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% 14bc57

% CISC 330
% October 23, 2017
% Assignment 2: Tumor Reconstruction in C-arm Fluoroscopy

Questions:

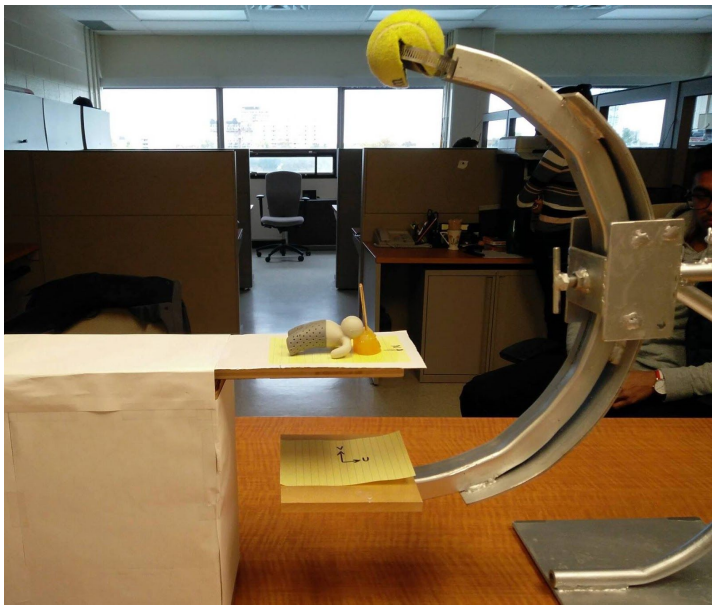

Figure 1: C-arm mockup top view labeled

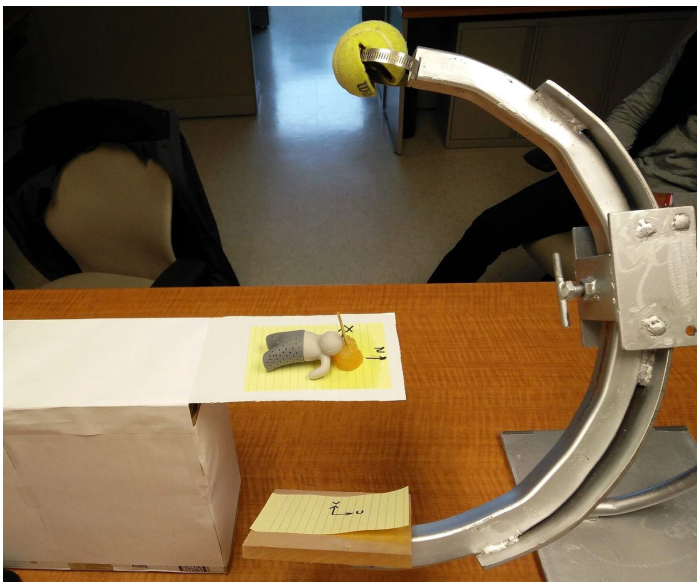

Figure 2: C-arm mockup rotated 45 degrees

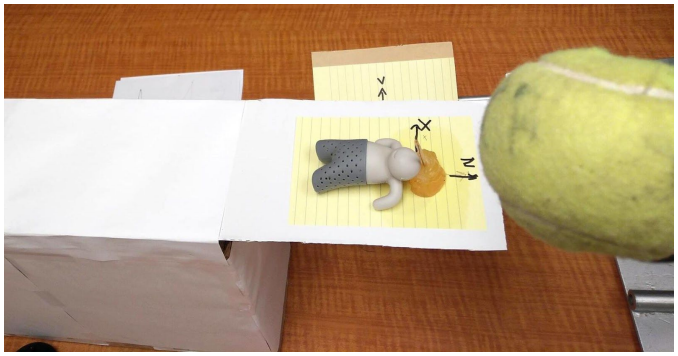

Figure 3: C-arm mockup top view

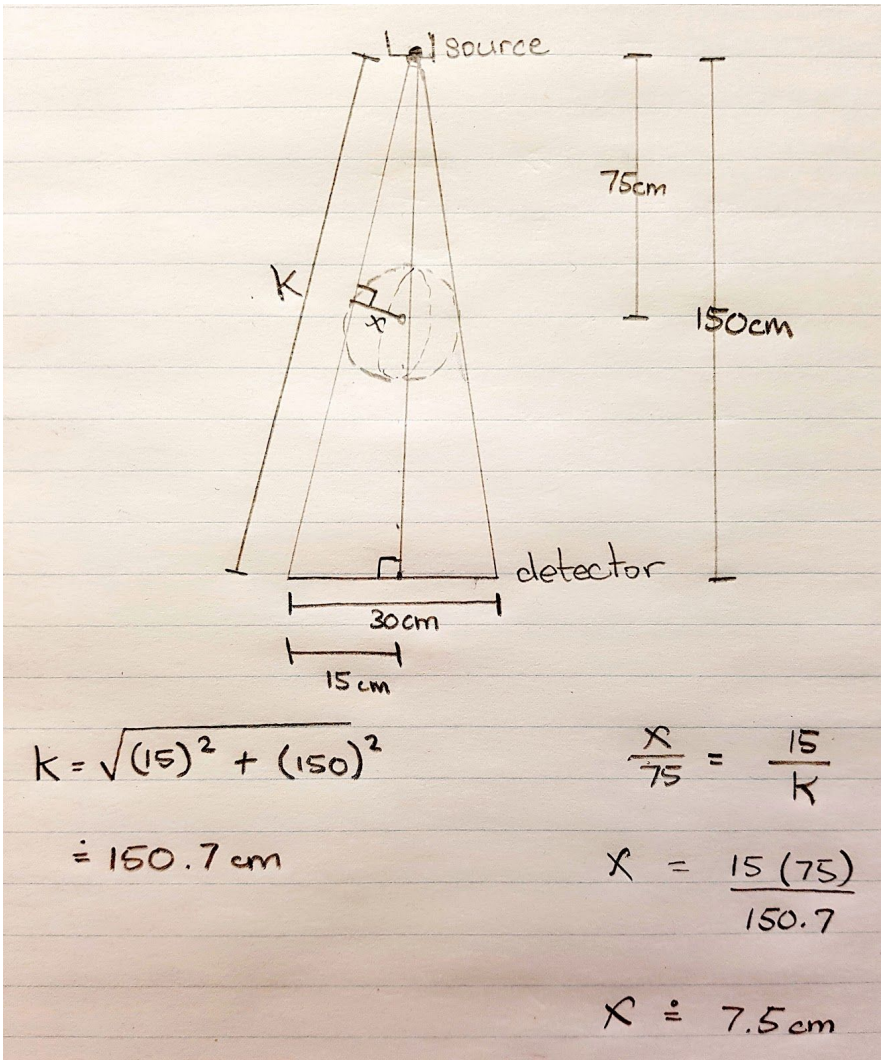

Figure 4: C-arm center calculations

The workspace around the C-arm center (beam iso-center) is a sphere of radius 7.5cm

