REU Program 2003
Cornell University

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— Project Description —

Injection Optimization for CESRc Operation at $\sqrt{s} = 3.76$ GeV

The Cornell Electron Storage Ring will begin operation in July, 2003 at a center-of-mass energy of 3.76 GeV with the goal of studying charmonium decays to unprecedented statistical precision. The CESR schedule thus presents a remarkable opportunity for a student to witness the commissioning of CESR with dramatically modified optics following the installation of six wiggler magnets in the storage ring. The success of the program depends critically on our understanding of the procedure used to transfer electrons from the synchrotron to the storage ring in the presence of a stored positron beam. The goal of this project is to determine parameters such as optimal orbits, betatron tune values and pulsed element settings for the CESRc configuration.

I. Literature

A. CESR notes and tutorials on the injection procedure

B. Standard introductory texts on accelerator physics

II. Software

A. General-purpose software Tools

1. The UNIX operating system
2. Fortran 90 programming language
3. CERN Physics Analysis Workstation data analysis and display package

B. Custom software for CESR

1. Injection simulation program INJTRACK
2. Injection simulation utility library INJLIB
3. CESR tracking program BMADZ

III. Research Program

Investigate for six-wiggler optics:

A. Stored e^+ beam orbit

B. Injected e^- beam orbit

C. Phase-space distributions

D. Injection efficiency dependence on:

1. Horizontal and vertical betatron tunes
2. Injected beam emittance
3. Injection angle
4. Injected beam position
5. Pretzel amplitude
6. Strength of parasitic long-range beam-beam interactions