

**ANALYSIS OF MAGNETIC RESONANCE IMAGING
DATA USING ANALYZE:**

MTL WIDTH

DONNA ROSE ADDIS

**DEPT. OF PSYCHOLOGY, UNIVERSITY OF TORONTO
TORONTO WESTERN RESEARCH INSTITUTE**

ACKNOWLEDGEMENTS

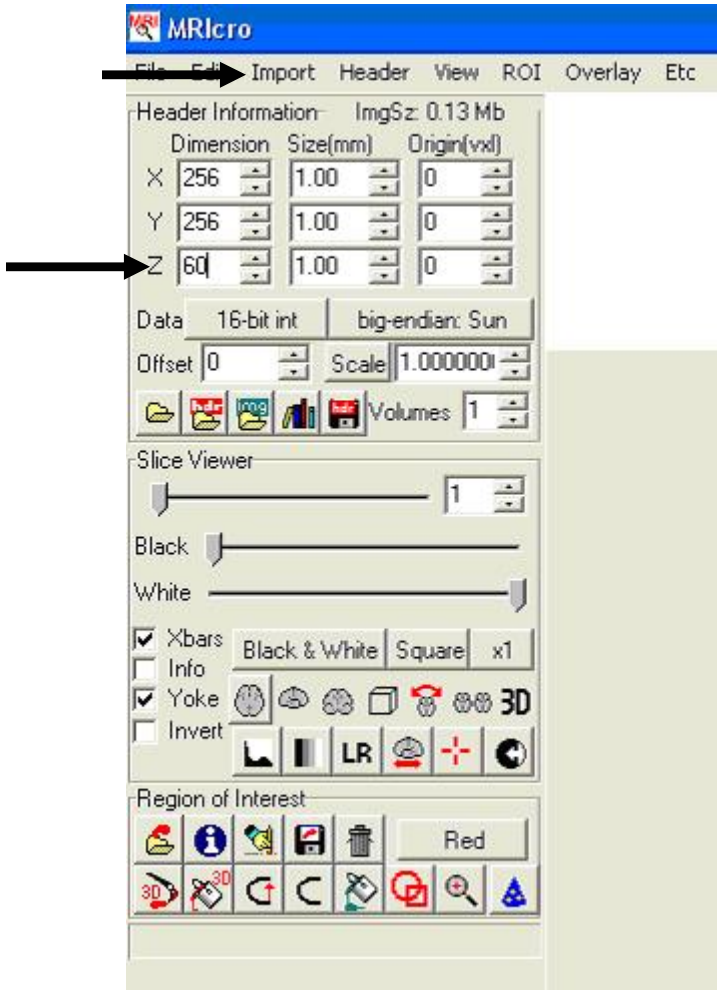
Information contained herein has been compiled from my own SPM99 experience at Toronto Western Research Institute, that of others in the Functional Imaging Research and Evaluation (FIRE) group at the University Health Network, the SPM email list (<http://www.fil.ion.ucl.ac.uk/spm/>) and helpful websites (such as that of Kalina Christoff, <http://www-psych.stanford.edu/~kalina/SPM99/>). Also, thanks to our over-worked physicist, Adrian Crawley, for all of his help.

ANALYZE: MTL WIDTH

1. Converting dicom images to Analyze using MRicro

Download MRicro from: <http://www.psychology.nottingham.ac.uk/staff/cr1/mricro.html>

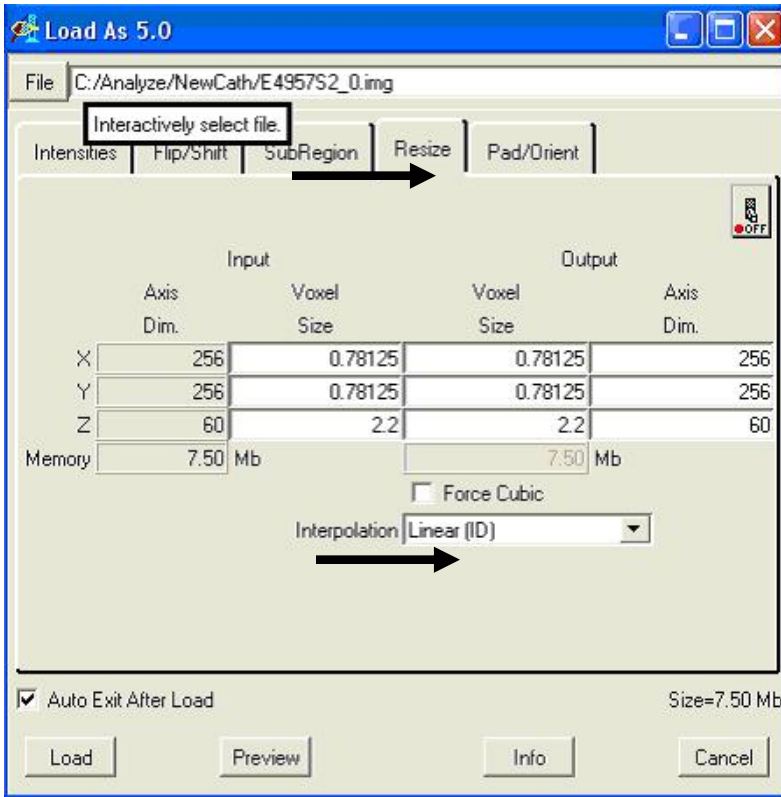
- Run MRicro
- Change Header information so Z is the number of slices (e.g., 60)



