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Overview of the JET results in support to ITER

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The JET contributors

Europe has elaborated a Roadmap to the realisation of fusion energy in which 'ITER is the key facility and its success is the most important overarching objective of the programme'. We review the contribution of the recent JET experiments with the ITER first wall materials mix, and, the underlying physics understanding to mitigate the scientific risks identified in the ITER research plan. Indeed, together with the ITER scenario development, a strong focus on JET is pursued for addressing ITER needs and developing a sound physics basis for the extrapolation through first principle and integrated modelling: plasma wall interaction, disruption mitigation (installation of a third mitigation valve), H mode access, W-control with higher electron heating (ICRH ITER-like antenna re-instated), pellet ELMs pacing with the optimised vertical high field side track. The JET ITER-Like Wall experiment provides an insight in the coupling between tokamak-plasma operation and plasma-surface interaction in the unique Be/W material environment and acts as test-bed to verify models and modelling tools for ITER. Disruptions are considered as the highest programmatic risk in the ITER Research Plan and experimental and modelling effort in Europe and JET are reviewed. High spatial resolution Doppler backscattering measurements have revealed novel insights into the development of the edge transport barrier. The operational constraints of a metal wall can prevent reaching plasma energy confinement required for QD-T=10 on ITER. Progress on JET to mitigate this risk is reported aiming at maximizing the core and pedestal performance in stationary condition with the W divertor constrain. The measured D-D neutron fluence and gamma dose rates have been successfully compared with simulations performed with the codes used for ITER nuclear safety analyses. Finally, the benefit to further use JET beyond 2020 to train the international ITER team with an upgrade tungsten divertor and with the ITER control tools will be discussed.

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