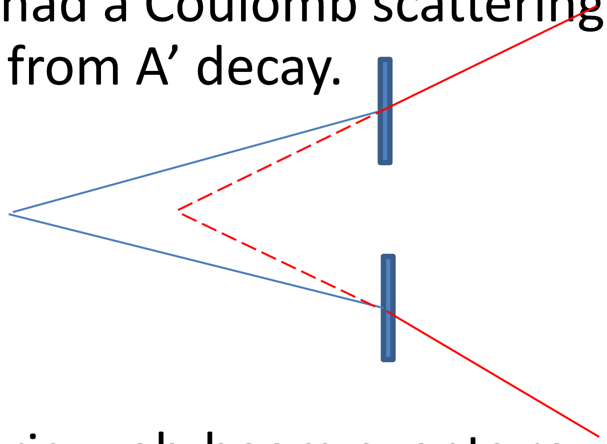
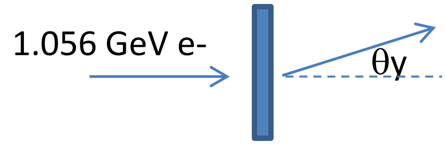
MC Production at SLAC

- Coulomb scattering in Si layer could generate high Z background.
- If both e+ and e- had a Coulomb scattering, the topology is indistinguishable from A' decay.



- High statistics tritrig-wab-beam events roughly equivalent to the statistics of the 2015 0.5 mm data.
  - Trident events are overlaid on wab-beam background at every 250 bunches.
  - 100,000 tritrig files (10^9 trident events)
  - Detector: HPS-EngRun2015-Nominal-v7-0-fieldmap
    - Millipede alignment + truth information in the inactive Si region
  - Beam: σx=125μm, σy=30μm, θx=30.5mrad, θy=0mrad, θ_{skew}=15°
  - Target: z=+0.5 mm

