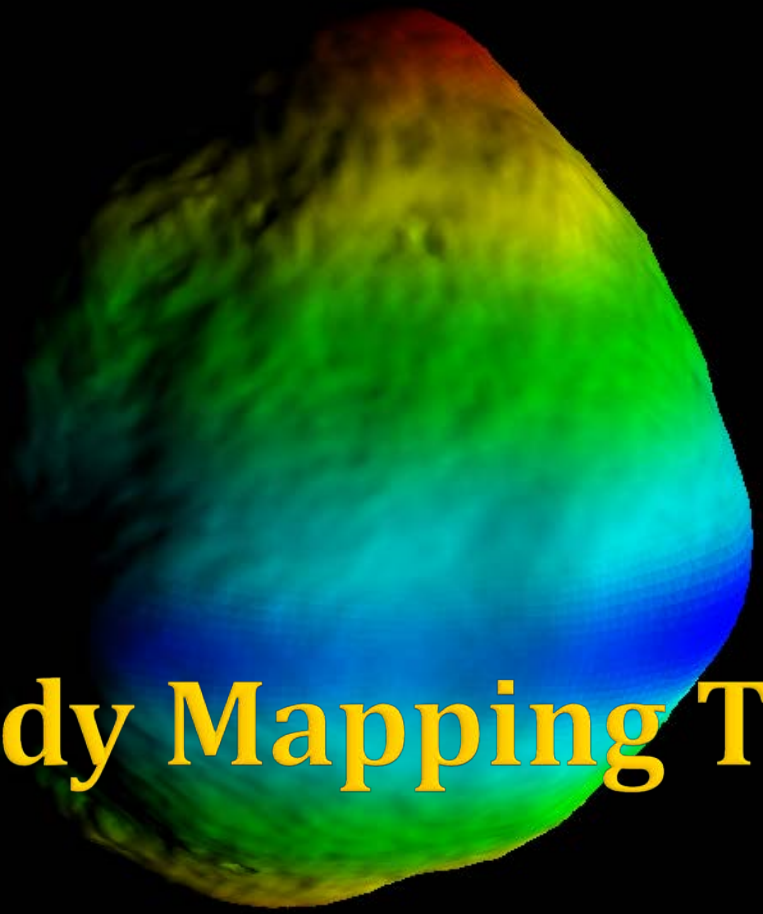
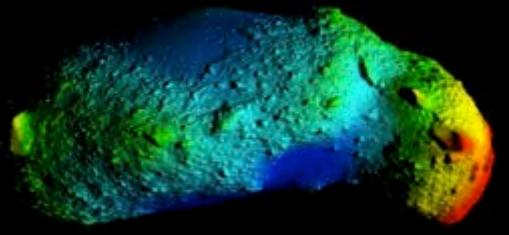


Small Body Mapping Tool Tutorial

Olivier Barnouin, Russell Turner, Philip Twu, Lillian Nguyen, Michael Zimmermann

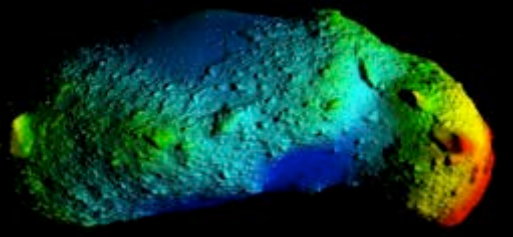
Johns Hopkins University Applied Physics Laboratory

Overview



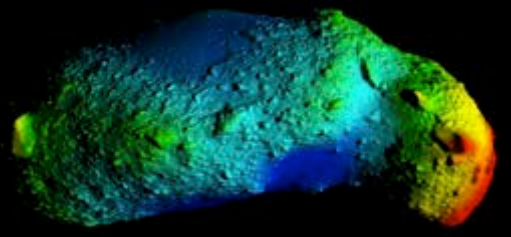
- Architecture of Small Body Mapping Tool (SBMT)
- Tutorial guiding you through how to start up and use the SMBT including a discussion of
  - General features of the tool
  - Case study of the NEAR landing site

SBMT Architecture Overview



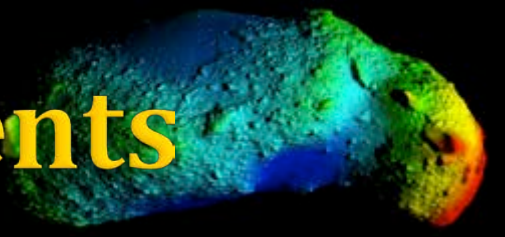
- The SBMT consists of 2 parts:
  - SBMT Client
  - SBMT Server

SBMT Client



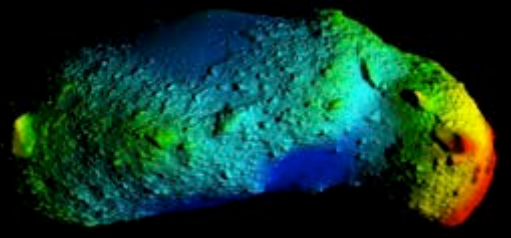
- The SBMT client is a program that runs on the desktop and communicates with the server to download data and perform queries.
- Written in the Java (version 8) programming language for cross platform support
- Uses additional 3rd party libraries:
  - VTK (http://vtk.org) for 3D visualization
  - Apache Commons Math for some mathematical procedures
  - JFreeChart for plotting
- Additional Components
  - Bob Gaskell's Mapmaker tool (in Fortran; about to converted to Bigmaps)
  - Implementation (in C++) of algorithms for computing the gravity of a general polyhedron (either Werner and Scheeres or Cheng et al).

SBMT Client Requirements

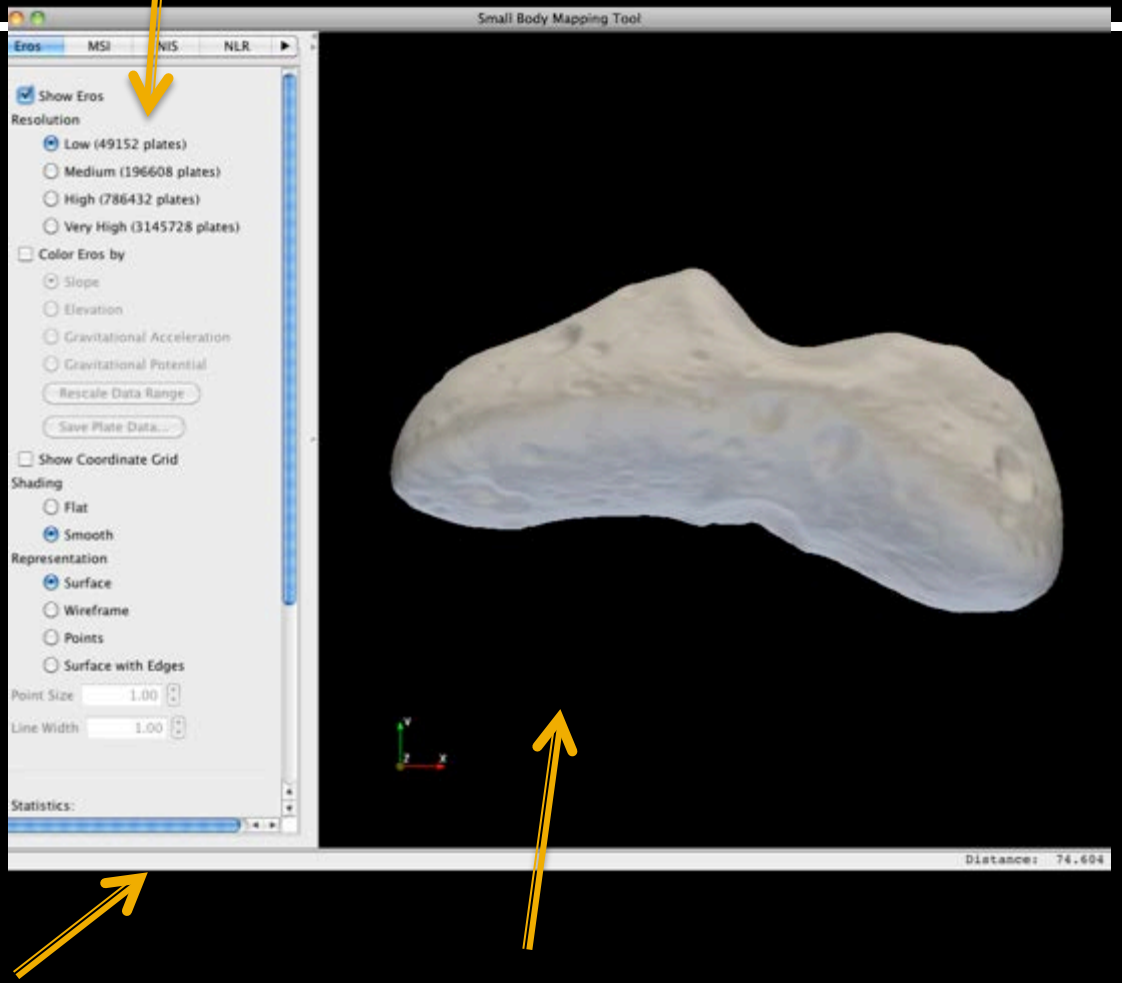


- Supported on:
  - Mac OS X (10.5 or later)
  - Windows (Window 7)
  - Linux (most recent distributions)
- The tool works best with
  - lots of memory
  - lots of bandwidth
  - good graphics card

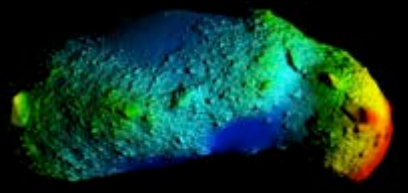
The Basics



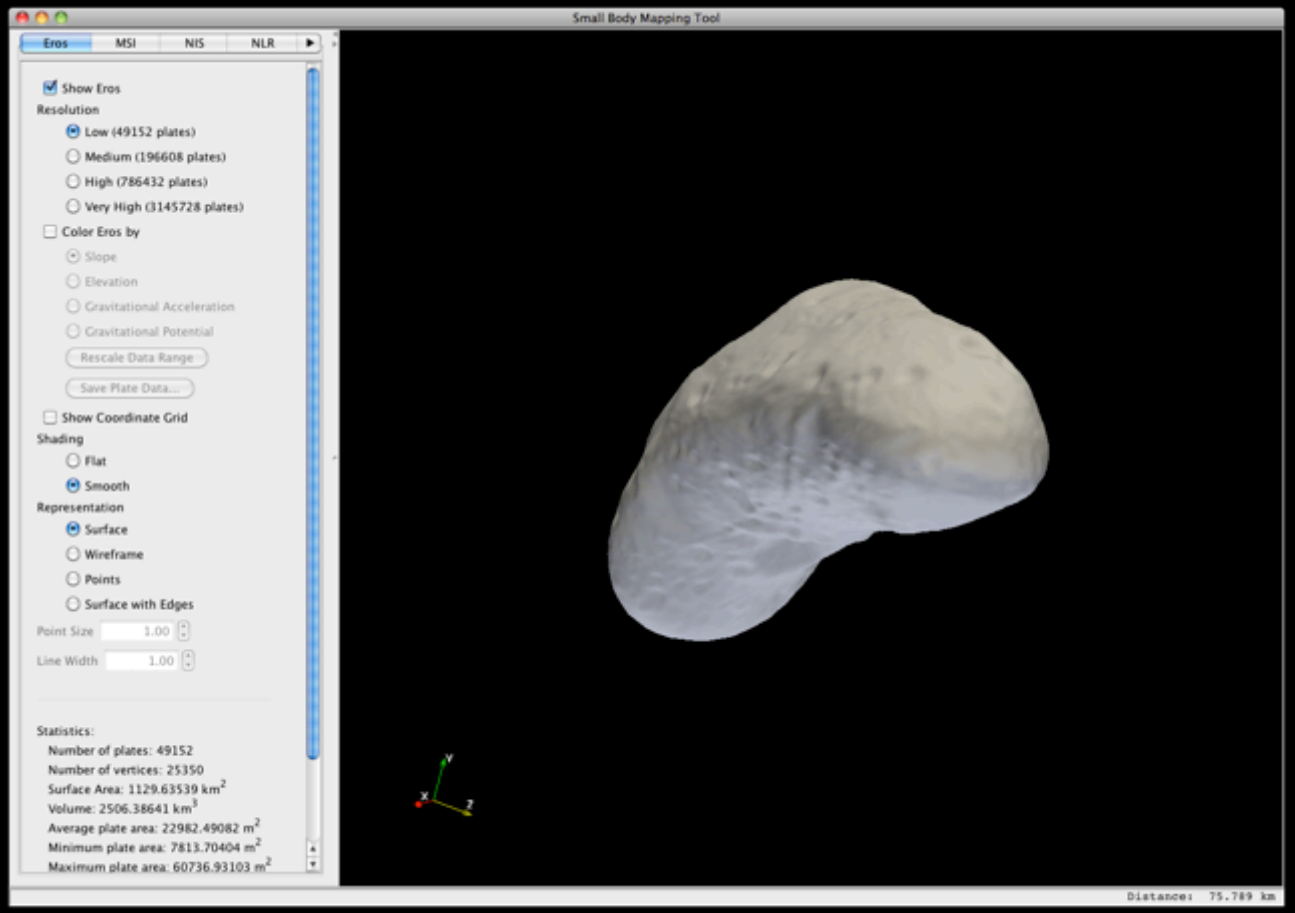
- The tool is divided into 2 main parts: A renderer panel on the right and control panel on the left. The renderer panel displays data in 3D and the control panel is used to control what gets displayed in the renderer.
- In addition, there is a menu bar on top with additional options and a status bar on the bottom



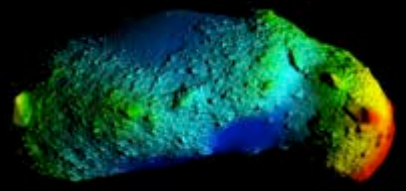
Rotating Shape Model



In the renderer view, rotate the asteroid by dragging the mouse while holding down the left mouse button.

