

P5.1010 ITER 15 MA DT scenarios with maximum expansion of poloidal magnetic flux on divertor target plates

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See full abstract here:

<http://ocs.ciemat.es/EPS2019ABS/pdf/P5.1010.pdf>

An increase of the poloidal flux expansion near the divertor target plates reduces the heat flux on the plates. A study has been performed with the goal to design and simulate with the DINA code [1] an ITER 15 MA DT scenario ($Q = 10$, $P_{fus} = 500$ MW) with a plasma configuration during the burn having a maximum expansion of the poloidal magnetic flux on the divertor vertical plates. A new feedback controller was designed with the purpose of feedback control (during the plasma current flattop) of the distance between the separatrix and “1 cm SOL” near the outer target plate (Δ_{out}), simultaneously with feedback control of the nominal set of plasma parameters (six plasma-wall “gaps” and plasma current). To obtain the maximum value of the parameter Δ_{out} , the target value of this parameter used in the feedback control was increased until the current in the PF4 coil hits the design limit (55 kA). Feedback control of the distance between the inner (with lower X-point) and outer (with upper X-point) separatrices in the plasma outboard region was also performed at the plasma current flattop with the target minimum value of 4.5 cm.

In the scenario considered, relative to scenarios with the nominal magnetic configuration, the values of Δ_{out} and Δ_{in} (the distance between the separatrix and “1 cm SOL” near the inner divertor target plate) are increased during the plasma current flattop by about 80% and 40%, respectively. The heat fluxes on the divertor vertical plates are reduced correspondingly. However, the poloidal flux expansion requires a higher value of current in the CS1 coils than that in the nominal scenarios. This leads to a decrease of the burn duration (limited by the maximum current in these coils). In the scenario with the fast plasma current ramp-up (during 50 s, limited by the allowable value of the magnetic field on the PF6 conductor of 6.4 T), the duration of burn is about 386 s (taking into account 1 MA of current driven by NBI).

[1] R.R. Khayrutdinov and V.E. Lukash. *Journal of Comp. Physics*, 107(2), 106 (1993)

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