

Inner Detector Offline Commissioning Session

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ID software
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ID commissioning phases

- **SR1 tests with random and cosmic triggers:**
 - SCT-TRT barrel
 - SCT-TRT endcap C
 - Pixel endcap A
- **Pit commissioning before M3**
 - Some TRT-Tile cosmic runs
 - Noise runs for SCT barrel
- **M3 combined run in the pit (June 4th-18th):**
 - First time the ID joins a Milestone period
 - SCT (4 CTB modules) and TRT (6/32 barrel sectors) integration successful
 - First cosmic data with TRT, Tile, LAr, MDT, TGC, SCT (noise) using a Trigger: Tile OR TGC
 - First time the combined reconstruction with calorimeters and muon chambers was exercised! (online @P1 and offline@Tier-0)
- **M4 combined run in the pit (Aug 23rd- Sep 9th):**
 - SCT (4 CTB modules) and TRT (16/32 barrel sectors)
 - Can use M3 data to be fully ready.



Session Talks

- A talk from each sub-system:
 - Pixels: [A.Andreazza](#)
 - SCT: [H.Hayward](#)
 - TRT: [C.Schmitt](#)

to address:

- Update on SR1 analysis (Pixels, SCT, TRT)
- Analysis of data taken in the pit (noise for SCT and cosmics for TRT)
- Future plans for next commissioning phases
- Status of combined tracking with muons (with simulated and real M3 data) [T.Cornelissen](#)
- Status of combined simulation [J.Boyd](#)

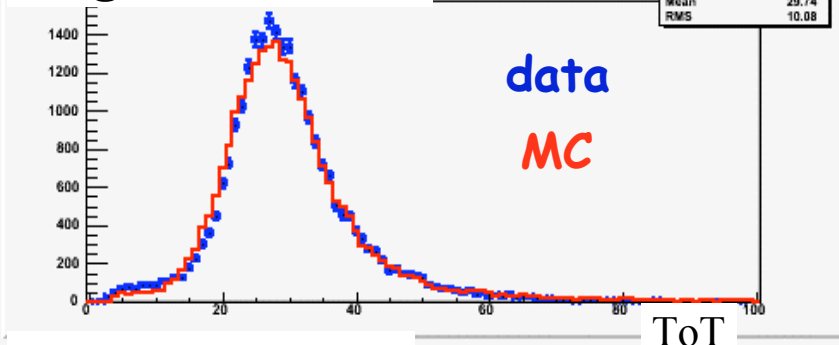
SR1 analysis update

Pixels endcap A

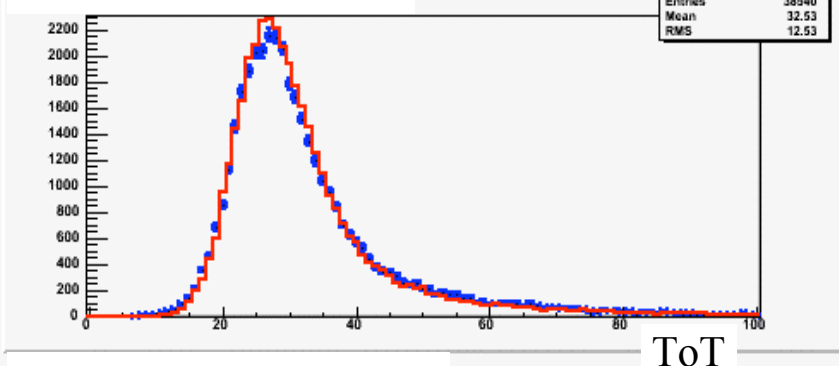
- Lots of progress on understanding the data but also:
 - Improvements on the simulation to get a good data/MC agreement
 - In reconstruction to deal with real data.
 - Monitoring tools to get ready for the next phase.

Ex: Calibration data obtained during production gives a good description of cosmos data

