Update on Light Gas Cherenkov

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For the SoLID Collaboration

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Background Rates

- Method for GEMC:
  - Simulate 11 GeV electrons incident on a 40cm LD_2 target.
  - Simulation Includes:
    - Target walls
    - Lead Baffles (5cm 1st baffle inner radius)
    - PVF Cherenkov Window
  - Simulation does not include:
    - Absorber
    - Exit beam pipe
    - Air (all “empty” space is vacuum).

Input card:

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```

Background Rates

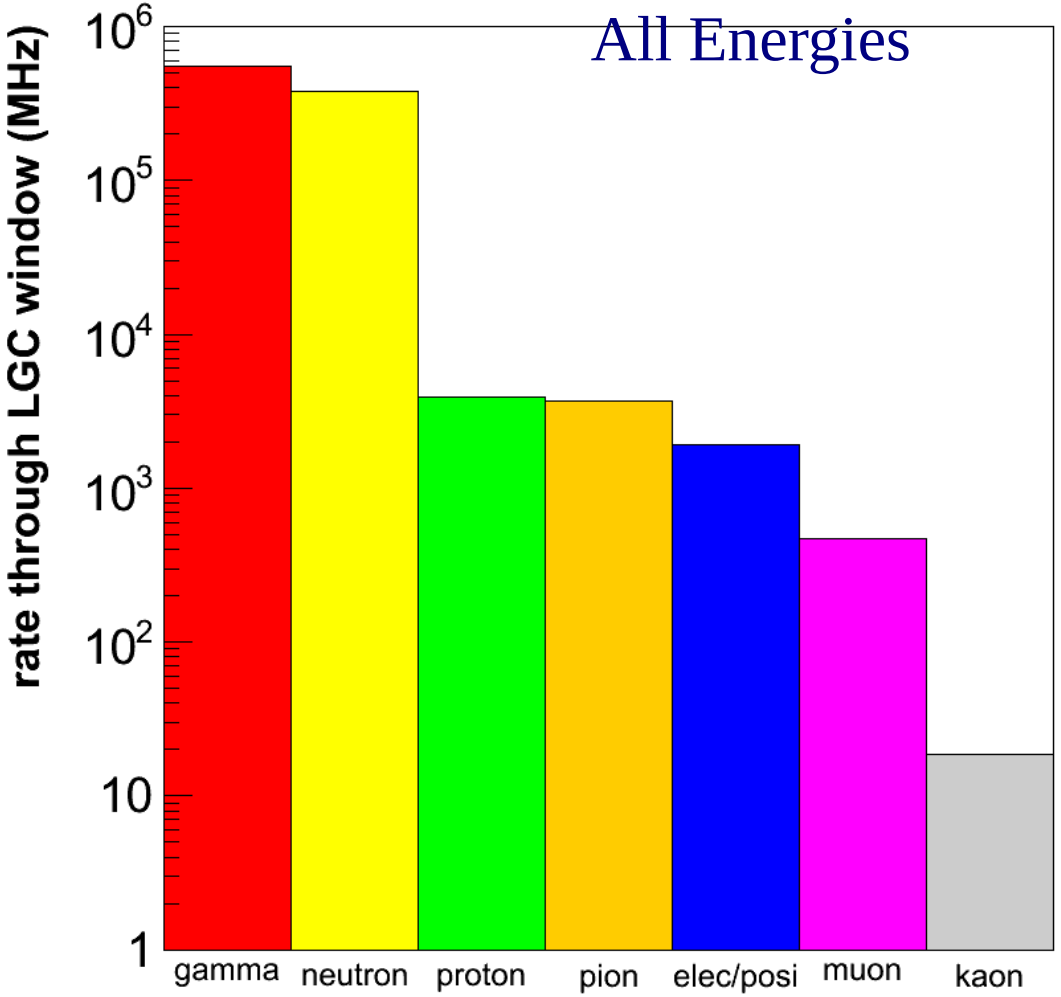
- Method continued:
  - Run 1000 times on farm (200k events each)
  - Record all particles passing through a plane immediately after the Cherenkov window.
  - Input those events into a new simulation with the full cherenkov geometry. (Optical processes ON).

Total computer time: 4000 hours

Beam time: 2e8 incident electrons x 1.6e-19 C/electron / 50e-6 C/s = 0.64 μs

Total Background Rates: Cherenkov

- Rates through the ENTIRE cherenkov window.
- Includes “overlap”
  - 1 beam electron can have > 1 particle pass through the LGC window



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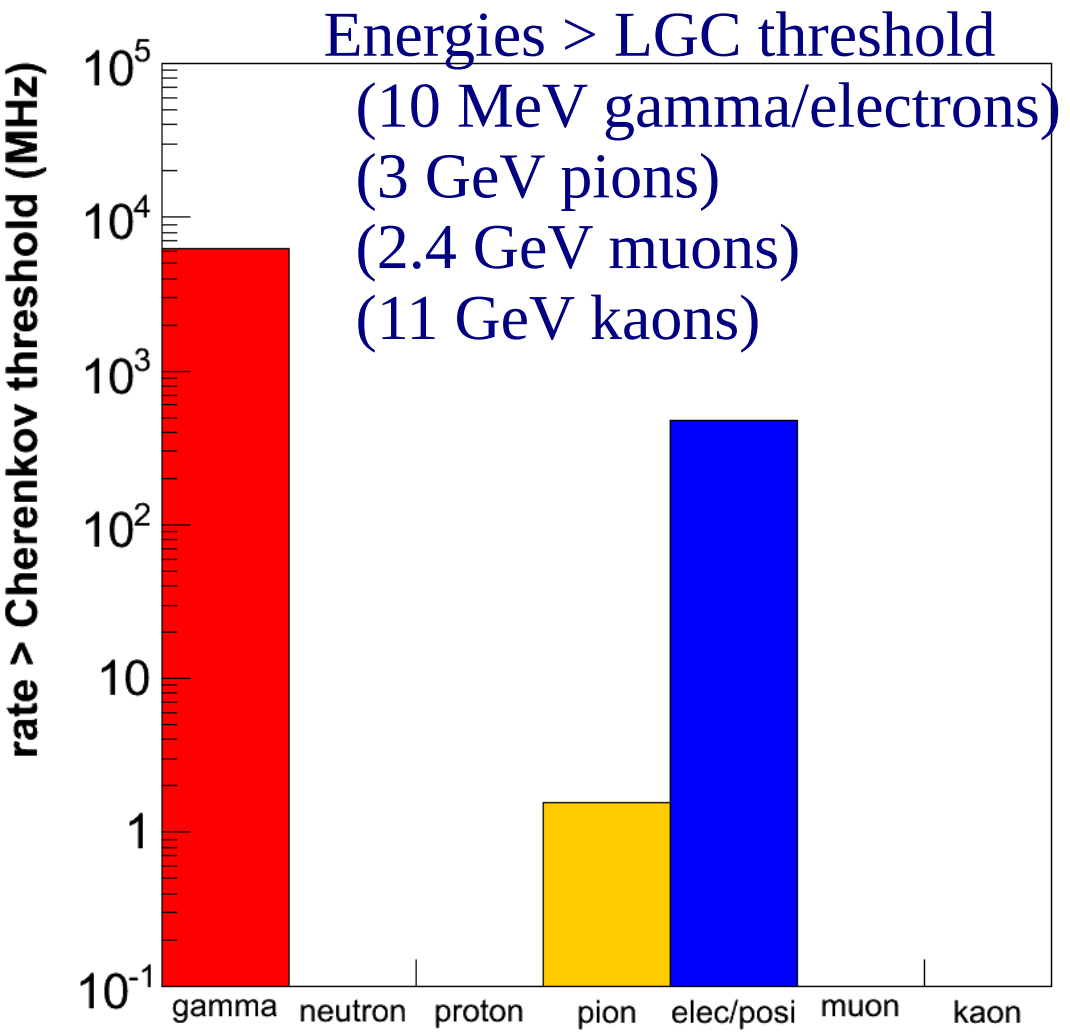

Total Background Rates: Cherenkov

- Rates through **ONE SECTOR** of the cherenkov window.
- At **LEAST 1** photoelectron.
- Includes “overlap”
  - 1 beam electron can have > 1 particle pass through the LGC window.

