Tracking Efficiency Using Mollers

Omar Moreno

Santa Cruz Institute for Particle Physics

University of California, Santa Cruz

omoreno1@ucsc.edu

Heavy Photon Search Collaboration Meeting

October 26-28, 2015

Preliminaries

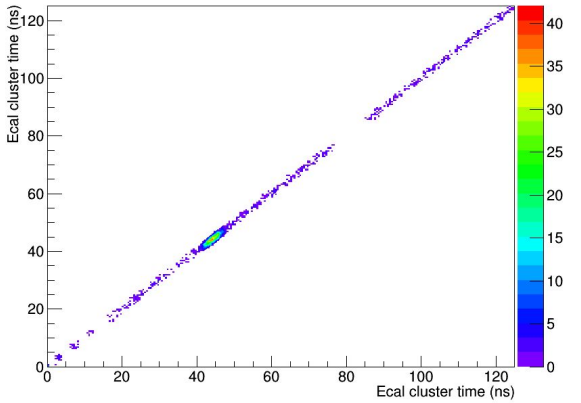
- Since Moller kinematics are known so well, they can be used to calculate the tracking efficiency via a tag and probe method
- Use pass 3, run 5772, singles1 triggers for the data (probably can use pairs1)
- Use pass 3, pure Moller sample to compare against and “optimize” cuts

Ecal Cluster Pair Selection

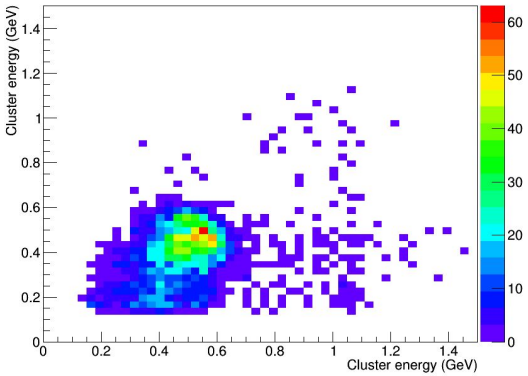
- Begin by requiring that the Ecal to have a pair of “good” clusters
  - have an event with two clusters whose cluster time -1.6 ns < delta t < 1.6 ns
  - have two clusters in opposite Ecal volumes i.e. top-bottom
  - have both clusters on the electron side
  - Cut on the cluster x position sum -175 mm < cluster x sum < -145 mm
  - Cut on cluster x difference abs(cluster x sum) > 80
  - cluster energy sum > .85 GeV and < 1.1 GeV
  - -100 MeV < cluster energy difference < 300 MeV
  - No row 1
  - Ecal cluster y < 50 mm

