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A New Stress-Relieving Layer in ATLAS ITk Strip Detector Modules

The Inner Detector system of the ATLAS detector is being entirely replaced with a new all-silicon detector known as the Inner Tracker (ITk) to prepare for high particle-rate conditions at the High Luminosity LHC. The innermost layers of the ITk will be composed of silicon pixels, while the outer layers will consist of silicon strips. The basic building block of the ITk Strip detector is the “module,” composed of front-end electronics glued to a silicon microstrip sensor. A critical problem was encountered during pre-production of ITk Strip modules wherein some silicon sensors crack due to thermal stresses when mounted to local support structures and brought to cold operating temperatures. A potential solution is being trialed in which the modules are redesigned to include a new layer of soft glue between the front-end electronics and the silicon sensor to absorb thermal stresses. This redesign necessitates a new R&D phase of the project, during which new modules must be assembled and proven to satisfy quality assurance and quality control criteria before ITk Strip modules can proceed to production. This presentation explores the technical challenges of incorporating the stress-relieving layer into the module assembly process, and evaluates the impact of the redesign on prototype modules. Results from quality assurance and quality control testing are shown.

Primary experiment

ATLAS

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