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Self-seeding scheme for testing CBXFEL configurations

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The next generation of X-ray free-electron lasers (XFELs) research is focused on the investigation of self-seeding techniques, and, more recently, X-ray cavity designs. Here, we explore the capabilities of the X-ray self-seeding (HXRSS) setup at LCLS. The self-seeding mechanism is initiated by generating SASE in the first undulator section, followed by monochromatization and seeding in the subsequent undulator sections. The electron bunch is delayed with respect to the produced seed field to temporally overlap with the monochromator wake. We then utilize the HXRSS setup to mimic the performance of recently proposed cavity-based XFEL (CBXFEL) experiment currently under construction at SLAC. When set up with 7 undulators for SASE generation, and 7 undulators for seeding, HXRSS setup approximately reproduces the conditions of the CBXFEL experiment. We investigate the self-seeding effects on the resulting photon flux, radiation bandwidth, and spectral pedestal. Our findings help optimize CBXFEL photon diagnostics and set up the lower bound on the resulting CBXFEL pulse quality.

Footnotes

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Author: SINGLETON, Madison (SLAC National Accelerator Laboratory)

Co-authors: LUTMAN, Alberto (SLAC National Accelerator Laboratory); Dr HALAVANAU, Aliaksei (SLAC National Accelerator Laboratory); TANG, Jingyi (Stanford University); HUANG, Zhirong (SLAC National Accelerator Laboratory)

Presenter: SINGLETON, Madison (SLAC National Accelerator Laboratory)

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