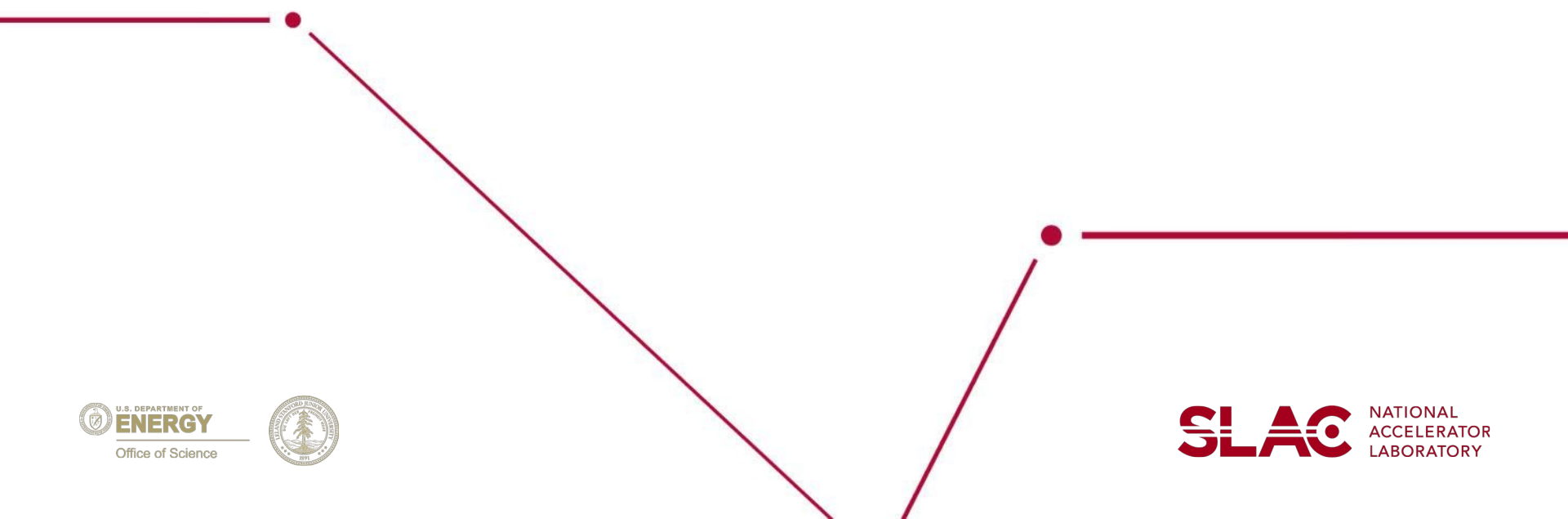


Understanding our FinalStateParticle Acceptance times Efficiencies

Cameron Bravo (SLAC)

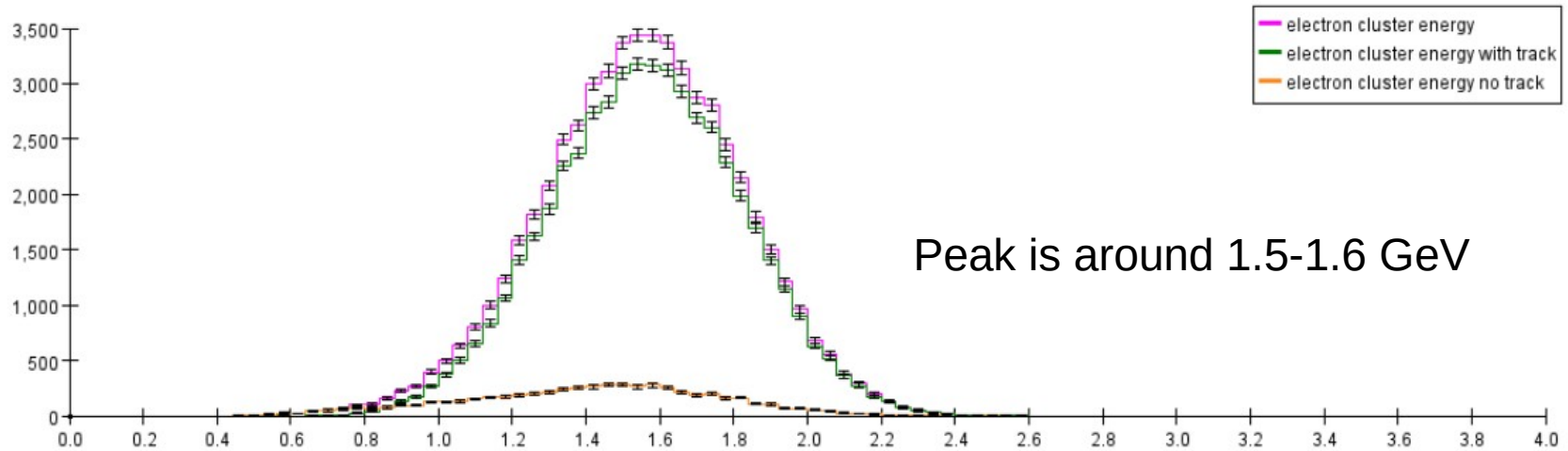


- Initial work has been done to get a data based estimate of our tracking efficiencies
 - We need this, it has the potential to seriously help us solve our alignment
 - Some improvements to that analysis are needed before it helps us fix issues
 - As is it can hint at issues we need to look into
- It is important to consider our acceptances when looking at these acceptance*efficiencies numbers
 - Track-cluster matching efficiency is folded in
 - Tracker/Ecal acceptance is folded in
 - Physics phases space must also be considered
- Let's take a look at simulated electrons and positrons near the energies included in the trident analysis of final state particle accpetance*efficiency

