



Contribution ID: 39

Type: **Invited Talk**

Operation and Performance of the ATLAS Tile Calorimeter Phase-II Demonstrator

The Tile Calorimeter, a central hadronic calorimeter of the ATLAS experiment at the Large Hadron Collider, is undergoing a major upgrade to meet the requirements of the High-Luminosity LHC (HL-LHC). The Phase-II upgrade aims to address the challenges posed by increased trigger rates of up to 1 MHz, higher radiation levels, and enhanced pile-up conditions through a complete redesign of the front-end and readout electronics. As part of an extensive research and development program, a Demonstrator Phase-II Upgrade module was constructed in 2014, featuring the new electronics architecture while preserving backward compatibility with the existing ATLAS Trigger and Data Acquisition system. The module was validated through a series of test beam campaigns at CERN and installed in the ATLAS detector in July 2019 to operate under real experimental conditions. During LHC Run-3 (2022–2026), it has provided valuable operational experience and performance data in a realistic environment. This contribution presents the hardware and software developments of the Demonstrator Phase-II Upgrade module and discusses its operational performance within ATLAS. The latest results demonstrate the viability of the upgraded design and provide essential input for the final implementation of the Tile Calorimeter Phase-II upgrade.

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Session Classification: Plenary

Track Classification: Instrumentation, Tech Transfer, and Quantum Information