UPDATES ON HiDRa ANALYSIS

7/9/22

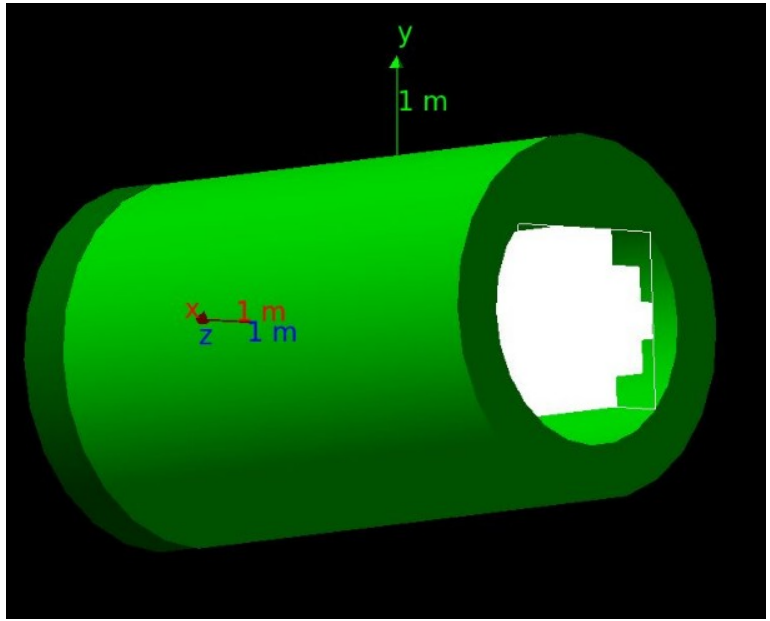
UPDATES ON LEAKAGE COUNTER

- **Problems with old leakage counter:**

  sphere with ~7m radius

  comes out from Geant4 World

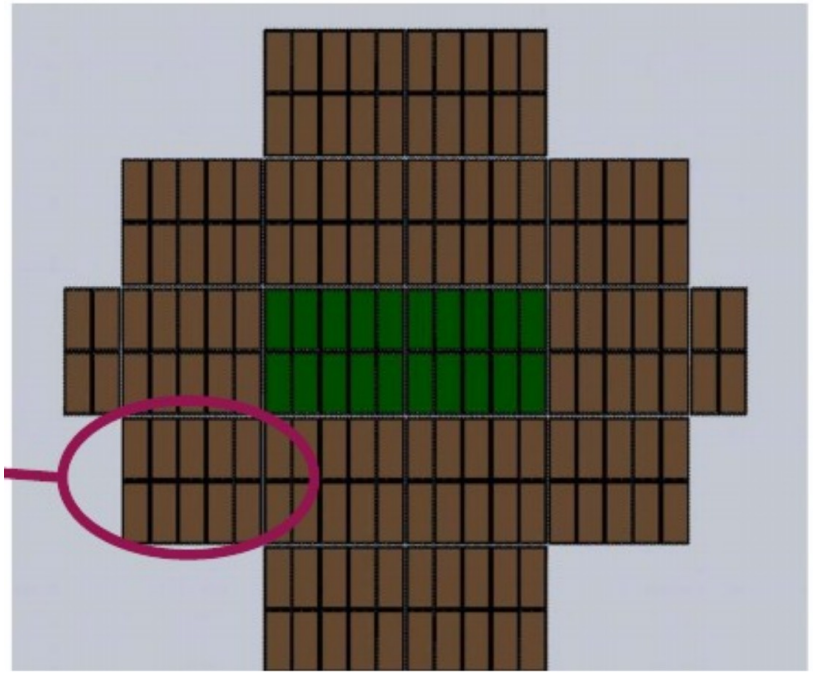
$$E_{Contained} + E_{Leaked} \neq E_{Beam}$$



