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Design and fabrication of a 15 T Nb₃Sn accelerator dipole demonstrator

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US Magnet Development Program (MDP) is developing a 15 T Nb₃Sn dipole demonstrator for a post-LHC pp Collider. The magnet design is based on 60-mm aperture 4-layer shell-type coils, graded between the inner and outer layers to maximize the magnet performance. An innovative mechanical structure based on aluminum IC-clamps and a thick stainless steel skin was developed to preload brittle Nb₃Sn coils and support larger Lorentz forces at high fields. To study mechanical properties of this structure as well as to optimize the magnet assembly and coil pre-load procedures, the structure was assembled with aluminum cylinders serving as “dummy” coils. These cylinders were instrumented with strain gauges to monitor radial and azimuthal and axial stresses during structure pre-loading. This paper describes the design of the 15 T dipole demonstrator, magnet fabrication status, and mechanical model test results.

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