

Status of GEANT3 TRT Code Release

Status of GEANT4 Hit Definitions

Fred Luehring

May 4, 2001

TRT GEANT3 Code Status

Since February, I have made a few modifications to the TRT digitization routines and put them in the official ATLAS code repository. I am also nearly finished with minor modifications to the TRT geometry that will be put into the repository soon.

1. A reminder of the current TRT geometry that is already in the repository:

- Shorter active lengths in the end-cap wheels. In the last two weeks, I rechecked with Fido that the lengths in the simulator are correct.
- Service gap locations and widths match engineering design from March 2000.
- NB: Must set GEOM=2 to select modular barrel geometry which is still NOT the default.

2. The geometry revisions made but not yet put into the repository are:

- Small (~2 mm) reduction in barrel straw length to match what is being built.
- Barrel cooling tubes resized to match current design.
- Short straws modelled in geometry instead of during digitization.
- Twister / glass tube combination adjusted to proper length and average density.
- Density of end-cap radiator stacks adjusted to match current Tulle specification. This means Type A & C stacks are 0.081 g/cm^3 and type B are 0.061 g/cm^3 . These densities are not used in our TR calculation and are only used by GEANT to produce secondaries.

TRT GEANT3 STATUS (continued)

3. Recent digitization changes that is already in the repository:

- Lowered low energy cut for range over which dN/dx is calculated.
- Introduced use of the exponential cluster resolution algorithm.
- Removed hard-coded GEANT cuts applied to TRT radiators, straw, and gas and added a check of the GEANT δ -ray cut to avoid double counting energy deposition.
- Introduced Pavel's correction for energy deposited by δ -rays created in the gas mixture.

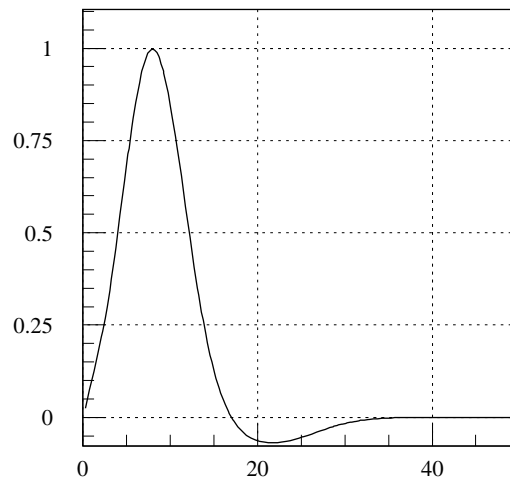
4. Since the February meeting the following digitization changes have been made:

- The HV parameter in the drift time calculation has been reduced from 1830 V to 1530 V solving a long standing problem. Thanks go to Elisabetta and Anatoli for spotting this.
- The check of the GEANT δ -ray cut had to be moved to ensure that it worked reliably.
- A problem causing ~4% of the hits in the TOF mode to be assigned to the wrong bunch crossing was corrected thanks to Mogens.
- An uninitialized variable that caused the official dice release to crash running standard muon test events was corrected.
- Two new digits (the full encoding and the trailing edge time) have been introduced to match the readout scheme.

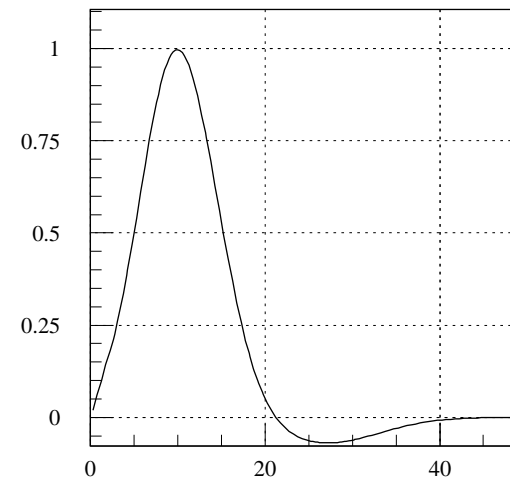
TRT GEANT3 STATUS (continued)

• Anatoli realized that the signal shaping function was too slow and too wide. After careful consideration a much more accurate representation of the ASDBLR signal shape was put into the simulation.

**New
Low
Threshold
Shape**



**New
High
Threshold
Shape**



• The TOF mode validation gate in the digitization routine that recognizes hits as coming from the in-time bunch crossing was adjusted to reflect the new signal shapes. The new shapes have faster rise-times and the validation gate had to be moved earlier.

TRT GEANT3 STATUS (continued)

There are some items that are incomplete, under discussion, or not yet decided:

1. Revised TRT service material amounts. In response to a request from the Radiation Task force I have been revising the TRT material estimates (see next talk). I now have detailed spread sheets for all parts of the TRT except the electronics and services at the outside of the end-cap wheels. Some of the revised material amounts still need to be put into the geometry.
2. The number ionization clusters for very low energy tracks may not be correct. Currently the number of clusters rises linearly in with decreasing $\log(\gamma-1)$ which is proportional to $\log(1/\beta^2)$. The particle data book suggests the proportion should be closer to $\log(1/\beta^{5/3})$. I discussed this with Pavel sometime ago but we never did anything more.
3. Minor changes to include electronic noise, threshold variation, crosstalk etc. that were requested by Daniel and Anatoli have not yet been put in.
4. Discussion with Rick Van Berg has again confirmed that the true signal shapes do change depending on the amount of charge that they receive. The current signal shapes do not use this dependency (which is available in the code). Mogens current work shows that the readout is fairly sensitive to the shaping.

TRT Hit Definitions

Comparison of Hits GEANT3 and GEANT4 Hits for Each Step in an Active Volume (Sizes Measured in Bits)

Geant3 Hit	Size	Geant4 Hit	Original	Reduced
TDR / Y - Distance of Closest App	7	Step Starting Position (X, Y, Z)	3x32 = 96	3x8 = 24
CZ - Cos(Θ)	6	Step Ending Position (X, Y, Z)	3x32 = 96	3x8 = 24
STP - Step Length	8	Track Energy Loss in Step	32	16
TOF - Flight Time	12	Flight Time to Middle of Step	32	16
LGAM / GG -log(γ -1)	8	Track Number or Pointer to Track	32	32
ELOSS /DE - Ion. or TR En. Dep.	8	Track E or γ (not in definition)	32	16
USR - Flag Word	4	Flag Bits (not in definition)	8	8
Z - Hit position along straw	9 or 10	Number of Clusters	32	8
ETOT - Track Energy (Redundent)	10	List of Cluster Energies	16/cluster	8/cluster
Track Number	16			
Total (ignoring shaded fields)	79	Total (ignoring shaded fields)	328	140

I assume that the additional storage needed for identify which straw was hit is in is approximately the same in GEANT3 and GEANT4 and do not show it.

Personnel and Tasks

We are short of experienced people. Here is a list of what tasks various people are working on or at least giving advice on.

GEANT3 Full Detector Simulation: Myself.

GEANT3 Digitization: Myself, Elisabetta, Serge Mo., Pavel (advisor).

GEANT4 Full Detector Geometry: Andrei and Yuri Zalite.

GEANT4 Digitization and PAI: Ketevi (will leave July 1). The Zalite's and also Else Lytken are expecting to take on this job.

GEANT4 TR: Vaso (will graduate).

Read-out Simulation: Mogens, Philippe (advisor)