PERFORMANCE OF AN ALL-PERMANENT MAGNET ECR ION SOURCE WITH A LARGE, UNIFORMLY DISTRIBUTED RESONANT-PLASMA VOLUME: FIRST RESULTS

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A compact, all-permanent magnet ECR ion source with a large uniformly distributed ECR plasma volume has been designed, fabricated, and subjected to initial testing at the Oak Ridge National Laboratory (ORNL)[1]. The central-field region is designed to achieve a flat-field (constant mod-B) that extends over the length of the central-field region along the axis of symmetry and radially-outward to form a uniformly distributed resonant plasma "volume," with tuned magnitude commensurate with the efficient adsorption of single-frequency (6 GHz) microwave radiation. The field design strongly contrasts with those used in conventional ECR ion sources where the central-field regions are approximately parabolic and the consequent ECR zones are "surfaces." The creation of an ECR "volume," rather than a "surface," dramatically increases the absorption of microwave power, thereby, increasing the electron-temperature and "hot" electron population within the plasma volume, conditions that are commensurate with higher charge states and higher beam intensities within a particular charge state [2, 3]. Details of the design attributes of the source and microwave injection system will be described. Operational parameter, emittance, charge-state distribution, intensity, and ionization efficiency data derived from first experimental measurements of the performance of the "volume" source will be presented. These data will be compared with analogous data derived from the source when configured with a conventional parabolic central field.

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