Analysis of ILD Muon System as Tail Catcher for HCAL

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DESY

Trade off of HCAL/Muon System Design for ILD

Good Particle Flow Calorimetry requires that Calorimeter System are positioning within the Detector Solenoid.

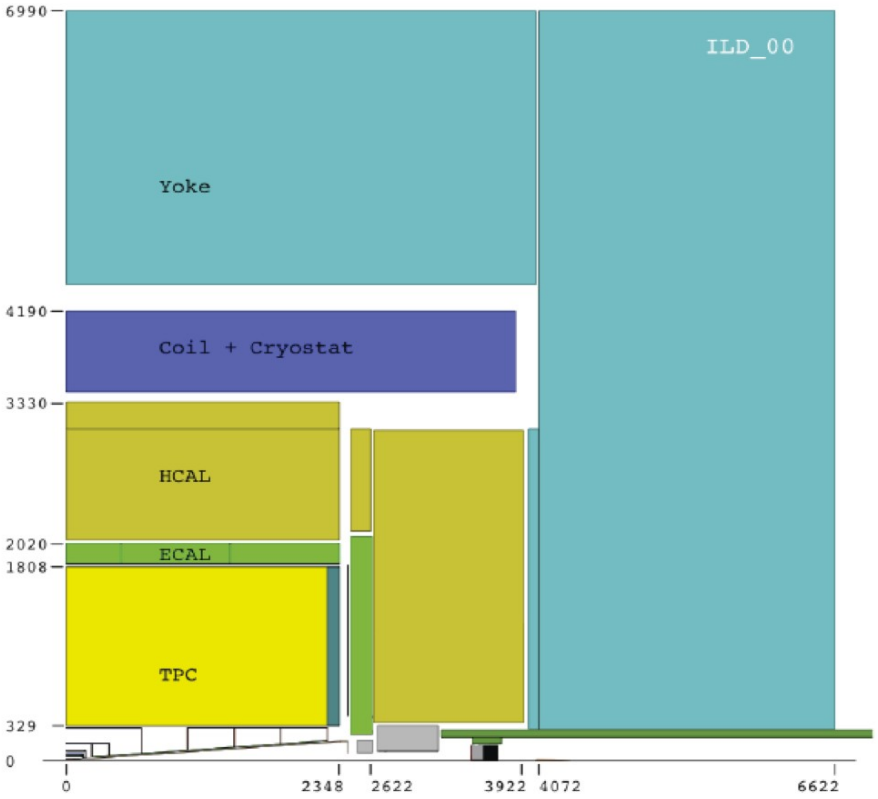
The thickness of the HCAL determines the average fraction of jet energy contained within the Calorimeter System. The impact of the HCAL thickness on particle flow performance is defined by Material and number of layers: preliminary estimation for Iron from 32 to 63 layers. This corresponds to a variation of 4.0 − 7.9 λ (4.8 − 8.7 λ) in the HCAL (ECAL+HCAL).