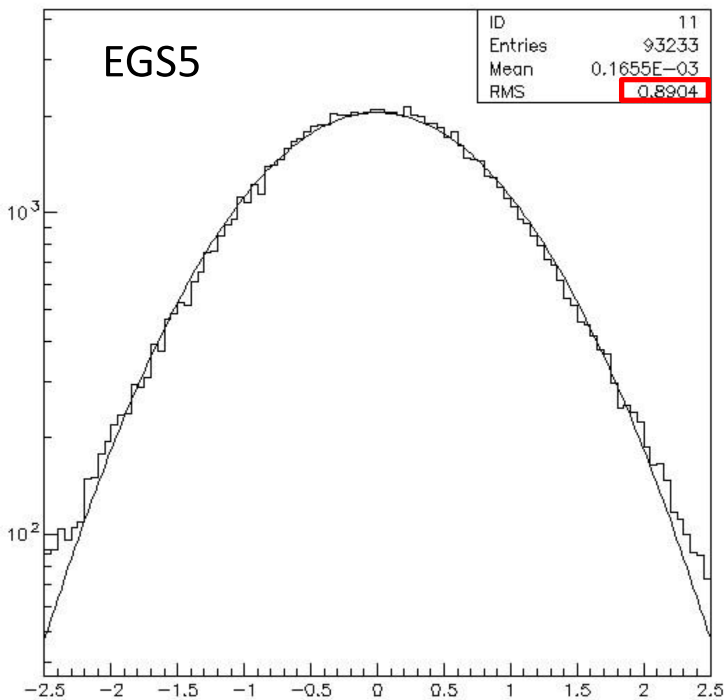
Checking simulators on scattering in Si



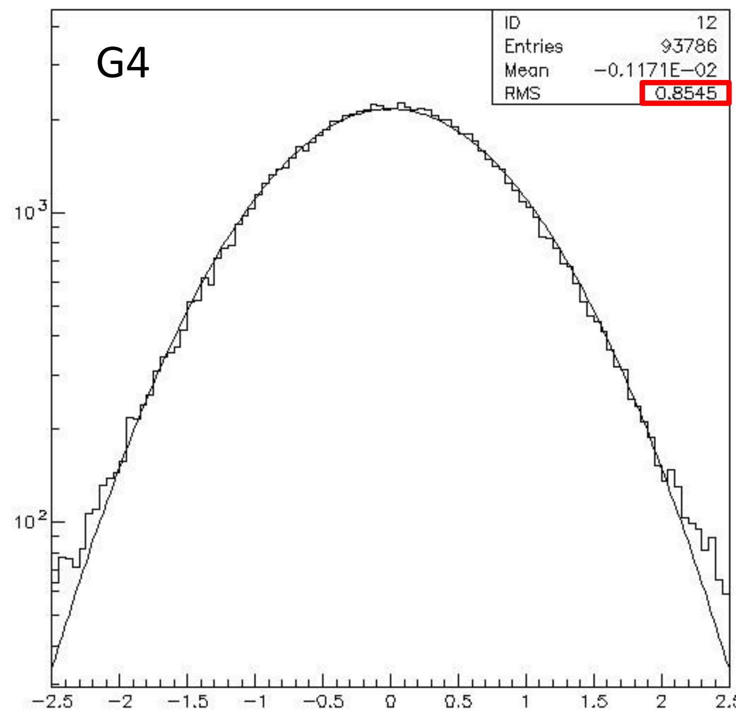
$$\theta y^{rms} = \frac{13.6\ MeV}{E}\sqrt{\frac{x}{X0}}\left[1 + 0.038 \ln\left(\frac{x}{X0}\right)\right]$$

θy^{rms} = 0.86 mrad for 640 μm Si

SLIC is based on Geant4 v10.03.p01

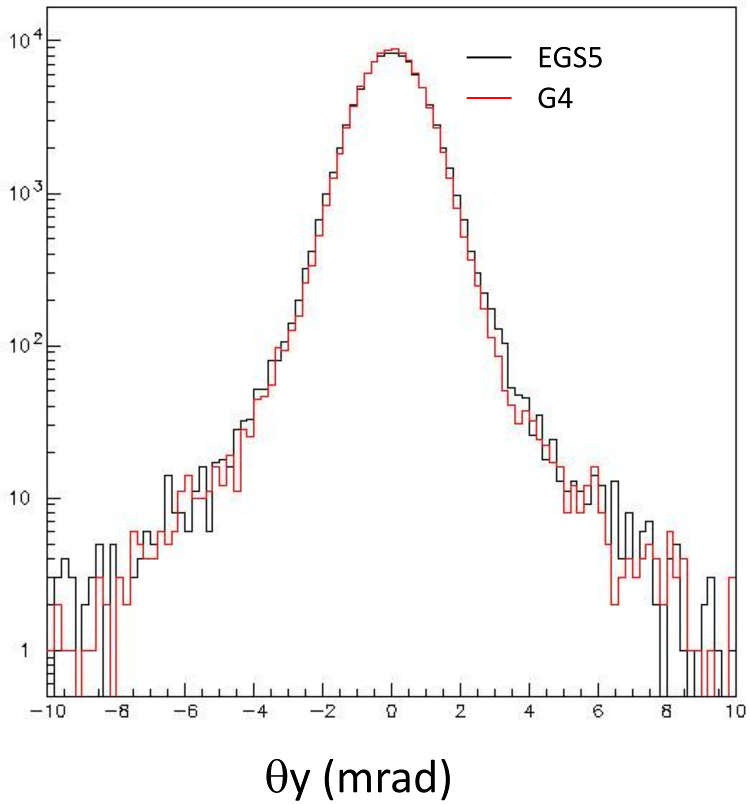


θy (mrad)

