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Establishment of characterization system for testing multi silicon micro-strip sensors at the University of Delhi

A major concern with the use of silicon sensor in nuclear and particle physics experiments is its survival in the intense radiation environment. The unprecedented increase in fluence in these experiments affects its long-term sustainability due to both bulk and surface damage, resulting in the deterioration of its static and dynamic properties. Hence, stringent tolerance criteria are imposed on these sensors to maintain the physics performance of an experiment. This necessitates the testing of the silicon sensors' performance under temperature and humidity controlled, dark and dust free, environment.

Our Group at the University of Delhi is in the process of establishing such a characterization system, for the first time in India, for testing a large array of silicon micro-strip sensors. A set of electrical characterization units, capable of providing 3000 V and measuring pico-Ampere currents and pico-Farad capacitances, are installed in the facility. Among other features, the probe station has a capability to translate in three directions, with a step size of 2 micro-meter over the range of 20 cm in XY directions. The entire system is interfaced through the Automated Characterization Suite (ACS) software and can be programmed in a such a way that one does not need to intervene manually as it switches from one silicon strip to another. Several measurements involving currents, capacitances and resistances can be performed for the total, strip and inter-strip parameters. It is primarily envisioned to utilize the setup for the qualification of micro-strip silicon sensors for the CMS outer tracker in the high-luminosity LHC upgrade. In this work, we present the details of this state-of-the-art characterization system and measurements performed on silicon strip sensors.

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