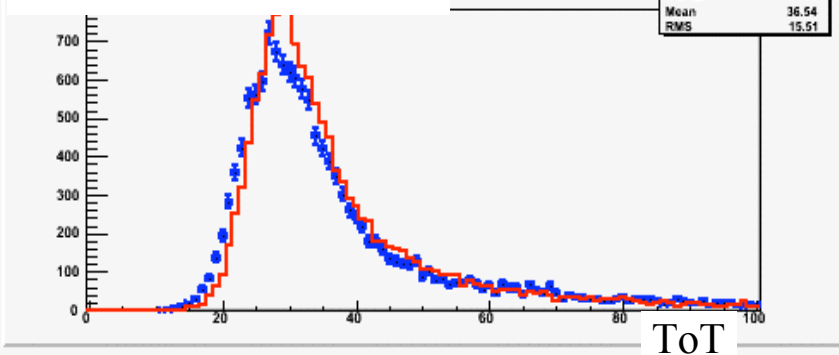
Single hit clusters



Two hits clusters

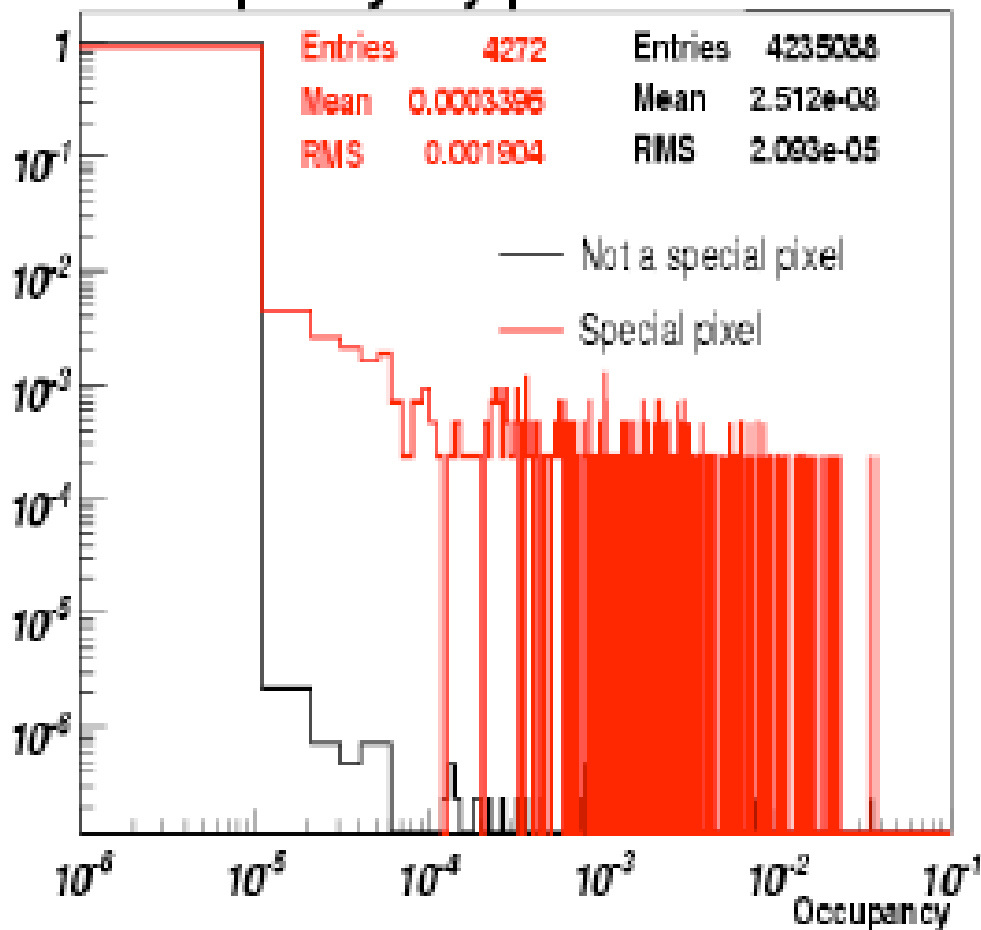


Three hits clusters



SR1 analysis update

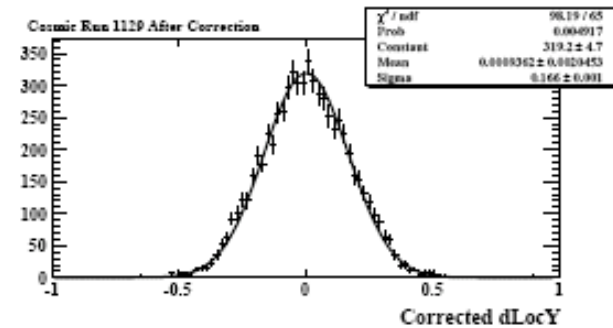
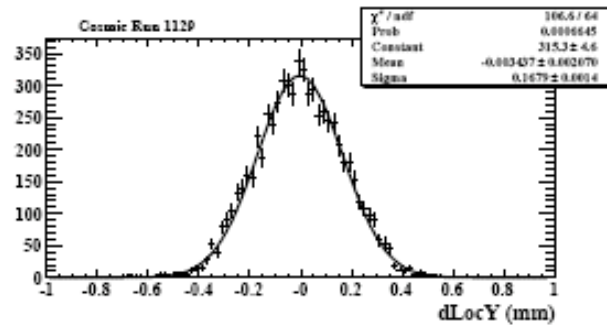
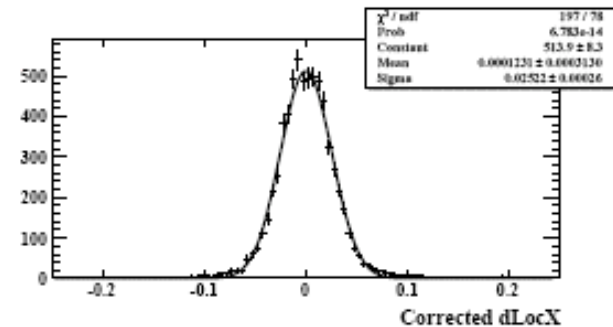
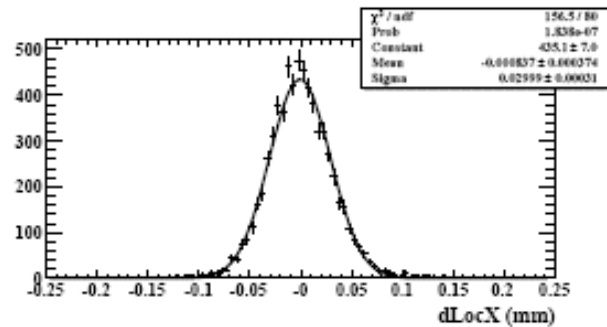
Occupancy by pixel



- Typical occupancy rate in noise runs is 1-3 10^{-8} per bunch crossing
- Noise is concentrated on few hot pixels:
 - ~90% are special pixels (identified during production)
 - remaining can be removed with an additional masking step.

SR1 analysis update

Residuals before and after Alignment (Overlap Residuals)



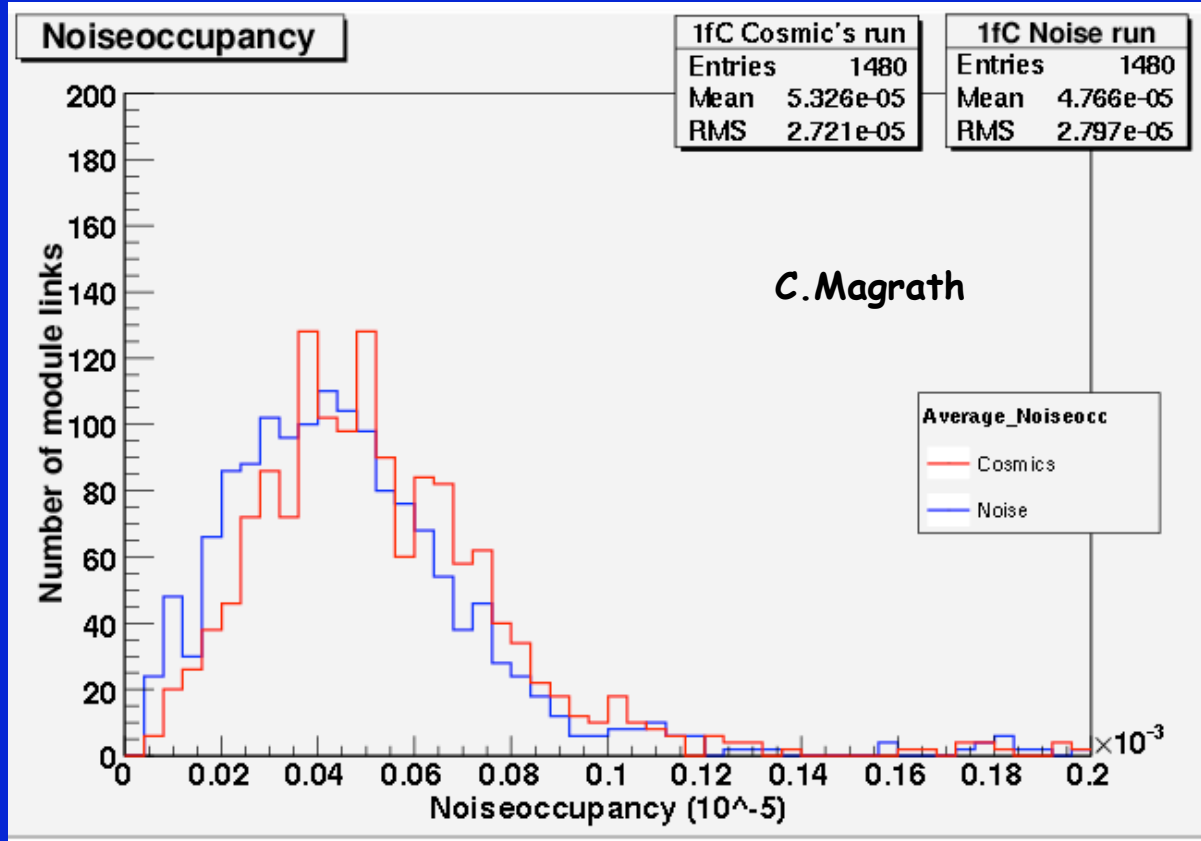
W. Yao

Resolution [μm]	Norminal+dz=4.25(mm)	After Alignment	MC
σ in dX	21	18	16
σ in dY	119	117	117

