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Towards Baseline Operation Integrating ITER-Relevant Core and Edge Plasma within the Constraint of the ITER-like Wall at JET

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The reference scenario for achieving Q=10 in ITER is an integrated type-I ELMy H-mode scenario that combines good core plasma performance of H_98_(y,2)˜1,□beta_N ˜1.8, <n>/nGW ˜0.85, and high fuel purity (Z_eff˜1.6), together with edge parameters compatible with the Be/W Plasma Facing Components (PFCs) in stationary conditions for t_stat˜400s (i.e. 100 times the energy confinement time tau□E). With extrinsic impurity radiation, the power flowing through the separatrix can be reduced such that only 5% reaches the divertor target plate between ELMs. Previously, it was reported that the fuelled JET ELMy H-mode plasmas with I_p=2.5MA, B_T=2.7T, q_95˜3.3, P_nbi ˜18MW, at high triangularity (delta˜0.4) had a pedestal pressure reduced by 40% with the change of PFCs from carbon (JET-C) to Be/W (JET-ILW). In these plasmas with horizontal target divertor geometry, N-seeding partially recovered the pedestal pressure loss. Good plasma performance, close the ITER requirements, was achieved but plasma conditions were not stationary (t_stat/tau□E˜ 6) due to the loss of sawtooth activity. Here, new experiments are reported where higher ICRH heating power was used to control the plasma core. This paper shows how the operational space for the integrated scenario has been expanded to: i) stationary plasma conditions ii) at lower <n>/nGW and iii) plasmas with different divertor geometries. The increased pedestal pressure in JET-ILW with N-seeding is confirmed to be dependent on plasma triangularity and effect is strongest for high-delta□plasma (40%) than for low-delta plasmas (15%). Plasmas with vertical target divertor geometry provide better control of the pedestal density and W contamination of the confined plasma than with a horizontal target configuration whilst maintaining good core performance of high-delta N-seeded plasmas. Stationary ELMy H-mode were obtained achieving plasma conditions of H_98_(y,2)˜0.85, beta□N ˜1.6, <n>/nGW ˜0.85, Z_eff˜1.6, f_rad˜0.55, P_RF˜3MW with low divertor target power load and partial detachment between ELMs for 7s — an increase of t_stat/tau□E from previous value of ˜6 to ˜28.

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