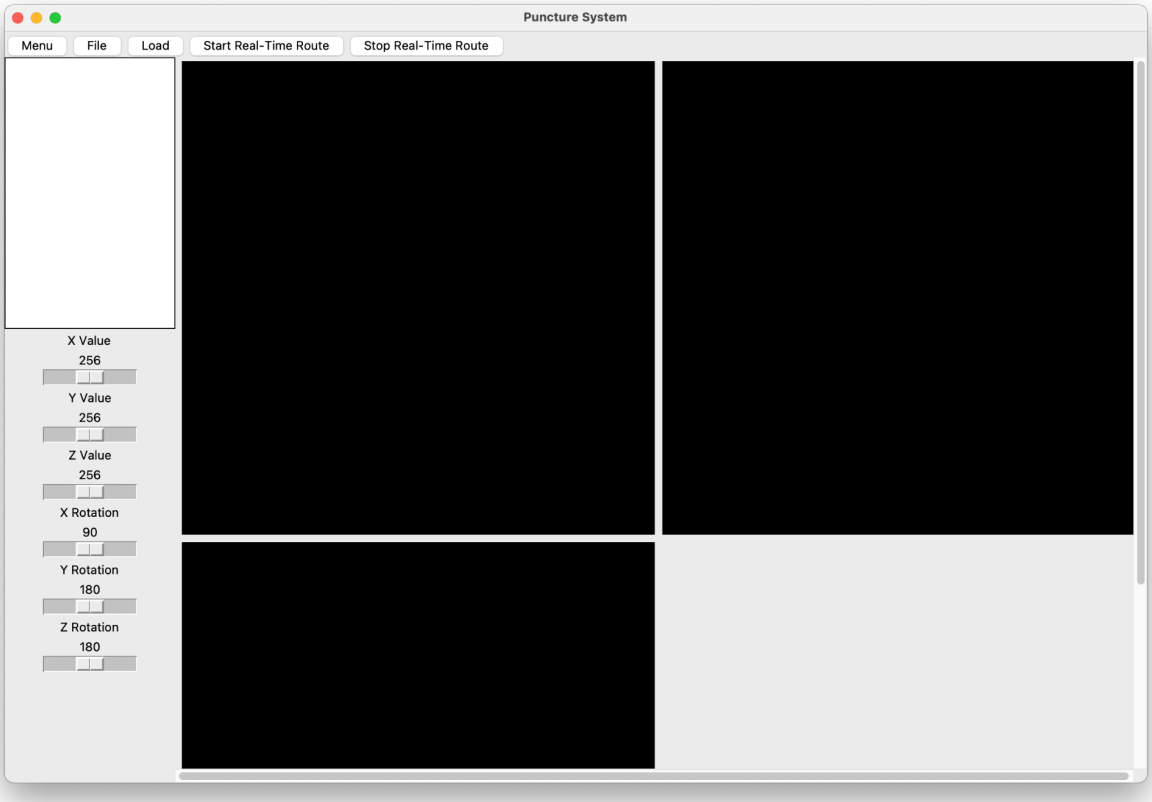
CT-Guided Puncture Assistance System Application Manual

The application main window.
This window will show when starting the program.

The application main screen consists of 3 panels.
XY-plane/Axial-plane (Top Left)
YZ-plane/Sagittal-plane (Top Right)
XZ-plane/Coronal-plane (Bottom Left)



