**I. Hardware Setup**

1. **Computer**
2. Power to white box
3. Power to silver box
4. Turn on computer
5. Password: rogue123
6. Launch Brainsight→Agree to terms
7. **Magstim**
8. Power switch on rear of all units
9. Turn on all units (front panel, top left corner, black button)
10. Set stimulation magnitudes (suggest 50/0/0)

* Front panel, bottom right, green dial
* Turn to adjust first value, press to move on to next value

1. **Calibrate Coil**
   1. Place black bracket on silver paddle
   2. Window→TMS Coil Calibration→Alpha→Re-calibrate
   3. Place coil on holder, hold still in camera field of view
   4. Speak “Begin Countdown”, hold very still
   5. Repeat until successful
   6. Close calibration windows
2. **Magnet Safety**
3. Remove phone and wallet from researcher’s pockets
4. Remove phone and wallet from participant’s pockets
5. **Participant Hardware**
   1. ***EMG***

* Attach Velcro wristband
* Clean electrode sites with alcohol wipe
* Negative: belly of muscle (have participant flex thumb and forefinger to find belly)
* Positive: Tendon, medial side of finger between 3rd & second knuckle
* Ground: Bony knob on lateral part of wrist
* Attach electrodes
* Participants hand should be in a relaxed facing up position
  1. ***Motion Capture***
* Screw triangle set into headband (located in black suitcase)
* Put on participant’s head
* Make sure triangle is opposite to side of stimulation

**II.a Software Setup: MNI template**

**(skip if individual T1 is available)**

1. **New MNI Head Project**

**II.b Software Setup: Individual T1**

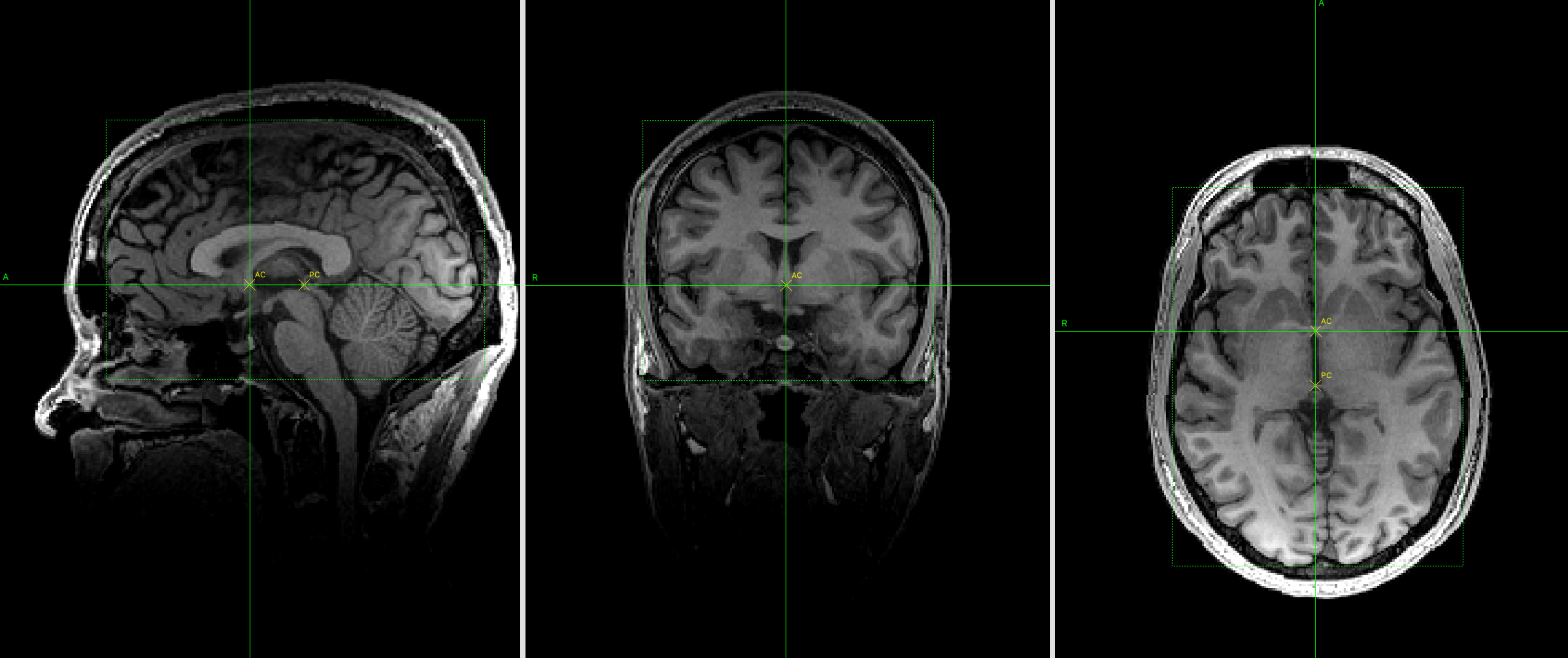
**(skip if individual T1 is not available)**

