

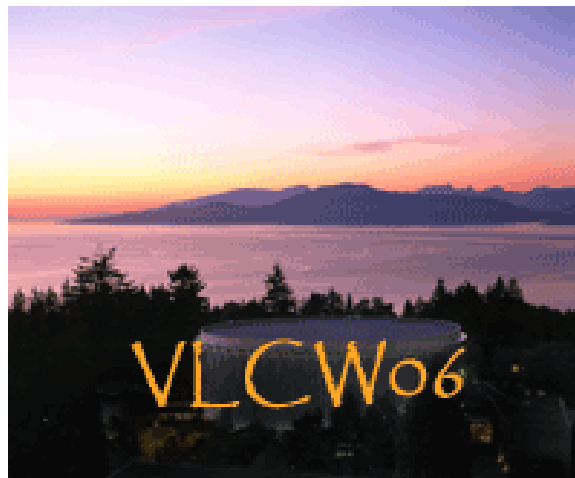


Recent Electron Cloud Studies at CESR and Future Plans

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• Recent Measurements at CESR

- Concerns about large e^+ emittance among other indicators
- ILC DR interest
- New instrumentation coming on line (CESR-c and ILC driven)

• Key CESR Parameters

- Circumference: 768.44 m
- Revolution frequency: 390.13 kHz
- RF frequency: 499.76 MHz
- Harmonic number: 1281
 - $1281/7 = 183$ bunches
- Spacing between bunches in train: 14 ns

• Instrumentation

- Bunch-by-bunch tune monitor
 - Capable of sampling up to 366 bunches in parallel
 - Vertical pinger used to excite the beam for this measurement
- Bunch-by-bunch beam size monitor
 - New capability has just come on line for multi-bunch operation
 - Utilizes Hamamatsu linear PMT array (H7260K) and 72 MHz digitizer unit

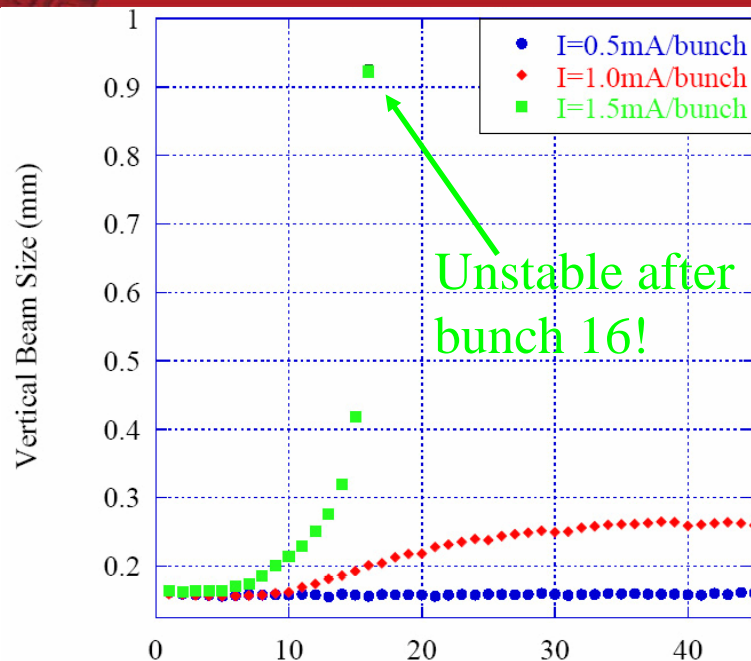
• People:

- D. Rice, G. Codner, E. Tanke, R. Holtzapple (Alfred U.) and students, M. Billing, and M. Watkins (CMU)

