

Hadronic showers / missing energy in protoDUNE

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Outline

- Particle gun MC of pions and protons
- Studying the MC true energy deposited in protodune
- Quantifying energy associated to primary, and to neutral secondaries (photons, neutrons)
- Examining how much of the true energy ends up as a reconstructed hit, and reconstructed clusters by 4 reconstruction modules
 - lineclusterdc, linecluster, pandoradc, pandora

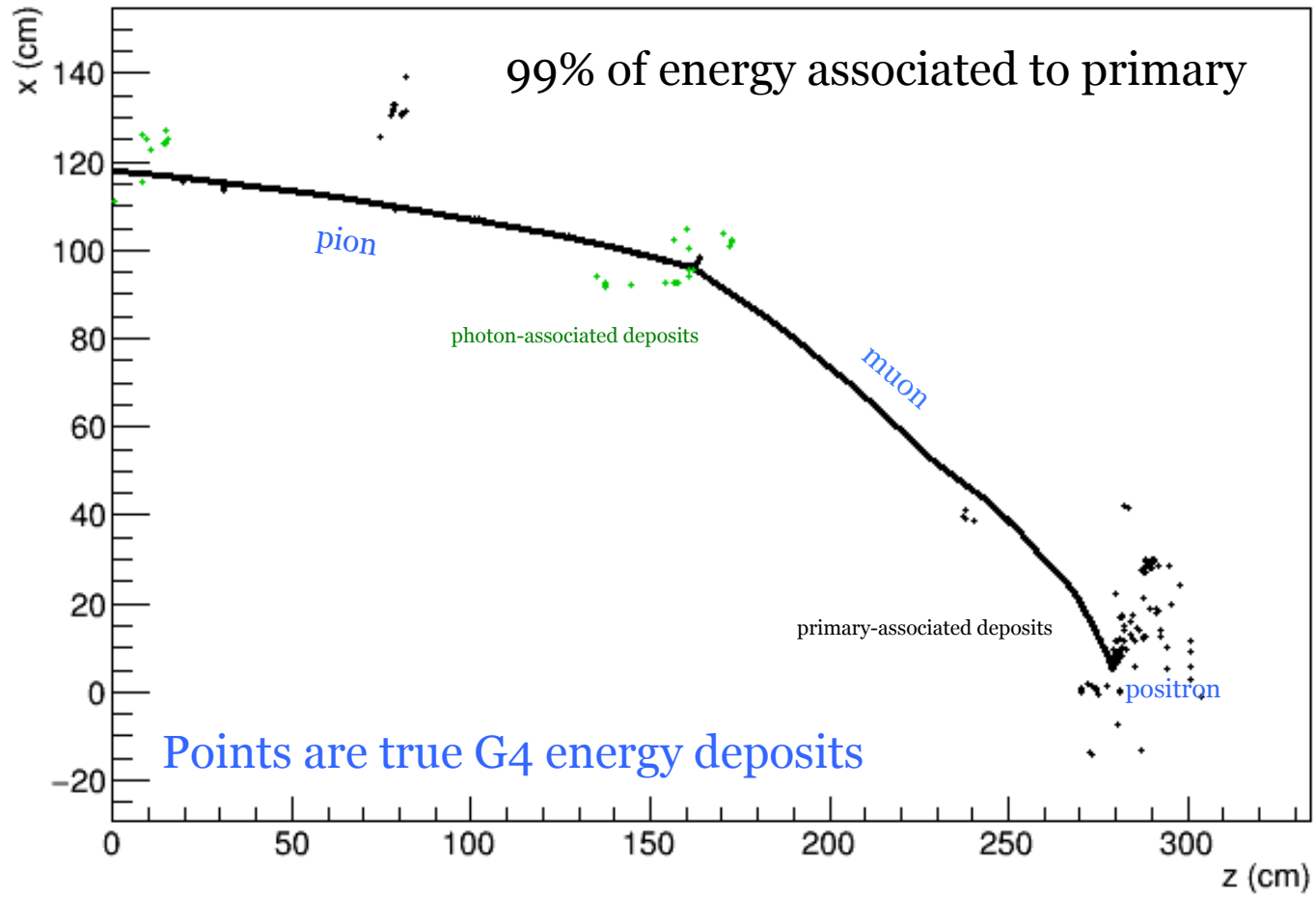
larsoft workflow

- Using dunetpc v05_13_00
 - protodune_v2 geometry
- `protoDUNE_gensingle.fcl`
 - Pion or proton, 0.1 – 3.0 GeV
 - x: 118.106 cm, y: 395.649 cm, z: 0 cm
- `protoDUNE_g4single.fcl`
- `protoDUNE_detsim_single.fcl`
 - Optical simulation is off, to save time
- `protoDUNE_reco.fcl`
- No cosmics / multiparticle events

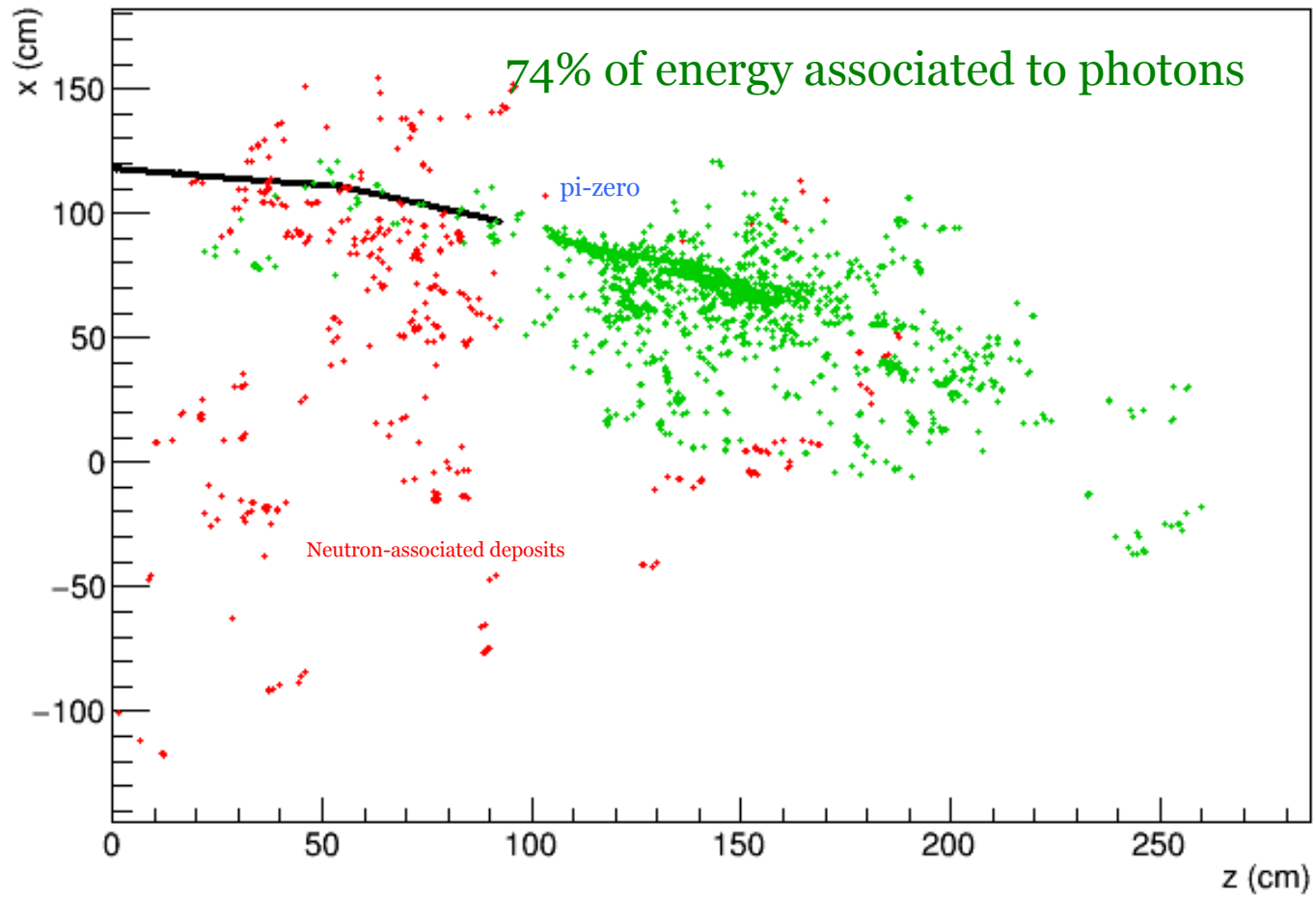
Analysis

- For now, only looking at the true energy deposits
- Associating each energy deposit to
 - Primary
 - Neutrons – and subsequent daughters
 - Photons – and subsequent daughters
- Calculating the fraction of energy deposited into those three categories
- Calculating how much of this true energy ends up in a reconstructed hit

