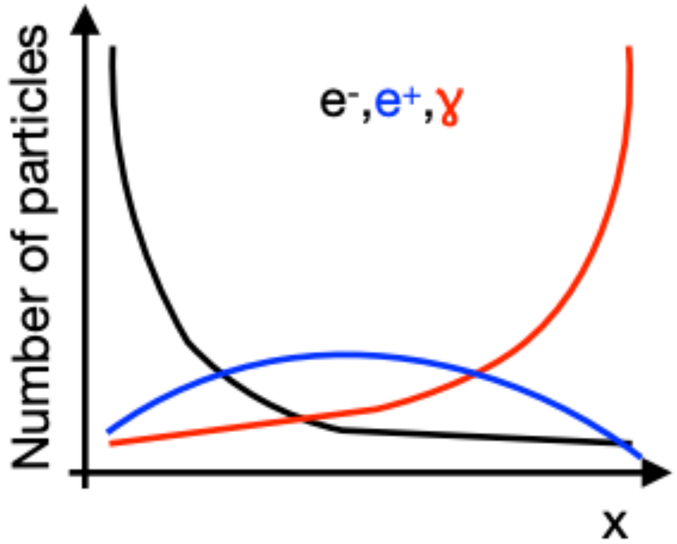
Particles in the Tracker Subsystem

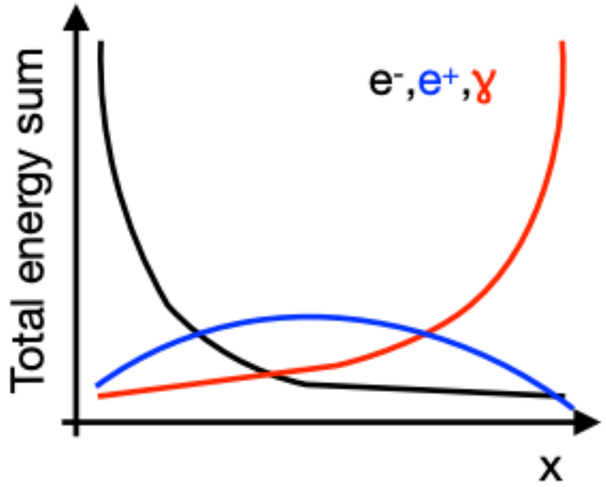
LUXE Daily Analysis Meeting

Arka Santra, November 19, 2020
Weizmann Institute of Science,
Rehovot, Israel

Making Standard Plots for the CDR

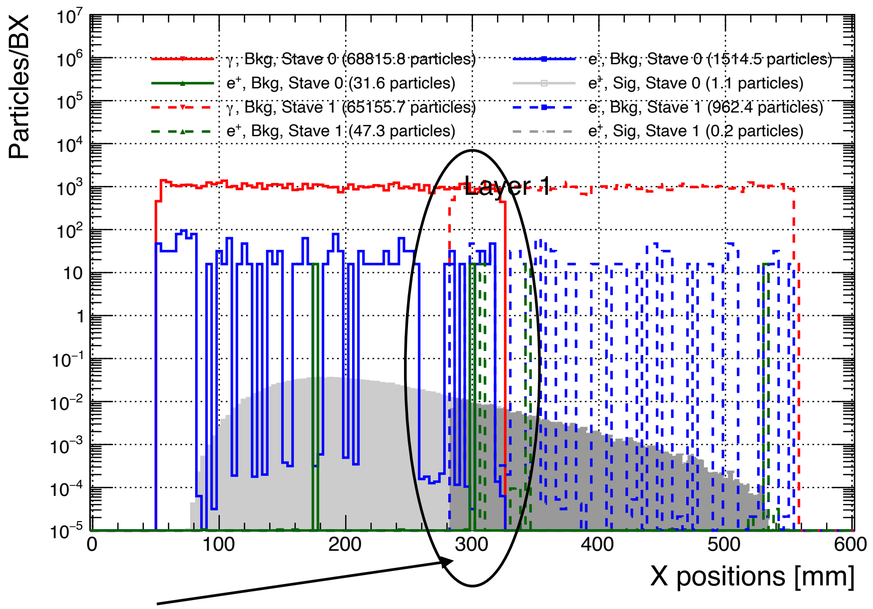
- Followed the recommendation by Ruth, Beate and others.
- Produced tracker plots from the tracks intersecting tracker layers:
  - Number of particle tracks vs track x
  - Particle energy vs track x
- Produced plots for first layer (staves 0 and 1) and last layer (staves 6 and 7)



