

Evaluation of Beam Properties of a Negative Hydrogen Source by Doppler Shift Spectroscopy

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ROBIN (RF Operated Beam source in India for Negative Ion research) is a negative H⁻ ion source, which is operational in IPR, Gandhinagar. For measurement of various beam parameters such as beam energy, beam divergence, beam homogeneity and the stripping losses, Doppler Shifted spectroscopy diagnostics was established on ROBIN. The beam properties are studied by varying the source pressure (0.3-0.6 Pa), RF power (30 kW-60kW), tank pressure (7×10^{-4} mbar – 5×10^{-5} mbar), the total applied voltage in the range of 7kV-24kV has been carried out. The beam divergence and stripping losses are estimated from the line profiles analysis of the observed Doppler shift spectrum. The homogeneity of the beam in the vertical direction has been evaluated by using eight lines of sight located at two symmetrical locations in the ROBIN test vessel. The effect of space charge compensation on beam divergence has also been studied by varying the test stand pressure. The observed beam divergence is found to be lower at lower applied voltages and started increasing monotonically with an increase in voltage. The beam divergence is found to be decreasing with increase in RF power. The stripping losses are higher at lower voltages and start decreasing with increase in applied voltage. The beam is more uniform in the upper portion in comparison with the lower portion. In this present work, the parametric evaluation of the beam properties is presented in detail and results are discussed.

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