

OVERVIEW OF THE CFETR PROTOTYPE TF COIL

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ABSTRACT:

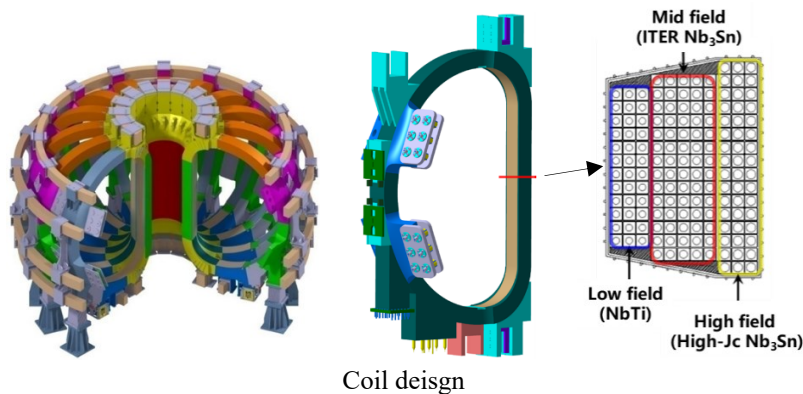
The CFETR TF magnet comprises 16 coils, which produce a 6.5 T central field and a 14.4 T peak field at an operating current of 95.6 kA. In order to develop and validate the design, manufacturing, testing, and QA/QC techniques for the CFETR TF coil, a full size prototype TF coil is being constructed in CRAFT and will be tested in 2025.

The TF coil is 20.5 m high, 12 m wide and weighs 582.4 tonnes. It is wound with high-performance and ITER-grade Nb₃Sn conductors in the High-field and middle-field WPs respectively, and NbTi conductor in the Low-field WP. Internal joints are adopted in and between the WPs. The coil case is made of high-strength austenitic stainless steel (yield strength above 950 MPa) and 316LN steel, based on the stress distribution.

All the design and analyses have been accomplished, including the conductor and coil (structure, insulation, cooling, internal joints, manufacturing and assembly) design, mechanical analyses, AC losses simulation, hydraulic analysis and quench protection. Critical manufacturing technologies for high-performance Nb₃Sn wire, high-performance Nb₃Sn conductor, internal joint, WP, coil case and coil assembly have been verified.

Up to now, A number of breakthroughs have been achieved regarding the coil manufacturing, such as the industrial production and delivery of high-performance Nb₃Sn wire is completed, manufacturing of all the full-size superconducting conductors, internal joints, WPs and coil case have been completed.

In 2025, the CRAFT TF coil will be assembled and tested.





WP manufacturing



Coil case manufacturing