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CS3200 - Assignment 9 Report
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Question 1

In order to actually see my working directory, open "Question1_View.pvsm" in Paraview.

After following the instructions provided in Question 1, I was able to achieve the expected view results in paraview. Here are my results:

Figure 1 - Streamline Visualization of Air Flow above a Heated Disk (Enabled VectorGlyph)

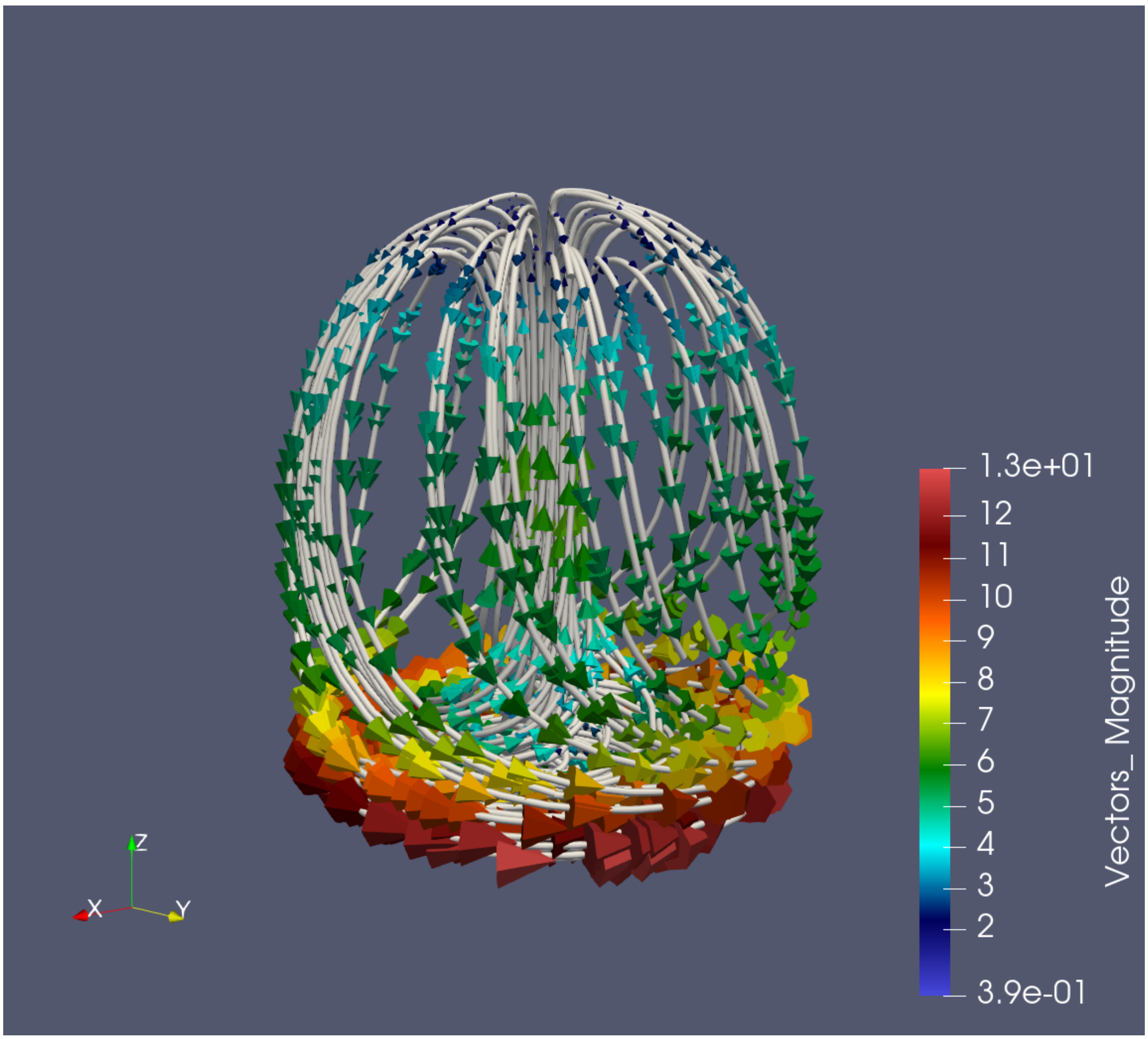


Figure 2 - Enabled ‘VorticityGlyph’ (Orientation Array is Vorticity)

