Detector background update for L*=3.51 m, L*(ext)=5.5m

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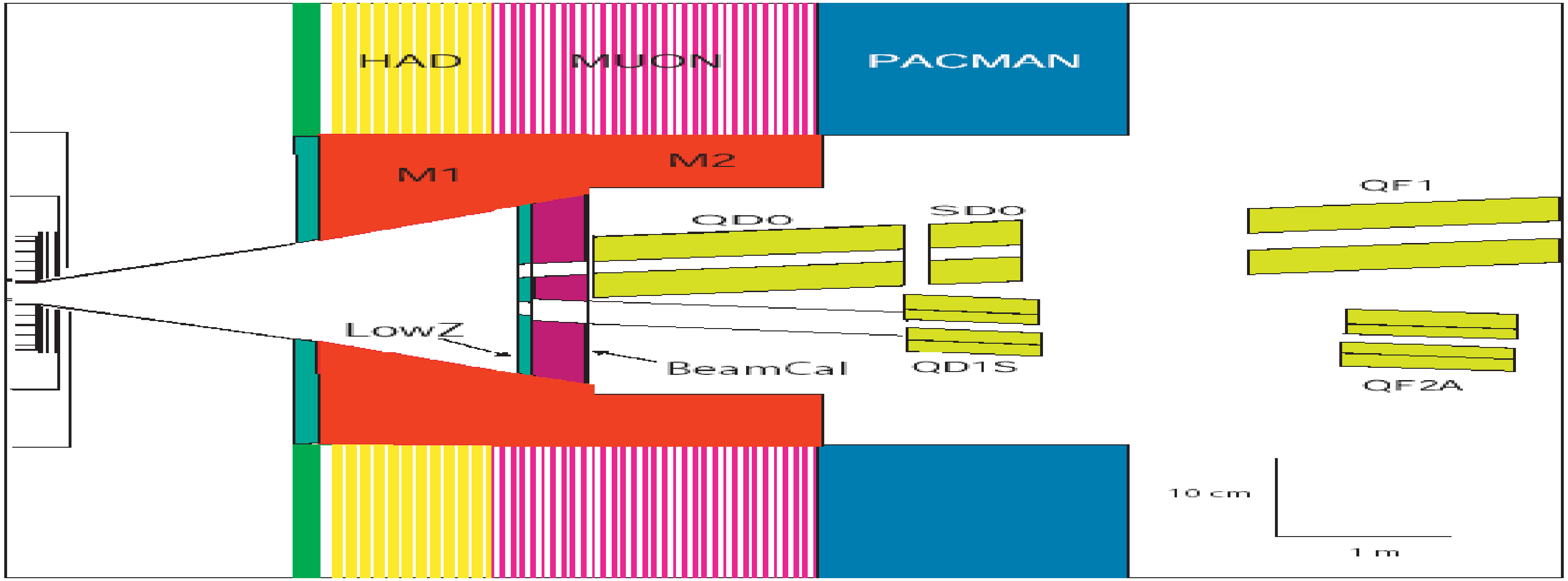
Updates

- SiD Detector with 14 mrad crossing angle
  - 5 Tesla solenoid field map + Anti-DID field
- L*=3.51 m and L* (ext)=5.50 m
- ILC 500 GeV Nominal beam parameters
- Sync radiations from FF quads
  - No sync radiations in the beamline apertures.
  - Collimation depth
- e+/e- background in vertex detector
- Photon background in Si tracker
- Neutrons in vertex detector

14 mrad crossing geometry

14 mrad crossing geometry in Geant 3 and FLUKA



Apertures:

QD0

R=1.0 cm@z=-3.51 m

Beampipe@IP

1.2 cm@0.0m

Low Z

1.35 cm
@2.85-2.95m

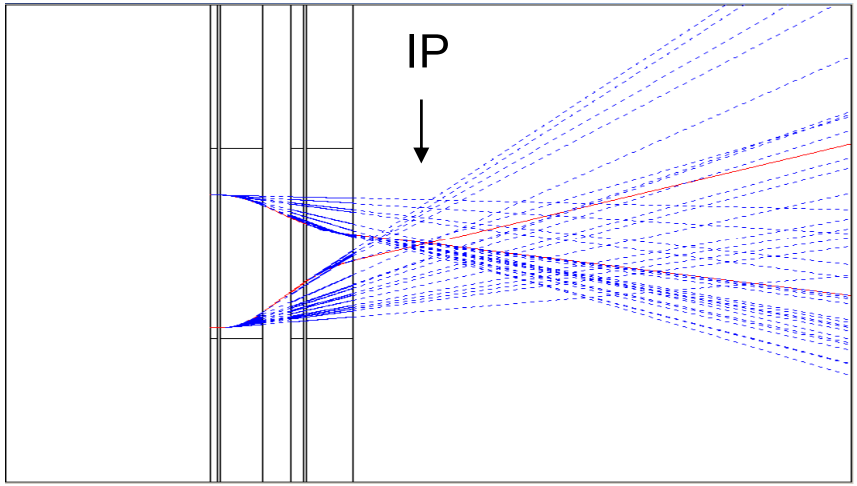
QD1S

1.5 cm
@5.5-6.56m

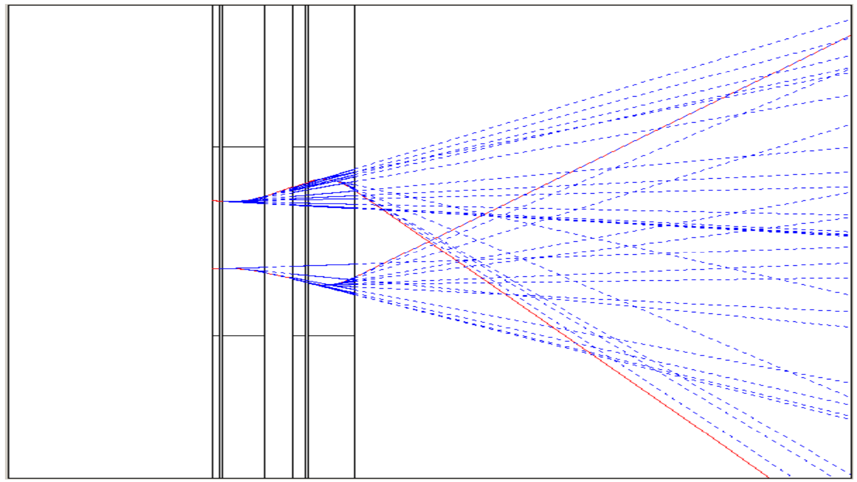
Sync radiations

- Back track 250 GeV beam from IP to SF1 without sync radiation, then track from SF1 to IP with sync radiation generation.
- Look at sync radiations at IP, Z=295 cm (Low Z), and Z=656 cm (Extraction Quad exit).

