Tutorial 11: Using Macros

In many cases, macros provide the user with a quicker implementationof topology. Macros TIL files, and like TIL files contain topology and surfaces. Any TIL file can be a macro. Macros can be loaded into the topology builder at any time, and you have the option of transforming to any location, scale to any size, and rotate by any axis you want. Macros are a powerful tool.

Macros are very useful if you have a topology section already built and you want to replicate it with some transformations. That's exactly what macros do. Using macros makes your work much simpler and faster. For example, if you have a pipe intersecting a surface, and you want to add more pipes in a similar way, using macros speeds the process. In general, if you think your topology might be divided into similar smaller components, then, you can probably import those smaller components as macros and link them together. This way, you have to create that component only once. This can save you a considerable amount of time in complex cases
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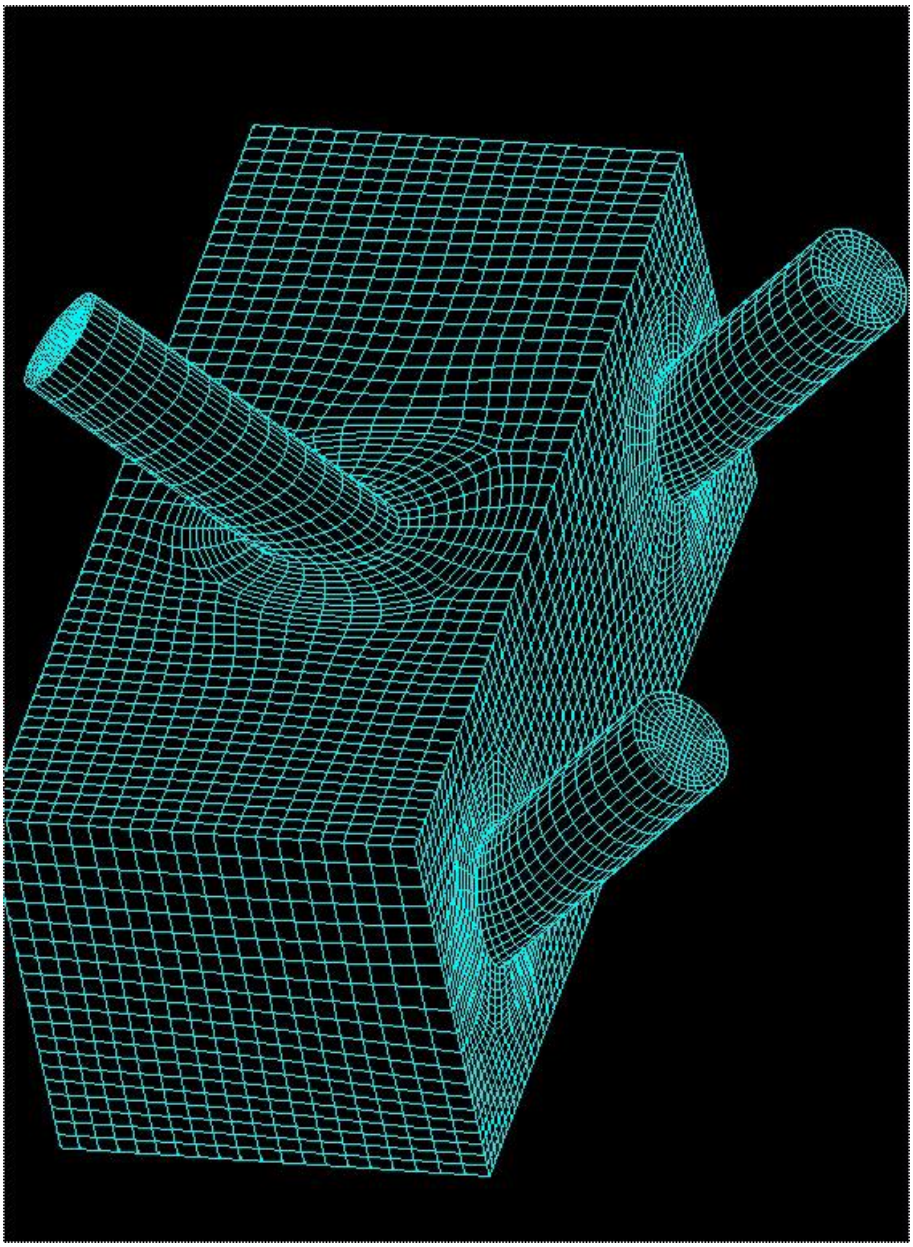
This tutorial is intended to introduce you to macros. You will be gridding a geometry in which a number of tubes are intersecting a box. You will create the topology for a single tube intersecting a box, and will replicate it as macros to create the other tubes.

What You Will Create



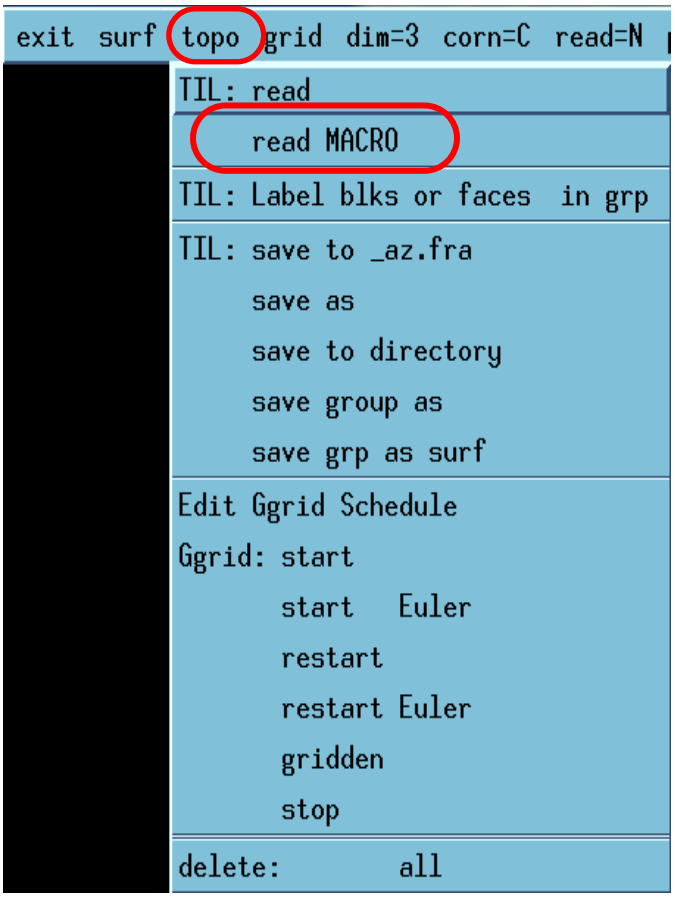
Tubes Intersecting a Box

What You Will Learn

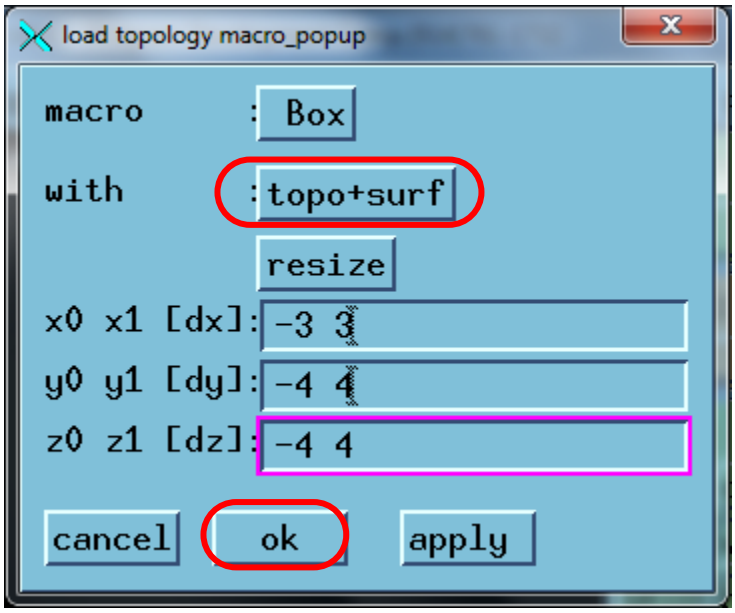
- Using Macros to create multiple copies of a topology
- Pasting topology groups together using the group link feature