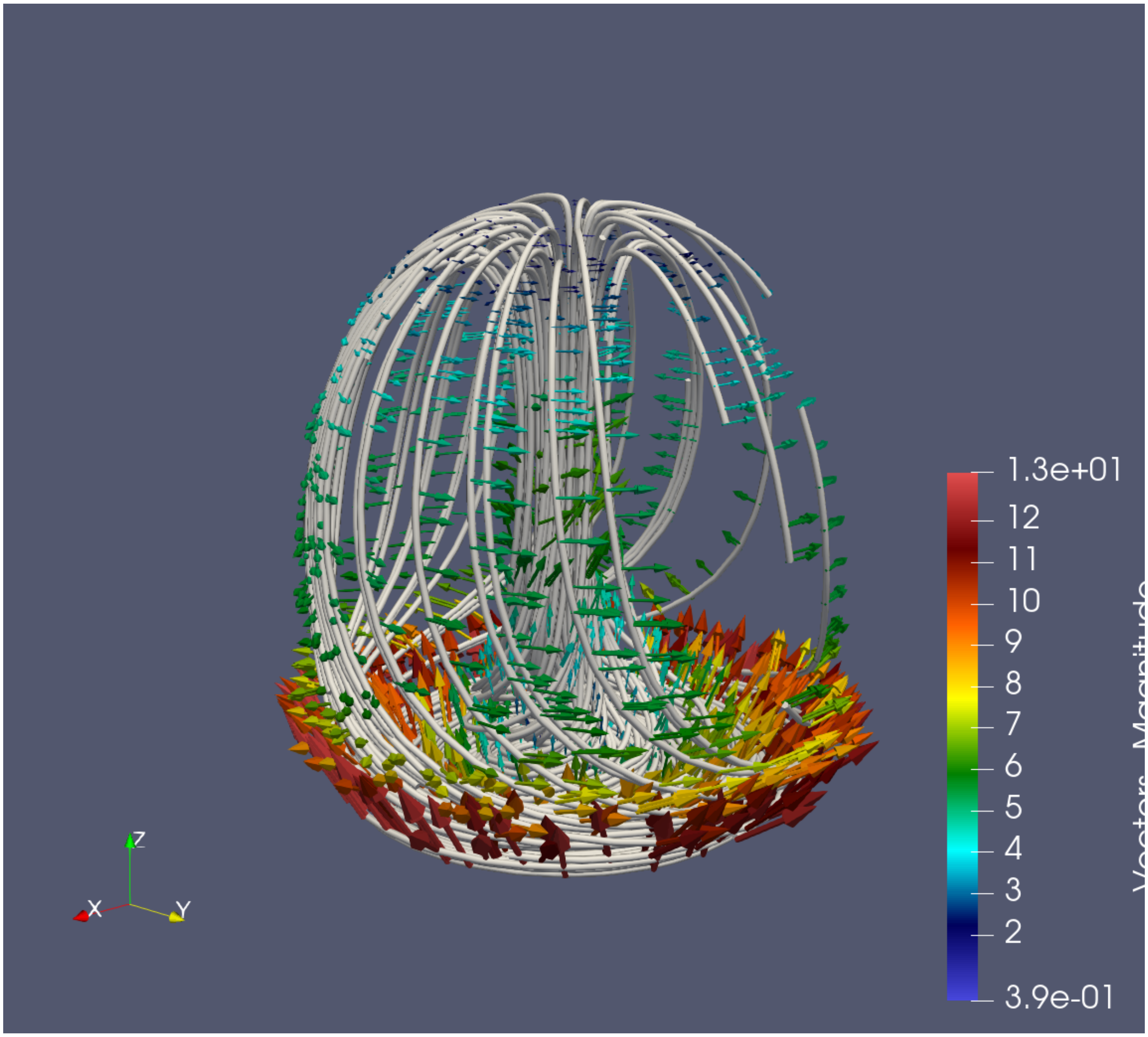


Figure 3 - Both VectorGlyph and VorticityGlyph Enabled

