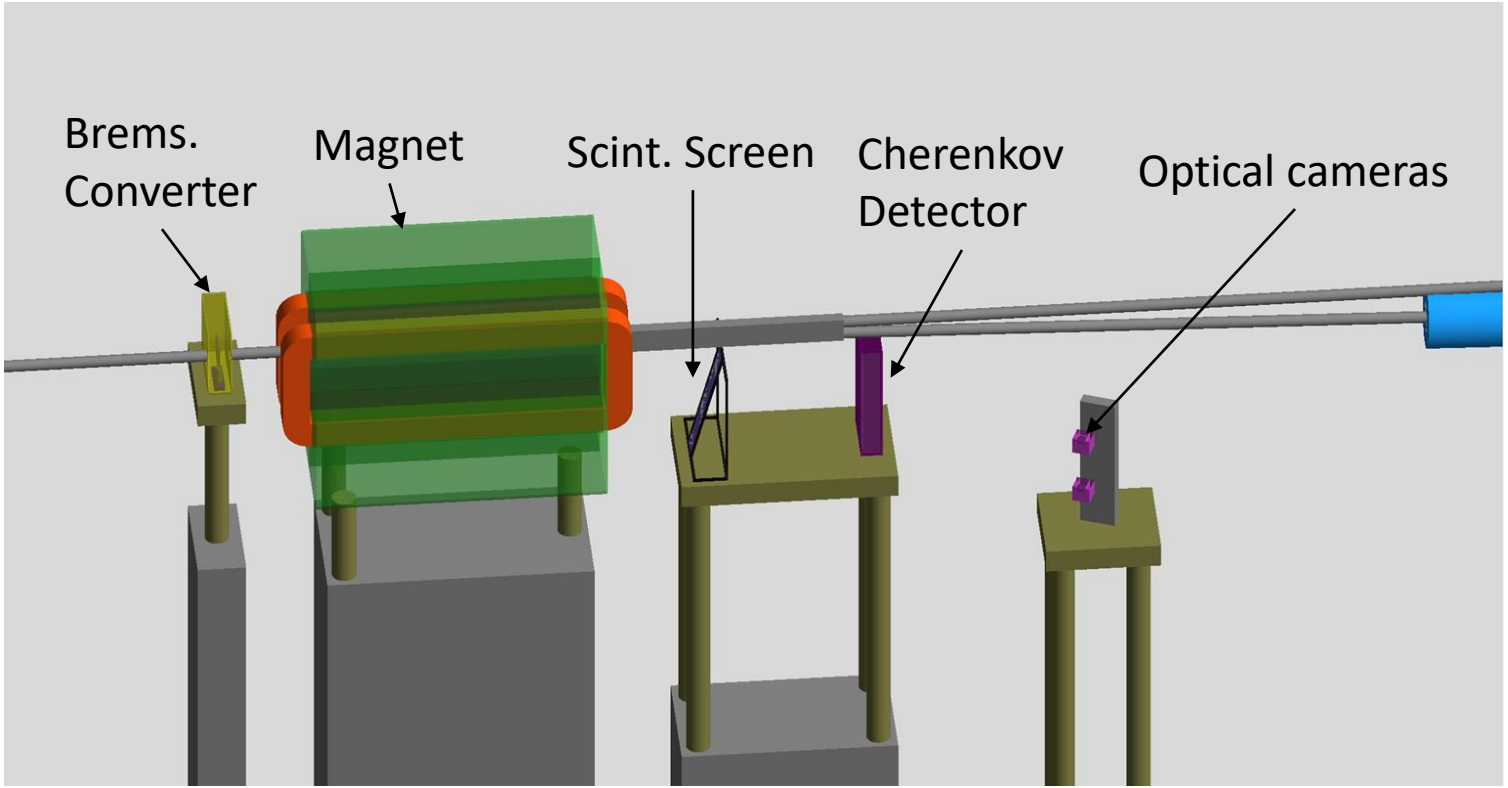
IBM Vacuum Chamber

IMPLEMENTATION OF A VACUUM CHAMBER IN THE INITIAL BREMSSTRAHLUNG MONITOR (IBM) PART OF THE LUXE EXPERIMENT

By Luke Hendriks - UCL

Current Set-up of IBM



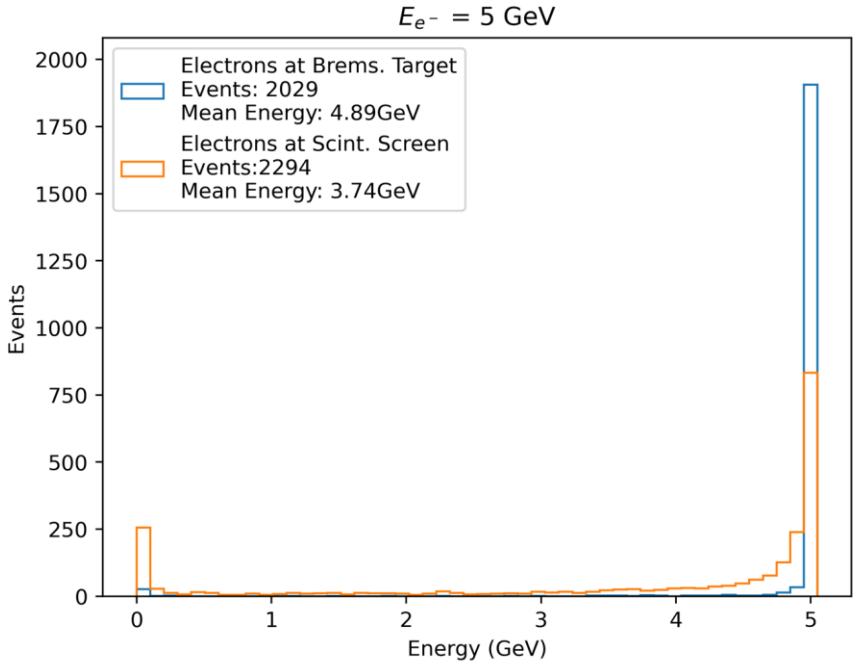
Problem with the Beam Pipe

- Want to measure deflected electrons in γ-laser mode
- In order to measure photon spectrum: $E_\gamma = E_{beam} - E_{electron}$
- Want to do it as precisely as possible

