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Acceleration Gap Effects on the Longitudinal Compression of Intense Ion Beams in the Neutralized Drift Compression Experiment[1]

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— Longitudinal compression of space-charge-dominated ion beams to high currents in nanosecond pulses for warm dense matter and heavy ion fusion applications is achieved by imposing a time-dependent velocity tilt to the charge bunch across the acceleration gap of a linear induction accelerator. The subsequent neutralization of the beam by a pre-formed plasma allows the intense charge bunch to compress above the traditional space-charge limit for quiescent propagation and longitudinal focusing. The detailed physics and implications of acceleration-gap effects and focusing aberration on optimum current compression are reviewed. Quantitative examples using particle-in-cell simulations explore the dependency of the axial compression on effects such as the finite-size acceleration gap, voltage waveform, and the beam's initial temperature, pulse length, intended fractional velocity tilt, kinetic energy uncertainty, and distribution function.

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