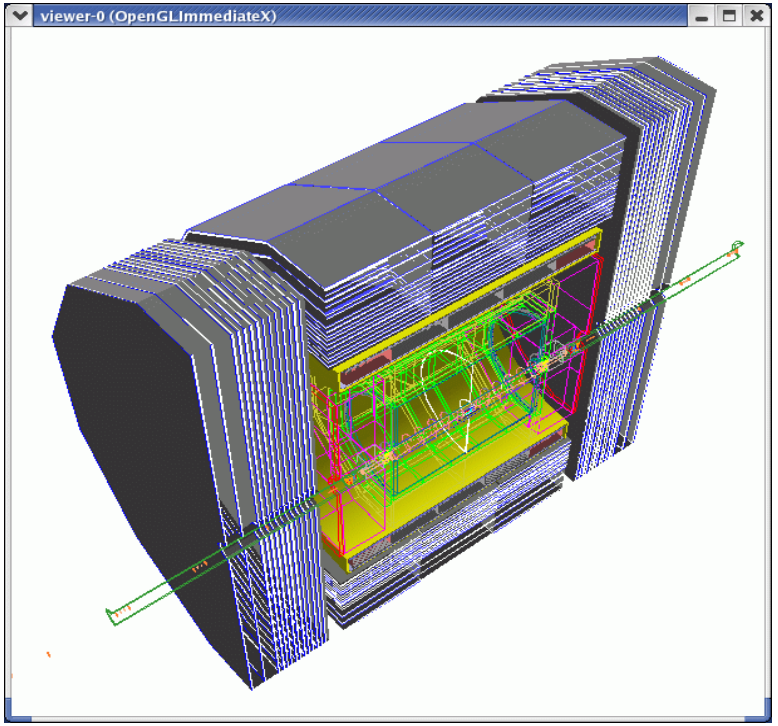
To allow for uncertainties in the simulation of the longitudinal development of hadronic showers, and to ensure the detector is appropriate for collisions at 1 TeV, a 48 layer (~6 λ) HCAL was chosen for ILD (LOI).

One of the way to improve the performance with min (optimal) HCAL thickness could relay on the possible use of the Instrumented Return Yoke (the Muon System) to correct for leakage of high energy showers out of the HCAL.

The effectiveness of this approach is limited by the fact that, mostly the Muon System is behind the relatively thick Solenoid Coil (2λ). Nevertheless, to assess the possible impact of using the Muon System as a “tail-catcher”, the energy depositions in the Muon Detector could be included in the PandoraPFA reconstruction.

