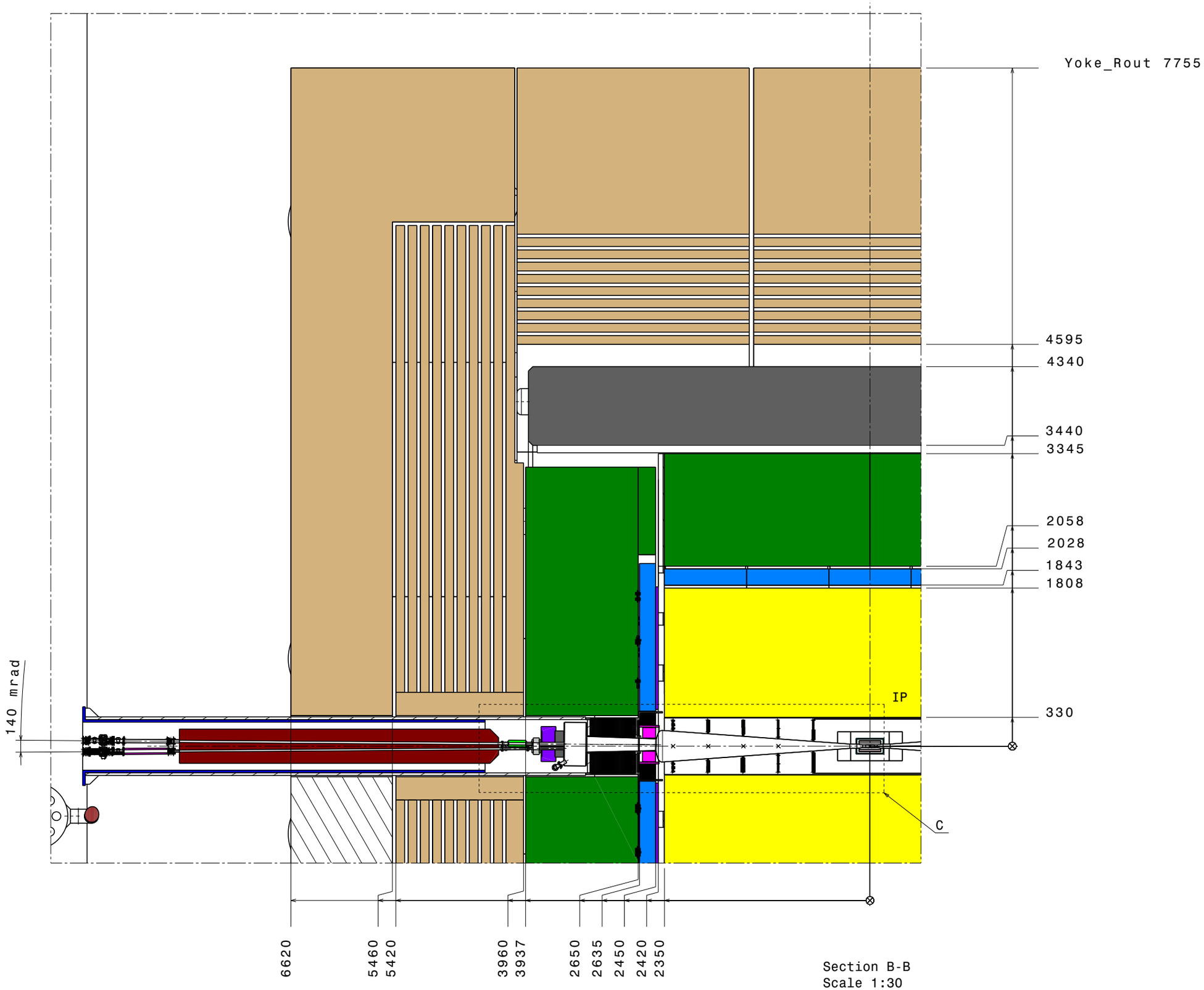
L* Status

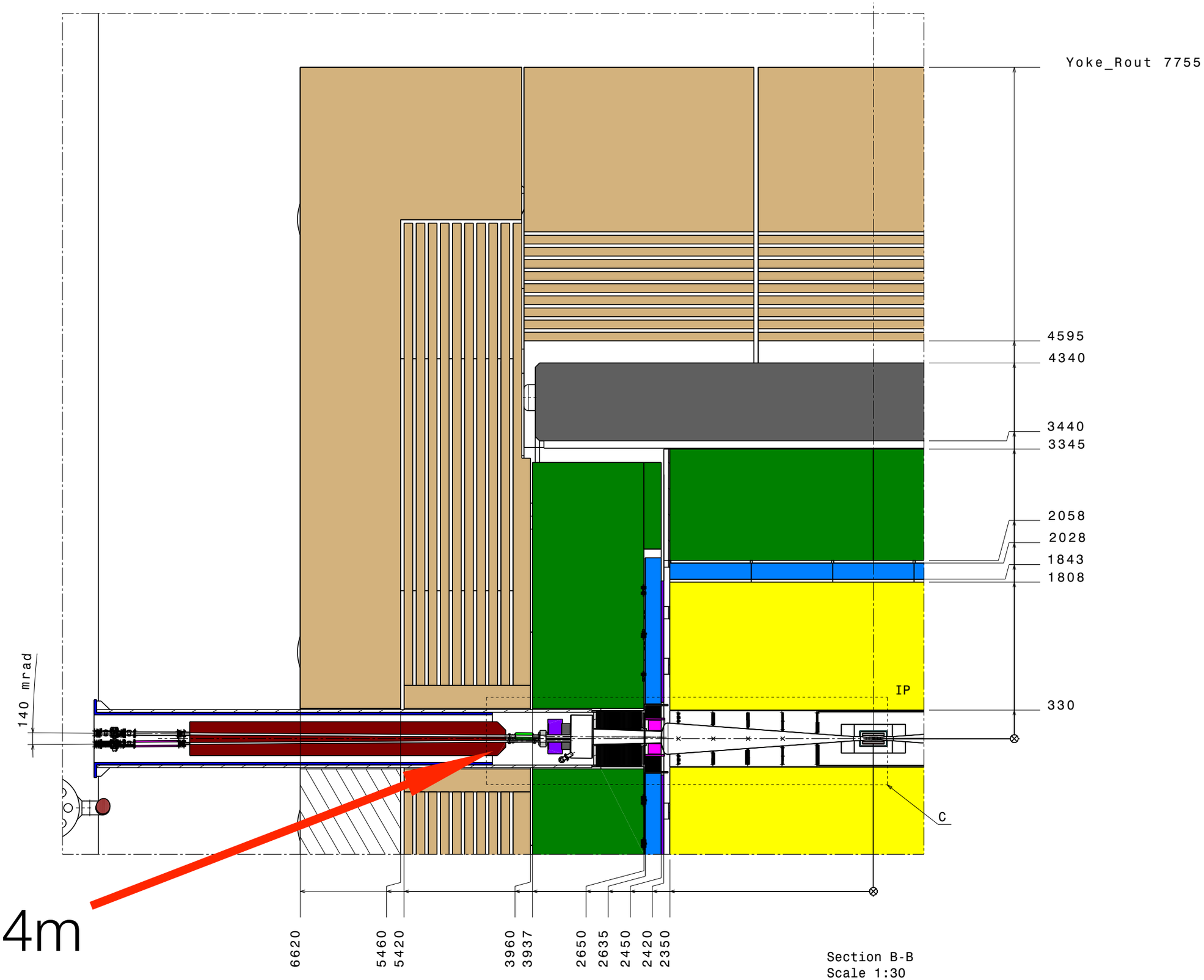
Karsten Buesser
28.11.2014

ILD Dimensions



Section B-B
Scale 1:30

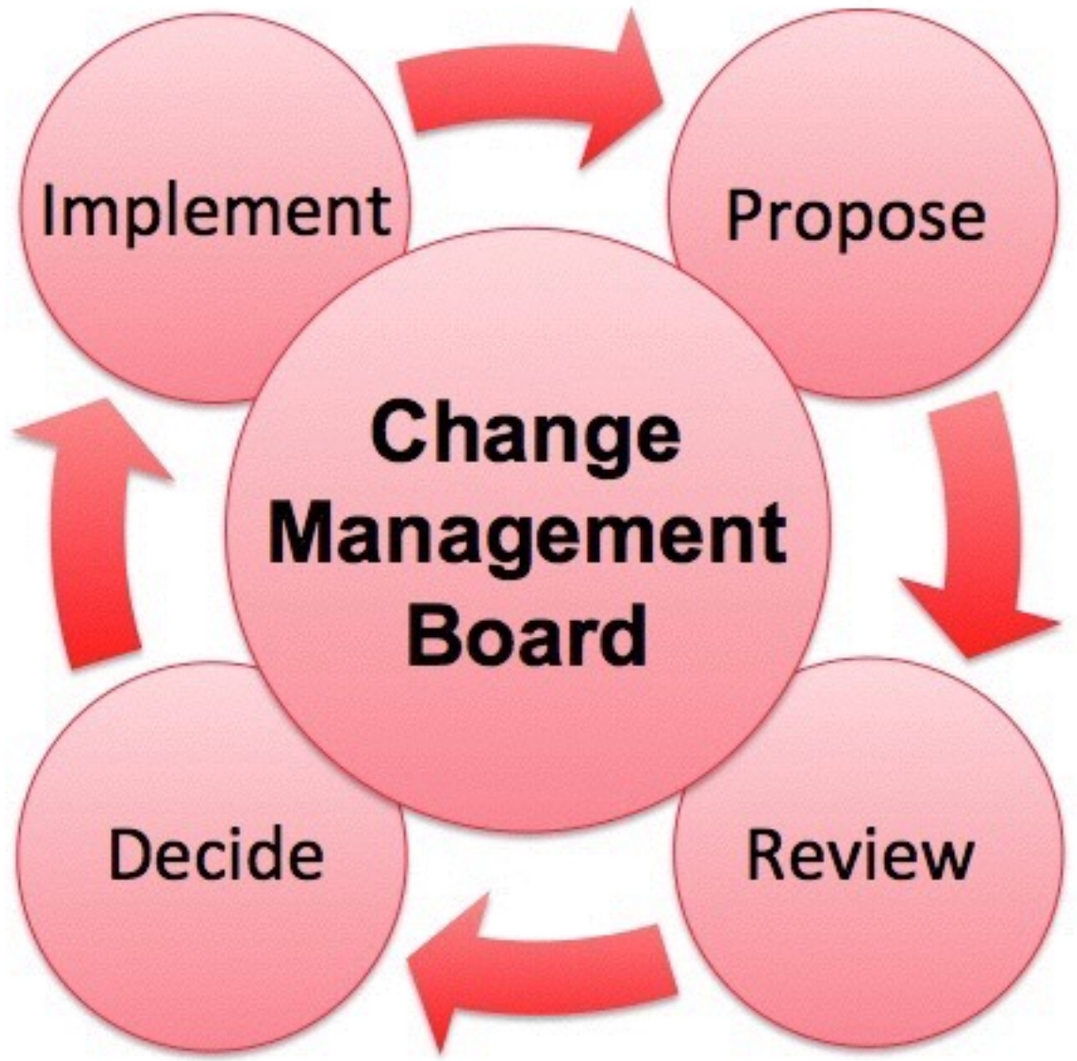
ILD Dimensions



L*=4.4m

Change Management Board

- Members:
  - M. Harrsion (BNL, chair)
  - H. Hayano (KEK)
  - V. Kuchler (FNAL)
  - B. List (DESY, change manager)
  - J. List (DESY, PD-Physics, ILD)
  - T. Markiewicz (SLAC, PD-MDI, SiD)
  - M. Ross (SLAC)
  - N. Solyak (FNAL)
  - N. Terunuma (KEK)
  - N. Walker (DESY)
  - A. Yamamoto (KEK)
  - K. Yamamoto (KEK)
- Final decision is made by CMB chair
- Can be escalated to LCC directorate, e.g. by PD director



