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Vector Field Visualization Project

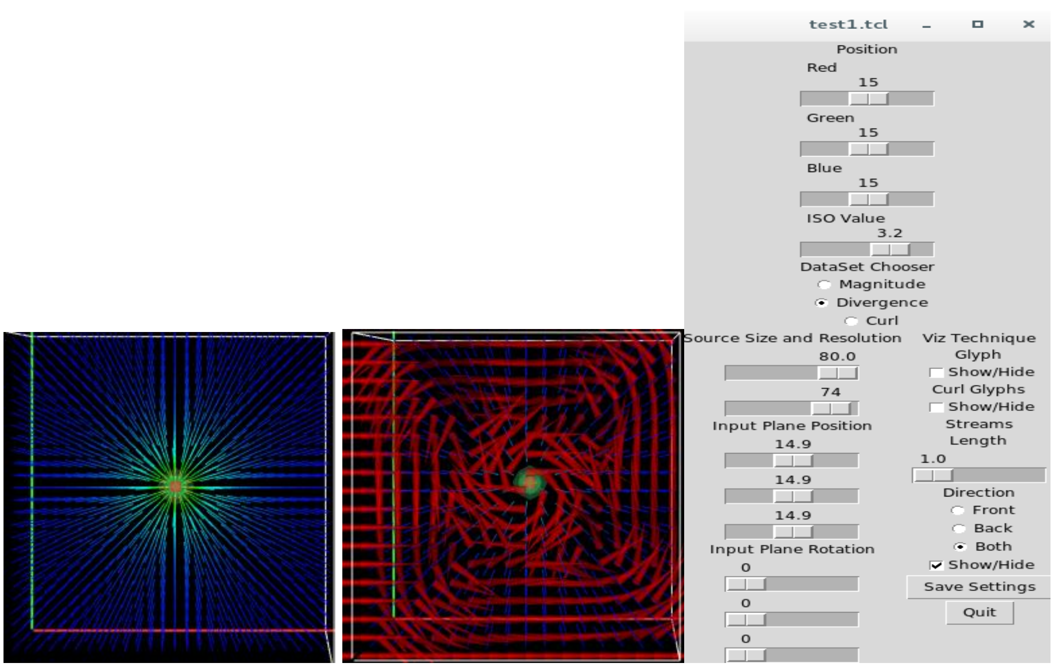
Part1.

The two tcl executables, calc.tcl and test1.tcl have been written into python codes. Except from a little problem with displaying vector field, the other functions like Tkinter widget, user/Mouse-Interaction, and calculating curl, magnitude, and divergence, worked fairly well.

Part2

To verify that the method I used to find critical points is correct, we need first run the two test files to make sure the critical points we got are exactly the ones given in the answer. Here, we only pick the TestVec0.vtk file as our test file. The following procedure will be used throughout our testing without being limited to this first test:

1. Change the input and output file names to TestVec0.vtk, and TestMag0.vtk, TestCurl0.vtk, etc., so that we can read and write with the correct target.
2. Run calc.tcl to generate vtk files by calculating and generating the curl, magnitude, and divergence data sets.
3. Run test1.tcl to produce visualization interface with which we can use isosurfacing technique to locate the critical point. The test file produced the following result:

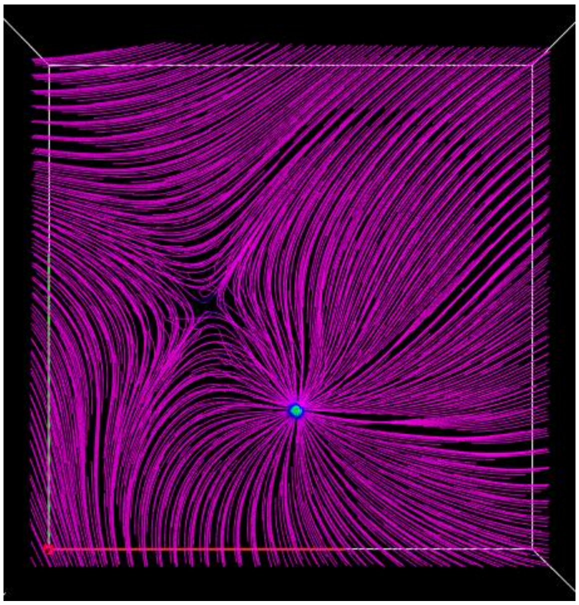


With the first graph confirming the appearance of critical point, and the second graph telling us the type of critical point with the help of streams, we can tell that the critical point is at **(15, 15, 15)**.

