Expected performances of the DTT heating systems

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The main purpose of the Divertor Tokamak Test is to study solutions to mitigate the issue of power exhaust in conditions relevant for DEMO. The tokamak proposed by Italy, I-DTT [1] (B_T=6T, I_P=5MA, n_e~$2\cdot10^{20}m^{-3}$, R_0=2.05m, a=0.7m and pulse duration of ~100s), is being designed to allocate the optimal divertor magnetic configuration under reactor relevant power flow (P_{SEP}/R>15 MW/m) in the scrape off layer. To achieve this goal it is planned to equip the machine with a significant amount of auxiliary heating power (45 MW). The heating power foreseen to get the target value of 45 MW at the plasma will consist of a mix of ECRH (28-40MW), ICRH (8-12MW) and NNBI (10MW). The final choice of each system contribution will be fixed at the end of the design review phase.

In this work we present the preliminary studies on the capability of each system to couple the target power to the plasma. The EC system is based on gyrotrons sources (1MW/170GHz/100s) and front steerable launchers to fulfill several requirements as bulk electron heating, additional current drive generation, avoidance of impurities accumulation and MHD control. The IC (f=60-90MHz) system is mainly dedicated to central plasma heating with the use of antennas designed to maximize the coupled power. NNBI with beam energy of 300 keV will be provided by two injectors with optimized tangential injection geometry to support plasma current generation.

A description of the three systems and estimations of the deposition profiles will be discussed in this work, underlining the specific technical solutions adopted to fulfill the requirements and maximize the performances.

[1] R. Albanese et al, Fusion Eng. Des. 122 (2017) pp. 274-284.