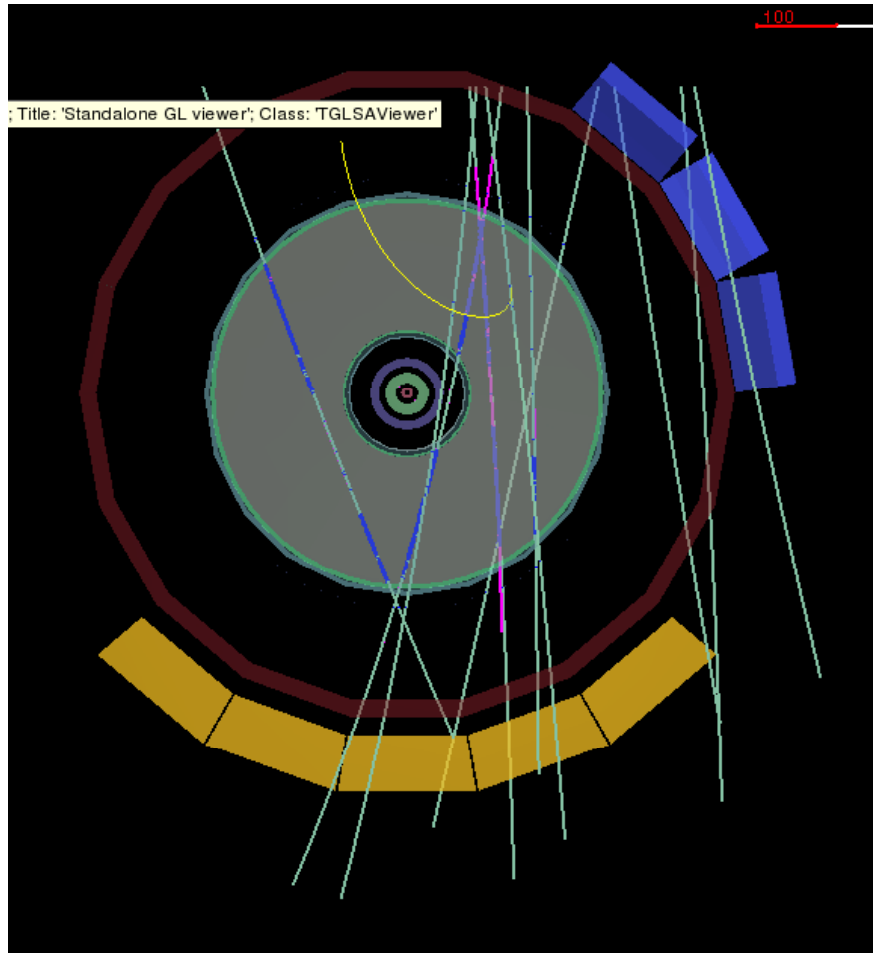
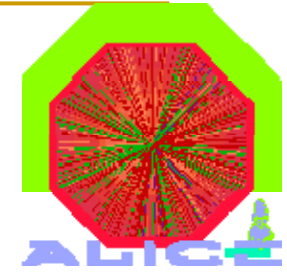
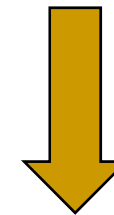


First cosmics run & alignment: comments, remarks, suggestions



October - November
~6 weeks of cosmic
RUN ?



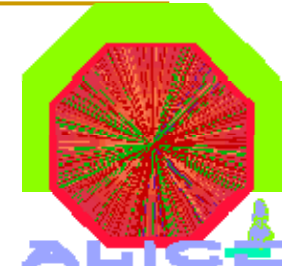
Only few days in December(10-21) !?

2007

Global Commissioning Runs

W. Riegler, CERN

TF 10/10/2007



We have accumulated significant delay, because ..

Magnet Test , Global Commissioning Run

Dec. 10th to Dec. 21st

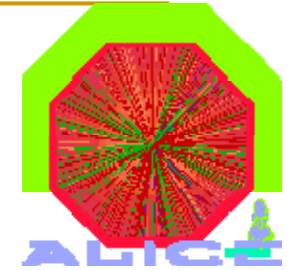
ACORDE / FMD1 / HMPID / SSD% / SDD% / 2TOF / TPC% / 1TRD / T0-C / Muon %

The goal is to start with 'the real thing': Shift crew, run organization etc ...

Planning

W. Riegler, CERN

Tech. Forum
10/10/2007



ITS A-side testing

Chariot, Beampipe fixation on TPC SSW:

Remove Delphi Frame (clear A-side zone)

Install 3TOF / 1TRD:

EMCAL:

1st PHOS module:

Miniframe:

Install TOF/TRD, Connect TPC+ITS Services:

Magnet Test , Global Commissioning Run

V0-A, FMD1, T0-A, Continue TOF/TRD:

Cosmic Run:

PMD:

Install TOF/TRD:

Oct. 1st to Oct. 8th

Oct. 8th to Oct. 17th

Oct. 19th

Oct. 22nd to Oct. 26th

Oct. 29th to Nov. 9th

Nov. 12th to Nov. 14th

Nov. 19th to Nov. 21st

Nov. 26th to Dec. 6th

Dec. 10th to Dec. 21st

Jan. 2008

Feb. 2008

Feb. 4th to Feb. 12th

March 2008

(w40)

(w41/42)

(w42)

(w43)

(w44/45)

(w46)

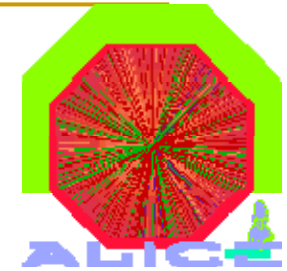
(w47)

(w48/49)

(w50/51)

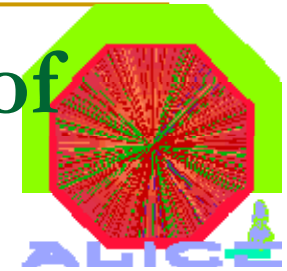
True cosmic run

Outline



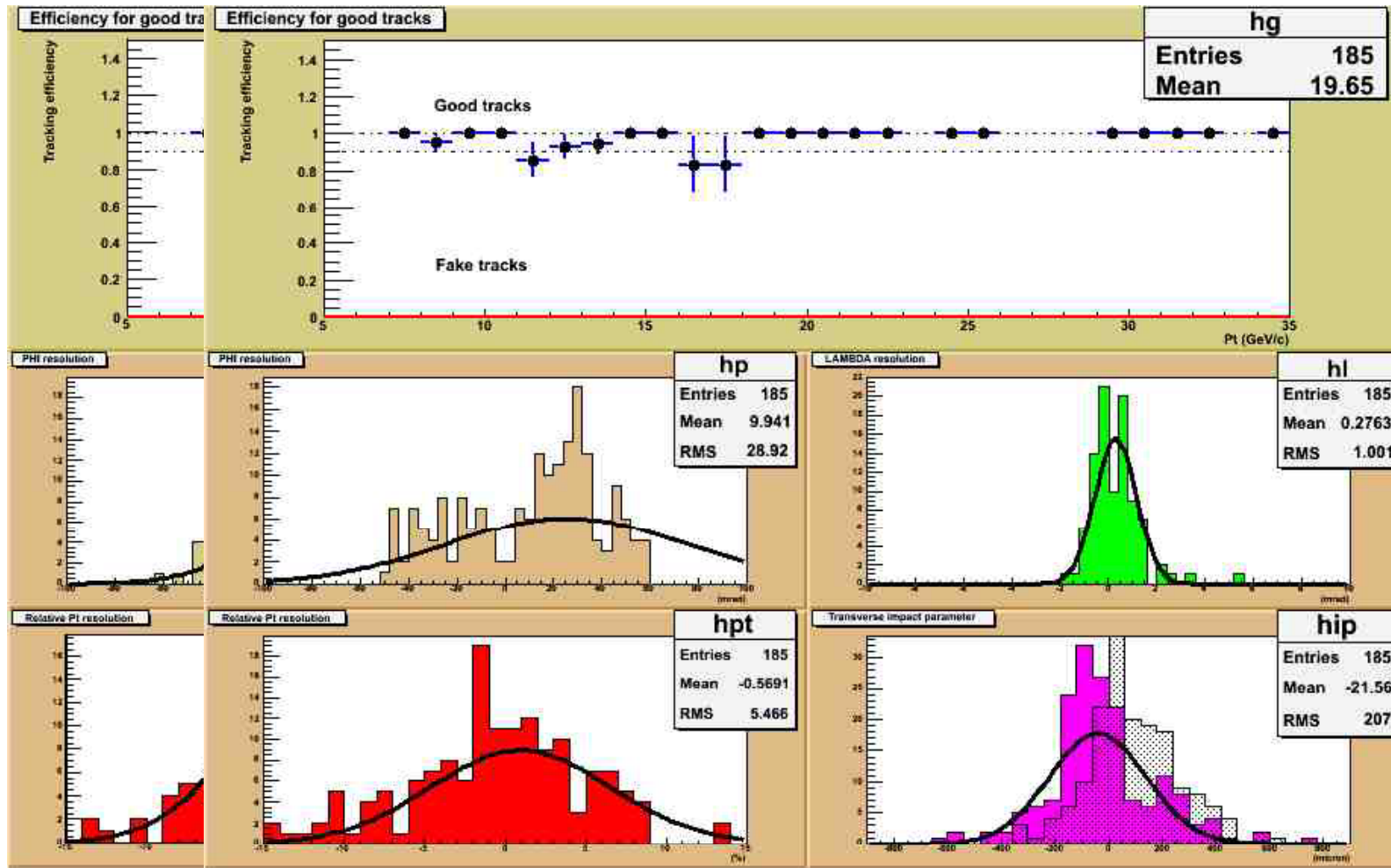
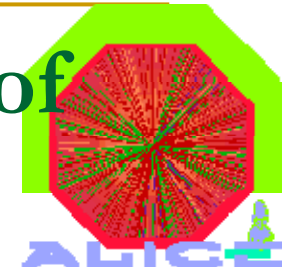
- **TPC + ITS cosmics reconstruction efficiency using the official Comparison macros**
- **Visual tools for the cosmics (pre)alignment and alignment QA**
- **Realistic misalignment simple tests**
- **Comment on the “natural” reference system for storing alignment objects**
- **Where is ALICE (0,0,0) origin point ?**
- **Cosmic run (alignment) organization aspects**
- **Final remarks**

TPC + ITS reconstruction efficiency of cosmic muons (0)



- **Official macros: AliITS(TPC)Comparison(V2).C** needing some modifications (one MC particle → 2 tracks, origin expected inside the beam pipe)
- **Robust reconstruction both for TPC + ITS and ITS stand alone → ~95%** (as Andrea D. has found)
- **Definition of “good” tracks: at least 4 points in ITS (kITSrefit == kTRUE)**
- **Practically no sensitivity to realistic misalignments !!**
- **Modified macros for cosmics available: AliXXXComparison_crt.C**

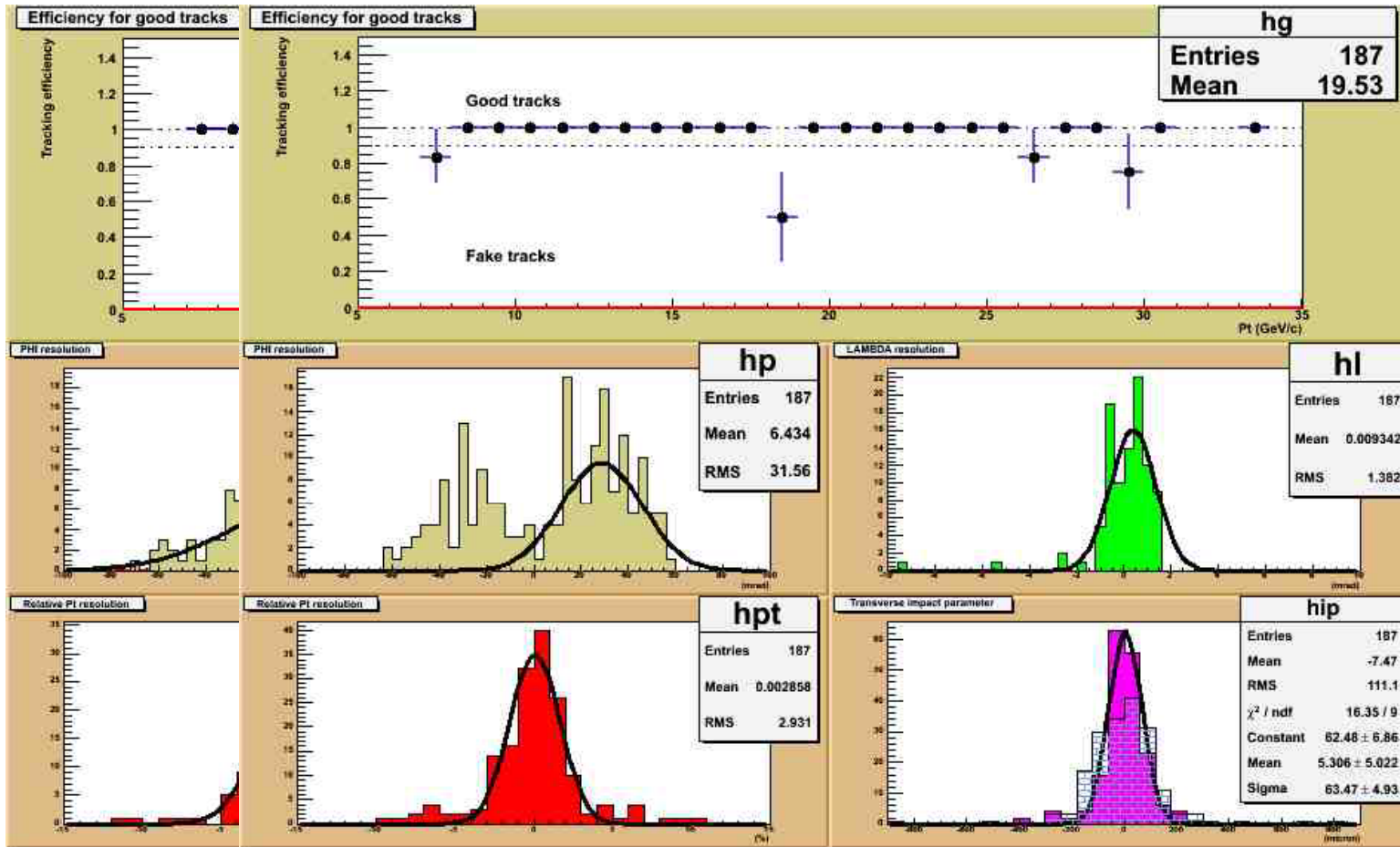
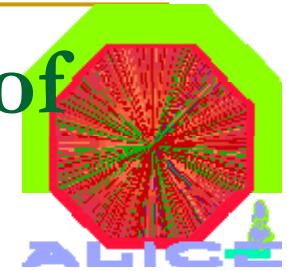
TPC + ITS reconstruction efficiency of cosmic muons (1) (Realistic misalignment)



ITSComp.

