EC Session on Experimental Planning

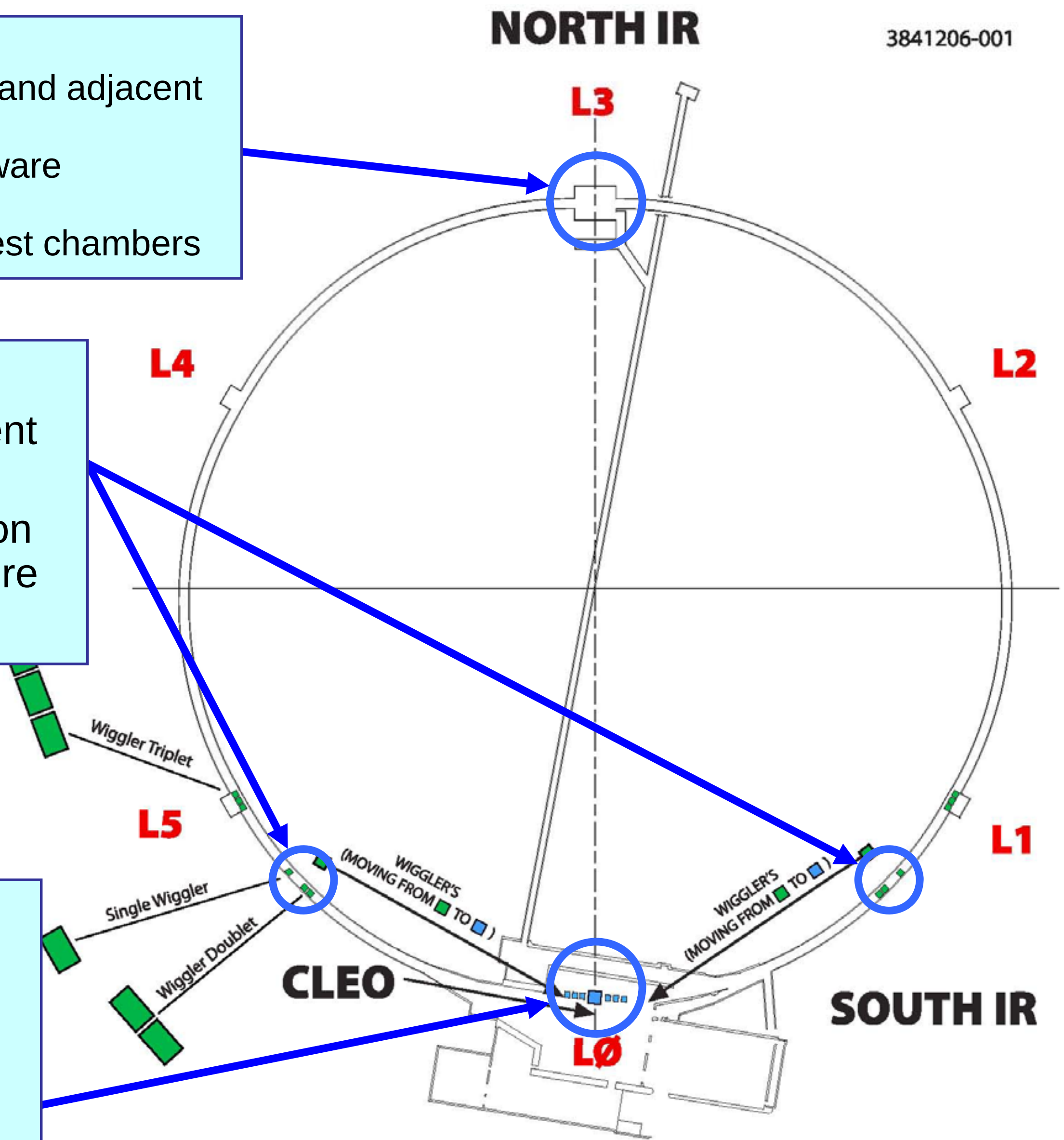
- Cesr-TA experimental plans-G. Dugan (Cornell)
- Experimental Plan at KEKB Positron Ring:
  Grooved Surface, and Clearing Electrode Ver.2-Y. Suetsugu (KEK)
- Plan of measuring cloud density in the solenoid field and in the quadrupole field-K. Kanazawa (KEK)
- EC plans in connection with eRHIC-W. Fischer (BNL)
- General discussion on key experiments for experimental planning-focused on code validation and mitigation techniques-all

CESR EC experimental areas

- L3 Straight Experimental area
  - Instrument large bore quadrupoles and adjacent drifts
  - Install of PEP-II experimental hardware (including chicane) in early 2009
  - Provide location for installation of test chambers

- Arc experimental areas
  - Instrument dipoles and adjacent drifts
  - Provide locations for installation of test chambers, in drifts where wigglers were removed.

