Contribution ID: **35** Type: **Oral (Invited)**

Applications of Bayesian data analysis at W7-X stellarator

Thursday 11 September 2025 13:30 (30 minutes)

Wendelstein 7-X (W7-X) is a superconducting optimized stellarator built in Greifswald/Germany which started its first operation with limiter plasmas in 2015. Since 2022 it is being operated with fully water-cooled first wall components including high heat flux graphite divertors, allowing quasi steady-state plasma operation. Approx. 50 diagnostic systems are applied to get insights into the physics phenomena of the intrinsically 3D shaped stellarator plasma. Analysis of large amount of data provided by various types of diagnostics/sensors sampling the plasma at different positions poses a big challenge in many modern large-scale nuclear fusion experiments. This complexity can be handled by application of probabilistic data analysis methods based on the Bayes'theorem in which all statistical and systematic uncertainties of the diagnostic setup itself, of the model parameters as well as interdependencies of global physics parameters can be incorporated providing reliable uncertainties of the inferred quantities as well as correlations between them. Several W7-X diagnostic models have been implemented in the Minerva scientific modelling framework. A few newer applications based on spectroscopic measurements will be presented, for example tomographic reconstruction of 2D impurity radiation profiles in the W7-X divertor plasma [1].

[1] M. Krychowiak et al., Gaussian Process Tomography of carbon radiation in the transition to detached plasmas in the Wendelstein 7-X stellarator, Proceedings of EPS conference 2021

Speaker's email address

cak@ipp.mpg.de

Speaker's Affiliation

Max-Planck-Institute for Plasma Physics, Greifswald, Germany

Member State or International Organizations

Germany

Author: KRYCHOWIAK, Maciej (Max-Planck-Institute for Plasma Physics)

Co-authors: GRADIC, Dorothea (Max-Planck-Institute for Plasma Physics); HENKE, Frederik (Max-Planck--Institute for Plasma Physics); SVENSSON, Jakob (Seed eScience Ltd); KWAK, Sehyun (Max-Planck-Institute for Plasma Physics); SEREDA, Stepan (Max-Planck-Institute for Plasma Physics)

Presenter: KRYCHOWIAK, Maciej (Max-Planck-Institute for Plasma Physics)

Session Classification: Sensor Fusion and Integrated Data Analysis

Track Classification: Sensor Fusion and Integrated Data Analysis