biomagnetic sensing SFB 1261

Magnetoelektrische Sensoren in der Medizin

Magnetoelectric Sensors:
From Composite Materials to Biomagnetic Diagnostics

Magnetoelectric Sensors for (Bio-) Medical Applications

C A U Kiel University Christian-Albrechts-Universität zu Kiel

UK SH UNIVERSITÄTSKLINIKUM Schleswig-Holstein

UNIVERSITÄTS KLINIKUM HEIDELBERG

Fraunhofer ISIT

IPN

Lumpsum Proposal – Keyword of the Idea

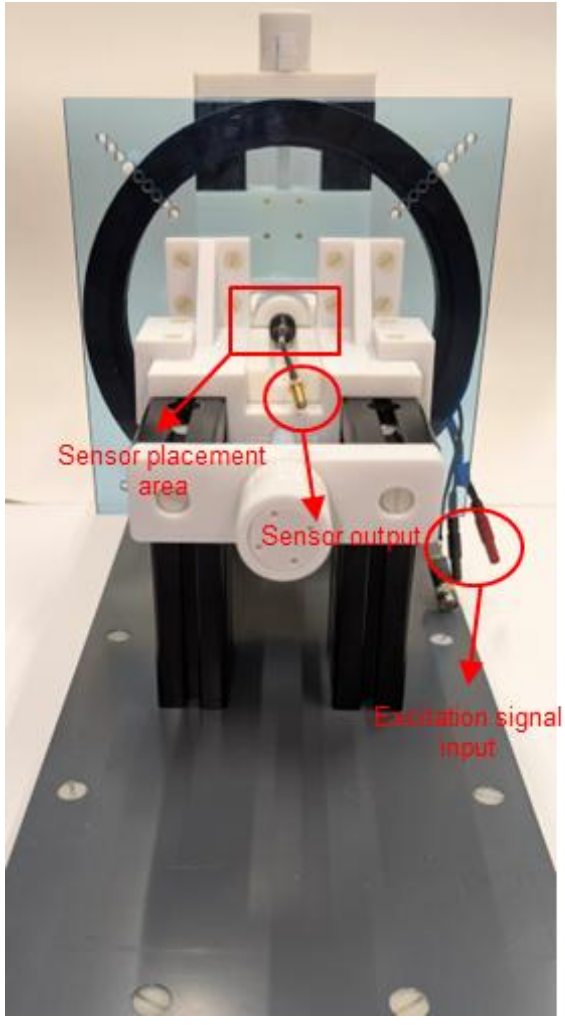
biomagnetic sensing SFB 1261

Overview of the proposal

Title	**Advancing the Measurement and Characterization of Functionalized Magnetic Nanoparticles under Earth's Magnetic Field Condition**
Required money	**≈ 23.040,00 € (net)**
Project	**Z2 (supported by B1 and B12)**
PI for correspondence	**Robert Rieger**
Short description	**A novel, unshielded, and portable measurement setup has recently been developed and described in a preprint [1], which, although not originally included in the CRC proposal, is essential for achieving the project's objectives. To advance this work further, a high-precision reference magnetometer with three-axis capability at one measurement point is required for accurate calibration of the complete system. Beyond its role as a calibration reference, the magnetometer will be employed to monitor the Earth's magnetic field during MNP measurements continuously, with particular relevance for MNP investigations and to track field gradients. Given the required performance specifications, we propose the use of a newly available Fluxgate Magnetometer (MAG-13 MSL-70, low-noise version). This capability enable also for optimizing and dynamically adjusting the magnetic operating point of ME sensors. In particular, it will allow for an adaptive control of the biasing coil, either PCB-integrated (cf. developments at B1) or external, by fine-tuning the applied coil current to achieve maximum ME sensor performance, depending on the given environment. Furthermore, the existing soundcard-based approach should be replaced by a more advanced 4-channel ADC/AWG system to enable synchronous signal acquisition (value-true measurement without extensive calibration as for soundcards) and generation. This system will also support DC recording and achieve sampling rates of up to 40 MS/s (synchronous sampling), thereby enabling precise phase evaluation. In addition, the platform offers the potential for future scalability through the integration of multiple devices.** **[1]** *G. Barbieri et. al: Unshielded Portable Gradiometer Setup for Magnetic Nanoparticles Characterization in Flow Condition, doi: 10.36227/techrxiv.175459406.68796737/v1*

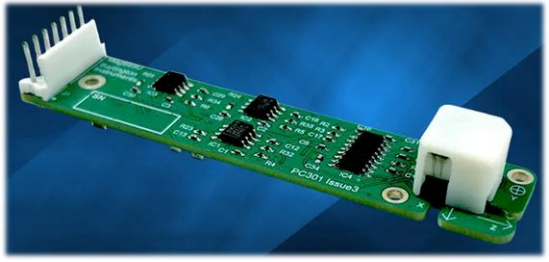
Lumpsum Proposal – Keyword of the Idea

biomagnetic sensing SFB 1261



IGM Geophysik
Bartington: 3-axis Fluxgate

➔ **one point-measurement, very low noise 6 pT/√Hz, calibrated**



Spectrum Instrumentation GmbH
DN2.813-04
4-Channel DAQ & 4 AWG Channels

➔ **phase synchronous detection, value-true measurement without calibration, DC - 20 MHz, 40 MS/s, synchronous sampling**