# Stato di RPC e LVL1-barrel di ATLAS

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# Outline

- Gas system status
- Power system and cabling status
- Temperature update
- DCS status
- Trigger status (coverage and timing)
- DQ status
- Results with cosmics

# Gas System

Gas infrastructure

Gas infrastructure was already close to final configuration

Heating of pipes in gas rooms installed, needed in filling mode with high fluxes

Gas leaks (total number of gaps: ~760 in BOLs, ~3000 in nonBOLs; total gas inlets: ~8000)

- End of last year:

21 leaks in BOLs + 2 in nonBOLs not yet repaired because of difficult access

- During shutdown:

2 BOLs in position 6 (ends of barrel spectrometer) dismounted + repaired + re-mounted

new detected leaks: 6 BOLs + 20 nonBOLs stations with gaps disconnected from gas loop

already repaired: 8 nonBOLs stations, two more weeks needed to complete nonBOLs

- Strategy for BOLs:

two gaps serially connected inside the station,

up today both gaps disconnected from gas loop when a broken inlet was found

Plan is to adjust gas flow direction (reverse it when needed) in order to have the leak on the output line

In this way input gap is recovered, output gap could be recovered as well

Under study intervention for systematic repair of gas inlets (detect small leaks with sniffer, fix with foam before inlet breaks up completely)

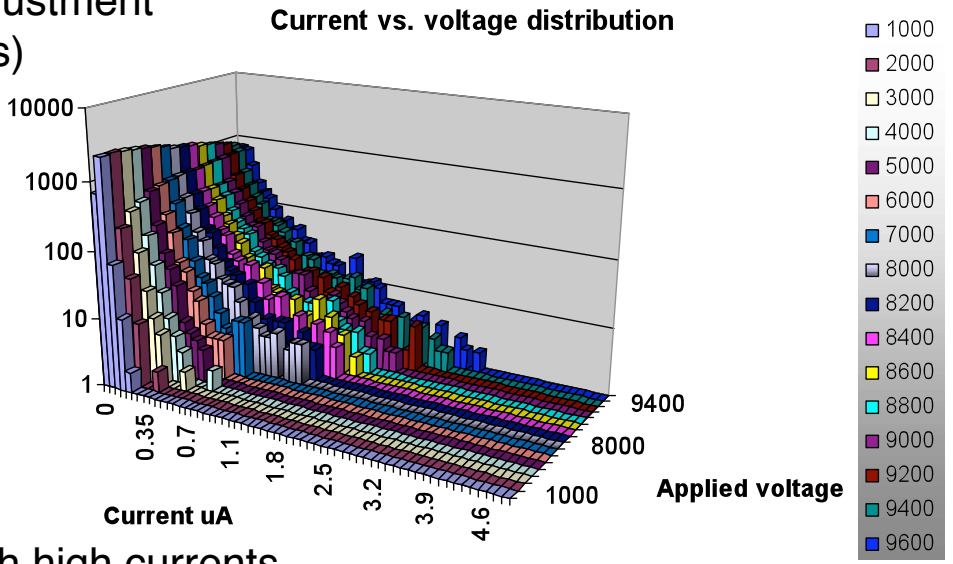
# Power system and cabling

- CAEN boards needed to switch on the whole detector available since end of last year
  (a few months with BO stations in sectors 9-10 off because 1HV + 1DAC board missing)
- 20+2 A3025 boards modified by CAEN on our request to drive higher current for the BOL6+BMF1 carrying 4 PADs
- BML7: cable test + station cabling + power-on done. Under debugging with cosmics
- Installation and cabling of gas and environmental sensors done
  Commissioning completed in half of detector (with help from 2 LNF technicians)
  2 more weeks x 2 technicians foreseen
- Installation of HV recovery lines done
  Already used to separately power-on ~50 gaps with high currents (> 4μA)
  Study of correlation between currents and gas flows is underway
- Recovery of sparking HV connectors
  15 connectors recovered, ~30 still to be done (2 weeks x 2 technicians)
- Fixing of cabling errors for HV and Igap readout. Started (2 weeks x 2 technicians)
- Re-routing of cables in front of crates where board replacement could be difficult
  Still ongoing: 4 weeks x 2 technicians (6 weeks paid by ATLAS muons)
- Present again request of doubling (2 to 4) of 48V service power supplies (MAO) as recommended by A.Lanza
  Request rejected last year, but high impact of failure and power consumption close to upper limit

# Other detector activities

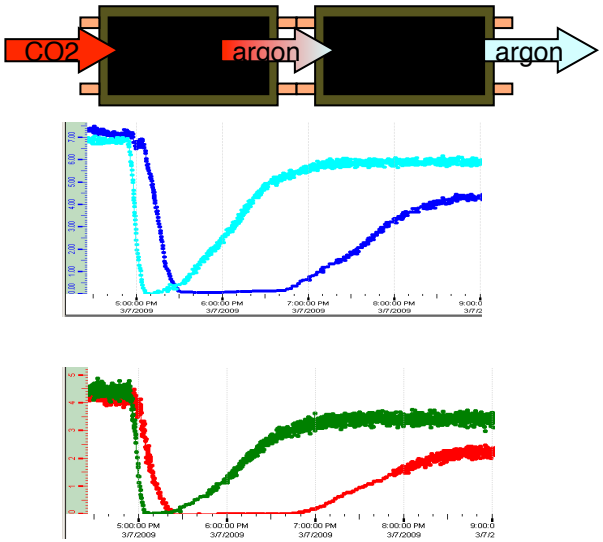
- Special chambers in sector 4,6 dismounted and re-mounted to allow MDT sag adjustment (1 physicist + 1 technician for 2 weeks)

- Full automatic HV scan of gas gaps




- Argon re-conditioning of ~50 gaps with high currents (2 weeks Jan-Feb)
  Most gaps now with normal currents,
  still high currents in a few gaps
  Stability to be checked

- Profiting of gas change, very detailed gas flow measurements have been performed in the whole detector (data are being analyzed), by measuring the current transition time associated to the gas change



