

# TRT SW Status and Plans

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Inner Tracker Software Meeting

# TRT Offline Status

- The last few months have been busy for the CTB code but pretty quiet for the offline TRT code.
- The main news items are:
  - Thomas Kittelmann has become the contact for TRT\_GeoModel, TRT\_PAI\_Process, and TRT\_TR\_Process.
    - Thomas will do the day to day maintenance on the PAI and TR packages but any substantial changes to the TR code will require help from Mogens.
  - Mogens will most likely be assuming a major role in coordinating the TRT software during the Atlas commissioning period.

# TRT Geometry

- In the simulation, the TRT barrel was rotated by  $180^\circ$  about the Y axis.
  - Thomas has put code to correct this into the TRT detector description.
  - By default the correction is not activated and we must turn it on before we start the production for Rome.
- Thomas also modified the TRT detector description so that the parameters could be read from Oracle instead of Nova.

# TRT Material

- We are going to have to redo all of the material estimates for the TRT services in both the barrel and the end-cap.
  - Portions of my spreadsheet are out of date.
  - It will take substantial effort from the engineers and electronics groups to get together the necessary information.
    - I estimate several weeks of effort are required.

# TRT Digitization (I)

- The main changes by Andrei and Yura Zalite:
  - The possibility to scale the r-t relationship linearly has been implemented to allow compensation for field on/off and for new/old gas mixture.
    - the default is a scale of 1 - i.e. no scaling and corresponds to  $B = 0$  T.
    - Linear scaling is not really appropriate as Peter C's studies show that the function has a somewhat different shape with the field on and off.
  - The r-t relationships for the new and old mixtures supplied by Peter C. were put in.
    - Need to check that these relationships go into the release used for the Rome production.
  - The HV used in the model still needs to be corrected from 1830 V to 1530 V.

# TRT Digitization (II)

- The main changes by Andrei and Yura continued:
  - The possibility to do multiple bunch (TOF) pile-up,
    - Previously only one bunch crossing was possible.
    - A small shift to avoid negative drift times was introduced.
  - The TR photons can be tagged with the particle ID -22 to distinguish them from other soft photons.
    - The -22 code is only visible privately within the TRT code and not visible to users of the public code interface.
- Thomas also made contributions:
  - Thomas' translation of Pavel's PAI code is now available in the TRT digitization by setting a switch.
    - The default remains the GEANT4 PAI model.
    - Using the this code would break the dependence on GEANT4.
  - Thomas also made an attempt to introduce the affect of diffusion in smearing the r-t relationship but it's not in use.

# TRT Conditions Database

- Rasmus Mackeprang and Peter Hansen worked out a way to store TRT drift time information and alignment data in the conditions database.
  - Rasmus wrote the package TRT\_DriftCircleOnTrackTool to facilitate this work.
  - Further work remains to finish this.

# SW Work During Commissioning

- There are many jobs requiring new software during the installation and early running with cosmic rays:
  - r-t calibration constants need to be calculated and stored.
  - Alignment constants need to be calculated and stored.
  - DCS needs to control and monitor the HV system, gas system, temperatures, etc.
  - The DAQ code to readout the TRT and form the ByteStream data needs to be written.
  - Monitoring code needs to be written and interface to Athena.
    - Need to debug the reconstruction of tracking finding and fitting.
  - The Atlas Event Display will probably need code to display the TRT correctly.

# A Few Results From TRT TB

- The follow slides were shown yesterday at the TRT testbeam meeting.

