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Long-term stability uncertainty of luminosity measurements of the ATLAS detector in Run 3 during the 2022 data-taking period

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Abstract. Precise measurements of luminosity play a crucial role in the ATLAS physics programme at the LHC, in particular for cross section measurements, where it can be one of the largest systematic uncertainties. The Tile Calorimeter of the ATLAS experiment plays an important role in these measurements due to its luminosity measurements being independent of pileup. The comparison of LUCID luminosity measurements in different detector operating conditions to those obtained by the Tile Calorimeter and the Inner detector is used to measure and study the dominant systematic uncertainty associated with the LUCID luminosity measurements. There are several factors affecting luminosity measurements, these include the aging of photomultiplier tubes and aging of scintillating tiles. The long-term stability studies are performed to evaluate time-dependent factors that affect the long-term stability of the uncertainties associated with the luminosity measurements.

Primary authors: RAPHEEHA, Phuti (Wits University); KUMAR, Mukesh (University of the Witwatersrand)

Presenter: RAPHEEHA, Phuti (Wits University)

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