Beam-gas scattering & detector background

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Beam-gas scattering in Geant 3

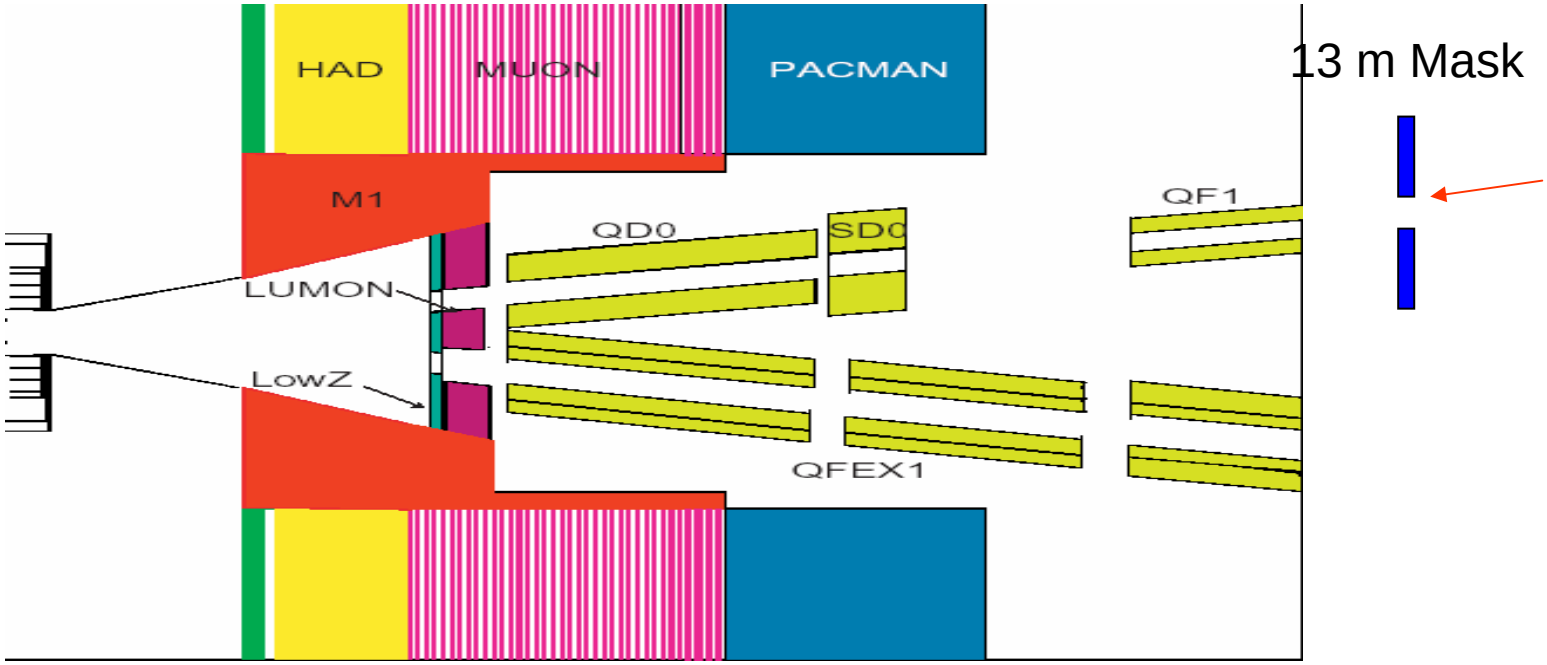
- Few years ago beam-gas scattering in the BDS was simulated in Geant and compared with Keller's TURTLE results.
  - Consistent within a factor of two.
- In Geant the beam line vacuum is replaced by a mixture of 62%H_2+ 22%CO+16%CO_2 at a pressure of 4.9×10^{-3} atm
  - $X_0 = 1500\ \text{m} \times 100$
- Sync radiation masks (FD protection collimators) at 50 m and 13 m take most of the beam-gas scatterings.
- Detector background

Beam-gas scattering rate at 10 nTorr

	100,000 incident	Two beams with $2x10^{10}$ e-/BX at 10 nTorr
50 m Mask (|x| > 0.78 cm, |y| > 0.4 cm)	1673	1.8
13 m Mask (|x| > 0.74 cm, |y| > 0.45 cm)	204	0.22
From QF1 to QD0	13	0.014
R > 1 cm at z = 350 cm	37	0.040