Muon System (Tail Catcher) in ILD Geometry

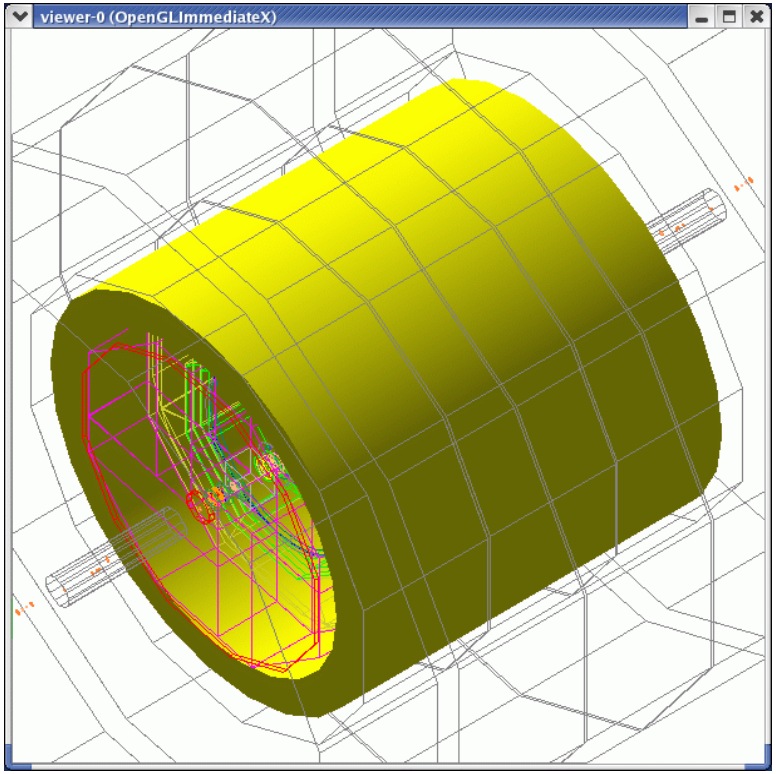


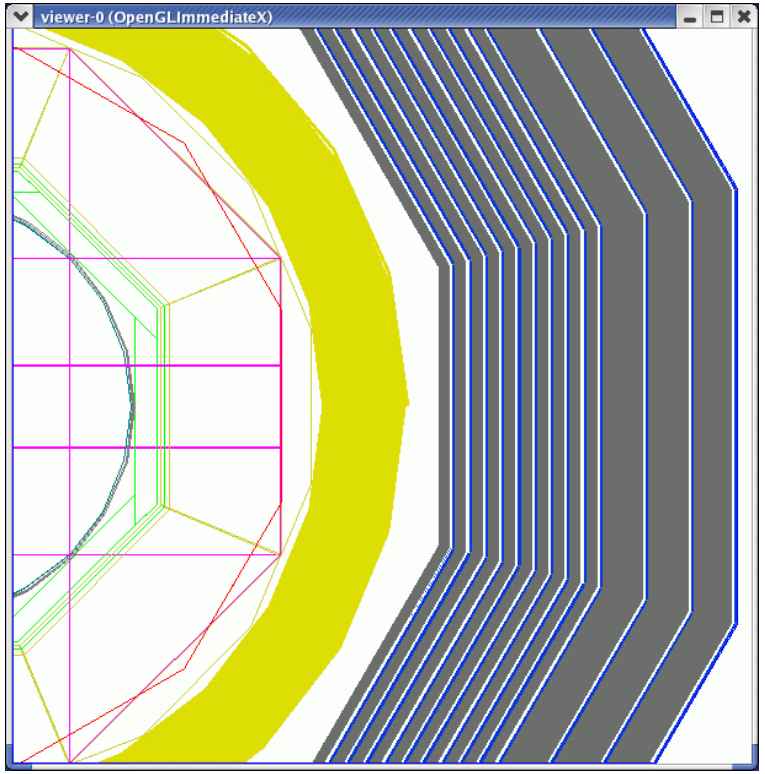


Muon System Geometry of ILD and Tail Catcher function

(Specific Instrumentation of Muon System)

