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Two-stage amplification of hard X-ray FEL using fresh-slice with wakefield from corrugated structure

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The world's brightest x-ray pulses are generated in a range of photon energy from 0.25 keV to 20 keV, and used for many scientific applications at PAL-XFEL. The self-amplified spontaneous emission, so-called SASE, mechanism is the simplest process for producing the high-brightness x-ray pulses. In the SASE mechanism, electron beams are accelerated to GeV energies and radiate the free-electron lasers (FELs) within periodic magnetic fields of an undulators. The FELs are then amplified, as the electron and the radiation fields interact through multiple undulators, to high intensity of approximately the millijoule. Typically, the quality of electron beams determines that of FEL output, for example, the FEL pulse length coincides with the electron bunch length. Since success of achieving bright XFELs, significant efforts have been made to increase the x-ray pulse power by reducing the pulse length while keeping its intensity. Works by LCLS and SwissFEL have demonstrated that the pulse power of XFELs can be significantly enhanced using a transversely tilted beam and producing FELs with specific bunch slices selectively through multi-stage undulator section. However, those efforts have so far been devoted for the soft x-ray FELs (up to 1.0 keV). In the PAL-XFEL, we applied the scheme to the hard x-ray FELs (2.47 keV) and enhanced the average pulse power by ~60 % compared to the SASE FEL. In this poster, we present the experimental procedure and results.

Contribution track

ICABU WG2. Beam Physics, Diagnostics & Novel Techniques

Paper submission Plan

No

Best Presentation

No

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