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Characterization of the properties of negative hydrogen ion beam of CRAFT NNBI test facility

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The Comprehensive Research Facility for Fusion Technology (CRAFT) serves as an integration of diverse testing and demonstrating facilities. Its primary aim is to develop crucial technologies and key prototype systems for the magnetic confinement fusion reactor.Neutral beam injection (NBI) system, as an effective means of plasma heating, has been widely adopted in magnetic-confinement nuclear fusion devices. In the pursuit of delving into the physical and engineering aspects of Negative Ion Source Neutral Beam Injection (NNBI) and accumulating operational experience with RF-driven negative ion sources, several diagnostic techniques are employed to characterize the beam properties of the CRAFT negative ion source. These techniques include One-Dimension Carbon Fibre Composite (1D-CFC) calorimeters, Tungsten Wire Calorimeters (TWC), Beam Emission Spectroscopy (BES), Secondary Electron Detector (SED), and Water Flow Calorimetry (WFC).The main beam parameters, such as beam divergence, homogeneity, and asymmetries, are examined under different operational scenarios, which involve different magnetic filter field setups and source settings. The impact of the magnetic field configuration on the beam homogeneity and asymmetries, as well as the evolution of the beam features, is investigated thoroughly. Meanwhile, the relationship between the beam divergence and source settings is also explored.

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