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Polarized He3 target and other detector instrumentation of the GEN-II experiment at JLab

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Nucleon elastic form factors encode crucial information about its charge and magnetization distributions. For many decades, nucleon form factors were studied by using unpolarized electron-nucleon cross section measurements. The advent of electron beams with higher luminosities and beam polarization coupled with large acceptance detectors, polarized targets and recoil polarimeters enabled a wealth of information on nucleon form factors over a broad range of momentum transfer (Q^2). While plenty of information is available on the proton, no data above $Q^2 = 3.5 \text{ GeV}^2$ is available on the neutron electric form factor. Pushing the data to a higher Q^2 allows constraining spin flip GPDs and serves as a bench mark for various theoretical models. Using quasi-elastic scattering of a polarized electron beam on a polarized ^3He target, one can extract the GEN term which is proportional to the measured asymmetry from opposite electron beam helicity.

The GEN-II experiment at Jefferson lab utilizes a polarized He3 target for a high Q^2 measurement of the neutron electric form factor. The target consists of a pumping chamber (where polarization of He3 takes place), a target chamber (where e- beam interacts with the target material) and transfer tubes (which facilitate a convective flow of the polarized material). ^3He gas at $\sim 8 \text{ atm}$ pressure is filled into the glass cells along with Rb-K alkali mixture and narrow band diode lasers are used for polarizing the He3 using a SEOP (Spin Exchange Optical Pumping) technique. The target system used in the experiment includes multiple Helmholtz coils to create a holding field that determines the direction of polarization for the ^3He nuclei. Two polarimetry techniques are used to determine the absolute (EPR) and relative (EPR) polarization during production running. The GEN-II experiment finished taking data at three out of four kinematic settings and is scheduled for completion in the Fall of this year. Overall target performance and other instrumentation used in the GEN-II experiment (GEMs, calorimeters and hodoscopes) will be briefly discussed in this talk.

session

A. Facilities and Detectors

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