MTCC :offline software reports status & perspectives

MU DTChambers and electronics- 20 June `06

A.T.Meneguzzo (*), Univ. di Padova & INFN Padova

- Runs
- MTCC data analysis in the New CMSSW s/w integration status
- Data Analysis

Runs

- *DTTF trigger rate (at least 2 DT chamber) : ~ 10-100 Hz depending on quality trigger and sector*

- **No magnetic Field**

  - **Data for Trigger/DAQ integration checks**
  - **Data for Alignment of chambers in CMS**

    - **NEW**
      Test run for Ros design validation with chamber on and full DAQ chain [with L1A~random (?) : ~50 runs with different ROS configuration] .

- **Magnetic field on**
  - **Data for chambers performance in Magnetic Field**
  - **Data for Alignment of chambers in CMS in Magnetic Field**

Back up slide: Magnetic field Bnormal to the chamber: layer 1 SL1 of MB1 of the 3 wheels (fileld map 2001)

Figure 21:

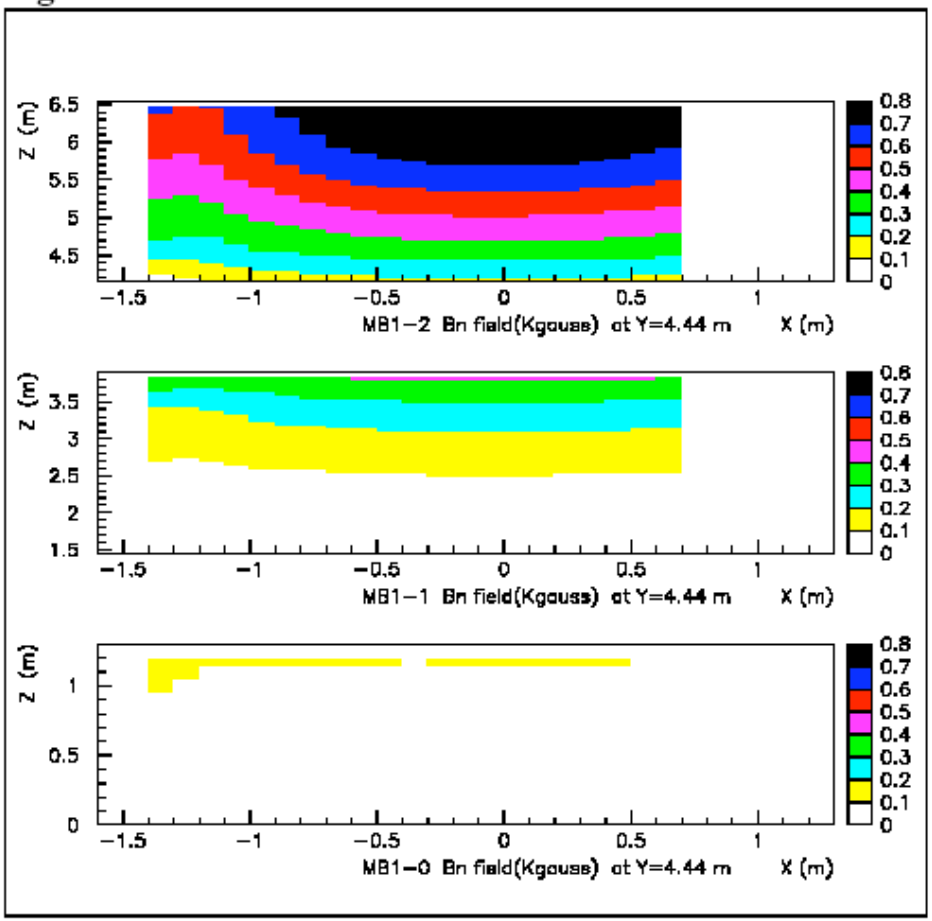


Table 1

U [kV]	B_N [T]	t_{drift}^{max}[ns]	$\bar{v}_{drift}[\frac{\mu m}{ns}]$	$\alpha_L[^\circ]$
	0	351±2	55,6±0,2	
3.3/1.5/-1.5	0.5	356±2	54,7±0,2	10,4±2
	1.0	394±1	49,5±0,2	26,4±2
	0	346±2	56,4±0,2	
3.6/1.8/-1.8	0.5	351±2	55,7±0,2	9,7±3
	1.0	373±1	52,3±0,2	22,4±1

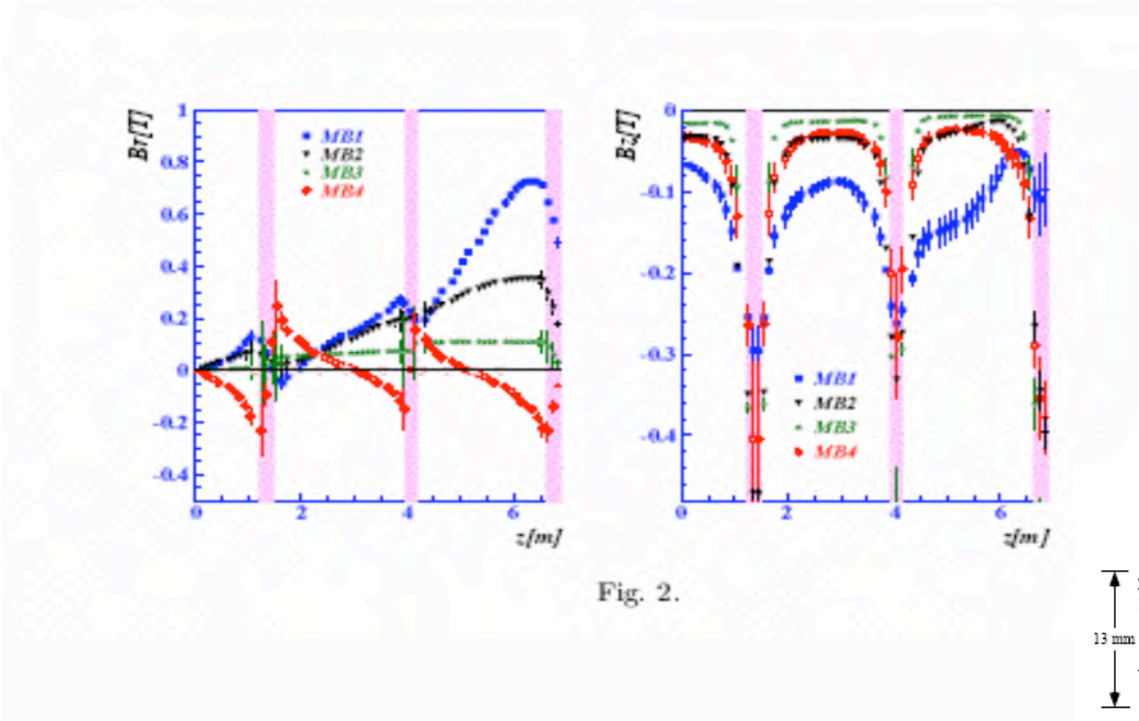


Fig. 2.

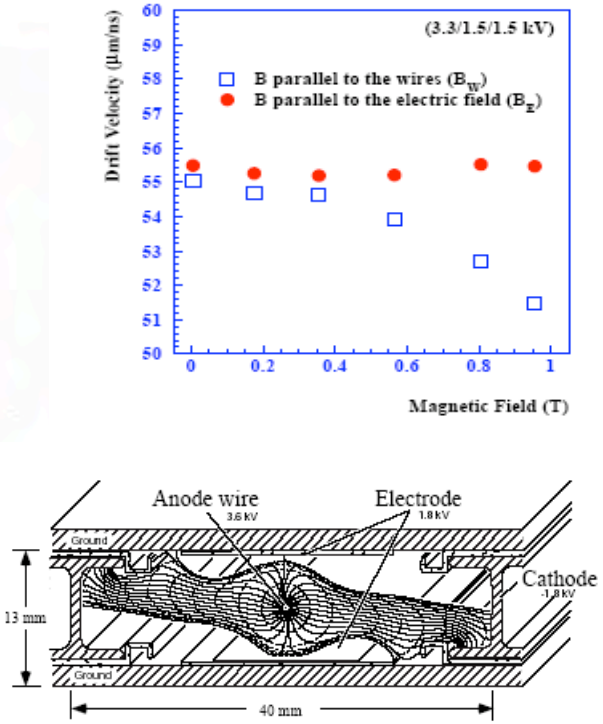


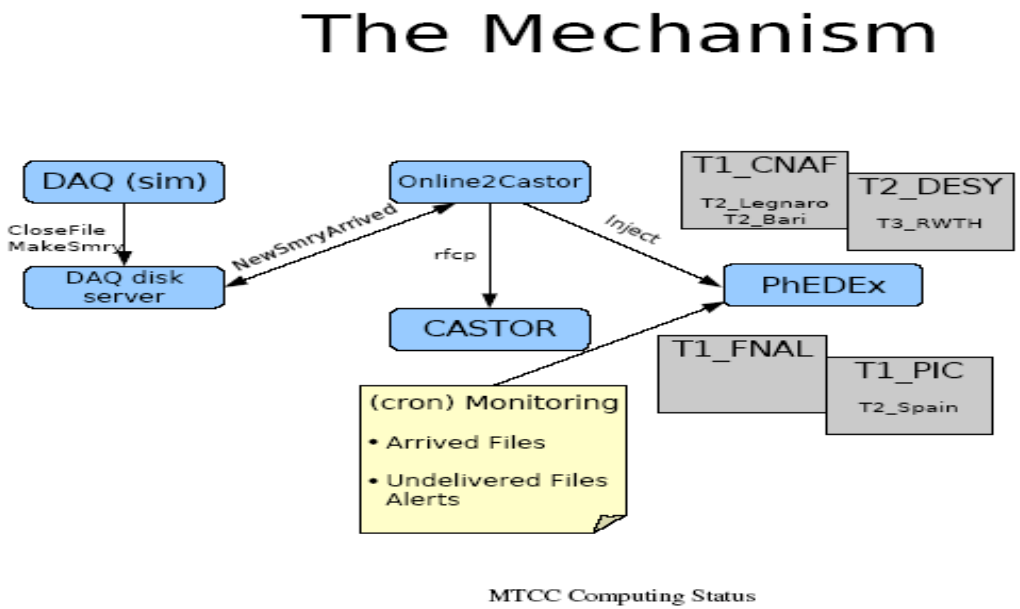
Fig. 3.

Figure 3: Drift lines in a cell of the CMS barrel muon detector under the influence of a magnetic field of 0.45 T parallel to the anode wires. The drift gas is Ar:CO_2(85:15). The anode is a 50 micron diameter stainless steel wire. Top and bottom planes are made of 2 mm thick aluminium sheets insulated from aluminium I beam cathodes by Lexan strips 0.5 mm thick. Two copper strip electrodes 14 mm wide, mylar backed for insulation purposes, improve field uniformity.

How to Access the M… …ta

Slide from PRS mu 30/05/06 and CPT week

- Data are written **at P5 to a DAQ disk server (two for swapping), sufficient for ~8 hours data taking.**
- **Copied to CASTOR. Transferred to IT = TIER0. Tested**
- **Injected to PhEDEx which distributes them to the primary sites (CNAF, DESY, FNAL, T2_Spain) and secondary (fetching data from the primary sites, T2_Legnaro, Aachen, …) Tested with dummy files. PhEDEx deployed.**



- **File with CSC global DAQ data exists at T0. Will be used for a test of event and non-event data between CERN and DESY/Aachen.**

New CMSSW s/w integration

Most recent overviews of the CMSSW s/w integration

- Annual Revue (Ugo Gasparini)
  http://indico.cern.ch/conferenceDisplay.py?confId=3247
  and PRS http://indico.cern.ch/conferenceDisplay.py?confId=3397

- DAQ online software
- DBase usage
- DATA Quality Monitoring
- Muon offline software in CMSSW

- CPT N.Amapane
  http://indico.cern.ch/getFile.py/access?contribId=12&sessionId=2&resId=1&materialId=slides&confId=1526=1&materialId=slides&confId=1526

DT software group developers CMSSW

P.Ronchese, M.Zanetti, S.Lacaprara +..... PD

N.Amapane, G.Cerminara, R.Bellan +..... TO +...

