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Modelling intra-beam scattering in the LHC for longitudinal beam loss studies

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In the Large Hadron Collider (LHC), intra-beam scattering (IBS) is one of the main drivers of longitudinal emittance growth during the long injection plateau. With the halo of the longitudinal bunch distribution being close to the separatrix, IBS consequently drives beam losses by pushing particles outside the RF bucket at the flat-bottom. As IBS and beam losses impose a requirement on the minimum RF bucket size, this mechanism has an important impact on the RF power requirements for the High Luminosity (HL-) LHC. In this contribution, the effect of IBS is introduced in the Beam Longitudinal Dynamics (BLonD) tracking code. This numerical model is then benchmarked against analytical estimates, as well as against beam measurements performed in the LHC. The impact of IBS-driven losses on the RF power requirements is discussed through the correlation between the time spent at flat-bottom and the average bunch length, which translates into start-of-ramp losses.

Footnotes

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