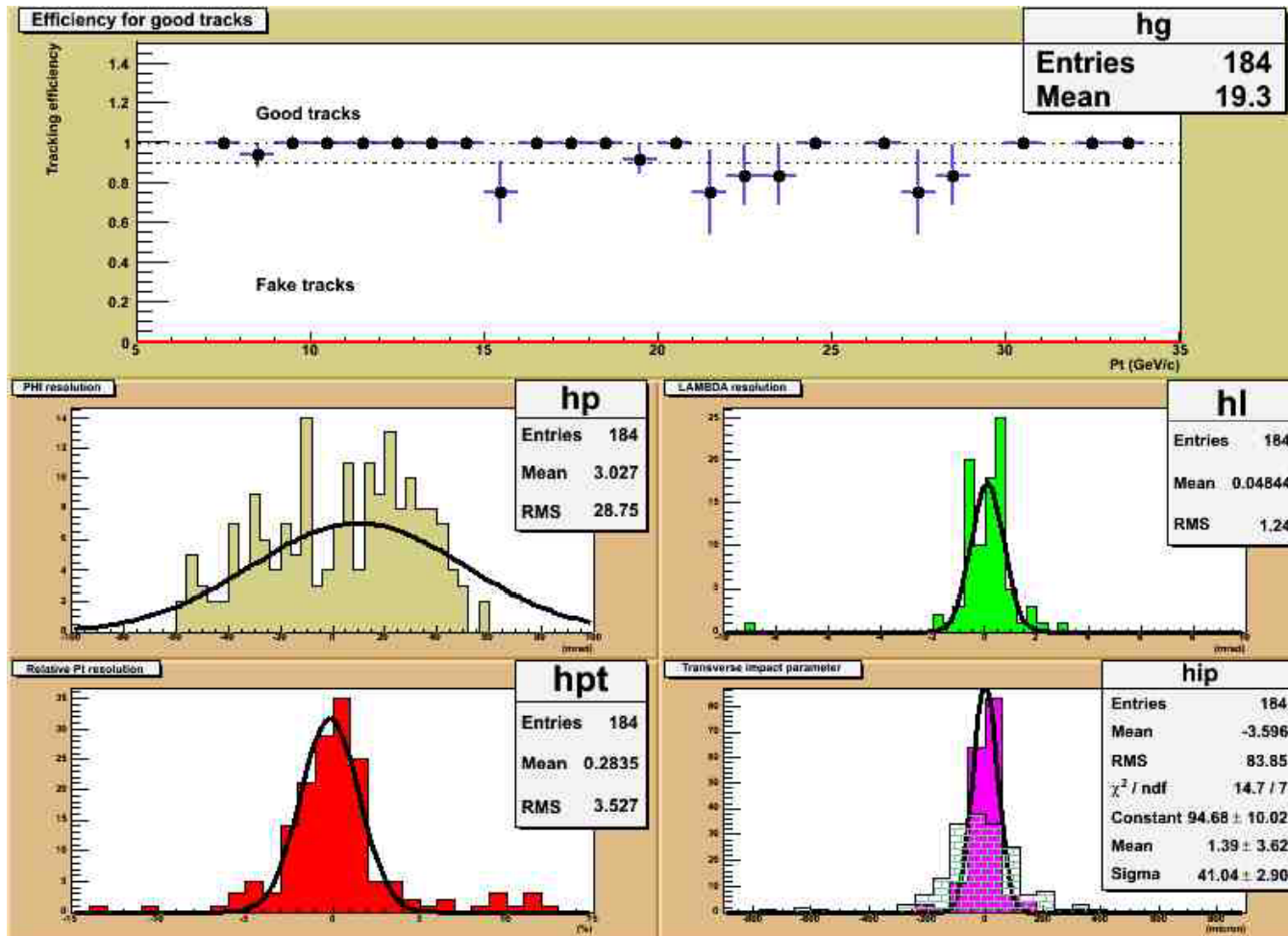
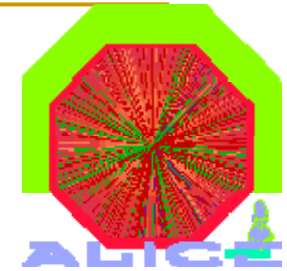
PHI comparison confusion !

TPC + ITS reconstruction efficiency of cosmic muons (2) (with realignment)



Question:
what is
relevant:
RMS or σ ?

TPC + ITS reconstruction efficiency of cosmic muons (3) (perfect alignment)

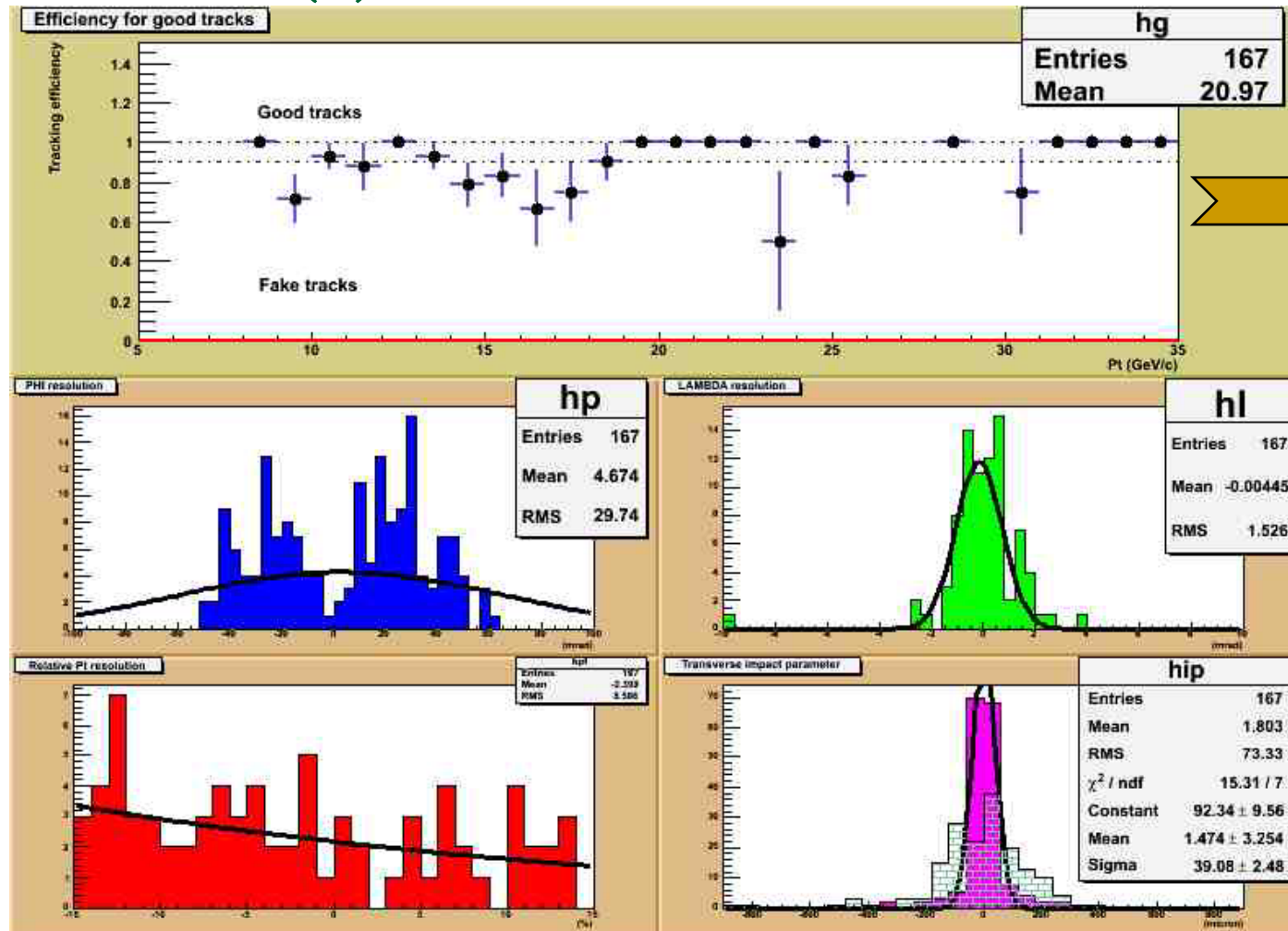
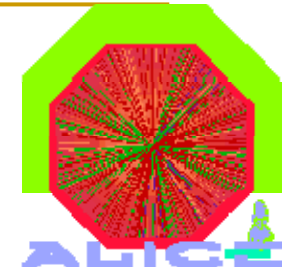


IP interpretation not straightforward but perfect align. better than re-alignment



ITS reconstruction efficiency of cosmic muons (4)

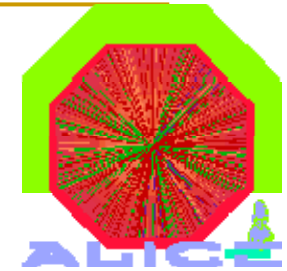
(perfect alignment, ITS_SA)