And first users : U.Gasparini http://indico.cern.ch/conferenceDisplay.py?confId=3397

PD

Philip Biallass Aachen

F.Cavallo Bologna

A.M. PD

Monitor/Reconstruction Data base

- DAQ + DCS store information on → OMDS (On-line Man. Data Storage) DataBase
  (hardware + run status +trigger configuration ..see previous talks)
- CMSSW Monitor and analysis DB → ORCON/ORCOFF DataBase

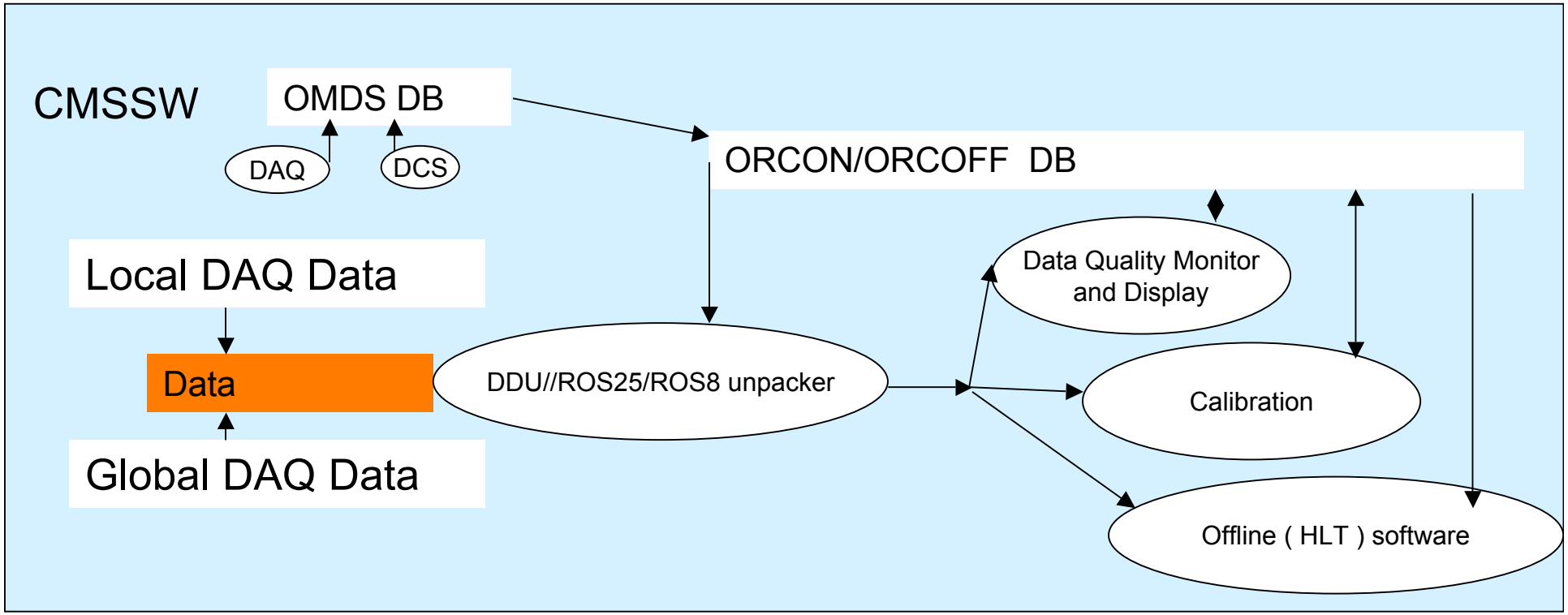
some OMDS DB informations → ORCON/ORCOFF (hardware mapping)
Calibration informations → ORCON/ORCOFF (tTrig , tmax)
dead/noise channels from monitor → ORCON/ORCOFF (status bit)
handled (monitor) feature→ ORCON/ORCOFF (t0i equalization)

- DBase usage CMSSW Monitor and analysis will not have access to the OMDS directly during MTTC

-DATA Quality Monitoring > see next slides

- Muon offline software in CMSSW > see next slides

Data analysis Flow in CMSSW

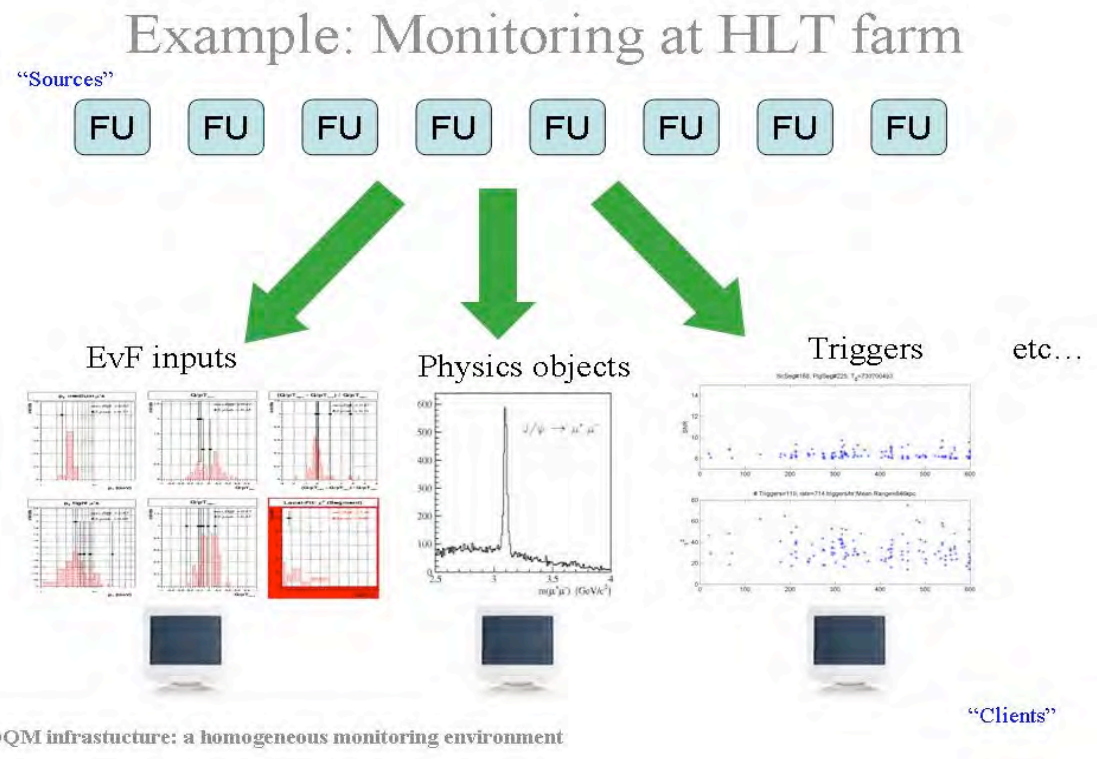


DQM : General Layout

Slide from Annual Revue

CMSSW general DQM framework implementation :

- **Sources:** processes run by the Filter Units, devoted to the production of "MonitorElements"(histograms, string, floats..), i.e. the observables for the diagnostics
- **Clients:** processes run remotely on the user workstation that receives a set of MonitorElements on which perform quality-tests or simply to visualize them



DT DQM Sources

Slide from Annual Revue

- **Test Pulses:**
  - **occupancy of the signals (to check for dead FE channels and DAQ readout per-wire)**
  - **Mean and RMS of the test pulse signal (to be used for per-wire t0-pedestals checks)**
- **Digis:**
  - **occupancy of the signals (i.e. within a predefined time-window)**
  - **occupancy of the noise**
  - **occupancy of the after-pulses (to check for disconnected cathods)**
  - **time boxes (to be used for per-chamber pedestal calibration)**
- **Local Muon Segments (2D and 4D):**
  - **reconstructed hit resolution**
  - **cell efficiency**
  - **segment position (and direction**

Data Integrity: Monitor the read-out boards (ROS and DDU) output, in particular event data consistency (e.g. order and size of the data blocks) and error bits.
Precise definition of the observables **still to be agreed** (hardware just released)

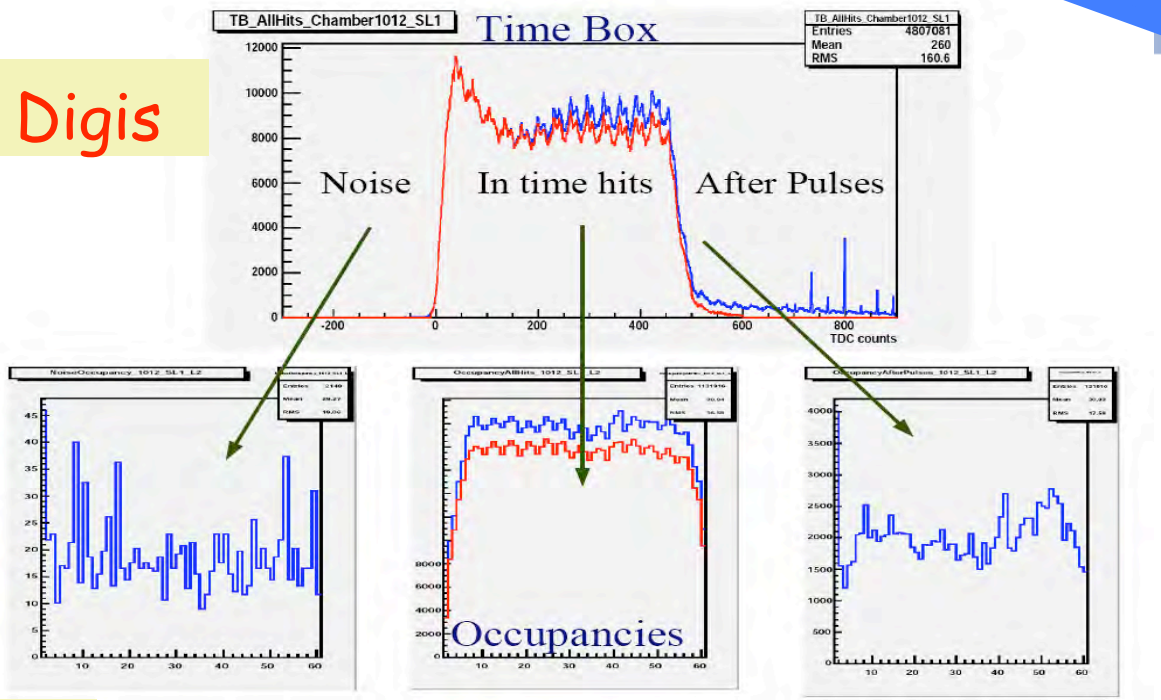
Trigger Objects: Software implementation of the objects **ongoing**

~~Muons tracks from Higher level reconstruction: Software implementation of the~~ objects **ongoing**

