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First proton crabbing at the LHC via head-on beam-beam interaction

Wednesday 4 June 2025 16:00 (2 hours)

The first experimental observation of a 10 μm crabbing orbit at 1˜σ_z induced by head-on collisions with a non-zero crossing angle (θ_c) in a high-energy proton beam at the LHC is presented. This challenging measurement required both the design of a dedicated experiment and a careful calibration and optimization of the beam instrumentation to produce and detect such a subtle effect. By varying the crossing angle from positive to negative values the reversibility of the effect and its dependence on the crossing angle were also demonstrated. Lattice simulations were performed to corroborate the experimental results, showing excellent agreement with the measured crabbing amplitudes. This experiment highlights the potential of the existing wideband beam-position monitors to diagnose crabbing effects, which will be crucial in the HL-LHC upgrade.

Footnotes

Paper preparation format

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Region represented

Europe

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