Cornell University
Laboratory for Elementary-Particle Physics

CesrTA Electron Cloud Mitigation Plans

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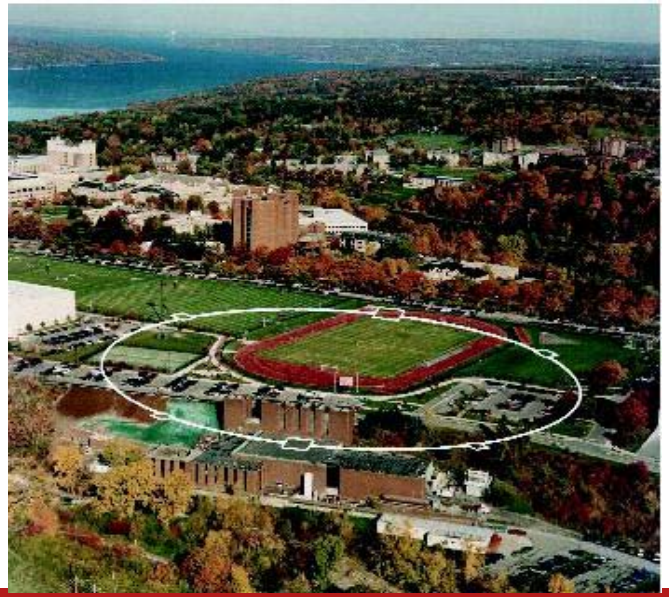
Accelerator-Based Sciences and Education

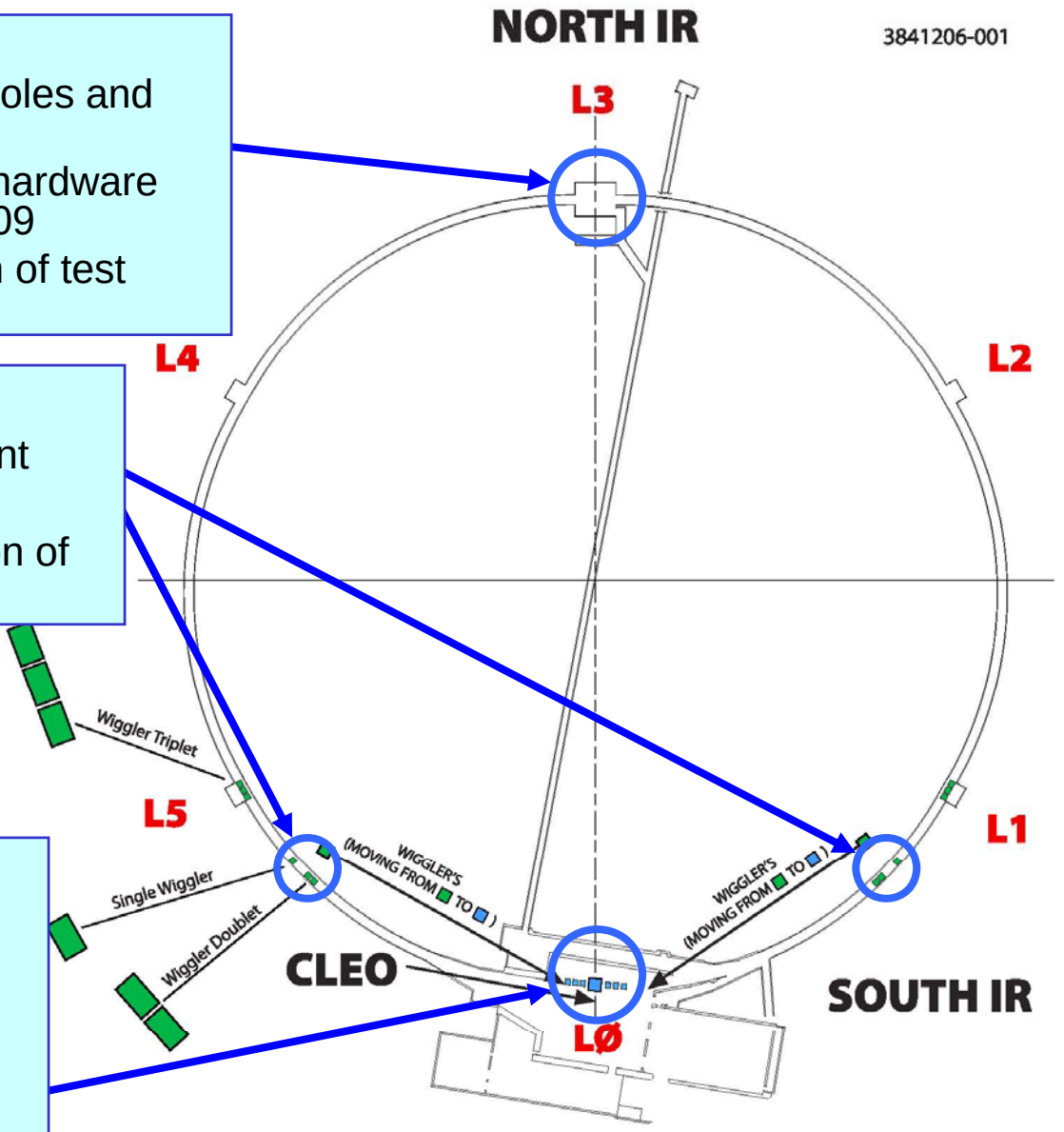


Outline

- Experimental Regions
  - Plans for L0
    - Wiggler Chambers
    - Other Chambers
  - Plans for L3
    - PEP-II Chicane
    - Test Region
  - Plans for the Arcs
    - CESR Chambers
    - Test Regions
  - SEY Studies
    - PEP-II hardware and SLAC/FNAL/CU collaboration
- Conclusion

