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P2.023 Conceptual study of an ICRH system for T-15MD using Traveling Wave Antenna (TWA) sections

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The low aspect ratio ($a/R=2.2$) D-shaped tokamak T-15MD with toroidal field of 2T on axis is currently under construction in the Kurchatov Institute [1, 2]. Ion-cyclotron resonance heating (ICRH) is considered as an important heating method for this device [1]. In addition, ion cyclotron current drive (ICCD) could contribute to sustain the non-inductive plasma current for long-pulse operation. To decrease the power density and associated high voltage a distributed antenna system is proposed for heating of the future fusion reactor with ICRH/ICCD. Among the different possible solutions a set of Travelling Wave Antenna (TWA) sections is considered as most promising [3, 4]. It optimizes coupling to the plasma, is load resilient and avoids a large Voltage Standing Wave Ratio in the feeding lines. A conceptual design of 2 superposed TWA sections with each 8 radiating straps, is made for T-15MD in view of operation e.g. at 60MHz for 2nd harmonic heating of H plasmas. This antenna, loaded by a simulated density profile of T-15MD, is modeled including its resonant ring feeding system. The ring feeding allows the recirculation of the non-radiated power and the termination of the TWA section on its iterative impedance. The paper describes the antenna design, the feeding ring tuning algorithm and expected performances of this antenna concept. The chosen geometry of the TWA sections is compatible with that of a future reactor and therefore this antenna in T-15MD represents also a testbed for DEMO.

[1] E.A. Azizov, et al., Status of project of engineering-physical tokamak, in: Proc.23rd IAEA Fusion Energy Conf., Daejeon, Korea, 2010, Rep. FTP/P6-01.

[2] P.P. Khvostenko, et al., Fusion Eng. Design 124, 114-118 (2017)

[3] R. Ragona and A. Messiaen, EPJ Web Conf. 157 (2017) 03044.

[4] A. Messiaen and R. Ragona, EPJ Web Conf. 157 (2017) 03033.

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