- L0 Wiggler Experimental area
  - All wigglers in zero dispersion regions for low emittance
  - Instrumented wiggler straight and adjacent sections



Experimental Plan at KEKB Positron Ring Grooved Surface, and Clearing Electrode Ver.2

Y. Suetsugu, H. Fukuma, KEK

M. Pivi and W. Lanfa, SLAC

Experimental Setup

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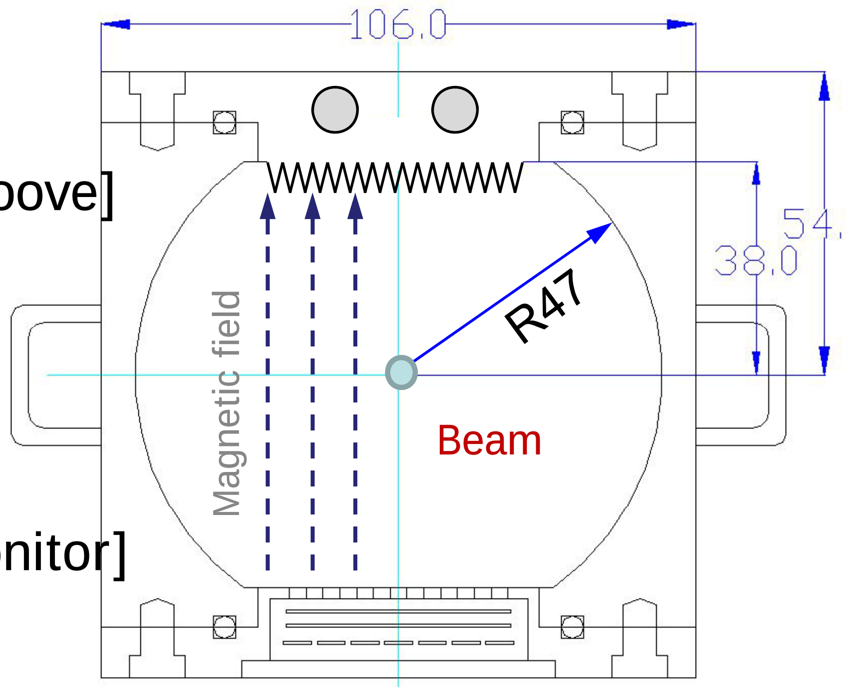
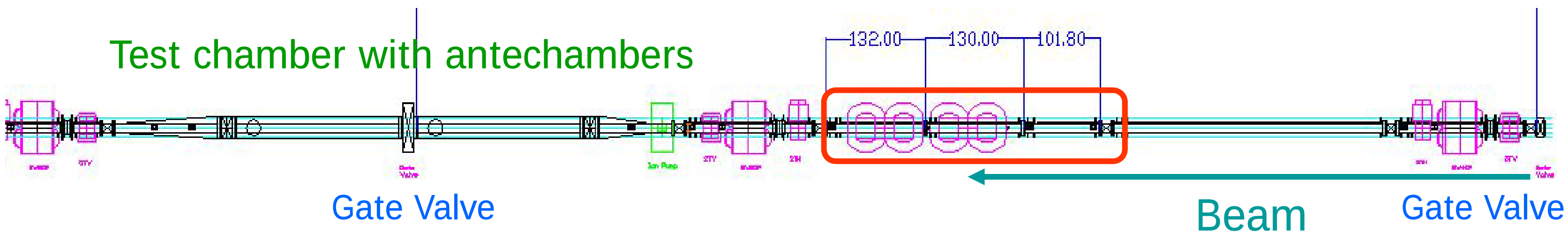
[Groove]

