FWHM.

Preliminary data at E_p= 160 MeV appears to indicate that the ratio of spin-flip to non-spin-flip strength is larger than at 120 MeV, but the resolution is sufficiently worse that the interpretation is less clear cut.

1) R.R. Doering, A. Galonsky, D.M. Patterson, and G.F. Bertsch, Phys. Rev. Lett. 35, 1691 (1975).

2) C.D. Goodman, Telluride Conference, March 29-31, 1979.

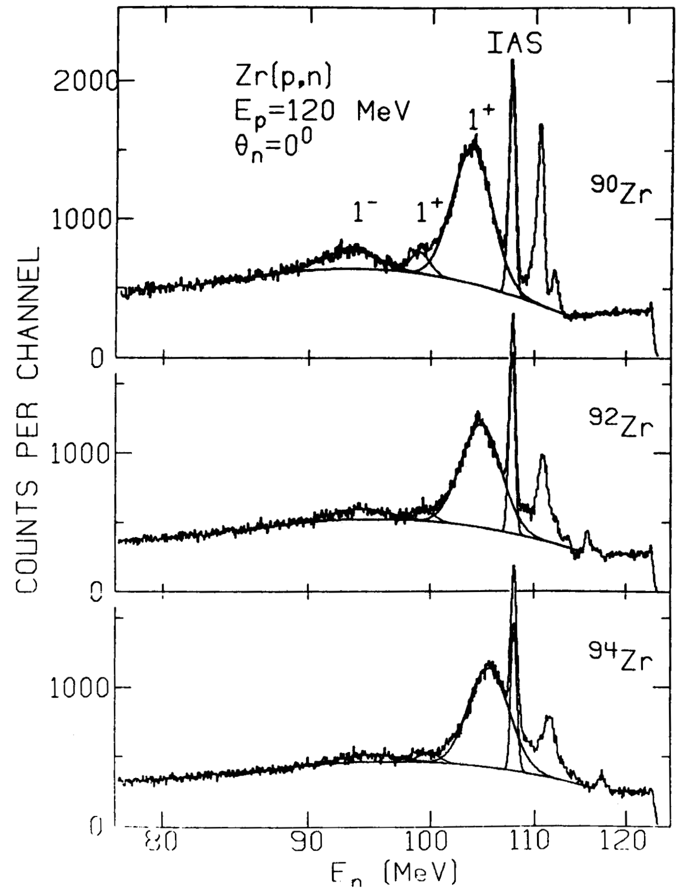

Figure 1. Neutron spectra including fits to peak shapes for the $^{90,92,94}Zr(p,n)$ reactions at 120 MeV proton bombarding energy.

NEUTRON MATTER DISTRIBUTIONS FROM QUASI-ELASTIC (p,n) REACTIONS

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Runs made early in the year on Zr, Sn and Pb to look at (p,n) neutron spectra at angles much larger than 15° indicated that the general background, mainly cosmic ray neutron and muon events, was so large that it was not possible to take angular distributions on large A targets at angles beyond 20°. The two features currently of interest are gound state IAS transition strengths and the giant resonance strengths. For both problems improved signal-to-background was needed.

In the past year very substantial improvements in the chopped beam current at the TOF targets has occurred. The other improvement made was the installation of large veto scintillation paddles to eliminate the charged component of cosmic rays. Two paddles were used; a vertical unit was placed in front and a horizontal unit on top of two neutron detectors. Thus charged particles generated by neutron interactions in the air ahead of the detectors were also eliminated. With these units, background when no neutron beam was present was reduced by a factor of about 7 for detectors operating at a threshold of 15 MeV for neutrons. Fig. 1 shows the neutron time-of-flight spectrum for ^{124}Sn at 20.2 deg and 79.3 MeV proton energy. The threshold was not quite high enough to eliminate neutrons from the preceding beam burst. There is to the left of the prominent IAS peak evidence for the giant resonance which is very prominent in Sn at 120 MeV, as well as in all Zr targets at this energy.