Instrumentation of Muon System in ILD

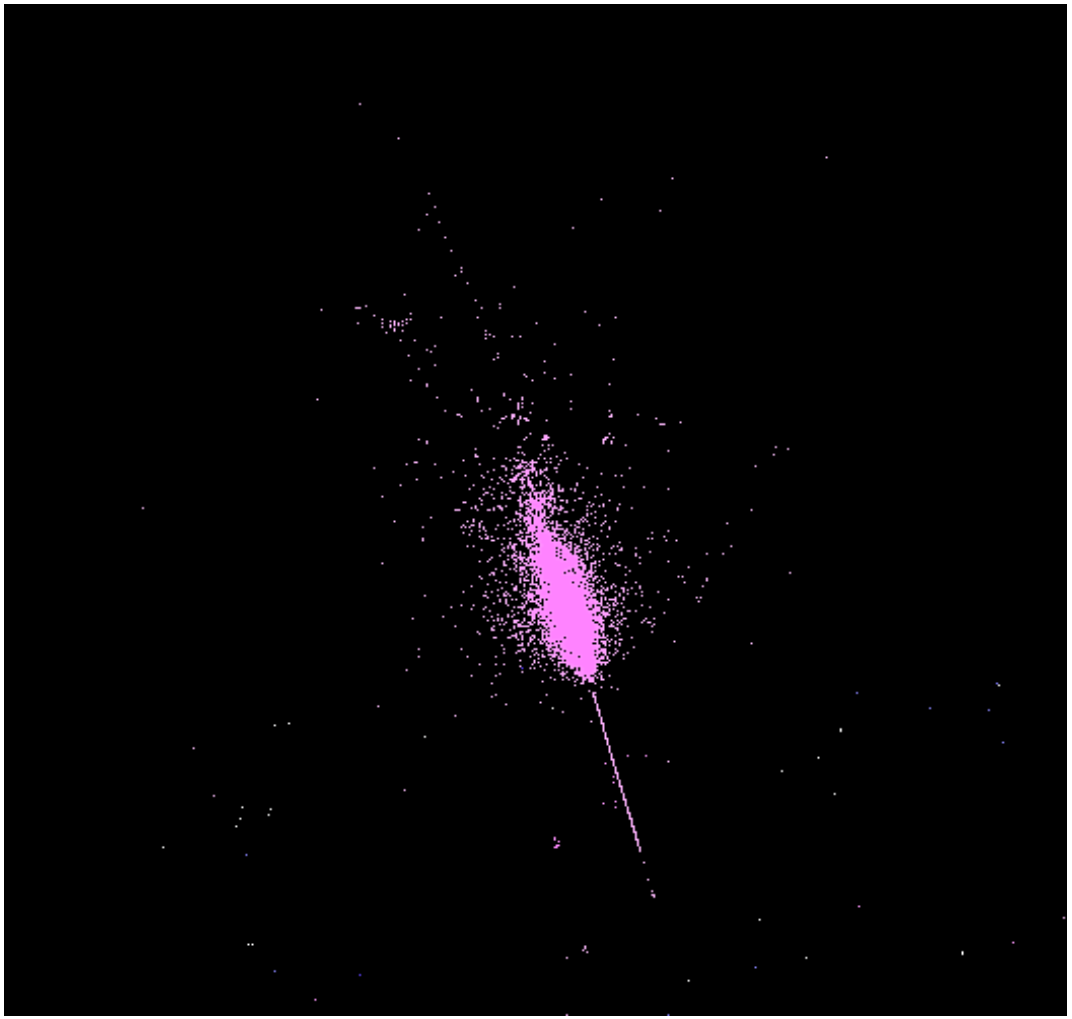




Muon System Geometry of ILD and Tail Catcher function

(Specific Instrumentation of Muon System)

