Abstract

Recently, the ITER Organization started developing, distributing, and maintaining SOLPS-ITER as the state-of-the-art numerical tool for edge plasma modelling. In order to be confident about SOLPS-ITER prediction detachment results for future tokamak devices e.g. the EU-DEMO and DTT, SOLPS-ITER modelling of ASDEX Upgrade L-mode detachment discharge is performed.

We first examine the backward compatibility of SOLPS-ITER with SOLPS5.0 and produce a basic test of the physics/numerics improvements/additions in SOLPS-ITER without considering the effect of drifts. SOLPS-ITER simulation results match well SOLPS5.0 results. The remaining differences might be from the ion energy source. An upstream density scan, covering the full range from attached to detached conditions produces closely matching results (∼10% differences). This suggests that the physics/numerics improvements/additions in SOLPS-ITER did not introduce unwanted effects.

Then, SOLPS-ITER modelling of three detachment states (the onset of detachment, the fluctuating detachment sate and the complete detachment) of ASDEX Upgrade are validated against experimental measurement, including electron density n_e and electron temperature T_e profiles at outer mid-plane, particle flux Γ_{ion} and electron temperature T_e profiles at inner and outer targets, electron density in inner divertor volume and neutral flux density at dome and pumping locations. Modelling results shows that the discrepancy of particle flux Γ_{ion} in previous SOLPS5.0 study at inner target are reduced. However, the discrepancy of particle flux Γ_{ion} at outer target in the onset of detachment and fluctuating detachment state still exist. For complete detachment state, SOLPS-ITER modelling results match well with experimental data. The effect of drifts, radial convective velocity and different boundary conditions are discussed. In the future, the modelling of ASDEX Upgrade impurity seeding L-mode discharge will be studied.