Noise impact on different OPM-MEG measuring components

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Optically pumped magnetometers (OPM) have in recent years proven to be a very good alternative to standard SQUID magnetometers for MEG measurements. They can be placed closer to the head, in theory, this significantly improves the signal-to-noise ratio (SNR). Currently, there are commercial magnetometers on the market, which can simultaneously measure more than one orthogonal component of the magnetic field. In this work we present a simulation study, where we analyzed the effect of noise on the SNR and inverse solution accuracy, using each measurement component of the OPM sensors separately. We also examined whether combining multiple components improves the results [1].

To calculate the magnetic fields around the head we simulated one equivalent current dipole (ECD) multiple times, the directions and positions were determined randomly. To the magnetic fields, we added noise, which represents spontaneous brain activity within the subject and also external noise sources such as fluctuating background fields. To solve the inverse solution we performed an ECD fit [2]. In this work, we used two forward models: source inside a homogeneous conducting sphere and inside a 3 layer BEM model (subjects individual geometry).

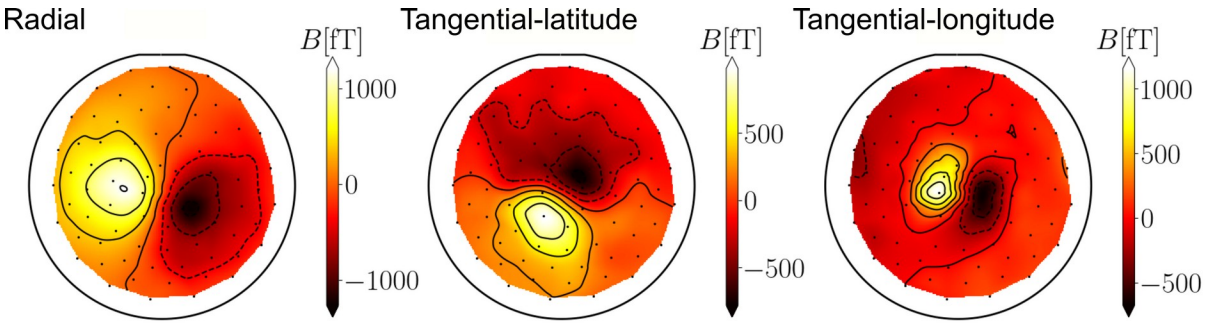

Figure 1: Magnetic field maps for one simulated ECD with added noise for each orthogonal measurement component of the OPM sensor (radial, tangential along the lines of latitude and longitude).

References

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