Electron Cloud R&D

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03-06 March 2008

R&D work at SLAC on mitigation techniques: Mauro Pivi

- Installed 5 chambers in PEP-II straight, January 2007:
  - **Project "ECLOUD1": a station with chamber that allows the insertion of samples directly into beam line to monitor the reduction of the SEY due to beam conditioning**
  - **Project "ECLOUD2": 4 Grooved and Smooth chambers installed to measure performance in PEP-II beam environment**

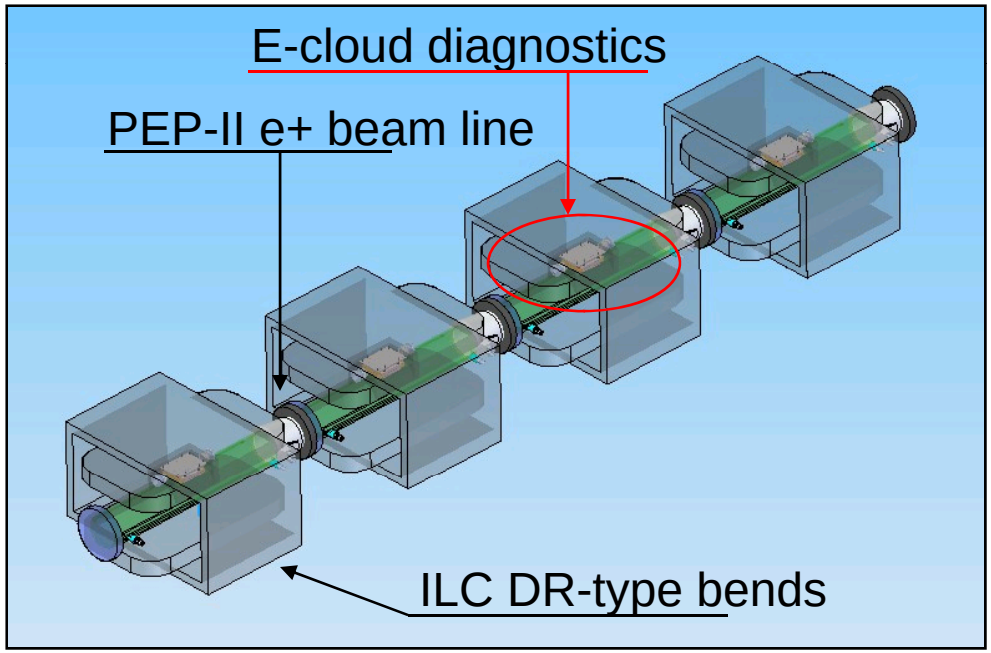
R&D work at SLAC on mitigation techniques

- New: Installation of an ILC chicane in PEP-II and multiple test chambers, in December 2007:
  - **Project "ECLOUD3": new chicane with ILC DR bend-type field, and test chambers including sections with**
    - Aluminum
    - TiN coating
    - Grooves
    - Non-evaporable getter NEG coating

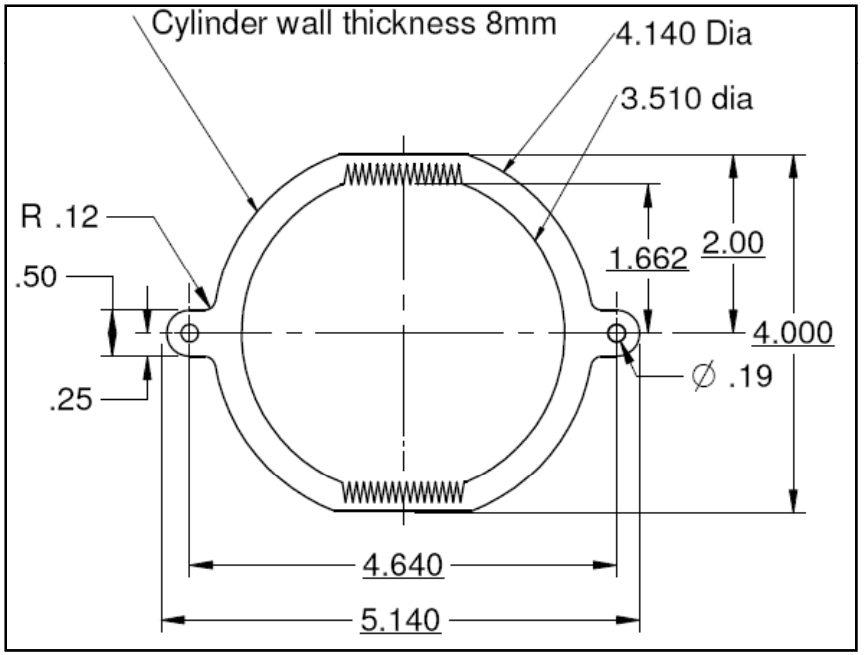
Installation plans that we had to stop due to US FY08 budget issues