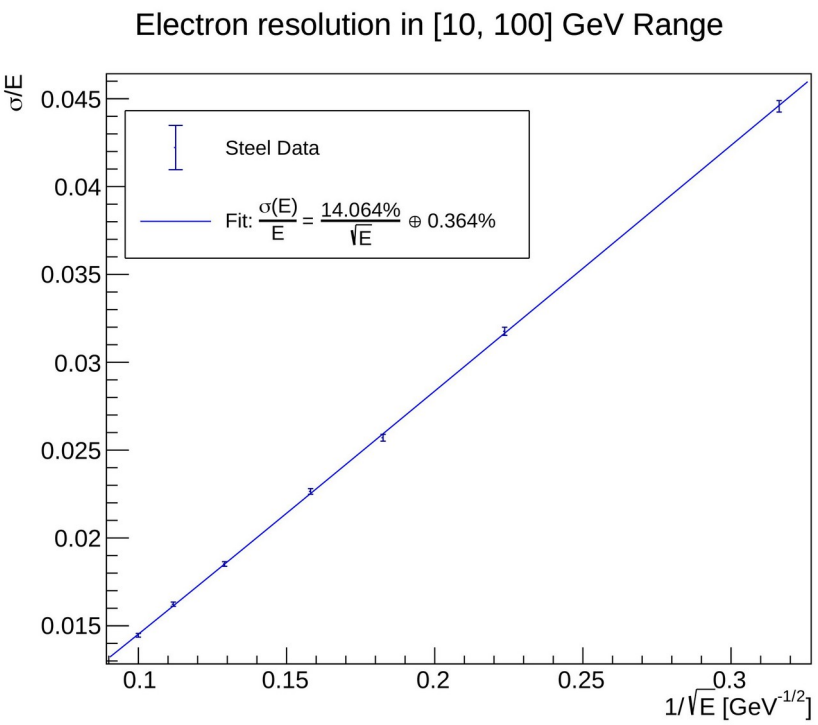
- **New leakage counter by Giacomo:**

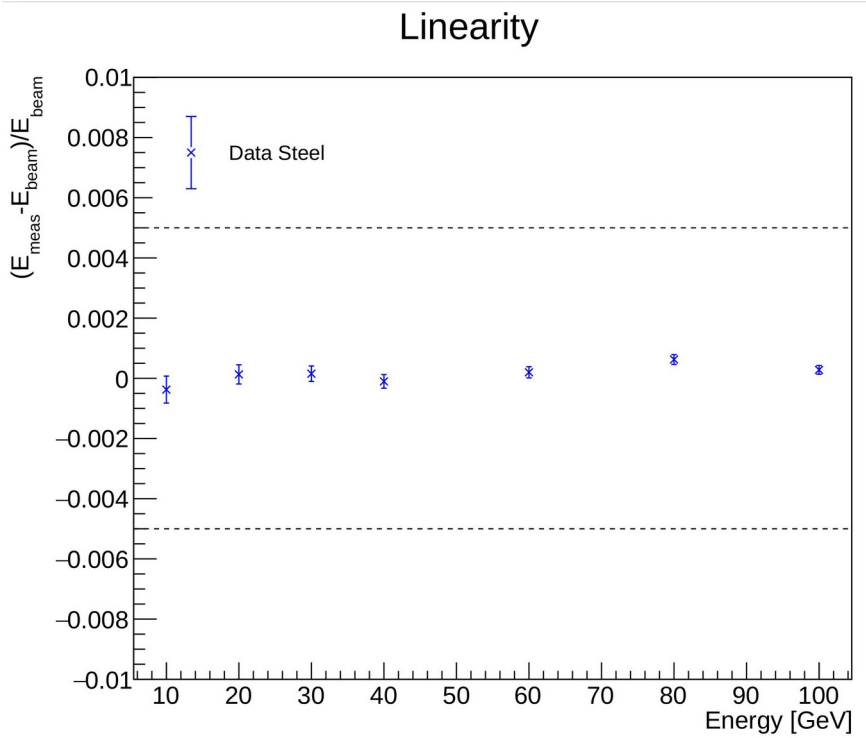
SETUP

- Standard Setup: 84 modules, Depth 2500 mm
  Rotation of 2.5° in both X and Y directions
  1mm fiber diameter
  Steel absorber material
- Checked differences with 2000 mm depth
- Tried out different configurations to increase containment for pions:
  “newGeo” ⇨ 104 modules
  “fullCont” ⇨ 480 modules



