**Overview of Bayesian plasma diagnostic modelling at W7-X**

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Scientific data analysis in a large-scale modern nuclear fusion experiment is a formidable challenge. Extracting information on the fusion plasma from a few hundred plasma diagnostics requires the capability of modelling not only individual diagnostics but also interdependencies between global physics parameters and heterogeneous measurements from different diagnostics. This work demonstrates a well-established method of delivering consistent inference of physics parameters by modelling diagnostics and their interdependencies within the Minerva scientific modelling framework. A number of applications from consistent profile inferences accounting for multiple diagnostic data to advanced tomographic techniques for the bolometers, soft-X ray and bremsstrahlung diagnostics at Wendelstein 7-X are presented. Furthermore, these Minerva applications can be accelerated by deep learning surrogate models for real-time inferences.

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