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P2.1049 Sensitivity analysis of collisional processes in a detached plasma in Magnum-PSI with B2.5-Eunomia

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The realization of fusion energy requires breakthroughs in divertor control to withstand the tremendous heat flux from a burning plasma. One solution is to operate in the detached plasma state. Reaching and controlling this state require better understanding of the underlying mechanisms. By using linear plasma generators, the repetitive rate of discharges is very high, diagnostics are more flexible and with superconducting coils steady-state plasmas are achievable. With the addition of computational modelling, atomic processes can be investigated using data from experiments and then be transferred to more sophisticated tokamak models.
Magnum-PSI[1] can simulate the conditions of ITER divertor, characterized by Te 5 eV and high ion flux 1024 m-2 s-1. Many detached plasmas have been made by increasing the neutral background pressure or injecting impurities in the target vicinity. Energy and ion fluxes are measured to decrease as a function of increasing pressure [2, 3]. In this paper we present the analysis of experimental data with the B2.5-Eunomia[4] fluid-kinetic Monte Carlo code. The first step of the study is to align the model boundaries with experimental data. Quantities such as electron density and temperature profiles near the target are matched with one experimental setting to determine the radial transport parameters. Once these parameters are established, subsequent simulations are run with different neutral pressure settings from the experiment. The decrease of power and ion flux as a function of background neutral pressure are compared with experimental measurements. Having the model results matched the experiments, the simulations are rerun while atomic processes are selectively eliminated to identify power and ion loss channels that lead to the detached plasma state.
References
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