

December 12, 2005

## Fusion Chamber Casting Coil B Dimensional Inspection Report

This report is to document the dimensional analysis of the first Coil B Fusion Chamber Casting. Also attached to this document is a 3D web inspection report and a two cross section IGES files for further analysis. All measurements within are in inches.

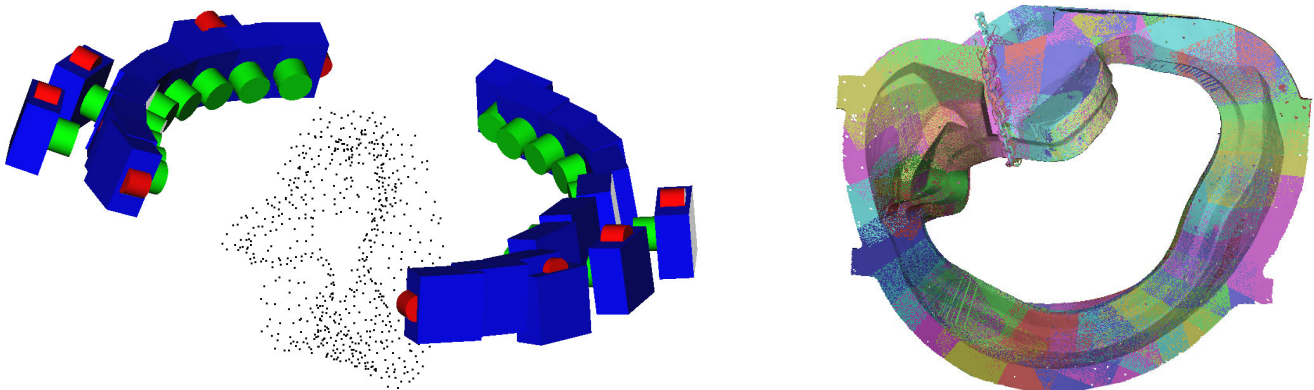
### Scanning

Two scanning technologies were employed to scan the patterns and castings, both photogrammetry and 3d laser stripe scanning were used to capture surface data from the 3 sets of patterns and the 2 castings. Photogrammetry is used to ensure an accurate scan over a large area without developing a tolerance stack. Below is a picture of the camera positions (blue, red, and green) and the target locations (black dots) from the photogrammetry session. After the photogrammetry software develops a reference cloud the scanning software will recognize unique patterns of targets within each scan frame and automatically place the scan frame in the correct orientation. Shown

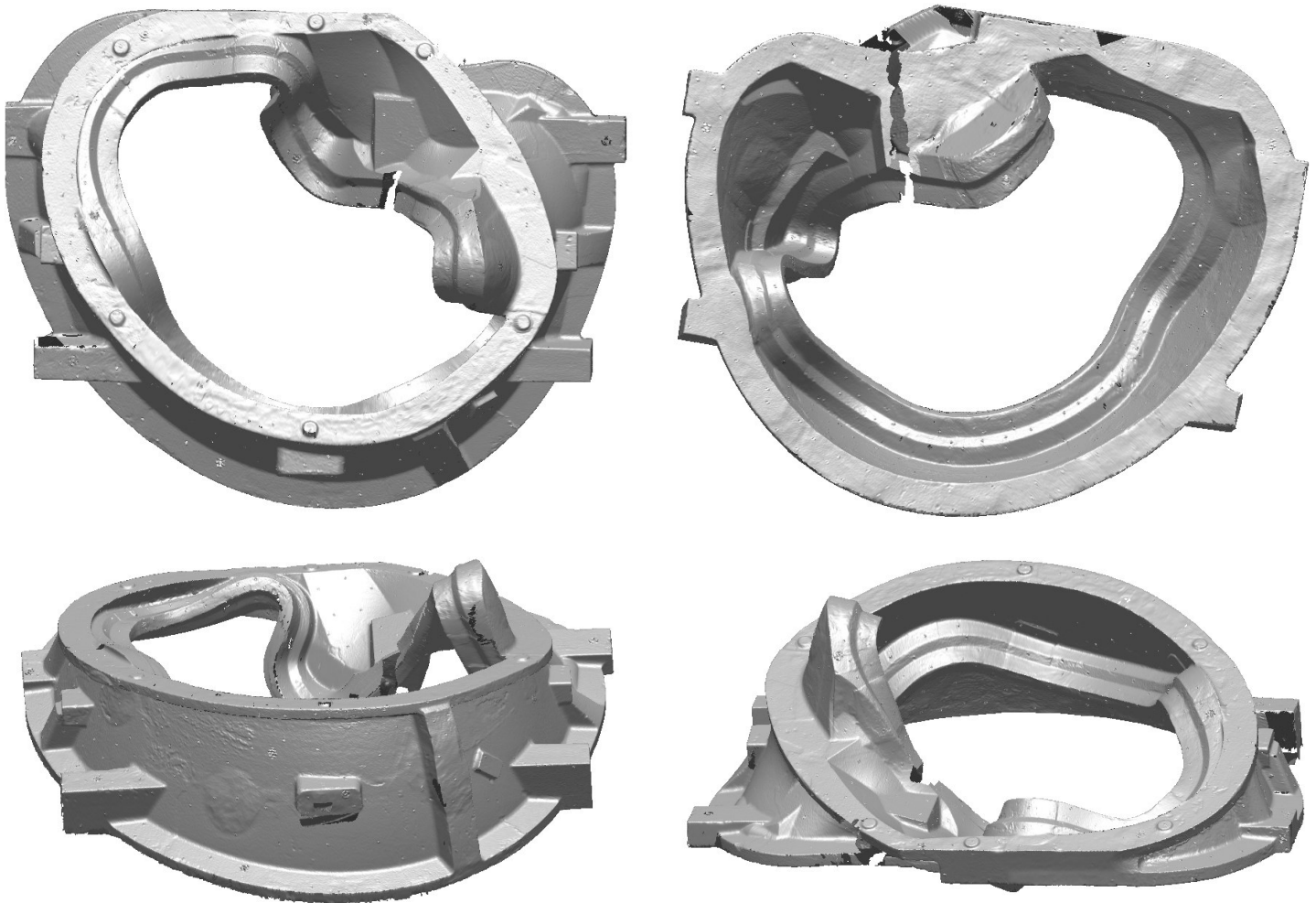


below is a picture of all the scan frames, each scan frame is shown in a different color.

Once the entire surface of the casting was captured the individual scan frames were merged into

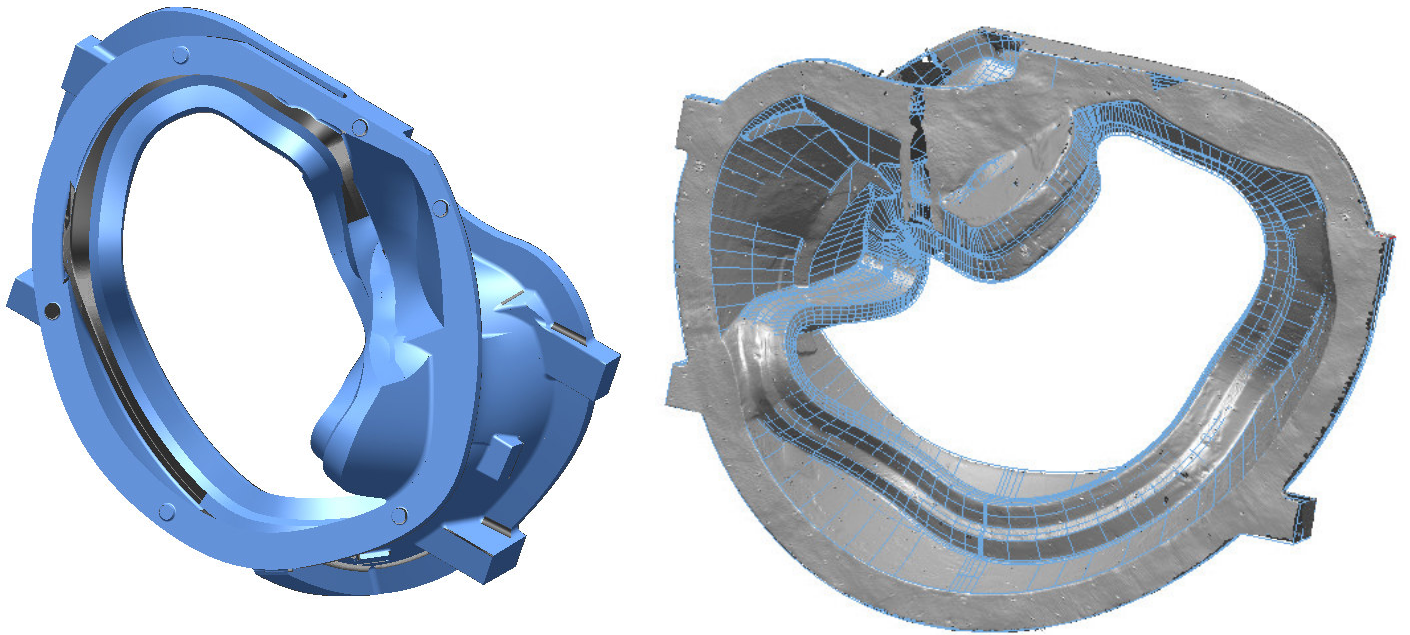


one scan file. This scan is actually a point cloud made up of millions of points. As pictured below the scan data is in stl format, which takes the point cloud data and creates triangles between the points. These triangles are shaded to give the scan surface a front and back and make viewing easier. The black areas within the scan are holes in the data, these holes occur for various reasons including non-capture of retro-reflective target data, aspect ratio minimum, and surface reflectivity. Because this is an inspection project these holes were left in the inspection reports to ensure no data was “created” therefore all the data used was actual surface data from the casting.

