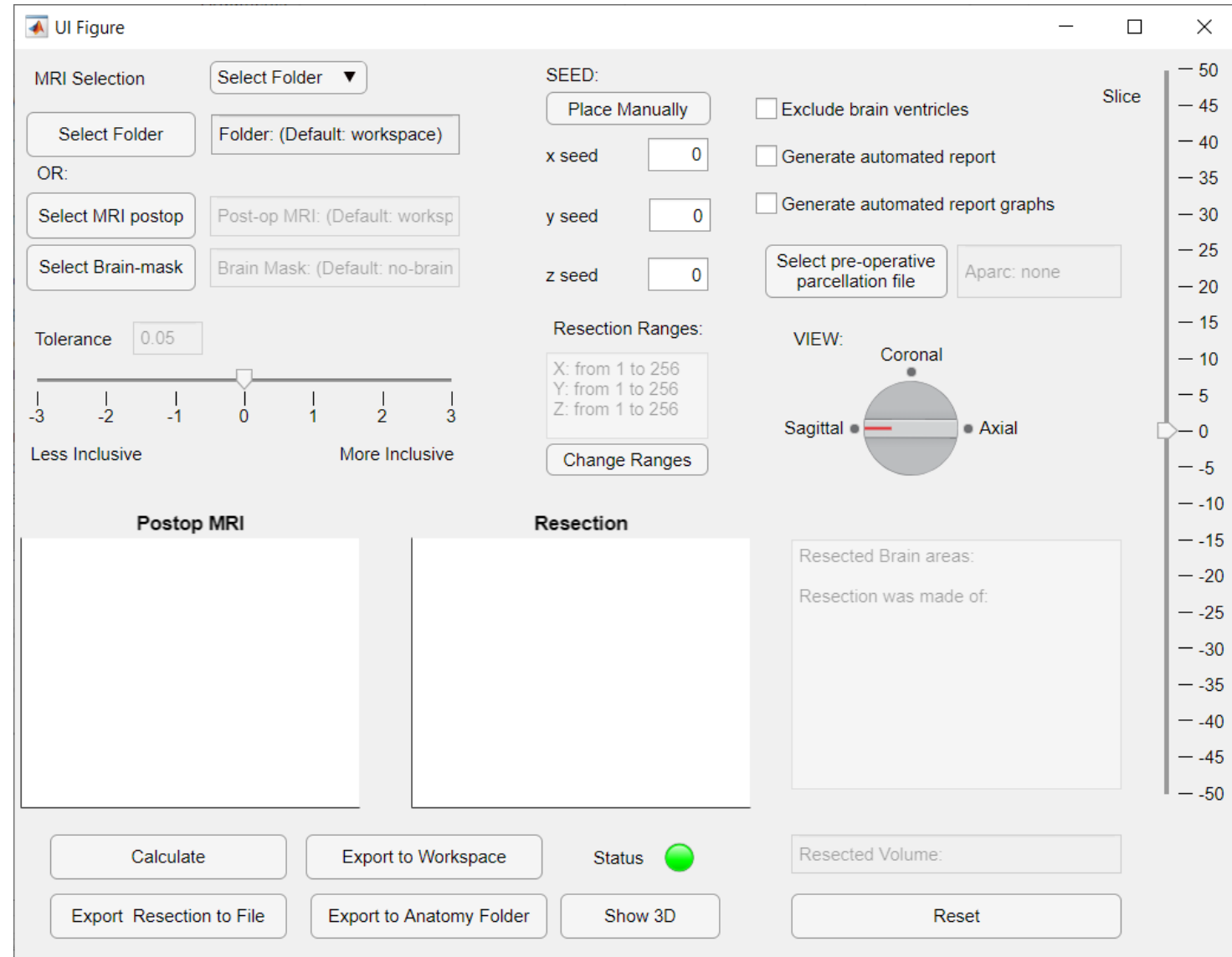


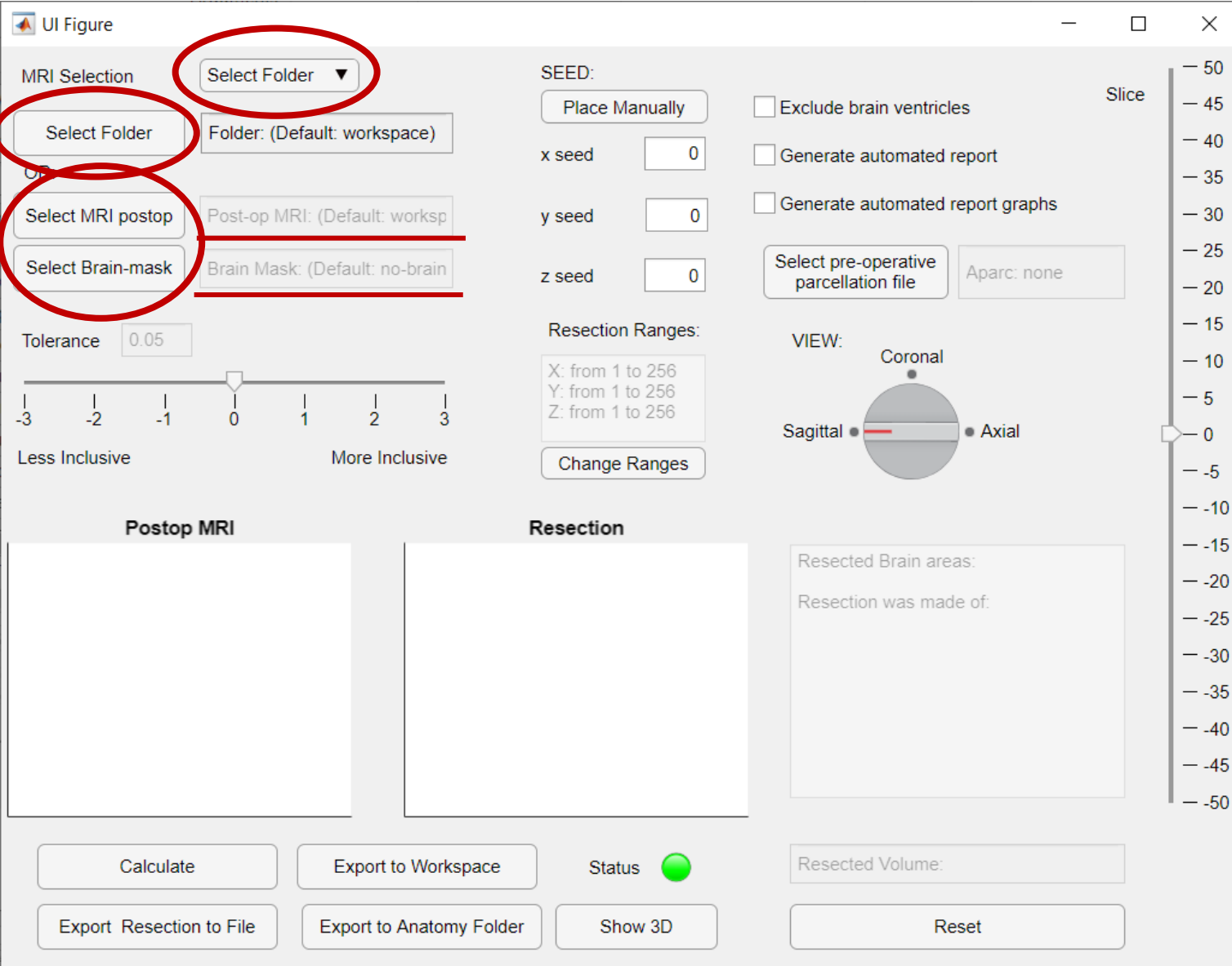
GUIDE: Resection Segmentation GUI

To start:

- Ensure that MATLAB appdesigner tool is installed and it is working on the machine by typing the command «appdesigner» in the command window
- Start Brainstorm, any protocol can be loaded
- Run resection_app.mlapp by double click or by using the «Open» button in appdesigner.
- If this is the first time you are using the GUI, click on the «Code View», and add an «addpath» line in the main app (anywhere between line 55 to 62) specifying the path where the GUI and the pop_up extension file are saved.
- Press the green Run button in the top left of the window
- You do not need to run popup_range.mlapp: the main app will do it for you if needed



HOW TO SELECT PATIENTS' MRIs



Two methods:

- Select the folder of the patient where the MRIs 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. If you want, you can change the names in line 513 and 517 (not recommended).

- 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.

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.

