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Hollow cathode discharges are well known as a simple means for producing relatively dense gaseous plasmas. Electrons can efficiently ionize the working gas due to their pendulum motion in the plasma between opposite cathode sheaths. A variety of plasma, electron, and ion sources have been developed based on this type of discharge. The introduction of a magnetic field leads to further enhancement of the plasma density without increase of the discharge power. In fact, experimental work has shown that plasma density enhancement can be achieved at even reduced power input. In the present work, a hollow cathode ion source was equipped with an exchangeable magnetic field coil. The hollow cathode had a diameter of 6 cm and a length of 8 cm; the exit hole toward the extractor had a diameter of 1 cm. The magnetic field coils had a length of 4 cm and 18 cm, producing a non-uniform or rather uniform field up to 0.1 Tesla, respectively. Ions were extracted via a multi-aperture extractor grid at a voltage up to 5 kV. Current-stabilized power supplies enabled simple, stable operation. Parameters of the discharge, plasma, and ion beams were measured as a function of magnetic field strength and uniformity. At constant discharge current, the discharge voltage and hence power is reduced when a magnetic field is present. The extracted ion current shows a non-monotonic behavior as function of the magnetic field strength but the magnetic field distribution had only little influence on the current-voltage characteristics and on all other, derived plasma and beam parameters.

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