Predictive integrated modelling simulations in preparation of the JET Deuterium-Tritium campaign

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The main objective of the future JET tokamak experimental campaigns is to prepare the future D-T scenarios of JET and ITER. Together with these experiments an important effort in modelling is needed to be able to test and improve the predictive capability of integrated modelling tools for D-T burning plasmas. Alpha particles along with isotope effects [1] on plasma confinement need to be further studied and understood. A particular topic of interest is the validity of first principle models for predicting turbulence in D-T conditions. Therefore, a significant effort towards that direction is required by analysing the physics of extrapolated D-T plasmas. Weakness of the models can be mitigated by proposing experiments specifically designed to improve such predictive capabilities in plasmas different than D, for instance in the future T campaign.

To help in the present modelling effort of D-T tokamak plasmas we have carried out integrated modelling simulations with the CRONOS code [2] using GLF23 [3], TGLF [4] and QuaLiKiz [5] turbulence transport models. A baseline JET shot (92436) has been extrapolated to higher power and D-T plasma conditions. This shot has been chosen because it is one with the highest neutron rate yield from the last campaign. In the present study we have carried out simulations varying the injected NBI power, first in deuterium and then in D-T plasmas. A scan in plasma current and in toroidal rotation velocity is performed. The results show the improvement of the plasma confinement with increasing toroidal rotation and the decrease of transport for D-T plasmas in some particular plasma regions (inner core and edge) compared to pure deuterium. The fusion power calculated from the different D-T plasmas simulations range between 13 and 16 MW for 41 MW of total injected power (6 MW of ICRH and 35 MW of NBI).

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