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FIVE COIL HELMHOLTZ CONFIGURATION OF DUNE NEAR DETECTOR SUPERCONDUCTING MAGNET

Deep Underground Neutrino Experiment (DUNE) is a facility to carry out studies related to neutrino science and proton decays. The proposed DUNE facility will consist of two neutrino detectors. The near detector is adjacent to beam source whereas far detector is 1300 Km downstream of the source in South Dakota. In near detector, interaction of Neutrinos with High Pressure Gas Time Projection Chamber (HPgTPC) in presence of magnetic field is aimed to be studied. In HPgTPC chamber 10 bar pressure of Argon gas is maintained. After neutrino interaction in multipurpose detector (MPD) muons are generated which are deflected by the magnetic field. The magnetic field requirement is 0.5 Tesla with a uniformity better than 20 % in a diameter of spherical volume (DSV) 5.2 m. DUNE near detector magnet inner diameter is 7.2 meters in order to encapsulate HPgTPC Pressure Vessel & ECAL. The length of the magnet is restricted to 12 meters. The neutrino, beam shall directly pass from Liquid Argon detector to HPgTPC along radial direction.
In this paper, the proposed magnet design is five coil Helmholtz configuration in which each superconducting coil will be housed in a separate cryostat. Design optimizations have been carried out to achieve the required field uniformity and reduction of stray fields. In order to improve quench performance of the magnet, it is proposed to use NbTi superconductor Rutherford cable extruded with high purity Aluminium. Quench Analysis of the magnet coils have also been carried to estimate maximum temperature reached in coils and voltage developed.

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