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12.51 Incorporating magnetic equilibrium information in Gaussian process tomography for soft X-ray spectroscopy at WEST

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Gaussian process tomography (GPT) is a recently developed tomography method within the Bayesian probability framework, applied earlier to soft X-ray (SXR) spectroscopy in the W7-AS. By modeling the SXR emissivity field in a poloidal cross-section as a Gaussian process (GP), the reconstruction can be carried out in a robust and extremely fast way. Owing to the short execution time of the algorithm, GPT 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 the inferred parameters. Remarkably, GPT has shown its flexibility by providing good reconstruction results without background information about the magnetic equilibrium. Meanwhile, information about the magnetic flux surface geometry can be useful for additional regularization of the solution. In this paper, we developed a way to take into account the equilibrium information, by constructing a covariance matrix of the prior GP depending on the flux surface geometry. The GPT method is validated using synthetic SXR emissivity profiles relevant to WEST plasmas, and compares favorably with the classical algorithm based on minimization of the Fisher information.

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