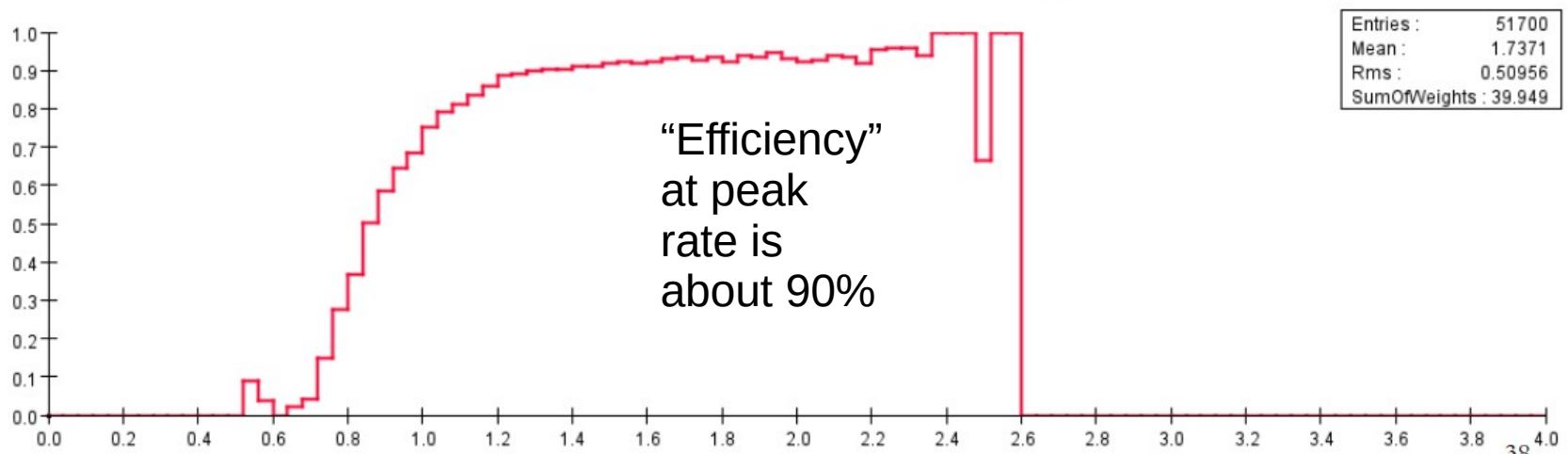
Trident Electron Efficiency by Energy



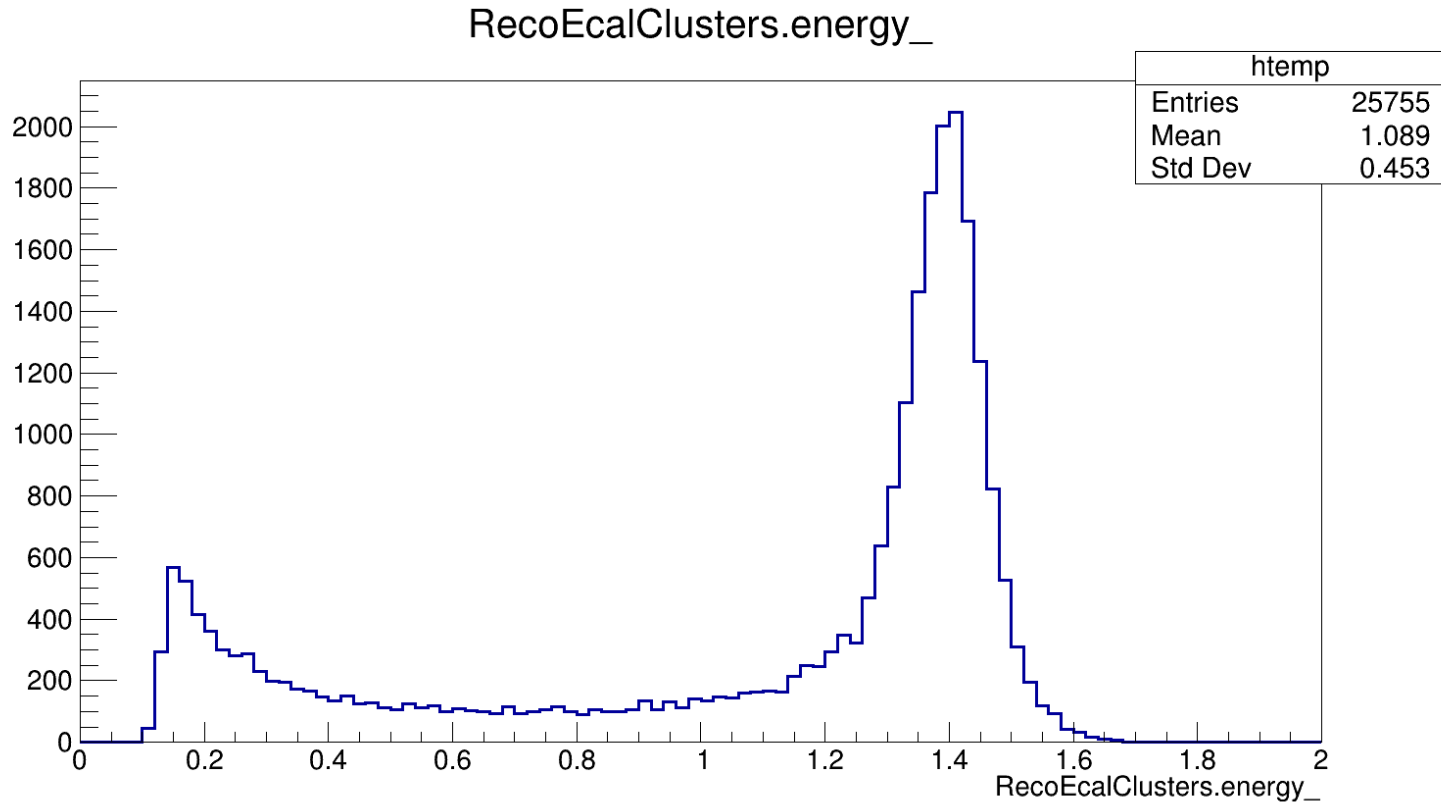
aida13253658907936871453.aida - 2021 3.74Gev - HPS_Run2021Pass1_v3 - EcalTridentCandidate analysis - electron tracking efficiency