ELECTRON PERFORMANCE

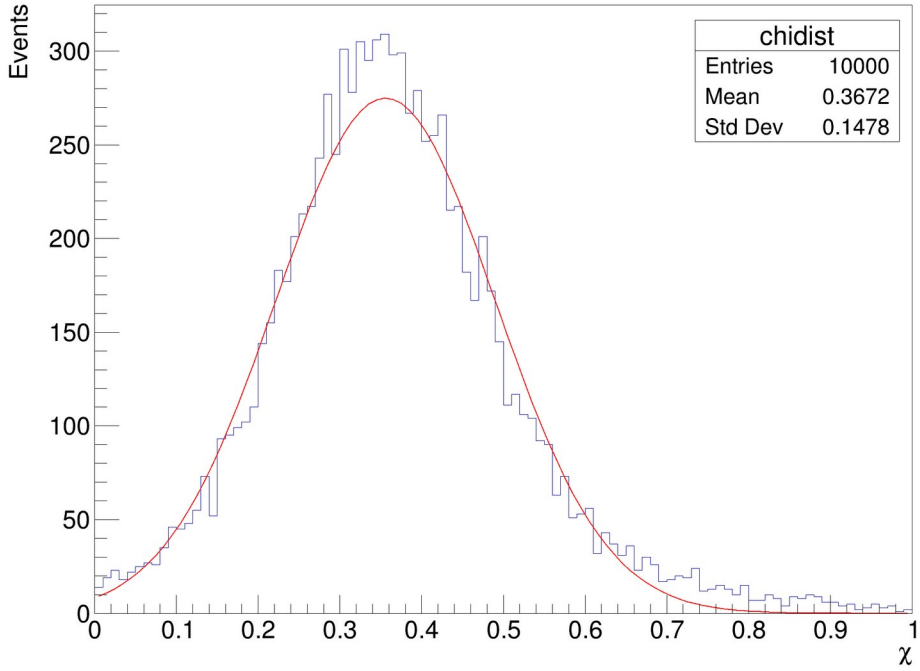




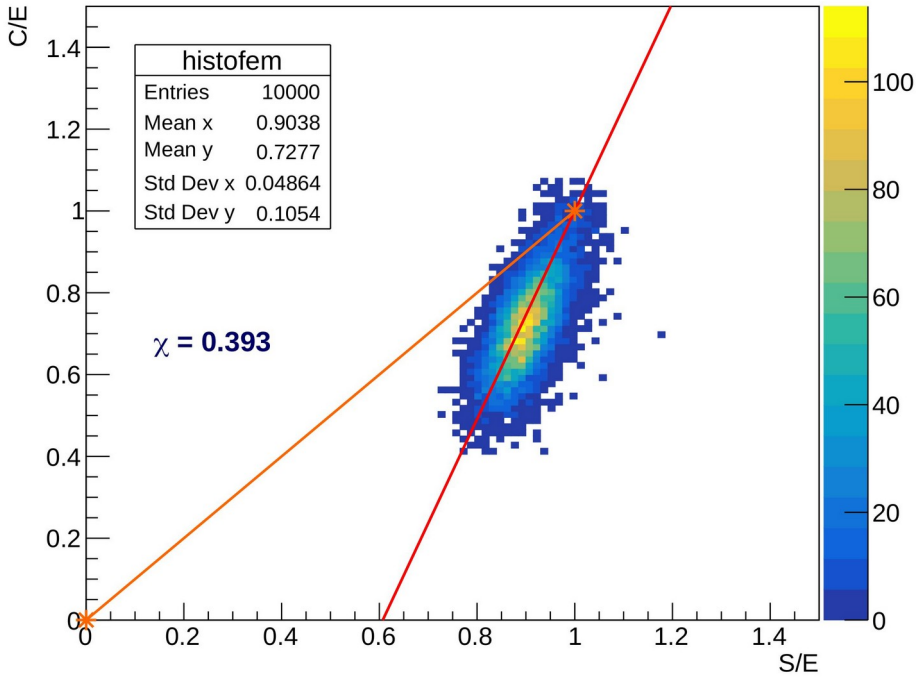
Extracted phe/GeV ratio as the mean of the ratios obtained at each energy

PION PERFORMANCE: chi factor

Two ways to extract χ factor:



40 GeV set



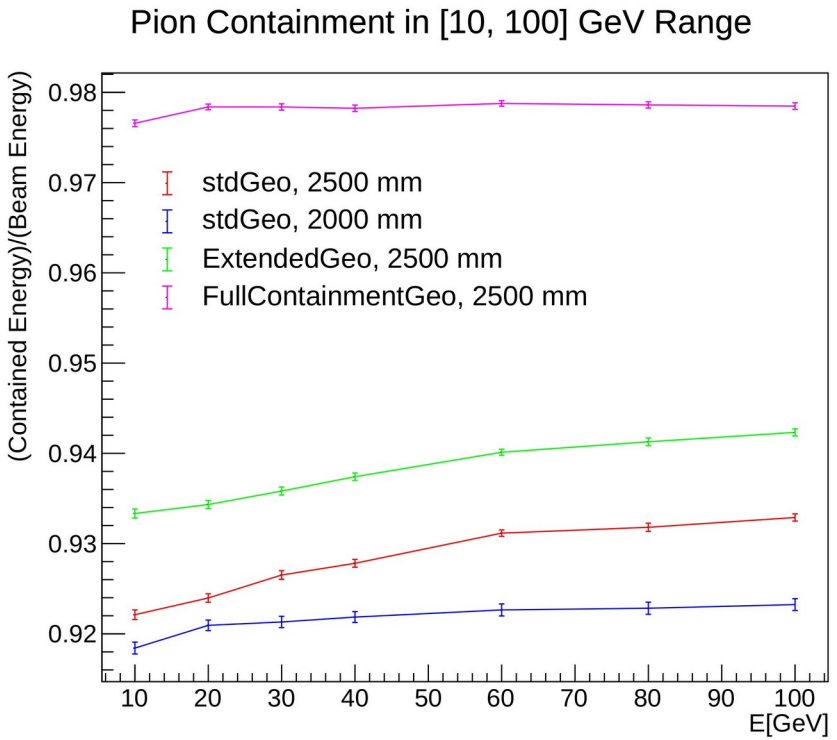
$$\chi = \frac{S-E}{C-E}$$

Following plots are obtained with χ obtained with the first method

PION PERFORMANCE: Containment

$$Containment = \left(E_{beam} - E_{leak} \right) / E_{beam}$$

$$E_{reco} = \frac{\left(1/containment\right) \cdot \left(S - \chi \cdot C\right)}{\left(1 - \chi\right)}$$

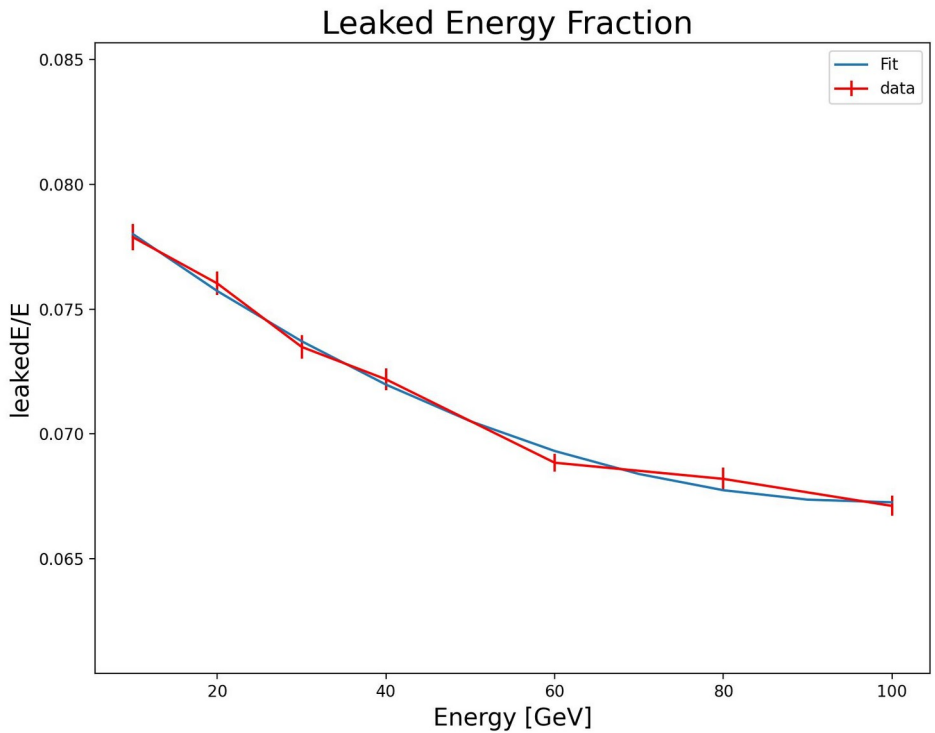


PION PERFORMANCE: Containment

$$Containment = \left(E_{beam} - E_{leak}\right) / E_{beam}$$

$$E_{reco} = \frac{\left(1/containment\right)\cdot\left(S - \chi\cdot C\right)}{\left(1-\chi\right)}$$

Previous presentations: containment taken as mean value of different energy datasets
This time: interpolate containment at each energy from fit



