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DEMO Design Using the SYCOMORE System Code: Conservative Designs and Pathways towards the Reactor

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A demonstration power plant is the next step for fusion energy following ITER. The design of such reactors is currently ongoing and still requires solving a number of issues regarding the models used for the different subsystems of the plant. System codes are able to address these questions as they model every major element of the fusion power plant and their interactions. This ensures that appropriate compromises between the different subsystems are handled correctly and enforces the global consistency of the design. The modular system code SYCOMORE has been used to propose a novel approach to DEMO design by starting the design process from present performance parameters and assessing the key variables to improve performances up to a reactor of reasonable size. The maximum allowed power on the divertor was found to be more critical in the range 5 to 10 MW/m2 than the H-factor in the range 0.9-1.2 for pulsed DEMO1-like designs (400-500 MW net electric power, 2 hours burn duration). Multi-criterion studies have also been carried out to find compromises between multiple figures of merit. Finally, sensitivity analyses have been done to estimate the width of the operational domain around the design points. For the pulsed designs considered in the study, the net electric power was found to be more sensitive to small changes of the minor radius than the burn duration.

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