

ATLAS Silicon Microstrip Tracker Operation and Performance

Tuesday 4 September 2012 15:20 (1 hour)

The Semi-Conductor Tracker (SCT) is a silicon strip detector and one of the key precision tracking devices in the Inner Detector of the ATLAS experiment at CERN LHC.

The SCT is constructed of 4088 silicon detector modules for a total of 6.3 million strips. Each module is designed, constructed and tested to operate as a stand-alone unit, mechanically, electrically, optically and thermally. The modules are mounted into two types of structures: one barrel (4 cylinders) and two end-cap systems (9 disks on each end of the barrel).

The SCT silicon micro-strip sensors are processed in the planar p-in-n technology. The signals from the strips are processed in the front-end ASICS ABCD3TA, working in the binary readout mode. Data is transferred to the off-detector readout electronics via optical fibers.

The completed SCT has been installed inside the ATLAS experimental cavern since 2007 and has been operational since then. Calibration data has been taken regularly and analyzed to determine the noise performance of the system. Extensive commissioning with cosmic ray events has been performed both with and without magnetic field. The sensor behavior in the 2 Tesla solenoid magnetic field was studied by measurements of the Lorentz angle. We find 99.3% of the SCT modules are operational, noise occupancy and hit efficiency exceed the design specifications; the alignment is very close to the ideal to allow on-line track reconstruction and invariant mass determination.

In the talk the current results from the successful operation of the SCT Detector at the LHC and its status after three years of operation will be presented.

We will report on the operation of the detector including an overview of the issues we encountered and the observation of significant increases in leakage currents (as expected) from bulk damage due to non-ionising radiation. The main emphasis will be given to the tracking performance of the SCT and the data quality during the many months of data taking (the LHC delivered 47pb⁻¹ in 2010 and 5.6fb⁻¹ in 2011 of proton-proton collision data at 7 TeV, and two times one-month periods of heavy ion collisions). The SCT has been fully operational throughout all data taking periods. It delivered high quality tracking data for 99.9% (2010) and 99.6% (2011) of the delivered luminosity.

The SCT running experience will then be used to extract valuable lessons for future silicon strip detector projects.

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Session Classification: Poster session

Track Classification: Radiation effects