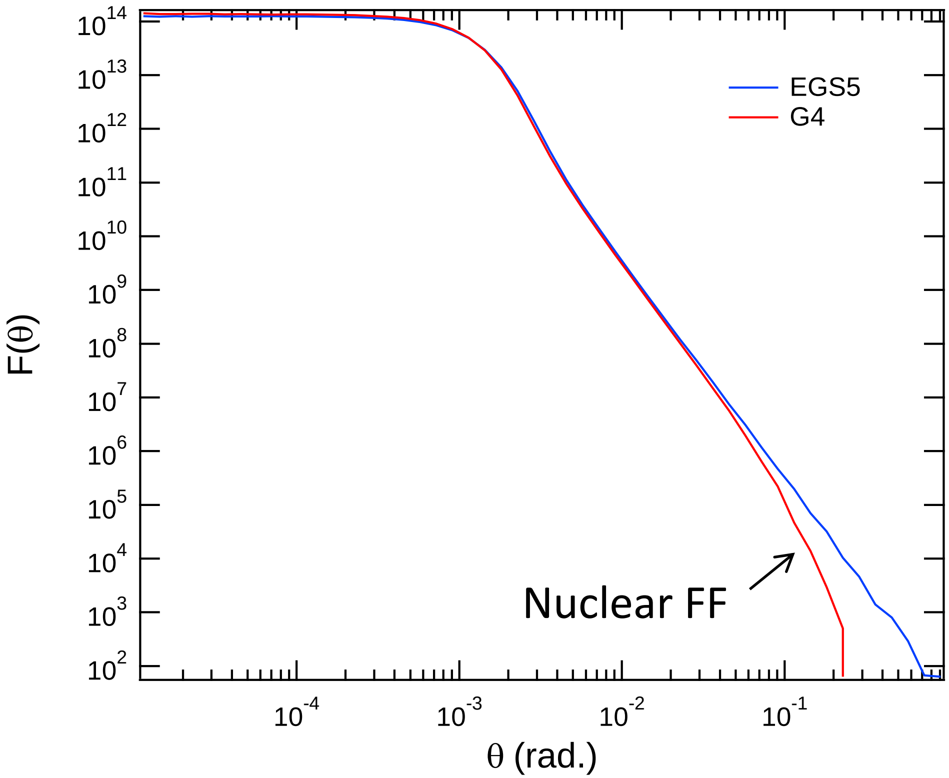


θy (mrad)

99.9% scattering within 10 mrad



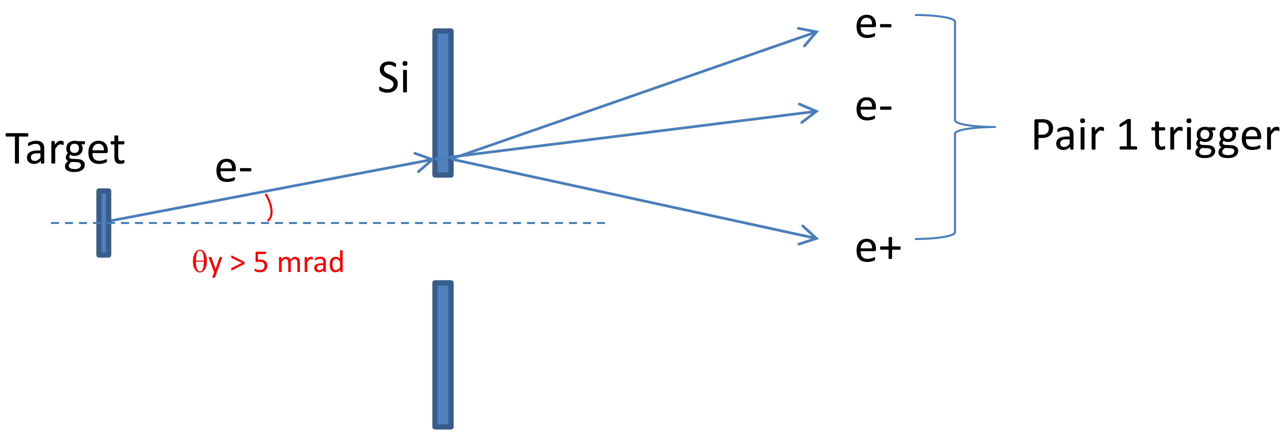
dσ~F(θ)d(cosθ)



- If the high Z background are due to Coulomb scattering in Si layer, we want 10× higher MC statistics.
  - Brute force generation is not practical.
    - Takes ~30 weeks
  - Use hps-sim to sample only large angle scattering.
  - Use the same 10^9 tritrig events ten times with different random number seed and no beam background overlay.

