ATLAS Software Status and Plans

Computing System Commissioning Goals:

- We have defined the high-level goals of the Computing System Commissioning operation during 2006 were defined
  - Formerly called "DC3"
  - More a running-in of continuous operation than a stand-alone challenge

- Main aim of Computing System Commissioning will be to:
  - test the software and computing infrastructure that we will need at the beginning of 2007:
    - Calibration and alignment procedures and conditions DB
    - Full trigger chain & Monitoring
    - Event reconstruction and data distribution
    - Distributed Data Management
    - Distributed Production (Simulation & Re-processing)
    - Distributed access to the data for analysis

- At the end of 2006
  - a working and operational system, ready to take data with cosmic rays at increasing rates

ATLAS Software towards Release 12

- Updating dead material
  - Cables, services, barrel/end-cap cracks, etc.
- Define reference coordinate systems
  - GLOB=installation survey, SOL(t), BEAM(t)
- Realistic B-field map taking into account non-symmetric coil placements
  - B-field map size issues…
- Displace detector (macro)-pieces to describe their actual positions
  - E.g. EM barrel axis 2mm below beam line and solenoid axis
- Include detector "egg-shapes" if relevant
  - E.g. Tilecal elliptical shape if it is has an impact on B-field…
- Mis-align detector modules/chambers inside macro pieces
- Include chamber deformations, sagging of wires and calo plates, etc.
  - Probably at digitization/reconstruction level
- Exercise the conditions database access and distribution infrastructure
  - With COOL conditions database, realistic data volumes and routine use in reconstruction
  - In a distributed environment, with true distributed conditions DB infrastructure
    - Athena support for conditions data reading / writing / iteration
    - Reconstruction using conditions database for all time-varying data
- Largely assuming required samples are available and can be selected
- But also want to look at initial 2007/2008 running at low luminosity
  - Selecting events from the 'initial realistic data sample'
  - Issues of streaming – using calibration and physics data

ATLAS Software towards Release 12

- Simulation
  - Ability to simulate a realistic, misaligned, miscalibrated detector
- Geometry description and use of conditions DB in distributed simulation and digitisation
- Reconstruction
  - use of calibration data in reconstruction
  - ability to handle time-varying calibration
  - Initially: static replication of conditions database – parameters in advance
- Calibration algorithms
  - Algorithms in Athena, running from standard ATLAS data (ESD, raw data?)
- Organisation and bookkeeping (run number ranges, production system,…)
- How do we ensure all the conditions data for simulation is available with right IoVs?
- What about defaults for 'private' simulations ?

Calib / Align subdetector parameters

SCT/Pixel	Alignment, dead/noisy channels, module distortions, pixel calib/thresholds
TRT	Module align., wire position, t_0, R-t, dead channels, resolution, efficiency
LAr	Electronics calibration, HV, cluster level corrections, dead material, misalignment
HEC	(Focus on energy/eta parameterisation)
TileCal	CIS calibration, cesium calibration, optimal filter coefficients
MDT	t_0, R-t, alignment corrections, temperature/field/sag/space charge corr^n
RPC	Pressure/temp, thresholds, HV/LV, currents, dead strip/efficiencies map, trig coinc.
CSC	ADC to strip charge, chamber alignment
TGC	Timing, delays, chamber alignment

Releases Schedule

- **Scheduled for 18 April 06**
  - A between Release 11.5.0 (4 April 06)

- **Primary goals**
  - Complete implementation of as-built geometry for all detectors
  - Conditions DB infrastructure in place and significant usage of COOL
    - Includes new COOL functionality (requires ROOT5)
  - Trigger AOD EDM in place
  - Implementation of MC Truth Task Force Recommendations
  - Implementation of Event Tag Working Group Recommendations
  - New Tracking validated and performance equal or better than alternatives
  - Backwards compatibility support in place for simulated data

- **Platforms and Compilers**
  - SLC3 with gcc 3.2.3 : is the only ATLAS supported OS/compiler
  - SLC3/gcc 3.4.4 will be added in the next few days
  - First in 32-bit mode (goal for release 12 in March)
  - Then in 64-bit mode ("functional but not validated" for release 13 in July)
  - Highly likely that SLC4 will be CERN supported platform for LHC turn on
  - CERN support for SLC3 until end 2006
  - ATLAS support for SLC3 at remote sites longer (need to decide until when)
  - Porting to SLC4/gcc 3.4.4 will start soon