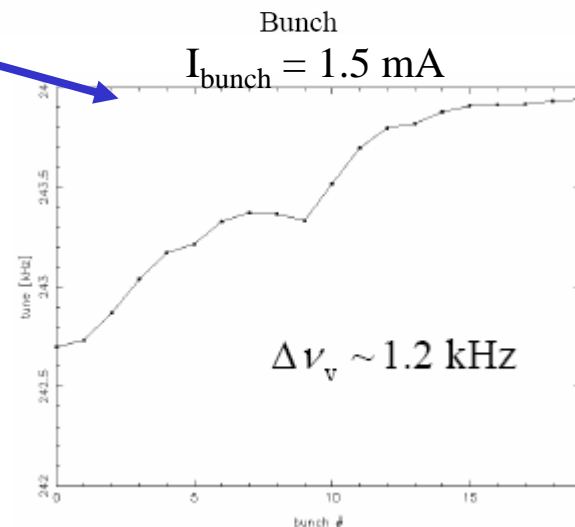
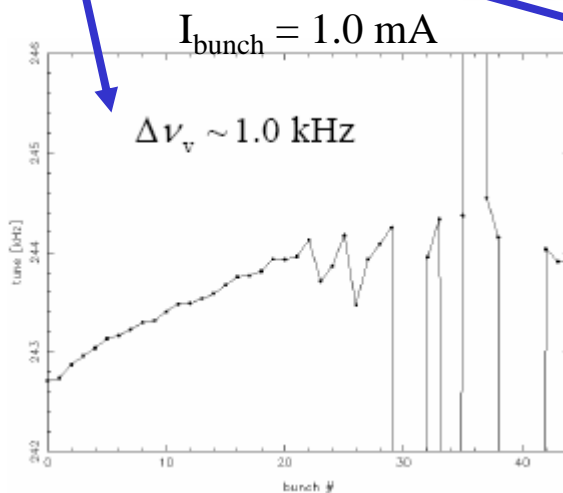
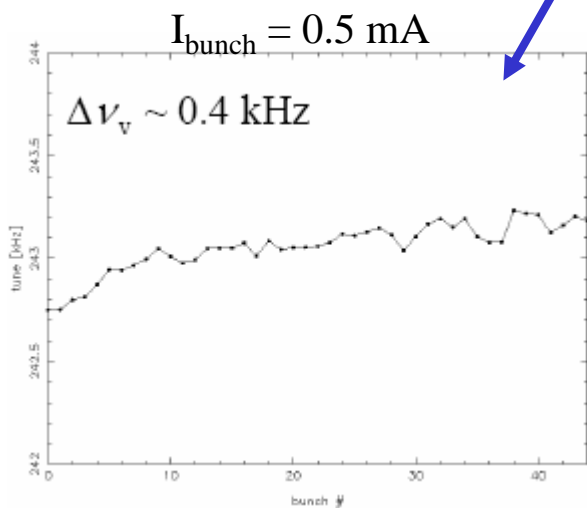


Cornell High Energy Synchrotron Source Running

- Most complete measurements carried out during last CHSS run
- Nominal setup: Single train with 45 bunches
- Assuming a constant electron density near the beam (and using $\beta_{avg} = 30m$ and parameters from p. 2), $\rho_e \sim 4 \times 10^{11} e^-/m^3$ for a vertical tune shift of ~ 1 kHz (0.00256)

