

*Hunold, Alexander; Funke, Michael; Eichardt, Roland;
Haueisen, Jens:*

**Sensitivity of EEG and MEG to orientation selective source
strength variations**

URN: urn:nbn:de:gbv:ilm1-2015210077

Published OpenAccess: January 2015

Original published in:

Clinical EEG and neuroscience : official journal of the EEG and Clinical
Neuroscience Society (ECNS). - London : Sage (ISSN 2169-5202). - 44 (2013) 4,
S. E56-E57, P015.

DOI: 10.1177/1550059413507209

URL: <http://dx.doi.org/10.1177/1550059413507209>

[Visited: 2014-10-14]

*„Im Rahmen der hochschulweiten Open-Access-Strategie für die Zweitveröffentlichung
identifiziert durch die Universitätsbibliothek Ilmenau.“*

*“Within the academic Open Access Strategy identified for deposition by Ilmenau University
Library.”*

*„Dieser Beitrag ist mit Zustimmung des Rechteinhabers aufgrund einer
(DFG-geförderten) Allianz- bzw. Nationallizenz frei zugänglich.“*

*„This publication is with permission of the rights owner freely
accessible due to an Alliance licence and a national licence (funded by
the DFG, German Research Foundation) respectively.“*



Clinical EEG and Neuroscience

<http://eeg.sagepub.com/>

Abstracts of Presentations at the International Conference on Basic and Clinical Multimodal Imaging (BaCI), a Joint Conference of the International Society for Neuroimaging in Psychiatry (ISNIP), the International Society for Functional Source Imaging (ISFSI), the International Society for Bioelectromagnetism (ISBEM), the International Society for Brain Electromagnetic Topography (ISBET), and the EEG and Clinical Neuroscience Society (ECNS), in Geneva, Switzerland, September 5-8, 2013

Clin EEG Neurosci 2013 44: E1 originally published online 24 December 2013

DOI: 10.1177/1550059413507209

The online version of this article can be found at:

<http://eeg.sagepub.com/content/44/4/E1>

Published by:



<http://www.sagepublications.com>

On behalf of:



[EEG and Clinical Neuroscience Society](#)

Additional services and information for *Clinical EEG and Neuroscience* can be found at:

Email Alerts: <http://eeg.sagepub.com/cgi/alerts>

Subscriptions: <http://eeg.sagepub.com/subscriptions>

Reprints: <http://www.sagepub.com/journalsReprints.nav>

Permissions: <http://www.sagepub.com/journalsPermissions.nav>

>> [Version of Record](#) - Jan 21, 2014

[OnlineFirst Version of Record](#) - Dec 24, 2013

[What is This?](#)

*P015. Sensitivity of EEG and MEG to Orientation
Selective Source Strength Variations*

**A. Hunold¹, M. Funke², R. Eichardt¹, J.
Haueisen¹**

¹Institute of Biomedical Engineering and Informatics, Ilmenau
University of Technology, Ilmenau, Germany

²Department of Pediatrics, University of Texas Health Science
Center at Houston, Houston, TX, USA

Clinical applications of simultaneous electroencephalography (EEG) and magnetoencephalography (MEG) recordings of interictal epileptic spikes revealed situations where both modalities showed different sensitivities to the epileptic-form activity. In previous studies, we showed that for focal and extended sources EEG and MEG provided varying sensitivities depending on the depth and the orientation of the spike source.

Here, we extend this work to effects of background source strength variations depending on the source orientation on the spike detectability in EEG and MEG simulations.

We build realistic 3-compartment boundary element method head models for 2 participants with 5120 triangles per layer.

The vertices in a triangular grid of the segmented boundary between white and gray matter provided the base points for single dipole sources. For each dipole, the angle between the source vector and the surface normal in the closest point of the inner skull mesh defined the source orientation. The Euclidean distance to the closest scalp vertex defined the source depth. In the baseline simulations, single dipoles generated interictal activity with a maximal strength of 600 nA m and approximately 30 000 randomly distributed dipole contributed to normal brain activity as background noise with an individual strength of 10 nA m. In further simulations, we selectively increased the strength of radial and tangential background sources to 300% of baseline strength. As detectability measure we calculated a linear ratio between spike and background amplitudes as signal-to-noise ratio (SNR) in the EEG/MEG channel with the maximal spike amplitude.

In the baseline simulations, spikes from radially oriented single dipole sources generated the highest SNR in EEG and tangential sources dominated the SNR in MEG responses for superficial source locations. With 3 times stronger radial background activity, the SNR in EEG responses marginally decreased and the SNR profiles of MEG simulations remained almost stable. Opposing, the increase of tangential background activity strongly lowered the SNR in MEG responses and also affected the SNR in EEG simulations.

Our simulations show complementary sensitivity profiles of EEG and MEG to superficial sources depending on their orientation. Due to the MEG's orientation selectivity, only increased tangential background activity lowered the SNR in MEG simulations.

The complementary SNR profiles of EEG and MEG to superficial sources indicate the benefit of simultaneous recording of both modalities.