Overall eff. drops below 90%

Momentum resolution collapse

Visual tools for (pre)alignment with cosmics

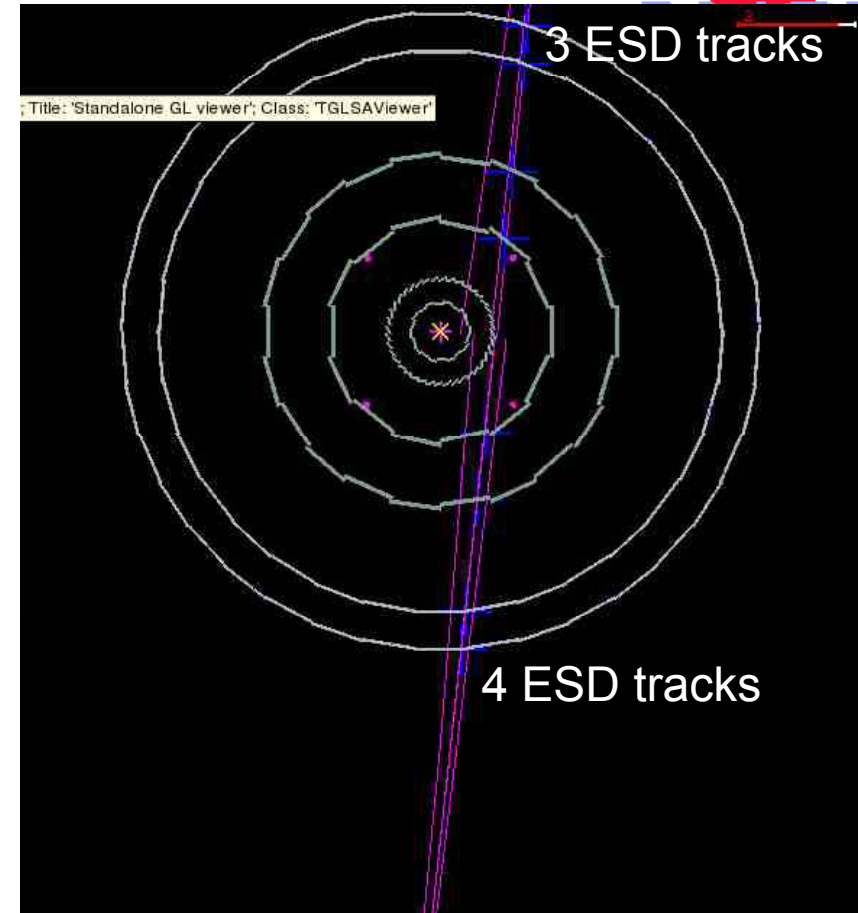
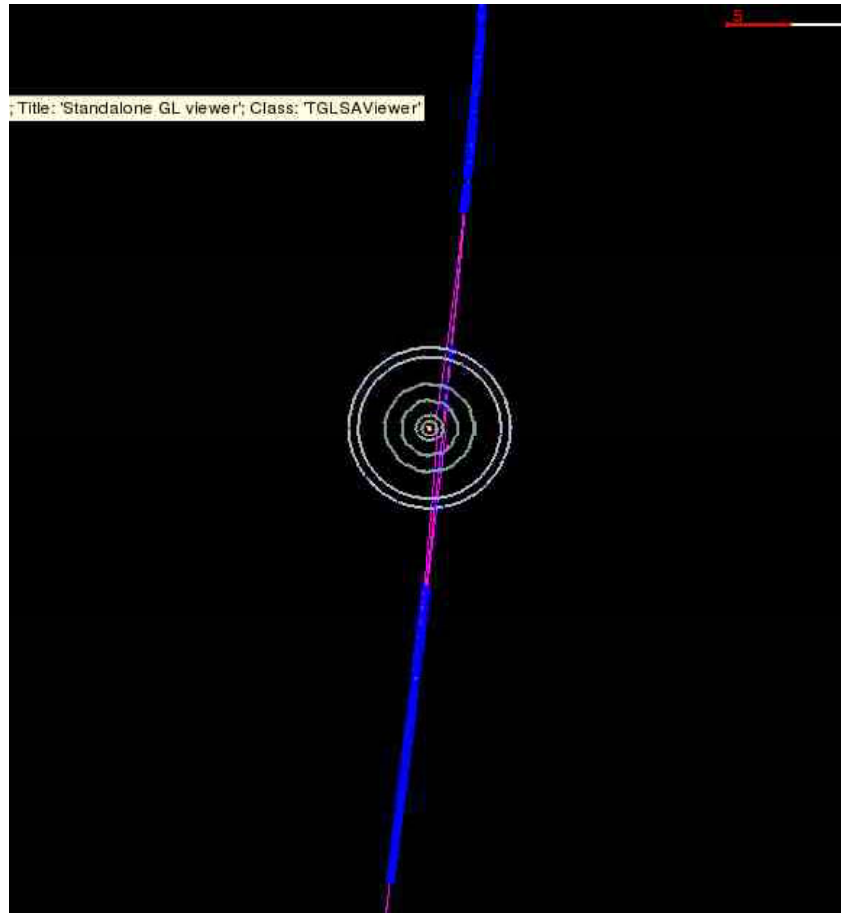


- **What we would like to investigate/see:**
 - Single layers tracklets in both projections
 - Comparison of tracklets (SPD,SDD,SSD) → angular matching, shifts etc
 - Construct tracklets from different layers: attempt to match upper and bottom tracklets → crude estimate of up-down misalignment
 - Assign clusters to a track and make a fit (B ON & B OFF)
 - Change alignment constants and re-display RecPoints
- **What tools do we have:**
 - AliEve – hits,digits,recpoints, ESD tracks..., zooms, projections...
 - DrawClustersV2_crt.C derived from DrawClustersV2 of Yuri

Alieve Display (tpc/its macros)

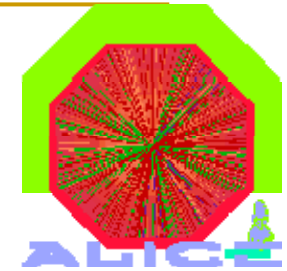


MC B-ON event

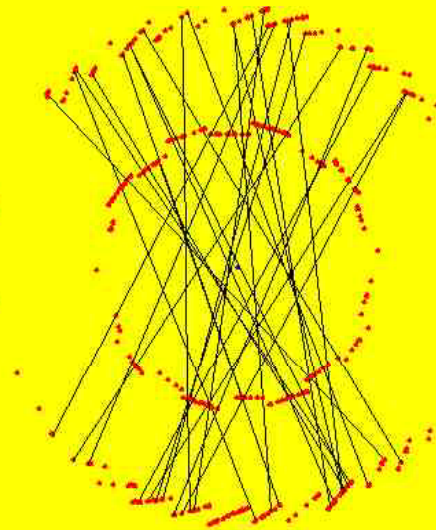


Still very limited interactivity (no fits, no selection of alignment..)

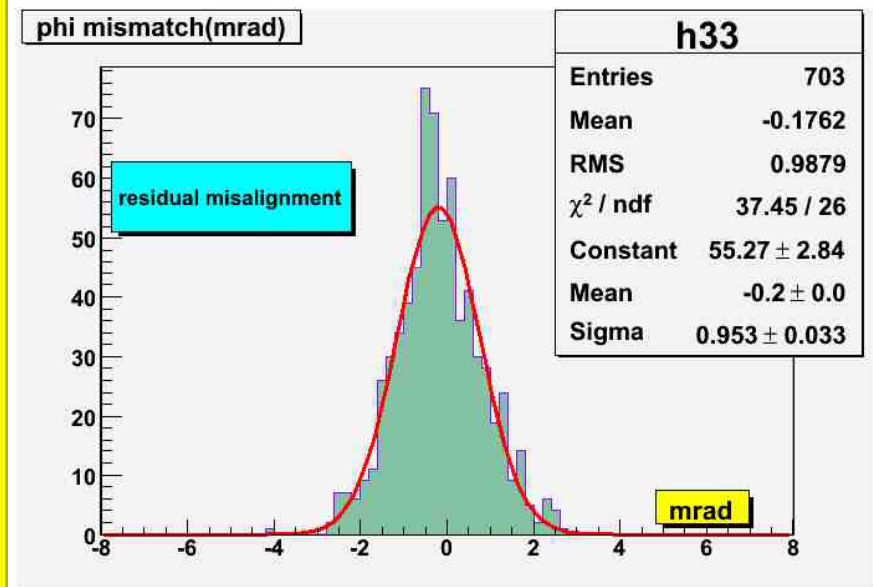
Visual tools for (pre)alignment with cosmics (2)



SPD tracklets



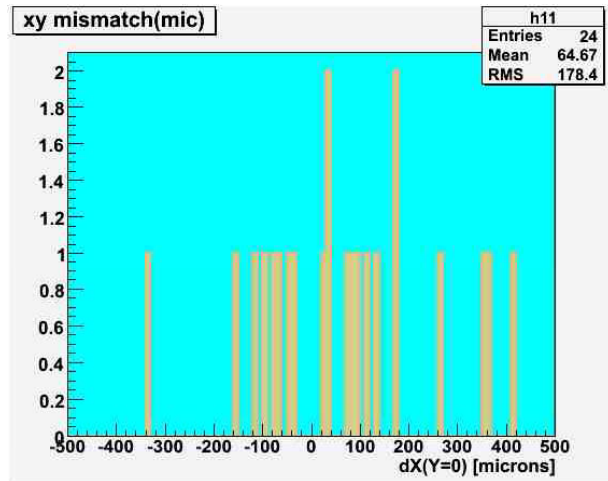
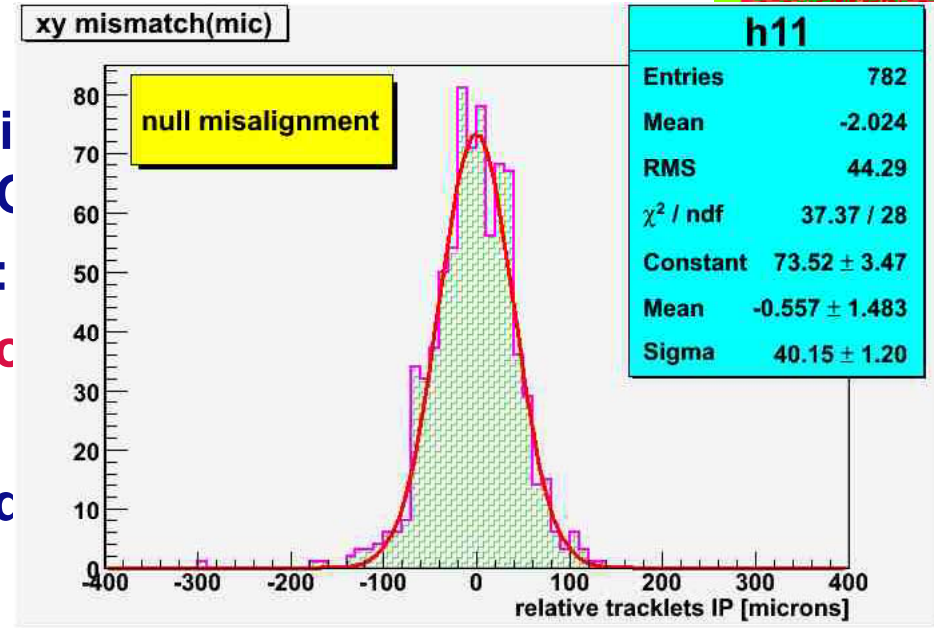
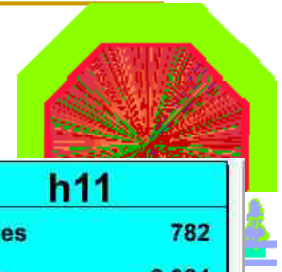
From DrawClustersV2 – Possibility to apply different re-alignment objects to see Implications for the simple difference histos



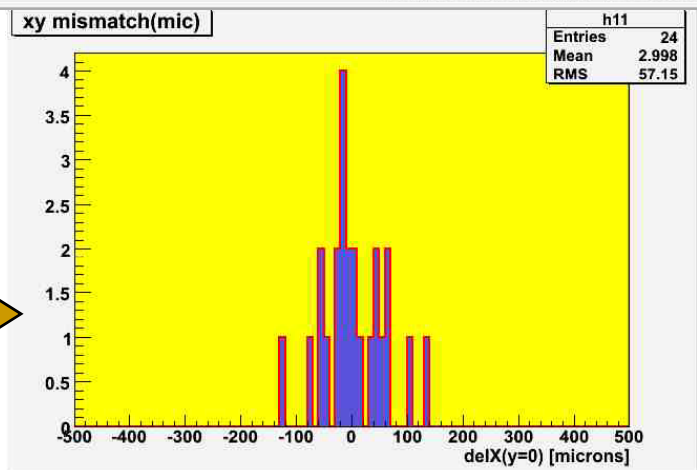
Testing realistic misalignment

(DrawClustersV2_crt.C)

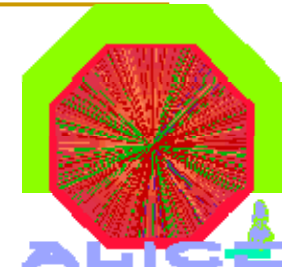
- ITSRecPoints can be moved via `AliGeomManager::ApplyAlignC`
- Global coordinates extraction:
 - `AliCluster *c = (AliCluster*)c`
 - `C→GetGlobalXYZ(g)`
- Then `g[0,1,2]` can be used for c actually available in AliEve



Realign. →

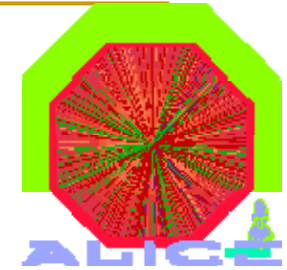


Display requirements/requests of the ITS group



- Some of them already implemented like special projections (fish eye, ρ -z etc)
- Extra requirements being collected by Yiota and Tadevz
- Minimum (my) request list:
 - ESD tracklets and all other (cosmic) tracklets
 - Flexibility in selecting alignment objects
 - Simple track fit for selected sets of points
 - ...
- Other suggestions ?
- See *News on Visualization* by Y. Foka – last First Phys Meeting (28/08/07)

Planning the scanning effort



(Yiota Foka, First Physics 28/08/2007)

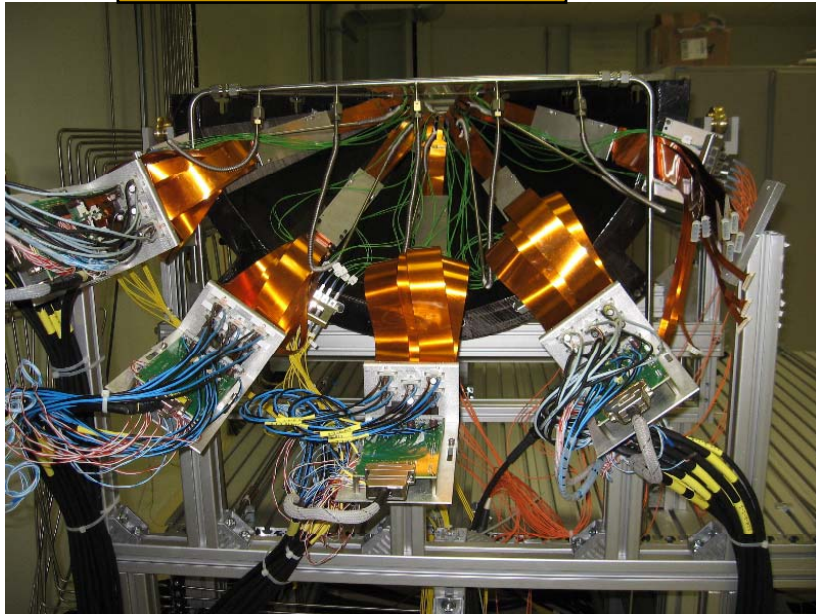
- Aim:
 - prepare a team of people for visual scanning of the first real data to spot pathologies
 - Train them on simulated data and **data from cosmics**
 - Validate reconstruction
 - Organize visualization of pathological events filtered out via QA ideally during night builds