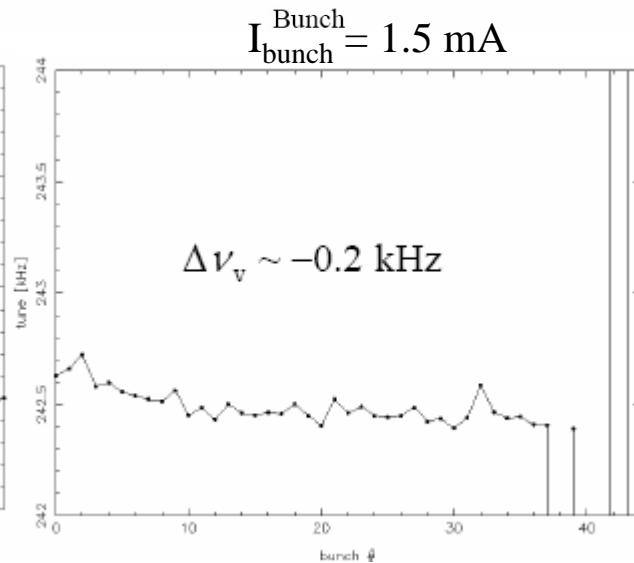
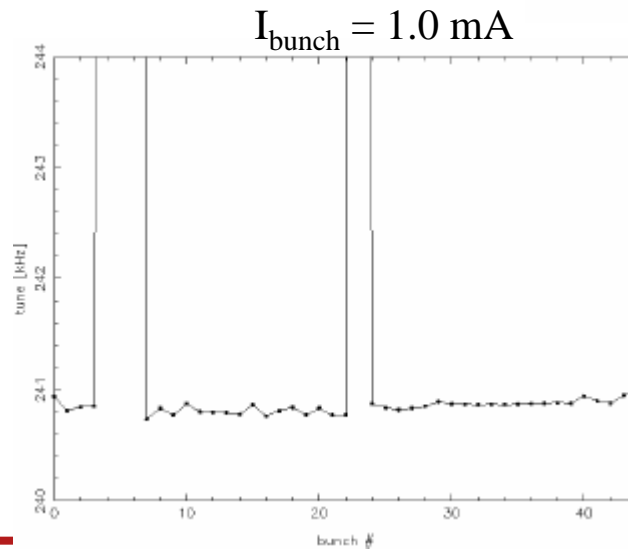
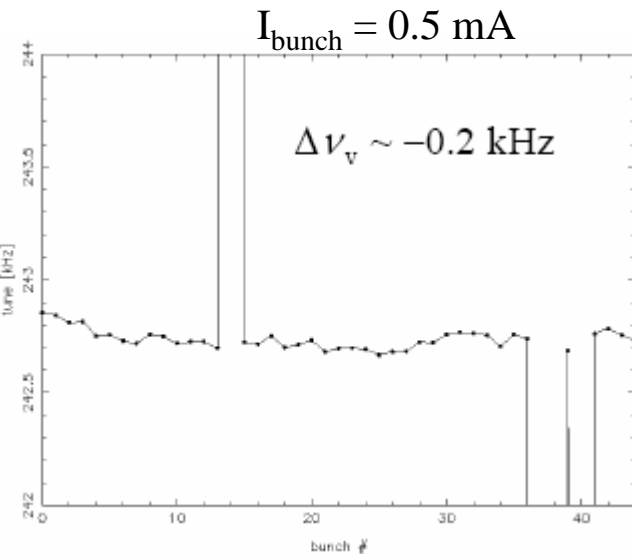
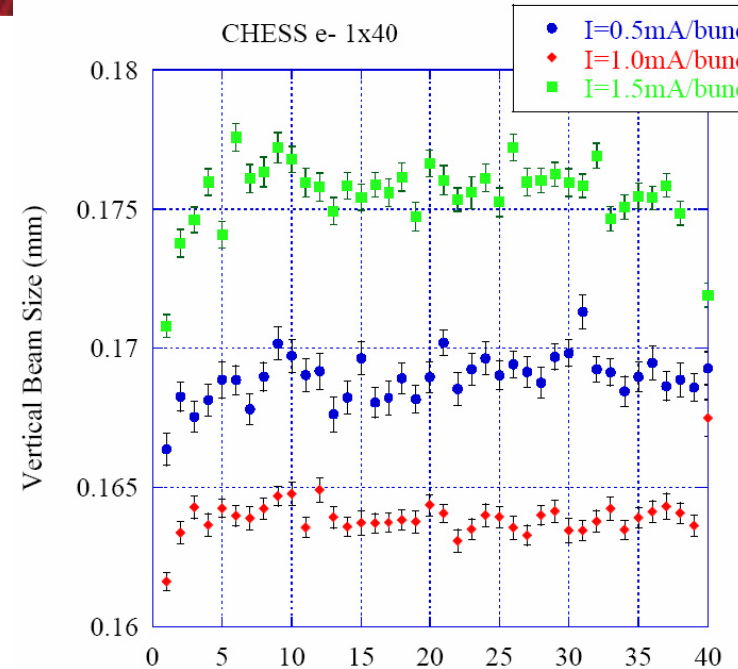