Total Rate: 4.95 MHz

(electrons): 3.4 MHz

(photon conversions inside cherenkov): 4.4 MHz

(pions): 260 KHz

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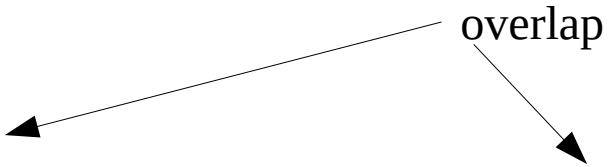
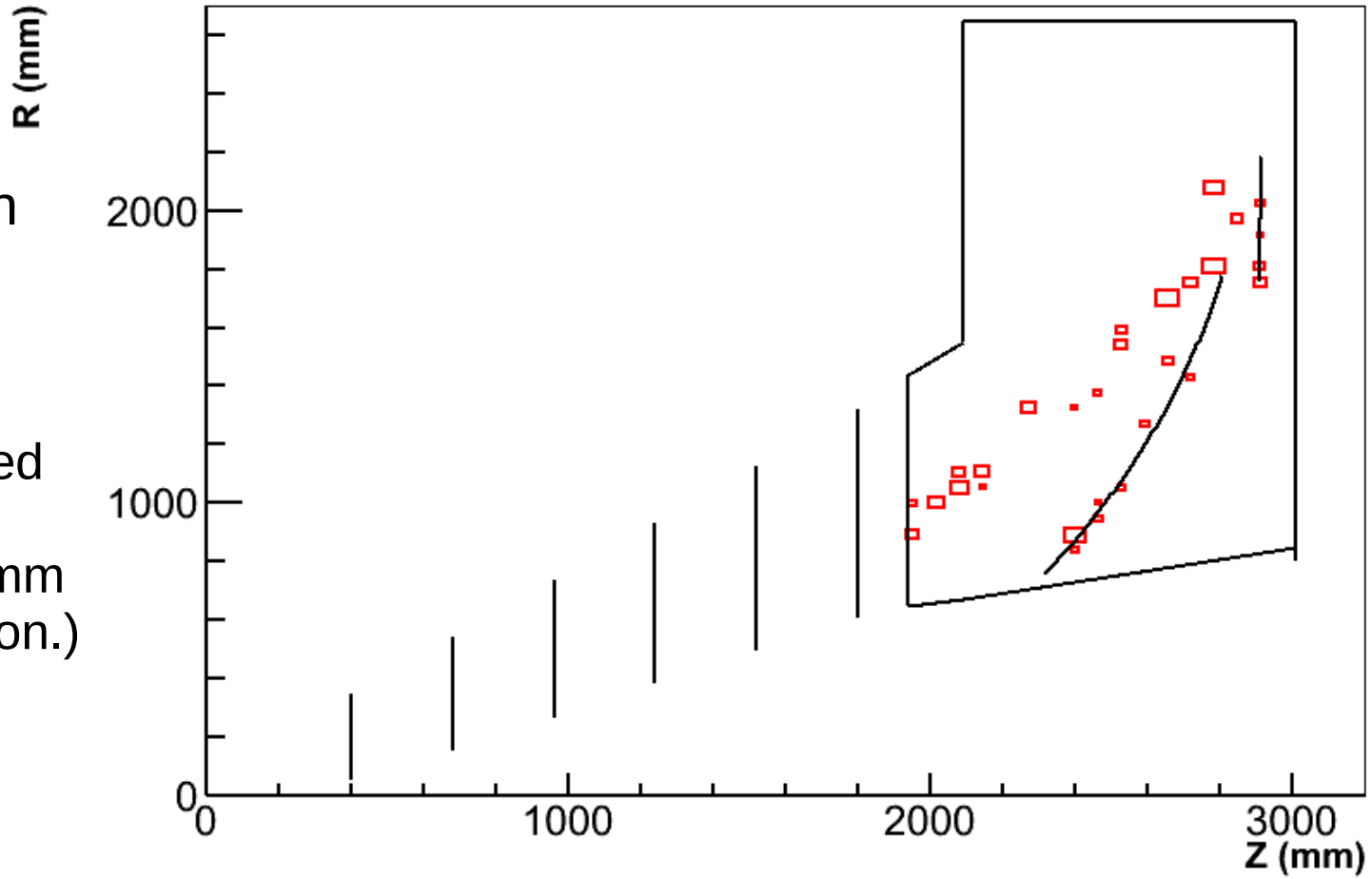


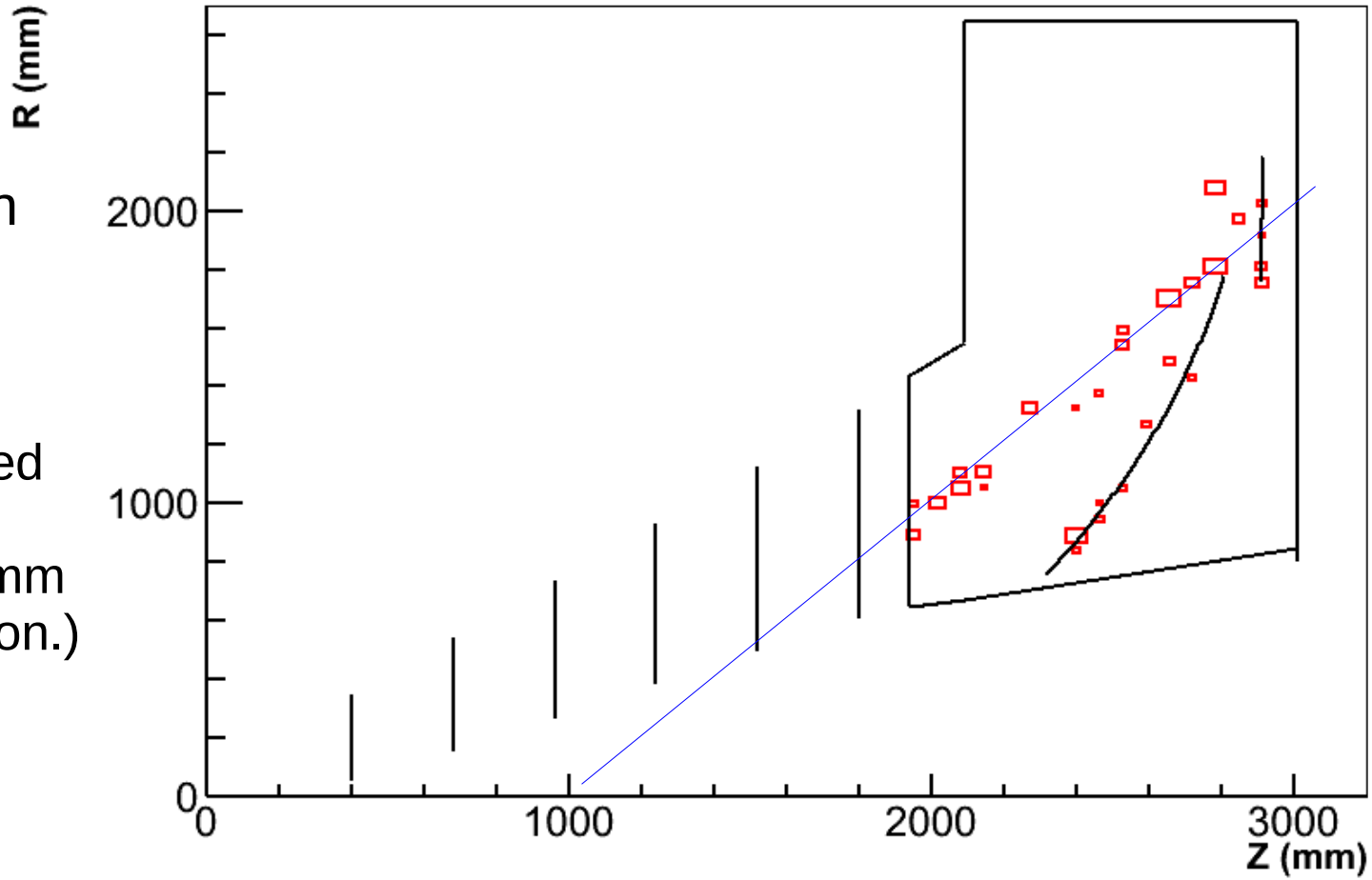
Total Background Rates: Cherenkov Conversions?

