Cut Based Electron Identification Study of LDC01Sc Model

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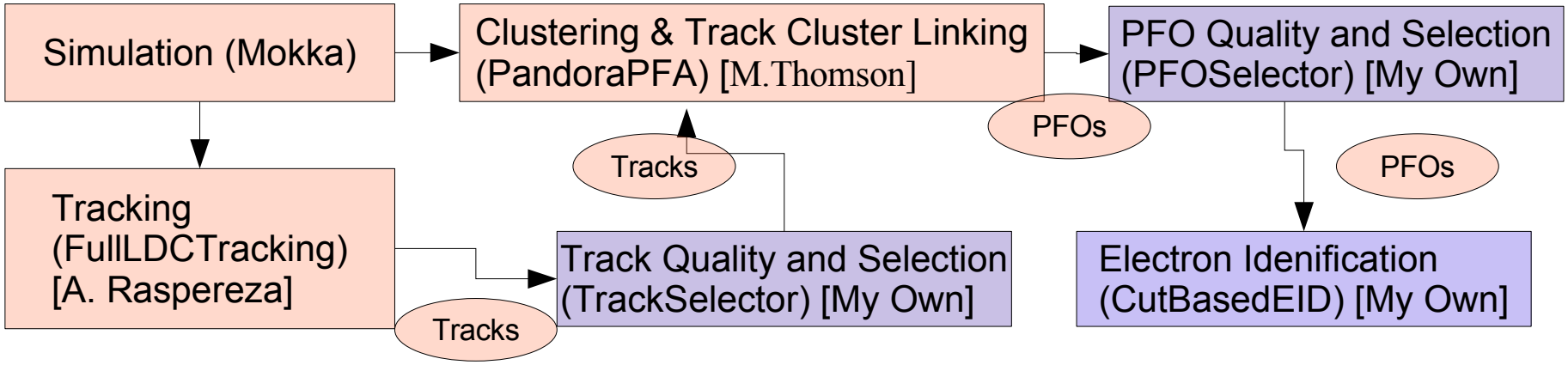
OUTLINE

- Objective and Work Flow
- Simulation / Data Samples
- Tracking Quality Check and Selection
- PFO Quality Check and Selection
- Cut Based Electron Identification
- Efficiency Check of Cut Based EID
- Conclusion / Outlook

Objective and Work Flow

- Objective:
  - Provide good electron data sample for Higgs Recoil Mass Study (ee->ZH->eeX)
- Work Flow

