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DESIGN OF A HIGH RESOLUTION PROBE (HRP) HEAD FOR ELECTROMAGNETIC TURBULENCE INVESTIGATIONS IN W7-X

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Wendelstein 7-X (W7X) is a large, superconducting stellarator with modular coils and an optimized magnetic field.
A multi-purpose manipulator (MPM) system has been developed and installed on the W7-X vessel, aimed at investigating the edge plasmas of the stellarator. It is a flexible tool for integration of a variety of different diagnostics as e. g. electrical probes, probing magnetic coils, material collection, or material exposition probes, and gas injection. The system is designed as user facility for many diagnostics, which can be mounted on a unique interface without breaking the W7-X vacuum. The manipulator system, located in the equatorial plane, transports the inserted diagnostic probe to the edge of the inner vacuum vessel. From there the probe can be moved over a maximum distance of 350 mm to different positions inside the plasma with a maximum acceleration and deceleration of 30 m/s2.

In the framework of the EUROfusion S1 work program for the preparation and exploitation of W7-X campaigns, a diagnostic insertable probe head called HRP (High Resolution Probe) was developed by Consorzio RFX in collaboration with IPP Greifswald, to study the electrostatic and electromagnetic features of turbulence in the edge region of W7-X using the MPM. In particular the aim of the HRP head is to provide information on parallel current density associated to L-mode filamentary turbulent structures as well as on ELMy structures in H-mode. Furthermore the possibility to measure the time evolution of radial profiles of flow was considered as a further interesting part of the study, given the strong interplay expected between the turbulent fluctuation and the average flows.

The paper reports the design development of the HRP head, from the choice of the sensors to the engineering design. The assumptions and evaluations supporting the main design choices, together with the R&D tests carried out to check the most critical parts, are described in detail.

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Eligible for student paper award?

No

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