



Outline:

TRT Barrel

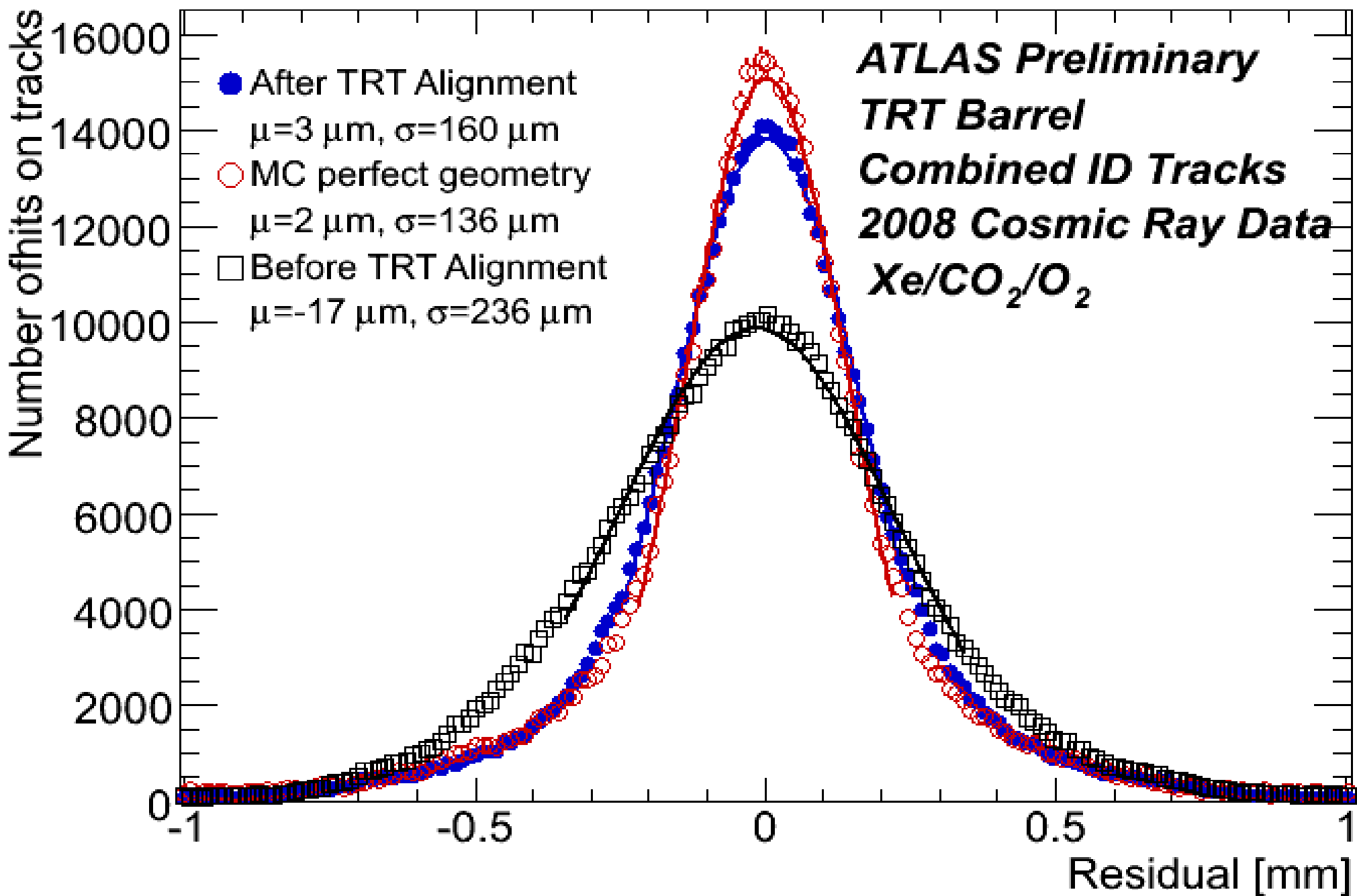
Endcap L1

Endcap L2

Alignment

John Alison

University of Pennsylvania





2009 Data

Run 135146, 1/physics_IDCosmic

InnerDetector/IDAlignment/Tracks_NoTriggerSelection/Residuals/trt_b_residualR

Location in ROOT file: IDAlignMon/Tracks_NoTriggerSelection/Residuals/trt_b_residualR

Assessment Details:

Name: trt_b_residualR

Status: **Red**

Algorithm: Simple_gaus_Fit

Num. of Entries: 136947

Underflow: 0

Overflow: 0

Configuration Parameters:

MinStat: 100

xmax: 0.3

xmin: -0.3

Sigma

XXXXXXXXI XXXXXXXX| XXXXXXXX

0.01

0.05

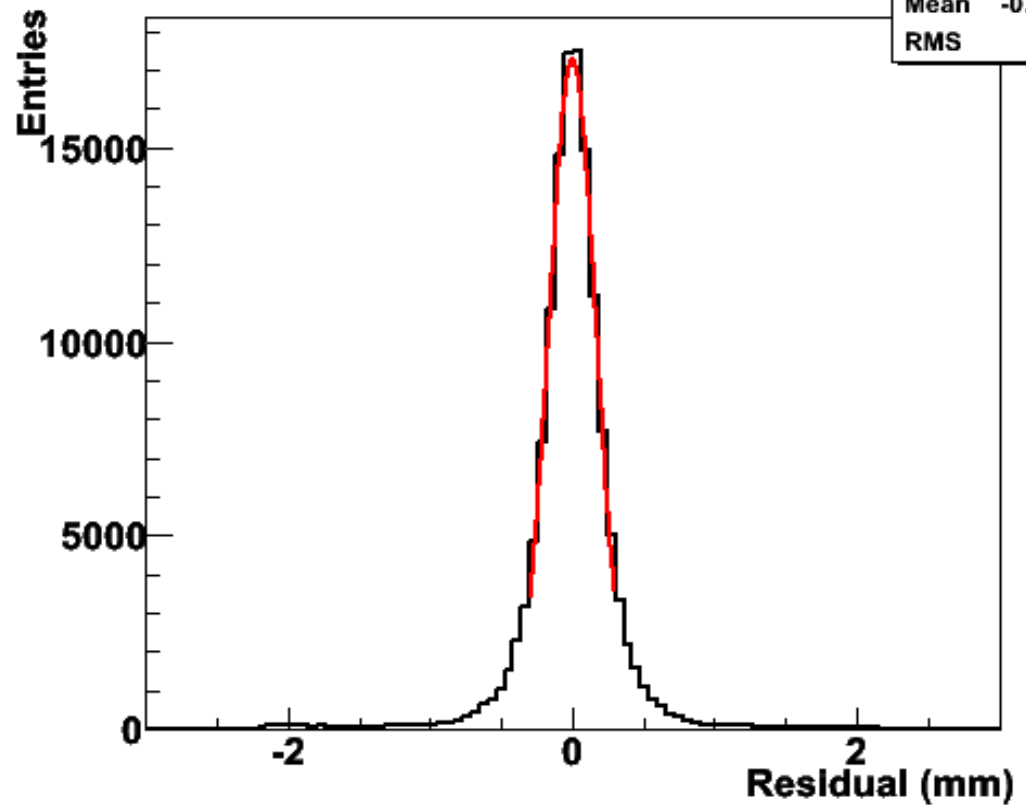
Results:

