Development and comparative tests of tomography at JET

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Plasma tomography retrieves spatial distribution of plasma emissivity from data on the emissivity projections. In fusion research diagnostics, data on the projections are typically sparse, making the task underdetermined. Besides, the procedure of tomography inversion is ill-posed by nature. Therefore, high precision of data, a robust inversion algorithm and sufficient set of a-priori information and constraints are required, e.g. in a form of penalisation of complexity of the spatial distribution.

At Joint European Torus (JET) efforts have been invested into benchmarking of present tomographic algorithms and their integration into analyses of soft X-ray (SXR) data, bolometric data and neutron data. In our contribution, the strategy and work progress shall be exemplified and detailed on the recent development of the Minimum Fisher Regularisation (MFR) tomographic code. The MFR code is based on Tikhonov regularisation, which makes the inversion robust and relatively modest on CPU time. The latter advantage makes the code suitable for emissivity evolution studies and Monte Carlo error analyses. The upgraded MFR code has been optimised in Python and includes advanced constraint on magnetic field configuration. As a new feature, it can directly compare the three different diagnostic data and determine evolution of total radiation from a pre-defined region.

Recent results of the MFR code shall be compared to results of Bayesian and neural network approaches to tomography following a brief explanatory note. A particular attention will be given to the challenging analyses of bolometric data. Importance of data reliability will be emphasized. Potential of tomography for its future integration into data analyses at fusion reactors including ITER, as well as its foreseen applications in real-time data analyses and extension to other data inversion tasks will be discussed.