ABSTRACT

Magneto-Optic Kerr Effect in a Magnetized Electron Gun. BENJAMIN HARDY (Bowling Green State University, Bowling Green, OH 43402) JOSEPH GRAMES (Thomas Jefferson National Accelerator Facility, Newport News, VA 23606).

Direct current high voltage photoguns like that of the Gun Test Stand at Jefferson Lab, successfully generate electron beams in order to advance studies in Nuclear physics. Magnetized electron beams result from electron production via photoemission within a solenoid’s magnetic field. As opposed to non-magnetized electron beam sources, magnetized sources have the potential to improve ion beam cooling efficiency quite significantly. The beam magnetization depends greatly on the applied magnetic field. At the Gun Test Stand at Jefferson Lab, a solenoid’s magnetic field has been modeled and will be measured. Due to electron beam specifications, the photogun will be in a relatively extreme vacuum state. Measuring and monitoring the magnetic field at the beam source without disrupting the vacuum borders impossibility when using conventional methods. The magneto-optic Kerr effect (MOKE), describes the change operated on polarized light by its reflection off of a magnetized source. The reflection off of the magnetized surface may alter the light’s polarization direction, ellipticity, or intensity. Magnetization is linearly related to the change in polarization direction and ellipticity enacted on the light by the sample. By swapping the photocathode with a magnetized sample such as iron and reflecting polarized light of its surface, we inferred the magnetic field at the source. A controlled MOKE system has been assembled in order imitate the magnetic field on site. It consists of a low power laser, polarizers to define and analyze light, a photo-elastic modulator that supplies a high frequency modulation of light polarization to improve signal to noise ratio, and a polished iron foil versatile in controlled and on site tests. Controlled tests use strong rare earth magnets to imitate the solenoid fields. Calibration of the MOKE system on site with the solenoid magnet occurs during field mapping. The “Kerr-mometer” will be available as a diagnostic of the magnetic field strength and uniformity, providing an adequate description of the field at electron beam source. The report summarizes the method and results of controlled tests and on site, field mapping calibration.