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Burn-in Testing for Transformer-Coupled Buck Converters in the ATLAS Tile Calorimeter's Low Voltage Power Supplies

The High Luminosity Large Hadron Collider (HL-LHC) is scheduled to commence operations in 2030, targeting a luminosity five times than that of the current LHC run. This substantial increase in luminosity necessitates significant upgrades to the LHC detector systems. The Phase-II upgrades of the ATLAS detector involve a complete upgrade to the low voltage power supply (LVPS) system of its Tile Calorimeter (TileCal). The TileCal includes 256 LVPS boxes, each composed of eight transformer-coupled buck converter boards alongside auxiliary components. The Phase-II upgrade buck-converter boards are designed to step down the input voltage from 200 V DC to 10 V DC, which is required to power the front-end electronics of the ATLAS detector. Half of the required buck-converter boards are slated for production in South Africa in 2025, with 104 units already produced during the preparatory pre-production phase. The LVPS boxes are located on-detector, limiting access to the buck-converter boards during the operation of the ATLAS detector. If a failure occurs in the boards, the front-end electronics that they supply power to will remain inoperative until the year-end technical stop. To ensure long-term reliability of the boards within the TileCal and identify potential early-life failures, all boards undergo a rigorous burn-in testing process. This process subjects the boards to extreme operational conditions beyond their standard operating parameters within TileCal. Such testing is essential to ensure that there are no failures in the boards, guaranteeing uninterrupted data-taking during operation of the ATLAS detector.

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Primary author: PILUSA, Thabo (University of the Witwatersrand)

Co-authors: MELLADO, Bruce (University of the Witwatersrand and iThemba LABS); MOSOMANE, Chuene (iThemba Labs); Mr VAN RENSBURG, Roger (University of the Witwatersrand); MCKENZIE, Ryan; CHABALALA, Vongani (University of the Witwatersrand)

Presenter: PILUSA, Thabo (University of the Witwatersrand)

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