



Contribution ID: 715

Type: Poster

Sat-Mo-Po.03-01: Strain and Axial Displacement Measurements in the SPARC Central Solenoid Model Coil

Saturday 5 July 2025 09:30 (1h 45m)

The SPARC Central Solenoid Model Coil (CSMC) designed and built by Commonwealth Fusion Systems in collaboration with the Massachusetts Institute of Technology Plasma Science and Fusion Center (MIT PSFC) aims to de-risk design aspects of the SPARC CS. One of the main risks associated with the bucked design of the SPARC tokamak is the large loads from the Toroidal Field magnets on the Central Solenoid. Average pressures of ~300 MPa on the CS insulation mean the solenoid must have high enough modulus to withstand the pressures without collapsing. The CS is insulated with composite layers consisting of E-glass and Kapton which provide structural support and electrical insulation. Additionally, it is important to predict the cool down axial displacement of the CS to ensure that the proper preload is maintained before operation. Here we present the methods used to measure insulation strains and winding pack displacements during the 20K CSMC test campaign at the MIT PSFC. Strains are measured using a fiber optic strain sensor bonded to the insulation of the winding pack and a low CTE linear displacement translator to measure displacement. This data in turn helps us understand the mechanical performance of the winding pack and determines future processes.

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Session Classification: Sat-Mo-Po.03 - Mechanics of Fusion Magnets