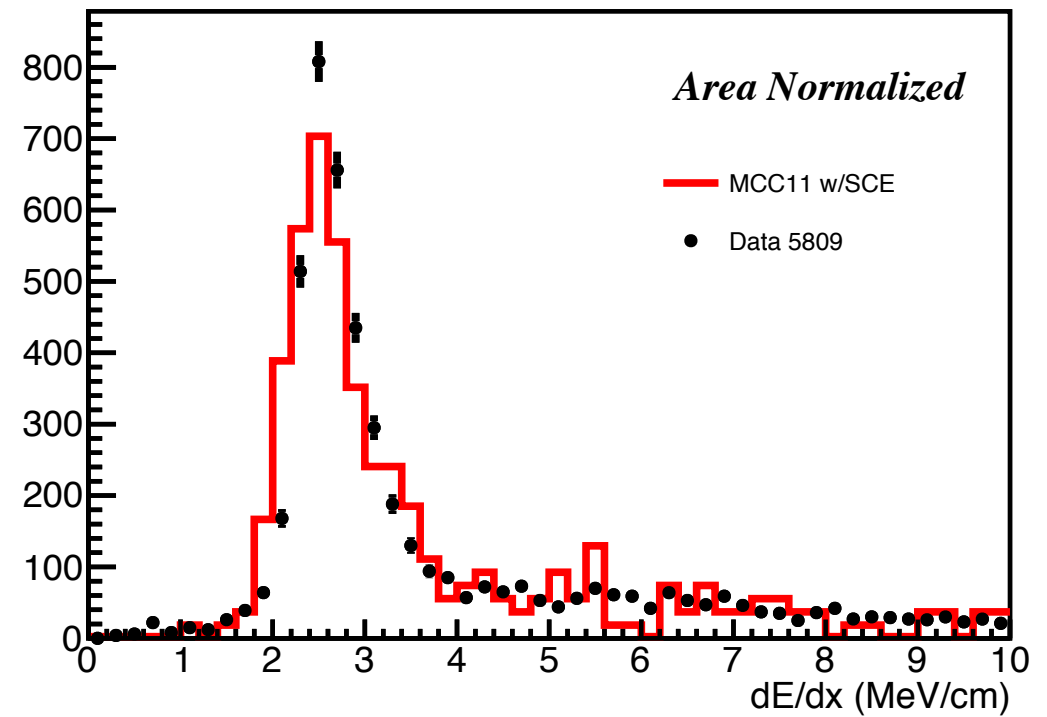
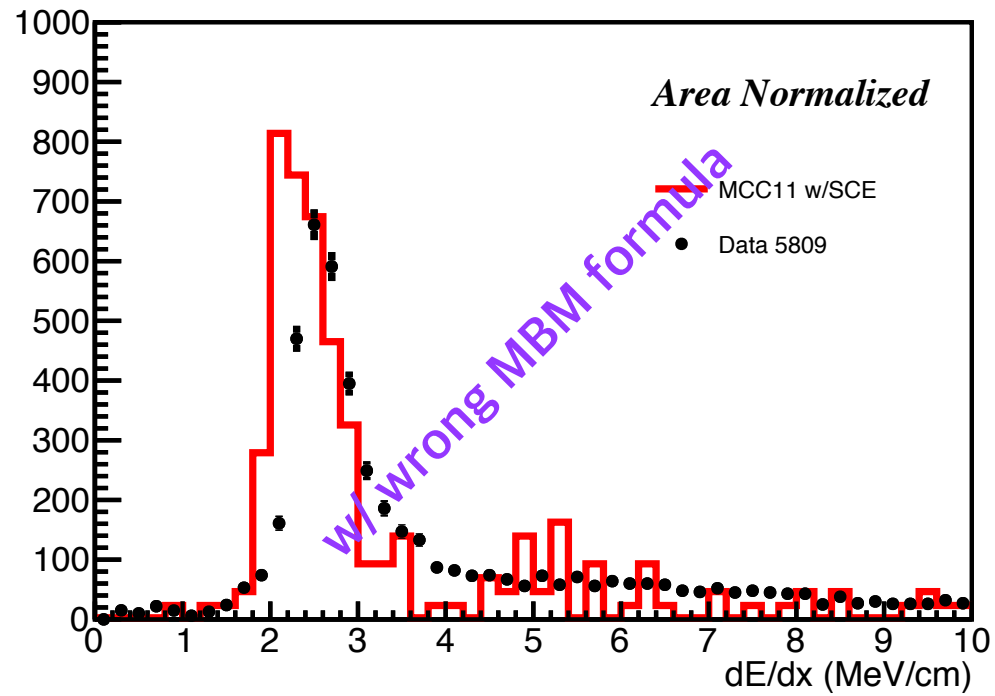


