ATLAS offline commissioning status for the combined cosmic runs

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On behalf of the ATLAS Offline Commissioning group

ATLAS Trigger & Physics week
6th June, 2007

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Goal of the group

- Responsibility of the group:

Provide combined simulation, reconstruction & analysis of the different commissioning phases (cosmic runs, single beam operations and first collisions)

- Organization: A coordinator(s) for each sub-system + overall coordination:

  - **Muons**: R.Nikolaidou
  - **Tile**: A.Solodkov, J.Maneira
  - **LAr**: H.Ma, R.Lafaye, W.Lampl,M.Vincter
  - **Inner Detector**: M.J.Costa, C.Schmitt
  - **HLT**: J. Boyd
  - **Coordination**: M.J.Costa

- Close contact with Data Preparation, Data quality, Monitoring, Tier-0, Databases, TDAQ, alignment, combined performance and physics groups needed.

Cosmic rays data and plans

Dates	Systems Integration	Detector configuration	Operations	Cosmic run
M1: 11-19/12 2006	DAQ R/O Barrel Lar & Tile CTP	Barrel calorimeters	Achieve combined run	2 days Tile cosmic trigger
M2 28/2 to 13/3 2007	DAQ/EB DAQ V. 1.7 Muon barrel (S. 13) Monitoring/DQ	Barrel calorimeters Barrel Muon	Combined runs Mixed runs	2 x weekd ends Tile cosmic trigger + RPC cosmic trigger Periodic cosmic runs after M2
M3 **4/6 to 18/6 2007**	**Barrel SCT** **Barrel TRT** **Muon EC (MDT, TGC)** **Offline**	**Barrel & Endcap calorimeters** **Barrel muon (5&6)** **EC muon MDT** **Barrel SCT, TRT** **EC muon TGC**	**1st week focus on operations, checklist management, coordination between desks**	**1 week** **Tile + Muon cosmic trigger (side A)**
M4 6/8 to 13/8	Level-1 Calo HLT DAQ 1.8; offline V 13?	Barrel & EC calos Barrel & EC muon Barrel SCT,TRT Level-1 Mu, Calo	ATLAS-like operations	1 week Try also calorimeter trigger
M5 8/10 to 15/10 (16/10 to 23/10)	ID EC Pixel	Converge to ATLAS detector	ATLAS-like operations	1 week
16/10 ->			Continuous operations	Global cosmic run Operations with beams

Main goal from offline: Integration during M3:

- **Tier-0 using 13.0.10**
- **Online using 12.0.5-COS-1**

ON GOING JUST THIS WEEK !!!!

Latest schedule from G.Mornacchi

Strategy to get ready

1. **Detector description** of the expected M3 setup

2. **Simulation** of the M3 setup
   - Cosmic generator
   - Geant4
   - Digitization and trigger emulation

3. **Reconstruction**
   - Integrate reconstruction of the different sub-systems
   - Include combined reconstruction

4. **Monitoring and analysis**
   - Integrate monitoring of the different sub-systems
   - Develop global monitoring

4. **Event displays**
   - Use them also for online monitoring

5. Test with M2 data (Calo & Muons)

6. Use M3 real data as input using final detector setup

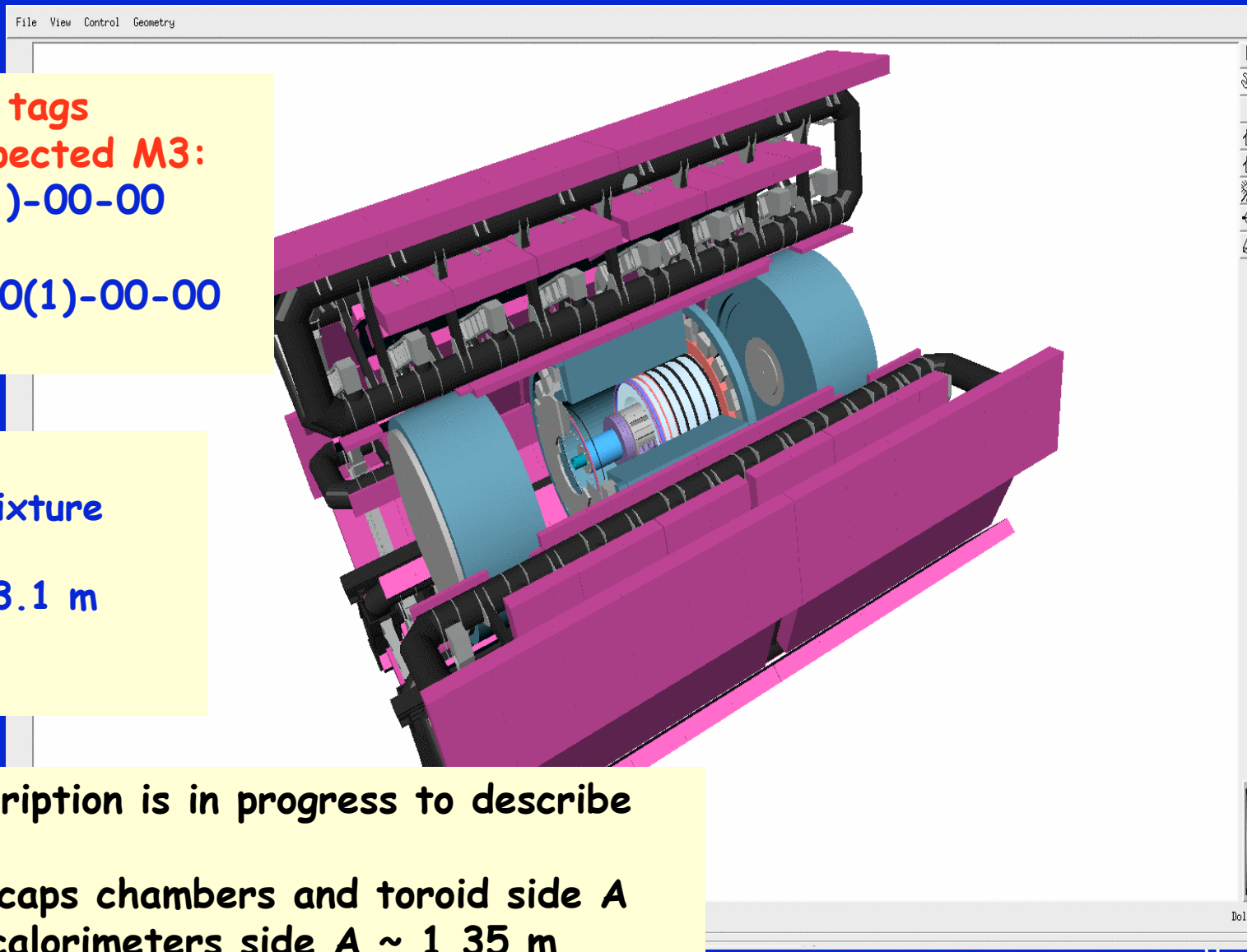
Repeat process for the different expected setups

Detector description

Coordinated by V.Tsulaia
Inner Detector: E.Klinkby,P.Ward
Calorimeters: V.Tsulaia
Muons: L.Chevalier

Detector description tags produced for the expected M3:

- ATLAS-Comm-00(1)-00-00 (nominal B field)
- ATLAS-CommNF-00(1)-00-00 (null B field)



Inner Detector:
TRT using Ar gas mixture
Calorimeters:
d(Barrel,Endcap) = 3.1 m
Muons:
no endcap

A new detector description is in progress to describe the final M3 setup:

- Including muon endcaps chambers and toroid side A
- d(Barrel, Endcap) calorimeters side A ~ 1.35 m

Simulation

Coordinated by J. Boyd (support by A.Di Simone)
Inner Detector: J.Boyd, E.Lykten
Calorimeters: H.Ma, P.Strizenec, E.Rezaie
Muons: N.Benekos,D.Rebuzzi

Cosmic generated in a given surface

Single muon

Filtering events requiring muon pointing within a given distance to the center of ATLAS

