PROGRESS IN ACCELERATOR RAMP;D FOR HIGH ENERGY DENSITY PHYSICS AND WARM DENSE MATTER APPLICATIONS

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Abstract

The research objectives of the U. S. Heavy Ion Fusion Science Virtual National Laboratory include: achieving warm dense matter conditions on near-term experiments and addressing the top-level scientific question: "How can heavy ion beams be compressed to the high intensities required for creating high energy density matter and fusion ignition conditions?" The accelerator R&D effort is focused on the Neutralized Drift Compression Experiment (NDCX), studies of electron cloud, and advanced theory and simulation. NDCX has achieved a longitudinal compression factor of 60 in a background plasma. Simulations using the LSP code agreed well the experiments. A kinetic model showed that the Vlasov equation possesses a class of exact solutions describing both transverse and longitudinal compression. Extensive measurements of electron cloud were carried out on a high brightness beam. An algorithm for large time-step advancement of electron orbits and a suite of models for electrons, gas, and wall interactions were implemented in the WARP 3D code. Electron-ion two-stream instabilities and the temperature-anisotropy instability have been simulated using a low-noise delta-f method by the BEST code.

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