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Bayesian equilibrium inference in the Minerva framework JAKOB SVENSSON, OLIVER FORD, Max-Planck-Institut fr Plasmaphysik, Teilinstitut Greifswald, D-17491 Greifswald, Germany, SEHYUN KWAK, Department of Nuclear and Quantum Engineering, KAIST, Daejeon 34141, Korea, LYNTON APPEL, 3CCFE, Culham Science Centre, Abingdon OX14 3DB, United Kingdom, KIAN RAHBARNIA, JOACHIM GEIGER, JONATHAN SCHILLING, Max-Planck-Institut fr Plasmaphysik, Teilinstitut Greifswald, D-17491 Greifswald, Germany — The Minerva framework is a scientific modelling system based on Bayesian forward modelling and is used at a number of experiments. The structure of the framework makes it possible to combine flux function based, axisymmetric or full 3D models. A general modularity approach makes it easy to replace underlying physics models, such as the model for force balance and corresponding current distribution. We will give an overview of the different models within Minerva for inference of equilibrium field and flux surfaces, for both tokamaks and stellarators. For axisymmetric devices, three methods of increasing complexity, Gaussian process based Current Tomography (CT), an iterative Grad-Shafranov solver, and a full nonlinear Grad-Shafranov based model, will be demonstrated for the JET device. The novel nonlinear Grad-Sharanov model defines a proper posterior distribution for the equilibrium problem thus defines the space of possible equilibrium solutions, and has the capacity to include any nonlinear constraints (e.g. from models of profile diagnostics). The Bayesian approach further allows uncertainties on the equilibrium parameters to be calculated. For the W7-X stellarator, two models based on the VMEC 3D solver and a fast function parameterization approximation will be demonstrated.

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