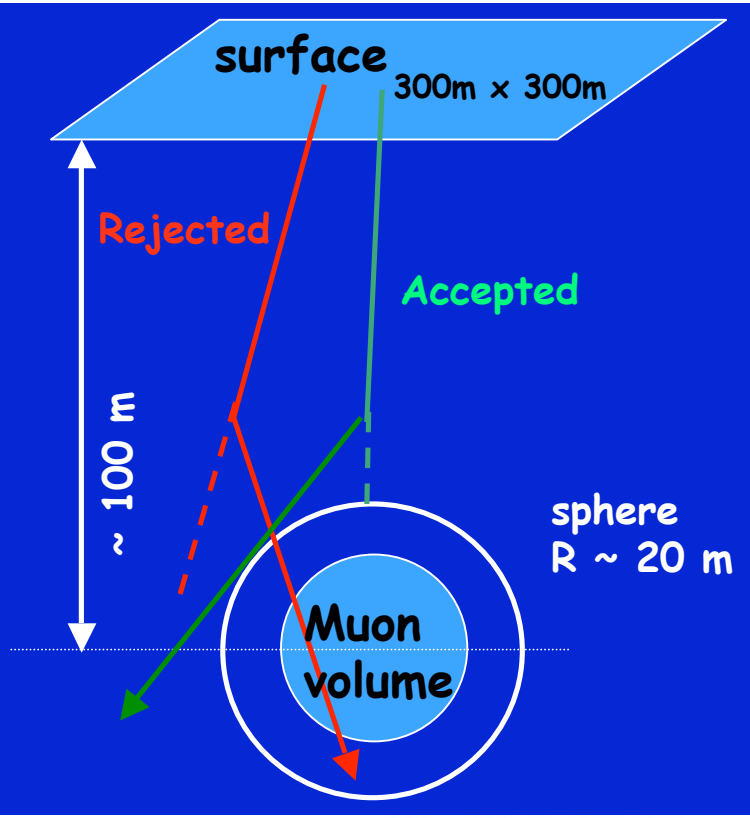
Geant 4 simulation

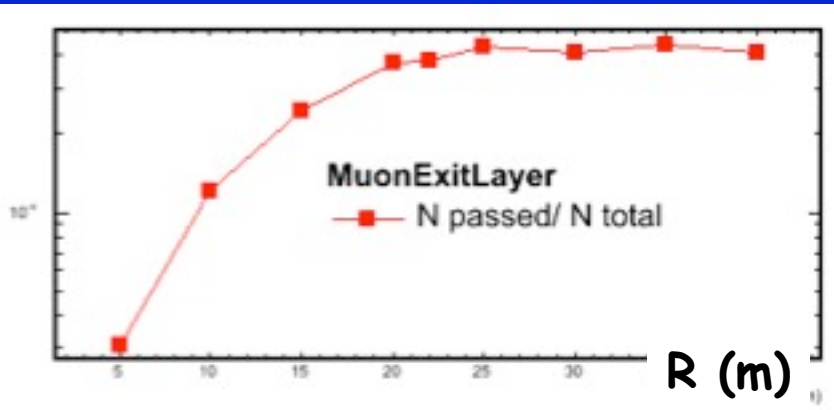
Hits

Filtering looking at hits in a given volume

Digitization & trigger emulation

RawDataObjects & trigger information





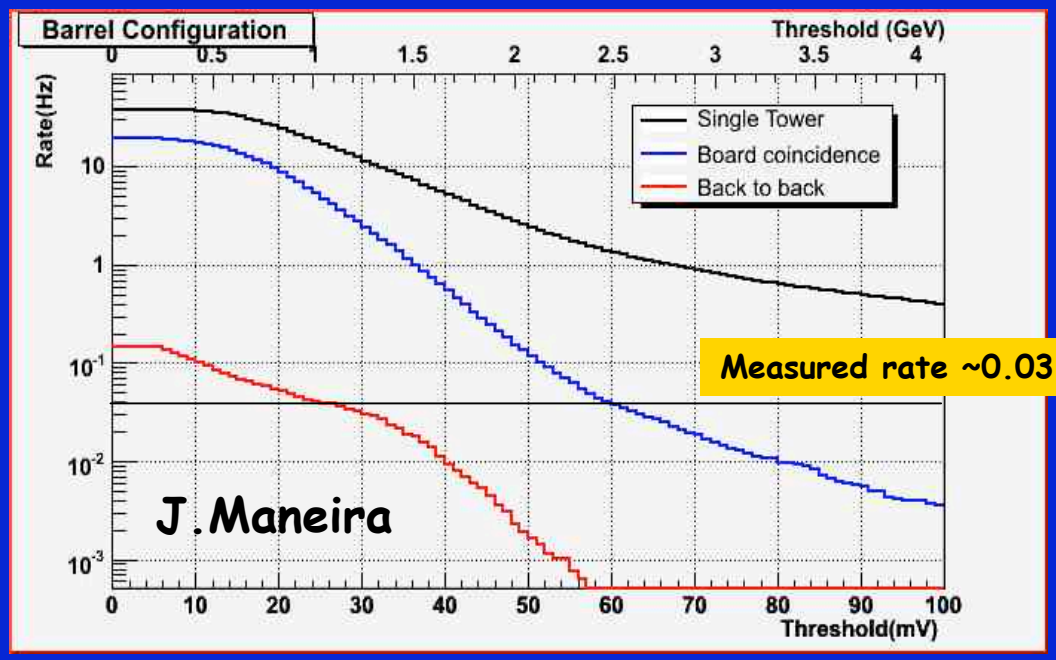
LVL1 Trigger

Tile: J.Maneira
RPC: F.Conventi,F.Pastore,S.Rosati,E.Solfaroli, L.Nisati

A simulation of the cosmic trigger configuration exists for both Tile and RPC systems:

- Tile: trigger information available for each event in the TileTrigger object.
- RPC: trigger information available for each RPC RDO. (a tool to take into account only active sectors in progress)

Tile cosmic trigger expected for M3



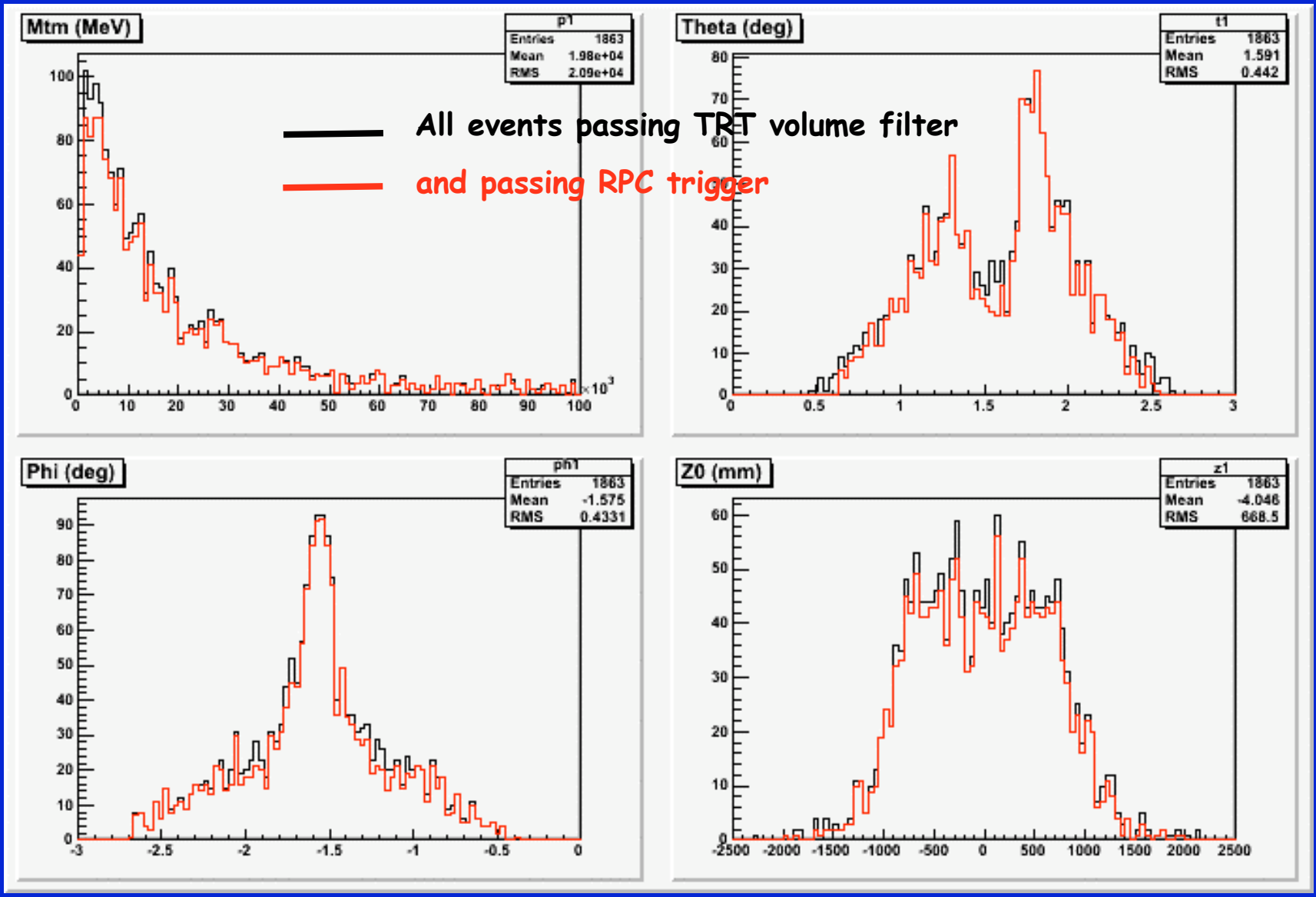
Measured rate ~0.03 Hz

Estimation of muon rate assuming an RPC trigger for full barrel (J. Boyd)

Muon Volume ~ 2 KHz
TRT Volume ~ 24 Hz

Reconstruction efficiencies not taken into account

Truth simulated track parameters



Simulation production

J.Boyd, E.Lykten

- Combined full simulation and digitization samples for the Comm setup have been provided using a frozen nightlies from 23rd Feb