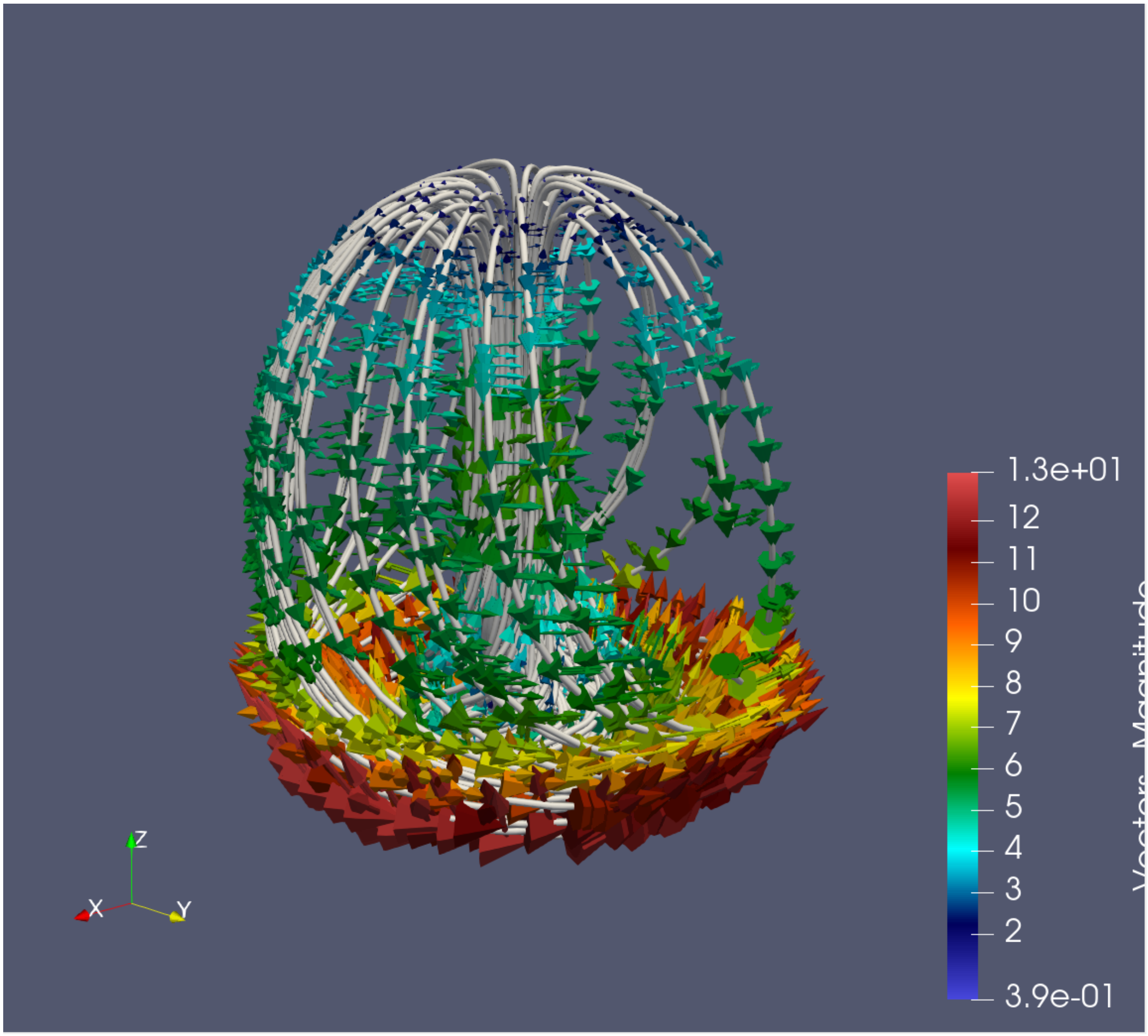
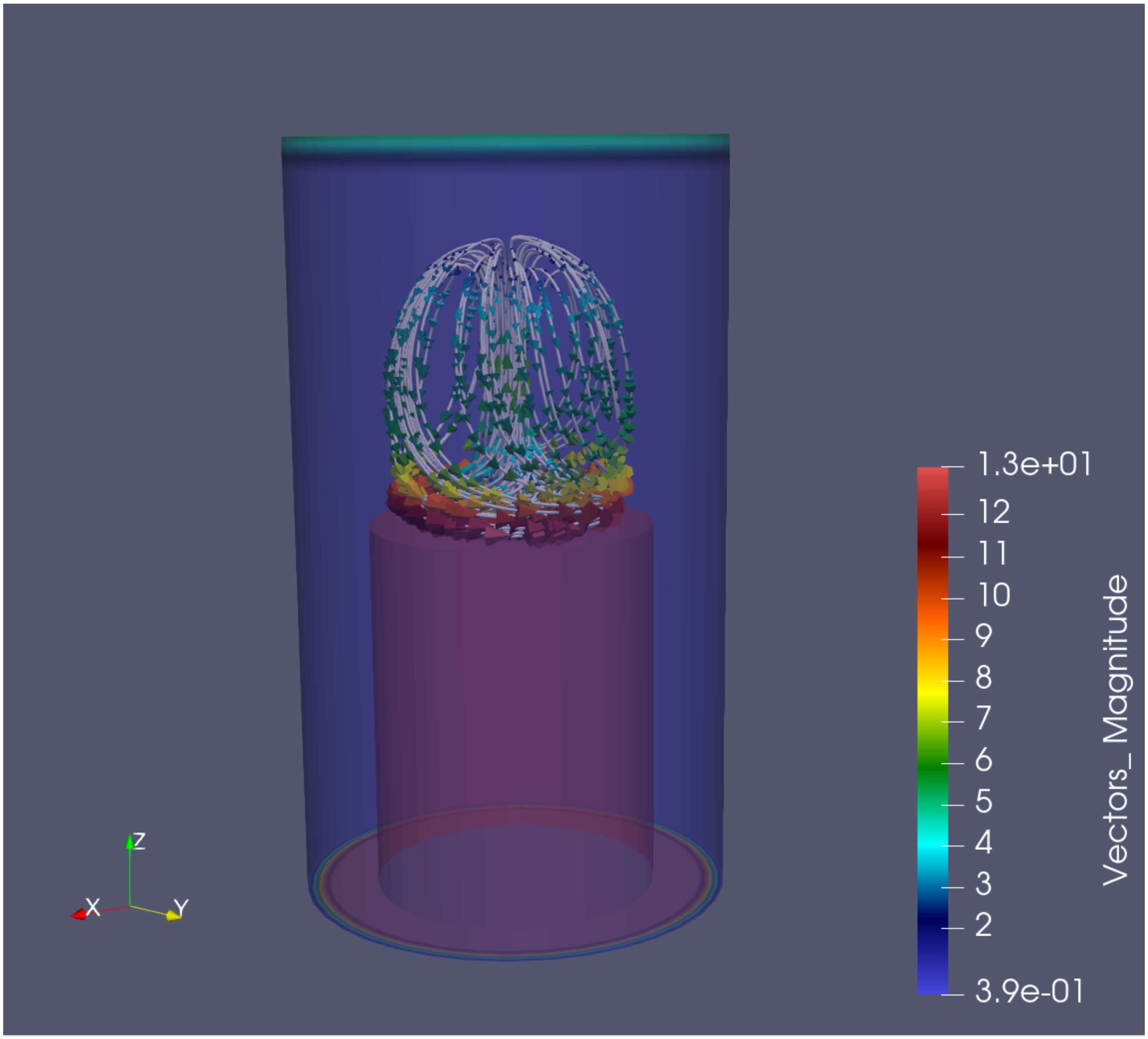


