



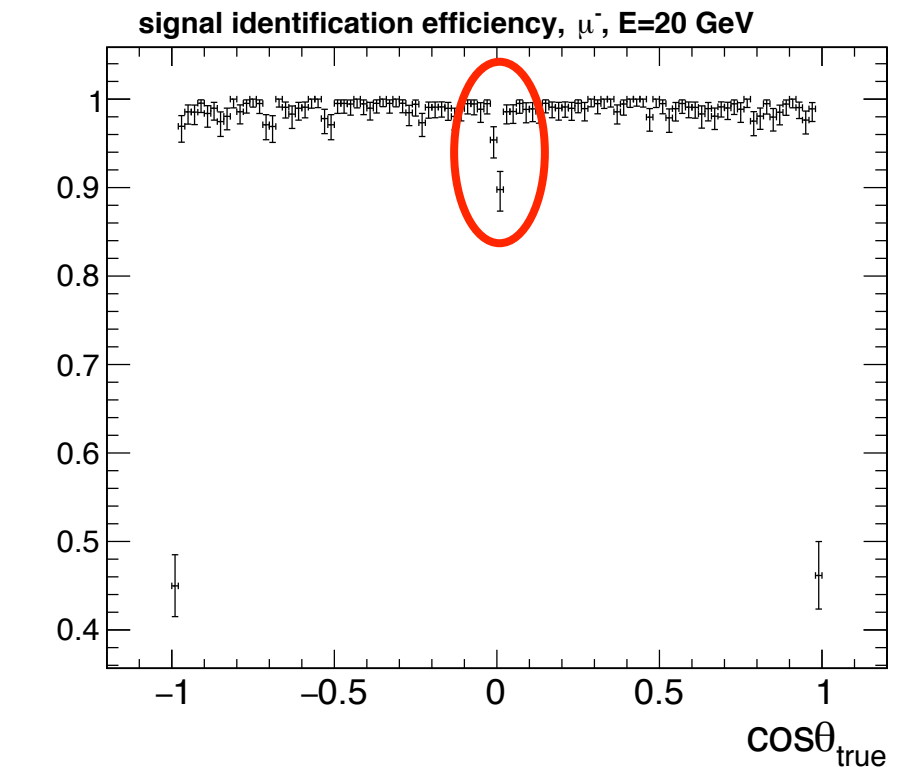
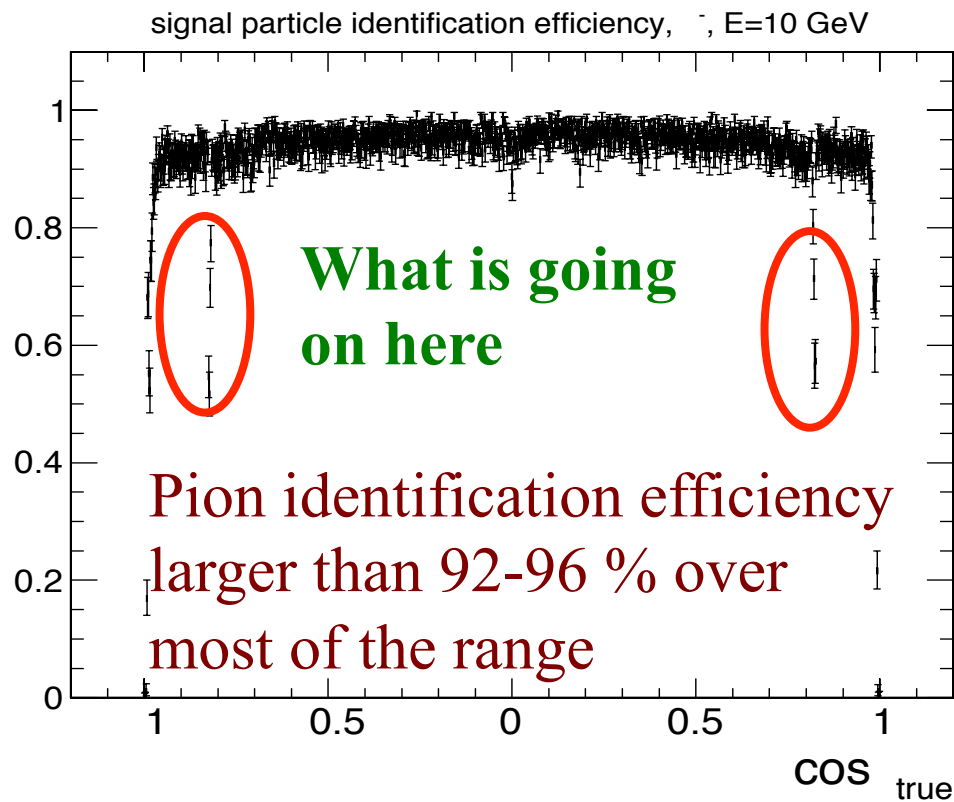
Particle Identification Inefficiencies

Matthias Weber (CERN)

Reminder: Particle Flow validation of CLICdet



Study performance of PandoraPFA with simulated and reconstructed particle gun events of isolated **electrons, pions, photons**, neutrons and muons for a few energy points → presentation at CLIC workshop



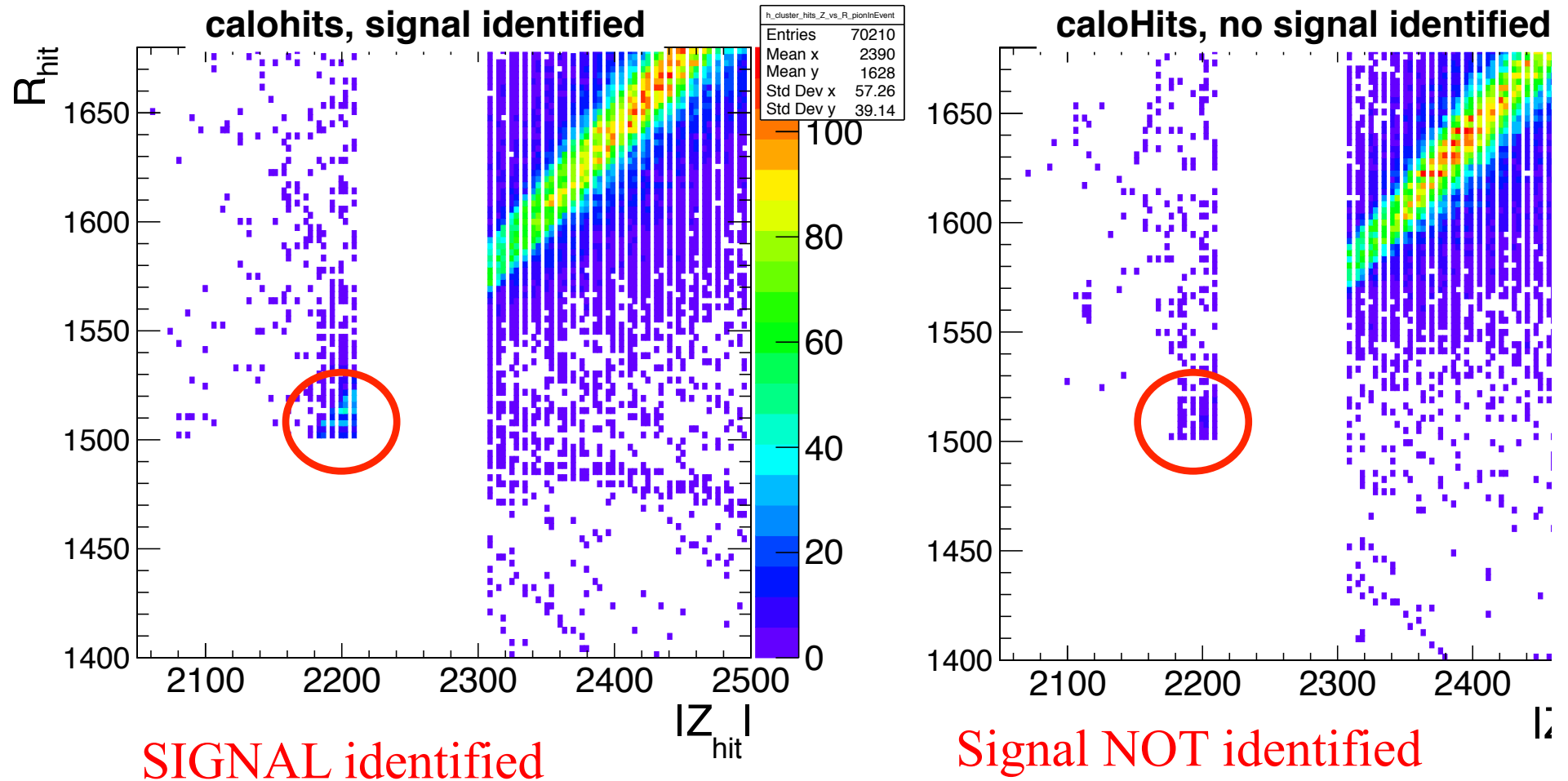
Muon identification issue at $90 \pm 1.5^\circ$

