A COINCIDENCE MEASUREMENT OF $D_{NN'}$ FOR p+p ELASTIC SCATTERING AT T_p=200 MeV.

S.M. Bowyer, A.D. Bacher, T.W. Bowyer, S. Chang, W. Franklin, J. Liu, J. Sowinski, E.J. Stephenson, S.P. Wells, and S.W. Wissink
Indiana University Cyclotron Facility, Bloomington, Indiana 47408

W.K. Pitts
University of Louisville, Louisville, Kentucky 40292

D.V. Bugg
Queen Mary College, London, United Kingdom

The πNN coupling constant, g_π^2, is an essential parameter in most NN interaction models. Recent determinations of the values of both the neutral, g_o^2 (Ref. 1), and the charged, g_c^2 (Ref. 2), coupling constants, based primarily on the analysis of NN and πN scattering data, respectively, have been significantly smaller than values determined prior to 1987. These smaller coupling constants do not agree with the value of g_π^2 required in meson-exchange models to yield the deuteron quadrupole moment and asymptotic D/S state ratio.[3] This discrepancy prompted an investigation by our collaboration into the sensitivity of the determination of g_π^2 to high precision spin observable data that could be obtained at IUCF. We found that the normal-component spin transfer observable $D_{NN'}$ for p+p elastic scattering is very sensitive to g_o^2 over the angular range in which the NN scattering amplitude δ crosses zero.[4] Of the existing $D_{NN'}$ data in the 150 MeV to 300 MeV energy range, none bracket the δ crossover (which occurs near $\theta_{lab} \approx 9°$), and all have relatively large statistical errors and normalization uncertainties.[5–7]

Experiment E367 will measure $D_{NN'}$ to an absolute uncertainty (including both statistical and normalization contributions) of ± 0.01 for p+p elastic scattering at 200 MeV over the angular range of the δ crossover and extending to larger angles: 5°, 7°, 9.5°, 12°, 15°, 18°, 23°, 30°, 37°, and 45°. We will use the K600 spectrometer (employing the septum magnet[8] for measurements at 5°–18°) and its associated focal plane polarimeter (FPP) in coincidence with a silicon/CsI recoil detector telescope to cleanly identify p+p elastic events. A solid CH_2 target will be used, and the excitation spectrum of ^{12}C, simultaneously obtained in the focal plane, will be exploited for absolute scattering angle information and sensitive monitoring of beam properties (e.g., polarization and position) and the hydrogen content of the target.

The Si/CsI recoil detector telescope was designed to function over a very large dynamic range, 1–100 MeV, which spans the recoil energies encountered at the angles listed above. It consists of a 500 μm 7-strip silicon detector backed by a tapered, 3.8–cm deep CsI crystal that measures 1.5 cm $\times$ 4.0 cm on the front face. Initial tests of this detector telescope were performed in December 1992, in which recoil protons with energies as low as 1.2 MeV were cleanly detected. Data were also taken at angles corresponding to recoil proton energies of approximately 6 MeV (see Fig. 1) and 15 MeV.

To achieve the desired systematic error on $D_{NN'}$ at all angles, we must accurately determine the effective analyzing power of the FPP, A_{FPP}, down to the lowest proton