ProtoDUNE

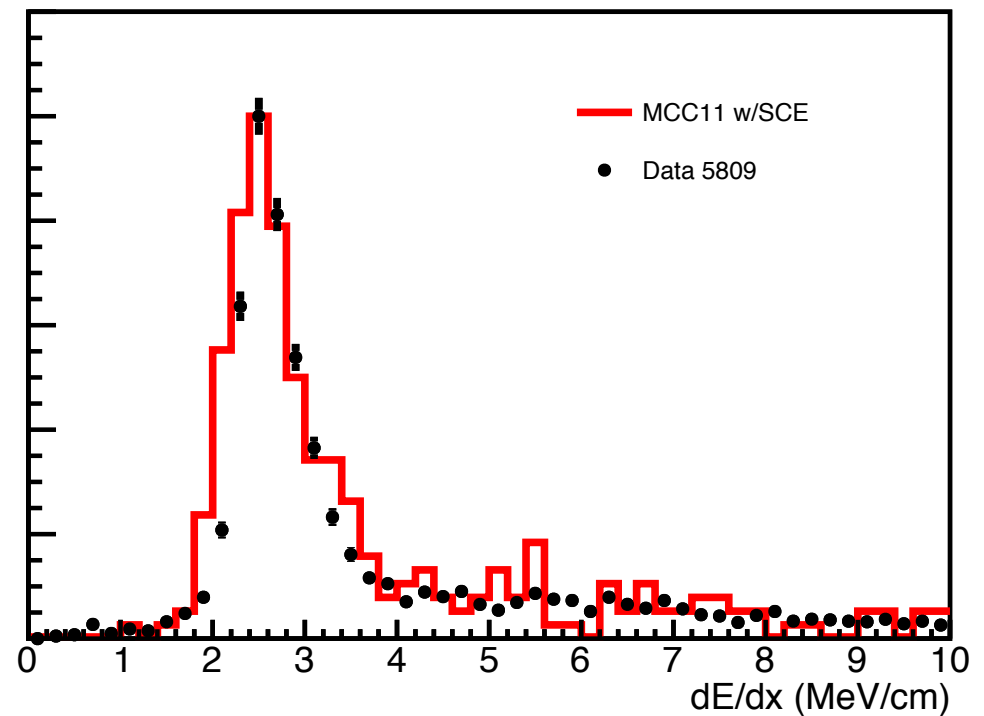
dE/dx electrons vs gammas

Aaron Higuera
University of Houston

Update on electron(e^+) dE/dx



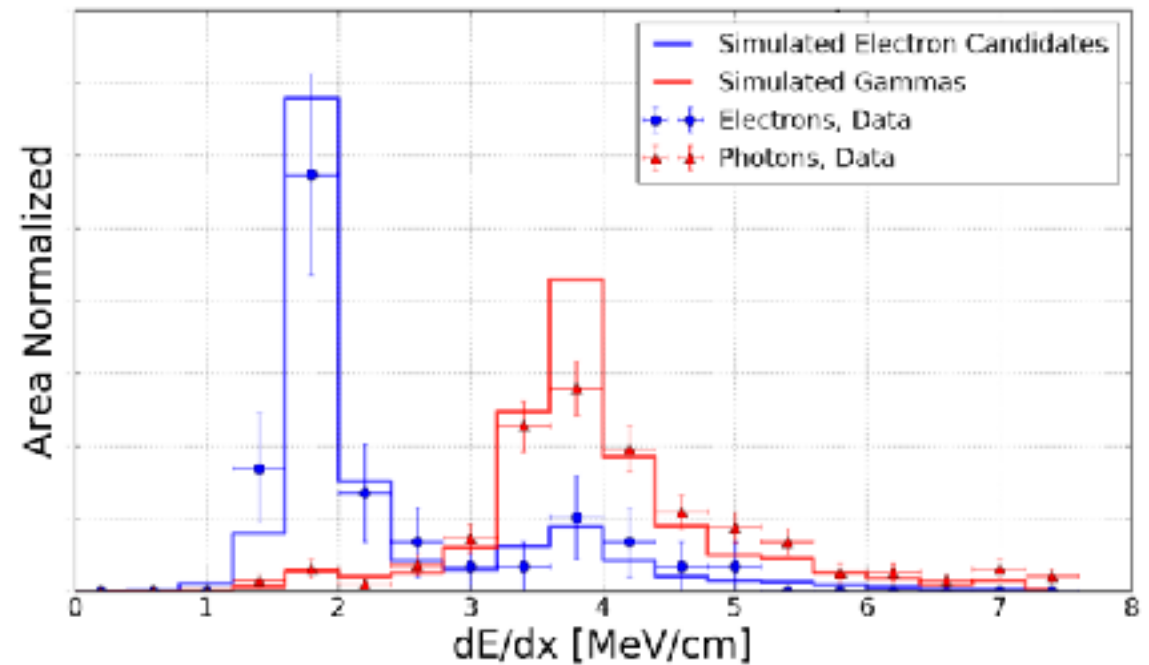
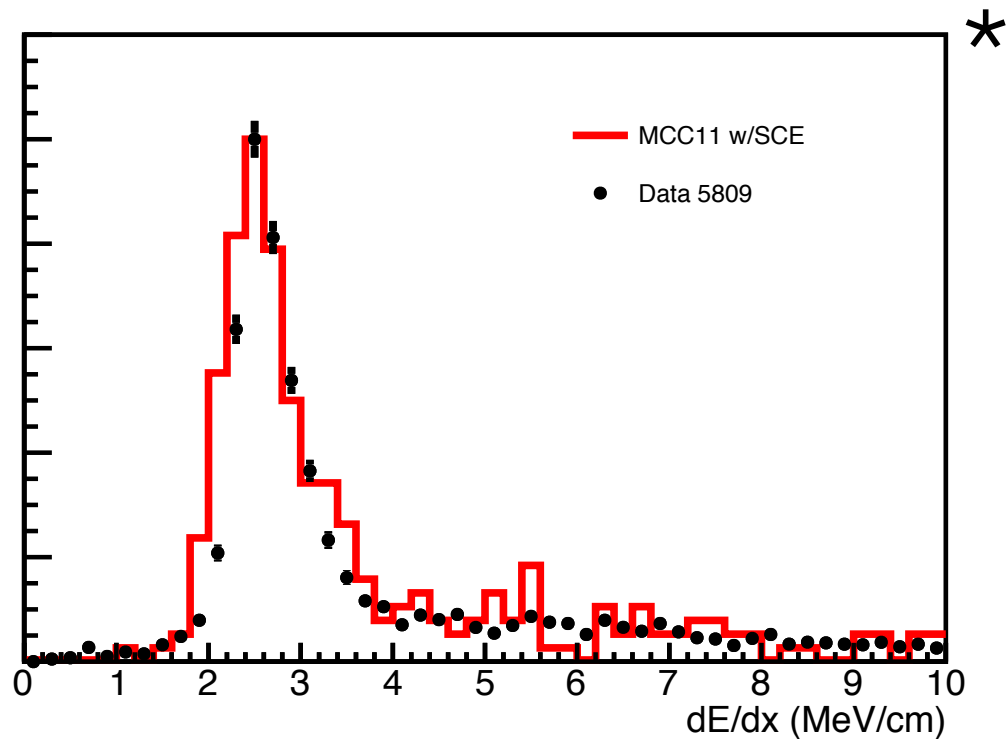
Thanks to Ajib for posting the documentation



dE/dx electrons vs gammas

dE/dx electrons vs gammas

PhysRevD.95.072005



Potential physic deliverables

1. dE/dx at the beginning of the shower
2. dE/dx electron-gamma separation

Where can we get gammas?

