SIMULATION OF LONG-DISTANCE BEAM PROPAGATION IN THE PAUL TRAP SIMULATOR EXPERIMENT*

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The Paul Trap Simulator Experiment (PTSX) simulates the propagation of intense charged particle beams over equivalent distances of many kilometers through magnetic alternating-gradient (AG) transport systems by making use of the similarity between the transverse dynamics of particles in the two systems. Plasmas have been trapped that correspond to normalized intensity parameters $\hat{s} = \omega_p^2(0)/2\omega_q^2 \leq 0.8$, where $\omega_p(r)$ is the plasmas frequency and ω_q is the average transverse focusing frequency in the smooth-focusing approximation. The PTSX device confines one-component cesium ion plasmas for hundreds of milliseconds, which is equivalent to over 10 km of equivalent beam propagation. Detailed comparisons are made with WARP 3D simulations, and initial results are presented for experiments in which the confining voltage waveform has been modified so that it is no longer purely sinusoidal. Results using a cesium ion source and a barium ion source are presented, and the development of a laser-induced fluorescence diagnostic system is discussed.

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