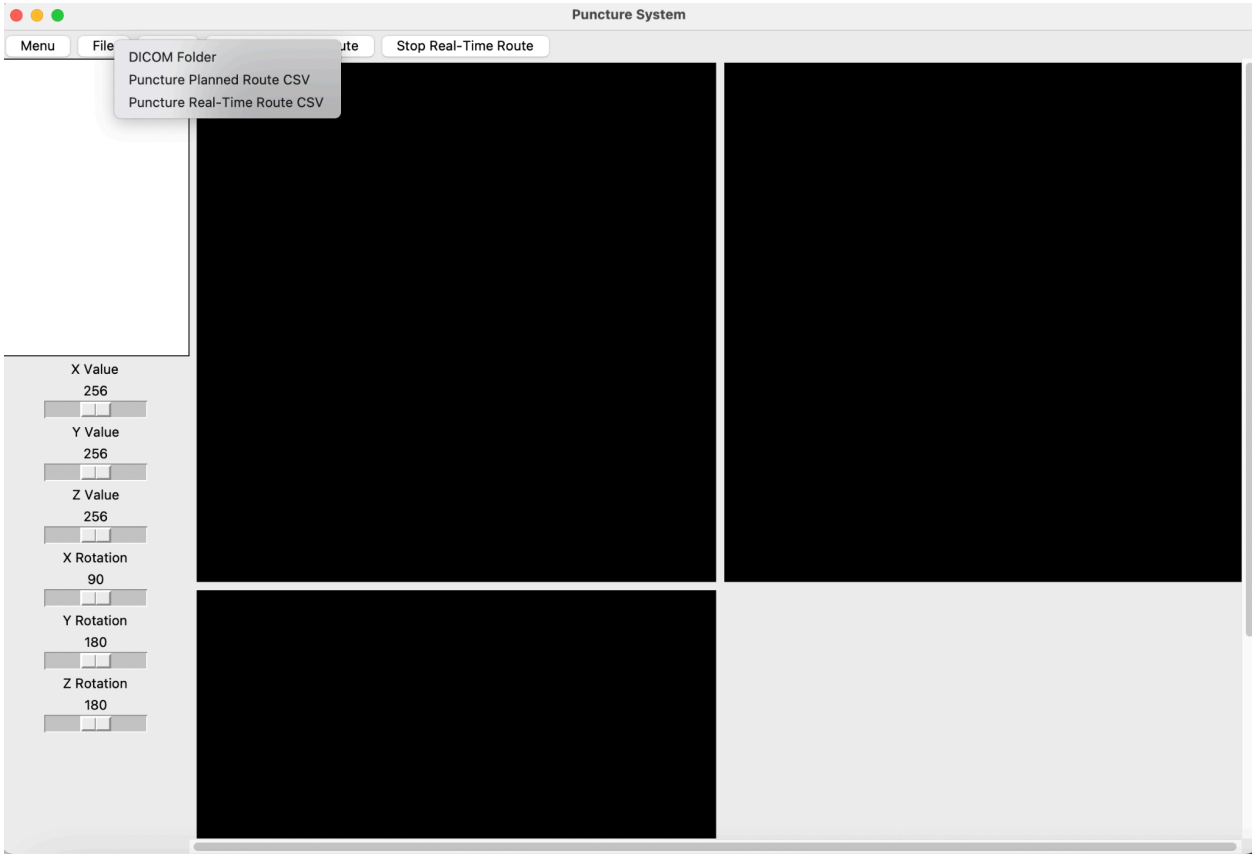
Main functions of the application

1. Importation of DICOM Format Files.
2. The display of sectional information of the human body from CT images.
3. The 3D visualization of the human body from CT images.

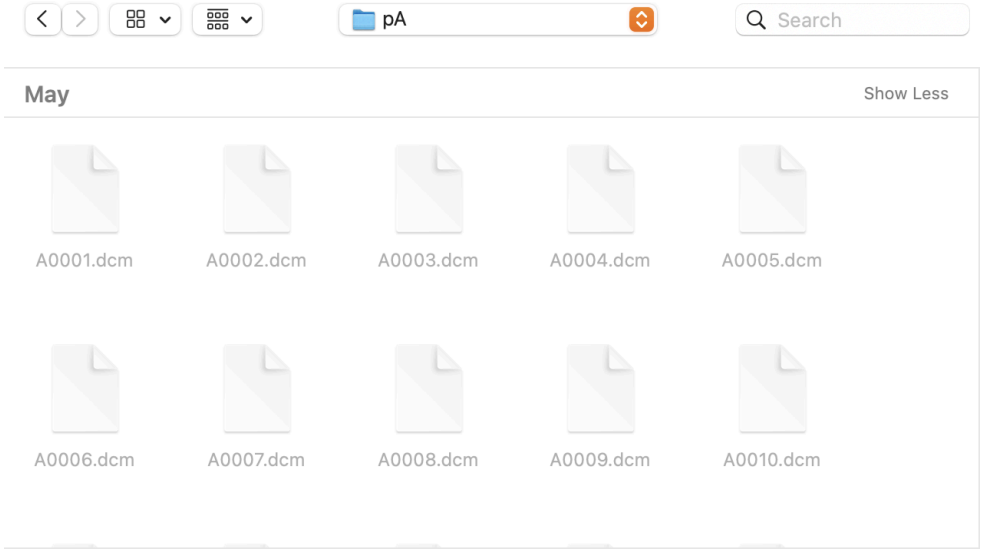
4. The display of X, Y, Z moving axes on the screen.
5. The display of the planned puncture route from the needle's start position to the target position (by import start point and target point).
6. The display of real-time puncture needle route (Real-time acquisition of X, Y, Z value from CSV file).

Step to importation of DICOM Format Files.

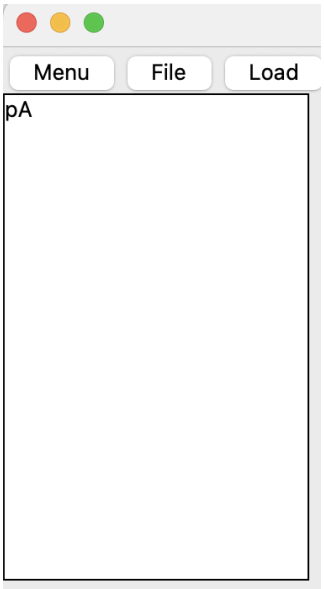
1. On the top menu bar, click the File button.
2. Click DICOM Folder to open up the file selection.



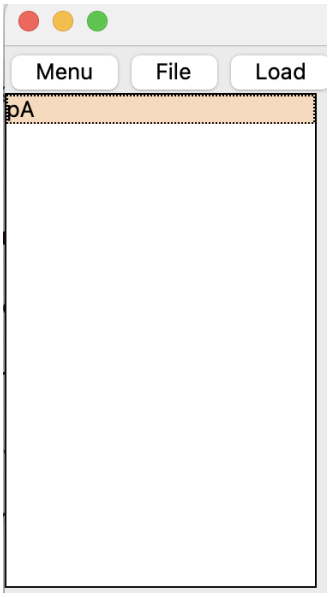
3. Choose the whole folder that contains multiple DICOM files.