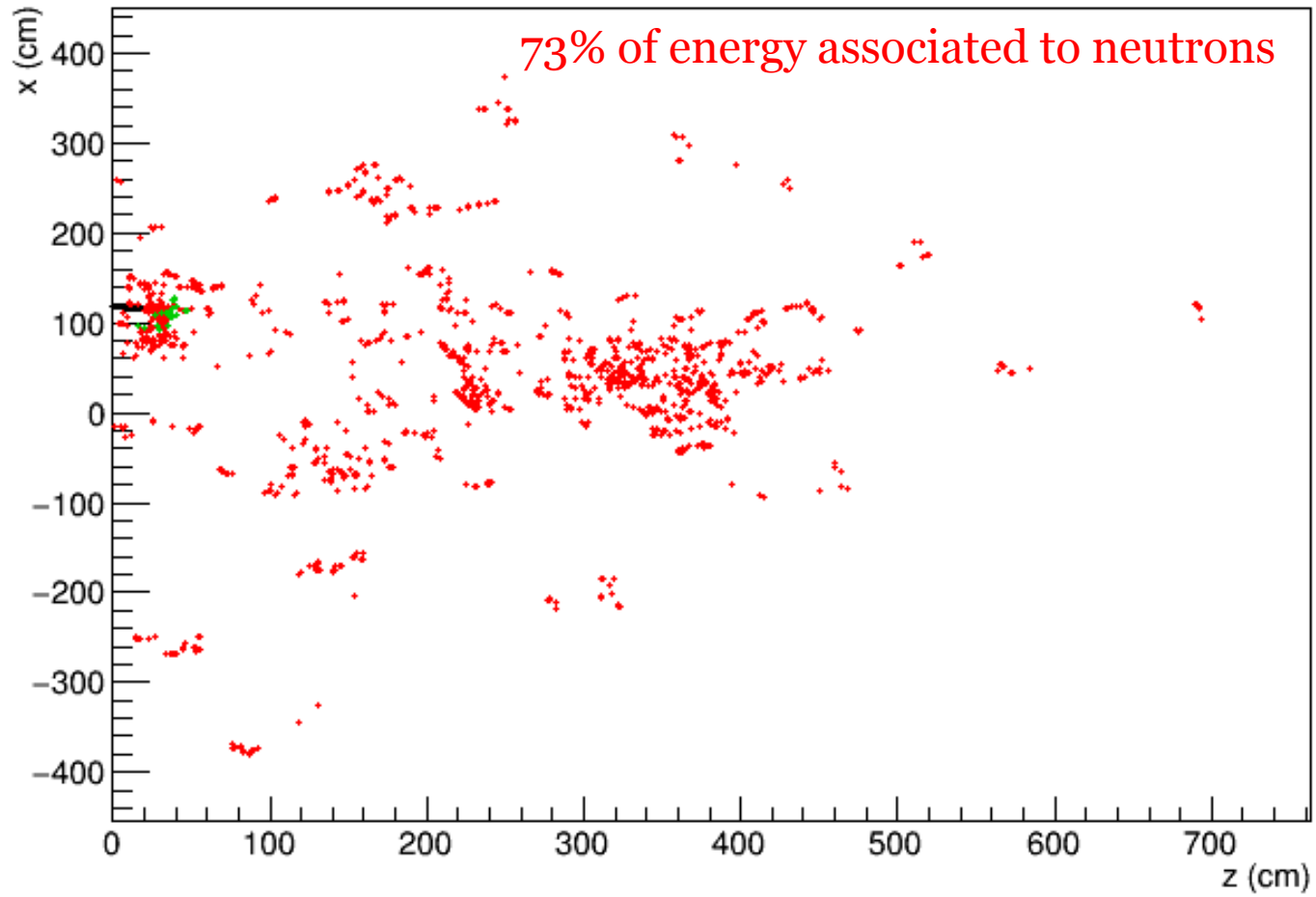
1.2 GeV pion



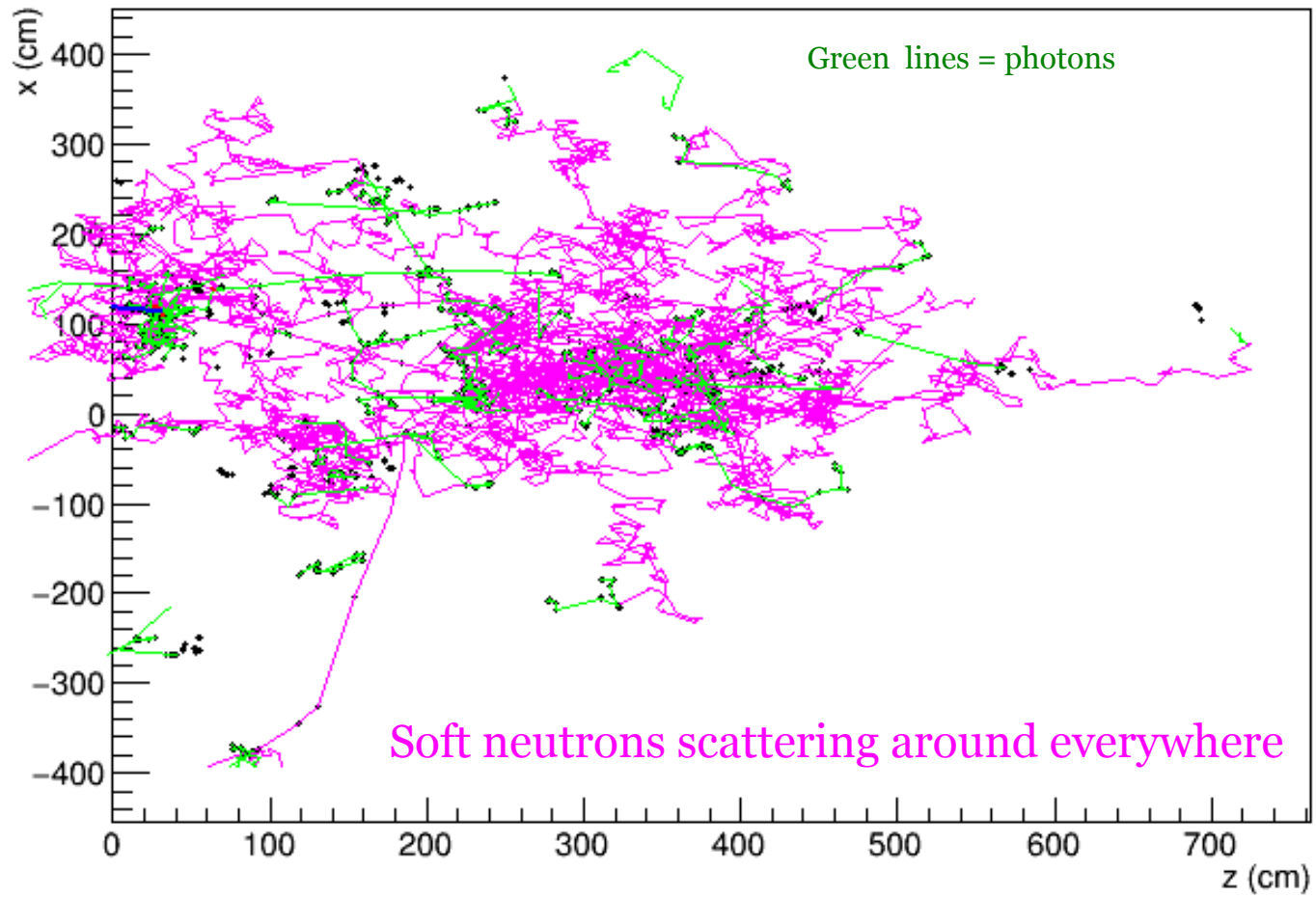
1.2 GeV pion



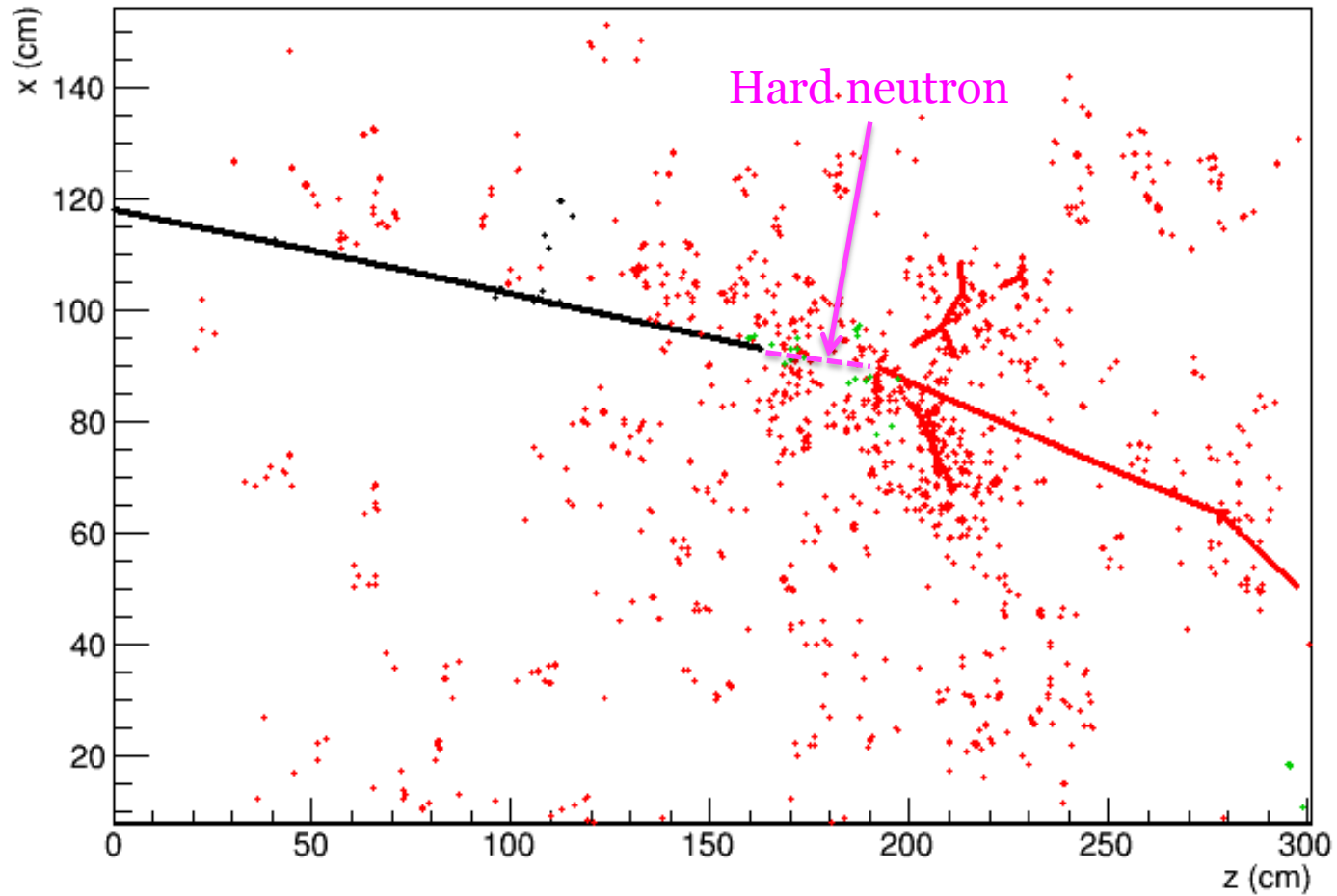
1.2 GeV pion



MC True particles

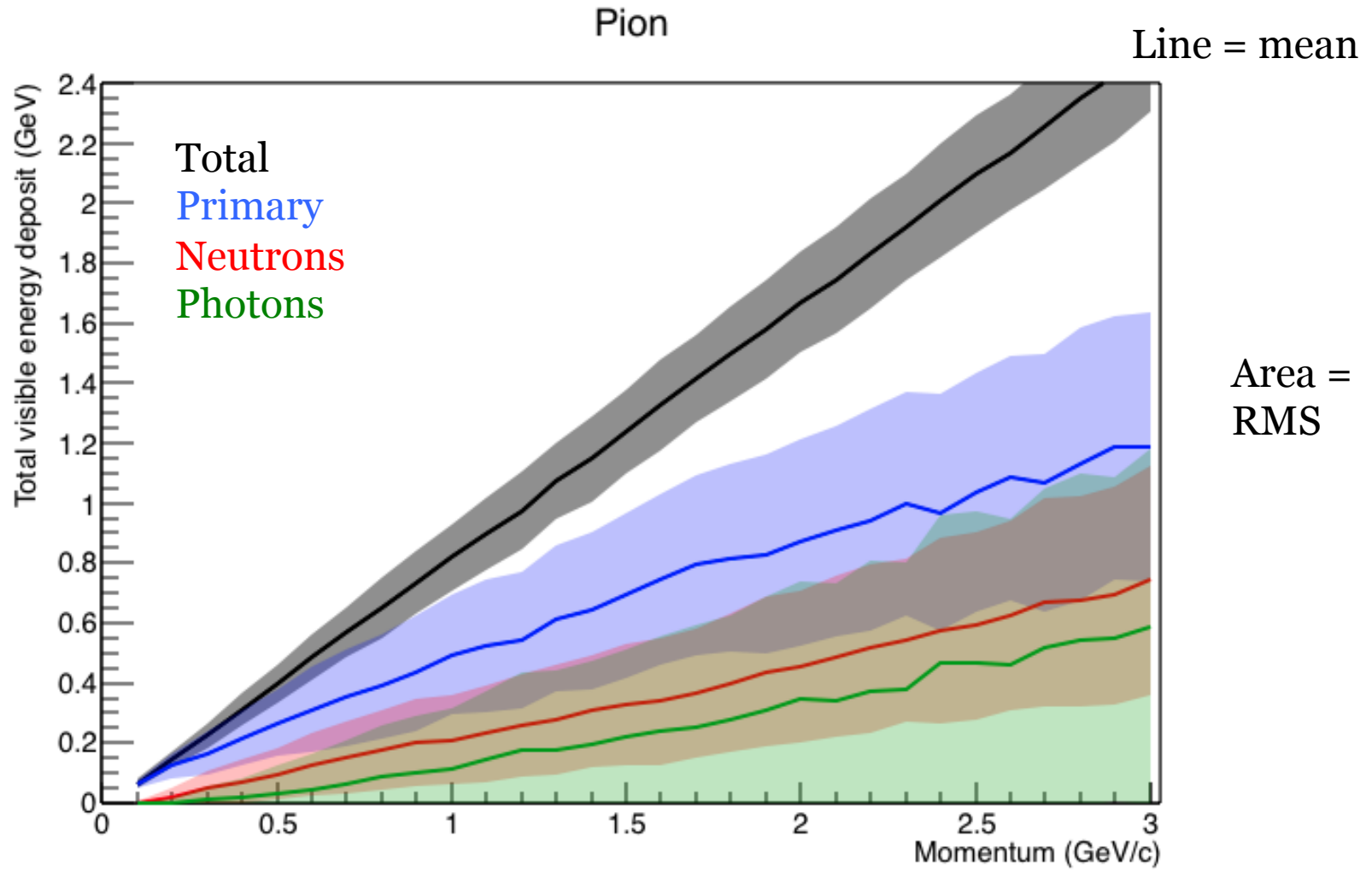