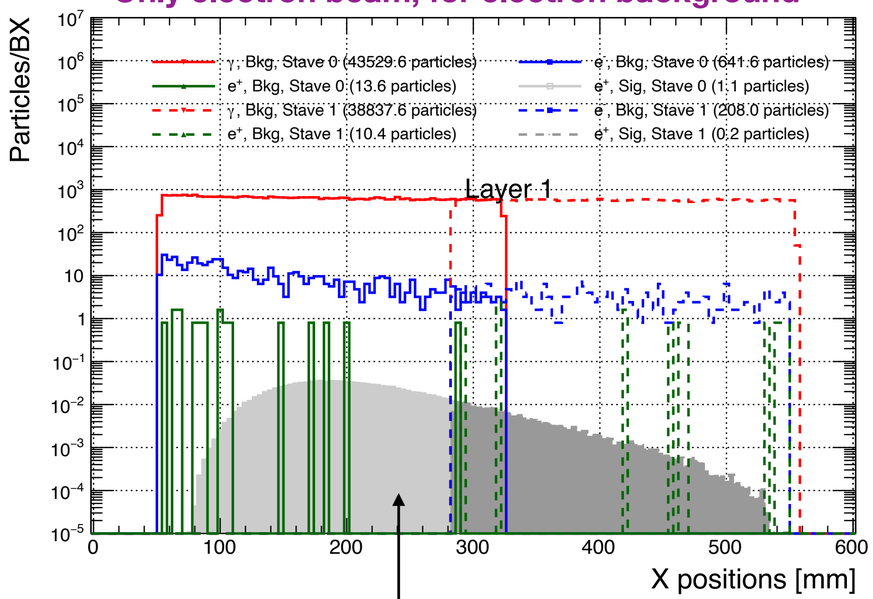


Number of particle tracks vs track x plots, first layer of tracker

e+laser hics w0 3000 nm



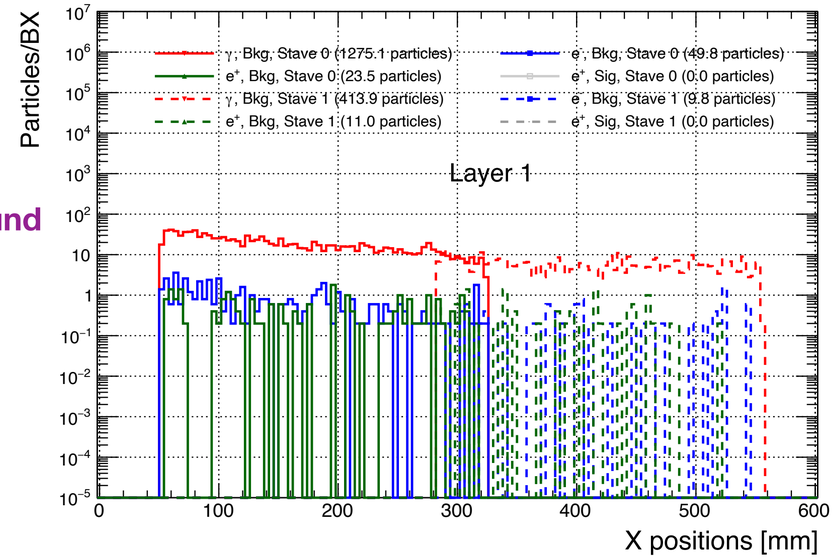
Only electron beam, for electron background



