

# ALICE Status Report to LHCC September 2008

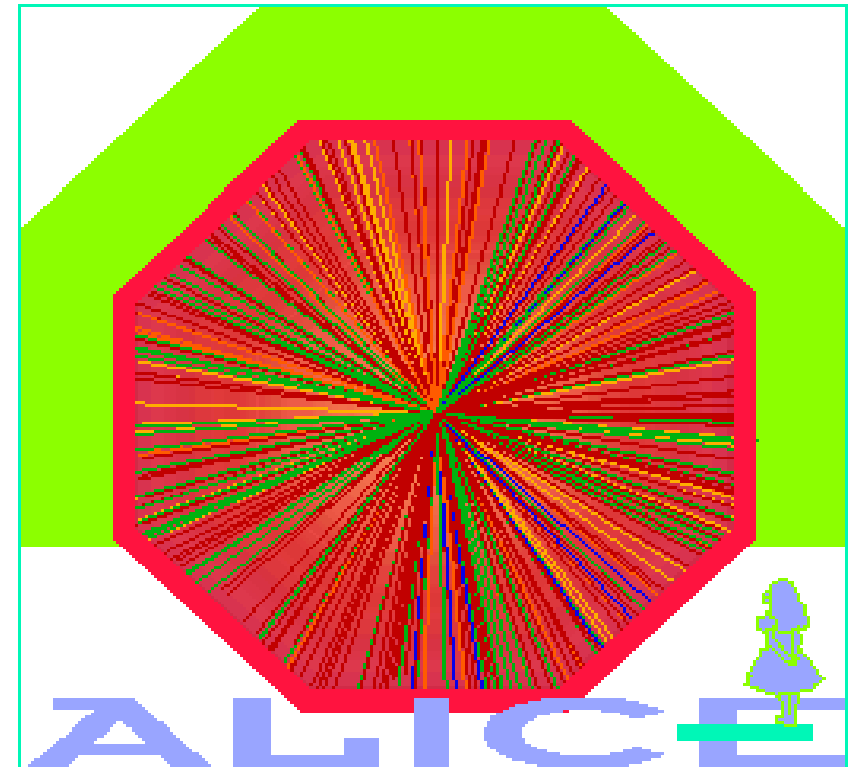
- **Collaboration News**

- **ALICE Status**

- ⇒ **Hardware status**

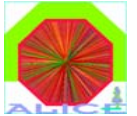
- ⇒ **Commissioning activities**

- ⇒ **Planning**





# Collaboration News



## ● New Institutes

- ⇒ **Purdue (USA)**
- ⇒ **Tennessee (USA);**
- ⇒ **Yonsei (Korea)**
- ⇒ **Pusan (Korea):** replaces Pohang which left end 2007
  
- ⇒ **Istanbul (Yildiz Technical University, Turkey)**
  - ★ **associate member** while looking for increased funding

**EMCAL**  
**EMCAL**  
**TRD, Physics**  
**Physics**  
  
**Physics**

## ● Institutes leaving

- ⇒ **IPE Karlsruhe (Germany), BARC (India)**
  - ★ **associate members, completed technical contribution** to the TRD/PMD electronics