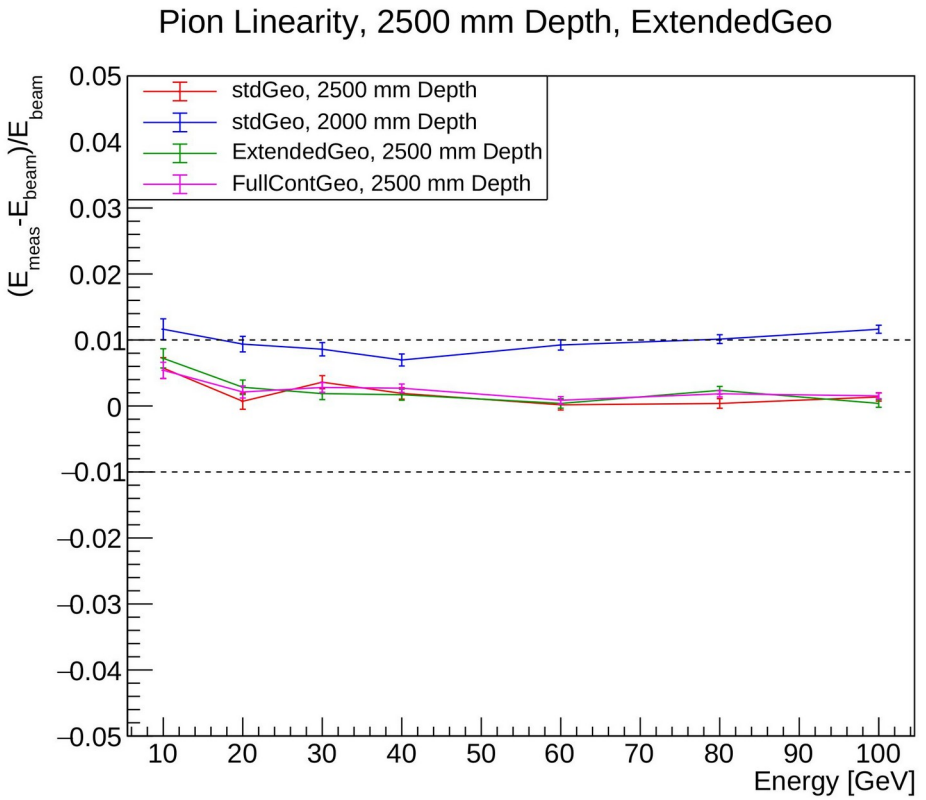
PION PERFORMANCE

Calibration with 40 GeV pion beam:

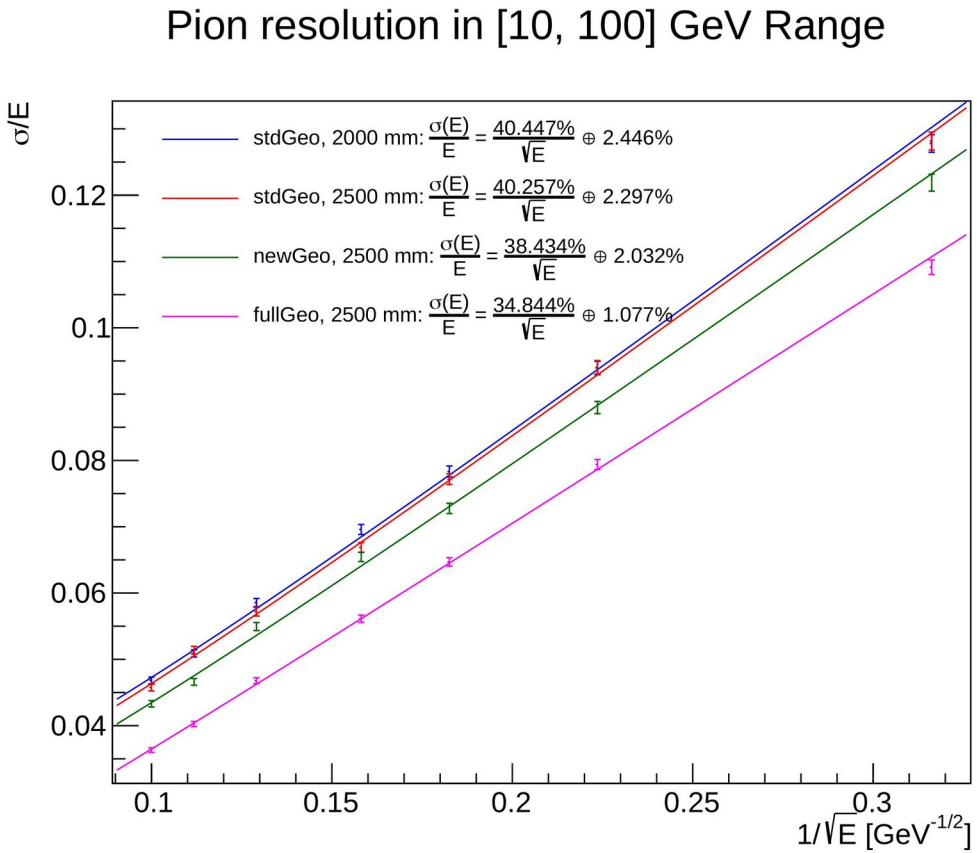
- Phe/GeV for S and C fixed with electrons
- χ taken from 40 GeV set for each geometry
- Containment at 40 GeV extracted from fit

