



Contribution ID: 1867 Contribution code: TUPL047

Type: **Poster Presentation**

Multi-bunch operation mode for simultaneously serving SASE and seeding FEL beamlines

Tuesday, 9 May 2023 16:30 (2 hours)

Modern free-electron laser (FEL) facilities are designed to simultaneously serve multiple undulator lines to provide x-ray pulses with high peak power and tunable wavelengths. To satisfy different scientific demands, it is preferred to make the separate undulator lines work under different FEL schemes, such as the self-amplified spontaneous emission (SASE) scheme and the echo-enabled harmonic generation (EEHG) scheme. However, different FEL schemes have different requirements on the beam longitudinal distribution. Here, we propose to use multiple bunches to simultaneously serve the undulator lines and put the bunches at different acceleration phase to change the bunch length with two compressor chicanes. The acceleration phase for each bunch is varied by adjusting the time delays of the photocathode drive laser pulses with the accelerator settings unchanged. The start-to-end simulation demonstrates that a fs bunch with high peak current can be produced to serve the SASE line while a bunch with hundred-of-fs length and uniform current distribution can be produced to serve the EEHG line. The FEL performances are simulated and discussed.

Funding Agency

Footnotes

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Yes

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Session Classification: Tuesday Poster Session

Track Classification: MC2: Photon Sources and Electron Accelerators: MC2.A06: Free Electron Lasers