Vacuum System

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BTR, LNF 8 July 2011

Vacuum system specifications

- RDR - electron damping ring:
    - <0.5 nTorr CO-equivalent in the arc cells
    - <2 nTorr CO-equivalent in the wiggler cells
    - <0.1 nTorr CO-equivalent in the straight sections
  - positron ring equal to the e- ring
  - an average pressure of 1 nTorr required to reduce FII

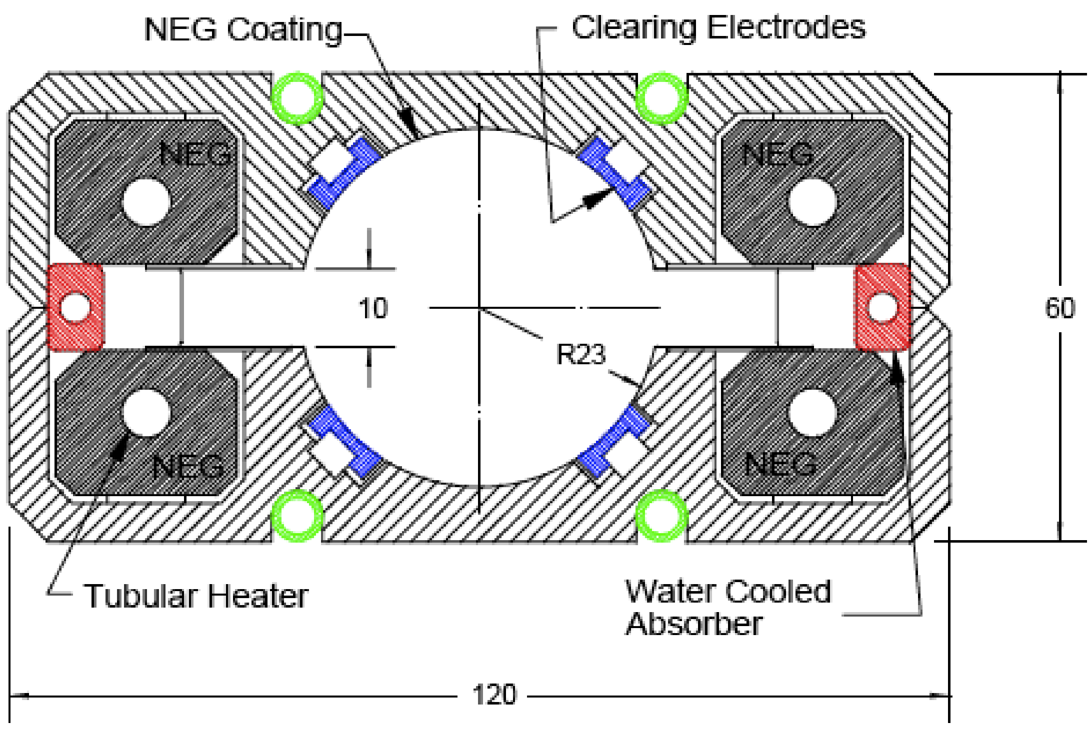
- TDR - 1305 electron bunches divided into 29 bunch trains, each consisting of 45 bunches with a gap of 62 linac RF buckets. At CO pressure of 0.1 nTorr, the FII growth rate is significantly reduced (simulation using DSB3, α_c=1.5e-4)

Summary of RDR Vacuum system

- Non-evaporable getter (NEG) coated aluminum tubular vacuum chamber
- No heater system
- No distributed pumping system
- Extruded aluminum tube, 1 cm thick (adds 2 cm to the magnets gap!)
- No “Diamond-like” bpms
- No synchrotron radiation absorbers (except the wiggler chamber)
- No electron cloud mitigations (except the wiggler chamber. Solenoids are mentioned but not costed)
- …

Summary of RDR Vacuum system

- e+ ring Vacuum system 12,686 k$
- Wiggler (80) and wiggler section quadrupole vacuum system ➔ 48%



