

## Master's/ Semester Thesis

### Development of a Magnetic Nanoparticle Accelerator

Keywords: Magnetic Separation, Particle Accelerator, Biotechnology, COMSOL

#### Project Description

Imagine turning the concept of a particle accelerator into a groundbreaking tool for biotechnology! This thesis project aims to revolutionize magnetic bioseparation by shifting from conventional batch processes to a continuous system.

Magnetic separation offers a promising and cost-effective alternative to traditional chromatography, which remains the most expensive step in biomolecule purification. While chromatography is highly effective, it comes with significant operational costs. Magnetic separation, on the other hand, has the potential to drastically reduce these costs but is currently limited by its batch-wise operation. By using the idea of a particle accelerator, we aim to overcome this limitation.

You will start by using COMSOL Multiphysics to design and simulate the accelerator, optimizing magnetic fields and particle trajectories. Once the simulation validates the concept, you will move on to designing and constructing a prototype, followed by experimental validation.

This is a full-cycle project, covering simulation, mechanical design, prototyping, and experimental testing – perfect for students who love combining theory and hands-on engineering.

#### Research Objectives

- CAD design using Autodesk Fusion
- Magnetic field and particle trajectory simulation using COMSOL
- Prototype development
- Experimental validation
- Feasibility assessment

**Start: flexible**

#### Profile

- Enrolled in Mechanical/Process Engineering, or a related field
- Above-average academic performance
- Experience with Autodesk Fusion and COMSOL (or willingness to learn)
- Problem-solving mindset and enthusiasm

