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Self-consistent modelling of the interface between the divertor and the pumping system in DTT

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DTT (Divertor Tokamak Test Facility) is a new facility, currently under build, in which various scaled experiments for testing different magnetic configurations and alternative solutions for the power exhaust system of DEMO will be performed. Although the divertor system is not finalized yet, the machine and port geometry set limitations on the divertor pumping system operational space. In the present work, an in-depth numerical study of neutral gas dynamics in the divertor region is performed based on the Direct Simulation Monte Carlo (DSMC) method by applying the Divertor Gas Simulator (DIVGAS) code, which over the last years has been proved as an efficient numerical tool for the simulation of the particle exhaust of fusion reactors. The information about the neutral particles imposed as boundary conditions on the DIVGAS simulations has been extracted by corresponding plasma simulations (B2-EIRENE). The scope of the present study is twofold. Firstly, to derive information on the particle exhaust fluxes and neutral pressures in the vicinity of the actual pumping opening based on the outcome of the plasma modelling of edge plasma of the DTT at full power in detached conditions, and secondly, to present a self-consistent approach that allows for a coupling between DIVGAS and the plasma code based on a physics basis satisfying the overall particle flux balance. Moreover, the albedo values, which up to now were treated as a free handshake parameter in the plasma modelling, are provided based on real physics strictly linked to the neutral gas dynamics of the sub-divertor area. The presented methodology is general and can be applied for the self-consistent evaluation of the divertor pumping efficiency in any fusion device. Overall, this study demonstrates how to successfully deal with one of the major interfaces between the plasma and the fuel cycle.

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