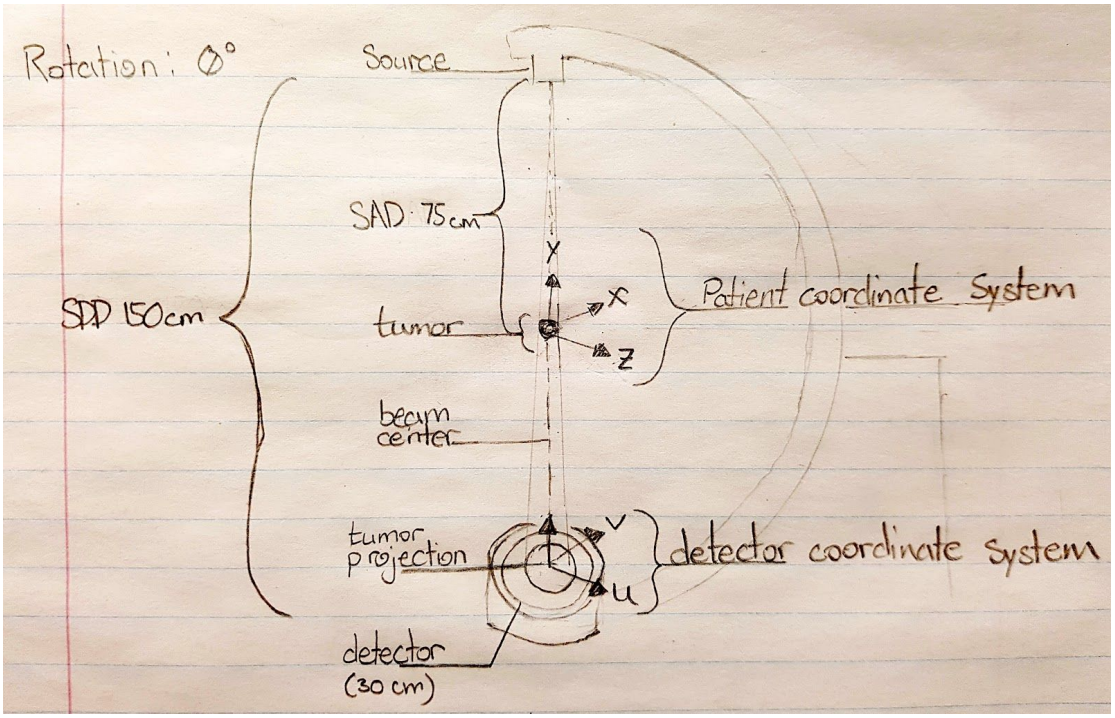

Figure 5: C-arm labeled

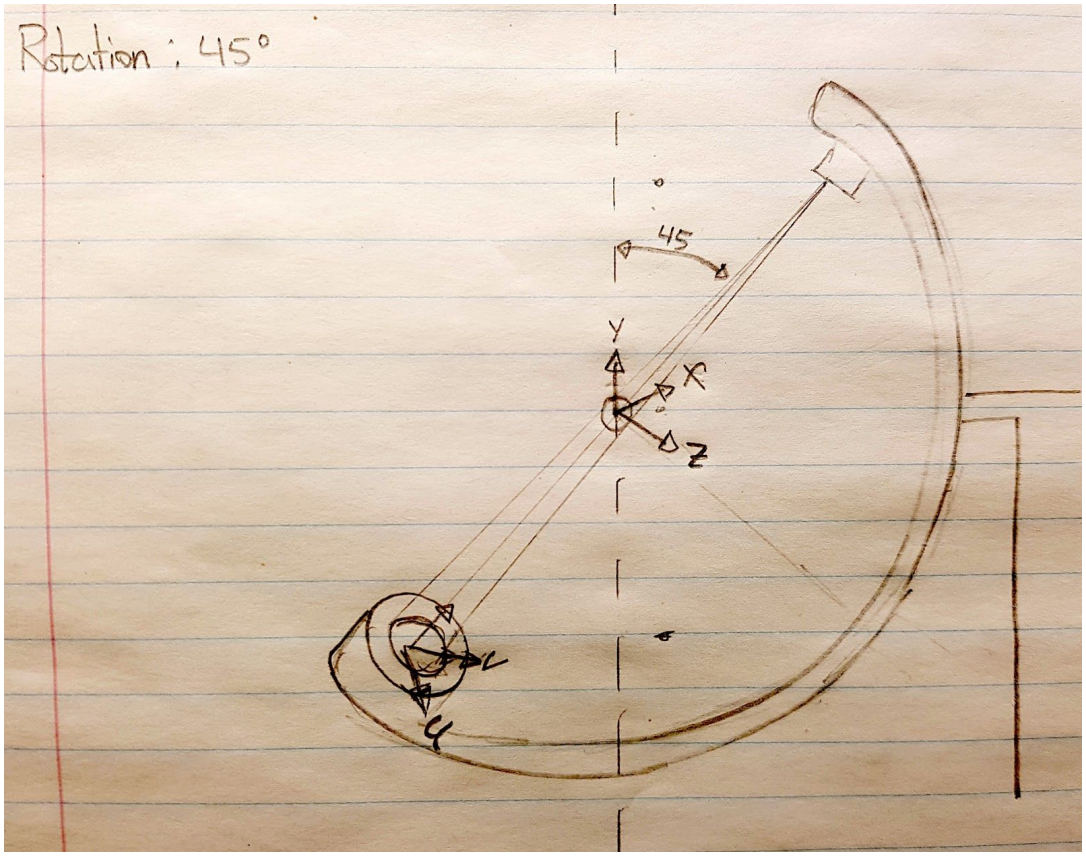

Figure 6: C-arm rotated 45 degrees

3. Explain the error sources in target reconstruction with a real-life mobile C-arm unit [5 pts]
    1. The C-arm requires calibration, improper calibration could be a source of error
    2. The ground which the C-arm is placed on must be level with the patient otherwise the patient will not be centered
    3. The ground which the C-arm is placed on must be flat, otherwise the C-arm may wobble or at a angle.
    4. Wheel of C-arm are not secured, and thus may roll around, or be bumped into by others in the room.
    5. Patient moves while the C-arm rotates which would cause different projections to be captured
    6. If the patient is not centered, while the C-arm rotates which causes error in projections