Trident electron tracking efficiency vs cluster energy



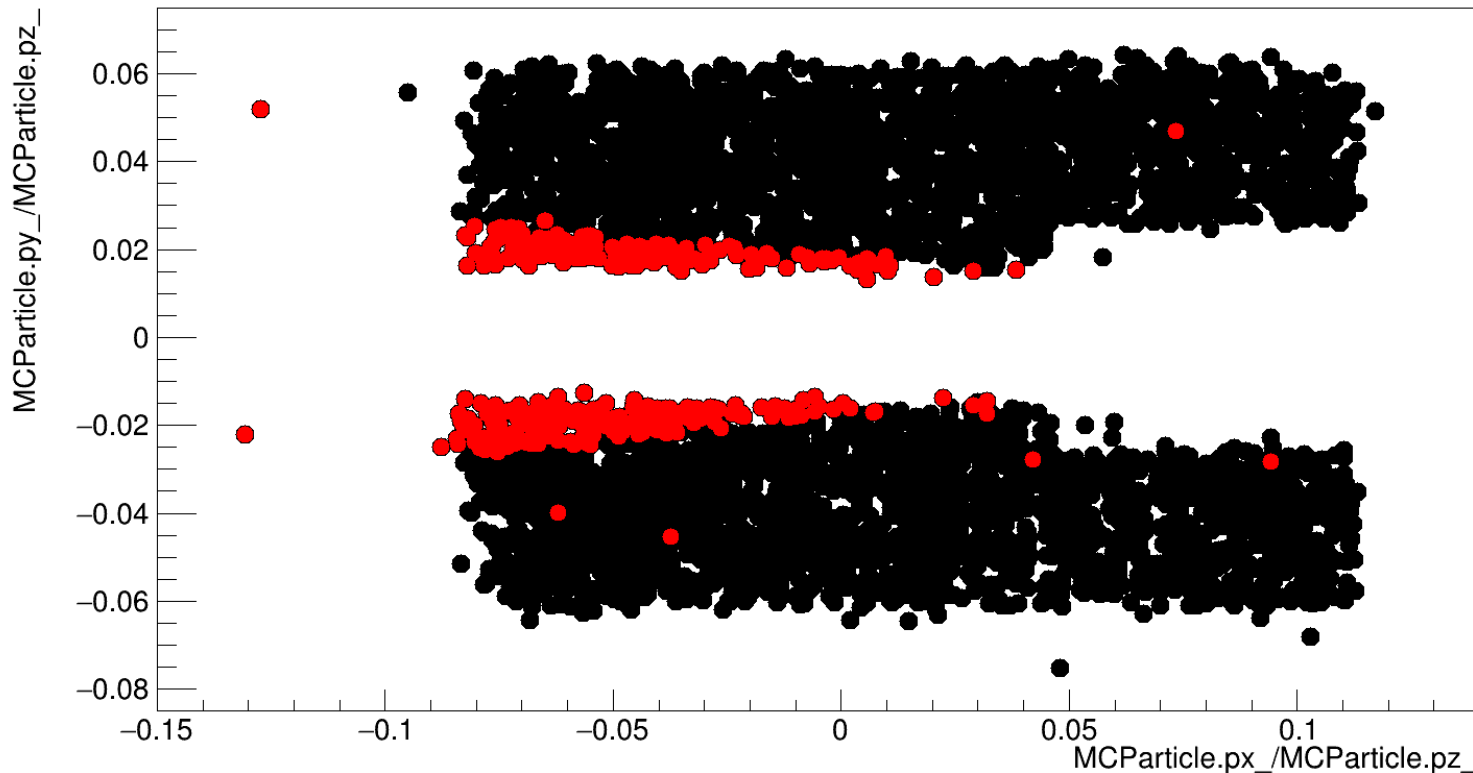
Primary 1.5 GeV Electron Ecal Cluster Energy



- Peak energy of Ecal clusters a bit low in MC
- Select clusters over 1.2 GeV to make sure we are not on the edge
- Also Require Ecal clusters to have $x < 0.0$ as is done in efficiency analysis

