PFPO plasma scenarios for exploration of long pulse operation in ITER

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Long Pulse Scenarios (LPS) in ITER at Pre-Fusion Power Operation (PFPO), foreseen in the ITER Research Plan (IRP) [1], are assessed using 1.5D transport simulations within the ASTRA framework [2]. Such assessment is required to predict the operational space for LPS operation in PFPO, as well as to estimate which physics processes for LPS operation at Fusion Power Operation (FPO) could be validated at PFPO. An important issue is to minimize lifetime consumption of the Central Solenoid (CS). Therefore, the maximum pulse length achievable in PFPO with no consumption of CS lifetime ($I_{CS} \leq 30$ kA) has been assessed showing that H-mode operation at 5 MA and 7.5 MA could provide LPS with a duration in excess of 1000 s. The operational space of such H-modes has been explored through density and power scans to determine the operational space with H&CD mix suggested for steady state phase of ITER operation [3] with acceptable NBI and ECH shine through loss (with the ECH calculated by OGRAY code [4]). For 7.5 MA/2.65 T plasmas weak reversed shear configuration with a high fraction of suprathermal ions, as expected in DT steady state ITER scenarios [3], can be obtained at PFPO between the sawteeth. The MHD stability was assessed with KINX [5] and TAE stability with NOVA-K [6] codes for half-field, B/Ip=2.65/7.5 T/MA, and third field, B/Ip= 1.8/5 T/MA, PFPO scenarios in L-mode and H-mode operations and compared with those at steady- state operation in DT [3].

References

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