Step 1 Creating the Basic Geometry

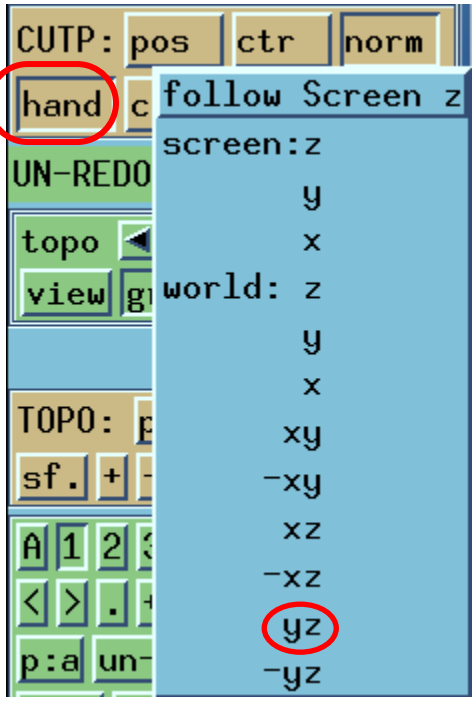
The basic geometry is a tube intersecting a box. First, load the box geometry by going to the **topo** menu and selecting the **TIL: readMacro.**



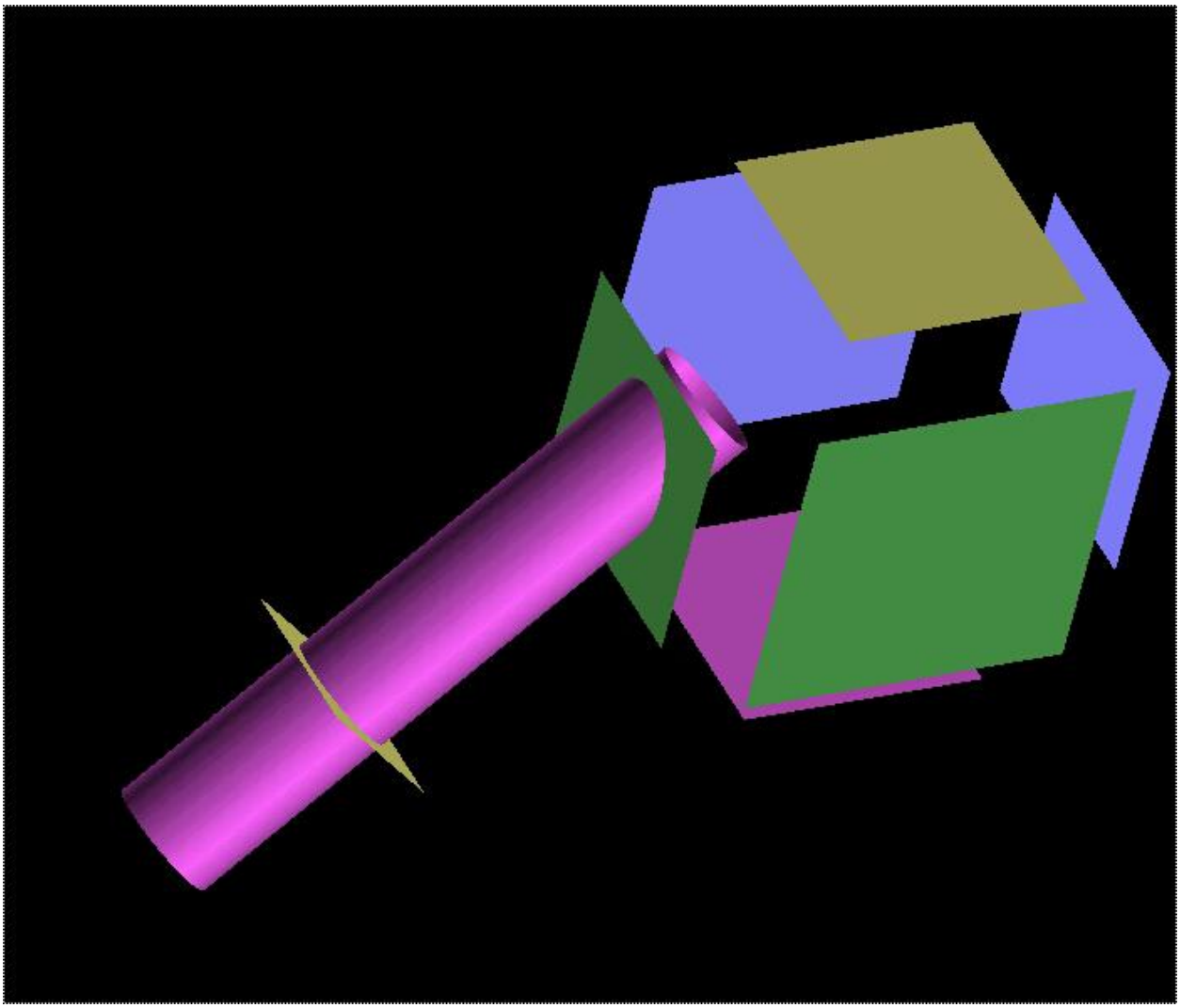
In the pop up window, enter the following parameters. Remember to load both the topology and the surfaces by selecting the **topo+surf** option. You should be able to see the topology and surfaces after you press **ok**.



Now, you have to add the tube intersecting the box. Turn on the **hand** in the **CUTP** panel and position the cut-plane towards the left hand side of the box. Make the cutplane slant by 45 degrees with respect to the box by clicking on the **norm** pull down button and choosing **yz** as the normal direction.

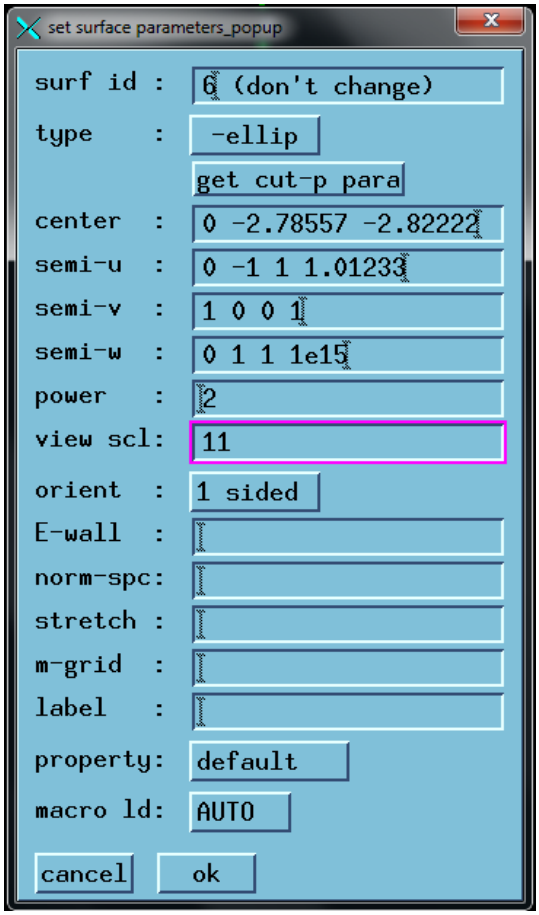


Now, drag the cut plane a bit away from the box as shown in the figure below. You can now load the tube surface by using the **load - ellip** operation in the **surf** menu, and using the **get cutp para option**.



