

JET New Diagnostic Capability on the route to ITER

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The JET mission is now aimed at developing plasma scenarios and testing technologies for ITER. Recent JET diagnostics upgrades have been mainly driven by the needs of scenario developments but, in direct support to ITER, several new “burning plasma” diagnostics and specific materials for radiation hard detectors are being developed.

Diagnostic enhancements, to support ITER scenario development on JET, have concentrated mainly on improved profile determination, better measurement of the plasma wall interactions as well as real-time control of key plasma parameters. Better diagnosis of the plasma profiles is attempted with the implementation of a new High Resolution Thomson Scattering (HRTS) system. Improved density profiles are obtained from an innovative sweeping reflectometer, taking advantage of new low losses corrugated waveguides. Several upgrades of the existing LIDAR systems and the ECE radiometers have improved the range and quality of these measurements. New, innovative detectors, like the quartz microbalance and the rotating collector, have been installed inside the vacuum vessel to investigate erosion and redeposition. A new infrared wide-angle camera is specifically devoted to the study of power loads on the machine first wall. In addition, the integration of many new diagnostics into the JET real-time control system extends the relevance from the ITER perspective. Now all the main plasma parameters are routinely available in real time, allowing an ambitious range of feedback experiments.

JET offers also a unique environment for the development and testing of relevant “burning plasma” diagnostics. New techniques to measure the slowing down of the fast particles, based on gamma-ray and EUV spectroscopy, have been devised and developed. A coherent set of neutron diagnostic upgrades, ranging from neutron counting and calibration to spectrometry was undertaken. Specific technological developments for ITER on JET include radiation-hard compact detectors for neutron counting and spectrometry and improved electronics for gamma and neutron detection. These changes bring time resolution, signal-to-noise ratio and a neutron/gamma discrimination levels into a range suitable for ITER. Testing of a ${}^6\text{LiH}$ neutron filter, with the goal of eliminating the neutron background from gamma measurements, to yield information on alpha particles, is of direct interest to ITER as is the testing of radiation-hard hall probes.