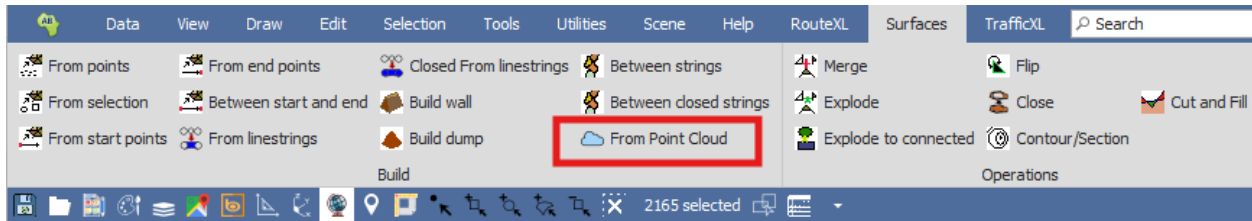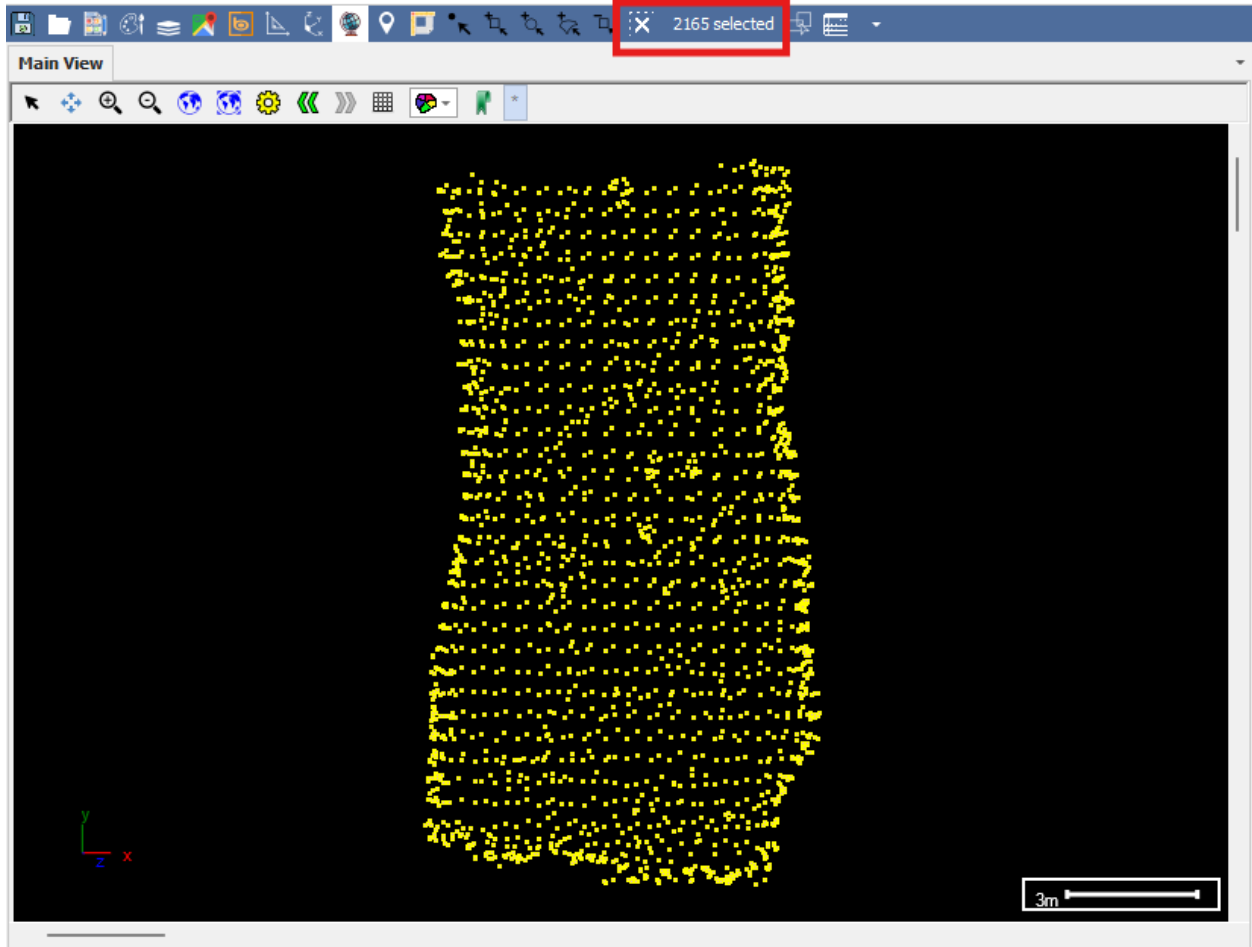# From Point Cloud

Introduction

The From Point Cloud tool allows you to build closed surfaces from point cloud data.

