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RESULTS ON INTENSE BEAM FOCUSING AND NEUTRALIZATION FROM THE NEUTRALIZED TRANSPORT EXPERIMENT*

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Abstract

In heavy ion inertial confinement fusion systems, intense beams of ions must be transported from the exit of the final focus magnet system through the target chamber to hit millimeter spot sizes on the target. Effective plasma neutralization of intense ion beams through the target chamber is essential for the viability of an economically competitive heavy ion fusion power plant. The physics of final magnetic transport and neutralized drift has been studied extensively with PIC simulations. To provide quantitative comparisons of theoretical predictions with experiment, the Heavy Ion Fusion Virtual National Laboratory has completed the construction and has begun experimentation with the NTX (Neutralized Transport Experiment). The experiment consists of 3 phases, each with physics issues of its own. Phase 1 is designed to generate a very high brightness potassium beam with variable perveance, using a beam aperturing technique. Phase 2 consists of magnetic transport through four pulsed quadrupoles. Here, beam tuning as well as the effects of phase space dilution through higher order nonlinear fields must be understood. In Phase 3, a converging ion beam at the exit of the magnetic section is transported through a drift section with plasma sources for beam neutralization, and the final spot size is measured under various conditions of neutralization. In this paper, we present results from all 3 phases of the experiment, with particular emphasis on the neutralization experiments.

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