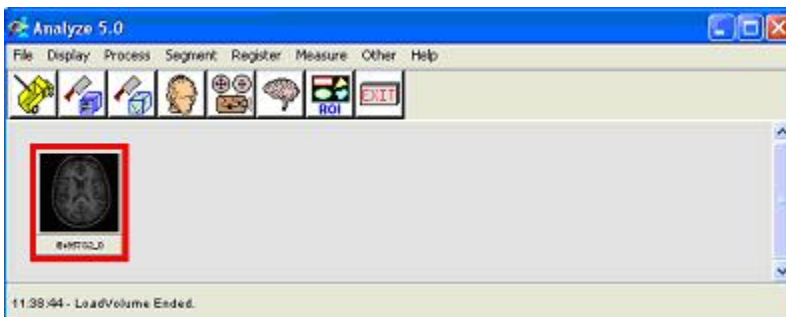
- Click **Import, Convert Foreign to Analyze**
- Check "**Flip Left/Right**"
- Number of files should read the same as number of slices you have (60)
- Hit **Select** (note that you only have to select the first file in the series of 60)
- Choose Location for saving the new Analyze files

2. Loading images in ANALYZE

- Click **File, Load As** to get the loading window
- Click on **File** to choose the img file you want to load

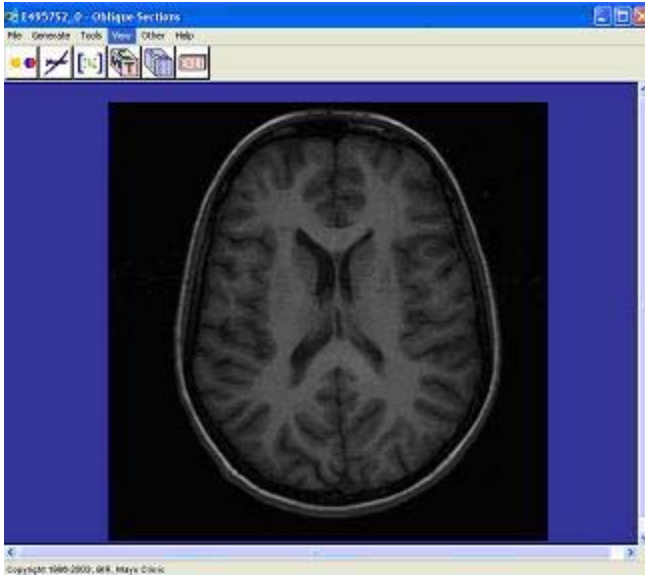


- Click on the **Resize** Tab.
- Check that the Voxel sizes are the same for x,y,z. If not, click **Force Cubic** and this should change them so they are.
- Note down the voxel size so you can calculate sizes later.
- Check the **Preview**. Here, you want to check that the image is loading the way it was acquired (ie, for axials that it loads from inferior to superior).
- Then click **Load**
- Once you have something loaded in Analyze, it is placed in the main window.
- To do something with that image, click on it to highlight it with a red box, and then choose from the toolbar what you wish to do.





3. AC-PC Aligning Images

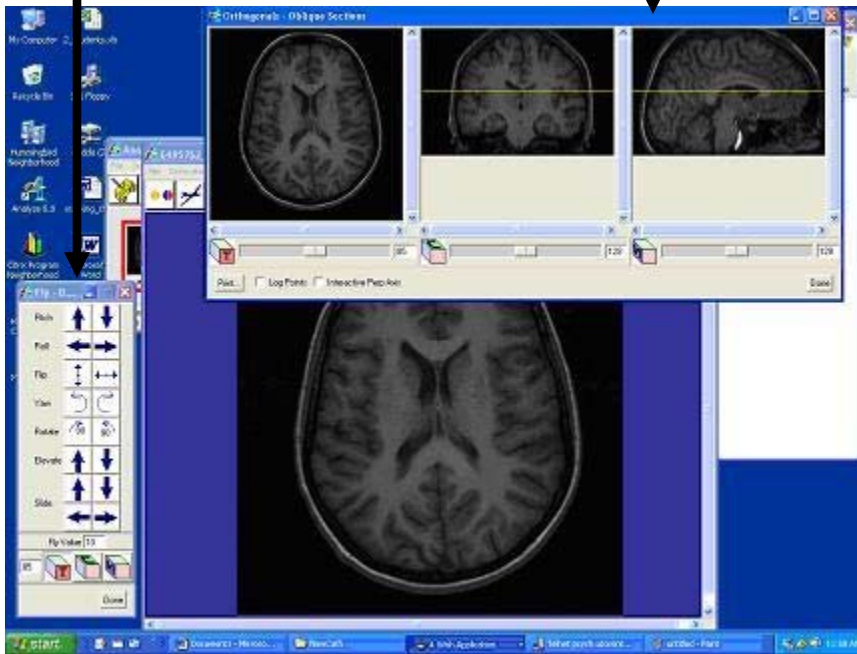
- First choose **Oblique sections**. This will load the highlighted image so you can AC-PC align it.



