INVITED

MEG Measurement Using a 40-channel SQUID System

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We have earlier developed a 40-channel SQUID system that can detect magnetic field component tangential to the scalp using a DROS planar gradiometer. The rms noise of about 10 fT was sufficiently low for MEG measurement. In addition to the noise level, an important figure of merit of a MEG system is the localization accuracy with which the underlying current source can be localized. We investigated the localization accuracy of single current dipoles from the tangential components of auditory evoked fields. The tangential fields were measured using planar gradiometers arranged in a way to detect two orthogonal field components parallel to a flat plane. Field responses to 1 kHz pure tones were recorded and equivalent current dipoles (ECD) of N1m peak were estimated based on a locally fitted spherical conductor model. As a measure of localization accuracy, the standard deviation of the coordinates of the ECDs of N1m was obtained from repeated measurements for one subject. The estimated ECDs had a standard deviation of 5.5 mm and their mean location was at the supratemporal plane in the sylvian fissure of the MR image of the subject. In order to investigate the contribution of various errors to the localization accuracy, simulations using a sphere model and experiments using a realistically shaped skull phantom were performed. It was found that the background noise was the main source of the errors that could explain the observed standard deviation. Further, the amount of systematic error, when modeling the head with a spherical conductor, was much less than the standard deviation due to the background noise. These results suggest that the localization of current dipoles from the tangential fields does not produce additional errors in the temporal area. Based on the obtained accuracy, we measured auditory stimulated signals when a sentence ended with a semantically or syntactically inappropriate word. Here, the preliminary results will be presented.

keywords : SQUID, MEG, localization, auditory evoked field