

Creating a Cortical Model for Imaging consist of :

1. Defining a closed bounding surface surrounding the cortex.
2. Defining upper and lower pixel amplitudes of cortical gray mater.

It is assumed that Volumetric MRI data that includes the entire brain has been imported into MEG Tools.

## **DEFINING THE BOUNDING SURFACE**

**STEP 1.** Choose the anterior and posterior limits of the bounding surface. The final model will contain x,y,z oriented dipoles at approximately 3500 cortical locations, such that each location represents activity within a radius of approximately 5 mm. Therefore, the anterior and posterior limits of the cortical model should be 5 to 7 mm from slices in which cortex is observed, (SEE FIG 1).

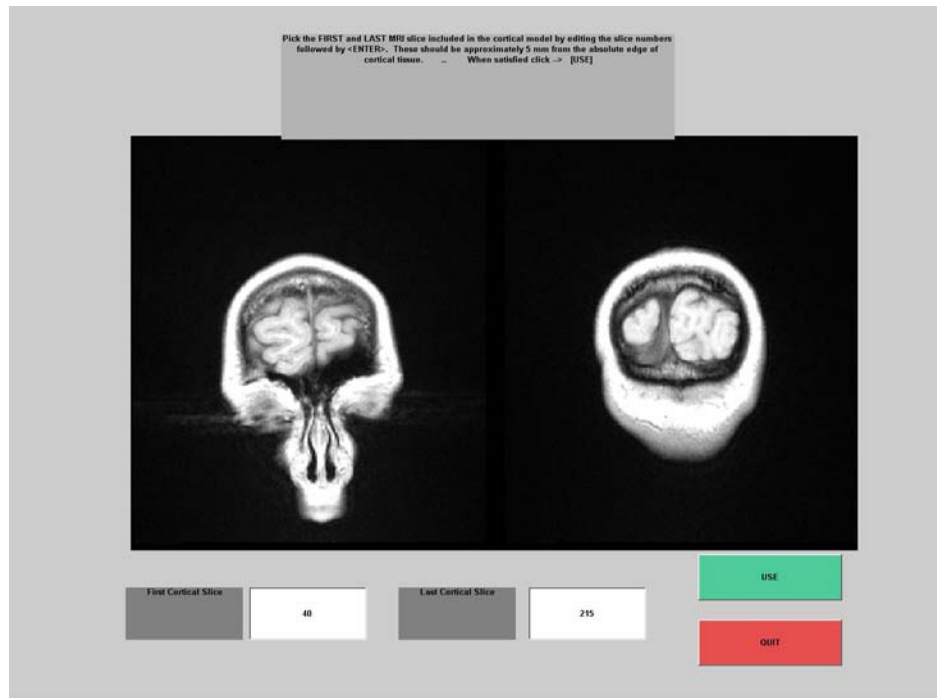


Fig 1 Choose front and back slices that define the anterior and posterior limits of the cortical model. These should be approximately 5 to 7 mm (5-7 slices with 1mm voxel dimensions) within the last slice with any visible cortex.

Step 2. On a set of 5 slices define the outer limits of the surface of the volume containing only cortical structures. Do not include skull, brain stem, or neck muscle within this volume. Using the mouse, depress and hold the left mouse button and draw around the cortical structures (SEE FIG 2, 3, 4). **IMPORTANT:** When completing the loop around the cortical region, **YOU MUST OVERLAP THE STARTING POINT**. Similarly, if you release the mouse button you can restart drawing provided you overlap the point where drawing was stopped. The REDO button is used to redo the boundary of the slice if a mistake is made. Use the RESTART button to restart the entire module.

