ACAT 2008

Contribution ID: **53** Type: **Parallel Talk**

# Alignment of the ATLAS Inner Detector tracking system

*Tuesday, 4 November 2008 16:10 (25 minutes)*

The CERN's Large Hadron Collider (LHC) is the world largest particle accelerator. It will collide two proton beams at an unprecedented center of mass energy of 14 TeV and first colliding beams are expected during summer 2008. ATLAS is one of the two general purpose experiments that will record the decay products of the proton-proton collisions. ATLAS is equipped with a charge particle tracking system built on two technologies: silicon and drift tube based detectors, composing the ATLAS Inner Detector (ID). The performance of the Inner Detectors has to be optimized in order to achieve the ATLAS physics goals. The alignment of the tracking system poses a challenge as one should solve a linear equation with almost 36000 degrees of freedom. The required precision for the alignment of the most sensitive coordinates of the silicon sensors is just few microns. This limit comes from the requirement that the misalignment should not worsen the resolution of the track parameter measurements by more than 10%. Therefore the alignment of the ATLAS ID requires complex algorithms with extensive CPU and memory usage.
So far the proposed alignment algorithms are exercised on several applications. We will present the outline of the alignment approach and results from a Combined Test Beam, Cosmic Ray runs and large scale computing simulation of physics samples mimicking the ATLAS operation during real data taking. For the later application the trigger of the experiment is simulated and the event filter is applied in order to produce an alignment input data stream. The full alignment chain is tested using that stream and alignment constants are produced and validated within 24 hours. Cosmic ray data serves to produce an early alignment of the real ATLAS Inner Detector even before the LHC start up. Beyond all tracking information, the assembly survey data base contains essential information in order to determine the relative position of one module with respect to its neighbors. Finally a hardware system measuring an array of grid lines in the modules support structure with a Frequency Scan Interferometer monitors short time system deformations.

**Primary authors:** SCHIECK, Jochen (Max-Planck-Institut für Physik); Mr ALISON, John (Department of Physics and Astronomy, University of Pennsylvania)

**Presenter:** Mr ALISON, John (Department of Physics and Astronomy, University of Pennsylvania)

**Session Classification:** Data Analysis - Algorithms and Tools

**Track Classification:** 2. Data Analysis