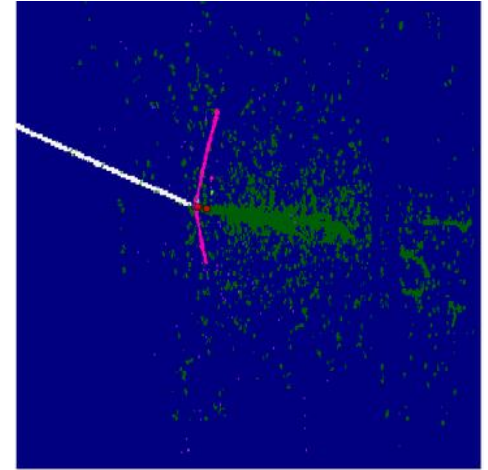
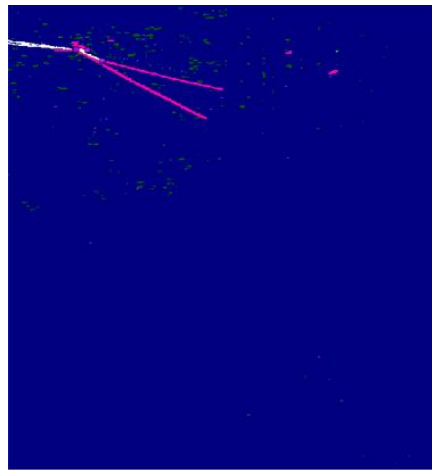
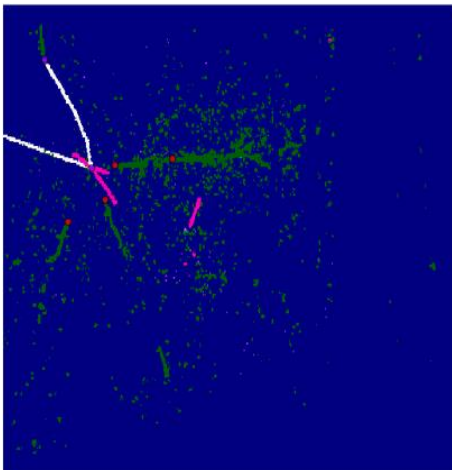


Hadronic energy shower reconstruction

Dorota Stefan (CERN/NCBJ)

Outline

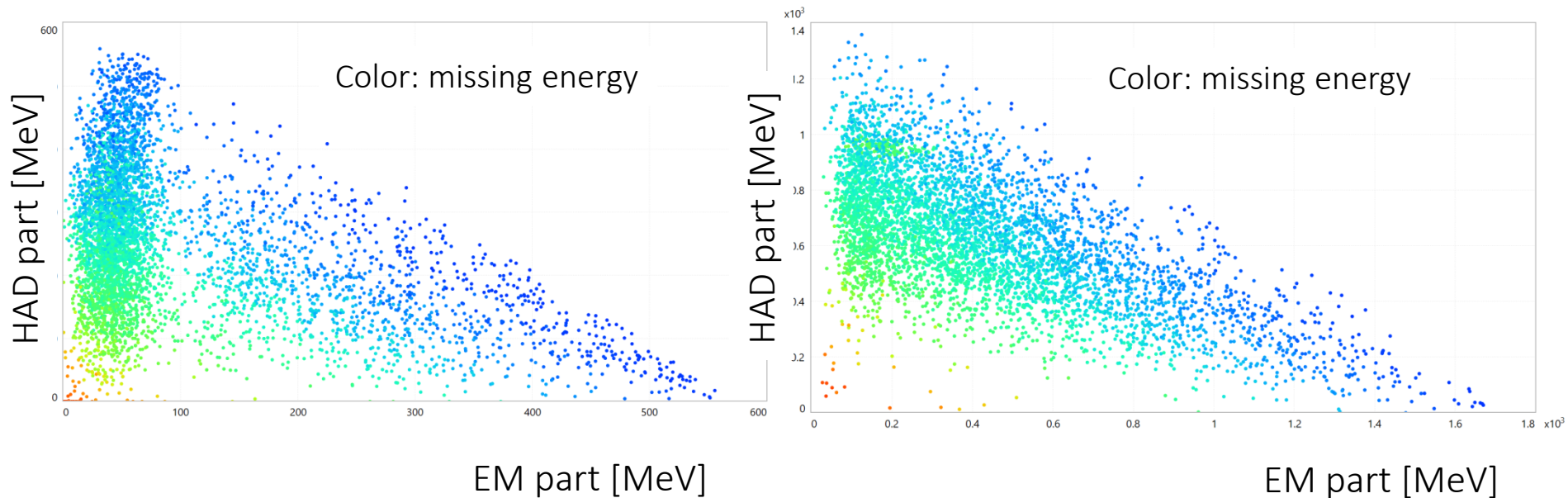
- CNN model for EM/track separation:
 - Support standard reconstruction (input to the clustering, tracking, ...).
 - In ProtoDUNE: studies of missing energy and testing models implemented in G4.



