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Fighting cold noise and early breakdown on the ATLAS ITk strips tracker

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The Large Hadron Collider (LHC) experiment is nearing the end of life at its current configuration. However, numerous upgrades across the machine and its detectors are scheduled to extend the lifetime of the experiment for more than an additional decade. The Inner Tracker (ITk) is the new, all-silicon tracker that will replace the current Inner Detector of the ATLAS spectrometer at the end of run 3 of the LHC experiment, in preparation for the High-Luminosity LHC (HL-LHC). The ITk consists of an innermost region, the pixel detector, surrounded by the strips tracker in the outermost layers. After many years of development and an extensive pre-production program, the silicon modules of the strips tracker were ready to enter its production phase. However, two standing issues showed up in the latest stages of pre-production that prevented the module production to be initiated. The first one is related to the apparition of very high noise in localized regions of the modules under certain conditions, and in particular when tested at cold temperatures. It is commonly referred to as the "cold noise" effect. The second effect appears mostly once the silicon modules are loaded and cooled down onto their local supports, in which a fraction of the silicon sensors exhibit very low breakdown voltages. The apparition of physical cracking of the sensors was quickly identified as the main reason for this effect, known as "early breakdown". In this contribution I will describe in detail both of these standing issues, the current understanding of their causes and the reasons why they were not detected at an early stage, the mitigation avenues investigated and being adopted at the moment to correct and prevent those features, which should allow us to initiate the production phase, and a look towards the future of the strips ITk production.

Collaboration

ATLAS ITk

Role of Submitter

I am the presenter

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