

## Bachelor/Master-Thesis

# Gradient Coil Design in Low-Field MRI System

### Keywords

**Low-Field MRI | Electromagnetism | Gradient Coils**

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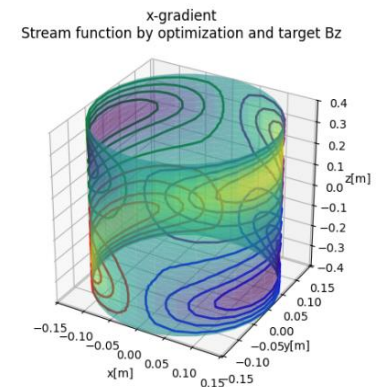
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### Background

Magnetic resonance imaging (MRI) is a widely used imaging technique that employs magnetic fields and radio waves to generate detailed images of internal body structures. Low-Field MRI systems operate with reduced magnetic field strength, making them more affordable and portable compared to high-field systems.

As part of the DeLoRI project, conducted jointly with Fraunhofer MEVIS, we are developing a low-field MRI device to enhance cancer diagnostics. A critical component of such MRI systems is the gradient coils, which are responsible for spatial encoding by generating magnetic field gradients. High-quality image reconstruction requires precisely designed and constructed gradient coils.



### Tasks

The objective of this thesis is to design gradient coils for the x, y, and z axes using established methods tailored to low-field MRI. The work will involve simulating generated magnetic fields as well as exploring different design configurations optimized for low magnetic field strengths. A key focus will be the investigation of the stream function method, a method that enables the design of gradient coils with high precision by representing current distributions as scalar potentials. The thesis will explore the use of open-source software tools such as CoilGen, pyCoilGen, and ThinWire to facilitate simulation and design optimization. The thesis aims to deliver innovative gradient coil solutions tailored to low-field MRI systems.

### Your Profile

The ideal candidate should have an interest in one or more of the following fields:

- Electromagnetic field simulation
- Gradient coil optimization frameworks | MRI
- Python programming | software development

### Our Offer

The call for applications is aimed at bachelor's and master's students with a background in physics and programming (e.g. physics or electrical engineering students) and is carried out in cooperation with Fraunhofer MEVIS in Aachen. A workstation with access to modern IT infrastructure, workshop facilities, and rapid prototyping tools will be provided.