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Mapping of an SRF electron gun focusing solenoid assembly

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SLAC's LCLS-II-HE upgrade will expand the energy regime of their XFEL at high repetition rates. Due to the low emittance requirement, a superconducting QWR based electron gun was proposed by SLAC and is being developed by FRIB in collaboration with ANL and HZDR. The emittance compensation solenoid consists of two main coils, along with horizontal and vertical dipoles as well as normal and skew quadrupole correctors. To validate the performance and characterize the field profile of the magnet, we developed a mapper system. We utilized a SENIS 3D Hall probe on a cantilevered rail driven by an Arduino controlled stepper motor. With high repeatability, we were able to measure peak field strengths and fall off. Further data analysis allowed us to determine their relative locations, in addition to confirming alignment and integrated field strengths. In accordance with design specifications, we measured the peak solenoid fields to be about 172mT and their centers to be less than 0.1mm apart transversely. The mapping design, assembly, process, analysis, and lessons learned are discussed herein.

Footnotes

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Primary author: JONES, Christopher (Facility for Rare Isotope Beams, Michigan State University)

Co-authors: ADOLPHSEN, Chris (SLAC National Accelerator Laboratory); NGUYEN, Hai (Facility for Rare Isotope Beams, Michigan State University); LEWELLEN, John (Los Alamos National Laboratory); SMEDLEY, John (SLAC National Accelerator Laboratory); WENSTROM, John (Michigan State University); XU, Ting (Facility for Rare Isotope Beams); DU, Xiaoji (Facility for Rare Isotope Beams, Michigan State University); CHOI, Yoonhyuck (Facility for Rare Isotope Beams)

Presenter: JONES, Christopher (Facility for Rare Isotope Beams, Michigan State University)

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