

Simulating Straw Tubes

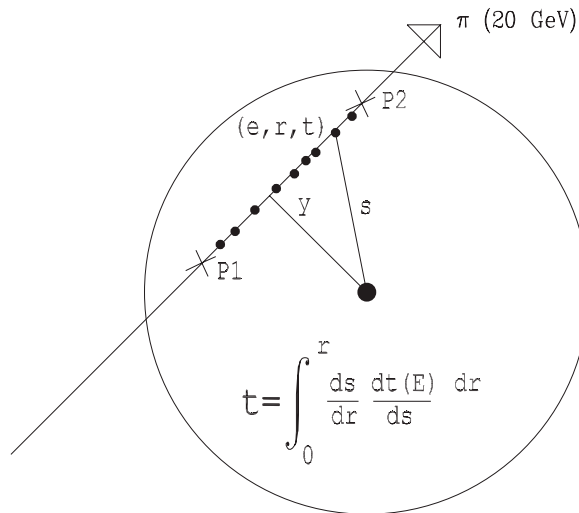
Fred Luehring

10/16/00

Talk Summary:

- 1. Modelling Algorithms**
- 2. Sample ATLAS Results**

Modelling Straw Tubes



Random distribution of cluster along the step, P1-P2

Cluster energy smearing, e

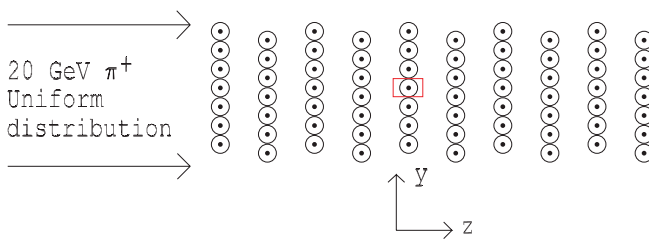
Drift distance calculation, r

Drift time calculation, t

The closest approach, y

r - t dependence

$$t = \int_0^r \frac{ds}{dr} \frac{dt(E)}{ds} dr$$

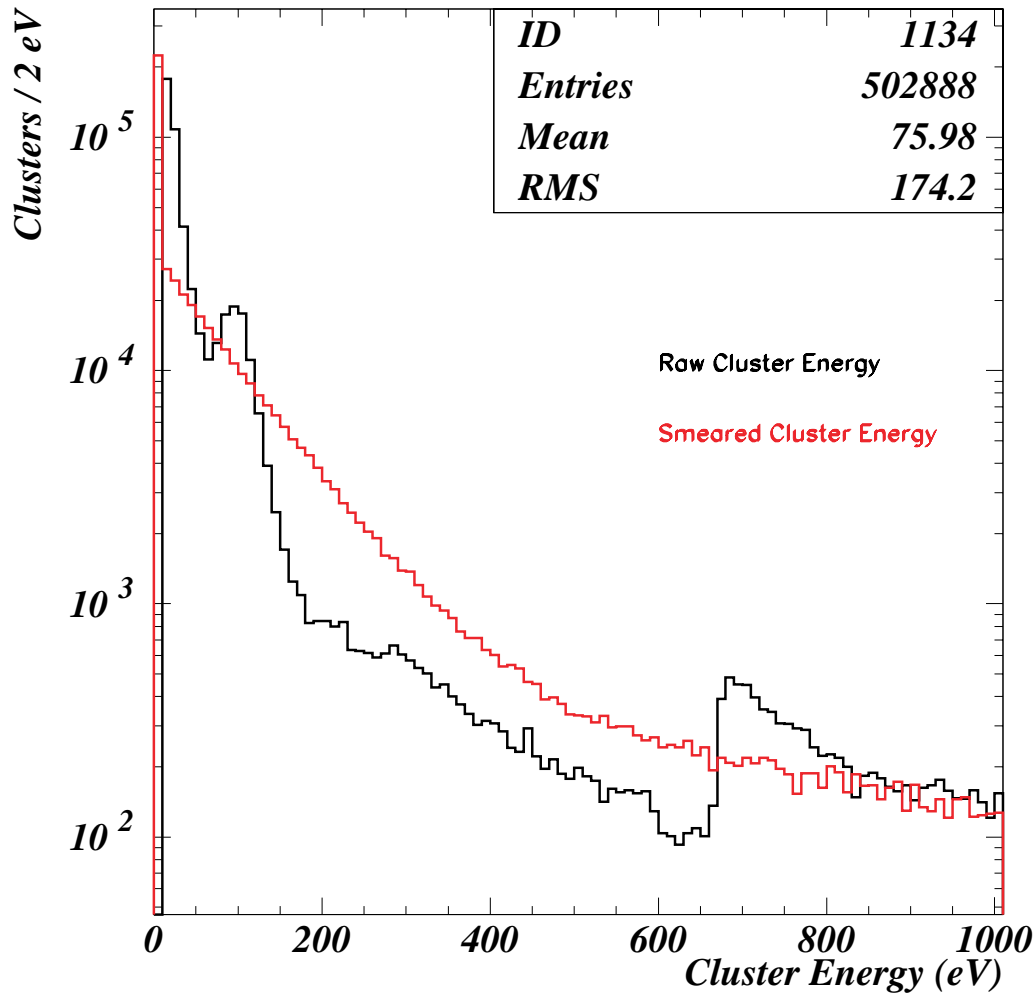


dE/dx:

