**Feasibility study of a Coherence Imaging Charge Exchange Recombination Spectroscopy diagnostic for Wendelstein 7-X**

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A feasibility study of a Coherence Imaging Charge Exchange Recombination Spectroscopy (CICERS) diagnostic has been carried out for the Wendelstein 7-X stellarator (W7-X). This diagnostic, based on Coherence Imaging Spectroscopy (CIS) [1] and Charge Exchange Recombination Spectroscopy [2], is expected to measure charge exchange radiation of the main impurity species present in the plasma. The spectral information of the radiation is encoded in a 2D fringe pattern, which is generated by birefringent plates, in order to obtain 2D maps of relevant impurity ion parameters such as rotation velocity, temperature and density after a demodulation procedure is applied to the fringe pattern.

A synthetic diagnostic has been developed, which enables the optimization of the design and components of the system, based on the already existing CIS diagnostic in W7-X [3], the latter optimized for impurity flow measurements from passive lines in the edge of the plasma. The CICERS system has been set up and characterized in the laboratory, finding good agreement in its behaviour when compared to the simulation results. This also increases the confidence of using the synthetic simulations in the calibration process of the diagnostic, which will be routinely calibrated with a laser before and after every measurement [4].

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[2] R. J. Fonck 1985 *Rev. Sci. Instrum.* **56** 855

[3] V. Perseo et al 2020 *Rev. Sci. Instrum.* **91** 013501

[4] D. Gradic et al 2019 *Fusion Eng. Des.* **146** 995–998