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Analysis of Tune Shift Dynamics Near the Third Integer Resonance

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Resonance islands are phenomena utilized in various storage rings to split or separate charged particle bunches. A new Hamiltonian model has recently been proposed to describe these phenomena [K. M. Nam et al., Revised Hamiltonian near third-integer resonance and implications for an electron storage ring, Phys. Rev. Accel. Beams (2024)]. However, the dynamics of these phenomena, particularly turn-by-turn dynamics, have not been extensively studied. This study introduces the first Hamiltonian model that captures the dynamics of resonance islands near the third integer resonance. Our analysis of tune dynamics in the primary orbit reveals oscillatory behavior for small actions, with amplitude- and phase-dependent shifts that align with conventional theory after long-term averaging. In contrast, within the islands, tune and action variations are calculated as functions of the distance from the stable fixed point. The approximate solution shows that the tune stabilizes to a constant value after long-term averaging. These theoretical predictions are well supported by particle tracking results. This study provides the first comprehensive model and method for understanding resonance dynamics in both the primary orbit and the islands, offering a unified description of these phenomena.

Paper submission Plan

No

Best Presentation

No

Contribution track

ICABU WG2. Beam Physics, Diagnostics & Novel Techniques

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