Missing energy in ProtoDUNE

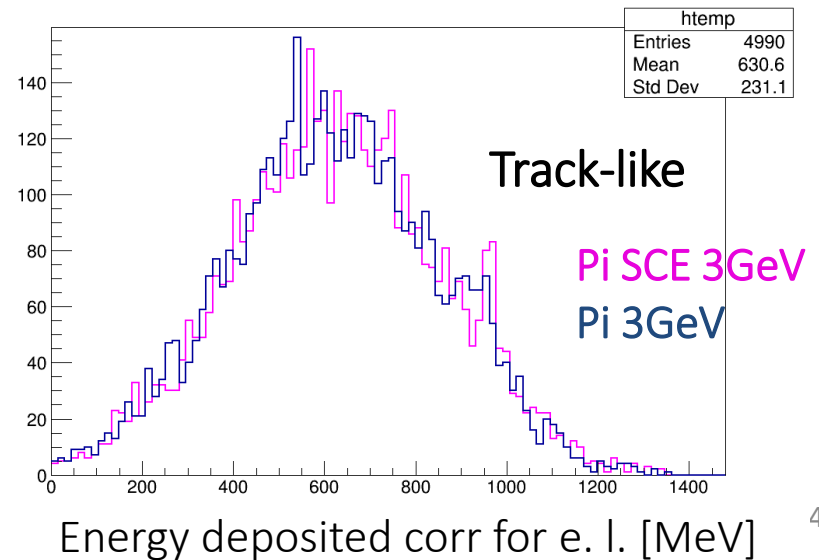
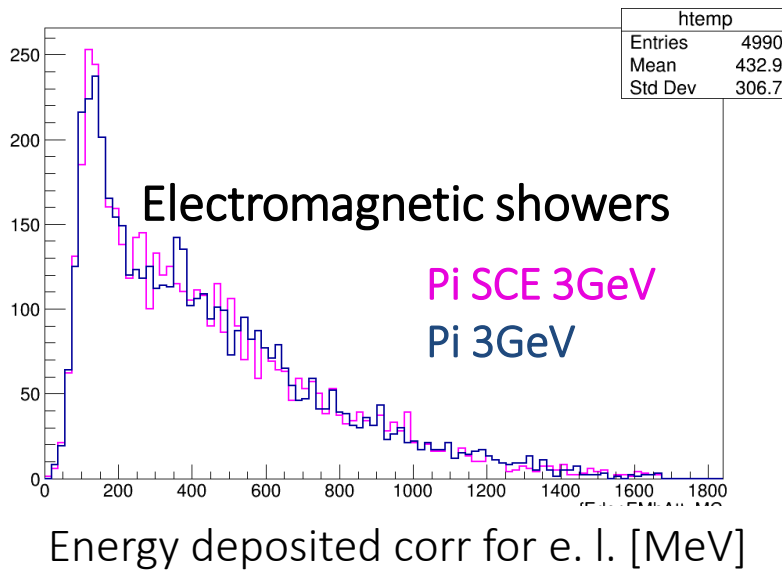