## ● Applying

- ⇒ **Houston (USA)**
- ⇒ **Comsats, Pinstec (Pakistan)**      associate members

**EMCAL, Grid computing**  
**Physics, computing**

## ● Elections/Nominations

- ⇒ **Spokesperson: JS re-elected**

1.3 2009 until 31.12.2010



# ALICE Detector Installation mid 2008



## Complete:

ITS, TPC, TOF, HMPID,  
FMD, T0, V0, ZDC,  
Muon arm, Acorde

## Partial installation:

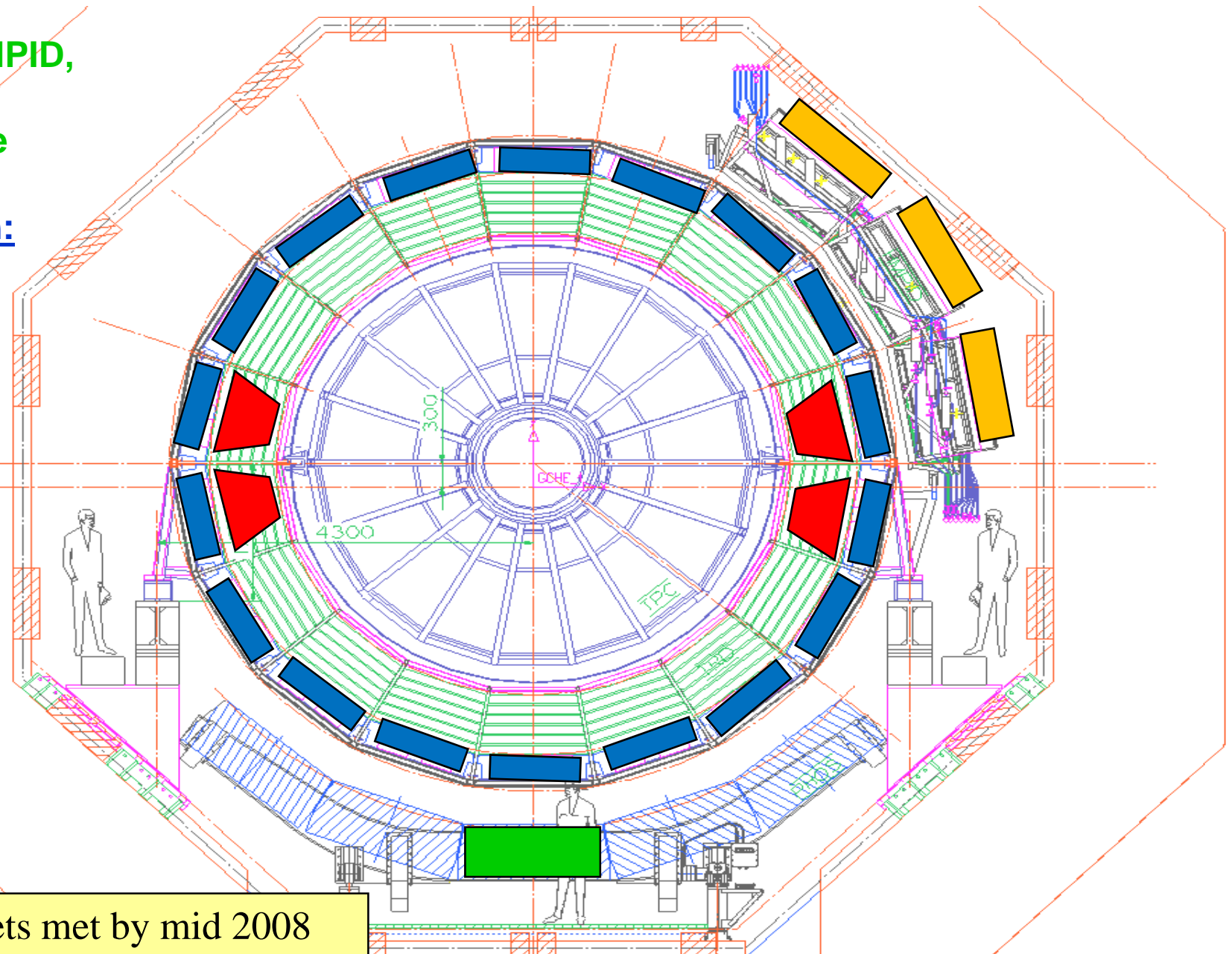
1/5 PHOS

4/18 TRD

9/48 PMD

0/6 EMCAL

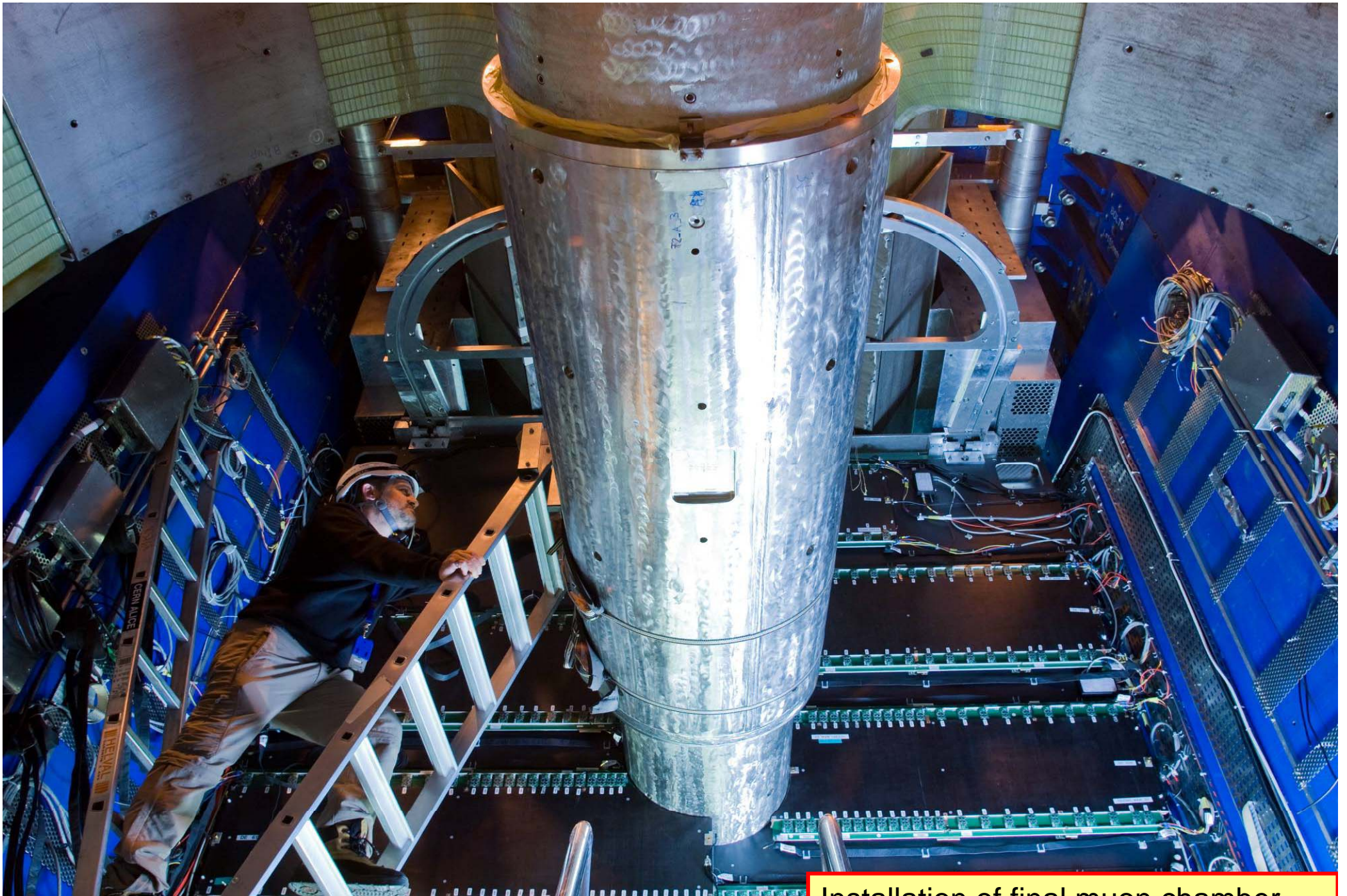
~ 40% DAQ/HLT



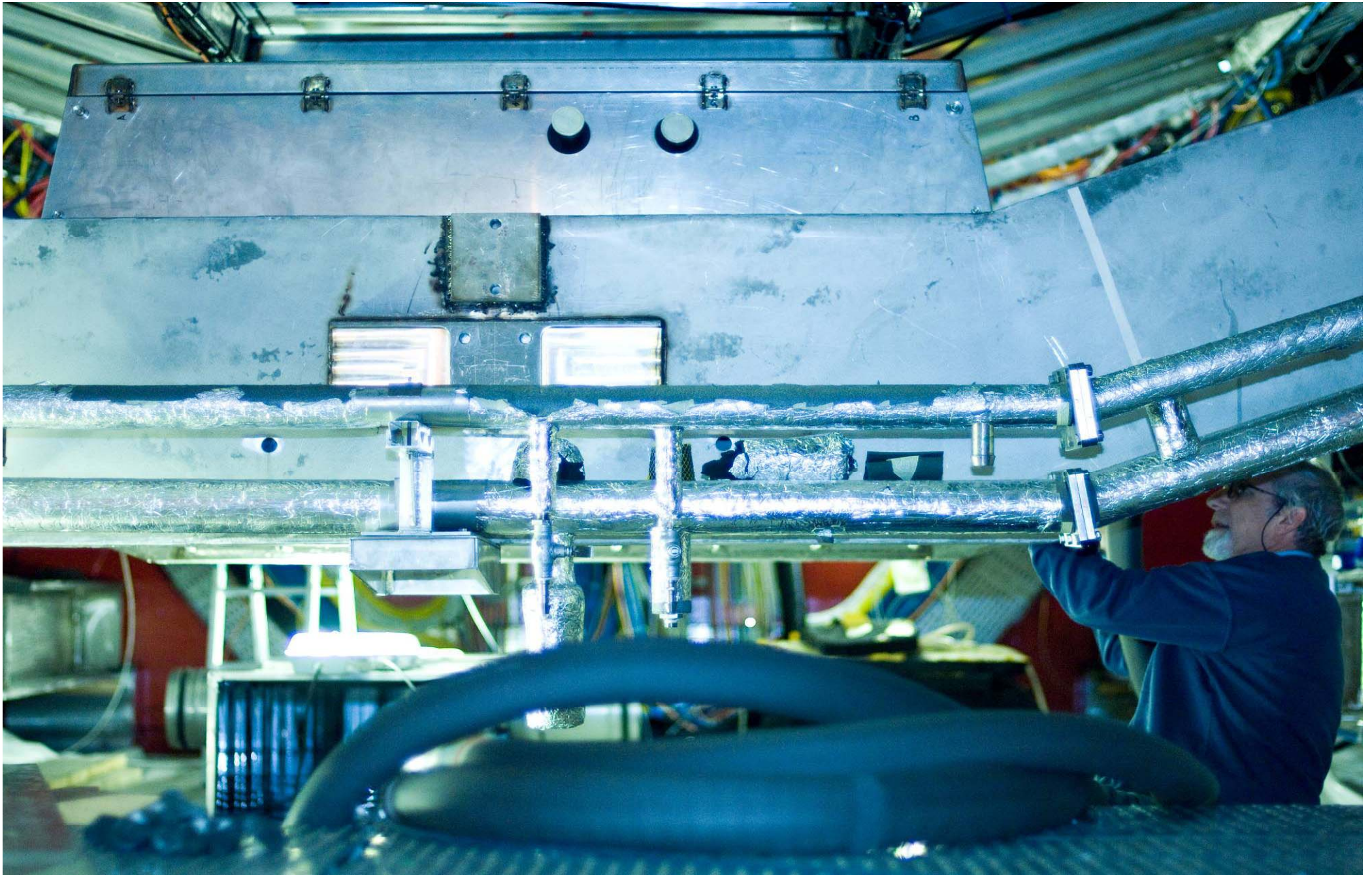
Installation targets met by mid 2008

24 April: Insertion of final TOF super module





Installation of final muon chamber



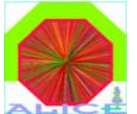
Installation 1<sup>st</sup> PHOS module



Formal end of ALICE installation



# Data Taking & Commissioning



## ● Commissioning runs (24/7)

⇒ **Cosmics I** (2 weeks, Dec 2007)

☆ **local** (individual detectors) and **start of global** (several detectors) commissioning

⇒ **Cosmics II** (3 weeks, Febr/Mar 2008)

☆ **local/global** commissioning, first few days of **alignment 'test' run**, **magnet commissioning**

☆ TPC was turned off after ~ 1 week (Drift HV instability, now understood & corrected)

⇒ **Cosmics III** (since May 2008 **continuous operation 24/7**)

☆ **global** commissioning, **calibration & alignment** production runs

## ● Injection tests

⇒ **TI2 dump** in June , **injection tests** August, first **circulating beam** September

⇒ observed **very high particle fluxes** during dumps and even during injection through ALICE

☆ 10's to 1000's of particles/cm<sup>2</sup> with beam screens in LHC and/or TI2

☆ decided to **switch off all sensitive detectors during injection**

SPD, V0 always on (trigger),

SSD, SDD, FMD, T0 occasionally

(beam was useful only for a small subset of detectors !)

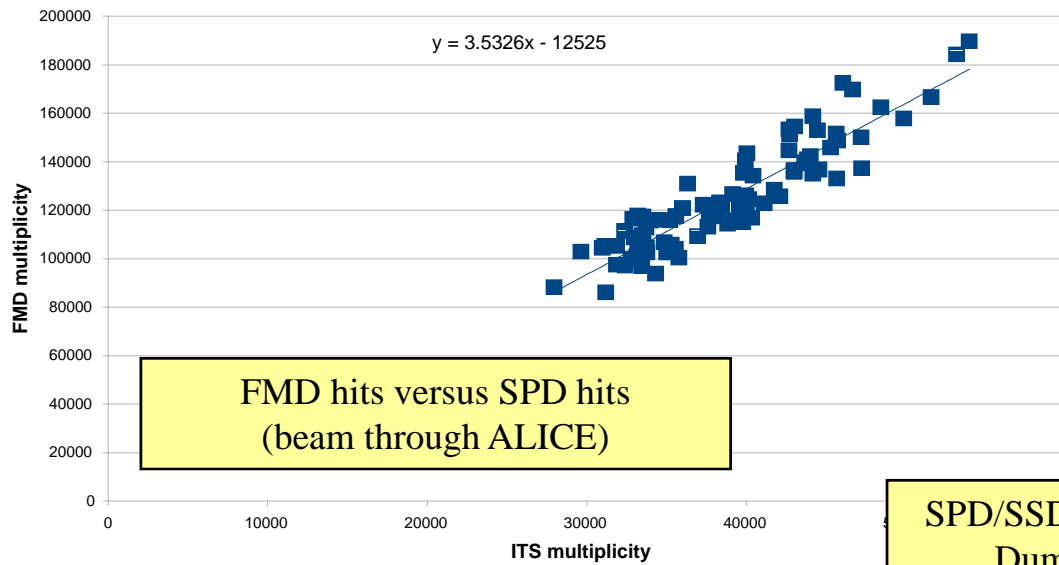
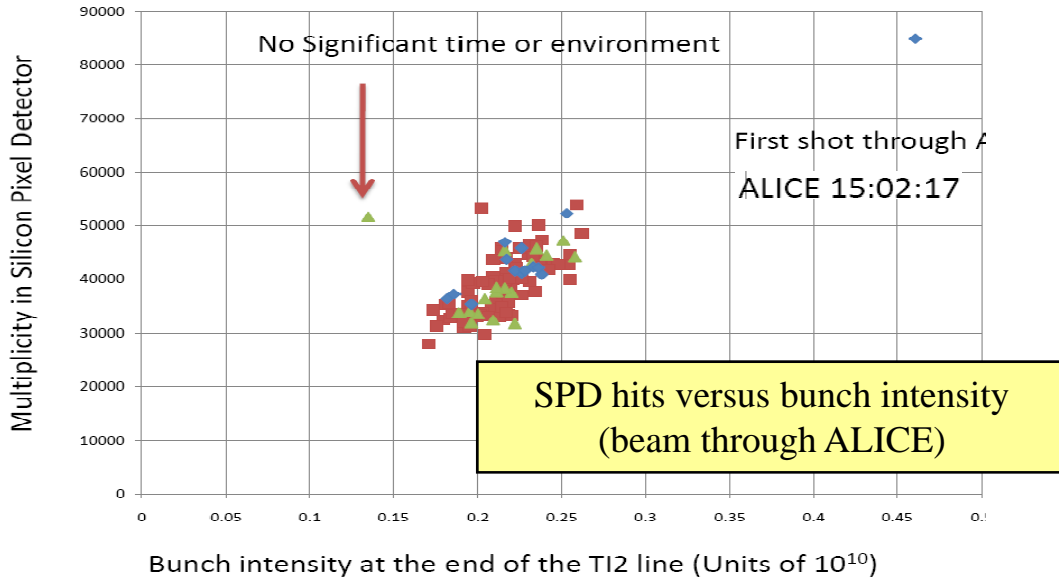




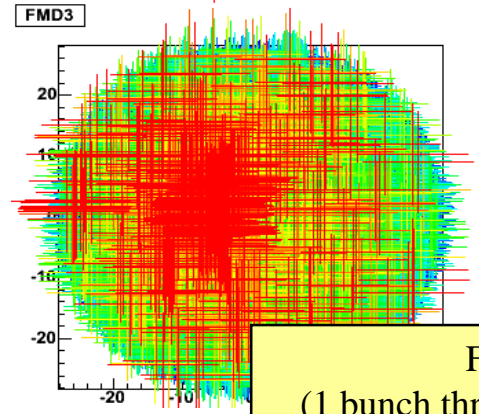
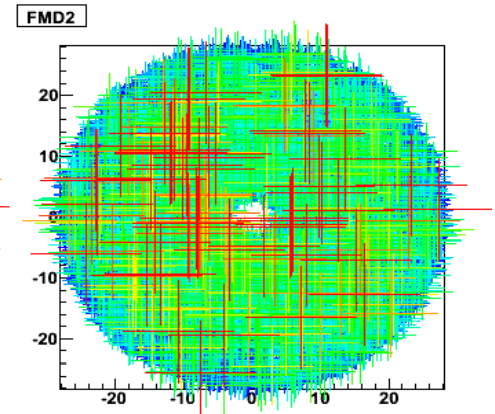
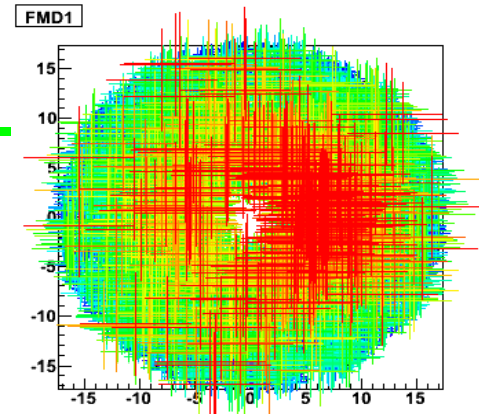
# Injection tests