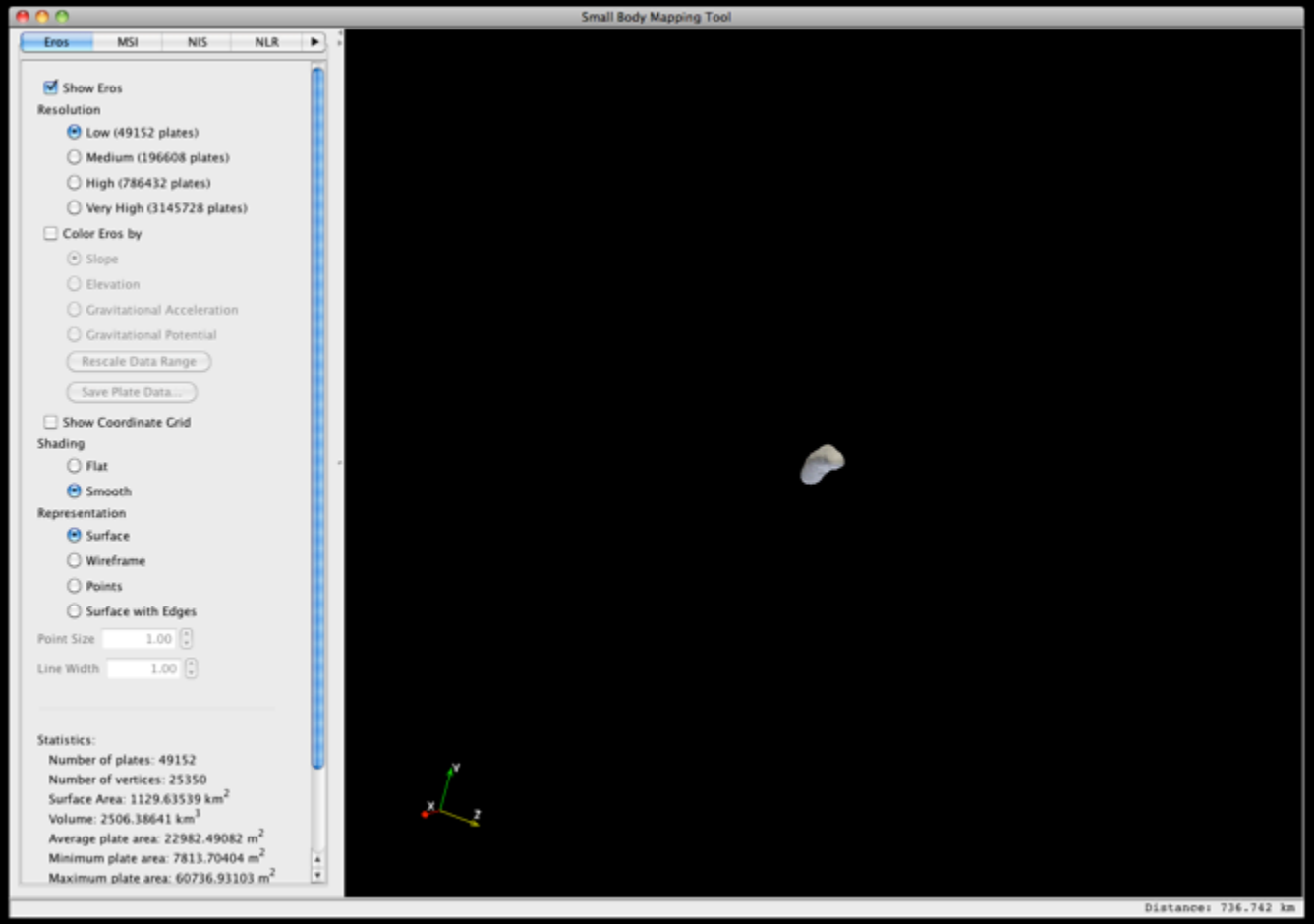


Zooming in and out of the Renderer

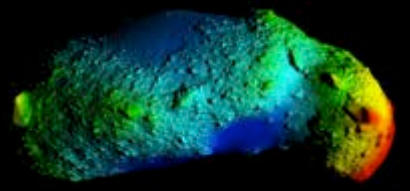


There are 2 ways to zoom in and out of the renderer.

1. Use the mouse wheel
2. Drag the mouse in the **upward** direction while holding down the right mouse button to zoom in. Drag the mouse in the **downward** direction while holding down the right mouse down to zoom out.

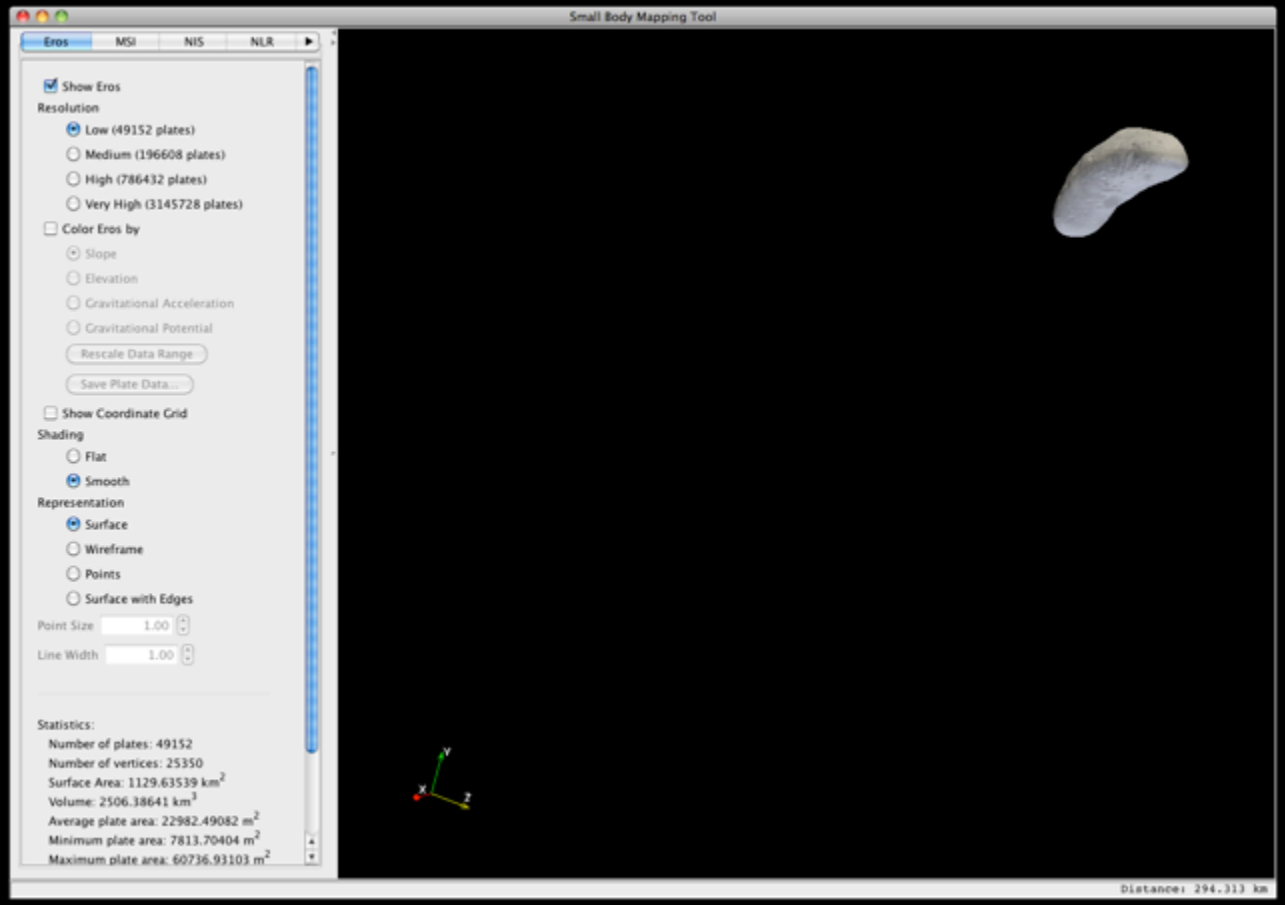


Panning the Shape Model

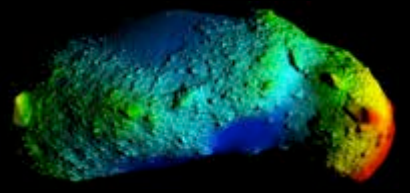


Panning moves the shape model sideways without rotating it.

To pan, drag the mouse while holding down the middle mouse button or hold shift button and drag

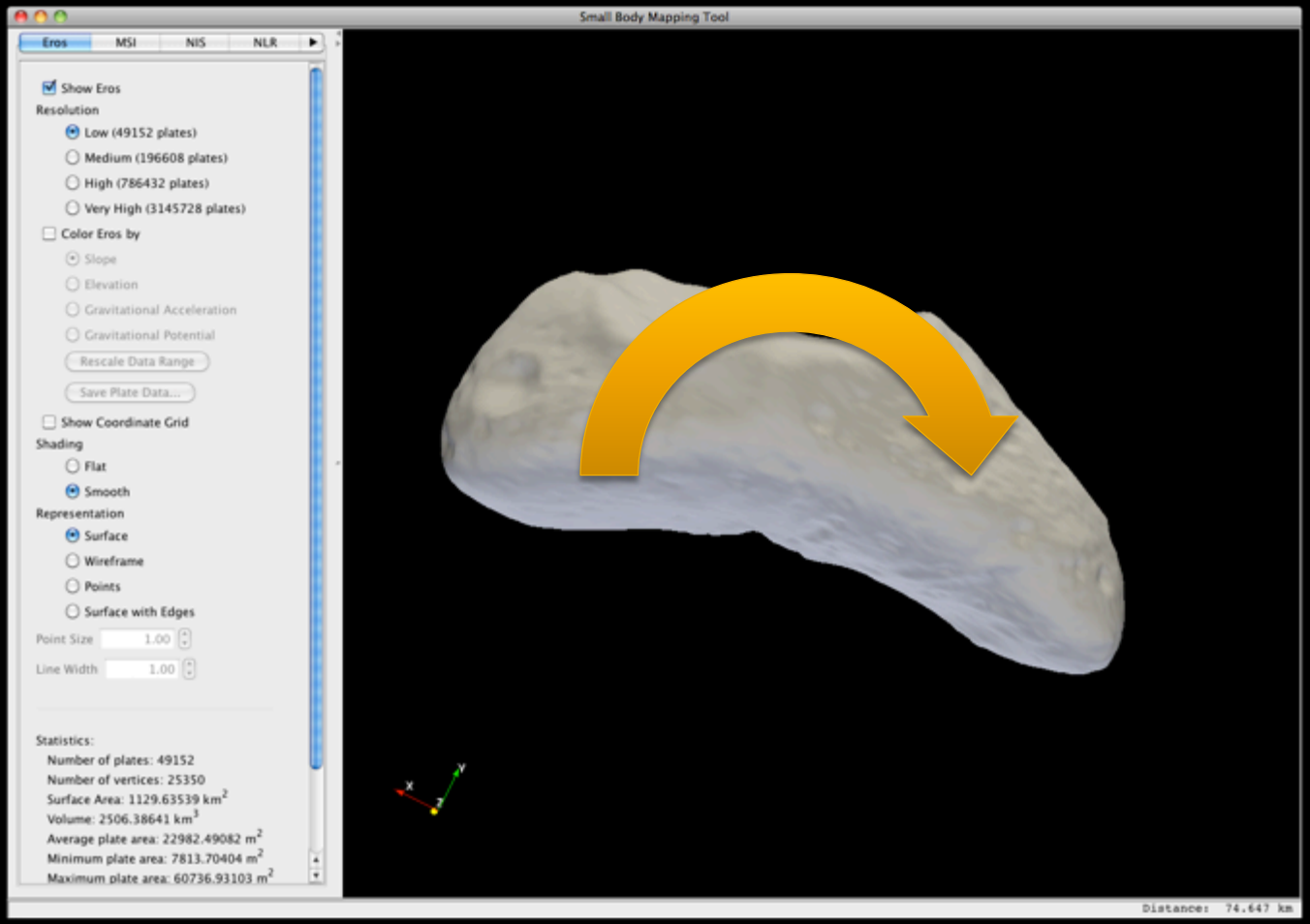


Spinning the Shape Model

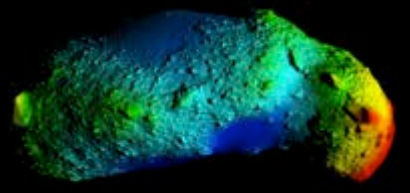


Spinning rotates the shape model around an axis that points into the center of renderer view.

To spin, drag the mouse while holding down the left mouse button **and the control key**.



