

## RF - Plasma source commissioning in Indian negative ion facility

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The Indian Program of the RF based negative ion source has started off with the commissioning of ROBIN, the inductively coupled RF based negative ion source facility under establishment at Institute for Plasma research (IPR), India. The facility is being developed under a technology transfer agreement with IPP Garching. It consists of a single RF driver based beam source (BATMAN replica) coupled to a 100 kW, 1 MHz RF generator, with a self excited oscillator, through a matching network, for plasma production and ion extraction and acceleration. The system is supported by a vacuum chamber housing a calorimeter, a set of turbo molecular and cryo pumps, optical and electrical probe based diagnostics and an in-house developed automated control and data acquisition system.

The delivery of the RF generator and the RF plasma source without the accelerator, has enabled initiation of plasma production experiments through the inductive coupling of the RF power using a 6.5 turn copper coil mounted on the RF driver of the source. The recent experimental campaign has established the matching circuit parameters that result in plasma production with density in the range of  $0.5 - 1 \times 10^{18} / \text{m}^3$ , at operational gas pressures ranging between 0.4 - 1 Pa. Various configurations of the matching network have been experimented upon to obtain a stable operation of the set up for RF powers ranging between 30 - 85 kW and pulse lengths ranging between 4-20 s. It has been observed that the range of the parameters in the matching circuit, over which the frequency of the power supply is stable, is narrow and further experiments with increased number of turns in the coil are in the pipeline to see if the range can be widened. Spectroscopy performed with a 4 channel optical emission spectrometer has enabled identification and study of variation of  $H_{\alpha}$ ,  $H_{\beta}$ ,  $H_{\gamma}$  and copper lines at the driver, the back plate and the diagnostic flange location as a function of the applied RF power. Development of a RF compensated Langmuir probe is underway to incorporate probe based measurements for plasma characterisation in future experimental campaigns. These shall be followed by experiments related to Cs feeding into the source and coupling it to the accelerator in order to enable negative ion beam extraction and acceleration to 35 keV.

In this paper, the description of the experimental system and the commissioning data related to the optimisation of the various parameters of the matching network to obtain stable plasma of required density as obtained during the commissioning of the ion source under this facility shall be presented and discussed.