The Geometry

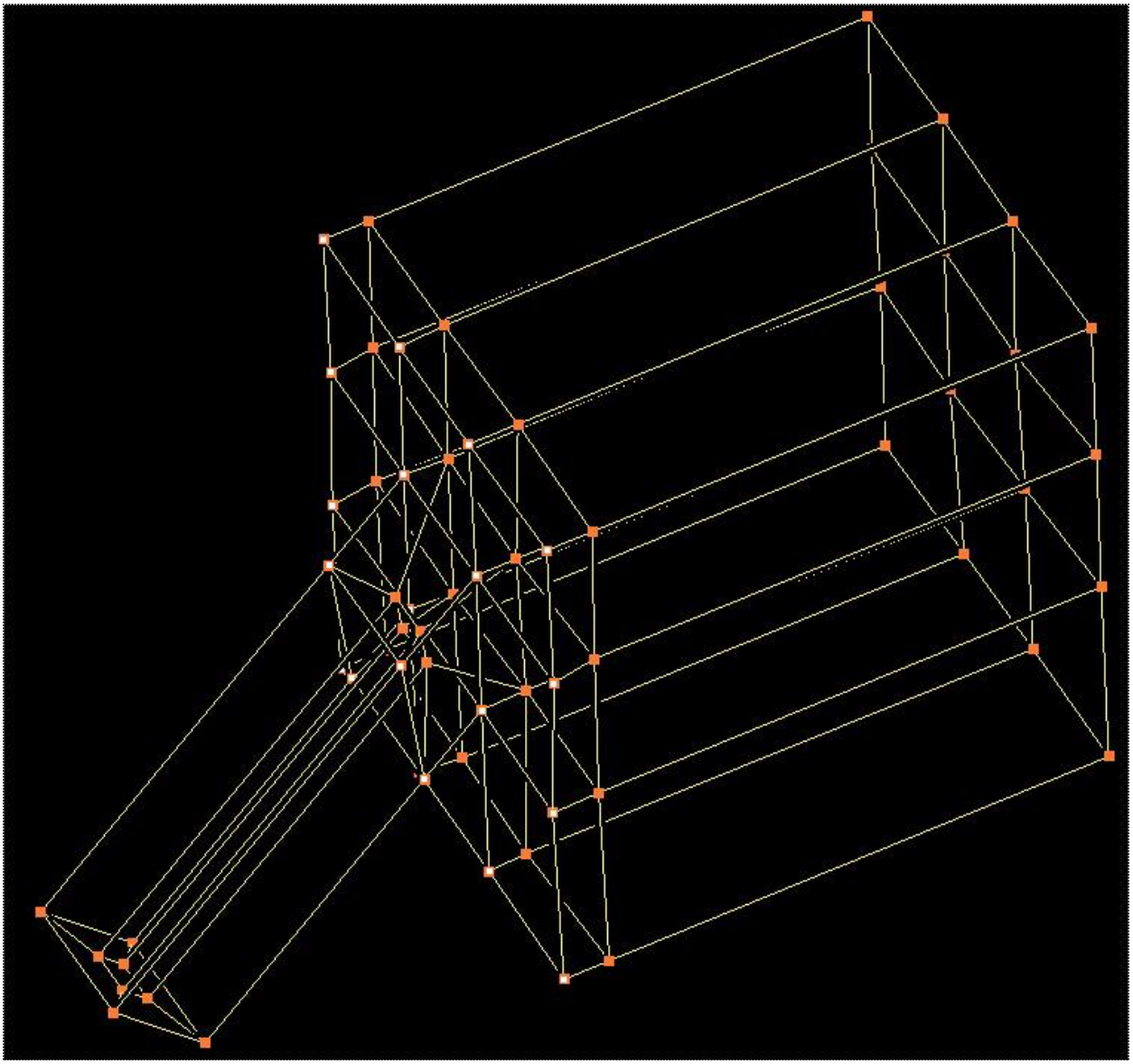
The geometry you create should be like the one in the picture shown above. The topology surrounding the box has been turned off in this picture. Note that this geometry looks similar to the one in **Tutorial_5**, the T-joint.



Position the cut-plane to the place where you can place a plane surface. Use the **load - plane** from the **surf** menu and the **get cutp para** to create the plane.

Step 2 Creating the Topology

The geometry is very similar to the T-joint geometry of **Tutorial_5**.The topology for this can be constructed by following the steps in **Tutorial_5**. Remember that you need not create a wrap around the box. Also, remember that you need to create an internal surface, and you need a triple assignment near the intersection for a smooth grid near the intersection. The final topology is given in the next page. It will be a good review exercise to construct this topology yourself.

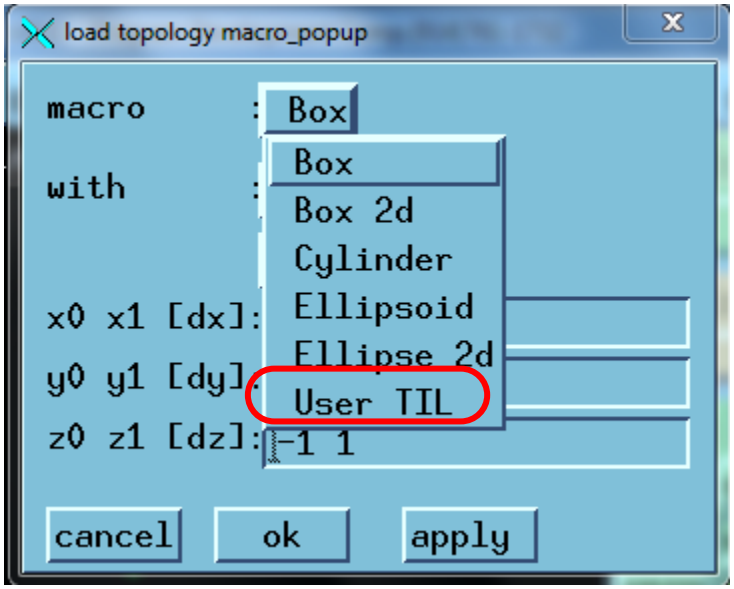


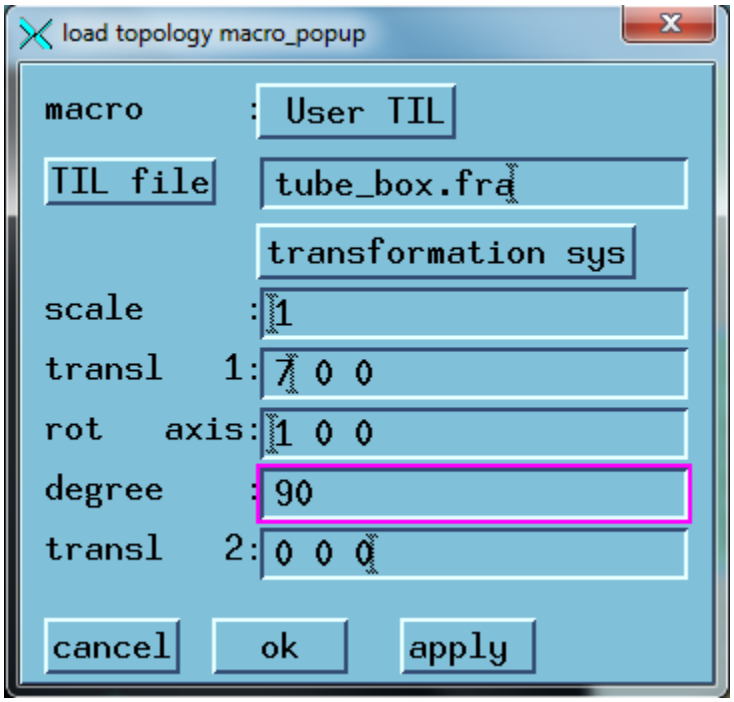
The surfaces have been turned off in the above picture.

As a precautionary measure, you may want to generate the grid for this to check your topology. Now, save this topology to a file – say **tube_box.fra**. It is important that you get this basic topology to work right, because this is going to be replicated as a macro to create more complex structures.

Step 3 User Defined Macros

After you have saved the topology file, you can load it as a user defined macro. To do so, select the **TIL: read macro** from the topo menu. In the pop up window, select **User:TIL** as shown below.





You should see a pop up window like the one above.

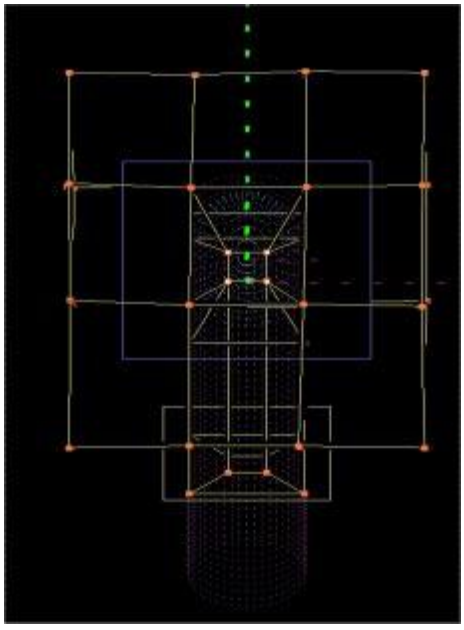
Any TIL file can be loaded as a user defined macro.The surfaces and the whole topology in the TIL file will be loaded into the topology builder.

You can click on the **TIL: file** or type the name of the TIL file in the space given In this case, the name **tube_box.fra** has been typed in. You can choose two types of transformation system. In the first, you can enter the transformation matrix to transform the coordinates of all the points (including the surfaces) in the TIL file. In the second, you can enter the first translation to be performed, and then specify a rotation axis and the degree of rotation to be performed with that rotation axis, and then specify a second translation which is done after the rotation.