Model CLIC_o3_v08



Focus on bins with lowest efficiency ($<60\%$, $0.822 < |\cos\Theta| < 0.826$)

Bins without identified signal have no cluster of hits in first layers of ECAL barrel

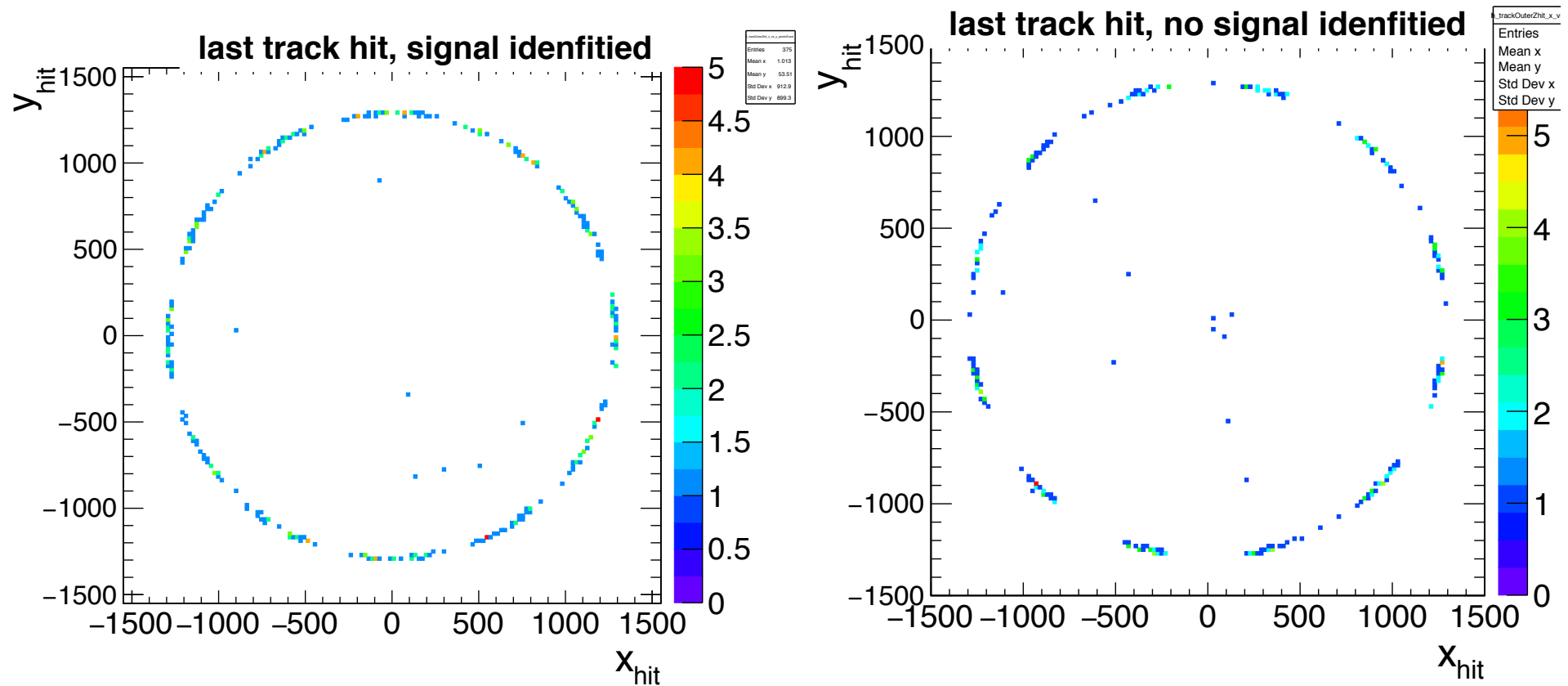


Model CLIC_o3_v08



Bins without identified signal have no cluster of hits in first layers of ECAL barrel