- B field = 0 and default
- Emulating RPC and Tile trigger
- Correct timing in all detectors (SCT is still too optimistic)
- Using different filter volumes for different user cases (Inner detector or calorimeter endcap studies)
- Using different digitization conditions (readout elements: SCT & TRT barrel, full SCT& TRT, full Inner Detector)

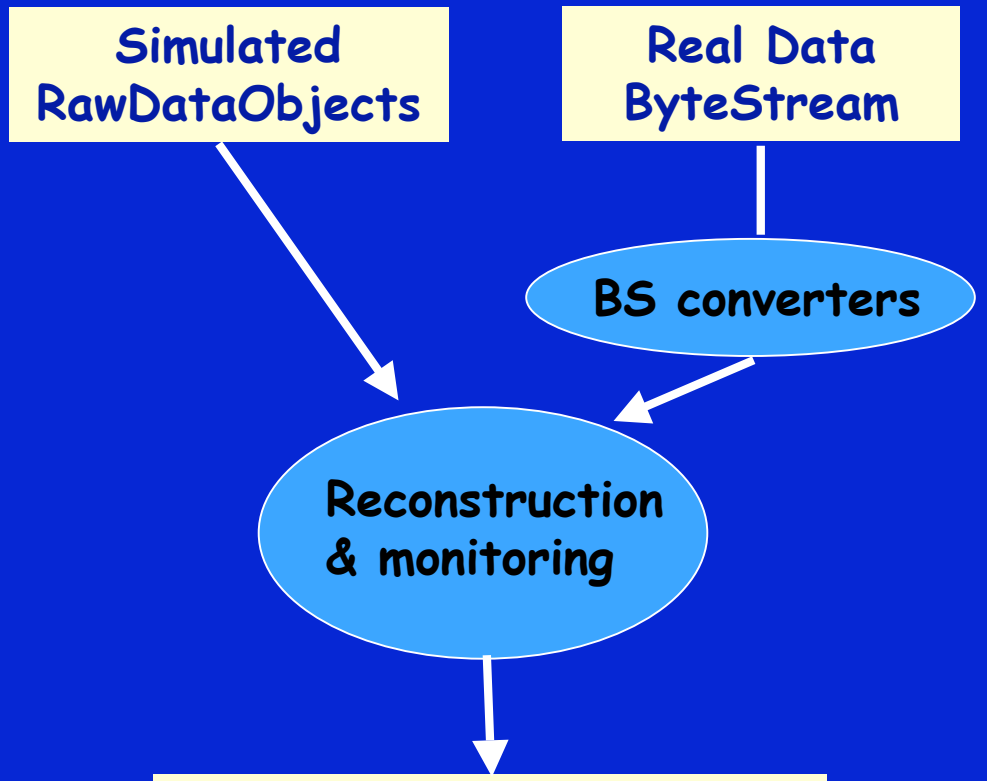
Production status can be found in:
https://twiki.cern.ch/twiki/bin/view/Main/HowToSimulateCosmicIn1250#First_production

New simulation should be done with final M3 conditions and detector setup

Reconstruction

Coordinated by M.J.Costa
Inner Detector: M.J.Costa, C.Schmitt
LAr: W.Lampl, H.Ma, P. Strizenek
Tile: J.Maneira, A.Solodkov
Muons: R.Nikolaidou

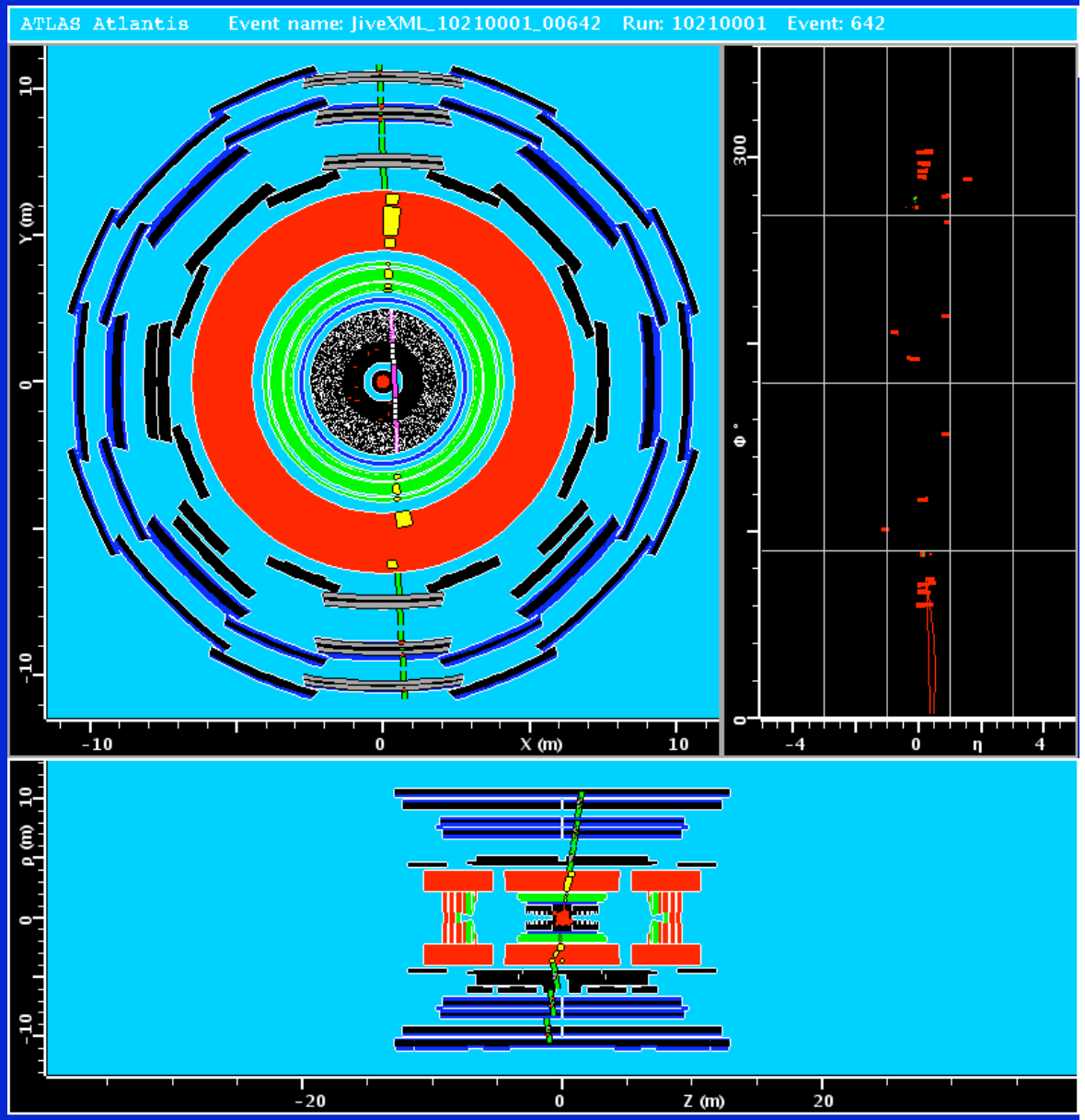
- A main jobOptions to run the combined cosmic reconstruction has been provided in the package RecExCommission in 13.0.10
  - Each sub-system reconstruction
  - Each sub-system monitoring
  - Combined reconstruction
  - Combined monitoring
  - Event displays (Atlantis, Persint)
  - Access to the same conditions database instance:
    - COMP200 for real data
    - CMC200 for simulated data



Output:
- CBNT
- Monitoring histograms
- ESD
- Event display information

Reconstruction of simulation

- The reconstruction and monitoring of each sub-system is in good shape and has been tested quite in detail.

