

Technical Meeting on Plasma Physics and Technology Aspects of the Tritium Fuel Cycle for Fusion Energy

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Deuterium-Tritium Fuel Cycle: Overview and DEMO objectives

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A self-sufficient fuel cycle is a significant contributor to enable commercial fusion energy. It also puts additional requirements on existing fuel cycle concepts. Driven by the need to reduce the tritium inventory in the systems to an absolute minimum, the work package TFV (Tritium –Matter Injection –Vacuum) of the European Fusion Programme has developed a three-loop fuel cycle architecture. This requires the continual recirculation of gases in loops without storage, avoiding hold-ups of tritium in each process stage by giving preference to continuous over batch technologies, and immediate use of tritium released from tritium breeding blankets. In order to achieve this goal, a number of novel concepts and technologies had to be found and their principle feasibility to be shown.

This talk will start from a functional analysis of the fuel cycle and introduce the results of a technology survey and ranking. The main interfaces to the plasma (breeding blanket, matter injection and particle exhaust) will be described. Based on this, the fuel cycle architecture will be delineated and required operational windows of the sub-systems defined, based on suitable figures of merit. To validate this, various R&D lines were established, the main results of which are reported, together with the remaining key technology developments to be addressed in the next years.

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