It will load the points and internally triangulate that surface in 3 dimensions. It does 3D triangulation as opposed to our other surface building tools which are more intended for flat surfaces.
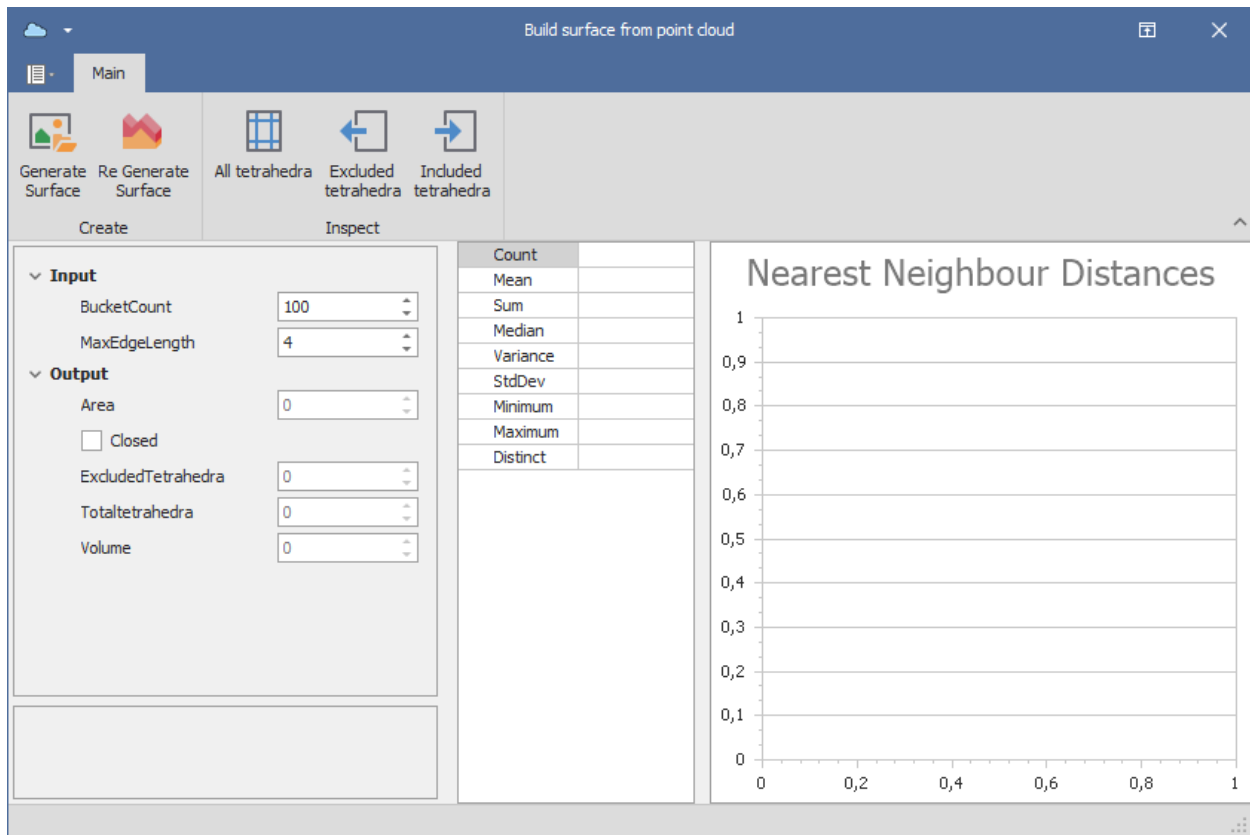
Build a surface from point cloud data

1. Use one of the selection tools to select the points in graphics, or right click on the layer, then go to Selection and Set to layer:

2. Then, open up the "From Point Cloud" tool in the Surfaces tab:
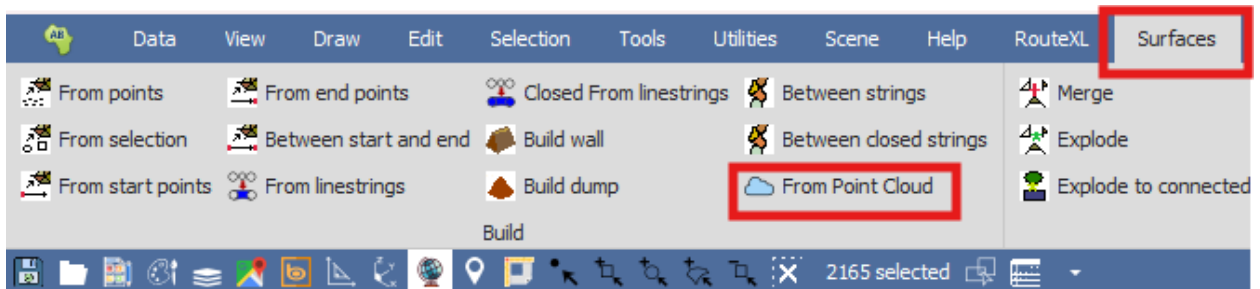
3. BucketCount is the number of buckets specified for the histogram that will show on the right when you load your points in. The histogram will show the distances to the closest neighbour of each point so you can get an idea of how close the points are, how triangulatable your surface is, and how closely you can follow the surface in generating it. A good number for the BucketCount is 100.