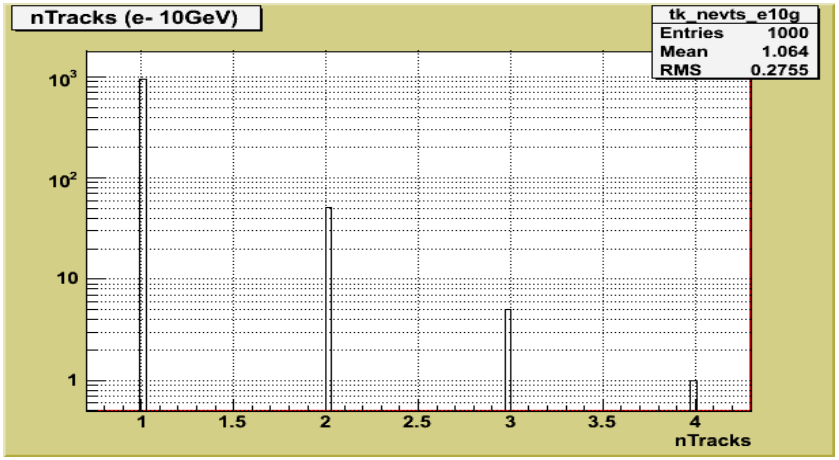


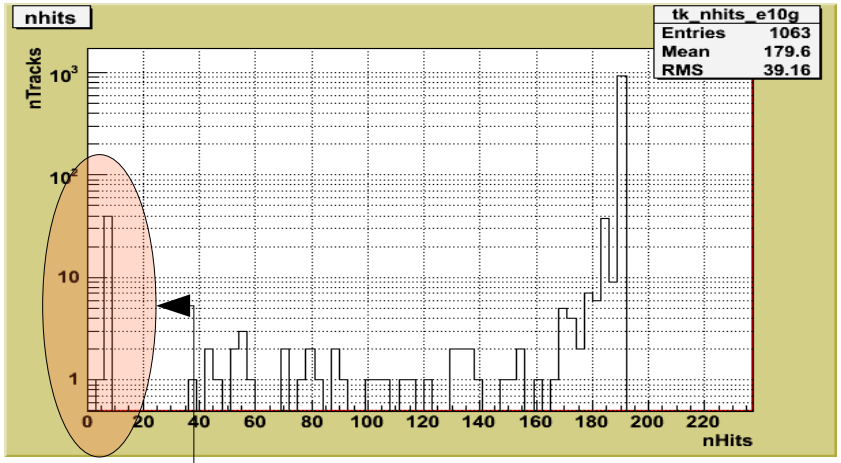
Simulation / Data Samples

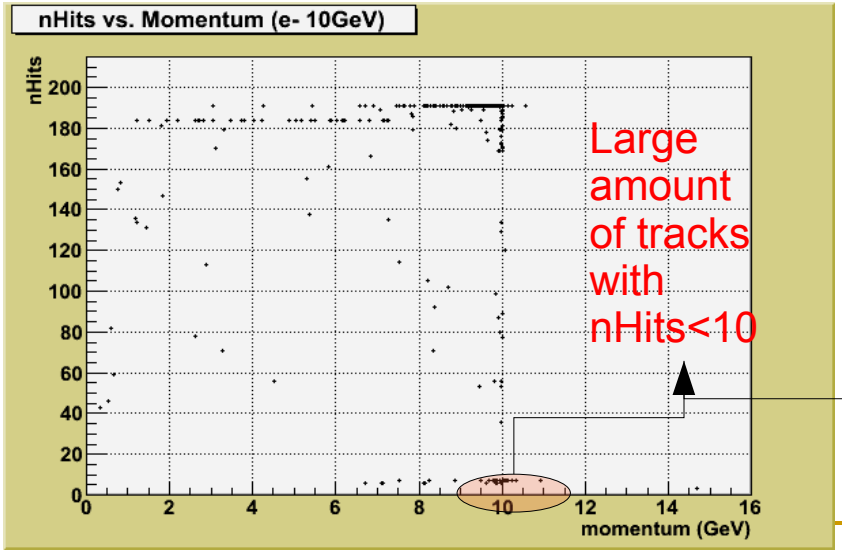
- Simulation
  - Mokka,
  - LDC01Sc Model, with Sit01 (instead of Sit00)
  - Particle Gun,
    - Theta smear (35°, 145°) : Acceptance range excluded FTD
    - Phi smear (0°, 360°)
- Data Samples
  - e-, mu-, pi-
  - 10GeV, 30GeV, 50GeV, 70GeV, 90GeV, 120GeV
  - 1000 Events Each

