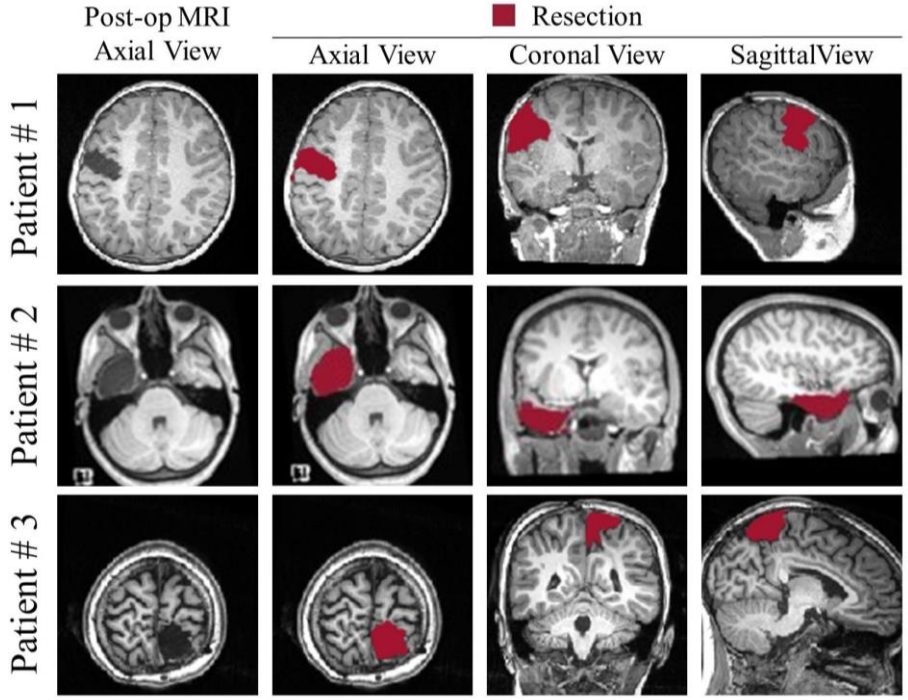
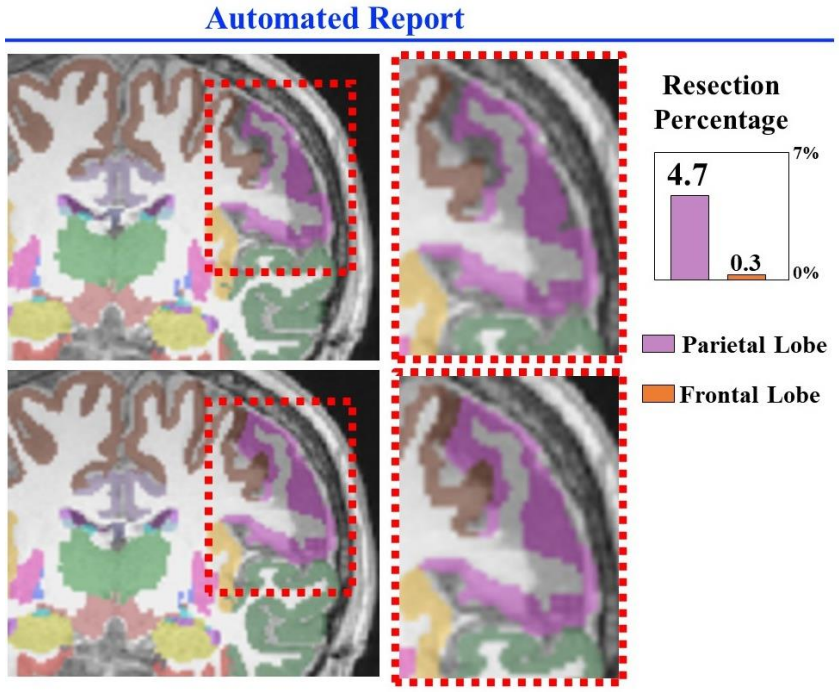
GUIDE: BrainResectionApp

BrainResectionApp

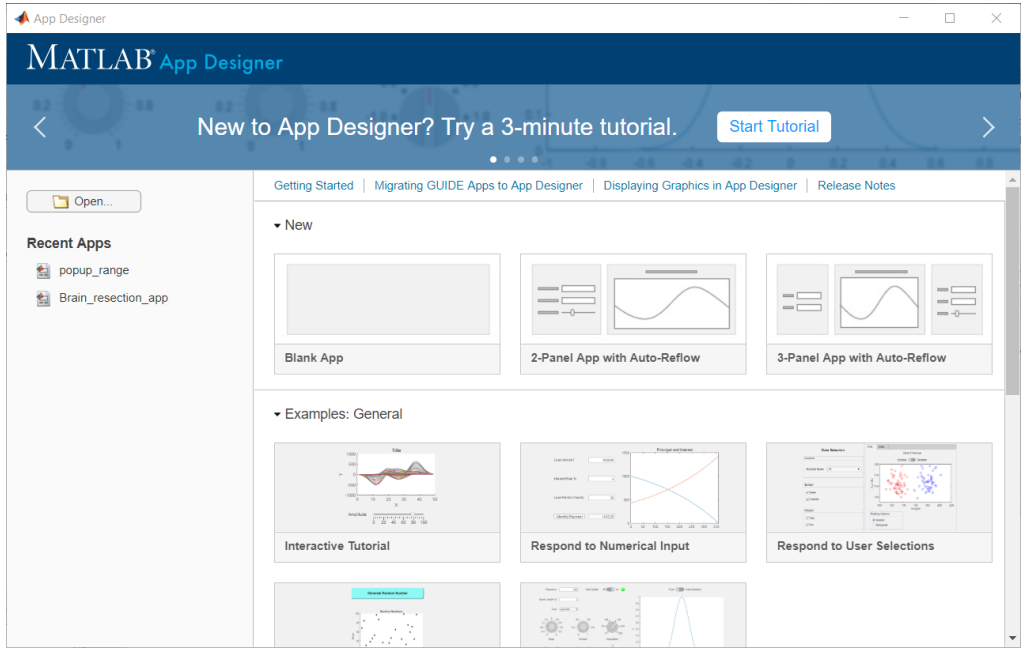
BrainResectionApp is a MATLAB Graphical User Interface (GUI) for accurate delineation of the resected brain region within the patient's MRI space. It integrates a validated semi-automated segmentation pipeline based on a hybrid approach combining region growing algorithm on post-operative MRI with the patient-specific pre-operative mask. Designed to maximize user efficiency and the output accuracy, the GUI is focused entirely on segmenting the resection cavity, where parameter selection is simplified and kept to a minimum and where the user is only asked to place an initial seed anywhere in the cavity that he/she desires to accurately delineate. This GUI is also designed to extract the resection cavity volume and its neuroanatomical labelling.