- Conversion to lepton vertex:
- In mirror material.
  - (My simulation used 3.2 mm of quartz glass, not the < 2mm of composite carbon.)
- In gas.



Total Background Rates: Cherenkov Conversions?

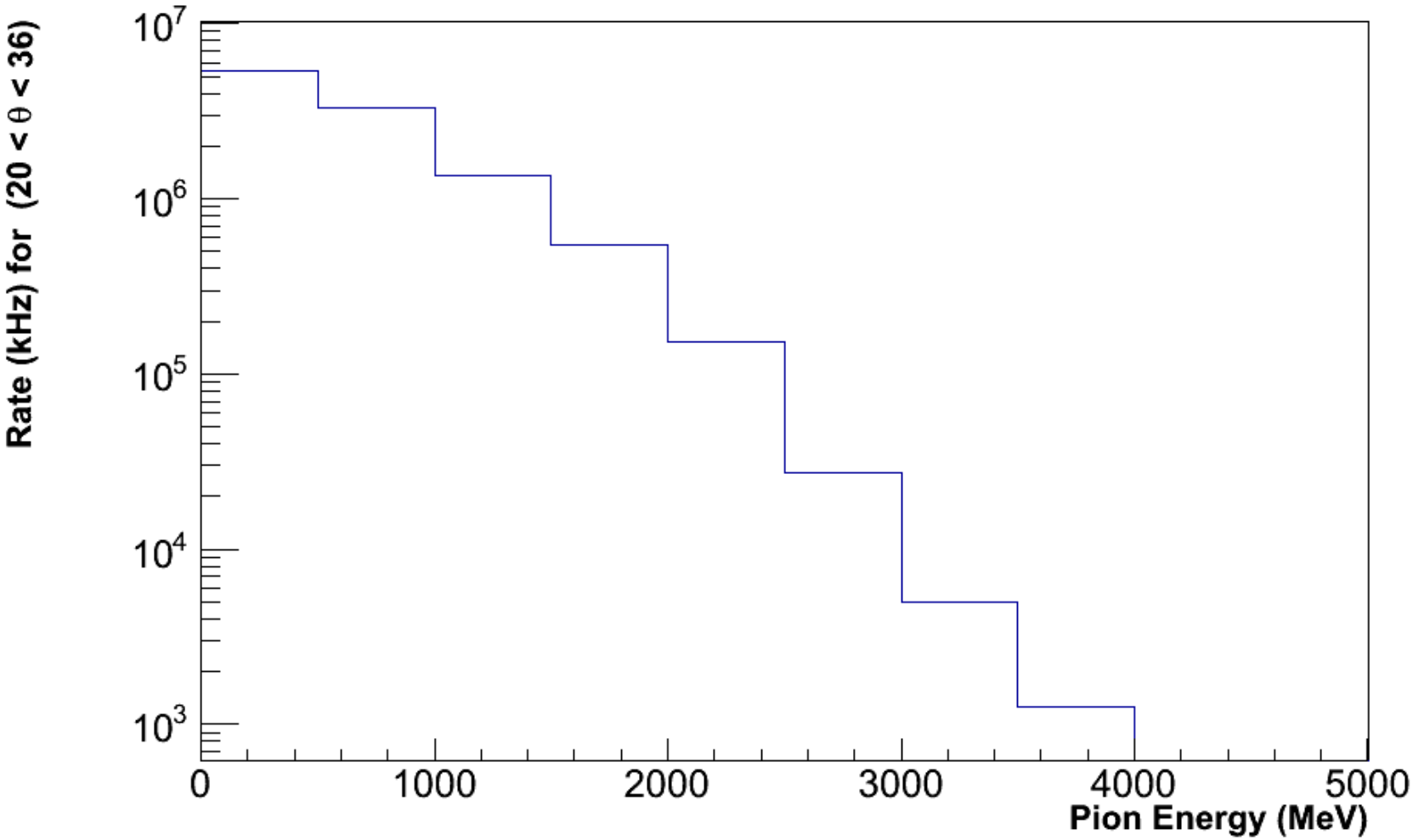
- Conversion to lepton vertex:
- In mirror material.
  - (My simulation used 3.2 mm of quartz glass, not the < 2mm of composite carbon.)
- In gas. (Line?)



Total Background Rates: Cherenkov High Momentum Pions?

- Separate simulation looking only at pions created by the “QGSP_BERT” physics list.
  - 11 GeV electrons incident on LD_2 target.
  - Detect outgoing pions from 20 degs to 36 degs.
  - Everything else vacuum (No Baffles, LGC, or anything else).

Total Background Rates: Cherenkov High Momentum Pions?



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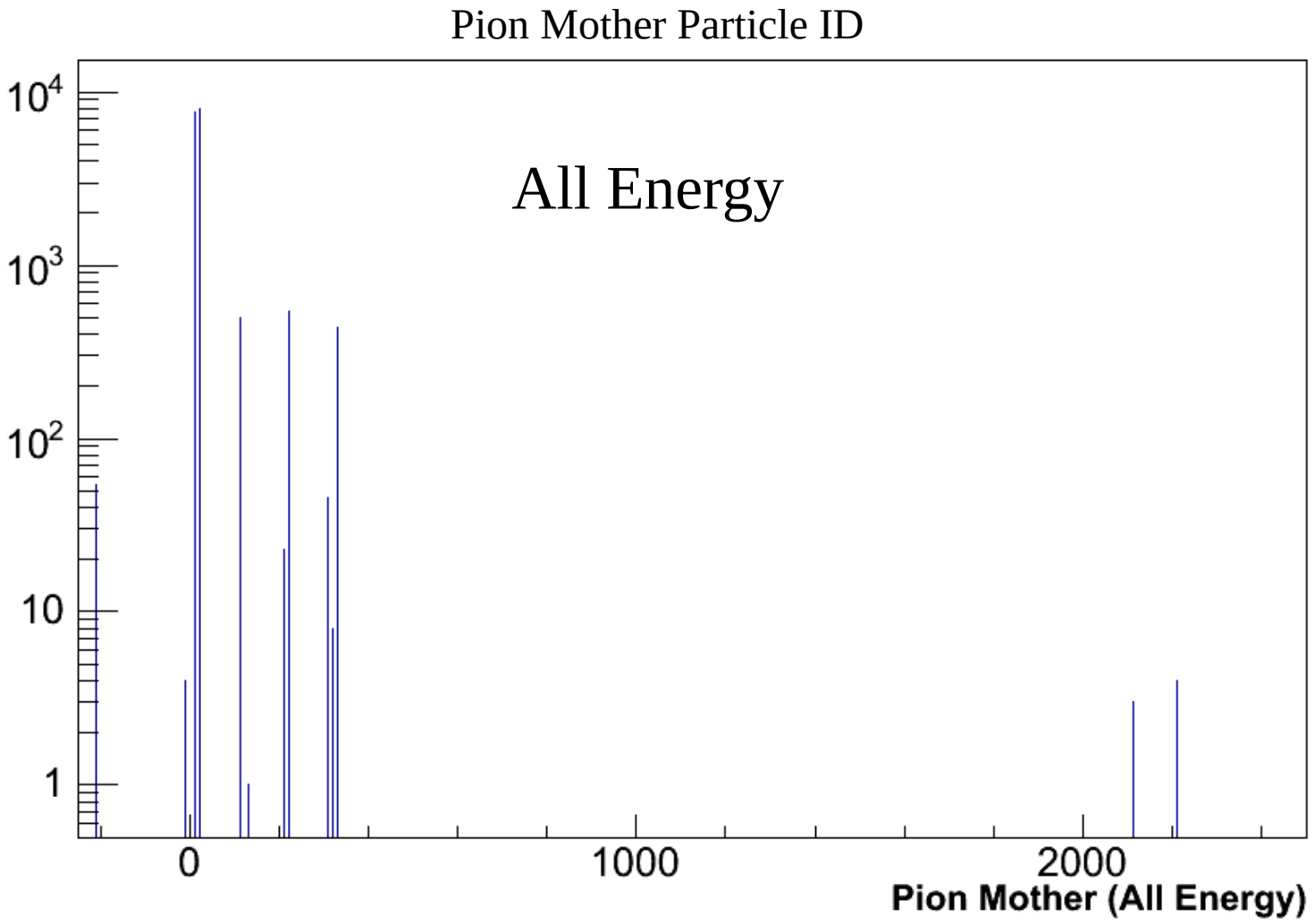

