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Investigation of Radiation-Resistant Components for the TileCal-ATLAS Detector

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The performance and longevity of photomultiplier tubes in high-radiation environments, specifically the Tile Calorimeter, are crucial to the ATLAS detector's efficiency. This research is part of an ongoing investigation into the electron emission yield and electronic properties of various materials to be used in the dynode chain, the main component of the photomultiplier tubes. This study aims to inform material selection for future radiation-hard PMT designs in the upcoming high-luminosity upgrade to the Large Hadron Collider. The materials of interest include aluminium oxide, gallium arsenide, thallium doped caesium iodide, and magnesium oxide. The changes in the electronic properties and electron emission yield before and after irradiation are studied. Results for the electronic properties were obtained using an electrical system optimised to measure high resistance. In addition to this, data pertaining to the electron emission yield has also been acquired using the Proton Microprobe at iThemba LABS'TANDEM accelerator.

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