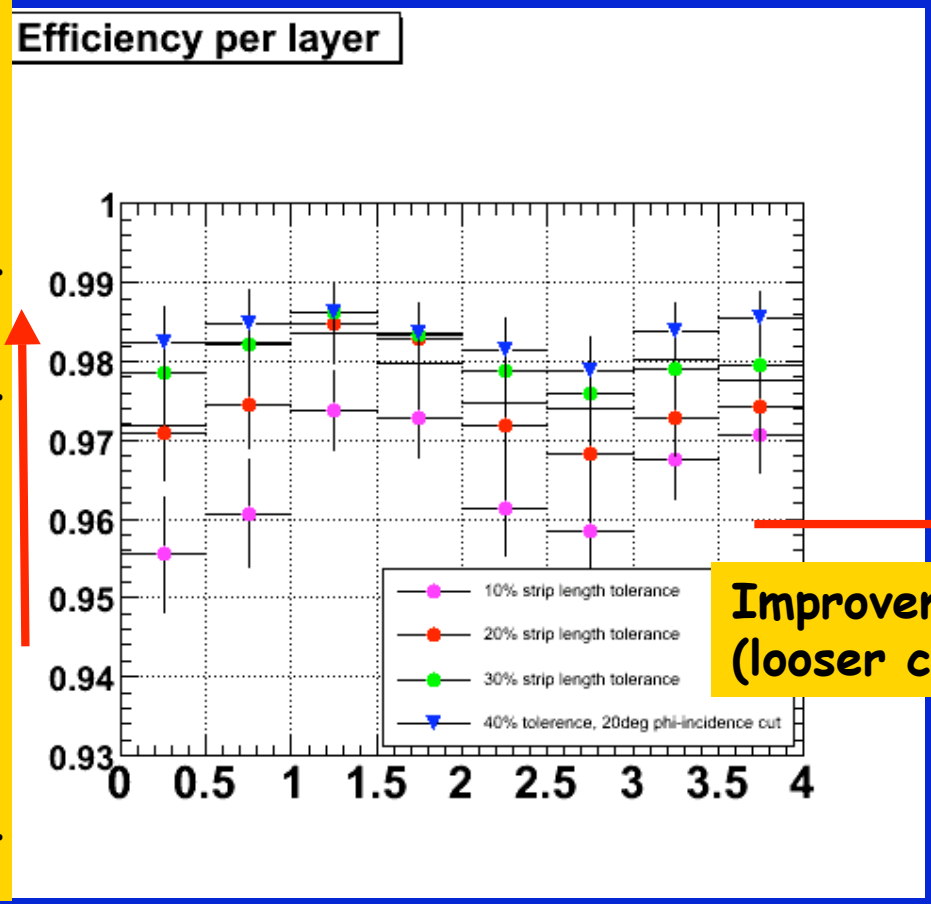


Reconstruction of simulation

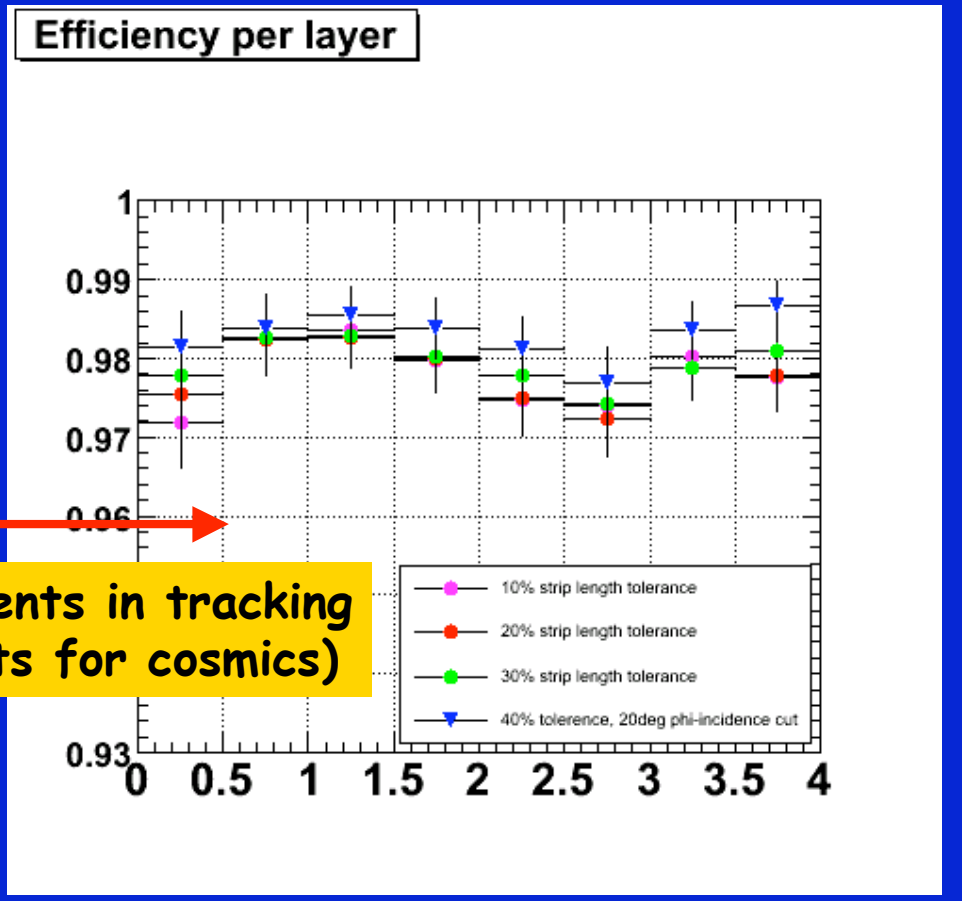
Example of Inner Detector tests: SCT efficiency study

H. Hayward, T.Cornelissen, R.Batley

Open tolerances in space point creation



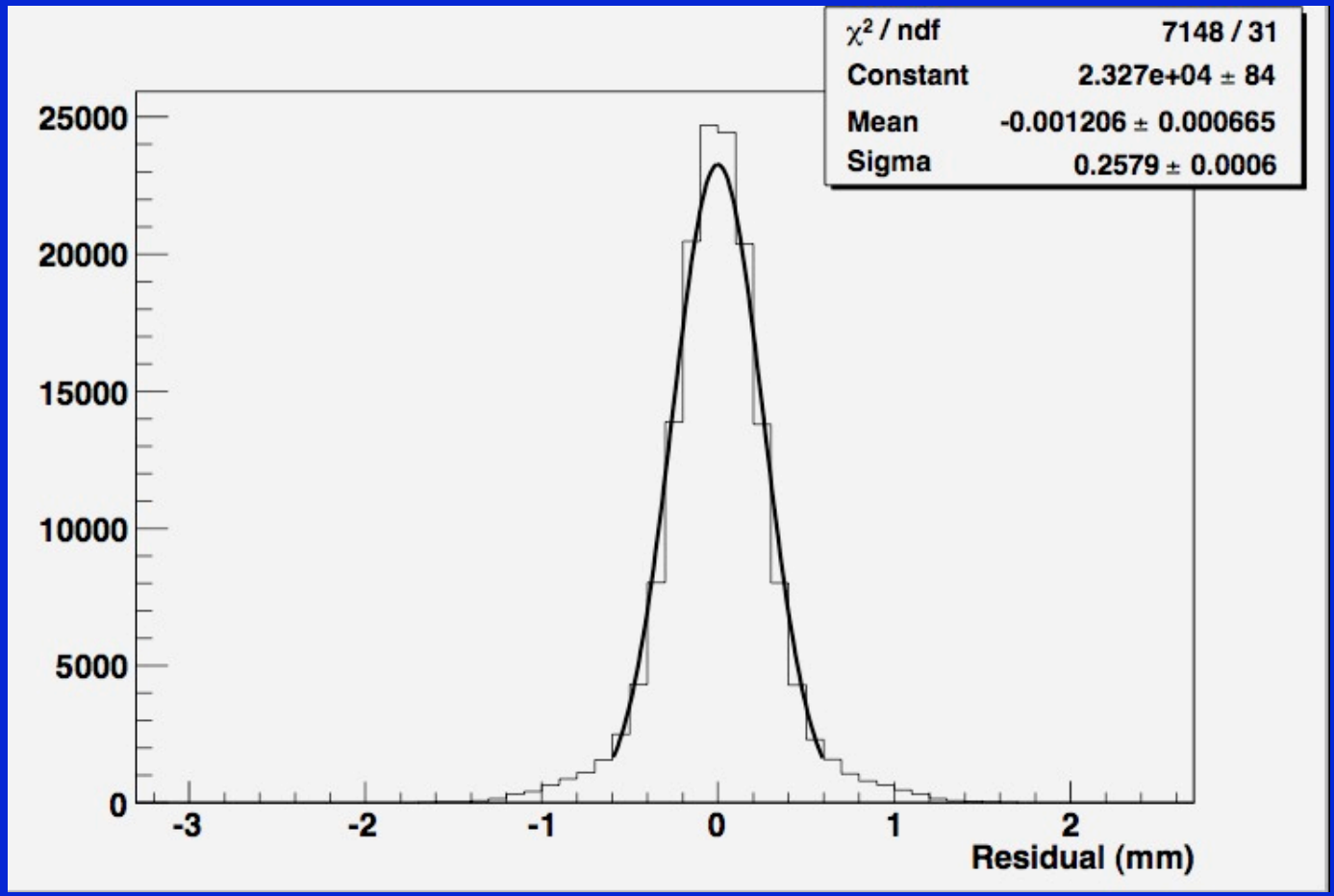
Improvements in tracking (looser cuts for cosmics)