MuonSpectrometer Geometry

Cleaning strategy (for Barrel / Endcap sector):

- We are building separately B(E)IL, B(E)IS, B(E)ML, B(E)MS, etc. with a veto in the MuonGeoModel chamber build() method (in MuonDetectorFactory001.cxx)
- Each station type represents **the unit** which one should care of clearing
- When two units are cleared, we put them together and clean the overlaps between them

This way, we will proceed for all the stations, last will be the feet

Configurations

- Release 10.4.1-11.1.0-11.2.0
- Layout “Rome-Final” , “MuonR0101.Initial”
- cmt version v1r18p20050501

HowTo on the MuonGeometryDC3 Wiki page

https://uimon.cern.ch/twiki/bin/view/Atlas/MuonGeometryDC3

which can be reached from the MuonSpectrometerSimulation Wiki Page

- https://twiki.cern.ch/twiki/pub/Atlas/MuonGeometryDC3/HowToDoClashBusting.htm

General Overview of Cleaning Status

So far, analyzed all barrel and endcap stations:

- **remaining clashes in the barrel-region**
  - https://twiki.cern.ch/twiki/bin/view/Atlas/MuonGeometryDC3#Barrel_Section
  - Most of the problems arise from conflicts between dead materials and chambers
    - **no misplacements or wrong size of chambers or inert materials, but just mother volume definition for the chambers.**
    - **soon a proposal from Vakho and Andrea about how to avoid the definition of a station mother volume**
  - Chambers, i.e. wires and strips are cross-checked with Amdc
    - We'd like to have similar cross check mechanism for dead materials

- **remaining clashes in the endcap-region**
  - https://twiki.cern.ch/twiki/bin/view/Atlas/MuonGeometryDC3#EndCap_Section
  - There are four major-problems in the end-cap within all chambers:
    - **Support-Structures extending the Station-Volume**
    - **Clashes between the Support-Structures**
    - **Drifttubes extending the chambers**
    - **The Usual MuonSys?-Promblem**
    - Detailed Report
    - https://twiki.cern.ch/twiki/pub/Atlas/MuonGeometryDC3/Clashes_mschott_EEEO.pdf

Goals for DC3 Rel 12.0.0

- ***Muon versions for DC3:***
  - *Goal: Muon spectrometer "as built" (more realistic...)*
  - *Muon Detector description: parameters from AMDB (activ & Dead)*

- *Version R : Symmetric description (more or less validated) (see previous slides)*
  - *MuonSpectrometer-R-01-01.Initial : muon tag in Oracle DB*
  - *Barrel/Endcap clash free for activ/activ part*
  - ***Full offline chain up to the RDO production tested for layout***
    - ***'Muon-R-01-01.Initial' (ATLAS-DC3-03)***

- ***Version R´:*** *egg shape description (7mm maximum for sector5)*
  - *MuonSpectrometer-R-01-01-initial_EGG: muon tag in Oracle DB*
    - *R' (should not be a problem)*
    - *soon in the pipe (11.4.0)*

- ***Version R":*** *egg shape + chambers shifted (~1mm) & tilted(~1mrd) randomly*
  - *MuonSpectrometer-R-01-01-initial_EGG_RNDM : muon tag in Oracle DB*
  - *R" problems expected due to the misalignement input*
  - but this version do not take into account
    - dead matter in forward region (big wheel)
    - tilt & shift of the big wheel and forward chamber as in the barrel
- ***Work in progress to test at Geometry & Simulation level R' and R''***
  - ***R already in the pipe(11.3.0)***
  - ***R' should be tested & validated before end of Feb (11.4.0)***
  - ***R" should be tested & validated before end of March (12.0.0)***

“As built” Muon Spectrometer geometry for the simulation

End Caps: Big wheels global displacements

Proposed simple set of displacements:

ECA
- EM wheel: $\delta x = 1mm$, $\delta y = 3mm$, $\delta z = 2mm$, $\delta\theta_z = 2mrad$
- EO wheel: $\delta x = -2mm$, $\delta y = -1mm$, $\delta z = -10mm$, $\delta\theta_z = -1mrad$, $\delta\theta_x = 1\ mrad$