Mitigations Tests SLAC: New ILC Chicane Installation

- Verify efficiency of mitigation techniques in dipoles.
- Installation of a new chicane in PEP-II with ILC DR-type bends, to test chambers with coatings (and chambers with grooves)

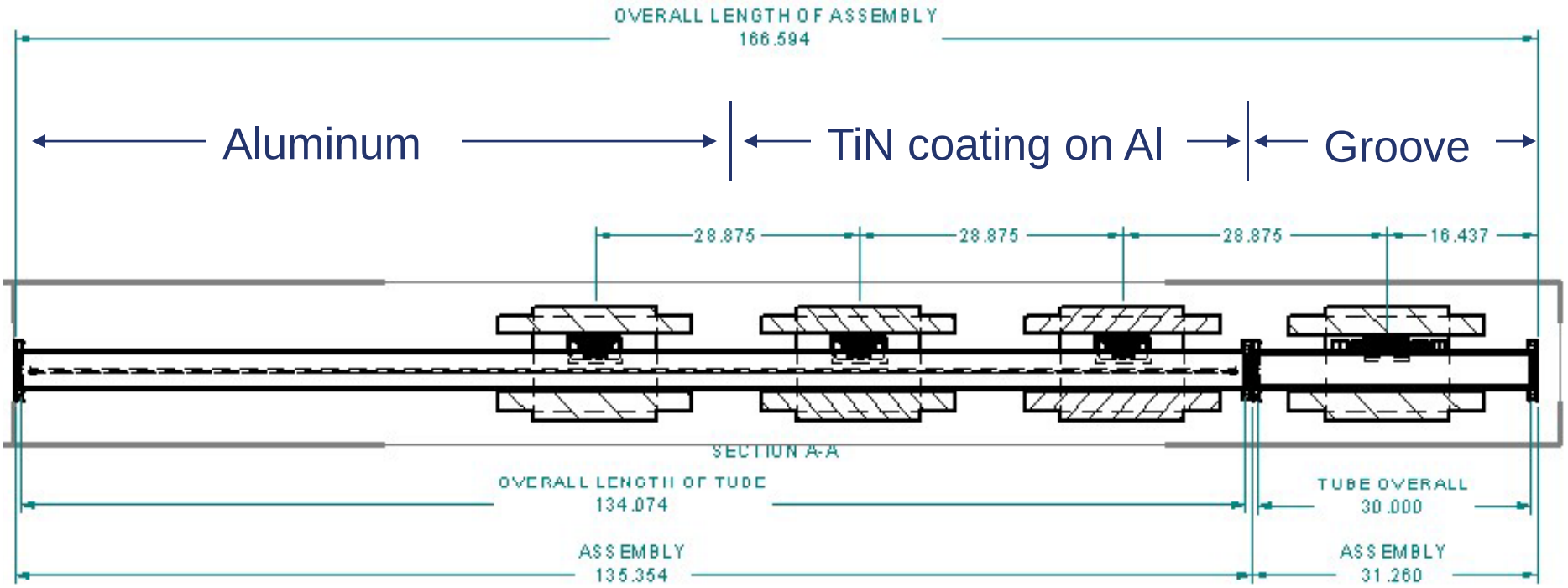


