The Geant4 Simulation for the g_2^p and G_e^p Experiments at Hall A Jefferson Lab

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The g_2^p (E08-027) and G_e^p(E08-007) experiments were recently completed at Hall A Jefferson Lab. The goal of the g_2^p experiment was to study the spin-denpendent structure function g_2 for the proton in the resonance region with low four-momentum transfer ($0.02 < Q^2 < 0.2$ GeV^2). The G_e^pexperiement was to meausure the proton elastic form factor ratio in the same low Q^2 region. These two experiments shared the same dynamic nuclear polarized (DNP) NH3 target except the orientation of the superconducting helmoholtz magnetic. The g_2^p required running the target magnetic field pointing at 90 degrees (horizontal left if looking downstream along the beam line) with 2.5 or 5.01 Tesla, while the G_e^prequired that the target field stays at 6 degrees with 5.01 Tesla. Several beam energies, ranging from 1.1 to 3.3 GeV, have been used. The g_2^p experiment is the first Hall A experiment where such high transverse target field for an NH3 target was used. In order to compensate the vertical bending of the incident electron beam while travelling through the target field, a magnetic chicane was placed upstream from the target and a local dump was newly built and placed at 79 cm downstream. To achieve low Q^2, a pair of septum magnetics was placed at 157 cm downstream, which bend 5.65 degrees elelctrons to 12.5 degrees so that they can reach the High Resolution Spectrometers of Hall A. A recoil proton detector, the 3rd arm, was also built to monitor the beam and target polalrization. A Geant4 Monte-Carlo program was developed for these two experiments to simulate the beam line, target and septum field, the local dump, the 3rd arm and HRS detector acceptance. The simulation results will be present.