1. **New Empty Project**
2. **Anatomical**
   1. File: Click Here to choose…Browse for T1 (any format, unzipped)
   2. Show Image & Details

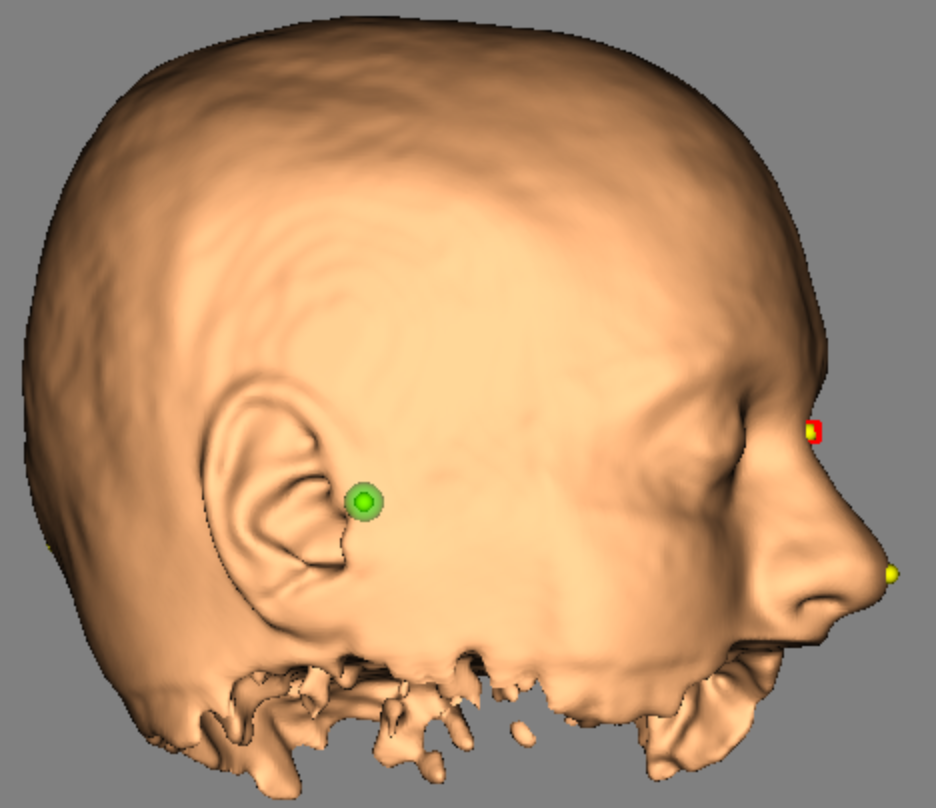
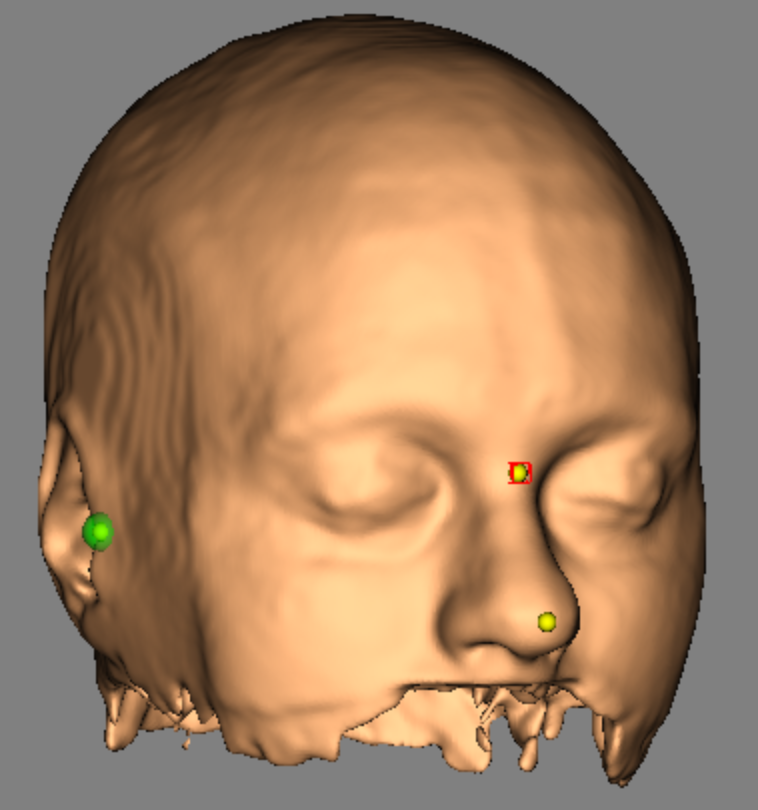
* Check that file loaded ok

