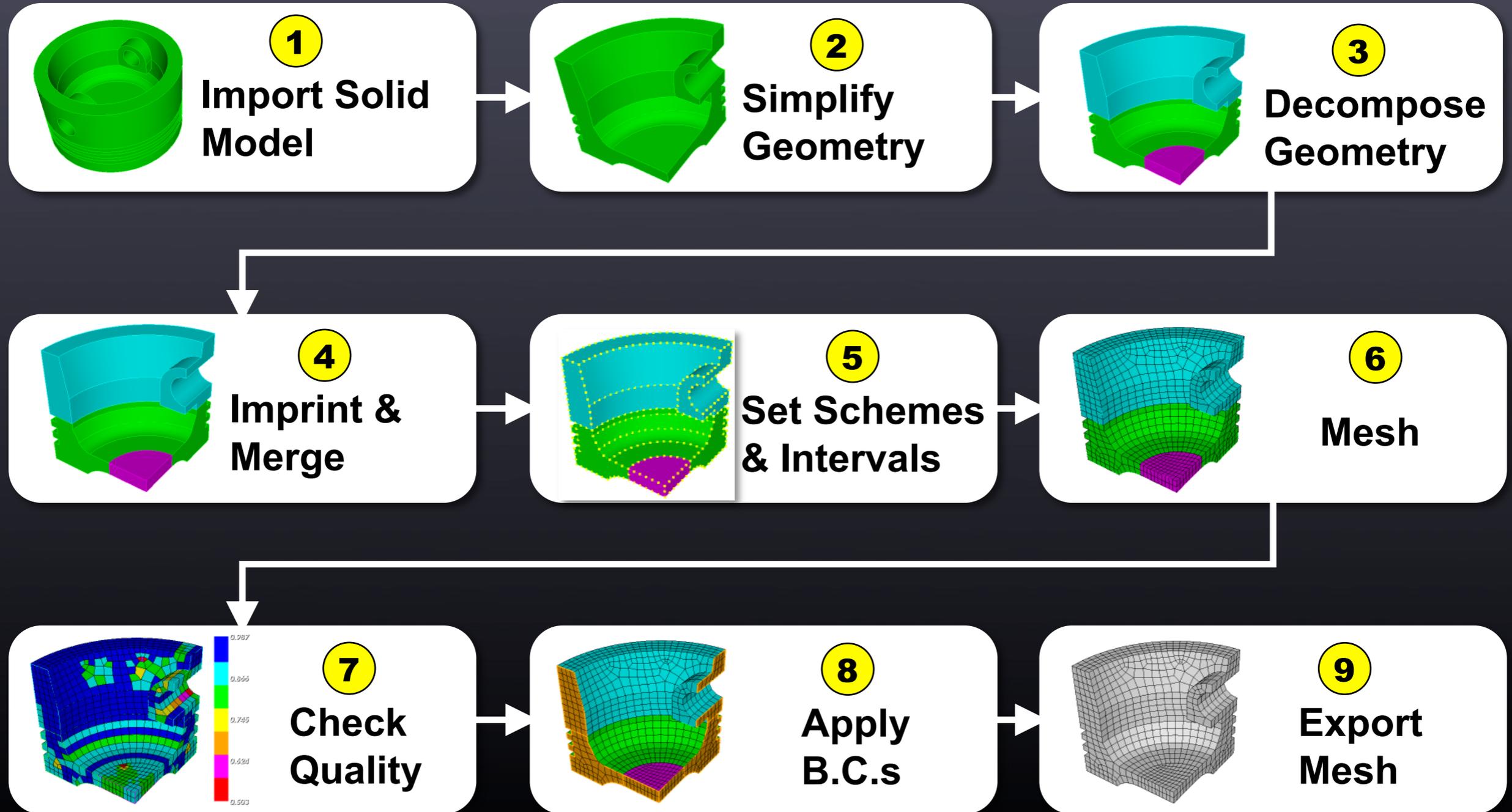
The screenshot displays the CUBIT 11.0b software interface. The main window shows a 3D model of a swept surface. A Journal Editor window is open, displaying a Python script for creating a sweep surface. The script includes commands for setting environment variables, resetting the model, and defining a function to create a sweep surface from a grid file. The right-hand panel shows the 'Sweep Surface' settings, including 'Webcut Target' (Volume ID 1), 'Sweep Surface ID' (7), 'Sweep Direction' (Vector), and 'Project' (Through All). The console window at the bottom shows the execution output, indicating that the sweep surface was successfully created.

```
name='/Users/emanuele/Desktop/stromboli/stromboli.xyz'  
xstep=10  
ystep=10  
nx=246  
ny=246  
#command = "reset"  
cubit.cmd(command)  
import os  
command = "set echo off"  
cubit.cmd(command)  
command = "set journal off"  
cubit.cmd(command)  
def create_line(n,step,grdfile):  
    last_curve_store=cubit.get_last_id("curve")  
    command='create curve spline '  
    for i in range(0,n):  
        record=grdfile.readline()  
        if i%step == 0:  
            x,y,z=record.split()  
            txt=' Position ' + x +' '+ y +' '+ z  
            command=command+txt  
            #print command  
            cubit.silent_cmd(command)  
            last_curve=cubit.get_last_id("curve")  
            if last_curve != last_curve_store:  
                return last_curve  
            else:  
                return 0  
    def skip_line(n,grdfile):  
        for i in range(0,n):  
            record=grdfile.readline()  
    u_curve=[]
```

Creating the new (webcut) volumes...
Created volume(s): 3
Updated volume(s): 1
Modified/Created volumes: 1 3
Journalled Command: webcut volume 1 sweep surface 7 vector 0 0 -1 through_all
CUBIT>

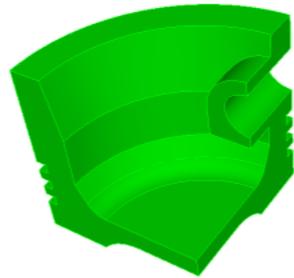
CUBIT introduction

MESHING PROCESS - ORDER!!!!



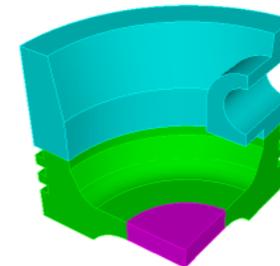
CUBIT a subduction zone

Build a geometry from scratch



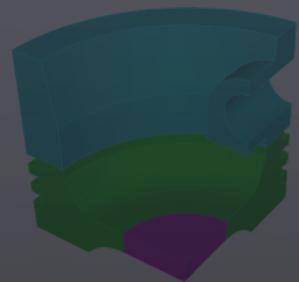
2

Simplify Geometry



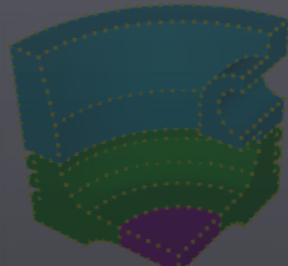
3

Decompose Geometry



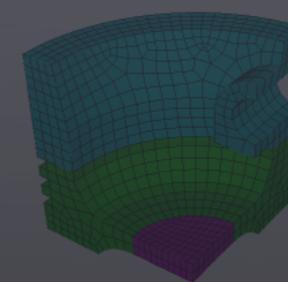
4

Imprint & Merge



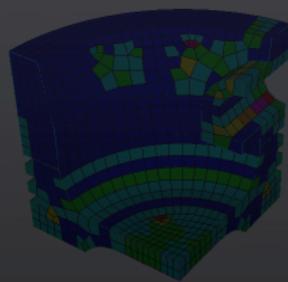
5

Set Schemes & Intervals



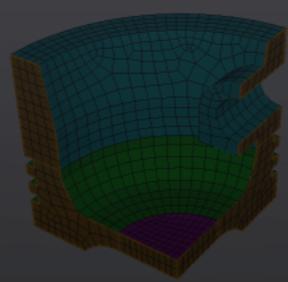
6

Mesh



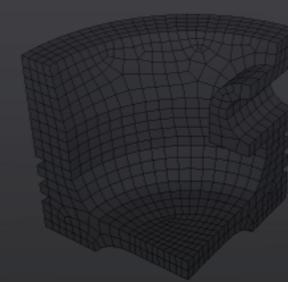
7

Check Quality



8

Apply B.C.s



9

Export Mesh

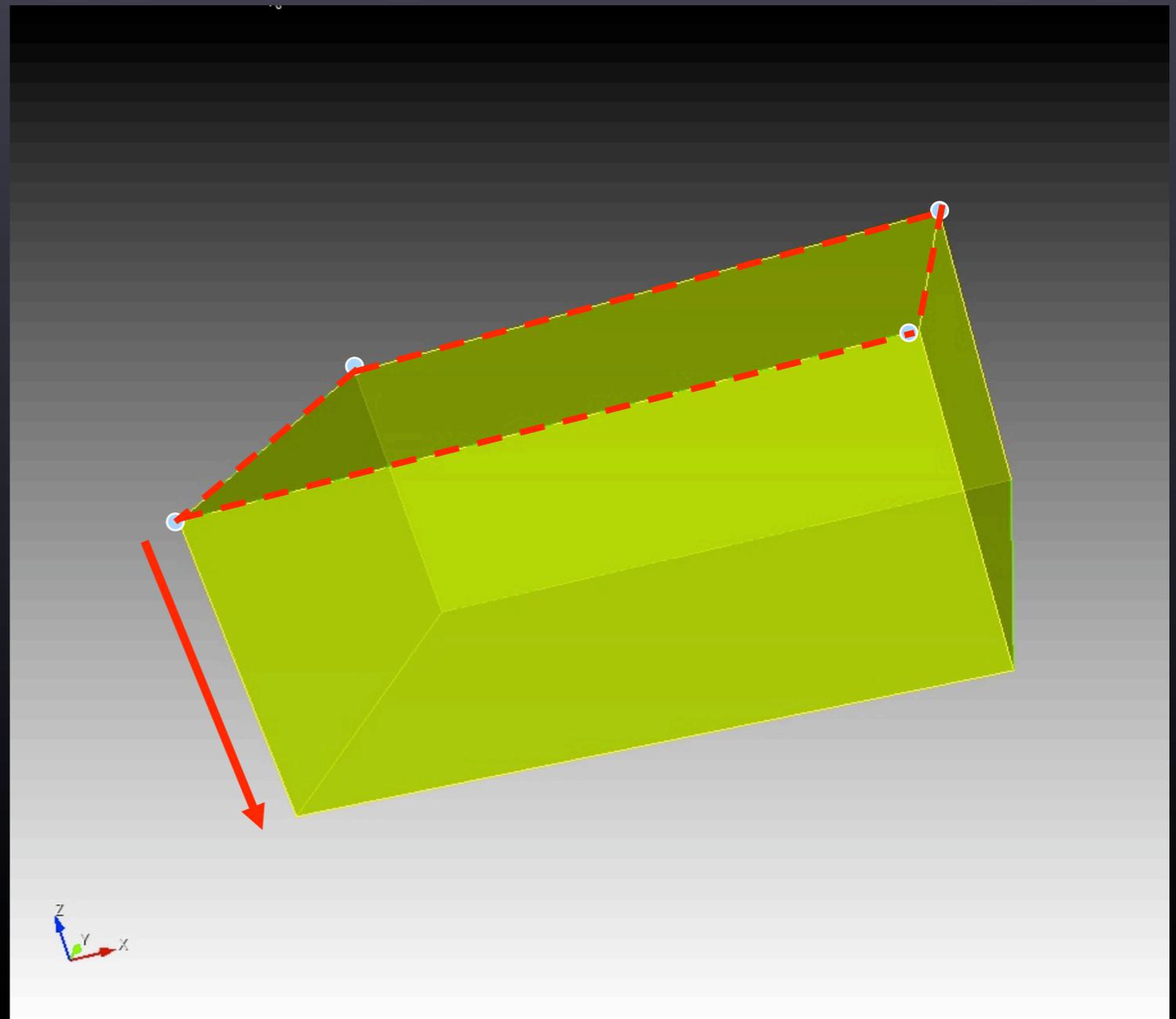
CUBIT a subduction zone

```
create vertex -1300 -1000 0  
create vertex -1300 980 0  
create vertex 1360 980 0  
create vertex 1360 -1000 0
```

```
create curve vertex 1 vertex 2  
create curve vertex 2 vertex 3  
create curve vertex 3 vertex 4  
create curve vertex 4 vertex 1
```

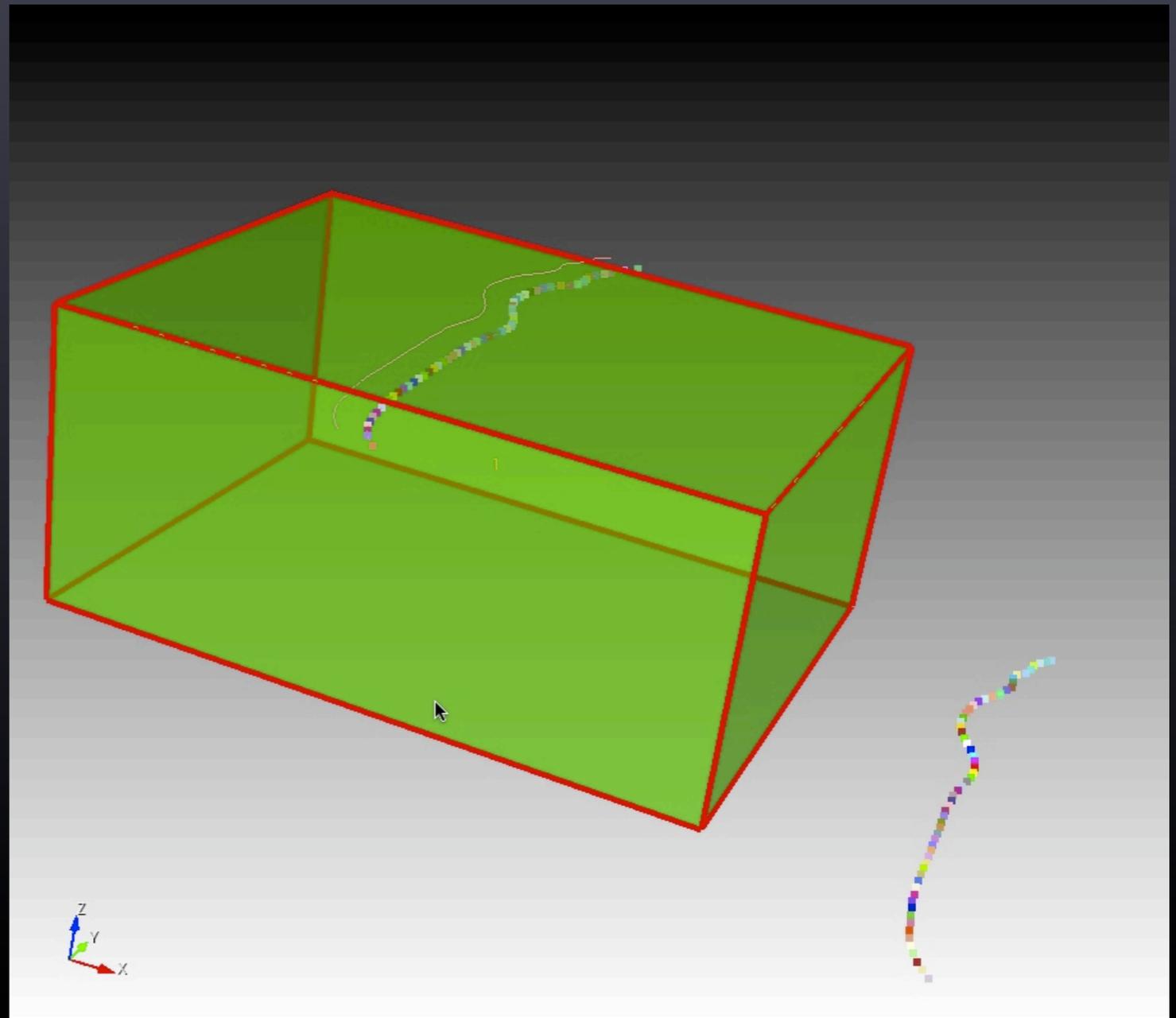
```
create surface curve 1 to 4
```

```
sweep surface 1 vector 0 0 -1 distance 1200
```



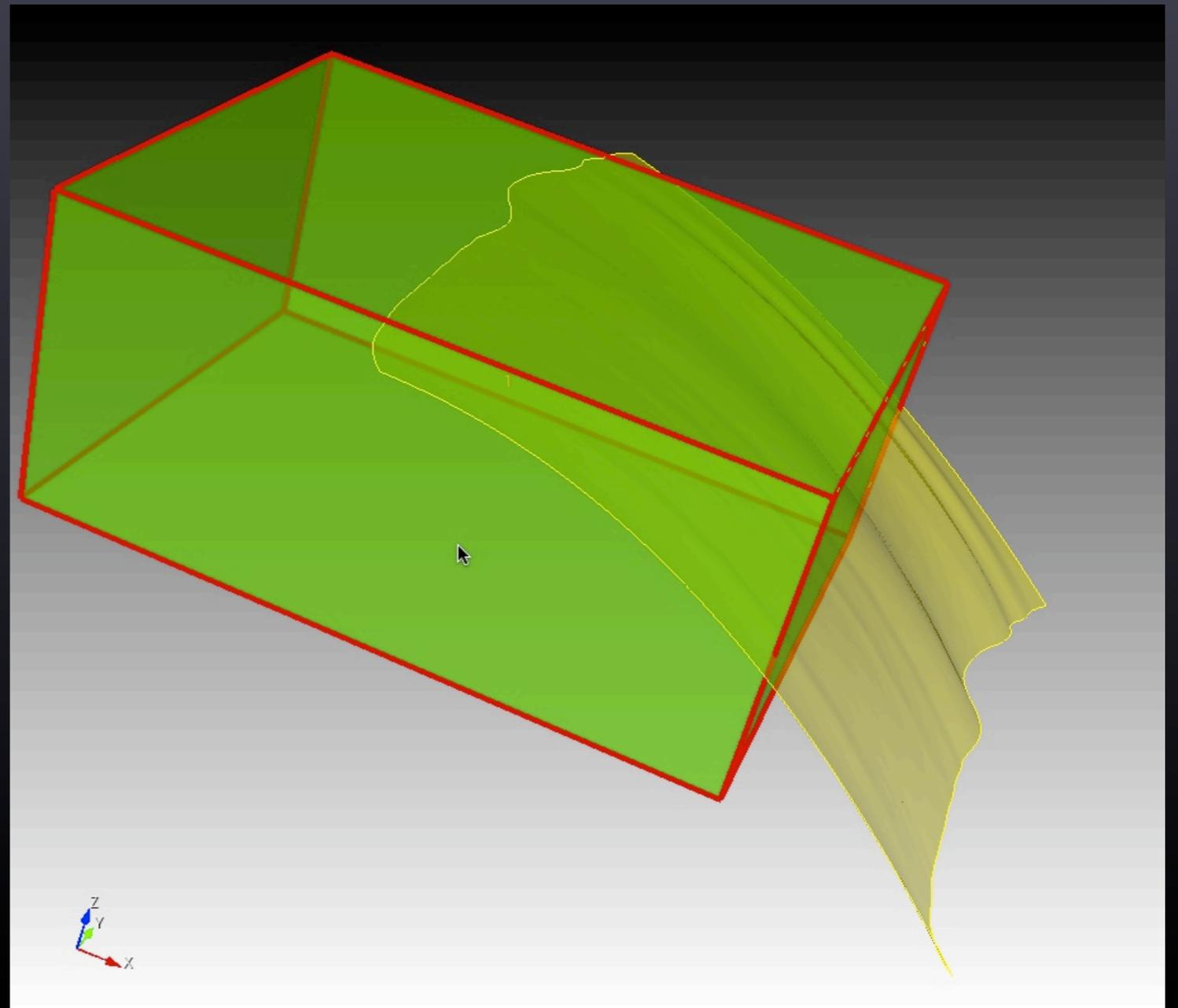
CUBIT a subduction zone

```
create vertex 7.1717 -1301.7994 -6
create vertex -19.4544 -1271.4112 -6
create vertex -43.1423 -1238.7129 -6
create vertex -63.2362 -1204.8409 -6
create vertex -80.9565 -1167.4718 -6
create vertex -94.7731 -1129.5139 -6
create vertex -105.2395 -1089.4459 -6
[...]
create curve spline vertex 137 to 198 delete
delete vertex all
```



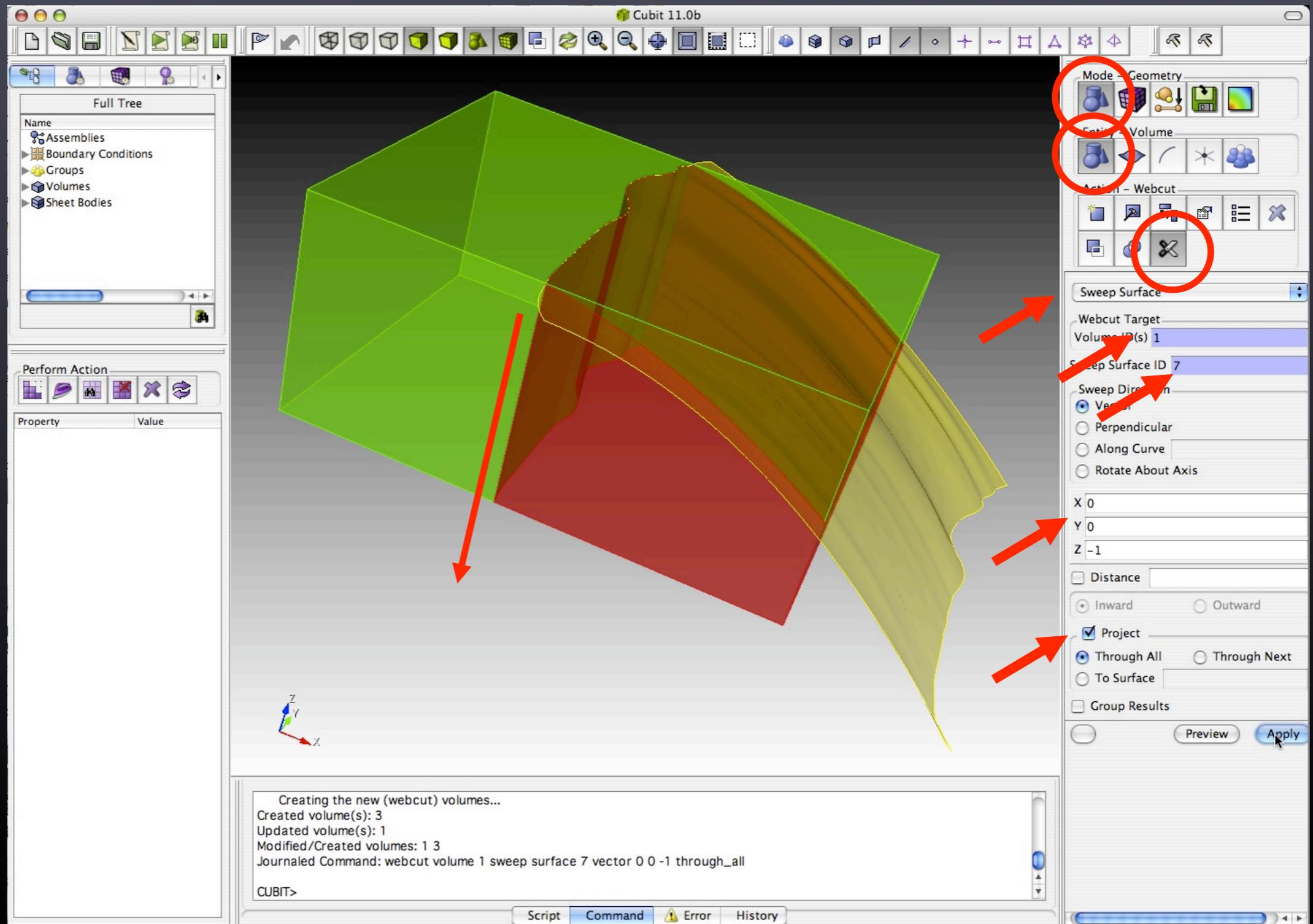
CUBIT a subduction zone

create surface skin curve 13 14 15
delete curve all



CUBIT a subduction zone

webcut volume 1 sweep surface 7 vector 0 0 1 through_all
webcut volume 1 sweep surface 7 vector 0 0 -1 through_all



