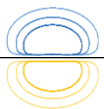


Module: Preparation of the participant

EOG, ECG, HPI coils : what, why and how



Introduction

In this module you will learn why EEG, ECG and HPI coils are important and how to attach them to the participant.

The video titled subject's preparation shows how to prepare the subject and place the different material.



Material needed for the preparation



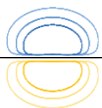
Treatment of the participant

You are going to touch the skin of your participant. You should have clean hand and nails before doing it. Hand sanitizer is at your disposal in the lab.

First, you need to scrub the regions of the face and neck where you are going to place the electrodes. Scrubbing the skin will allow a good impedance of the electrodes and thus a good signal will be recorded. To scrub the skin, we use an abrasive gel on a cotton pad. Make sure to scrub gently. You do not need to scrub much, 3 to 5 circular wipes are enough. Be careful not to scrub too hard, you don't want to hurt your participant.

Once you are done, you will now use alcohol pads to get rid of the abrasive gel on the same regions and degrease the skin. Cleaning the skin with alcohol will degrease the skin and allow the electrodes to stick better. You should also use the alcohol to clean the surface of the skin where the HPI are going to be placed.

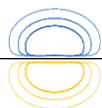
Do not forget to ask your participant to notify you if you are not scrubbing too hard or if the product doesn't hurt him/her.



Material : Electrodes

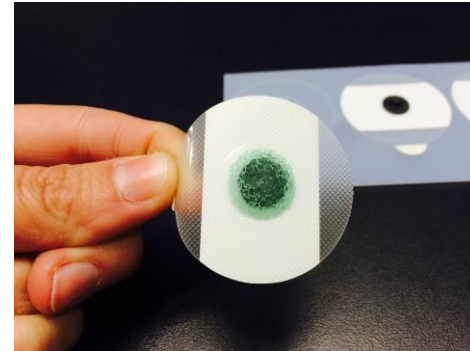
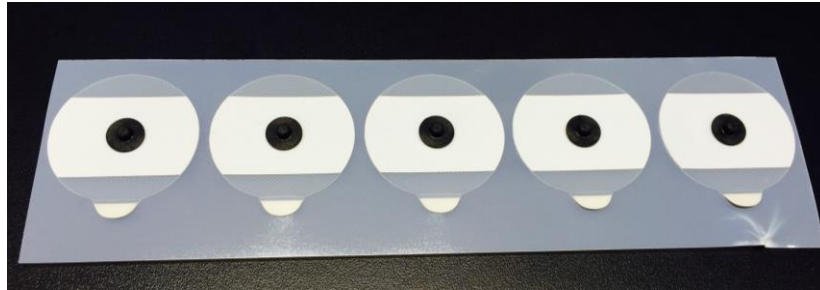
Simultaneous acquisition of EOG (horizontal and vertical) and ECG is recommended for several reasons (From Gross et al. 2013 Neuroimage. *Good practice for conducting and reporting MEG research*):

- Eye movements/blinks may be induced by experimental conditions, task and instructions in a non-trivial way (Picton et al., 2000). **Recording the EOG allows for comparison of eye movements/blinks between conditions.**
- The magnetic field generated by the heart is several orders of magnitude stronger than the field generated by the brain and may contribute as a strong source of artifacts to the data recorded at the MEG sensors. **ECG components in the data may have a detrimental effect on source reconstruction and confound the interpretation of connectivity estimates.**
- In general, both EOG and ECG components can have a **detrimental effect** on single trial analysis (e.g. by affecting single trial phase and amplitude estimates to a variable degree at different frequencies).
- EOG/ECG signals **facilitate artifact rejection and correction** by acting as references.