Requirements

BrainResectionApp is an “Appdesigner” GUI. You can ensure that MATLAB Appdesigner tool is installed, and it is working on the machine by typing the command «appdesigner» in the command window.
Further information or download at:
https://www.mathworks.com/products/matlab/app-designer.html

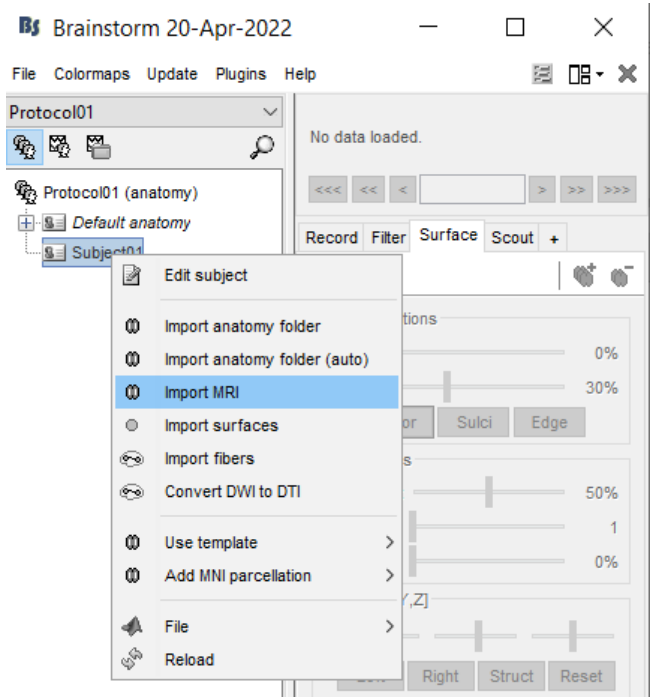


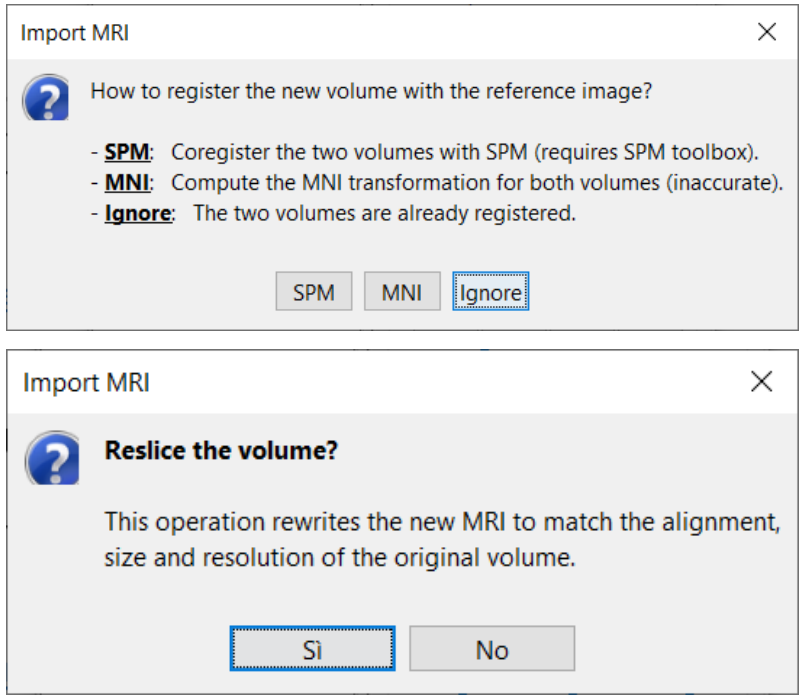
Visualization functions of BrainResectionApp lean on Brainstorm toolbox. Please install the latest version of this toolbox at:
https://neuroimage.usc.edu/brainstorm/

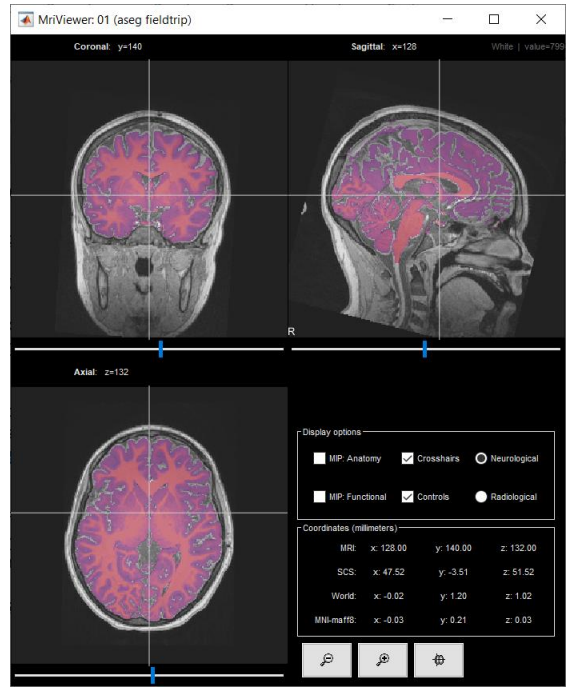
Download all the files in https://github.com/rbillardello/BrainResectionApp and store them in a folder on you Computer.
- Launch Brainstorm
- Launch Brain_resection_app.mlapp

