4) W.R. Gibbs, LASL Report No. LA-8303-C, 1980 (unpublished), p. 232, and private communication.

5) T.P. Sjoreen et al., Phys. Rev. Lett. 45, 1969 (1980).

MEASUREMENT OF THE $^2H(\vec{p},\pi^\circ)^3He$ THRESHOLD CROSS SECTION AND ANALYZING POWER

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Differential cross sections and analyzing powers have been measured for proton induced neutral pion production from deuterium at three energies within 4 MeV of threshold, T_{th} = 198.70 MeV. These data should prove useful in making a less ambiguous study of the reaction mechanism for (p,π), as the initial and final states are better understood than those of heavier systems.

To perform the measurement we used the QDDM spectrograph set at, or near, 0° to detect the recoiling ^3He in coincidence with either one or both of the decay γ-rays emitted in the π° decay. The high-energy photons were detected using lead glass detectors placed on the left and right of the CD_2 target. From the energy of the recoil ^3He the scattering angle was deduced. The flight time of the ^3He between target and focal plane was used to determine whether it was emitted to the right or the left (TOF is an approximately linear function of the projected horizontal angle at which the recoil enters the spectrograph). We were thus able to measure the angular distribution of both the cross section and the analyzing power of the reaction.

Because the experiment was done with the QDDM at or near 0°, a special Faraday cup had to be placed within the dipole magnet of the QDDM. The high rates in the QDDM focal plane arising from background generated by this cup made it necessary to use a 14 element high-rate scintillator hodoscope constructed for this purpose to act as the focal plane detector. To tag each event with one or both of the γ-rays from the decaying π°, it was necessary to assemble two large lead glass detector arrays, each composed of 4 pieces of Schott F2 glass, 15 cm x 15 cm x 30 cm. The 24" scattering chamber for the QDDM had to be replaced with a smaller chamber, 2.50" in diameter, and a stable detector support to allow positioning the large lead glass detectors as close to the target as possible.

The experiment was completed in the summer of 1980 and consisted of measurements of the differential cross section and asymmetry at proton energies T_p = 199.53, 201.26, and 203.01 MeV, corresponding to pion center-of- mass energies of $T_\pi{}^{cm}$ = 0.48, 1.53, and 2.59 MeV. Figure 1 shows our preliminary results for the $T_\pi{}^{cm}$ = 2.59 MeV cross section. It is important to note that the large forward to backward ratio indicates the p-wave amplitude plays an important role even at these low energies. Our measurements made at lower energy show cross sections becoming more isotropic as one approaches threshold, but even at $T_\pi{}^{cm}$ = 0.48 MeV we observe a forward-to-backward ratio of about 2 to 1.

We are presently in the process of evaluating the necessary corrections to the data and the various uncertainties in the final result. The principal effects one must consider in such an analysis are:

1) the beam energy uncertainty
2) the acceptance of the QDDM

3) the hodoscope calibration

4) the efficiency of the lead glass detectors, both intrinsic and due to a resricted geometry

5) distortion due to the finite target thickness

6) distortion due to a finite spread in the beam energy

7) distortion due to a finite angular spread in the incident beam caused by a non-zero emittance and a finite sized-beam spot

8) distortion due to multiple scattering

All these effects are well understood, although rather time consuming to evaluate. This work will be completed by March, 1981. A preliminary report of this work has been presented.[1)]

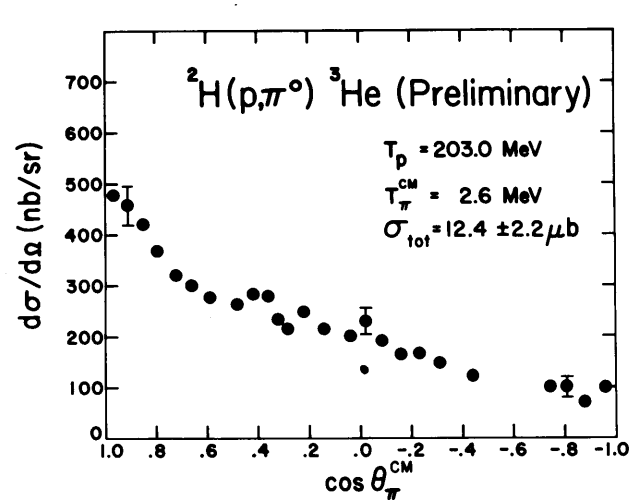

Figure 1. $^2H(p,\pi^\circ)^3He$ differential cross section at T_π^{cm} = 2.59 MeV. The indicated uncertainties are statistical only.

1) M.A. Pickar, R.E. Pollock, H.-O. Meyer, A.D. Bacher, and G.T. Emery, Bull. Am. Phys. Soc. 25, 725 (1980).

ANALYZING POWERS OF THE $^{16}O(p,\pi^+)^{17}O$ REACTION AT 157 MeV BOMBARDING ENERGY

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Recently Auld et al.[1)] measured analyzing powers of the $^9Be(\vec{p},\pi^+)^{10}Be$ and $^{12}C(\vec{p},\pi^+)^{13}C$ reactions at 200 MeV bombarding energy ($T_\pi^{cm} \simeq 40$ MeV) and discovered that the analyzing power angular distributions, at least for the states studied, were remarkably similar in nature. Each transition was characterized by analyzing powers which were negative at all angles, with maximum absolute value near $\theta_\pi^{cm} = 60°$. These results have been used to suggest that the $(\vec{p},\pi^+)$ analyzing power distributions are not sensitive to the final states, and are a feature only of the reaction mechanism. So far theoretical calculations of analyzing powers using the stripping model[2)] (projectile emission) or the pionic knockout model[3)] (target emission) have not been able to reproduce this feature. Generally, the calculations yield negative analyzing powers in the forward hemisphere, but often show a state dependence in the magnitude and shape of the analyzing power distributions.

In order to obtain additional information about the state dependence of the analyzing powers for the $(\vec{p},\pi^+)$ reaction, we have measured near threshold (T_π^{cm} < 12 MeV) spin-averaged differential cross sections and analyzing powers of the $(\vec{p},\pi^+)$ reaction for transitions to the ground, 2.12 MeV, and 4.44 MeV states in ^{11}B, the ground, 3.09 MeV and (3.68-3.85) MeV