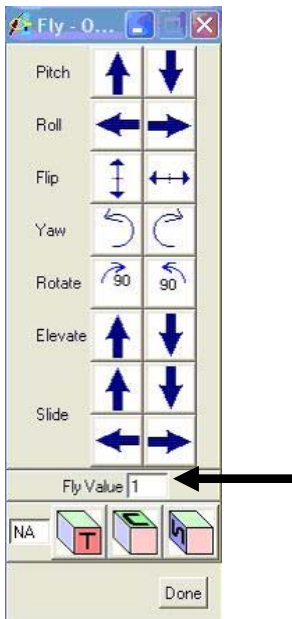
- To change the intensity, select
- Slide the bar to the left for a brighter intensity.



- Select **Fly**  which opens the alignment menu, and  open the 3d viewer.

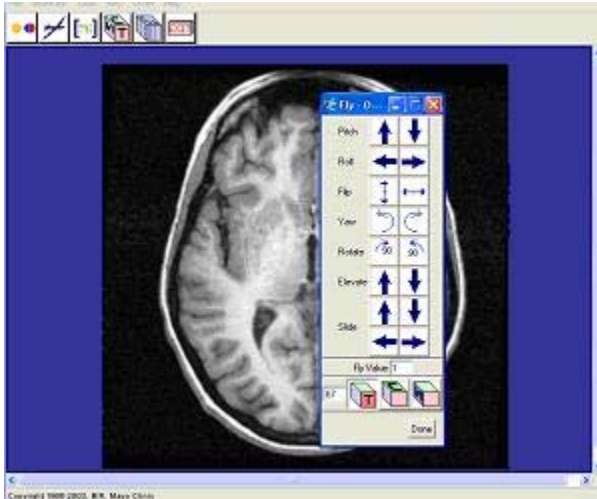


- The **Fly value** (on Fly menu) indicates how many degrees or slices it will move.



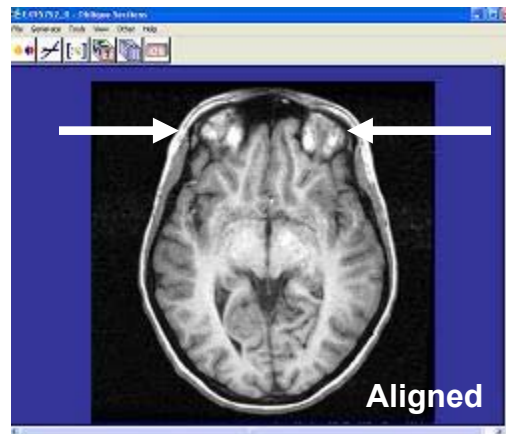
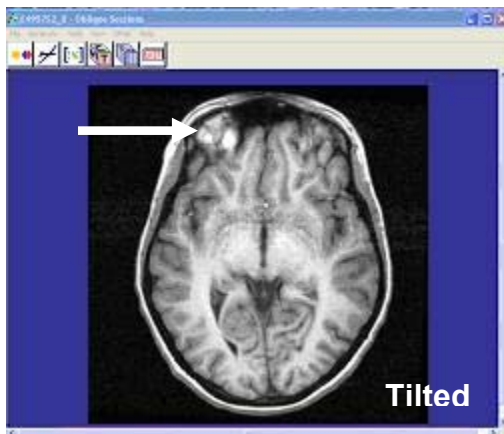
Aligning the midline

- You have to align the **YAW** (ie, make sure the midline is straight).
- You can actually use the long line of the menu as a ruler and press yaw (with fly value of 1) to change the alignment until it is straight.



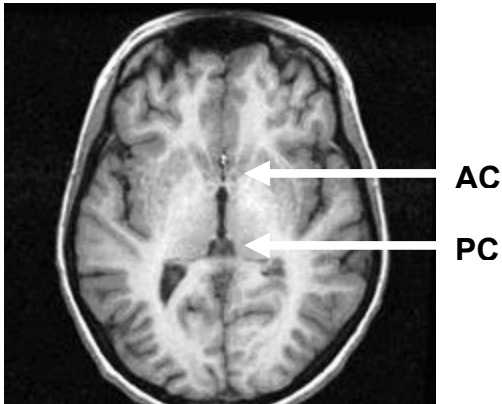
L-R alignment.

- Using the **ELEVATE** arrow buttons on the fly menu, move down through the slices until you come to the eyes. Check if one eye appears before the other. This will indicate that the L-R alignment is off.
- Using the **ROLL** buttons, adjust until the eyes appear at the same time. Double check lower down with the optic nerve.
- If the optimal alignment is in between a roll movement (ie, when you roll 1 the left eye appears first, when you roll 1 the other way the right eye appears first), always take the LEFT eye as appearing first.