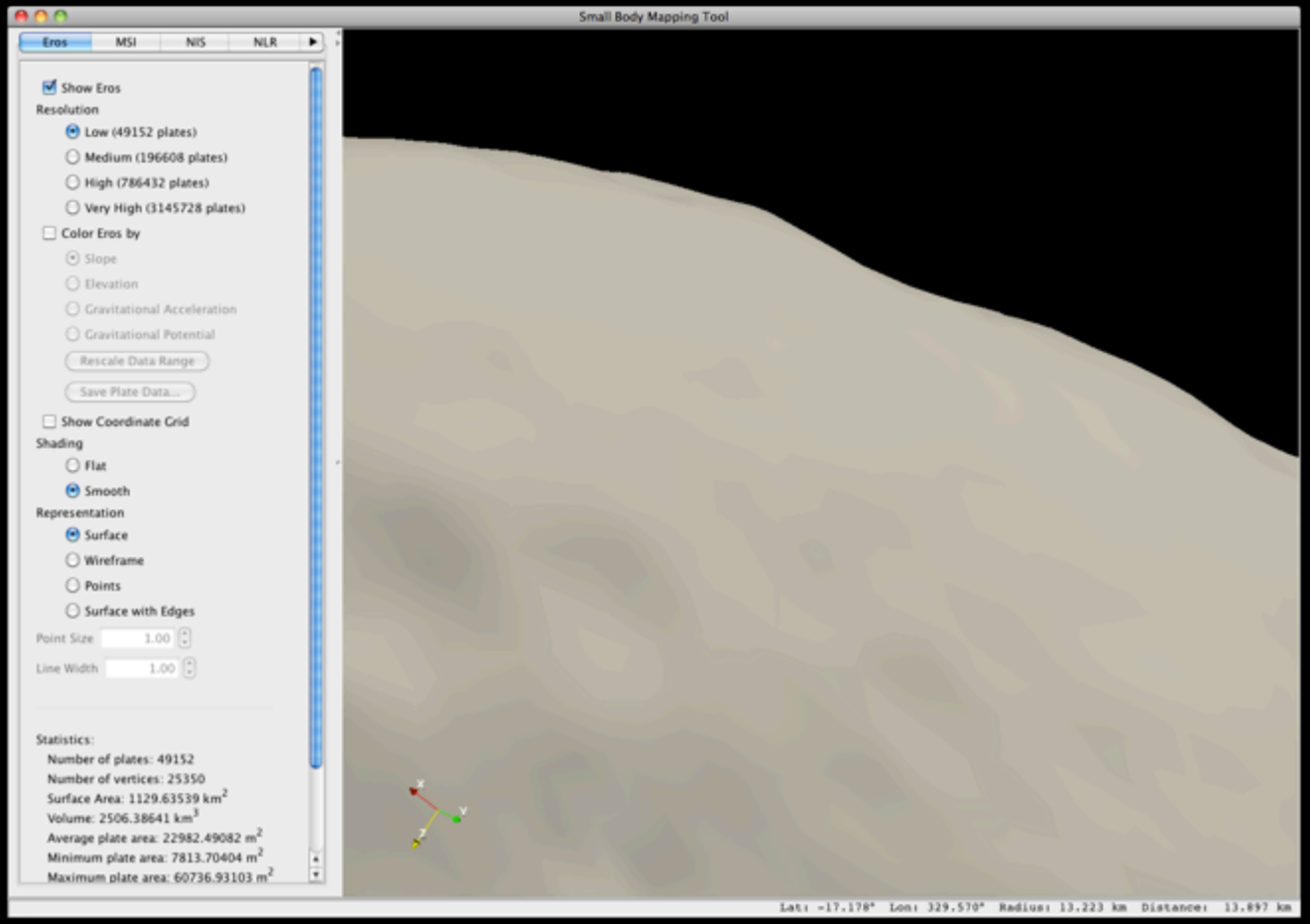
Change Center of Rotation



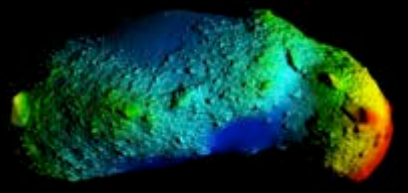
By default when rotating the camera (while dragging with left mouse button), the shape model rotates around the center of the shape model.

To rotate around a different point on the shape model, position the mouse over that point and press the ‘c’ key.

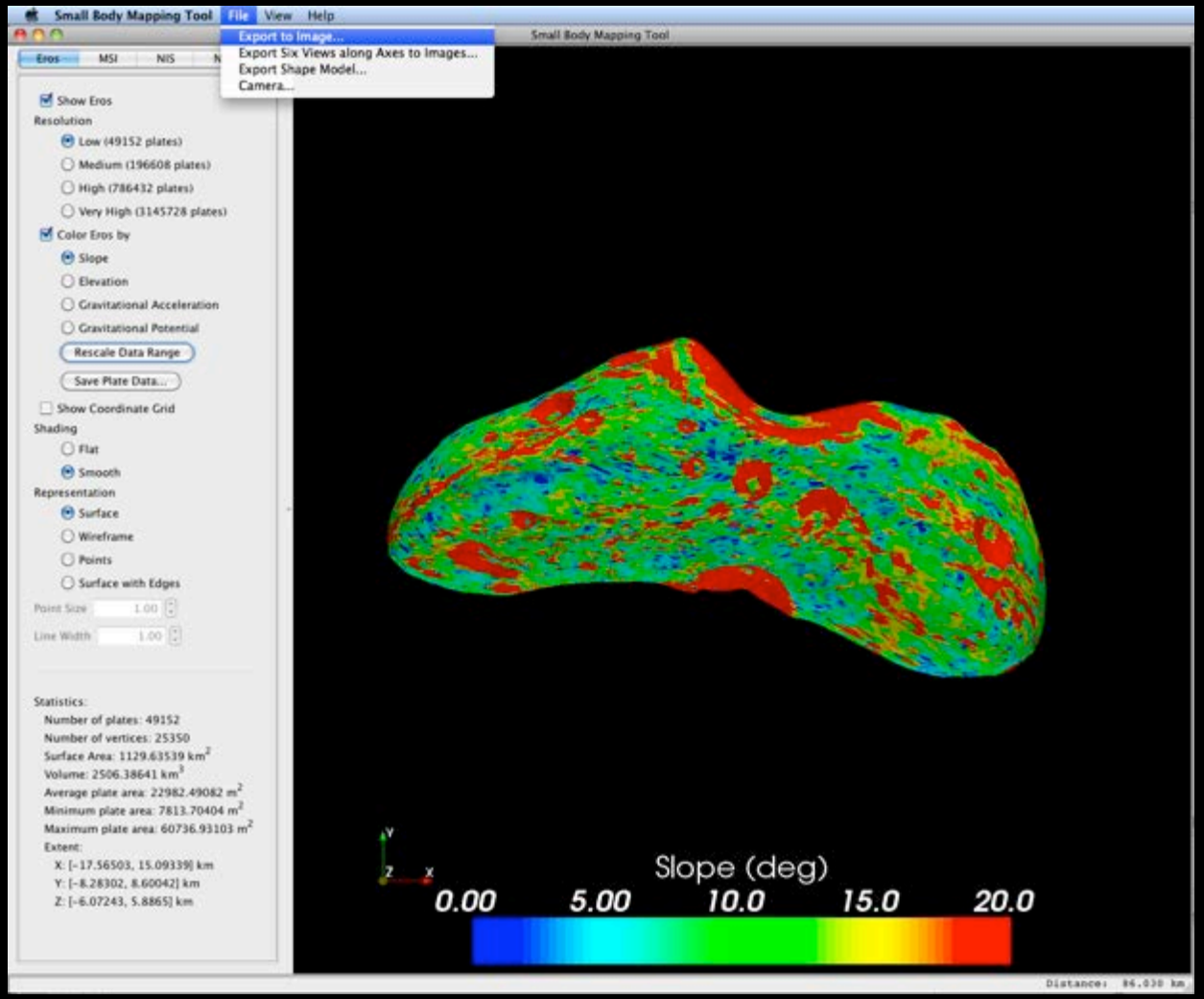
To return to the default center of rotation, press the ‘r’ key (for reset).



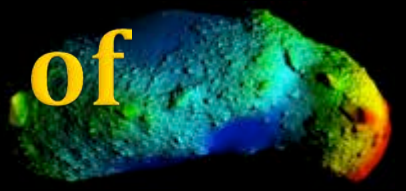
Save renderer view as image



Click on the “Export to Image…” in the File menu. Choose a format and name for the image.



Change Camera Vertical Field of View and Distance



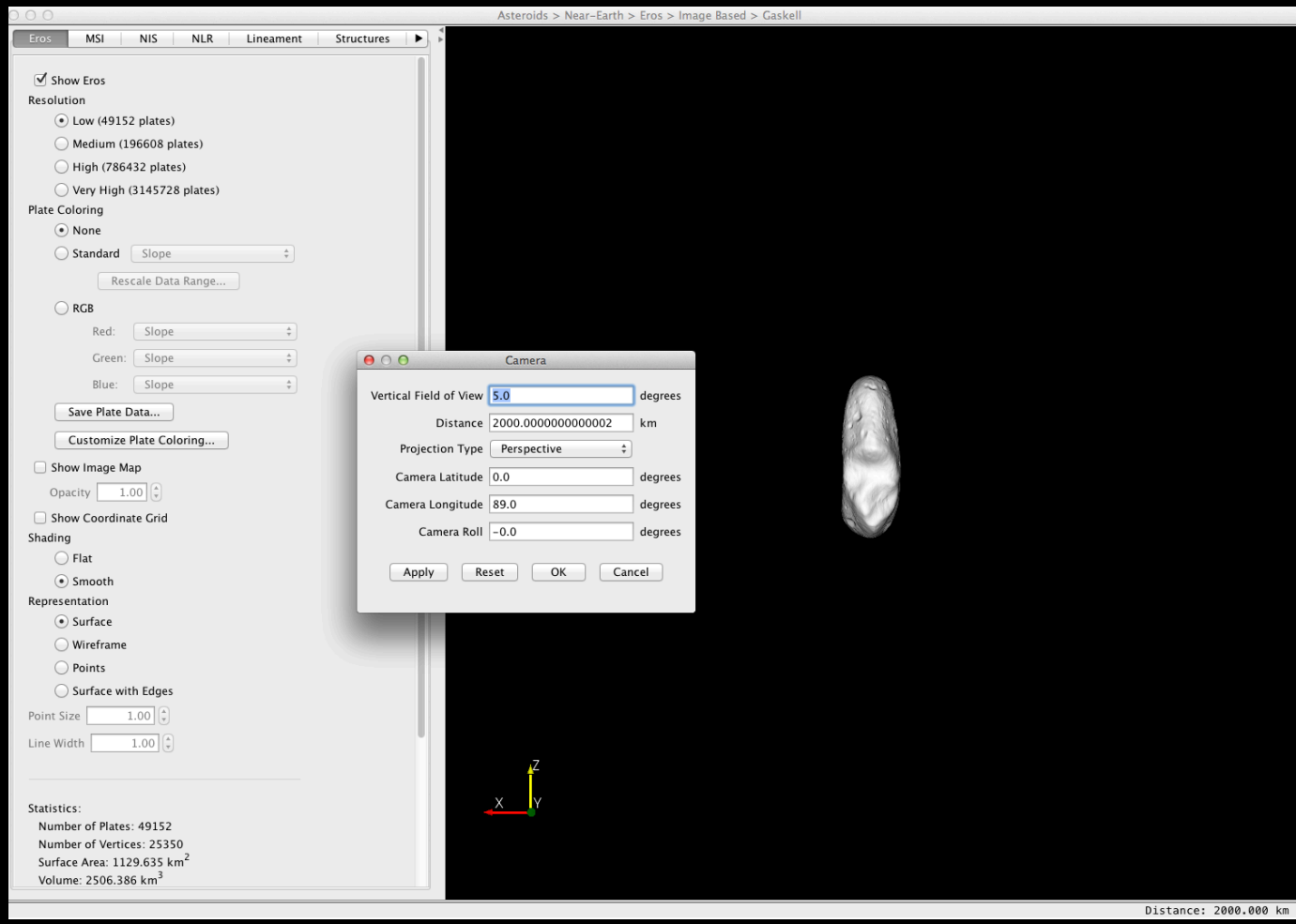
By default the vertical field of view of the camera is 30 degrees and the distance is chosen so the entire shape model fits in the renderer view.

To change these values, open the Camera… dialog in the File menu.

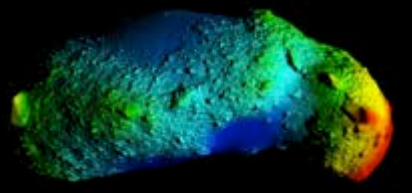
Enter a field of view of 5 degrees.

Enter a distance of 2000 km.

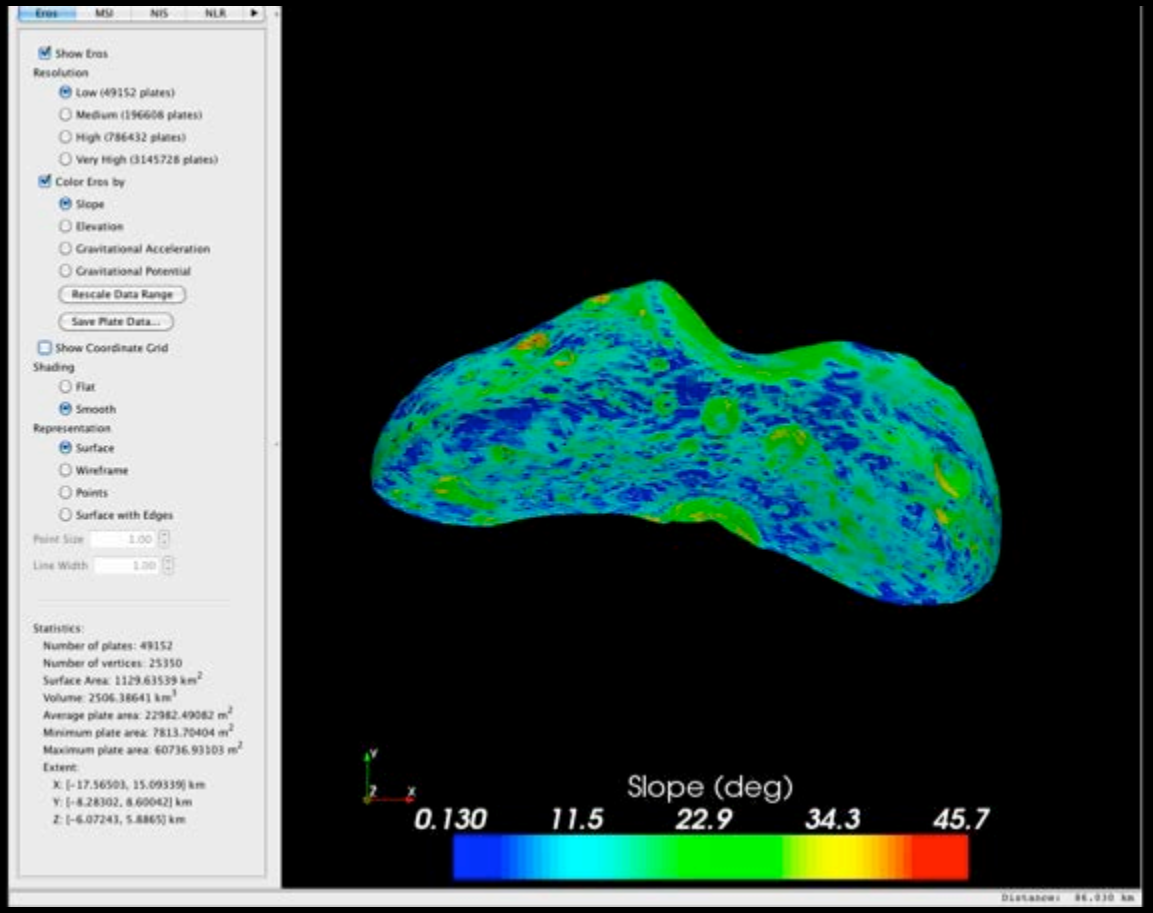
Then click OK



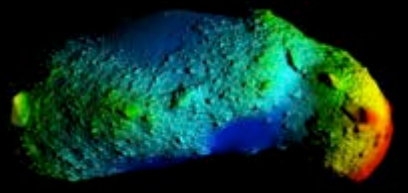
Control panel features: Show Slope map of Eros