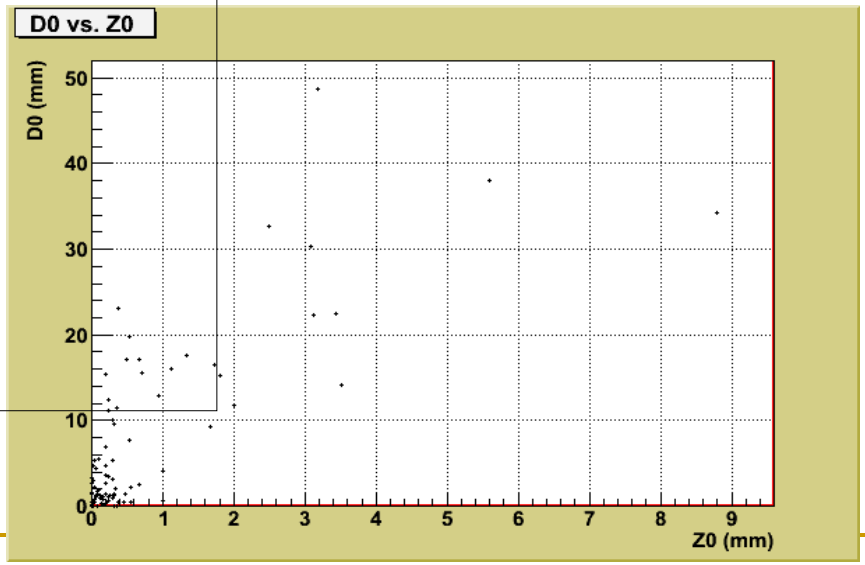
Tracking Quality Check and Selection

10GeV e- sample



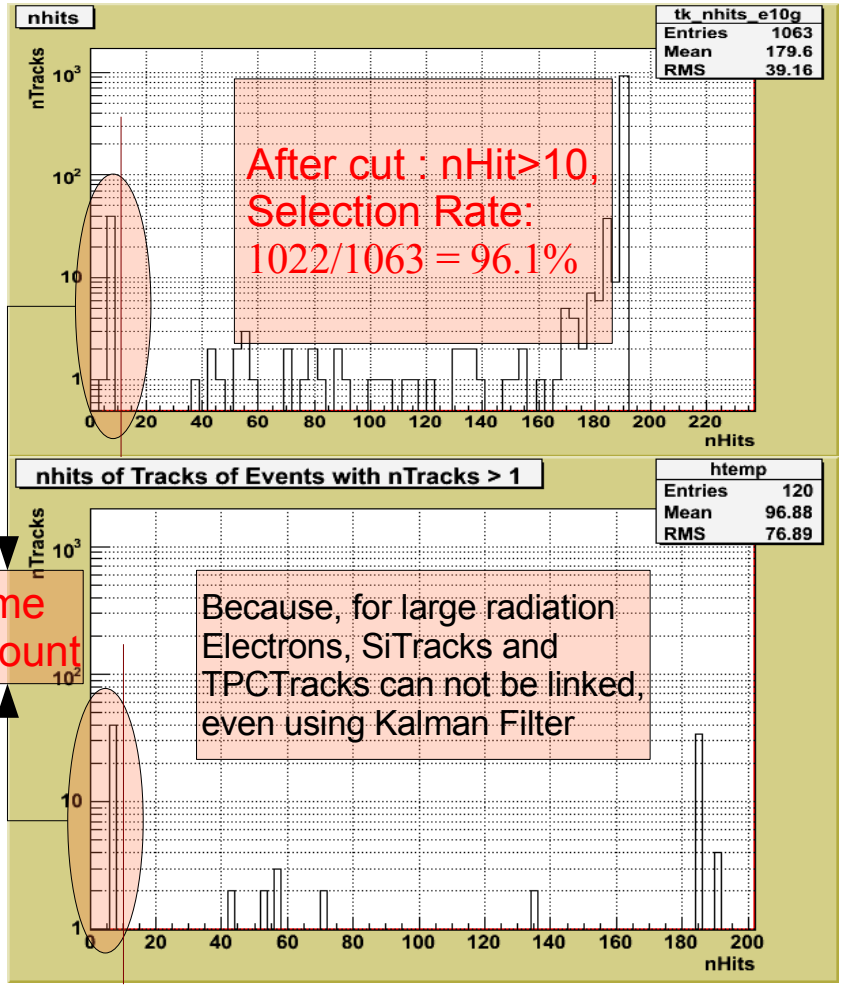




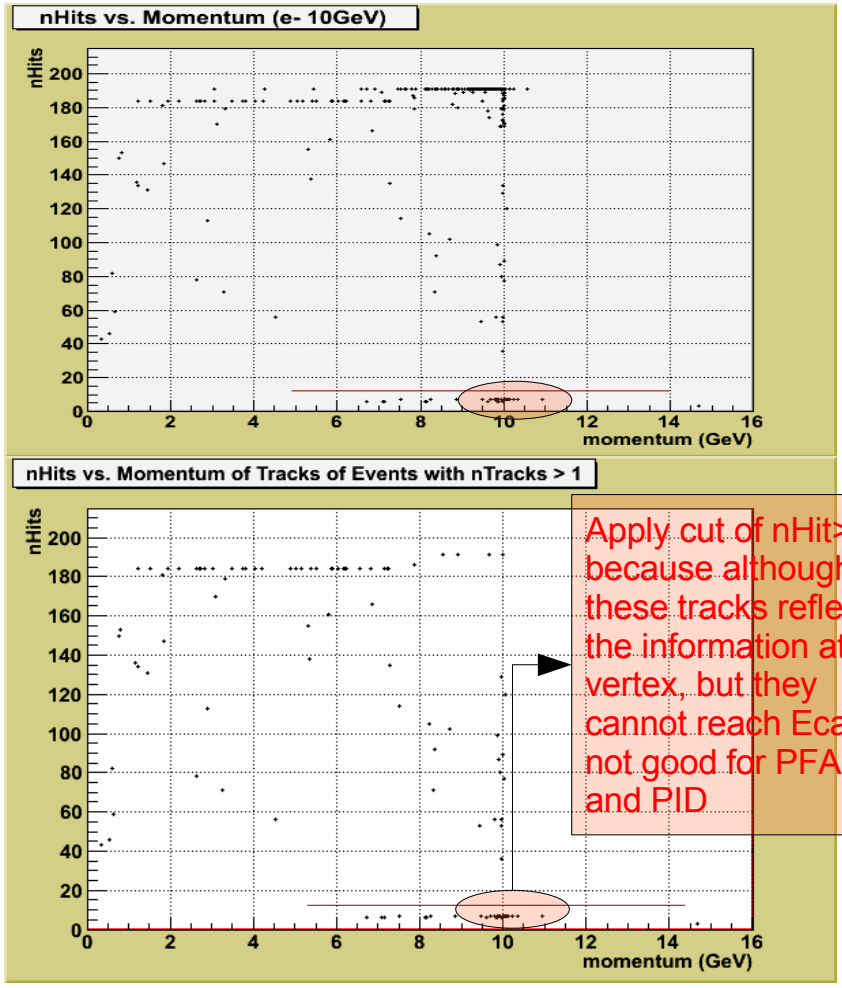


Tracking Quality Check and Selection

10GeV e- sample



Same Amount

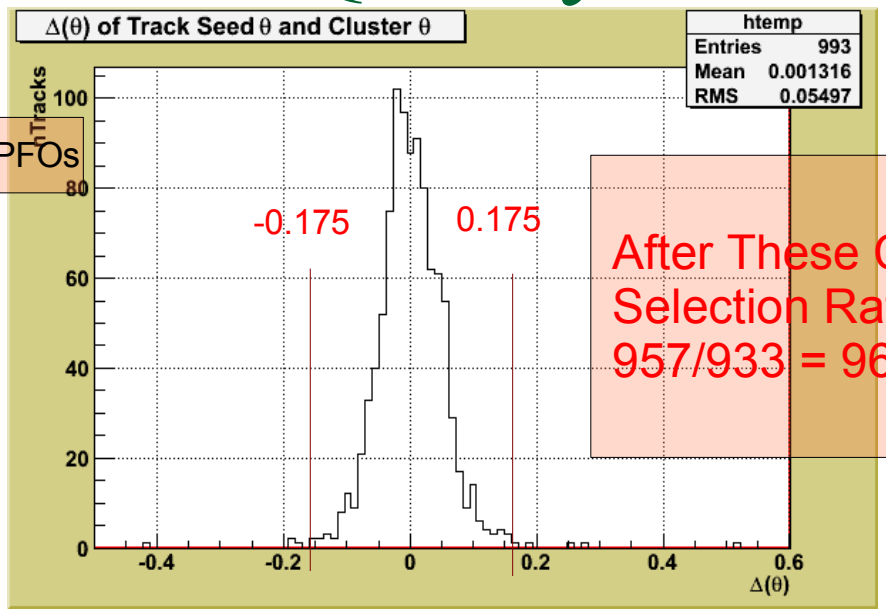