ECC
- EM wheel: $\delta x = -1mm$, $\delta y = -3mm$, $\delta z = -2mm$, $\delta\theta_z = -2mrad$
- EO wheel: $\delta x = 2mm$, $\delta y = 1mm$, $\delta z = 10mm$, $\delta\theta_z = 1mrad$, $\delta\theta_y = 1\ mrad$

No EI and TGC wheels displacements

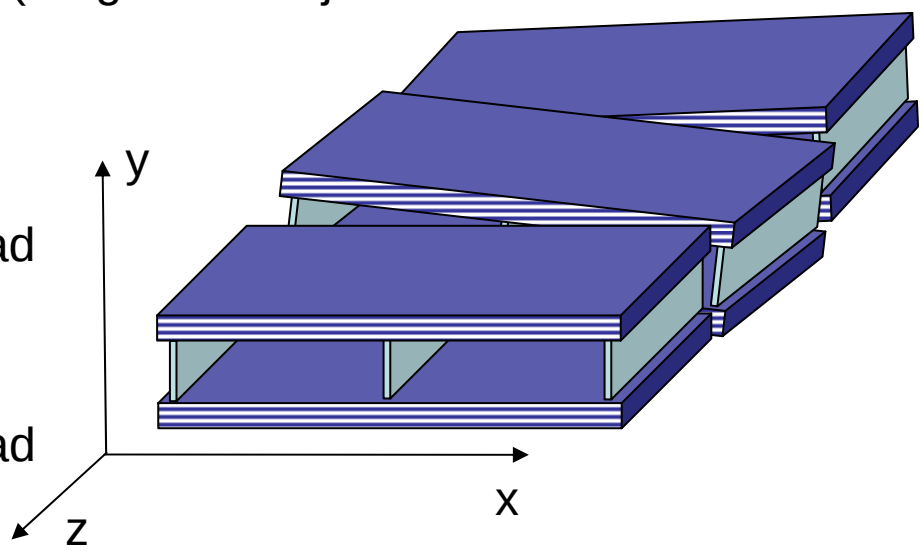
=> Layout Version R’ to be implemented in version 11.4.0 (clash free)

“As built” Muon Spectrometer geometry for the simulation (cont’d)

If clashes elimination at GeoModel/Geant4 level can be worked out (not guarantied to be ready for CSC production):

Random chamber displacements (ranges are adjusted to minimize the risk of clashes):

barrel	Δz = +- 1mm	$\Delta\theta_z$ = +- 2mrad
	Δx = +- 4mm	$\Delta\theta_x$ = +- 2mrad
	Δy = +- 4mm	$\Delta\theta_y$ = +- 0.5 mrad
EC	Δz = +- 1mm	$\Delta\theta_z$ = +- 1mrad
	Δx = +- 4mm	$\Delta\theta_x$ = +- 2mrad
	Δy = +- 2mm	$\Delta\theta_y$ = +- 0.5 mrad



=> Layout Version R’’ to be implemented in version 12.0 (Not guarantied to be clash free!)

Cavern Backgound for CSC Samples

- In the CSC Samples the CB simulation will still be "à la DC2"
  - evtgen files produced with Geant3/GCALOR (P.Nevski) from 'old' pregenerated fluxes provided by the Radiation Task Force (M.Shupe)
  - Recorded when crossing "scoring volumes" (SV)
  - Kine information converted to HepMC/POOL (A.Nairz, NB)
  - Produced with different safety factors already at the generation level
- Simulation, digitization, reconstruction will be performed by the Central Production
  - Cuts in range for the simulation tuned to track low energy particles

