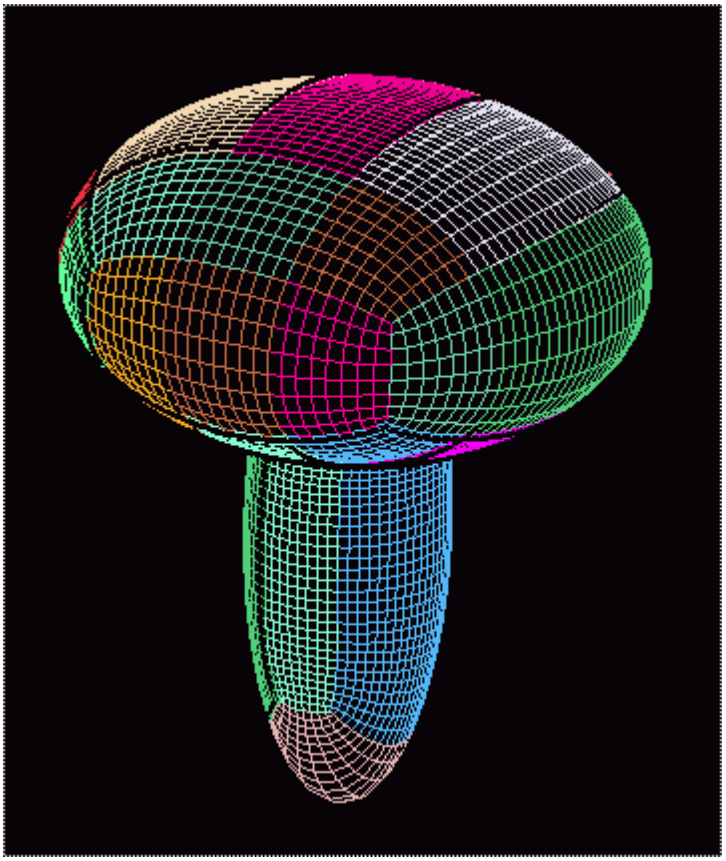
Tutorial 4.2

What You Will Create

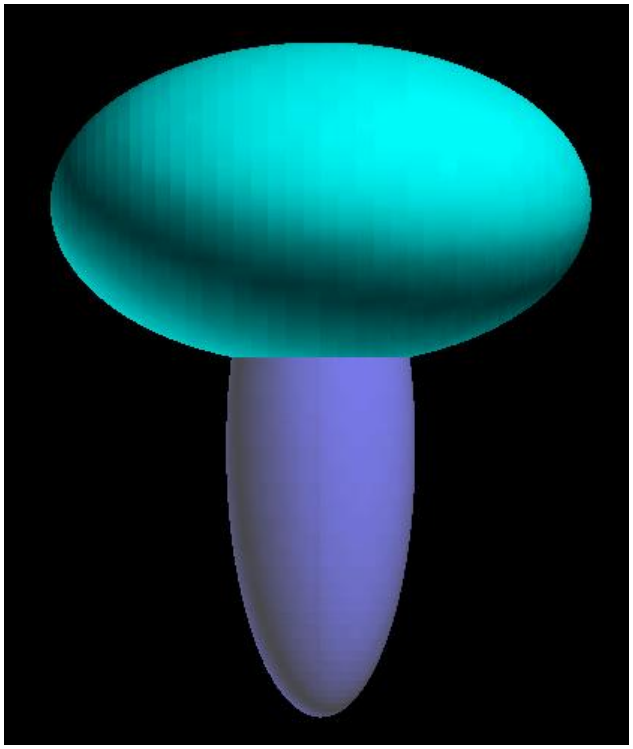


What You Will Learn

- Automatically creating an internal surface at the intersection of two surfaces.
- Creating surfaces from topology.
- Fitting the *Cut-Plane* to a group of topology.

Step 1 Introduction to Creating an Internal Surface

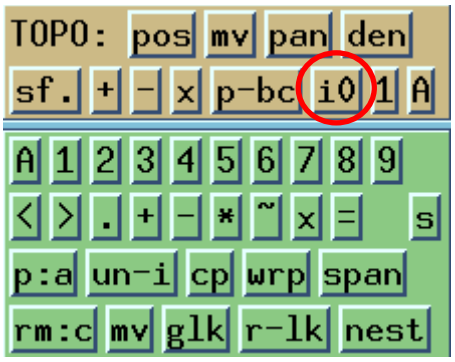
Open the **Tutorial_4.2.fra** file, turn off the **Cut-Plane** and the **Axis** and turn on shade with hidden line removal. Two ellipses forming a mushroom should be displayed as in the picture below. The cap should have an x,y,z magnitude of 2,1.2,2 and center 0,2,0 while the stem should have an x,y,z magnitude of 0.7,2,0.7 and center 0,0.2,0.



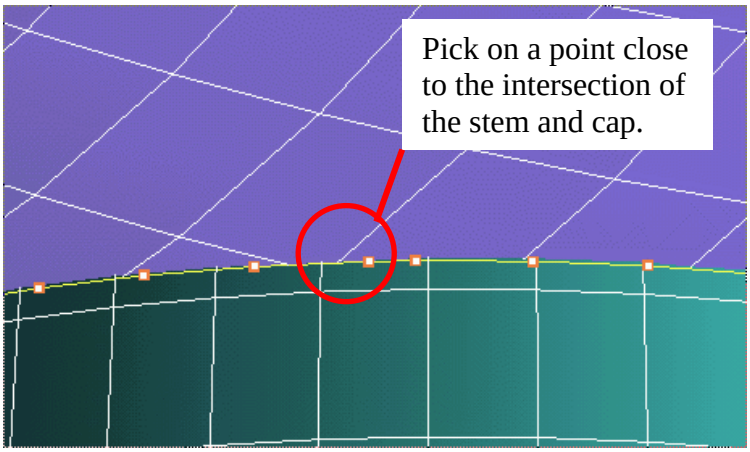
We have learned that when two surfaces intersect and create a convex corner, it is best to mesh the volume using an internal surface. **GridPro** contains a function that automatically creates an internal surface between two intersecting surfaces. **Zoom-in** on the mushroom intersection and rotate the work plane so you are looking upward from the bottom of the stem as in the picture above.