## Noisy/dead channels investigation

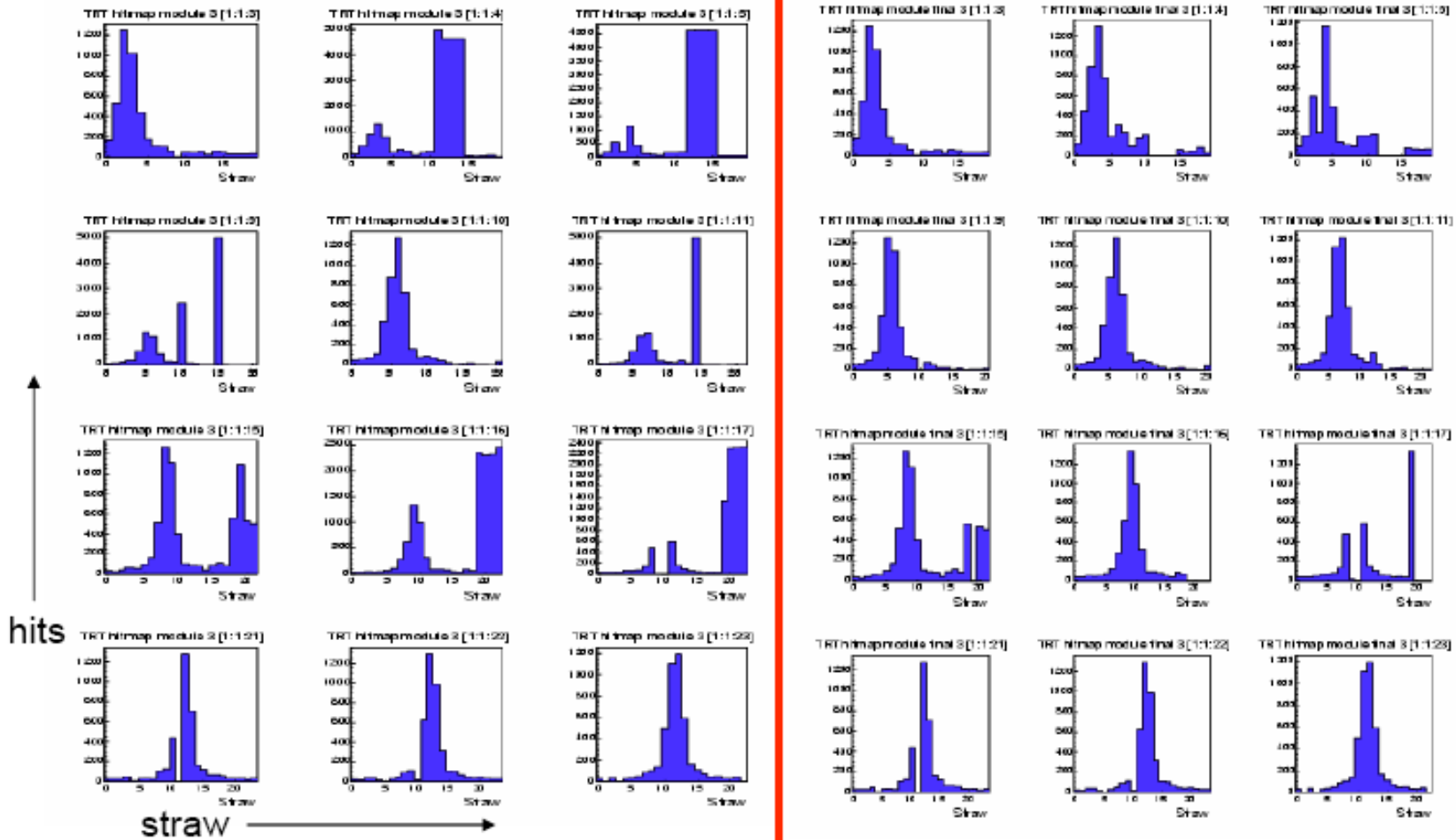
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- Noisy straws are characterized as;
  - Having a low threshold hit while track is not passing through it
  - Distance from track  $> 4$  mm (i.e should not be neighbour to hit straw (??))
  - Noise occupancy  $> 4$  X mean noise occupancy of all noisy straws in a straw layer
  - The output of analysis is a text file containing identifiers and straw status
  - A straw is bad if it is noisy/dead(2/3)
  - Analysed all good runs
  - registration in the CondDB is in progress

Noisy channels as vertical columns are removed (still not 100% efficient)