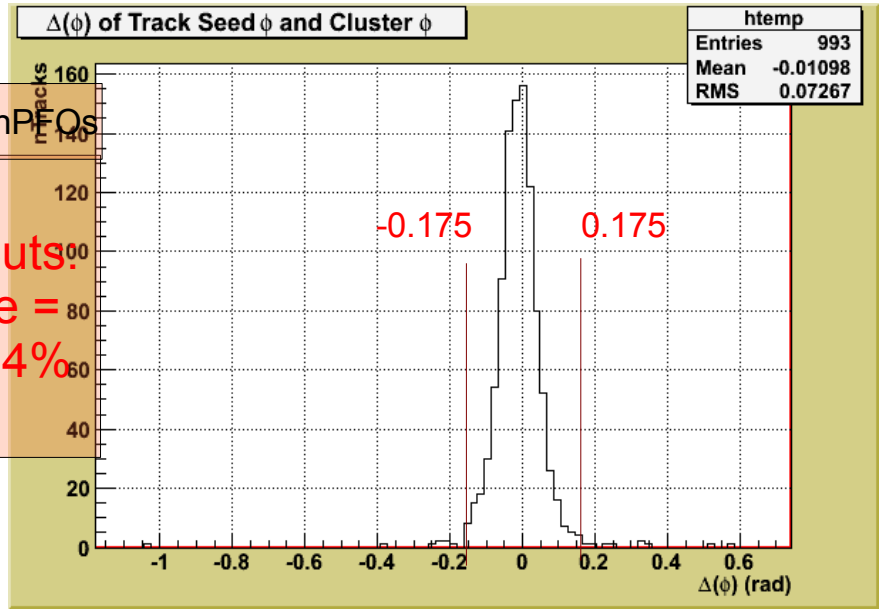
PFO Quality Check and Selection

- Track Cluster Linking Quality Check (10GeV e-)
  - Criteria Used in PandoraPFA
    - Distance of the Nearest Cluster Hit to Track Trajectory, for the first 10 pseudo layers
  - Criteria in this PFO Quality Check
    - Delta(Theta) of Track Theta at Seed and Cluster Theta
      - Seed defined as the interaction point of Track and ECal
    - Delta(Phi) of Track Phi at Seed and Cluster Phi
    - Distance of Seed to the Nearest Cluster Hit
    - Distance of Cluster Center of Gravity to Track Trajectory
  - If these 4 criteria applied, no bad PFOs can get into our eyes :D

