

Statistical analysis of Chamber Calibration Data

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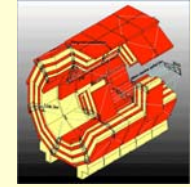
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⁴ European Organisation for Nuclear Research (CERN), Geneva, Switzerland
(on leave from Research Institute for Particle and Nuclear Physics, Budapest)

Special thanks to CERN TS-SU Survey group!

This project is supported by the Hungarian Scientific Research Fund (OTKA): T043145 and T034910

Chamber calibration status

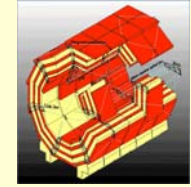


- Chambers already calibrated:

MB1	49
MB2	53
MB3	54
<u>MB4 (all types)</u>	<u>53</u>
Total calibrated:	209

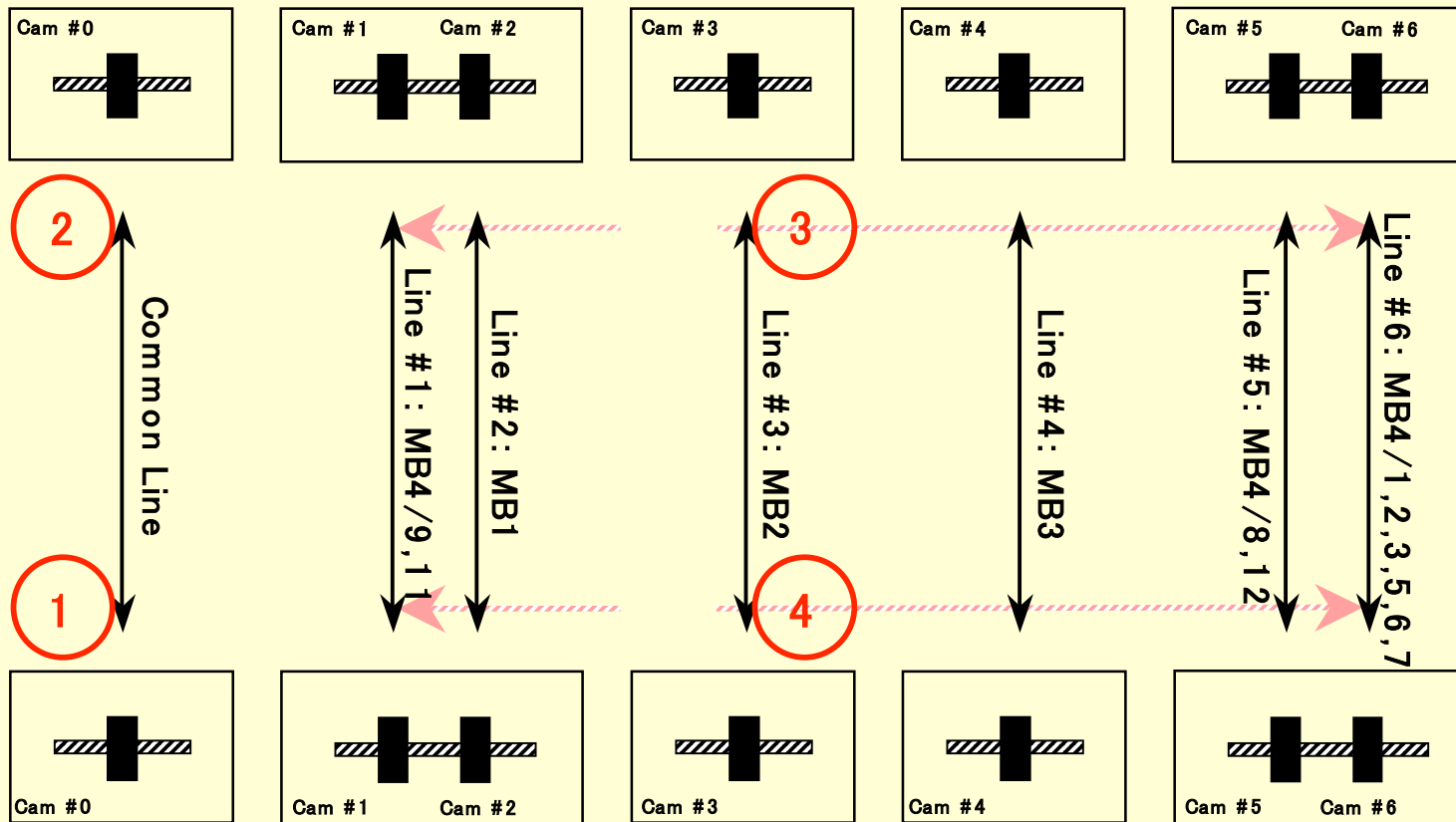
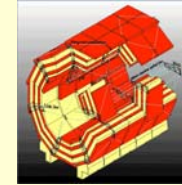
- Up to date status can be found at:

<http://kismalac.phys.klte.hu/cgi-bin/Chamber/ChamberSummary.pl>



Chamber Calibration Procedure

ISR Chamber calibration bench layout



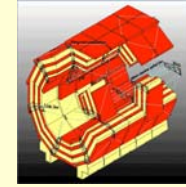
Chamber FrontEnd side

○: Chamber corner

Top view



Chamber calibration procedure



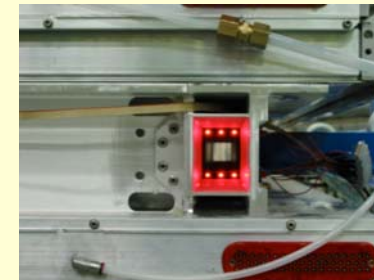
1) Photogrammetric measurement

Provides the Corner Block target positions in the Lab reference frame



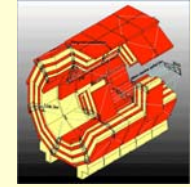
2) Fork LED measurement with cameras

Provides the fork LED centroid positions in the Lab reference frame



3) Analysis – Calculation of

- a. Corner Blocks in the SuperLayer Reference frame ...**DONE**
- b. SuperLayers in the Chamber Reference frame ...**DONE**
- c. Fork positions in the Chamber Reference frame ...working on



Analysis on the Corner Block positions of the SuperLayers

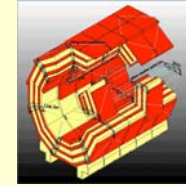
Analysis on all chamber types can be found here:

<http://kismalac.phys.klte.hu/cgi-bin/Survey/GetSurveyStatistics.pl>

Individual chamber data can be accessed through:

<http://kismalac.phys.klte.hu/cgi-bin/Chamber/ChamberSummary.pl>

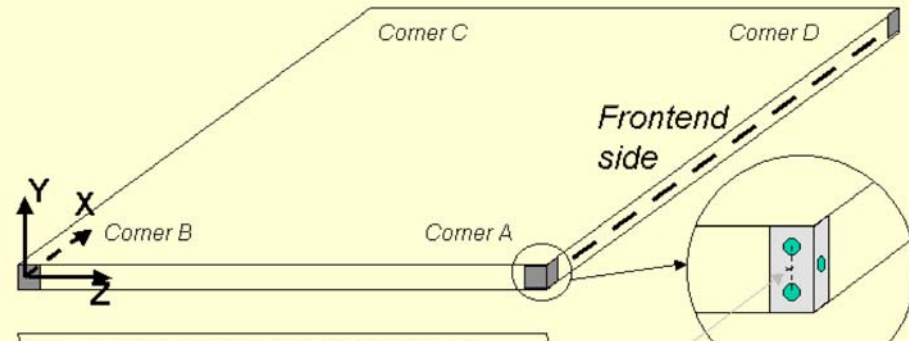
Introduction



Gives

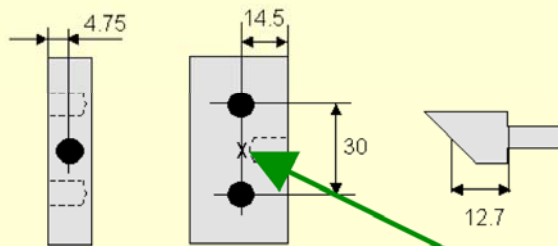
- Z position of Corner A
- XZ position of Corner C
- XYZ position of Corner D

in the frame of the SuperLayer



The superlayer coordinate system is attached to the corner blocks A,B,C:
Origo: corner B.
Z-axis: trough corner A
X-Z plane: corners B,C,A.

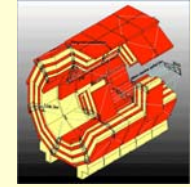
Corner block reference point: middle-point on the line drawn on the surface and connecting the centres of the holes on the two-hole side.



Corner block reference point: middle-point on the line drawn on the surface and connecting the centres of the holes on the two-hole side.

Middle point on Corner Blocks' two-target surface is used for this analysis

Results

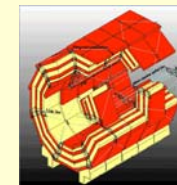


On the successive slides we show the planarity and trapezoidity analysis has been performed on all chambers for both SL2 and SL3.

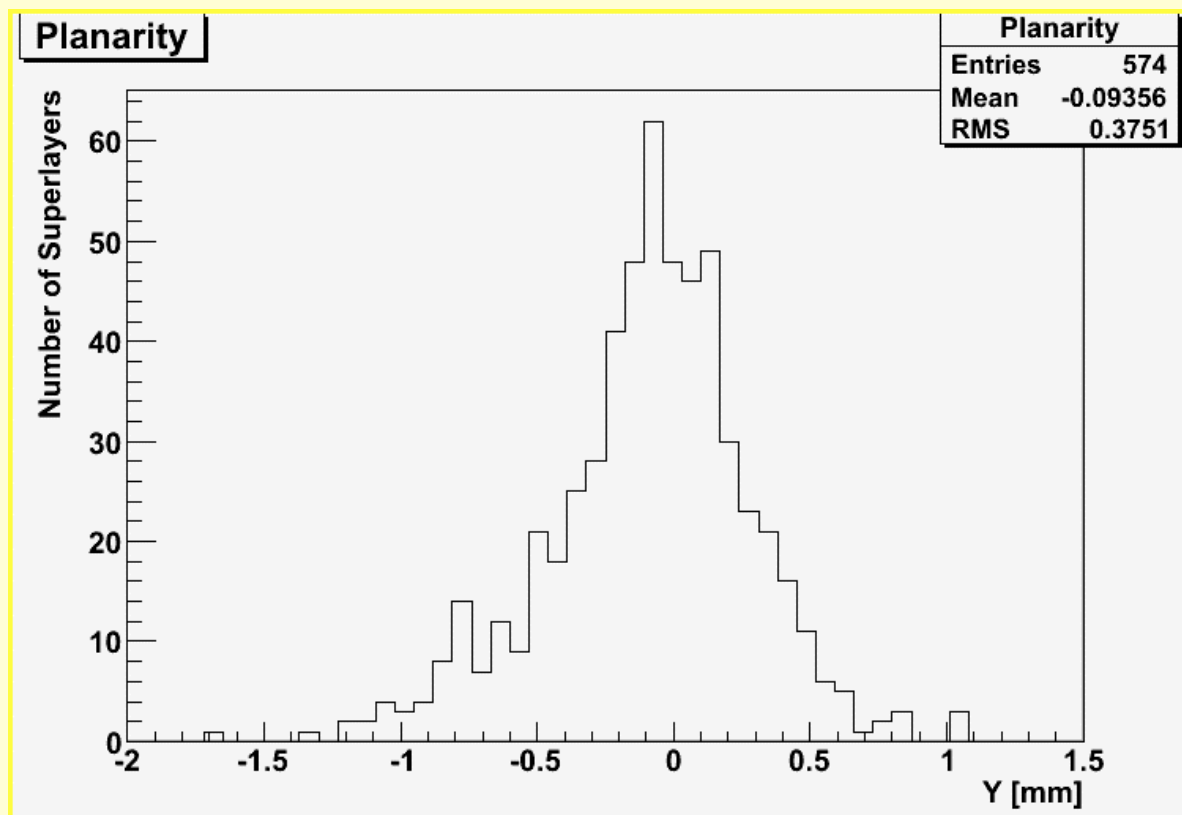
Sample size: 574 SuperLayers

(Analysis for different chamber types and for superlayers is planned to be put on the web soon...)

