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Publication Date

2007-01-04

Bunching and focusing of an intense ion beam for target heating experiments

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Abstract. Future warm dense matter experiments with space-charge dominated ion beams require simultaneous longitudinal bunching and transverse focusing. The challenge is to longitudinally bunch the beam two orders of magnitude to a pulse length shorter than the target disassembly time and focus the beam transversely to a sub-mm focal spot. An experiment to simultaneously focus a singly charged potassium ion beam has been carried out at LBNL. The space charge of the beam must be neutralized so only emittance limits the simultaneous focusing. An induction bunching module provides a head-to-tail velocity ramp upstream of a plasma filled drift section. Tuning the initial beam envelope to compensate for the defocusing of the bunching module enables simultaneous focusing. A comparison of experimental and calculated results are presented, including the transverse distribution and the longitudinal phase-space of the beam.

(This work was supported by the U.S. D.O.E. under DE-AC02-05H11231 and DE-AC02-76CH3073 for HIFS-VNL)