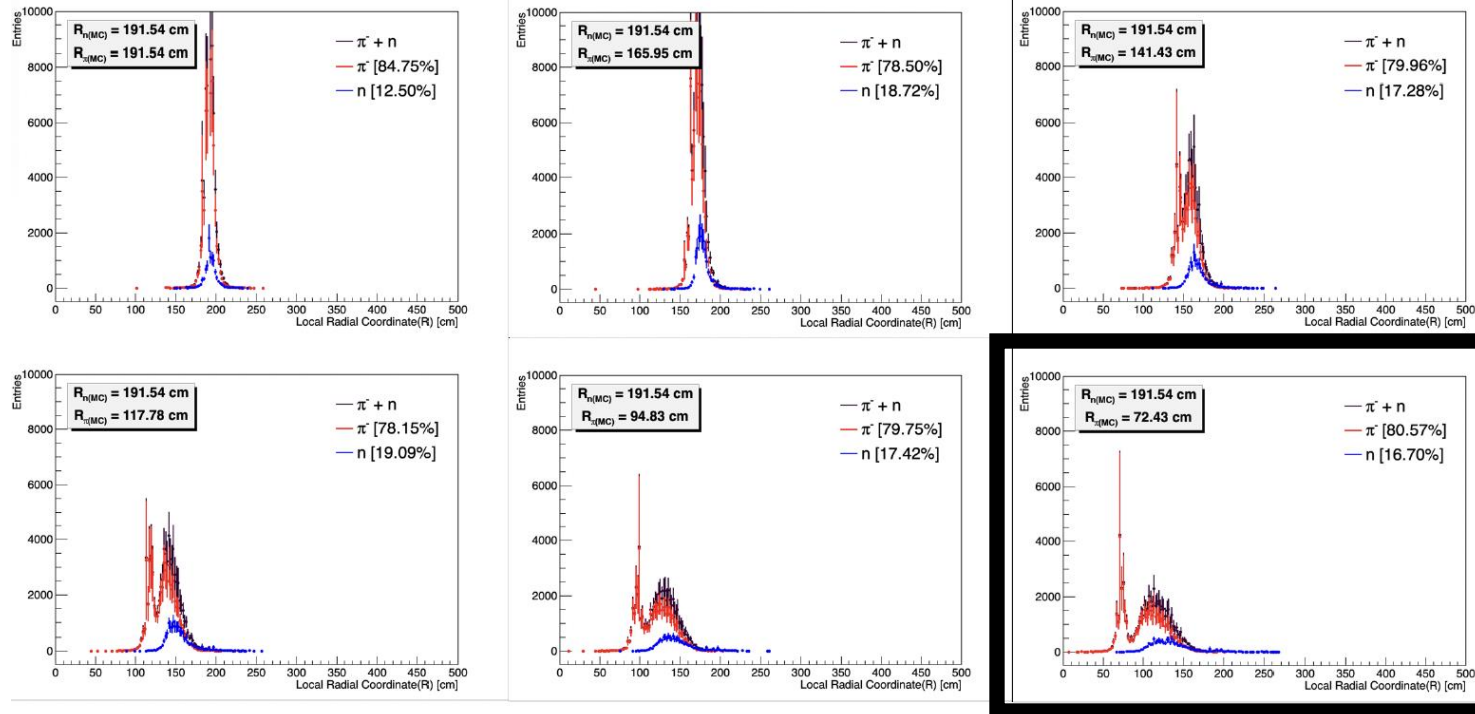# nHCal Updates

16.08.2024

Recap

Cluster Radial Coordinates

Percentages are based on ClusterMCParticle associations

Neutron Clusters start to shift inwards as $(R_n - R_\pi)$ increases