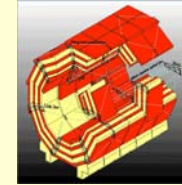
Planarity result



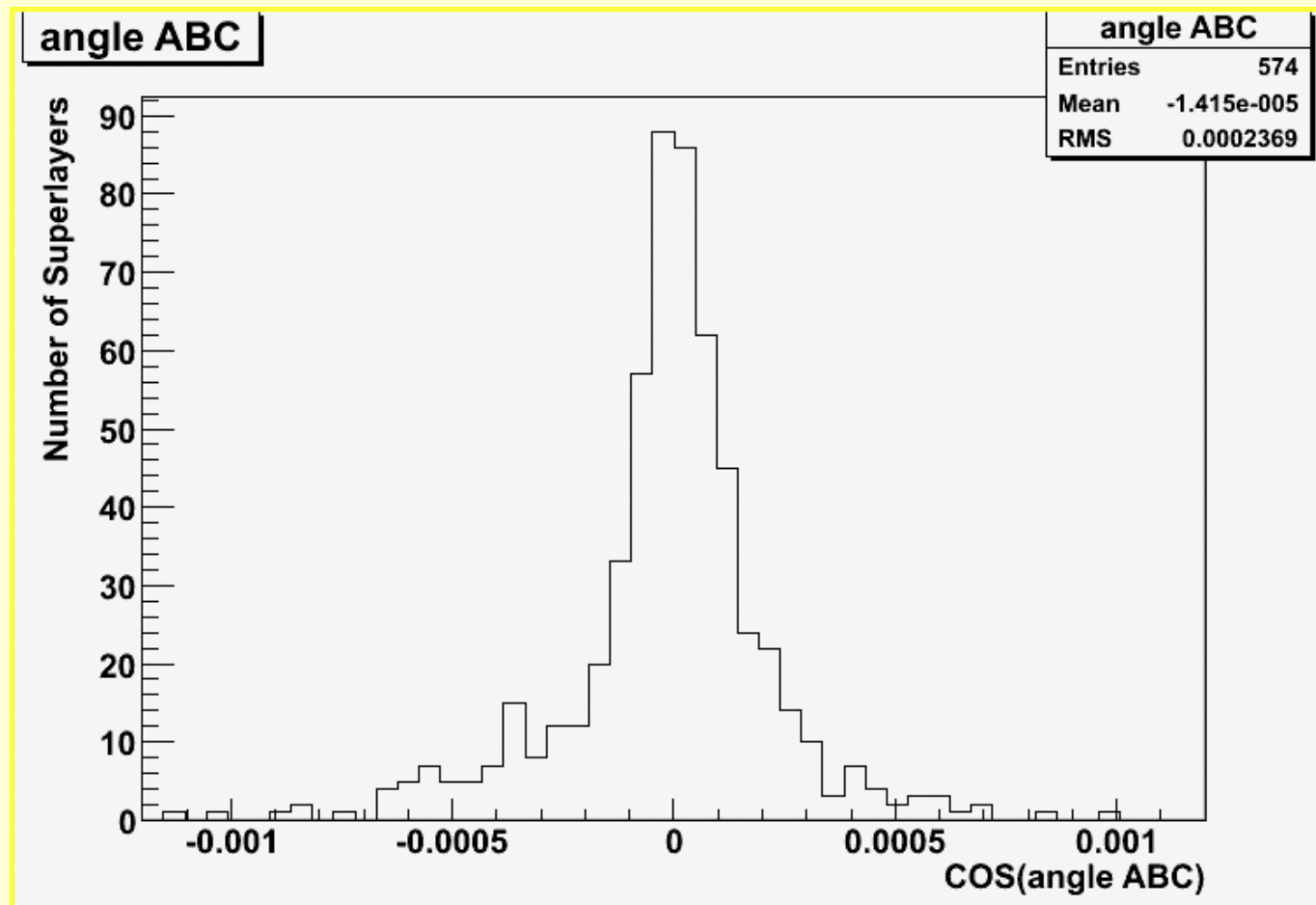
Y position of Corner D in the SuperLayer's frame