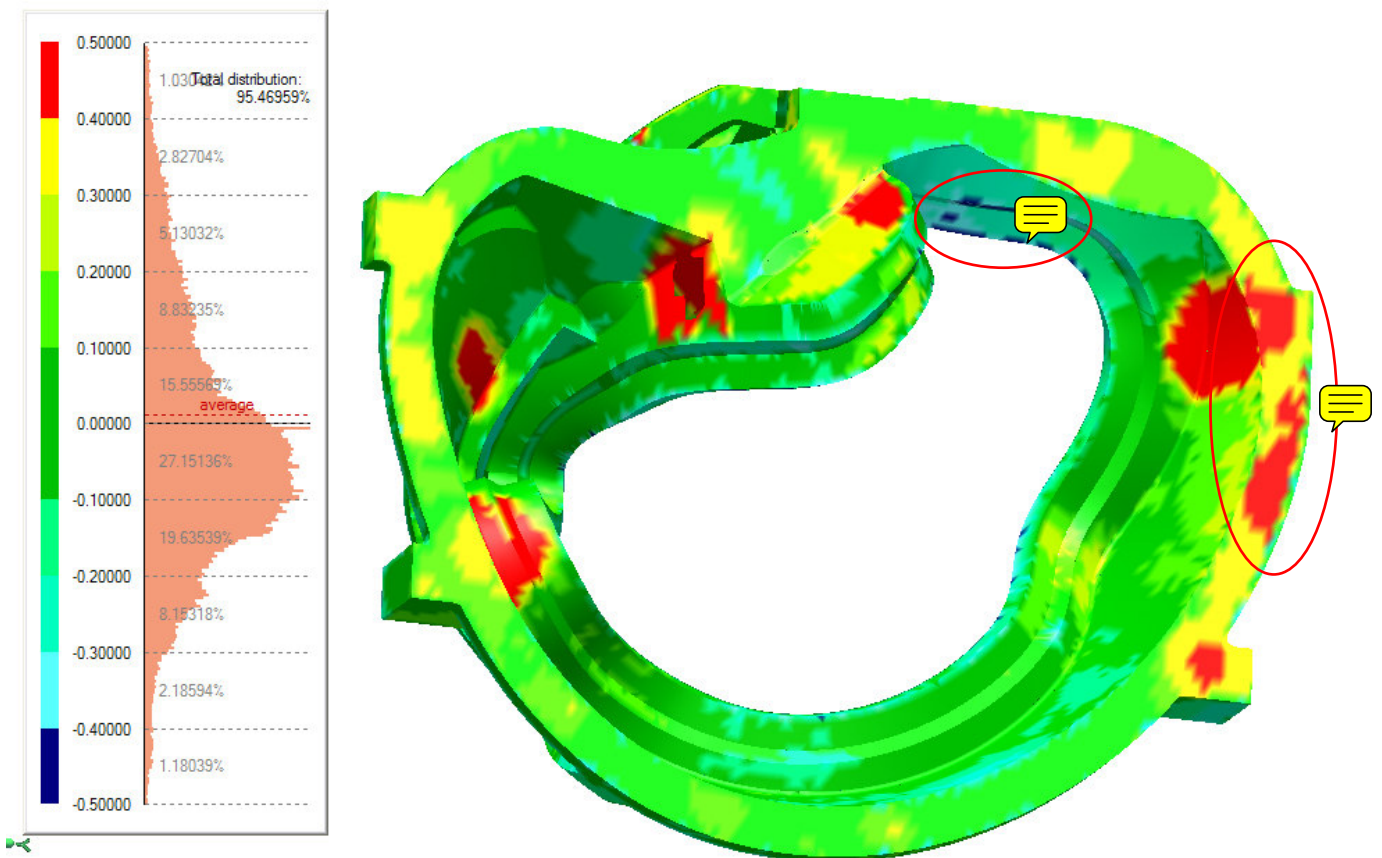


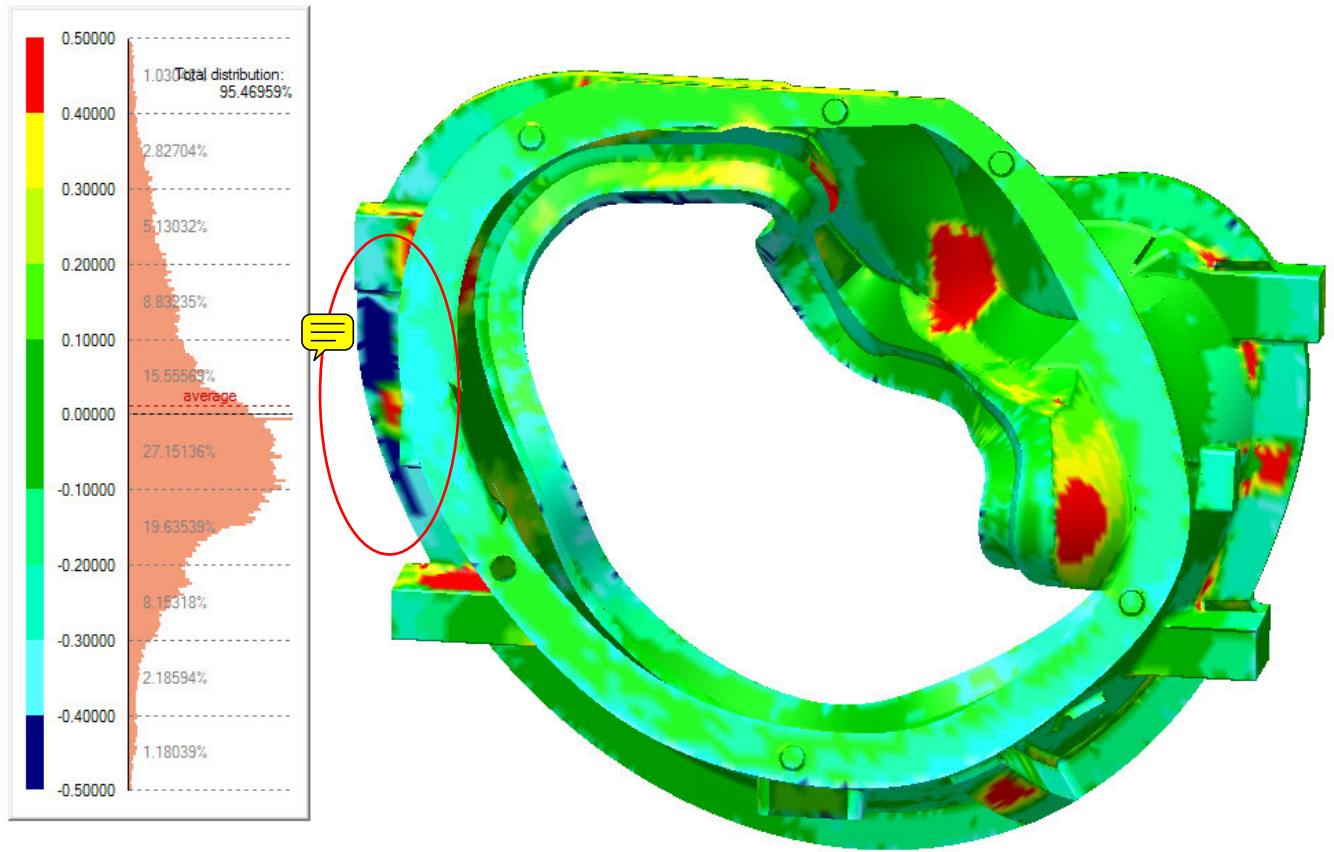
### **Inspection**

Once scanning was completed the scan data was compared to the as designed CAD. This is done by aligning the scan data to the CAD, datum features are typically used to align the scan data. For this inspection the entire CAD model was used as a datum feature to align the scan data. The CAD is shown in blue below with the scan data best fit to it.