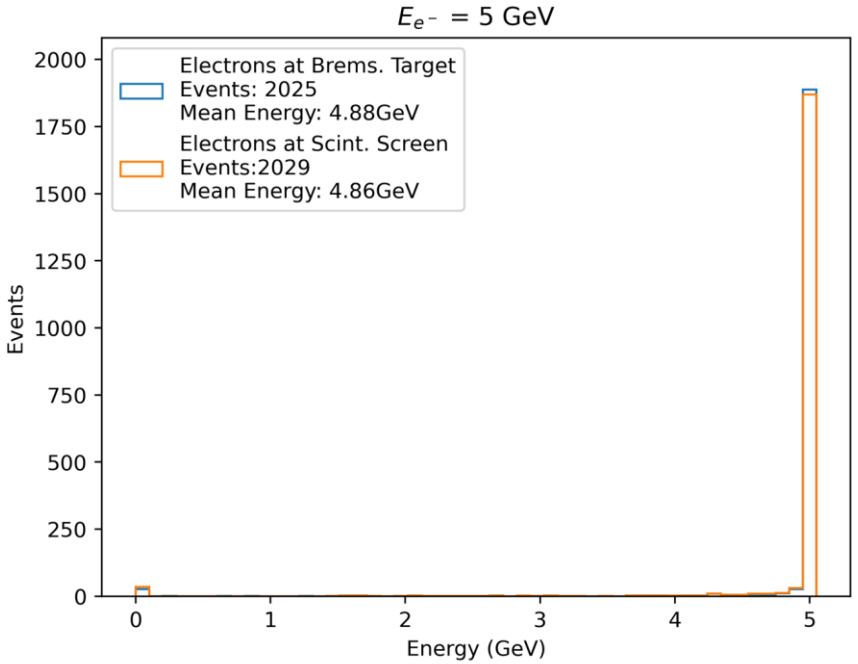
Problem with the Beam Pipe

- Beam Pipe main component of energy loss

IBM with Beam Pipe

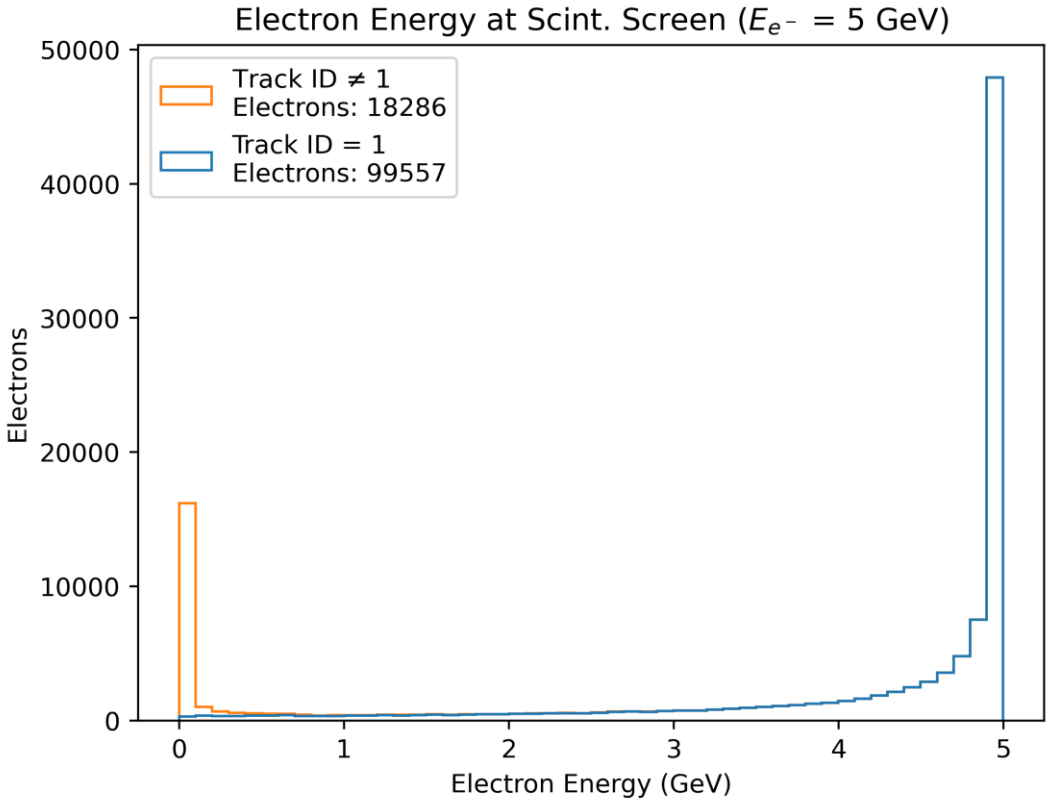


IBM without Beam Pipe

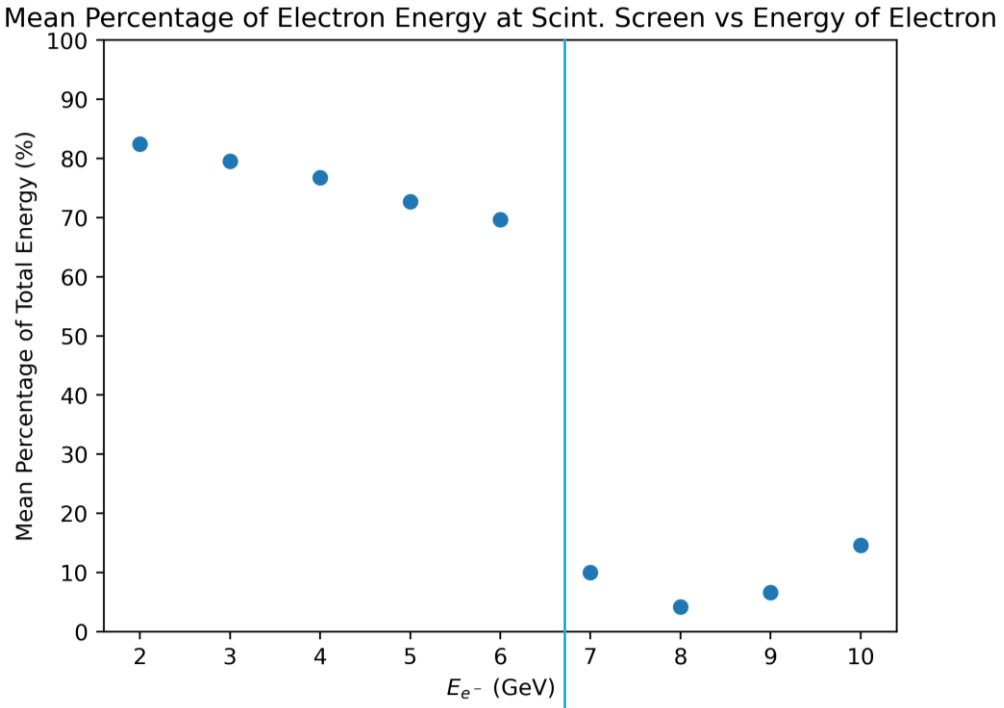


