SoLID baffle update

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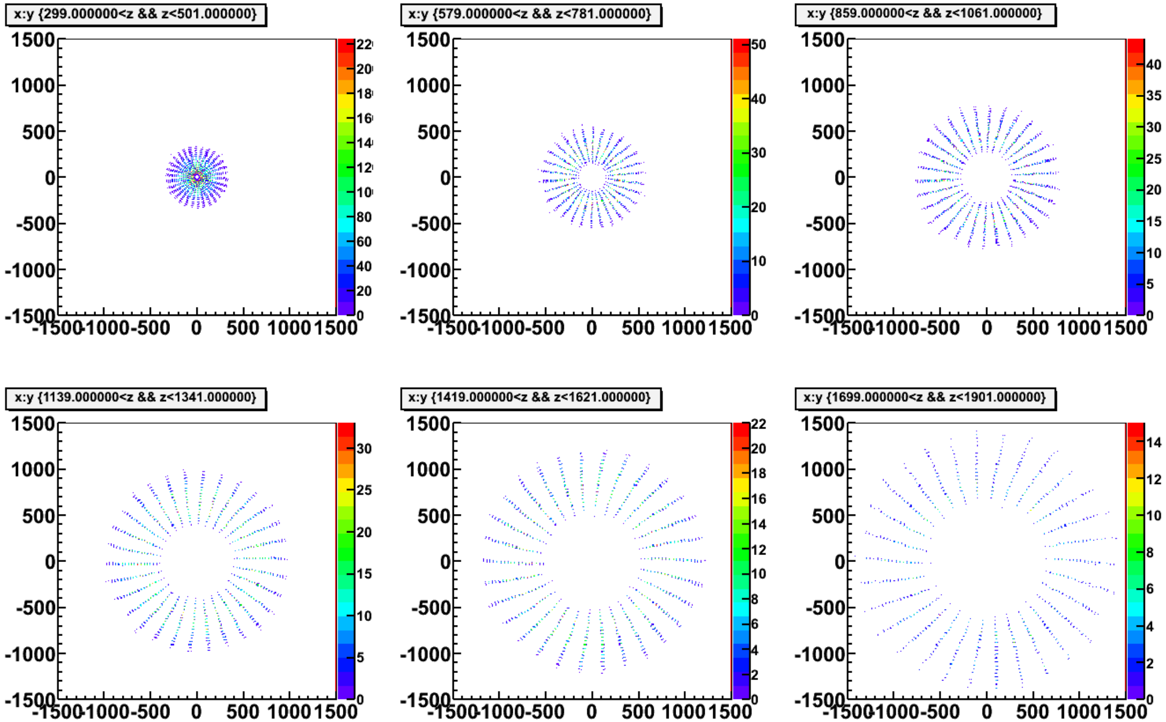
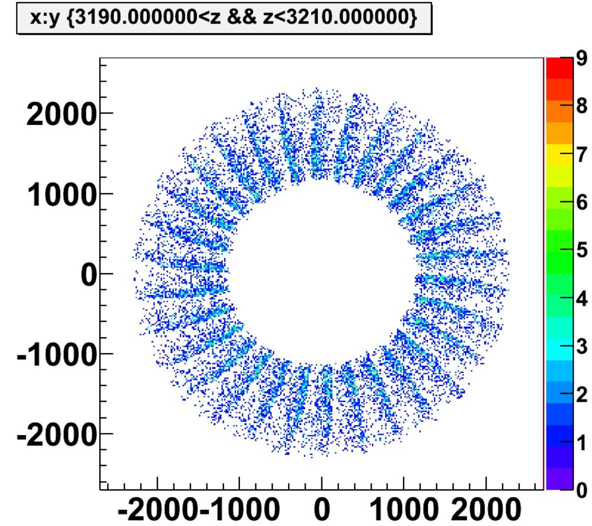
Current Baffle

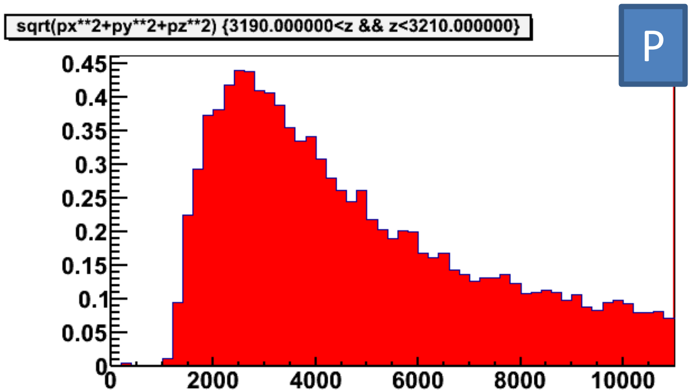
- The total distance from plane 1 to 6 is 150cm which is a few cm overlapping with endcap nose and no place for 2nd GEM behind last baffle plane
  - Z(40, 70, 100, 130, 160, 190)cm
- Opening is not optimized for full PVDIS target. The first baffle inner radius reaches 0.4cm which can cause a lot radiation
  - Rin (0.40, 12.52, 24.65, 36.77, 48.89, 61.01)cm
  - Rout (41.31, 62.32, 83.32, 104.33, 125.34, 142.00)cm
- The slits have only small curvature

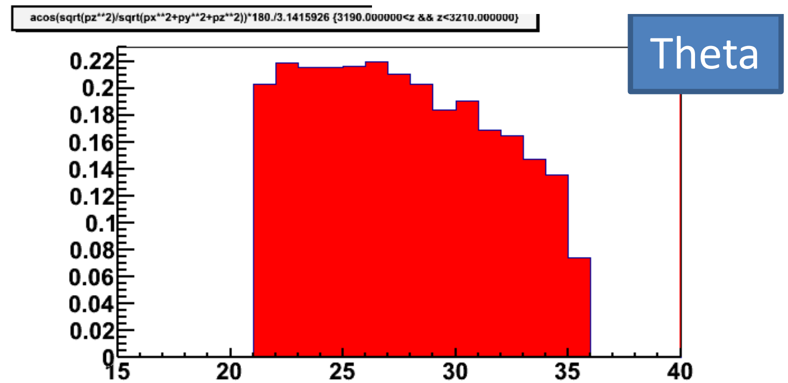


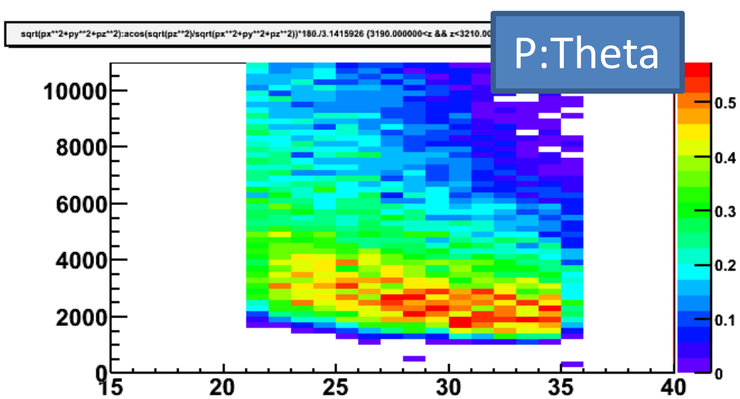
Current Baffle (neg acceptance)