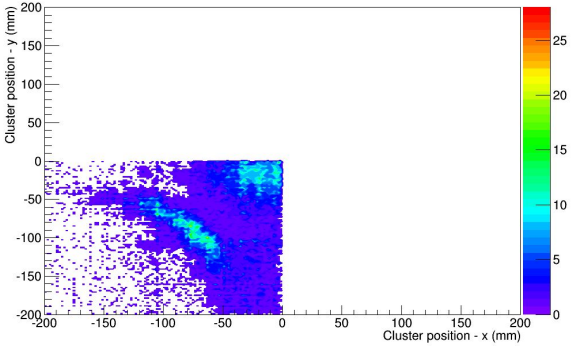
Ecal Selection

cluster pair time - cuts: fiducial, time

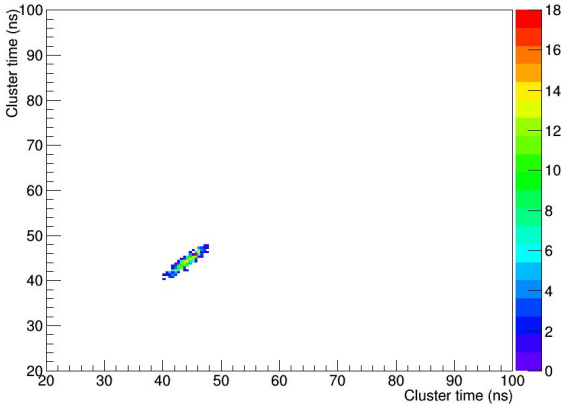


cluster pair energy - cuts: fiducial

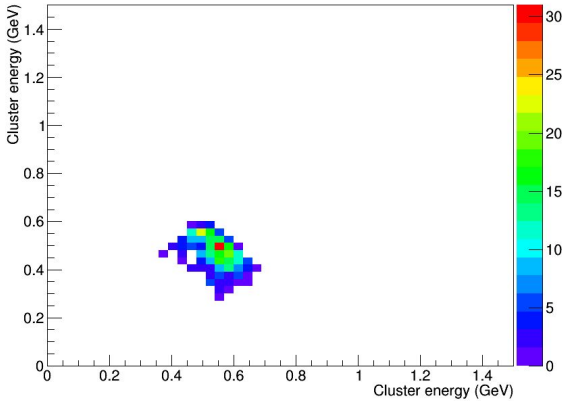




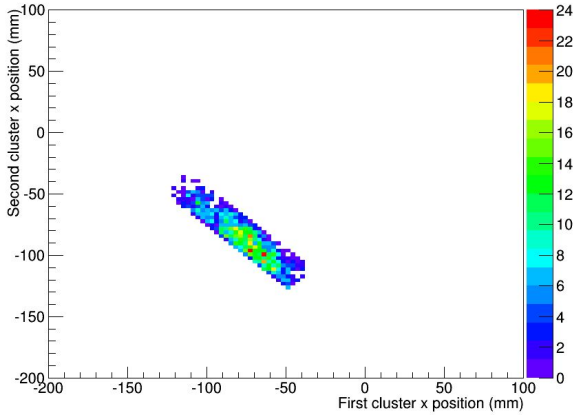
cluster pair time - candidates



cluster pair energy - candidates



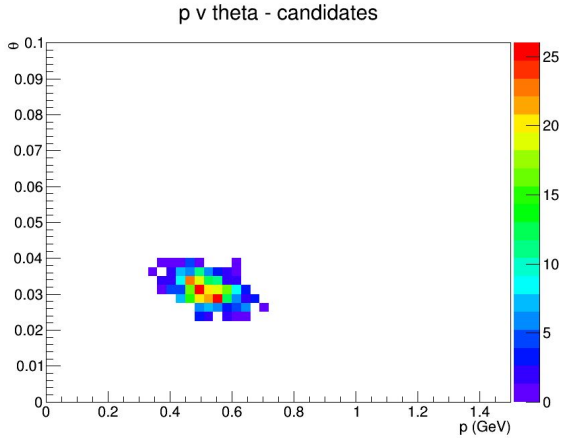
cluster x vs cluster x - cuts: fiducial, sum, diff

