ID de Contribution: **68**   Type: **12mOral**

A lightweight algorithm to model radiation damage effects in Monte Carlo events for High-Luminosity LHC experiments

mercredi 20 novembre 2024 11:30 (17 minutes)

Radiation damage significantly impacts the performance of silicon tracking detectors in Large Hadron Collider (LHC) experiments such as ATLAS and CMS, with signal reduction being the most critical effect. While adjusting sensor bias voltage and detection thresholds can help mitigating these effects, generating simulated data that accurately mirrors the performance evolution with the accumulation of luminosity, hence fluence, is crucial.

The ATLAS and CMS collaborations have developed and implemented algorithms to correct simulated Monte Carlo (MC) events for radiation damage effects, achieving impressive agreement between collision data and simulated events.

In preparation for the high-luminosity phase (HL-LHC), the demand for a faster ATLAS MC production algorithm becomes imperative due to escalating collision, events, tracks, and particle hit rates, imposing stringent constraints on available computing resources. This article outlines the philosophy behind the new algorithm, its implementation strategy, and the essential components involved. The results from closure tests will be presented for different sensor's geometry; some preliminary
results on computing performance will be commented too.

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Classification de Session: Sensing materials & Radiaiton tolerance

Classification de thématique: High energy and nuclear physics experiments