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A High Current Density RF-driven Plasma Ion Source for Heavy Ion Fusion*

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In developing high current and high brightness beams for HIF, an ion source was constructed aiming at producing > 0.5 A of Ar^+ . The chamber is 33 cm in diameter with multicusp permanent magnets to confine plasma. RF power (~ 11 MHz, > 10 kW) is applied to the source via a 2-turn, 11-cm diameter antenna inside the chamber for producing beam pulses of 20 μs at up to 10 Hz. Ions are extracted from the ion source in an array of beamlets that will be merged into a single beam later. With 5 mA per beamlet, the beamlet current density is ~ 100 mA/cm². Plasma probe data has recorded > 200 mA/cm² of ion saturation current near the chamber center with 2 mT of fill pressure. We will present measurements of the extracted current density as a function of RF power and gas pressure, the beam rise time, current density uniformity, energy dispersion (due to charge exchange) and the percentage of high charge state ions in the beam.

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