CUBIT a subduction zone

surface 7 move x 0 y 0 z -15

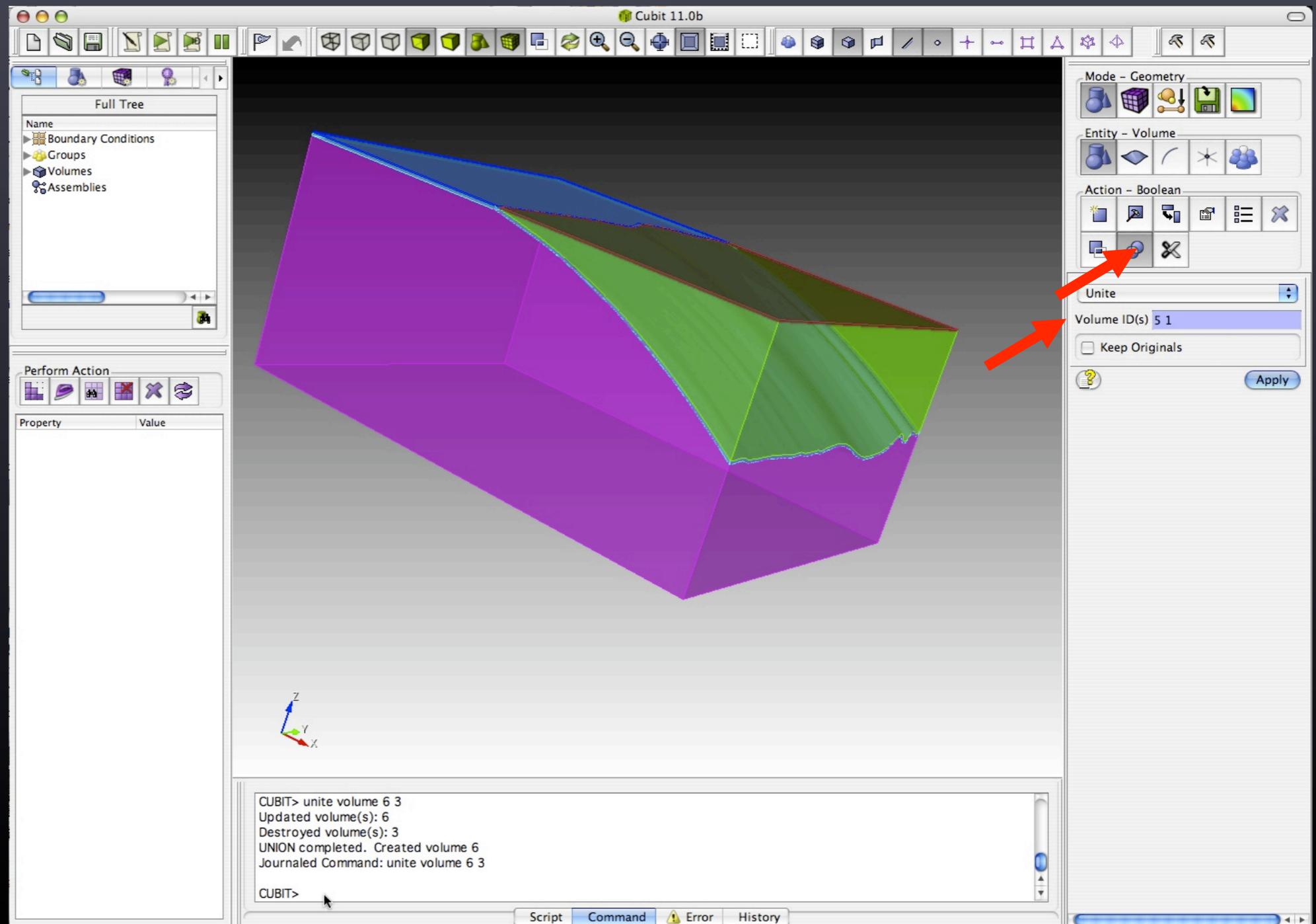
webcut volume 4 with sheet extended from surface 7

delete volume 2

webcut volume 1 sweep surface 35 vector -1 0 0 through_all

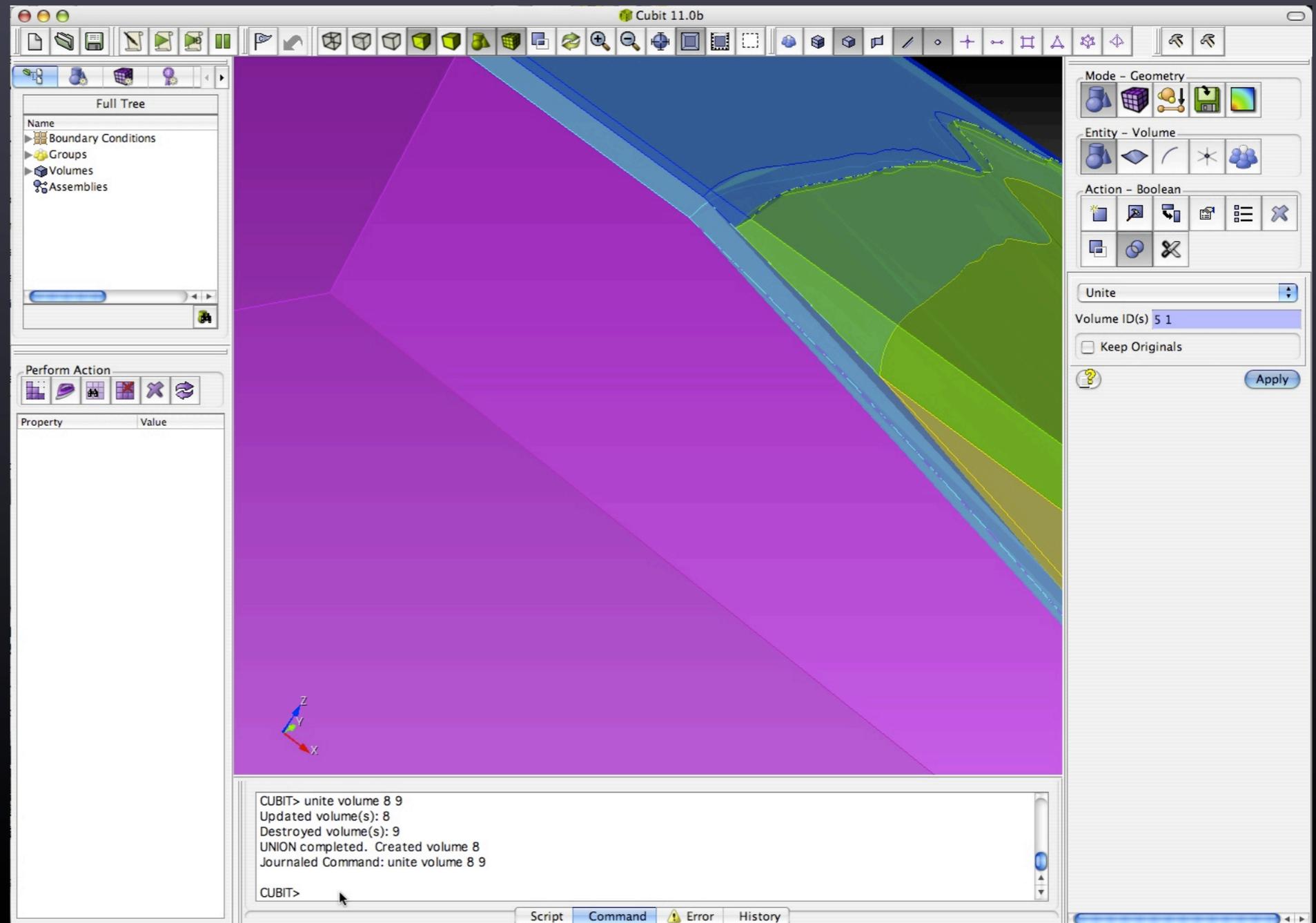
unite volume 4 7

unite volume 5 1



CUBIT a subduction zone

```
webcut volume 3 with plane zplane offset -10 noimprint nomerge  
webcut volume 3 sweep curve 102 vector .5 0 1 through_all  
unite volume 6 3  
webcut volume 8 with plane zplane offset -30 preview  
webcut volume 8 with plane zplane offset -30 noimprint nomerge  
unite volume 8 9
```



CUBIT a subduction zone

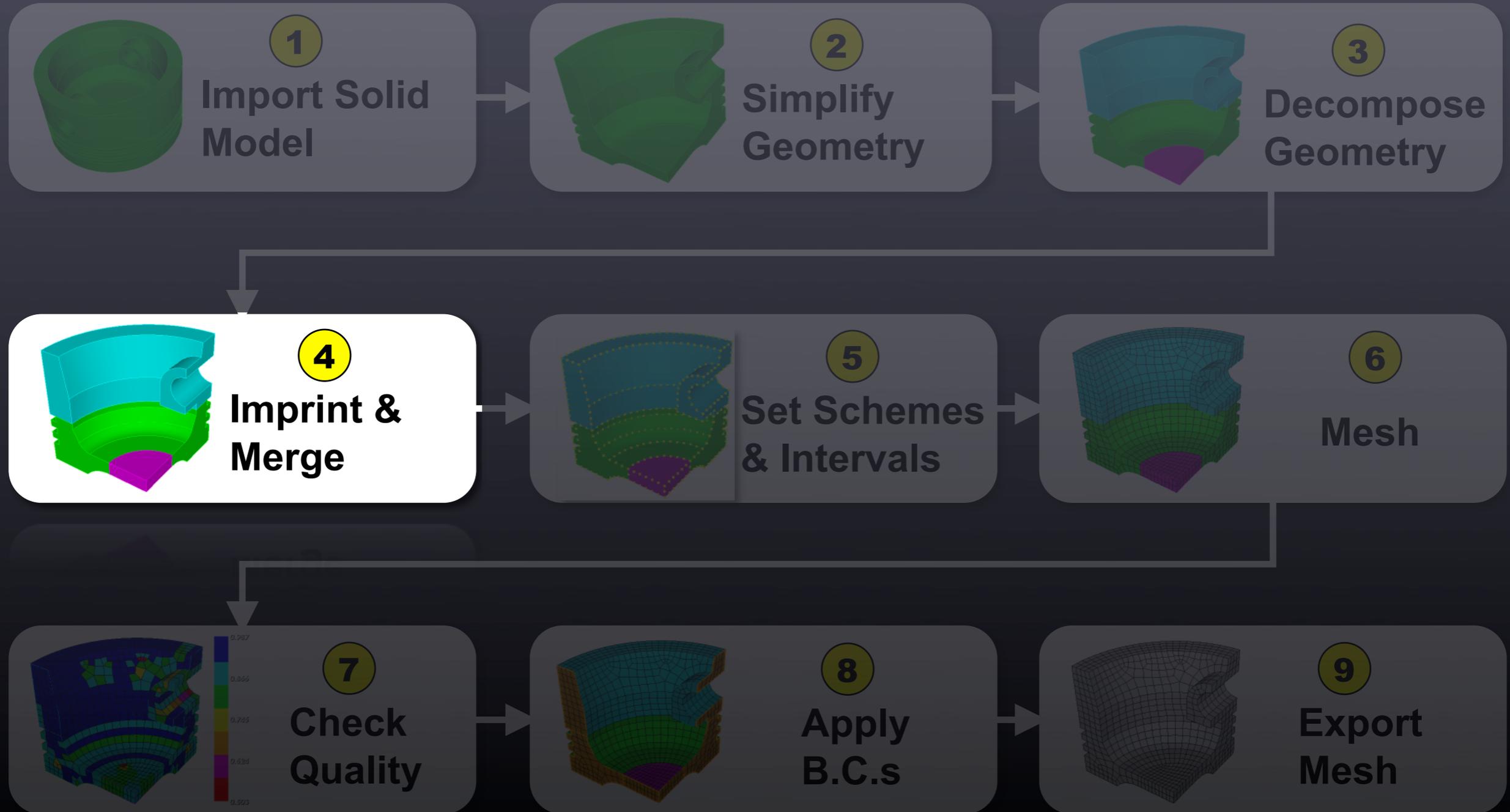
color Volume 4 10 red
color Volume 5 lightblue
color Volume 8 saddlebrown
regularize vol all
Volume 5 rename 'slab'

The screenshot shows the CUBIT 11.0b software interface. The central 3D view displays a complex geometric model of a subduction zone with various colored volumes. The left sidebar contains a 'Full Tree' and a 'Perform Action' panel. The 'Perform Action' panel shows a table of properties for the selected entity, Volume 5. An orange arrow points to the 'Name' field, which is currently set to 'slab'. The right sidebar shows the 'Unite' dialog box with 'Volume ID(s) 5 1' and the 'Apply' button. The bottom status bar shows the command history.

Property	Value
General	
Id	5
Type	Volume
Name	slab
Color	
Geometry	
Engine	ACIS
Volume	8.11467e+07
Meshing	
Is Meshed	No
Number of Ele...	0
Intervals	1
Interval Size	1
Meshed Volume	0
Mesh Scheme	Default
Smooth Scheme	Untangle

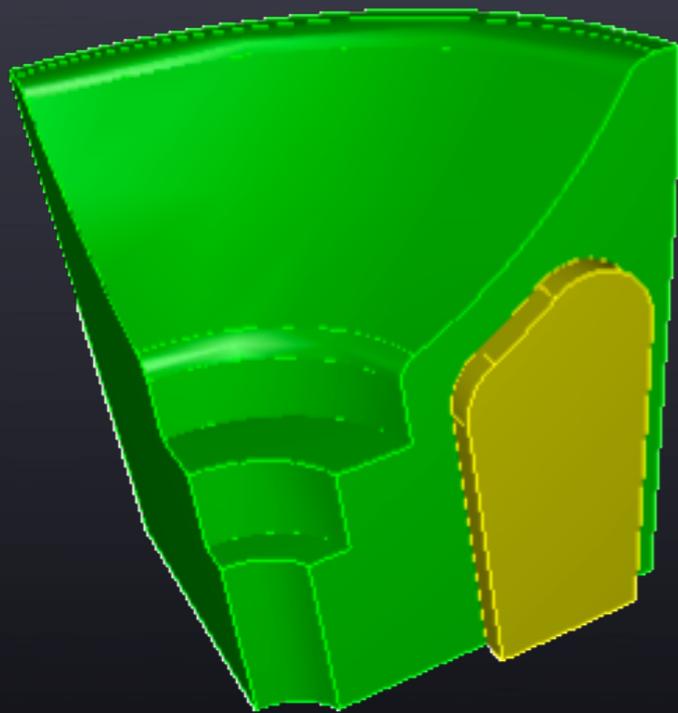
```
CUBIT>  
Journaled Command: volume 8 rename "lithosphere"  
  
Current entity is Volume 4.  
Current entity is Volume 10.  
Current entity is Volume 5.  
CUBIT>
```

