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Halo formation based on 2D and 3D particle-core model

Thursday 29 August 2024 16:00 (2 hours)

Using 2D and 3D particle-core models, we thoroughly studied potential resonance interactions between particles and core in matched beams within complete periodic and double periodic channels. By keeping consistent geometrical structures and phase advances, we compared the Poincaré sections obtained from both models. The findings show that the differences between the models are negligible. This implies that the predicted resonance orders remain consistent, and the size of the resonance island shows only minor discrepancies.
We conducted in-depth studies on resonance behavior in matched beams within periodic structures with varying zero-current phase advances (σ0) using a 3D particle-core model. Our research discovered that a 4:1 resonance phenomenon is triggered when σ0 surpasses 90°. Particularly, in beams influenced by space charge effects, particles within the 4:1 resonance island have the potential to transform into halo particles, a transformation not observed in beams governed by emittance. When σ0 is less than 90° and space charge effects are substantial, 6:1 resonance may emerge. Contrary to the conventional belief that 2:1 resonance caused by mismatch in uniform focusing channels drives particles towards higher amplitude regions, our study revealed that not 2:1 resonance results in particle migration to larger amplitudes. Our research employed TraceWin to confirm these insights, offering valuable contributions to the comprehension of beam dynamics in SCLs.

Footnotes

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