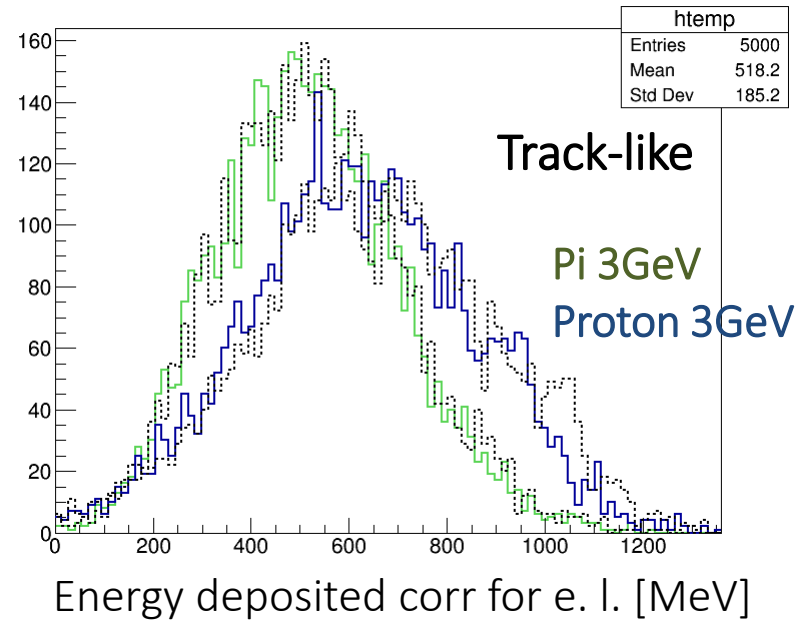
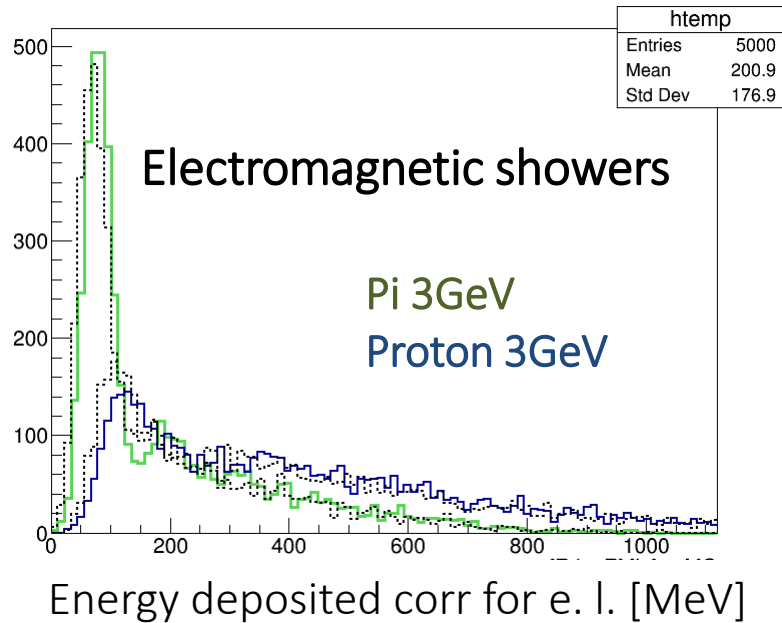
Pion 1 GeV

