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Correction of long-range beam-beam driven normal sextupolar resonance driving terms

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Beam-based studies at the LHC injection energy showed that compensation of the strongly driven sextupolar resonance, Q_x+2Q_y , improved both the dynamic aperture and lifetime of the beam, even when far from the working point and on the far side of the $3Q_y$ resonance. Thus, a reduction of other strong normal sextupolar resonance sources was of interest. In 2024, the first measurements of resonance driving terms with long-range beam-beam (LRBB) interactions were performed. These showed that LRBB was driving the same Q_x+2Q_y resonance strongly when colliding, in agreement with model predictions. A correction was found for the strongest normal sextupole resonances using the existing sextupole corrector magnets in the LHC, obeying the constraints on the chromatic coupling and the maximum magnet powering. Beam-based tests to validate the response of this correction with non-colliding beams have been performed along with the testing of the LRBB resonance correction during LHC commissioning.

Footnotes

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Europe

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