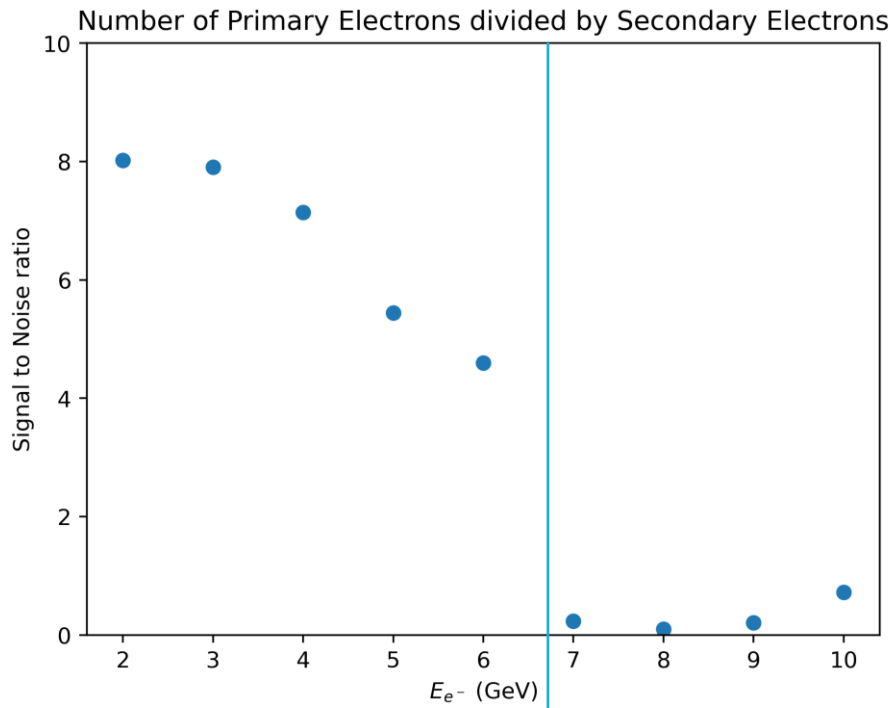
Problem with the Beam Pipe

- Track ID = 1: Initial electrons (100k)
- Track ID ≠ 1: Electrons created in secondary processes



Problem with the Beam Pipe