Primary 1.5 GeV Electron Acceptance

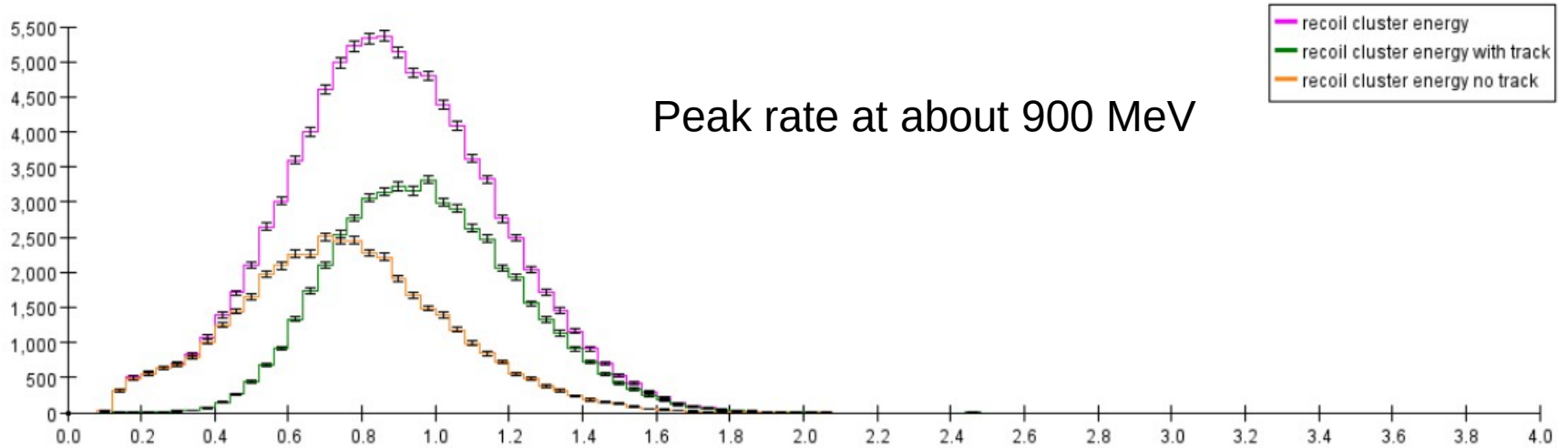
MCParticle.py_/MCParticle.pz_:MCParticle.px_/MCParticle.pz_ {MCParticle.gen_==1&&RecoEcalClusters.x_<0.0&&RecoEcalClusters.energy_>1.2}



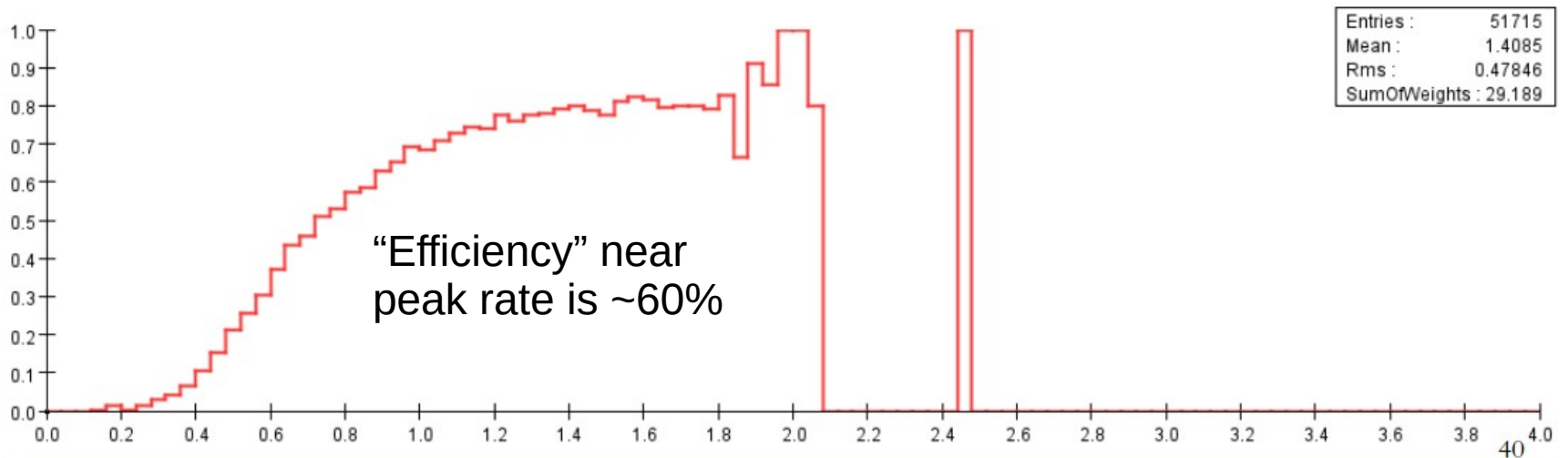
- Black is where all primary electrons are generated that leave cluster, red is where they explicitly don't leave a track (~7% of black)
- phase space peaks at ~0.03 on the x axis and towards zero on the y-axis

