An All-Permanent-Magnet ECR Ion Source with a Large Uniformly Distributed Resonant Plasma Volume: Initial Performance

G. D. Alton, Y. Liu, H. Zaim,[1] G. D. Mills and S. Murray
Physics Division, Oak Ridge National Laboratory[2]
P. O. Box 2008, Oak Ridge, TN 37831-6368 USA

A compact, all-permanent-magnet, "volume"-type, ECR ion source has been subjected to initial testing at the Oak Ridge National Laboratory. The central-field region of the source is uniformly distributed over a large plasma "volume" with magnitude resonant with single-frequency (6 GHz) microwave radiation. The source is equipped with provisions for mechanically tuning the central-field source over a limited frequency range (5.5 to 6.8 GHZ) to account for shifts in the magnitude due to diamagnetic effects induced by changes in the plasma density. The broadband RF injection system is designed so that a gradual change from rectangular-to-circular wave guide is achieved that has an excellent voltage to standing wave ratio while converting the dominant TE_{10} eigenmode of the rectangular wave guide to the dominant TE_{lnp} eigenmode for the circular wave guide. The injection system is also provided with a frequency independent, right-hand elliptical polarizer for studying the effects of polarized radiation on source performance. The source is also equipped with a remotely positioned, three-electrode extraction system that greatly facilitates ease of operation. Results derived in preliminary measurements support arguments[3] that the flat-field source significantly outperforms its conventional parabolic central field complement. Details of the source and RF injection systems, and initial performance of the source, will be presented in this report.

---

[1] Ph.D. student: University of Versailles, Versailles, France.
[2] Managed by UT-Battelle, LLC, for the U.S. Department of Energy under contract DE-AC05-00OR22725.
[3] G. D. Alton and D. Smithe, Rev. Sci. Instrum. **65** (1994) 775.