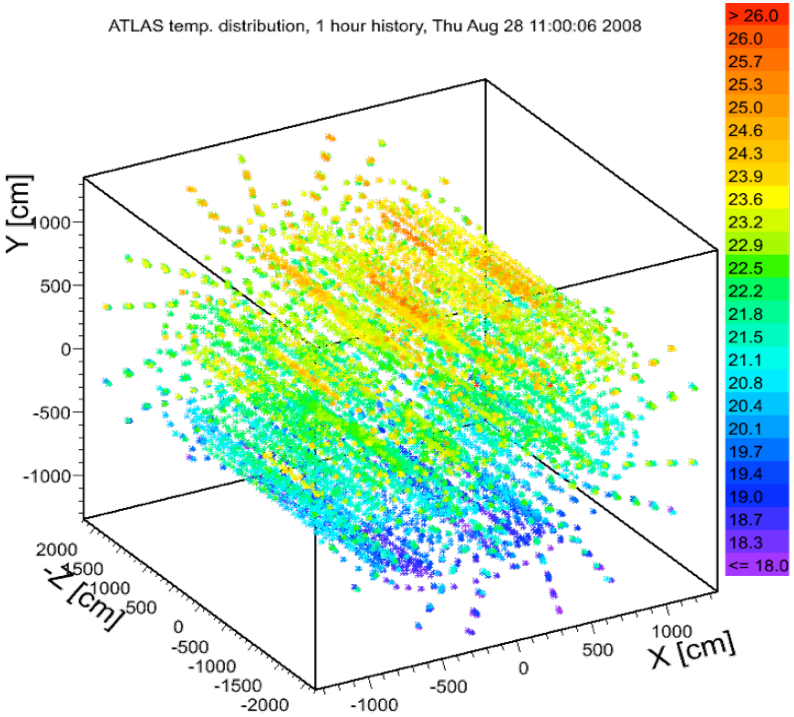
# RPC Temperatures

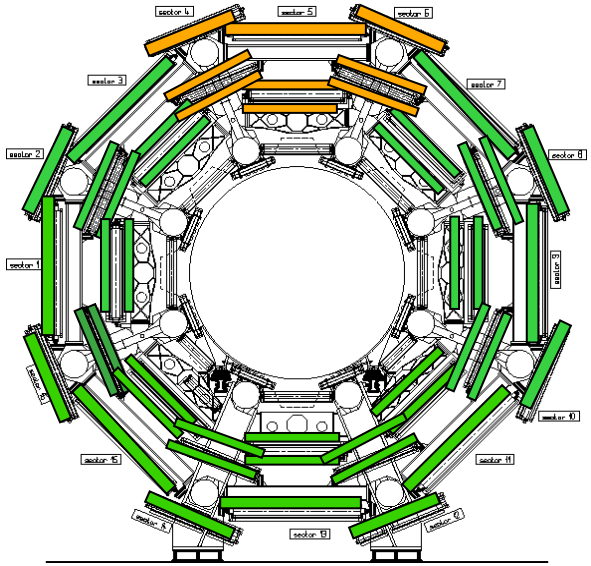
RPC temperature wish: the lower the better, 24 $^{o}$C still tolerable for a minority of chambers

## Last year status

Temperatures ranging from 19 to 26 $^{o}$C

Top sectors (4-5-6) were operated at lowered voltage (9.6 ⇒ 9.2kV)



Measurements from MDT temperature sensors

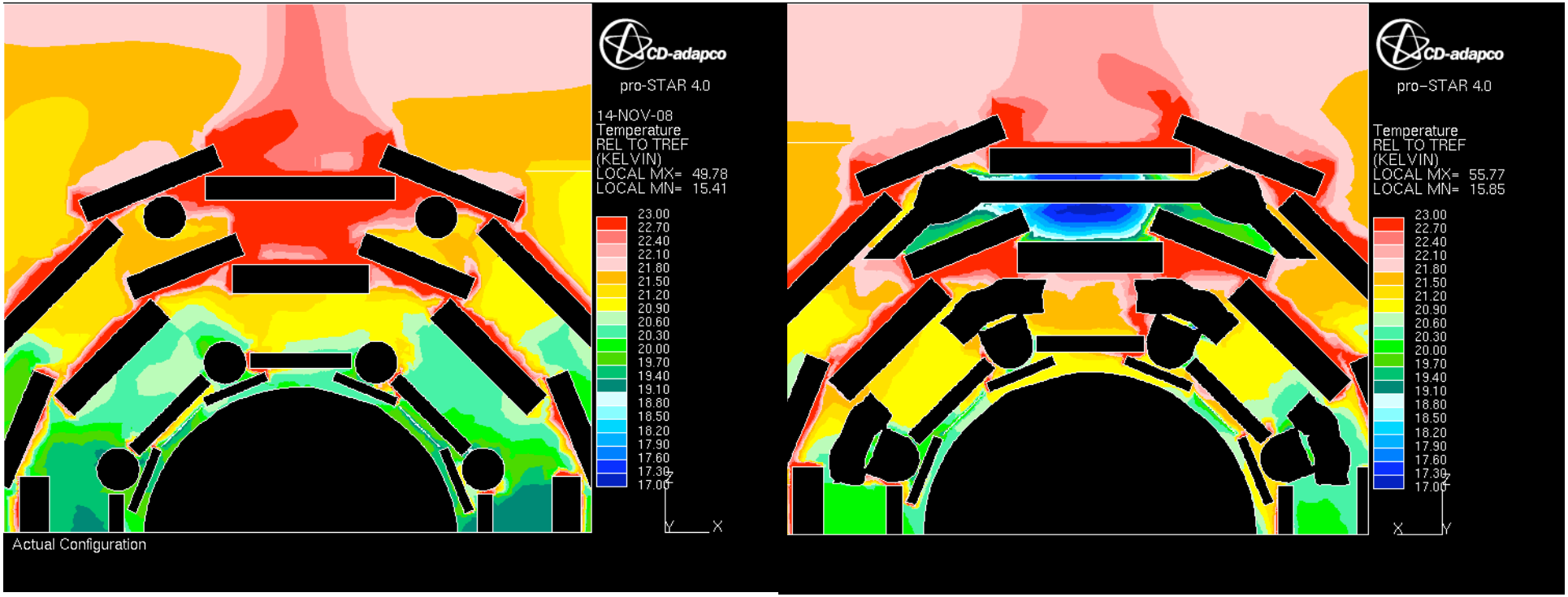
# RPC Temperatures

Installation of pipes from cavern walls to top of detector in order to convey fresh air from the cooling air system directly on hot sectors
Works started at end of April, should be finished by first/second week of May

## Temperature simulation

Present configuration

New configuration



# DCS status

## Overall Status

- System fully upgraded. Latest OS and DCS software (PVSS II 3.8)
- Stable operation with 4 Power System Mainframes (CAEN SY1527)
- Improved Finite State Machine (monitor and simplified operation)
- Improved user and expert operation and interfaces
- HV automatic scanning tool implemented
- Alarms and watchdogs for unattended operation

