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Thu-Af-Or21-01: A Superconducting Demonstrator Magnet for Magnetic Density Separation

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We present the NbTi magnet system that is currently being constructed at the University of Twente for the demonstration of superconducting Magnetic Density Separation (MDS) . MDS is a new recycling technology that allows to separate non-magnetic waste materials based on their mass density, by combining a ferrofluid with a vertical magnetic field gradient.
The major challenge in the design of the planar 1.5 m by 1 m large magnet system was to minimize the distance between the conduction-cooled racetrack coils and the ambient-temperature ferrofluid. This minimization leads to the conflicting requirements of a robust and stiff mechanical structure and of low thermal cryostat losses.
The paper focusses on the design choices that were made to bring the magnet and fluid as closely together as possible. One of these is the inclusion of room-temperature pillars that run through holes in the coil yokes. These pillars support the flat top plate of the vacuum cryostat, allowing it to be made thinner. Opting for conduction-cooling avoids the need of a double-walled cryostat, bringing a further decrease of the distance between the ferrofluid and the magnet. Extra design considerations arise from the attractive force between the coils and the ferrofluid, which places additional requirements on the mechanical structure.

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