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Implementation and exploitation of jet enhancements in preparation for dt operation and next step devices

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JET presents some unique capabilities: the reactor fuel, ITER wall materials and the capability to confine the alphas. JET next T-T and D-T experimental campaigns can therefore address major physics and technological gaps for the development of fusion energy: the isotopic effects on confinement, the access the H mode and ELM behaviour. The total yield of the final D-T phase is expected to be 1013 n/s·cm2, a factor of six higher than the previous DTE1. In this context, three main aspects of JET capability have been recently improved: 1) scenario development to enhance performance 2) the quality of the measurements to maximize the scientific exploitation 3) specific technologies for ITER and DEMO.
With regard to the scenarios, the performances of JET with a carbon wall have been reproduced up to a current of 3 MA, which supports the prediction of 15 MW fusion power in full DT. Moreover improved control systems (wall load protection, simultaneous control of ELM frequency and beta, plasma mixture) insure that the plasma configurations are compatible with the wall properties, from melting to retention and dust production.
In terms of general diagnostic capability, JET can now deploy much better resolution diagnostics, particularly for the edge quantities, and a consistent set of techniques to diagnose the fast particles, from redistribution to losses, using techniques ranging from gamma ray spectroscopy to a scintillator probe and Faraday cups. A full calibration of the neutron diagnostics for the 14 MeV neutrons has just been completed successfully.
With regard to ITER and DEMO relevant technologies, specific programmes are being pursued to investigate: the radiation field, the induced activity and dose rates and the radiation damage of materials. Dedicated studies for DEMO, including the tests of a new tritium pumping cycle and a tritium breeding blanket mock-up, are also almost completed.

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