Time dependent boundary conditions (BCs) during ELMs

I. Vasileska[1], D. Tskhakaya[2,3], L. Kos[1]

[1] *Faculty of Mechanical Engineering, University of Ljubljana, 1000 Ljubljana, Slovenia,*

[2] *Institute for Mathematics, University of Innsbruck, Fusion@ÃŰAW, A-6020 Innsbruck Austria,*

[3] *Institute of Plasma Physics of the CAS, Prague, Czech Republic*

Most of the plasma edge studies are focused on the problem of the transition between a hot plasma and a material surface in tokamaks. The wall erosion caused, by the bombardment between the high-energy charged particles and the divertor materials, releases impurities, which migrate towards the bulk plasma and can causes deviation of the parallel transport from the classical one during time [1]. However, the transient heat loads such as ELMs (Edge-Localized modes) occur in tokamak edge during H-mode confinement lead to a significant loss of stored plasma energy. Once the ELM-driven plasma pulse has crossed the magnetic separatrix, it travels mainly parallel to the magnetic field lines and ends up hitting the divertor plate. To keep the limits of the erosion effects, caused by the high-energy neutrals and charged particles, it is important to formulate the boundary conditions (BCs). The BCs and limiting expressions for parallel heat flux and viscosity, and their time dependencies are important tasks for plasma edge tokamaks studies.

Based on the previous work in EPS 2019 [2], where were obtained BCs during ELM-free and Type I ELMs states for a simulated plasma without neutrals, here in this work will be obtained the BCs for a plasma where the neutrals will be added in the kinetic simulations. The kinetic simulations are done under under high performance conditions using the 1D3V electrostatic parallel Particle-in-Cell (PIC) code BIT1 [3]. A typical simulation requires up to 60 days running massively parallel 1152-2304 cores of the EU Marconi super-computer. The duration of the ELM pulse is taken to be between 100-200 μs. In a later stage of the work, these will be used as boundary conditions for calculations of ELM target heat loads using the SOLPS-ITER [4] code.

References

[1] D. Tskhakaya and S. Kuhn, Contrib. Plasma Phys., **44**, 5-6 (564-570), (2004);

[2] I. Vasileska, D. Tskhakaya, L. Kos, 46th EPS Conference on Plasma Physics, **43C**, (P5.3011), (2019);

[3] D. Tskhakaya et al., Plasma Phys. Control. Fusion, **59**, 114001 (19pp), (2017);

[4] X. Bonnin et al., Plasma and Fusion Research, **11**, 1403102, (2016).