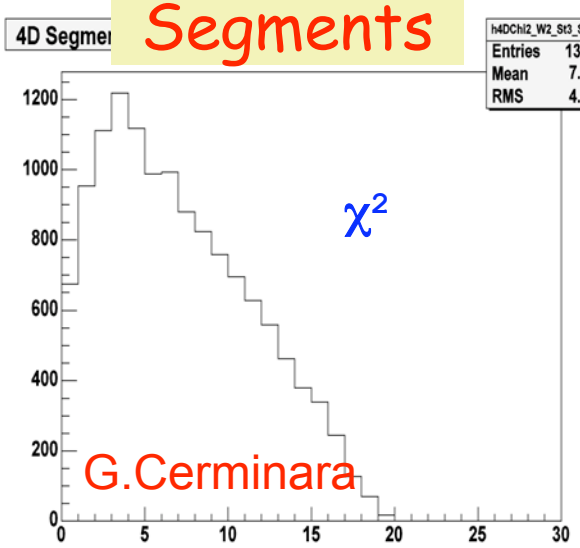
Sources: examples

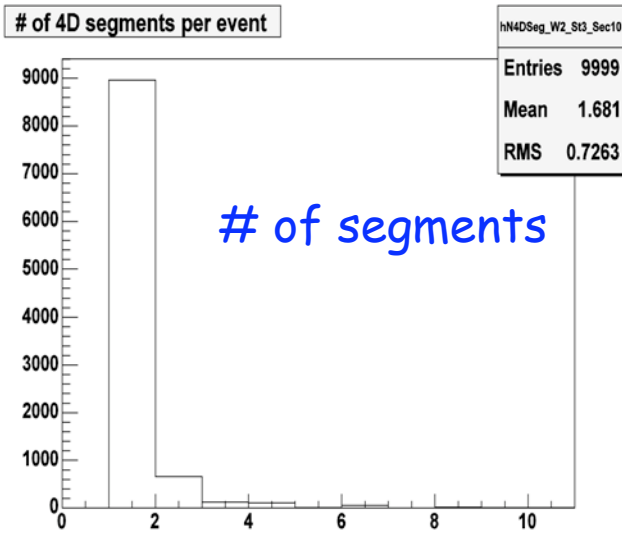
Slide from Annual Revue

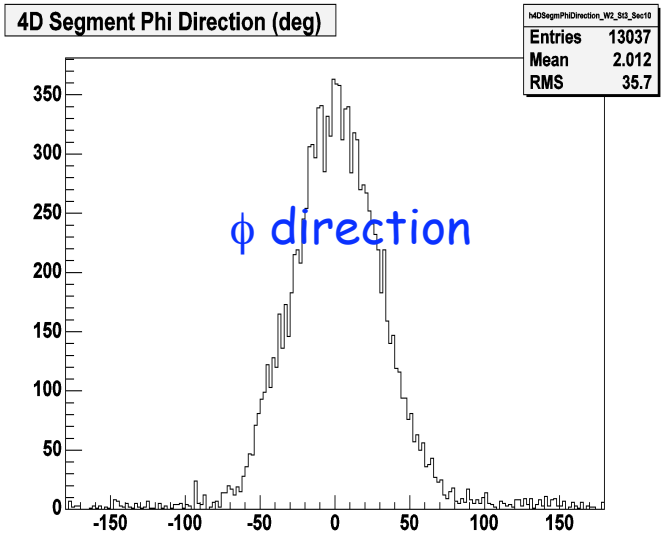
Digis



Segments







Client

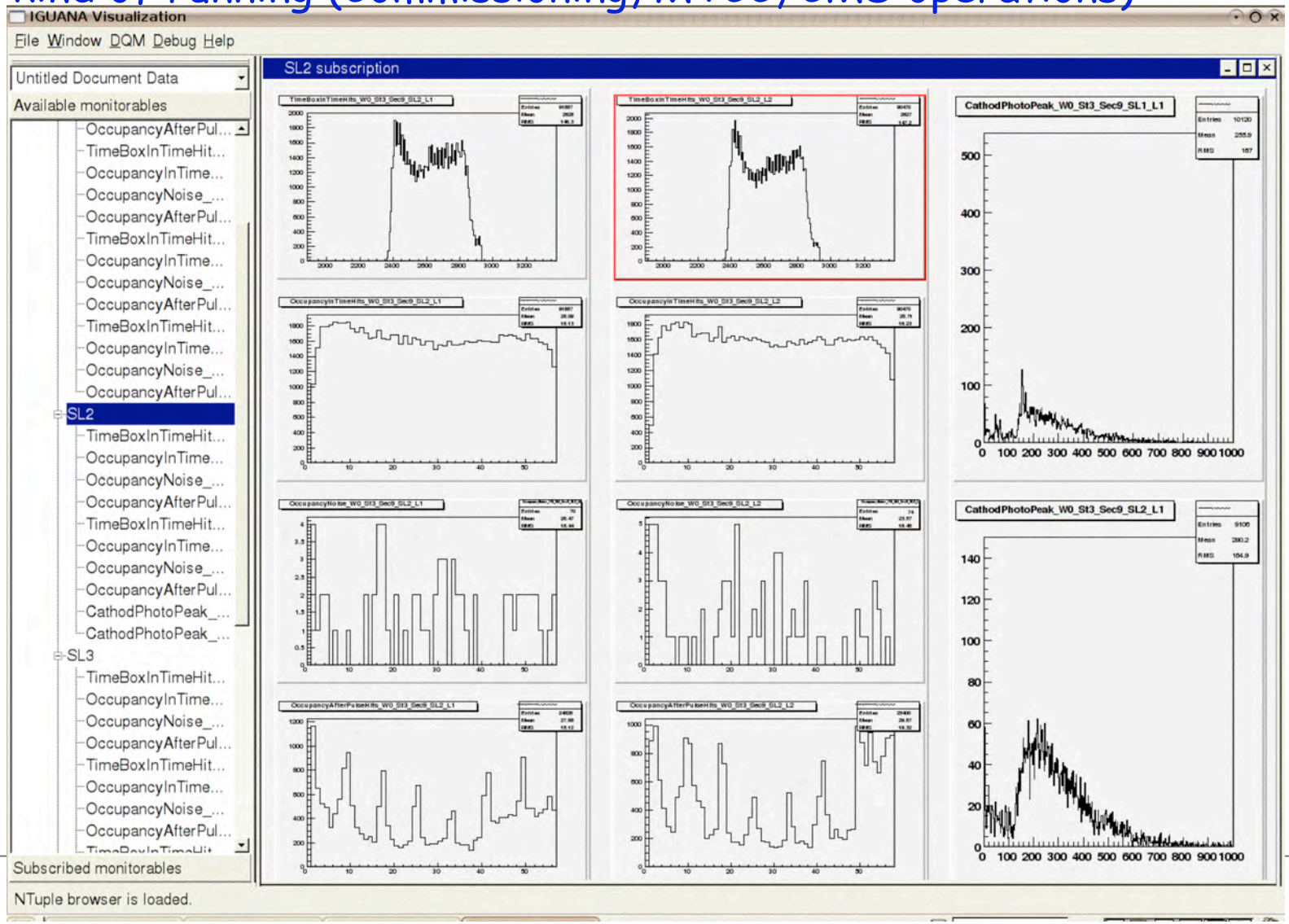
Slide from Annual Revue

- the algorithms for the quality tests to be executed on the sources' MonitorElements are provided centrally and they can be executed in a common web-based tool (WebClient)
- Custom applications have however to be implemented for specific detector needs. They have to be xdaq applications.
- There is not yet the possibility for the client xdaq applications to access non-event data related to the actual data analized (EventSetup). This means in particular that it not possible NOW to access the HLT DataBase (ORC-ON)
- This is a critical issue because:
  - we need references for the quantities measured online (e.g. time-pedestals or average noise per chamber).
  - we need to store the measured quantities for time evolution studies ("history-plots")
- Some standalone (i.e. source and client merged together) applications already exists e.g. to find the noisy/dead channels and to write the pedestals from the test pulses runs. They are good for

DQM: Visualization

Slide from Annual Revue

Iguana used as client for remote visualization. Custom "layouts" for each kind of running (Commissioning, MTCC, CMS operations)



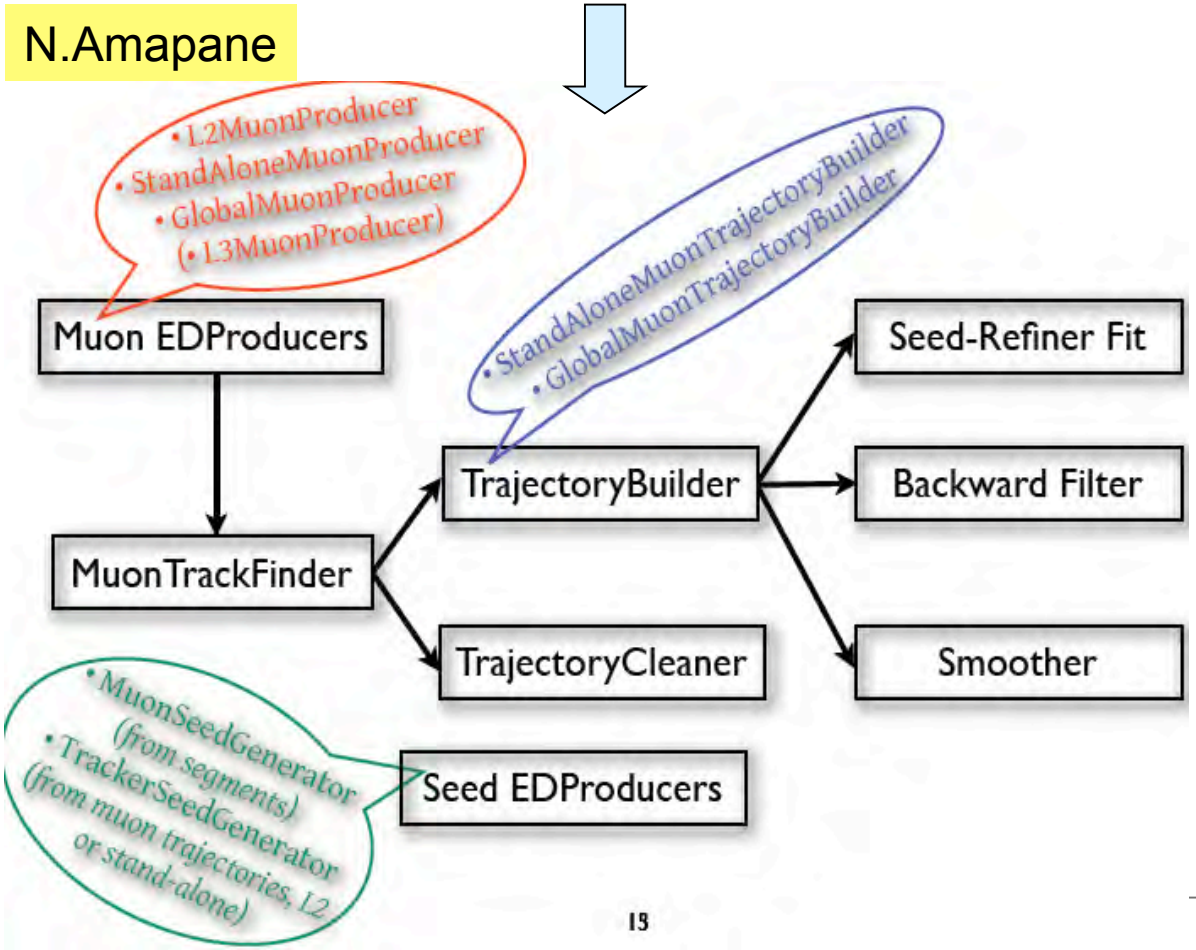
Muon Offline software

Slide from Annual Revue

Offline muon reconstruction code is well advanced in CMSSW:

-Event Data Producers have been defined; basic classes implemented; majority of algorithmic parts already ported from ORCA (with substantial reingeniering) ; Muon Standalone reconstruction almost completed …

N.Amapane



-I'll NOT review this part (higher level objects, of more general interest)

- Rather concentrate on the usage/test of the lower level objects:
  - "nearest" to the detector, mandatory to study/ understand its behavior
  - input to MuonStandAlone/ HLT-L2 reconstructions

Muon offline software in CMSSW

Slide from Annual Revue

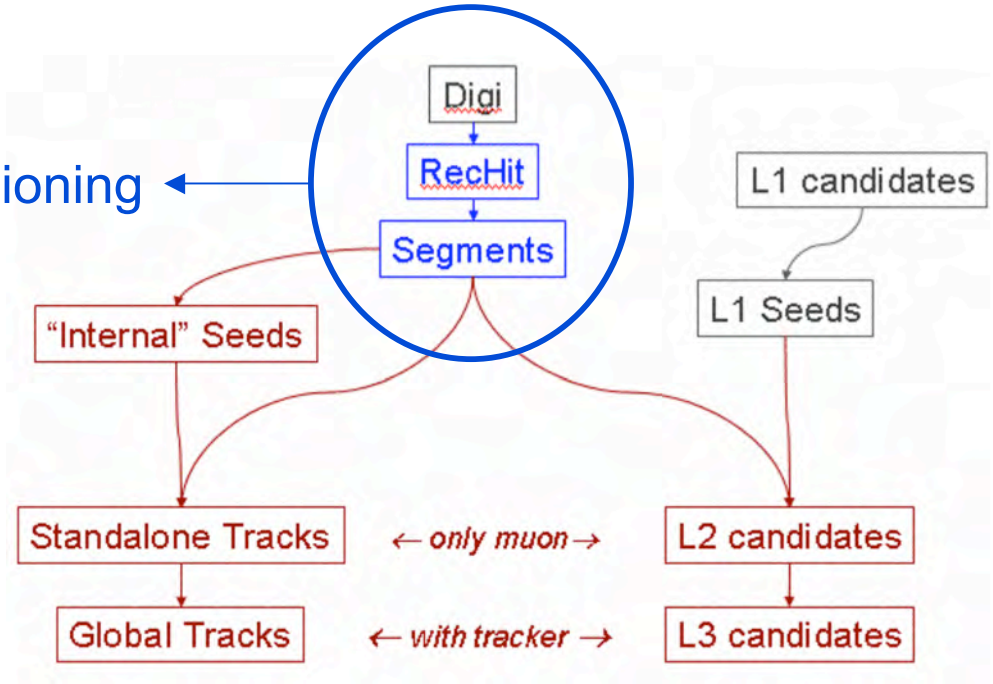
Packages have been developed for:

- accessing/unpacking DT muon raw data (ROS8/ROS25/DDU) formats
- DataBase access to calibration data (time pedestals)
- hit reconstruction
- local segment reconstruction (2D in r-ϕ, r-z views; 3D in space)

in:

CMSSW/IORawData/DTcommissioning

CMSSW/RecoLocalMuon

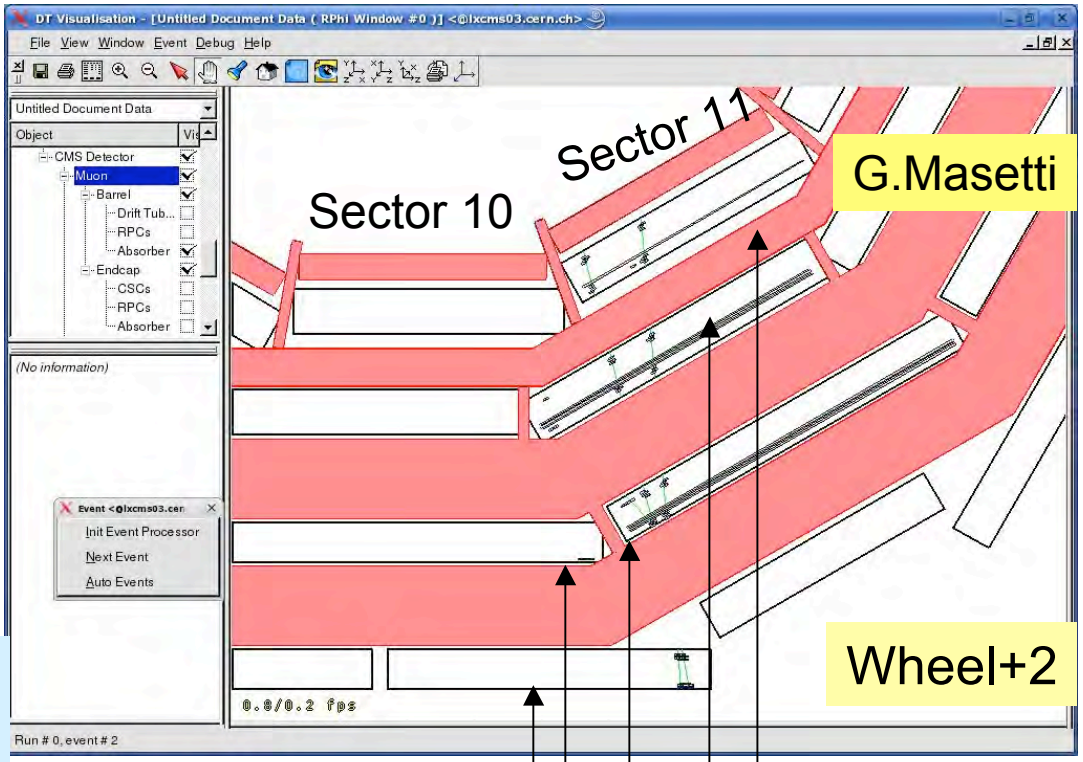


Muon offline software in CMSSW

Slide from Annual Revue

- They have been widely used in analysing first 'sector test' data collected in the past months

- Successful test of readiness for MTCC analysis



IGUANA visualization
of a cosmic event

(sector test run, March'06;

trigger: MB1_sect11 & MB4_sect10)

5 equipped chambers

First DT sector test data analysis in CMSSW

Slide from Annual Revue

Data have been processed with CMSSW , up to:

RecoLocalMuon/DTSegment package

- Data unpacked with ROS8 format (not yet DDU/ROS25 data format available);
- Passed through

dtunpacker,
DTRecHit1DProducer,
DTSegment2DProducer,
DTSegment4DProducer

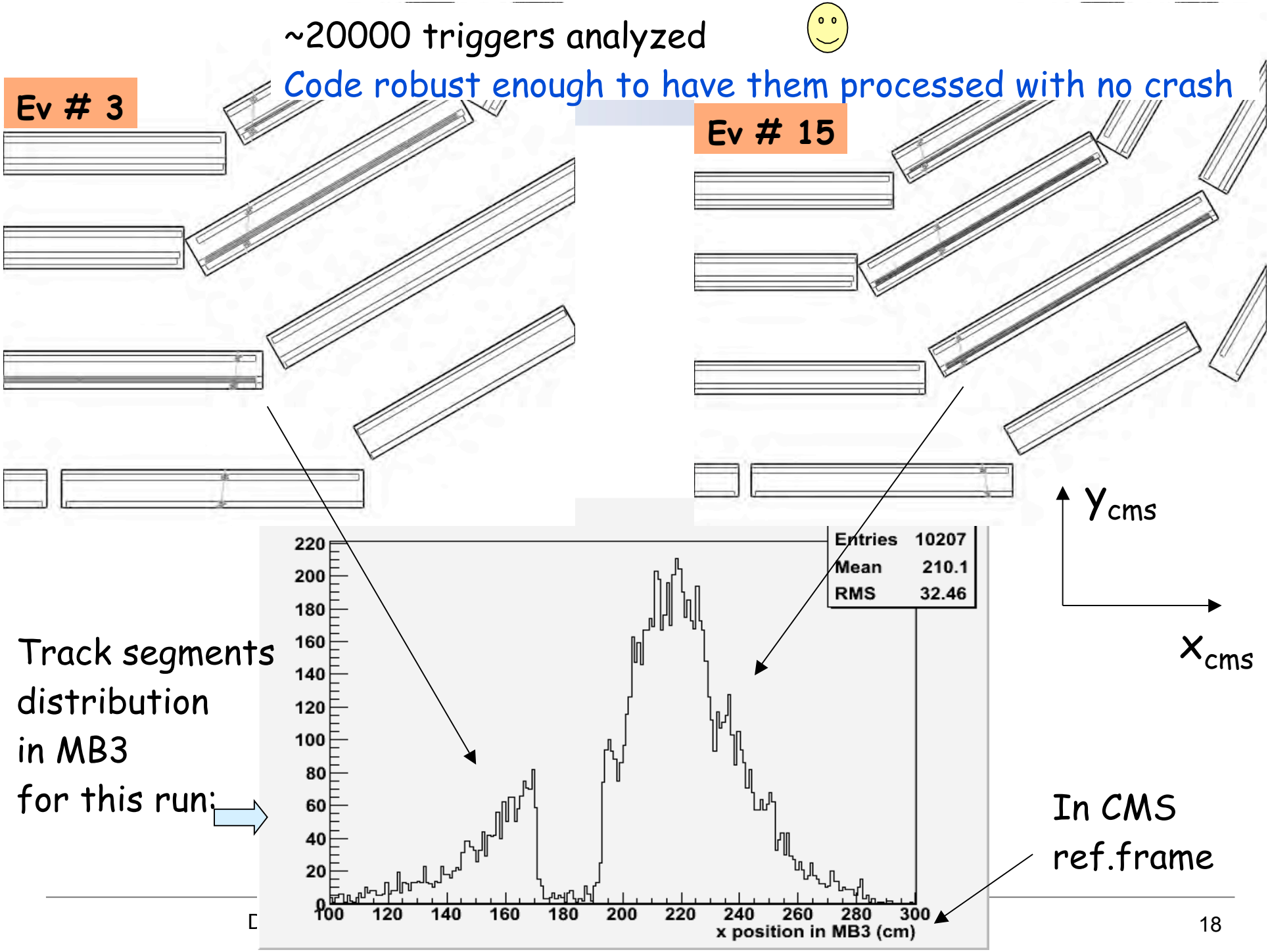
- Calibration data (t_0, trigger) handled through sql db files declared in cfg (see CMSSW/RecoLocalMuon/DTSegment/test/

~20000 triggers analyzed

Code robust enough to have them processed with no crash

Ev # 3

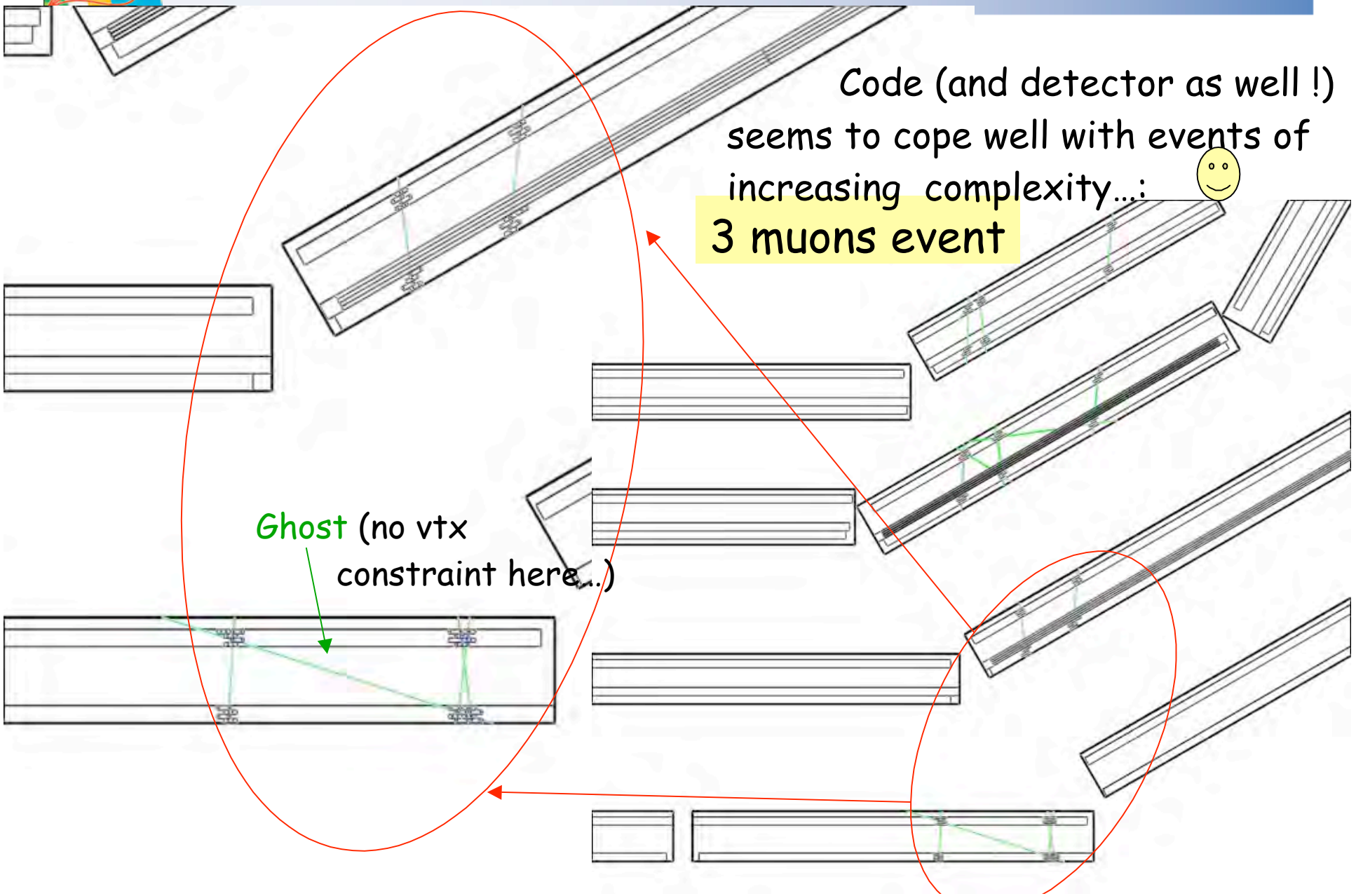
Ev # 15



Track segments distribution in MB3 for this run:

In CMS ref.frame

DT sector test data analysis in CMSSW

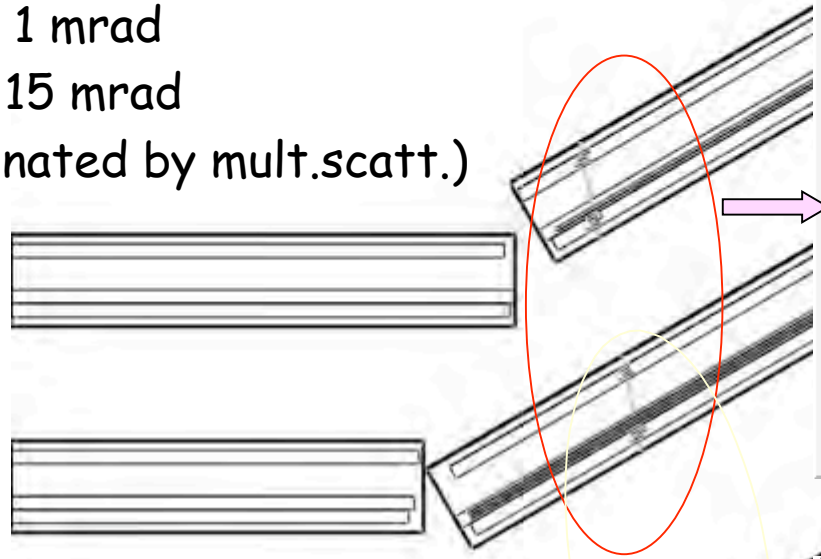


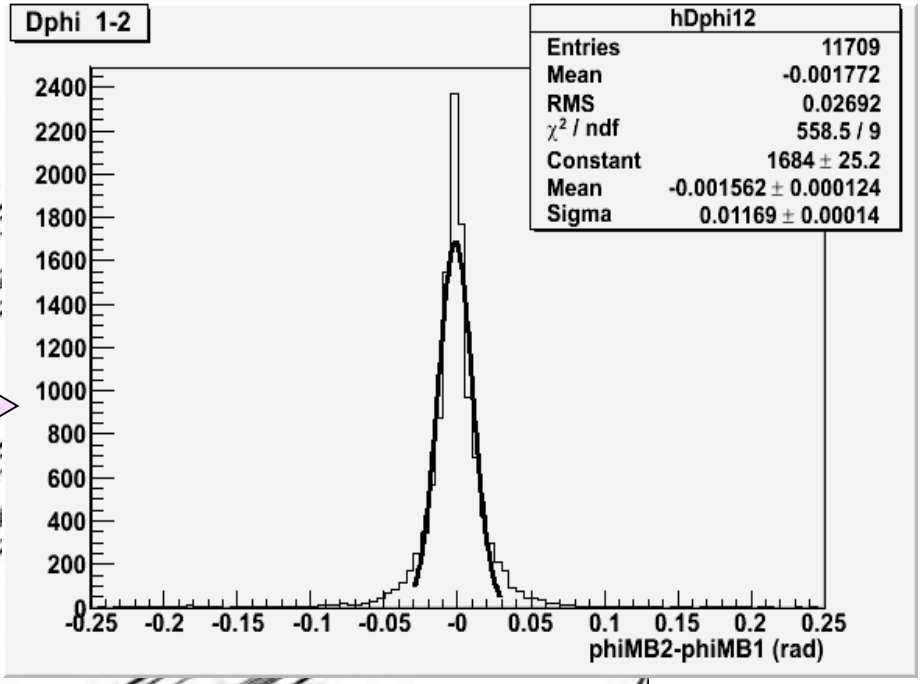
Angular difference distributions in r-phi plane:

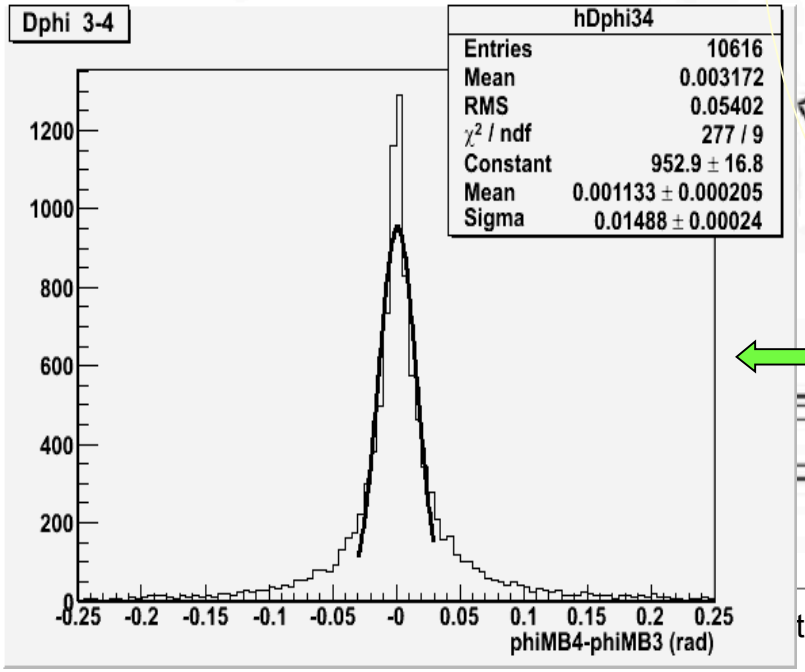
$\langle\Delta\phi\rangle \sim$ 1 mrad

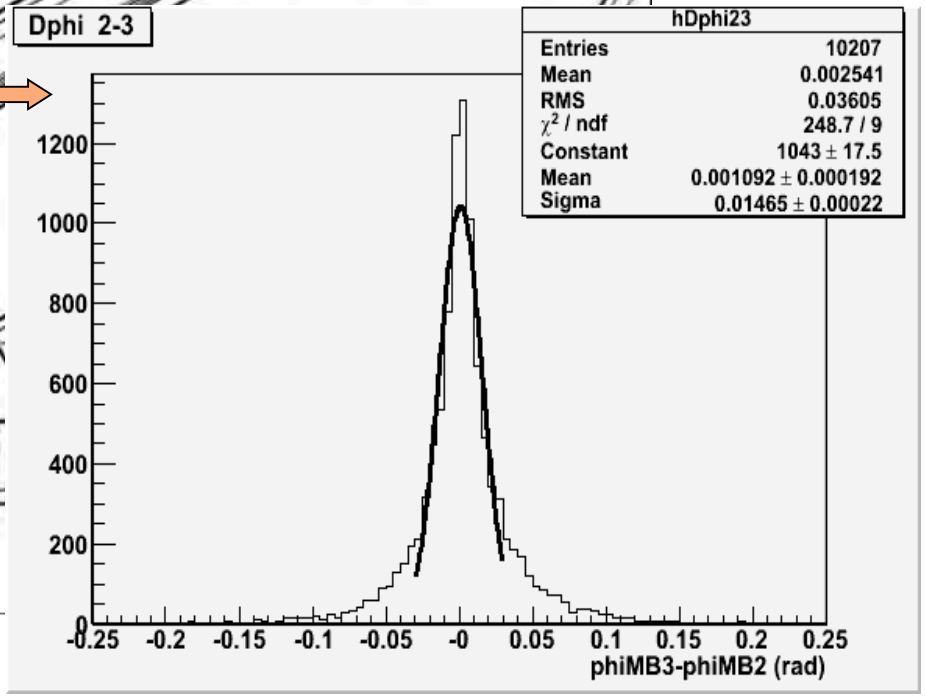
$\sigma_{\Delta\phi}$ ~ 15 mrad

(dominated by mult.scatt.)