Reconstruction of simulation

Example of Inner Detector: TRT T0 calibration

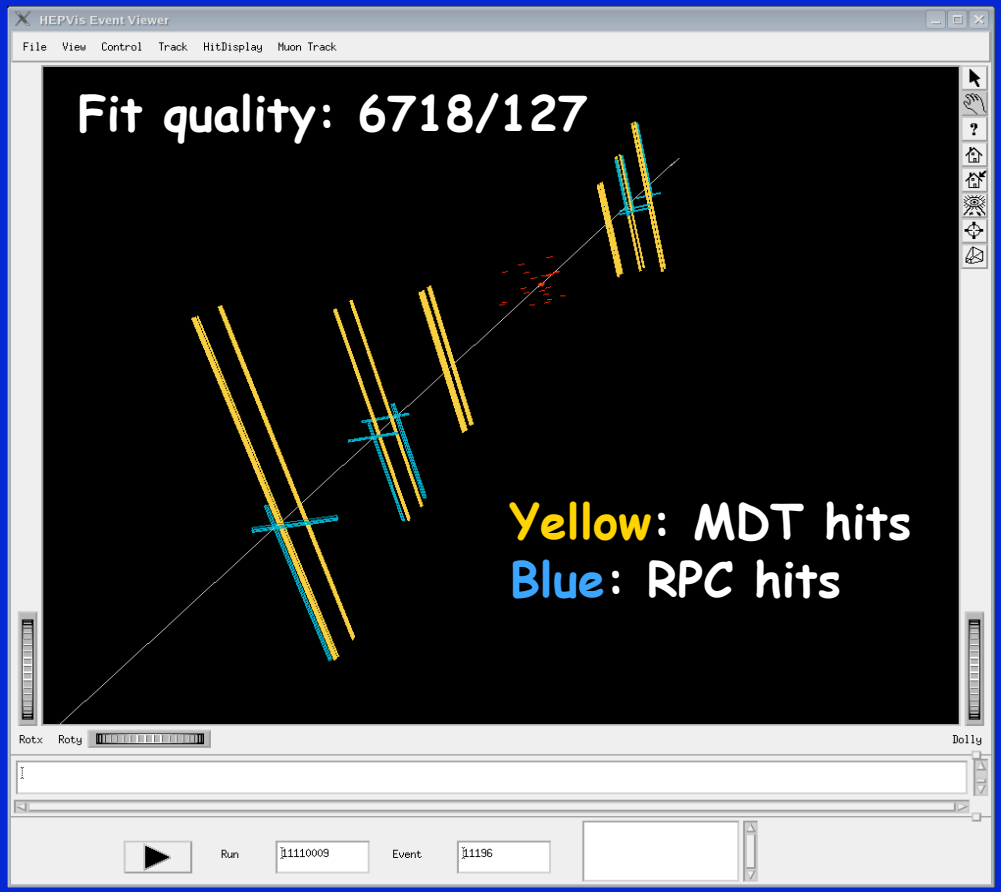
C.Driouichi

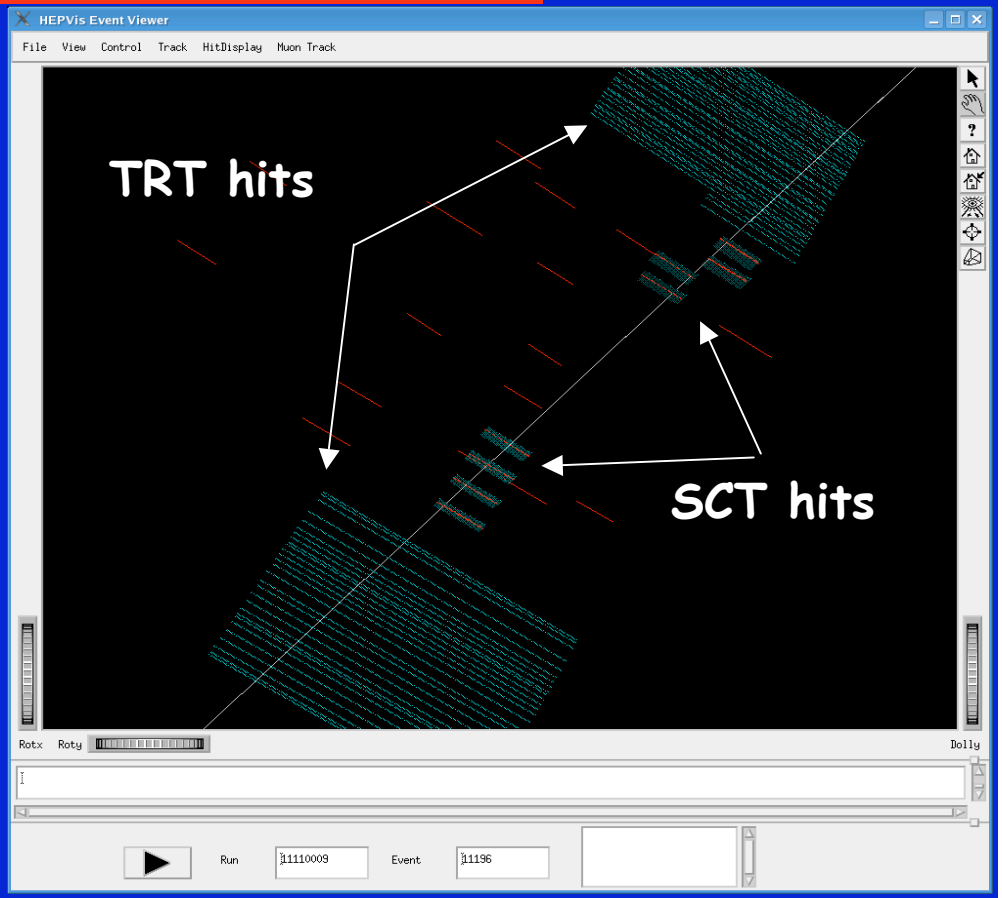


Combined reconstruction of simulation

Combined tracking Inner Detector - Muon system with GlobalChi2 fitter

T.Cornelissen et al.





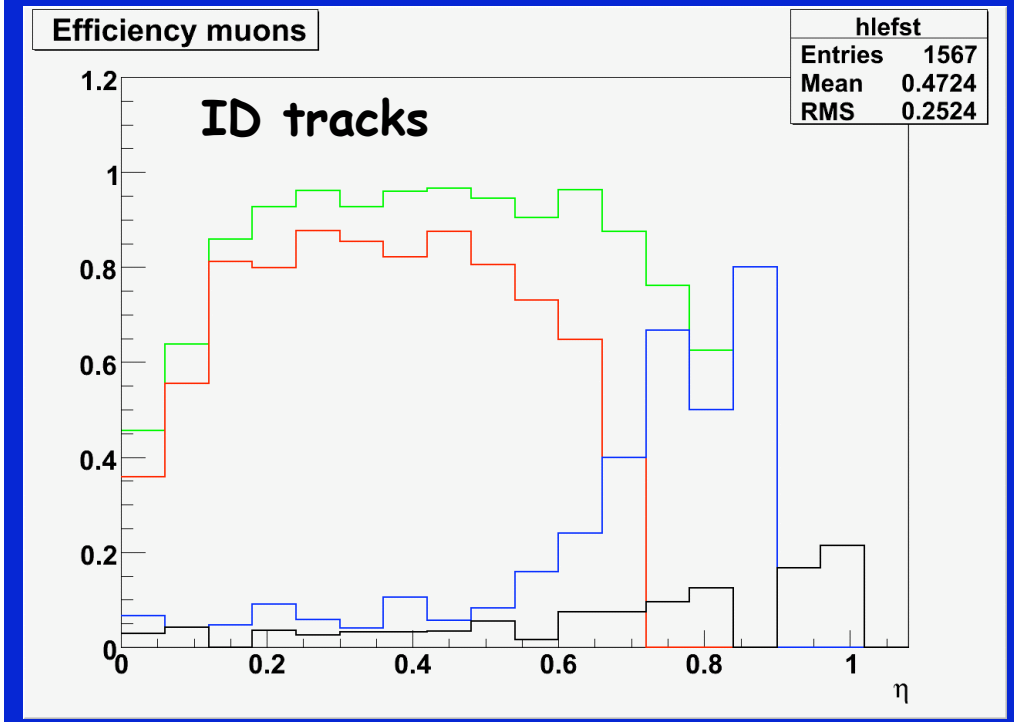
First attempt to perform a global fit without material corrections and B = 0
Plan to include material effects: Measured Eloss from calorimeters and the expected cosmics <p>

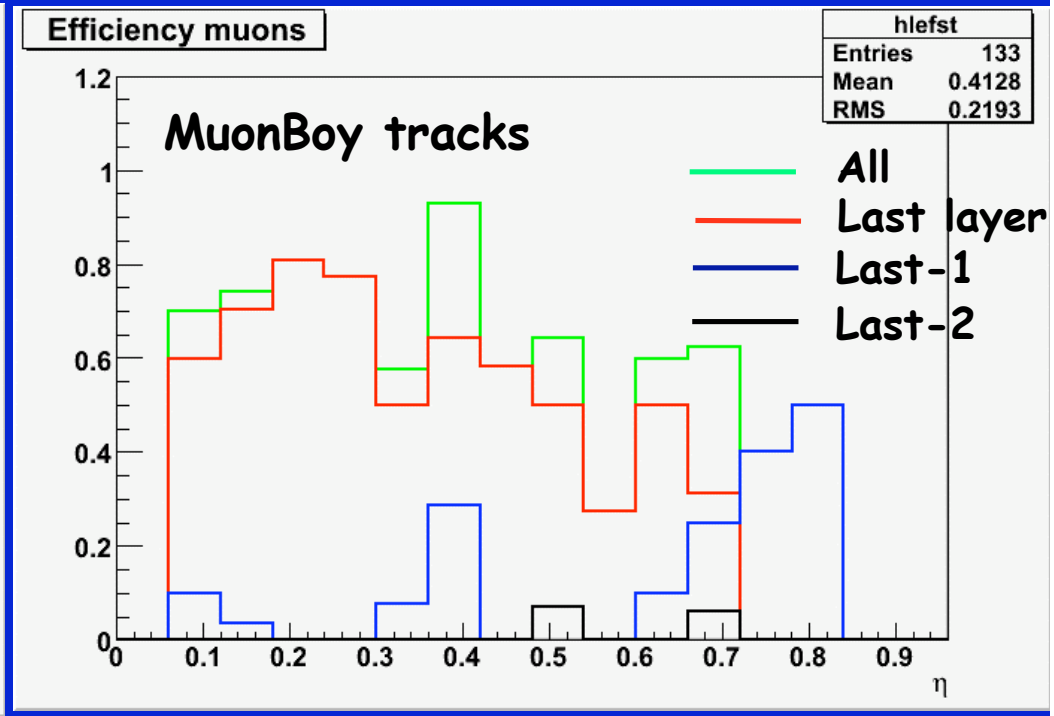
Combined reconstruction of simulation

Track muon tagging CaloTrkMuonID

G. Ordoñez

- It tags tracks as muons using hadronic calorimeter deposits
  - Extrapolates the track to the HCAL and looks for the closest cell in eta and phi in the last 3 layers of the calorimeter.