HOW TO SELECT METHODS AND TOLERANCES

The screenshot shows a software interface titled "UI Figure". It features several sections for user input and visualization. On the left, under "MRI Selection", there are buttons for "Select Folder", "Select MRI postop", and "Select Brain-mask", each with a corresponding text field. Below these is a "Tolerance" slider set to 0.05, with a red circle highlighting it. The slider has labels "Less Inclusive" on the left and "More Inclusive" on the right. In the center, the "SEED:" section includes a "Place Manually" button and input fields for "x seed", "y seed", and "z seed", all set to 0. Below this is the "Resection Ranges:" section with text boxes for "X: from 1 to 256", "Y: from 1 to 256", and "Z: from 1 to 256", and a "Change Ranges" button. To the right of the seed inputs are three checkboxes: "Exclude brain ventricles", "Generate automated report", and "Generate automated report graphs". Further right is a "VIEW:" section with a circular diagram showing "Coronal", "Sagittal", and "Axial" views, with "Sagittal" selected. Below this is a "Resected Brain areas:" section with a text box for "Resection was made of:". At the bottom, there are buttons for "Calculate", "Export to Workspace", "Export Resection to File", "Export to Anatomy Folder", "Show 3D", and "Reset". A "Status" indicator shows a green light. On the far right, a vertical "Slice" scale ranges from -50 to 0, with a slider handle at 0.

UI Figure

MRI Selection

Select Folder

Select Folder

Folder: (Default: workspace)

OR:

Select MRI postop

Post-op MRI: (Default: worksp

Select Brain-mask

Brain Mask: (Default: no-brain

Tolerance

0.05

Less Inclusive

More Inclusive

SEED:

Place Manually

x seed

0

y seed

0

z seed

0

Exclude brain ventricles

Generate automated report

Generate automated report graphs

Select pre-operative parcellation file

Aparc: none

VIEW:

Coronal

Sagittal

Axial

Resection Ranges:

X: from 1 to 256

Y: from 1 to 256

Z: from 1 to 256

Change Ranges

Postop MRI

Resection

Resected Brain areas:

Resection was made of:

Calculate

Export to Workspace

Status

Export Resection to File

Export to Anatomy Folder

Show 3D

Resected Volume:

Reset

Slice

-50

-45

-40

-35

-30

-25

-20

-15

-10

-5

0

-5

-10

-15

-20

-25

-30

-35

-40

-45

-50

Change the region growing tolerance value using the tolerance slide.

To be more inclusive (bigger resections) use higher tolerance values (slider to the **right**)

To be less inclusive (smaller resections) use lower tolerance values (slider to the **left**).

If you are not sure on the value to use, leave it at its default value.

SEED PLACEMENT AND RANGES pt1

UI Figure

MRI Selection Folder: (Default: workspace)

OR: Post-op MRI: (Default: worksp)

Brain Mask: (Default: no-brain)

Tolerance

Less Inclusive More Inclusive

SEED:

x seed

y seed

z seed

Exclude brain ventricles ☐

Generate automated report ☐

Generate automated report graphs ☐

Select pre-operative parcellation file

Resection Ranges:

X: from 1 to 256
Y: from 1 to 256
Z: from 1 to 256

VIEW: Coronal Sagittal Axial

Postop MRI

Resection

Resected Brain areas:

Resection was made of:

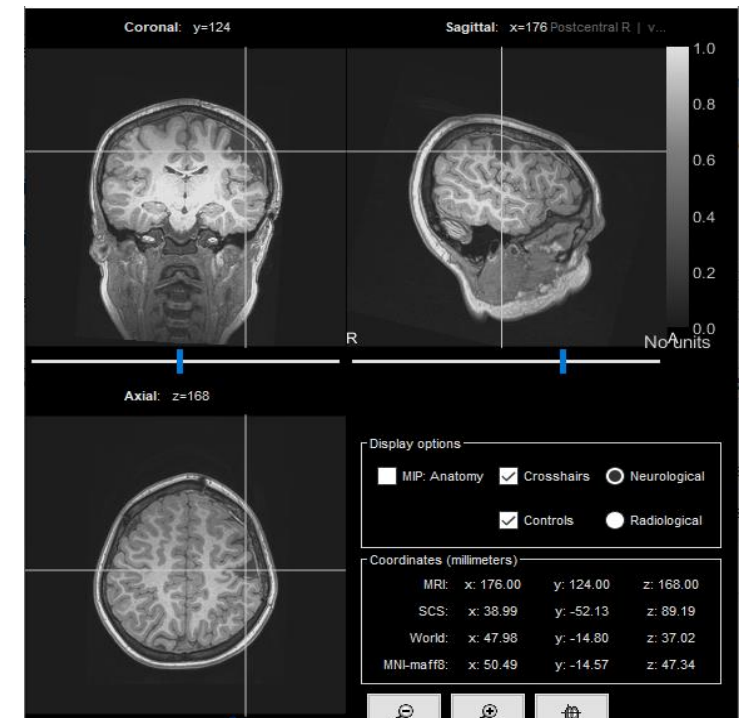
Calculate Status ●

To place the seed, change the x,y and z voxel coordinates by typing, or click «select Manually»

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.



