

STUDIES OF PROTON-INDUCED NEUTRAL PION PRODUCTION NEAR THRESHOLD

M.A. Pickar, H.J. Karwowski, M. Hugi, J.R. Hall, M. Fatyga, R.E. Pollock, A.D. Bacher, H.O. Meyer, and G.T. Emery
Indiana University Cyclotron Facility, Bloomington, Indiana 47405

Measurements have been performed yielding differential cross sections and analyzing powers for (p, π^0) on ^{12}C and ^{14}N near threshold. The work done in this experiment (#127) extends that done^{1,2,3} in Expt. 95 on $^2\text{H}(p, \pi^0)^3\text{He}$ to heavier nuclei, and adds to the measurements^{4,5} done in Expt. 18 on $A(p, \pi^0)A+1$.

Although analysis of the data is still underway, a preliminary result for the reaction $^{12}\text{C}(p, \pi^0)^{13}\text{N}_{g.s.}$ at an energy yielding pions of 1.7 MeV in the center of mass is that the cross section is very forward peaked and that the analyzing power is small and negative. We observe a cross section of ~ 13 nb/sr at 0° , decreasing to ~ 2 nb/sr at 180° . The analyzing power at forward angles is ~ -0.1 .

The measurements were made using an array of eight gamma ray detectors. An event was defined as a coincidence between any two detectors. The detectors were arranged so that various pairs could detect the decay gamma rays of neutral pions emitted in only a restricted angular range. Yields obtained from detector pairs sensitive to nearly independent regions of the pion phase space allow one to reconstruct the angular distribution of the differential cross section and the analyzing power.

The apparatus with which these measurements were performed constitutes an effective and efficient means of studying pion production near threshold. For example, in the geometry used in the aforementioned study of $^{12}\text{C}(p, \pi^0)^{13}\text{N}_{g.s.}$, the effective solid angle for each detector pair of major consequence, of which there were four, was 1.9 msr. We were able to complete measurements yielding an uncertainty of less than 1 nb/sr, the approximate level of the background observed, at all necessary angles in less than 2 shifts of beam time. It is to be hoped that data obtained with this new device will prove useful in increasing our understanding of the (p, π) reaction.

- 1) M.A. Pickar, "Near-Threshold Proton-Induced Neutral Pion Production from Deuterium", Ph.D. thesis (unpublished), Indiana University, 1982.
- 2) M.A. Pickar, Proc. of the Workshop on Pion Production and Absorption on Nuclei-1981, ed. R.D. Bent, AIP Conf. Proc. 79 (1982) 143.
- 3) M.A. Pickar et al., IUCF Technical and Scientific Report 1980, p. 59.
- 4) M.A. Pickar et al., IUCF Technical and Scientific Report 1979, p. 77.
- 5) M.A. Pickar et al., Bull. Am. Phys. Soc. 24, 819 (1979).