Preliminary MRI loading and co-registration

In order to produce an accurate 3D resection model, BrainResectionApp requires a pre-operative brain mask and a post-operative MRI, in a *.mat format.
- To obtain *.mat file, please load your MRI NIfTI files in Brainstorm, by right clicking on a subject in the protocol and then on “Import MRI”.
- During the second import, the user is asked to co-register and to reslice the new volume, to the previously loaded one.
Depending on these files, you may try different options to get the MRIs co-registered.
Once the MRIs are co-registered, you can use BrainResectionApp.

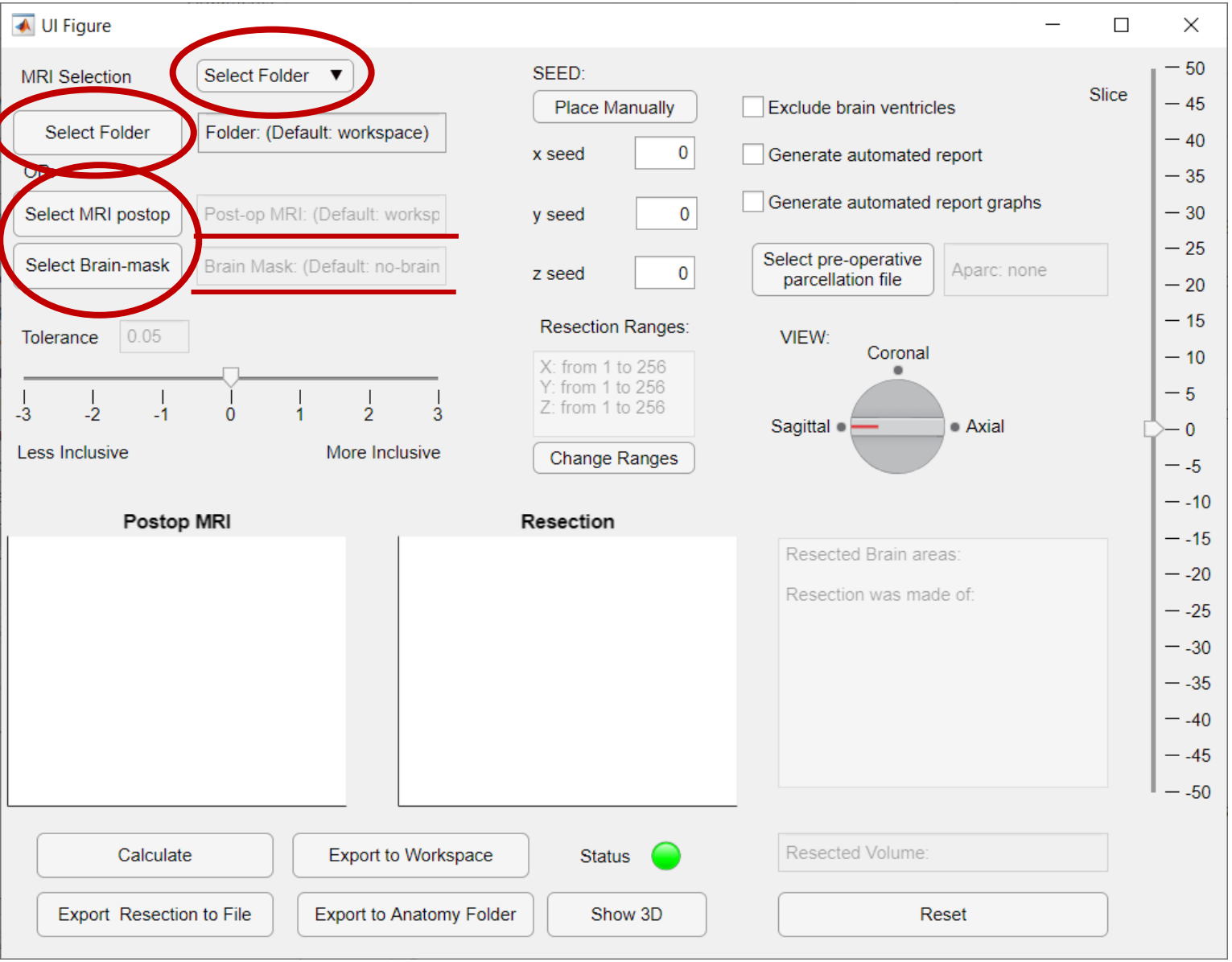






*correctly co-registered post-operative MRI (grey-scale) and pre-operative brain mask (purple)