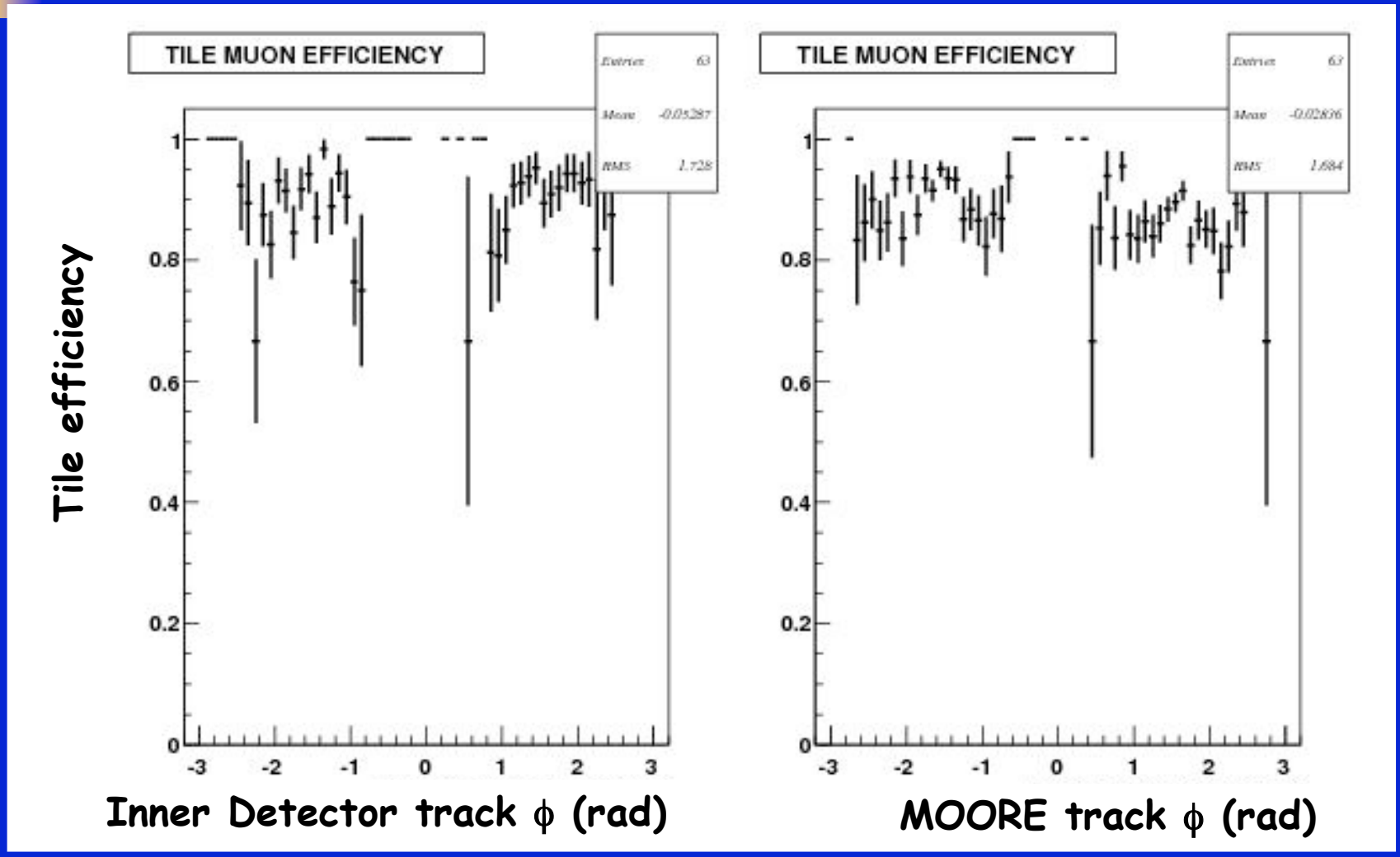


Combined monitoring

Inner Detector: T.Vu Anh
LAr: F.Spano
Tile: L.Fiorini
Muons: M. Woudstra

- In addition to the sub-detector monitoring tools integration.
  - A new package has been created to add the combined monitoring tools in DataQuality/DataQualityTools
- Primary goals:
  - Check if detectors are synchronized by looking at:
    - ROD BCIDs and LVL1IDs (DONE)
    - Reconstruction efficiency of each sub-detector (DONE)
    - Correlations in space between ID tracks, Muon System tracks and Calorimeter muon objects.
  - Check the trigger quality, i.e. purity of the trigger
- Event displays are also essential as part of monitoring:
  - Atlantis
  - Persint (not including Inner Detector)

Combined monitoring of simulation

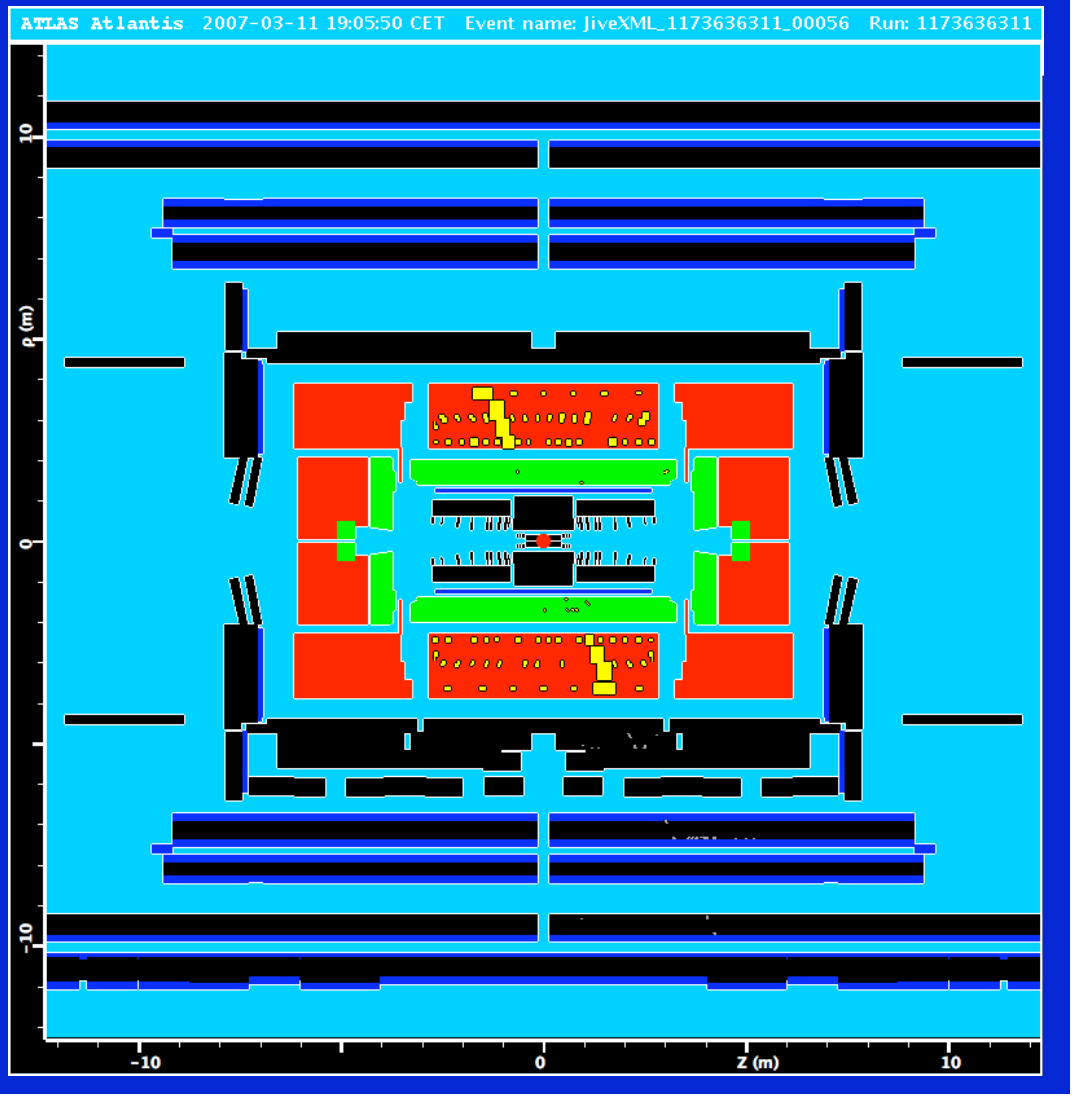


First results from the efficiency monitoring tool. Acceptance effects are under study.