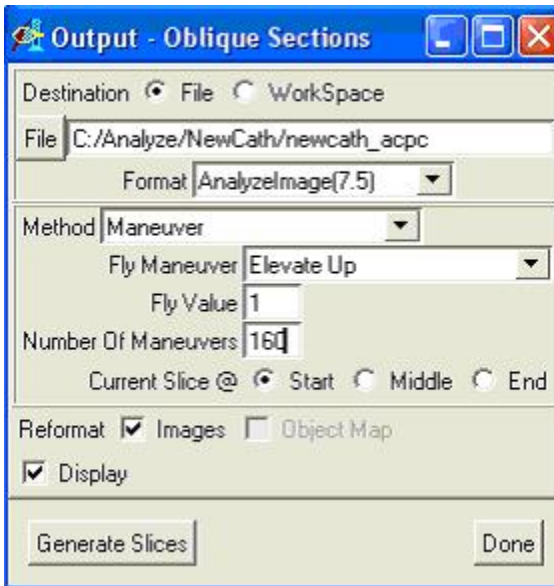


AC-PC alignment

- Uses the 3D brain windows.
- Right hand click on the sagittal and click on **track** to turn it off.
- Click on **Lines** to turn it on.
- Change the **size** (double) so you can zoom in on the sagittal.
- Using the **PITCH**, orient the line until in the main oblique window (with large axial image) you can see both the AC and PC in the same slice. You may also need to **ELEVATE** up and down to see this. Try to get it on the top of the PC and the centre of the AC (where the bottom of the U is flattest).





- Once all of this has been done, save these changes.
- Click **File** (on main oblique window), **Output**.



- Check Destination: **File**
- Name the file: ***SubjectName_acpc***
- Select Format: **Analyze 7.5**
- Method: **Maneuver**
- Fly Maneuver: **Elevate Up**
- Fly Value: ***1*** (so you save every slice)

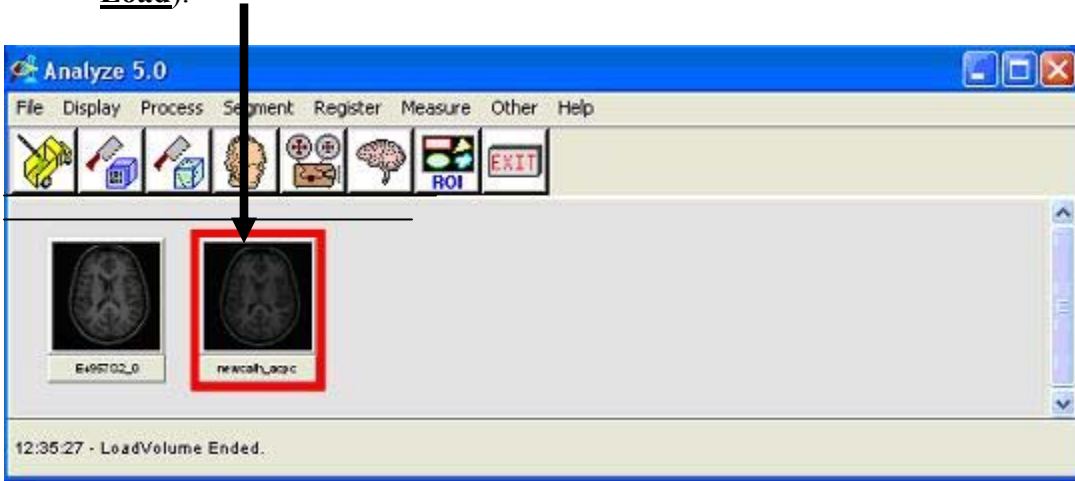
- Number of maneuvers: ***Enter number of maneuvers***. This is the number of fly values to get from the very bottom of your image to the top, so you save all the slices. To determine this, go to the very bottom of your image on the main oblique window (using the elevate arrows), you should be at the cerebellar tonsils of the bottom of your image if you did not acquire images this inferiorly. Change the fly value to **160**, and elevate up. If you reach the top of your image (ie, above the dura), this is the number of maneuvers you have to enter. If it is wrong, elevate back down, change fly value and try again. Once you have it, return to the most bottom point.
- Current slice @: **Start** (because you have elevated back down to the bottom, and you have said your fly maneuver is Elevate Up).
- **Generate Slices**.
- Click **Done** when it has finished.


Saving the matrix of transformations

- You can also save a record of the changes you have made, by saving the Matrix.  
- Then at a later time, you can load the raw images, apply the matrix and it will be AC-PC aligned.
- Save matrix with file name: ***SubjectName_acpc***

4. MTL alignment for the LEFT MTL

- On the main Analyze window, Load the ac_pc aligned image you just created (using, **File, Load**).