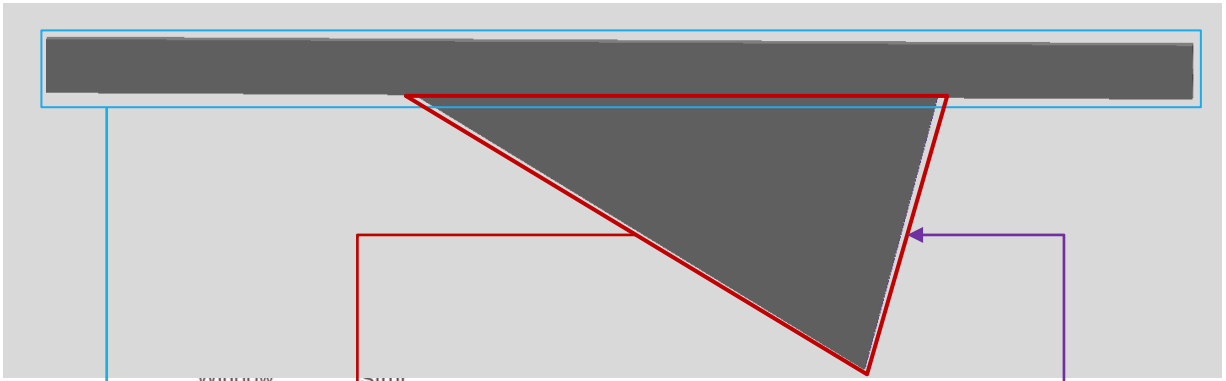


Upper Edge of Scint. Screen

Creating the Vacuum Chamber

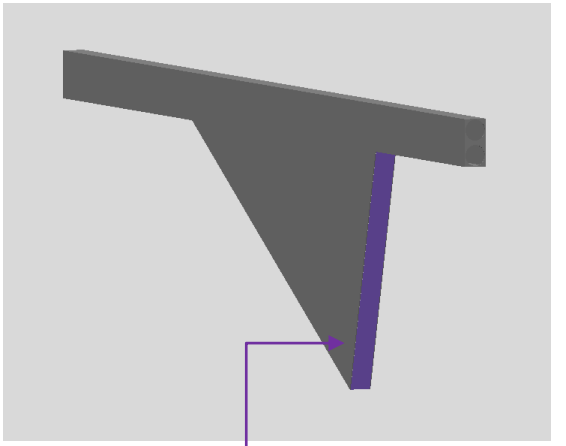
- Vacuum Chamber design inspired by AWAKE Vacuum Chamber after Louis's suggestion