With noisy channels

Masking noisy channels



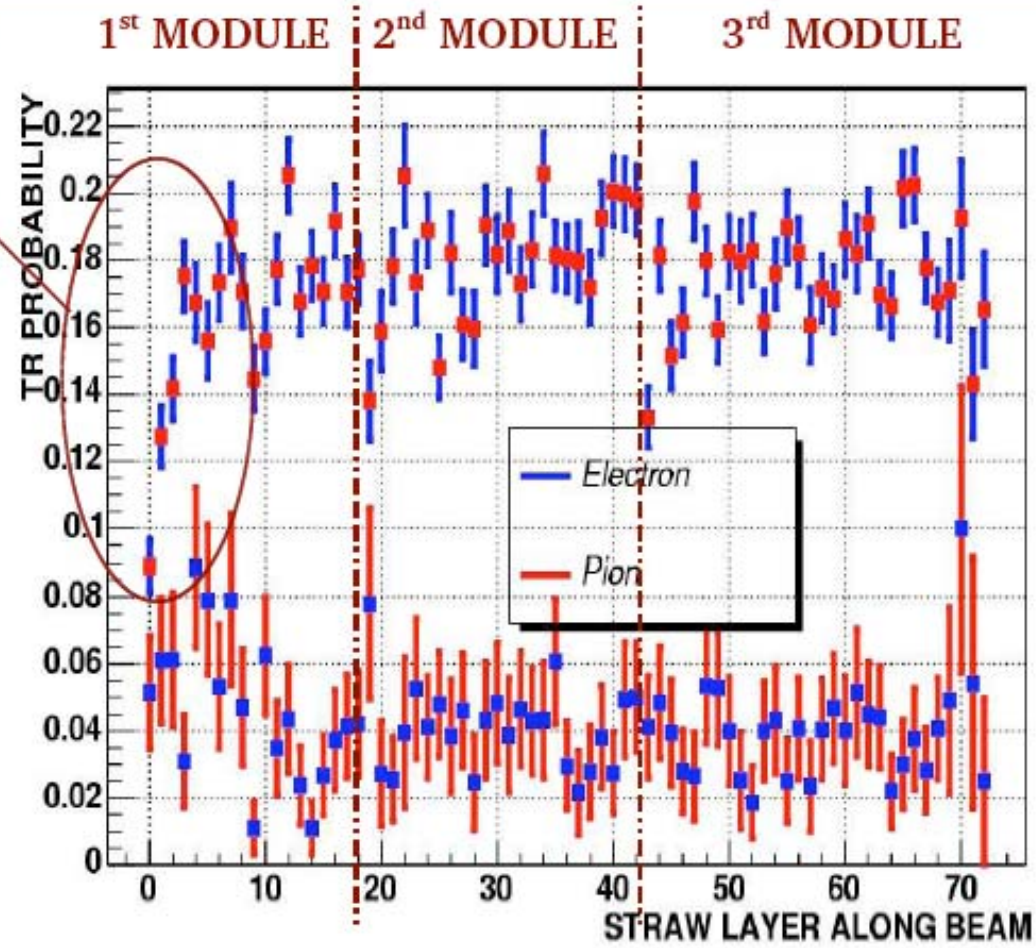
# TR hit probability along beam axis

- Mixed beam at 2 GeV

TR accumulation effect over first radiator layers

TR probability drops at module boundaries

Similar behaviour observed for different beam energies

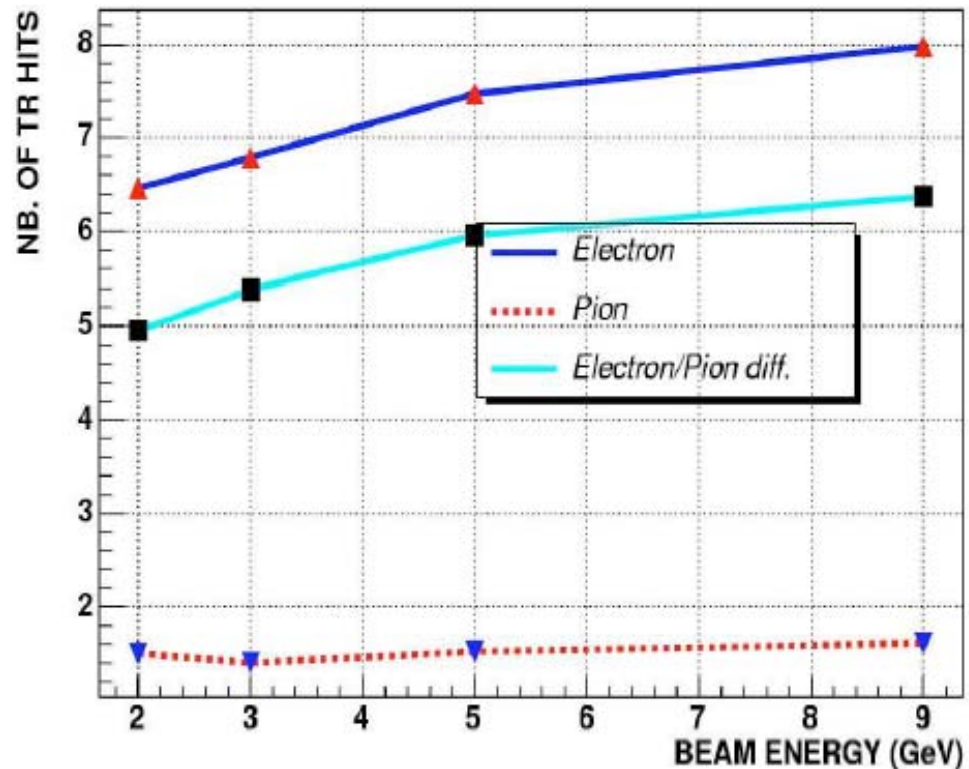


## Number of TR hits as function of beam energy

- Number of hits is stable for pions and increases by  $\sim 1.5$  for electrons

- Naively, we expect the electron TR curve to reach the saturation level quickly, i.e. below  $\sim 3$  GeV