## Databases

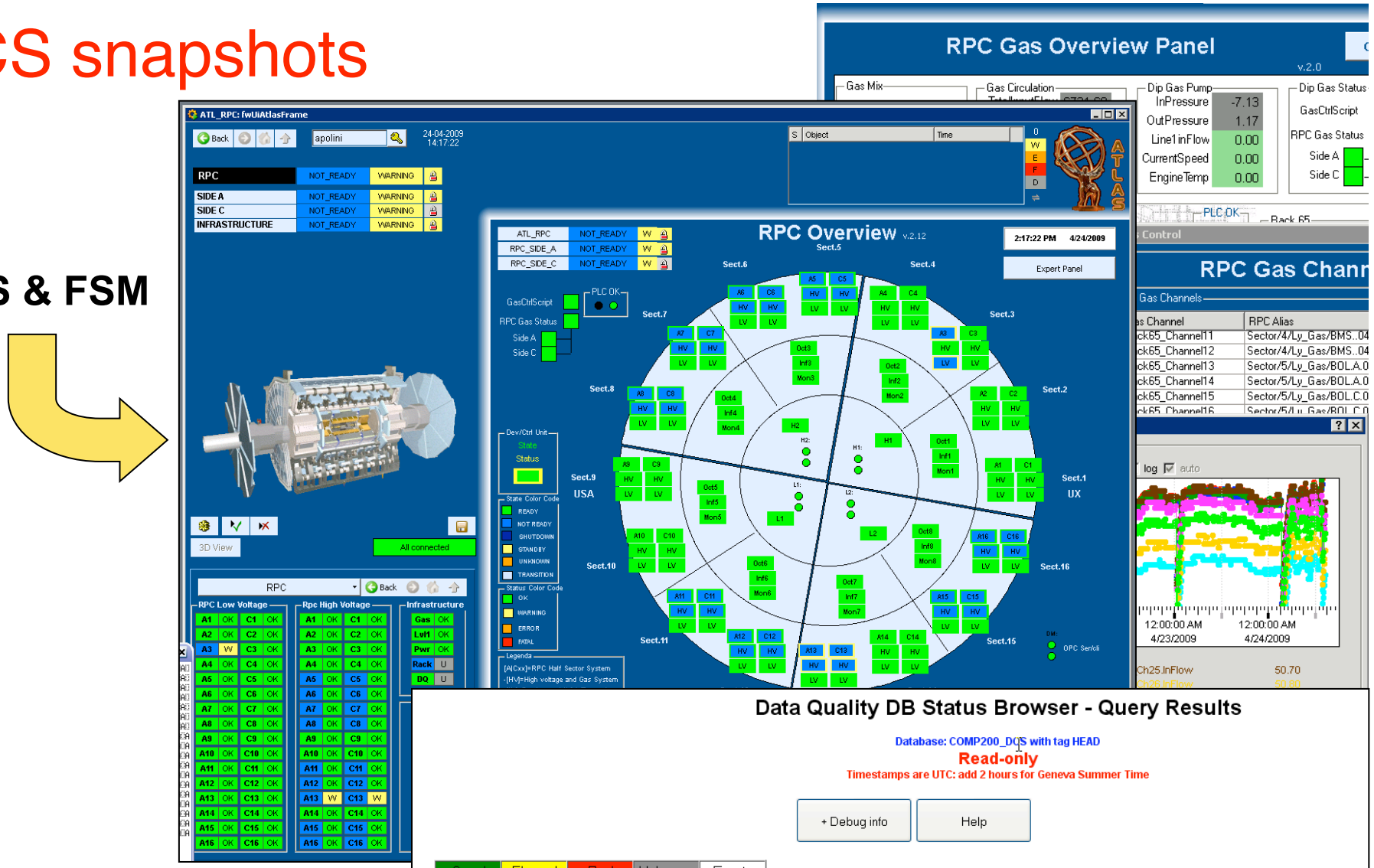
- Oracle Archive (well established)
- Configuration database for detector configurations
- Condition Database (COOL) and connection to DQA (new)

## Next Steps

- DCS - DAQ Communication
- Installation of hardware watchdog and integration in DSS
- LV automatic scan to be finalized
- Finalize all parts

# DCS snapshots

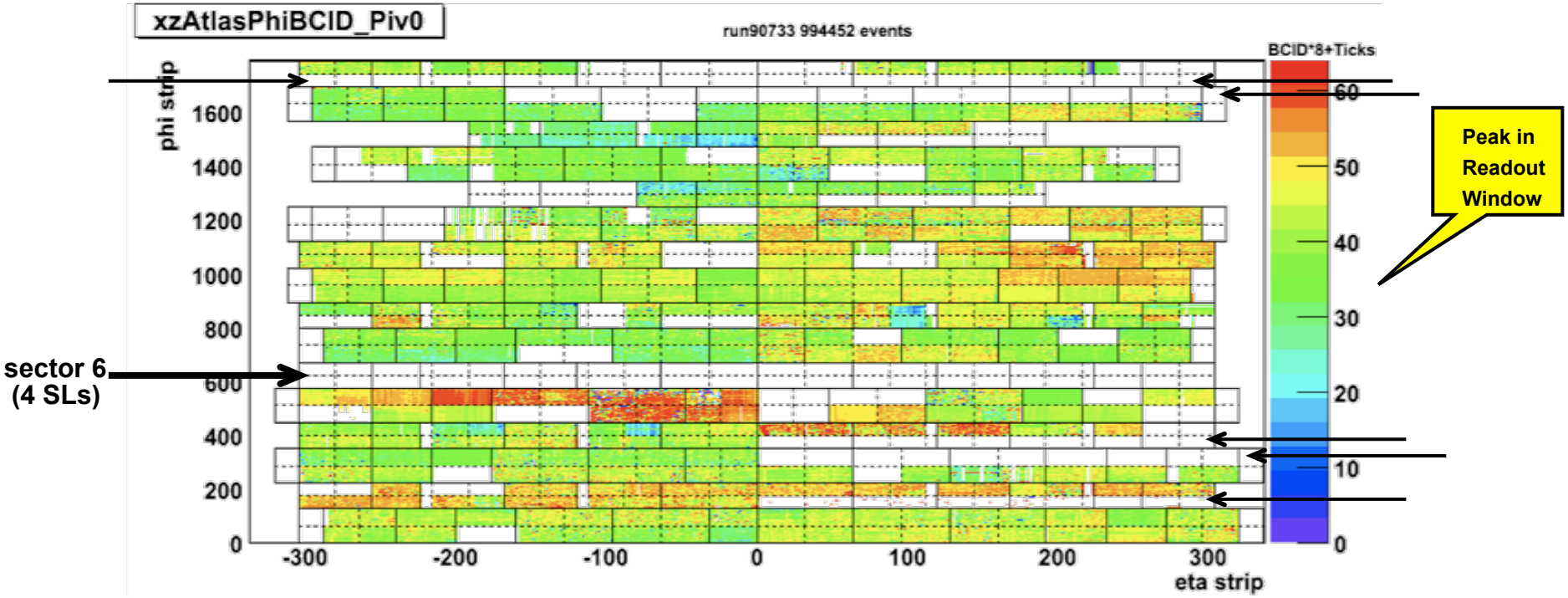
**DCS & FSM**




**DQA flags**

# Trigger coverage in Oct 2008

RPC readout window = 8 BC (x 8 ticks)




RPC readout window = 8 BC (x 8 ticks)

Most sectors centered in readout window

Excluded Sector Logic

**~70%** of total barrel read-out (BML7 excluded)

# RPC-LVL1 activities after end of combined runs

- Cycles of data taking (standalone and combined) for timing and detector studies
  - Recover from out-of-sync in the RO chain
  - Align the readout latencies, mainly for high-pt data
  - Timing studies, test/optimize procedures
  - Test of detector calibration procedures, through HV and threshold scans