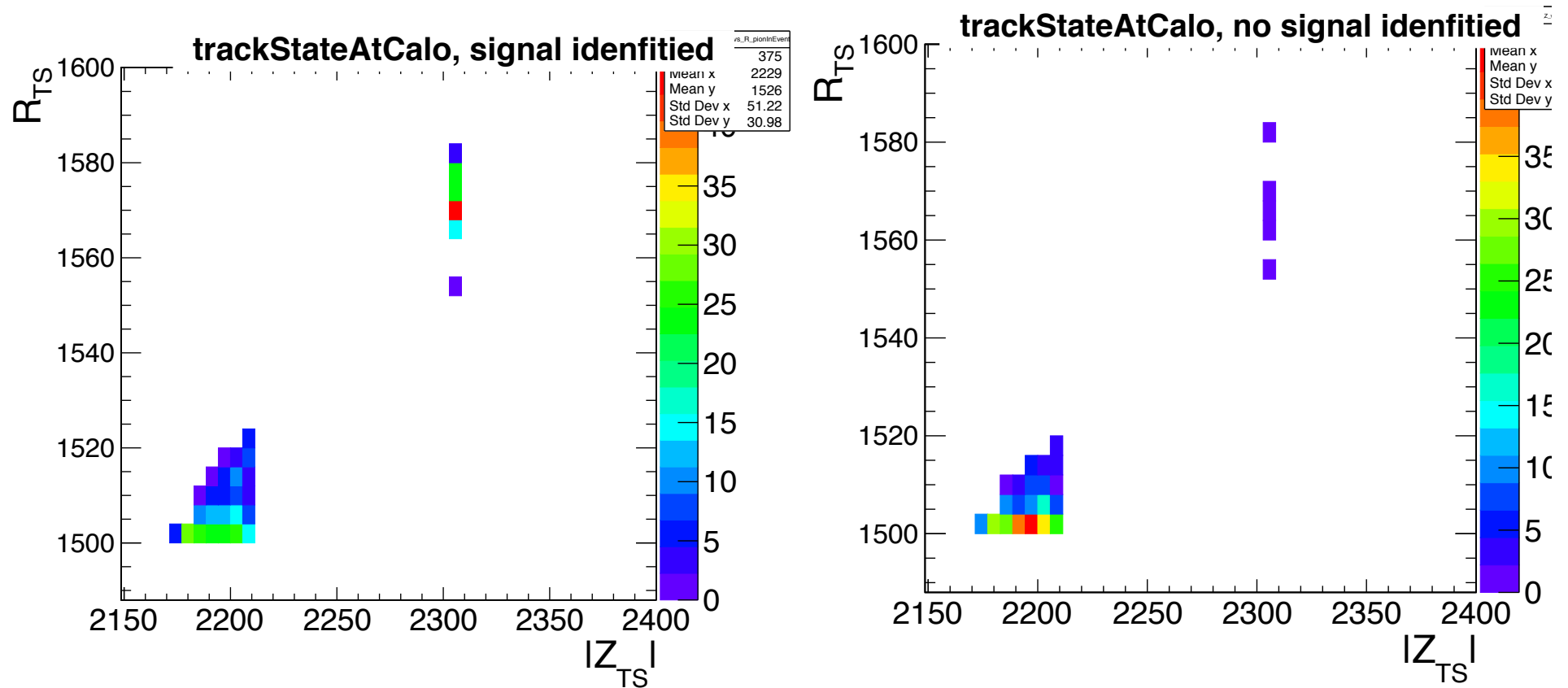
Unidentified events at edges of ECAL (see last tracker hit distribution, most hits close to barrel surface in fact)



Model CLIC_o3_v08: Track State Location in R vs Z



For unidentified events TrackState almost always set at barrel surface, for identified particles more set at Endcap Surface

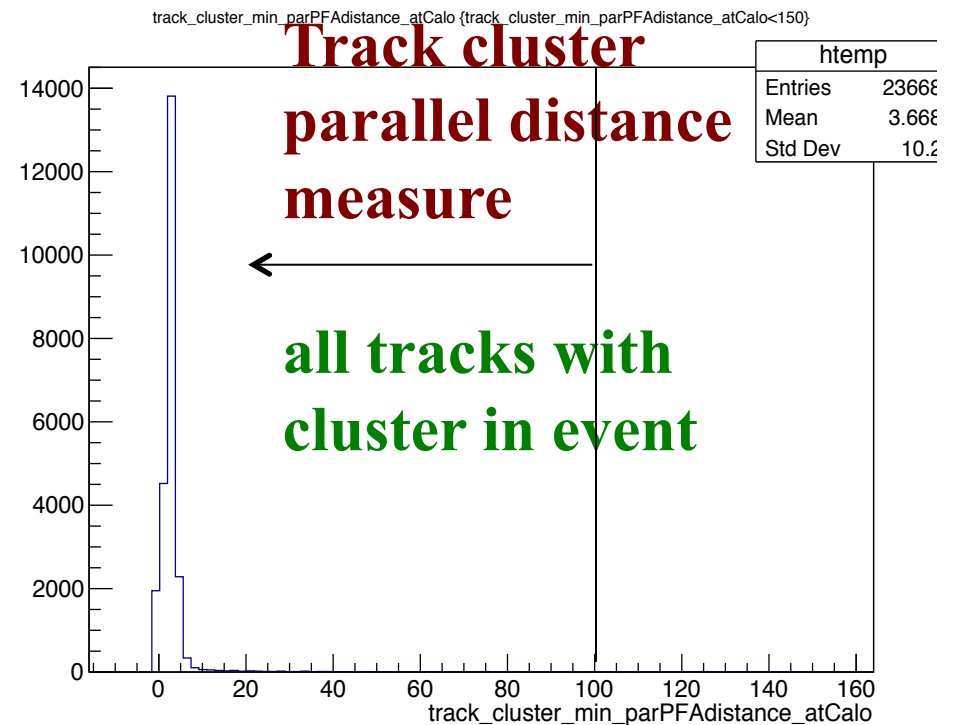
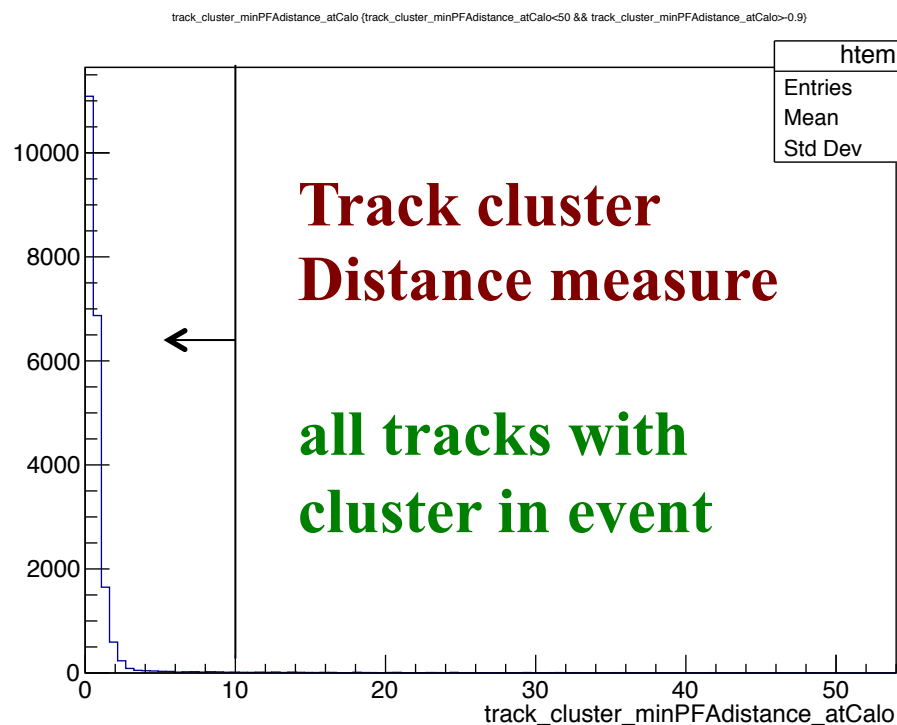


Model CLIC_o3_v10

distance measures



PandoraPFA assigns tracks to calorimeter clusters by checking the distance of the first hits in ECAL with respect to the TrackStateAtCalo position → 2 distance measures in depth and in parallel distance, cluster with smallest distance measure is associated to the track