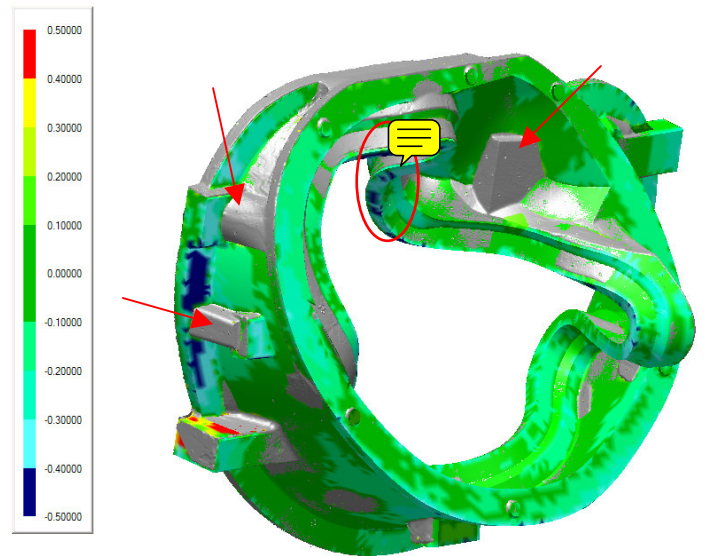
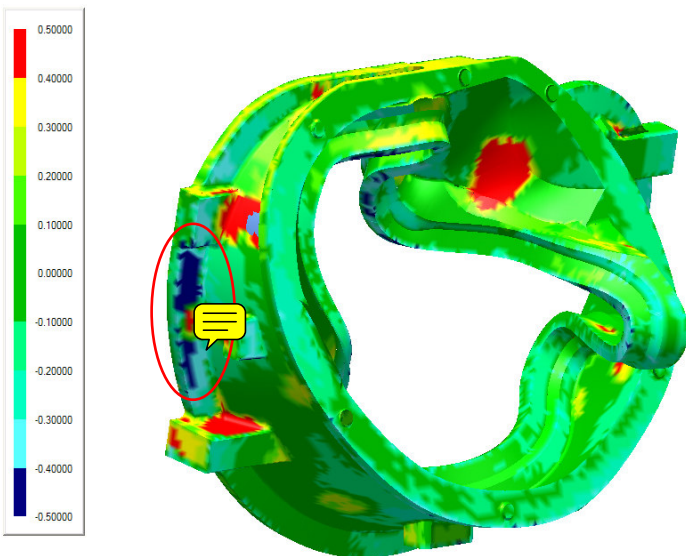


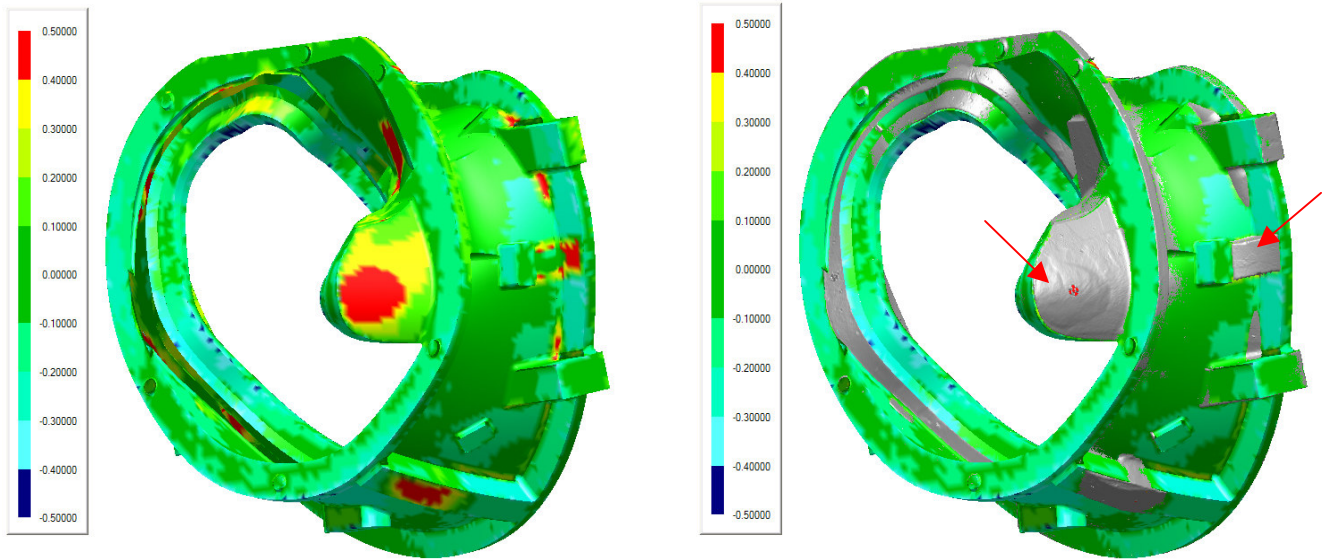
After the scan data is oriented properly an inspection report is generated by computing the distance from each scan point to it's nearest CAD surface. In the situation where two CAD surfaces are close to the same point, the surface normal of the scan point is used to assign a CAD surface to it. Below are screen shots of the colormap inspection report, note the histogram shows where the majority of the data lies. The colormap presents the distance from scan data to CAD by coloring each scan point according to it's distance from CAD.





The following images show features in the casting which are not in the CAD file used for this inspection.

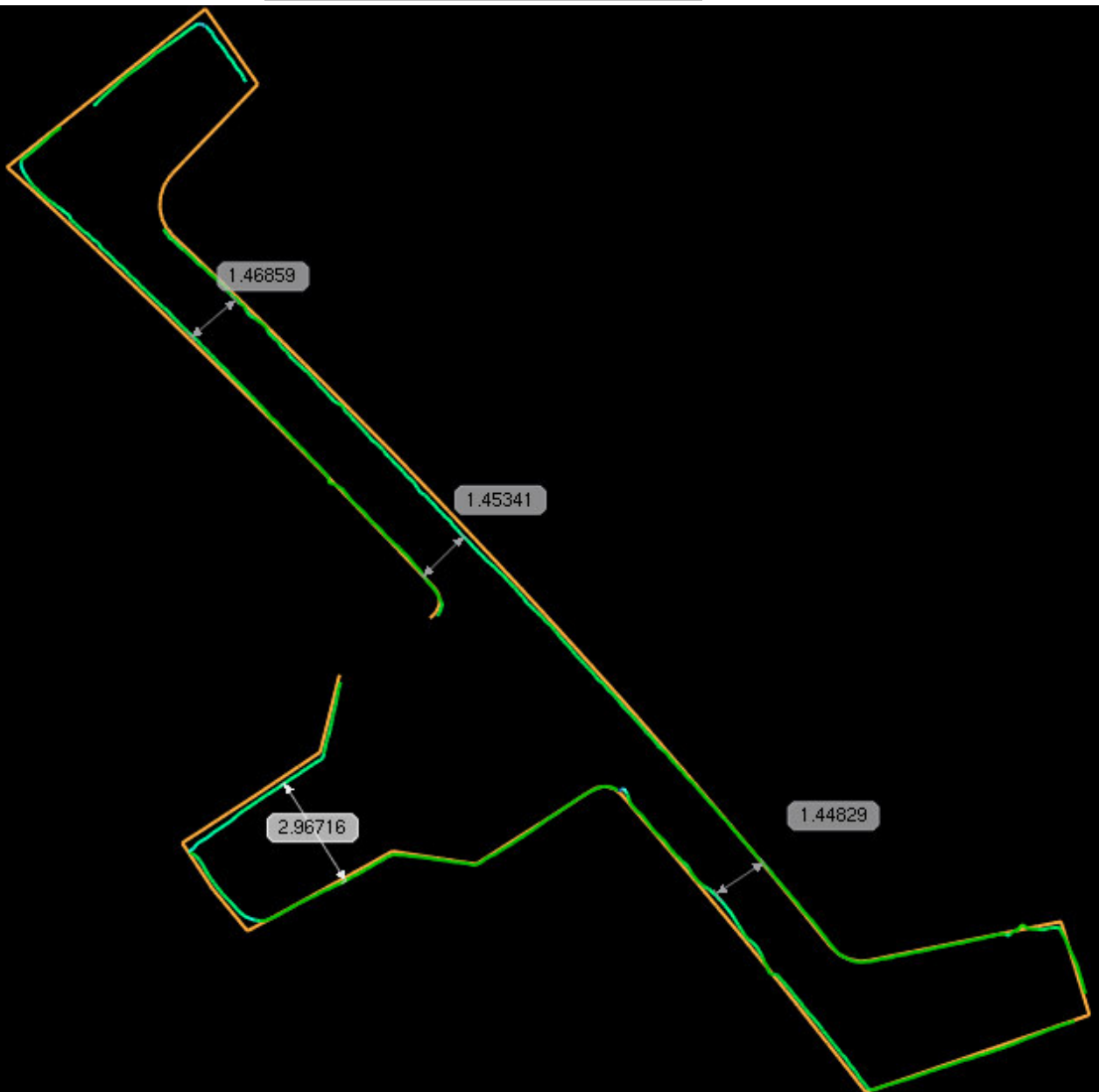
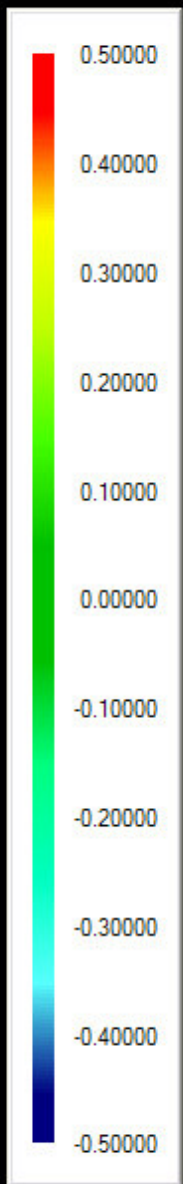
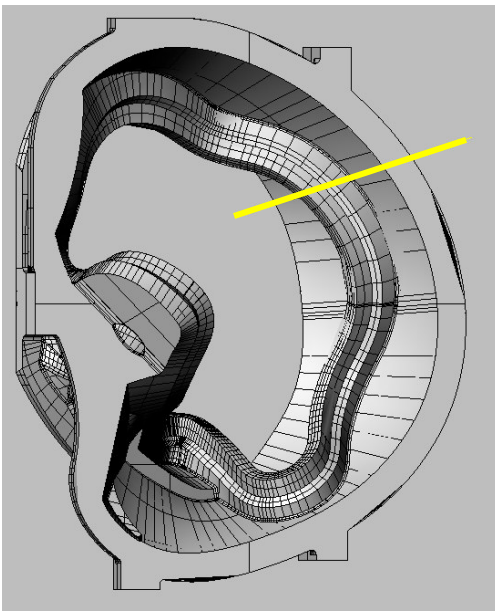




