IV: Subject Preparation and Experimental Setup

Before beginning any measurement, several steps must be taken to prepare the subject and the acquisition system. An overview of these steps is as follows:

Consenting the Subject You MUST receive the subject's consent before he or she can begin the study. Also, for subjects measured post 4/14/03, they must sign both an Authorization form and acknowledge that they have received a copy of the Privacy Rule. Please make two copies of each of these documents: one for the subject and one for the MEG lab. Leave the latter copy in the drop slots located outside the MSR.

De-

PC Event Code	Trigger Combination
1	1
2	2
3	12
4	3
5	13
6	23
7	123
8	4
9	14
10	24
11	124
12	34
13	134
14	234
15	1234
Response 1 (16)	5
Response 2 (32)	6
Offline Event Codes:	Trigger Combinations:
16	5
17	15
18	25
19	125
20	35
21	135
22	235
23	1235
24	45
25	145
26	245
27	1245
28	345
29	1345
30	2345
31	12345
32	6
33	16 etc.

metalling Have the subject empty pockets, remove all jewelry, glasses, wire-bras, etc and take off shoes. All subjects are required to wear hospital-issued pants, and if necessary (due to non-removable metal on shirts), subjects can be provided with tops and robes. Those subjects requiring glasses will be given special non-magnetic frames and lenses.

Experimenters should also de-metal to the extent of removing items from pockets, jewelry, ID tags, etc, and most importantly anything electronic. (It is not necessary to remove glasses so long as you do not bring your face especially close to the sensors).

EEG cap If you will be using the EEG cap, position it on the head and prepare all the electrodes before proceeding to the following steps. See the EEG manual for detailed instructions.

Applying EOG Electrodes (This step should be completed whether or not the EEG cap is used)

All supplies for applying EOGs, the EEG cap, and HPI coils can be found in the cabinet marked “daily preparation supplies.” Check the cabinet to the right of it (extra prep supplies) for extras when a product runs out.

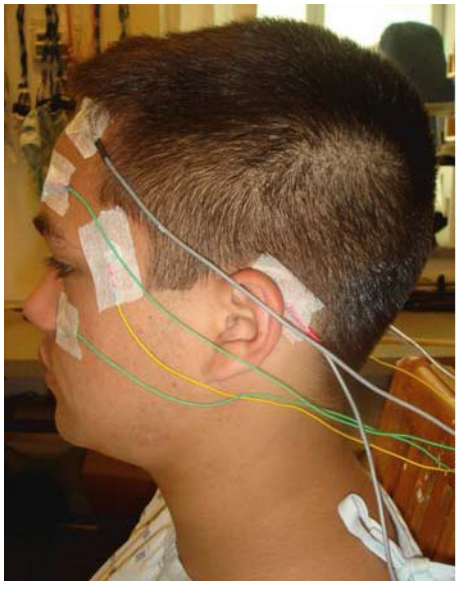
With a Q-tip and Nuprep abrasive gel, cleanse the skin where the electrodes will be placed. Next place a generous amount of EC2 cream into the cup of the electrode, and affix it to the face with micropore (paper) tape.

Typically five electrodes will be used: two pairs of bipolar electrodes (horizontal and vertical) to monitor eye movements, and a ground (typically an area of the collarbone is used). If using the EEG cap, a reference electrode will be needed which is generally placed on the nose.

So that the leads do not pull or become tangled, it is a good idea to tape them all together onto the subject’s left shoulder. (Leads will be plugged into the portion of Vectorview to the left of the subject).

Impedances should then be checked; the impedance meter is on the shelf above the EEG supplies. Plug in the ground (or reference, if using the cap) electrode to one of the bipolar slots, and compare all other electrodes to this one. Typically you’re looking for an impedance of under 5 kΩ, although for some subjects this is nearly impossible and less than 10 kΩ is acceptable.

Applying HPI Coils If not using an EEG cap, the four HPI coils should be placed in four specific locations to maximize distance between them: two on each side of the forehead (right below the hairline) and one behind and above each ear, ensuring that, once the subject is in the machine, all coils will be inside the dewar and not below it. The coils require no paste, and should be affixed using both double-sided rings and micropore tape.



HPI (4 gray leads) positions without EEG cap 2 horizontal EOG electrodes (yellow leads) and 2 vertical EOG electrodes (green)

If using the EEG cap, it is again necessary to place the coils as far apart as possible, but in this instance they will be attached directly to the cap rather than to the subject's skin. The double-sided rings can be used, but rather than using micropore tape, use the transpore (plastic) tape since it better adheres to the cap.

As with the EOG electrodes, it is a good idea to tape the HPI leads to the subject's

shoulder, this time to the right side.

HPI (4 gray leads) positions with EEG cap 2 horizontal EOG electrodes (yellow leads) and 2 vertical EOG electrodes (red)

Starting the Acquisition Program In the Neuromag folder, open the Acquisition program. You will be prompted to enter your nmr account, password and 3-digit billing code; it is at this point that you will begin to be charged for your time (unless you are using development or pilot time).

First, load your project and settings; details on how to use the program are below in the section entitled "Data Acquisition." These settings should have been previously created and saved so that time is not wasted while the subject is present. Once the necessary settings are loaded and double-checked, you are ready to register the subject (details below).

