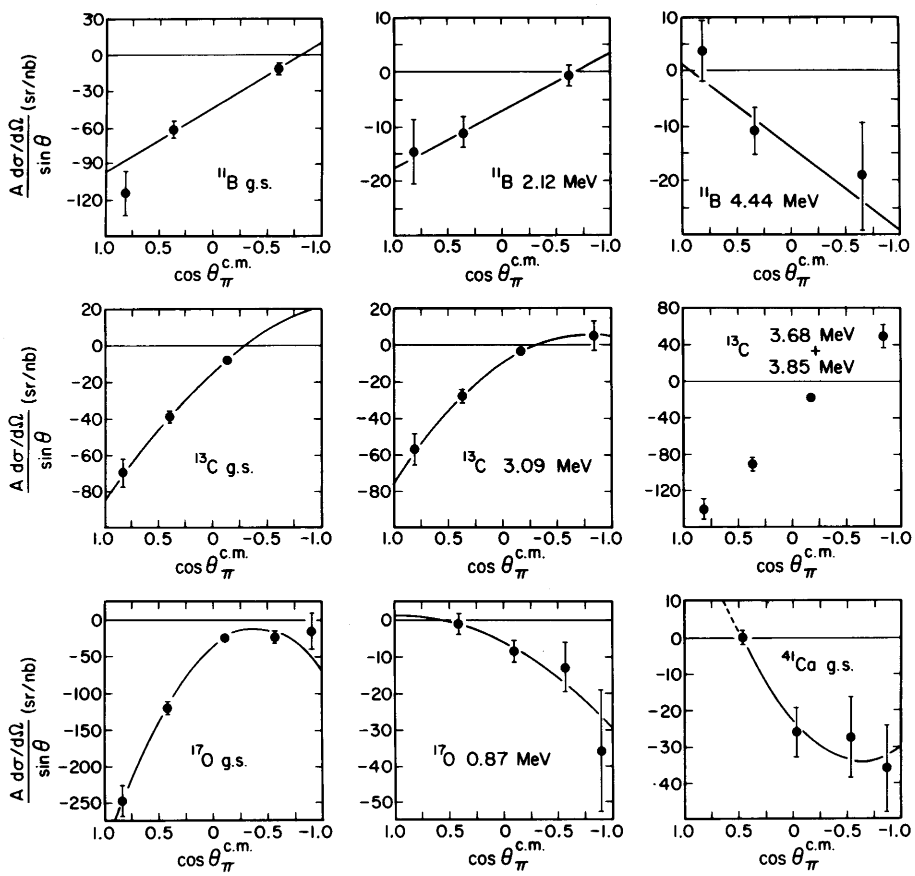

Figure 2. Results of near-threshold analyzing power measurements represented in the form $A(d\sigma/d\Omega)/\sin\theta_\pi$ vs. $\cos\theta_\pi$.

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DEVELOPMENT OF A TWO-NUCLEON MODEL CODE FOR THE (p,π) REACTION

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Although a substantial amount of (p,π) data has been produced at IUCF during the past 4 years, the reaction mechanism is still poorly understood, and the (p,π) reaction has not yet become a useful nuclear structure probe. The DWBA stripping theory has been found[1] to be only partially successful in reproducing the main features of existing data.

In view of the gap between data and analysis, the development of a (p,π) code based on a more fundamental approach has been undertaken. It is assumed that the pion production processes at low energies is basically a two-nucleon process in which the meson propagation between two nucleons is explicitly incorporated. Transition amplitudes are decomposed into S-wave π rescattering and P-wave π and ρ rescattering terms. The former is described in terms of S-wave πN scattering amplitudes with parametrization to include σ, ρ and hard core contributions. The latter is related to intermediate nucleon-pole and Δ-isobar propagations, and non-static contributions are also included. The rest of the higher-order terms are treated as distortions via π-nucleus and proton-nucleus optical potentials.

To test this picture, the model will be applied initially to (p,π^+) reactions on closed shell target nuclei leading to single-particle and 2p-1h states in the residual nucleus.

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ACTIVATION MEASUREMENTS OF THE $^{208}Pb(^3He,\pi xn)^{211-xn}At$ REACTION

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Recent experimental[1,2,3] and theoretical[4] studies of pion production with complex projectiles have emphasized the importance of further study of reactions such as $(^3He,\pi)$ at energies well below the free nucleon-nucleon pion production threshold in order to test for collective effects in pion production. Bertsch[4] has calculated the $(^3He,\pi)$ reaction cross section at 70 MeV/nucleon (which is zero, neglecting collective effects). By including the internal momentum of the ^3He nucleons, he calculated ~1 nanobarn total cross section. Wall et al.[1] have measured the $^{208}Pb(^3He,\pi^\circ)^{211}Po$ cross section for 200 MeV ^3He to be 6.0×10^{-2} nb/sr-MeV, yielding a total cross section of 2.4 nb (with a factor of 3 uncertainty). Doubly coherent production[2] of π^- by 910 MeV ^3He ions on ^6Li yielded a double differential cross section of $(0.42 \pm 0.11) \times 10^{-3}$ nb/sr-MeV, or a total cross section of about 1.2 nb. Apparently the total doubly coherent cross section increases little with increasing energy.

In the present investigation Astatine was radiochemically separated[5] from the 10-100 mg/cm^2 activated Pb metal or nitrate targets in separation times of 1-3 hours and finally deposited electrochemically onto Ag foils. The sources from both thick (100 mg/cm^2) and thin (10 mg/cm^2) targets were α-counted using standard α-spectroscopy. Tentative results for the excitation function for the production of Astatine isotopes is given in Table 1. The below-threshold measurement gave an upper limit of 0.1 nb, indicating little secondary background problem. Above the π^- threshold of 134.8 MeV, the cross section

Table 1. Measured Astatine cross sections produced in 130-230 MeV ^3He on ^{208}Pb.

^3He Energy (MeV)	$\sigma(207)$ (nanobarns)	$\sigma(211)$ (nanobarns)	Target Thickness (mg/cm^2)
130	<0.1	<0.1	10
158	13	3.4	63
200	10	6.6	71
230	<2.5	2.5	75

Total uncertainties include chemical yield (40%), beam integration (5%), statistics (30%) and target thickness (5%), yielding in quadrature a total error of 50%.