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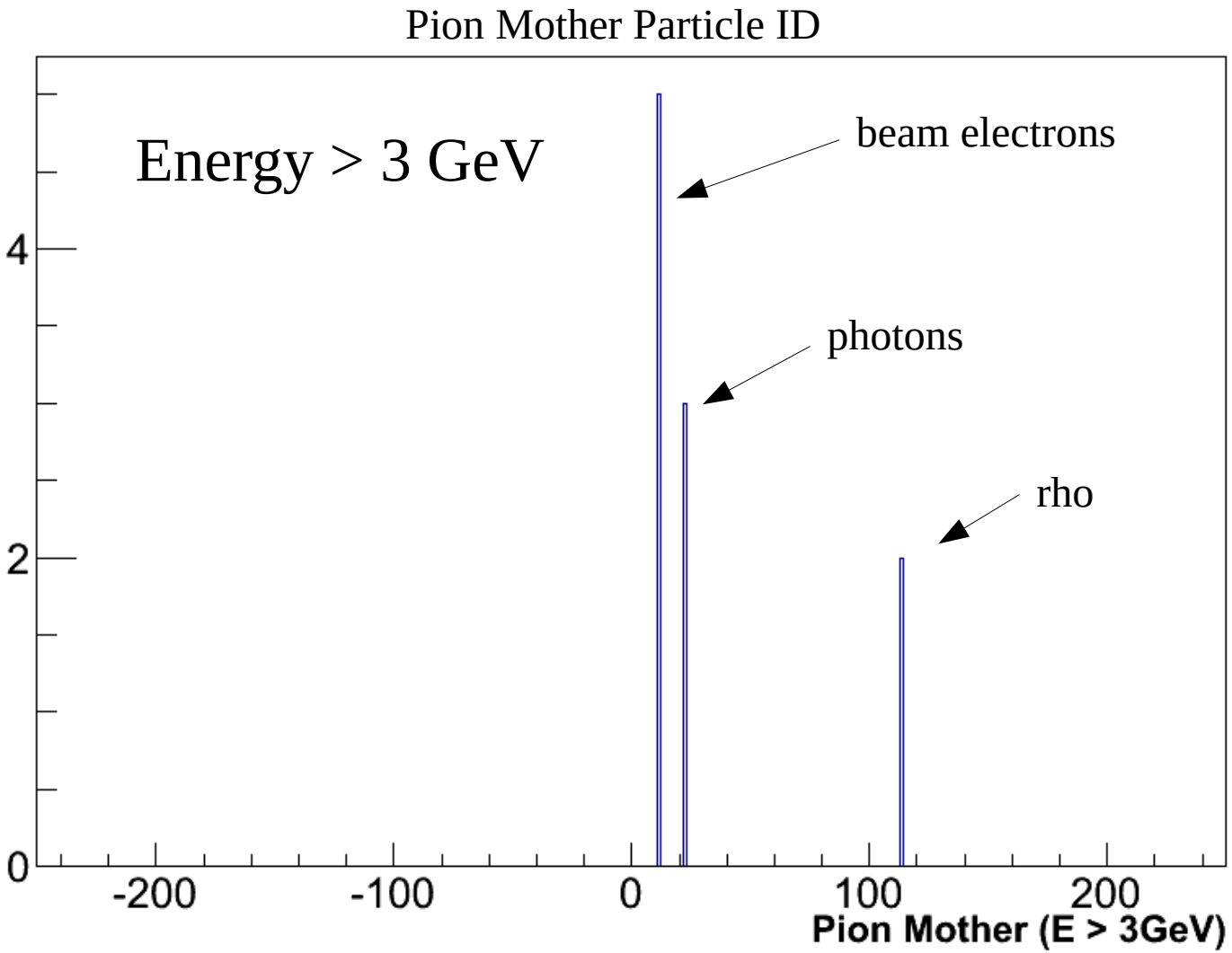

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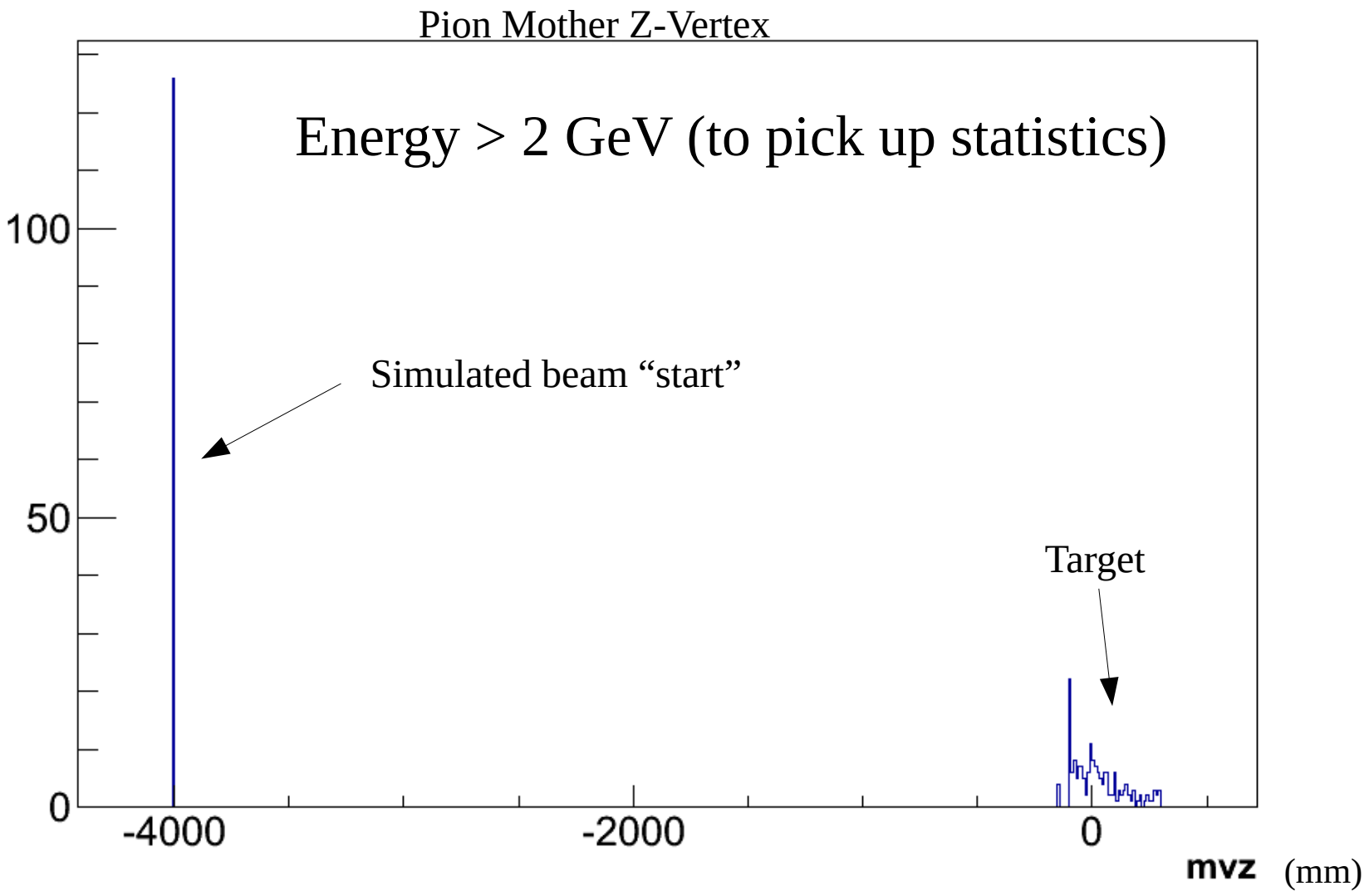