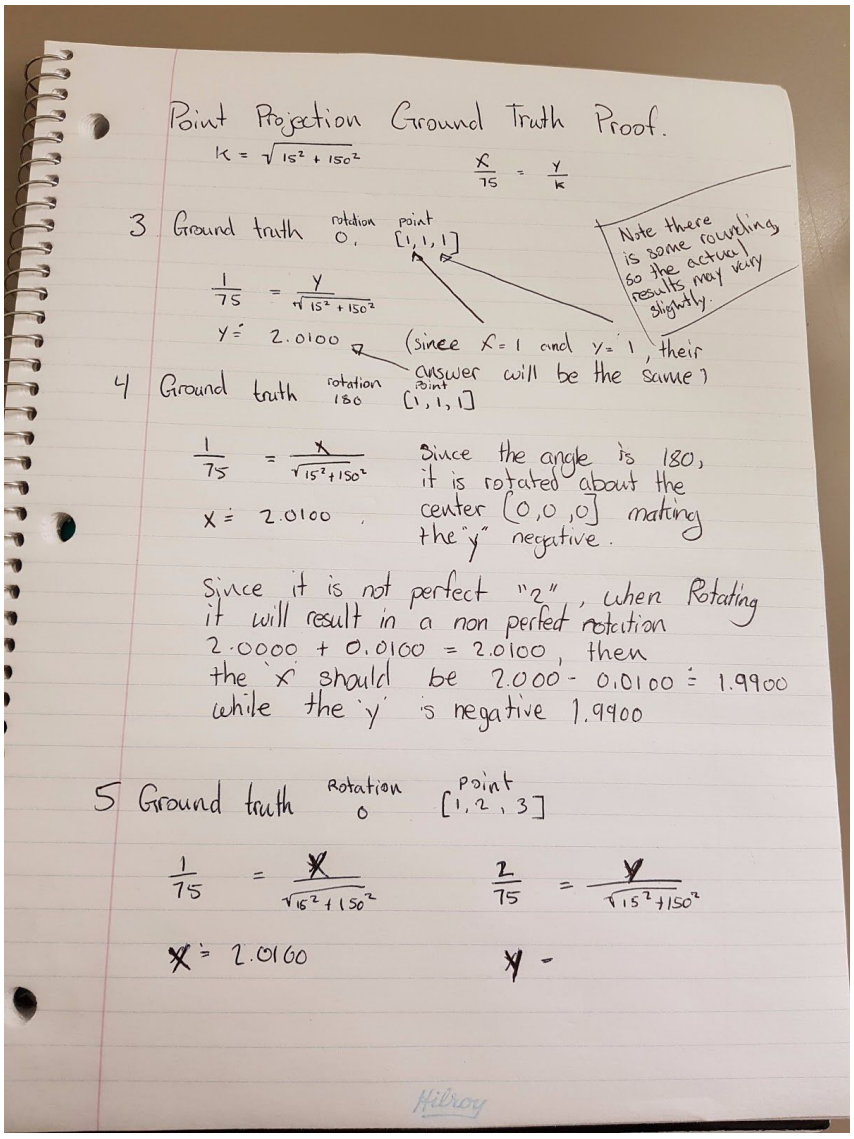

Figure 7: Ground Truths Proof/calculation

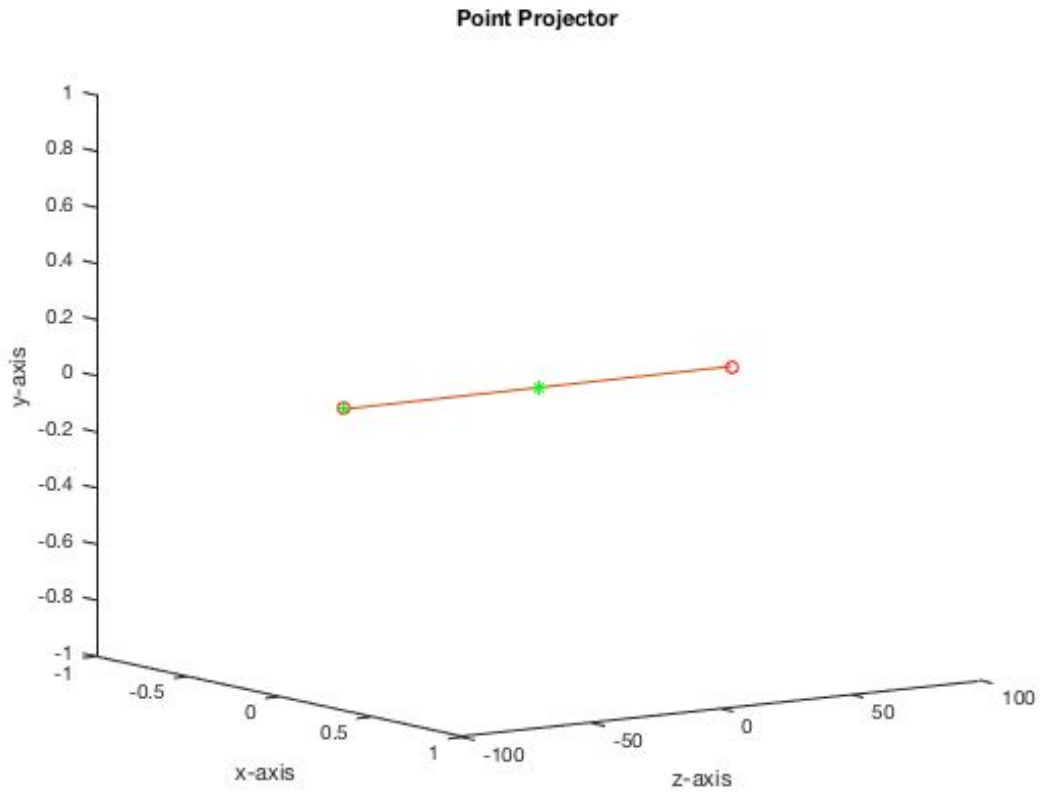

Figure 8: Ground truth 1: see comments in TESTPOINTPROJECTOR and figure 7

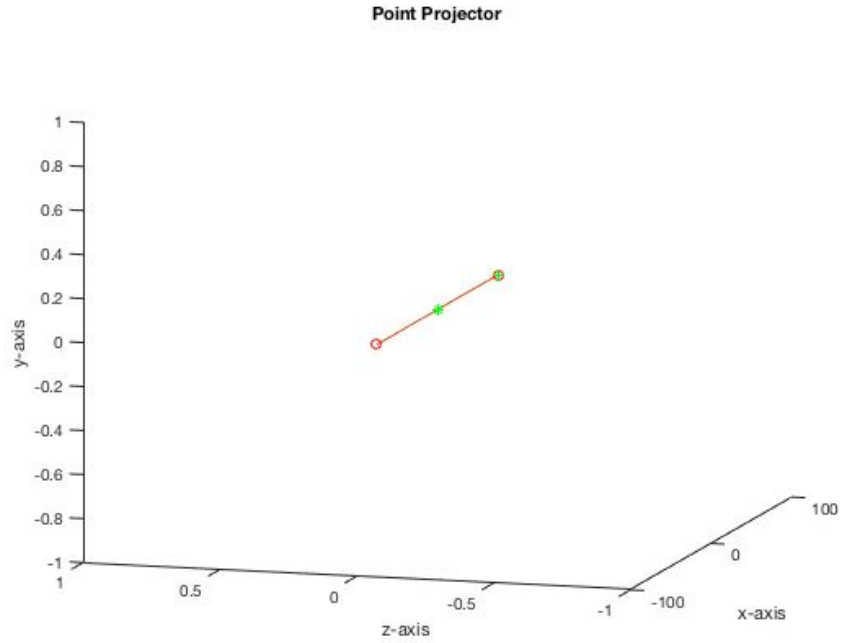

Figure 9: Ground truth 2: see comments in TESTPOINTPROJECTOR and figure 7

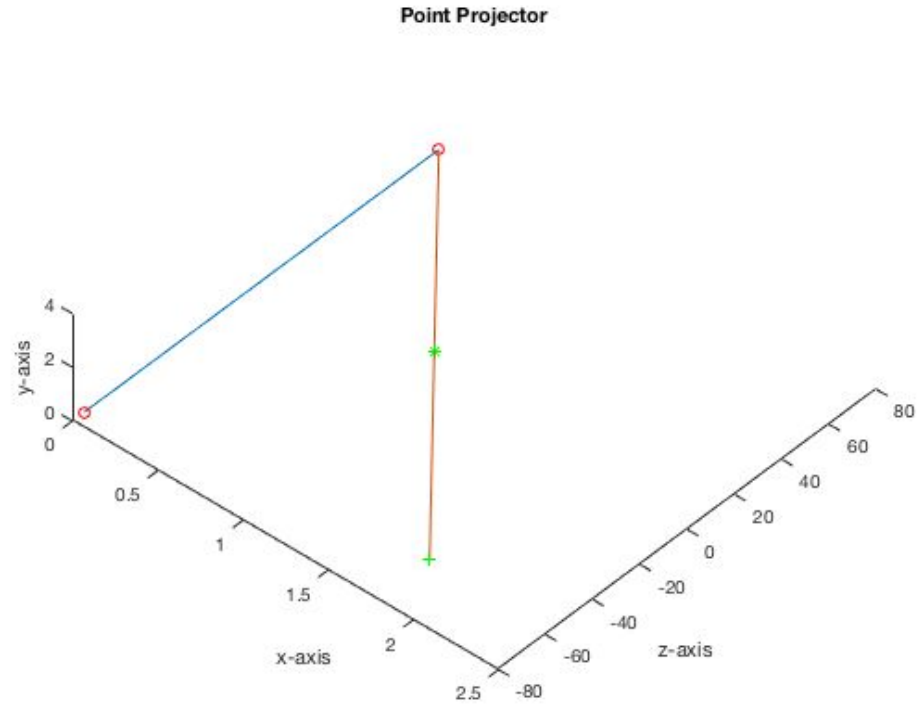

Figure 10: Ground truth 3: see comments in TESTPOINTPROJECTOR and figure 7