Trident production from Si Layer 1

- Matt S. found trident productions from Si Layer 1.



- Any high energy e-'s hitting the Si layer can generate tridents.
  - FEE
  - Moller
  - WAB
  - Beam halo

Trident production cross section in Si

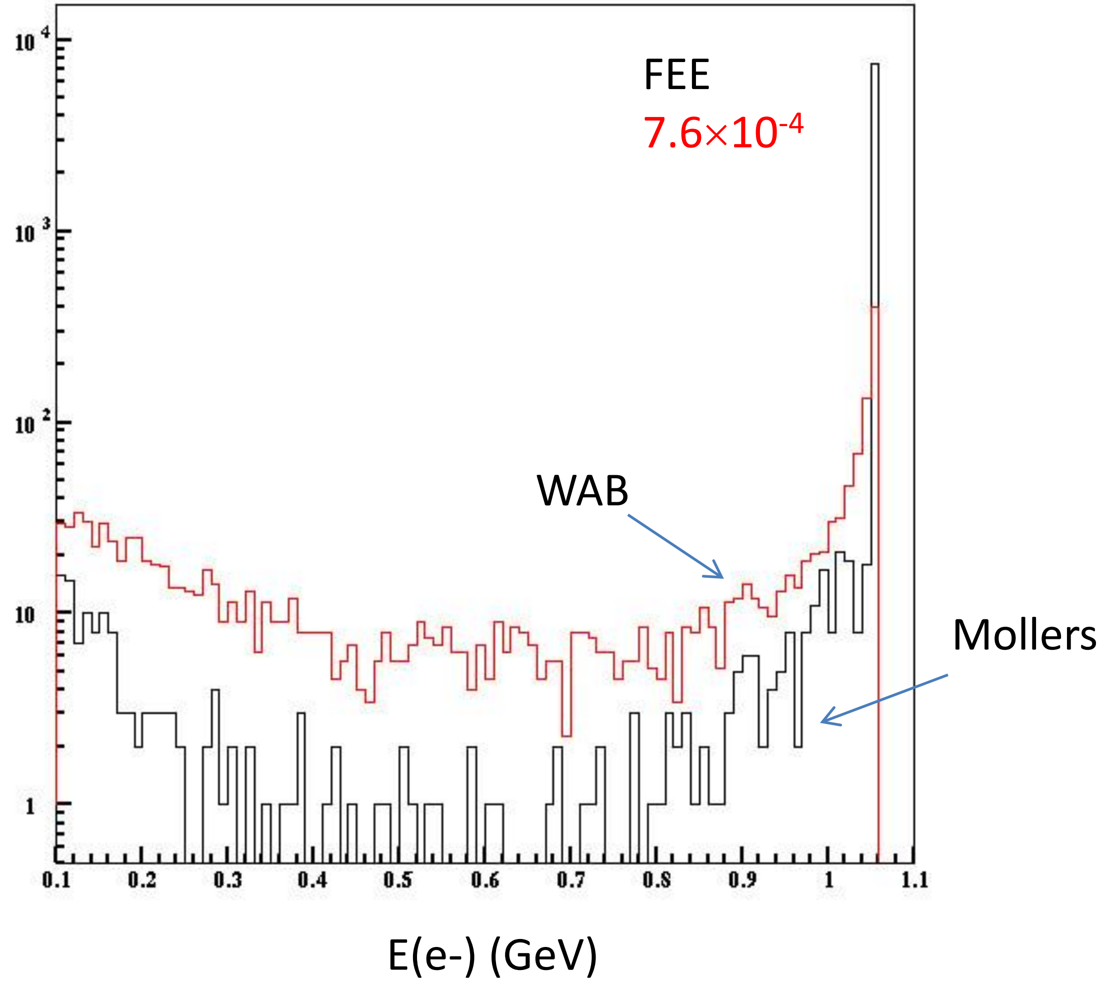
- Trident production $\sim Z^2$
- MadGraph 5 cuts for Eb = 1.056 GeV:
  - Tridents from the target: $\sigma = 1069\ \mu b$
    - E > 50 MeV
    - Esum > 0.5 GeV
    - Mass(e+e-) > 10 MeV
    - $|\theta y| > 10$ mrad
  - Tridents from Si: $\sigma = 105\ \mu b$
    - E > 50 MeV
    - Esum > 0.5 GeV
    - Mass(e+e-) > 10 MeV
    - $|\theta y| > 5$ mrad

