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P5.1083 The role of the edge barrier in the penetration of impurities in the JET ELMy H-mode plasmas

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Increasing the heating power in both baseline and hybrid JET H-mode scenarios modifies the edge kinetic profiles in a way that progressively reduces the neoclassical inward velocity of impurities [1]. Along this path JET approaches the situation expected in ITER where heavy impurities should be repelled at the H mode barrier by a strong neoclassical barrier associated with a "favorable" combination of density and ion temperature profiles. Such finding has motivated the extension of the impurity modeling activities of the core to the edge [2], in the direction of an integrated core-edge description of the impurity behavior that incorporates the way medium and high Z impurities penetrate into the plasma core of JET as ELM frequency and heating power vary. Full predictive modeling includes simulations by means of integrated JETTO-SANCO-Edge2D, available in the JINTRAC suite of codes [3], with two impurities (Ne, W). Modeling has focused on the simulation of a high power (32 MW) "hybrid" discharge in which traces of Ne have been puffed for diagnostic purposes, in particular to provide ELM resolved Ne density profiles in the edge barrier region. The EDWM model [4] for the turbulent transport in the core and NCLASS for the neoclassical transport have been adopted. For the ELM description we have assumed a heuristic model with either ad hoc enhancements of heat and particle diffusivities or an ad hoc burst of the outward radial velocity in the barrier. In this way the impact of convective versus diffusive transport during an ELM event has also been investigated. Transport in the barrier region outside the ELM event is also described heuristically imposing neoclassical transport and an ad hoc turbulent transport multiplier. The ELM frequency has been artificially varied in order to replicate the experimental evidence according to which an increased main gas fueling leads to an increase of the ELM frequency and to a decrease of the concentration of any type of impurities. The paper presents the results of ELM frequency and density scan and a comparison with JETTO-SANCO core only simulations featuring QualiKiz [5] and NEO [6] for turbulent and Neoclassicla transport respectively.
[1] Valisa M et al Proc. 44th EPS Conf.2017 http://ocs.ciemat.es/EPS2017PAP/pdf/P4.174.pdf [2] F Koechl et al Pl. Phys. Contr. Fus. 60, (2018) [3] Romanelli M et al Plasma Fusion Res. 9, 3403023. [4] Strand P I et al 31th EPS Conf. , London 2004, EPS(2004), Vol. 28. [5] Bourdelle C et al Phys Pl. 14 112501(2017) [6] E. A. Belli and J. Candy, Pl Phys. Contr. Fus, 50 (2008), 1, (2009) 75018; c) Plasma Phys. Control. Fusion, 54 2012), 15015 ____
*See the author list of "Overview of the JET preparation for Deuterium-Tritium Operation" by E. Joffrin et al. to be publ. in Nuclear Fusion Special issue: overview and summary reports from the 27th Fusion Energy Conference (Ahmedabad, India, 22-27 October 2018)

Presenter: VALISA, M. (EPS 2019)

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