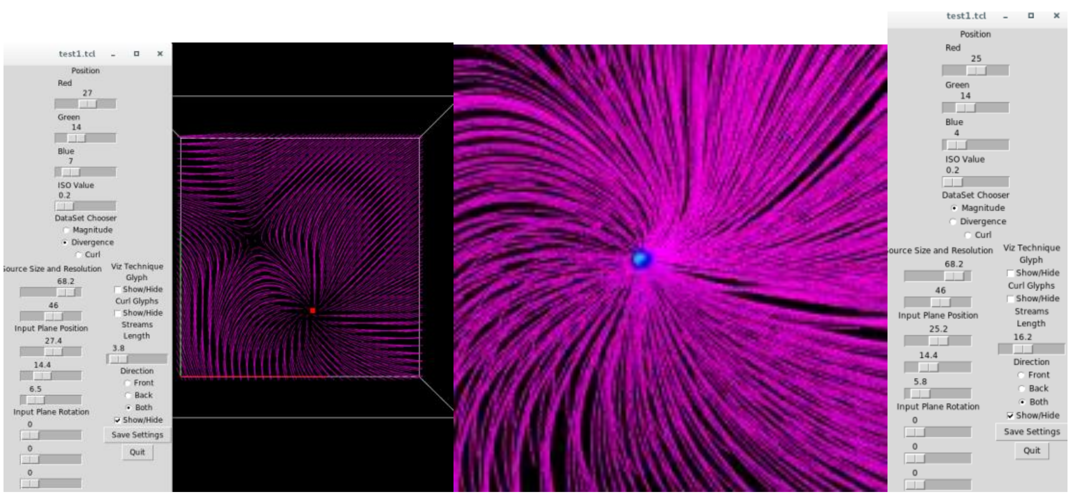
Part 3-1.

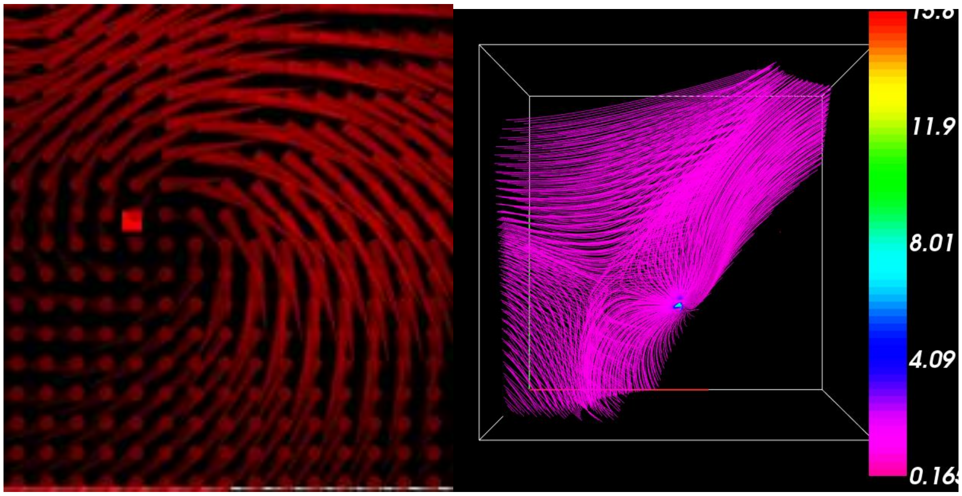
In this part, we will first run through the procedure and result we get from finding critical points of the ChalVec0.vtk file, and then do the same with the second vtk file ChalVec1.vtk. Note, the procedure we used were basically the same as the one employed in Part 2.