The Photo Absorption Ionization (PAI) to calculate the number of clusters along the track step and total energy absorbed. The energy deposit depends energy of the track follows the Bethe-Bloch formula for the gas mixture.

NB: Geant3 is not necessarily completely correct in calculating the energy deposition.

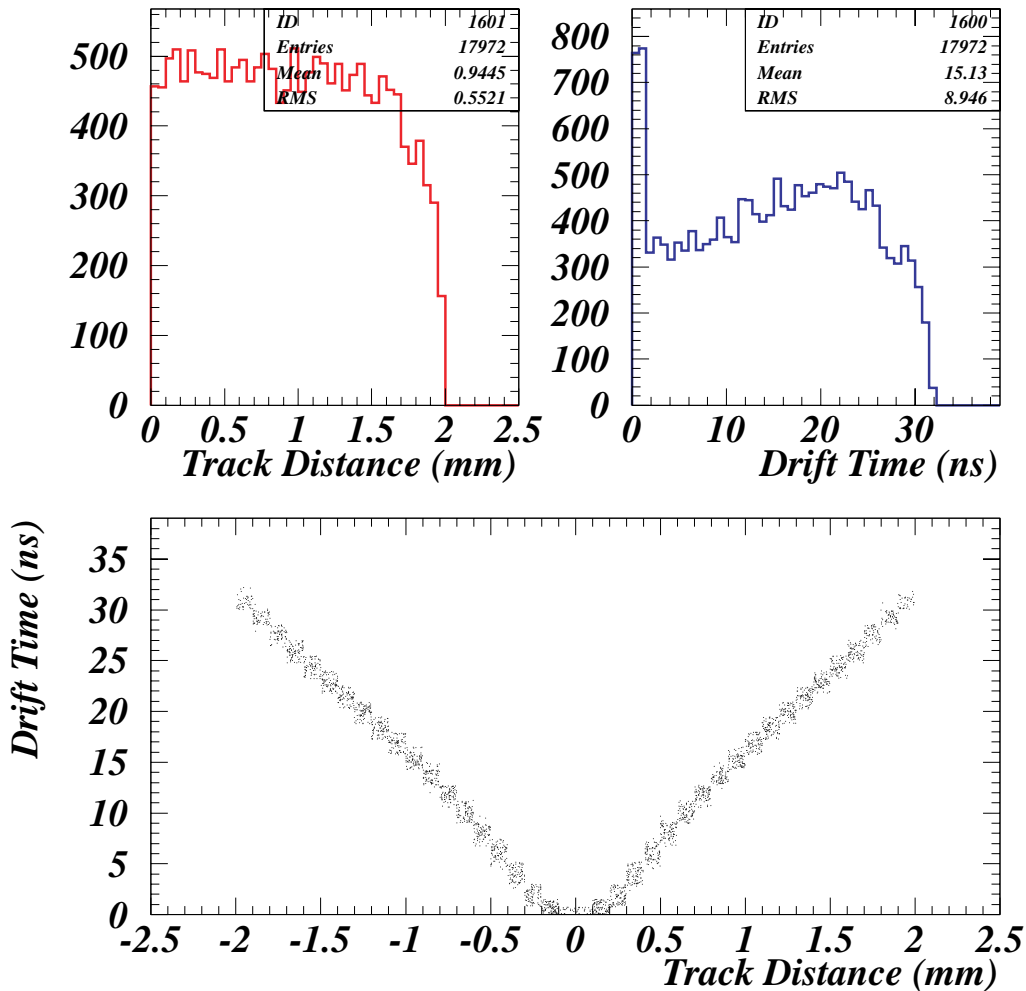
Energy Smearing



Energy Smearing

The energy is then smeared with an exponential function which reflects the band structure of the gas. For expediency you can use a Gaussian energy smearing and set energies that smear to negative values to zero.

