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# TH/P4-26: Impact on Divertor Operation of the Pattern of Edge and SOL Flows Induced by Particle Sources and Sinks

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The role of divertors in present device operation is to control particle sources and sinks and consequently the energy flux channels in the boundary region of magnetically confined plasmas. The ESPOIR effort is based on a set of fluid codes from 1-D parallel to 3-D micro-turbulence modelling. Due to the long range particle transport into the SOL governed by intermittent turbulent bursts, the precise location of the particle sources at the wall is required to properly address the screening of the neutral particle influx. To that end we have developed a penalisation technique that extends the simulation domain up to all the plasma facing components of interest. The penalisation technique initiated for particle and momentum sinks has been extended to the temperatures as well as to electric currents. We have used the penalisation technique in 2D simulations of the radial shift of the plasma from the low field side modular limiter to the high field side bumper limiter. Experiments of the kind where achieved in TFTR, JET and Tore Supra to investigate the particle confinement time and particle trapping in the wall. We show that the ballooned transport plays a crucial role in these experiments so that most of the core density drop is reversible. In the divertor configuration, low ionisation sources are shown to govern a supersonic solution. Simulations of such a regime exhibit weak divertor density variation as the core plasma density is ramped up, in agreement with analytical predictions. In the standard divertor regimes, we show analytically that the plasma tends to a supersonic flow when the total plasma pressure is conserved along the field lines. The back transition to the subsonic flow at the plate then takes place at the cross-over between the diffusive heat transport and the convective energy transport. Such behaviour disappears when total plasma pressure losses take place. In the case of very strong divertor screening one finds a Mach number close to zero at the X-point and that the core particle fuelling is governed by the main chamber recycling. In this limit case, we thus model the known bifurcation between the low and high screening SOL and its possible relationship to the H-mode termination and density limit physics. Edge plasma turbulence simulations will also be addressed in conjunction with the effects of volumetric sources and large scale flows.

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