T12 injection test Sunday August 24<sup>th</sup> 2007, Beam through ALICE

All shots from 15:02:17 (first shot through ALICE) to 19:08:46



SPD/SSD, Sunday, 15.6  
Dump on TED



Event # 21

# hits in FMD1: 10240

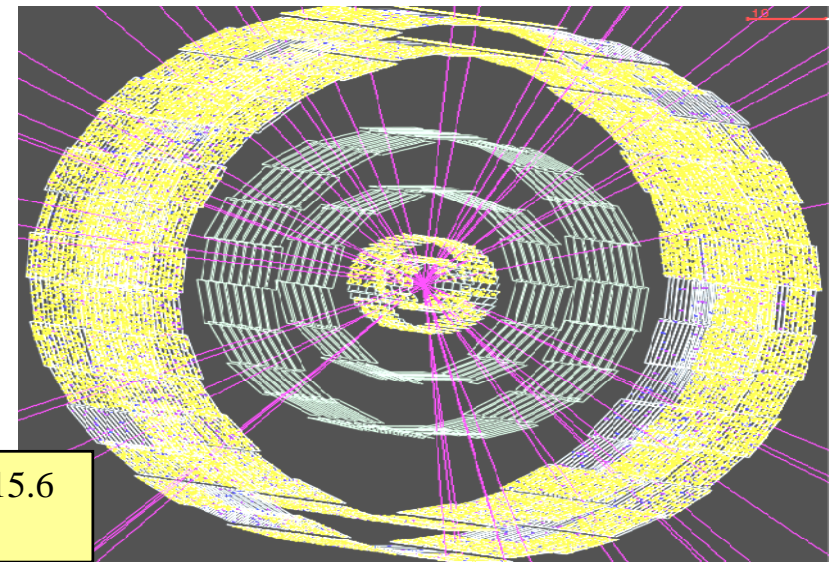
# hits in FMD2: 20479

# hits in FMD3: 20480

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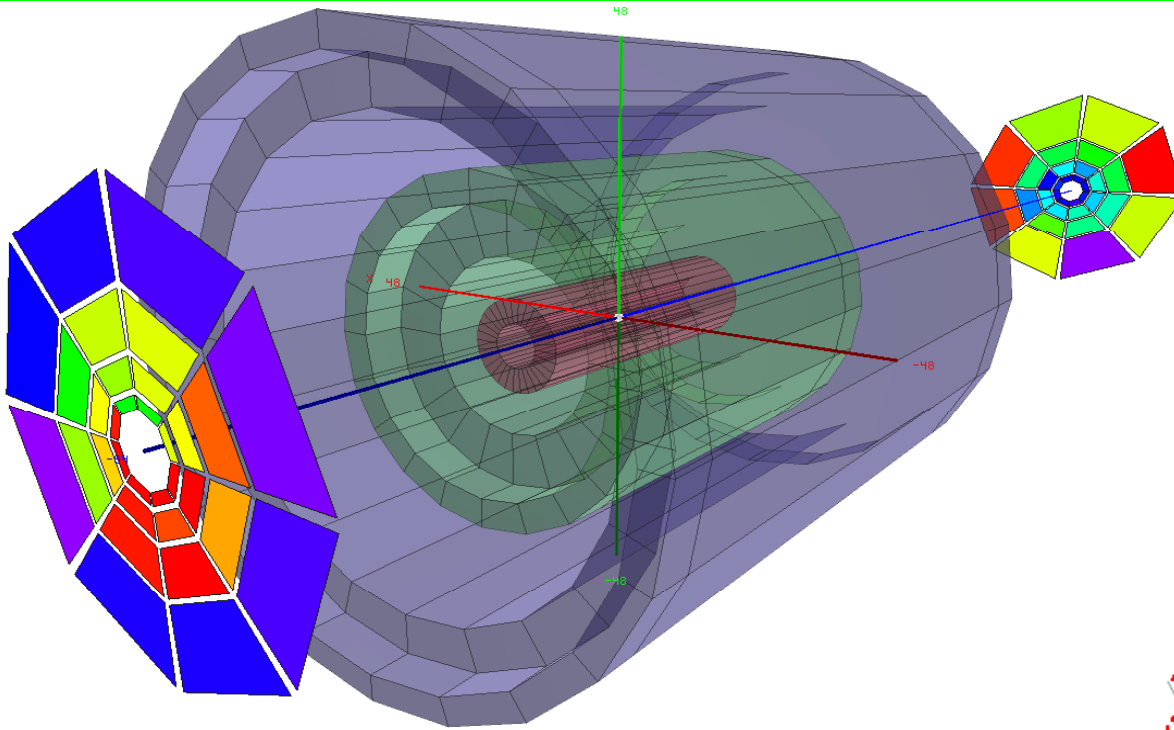
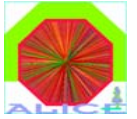
Total: 51199/51200 (99%)

FMD event display  
(1 bunch through ALICE, > 100 000 hits)



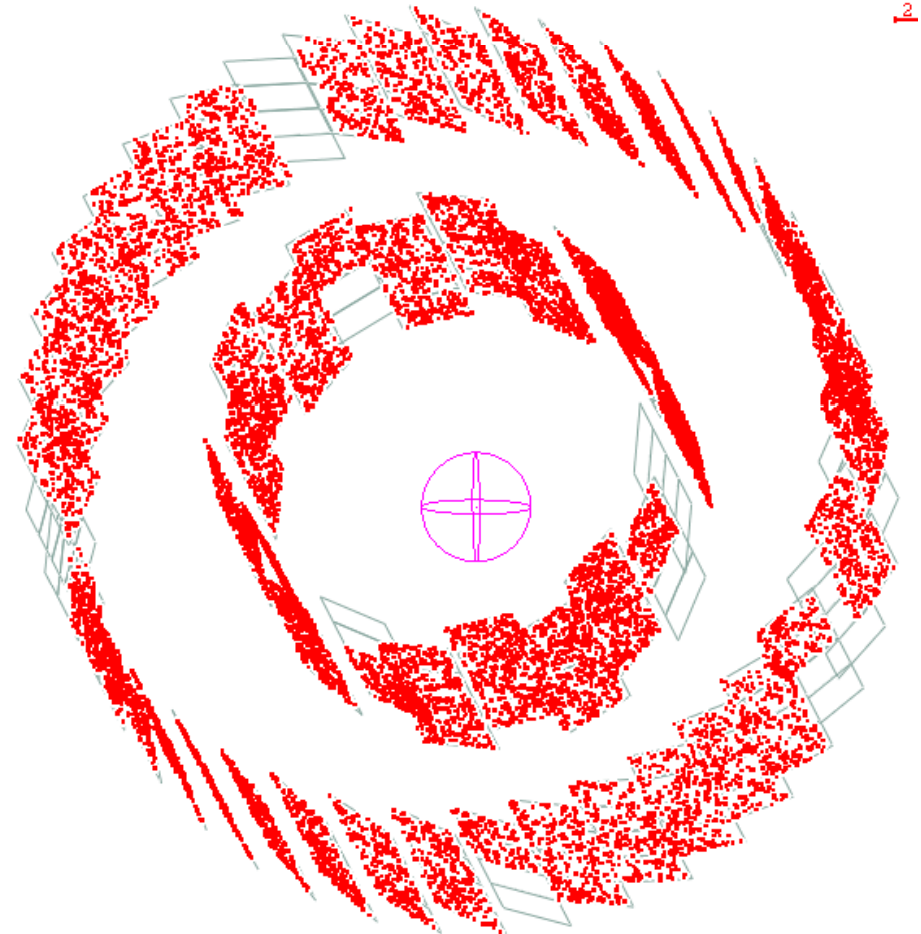


# First beam 10<sup>th</sup> September



V0 hits on 10.9.2008, shortly after 9 am

SPD hits on 10.9.2008, shortly after 9 am



# Scalers Control

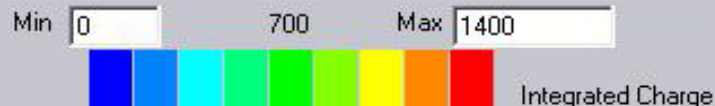
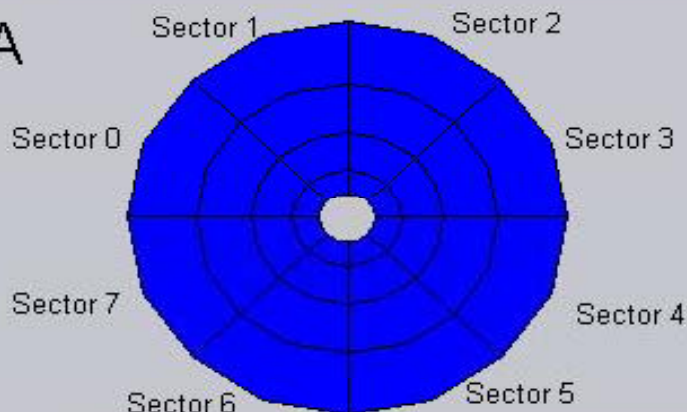
## Luminosity monitor (V0)

Triggers Scalers

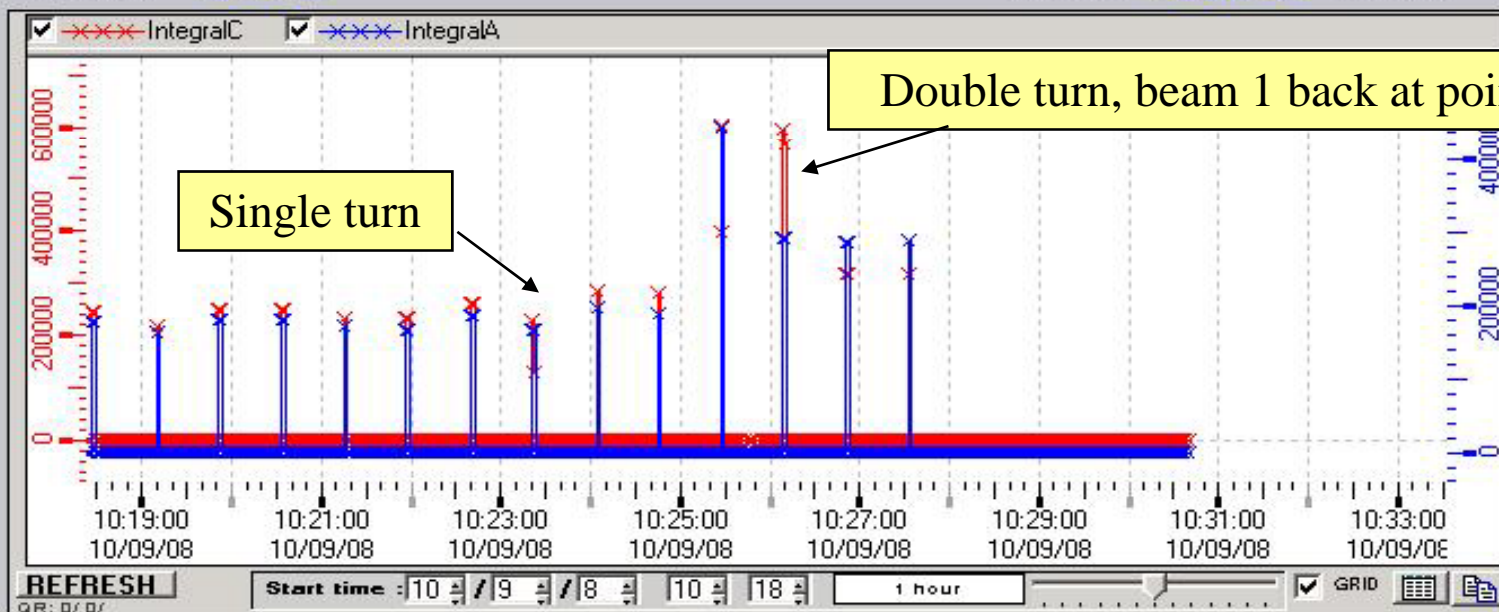
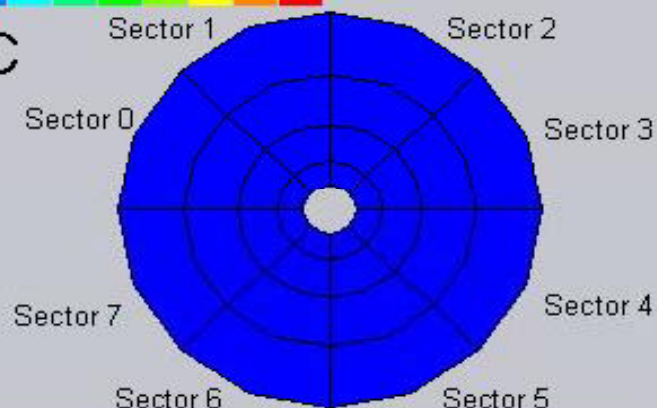
Integrated Charge Scalers