Constant: 1.726e+04

Mean: 0.002302

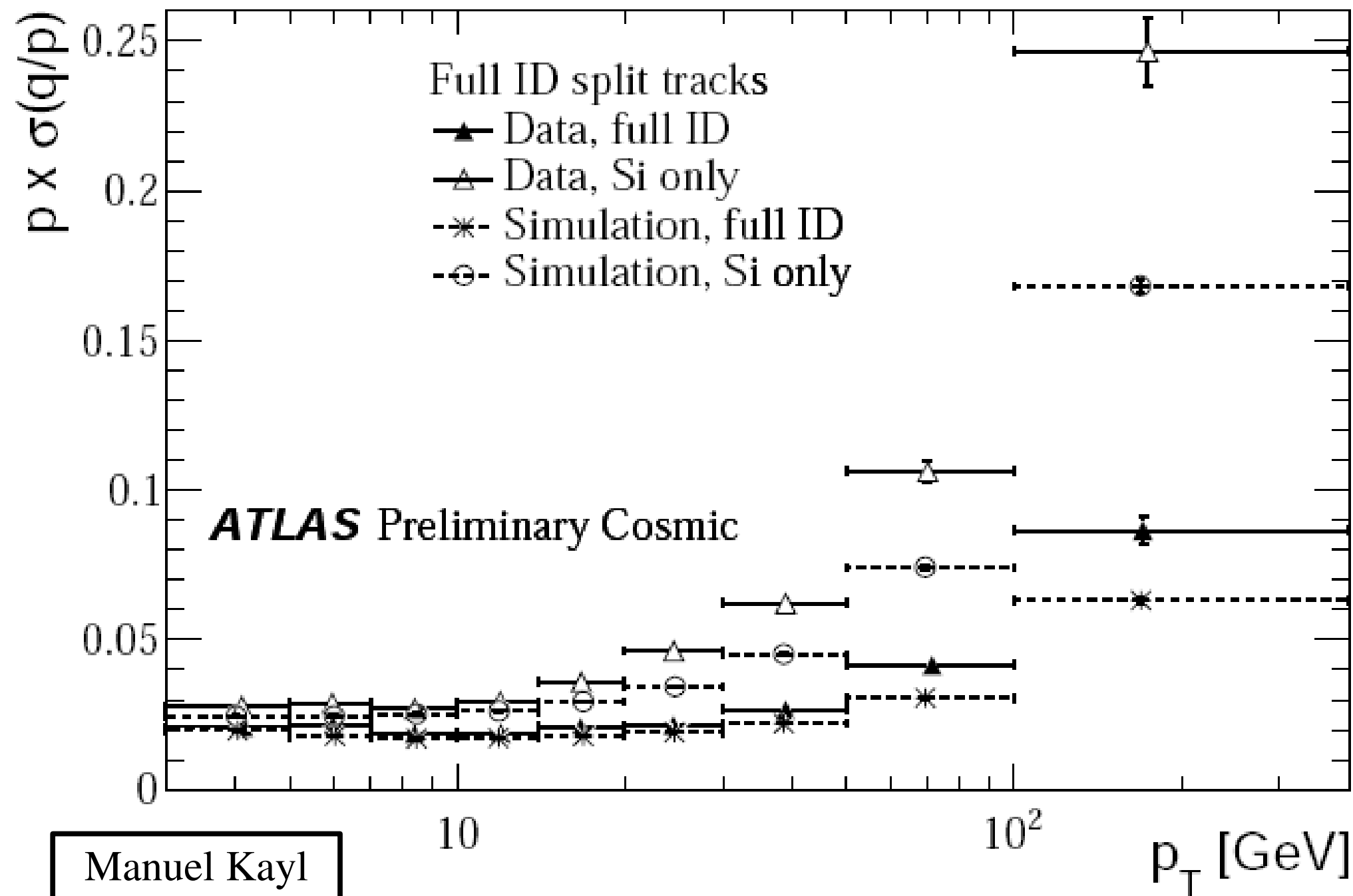
Sigma: 0.1664

UnBiased Residual for the TRT Barrel



Run 135146, 1/physics_IDCosmic

/InnerDetector/IDAlignment/Tracks_NoTriggerSelection/Residuals/trt_b_residualR



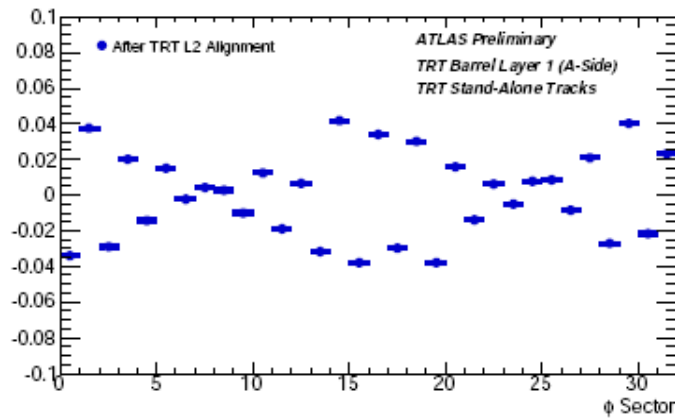
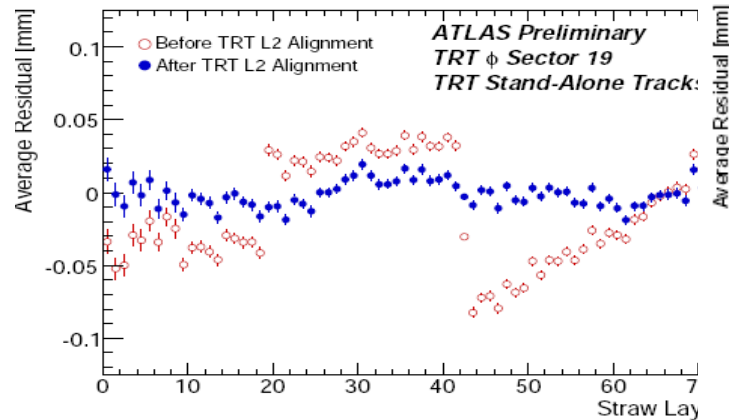
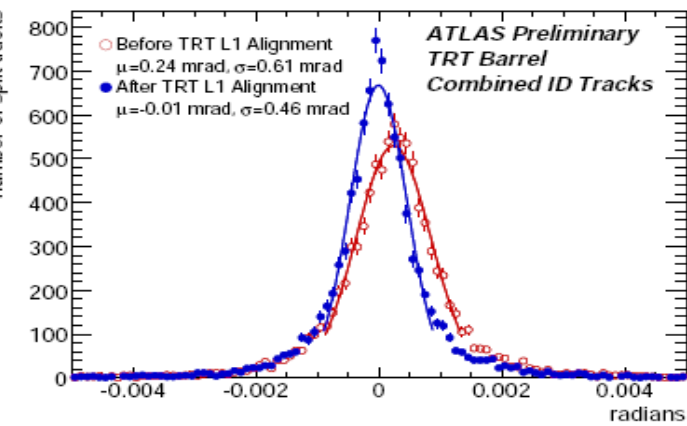
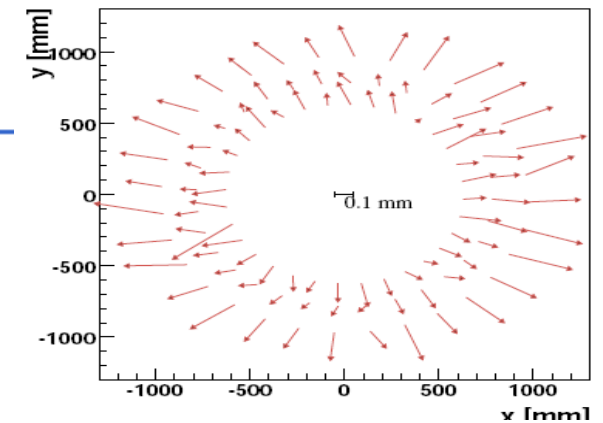
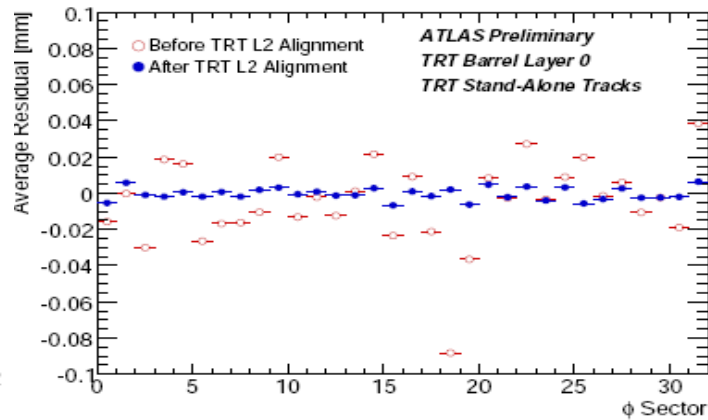
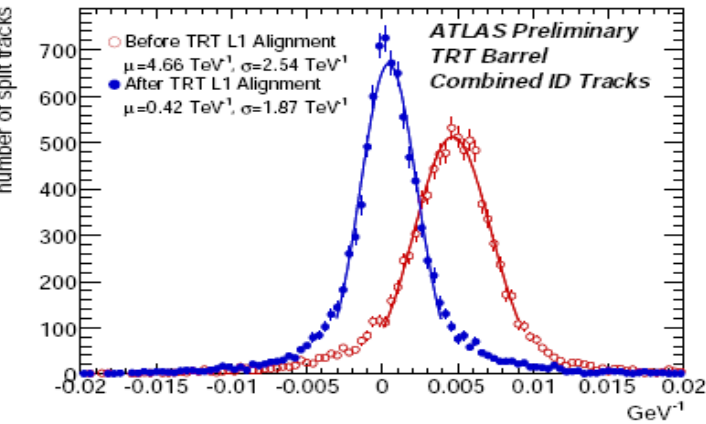
TRT Barrel Alignment With Cosmics



Information References Discussion Usage statistics Fulltext

Internal Note

Report number	ATL-COM-INDET-2009-044
Title	TRT Alignment with Cosmic Ray Data
Author(s)	Alison, J (University of Pennsylvania) ; Bocci, A (Duke University) ; Kroll, J (University of Pennsylvania)
Imprint	18 Dec 2009. - 32 p.
Subject category	Detectors and Experimental Techniques
Accelerator/Facility, Experiment	CERN LHC ; ATLAS
Free keywords	TRT ; Alignment ; Cosmic ; Inner Detector ; Commissioning
Abstract	We describe the TRT alignment procedure using data from cosmic-ray muons taken during the fall of 2008. The TRT Barrel was aligned internally, at the module level, and globally with respect to the rest of the Inner Detector. We present the results of this alignment and their impact on the Inner Detector reconstruction. Ongoing studies are summarized and several outstanding issues are highlighted.





TRT L1 Endcap Alignment

TRT L1 Endcap Alignment done with **both**

- **Field on** (with respect to *InDet_Cosmics_2008_06*)
- **Field off** (with respect to *InDet_Cosmics_2008_05*)

Large differences found: due to problem with CoG.

Repeated the L1 Endcap alignment for several **different runs**.

