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Simulations and experiments for dynamic aperture studies in the LHC ion operation

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Dynamic Aperture (DA) studies, based on single-particle tracking simulations including important non-linear fields such as beam-beam effects, have played a crucial role in guiding the operation of the Large Hadron Collider (LHC) in proton-proton collisions. The correspondence between DA computed through simulations and the actual beam lifetime during operation has been established for proton beams through dedicated experiments at the LHC. However, such an approach has not yet been applied to the Pb ion operation of the accelerator, as the simulation tools have not been rigorously benchmarked against experimental data yet. The present paper presents the simulation studies and experimental tests performed to establish the correlation between DA and beam lifetime for ions. The main focus lies on exploring the beam-beam limit when the crossing angle is significantly reduced in all LHC experiments as compared to the nominal configuration. This approach opens the possibility to operate with reduced crossing angles or reduced β^* within the beam-beam limit, potentially leading to an enhanced performance of the accelerator with ions.

Footnotes

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