TITLE

Evaluating magnetic field near electron beam sources using the magneto-optical Kerr effect

{^Is this too boring? Haha… I feel like this description doesn’t do the project justice but meets the need for a short title.}

ABSTRACT

Presently, the generation and characterization of magnetized electron beams from a DC high voltage photogun are being developed. These magnetized beams have potential to drastically improve the electron cooling efficiency for experiments such as the JLEIC. A cathode solenoid will surround the beam just after the source of emission from the photocathode. The magnetization of the solenoid focuses the electron beam and therefore increases electron ion interaction thereby increasing cooling efficiency**\***. Due to electron beam specifications, the photocathode will be in a relatively extreme vacuum state. Measuring and monitoring magnetic field at beam source with a probe without disrupting vacuum borders impossibility. By using the magneto-optical Kerr effect, a diagnostic was created in order to measure and monitor the magnetic field at the source. Polarized laser light is reflected off of an iron foil near the source and in turn rotated by the solenoid’s magnetization of the foil. This change on the polarized light by the alignment of electron spins on the surface of the foil is the magneto-optical Kerr effect**\*\***. The rotation is linearly related to the magnetization of the foil. Magnetization of the source area is then measured and monitored. These values will play a crucial role in giving a quantity of magnetic field at the source and therefore aid in explaining the effect of beam magnetization on electron cooling efficiency. The diagnostic or as we call it the “Kerrmometer”, will contribute to Jefferson Lab having direct experience and knowledge of magnetized electron beam sources.

**\*** Do I need to explain this more? I left out information regarding the cooling solenoid, so my explanation here seems too simple.

Optional sentence at **\*\*** :A photo elastic modulator was then used in order to amplify the signal to noise ratio and thus more clearly depict a change in polarization by the foil magnetization.