4. Specifying a MaxEdgeLength will make sure surface faces are not built between points greater than a certain distance from each other and will thereby allow you to precisely generate the surface following along the correct shape and contours of the surface.
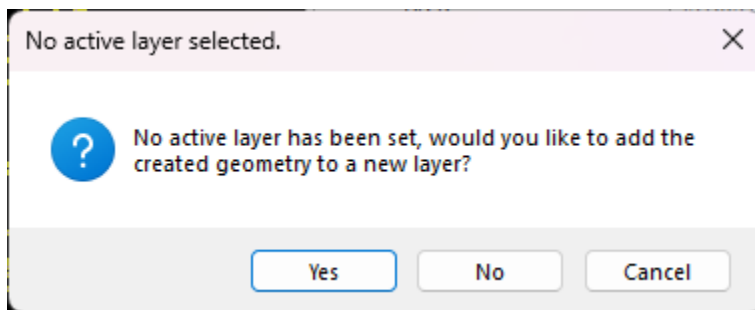
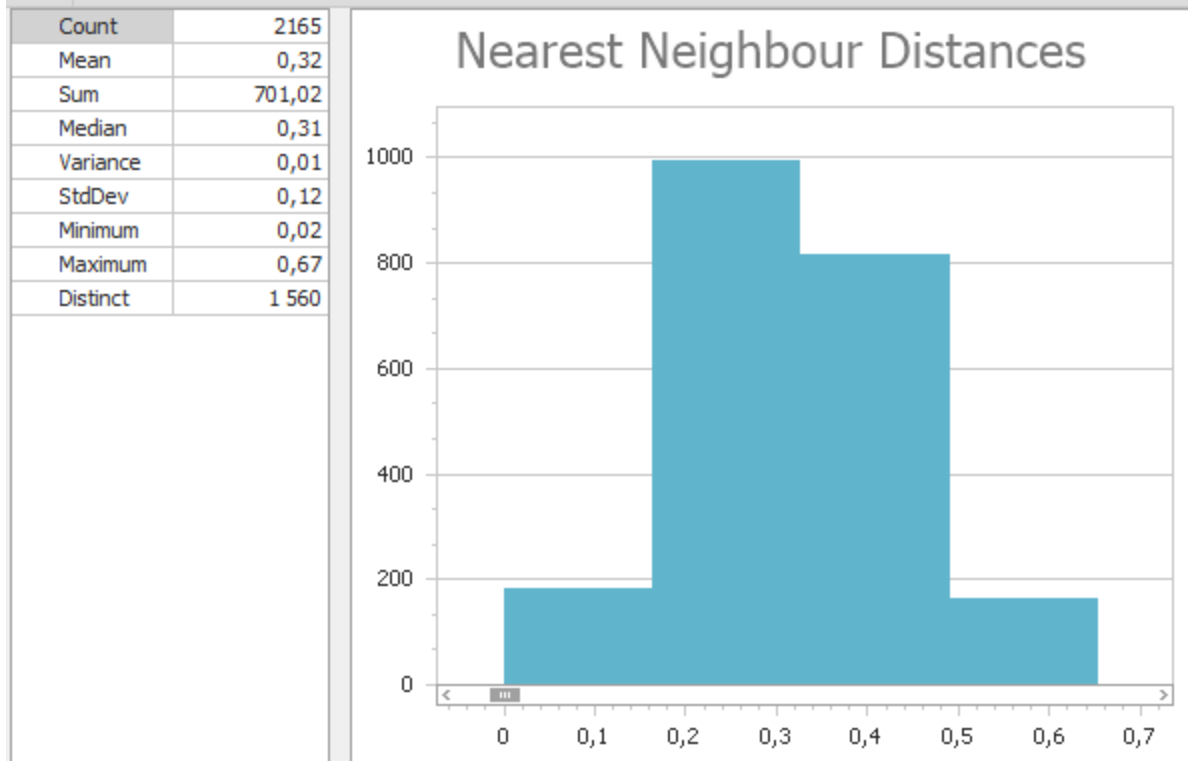To start with, I set a max edge length of 10 meters.

5. "Generate Surface" will load the selected points and internally triangulate them based on the MaxEdgeLength you choose.

6. Once you click "Generate Surface" the surface will be generated for you and will be added to whatever layer you have active or it will prompt you to add a new layer.


7. The histogram on the right will now populate. You can hover over the chart and mouse scroll to zoom in closer to the bars:

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Count	2165
Mean	0,32
Sum	701,02
Median	0,31
Variance	0,01
StdDev	0,12
Minimum	0,02
Maximum	0,67
Distinct	1 560

Nearest Neighbour Distances

You can see here that most of my points are quite close together at an average distance of 0,32 meters.