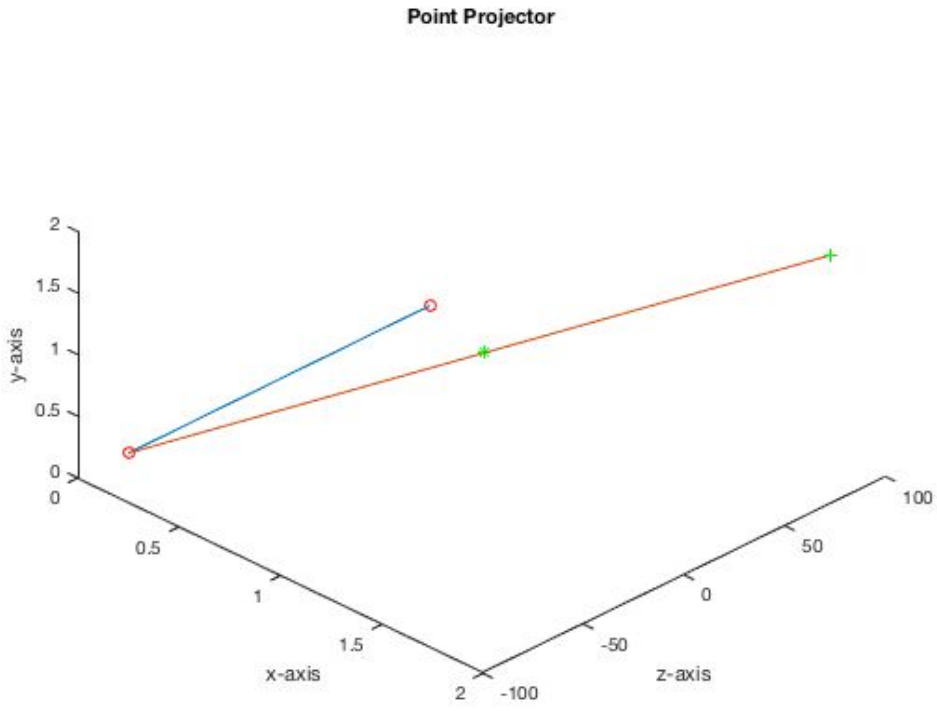

Figure 11: Ground truth 4: see comments in TESTPOINTPROJECTOR and figure 7

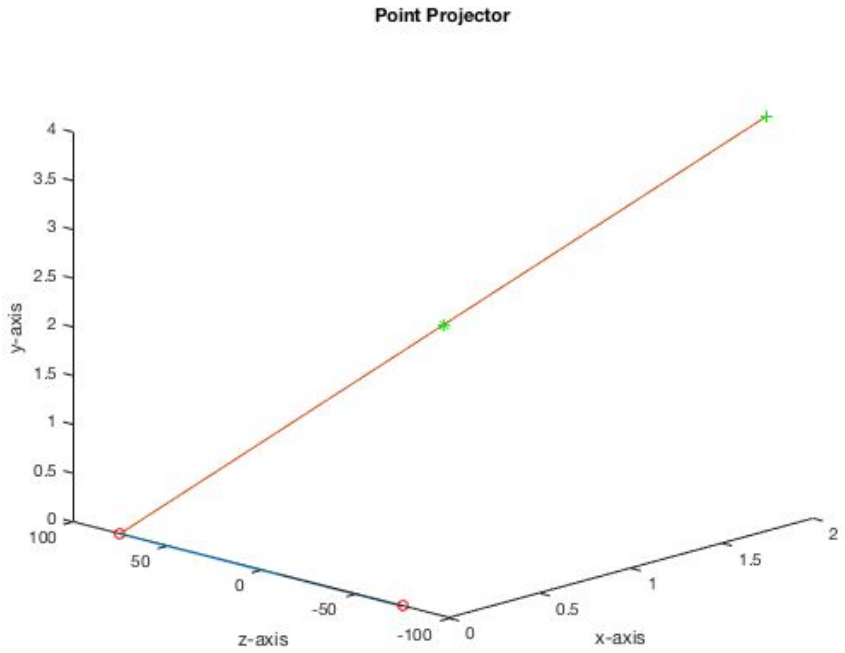

Figure 12: Ground truth 5: see comments in TESTPOINTPROJECTOR and figure 7

Tumor Projector

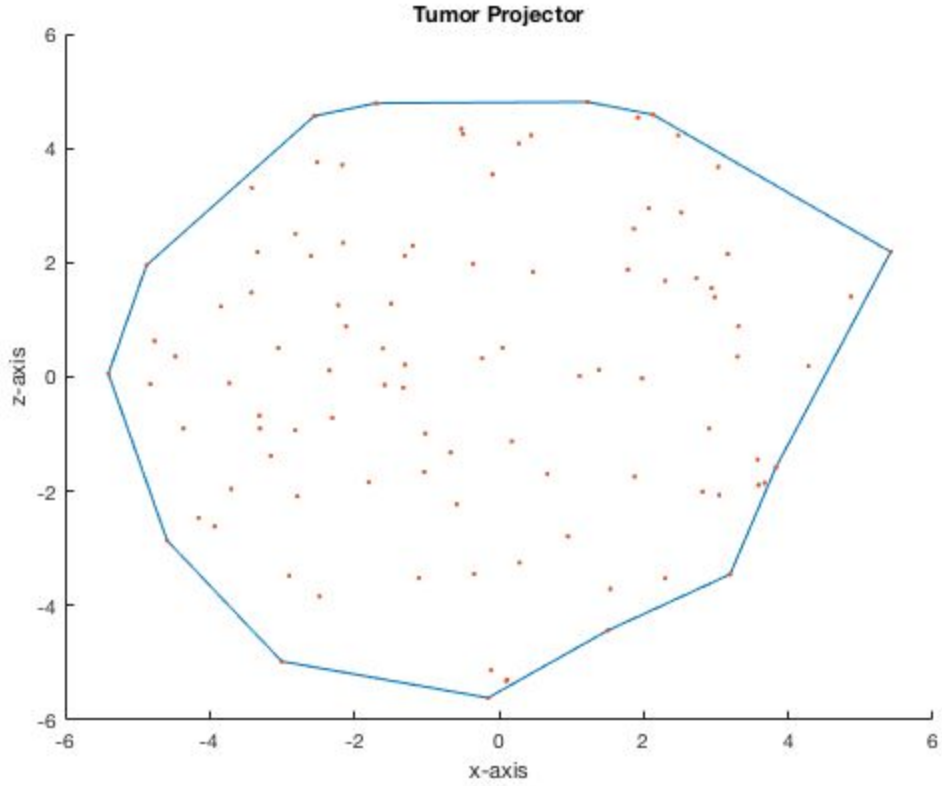

Figure 13: Tumor Projection of generated sphere with radius of 3