Now we begin testing ChalVec0.vtk. By adjusting the graph to gain a good overview of the whole picture, it is obvious to conclude that there are 2 critical points in this challenge volume. One on the upper left, one on the lower right as indicated in the following picture:



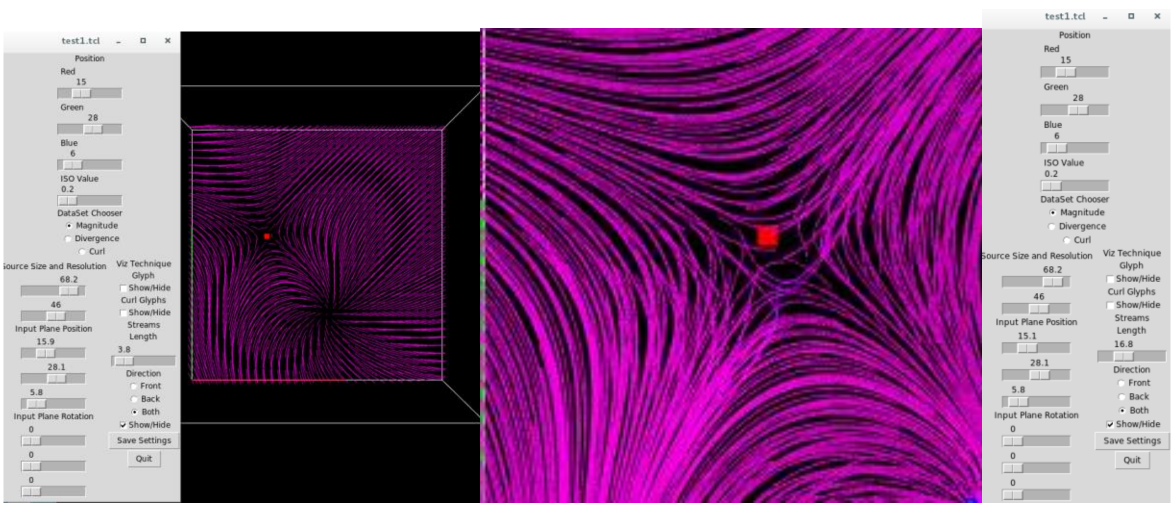
The location of our **first critical point is (25, 14, 4)**, because we isosurfaced the (red, green, blue) values to transit the center of our Dataset Chooser to exact the same position indicated by the "Input Plane Position". Thus, we obtained our first critical point. The following graphs were captured to demonstrate how the first critical point was discovered. By adding streams to the graph, we can easily determine the type of this critical point as a **repelling-spiral:**

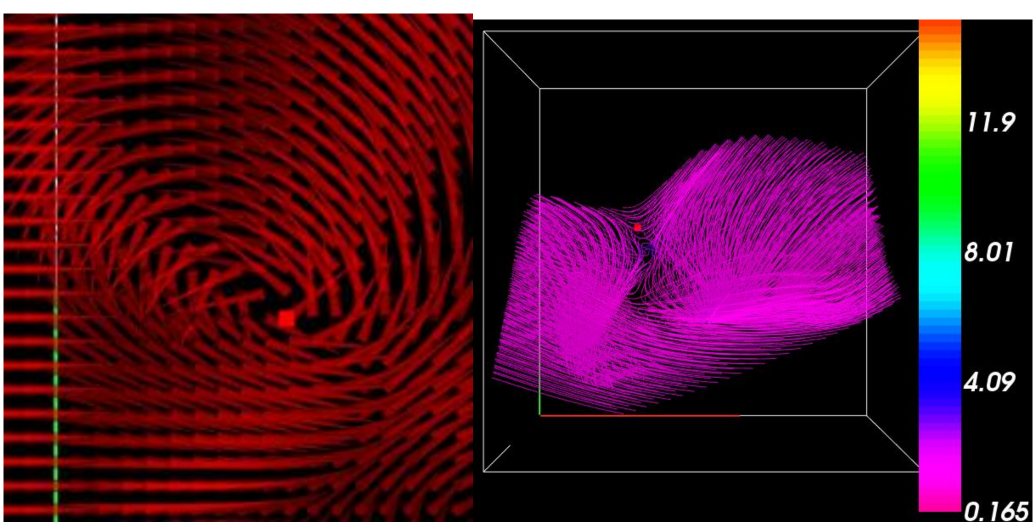




The value of the magnitude of this point is relatively low, because it is around 4 – 8, more adjacent to 0 .