3.0 GeV proton

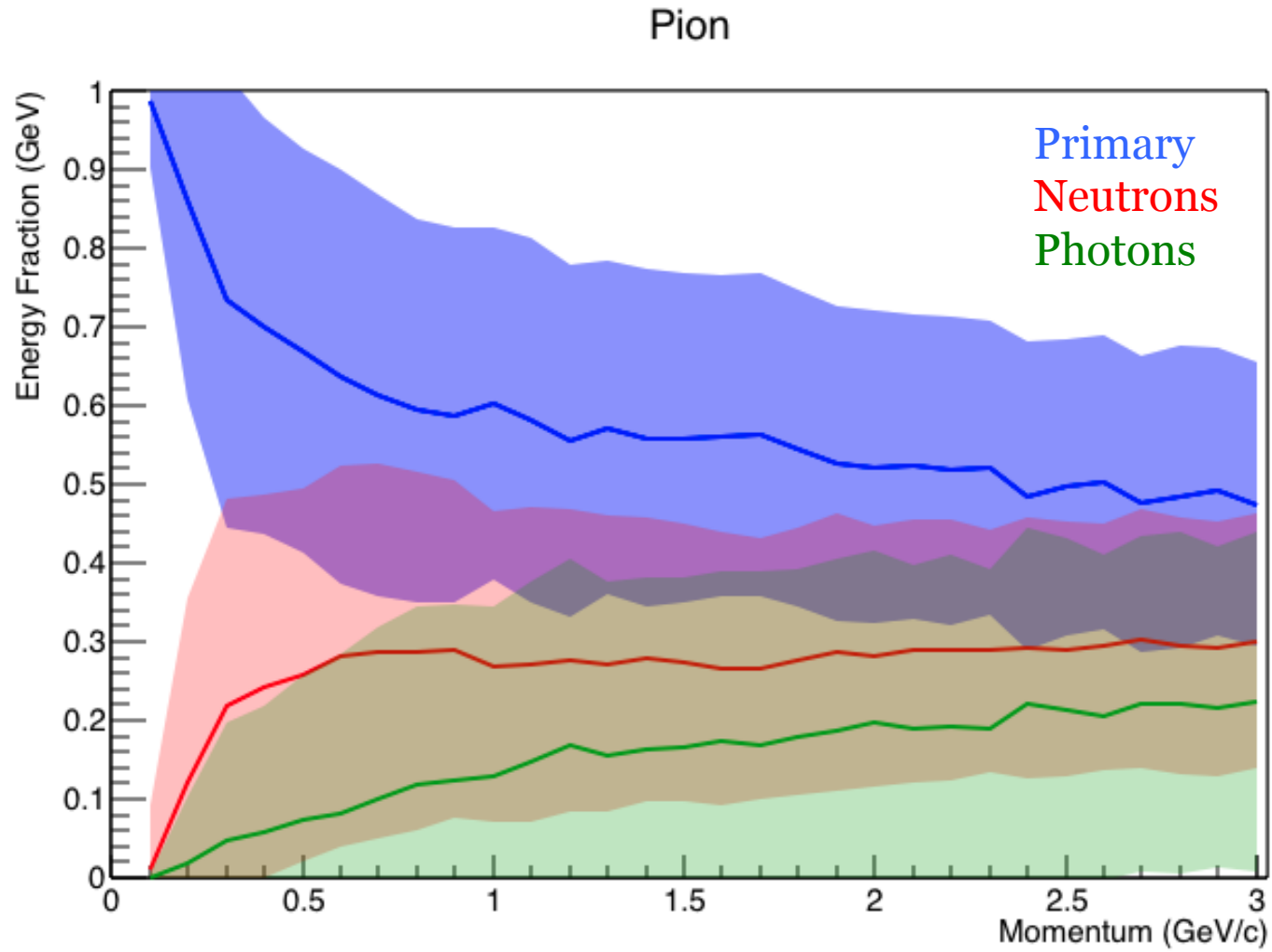


PIONS

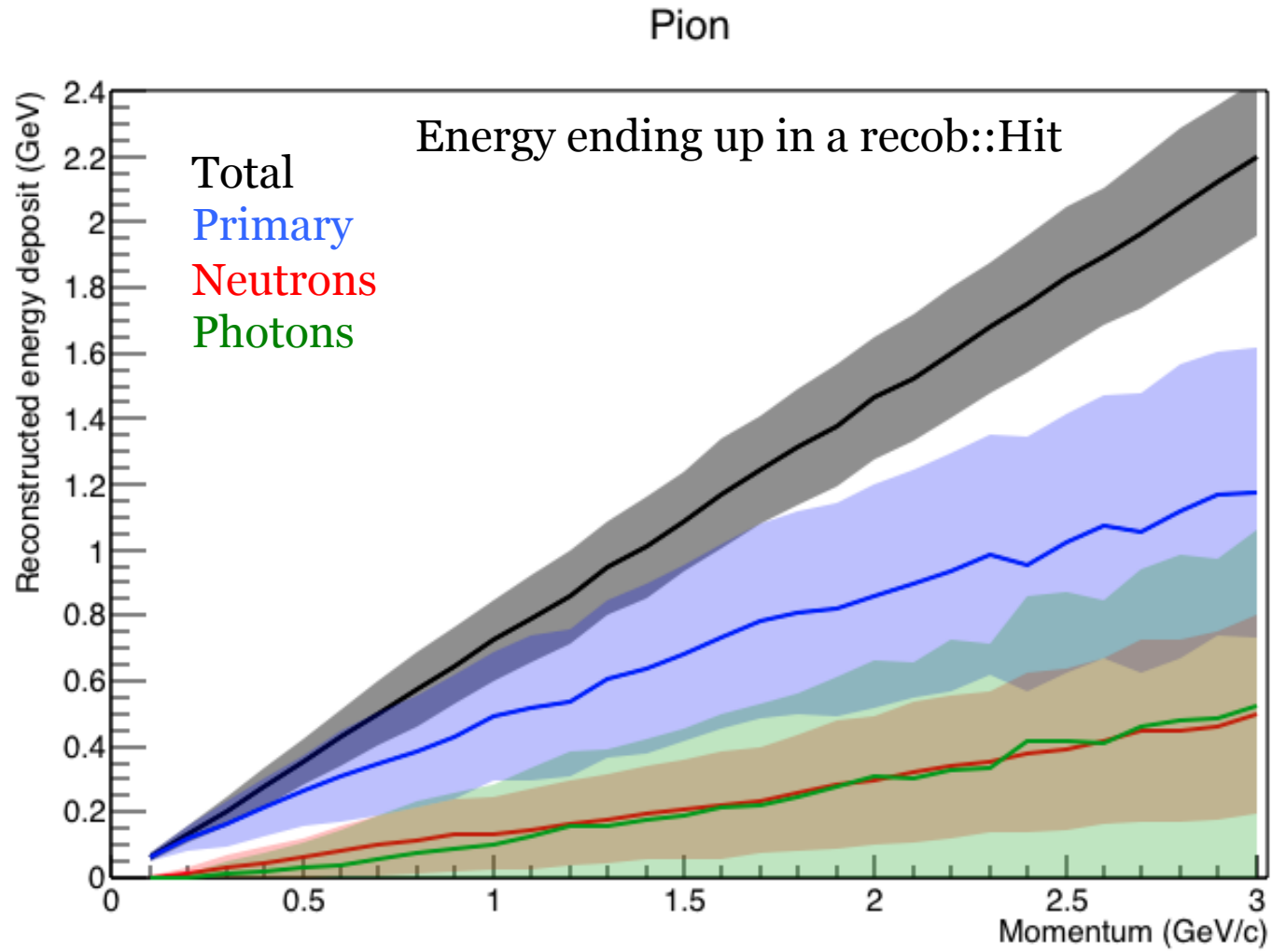
Pion energy deposit



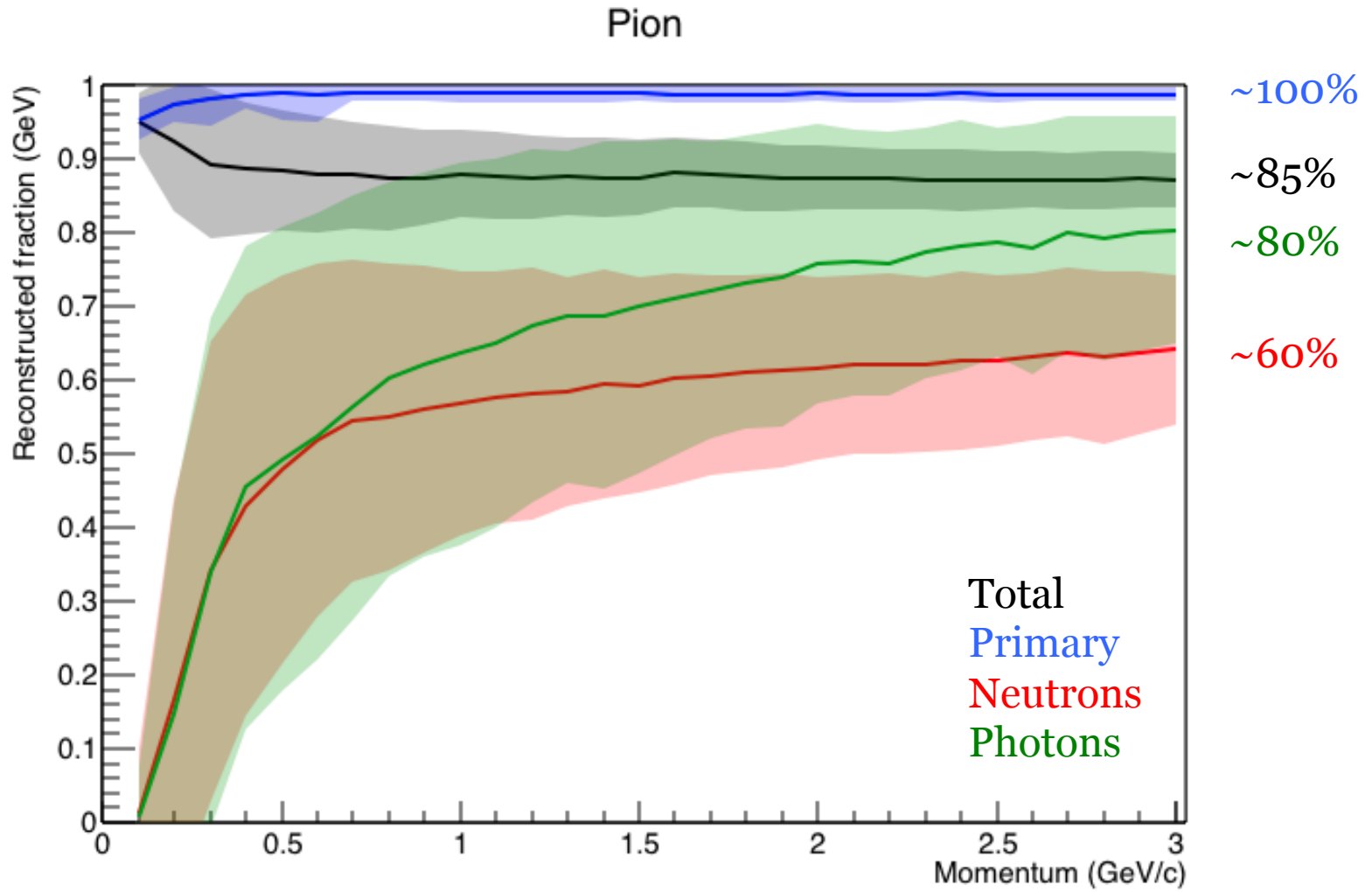
Fractional components