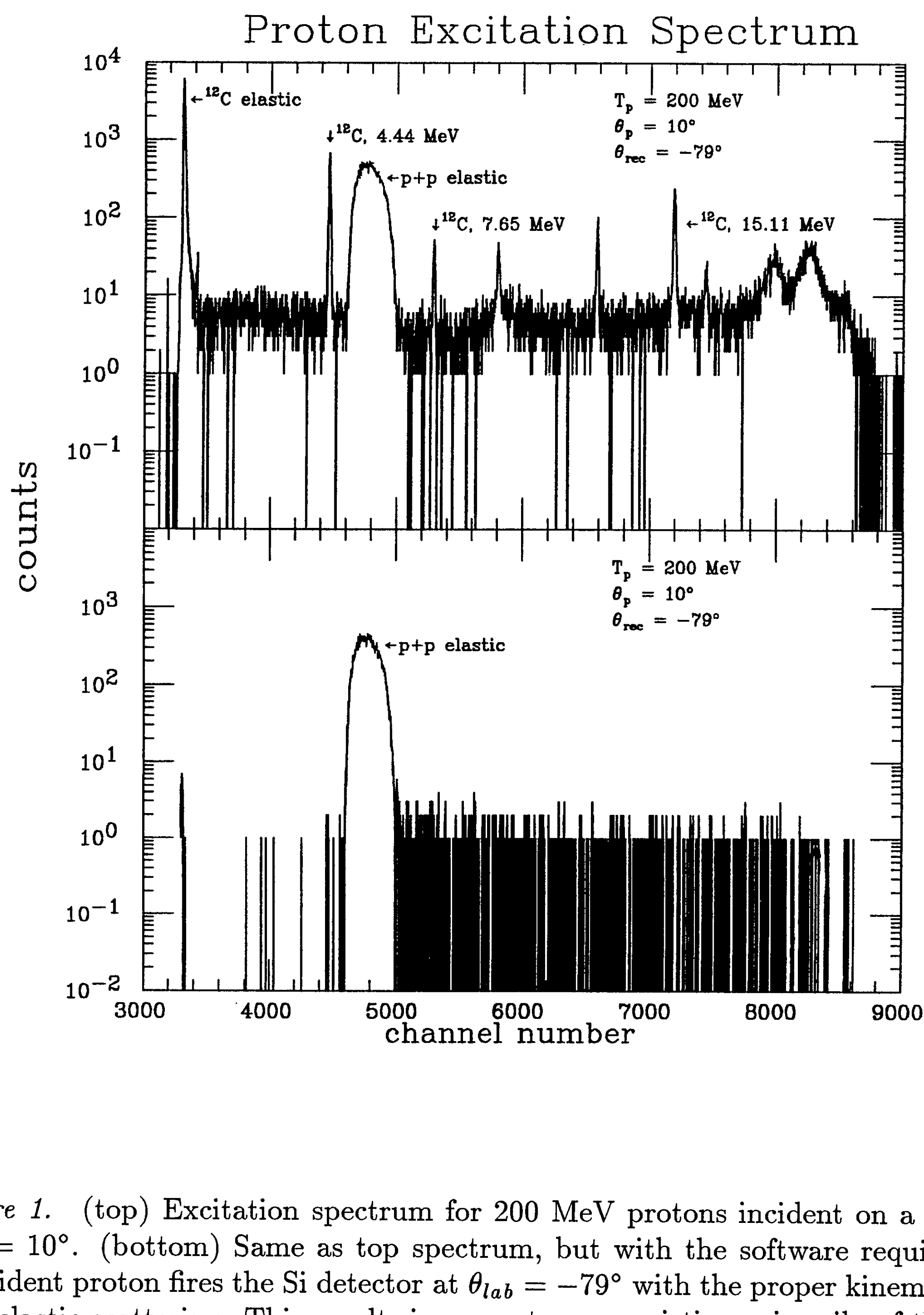

Figure 1. (top) Excitation spectrum for 200 MeV protons incident on a CH_2 target at $\theta_{lab} = 10°$. (bottom) Same as top spectrum, but with the software requirement that a coincident proton fires the Si detector at $\theta_{lab} = -79°$ with the proper kinematic energy for p+p elastic scattering. This results in a spectrum consisting primarily of the p+p elastic peak, plus a constant low energy tail from slit edge scattering.

energy to be detected in the K600, ~100 MeV. The needed accuracy (for $\delta D_{NN'}$=±0.01) depends on the magnitude of both $D_{NN'}$ and A_{FPP}, each of which will vary with θ_{lab}. During a split beam run in February 1993, calibrations at 150 MeV with both a 2″ and 1″ thick carbon analyzer and at 120 MeV with both a 1″ and 0.5″ thick carbon analyzer were obtained. The calibration method of Ref. 9 was employed, in which data is taken at scattering angles where A_y=0, and also at scattering angles where $A_y \simeq 1$. Analysis of this data is currently underway.

At present, we plan to complete the A_{FPP} calibration and the $D_{NN'}$ measurements discussed above in August 1993.

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