Side View



AWAKE Vacuum chamber assembly with an optional strut.
SPSVCW__0082, N. Chritin

Front View at an Angle

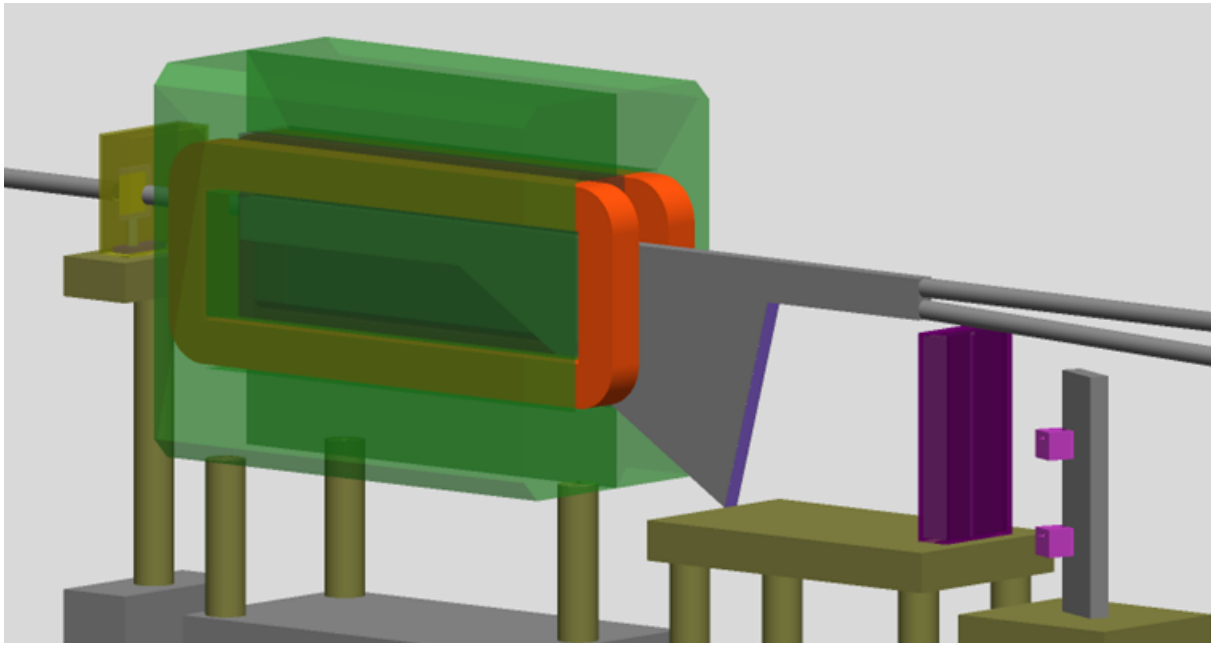


Vacuum Chamber Addition

Original Beam Pipe

Scint. Screen

Creating the Vacuum Chamber

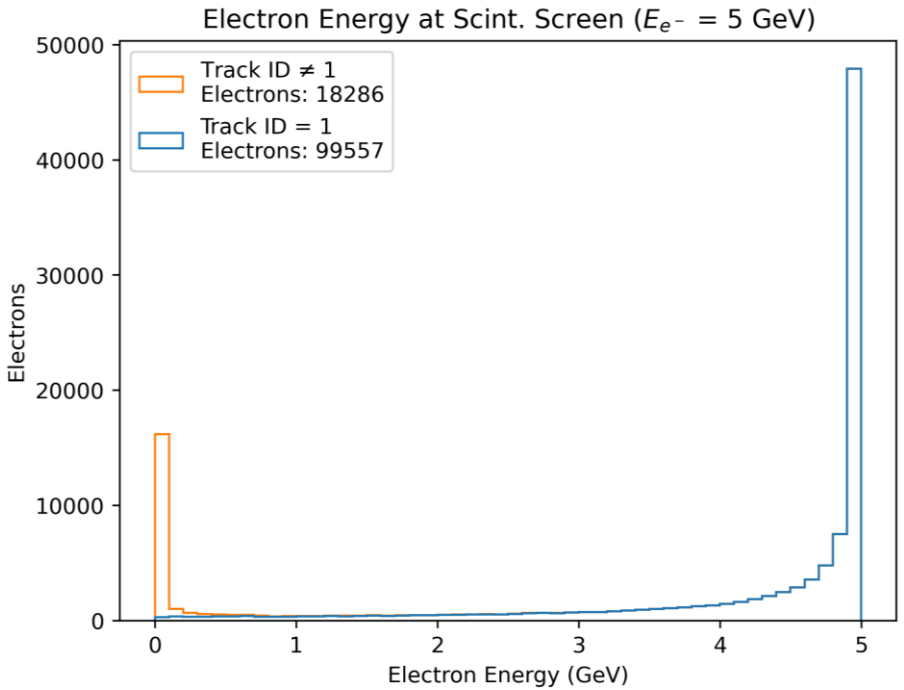


- Scint. Screen at same position & angle
- Made it thinner to fit beam pipe width
- Elongated so screen reaches beam pipe