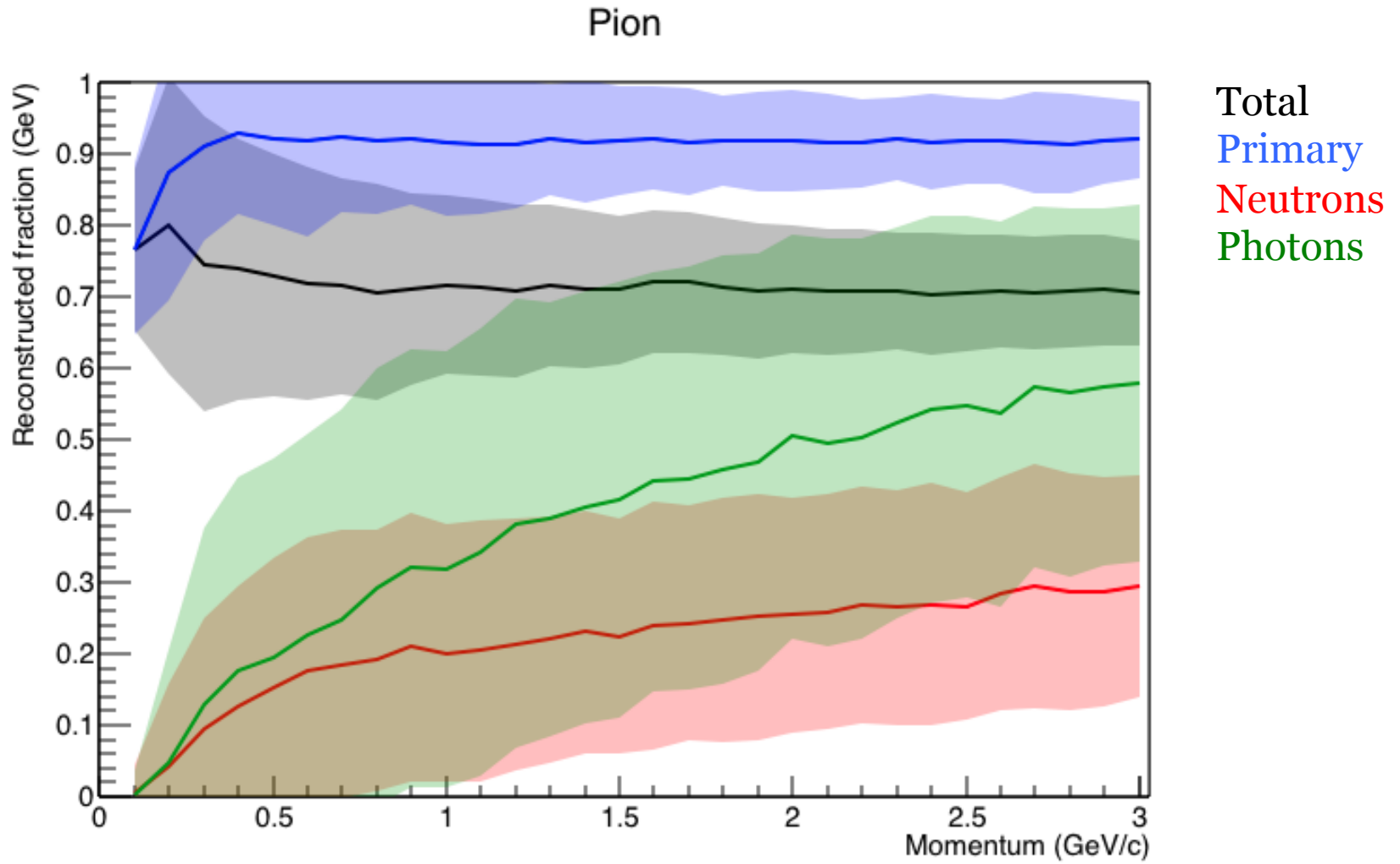
Reconstructed hits



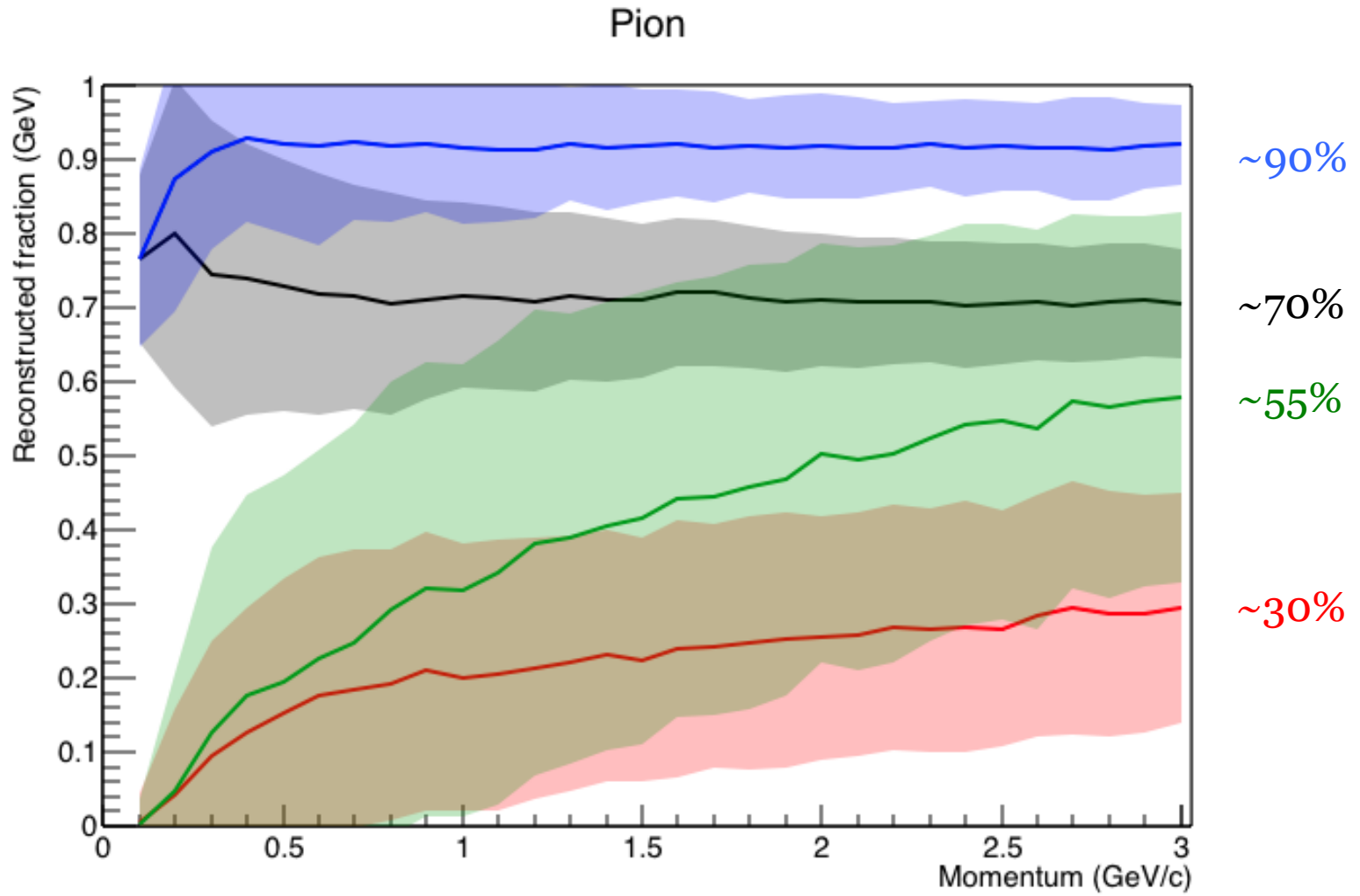
Reconstructed fraction



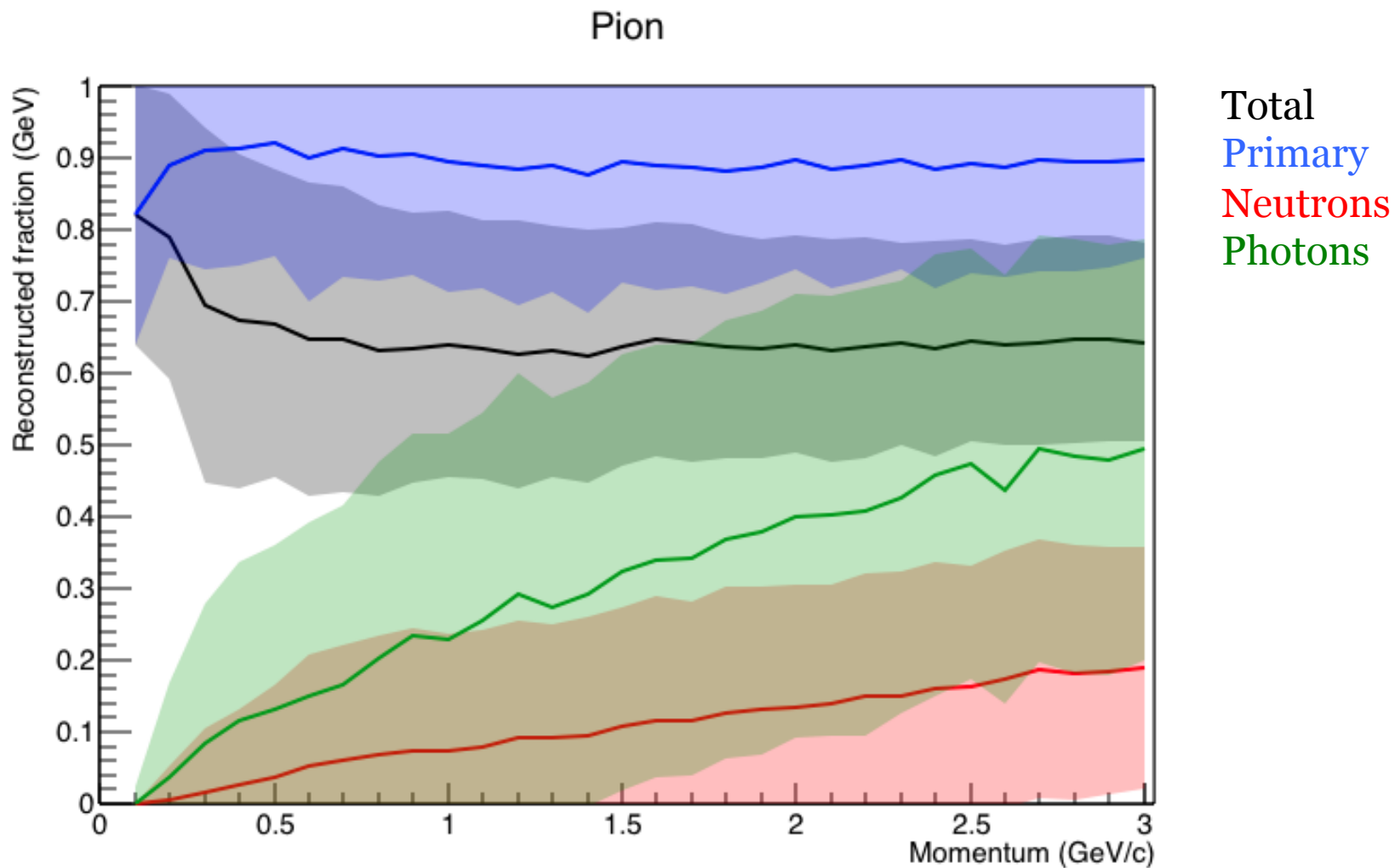
lineclusterdc Clusters



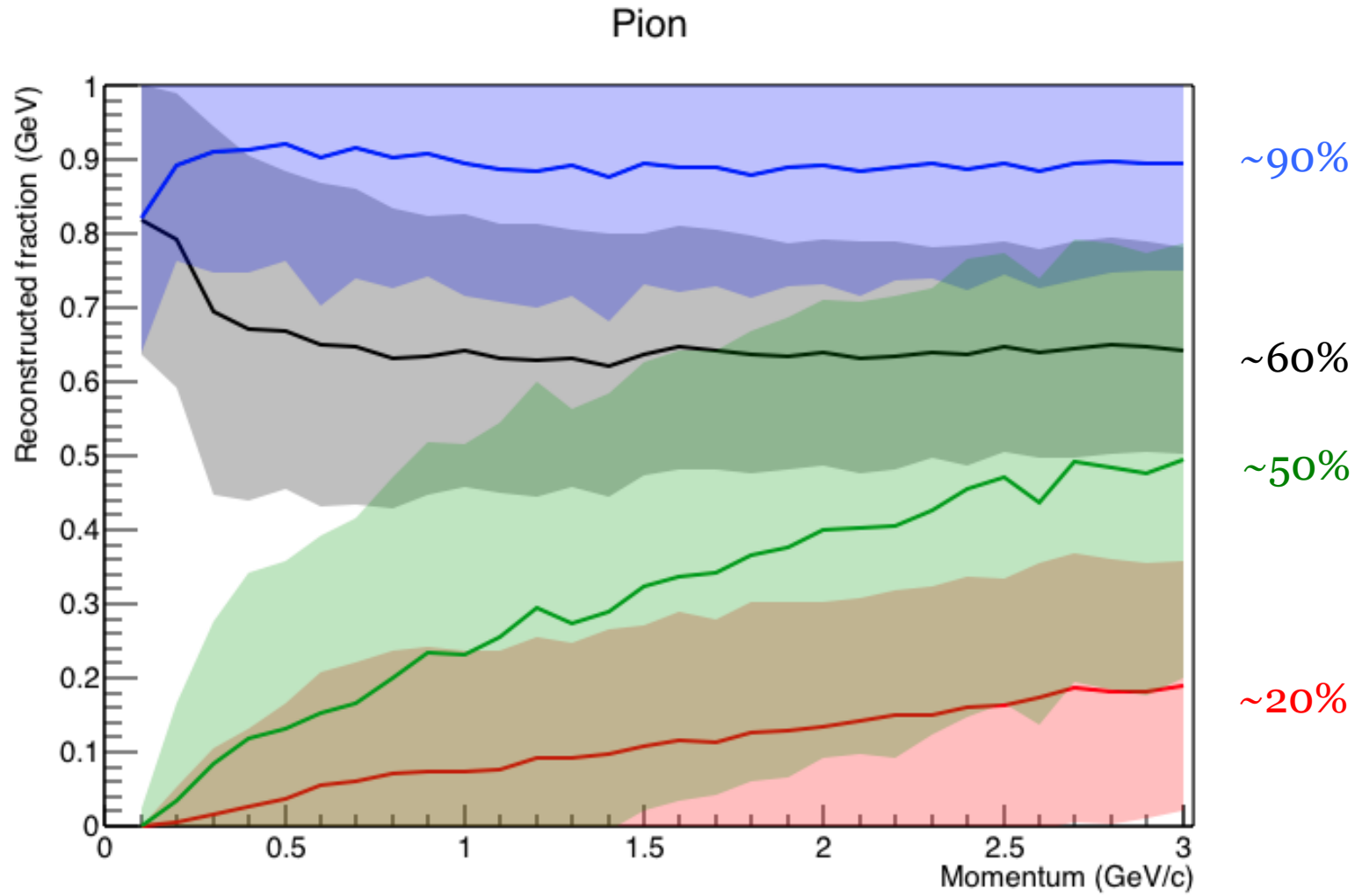
