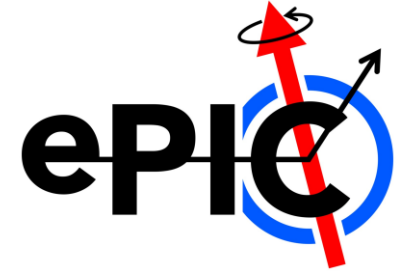


Truth-Cluster Chat | Main Logic

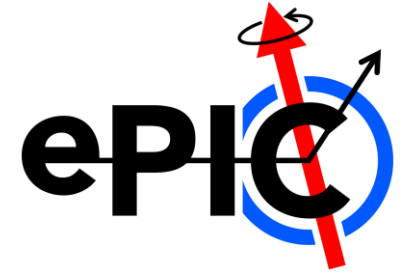


Main:

For each cluster do:

1. **Find** largest energy (reco) hit
2. Get matching sim hit based on cell ID
3. Grab first contribution sitting in `getContributions()` and set particle as association (with weight 1.0)

- Current logic of truth-cluster associations sitting in `CalorimeterClusterRecoCoG`
- **Note:**
 - 1) Collect list of all sim hits in cluster
 - 2) Check energy of each contributing particle across sim hits until a majority of contributed energy has been accounted for
 - 3) Set the biggest contributor as the association



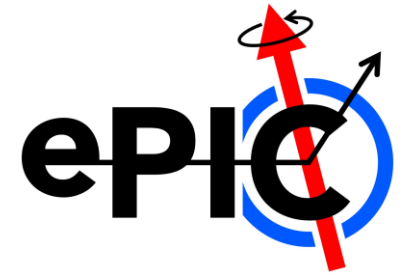
Truth-Cluster Chat | PR #1396 Logic

PR#1396: updated association logic

For each cluster do:

1. **For each hit in cluster do:**
 - a) Find matching sim hit based on cell ID
 - b) Add e_{sim}^{match} to sum (e_{sim}^{total})
 - c) Add matching sim hit to list of sim hits in cluster
2. **Sort** list of sim hits in order decreasing energy
3. **For each sim hit in sorted list do:**
 - a) **For each contribution in sim hit do:**
 - i. Grab linked particle
 - ii. Add $e_{contrib}^{par}$ to relevant entry in list of contributing particles vs. energy contributed
 - iii. Add $e_{contrib}^{par}$ to total energy checked ($e_{contrib}^{check}$)
 - b) Find highest energy contributor (w/ energy $e_{contrib}^{max}$)
 - c) **If** $e_{contrib}^{max} < (e_{sim}^{total} - e_{contrib}^{check})$
⇒ Set highest energy contributor as the association (with weight 1.0) and **break**

- [PR#1396](#) updates logic of truth-cluster associations to search over all contributing particles
- **Gist of logic is:**
 - 1) Collect list of all sim hits in cluster
 - 2) Check energy of each contributing particle across sim hits until a majority of contributed energy has been accounted for
 - 3) Set the biggest contributor as the association



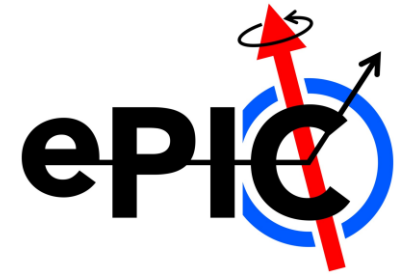
Truth-Cluster Chat | Extending PR #1396

PR#1396: updated association logic

For each cluster do:

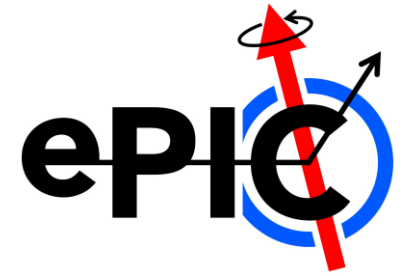
1. For each hit in cluster do:
 - a) Find matching sim hit based on cell ID
 - b) Add e_{sim}^{match} to sum (e_{sim}^{total})
 - c) Add matching sim hit to list of sim hits in cluster
2. Sort list of sim hits in order decreasing energy
3. For each sim hit in sorted list do:
 - a) For each contribution in sim hit do:
 - i. Grab linked particle
 - ii. Add $e_{contrib}^{par}$ to relevant entry in list of contributing particles vs. energy contributed
 - iii. Add $e_{contrib}^{par}$ to total energy checked ($e_{contrib}^{check}$)
 - b) Find highest energy contributor (w/ energy $e_{contrib}^{max}$)
 - c) If $e_{contrib}^{max} < (e_{sim}^{total} - e_{contrib}^{check})$
⇒ Set highest energy contributor as the association (with weight 1.0) and **break**

- [Issue#1475](#) proposes to:
 - Create association for each *primary* contributing to cluster; and
 - Assign a weight of e_{par}/e_{clust} to association
- How could PR#1396 be extended towards this?
 - 1) Step 3(a)(i) would be changed to walk back through parents until a primary is hit
 - 2) Step 3(a)(iii) would instead just build a list of all contributing primary particles
 - 3) All things in violet would be removed
 - 4) And step 3(c) would be replaced by one that converts the list in change (2) to associations

