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Development of Nb₃Sn strands and Rutherford Cables for 16 T Accelerators Magnets

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Fermilab, as part of US MDP, is conducting Nb₃Sn wire and cable R&D, with the goal of improving key properties and providing conductor specifications and data for design and construction of SC accelerator magnets for a future very high energy pp collider. SC wire R&D focused first on optimizing the regular Restacked-Rod Process Nb₃Sn conductor by Bruker OST. Then, efforts were intensified on research to improve Nb₃Sn inherent flux pinning by producing artificial pinning centers in the Nb₃Sn phase, which refines grain size to 30 nm. In parallel, Fermilab is collaborating with industry to develop Nb₃Sn wires with increased specific heat to improve conductor stability and reduce sensitivity to external perturbations. Rutherford cable development includes heat treatment studies to boost performance of existing cables, and innovative design ideas for larger cables, which are preferred for 16 T magnets with appropriate operational margin. This paper will give an overview of the various SC R&D activities at Fermilab and their associated results.

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