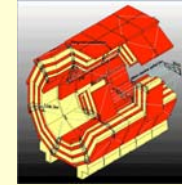
Trapezoidity results



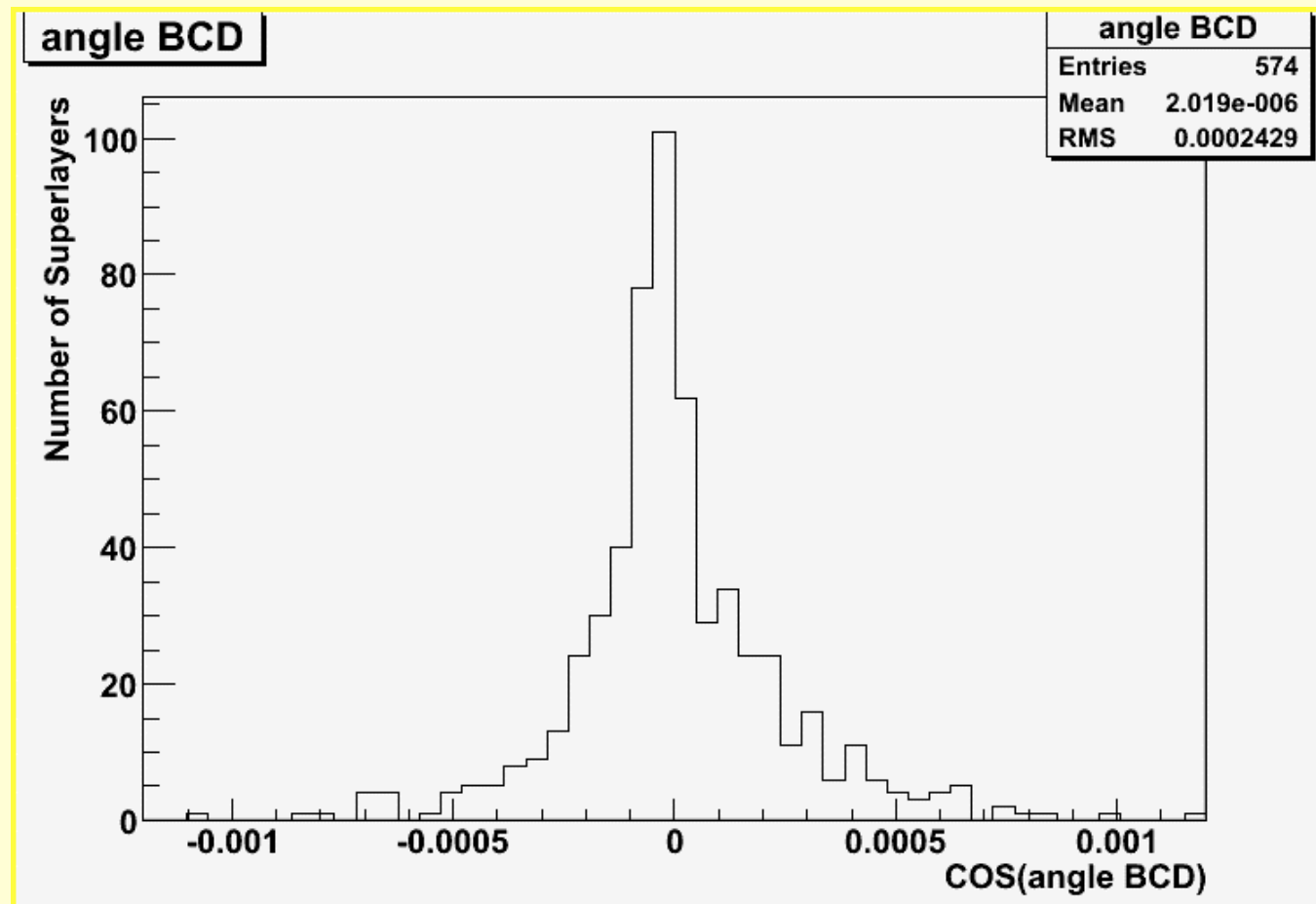
Cosine of angle at Corner B



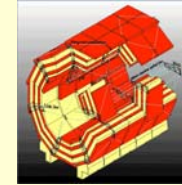
Trapezoidity results



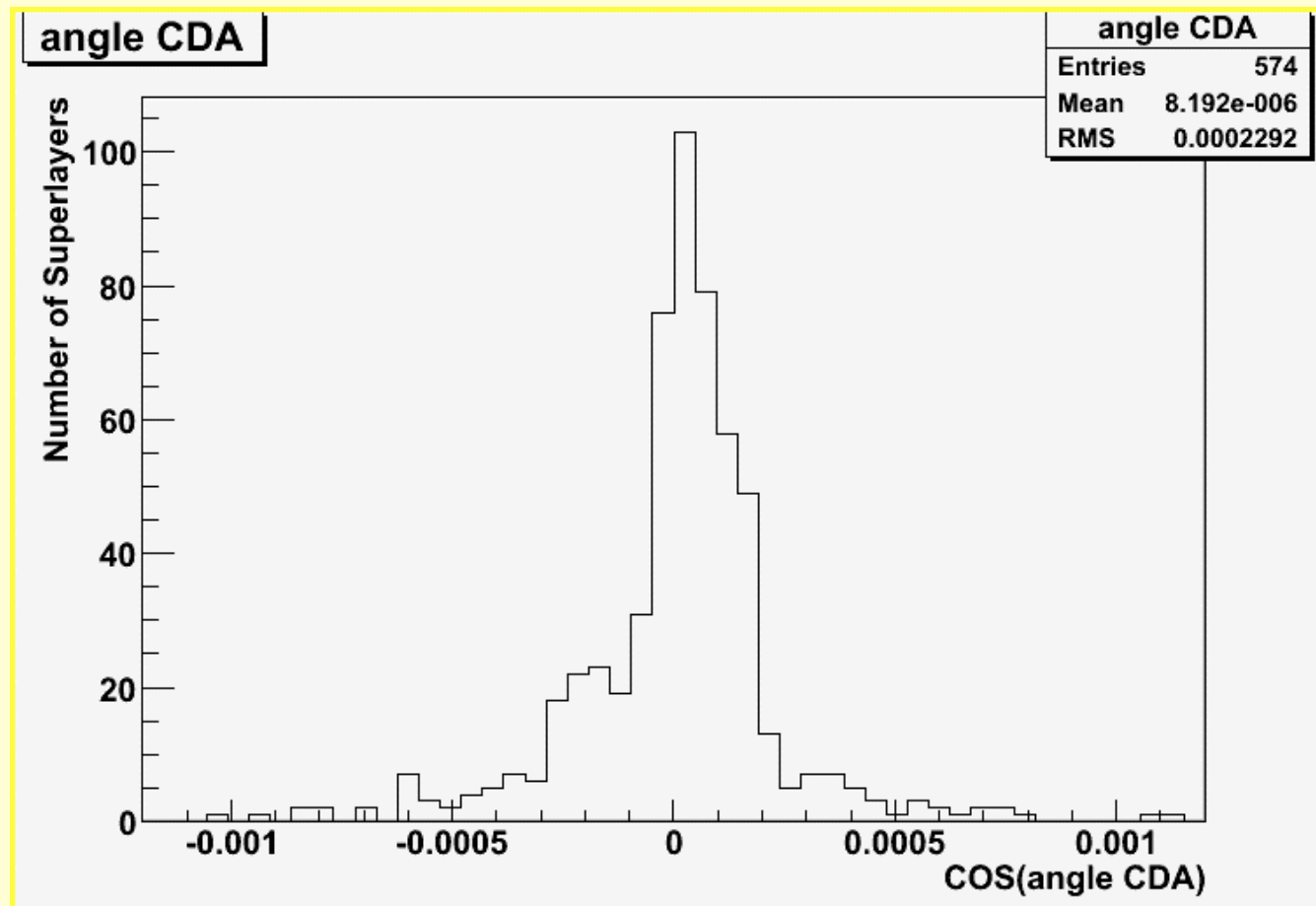
Cosine of angle at Corner C



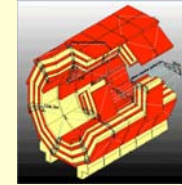
Trapezoidity results



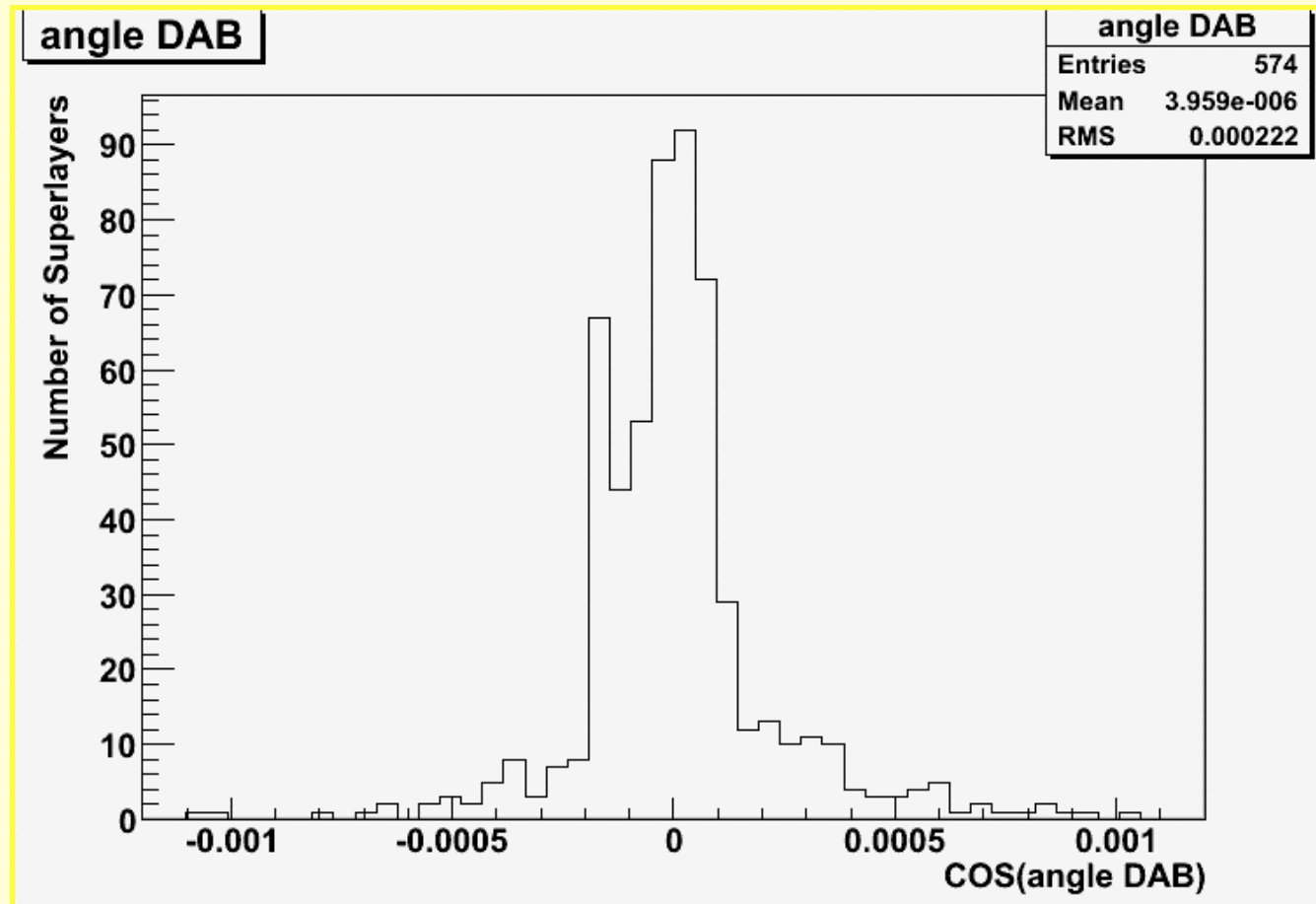
Cosine of angle at Corner D

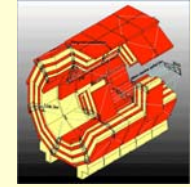


Trapezoidity results



Cosine of angle at Corner A





Statistical analysis on SuperLayer positions in the Chamber Frame

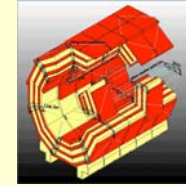
Analysis on all chamber types can be found here:

<http://kismalac.phys.klte.hu/cgi-bin/Survey/GetSLTrStatistics.pl>

Individual chamber data can be accessed through:

<http://kismalac.phys.klte.hu/cgi-bin/Chamber/ChamberSummary.pl>

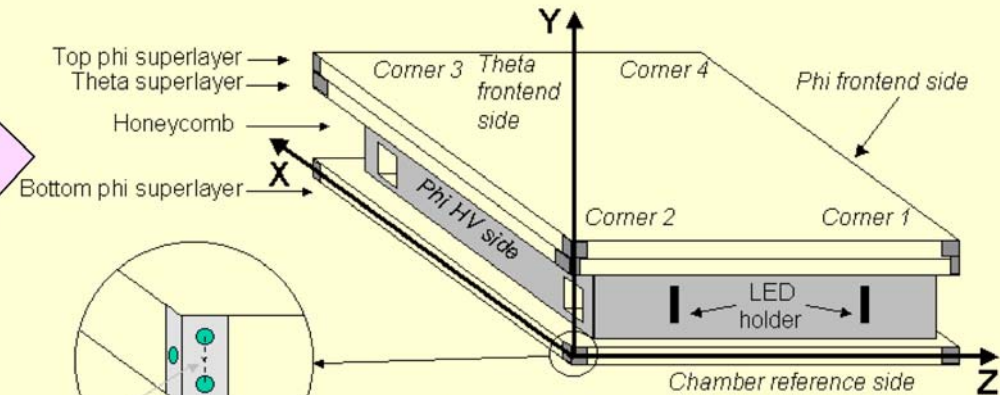
Introduction



Gives:

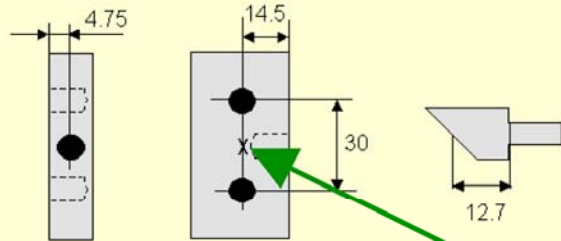
- XYZ position of SL2 & SL3
- rotation angles of SL2 & SL3

in the Chamber Reference Frame



The chamber coordinate system is attached to the corner blocks 1,2,3 of the bottom superlayer:
Origo: corner 2.
Z-axis: trough corner 1
X-Z plane: corners 2,3,1.

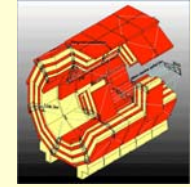
Corner block reference point: middle-point of the line drawn on the surface and connecting the centres of the holes on the two-hole side.



Corner block reference point: middle-point on the line drawn on the surface and connecting the centres of the holes on the two-hole side.

Middle point on Corner Blocks' two-target surface is used for this analysis

Results



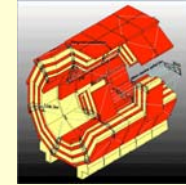
On the successive slides we show the analysis running on all chambers SL3.

Sample size: 209 SuperLayers

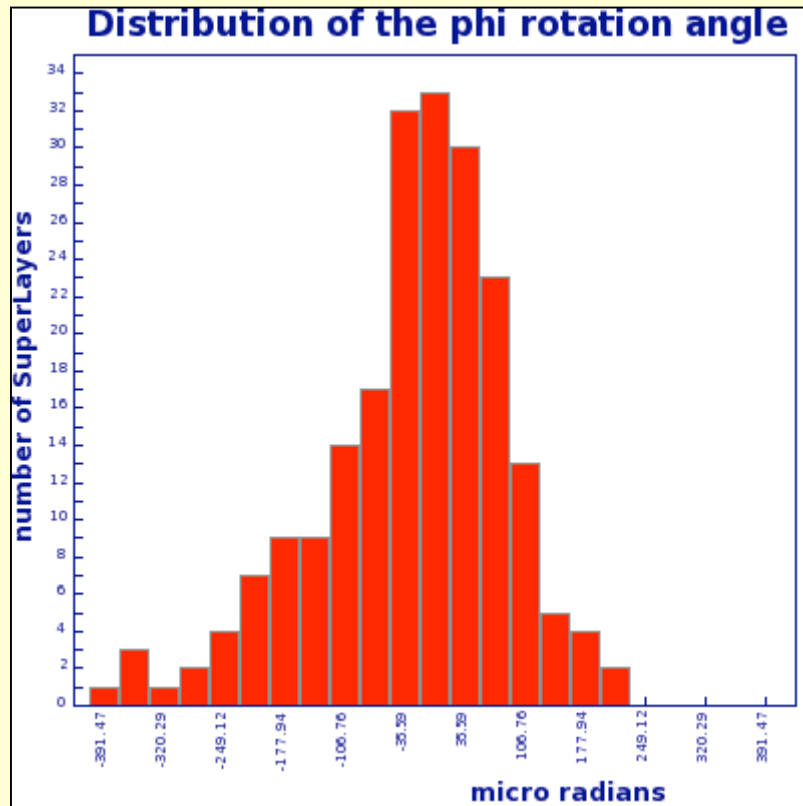
This analysis has been sent into the PTDR.

(Analysis for different chamber types and for SL2 can be seen on the web...)

Results

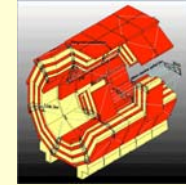


Rotation around the X axis of the chamber:

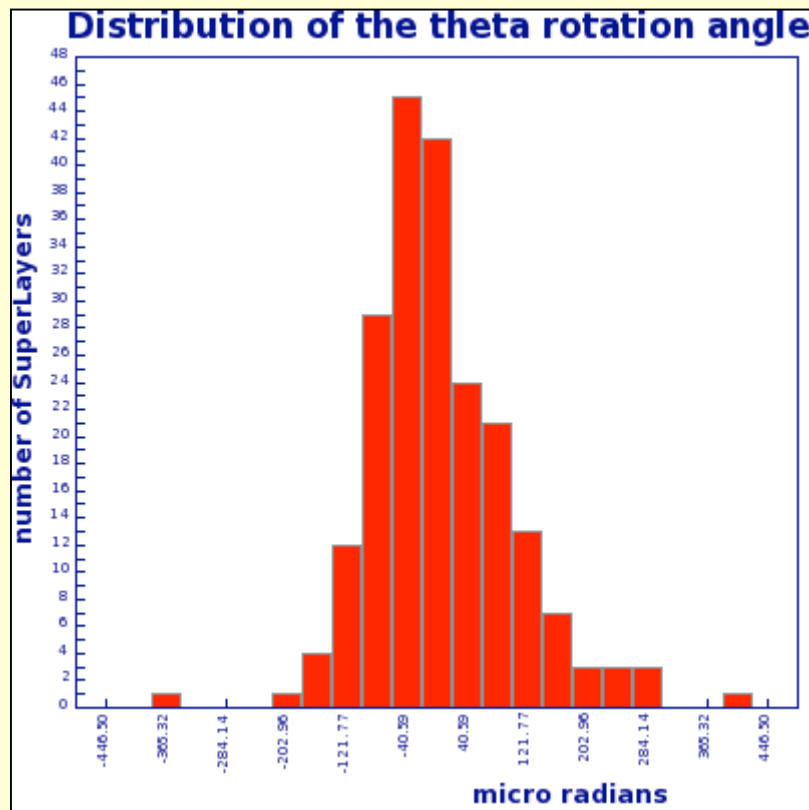


Average : -27.59 μrad
Sigma : 111.29 μrad
Max : 206.75 μrad
Min : -373.68 μrad

Results

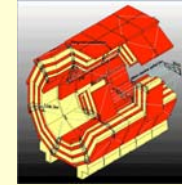


Rotation around the Y axis of the chamber:

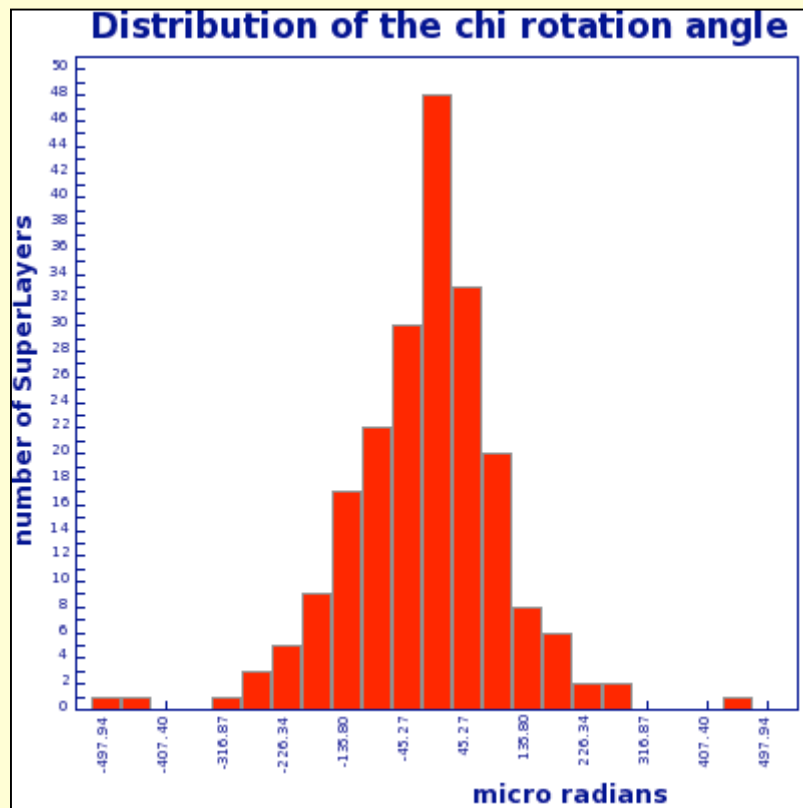


Average : 4.81 μ rad
Sigma : 96.39 μ rad
Max : 426.21 μ rad
Min : -363.83 μ rad

Results

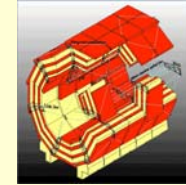


Rotation around the Z axis of the chamber:

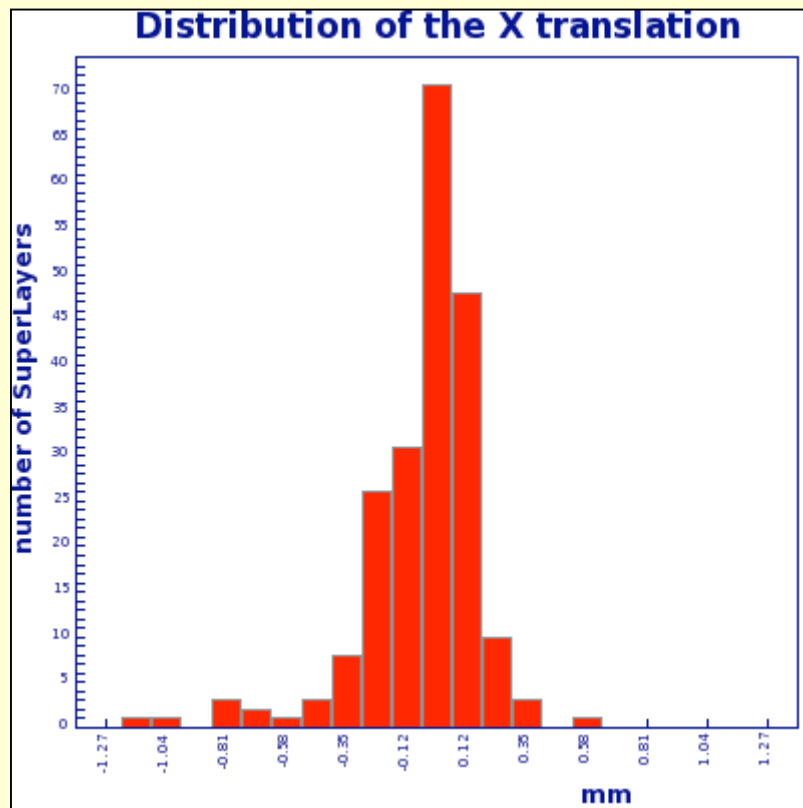


Average : -18.19 μ rad
Sigma : 116.85 μ rad
Max : 465.47 μ rad
Min : -475.30 μ rad

Results

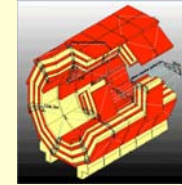


Translation along the X axis of the chamber – X_{tr_design} :

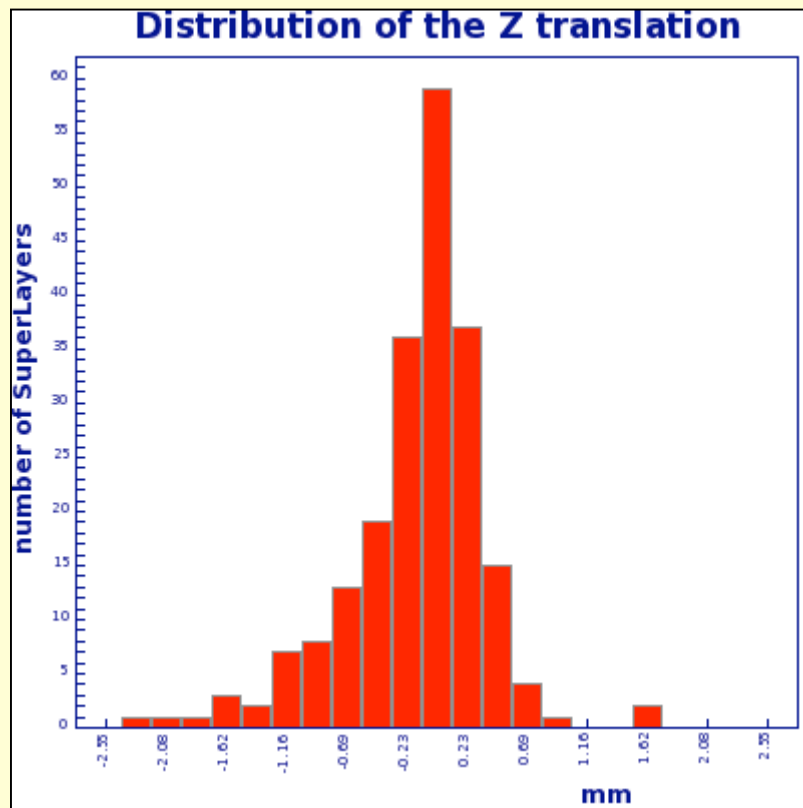


Average : -0.05 mm
Sigma : 0.23 mm
Max : 0.64 mm
Min : -1.22 mm

Results

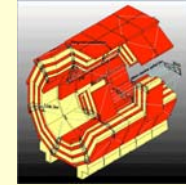


Translation along the Z axis of the chamber – Z_{tr_design} :