Estimate uncertainties from spread in alignment parameters

Endcap A*

$$D_x = -1.89 \pm 0.02 \text{ mm}$$

$$D_y = 0.16 \pm 0.05 \text{ mm}$$

$$D_z = -2.68 \pm 0.03 \text{ mm}$$

$$\text{Rot}_x = -0.13 \pm 0.06 \text{ mrad}$$

$$\text{Rot}_y = 0.69 \pm 0.02 \text{ mrad}$$

$$\text{Rot}_z = -7.136 \pm 0.003 \text{ mrad}$$

Endcap C*

$$D_x = -1.16 \pm 0.01 \text{ mm}$$

$$D_y = 1.40 \pm 0.04 \text{ mm}$$

$$D_z = 2.24 \pm 0.03 \text{ mm}$$

$$\text{Rot}_x = -0.62 \pm 0.04 \text{ mrad}$$

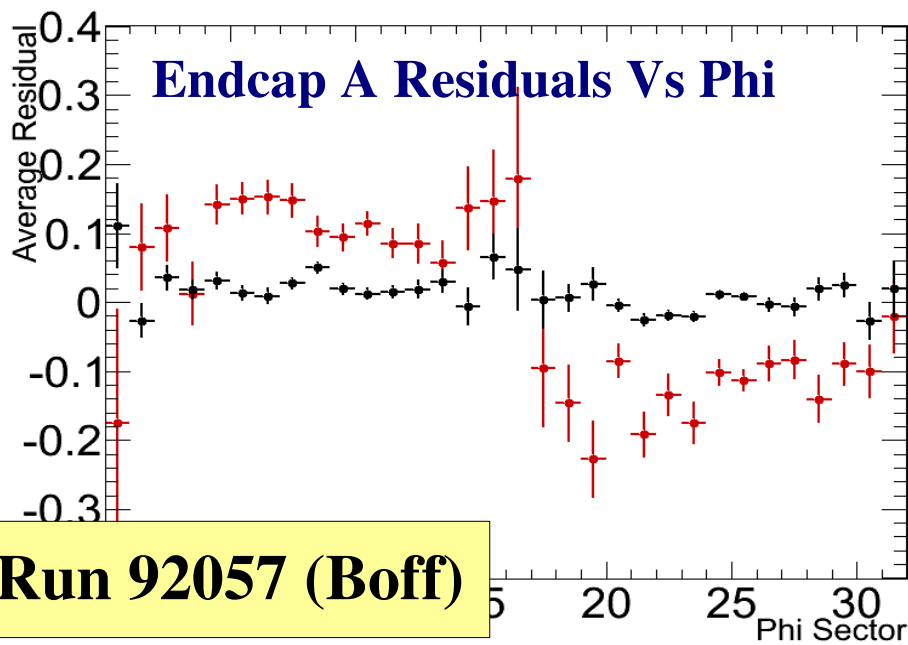
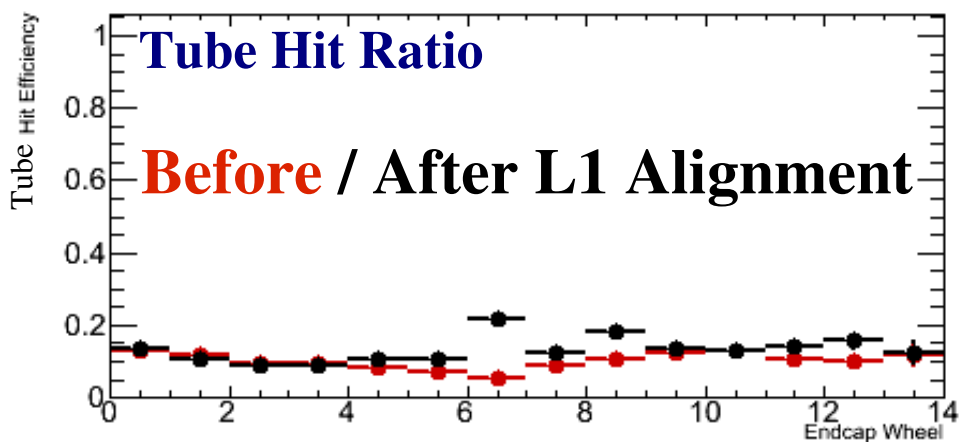
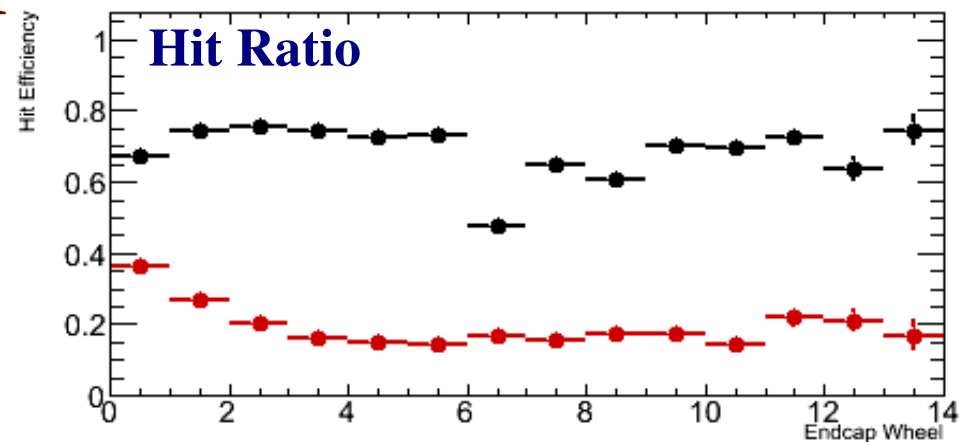
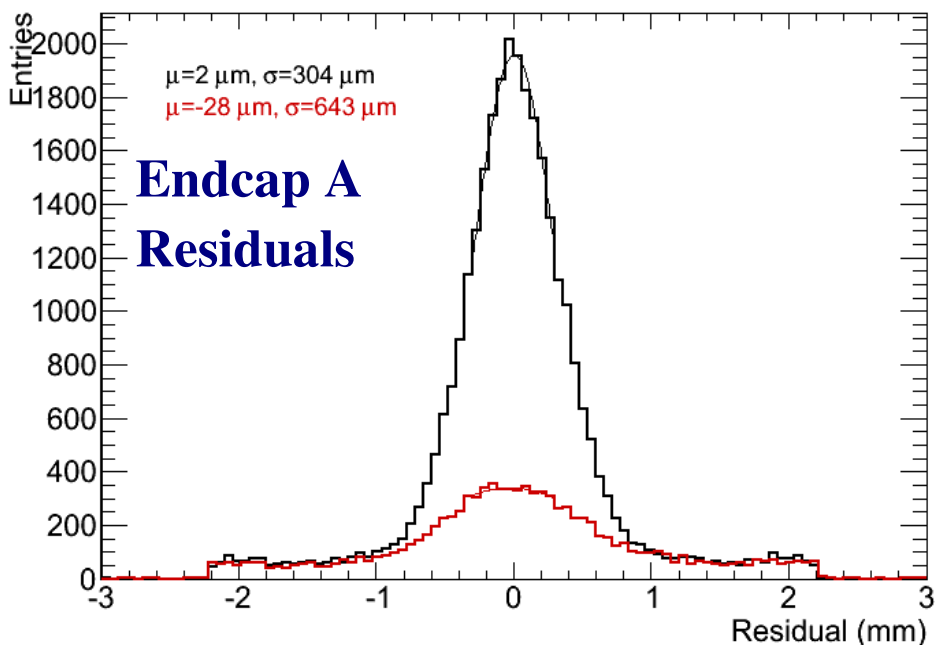
$$\text{Rot}_y = 0.080 \pm 0.009 \text{ mrad}$$

$$\text{Rot}_z = 6.162 \pm 0.009 \text{ mrad}$$

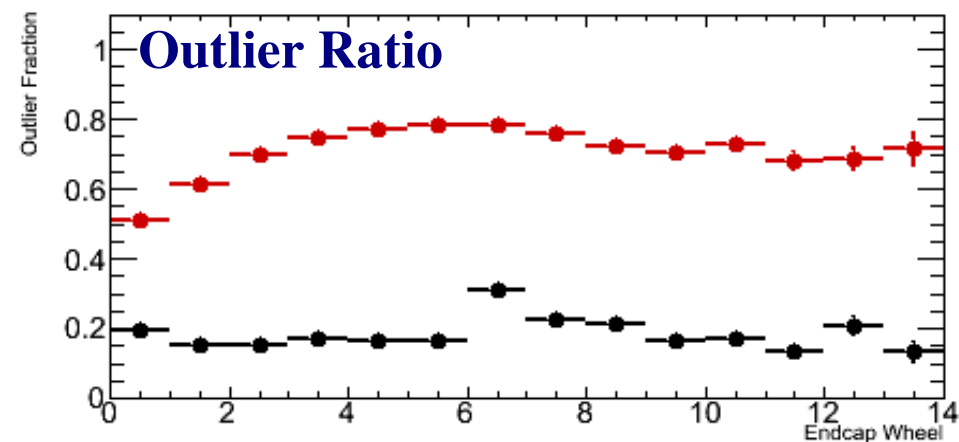
* For Bon. Endcap Alignment done with 5 Golden runs.



L1 Endcap Validation

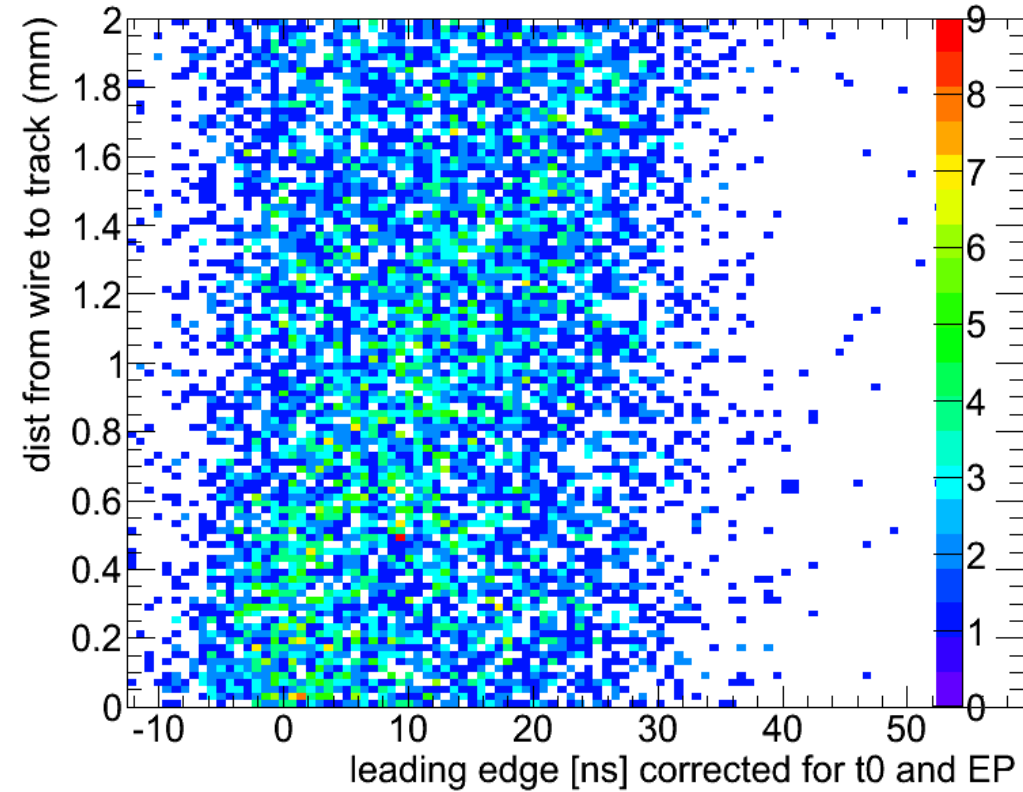


Run 92057 (Boff)

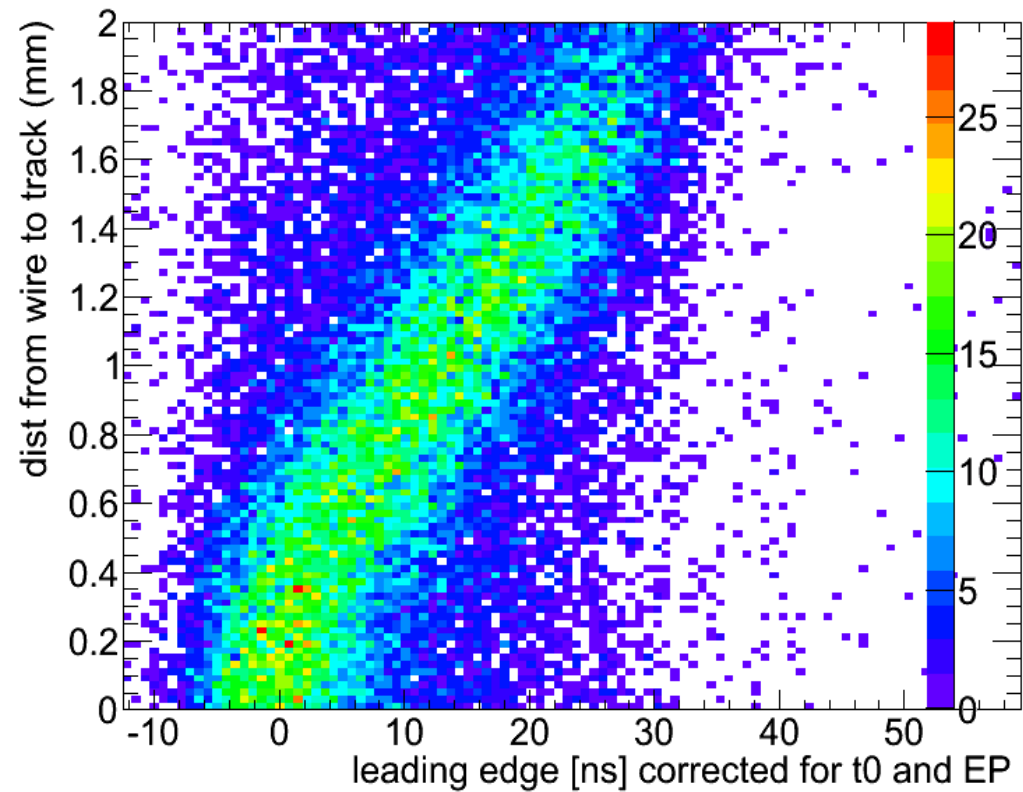




Impact on TRT Calibration



**Before L1 Endcap
Alignment**



**After L1 Endcap
Alignment**

Run 92057 (Boff)



L2 Endcap Alignment

Internal TRT Endcap alignment had never been done!