Layout new chicane installation in PEP-II LER



PEP-II chamber with triangular grooves

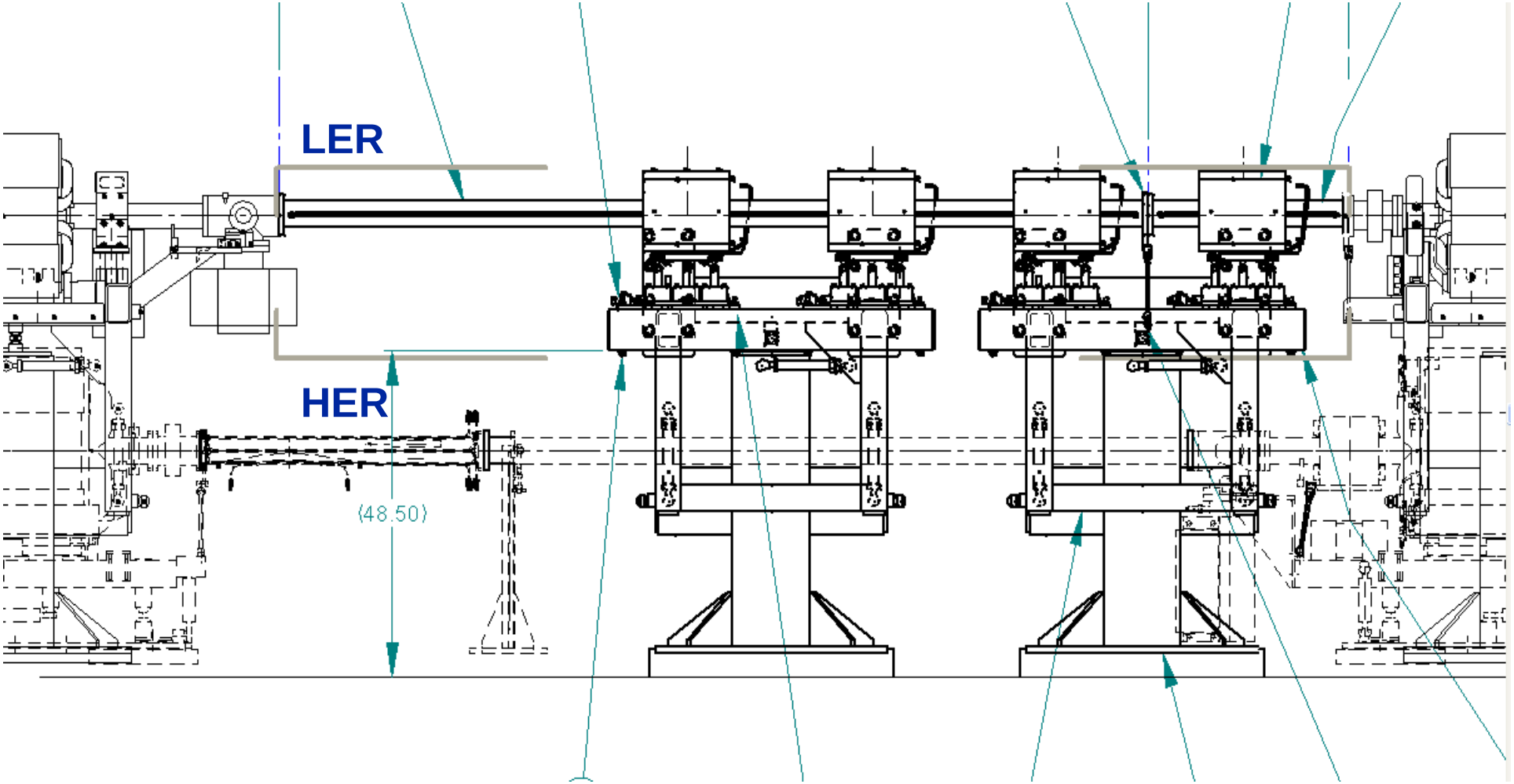
Vacuum chambers Layout



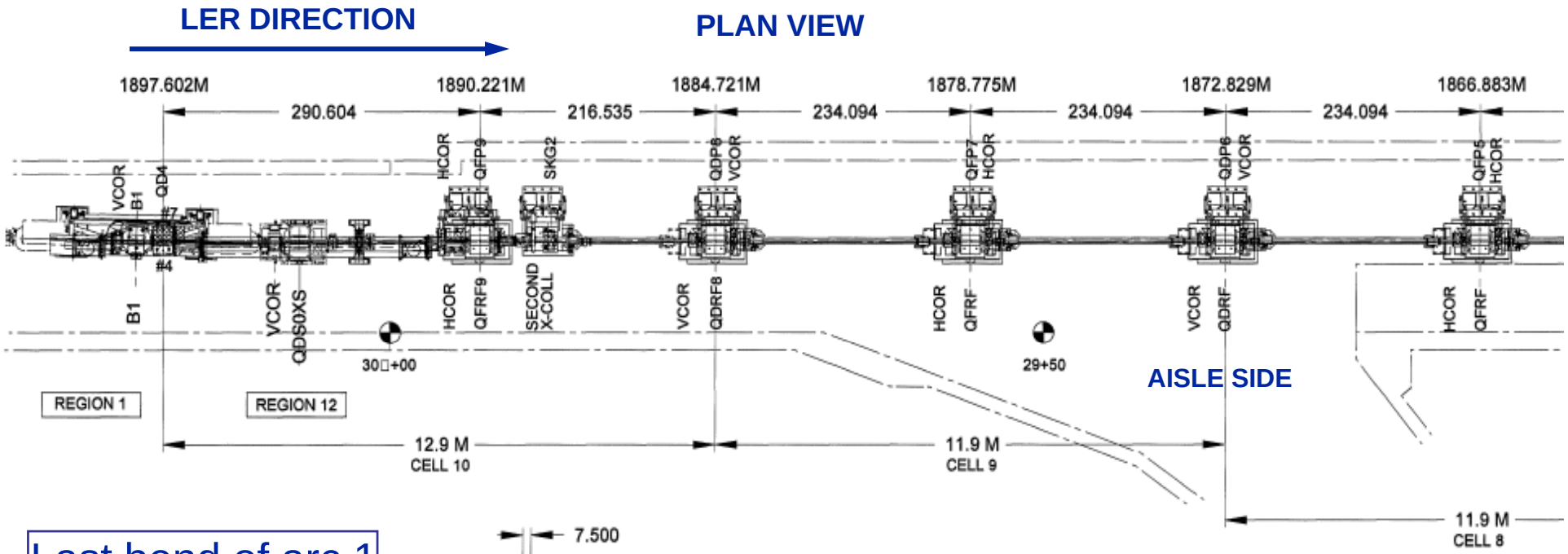
- 2 chambers: 135.3” and 31.2”.
- 4 analyzer electron cloud detectors, one at each magnet location

