

## Development of Hardware and Software Components for Head Motion Detection in Magnetoencephalography

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A major drawback of almost all MEG systems is the lack of information about the head position during MEG experiments. The neuro-magnetic field changes refer to only one of the head location measurements that are usually conducted before and after the MEG experiment. Hence, any head motion during measurements will decrease the accuracy of any source localization method if no data correction is applied.

Therefore, we developed and implemented an open hardware and software project for extended head motion tracking in continuous or intermittent mode. Based on the standard head location procedure provided by our own MEG system, we use 5 head location coils during the MEG measurements that are fixed on the patient's head. All coils are energized separately with particular frequencies, which are far from the frequencies of neural activities. As a result, different magnetic fields are generated from these coils due to their individual coil currents. After offline recalculation of these coil's positions, head motion correction can be applied for MEG source reconstruction [1].

The project is based on an Arduino microcontroller platform to replace the existing hardware provided by our MEG system into a most flexible MEG-system-type independent solution e.g. MEG HTC Multichannel System. Choosing Arduino as an open-source prototyping platform allowed us to develop a cross-platform software interface to implement and control the head motion procedure within a stimulation task. Interfaces to common software packages e.g. Python, Lazarus, Matlab, nbs-presentation are provided or are at least straightforward to implement.

Furthermore, this system can also be used to provide optimum head position as reference to validate eye-tracking data from an eye-tracking system with their corresponding correlations. In the future, it can be used to implement an optical motion capturing system in MEG system as well as can be integrated into a MEG online recording system.

### References

- 1 Dammers, Jürgen, Thomas Fieseler, Frank Boers, Andrea Muren, and Peter A. Tass. 2001. Improving MEGs source localization accuracy by using continuous head motion detection. *NeuroImage* 13, no. 6 (June): S104-S104.