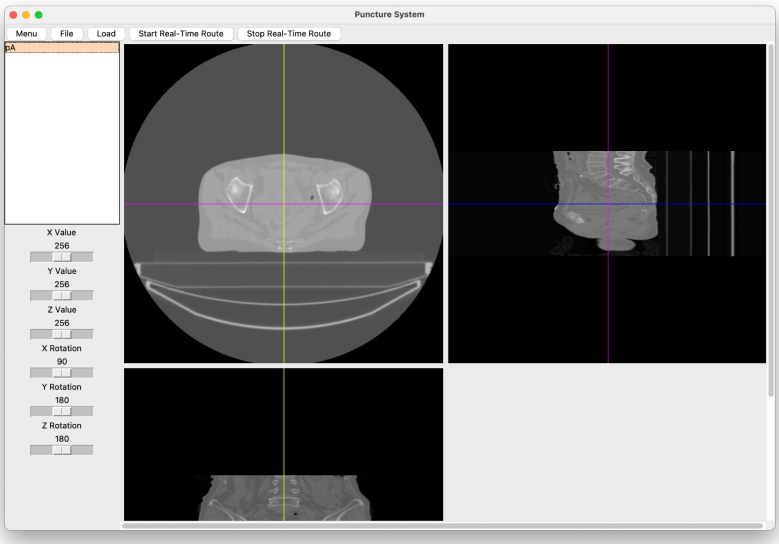
The file name will appear on the top left corner box of the application.

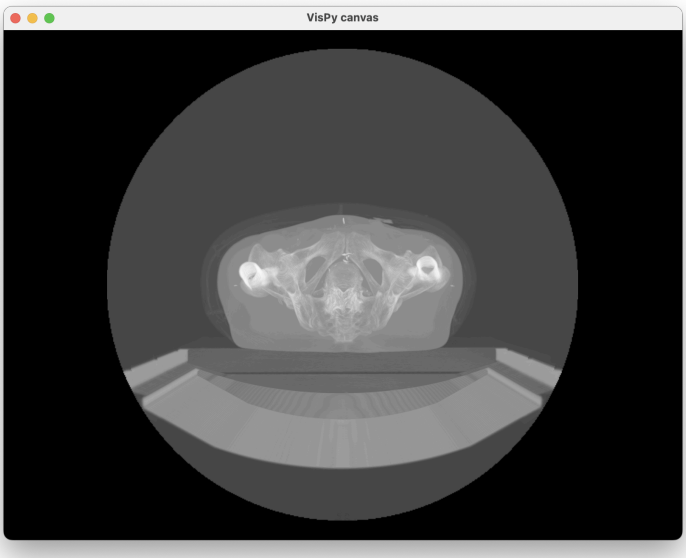


4. Click the file name in the box

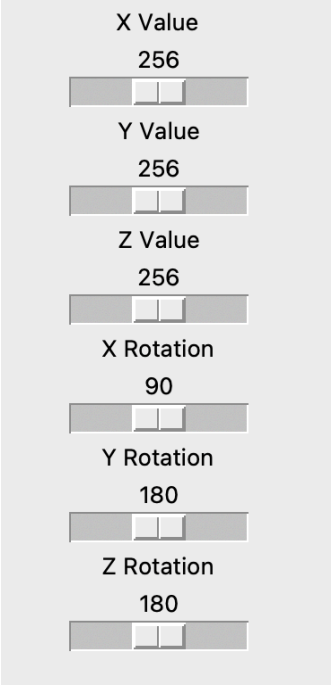


5. After clicking the file name in the box, click the Load button.
6. The CT images should appear in the 3 main screens XY-plane, YZ-plane, and XZ-plane. The 3D visualization window was also created at this time.





Step to display the sectional information of the human body from CT images and X, Y, Z moving axes.

