Current Distribution Inference from MSE coherence imaging using Bayesian Tomography

O. P. Ford[a], J. Howard[b], R. Wolf[a], J. Svensson[a]

a Max-Planck Institut für Plasmaphysik, Greifswald, Germany
b Plasma Research Laboratory, Australian National University, Canberra

e-mail address: ishw@oliford.co.uk

The recent development of the Imaging Motional Stark Effect (IMSE) diagnostic, based on coherence imaging techniques, promises a significant improvement in the knowledge of internal plasma current in fusion devices. The capture of a polarisation image brings a large increase in the number of field measurements over traditional multi-channel systems, but also gives field measurements in 2D. The benefits of this extra dimension of information is examined and the possibilities of determining plasma current without the assumption of equilibrium is investigated using Bayesian Techniques.

A detailed forward model has been produced for an IMSE system under development for the ASDEX Upgrade Tokamak. Realistic generated images are used in a tomographic reconstruction of plasma current, demonstrating that sufficient information is available to infer 2D plasma current maps assuming little more than axisymmetry.

The more complex situation for Stellerators is then investigated, where axisymmetry cannot be assumed. The IMSE forward model is configured for a hypothetical implementation on the W7X Stellerator, to determine if an IMSE system could be used to distinguish the small plasma induced currents from the vacuum field.