Effect of pedestal width on the performance of ITER

T. Onjun[1], K. Tharasrisuthi[1], A. Y. Pankin[2], and O. Onjun[3]

[1] *Sirindhorn International Institute of Technology, Thammasat University, Klongluang, Pathumthani, Thailand*

[2] *Department of Physics, Lehigh University, Bethlehem, Pennsylvania, USA*

[3] *Department of Science Service, Bangkok, Thailand*

E-mail: thawatchai@siit.tu.ac.th

In this work, three pedestal temperature models in Ref. [1] are selected to provide boundary conditions for carrying out self-consistent simulations of the International Thermonuclear Experimental Reactor (ITER). These pedestal temperature models are based on three different theoretical-based pedestal width scalings; magnetic and flow shear stabilization [$\Delta \propto \rho s^2$], flow shear stabilization [$\Delta \propto (\rho R q)^{1/2}$], and normalized poloidal pressure [$\Delta \propto R(\beta_{\theta,\mathrm{ped}})^{1/2}$]. These pedestal width scalings are combined with a pedestal pressure gradient model based on ballooning mode limit to predict the pedestal temperature. The developed pedestal temperature models are used together with a core transport model, which is a combination of an anomalous transport and a necoclassical transport. An anomalous transport is calculated either using the Mixed Bohm/gyro-Bohm model or using the Multi-mode model; while a neoclassical transport is computed using the NCLASS model. At the reference design point (with 40 MW auxiliary heating: 33 MW NBI and 7 MW RF), the results of the ion pedestal temperature ($T_{\mathrm{i,ped}}$), the ion central temperature ($T_{\mathrm{i,0}}$), alpha power (P_α), and Fusion Q are summarized in the following table:

Pedestal Width	Mixed Bohm/gyro-Bohm model				Multi-mode model			
	$T_{\mathrm{i,ped}}$ (keV)	$T_{\mathrm{i,0}}$ (keV)	P_α (MW)	Fusion Q	$T_{\mathrm{i,ped}}$ (keV)	$T_{\mathrm{i,0}}$ (keV)	P_α (MW)	Fusion Q
$\Delta \propto \rho s^2$	2.6	9.7	13.3	1.7	2.7	16.2	47.8	6.0
$\Delta \propto (\rho R q)^{1/2}$	2.4	9.2	11.2	1.4	2.5	15.8	45.0	5.6
$\Delta \propto R(\beta_{\theta,\mathrm{ped}})^{1/2}$	2.9	10.3	15.8	2.0	2.9	15.9	51.4	6.4

In addition, the plasma parameters, like line average density and heating power, are varied to investigate the sensitivity of the performance.

[1] T. Onjun *et al.* 2002 *Phys. Plasmas* **12** 5018