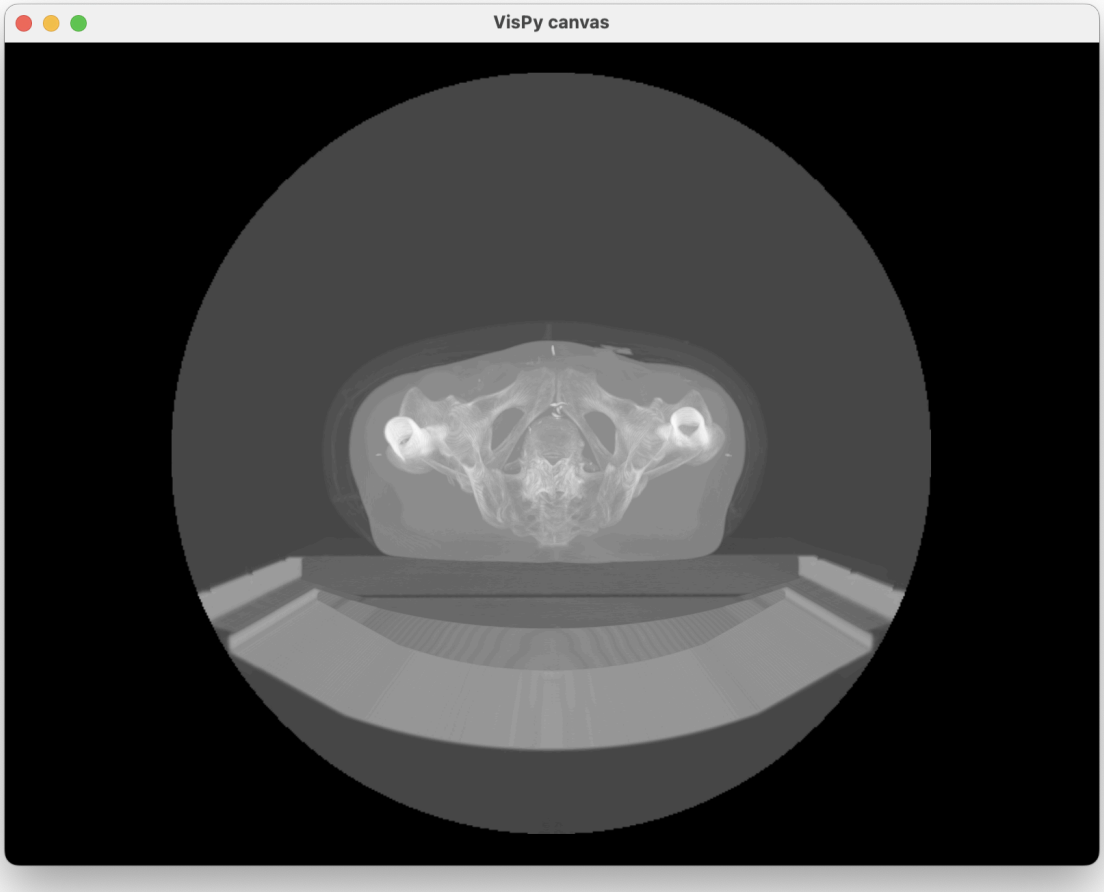


By adjusting the slider,
X, Y, Z values slider can change the section of the CT images on 3 panels.
X, Y, Z rotation slider can change the viewpoint on 3D visualization.

There are 4 ways to move the slider.

1. Click and drag the slider left and right
2. Position the mouse pointer over the left/right space one-left-click at the blank space to adjust by 1 value.
3. Position the mouse pointer over the left/right space, left-click and hold to smoothly adjust the value of the slider.
4. Position the mouse pointer over the black space, one-right-click to adjust the slider value immediately.

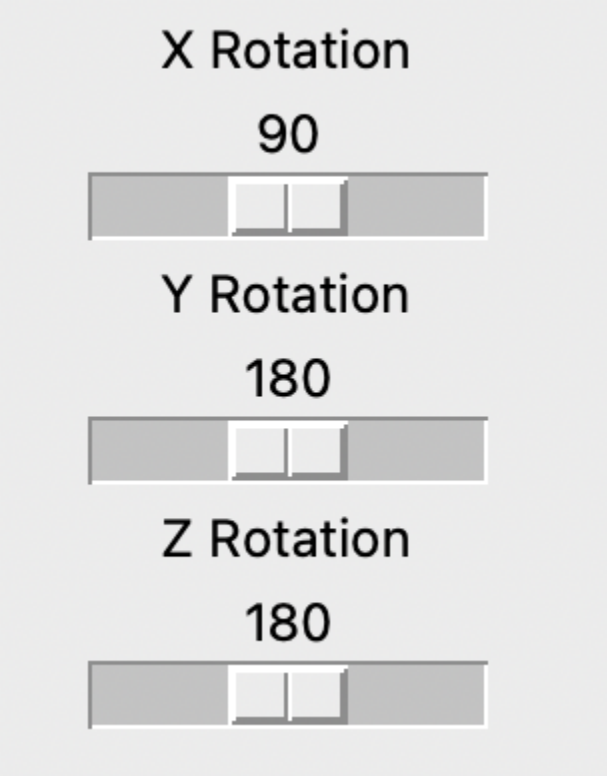
The 3D visualization of the human body from CT images.



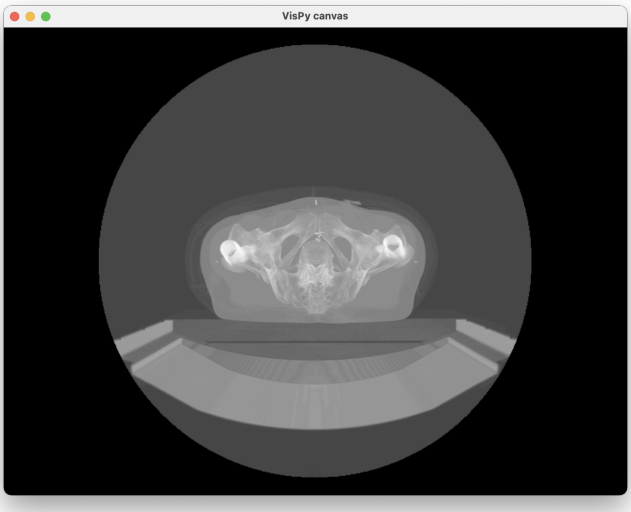
Here is the 3D visualization of the human body created by Vispy canvas

There are 2 main ways to interact / rotate with 3D visualization

1. Changing the value of X, Y, Z rotation will rotate the 3D visualization.



2. Interact with 3D visualization directly on Vispy canvas by computer mouse

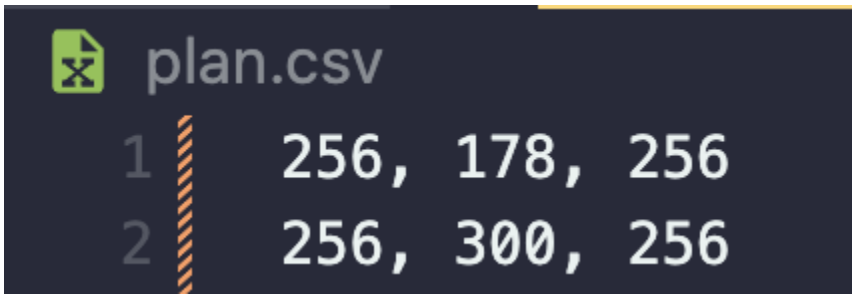


- Left-Click drag can rotate the 3D visualization.