Change Request No 2: Common L*<= 4m

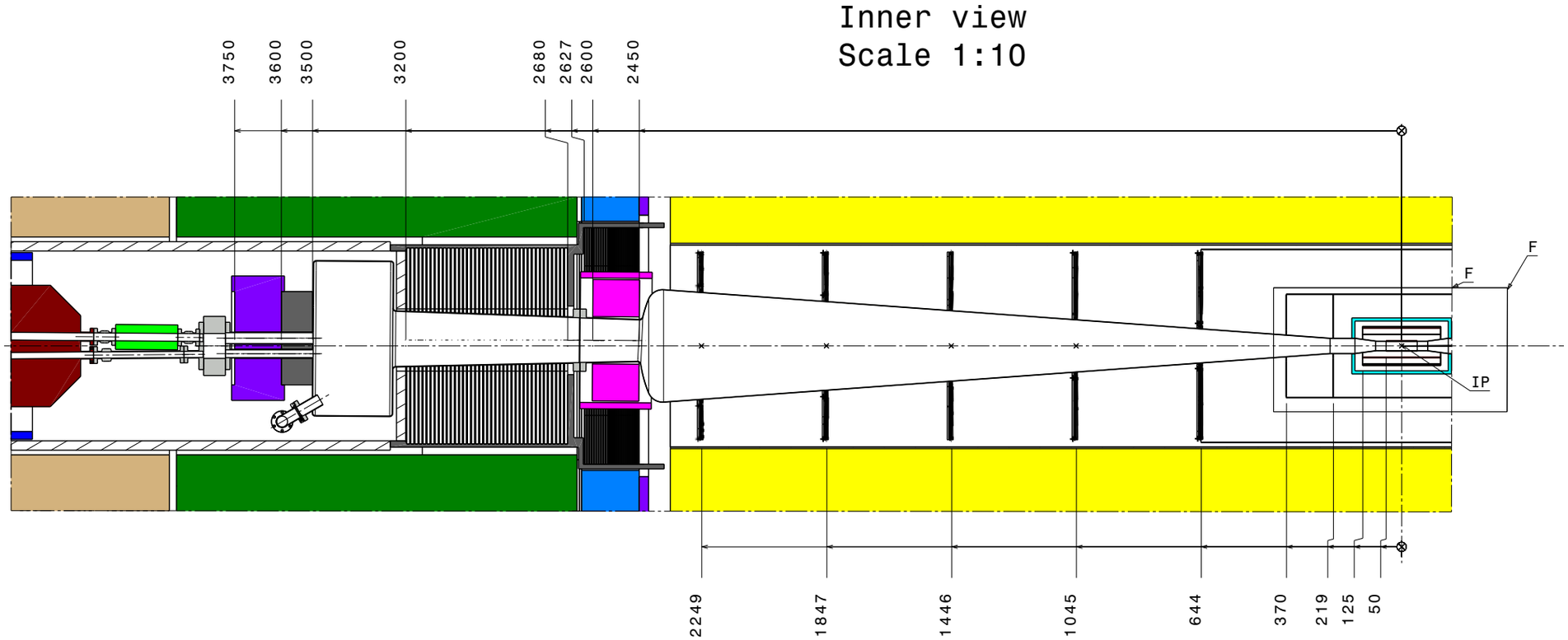
CHANGE REQUEST NO. ILC-CR-0002	EDMS No: **D*01082495**	Created: **02-09-2014** Last modified: **09-09-2014**

BASELINE OPTICS TO PROVIDE FOR A SINGLE FFS L* (QD0 EXIT – IP DISTANCE) OPTICS CONFIGURATION

The final focus system (FFS) and beam dump extraction system (EXT) baseline design is to provide a standard optics with fixed L* (yet to be determined, but provisionally assumed to be ≤4m). This optics solution is to be common to both detectors.

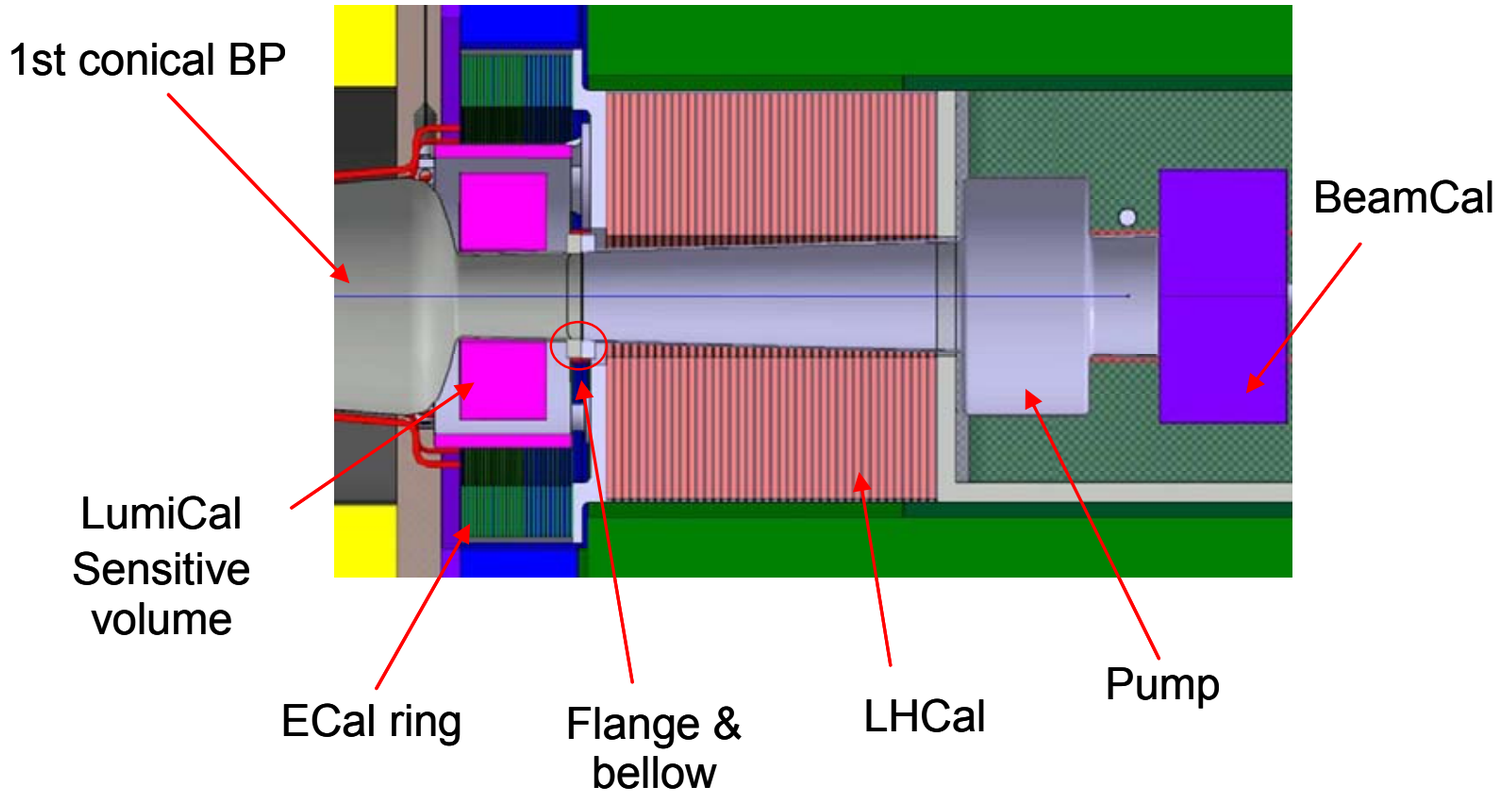
- Submitted by Glen White (BDS WG leader) in September 2014
- Change Management Board has formed a Change Review Panel for this request:
  - T. Markiewicz (SiD), N. Terunuma, N. Walker, G. White, KB (MDI, ILD)
  - CRP has agreed to come to a suggestion at the time scale of the next ILC workshop (April 2015, Tokyo)
  - CMB will decide eventually

