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Numerical simulation of high neutron rate JET-ILW DD pulses in view of extension to DT experiments

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This paper is focused on the simulation of JET ELMy H-mode pulses pertaining to the baseline scenario with medium-high electron density, n_e, and auxiliary power, P_aux, in excess of 30 MW. The auxiliary heating is provided mostly by NBI, while ICRF heating does not exceed 5 MW. We have considered two pulses (Ip=3 MA, Bt= 2.8 T) at n_e = 6.5-7x10^19 m^-3 which show very high neutron rates and are characterized by Ti/Te >1 with T_e(0) about 7 KeV. The density was provided either by pellet injection or by gas puffing. The thermal stored energy is 8.1-8.7 MJ, the temperature at the plate, T_e,pl, is 25-35 eV and the total power to the target is 15-17 MW. These pulses are slightly Ne seeded (c_Ne about 0.2 %) with radiated power fraction, f_rad= 0.40. Once the simulations of the experimental pulses have been established, extrapolation to DT plasmas has been done, keeping unchanged the code inputs. We have used the COREDIV code, self-consistent with respect to the core-SOL as well as to impurities-main plasma. In spite of some simplifications, the exchange of information between the core (1D) and the SOL (2D) module renders this code quite useful when, as in the case of the JET ILW, the interaction SOL-core is crucial.
Extrapolation to DT plasmas depends on the assumptions for tau*_He/tau_E and for the impurity species considered. Although the DT simulations are ongoing, some comments can be made at this stage. Keeping in the DT simulations n_e and P_aux at the same level as in the corresponding experimental pulses the resulting P_alpha is between 0.7 and 1.1 MW, depending on the assumptions made, with practically unchanged T_e,pl and power to the target. Increasing P_aux to 41 MW, P_alpha increases only slightly while the power to the plate is 27 MW with T_e,pl = 70 eV.
Recalling that in our simulations only P_alpha arising from thermal reactions is accounted for, these preliminary results indicate that strike point sweeping might not be sufficient to control the heat load to target plates at peak plasma performance for 5 s and additional impurity seeding might be necessary.
As next step, Ip will be increased to 4 MA, keeping unchanged either n_e or n_e /n_Gw.

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