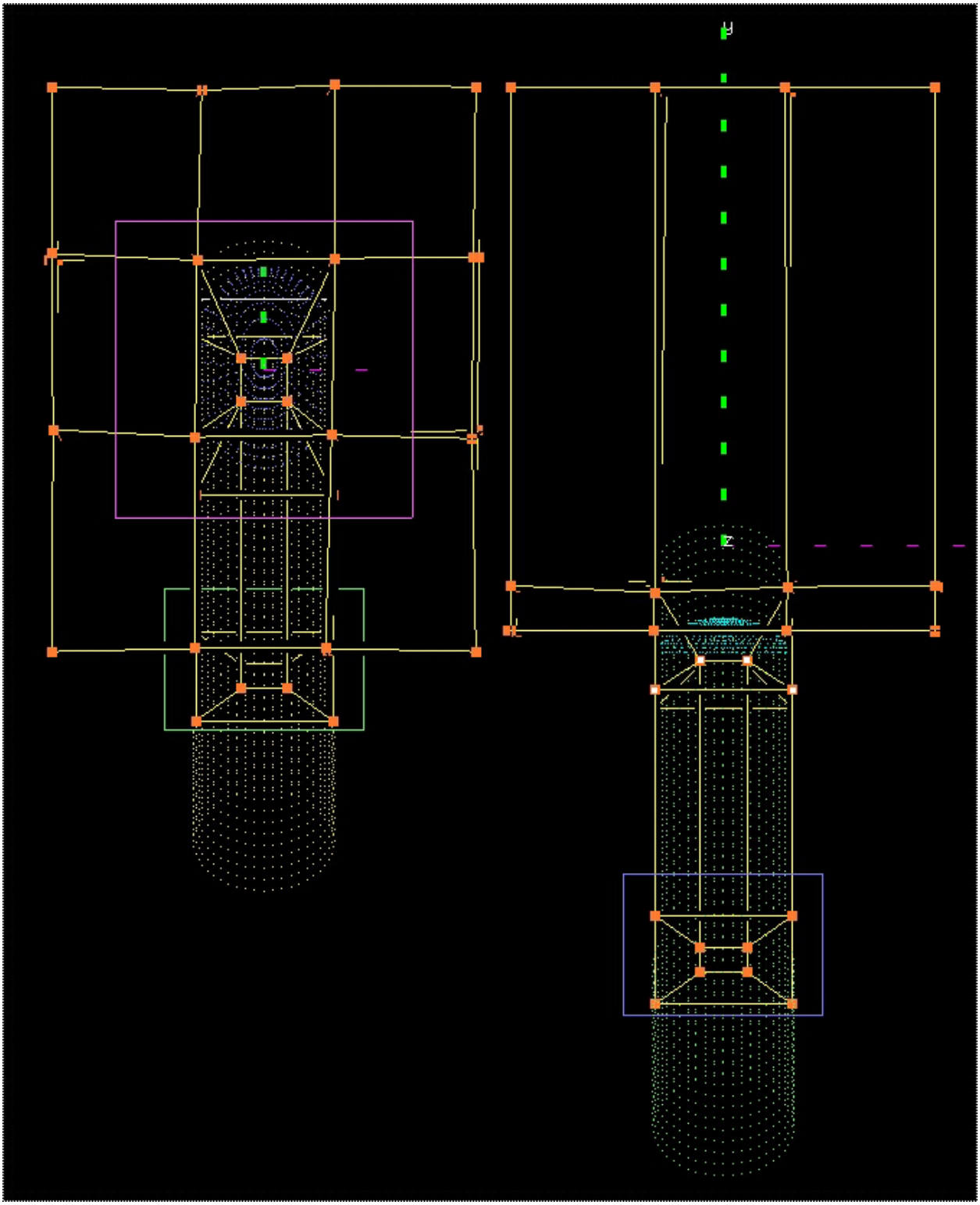
The second type of transformation system, involving translations and rotations is implemented in this to rotate the macro by 90 degrees along the x-axis and place it along side the already existing topology.

Enter the parameters as shown in the figure and press **ok**. You will see a topology as shown in the figure below. Note that the new structure has been rotated and placed along side the old one. You now have to merge these two structures together to get a single one. But before that, load the **tube_box.fra** macro again with parameters as shown below. This will create a third structure to the right of the second structure.

