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Experimental designs of coherent synchrotron radiation in complex beams

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Coherent synchrotron radiation (CSR) is one critical beam collective effect in high-energy accelerators, which impedes the generation of high-brightness beams. The Argonne Wakefield Accelerator (AWA) facility is unique in the experimental investigation of CSR effects in complex beams, offering a large parameter space for the bunch charge and size, various bunch profiles (round and flat beams), and the capability of generating shaped bunches through both laser shaping and the emittance exchange approach. This presentation will outline planned experiments at AWA and their designs, including a CSR shielding study using a dipole chamber with a variable gap size, and the effect of CSR on the beam phase space in a laser-shaped short electron bunch. This work is part of a comprehensive study involving self-consistent CSR code development and experimental investigation. The experimental component aims to provide benchmarking with the advanced codes under development, explore the boundaries of 1/2/3D CSR effects on beam dynamics, evaluate CSR effects in complex beams, and eventually propose CSR mitigation strategies.

Footnotes

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