Overlap of staves

signal positron overlaid from the left plot

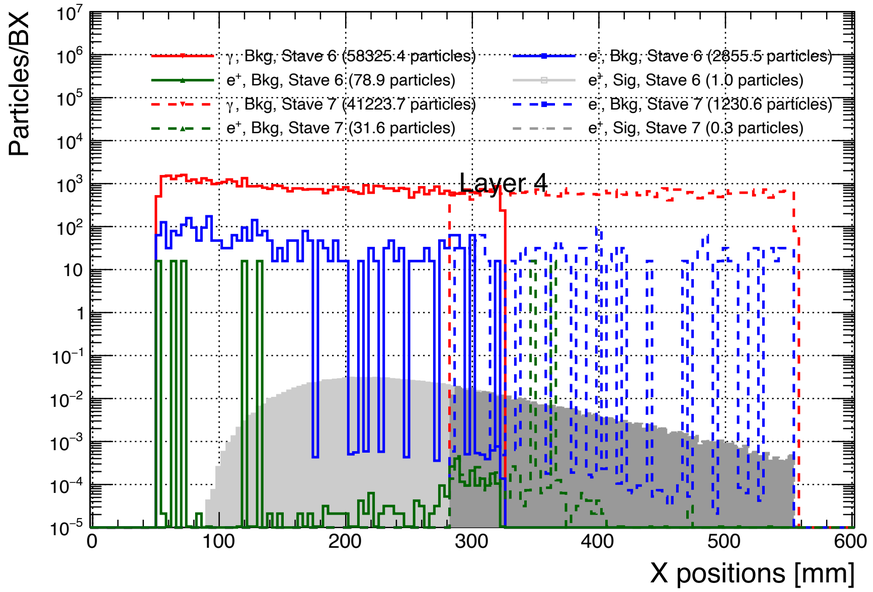
photon+laser background



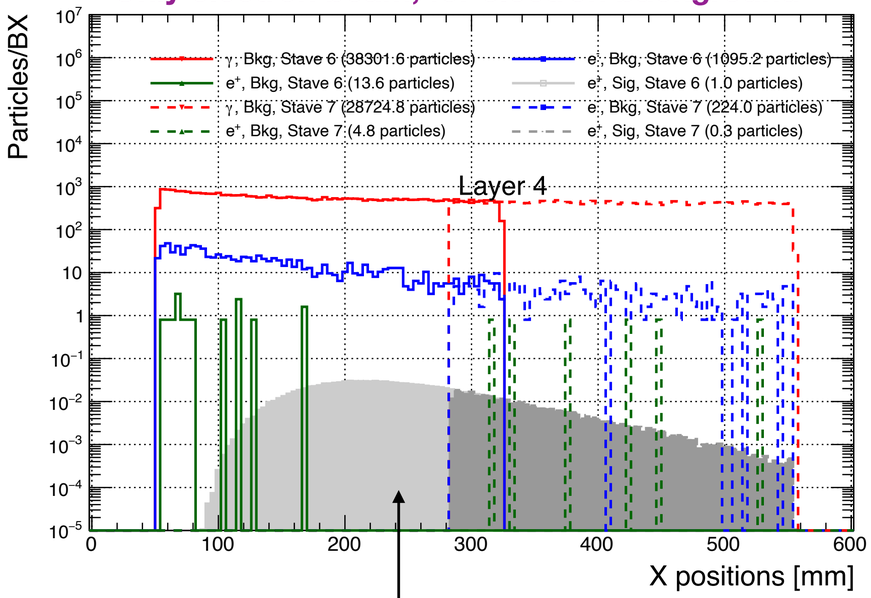
- The unwanted tracks from vtx_x < 0 and (vtx_z > 3600 && vtx_z < 4600) removed.
  - The end window of vacuum chamber, lanex planes etc.
- Solid lines are from inner stave (left side of plot), dotted lines from outer stave (right side of plot).
- Different colours for different particles.
- For only electron beam, the signal positron is overlaid from the e+laser hics JETI 40 w0 3000 nm setup: for comparison.

