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Fri-Af-Po.06-04: Detailed manufacturing design of REBCO insert and cooling performance of 33T Cryogen-Free Superconducting Magnet

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The 33T Cryogen-Free Superconducting Magnet (33T-CSM) project is progressing at Tohoku University Institute for Materials Research. The 33T-CSM consists of a 19T REBCO coil (HTS) with a 68mm bore and a 14T Nb3Sn+NbTi Rutherford coil (LTS) with a 320mm bore. The 14T-LTS coil was completed in 2024 and its stand-alone test was successfully performed. The 19T-HTS coil design, which involves winding REBCO tape conductors in a two-layer bundle and impregnating only the end faces, has been completed and is expected to enter the manufacturing phase soon. This design reduces the risk of local degradation, which can cause hotspots, and optimizes the stress distribution within the coil to minimize maximum stress. Following these concepts, detailed manufacturing design of specific stacking methods of the pancakes and connections between the pancakes is discussed. In addition, the evaluation of the cooling capacity of the GM-JT refrigerator and GM refrigerator used for gas circulation cooling of the HTS and LTS coils in the cryostat of the 33T-CSM, as well as the future scalability, will be presented.

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