Invited Paper Title
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Longitudinal and Transverse Neutralized Beam Compression Experiments

Abstract

This paper describes plans for neutralized drift compression experiments, precursors to future target heating experiments using intense ion beams. The target-physics objective is to study warm dense matter (WDM) using short-duration (~ 1 ns) ion beams that enter the targets at energies just above the dE/dx peak. High intensity on target is achieved by a combination of longitudinal compression and transverse focusing. This research will build upon recent success in longitudinal compression, where the ion beam was compressed lengthwise by a factor of more than 50 by first applying a linear head-to-tail velocity tilt to the beam, and then allowing the beam to drift through a dense neutralizing background plasma. In separate experiments, transverse beam-density enhancement by a factor of ~102 was demonstrated when a converging, space-charge-dominated ion beam was neutralized by a plasma source. It is planned to demonstrate simultaneous transverse focusing and longitudinal compression in a series of experiments, thereby achieving conditions suitable for WDM target experiments. Future experiments may use solenoids for transverse confinement of un-neutralized ion beams during acceleration. Recent results are reported in the transport of a high-perveance heavy-ion beam in a solenoid transport channel. The principal objectives of this solenoid transport experiment are to match and transport a space-charge-dominated ion beam, and to study associated electron-cloud and gas effects that may limit the beam quality or beam control in a solenoid transport system. Ideally, the beam would establish a Brillouin-flow condition (rotation at one-half the cyclotron frequency). Other mechanisms that would degrade beam quality are being studied, such as focusing-field aberrations, beam halo, and separation of lattice focusing elements.