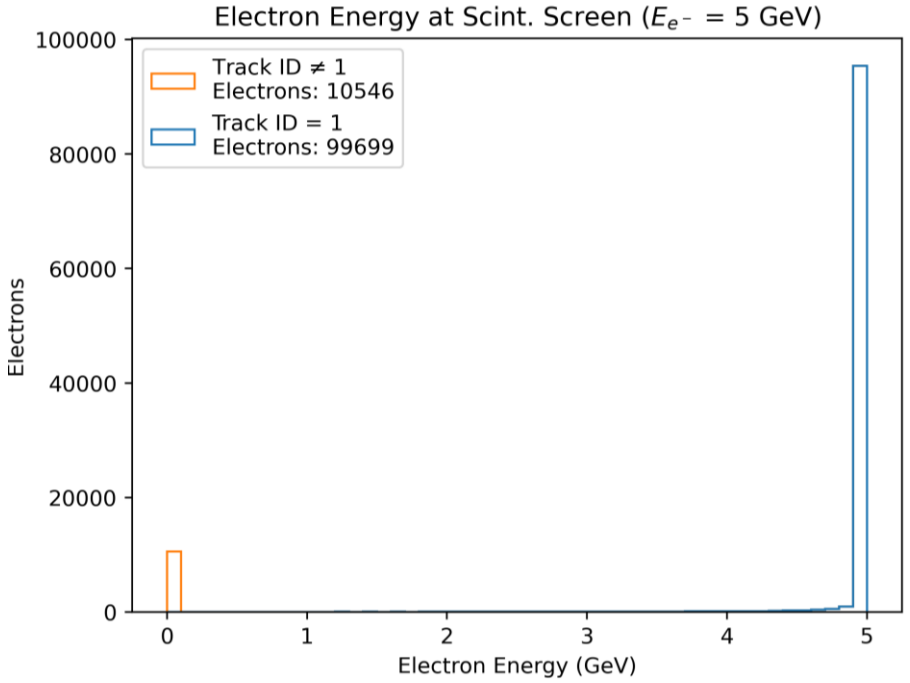
Results after implementing Vacuum Chamber