Hierarchical misalignment scheme

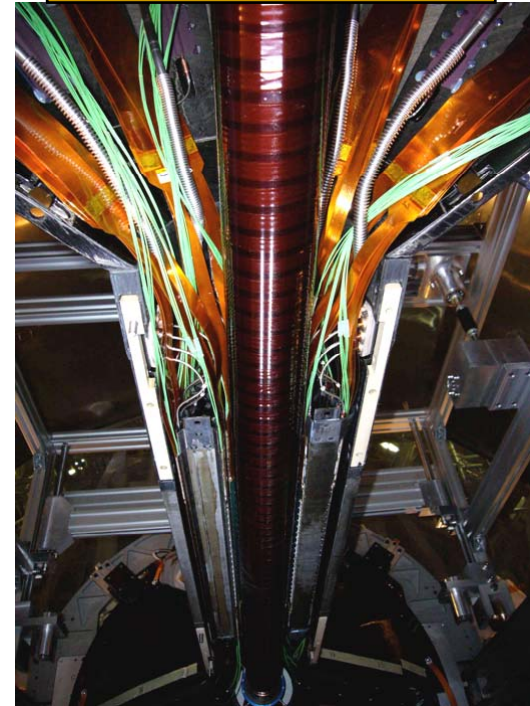
(MakeITSRealisticMisAlignment.C of Ludovic G. and Andrea D.)



halfSPDbarrel



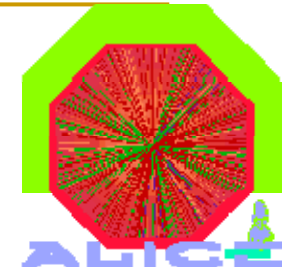
beam pipe



- Seems to work as expected
- There was a controversy on the global ITS shift and ITS – beam pipe (inter)dependence
- Implications for the re-alignment procedures !



What is a *natural* RS to store the misalignment Δ ?



Delta Transformation in Local and Global Reference System

Raffaele Grosso

Pros and cons for storing the global/local delta

Misalignment on more levels

The most frequent case is probably misalignment on more levels of the geometry tree, i.e. a volume is misaligned but also some of its parent volumes are. In the following example volume C and mother volume B.

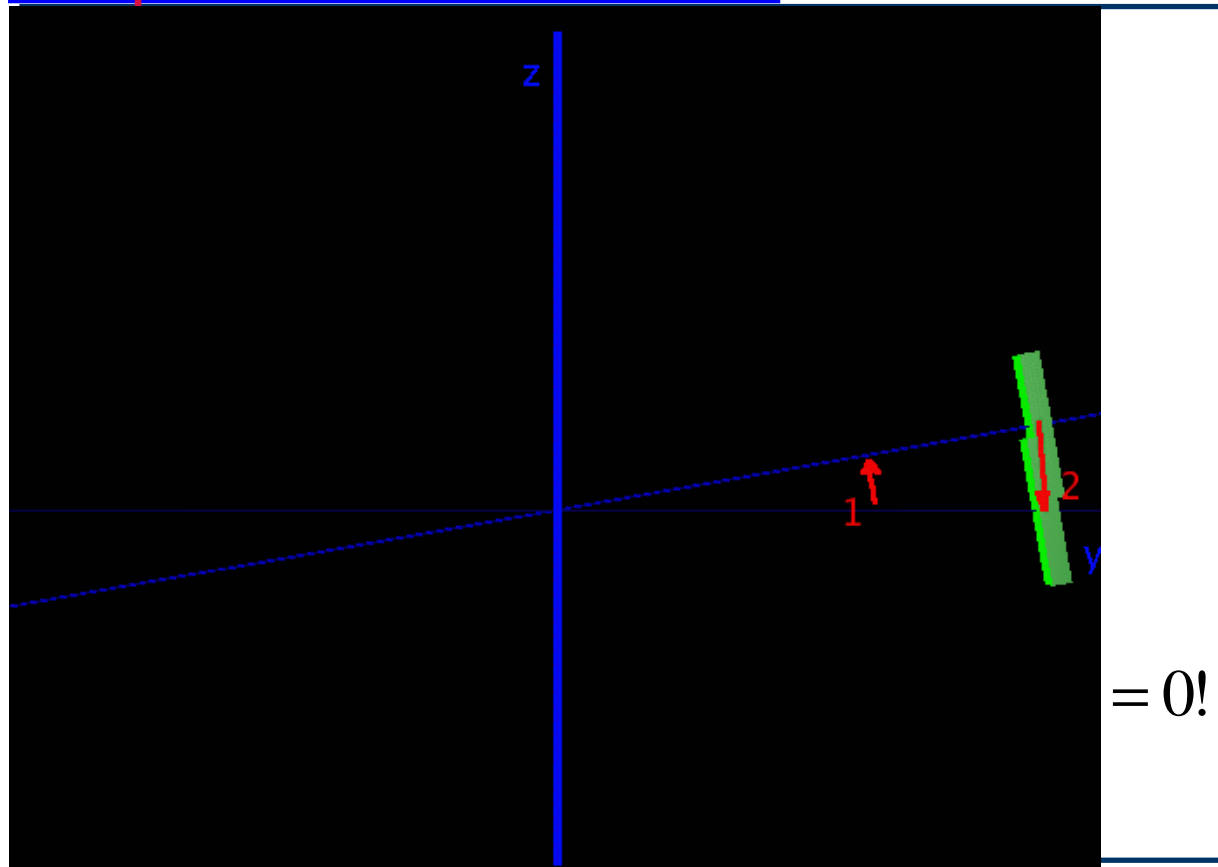
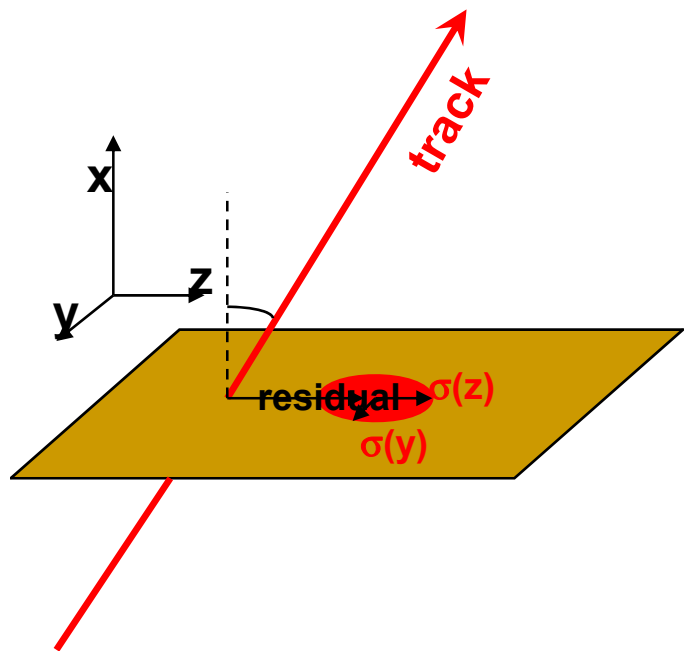
$$\begin{aligned} \mathcal{G}_C^a &= ABbCc & (3) \\ &= \Delta_C ABbC & (4) \\ &= \Delta_C \Delta_B ABC & (5) \end{aligned}$$

Global Δ – a convolution of many local Δ s
→ confusion

Interpretation of the shifts in the GRS.



(The ALICE alignment framework)
 Note in preparation (RG+CC+AG)

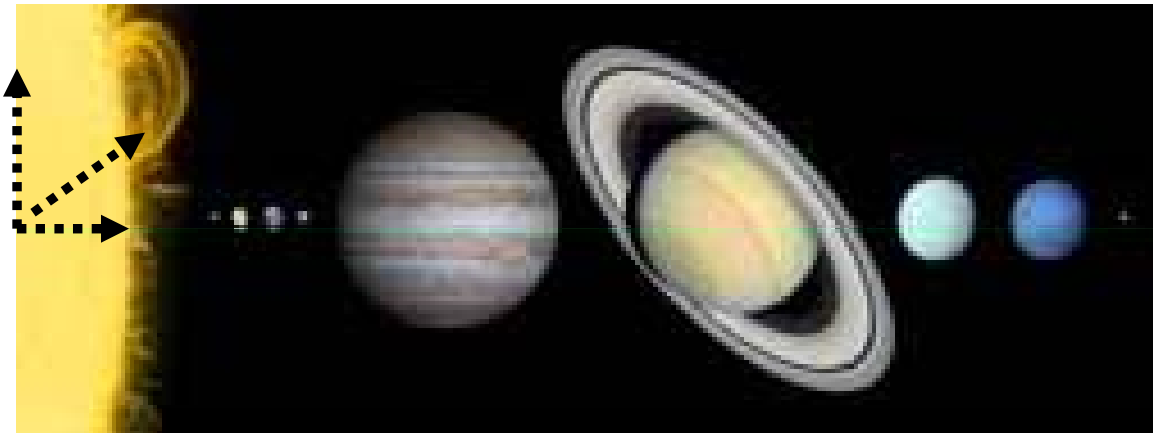
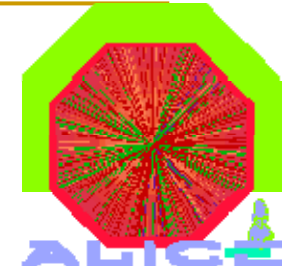


**Pure angular
 (local) misalignment
 Induces shifts in the
 Global Correction Δ**



Not straightforward interpretation of the AliAlignObj elements in GRS

In which RS to describe (easier) *displacements* of the Mars Rover ?

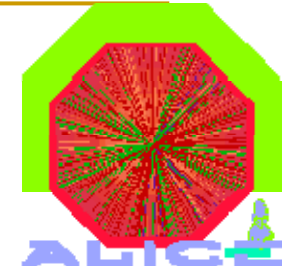


Local (Mars) RS ?

Or Global (Earth) RS ??

Both are equivalent but ...

Looking for the ALICE (0,0,0)



- Question raised when discussing a possible ITS – beam pipe misalignment
- A fictitious (0,0,0) point (imaginary beam crossing) is somehow connected to other survey points
- Beam crossing measured relatively to the ITS → beam pipe could be not centered (?)
- *Moving* ITS (with beam pipe?) displaces the beam which could be re-steered anyway !
- → practical (0,0,0) point does not coincide necessarily with the ALICE RS origin !!!
- Should we misalign also passive objects/nodes ??