Hadron Processes in ILD



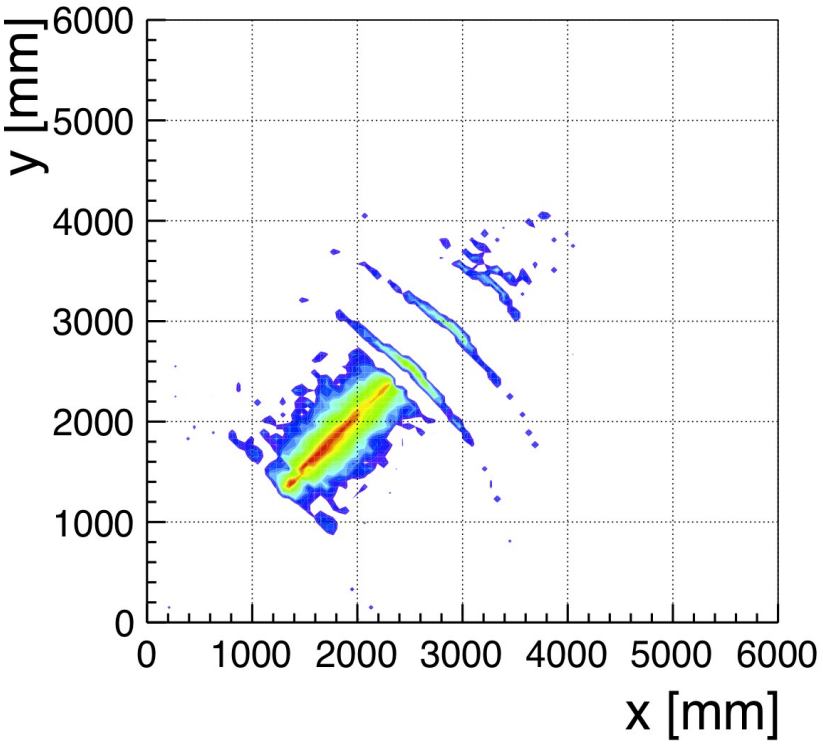
Mokka Simulation Framework

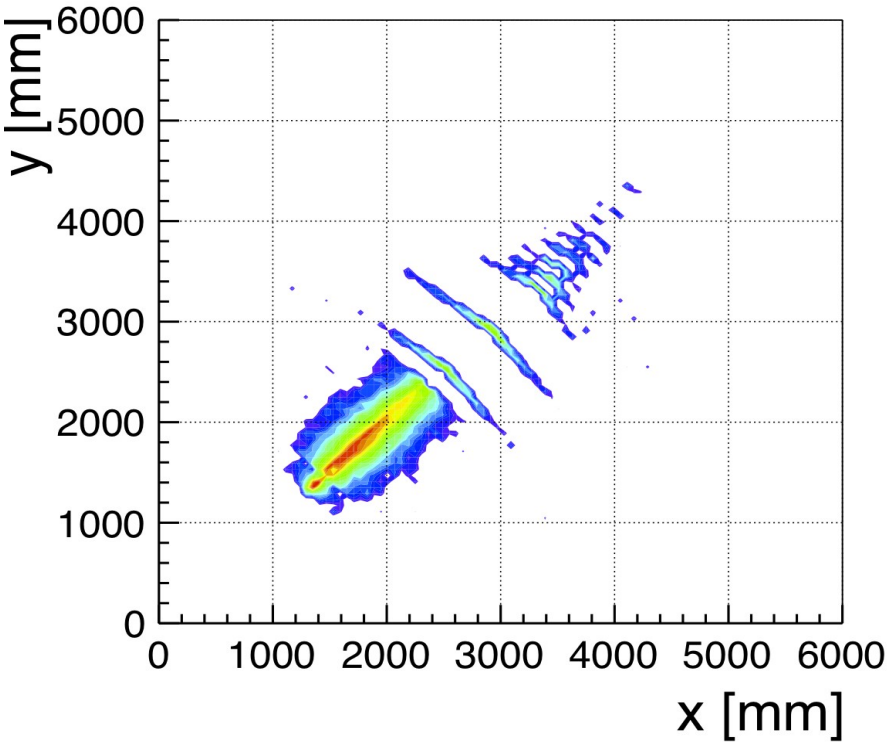
Simulated pi- shower with energy 100 GeV