Following the same pattern, we find **the second critical point as (15, 28, 6):**

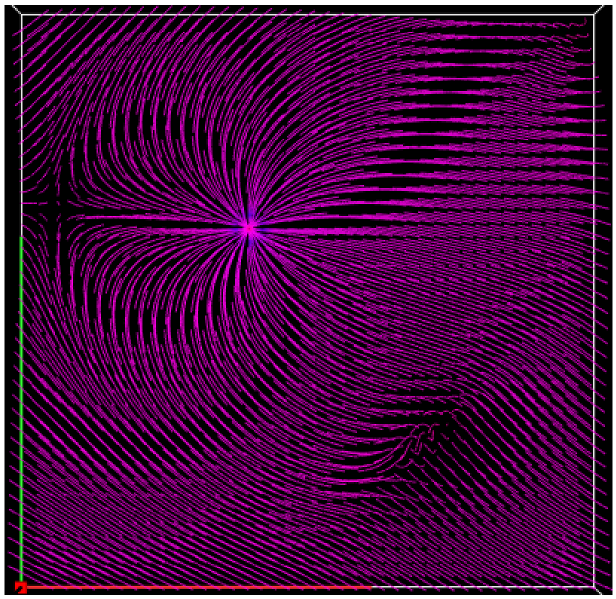




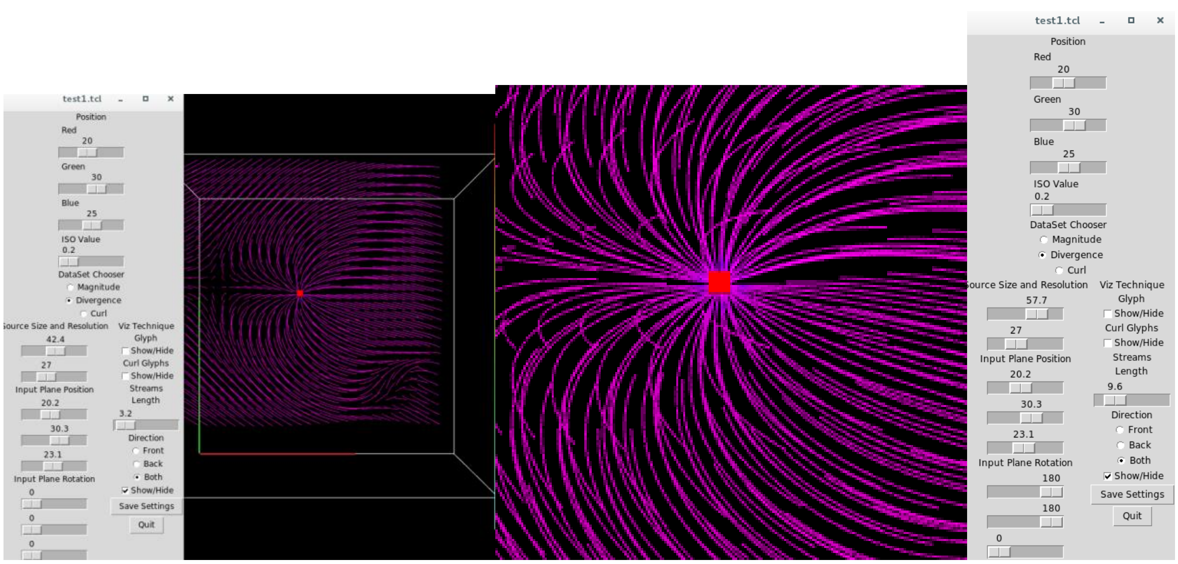
The streams in the 3rd graph indicated that **the type of this point is a center**. **Its magnitude is low around 4.09**.

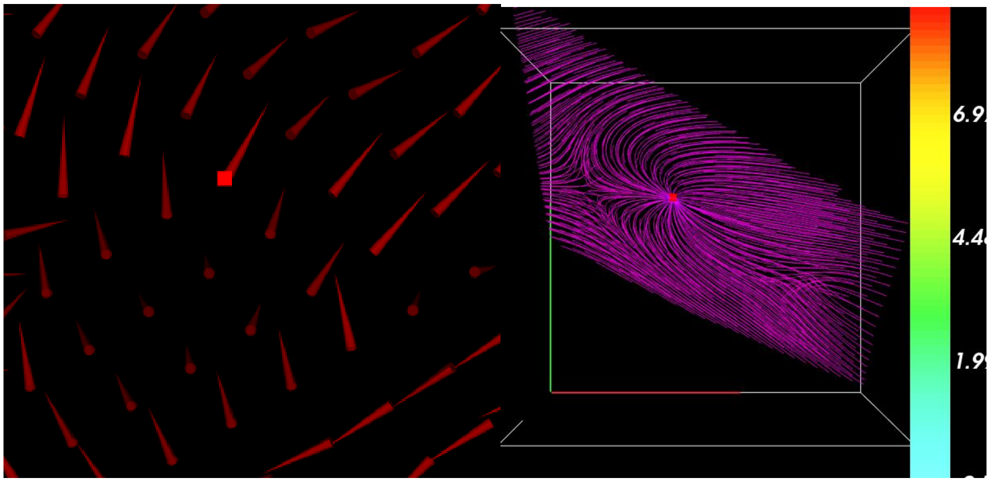
Part 3-2.