Chicane Assembly Layout

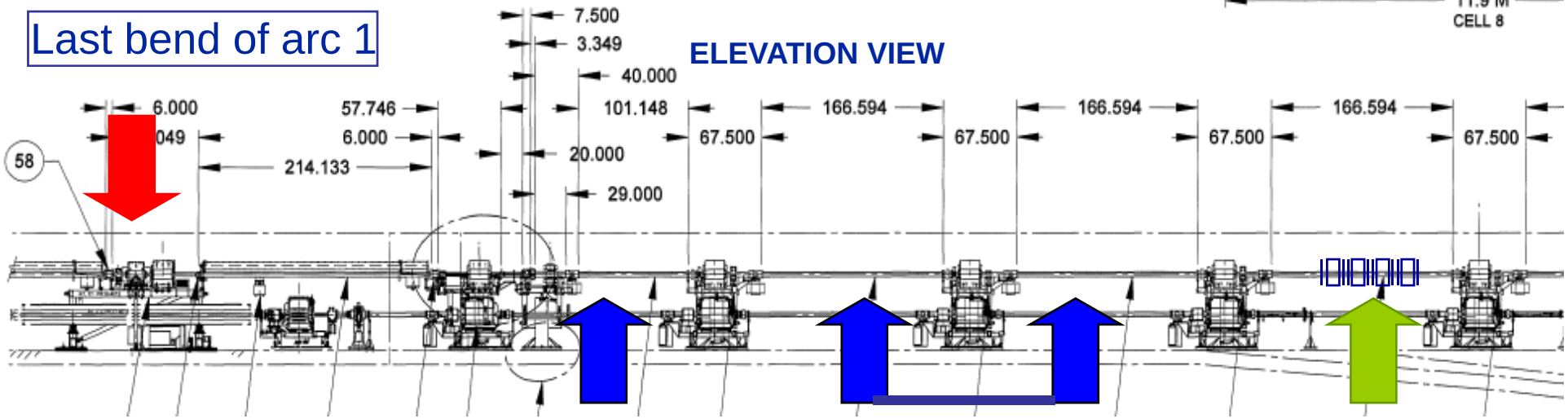
PEP-II



Layout of electron cloud tests in PEP-II

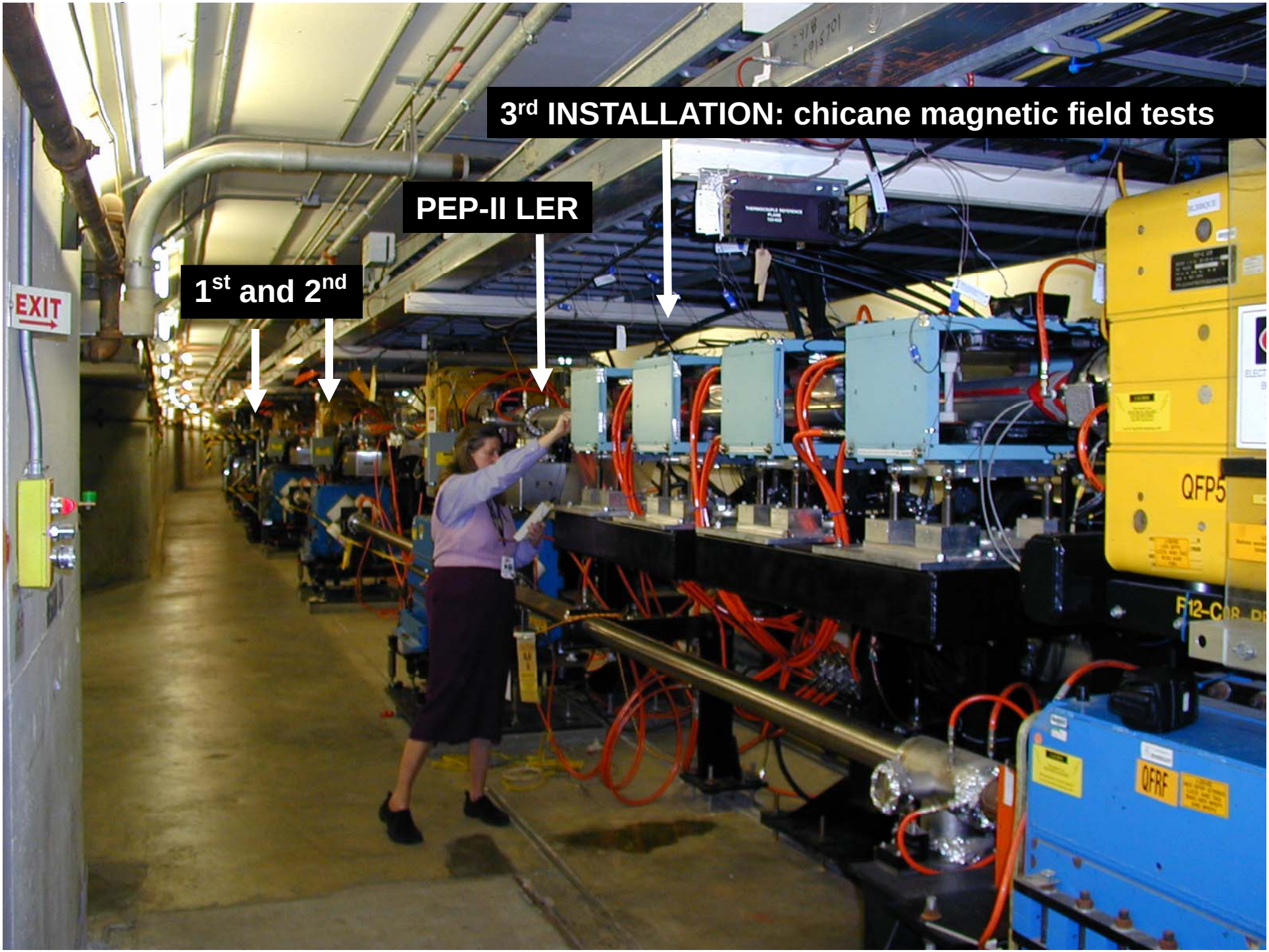


Last bend of arc 1



SEY station Grooves/Smooth New chicane


Dec 3, 2007
HCOR


3rd INSTALLATION: chicane magnetic field tests
PEP-II LER
1st and 2nd
EXIT
QFP5
QFRF

Electron cloud mitigations tests in PEP-II: ILC chicane

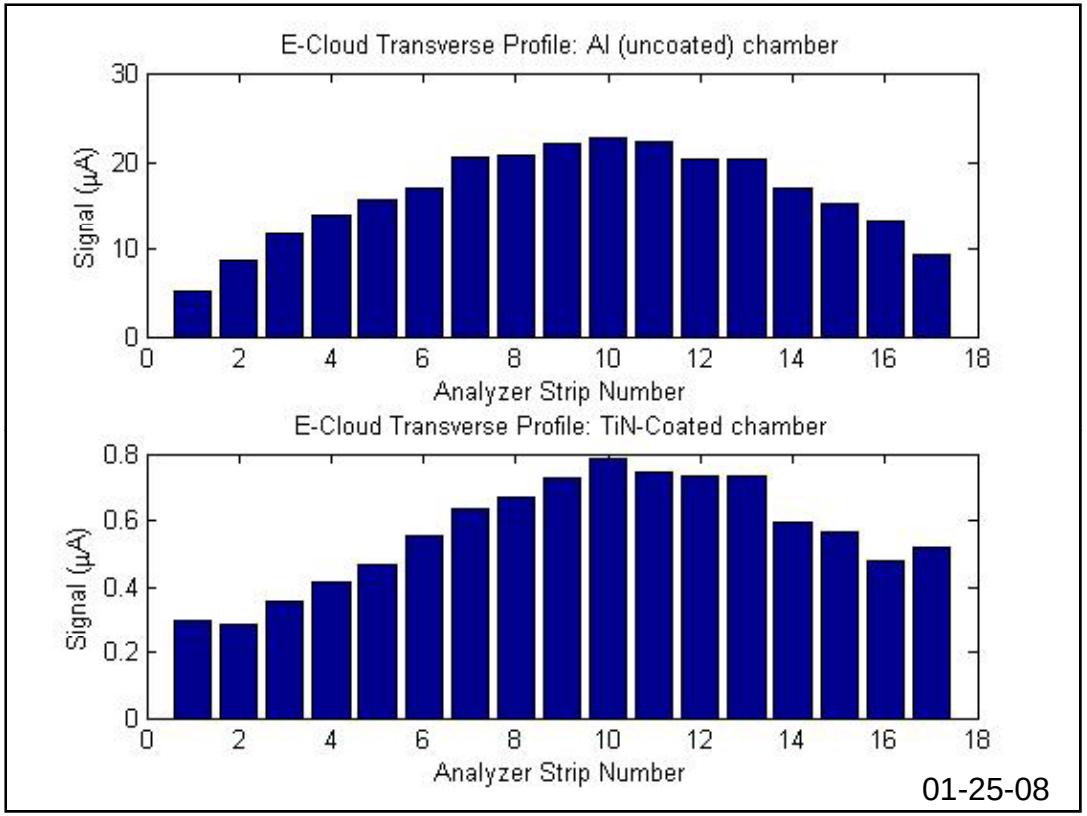
- **Magnets –** C. Spencer
- **Power Supplies –** P. Bellomo
- **Magnets Stand Supports –** D. Kharakh
- **Vacuum chamber drawings –** F. Cooper
- **Vacuum chamber diagnostics & assembly –** R. Kirby
- **Cabling –** F. King
- **Electronics** A. Kacharovsky

and colleagues B. Smith, B. Kuekan, M. Munro, W. Wittmer, L. Wang, D. Arnett, J. Olszewski, Wallace, M. Venturini, T. Raubenheimer, J. Ng, M. Pivi

