Contribution ID: **718** Contribution code: **WEPS105** Type: **Poster Presentation**

Benchmark study of transverse coupled-bunch instability driven by the resistive wall impedance in the PF-HLS 2.5 GeV storage ring

Wednesday 4 June 2025 16:00 (2 hours)

Effect of the transverse coupled-bunch instability driven by the resistive wall impedance in the PF-HLS (Photon Factory Hybrid Light Source) 2.5GeV storage ring*are investigated and compared with three methods: an analytical method with azimuthal modes, a Vlasov solver DELPHI***and beam tracking code MBTRACK2****.
The PF-HLS is proposed as the successor machine to the PF-2.5GeV ring and the PF Advanced Ring at KEK. Its concept is a 2.5/5.0GeV energy switchable high-brightness storage ring with a circumference of 750m. A feature of this ring is the adoption of isochronous cells over a large part of the ring, which allow electrons having a bunch length shorter than one nano-second to pass through without significant bunch lengthening. However, in return for this feature, the momentum compaction factor becomes small, which is estimated to 3.24x10-5. In this case, the coherent beam motion may be sensitive to the ring chromaticity.
As the results, it's suggested that the higher-order modes of the coherent beam motion determine the stability of the beam. In the paper, the chromaticity dependence of the instability growth rate for each method is compared and reported in detail.

Footnotes

- K. Harada et al., JSR 29, 1, pp.118-124 (2021).

** M.S. Zisman, S. Cattopadhyay, and J.J. Bisognano, LBL-21270, ZAP user's manual (1986).

*** DELPHI, https://abpcomputing.web.cern.ch/codes/codes_pages/DELPHI/

**** MBTRACK2, https://gitlab.synchrotron-soleil.fr/PA/collective-effects/mbtrack2

Paper preparation format

LaTeX

Region represented

Asia

Funding Agency

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Session Classification: Wednesday Poster Session

Track Classification: MC5: Beam Dynamics and EM Fields: MC5.D05 Coherent and Incoherent Instabilities Theory, Simulations, Code Development