Initial no. electrons: 100k

No Vacuum Chamber

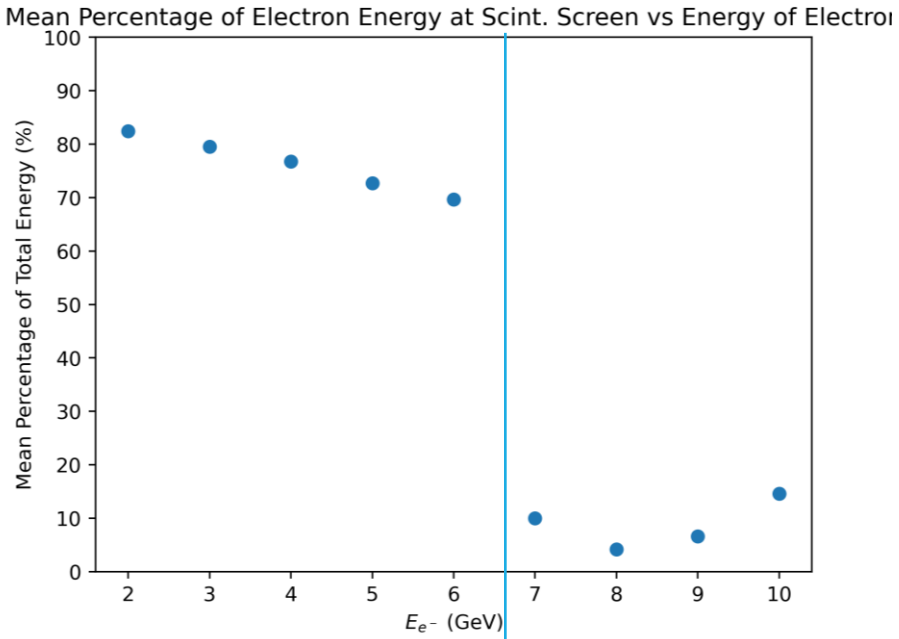


Vacuum Chamber

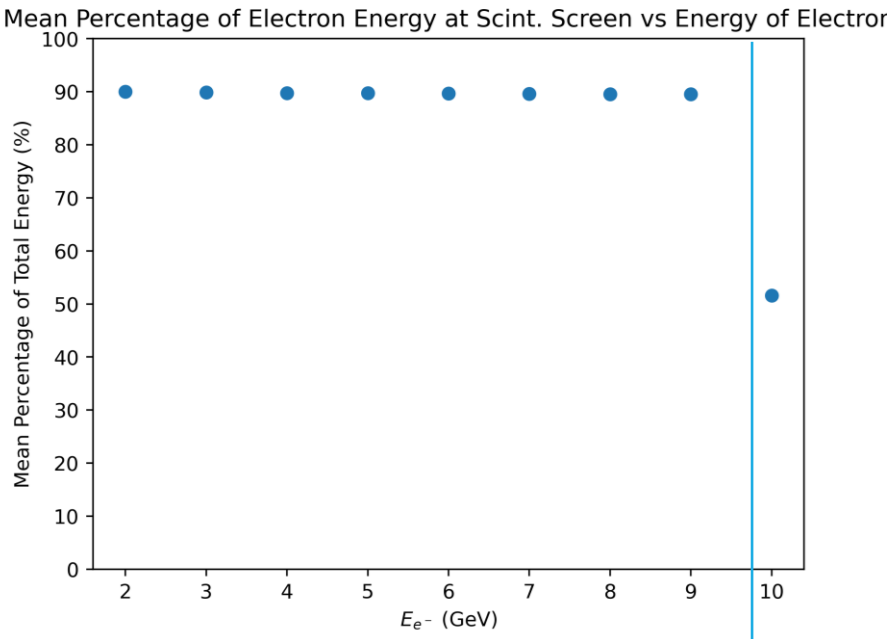


Results after implementing Vacuum Chamber

No Vacuum Chamber



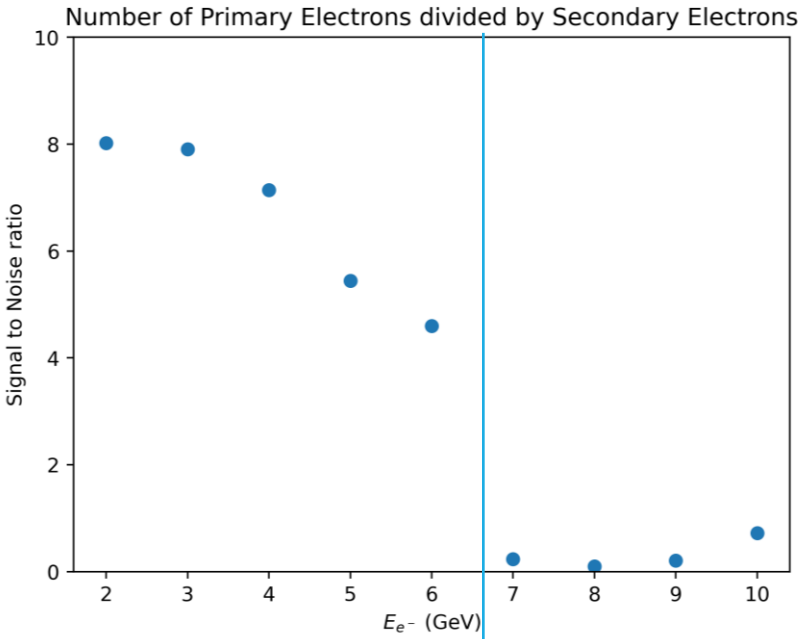
Vacuum Chamber



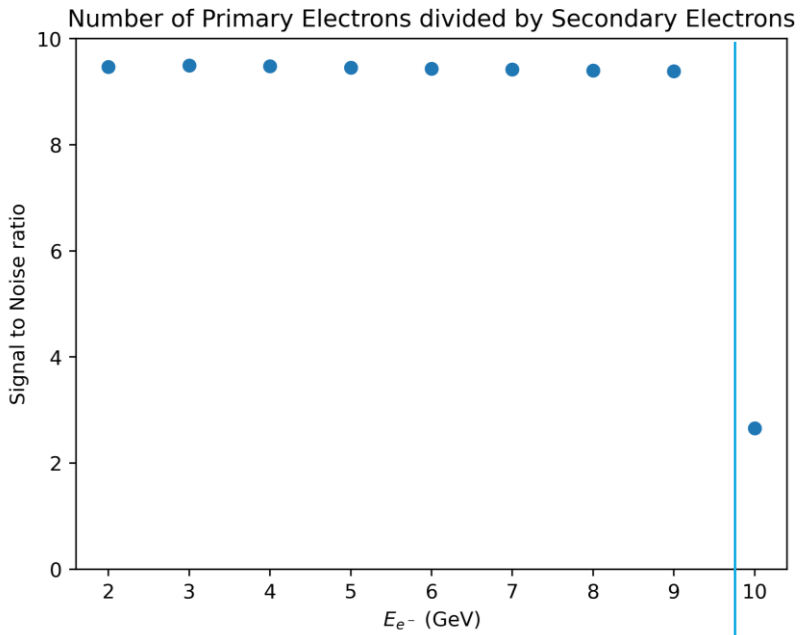
Upper Edge of Scint. Screen

Results after implementing Vacuum Chamber

No Vacuum Chamber

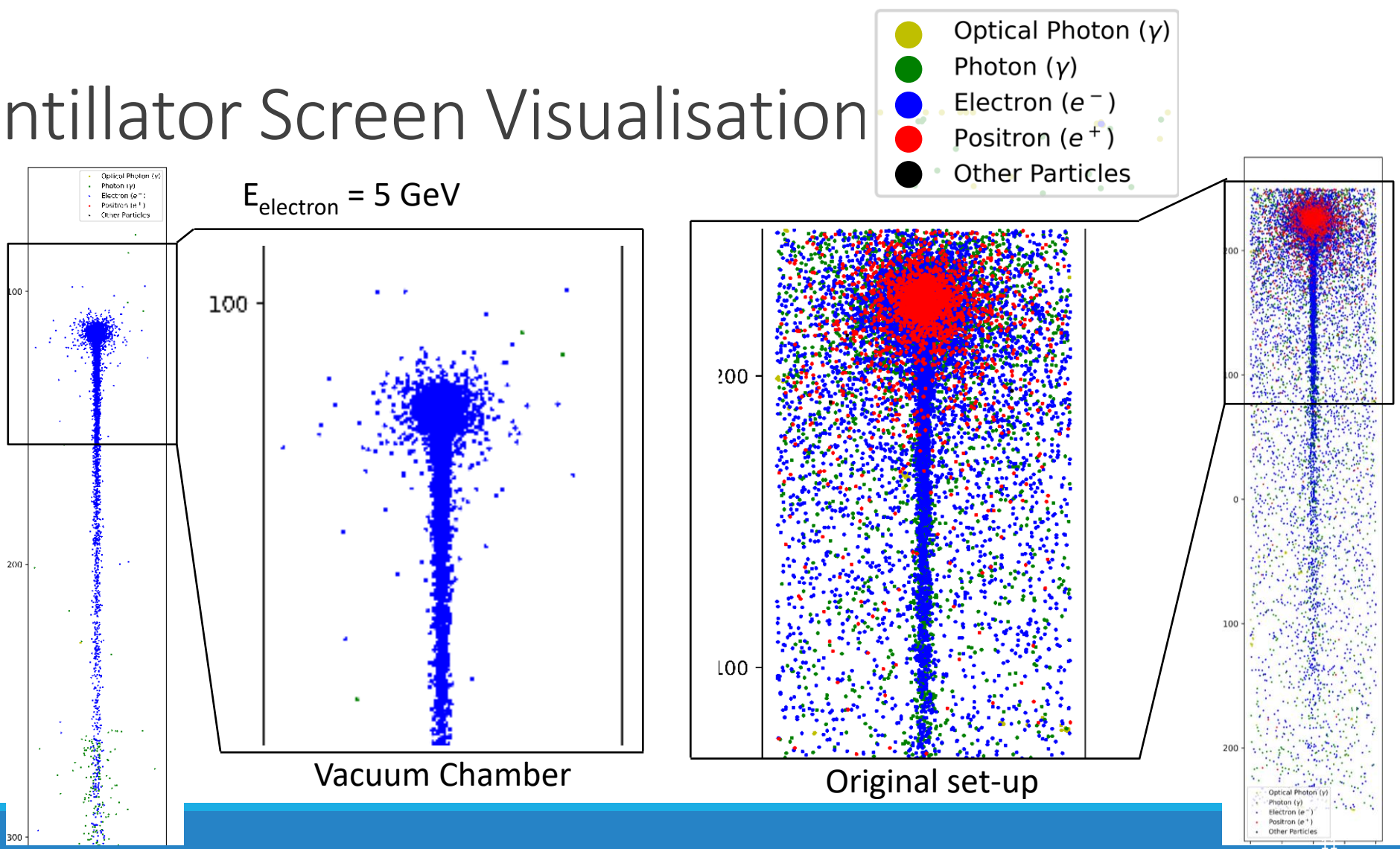


Vacuum Chamber



Upper Edge of Scint. Screen

Scintillator Screen Visualisation



Conclusion

- A vacuum chamber in the IBM is necessary to accurately measure the electrons to determine the energy of the photons
- This vacuum chamber is very good at preserving the energy and increases SNR (less secondary electrons)
- Limitations
  - Unsure if structurally strong, probably needs reinforcing
  - Did not yet fully study the other particles (e.g. positrons) hitting the scintillator screen
  - Not yet studied what would be observed in the Cherenkov detector