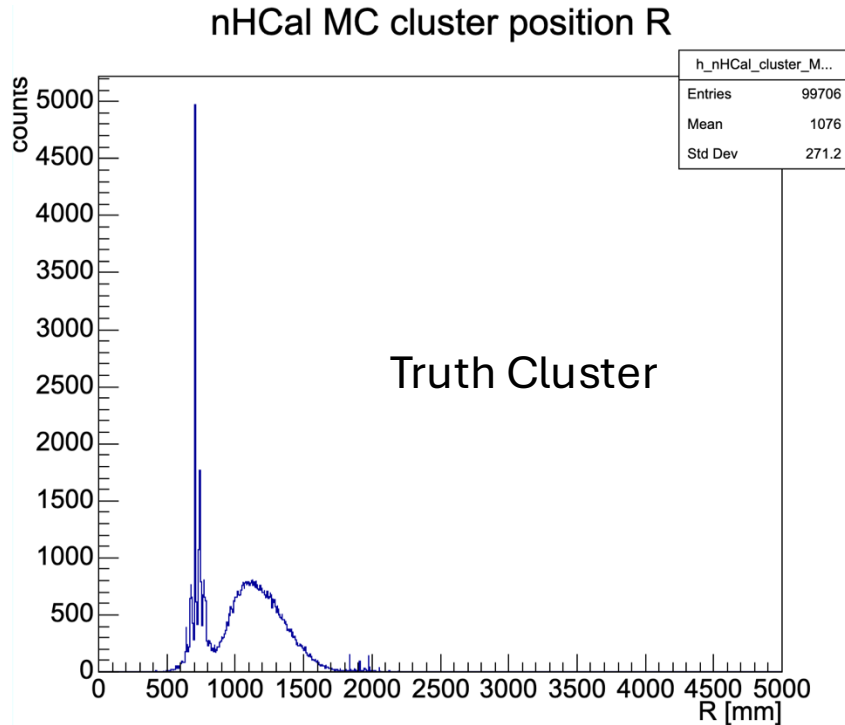~ 80% of the clusters associated with pions

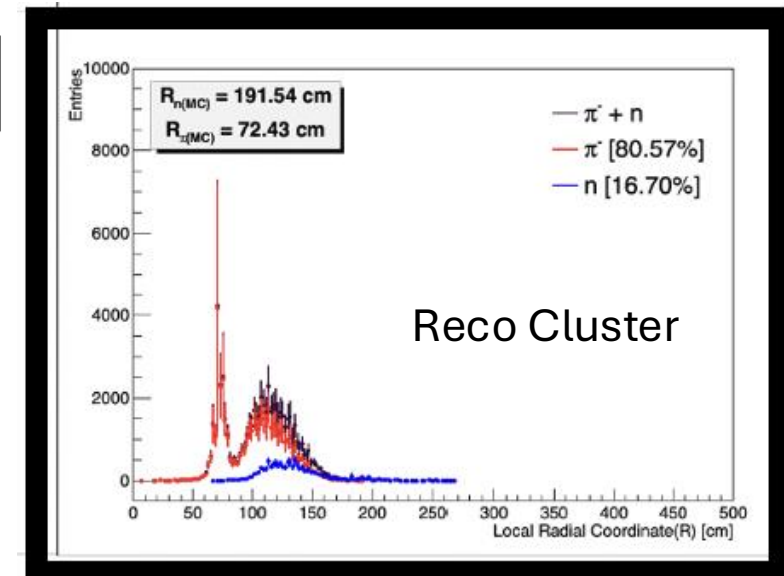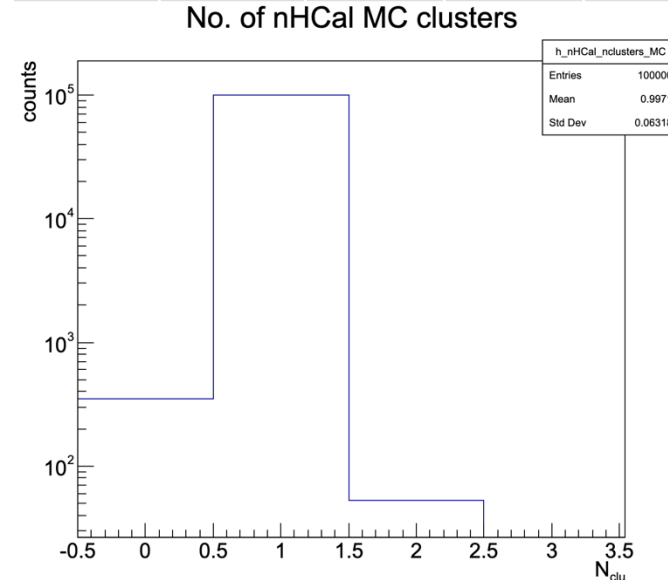~ 20% of the clusters associated with neutrons