Pion 3 GeV



- No obvious correlation between the missing energy and $f(\text{hadronic}; \text{EM})$ in the events from the test beam particles.
- Knowing the momentum of the incoming particle one can measure the missing energy (but note all the complexity of the on-surface detector).

Testing MC models in ProtoDUNE



- Working Groups

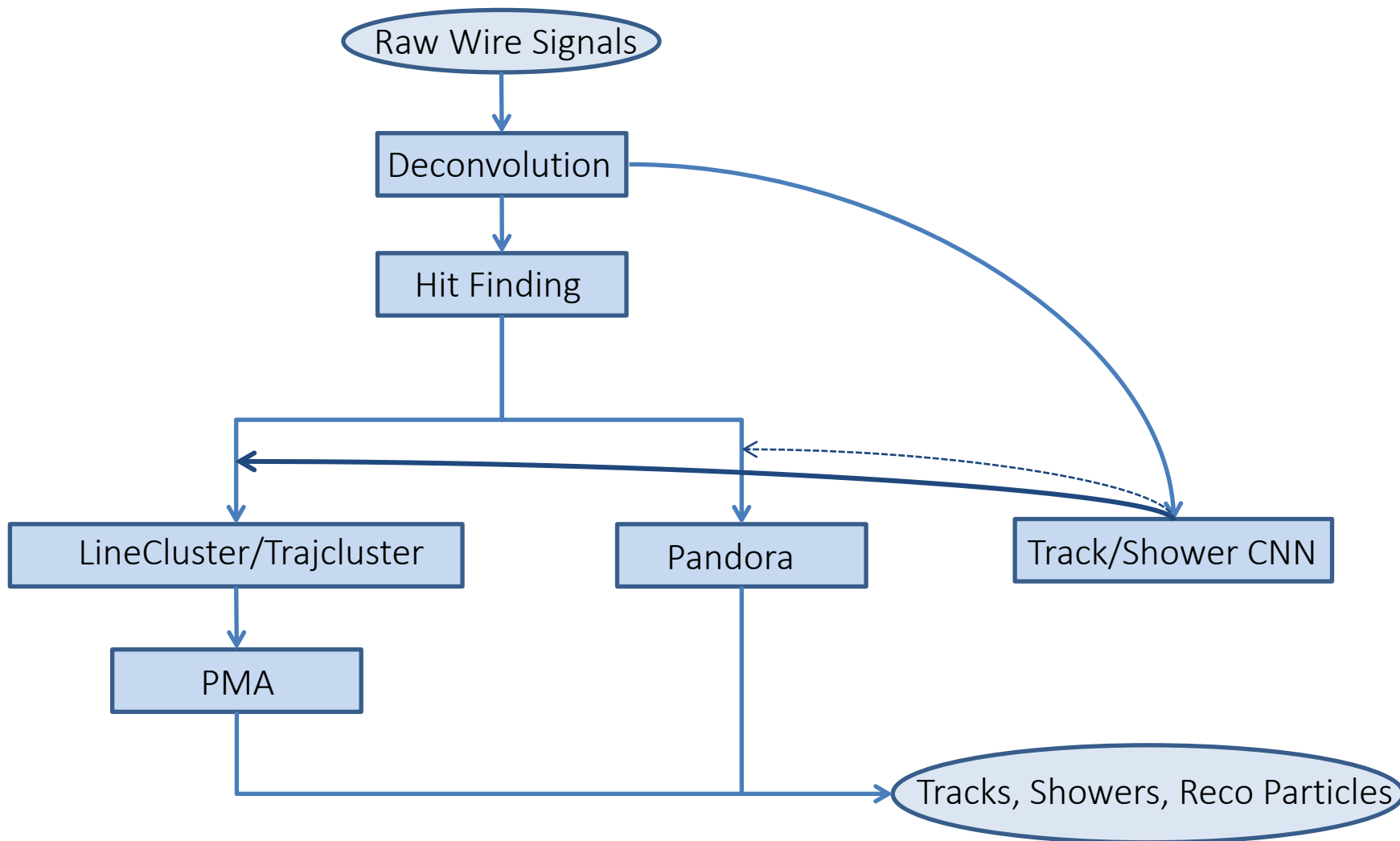
- Physics
- Far Detector
- Near Detector
- Detector Prototypes
 - 35-t Prototype
 - ProtoDUNE Single-Phase
 - ProtoDUNE Dual-Phase (external)
 - ProtoDUNE Systems Engineering
 - ProtoDUNE Infrastructure
 - ProtoDUNE Sim, Reco & Analysis
- Acc & Beam Interface
- Computing
- Task Forces
- Participate in a WG



<https://web.fnal.gov/collaboration/DUNE/SitePages/Data%20Reconstruction%20Analysis%20Working%20Group.aspx>

