

21st joint workshop on electron cyclotron emission (ECE) and electron cyclotron resonance heating (ECRH)

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Development of the Multi-Beam Transmission Line for DTT ECRH system

Tuesday, 21 June 2022 14:00 (2h 30m)

The DTT tokamak [1], whose construction is starting in Frascati (Italy), will be equipped with an ECRH system of 16 MW for the first plasma and with a total of 32 gyrotrons (170 GHz, ≥ 1 MW, 100s), organized in 4 clusters of 8 units each in the final design stage. To transmit this large number of power beams from the Gyrotron Hall to the Torus Hall Building a Quasi-Optical (QO) approach has been chosen by a multi-beam transmission line (MBTL) similar to the one installed at W7-X Stellarator. This compact solution, mainly composed of mirrors in “square mirrors configuration” [2] shared by 8 different beams, minimizes the mode conversion losses. Single-beam QOTL is used to connect the gyrotron MOU output to a beam-combiner mirror unit and, after the MBTL, from a beam-splitter mirror unit to the ex-vessel and launchers sections located in the equatorial and upper ports of 4 DTT sectors. A novelty introduced is that the mirrors of the TLs are embodied in a vacuum enclosure to avoid air losses, using metal gaskets to avoid microwave leaks. The TL, designed for up to 1.5 MW per single power beam, will have the total optical path length between 84 m and 138 m from the gyrotrons to the launchers. The main straight section will travel along an elevated corridor ~ 10 m above the ground level. The development of the optical design reflects the buildings and neutronic constraints and minimizes overall losses to achieve the target of max 10%.

References

- [1] R. Martone et al. Eds., DTT-Divertor Tokamak Test facility. Interim Design Report (2019)
- [2] L. Empacher and W. Kasperek, IEEE Transactions on Antennas and Propagation, 49, 3 (2001).

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