CUBIT a subduction zone

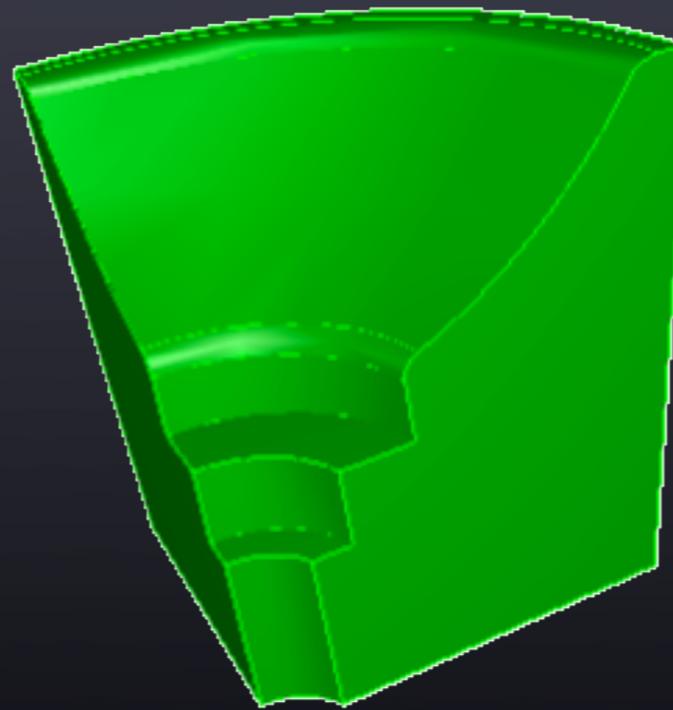


CUBIT a subduction zone

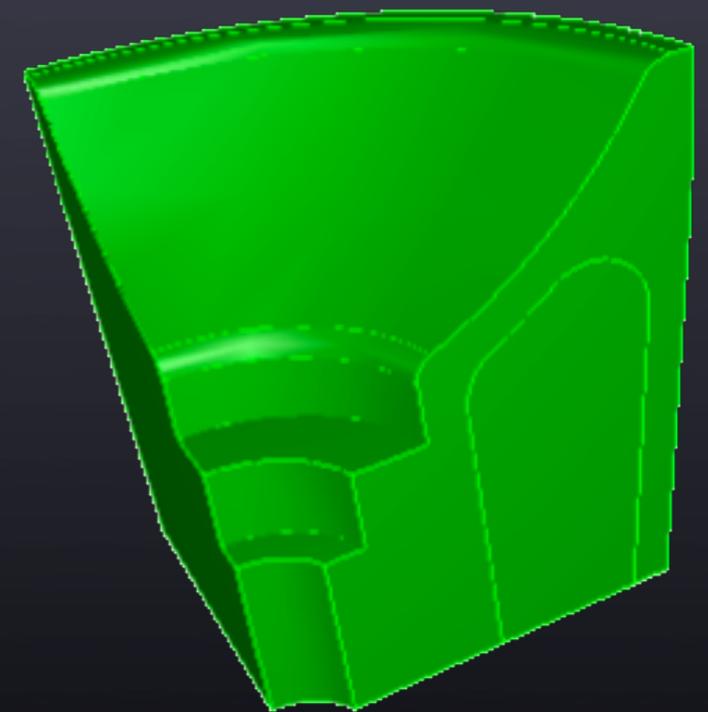
Imprint all
Merge all



Body 1 and 2



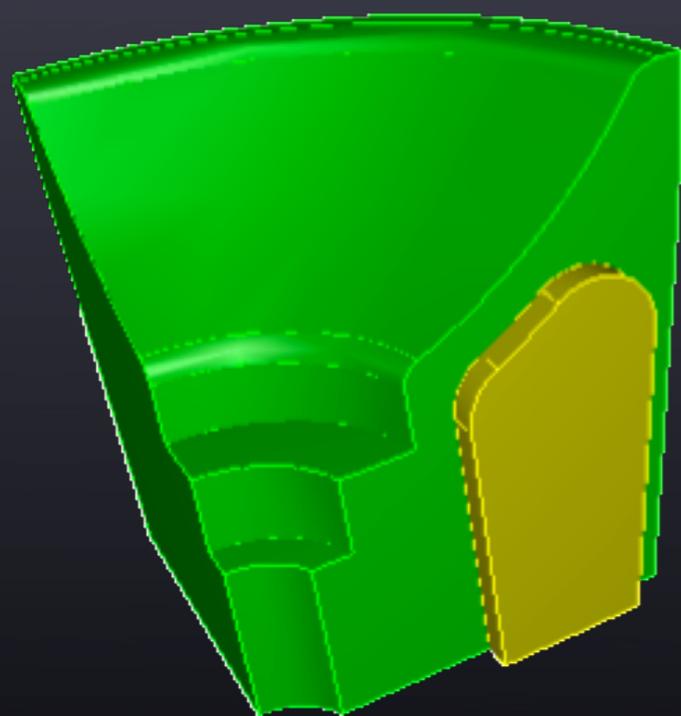
Body 1
before imprinting



Body 1
after imprinting

CUBIT a subduction zone

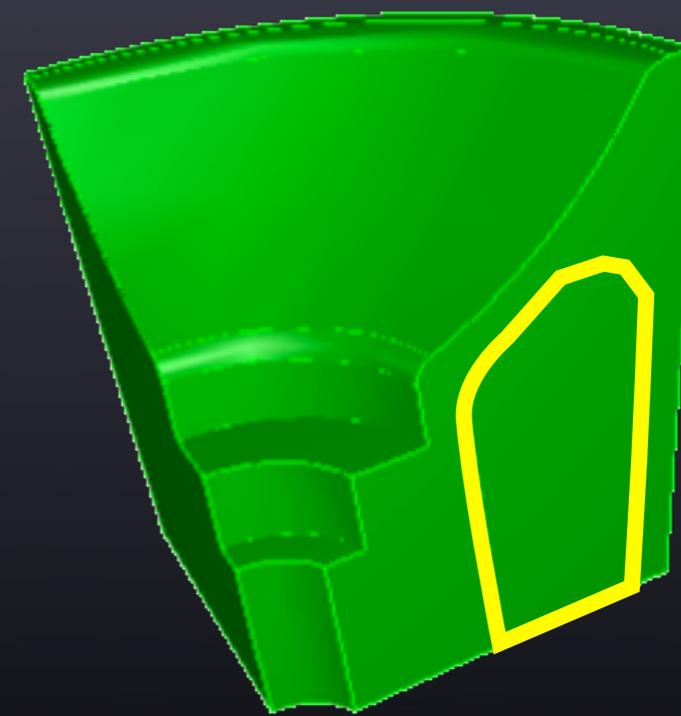
Imprint all
Merge all



Body 1 and 2

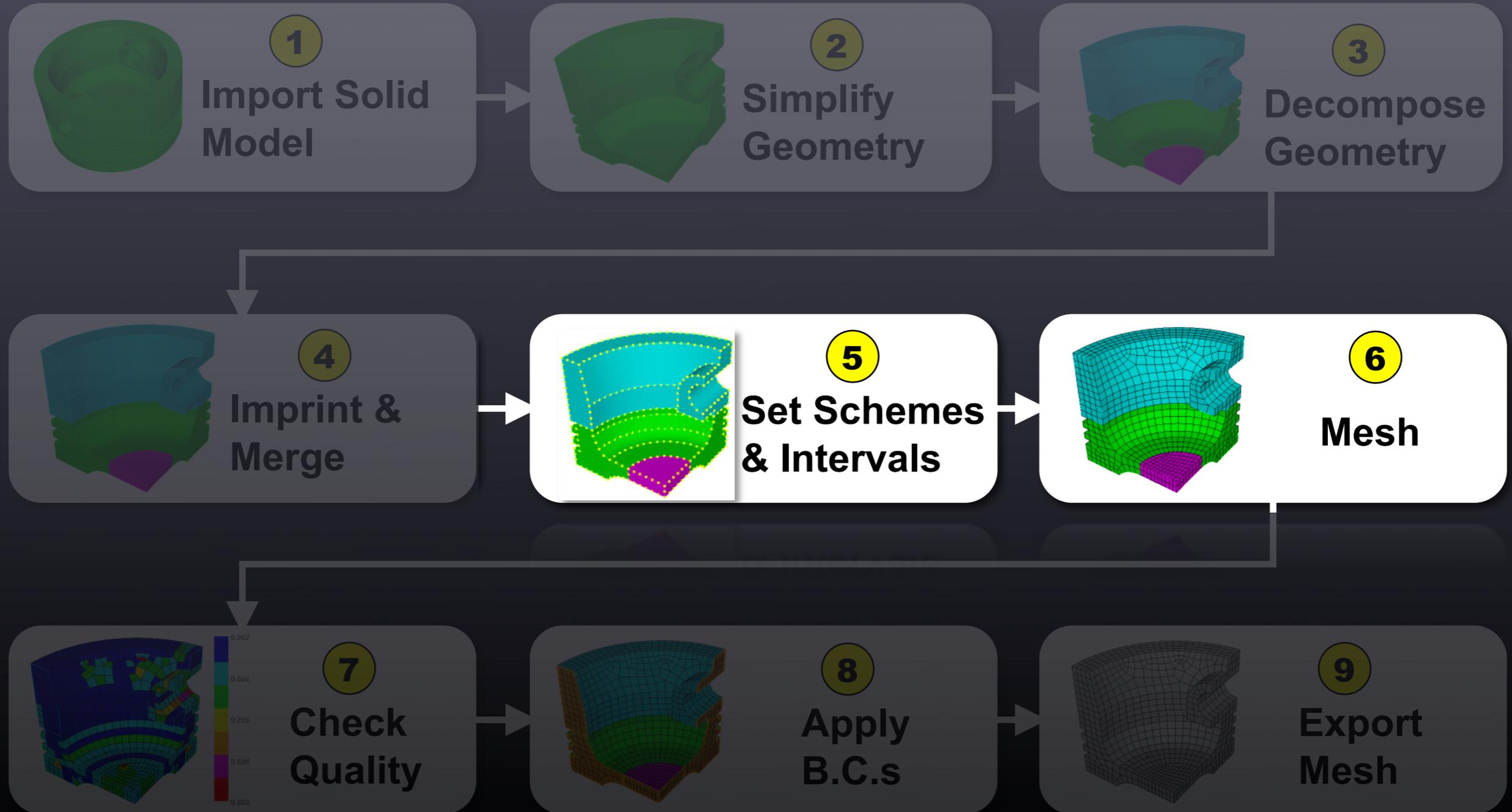


Body 1
before imprinting



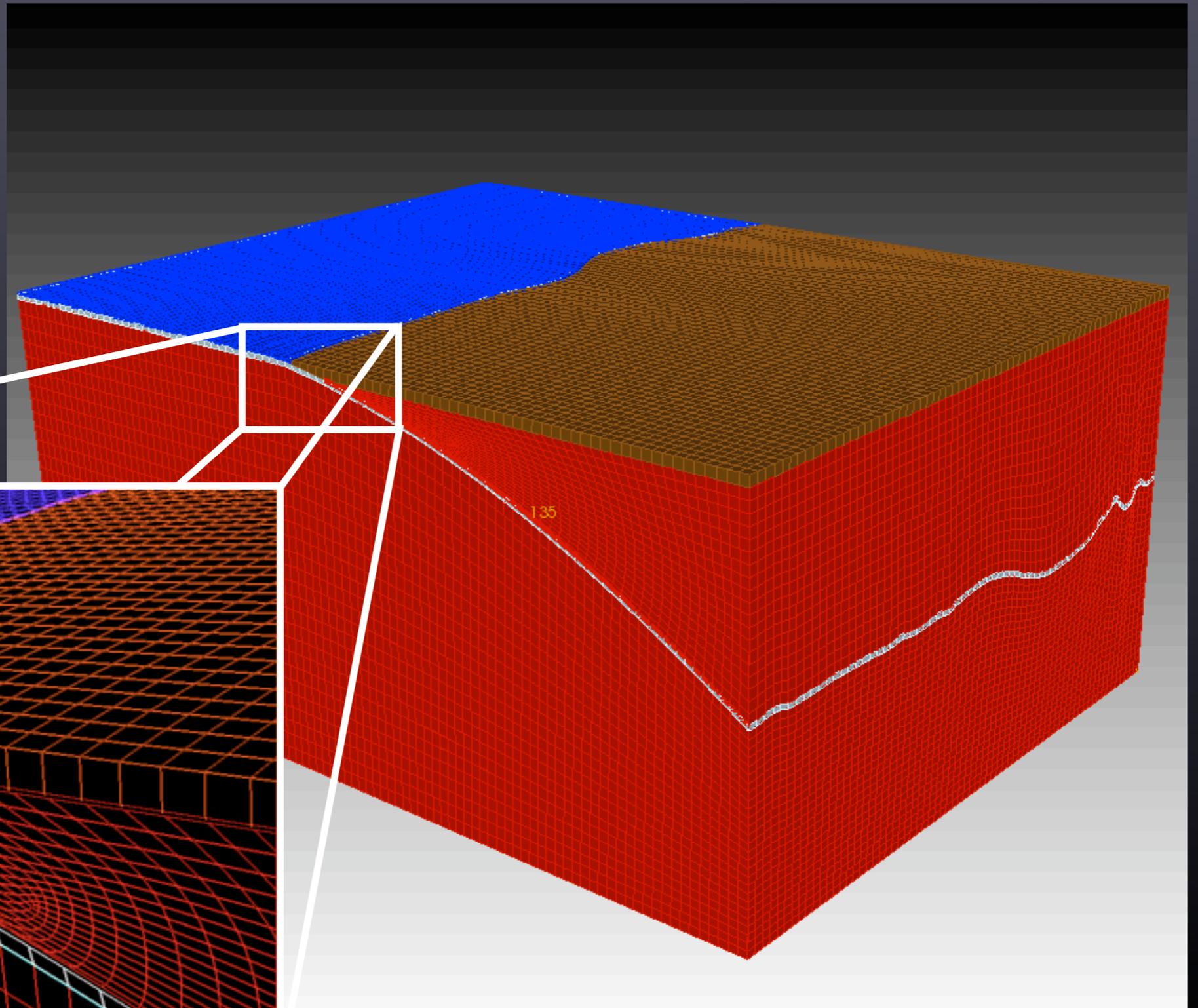
Body 1
after imprinting

CUBIT a subduction zone



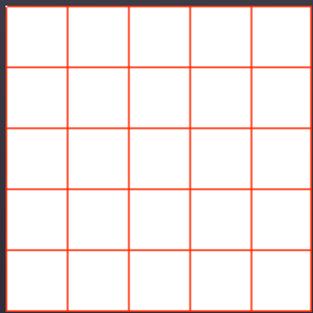
CUBIT a subduction zone

Vol all size 30
Mesh vol all

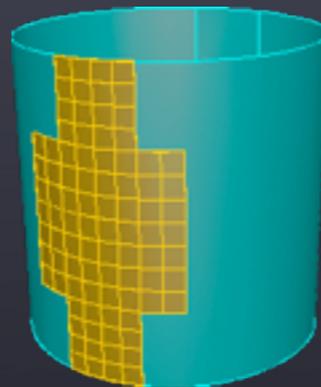
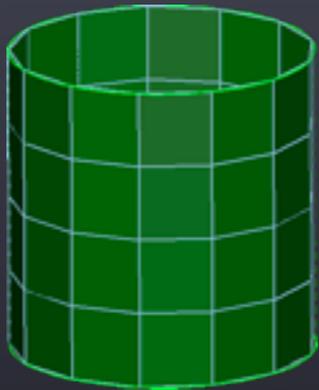


CUBIT meshing scheme

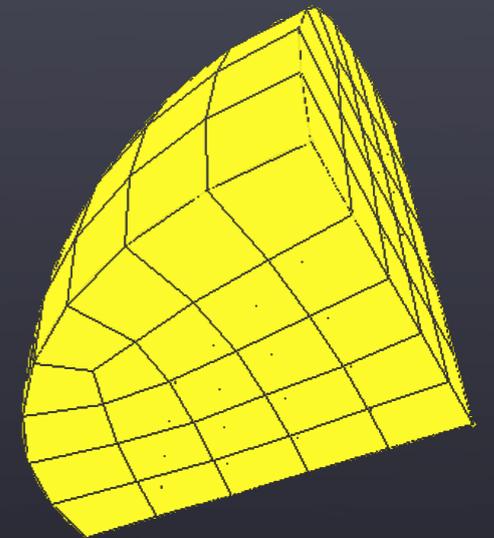
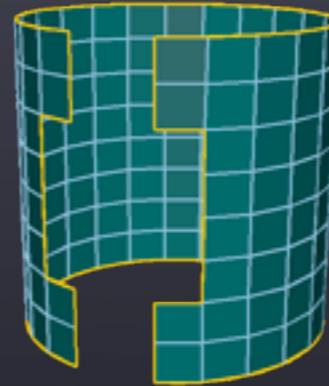
Surface meshing



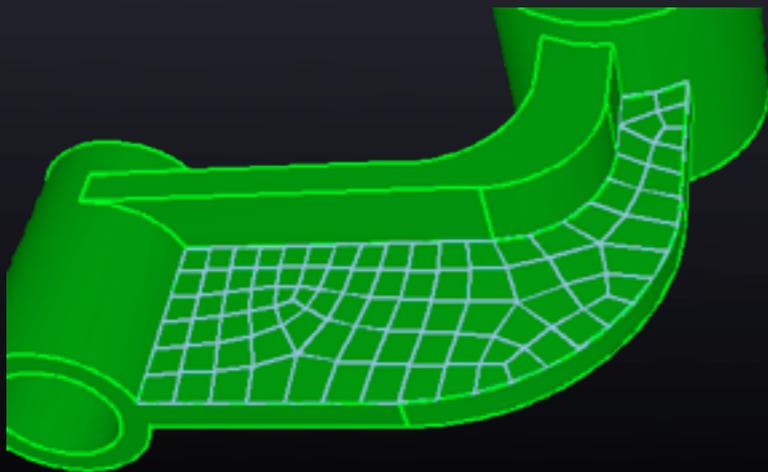
Mapped



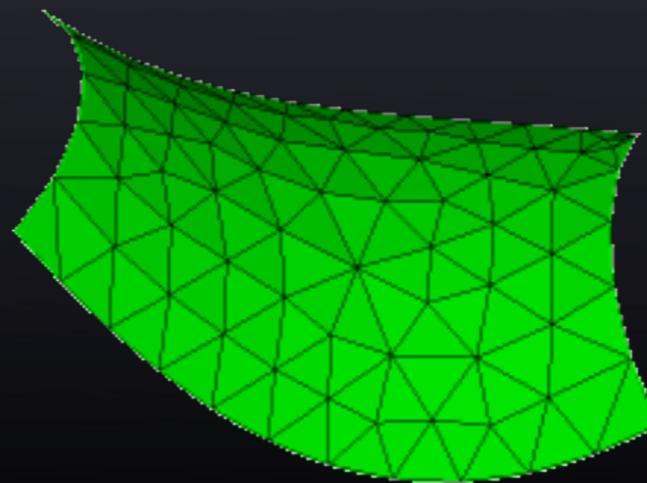
Sub-map



Triprimitive



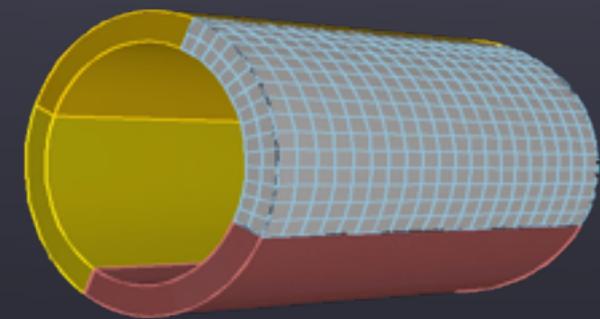
Pave



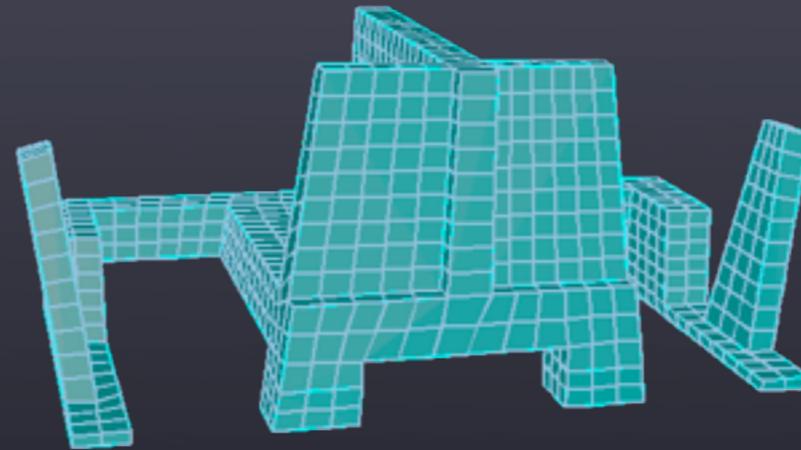
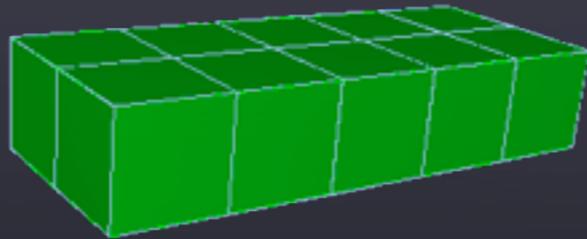
Trimesh

CUBIT meshing scheme

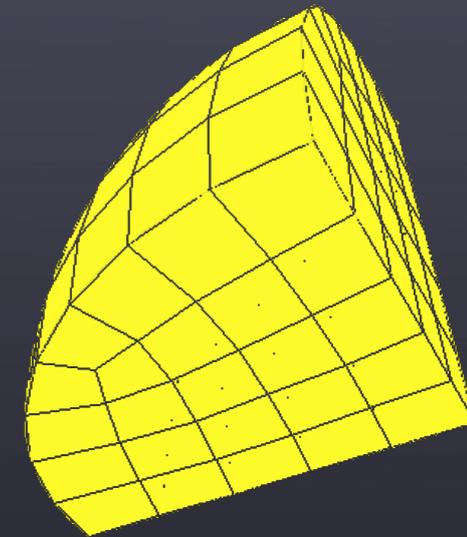
Volume meshing



Map



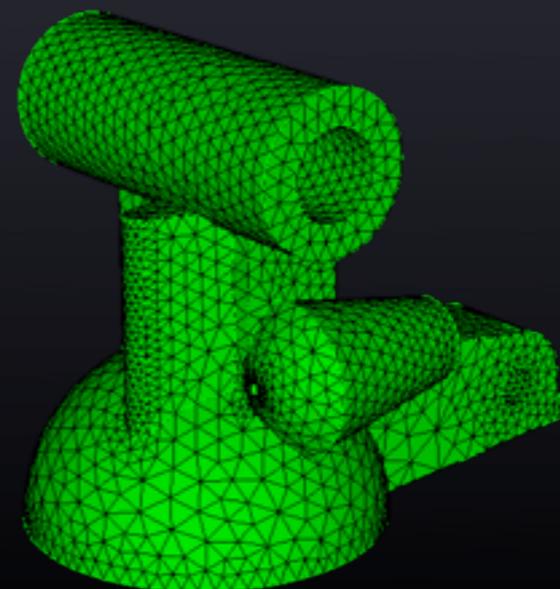
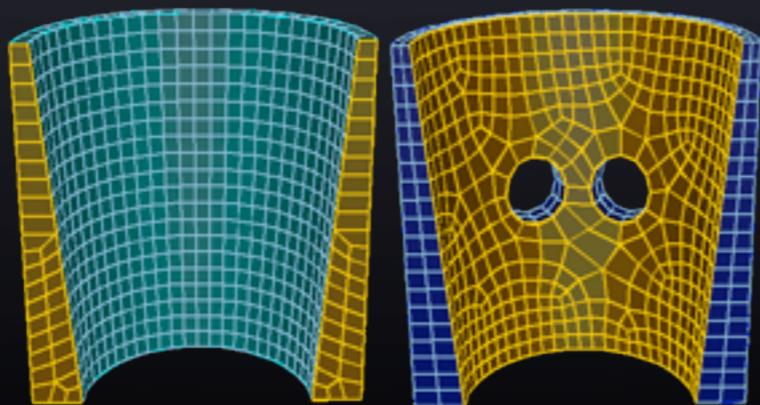
Sub-map



Triprimitive



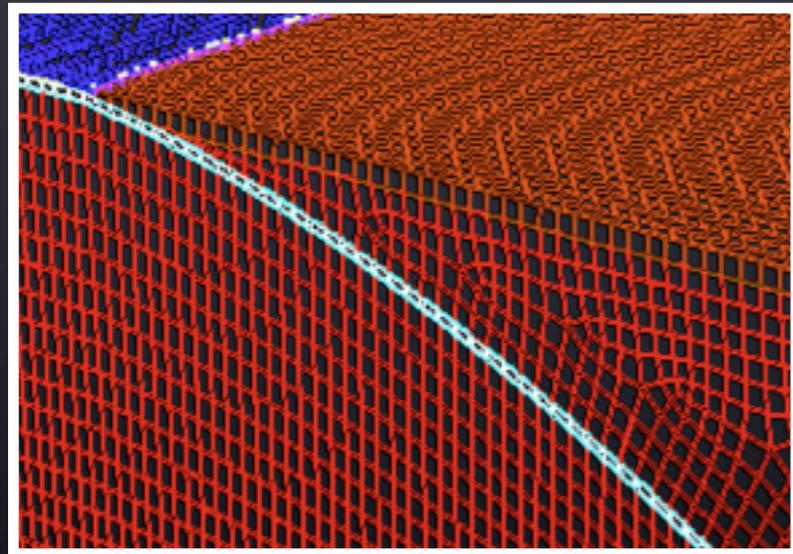
Sweep



Tetmesh

CUBIT a subduction zone

delete mesh volume 10 propagate
surface 78 scheme pave
mesh surface 78
volume 10 scheme Sweep source surface 78 target surface 80 rotate off
Mesh vol all



Mode - Meshing

Entity - Volume

Action - Mesh

Select Entities to Mesh

10

Select Meshing Scheme

Sweep

Advanced

Cubit Selects Source/Target

Source Surface ID(s) 78

Target Surface ID(s) 80

Approximate Sweep Direction

X Value

Y Value

Z Value

Rotate

Sweep Smooth Auto

Apply Scheme

Check For Overlapping Surfaces

Scheme: Default Mesh

Property	Value
General	
Id	80
Type	Surface
Name	Surface 80
Color	Not Set
Geometry	
Is Merged	No
Is Virtual	No
Engine	ACIS
Surface Area	281296
Analytic Type	
Meshing	
Is Meshed	No
Number of Ele...	0
Intervals	1
Interval Size	30
Meshed Area	0
Mesh Scheme	Pave
Smooth Scheme	Untangle

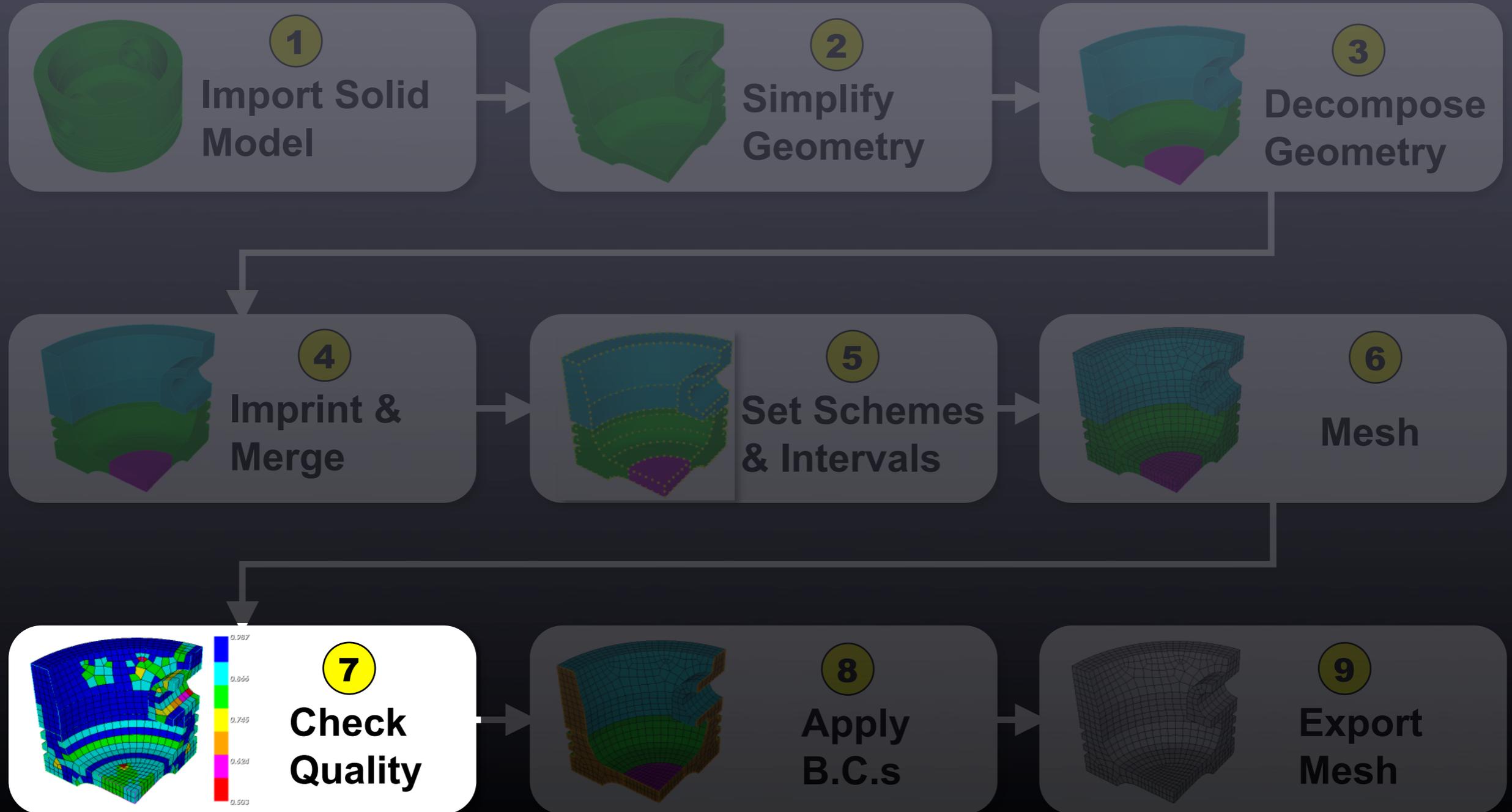
```
CUBIT> volume 10 scheme Sweep source surface 78 target surface 80 rotate off
Journaled Command: volume 10 scheme sweep source surface 78 target surface 80 rotate off

CUBIT> volume 10 sweep smooth Auto
Journaled Command: volume 10 sweep smooth auto

CUBIT> |
```