Upon visual inspection of the 2-D plot all points are contained within the silhouette. This is verified by checking with the values. The points are between 6 and -6 on both x and z axis which supports the radius of 3.

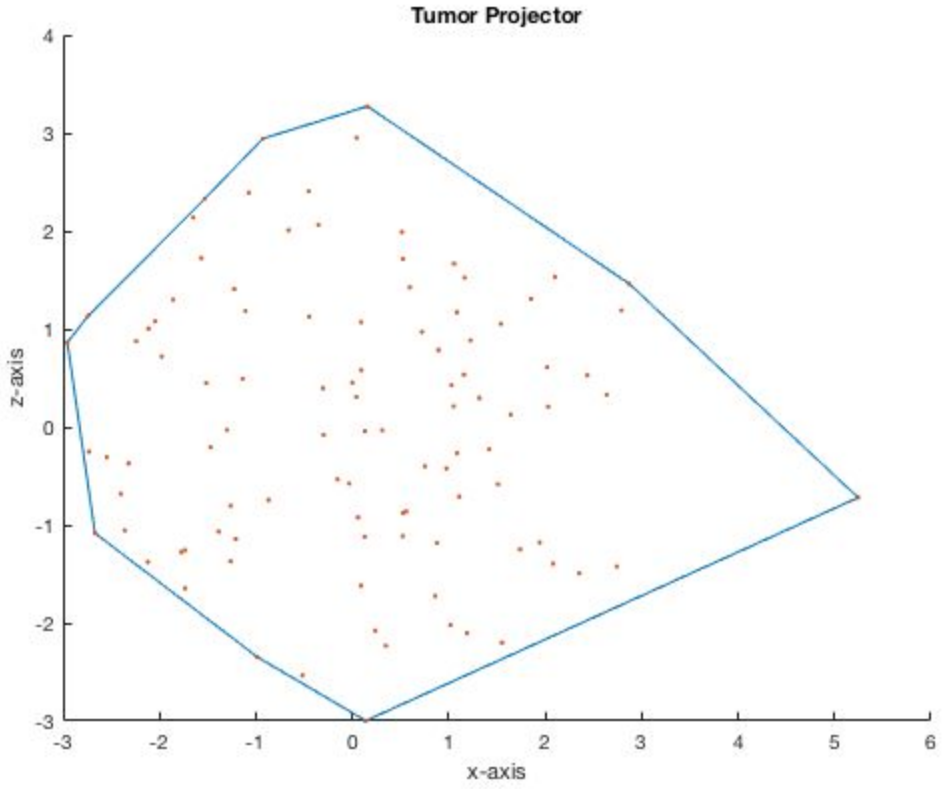

Figure 14: Tumor Projection of generated ellipsoid with a=1, b=2, c=3, and at 0 degrees Upon visual inspection of the 2-D plot all points are contained within the silhouette. This is verified by checking with the values.

