High Brightness Injector for Warm Dense Matter Studies

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A high brightness heavy ion accelerator for creating powerful beams to study warm dense matter is being designed at LBNL. The components include an injector that delivers a lithium ion beam, and an accelerator that boosts the energy to 2.8 MeV. Further beam manipulations will compress the beam to a final spot radius of less than 1 mm and a pulse length of 1 ns. In order to reach those final parameters, it is required to extract a high brightness beam and minimize the transverse and longitudinal emittance growth along the accelerator. We have considered several scenarios with different amounts of beam charge deposited on the target. In the case of a conservative approach, the injector requirements can be met by using an ion source that provides 2 A of Li^+, for 200 ns and a normalized emittance ~ 1 π-mm-mr. The injector is based on the Accel-Decel concept which enables the extraction of a high line charge density beam from the ion source at 100 kV above ground potential, and the accelerator is based on either a standard switched electrostatic accelerator column or a Pulse Line Ion Accelerator that uses a slow-wave structure based on a helical winding. We will present the physics design and the numerical simulations of the beam dynamics for this system.

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