ALICE coordinates

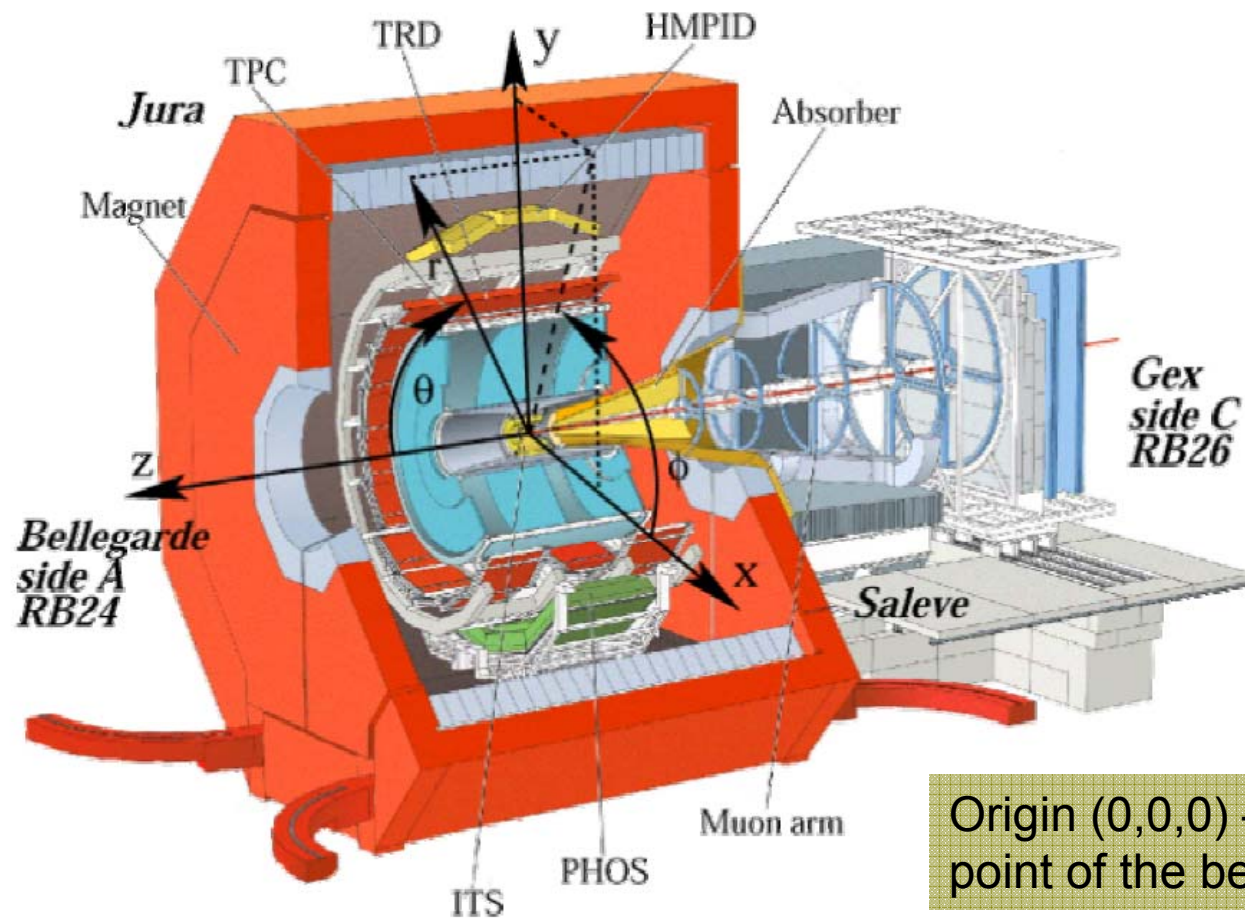
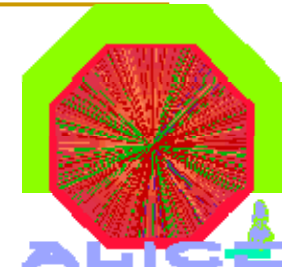
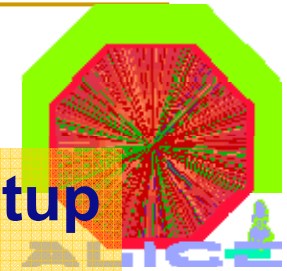


Fig1. Definition of the ALICE coordinate system axis, angles and detector sides.

(Cosmic) Run Organization Aspects



- Cosmic run **coordination**: detectors operation , setup configuration, trigger, magnetic field, data taking program
- **Shifts organization**: # of shifters (> 50 ?), distribution of tasks, responsibilities, scheduling (8-9 days cycle ?)
- Shifters **training courses** (?)
- Regular shifters vs on-call detector **experts**
- Computing - **offline** parallel shifts
- Event **scanning** organization QA → feedback
- **Alignment/ITS** – part of QA & commissioning
- Data preparation and distribution

Concerning aligners

A first estimate...

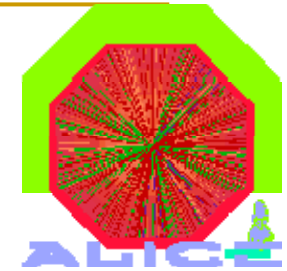
F. Antinori, TB 08/08/2007 & MB 24/08/2007

(See also last EDMS document, Run Organization by Federico Antinori)

- **Total operations manpower**
 - **PC + general shift + subsystem shift + offline shift + on-call**
 - **70 to 100 people (about 2/3 for subsystem operations)**
 - **(ATLAS, CMS ~ 200)**

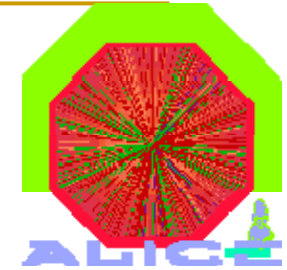
- **2008 estimate (first guess of bracket)**
 - **40 weeks operation**
 - **2800 to 4000 people*week**
 - **(N.B.: 1 “shift week” = 8-9 days)**
 - **if divided among institutes in proportion to M&O:**
 - **5.1 to 7.2 “shift weeks” per M&O equivalent**

- **2007**
 - ~~**6 weeks operation**~~
 - ~~**~ 1 shift week per M&O eq.**~~



Work in progress...

F. Antinori, TB 08/08/2007 & MB 24/08/2007

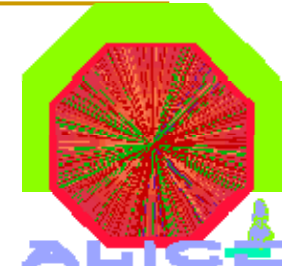


- **Definition of General Shift (crew/tasks)**
- **Definition of Software Shift (crew/tasks)**
 - + Offline group
- **Integration with Service Agreements' piquet services**
 - + F Cliff
- **Preparation of shift management software →**
 - + Offline group
- **Preparation of electronic logbook**
 - + DATE group

SMS (?)

Run Coordination

(F. Antinori, Technical Forum 04/10/2007)



- **Run Coordinator, in charge of:**
 - **implementation of data taking plans**
 - **organization and coordination of real-time activities**
 - **hardware and offline shifts**
 - **implementation of data quality control**
- **Paul Kuijer nominated Run Coordinator (RC) for 2008**

- **For each subsystem: System Run Coordinator, in charge of:**
 - **detailed organization of subsystem real-time operations**
 - **interface between subsystem and RC**
- **Paul will contact each project about this**

ATLAS control room during a cosmic run

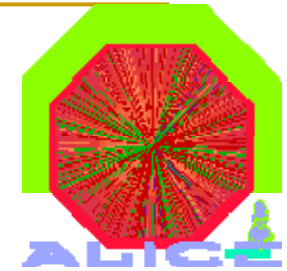
Towards Physics (2) : detector commissioning with cosmics in the underground cavern (the first real data in situ !)

Very useful to:

- Run an increasingly more complete detector with final trigger, data acquisition and monitoring systems. Data analyzed with final software
- Shake-down and debug the experiment in its final position → fix problems
- Gain global operation experience in situ before collisions start

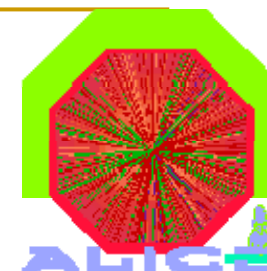


The ATLAS control room during a cosmics run

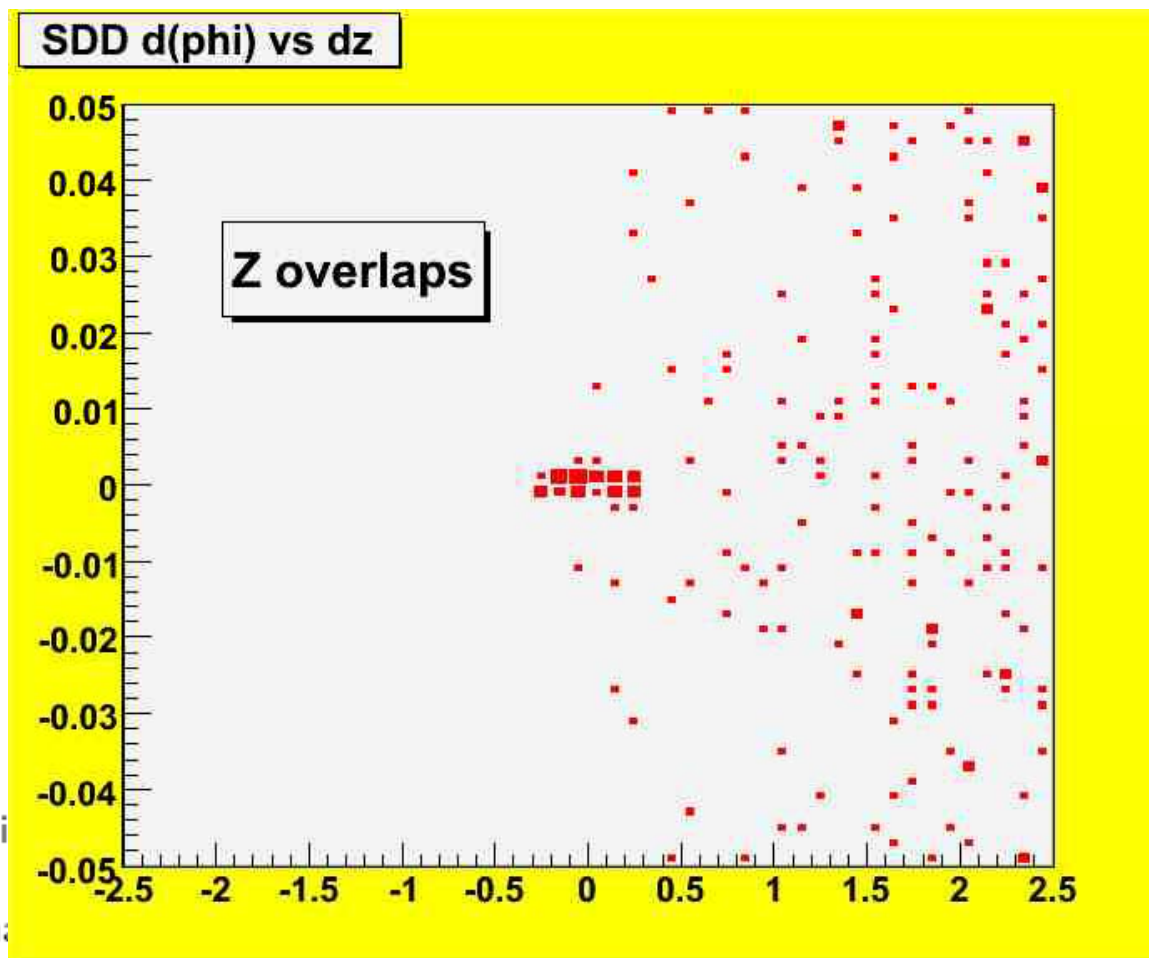


When such picture from ALICE ???

Update on Cosmic Tracking Studies With Pixel EndCapA Cosmic Test



Wei-Ming Yao

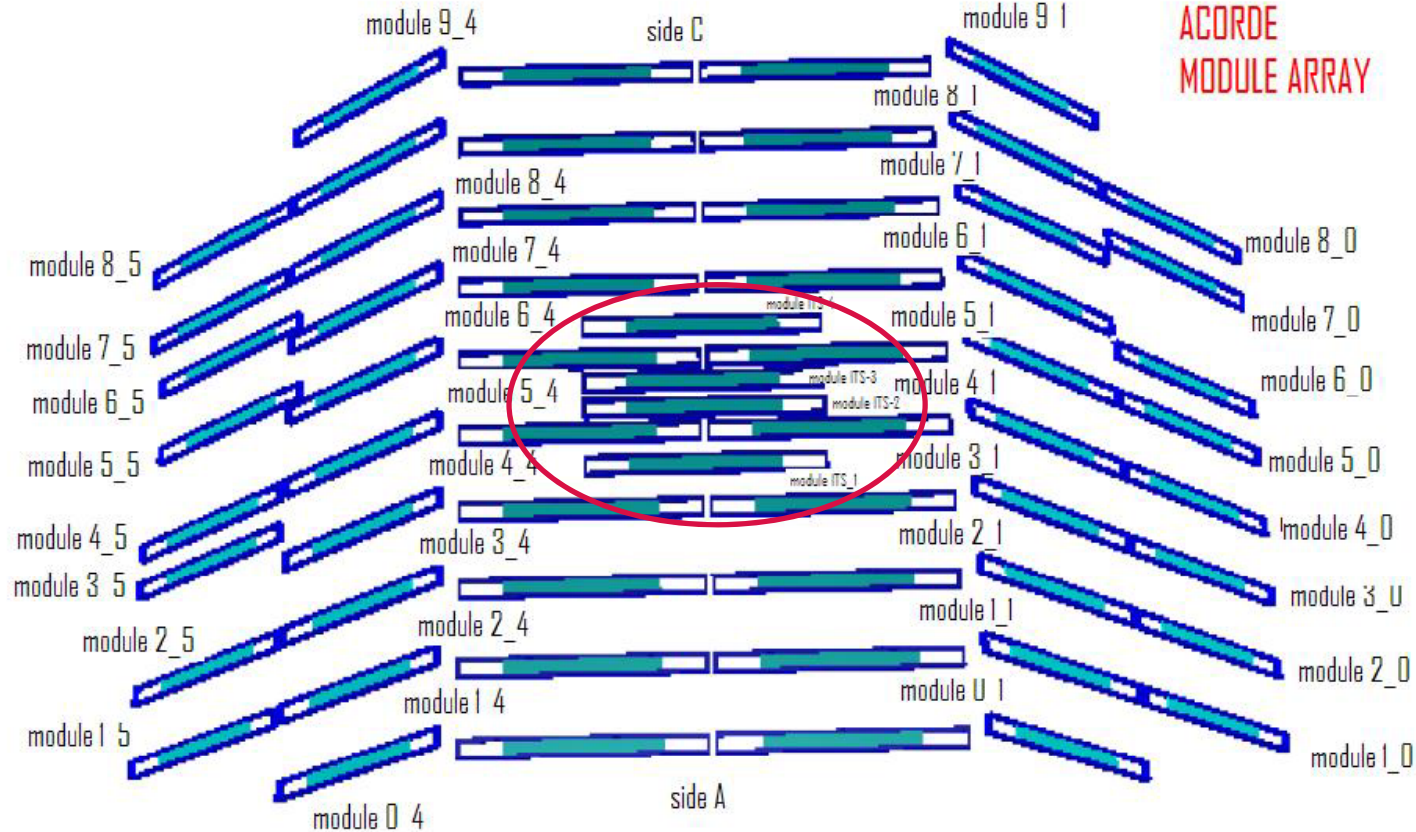


**Small statistics
in our case
but we should try !**

← interactions

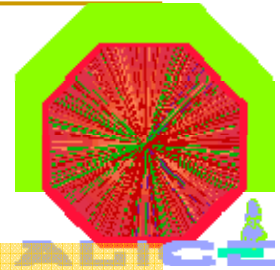
Cosmic trigger-Modified ACORDE

Only displacements of the peripheral modules \rightarrow negligible influence on the trigger rate