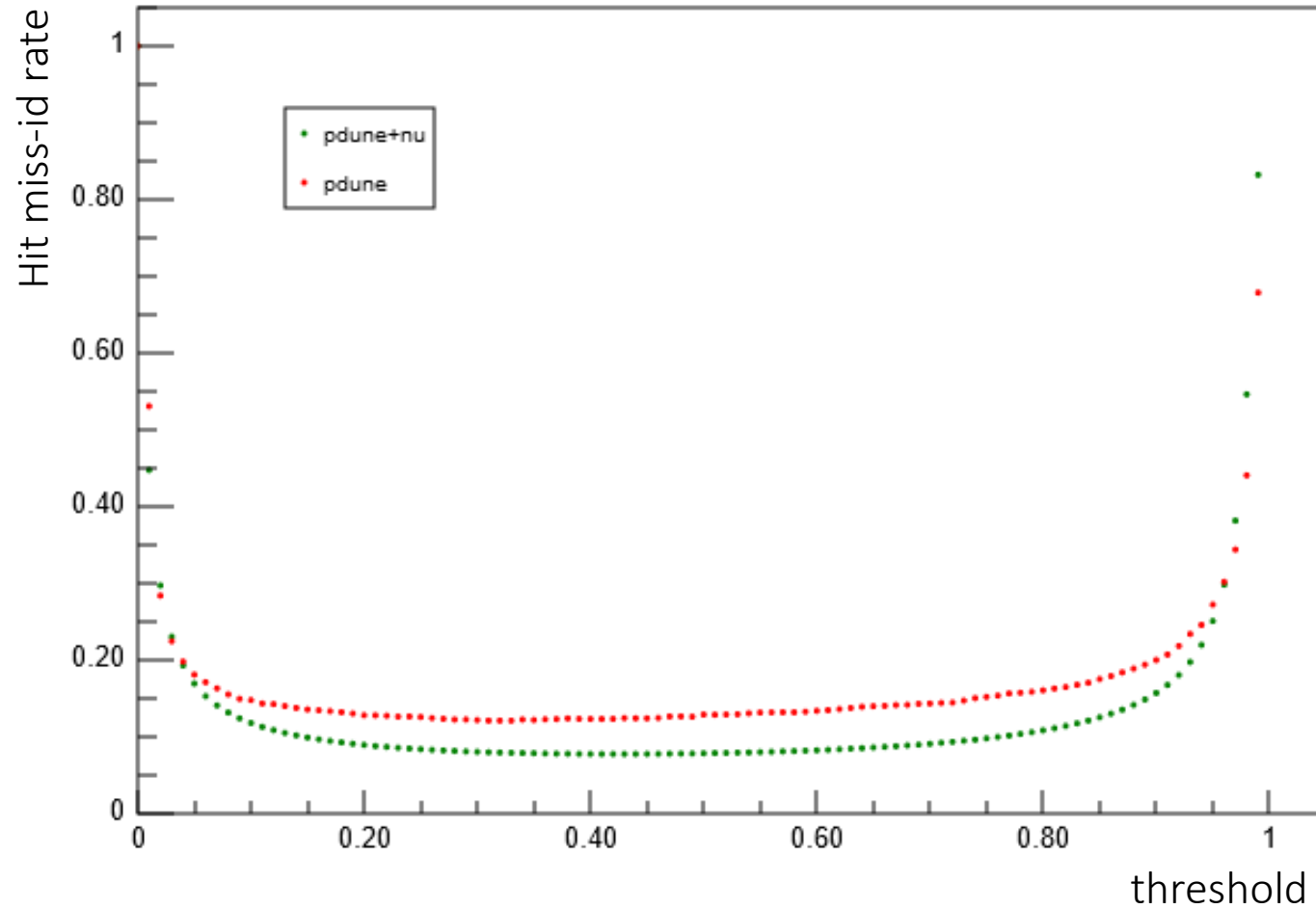
backup

ProtoDUNE reconstruction chain

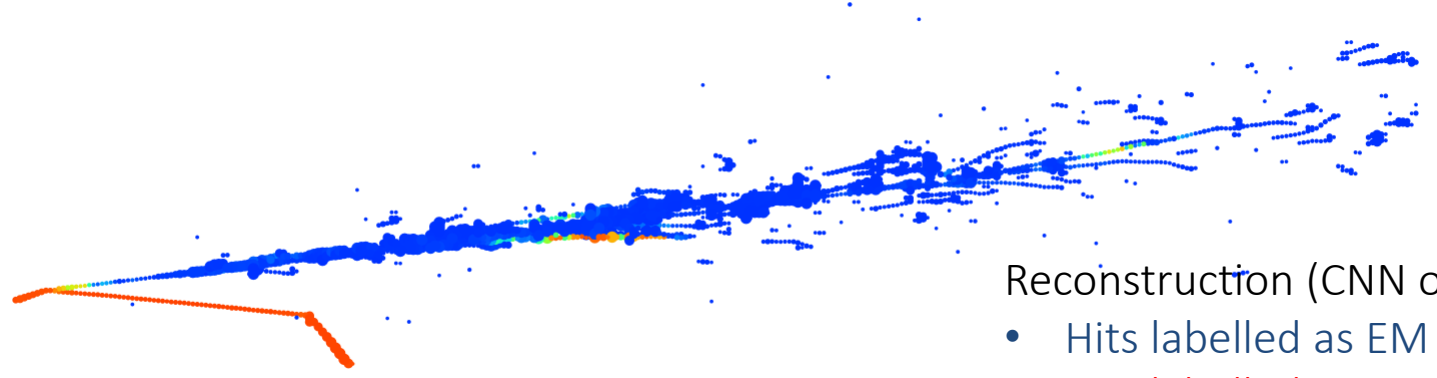


- EM/track CNN as an input to Line/Trajcluster, or Pandora: worth to be considered also in the DUNE FD reco.