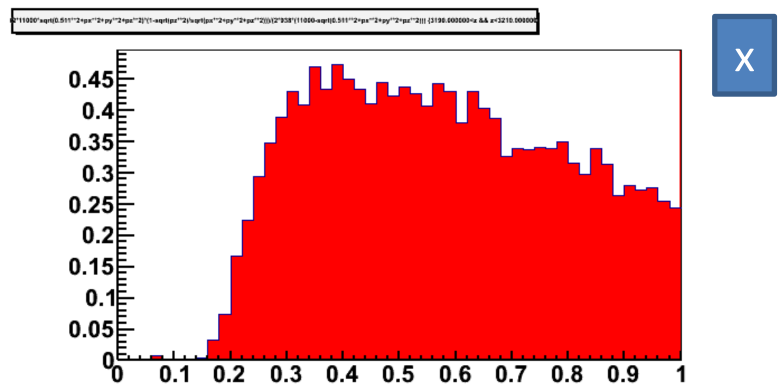
- 45% - 10% along P





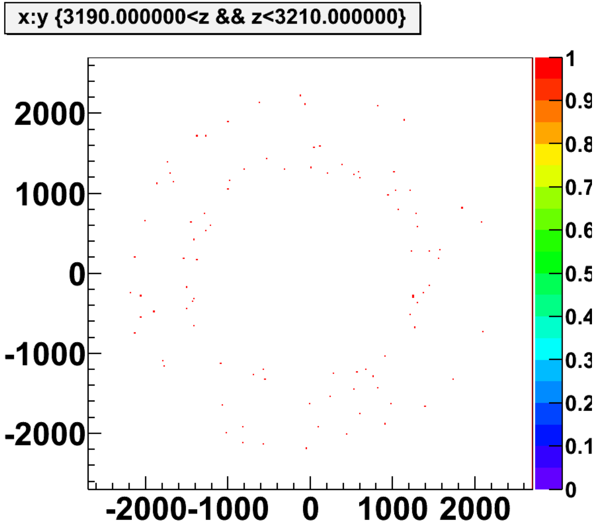


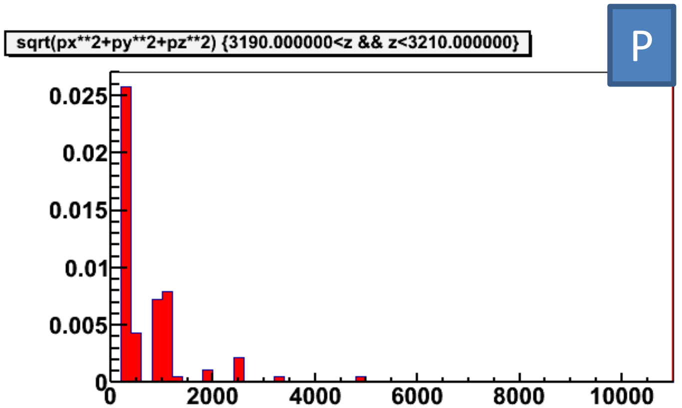


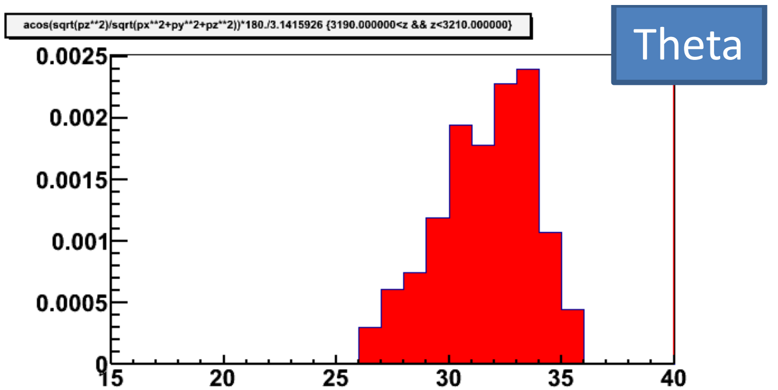


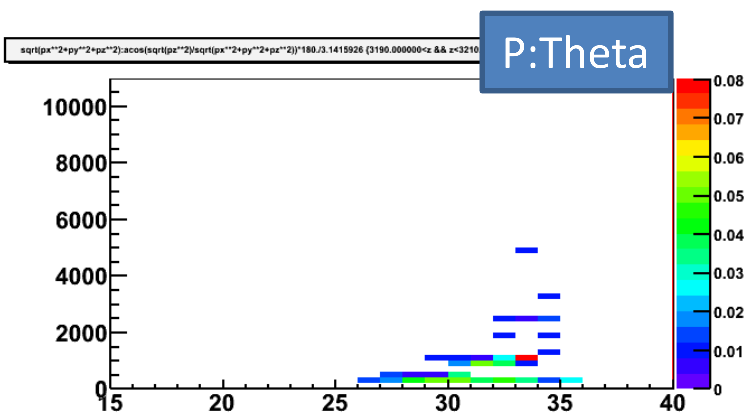
Current Baffle (pos acceptance)

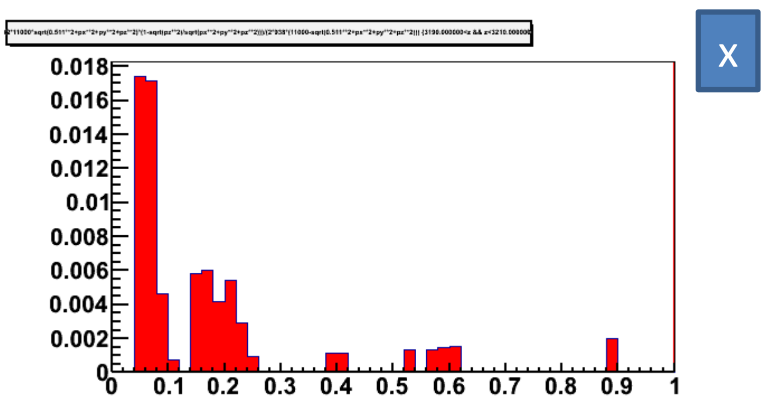
- small





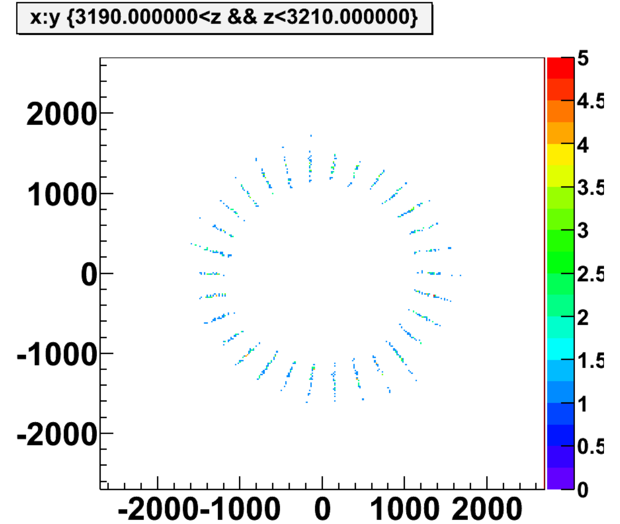


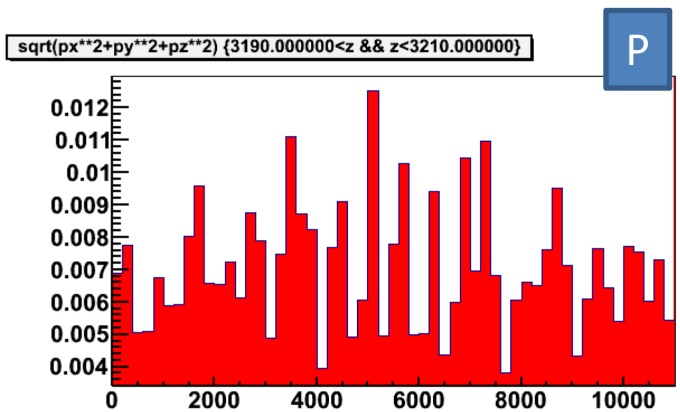


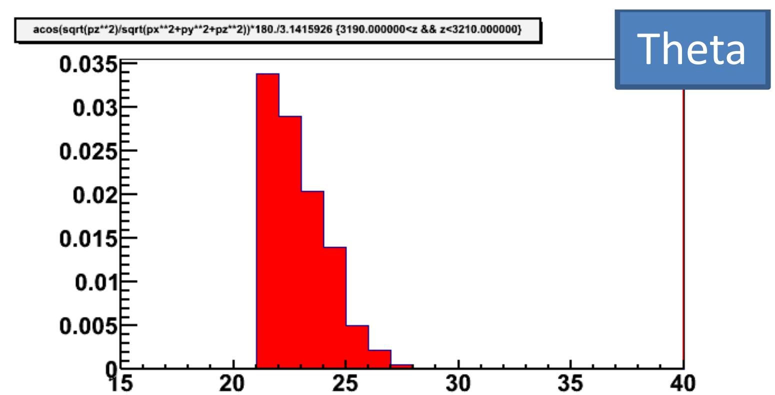


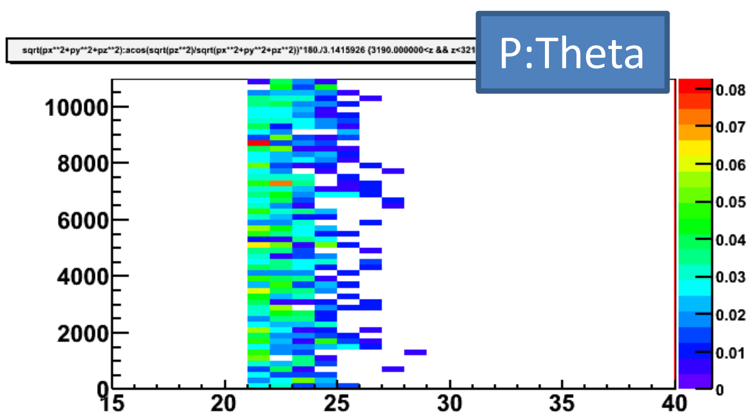
Current Baffle (neutral acceptance)