*

once the proper SCE calibration is done the MIP peak should be around the expected value

$$\text{Pions}^+ \longrightarrow \pi^0 + X$$

Where can we get gammas? Pion scattering: $\pi + {}^{40}\text{Ar} \longrightarrow \pi^0 + X$

To study dE/dx electron-gamma separation I generated single particles

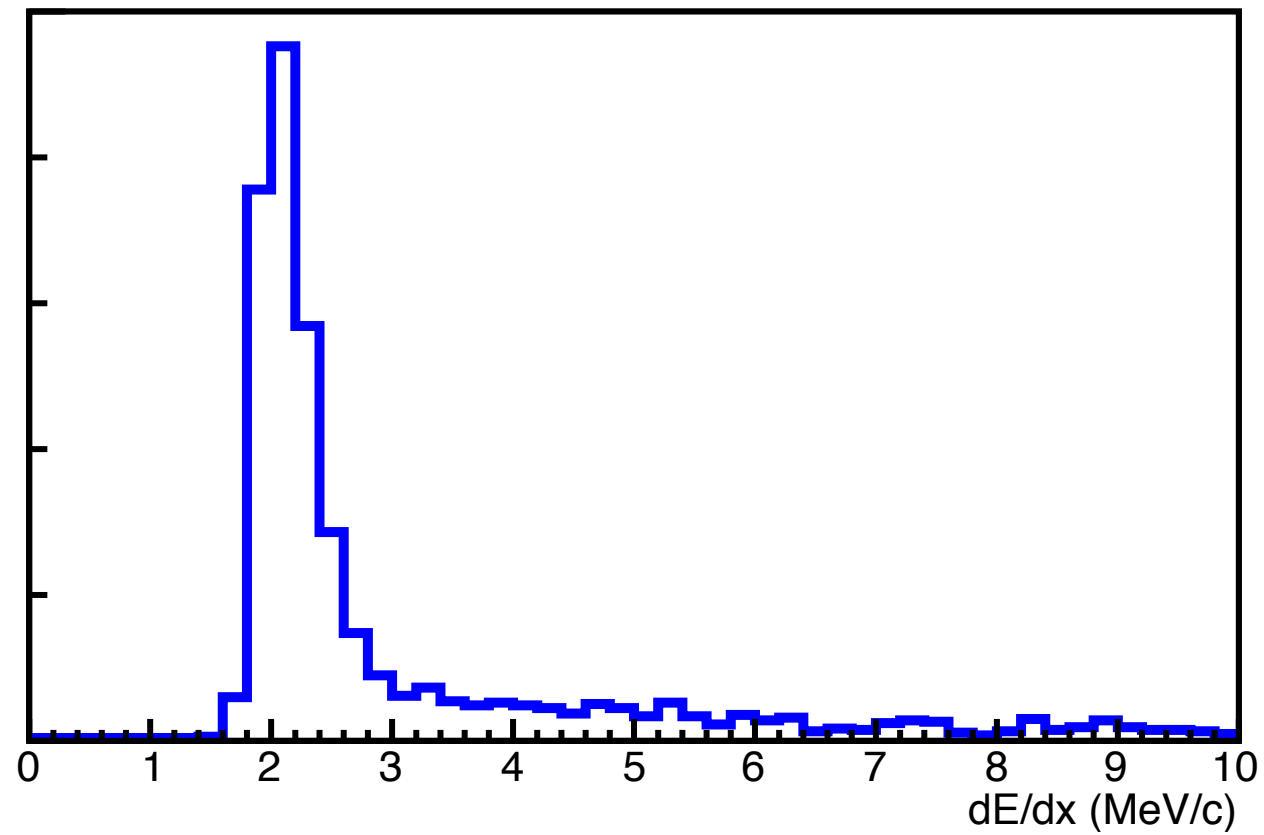
Single positron with momentum 1GeV sigma = 5% w/vertex at the beamline window

Single pions⁺ with momentum 1GeV sigma = 5% w/vertex at the beamline window

dunetpc v07_13_00 w/Pandora reconstruction, w/NO SCE

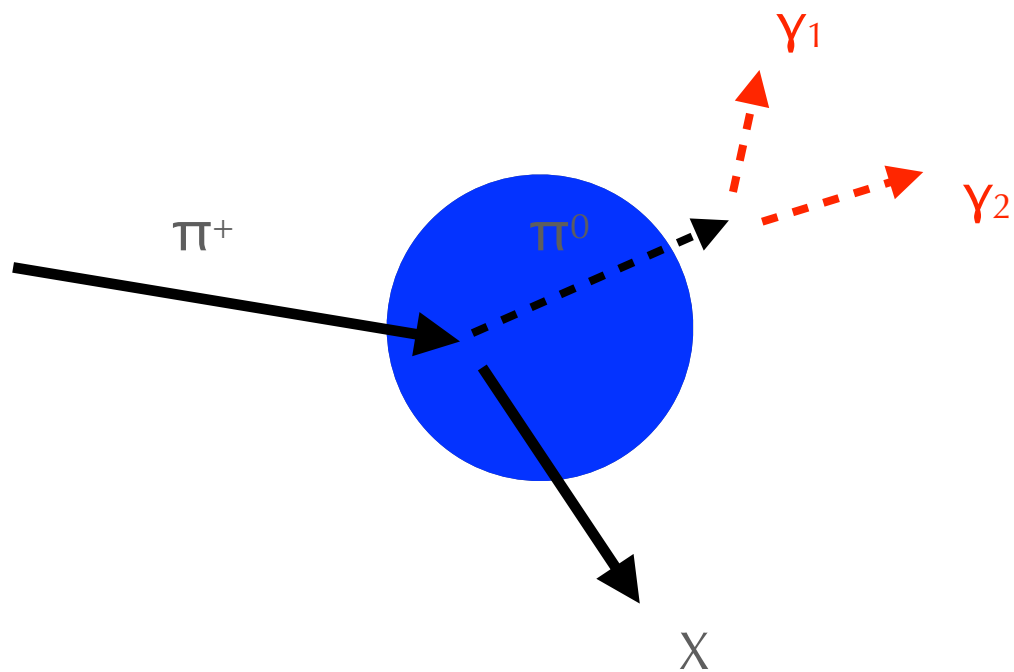
dE/dx electrons(e⁺)

After selecting completed showers (see [talk](#))
dE/dx for electrons at the beginning of the shower

