

Supplementary material
for
“Sensor array design of optically pumped magnetometers
for accurately estimating source currents”

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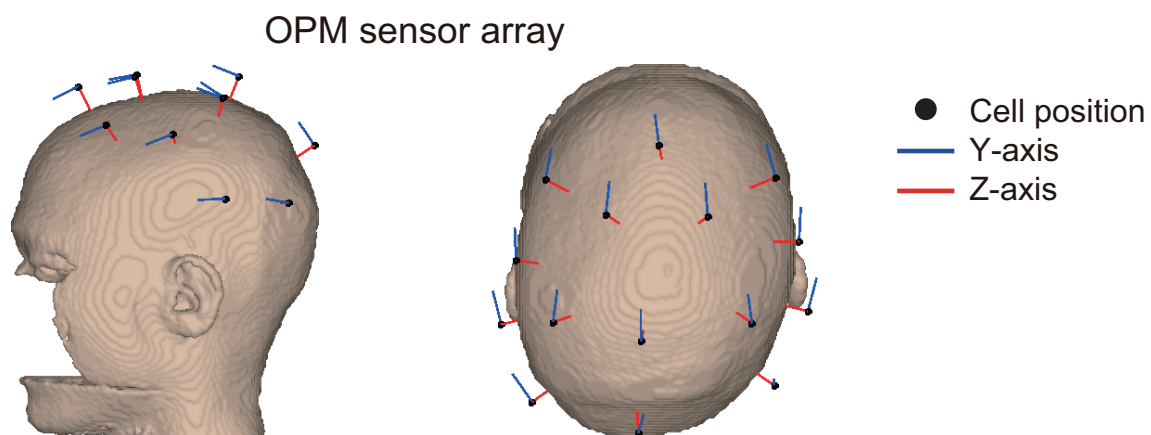


Figure 1: OPM sensor array of OPM-MEG, SQUID-MEG, and EEG (OSE) dataset. OPM-MEG data were recorded with 15 sensors, each of which recorded a magnetic field along two axes (Y and Z).

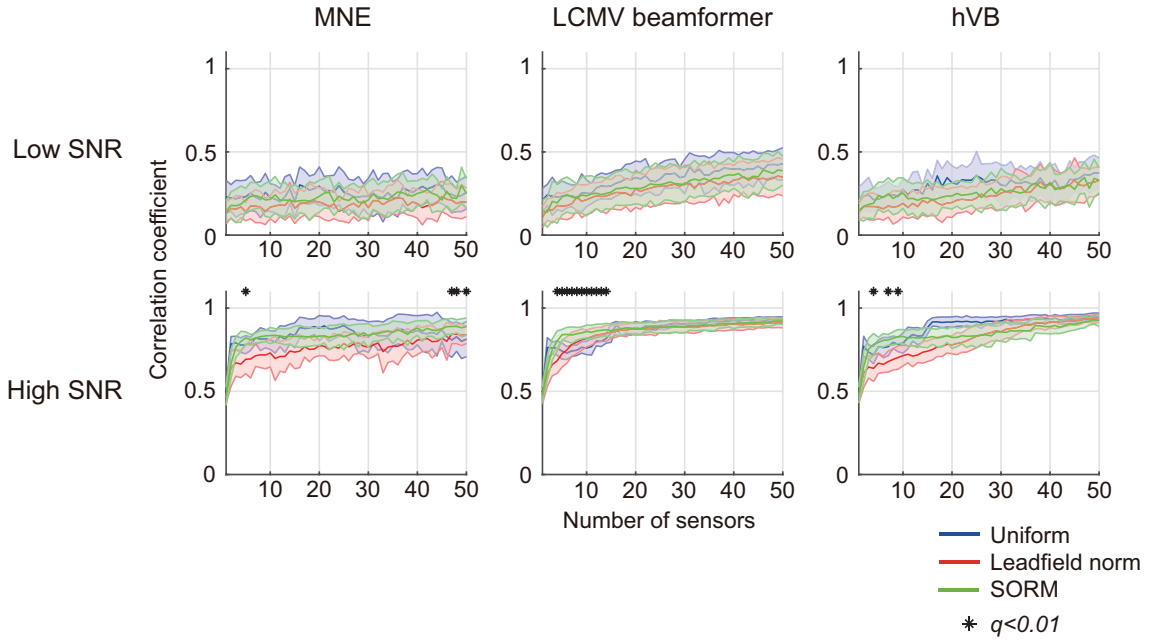


Figure 2: Time-series accuracy of estimated source currents in realistic simulation test. We examined two cases: low and high SNRs. Low- and high-SNR OPM-MEG data were generated by multiplying \mathbf{J} (Section 3.3.2) by 0.2 and 2. SNRs of OPM-MEG data were -32.44 ± 1.44 dB and -12.44 ± 1.44 dB for low- and high-SNR cases. We used same sensor arrays as simple simulation test (Fig. 4B) because we set the same ROIs as in simple simulation test (early auditory cortices, Fig. 4A). For each subject, we calculated correlation coefficients between true and estimated currents at left and right sources and averaged them between hemispheres. Thick lines and shaded areas represent averages and SDs of correlation coefficients across subjects. Asterisks indicate that correlation coefficients of SORM were significantly higher than those of uniform and leadfield norm methods ($q < 0.01$).

