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Performance and operation experience of the Atlas Semiconductor Tracker

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After more than 3 years of successful operation at the LHC, we report on the
operation and performance of the ATLAS Semi-Conductor Tracker (SCT) functioning in a high luminosity, high radiation environment. 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 are processed in the front-end ABCD3TA ASICs, which use a binary readout architecture. Data is transferred to the off-detector readout electronics via optical fibers. 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. We will report on the operation and performance of the detector, including an overview of the issues encountered. We will report the expected observation of significant increases in leakage currents from bulk damage due to non-ionizing radiation and make comparisons with the predictions.
We will also cover the time evolution of the key parameters of the strip tracker, including the evolution of noise and gain, the measurement of the Lorentz angle and the tracking efficiency in the harsh LHC environment. Valuable lessons for future silicon strip detector projects will be presented.

Summary

The proposed talk is a status report of the operation of one of the largest Silicon detectors presently in function. A long shutdown period has just started for the LHC and we can now show the performance over the entire range of this initial period of data taking.
We have a new and updated determination of the radiation damage, also for the end-cap, for the entire 2010-2013 data-taking period, updating the partial result shown last year.
We can show the performance (efficiency) as a function of instant luminosity;
Measurements of backplane resistance and electronic gain may also be shown.
During this shutdown the SCT will remain unchanged, with the addition of off-detector read-out cards to increase the bandwidth, to cope with the increased instantaneous luminosity of the LHC. This plan will also be detailed in the talk.

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