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Model Data Fusion: developing Bayesian inversion to constrain equilibrium and stability theory[1] MATTHEW HOLE, Australian National University, J. SVENSSON, Max-Planck-Institute for Plasmaphysics, L.C. APPEL, Euratom/UKAEA Fusion, G. VON NESSI, R.L. DEWAR, J. BERTRAM, B.D. BLACKWELL, J. HOWARD, Australian National University — Recently, a new probabilistic "data fusion" framework based on Bayesian principles has been developed on JET and W7-AS. The Bayesian analysis framework folds in uncertainties and interdependencies in the diagnostic data and signal forward-models, together with prior knowledge of the state of the plasma, to yield predictions of internal magnetic structure. A feature of the framework, known as Minerva (J. Svensson, A. Werner, Plasma Physics and Controlled Fusion 50, 085022, 2008), is the inference of magnetic flux surfaces without the use of a force balance model. We discuss results from a new project to develop Bayesian inversion tools that aim to (1) distinguish between competing equilibrium theories, which capture different physics, using the MAST spherical tokamak; and (2) test the predictions of MHD theory, particularly mode structure, using the H-1 Heliac. A novel spin-off application is development of a Tikhonov cross- validation method, that sequentially removes "anomalous" diagnostic data until the change in the inferred toroidal current is minimised.

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