[Monitor]



Wiggler magnets
B = 0.75 T



Plan of measuring cloud density in the solenoid field and in the quadrupole field

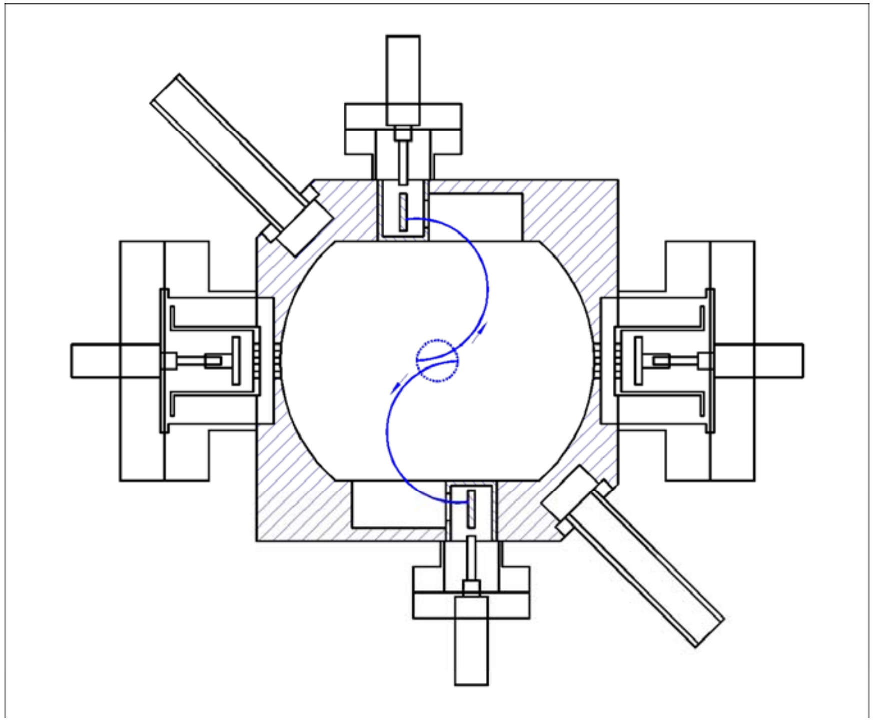
K. Kanazawa (KEK)

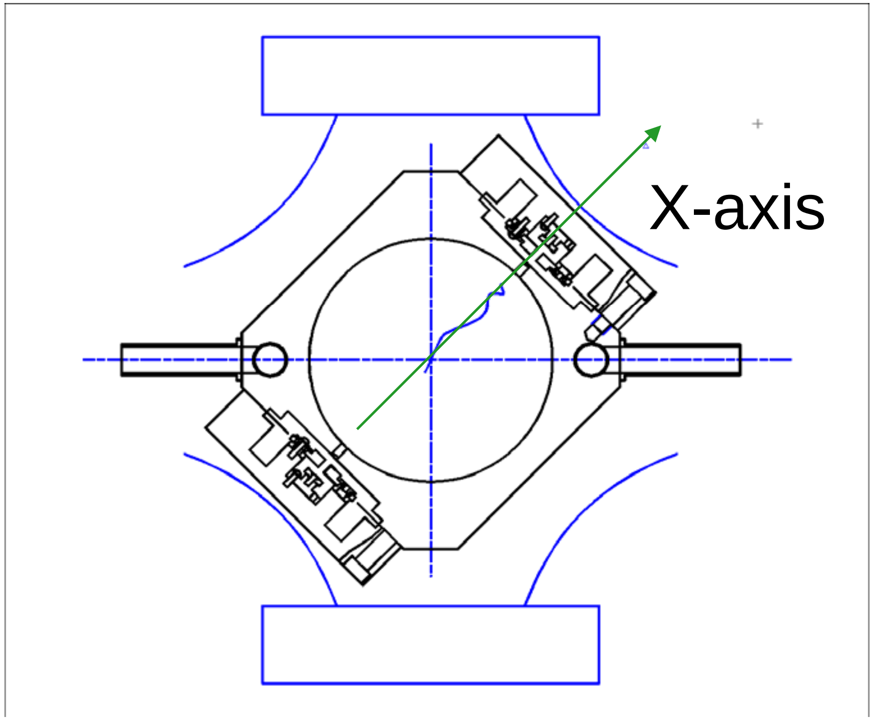
SOLENOID

• Given a solenoid field and the position of detection, the energy of measured electrons is automatically selected (=the volume is automatically defined).