linecluster Clusters



pandoradc Clusters

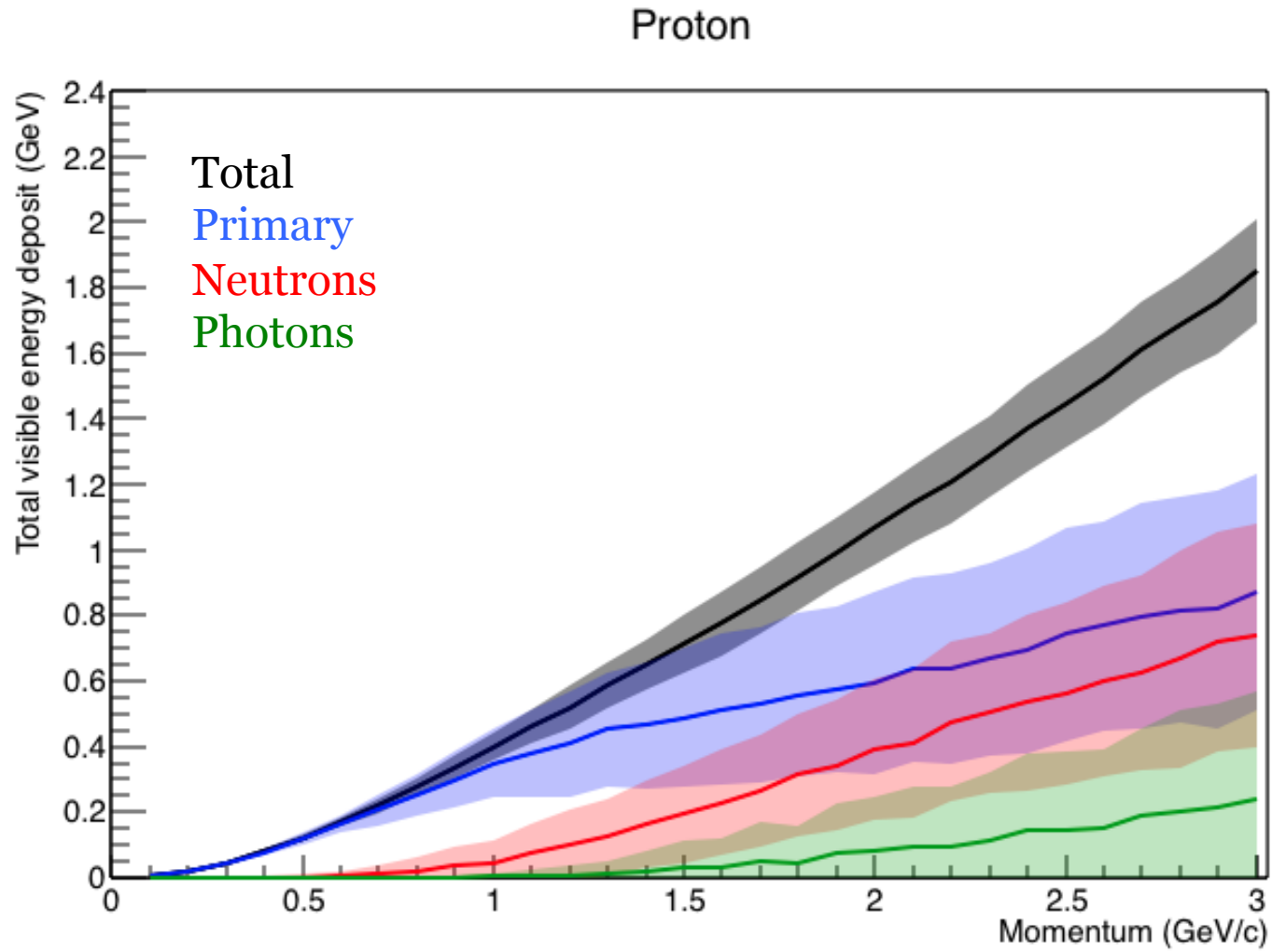


pandora Clusters

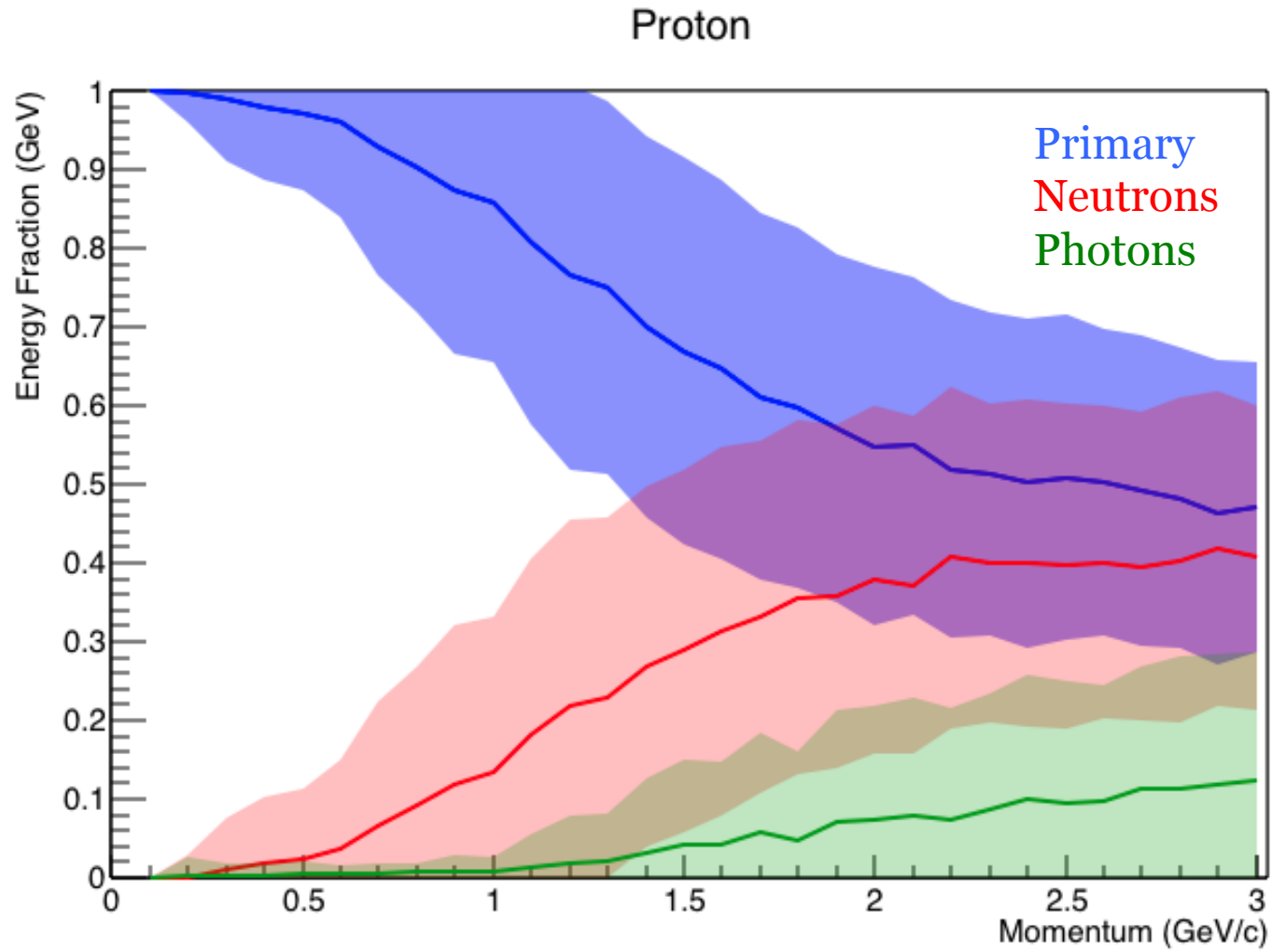


PROTONS

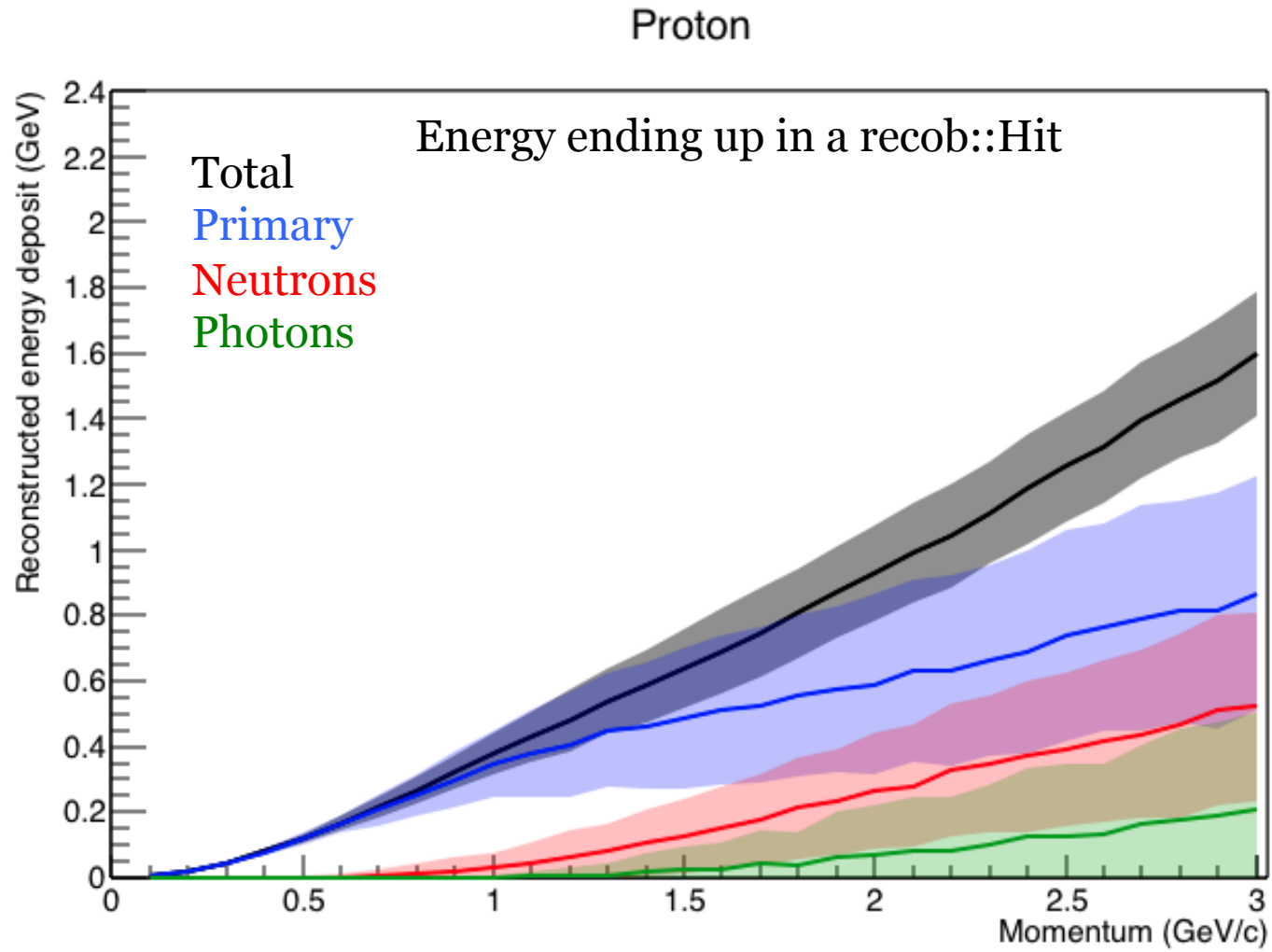
Proton energy deposit