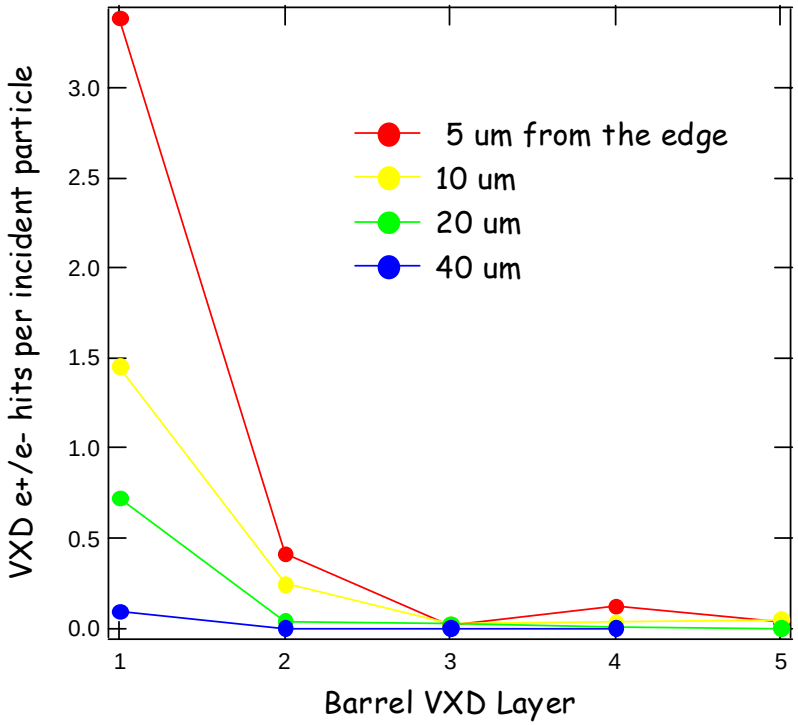
Detector background from beam-gas scattered particles hitting the mask at 13 m

SiD Detector with 14 mrad crossing angle

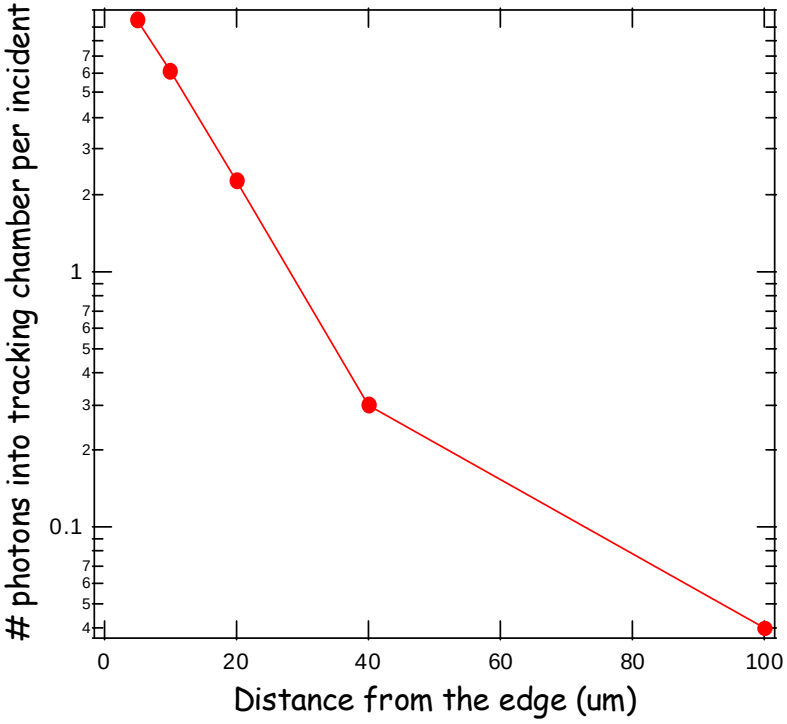


Central detector is well protected.
Negligible detector background would be generated unless particles hit the mask edge within ~10 um.

Detector background from 250 GeV e- hitting the 13m mask



VXD hits from pairs ~300/BX



Photons from pairs ~1000/BX

Conclusions

- Protection Collimators at 13 m and 50 m would take most of beam-gas scattered particles.
  - 1.8 hits/BX at 50 m @10 nTorr
  - 0.22 hits/BX at 13 m @ 10 nTorr
- Detector background from particles hitting the 13m mask was estimated.
- To be comparable with the pairs background, ~100 particles must hit the mask edge within 10 um.