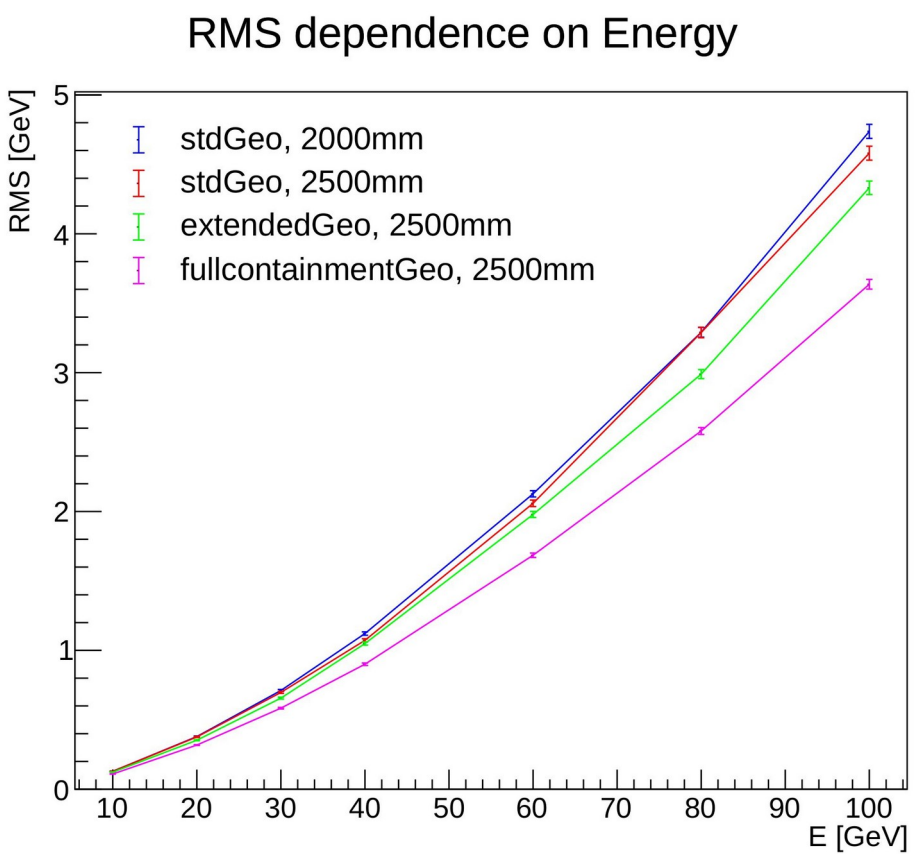
⇨ Expect reconstructed energy to be exactly 40 GeV

Non-gaussian leakage leads to faulty reconstruction (worse on 2000 mm deep calo, more on that later)

