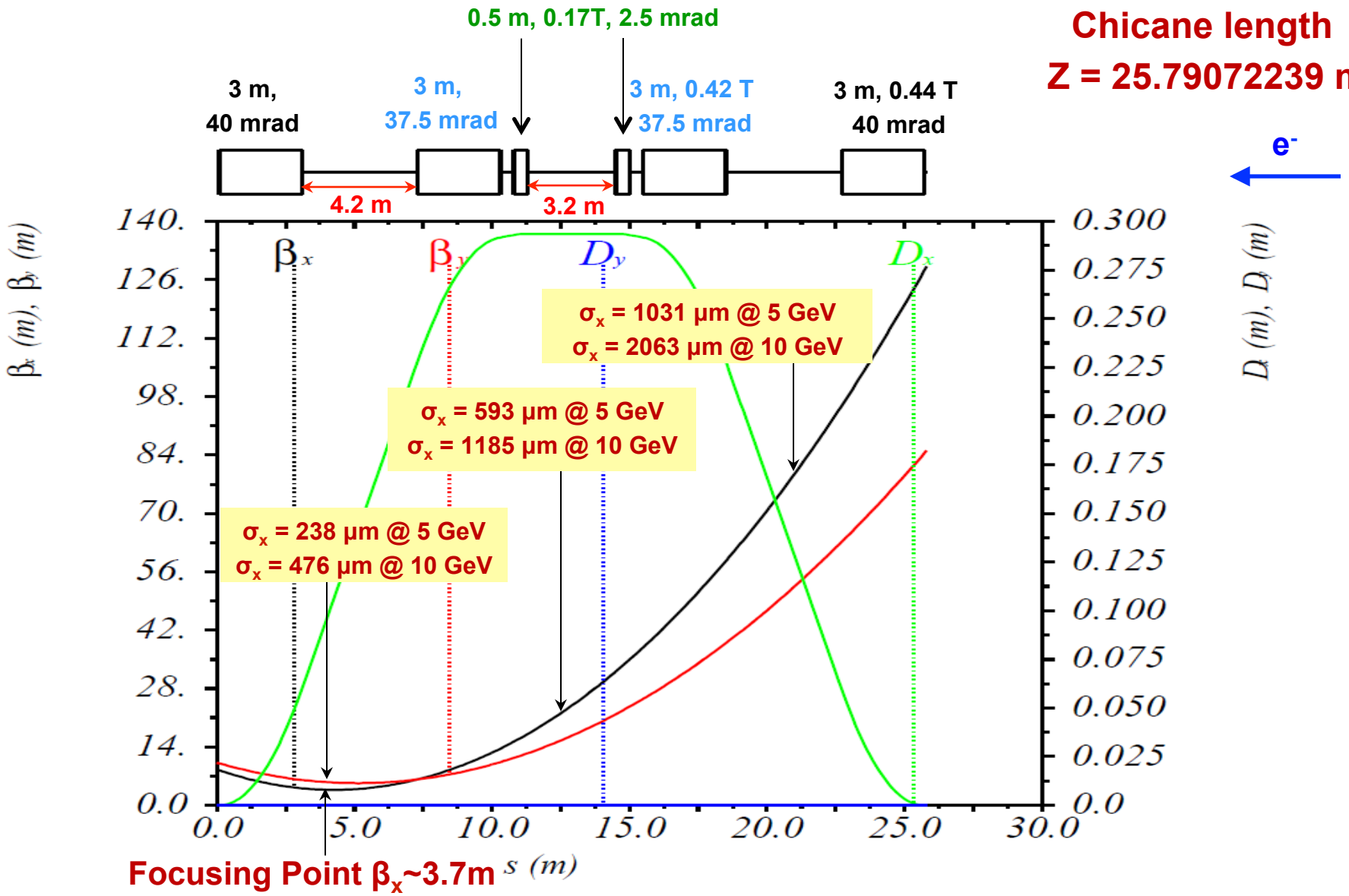
mEIC Compton Simulation Update

September 9, 2015

GEANT3 Simulation Updates

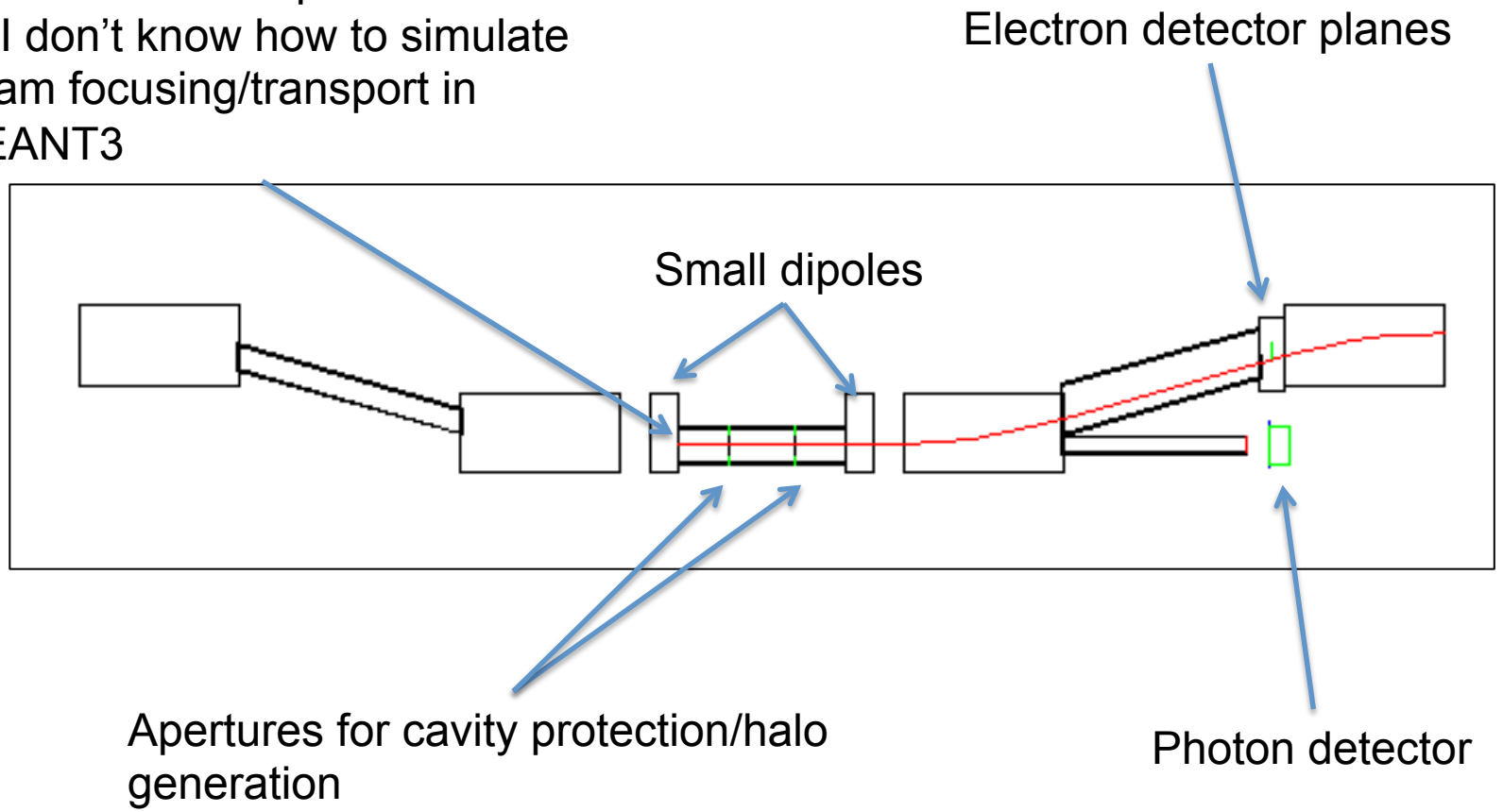
- Updated geometry to agree with latest chicane design
  - Incorporated additional small dipoles near dipoles 2 and 3
- Improved halo event generation scheme
  - Can generate halo events with high efficiency and desired shape
  - I'm pretty sure the normalization is even correct now