1. **Register MNI with T1**
   1. Click on Atlas Spaces
   2. New→Manual (AC-PC-Box)
   3. Navigate to Anterior Commissure→*Set AC*
   4. Navigate to Posterior Commissure→*Set PC→Next Step*
   5. Click & drag green box to L/R, A/P, D/V boundaries
      * Anterior/Posterior use sagittal view
      * Dorsal/Ventral use coronal view
      * Left/Right use axial view
   6. *Finish*
   7. *Apply then close*

*Sample Registration*

**

1. **If functional localizers are available**
   1. Use other software to make thresholded statistical maps from fMRI
   2. Resample these images to same resolution as T1
   3. *Overlapys tab*→*Configure Overlay*
   4. *Add…* (top left) →Browse for function
   5. Navigate to check that images are properly registered
   6. Close
2. **Reconstruction**
   1. *New*→Skin→*Compute Skin*→close
   2. *New*→Full Brain Curvilinear→*Compute Curvilinear*
      * Adjust peal depth (top left scale) to reveal area of interest (~4mm)
      * If fMRI localizers are available: Click blue *i*→Overlays→Show
   3. Close
3. **Landmarks**
   1. *Configure Landmarks*
      * Nasion (concavity above the nose)
      * Tip of Nose
      * Back of head (bottom of inion)
      * Left & Right Ear (supratrageal notch)
   2. Click each location of Skin surface→New→Give a sensible name
   3. Make sure points are easy to replicate on actual head
   4. Close