Trident Recoil Efficiency by Energy

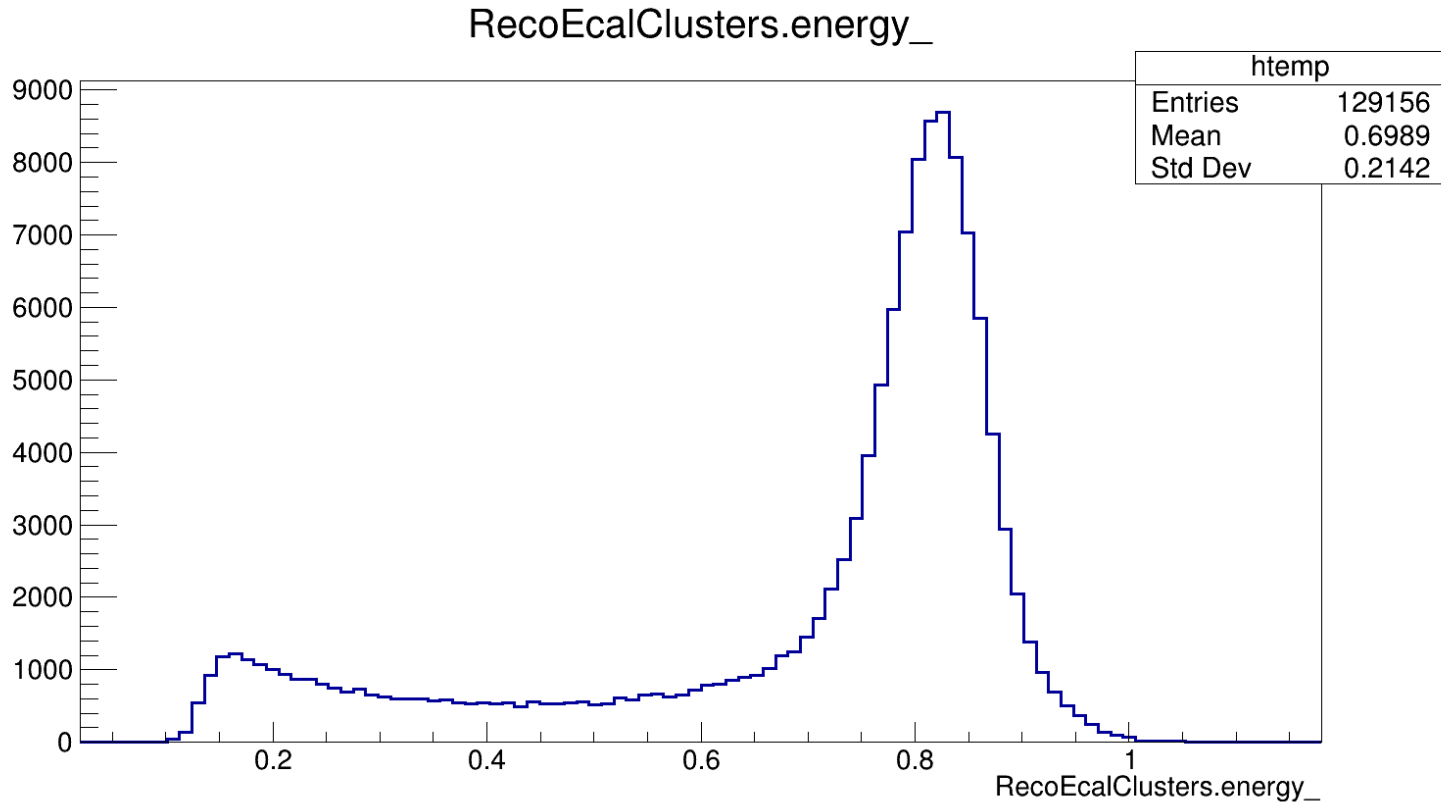
aida13253658907936871453.aida - 2021 3.74Gev - HPS_Run2021Pass1_v3 - EcalTridentCandidate analysis - recoil tracking efficiency



Trident recoil tracking efficiency vs cluster energy



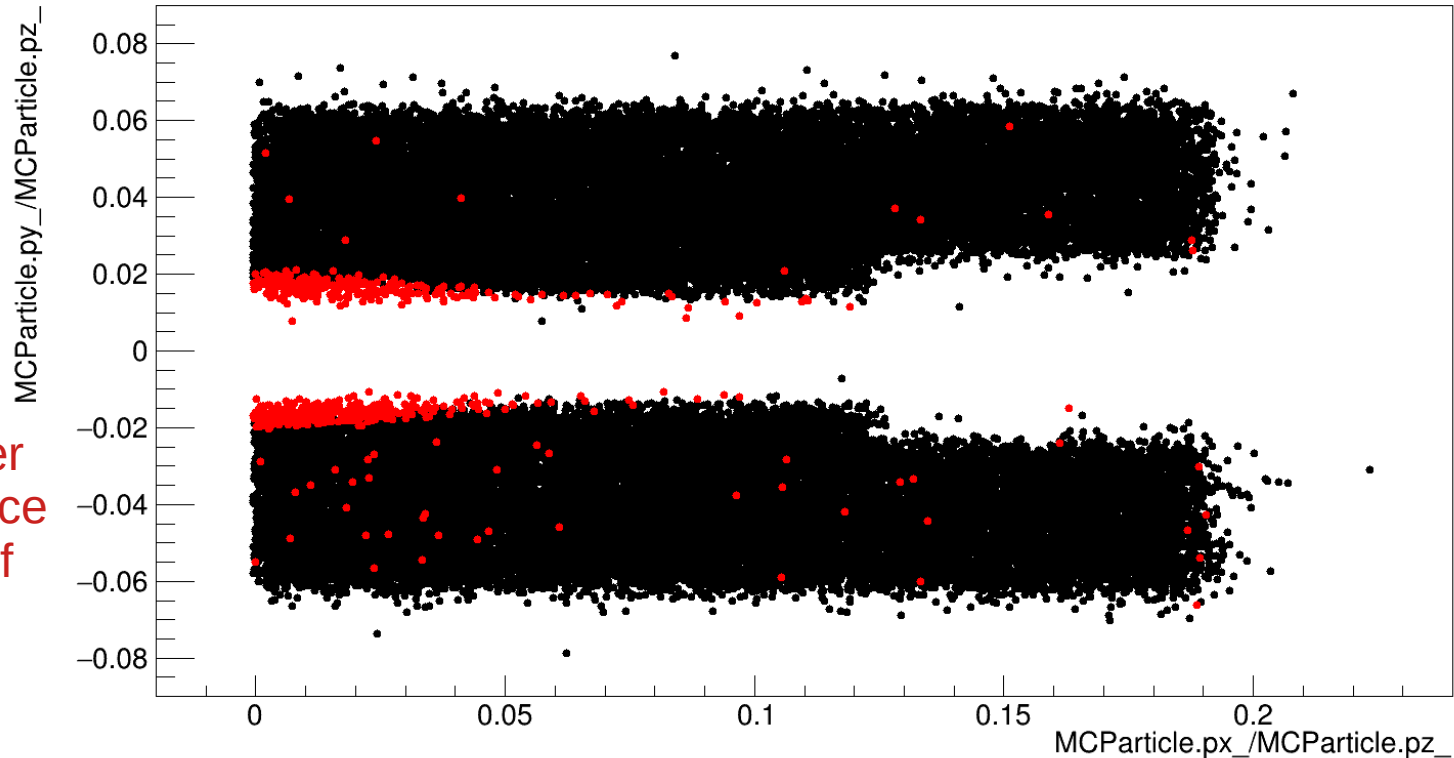
Primary 0.9 GeV Electron Ecal Cluster Energy



