# MEASUREMENT OF THE TOTAL (p,π) CROSS SECTIONS THROUGH RESIDUAL ACTIVITY

D.L. Friesel, P.P. Singh, T.E. Ward, A. Doron*, A. Yavin*

The residual activity measurement of pion production near threshold has centered on the $^{209}Bi$ (p,$\pi^o$) $^{210}Po$ reaction. Radiochemical procedures for the separation of Bi, Po and At activities have been developed, and the Po activities were detected by alpha counting. Preliminary results at various energies near pion threshold (∿131 MeV) indicate that secondary isotope production processes from thick targets are a problem.

Monoisotopic bismuth is ideal for a standard measurement of the total (p,π) cross section for a number of reasons. These are: a) Bismuth lacks spectroscopic impurities of higher Z elements (of those higher in Z, only Th and U are "stable") and b) The reaction products $^{210}At$ ($\pi^-$), $^{210}Po(\pi^o)$ and $^{210}Bi(\pi^+)$ are easily separated radiochemically and identified by alpha- or gamma-ray counting. To date we have irradiated several targets of various thicknesses (5, 25, 600 mg/cm$^2$) at proton energies of 127-, 147- and 160- MeV with beam currents ranging from 1 - 100 na. The production of $^{210}Po$ has been observed in each of these targets; however we did not look for either $^{210}At$ or $^{210}Bi$ as the chemistry for them has only recently been worked out.

The results to date indicate substantial secondary isotope production, in particular the (α, 2n) reaction, with the very thick (600 mg/cm$^2$) targets. The thin targets (5-25 mg/cm$^2$) do not suffer from the secondary problem but require high beam currents (∿100 na) for sufficient production count rates. The products observed in the Po fraction range in half-life from 30 minutes to 100 years, with 8.8-day $^{206}Po$ being the most prominent activity observed for the period of 1-6 weeks after bombardment. As $^{210}Po$ has a longer half-life (138 days) and a lower cross section, the Po sample must be counted over a period of several months. Final results from these samples on the production cross-section of $^{210}Po$ must await further analysis of the decay data. The next series of runs will focus on thin-target high-current production of $^{210}At$, $^{210}Po$ and $^{210}Bi$ above and below pion threshold.

*University of Tel-Aviv, Israel.

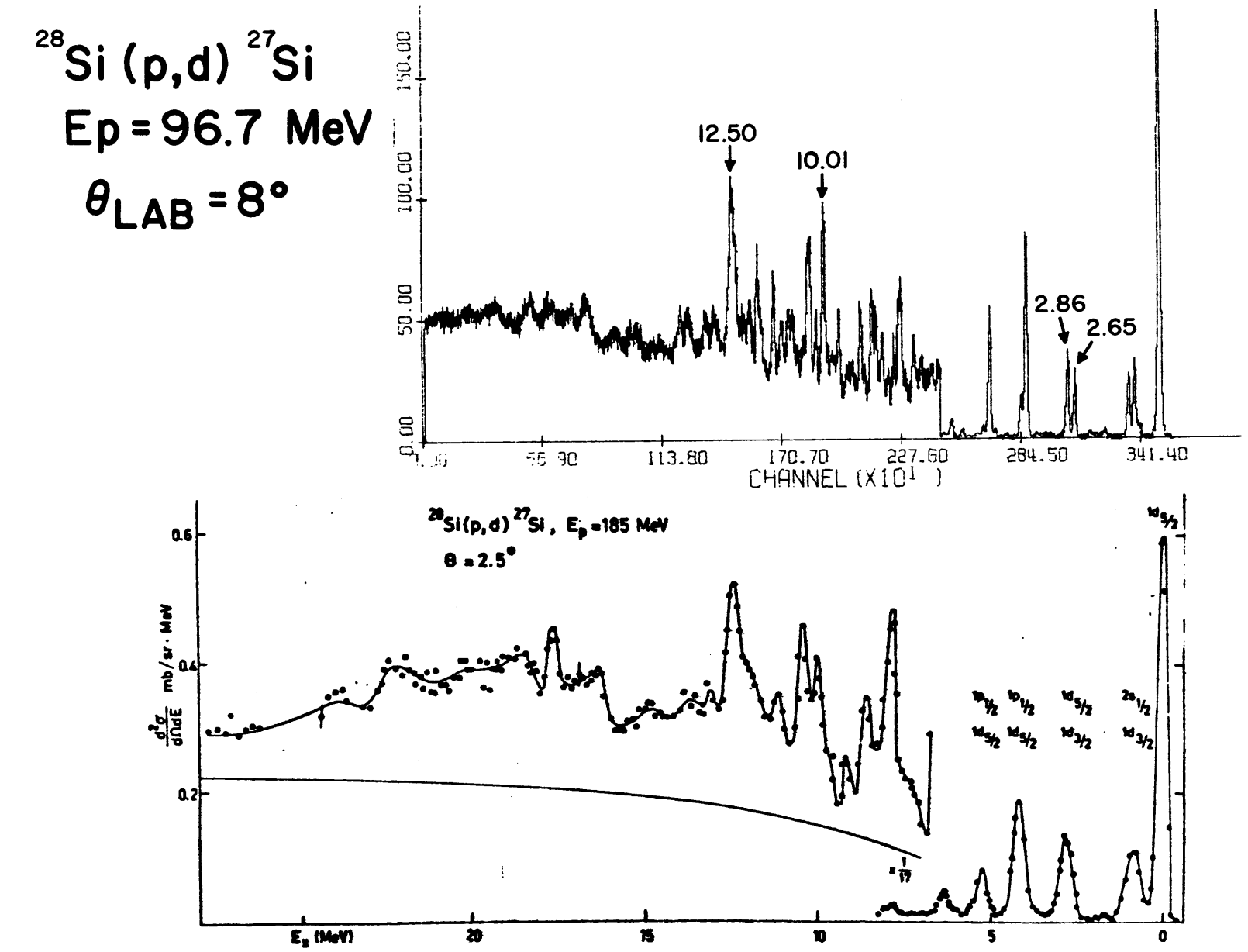


Figure 1. Comparison of Uppsala (p,d) results (Ref. 2.) with IUCF data for the same final nucleus.