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ATLAS Inner Detector: Commissioning with Cosmics Data

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The ATLAS experiment at the CERN Large Hadron Collider (LHC) has started taking data last autumn with the inauguration of the LHC. Determination of vertex position and charged particle tracks is performed in the Inner Detector which consists of pixel and microstrip Silicon sensors and transition radiation tubes. In this talk construction and commissioning of these three detectors will be presented.

The Pixel Detector is the innermost detector of the ATLAS experiment with approx. 80 million readout channels. After connection of cooling and services and verification of their operation the ATLAS Pixel Detector is now in the final stage of its commissioning phase. Prior to the first beams expected in Autumn 2009, a full characterization of the detector is performed.
The SemiConductor Tracker (SCT) is made up from silicon micro-strip detectors processed in the planar p-in-n technology. Sensors are assembled into 4000 modules with 6 million readout channels. The completed SCT detector was operated for many months under realistic conditions. Calibration data has been taken and analysed to determine the noise performance of the system. In addition, extensive commissioning with cosmic ray events has been performed both with and without magnetic field. The cosmic muon data has been used to align the detector, to check the timing of the front-end electronics as well as to measure the hit efficiency of modules.
The ATLAS Transition Radiation Tracker (TRT) is the outermost of the three sub-systems of the ATLAS Inner Detector. It consists of close to 300000 thin-wall drift tubes (straws) providing on average 35 two-dimensional space points with 0.17 mm resolution for charged particle tracks with pT > 0.5 GeV within $|\eta| < 2$. Transition radiation X-rays, generated by particles with $\gamma > 1000$ in the special material between the straws, are absorbed in the Xenon based gas mixture and give rise to large signal
amplitudes. The front-end electronics implements two thresholds to discriminate the signals: a low threshold (< 300 eV) for registering the passage of minimum ionizing particles, and a high threshold (> 6 keV) to flag the absorption of transition radiation X-rays. The talk will report on the commissioning and first operational experience of the TRT detector and its sophisticated o#-detector systems for cooling, active gas, low- and high-voltage, data acquisition and control. Initial performance studies, based on the reconstruction and analysis of several million cosmic ray tracks, and
from beam-halo or beam-splash events from single beams in LHC, will be described.
All three sub-detectors were run in standalone and in a combined mode (also with other ATLAS subsystems). The current status of the Pixel, SCT and TRT detectors will be reviewed, including results from recent data-taking periods, and from the detector alignment. We will report on the commissioning of the detector, including overviews on services, connectivity and observed problems. The commissioning and running experience will then be used to extract valuable lessons for future silicon detector projects.

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