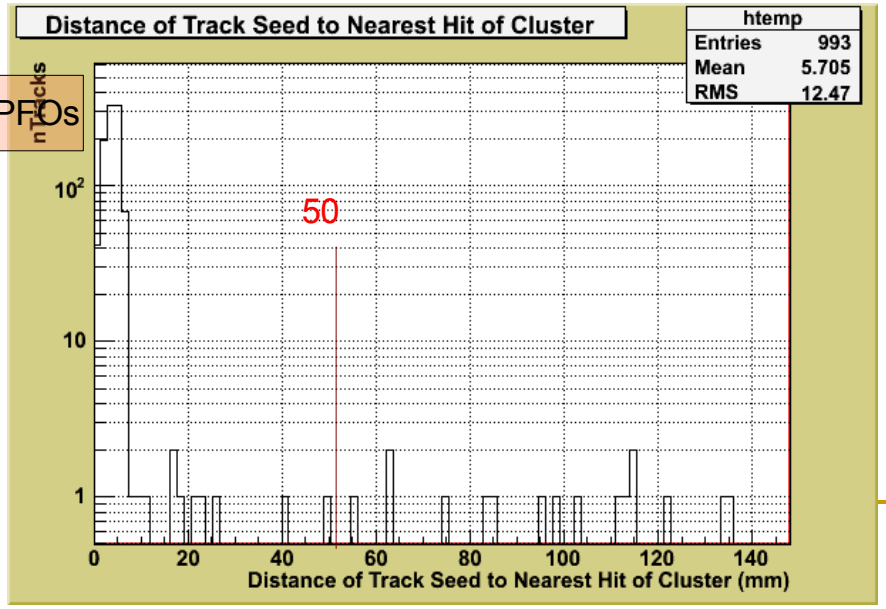
10GeV e- sample

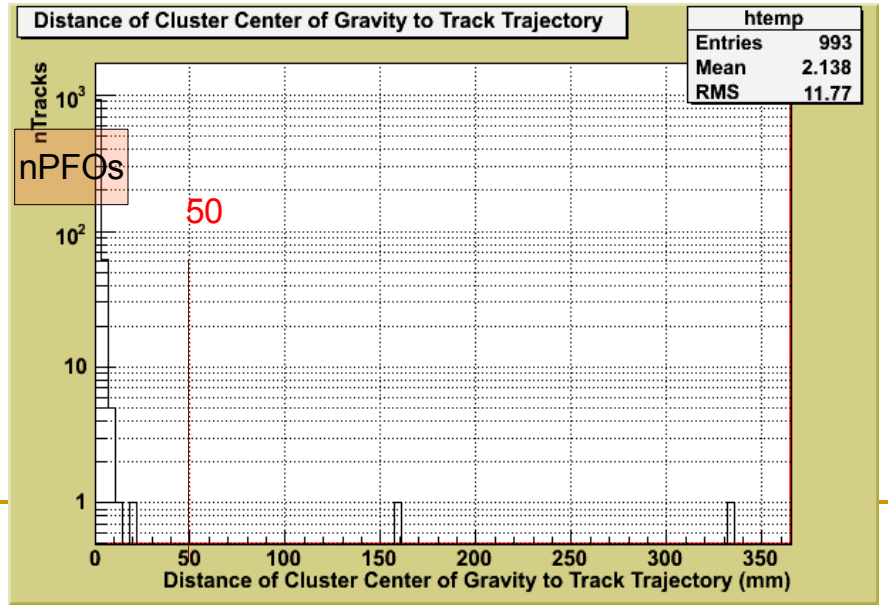
PFO Quality Check and Selection





After These Cuts:
Selection Rate =
957/933 = 96.4%



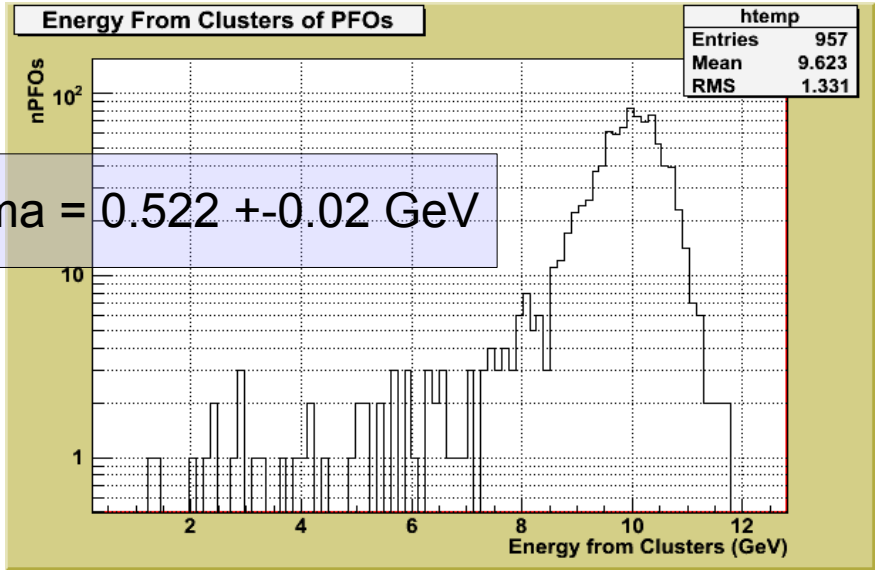