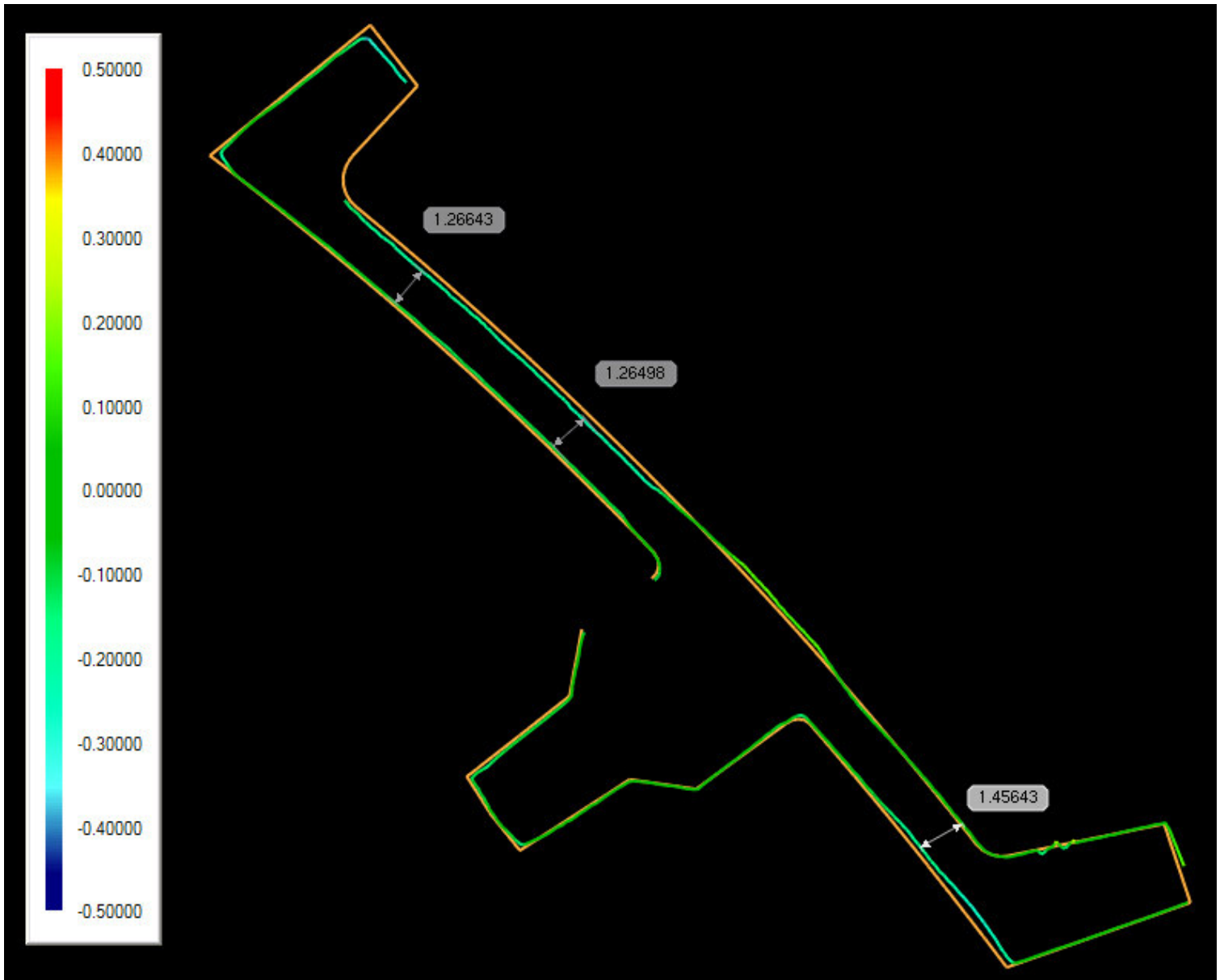
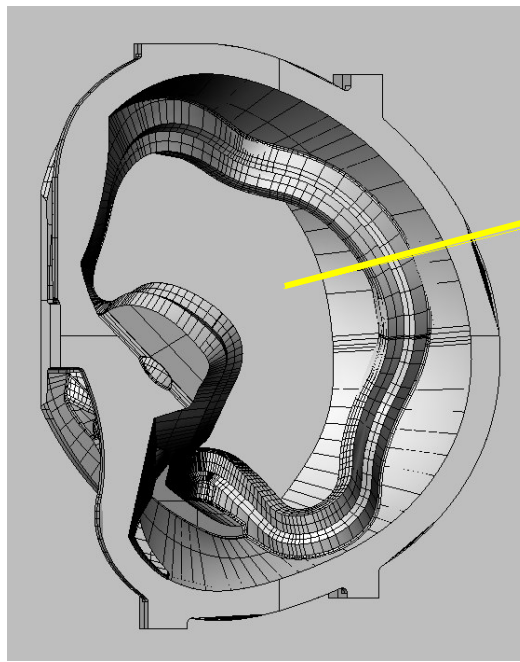
### Cross Section Analysis

The following pages show a cross section analysis of the casting. The yellow line shows where the cross section was taken. Attached to this inspection report are the cross sections in IGES format for further analysis. The solid orange line is the CAD and the varying color line is the scan data, dimensional thickness measurements have also been taken at several key locations.