Zoom-in closer and go to the **TOPO** sub-command menu and left click on the 

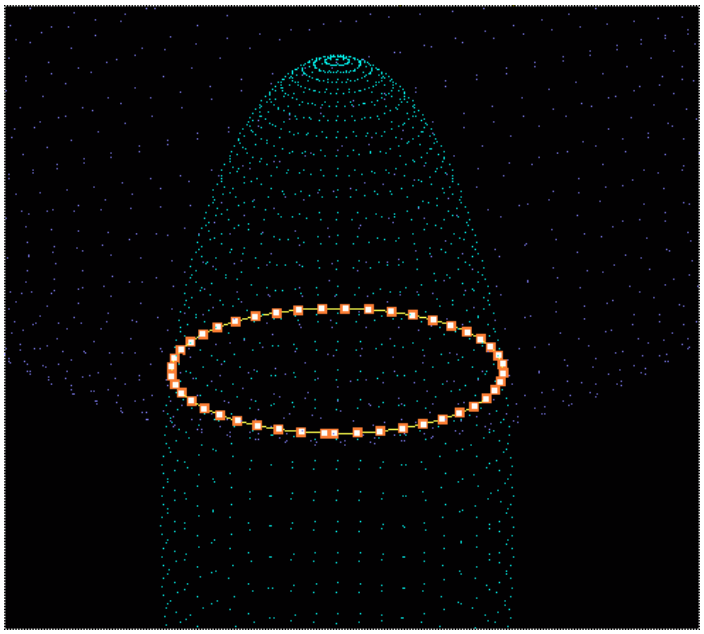
button,



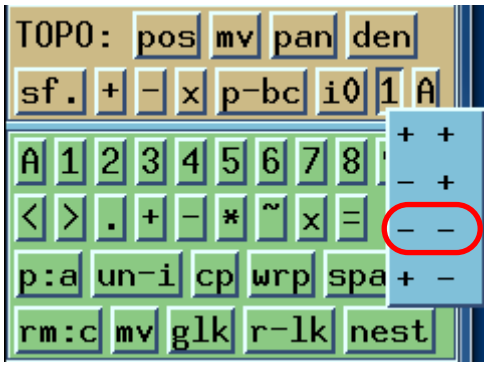
and left click on a point close to the surface intersection as in the picture below. **Note:** the point does not have to be on the intersection but only close to it.



A loop of corners and edges is automatically created at the intersection. Turn off shading, turn on display with points and **zoom-out** for a better view of the loop.



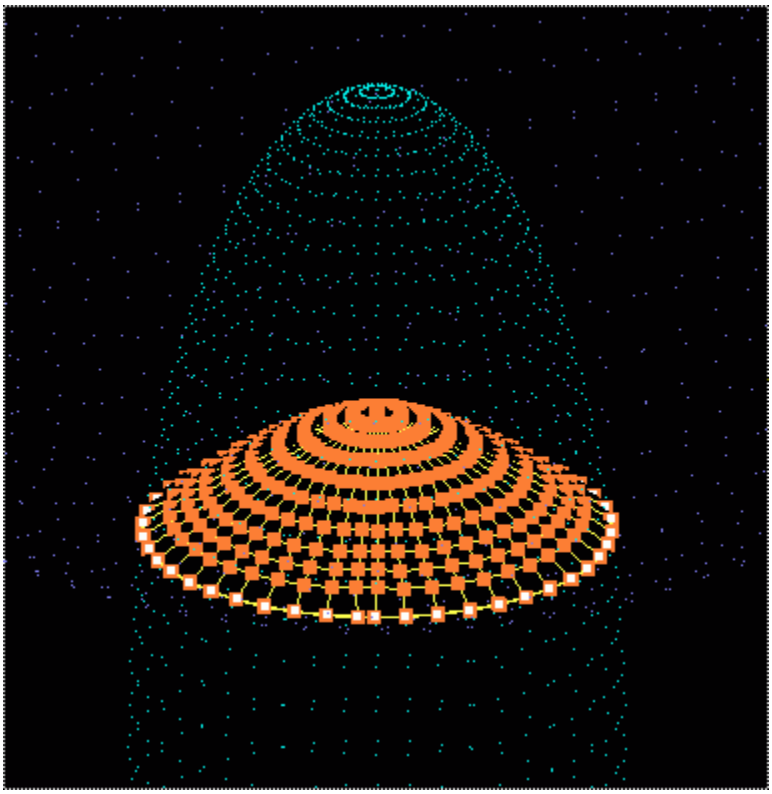
Go back to the **TOPO** sub-command menu and click on the 1 button and choose - - from the sub-menu



