Advanced Alignment of the ATLAS Inner Detector

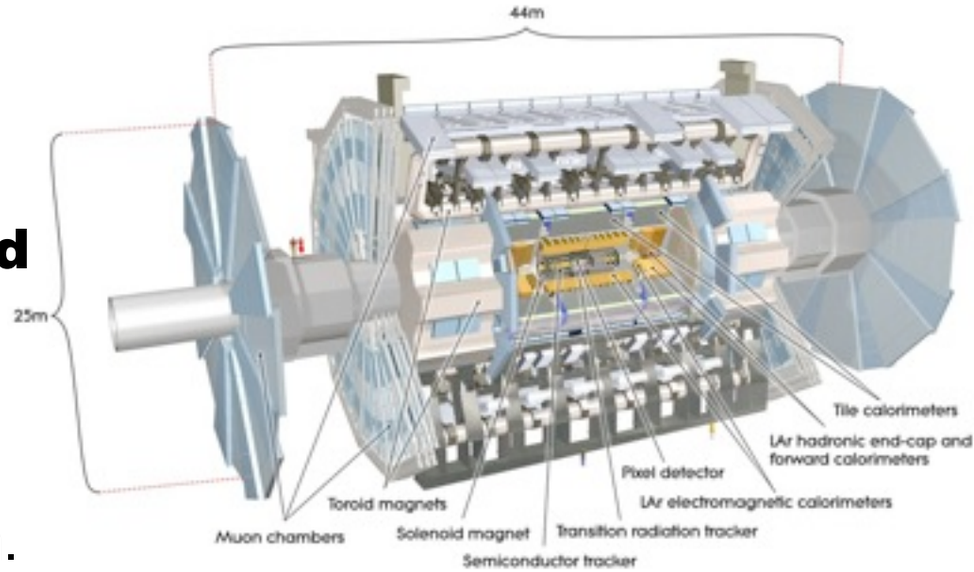
Jonathan Stahlman, on behalf of the ATLAS Collaboration

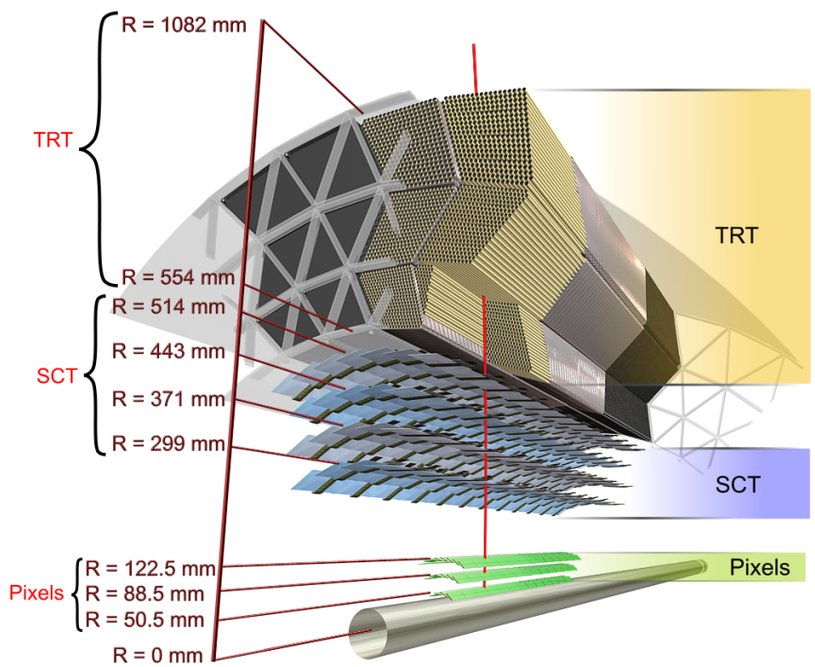
Penn
University of Pennsylvania

The ATLAS physics goals require **high resolution**, **unbiased** measurements of all charged particle kinematic parameters.

These measurements critically depend on the **proper alignment** of the detector elements within the tracking system. **Systematic effects** related to the alignment must also be well understood.

