Cornell University
Laboratory for Elementary-Particle Physics

Summary

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Accelerator-Based Sciences and Education

R&D Priorities

CesrTA will address most of the highest priority R&D

- Demonstrate
  5-10 pm for *positrons* in a *wiggler dominated ring*
- Characterize electron cloud build up
  - Dipoles, drifts, quadrupoles, and *wigglers* at 5GeV
  - *For both electrons and positrons*
- Develop and test electron cloud suppression techniques
  - *In superferric wigglers at 5GeV*
- Develop modeling tools for electron cloud instabilities
- Determine electron cloud instability thresholds
  - *For positrons in the ultra-low emittance regime*
- Characterize ion effects
- Specify techniques for suppressing ion effects

- On a timescale consistent with an Engineering Design Report in 2010

Core needs of program

- Low emittance tuning
  - Survey equipment
  - Bunch by bunch beam position monitors
  - X-ray beam size monitor
  - Machine time
- Electron cloud characterization
  - Chambers to measure cloud density
  - Chambers designed to suppress cloud
  - Photon stop for 5GeV operation with 2.1 T wigglers
  - Machine time
- Electron cloud induced instability thresholds
  - Low emittance beam and monitor to measure beam size
  - 4ns longitudinal feedback
  - Machine time
- Simulation, modeling, analysis
  - Collaborators and students

Train students

Students have already made important contributions

- Graduate students
  - Rich Helms - Low emittance tuning
  - Jeremy Urban - Wiggler characterization
  - Jim Shanks - Space charge effects
- Undergrad and REU (Research Experience for Undergraduates)
  - Mike Ehrlichman - intrabeam scattering,
  - Jim Shanks - lattice design
  - Joseph Burrell - Beam Position monitor
  - Daniel Carmody - Electron cloud modeling
  - Pauli Kehayias - Fast Ion Instability
  - Chris Cude-Woods - Diagnostics for electron cloud measurements in CESR
  - Jennifer Yu - Electron cloud simulation in wigglers
  - Joshua Kennedy - Mechanical design and layout of CesrTA
  - Sheng Xu - Mechanical design and layout of CesrTA

We will continue to involve students (and to depend on them)

Outreach at LEPP

- 30-35 undergraduates employed each year
- Internships for local high school students
- 10 students from Cornell SPS participated in LEPP sponsored enrichment programs for middle school and elementary school
- Hosted 153 REU and 17 RET students since 1998
- 1000 people tour the lab each year
- 525 middle/high school students and 85 teachers received guided tours in 2006
- In 2006, 35 physics educators participated in lab sponsored Preparing Future Physics Teachers Conference
- Hosted two conferences dedicated to improving high school science curriculum
- Participant in the international collaboration InterActions

Benefits to other accelerator activities

- Instrumentation
  - Xray beam size monitor (~1μm resolution)
    - ILC damping ring, light sources
  - Multibunch turn by turn beam position monitors
    - Light sources, ERL
- Electron cloud physics
    - Light sources, LHC, SNS - beam physics
- Low emittance tuning algorithms
    - Light sources, damping rings
- Training of students and accelerator scientists
    - All future accelerators