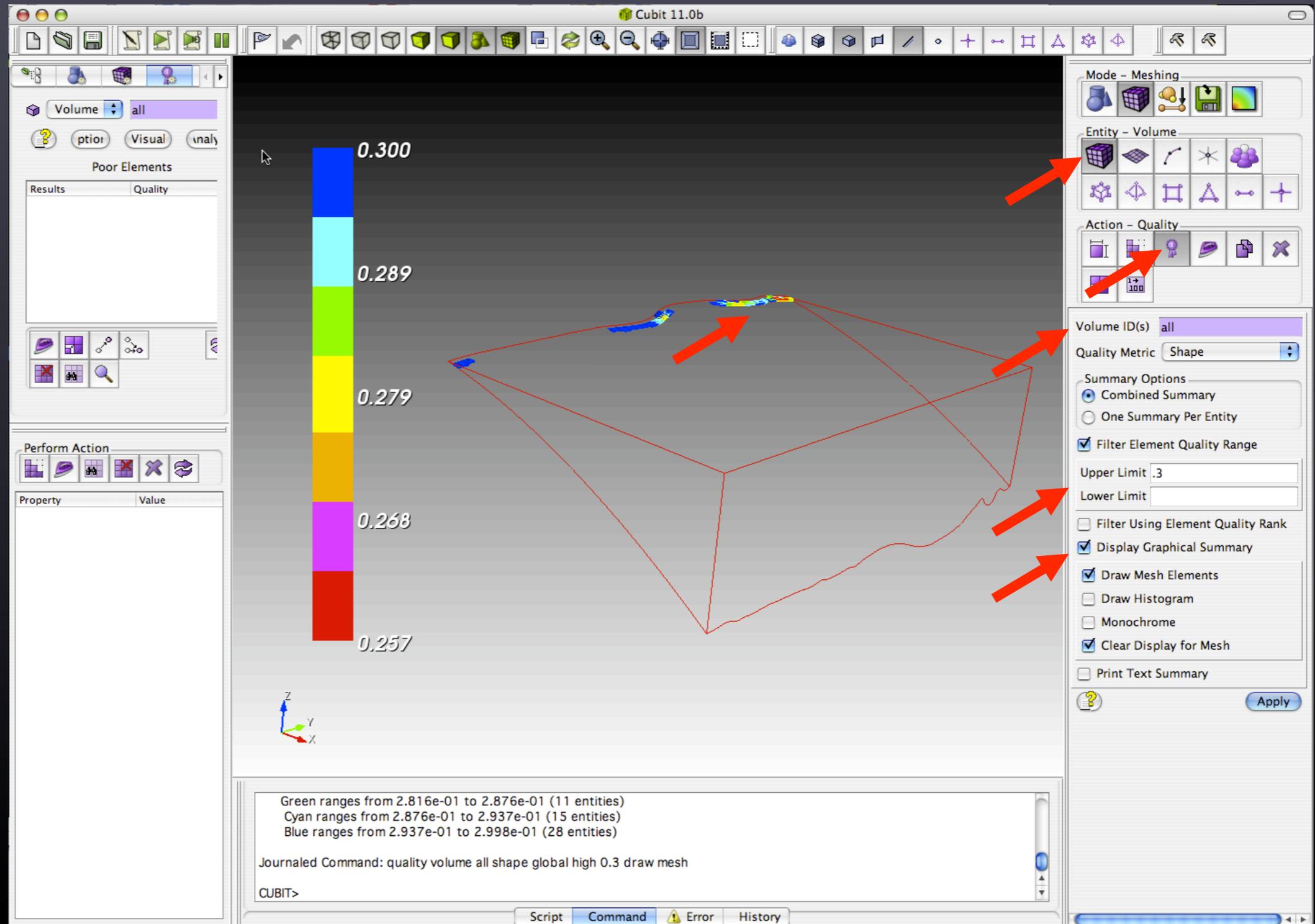
Working Directory: /Users/emanuele/Desktop

CUBIT a subduction zone



CUBIT a subduction zone

quality volume all Shape global list
quality volume all Shape global high .3 draw mesh list
list model



CUBIT a subduction zone

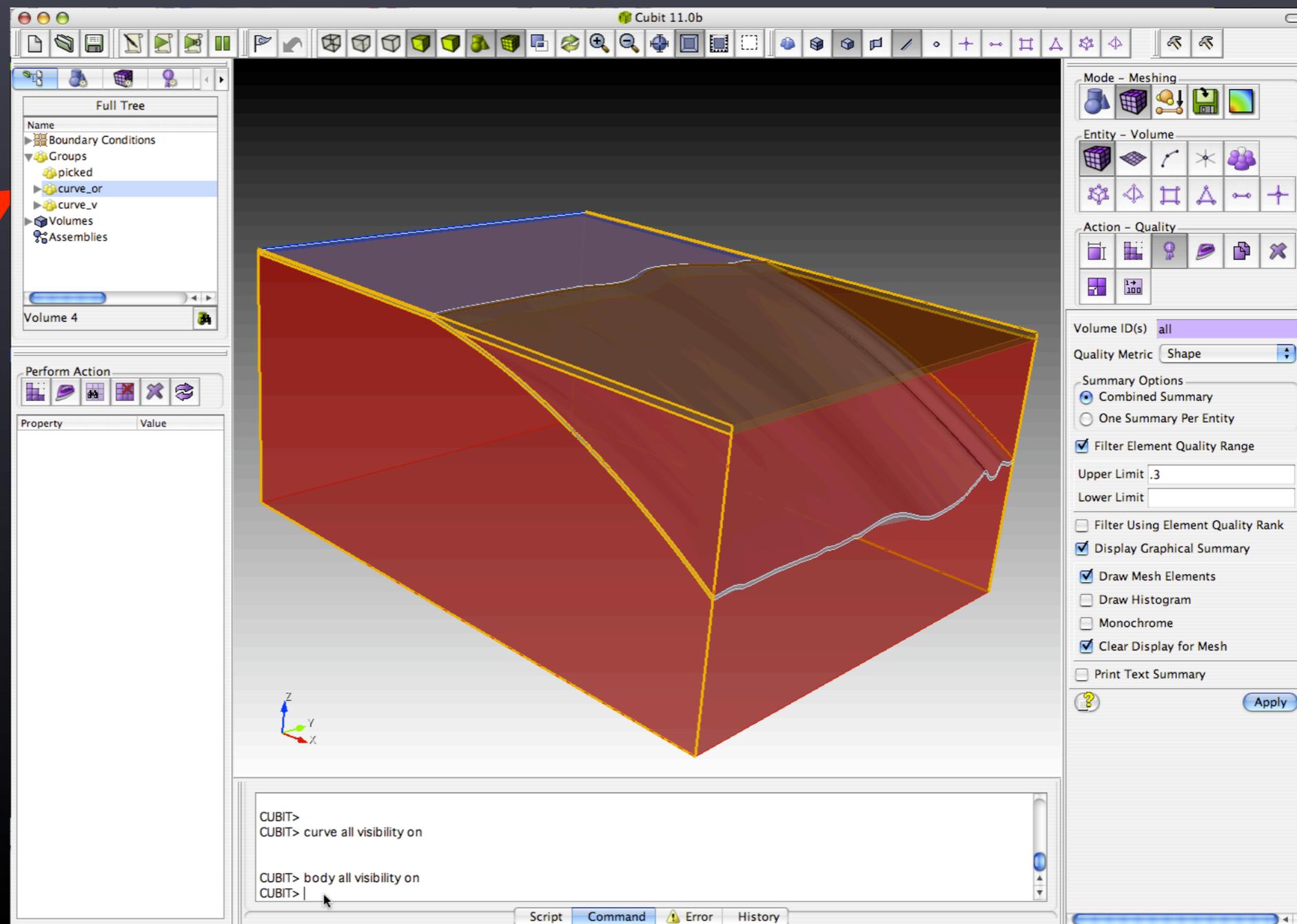
reset vol all

create group 'curve_or'

group 'curve_or' add Curve with $Y_{\text{coord}} > 970$

group 'curve_or' add Curve with $Y_{\text{coord}} < -900$

group 'curve_v' add Curve all except curve in group 2



CUBIT a subduction zone

vol all size 30

curve in group 3 interval 55

curve in group 3 scheme dualbias fraction 0.04

mesh vol all

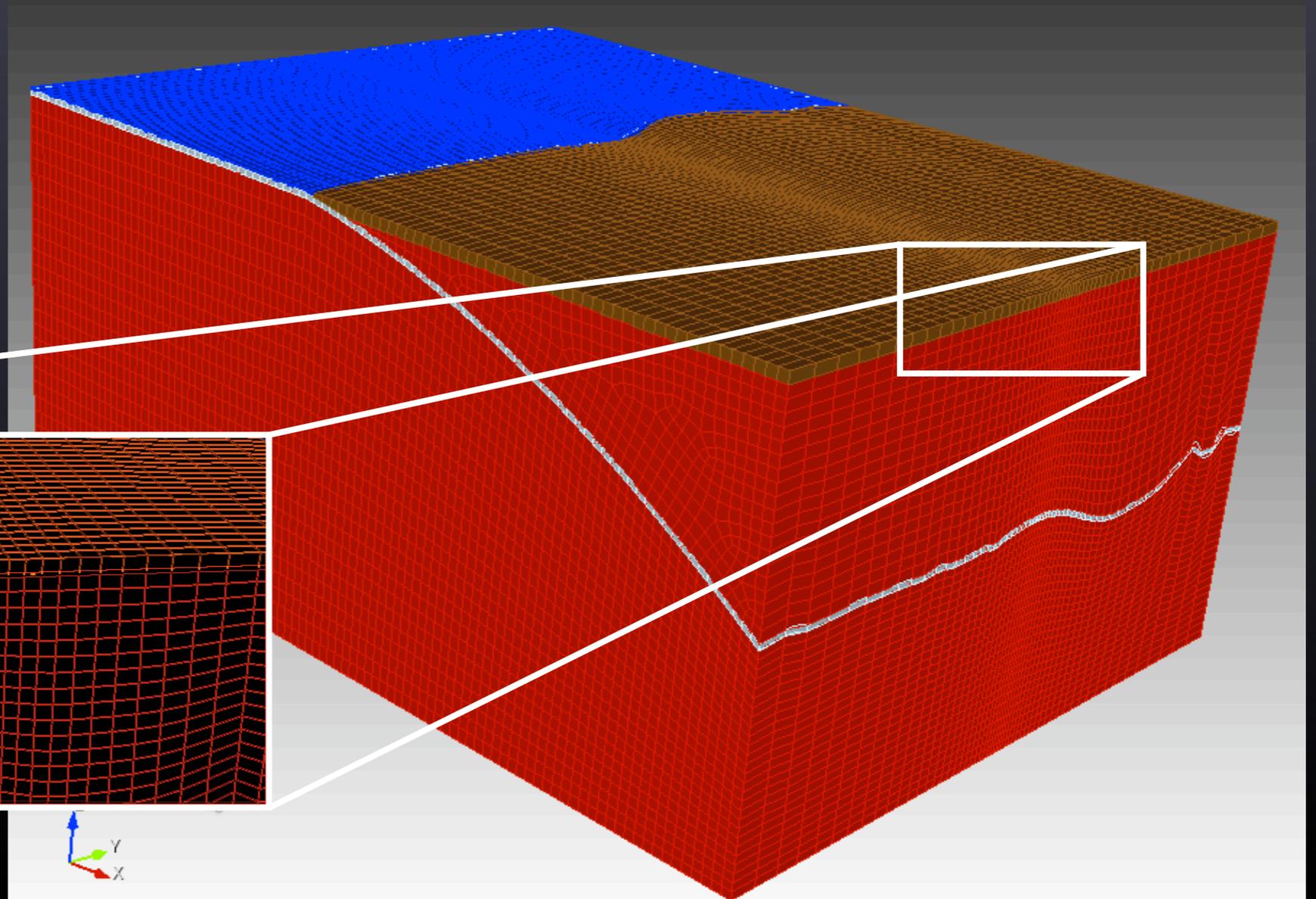
delete mesh vol 10 prop

surface 80 scheme pave

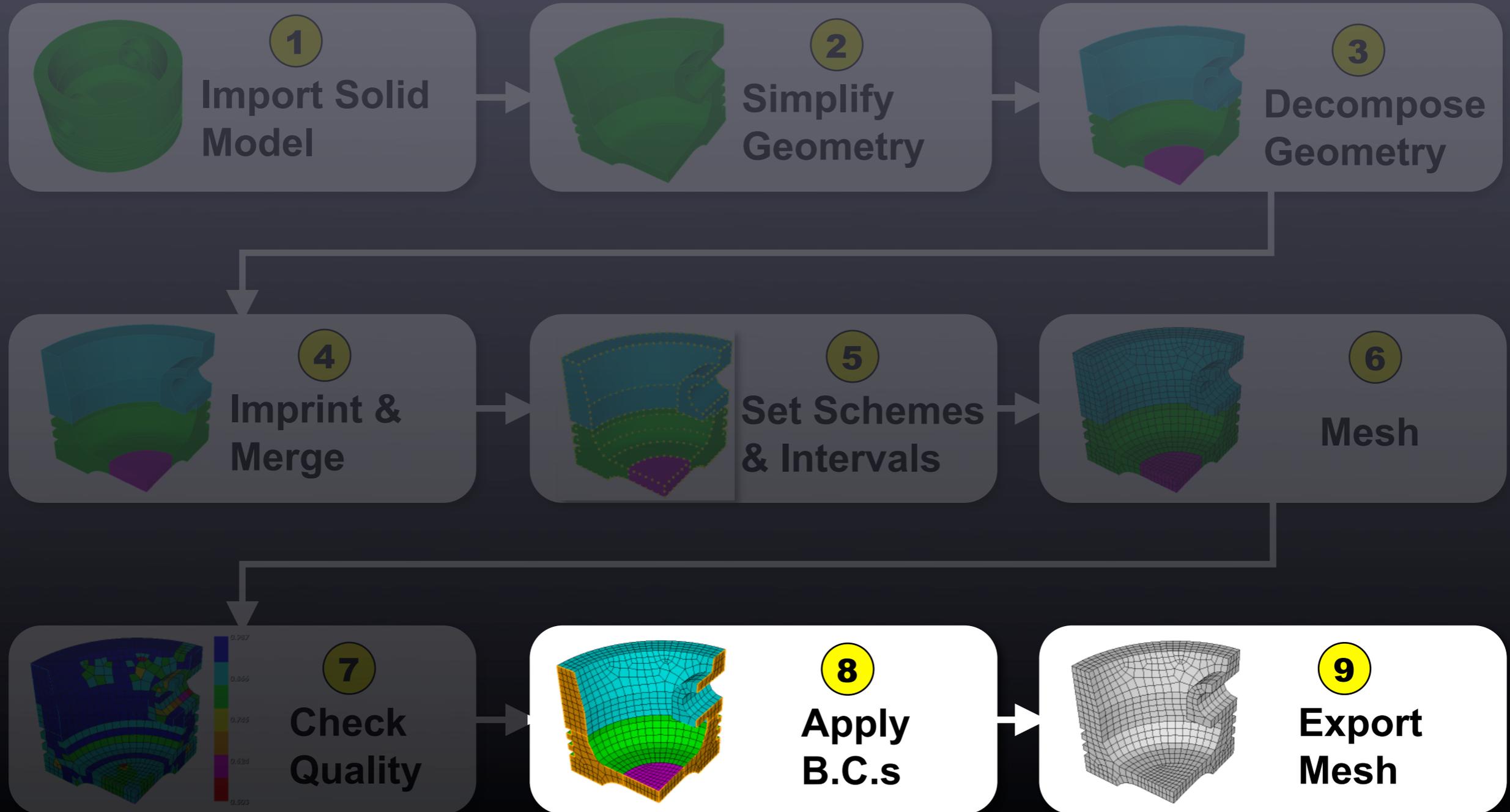
volume 10 scheme Sweep source surface 80 target surface 78 rotate off

mesh surface 80

mesh vol all



CUBIT a subduction zone



CUBIT a subduction zone

block 1 volume 8 , block 2 volume 10 4, block 3 volume 6 , block 4 volume 5

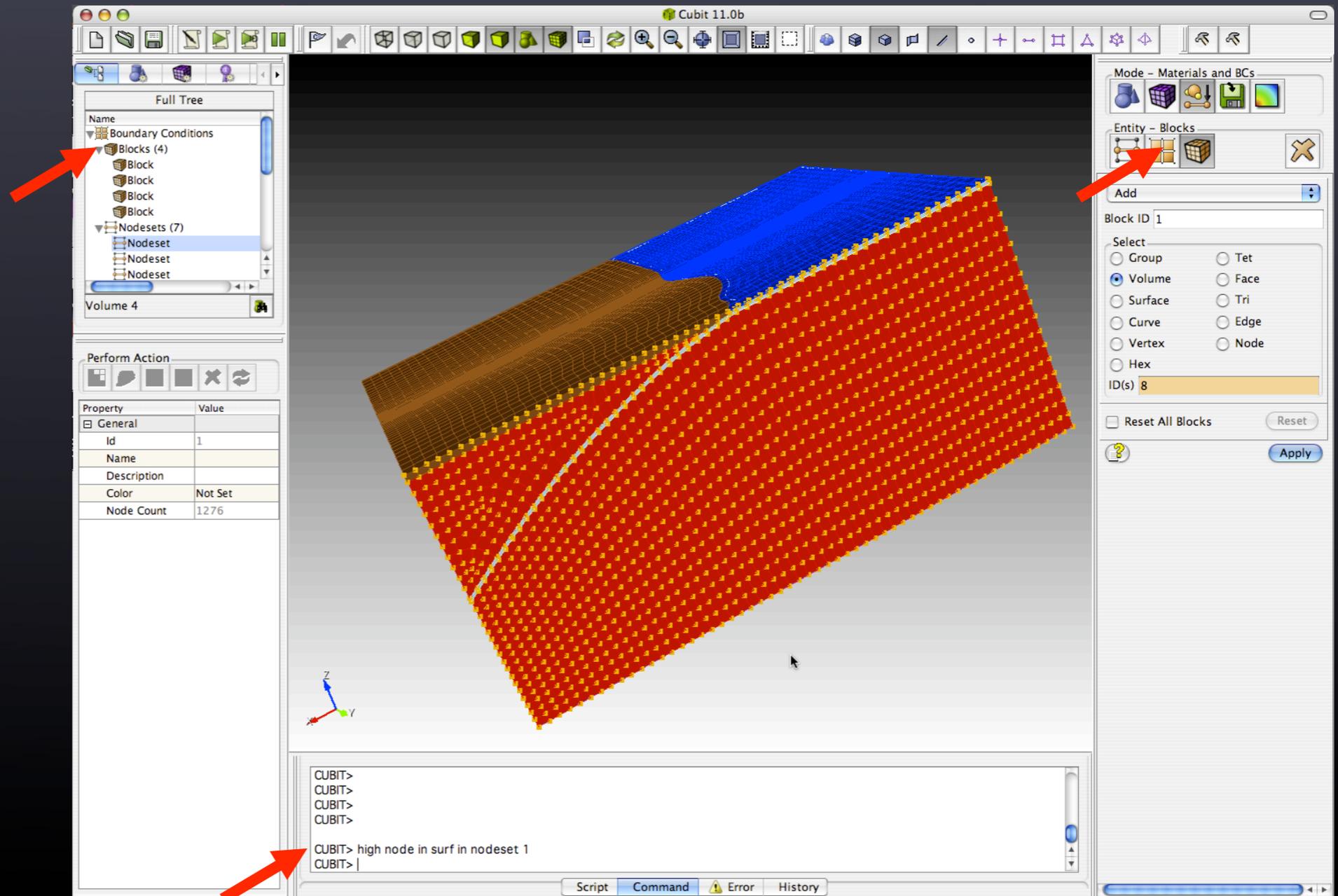
nodeset 1 surface 31 34 39 72 80 , nodeset 2 surface 29 78 74 41 36

nodeset 3 surface 77 75 33 , nodeset 4 surface 42 40 50 , nodeset 5 surface 70 10 , nodeset 6 surface 26

group "fault" add node in surf 73 79 with $y_coord < 295$ and with $(y_coord + 300 > 0$ and $x_coord < 127 > 0$)