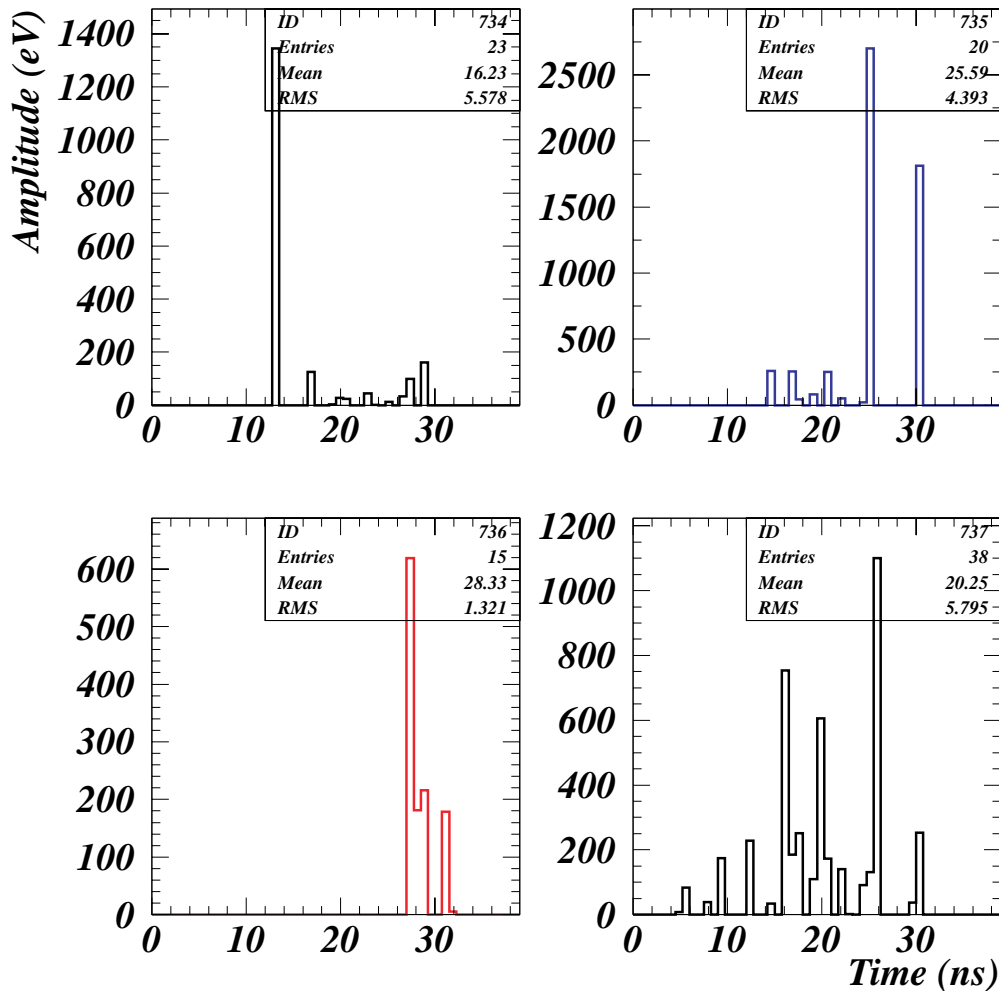
Drift-Time



Drift Time:

Each cluster is positioned at a random location along the step. The distance to the wire is fed into the measured drift time to drift distance relationship and the drift time for each cluster is calculated.

Cluster Arrival Time



For each hit straw on each event, the cluster arrival time distribution is calculated.

The cluster arrival time is offset for particle flight time and bunch crossing time. The clusters from all tracks hitting the straw are put on the time distribution (natural way of piling-up).

Electronics Effects

- The measured ASDBLR signal shaping is then applied to each bin of the cluster energy distribution (shot approximation?).
- The shape can and does depend on the amount of charge at the shaping circuit input.
- The the actual discriminator threshold is applied and hit times calculated. For ATLAS the discriminator parameters are:
Minimum width: 6 ns
Output exceeds time over threshold by: 1.5 ns
Dead-time: 6 ns
- To this distribution the read-out scheme is applied in ATLAS we discovered that since all tracks deposit charge near the straw wall, that an ~10 ns wide gate looking for charge at the end of the ~40 ns wide time in which the charge is collected is a good cut for selecting in-time hits.

I would like to thank Ketevi Assamagan for providing the plots I showed you.