Figure 4 - View with ‘output.vtu’ enabled



The visualizations tell me that the direction of the flow is counter clockwise with the magnitude being the heat generated by the disk it lays on as seen in Figure 4.In Figure 1, the flow of air essentially circulates from the outside and eventually funnels inward at cooler temperatures where it creates a mini-vortex that flows upward to its most cool iso value and then outward. This outward force of air is then heated as it circulates back to the outer base and most hot point in airflow.

In Figure 2, the vorticity travels perpendicular to the air flow at a similar magnitude. Therefore, the airflow is traveling positive (in continuum) in a counterclockwise motion as described at iso values ~5-6 which reinforces the behavior in Figure 1 at iso values ~10-12. Another interesting observation is the vorticity of air at the hottest values travels outward because air is escaping the field after cycling through the centripetal vortex. This makes sense as air will escape and will prevent the innermost air cycle to increase in temperature.

When compared side-by-side in Figure 3, not much new is truly observed but it is worth noting the flow of air at certain vorticity points. I noticed a lot of the base of the cone tube has air escaping outward because the direction of the flow produces a velocity for the air flow to continuously follow at a perpendicular angle.

Question 2

In order to actually see my working directory, open “Question2_View.pvsm” in Paraview.

After following the instructions provided in Question 2, I was able to achieve the expected view results in paraview. Here are my results:

Figure 1 - Vector Field Visualization (Surface LIC Representation)

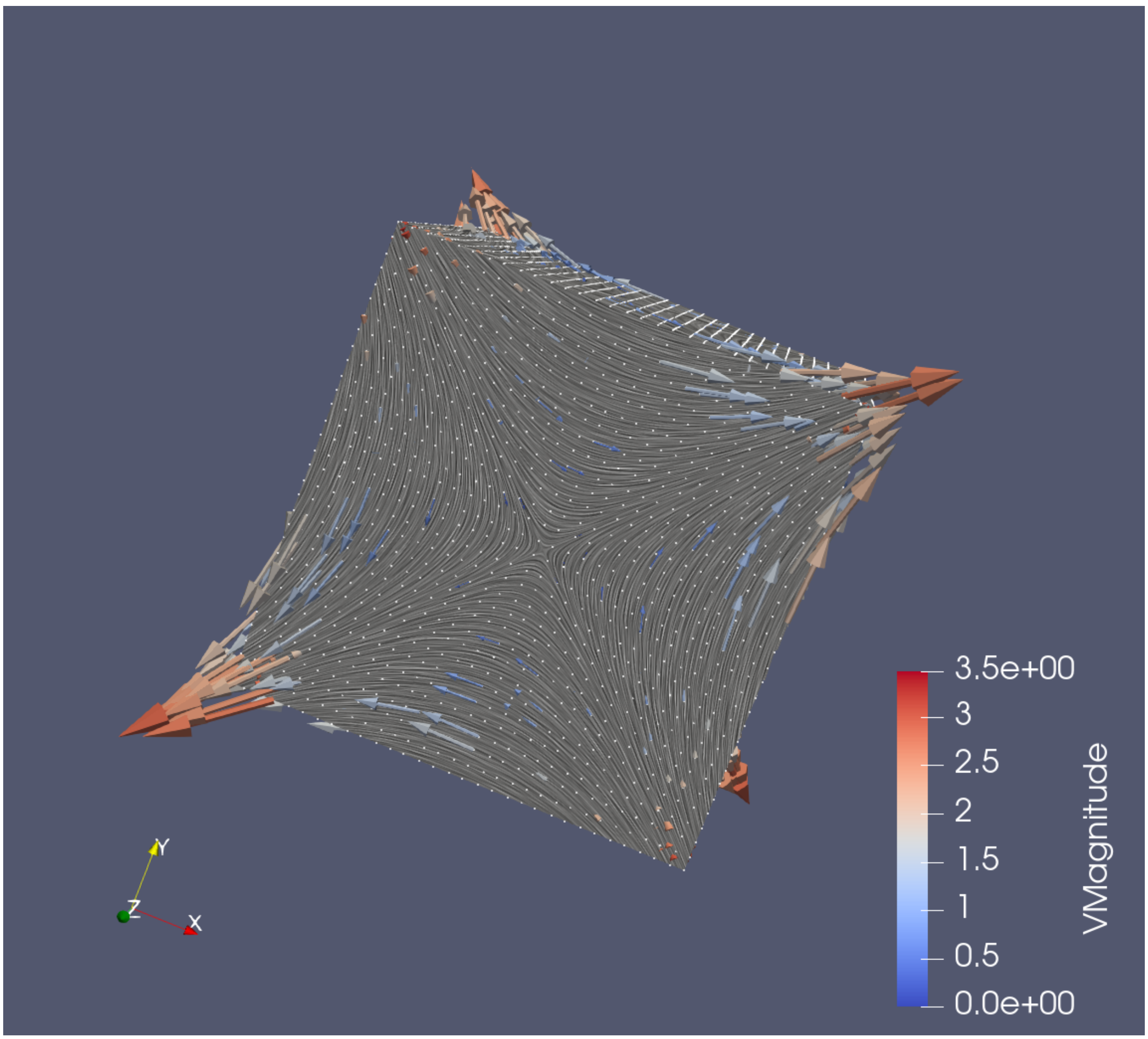


Figure 2 - Vector Field Representation (Points Representation)