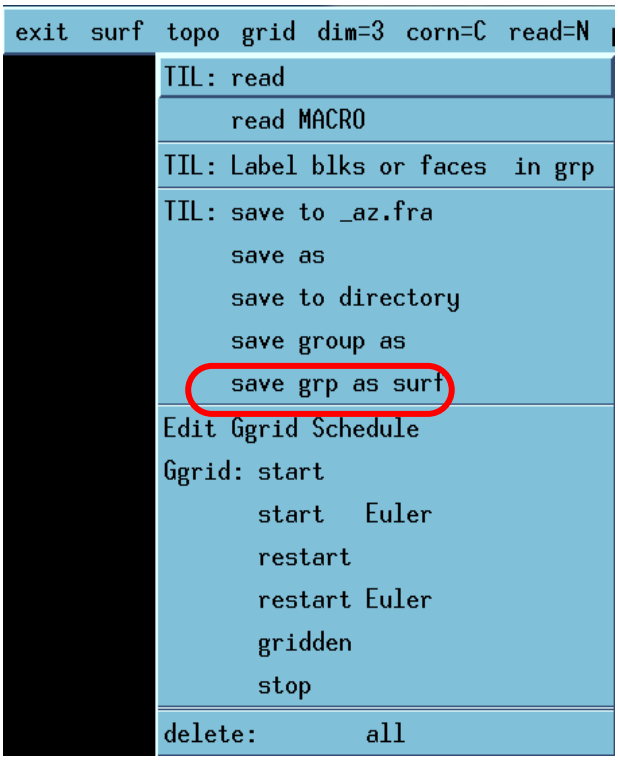
Choosing the Surface Normals

The positive/negative choices in the 1 sub-menu indicate the direction of the normal vectors to the boundary surfaces. In this case, those surfaces are the two ellipsoids forming the mushroom boundaries. Each ellipsoid is defined to have a positive normal direction that points away from the center. It is needed to define tangent directions along the curve of intersections for the construction of an internal surface that bisects the angles of the convex corners. For this purpose, the normal of each ellipsoid must be flipped to the negative direction. Then the average of these units normal will point in the correct tangent directions for the creation of the new surface. This then requires the double flip as seen in the choice of (- -). If the operation does not create a cone shaped topology group as in the picture below, choose another combination as in (++) or (+-), until it is created correctly.

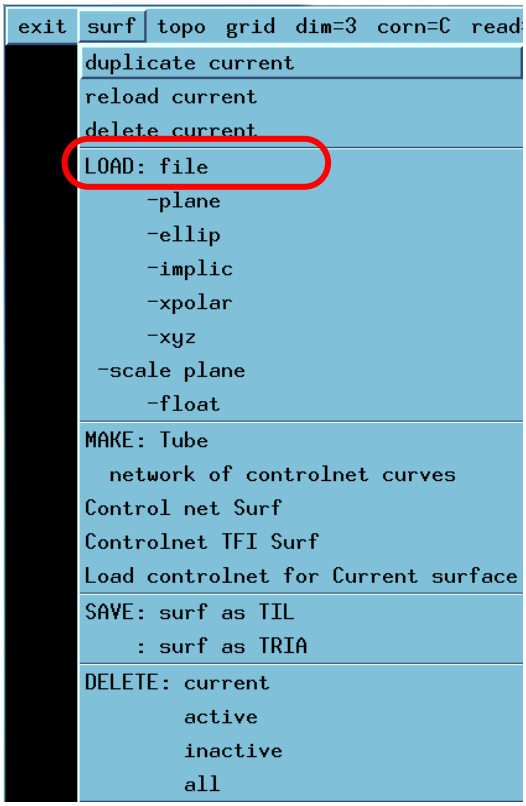
A topology of corners and edges shaped like a cone will be created as in the picture below.



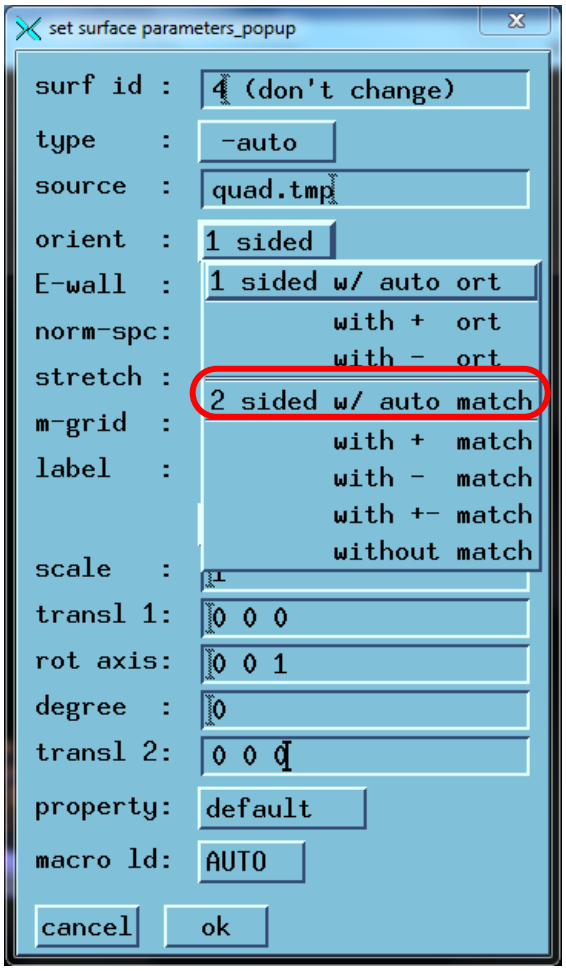
In **GridPro** a function exists that converts a group of topology into a surface. In this case, we need to convert the cone shaped topology into a surface to create an internal mesh inside the mushroom. Add the topology to **Group 2** and go to the **topo** sub-menu at the top and choose **save group as surface**. The surface will be saved in a file called **quad.tmp**.