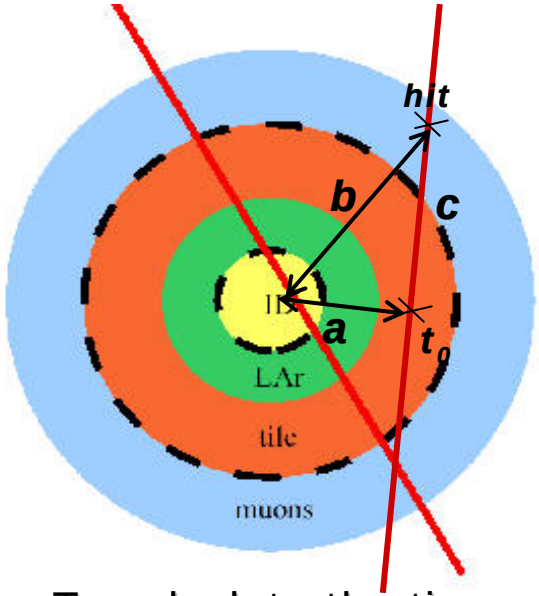
Known problem: slight multiple particle counting due to neutral particles crossing more than one SV

  - An expected mean factor no larger than two with respect to the nominal fluxes

This is the best CB approximation available for the moment

  - Used in the recent past by the reconstruction and trigger muon groups
  - Work will be done to improve the present model

Muon System Simulation for Offline Commissioning with Cosmics



- Proposal to define t_0 as the time to the closest approach of the cosmic track to the (0,0,0) vertex
  - Each track has its own t_0 which should be the same for all the subdetectors
- In this scheme the time of flight is the distance of the hit w.r.t the t_0 point

- To calculate the time of flight for the cosmics in the simulation, the SensitiveDetector has been modified (in a private version for the moment)
- The digitization windows match with this cosmic tof redefinition
- Some validation samples have been produced
  - Validation efforts in collaboration with the reconstruction people (Stephane W. and Rosy N.)
- When the SD will be fully validated, the SD code will be committed and a large scale production is foreseen
  - Needed by the LVL1 and LVL2 people

Conclusion

- All clashes in Barrel and Endcap region are understood
- Most of them are removed
- The clash-buster and Validation team has made great progress during the last week
  - This is also due to the good collaboration with Steve, Laurent and MuonGeoModel experts
- Wiki-Web-page
  - Restructuring the existing by putting all the necessary info

❑ **Full validation from Geometry to Digits between Releases has started**
  - *Giorgos D. is looking on Geometry*
  - RTT's
  - X0 map
  - Material density for different values in ϕ
  - Positions of chambers
  - 'Eight Points For Our Chambers' to detect overlaps between chambers and between chambers and inert materials by means of Persint

