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Bunch lengthening induced by a combination of higher-harmonic cavities of different order in low-emittance rings

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The next generation of light sources aim to provide bunch beams with small transverse emittances. A common feature in the design of light sources with small emittance lattices is the small value of the momentum compaction, which implies a short nominal equilibrium bunch length. Combined with the small transverse emittances, a short bunch length can pose severe limitations on the beam lifetime caused by collective effects such as intra-beam and Touschek scattering. To improve the beam lifetime of the bunches, an efficient way is to use a Higher-Harmonic Cavity (HHC) system, which leads to an increase of the equilibrium bunch length without an increase of the energy spread. Besides the improvement of beam lifetime, the HHC system plays an important role to cure beam instabilities and mitigate possible beam induced heating issues of the storage ring vacuum components. Present HHC systems are based on HHCs of the same order. To increase the bunch lengthening factor induced by the HHC system, we investigate a novel scheme based on the combination of HHCs of different order. The feasibility and performance of the novel scheme will be studied with the beam dynamics codes SPACE and Elegant, with parameters of the NSLS-II upgrade.

Footnotes

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