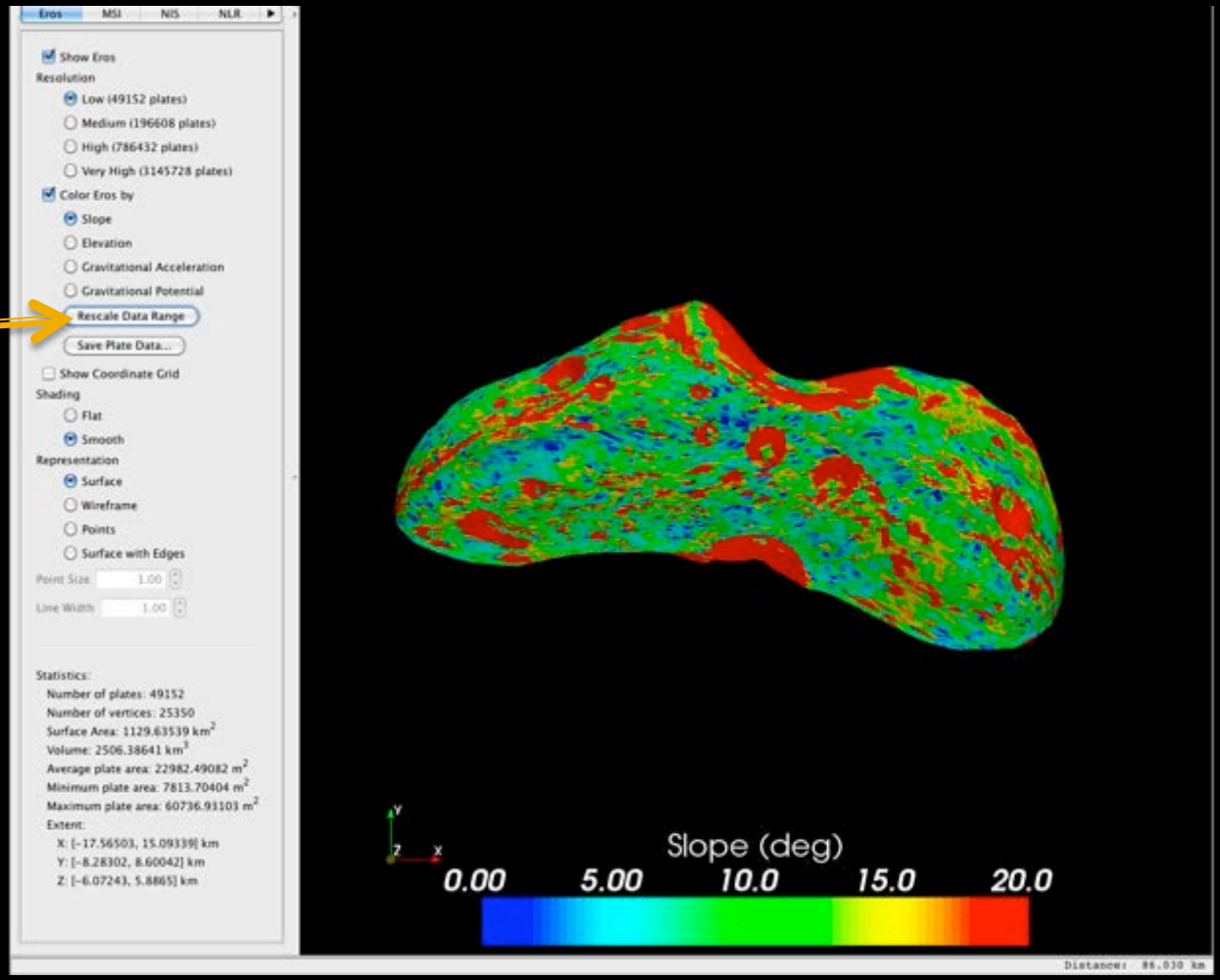
Check the “Color Eros by” checkbox. You will now see the asteroid colored by slope.



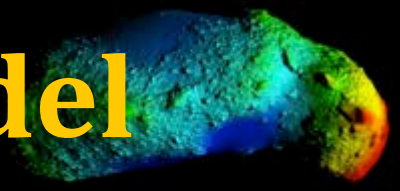
Control panel features: Rescale range of slopes



The slope base map ranges from close to zero to about 45 degrees. We will now change the range from 0 to 20 degrees. Click the “Rescale Data Range” button. In the new window, Enter 0 for the minimum and 20 for the maximum. Then click OK.



Draw Paths on Shape Model



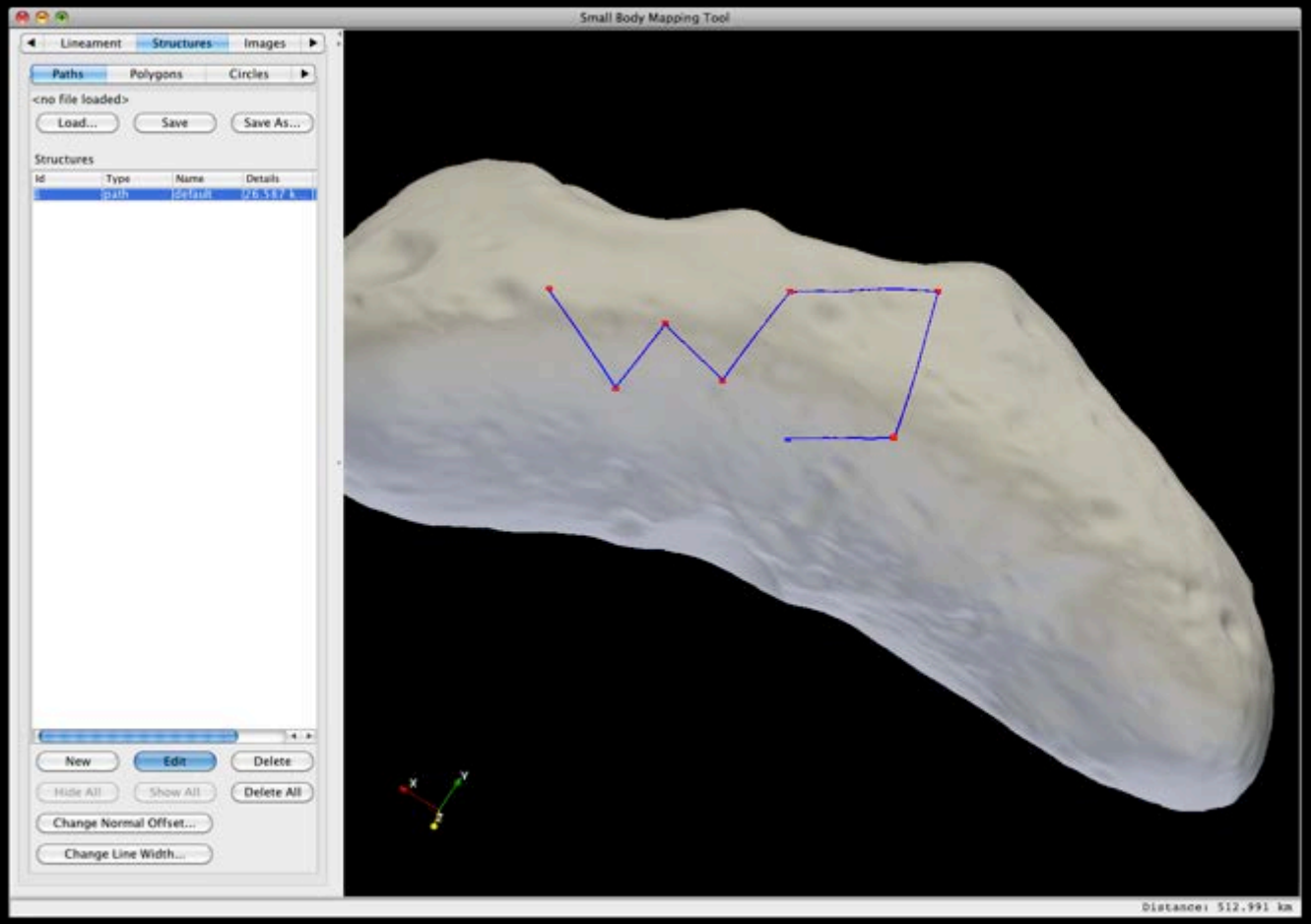
Switch to Structures tab and within that tab click on the Paths tab.

Press New to begin drawing a Path.

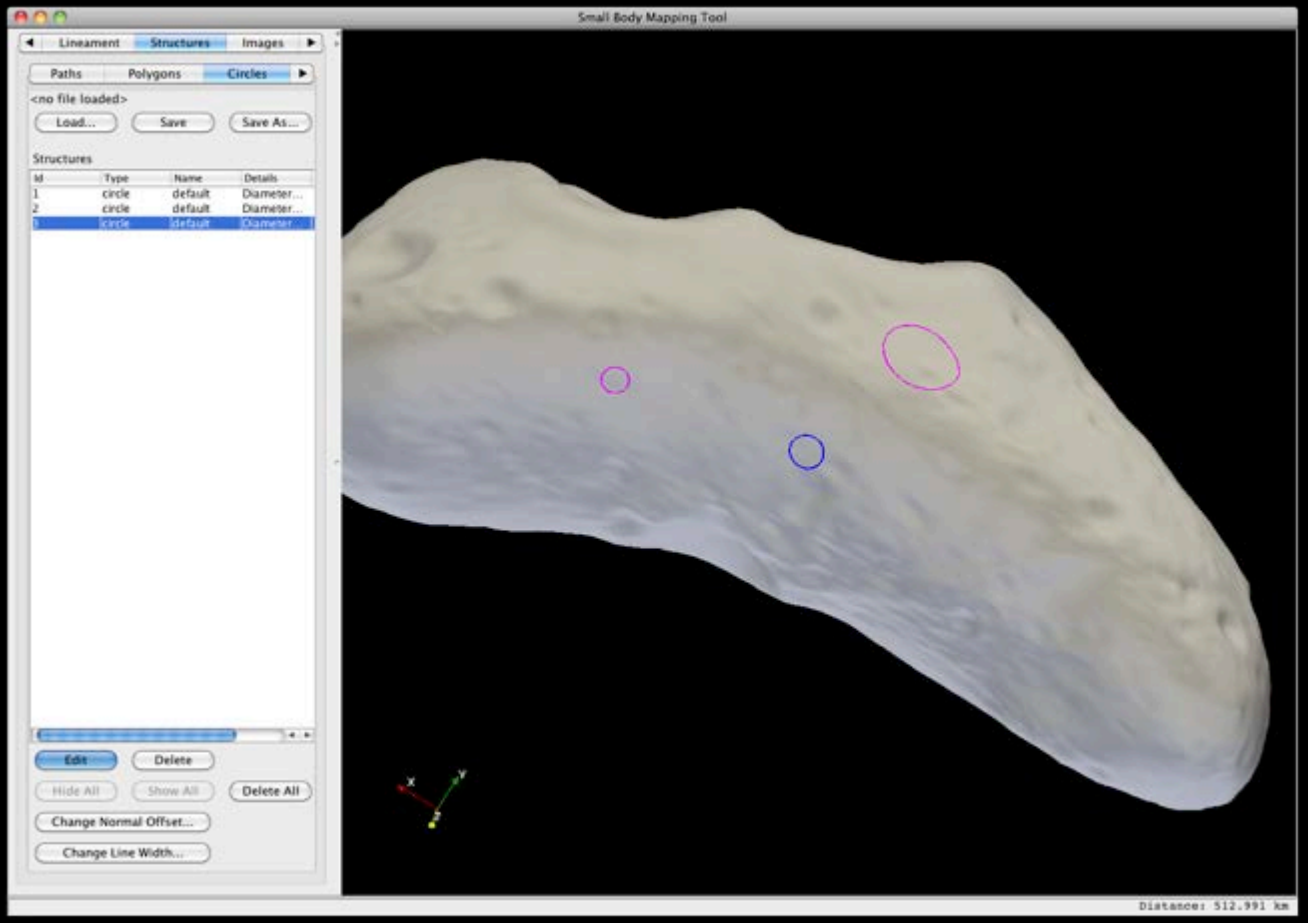
You will be in Edit mode in which the shape model is frozen in the renderer and you will not be able to rotate, zoom and pan.

In the renderer view click on the shape model to specify the vertices of the Path.

When finished drawing the Path, press the Edit button to return to normal navigation mode.



Draw Circles on Shape Model



Switch to Structures tab and within that tab click on the Circles tab.

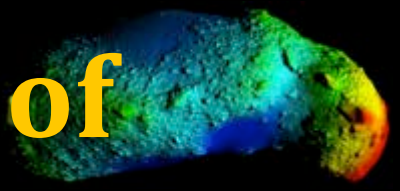
Press Edit to begin drawing circles.

In the renderer view click on the shape model 3 times on the perimeter of the circle. After clicking the third point, a circle will appear through the 3 points.

Click on another 3 locations to draw a second circle.

When finished drawing circles, press the Edit button again to return to normal navigation mode.