CNN model trained on protoDUNE and electron neutrinos

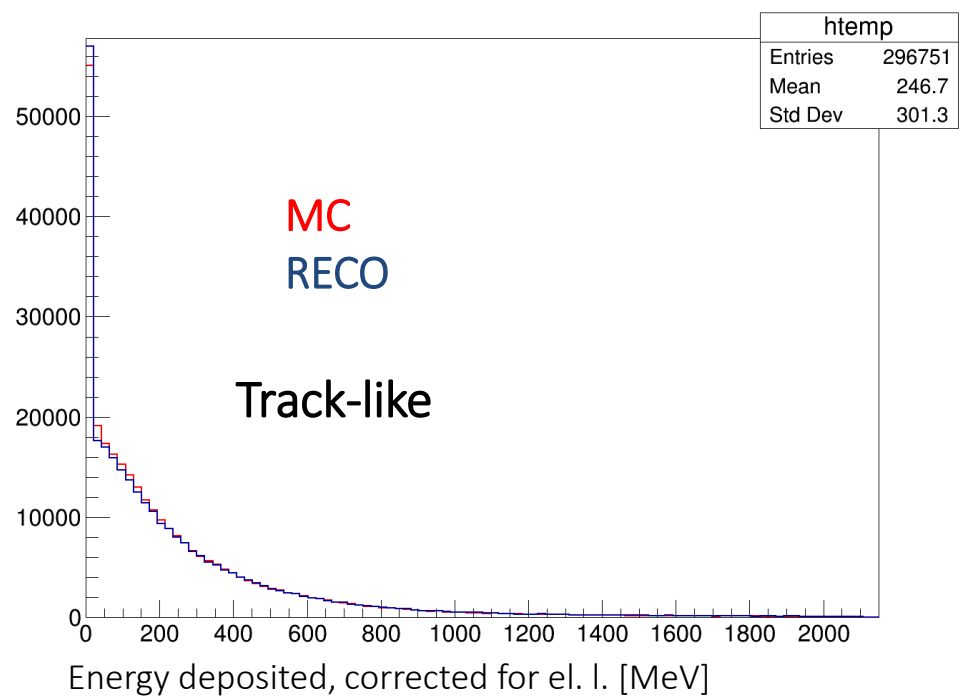
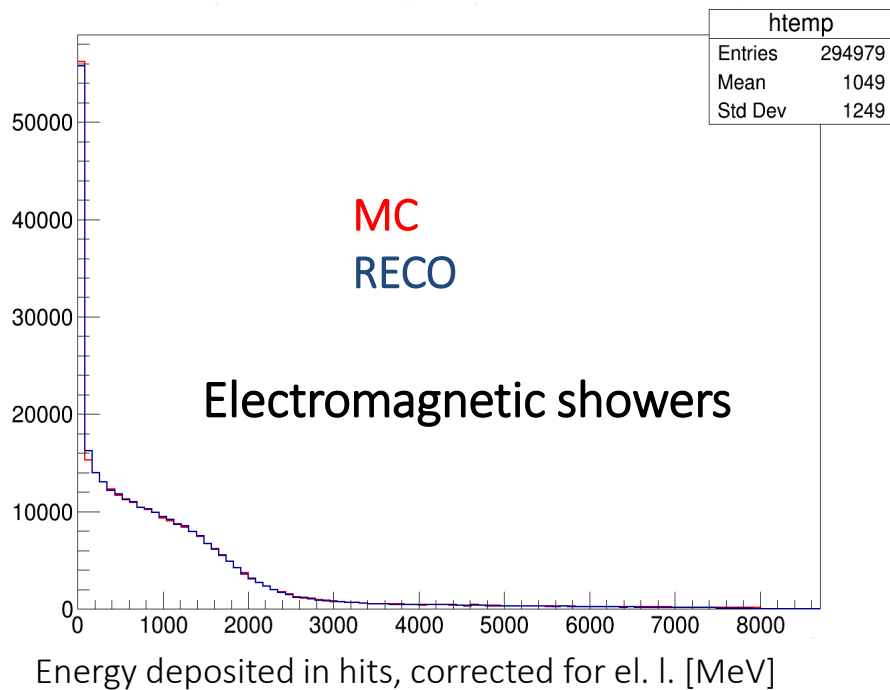