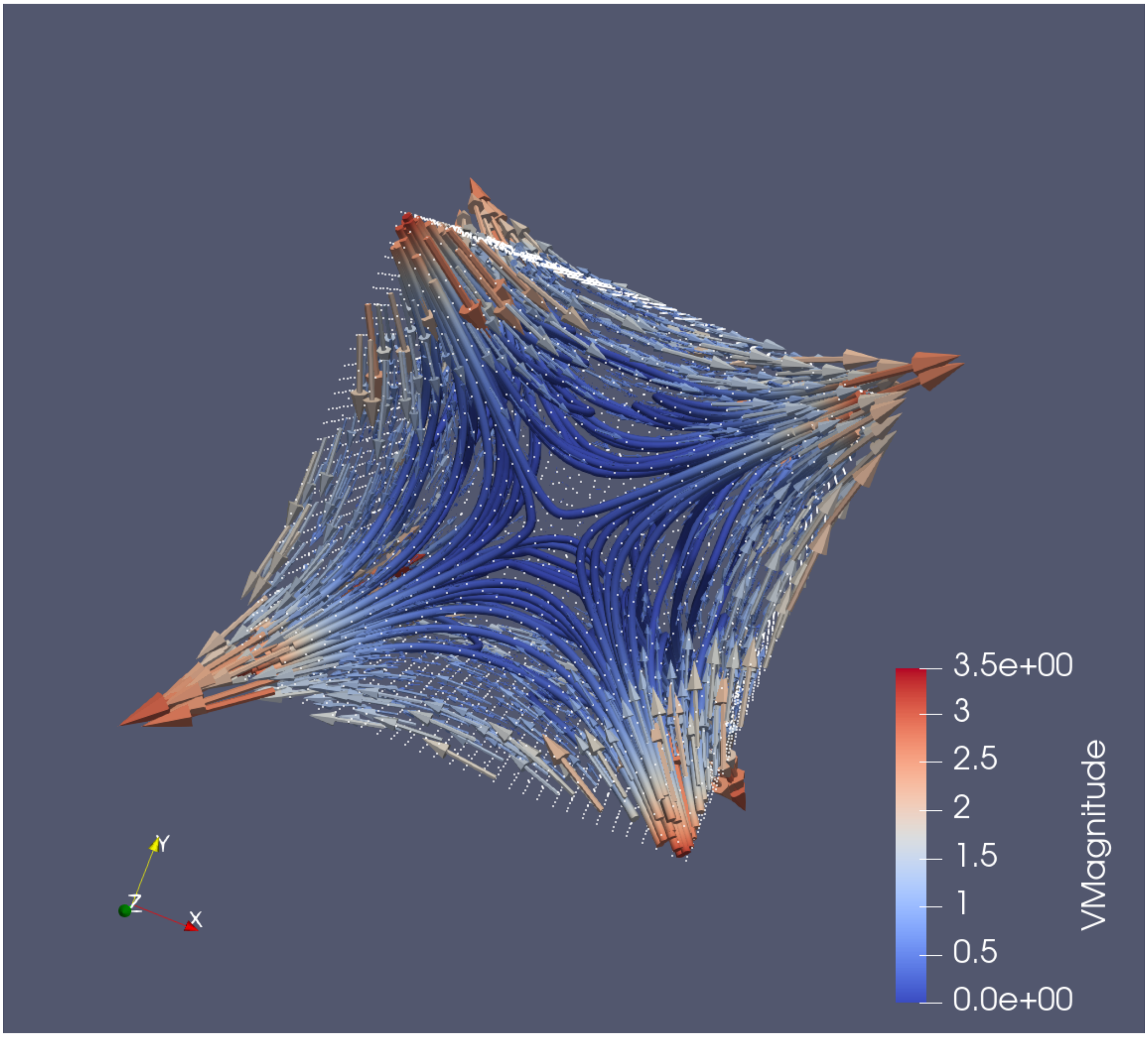


Figure 3 - Disabling ‘Calculator2’ and ‘Glyph1’

