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High Voltage Design of the BNL EIC Polarized Electron Source

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The Electron Ion Collider (EIC) is a new Nuclear Physics Facility that will use collisions between polarized Ions and polarized electrons to study the inner structure of the Nucleon. The EIC will be sited at Brookhaven National Laboratory (BNL) and is designed in collaboration with JLab to address profound questions about nucleons. For this purpose, the EIC takes advantage of the entire existing Relativistic Heavy Ion Collider (RHIC) facility with the addition of an Electron Storage Ring (ESR) inside the present RHIC tunnel providing polarized electron beams up to 18 GeV for collisions with polarized protons or heavy ions with Center-of-mass energy of 20 to 140 GeV. Polarized electrons are injected into the ESR from a Rapid Cycling Synchrotron (RCS) with a Pre-Injector comprised of a 300keV polarized photoelectron source and a 400 MeV linear accelerator with bunch stretching capabilities. We present the high voltage design considerations to make operation at this voltage while liquid cooling the photo cathode possible. The design starts with a standard spring loaded R35 connector in a ceramic receptacle. The R35 connector was then modified with Fluorinert cooling channels. Two key design features of the ceramic receptacle are discussed. First is the effectiveness of doping the ceramic to slightly increase its resistivity. Second is the structural design to withstand the forces due to the spring loading and the weight of the cathode assembly. The requirement to be both oil and SF6 free led to the use of a semiconducting jacket over a long high voltage cable to drain charge while limiting energy to an arc. This semiconducting jacketing was formed into stepped cones at ground interfaces to reduce field gradients. The polarized electron source is currently in operation at 300kV.

Category

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