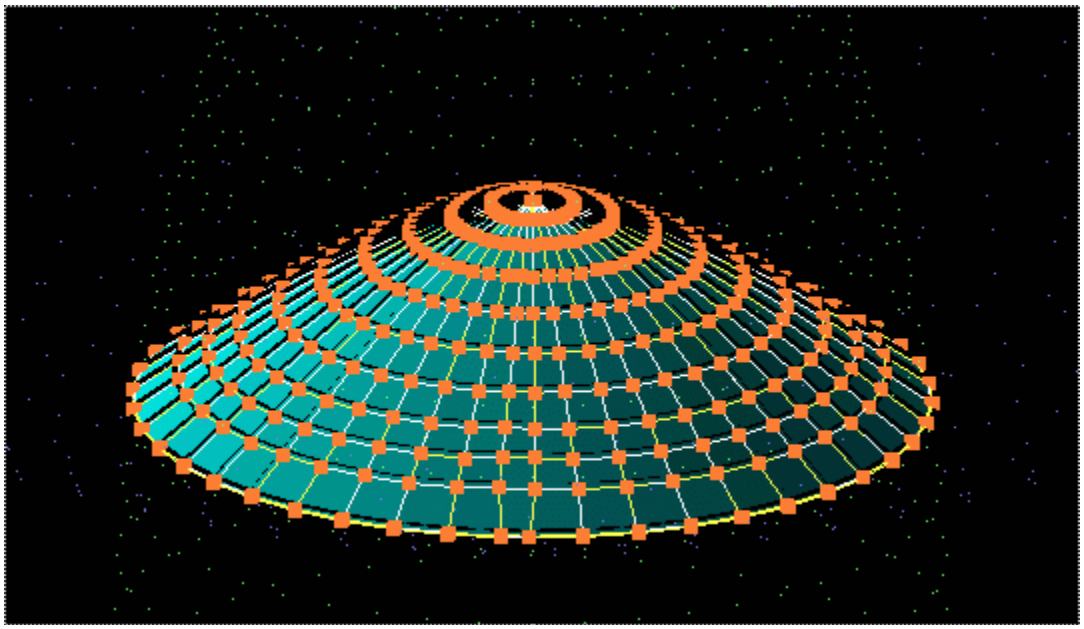
Now that the surface has been created, import it from the **surf** sub-menu located at the top. Make sure you double click on the **quad.tmp** file to load the surface.



A **set-surface parameter** pop-up menu will appear. Since we want to create a grid on both sides of the surface we must import it as a **2-sided** surface. Click on the **Orient** button and choose import as a **2-sided surface with auto matching.**



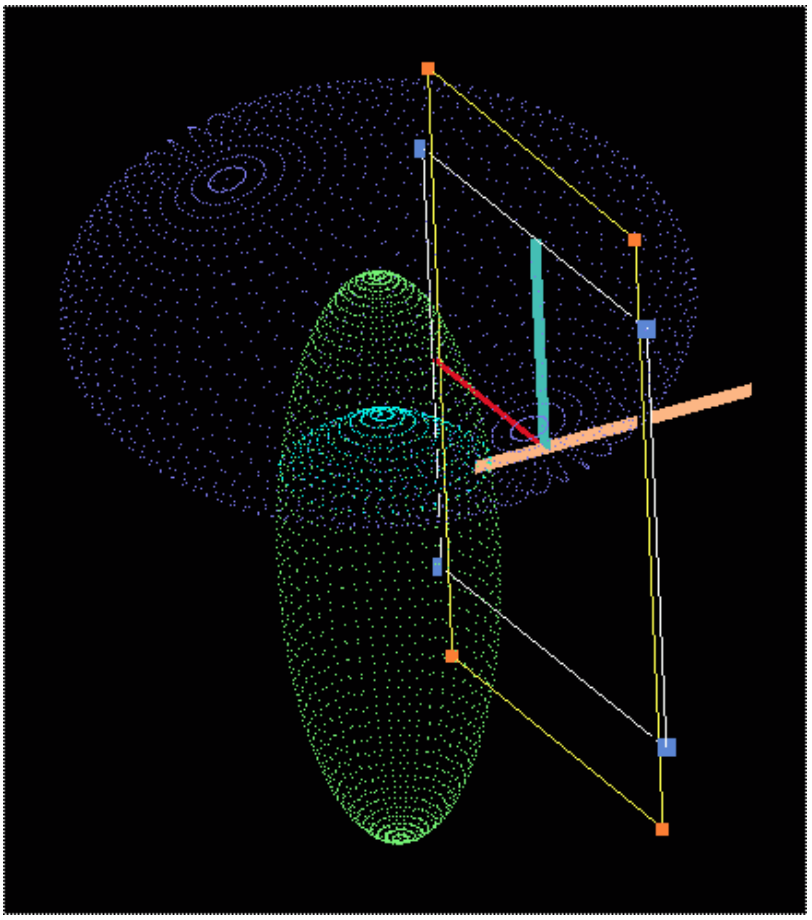
Zoom-in on the surface and topology. Turn on the **shade with HLR** for the current surface in the **STYLE** sub-command panel. The surface should look like the picture below.



Since we do not need the topology, remove it from the work plane. Turn off the **shade with HLR** in the current surface **STYLE** sub-command panel by switching it to **same as stop style**.

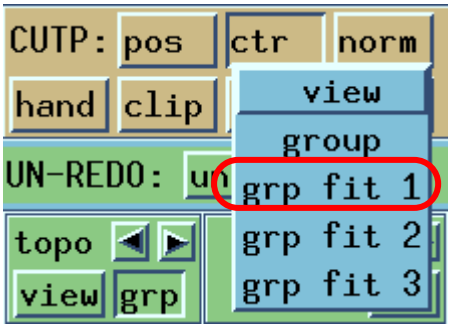
Step 2 Creating the Topology

Instead of creating the topology on the outside of the geometry and wrapping inward as we did in **Part I**, in this case, let's make the topology inside and wrap it outward. Create a rectangular loop of topology about half way between the stem center and the outer edge of the cap**.**



At this point, we want to move the **Cut-Plane** to the opposite side and copy the topology to the **Cut-Plane** using **drop back edges**. However, before moving the **Cut-Plane**, make sure that the center of its axis is at the topology's center of gravity and the normal are aligned by adding the topology to a group and clicking on 

