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Test Results of HD1b, an Upgraded 16 Tesla Nb_3Sn Dipole Magnet

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The Superconducting Magnet Group at Lawrence Berkeley National Laboratory has been developing high-field, brittle-superconductor, accelerator magnet technology. A brittle conductor's support system can significantly impact conductor performance (as well as magnet training). A recent H-dipole coil test (HD1) achieved a peak bore-field of 16 Tesla, using two, flat-racetrack, double-layer Nb_3Sn coils. However, its 4.4 K training plateau was erratic at ~92% of its un-degraded "short-sample" expectation (~16.7 T). Furthermore, all training quenches exhibited very fast precursor flux transients, and originated in regions where abnormally low conductor pre-stress had been expected (from 3-D FEM predictions, and initial 300 K assembly measurements). These anomalies were supported by post-test disassembly observations, and significantly addressed with only minor coil-support changes. The coils were re-assembled and tested with a slightly (20 MPa) higher average pre-stress (for ~17 T pole-turn lift-off). Assembly and test results are presented and discussed, including some implications for future high-field magnet development.
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