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Phase-Locked Hard X-Ray Self-Seeding FEL Study for the European XFEL

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Phase-locked pulses are important for coherent control experiments. Here we present theoretical analyses and start-to-end simulation results for the generation of phase-locked pulses using the Hard X-ray Self-Seeding (HXRSS) system at the European XFEL. As proposed in Ref. [1], the method is based on a combination of self-seeding and fresh-slice lasing techniques. However, at variance with Ref. [1], here we exploit different transverse centroid offsets along the electron beam. In this way we may first utilize part of the electron beam to produce SASE radiation, to be filtered as seed and then generate HXRSS pulses from other parts of the beam applying appropriate transverse kicks. The final result consists in coherent radiation pulses with fixed phase difference and tunable time delay within the bunch length. This scheme should be useful for applications such as coherent x-ray pump-probe experiments.

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