- Right-Click drag can zoom-in/zoom-out the 3D visualization smoothly.
- Scroll wheel on the mouse can zoom-in/zoom-out the 3D visualization roughly.
- Shift + Right-Click drag can change the perspective of the 3D visualization.

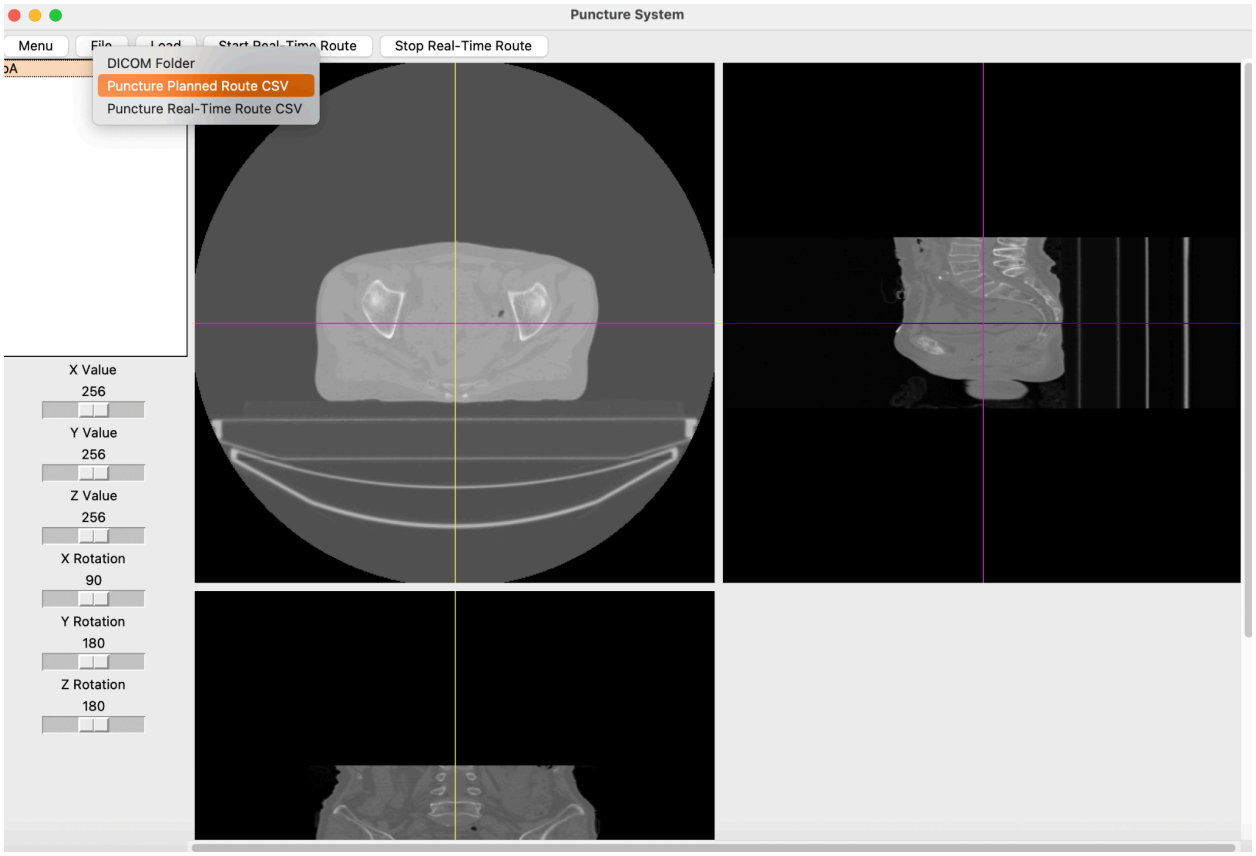
The display of the planned puncture route from the needle's start position to the target position (by import start point and target point).

In this function, we need a csv file (planned puncture route) that contains the start point (X-start, Y-start, Z-start) and target point (X-target, Y-target, Z-target).

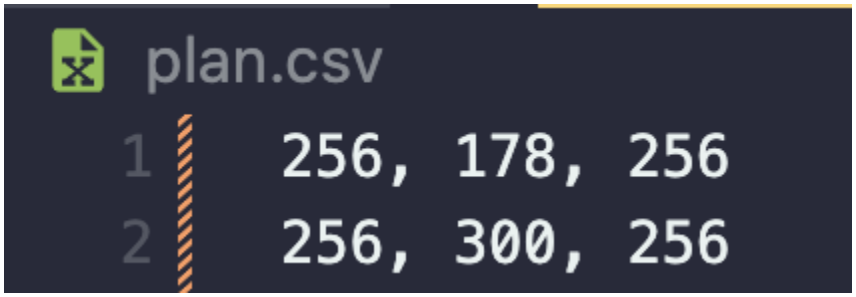


Step:

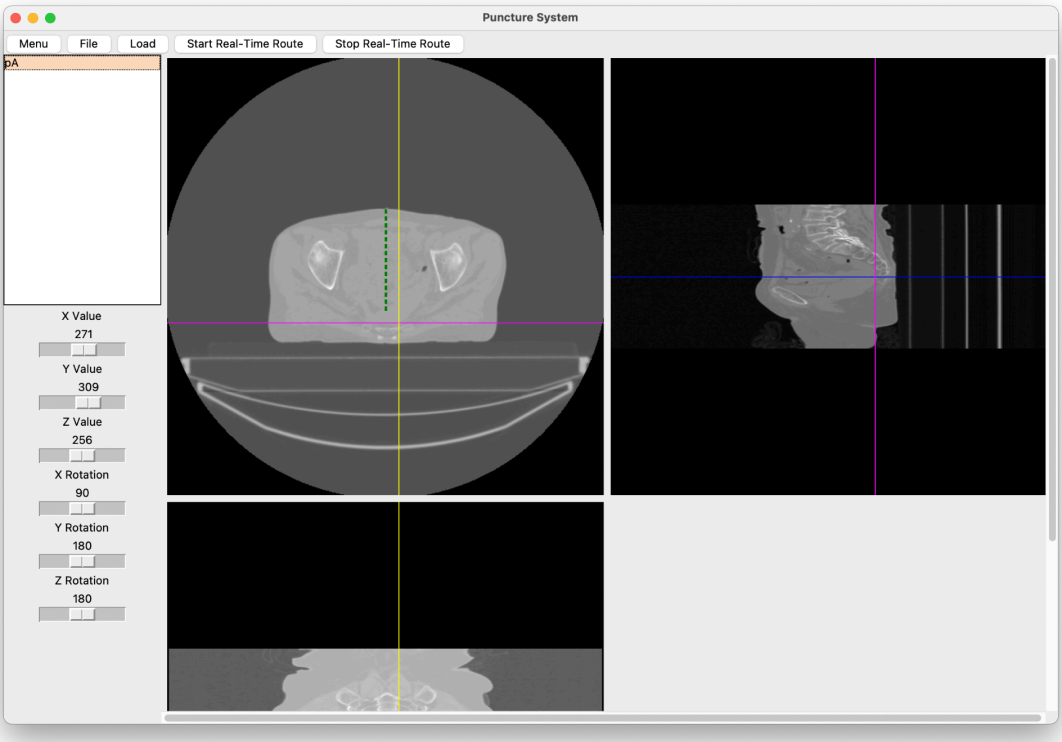
1. On the top menu bar, click the File button.
2. Click Puncture Planned Route CSV to open up the file selection.

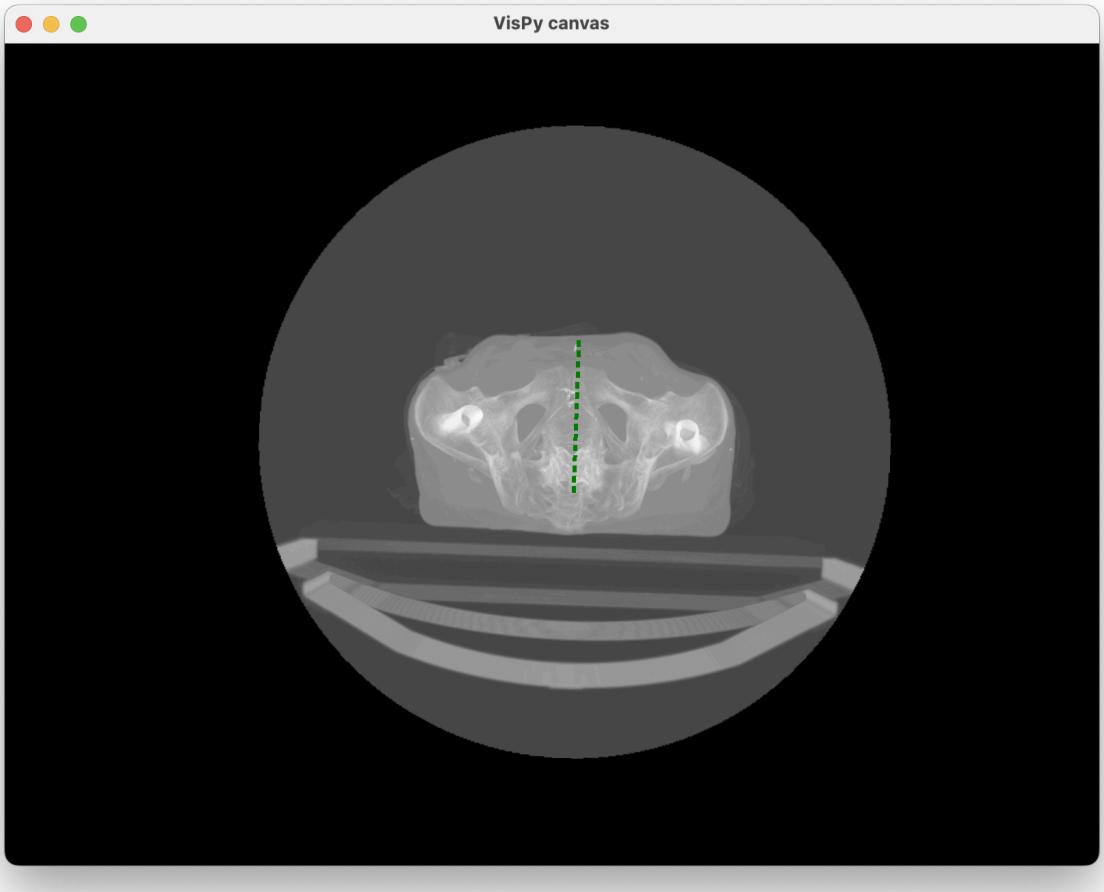


3. Select the CSV file that contains the start point and target point. In this example plan.csv file.



4. After selecting the CSV file, the dotted green line (planned puncture route) should display on XY-plane and 3D visualization.