SEED PLACEMENT AND RANGES pt2

The screenshot shows the 'UI Figure' window with various controls for seed placement and resection. The 'Resection Ranges' section is circled in red, showing default values: X: from 1 to 256, Y: from 1 to 256, and Z: from 1 to 256. Other visible controls include 'MRI Selection' (Folder, Post-op MRI, Brain Mask), 'Tolerance' (0.05), 'SEED' (Place Manually, x seed, y seed, z seed), 'Exclude brain ventricles', 'Generate automated report', 'Generate automated report graphs', 'Select pre-operative parcellation file', 'Aparc: none', 'VIEW' (Coronal, Sagittal, Axial), 'Postop MRI', 'Resection', 'Resected Brain areas', 'Resection was made of:', 'Resected Volume:', 'Calculate', 'Export to Workspace', 'Status' (green dot), 'Export Resection to File', 'Export to Anatomy Folder', 'Show 3D', and 'Reset'.

By clicking «Change Ranges», a popup window will appear, where the user can edit the resection ranges. When 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. Did you add the «addpath» line ? (see slide 2)

The screenshot shows the 'UI Figure' popup window for editing resection ranges. It contains input fields for X start (145), X end (210), Y start (100), Y end (150), Z start (140), and Z end (180). A 'Save' button is located at the bottom right.

VENTRICLES EXCLUSION AND % REPORTS

The screenshot shows the 'UI Figure' application window. It features a top toolbar with standard window controls. The main interface is divided into several sections:
1. **MRI Selection:** Includes a 'Select Folder' dropdown, a 'Select Folder' button, and a text field showing 'Folder: (Default: workspace)'. Below this is an 'OR:' section with 'Select MRI postop', 'Post-op MRI: (Default: worksp', 'Select Brain-mask', and 'Brain Mask: (Default: no-brain'.
2. **Tolerance:** A slider ranging from -3 to 3, currently set at 0.05, with labels 'Less Inclusive' and 'More Inclusive'.
3. **SEED:** A 'Place Manually' button and three input fields for 'x seed', 'y seed', and 'z seed', all set to 0.
4. **Resection Ranges:** A section with 'X: from 1 to 256', 'Y: from 1 to 256', and 'Z: from 1 to 256', and a 'Change Ranges' button.
5. **VIEW:** A circular view selector with 'Coronal', 'Sagittal', and 'Axial' options.
6. **Options:** Three checkboxes: 'Exclude brain ventricles', 'Generate automated report', and 'Generate automated report graphs'. Below these are buttons for 'Select pre-operative parcellation file' and 'Aparc: none'.
7. **Postop MRI and Resection:** Two large empty rectangular areas for displaying results.
8. **Bottom Bar:** Contains buttons for 'Calculate', 'Export to Workspace', 'Status' (with a green indicator), 'Export Resection to File', 'Export to Anatomy Folder', 'Show 3D', 'Resected Volume:', and a 'Reset' button.
9. **Right Panel:** A vertical 'Slice' scale from -50 to 0, with a slider handle at 0.

