PandoraPFA Questions

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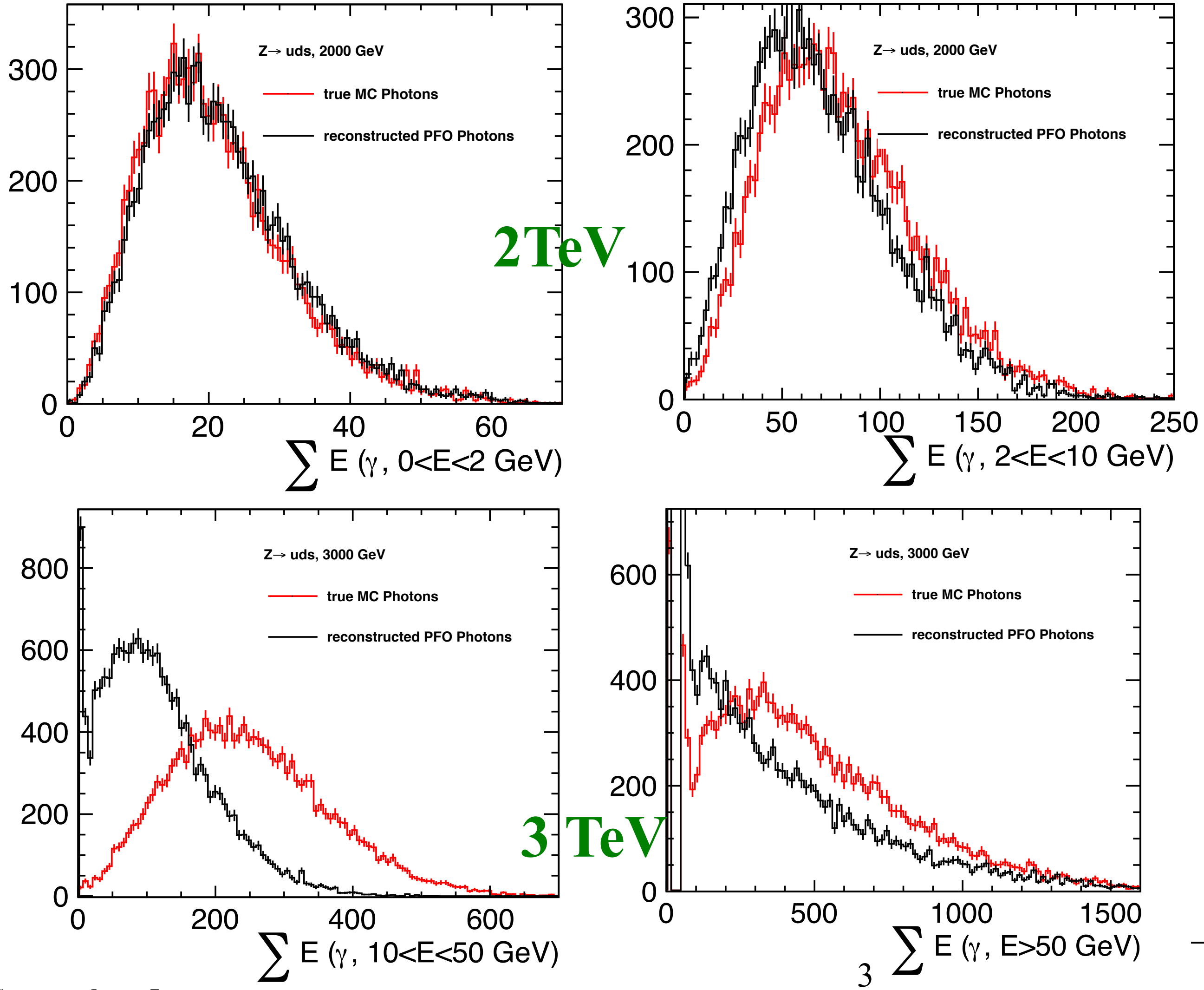
Photon Identification inside of jets:
At high energies we lose photons into neutrons