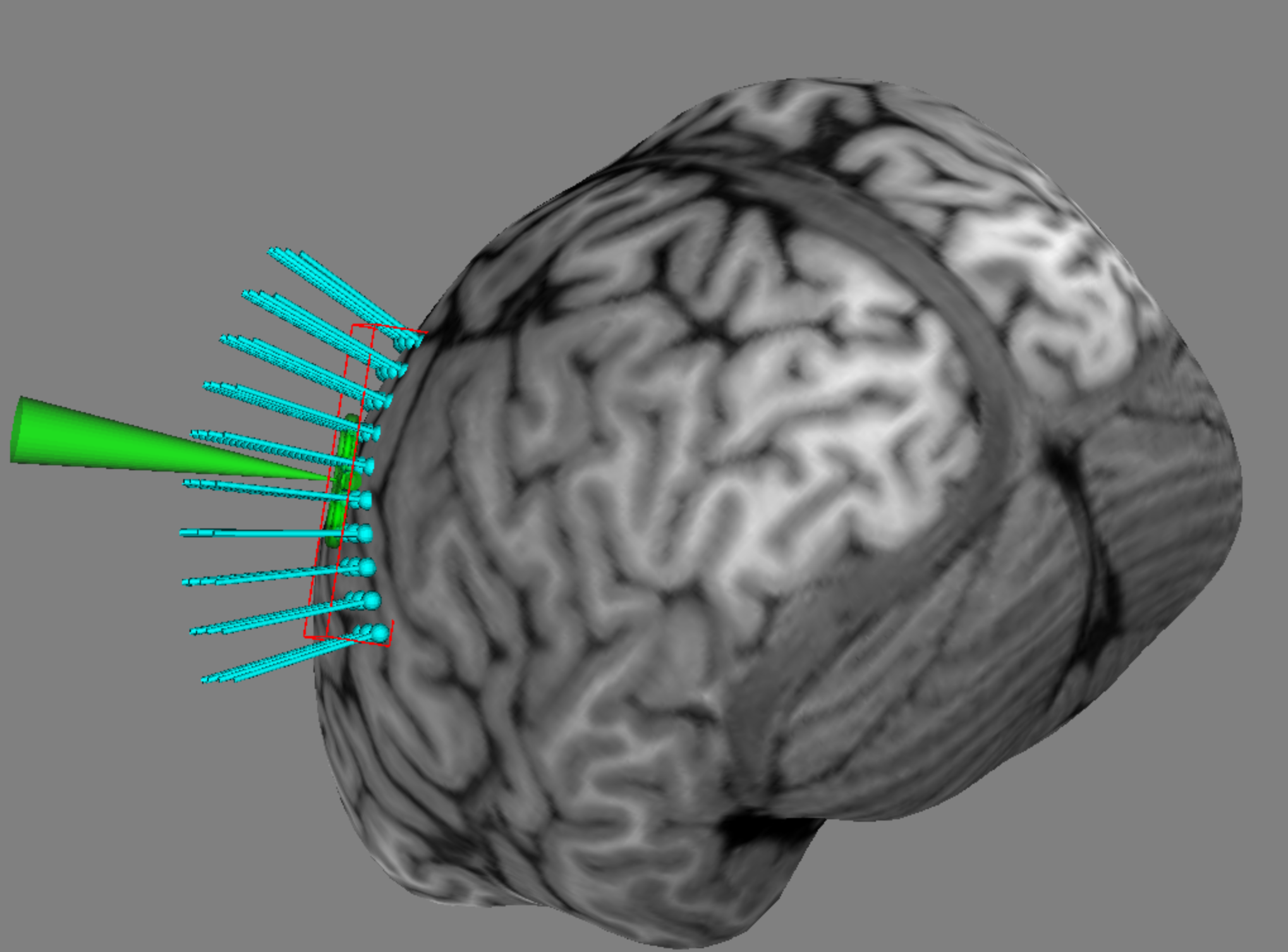
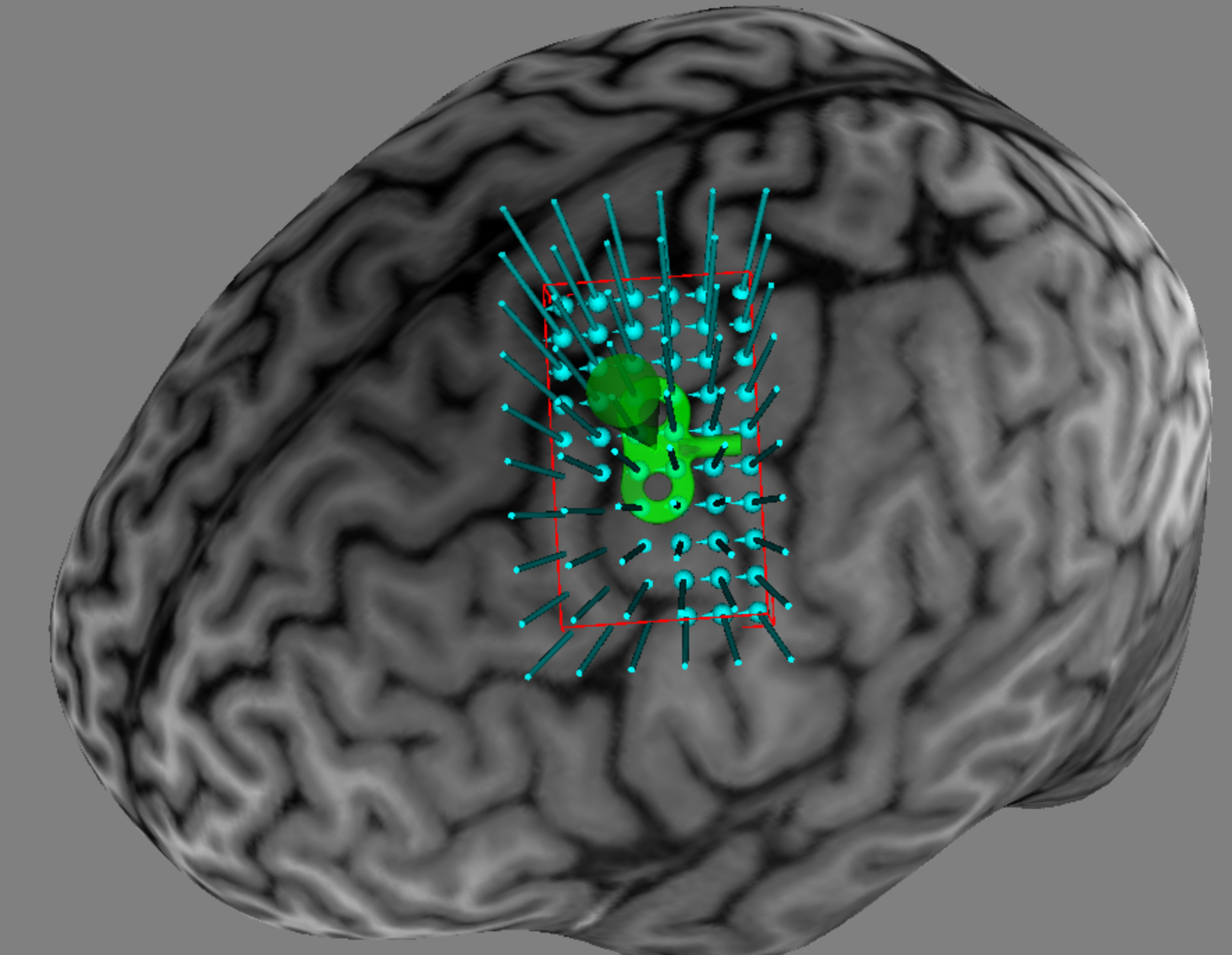
  

