Scenario development of Thailand Tokamak 1 using integrated predictive modelling code

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Thailand has recently been donated an HT-6M tokamak chamber and basic parts from the Institute of Plasma Physics, Chinese Academy of Sciences (ASIPP). The newly reconstructed device is called Thailand Tokamak 1 (TT-1). The first plasma in Thailand was shot in 2023 successfully. Experimental campaign and plans are discussed to perform in the near future after the completion of several diagnostics systems installation.

This work focuses on using a CRONOS integrated predictive modelling code to predict and develop scenarios for TT-1 plasmas [1]. The code consists of a 1D transport solver with general 2D magnetic equilibria, and includes several heat, particle and impurities transport models as well as heat, particle and momentum sources. A combination of a mixed Bohm/gyro-Bohm anomalous transport model and an NCLASS neoclassical transport model are used to calculate plasma core diffusivities. The boundary condition of the transport simulations is taken to be at the top of the pedestal, where the pedestal region is modelled based on an international multi-tokamak scaling. The engineering parameters used for simulation are set as follows: major radius (0.65 m), minor radius (0.20 m), plasma current (100 kA), toroidal magnetic field (1.0 T) and central electron density (10^{19} m^{-3}).

Sensitivity analyses on plasma performance are investigated by varying plasma current, toroidal magnetic field and external heating schemes such as ECRH, ICRH, LH and NBI, examples are shown in Figure 1.It is found that the performance in H-mode plasmas such as transport barrier at plasma edge and central temperatures are found to be sensitive to heating schemes and their magnitudes. Additionally, ICRH and LH methods appear to be the most effective scheme of heating for ion and electron temperatures, respectively.

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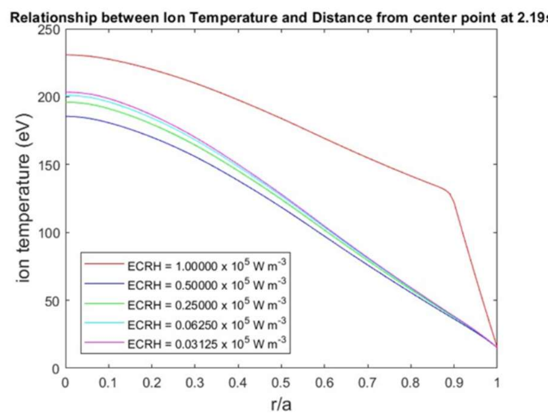
References

[1] J.F. Artaud *et al*., Nucl. Fusion. 50, 043001 (2010)



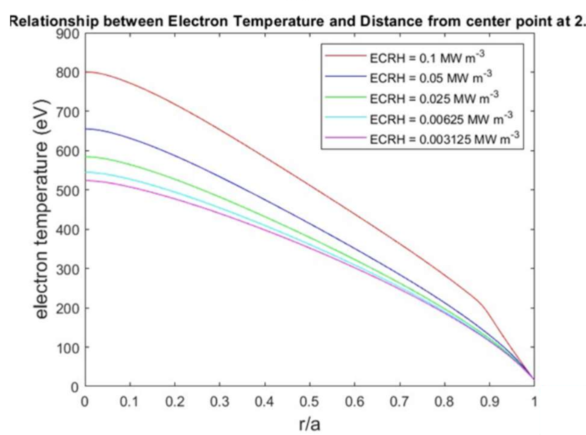


Figure 1 demonstrates the examples results of ion and electron temperatures profiles as a function of normalized minor radius at various values of ECRH heating.