Triaxial OPMs: Next generation of wearable MEG?

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MEG systems based on SQUID sensors typically measure one component of the neuromagnetic field, due to the complexity of the required geometry of flux transformers. However, newly available commercial OPMs offer the possibility to measure a complete triaxial magnetic field at multiple locations across the scalp. Here, we aimed to test the suitability of such sensors for MEG.

A simulated MEG system based on triaxial sensors (Figure 1a) showed that vector measurement might be particularly useful for studying the infant brain: As the brain of an infant is closer to the sensors than that of an adult, a radial-only system results in gaps in coverage. However, a triaxial array fills these gaps, providing more uniform coverage. In addition, previous work suggests that triaxial measurements would be advantageous for rejecting interference [1].

Triaxial wearable MEG devices are now commercially available, and using 4 of these sensors, we tested their suitability to measure biomagnetic signals. Figure 1b shows the magnetic field from the human heart, measured at multiple locations above the chest. Figure 1c shows 4 triaxial sensors used to measure the magnetic field from the brain (the field generated by a burst of beta activity in the left primary somatosensory cortex). In both cases sensors showed excellent sensitivity to the biomagnetic field, across all three available axes.

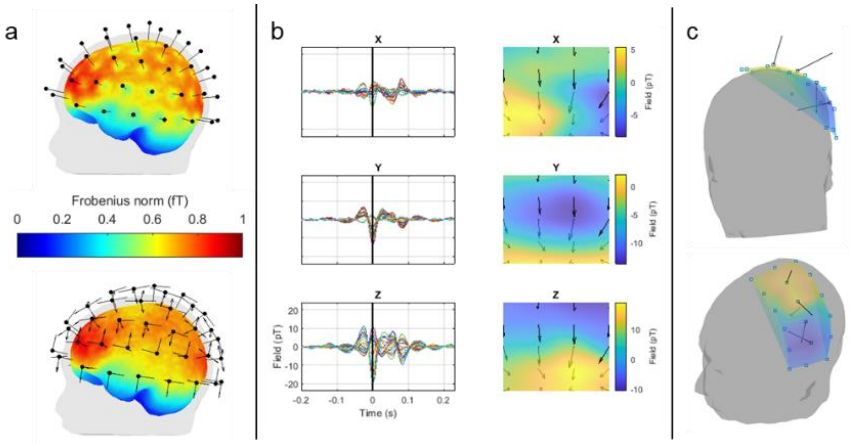

Figure 1: a) A simulated triaxial array (bottom) results in more uniform coverage, compared to a radial-only array (top). b) MCG signals measured with triaxial sensors. c) Vector neuromagnetic fields from 4 triaxial OPMs placed over left primary sensorimotor cortex.

These data show clearly the utility of triaxial sensors for MEG, which offer similar performance to the conventionally available dual axis OPMs, but with the added benefit of an additional measurement. We believe triaxial OPMs will show utility in scanning infants (due to improved coverage) and will offer improved rejection of interference.

References

[1] M.J. Brookes et al., NeuroImage **236**, 118025 (2021).