Bunch-by-bunch tune



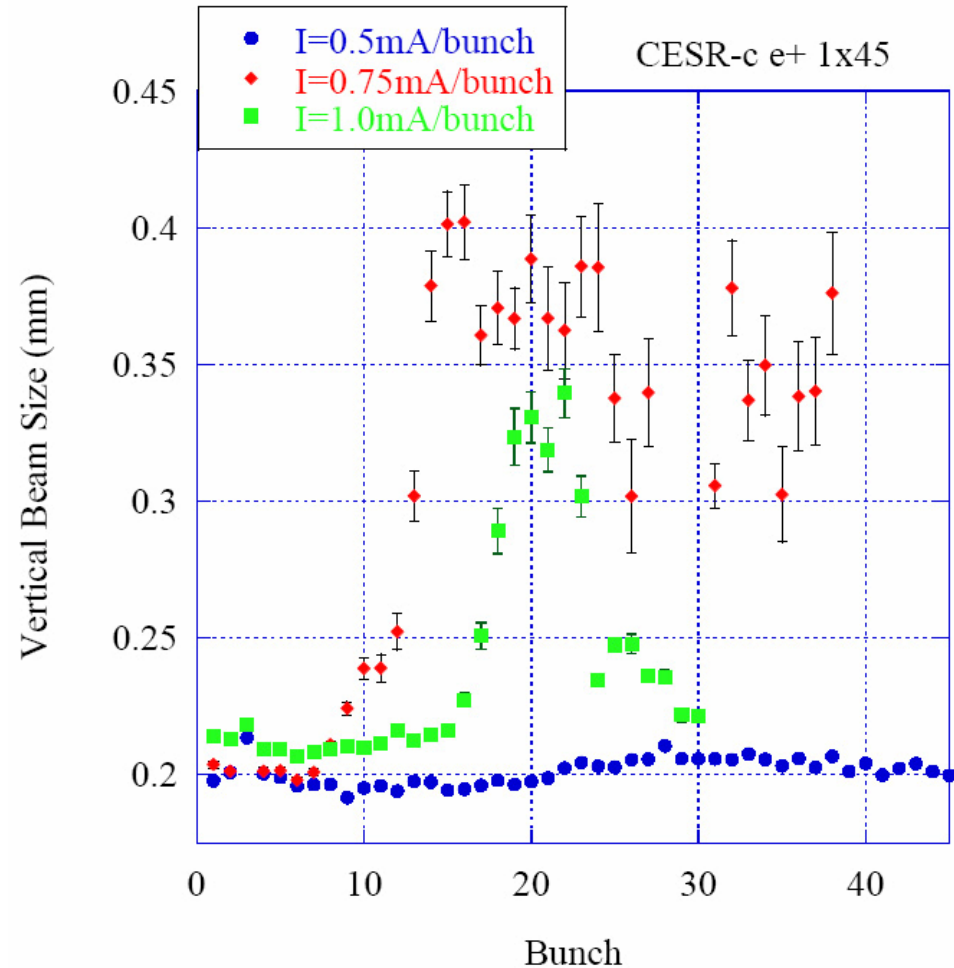


- Cross-check with electrons
 - Similar conditions to e⁺
 - Stable behavior in both tune and vertical beam profile





- ~ 2 GeV
- Have only had one *very* brief experiment with all new hardware operational
 - Latest hardware installed at the transition from CESR-c to CHSS running
 - Had only a few hours to commission and take some initial data at low energy
- Next experiment scheduled for *next week!*
 - Preliminary results suggest that a detailed experiment is likely to be quite interesting



Vertical tune change down the train:
 ~ 3 kHz at 1 ma/bunch



- **Immediate Future**
 - Have just started a CESR-c run after our summer shutdown
 - New measurements at ~ 2 GeV begin next week
- **Now \Rightarrow March 31, 2008 (end of HEP ops)**
 - Design and prepare suitable electron cloud diagnostics for CsrTF operation
 - CESR will be in production running throughout
 - However, if an opportunity presented itself, we could consider installing some diagnostics before the end of CESR-c
 - Start modifications on two spare CESR-c wigglers for electron cloud suppression studies (with M. Pivi and L. Wang)
- **CsrTF period: April 2008 – 2012(?)**
 - Electron cloud studies in wigglers meeting the ILC spec are central to the CsrTF plan
 - Initial downtime to install wigglers in CESR's north IR (see following slides).
 - Estimate 3 months duration
 - Wigglers, with electron cloud modifications, will be part of the 6 wiggler complement
 - Initial CsrTF run in 2008 to focus on wiggler region electron cloud studies
 - Long term plan includes testing ILC DR wiggler and wiggler vacuum chamber prototypes in CsrTF



