Electron Signal Studies for the ATLAS Forward Calorimeter

Teresa M. Embry
Physics Department, University of Arizona

Outline

- Introduction
  - ★Shower characteristics for electrons/pions in our Calorimeter
  - ★ Event selection for electrons
- Results
  - ★Linear response requirement
  - ★Resolution
- Outlook and Conclusions

Linearity Requirement for Electrons

- It is a primary consideration for a calorimeter that the signal is directly proportional to the energy deposited by the electron (signal linearity)
- It is a requirement of physics in ATLAS that deviation from linearity be:

  ± 1% for Electrons

  ± 5% for Pions

Electron Resolution (1)

- The error of the energy measurement in a calorimeter is determined by its resolution
- Resolution for each energy is determined from a gaussian fit of the signal spectrum
- Gaussian fits were restricted to reduce pion background at 120 and 200 GeV

Electron Resolution (2)

The usual model to describe the energy dependence of the resolution is: $\sigma/E = (a^2/E + b^2/E^2 + c^2)^{1/2}$

- Sampling Term: a - all effects from the stochastic nature of the signal
- Noise Term: b - all effects on the measurement from the read-out electronics
- Constant Term: c - high energy limit on the resolution introduced by the specific detector design

Improved Signal Definition

- Resolution is dominated by noise contribution, especially at low energy (20 - 60 GeV)
- To reduce noise contribution collect signal in cylinders around particle direction
- Finding the ‘best’ cylinder radius - two factors:
  Resolution
  Response

Conclusions

- Deviation from linearity is well within guidelines established for physics in ATLAS, ± 1% for electrons
- Electron resolution is sufficient with first cuts
- Collecting signal in cylinders helps reduce the contribution from noise and improve the resolution giving a sampling term around 27 % and constant term around 4.4 %