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Dynamic Aperture Studies for Vertical Fixed Field Accelerators

Sunday, 7 May 2023 16:00 (2 hours)

Vertical orbit excursion Fixed Field Accelerators (vFFAs) feature highly non-linear magnetic fields and strong transverse motion coupling. The detailed study of their Dynamic Aperture (DA) requires computation codes allowing long-term tracking and advanced analysis tools to take the transverse motion linear and non-linear coupling into account. This coupling completely transforms the beam dynamics compared to a linear uncoupled motion, and an explicit definition of the DA is needed to characterize the performance and limitations of these lattices. A complete study of the DA in the 4D phase space in highly non-linear and strongly coupled machines must give a measure of the stability domain but also means to assess the operating performance in the physical coupled space. This work presents a complete set of methods to perform such detailed analysis. These methods were explored and compared to compute and characterize the DA of an example vFFA lattice. The whole procedure can be further applied to evaluate DA using realistic models of the magnetic fields, including fringe fields and errors.

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Footnotes

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Yes

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