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Equilibrium and Divertor Design of the EHL-2 Spherical Torus

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The objectives of EHL-2 project is to build a spherical torus experiment with R_0 = 1.05m, Ip = 3MA, and B_T = 3T to address the key physics issues of proton-boron plasmas at temperatures above 20keV and densities of the order of $10^{20}/m^3$ and to explore the feasibility of direct energy conversion (DEC) in spherical torus. Heat exhaust and fueling would be the main challenges in the design to control power load and particle recycle. Super-X divertor has been selected as a main option, taking into account the engineering feasibility of the PF coil and vacuum systems. The advanced V-shaped divertor congfiguration has been designed to efficiently dissipate power in the divertor to ensure the maximum steady-state power load at the divertor target below 2 MW/m^{-2}. The electron temperature at the divertor target plates must be maintained at such a low level as Te ~5–10 eV to suppress erosion. CFC has been selected as the primary plasma-facing material in the absence of tritium retention issues. The effects of real-time boronization of the CFC wall and divertor, and the separation degree of outward flowing ions and electrons in the SOL and divertor, which is essential for DEC, will be analyzed.

Key words: Equilibrium; Divertor; particle recycle; CFC; boronization.

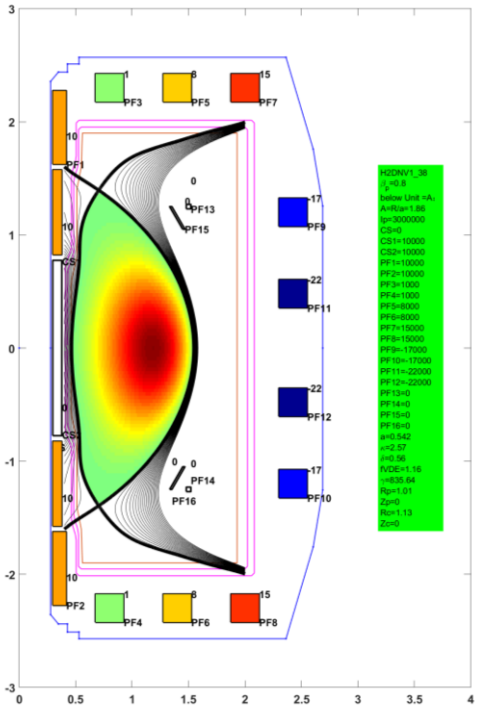

Figure 1: Equilibrium of super-X divertor

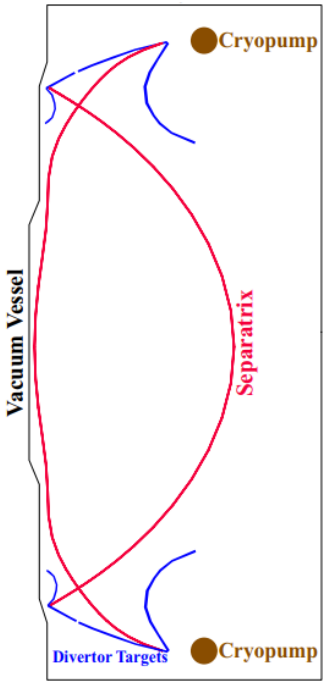

Figure 2: The advanced V-shaped divertor congfiguration