End CESR-c HEP operations on March 31, 2008

Design studies are presently underway to modify CESR for ILC Damping Ring R&D \Rightarrow CesrTF

Primary Goals:

Electron cloud measurements

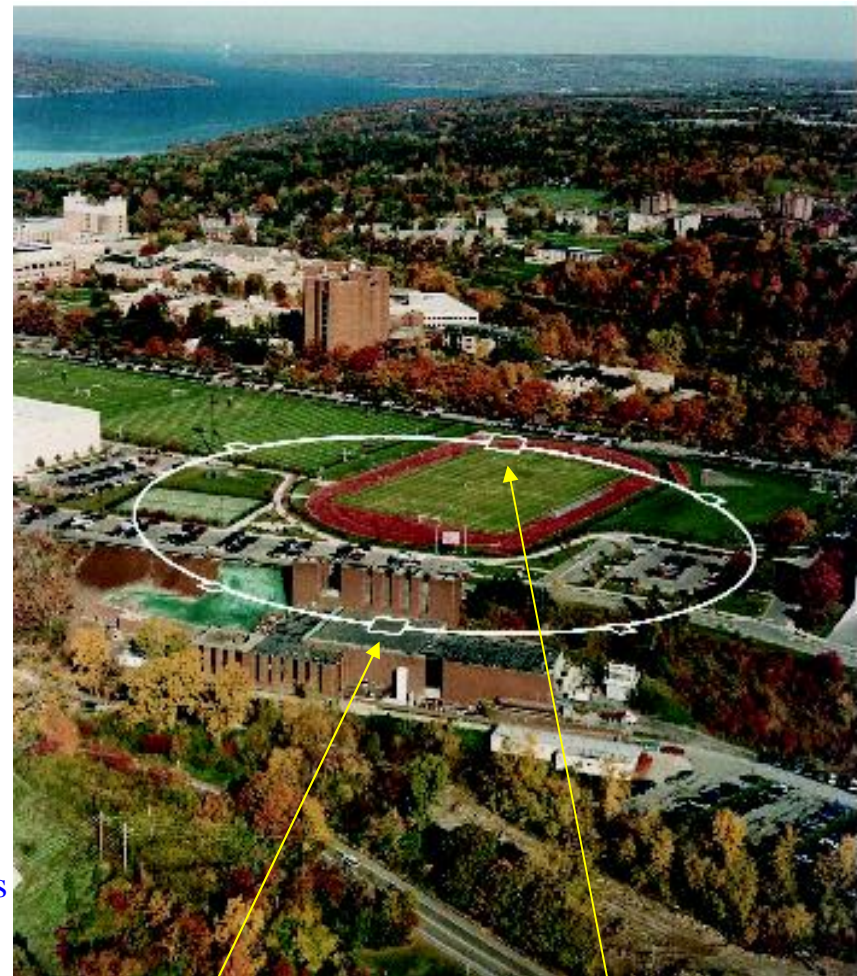
- e^- cloud buildup in wigglers
- e^- cloud amelioration in wigglers
- Instability thresholds
- Validate the ILC DR wiggler and vacuum chamber design (critical for the single 6 km positron ring option)

Ultra-low emittance and beam dynamics

- Study emittance diluting effect of the e^- cloud on the e^+ beam
- Detailed comparisons between electrons and positrons
- Also look at fast-ion instability issues for electrons
- Study alignment issues and emittance tuning methods
- Emittance measurement techniques

ILC DR hardware testing

- Wigglers, wiggler vacuum chamber, SRF, kickers, alignment & survey techniques, instrumentation, *etc.*



South (CLEO) and North
Interaction Regions