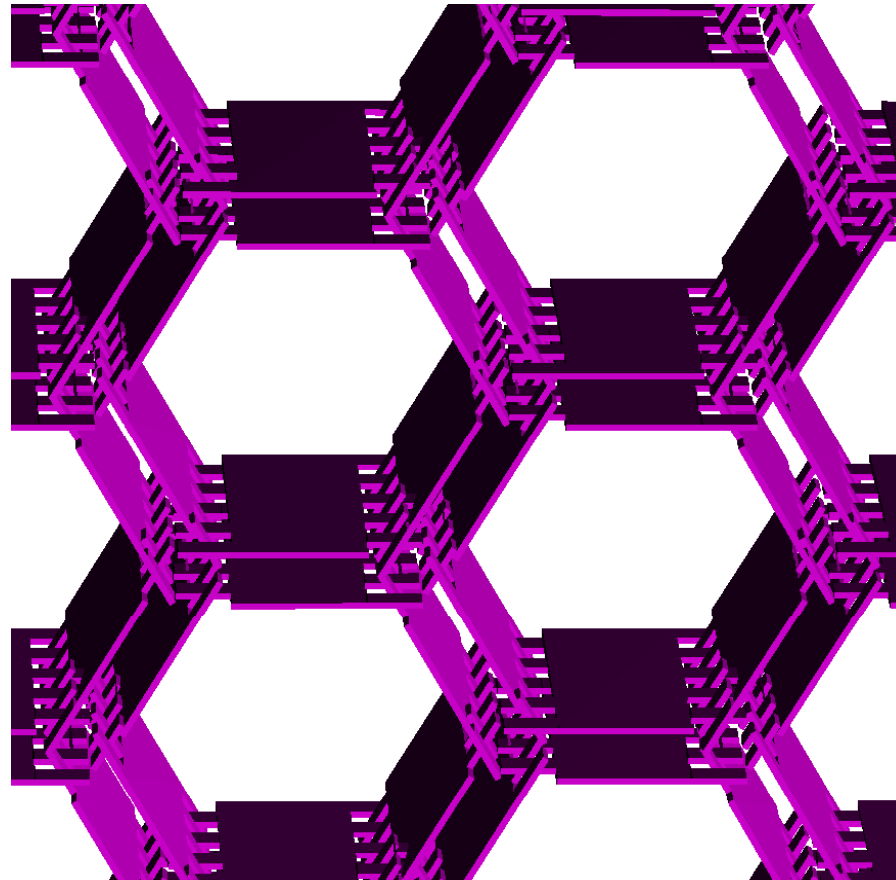
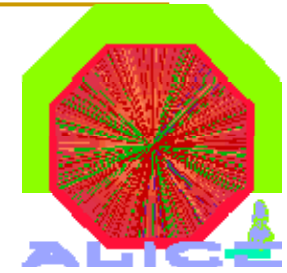
FASTOR (SPD) trigger expected rate $\approx 10^{e-3}$ ACORDE trigger

Final Remarks



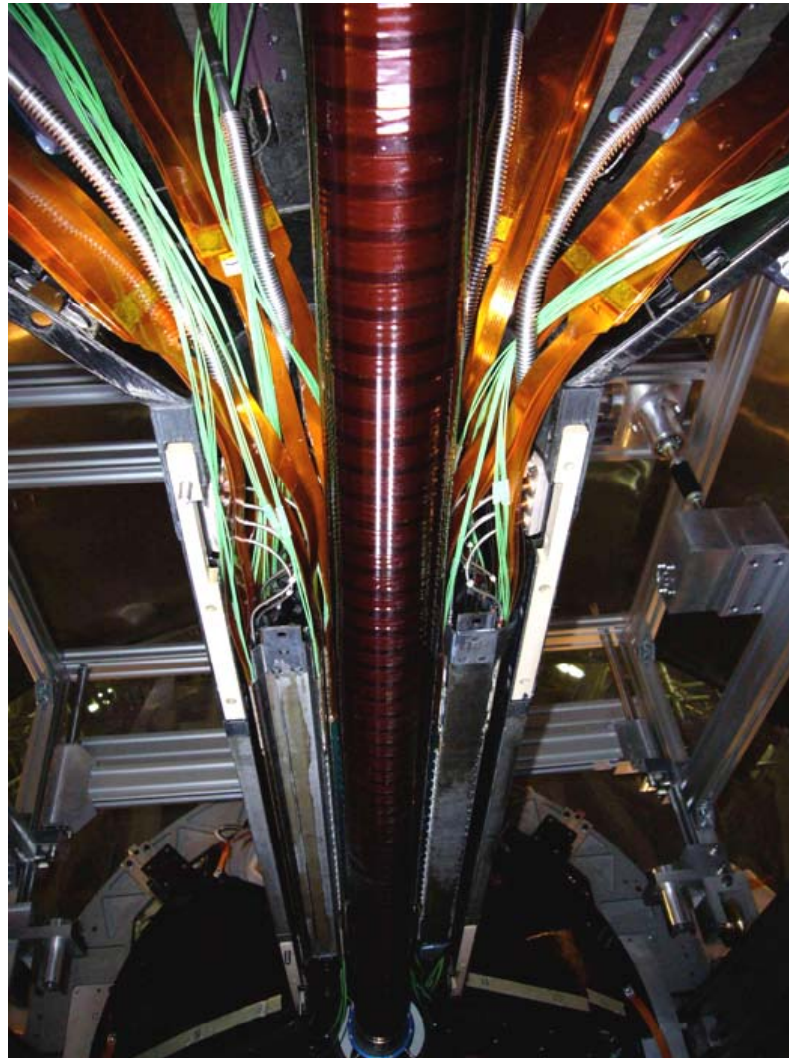
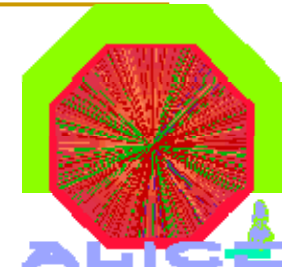
- **First cosmics run reduced to a short test run, (December 2007)**
- **Only qualitative alignment tests will be possible → need of simple diagnostic tools (visual scanning and histogramming) first**
- **Realistic, hierarchical misalignment scheme is working fine (but is it really fully realistic ?)**
- **Last days of possible improvements in the framework, then it should stay frozen (RS for Δs !)**
- **Preparations for the First ITS Alignment with cosmics - still a lot of work !**
- **AOB ?**

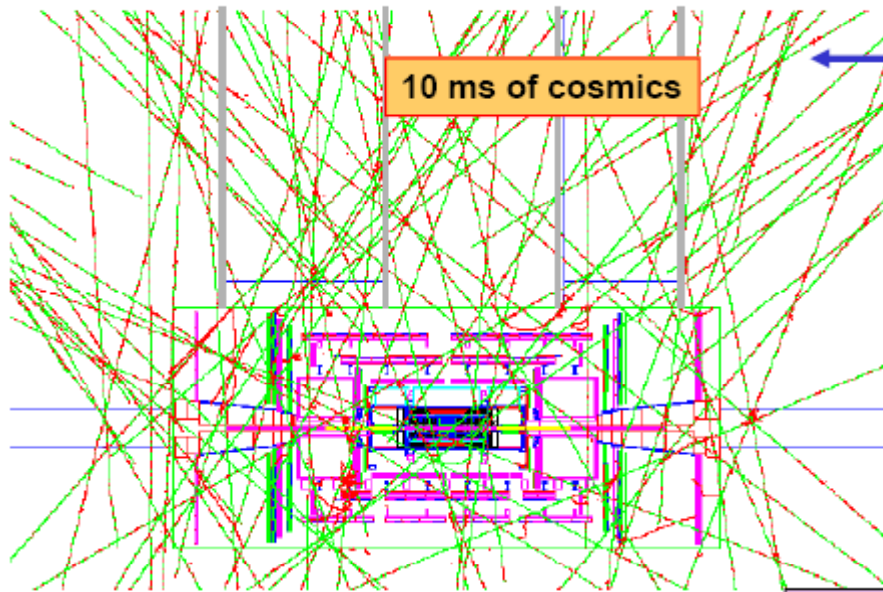
Backup Slides



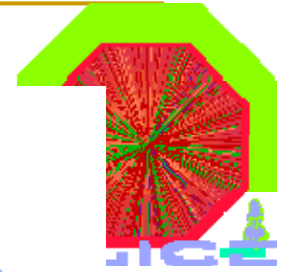
EXEMPLE OF AN ASSEMBLY

Beam Pipe & SPD

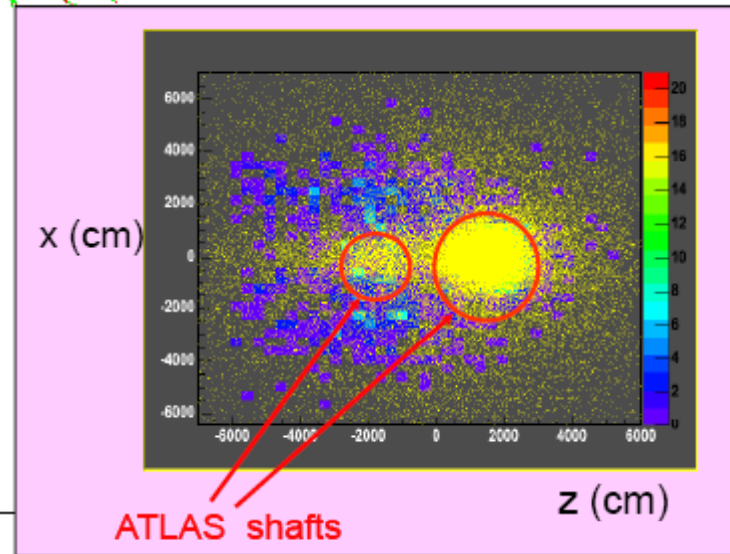




Simulated cosmic flux in the ATLAS cavern

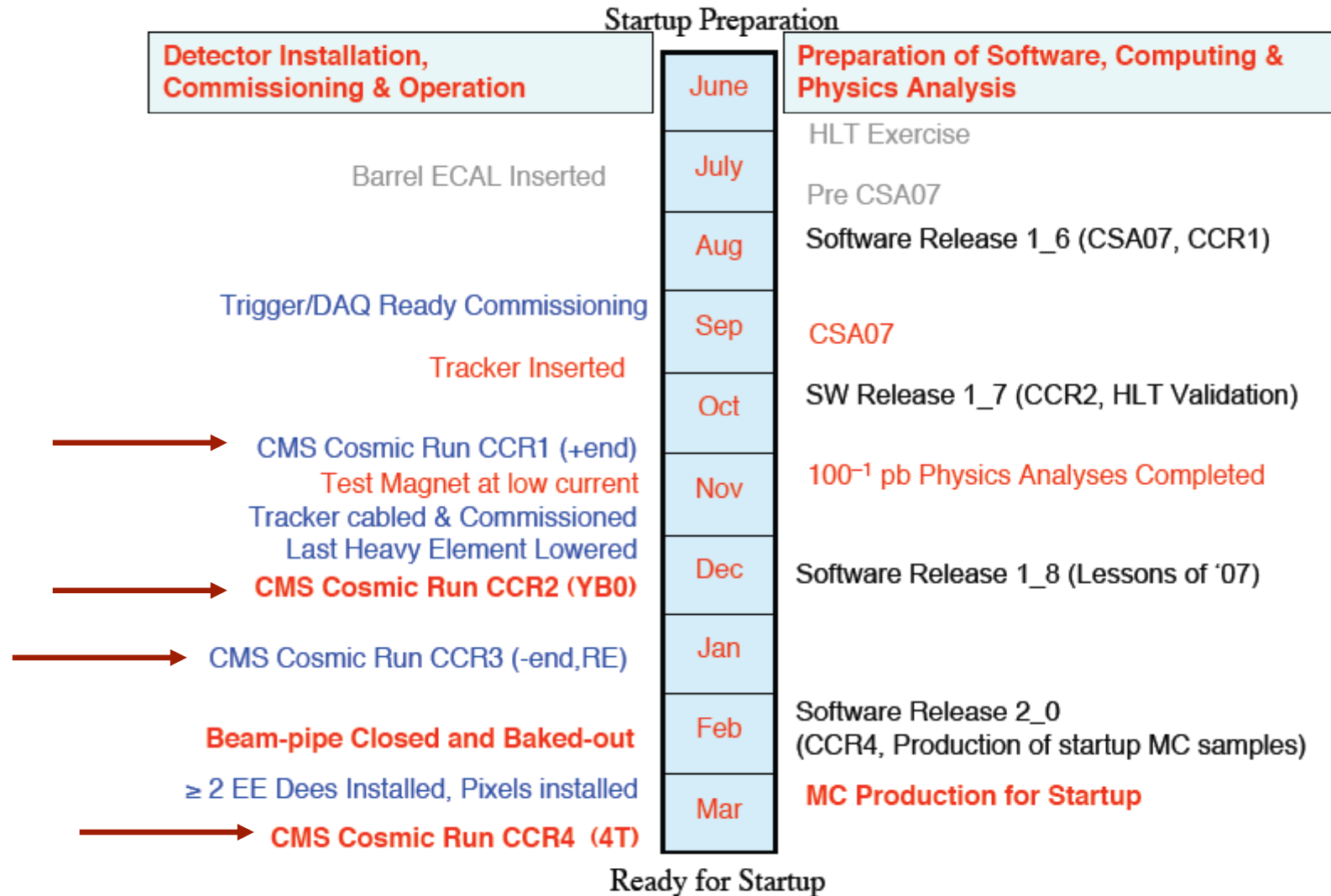
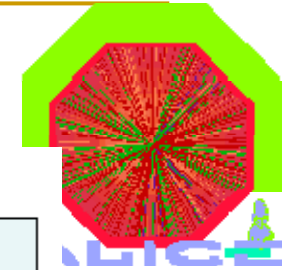


