

TRT test beam sector prototype simulation with GEANT4

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Detector Description

- TRT Test Beam Sector Prototype
 - 5 sectors (parametrised volumes along z)
 - of 16 planes each (parametrised volumes along z , with appropriate ϕ_0 offset)
 - each plane consists of a plane of radiator and a plane of 16 straws (parameterised in ϕ and z)
 - the radiator plane can be described as a block of some average density or as a set of 17 CH₂ foils (parameterised along z)
 - straws are made of Kapton, contain a mixture of 70% Xe, 10% CO₂ and 20% CF₄ and have a 50 μm Al wire

Particle Generation and Physics Processes

- G4 Particle Gun is used to generate single particles
- All "standard" physics processes provided by G4 (incl. TR for irregular radiators) are implemented; some problems are being investigated. Also
- The effect of using the PAI classes (if any) will be investigated
- Different TR models will be used when they become available

Hits and Digits

- Hits are recorded in the sensitive detector (gas)
- They're implemented as rather simple objects
TRTTrackerHit(strawID,edep,pos,istraw,iplane,isector,itrack) with a few extra methods for printing and drawing
- Digit implementation is rudimentary (just sum of energy deposited in single straw); will depend on CHAOS decision on whether to use G4 or stand-alone digitisation

Preliminary results and known problems (I)

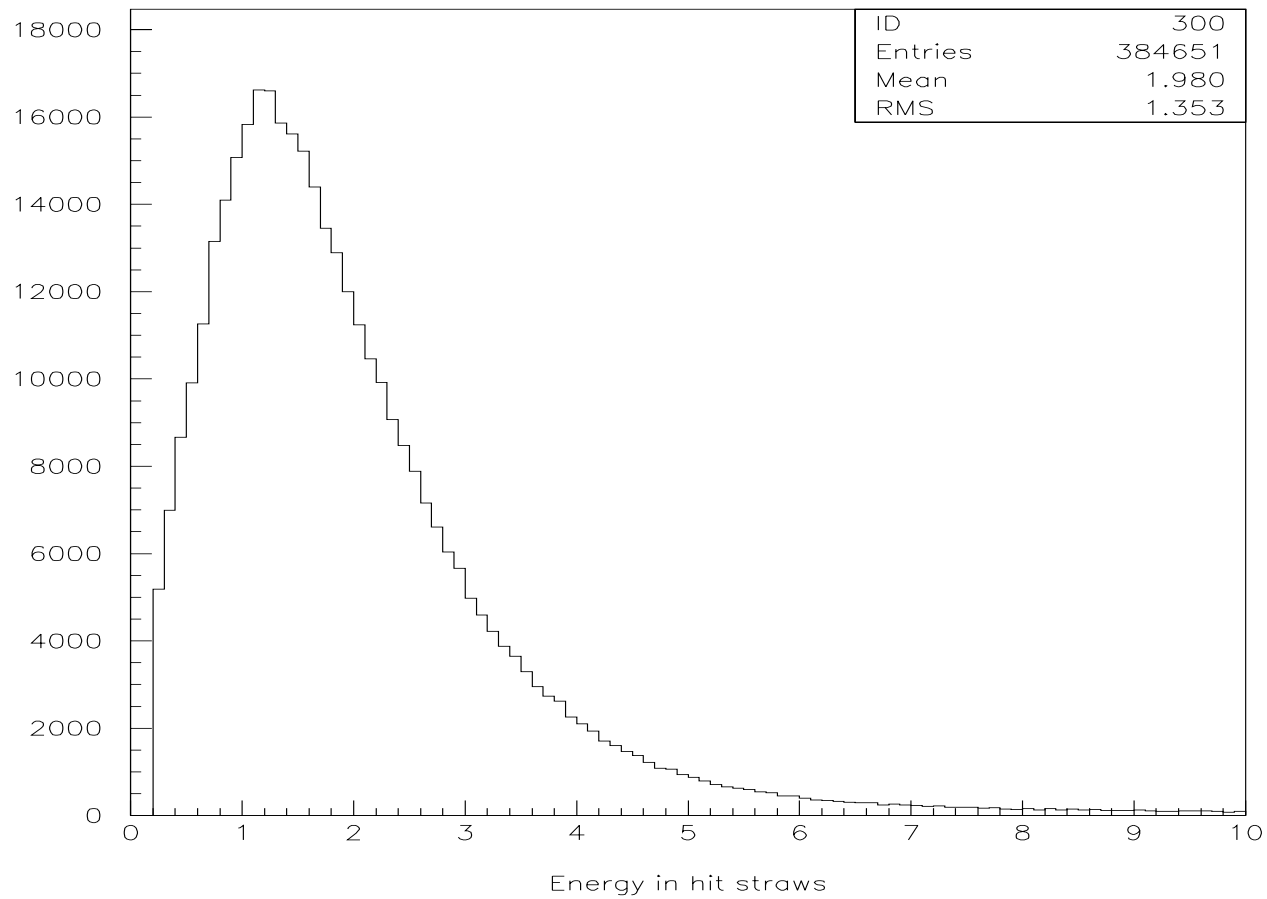
- Detector geometry "debugged" in terms of overlaps graphically, using DAWN (Drawer for Academic WritiNgs) and DAVID (DAwn's Visual Intersection Debugger)*
- Detector geometry also "tested" with tracking (10000 pions).
- Material "measured" by shooting geantinos:
~ 8–10% X0 at normal incidence.