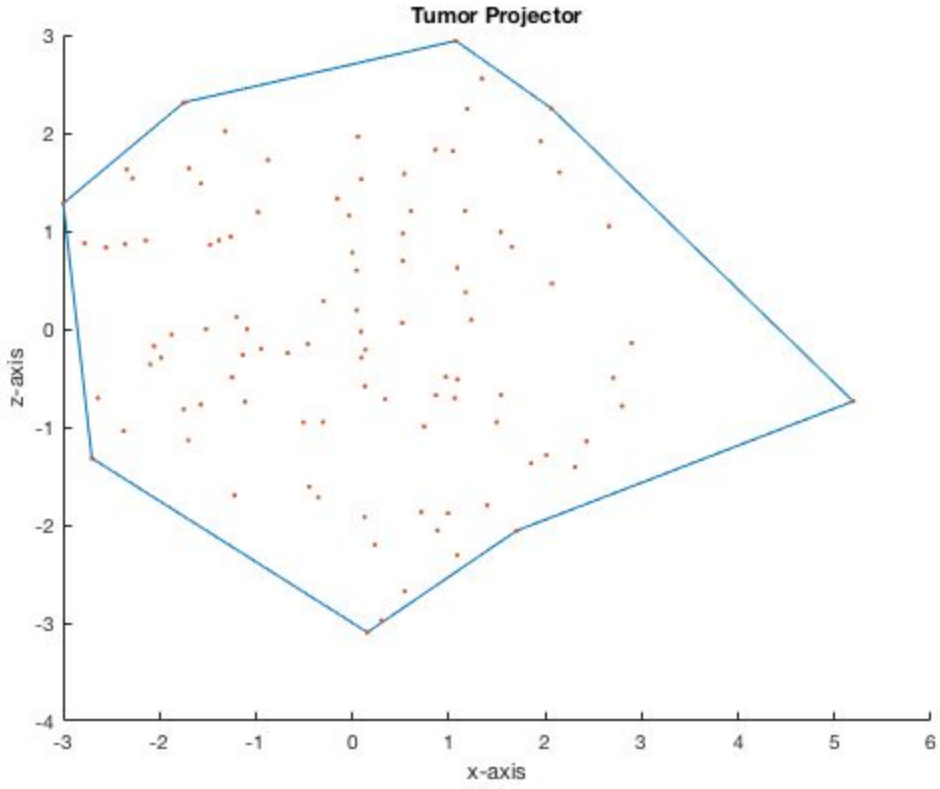

Figure 15: Tumor Projection of generated ellipsoid with a=1, b=2, c=3, and at 90 degrees Upon visual inspection of the 2-D plot all points are contained within the silhouette. This is verified by checking with the values.

Super Sphere

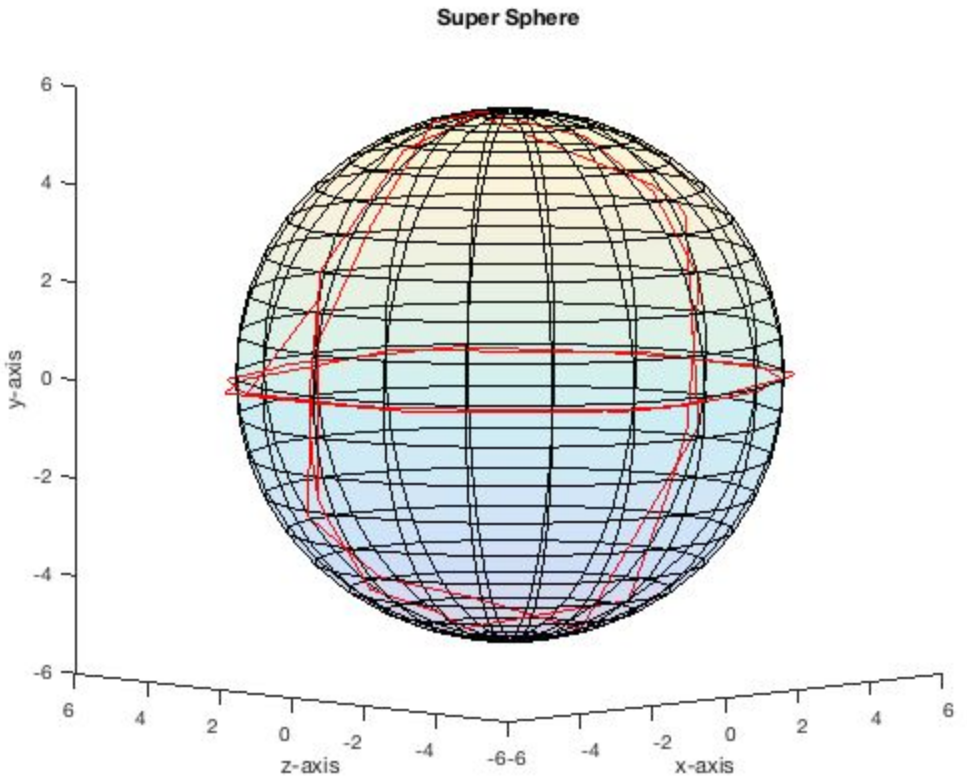

Figure 16: Super sphere of a generated sphere with radius of 3

Upon visual inspection of the 3-D plot all points are contained within the silhouette. This is verified by checking with the values. The points are between 6 and -6 on both x , y and z axis which supports the radius of 3. It is noted that some points may appear to be outside the boundaries of the super sphere, however this is due to the projection being larger than the actual tumor when projected. It can be verified that all actual tumor points are encapsulated within the supersphere.

