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Simulations of incoherent effects driven by electron clouds forming in the inner triplets of the Large Hadron Collider

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During Run 2 and Run 3 of the Large Hadron Collider (LHC), slow losses from electron cloud (e-cloud) effects have been systematically observed during the full duration of fills with closely-spaced proton bunches. In particular, these effects had been found to depend strongly on the crossing angle of the two beams and the value of the betatron functions in the interaction points. Due to this observation, the main cause of this effect was attributed to the non-linear forces induced by electron clouds forming in the vacuum chamber of the LHC Inner Triplet quadrupole magnets. In this contribution, electron cloud buildup simulations reveal that the induced forces depend strongly on the transverse coordinates of the beam particles, on time, as well as on the longitudinal coordinate within the Inner Triplet. Finally, non-linear maps are generated based on the buildup simulations, and the effect of these forces on the motion of the protons is simulated.

Footnotes

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