Simulations of ITER H-mode scenarios using the new generation of quasi-linear models

B. Baiocchi[1], P. Mantica[1], J.F. Artaud[2], V. Basiuk[2], C. Bourdelle[2], J. Citrin[2,3], J. Garcia[2], F. Imbeaux[2], F. Koechl[4,5], A. Loarte[6], M. Schneider[2]

[1]*Istituto di Fisica del Plasma "P. Caldirola", IFP-CNR, 20125 Milan, Italy*
[2]*CEA, IRFM, F-13108 Saint Paul Lez Durance, France*
[3]*FOM Institute DIFFER – Dutch Institute for Fundamental Energy Research, P.O. box 6336, 5600 HH Eindhoven, The Netherlands*
[4]*CCFE, Culham Science Centre, Abingdon, UK*
[5]*Technical University Wien, 1020 Vienna, Austria*
[6]*ITER Organization, Cadarache, F-13067 Saint-Paul-lez-Durance, France*

Theory-based predictions of ITER plasma profiles are of key importance in addition to 0D scaling extrapolations to infer the expected performances and identify optimum operational paths for scenario development. ITER simulation work based on models like GLF-23, Weiland or Bohm-gyroBohm has been useful to provide a first understanding of various ITER operational issues. These models however have shown deficits in reproducing existent machines and have therefore been replaced by a new generation of quasi-linear models, such as QuaLiKiz (Bourdelle et al. Plasma Phys. Control. Fusion 58 (2016) 014036) and TGLF (Staebler et al. Phys. Plasmas 12 (2005) 102508), allowing a better approximation to the predictions of non-linear gyro-kinetic codes. These models are being validated against present devices. However the specificity of the ITER scenarios with respect to the existent tokamak regimes (i.e. operational physics parameters, heating systems features and fuelling methods) requires a timely effort to evaluate their implications on ITER predictions. In this work we present comprehensive simulations of the core density and temperature profiles in various H-mode ITER scenarios, using the transport code CRONOS (Artaud et al. Nucl. Fusion 50 (2010) 043001) coupled to the newest available versions of the quasi-linear transport models QuaLiKiz and TGLF. Self-consistent simulations and stand-alone analysis are carried out in order to evaluate the expected density and temperature profile peaking and their parametric dependences. The impact of the ITER heating schemes on the density and temperature profile peaking is investigated. Finally the effect of the post-pellet transport on the pellet fuelling efficiency is studied and estimates for the optimization of pellet parameters for optimum fuelling, taking into account the post-pellet transport transient, are given.