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Thu-Af-Or24-06: Design and initial test results for a canted-cosine-theta dipole subscale magnet series

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The U.S. Magnet Development Program is developing Canted-Cosine-Theta (CCT) magnet technology for future high field accelerator magnets. The CCT concept prevents Lorentz force accumulation by placing turns within precision-machined grooves that are separated by ribs and a spar that intercept forces, substantially reducing the stress in the conductor. CCT technology has been advanced through the fabrication and testing of three Nb3Sn CCT (CCT3/4/5) dipole magnets, with the final magnet reaching 88% of short sample current. A subscale CCT magnet program has been initiated in order to better understand and reduce training in this type of magnet. The goal of the nominal subscale design is to reach a similar stress state as for the CCT3/4/5 series at the short sample limit, with a reduced coil size in order to achieve reduced fabrication and testing time for dedicated training studies. A similar stress state can be obtained in the smaller, lower field magnets by operating near the peak of the Lorentz force curve for the superconductor, and by optimizing the coil geometry. For reference, the short-sample bore field is approximately 10 T for the CCT3/4/5 series with a 90 mm bore and approximately 5 T with a 50 mm bore for the subscale CCT series. The design and analysis for the nominal subscale magnet will be presented, along with results for the first set of subscale magnet tests.

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