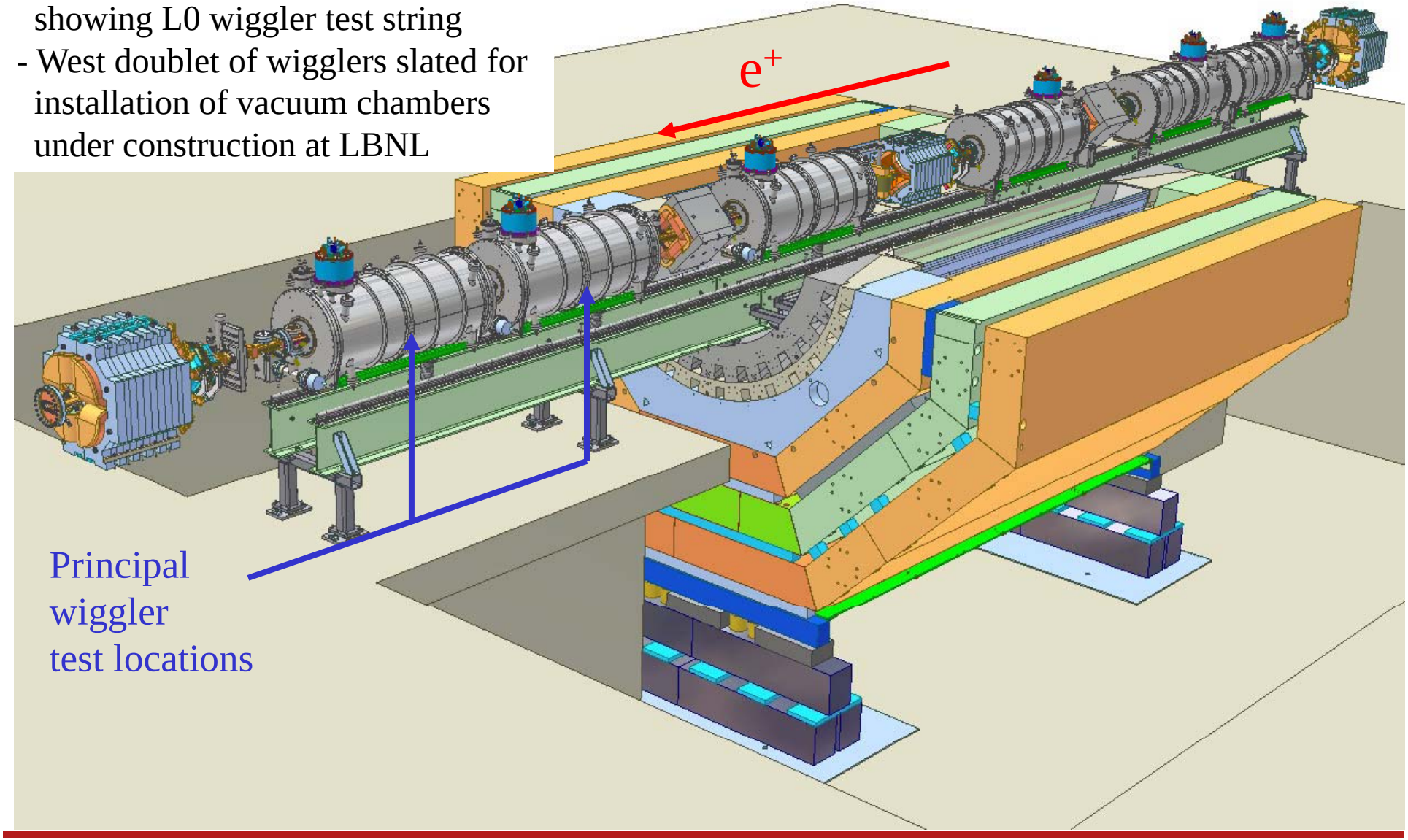
CESR Reconfiguration

- L3 Straight
  - 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
- Arcs where wigglers removed
  - Instrument dipoles and adjacent drifts
  - Provide locations for installation of test chambers
- L0 Straight
  - All wigglers in zero dispersion regions for low emittance
  - Instrumented wiggler straight and adjacent sections