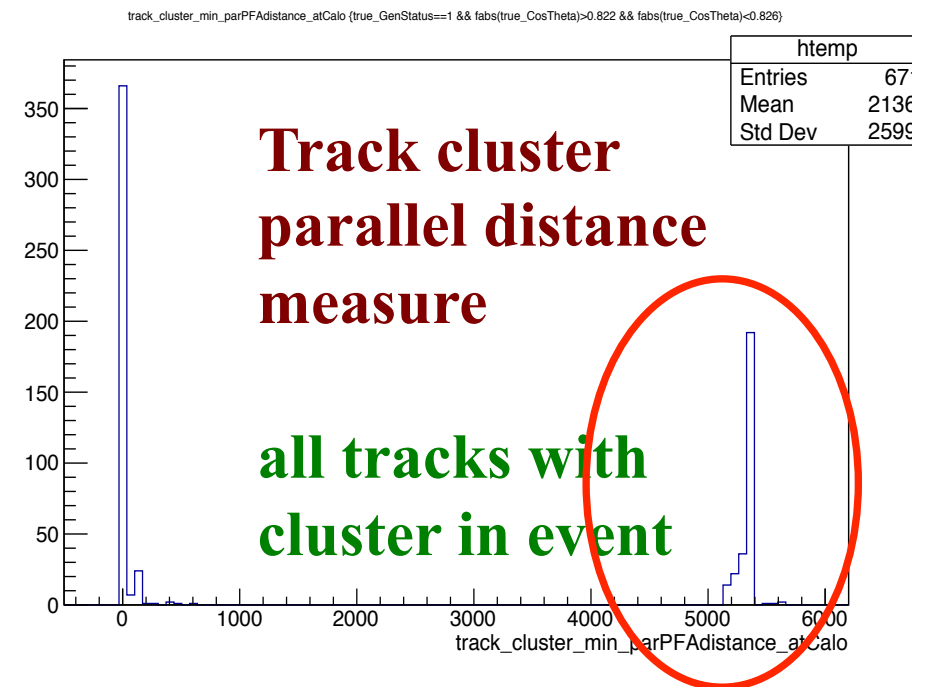
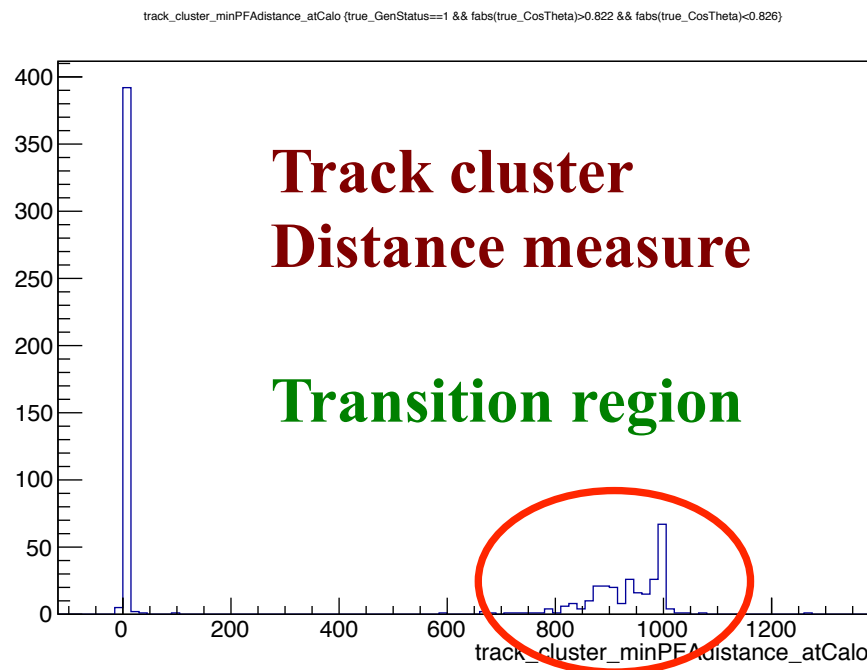
Model CLIC_o3_v10

distance measures in transition region



TrackStateAtCalo not optimally set in transition region → distance measure cut values too tough gap clusters → relax cuts

Transition region defined by $0.822 < |\cos\theta_{\text{true}}| < 0.826$



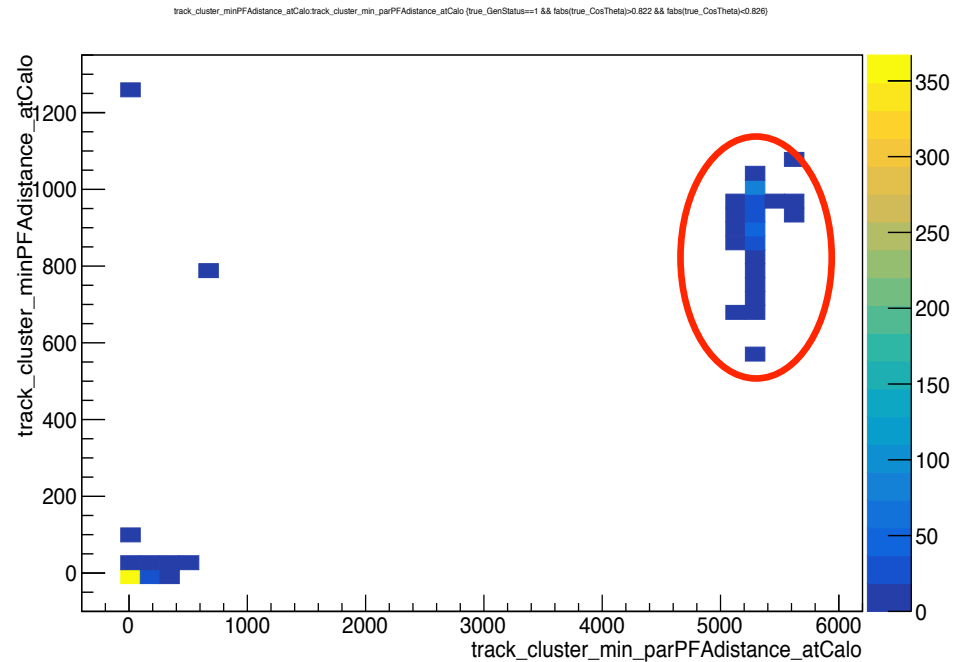
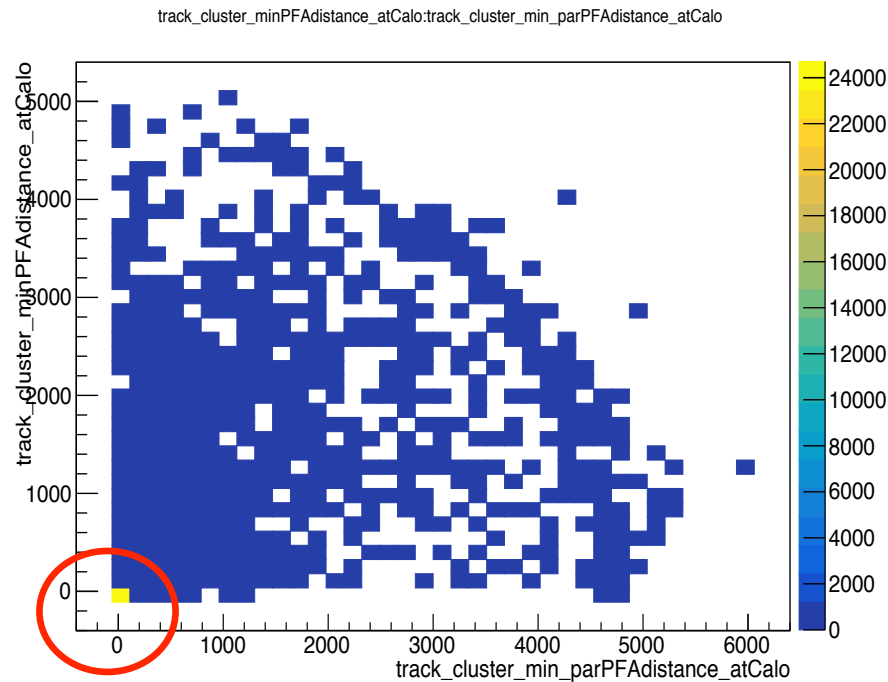
Events of second peak fail → increase cut for parrallel distance from 100 to 5500 and for distance measure from 10 to 1100