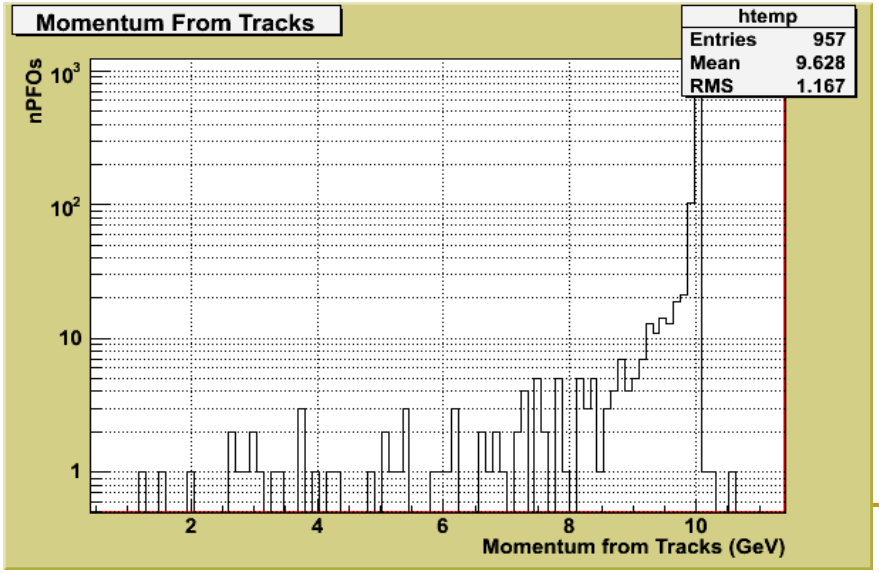
PFO Quality Check and Selection

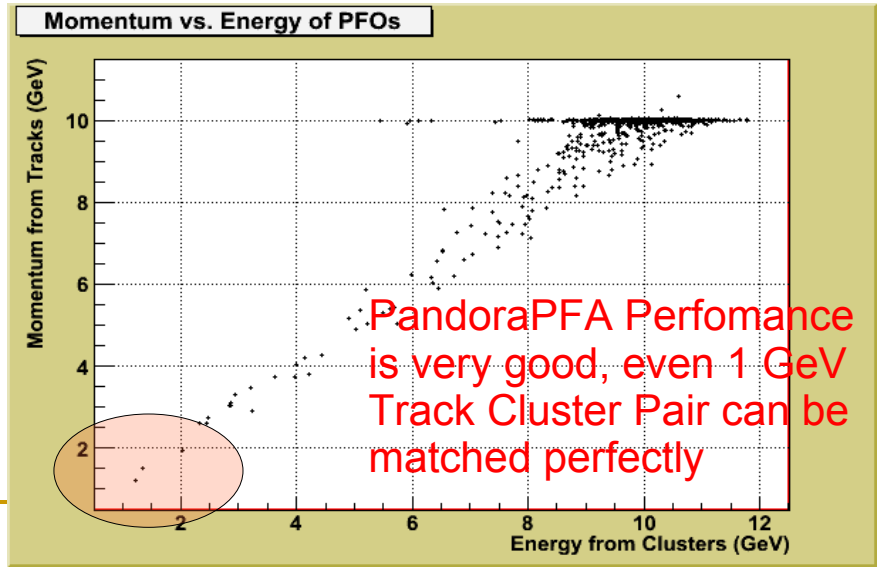
10GeV e- sample

- After PFO Selection:
  - Momentum from Tracks,
  - Energy from Clusters,
  - Momentum vs. Energy