Vacuum Design work at Cockcroft Institute

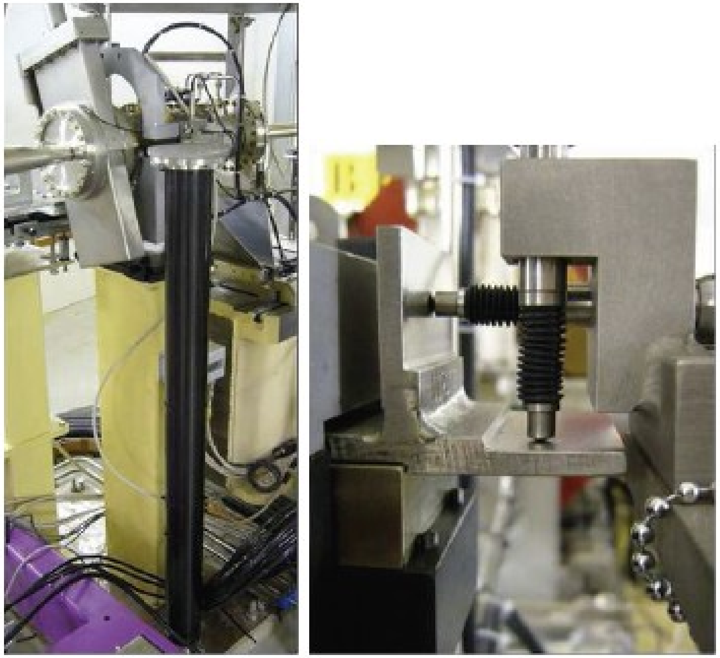


Figure 13: BPMs in DIAMOND. The picture on the left shows the BPM support system; the black pillar in front of the beam line is a glass fibre reference pillar, that supports linear encoders (close-up, right) that monitor the position of the BPMs.

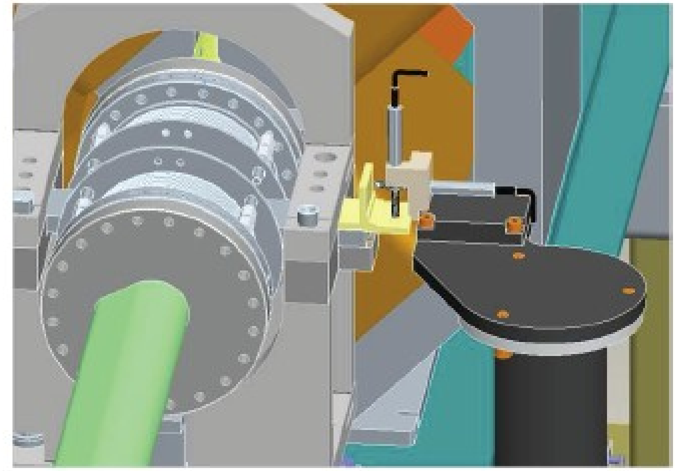


Figure 15: Damping ring BPM support and reference pillar from the CAD model, showing the linear encoders for monitoring any movement of the BPM.

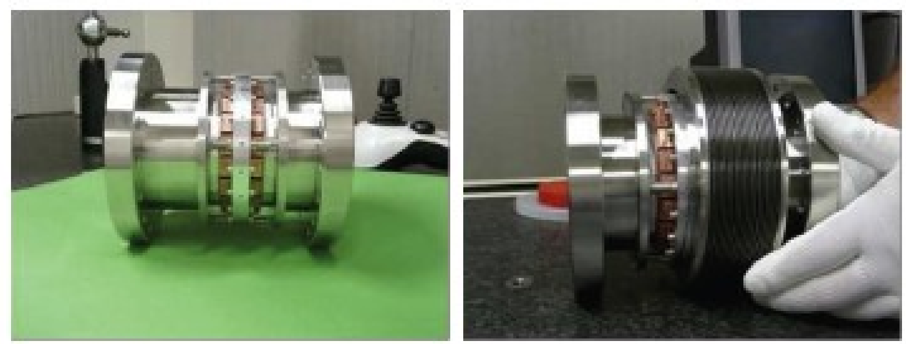


Figure 16: LNF design of bellows.