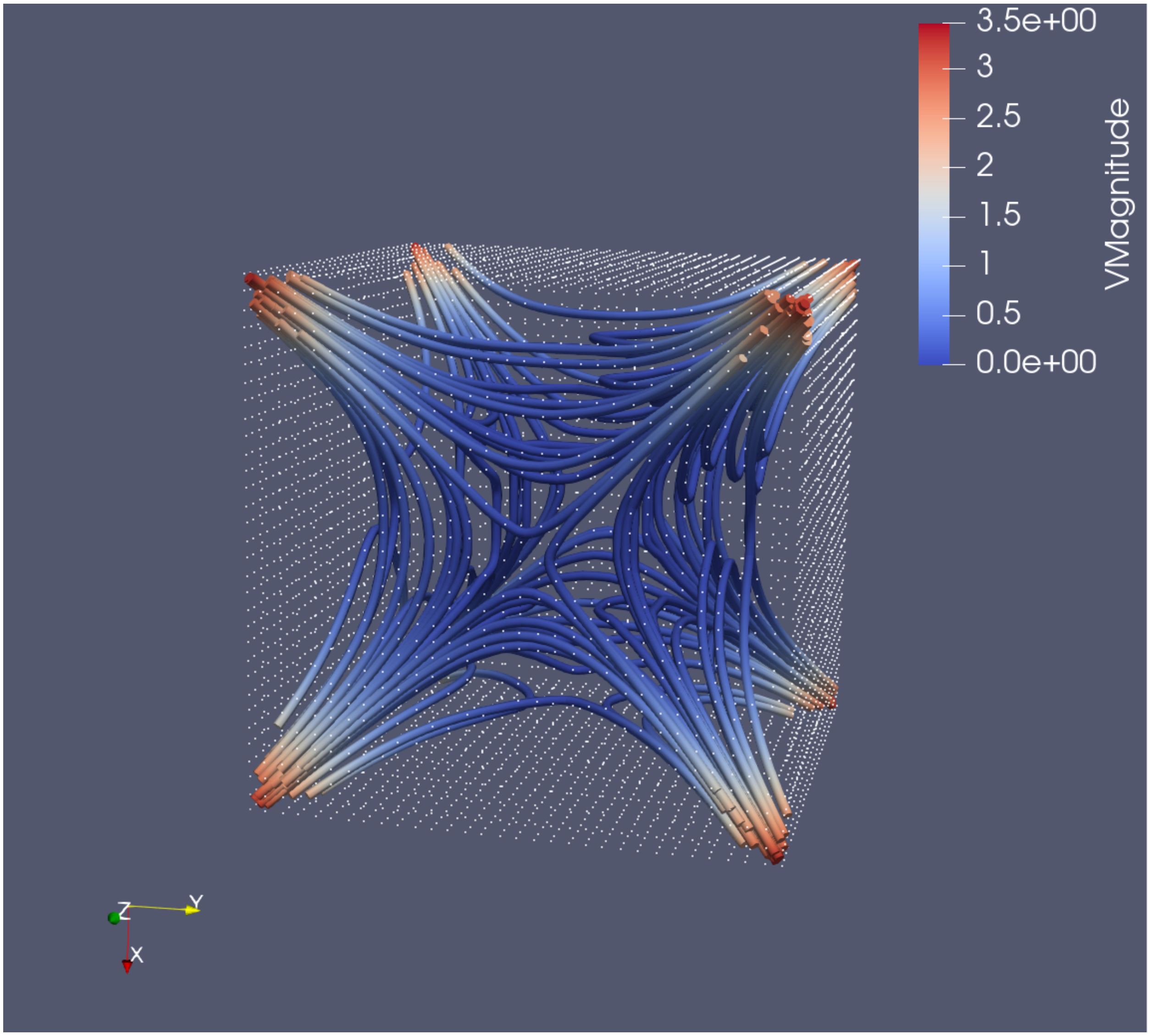
