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P3.130 Evaluation of feasibility and costs of alternative magnetic divertor configurations for DEMO

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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. Part of this mission is an assessment of several alternatives to the conventional divertor configuration, including 'Advanced Magnetic Configurations' such as the double null, SnowFlake, X and Super-X divertors.
In this paper, starting from the geometrical description of a conventional European DEMO scenario with an aspect ratio of 3.1 and a reference single null configuration, we investigate the feasibility and the costs of the alternative divertor configurations (ADC) on DEMO. We have developed DEMO descriptions for ADC optimizing the plasma shape, the machine geometry (first wall, divertor structure, vessel and TF coil shells) and the PF coil system. The magnetic configurations, designed at the same plasma current as the reference single null, 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 preliminary vertical stability analysis and a shape sensitivity analysis in case of VDE and disturbances (ELMs and MDs) have been also performed. The costs of the alternative configurations are quantified in terms of fusion power parameters, such as plasma volume and maximum flux swing at the flat top, and costs of the PF and TF coil systems, such as total current request on the PF coils and the ratio between the TF coil volume and the plasma volume.

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