**III. Define Targets**

1. **Targets tab**
   1. *Configure Targets*
2. ***Set Layout***
   1. Set layout to *1|2*
   2. Set largest panel to curvilinear
3. ***Set Targets*** (M1-hand grid-search)
   1. Click brain surface centered on area of interest
   2. Use sliders to set orientation (suggest 20, 40, 140)
   3. New… (Top left)→Rectangular Grid
      * Name = M1\_10x6 (or whatever)
      * 3D size = 3
      * Kind = Trajectory
      * Grid size = 10 X 6
      * Spacing = 5mm X 5mm
   4. Set Curvature

* Rotate curvilinear brain to view grid from front
* Adjust curvature slider until grid hugs surface
* Suggest about 150mm
  1. Note: To nudge the center of the grid
     + click new center location→Move target to Crosshair Origin
  2. Close

Sample 10 X 6 Grid over hand M1



**IV. Perform**

*(Everything up to this point could be done before participant arrives)*

1. **Start the session**
   1. *Session* → *New Online Session* (opens new window)
2. **Carry over Targets**
   1. Select from left panel
   2. Click *Add*
   3. To select all 🡪 click the top one + shift + select the bottom one
   4. Click *Randomize Selected*
   5. Repeat for number of desired samples per target
   6. Next Step
3. **Input/output**
   1. Check *Use TTL Channel 1*
   2. Check *Acquire EMG Channel 1*
   3. Check *Acquire EMG Channel 2* (if used)
   4. *Auto Compute*
   5. Ask participant to wiggle thumb slowly. Does the EMG track?
   6. *Next Step*
   7. Confirm that patient head is in camera field of view
   8. *Next Step*
4. **Registration (*might already be done for custom T1)***
   1. Turn on voice recognition
   2. Place registration gun at participant’s Nasion

* Concavity between the nose and brow
  1. Speak “Sample”
  2. Repeat for LPA & RPA
* Concavity above ear notch
  1. Repeat for inion
* Back of head
  1. *Next Step*

1. **Scaling**
   1. Use registration gun to identify landmarks
   2. Ask participant to tilt head if necessary
   3. Important: Use 2D views to ensure that selected location are at the extreme edges of brain
      * Frontmost (check sagittal view)
      * Topmost (check sagittal view)
      * Backmost (check sagittal view)
      * Rightmost (check axial view)
      * Leftmost (check axial view)

Note: If validation fails, consider adding additional points over area of interest.