Reconstruction with real data

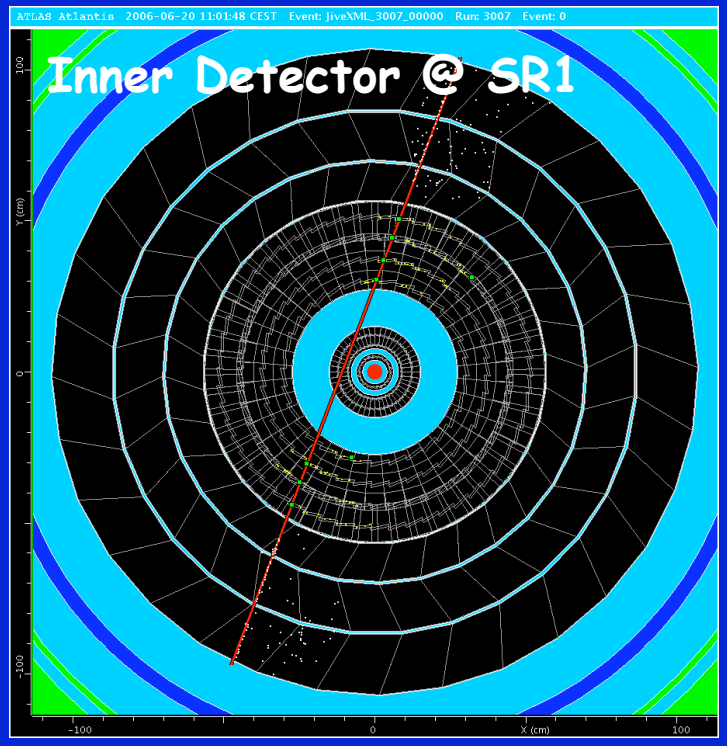
M2 data: LAr, Tile, MDTs and RPCs in sector 13

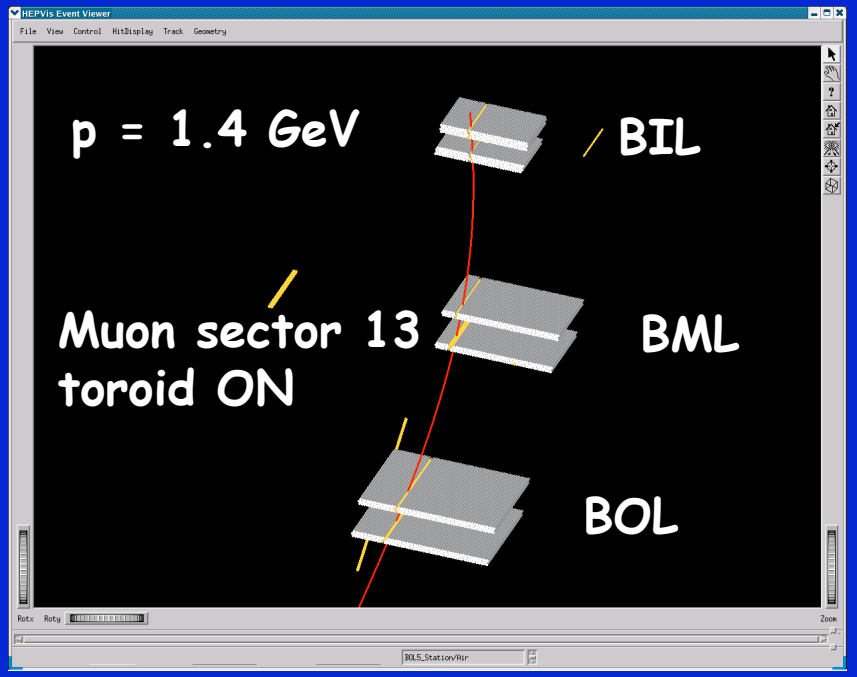
- M2 data was used to test the reconstruction with real data before M3:
  - Conditions data had to be migrated to COMP200 for all systems
  - Problems in RPC BS converters still to be solved in 13.0.10



Reconstruction with real data

Previous to M2 data: Tests with global chi2 fitter for ID and Muons





Combined fits with real data might be done next week with TRT, MDTs and RPCs

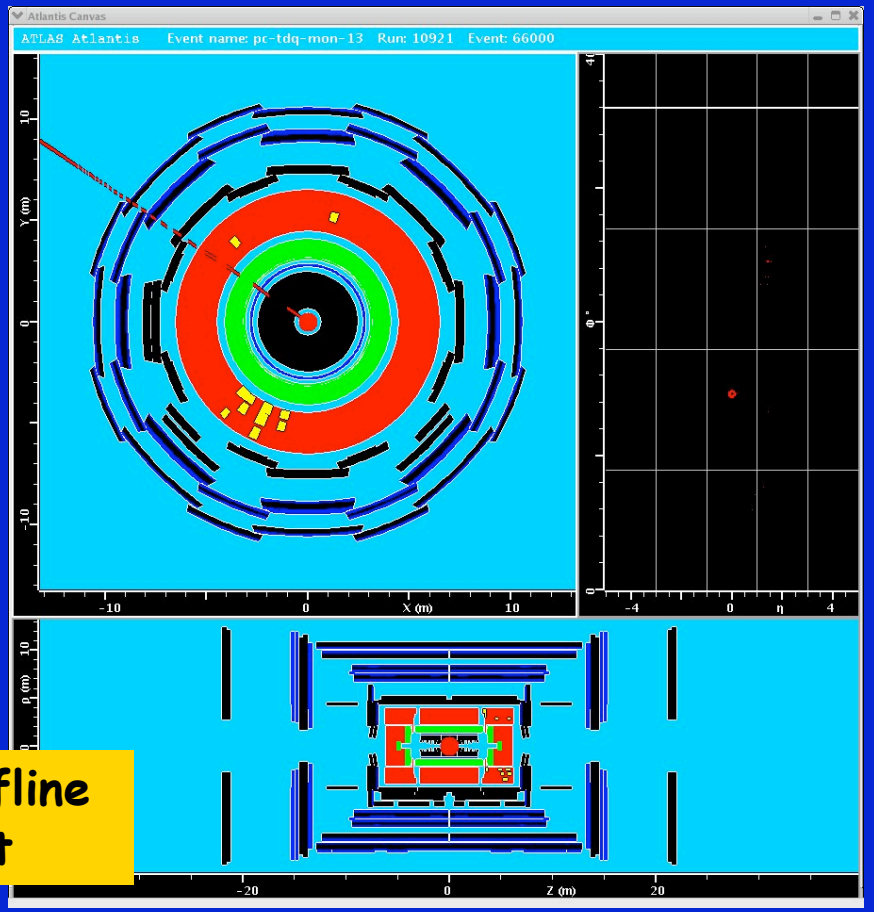
M3 reconstruction status

Data available

- **Combined cosmics data already taken with: LAr, Tile and MDTs barrel and endcap sectors**
- **Integration of RPCs, TRT, TGCs, (SCT DAQ) coming up**

Online reconstruction in AthenaPT at Point 1 with 12.0.5-COS-1

- A HLT release 12.0.5-COS-1 has just been installed at point 1 to allow for an online event display in Atlantis & HLT tests (13.0.10 incompatible with TDAQ 1.7).
- Test with Tile reconstruction successful.
- Work in progress to get it running also with MDTs and LAr.