Change position and Size of Circle

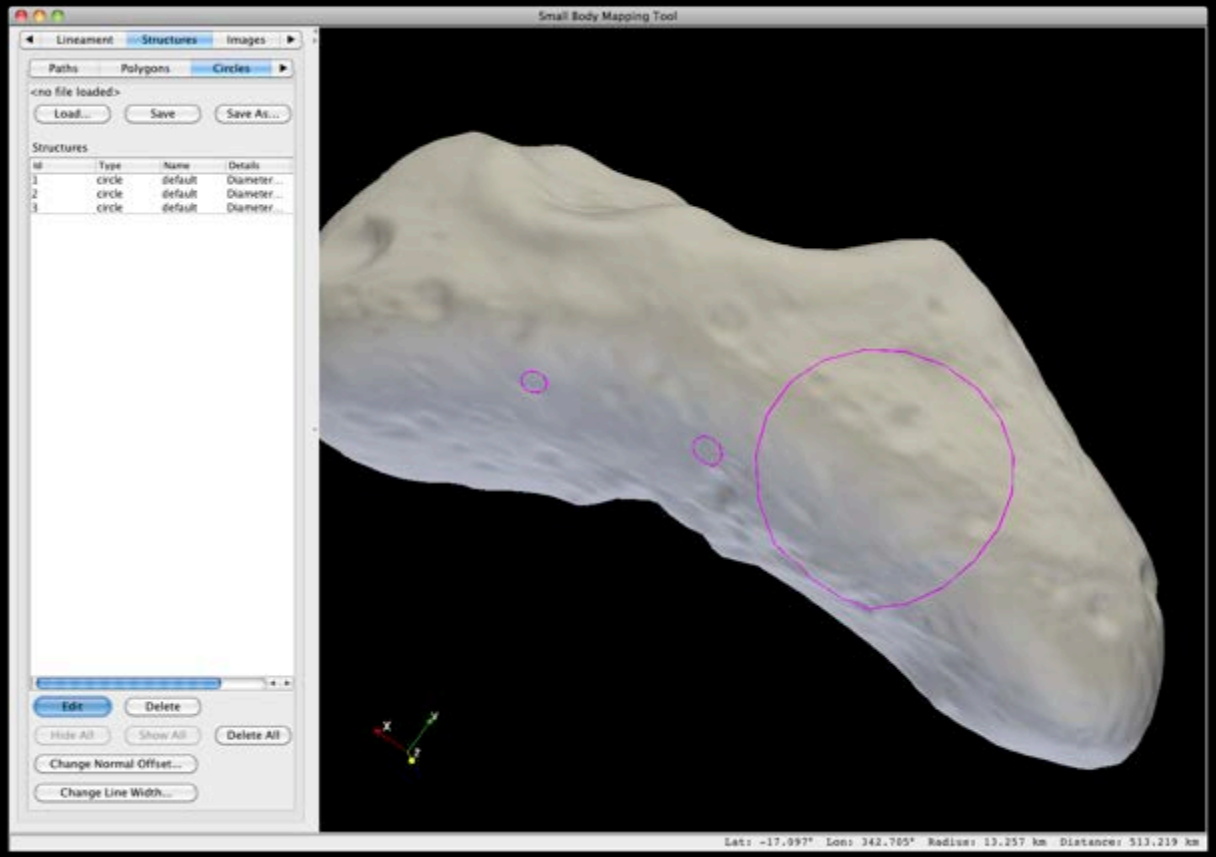


Click on the Edit button to enable Edit mode.

Position the cursor over a circle. The cursor will change to a hand shape.

Drag the circle while holding down the left mouse button to move it to a new location

Drag the circle while holding down both the left mouse button **and** the control or shift button to change its size.



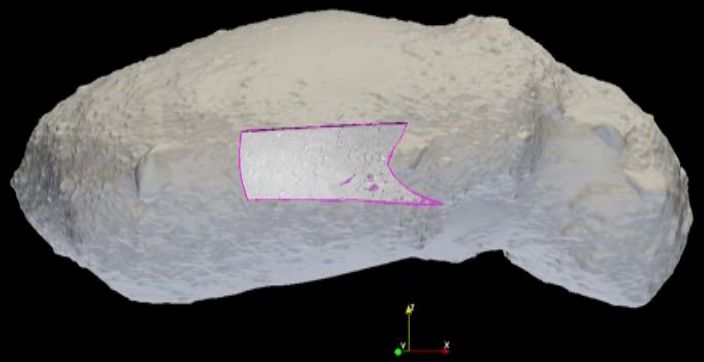
Draw Ellipses on Shape Model

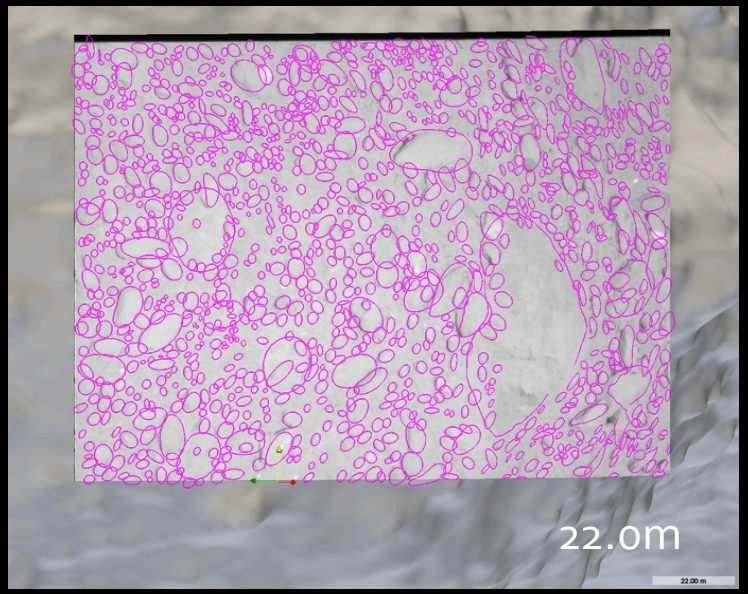
Switch to Structures tab and within that tab click on the Ellipses tab.

Press Edit to begin drawing ellipses.

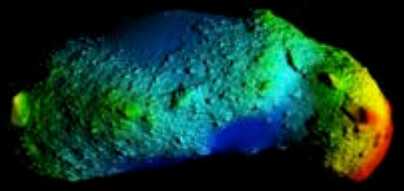
Click on the shape model 3 times, first along the semi-major axis, and then perpendicular along semi-minor axis. After clicking the third point, an ellipse will appear through the 3 points.

When finished drawing ellipses, press the Edit button again to return to normal navigation mode.





Change Flattening and Orientation of Ellipse



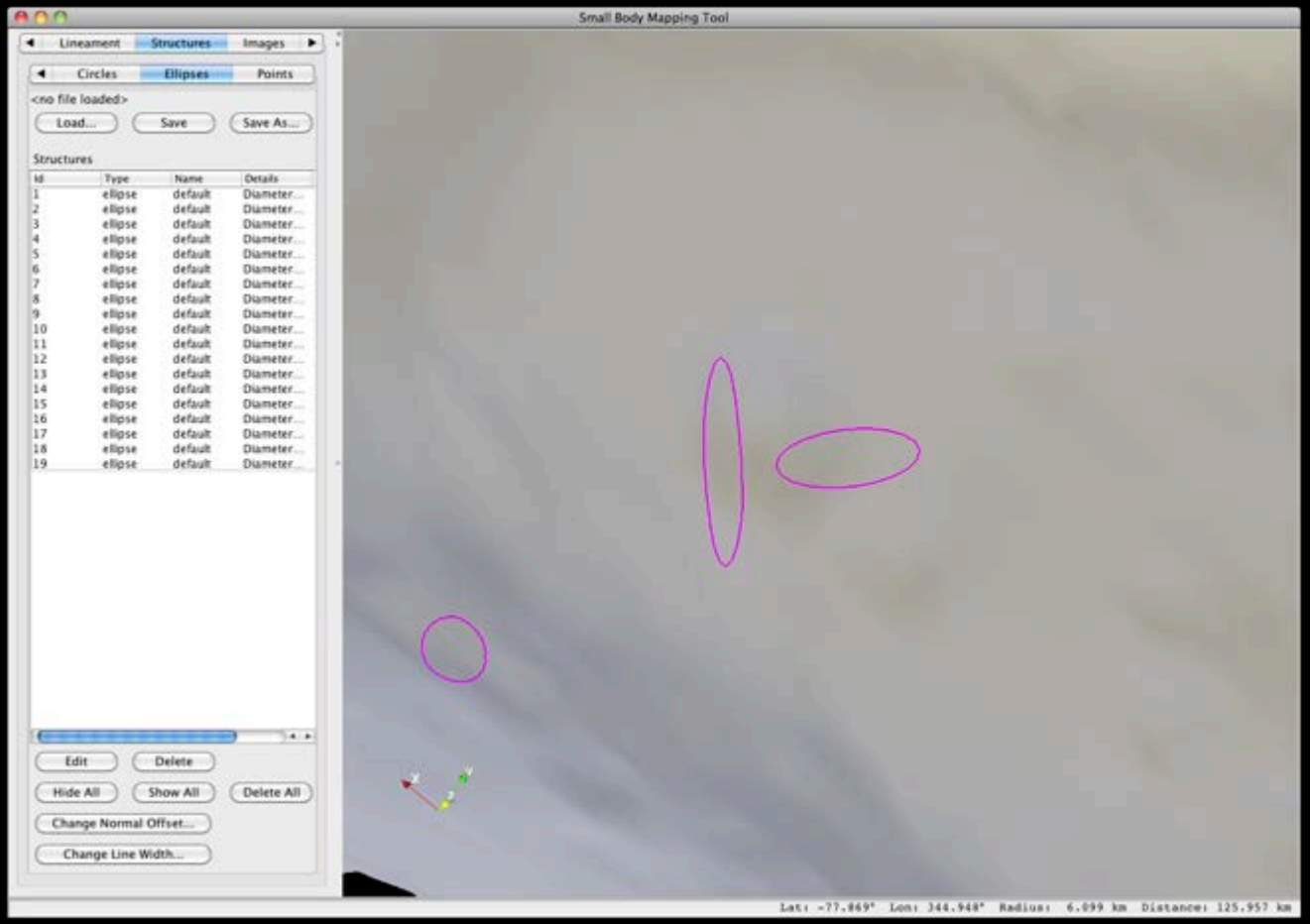
Click on the Edit button to enable Edit mode.

Position the cursor over an ellipse. The cursor will change to a hand shape.

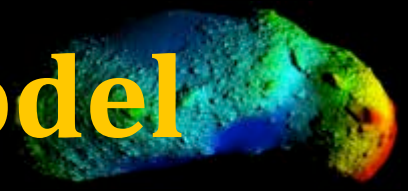
To change the flattening of the ellipse (ratio of semi-minor to semi-major axis), drag the ellipse while holding down the left mouse button and the ‘z’ or ‘/’ (forward slash) key.

To change the orientation of the ellipse, drag the ellipse while holding down the left mouse button and the ‘x’ or ‘.’ (period) key.

The position and size of an ellipse can be changed in the same manner as circles.



Draw Points on Shape Model

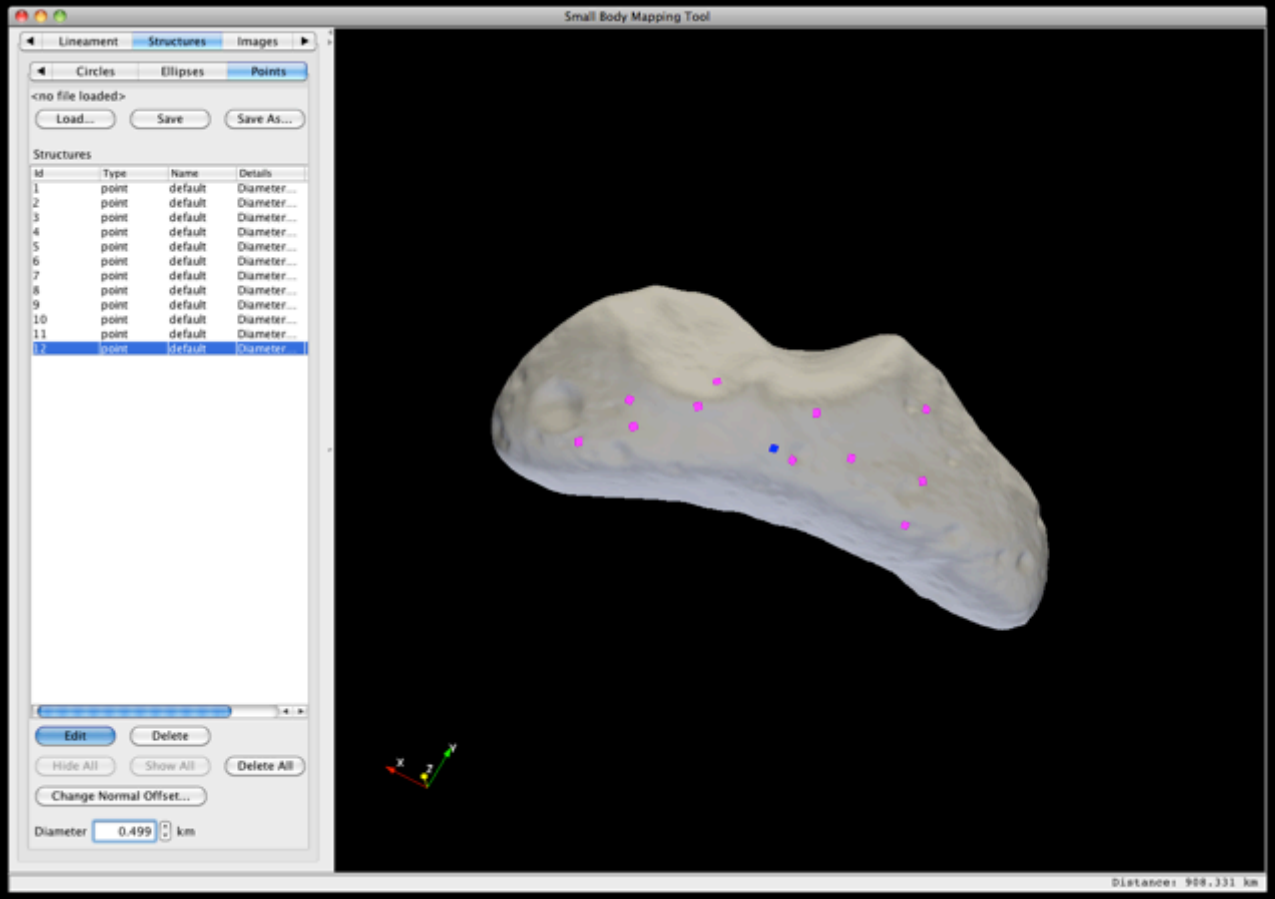


Switch to Structures tab and within that tab click on the Points tab.