8. This is how my generated surface looks in graphics:
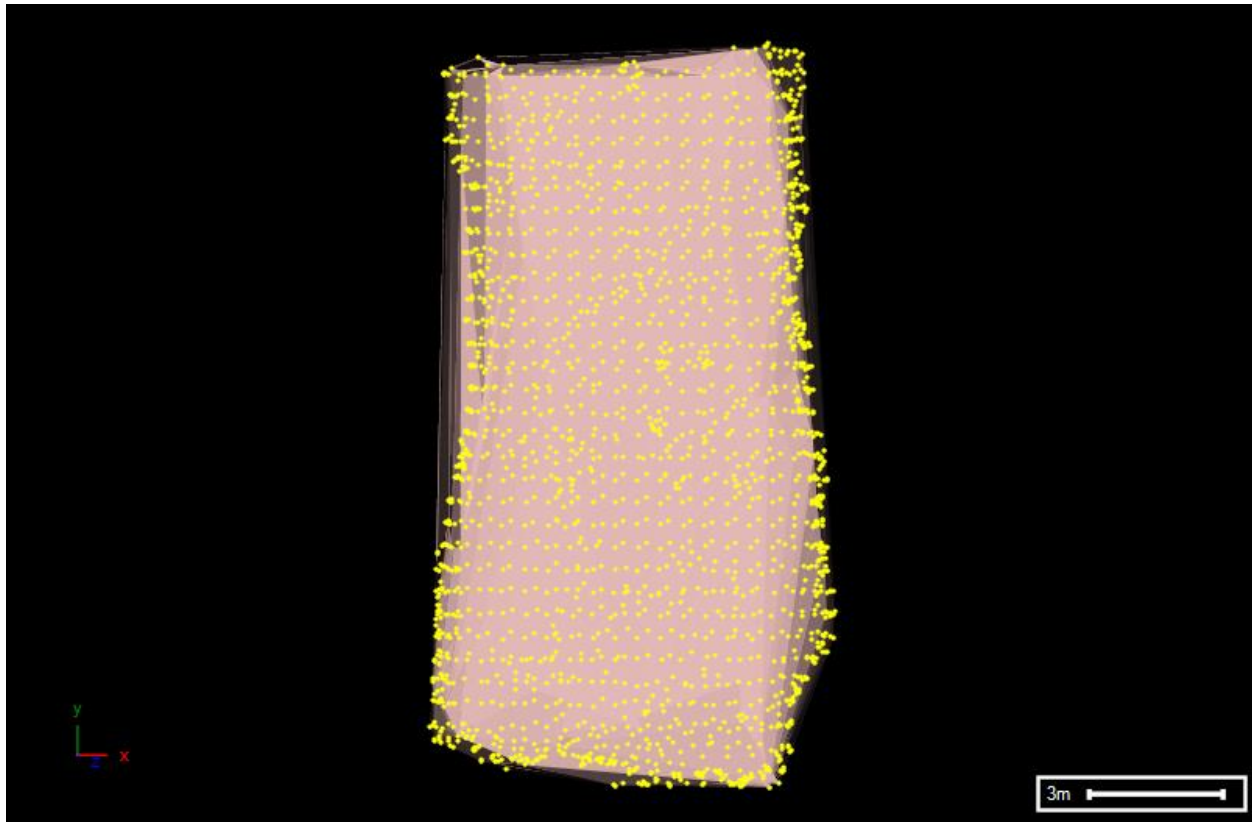
9. In the "Output" section on the pane on the right you can see the total "**Area**" of my surface is given; "**Closed**" is also ticked on which is good and means that the surface was able to be closed up with the tetrahedra used by the tool in creating the surface.

   A tetrahedron (plural, tetrahedra) is a 3D triangular pyramid shape with 4 triangular faces. These are the elements used in creating a 3D surface.

ExcludedTetrahedra will tell you the number of tetrahedra that were excluded in generating the surface based on the MaxEdgeLength you specified.
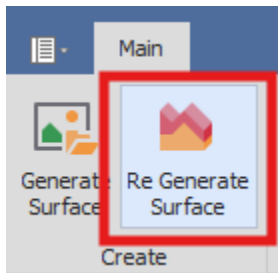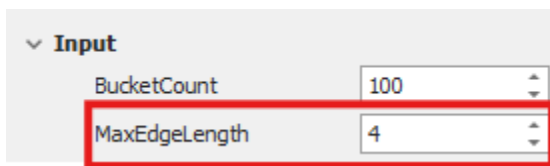
Totaltetrahedra will tell you the total number of tetrahedra created when generating the surface.

Volume gives you the total volume of the surface created.

10. In this example the surface doesn't quite follow along exactly on the edges and go in where it is supposed to.
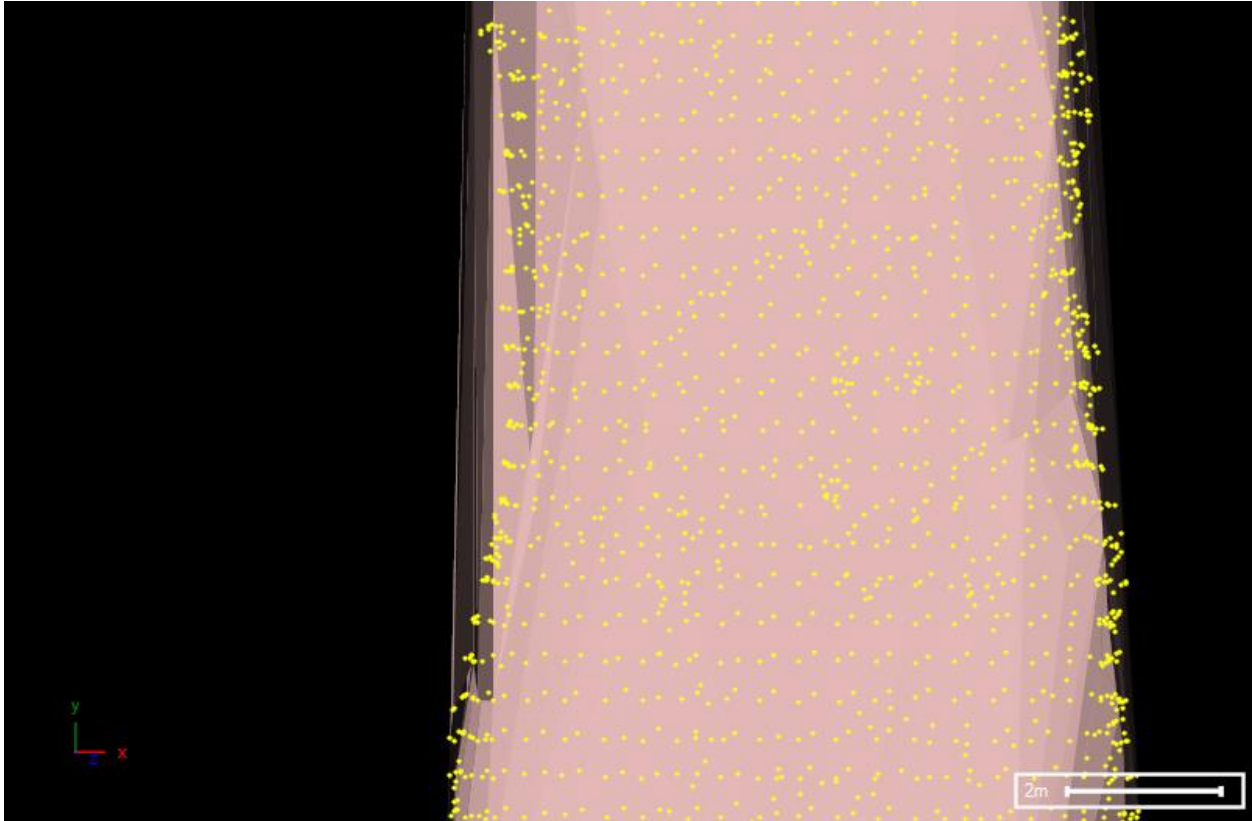
So, what I can do is adjust my MaxEdgeLength and then hit "Regenerate Surface".


