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P5.1036 Systems Studies of Double Null Divertor Models

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As conceptual design options for a demonstration fusion power plant (DEMO) are explored it is important to understand the design space for possible non-ITER like design options. The power exhaust is a key design driver for a fusion power plant, and puts strong constraints on the size of the machine. One candidate for an alternative design is a double null divertor configuration which provides better power and heat flux management[1, 2], but involves decreased space in the first wall for blanket technologies and greater design complexity with more demanding remote handling considerations[3].
A tool for understanding large integrated technology problems is a systems code, such as PROCESS[4]. The systems code models all important plant systems and allows for the fast evaluation of consistent scenarios which can therefore also be used to explore alternative designs for baseline design options, with the need for later extensive detailed studies. In this work we will use the PROCESS system code to analyse the effect of double null divertors, and explore advantages and disadvantages in employing this divertor technology on the exhaust power handling, plasma physics and blanket systems within the power plant.
The greatest benefits of double null are achieved by operating in a regime in which the power across the separatrix is shared nearly evenly into both the upper and lower divertors, known as a connected double null. But, this configuration is not easily controlled due to vertical displacements. A proposed method of overcoming these issues is driving a cyclic vertical motion in the plasma, which leads to a continuous wobbling of the power and heat loads on the upper and lower divertor targets[5]. We assume operation in the regime of cyclic motion and present the constraints put on the DN divertor design by the wobbling of the heat loads. This assumes the technological challenges of achieving meaningful control for load sharing can be overcome.

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