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Impact of non-linearities on collimation losses at the LHC

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Since the start of the third operational run of the CERN Large Hadron Collider (LHC) in 2022, multiple observations have highlighted the significant influence of non-linearities within the accelerator on the collimation loss patterns of circulating beams. Understanding this phenomenon is particularly relevant for qualifying and validating collimation performance for machine operation at high intensity. In this study, we explore the capability of advanced numerical simulations to reproduce the observed loss patterns, incorporating a detailed representation of various non-linearities. These include magnetic field inhomogeneities, strong octupole fields, and high chromaticity. A comprehensive parameter scan was conducted to investigate the sensitivity of loss patterns to these effects, accompanied by an in-depth analysis comparing the simulation results to experimental measurements. These findings provide valuable insights into the interplay between machine non-linearities and beam losses.

Footnotes

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