- All previous alignment with cosmics has been Barrel only
- *CSC misalignments @ L2 were Barrel Only*

Vast majority of Validation tools, existed for Barrel Only.

- Big effort to bring these up to speed.

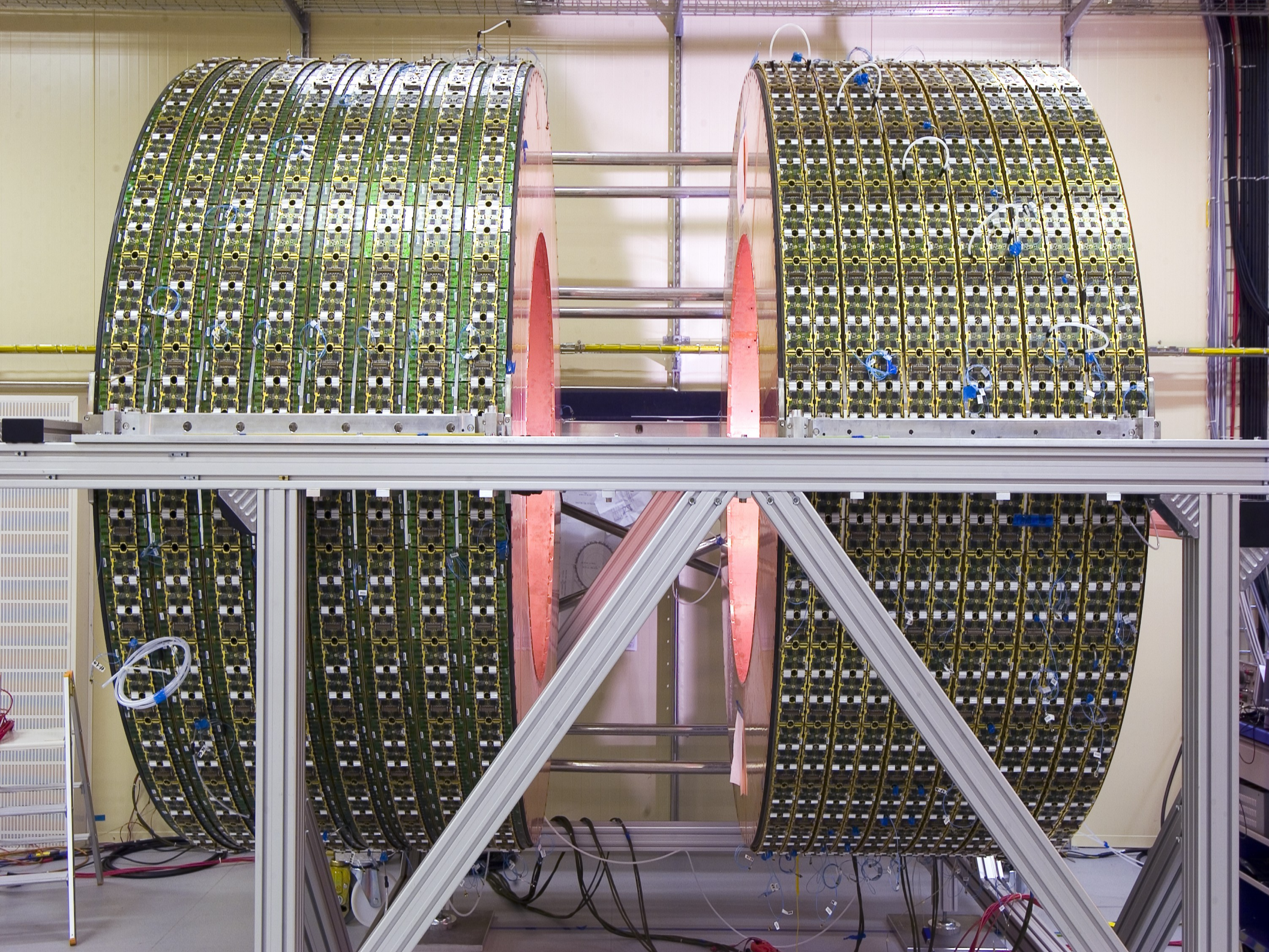
Changed the granularity on which the alignment will be done.

- Implies changes to data base tools.
- Implies change of what sorts of things should be monitored.

X² derivative calculation and Db access, implemented, validated with MC

Alignment was done with to 2008 and 2009 cosmics.

- Rotation-z / Rotation-z + Translation - X & Y

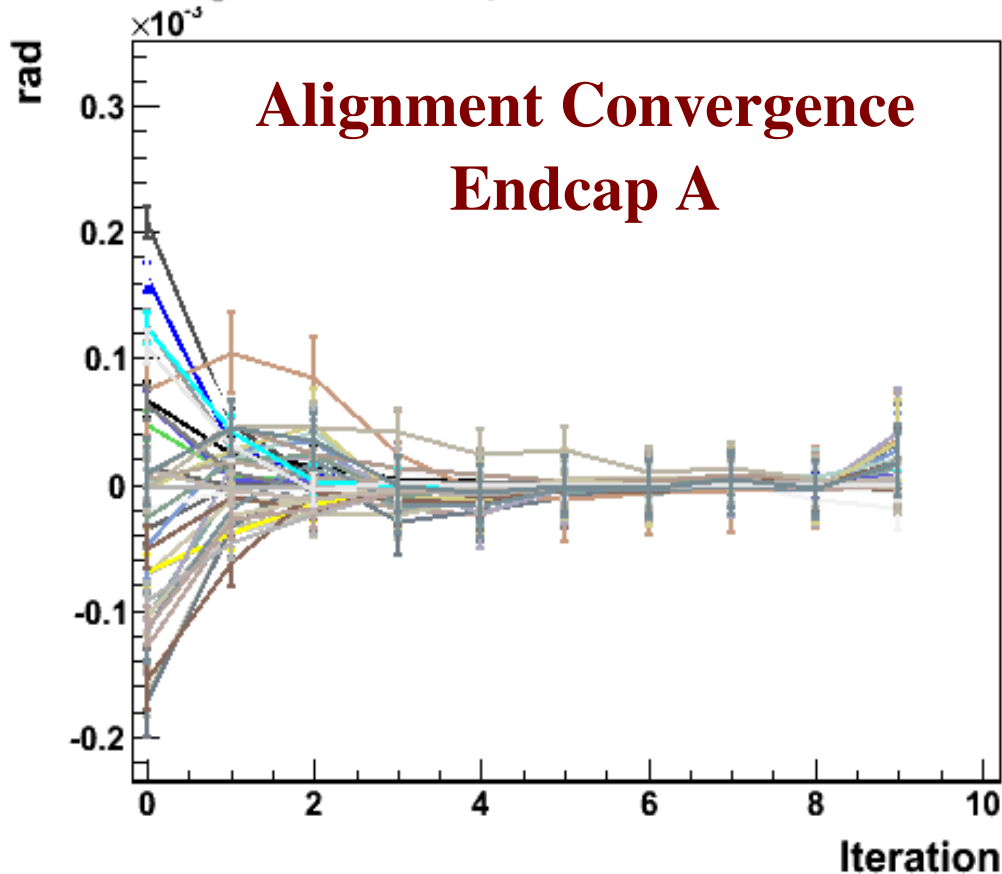




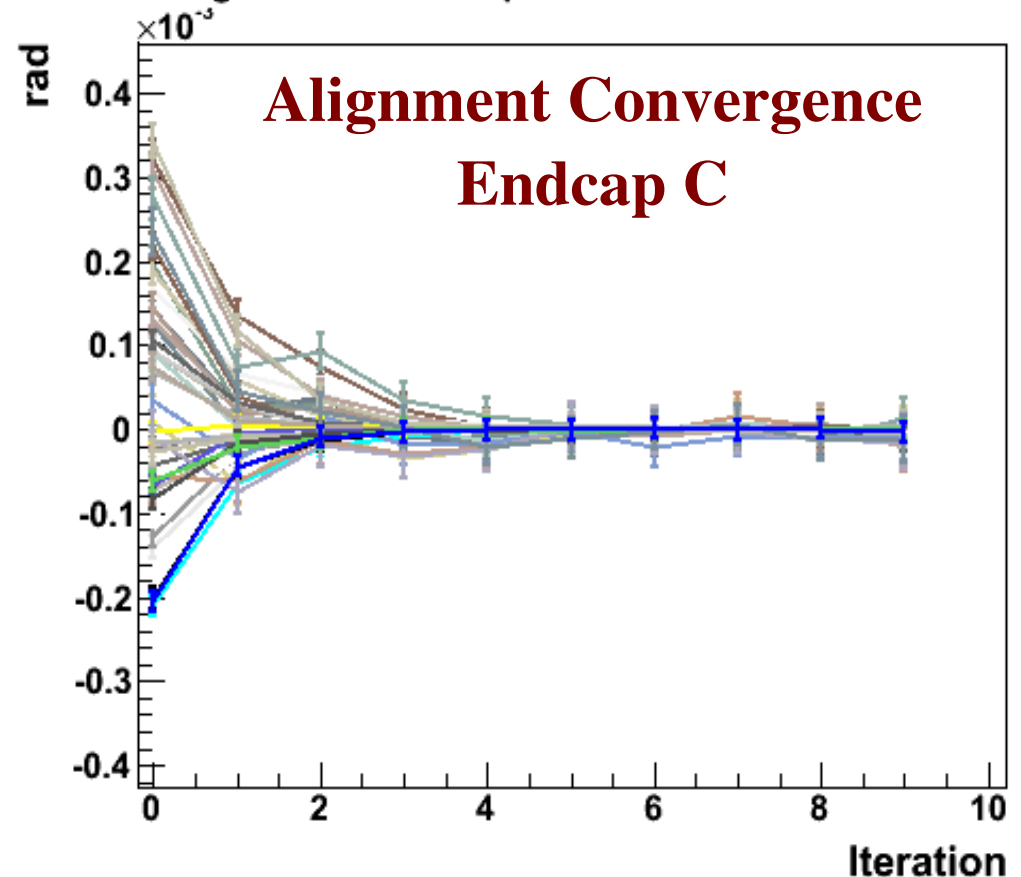
L2 Endcap Alignment

- **400K** events from fall **2008** data taken with **TGC stream**.
- Require **10 TRT Endcap hits, 5 SCT hits**
- Align each **4-straw plane wheel**. ($6 \times 2 \times 2 + 8 \times 2 = 40$ rings/endcap)
- First step: align **rotations around global z**.
- 3K tracks, ~ 1000 Hits per ring.