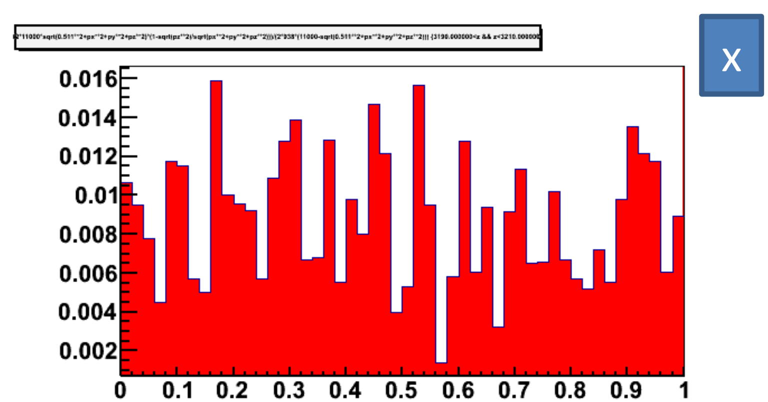
- ~0.5% along P



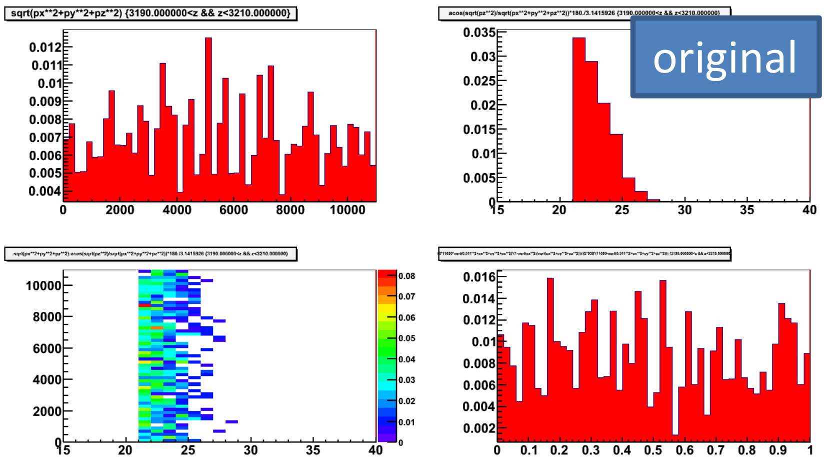




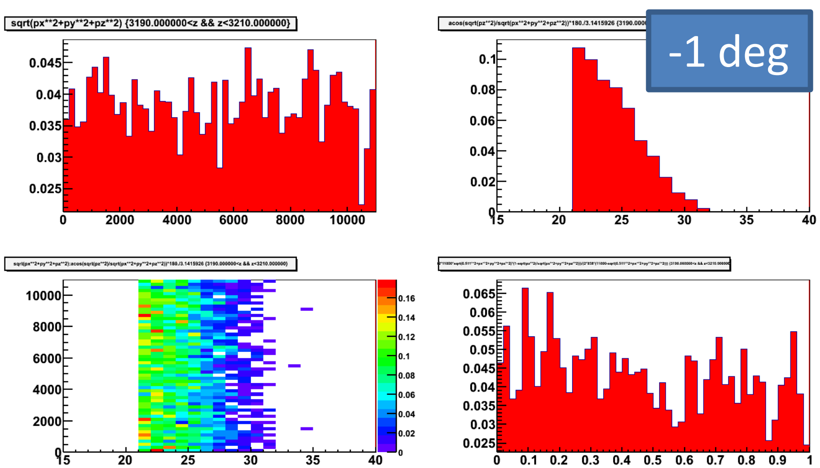


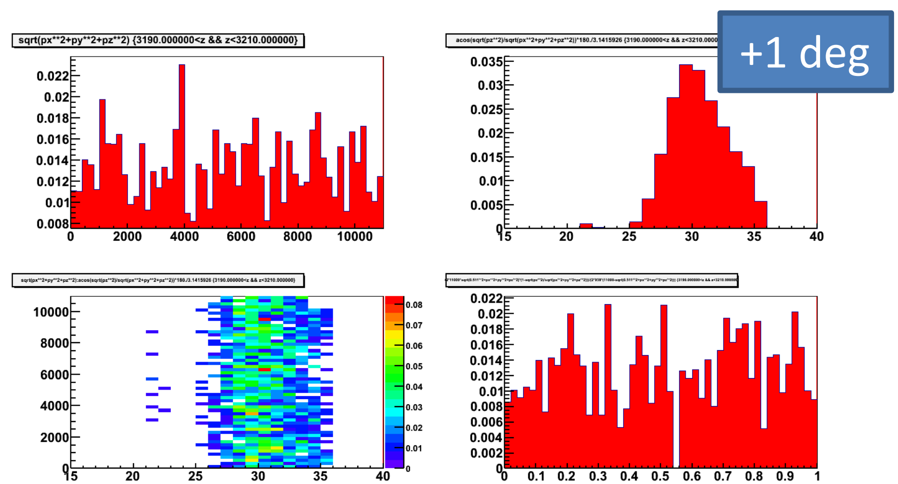


Current Baffle (neutral acceptance)



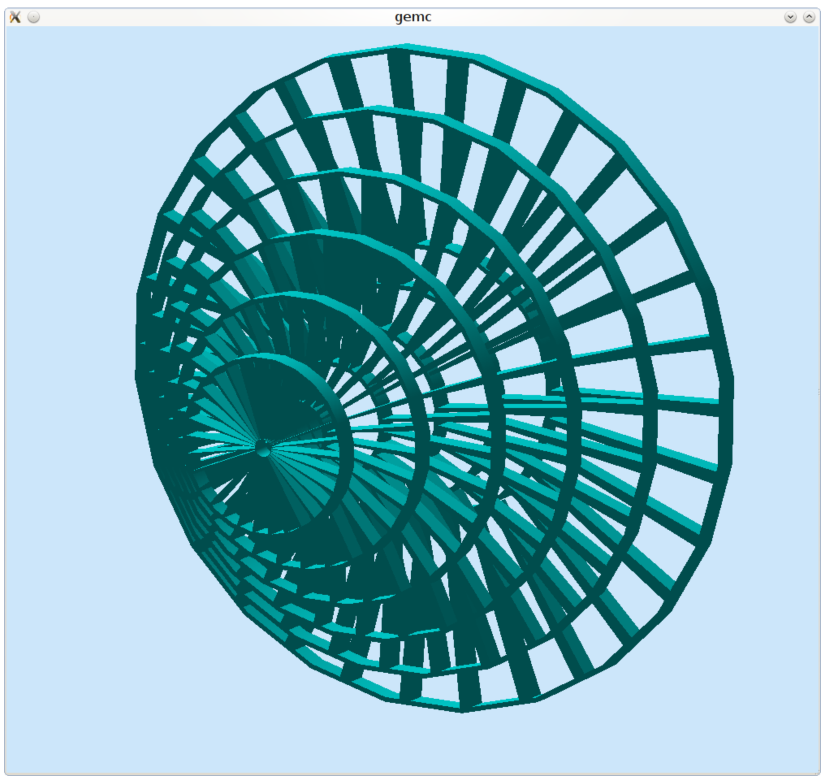
- Rotating last baffle by +1 or -1 degree increase neutral acceptance to 1% or 3%

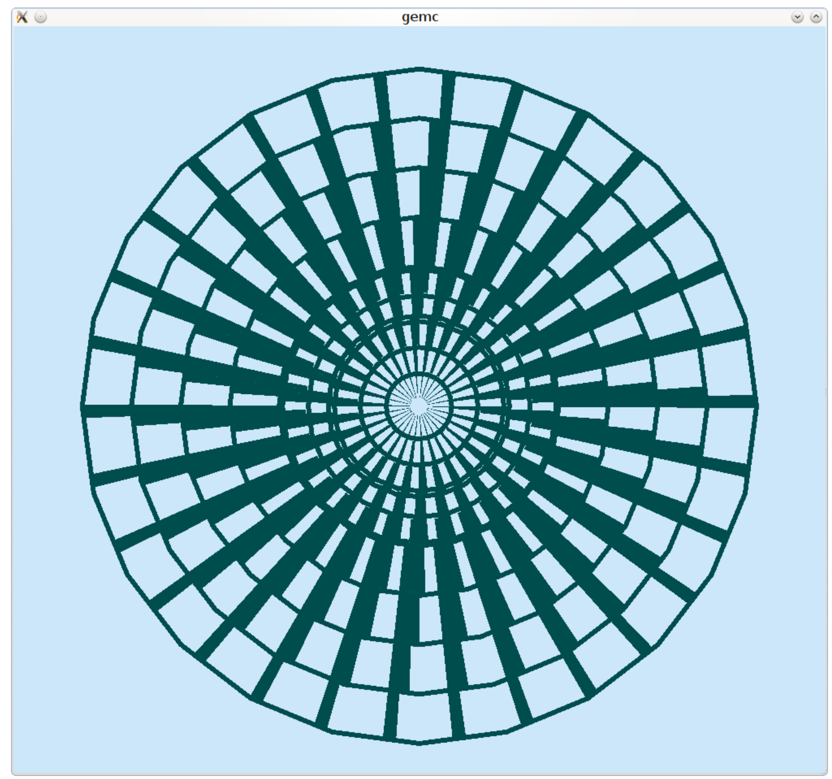




New Idea

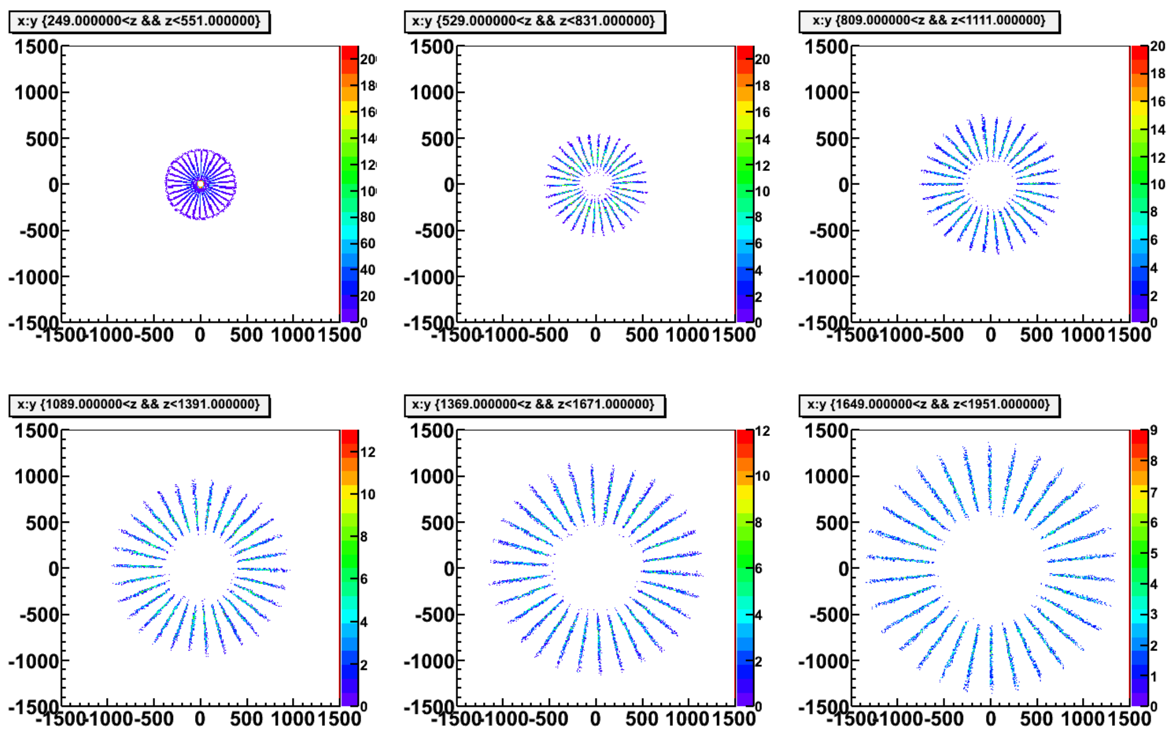
- Still 30 sectors with each sector covering 12 deg
- In each sector, each slit covers 2 deg, 6 slits shift 2 deg from each other
- all slits are straight
- Line of sight from Z axis is blocked completely





