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Comparison of BCMS and standard beams at LHC injection energy

Monday 2 June 2025 16:00 (2 hours)

During the LHC run in 2024 two beam types were used for physics production with protons. A key difference between the standard 25 ns and the batch compression merging and splitting (BCMS) beams at injection into the LHC, is the smaller transverse emittance achieved with the latter in the injector chain. Despite both beam types appearing indistinguishable in the longitudinal plane, the BCMS beam caused significantly higher beam losses at the start of the acceleration ramp. For the HL-LHC era, start-of-ramp losses will be limiting due to a lack of RF power. It is therefore important to understand the origin of the increase, as both beam types may be used for operational runs after the HL-LHC upgrade. Systematic analysis of the emittance evolution in all three planes have been conducted to investigate the contribution from loss mechanisms like intra-beam scattering and RF background noise. Furthermore, estimates of the beam population outside the bunches and start-of-ramp losses are given to understand the differences in the off-momentum population before the ramp.

Footnotes

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