Master/- Bachelor Thesis

Iterative Design and Experimental Validation of Resistive B_0 Coils for Low Field MRI

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Background

Magnetic resonance imaging (MRI) uses a static magnetic field B_0 and radiofrequency signals to create detailed anatomical images. While most clinical scanners operate at 1.5–3 T, low-field MRI (around 50 mT) is gaining attention for enabling compact, lower-cost, and more portable systems. This can expand MRI access to bedside imaging, emergency settings, and resource-limited environments. Together with the Fraunhofer MEVIS Institute, we are developing a low-field MRI device and investigating new hardware and software concepts. One area of research is exploring new scanner designs and geometries that are more closely optimized for specific anatomies and targeted imaging tasks.

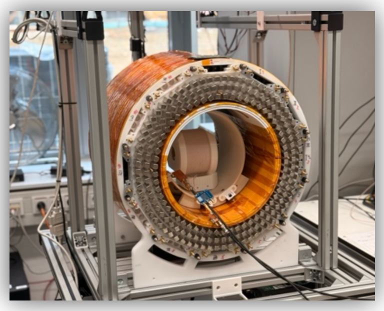

Figure 1: Low-field MRI - Lab setup.

Tasks

A key step toward the next generation of our low-field MRI system is a specialized resistive B_0 coil that produces a very uniform field in the right place. You will help achieve this by designing and evaluating coil concepts to meet the required homogeneity in a defined region of interest. With tools like PyCoilGen, you'll simulate optimized coil layouts on curved, anatomy-shaped surfaces for a specialized imaging setup (such as brain, prostate, or breast) and iteratively improve them while keeping practical constraints in mind. You will translate the best layouts into manufacturing-ready designs, build prototypes, and set up a repeatable B_0 field-mapping workflow (sensor selection, fixtures, positioning, and calibration). The measured field maps will then be used to validate the design and guide the next improvement step.

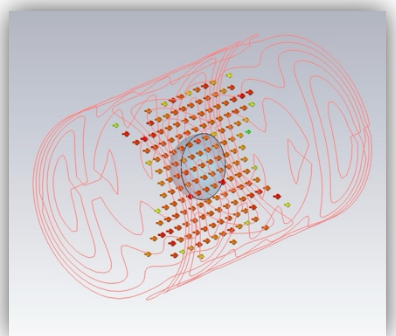

Figure 2: Simulated resistive B_0 coil producing a transverse B field relative to the bore axis.

Your Profile

- Student (BSc or MSc) in a relevant field (e.g., Electrical Engineering, Physics, Biomedical Engineering) with solid Python skills and motivation for hands-on prototyping and lab testing.
- Nice to have: familiarity with numerical simulation/optimization, basic magnetostatics or MRI field concepts (B_0, homogeneity, ROI), and experience building or using sensor-based field mapping setups (fixtures, positioning, calibration).

Our Offer

We offer a collaborative culture in a dynamic team of students, PhD candidates, and postdocs that values new ideas and lively discussion. A workstation can be provided in our student office, together with modern IT infrastructure that includes around 2000 CPU cores and 100 GPUs, including multiple nvidia rtx pro 6000 class server GPUs. You will also have access to a workshop and rapid prototyping facilities, including 3D printers with multi toolhead capability, to support fast iteration from design to hardware.