in the Barrel part of ILD, the main activity in the ECAL and HCAL

(Barrel Region)

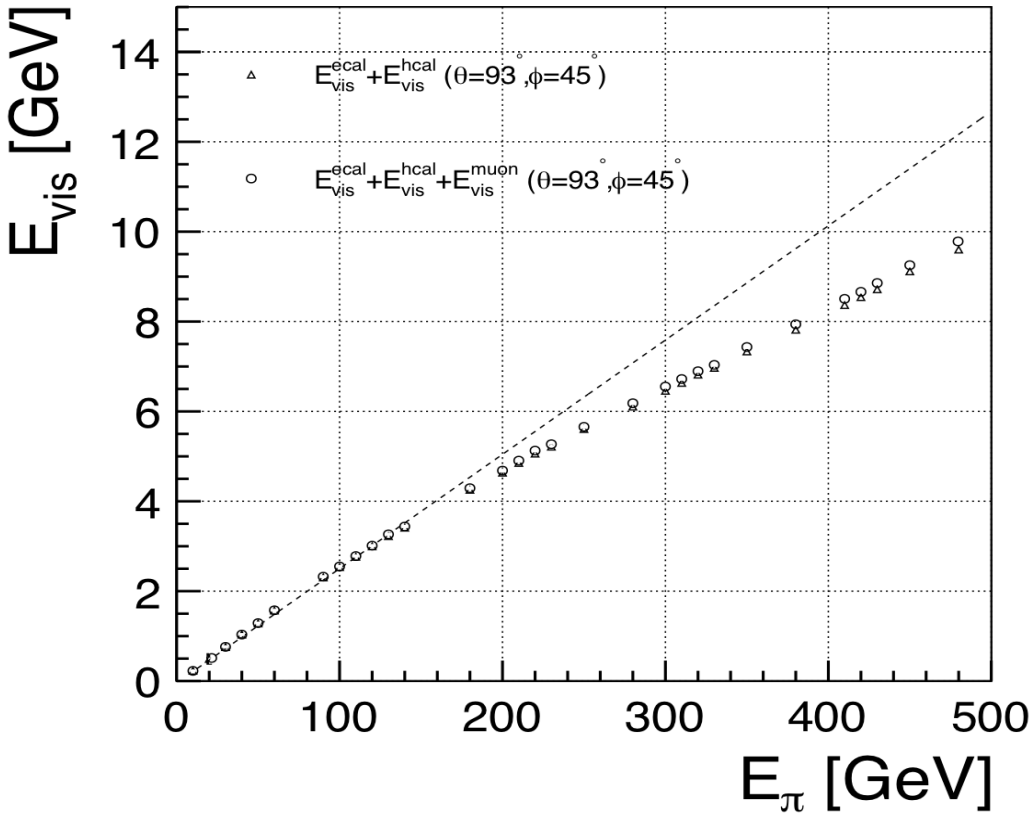
Analysis of the Muon System for Hadron Processes