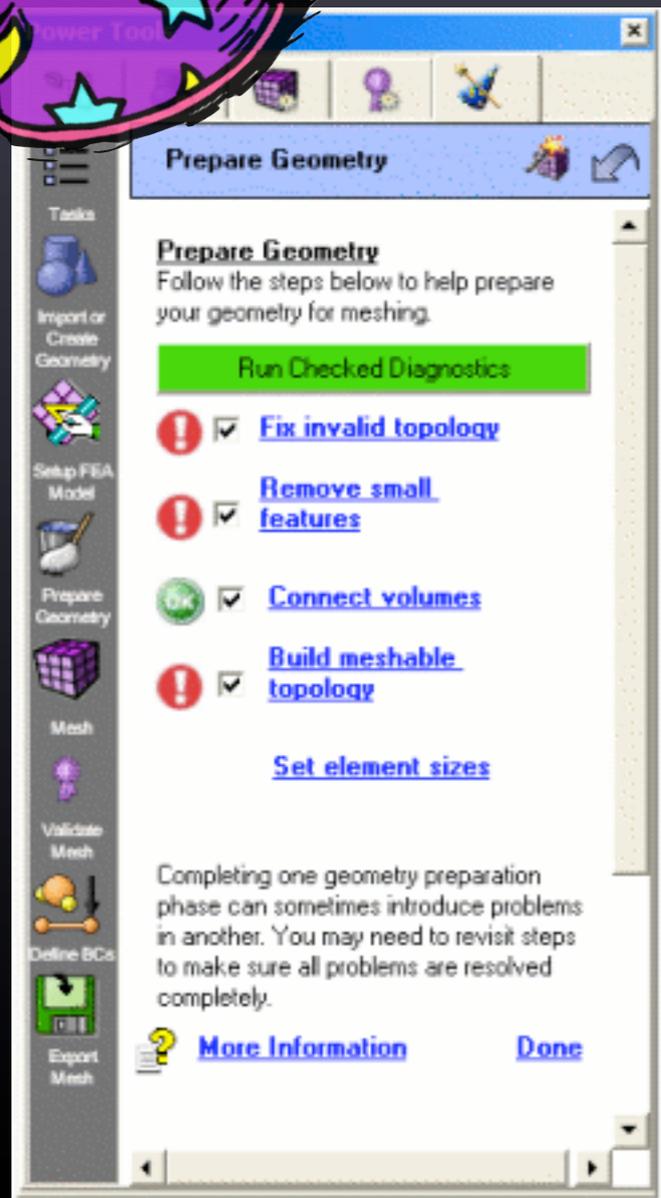
nodeset 7 group 4

export mesh "subduction.e" overwrite



CUBIT ITEM

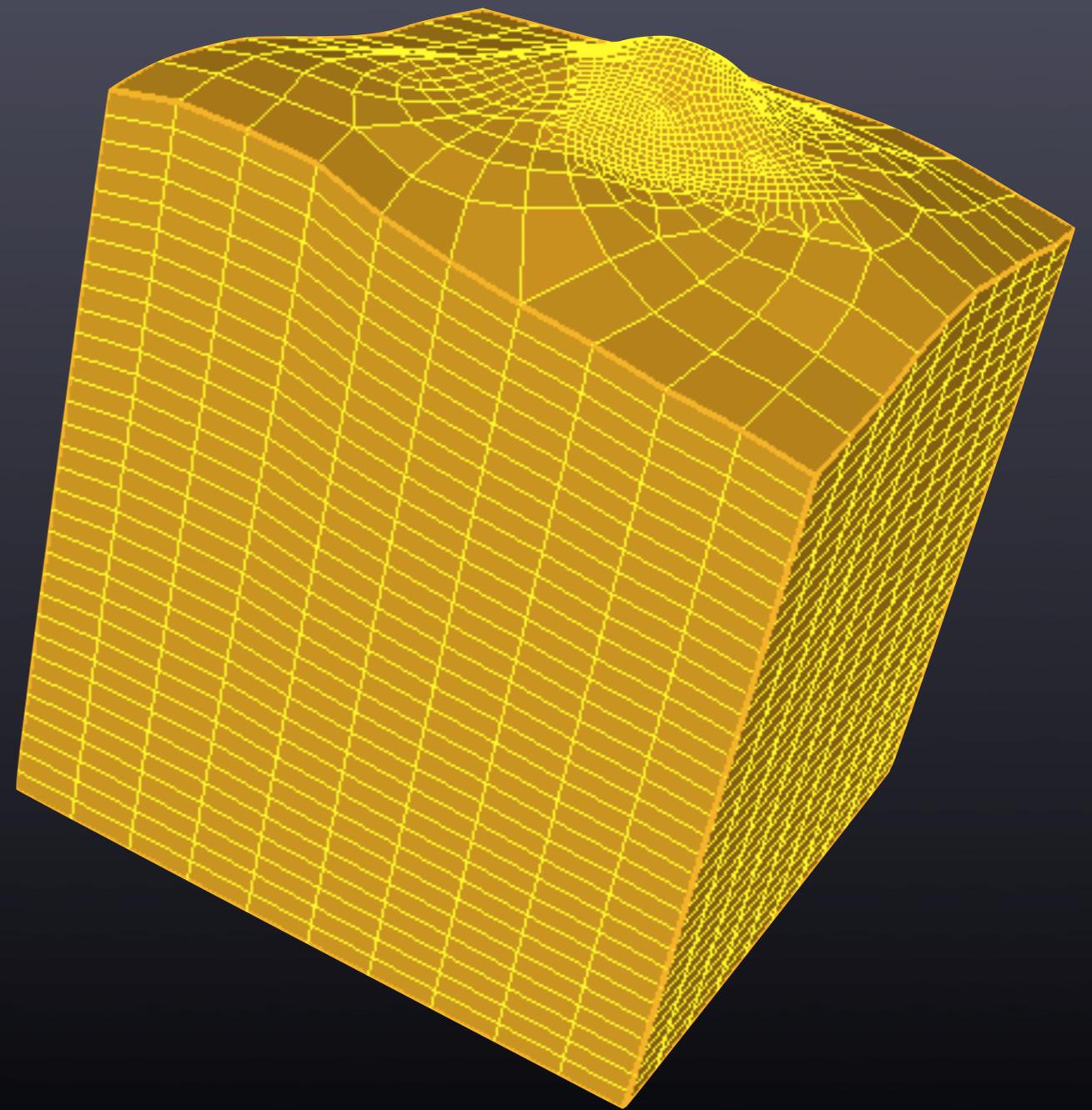
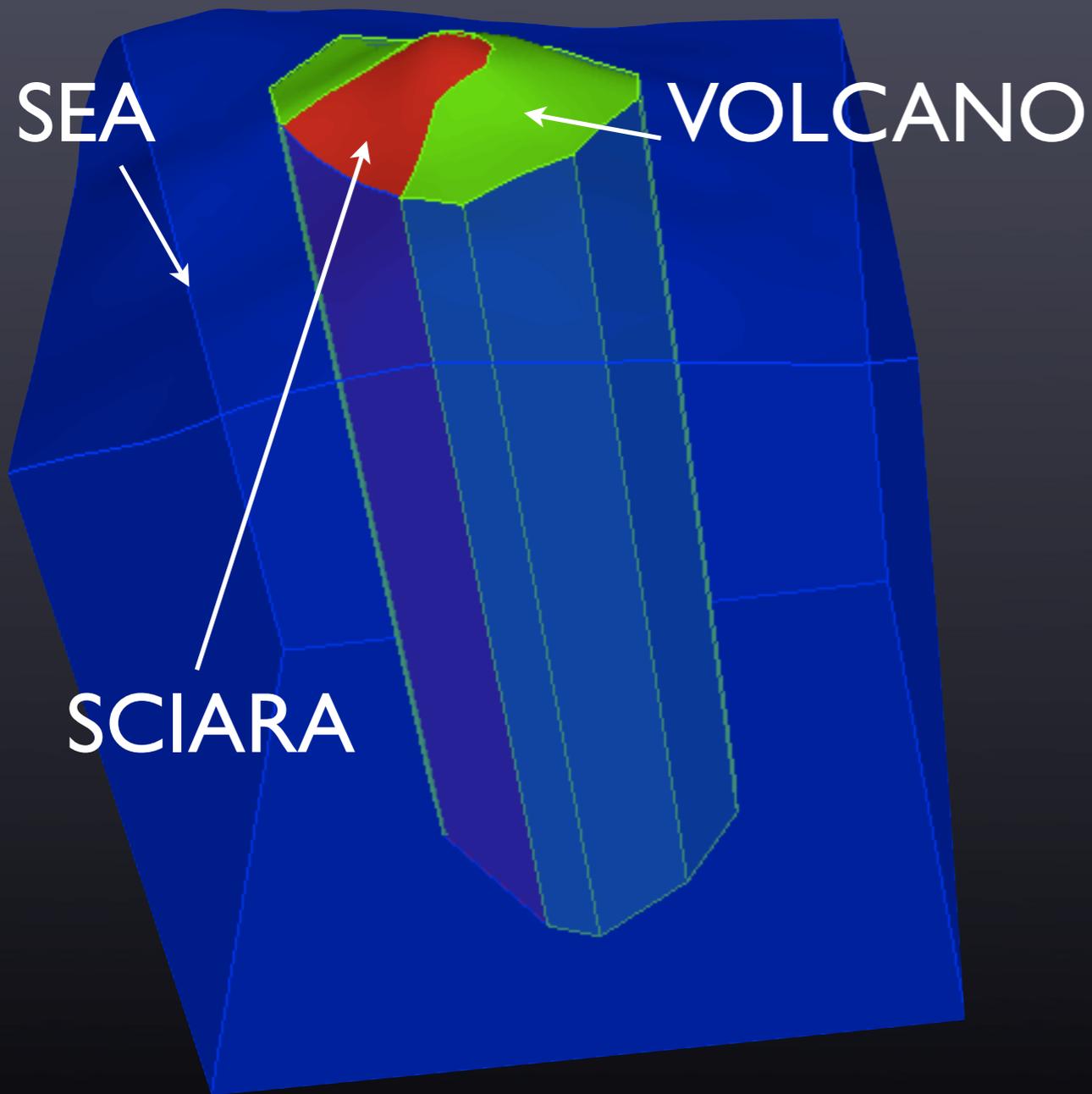
Immersive **T**opology Environment for **M**eshing



ITEM integrates model building expertise within a smart system that will diagnose potential problems and visually preview specific solutions that can be easily executed.

Many of the solutions developed in ITEM are exclusive to this tool and represent a significant advance in pre-processing technology for analysis. For example, the ability to automatically rebuild the local topology of a solid model to simplify the model for analysis, the ability to adjust local topology to correct for misalignments in assemblies as well as the ability to present alternatives for geometry decomposition to admit a hexahedral mesh topology.....

CUBIT a volcano (Stromboli)



CUBIT a volcano - 1

```
open "geometry_stromboli_600m.sat"  
surface 4 size 900  
surface 18 size 300  
surface 26 size 100  
surface 4 18 26 scheme pave  
mesh surface 4 18 26  
vol all size 100  
mesh vol all
```

CUBIT a volcano - 1

```
open "geometry_stromboli_600m.sat"
```

```
surface 4 size 900
```

```
surface 18 size 300
```

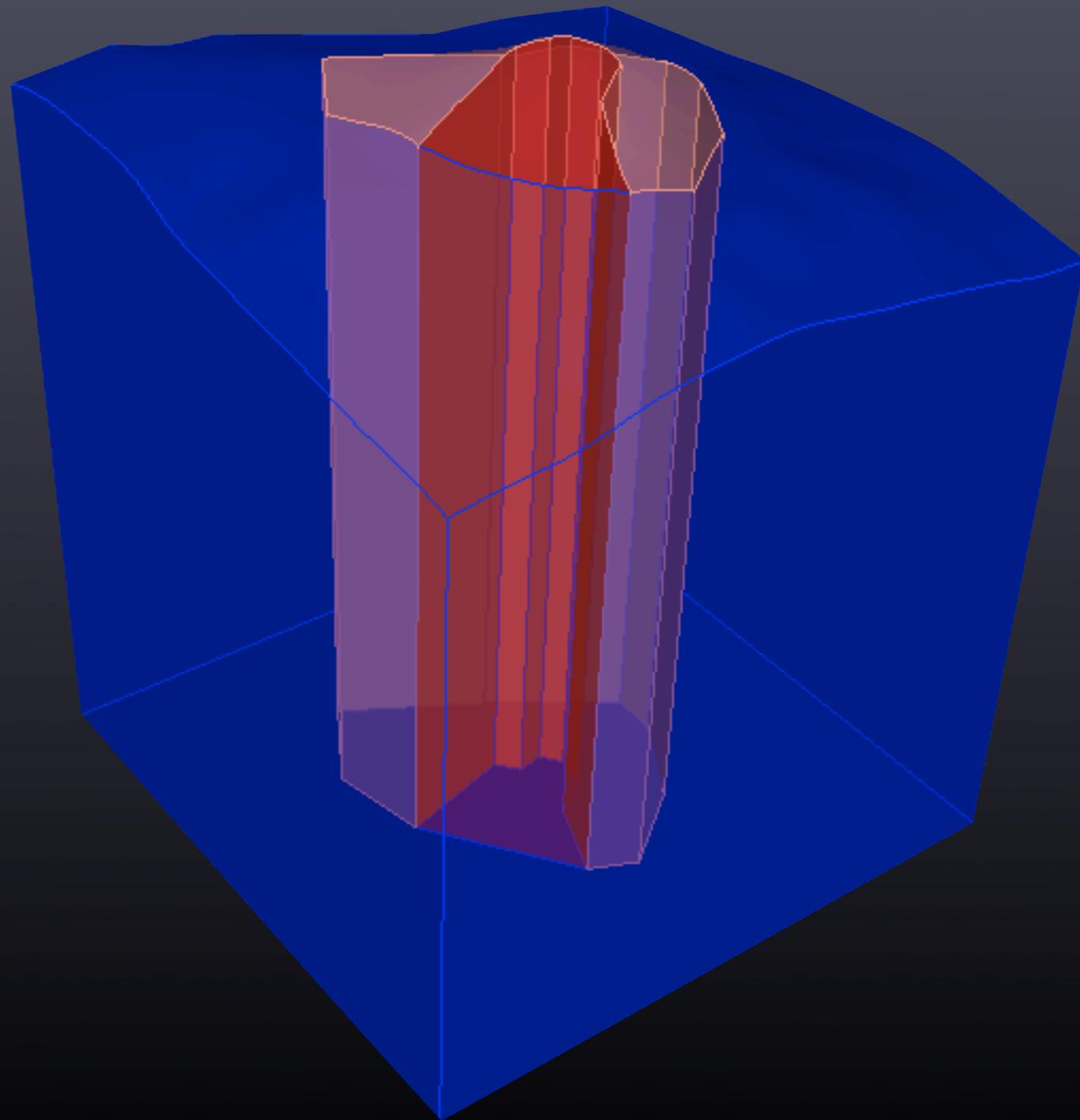
```
surface 26 size 100
```

```
surface 4 18 26 scheme pave
```

```
mesh surface 4 18 26
```

```
vol all size 100
```

```
mesh vol all
```



CUBIT a volcano - 1

```
open "geometry_stromboli_600m.sat"
```

```
surface 4 size 900
```

```
surface 18 size 300
```

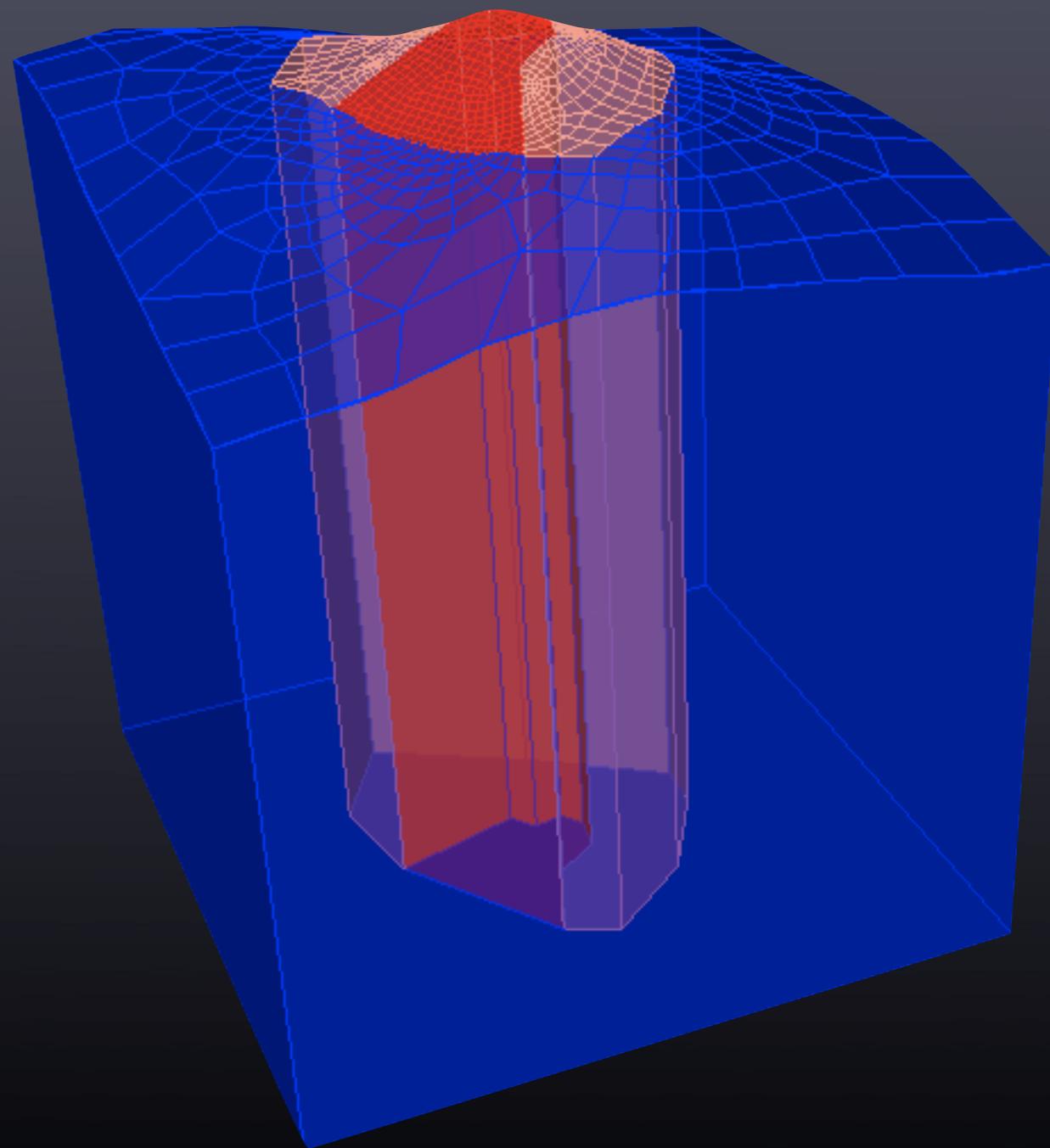
```
surface 26 size 100
```

```
surface 4 18 26 scheme pave
```

```
mesh surface 4 18 26
```

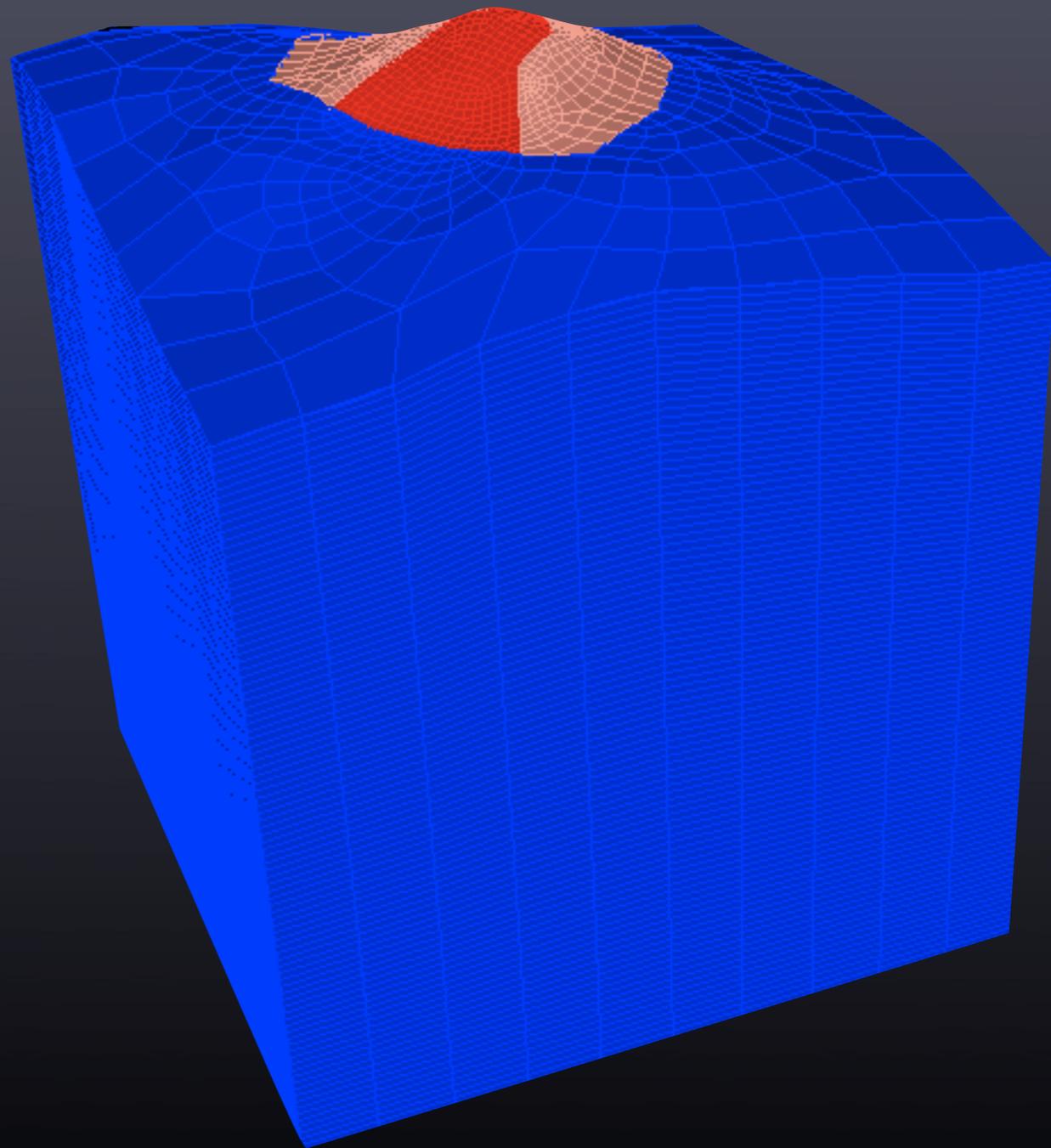
```
vol all size 100
```

```
mesh vol all
```



CUBIT a volcano - 1

```
open "geometry_stromboli_600m.sat"  
surface 4 size 900  
surface 18 size 300  
surface 26 size 100  
surface 4 18 26 scheme pave  
mesh surface 4 18 26  
vol all size 100  
mesh vol all
```



CUBIT a volcano - 2

```
open "geometry_stromboli_600m.sat"  
surface 4 size 900  
surface 18 size 300  
surface 26 size 300  
surface 4 18 26 scheme pave  
mesh surface 4 18 26  
vol all size 300
```

```
mesh vol all  
refine hex in sciara with Z_coord > -2000....  
... except hex in node in (sea volcano)
```

CUBIT a volcano - 2

```
open "geometry_stromboli_600m.sat"
```

```
surface 4 size 900
```