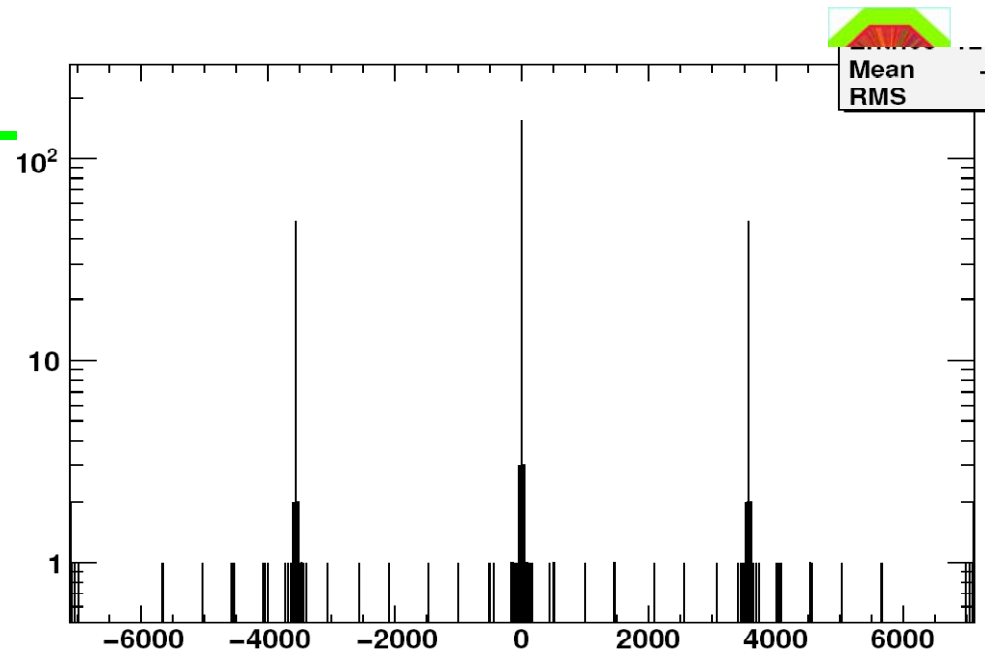
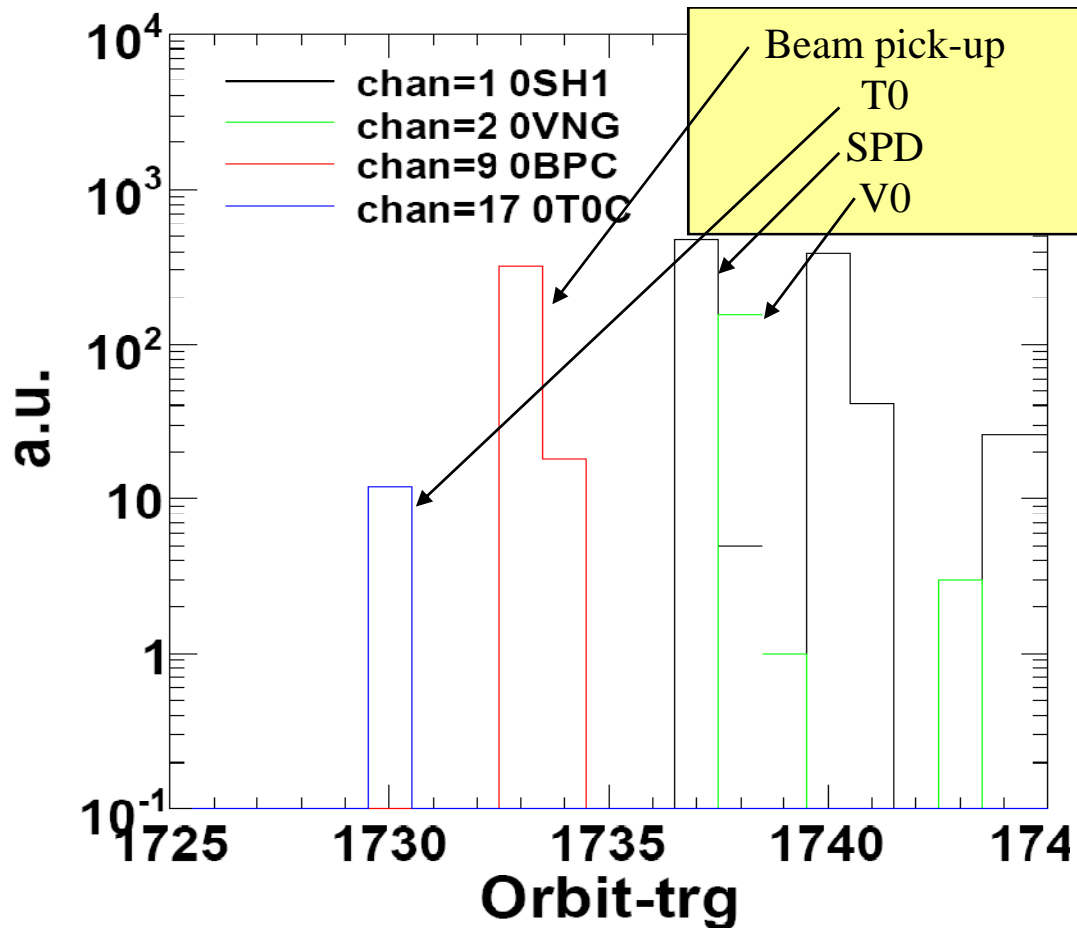
### Integrated Charge Scalers

VOA



VOC



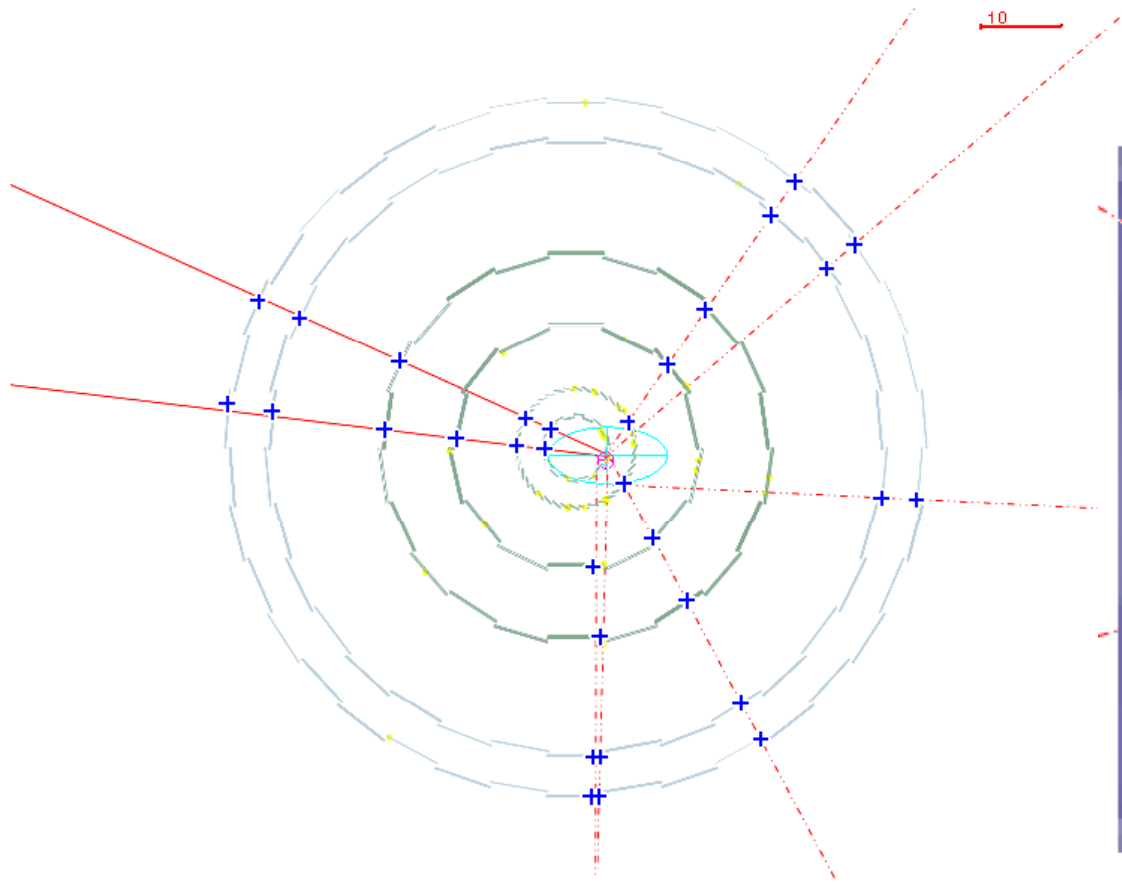


Auto-correlation for SPD trigger,  
 with multi-turn correlations  
 (3564 bunch crossings)

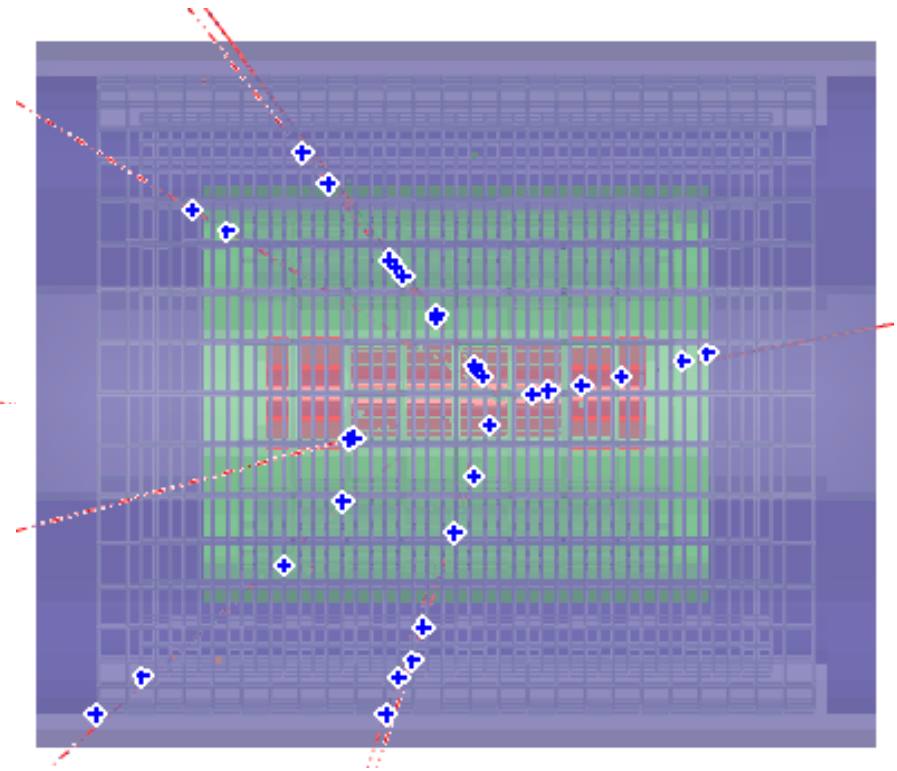
Trigger timing (before alignment) versus bunch number  
 single shot  
 for SPD, V0, beam-pickup BPTX, T0 triggers



# First interactions 12<sup>th</sup> September



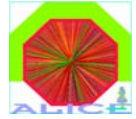
ITS tracks on 12.9.2008  
7 reconstructed tracks, common vertex



Circulating beam 2:  
stray particle causing an  
interaction in the ITS



# TPC Commissioning



## ● TPC up and running since end 2007

⇒ chamber+FC, gas system, cooling, FEE, Laser, DCS, DAQ, HLT,...