As a result of earlier experience with Sn targets at 120 MeV, it was decided to set the proton energy at 80 MeV and use a flight distance of 46.3 meters with optimum veto shielding to insure that angular distributions could be generated out to angles where significant analysis becomes possible. Two experiments were carried out together. A Michigan State University group took data on $^{90,92,94}Zr$ for the giant resonance phenomena and is reporting their results separately. This group confined analysis to the IAS states in $^{90,92,94}Zr$ and $^{112,116,124}Sn$. In the time available, runs from 0^{o} to 24^{o} lab angle range were recorded. The beam was pulsed with one pulse in five R.F. cycles accepted and yielded up to 350 nA at the target. A proton monitor detector consisting of a fast passing counter (Pilot U scintillator mounted on a C31024 RCA phototube) generated time reference pulses for the time compensation circuitry to accept. Optimum time resolution was 1 ns but timing was quite stable. This

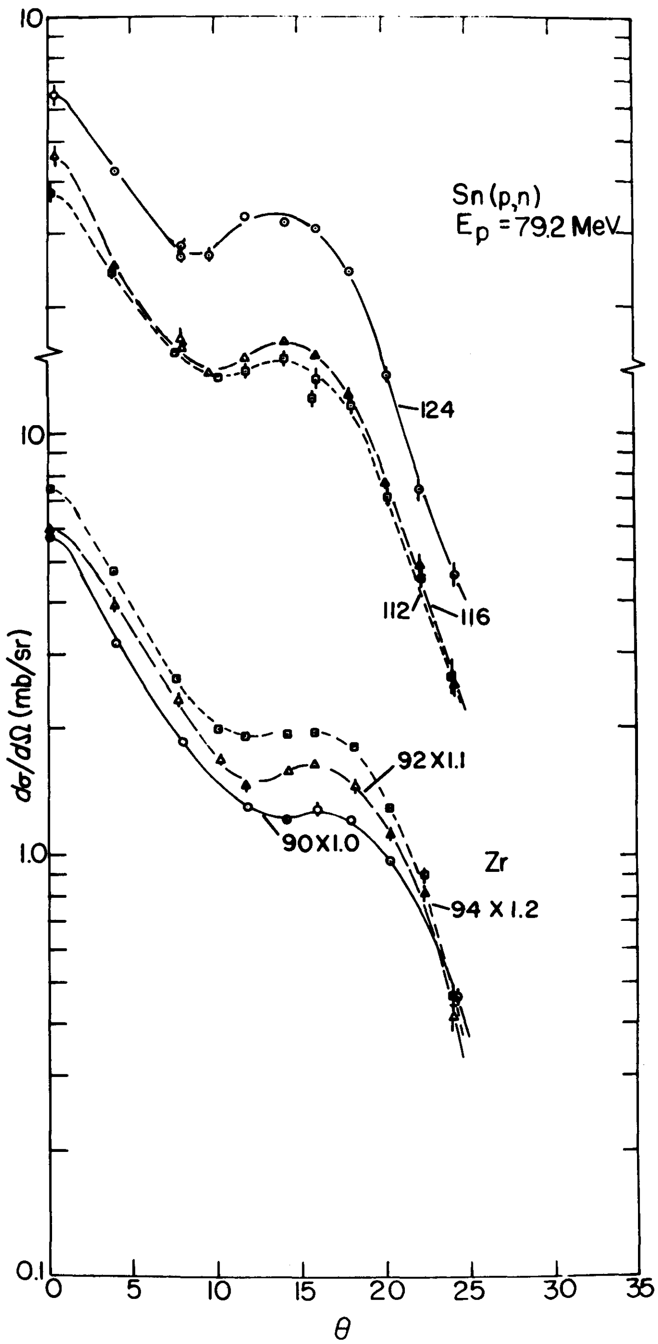

Figure 2. Angular distribution data taken for the IAS state with targets of $^{90,92,94}Zr$ and $^{112,116,124}Sn$ by the (p,n) reaction at an energy of 79.2 MeV. Note that points for Zr isotopes have been displaced relative to one another.

resolution was not detrimental for the data that these experiments provided. It was moreover, consistent with the beam current pulse as seen by the proton monitor, the energy loss in the targets and the depth of the neutron detector.