- PAD recovery in the cavern (during conditioning with Ar)

- Fiber measurements and re-cabling during shutdown
  - Campaign of measurements with a reflectometer in order to understand timing misalignments

# LVL1 trigger electronics recovery

## Hardware recovery

- Work in the cavern to replace broken PADs and understand failures
  - 20 (out of 810) PADs replaced with various hardware problems, like shorts due to metallic dust and broken TX links
  - ~30 recovered on-site (mainly out-of-sync problem)
- Commissioning of end-chambers (special BML7) on Large sectors started (total of 32 PADs)

## Firmware upgrades

- The main loss of coverage during 2008 was due to the failure of the readout chain for synchronization problems among RO elements (CLK and L1A/BCR/ECR signals)
  - First attempt to align the clock phase has been made in December
  - Now a systematic procedure is under development to be robust against signals jitters
- Major upgrades in the firmware of all the boards (RX/ROD/PAD) to add more stability, control and monitoring tools
  - Will solve out-of-sync events and will try to recover from problematic status

# Trigger timing studies

- Many studies in parallel, aimed to understand existing timing misalignments
  - Calibration done with muons, with 3.125 ns precision
  - Tower misalignments due to wrong fiber lengths (different from design)
  - Cross checks with data from different sources: RPC (CM hits and SL info), MDT, CTP, MUCTPI

- Timing-in with cosmic tracks is a complex exercise, due to the extended acceptance of the spectrometer (ToF can vary from 0 to 4 BCs)

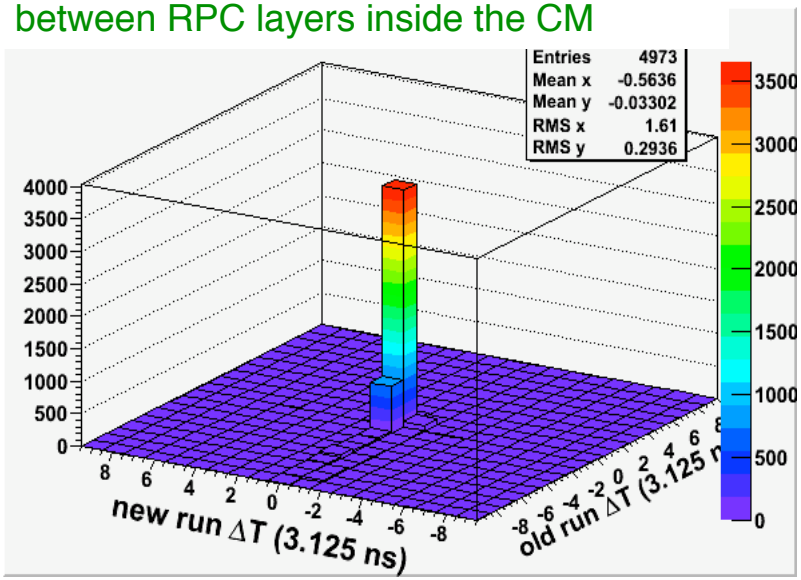
- Current time alignment:

  **<<1BC inside trigger tower**

  **~1BC among trigger towers**

  Alignment with cosmics will be translated to collisions using simulations

Example of convergence of the alignment between RPC layers inside the CM

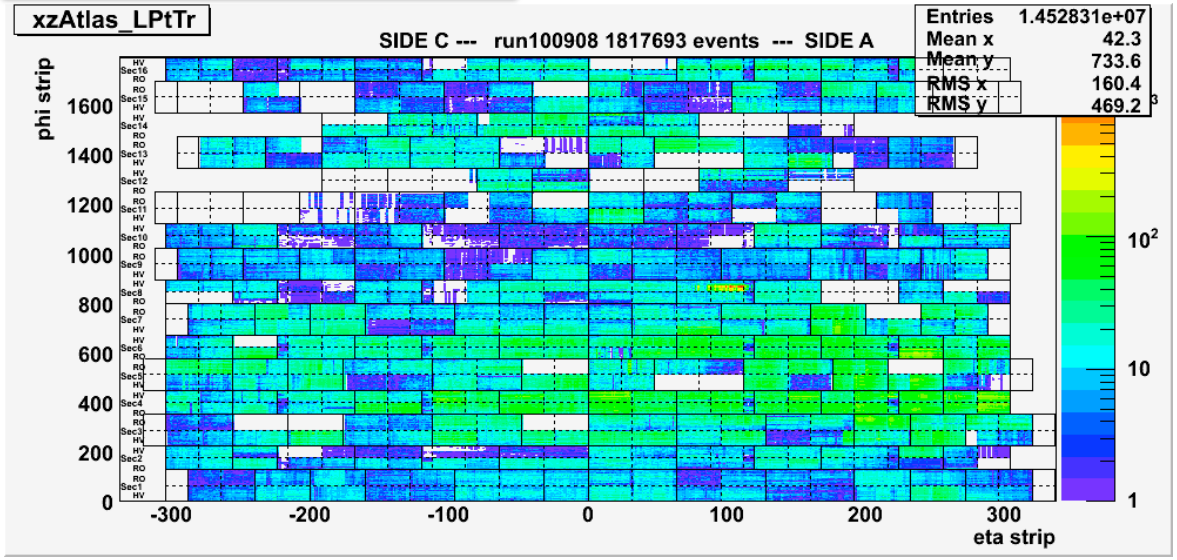



**Use of external reference triggers required for studying global alignments, to prepare for collisions**

# Trigger coverage last January

Low pt trigger occupancy

**90,5%** of total barrel read-out for Low-Pt (BML7 excluded)

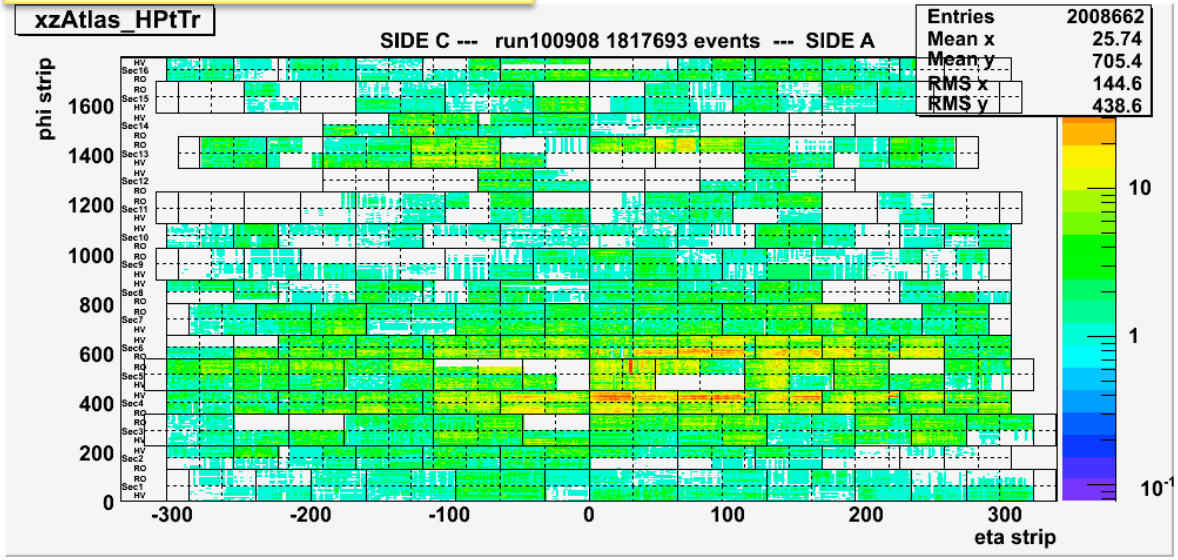



Many trigger towers recovered in January after

- latency adjustment
- alignment of RO chain

(main progresses on High-pt trigger)