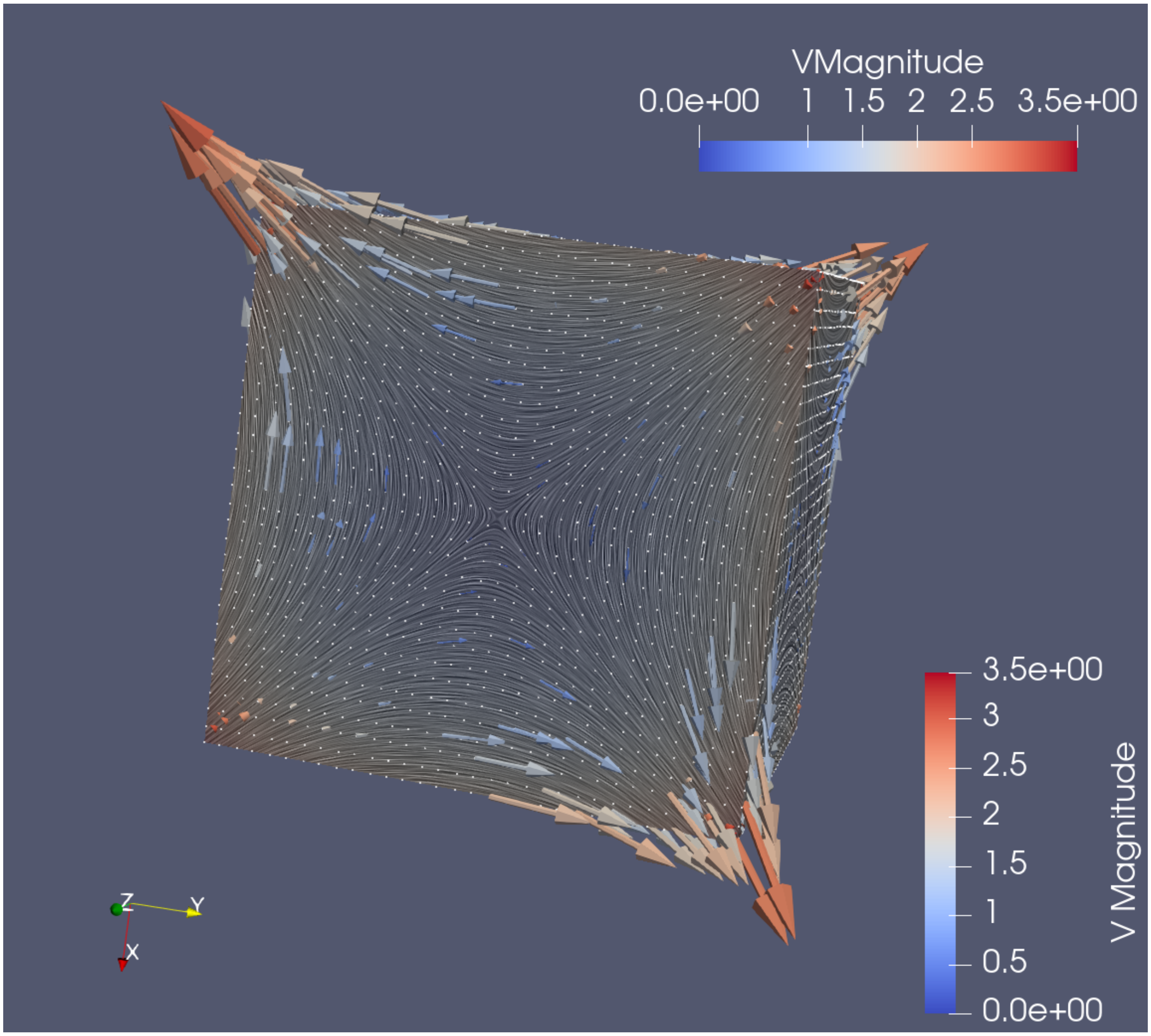