Change in Rotz Endcap A



Change in Rotz Endcap C





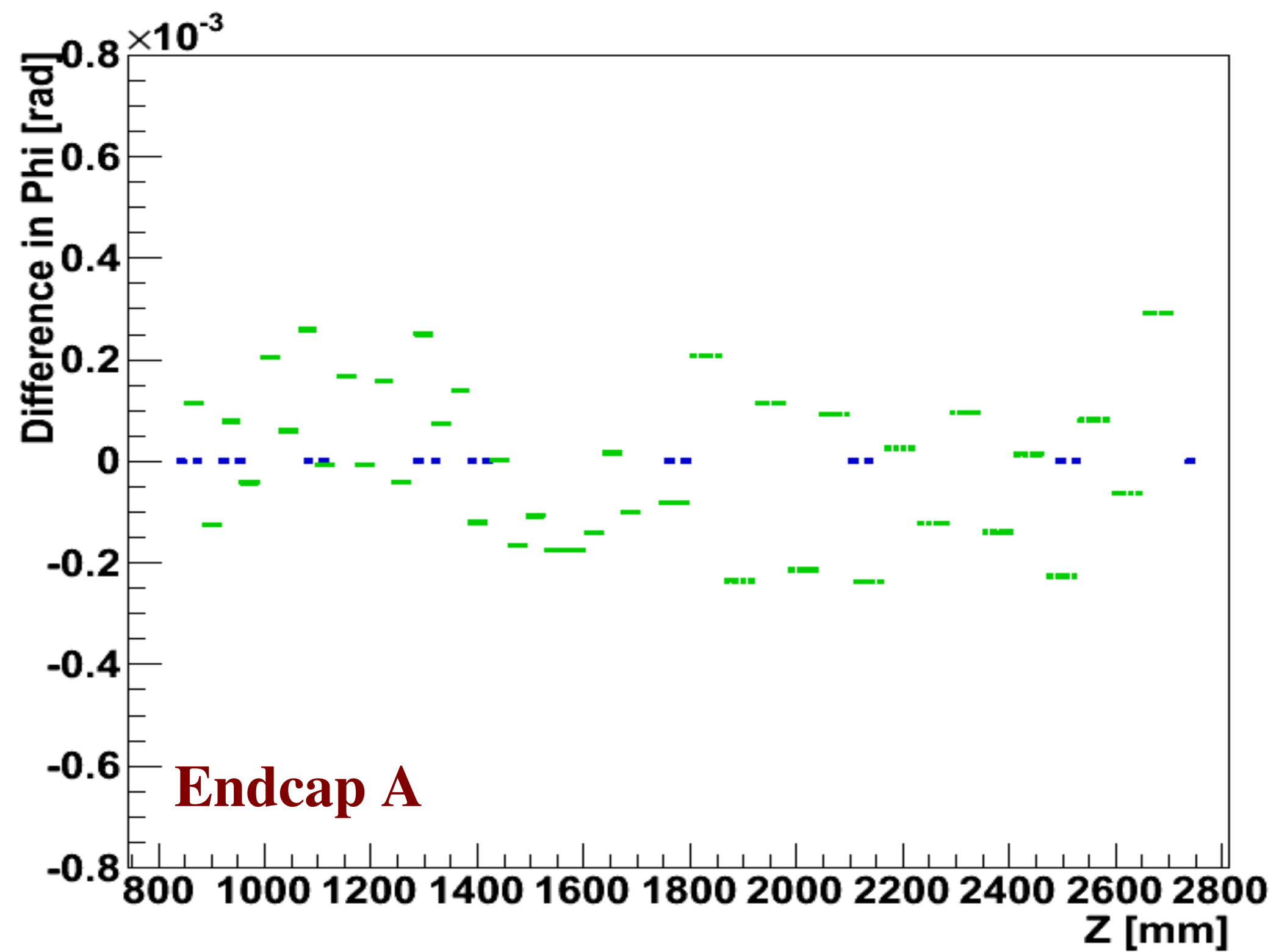
Geometry Comparison

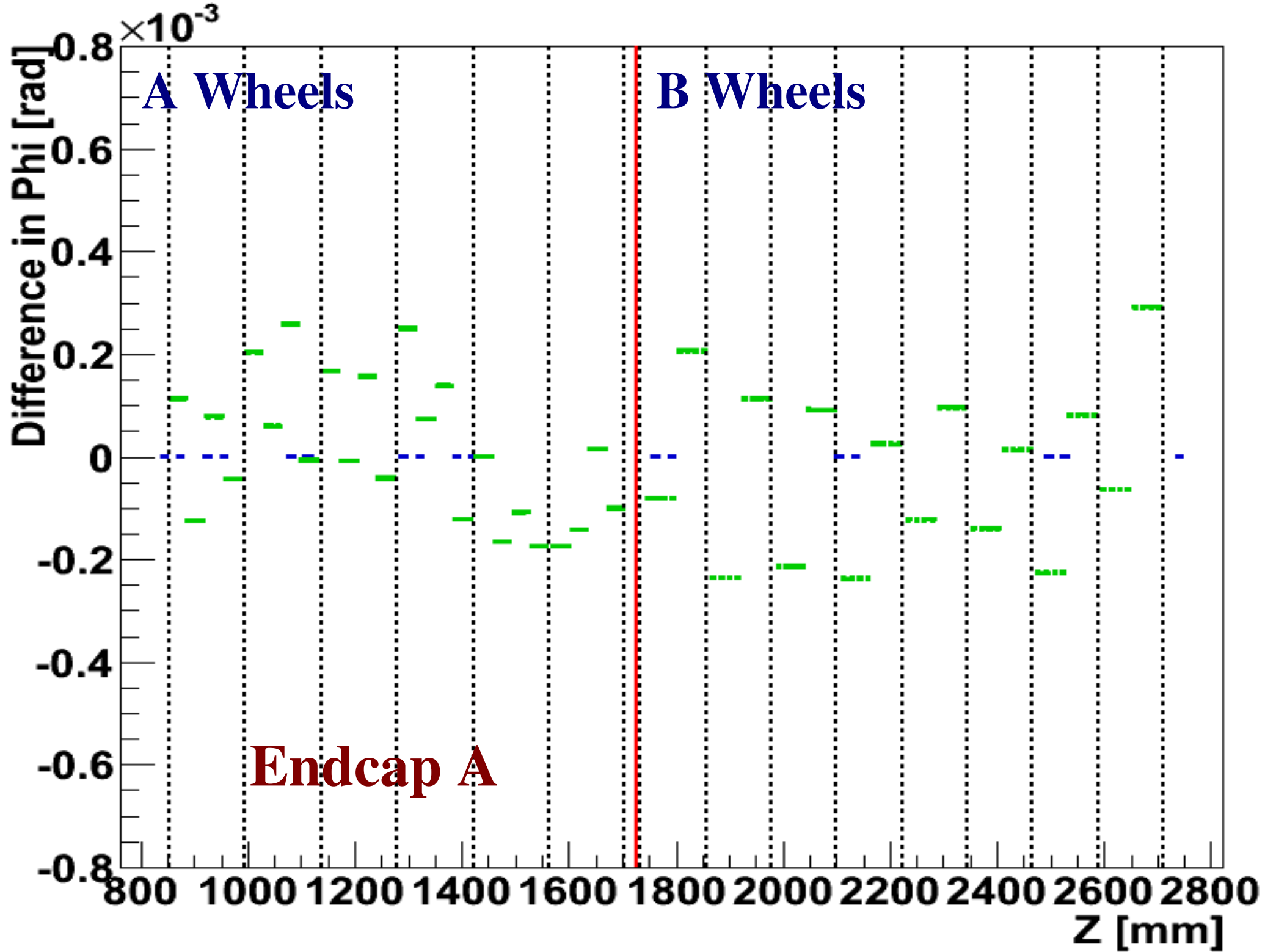
Following slides show **differences** in Phi

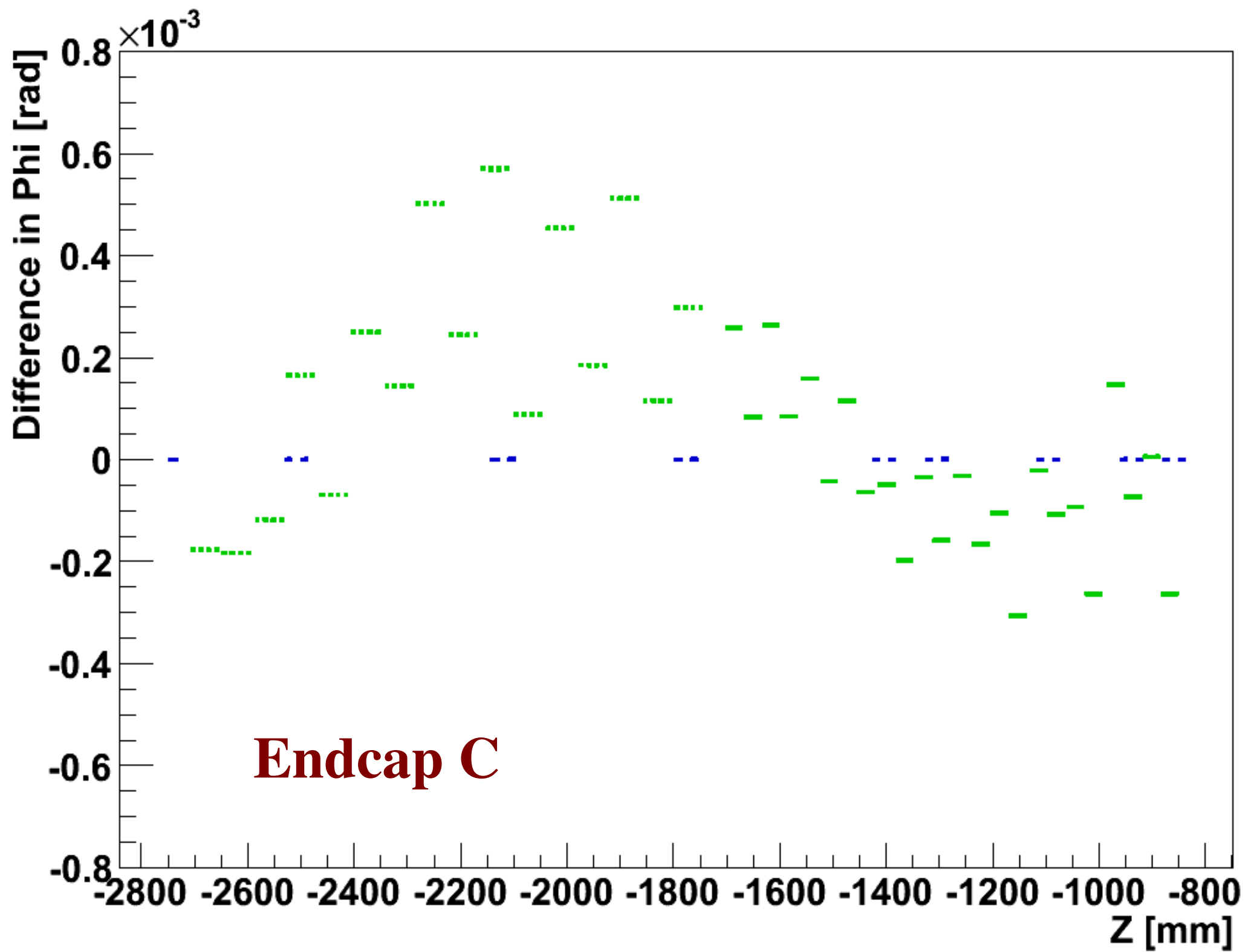
$$(\textit{delta phi} = \textit{atan}(y1/x1) - \textit{atan}(y2/x2))$$