L0

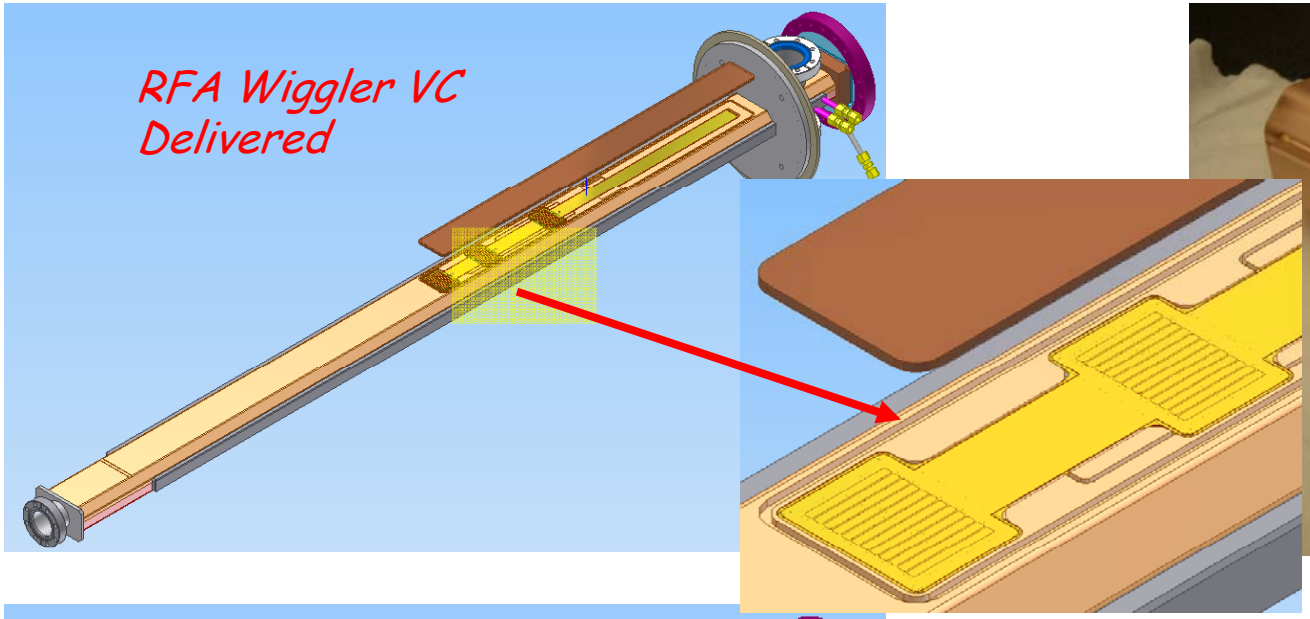
- Cutaway through CLEO iron showing L0 wiggler test string
- West doublet of wigglers slated for installation of vacuum chambers under construction at LBNL

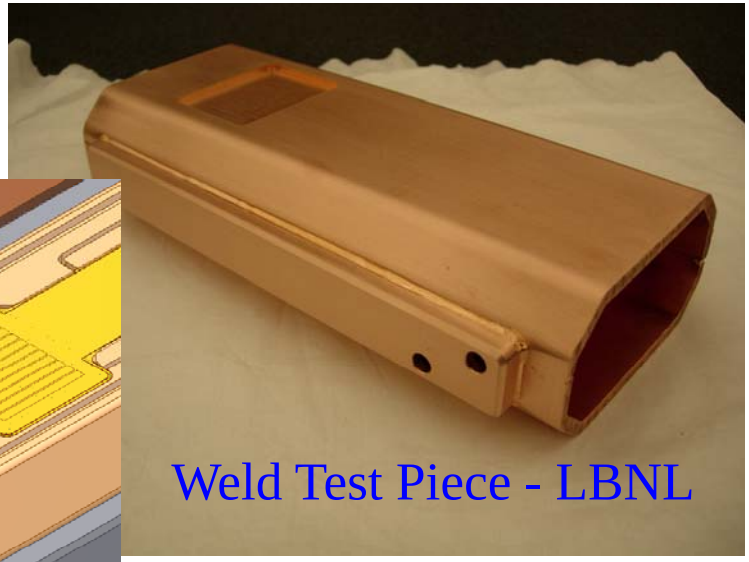


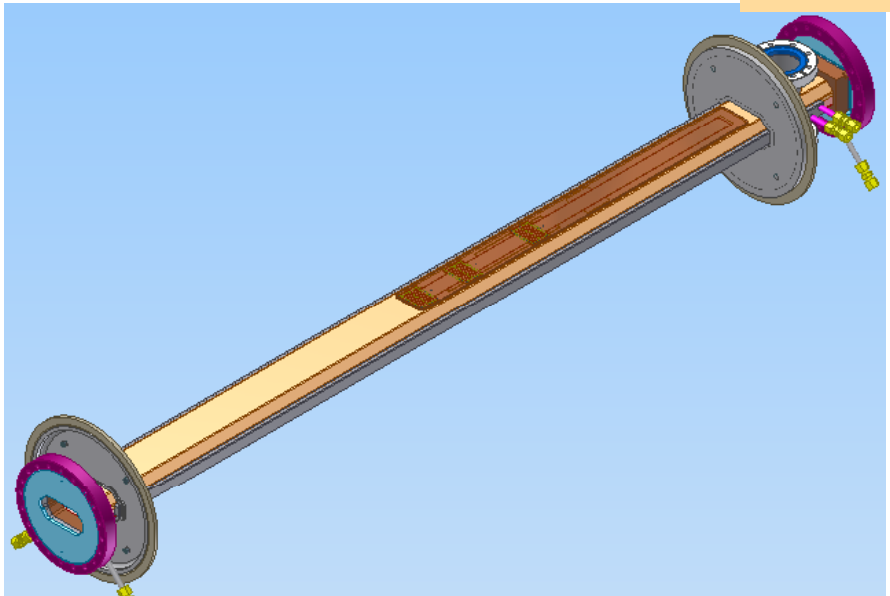
L0 Features

- Chambers
  - Wiggler test location at downstream end (west end) of straight for e^+ beam
  - Instrumented chambers throughout region
    - RFAs
    - Vacuum monitoring, RGA
    - Spare buttons for TE wave transmission experiments
  - Initially: Q02W, Q01W, Q00W are TiN coated and instrumented
  - Pressure bump capability
- Targeting a series of wiggler VC mitigation tests