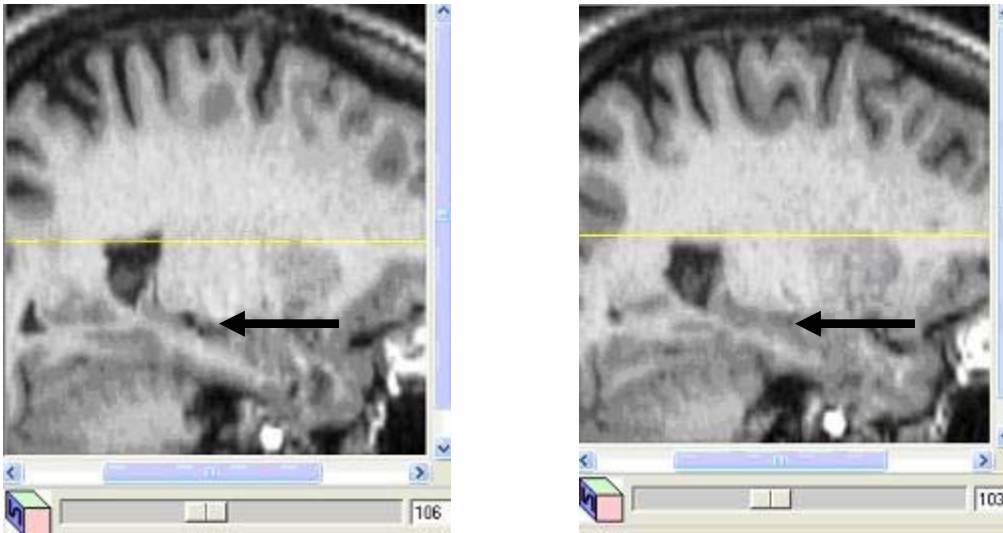
- Highlight this image in red (as above)
- Click on the **Oblique Sections** button.  This will open it so you can align it to the MTL.
- Open the fly menu and 3D viewer.
- Adjust fly value to *1*.
- Right click on Sagittal; turn off **Track**, turn on **Lines**, and zoom in the **size**.
- Note that when the slice number is around 130, you are probably at the centre slice.



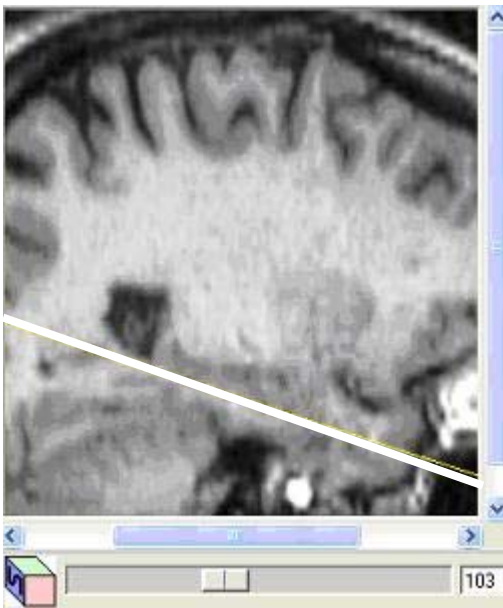
← **Slice number**


- When you want to move further more lateral in the left hemisphere, decrease the value by sliding the bar along (if, in your slices, left is left, otherwise it is the opposite).

- For MTL alignment, move laterally until you reach the first slice where the gap in the hippocampus body no longer shows.



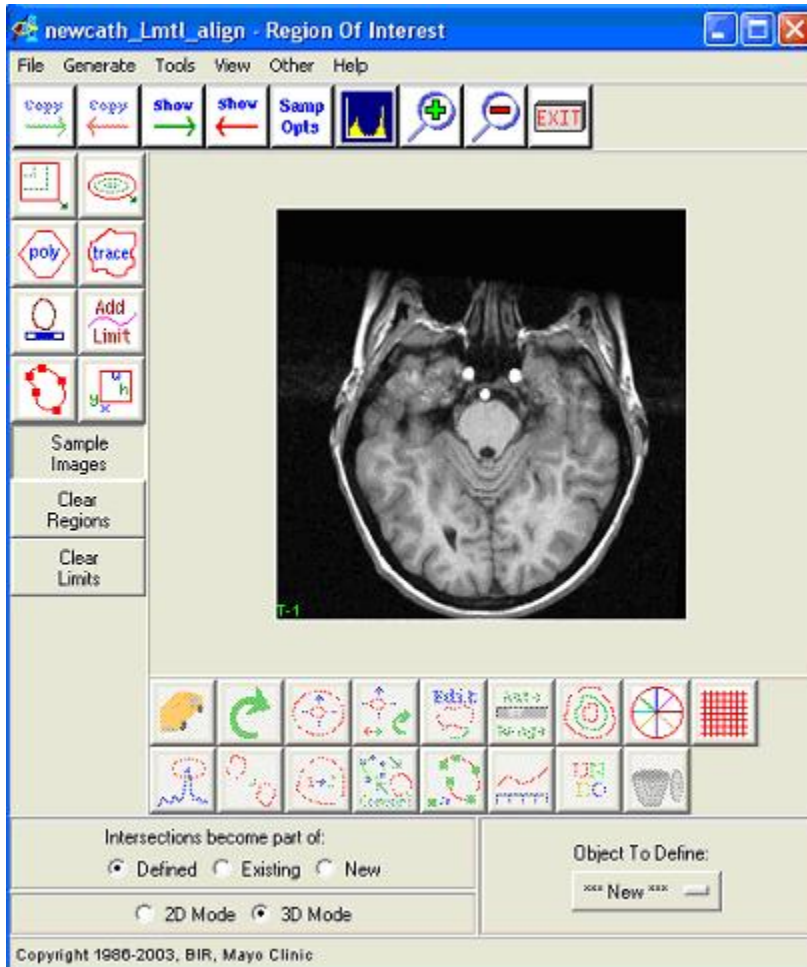
- Using the **PITCH** and **ELEVATE** line up the yellow line with the bottom of the hippocampus. If the bottom line of the grey matter is a W or inverted U shape, line it up with the bottom points of the W or inverted U.