Figure 4 - Changing ‘Calculator2’ from Solid Color to ‘V’ Mapping



After adding the Tube Filter as shown in Figure 3, the flow inside the volume indicates the direction it takes through the volume. This is signified by the glyph showing the beginning and end points of the direction it takes through the volume. These are the definite points that are taken defining the flow observed in Figure 2 given the direction it leaves the volume at its several vertex points. This is also supported by the direction the arrows follow the tube in an ‘arc’-like motion.

When changing to the Surface LIC Representation as shown in Figure 1 and 4, we see the same flow pattern in Figure 2 and 3 along the volume’s surface. This proves that the flow is following at the same local position, however, it doesn’t define a local direction whereas the glyph representation does. It also lacks depth where the flow is within the volume on a 3-dimensional level (it only shows it on a flat surface). Enabling the mapping to not show a solid color additionally adds to the Surface LIC representation by also showcasing the same magnitude of flow on the surface at some given position on the volume. Despite the praise for the glyph representation, it doesn't precisely help define local 2D points along the curve to better visualize the flow inside the cube unlike the Surface LIC representation.

Overall, Surface LIC is better at showing a representation of the flow on the surface by precisely showing where there might be local points and potential saddle points along the 2D curve whereas the glyph is better at volumetrically displaying the direction of the flow within the cube.

Sources

1. https://my.eng.utah.edu/~cs3200/Assignment9.pdf

2. https://my.eng.utah.edu/~cs3200/Paraview.pdf

3. https://my.eng.utah.edu/~cs3200/Volume_Rendering.pdf