Puncture System
Menu
File
Load
Start Real-Time Route
Stop Real-Time Route
pA
X Value
271
Y Value
309
Z Value
256
X Rotation
90
Y Rotation
180
Z Rotation
180

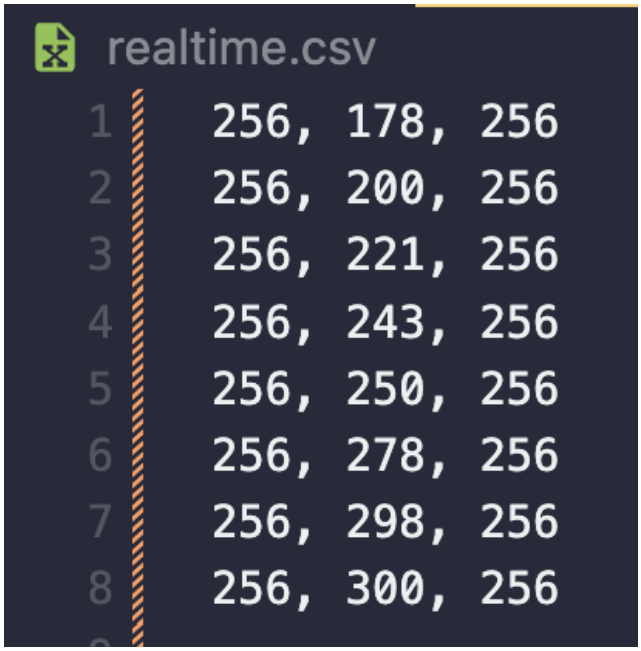

VisPy canvas

The display of real-time puncture needle route (Real-time acquisition of X, Y, Z value from CSV file).

In this function, we need a csv file that contains real-time coordinate data that continuously input into this CSV file. This application will acquire the position X, Y, Z value from the CSV file we selected in this step.

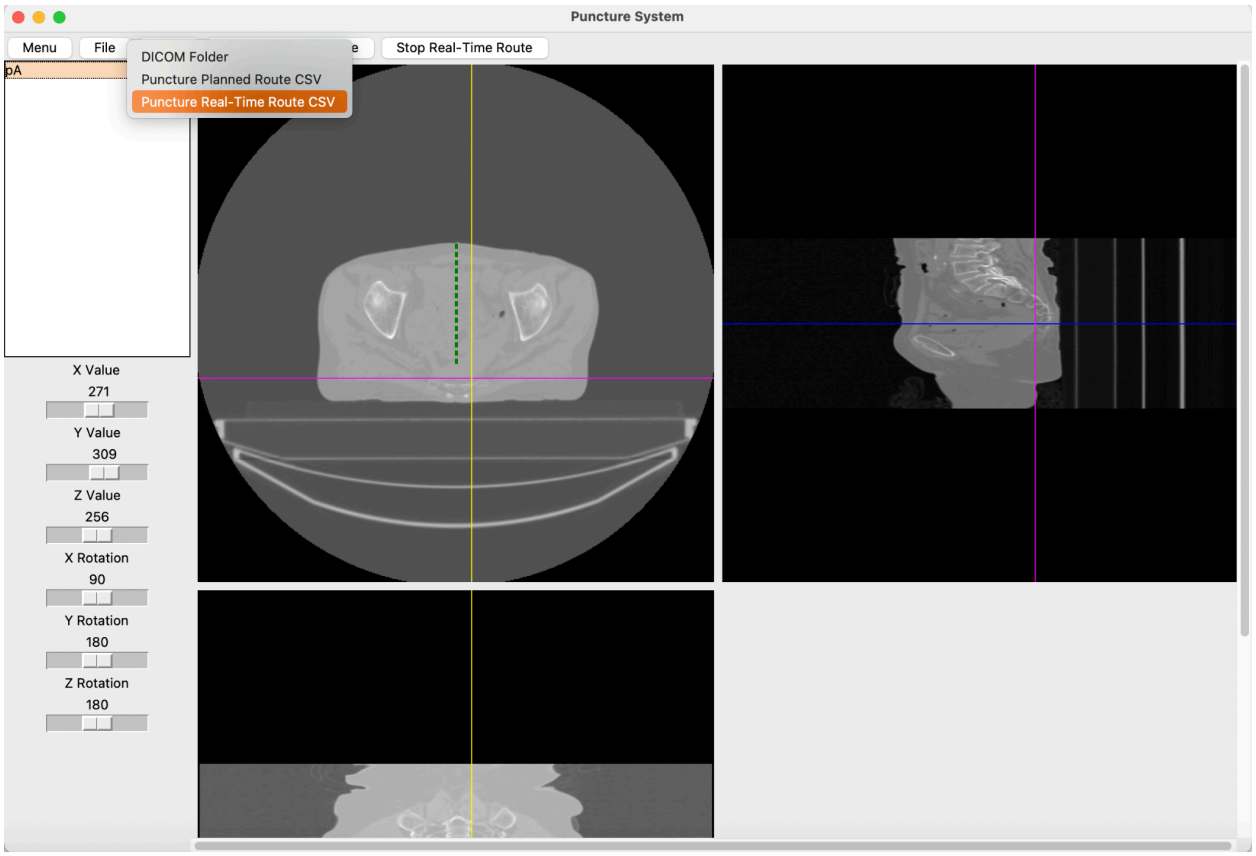
When the new coordinate data comes into the CSV file, the red dotted line will be drawn on both XY-plane and 3D visualization.

