The status of Particle Flow Algorithm in IPNL

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Outline

Identification of low energy photon

- Some cluster fragments ($\lesssim 2$ GeV) are not merged by the algrithm.
- If we could merge them perfectly, the JER will get to 3.9% or so.
- We can tag the photon in the low energy cluster, and then deal with the other hadronic clusters.
- The variables of cluster which were considered in the PID algorithm
  - ▶ Ratio of energy deposition in ECAL and HCAL.
  - ▶ Shower starting layer and end layer.
  - ▶ Shower angle.
- Additional variables are taken into account for low energy photon identification
  - ▶ Mean hit number per layer.
  - ▶ Hit number at first layer
  - ▶ Mean hit density.
  - ▶ The ratio of connectors and hits number.
  - ▶ Diffence of hit RMS in transverse directions of shower.
 - ▶ Nearby cluster's PID.
  - ▶ Cluster time.

A little comment

- Nearby cluster's PID, for curing shortcoming of clustering.
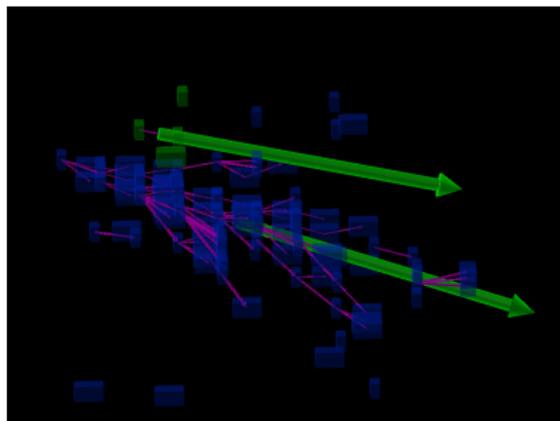
- Cluster time
  - it is effective to veto the delayed component of hadronic shower, while this also related the layer.
 - Time cut: 40 ns.

PID performance
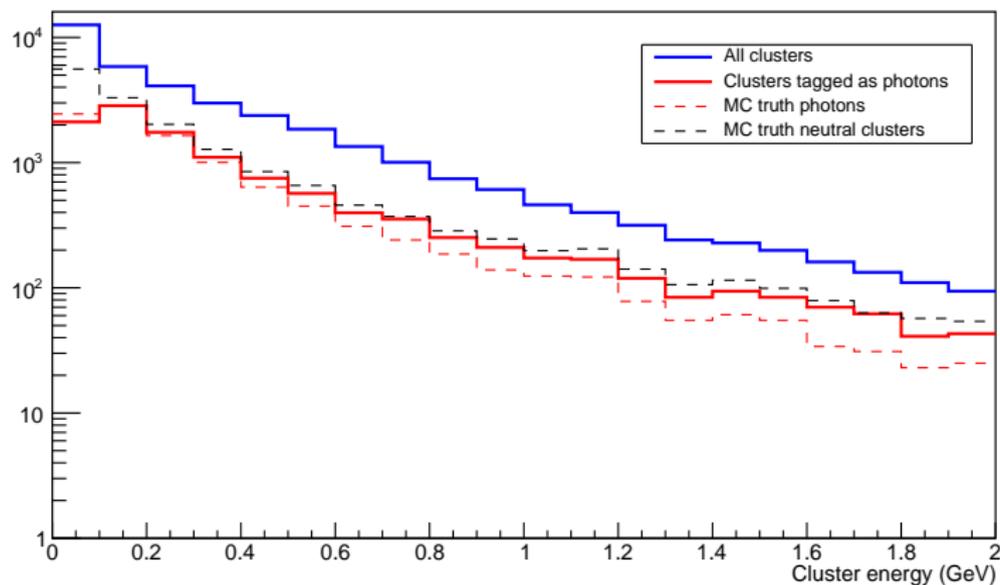
- Photon identification efficiency: 0.72%; Purity: 67% (for neutral: 76%).

Update of cluster variables computation

- Cluster axis computation: the connected hits in a cluster were used to calulate the axis by Principal componet Analysis $\rightarrow$ now I am using the nearby hits in a domain (given by DBSCAN) of a cluster.
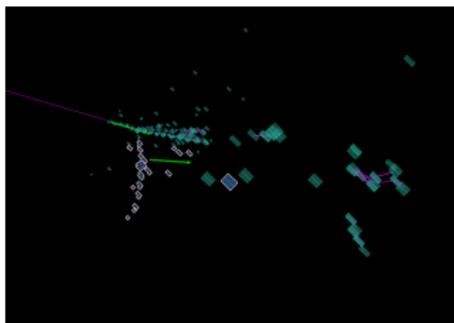
(a) Connected hits
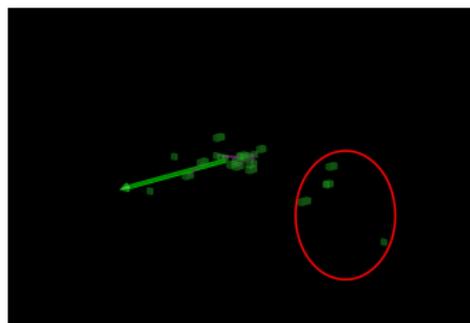
(b) Nearby hits

- RMS of cluster
  - Transform the hit position in the coordinate system of detector to that of cluster.
  - Fill the positions of hits into a 2D histogram.

Summary

- The photon identification performance is improved at low energy.
- Methods to compute the cluster variables are updated.
- The merging of the rest of fragments is ongoing.