Investigation of operational space of KSTAR with new actively cooled tungsten divertor using SOLPS-ITER code package

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Gradual upgrade of heating & current drive (H&CD) system and actively cooled tungsten divertor of KSTAR, aiming to achieve the final goal of 300-sec long pulse steady state H-mode discharges is on the way. The total input power of H&CD of KSTAR will reach up to 24 MW with plasma current up to 2 MA. For such a high-performance operation, the engineering limits of each component are critical and have to be seriously considered in advance. Especially, the upper limit of the heat flux handling capability of the new tungsten divertor is one of the most important factors to be known.

In order to set the operational space with the new tungsten divertor, the levels of heat flux depending on various operation conditions have to be evaluated. We had estimated the levels of heat flux and its width ($\lambda_q$) based on empirical scaling law and simple model for the first design of the new divertor. However, such a simple estimation is not sufficient to draw any conclusion on the operational space. Full SOLPS-ITER modeling with drift has to be done for possible combinations of operation parameters on KSTAR.

In this study, SOLPS-ITER code package has been employed to investigate operational space of KSTAR with actively cooled new divertor: Toroidal magnetic field ($T_F$) from 1.8 T to 3.5 T, plasma current ($I_P$) from 0.5 MA to 2 MA, input power from 3 MW to 24 MW are scanned and analyzed. The results were compared with that of simple model estimation to improve the design of the divertor and to find possible combinations of operation parameters.