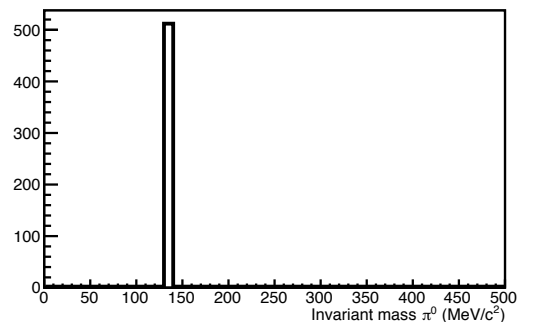
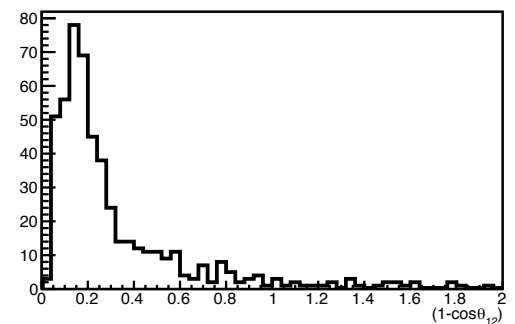
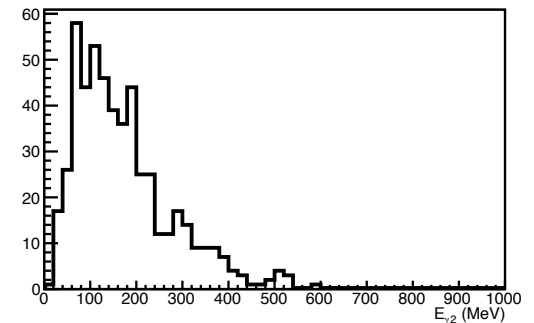
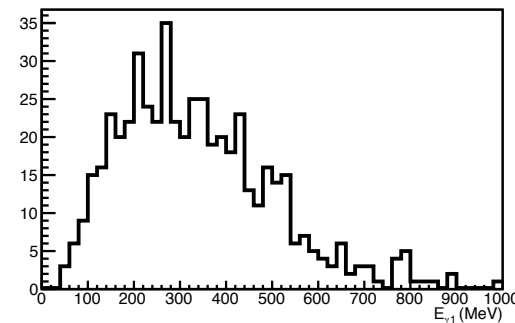


$$\text{Pions}^+ \longrightarrow \pi^0 + X$$

Where can we get gammas? Pion scattering: $\pi + {}^{40}\text{Ar} \longrightarrow \pi^0 + X$

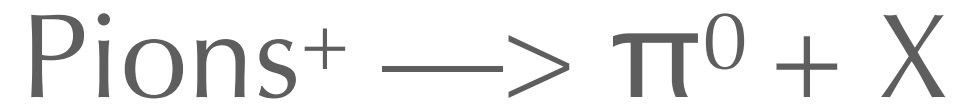


20% of events produce at least one π^0

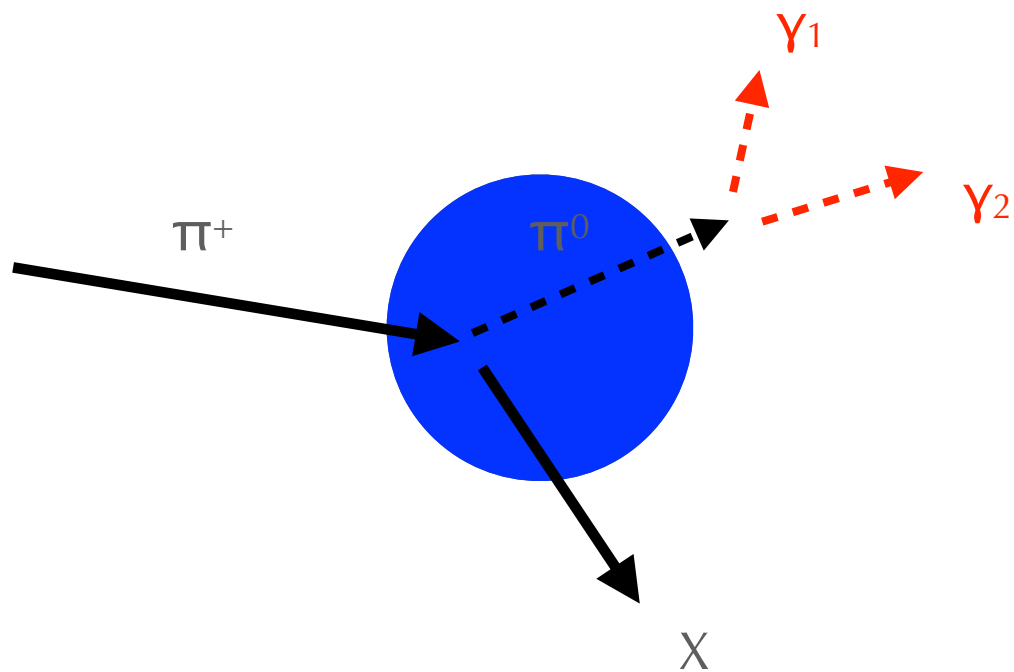


$$m_{\pi^0}^2 = 2E_1 E_2 (1 - \cos\theta_{12})$$

Single pions⁺ with momentum 1GeV sigma = 5%



Where can we get gammas? Pion scattering: $\pi + {}^{40}\text{Ar} \longrightarrow \pi^0 + X$



Selection:

Events with at least one true π^0

All below based on reco info

A track Primarybeam PFParticle

W/two daughter showers

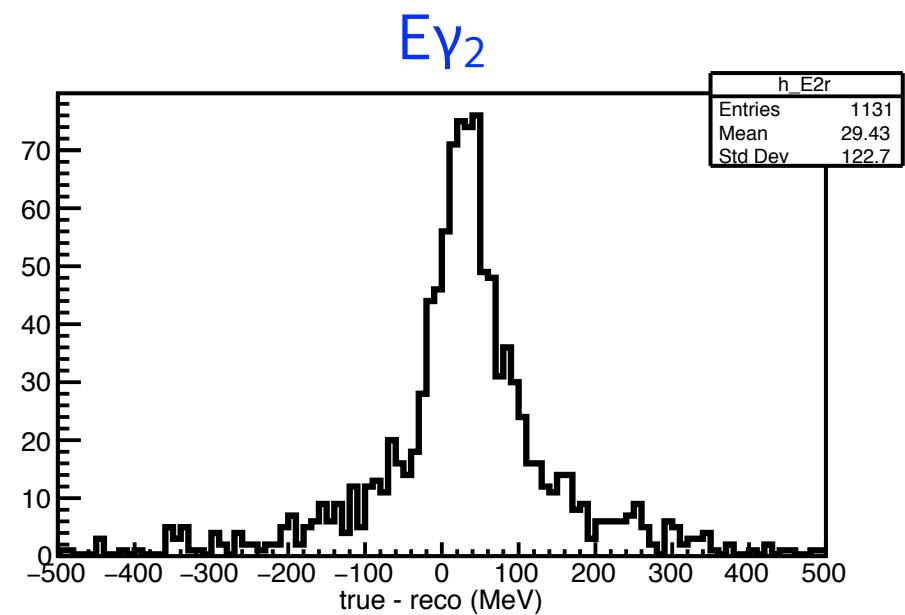
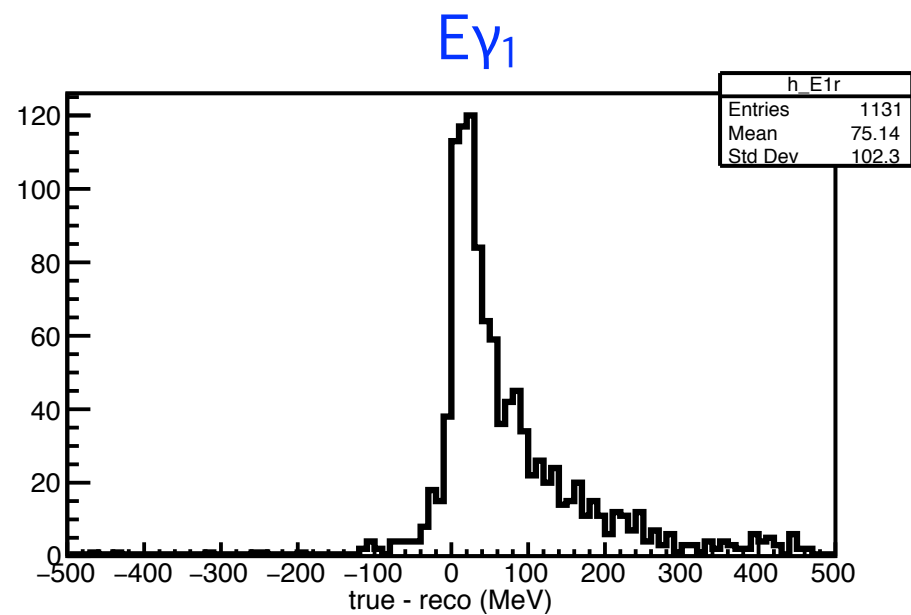
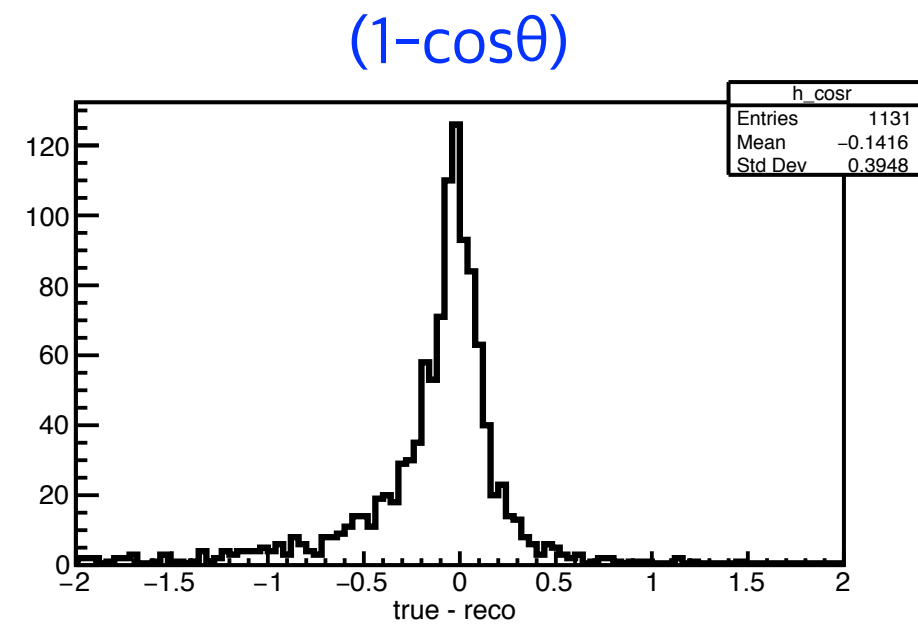
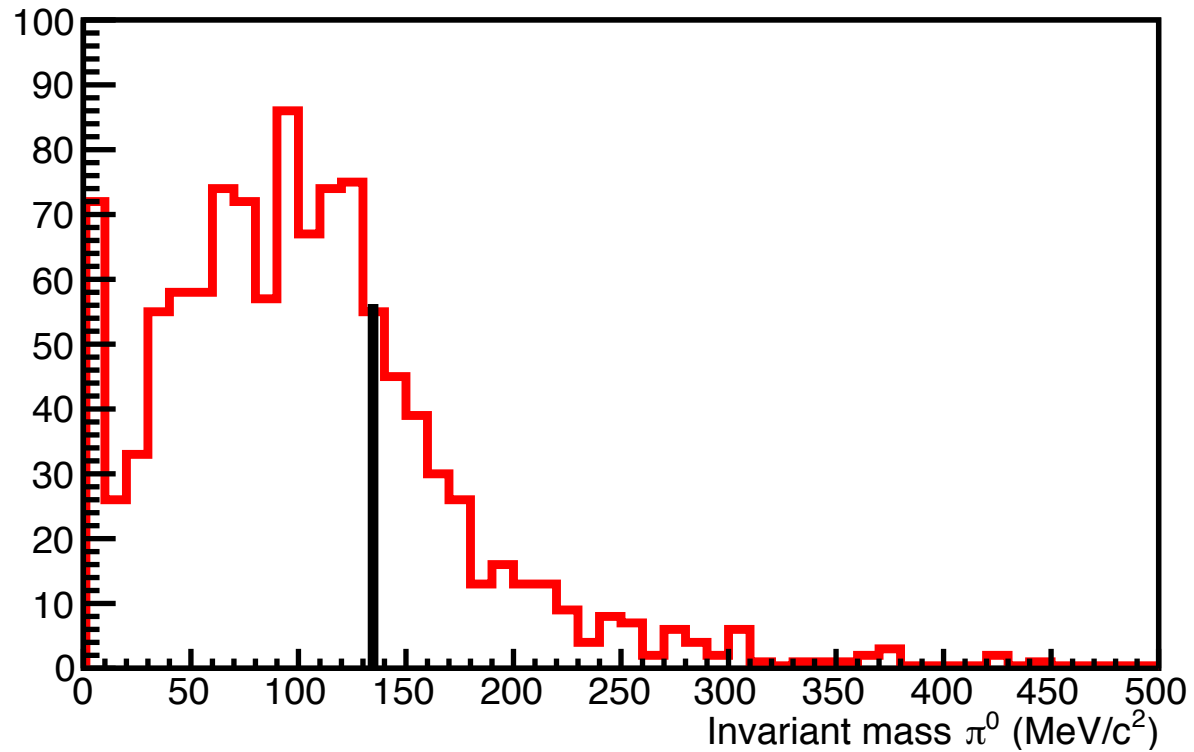
reconstruct invariant mass