Model CLIC_o3_v10

distance measures in transition region



Parallel distance cut and PFA distance cut correlated



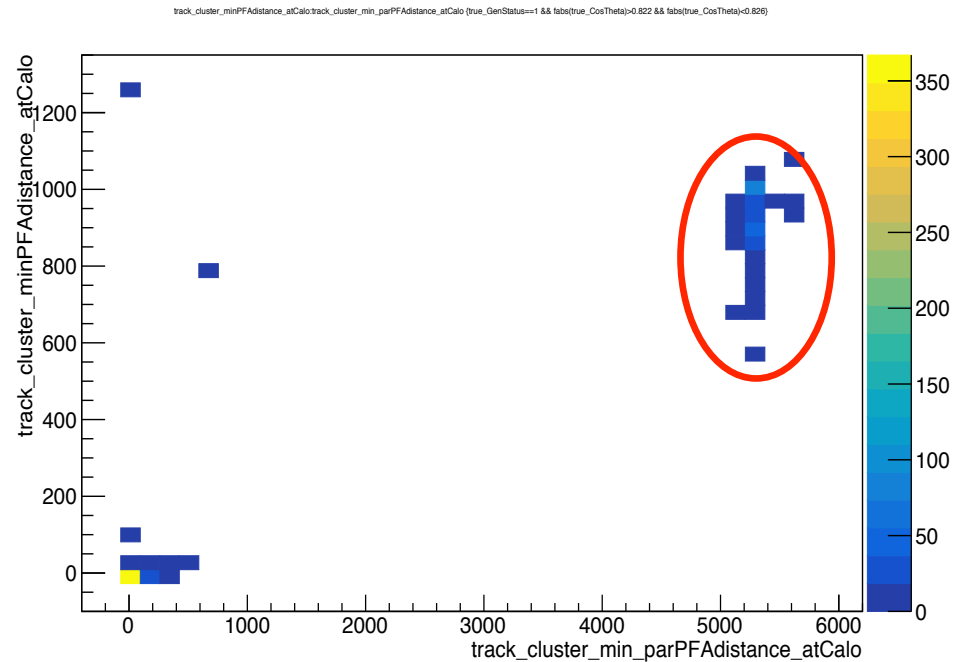
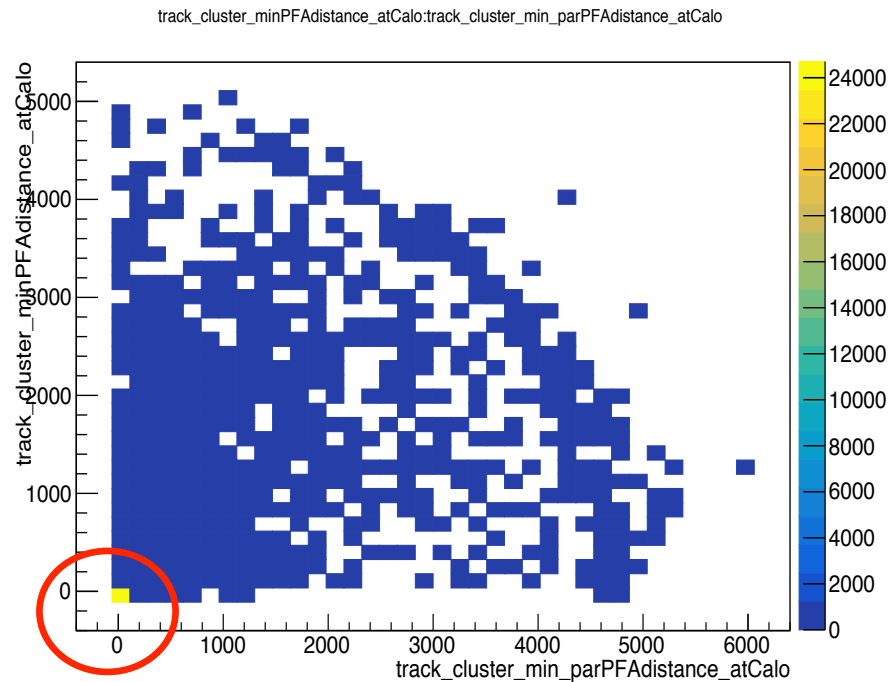
Overall correlation for high second peak events of transition region absolutely negligible