QUADRUPOLE

Electrons accelerated by a bunch along X-axis reach the detector.





Possible experiments at CesrTA for eRHIC

W. Fischer, BNL

Create highest possible <u>average</u> e^+ beam, constrained by electron cloud

- **Maximize bunch charge**
  >2x10^{10}, ideally as high as 2x10^{11}
- **Minimize bunch spacing**
  4 ns possible

eRHIC: I_{avg} = 445 mA CesrTA: I_{avg} = 800 mA (avg. over train)

Generally: test e-cloud density scaling with bunch charge and bunch spacing
(To what extent can this go beyond B-factories?)

Key questions for experimental planning

Code benchmarking and validation- ECLOUD, Cloudland, POSINST, WARP/POSINST, HEADTAIL, PEHTS, CMAD

- What specific experiments are required to best determine each feature of the codes?
- Cloud growth-What experiments will best pin down the SEY model parameters, particularly the number of rediffused electrons? The photoelectron generation model parameters?
    - Fit of cloud saturation as measured by RFA to SEY peak and SEY yield at zero energy.
    - Fit RFA energy-differential current and/or tune shift as a function of beam current and time to disentangle photoelec parameters from SEY yield parameters. High energy region of RFA spectrum should be sensitive to rediffused component of secondaries, for example. Transverse shape of RFA current measurement can be sensitive to SEY model parameters.
    - RFA measurements in quadrupole can be important since they are at peak beta values. Electron density will also peak here since quad fields trap electrons.
    - Improved RFA time resolution is important, to probe time dependence of RFA current
    - TE wave transmission can measure growth and decay of average cloud density in a local area of the ring-(with upgraded spectrum analyzer and better amplifiers and couplers)

Key questions for experimental planning

- **Code benchmarking and validation (con’t)**
  - Interaction of the cloud with the beam
    - How can we test that the effects of the “pinch” are being properly modeled?
      - Head-tail instability threshold.
      - Bunch length dependence of tune shift measurements
    - How can we best establish confidence in the instability predictions? The predictions for emittance growth?
      - Scaling-Threshold of head-tail instability-dependence on beam size? Dependence is stronger on sync tune, avg beta, chromaticity. Should be roughly independent of emittance, (Not at low bunch currents, but instability does not set in here for EC).
      - Emittance growth-need transverse feedback, turn by turn beam size measurements. Difficult measurement. Codes that can be validated here:WARP, Ohmi’s PEHTS, HEADTAIL

Key questions for experimental planning

- **Code benchmarking and validation (con't)**
  - Are there other bench measurements (eg, SEY secondary spectrum) which could help establish code parameters?
    - Measure (using Auger spectrometer) secondary spectrum of initial (and irradiated?) chamber samples.
    - Measure <15 eV part of SEY curve-light sources? Try to think of other ways to do this.
    - XPS to measure photoelectron spectrum (or with synchrotron light beam line from CHESS?) and photon reflectivity vs. energy, angle…data may exist for the latter.
  - Effects of positive ions.

Key questions for experimental planning

Mitigation Techniques

- What additional experiments are needed to establish high confidence in the proposed mitigation techniques to be used in the ILC damping ring?
  - Repeat measurement of EC cloud suppression for TiN and NEG.
  - Investigate chamber exposure to gases such as SF6, N2, O2.
  - Try carbon coating proposed for SPS-durability under SR radiation
  - Long term lifetime of TiN-PEP II and KEK can provide data.
  - Clearing electrodes in wiggler and dipole, and grooves in dipole. Grooves for wiggler chamber should continue to be studied.
  - Investigate feasibility of measuring transverse wake from single grooved chamber (and electrodes) using local field probes.
- What types of RFA, beam, or bench measurements are needed to fully characterize the proposed mitigation techniques?
  - Depending on the type of mitigation (e.g., electrodes), there may be some additional code validation required.