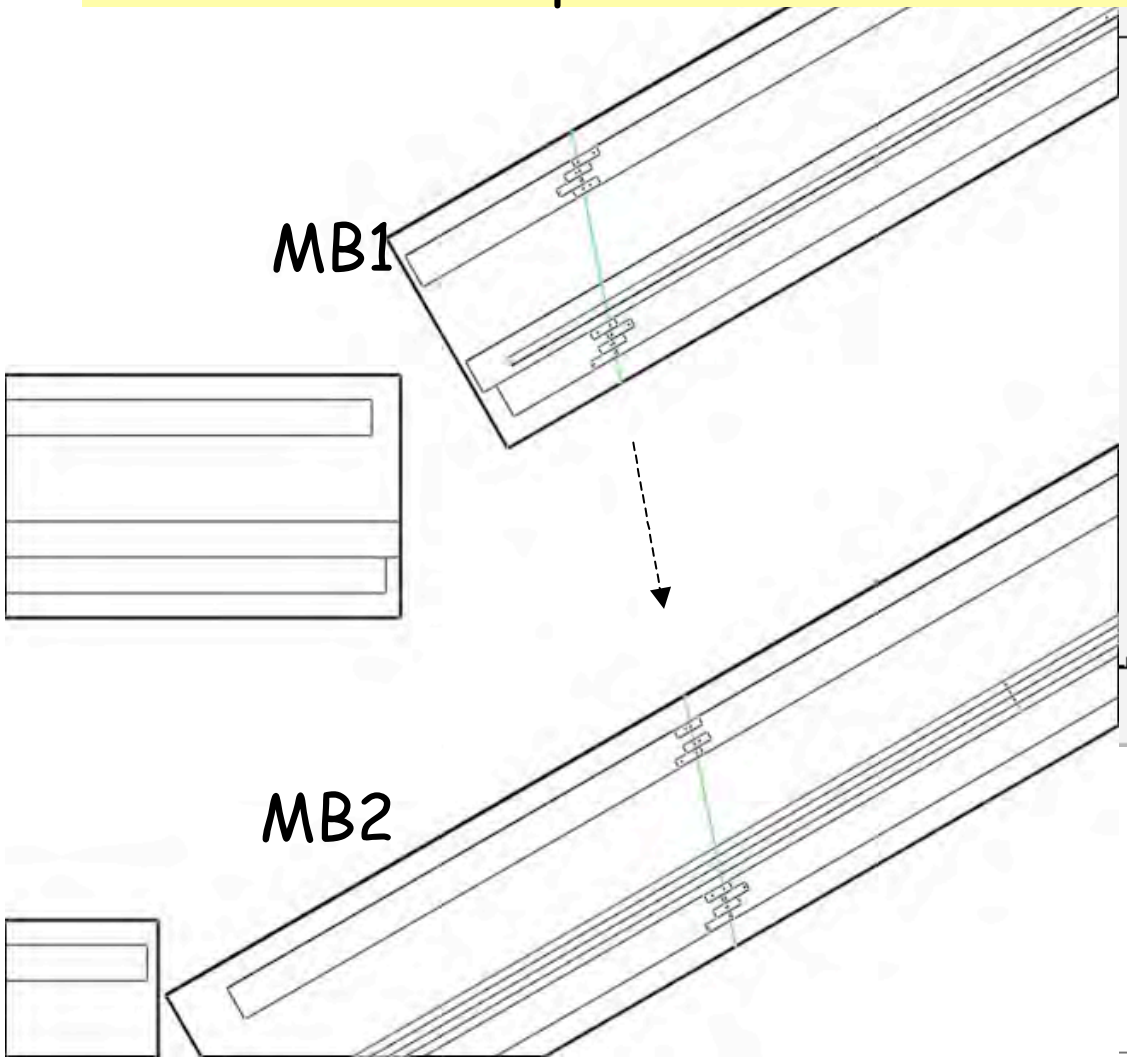


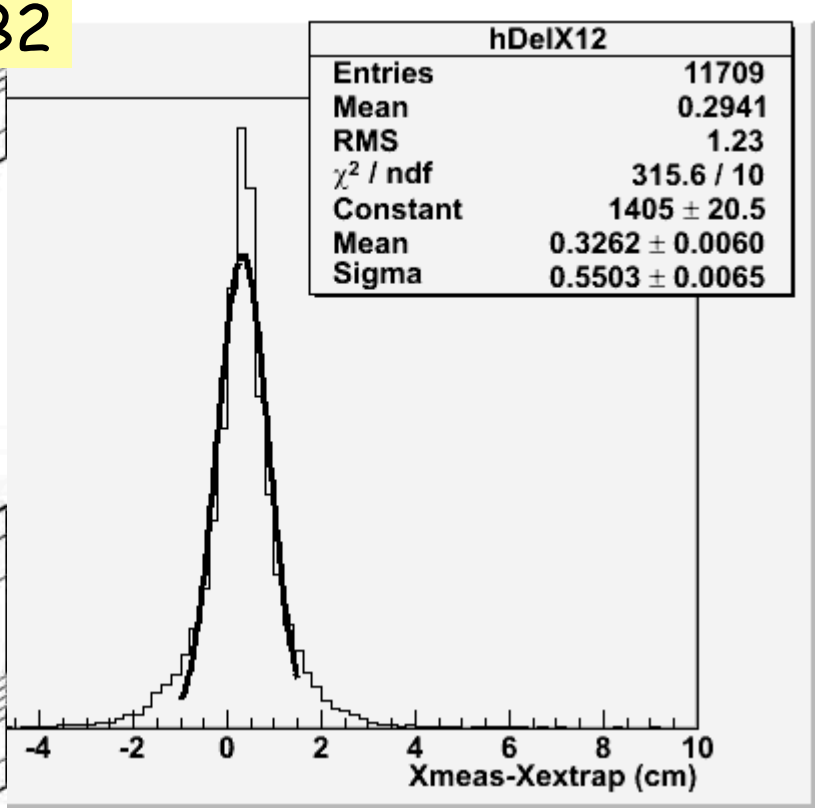




DT sector test data analysis in CMSSW

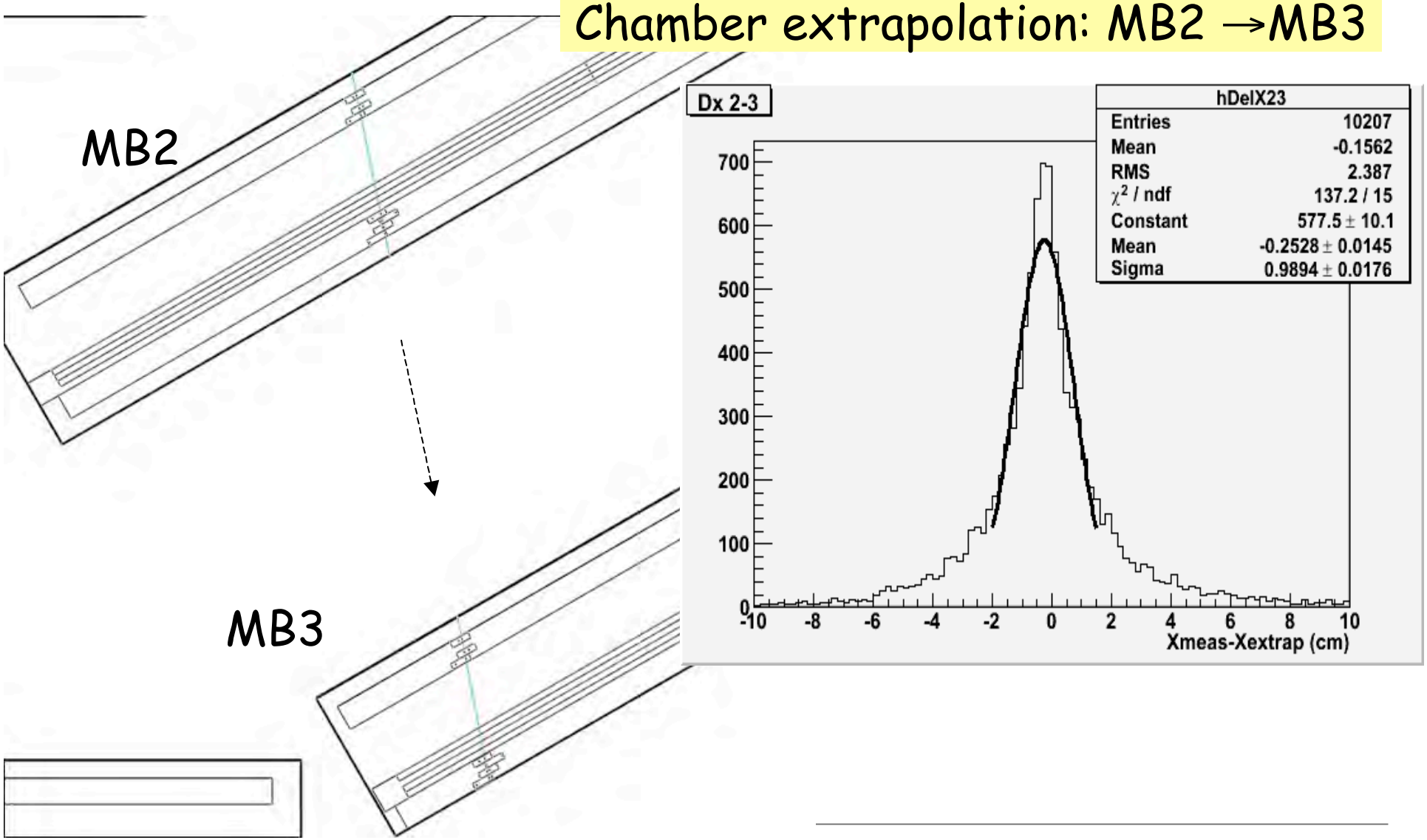
Chamber extrapolation: MB1 →MB2





DT sector test data analysis in CMSSW

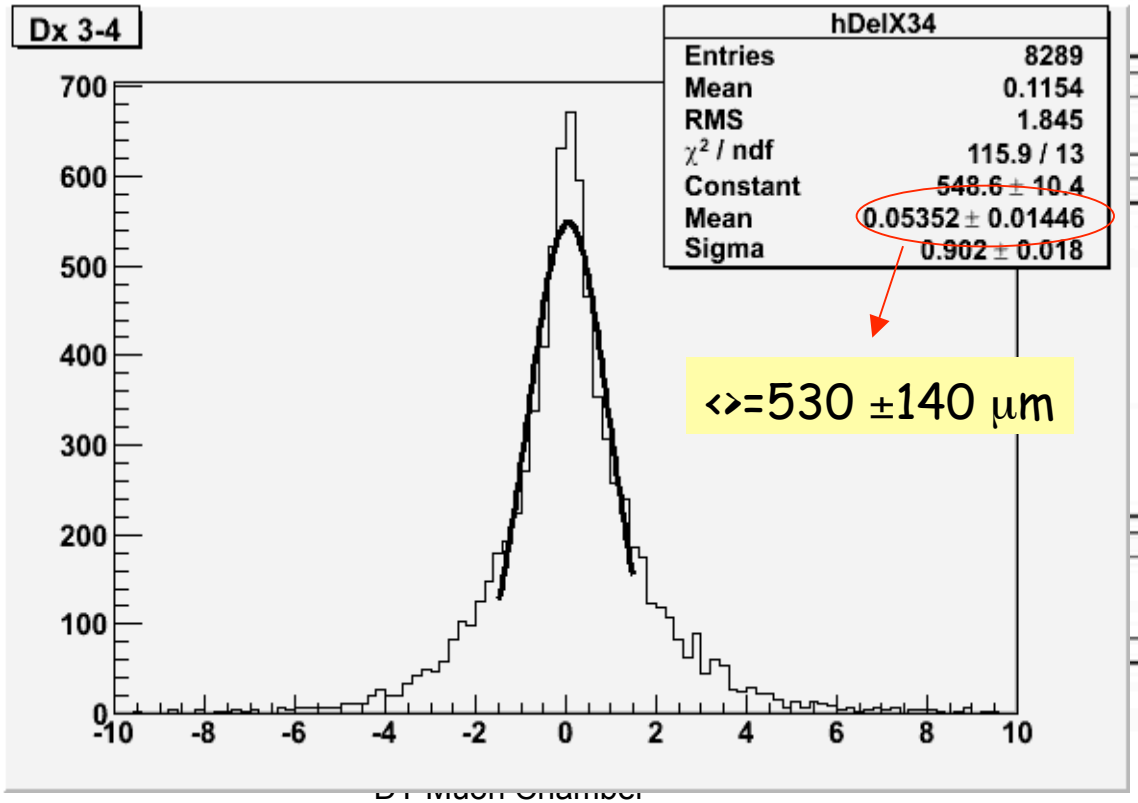
Chamber extrapolation: MB2 →MB3

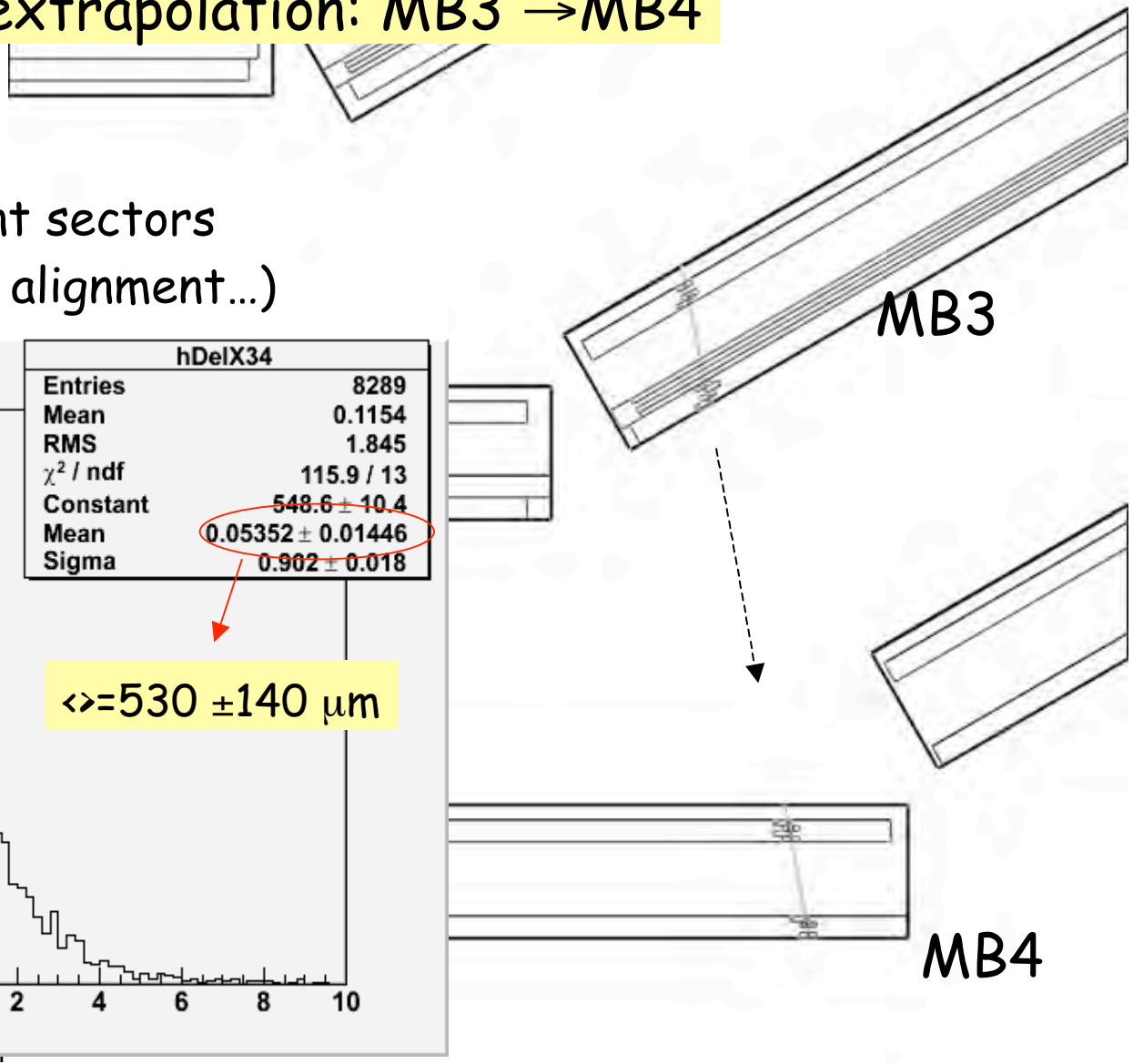


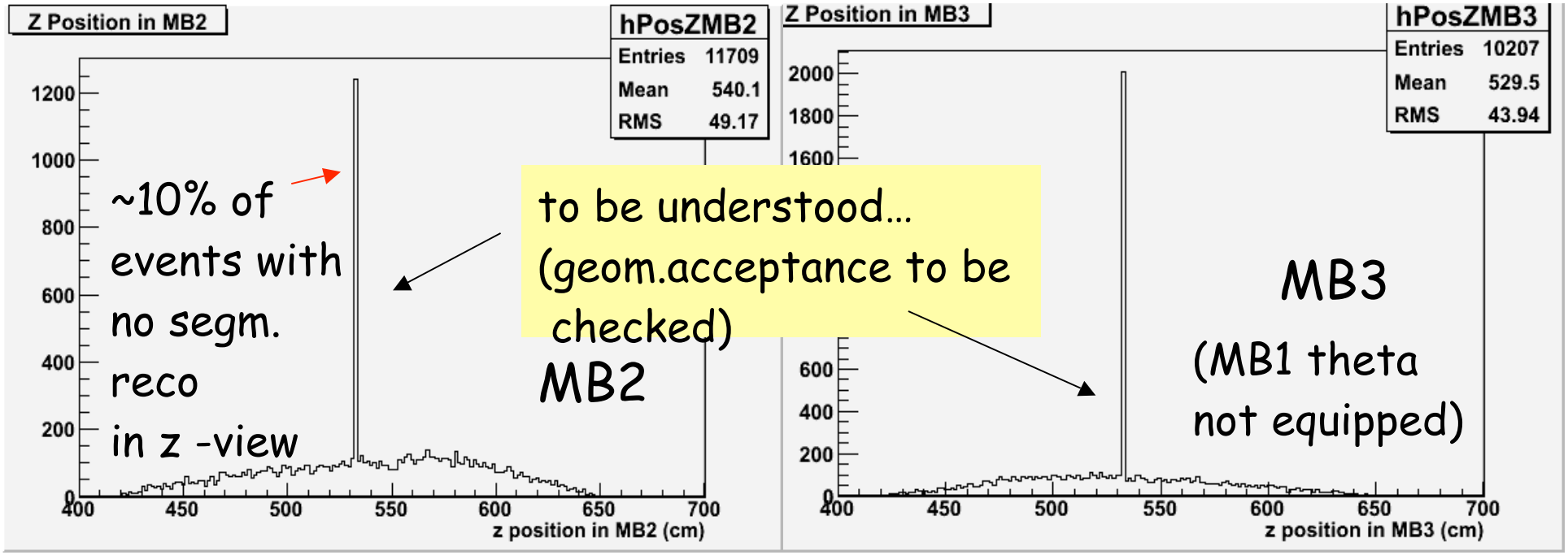
DT sector test data analysis in CMSSW

Chamber extrapolation: MB3 →MB4

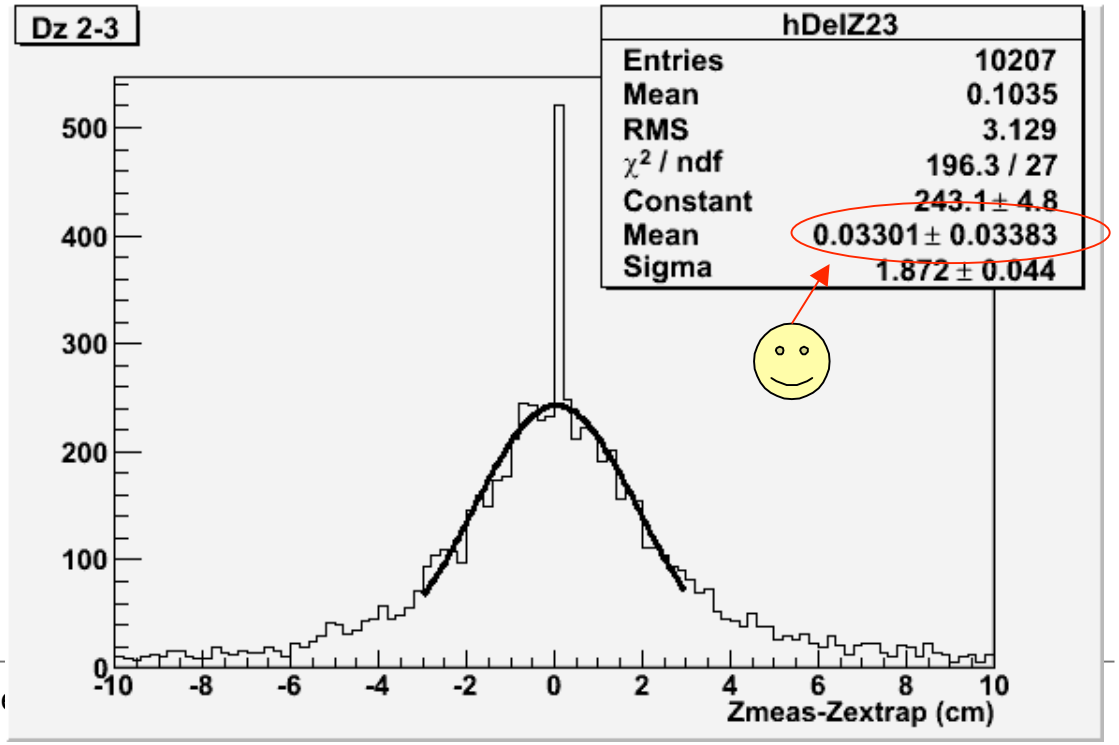
Note:
MB3, MB4 in different sectors
(quite interesting for alignment…)