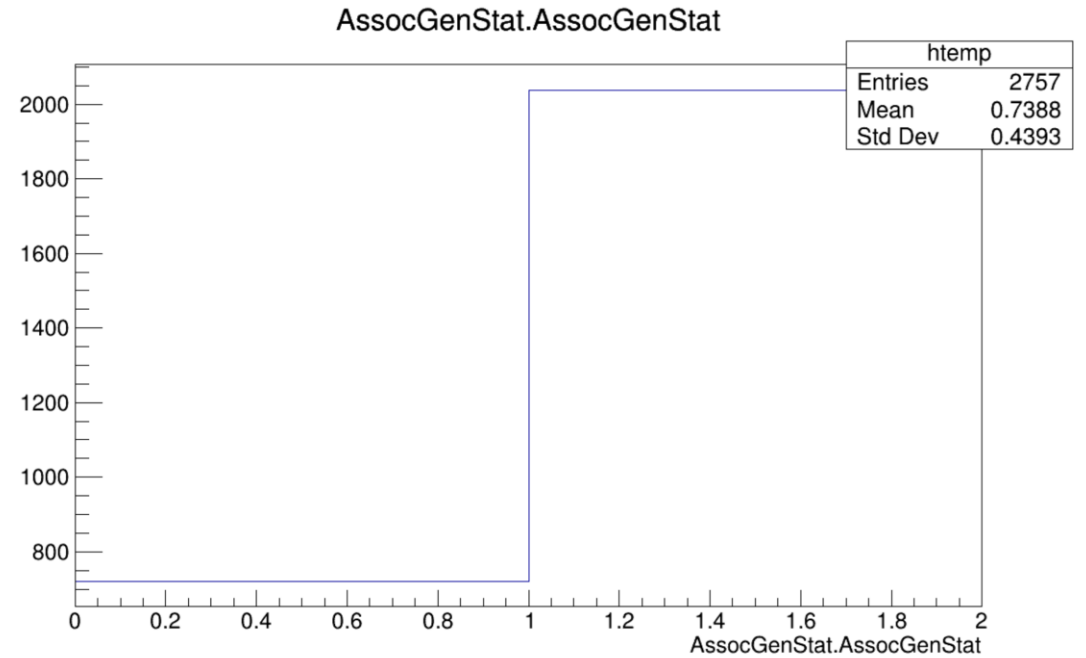
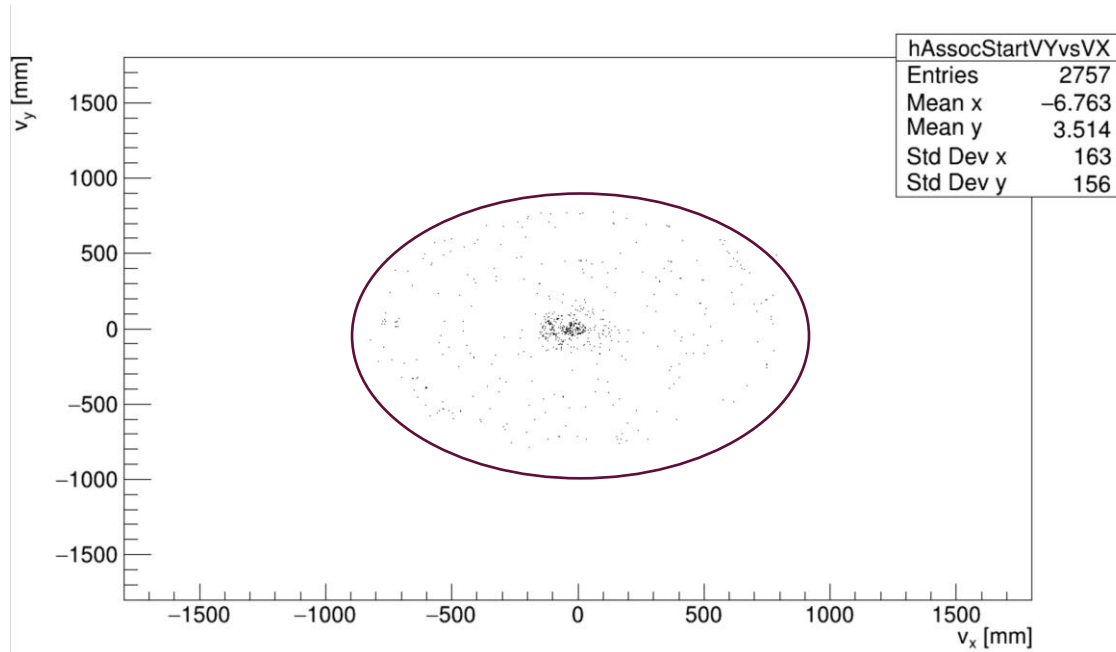


Truth-Cluster Chat | Other Thoughts

- On weights in Issue#1475:
 - ☞ **Would it make sense to assign weights of of $e_{contrib}/e_{sim}^{total}$ rather than e_{par}/e_{clust} ?**
- Truth Clusters deploy a similar logic to the associations in main...
 - ☞ **Should we update this as well?**
- Currently we don't store the edm4hep::CaloHitContributions in the campaign output
 - Makes walking back **through relations** to truth impossible
 - But this could be useful information to have...
 - › Especially if associations go back to the primaries
 - ☞ **Would it be reasonable to add those to the campaign output?**
 - ☞ **Or at least for specific productions?**



Backup | Association Vertex & Generator Status



- Vertex (x, y) and generator status for BHCAL Associations in 500 18x275 NC DIS ($Q^2 > 100$) events
 - ☞ Using logic in main