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Permanent magnet plasma lens

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ABSTRACT

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Permanent Magnet Plasma Lens

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In work preliminary to that described here, experimental investigations of the plasma lens have been performed at the Institute of Physics NASU (Kiev) and LBNL (Berkeley). In these experiments, the focusing of broad beams of heavy metal ions was demonstrated using a lens in which the magnetic field was provided by a conventional current-driven solenoid. Here we describe the first experimental results of the focusing properties of a simple and compact plasma lens that is based on the use of small permanent magnets. The focusing of large area, moderate energy, metal ion beams produced by a vacuum arc ion source was explored. The lens was located 30 cm from the ion source extractor, the diameter of the lens input aperture was 7 cm, and the lens employed 13 ring electrodes with up to 4.7 kV applied to the central electrode. The magnetic field strength within the lens was up to 0.036T. Our experiments indicate that the permanent magnet plasma lens works well, with variation of the electrode potential distribution providing control from focusing to defocusing regimes. Under optimized operation the ion beam current density at the focus was compressed by a factor of up to 25.

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