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Integrated Simulations of H-mode Operation in ITER including Core Fuelling, Divertor Detachment and ELM Control

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ELM mitigation for divertor protection is one of the main factors affecting plasma fuelling and detachment control at full current operation. Here we derive the scaling for the operational space, where the ELM mitigation for divertor protection is not required and parameters of ELM-pacing pellet injection are determined by the tungsten control. The scaling eliminates the uncertainty connected with the ELM affected area and enables definition of the operational space through global plasma parameters. It is based on the empirical scaling for ELM power load, and pedestal height based on the stability code predictions. The analysis revealed that in particular for the pedestal height, predicted by EPED1+SOLPS scaling, the ELM mitigation for divertor protection is not required in a rather wide range of plasma currents, Ip,max < 7.5-15 MA. The pellet and gas fuelling requirements compatible with control of plasma detachment, tungsten accumulation and the H-mode operation are assessed by 1.5D transport simulations for full tungsten redeposition and for the most conservative assumption of zero redeposition. The tungsten influx as a function of the ELM frequency is derived on the basis of consistent core-divertor simulations.

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