e- flux

- FEE, Moller: EGS5
  - |θy(e-)| > 5 mrad
- WAB: MadGraph 4
  - Cuts are applied to e-.
    - E(e-) > 0.1 GeV
    - |θy(e-)| > 5 mrad

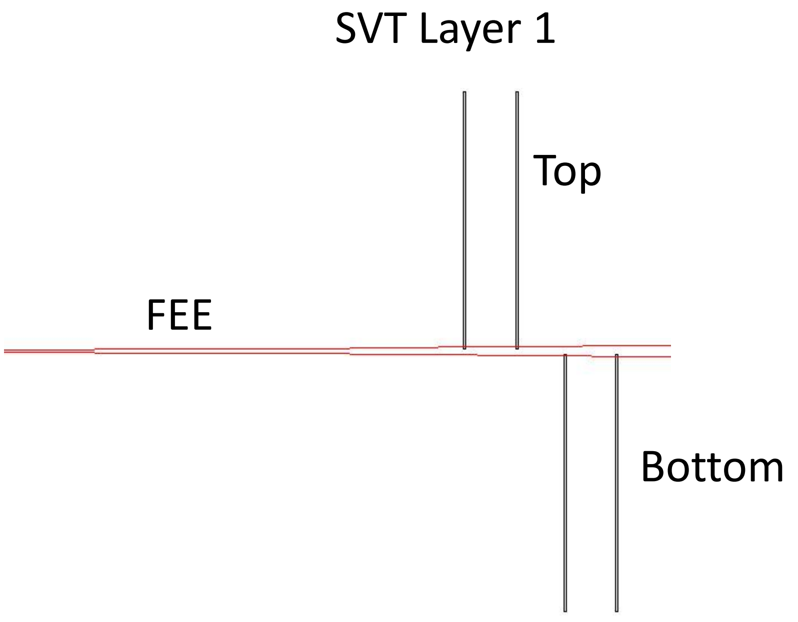
FEE dominates.

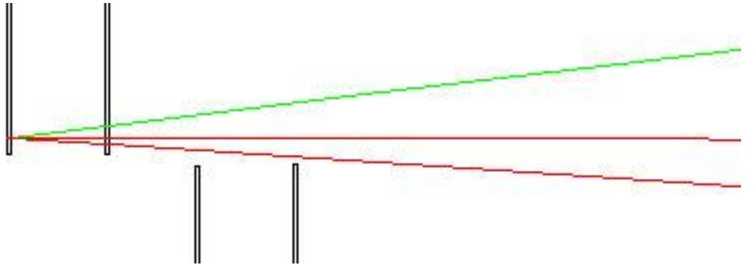
Use only FEEs.
E(e-) is fixed at Ebeam.
No changes in σ and kinematics.