BrainResectionApp - 1: Selecting MRIs



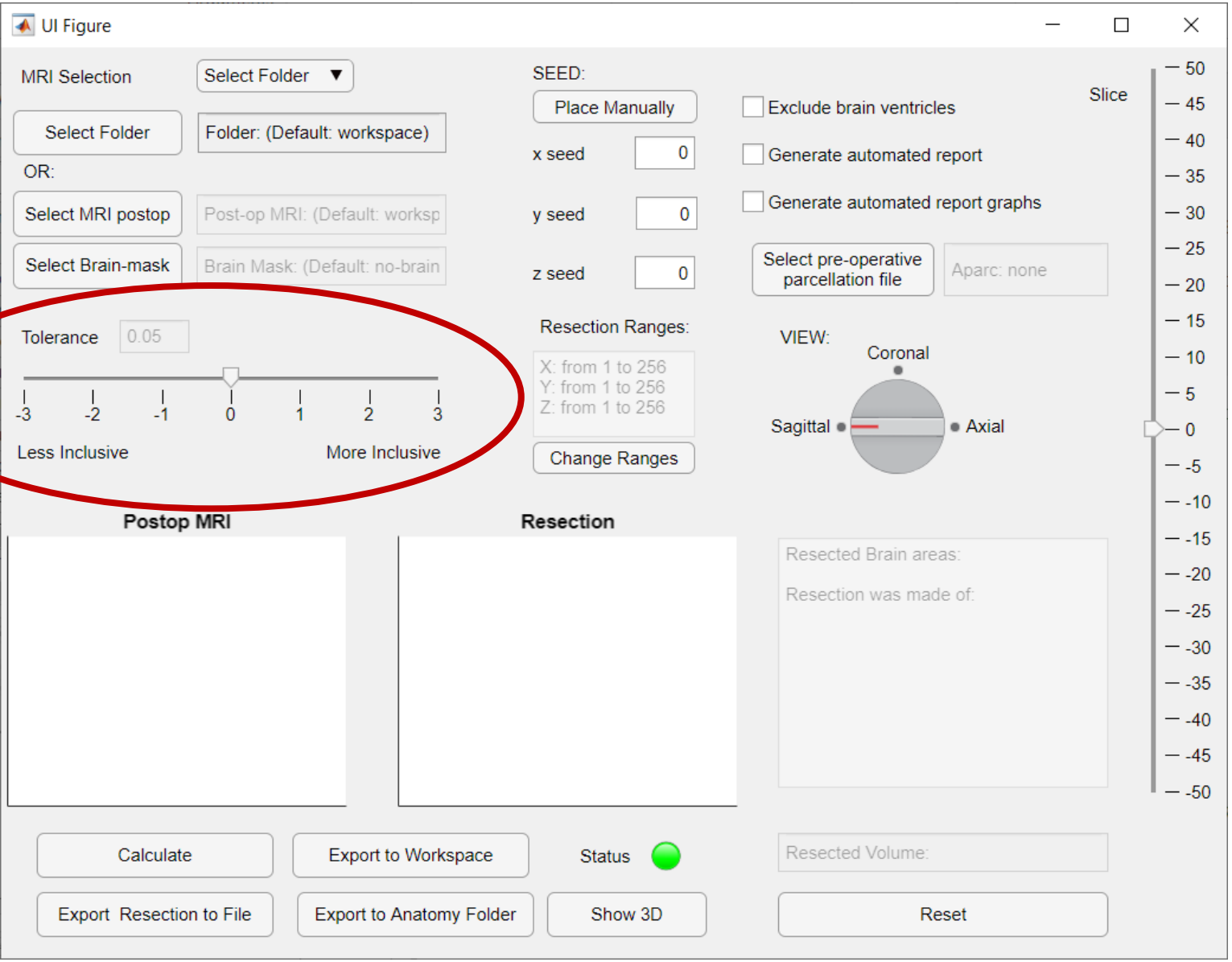
Two methods:

- Select the Brainstorm folder of the patient where the MRIs (*.mat) are. Click «Select Folder» and select the patient's Brainstorm anatomy folder. The GUI will search for files named:
subjectimage_MRI_postop
subjectimage_brainmask
The GUI assumes that the brainstorm files have been renamed as "MRI_postop" and "brainmask" after being imported.

- Select the files separately, by clicking on "Select MRI postop" and then "Select Brain-mask". You can choose to load a *.mat or a *.nii file.
Note: if you choose the NIfTI format, ensure that MRIs are co-registered.

In both cases a popup window will appear to select the folder or the files. In both cases, the text fields will show the MRI names.

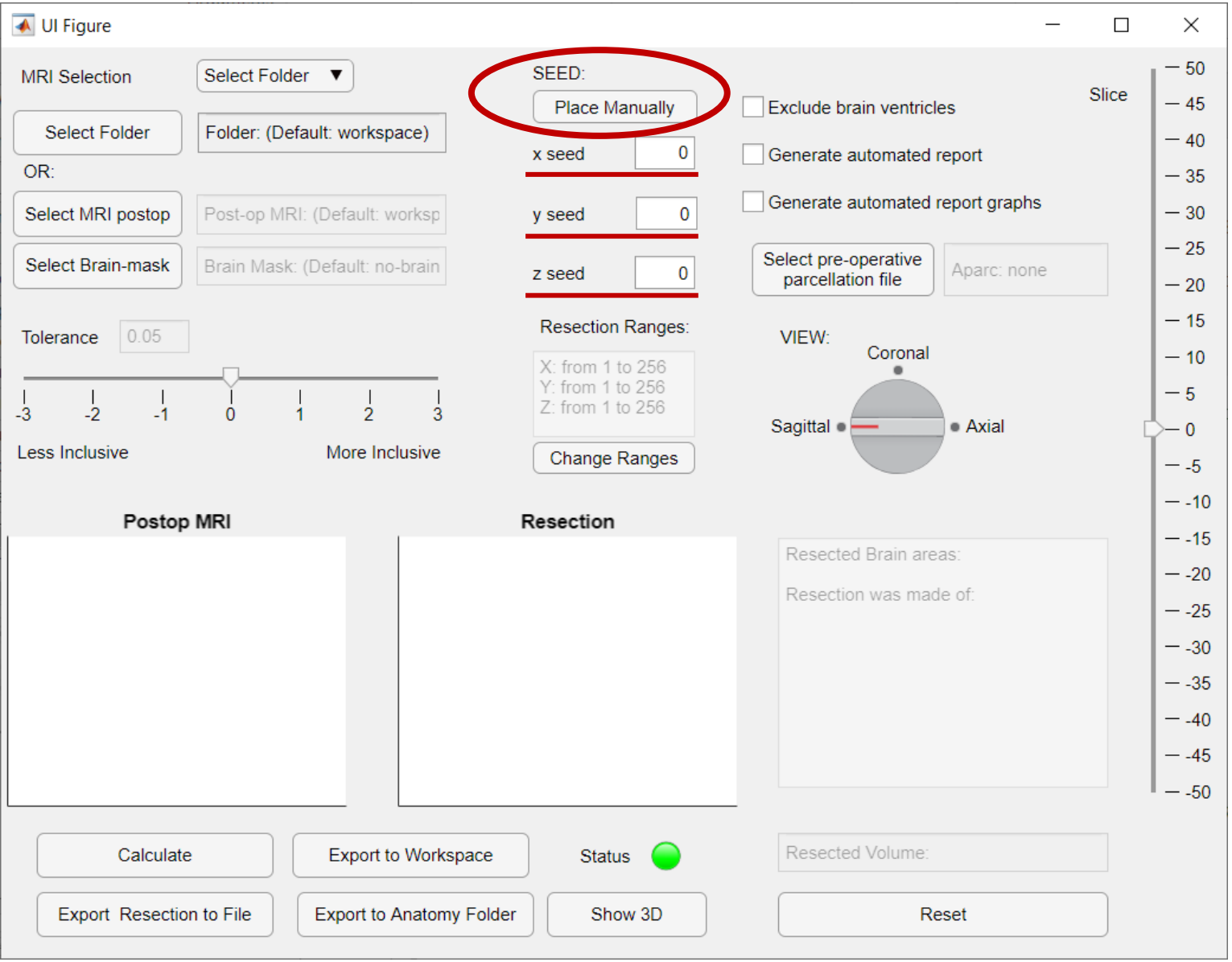
BrainResectionApp - 2: Tolerance selection