Here is the example of the realtime.csv file:



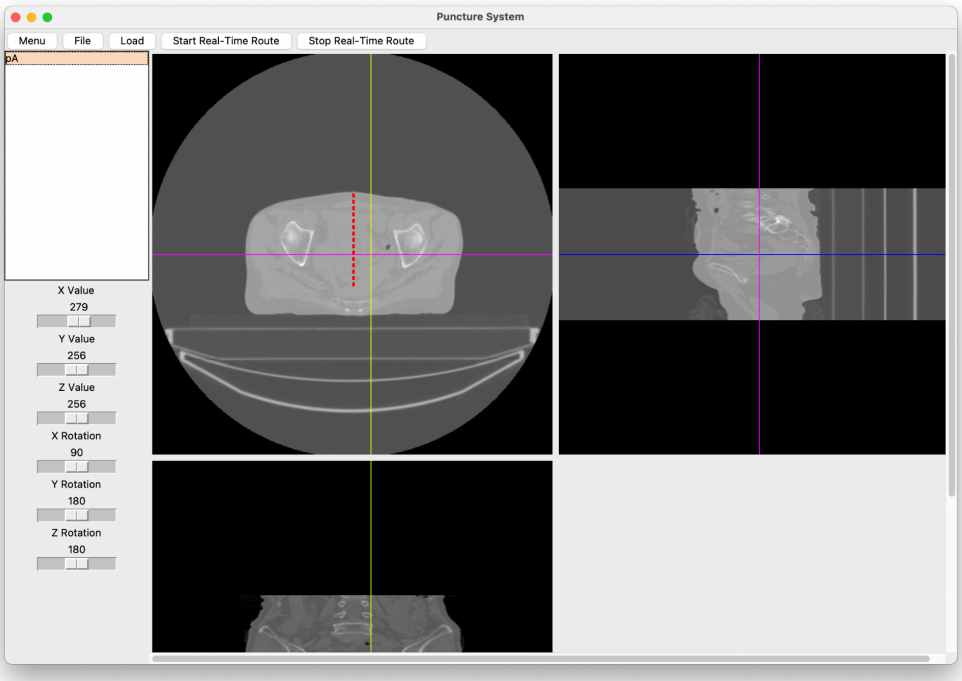
Step:

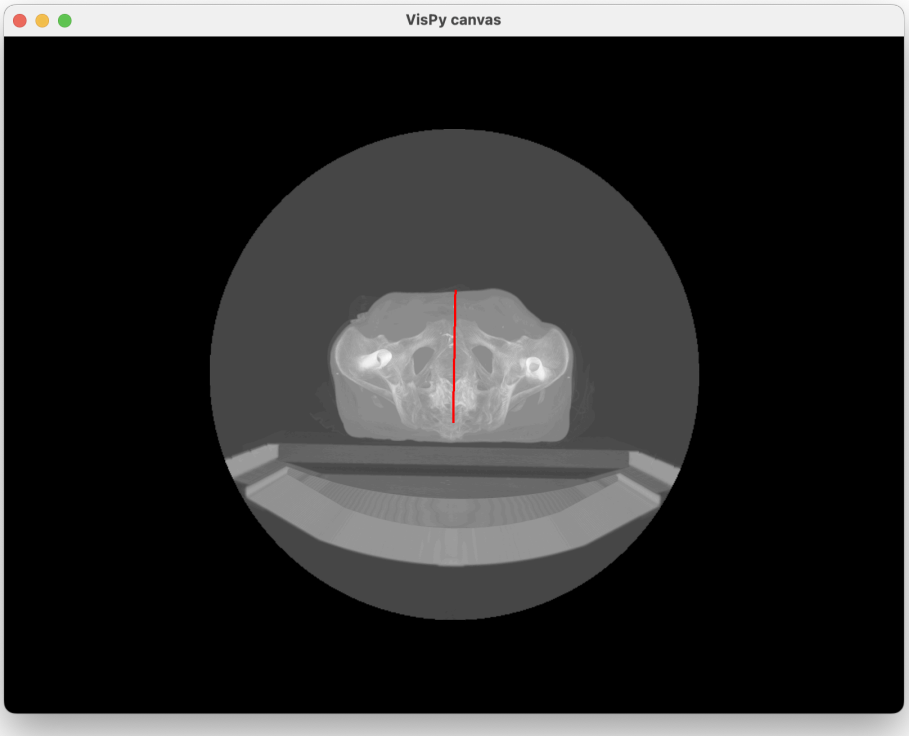
1. On the top menu bar, click the File button.
2. Click Puncture Real-Time Route CSV to open up the file selection.



3. Select the CSV file that we want to acquire.
4. After selecting the CSV file, the dotted red line will not display until we click the Start Real-Time Route button.
5. After clicking the Start Real-Time Route button the dotted red line should display on XY-plane and 3D visualization. Now when new coordinates data is added in CSV file, the new dotted red line should continue draw immediately.

To stop drawing a Real-Time route on the screen, Press Stop Real-Time Route button.


Puncture System
Menu
File
Load
Start Real-Time Route
Stop Real-Time Route
pA
X Value
279
Y Value
256
Z Value
256
X Rotation
90
Y Rotation
180
Z Rotation
180


VisPy canvas