Trident production in Si layer

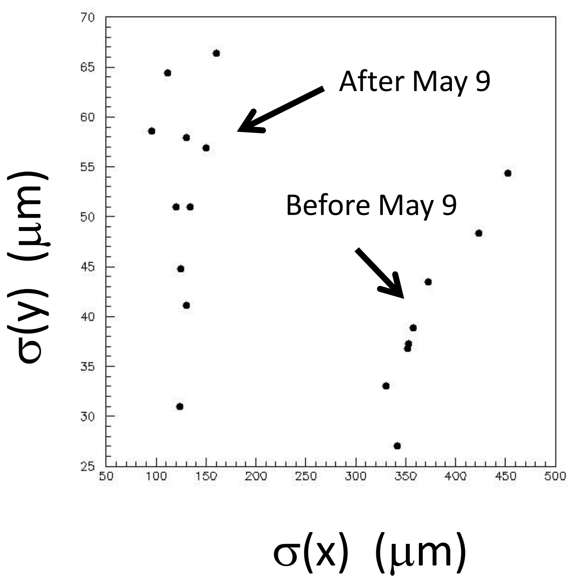
- Use Fast MC
- Track FEE to SVT Layer 1
- Sample interaction point uniformly over two Si layers
- Rotate event along the FEE direction
- Save event in stdhep
- Simulation with hps-mc



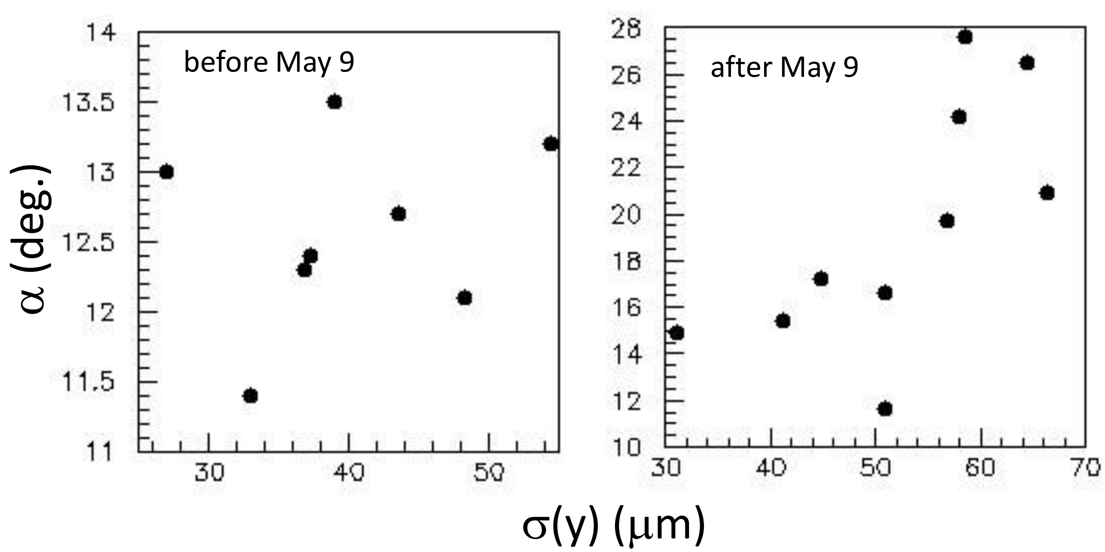


MC Production for the 2015 1.5 mm run

- Use the same 10^9 tritrig events, wab, and beam background.
- Detector: HPS-EngRun2015-1_5mm-v7-0-fieldmap
  - Millipede alignment with SVT angle + truth info in the inactive Si
- Beam: σx=125μm, σy=30μm, θx=30.5mrad, θy=0mrad, θ_{skew}=15°
  - The same beam parameters as the 0.5 mm run.
- Target: z=+0.5 mm



Skew Angle



MC Production for the 2016 2.3 GeV run

- 10^9 tritrig events, wab and beam background have been generated.
- Waiting for the alignment
- Need before production:
  - Check ECal position
  - Beam parameters
  - Target position