Model CLIC_o3_v10

distance measures in transition region



Parallel distance cut and PFA distance cut correlated



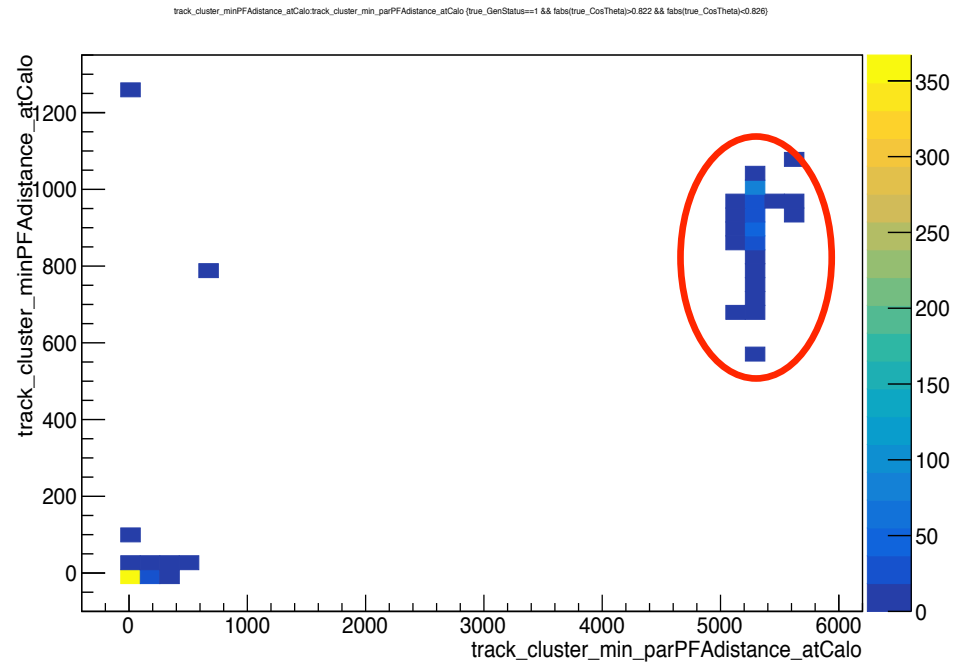
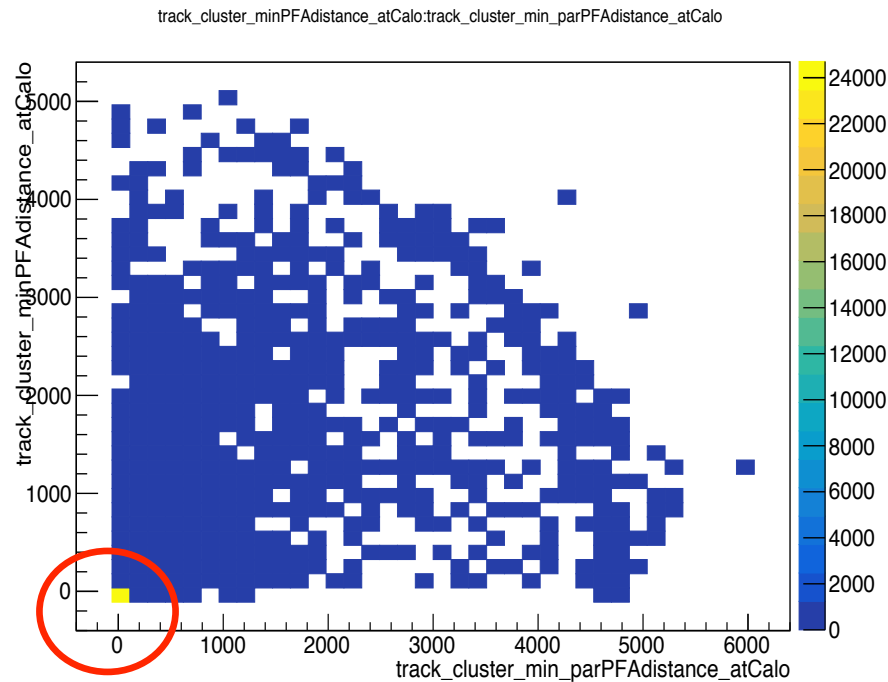
Overall correlation for high second peak events of transition region absolutely negligible

Model CLIC_o3_v10

Efficiency relaxed cuts



Parallel distance cut and PFA distance cut correlated

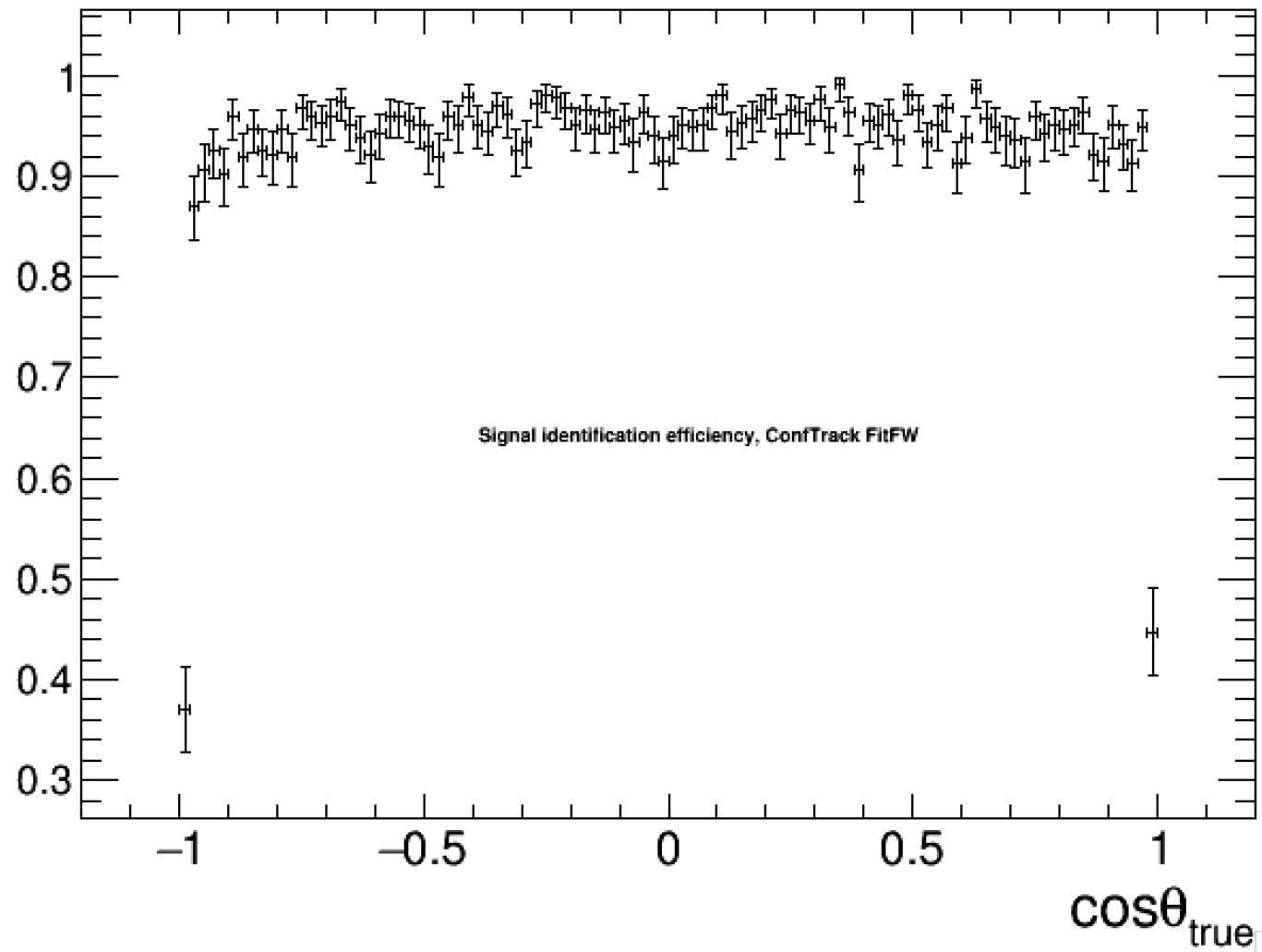


Overall correlation for high second peak events of transition region absolutely negligible