BrainResectionApp requires the definition of a single parameter, which can be adjusted accordingly to the desired result. This parameter is the Tolerance value, and you can change its value using the tolerance slide.

To be more inclusive (bigger resections) use higher tolerance values (slicer to the right)
To be less inclusive (smaller resections) use lower tolerance values (slicer to the left).
If you are not sure on the value to use, leave it at its default value.

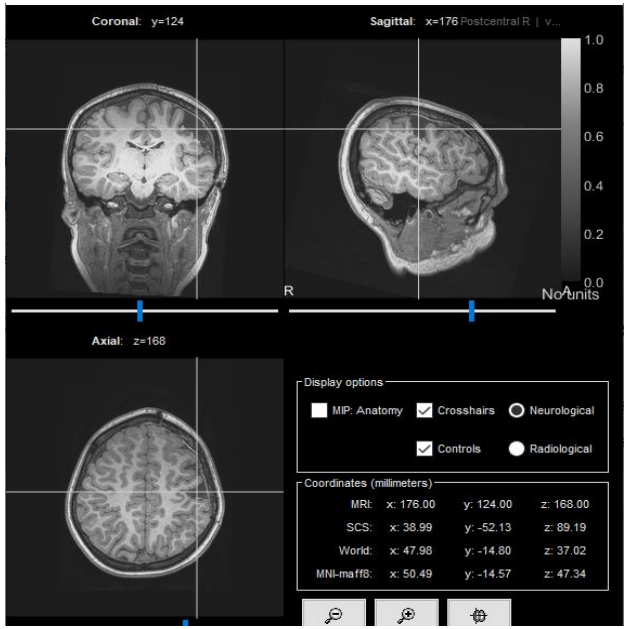
BrainResectionApp - 3: Seed placement



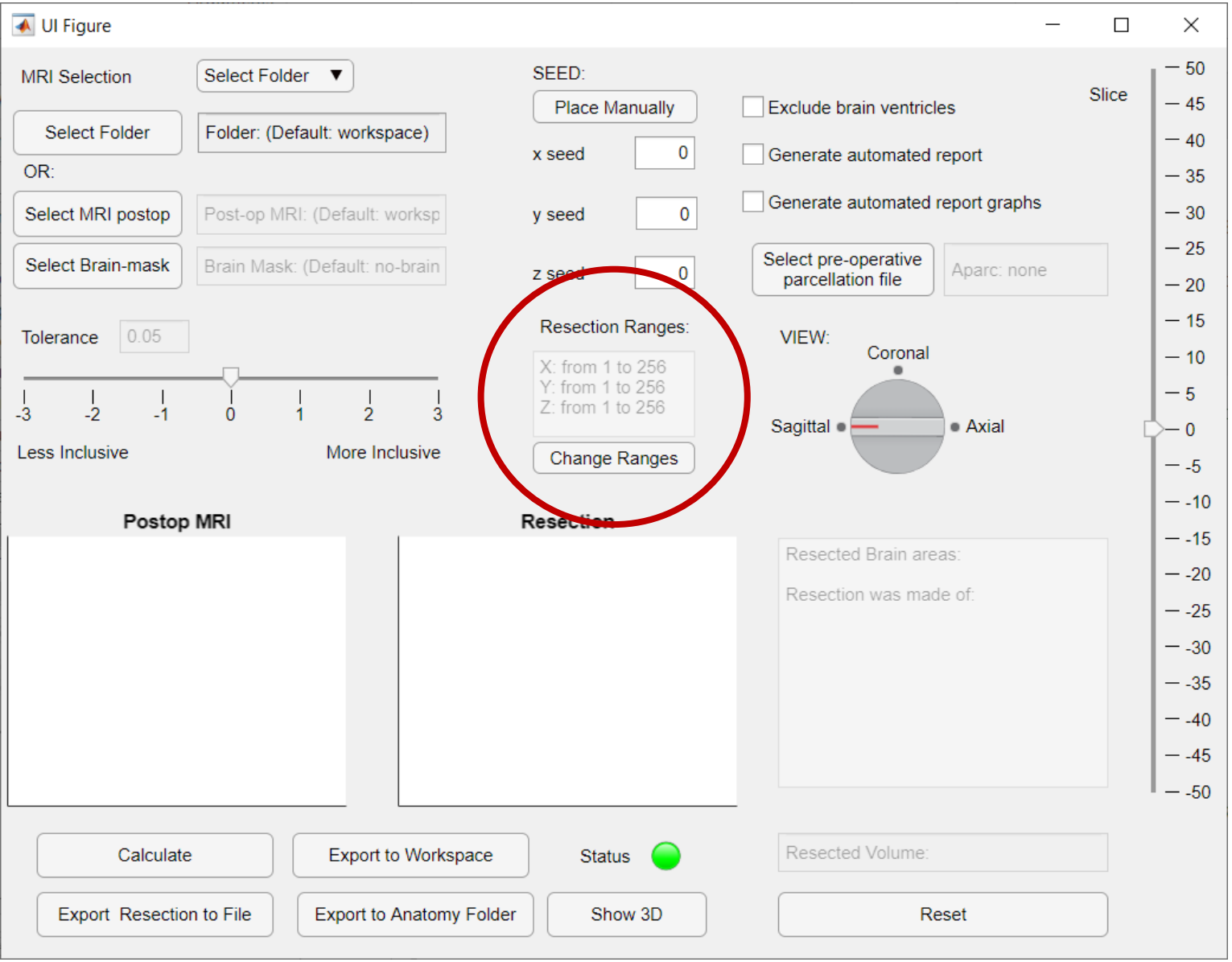
To place the seed (i.e. the point from which the resection model will start growing), change the x,y and z voxel coordinates by tiping, or click «select Manually». This point can be placed anywhere <u>within the resection cavity,</u> but we also suggest to ensure that the selected point has low intensity.

