DTT: Overview and Status of the Project

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DTT (Divertor Tokamak Test) is an Italian scientific project in the field of nuclear fusion aimed at creating a European facility for the testing of power exhaust and helium removal strategies alternative to the one implemented in ITER, the international experiment in fusion that will prove the feasibility of fusion energy on a large scale from 2025.

In the European Fusion Roadmap to the realisation of fusion energy within 2050, one of the main mission is indeed the study of the power released by the plasma core to the so-called divertor, a key-component of any present tokamak machine on which the thermal power is directed. This will be tested also in ITER on a "standard" divertor operating in a plasma fully detached condition, i.e. no contact between plasma and first wall of the vessel. Nonetheless, the baseline strategy implemented in ITER could not be extrapolated to DEMO and future power plants, then the problem of thermal loads on the divertor may remain particularly critical in the road to the realization of a reactor.

For this reason, a facility like DTT, where a number of scaled experiments, fully integrated with the expected physical parameters and engineering solutions to be used in DEMO, could be tested, is of paramount importance. Indeed, DTT has been designed so far to retain the possibility of testing different divertor magnetic configurations, including liquid metal divertor targets, and other possible promising solutions to face the power exhaust problem.

The construction, recently approved by the Italian government, is rapidly approaching on the base of a completely renovated design with respect to the original proposal in order to account also for double-null configurations (up-down symmetric) and to keep costs within the original budget. DTT will be a high field superconducting toroidal device (6 T) carrying plasma current up to 5.5 MA in pulses with length up to about 100s and with 45 MW of additional heating power. The nominal cross section is elongated with a major radius R=2.11 m and a minor radius a=0.64m.

This paper describes the status of the design activities of DTT. In particular the integrated design approach adopted, the rationale for the design choices, the development of the integrated management system are illustrated. Also a look on the main components, namely magnet system, plasma scenarios, vacuum vessel, in-vessel components, thermal shield, neutron shield, and additional heating system will be taken.