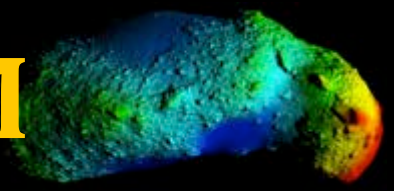
Press Edit to begin drawing points.

Each time you click on the shape model with the left mouse button, a point will appear at that location.

When finished drawing points, press the Edit button again to return to normal navigation mode.



Importing a regional DTM



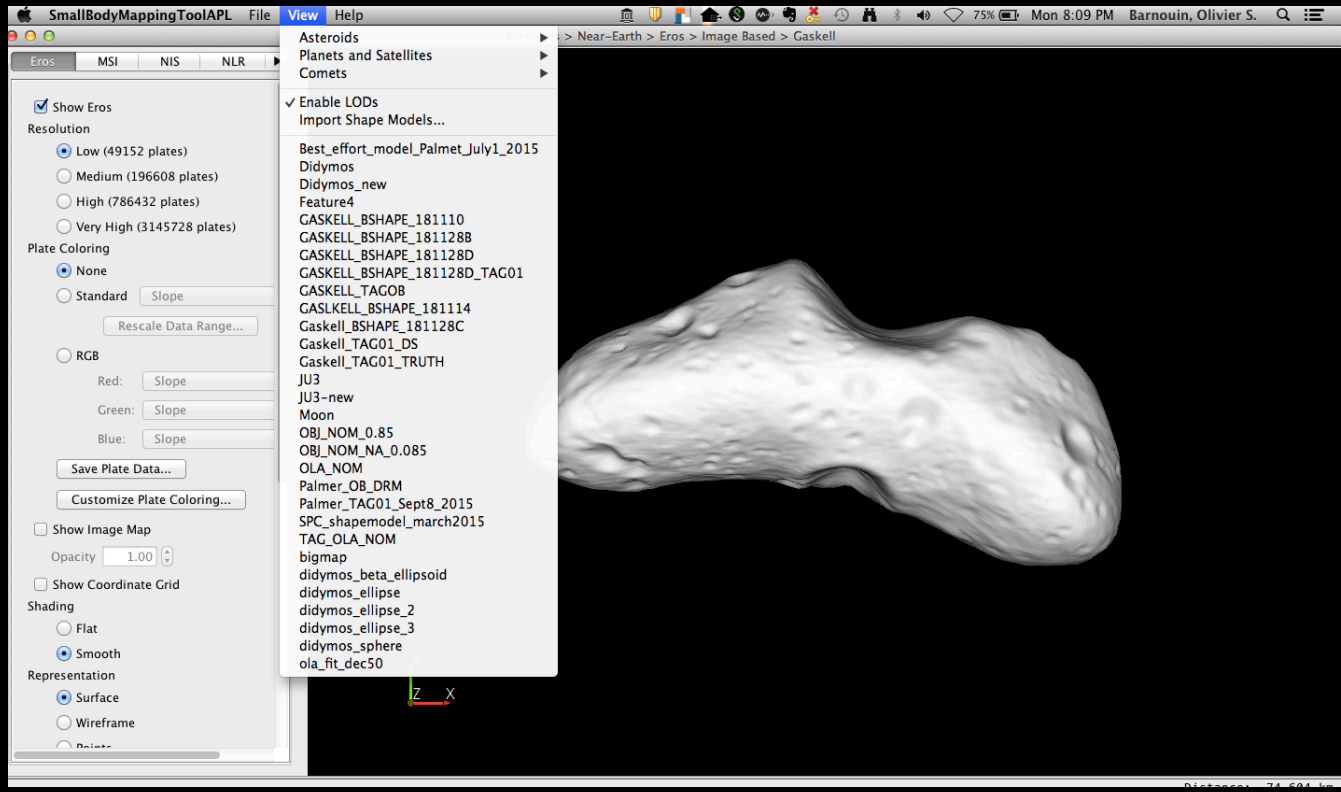
Two main ways to import a shape model into sbmt

Quick and dirty approach – you just made an obj and you want to take a look.

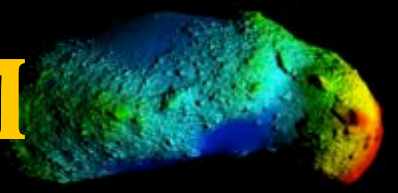
At command line run: Runsbmt nameoffile.obj

If you want to add ancillary data, images and so on.

View>import shape model



Importing a regional DTM

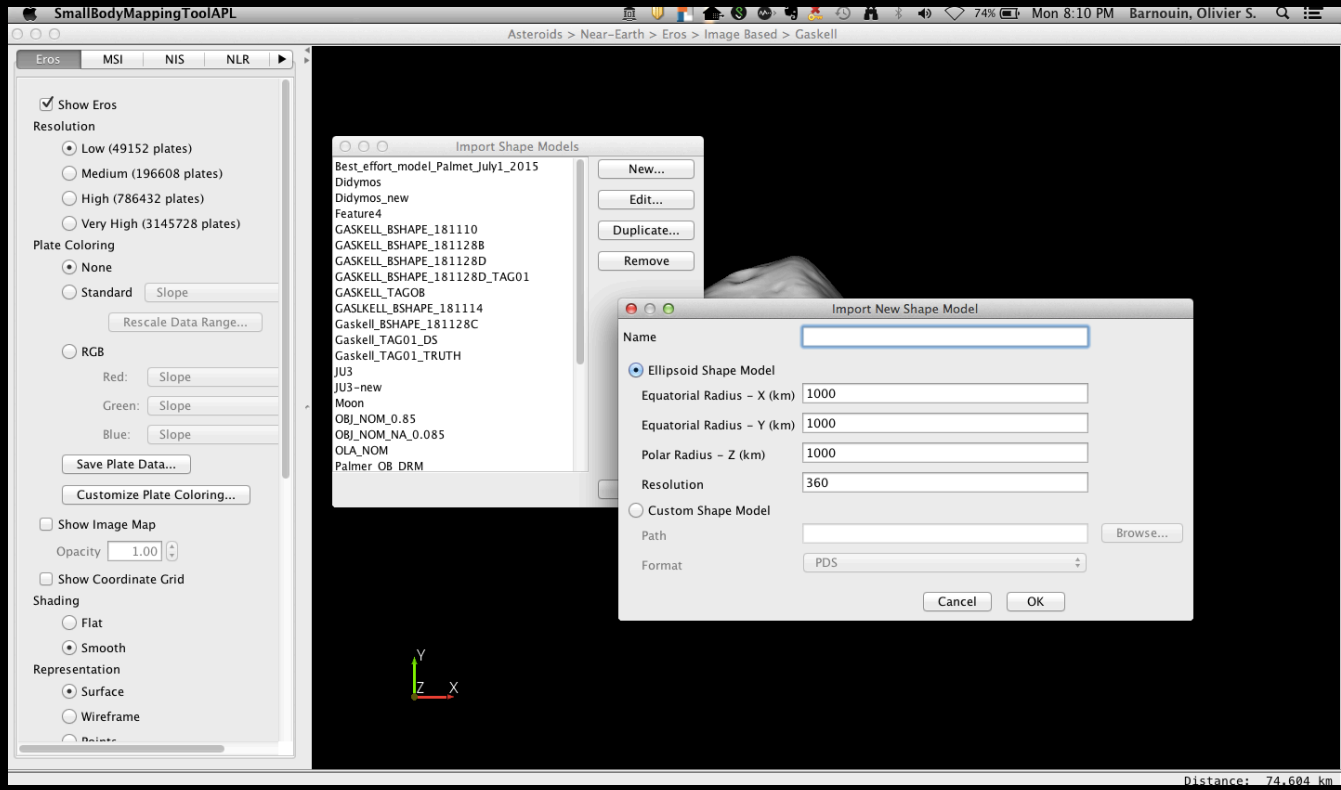


Click on New

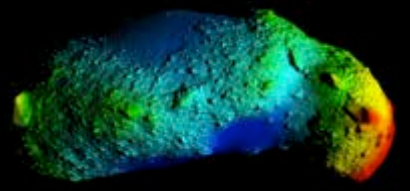
Type in name of new shape model.

Choose new model type: You have the option of generating an ellipsoid or adding a new shape model (OBJ, PLT – Gaskell plate format, or Vtk fomat)

Custom model: browse to model



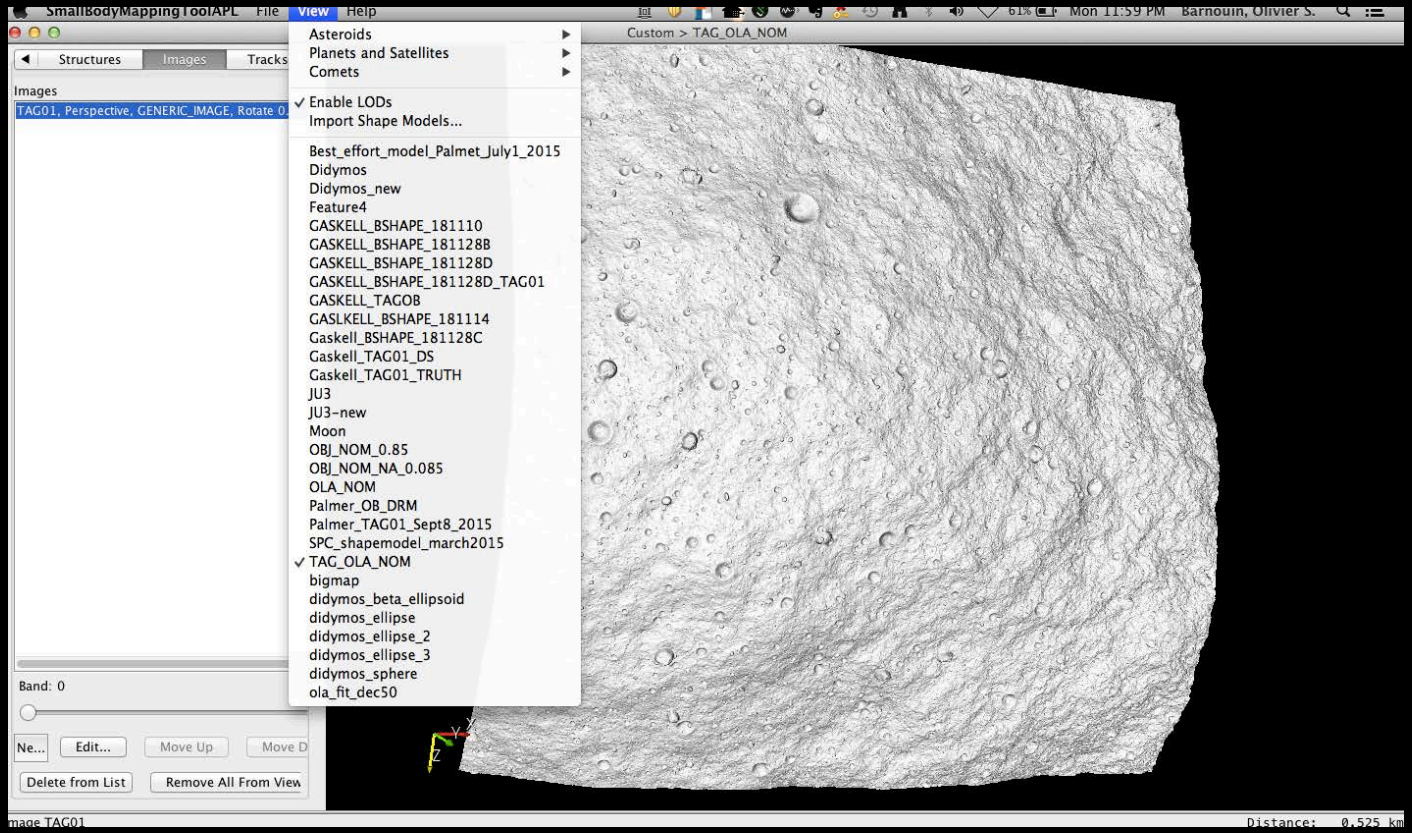
View Imported DTM



Click on View

Select from list of model you imported

Chose OLA DTM



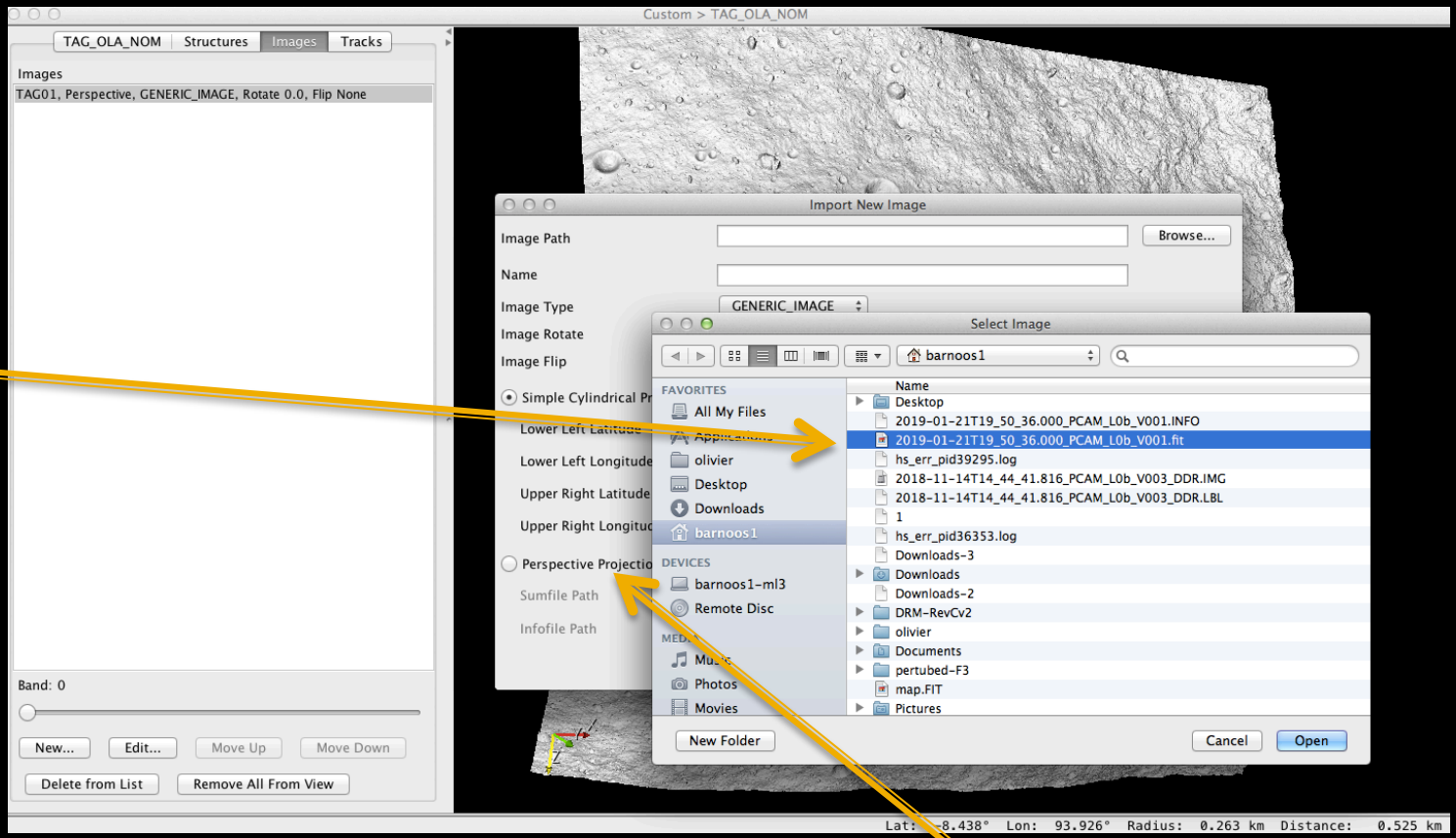
Overlay an Imported Image on Imported DTM