Remaining issues at high energies: contribution from photons

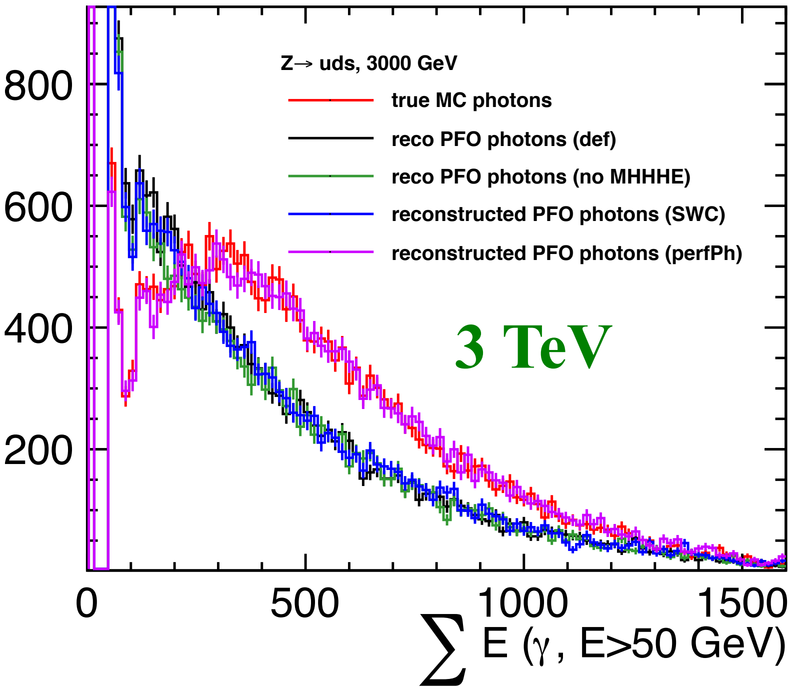
Check what might cause the higher jet energy resolution values for high energetic jets: photon energy distributions

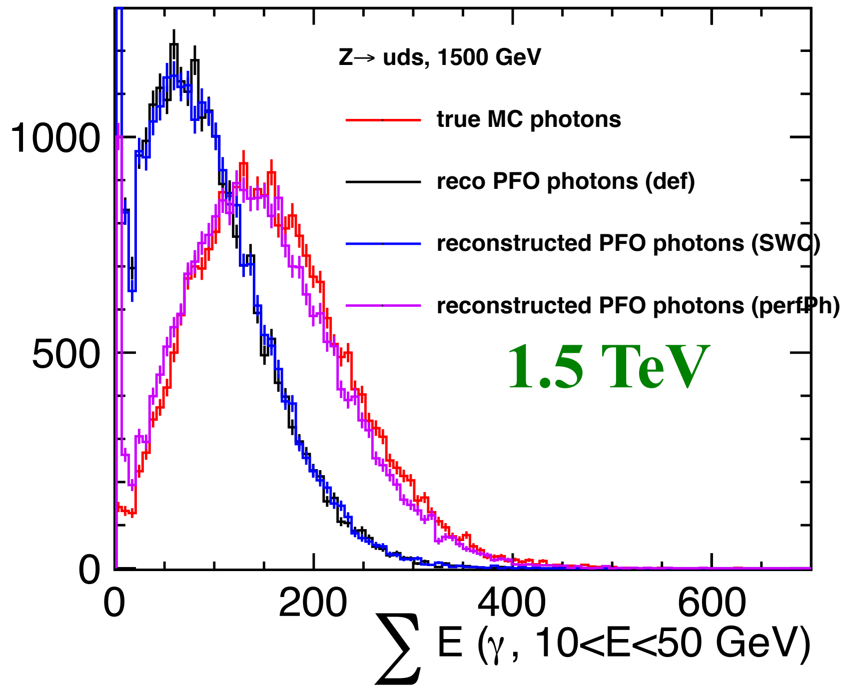


For low energetic photons contribution well reconstructed, contribution from photons between 10 and 50 GeV vastly underestimated

PhotonEnergy component in jets

PandoraPerfectPhoton (cheats photo pattern recognition) gives far better result of energy sum of high energetic photons



