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P3.017 Conceptual definition of an ICRF system for the Italian DTT

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An Italian Divertor Tokamak Test (DTT) facility has been proposed to tackle a major mission of the European roadmap to fusion electricity, i.e., the problem of power exhaust. DTT is conceived to accomplish very different magnetic configurations and to reproduce edge conditions as close as possible to DEMO, allowing a reactor-relevant exploration of alternative power exhaust solutions in an integrated plasma scenario. To attain a power-over-radius ratio of around 15 MW/m crossing the separatrix, a heating power of around 40-45 MW is required and will be provided by a suitable mix of electron cyclotron resonance heating, neutral beam injection and waves in the ion cyclotron range of frequency (ICRF).
The ICRF system is called to couple 5-10 MW of power to plasma in the frequency range 60-90 MHz for pulse lengths of 100 s every 30 minutes, allowing central heating of either 3He or H minority species in the reference D plasma. The system will be also an essential tool for fast particle generation, allowing the emulation of alpha's behaviour and the study of enhanced reaction rates via optimization of particle distribution functions. This paper reports the status of its conceptual design, providing the rationale behind main design choices as for example the external matching scheme or the power density at the launcher front face. Different antenna concepts are reviewed and RF designs based on two, three and four straps in toroidal direction are compared on the basis of simulation results and performances documented in literature. Strengths and weaknesses of each antenna candidate are discussed to identify the most promising concept for DTT. Innovative solutions, e.g., based on the use of high-impedance surfaces, are considered too.

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