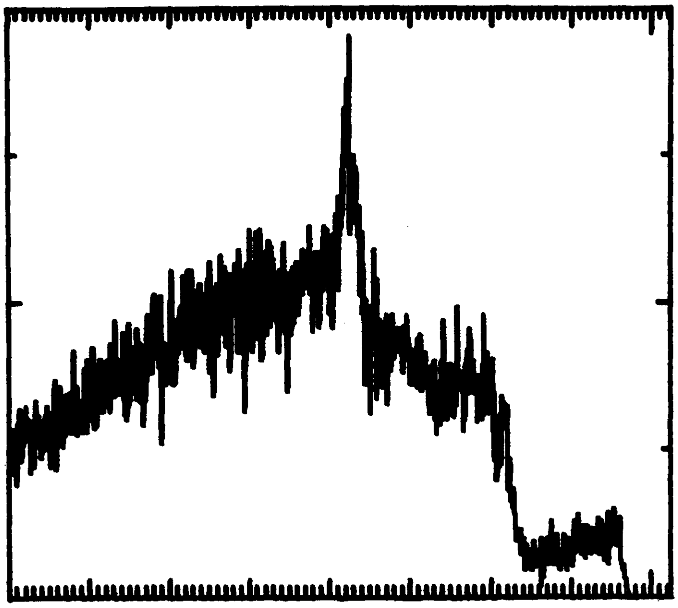

Figure 1. Neutron time-of-flight spectrum for the $^{124}Sn(p,n)^{124}Te$ reaction at 79.2 MeV and 20.2 deg. The figure contains 1000 channels with 200 counts/channel full scale.

The angular distribution data are presented for each isotope in a sequence in Fig. 2. The statistical error on each data point is shown. Areal densities of the Zr targets were determined by weighing. The Sn targets were compared by measuring the elastic scattering of protons at 8^o in the lab frame and calculating the apparent relative densities using a global optical model to predict relative angular distributions. There was also some uncertainty in the precise reproducibility of measurements. These uncertainties are indicated by error bars on the 0^o point for each isotope. The curves for Sn are on the same ordinate scale and show the actual differences between isotopes. In the case of Zr the curves for ^{92}Zr and ^{94}Zr have been displaced upwards by 1.1 and 1.2, respectively. The differences are in the vicinity of the first maximum at 18^o and are generally much smaller than for the Sn.

Absolute normalization was done using the $^{7}Li(p,n)^{7}Be$ total cross section and angular distribution measurements. The method used is described briefly by Ward et al.[1] in the 1978 IUCF Annual Report. The yield in the (p,n) reaction on a ^{7}Li target of known areal density was measured at 0^o. The absolute normalization is ±15 percent. For the purposes of the model analysis this value is not of importance since only relative changes between the isotopes will be used.

The analysis requires the folding model code developed by Schery.[2] As soon as it is adapted to University of Colorado computing facilities, searches for the best fit parameters will be made. Predictions for the angular distributions to larger angles will be made to plan for future runs on this experiment. Such results are not yet available.

1) T.E. Ward, C.A. Goulding, M.B. Greenfield, C.C. Foster, J. Rapaport, C.D. Zafiratos, S.D. Schery and C.D. Goodman, IUCF Annual Report, 54 (1978). Also C.C. Foster et al., Bull. Am. Phys. Soc. 24, 828 (1979).

2) S.D. Schery in "The (p,n) Reaction and the Nucleon-Nucleon Force" Proceedings, Telluride, CO (1979), to be published.