If you pressed the «Select Manually Button», a 3D MRI viewer of the post-operative MRI will appear. If not, there may be a problem with the brainstorm protocol or Brainstorm might not have been opened.
Scroll the 3D viewer until you see the resection and place the crosshairs in the middle of the resection. Then, click on the command window and press enter.
The coordinates will be updated automatically.

We suggest to write down the limits in which you expect the resection to be, so that you can click on «Change Ranges» and modify them.

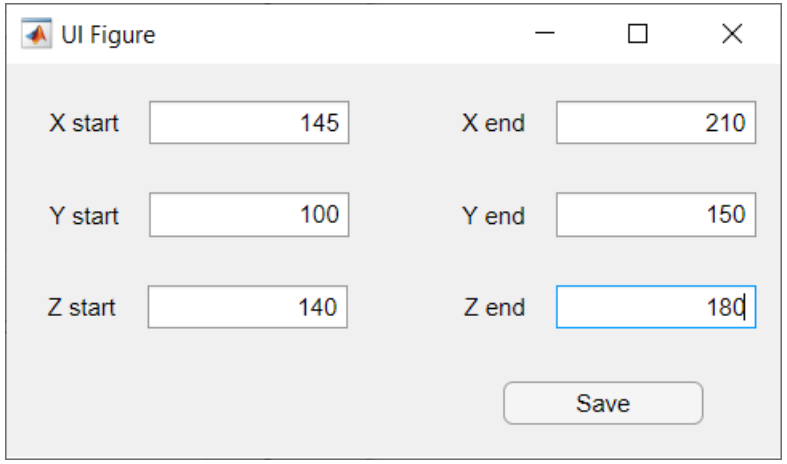


BrainResectionApp - 4: Range Selection (optional)