LArTPC as EM/track-like calorimeter

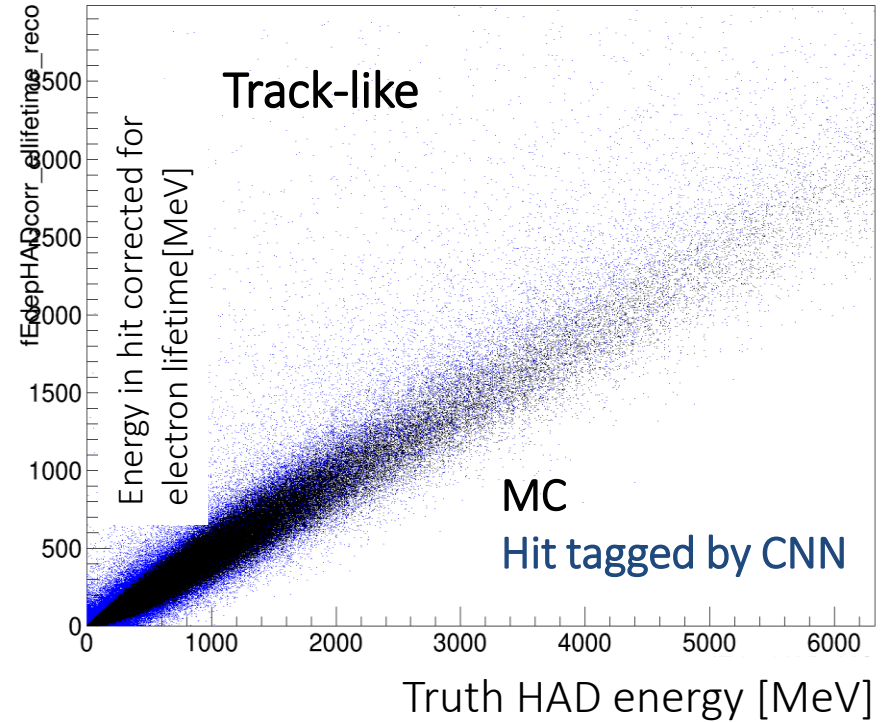
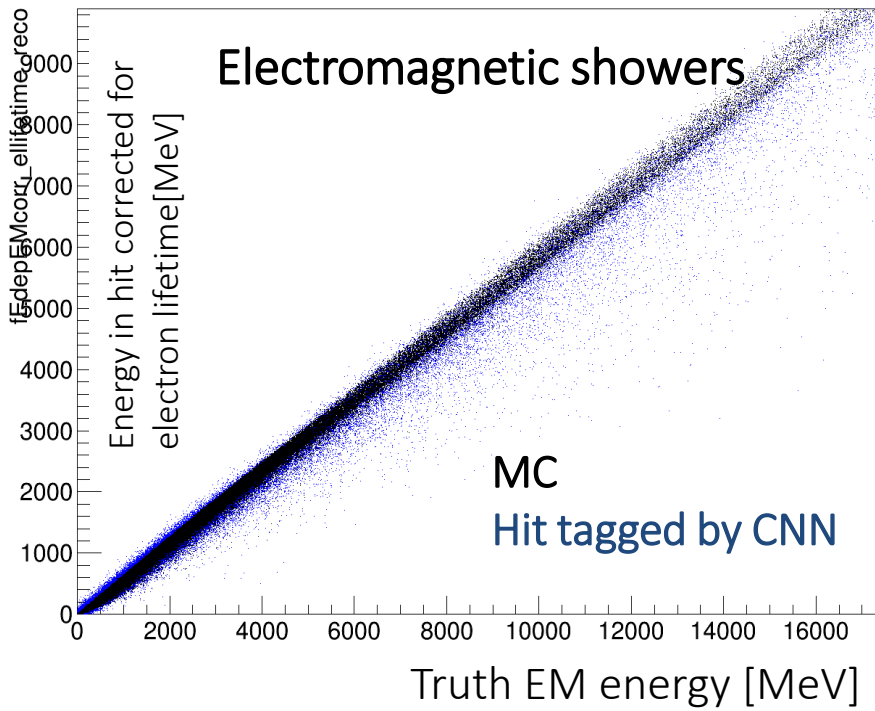


Reconstruction (CNN output):