Thanks to PEP-II colleagues: J. Seeman, S. De Barger, M. Sullivan, U. Wienands

Latest installation: electron cloud chicane

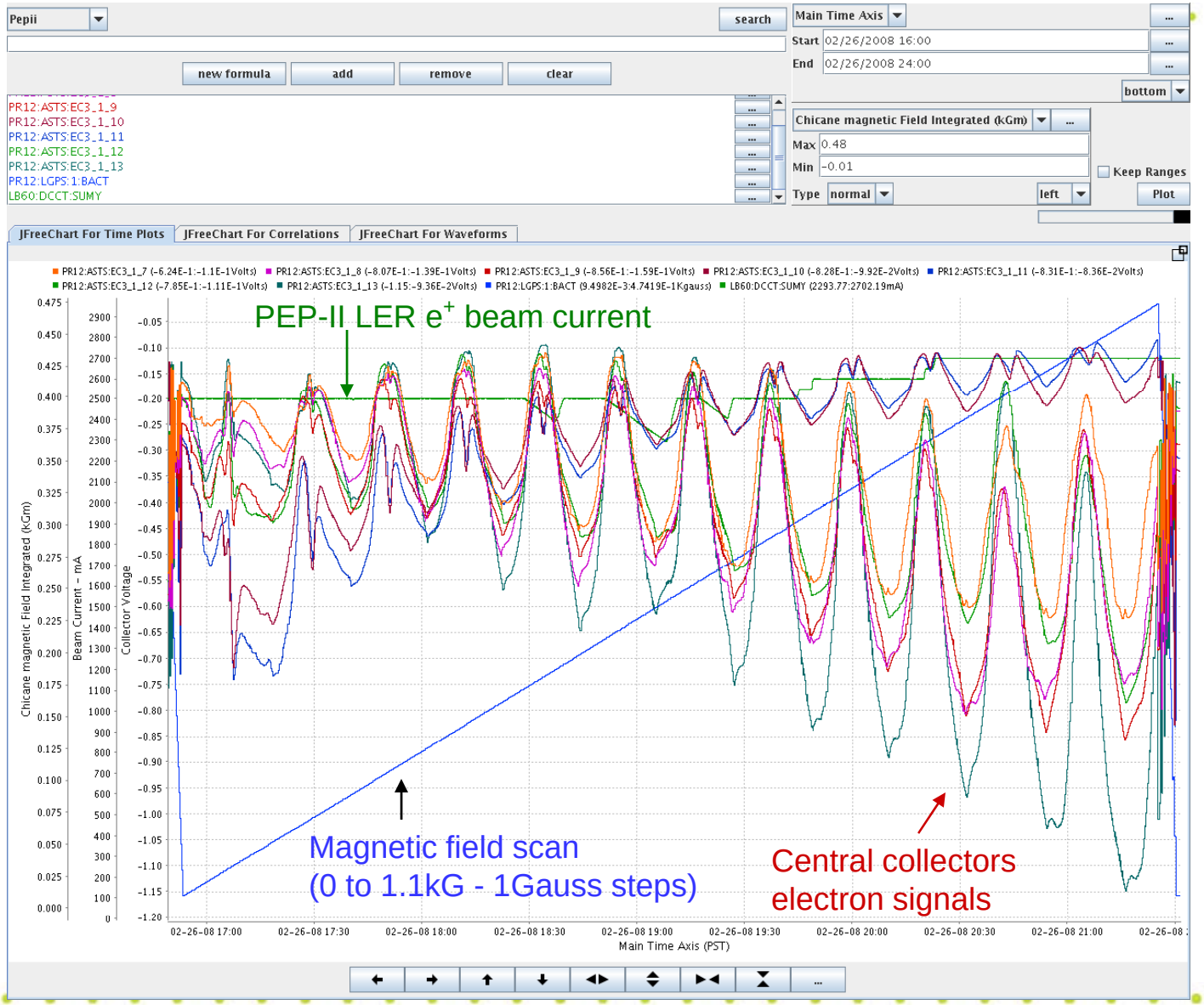
Special detectors allow measuring the horizontal distribution of the electron cloud in a dipole magnetic field and the analysis of the electron energy.



Chicane **magnetic field Off**. (Preliminary results. Data with chicane on still being analyzed.)