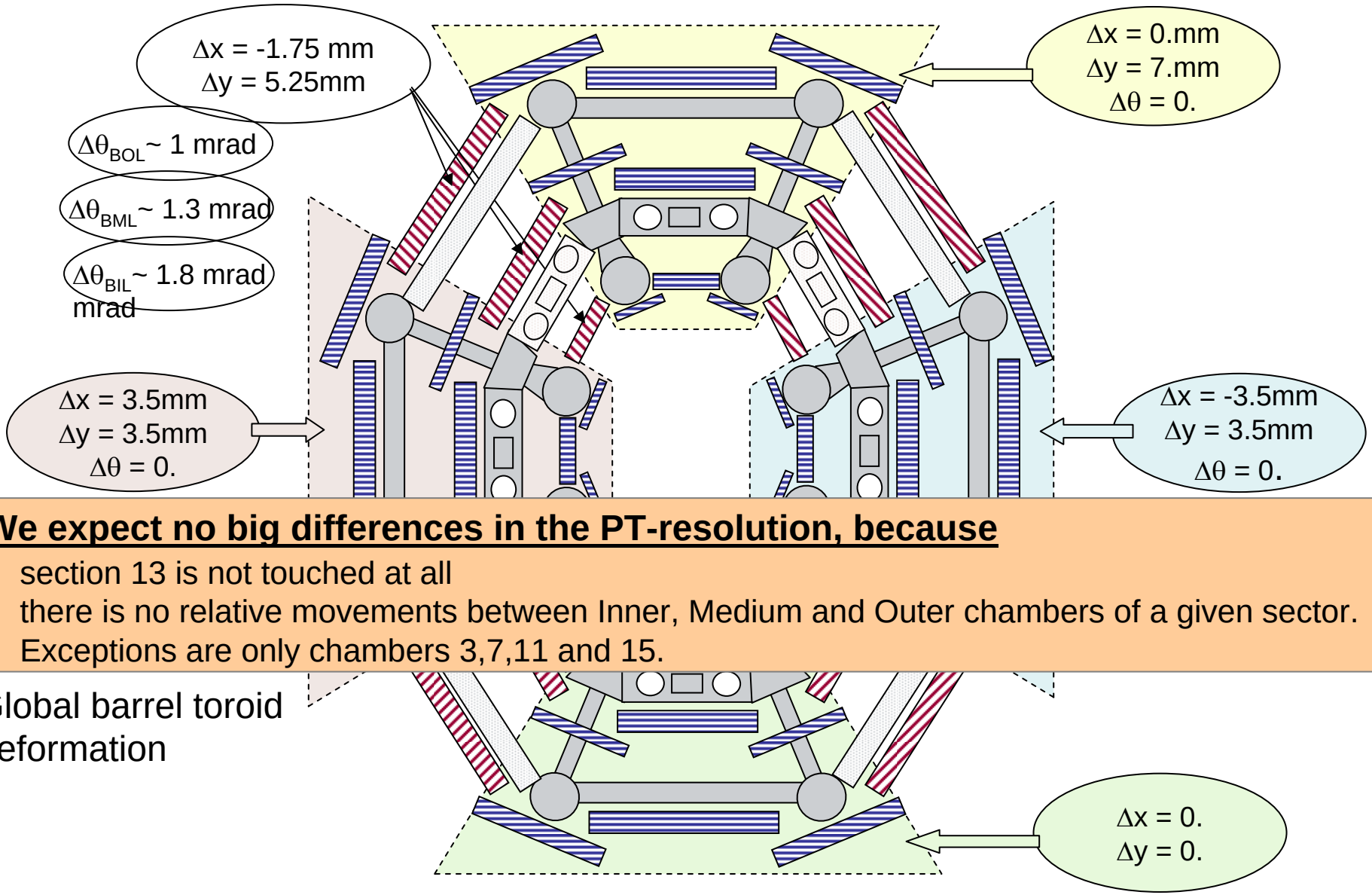
❑ Validation of Egg_shape layout (R') done (Matthias S.)

❑ R' in Oracle for 11.4.0 (?)

❑ R' in MuonGeoModel (?)

❑ **We need time (~2 weeks)** for checks, fixes and possibly some further developments and **(~ 2 weeks)** testing the magnetic field
  - ❑ test of B1, B2, B3 – meshings
    - ❑ (provided(soon) by Laurent)
    - ❑ simulation pt=10,100,1000 GeV
  - ❑ adjustment of the size of the map for the DC3
  - ❑ The idea is to have a big step in the FM calculation therefore we'll have a less detailed map-MF

