

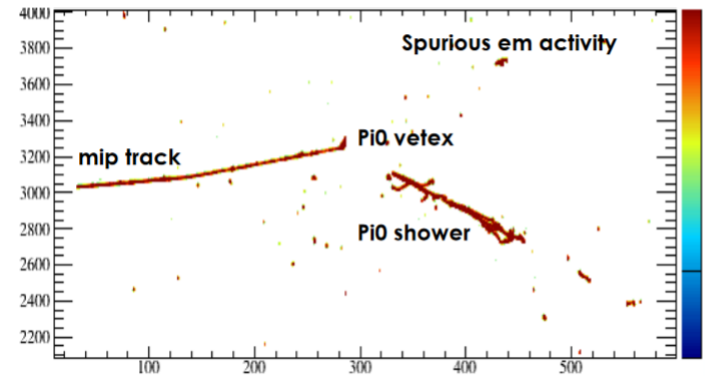
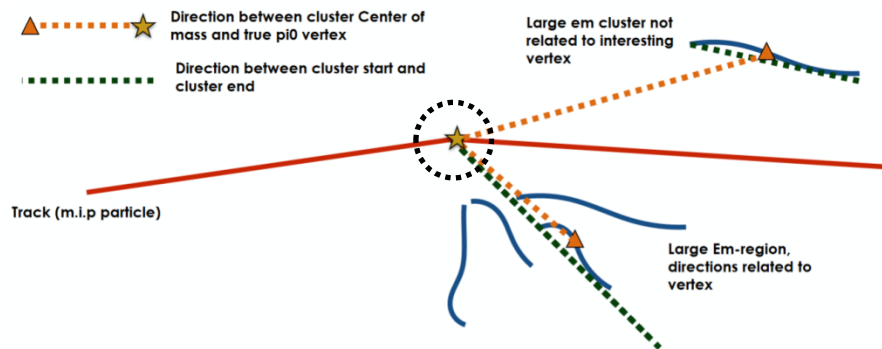
# Update on reconstruction for Dual Phase in LArSoft

Dorota Stefan, CERN/NCBJ  
Science Board Meeting, 21 June 2017

- $\pi^0$  rejection studies,
- Cosmic muon simulation.

# $\pi^0$ rejection studies

- Select a vertex with a  $\pi^0$  decay.
- Select EM activity in the event.
- Find the nearest EM activities compatible with the vertex (gap identification):
  - a distance between the vertex and the start of EM shower is a powerful discriminator in  $\nu_e$ CC background rejection.

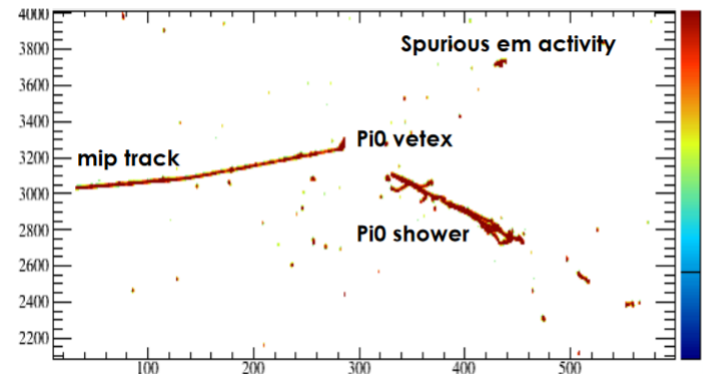
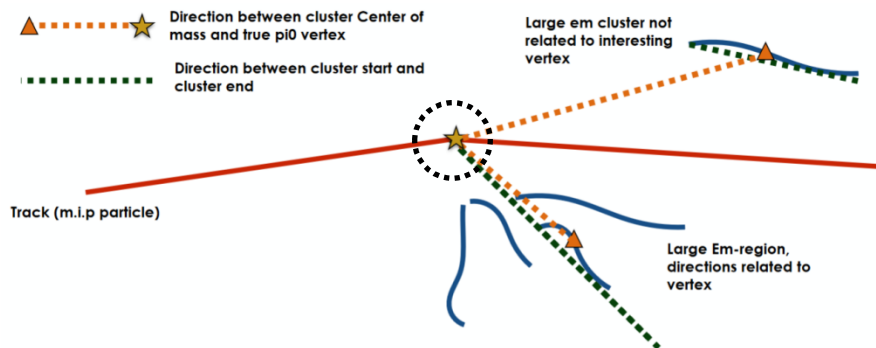


