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Extraction and compression of high line charge density ion beams

E. Henestroza, S.S. Yu, J.W. Kwan
LBNL, Berkeley, CA, USA

R.J. Briggs
SAIC, Alamo, CA, USA

Abstract
HEDP applications require high line charge density ion beams. An efficient method to obtain this type of beams is to extract a long pulse, high current beam from a gun at high energy, and let the beam pass through a decelerating field to compress it. The low energy beam bunch is loaded into a solenoid and matched to a Brillouin flow. The Brillouin equilibrium is independent of the energy if the relationship between the beam size (a), solenoid magnetic field strength (B) and line charge density is such that (Ba)^2 is proportional to the line charge density. Thus it is possible to accelerate a matched beam at constant line charge density. An experiment, NDCX-1c is being designed to test the feasibility of this type of injectors, where we will extract a 1 microsecond, 100 mA, potassium beam at 160 keV, decelerate it to 55 keV (density ~0.2 microC/m), and load it into a 2.5 T solenoid where it will be accelerated to 100–150 keV (head to tail) at constant line charge density. The head-to-tail velocity tilt can be used to increase bunch compression and to control longitudinal beam expansion. We will present the physics design and numerical simulations of the proposed experiment.

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