Alignment on Cosmics

- Study is almost complete
- Might want to add some more deformation but not sure
- Need to finalize a study on statistical uncertainties
- Development of the code:
  - Write the TRT alignment constant in the new database framework
  - Use the TRT only tracks and compare the results
  - Some minor things on track refitting tuning
- Except for the DB issue all other development does not need cosmics data
- Write up the results in the note

In the following I will show some selected slides of my talk at the Alignment Session last week
Module deformations

- We know that the simple module translation+rotation are not the only effect we have to take into account for a proper TRT alignment.

- Several other effects have been put forward as possible cause of a spoiled alignment (twist, wire displacement, various deformation, ...)

- The question is if cosmic data can tell us something about such effects and/or give us an idea (or upper limit) on their magnitude.

- The easiest one to study is the twist, when two endplates of a module have a relative rotation.

- Last year we started looking into this splitting modules in z>0 and z<0
  - We used one single iteration to have an idea of the effect
  - This study is possible only on the top side in cosmics
  - In case of no-twist with an extra-iteration the two sides should provide the same alignment constants...
  - ... of course inside the statistical errors.
Number of hits vs. $z$

- To minimize statistical fluctuations we used (almost) all the data available
  - Hit distribution along the wires not constant (scintillator acceptance)
  - Statistical fluctuation inevitable at the edge of the modules
Control Check: Twist on MC

- Without module twist droty should be flat as a function of $z$.
  - How we define “flat”?? (stat. fluct. Issue)
  - We looked at the MC to have an idea on what expect in the no-twist scenario
Roty vs. z on Real Data

- The “split” plots in reality hid some more complicated structure
  - Some we understand (6_1 and 7_2) but some are unexpected
Roty vs. z on Real Data

To try to rule out a statistical fluke we divided the dataset in 3 independent subsets

- If they all show the same behavior it is more likely that those effects are for real.

Module 6

Module 7

Layer 1

Layer 2

Run: 3000–3028
Run: 3030–3097
Run: 3098–3100
TRT alignment for SR1 cosmics and beyond

Andrea Bocci and Wouter Hulsbergen

January 24, 2007

We present the TRT alignment algorithms used for the analysis of cosmics data taken with the ID barrel in SR1.

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Note in preparation

Mostly done by Wouter, I contributed mainly on the result sessions
Alignment on CSC

- Started after moved to CERN

- After the first straggle to adapt the code for the full ATLAS configuration (that was expected), a lot of problems encountered...

- This Data Challenge is a challenge indeed!!

- Main problem IMHO is that the misalignment introduced is unrealistically big (TRT 10 mm away from the silicon...) and the offline code was not written to handle that (tracks lost, road on pattern recognition inflated x10, bias on left-right assignment, etc...)

- Started to tackle the problems one by one but a sizeable change in the code and in the alignment strategy will be required

- Good news is I got a lot of feedback from the community in term of idea but eventually I have to implement them!

In the following I will show some selected slides of my talk at the Alignment Session last week and the update at the TRT SW meeting
First Experience with CSC Data

- Started last week to run the TRTAlignAlgs on CSC data
- Huge leap from a cosmic configuration (with 4 TRT modules only) to the full ATLAS setup
  - Thanks to the excellent code infrastructure (and with the help from Christian) the transition was (almost) effortless
- The use of the ESD files made available by Tobias spared me also the time to learn/do the reconstruction
- Still needed some little tuning
  - The MeasuredPerigee links are missing (used to retrieve the track parameters to apply quality cuts). I commented out those lines for the time being
  - I wasn’t able to run iterations writing/reading a POOL files. Switched to the old way (text file) to test the machinery

- Anyway those are details, the real problems are elsewhere...
  - Caveat: just got these plots on Friday, didn’t have much time to show them around and have feedback/opinion from the experts
First Experience with CSC Data

Chi2 Distribution

Why is it cut at 2?

Number of TRT hits

Hit-Wire distance

Cosmic Data

(11% of zeros)

Cosmic MC

70% of zeros??
Digi problem?
Reco problem?

...
Module 10 (as an example)

If this is not an error we are not prepared to deal with such misalignment.
The Problem

Hit-Wire distance

Cosmic Data
(11% of zeros)

70% of zeros??
Digi problem?
Reco problem?
...

Cosmic MC
The Puzzle

Not misaligned Detector (CSC)

About 13% as expected from noise

Several emails/discussions/cross-checks among the NBI group, Christian and myself in the last few days to figure out what is going on...
Possible Explanation

Drift Time RAW (from PrepRawData)

X-axis: Hit distance as stored from tsos (after pattern recognition and left-right solved)
Y-axis: RAW DriftCircle from drifttime

Explanation (Christian):
Pattern Recognition ignores hit position/error when they are too far from the track and takes instead the wire position \((r=0)\) with an error \(p/\sqrt{12}\).

They are supposed to be the same!
Conclusions/Plans for CSC

- First look at the CSC data quite a shock
- More serious debugging needed to pin down the reasons for those poor residuals
- What I plan to try is:
  - Run the Global SCT-TRT Alignment and check again
  - Look at the hardcoded tuning of the fitter and loose requirements
  - Try the TRT only tracks (not sensitive to global transformation of the barrel)
  - Exploit the feature of the TRTAlignAlgs to run the SCT and TRT alignment simultaneously (local chi2 method)
- Other problems (digitalization, timing simulation, etc…) beyond my reach (need help!)

Besides all that it is clear that a large misalignment of the silicon make difficult/impossible the TRT alignment (also because of its high weight)
  - Need to tackle the issue on how to align the TRT when the SCT/Pixel misalignment is unknown