Click on Images

Click on New

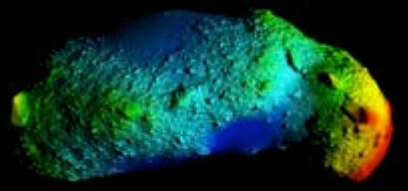
Click on Browse and find image you would like to place over model

You may need to rotate and flip image depending on camera (not required for these Polycam images)



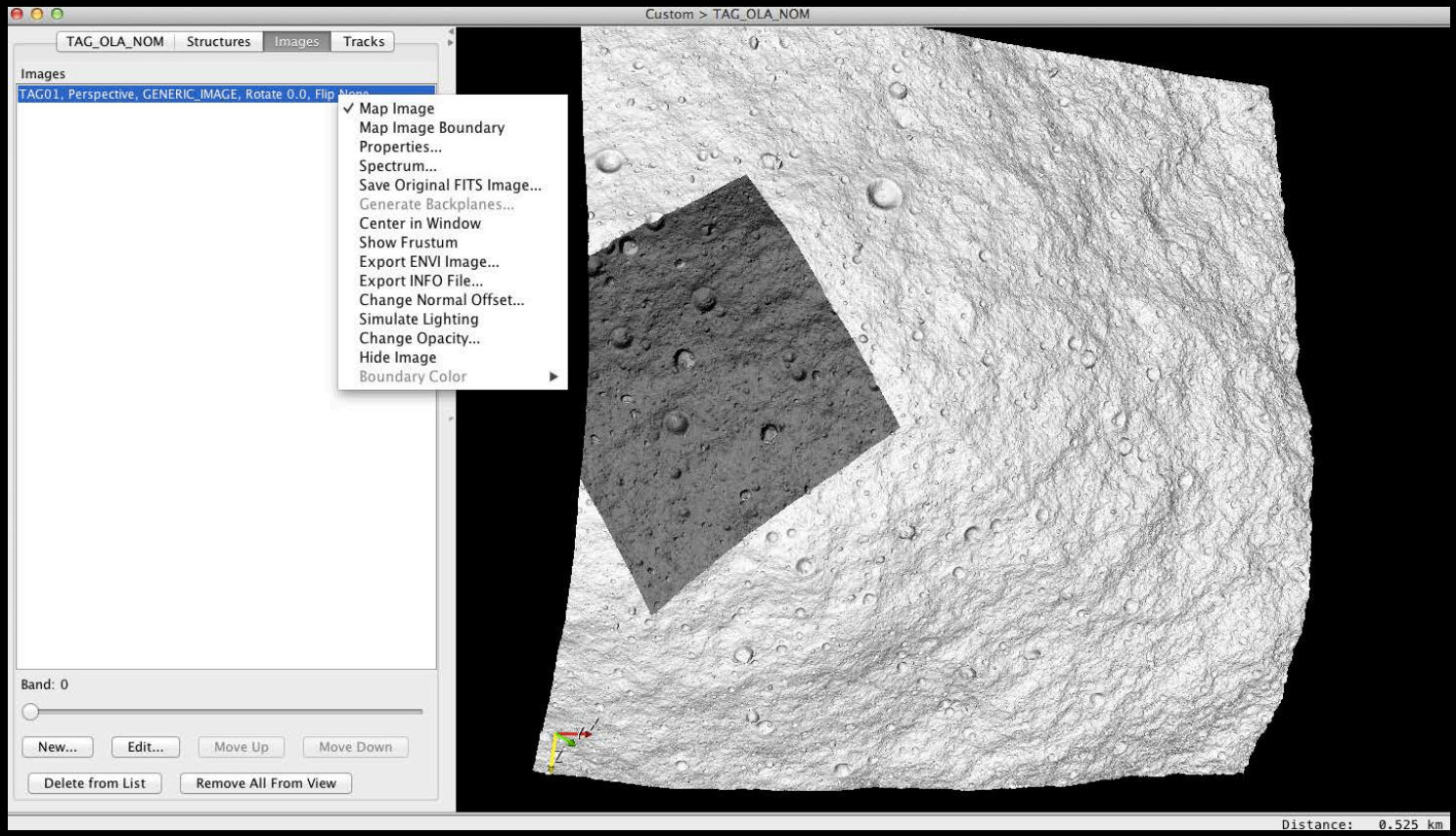
Can overlay image using simple cylindrical projection or sbmt infofile or gaskell sumfile. Infofiles can be generated once an image is saved from SBMT. They are also easy to compute.

View Imported Image on Imported DTM

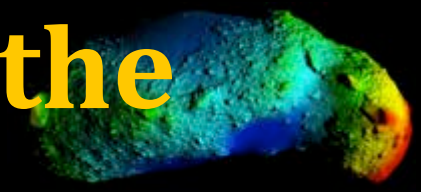


Left click on image that you imported

Click Map image



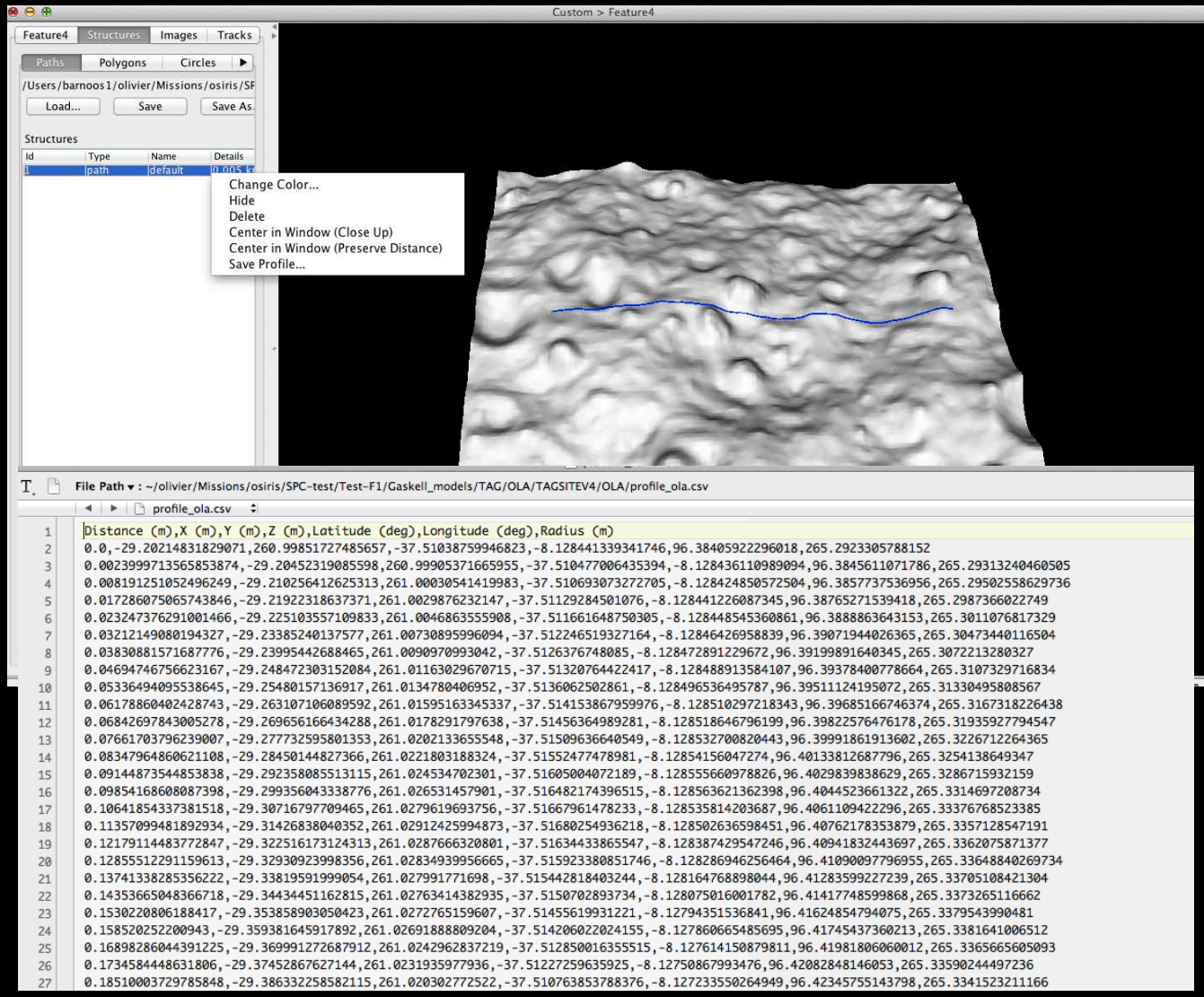
Drawing a profile across the asteroid



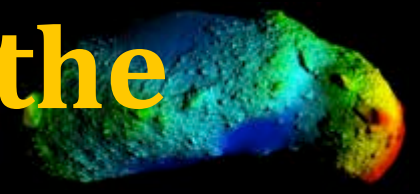
Switch to Structures tab and within that tab click on the Path tab.

Press Edit to begin drawing path. For profile use only two points.

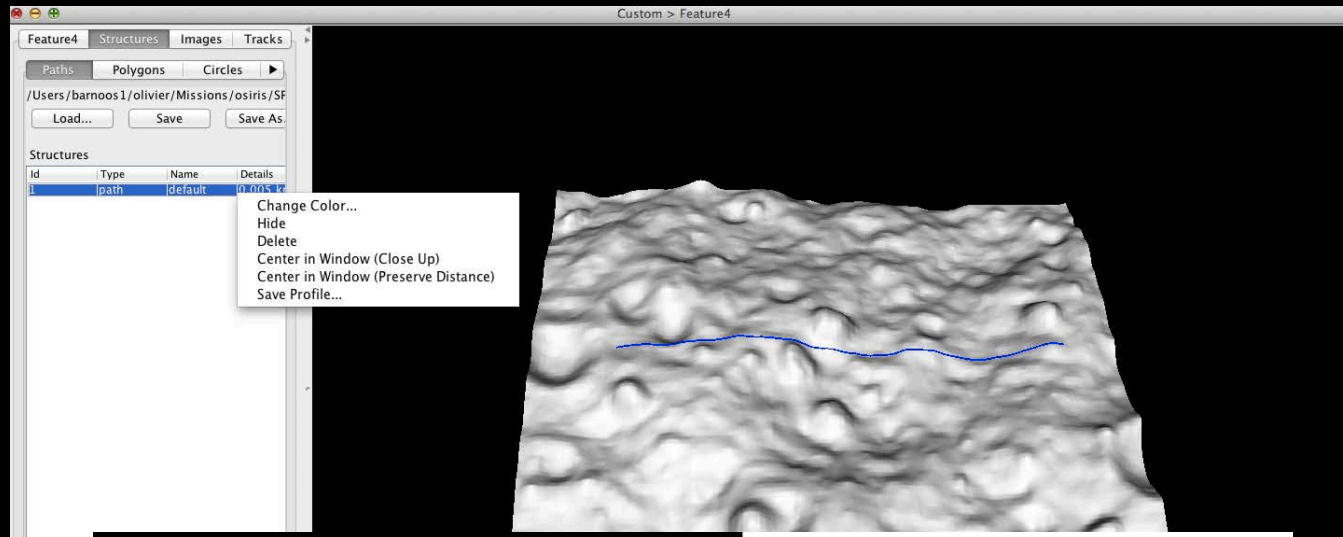
Press Edit to get out of edit mode. Then right click on the path you just created and save profile. It will output all available data associated with shape model along path.