SR1 analysis update

SCT and TRT barrel

Comparison of SCT noise occupancy in cosmic and noise runs



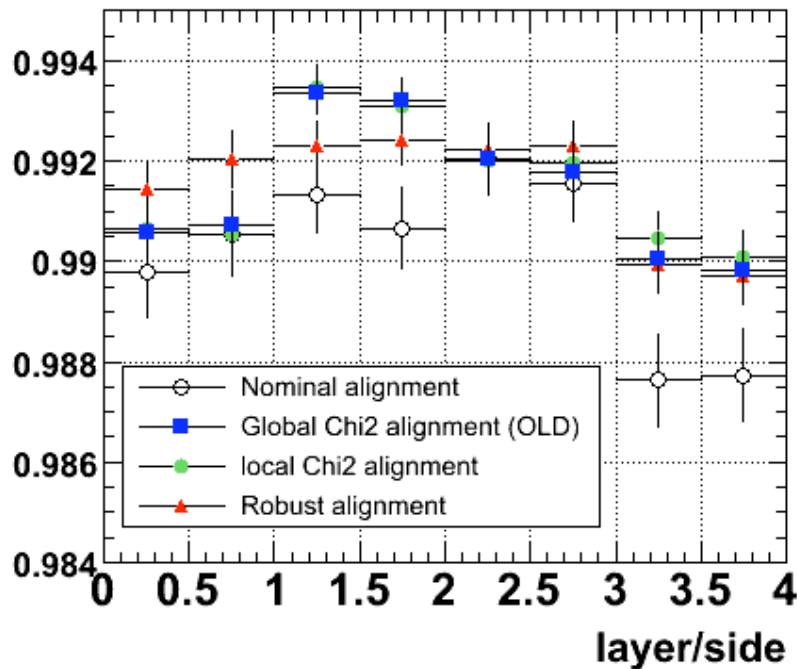
- Measurement is higher in cosmic runs
- Probably due to track hits contamination (under study)