Number of particle tracks vs track x plots, last layer of tracker

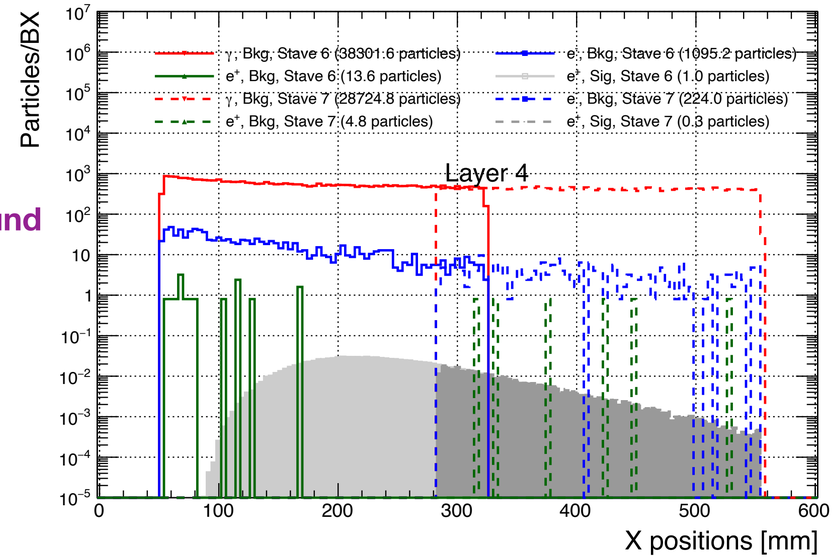
e+laser hics w0 3000 nm



Only electron beam, for electron background



photon+laser background

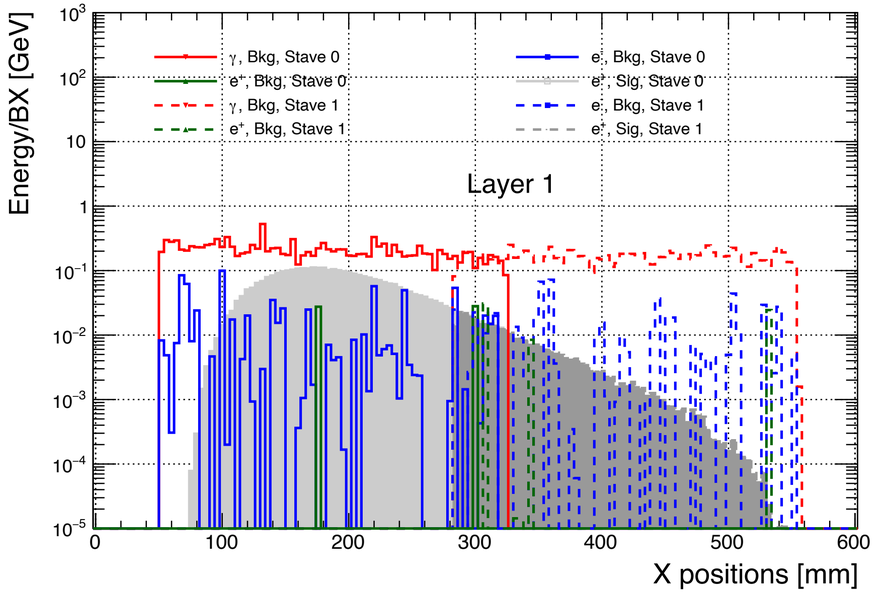


signal positron overlaid from the left plot

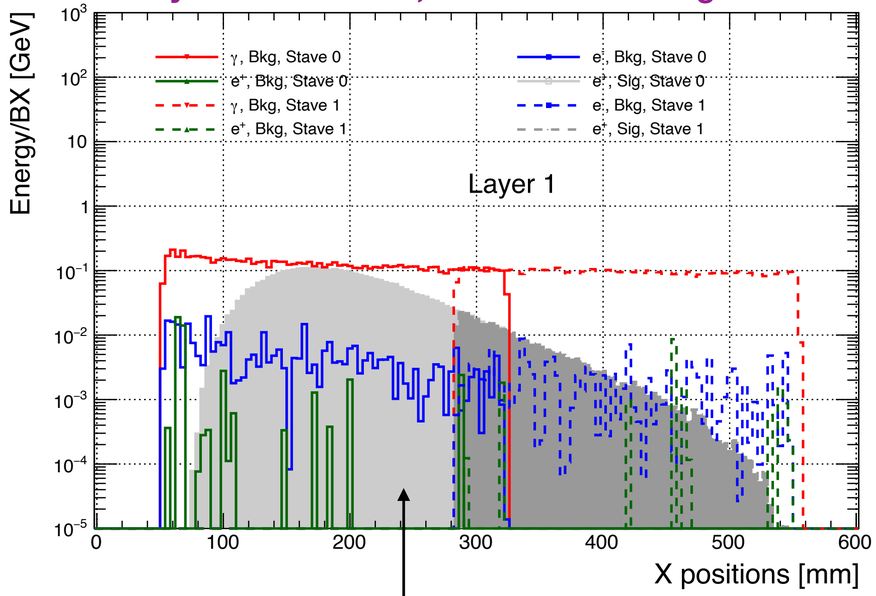
- The unwanted tracks from vtx_x < 0 and (vtx_z > 3600 && vtx_z < 4600) removed.
  - The end window of vacuum chamber, lanex planes etc.
- Solid lines are from inner stave (left side of plot), dotted lines from outer stave (right side of plot).
- Different colours for different particles.
- For only electron beam, the signal positron is overlaid from the e+laser hics JETI 40 w0 3000 nm setup: for comparison.