Note: Before regenerating the surface, make sure to delete the previous geometry that was generated for the surface. You can easily do this by going to Edit tab and the selecting Undo or simply clicking in the scene and doing a ctrl Z.

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We can see now, after changing my MaxEdgeLength down to 4 and then regenerating, the surface looks much better and more closely follows the contours of the original point cloud:
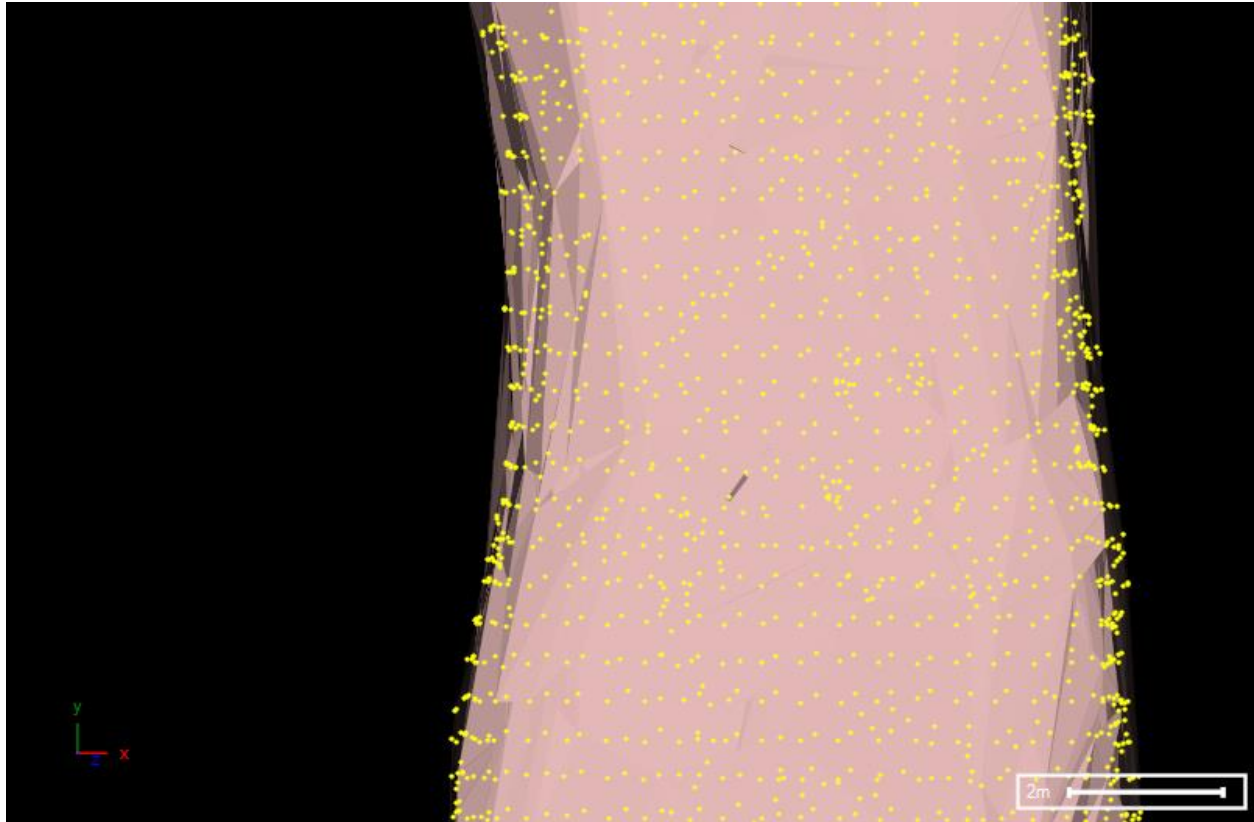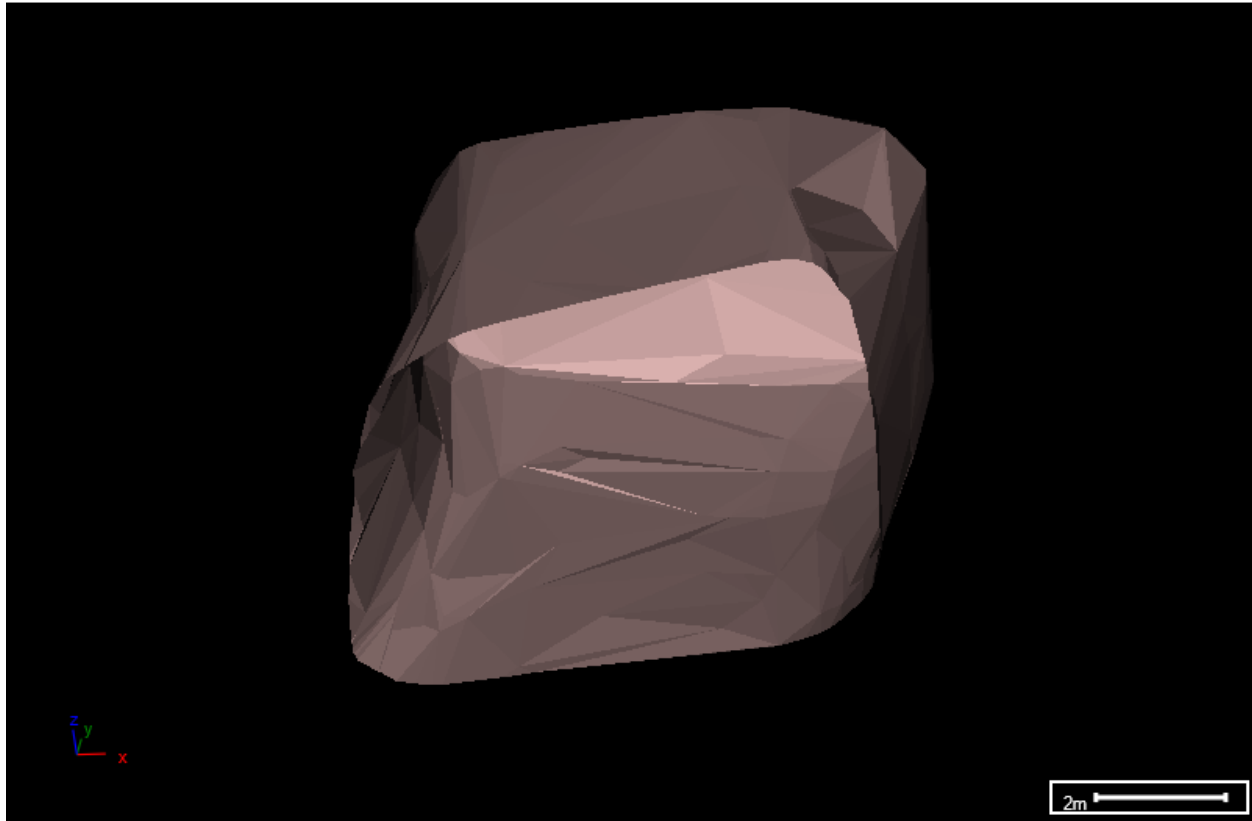

