REACTION MECHANISM STUDIES IN THE Ni AND RARE EARTH REGION: MEASUREMENTS OF FIRST AND HIGHER ORDER MULTIPLICITIES OF THE γ-CASCADES FOLLOWING (particle, x particle γ) REACTIONS

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An apparatus for γ-ray multiplicity experiments,[1,2] constructed at Washington University, St. Louis, was brought to IUCF for the runs and set-up in the gamma cave. It has two lead shields which support seven and two 2" x 3" NaI detectors, respectively. The latter shield also positions a Ge(Li) detector at 90°, 5 cm from the target. The shields were mounted outside the target chamber giving a target to detector distance of 10 cm. Five of the NaI detectors are in the reaction plane at 45°, 50°, 90°, 135° and 140°.

A specially-constructed multiplicity generating overlap coincidence unit[2] gives the number of NaI detectors coincident with a Ge(Li) event. The experimental setup was checked in a test run of one shift in June 1976. A number of minor problems specific to the reactions with high energy protons were realized and corrected in subsequent experiments.

Two series of γ-ray multiplicity experiments based on the available beams at the IUCF were initiated. The first consists of measurements with 80 MeV protons on ^{62}Ni and ^{169}Tm. The second employed the reactions induced by 65 MeV ^{6}Li on ^{56}Fe, ^{165}Ho and ^{169}Tm. In these experiments Ge(Li) spectra were recorded on magnetic tape in the event-by-event mode in coincidence with any of the 0-, 1-, 2-, 3- or more NaI detectors. At the same time energy spectra in four NaI detectors, located at 50°, 90°, 135° and 140° to the beam direction, were recorded in coincidence with the Ge(Li) detectors. From these experiments the average multiplicity for every exit channel as well as the width of the multiplicity distributions will be deduced.

Unfolding of the NaI spectra will provide the average γ-ray energies $\bar{E}_\gamma$ associated with the exit channels and this will permit the determination of the multiplicity values, in view of the fact that there is an energy dependence of the integral efficiency of the NaI detectors. Angular distributions of the γ-rays from the continuum will also be obtained.

Further experiments have been planned to extend these measurements to other higher bombardment energies with both the proton and ^{6}Li beams.

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1) D.G. Sarantities, J.H. Barker, M.L. Halbert, D.C. Hensley, R.A. Dayras, E. Eichler, N.R. Johnson and S.A. Gronemeyer, Phys. Rev. C14, 2138 (1976).

2) L. Westerberg, D.G. Sarantities, R. Lovett, J.T. Hood, J. Barker, C.M. Currie and N. Mullani, (to be published).

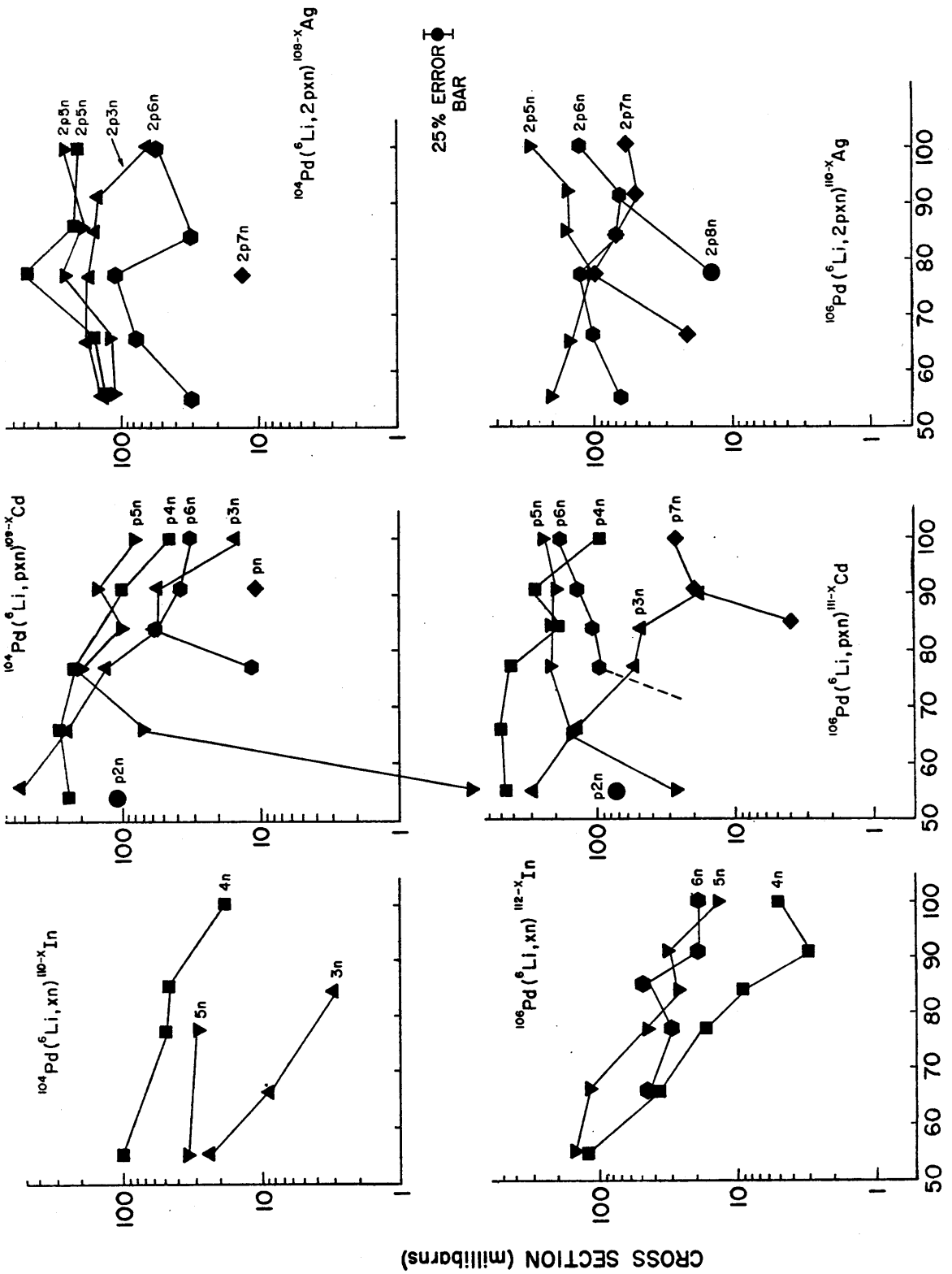

Figure 1. Summary of excitation function data from ^{6}Li incident on light palladium targets. Cross sections are quoted with a 25% uncertainty.