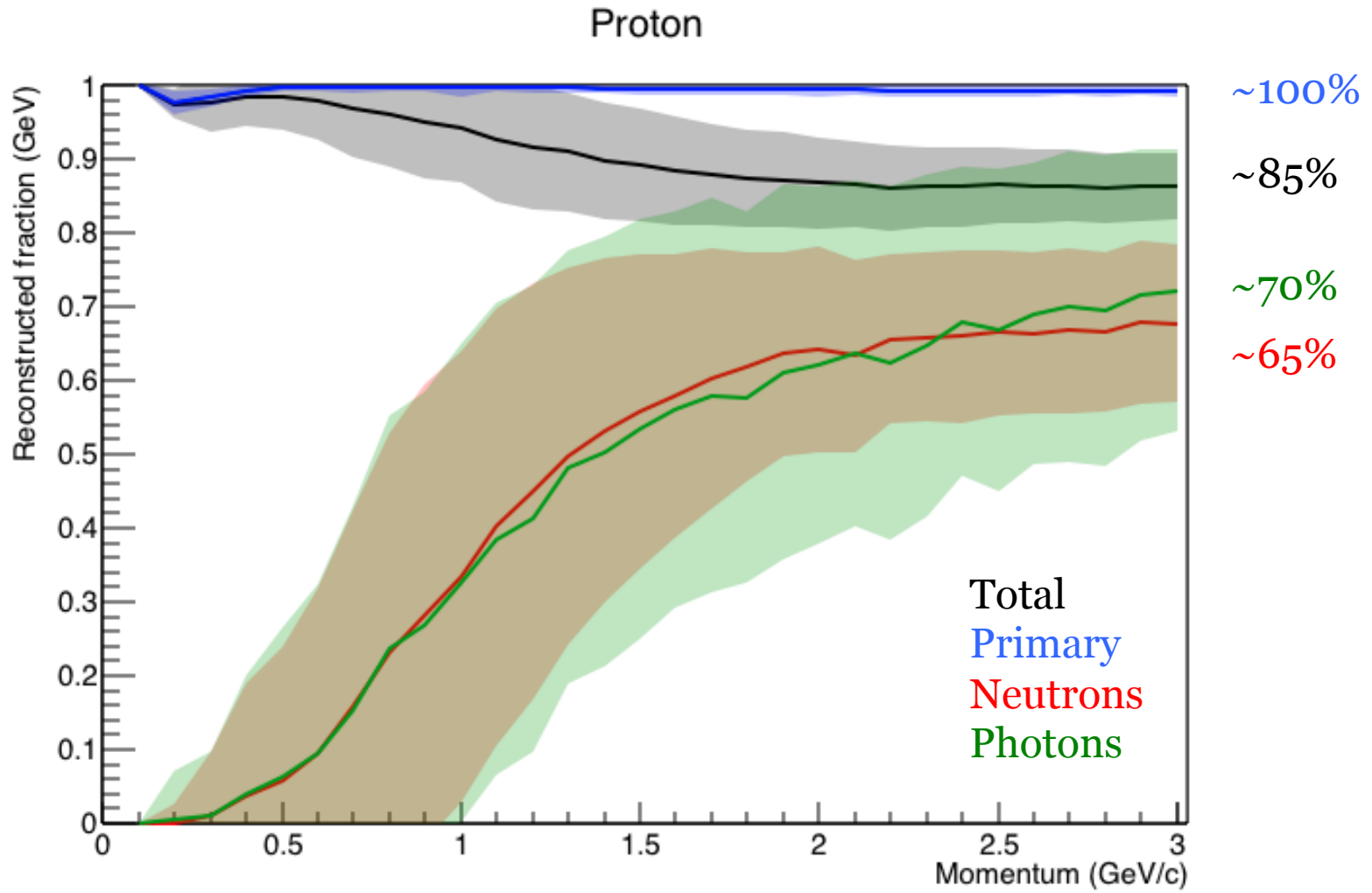
Fractional components



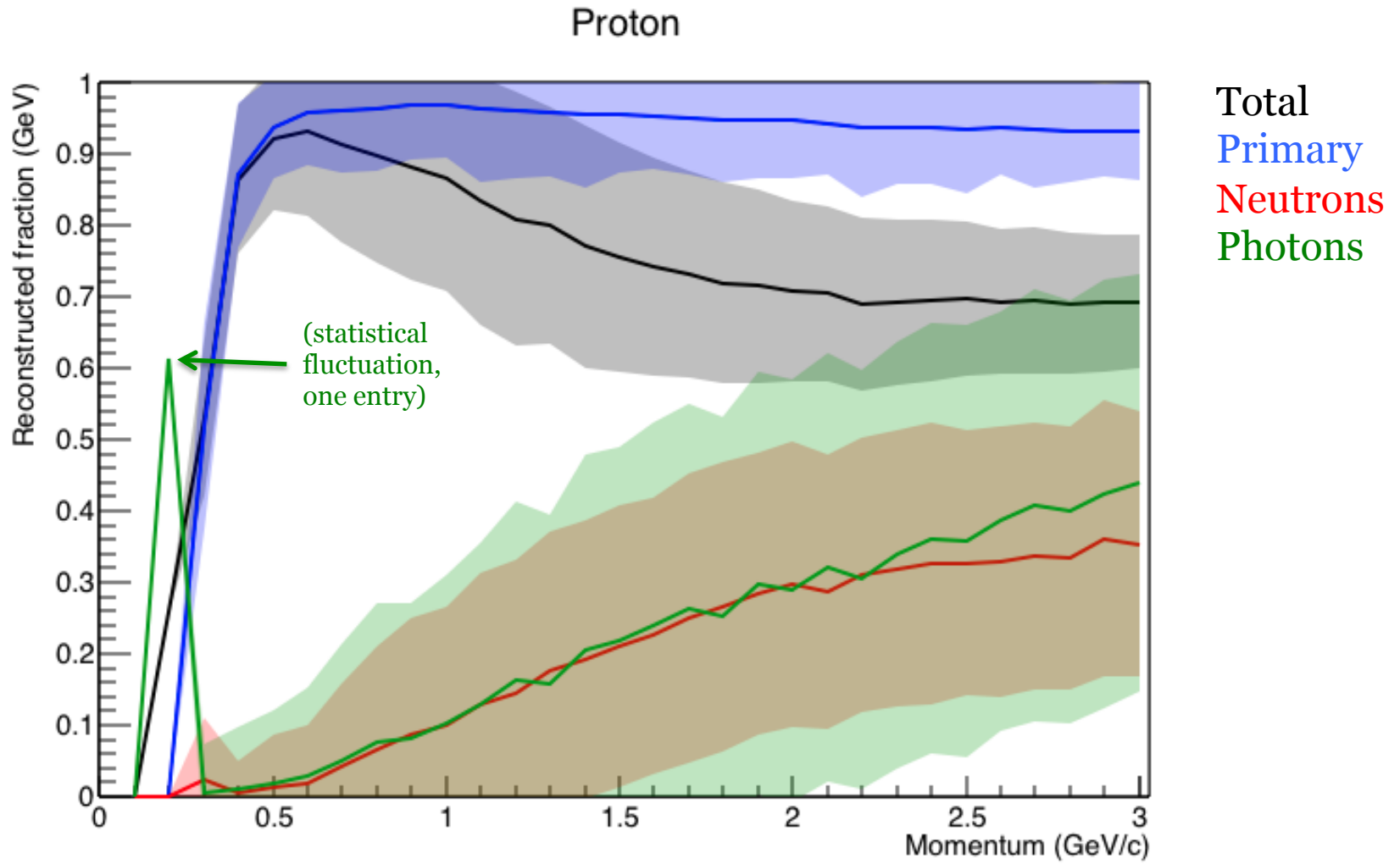
Reconstructed hits



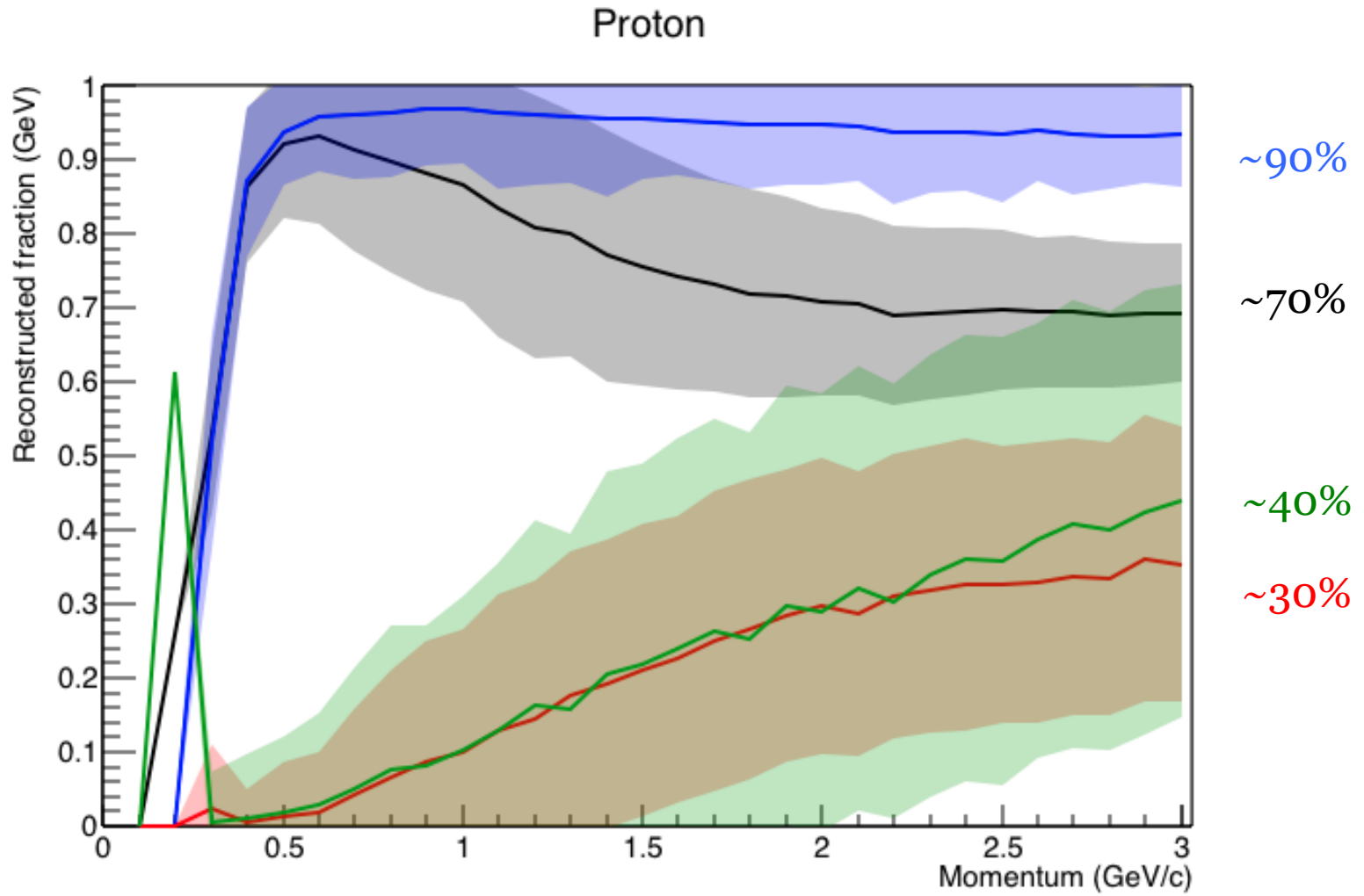
Reconstructed fraction



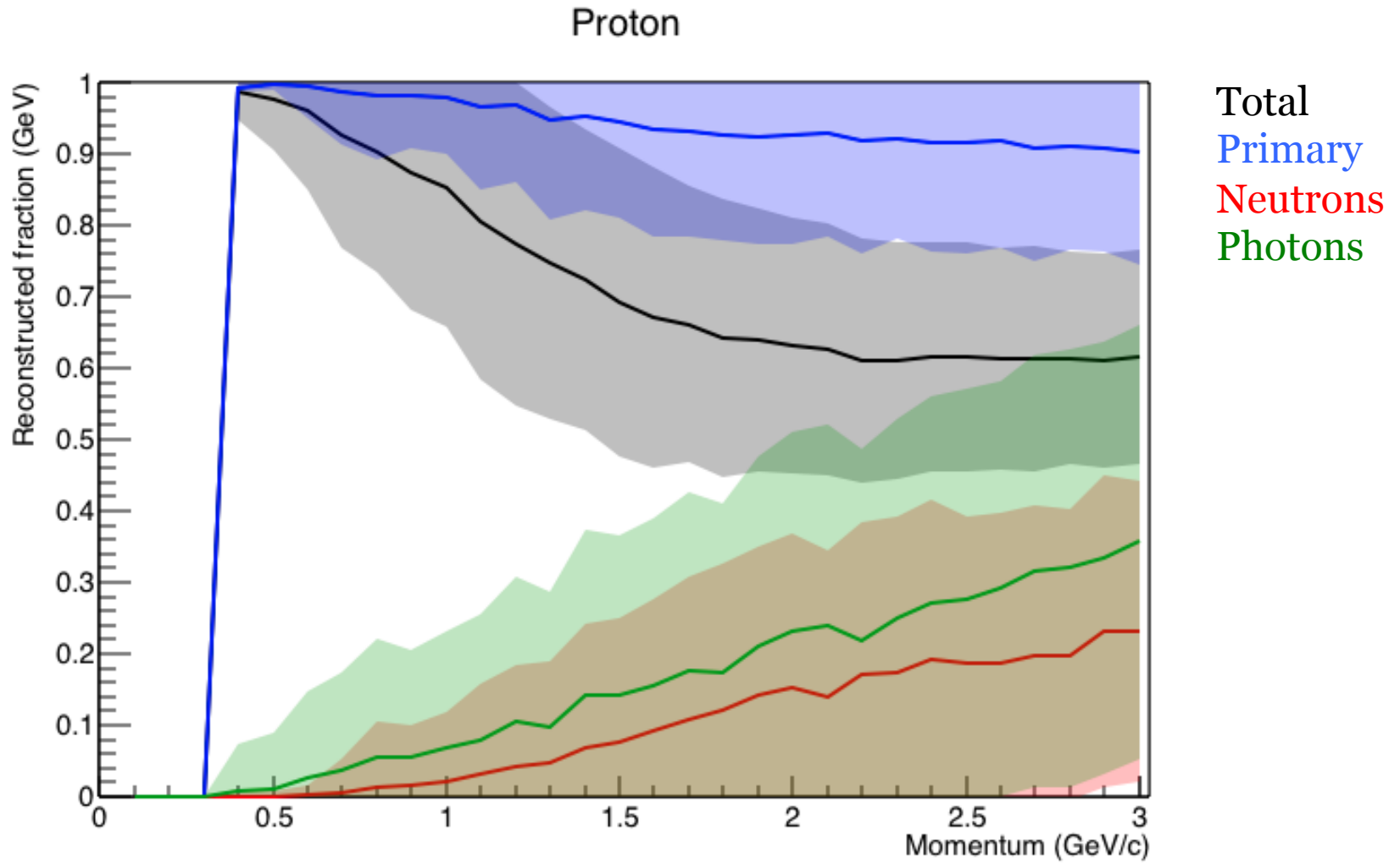