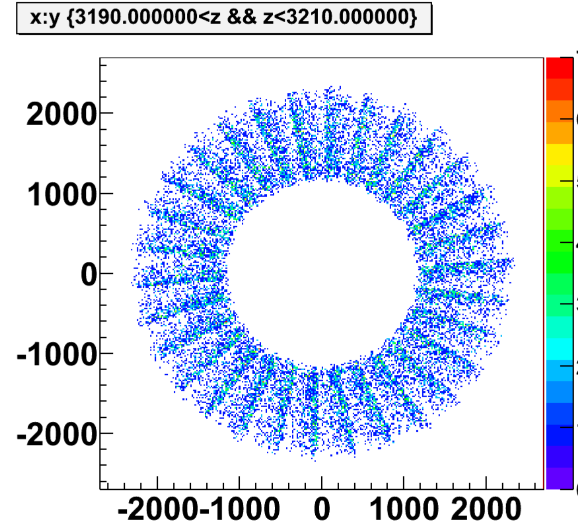
New Idea

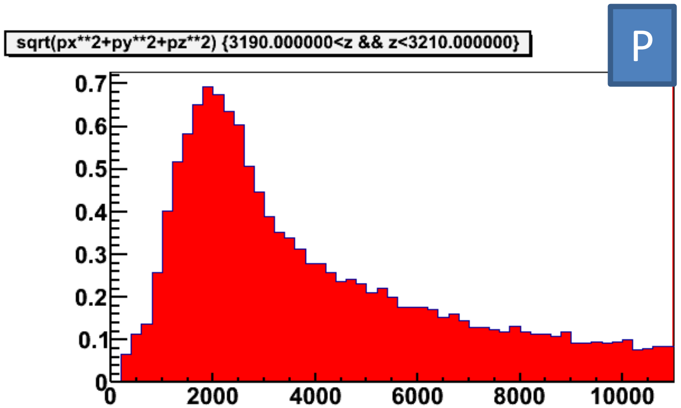
- Still each plate is 9cm thick
- line of sight is open for vertex off Z axis. Increasing slit size will help blocking it. Assume vertex is with 2mmD and set slit width at 2.3 deg
- Fit within the current setup without overlap
  - Z (40, 68, 96, 124, 152, 180) cm
- Opening in R is optimized for acceptance from 21 to 36 deg for full 40cm long target with center at 10cm
  - Rin (3.8,14.5,25.3,36.0,46.8,57.5)cm
  - Rout (36.4,56.7,77.1,97.4,117.8,138.1)cm

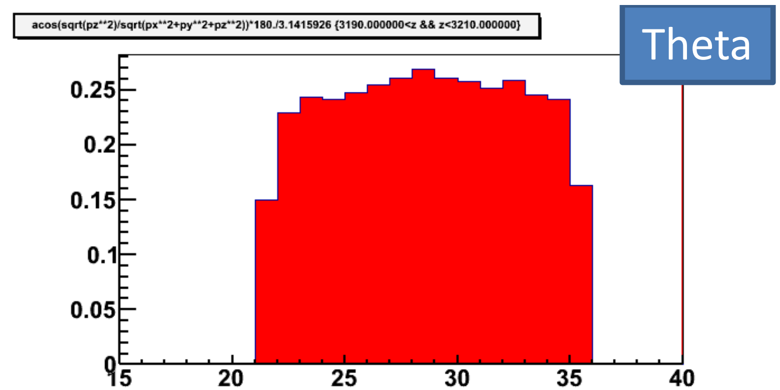


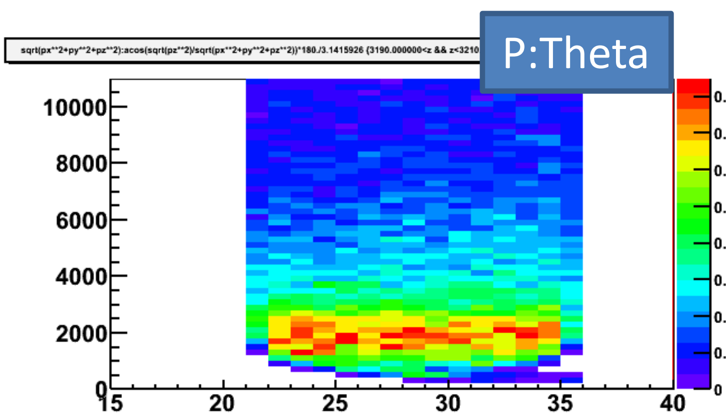
New Baffle (neg acceptance)

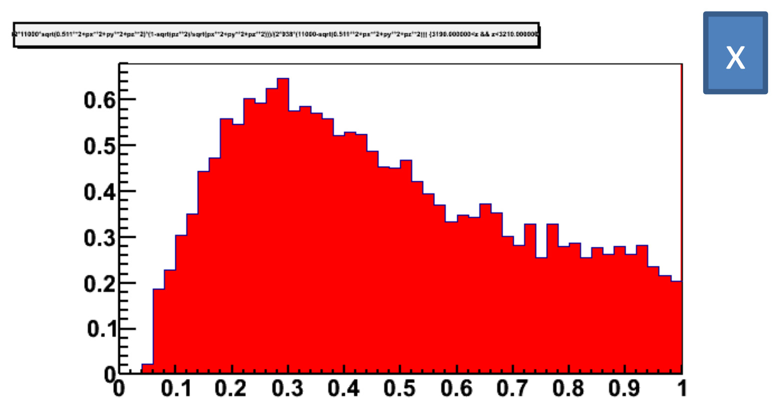
- 70% - 10% along P
  - Larger than current baffle
  - PVDIS of FOM should be better also
  - Don’t have cut off at 2GeV





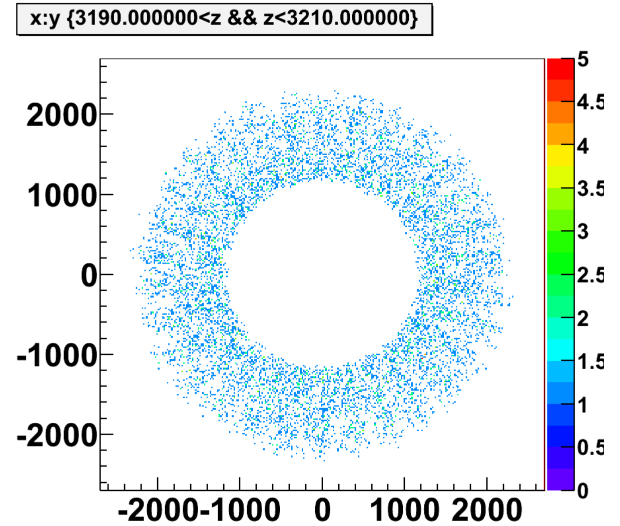


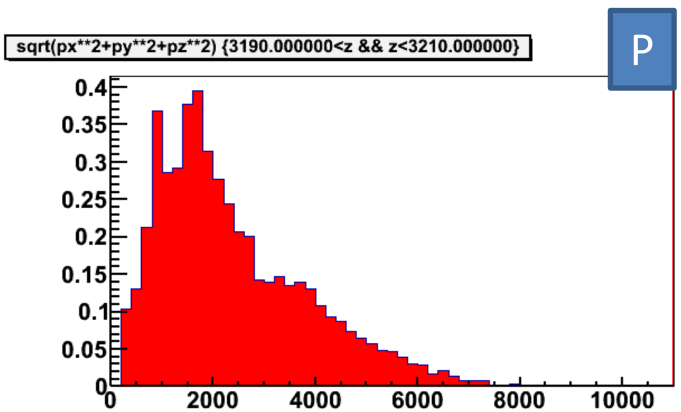


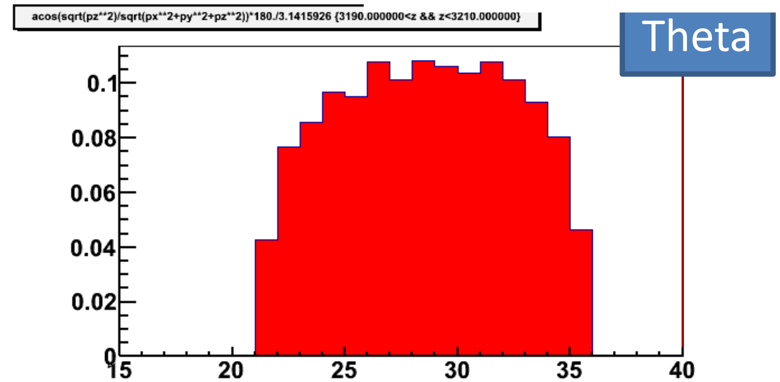


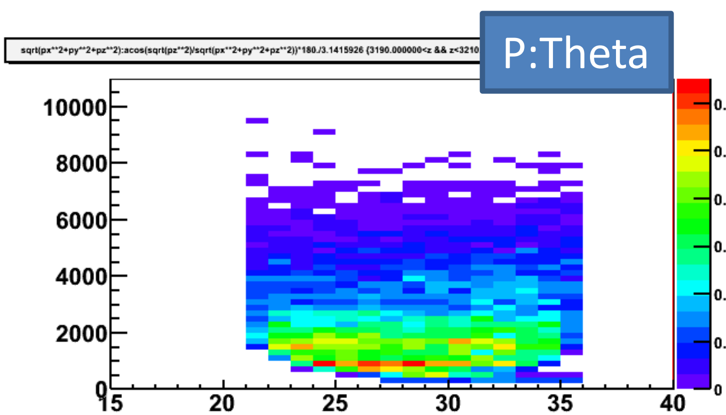
New Baffle (pos acceptance)