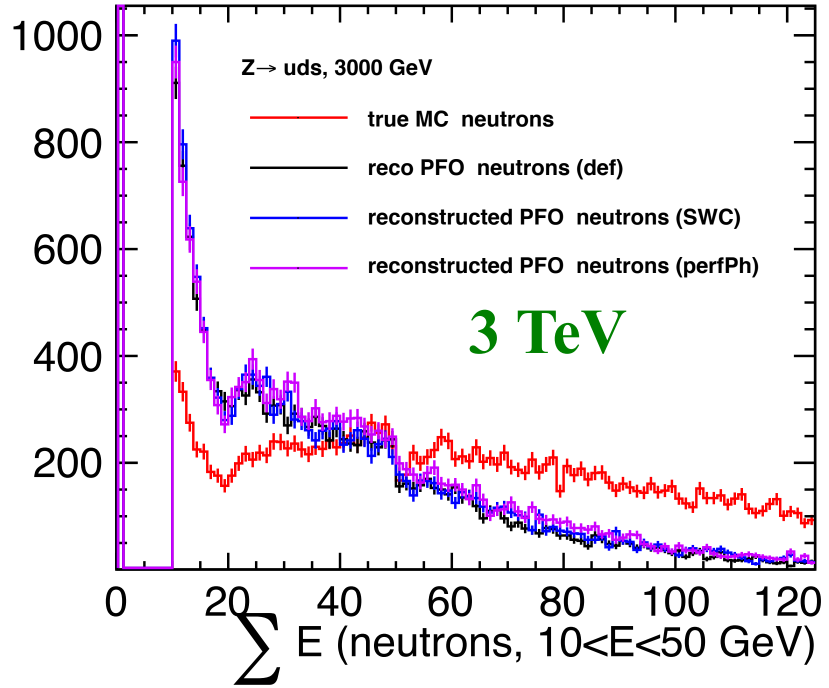


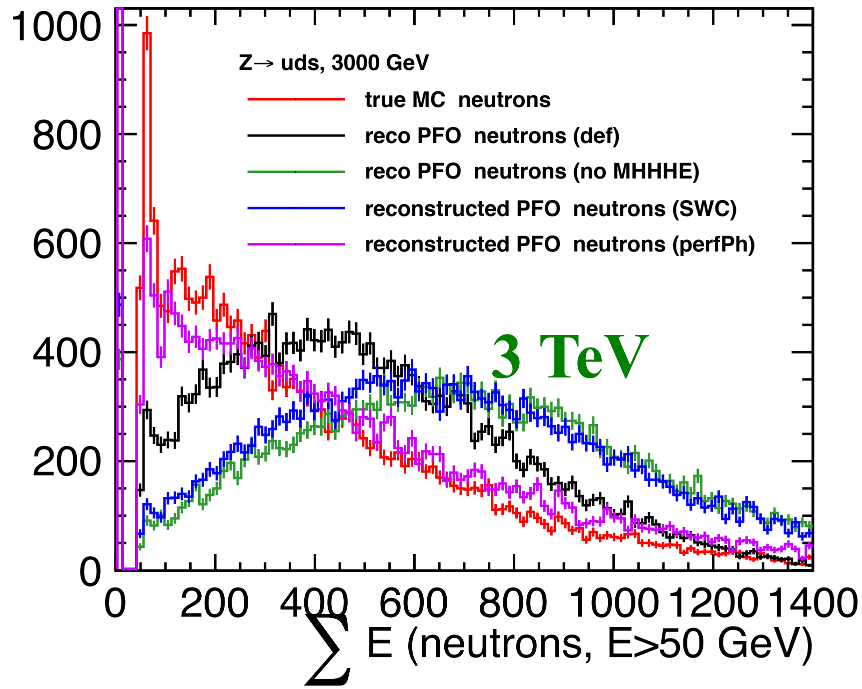
Only (cheated) perfect photon pattern recognition achieves to correctly identify the contribution of high energetic photons to the event energy

For all other settings (CLIC default settings, default setting removing MHHHE cut, software compensation) distribution shifted to lower values, but agreeing with each other

