Neon seeded ITER baseline scenario experiments in JET D and D-T plasmas

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Compatibility between plasma performance and a solution to the heat exhaust via extrinsic impurity radiation to avoid damage to the plasma facing components is of paramount importance for the ITER full power operation. This core-edge integration has been successfully demonstrated in a JET experiment for the first time at high current with a high-performance neon (Ne) seeded H-mode in 50:50 deuterium-tritium (D-T) with the following plasma parameters; $I_p \approx 3$ MA, $W_p \approx 8$ MJ, $\beta_N \approx 2$, $\delta_{av.} \approx 0.35$, $f_{GW} \approx 0.62$, $f_{rad} \approx 0.8$, $T_{e,ped} \approx 1$ keV, $T_{i,ped} \approx 1.4\times T_{e,ped}$, $n_{e,ped} \approx 4.7\times10^{19}$ m^{-3}, $q_{95} \approx 2.7$, $C_{ne} \approx 1\%$, $P_{in} \approx 35$ MW. This was performed in the context of the multi-year JET effort devoted to ITER baseline seeded scenario development at high triangularity with both strike points on the vertical targets and with a divertor in high recycling regime. This D-T plasma showed no signs of tungsten accumulation and was held stationary for more than 6.5s with respect to the main plasma parameters including core radiation.

At the highest D-T gas rate, a high performance, no-ELM scenario was also obtained with a fully detached divertor ($W_p \approx 7$ MJ, $\beta_N \approx 1.8$, $f_{GW} \approx 0.77$, $f_{rad} \approx 0.9$, $T_{e,ped} \approx T_{i,ped} \approx 0.75$ keV, $n_{e,ped} \approx 5.2\times10^{19}$ m^{-3}, $q_{95} \approx 2.7$, $P_{in} \approx 35$ MW). This is a significant step forward in demonstrating that the expected conditions of an integrated equivalent scenario in ITER can be achieved. It also provides an important experimental target for the validation of the assumptions used in simulations of the ITER $Q_{DT} = 10$ scenario from the point of view of both divertor/edge and integrated modelling.

These results were obtained following a significant dedicated scenario development effort in D and D-T plasmas, with parameter scans in plasma current, I_p = [2.5, 3, 3.2] MA at different q95 and for wide variations in fuelling and impurity seeding rates. These scans provide information on the operational space over which Ne seeding can achieve improved confinement, combined with acceptable heat exhaust and with small to no ELMs.