- One more thing to be investigated further



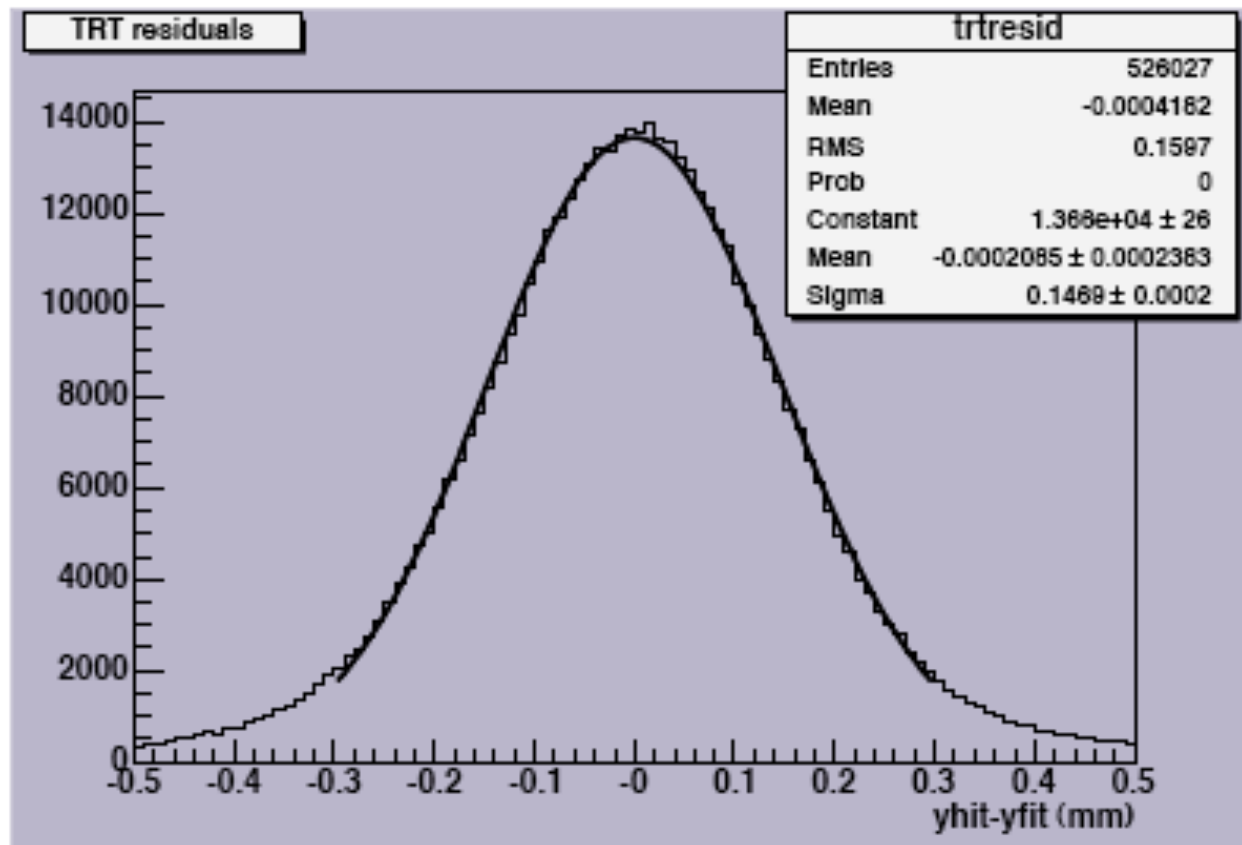
## General method used at test beam

- So-called **V-plots** have the **drift-time** plotted against an estimator of the **true particle position**. The estimator is a fitted track intercept.
- At each position bin, **5-7 time-bins are averaged** and fitted to a **"V"**. This yields the **wire  $r\phi$**  and the  **$T_0$** .
- The  **$r\phi$ 's are averaged on each side** and their difference is fitted to a third degree **R(t)** polynomial.
- In testbeam, the TRT straws are **aligned internally** and calibrated using **TRT-only tracks**.
- The **orientation of a TRT phi-sector** is fixed by **tracks extrapolated from the silicon tracker**.

From Peter Hanson's talk on TRT calibration and alignment.

# What calibration can do for you

The resolution went from 0.5mm to 0.147mm after calibration in this particular run with 180 GeV pions:



From Peter Hanson's talk on TRT calibration and alignment.

# TRT SW Plans

- Continue to work on the testbeam data.
- Plan a new organization for the TRT software effort.
  - New students and postdocs will join the the institutes that have built the TRT as the onset of Atlas data taking approaches. We are working on a plan to use these new people efficiently.
  - Need to allocate personnel for SW needed for detector commissioning.
  - Need to provided effort for the SCT & TRT cosmic ray run this autumn.
  - The TRT steering group will discuss this tomorrow.