p = 1 GeV/c

HCal Only geometry

Problems:

nHCal MC cluster position R

Truth Cluster

- 100000 events
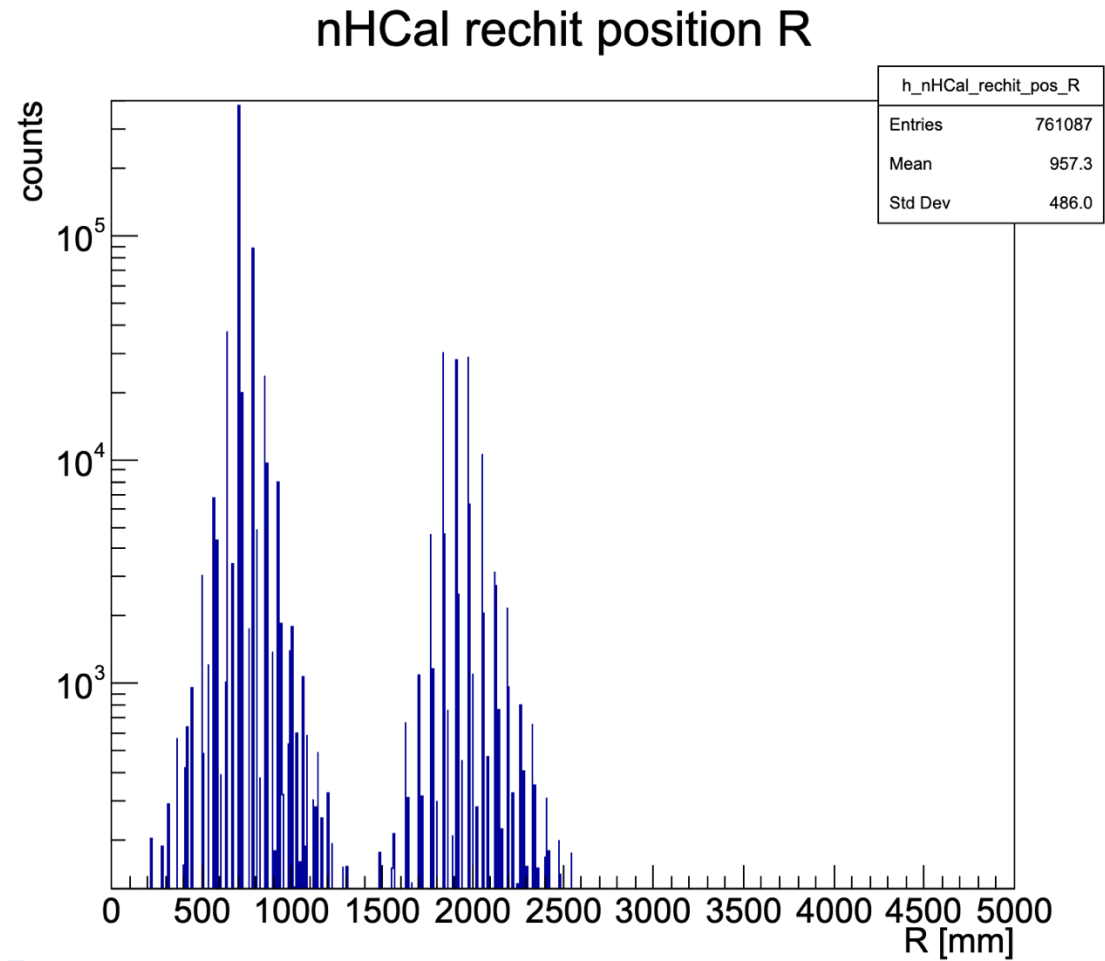- Pi- and Neutron in each event