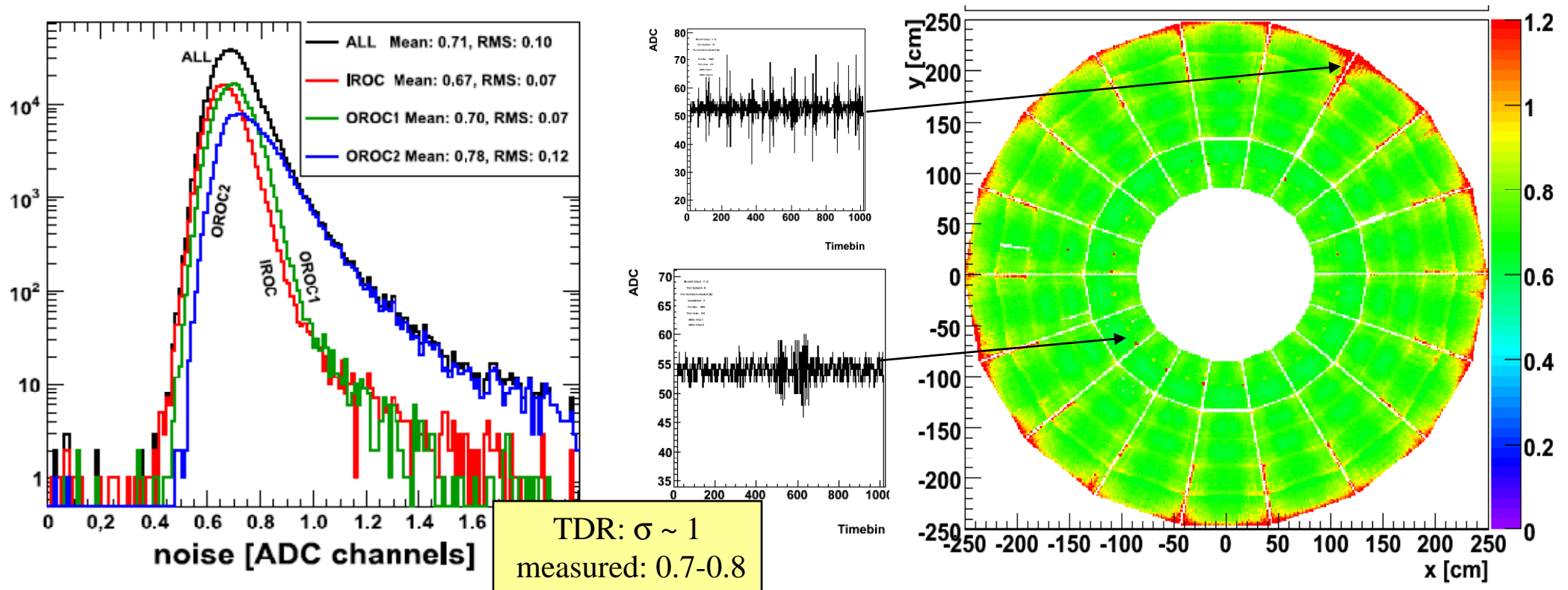
☆ **noise reduction**: modify PS (some occasional excess noise remains in outer parts)

☆ replaced several faulty electronics components (FEE, RCU, ..)

☆ some IROC **decoupling capacitors** show leakage after months of operation

already several replaced, currently 2 'weak' left + 2 IROCs not operational

☆ **difficult or no access to parts of the TPC => modify cabling during long WS**





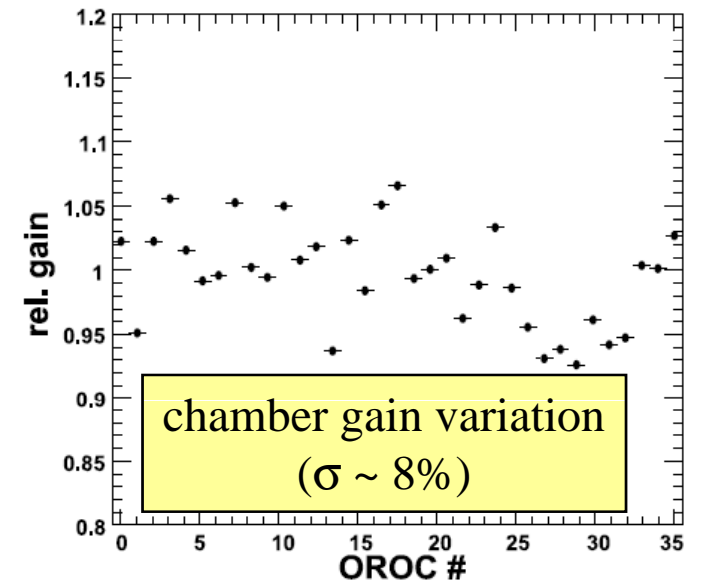
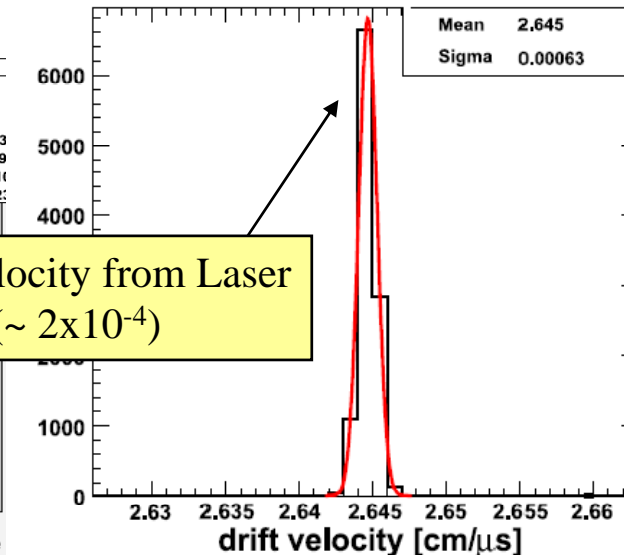
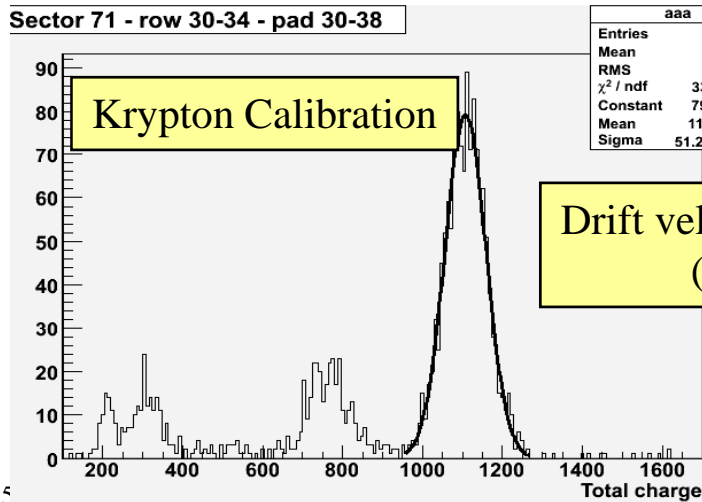
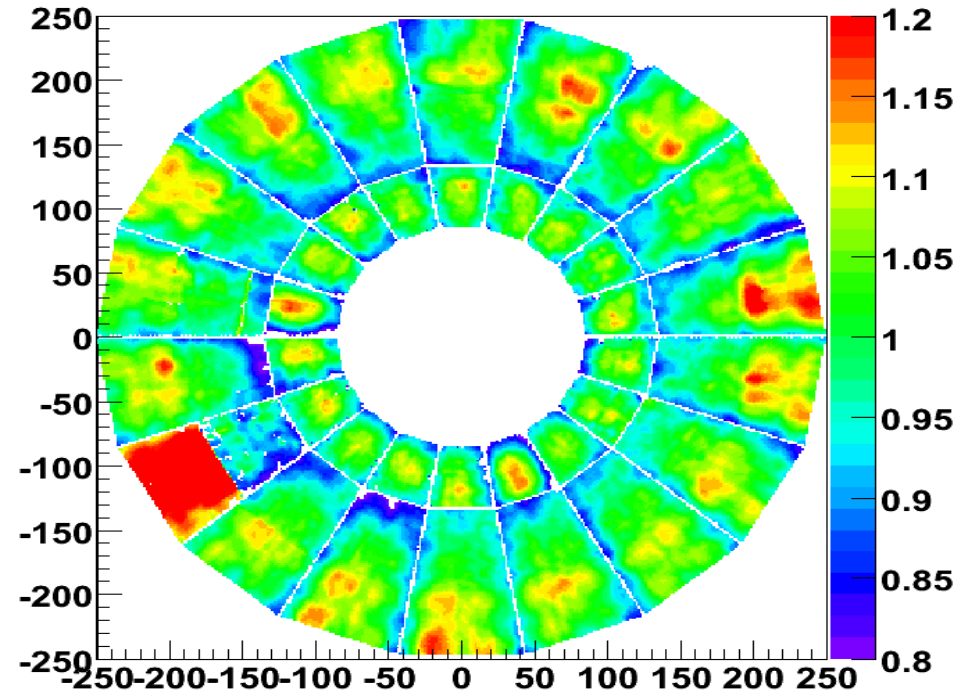
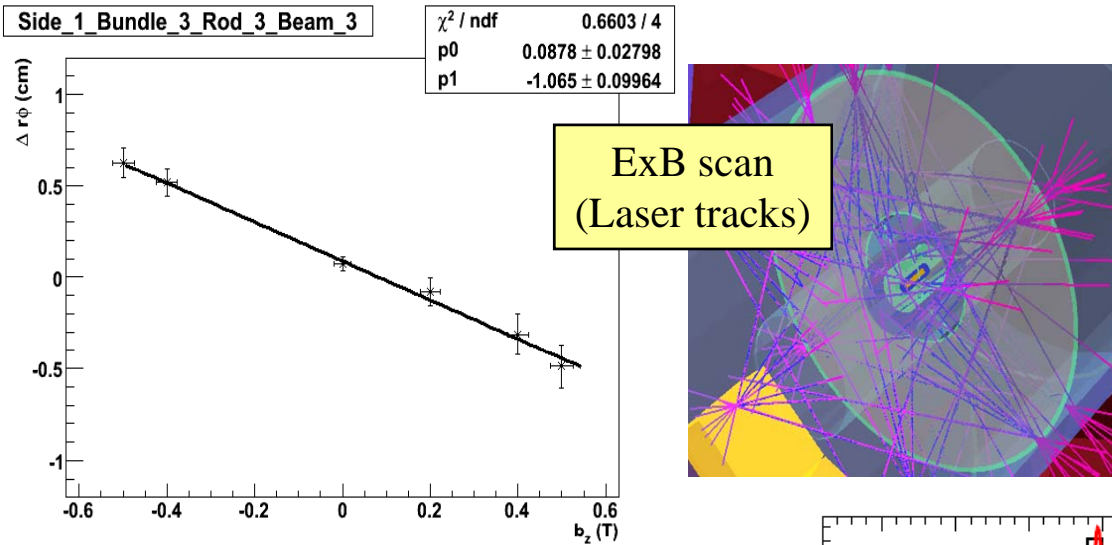
# TPC Calibration

## Krypton Gain Calibration



### ● Gain, drift velocity, ExB, alignment,..

⇒ Laser, Cosmics, Krypton, drift velocity monitor, gas composition, T/P sensors ..