Inspecting your surface

Use of one of the Snap tools at the bottom of the viewport to snap to the surface and then hold down ctrl and left click and then drag to rotate the surface:
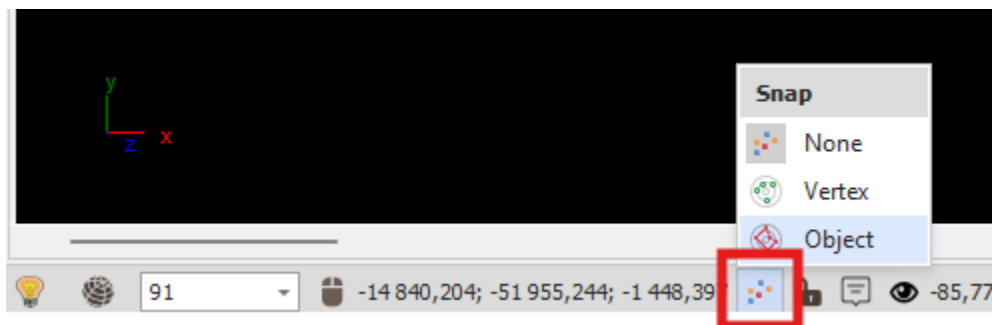
You can move into the scene and through your surface by holding down shift and mouse wheeling in:

11. Now, even though the generated surface will be smoothed out according to the MaxEdgeLength you specified, internally in the From Point Cloud too, all the tetrahedra composing that surface are still stored.