Chambers with Thin RFAs







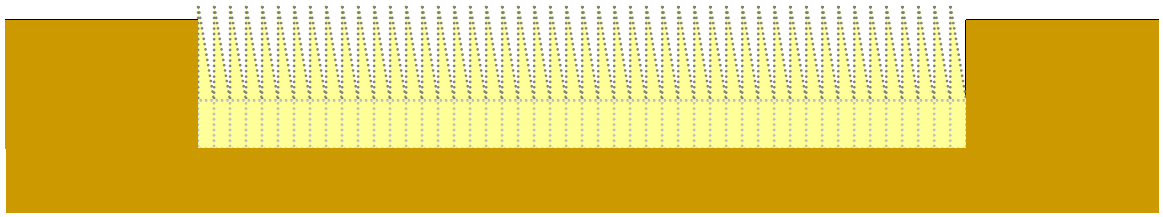
- Planned Chambers
  1. Control – diagnostics only
  2. TiN Coated
  3. Clearing Electrode
  4. Grooves?
  5. Other
- 4 untouched extrusions remain available

Wiggler Chambers

- Just back from E-Beam Welding

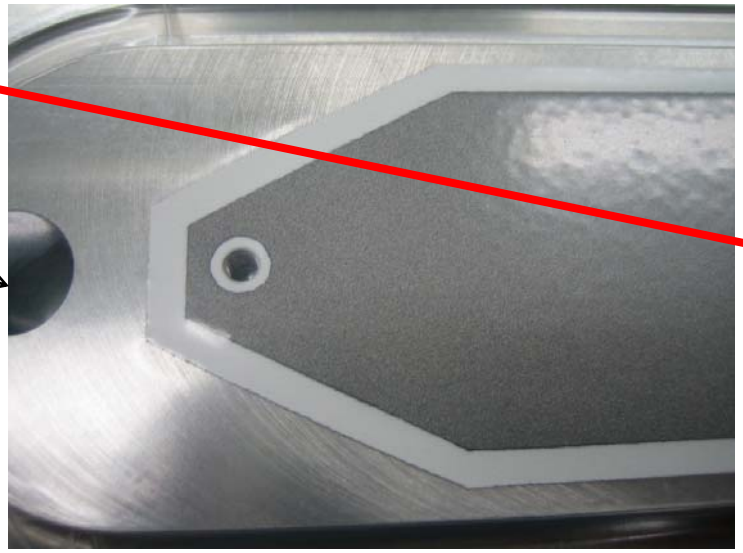
Mitigation Techniques

- Wiggler extrusion split into top/bottom halves ⇨ provides exposed vacuum chamber surface for modifications
  - Possibility of adding grooved surface
  - Tungsten Electrode (hot spray) on alumina – see talk by Suetsugu

