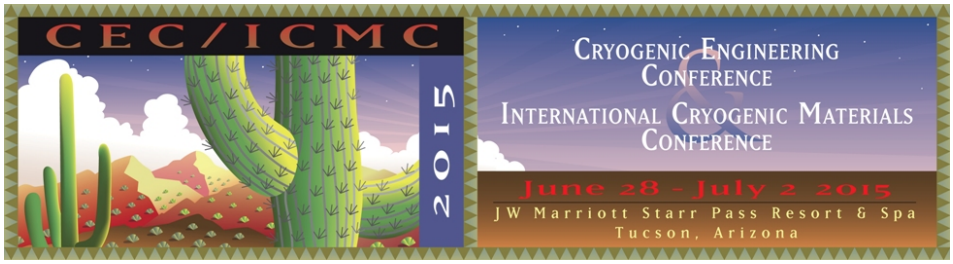

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Persistent Magnetization and Decay in Bi:2212, YBCO, and Nb3Sn and influence on Accelerator Magnet Field Errors

Monday, 29 June 2015 11:30 (15 minutes)

Cable magnetization leads to field errors in precision beam-line accelerator magnets. These errors are particularly problematic at the injection field, both in their base value, as well as their temporal drift. Drift in NbTi cable magnetization is due to the influence on strand magnetization of the decay of long-range coupling currents. But with HTS cables and magnets, a new drift mechanism will come into play – flux creep. Negligible for LTS, creep will be significant for HTS even at low temperatures, at least in the context of high precision field requirements. We have measured the magnetization of HEP relevant Nb3Sn, Bi:2212, and YBCO conductors; these are compared and estimates made of their relative impact on error fields in accelerator magnets, as compared to NbTi. We have also measured the magnetization creep of these strands for a time span of ~1200 s (20 min)—the time of a typical injection plateau in the Large Hadron Collider. Short samples and small helical coils of Nb3Sn and Bi:2212, as well as short samples of YBCO, were measured in applied magnetic fields of 1 T ("injection") and 12 T ("collision"). From a persistent magnetization viewpoint, Bi:2212 is seen to be comparable to Nb3Sn once correcting for the flatness of the Jc vs B curve; YBCO magnetization contributions will be highly dependent on magnet and cable design. Creep led to magnetization changes of 15-20% for YBCO, and 20-30% for Bi:2212 over the 1200 s time span (20 min). This led to estimates of b3 drift in units for Bi:2212, and tens of units or (much) more, for YBCO (depending heavily on cable and magnet geometry). A YBCO striation target is suggested to reduce the large magnetization and drift.

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