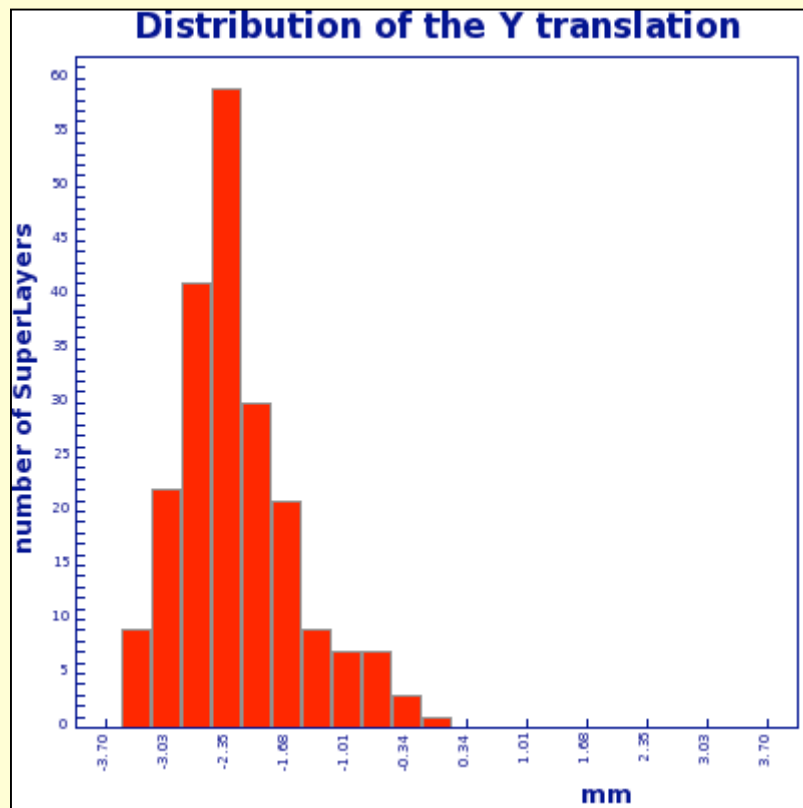


Average : -0.16 mm
Sigma : 0.54 mm
Max : 1.67 mm
Min : -2.43 mm

Results

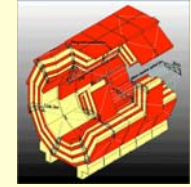


Translation along the Y axis of the chamber – Y_{tr_design} :



Average : -2.24 mm
Sigma : 0.64 mm
Max : -0.11 mm
Min : -3.53 mm

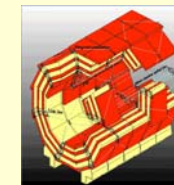
Results show that the Y_{tr} design parameters we use are not correct...



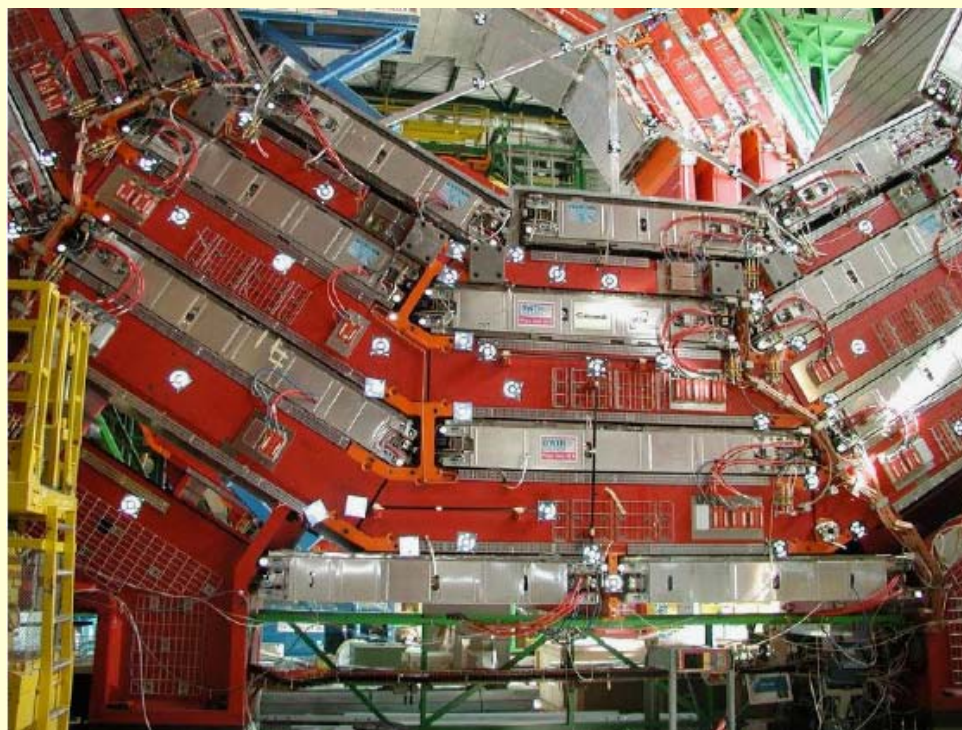
Survey measurement of chambers in the wheels

**Based on work of R. Goudard, J.F.Fuchs and J.D. Maillefaud (TS-SU)
(EDMS ID: 674805, 682052)**

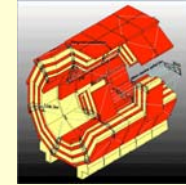
Survey measurement of chambers in the wheels