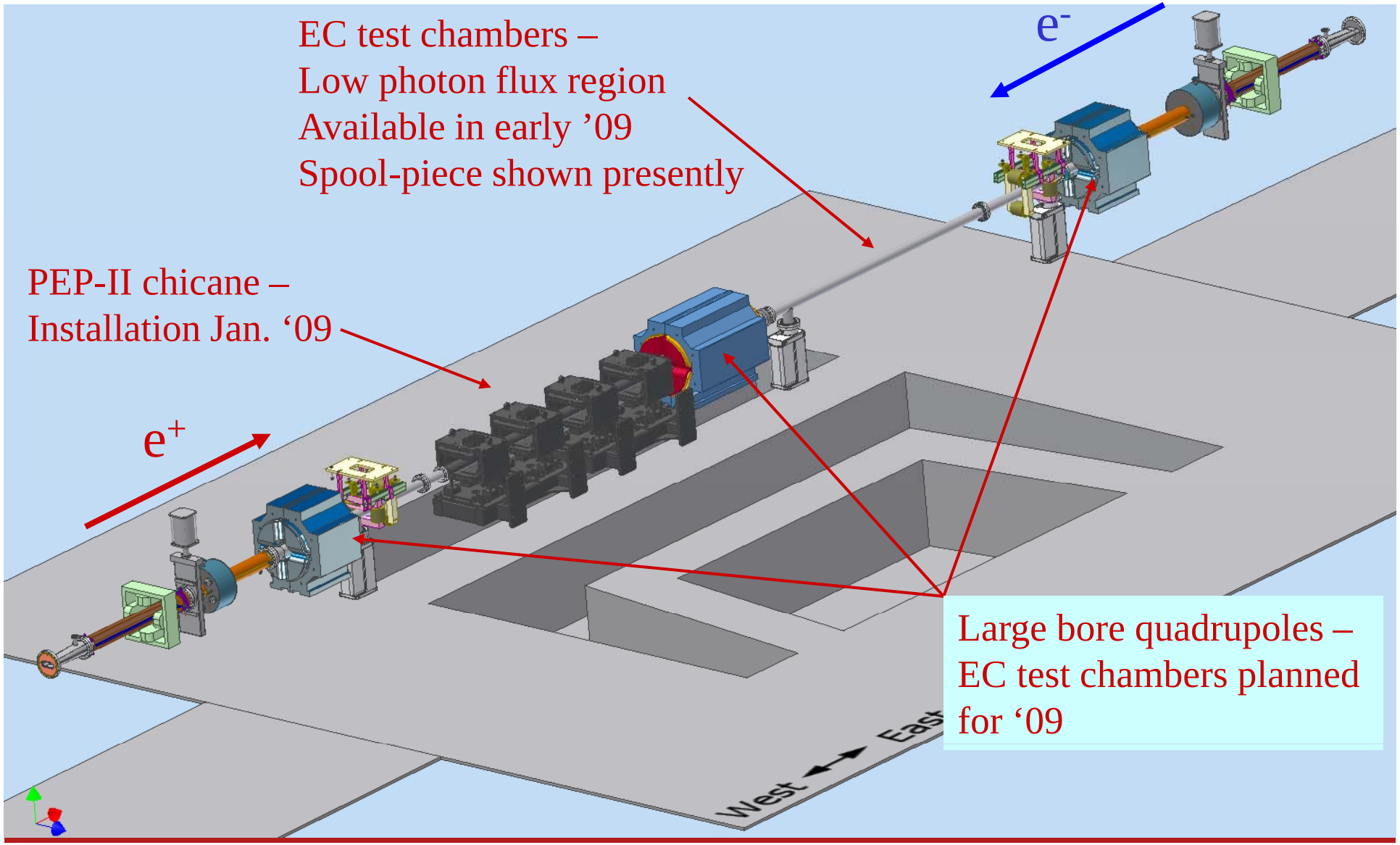


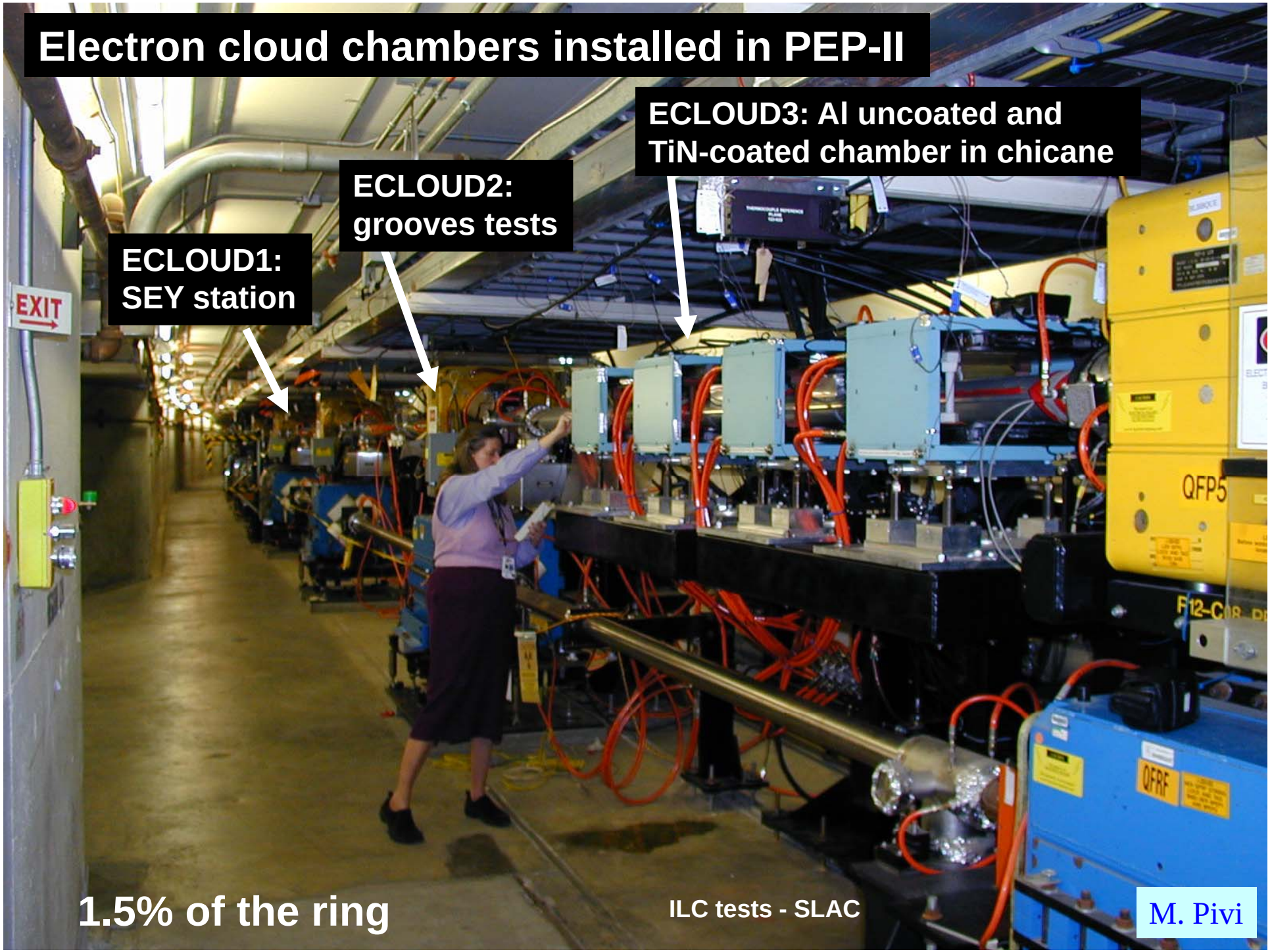
Propose to pursue this option next

For feed-through ↘ Looking at options for low impact feedthroughs

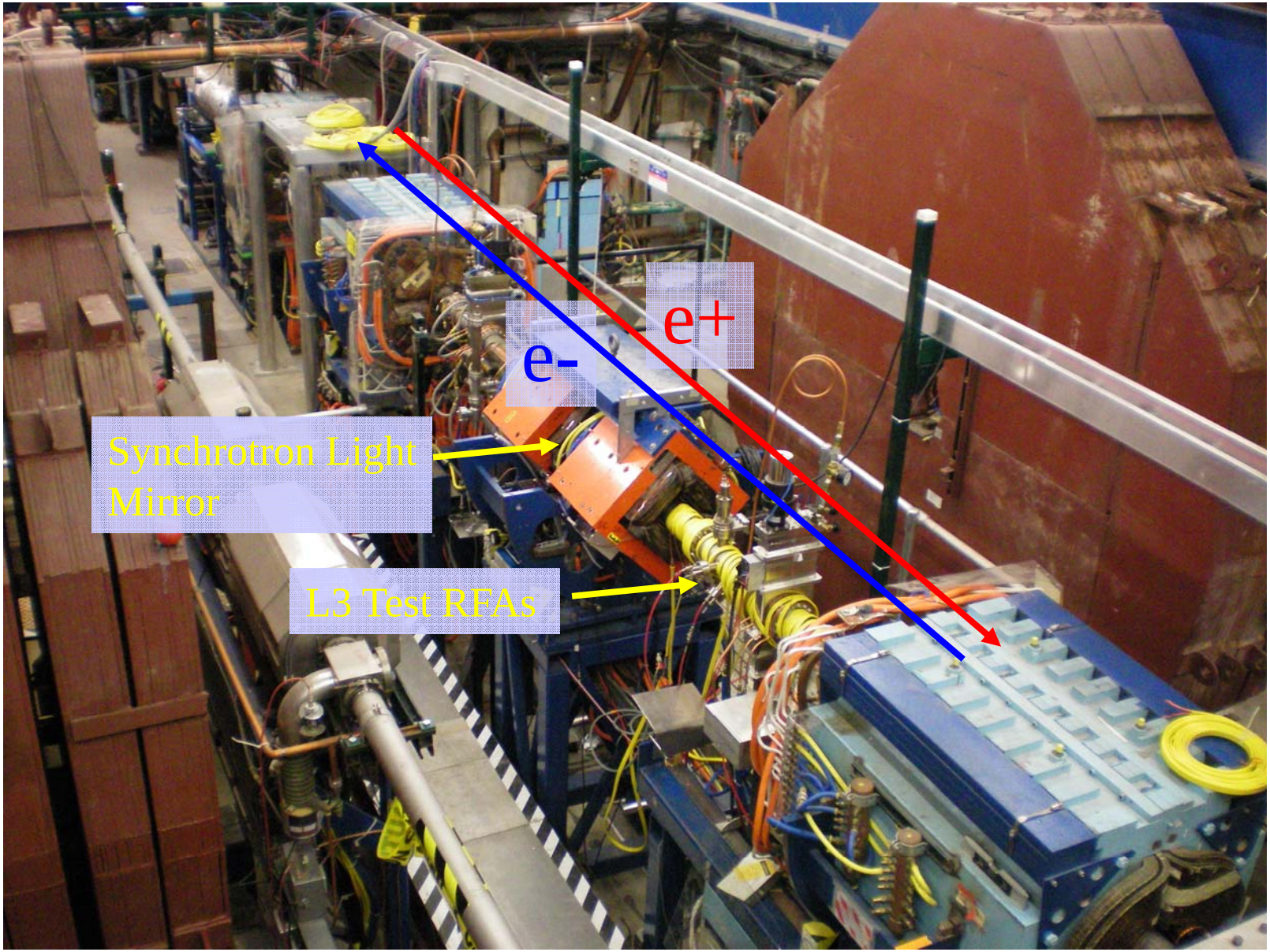


L3


EC test chambers –
Low photon flux region
Available in early ’09
Spool-piece shown presently
e-
PEP-II chicane –
Installation Jan. ‘09
e+
Large bore quadrupoles –
EC test chambers planned
for ‘09
West
East


Electron cloud chambers installed in PEP-II
ECLOUD3: Al uncoated and TiN-coated chamber in chicane
ECLOUD2: grooves tests
ECLOUD1: SEY station
EXIT
QFP5
QFR
1.5% of the ring
ILC tests - SLAC
M. Pivi