# TPC Performance



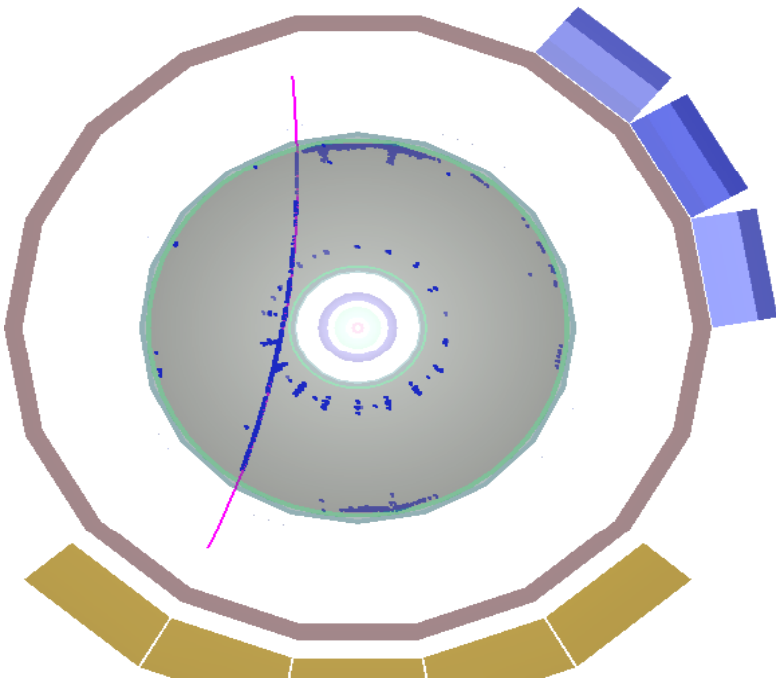
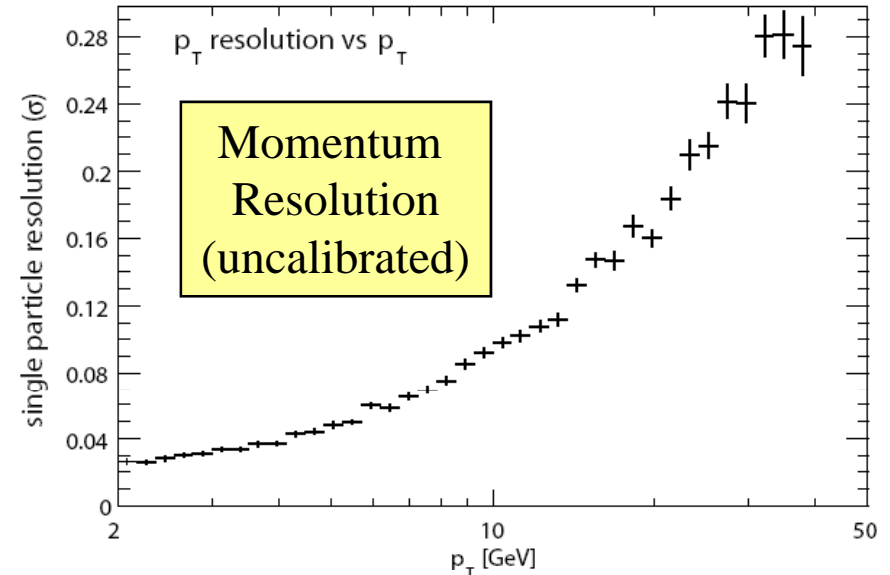
## ● First preliminary results from cosmics

⇒ dE/dx resolution (PPR goal: ~ 5.5%)

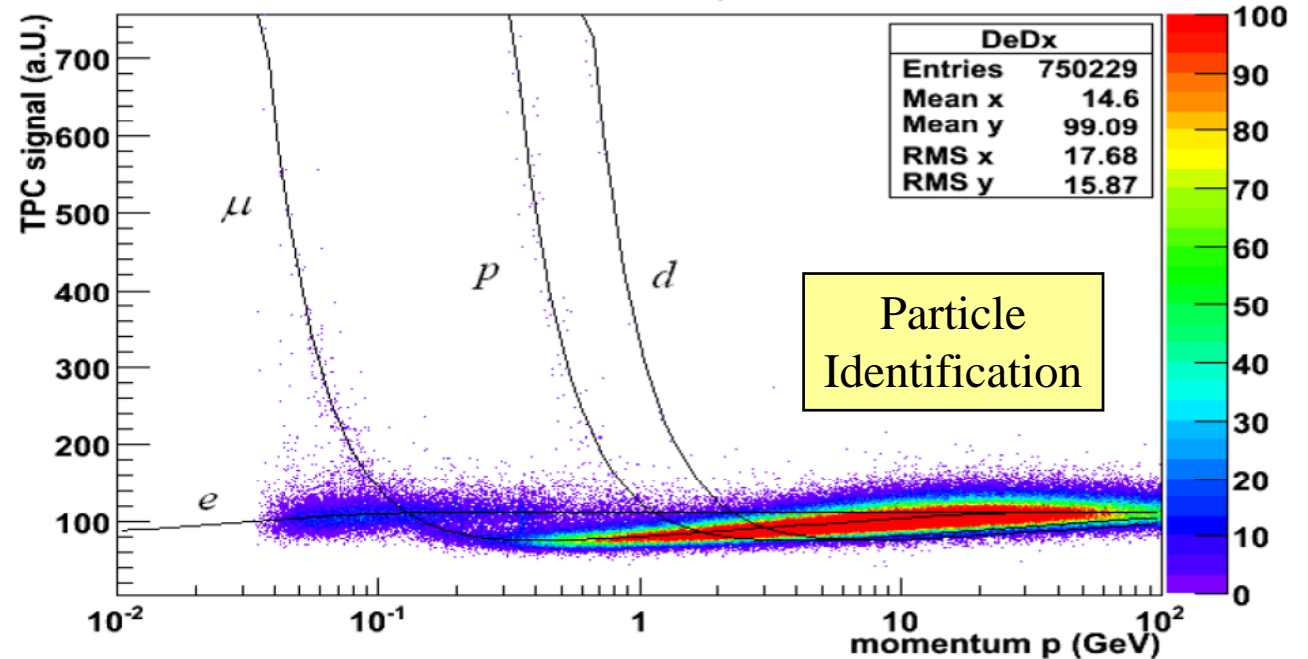
★ < 6%

⇒ p<sub>t</sub> resolution (PPR goal: ~ 5% @ 10 GeV)

★ ~ 10% @ 10 GeV w/o calibration



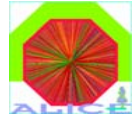
5,000,000 cosmic events from JUNE 2008, simple KR calibration



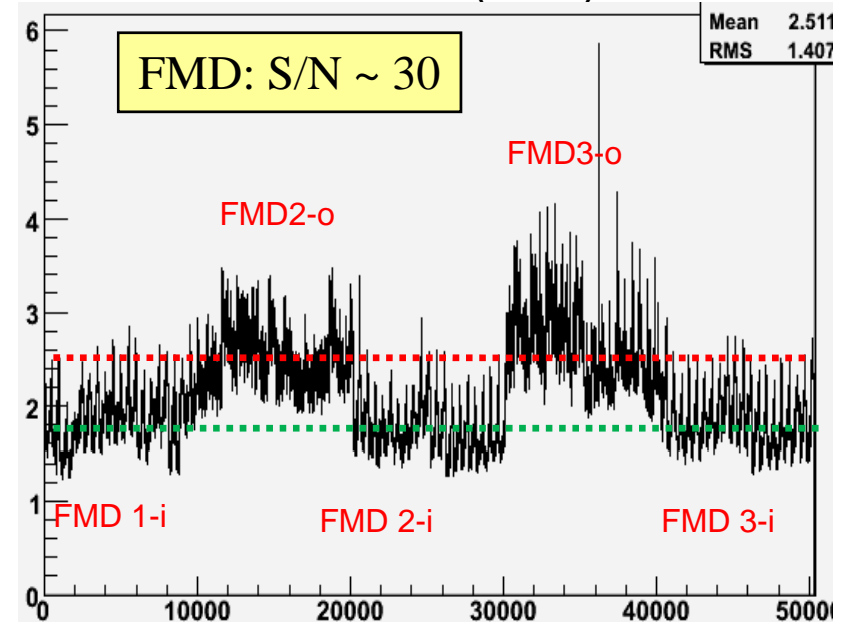
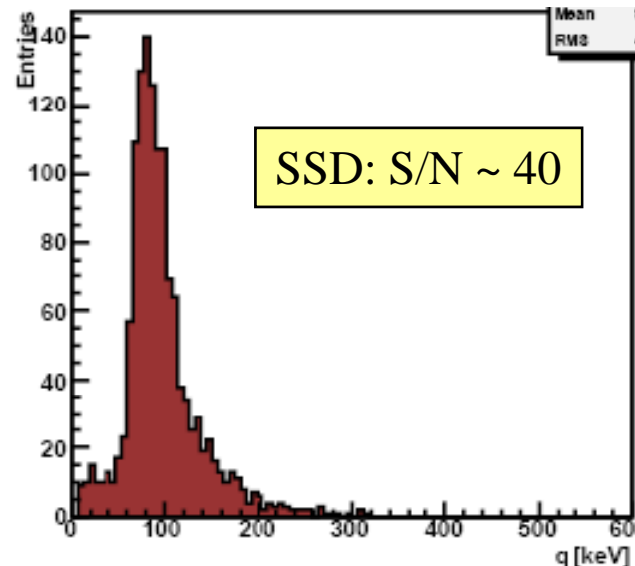
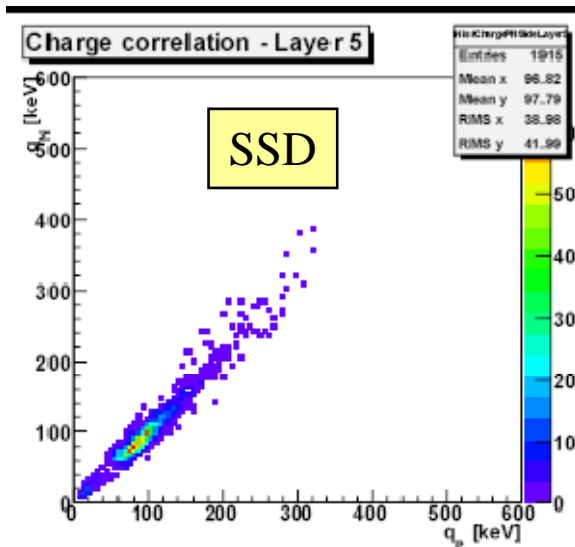




# Silicon: ITS & FMD status



- all silicon detectors fully commissioned (Det., DAQ, DCS, cooling, ..)
  - ⇒ pixel trigger worked 'out of the box' and was heavily used
  - ⇒ individual bad/noisy channels ~ within specs (<0.15% SPD, FMD, 1.5% SSD, 3% SDD)
  - ⇒ lost some modules/half-ladders (tracking is sufficiently redundant, so physics impact is minor)
    - (ITS detectors could only be fully tested after cabling on miniframe, i.e. w/o access)
  - ☆ **SPD**: 12.5% half-staves (2 connection, 13 insufficient cooling flow)
    - plan to improve flow regulation for individual circuits next WS
  - ☆ **SDD**: 5% modules (~ 1/3 can be recovered during shutdown)
  - ☆ **SSD**: 3.8% modules, 9% half-ladders
    - mostly Sintef ladders which developed excessive bias current (8/22)





# ALICE Inner Tracking System: Alignment with Cosmics



## Silicon Pixel Detector (SPD):

- ~10M channels
- 240 sensitive vol. (60 ladders)