High pt trigger occupancy

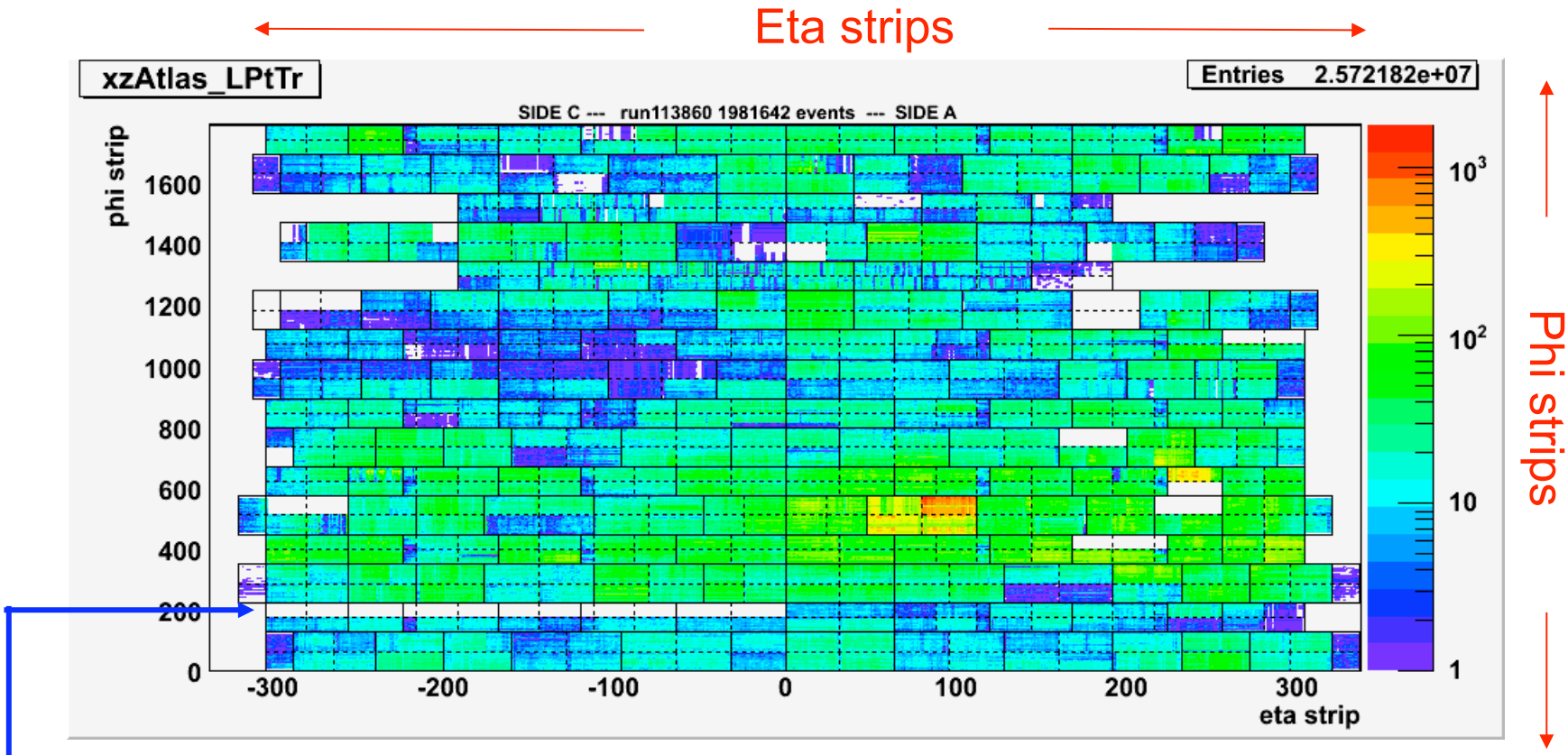



After

- replacing of PAD boxes

no acceptance holes foreseen due to trigger electronics failures

# Trigger coverage (Low Pt) last week




1 sector-logic excluded from DAQ (SL-ROD communication problem: to be studied)

**~95%** of total barrel read-out (**BML7 included**)

# DQ status

## DCS DQ

- online shifter: 1 flag per trigger tower (~400), indicating on/off and quality (stored to COOL)
- status presenter will be released in a few weeks
- DQ flags: writing a flag per partition (side A, side C)

## Online DQ

New RPCGnam version installed at point 1:

- new LVL1 oriented histograms added
- new naming schema to help the shifter in browsing
- new basic presenter configuration with tabs for each sector

DQMF:

- basic version running in ATLAS partition but still under development

Work in Progress:

- shifter documentation
- new summary histograms to be added

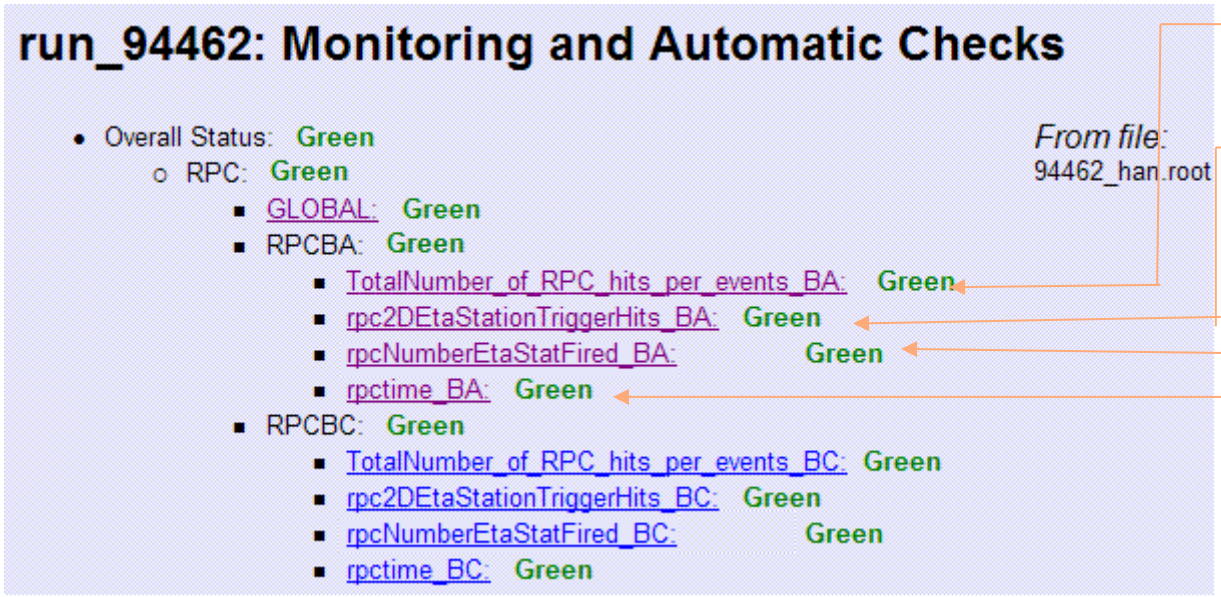
# DQ status

## Offline DQ

Plots for barrel A / C and Global

- uniformity with other detectors
- store flag results to COOL at tier0

## Snapshot from ATLAS DQMF offline (webdisplay)




Select run with enough statistics

Check RPC coverage

Check RPC stability during the run

Check RPC time alignment

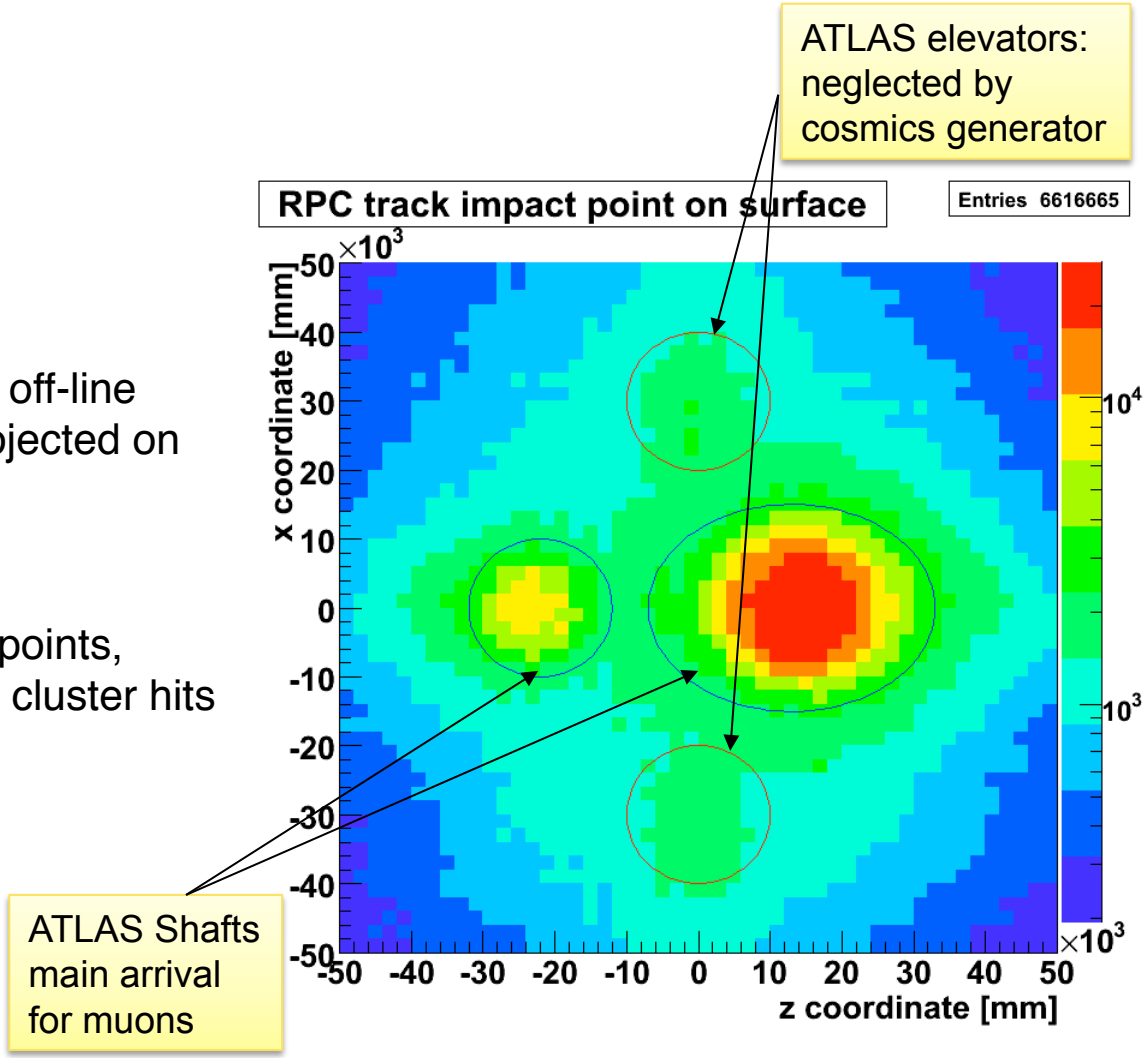
For cosmics using all hits

For collisions will use clusters associated to RPC standalone tracks

# RPC standalone cosmics reconstruction

Cosmics muon map reconstructed by off-line RPC standalone muon monitoring projected on surface (y=81m)

The tracking is based on RPC space points, which are defined by orthogonal RPC cluster hits



