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Recent results from the High Current Experiment for Heavy Ion Inertial Fusion

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The High Current Experiment (HCX) is exploring heavy-ion beam transport in an alternating gradient quadrupole focusing channel at a scale representative of the low-energy end of an induction linac driver for fusion energy production. A primary mission of this experiment is to investigate aperture fill factors ($F = \text{diameter of maximum beam excursion} / \text{aperture diameter}$) acceptable for the transport of space-charge dominated heavy-ion beams at high space-charge intensity (line-charge density ~ 0.2 microC/m) over long pulse durations (> 4 microsec). We present the phase space evolution of a K^+ ion beam transported ($F > 0.5$) through the matching section, 10 electrostatic transport quadrupoles and 4 magnetic quadrupoles. Transverse phase space is measured including beam halo and particle loss. Space charge waves are also studied along with their influence on the transverse beam evolution. New data on beam energy and phase space projections better constrain beam parameters and improve agreement with simulations. The consequences for beam control and fill-factors in future induction accelerators will be discussed.

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