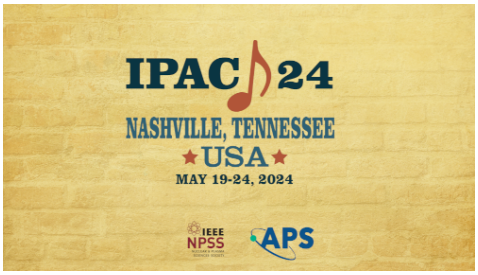

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Harmonic generation from hard X-ray self-seeded free-electron laser

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

Hard X-ray self-seeded (HXRSS) free-electron lasers (FEL) provide high intensity radiation pulses with both transverse and longitudinal coherence in the hard X-ray regime. These sources are important for experiments requiring high spectral density and high photon energies like nuclear resonance scattering. However, as the photon energy increases, HXRSS efficiency may decrease in a typical HXRSS system with limited undulator length. Harmonic generation can be a relatively cheap and efficient way to extend the photon energy range for the existing FEL beamlines. Here we present experimental results about harmonic generation from the HXRSS system at the European XFEL. We first tune the HXRSS system targeting at the subharmonic of the high photon energy, and split the last undulator section into two parts with undulator strength resonant at subharmonic and high photon energies separately. This method is a combination of HXRSS, harmonic bunching, post-saturation tapering techniques without hardware change to the existing HXRSS system. With optimized taper the final amplification is close to saturation and hundreds of micro-Joule pulse energy is obtained for the high photon energy.

Footnotes

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