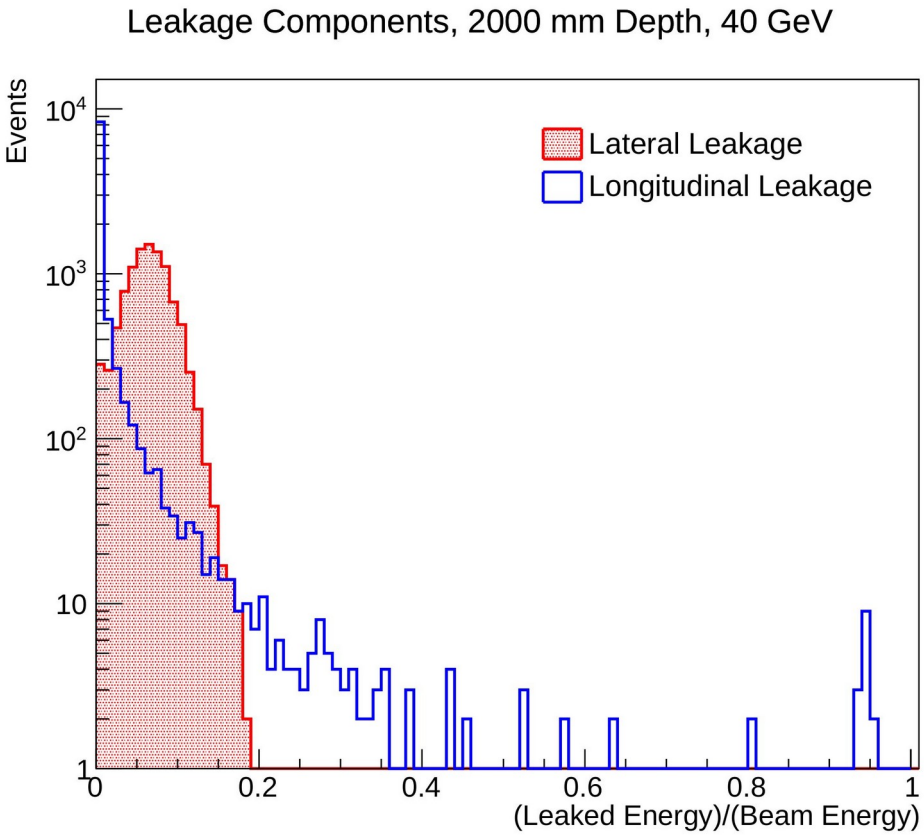


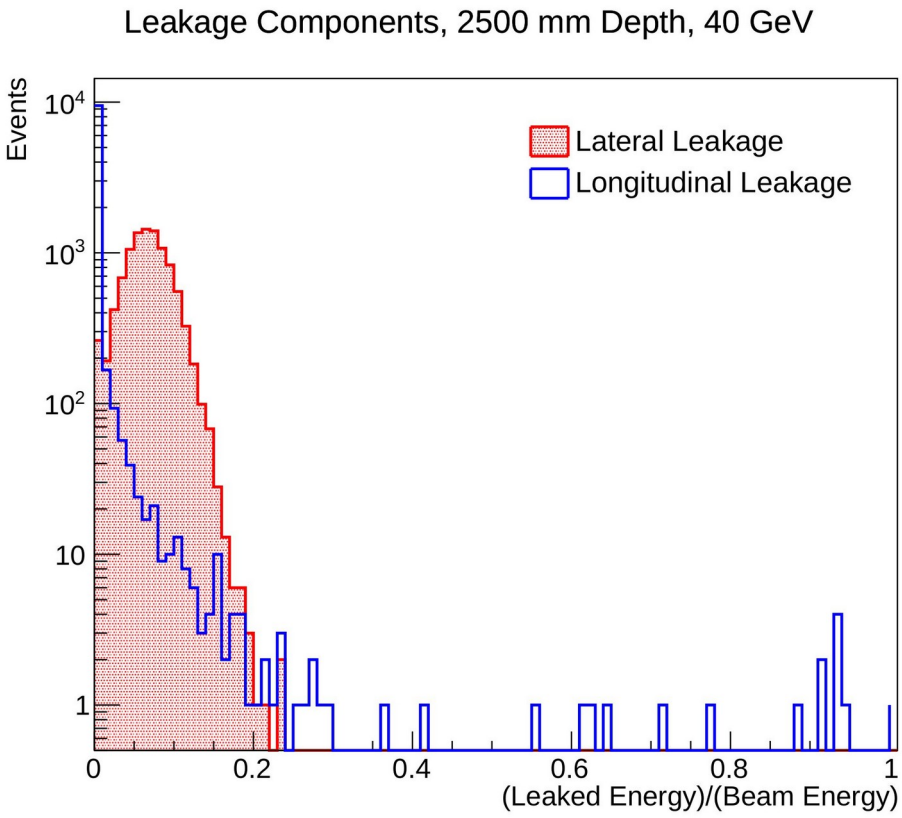
PION PERFORMANCE: Resolution





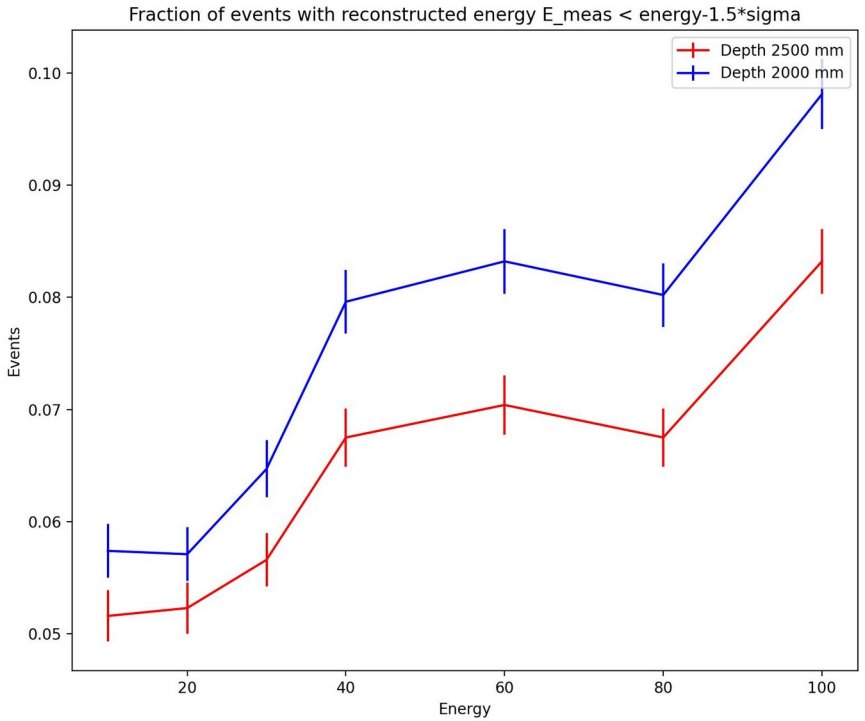
LEAKAGE STUDY: Components