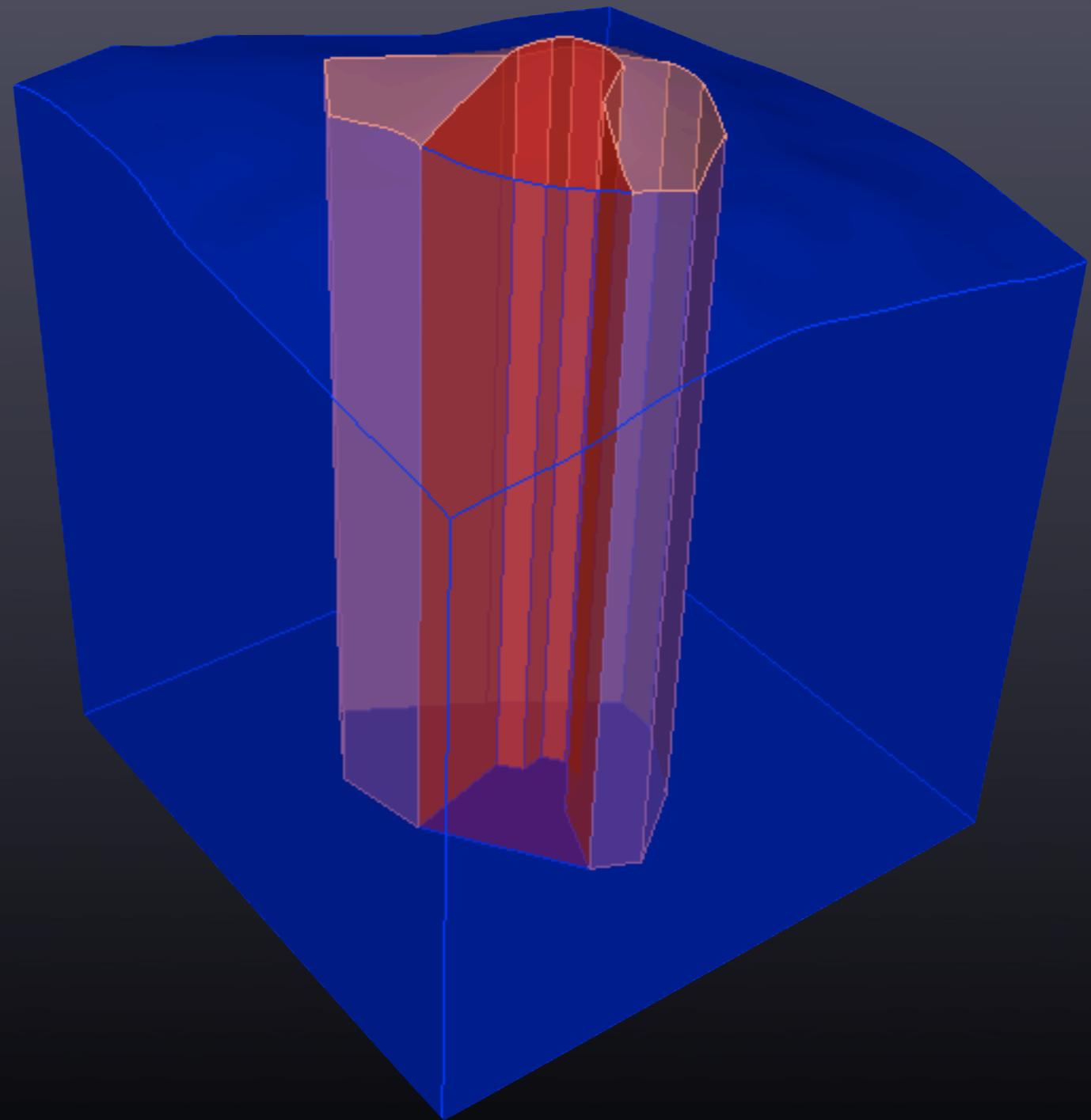
```
surface 18 size 300
```

```
surface 26 size 300
```

```
surface 4 18 26 scheme pave
```

```
mesh surface 4 18 26
```

```
vol all size 300
```



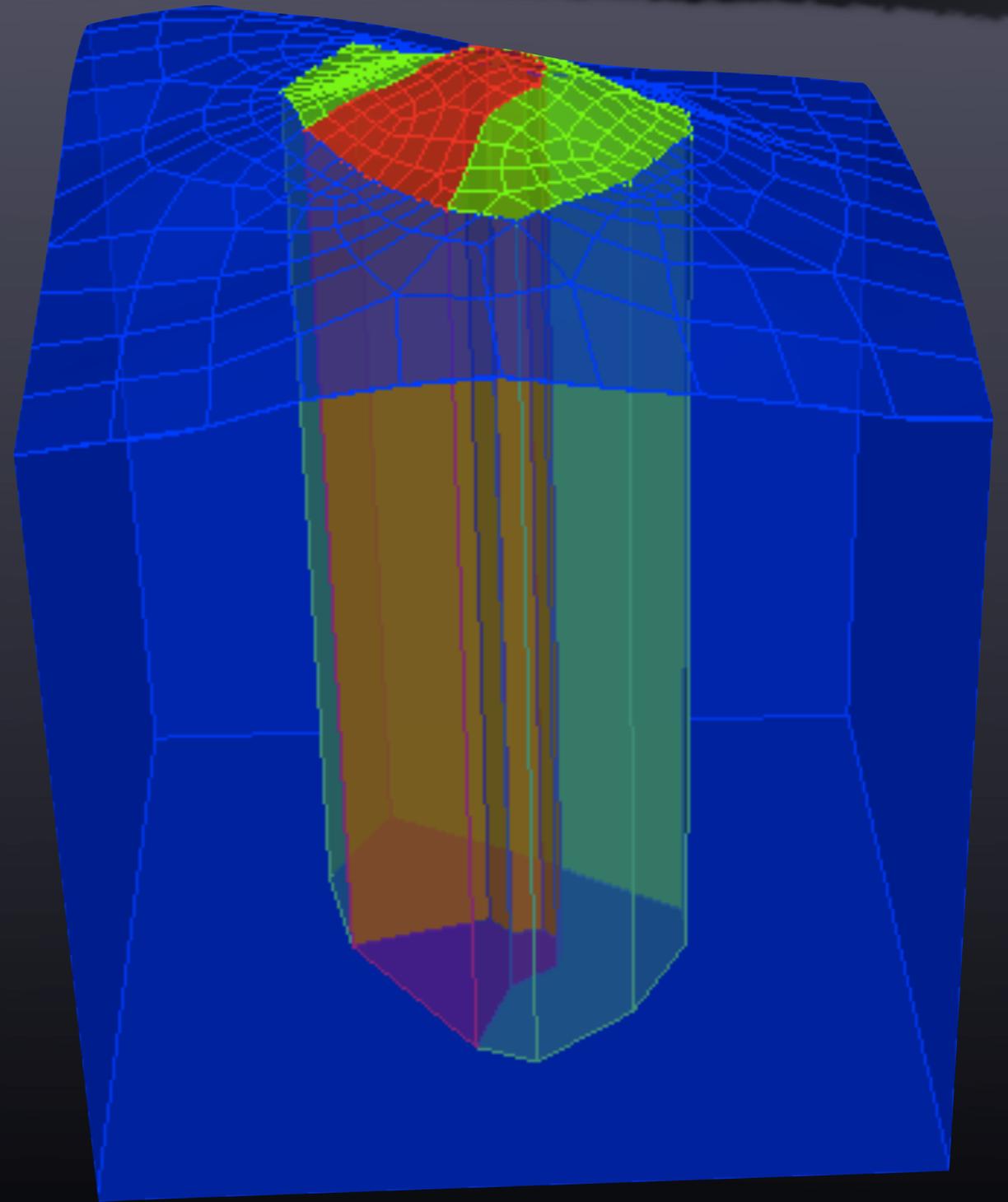
```
mesh vol all
```

```
refine hex in sciara with Z_coord > -2000....
```

```
... except hex in node in (sea volcano)
```

CUBIT a volcano - 2

```
open "geometry_stromboli_600m.sat"
surface 4 size 900
surface 18 size 300
surface 26 size 300
surface 4 18 26 scheme pave
mesh surface 4 18 26
vol all size 300
```



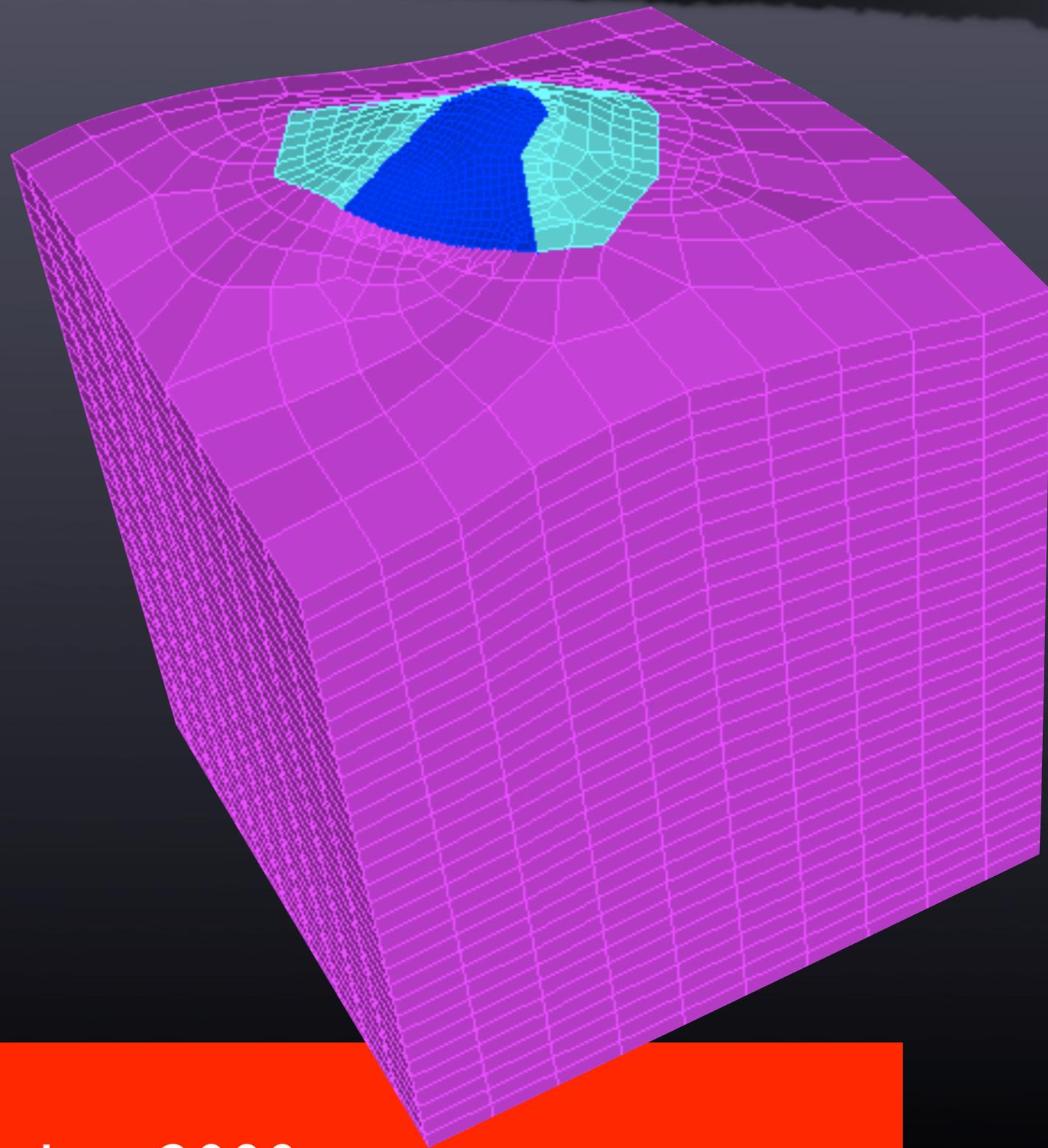
```
mesh vol all
```

```
refine hex in sciara with Z_coord > -2000....
```

```
... except hex in node in (sea volcano)
```

CUBIT a volcano - 2

```
open "geometry_stromboli_600m.sat"  
surface 4 size 900  
surface 18 size 300  
surface 26 size 300  
surface 4 18 26 scheme pave  
mesh surface 4 18 26  
vol all size 300
```



```
mesh vol all  
refine hex in sciara with Z_coord > -2000....  
... except hex in node in (sea volcano)
```

CUBIT a volcano - 3

```
open "geometry_stromboli_600m.sat"
```

```
webcut volume all with plane zplane....
```

```
.... offset -2000 noimprint nomerge
```

```
imprint volume all
```

```
merge volume all
```

```
surface 4 size 900
```

```
surface 18 26 size 900
```

```
surface 4 18 26 scheme pave
```

```
mesh surface 4 18 26
```

```
volume all size 900
```

```
mesh vol all
```

CUBIT a volcano - 3

```
open "geometry_stromboli_600m.sat"
```

```
webcut volume all with plane zplane....
```

```
.... offset -2000 noimprint nomerge
```

```
imprint volume all
```

```
merge volume all
```

```
surface 4 size 900
```

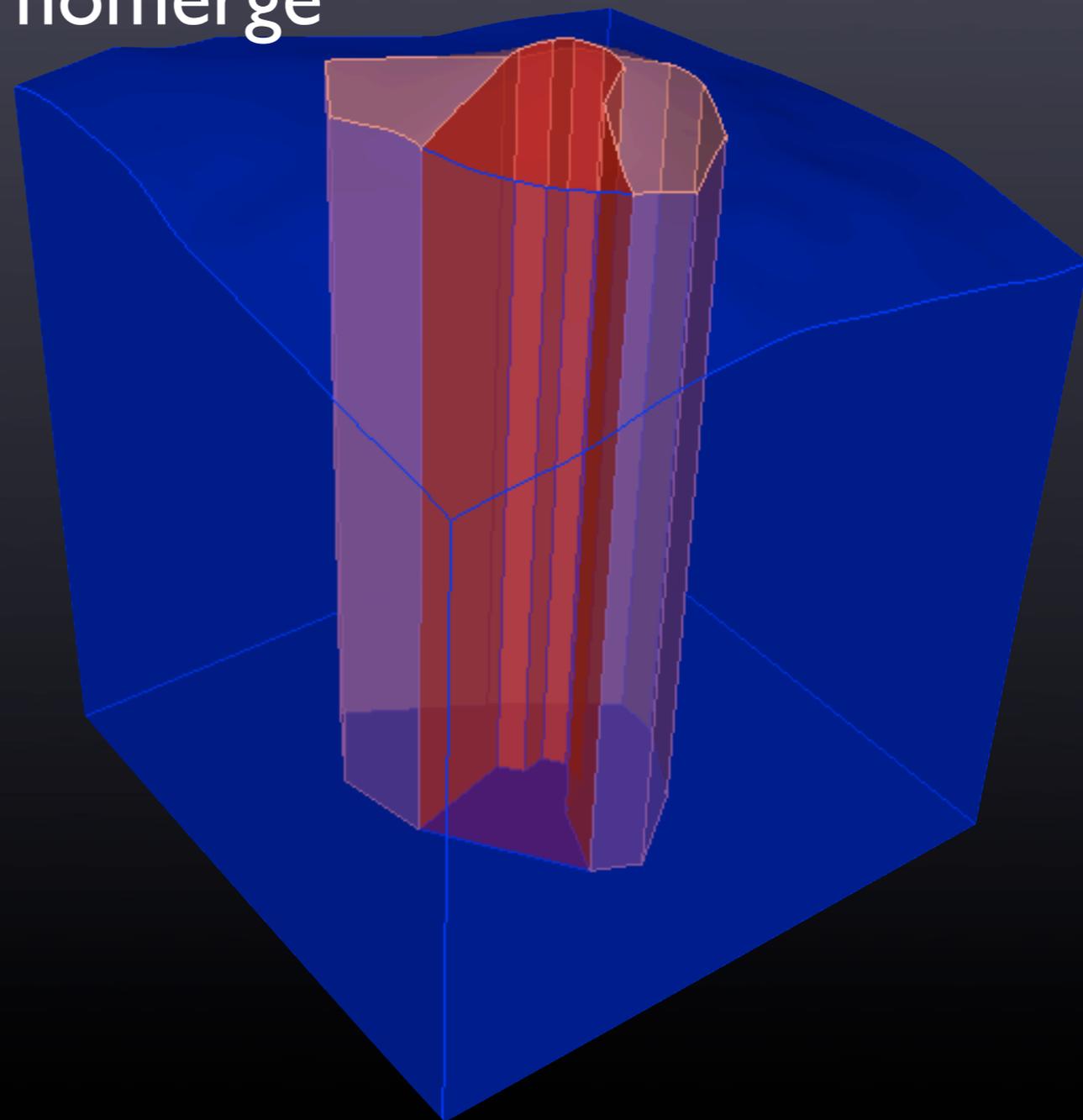
```
surface 18 26 size 900
```

```
surface 4 18 26 scheme pave
```

```
mesh surface 4 18 26
```

```
volume all size 900
```

```
mesh vol all
```



CUBIT a volcano - 3

```
open "geometry_stromboli_600m.sat"
```

```
webcut volume all with plane zplane....
```

```
.... offset -2000 noimprint nomerge
```

```
imprint volume all
```

```
merge volume all
```

```
surface 4 size 900
```

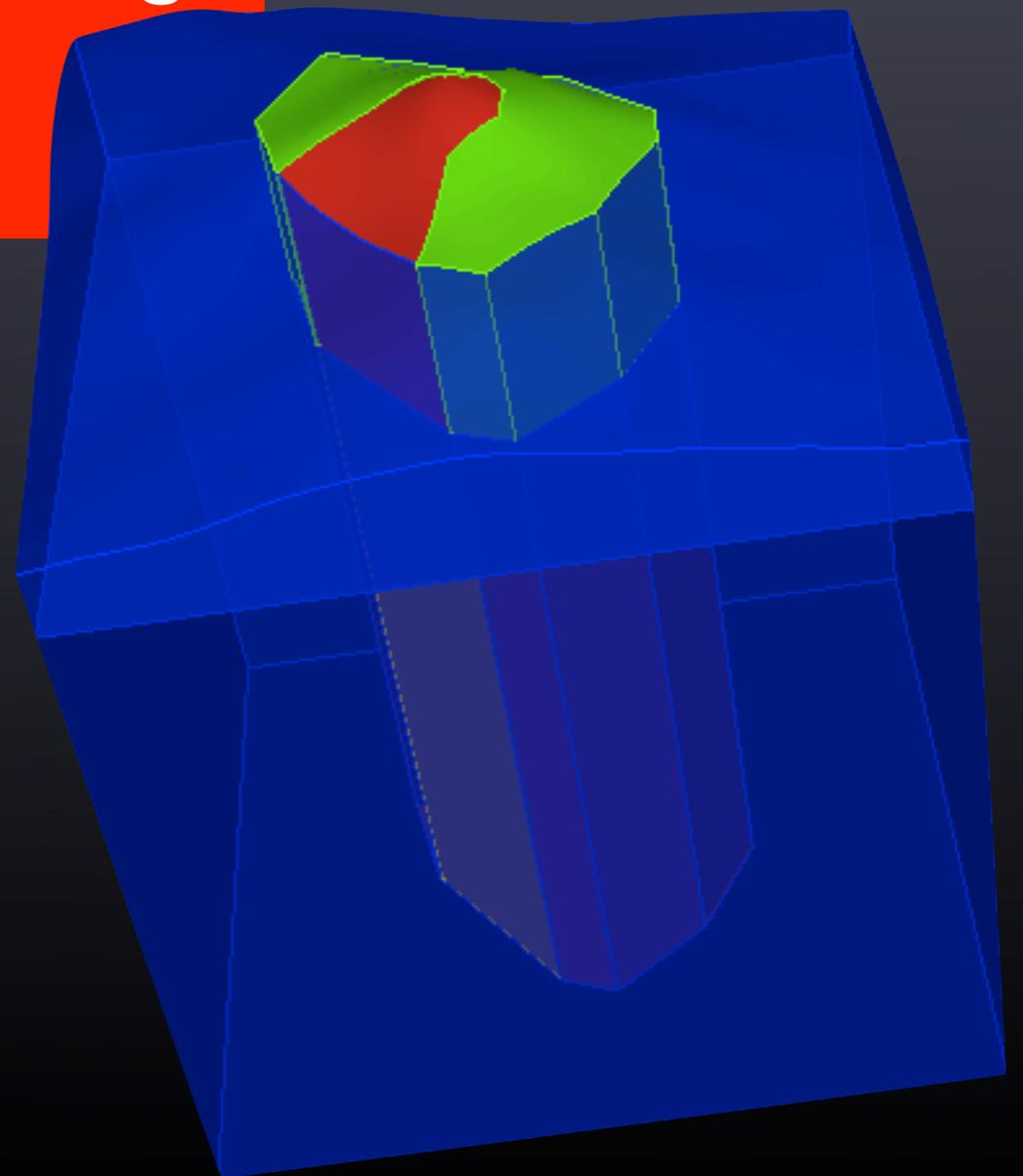
```
surface 18 26 size 900
```

```
surface 4 18 26 scheme pave
```

```
mesh surface 4 18 26
```

```
volume all size 900
```

```
mesh vol all
```



CUBIT a volcano - 3

```
open "geometry_stromboli_600m.sat"
```

```
webcut volume all with plane zplane....
```

```
.... offset -2000 noimprint nomerge
```

```
imprint volume all
```

```
merge volume all
```

```
surface 4 size 900
```

