TPC Alignment

1. Alignable parts
2. Influence of the alignment on the calibration
3. Residual misaligments
4. Converting surveyers data to the AlignObj
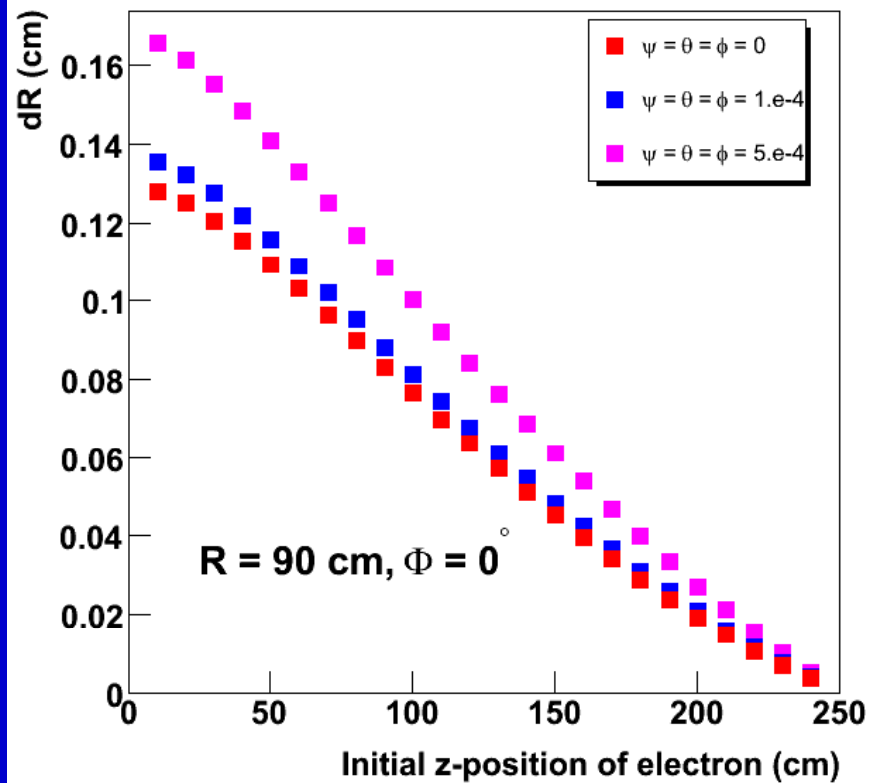
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Alignable parts

- central membrane
- readout chambers
- the TPC itself in the magnet

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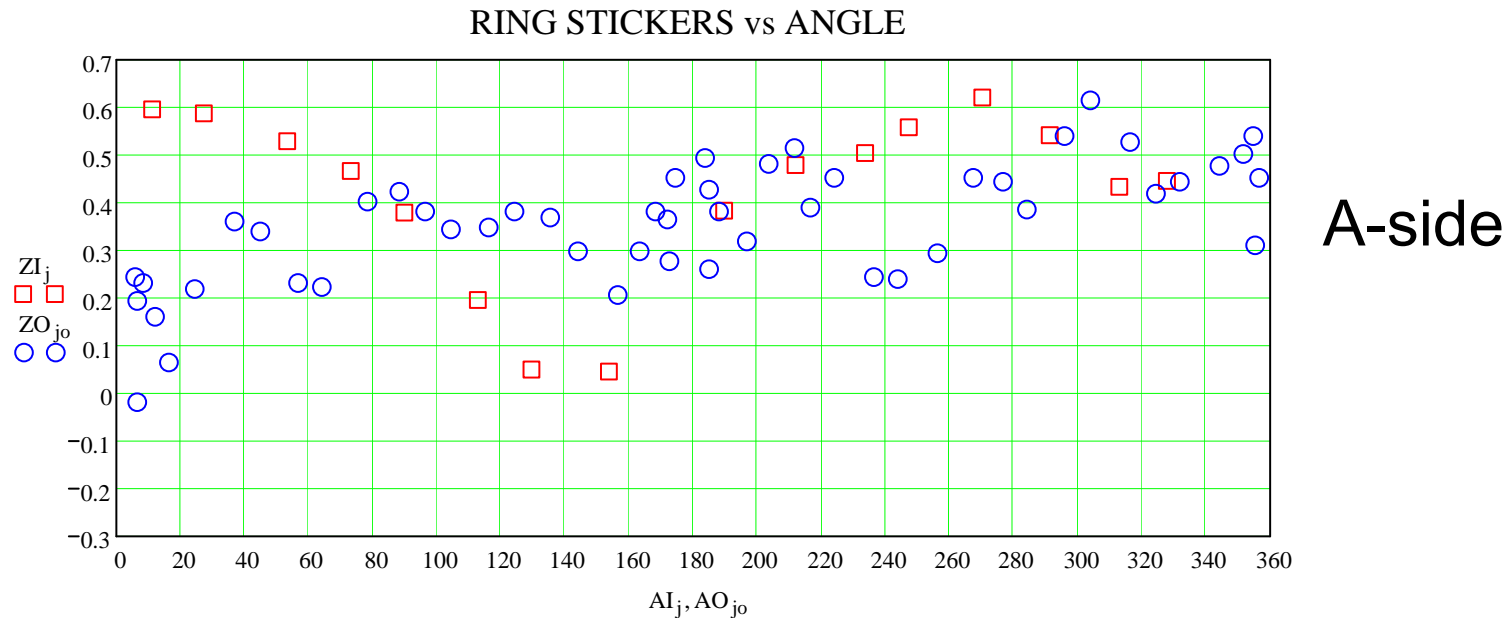The alignment of the TPC in the most cases affects the detector calibration