New Chicane Design (@ 10 GeV)



GEANT3 Simulation

Halo event: generated near closest relevant aperture
→ I don't know how to simulate beam focusing/transport in GEANT3



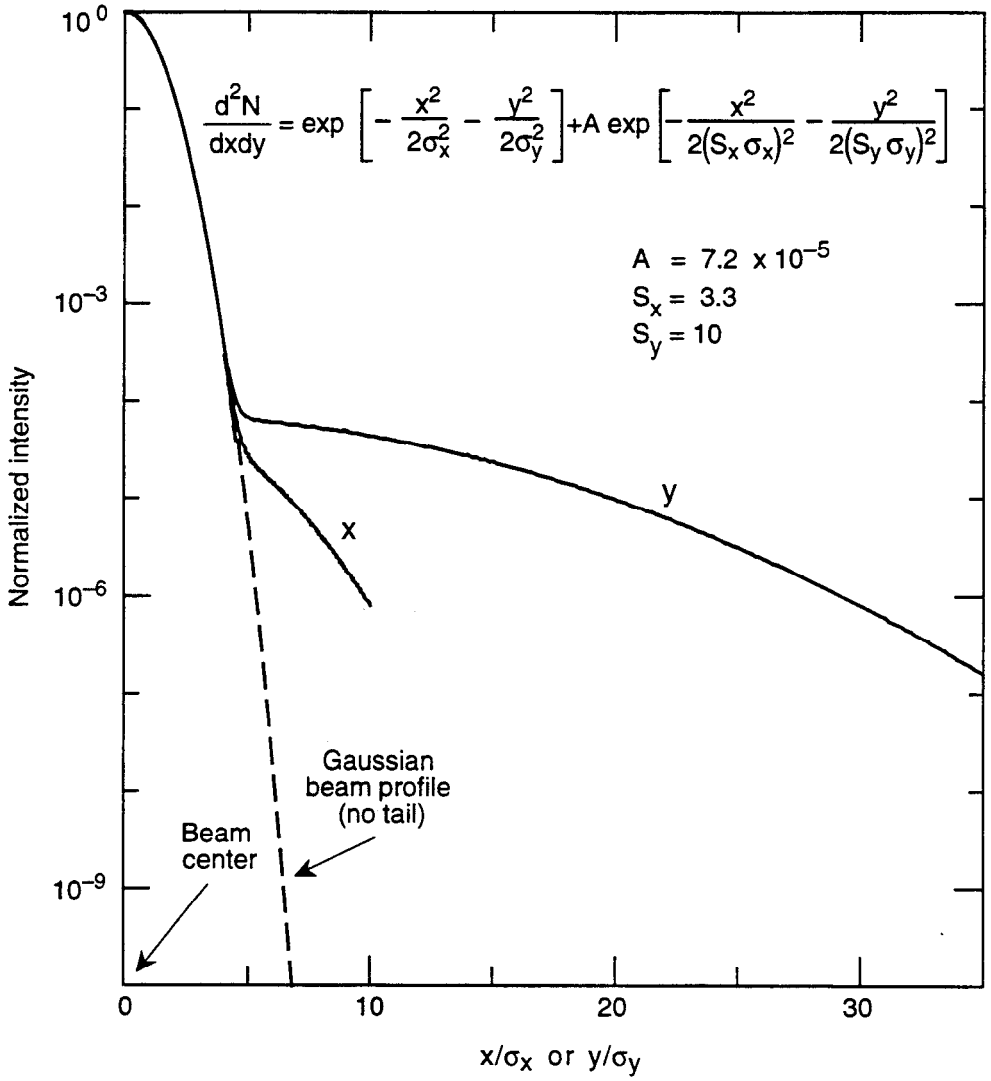
Simulations - Halo

GEANT3 simulations for 2014 version of R&D proposal used description of beam halo from PEP-II design report (SLAC-R-418 p. 113)