12. "All tetrahedra" allows you to see the surface with all tetrahedra used to build it. This Inspect section of the ribbon is more for debugging purposes so you can see the actual tetrahedra making up the surface and then also see where they are being excluded or included using the "Excluded tetrahedra" and "Included tetrahedra" buttons. So if you are ever creating a surface and it is not looking like you expect, then you can use this Inspect section to inspect the surface.
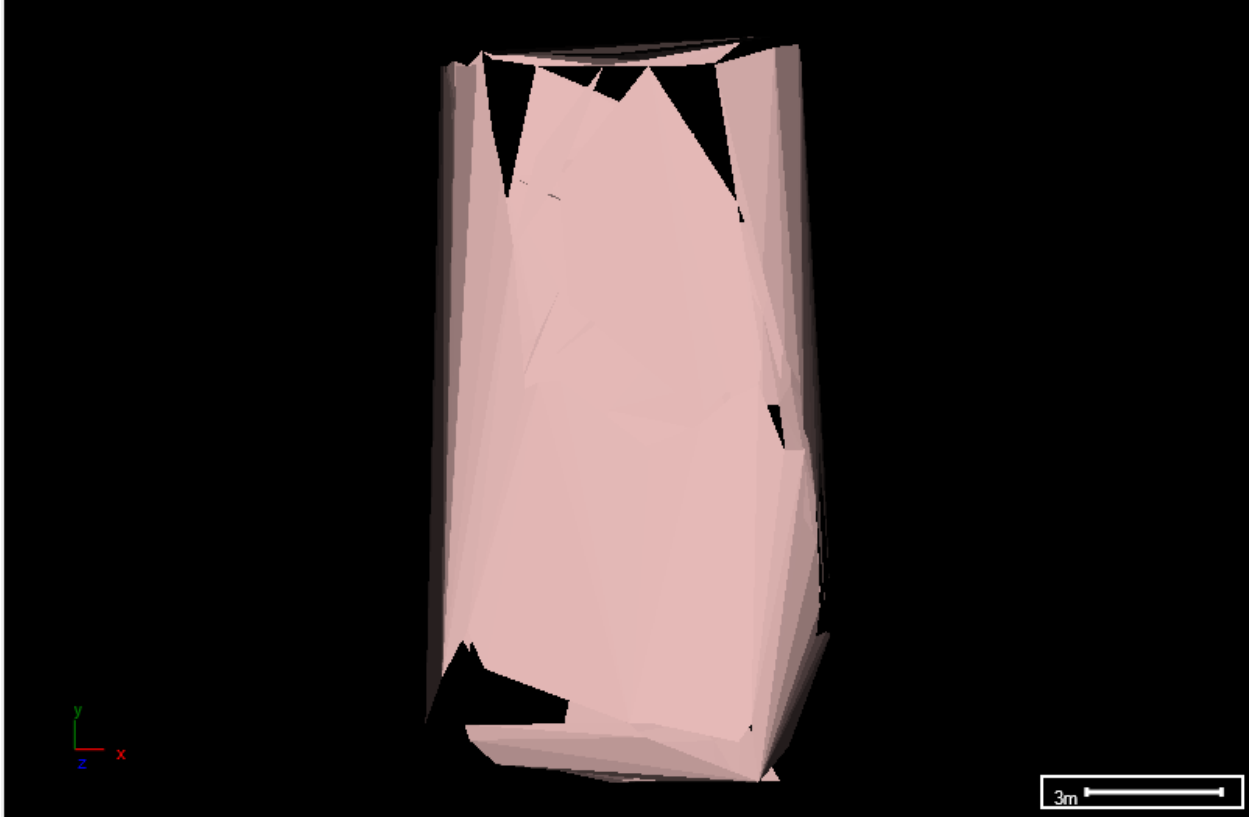
Note: Before showing the various tetrahedra, make sure to delete the previous geometry that was generated. You can easily do this by going to Edit tab and the selecting Undo or simply clicking in the scene and doing a ctrl Z.
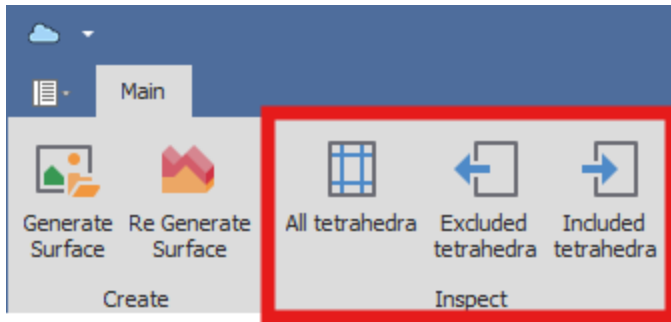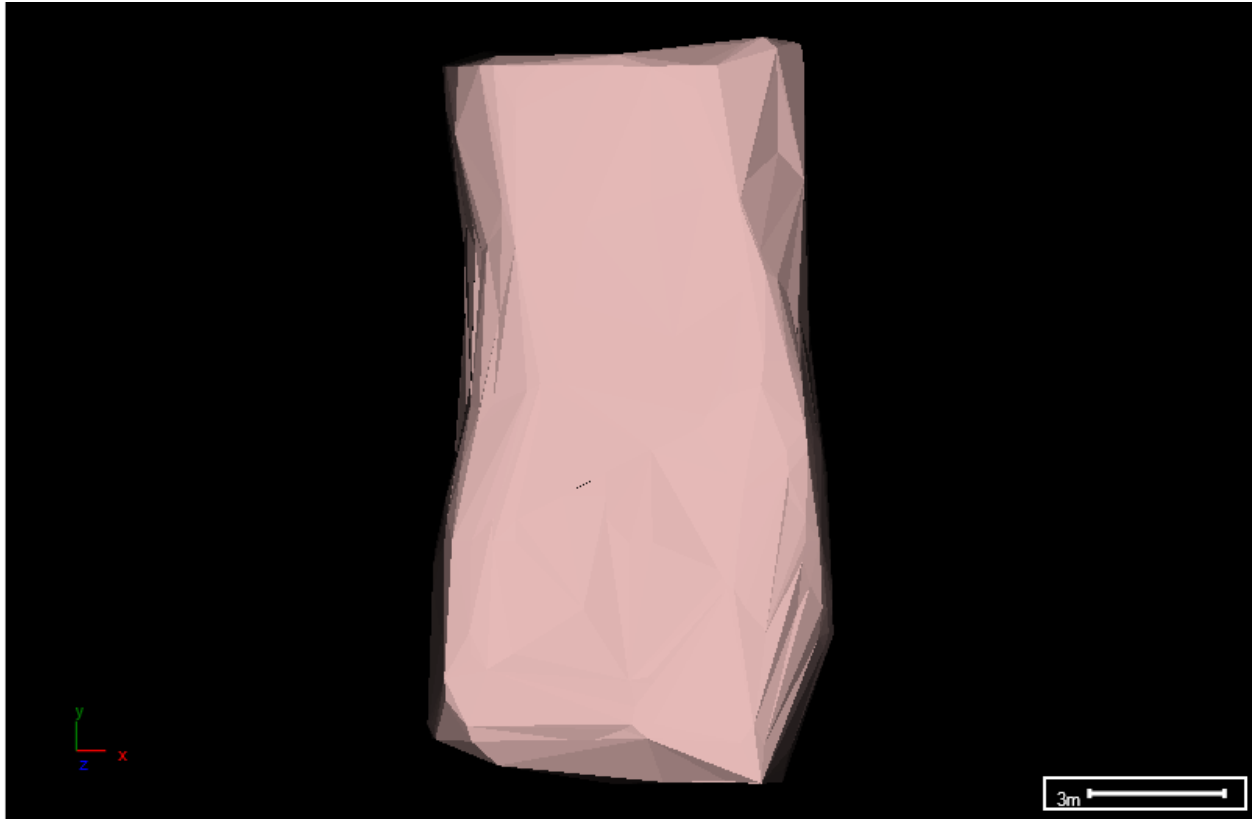
All tetrahedra:
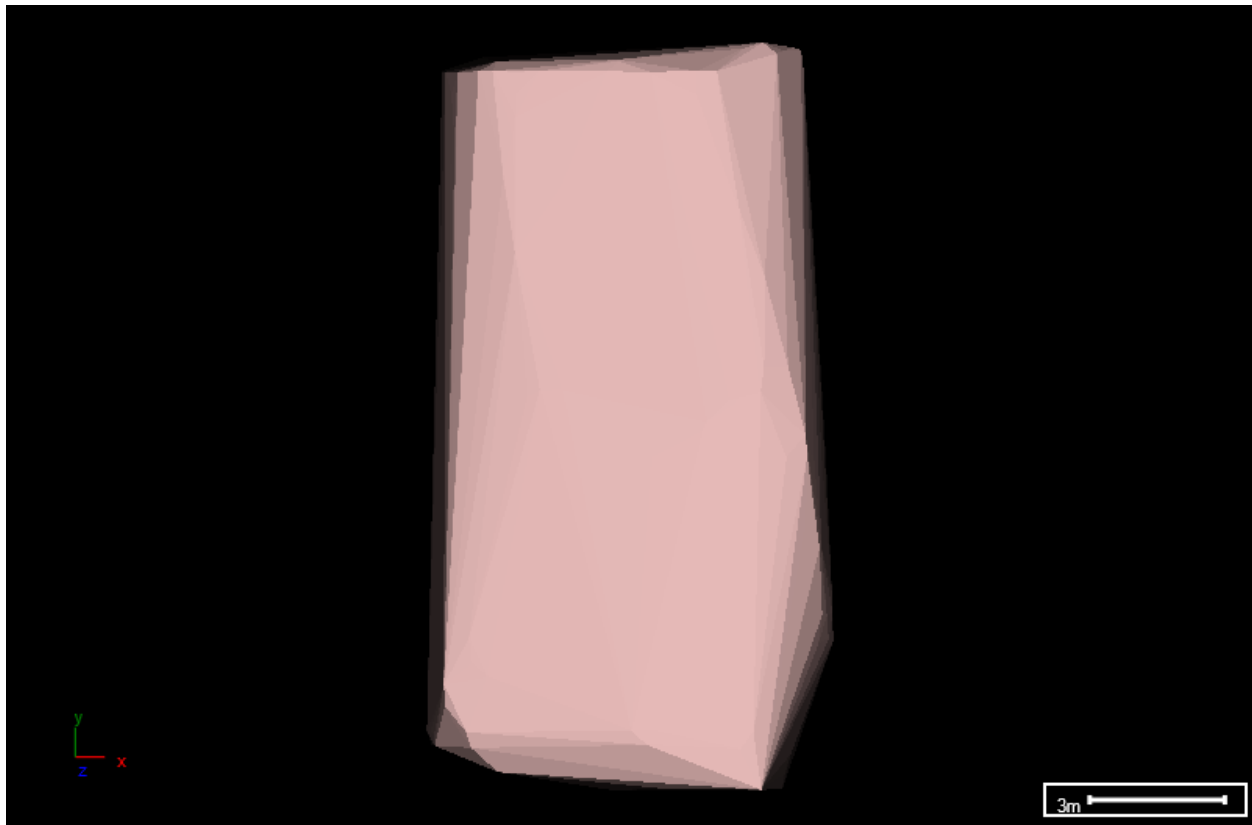
Excluded tetrahedra:

Included tetrahedra:

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