*For foil setup, DAVID's tolerance has to be increased to ~270 microns (foil separation).

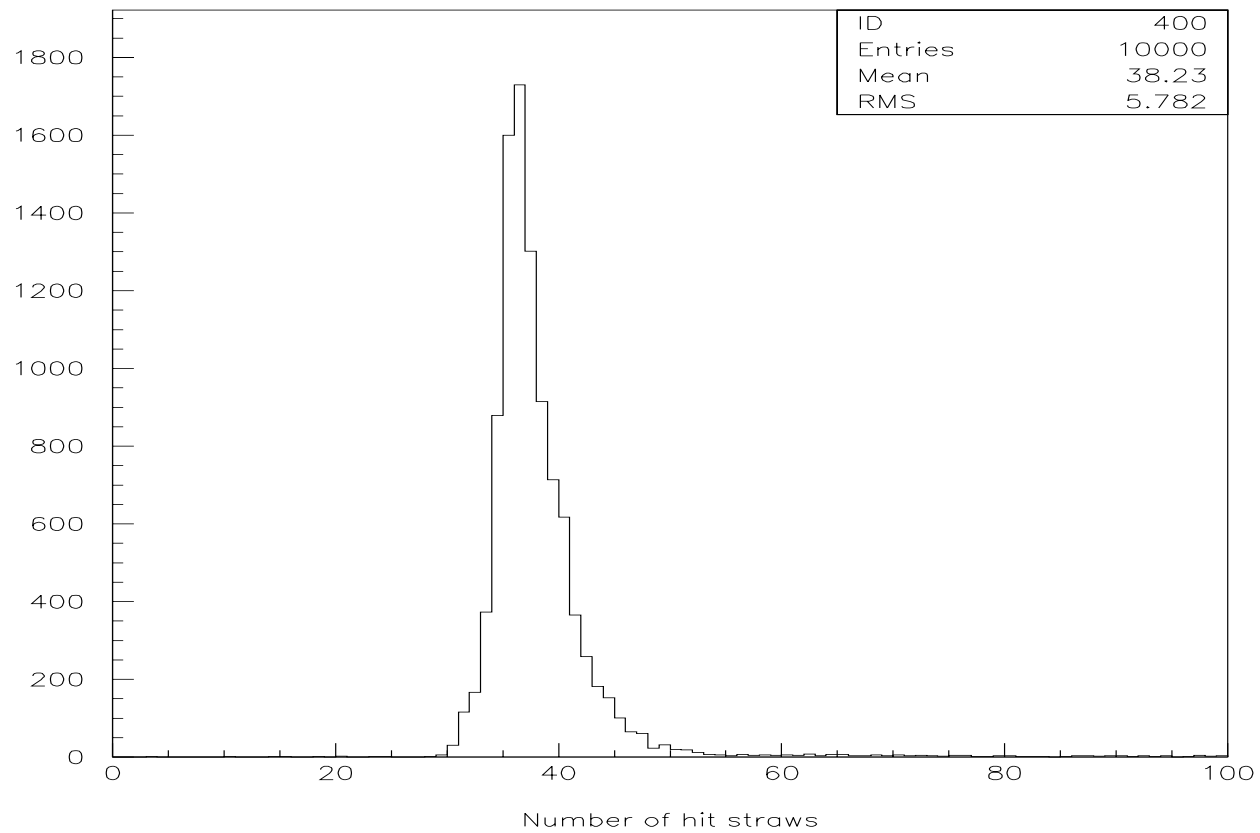
Preliminary results and known problems (II)

