IPAC'25 - the 16th International Particle Accelerator Conference



Contribution ID: 2279 Contribution code: SUPS011

Type: Student Poster Presentation

Introducing an open-source 3d electromagnetic wakefield solver for beam-coupling impedance simulations

Sunday 1 June 2025 14:00 (2 hours)

The determination of electromagnetic wakefields and their impact on accelerator performance is a longstanding challenge in accelerator physics. These wakefields, induced by the interaction between a charged particle beam and the surrounding vacuum chamber structures, significantly affect beam stability and power dissipation. Accurate characterization of these effects via beam-coupling impedance is crucial for predicting and mitigating performance limitations. While analytical methods are sufficient for simple geometries, realistic accelerator components require full-wave, three-dimensional numerical solutions of Maxwell's equations. In alignment with CERN's Open Science initiative, this contribution introduces an open-source 3D electromagnetic time-domain solver specifically designed for computing wake potentials and impedances in arbitrary geometries. The solver's numerical implementation, optimized for CUDA-enabled GPUs, is presented and validated through benchmarks against established commercial codes. By fostering a collaborative framework, this solver aspires to address emerging challenges in accelerator design.

Footnotes

Paper preparation format

LaTeX

Region represented

Europe

Funding Agency

Author: DE LA FUENTE, Elena (European Organization for Nuclear Research)

Co-authors: ZANNINI, Carlo (European Organization for Nuclear Research); IADAROLA, Giovanni (European Organization for Nuclear Research); GIACOMEL, Lorenzo (European Organization for Nuclear Research)

Presenter: DE LA FUENTE, Elena (European Organization for Nuclear Research)

Session Classification: Student Poster

Track Classification: MC5: Beam Dynamics and EM Fields: MC5.D03 Calculations of EM fields Theory and Code Developments