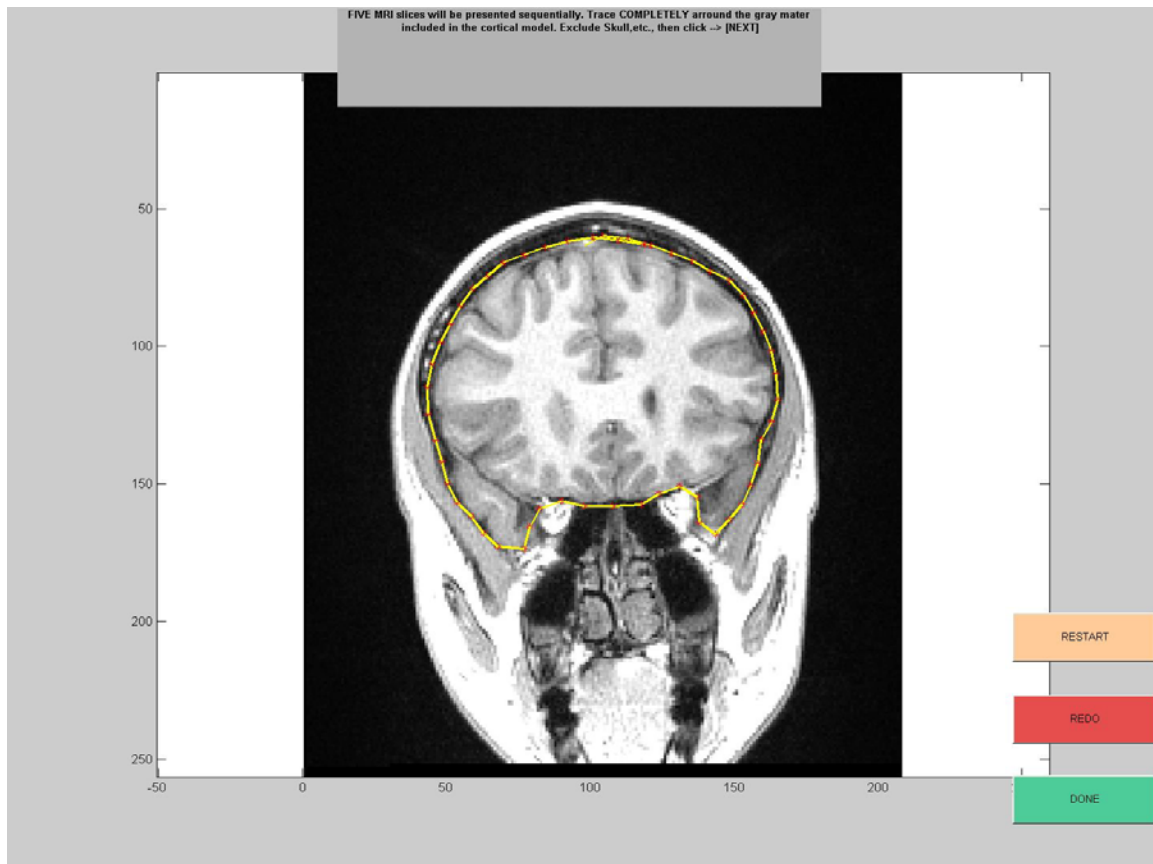


Fig 2. Example of defining the boundary of the region of brain containing cortical structure. Drawing can be started anywhere on the boundary. The first and last line segments must overlap.