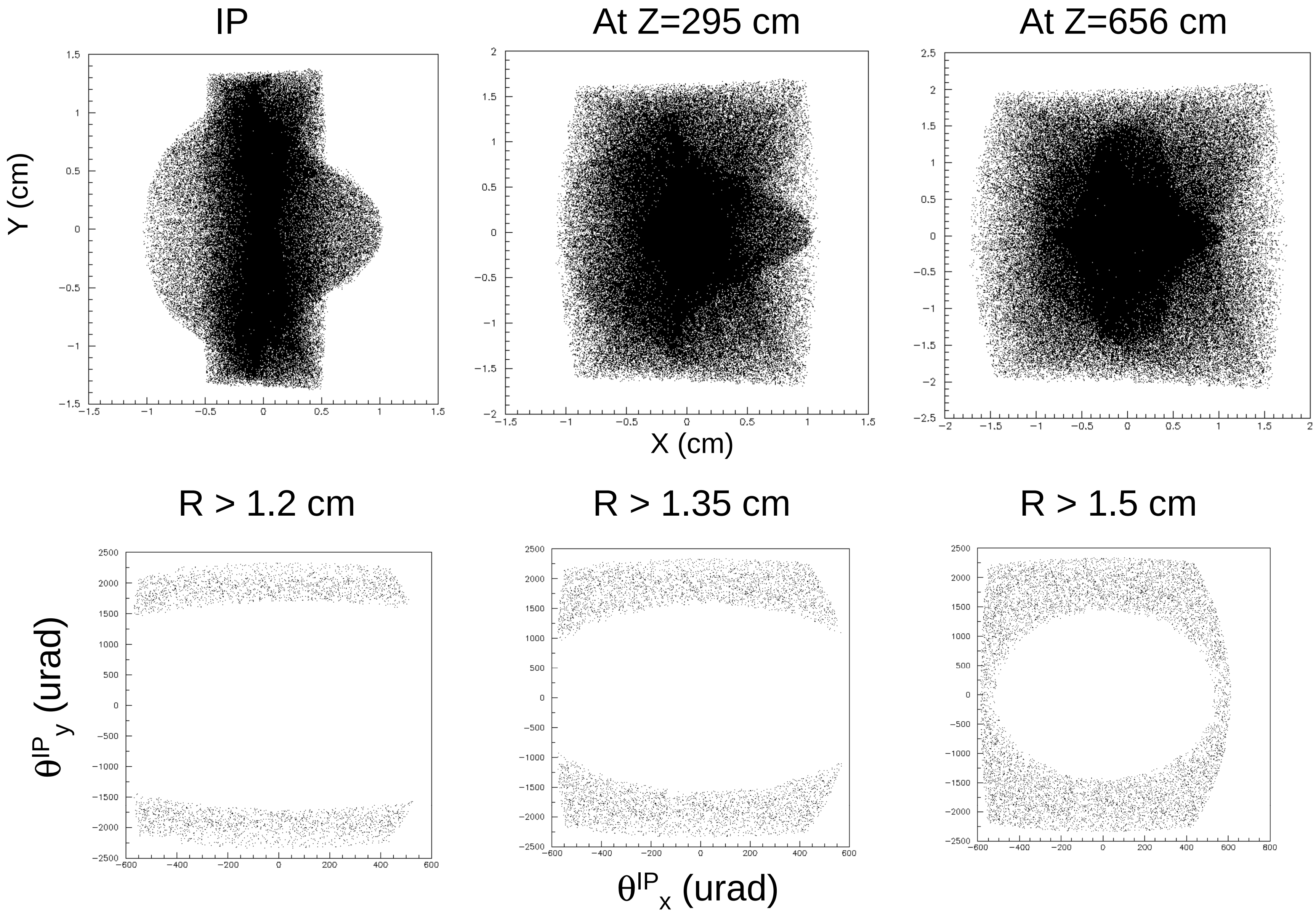
Horizontal view



Vertical view

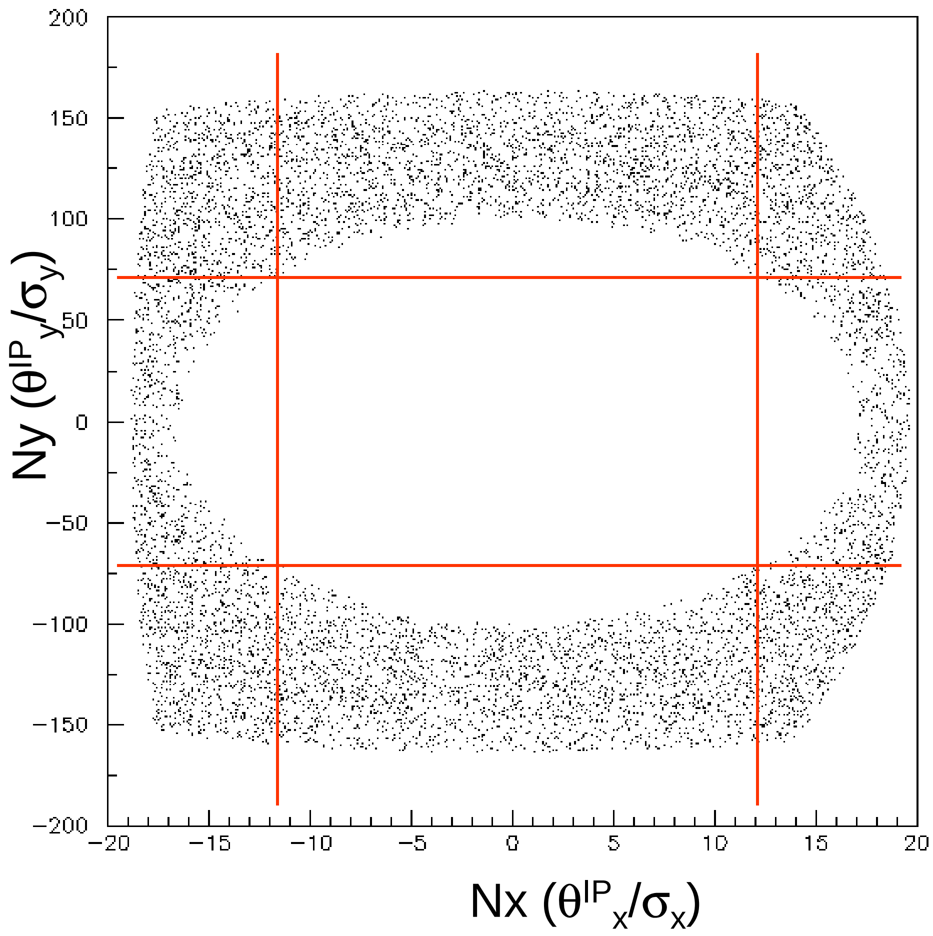


Sync radiations from FF quads



Collimation depth

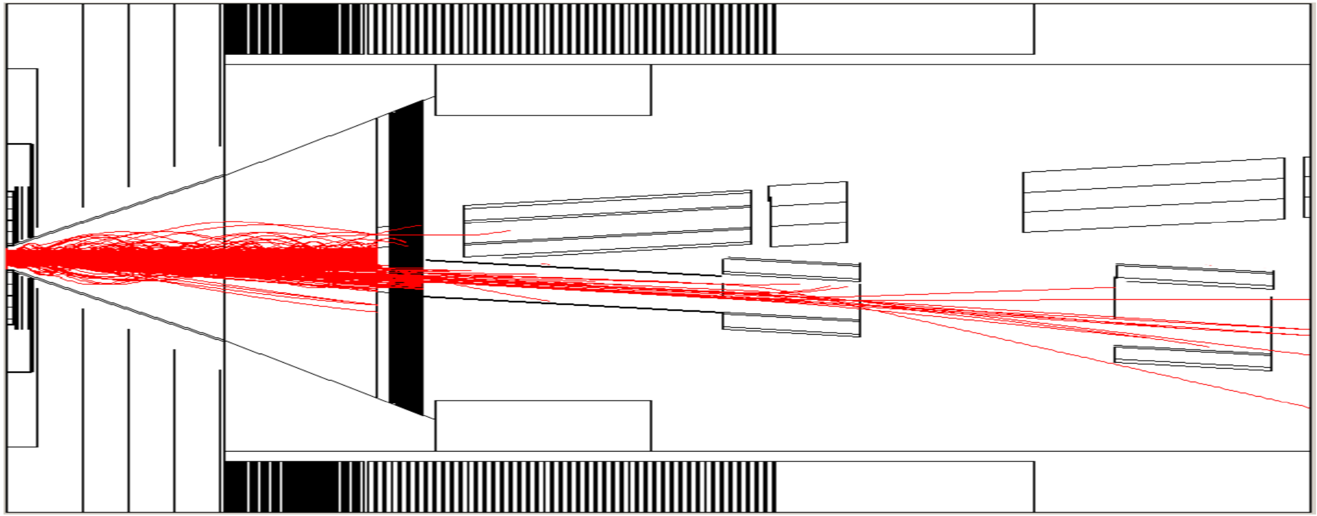
- First extraction quad constrains the collimation depth.
- Consistent with Frank Jackson (BILCW07)
  - 11.9σ_x 70.7σ_y in red lines
- Collimation depth cannot be defined by just two numbers.– The elliptical curve in (nx, ny) must be used.
- Does the collimation in the collimation section actually achieve this collimation depth?
- Need to study re-population outside the collimation depth.