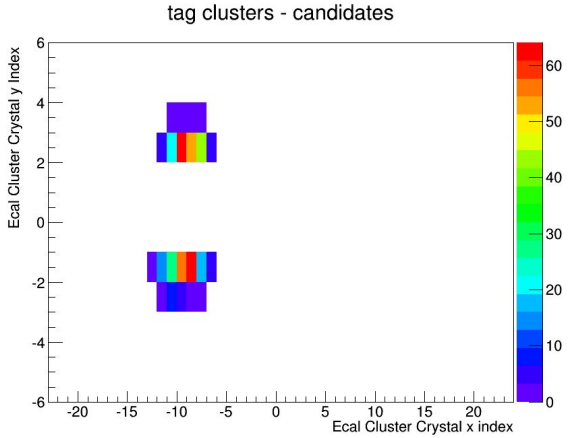


Candidates

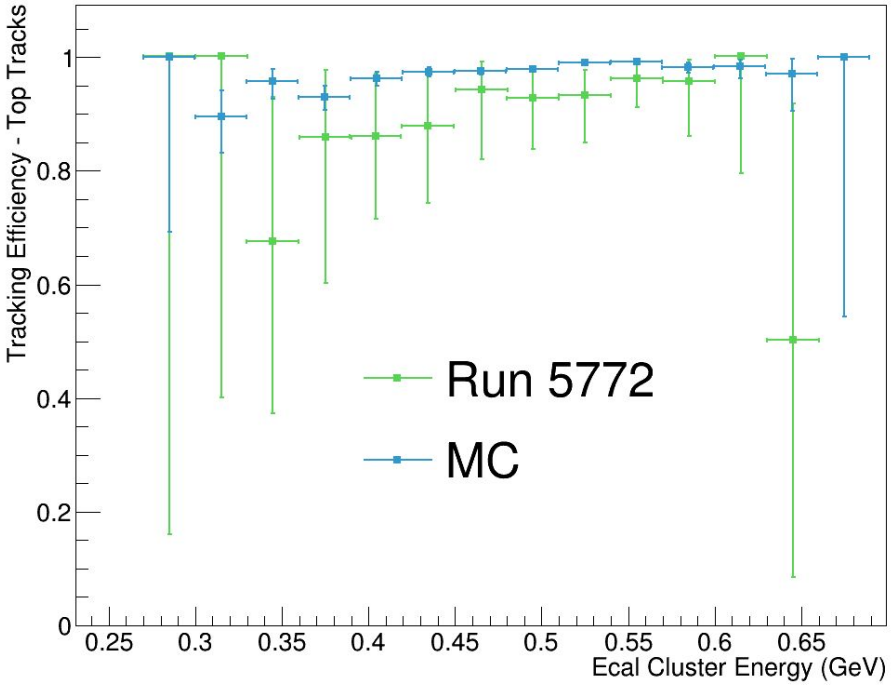
- Since Moller kinematics are known so well, they can be used to calculate the tracking efficiency via a tag and probe method
- If a pair of clusters passes all cuts, the tag cluster is chosen at random and a track is matched to it
  - Require that the track is an electron and E/p > .8
- A track-cluster match passing the E/p requirement is a candidate tag event
- A track is then attempted to match to the probe cluster and the efficiency is calculated as

