

ACCELERATOR SEMINAR

“Differential Algebraic Methods for Space Charge Modeling and Applications to the University of Maryland Electron Ring”

Edward Nissen

As the importance of beam intensity increases within the accelerator physics world, new methods of modeling intense beams will become equally important. The methods presented here have been developed to model space charge in the University of Maryland Electron Ring, which uses low energy electrons as proxies for high energy ions in order to study space charge. The work was performed using the computer code COSY Infinity 9.0 which uses differential algebras to determine high order, exact, numerical derivatives. The tools developed here go beyond merely tracking particles through the ring, and include the geometry of the injection line, the effects of the Earth's magnetic field, and the effects of space charge on the transfer map of the system. Using this map, quantities of interest such as tunes or chromaticities can be extracted directly using normal form methods. This method of adding space charge to the map of the system uses a novel Poisson solver that is massively parallelizable and scales linearly with particle number. Additionally, an implementation of the fast multipole method has been included. The calculations that have resulted from this model are also compared to experimental data taken on the ring itself.

Thursday, April 21, 2011

3:30 p.m.

CEBAF Center, Room F113

Coffee before seminar at 3:15 p.m.