# $\pi^0$ rejection studies

- Currently, vertex has been selected using MC truth.
- CNN were used to tag clusters as EM-like/Track-like.
- Search for the compatible EM-like hits in the close vicinity of the vertex: different criteria has been tested (various existing shower reconstruction algorithms/components to be tested).

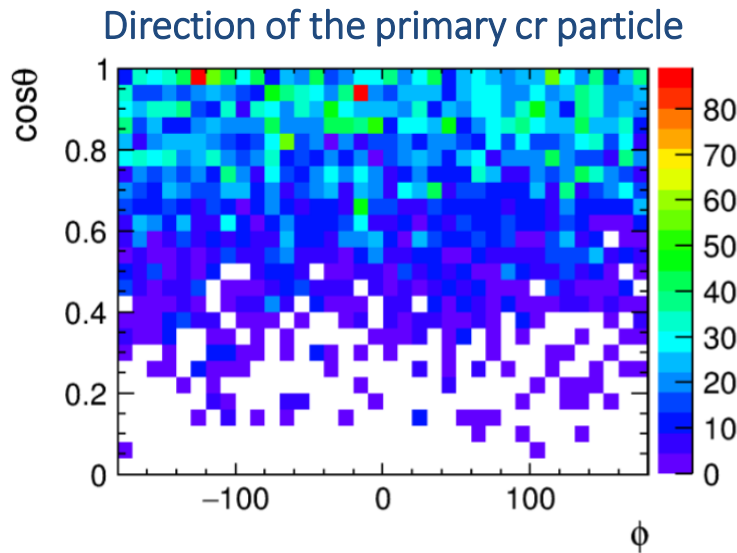
Algorithms shared between DP and SP:

- CNN tagging, which allows for:
- algorithms dedicated to EM showers: never tried with reasonable EM/track separation in full events.



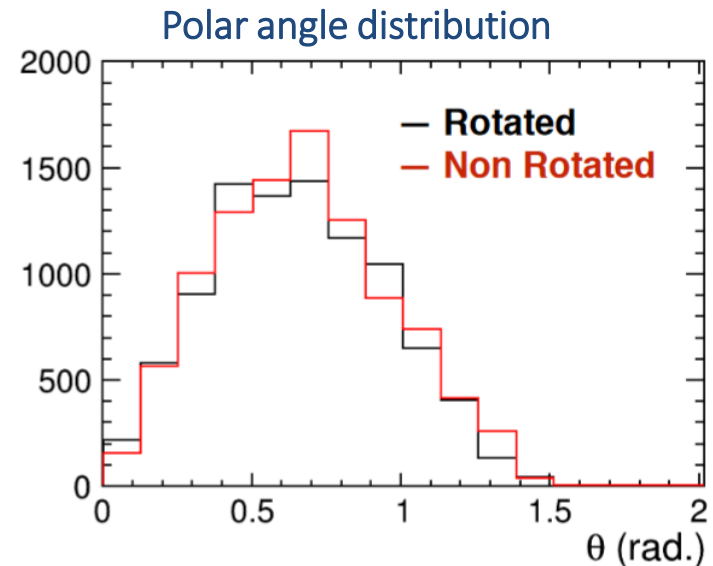
# Towards cosmic muon simulation

- Simulation of cosmic rays is being prepared in CORSIKA for both ProtoDUNE-DP and 3x1x1.
- Geant4 is used to propagate muons inside the detector.
- Still using DP geometry with the horizontal drift: muons rotated accordingly.



rotated simulation:

$$\cos\theta = -P_x/|P| \quad \Phi = \text{tg}^{-1}(P_z/P_y)$$



Not rotated simulation: Y vertical, X horizontal  
Rotated simulation: X vertical, Y horizontal.

LArSoft Reconstruction Hackathon, 28-29 June, at CERN