Survey measurement of chambers installed on YB+2 and YB+1 are ready

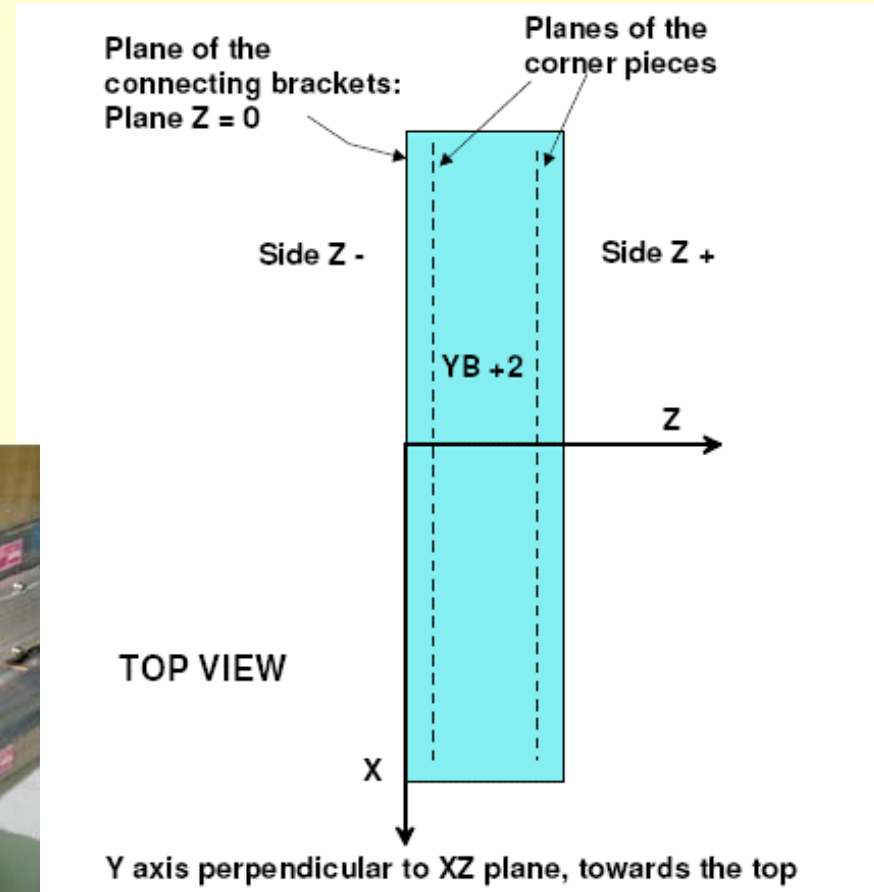


Survey measurement of chambers in the wheels

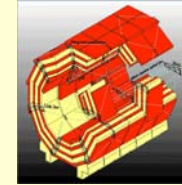


Coordinate system Of the Survey measurement:

Targets positions on the Muon Chamber:



Survey measurement of chambers in the wheels



Maximums and minimums of the results:

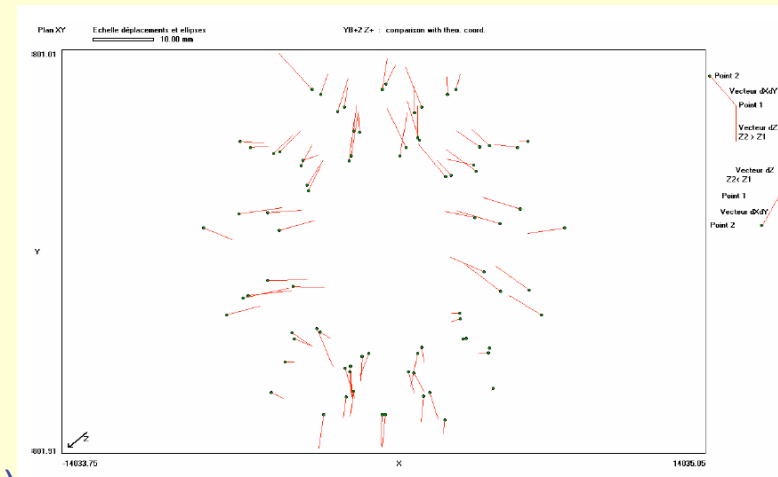
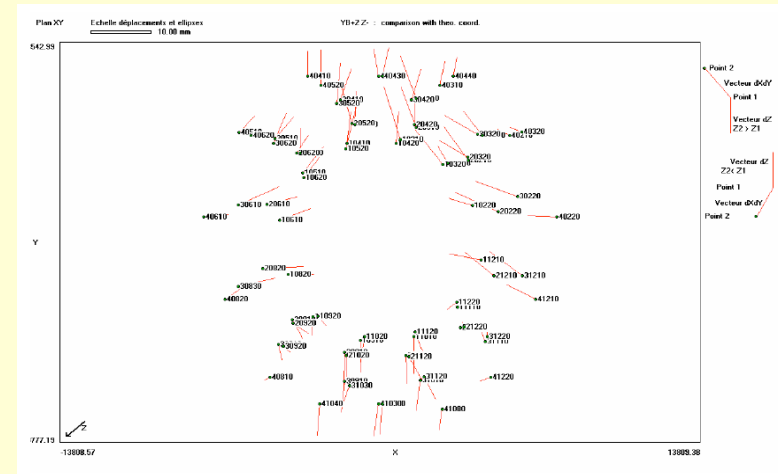
-Z side of YB+2:

Calc. - Theo. (mm)		
DX	DY	DZ
7.1	6.2	4.6
-6.7	-8.7	-3.3

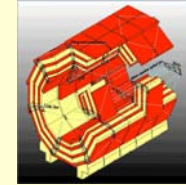
+Z side of YB+2:

Calc. - Theo. (mm)		
DX	DY	DZ
7.1	6.2	4.0
-7.4	-7.2	-3.2

- 40 (of 50) chambers have been measured
- 4 + 4 targets were inserted (some may not be seen)



Survey measurement of chambers in the wheels

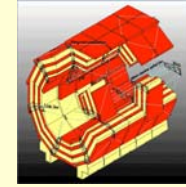


Conclusion:

Since $\Delta_{\text{meas-theo}}$ can be large, these results are better to be taken as starting parameters for COCOA calculation.

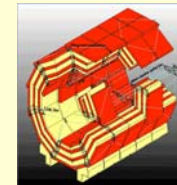
But, hardware is still OK, since sector corners move more or less coherent!

Wire position data



Accessing wire position data

Wire position data



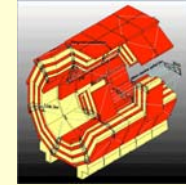
Physics reconstruction needs rather the wire positions than that of the Corner Blocks in Chamber.

Our group has been asked by the group working on the preparation for physics reconstruction (Francisco Matorras) to build a wire position DB (besides the full geometry DB) for all the chambers.

Two possible approaches of this DB:

1. Store all wire pos wrt CB in all layers of all SL.
2. Store only 1st wire pos, mean, sigma + renitent wire data for all SL.

Wire position data



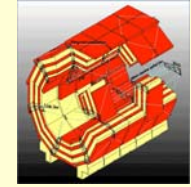
In order to make this we need wire positions wrt. Corner Blocks.

However:

- different production sites have different "data bases" (mainly text files)
- common Oracle DB is not updated long since
- none of them contains the CB \leftrightarrow ref wire distance

We have already contacted all production sites to get wire data.

Wire position data – a proposal



At the moment we concentrate on the Legnaro data (Paolo Checchia).

This is why we found their note (CMS NOTE 2004/001, M. Benettoni et al.) on the internal alignment of 21 chambers with cosmic ray tracks.

Proposal:

We propose to rerun the above mentioned analysis but include our chamber composition data of the SLs (and the wirepos) instead of the design numbers.

It would be nice to see whether the corresponding distributions get narrower...