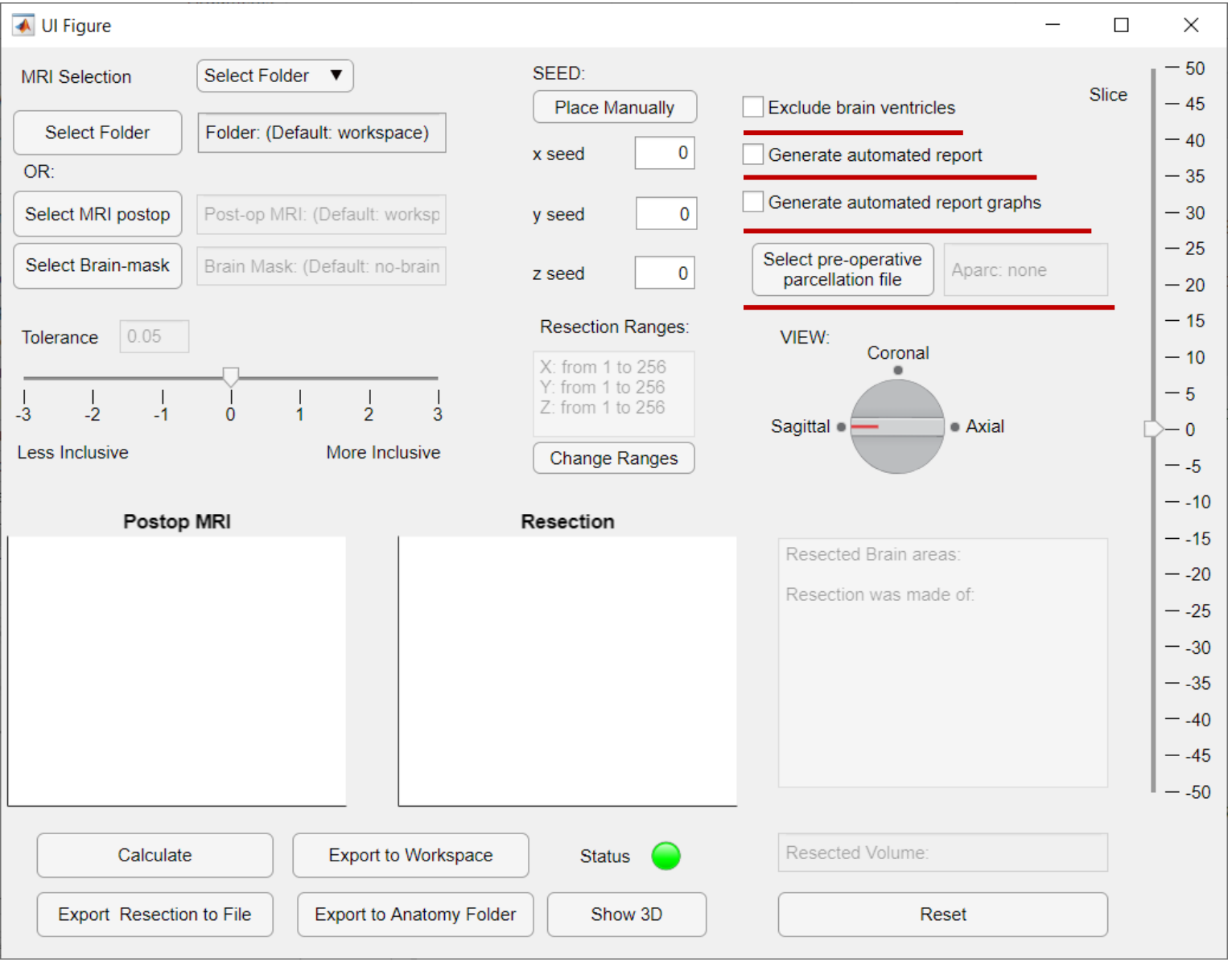


By clicking «Change Ranges», a popup window will appear, where the user can edit the resection ranges. This allows the definition a reduced ROI which could decrease the computational time or, in some cases, improve the performances. If not specified, resection ranges corresponds to the image dimensions (usually 256x256x256)

If the window does not appear, there may be a problem with the popup_window file, or it may be missing.



BrainResectionApp - 5: Ventricles exclusion



The app allows the user to exclude the growth of the resection model over the brain ventricles. This can be particularly important in resections such as in the temporal lobectomy

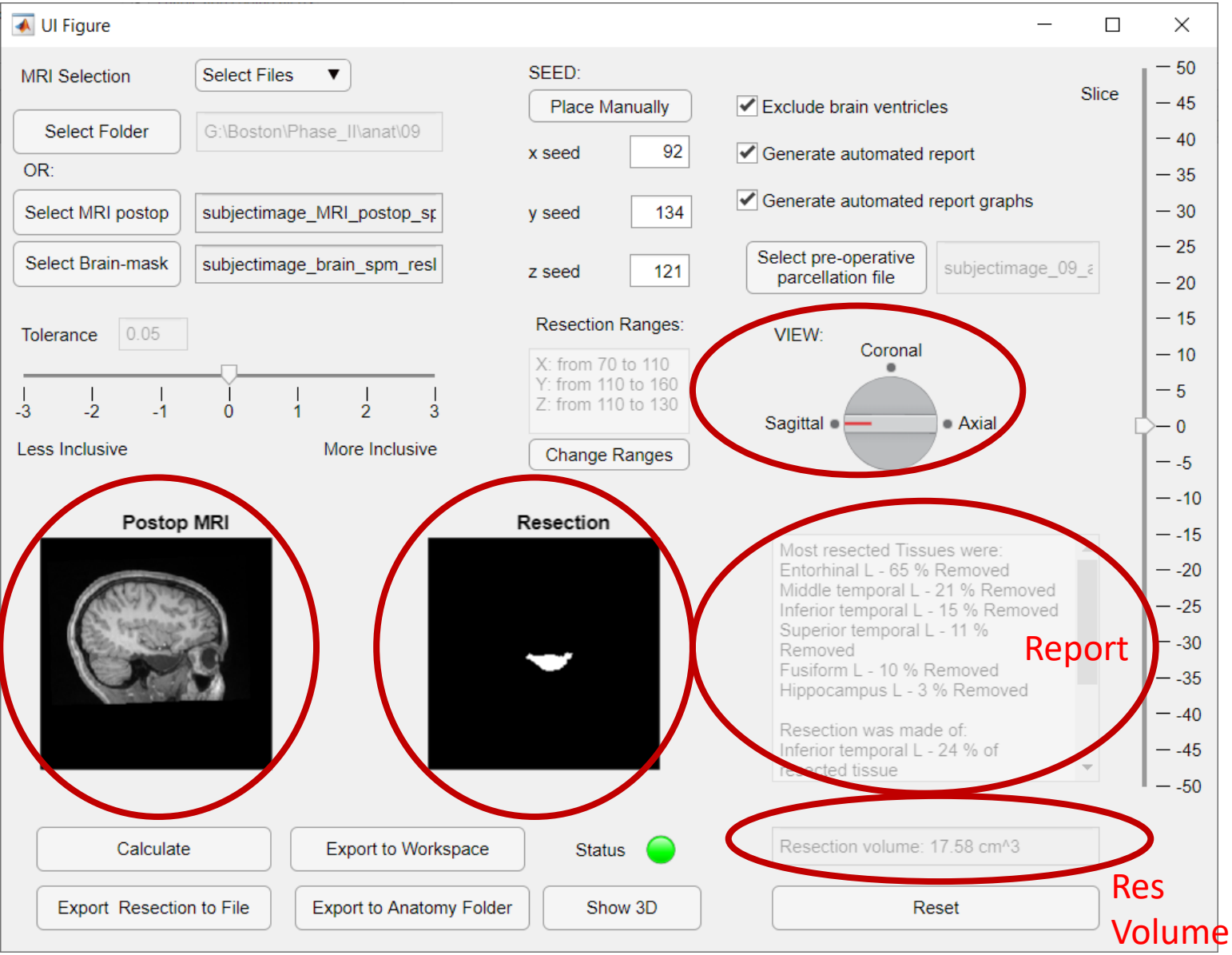
By selecting «exclude Ventricles», a popup window will appear for the user to select a preoperative segmentation or cortical parcellation file (if not already selected). Parcellations from Freesurfer, or segmentation files from SPM or Fieldtrip will work fine.

