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Parameter Optimization of Passive Harmonic Cavity and Analysis of Robinson Instability based on the PLS-II Lattice

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In synchrotron light sources, Higher Harmonic Cavities (HHCs) are employed to increase the bunch length, thereby reducing Touschek scattering and enhancing beam lifetime. This is particularly critical in 4th generation light sources, where the electron beam size is reduced to the diffraction limit of the photon beam. Typically, a Passive Harmonic Cavity (PHC) is tuned to a frequency higher than the fundamental mode resonant frequency to achieve bunch lengthening. However, this tuning can induce Robinson instability, potentially degrading beam quality.

This paper presents an analysis of bunch lengthening using a 3rd harmonic cavity for the 3 GeV 3rd generation synchrotron light source, PLS-II, and proposes optimized PHC parameters. Additionally, a modified equation for Robinson instability, which incorporates damping effects, is derived to demonstrate a stable operational method.

Paper submission Plan

No

Best Presentation

No

Contribution track

ICABU WG2. Beam Physics, Diagnostics & Novel Techniques

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