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Optics robustness of the ATLAS Tile Calorimeter

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TileCal, the central hadronic calorimeter of the ATLAS detector is composed of plastic scintillators interleaved by iron plates, and wavelength shifting optical fibres. The optical properties of these components are known to suffer from natural ageing and degrade due to exposure to radiation. The calorimeter was designed for 10 years of LHC operating at the design luminosity of $10^{34}\,\mathrm{cm}^{-2}\mathrm{s}^{-1}$. Irradiation tests of scintillators and fibres have shown that their light yield decrease by about 10% for the maximum dose expected after 10 years of LHC operation.
The robustness of the TileCal optics components is evaluated using the calibration systems of the calorimeter: Cs-137 gamma source, laser light, and integrated photomultiplier signals of particles from proton-proton collisions. It is observed that the loss of light yield increases with exposure to radiation as expected. The decrease in the light yield during the years 2015-2017 corresponding to the LHC Run 2 will be reported.
The current LHC operation plan foresees a second high luminosity LHC (HL-LHC) phase extending the experiment lifetime for 10 years more. The results obtained in Run 2 indicate that following the light yield evolution in TileCal is an essential step for drawing a prediction of the calorimeter performance in future runs. Preliminary studies attempt to extrapolate these measurements to the HL-LHC running conditions.

Secondary topics

Applications

Experience with current calorimeter at the energy frontier

Primary topic

Scintillators

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