SOLPS simulation of TCV divertor leg length studies

M. Wensing[1], H. De Oliveira[1], B. P. Duval[1], O. Février[1], A. Fil[2], R. Maurizio[1], H. Reimerdes[1], C. Theiler[1], C. K. Tsui[1,3] K. Verhaegh[1,2], M. Wischmeier[4], the EUROfusion MST1 team and the TCV team

[1] *EPFL - Swiss Plasma Center (SPC), Lausanne, Switzerland*

[2] *University of York - Plasma Institute, York, United Kingdom*

[3] *University of California San Diego (UCSD), San Diego, United States*

[4] *Max-Planck-Institut für Plasmaphysik, Garching, Germany*

This contribution uses TCV experiments with varying divertor configurations to investigate the particle and heat cross-field transport within the scrape-off layer, which greatly determines the peak heat flux on the plasma-facing components. The proximity of expected peak heat fluxes to the material limits for ITER raises the necessity of obtaining a quantitative understanding of the mechanisms that determine the heat flux profiles on the divertor plates. Target heat flux profiles are often described by a truncated exponential profile with a decay length λ convoluted with a Gaussian of width S, which are interpreted as broadening due to diffusive transport upstream and in the divertor regions, respectively [1].

The TCV tokamak with its 16 independent poloidal shaping coils provides unique capabilities for studying the effect of divertor geometry on target heat flux profiles and large variations in divertor leg length L_{div}, flux expansion and flux flaring have been achieved. It is, in particular, found that an increase of L_{div} (~ factor 3.5) leads to a somewhat unexpected increase of λ, while having little effect on S [2].

The aim of this study is to reproduce the experimental findings quantitatively using the SOLPS code package. Sensitivity studies on spatially constant transport parameters were performed to match an experimentally well-diagnosed case. It is shown that diffusive transport without spatial dependence fails to reproduce the experimentally observed trends in λ and S, in agreement with earlier studies [3]. Different setups of transport profiles are investigated: in the first case the upstream cross-field transport increases as function of L_{div}, whereas in a second approach the cross-field transport in the divertor is chosen to be radially asymmetric.

References

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