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P2.223 Validation and sensitivity of CFETR design in EU systems codes

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The Chinese Fusion Engineering Test Reactor (CFETR) bridges the gap between ITER and a demonstration fusion power plant (DEMO). The primary objectives of CFETR are: demonstrate tritium self-sufficiency, ~ 1 GW fusion power, operate in steady-state and have a duty cycle of 30-50 %. CFETR is in the pre-conceptual design phase and is currently envisaged to be a two-phase machine (phase I ~ 200 MW, phase II ~ 1 GW).

In 2016 the EU and China began a collaboration on topics relating to nuclear fusion research. This contribution documents the progress on the collaboration on systems codes. Systems codes attempt to model all aspects of a fusion power plant using simplified models (0-D, 1-D) and capture the interactions between plant systems. This allows the user to explore many reactor
designs at a high level and optimise for different figures-of-merit (e.g. minimise major radius). The EU systems codes used for the work are PROCESS and SYCOMORE.

This paper details the work on analysing the 2018 CFETR design in EU systems codes and the feasibility of the design with regards to meeting the performance objectives and operation of the machine. The work considers the two-phased nature of the device and comments on the systems codes output for phase I and phase II. In combination with systems codes, uncertainty
quantification tools are used to quantify the sensitivity of the CFETR design to the input assumptions in the systems codes. This paper details the key sensitivities for the CFETR design and whether at the bounds of the uncertainty CFETR still fulfils its high-level objectives.

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