Sum of energy vs track x plots, first layer of tracker

e+laser hics w0 3000 nm

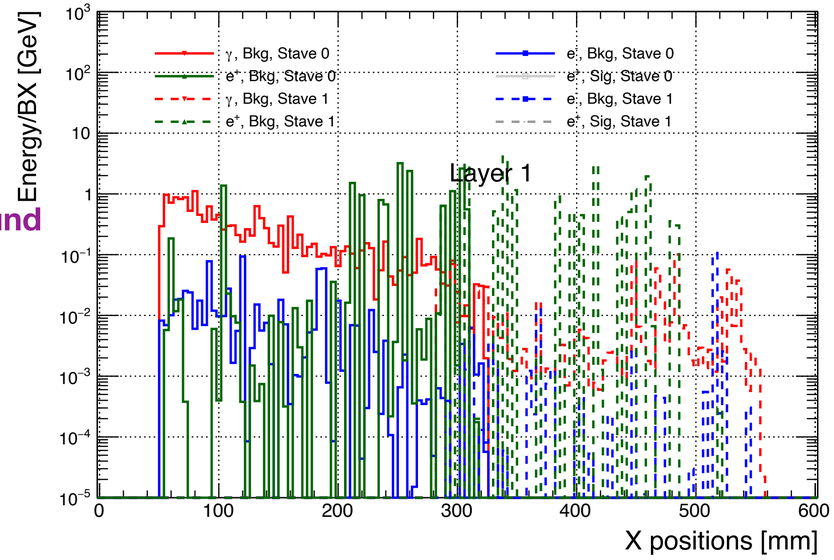


Only electron beam, for electron background



signal positron overlaid from the left plot

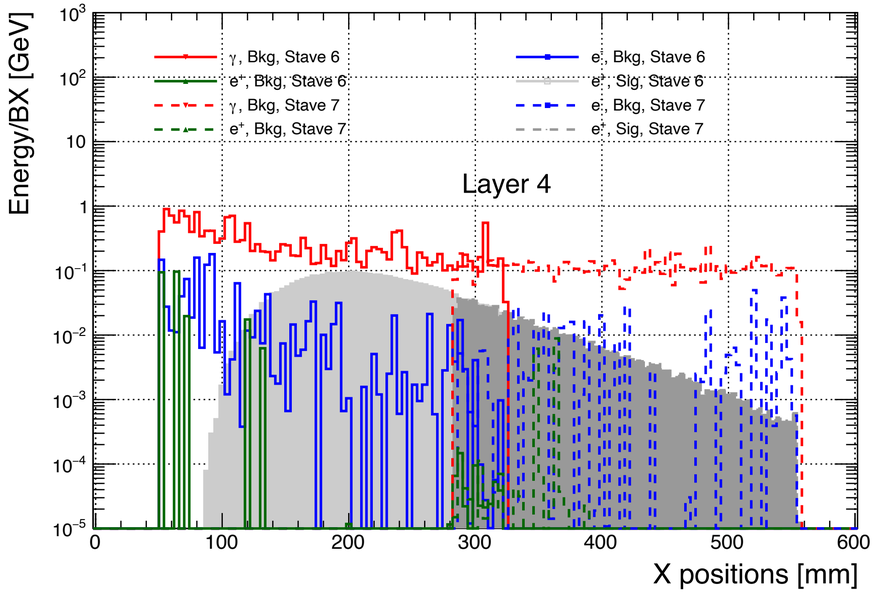
photon+laser background



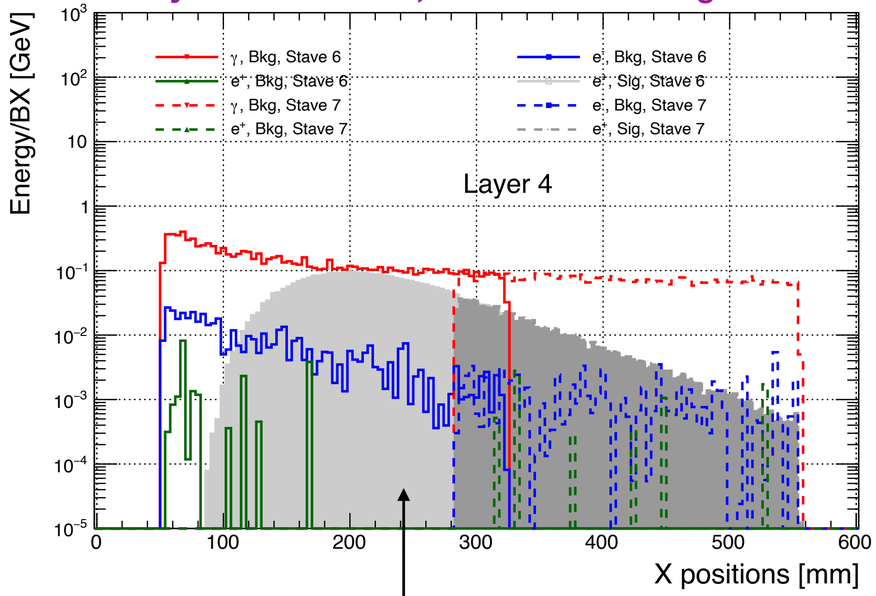
- The unwanted tracks from vtx_x < 0 and (vtx_z > 3600 && vtx_z < 4600) removed.
- The end window of vacuum chamber, lanex planes etc.
- Solid lines are from inner stave (left side of plot), dotted lines from outer stave (right side of plot).
- Different colours for different particles.
- For only electron beam, the signal positron is overlaid from the e+laser hics JETI 40 w0 3000 nm setup: for comparison.