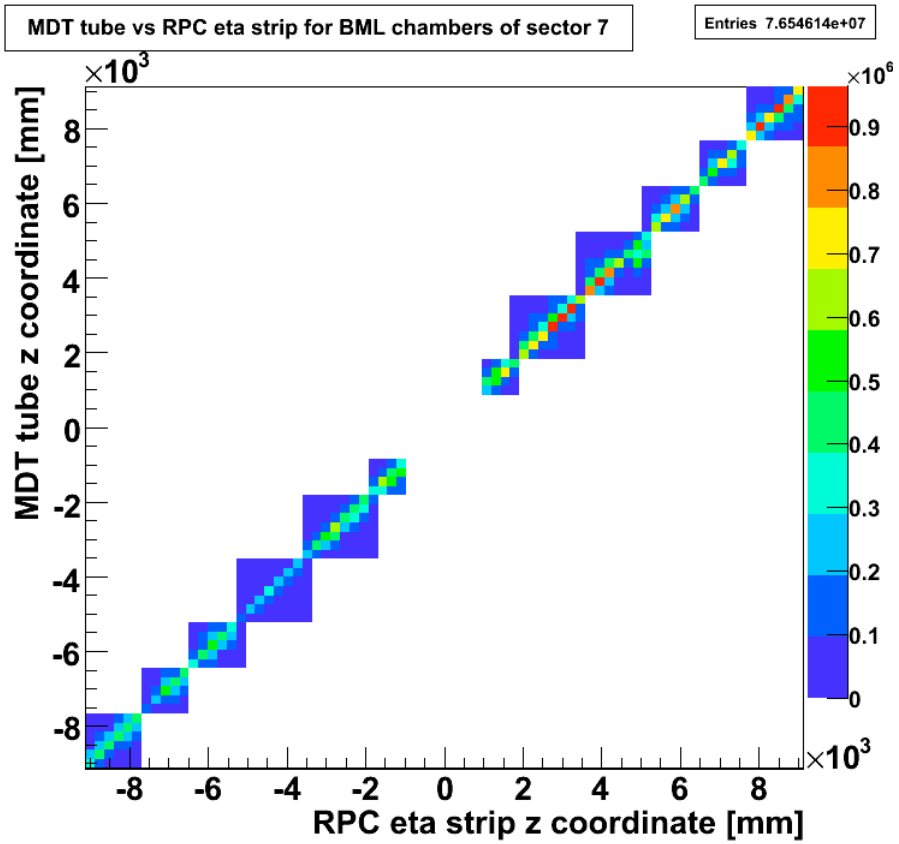

**From RPC stand-alone in tier0 Offline Monitoring**

# MDT–RPC spatial correlation

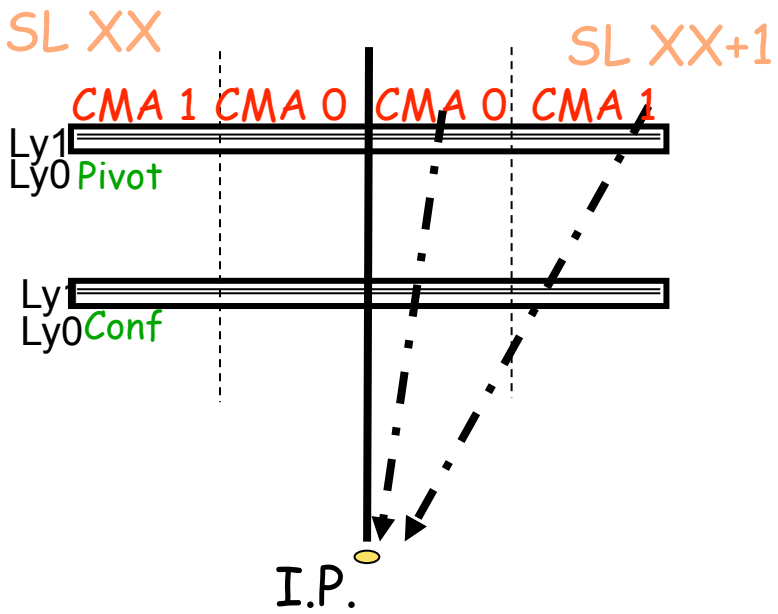
Spatial correlation between MDT tubes and RPC eta hits with cosmic data

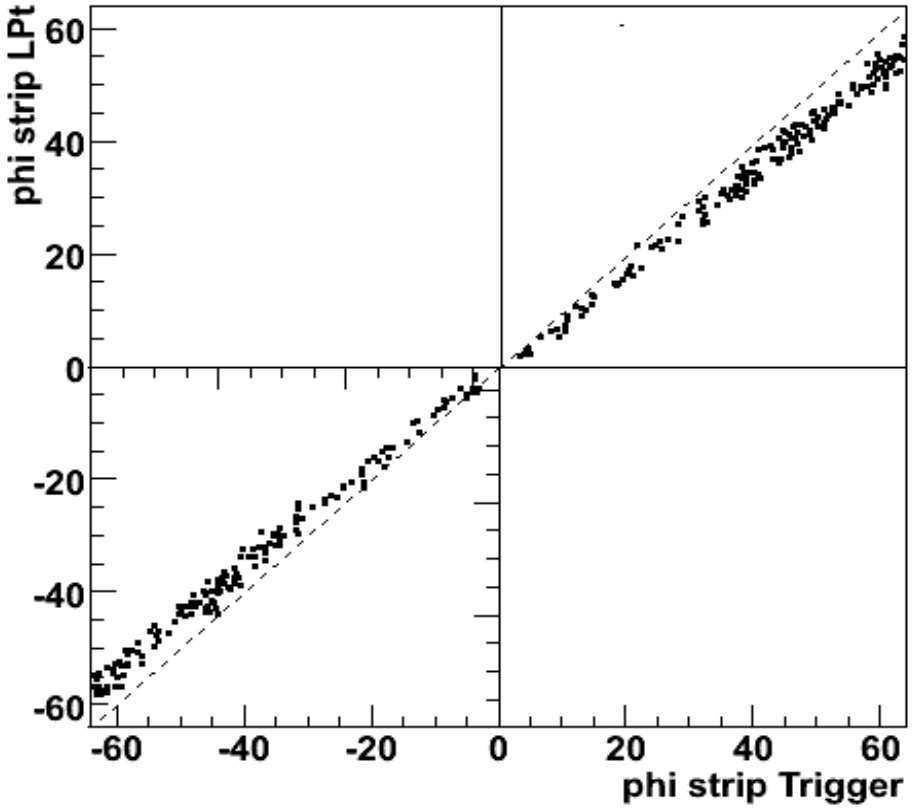
The picture shows the scatter plot between MDT tubes z coordinate and RPC eta hits z coordinate of the same chamber along sector 7 for the Middle chamber

The blue squares are due to uncorrelated hits and show the station geometrical boundary along the z-axis.



# Phi trigger roads




RPC spatial correlation between trigger strip (Pivot) and confirm strip (LowPt) in phi view for a programmed trigger road in cosmics data

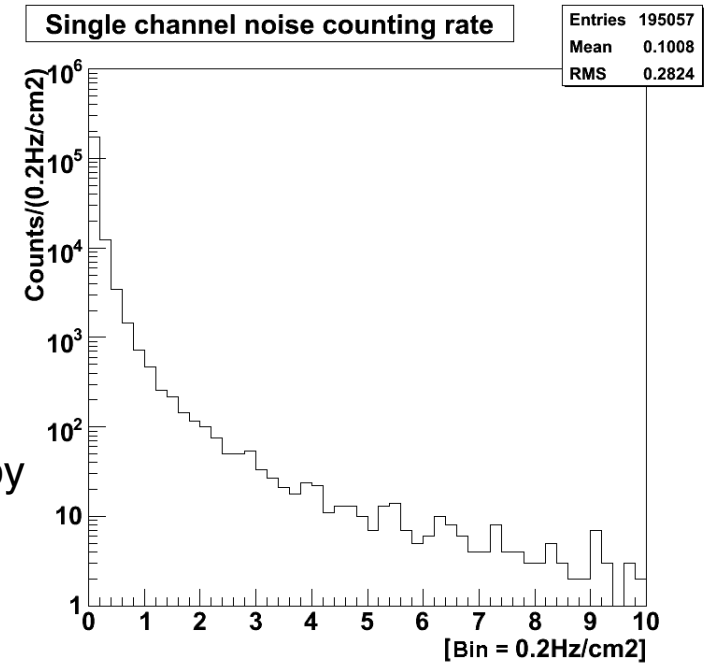
Strip number 0 corresponds to the center of the geometrical sector.