- Save the matrix, which can be later applied to the ac_pc, aligned file for that subject 
- Filename: ***SubjectName_LMTLalign*** (as this is aligned to the Left MTL)
- To save the file, go to **File, Output**
- Save as you did for the AC-PC aligned image, but this time when selecting the number of slices to save, use elevate to get below the MTL and the elevate up about 20 or 30 slices and see if you're above the MTL. If you are, enter that number of slices as the number of maneuvers in the Output window, and don't forget to elevate back down to below the MTL before you save it.
- Filename: ***SubjectName_LMTL***

5. Determining the Inter-Colliculus Sulcus (ICS)

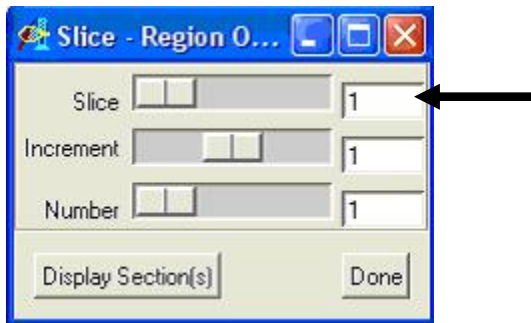
- In the main Analyze window, highlight the MTL_aligned image. Click on **ROI**.



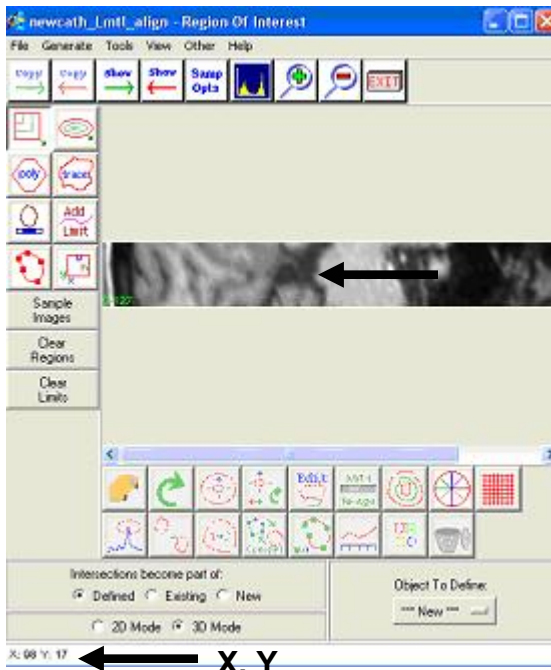
- Change intensity of image, by clicking **View**, **Intensities**, **Loaded Volume**.
- You need to view the image in the Sagittal orientation. To do this, click: **Generate**, **Orientation** and you get this little window




- The image will look black, as you are way out of the brain (laterally). So you need to move in towards the midbrain so you can see the ICS. Click **Generate**, **Slice** to get a little window that allows you to slide through the slices.

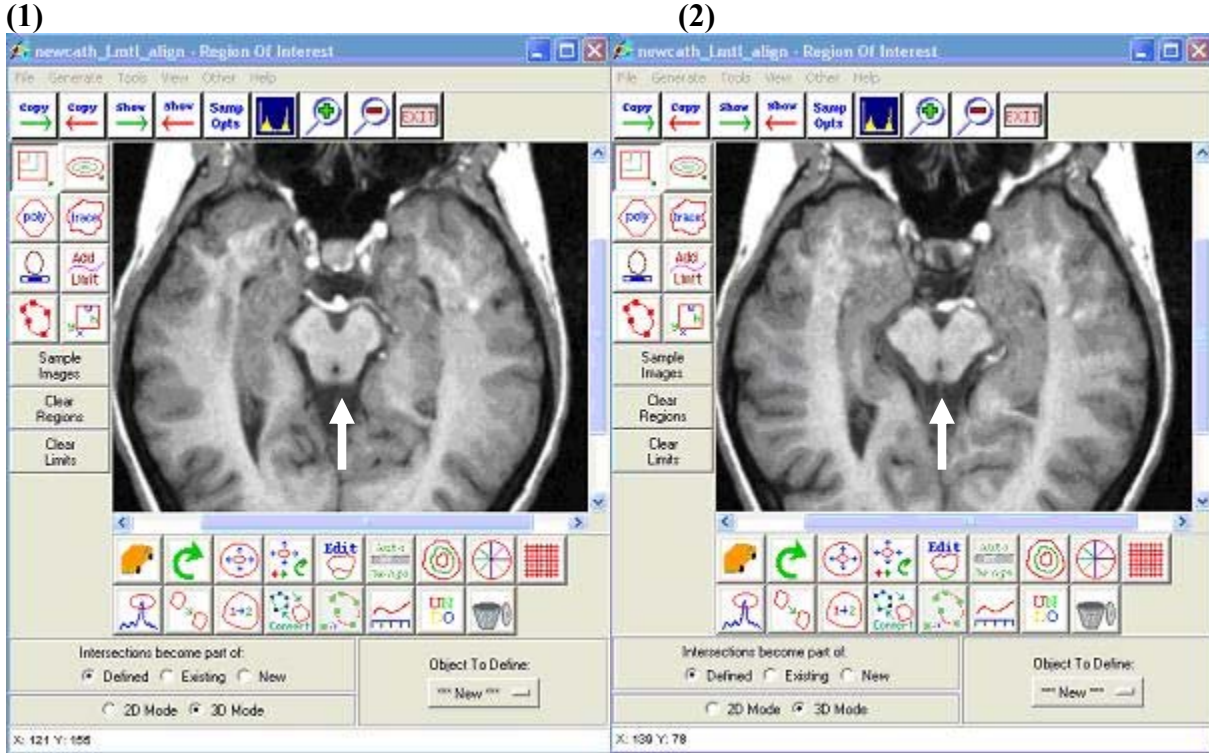



- Also, zoom in using the magnifying glass so you can better see the ICS.
- Move to the slice where the LEFT colliculi look the bumpiest.