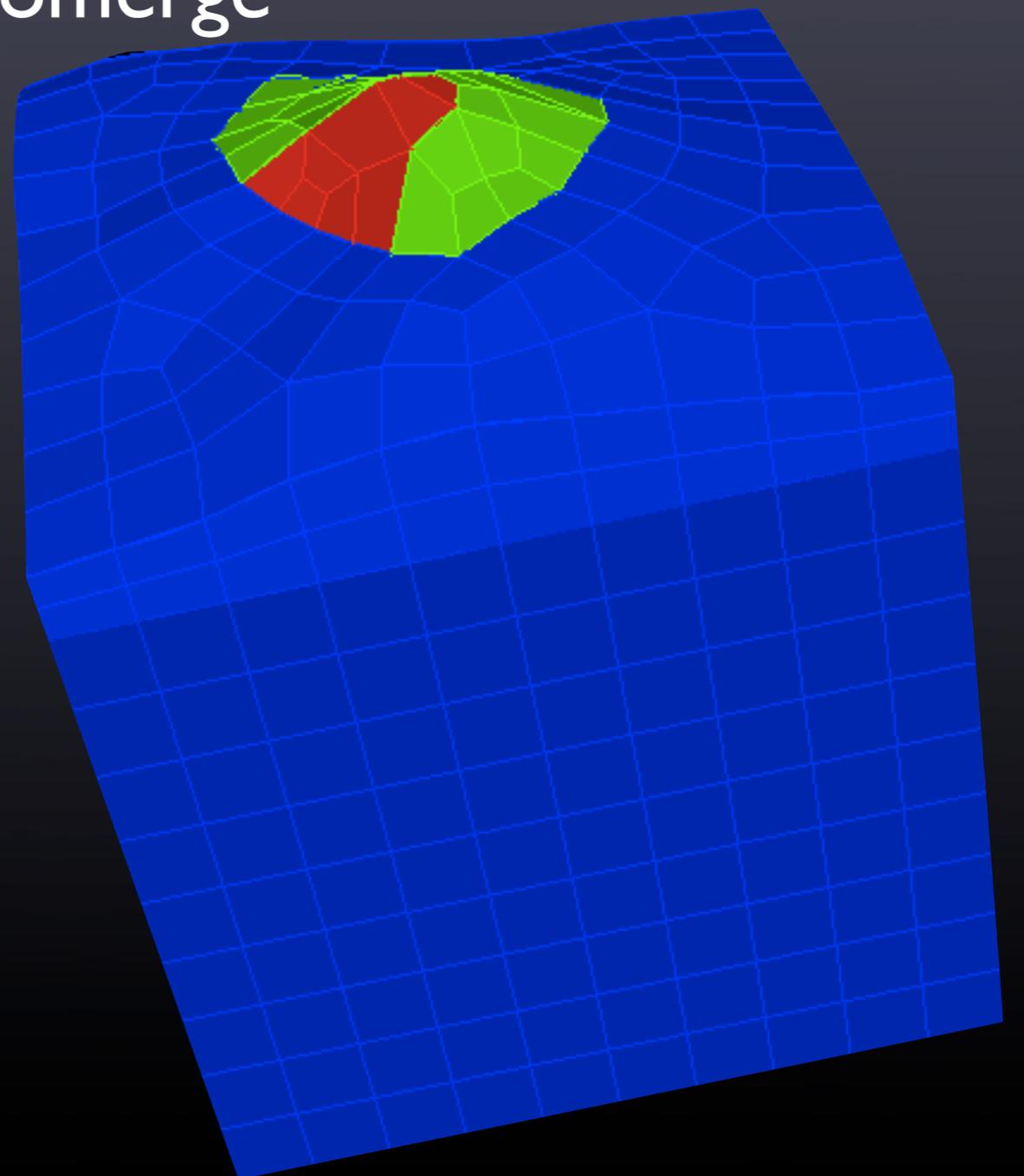
```
surface 18 26 size 900
```

```
surface 4 18 26 scheme pave
```

```
mesh surface 4 18 26
```

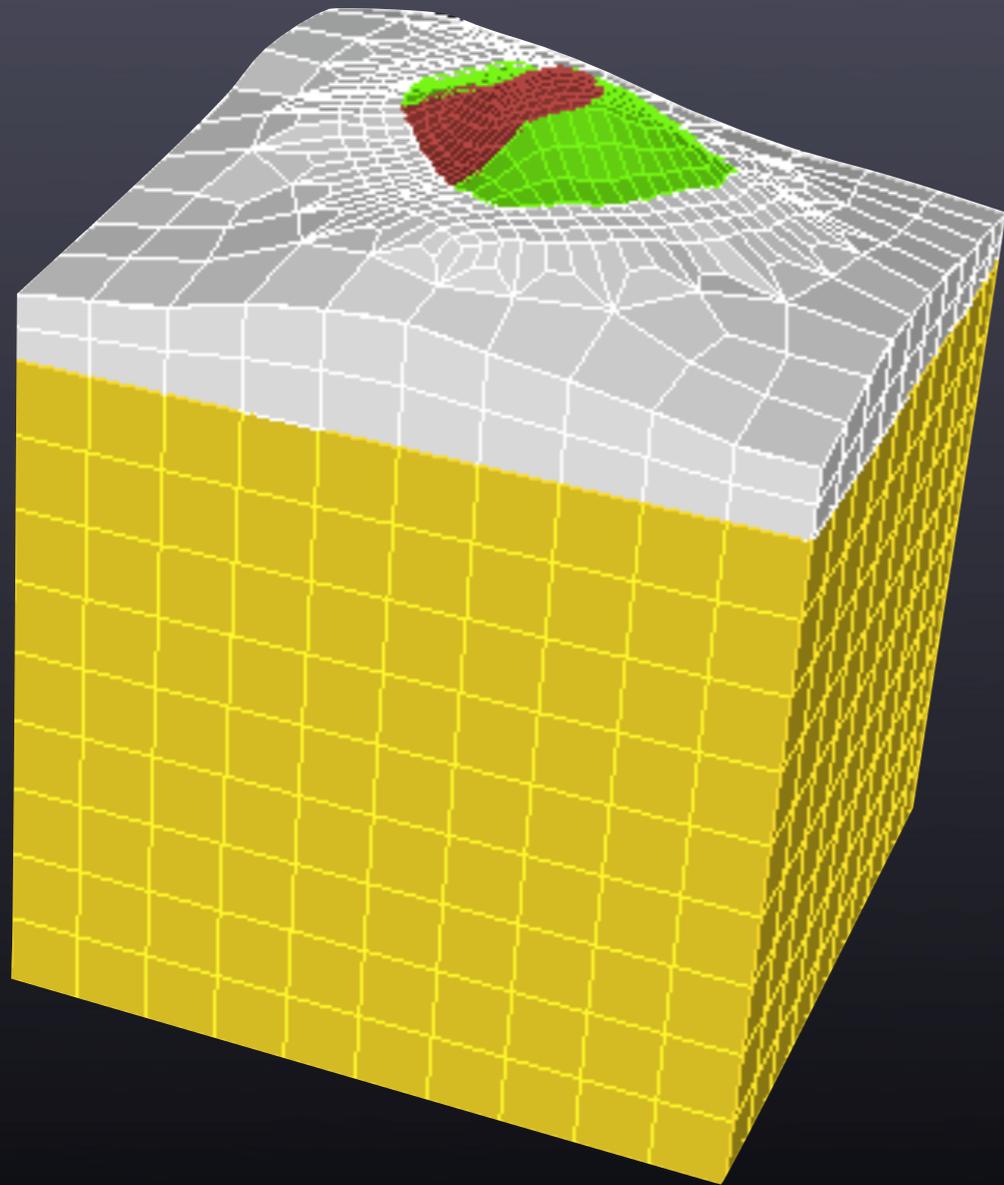
```
volume all size 900
```

```
mesh vol all
```



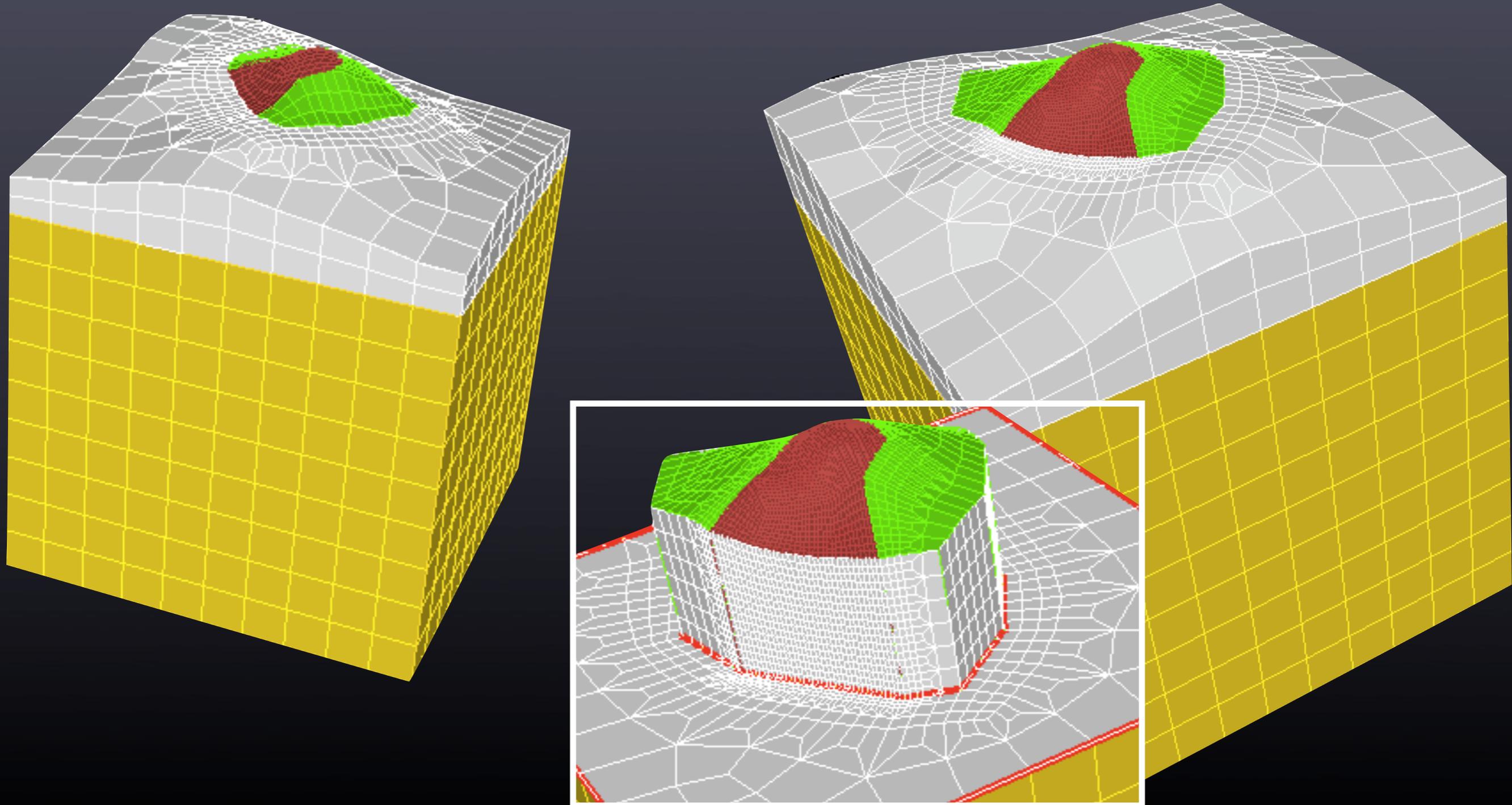
CUBIT a volcano - 3

refine hex in volcano sciara volcano@A sciara@A



CUBIT a volcano - 3

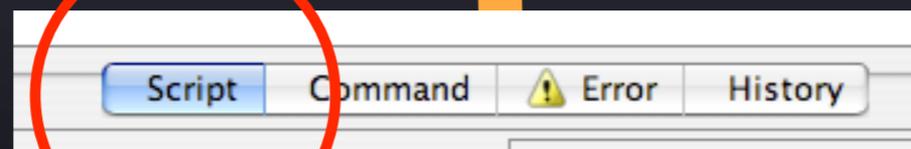
refine hex in volcano sciara volcano@A sciara@A



refine hex in sciara

CUBIT and Python

- CUBIT: } is a command-line driven code
 "create brick x 10"
 "mesh volume all"
 } is accessed via CUBIT Interface
 } is loaded as a component into Claro (GUI)
- CUBIT Interface: } is accessible via Python inside Claro



We can use Python and CUBIT to mesh a volume

CUBIT and Python

The image shows the CUBIT 11.0b software interface. The main window is titled "Cubit 11.0b" and contains a "Full Tree" on the left, a "Perform Action" section, and a central workspace. A red arrow points from the "Full Tree" to the "Journal Editor" window, which is titled "Journal Editor" and contains the following Python code:

```
name='sum_topo.txt'  
xstep=20  
ystep=20  
nx=290  
ny=177  
exag=50.  
  
grdfile = open(name, 'r')  
  
coorx=[]  
coordy=[]  
elev=[]  
  
icoord=0  
for ix in range(0,nx):  
    for iy in range(0,ny):  
        x,y,z=map(float,grdfile.readline().split())  
        if ix%xstep == 0:  
            if iy%ystep == 0:  
                coorx.append(x)  
                coordy.append(y)  
                elev.append(z)
```

Below the Journal Editor is a "Script Tab" window, which is titled "Script" and contains the following commands:

```
%>vmin=min(v_curve)  
%>cubitcommand= 'create surface net u curve '+ str( vmin )+' to '+str( vmax )+' heal'  
%>cubit.cmd(cubitcommand)  
Creating net surface...  
Journaled Command: create surface net u curve 1 to 15 v curve 16 to 24 heal  
%>
```

The "Script Tab" window has tabs for "Script", "Command", "Error", and "History". A red arrow points to the "Script" tab.

Script Tab (Python Interpreter)

CUBIT and Python

Examples:

Query:

```
cubit.get_last_id("vertex")
```

Executive:

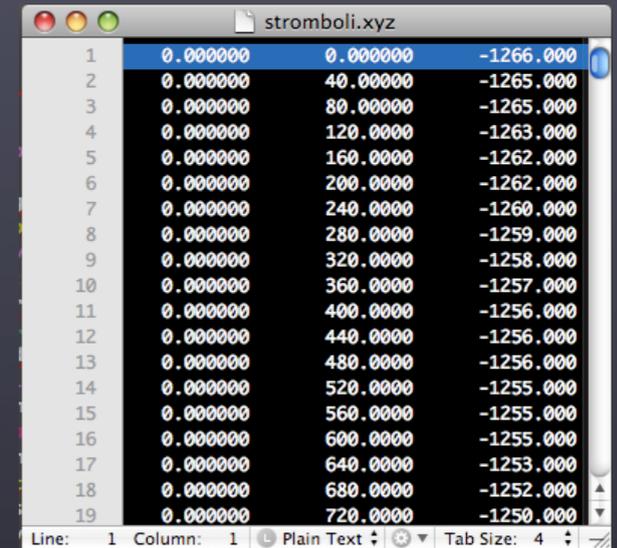
```
command = 'create vertex '+ str(x)+' '+ str(y)+' '+ str(z)
cubit.cmd(command)
```

```
for ix in range(0,nx):
    if ix ==0:
        store_vertex=0
    else:
        store_vertex=cubit.get_last_id("vertex")
    for iy in range(0,ny):
        x,y,z=map(float,grdfile.readline().split())
        if ix%xstep == 0:
            if iy%ystep == 0:
                cubitcommand= 'create vertex '+ str( x ) +' '+ str( y )+' '+ str( z*exag )
                cubit.cmd(cubitcommand)
```

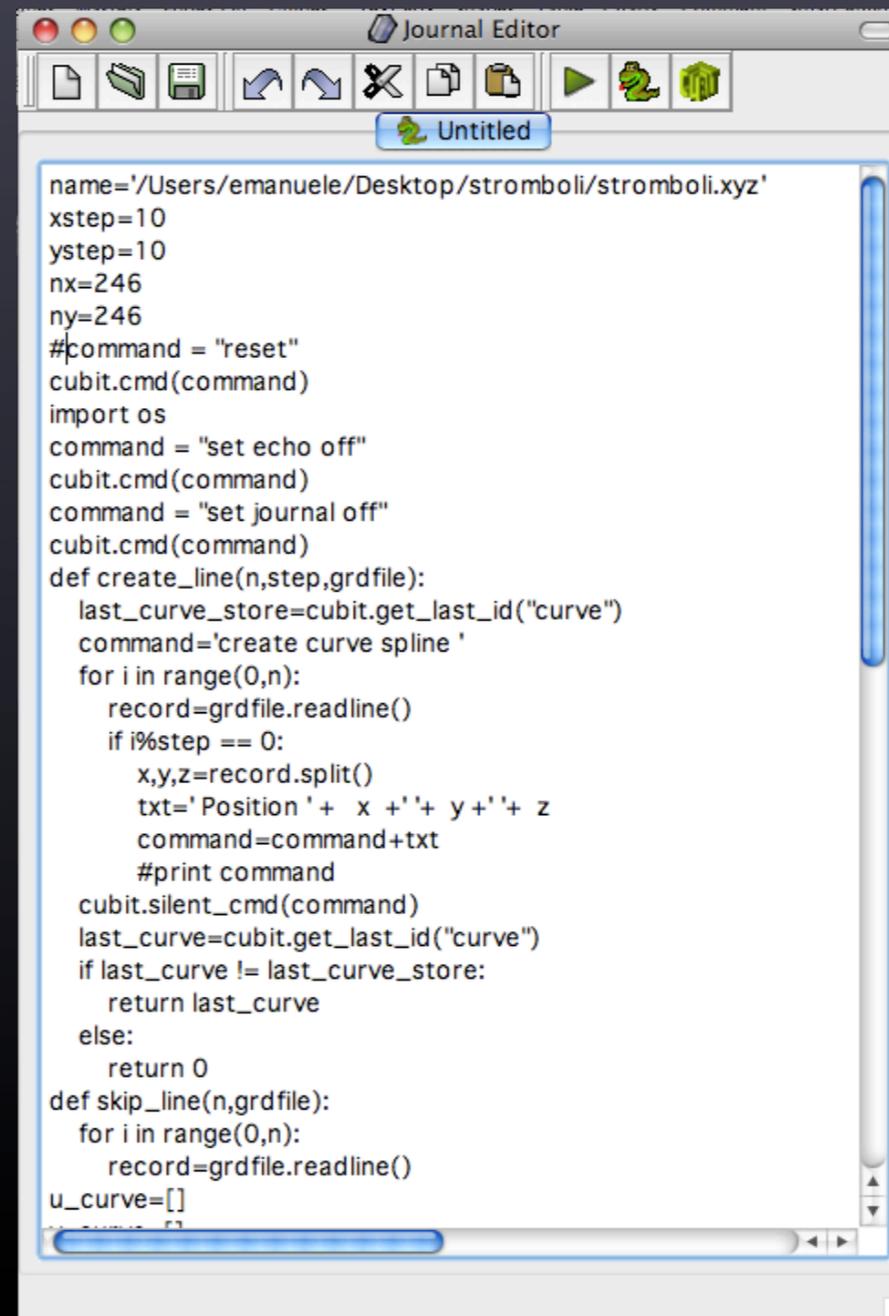
CUBIT+Python: building a topography

1) Stromboli.txt (40 m topography)

2) create_topography.py



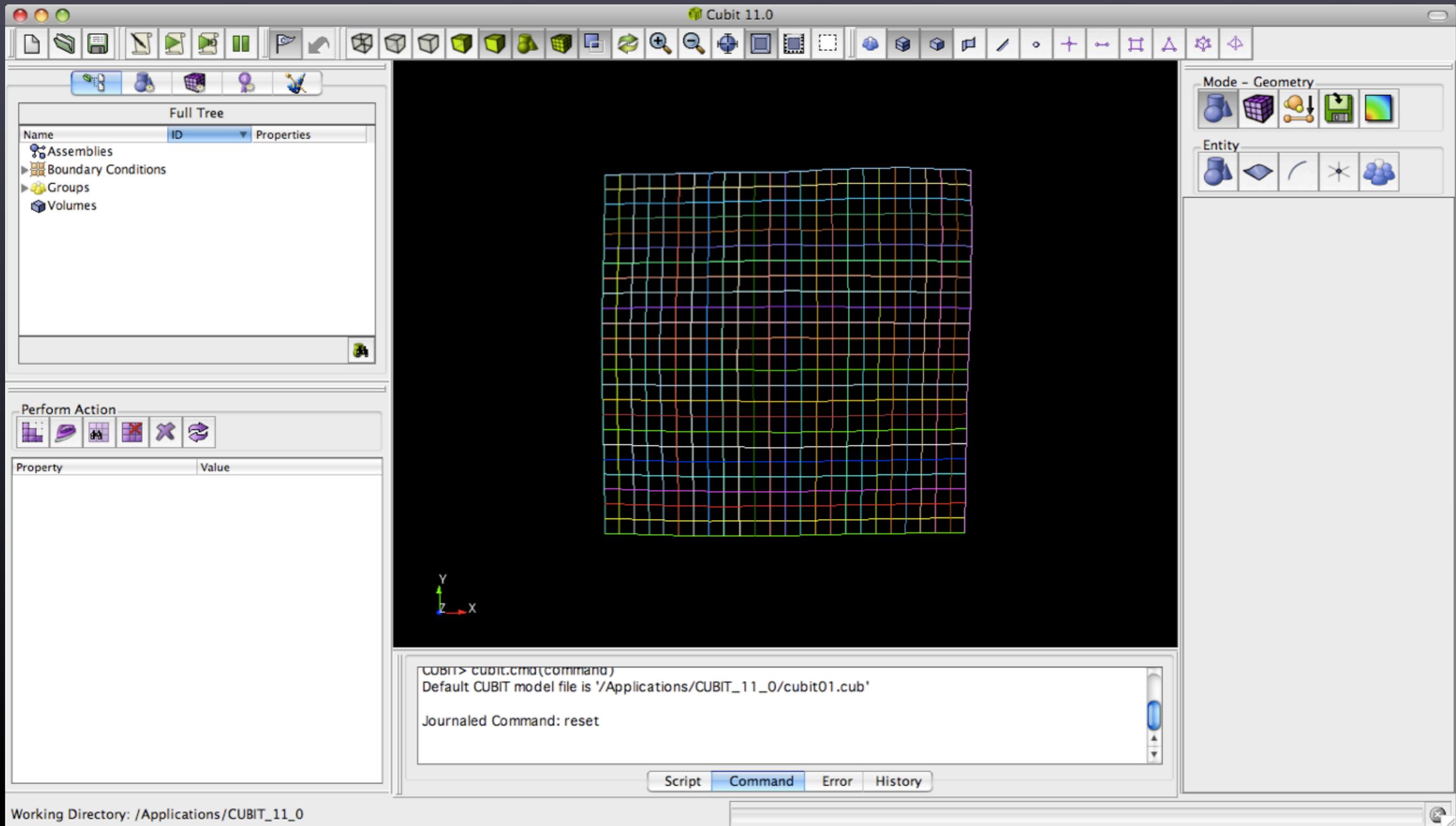
Line	Column 1	Column 2	Column 3
1	0.000000	0.000000	-1266.000
2	0.000000	40.00000	-1265.000
3	0.000000	80.00000	-1265.000
4	0.000000	120.0000	-1263.000
5	0.000000	160.0000	-1262.000
6	0.000000	200.0000	-1262.000
7	0.000000	240.0000	-1260.000
8	0.000000	280.0000	-1259.000
9	0.000000	320.0000	-1258.000
10	0.000000	360.0000	-1257.000
11	0.000000	400.0000	-1256.000
12	0.000000	440.0000	-1256.000
13	0.000000	480.0000	-1256.000
14	0.000000	520.0000	-1255.000
15	0.000000	560.0000	-1255.000
16	0.000000	600.0000	-1255.000
17	0.000000	640.0000	-1253.000
18	0.000000	680.0000	-1252.000
19	0.000000	720.0000	-1250.000



```
name='/Users/emanuele/Desktop/stromboli/stromboli.xyz'
xstep=10
ystep=10
nx=246
ny=246
#command = "reset"
cubit.cmd(command)
import os
command = "set echo off"
cubit.cmd(command)
command = "set journal off"
cubit.cmd(command)
def create_line(n,step,grdfile):
    last_curve_store=cubit.get_last_id("curve")
    command='create curve spline '
    for i in range(0,n):
        record=grdfile.readline()
        if i%step == 0:
            x,y,z=record.split()
            txt=' Position ' + x +' ' + y +' ' + z
            command=command+txt
            #print command
            cubit.silent_cmd(command)
            last_curve=cubit.get_last_id("curve")
            if last_curve != last_curve_store:
                return last_curve
            else:
                return 0
def skip_line(n,grdfile):
    for i in range(0,n):
        record=grdfile.readline()
u_curve=[]
```