SR1 analysis update

SCT efficiencies

Efficiency per layer

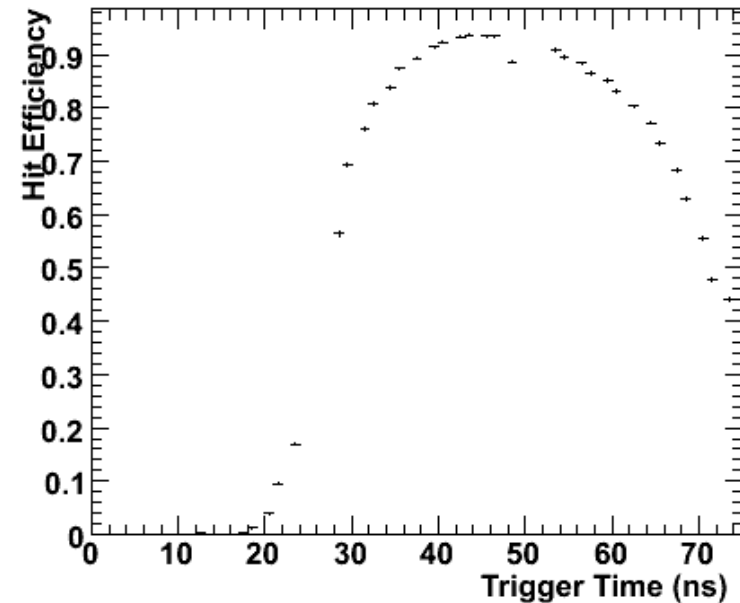
H. Hayward



TrigTimeNum

H. Hayward

TrigTimeNum	
Entries	429639
Overflow	0



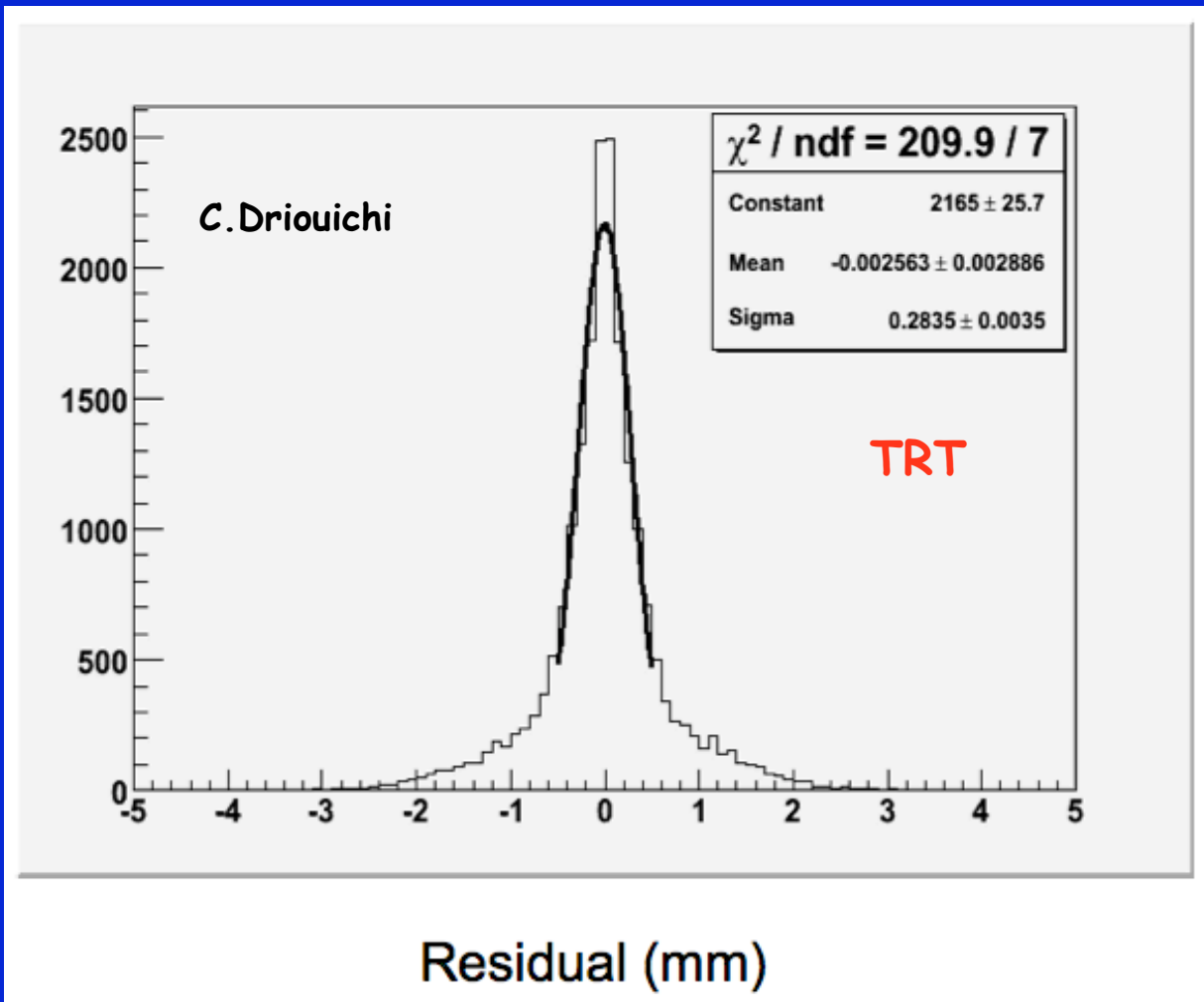
2007-07-04 17:11:01

- A cut on $|\phi| < 20^\circ$ introduced
- If 150 μm instead of 2mm cut is used, efficiencies are too low (also in simulation)

- New result of efficiency variation as a function of trigger phase time!

SR1 analysis update

SCT and TRT endcap

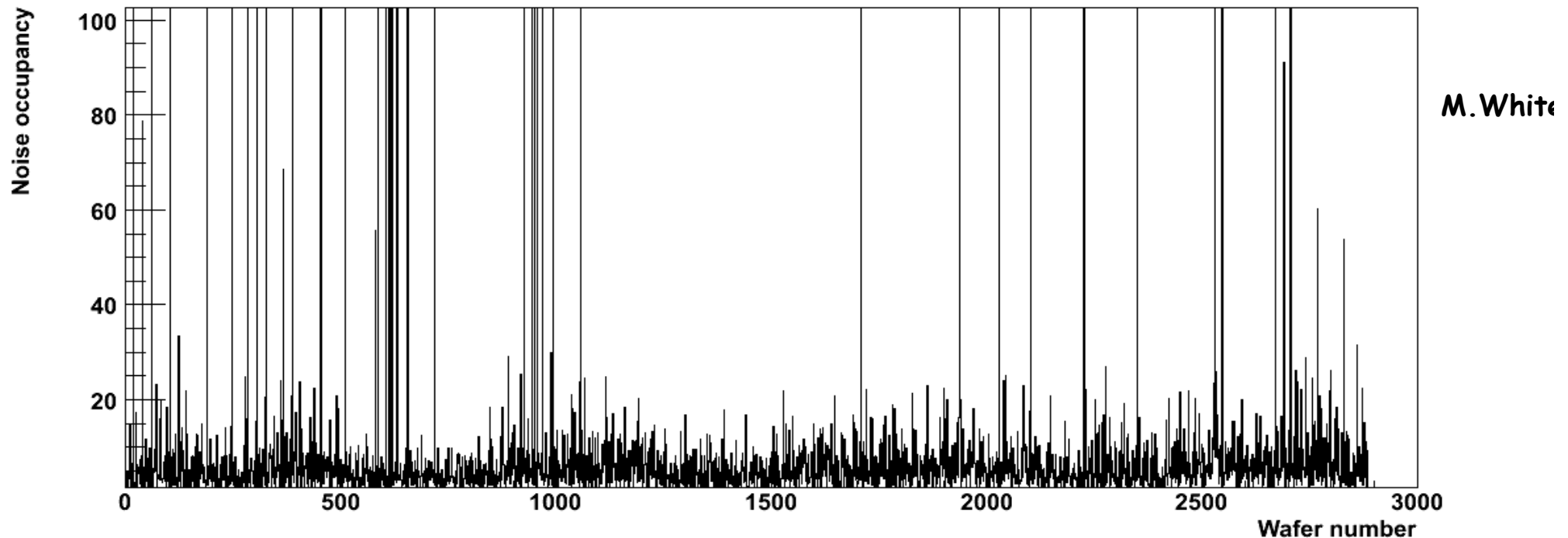


Fit within $\pm 300 \mu\text{m}$:
 $\sigma = 214 \mu\text{m}$

Performing hard cuts on hit and track quality the TRT resolution is at the level of the barrel data.

Commissioning in the pit previous to M3

SCT May noise runs analysis



- A mean value of 5×10^{-5} measured
- 39 wafers with noise $> 5 \times 10^{-4}$ (checking with calibration results and DCS conditions in progress)
- No increase of noise observed when TRT on.

