

Project #5: SCIENTIFIC VISUALIZATION USING PARAVIEW

EN 605.662.SU20 Data Visualizations

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**Abstract**

Data Scientists have a wide range of tools at their disposal for data visualization purposes. This project sought to expose students ParaView, such that they could explore different techniques for visualizing scientific data. Two separate 3-Dimensional data sets were utilized to offer a wide variety of visualization styles.

## Introduction

In this particular assignment two 3D datasets are selected from web for different visualizations of the data using ParaView. Both of the selected datasets have specific X, Y and Z co-ordinates with no NAN values. Different visualizations techniques like points plot, surface plot, and volume plot with customer filtering are used to display three unique representation of each dataset as depicted below. Both of the datasets are obtained from the official ParaView websites as given below.

### Data Set 1: test.csv

Source: [https://www.paraview.org/Wiki/ParaView/Data\\_formats](https://www.paraview.org/Wiki/ParaView/Data_formats)

Size: 1 kilobytes

X domain: [-0.5,1]

Y domain: [-0.5,1]

Z domain: [0,1]

Data:

x coord, y coord, z coord, scalar

0, 0, 0, 0

1, 0, 0, 1

0, 1, 0, 2

1, 1, 0, 3

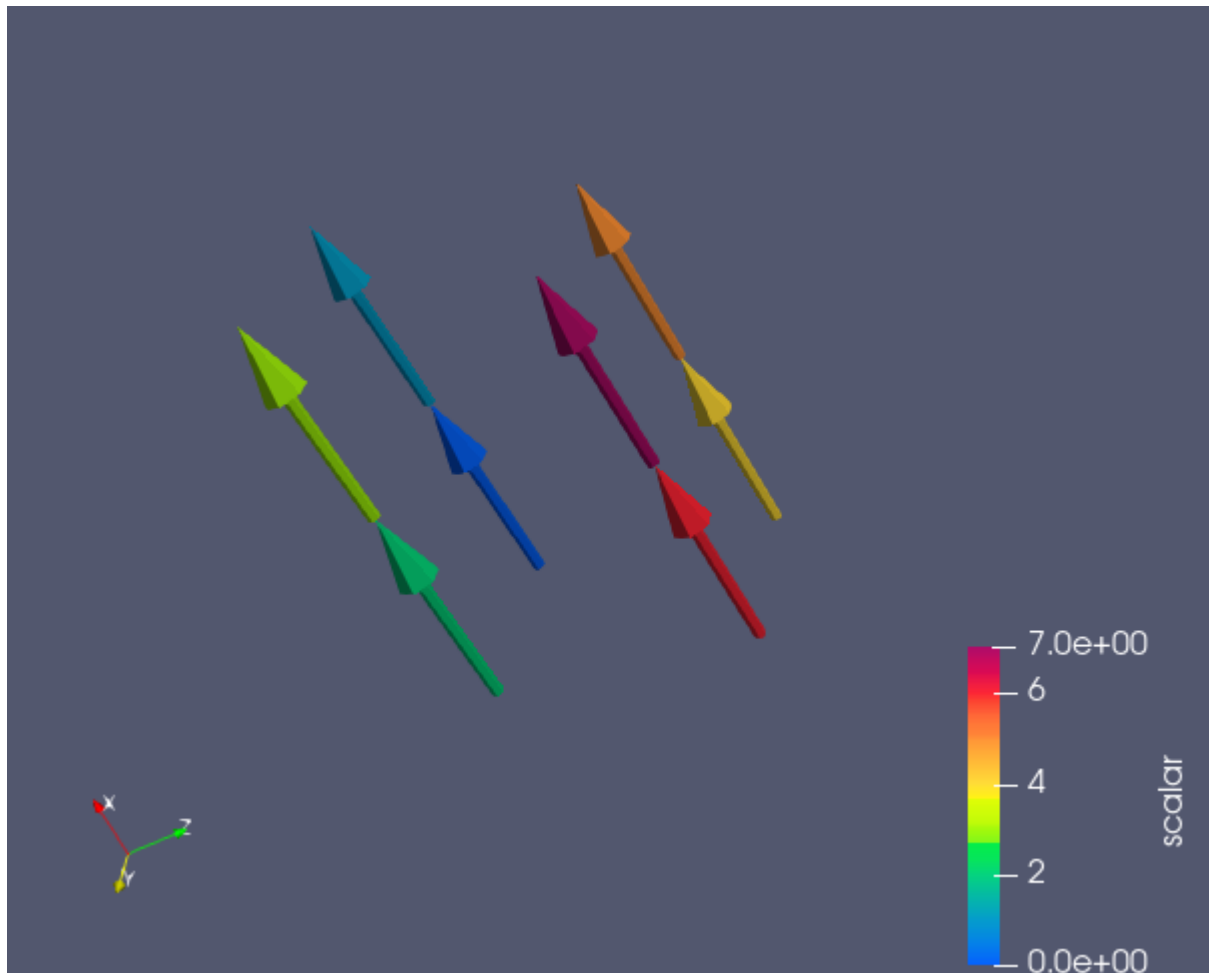
-0.5, -0.5, 1, 4

0.5, -0.5, 1, 5

-0.5, 0.5, 1, 6

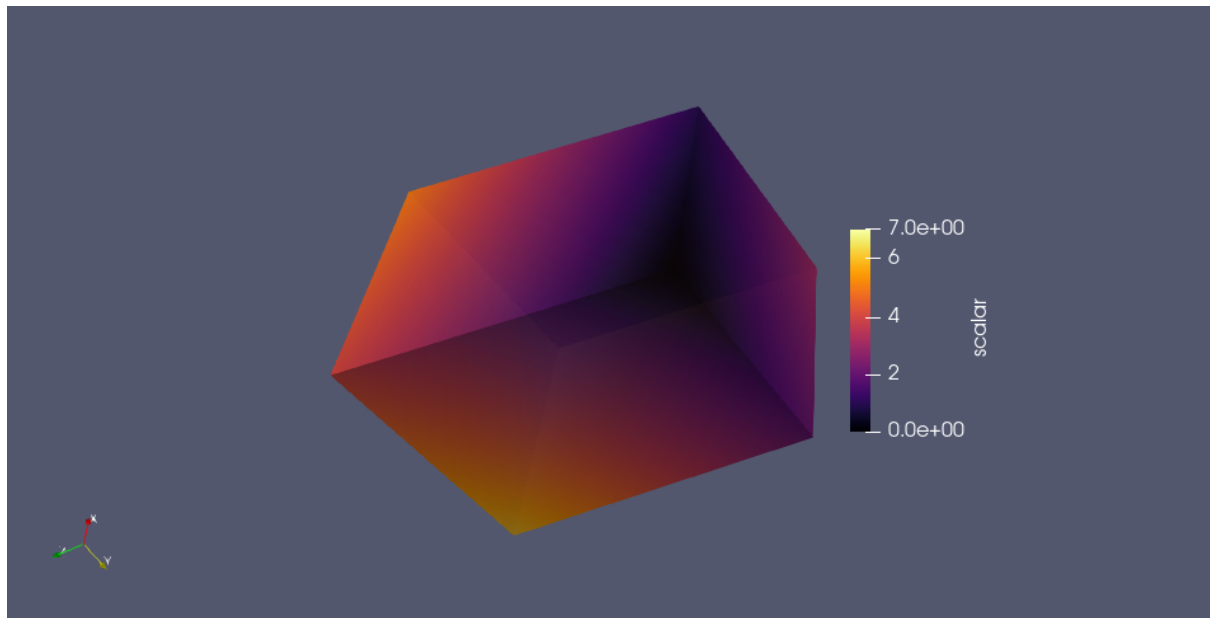
0.5, 0.5, 1, 7

## Glyph View (Data Set 1)



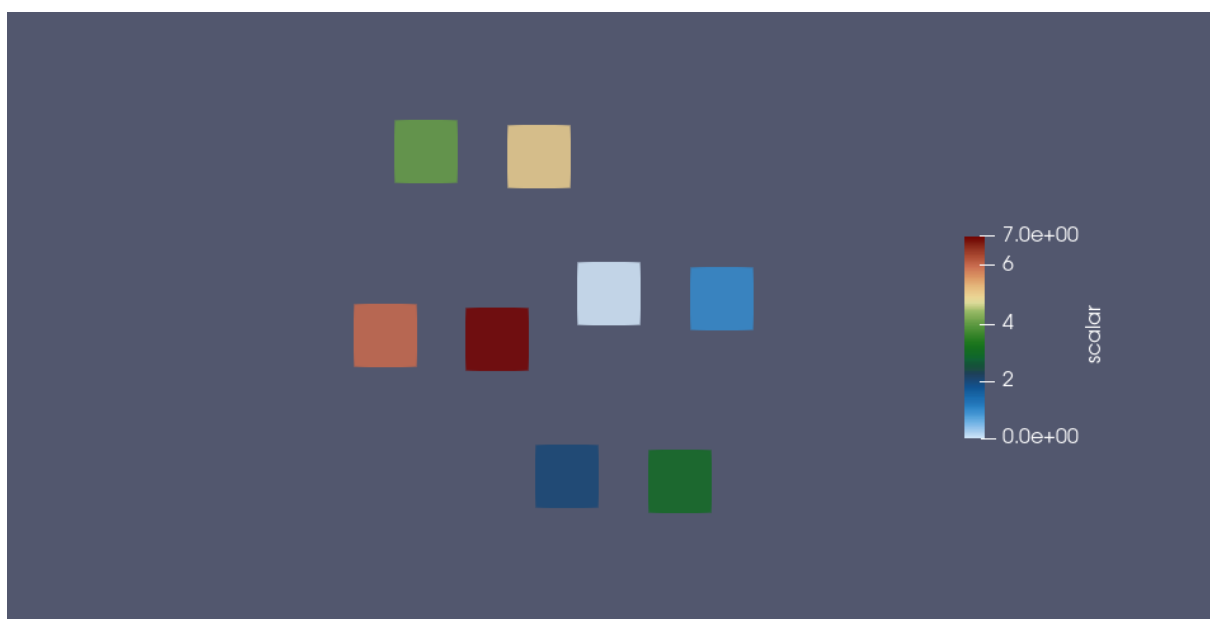
The Glyph filter generates a glyph (i.e., an arrow, cone, cube, cylinder, line, sphere, or 2D glyph) at each point or cell in the input dataset. The glyphs can be oriented and scaled by the input scalar and vector arrays. Here, in the Glyph view of the dataset, each point of 3-D data is represented by vectors having the direction of scale, which is unique in the range 0 to 7. Hence, the coloring of each arrow is different but the direction of arrows are same as the scale is positive for all data points.

### Surface Plot (Data Set 1)



In the surface view of this data, the surface enclosed by the points is displayed with a color range given by the scale variable. The color is black for the lowest scale value, red for medium scale values, and yellow for highest scale value. A medium opacity between 0 and 1 is set for the object to display the edges on the other size of the 3D plot.

### Points plot:



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In the points plot of the dataset the each 3D point is plotted as square of uniform size and the colours of each point is determined by the scale variable which has unique values and thus each point have unique colours.

### **Data Set test2.csv**

Source: [https://www.paraview.org/Wiki/ParaView/Data\\_formats](https://www.paraview.org/Wiki/ParaView/Data_formats)

Size: 1 kilobytes

X domain: [0,1.5]

Y domain: [0,1.5]

Z domain: [0,1]

Data:

x coord, y coord, z coord, scalar

0, 0, 0, 0

1, 0, 0, 1

0, 1, 0, 2

1, 1, 0, 3

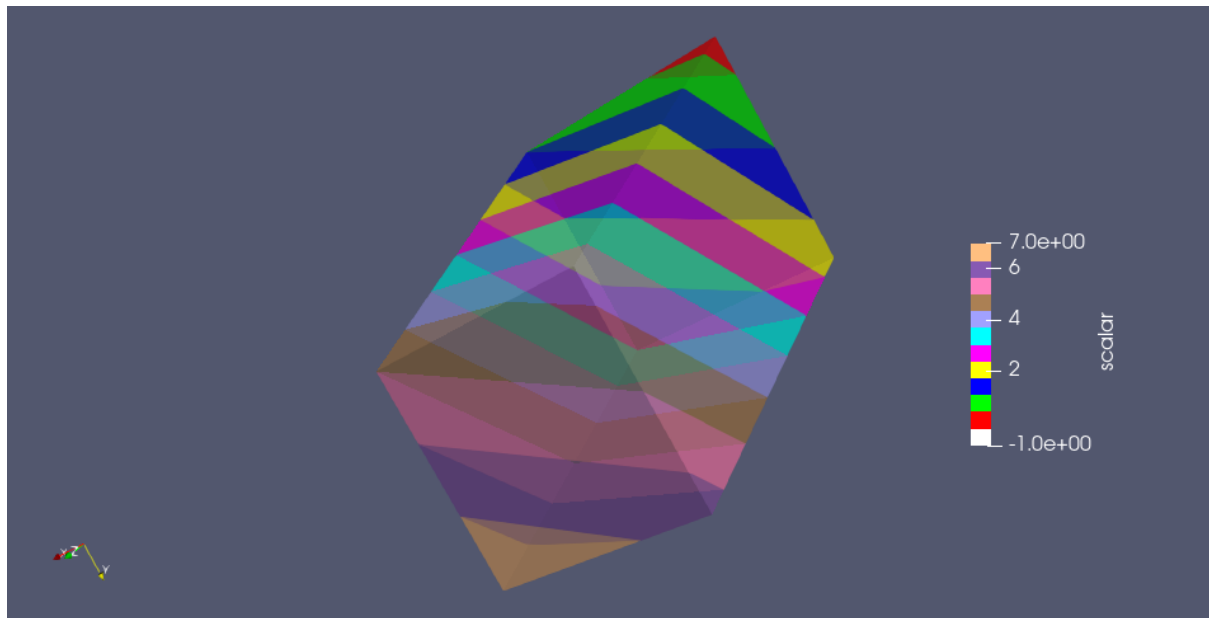
0.5, 0.5, 1, 4

1.5, 0.5, 1, 5

0.5, 1.5, 1, 6

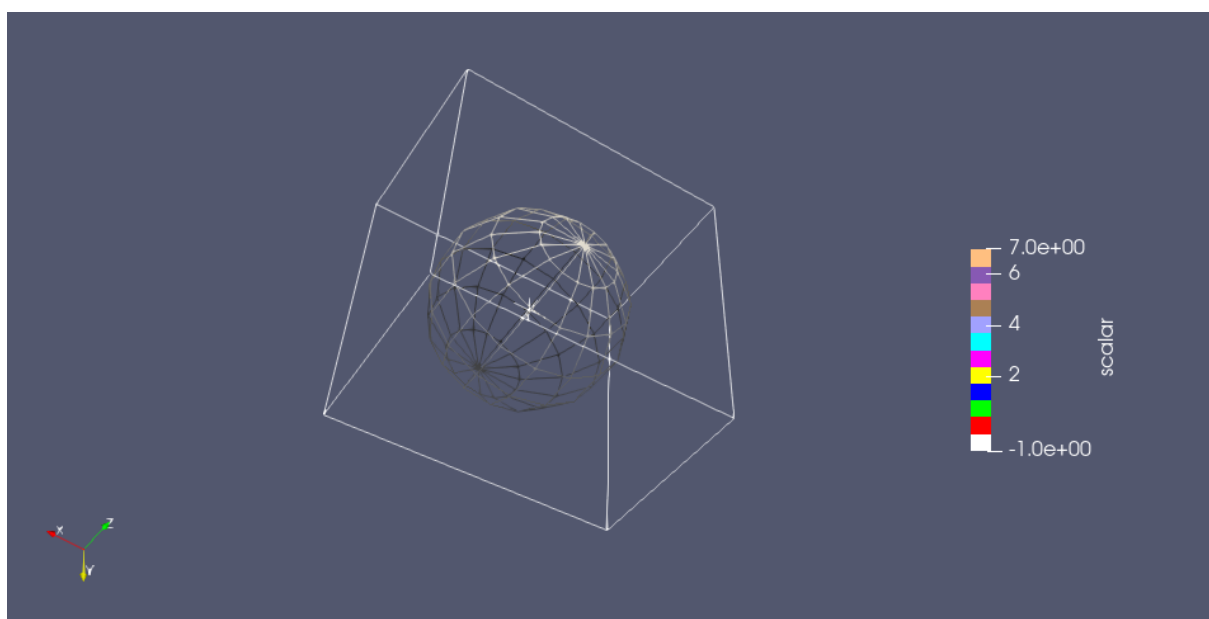
1.5, 1.5, 1, 7

### Iso-volume Plot (Data Set 2):



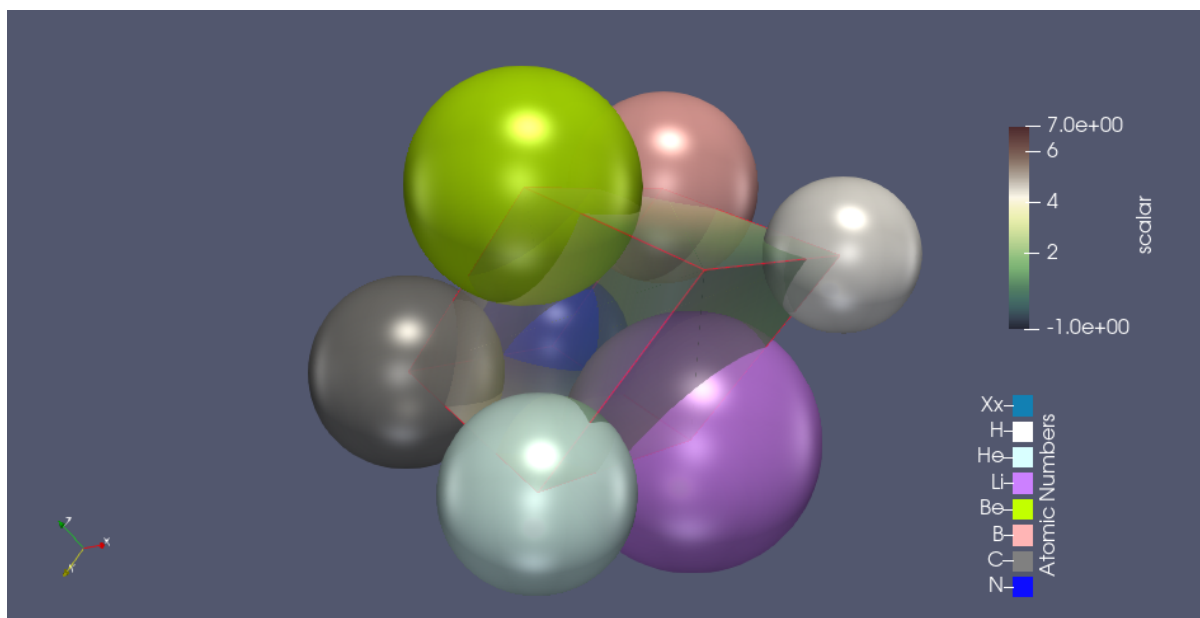
In the above plot, the isometric volume enclosed by the points is displayed with coloring given by the scalar variable in range  $[0,7]$  divided among different discrete colors for a specific preset as available in the list. The opacity for the volume is set just over 0.5 to make the parts of block visible in the other side.

### Sphere slicing plot (Data Set 2):



In this plot, a sphere of radius 0.5 with centre co-ordinate  $(0.82, 0.71, 0.44)$  is sliced from the volume of the 3d object created by the data points as given in outline.

## Surface Plot with Molecule View (Data Set 2)



This plot is one of the advanced surface plots, where the surface with edge created by the data points are integrated with unique molecular representation of each data point, which are basically the corners of the block. Each molecule here is different and has the radius proportional to their actual molecular radius, which is modelled by the scalar variable. The data point with minimum scalar value is 0 and is represented by the molecule Hydrogen while the data point with maximum scalar value is 7 and is represented by molecule Nitrogen.

## Conclusion

Three different ParaView visualizations for two separate data sets. The concepts of volume rendering, points, surface, wireframe, Gaussian points, outlining, slicing and clipping are understood in the process of creating visuals. Also, different type of data sets that can be loaded using Paraview are learned and the process of loading dataset with appropriate properties are acknowledged.