- Click on **Rectangle**.  As you move your arrow over the image, an X and Y co-ordinate will be at the bottom of the screen. Place the arrow at the point of the sulcus, and note the Y co-ordinate (e.g., 17).

- Change the view to axial (Click **Generate, Orientation** and check **Transverse**).
- Slide along to slice 17.
- Check that the midbrain where the colluli are is pretty flat (as in **1**; as it is the sulcus, it should be). Move one slice up and one down to check that this is the case (**2**). At the point that it is flattest is the one you should take. (**1**)

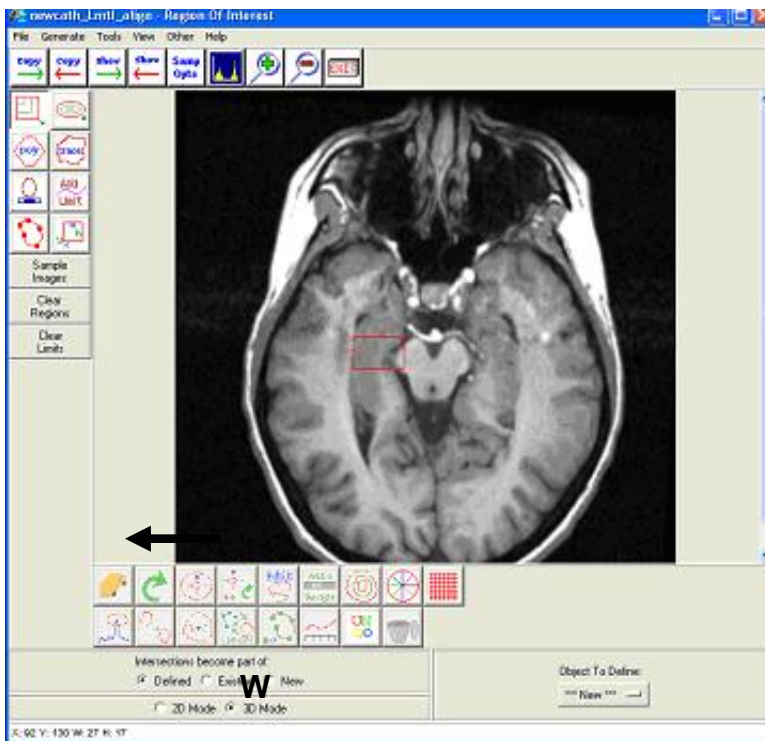


- This is the slice you will do your hippocampal width measurements at.
- On this screen, the Y is your anterior/posterior co-ordinate, and X is your left-right co-ordinate.
- Make sure that **Rectangle**  is still selected so you can draw lines.

6. Anterior LEFT MTL width

- To do your first measurement, go to the most anterior point of the midbrain and **note down the Y**.
- Move across to the left MTL and at that Y value; draw a line to measure the MTL.
- Note it is easier to see what you are doing if you draw it as a rectangle with only a thin line where you are measuring (1). You can then close the rectangle to form a line if you wish to keep the image.
- As you draw the line, hold down the mouse and when you have covered the width of the MTL, note down the W value it gives you at the bottom (with the X and Y co-ordinates). This W value is only there until you release the mouse button.
- Take down the W value (**width in voxels**) and multiply by the size of the voxels (e.g., .78mm) to give you the width in mm.

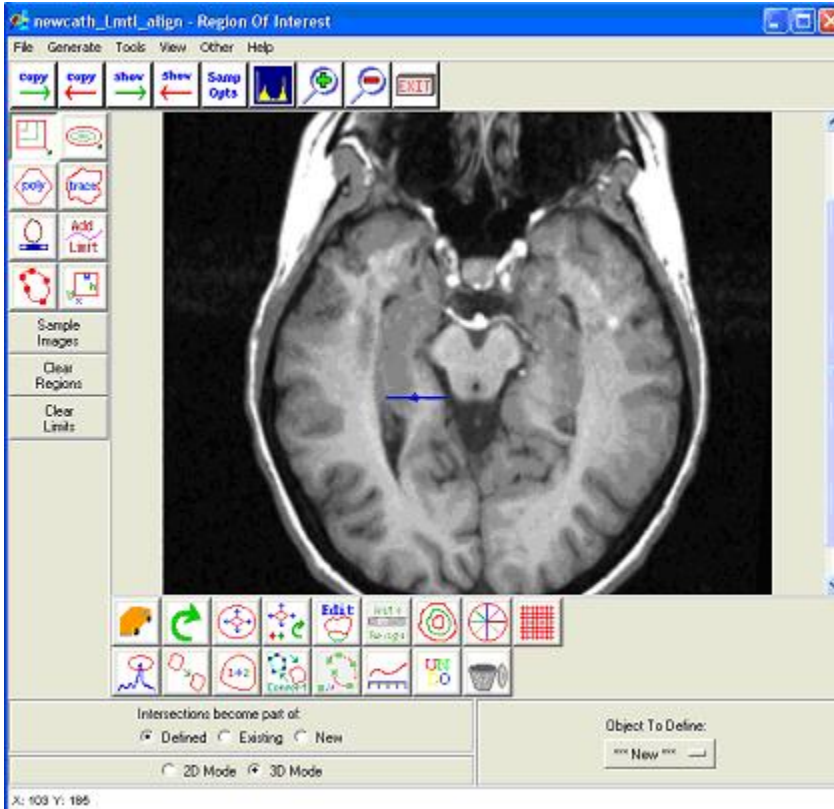
(1)



