AA and AT Differences and Proposed changes.

April 24, 2001

1 Isolation and Association

1.1 Problem Overview

The AtlfastTemp algorithm for the combined creation and isolation of particles leads to a result which depends on the order in which the particles are processed.

1.2 Problem Description

AtlfastTemp has the concept of cells (rectangles in $\eta - \phi$ space representing calorimeter cells), and clusters (the struck cells lying in a cone centered on a high E_t cell).

The isolation of a particle is currently calculated using both clusters and cells.

The AtlfastTemp algorithm is as follows (abbreviated description, from Elzbieta.)

- find kine-electron in the list of generated particles
- check kinematic thresholds (in fact I also apply smearing before so you might find some residuals from here)
- choose the closest cluster to the kine-axis
- if the closest cluster within given cone it is marked as associated
- check isolation criteria from all OTHER clusters
- check isolation criteria from all cells within given cone after subtracting energy of kine-particle (in fact it subtract already smeared energy so you mind find some residuals from here)

- if isolation passed remove marked cluster from cluster list

Clusters are used in the isolation calculation if they are not associated to a particle (motivation: you do not want an electron to be marked as non-isolated by its own cluster, or the cluster due to another electron or gamma).

Clusters are assigned to the particles as the particles are being formed. They are then removed from the list of clusters available for the isolation calculation.

The clusters participating in the calculation of the isolation of a given particle is thus dependent on the order in which the particles are processed.

1.3 Examples of Problem

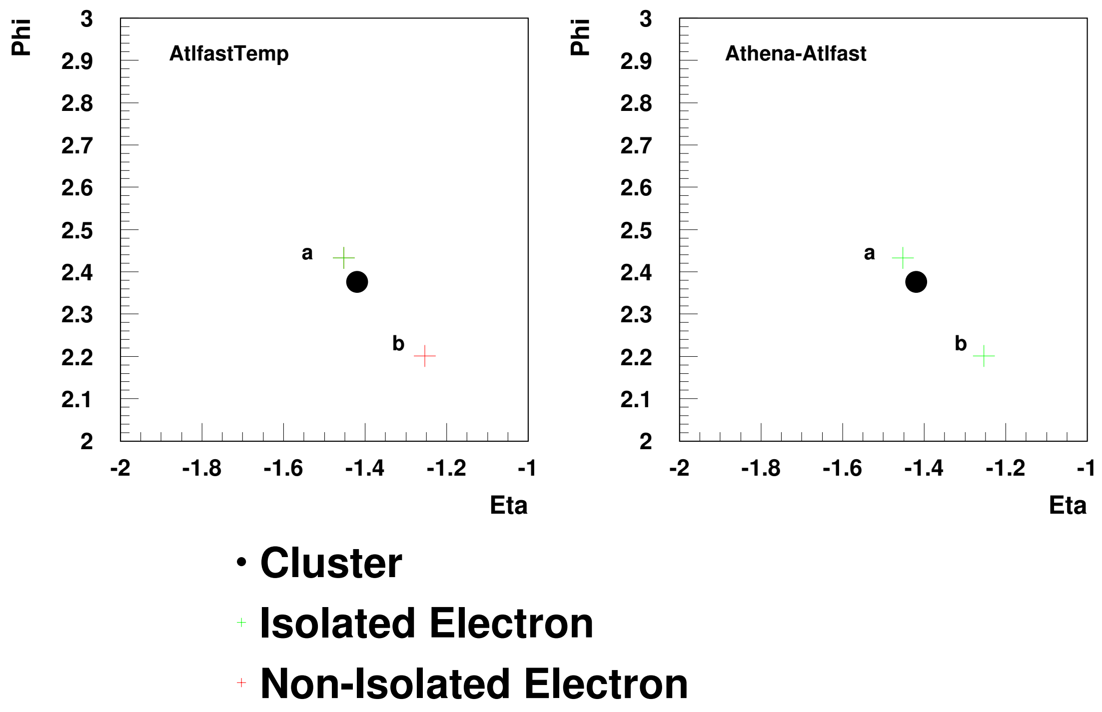

Figure 1: Example of the problem of ordering with Isolated electrons

Figure 1 shows an example of the problem caused by the order in which reconstructed particles are considered.

