

Latest Developments of the Maximum Likelihood Approach to Tomography for both Offline and Real Time Investigation of the Total Emission of Radiation

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Quantification of the total emitted radiation is essential for the understanding and control of magnetic confinement plasmas. Its relevance is going to increase in the next generation of metallic devices that will have to operate at very high radiated fractions. The local emission from the bolometric integrated measurements is obtained with sophisticated tomographic algorithms. The layout of the diagnostics and the radiation patterns encountered in practice typically require solving very ill-posed inversion problems. The maximum likelihood tomography is one of the most advanced inversion methods and in this contribution the latest developments of the technique are presented. Firstly, the computational times are reduced of orders of magnitude by a matrix formulation of the problem, rendering the approach suitable for real-time feedback control. Secondly an adaptive procedure autonomously adjust the filtering to the radiation patterns, eliminating the need for human tuning of the hyperparameters and improving the capability of the technique to discover unexpected radiation patterns. Finally, the error estimation, a specific competitive advantage of the technique, is improved and validated with systematic Monte Carlo simulations. The performances of the new versions of the algorithms are compared with those of other methods reported in the literature with both synthetic and experimental data. The potential of the new improvements is substantiated by the analysis of the emitted radiation in phenomena such as MARFE, temperature hollowness and detachment in JET with a metallic wall.

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