PhotonEnergy component in jets where do we lose the energy, where does it go to

Check all energy contributions comparing the perfect photon cheated identification with other reconstruction settings





All pion distributions unchanged, same for energy contribution from low and medium energetic neutrons →contribution from high energetic neutrons overestimated by all "real" reconstruction settings, energy from default CLIC settings lower than high MHHHE and SWC settings

Photon Identification tuning in PandoraPFA
What we tried

For each model the photon identification is retuned

→ Use PandoraSettingsPhotonTraining configuration file, result is a likelihood file for photons

→ Binned in terms of energy (0, 0.2, 0.5, 1, 1.5, 2.0,5,10,20 GeV)

→ After photon likelihood file has been determined rerun calibration

→tested increase in photon identification bins to 11 to account more for possible differences at high photon energies (0, 0.2, 0.5, 1, 1.5, 2.0,5,10,20,35,50 GeV)

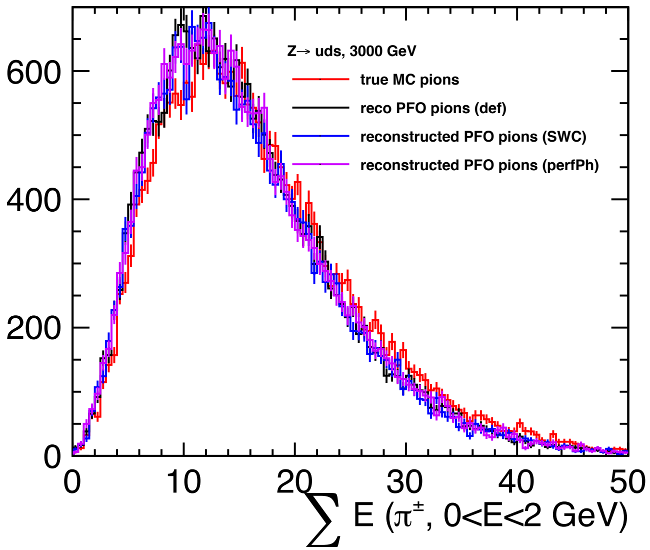
→ Unfortunately no sizeable improvement observed

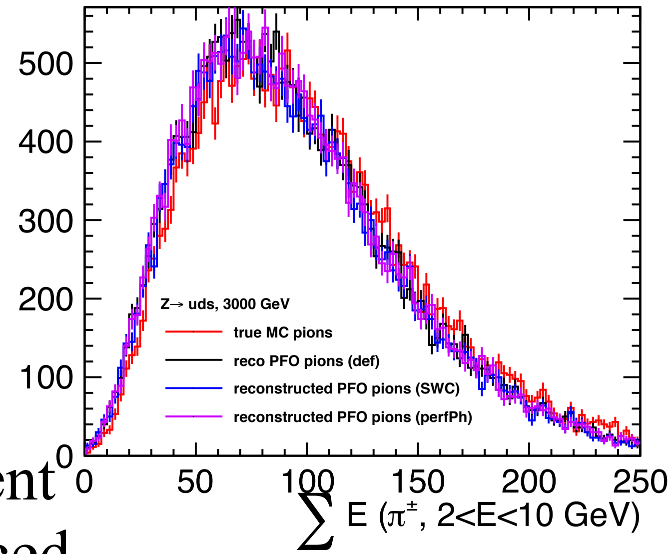
→ What could we do as next step: how are the signal and background like distributions defined

→ Could we check if input distribution in likelihood might lose discrimination power for higher photon energies, or where things might get a bit different