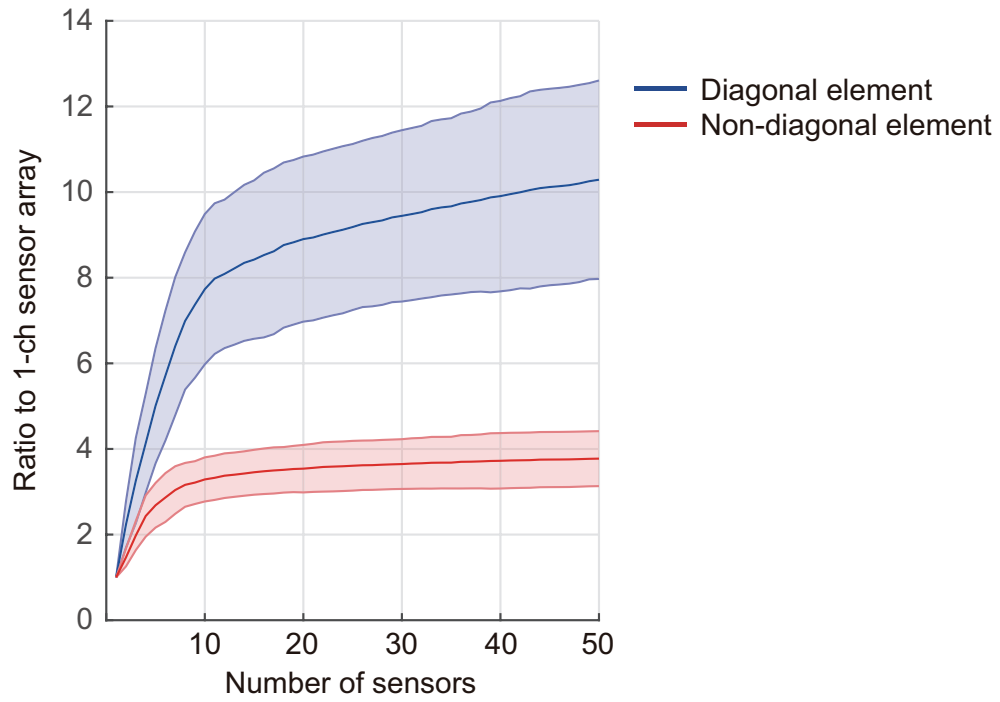


Figure 3: Magnitudes of diagonal and non-diagonal elements at ROIs in MNE’s resolution matrices. For each sensor array designed by SORM for auditory task, we calculated magnitudes of diagonal and non-diagonal elements at ROIs in MNE’s resolution matrices and converted magnitudes to ratios by dividing them by those of 1-ch sensor arrays. Thick lines and shaded areas represent averages and SDs across subjects.

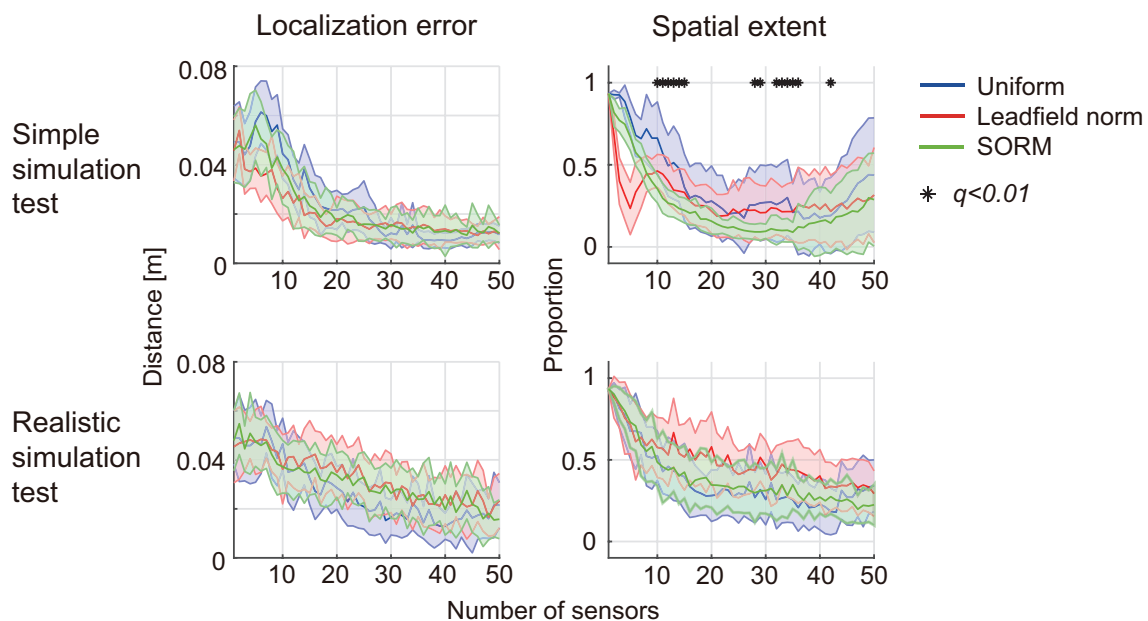


Figure 4: Spatial accuracy of cortical currents during auditory task estimated by MNE. We normalized estimated currents to have mean 0 and SD 1 during a baseline period for each vertex and calculated localization error and spatial extent. Localization error is Euclidean distance of peaks between true and estimated currents. Spatial extent is proportion of vertices whose amplitudes exceeded 0.5 of maximum value across vertices. Thick lines and shaded areas represent averages and SDs across subjects. Asterisks indicate that SORM exhibited higher accuracy than uniform and leadfield norm methods ($q < 0.01$).