STATUS, PROSPECTS, AND BENCHMARKING OF THE MINERVA BAYESIAN MODELING FRAMEWORK AT WENDELSTEIN 7-X

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Abstract

Over the last years, Bayesian Analysis became a standard method in plasma physics for a common plasma parameter profile determination and mathematical correct error analysis [1-3], evaluating data measured by various diagnostics.

This paper gives an overview of established as well as recently deployed physics models within the Minerva Bayesian analysis framework [2] for a wide range of different diagnostics operated at Wendelstein 7-X, such as two X-ray imaging spectrometers (XICS) [4], a charge exchange recombination spectroscopy diagnostic (CXRS) [5], an X-ray tomography system (XMCTS) [6,7], a Thomson scattering (TS) [8], an electron cyclotron emission (ECE) [9], and an effective charge measurement (Zeff) [10] diagnostic.

Upon individual examples, benchmarking of evaluated plasma parameters in cross comparison for different diagnostics, e.g. T_e , T_i , and n_{Ar} observed with XICS, CXRS, and TS will be discussed as well as prospects for the application of artificial neural networks for fast data analysis of complex physics models.

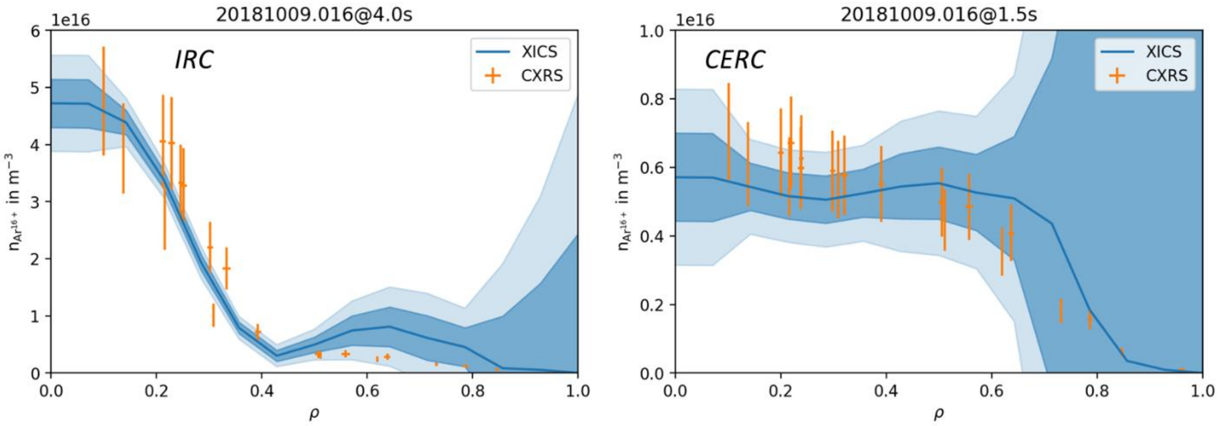

Fig.1: Benchmarking of XICS and CXRS diagnostics for impurity density profile (n_{Ar}^{16+}) peaking vs. flat density profile in the two different confinement scenarios, ion root (IRC) and core electron root (CERC) confinement observed at W7-X. Errors are shown for one standard deviation, 1σ, in bars and dark blue, 2σ in light blue.

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