

*Haueisen, Jens; Lau, Stephan; Flemming, Lars; Sonntag, Hermann; Maess, Burkhard:*

**Skull defects influence MEG source reconstruction**

**URN:** urn:nbn:de:gbv:ilm1-2015210119

**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. E14, S09\_1.

**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?](#)

Artificial skull inhomogeneities comprise, for example, surgical holes or sutures. During the modeling process, artificial skull inhomogeneities might be introduced due to erroneous segmentation or meshing. Skull conductivity inhomogeneities are known to influence electroencephalography (EEG) signals and consequently EEG source reconstruction. However, they are thought to have no or minor influence on magnetoencephalography (MEG) signals and MEG source reconstruction. In this talk, the influence of skull conductivity inhomogeneities caused by surgical holes and modeling errors on the MEG forward and inverse problem will be assessed.

We implanted an artificial current dipole in the brain of rabbits and measured simultaneously electric surface potentials (64 channels) and magnetic fields (16 channels). One or two skull defects (holes) were introduced in a surgical procedure. The electric potential amplitudes changed up to a factor of 10 and the magnetic field amplitudes up to 20%, when comparing the data measured over intact skull and skull with one or two holes.

We constructed individual finite element method (FEM) models for the rabbits, including gray and white matter, cerebrospinal fluid (CSF), intracranial blood vessels, compact and spongy bone, skull defects, ocular humour and lens, and body. The computed magnetic field and electric potential differences based on models with and without skull defects confirmed the experimental results. Artificial skull inhomogeneities (a number of small holes) introduced due to erroneous segmentation and meshing resulted on average in 20% amplitude change of the magnetic field; however, in worst cases up to 200%.

We conclude that skull conductivity inhomogeneities have a nonnegligible effect on the MEG forward and inverse problem. Especially when source positions are expected to be in the vicinity of the conductivity inhomogeneity and when a large difference with respect to the skull conductivity is indicated, the modeling approach should take the inhomogeneities into account.

#### Acknowledgment

BMBF3IPT605A, DFG Ha 2899/14-1.

### S09\_1. Skull Defects Influence MEG Source Reconstruction

**J. Haueisen**<sup>1,2</sup>, **S. Lau**<sup>1,2,3,4</sup>, **L. Flemming**<sup>2</sup>, **H. Sonntag**<sup>5</sup>, and **B. Maess**<sup>5</sup>

<sup>1</sup>Institute of Biomedical Engineering and Informatics, Ilmenau University of Technology, Ilmenau, Germany

<sup>2</sup>Biomagnetic Center, Department of Neurology, University Hospital Jena, Jena, Germany;

<sup>3</sup>NeuroEngineering Lab, Department of Electrical and Electronic Engineering, University of Melbourne, Melbourne, Victoria, Australia

<sup>4</sup>Department of Medicine, St. Vincent's Hospital, University of Melbourne, Fitzroy, Victoria, Australia

<sup>5</sup>Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany

Skull conductivity inhomogeneities include naturally occurring large conductivity variations such as fontanelles in infants or the spongy bone structure embedded in the compact bone.