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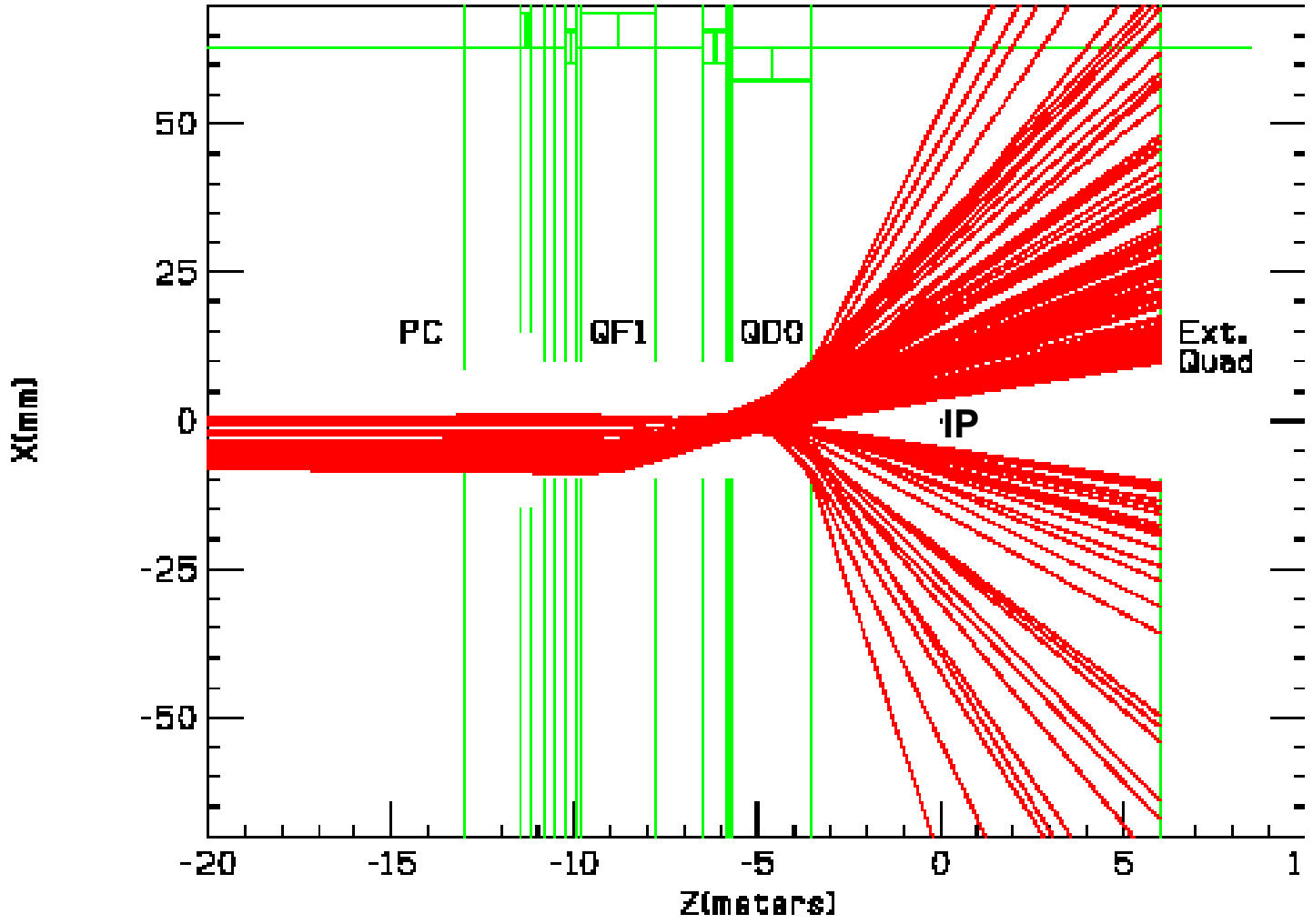
Beam-Gas Bremsstrahlung Electrons Hitting Beyond the Final Doublet

