Joint DESY and University of Hamburg Accelerator Physics Seminar

Tuesday, April 26, 2005

(16:00 in Room 459/30b)

Fast Space Charge Calculations with a Multigrid Poisson Solver & Applications

Gisela Pöplau

Universität Rostock

Abstract

Fast calculation of 3D non–linear space–charge fields is essential for the simulation of high–brightness charged particle beams. A well–known method to calculate space-charge fields is the particle mesh method, solving Poissons equation for the electrostatic field in the rest frame of the bunch. In the talk we give a new approach to the particle mesh method with an adaptive meshing following the particle density distribution and an adaptive multigrid method as Poisson solver.

Since the multigrid Poisson solver depends only linearly on the number of mesh points for the discretized electrostatic problem the space–charge routine scales linearly with the number of particles in terms of CPU time. This performance allows a million particles to be tracked on a normal PC. The choice of the routine parameters for an optimal performance (such as number of particles, particle distribution, number of meshlines, ect.) will be discussed with a model bunch. The 3D space charge routine is available in the tracking code GPT. Simulation results of the DESY RF–photogun will be discussed in comparision with ASTRA simulations.

D.P.Barber (MPY), J.Rossbach (Univ. HH) and M.Vogt (MPY).