L3 Now



L3 Capabilities

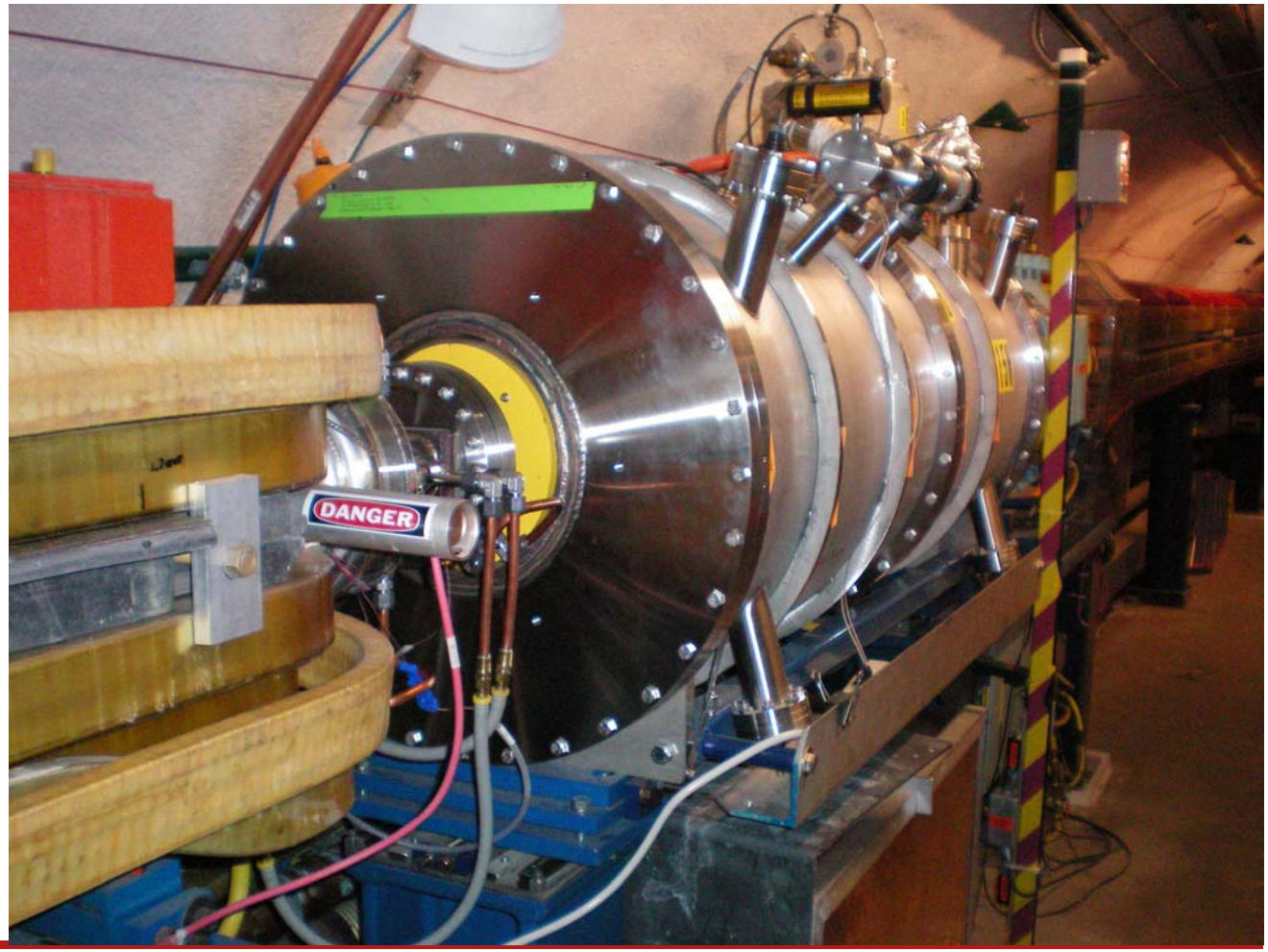
- By mid-2009:
  - PEP-II Chicane with single slot for swapping in test chambers
    - Will complete and test grooved chamber which could not be tested in PEP-II
  - Drift region test chamber slot(s)
    - Available for collaborator and local use
    - Provides relatively low direct synchrotron radiation load
      - ~0.025 photons/beam particle/meter @2GeV
      - ~0.065 photons/beam particle/meter @5.3GeV
  - Present bi-directional synchrotron light mirror at L3 center to be replaced by 2 *retractable* mirrors at either end of section (just inside Q48s)
    - *Retractable mirrors will allow controlled masking of synchrotron radiation stripe for either beam*
  - Ready for deployment of large bore quadrupole test chambers

CESR Arcs

- Remove wigglers
- Install local gate valves and spool pieces initially
- Two locations:
  - 15W
  - 15E
- Flexible VC test locations which see CESR dipole radiation

