Contribution ID: **469** Type: **Poster**

Modeling and Qualifying Operational and Cooldown Strains of the NSTX-U PF1a Coils

Wednesday 7 June 2017 13:40 (2 hours)

Two sets of three coils are positioned near the upper and lower divertor in NSTX Upgrade. These are collectively called the inner PF coils and consist of PF1a,b,c upper and lower. These are used in strike point position control, advanced divertor configuration studies, and Coaxial Helicity Injection (CHI) experiments. The NSTX Upgrade Inner PF coils have low Lorentz force derived stresses during operation. PF1a upper failed during the initial NSTX-U run, and this paper investigates the stress state in the original and proposed replacement PF1a coils. The inner PF coils are sized based on temperature limits for long (5 second) pulses. More significant stresses and insulation strains develop during the cooldown process for the fully heated coil than during the energized, operational state. The current PF1a design is a relatively tall thin coil cross section with 4 layers of 16 turns each. Coolant is fed into the outside layer and extracted from the inner layer. The long coolant path produces cooling that progresses as a wave along the length of the conductor. At one point in the process, the outer layer is at the coolant temperature of 12C and the inner three layers can be as high as 100C. For the original PF1a coil the thermal stress in the outer conductor is close to the yield of the copper that was used, and above the fatigue limit set for NSTX-U conductors. For the replacement coil, yielding of the outer layer is allowed, and the resulting deformations have been qualified in terms of the cyclic shake-down of the copper, and strains imposed on the insulation system. Issues associated with qualifying cooldown insulation strains in the PF1a coils are similar to those faced in the qualification of the NSTX-U OH coil. Strain controlled cyclic displacement tests were performed on the OH insulation system which uses the same interleaved Kapton – glass system as planned for the pf1a coil. The tests indicate ample cyclic strain absorbing capability for the insulation system. The qualification of the cooling strategy and all operational stresses for the original and replacement PF1a coils is presented.

Eligible for student paper award?

No

Authors: Mr TITUS, Peter (Princeton Plasma Physics Laboratory); BROOKS, Arthur (Princeton Plasma Physics Laboratory)

Presenter: Mr TITUS, Peter (Princeton Plasma Physics Laboratory)

Session Classification: W.POS: Poster Session W

Track Classification: Magnets