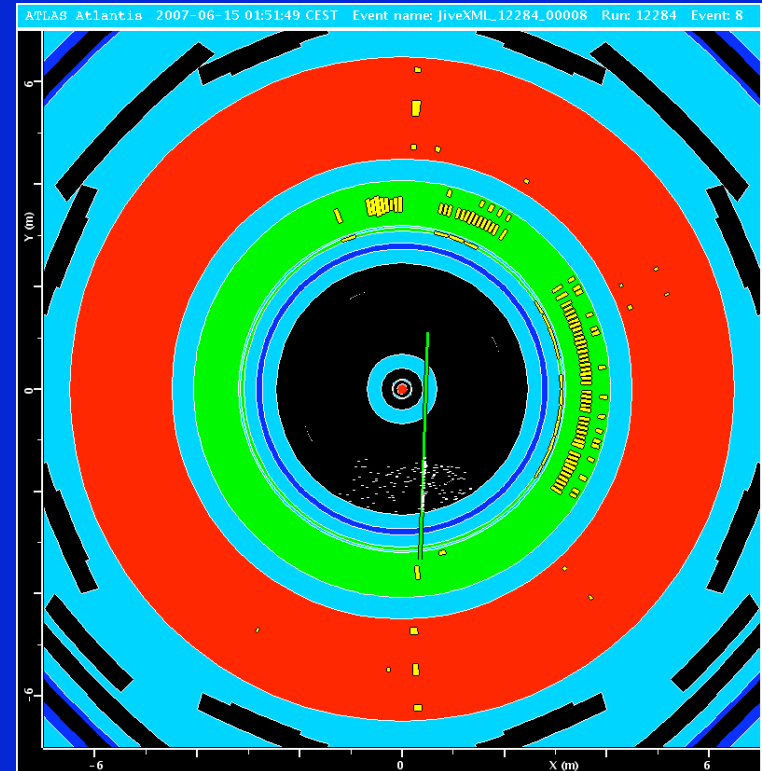
M3 run

- **Detector participation:**

- SCT: 4 modules from the CTB
- TRT: 6 out of 32 barrel sectors

- **Software participation:**

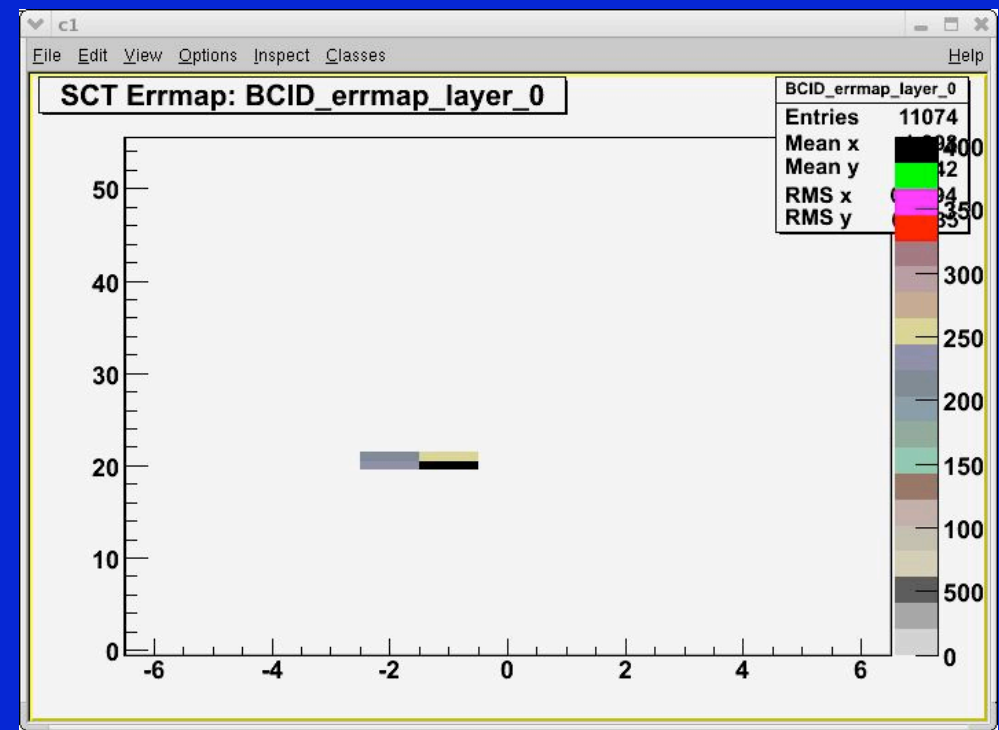
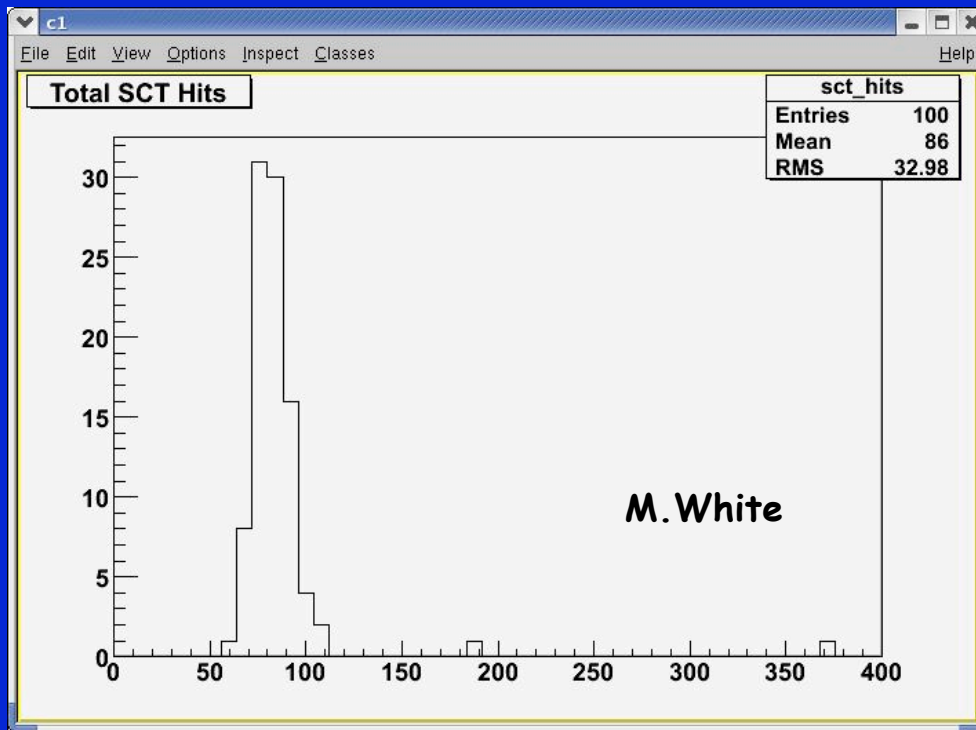
- Online reconstruction and event display @ P1 (SCT hits came 1 day too late)
- Full offline combined reconstruction @ Tier-0 (no crashes due to ID reported!)



M3 reconstruction and analysis

SCT reconstruction & analysis

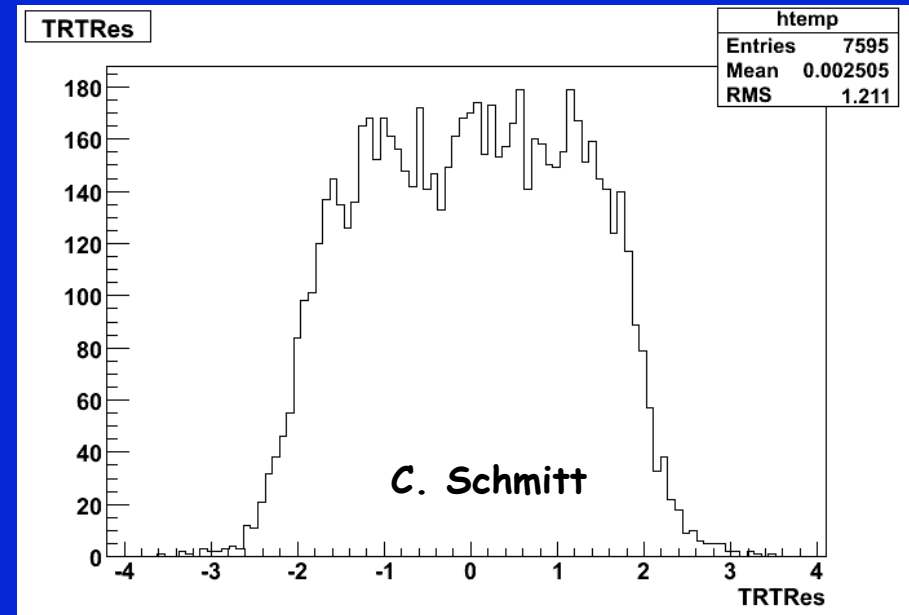
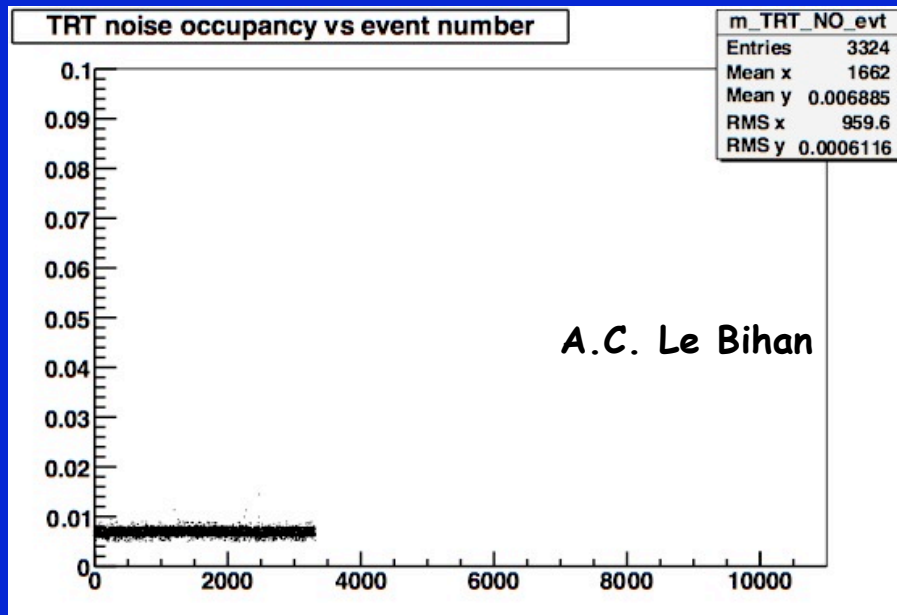
- Data itself not so interesting but a good software exercise as well (reconstruction & monitoring chain up to clusters)