- Peak energy of Ecal clusters a bit low in MC
- Select clusters over 0.7 GeV to make sure we are not on the edge
- Also Require Ecal clusters to have $x < 0.0$ as is done in efficiency analysis

Primary 1.5 GeV Electron Acceptance

MCParticle.py_/MCParticle.pz_/MCParticle.px_/MCParticle.pz_ {MCParticle.gen_==1&&RecoEcalClusters.x_<0.0&&RecoEcalClusters.energy_>0.7}

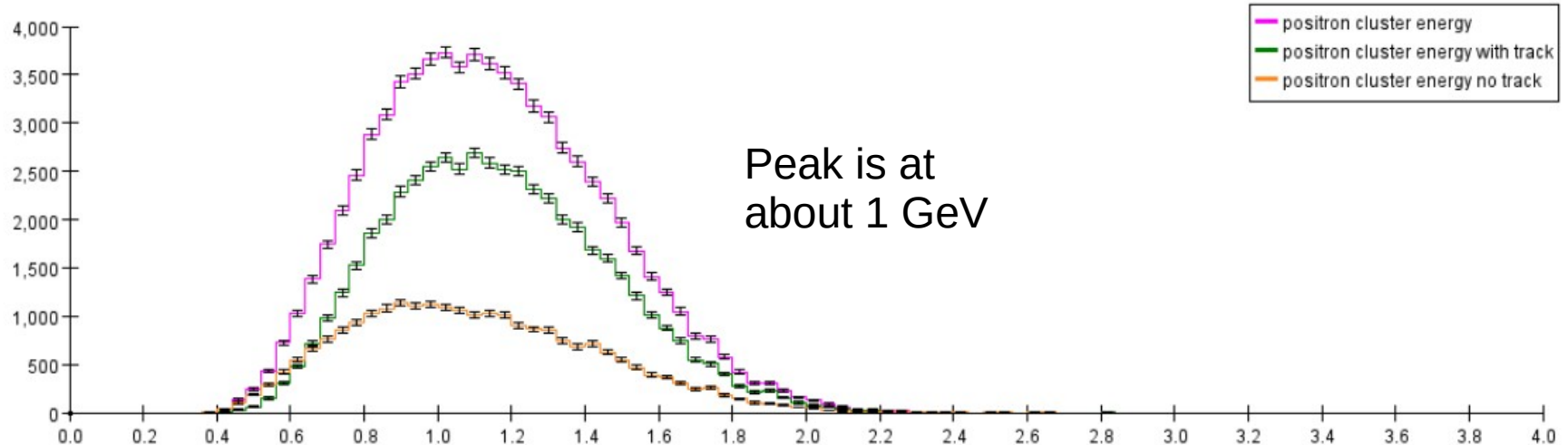


No tracker acceptance at peak of phase space!