Sum of energy vs track x plots, last layer of tracker

e+laser hics w0 3000 nm

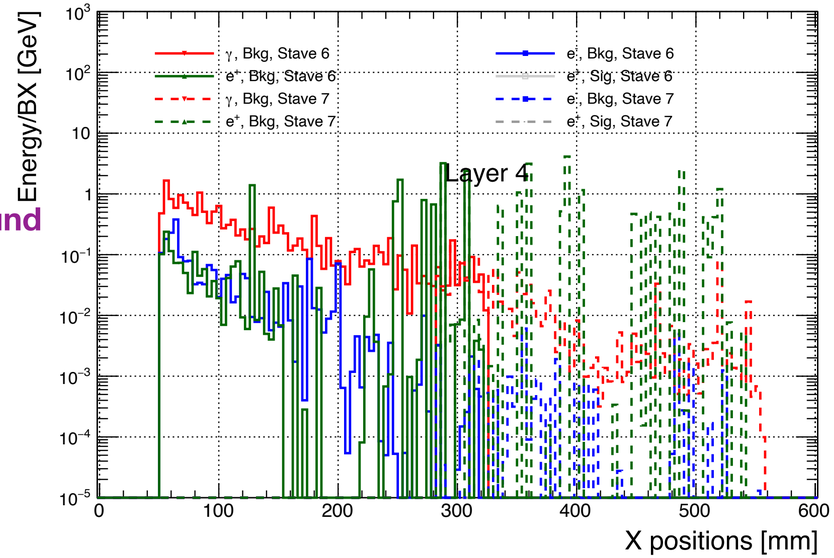


Only electron beam, for electron background



signal positron overlaid from the left plot

photon+laser background



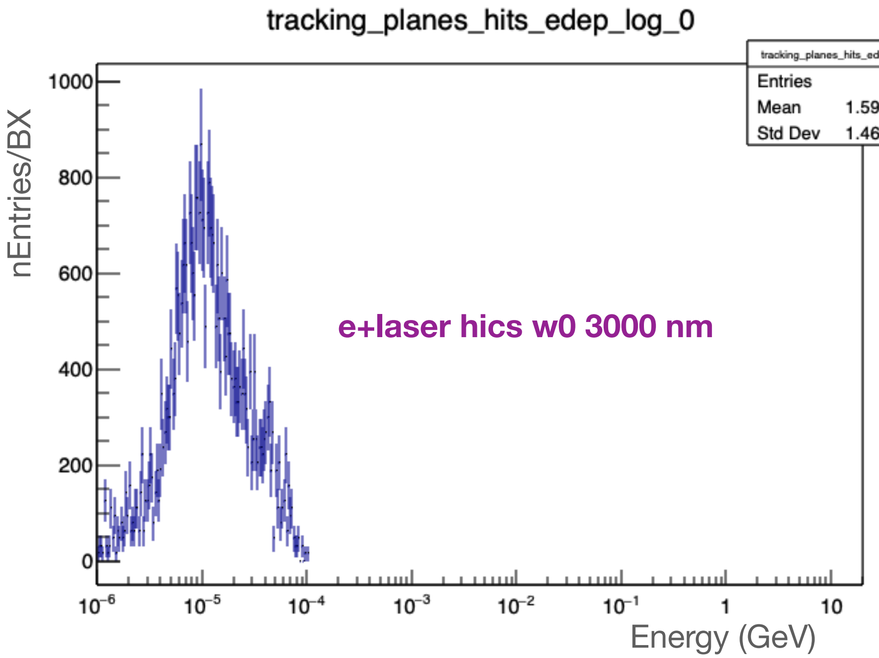
- The unwanted tracks from vtx_x < 0 and (vtx_z > 3600 && vtx_z < 4600) removed.
  - The end window of vacuum chamber, lanex planes etc.
- Solid lines are from inner stave (left side of plot), dotted lines from outer stave (right side of plot).
- Different colours for different particles.
- For only electron beam, the signal positron is overlaid from the e+laser hics JETI 40 w0 3000 nm setup: for comparison.

Summary and To Do:

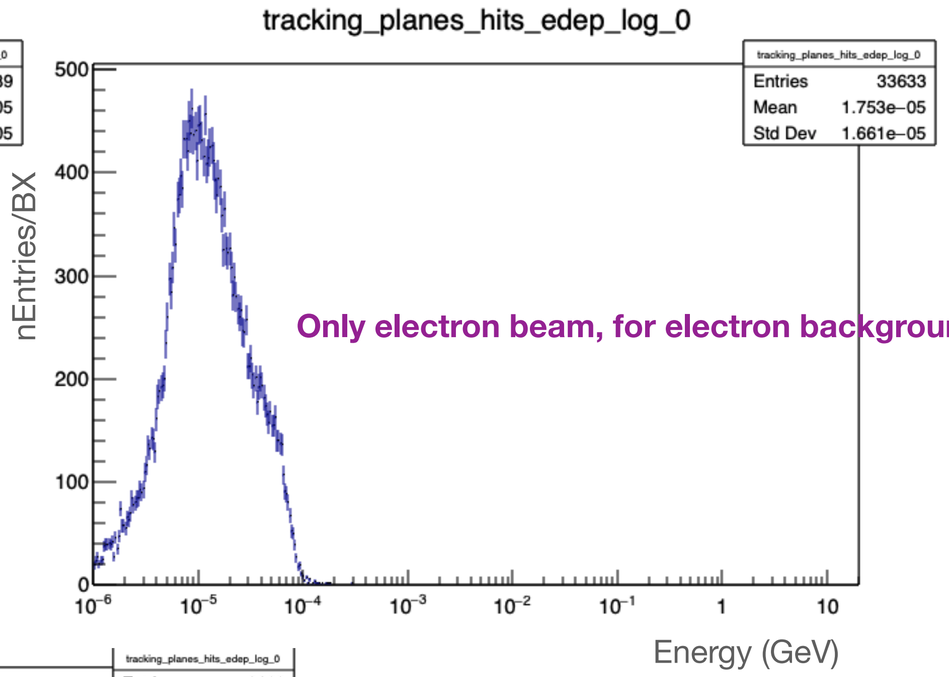
- Making seeds out of the tracks in the tracker plane.
  - Checking if the extrapolated tracks from tracker layer 4 and layer 1 go back to the dipole magnet.
  - Will consider seed if the E_seed > 1 GeV.
- Looking at the energy deposits (hits) at the tracker layer.
  - Preliminary studies done, need to work on to associate tracks with them.

