Structral Design of the Negative Triangularity Spherical Tokamak (NTST)

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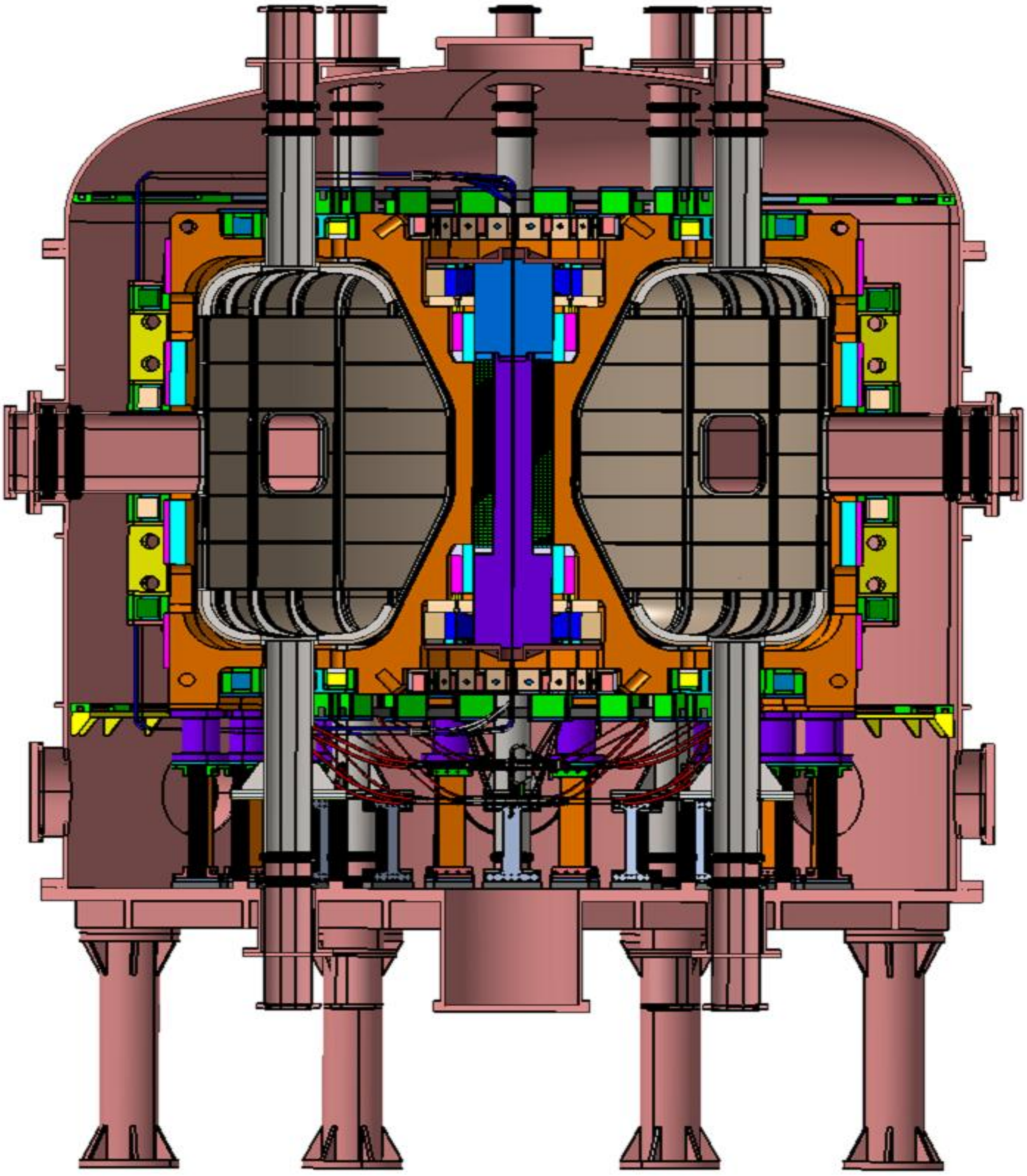
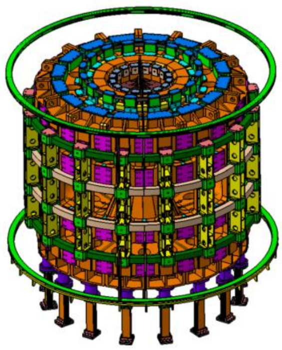
The NTST is the world's first originally negative triangularity spherical tokamak. It is designed to in-depth investigate the performance of negative triangularity plasmas and application prospects in fusion reactors. The unique idea of the NTST brings unexpected challenges in structual design, including compact spatial constraints and complex vacuum chamber geometries. Within a 4.5m diamiter, and 7 m height overall structure space, we expect to achieve **1.4T@R=0.65m**. Integrating advanced structural schemes and innovative concepts, the NTST has completed critical tasks including overall structural scheme evaluation, detailed structural design, and performance verification of key components. The TU1(and Cr-Zr-Cu) coppers are used in the magnets on 77K temperature for low resistance, and Inconel625 alloys are used in vaccum vessels for high resistance. The design considerations and objectives of the NTST are introduced. The main structural scheme derived from multi-physics optimization encompassing electromagnetics, thermodynamics, materials science, and structural mechanics is highly stressed. Additionally, it details the mechanical design solutions for structures such as magnetic coils and vacuum Dewar . Finally, briefly summary the overall progress of the NTST project.

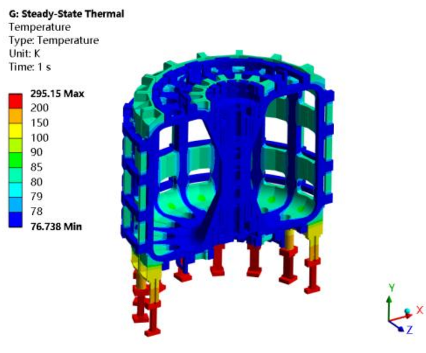
Keywords: NTST Tokamak, Host structure, scheme design, evaluation, structural design, progress



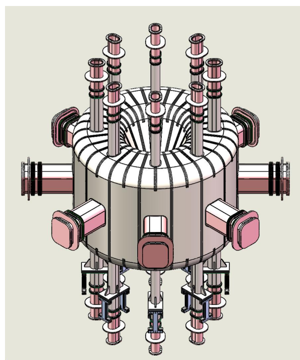
Host structure overview



magnet overview



working temperature contour



vacuum vessel overview