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M4Or1A-01: [Invited] Magnetization and current sharing in REBCO cables and their impact on field error in Accelerator magnets

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ReBCO cables are of increasing interest for HEP dipole and quadrupole magnet inserts. Cables are typically desired for both current sharing and redundancy as well as inductance minimization. In this work we explore the effect of round configuration REBCO cables (e.g. CORC or STAR) on field error in cos theta and canted cos theta insert magnet designs. We present magnetization measurements on existing CORC and STAR cables, and then use analytic models to predict the magnetization and penetration fields of cable variants (e.g., different strand numbers, different cable I_c values). These models can be fed into finite element treatments that treat the conductor as a magnetic material, this leads to field error predictions. We obtain b_3 values of several hundred units in some cases, but there is a strong impact of the field cycle and the penetration field on the results. Current sharing in cables is also considered, and values of ICR to allow acceptable current sharing under various thermal boundary conditions discussed. Based on these values, we estimate the variation of the additional contribution to cyclic AC loss in the accelerator with various levels of interstrand contact resistance; this is compared to the cyclic hysteretic loss.

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