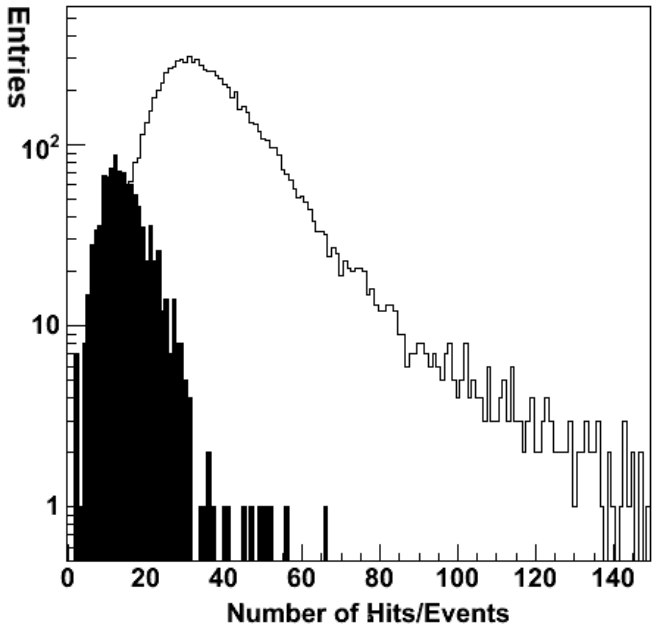
# Noise and occupancy

HV=9.6kV, Vth=-1V (standard operating conditions)

RPC distribution of single channel noise counting rate per unit area measured with random triggers

The noise is referred to the front-end channel and is calculated by the total number of hits divided by the total number of random triggers and the readout window (200 ns) normalized by the equivalent strip surface.



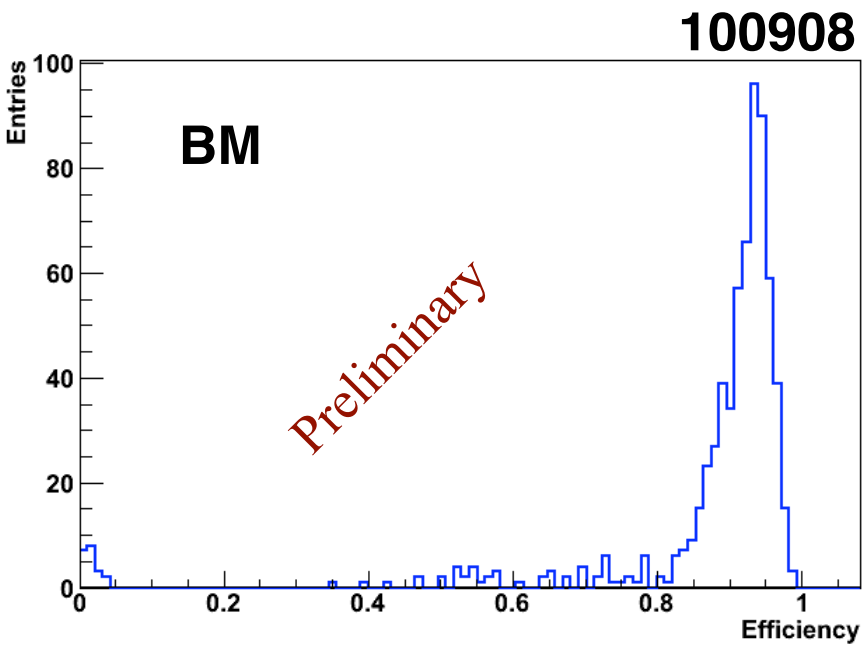




Distribution of RPC hits per event with RPC cosmic trigger (not filled area) and with random trigger (black filled area)

The distributions correspond to the RPC detector occupancy due to cosmics and uncorrelated noise (readout window 200ns)

# Efficiency and spatial resolution with MDT tracks

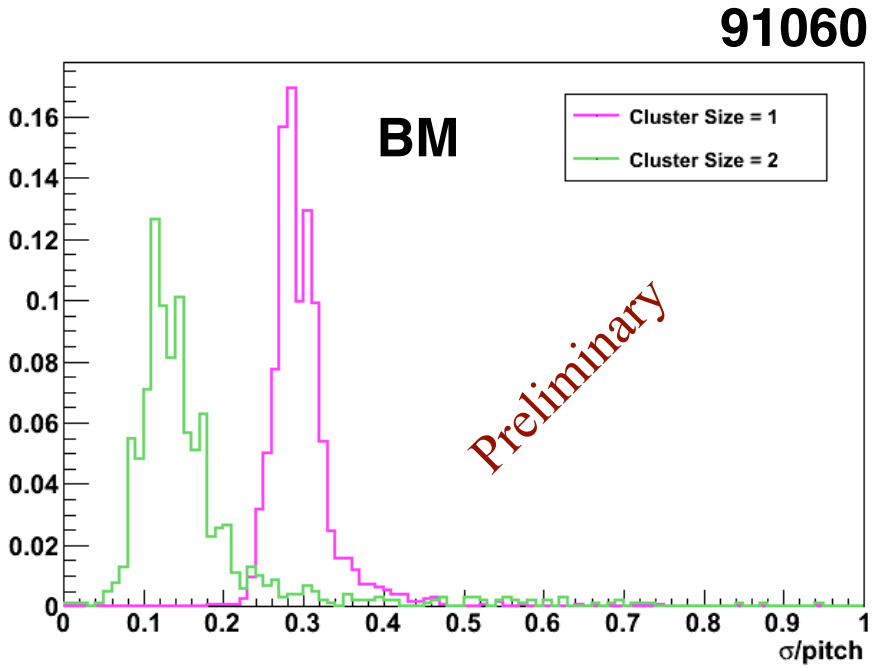
- Events triggered by RPCs with ¾ majority
- Only 1 MDT track reconstructed by MuonBoy
- Look at 4th layer when trigger justified offline by 3 layers




**Efficiency for BM chambers**
with HV=9.6kV, Vth=-1V

BO efficiency slightly lower than BM
but GREAT IMPROVEMENT wrt 2008 runs

Specific tuning of detector parameters
still to come




**Residual distribution**
normalized to strip pitch

# Summary

- Impressive amount of work done in the last months
- Gas inlets repair still on-going
  Under study the possibility to operate on weak inlets to prevent new fractures especially in BOL stations
- DCS improved a lot: monitoring and operations much easier
  Now developing the interaction with databases and with DAQ
- DQ already advanced in offline
  Many recent progresses on DCS and online
- Large improvement of trigger coverage in the last months thanks to the work on PADs
  Currently around 95% for Low-Pt triggers
- Trigger system made more robust during last months, both for trigger (reduced jitter due to more aligned signals) and for readout (robust synchronization between the data-flow elements)
- Timing issue is on-going with more complex studies using the complete geometry of the system, to prepare the configuration for collisions
  New help from 2 young offline experts