Mott Polarimeter Upgrade at Jefferson Lab

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Begin Abstract.

A Mott polarimeter based on the scattering of 5MeV polarized electrons has been in use at the CEBAF accelerator for nearly two decades. The polarimeter design, detectors and data acquisition have evolved over this duration in significant ways leading to a device with precision approaching 1%. The most recent evolutionary steps are presently taking place preparing for an upcoming experiment to test and document the polarimeter at this level. The aim of this submission is to explain the goals of the planned experiment and the theoretical, simulation and hardware efforts being made in its preparation.

End Abstract.

Precision Mott electron polarimetry is ensured by addressing three concerns:

- 1. Precise determination of the theoretical Sherman function for single elastic scattering,
- 2. Measurement of the asymmetry for every target by achieving pure energy spectra,
- 3. Precise extrapolation of the Sherman function to target foils and conditions used.

Main Efforts

- Aligned/calibrated positions of target, collimator and detector ports
- Modify dump plate to reduce background: lower atomic Z and optimum position
- Theory calculation of analyzing power, spin rotation functions, cross-section for 2-8 MeV
- "New" detectors w/ improved energy resolution
- Upgraded data acquisition system
- Geant4 model of detector efficiency (everything on air side of vacuum window)
- Geant4 model of polarimeter configuration with theory calculations
- Strategy of targets, beam energies, configuration for: commissioning, systematics, production