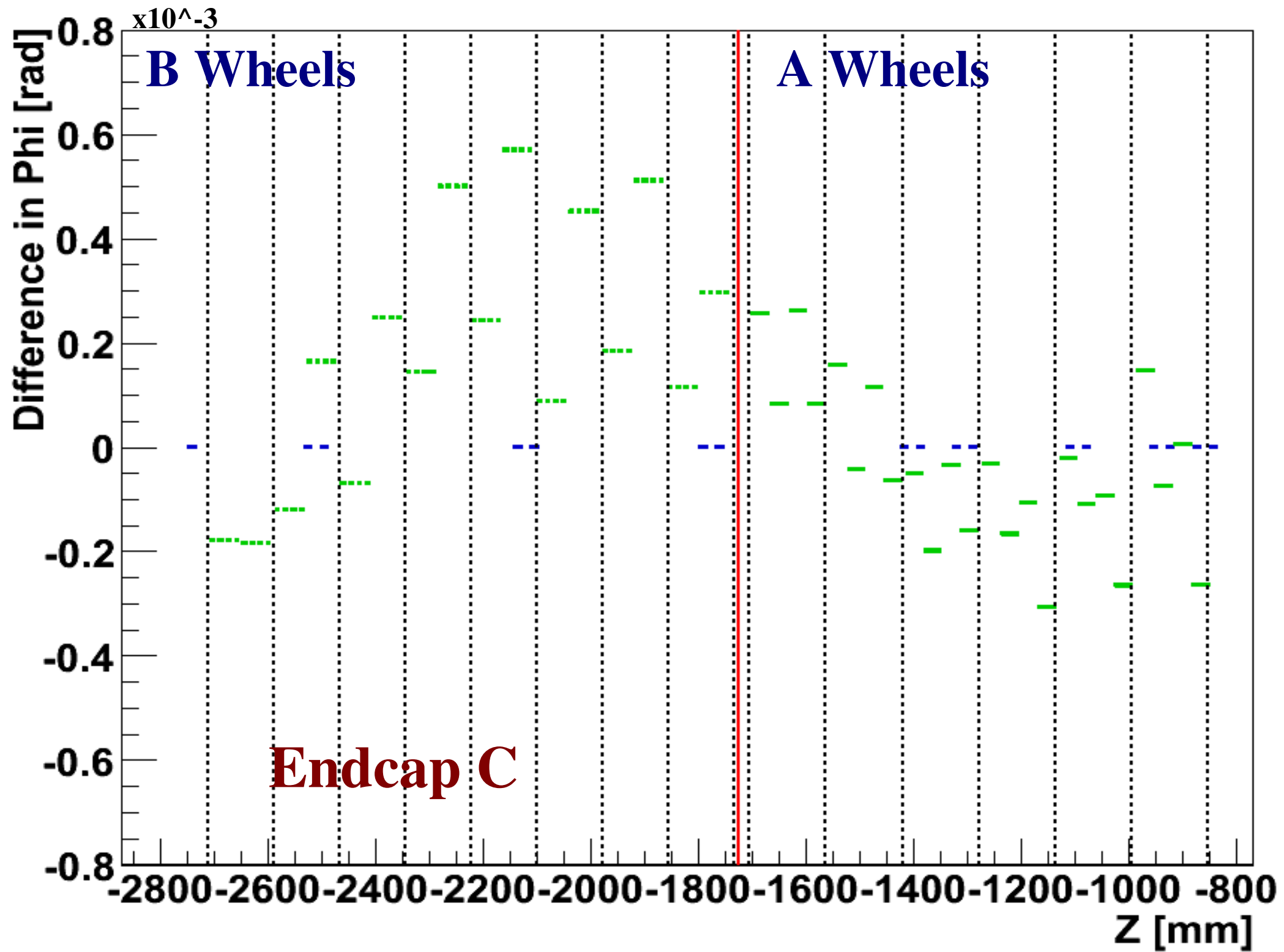
Between Geometry **Before** and **After** L2 Endcap Alignment.

These differences represent the L2 alignment constants.











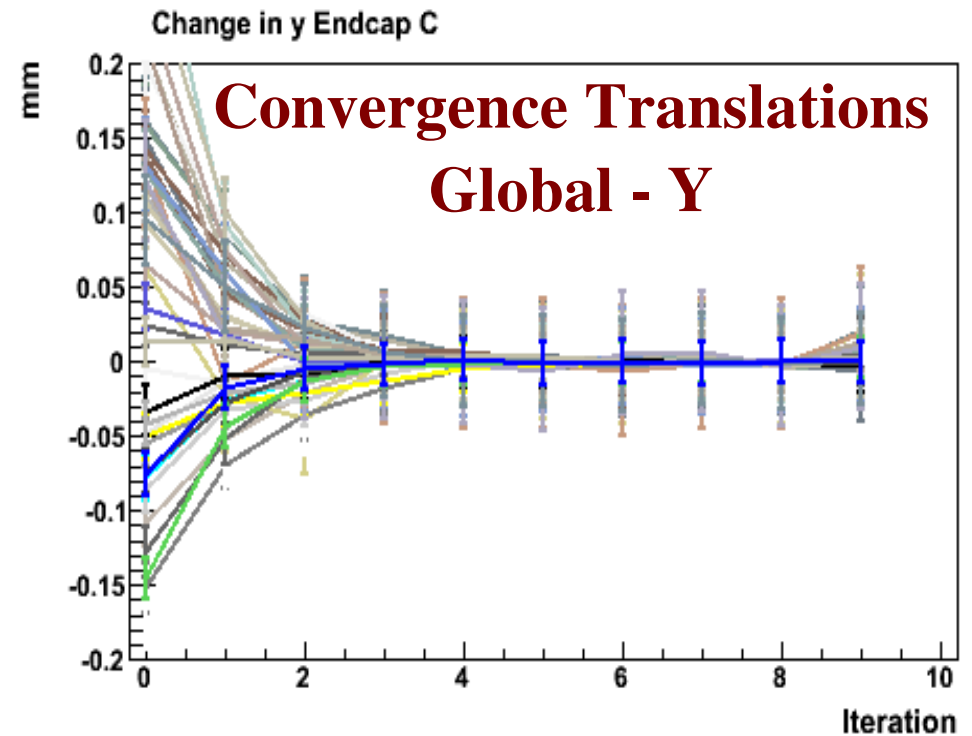
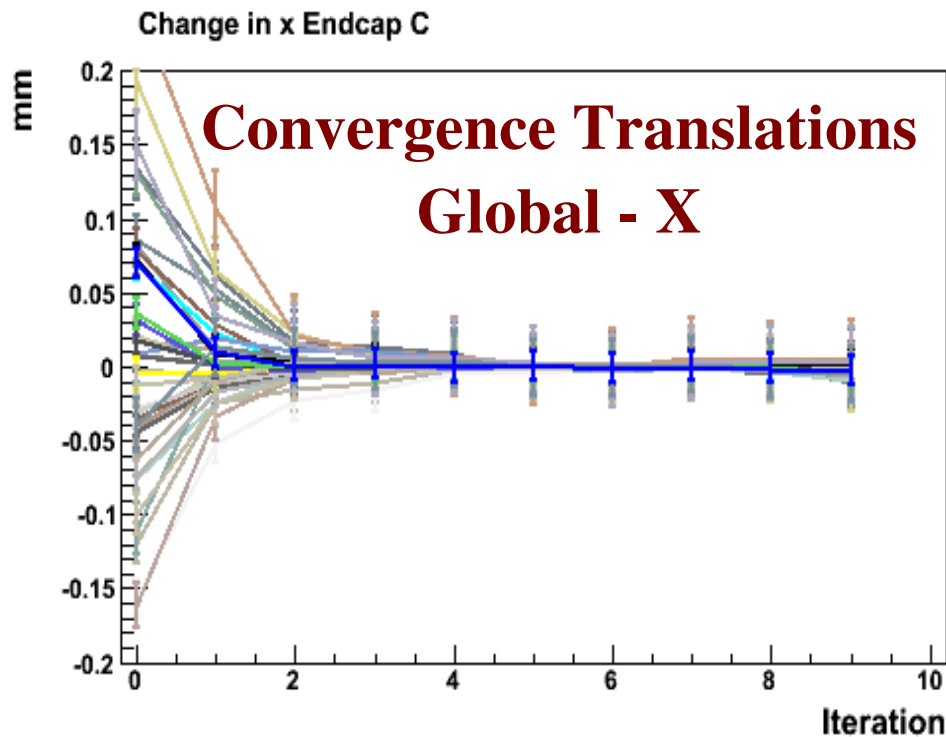


L2 Endcap Alignment 3 Dof

L2 Alignment repeated using same runs with 3 DoF.