Following the analysis of the first large volume, we continue to analyze the second challenge volume whose data was stored in ChalVec1.vtk. Here we ignore the preprocessing steps because they were introduced in the previous part. This time, from the overview graph of the challenge volume, we can distinguish 3 critical points.



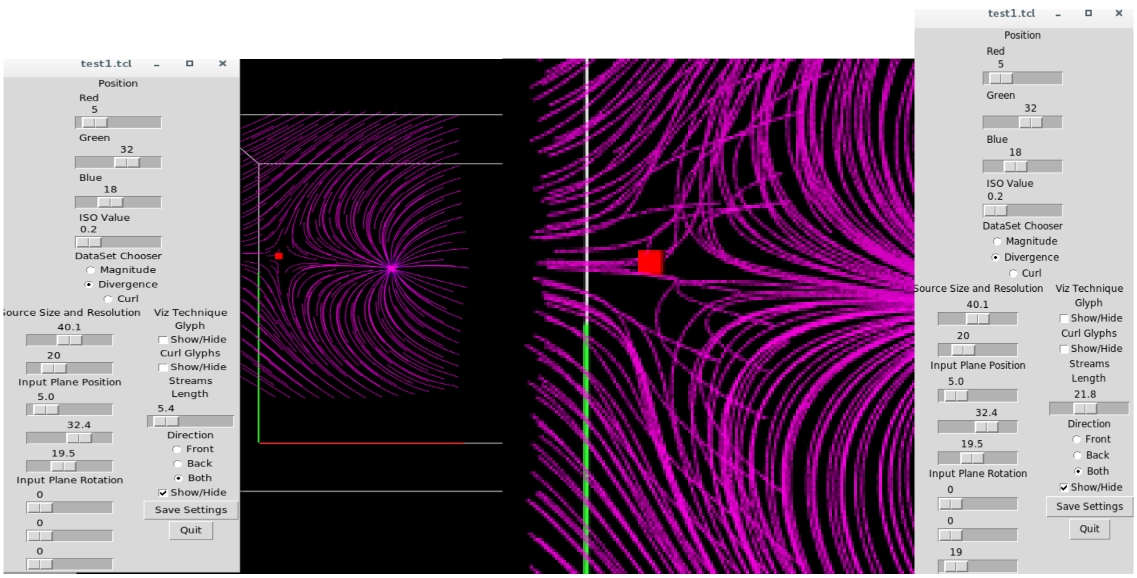
The location of the **first critical point is (20, 30, 25):**