Pion 10 GeV sample



Pion particle gun \rightarrow dip in identification efficiency GONE

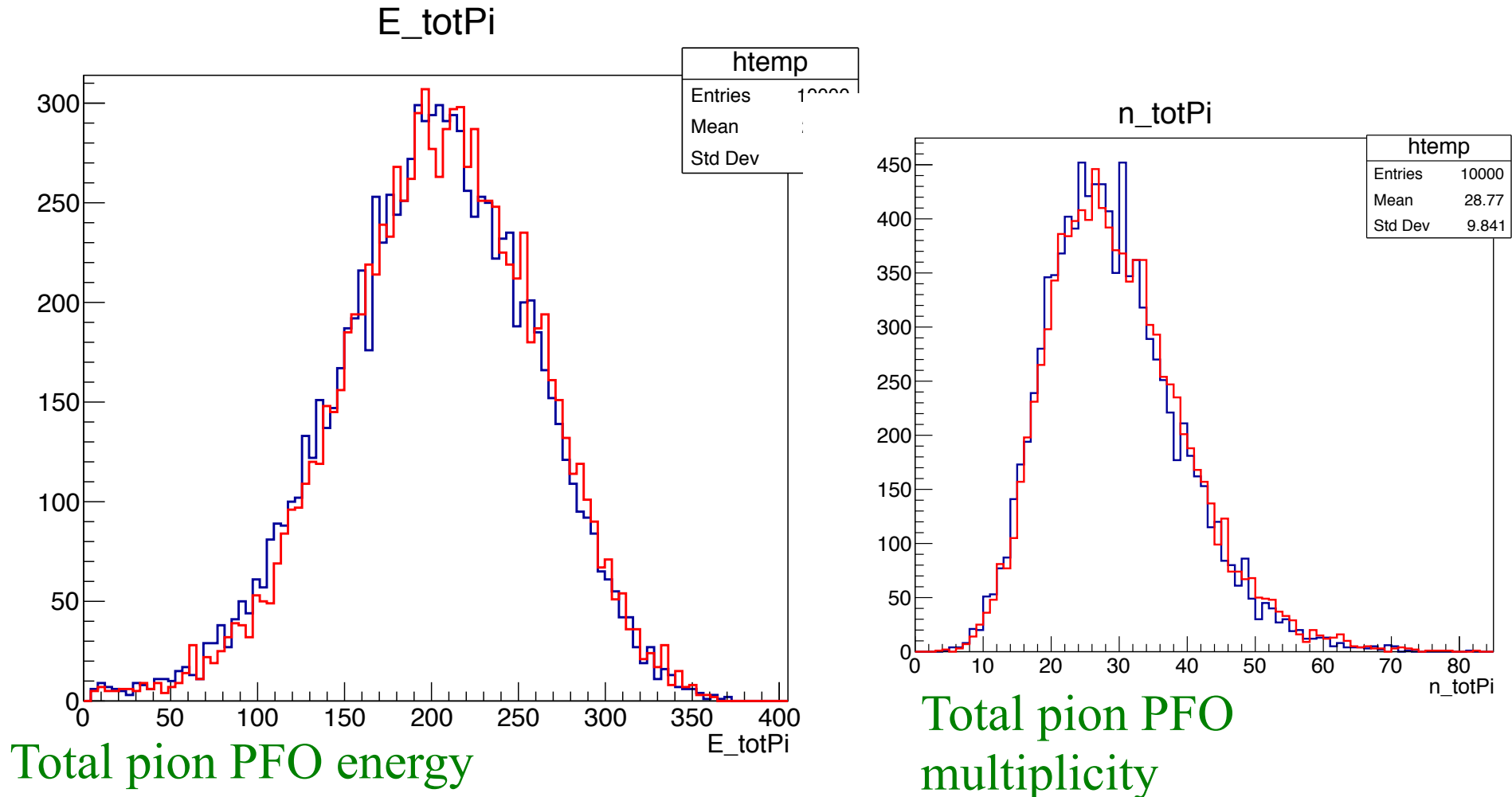


Z → uds, default relaxed trackCluster cuts 380 GeV sample



Pion energy and charged multiplicity pretty similar

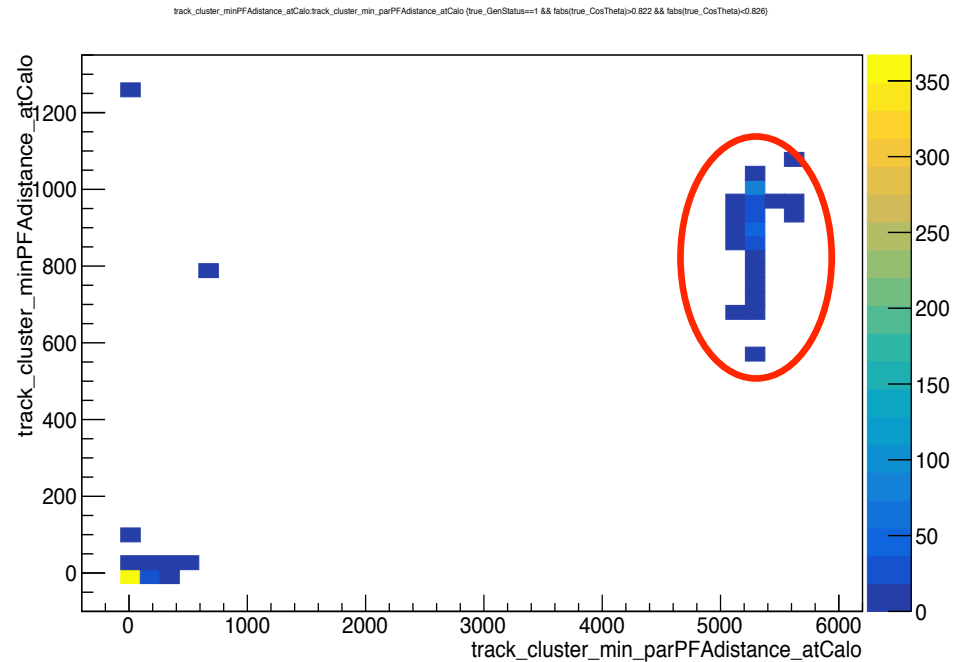
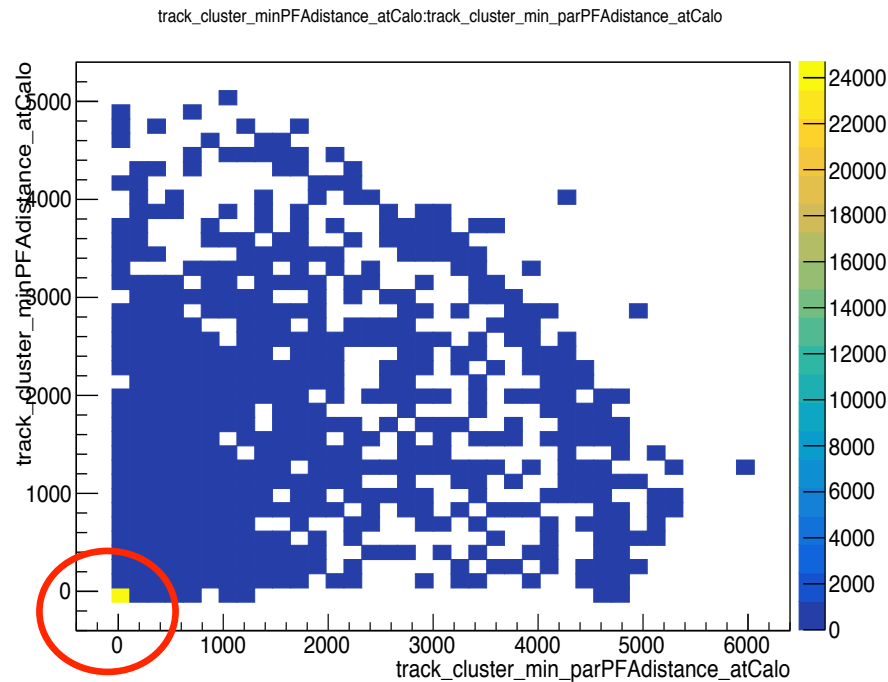
Default track cluster distance values vs Relaxed track cluster distance values