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

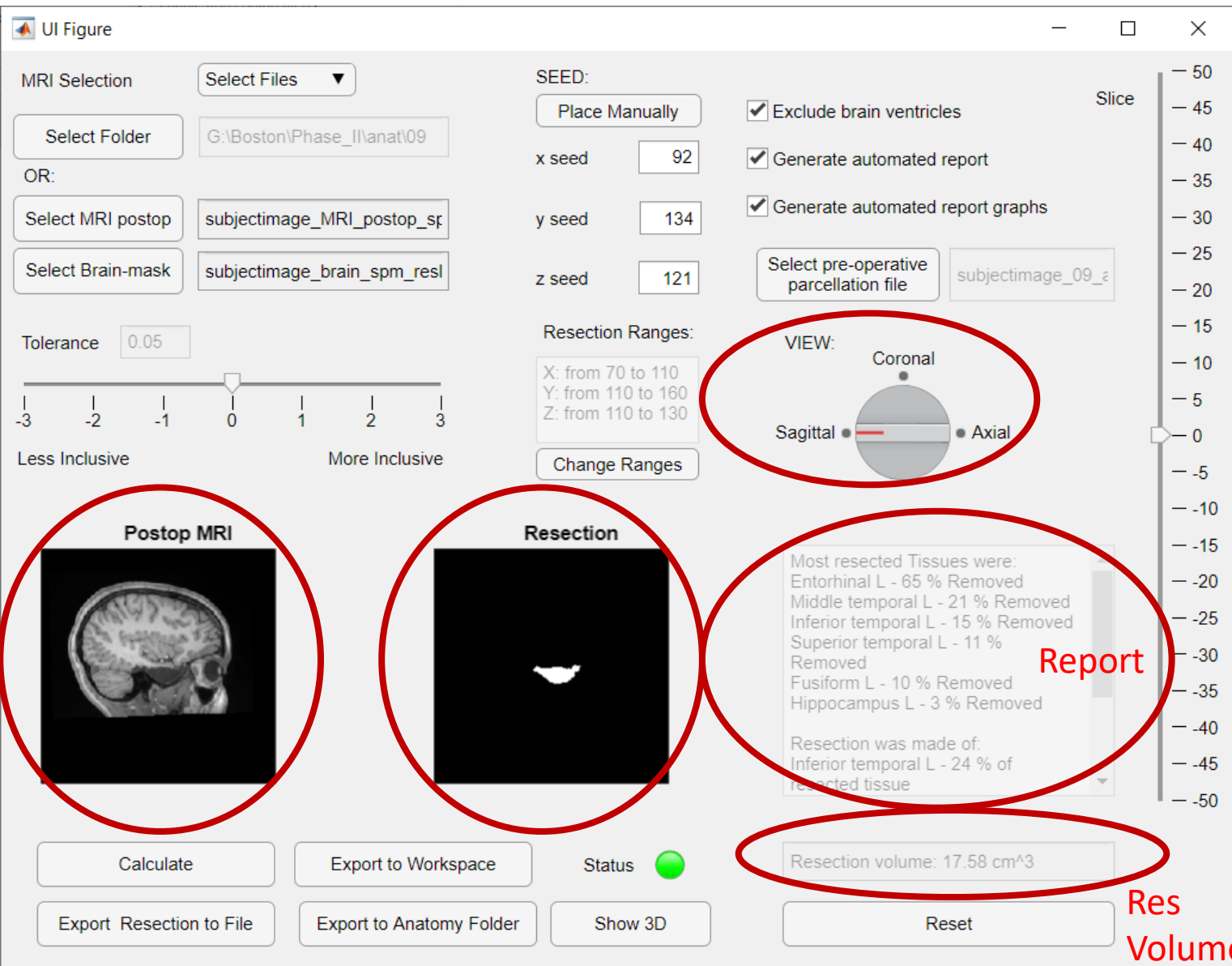
By selecting «exclude Ventricles», a popup window will appear for the user to select a preoperative segmentation or cortical parcellation file (if not already selected). Parcellations from Freesurfer, or segmentation files from SPM or Fieldtrip will work fine.

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»

RESULTS



Click «Calculate» to have a preview of the segmentation process. You will see the post-operative MRI (left), and the resection (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 .

EXPORT THE RESULTS

UI Figure

MRI Selection: Select Files ▼

Select Folder: G:\Boston\Phase_II\anat\09

OR:

Select MRI postop: subjectimage_MRI_postop_sf

Select Brain-mask: subjectimage_brain_spm_resl

Tolerance: 0.05

SEED:

Place Manually

Exclude brain ventricles ☒

Generate automated report ☒

Generate automated report graphs ☒

Select pre-operative parcellation file: subjectimage_09_ε

VIEW: Coronal, Sagittal, Axial

Resection Ranges:

X: from 70 to 110

Y: from 110 to 160

Z: from 110 to 130

Change Ranges

Postop MRI

Resection

Most resected Tissues were:

- Entorhinal L - 65 % Removed
- Middle temporal L - 21 % Removed
- Inferior temporal L - 15 % Removed
- Superior temporal L - 11 % Removed
- Fusiform L - 10 % Removed
- Hippocampus L - 3 % Removed

Resection was made of:

- Inferior temporal L - 24 % of resected tissue

Calculate

Export to Workspace

Status: ●

Resection volume: 17.58 cm³

Export Resection to File

Export to Anatomy Folder

Show 3D

Reset

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

... Or you can 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.

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

For any enquiry about the software please
contact:

roberto.billardello@gmail.com

Eleonora.Tamiglia@childrens.harvard.edu