Bayesian soft X-ray Tomography on Tore Supra and WEST

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Gaussian Process Tomography (GPT) [1] is a recently developed tomography method based on Bayesian probability theory. This method has been applied to many nuclear fusion diagnostics, for example soft X-ray diagnostics in [2]. By modeling the SXR emissivity field in a poloidal cross-section as a Gaussian process, Bayesian SXR tomography can be carried out in a robust and extremely fast way. Owing to the short execution time of the algorithm, it is an important candidate for providing real-time information on impurity transport and for fast MHD control. In addition, the Bayesian formalism allows quantifying the uncertainty on various profile parameters.

In this paper, Gaussian process tomography is validated using a synthetic data set and results are shown of its application to the reconstruction of SXR emissivity profiles on the Tore Supra and WEST tokamak. The method is compared with the classical algorithm based on minimization of the Fisher information, in terms of accuracy, robustness and computational load.

Keywords:

Soft X-ray diagnostic, tomography, Bayesian probability theory, Gaussian processes

Reference:

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