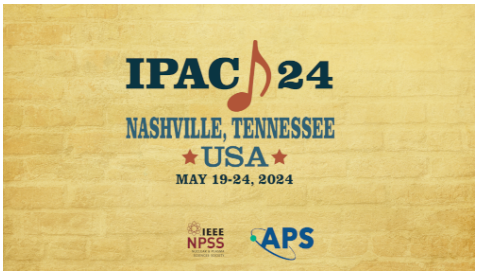

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Start-to-end simulation of second hard X-ray beamline at the PAL-XFEL and plans of R&D activities on high-brightness XFEL generation

Monday, 20 May 2024 16:00 (2 hours)

A second hard X-ray beamline (HX2) at the PAL-XFEL (Pohang Accelerator Laboratory, X-ray Free Electron Laser) has been proposed to meet the increased demands of XFEL science. A photon energy ranging between 1.5 to 10 keV was determined to cover low photon energy with enhanced FEL pulse energy of about 3.0 mJ, and to cover mostly used range between 8 to 10 keV simultaneously. Accordingly, baseline design of the electron beamline was completed using MAD-X code. Here, to avoid physical overlap of the beamline elements, a dog-leg transport line is installed. In addition to first-order optics design, complete start-to-end simulation is performed to understand the evolution of the 6D electron beam phase space and to optimize the beam parameters such as energy chirp, energy spread, and emittance at the entrance of the undulator. In this study, we will show the start-to-end simulation by using Impact-T for injector section and ELEGANT for the remaining sections from linac modules to the end of the HX2 undulator line. Particularly, we will discuss whether coherent synchrotron radiation effects along the dog-leg section is suppressed so that the beam phase space distortion is minimized. Plus, we will introduce planned R&D activities such as AI/ML-based injector operation (virtual machine) and various studies on the XFEL modes such as multi-bunch operation, enhanced SASE (ESASE), and THz FEL.

Footnotes

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