In this version of the GEANT3 simulation, I used

S_x=3, S_y=10

Like PEP-II



Rates at 3 GeV – No FP cavity apertures

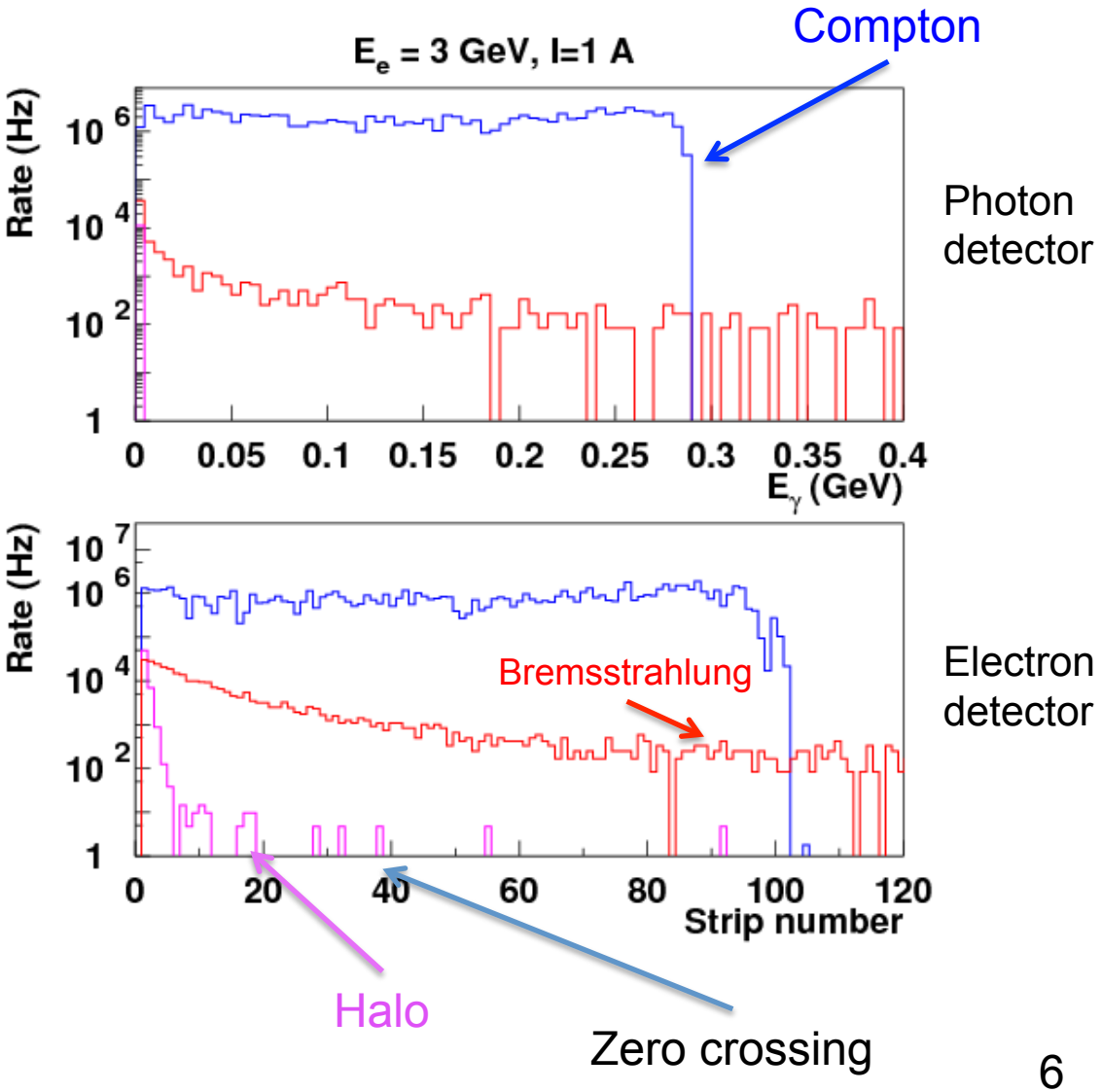
Simulation Parameters

Beam sizes taken at 5 GeV values

Laser power = 1kW
Laser-beam crossing angle = 2.7 deg.