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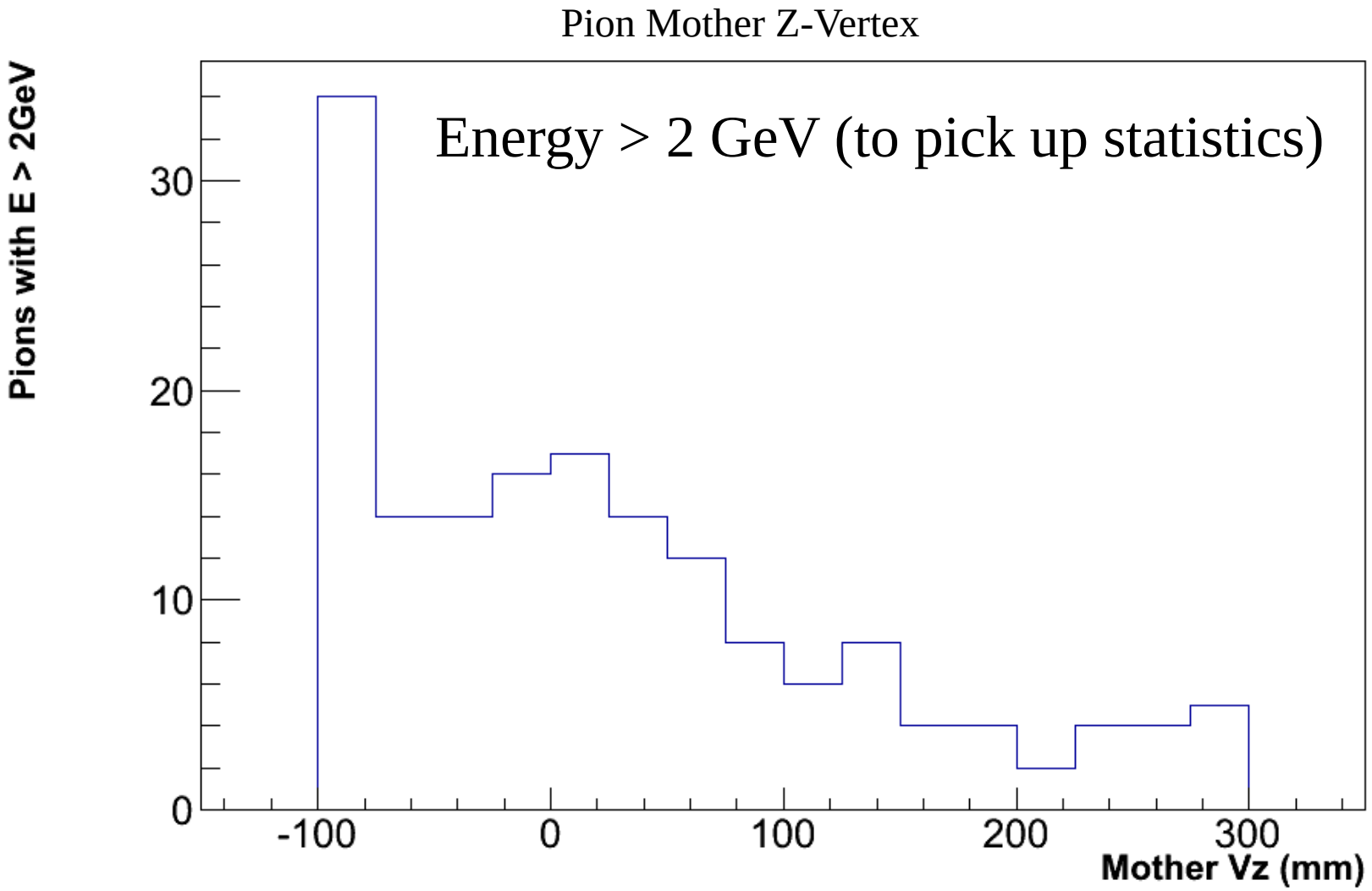
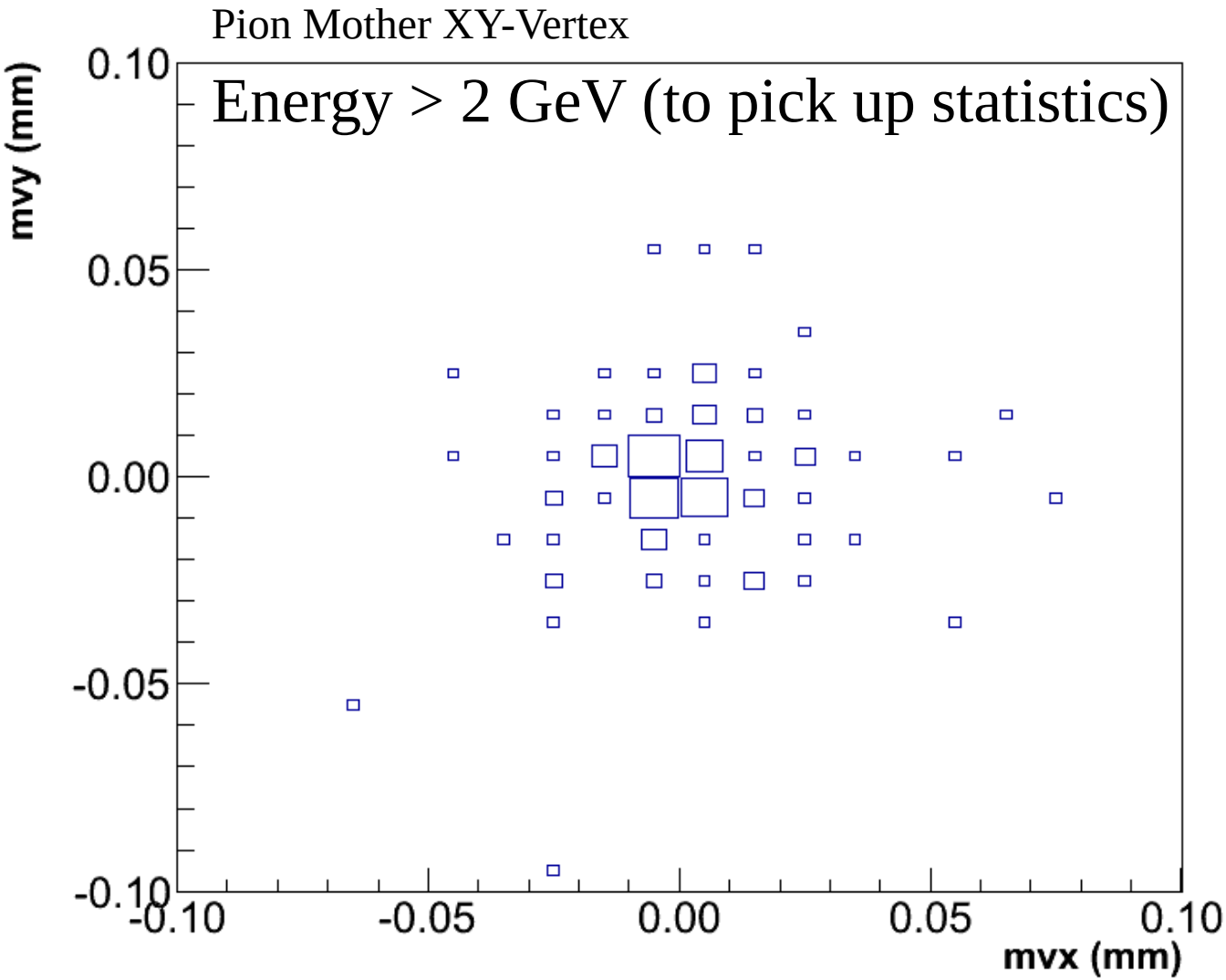


