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Magnetic configurations and electromagnetic analysis of the Italian DTT device

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The European roadmap to the realisation of fusion energy has identified a number of technical challenges and defined eight different missions to face them. Mission 2 'Heat- exhaust systems' addresses the challenge of reducing the heat load on the divertor targets. Divertor Tokamak Test (DTT) facility [1]-[2] has been launched to investigate alternative power exhaust solutions for DEMO. DTT should offer sufficient flexibility to be able to incorporate the best candidate divertor concept (e.g. conventional, snowflake, super-X, double null).

In this paper, the revised up-down symmetric Italian DTT device is presented. The up-down symmetrization of DTT makes possible to increase the reference values of the plasma current. At the same time, it has an impact on the costs, for which a slight revision of the main parameters has been considered, e.g. a reduction of the major radius.

Starting from a conventional Single Null configuration for the DTT facility, we investigate the feasibility and the costs of the alternative magnetic configurations on DTT. We have developed SnowFlake, X-Divertor, Super-X and Double Null configurations optimizing the plasma shape and the currents on the PF coils. The magnetic configurations feature the main characteristic of each alternative divertor concept with a constraint on the plasma-wall distance and on the plasma elongation. The feasibility of the configurations is evaluated in terms of maximum vertical force and current density on the PF coils at the start of the current flat top (SOF) and at the end of the flat top (EOF). A 2D and 3D vertical stability analysis is also performed to evaluate the effectiveness of the configurations.

[1] R. Albanese, et al., Fusion Engineering and Design (2017),

https://doi.org/10.1016/j.fusengdes.2016.12.025

[2] R. Ambrosino, et al., Fusion Engineering and Design (2017),

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