$$m_{\pi^0}^2 = 2E_1E_2(1 - \cos\theta_{12})$$

Single pions⁺ with momentum 1GeV sigma = 5%

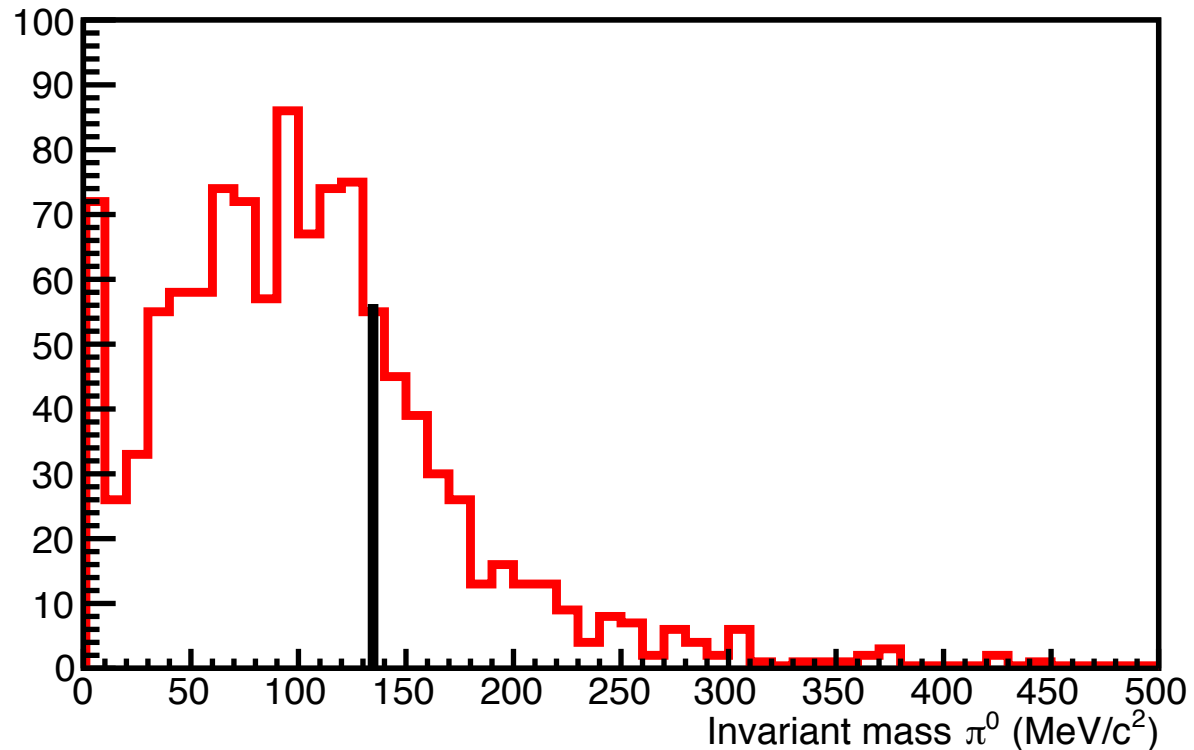
$$\text{Pions}^+ \longrightarrow \pi^0 + X$$