## Silicon Drift Detector (SDD):

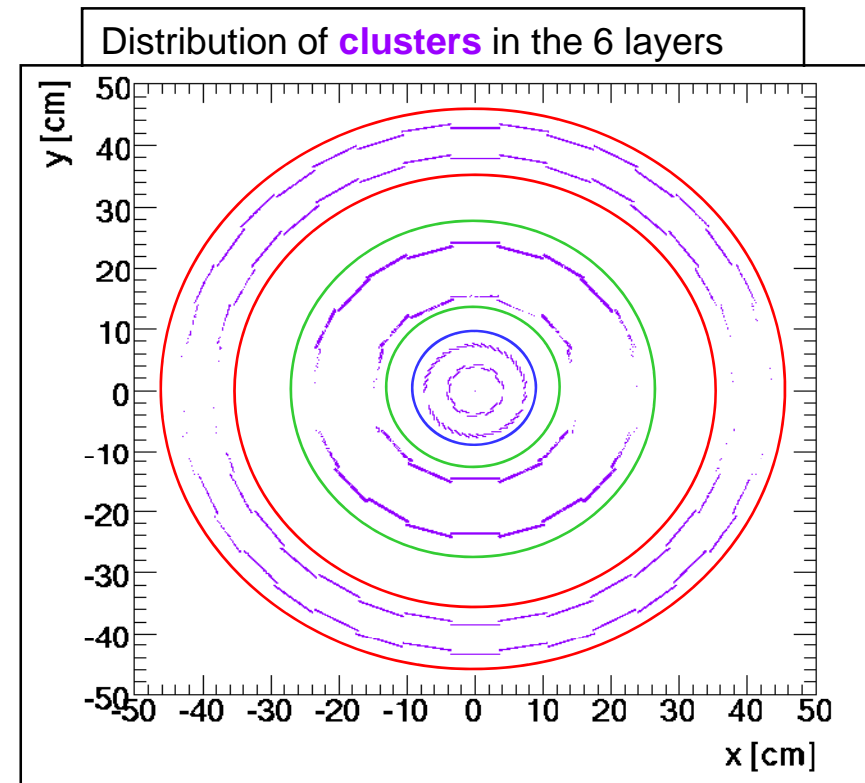
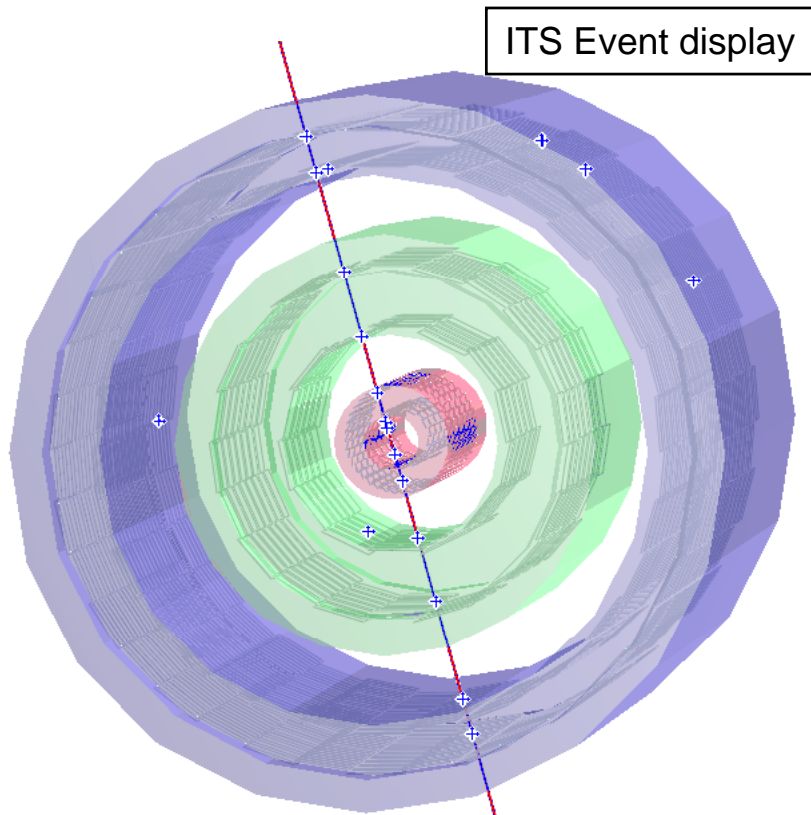
- ~133k channels
- 260 sensitive vol. (36 ladders)

## Silicon Strip Detector (SSD):

- ~2.6M channels
- 1698 sensitive vol. (72 ladders)

**ITS total: 2.2k alignable sensitive volumes → 13k degrees of freedom**

- Alignment using tracks and Millepede program in a hierarchical approach
- ~50k cosmic  $\mu$  for alignment collected since end of May (~0.1 Hz), using Pixel trigger



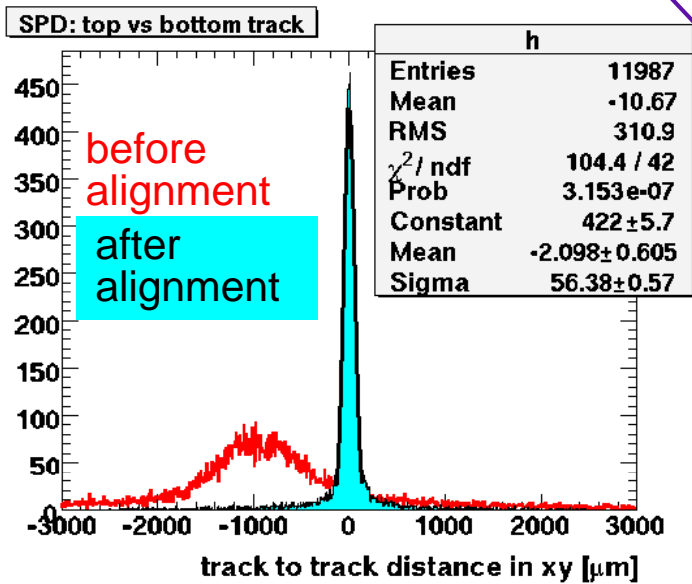


# ALICE Inner Tracking System: Alignment with Cosmics

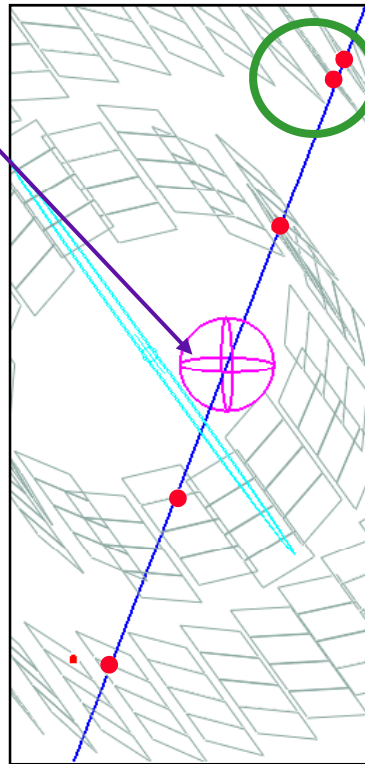


- Preliminary results for SPD (Pixels, ~ 80% prel. aligned):

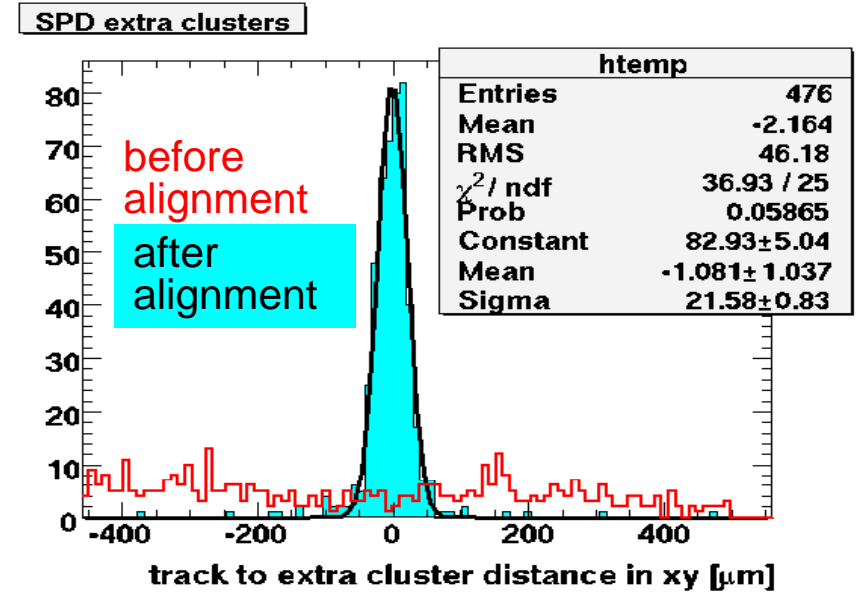
Track-to-track (top vs bottom) distance in transv. plane



$\sigma = 55 \mu\text{m}$  (vs  $40 \mu\text{m}$  in simulation without misalignment)



Track-to-“extra clusters” distance in transv. plane (sensor overlap)

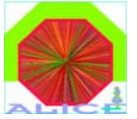


$\sigma = 21 \mu\text{m}$  (vs  $15 \mu\text{m}$  in simul. without misalignment)

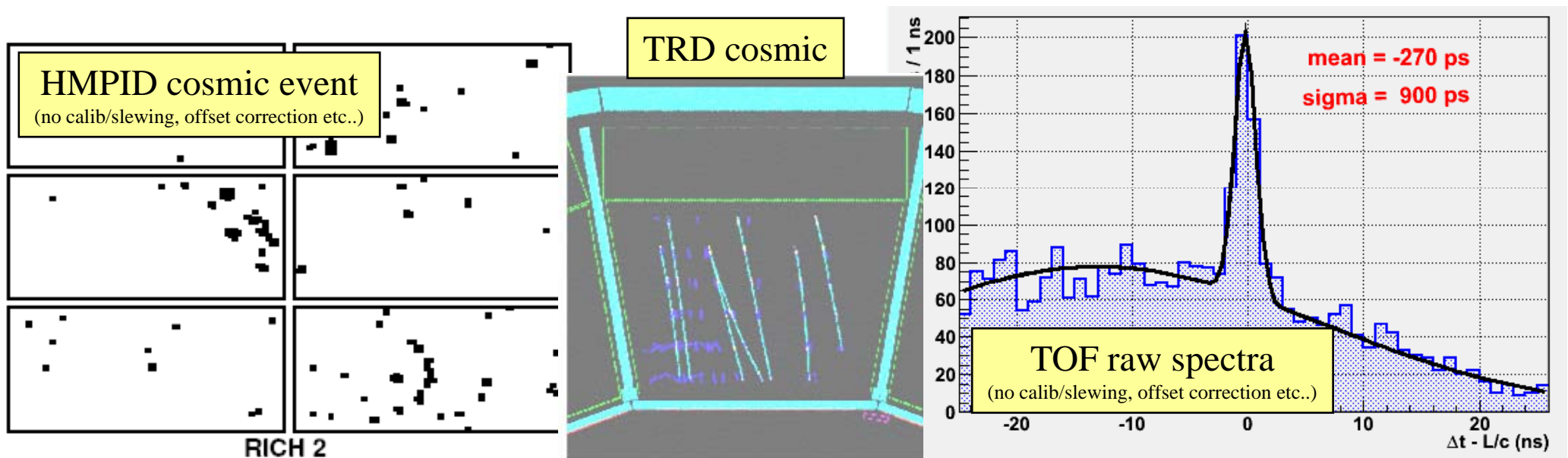
- Residual misalignment  $< 10 \mu\text{m}$  (detector resolution =  $12 \mu\text{m}$  in  $r\phi$ )
- SSD & SDD, as well as ITS/TPC alignment has started (smaller coverage)



# Other Detectors

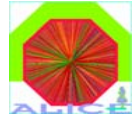


- **TOF:** 2/3 fully commissioned (3 finishing gas tests, 3 missing DC-DC converters)
  - ⇒ TOF trigger works very well (noise factor 2 better than in tests)
- **TRD:** 4 SM's installed (2 final ones), noise and L1 trigger ok
- **HMPID:** fully commissioned, noise at specs
- **PHOS:** 1 module fully commissioned, trigger com. ongoing
  - ⇒ occasional noise pickup (depends on the day..)
- **Muon tracking:** ~ 70% commissioned, noise problem cured in all but station 3
- **Muon trigger, V0, T0, ACORDE, ZDC:** all up and running