Thanks to the monitoring working group, offline and HLT release managers for their support

M3 reconstruction status

Offline reconstruction at the Tier 0 with 13.0.10

Close collaboration with Tier-0 monitoring and data quality groups

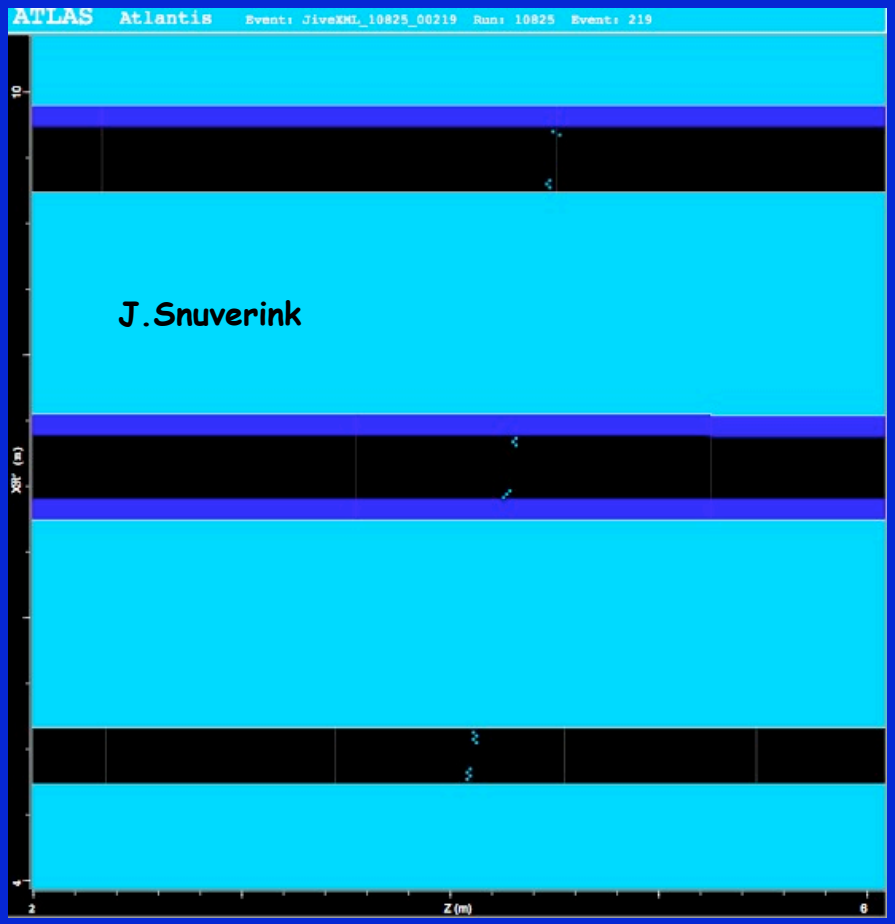
- Goal is to run the full reconstruction and monitoring chain at the Tier-0 producing as output:
  - Monitoring histograms → Merge them for a given run and send them to a web accessible at Point 1
  - CBNT ntuple
  - ESD
- If feasible, monitor the Tier-0 reconstruction using Atlantis
- Right now, checking the reconstruction and data out of Tier-0

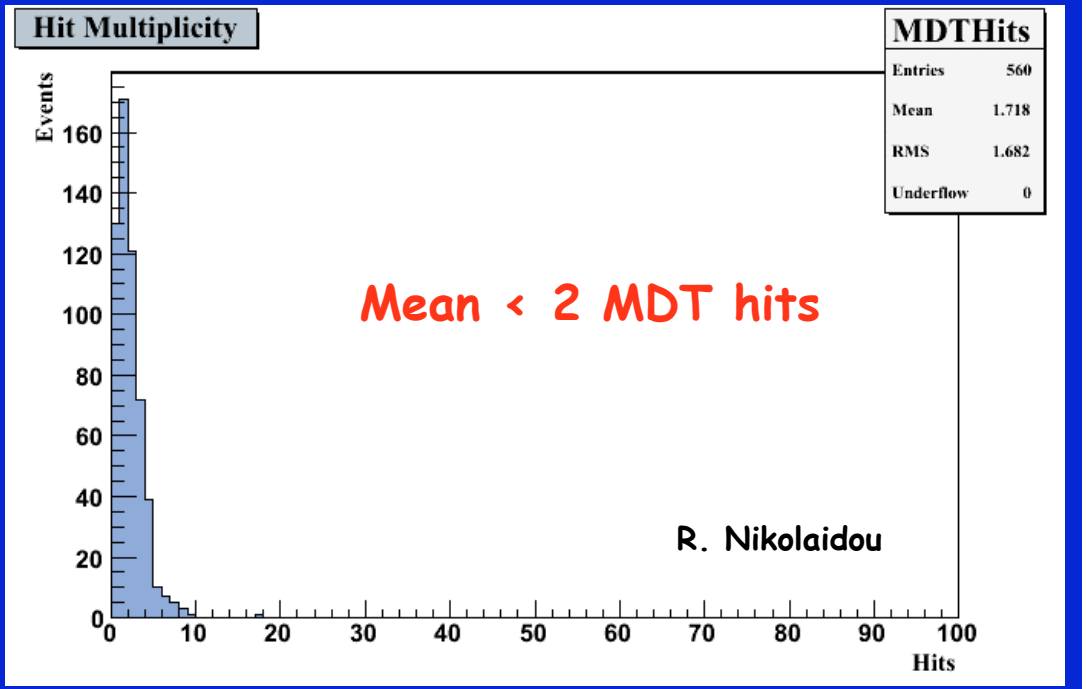
M3 reconstruction status

- Results of the first analysis are uploaded to a virtual agenda:

http://indico.cern.ch/conferenceDisplay.py?confId=17130

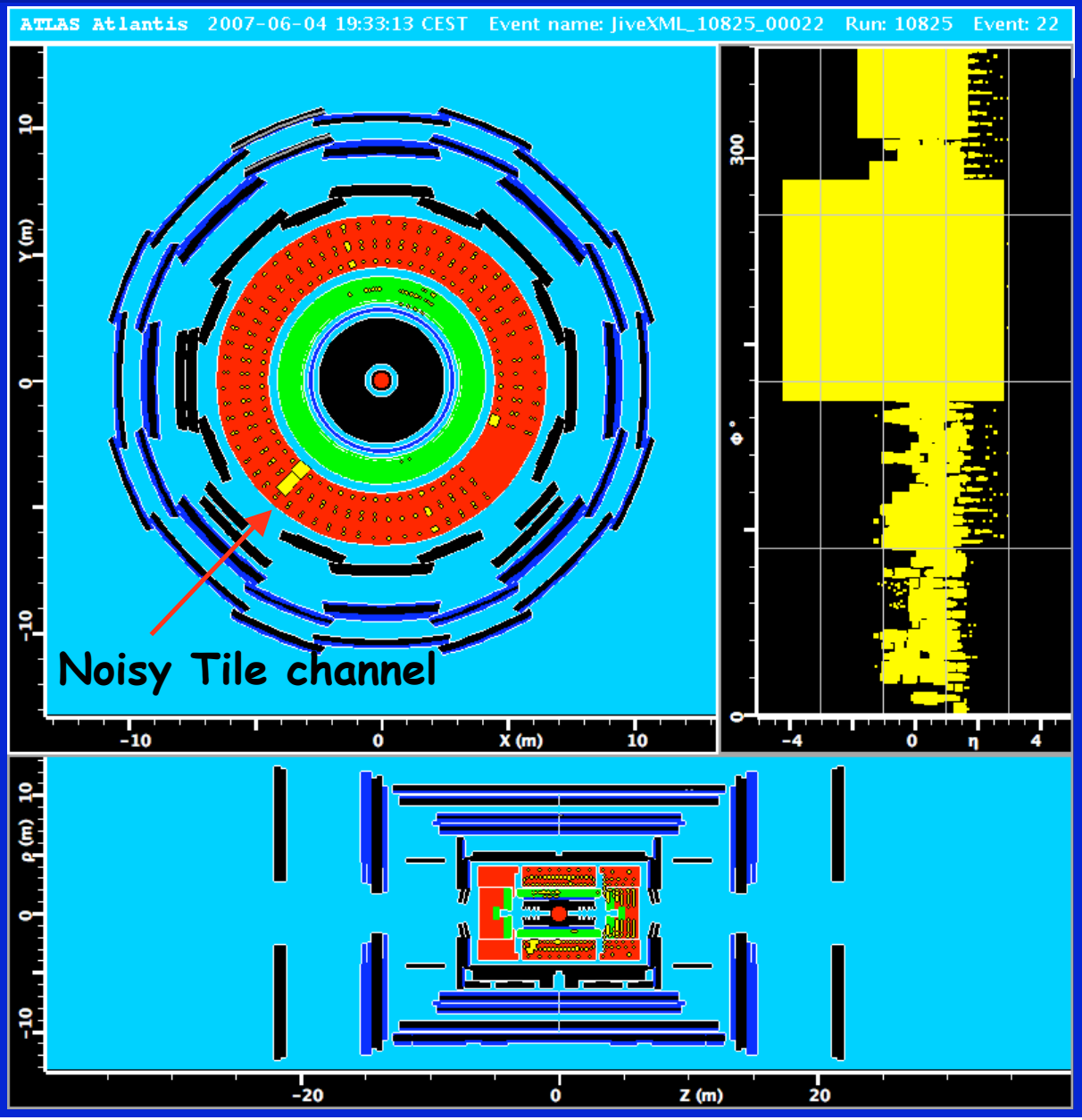
  - Slides concerning calorimeter checks (A.Gibson)





Nice MDT event
But usual number of MDT hits is small
(small acceptance of MDT barrel sectors)

M3 reconstruction status



Conclusions

- A lot of progress has been done in the last months to get ready for M3 (taking place now) in 13.0.10:
  - A combined simulation has been put in place and first production done
  - A combined reconstruction & monitoring chain is in good shape for simulated data (still some work on going as for combined tracking)
  - Starting to test with real M3 data (RPC cabling missing, …) and running at Tier-0 will start today.
- A recent effort has been done to provide in addition a minimal combined reconstruction with 12.0.5 COS to run online monitoring during M3.
- Thanks to all people contributing to this effort and apologies if I did not mention work on some areas.