Using fully reconstructed events

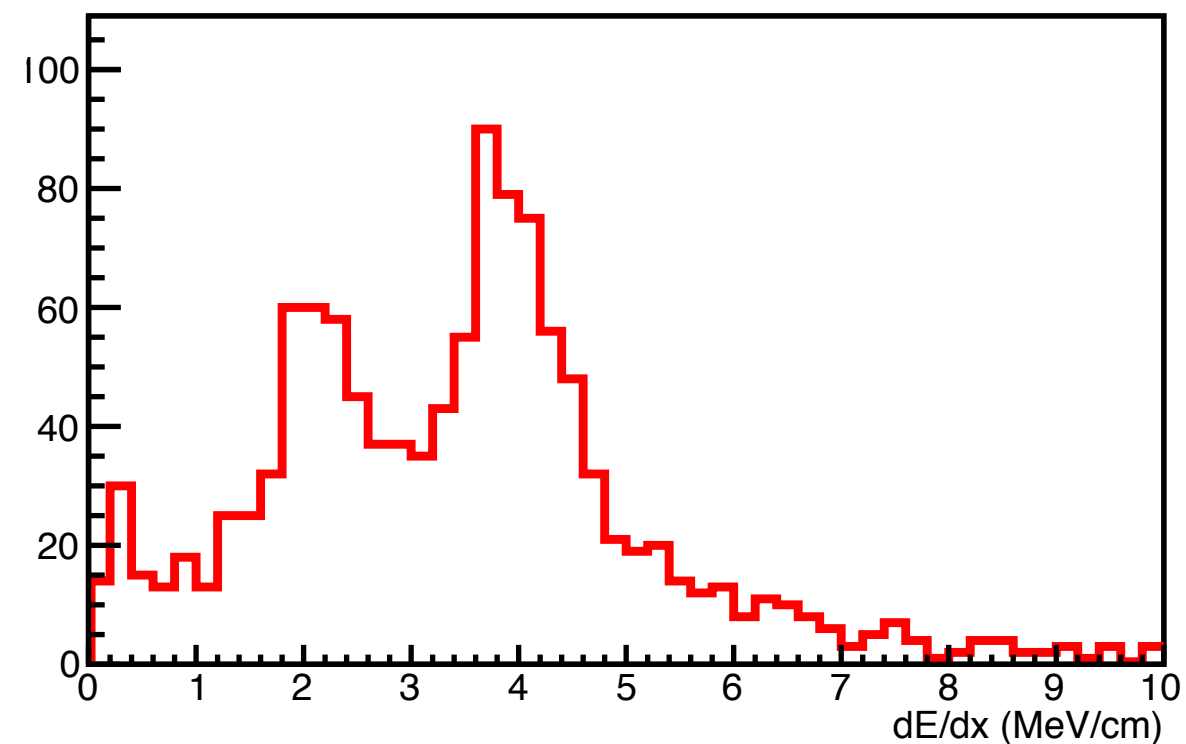


$$\text{Pions}^+ \longrightarrow \pi^0 + X$$

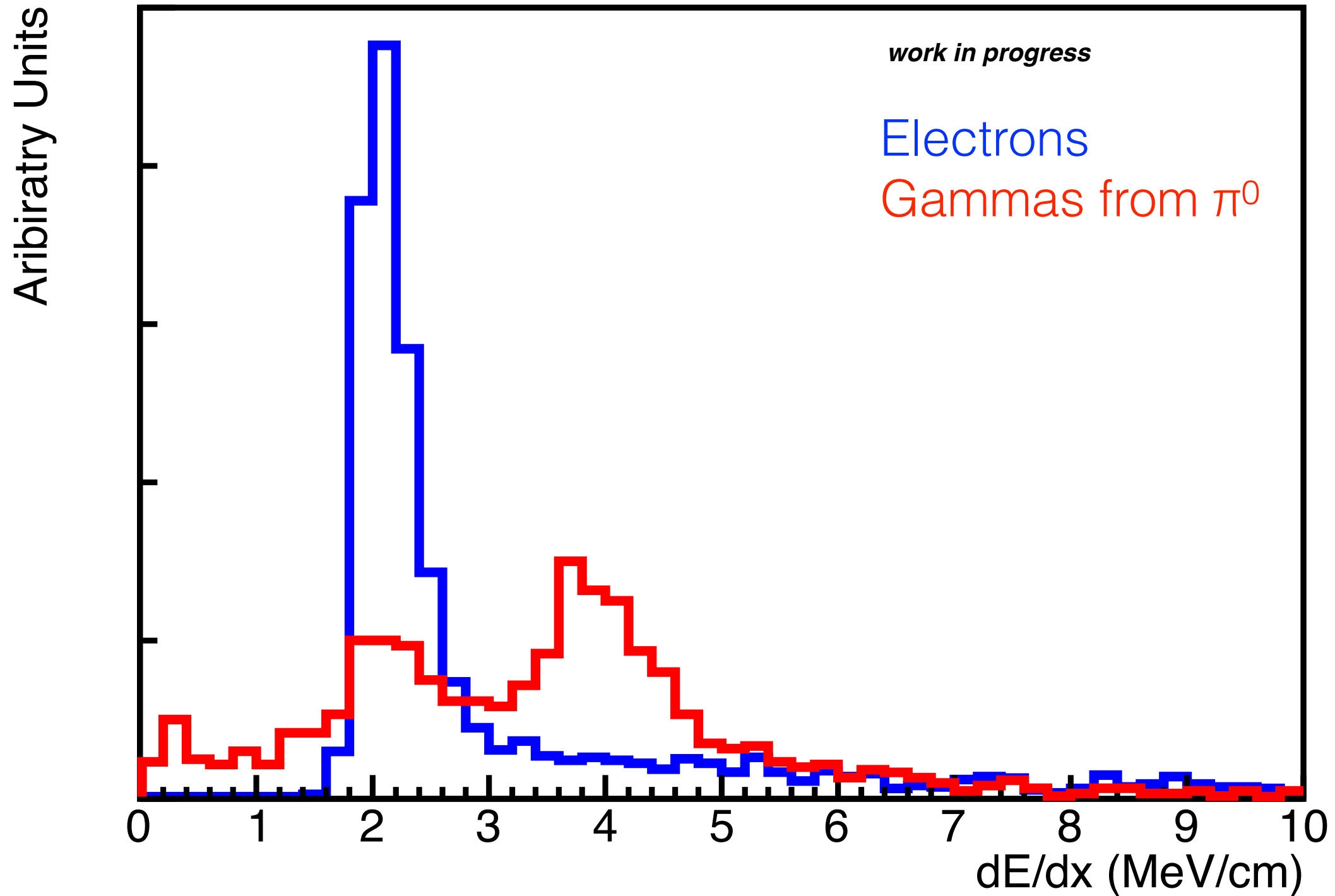
Using fully reconstructed events



dE/dx at the beginning of the shower



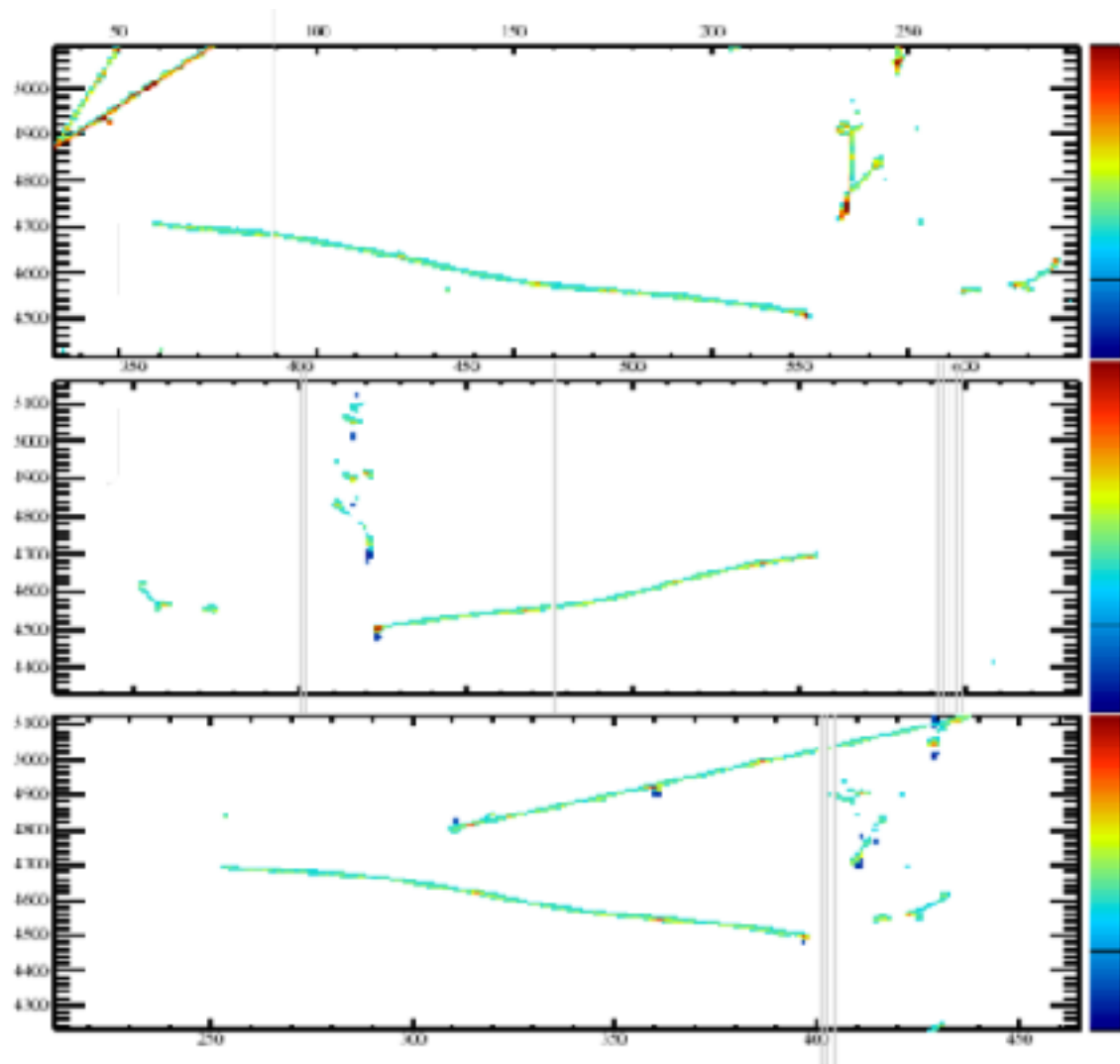
dE/dx electrons vs gammas



