Why attach HPI coils?

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"*Head positioning should be monitored either **continuously** throughout the acquisition or **at the start and end of the recording**. The MEG acquisition is done only with respect to the MEG device, instead of the anatomy of the subject. Therefore, MEG devices include a subsystem to determine the position of the head with respect to the MEG sensors. As MEG (unlike MRI) cannot directly measure the position of the head, small coils known as Head Position Indicator coils (**HPI**) placed at known locations on the scalp of the subject, when energized, will generate a magnetic field that helps to localize the position of the head in a three-dimensional space, with respect to the MEG sensor array. If continuous head position tracking is enabled, generally small movements are acceptable with a maximum error of 5mm.*

Information about the subject's head position, orientation, and shape is obtained by digitizing (using a Polhemus Fastrak) the standard fiducial points, HPI coils, and the required additional points creating Cartesian coordinates in a 3D space. Digitization of four HPI coils, and landmarks, which include three bony fiducial points (Nasion, left, and right pre-auricular points), and additional points, is performed.

The HPI coil positions, and hence the head position, are estimated from the coil signals. This estimation is done several times per second, allowing the system to track also relatively fast movements. Once the head position is estimated, the MEG signals are transformed to a reference head position. This conversion is sequentially performed at each time point throughout the continuous (raw) data file.

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, a head position indicator (HPI) system is used. Before the measurement, one attaches small coils with Tegaderm skin tape, Blenderm tape, or Micropore 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 only four are used (the YELLOW one is discarded). See **HPI Coil Placement and Frequencies** for the reason why.*

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 again not on the hair. The four coils need to be attached so that they will 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.

***Figure 2. Standard locations of HPI coils** shows where to place the coils on the head. The coil colour is important! Four coils are used during the measurement (the YELLOW coil is discarded).*"