Total Background Rates: Cherenkov High Momentum Pions?

Raster not simulated.

- Events are close to center (not in walls).



Rates with photoelectron multiplicity triggers.

Rate per sector with cut on SINGLE pmt.

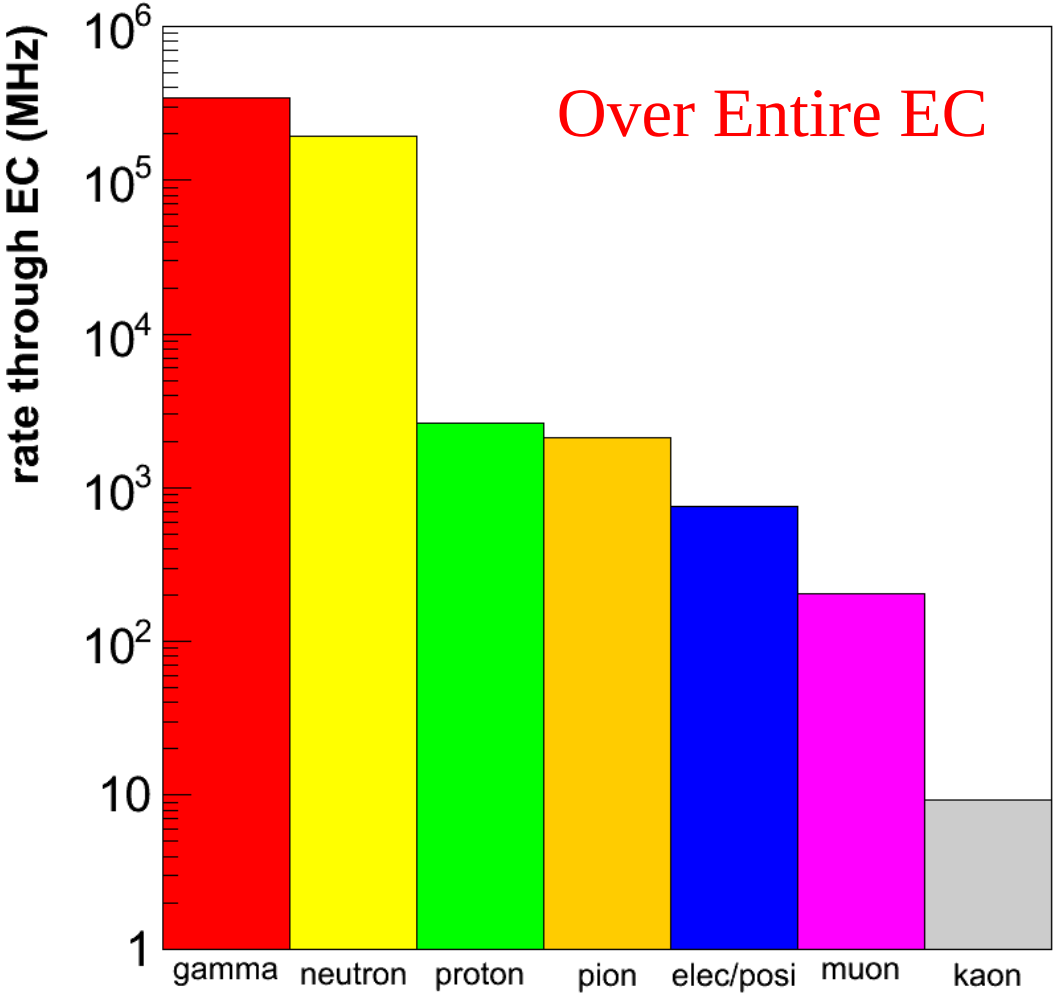
p.e. cut	1	2	3	4
Rate (MHz)	4.95	3.44	3.02	2.81

Rate per sector with cut on TWO pmt's in coincidence.

p.e. cut	1	2	3	4
Rate (MHz)	3.20	2.40	1.93	1.41

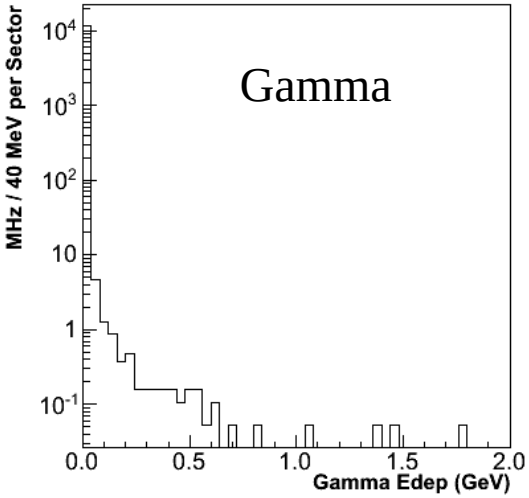
Background Rates: EC extrapolated

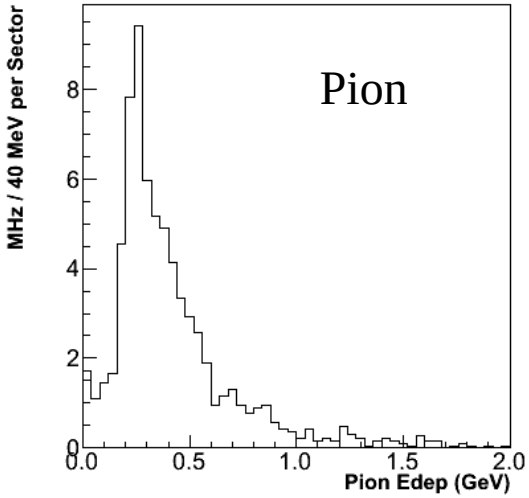
- The events through the cherenkov window are extrapolated to the EC window.
  - Assumes no additional interactions!
  - Must fall withing acceptance of EC.
  - Over ALL sectors.