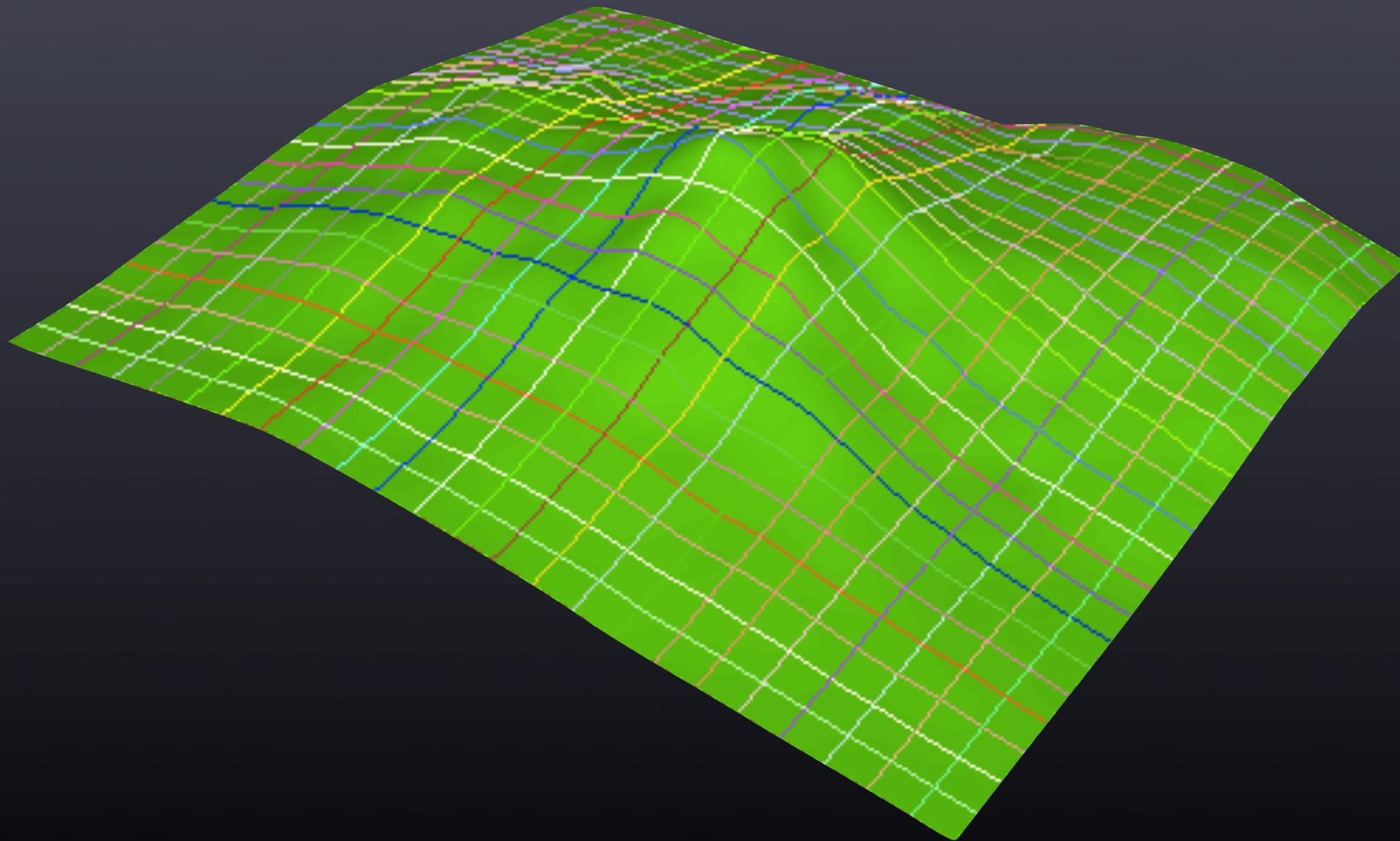
CUBIT+Python: building a topography

{1} create spline from topography points



CUBIT+Python: building a topography

{2} create surface net u-v curve



CUBIT: the geometry engines

CUBIT FILE: geometry layer + meshing layer

ACIS.

Nurbs

- > Main engine
- > All the features of CUBIT are available
(cleanup tool, imprinting, decomposition geometry)
- > Perfect for mechanical object (CAD...)
- > **Heavy usage of memory**
- > **ACIS/Nurbs are not common in geoframeworks**
(Rhynoceros)
- > Best option for us: creating the geometry in CUBIT

FACET

Triangulate
surfaces

- > secondary engine
- > **NOT all the features of CUBIT are available**
(cleanup tool, imprinting, decomposition geometry are in
developing mode)
- > Perfect for **GOCAD** (see ts2fac.py)
- > Much less usage of memory
- > Triangulate surfaces are everywhere in geophysics
- > Best option for us: creating and decomposing the
model not in CUBIT

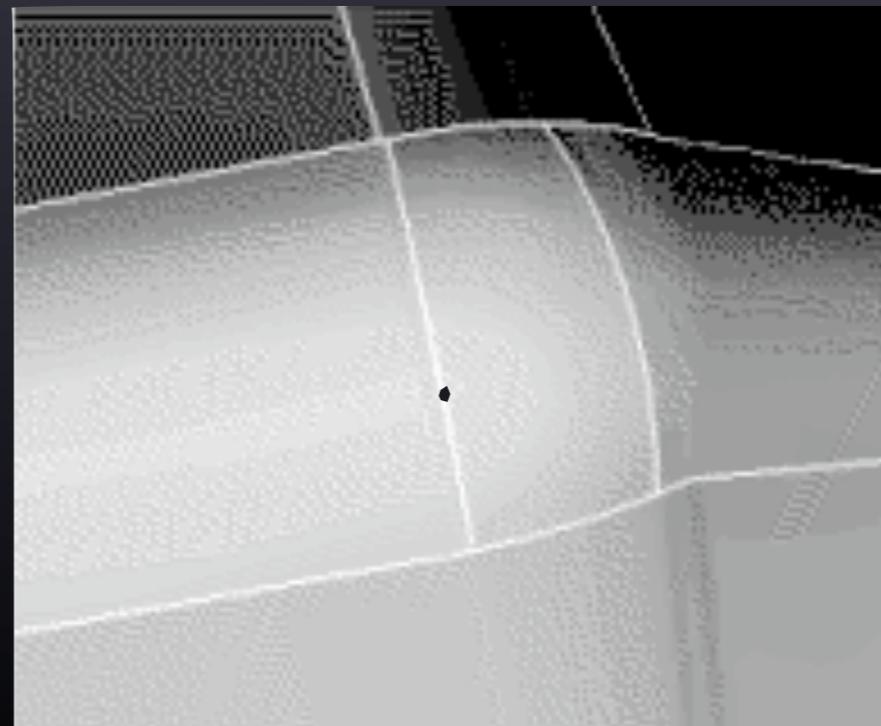
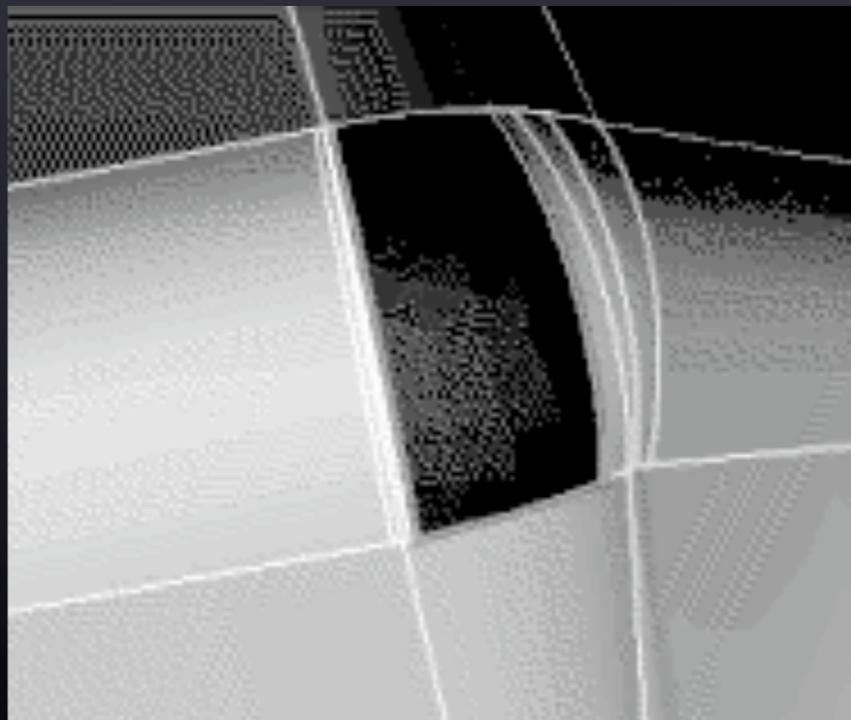
CUBIT: the geometry engines

CUBIT FILE: geometry layer + meshing layer

VIRTUAL:

intermediate
layer

- > cleanup the model and prepare it for meshing
- > ex. composite
- > mainly only with ACIS geometry engine



CUBIT: FACET -> ACIS?

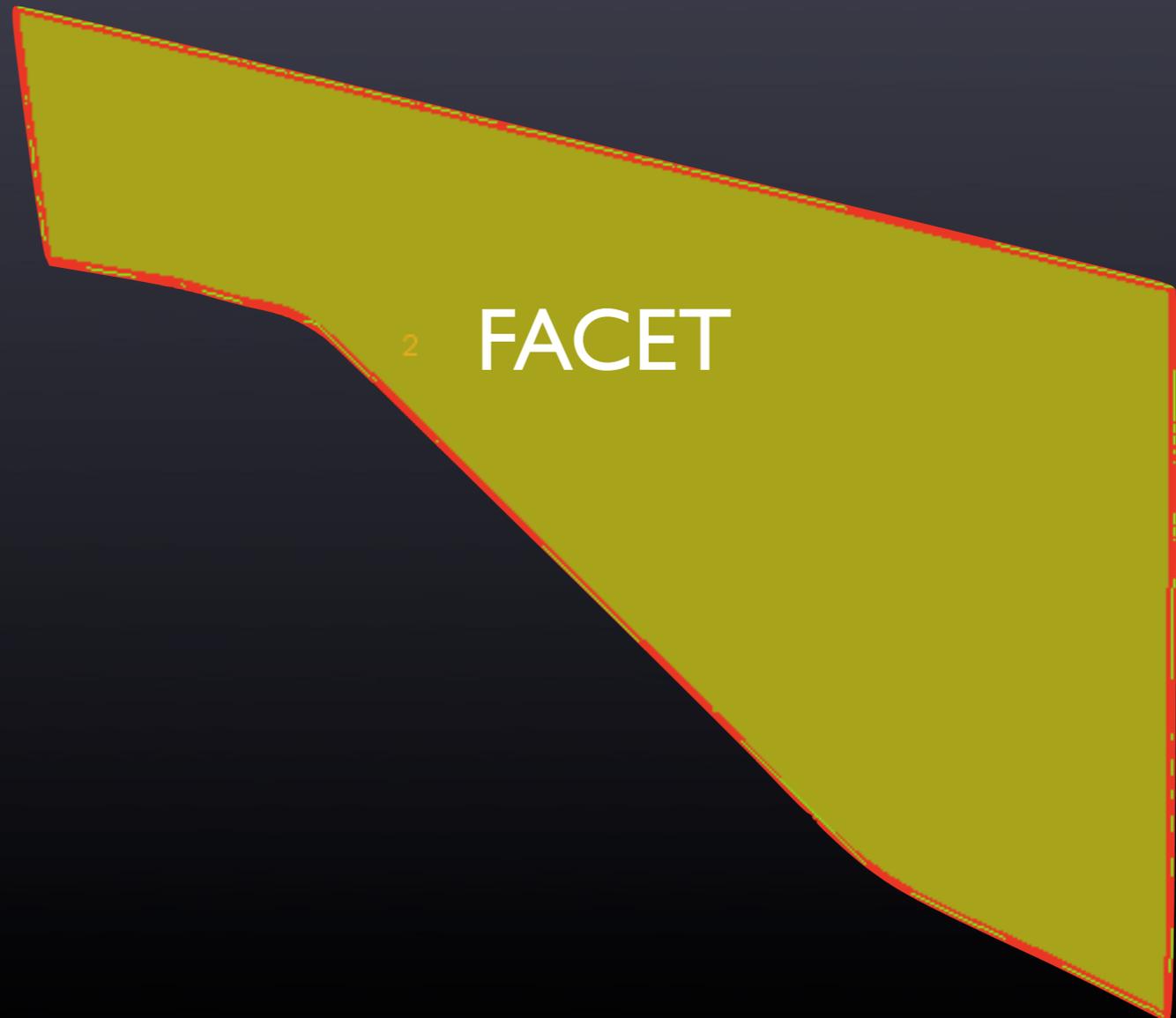
I have a facet file from GOCAD and it's a 4 side surface (MAP)

```
import facets "cfma_sa_cholame_extrapolated_complete.facet" feature_angle 115.00 linear merge  
surface 1 size 5000  
mesh surf 1  
surface 1 scheme Map  
mesh surf 1  
create acis from surf 1  
del surf 1
```

CUBIT: FACET -> ACIS?

I have a facet file from GOCAD and it's a 4 side surface (MAP)

```
import facets "cfma_sa_cholame_extrapolated_complete.facet" feature_angle 115.00 linear merge  
surface 1 size 5000  
mesh surf 1  
surface 1 scheme Map  
mesh surf 1  
create acis from surf 1  
del surf 1
```

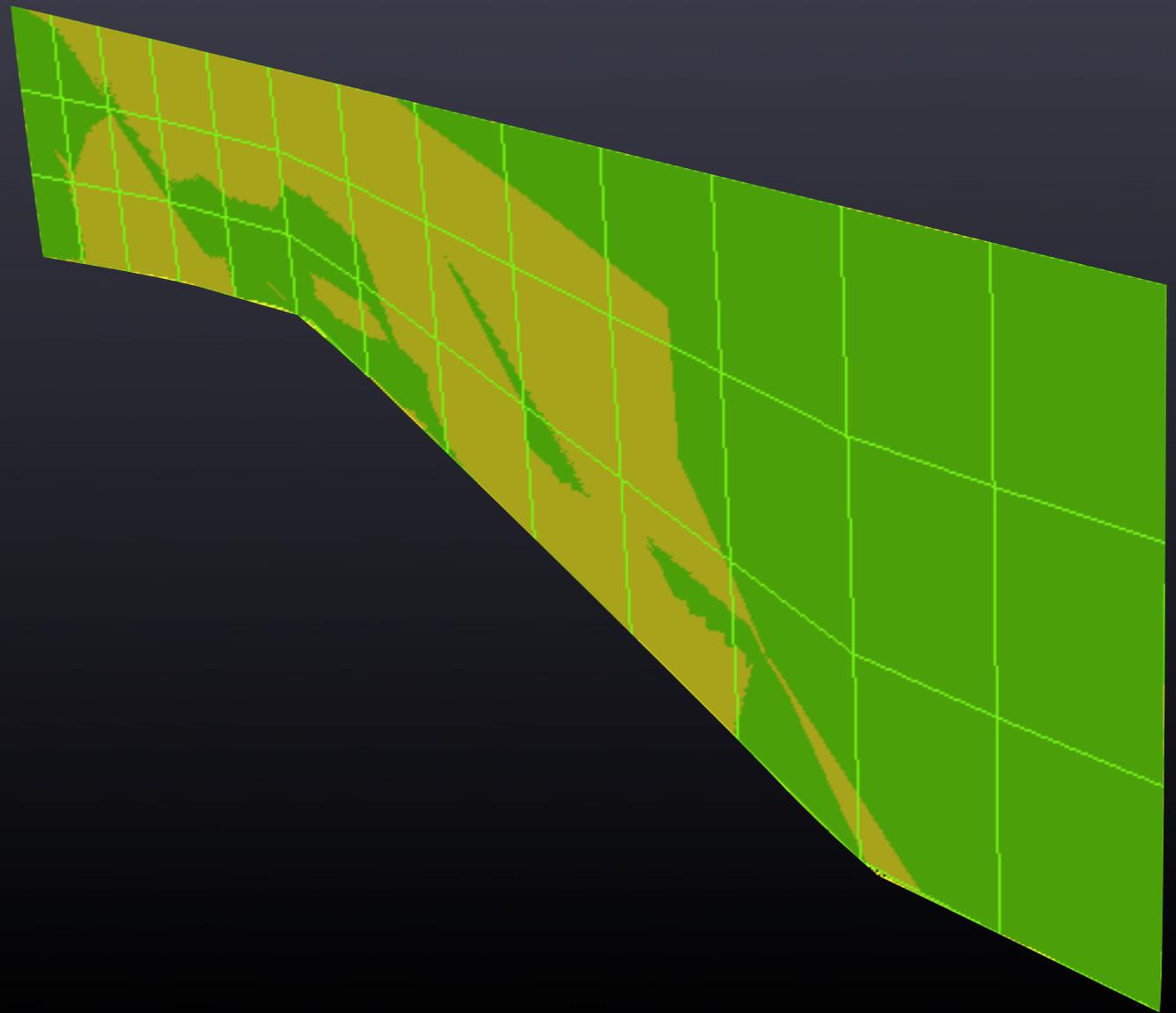


CUBIT: FACET -> ACIS?

I have a facet file from GOCAD and it's a 4 side surface (MAP)

```
import facets "cfma_sa_cholame_extrapolated_complete.facet" feature_angle 115.00 linear merge
```

```
surface 1 size 5000  
mesh surf 1  
surface 1 scheme Map  
mesh surf 1  
create acis from surf 1  
del surf 1
```

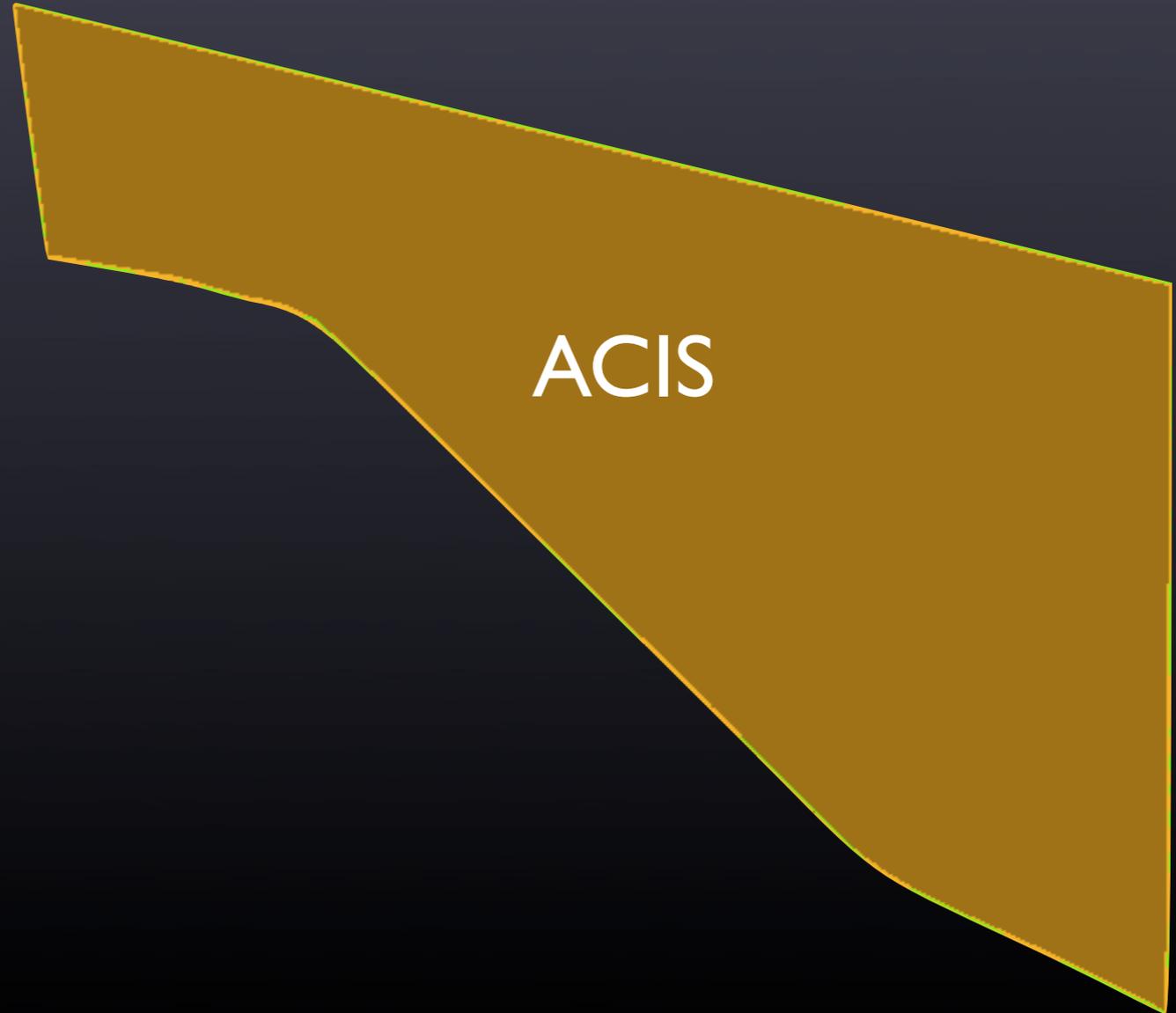


CUBIT: FACET -> ACIS?

I have a facet file from GOCAD and it's a 4 side surface (MAP)

```
import facets "cfma_sa_cholame_extrapolated_complete.facet" feature_angle 115.00 linear merge  
surface 1 size 5000  
mesh surf 1  
surface 1 scheme Map  
mesh surf 1
```

```
create acis from surf 1  
del surf 1
```



Thanks!!!

{ CAMPI FLEGREI CALDERA (I) }

Numb. Elem. : ~**6.200.000** - 256 processors - ~300 s wall clock
 Δh surface: 60 m Area: 800 km²
Accuracy: period down to .16 s (6 Hz)