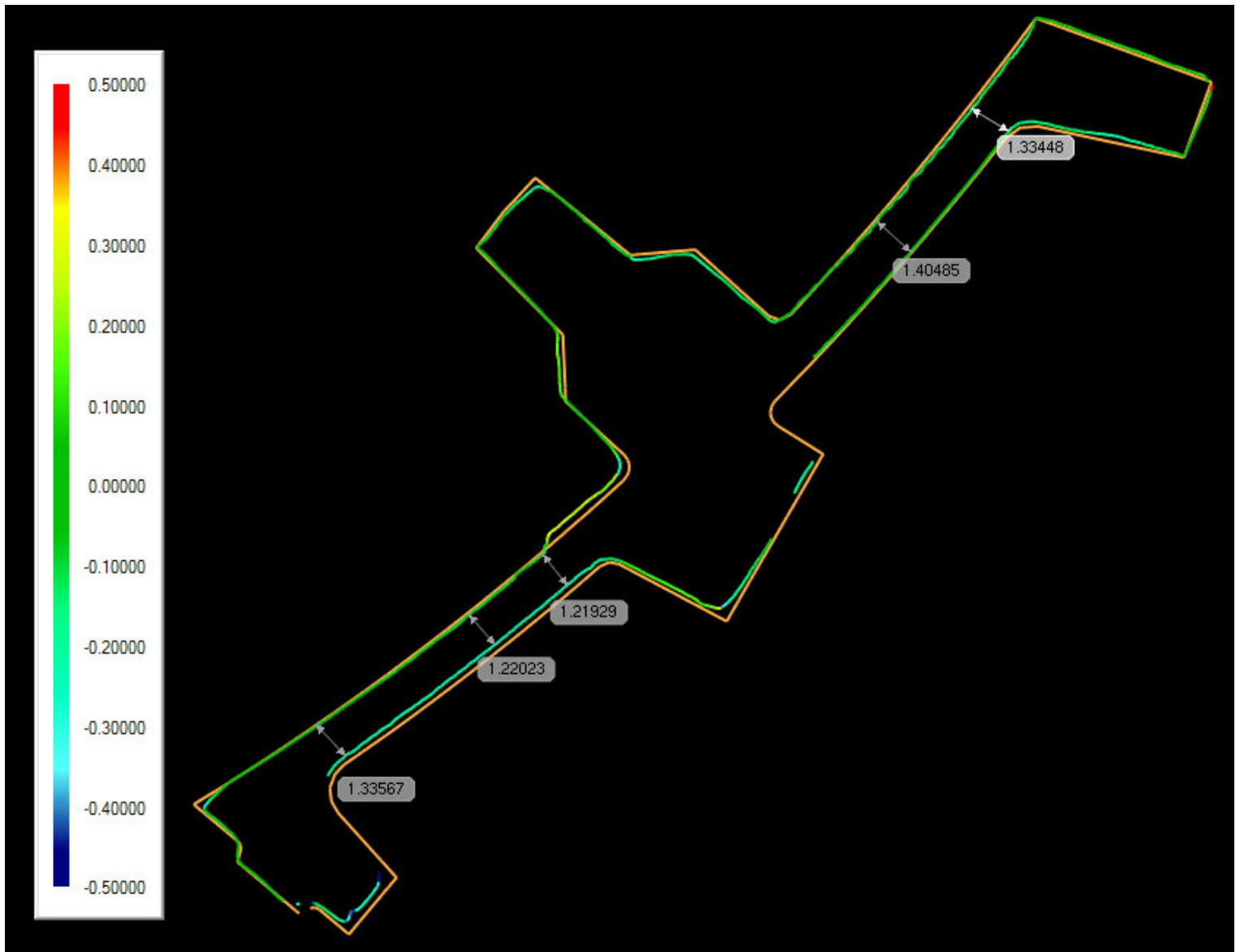
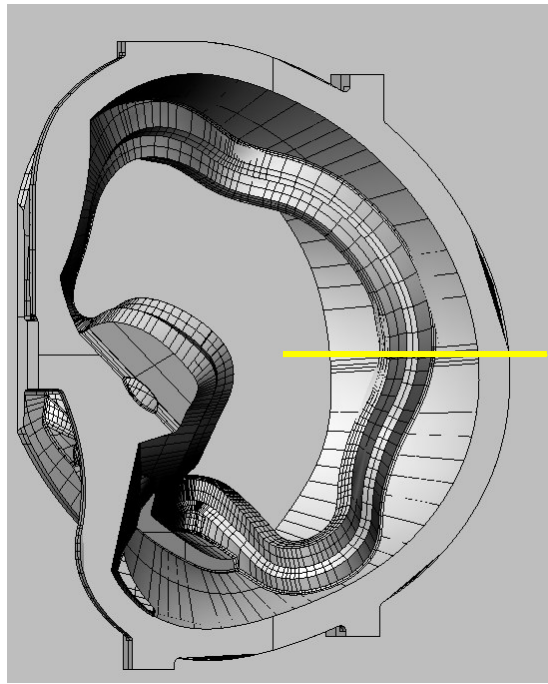
Section 1



## Section 2

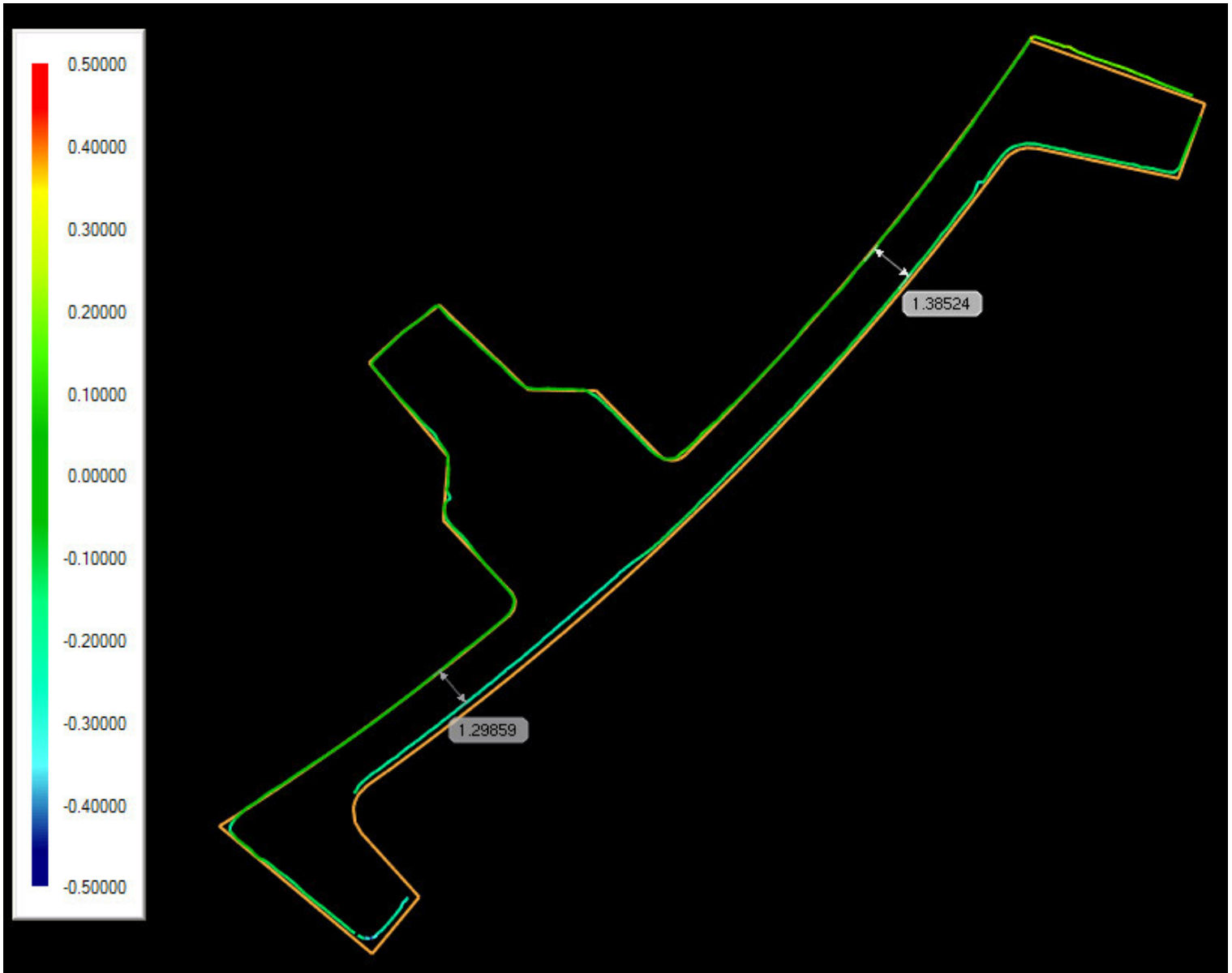
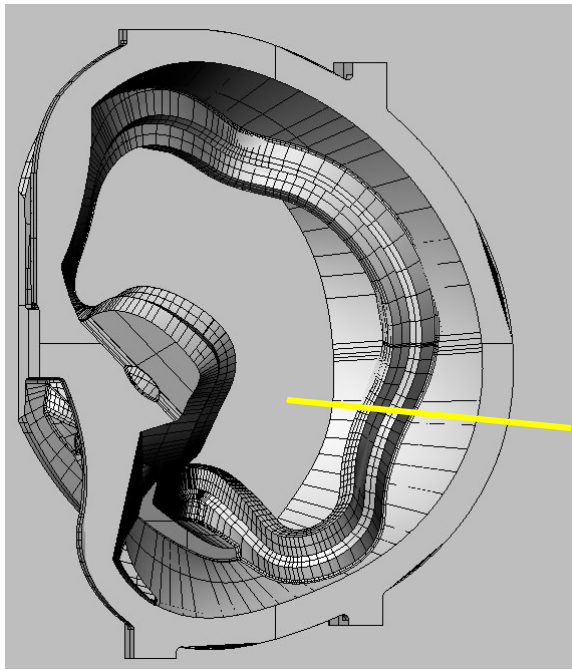


