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## Development of High Current Density Helicon Ion Source for DNB in VEST

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The combined system of Charge Exchange Spectroscopy (CES) and Beam Emission Spectroscopy (BES) will be developed in Versatile Experimental Spherical Torus (VEST) to measure ion temperature and rotation velocity by not using impurity but main hydrogen ion emission line directly. Diagnostic Neutral Beam (DNB) system is needed to supply high energy neutral particles for charge exchange reaction in this system.

A 9 kW compact high-current density helicon ion source has been developed for DNB. The target beam current is set to be  $\sim 300$  mA at 30 kV to get a sufficient light intensity for CES. The Helicon ion source system consists of three parts: plasma source, extraction system, and power systems. Plasma density of the plasma source is measured to be as high as  $\sim 5 \times 10^{18}/\text{m}^3$ , indicating maximum extractable beam current density of  $600 \text{ mA}/\text{cm}^2$ . In order to extract  $\sim 300$  mA beam current, circular hole with 8 mm diameter is chosen as extraction hole. Triode extraction system to maximize beam current density at low energy is designed. Marx modulator is developed for extraction power system. In this paper, detailed design of the helicon ion source system will be presented with initial performance data such as beam power from calorimeter measurement.

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