Electron cloud signal on collectors distributed along the horizontal axis. Signal for aluminum section (above) and section with TiN coating (below) show a reduction of ~30 in favor of the coating.

Scan Chicane Magnetic field: Preliminary Results



Work in progress LBNL/SLAC to simulate PEP-II case. See C. Celata talk.

Groove chamber in dipoles

- Aluminum chamber has been manufactured by extrusion with a triangular groove profile, but it has not been installed in PEP-II due to FY08 budget issues.

- To optimize the secondary electron yield (SEY), the grooves in a dipole region have a triangular geometry, (differently from field free regions where the grooves profile is rectangular).

- SEY is affected by roundness of groove tips and valleys.
- Present groove chamber, roundnesses:
  - **Tips: ~70um (good).**
  - **Valley: ~180um; Electrical Discharge Machining EDM of valleys is underway at RWI company**

Groove chamber aluminum extrusion

Groove valley
~180um

Surface and Materials Science Department
Metallography Report

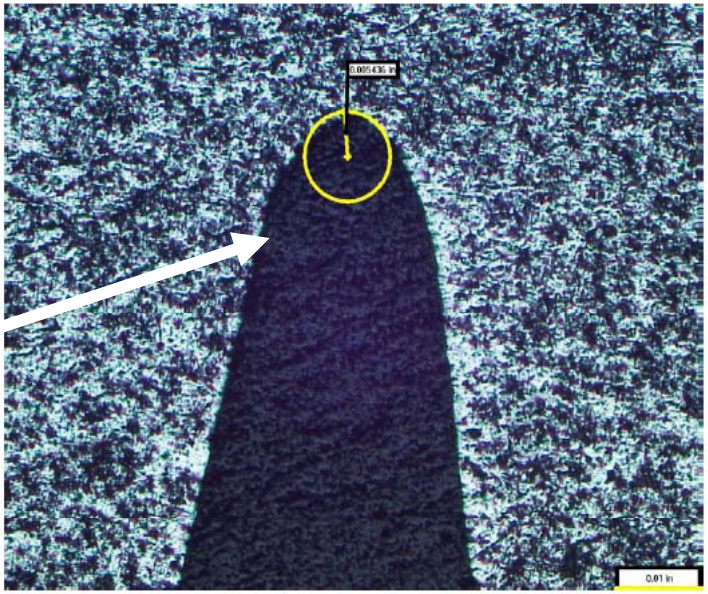
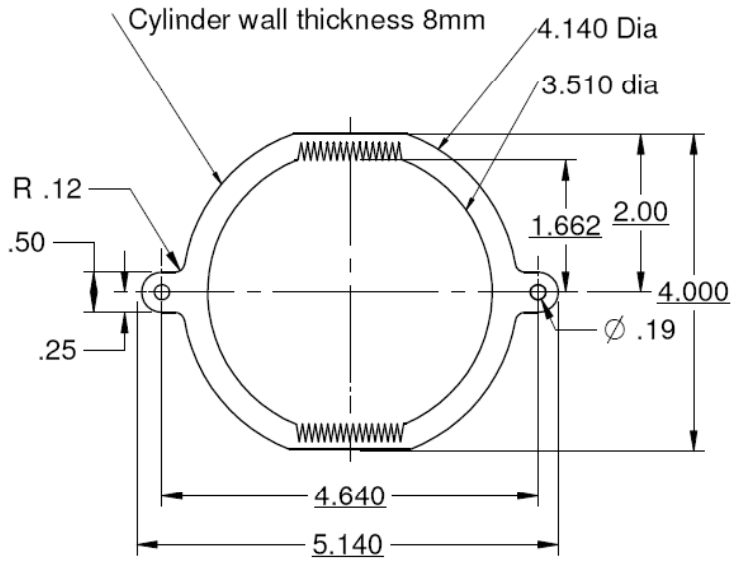