Bottom edge of electron detector = 4.5 mm from beam

Compton edge = 2.4 cm from beam
Zero-crossing = 1.2 cm from beam (about strip 38)



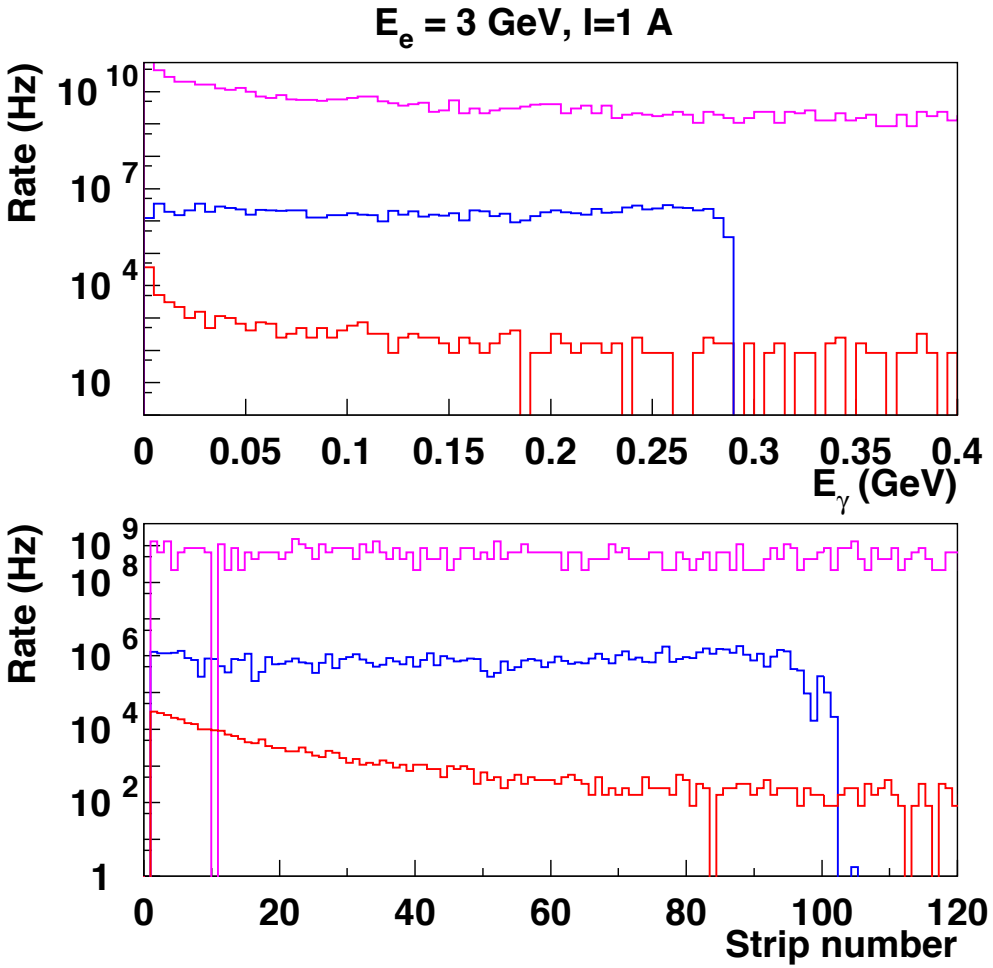
Rates at 3 GeV – FP cavity apertures

4 cm FP cavity aperture

2.7 degree crossing angle implies 2 cm wide aperture near FP cavity

→ Halo contribution was way off scale for 2 cm

Here I have widened the aperture without increasing the laser crossing angle (Compton rate would drop about factor of 2)



