

Identification and Recovery of ATLAS18 Strip Sensors with High Surface Static Charge

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The new all-silicon Inner Tracker (ITk) is being constructed by the ATLAS collaboration to track charged particles produced at the High-Luminosity LHC. The outer portion of the ITk detector will include nearly 18,000 highly segmented and radiation hard silicon strip sensors (ATLAS18 design). Throughout the production of 22,000 sensors, anticipating expected losses, the strip sensors are subjected to a comprehensive suite of mechanical and electrical tests as part of the Quality Control (QC) program. In a large fraction of the batches delivered to date, high surface electrostatic charge of 80 to several 100s of volts was measured. High static charge was also measured on the plastic sheets which sheathe the sensors for shipping and handling rigidity. Aggregate data from across QC sites indicate a correlation between observed electrical failures and the sensor/plastic sheet charge build up. To mitigate these issues, the QC testing sites introduced recovery techniques involving irradiation of the sensor surface with UV light or application of intensive flows of ionizing gas to remove accumulated static charge. In addition, significant modifications to sensor handling procedures were made to prevent subsequent build up of static charge. This presentation details a precise description of the issue, trend analyses of sensors initially failing electrical tests (I-V, strip scan, etc.) and their performance over time after the recovery treatment. We also discuss results after mitigation attempts by the vendor, and interesting cases where little static charge was observed.

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