The CERN Accelerator School

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Beam Tracking I

Friday 23 June 2023 08:30 (1 hour)

The lectures treat longitudinal beam tracking in synchrotrons. After introducing the basics of creating an accelerator model and discretisation, the lecture discusses the choice of the time frame and coordinates for longitudinal tracking. Concerning tracking without intensity effects, it touches on symplectic, periodic boundary conditions, and RF gymnastics. Concerning collective effects, the course details how to include and discretise induced voltage in simulations and how to choose simulation parameters to well resolve beam and impedance. It briefly describes beam instabilities, multi-turn wakes, and synchrotron radiation. Thereafter, RF modelling is treated, including cavity-beam-transmitter interaction, phase and frequency modulation, as well as modelling global and local control loops. Then, the lecture walks through the generation of particle distributions and mentions some six-dimensional effects. Finally, code optimisation and benchmarking are treated, touching on code-design aspects, good practises runtime and memory considerations, as well as how to test, compare, and benchmark simulation code.

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