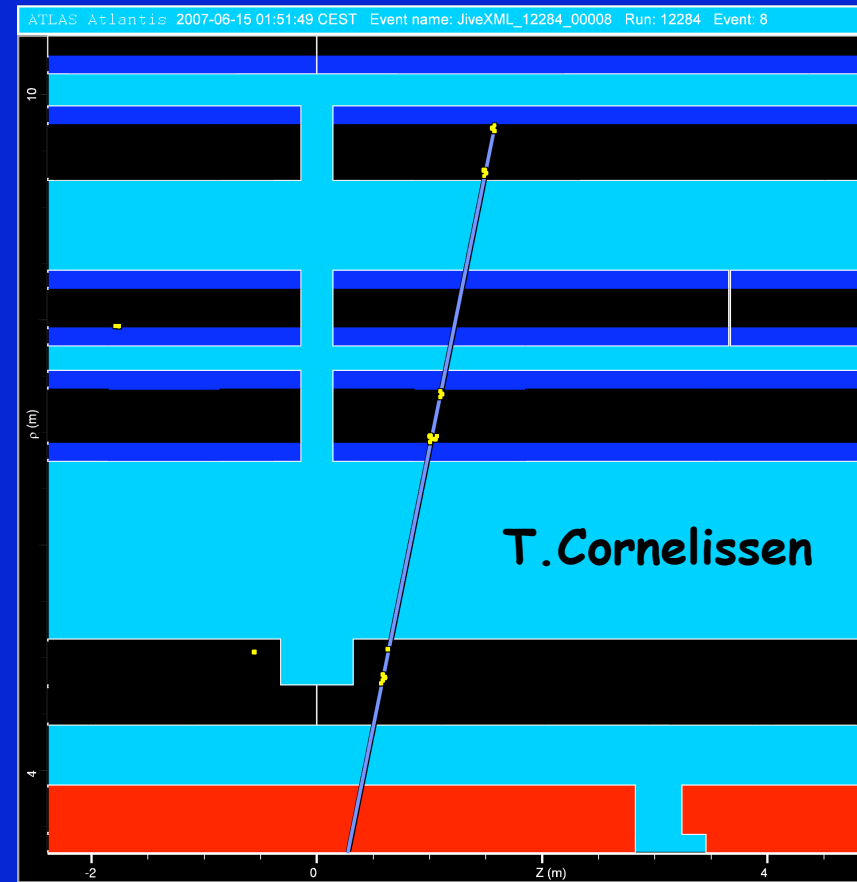
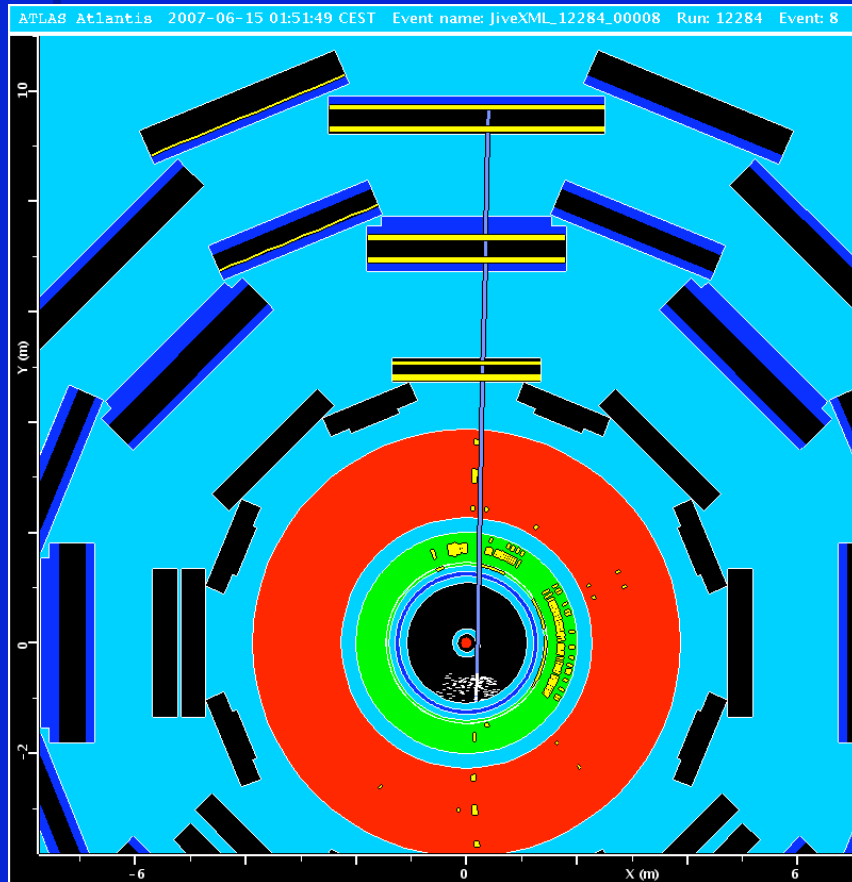
M3 reconstruction and analysis

TRT reconstruction & analysis

- Full reconstruction chain up to tracks in place (after fix in BS Cnv, also including the possibility to compute phase time per event)
- Noise occupancy < 1%
- Track occupancy: 0.025 ± 0.003 tracks per event
- ~900 tracks recorded \rightarrow not enough to provide calibration



