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# The effect of magnetic field configurations in ion beam generation using a Compact ECR plasma source

Priti Singh, Anshu Verma, Debaprasad Sahu, Ramesh Narayanan, Ashish Ganguli, R D Tarey
Department of Energy Science and Engineering, Indian Institute of Technology Delhi, New Delhi
e-mail (speaker): rams@dese.iitd.ac.in

The mechanism of electron cyclotron resonance (ECR) power coupling is well known in literature to be one of the most energy efficient processes for plasma applications. The Plasma Lab at IIT Delhi has indigenously developed a patented Compact ECR Plasma Source (CEPS) which has demonstrated the CEPS to be a generic source suitable for various applications [1, 2]. One of the major emphasis in the recent past has been the studies on high energetic ion beams that were observed when the CEPS has been attached to a larger expansion chamber.

The experiments presented in this paper were undertaken in a cylindrical vacuum chamber with an indigenously developed ECR plasma source mounted onto one end of the cylindrical chamber [diameter = 50 cm, length = 75 cm], the Medium Volume Plasma System (MVPS) [Fig 1(a)]. The source section uses two different magnetic field configurations (MF1 and MF2), which are

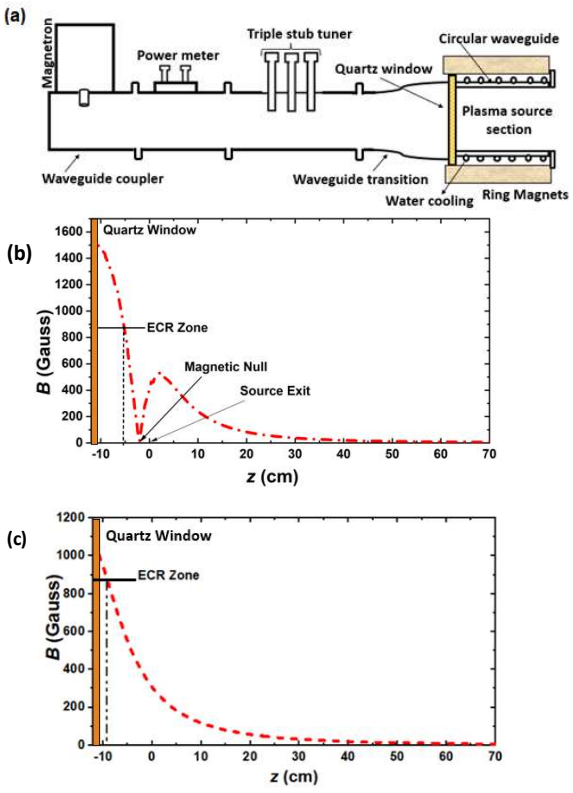


Figure 1: (a) Schematic of the essential components of the ECR plasma source with permanent NdFeB ring magnets; Axial magnetic field profile of (b) MF1 (CEPS) and (c) MF2 (NEPS)

demarcated as Compact ECR Plasma Source (CEPS) and Non-compact ECR Plasma Source (NEPS), with the former having a more complex magnetic field configuration (MF1) than the latter (MF2). The magnetic field configuration (MF1) of CEPS [Fig 1(b)] as well as the alternate or second magnetic field configuration (MF2) of NEPS [Fig 1(c)] generate suitable ECR fields within the plasma source section (PSS) but which are still distinctly different from each other.

A series of experiments were performed for different operating parameters in both magnetic field configurations using hydrogen and argon plasmas [3]. The primary diagnostics used in this work are a set of radial and axial Langmuir Probes (LPs) along with a Retarding Field Energy Analyzer (RFEA); all diagnostics being fabricated in-house [Fig 2]. It was observed that the complex magnetic field configuration of MF1 was able to generate more energetic ion beams as compared to that of the MF2 configuration.

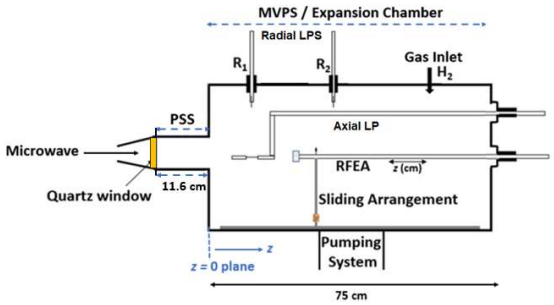


Figure 2: Schematic of MVPS showing mounting of the PSS for the CEPS / NEPS and the location of ports for various diagnostics.

The energetic ion beams are currently being studied from the perspective of plasma applications [2], such as plasma processing and plasma-based thrusters [4, 5]. Details of these investigations would be presented in this work.

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