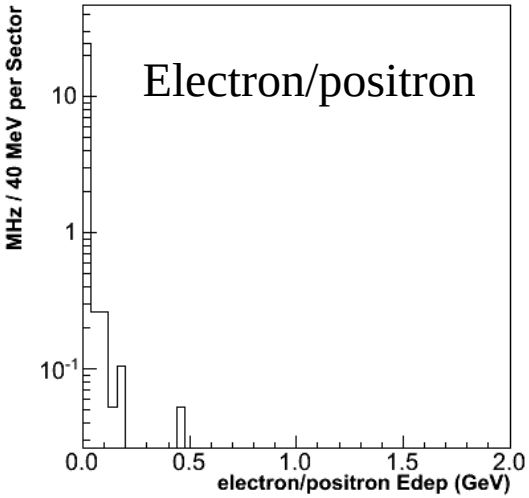


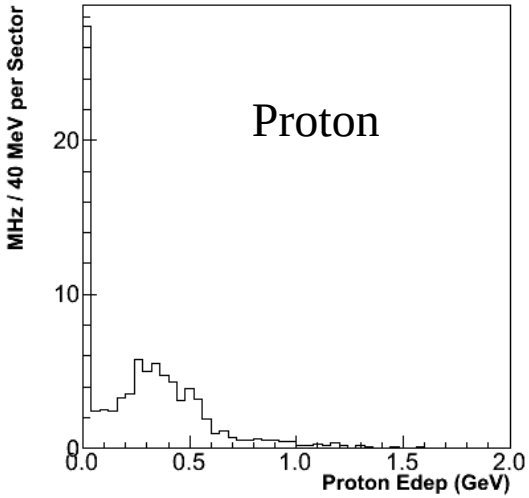
Background Rates: EC

- Now looking **PER SECTOR!**
  - Assuming some sort of sector matching is possible.
- Energy deposit (shower) in EC is parametrized (courtesy Jin) and energy rates are calculated.



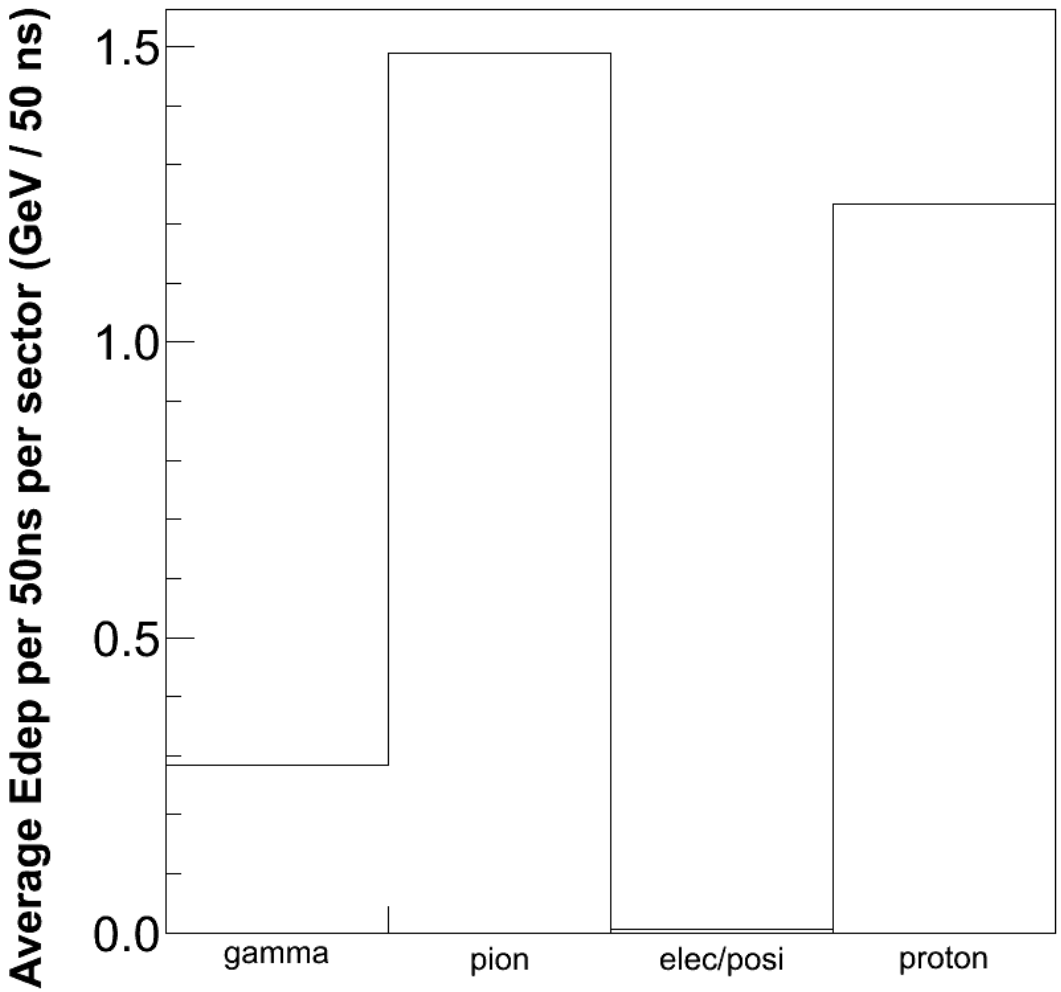






Background Rates: EC

- All rates are PER SECTOR.
- Assume a 50ns window (to start) for a coincidence between Cherenkov and EC.