AtlfastTemp processes electron b first. There is a cluster in the vicinity, but too far to be associated, and the electron is considered to be non-isolated. Electron a is then considered. The cluster is close enough to electron a to be associated with it. Electron a is considered to be isolated.

Athena-Atlfast looks at electron a first. It sees that there is a cluster close enough to be associated with it. Electron a is thus considered to be isolated and to have an associated cluster. The cluster is removed. When electron b is considered, there are no further clusters nearby, and this electron is also considered to be isolated.

A similar effect can be seen in figure 2, only this time with isolated photons.

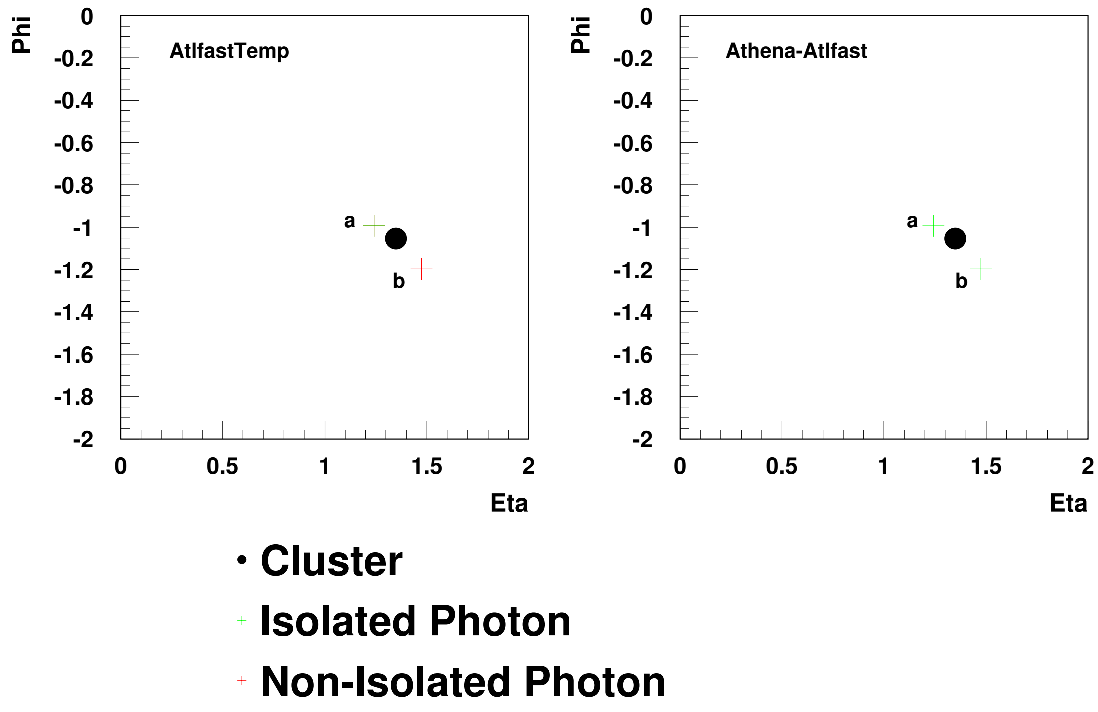

Figure 2: Example of the problem of ordering with Isolated photons

1.4 Proposed Solution

Remove isolation with respect to clusters. Match clusters and isolated particles by considering the complete sets.

Isolation of a particle would be calculated by requiring the p_t sum of cells lying within an isolation cone centered on the particle to exceed a threshold (this requirement already exists in AT and AA). Self-vetos are avoided by subtracting the particle p_t from the sum. Note that a nearby electron or gamma could cause the particle being considered to be non-isolated, but this reflects the inability of the detector to resolve overlapping particles.

Armed with the list of isolated electrons and gammas, and the list of clusters, one can make an order independent match. The match requirement would be coded in a manner to make it easily modifiable.

As a further step, the match requirement - which is currently the requirement that the match is between the cluster and particle that are closest - could be modified to ensure good energy matching. For example, the requirement could become the match that minimises $\chi(E, \Delta R)$.