Cornell University
Laboratory for Elementary-Particle Physics

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Recent Operational Experience and Future Plans for the Cornell Electron Storage Ring

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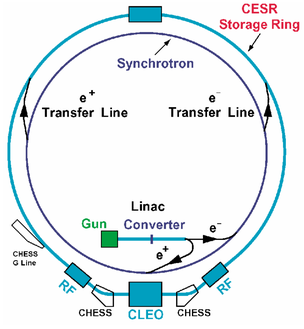
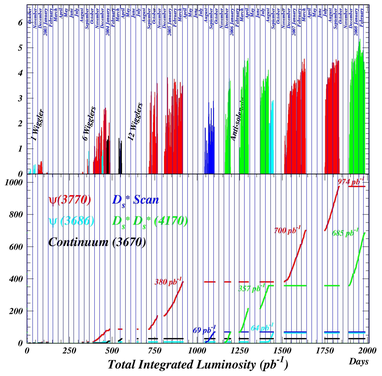
Abstract

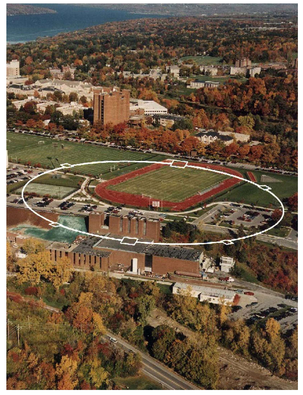
Operation of the Cornell Electron Storage Ring CESR for the production of charm quark bound states from 2002 to 2008 has resulted in world-record data sets of decays of ψ(2s), ψ(3770) and D_s^+ mesons. The CESR-c project required the resolution of a unique array of accelerator physics problems associated with the dynamics of counter-circulating e^+/e^- beams in a single beam pipe and with the wiggler-dominated optics which resulted from the installation of twelve wiggler magnets to reduce the damping time from 500 ms to 50 ms. Future plans for CESR, including its continued operation as the synchrotron light source CHESS, its near-term conversion to CesrTA, an ILC damping ring R&D testbed, and its use as an essential component for a proposed Energy Recovery Linac are presented as well.



CESR-c Operation since 2003
12 superconducting wigglers since mid-2004
768 m circumference
1.5-6 GeV beam energy
24 bunches/beam 60 mA/beam

CESR-c 2002-2008





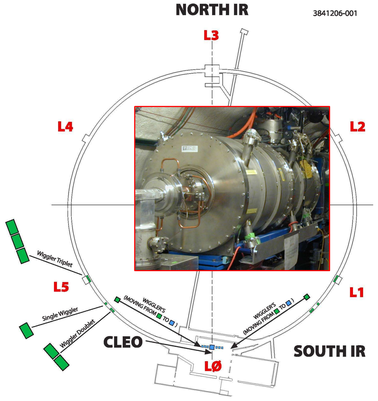
MILESTONES

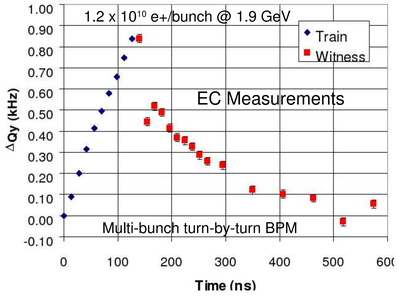
CESR	1975	CESR proposal
	1977	NSF funding approved
	1979	First circulating e^- beam
		First e^+e^- collisions
	1981	Mini-beta focusing at interaction region
	1984	Multiple bunches in pretzel orbits
	1988	Luminosity exceeds 10^{32} / cm^{2}s
	1994	Crossing angle and bunch trains
	1999	Superconducting RF cavities
	2003-04	CESR-c superferric wigglers
CLEO	1975	"South Area Experiment" group conceives CLEO
	1979	First data collected
	1983	B meson discovered
		D_s meson discovered
	1986	CLEO II detector with CsI calorimeter installed
	1989	b → u transitions discovered
	1993	b → s penguin decays discovered
	1995	CLEO II.V with silicon vertex detector installed
	1999	CLEO III with RICH installed
	2003	CLEO-c data collection started
	2004	h_c discovered
		D^+ meson decay constant measured
	2007	450th paper published

CesrTA

Test Accelerator for the International Linear Collider Damping Rings R&D

- **CesrTA Program has been funded jointly by the U.S. NSF and DOE ILC Damping Ring R&D program starting in mid-2008**
- **CESR/CHESS operates ≈120 days/year**
- **CesrTA Configuration:**
  - 12 damping wigglers located in zero-dispersion regions for ultra low emittance operation. Requires moving 6 wigglers from the arcs to L0. (NB: The ILC DR wiggler baseline design adopts the CESR-c pole parameters.)
  - Diagnostic vacuum chambers with electron cloud (EC) measurement and mitigation techniques
  - Designated sections available for installation of ILC prototype devices
  - Precision instrumentation
    - Multi-bunch turn-by-turn BPM system
    - Fast X-ray beam profile monitors
  - 4 ns bunch train operation





CESR-TA Baseline Configuration

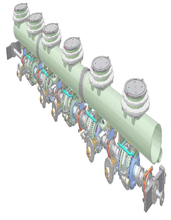
Parameter	Value
Nr of Wigglers	12
Wiggler Field	2.1 T
Beam Energy	2.0 GeV
Energy Spread (ΔE/E)	8.6×10^{-4}
Target Vertical Emittance	<20 pm
Horizontal Emittance	2.3 nm
Damping Time	47 ms
Bunch Spacing	4 ns
Bunch Length	9 mm

Proposed Energy Recovery Linac

ERL Phase Ia Test Facility at Wilson Laboratory
(Photos taken 3/31/08)

Five two-cell niobium superconducting cavities operate at 1.8K to accelerate beam to 5-15 MeV. Electron beam from photo cathode gun (presently in the gun test lab).

Five klystrons deliver 500 -700 kW of 1.3 GHz RF power to cavities from upper deck.



LEPP, the Cornell University Laboratory for Elementary-Particle Physics, has joined with CHESS to become the Cornell Laboratory for Accelerator-based Sciences and Education (CLASSE). LEPP's primary source of support is the National Science Foundation.