“As built” Muon Spectrometer geometry for the simulation



We expect no big differences in the PT-resolution, because

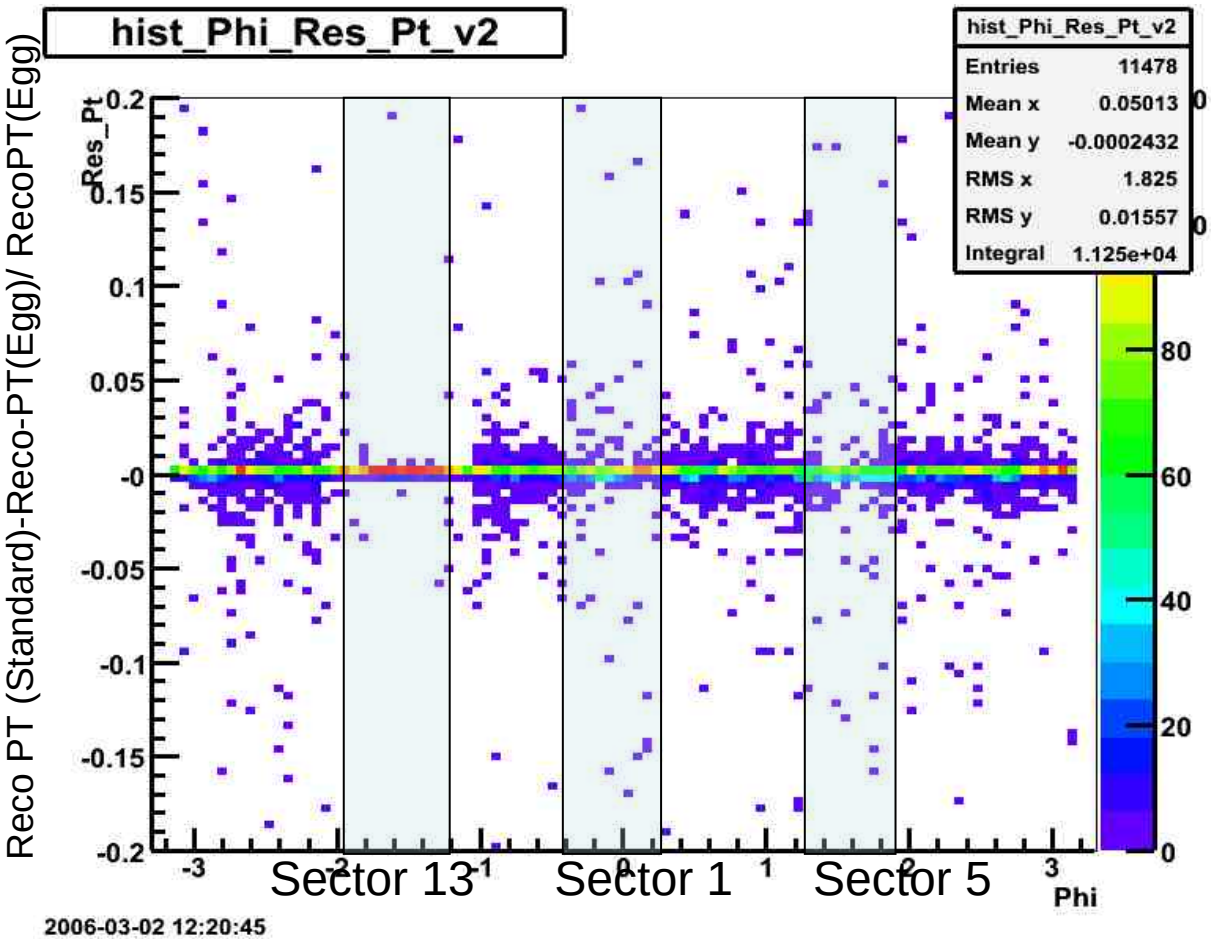
- section 13 is not touched at all
- there is no relative movements between Inner, Medium and Outer chambers of a given sector.
- Exceptions are only chambers 3,7,11 and 15.

Global barrel toroid deformation

M.Schott
NB, L. Ch. J-F.L

Validation of the Egg-Shape Layout

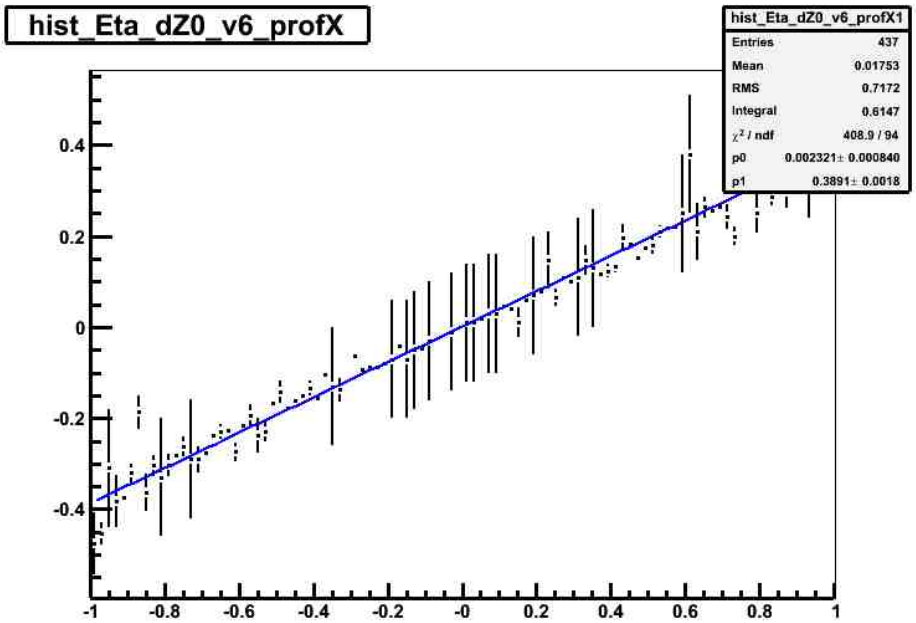
- The Comparison between the Measured PT in the Standard and the Egg-shape-Layout on an **Event by Event Basis** provides a good opportunity to understand the Layout (Following Ideas from Jean-Francois