Cosmics data: →
 muon impact points extrapolated to surface as measured by Muon Trigger chambers (RPC)
 Rate ~100 m below ground: ~ $O(10 \text{ Hz})$

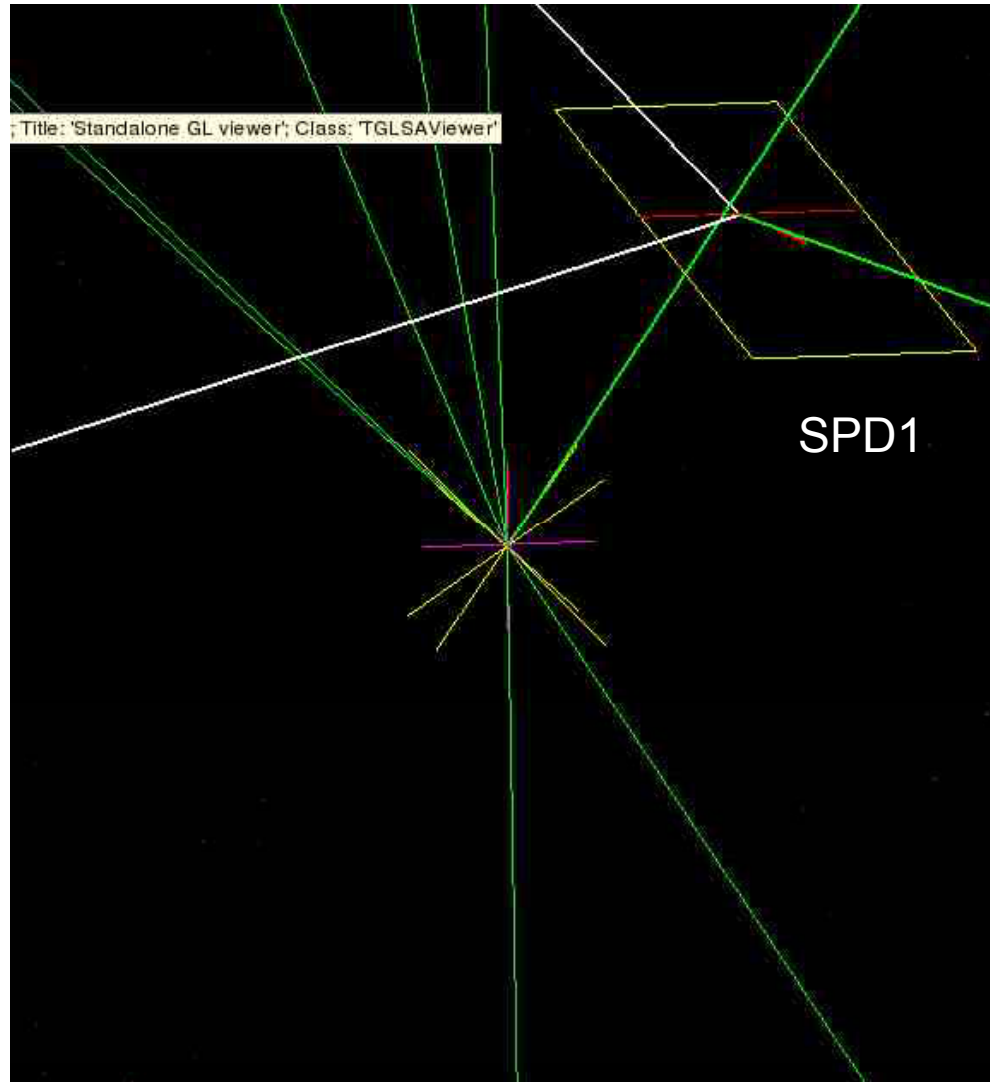
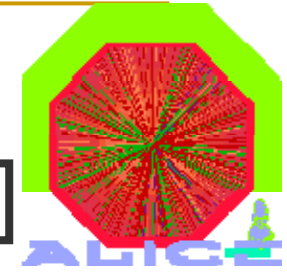


F. Gianotti, CERN TH Institute, 23/8/2007

CMS planning



Pathological PDC06 event

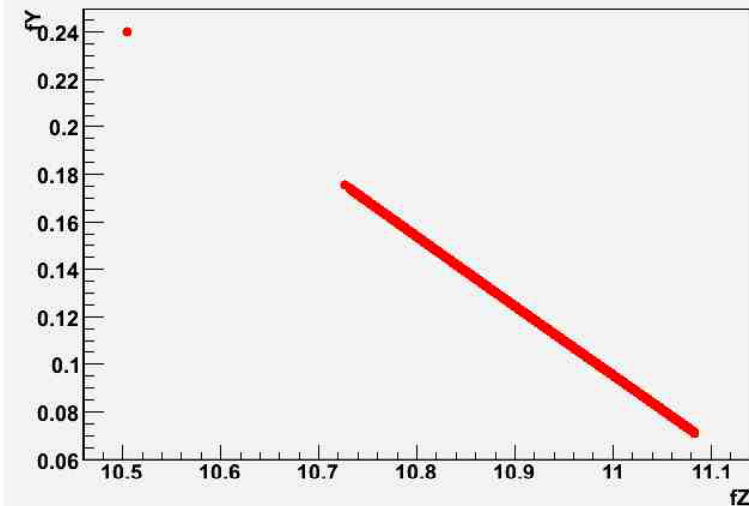


$$\pi^+ + X \Rightarrow \pi^+ + \pi^+ + p + p$$

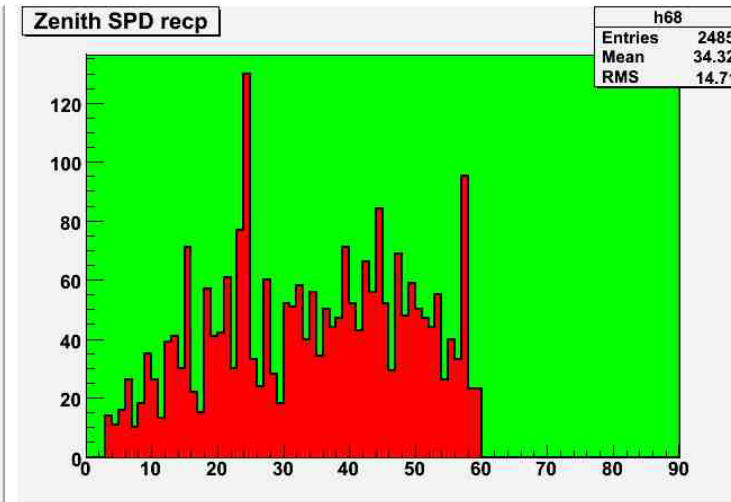
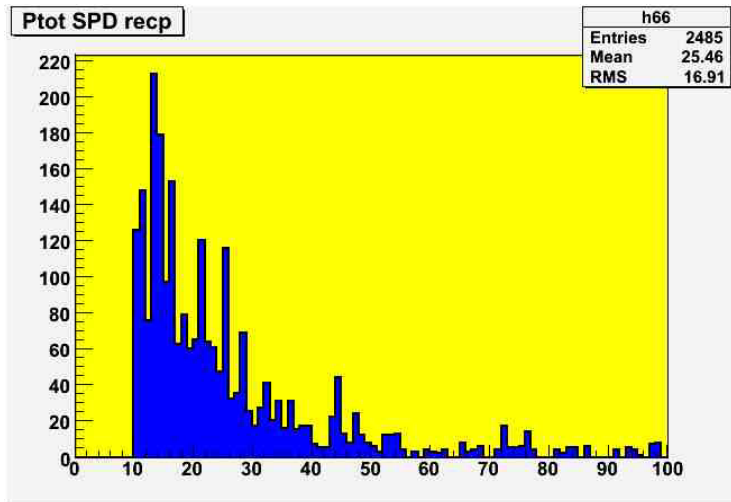
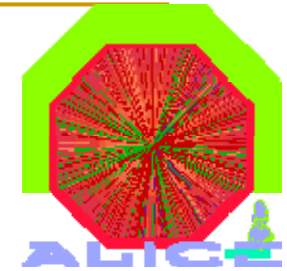
In this view → primary pi+ not well connected to the secondary tracks, no kink !

QUESTION: should we worry ?
A very rare case, 1 in ~60000

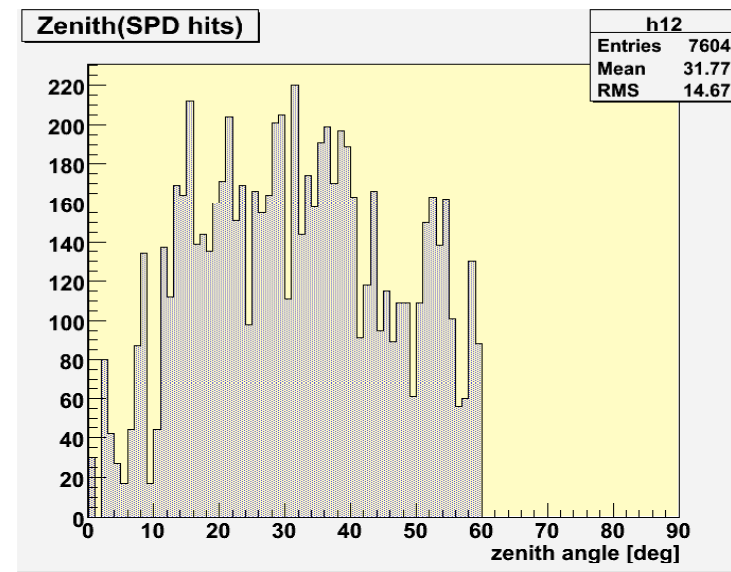
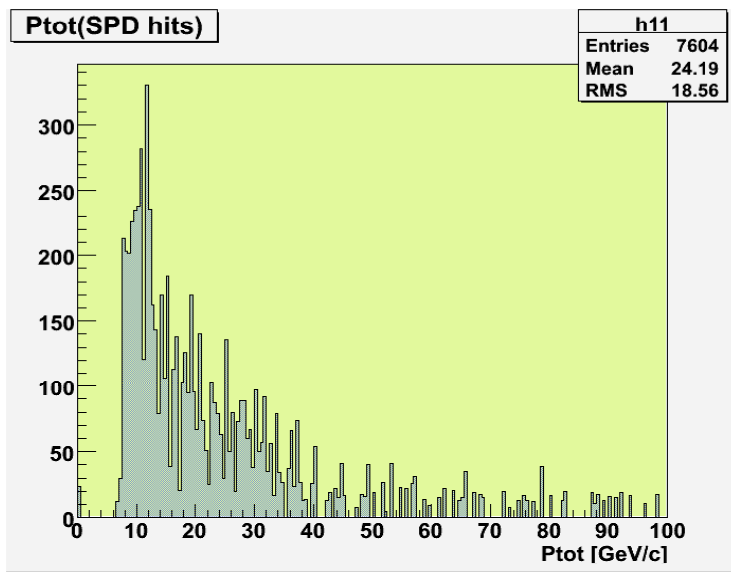
fY:fZ {fTrack==999}



Muon distributions (1000 events)