Section 3

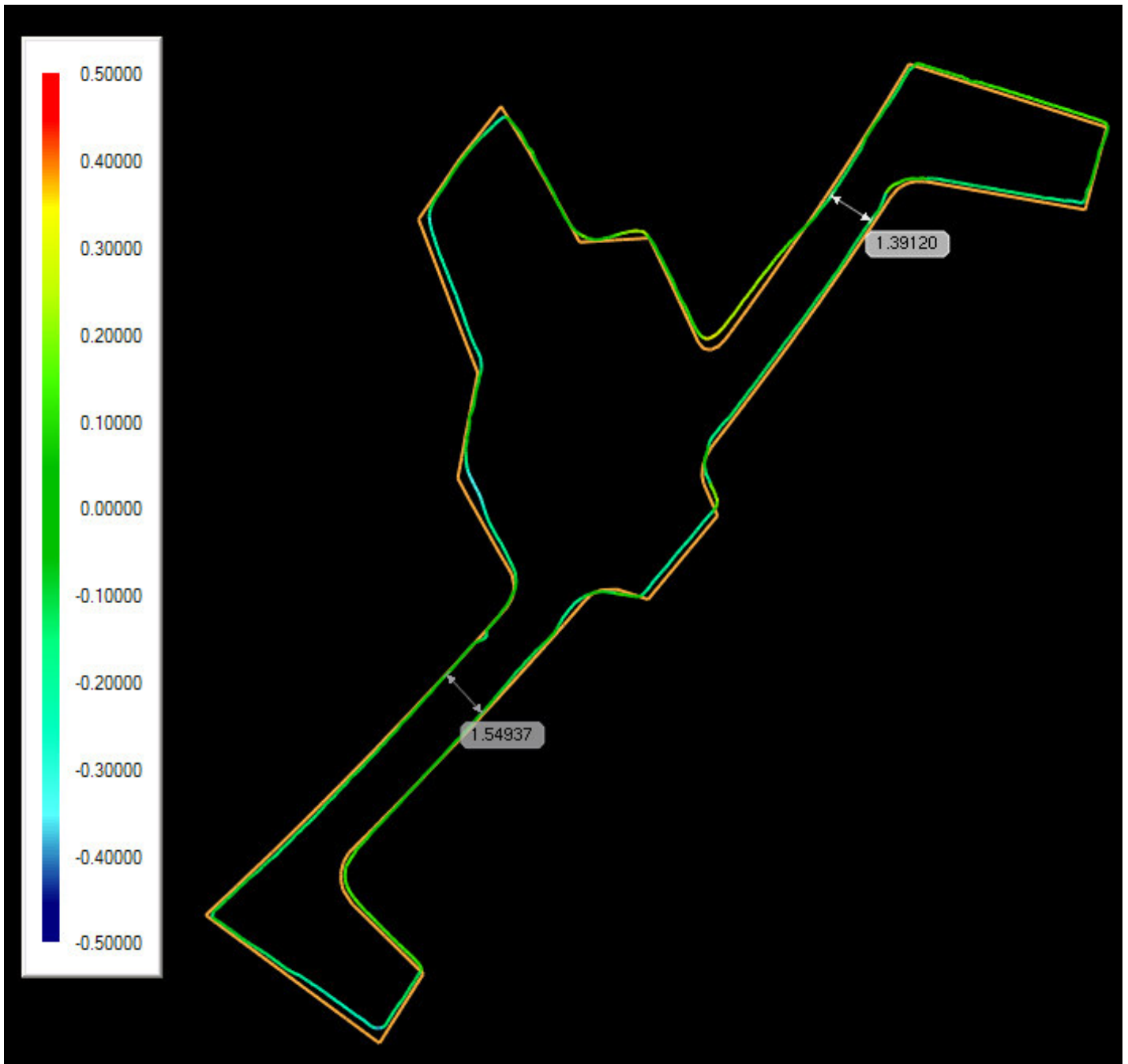
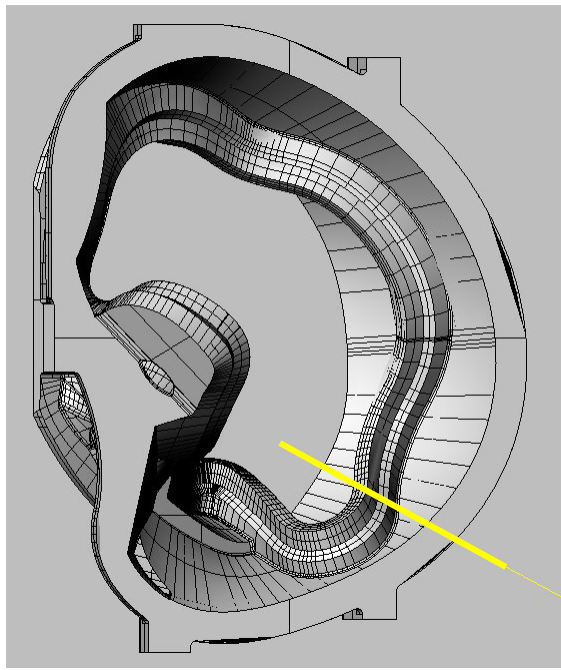




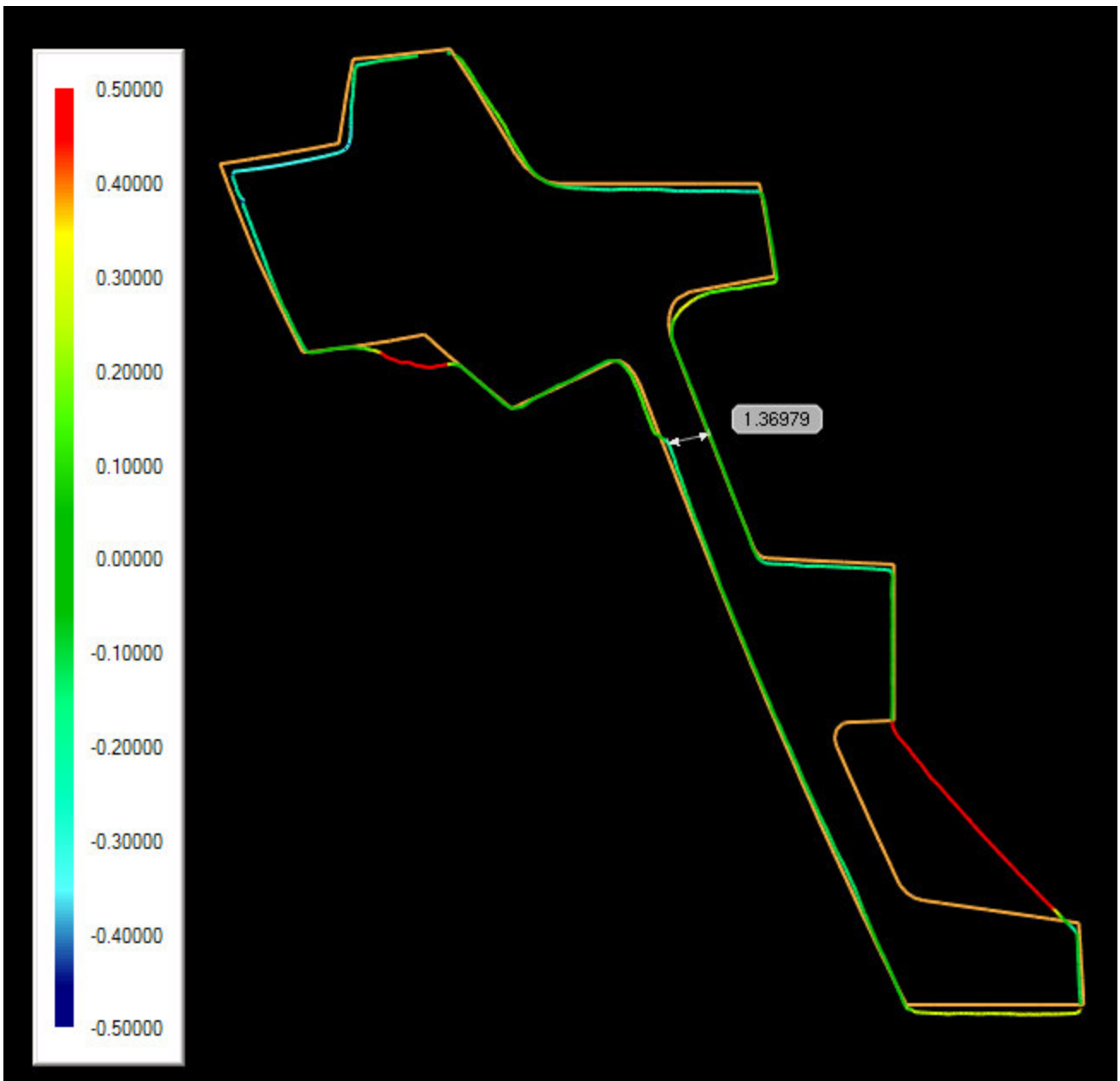
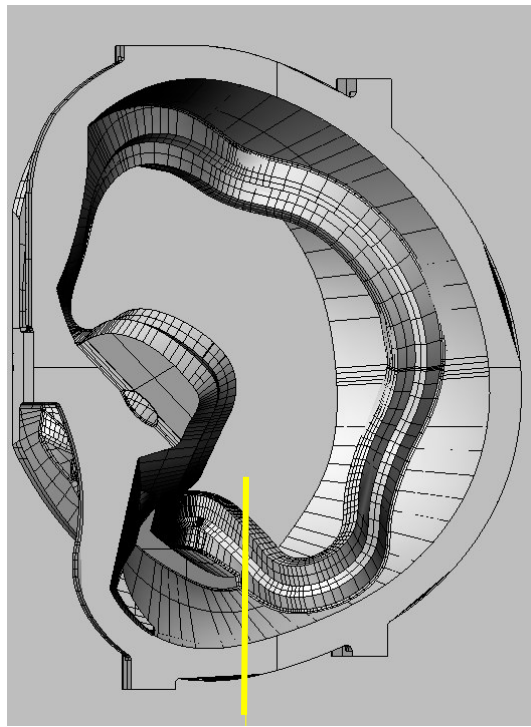
Section 4