Select «Generate automated report» to get an anatomical report of the resection (you must select a preoperative cortical parcellation file if you have not already)

Select «Generate automated report graphs» to get graphs of the anatomical report (you must select a preoperative cortical parcellation file if you have not already)

To change the parcellation/segmentation file, click on «Select pre-operative parcellation file»

BrainResectionApp - 6: Results preview

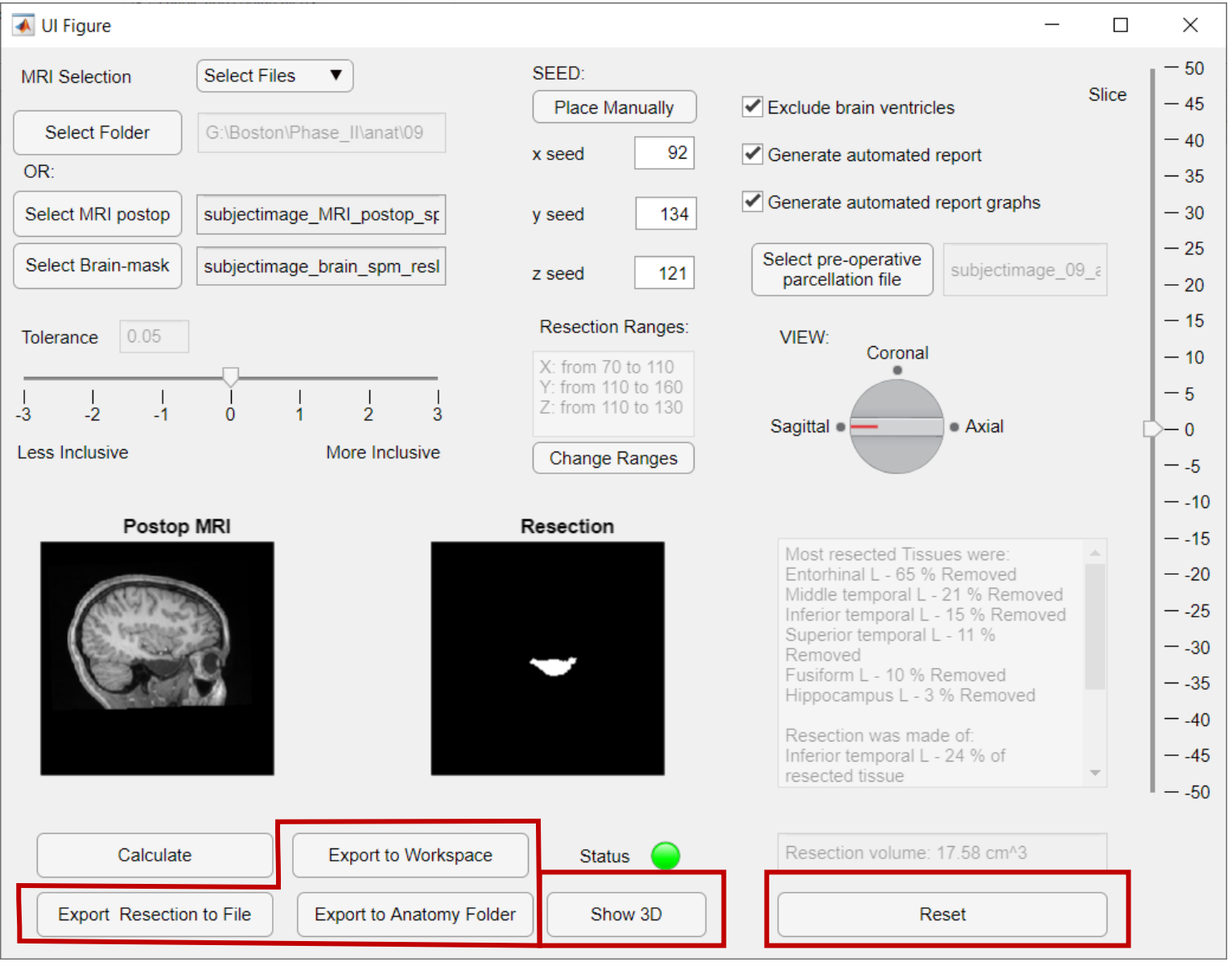


Click «Calculate» to have a preview of theoutput of the segmentation process. You will see the post-operative MRI (left), and the resection model (right).
Use the «Slice» slider on the right to change slice, or the VIEW Knob to change the MRI view.

On the right of the resection, there will be the anatomical report, showing both the most resected tissues (Top), and what the resection is made of (bottom).

Below the anatomical report there will be the resection volume in cm^3.

BrainResectionApp - 7: Export the results



If you are satisfied from the results, you can export the model and other info to workspace by selecting «Export to workspace». You can choose to use the scs or the voxel coordinates

You can also export the *.mat file of the model by selecting «Export Resection to File». This is suggested when the resection model has to be inserted in a brainstorm protocol: in this case the user has to select the patient's anatomy folder*[1].

If you want to save the resection model in the exact same patient's folder as the post-operative MRI, you can also select «Export to Anatomy folder».

It is also possible to visualize the 3D model through the Brainstorm 3D MRI viewer, by clicking on «Show 3D»

Click the «Reset» button to clean all the results and start over

*1 - This option will by-pass the import of the resection model. Just right click on the patient in the Brainstorm window, and select "Reload"

For any enquiry about the software please contact:

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