ILD: Current Lower Constraints on L*



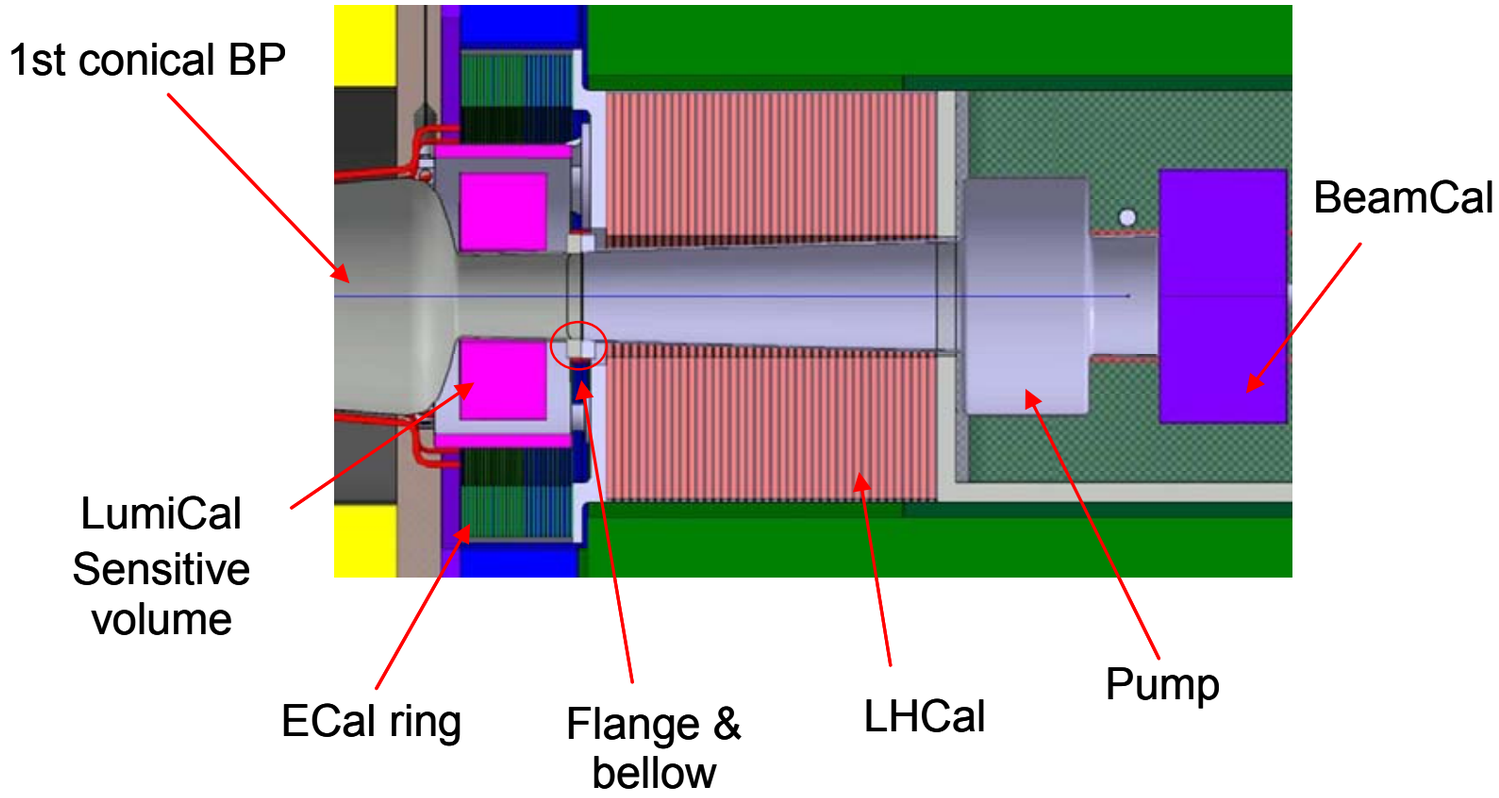
- Detailed design of forward region:
  - LumiCal, LHCAL, BeamCal
  - Beam Pipe, Bellows, Flanges, Vacuum Pumps
  - Optimised (many FTEs in the last ~10y) for
    - operations: no FCAL or masks inside the tracking volume
    - assembly and maintenance
    - physics: VTX (occupancies and layer radii), FCAL performance, hermeticity

Forward Region - possible changes towards L*=4m



- Need to find ~40cm in current design
- Look into design optimisations of all structures
  - maybe find some 10cm there, but more?
- Biggest devices:
  - Pump in front of BeamCal (30cm)
  - LHCAL (~50cm)

