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P2.139 Preliminary configuration of the torus vacuum pumping system installed in the DEMO lower port

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In the European DEMO program, the design development of the demonstration power plant is currently in its pre-conceptual phase. This work includes also the design development of the vacuum vessel, where lower ports are important appendices that house the Metal Foil Pumps and the Linear Diffusions Pumps as major components of the vacuum pumping and fuel processing systems (the so-called KALPUREX-process).

For the design development of the vacuum pumping system - especially for the design of the lower ports - two issues have to be addressed: First, the whole vacuum pumping equipment installed inside the lower ports has to be handled remotely. This requirement has a strong effect on the design of the vacuum pumps, on the other components installed inside the ports and on the design of the remote maintenance systems.

Secondly, the interspace design and the distance between vacuum pump inlet and the sub-divertor region has a strong influence on the conductance and, thus, on the required size of the pumps and/or the achievable pressure in the sub-divertor region. Based on the preliminary design elaborated before, a study has been carried out using the Monte-Carlo code ProVac3D (i) to quantify the influence of different distances between sub-divertor region and pump inlet and (ii) to investigate the effect of using Metal Foil Pumps with different length over diameter ratios (a requirement for gas separation in the Direct Internal Recycling concept) on the achievable pumping speed.

This paper concludes with a preliminary design of the vacuum pumping systems installed inside the lower ports. It shows the limitations (design as well as performance) of such a fully integrated vacuum pumping system and states clearly where special attention is required in order to come up with a sound pre-conceptual design for DEMO in 2020.

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