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P2.025 Preliminary conceptual design of the DTT EC heating system

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The Divertor Tokamak Test (DTT) facility has been proposed in the European roadmap to study solutions to mitigate the issue of power exhaust in conditions relevant for DEMO. The Italian DTT tokamak [1] (BT=6T, IP=5.5MA, R0=2.08m, a=0.65m and pulse duration of 90-100s) is being designed to allocate the optimal divertor magnetic configuration under reactor relevant power flow (PSEP/R>15 MW/m) in the scrape off layer. A mix of three heating systems (ECH, ICH and NNBI) will equip the machine to reach the target value of 45 MW at plasma. The present reference design considers a capability of 20-30 MW of EC power at plasma to support and assist different tasks such as bulk electron heating, non-inductive current drive, avoidance of impurities accumulation and MHD control. The gyrotron sources (1MW/170GHz/100s) will be based on the depressed collector technology with 50% efficiency and will exploit the experience gained in developing the solutions for ITER. Two Solid State High Voltage Power Supplies will feed the gyrotrons, the main one for the cathode (−55 kV, 50 A) and a second stage for the anode (35kV, 0.1A). A Transmission Line (TL) with 90% efficiency and 1 MW power handling is being considered and two solutions are studied: evacuated waveguide, as in ITER, and quasi-optical multiple-beam TL, in use at W7-X, are presented and discussed in terms of layout, dimensions and theoretical losses. The conceptual design of equatorial and upper launchers based on the front steering concept is being developed to reach the required deposition location. The EC wave absorption efficiency has been investigated and is presented here, considering a selection of injection angles and launching points with dedicated beam tracing calculations using the GRAY code [2].
[1] R. Albanese et al, Fusion Eng. Des. 122 (2017) 274
[2] D. Farina, Fusion Sci. Technol. 52 (2007) 154

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