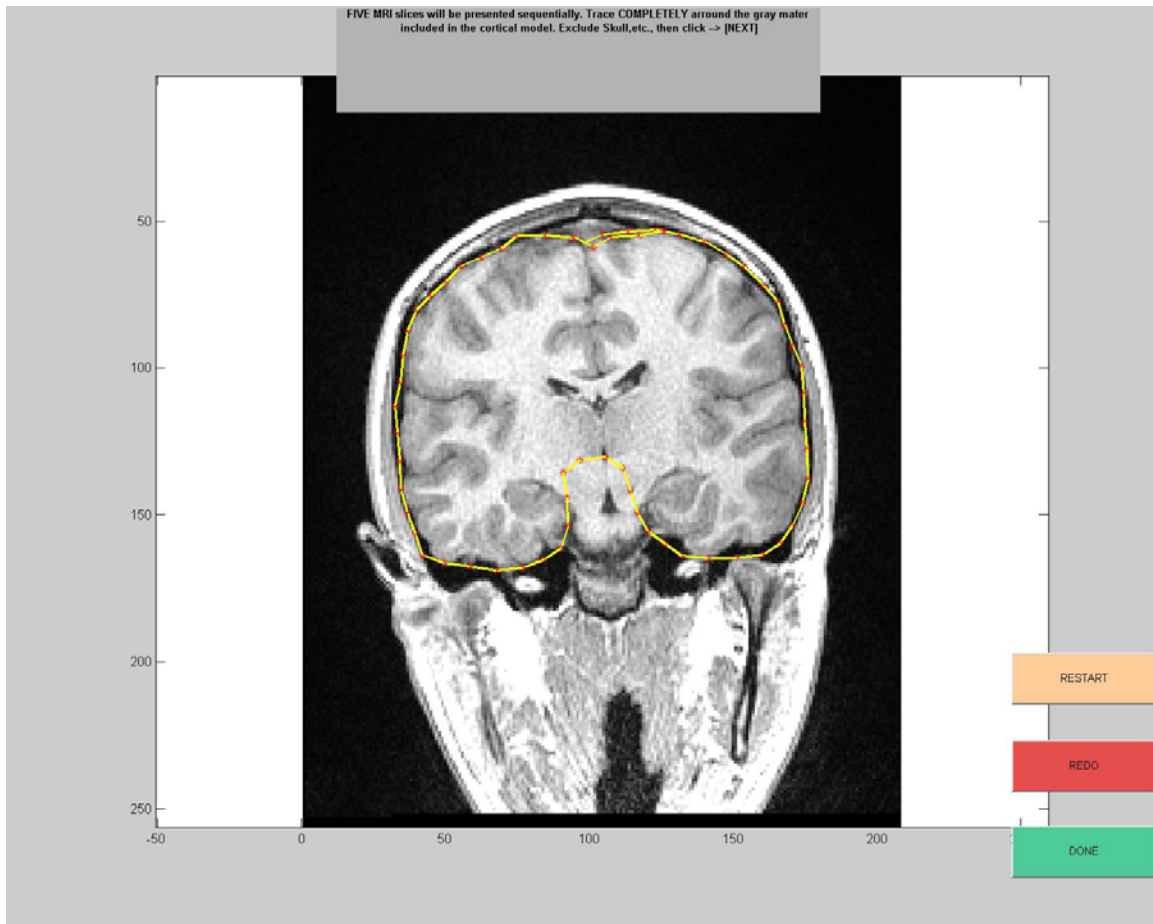


Fig 3. Another example of defining the boundary of cortical structure.