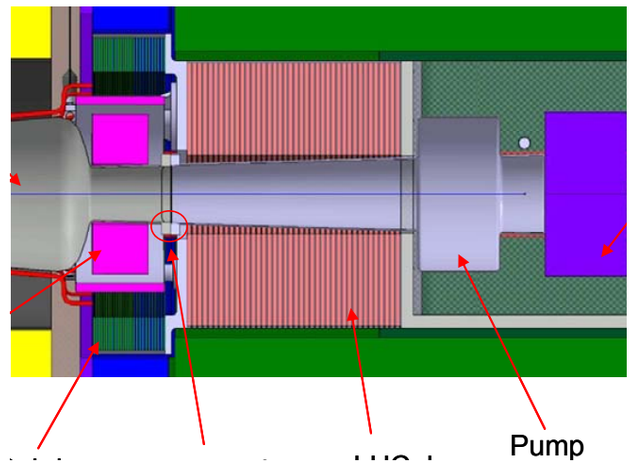
FCAL

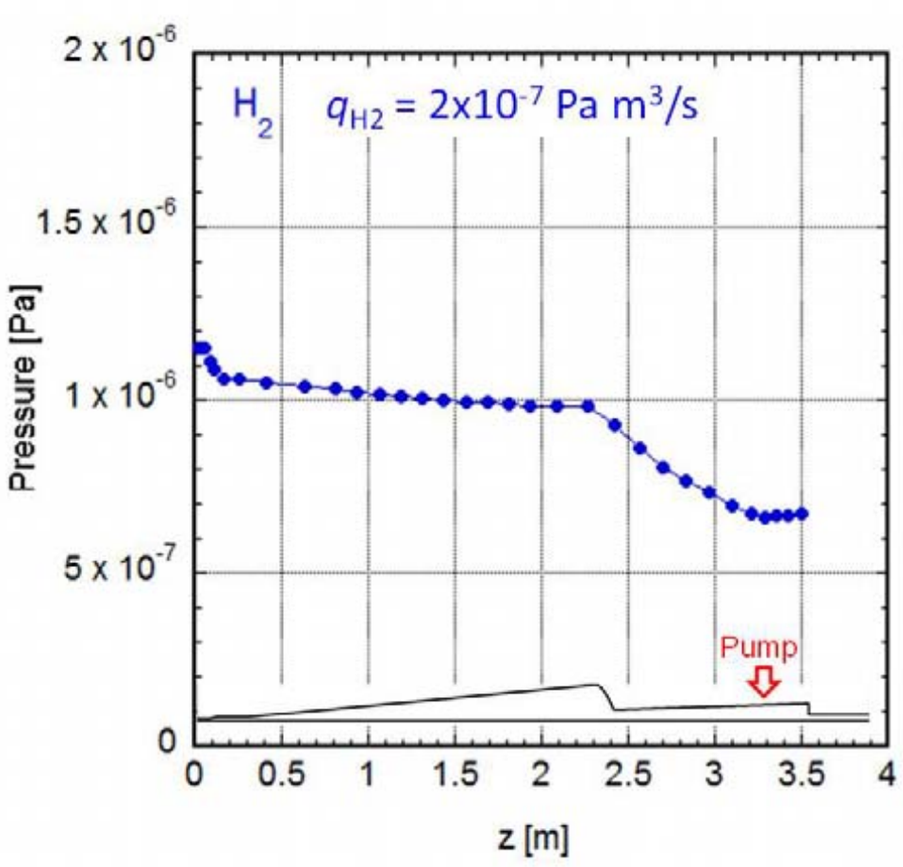


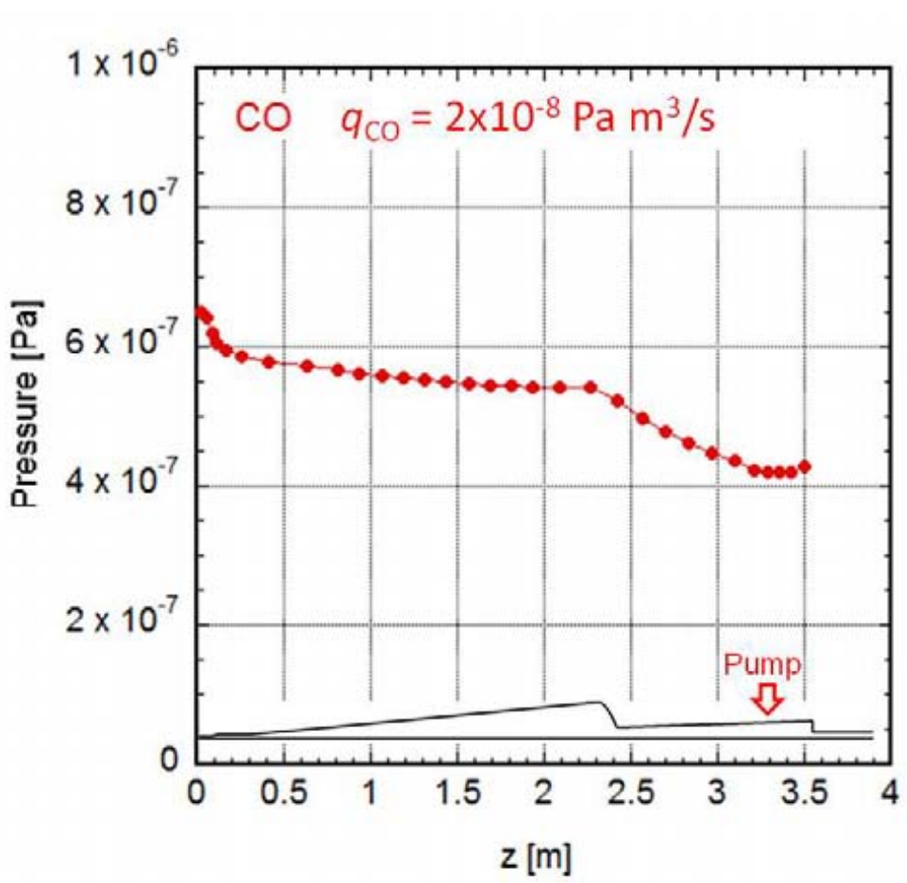
- Had discussion with FCAL collaboration on Monday
- They will look into optimisation of existing BeamCal and LumiCal design
  - not sooo eager to start activities on LHCAL
- Lucia Bortko (Zeuthen) will start background simulation on pair background with new BeamCal location

Vacuum Conditions

- What about the vacuum pump?
- SiD has no pump in front of QD0, but behind
- ILD vacuum studies done for LoI
  - Y. Suetsugu,“Technical Note for ILD Beam Pipe“:
  - 6E-7 Pa (6E-9 mbar, ~4.5 nTorr) for CO
  - 1E-6 Pa (1E-8 mbar, ~7.5 nTorr) for H_2