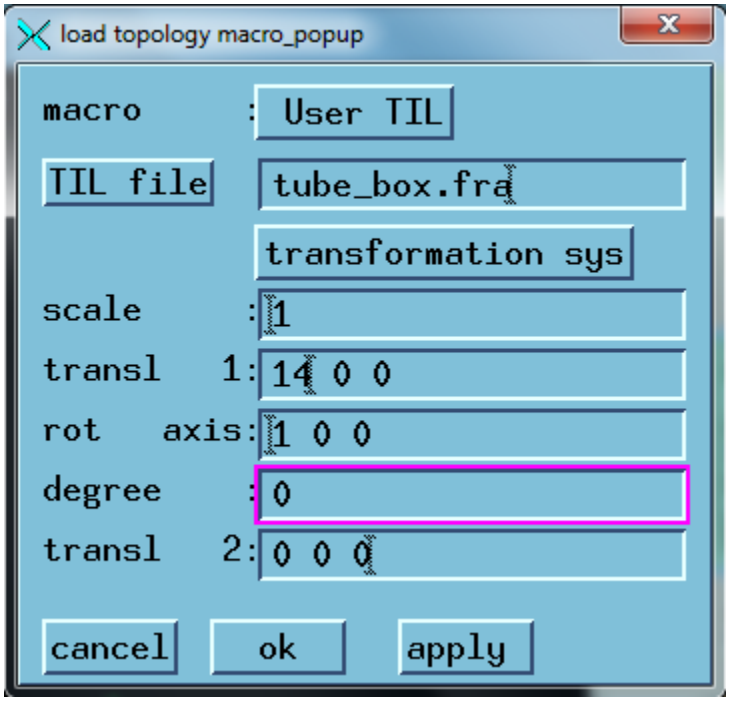
The *tube_box.fra* Macro



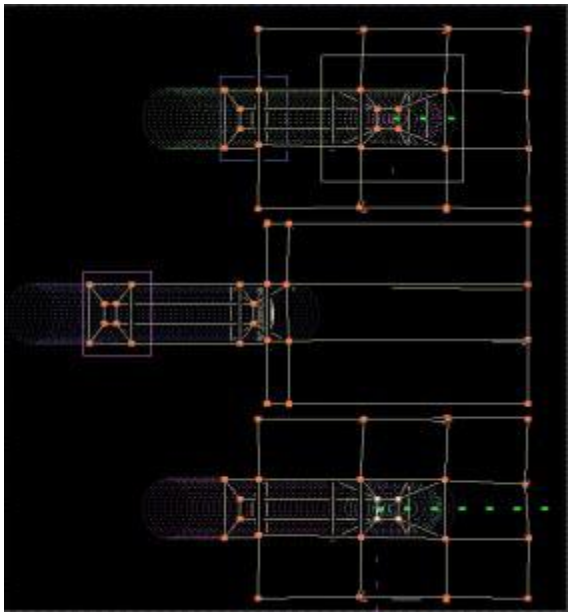
The First Macro Added



Load One More Macro



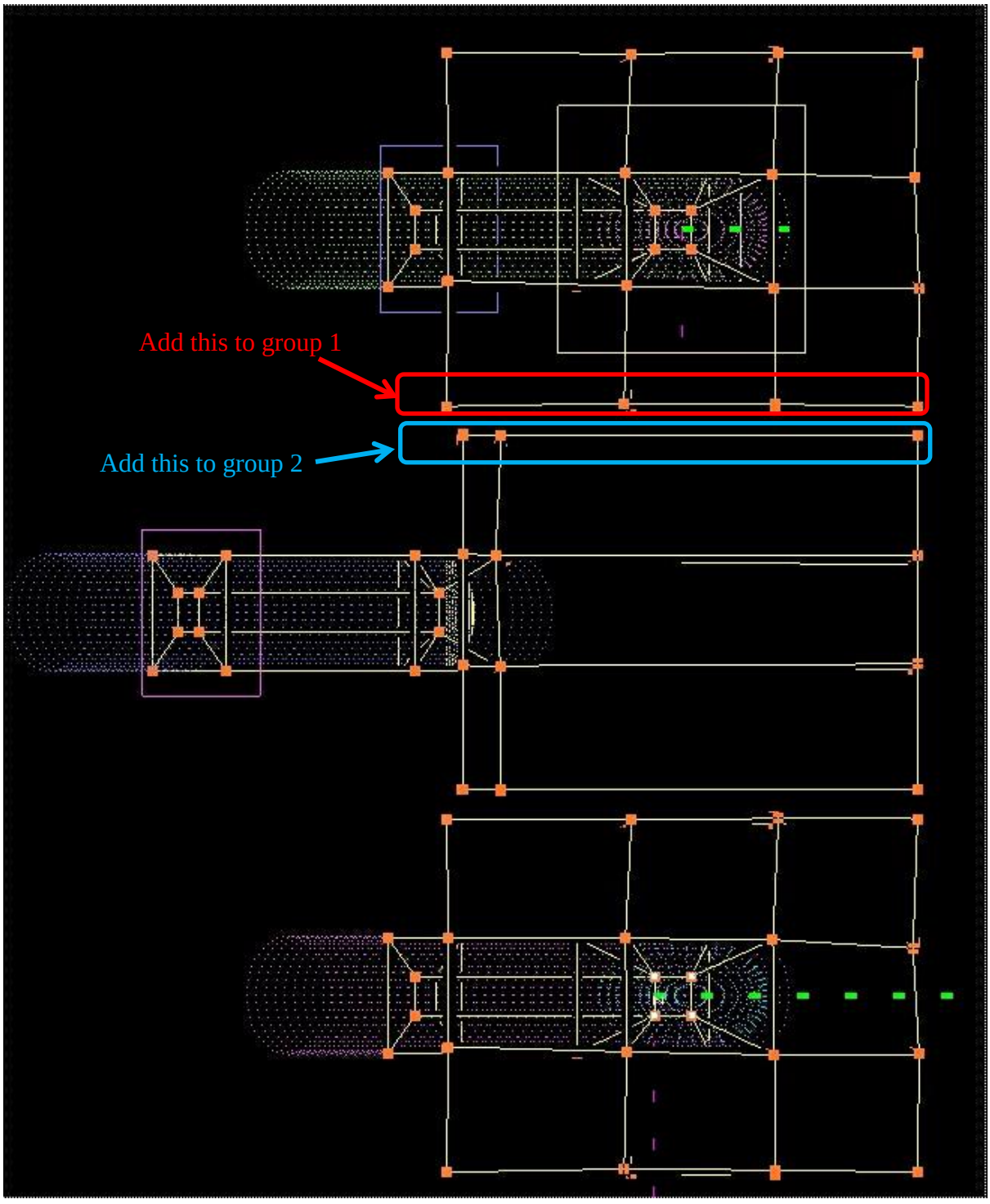
Load the same TIL file as another macro to create a topology and geometry which looks like the picture shown below.



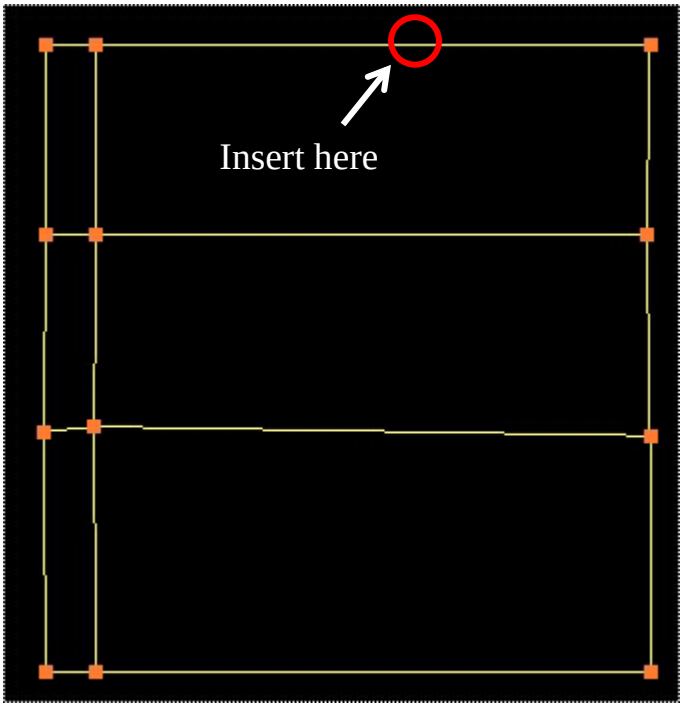
The Second Macro Added to the Existing Two Structures

Step 4 Merge the Three Structures

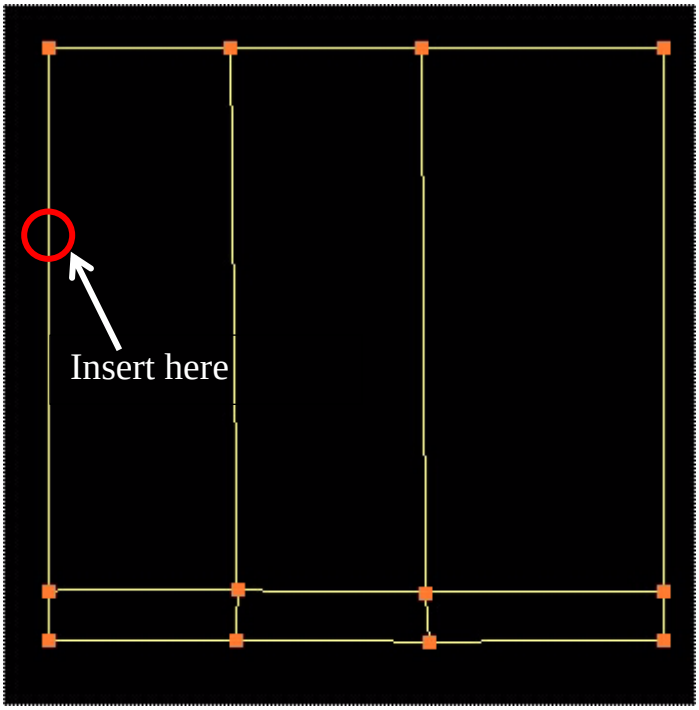
After you have created these macros, you have to merge them together to create a single topology for the geometry. To do so, add the corners shown in the following pictures to a group.



Now, before you merge these two groups, you must make the two groups compatible.



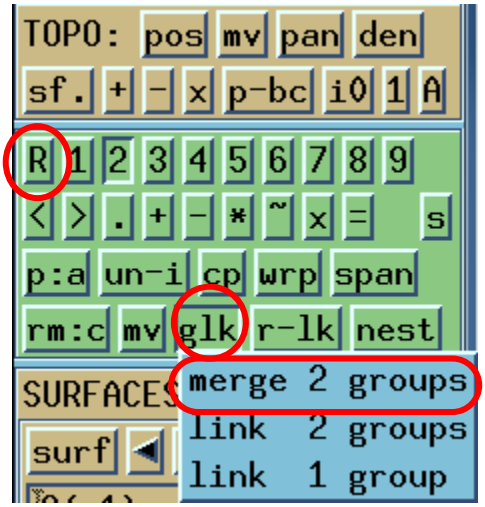
Group 1



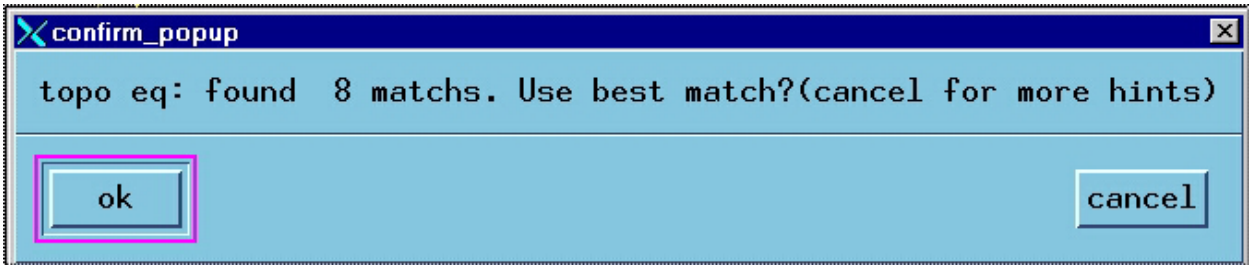
Group 2

Create inserts in the locations shown in the above pictures. This will make the two groups compatible. Make sure that you have the insert mode set to **i:a** (insert all) before you perform these inserts.

After this turn on group 2. Put the background group mode to the reference mode **R**. Press **g-lk** on the TOPO panel to get a pull down menu.