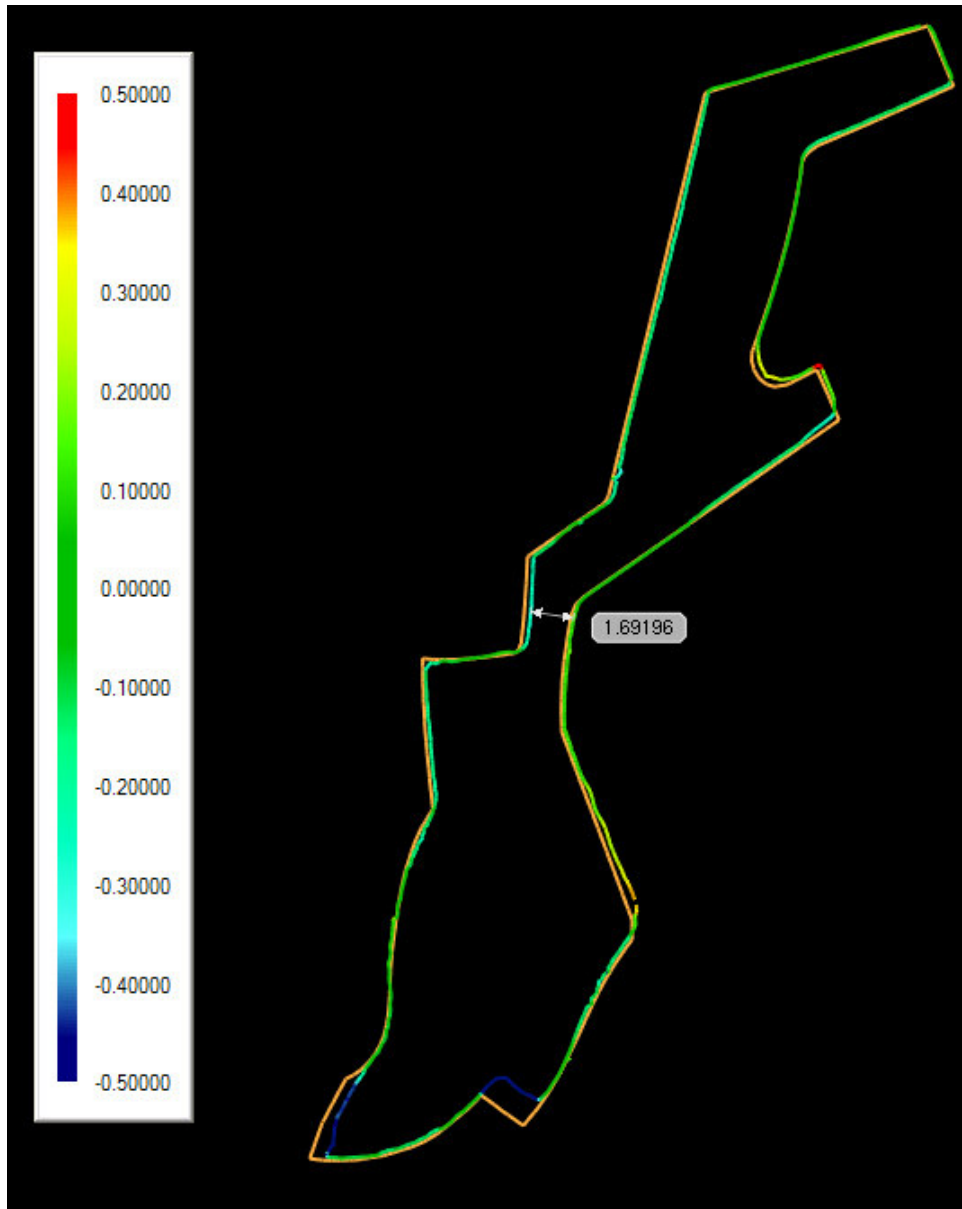
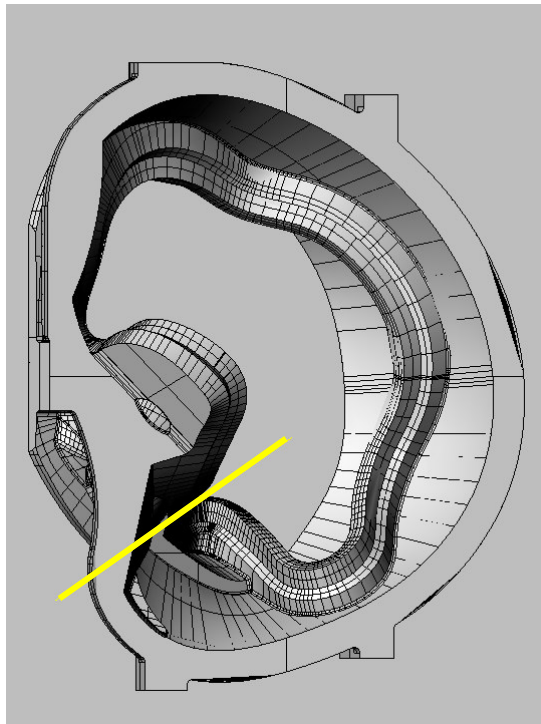
# Section 5



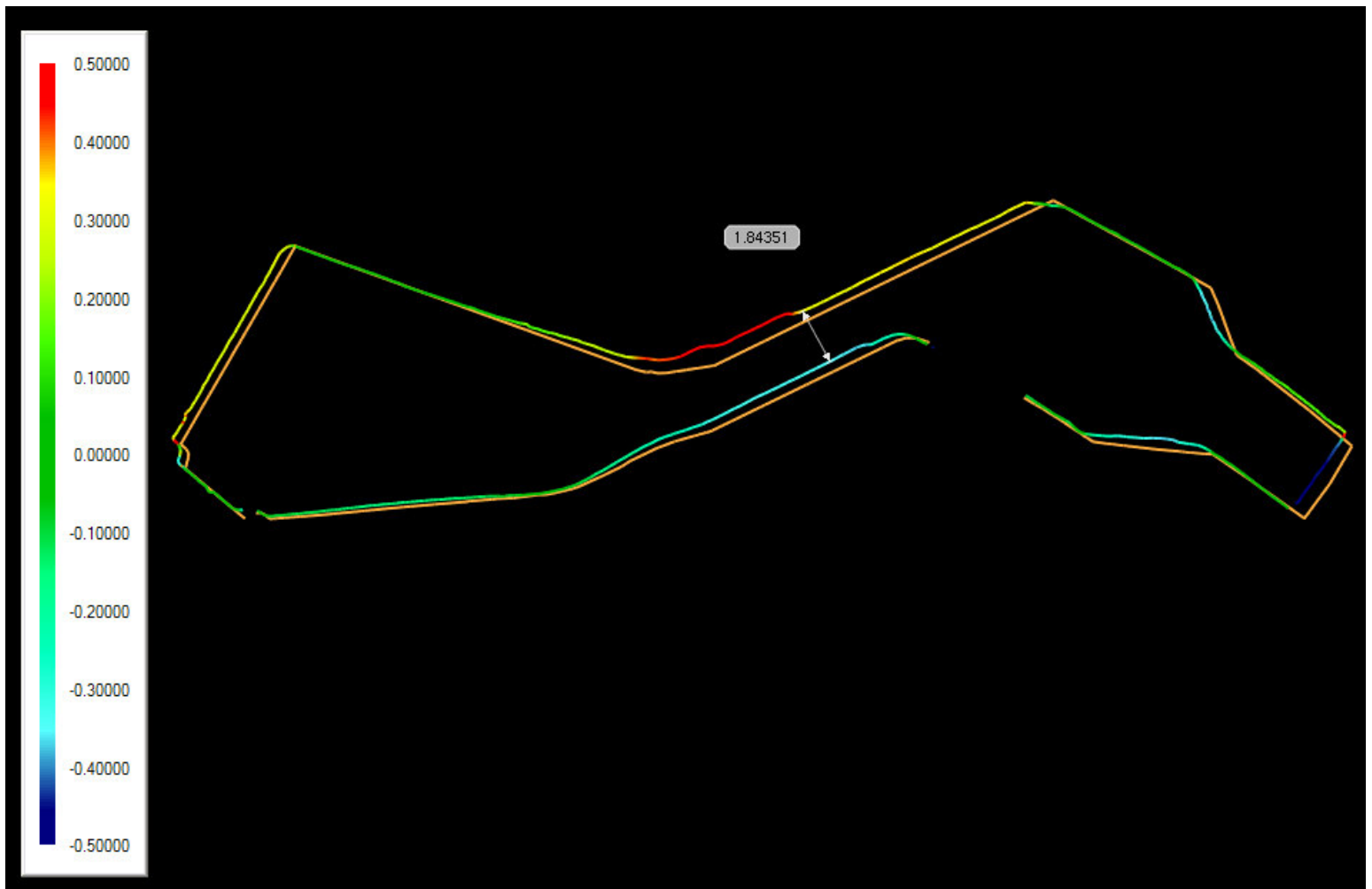
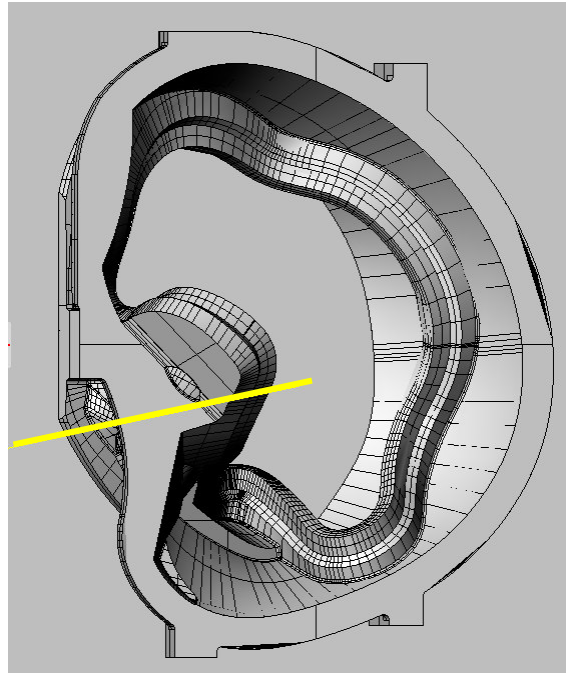
# Section 6