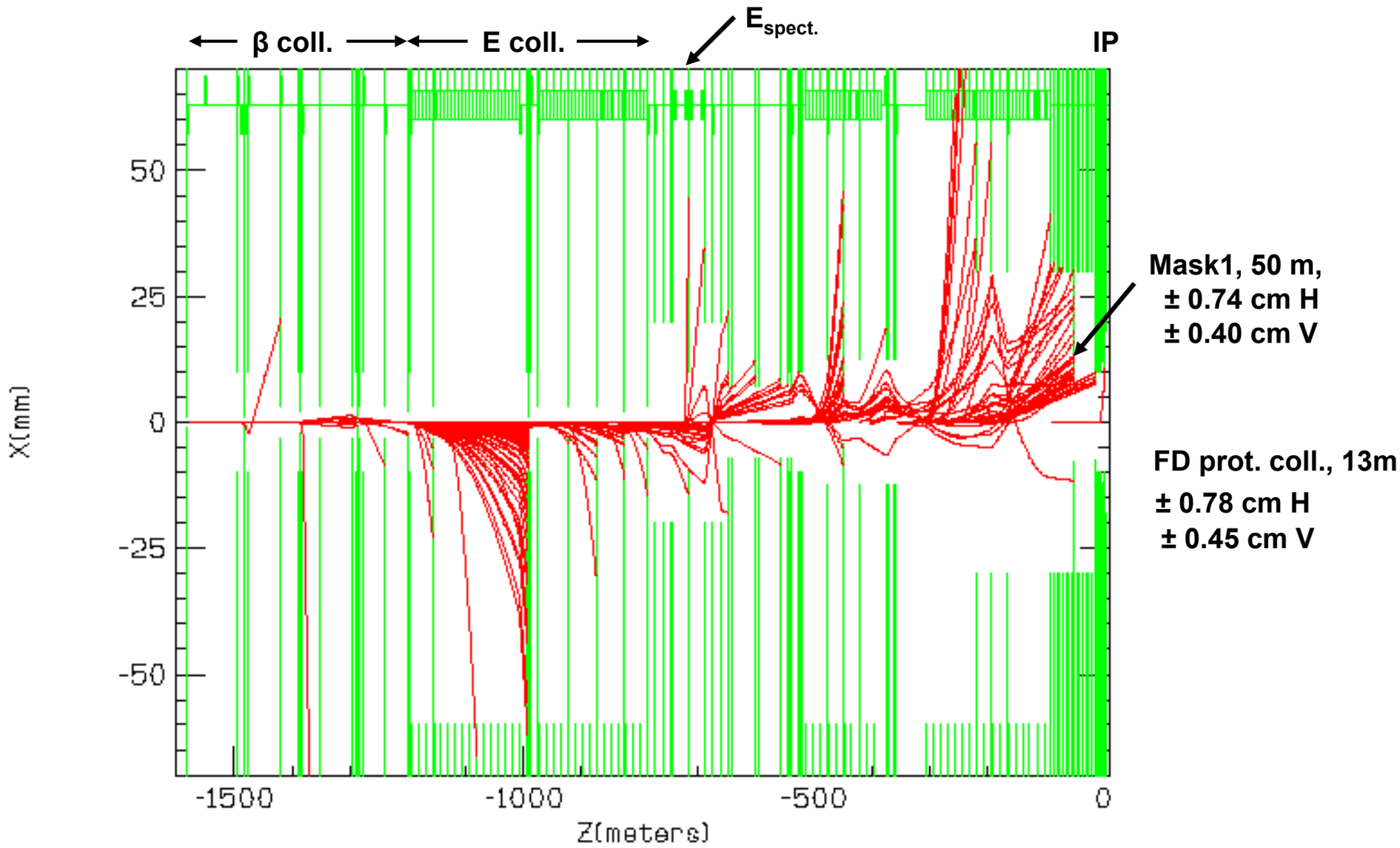




Vacuum Requirements

- L. Keller, T. Maruyama, T. Markiewicz - ILC-Note-2007-016

Loss pts. of 150 random beam-gas brem. trajectories in the BDS using LP TURTLE



Vacuum Requirements

- L. Keller, T. Maruyama, T. Markiewicz - ILC-Note-2007-016

Summary of Hits/bunch and Hits/160 bunches (TPC) – both beams, 10 nTorr

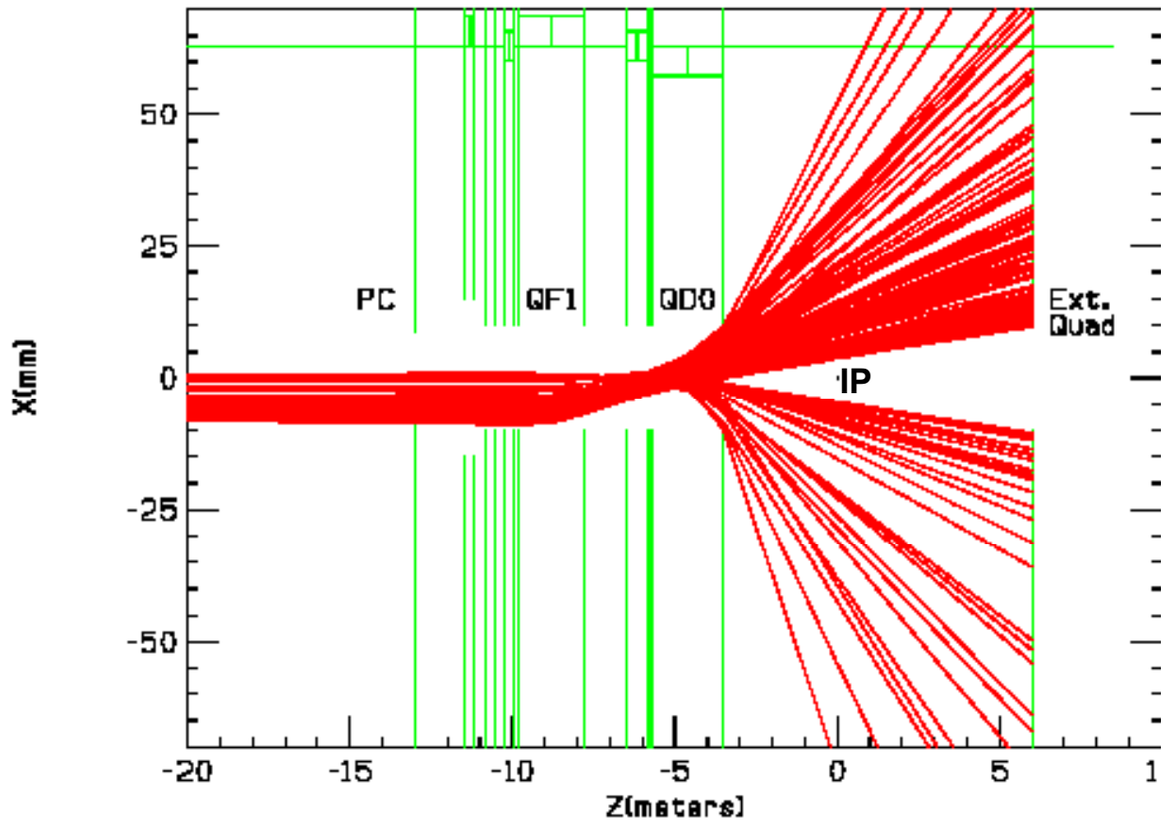
Hits/bunch Hits/160 bunches (TPC)