TauFinder



Parallel distance cut and PFA distance cut correlated



Overall correlation for high second peak events of transition region absolutely negligible



Muon Identification Inefficiencies

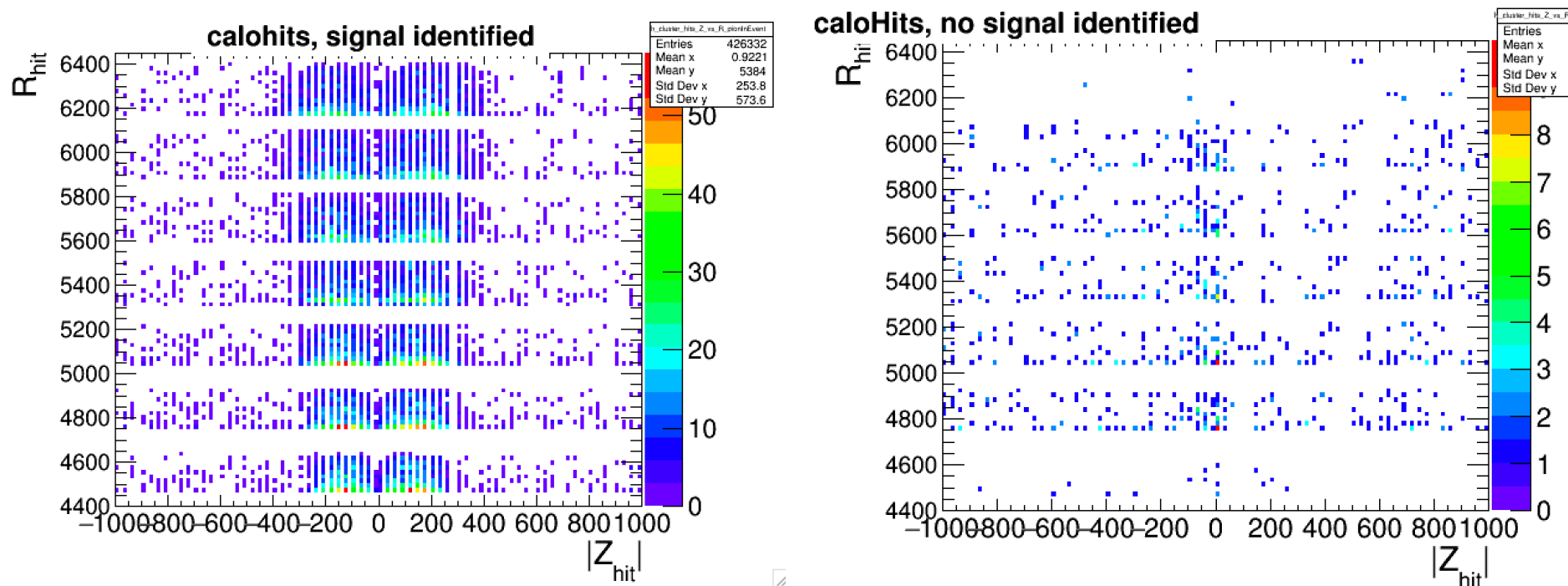
Matthias Weber (CERN)

MuonHits positions in clusters



Muon hits inside cluster for identified and missed muon events

→ Inefficiency mainly for hits in corridor at -30,0, and 30 mm [in z direction]



Hits are there, but at 0 typically around 20-30 hits, compared to 30-40 exactly in neighbouring bins

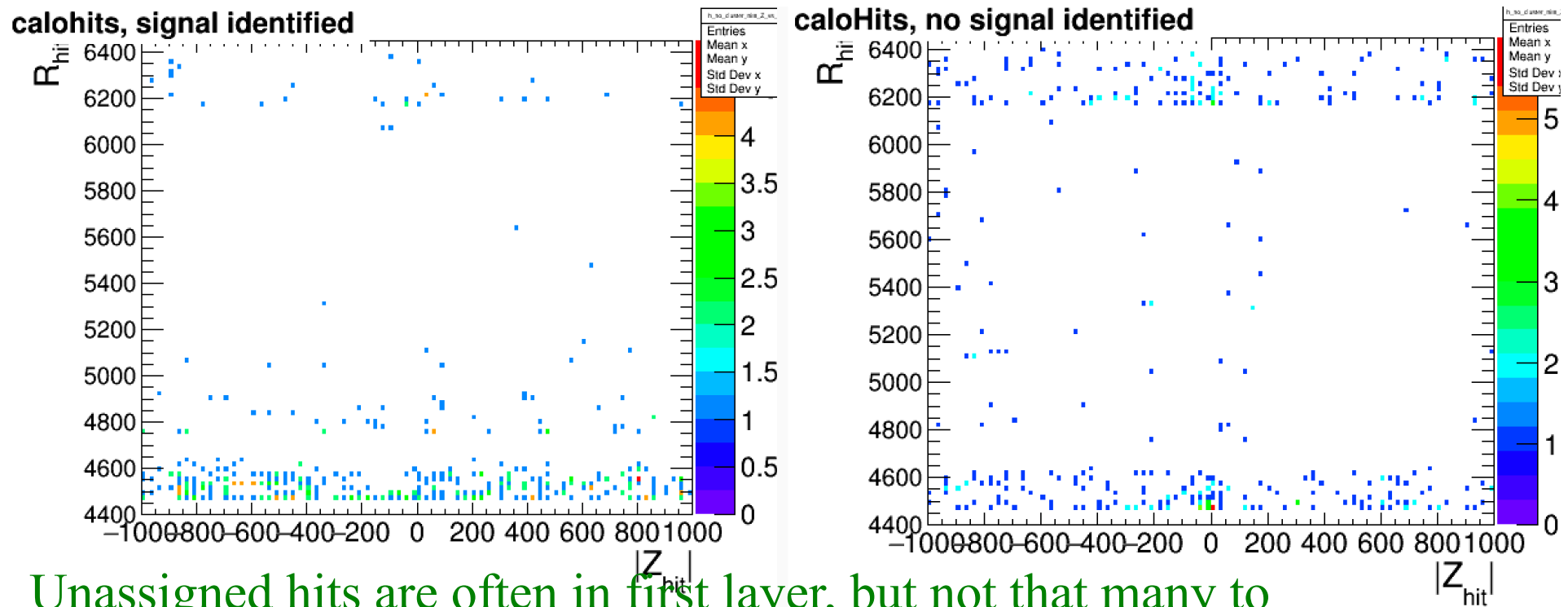
MuonHits positions unassigned to clusters



Muon hits inside cluster for identified and missed muon events

→ Most of unassigned hits in first layer, or last layer

→ For 90 degrees it can happen that all muon hits in are not assigned to clusters, so MuonHit to CalorimeterCluster association misses those completely



Unassigned hits are often in first layer, but not that many to explain deficit