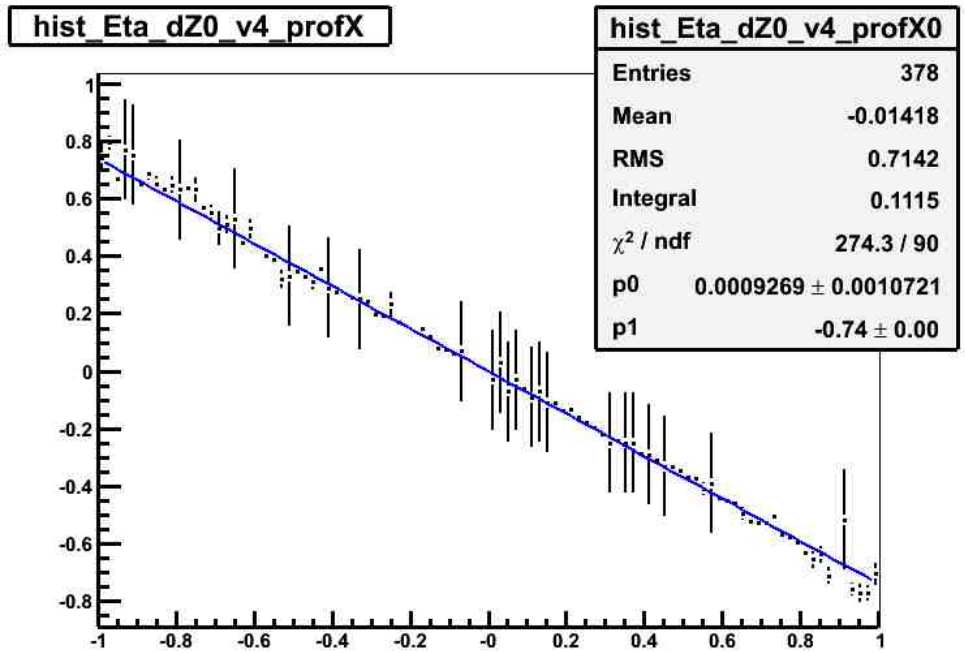
- We expect no effect on the pT-Resolution for Sector 13: **OK**
- We expect very small effects on the pT-Resolution for Sector 1 and 5 and 9: **OK**
- We expect visible and identical effects for Sector 11 and 13 and Sector 3 and 7: **OK**

Validation of the Egg-Shape Layout

- Comparison between Impact-Parameter Z0 vs Eta on an **Event by Event Basis** provides a good opportunity to check the 7mm and the 3.5mm shift



- Sector 1: The line should start at -3.5mm and end at 3.5mm: **OK**



- Sector 5: The line should start at 7mm and end at -7mm: **OK**

Others Sectors have been checked too.

Validation of the Egg-Shape Layout

- Comparison between Parameter L0 vs Phi on an **Event by Event Basis** provides also a good opportunity to check the shifts
- L0 = dPhi0 * Distance + R0, where
  - dPhi0= Phi_StandardLayout – Phi_EggShapeLayout
  - Distance = the Distance from Middle RPC to Interaction Point or Distance from Outer RPC to Interaction Point
  - R0 = Sqrt (X^2 + Y^2), where X,Y=Impact-Parameters

Sector	dPhi*	dR0*	Distance M	Distance O	L0 with (M)	L0 with (O)	Expected [mm]
1	-0,000270	-1	7100	9800	-2,917	-3,646	-3,5
3	-0,000300	-1,5	7100	9800	-3,63	-4,44	-4,9
7	0,000280	1,7	7100	9800	3,688	4,444	4,9
9	0,000250	1,4	7100	9800	3,175	3,85	3,5

  - *Gaussian Fit-Error 10 %
  - Everything look fine ! (Other Sectors have been checked too)