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Design, Fabrication, and Test Results of Undulators Made with Nb₃Sn Cable*

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For over 20 years Lawrence Berkeley National Laboratory has been developing high field magnets of NbTi and Nb₃Sn for HEP applications. Recently, this experience has been leveraged in the design of undulator magnets. Two undulators, made with Nb₃Sn superconductor, are being designed, fabricated, and tested. One design consists of 6 periods of 30mm while the other design has 12 periods of 15mm. Each design utilizes a Rutherford cable consisting of 6 strands of Nb₃Sn multifilamentary wire that is insulated with S-glass fiber yarn woven onto the cable. Due to the small bending radius in the coils a wind-and-react approach has been taken. The 30mm period device was assembled and tested at a gap of 11 mm. The magnet achieved about 80 % of short sample current. Since the conductor has 52% Cu in the cross section the Cu current density was ~ 3940 A/mm² during a quench. Even with this high current density the magnet is safely protected with a passive diode protection circuit. In the second 15 mm period device phase error correction is addressed with the addition of NbTi strands placed along a pole normal to the beam direction. The design, fabrication, and protection philosophies of the coils will be discussed along with quench characteristics and performance of the magnets.

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