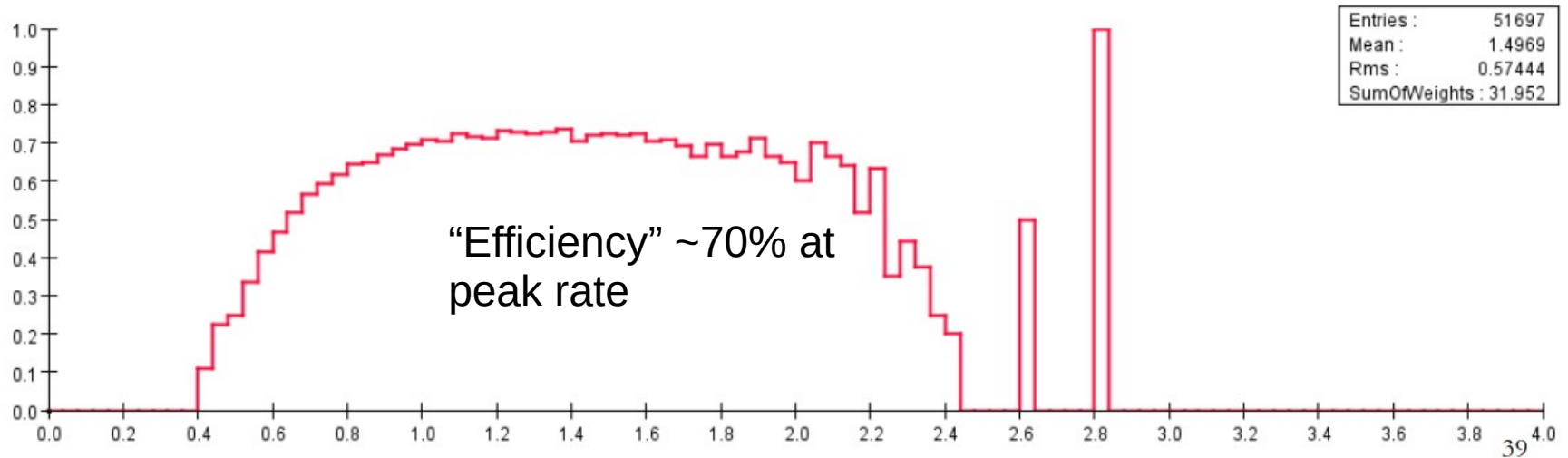
- Black is where all primary electrons are generated that leave cluster, red is where they explicitly don't leave a track (~1.5% of black)
- Phase space peaks at ~0.03 on the x axis and towards zero on the y-axis

Trident Positron Efficiency by Energy

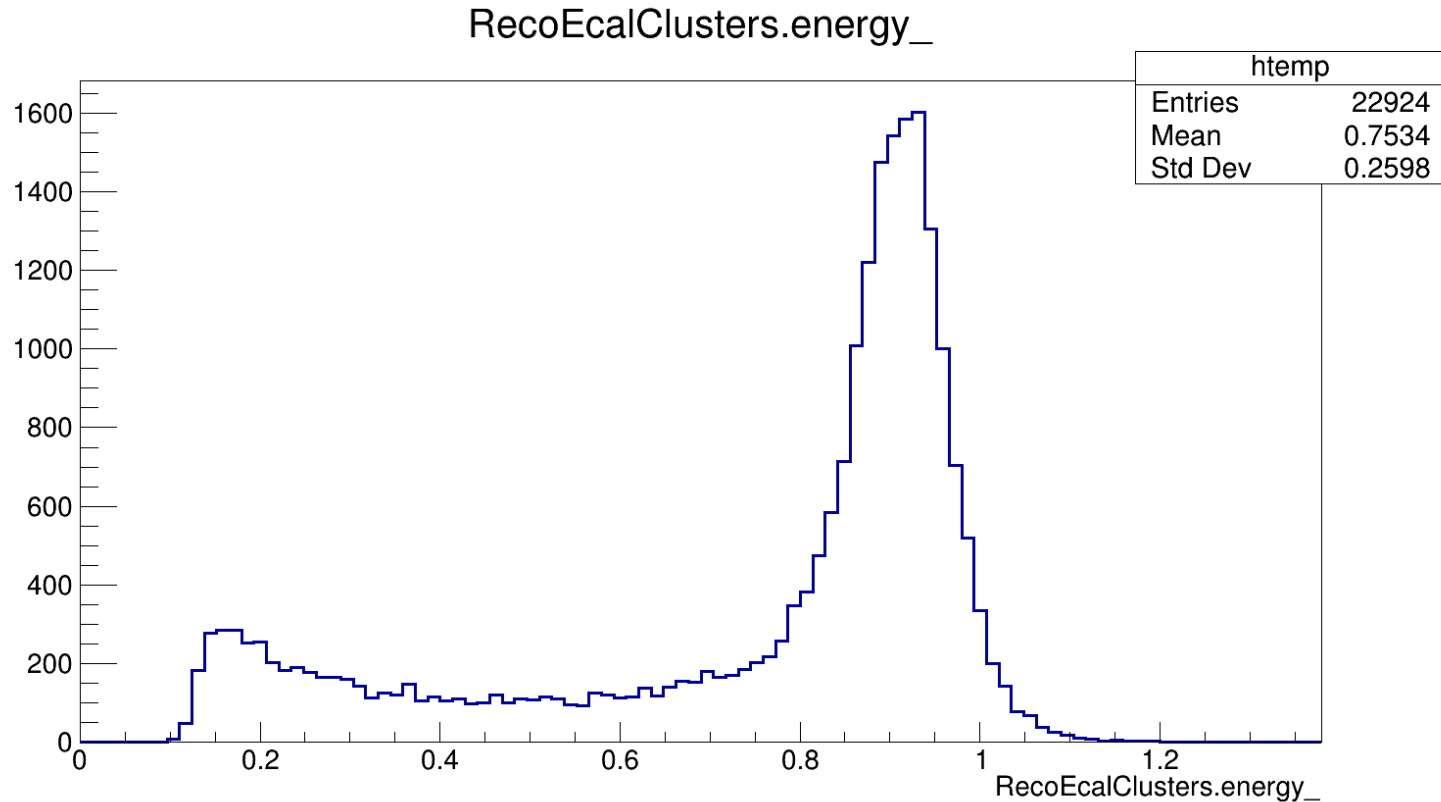
aida13253658907936871453.aida - 2021 3.74Gev - HPS_Run2021Pass1_v3 - EcalTridentCandidate analysis - positron tracking efficiency