- For 20 GeV pions, the energy deposited in straws and the distributions of hits above 0.2 and 5 keV look qualitatively correct; a detailed quantitative comparison will probably have to be done by the TRT experts
- For electrons, the distribution of energy deposited in straws is wrong and is being investigated; the effect of transition radiation will have to be studied after this problem is solved

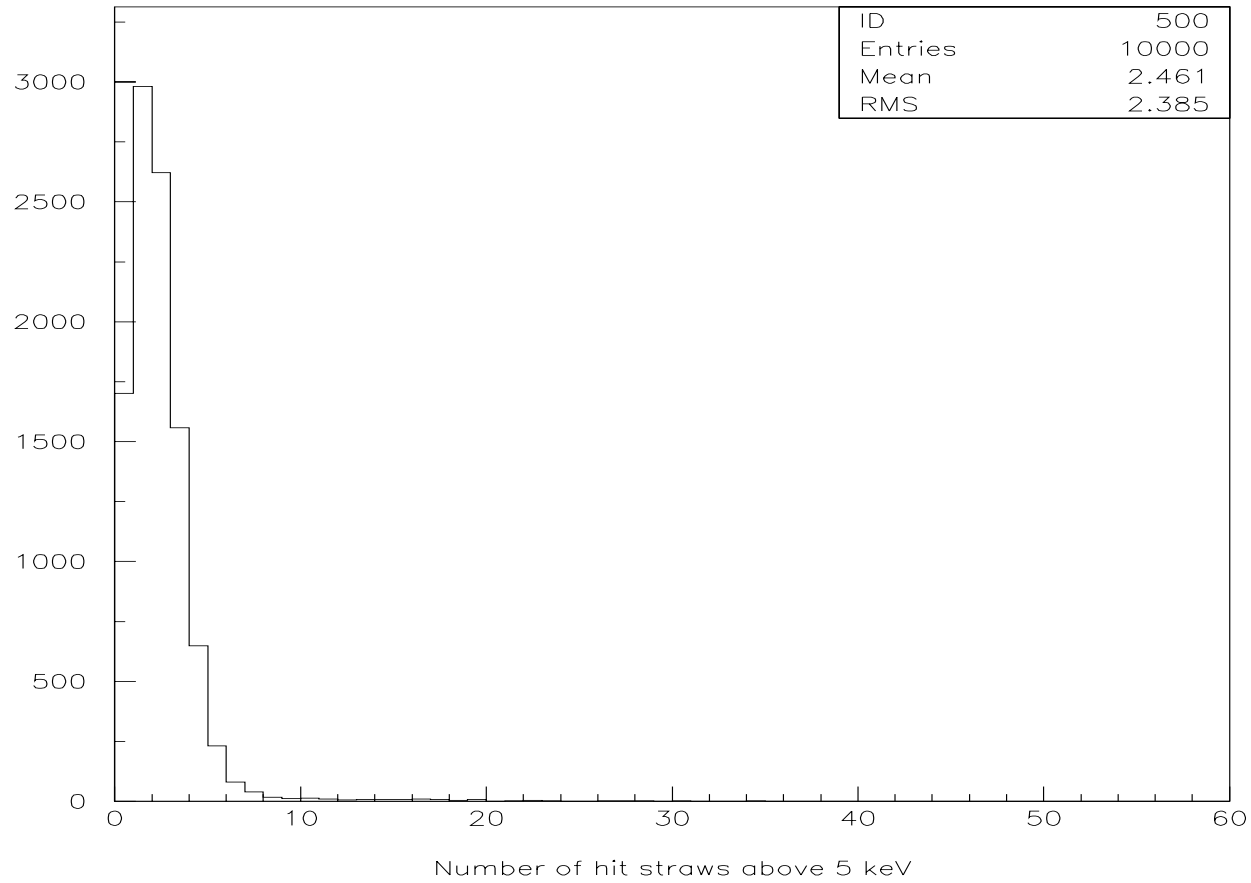
Energy in straws deposited by 20 GeV pions



Number of hit straws (20 GeV pions)



Number of hits above 5 keV (20 GeV pions)



Plans for next steps

- Use the PAI classes for a first comparison
- Study electrons without and with Transition Radiation
- Improve digitisation
- Implement irregularity in foil radiator description; investigate feasibility of geometrical description of irregular radiators (foam-like)
- Investigate fast simulation options (esp. for non TR-emitting particles in the radiator)
- Implement first prototype of persistency for geometry, hits and digits
- Implement transient and persistent HTL histograms
- Implement more complete test beam setup
- Other?