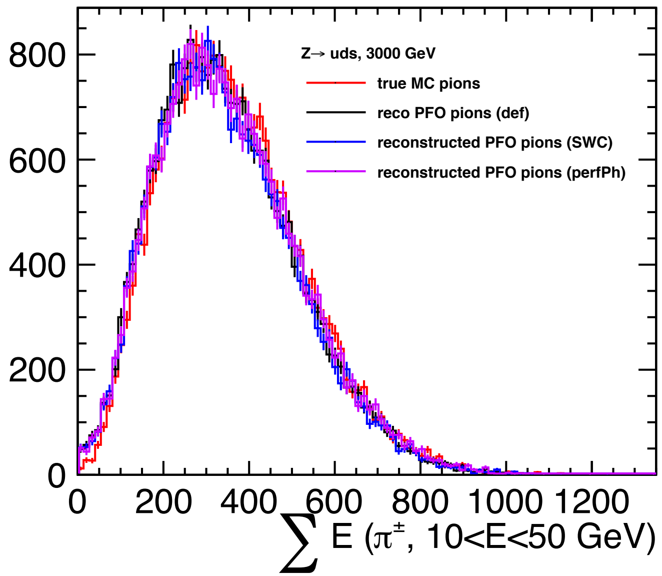
→ Produce maybe map in energy and theta, to check where problem appears precisely

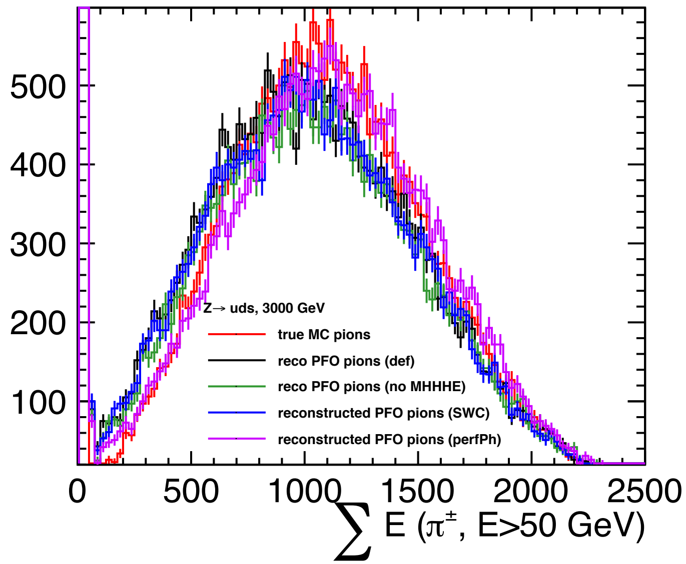
Pion Energy component in jets





Charged component correctly reproduced





Software Compensation Questions:
Input is the arXiv draft in
https://arxiv.org/abs/1705.10363

Software Compensation training samples

Paper states training sample of single K0L and neutrons from 10-95 GeV

→ What is the ratio of K0L to neutrons (spectrum is slightly different in Z→uds files) is it 1:1 and mixed

→ Are the training samples discrete (e.g. one sample at 10 GeV, another at 20 GeV etc), or is it a sample flat in cosTheta and flat in energy

→What is the physics behind the energy dependence of equations 4-6, is it empirical or based on a certain theory model (i.e. can we use them for even higher energetic neutral hadrons)

→ I assume equation (3) holds for all energy densities $\omega(\rho) = p1 \exp(p2\rho)+p3$

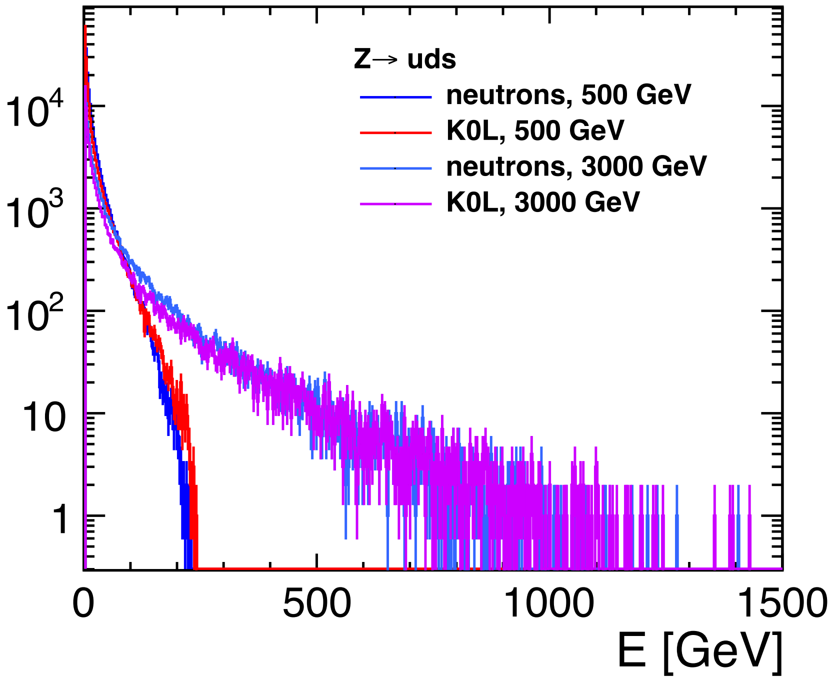
Implementation:

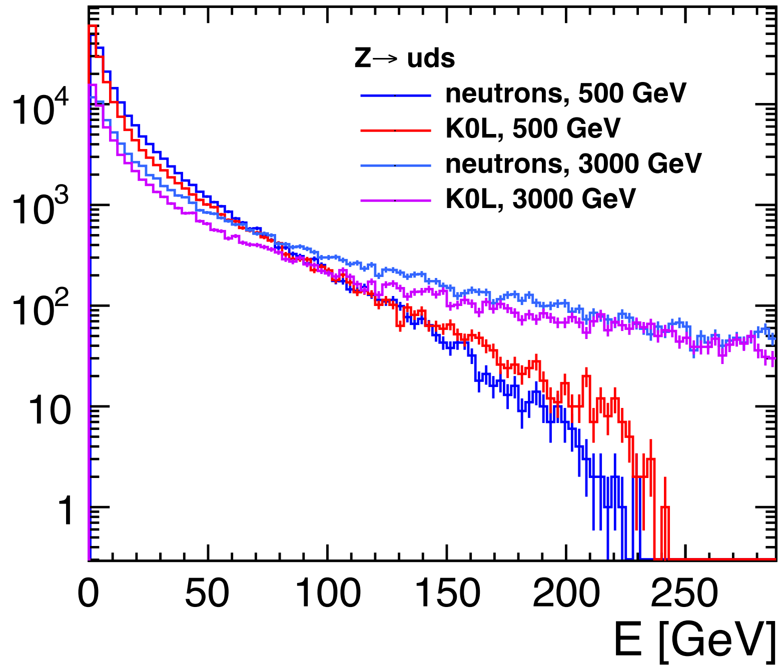
→ The default weights are hard coded, can we try to make the number of density bins variable, everything else seems to be possible to read in via xml settings in the function of LCSoftwareCompensation::ReadSettings(const TiXmlHandle xmlHandle)

Hadron spectrum for CLIC (Zuds 500 vs Zuds 3000 GeV)

For 500 GeV dataset neutral hadron energies beyond 90 GeV are 1.9 %, for 3000 dataset 13.7 % → if we want same coverage of neutral hadron energy spectrum need to calculate weights for samples up to 400 GeV (1.7 % beyond that point for 3000 GeV sample)

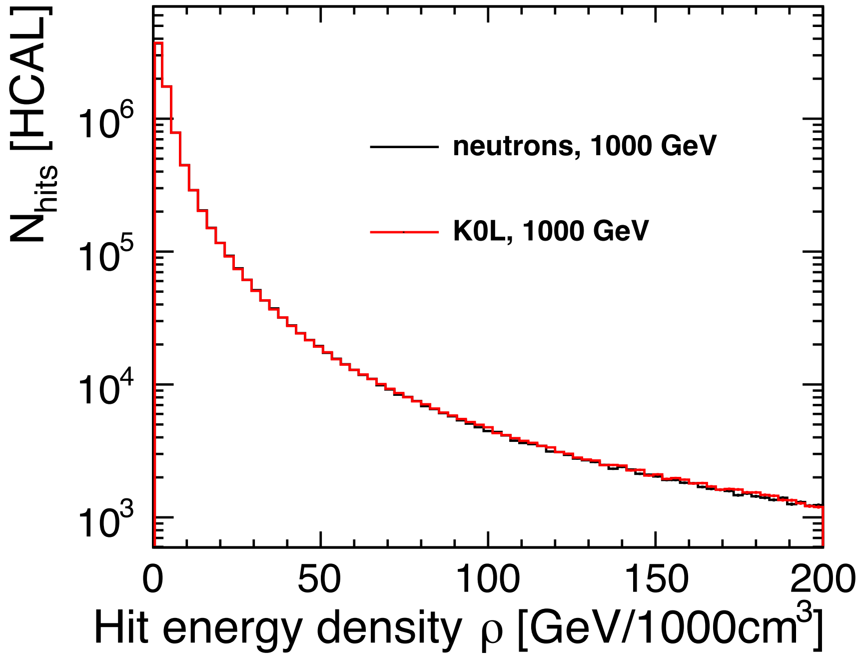
→ For high end tail definitely need CLIC specific weights