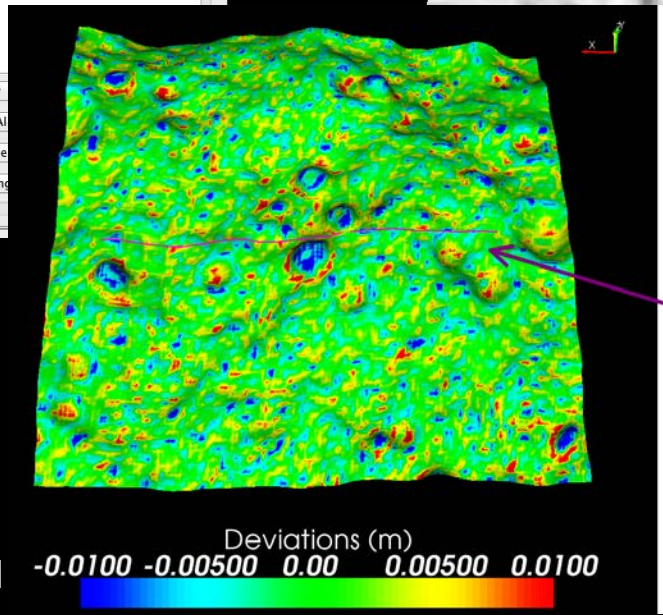


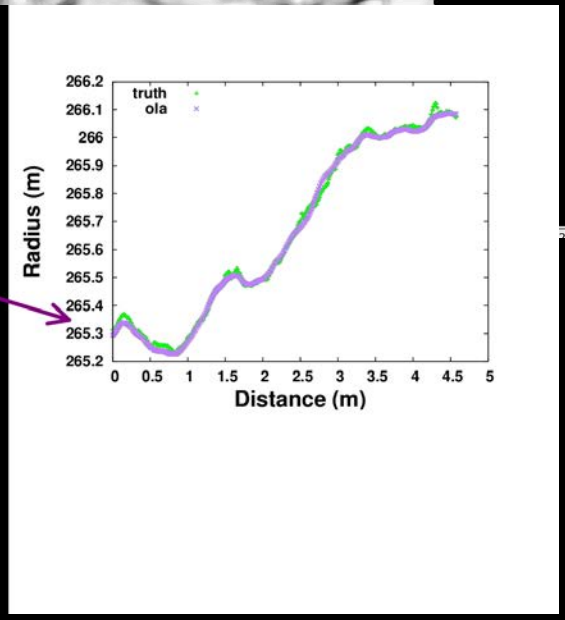
Drawing a profile across the asteroid



Import profile in your favorite plotting program (gnuplot output shown)

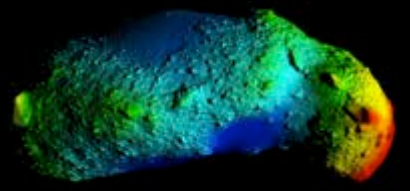




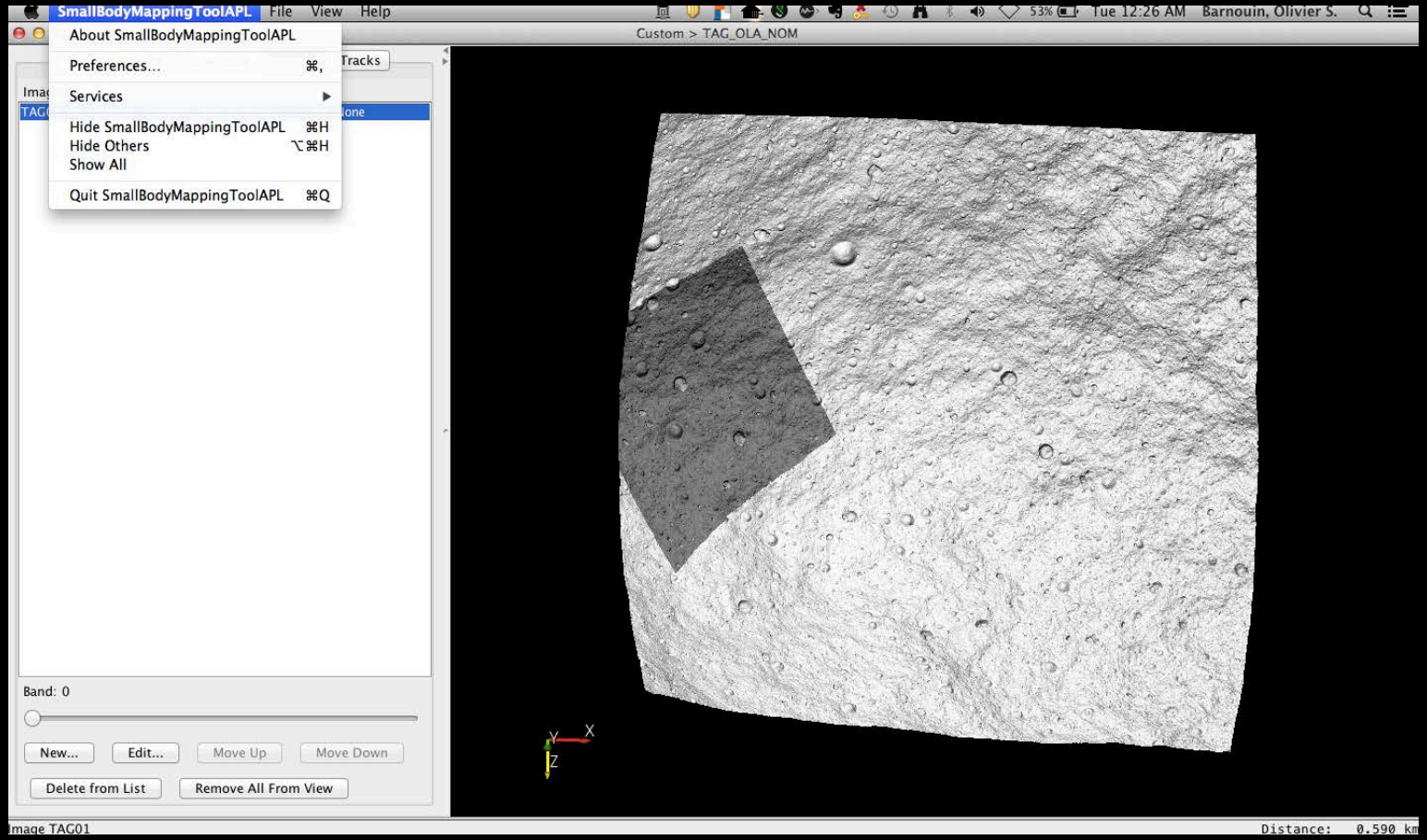


Difference between a truth DTM and a simulated OLA DTM

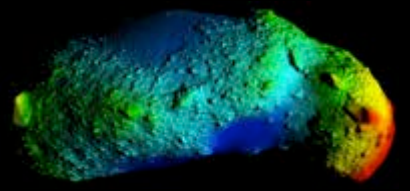
Changing preferences



Want a white background? Change the color of the axes shown or remove it altogether?
Changing lighting of model?



Changing preferences



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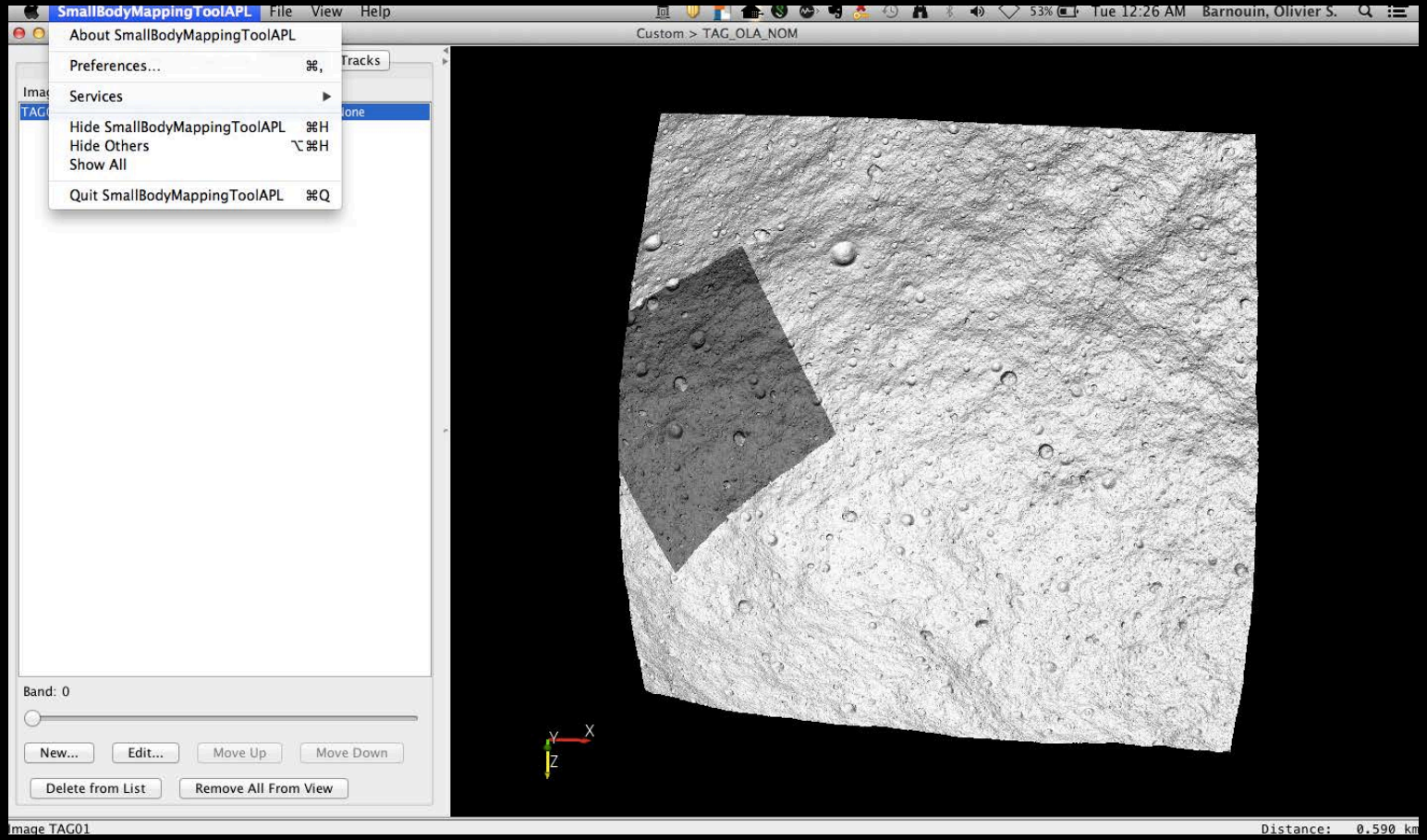
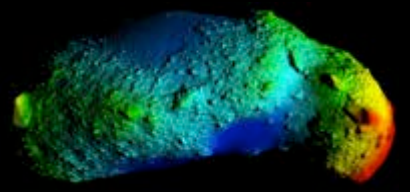


Changing preferences



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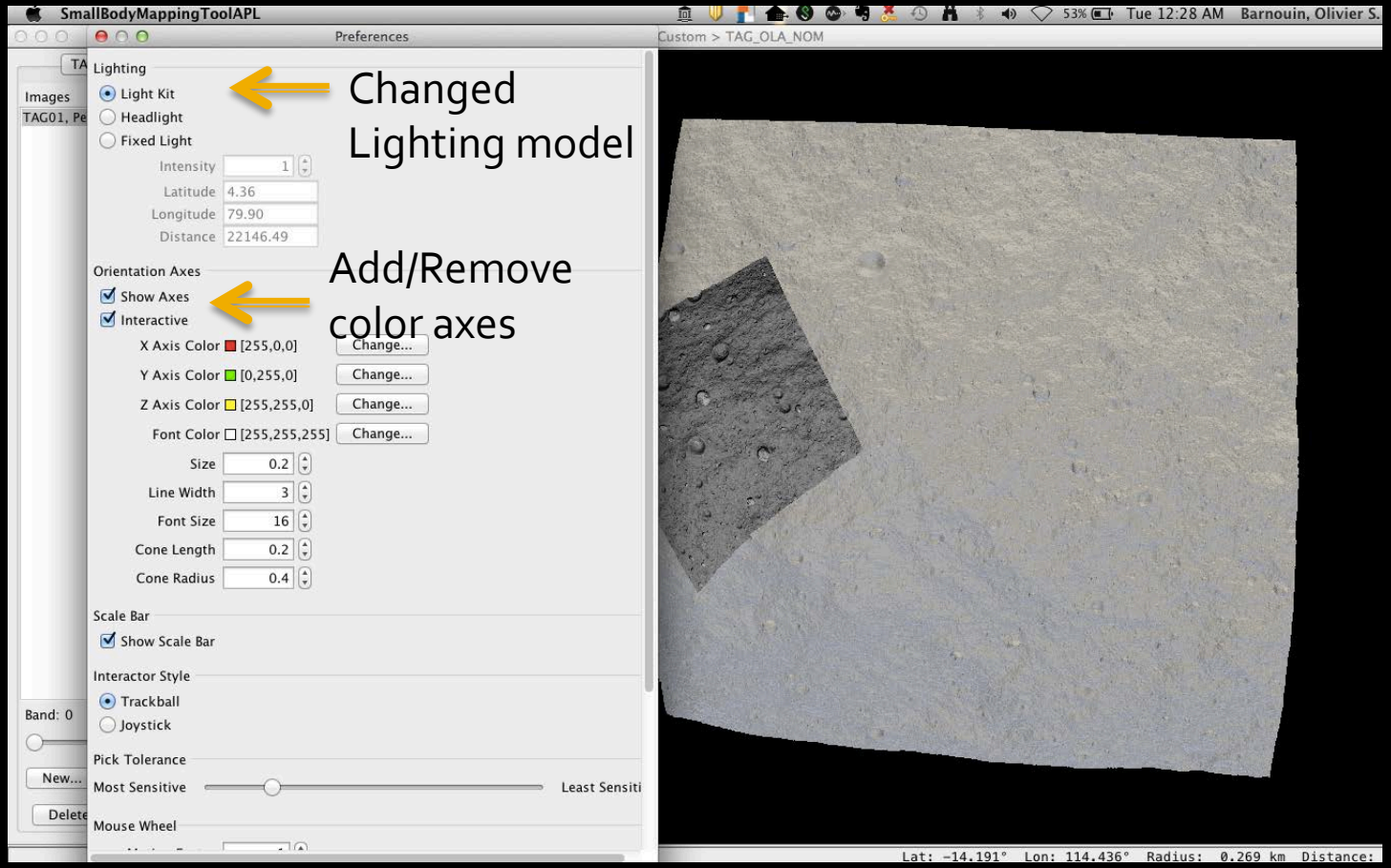
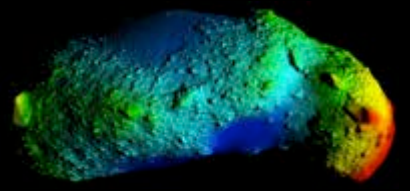


Changing preferences



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Changing lighting of model?