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High-Brightness Heavy-Ion Injector Experiments*

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To provide a compact high-brightness heavy-ion beam source for HIF accelerators, we have been experimenting with merging multi-beamlets in an injector which uses an RF plasma source. In an 80-kV 20-microsecond experiment, the RF plasma source has produced up to 5 mA of Ar^+ in a single beamlet. An extraction current density of 100 mA/cm^2 was achieved, and the thermal temperature of the ions was below 1 eV. We have tested at full voltage gradient the first 4 gaps of an injector design. Einzel lens were used to focus the beamlets while reducing the beamlet to beamlet space charge interaction. We were able to reach greater than 100 kV/cm in the first four gaps. We also performed experiments on a converging 119 multi-beamlet source. Although the source has the same optics as a full 1.6 MV injector system, these test were carried out at 400 kV due to the test stand HV limit. Our goal is to confirm the emittance growth and to demonstrate the technical feasibility of building a driver-scale HIF injector.

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