Trident positron tracking efficiency vs cluster energy



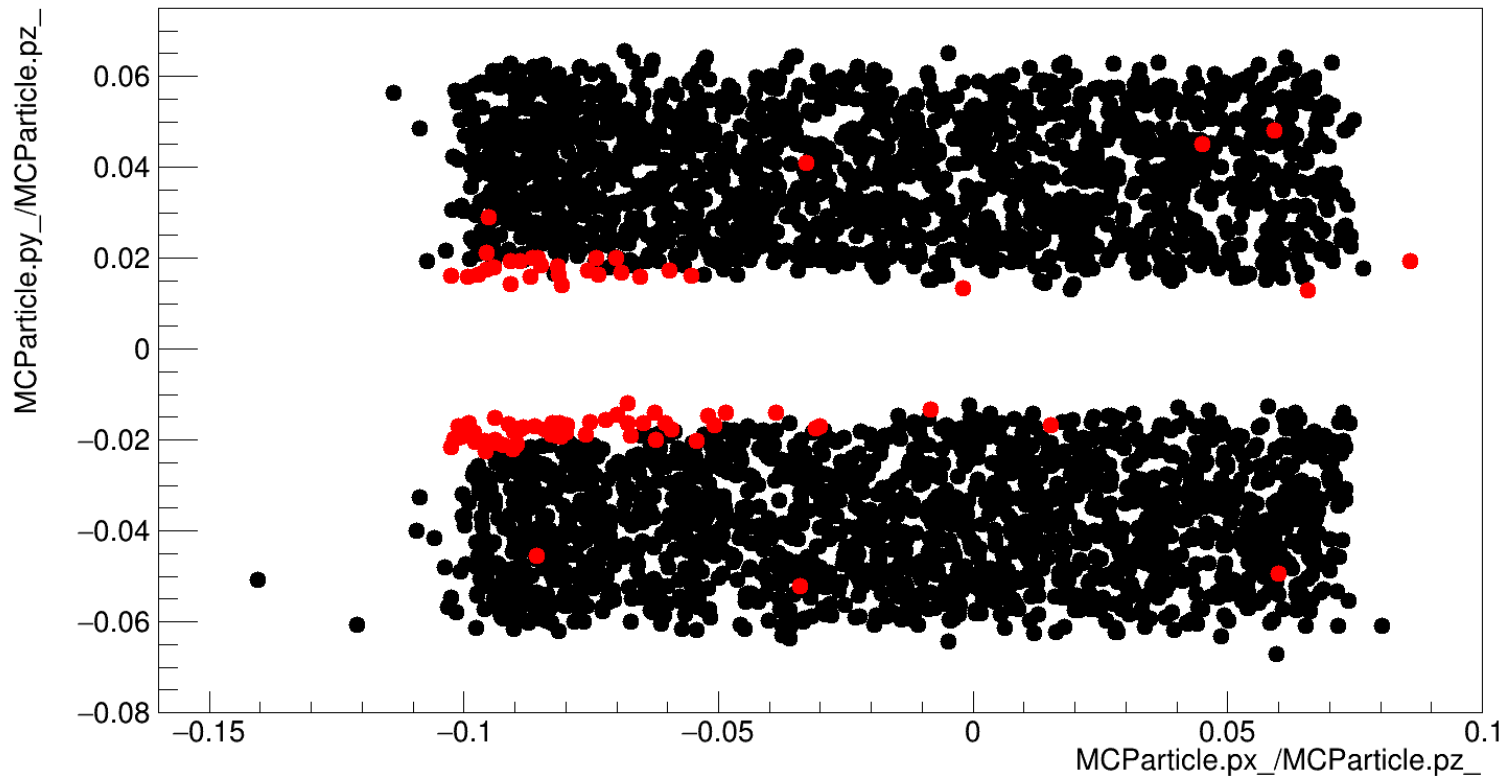
Primary 1.0 GeV Positron Ecal Cluster Energy



- Peak energy of Ecal clusters a bit low in MC
- Select clusters over 0.8 GeV to make sure we are not on the edge
- Also Require Ecal clusters to have $x > 100.0$ as is done in efficiency analysis

Primary 1.5 GeV Electron Acceptance

MCParticle.py_/MCParticle.pz_/MCParticle.px_/MCParticle.pz_ (MCParticle.gen_==1&&RecoEcalClusters.x_>100.0&&RecoEcalClusters.energy_>0.8)



- Black is where all primary electrons are generated that leave cluster, red is where they explicitly don't leave a track (~2% of black)
- Phase space peaks at ~0.03 on the x axis and towards zero on the y-axis

- Ecal cluster energies in MC are off, maybe we just need to change steering file in a trivial way?
- We have acceptance to Ecal clusters and no tracker acceptance for electrons at energies in “efficiency” analysis
- This region is close to or covers where the peak physics rate is in the acceptance of Ecal clusters used in that analysis
- I am including a cut to remove edges of Ecal where we don’t reconstruct the full energy of the incident particle, which does improve the situation wrt how much tracker of Ecal acceptance does not have tracker acceptance
- Positrons do potentially have a real issue
 - Could be we are not matching the cluster to the correct track
 - Need to investigate these events further, but acceptance the tracker acceptance will still have a small (yet significant) effect