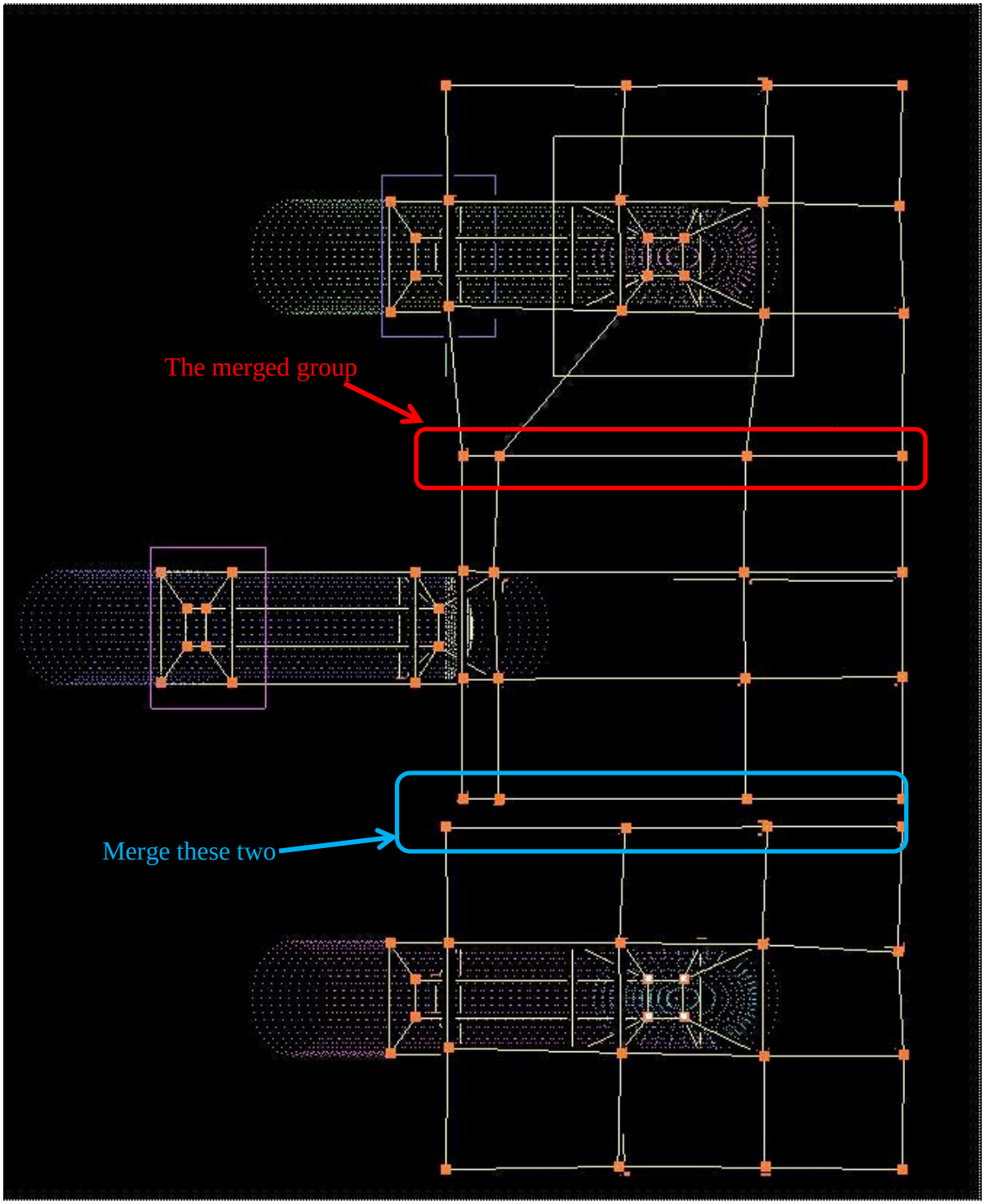


Select **merge 2 groups** from this. A window like the one shown below will pop up.

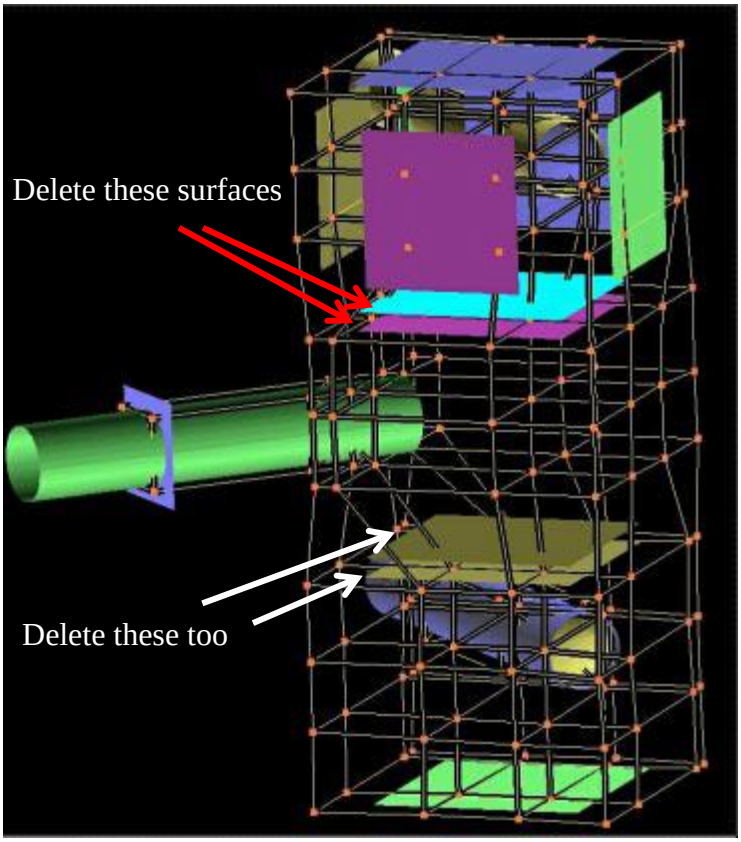


Press **ok** in this for this case. But remember that you can add links in between the groups to hint at the sort of merge you want. In this case, the merge is pretty straight forward and you don't need to add links as hints.

The topology looks like the one shown below.

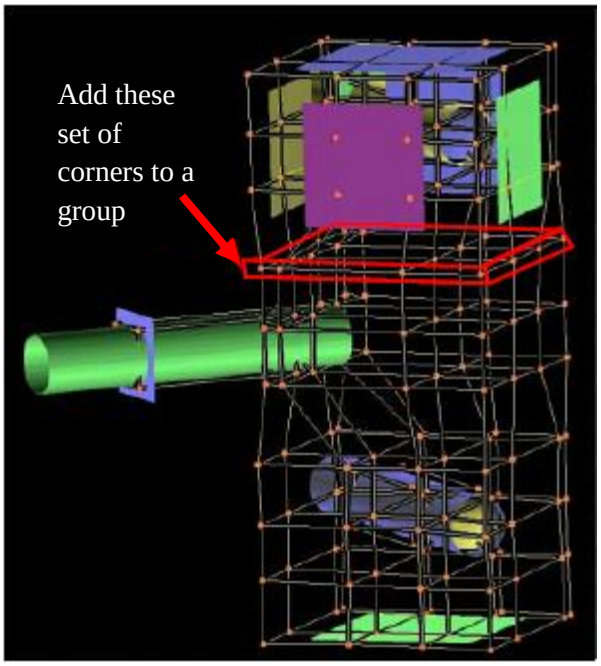


Note that the 2 groups have been merged into one. Similarly, merge the other 2 groups shown in the picture above. Also note that the top and bottom surfaces have been merged. You still need to delete the 2 surfaces as shown in picture below.