At this time it is also a good idea to begin filling out a "run sheet" (kept in the shelving in the lab beside the telephone). This form is used to record more specific details about the subject and his or her measurement, such as noisy channels, the name of the data files, etc. These forms are for your personal use and thus do not need to be copied and kept in the MEG lab.

Subject Registration With the HIPAA regulations we have made several changes in how to register subjects, so be sure to follow these steps in order to be compliant!

- Press the second "Change" button marked Subject
- At the top of the window, select *Subject Type*: Patients, and *Accessible to group*: acqxxxx (This is very important since it will enable you to access to your data after collected.)
- Enter name, birth year, sex, and handedness (height/weight can be skipped)
- • In the box marked *HIS ID* enter a unique subject code (e.g. halg014)
    - o This code will automatically be used as the directory name for megraid
    - o Save filenames with this code as well

Digitization Once registration is complete, you are ready to digitize the subject. In the Acquisition program, press the sixth "Change" button marked Digitize. At this point you will be prompted to digitize cardinal landmarks, HPI coils, electrodes, and extra head points. The polhemus system, which is used for digitization, is located in a cabinet labeled "Polhemus". Instructions for using the system are as follows:

- Have the subject sit in the wooden chair
- Move all rolling chairs and other objects with large metal components away from the chair and polhemus
- Slide the chair sensor into the back of the chair, with the cable pointing downwards
- Position the goggles on the subject's head, being careful not to cover up any electrodes or HPIs. It is critical that the goggles are tight and do not move once digitization has begun
- Turn on the polhemus and be sure that both cabinet doors are open
- In the Acquisition program, select the last "Change" button which will take you through digitization
- At the top of the screen, hit the "Coordinate frame alignment" button; you are now ready to begin digitization
- In any order, digitize the three cardinal landmarks (nasion plus right and left pre-auricular points, see below) by pointing to each and simultaneously clicking the button on the stylus. It is a good idea to check that the two ear points are within a maximum (absolute value) distance of 3mm.

Right PA. For the Nasion mark the lowest indention above the crown on the nose as shown here.

Left PA

- After the third point has been digitized, you will hear two beeps instead of one—this is simply to indicate that you are done digitizing a section. If at any point during the digitization of the different sections you hear two beeps (*before* the last point), you have accidentally pushed the stylus button twice and should start over. Instructions on how to do this are further below.
- To move on to the next section (HPI coils), there is no need to click anything else; you will simply be prompted to begin digitizing HPI.
- Digitize the four HPI coils in any order. Be *very* careful when digitizing these points, as they can come back to haunt you later if not done properly the first time!
- Next, if using the EEG cap, digitize the electrodes *in order*, starting with the reference electrode. A map of electrode locations can be found in the folders for screening forms.
- If not using the cap, you will *not* be prompted to digitize any electrodes (unless you failed to rename any of your facial electrodes as EOG rather than EEG).
- Finally, you will be asked to digitize additional head points. It is a good idea to make a straight line down the forehead and nose, as the nose is easily identifiable in the subject's MRI. An extra 20 or so points from the head should be taken by making a spiral; these will also be used in conjunction with the MRI.
- When finished, hold the stylus about a meter away from the subject and press the button.
- If at any point you should make a mistake, you can hold the stylus away, press the stylus button, and then click on the button at the top of the section you would like to do again. This will clear any points taken in a given field, allowing you to start over. (It will not clear points in previous fields).

Connecting HPI, Electrodes, etc to Vectorview The plug for the HPI coils is inserted into the "subject's" right side of Vectorview. The plug has a small notch on it; this should be placed downwards, and the whole plug should be positioned so that extra spaces are on the right. The earphones are also plugged in on the subject's right into the slot labeled "auditory stim out."

All electrodes are plugged in on the subject's left. For EOG and other bipolar electrodes, be sure to pair them together correctly (eg, vertical with vertical and not vertical with horizontal), although which goes in (+) and which goes in (-) is unimportant. Ground and reference are plugged into the same location labeled ground and reference, respectively. If using the EEG cap, the cap's connectors should be plugged into the slots with corresponding numbers.

If doing an auditory study, be sure to place the earphones in the subject's ears before pushing the subject up into the helmet. The foam insulation for the earphones can be found in the cabinet marked "daily prep supplies." To adjust volume, use the audio attenuator in the stimulus cabinet to the left of the acquisition machine.

Placing Subject in the Helmet The pump for the chair is located on the "subject's" right; the longer lever pushes the chair up; the shorter one lowers it. Subjects should be pushed up far enough so that they can feel pressure on the top and back of their head. It is important to have subjects first slouch down and get comfortable so that they do not do so later and slip down in the helmet.

If using the bed, lock the wheels and move only the upper portion of the bed. This way subjects can position themselves comfortably, and you can easily slide them into the helmet until their head touches the back.

Subject Instructions Before exiting the MSR, be sure to remind the patient of both the general MEG instructions as well as any instructions specific to your task. General instructions include:

- For auditory studies, focus on a point on the wall or a fixation cross displayed on the screen; for visual studies, focus on the fixation cross.
- For any kind of stimulus, try not to blink while stimuli are being presented or while responding.
- Do not move once the measurement has begun, even during breaks!! (This is due to the fact that, if presenting several runs which you will later average together or compare, it is important that the subject does not change his or her head position at any time, including any large movements of the limbs since this is also bound to alter head position).
- To communicate with the experimenter, simply speak aloud; there is a microphone built into the machine. However, you should avoid speaking during a measurement, unless it is an emergency.