SIMULATION OF COHERENT ELECTRON COOLING FOR HIGH-INTENSITY HADRON COLLIDERS

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Abstract

Novel electron-hadron collider concepts are a long-term priority for the international nuclear physics community. Effective beam cooling for intense, relativistic hadron beams will be necessary to obtain the orders-of-magnitude higher luminosities being proposed. Coherent electron cooling (CEC) [1] combines the best features of electron cooling and stochastic cooling, via free-electron laser technology [2], to offer the possibility of cooling high-energy hadron beams much faster. Many technical difficulties must be resolved via full-scale 3D simulations, before the CEC concept can be validated experimentally. The parallel VORPAL framework [3] is the ideal code for simulating the modulator and kicker regions, where the electron and hadron beams will co-propagate as in a conventional electron cooling section. We present initial VORPAL simulations of the electron density wake driven by single ions in the modulator section. Also, we present a plan for simulating the full modulator-amplifier-kicker dynamics, by through use of a loosely-coupled code suite including VORPAL, an FEL code and a beam dynamics code.

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