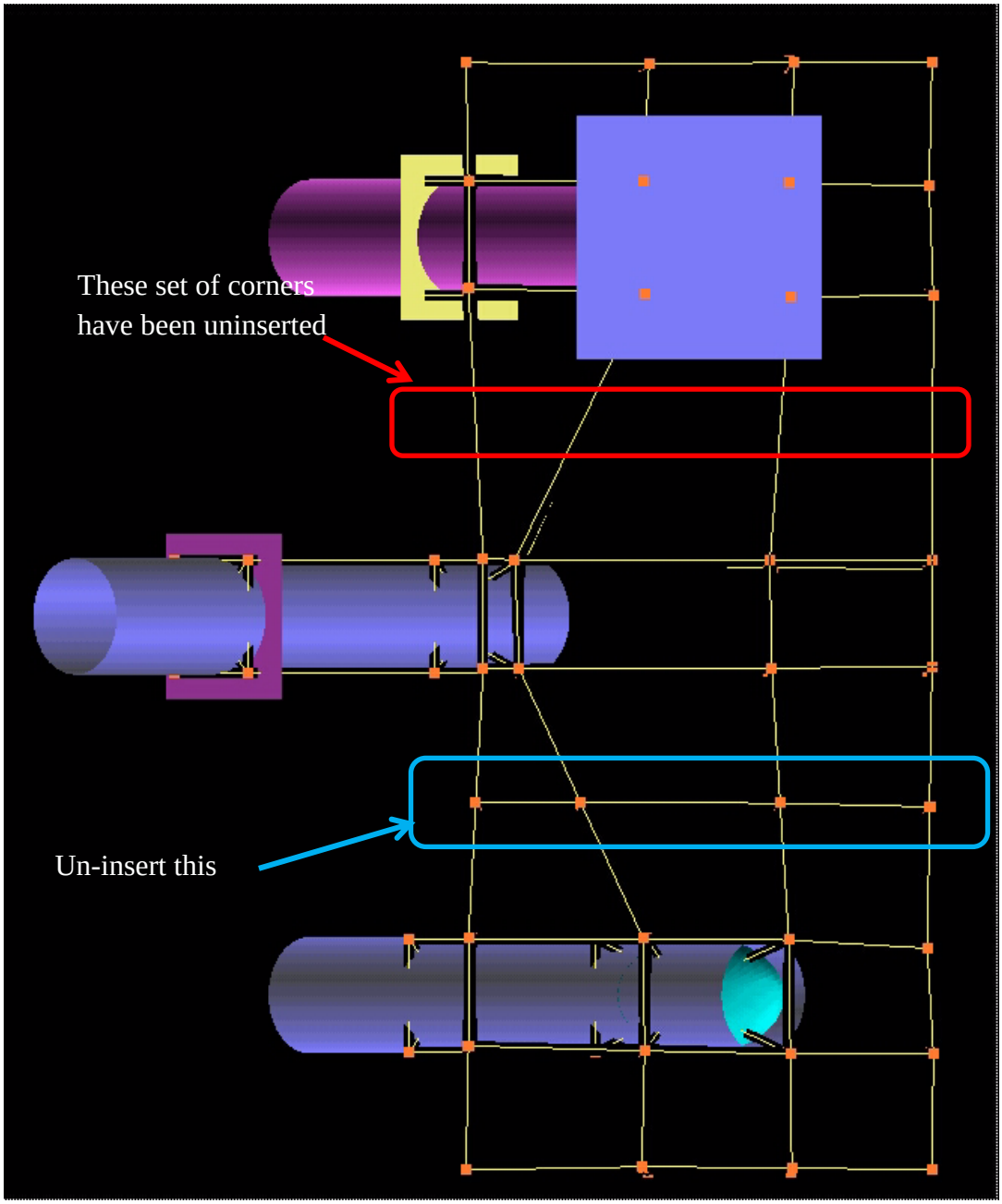


Delete these surfaces

You can make the topology conform even more to the geometry by doing an **'un'insert**. Add a set of merged corners to a group as shown in the picture below.

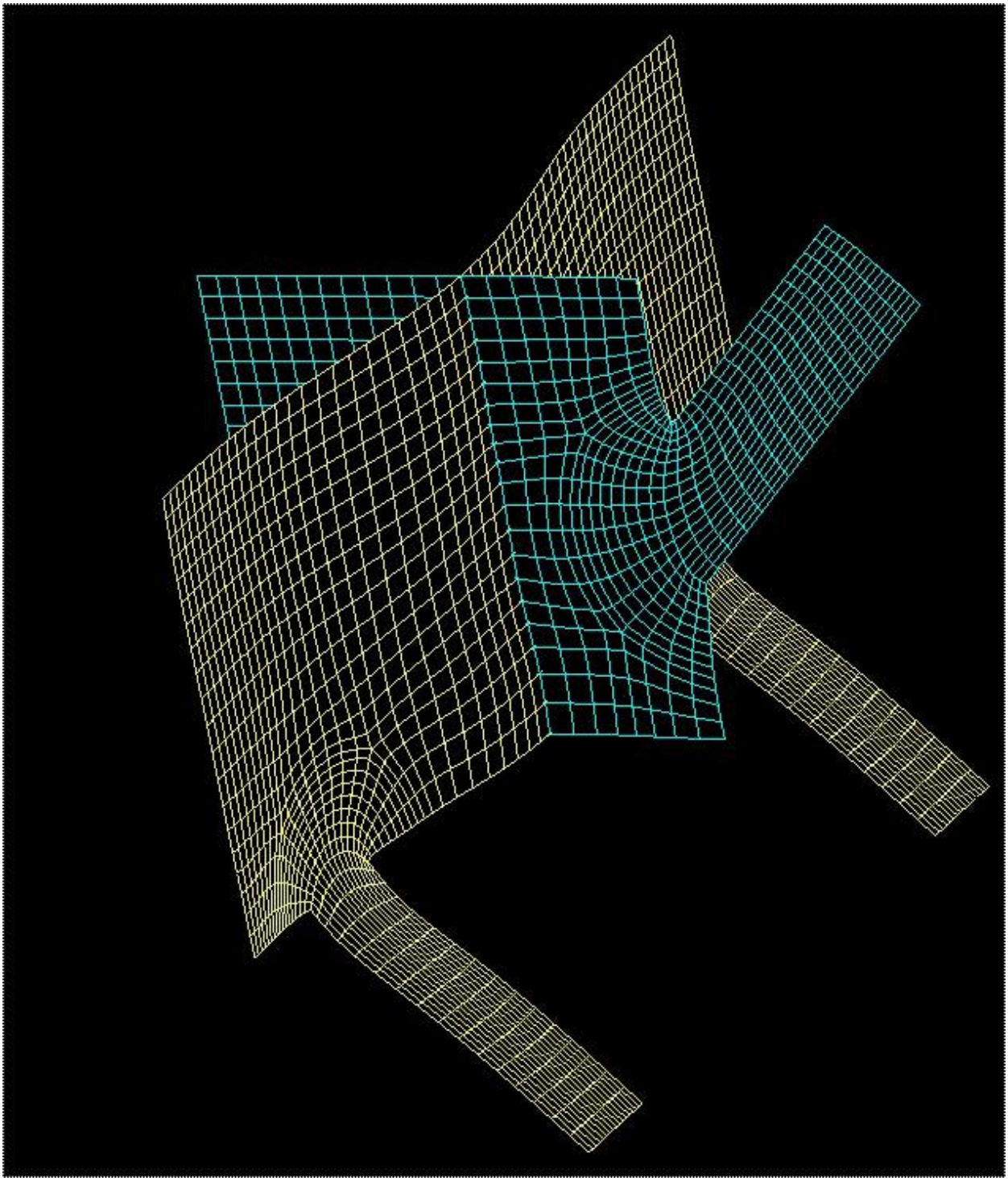


Now, press on the **un-i** button in the TOPO panel. The group will vanish, and the resulting topology is shown below. ‘Un’insert is a useful tool and can be used to save time in topology construction.