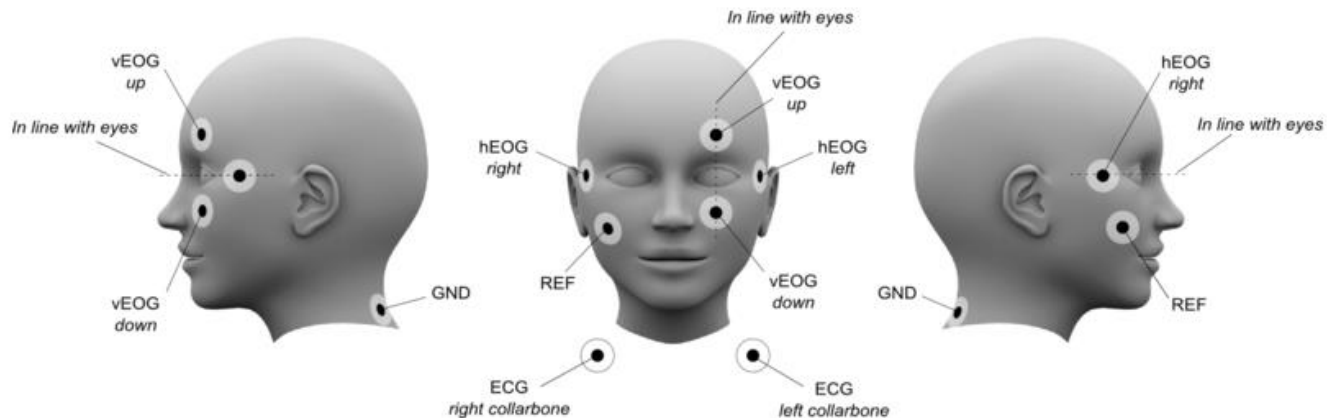
Material : Electrodes

The bipolar electrodes are connected to the electrode interface panel on the side panel of the gantry inside the magnetically shielded room.

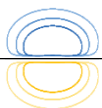


adhesive disposable Pre-gelled electrodes used for EOG and ECG.

Seven electrodes will be placed on the face and neck of the participant.



Placement of the EOG and ECG electrodes



Material : Electrodes

The disposable electrodes already contain conductive gel in the center, so you don't need to add any yourself. When placing the electrode, apply pressure around the electrode on the white surface. Do not press on the center to avoid spreading the gel underneath the adhesive border.

We start by attaching the electrodes above the collarbones. Then we place the ground electrode at the back of the neck.

The adhesive electrodes are large, so for the 4 electrodes around the eyes we cut them so they can be placed closer to the eyes. When placing the 4 electrodes around the eyes make sure that the electrodes are in line with the eyes: horizontally and vertically in line with the center of the eye.



Material : Impedance meter

Impedance needs to be checked to verify if the electrodes make a good contact with the skin and thus if you will record a good signal. If the impedance is below 20kOhm the signal will be good (the smaller the better) but if it is above this threshold then you might want to improve the impedance by cleaning the skin again and placing new electrodes. To measure the impedance we use an impedance meter.



Impedance meter with cables



Material : Impedance meter

- 1 - Connect the three cables to the electrodes according to the label.
- 2 – Click in the middle white button to turn SIGGI on and select Impedance .

2 – Click in the middle white button to turn SIGGI on

select Impedance by pressing again on the white button.



Material : Impedance meter

3 – Read the impedance for each channel

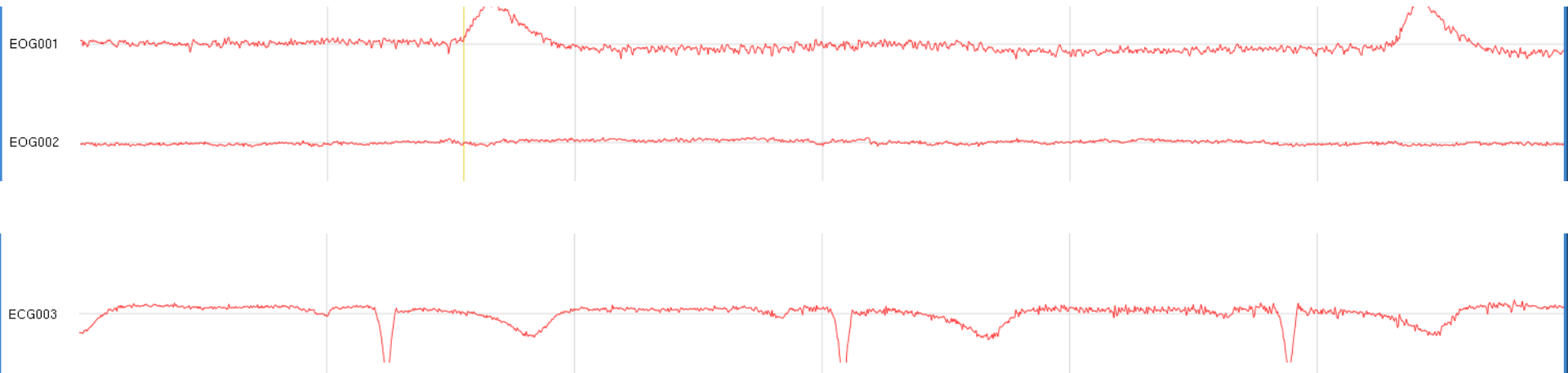
Impedance for the electrode attached to the cable

Impedance for the Reference

Impedance for the Ground



During the MEG recording you are able to visualize the EEG and ECG.



Once the participant is in the scanner and before your experiment start, to verify the signal from the EEG and ECG, you are encouraged to ask your participant to blink many times. You can check quickly if the signal from the EOG is good.