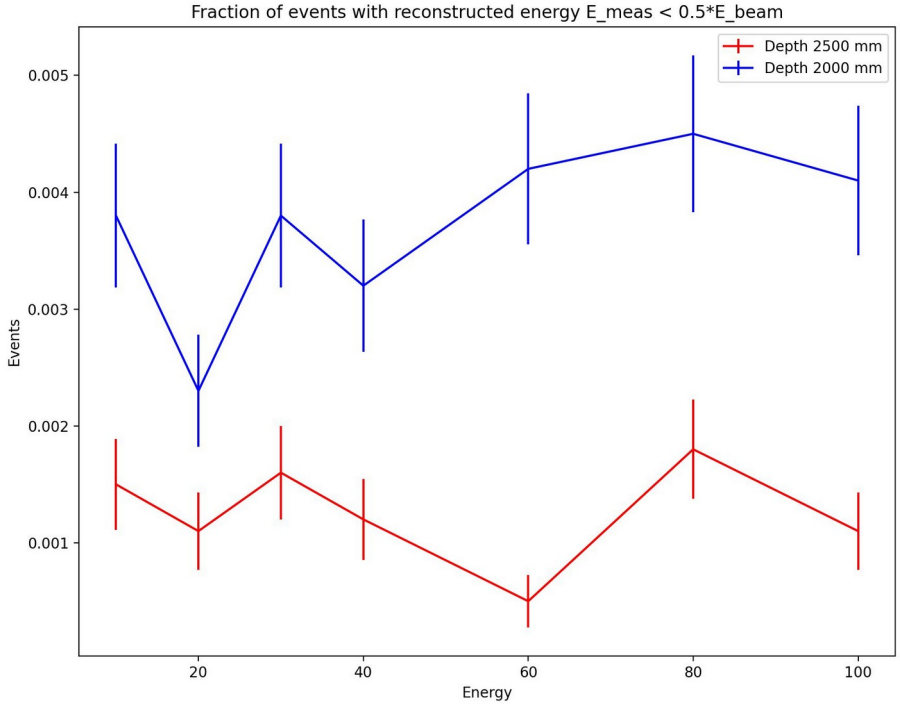




LEAKAGE STUDY: Reconstructed Energy

Pion resolution obtained from fit between $E_{peak} - 1.5 * \sigma$ and $+\infty$





LEAKAGE STUDY: Energy Containment