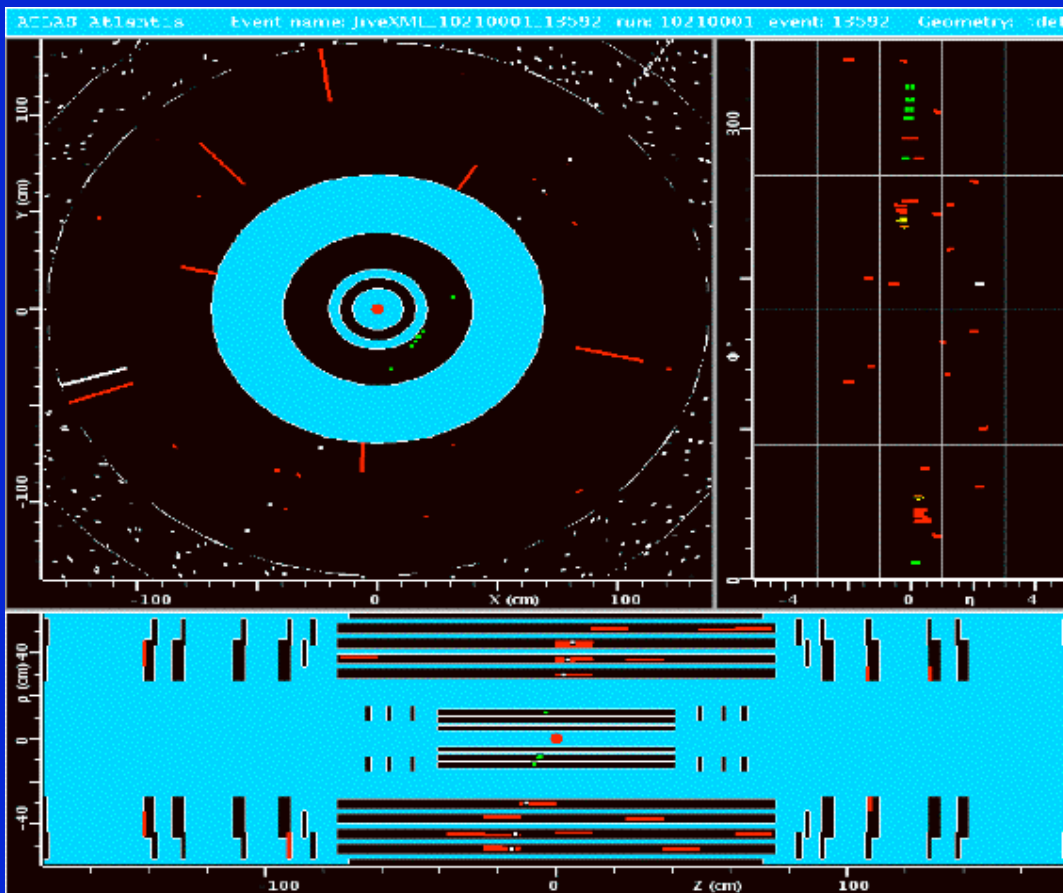
M3 combined reconstruction



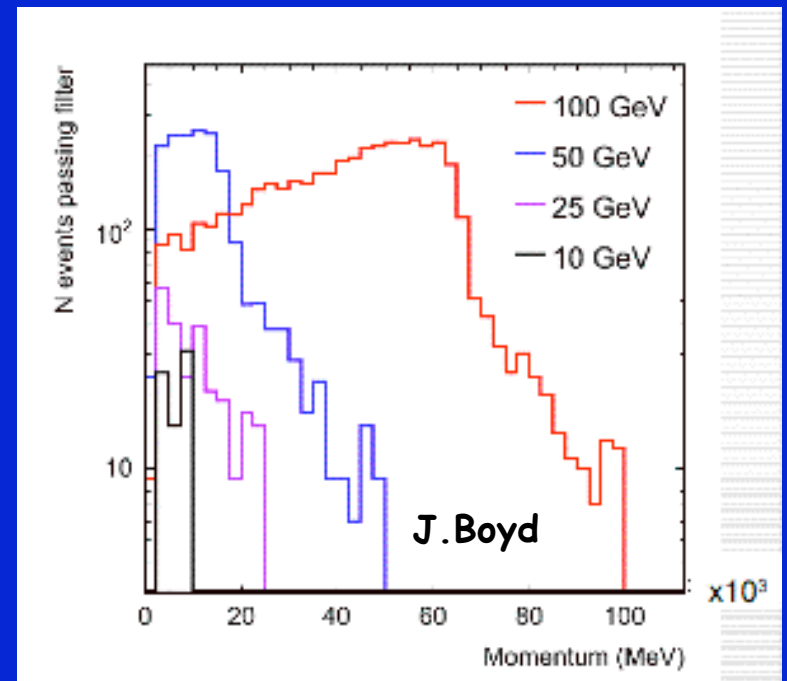
- First straight line fit to TRT and MDT hits (56 hits)
- Fit quality $\chi^2/\text{dof} = 94/52$ (assuming 3mm for MDT resolution)

Combined simulation of cosmic rays in the pit

- Combined (ID, Calo, Muons) simulations available with Pixels, SCT and TRT (Bfield = 0)
- Some misaligned data for SCT and TRT and some data with B field as well.



Studies to understand truth track parameters distributions, energy loss, trigger rates have been done.

