Measurement of the Electric Form Factor of the Neutron at MAMI

Michael Seimetz, (for the A1 collaboration[a])
[a]Johannes Gutenberg-Universität, Institut für Kernphysik, Mainz, Germany

The measurement of the elastic form factors of the nucleon provides a crucial test of our understanding of hadron structure. The electric form factor of the neutron, $G_{E,n}$, has gained particular interest, because it directly reflects the inner structure of the neutral particle. However, the neutron form factors are difficult to access, due to the lack of a free neutron target. Therefore, usually deuterium or ^{3}He are used as target material, demanding, sometimes significant, corrections of medium effects. Moreover, $G_{E,n}$ is small in comparison to the other nucleon form factors. Nevertheless, it can be measured in a model independent way in double polarization experiments, which are sensitive to the form factor ratio $G_{E,n}/G_{M,n}$.

A new D ($\vec{e}$, $e'\vec{\eta}$)p experiment has recently been performed at the Three Spectrometer Setup of the Mainz Microtron MAMI. Data were taken at Q^2 = 0.3, 0.6, and 0.8 $(\mathrm{GeV/c})^2$). For this measurement, a new neutron polarimeter was designed and optimized to withstand thehigh electromagnetic background rates at forward angles. It consists of two walls of highly segmented plastic scintillators which allow the reconstruction of the neutron trajectory and flight time. By calculating an asymmetry of the neutron scattering angles in the first wall, an absolute calibration of the neutron detection efficiency could be circumvented. Furthermore, making use of a spin precession method, the measured ration $G_{E,n}/G_{M,n}$ is independent of the polarimeter's analyzing power. Quasifree *e-n* scattering was selected by coincident detection of the scattered electrons I a magnetic spectrometer. This, in particular, enabled the precise reconstruction of the direction of momentum transfer.

We present the spin precession method, the experimental setup, and first results of our D ($\vec{e}$, $e'\vec{\eta}$)p experiment.