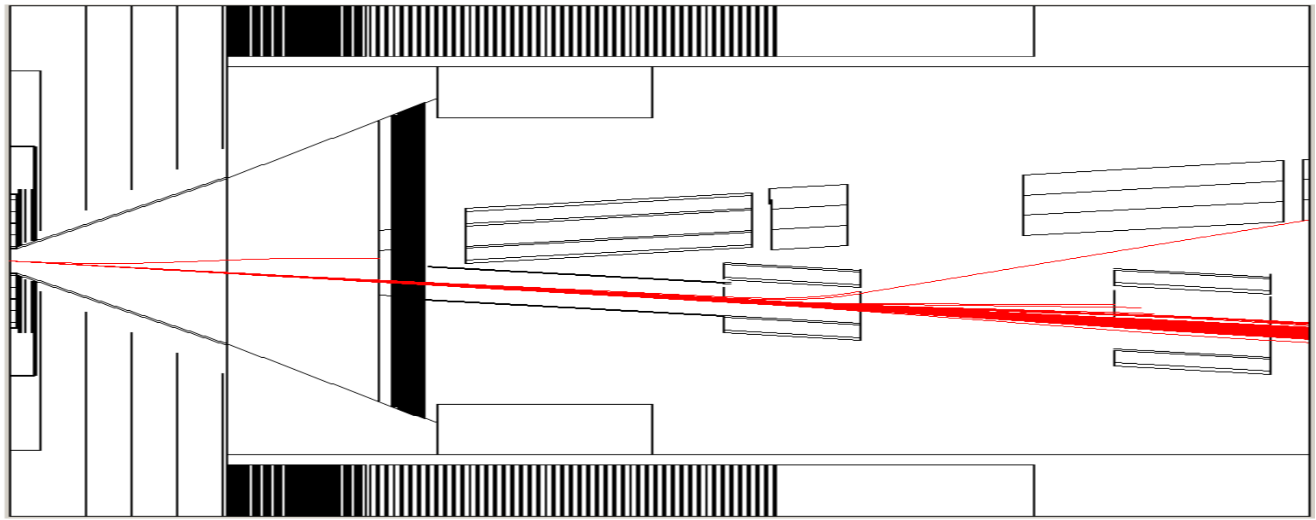
Pairs and radiative Bhabhas in 14 mrad crossing geometry

Interaction is turned off.

