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An updated HL-LHC halo population model based on recent experimental measurements

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The transverse beam halo population in the Large Hadron Collider (LHC) has been found to carry a significant fraction of the total stored beam energy, potentially reaching several percent. With the anticipated increase in beam brightness for the High Luminosity LHC (HL-LHC), this poses an increasing risk to machine safety, particularly during abrupt orbit shifts or critical component failures. A comprehensive understanding and an accurate modelling of the transverse beam halo are crucial for simulations of beam losses around the ring as a consequence of such failure scenarios in the HL-LHC era. Various models, including Gaussian, double-Gaussian, and q-Gaussian distributions, have been used to describe the LHC beam halos for fitting the measured distributions. This paper provides an in-depth analysis of halo modelling based on collimator scraping measurements from the LHC operational Run 2 and Run 3, and evaluates the accuracy and representativeness of these different distribution models.

Footnotes

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