Pions Shower in the ILD with energy 140 GeV and 350 Gev (Barrel Region)



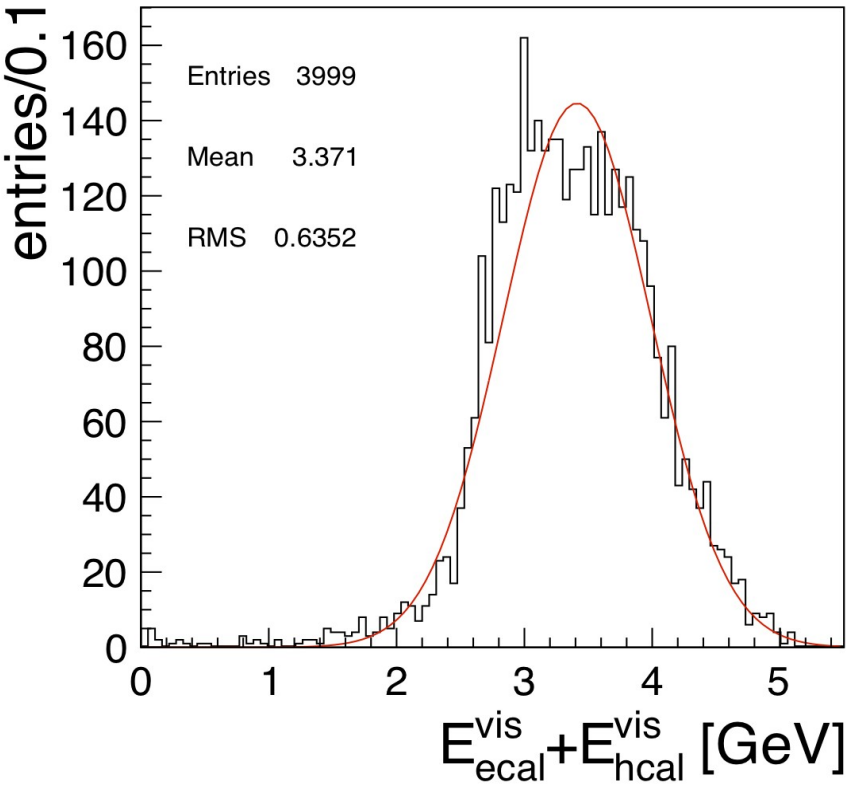


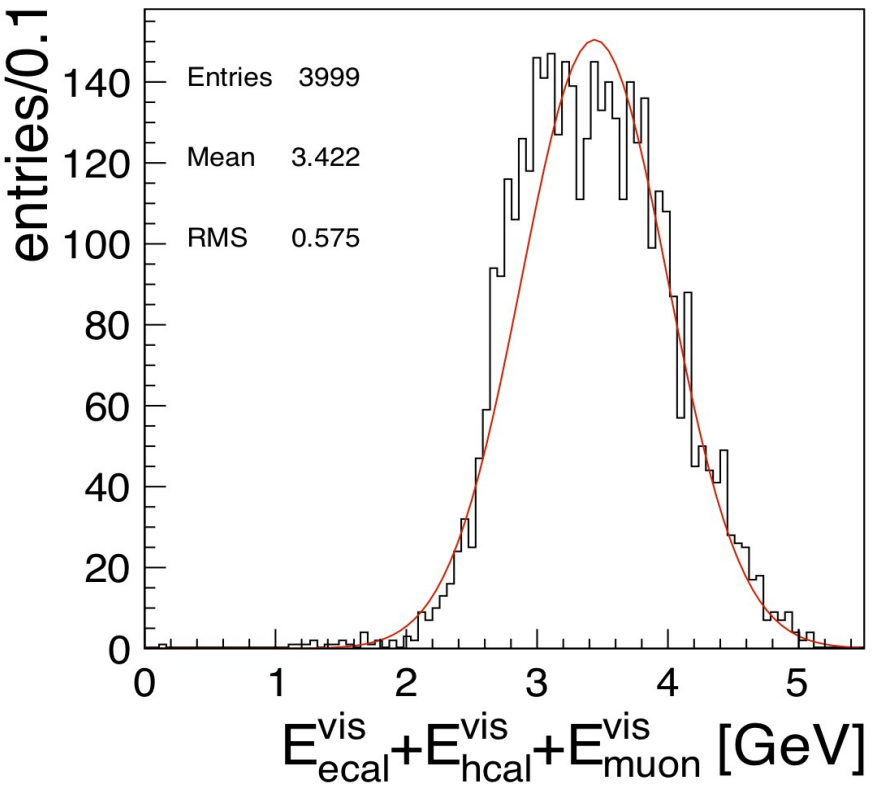
Estimation of pion Shower Energy



Pion showers in the Barrel Region of ILD

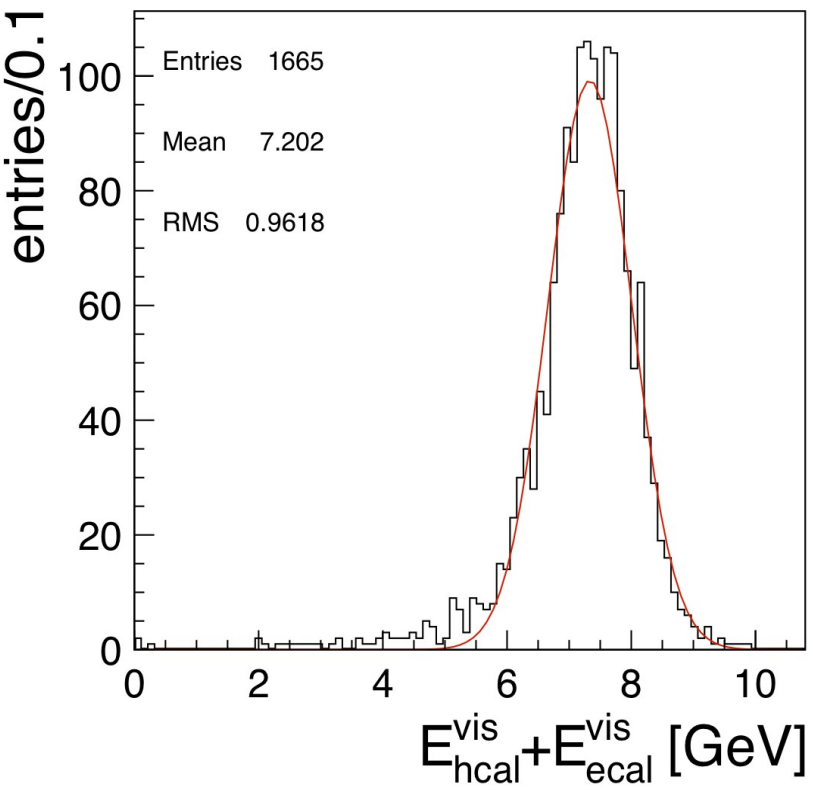
Estimation of pion Shower Energy

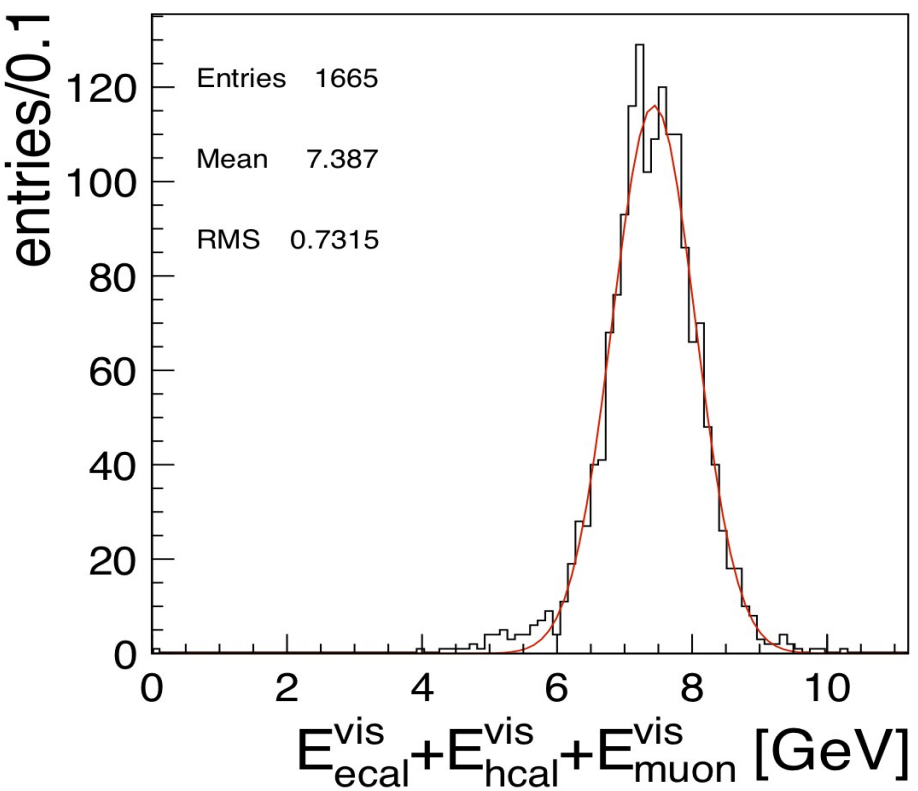




Visible Energy of the pion showers in ILD, energy 140 GeV
with Muon System Instrumentation as Tail Catcher (Barrel Region)

Estimation of pion Shower Energy





Visible Energy of the pion showers in ILD, energy 350 GeV
with Muon System Instrumentation as Tail Catcher (Barrel Region)

Summary

- The Instrumentation of the Endcap region of ILD as Tile Catcher seems reasonable, even is expected the high energy hadron activity in forward directions at high LC energy (CLIC ?)

- The Impact of Instrumentation of the Barrel Region of Muon System as Tail Catcher on the performance is limited by large material ammount of Coil.

- Nevertheless for the high energy jets it could be usefull to improve the performance, especialy resolution.

- Instrumentation of the Barrel Part of ILD as Tile Catcher needed more detailed study, may be reasonable includ the Insrumentation of Coil, first sensitive layer of Muon System should be before radiator.

Jet Resolution in ILD (LOI)