

Modeling Radiation Damage to Pixel Sensors in the ATLAS Detector

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Silicon pixel detectors are at the core of the current and planned upgrade of the ATLAS detector at the Large Hadron Collider (LHC). As the closest detector component to the interaction point, these detectors will be subjected to a significant amount of radiation over their lifetime: prior to the High-Luminosity LHC (HL-LHC), the innermost layers will receive a fluence of $1-5 \cdot 10^{15} \text{ 1 MeV neq/cm}^2$ and the HL-LHC detector upgrades must cope with an order of magnitude higher fluence integrated over their lifetimes. Simulating radiation damage is critical in order to make accurate predictions for current future detector performance. A model of pixel digitization is presented that includes radiation damage effects to the ATLAS pixel sensors for the first time. In addition to a thorough description of the setup, predictions are presented for basic pixel cluster properties alongside early studies with LHC Run 2 proton-proton collision data.

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