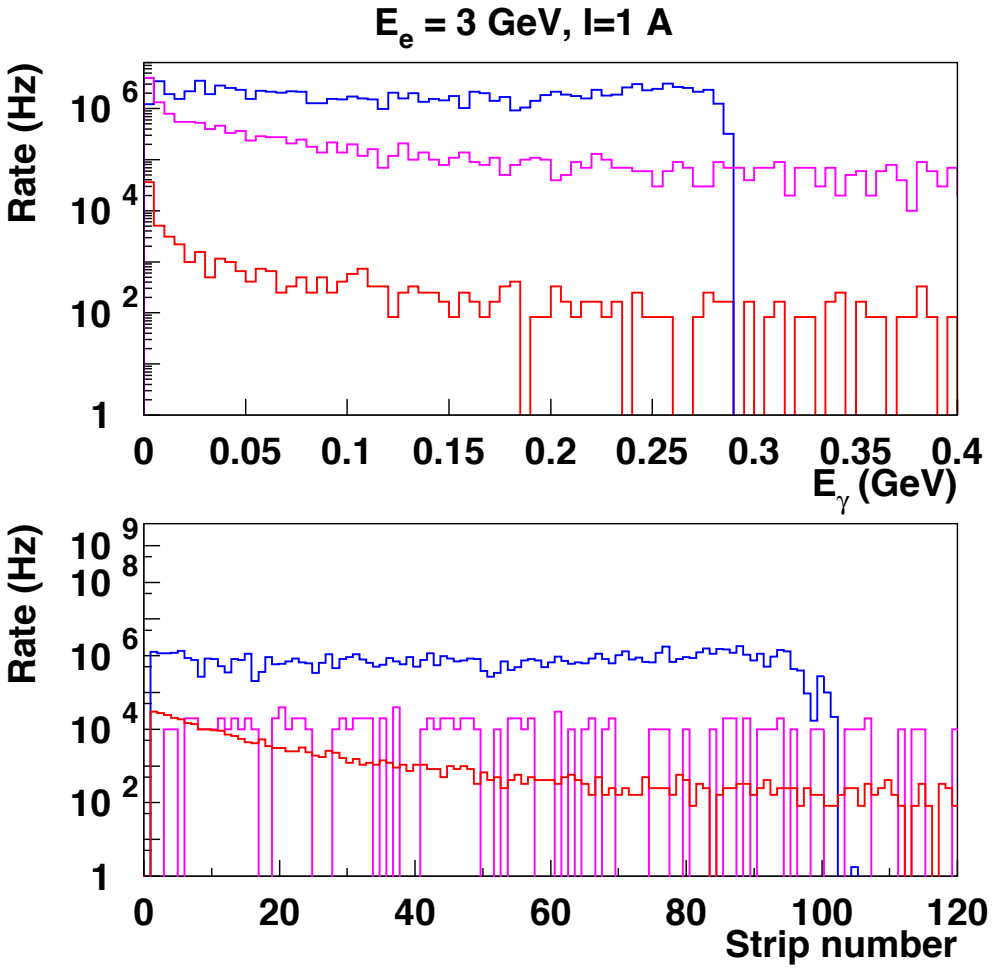
Rates at 3 GeV – FP cavity apertures

6 cm FP cavity aperture

2.7 degree crossing angle implies 2 cm wide aperture near FP cavity

→ Halo contribution was way off scale for 2 cm

Here I have widened the aperture without increasing the laser crossing angle (Compton rate would drop about factor of ~~2~~ → 3)



Conclusions

- Need more thorough, high statistics simulations
- Already see that FP cavity will be challenging → can increase mirror distance from beam without losing much Compton rate by increasing cavity length
- These simulations were done with 5 GeV beam properties → at 10 GeV beam size is about twice as large
- More sensitive to size at cavity – can we move the focus there?