Hit Location	GEANT3 Beam-gas brem (charged)	TURTLE Beam-gas brem (charged)		TURTLE Beam-gas brem (photons)		TURTLE Coulomb (charged)	
	Hits	Hits	<E>	Hits	<E>	Hits	<E>
FD Prot. Coll. (13 m) |x| > 0.74 cm |y| > 0.45 cm Origin 0-800m from IP	0.22 35	0.17 27	235 GeV	0.056 9.0	~50 GeV	0.009 1.4	250 GeV
Inside F.D. (10 – 3.5 m) (QF1 to QD0) Origin 0-100m from IP	0.014 2.2	0.006 1.0	~100 GeV	0	-	0	-
IP region (± 3.5 m) (R > 1 cm at Z = 6.0 m) Origin 0-200m from IP	0.04 6.4	0.02 3.2	~100 GeV	0	-	0	-

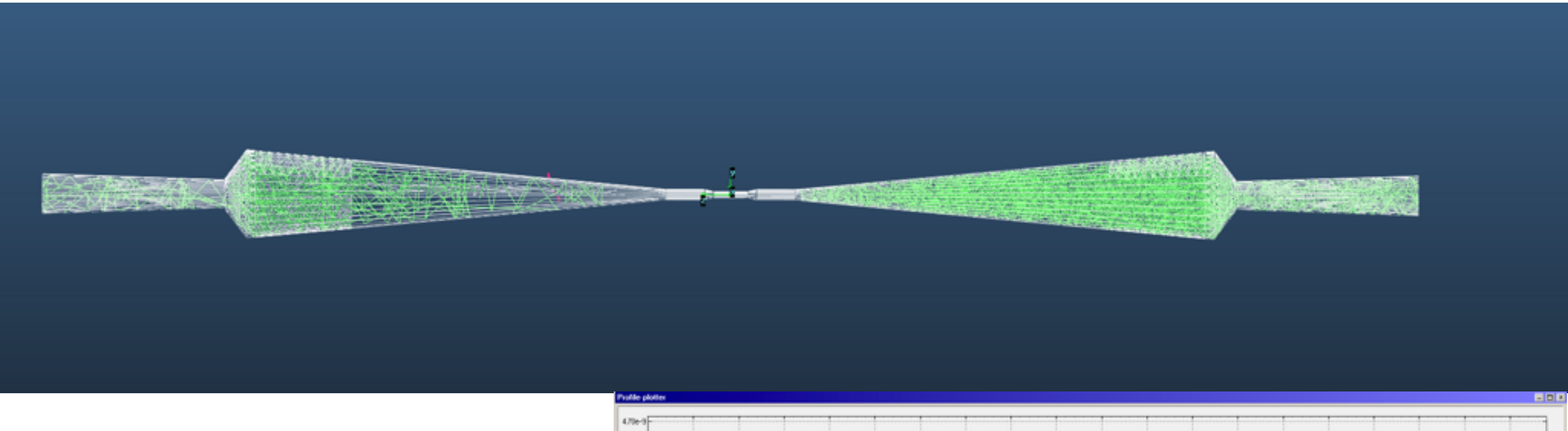
GEANT3 simulations show that only hits in the IP region (± 3.5 m) cause problems for the vertex detector

How relevant is the Vacuum inside the detector?

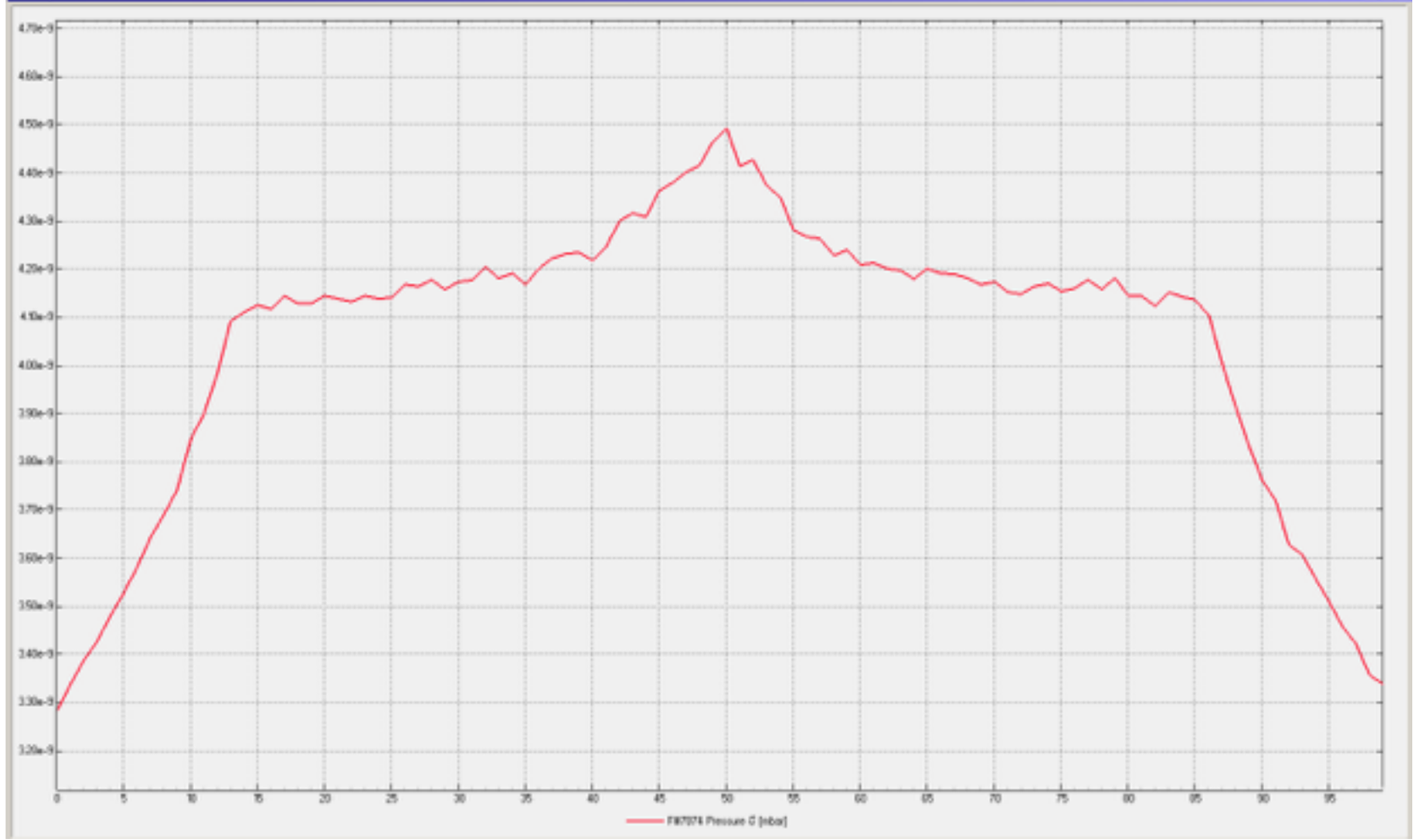
- Beam-Gas scattering in the BDS upstream is relevant for detector backgrounds
- O(10 nTorr) is the required vacuum level up to +- 200m
- Beam-Gas background produced inside the detector is mostly forward peaked - leaves the detector through the beam pipe
- So in theory, vacuum level inside the detector could be much higher
- To be checked with full detector simulations!