Example:
- rotation of the TPC increases the ExB distortions
- inclination of the central membrane affects the drift field - ExB

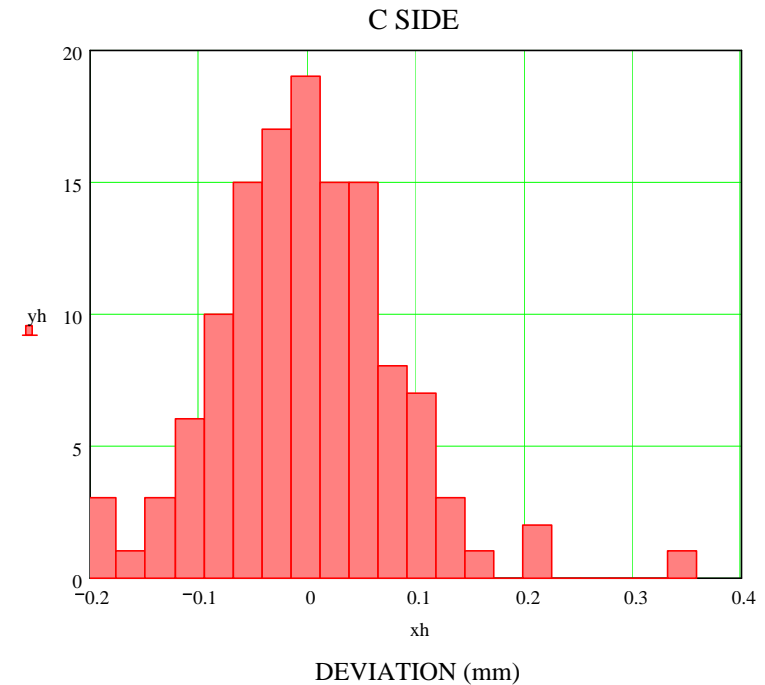Calculations include nonuniformity of the B-field and the ion pile-up
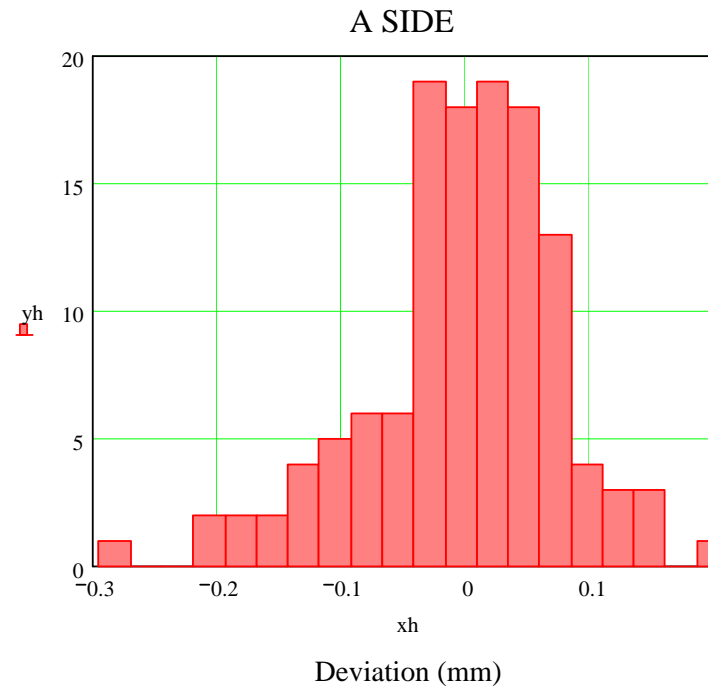
Central membrane planarity

$$\langle ZI \rangle - \langle ZO \rangle = 14 \mu m$$

Before intervention is was ~2 mm

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Alignment of ROCs

Deviation of reference points from the ideal plane after alignment of ROCs

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The TPC is considered internally aligned, (within the accuracy of measurements)

The residual misalignment will be corrected using tracks

Conversion of the surveyers' data into Alignment Object

Remaining question – alignment of the entire detector in the ALICE reference frame

We have surveyers' measurements of the reference points in the TPC reference frame and in the ALICE reference frame

Procedure

1. Load the surveyers' data
2. Apply the transformation
3. Create and store the alignment object(s)

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Loading the surveyers' data

Framework provided by Ricardo da Silva, however some parts still missing…

```
AliSurveyObj *s = new AliSurveyObj();
```

Then one has to do:
- Fill(FromLocalFile)
- get AliSurveyPoint *p (via *s)
- GetX, GetY GetZ (methods of AliSurveyPoint)

Algorithm

In order to secure the linearity of the problem, taking into account the rotation angles are small, we assumed

$$\sin(\vartheta / \varphi / \psi) = \vartheta / \varphi / \psi$$
$$\cos(\vartheta / \varphi / \psi) = 1$$

$$ROT = \begin{bmatrix} 1 & -\varphi & \theta \\ \varphi & 1 & -\psi \\ -\theta & \psi & 1 \end{bmatrix}$$

Y-convention

$$\widehat{Y} = ROT \cdot \widehat{X} + SHIFT$$

we have 6 parameters and 24 measuremets (8 points)

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Creation of Alignment Object

Framework provided by Raffaele Grosso

AliAlignObjParams *p = new AliAlignObjParams();
p->SetRotation
p->SetTranslation

Store either in the Data Base or in the root file

AliTPCAlign class

A simple class which reads the surveyers' data
and creates the TPC alignment object

Functionality:

- LoadSurveyData
- ComputeTransform
- CreateAlignObj

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