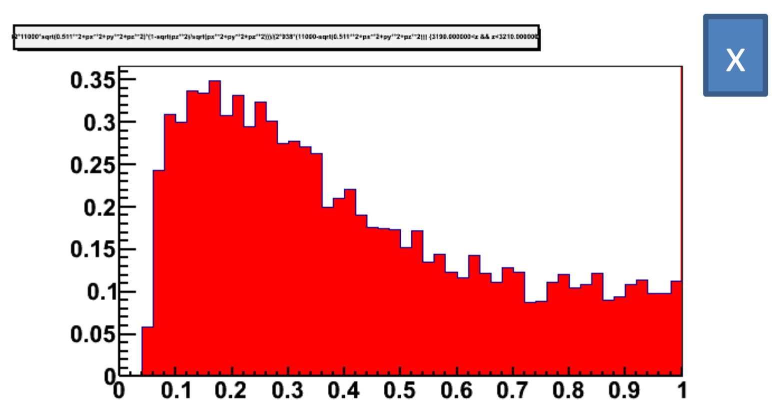
- 40% - 0% along P
  - much more than current baffle





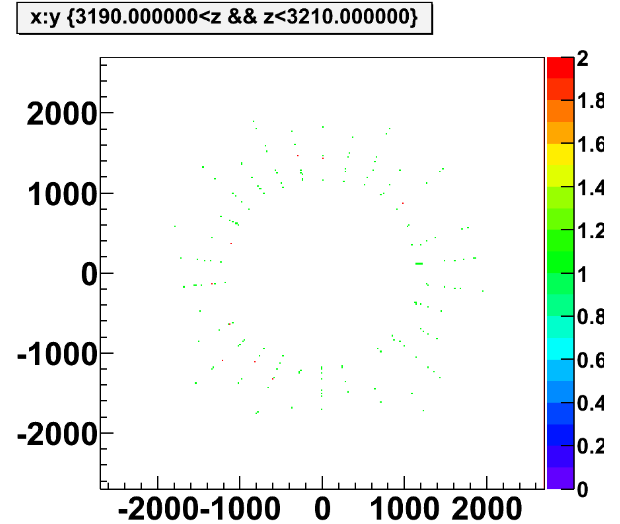


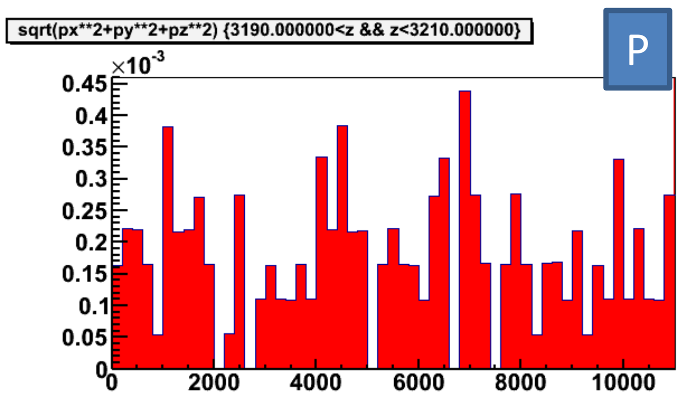


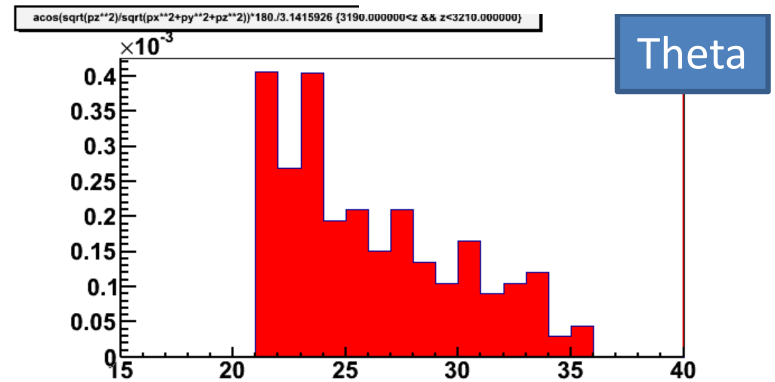


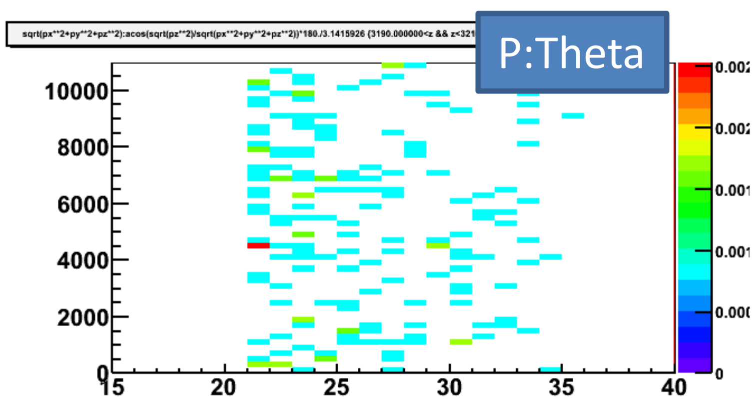
New Baffle (neutral acceptance)

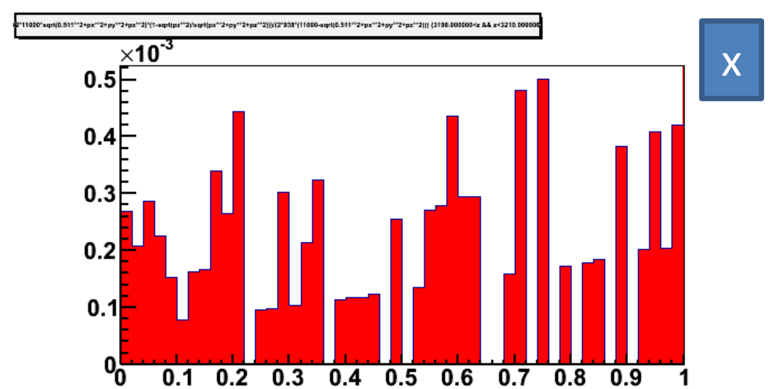
- ~0.02% along P
  - At least 1 order less than current baffle





