MT 26
International Conference
on Magnet Technology
Vancouver, Canada | 2019

Contribution ID: **1545** Type: **Poster Presentation**

Wed-Af-Po3.15-14 [18]: New Application of Superconducting MgB2 Tubes for Passive Magnetic Field Shielding for Electron Ion Collider

Wednesday, 25 September 2019 14:00 (2 hours)

Abstract—Electron Ion Collider (EIC) will be a next generation collider to address outstanding puzzles in modern nuclear physics, supported by both Brookhaven National Laboratory (BNL) and Jefferson Laboratory (JLab). The design of the interaction region (IR) requires a high field quadrupole for the heavier proton beams and an almost field free path (desired magnetic field within a few mT) for the electron beams. As the two beams passing close by each other, the magnet design in the interaction regions have great challenges due to tight space. Thus, a passive shielding is highly desired. Magnesium and Diboride (MgB2) - an intermediate temperature (39 K) superconductor which seems to be the most effective candidate for such a magnetic shielding. Thanks to its higher critical temperature, an MgB2 shield tube does not need the same level of helium cooling as NbTi and could conceivably be integrated with an intermediate temperature thermal shield and thereby save radial space. Owing to primary elements of magnesium and diboride, it's much cheaper than high temperature superconductors Bi2Sr2Ca2Cu3O10+x(Bi-2223) or REBa2Cu3O7-x (where RE stands for rare-earth) in addition to low fabrication cost. MgB2 can be made in long tubes of various and complex shapes. We will develop superconducting magnetization model and perform shielding simulations at BNL. Critical current density of MgB2 at temperatures ranging from 4.2 K to 20 K will be considered to optimize tube diameters and thicknesses to effectively shield magnetic field of ˜50 mT. Hyper-Tech will prototype and manufacture the MgB2 tubes based on the optimized parameters and magnetic shielding tests are expected to be performed at Ohio State University. We will report on the shielding design, fabrication and testing of the MgB2 tubes for the IR magnets for the future EIC collider.

Acknowledgement
This work was supported in part by the U.S. Department of Energy, Office of Science, Office of Nuclear Physics under contract DE-FOA-0001940.

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Session Classification: Wed-Af-Po3.15 - HTS Magnets and Conductors for Accelerators