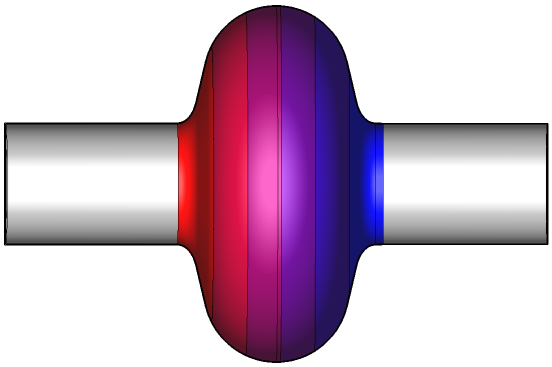
Modeling of Sputtering Distributions on Cavities with CST Microwave Studio

TECHNISCHE UNIVERSITÄT DARMSTADT

Proposal for a Bachelor's thesis | Master's thesis | HiWi job | PEMCAD seminar
Study field: Computational Engineering | Electrical Engineering
March 12, 2025

Description

The operation of bulk **Nb accelerator cavities** is extremely expensive due to the low-temperature helium cooling. It is expected that **Nb_3Sn-coated cavities** and cavities with **superconductor-insulator-superconductor layered coatings** can be operated with higher fields and higher temperatures, leading to a decrease in power consumption. Such coatings are applied to the cavity via **sputtering**. However, the sputtering distribution on a complex shape, such as a TESLA cavity, is typically inhomogeneous. This leads to the question of what the influence of inhomogeneous sputtering is on the quality of the cavity. Before attempting to answer this question, we want a way to represent this sputtering distribution in a simulation software standard in the field, namely CST.



Work plan

- Programmatically generate shell around cavity in CST.
- Slice the shell into smaller pieces, and assign material according to parameter distribution.
- Study robustness of the procedure, e.g. leads to the same result over multiple runs with identical settings.
- Study convergence of the procedure, e.g. increasing the shell slices leads to convergence.

References

- Dassault Systemes, CST Studio Suite: `https://www.3ds.com/products/simulia/cst-studio-suite`
- Python programming language: `https://www.python.org/`

Contact:
Aaron Gobeyn, M.Sc.
aaron.gobeyn@tu-darmstadt.de
Office: S2|17 142

SIMULIA CST STUDIO SUITE

Figure 1: CST Studio Suite for 3D-EM simulations.

python™

Figure 2: Python programming language.

Microsoft Visual Basic for Applications

Figure 3: Visual Basic for Applications (VBA) programming language for controlling CST.

T E M F