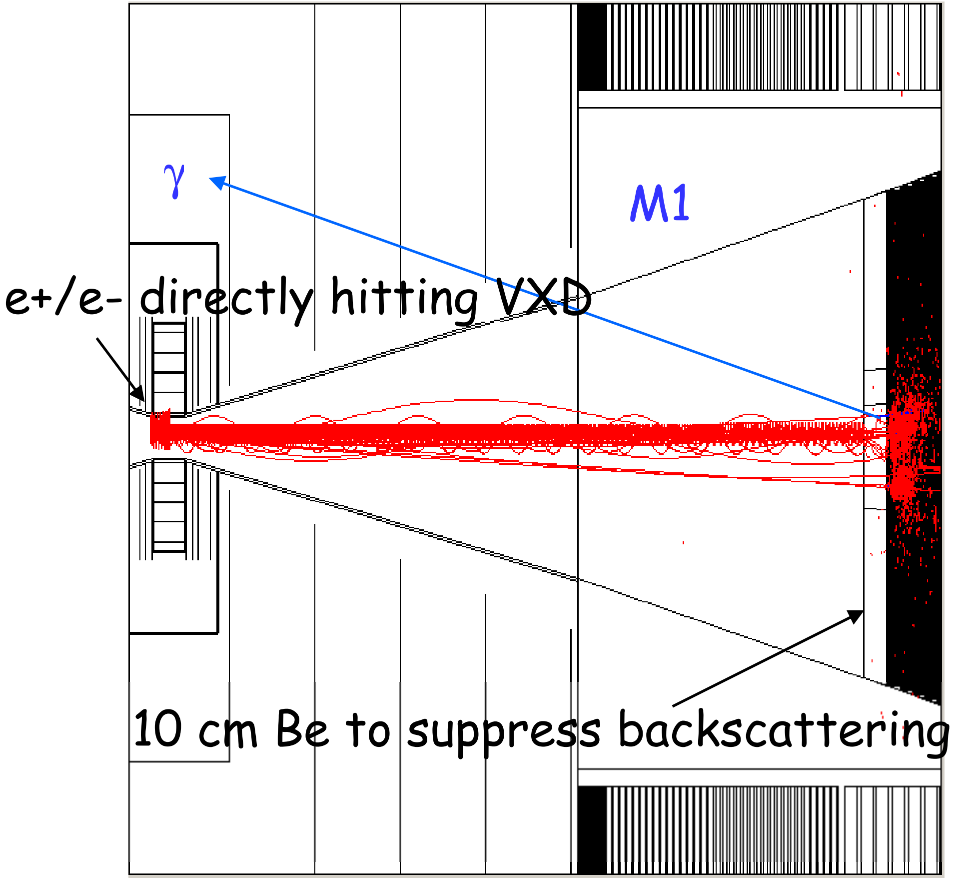
Pairs



Radiative Bhabhas

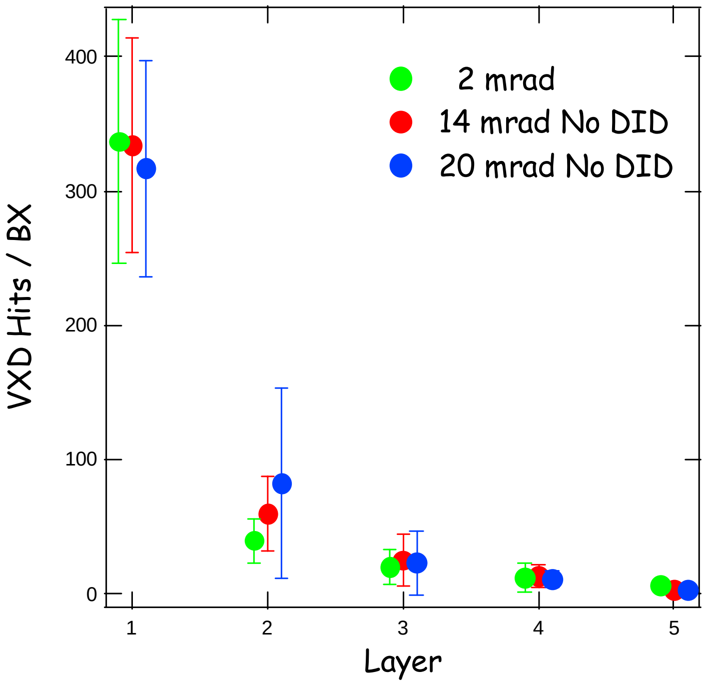


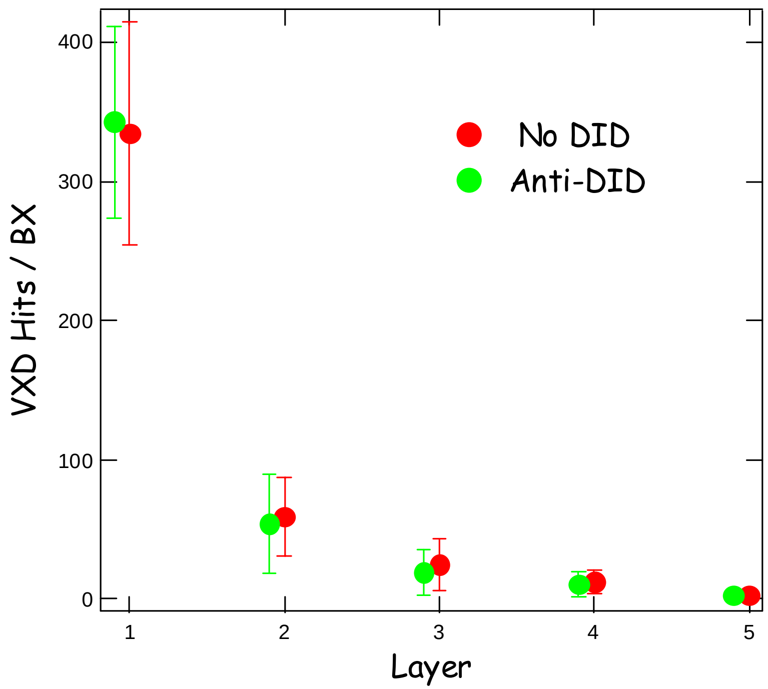
Pair background in Tracker



- e+/e- directly hitting VXD and Si Tracker.
  - e+/e- can spiral many times; multiple VXD hits
- e+/e- backscattering from BeamCal is ~10% of VXD hits.
- Photons from beam pipe and VXD
- Photons from BeamCal
  - M1 aperture and length are important