ILC Damping Ring Design Studies at the Cockcroft Institute, A.Wolski, M.Korostelev, K.Panagiotidis, A.Thorley, O.Malyshev, N.Collomb, J. Lucas, S.Postlethwaite, K. Zolotarev, ILC-NOTE-2010-057

Vacuum Design work at Cockcroft Institute

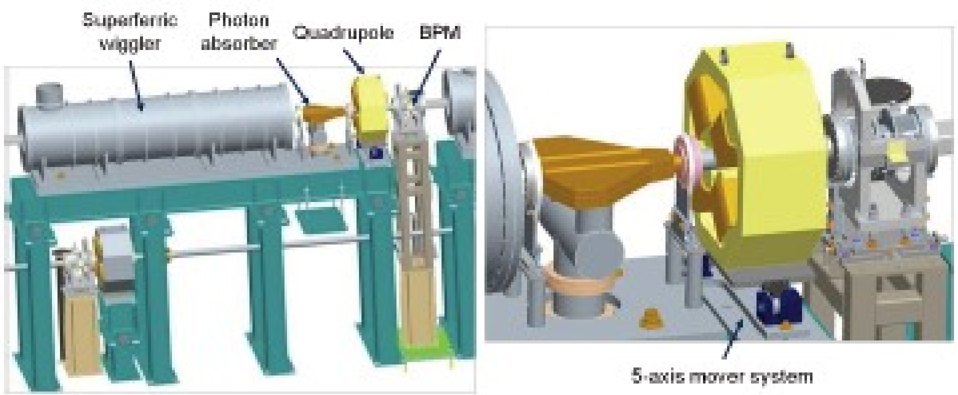


Figure 21: Wiggler unit and adjacent components.

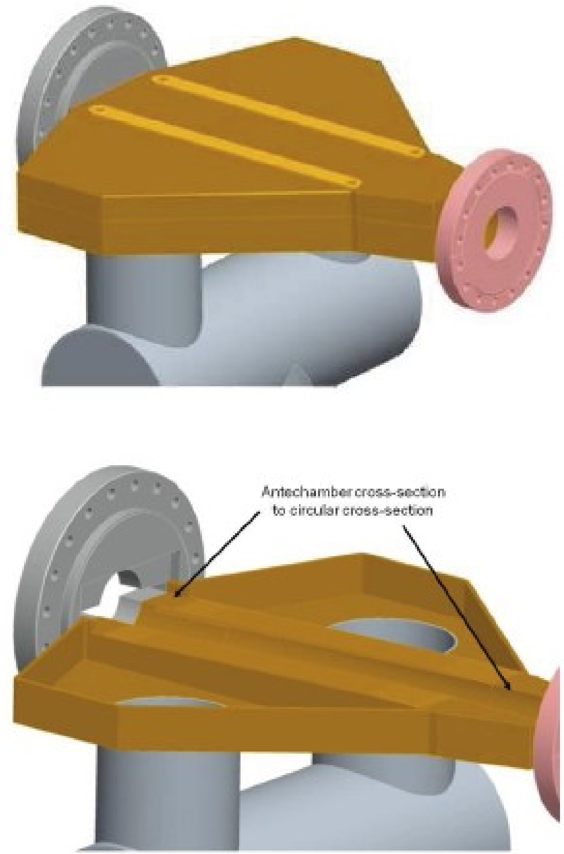


Figure 26: Photon absorber assembly. The beam direction is from left to right. Top: external view. Bottom: with "top" removed, showing the internal profile from antechamber section (in the wiggler) to circular section (through quadrupole and BPM).

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EC Working Group Baseline Mitigation Plan

Mitigation Evaluation conducted at satellite meeting of ECLOUD`10
(October 13, 2010, Cornell University)

EC Working Group Baseline Mitigation Recommendation

	Drift*	Dipole	Wiggler	Quadrupole*
Baseline Mitigation I	TiN Coating	Grooves with TiN coating	Clearing Electrodes	TiN Coating
Baseline Mitigation II	Solenoid Windings	Antechamber	Antechamber	
Alternate Mitigation	NEG Coating	TiN Coating	Grooves with TiN Coating	Clearing Electrodes or Grooves

*Drift and Quadrupole chambers in arc and wiggler regions will incorporate antechambers

- Preliminary CESRTA results and simulations suggest the presence of *sub-threshold emittance growth*
  - Further investigation required
  - May require reduction in acceptable cloud density ⇨ reduction in safety margin
- An aggressive mitigation plan is required to obtain optimum performance from the 3.2km positron damping ring and to pursue the high current option

S. Guiducci, M. Palmer, M. Pivi, J. Urakawa on behalf of the ILC DR Electron Cloud Working Group