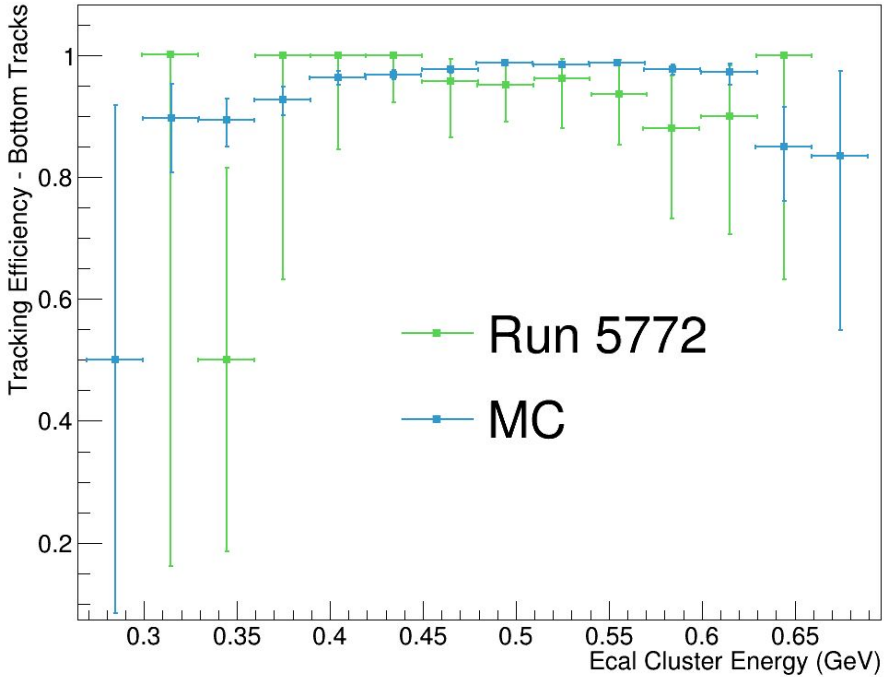
efficiency = probe matches/candidates





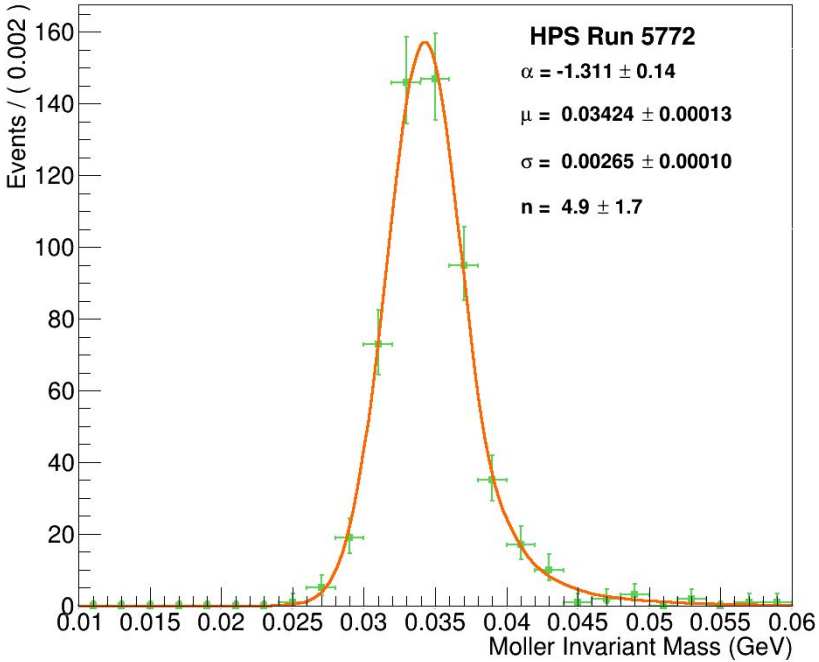
Tracking Efficiency

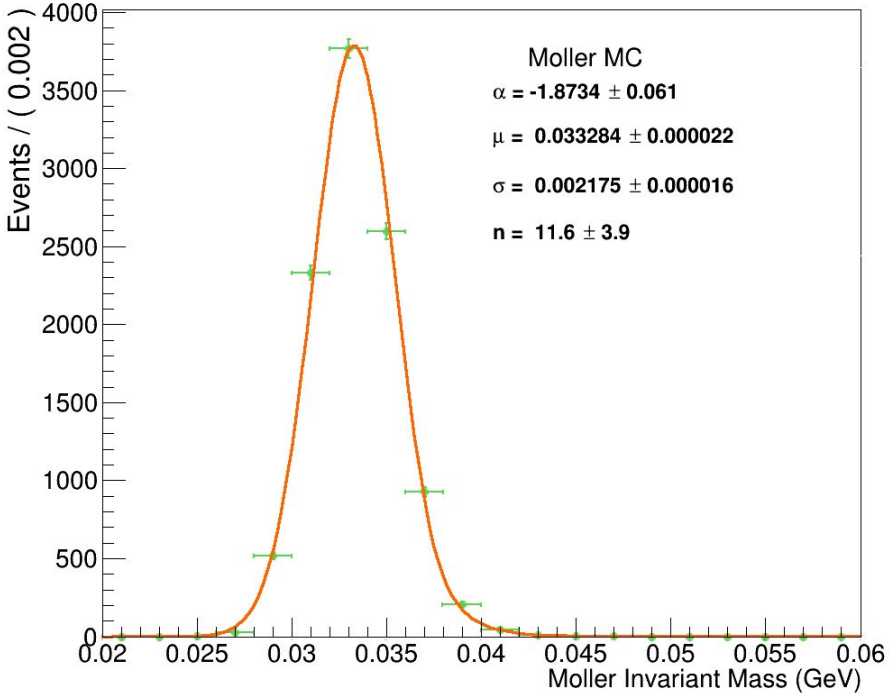




Invariant Mass

- Calculate invariant mass using successful tag and probe events
- Invariant mass is fit to Crystal Ball function





Conclusions

- Tracking efficiency looks to be at the 90%-95% level and agrees reasonably well with MC
- Need to run over multiple runs in order to improve efficiency errors
- Better approach? Use tridents with the tag required to be proton? This is the tracking efficiency we actually want.