Figure 1: Root 31x



Groove tips
< 70um

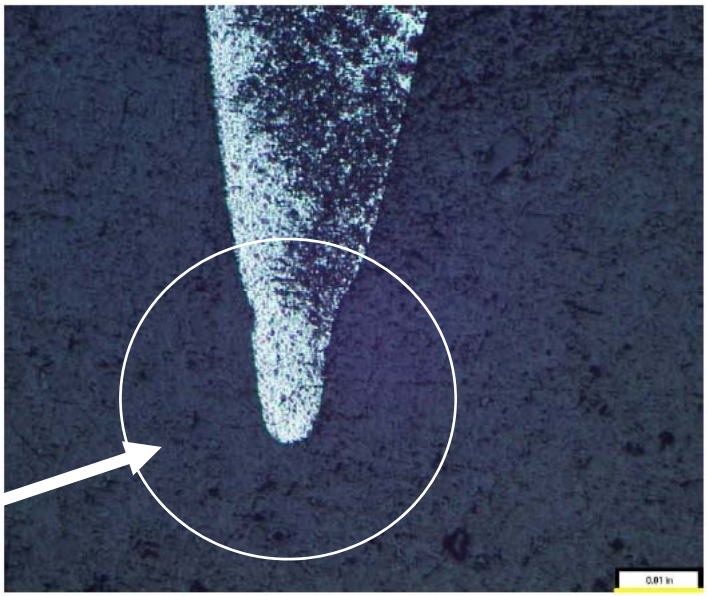
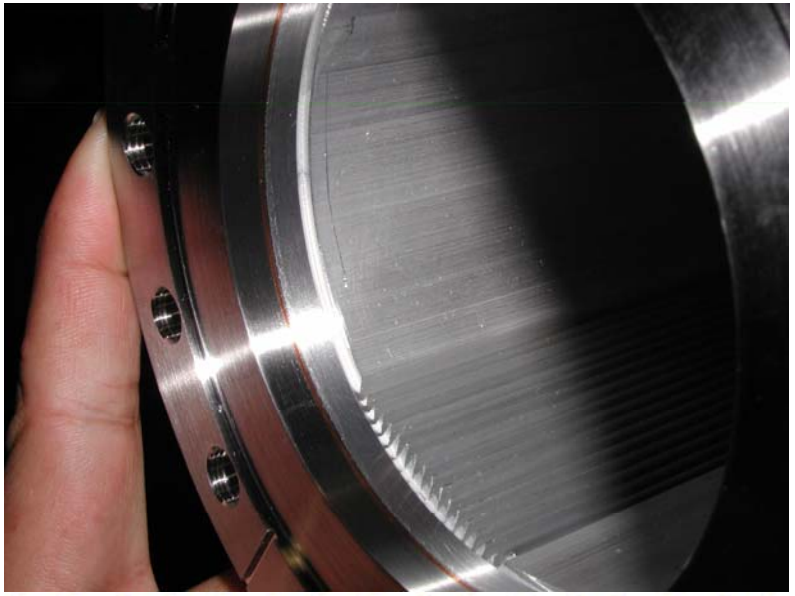


Figure 2: Tip 31x



Estimation of groove efficiency in magnetic fields: Lanfa Wang

Estimation of SEY of the triangular groove

Simulation Parameters

Peak SEY δ_0=1.2

Width =2mm

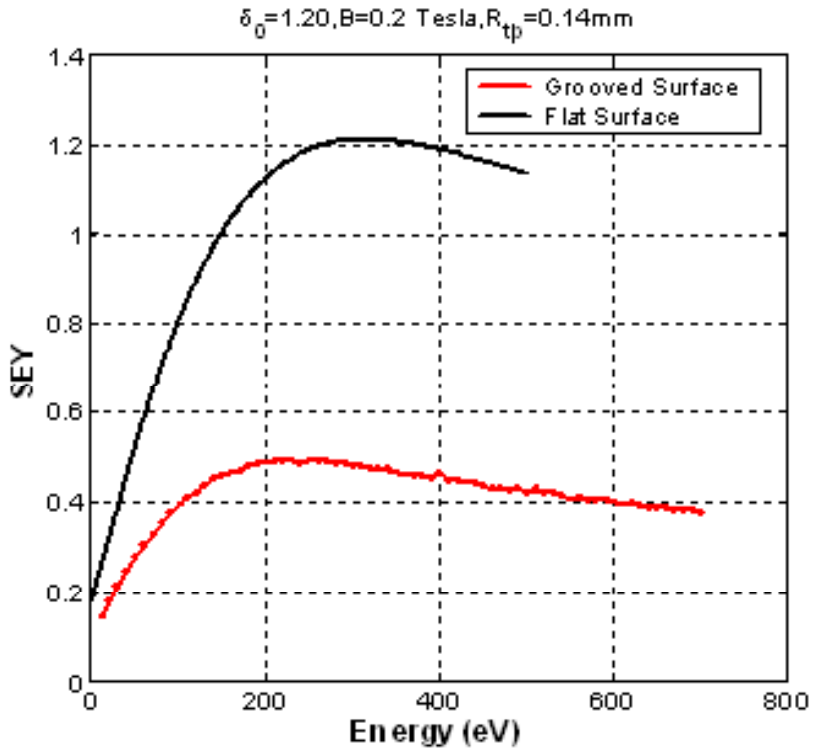
Height=3.82mm

Radius of tip=0.14mm

α=/8.6º

Dipole field=0.2Tesla

1. Use the same radius for both tip and bottom
2. Slope angle is adjusted to keep the height same as the measured one



Recent estimation based on extruded groove chamber geometry

- Plan is to move the chicane and continue tests including the groove chamber tests from SLAC to CesrTA, Cornell. Summer 2008

- Surface and Material Science Laboratory at SLAC – including XPS, Auger Spectroscopy and Secondary Electron Yield Measurements - has been eliminated … as a result of the FY08 budget