Contribution ID: **111** Type: **Contributed Oral Presentation**

Calorimetrically Measured Interstrand Contact Resistances and Coupling Magnetizations in Cored QXF-Type Nb3Sn Rutherford Cables for the LHC Quadrupole Upgrade

Monday, June 29, 2015 5:15 PM (15 minutes)

When exposed to a ramping magnetic field the Rutherford cable is the seat of coupling magnetization produced by interstrand coupling currents passing through the interstrand contact resistances (ICR) – the strand crossover resistances, Rc, and the side-by-side (adjacent-strand) resistances, Ra. The coupling magnetization, is greatest when the applied field is normal to the cable's surface in which case it is proportional to 1/Rc + 20/N^3Ra, which defines an effective reciprocal ICR, 1/Reff, For an uncored cable Reff is essentially Rperpc while the introduction of a fully insulating core raises it to (N^3/20)Ra. The transport-current ramping of LHC quadrupole magnets has been shown to produce field errors of about 2 units of b1 and less than 0.2 units of cn, consistent with Rcs of on-average 125 μΩ. Evidently such ICRs have contributed to the successful operation of the LHC quadrupoles to date and hence could be recommended as target values for the QXF cable after the appropriate values of N and the other the cable-design parameters, w/t (width/thickness), Lp (semi-transposition pitch), have been included. Since the Rc of a typical uncored Nb3Sn cable is 0.25 μΩ a core needs to be included to raise its Reff into the multi-100 μΩ range. In preparation for investigating the effect of core-insertion on Reff a series of five QXF-type Rutherford cables have been wound with cores of widths ranging from 11.9 to 15.9 mm, representing core coverages, W, of from 72 to 97%. Interstrand contact resistances, Reff, were extracted from the results of low-frequency calorimetric AC-loss measurements, presented in the format Reff versus W%, and compared with predictions derived from the fortran program CUDI©.

Primary author: Prof. COLLINGS, Ted (MSE, OSU)

Co-authors: Dr NIJHUIS, Arend (Energy, Materials, and Systems Group University of Twente); DIETDERICH, Daniel (Lawrence Berkeley National Laboratory); SUMPTION, Mike (The Ohio State University); WANG, Xiaorong (Lawrence Berkeley National Laboratory)

Presenter: Prof. COLLINGS, Ted (MSE, OSU)

Session Classification: M1OrC - Superconductor Stability and AC Losses

Track Classification: ICMC-08 - Superconductor Stability and AC Losses