- To remove the rectangle, press **Clear regions**.

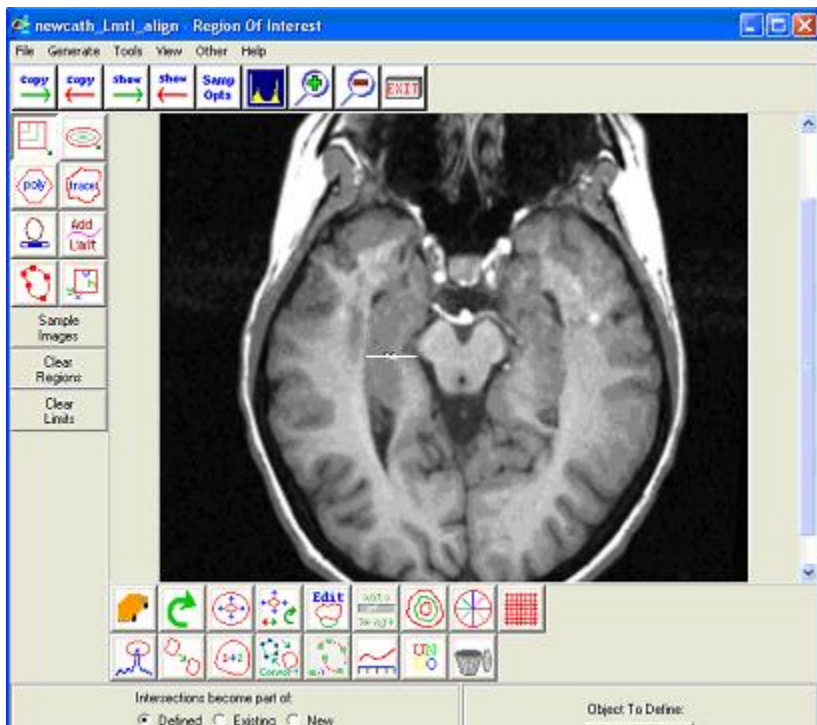
7. Posterior LEFT MTL width

- Repeat this process, but instead of going to the most anterior point of the midbrain, go to the most posterior.



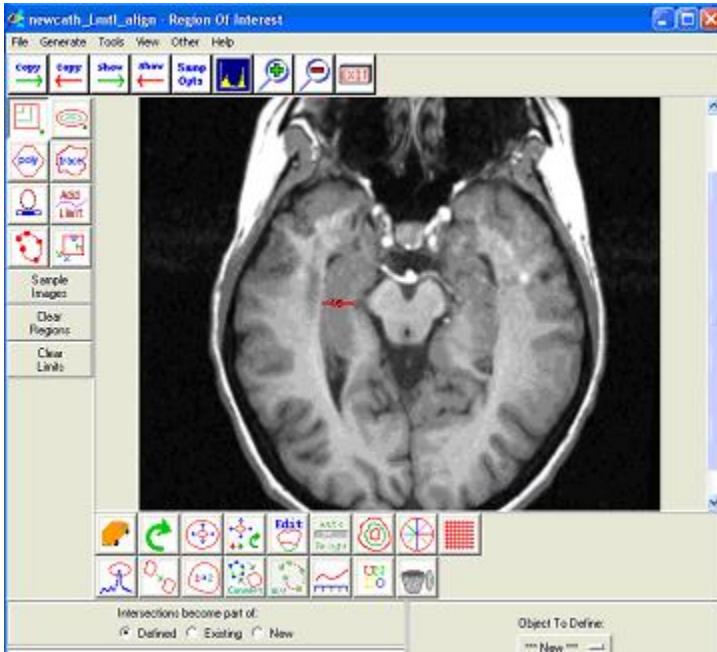
8. Midway LEFT MTL width

- To determine midway point, subtract the most posterior Y value from the most anterior Y value and divide by 2.
- Go to this Y value, and measure the left MTL.



9. Thinnest LEFT MTL width

- By eye, find the thinnest MTL width within the region of MTL that falls within along the length of the midbrain.
- You might measure a few to see which is in fact the thinnest.



10. To measure the RIGHT MTL

- Load AC_PC aligned image in main Analyze window.
- Repeat MTL alignment, aligning to the right MTL (Filenames: *SubjectName_RMTL*)
- Determine the ICS using the right colliculi
- Measure the right MTL!