Investigating the thermal stability of highly radiative discharges on JET with a new tomographic method

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Abstract:

The next generation of Tokamak devices is expected to work at very high radiated fractions, well above 90%, to preserve the integrity of the plasma facing components in general and the divertor in particular. In addition to maintaining high confinement, these configurations will also have to guarantee a low disruptivity. An accurate determination of the emitted radiation will therefore become increasingly important, not only for the global power balances but also for specific regions of the plasma cross section (for example to properly control detachment). In this perspective, a new tomographic inversion method, based on the maximum likelihood (ML) approach, capable of providing routinely confidence intervals in the estimates of the radiated power, has been applied to the investigation of high radiative discharges on JET with the ITER like wall (ILW). The emission has been increased with injection of extrinsic impurities. Taking into account all the major sources of uncertainties, a systematic analysis of the configurations has shown that it has not been possible to develop stable configurations with radiated fraction higher than 70% of the input power. At higher radiated fractions the discharges always disrupt. Therefore significant work remains to be done to extend JET operation in a reactor relevant regime of sufficient radiation in preparation for ITER and DEMO.