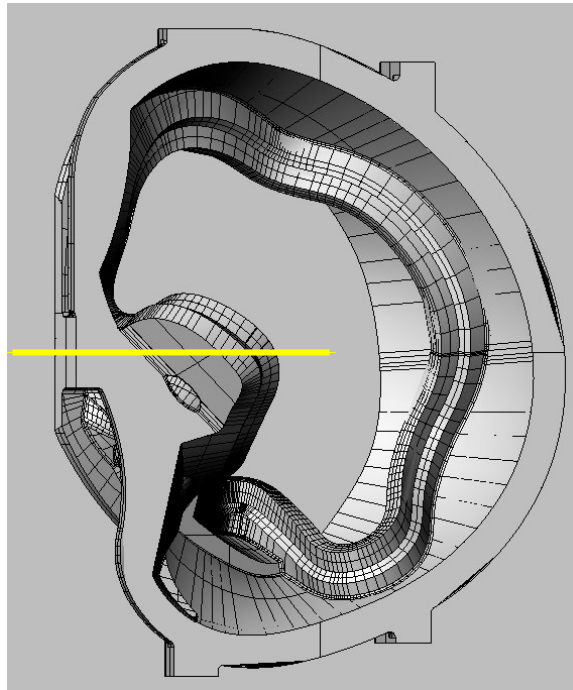
Section 7



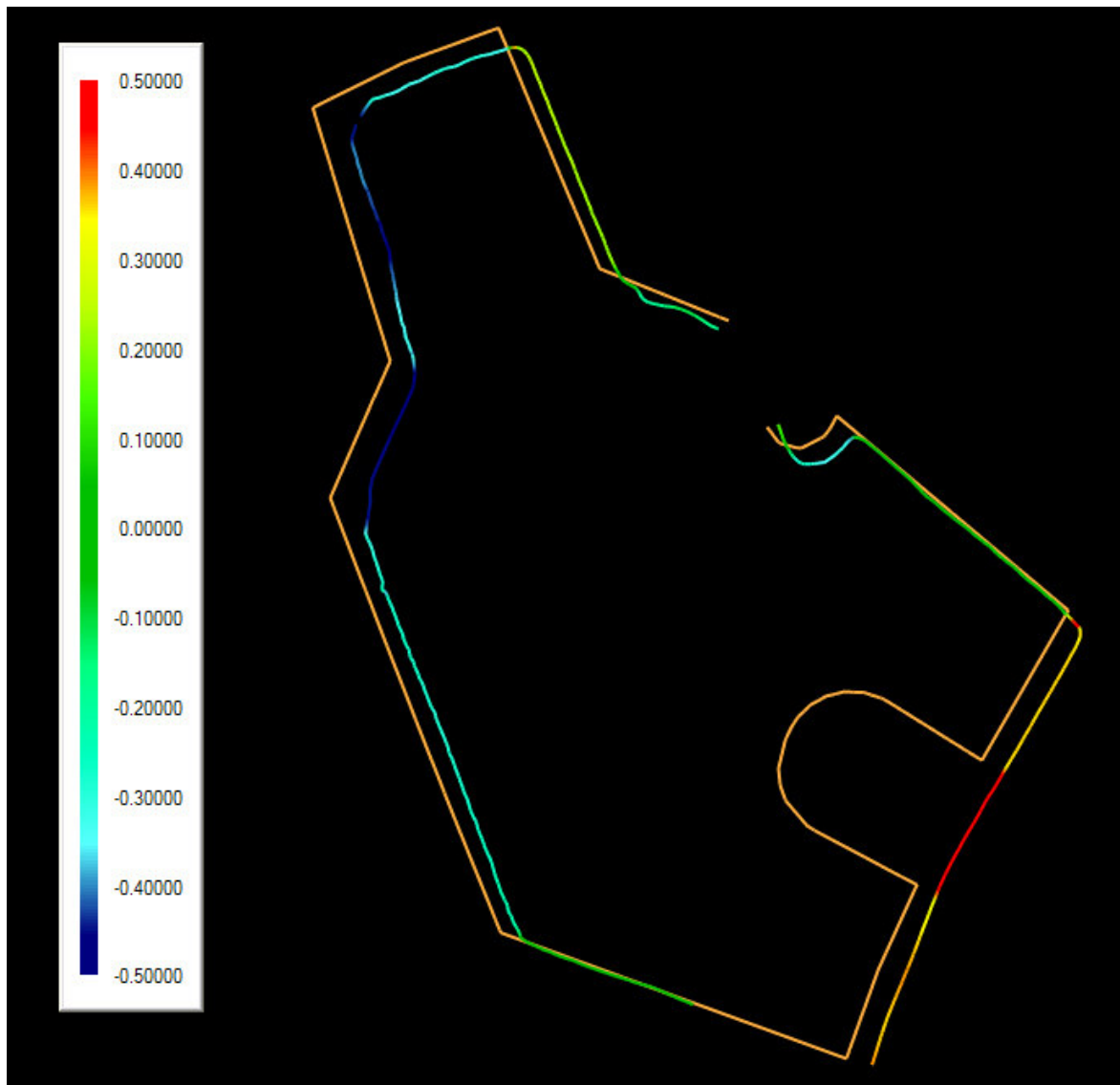
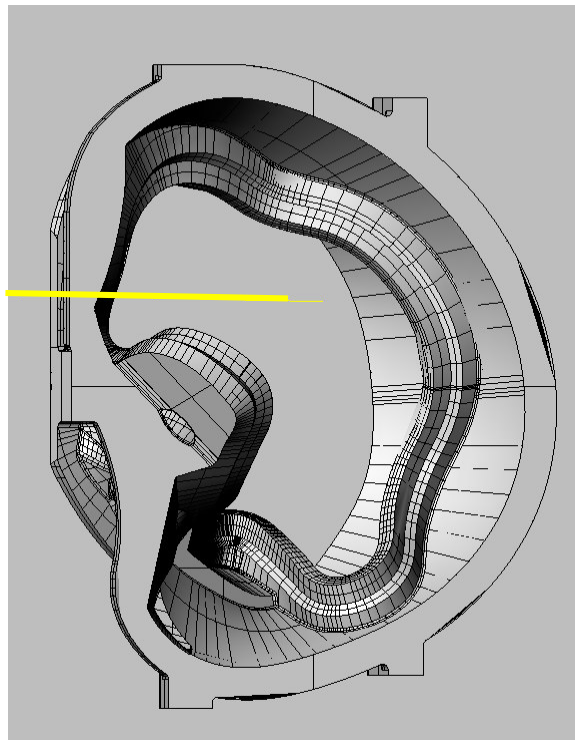
Section 8



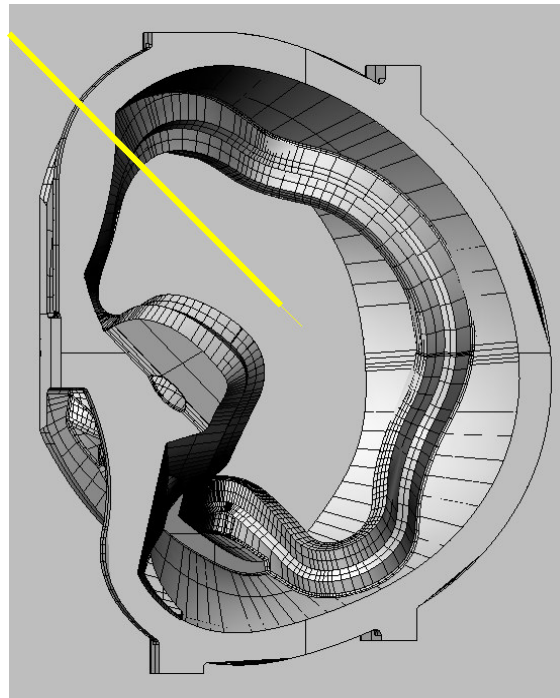
Section 9



Section 10



Section 11





# Section 12