1. **Validation**
   1. Run registration gun across scalp slowly and firmly
      * From anterior point to posterior point
      * From left to right
      * Check particularly around target area
   2. Watch Crosshairs 🡨🡪 Skin value.
   3. If all Green/Orange range, continue
   4. If red, particularly in area of interest, repeat steps 6 and/or 7
   5. <5mm ok, <2mm good.
   6. *Next Step*
2. **File Save Project As…**
   1. **ID#\_Session#\_YYYYMMDD**
   2. Click *Resume*

**V. Data Collection**

1. **Neuro-navigation setup**
   1. Arrange windows 2 X 2

* Curvilinear Brain & Samples
* Bullseye (Coil Centric) [Driver = Alpha]
* EMG
* EMG Pod Recording
  1. Top left list 🡪 select first sample
  2. Bottom left list → adjust so *Error* and *EMG channel 1* are visible
  3. Bring coil to target. Prefer errors <1mm
     + Circle = location on skin surface
     + Dot = location on brain surface
     + Line = orientation (should face up)

1. **Science!**
   1. Arm TMS machine by pressing the green button on the top unit (orange light will flash on when machine is armed)
   2. Press peddle and buttons to zap
   3. Speak “Next” to change targets
   4. Rinse and repeat

* Leave about 3s between stimulations

1. **Trouble Shooting**
   1. Is Magstim armed?

* Should have orange indicator light, topright corner
  + - If not, press right-side green button
  1. Did the pedal time out?
     + Step off then back on the peddle

1. **File Save Project**
   1. Close Perform Window

**VI. Post-Processing**

1. **Review Data**
   1. Session→Review
   2. Layout = 1X2 (curvilinear in largest screen & EMG)
   3. Top left *Targets* window 🡪 check/uncheck Targets to show/hide grid locations
   4. Underneath *Targets* window, see *Sessions* window 🡪 uncheck Session 1 to hide sample locations
2. **MEP heat map**
   1. Blue *i* icon (middle top)
   2. Motor Maps
   * Check *Show Map*
   * Check *Colour Samples*
   * *LUT=Hot*
   * Threshold about 50 -1500 (depending on range of observed MEPS)
   1. Change full width half max to 5mm
   2. Update Selected Map
3. **Export Data**
   1. Export (bottom-left) →Brainsight Text file
   2. Choose things to save, probably everything

* Name file **ID\_Session\_YYYYMMDD**
  1. Save
     + Tab delimits columns
     + ; delimits rows

**VII. Take Down**

1. **Make sure everything is saved**
2. **Return equipment**
   1. Return to cart EMG equipment to cart
   2. Return tracking equipment to black case
3. **Close all windows**
4. **Power Down Computer**
   1. Turn off computer
   2. White box power switch
   3. Silver box power switch
5. **Power Down Magstim**
   1. Power buttons (all units)
      1. Front panel, left side, black button
   2. Magstim power switches (rear panel)

*Phase 1: Mapping*

* + - 1. Stimulate across target grid
         1. Use grid targets to map both hemispheres
         2. Use review panel to make heat maps for both hemispheres
         3. Define new targets at the peak of each heat map
         4. Might be necessary to convert an observed stimulation site to target

*Phase 2: Motor Threshold*

* + - 1. Positioning
         1. Place chinrest for participant
         2. Let’s take extra care to make sure that their comfortable
         3. Navigate left hemisphere coil to target and fix in place
         4. Navigate right hemisphere coil to target and fix in place
         5. Readjust left of necessary.
         6. Participant should stay still now.
      2. Code setup
         1. In python find the names of the serial ports for the stimulators
         2. Should be something like tty.usbserial, and tty.usbserial1)
         3. In Terminal: /dev/tty.\*
         4. Open MT.py and check that MagOne = …. Has the name of a serial port
      3. Test some thresholds for one hemisphere
         1. Warm participant that some stimulation will start
         2. Navigate to folder

In Terminal: cd Experiments/BiHem

* + - * 1. Run a stimulation train

In Terminal: python MT.py

* + - * 1. This will ask you for a motor threshold to try (start around 45)
        2. Watch Brainsight for MEPs, count number >50mV
        3. If half of stims elicit MEPs keep this value
        4. If not try another value
      1. Repeat for other hemisphere with other serial port.

*Phase 3: IHI (~15 min)*

* + - * 1. Leave stimulators set to motor thresholds, code adjusts automatically
        2. In Terminal: python BiHem.py
        3. First answer some questions about the participant
        4. Look at the stimulators and see which display has #1
        5. Warn the participant that stimulation will start soon
        6. Answer some questions about the stimulators
        7. Let this run for a while. The code might now close properly this is some problem that I haven’t solved yet. All of the data are collected ok, just close Terminal and shut off the computer.
        8. In brainsight be sure to save the session and export the EMG data.