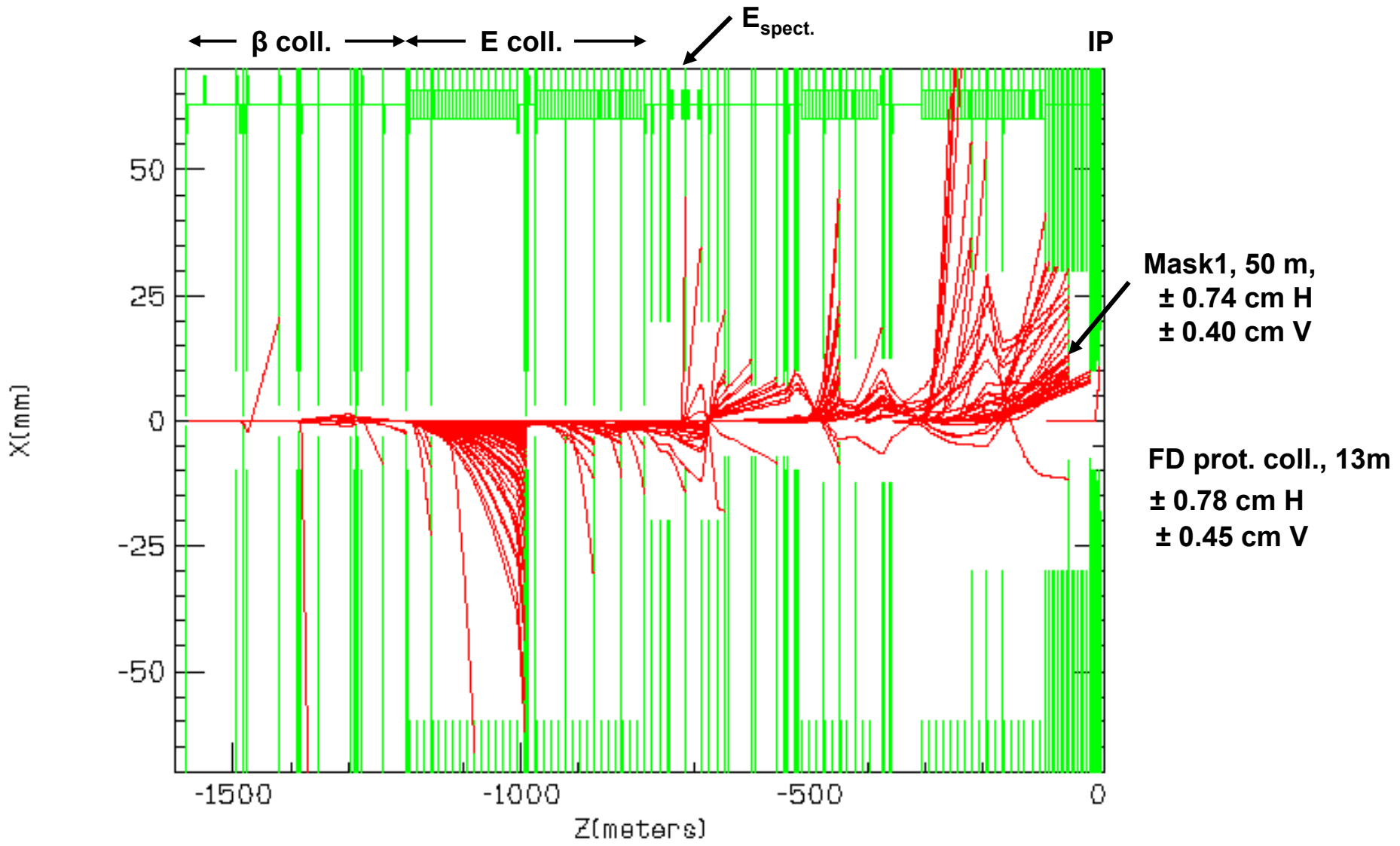
Cut: Outside 10 mm at entrance to 1st extraction line quad

Average Energy = 100 GeV

Origin is inside 200 m from the IP



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



Scattering Rates, 10 nT

1500 m, "SLC" gas: 62% H_2, 22% CO, 16% CO_2 => $X_0 = 5 \times 10^{13}$ m @ 10 nT

- **Compton scattering on thermal photons (irreducible): 1.1/bunch**
- **Beam-gas bremsstrahlung (αZ^2): 2.9/bunch**
- **Coulomb (αZ^2): 2.3/bunch**
- **Moller (αZ): 0.3/bunch**

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

What are the vacuum specs between the QD0's ?
(where there is no room for pump installation)

1. We have seen that 1 nT out to 200 m is conservative, but near the IP, it could be one to two orders of magnitude higher from a bremsstrahlung standpoint. What about electro-production of hadrons?

2. **Electro-production of hadrons in gas near the IP (± 3.5 m)**

σ_{tot} ~ 2 mb => ~ 5×10^{-5}/BX @ 10 nT

Lumonosity bkg.: gamma-gamma at $\mathscr{L}_{max}$ ~ 0.5/BX

Therefore the near-IR pressure requirement is not determined by the beam-gas background rates

Summary for 10 nTorr:

1. Within the IP region there are 0.02 - 0.04 hits/bunch (3-6 hits TPC)
   at an average energy of about 100 GeV/hit originating 0–200 m from the IP.
   Therefore 1 nT from 0–200 m is conservative.

2. On the FD protection collimator there are 0.20 charged hits/bunch (33 hits TPC)
   at an average energy of about 240 GeV/hit and 0.06 photon hits/bunch (9 hits TPC)
   at an average energy of about 50 GeV/hit originating 0–800 m from the IP.
   Therefore 10 nT from 200–800 m.

3. Beyond 800 m from the IP the pressure could conceivably be at least
   an order of magnitude higher than 10 nT, pending look at BGB
   background in the Compton polarimeter and energy spectrometer.

4. Need feedback from the detector groups on the effect of these
   hit rates on their detectors.

Note: hits in the IP region are defined in slide 1