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EMF Shielding of One Set of Coils and Shielding with Installation Errors

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Jiangmen Undergroud Neutrino Observatory (JUNO) is a reactor antineutrino experiment with the main purpose for determining the neutrino mass hierarchy by precisely measuring the energy spectrum of nuclear reactor electron antineutrinos at a distance of ˜53 kilometers from the reactors (Yangjiang and Taishan nuclear power plants) in a 700-m-deep-underground to reduce cosmogenic muon flux. The JUNO consists of a central detector (CD) of 20 kiloton LAB based liquid scintillator at the center, surrounded by a water pool, muon veto and approximately 18,000 20" and 36,000 3" photomultiplier tubes (PMTs) on CD truss, 2,000 20" PMTs on the wall and bottom of the pool. These PMTs are extremely light sensitive detectors in the ultraviolet, visible, and near-infrared ranges of the electromagnetic spectrum. The PMT is very sensitive to external magnetic fields. Thus, The earth magnetic field (EMF) passing through the PMTs without any shielding would largely reduce the efficiency of the PMTs. In order to reduce EMF inside the detector, JUNO has been planing to use the DC coils for shielding EMF in PMTs region for decreasing the Earth's geomagnetic field at Jiangmen and aims to get the residual intensity to less than 10 % on PMT areas which EMF at JUNO reactor on x, y, and z axes are 0.37988, -0.01505, and 0.23772 Gauss, respectively.

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