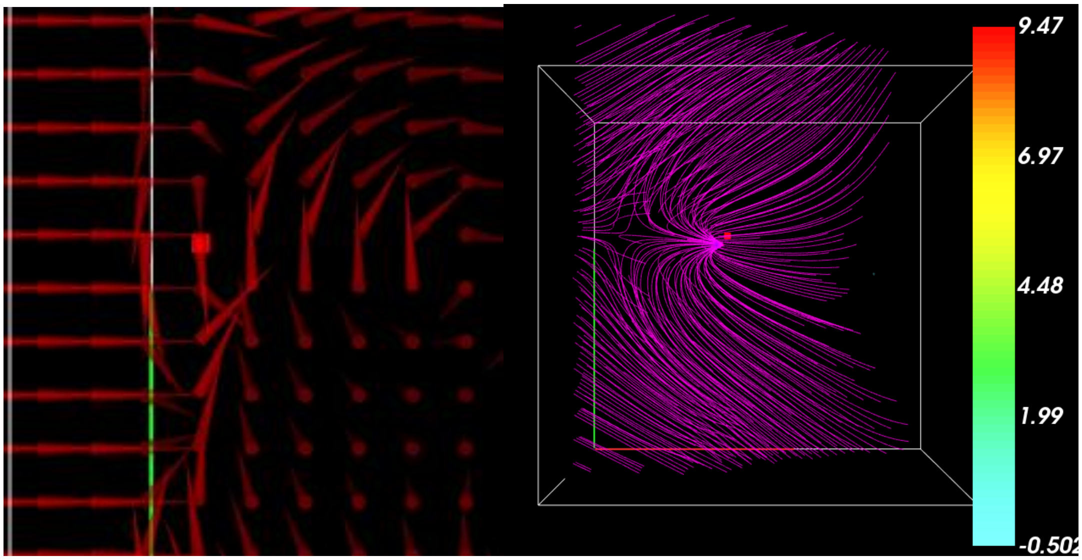




The type of this critical point is still repelling-spiral, and the magnitude of it is **relatively high** around 7 up, as indicated in the above graphs.

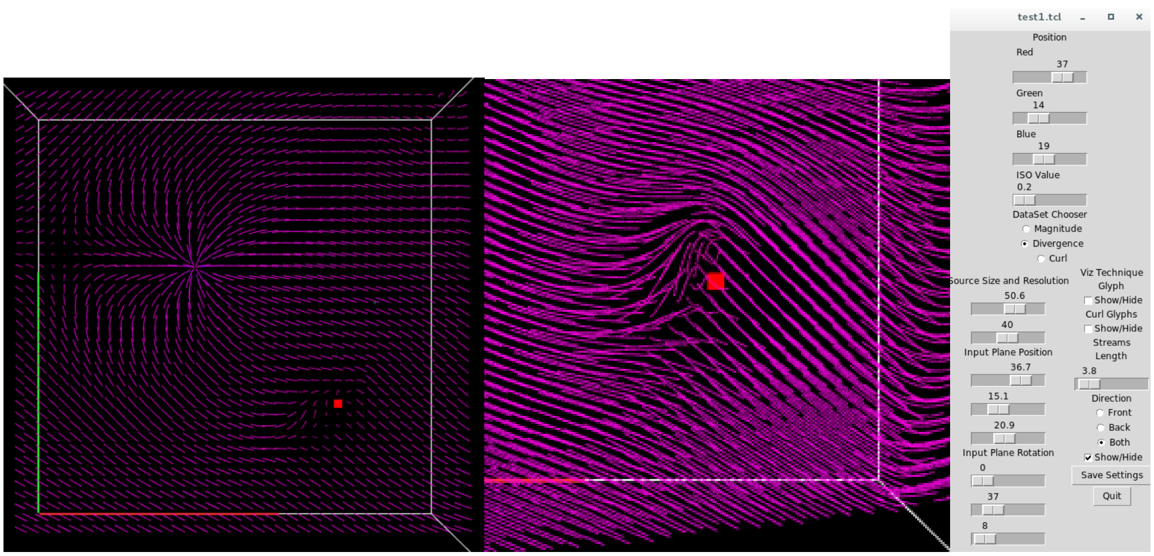
The location of the **second critical point is (5, 32, 18)**:

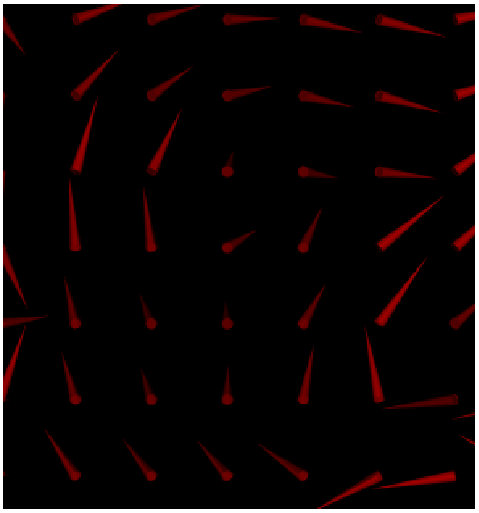




This point is a sink, whose **magnitude is low around 2**.

The last critical point is at (37, 14, 19):





This point is again a **repelling-sprial,** and it's magnitude is **low**.