Hit energy density for 1000 GeV neutral hadrons

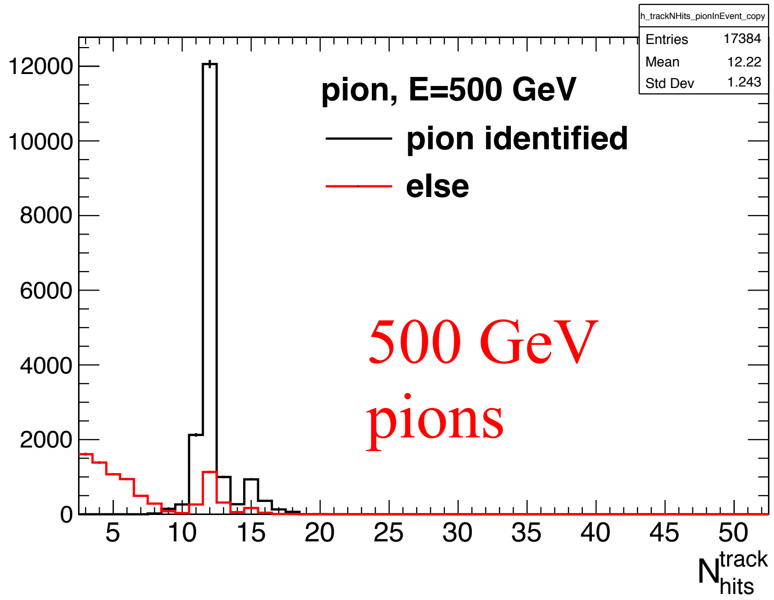
Software compensation weights are determined by minimisation of a χ^2 like function using all energy points and densities up to 30 GeV/1000 cm^3

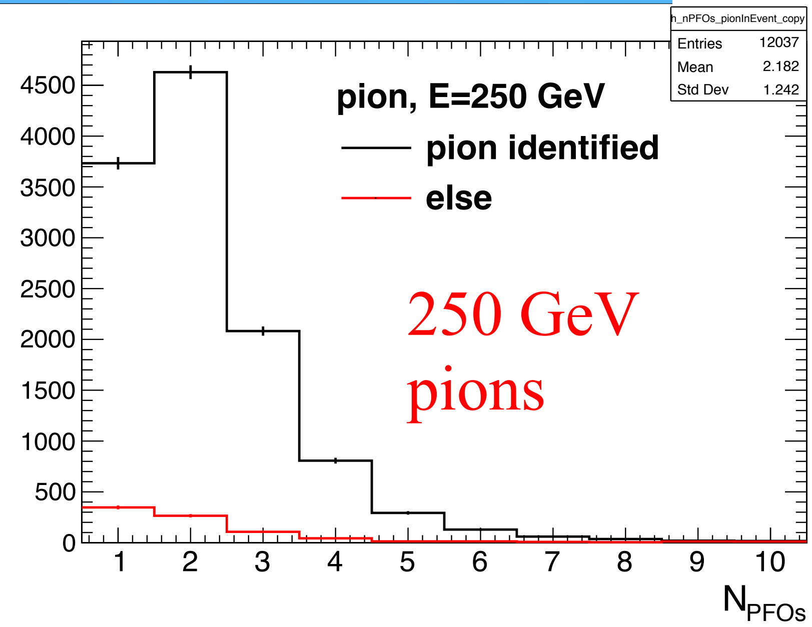


Quite a few hits with high energy density beyond 100 GeV/dm^3 (cutoff until when weights are applied) → so we need to extend the software reweighting
→ In case we do use the current weights most cell energies are reweighted with a constant factor smaller than 1(energy dependence