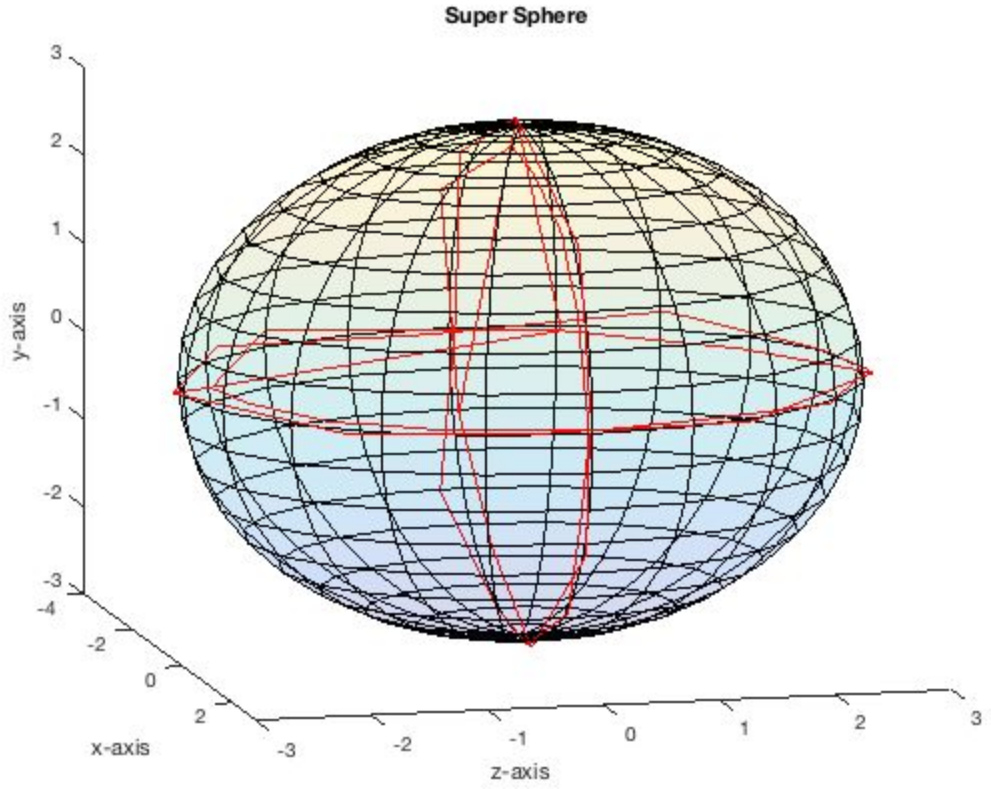

Figure 17: Super sphere of a generated ellipsoid with a=1,b=2,c=3

Upon visual inspection of the 3-D plot all points are contained within the silhouette. This is verified by checking with the values. It is noted that some points may appear to be outside the boundaries of the super sphere, however this is due to the projection being larger than the actual tumor when projected. It can be verified that all actual tumor points are encapsulated within the supersphere.

Tumor Reconstructor

One bottleneck is the triple for loop which can cause the programs to be slow due to inefficiency

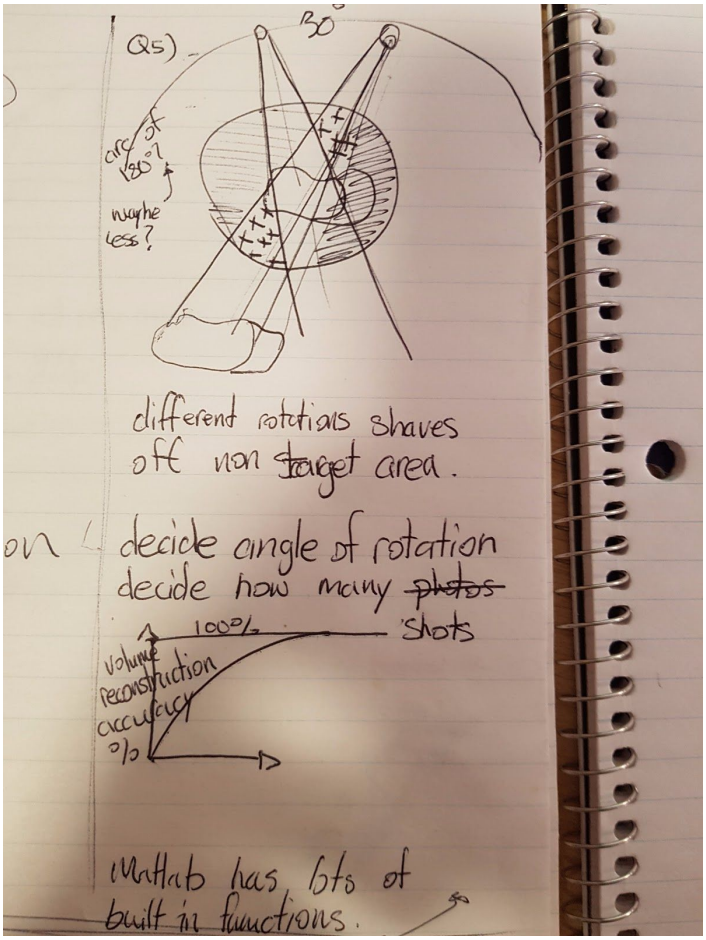

Figure 18: explanation of method (block diagram, pseudo code, text)

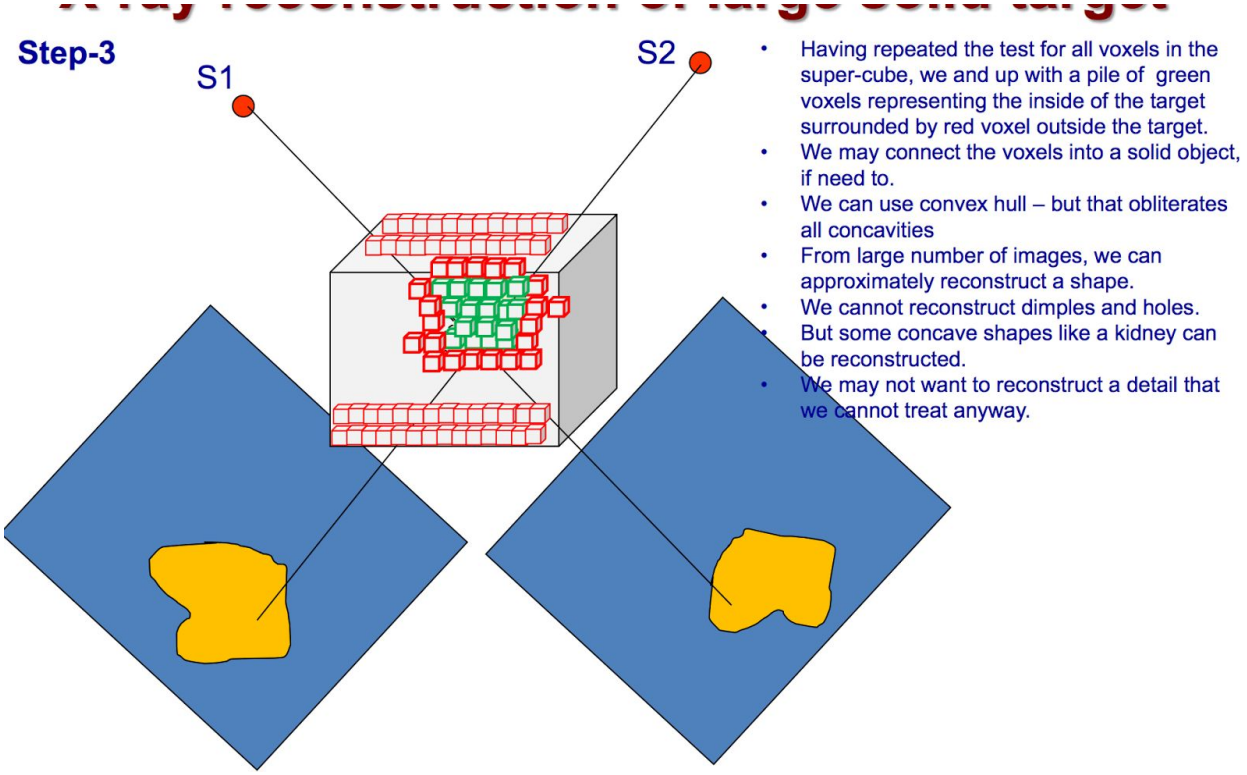

Figure 19: explanation of method (block diagram, pseudo code, text)