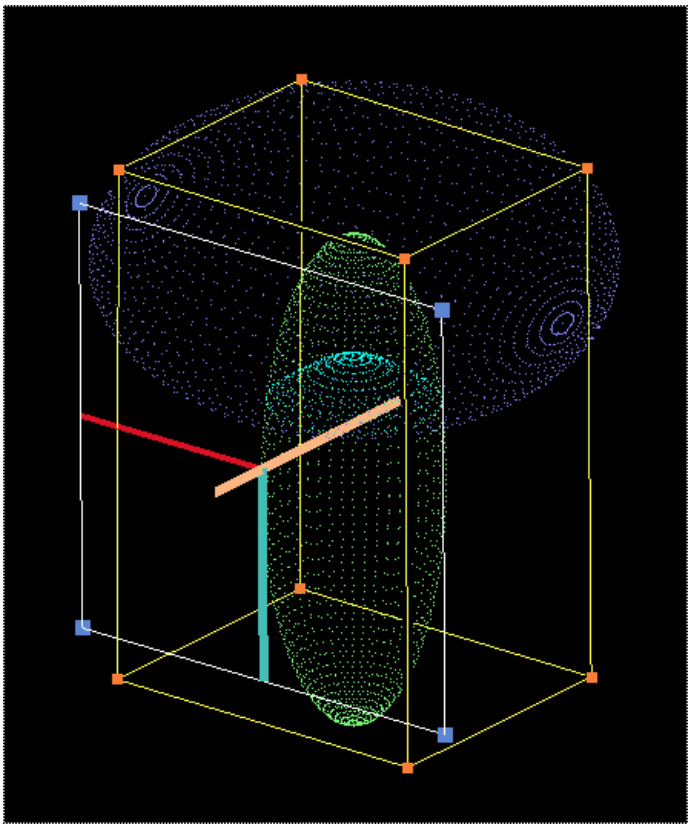
and choosing **group fit 1**.



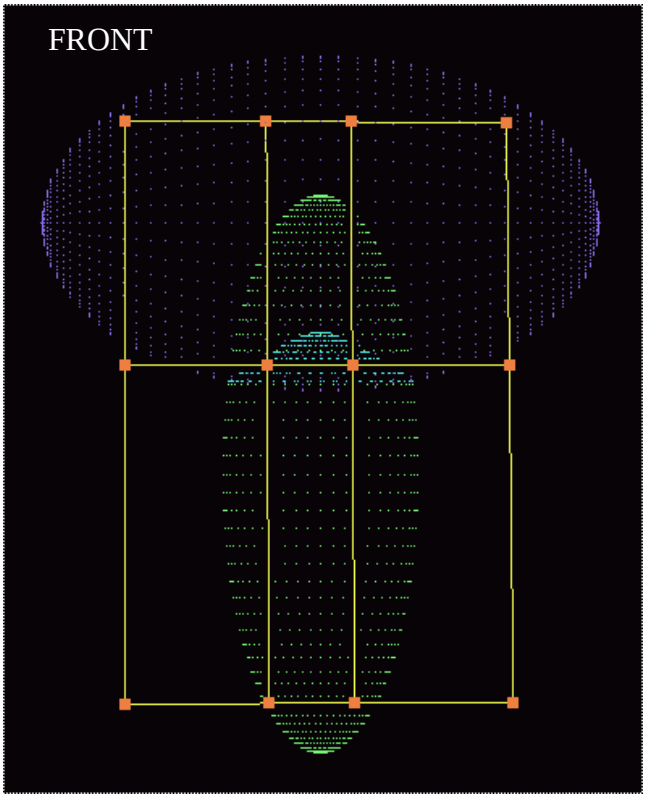
Group Fitting Cut-Plane

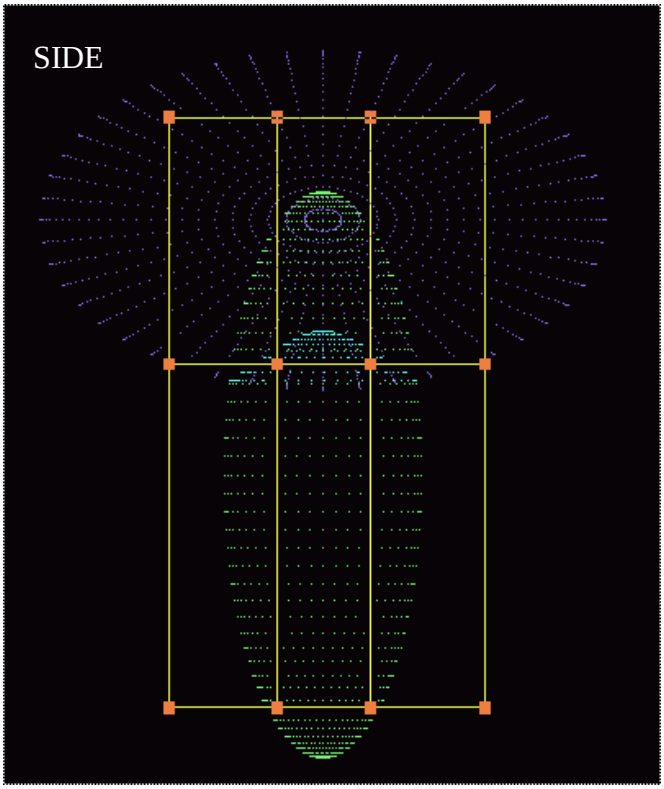
Group fitting the Cut-Plane is extremely useful tool for topology creation inside of **GridPro**. When you choose **grp fit** the **Cut-Plane** center is snapped to the center of mass of the grouped topology. The **Cut-Plane** and topology normal are also forced to be parallel. Group fit 1, 2, and 3 gives the "best fit ellipsoid" with shortest semi axis for 1, longest For 3, and in-between for 2.