High energetic pions:
Cluster split to create separate high energetic neutron

High energetic pions

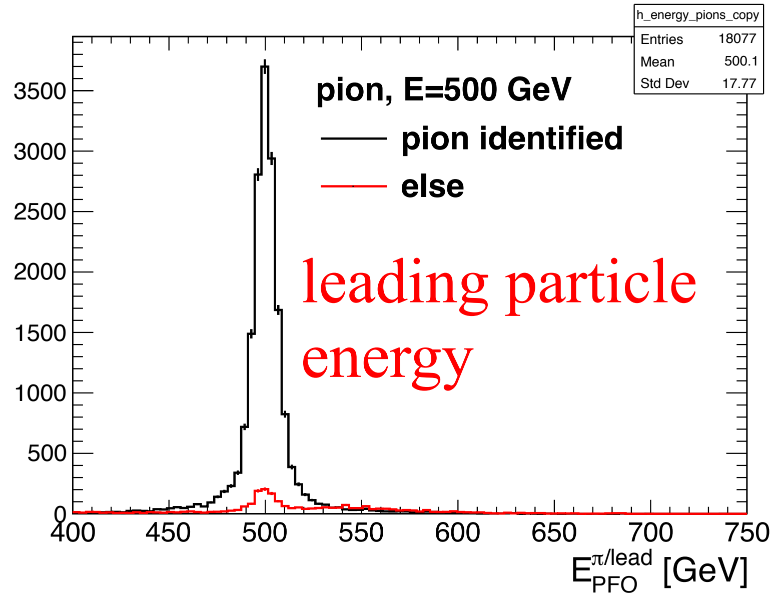


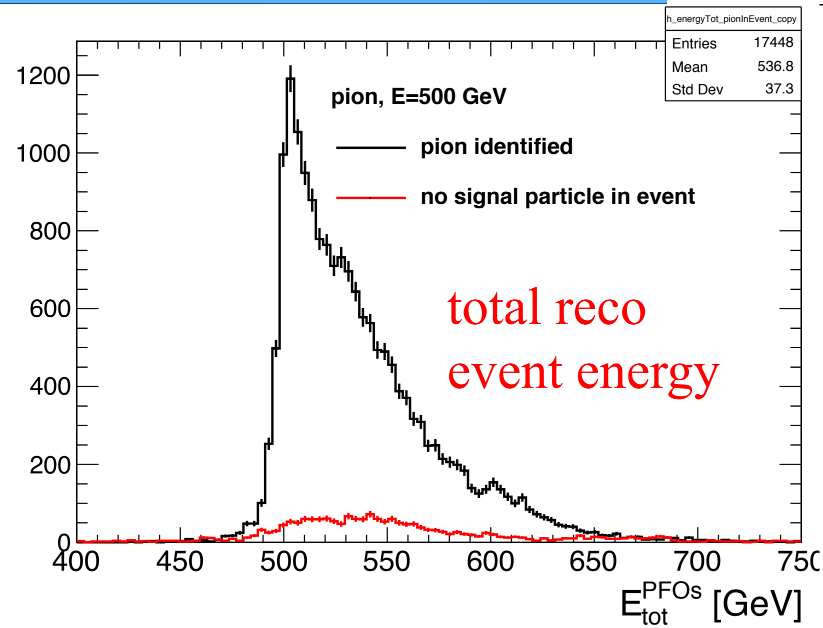


We checked high energetic tau's and discovered a huge drop in tau identification efficiency for 1 prong decays (thus most probably related to pion identification)

In majority of events Pandora reconstructs two or more particles in the event

High energetic pions: energy reconstruction at 500 GeV





- Leading particle is at correct energy,
- Splitting into several calorimeter clusters creates long tail for total reconstructed energy
- Sum of all calorimeter cluster energy symmetrically distributed (mean higher as 500 GeV at 540 GeV)