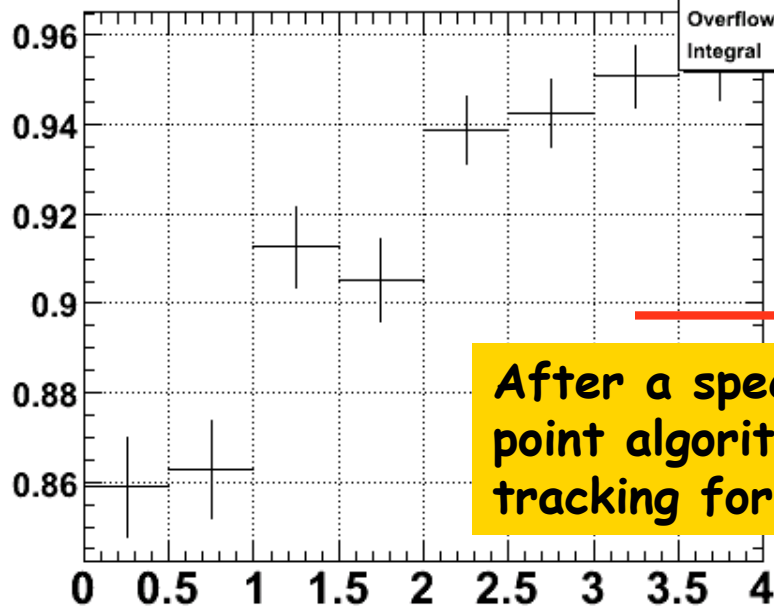


Reconstruction with simulated data

SCT efficiency study

Efficiency per layer

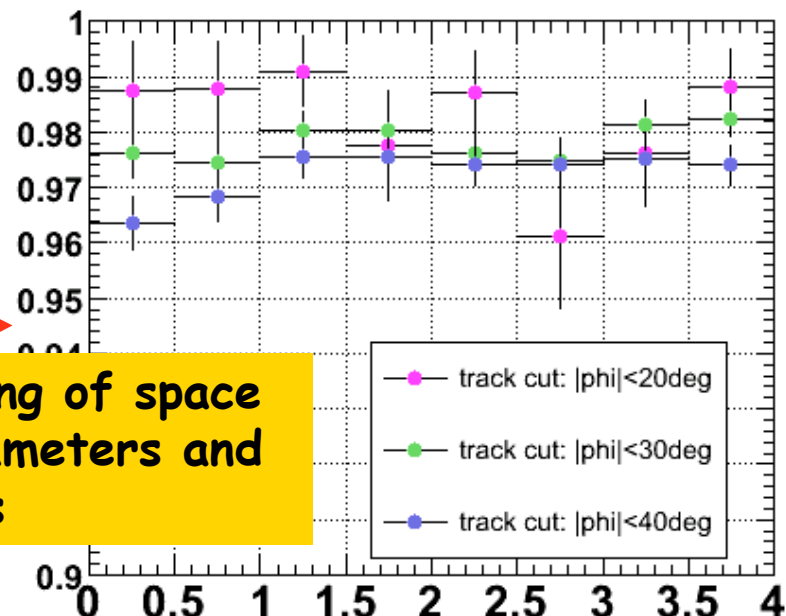
EffSum	
Entries	8
Mean	2.042
RMS	1.141
Underflow	0
Overflow	0
Integral	7.324



After a special tuning of space point algorithm parameters and tracking for cosmics

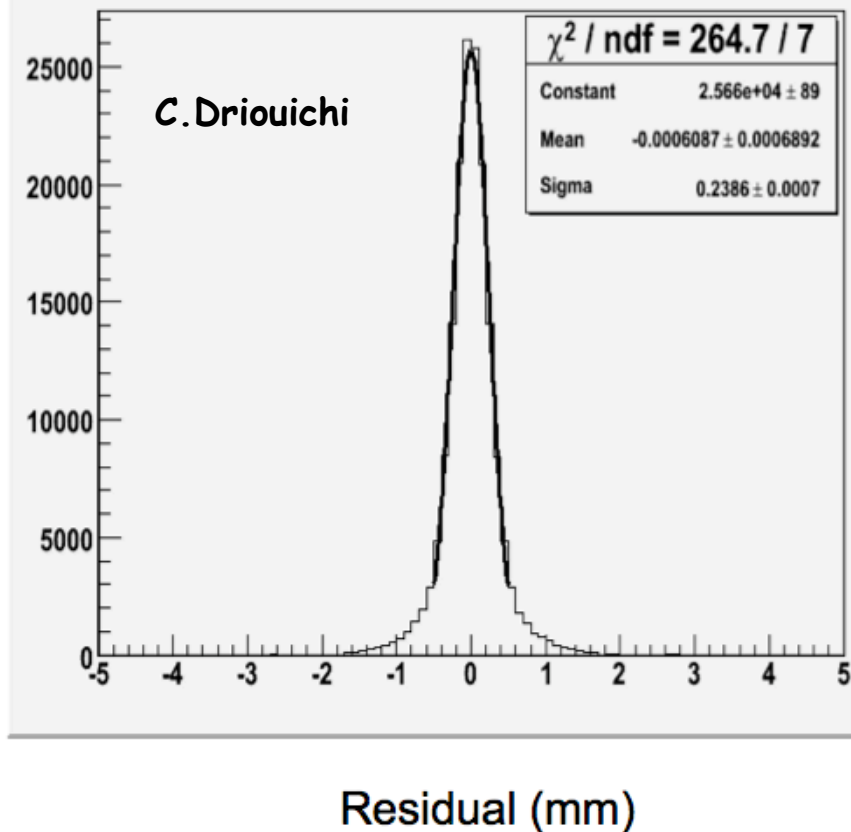
Efficiency per layer

R. Batley
H. Hayward



Reconstruction with simulated data

TRT calibration



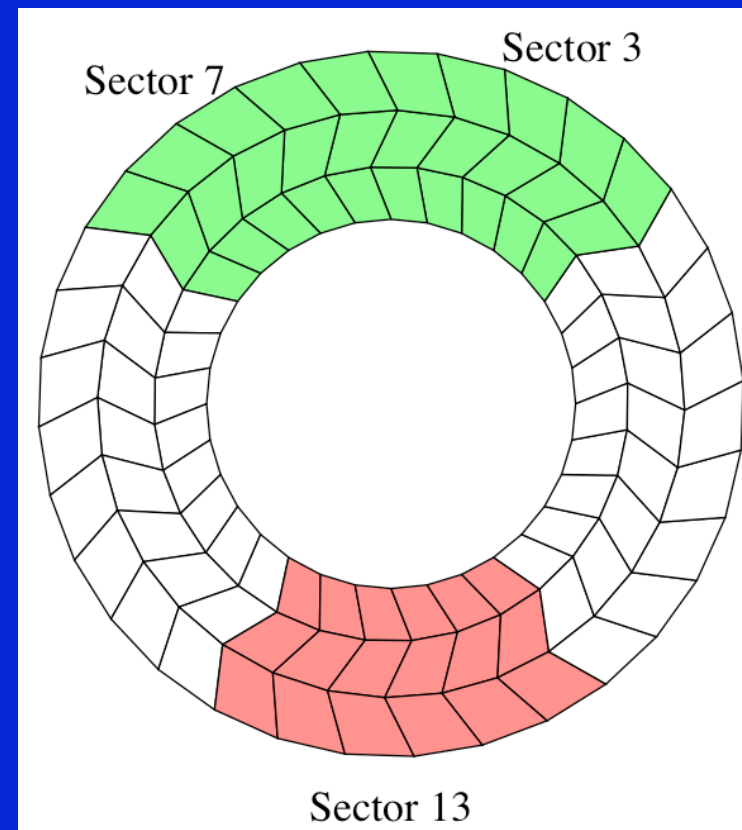
- A new TRT calibration is now available for simulation:

Fit within $\pm 300 \mu\text{m}$:
 $\sigma = 220 \mu\text{m}$

From now on the combined simulation will include all ID technologies and a production with misalignments will be produced

Future plans

- Participation in the next Milestone period M4 (23rd Aug - 9th Sept)
- Same sub-systems as M3:
 - SCT: 4 CTB modules
 - TRT: 16/32 barrel sectors
- TDAQ 1.8 will be used (compatible with 13.0.20-COS)
- Should provide a better online reconstruction and monitoring @ P1 and hopefully HLT reconstruction (depends on availability of full HLT release)





Conclusions

- Analysis of the SR1 data are close to be finished and 2 ATLAS notes are being written
- First participation of the Inner Detector in a Milestone week taking data together with calorimeters and muons (in terms of DAQ, DCS and online & offline reconstruction)
- The data is being analysed and the combined reconstruction and monitoring is being tested.
- Getting now ready for the next cosmic runs using simulation