HCal Only geometry

❑ Expected no. of clusters per event = 2; But > 99% events have 1 cluster.
  - ▪ Clusters are getting merged.
❑ Neutron Clusters are not in expected position (~ 1200 mm instead of 1915.4 mm)
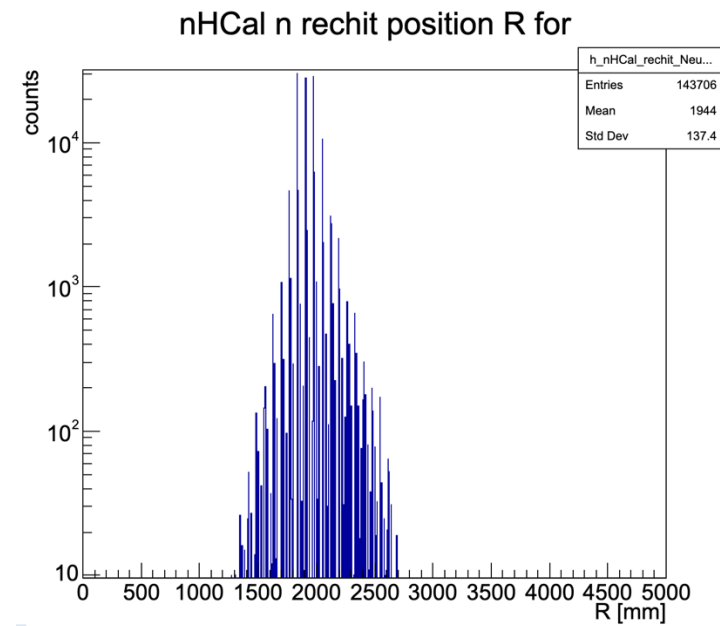

No. of nHCal MC clusters

$R_{n(MC)} = 191.54$ cm
$R_{z(MC)} = 72.43$ cm

π⁻ + n
π⁻ [80.57%]
n [16.70%]

Reco Cluster

nHCal rechit position R

nHCal π⁻ rechit position R for

nHCal n rechit position R for

HCal Only geometry
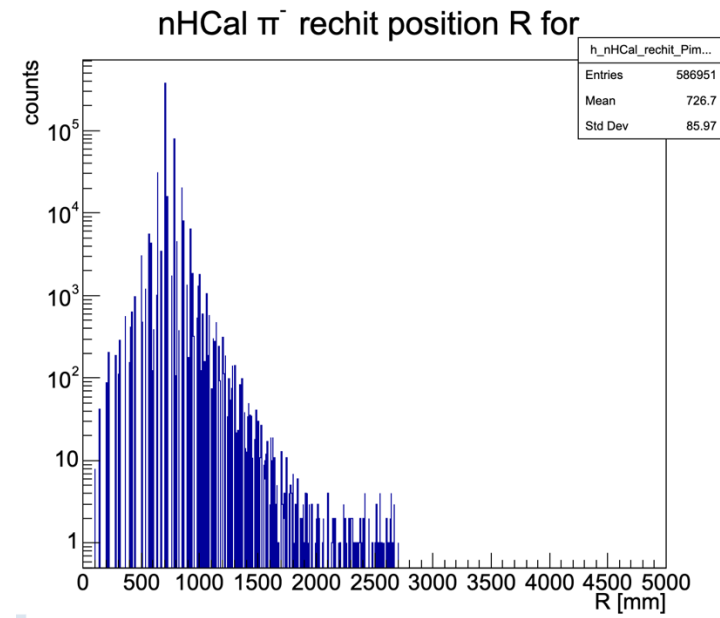
Based on highest energy hit contribution

Single Particle Simulation

Generator Status of the MCParticle matched to HitContribution

h1	
Entries	1.164532e+07
Mean	0.9969
Std Dev	0.05568

Single Particle Simulation (old)