Now move the **Cut-Plane** to the opposite side as in the picture below and copy the topology using **drop back edges.**



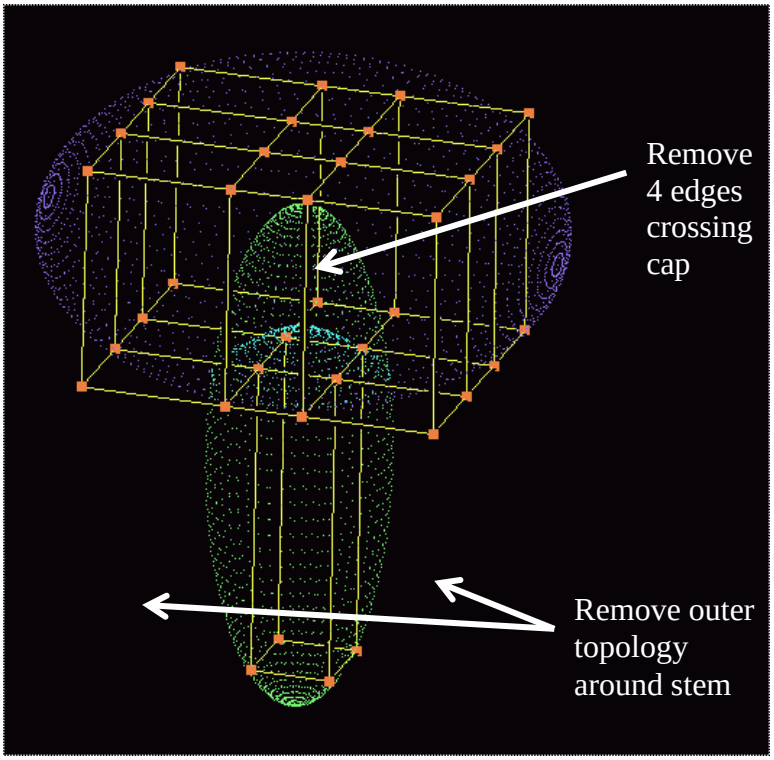
Turn off the **Cut-Plane** and make the inner topology by inserting topology sheets as in the pictures below**.**



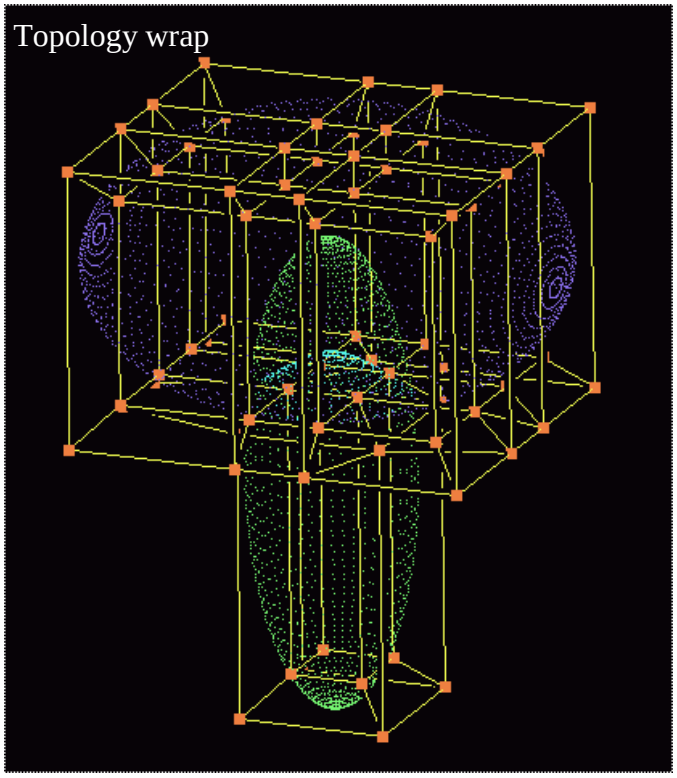


Step 3 Creating the Wrap

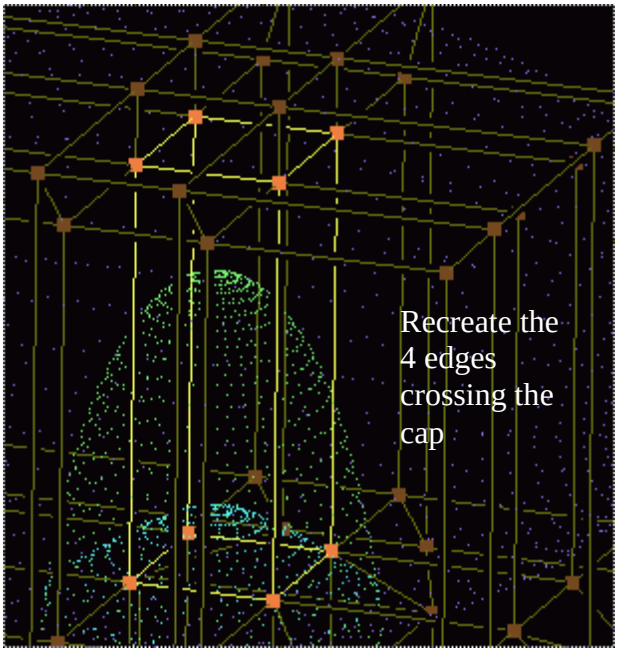
Remove the topology on both sides of the stem and the inner edges crossing the cap.



