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Wed-Mo-Or1-03: The STEP magnetic cage –latest concept development

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The Spherical Tokamak for Energy Production (STEP) is the United Kingdom's next-generation publicly funded fusion power plant prototype, aiming to export 100 MW of electrical power to the grid. For all magnets, the basic requirements imposed by the plasma and the spatial constraints are provided, as well as the anticipated modes of operation where applicable. Then, the most up-to-date concept design for each system is shown. It is illustrated by presenting relevant results of electromagnetic, thermohydraulic, structural, and quench protection analysis conducted using COMSOL, Quanscient Allsolve, ANSYS, and Python-based in-house algorithms.

STEP's preferred maintenance strategy directs that the TF magnets centre column must be lifted in and out of place remotely in-situ, which heavily restricts its geometry and winding pack design. In relation to this, several of the PF coils and the CS must be manufactured around the completed TF centre column. Also, the large stored energy in the TF poses a significant challenge for quench protection especially when considering the expected voltage limitations. This work also details the endeavour to address these and other challenges so that the existing baseline design can be refined.

At the end, an overview of the future steps in concept design is given against the backdrop of the STEP delivery schedule.

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