Development of the ECRH system for DTT

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The Divertor Tokamak Test (DTT) facility [1], whose construction is started in Frascati (Italy), will be equipped with an ECRH (Electron Cyclotron Resonance Heating) system of 32 gyrotrons. The procurement of the first batch of 16 MW, based on 170 GHz/≥ 1 MW/100s vacuum tubes, is in progress and will be available for the first DTT plasma. The system is organized in 4 clusters of 8 gyrotrons each. The power is transmitted from the Gyrotron Hall to the Torus Hall Building by a Quasi-Optical transmission line (TL), mainly composed of large mirrors shared by 8 different beams and designed for up to 1.5 MW power per single beam, similar to the one installed at W7-X Stellarator. One of novelties introduced in DTT system is that the mirrors of the TLs are embodied in a vacuum enclosure, using large metal seals, to avoid air losses and microwave leaks. The TL estimated volume is between ~70 and ~85 m^3 to be maintained at 10^{-5} mbar. The direct connection of the TL to the tokamak vessel vacuum has been evaluated and solutions proposed in order to prevent a possible impact on DTT operations. The microwave power is injected into the tokamak using independent single beam front-steering launchers, real-time controlled and located in the equatorial and upper ports of 4 DTT sectors. In-vessel piezoelectric walking drives are the most promising candidates for the launcher mirror movement because of their compactness in an environment with strong magnetic field under ultra-high vacuum. The DTT ECH system design, presented here, is based mainly on existing and assessed solutions, although the challenging adaptations to the DTT case are considered.

[1] R. Martone et al., *DTT Interim Design Report*, (2019).