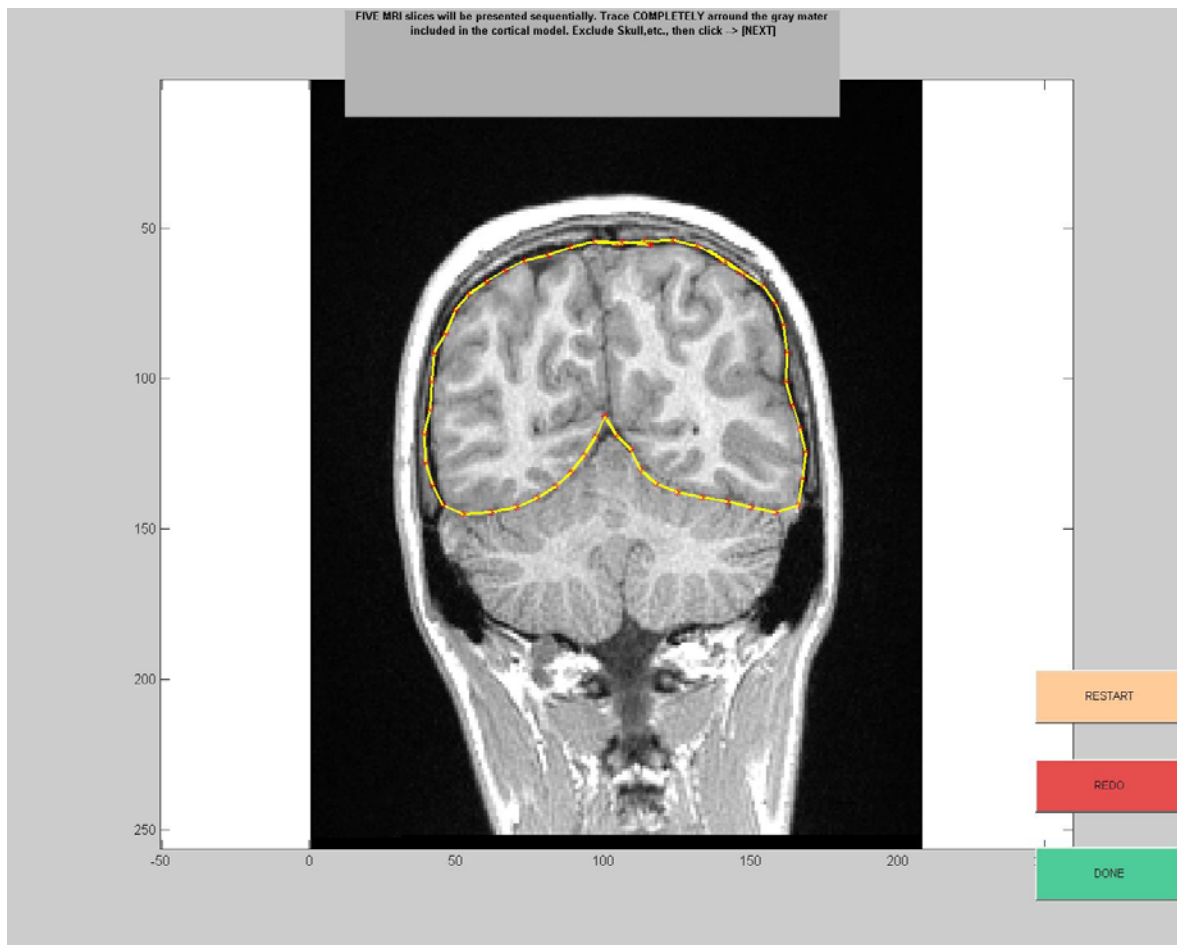


Fig 4 In this example, the cerebellum has been excluded.

## **DEFINE PIXEL AMPLITUDE LIMITS OF GRAY MATER**

The slider is moved to change the pixel amplitudes that are colored RED on a central slice of the cortex. In Fig 5, the slider has been adjusted such that red pixels correspond to the outer border of the gray mater. In Fig 6, the slider has been adjusted until the RED pixels correspond to gray mater at the border with white mater. The final cortical model is constructed by scanning all MRI volumetric brain slices for the location of pixels with amplitudes between these limits that also lie within the volume surrounded by the surface boundary previously constructed. Next, 3500 cortical model locations are distributed such that each location represents the same amount of cortical gray mater pixels (Fig 7).