  ~0.5 γ/particle/m @ 2 GeV

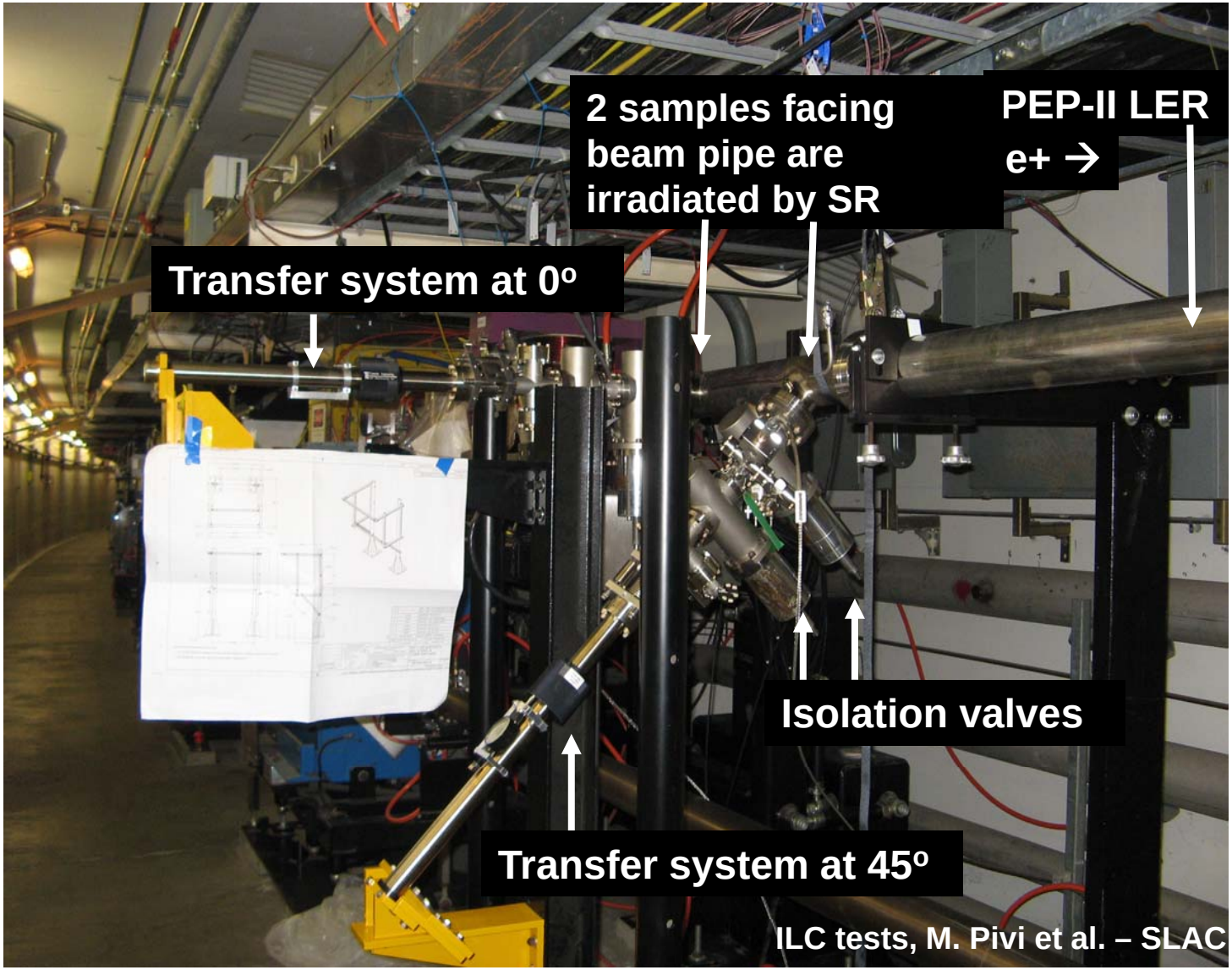
  ~1.2 γ/particle/m @ 5 GeV



SEY Studies

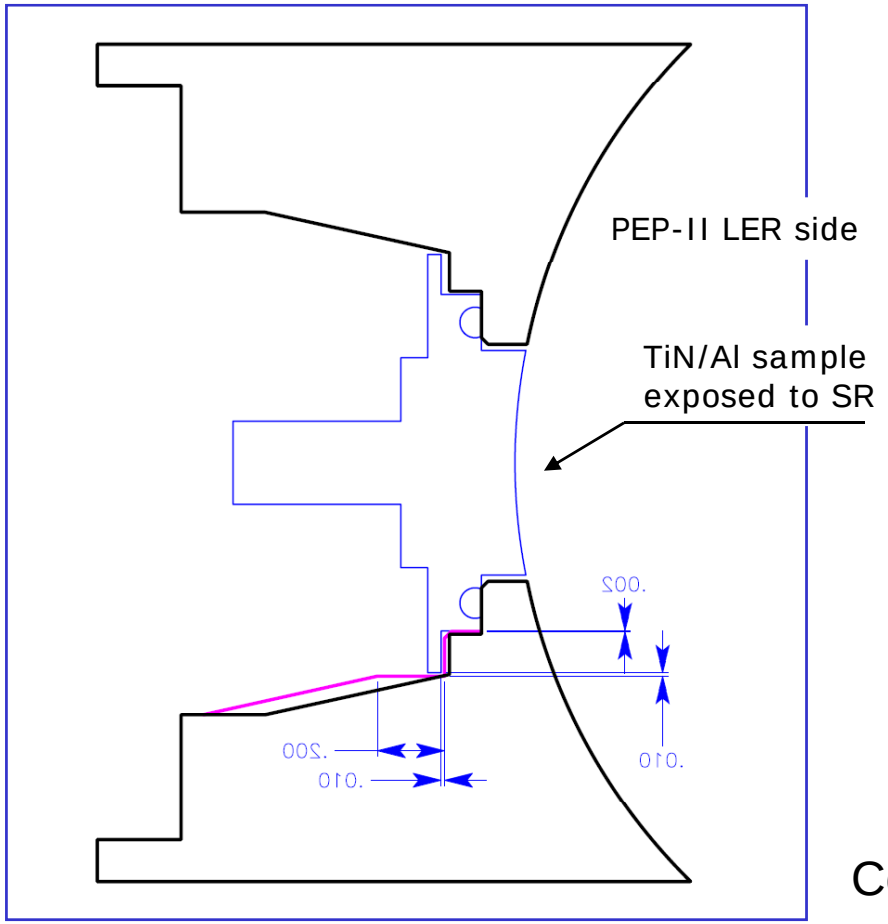
- Plan to re-deploy SLAC SEY hardware as part of SLAC-FNAL-CU collaboration
  - Deploy initially at CESR
  - Then re-deploy at FNAL
- Will provide the ability to cross-check performance of vacuum chamber surfaces with direct SEY measurement
- Long-term will provide an opportunity to check response of surfaces to processing by both synchrotron radiation and particles

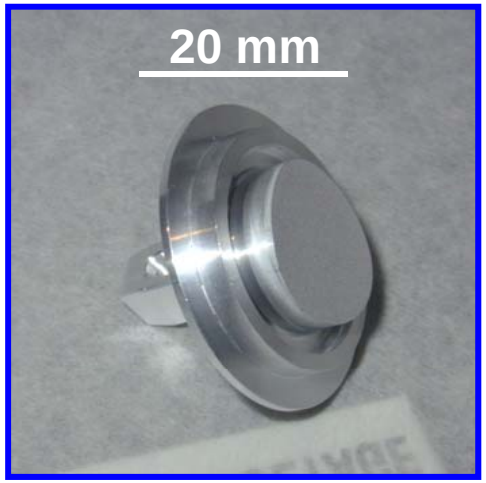
SEY Test Station



SEY TESTS at PEP-II

Expose samples to PEP-II LER synchrotron radiation and electron conditioning.
Then, measure Secondary Electron Yield (SEY) in laboratory.
Samples transferred under vacuum.





Complementary to CERN and KEK studies

Conclusion

- First deployment of CESR hardware for EC mitigation studies beginning now
- Dedicated experimental regions to appear over the course of the next half year
  - Ability to efficiently install test chambers
  - Support for collaborators
- A high priority is to lay out a detailed plan of mitigation tests that need to be undertaken as part of CesrTA
  - Need lead time to prepare chambers
  - Need to ensure that we focus on the most critical tests