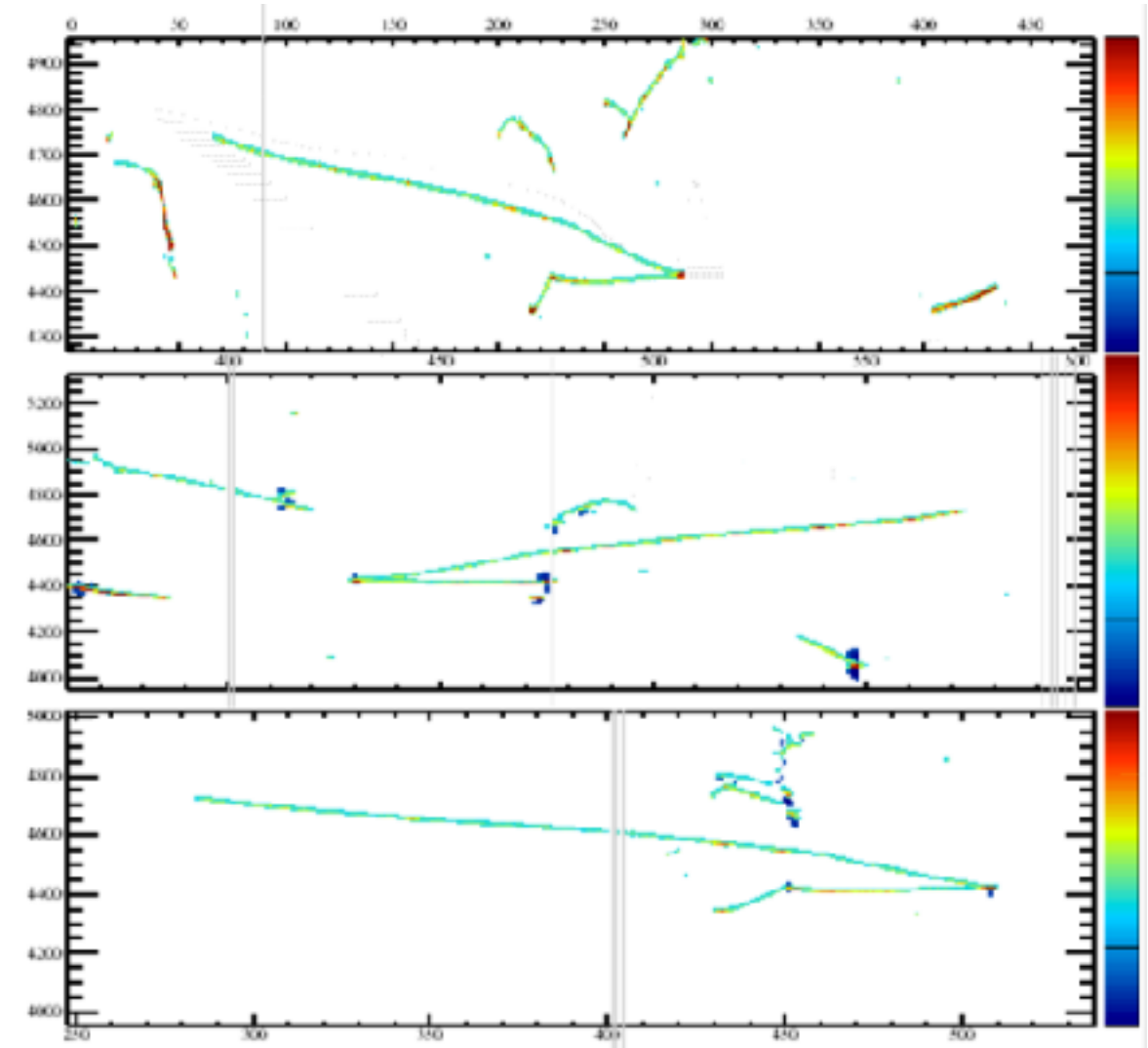
$$\text{Pions}^+ \longrightarrow \pi^0 + X$$

Data candidates

run 5387 event 64290



run 5387 event 76962



Comments

1. Improvements on shower reconstruction?
2. Investigate 1MIP dE/dx component in gamma sample
3. Pi-zeros are going to be a challenge
4. Let's turn the crank on the data

The End