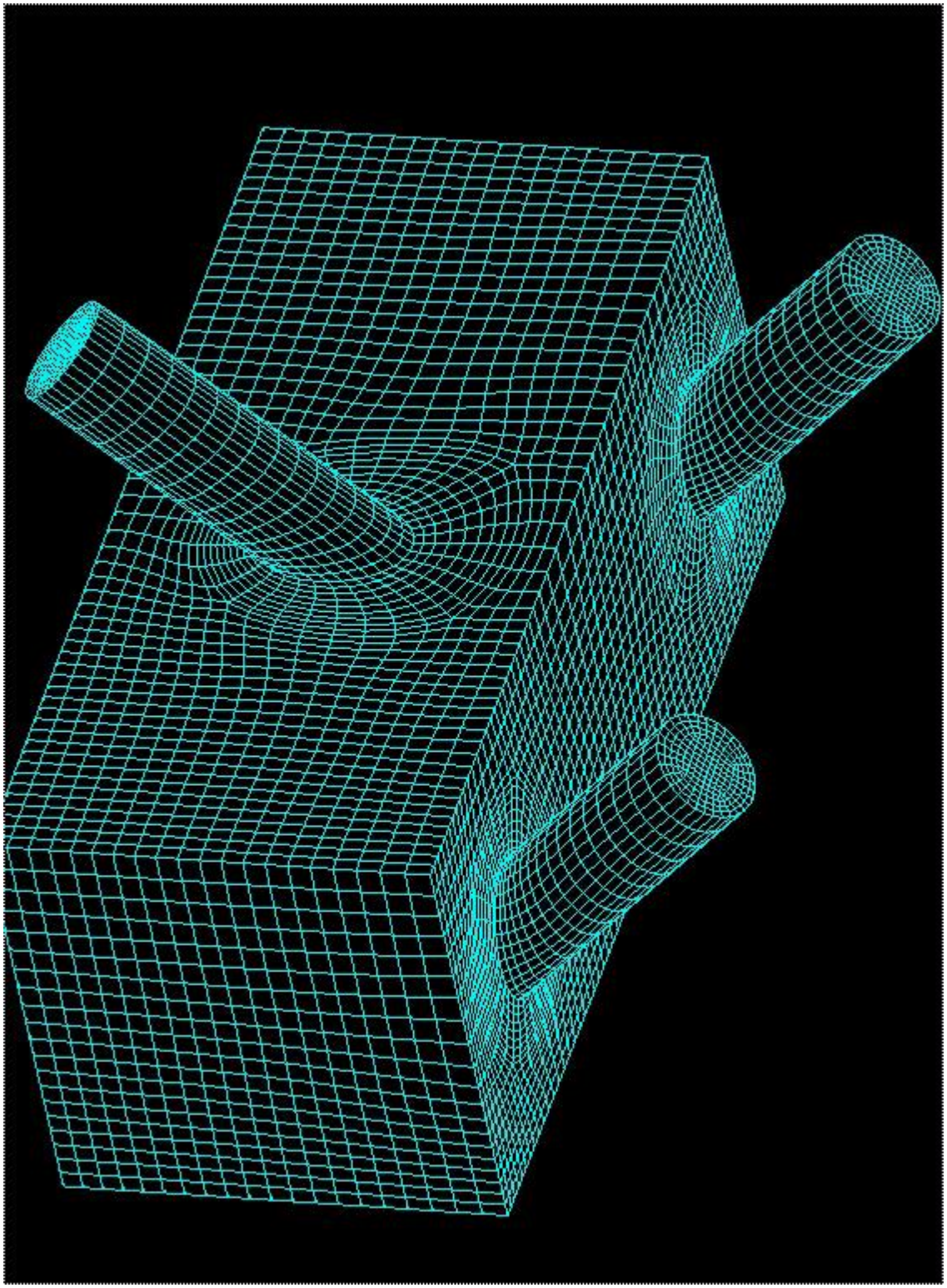


Similarly un-insert the corners shown above to create a topology which conforms to the geometry very well. This creates a seamless merge of the three structures. You can now grid this topology.

Step 5 The Grid



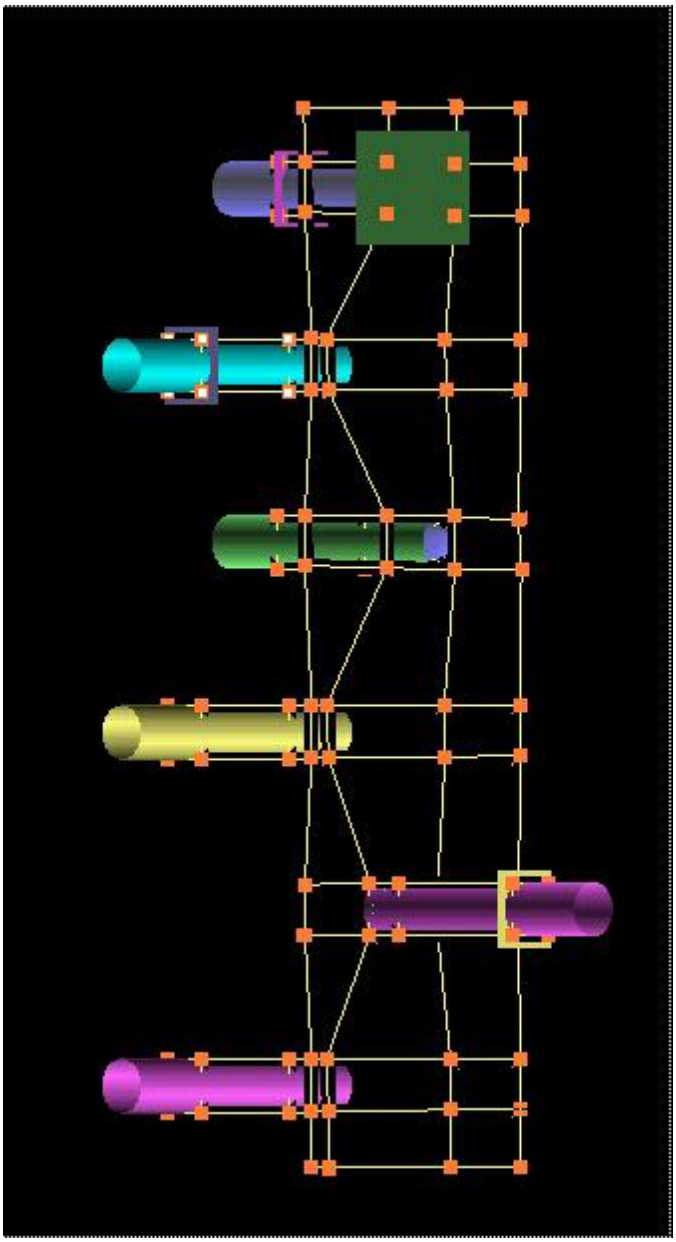
Cross-Sections of the Grid



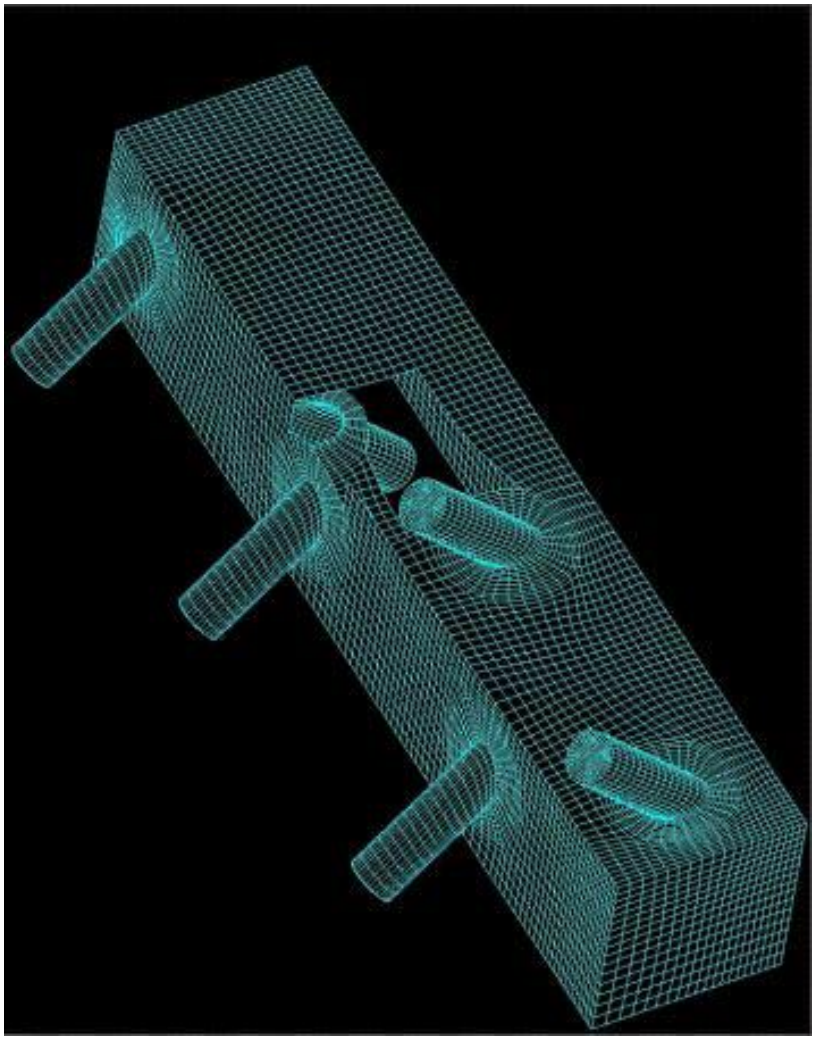
The Outer Shell

Step 6 Try This

Now, save this topology to some file, say **tube_box3.fra**, and then try to load this as a macro and have six tubes intersecting a box. You can rotate this macro by 90 degrees. The resulting grid and topology is given below.



The Topology



The Grid

Part of the shell has been taken off to give a view of the pipe below.