Bonus slides

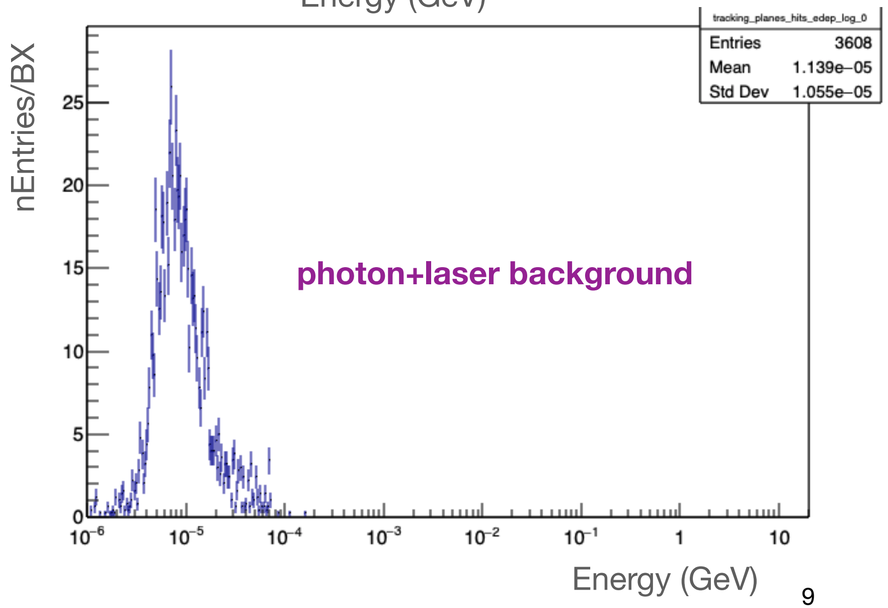
First look at the energy deposit by hits, inner stave (Stave 0) of tracker



e+laser hics w0 3000 nm



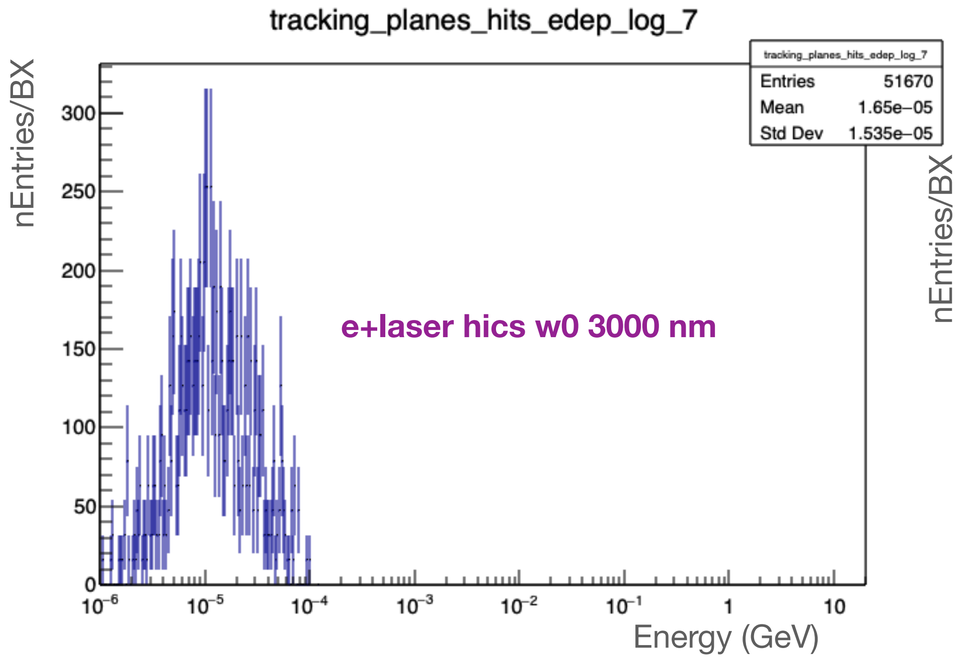
Only electron beam, for electron background