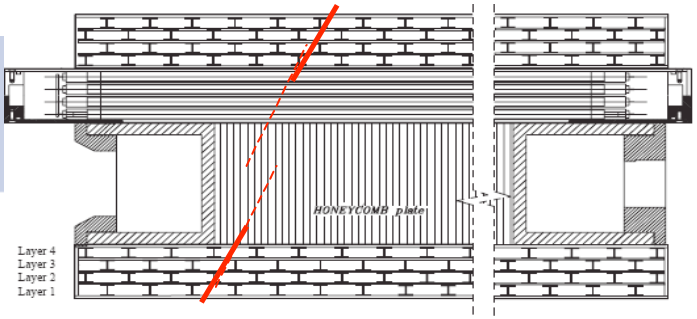




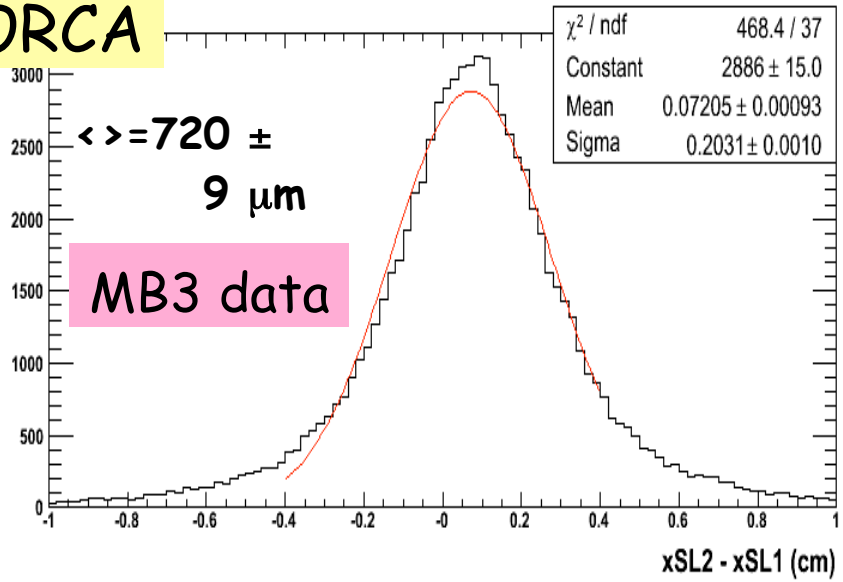
MB2 → MB3 extrapolation in r-z view:



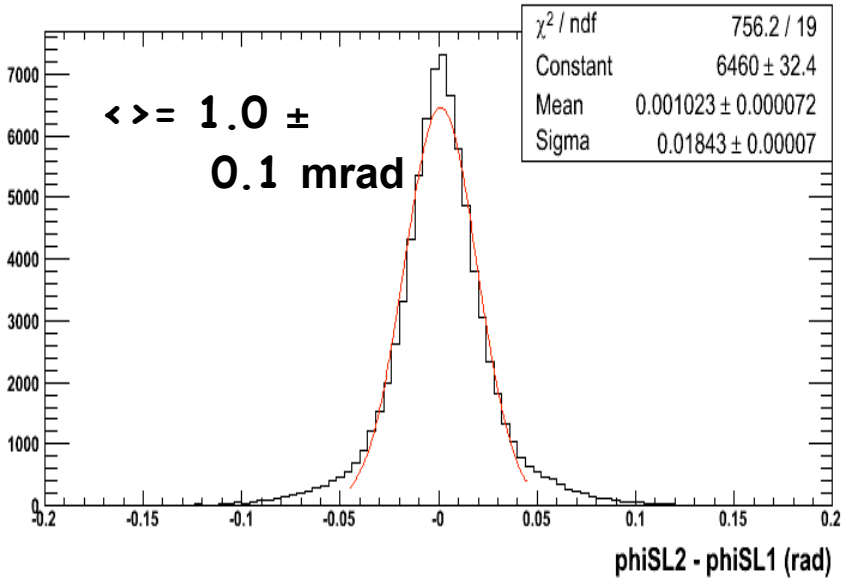
Yet to be done: Detailed ORCA vs CMSSW comparison



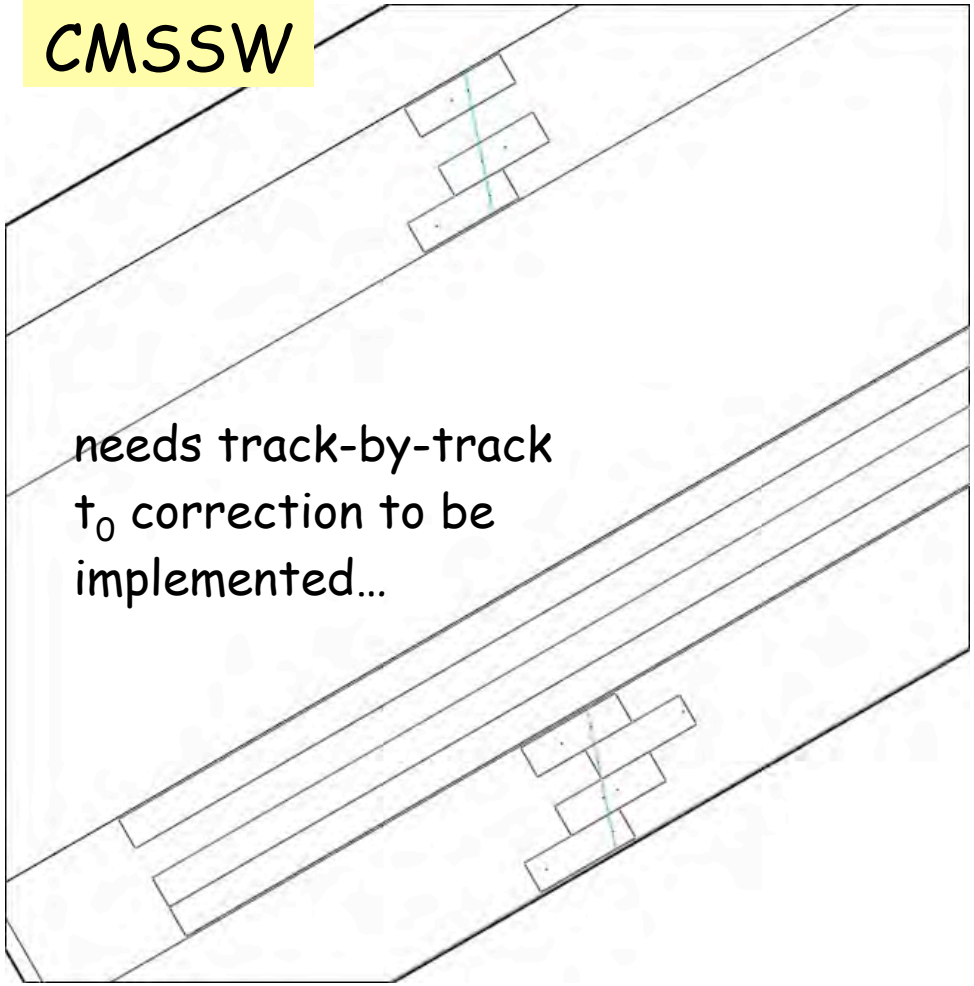
ORCA



MB3 data



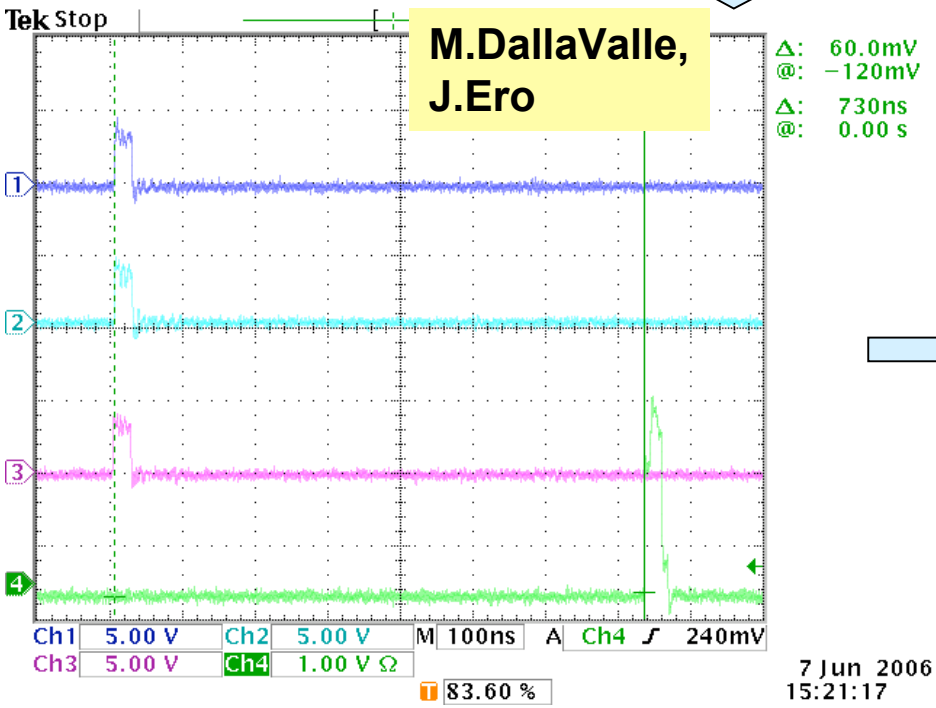
CMSSW



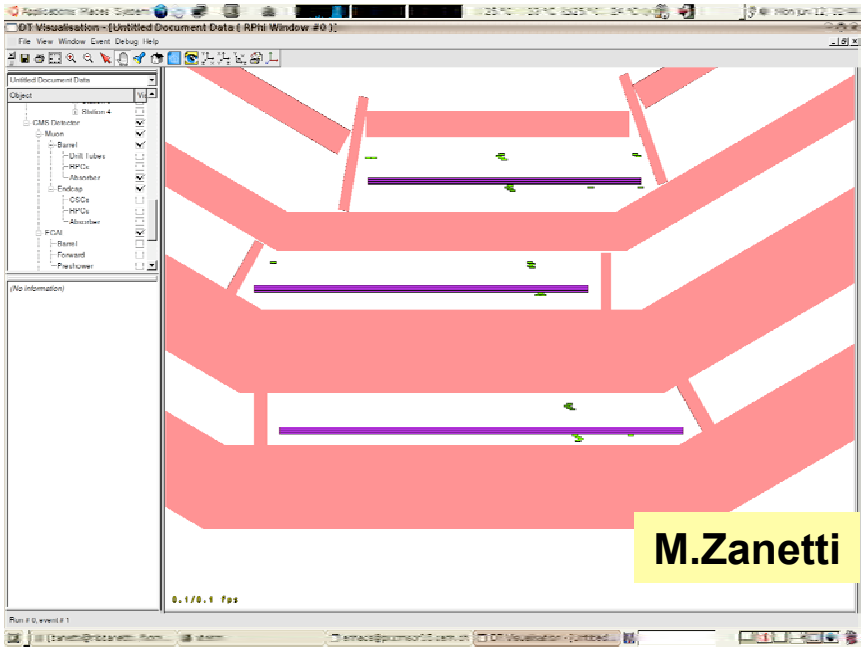
needs track-by-track t_0 correction to be implemented…

ROS25 data triggered by SC/DTTF/Sorters/LTC

You may have seen this screenshot in M.d.V. mail on June 7th



Data recorded (with ROS25) on DAQ PC dtfed1, analyzed through the CMSSW chain



Regional muon trigger generated,
L1A distributed back to the detector
(LVDS inputs through sector collector, optotransmission, regional trigger processing, LTC, LV1A received back at ROS = 100BX)