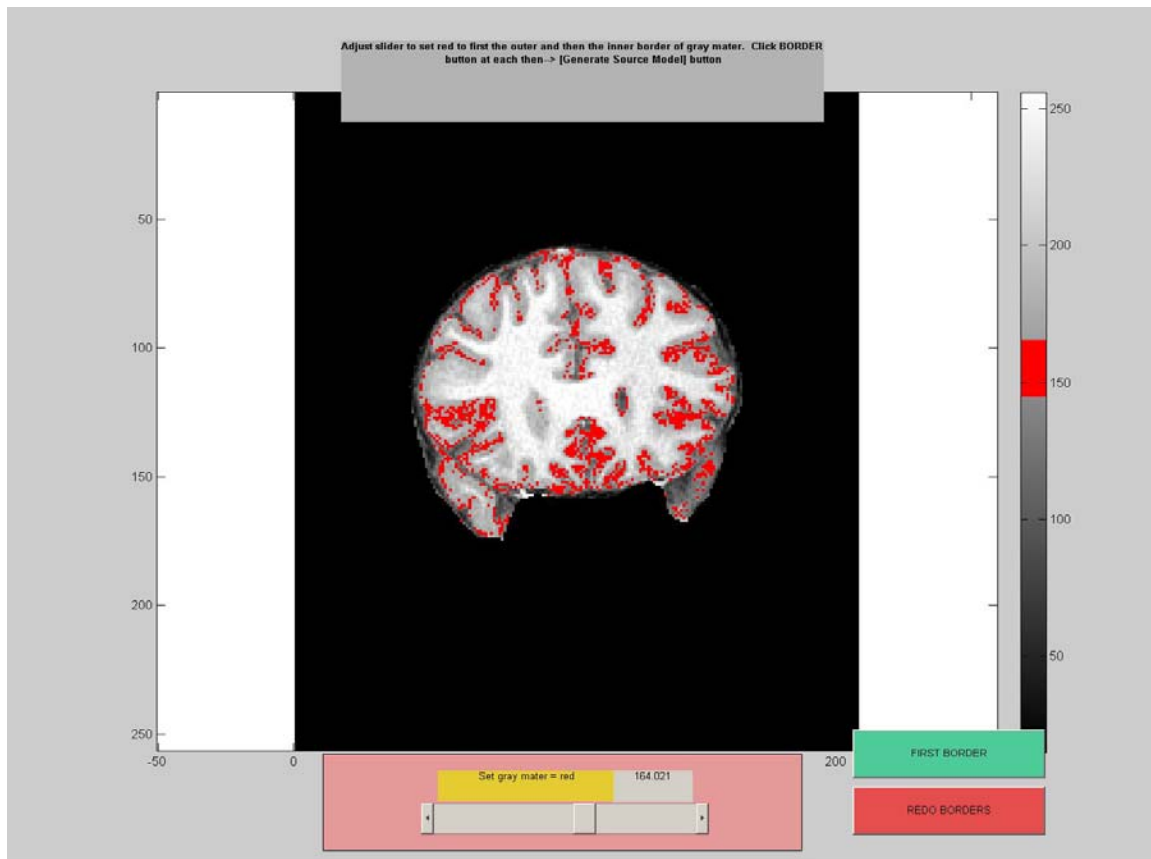


Fig 5 Define one of the limits of pixel amplitudes that correspond to cortical gray mater. This amplitude corresponds to cortical gray mater adjacent to outer cortical surface.

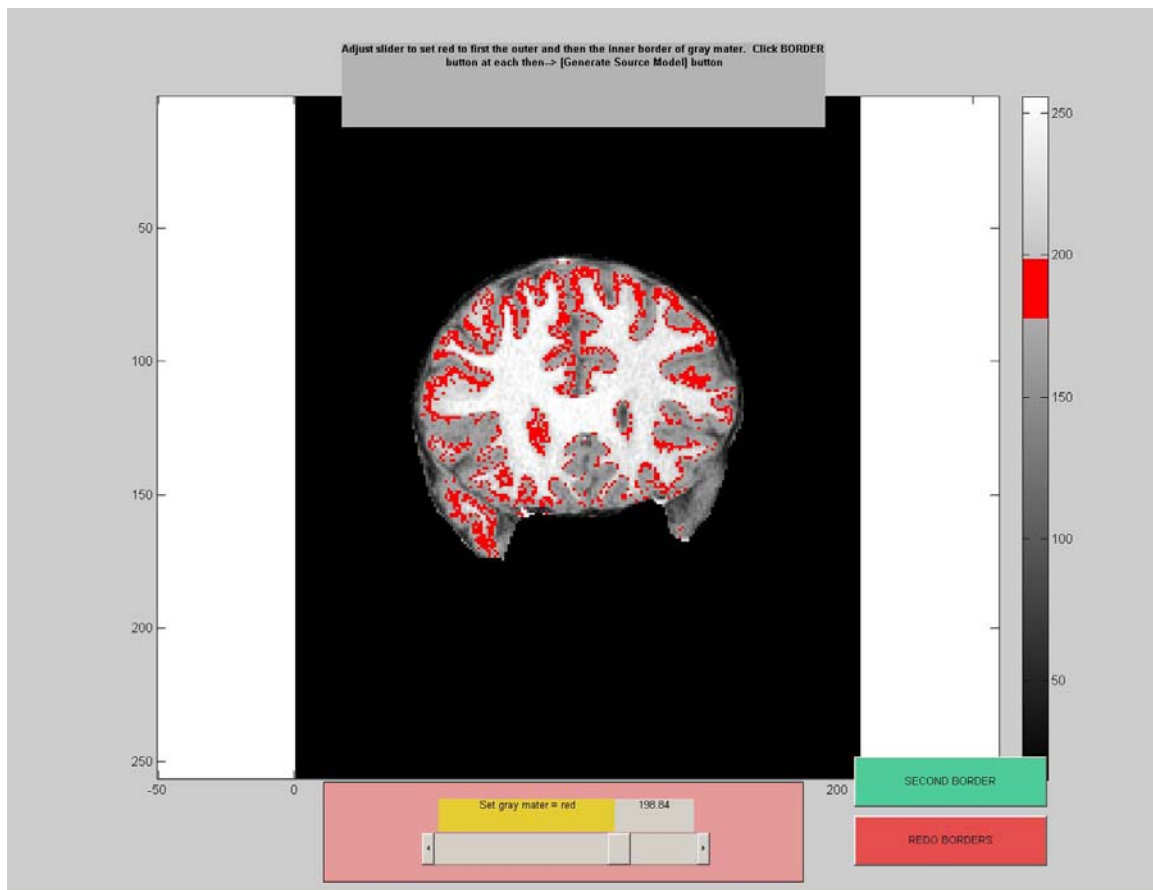


Fig 6 Define the other (maximum or minimum) limit of cortical gray mater. In this figure, the limit corresponding to gray mater adjacent to white mater has been selected. Note: Either limit may be defined first.