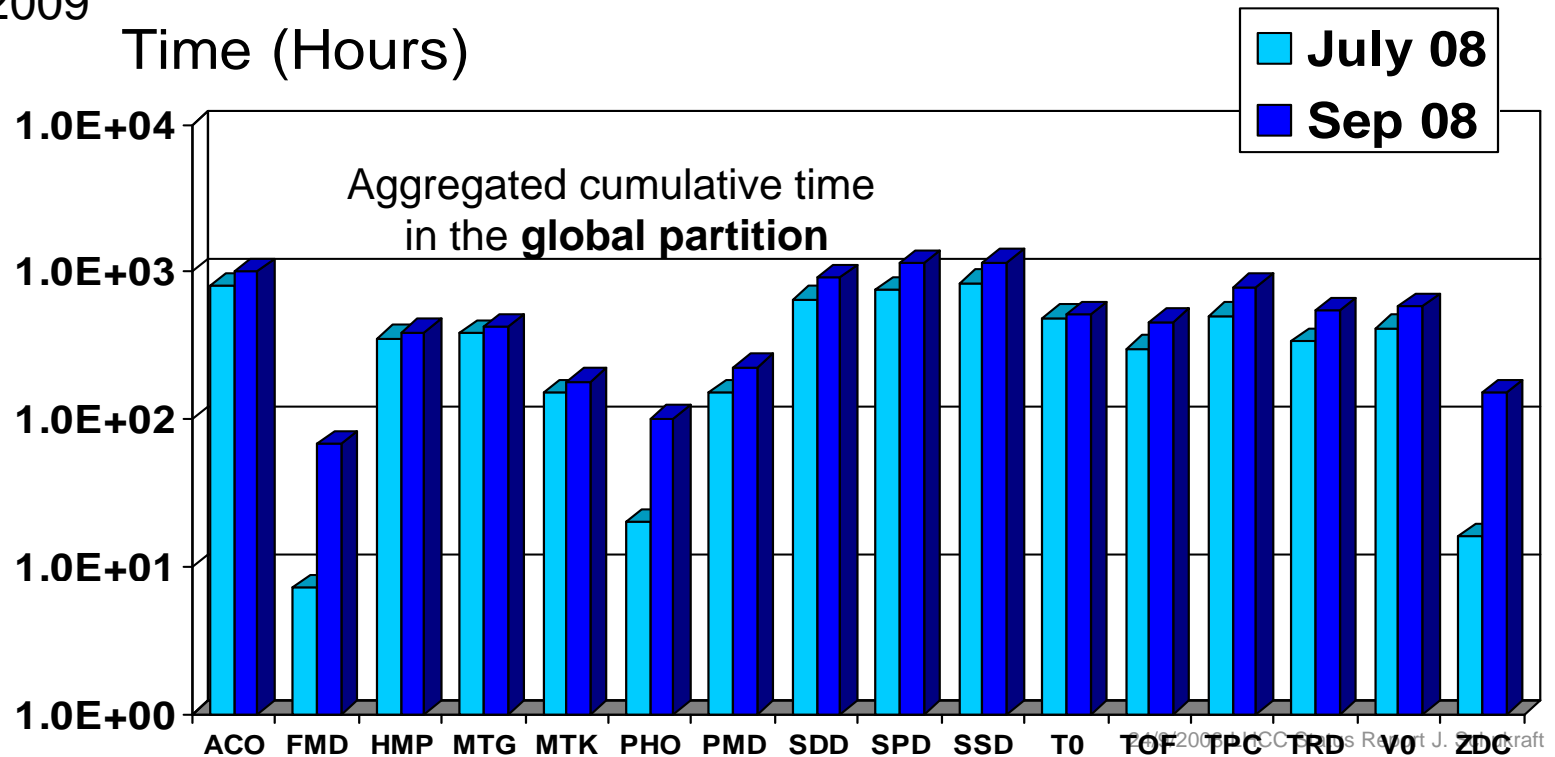


# Online



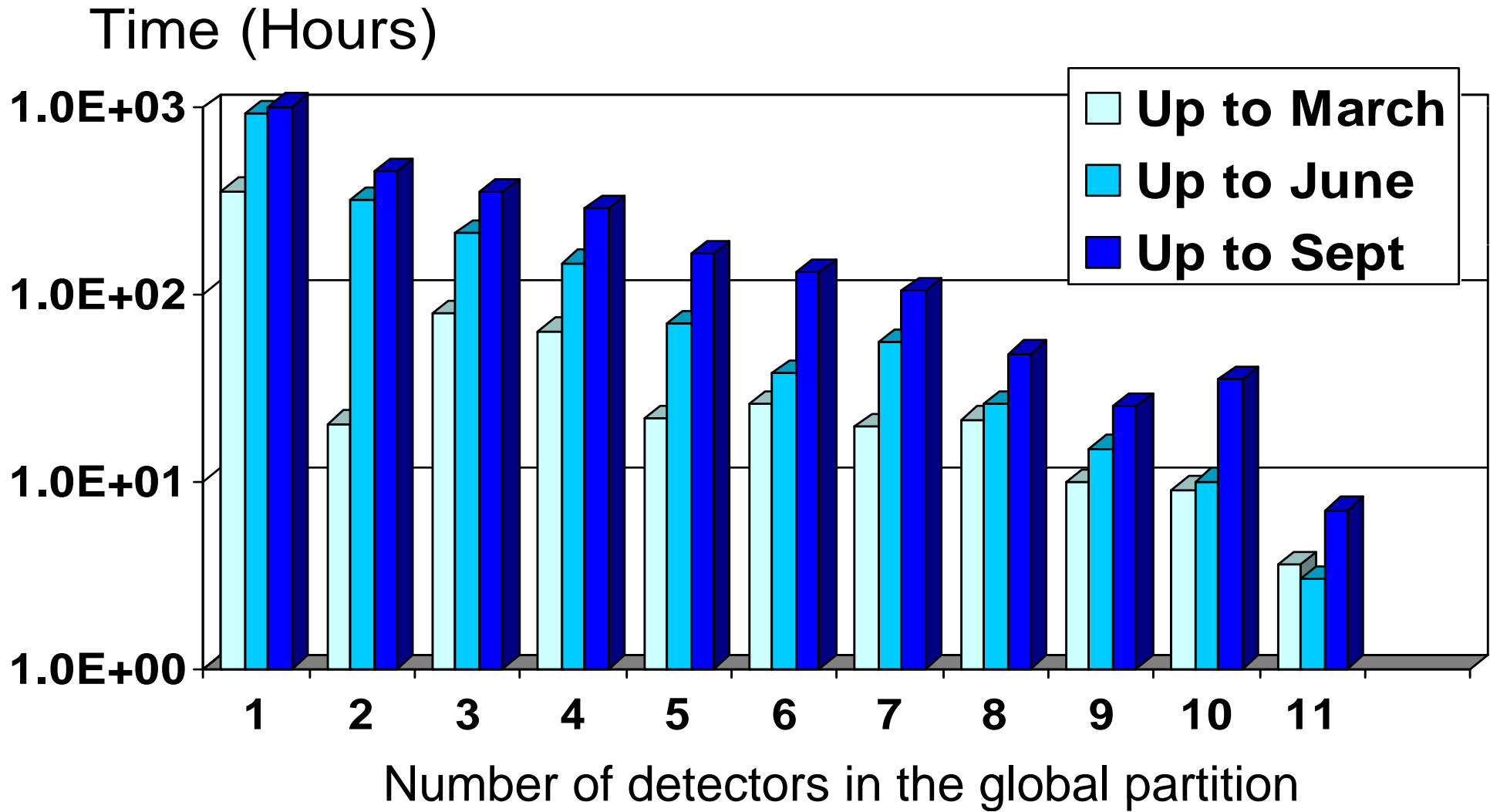
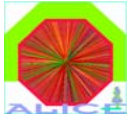
## ● Continuous online operation since March (24/7)

- ⇒ **DAQ**: 40% HW installed, **stable operation** up to **500 MB/s** transfer, data taking **> 3 kHz**
  - ☆ complete HW in 2009
- ⇒ **DCS/ECS**: all **essential functionality operational**, continuous improvement in functionality
  - ☆ some problems encountered with scalability (mostly resolved)
- ⇒ **CTP**: some problems with spurious triggers resolved, **running well**
- ⇒ **HLT**: 500 CPU's, **very successful operation** (online reconstruction, data reduction)
  - ☆ complete HW in 2009





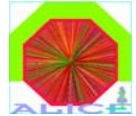
# DAQ: Global Partitions



Now also runs with large number of detectors run stable over hours with realistic trigger sequences !  
(Useful cosmic data taking done for subsets of detectors working with different triggers)

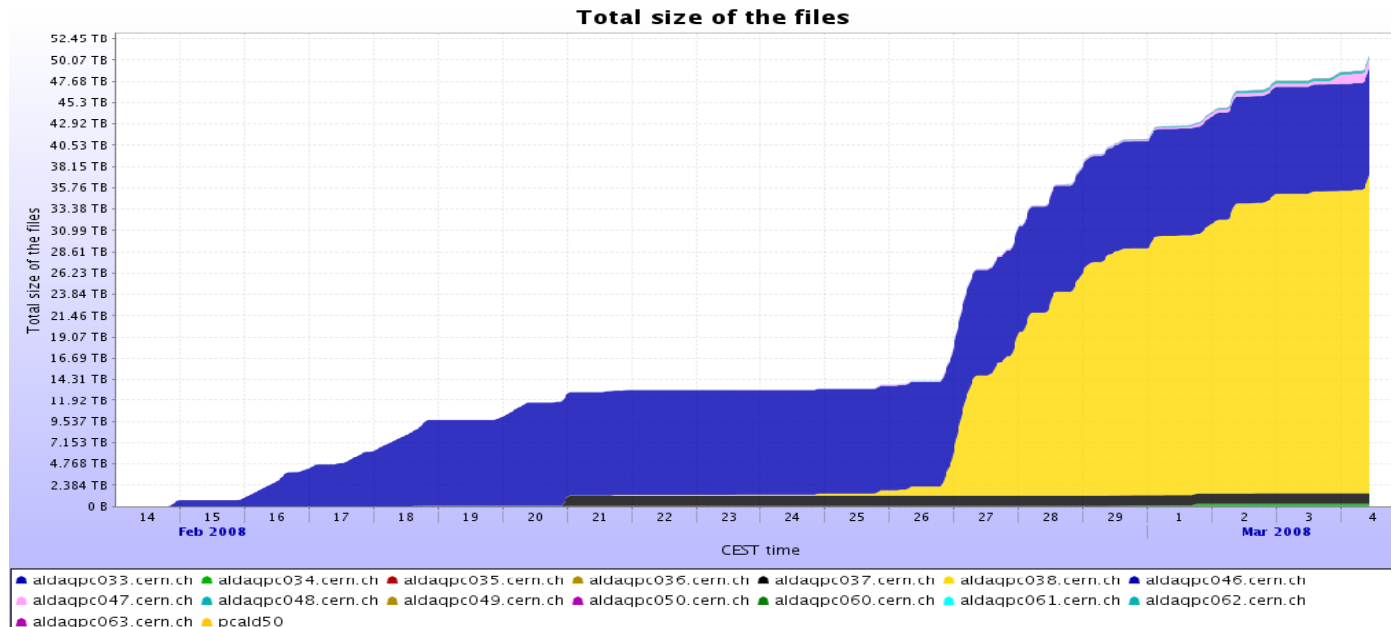


# Offline & Physics 'commissioning'



## ● Offline

⇒ exercise data transfer to T0/T1, prompt reconstruction, prompt calibration, data Q/A



## ● Concentrating on early physics at 900 GeV and 10 TeV

- ⇒ global event features, pt spectra, particle ratios, baryon transport, ....
- ⇒ detailed trigger & data taking scenario elaborated
- ⇒ fast calibration/alignment/reconstruction prepared
- ⇒ since several weeks daily meetings of 'first physics task force' to exercising analysis



# Planning



- Short term

- ⇒ continue cosmic running & consolidation of online software for ~ 2-3 weeks

- Medium term

- ⇒ **A)** 'standby mode' + continue hardware commissioning (muon chambers, TOF)

- ⇒ **B)** 'shutdown mode', start with activities planned for winter shutdown

- ✱ replace TPC capacitors; re-arrange cabling on mini-frame (ITS,TPC) to allow better access to electronics; detector installation (TRD, PHOS, PMD, EMCAL), ...

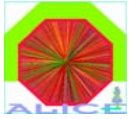
- Long term: complete detector

- ⇒ **PMD (2008), DAQ/HLT(2009),TRD (2009), PHOS (2010/11), EMCAL (2010/11)**





# Summary



## ● Installation:

⇒ met all installation goals by mid 2008

## ● Commissioning and initial calibration/alignment

⇒ went rather well, sometimes even better than expected (e.g. TPC, SPD alignment + trigger)

⇒ some (mostly minor) hiccups / problems (noise, lost channels) / bug fixing

⇒ to be improved:

★ access to TPC for repairs/FEE exchanges

★ cooling flow of SPD

## ● Detector performance

⇒ better – within - very close to specs  
(at least as far as could be verified with cosmics)