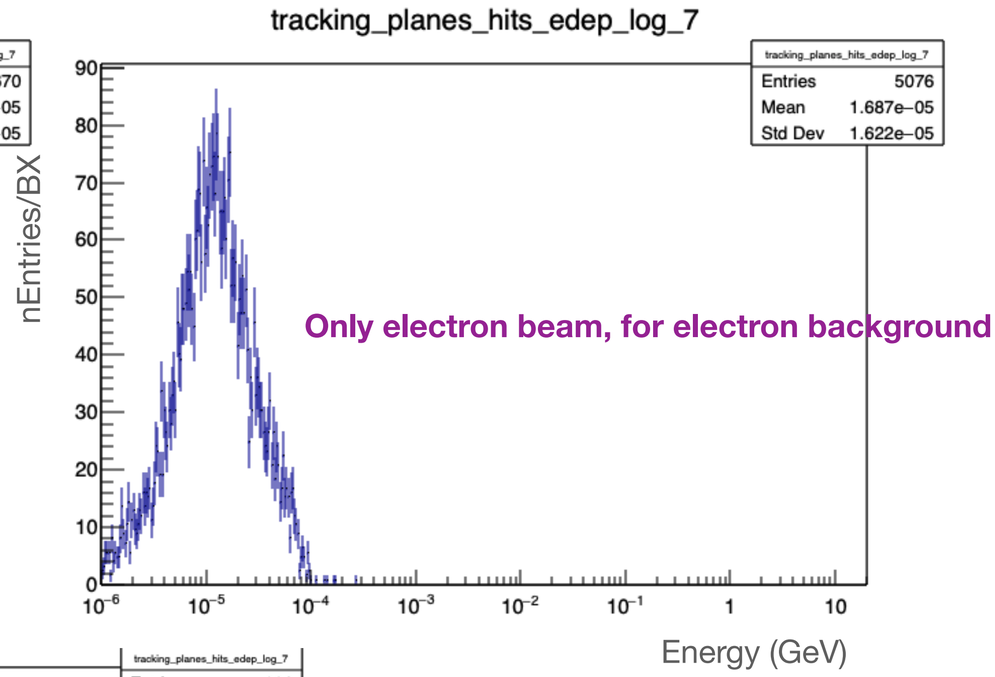


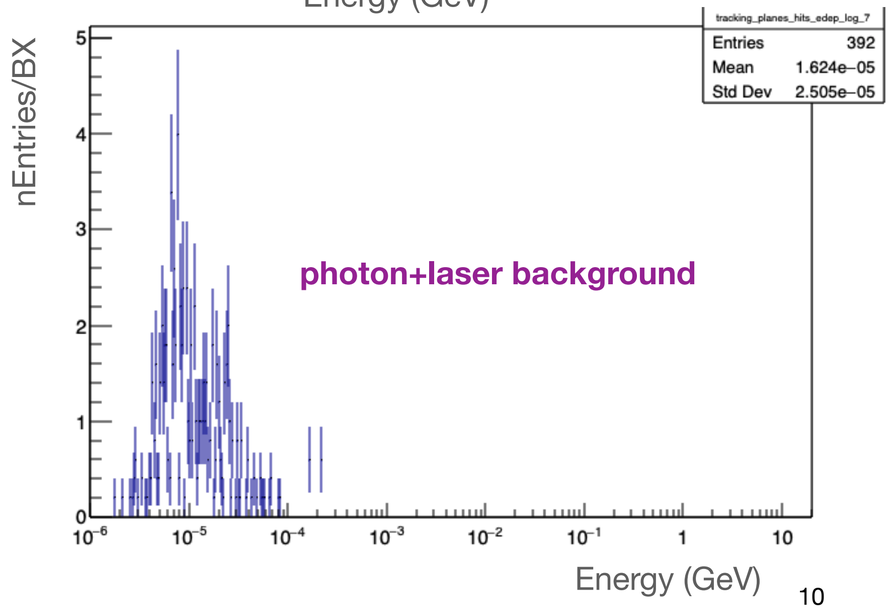
photon+laser background

- Notice the the Y axes ranges: different for different plots.
- First look at the hits given by Geant4 simulation.
  - These are all hits, not divided by the generating particles.
  - Still could not associate tracks with the hits, work in progress.
    - That will help identify the particles.

First look at the energy deposit by hits, outer stave (Stave 7) of tracker







- Notice the the Y axes ranges: different for different plots.
- First look at the hits given by Geant4 simulation.
  - These are all hits, not divided by the generating particles.
  - Still could not associate tracks with the hits, work in progress.
    - That will help identify the particles.

- For 10 keV to 10 MeV electrons:
  - E-loss is ~0.5<dE/dx<4 keV/µm
  - Electrons with 10 keV can travel at most ~2.5 µm before dying
  - Electrons with 10 MeV will not be stopped in the sensitive material (true for ALPIDE)
- Minimum ionisation at ~1 MeV
- At electron energies >50 MeV radiative energy loss dominates