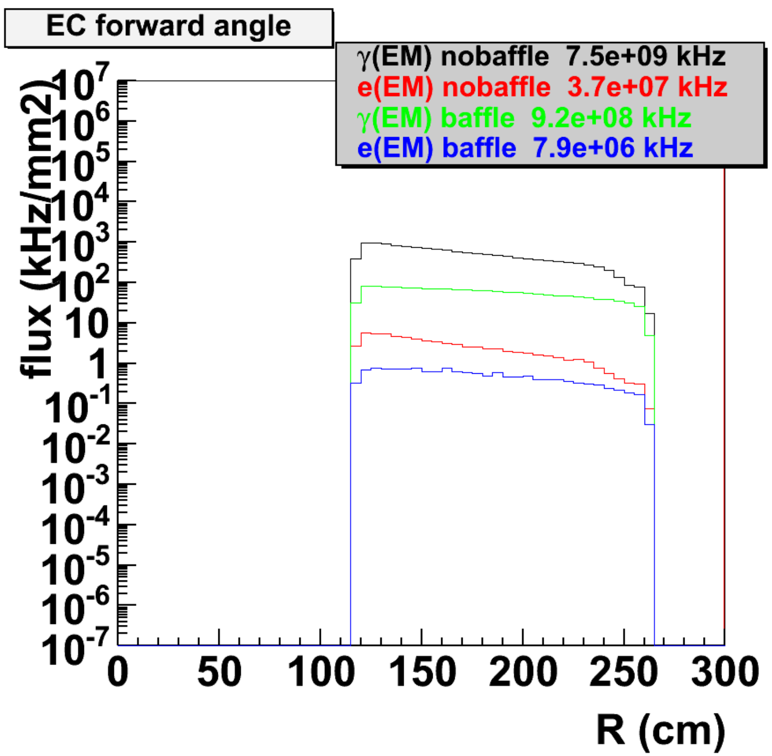


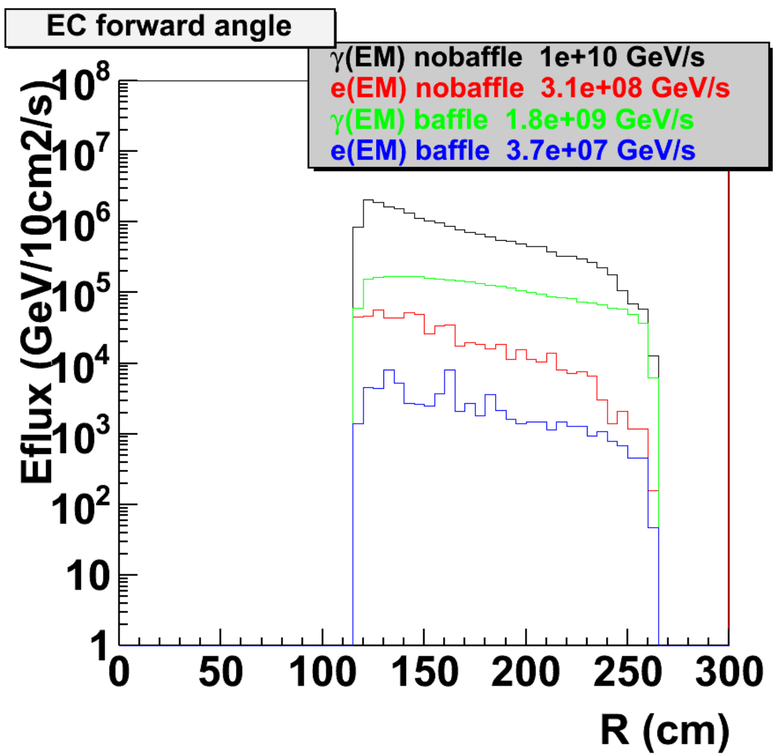




New baffle

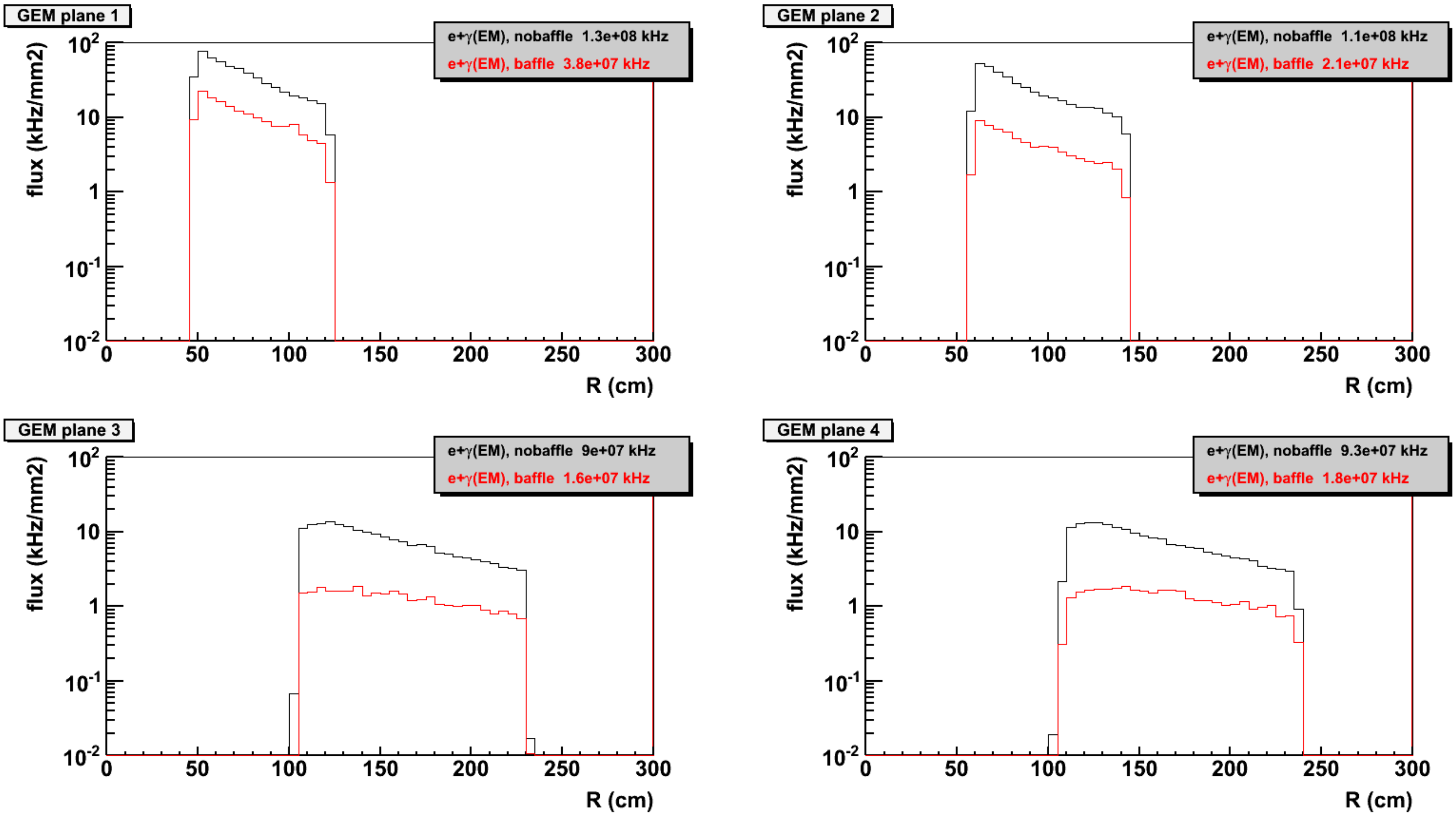
- Testing lead baffle effect on low energy EM entering EC
- Energy flux of
  - gamma in total drops by 6
  - electron in total drops by 8





New baffle

- Testing lead baffle effect on low energy EM with energy deposited in GEM
- It drops by 5 on all planes



New baffle

- Advantage
  - Line of sight blocking doesn’t depend on field, nor target length
  - Straight slits, easier to make and align, cost saving(?)

- Disadvantage
  - Line of sight blocking depends vertex transverse size. Need small raster and small target width. Any baffle will have this though.
    - PVDIS 6GeV used 2mmx2mm raster, what’s the minimum size for 12GeV?
  - Large acceptance of pos particles, can EC and CC handle the rate?

- Other consideration
  - higher field will always help, especially the large P and corresponding high x acceptance.

Eugene's baffle has about 2 times better acceptance at higher P

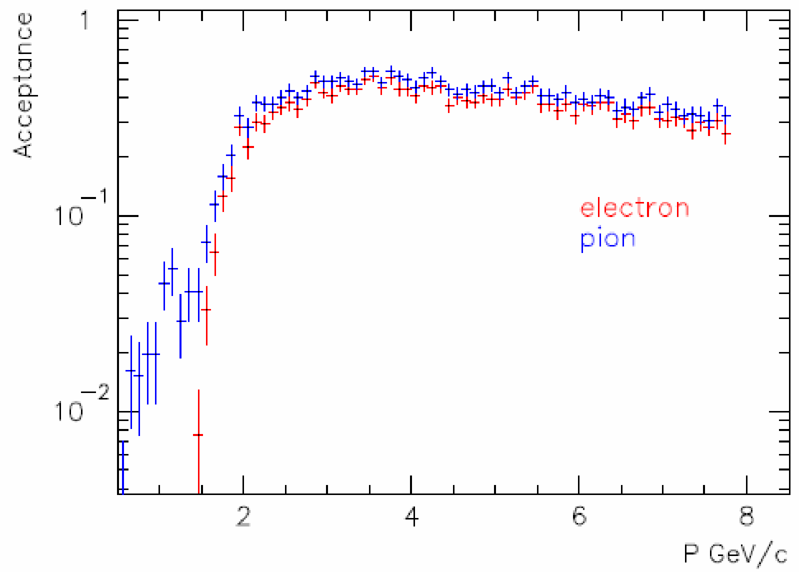


Figure 3.8: The acceptance dependence on the particle momentum for electrons and pions. The baffles reject electrons with $p < 1.5$ GeV, while pions below 1.5 GeV are reduced by a factor of 20-50.

- Original PVDIS design with small endcap and BaBar coil, the field reached 1.5T
- Currently we have larger endcap to accommodate SIDIS and CLEO coil, the field reaches 1.4T
- It could be a better design or just with stronger field(?)

