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Energy Flow the improvement in Energy resolution of the reconstructed jets in Atlfast

Carmen Iglesias[a]

a: Tical Group, Valencia, Spain
IFIC-CSIC, Departamento Fis. Atomica - Univ. Valencia

Abstract

The Energy Flow algorithm allow us to use in combined way the information about the deposited energy in the towers or cells of the calorimeter whit the measurement of the tracking in the central detector, as well as the identification of the particle in order to try to improve the energy resolution for jets. The very fundamental fact that around 2/3 of the jet energy come from charged particles (mainly pions and kaons) but however the jet reconstruction algorithm only work in energy information and they do not use the measured of the track from charged particles is the origin of the concept of the Energy flow algorithm.

For low momentum charged particles, the tracking error is much smaller than the calorimetric energy error. Then, the basic idea of the algorithm is substituting the random fluctuation of energy in the calorimeter by the well measured charged particle momentum, in order to obtain better resolution in jet energy. But firstly we must localizate the expected energy deposit in EM and HAD cluster by the charged hadrons to remove it and substitute it by the measurement of the momentum.

The use of track momentum improves resolution only if cluster is isolated. Then, if track shares cluster with neutrals then gain in resolution from track offset by loss of resolution from remaining cluster. So, the efficiency of the algorithm is limited by the overlapping between neutral and charged particles in the cell of the calorimeter. We need to know more about this effect and its influence in the analysis.

Jets have been reconstructed first using the fast simulation package of ATLAS, namely Atlfast, and later from the energy of the particles to form them. In order to study the overlapping of particles inside the cells, we have done a classification of the cells in three classes: charged, mixed and neutral cells, adopting different method to determine the energy collected in each cell, which relies of the kind of particle hitting the cell. Energy Flow Algorithm has been applied only over charged hadrons inside cells no shared with neutral particles.

The results have been calculated for two values of the radius of the cone, 0.4 and 0.7 and different range of E_T of the generated QCD jets, in order to compare the behaviour of the algorithm with the variation of these parameters. We can conclude that considering the region of E_T where the momentum resolution of the inner detector is better than the energy resolution of the hadronic calorimeter, that is below 140 GeV, the use of the Energy Flow Method give us an improvement in the energy resolution of the jet around 45-30% for R=0.4 and 35-30% for R=0.7.