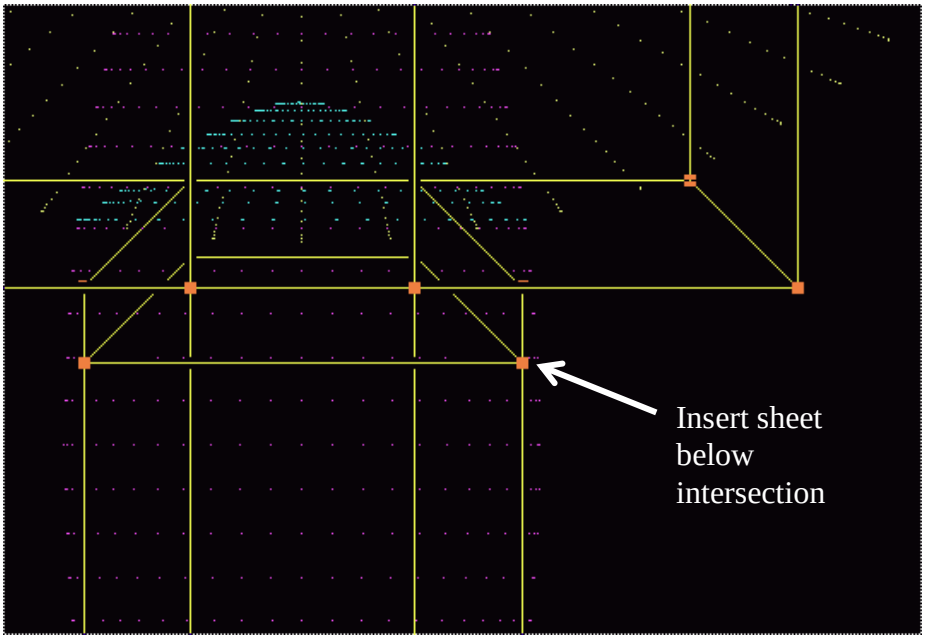
Wrap the topology **10% larger**.



Since we want to mesh the inner volume of the mushroom, recreate the edges crossing the cap.

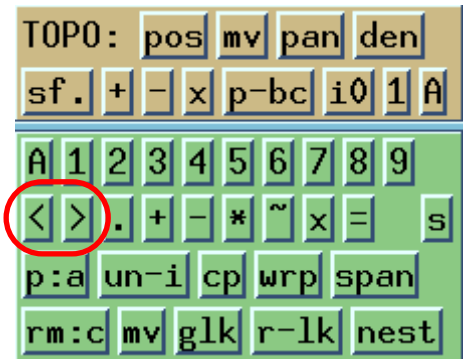


Make sure that the singularity will converge to equilibrium away from the internal surface and inside the cap by inserting a topology sheet immediately below the intersection. See the picture below.