After creating the model 5 slices of the model that demonstrate the match between the distribution of cortical model locations and corresponding gray matter are displayed. These should be reviewed to determine if the cortical model was created correctly. The orientation of gray matter may appear upside-down or left-right reversed. This is not a problem. Rather, check that only gray matter is included and the cortical model locations are distributed properly.

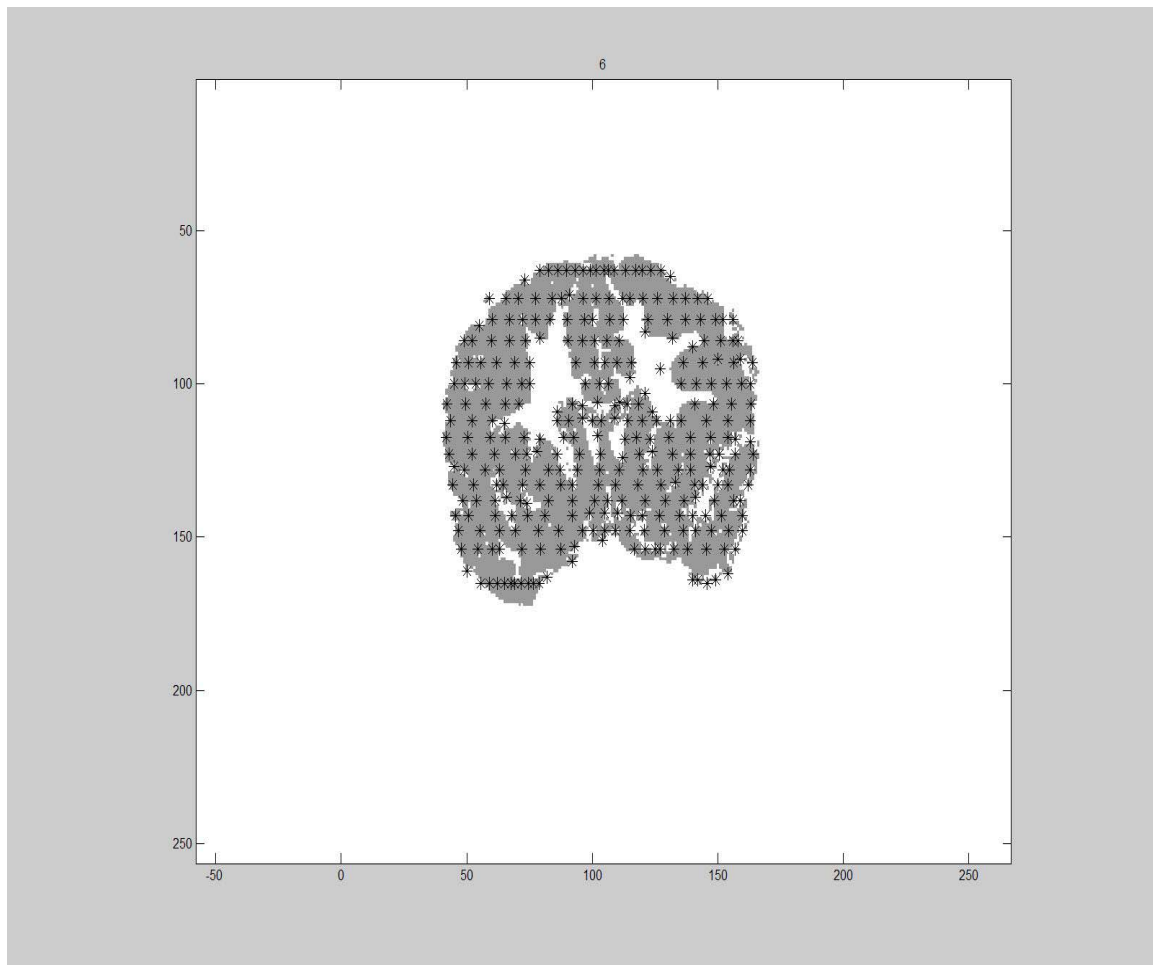


Fig 7 One of the 5 slices containing gray matter and corresponding cortical model locations. Skull surface or white matter should be seen.