lineclusterdc Clusters



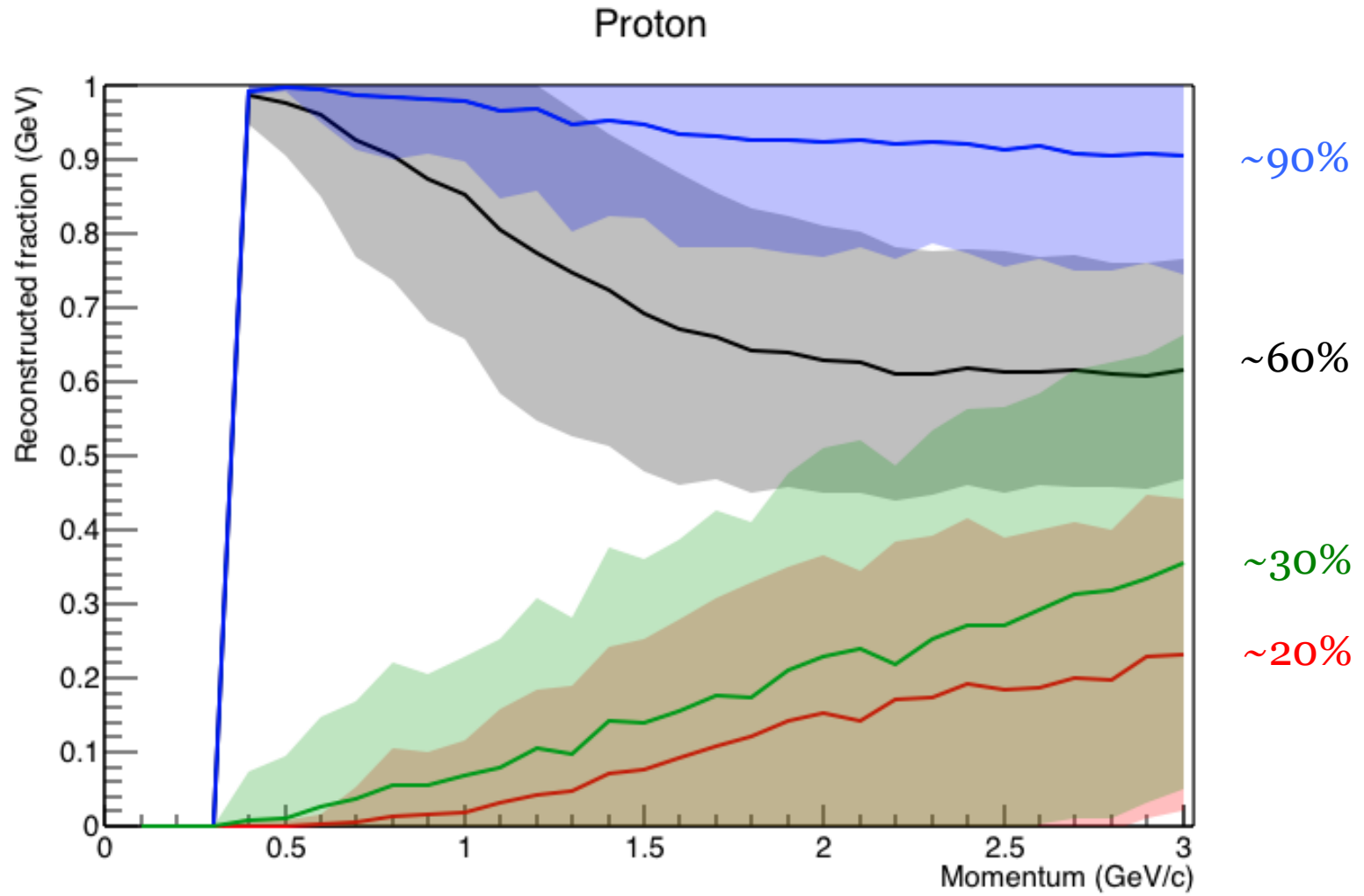
linecluster Clusters



pandoradc Clusters



pandora Clusters



Summary

- ~100% of primary energy deposit is reconstructed in hits
- ~40% of neutron energy is lost
- ~30% of photon energy is lost

- Even more energy is unclustered
- Pandora doing worse than linecluster
- No difference between 'dc' and non-'dc'

BACKUPS

Total E deposit for 1.0 GeV pion