backup

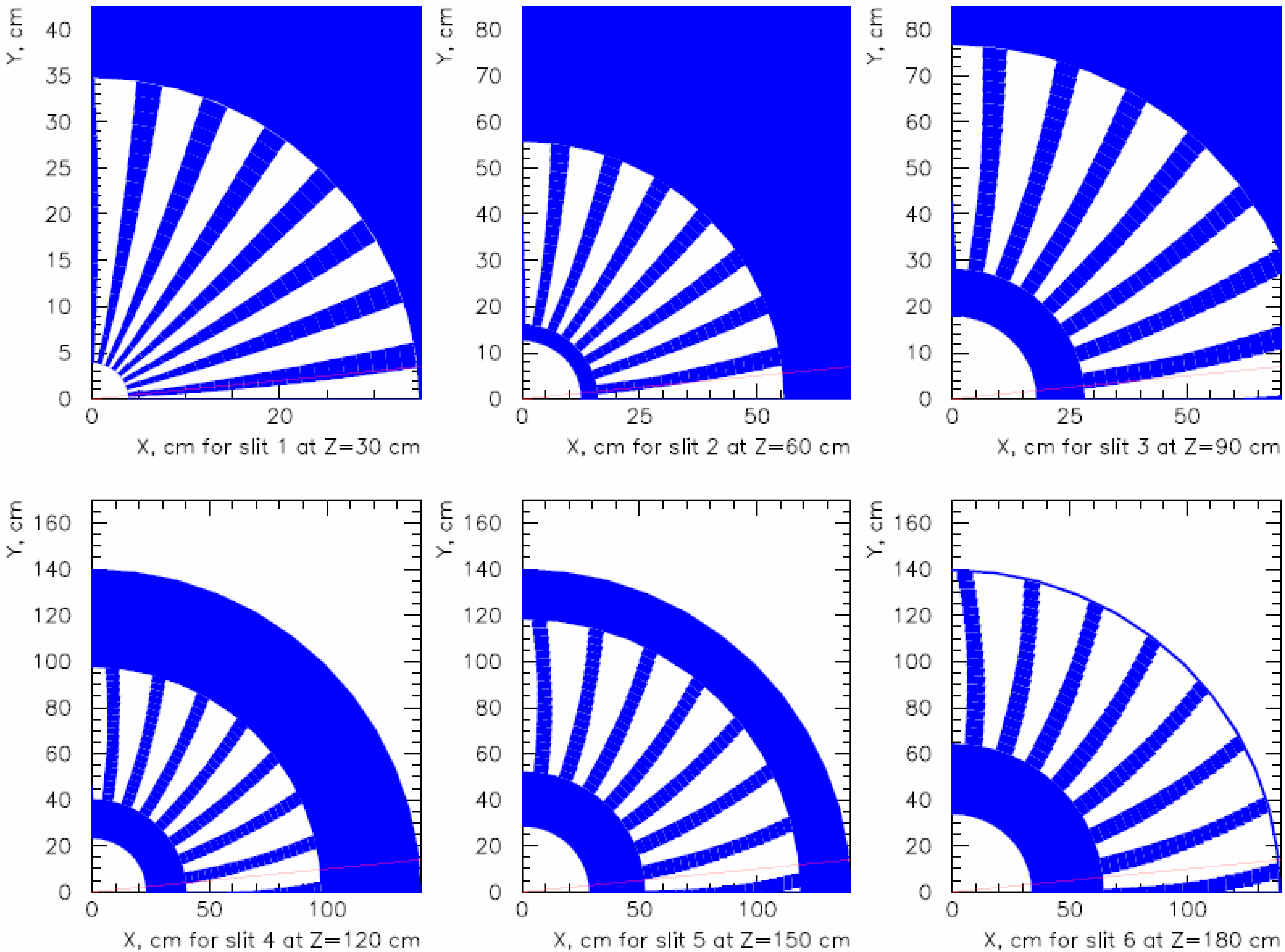


Figure 3.7: The optimized geometry of the baffles.

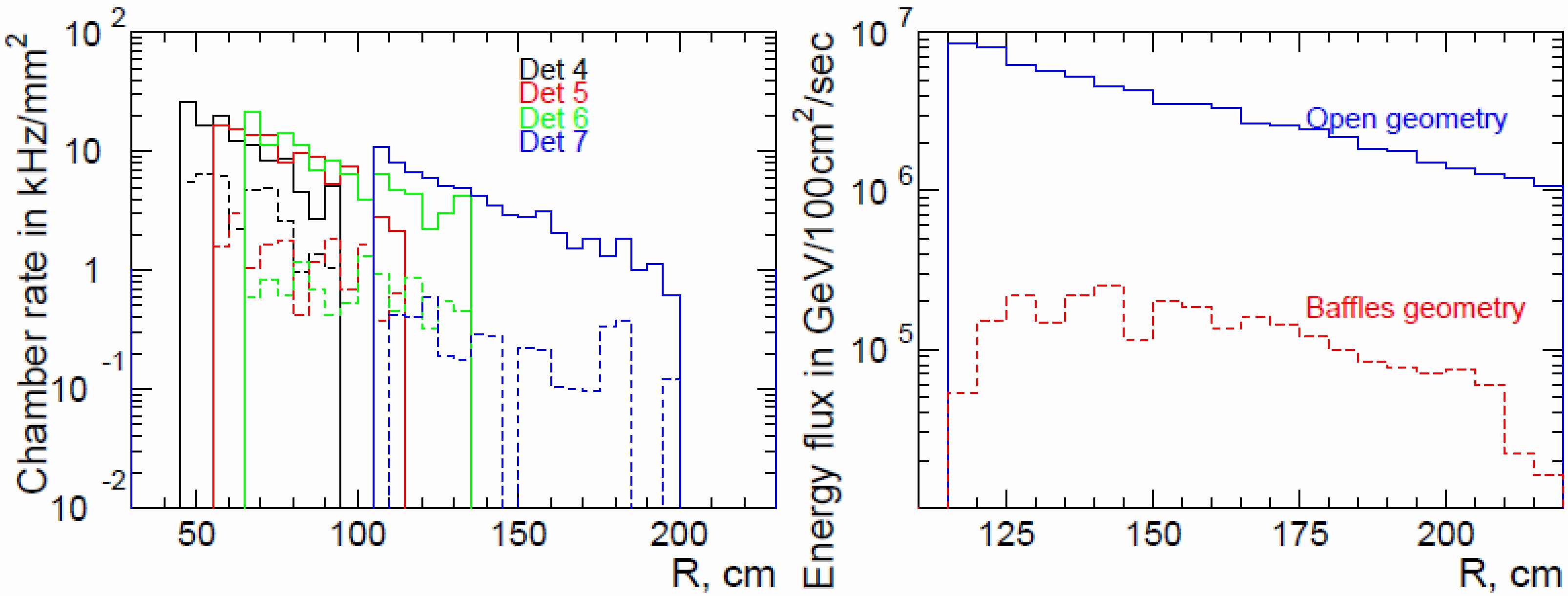


Figure 3.9: Left: the background rate in the coordinate detectors in kHz per mm^2, depending on the radius, without the baffles (the solid lines) and with the baffles (dashed lines). The baffles reduce the rate by a factor of $\sim$10 for the detectors 5-8. Right: the energy flow in the EM calorimeter in GeV/100cm^2/s, without baffles and with them. The baffles reduce the rate by a factor of 15-50.

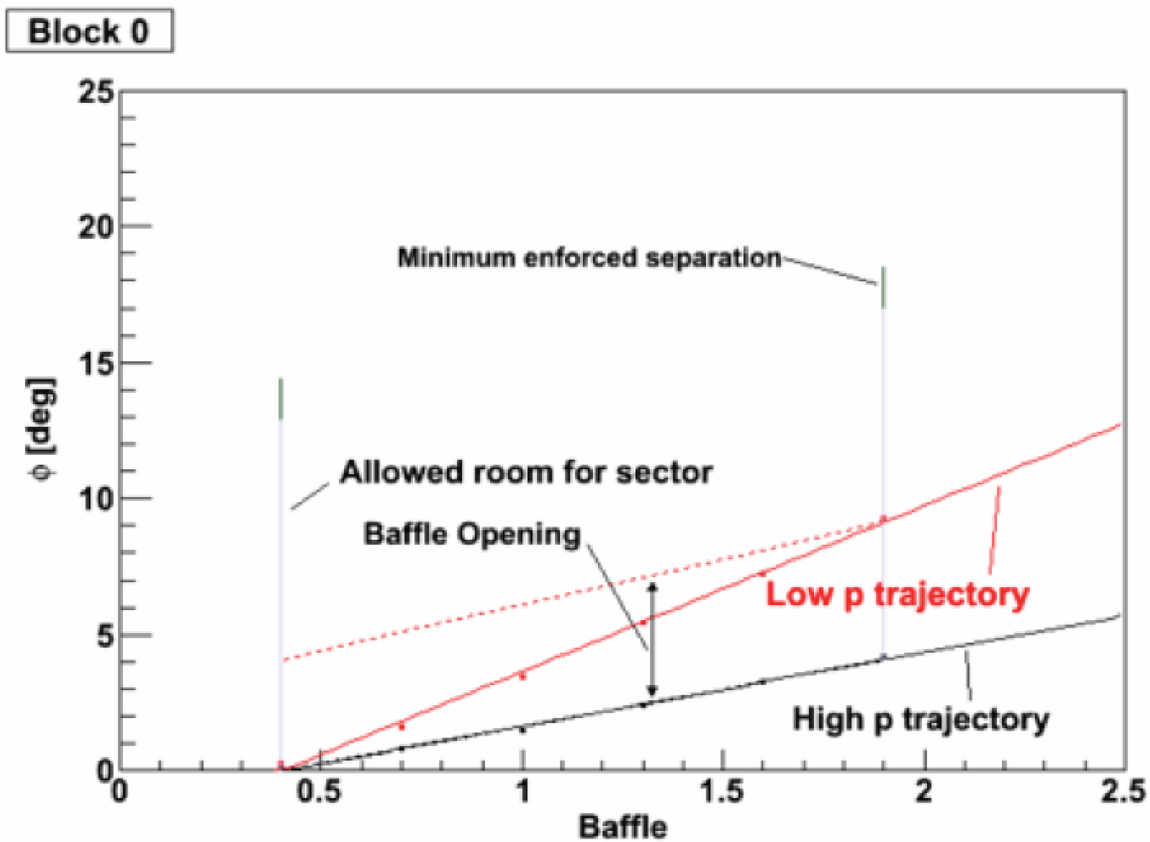


Figure 50: Raytraced electron trajectories used in baffle width design.