Check Vacuum Conditions

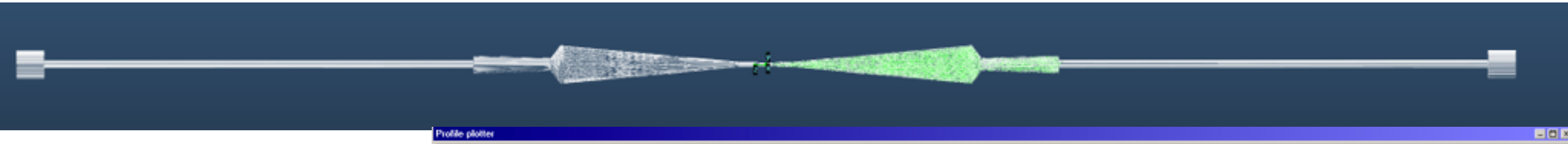


- MolFlow+ (CERN)
- Molecule tracker for given gases, materials and geometries
- For CO: 4.5E-9 mbar
  - Suetsugu: 6E-9 mbar

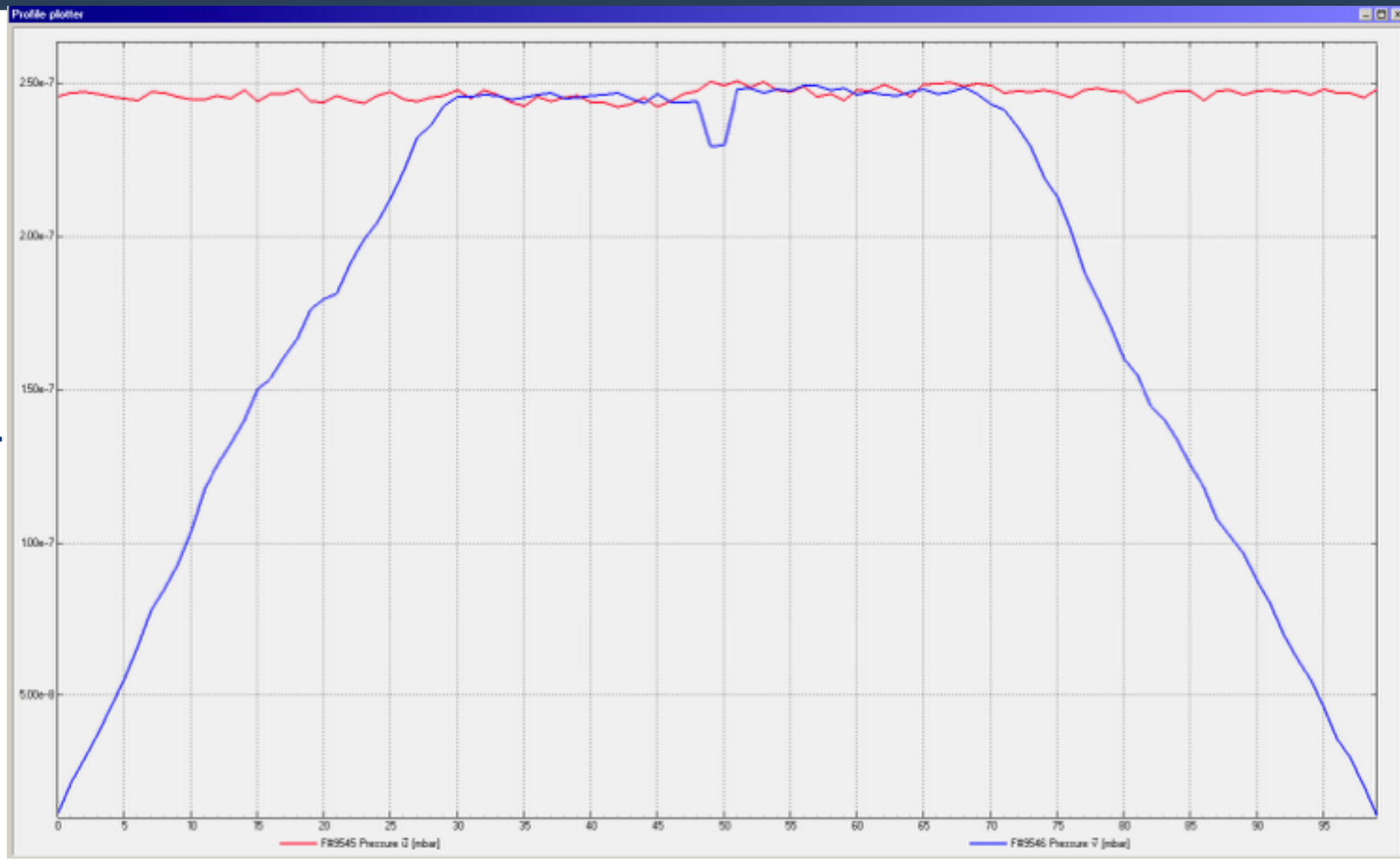


New Vacuum Geometry

- Moved the pumps to the upstream sides of both QD0s
  - increases pumping lever arm by ~5m on both sides…



- Increases level to 2.5E-7 mbar
  - for CO
- ~200 nTorr
- ~50 times higher than with old pump location



Vacuum - Things to Do

- Simulate vacuum conditions for relocated pump geometries
  - all relevant gases (H_2, CO, CO_2)
  - check influence of cold QD0 magnet - acts like a cryo pump…
  - work in progress (DESY, LAL)

- Do a full detector simulation study with different levels of rest gas in the beam pipe
  - try to find someone at DESY

- Agree on tolerable level for residual gas pressures