Joint DESY and University of Hamburg Accelerator Physics Seminar

Tuesday, December 18-th, 2007

(16:00 in Room 459/30b)

Recent Developments on Beam Dynamics and Wake Field Simulations at TEMF

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Abstract

The calculation of short range wake fields for ultra–relativistic bunches is of fundamental importance for the design of many beam line elements. A reliable method to perform wake field computations is based on the time domain solution of the full Maxwell equations using dispersion–free numerical algorithms. This approach enables efficient wake field simulations on moving computational windows for long accelerator structures. These ideas have been realized in PBCI; a parallelized, fully 3D wake field code. As an important application, a large scale wake field simulation of the TESLA 9–cell cavities, including the HOM couplers, will be shown in the presentation.

In the context of self–consistent PIC simulations, the application of novel class of higher order FEM type discretizations in the time domain will be discussed. These solvers are perfectly suited for the space–charge dominated PIC simulation, e.g. of the PITZ gun. The higher order discretization allows for higher solution accuracy, in particular, in the short wave length limit. This results in substantially less numerical heating, which represents the major limitation of traditional PIC simulations. We will discuss issues related to the stability, energy and charge conservation as well as to the dispersion properties of the method.

Furthermore, beam dynamics simulation on the basis of computational particles can be successfully extended from fixed sized macroparticles to those with variable dimensions. The so called 'ensemble model' represents the 6D phase space distribution in terms of discrete moments of the distribution function and enables the calculation of bunched beam parameters using just a few ensembles. In the presentation an overview of the method and comparative simulation results will be given.

D.P.Barber (MPY), S.Khan (Univ. HH), J.Roßbach (Univ. HH) and M.Vogt (MPY).