h_NTruthclusters	
Entries	100000
Mean	0.9391
Std Dev	0.2444

NTruthclusters
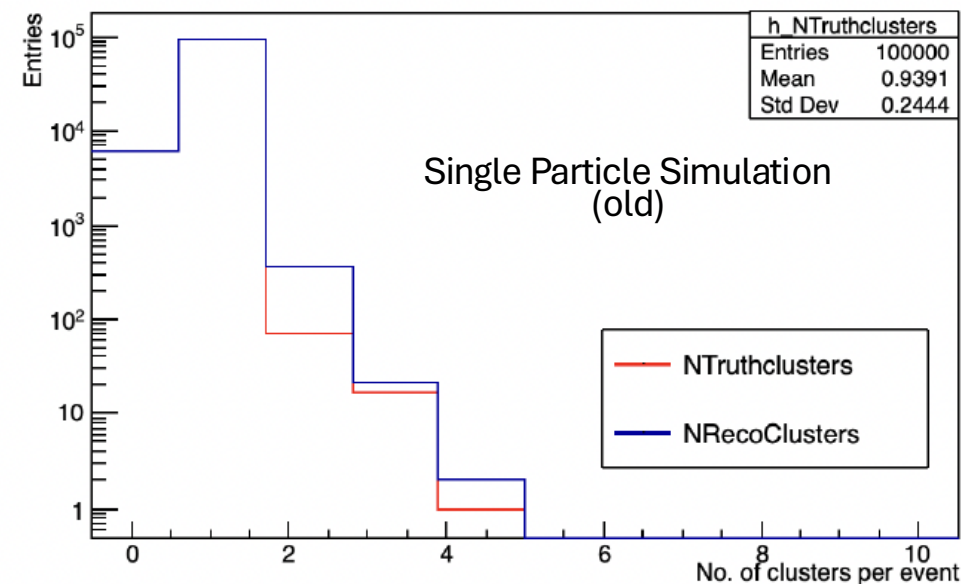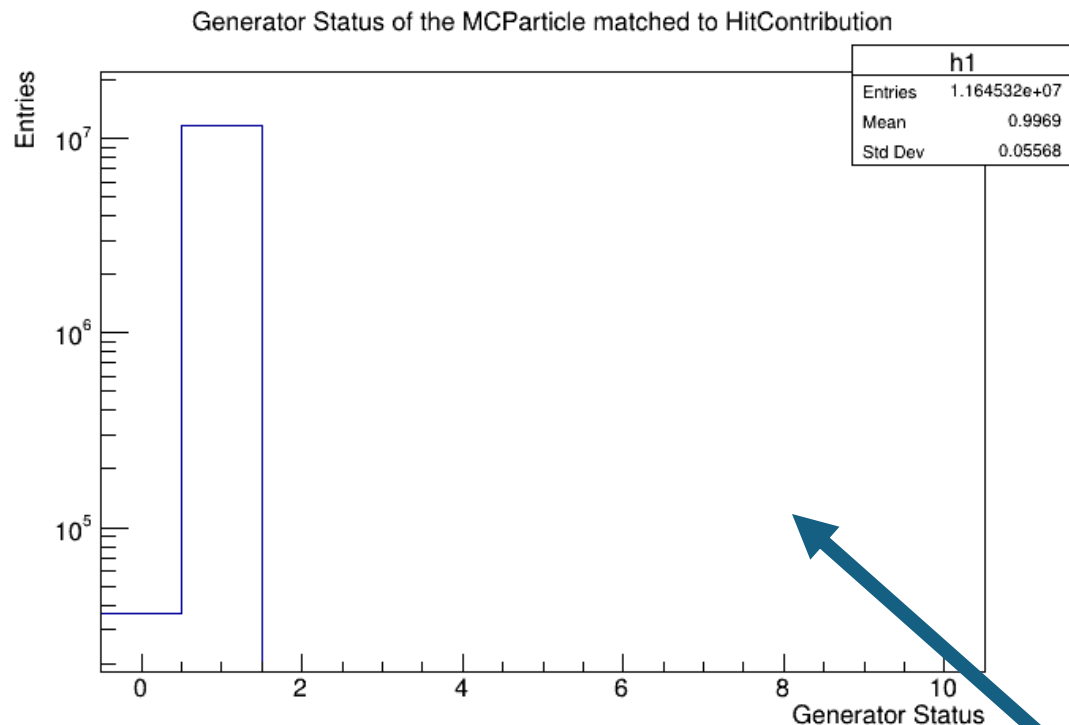
NRecoClusters

Cases with > 1 clusters are appearing most likely when the matched MCParticle is a secondary particle (not a generated particle)

```cpp
const auto &trackID = (*mc)[mcIndex].getContributions(0).getParticle().getObjectID().index;
// Create a new protocluster if we don't have one for this trackID
if (protoIndex.count(trackID) == 0) {
clusters->create();
protoIndex[trackID] = clusters->size() - 1;
}
// Add hit to the appropriate protocluster
(*clusters)[protoIndex[trackID]].addToHits(hit);
(*clusters)[protoIndex[trackID]].addToWeights(1);
```

HCal Only geometry

Code Snippet from EICRecon Truth Clustering Algorithm