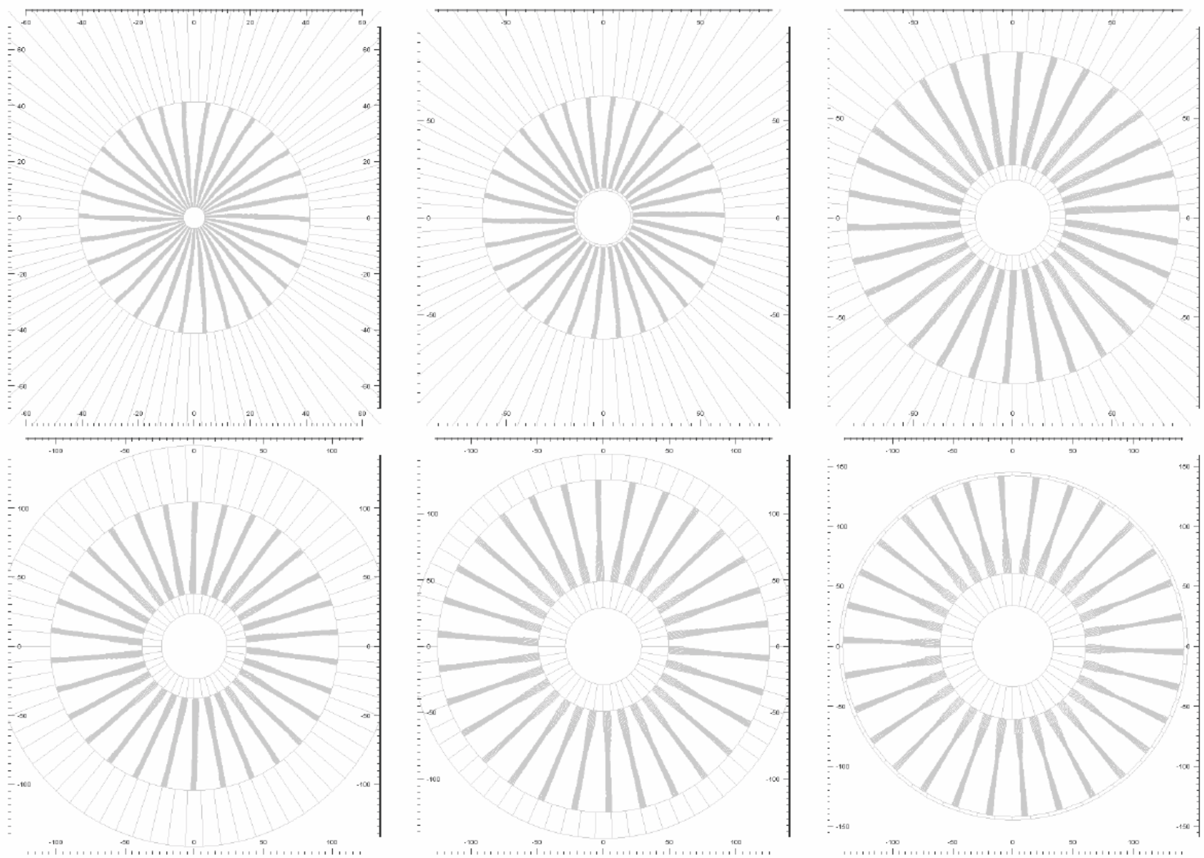


Figure 51: Baffle profiles

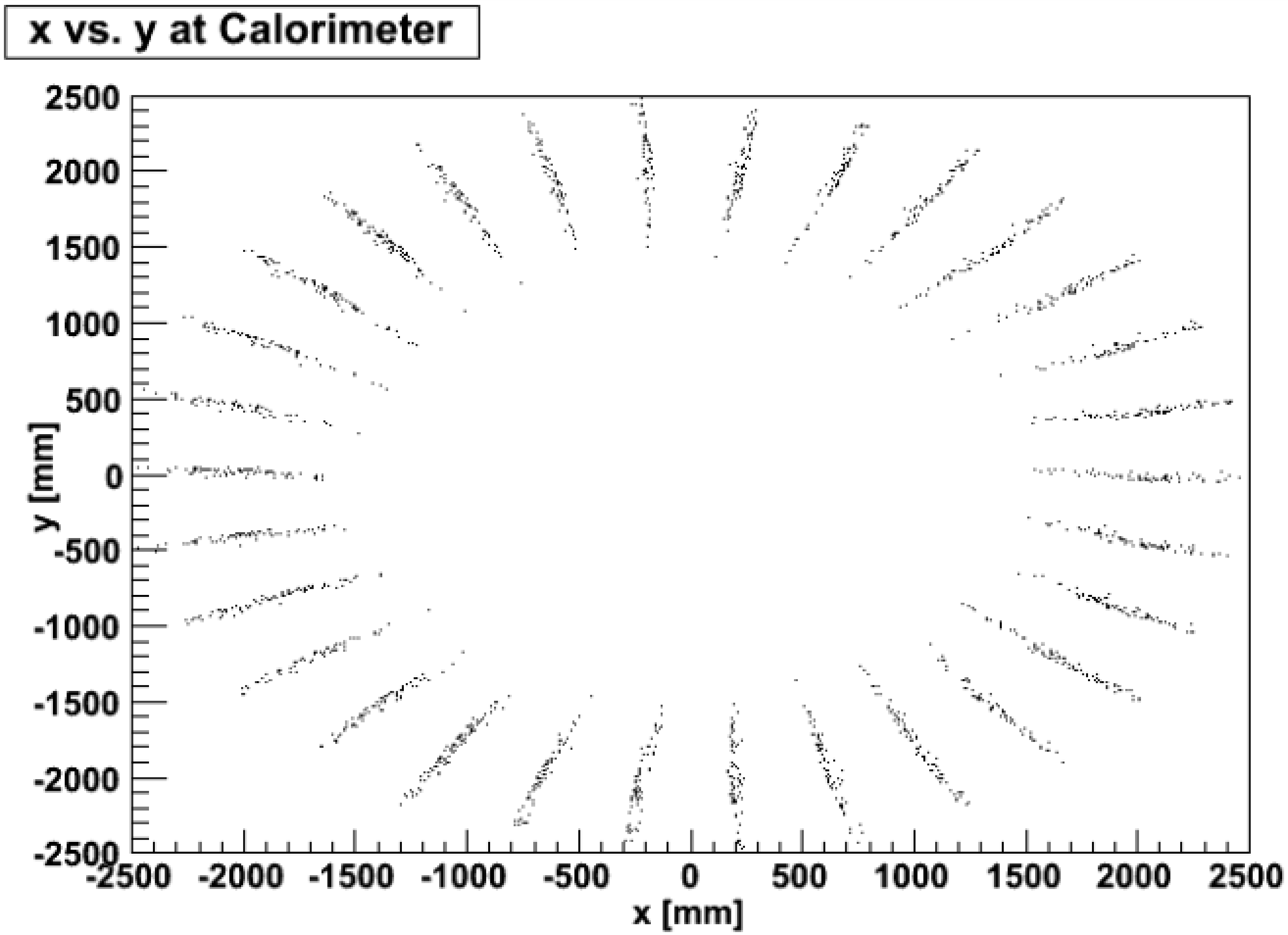


Figure 52: Photons leak through baffles

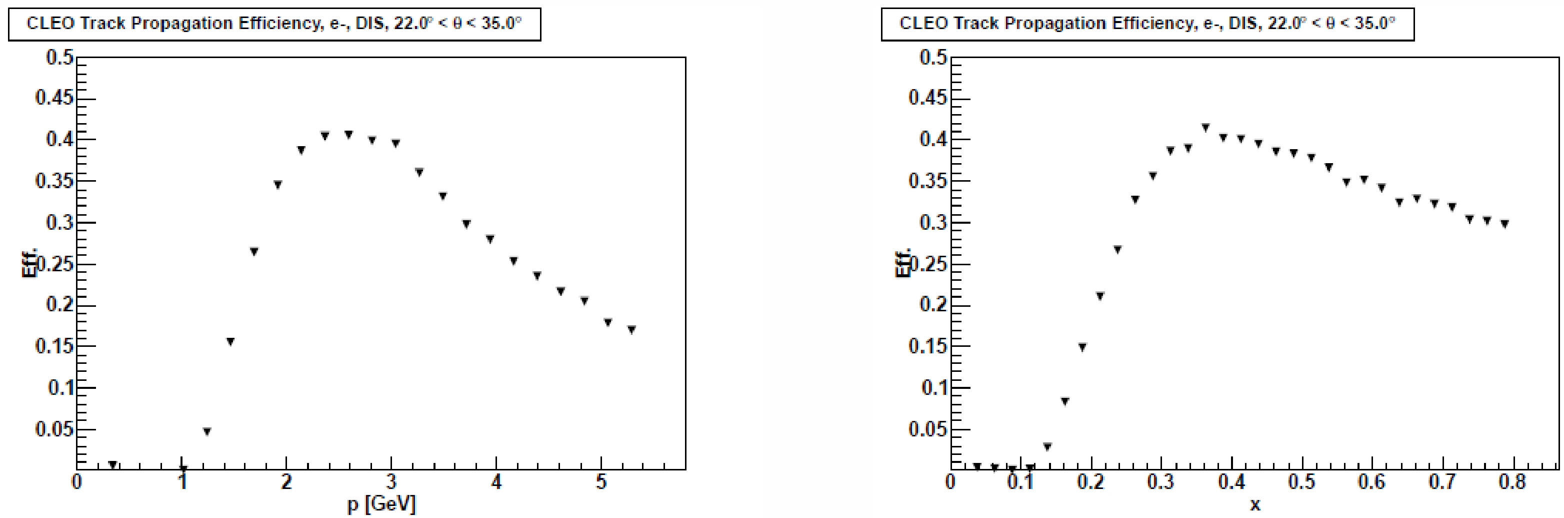


Figure 53: DIS electron propagation efficiencies