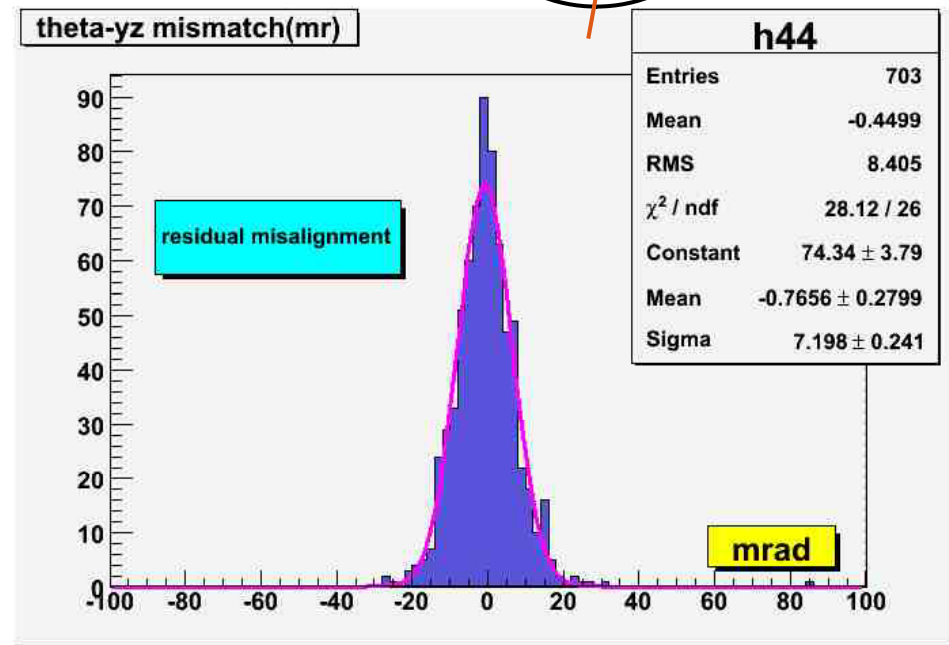
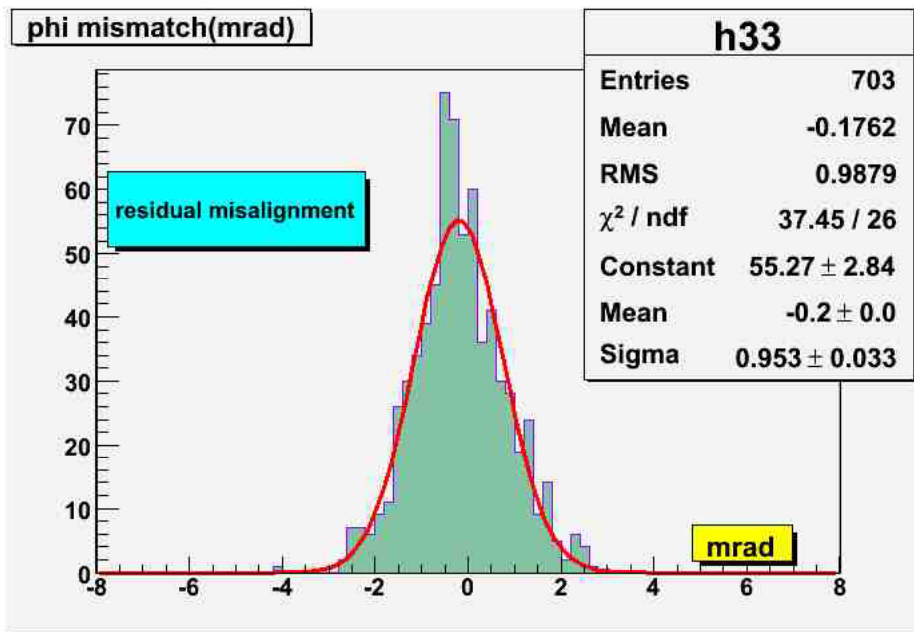
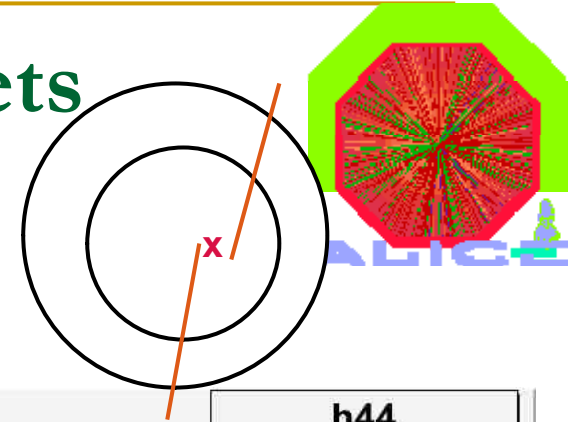
generated:
one entry
per recpoint



muons at
hit level:
one entry
per hit

NOTE: only muons reaching SPD

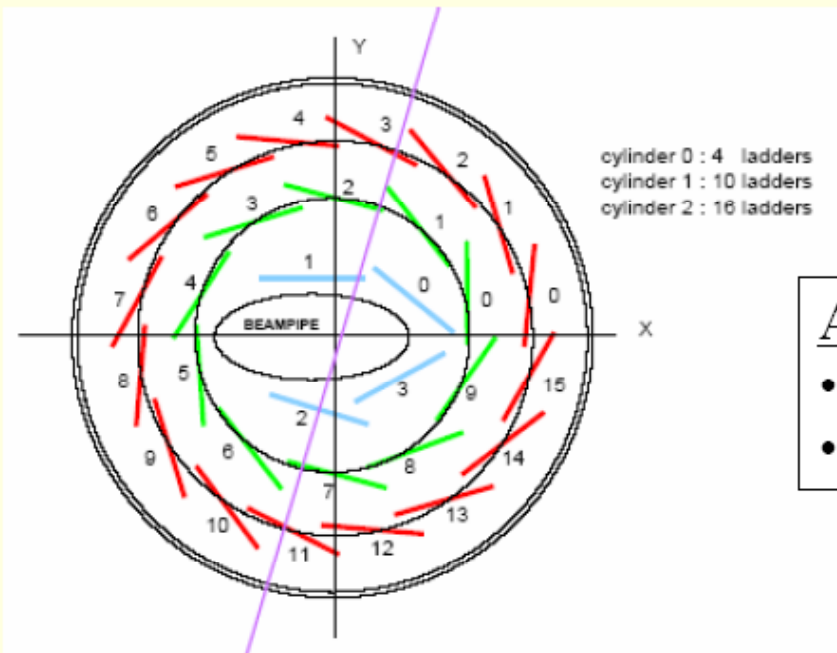
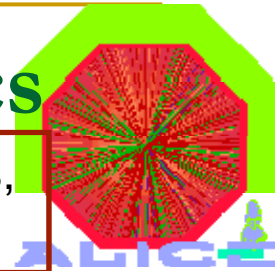
Example of the angular tracklets mismatch



Consistent with the IP resolution

An example of alignment with cosmics

T. Kohno, Alignment of the ZEUS micro-vertex detector using cosmic tracks,
Nucl. Instr. & Methods in Phys.Res. A 559 (2006) 153-157



- 30 ladders in 3 layers
- 3 translation + 3 rotation degrees of freedom \rightarrow 180 parameters

Advantage

- Tracks with many MVD hits.
- Less ambiguities in pattern recognition.

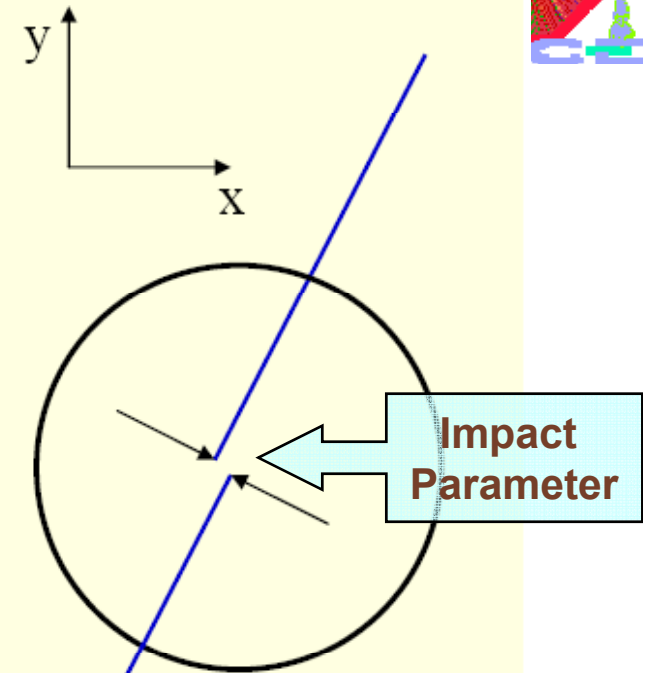
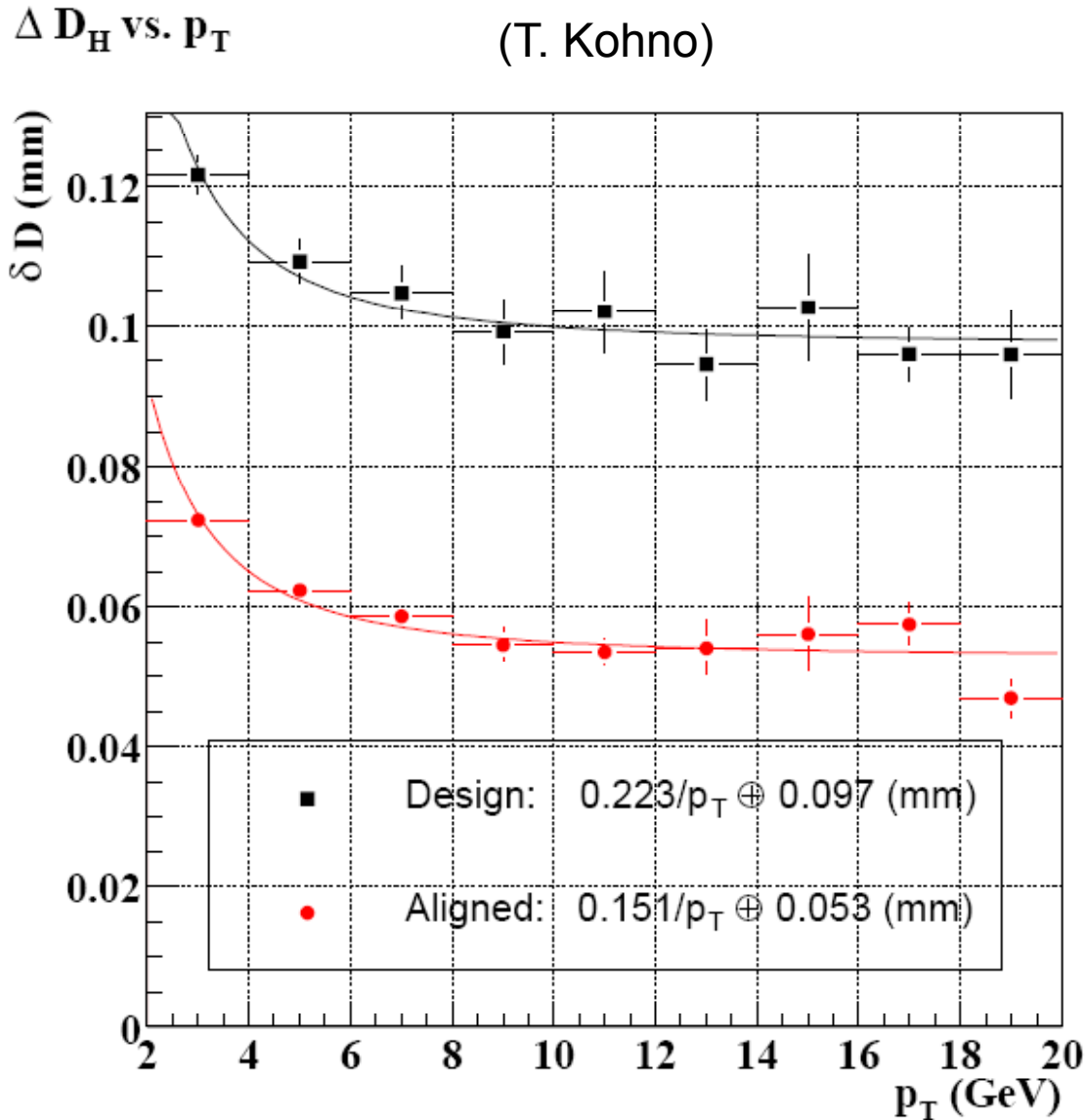
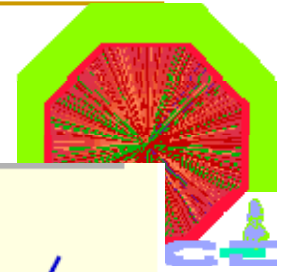
Disadvantage

- Non-uniform angular coverage.
- Only possible for the barrel MVD.
- Needs a special cosmic run.

Track sample (cosmic muons) :

- Rate \sim few Hz
- 1 week of dedicated cosmic runs \rightarrow 60k cosmic tracks for the alignment.

Effect on IP resolution



Improvement
 $\sigma(D_H): 97 \rightarrow 53 \mu\text{m}$