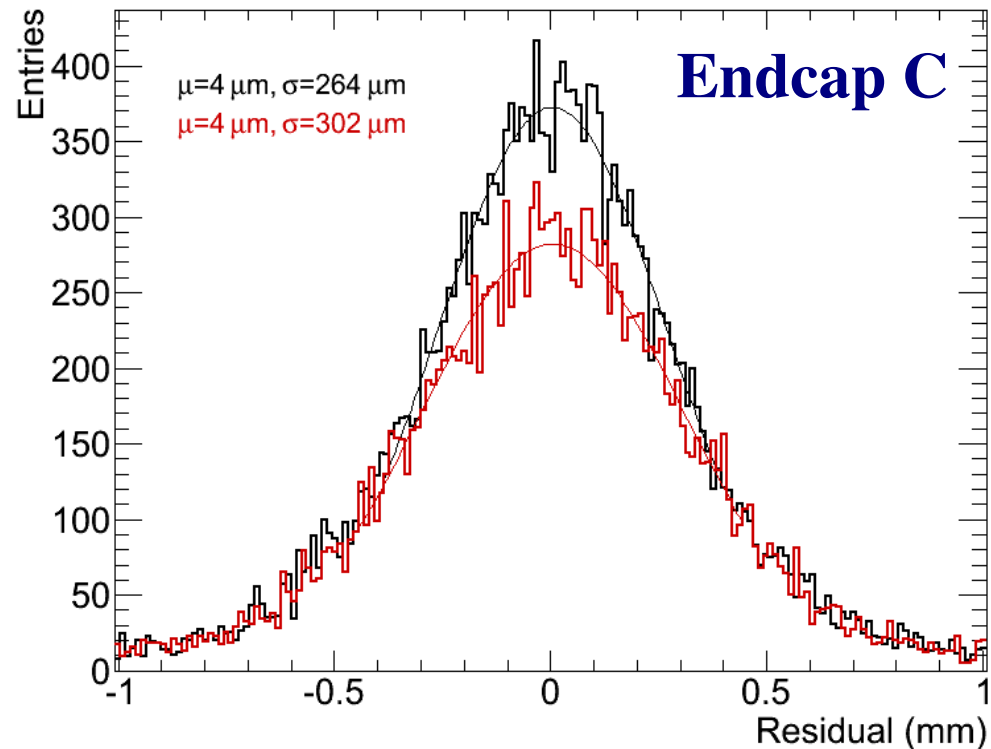
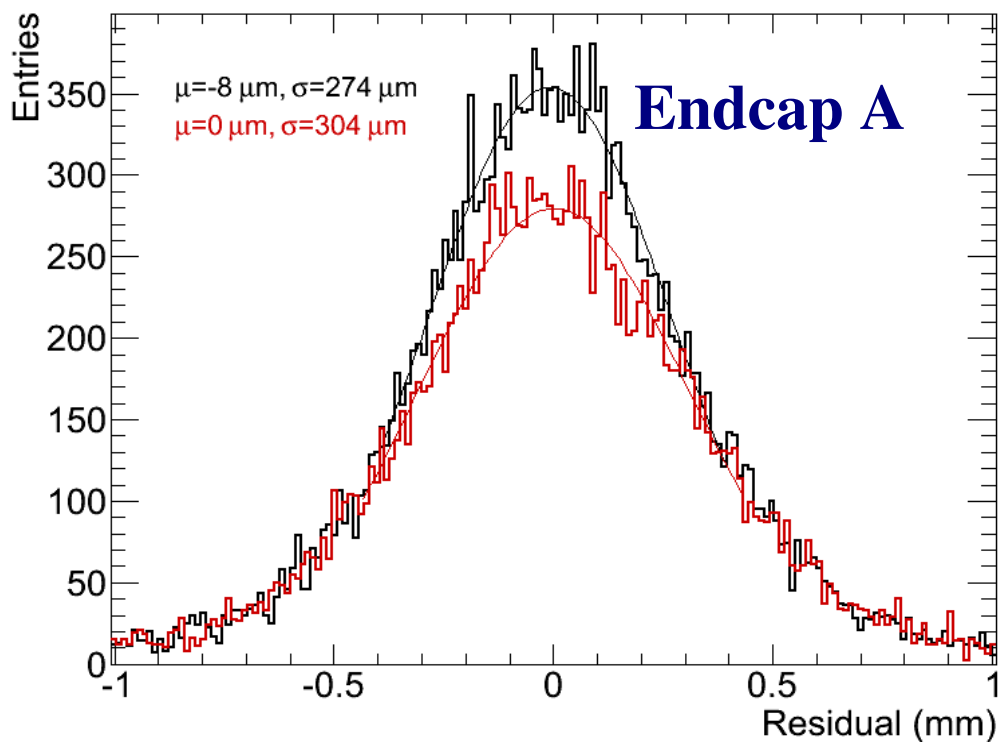
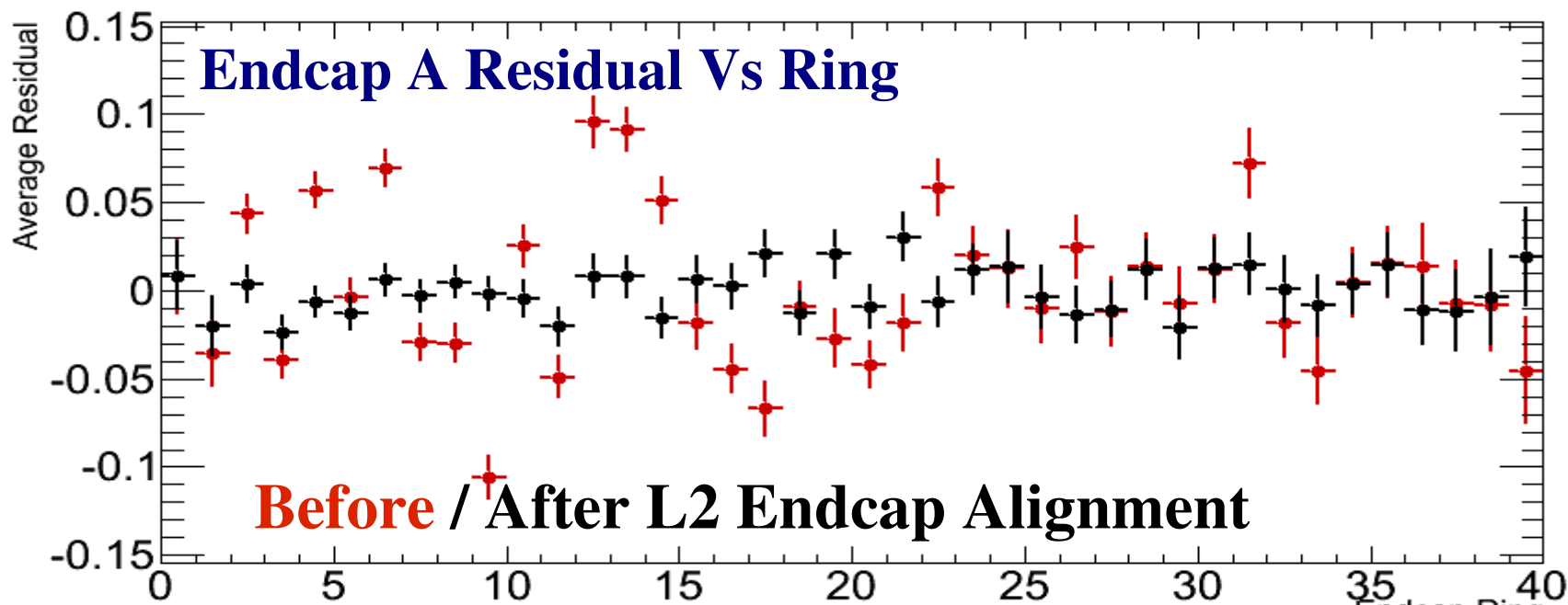
(Add Translations about global-x and y)

Systematic rotation within 8-plane wheel seen again.