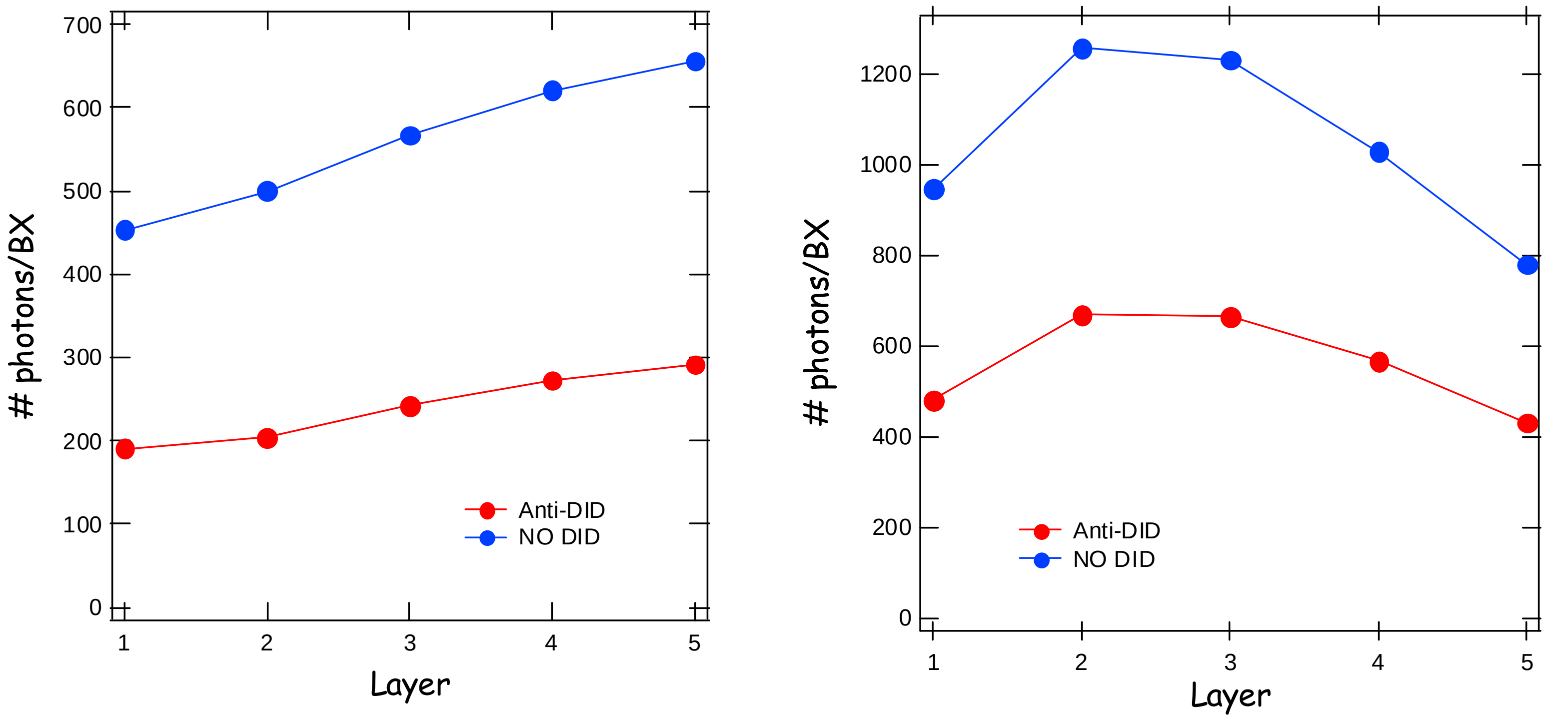
e+/e- hits in Vertex Detector





- Use 20 statistically independent bunches.
  - Bunch-to-bunch fluctuation is much larger than the crossing angle difference or DID dependence.
- e+/e- VXD hits come primarily from pairs directly reaching the vertex detector layers.
- Different L* designs should not have any significant effect.

Photons into Si Tracker



- Secondary photons generated in BeamCal dominate the tracker background.
  - The more energy dumped in BeamCal, the more photons.
- Smaller crossing angle is better.
- Anti-DID can reduce the photon rate by a factor of two; comparable to 2 mrad crossing.