	gamma	pion	elec/posi	proton
Avg Number:	575	3.5	1.25	4.2

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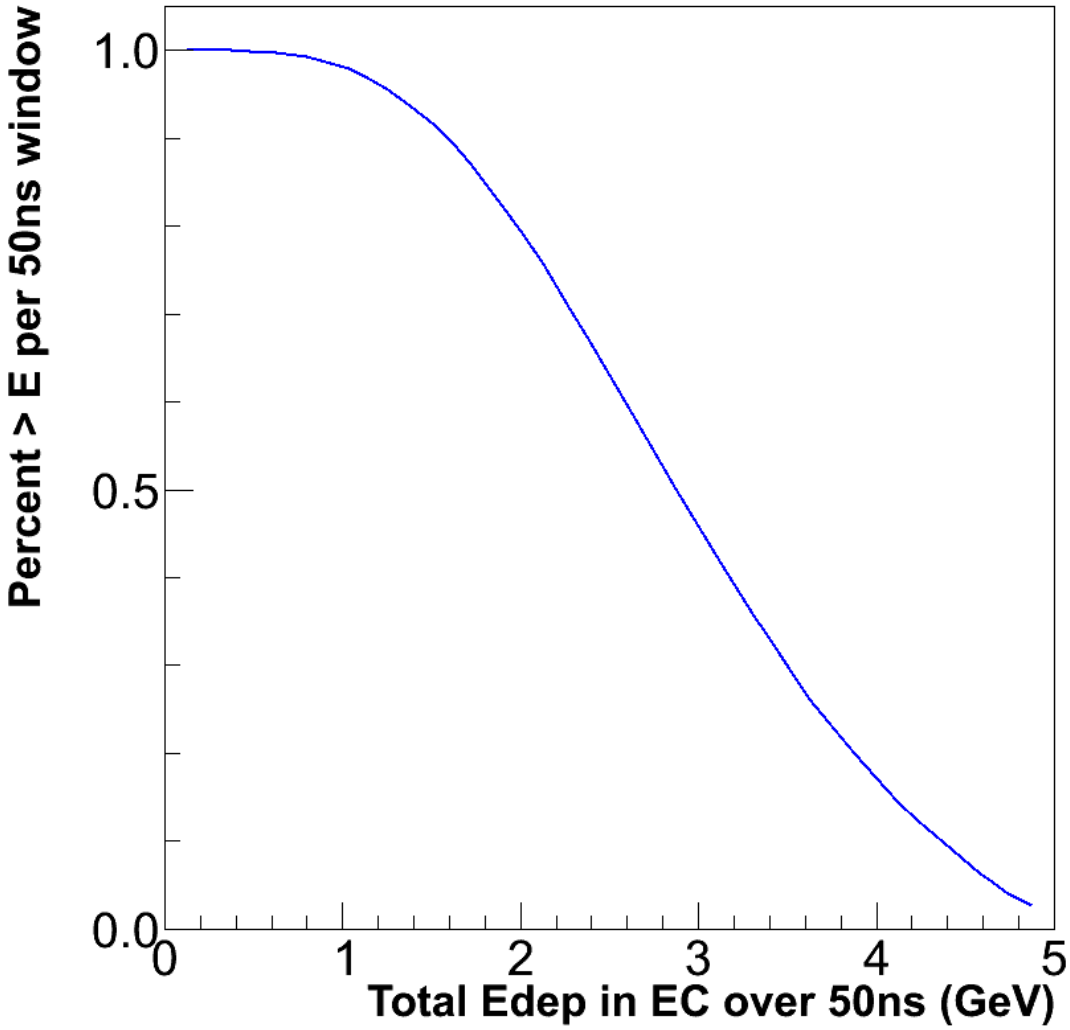
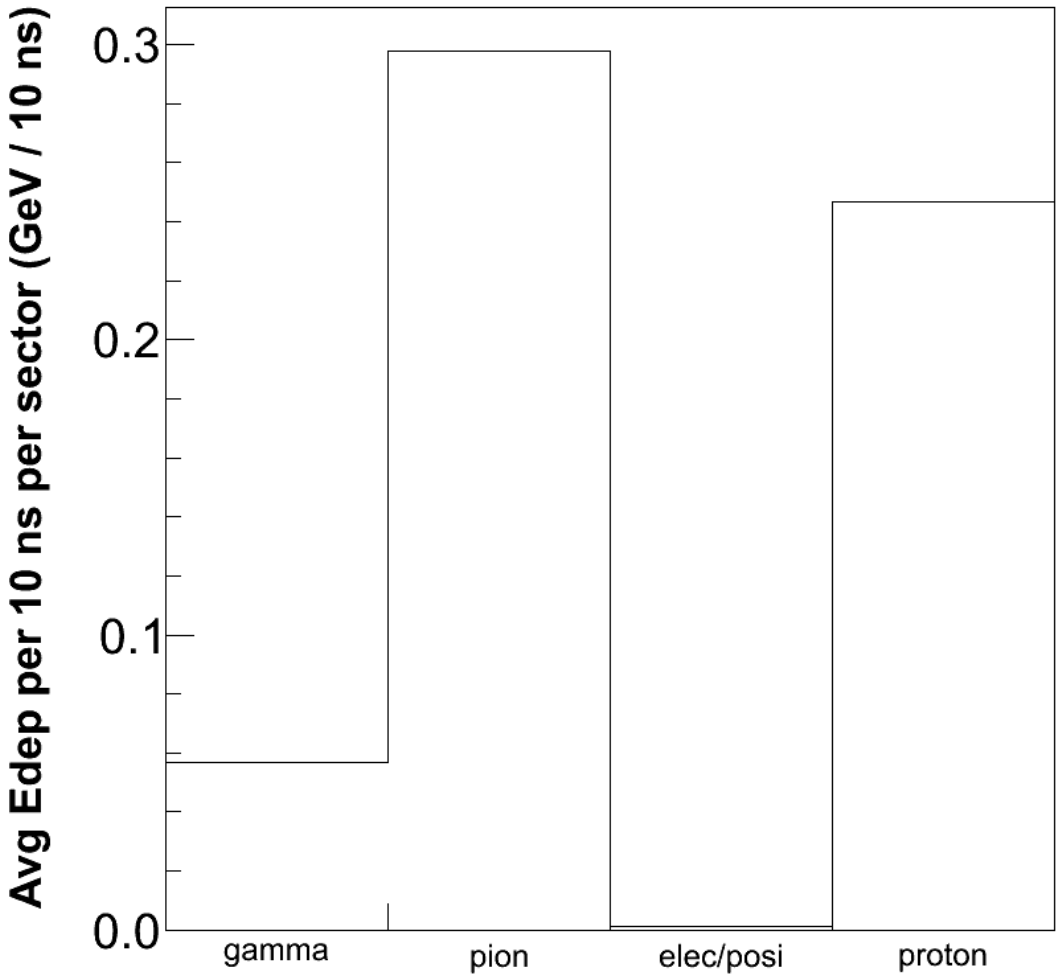


Background Rates: EC

- All rates are PER SECTOR.
- Assume a 10ns window.



Avg Number:	115	0.7	0.25	0.88

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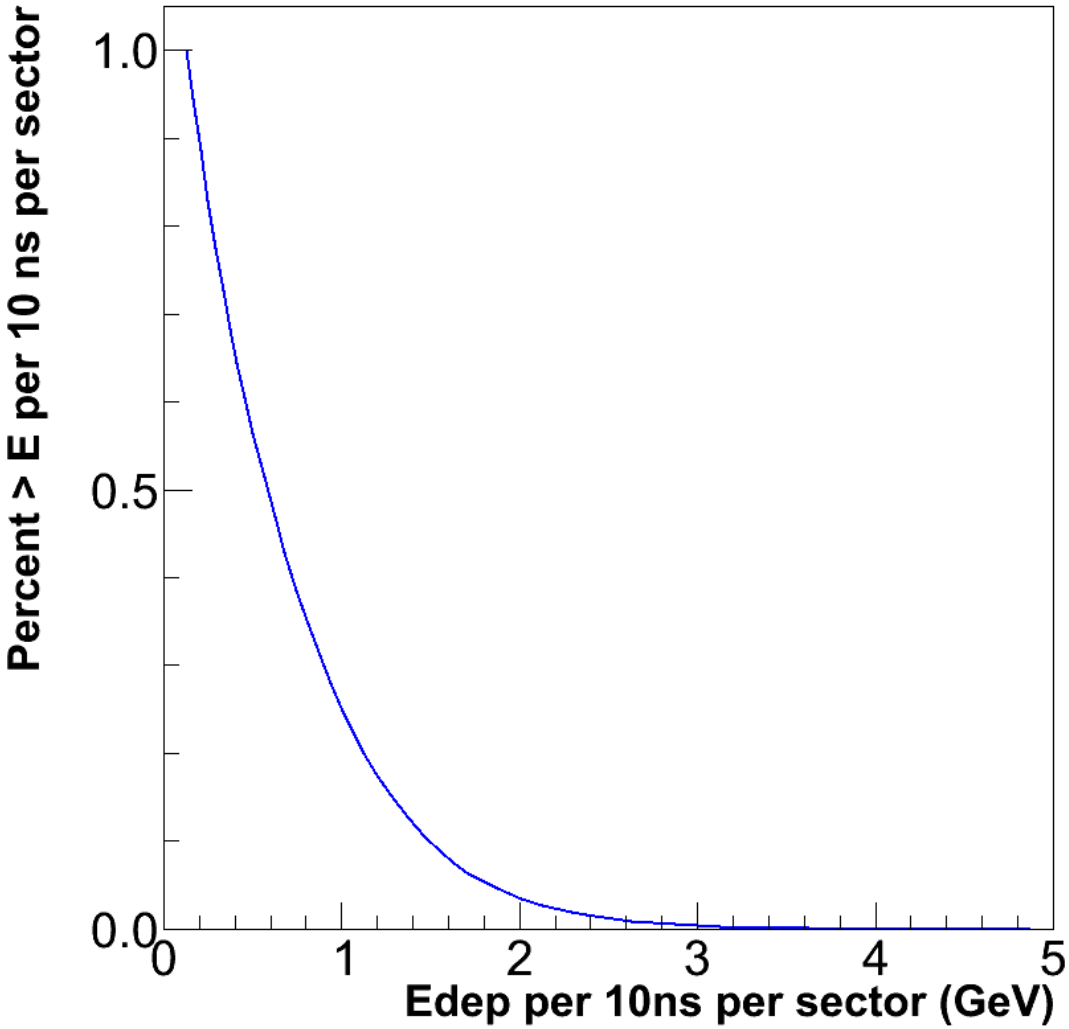

Backups