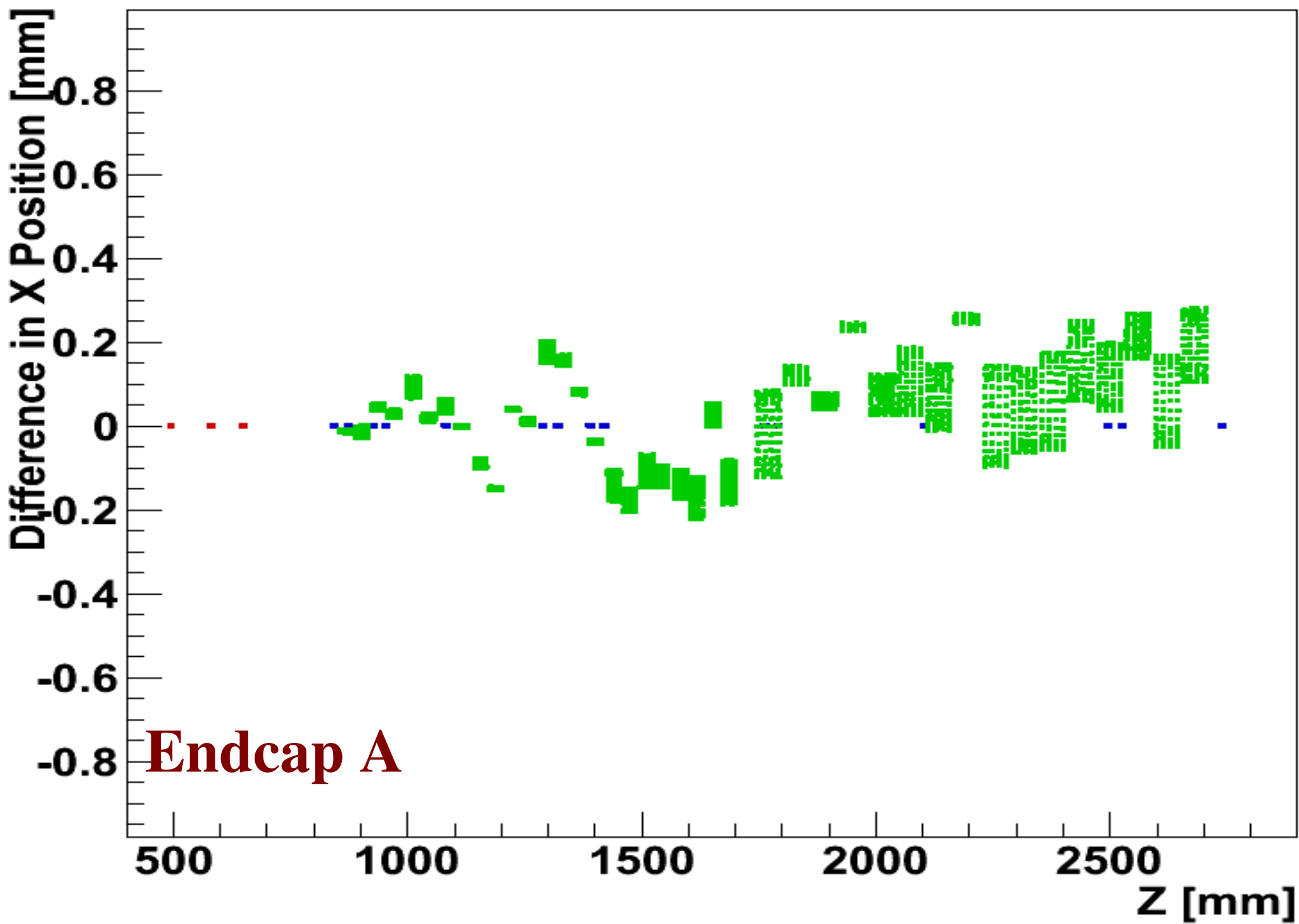




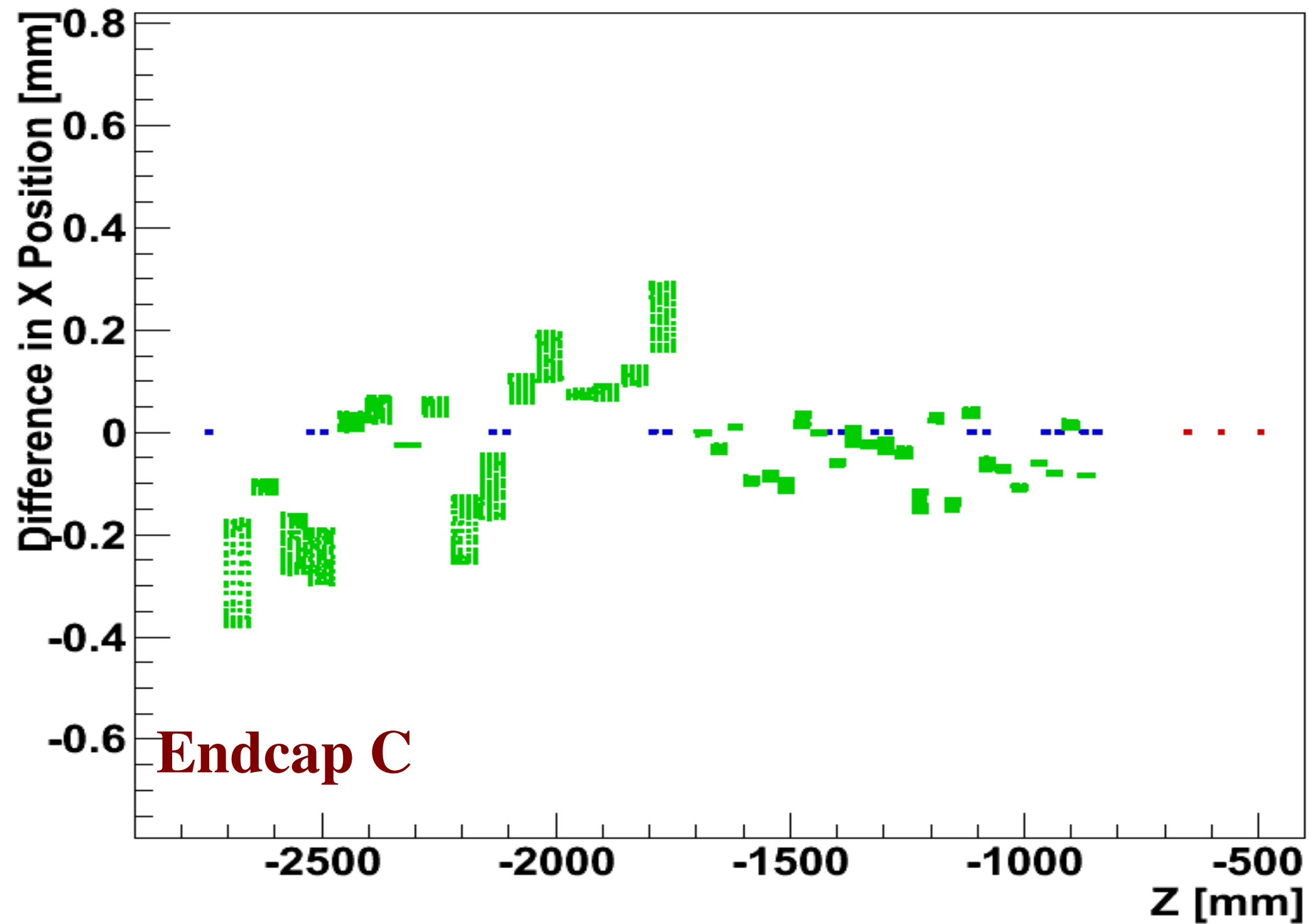
L2 Endcap Validation



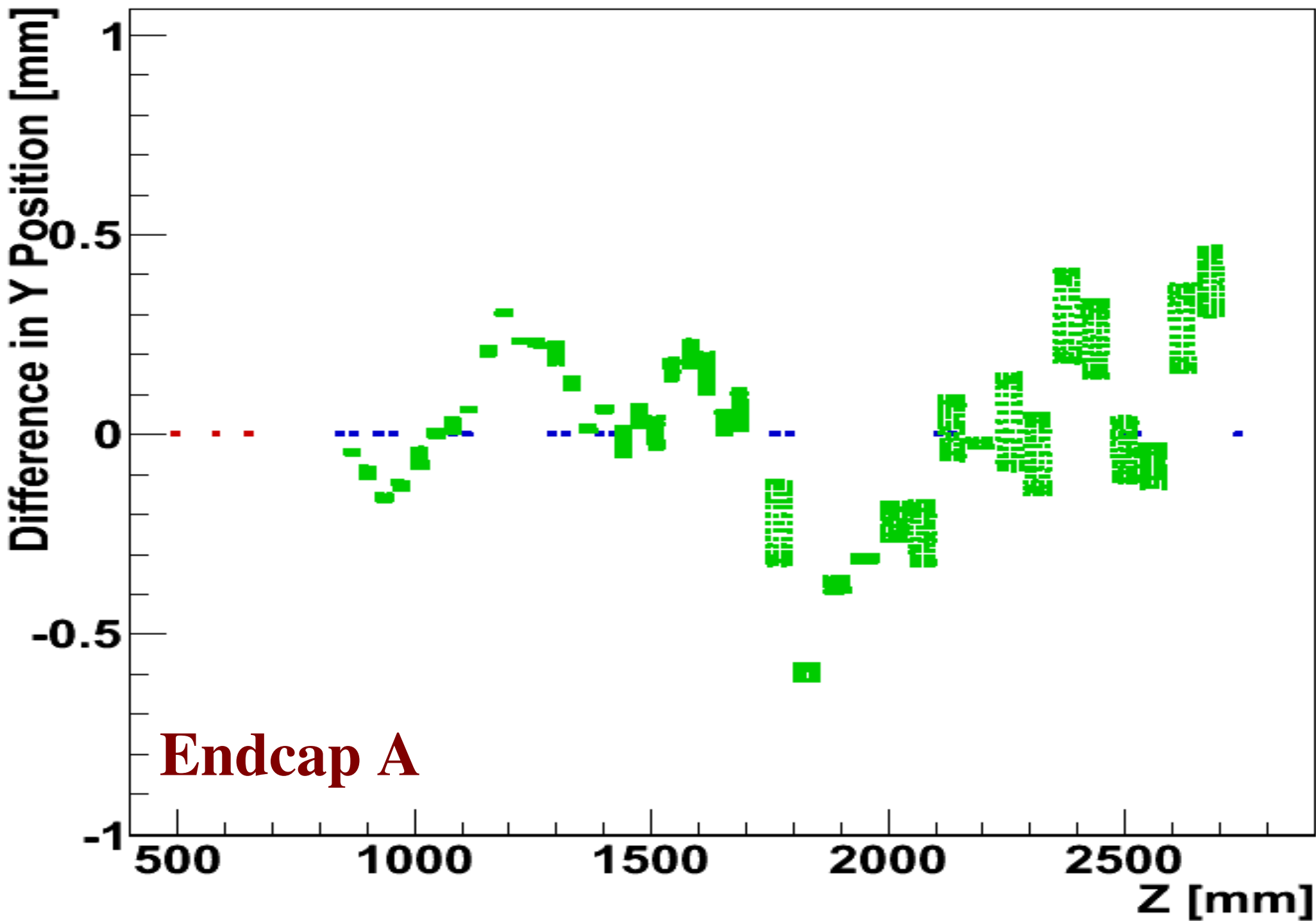
Differences in X Position (Pix/SCT/TRT) vs Z



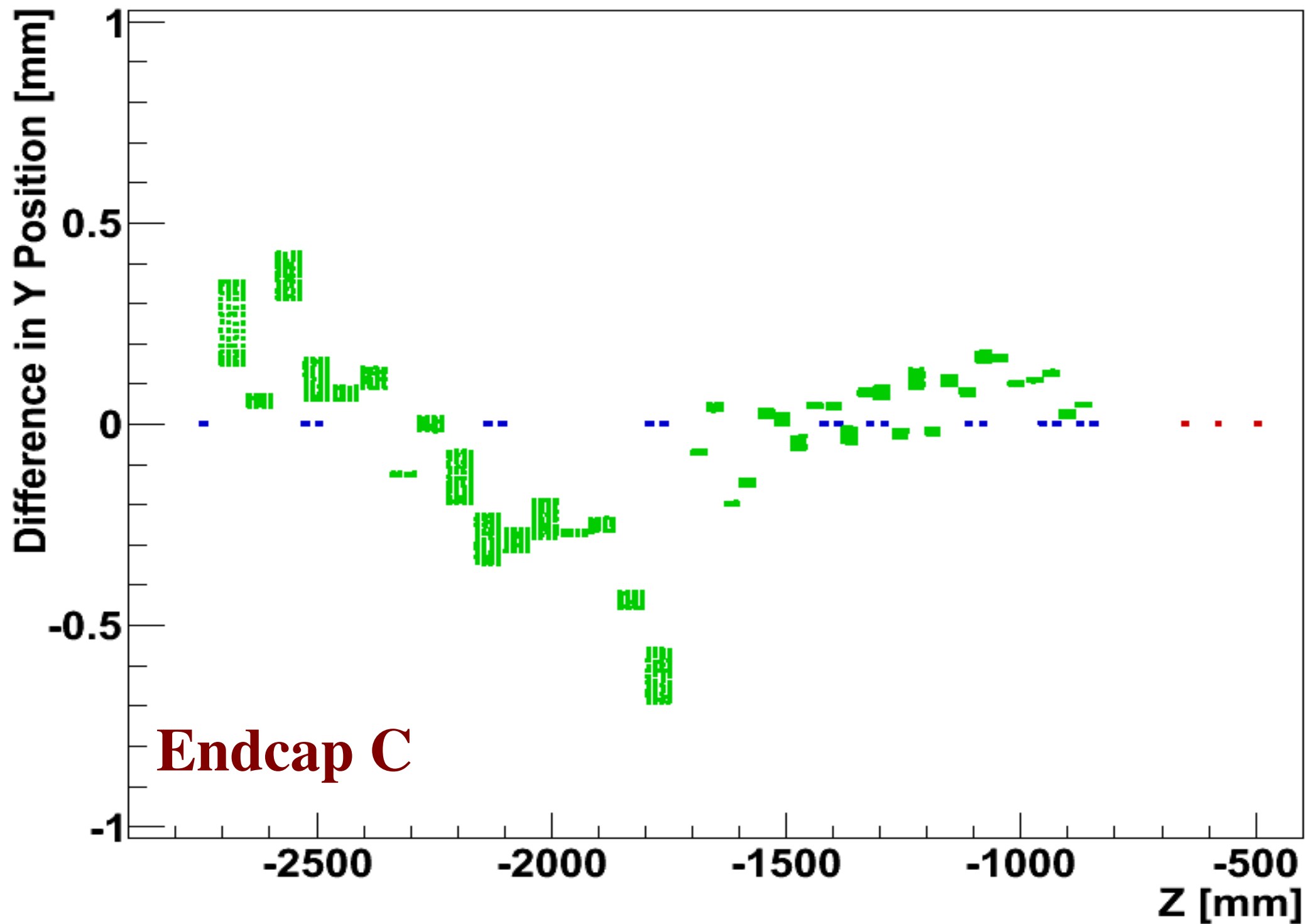
Differences in X Position (Pix/SCT/TRT) vs Z



Differences in Y Position (Pix/SCT/TRT) vs Z



Differences in Y Position (Pix/SCT/TRT) vs Z





Summary

Barrel

- Large effort combining Alignment and Calibration.
- Focus on documentation.

Endcaps

- Developed needed infrastructure. Now largely in place:
 - **defined geometry**
 - **added monitoring tools**
- Validated (**for the 1st time**) L2 Endcap alignment
- **Have aligned Endcaps with data.**

A lot more work validate the cosmic results.

Future

- Push to get ready for collisions
 - Automate alignment scripts
 - Move to Future Alignment Code. (Validation on-going)
- L3 alignment