Conclusions

- DAQ / online sw:

  - fully integrated in xDAQ; MTCC version of the system being operating @ SX5; GUI developed for DAQ/DCS controls

- DQM functionality:
  - code for DQM sources production developed and running in CMSSW;
  - still some objects to be developed (L1 trigger obj, data integrity, higher level (HLT) objects..): on going
  - standalone applications developed in CMSSW, using IGUANA for visualization

Conclusions (II)

- Offline sw is in good shape:
  - a first analysis of DT sector test cosmic muon data was performed using CMSSW (+ IGUANA…);
  - good functionality of the package to study det. performance/ behavior up to local reco; encouraging preliminary results obtained when comparing measurements from different chambers
  - usage of DB in calib.constants handling implemented; lot of feedback given to SW group on DB issues…
  - Full StandAlone Muon reconstruction almost completed (due in CMSSW_0_7_0
    ⇒ - Propagation with B field
    - extrapolation in iron (e.g. fast "SteppingHelix" implementation)

    mandatory for MTCC…

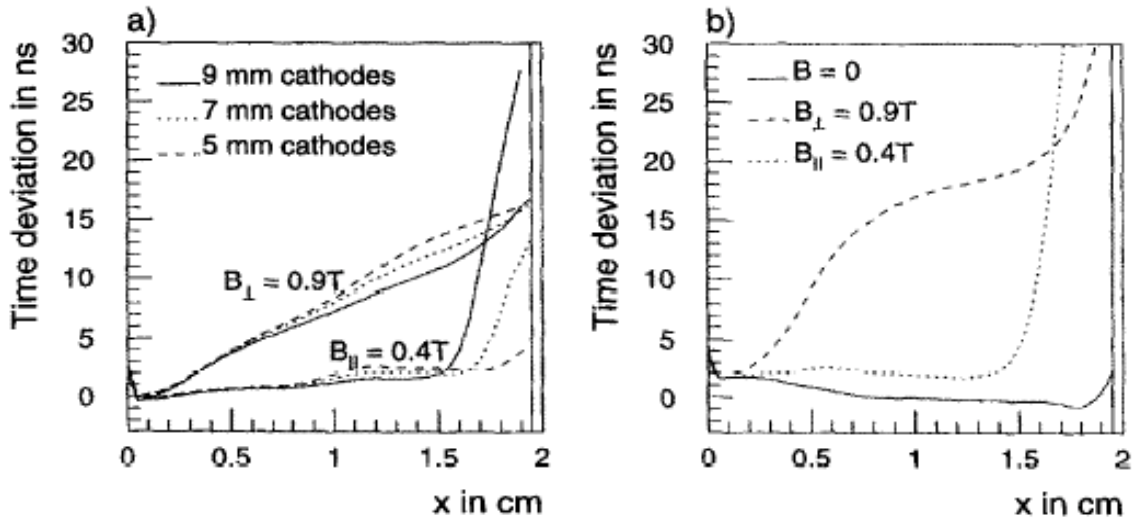
END END

Back up Conclusion III

- Goal of MTCC is a test of integration
- Software integration is going on quite well : segments on each chambers are built and segments (Muon Standalone tracks in CMS) are coming . Tuning is under way
- but
  - data are just coming from SX5 with MTCC hardware configuration , DAQ , DCS.
  - features so far have been tested on real data on “2 Sector” situation
  - most of the feature are not as ‘elastic’ as DAQ/DCS/TRIGGER tests would requires since are built for a full CMS monitor/analysis as they should but we have to check the full staff.
  - some features will not be available to the CMSSW software/analysis for MTTC (DB DCS configuration for example)

Simulations in the development of the barrel muon chambers for the CMS detector at LHC

Nuclear Instruments and Methods in Physics Research A 405 (1998) 20–29



Back up slide: Magnetic field Bnormal to the chamber for MB1 for the 3 wheels (old fileld map)

Figure 21:

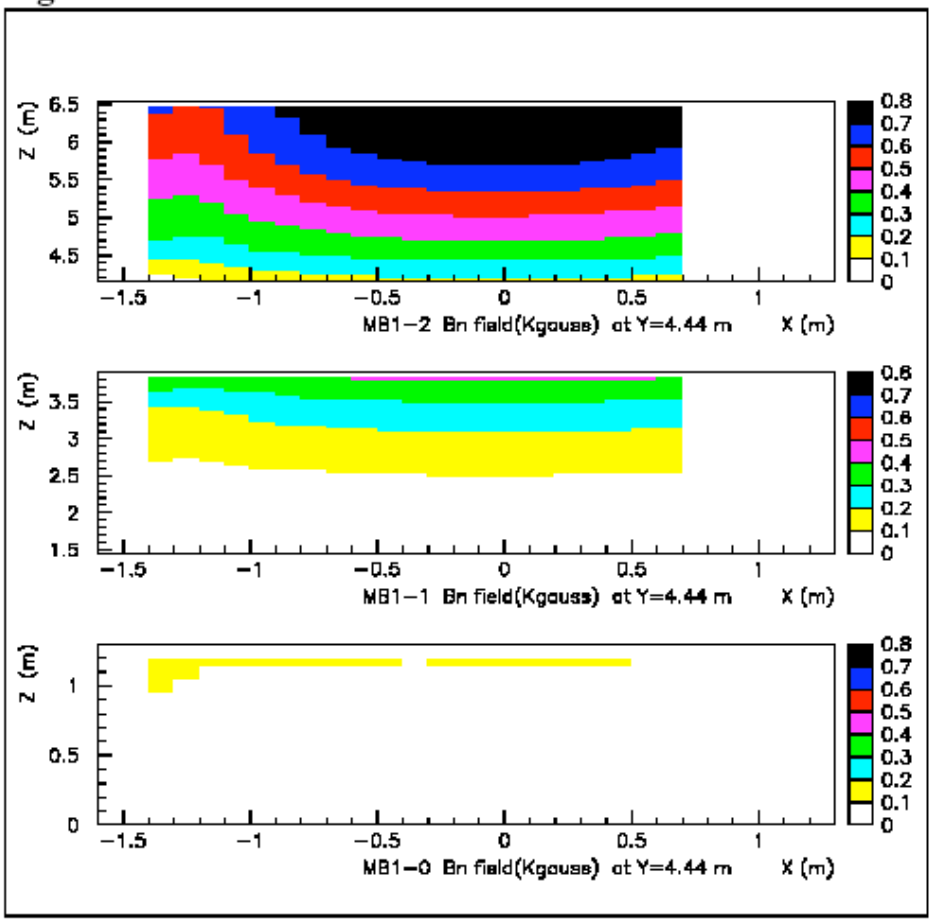


Table 1

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	1.0	394±1	49,5±0,2	26,4±2
3.6/1.8/-1.8	0	346±2	56,4±0,2	
	0.5	351±2	55,7±0,2	9,7±3
	1.0	373±1	52,3±0,2	22,4±1

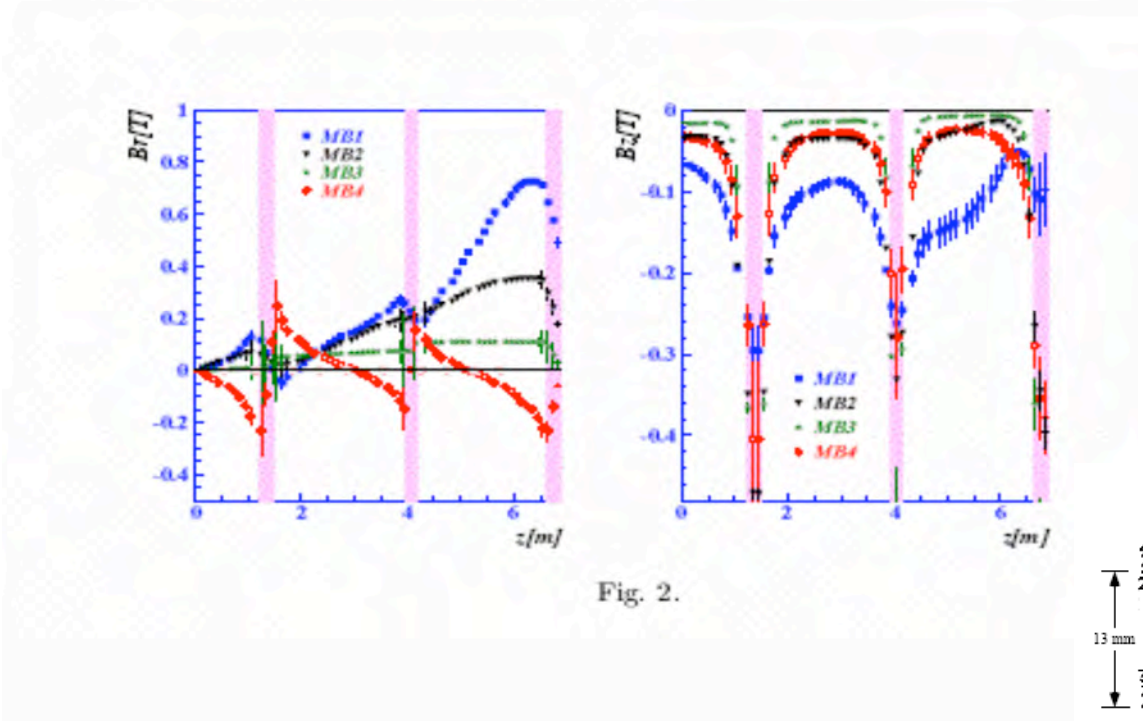
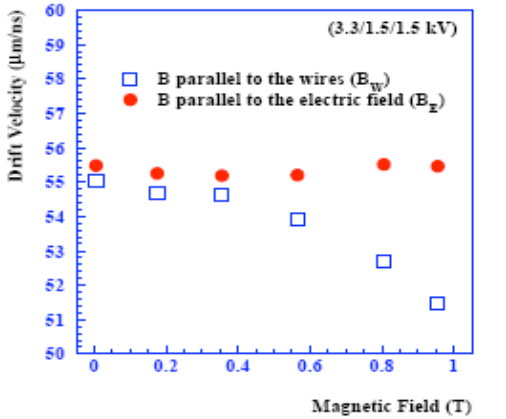


Fig. 2.



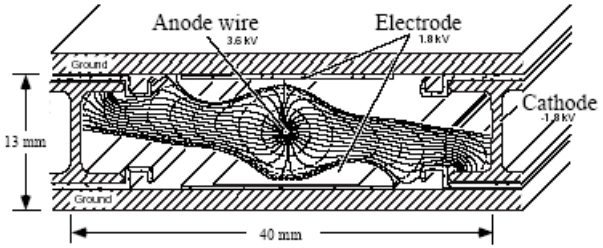


Fig. 3.

Figure 3: Drift lines in a cell of the CMS barrel muon detector under the influence of a magnetic field of 0.45 T parallel to the anode wires. The drift gas is Ar:CO_2(85:15). The anode is a 50 micron diameter stainless steel wire. Top and bottom planes are made of 2 mm thick aluminium sheets insulated from aluminium I beam cathodes by Lexan strips 0.5 mm thick. Two copper strip electrodes 14 mm wide, mylar backed for insulation purposes, improve field uniformity.

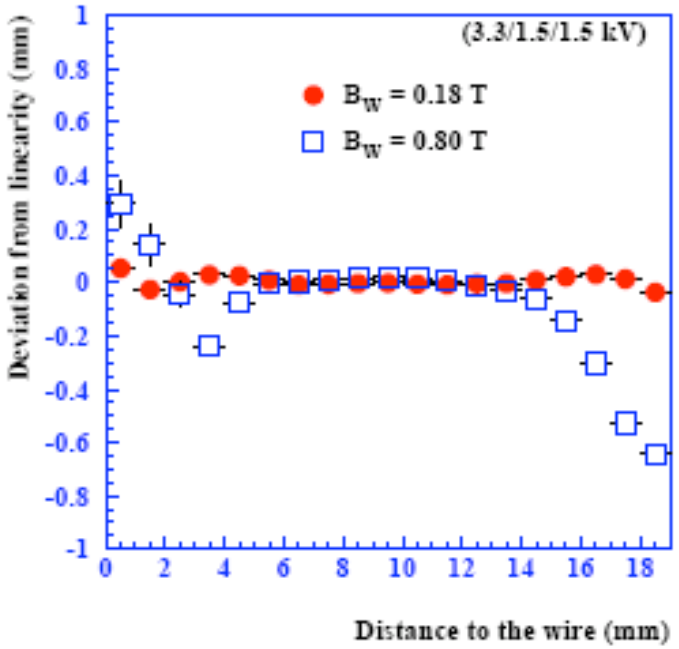

(3.3/1.5/1.5 kV)
B_W = 0.18 T
B_W = 0.80 T
Deviation from linearity (mm)
Distance to the wire (mm)
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0
2
4
6
8
10
12
14
16
18

Fig. 6.