- Hits labelled as EM
- Hits labelled as Track-like

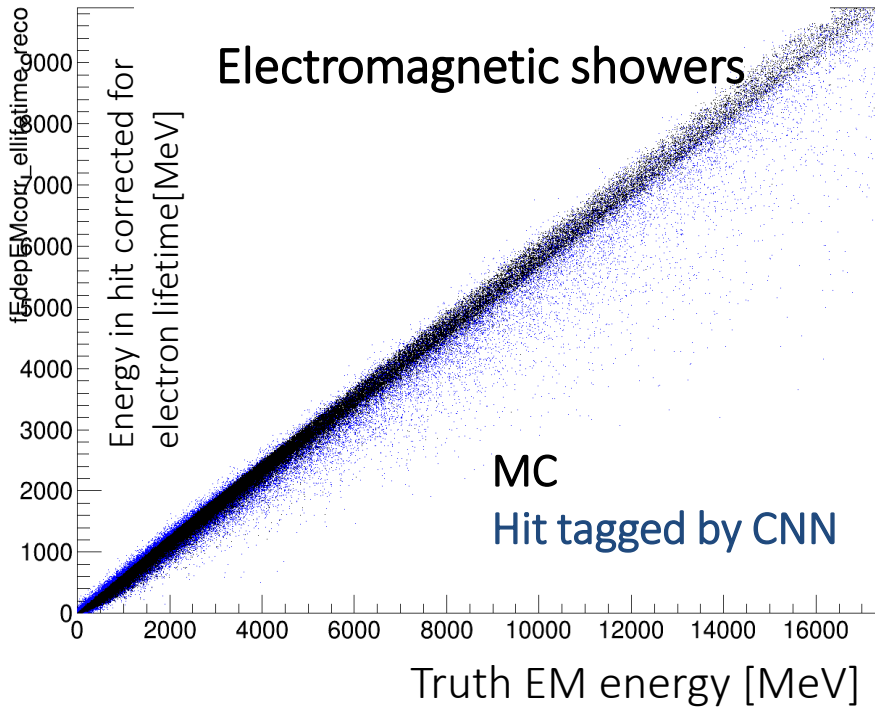


Calorimetry: EM/track-like

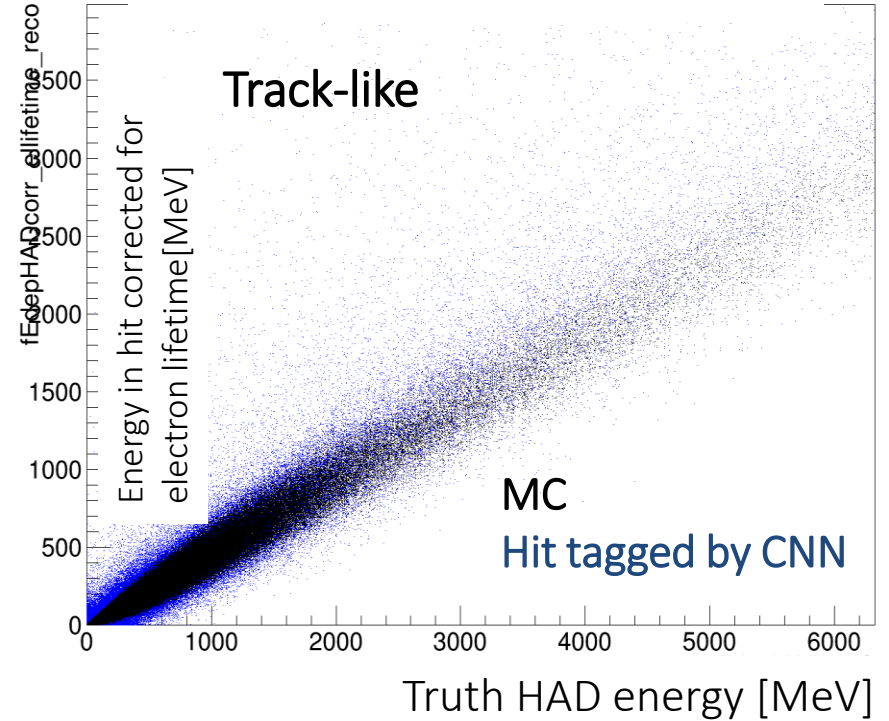


- similar pattern for various energy neutrino bins

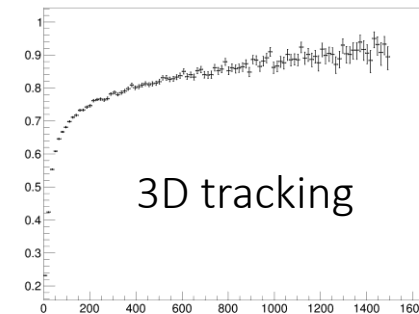
CNN tagging as an input to the standard reconstruction



3D shower reconstruction



tracking efficiency



backup