This poster presents the alignment techniques used to determine the nearly **750k alignment parameters** used to describe the ATLAS Inner Detector geometry and the methods used to **measure and remove** systematic track parameter biases.





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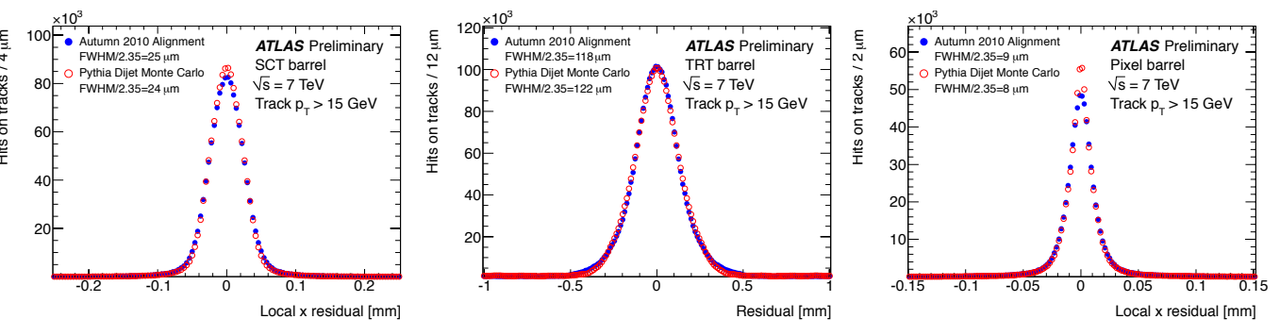
These techniques include:

Global/Local χ^2 Alignment

Global χ2 method used to determine corrections to alignment parameters using particle tracks resulting in near optimal hit resolution in all sub-detectors of the tracking system

Local χ2 method developed to determine alignment parameters when number of degrees of freedom is large (greater than 50k DoF)

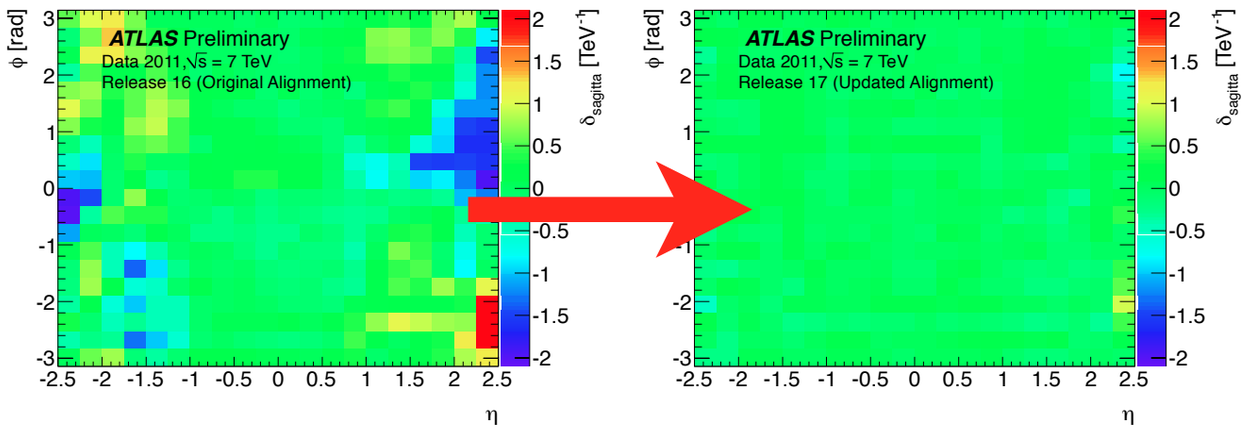


Near Optimal Hit Resolution

Systematic Effect Studies

Multiple techniques developed to measure systematic track parameter biases using known particles resonances, calorimeter information, and beam spot constraints.

Incorporation of these results into the alignment algorithm yields methods to significantly reduce alignment-induced track parameter biases.



Significant Reduction of Momentum Biases