- Different L* design should not affect the photon rate.

Neutrons in VXD (FLUKA)

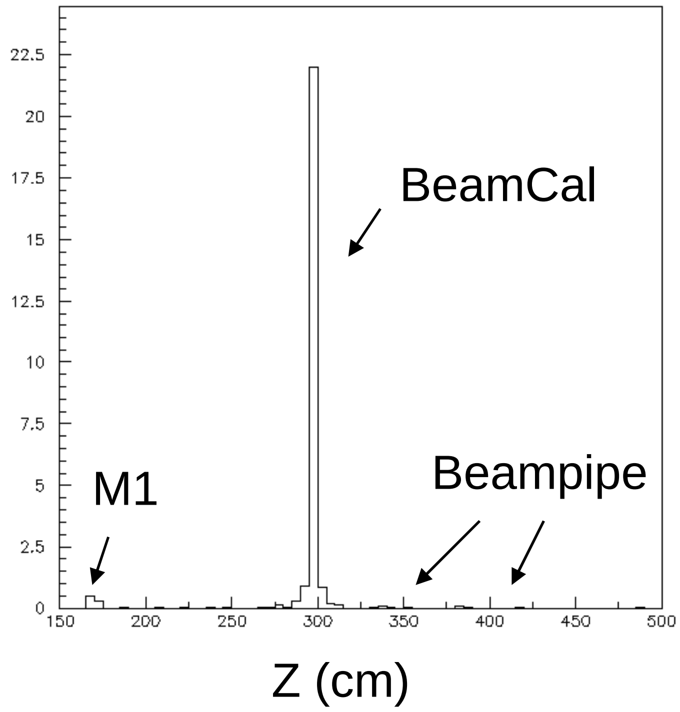
Neutrons from pairs

	Hits/cm^2/BX	Hits/cm^2/1x10^{7}sec
No DID	(3.6 ± 0.2)x10^{-3}	5.0x10^8
Anti-DID	(2.4 ± 0.2)x10^{-3}	3.4x10^8
DID	(4.1 ± 0.2)x10^{-3}	5.7x10^8

Neutrons from radiative Bhabhas

	Hits/cm^2/BX	Hits/cm^2/1x10^{7}sec
No DID	(1.6 ± 0.4)x10^{-4}	0.22x10^8
Anti-DID	(0.3 ± 0.2)x10^{-4}	0.04x10^8
DID	(2.0 ± 0.6)x10^{-4}	0.27x10^8

Neutron origins



- Neutrons that reach the vertex detector are mostly generated in the BeamCal.
- Anti-DID can reduce the neutron flux.
- Different L* design should not affect the neutron flux.