

Mission and Overview of a Fusion Development Facility

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Abstract

The objective of the Fusion Development Facility (FDF) under consideration is to fill the gaps between ITER and current experiments and a fusion demonstration power plant (DEMO). FDF should carry forward Advanced Tokamak (AT) physics and enable development of fusion's energy applications. Near term advanced tokamak physics and non-superconducting magnet technology will be used to achieve steady-state with burn, producing 100-250 MW fusion power with modest energy gain ($Q < 5$) in a modest sized device (between DIII-D and JET). FDF will further develop all elements of AT physics for an advanced performance DEMO. With neutron flux at the outboard midplane of $1\text{-}2\text{ MW/m}^2$, continuous operation for periods up to two weeks, and a goal of a duty factor of 0.3 per year, FDF can produce fluences of $3\text{-}6\text{ MW-yr/m}^2$ in ten years of operation, for fusion nuclear component research and development. The development of blankets suitable for tritium, electricity, and hydrogen production will be done first in port modules. Then, the most promising candidates will be deployed as full blankets in FDF. Two to three full blankets and about a dozen port blanket types could be tested. A goal of FDF is to demonstrate closure of the fusion fuel cycle, producing its own tritium. FDF, ITER, IFMIF, and other AT devices will provide the basis for a fusion DEMO power plant of the ARIES-AT type.