You also should check the quality of the ECG signal before the experiment start by visualizing it.

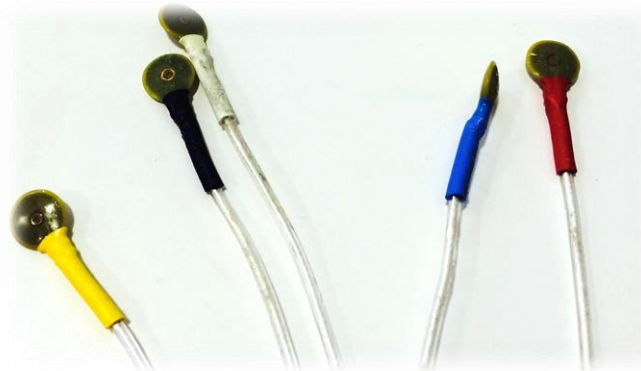


Material : HPI coils

In order to be able to locate signal sources relative to the head, one must know the position of the head within the probe. For this purpose we use a head position indicator (HPI) system. Before the measurement, one attaches small coils with skin tape to the head and digitizes their locations on the head.

Before and during recording a small current will run through the HPI coils. This generates magnetic fields that can be localized in the helmet. It is very important to make sure that all the coils are well fixated to the subject's head so they don't move.

Five coils are available but we are going to use only 4 (we discard the YELLOW one).



HPI coils



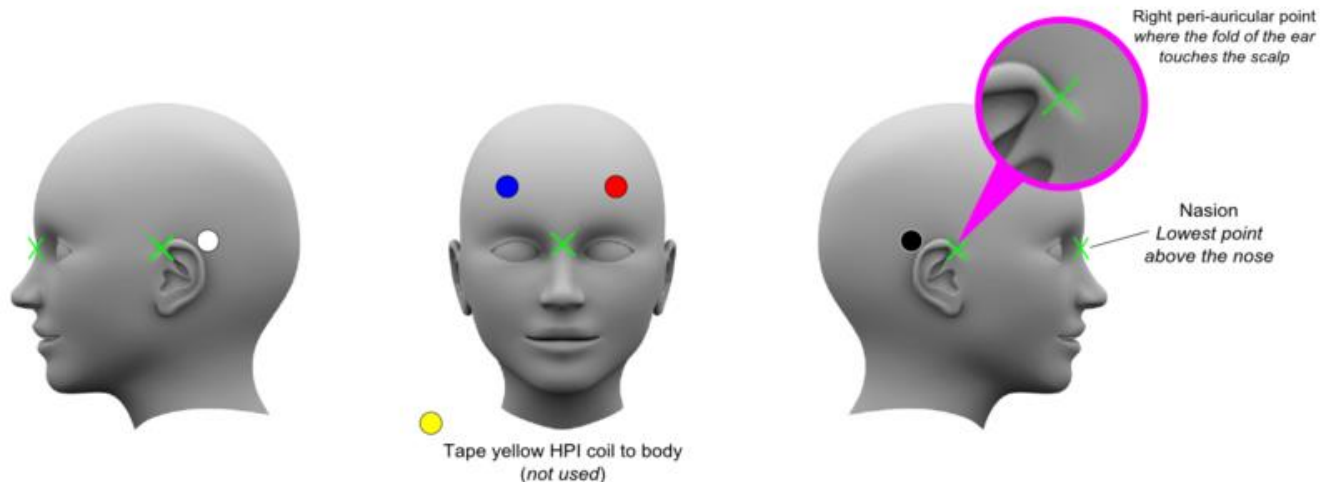
Method : HPI coils

The coils are placed so that two are behind the ears as high as possible without being on the hair, and two on the forehead well separated but not on the hair. The four coils need to be inside the MEG helmet.

The most precise HPI information is obtained when the coils are as far apart as possible but still within the sensor helmet. Try avoiding situations where coils form a nearly perfect square.

The figure below shows where to place the coils on the head. The colors are important. 4 coils are used during the measurement (the yellow coil is discarded).

CAUTION! Do not use conducting EEG paste to attach HPI coils.



Placement of the HPI coils



Material : other equipment

Many other equipment are available at the lab, e.g.:

Eyetracking

Eyelink 2000, by SR Research

MEG compatible EEG caps : 128-channel and 74-channel EasyCap, in most sizes

Somatic recordings : Biopac and Pletysmography, EMG, ECG

Subcutaneous EMG recordings

Fiber Optical response Joystick by Current Design

Auditory Stimulation

Customized Audio tubes by Kar audio

Directional Sound panels by Panphonics

Somatosensory Stimulation Biopack integrated

Pain Stimulation

Olfactory Stimulation

If you planed to work with any of those let us and you will be trained on how to use them.

