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IShTAR: a dedicated facility to characterize the interactions between ICRF waves and plasma

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IShTAR (Ion Sheath Test ARrangement) is dedicated to the investigation of the interactions between an ICRF antenna and a plasma in the conditions (plasma temperature and density, magnetic configuration) representative of the plasma edge of a magnetic confinement fusion machine. The test bed is composed of a helicon plasma source and a main vessel, in which a dedicated single strap ICRF antenna is installed.

Firstly, the optimization of the plasma source in order to get the highest density and most radially uniform plasma is presented (by changing of the position of the source and by scanning the operational parameters). In addition, the efficiency of the installed diagnostics (compensated/noncompensated Langmuir probes, B-dot probes, wideband spectrometer) is discussed.

The second part addresses the effect of the ICRF operation on the generated plasma; the wave profiles in vacuum and plasma are recorded. The impact of the eigenmodes due to the small size of the vessel on the wave field at the interface antenna/plasma is evaluated. The effect of the additional ionization on the density profile is also measured with the spatial variation of the plasma potential near and inside the RF sheath in front of the antenna strap.

Finally, the feasibility of a diagnostic to directly measure the electrical field in the sheath by using the change in emission from energy levels modified by Stark effect and mixing is discussed.

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