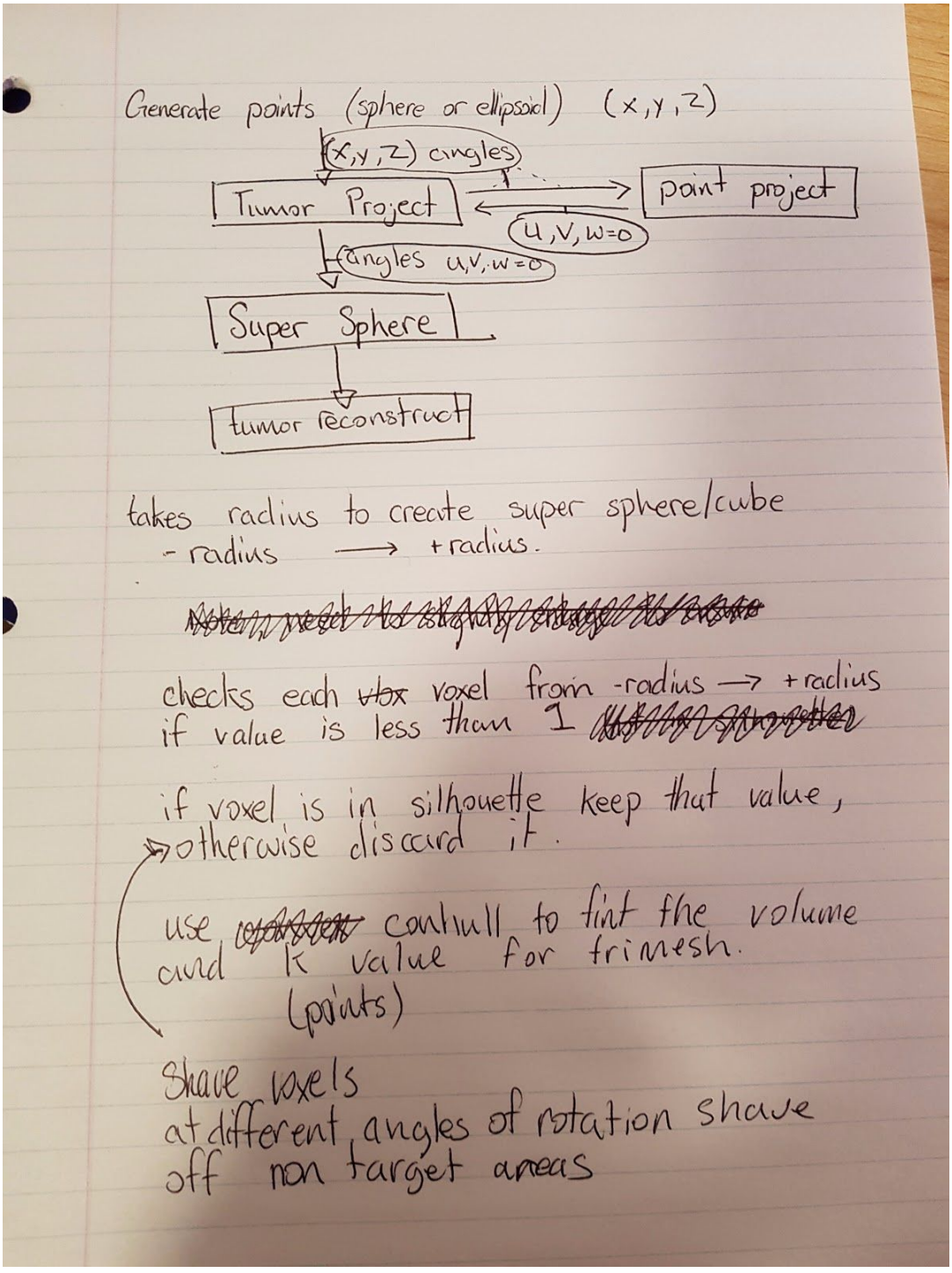

Figure 20: explanation of method (block diagram, pseudo code, text)

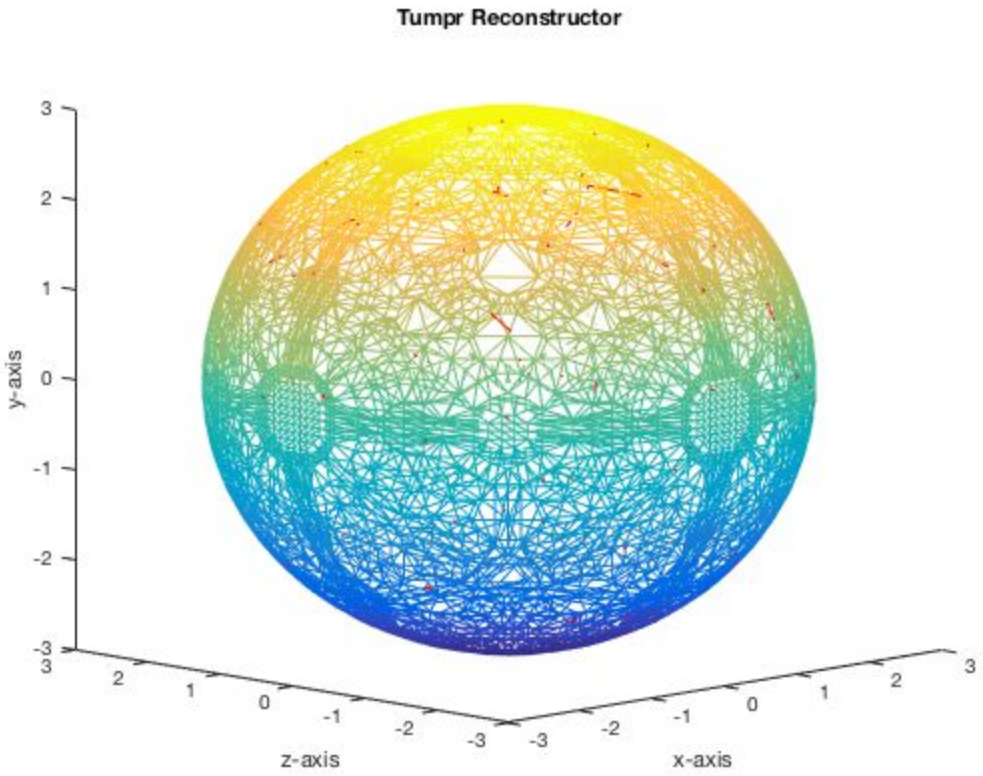

Figure 21: Upon visual inspection of the 3-D plot all points are on the tumor reconstruction. This is verified by checking with the values. The points are between 3 and -3 on both x , y and z axis which supports the radius of 3.

The volume reconstruction accuracy of TESTTUMORRECONSTRUCTOR (Questions and Problems) is a logarithmic function which approaches 100% accuracy as seen in figure 18