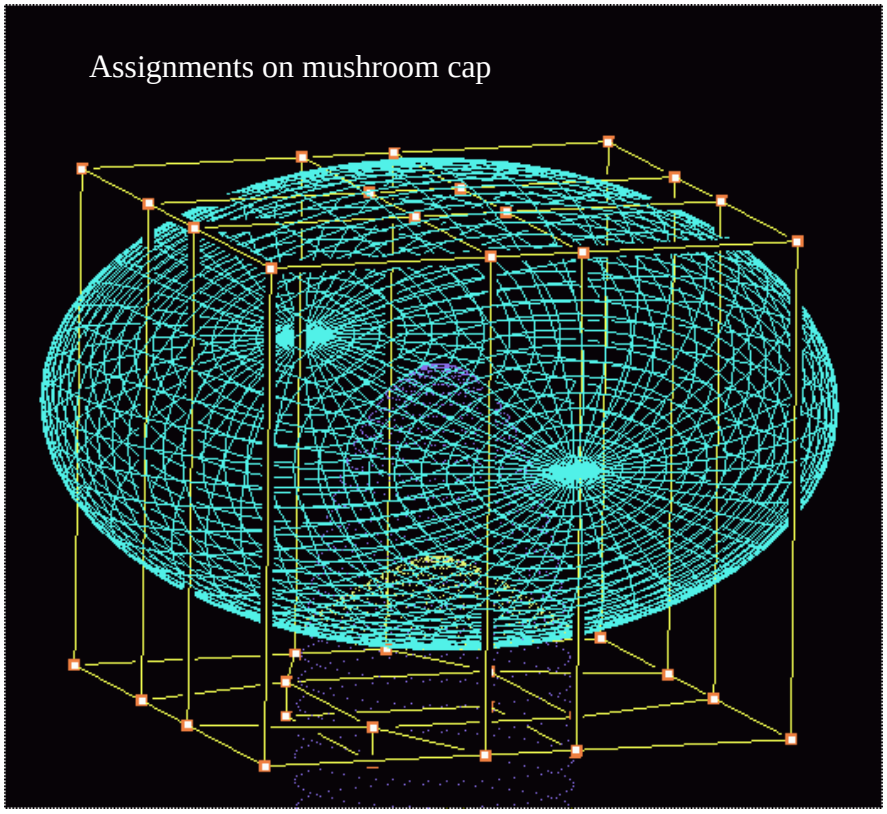


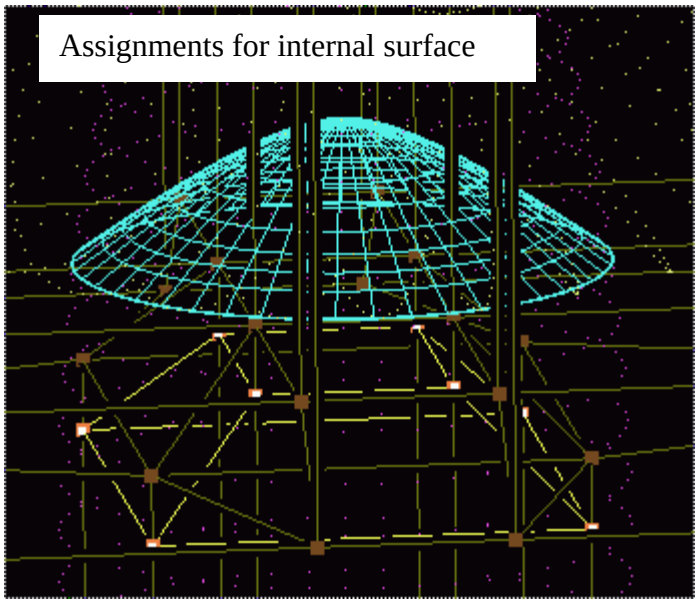
Step 4 Surface Assignments

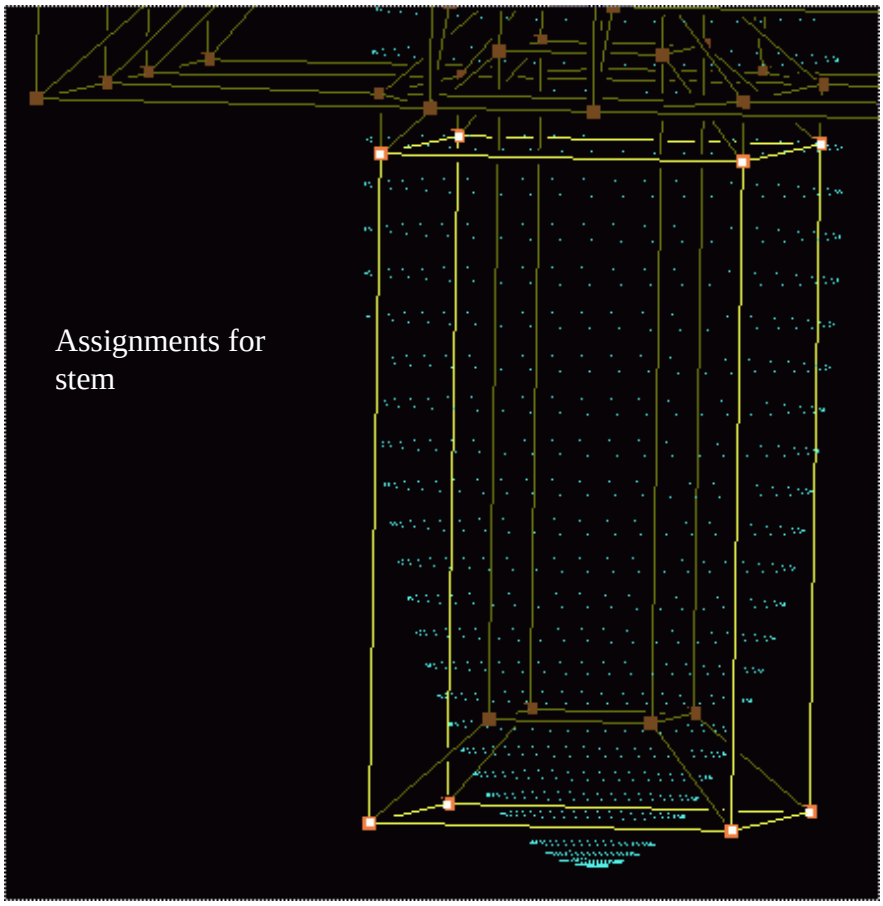
Assign the topology corners to the surface by scrolling through the **backup group** scroll bar in the **TOPO** sub-command panel.



Scroll to the outer highlighted topology and assign the surfaces as in the pictures below.

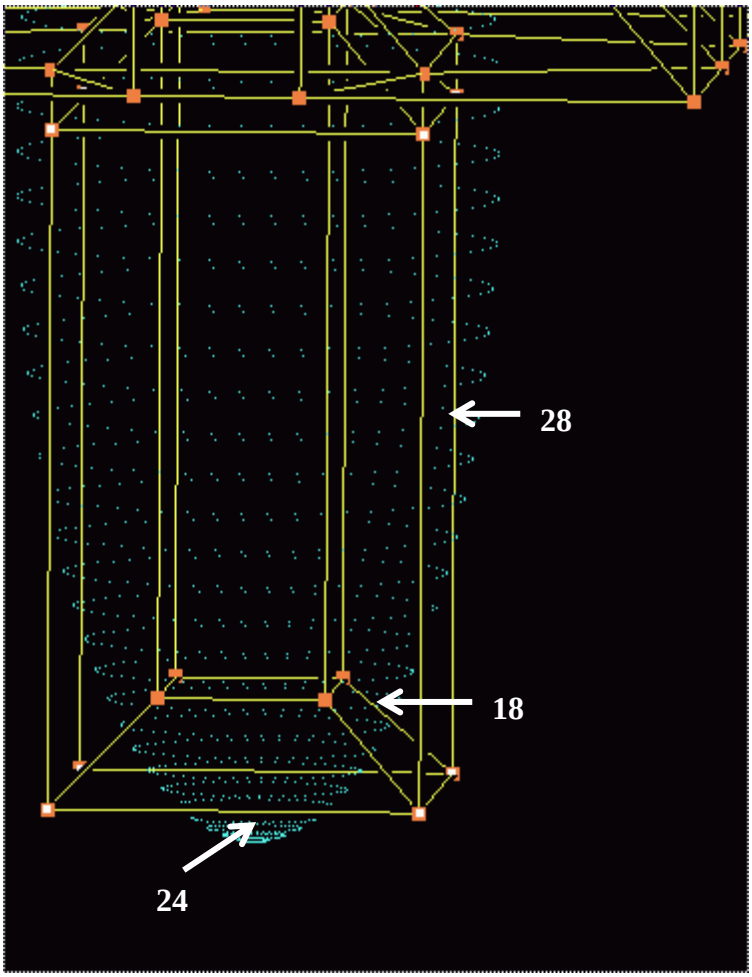



Assignments for internal surface


Assignments for
stem

Step 5 Density Assignments

Assign the same density value to the mushroom stem as we did in **Tutorial 4.1**. See the picture below.



Start the gridding process and view the results.