Sigma = 0.522 +-0.02 GeV



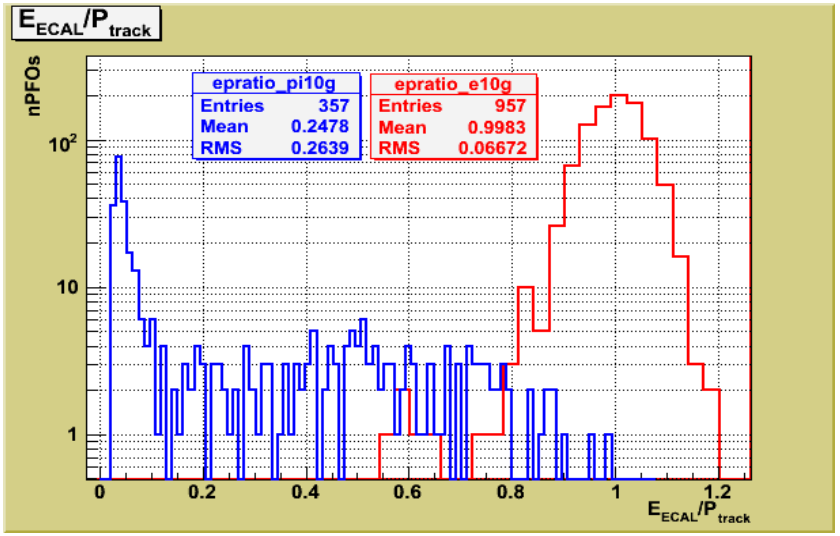


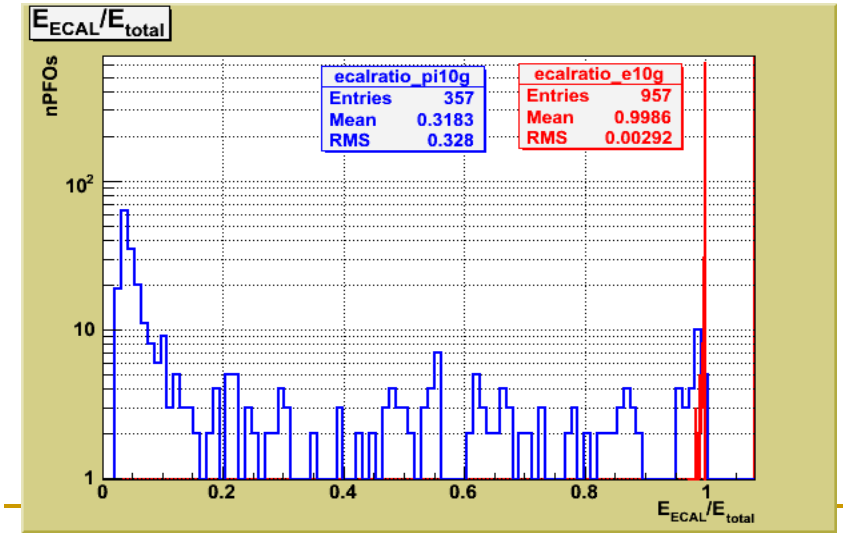


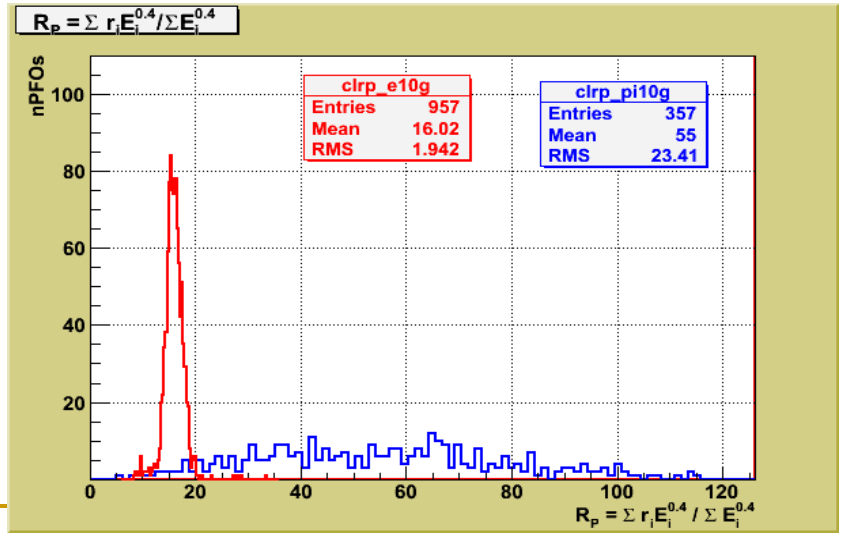
Cut Based Electron Identification

10GeV e- and pi- sample
Blue: pion; Red: electron

- Cuts Definition:
  - E_{ECAL} / E_{total} *of Clusters*
  - E_{ECAL} / P_{Track}
  - $R_P = \sum_{i=nHits} r_i E_i^{0.4} / \sum_{i=nHits} E_i^{0.4}$ *of Clusters*







Efficiency Check of Cut Based EID

- Apply the same Cuts
  - $E_{ECAL} / E_{total}\ of\ Clusters$ > 0.9
  - E_{ECAL} / P_{Track} Within (0.6, 1.5)
  - $R_P = \sum_{i=nHits} r_i E_i^{0.4} / \sum_{i=nHits} E_i^{0.4}\ of\ Clusters$ Within (8, 40)
- Efficiency Of Electrons
  - Efficiency = (Number of e- Identified) / (Number of PFOs After Selection)

e-	10GeV	30GeV	50GeV	70GeV	90GeV	120GeV
Efficiency (%)	99.69	99.68	99.14	98.19	97.34	96.48

- Rejection Rate Of Muons
  - Rejection Rate = 1 – (Number of e- Mis-Identified) / (Number of PFOs before Selection)

mu-	10GeV	30GeV	50GeV	70GeV	90GeV	120GeV
Rejection Rate (%)	100	100	100	100	100	100

- Rejection Rate Of Pions

pi-	10GeV	30GeV	50GeV	70GeV	90GeV	120GeV
Rejection Rate (%)	97.41	98.55	99.51	98.96	99.24	99.52

Conclusion and Outlook

- During this analysis, I found:
  - FullLDCTracking performance : good! :D
  - PandoraPFA perfomance: good! :D
- Electron Identification Object achieved
  - EID cuts should be optimized for physics study
- A later correction for the radiation of electrons is needed
  - Although the electron is identified, but the identified electrons, in some rate, cannot show us correctly the information of their parents (from the vertex)