NASA CR-72598
GA-9480

FINAL REPORT

REEVALUATION AND ANALYSIS OF NEUTRON SPECTRA IN LIQUID HYDROGEN

by

G. D. Trimble and W. E. Selph

GULF GENERAL ATOMIC

prepared for

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NASA Lewis Research Center
Contract NAS 3-11228
R. L. Danilowicz, Project Manager

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August 4, 1969

CONTRACT NAS 3-11228

NASA Lewis Research Center
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ABSTRACT

Under Contracts NAS3-4214 and NAS3-6217, angular neutron spectra were measured from 15 MeV to 0.0005 eV at various angles for liquid hydrogen thicknesses of 2.5, 4.5, 7.0, 10.5, and 13.0-in. Since considerable time had elapsed between the two contracts, it was felt desirable to reevaluate and update all the spectral data in a consistent manner using the latest available techniques.

This report describes those methods and techniques used to reevaluate and update all the spectral data generated under the abovementioned contracts. Calculations were performed using the O5R Monte Carlo and 1DF discrete ordinates codes for comparison with selected spectral measurements.

The reevaluated and updated spectral data and calculations are tabulated in the report.

1. INTRODUCTION

This final report describes the work performed on a research program under Contract NAS3-11228 with the Nuclear Systems Division, NASA-Lewis Research Center.

The purpose of this program was to reevaluate and update all spectral data generated under Contracts NAS3-4214 and NAS3-6217 using the latest available techniques. The methods and techniques whereby the neutron spectral measurements were made, under the above mentioned contracts, have been described in detail in References 1 and 2, and a detailed listing of these measurements is given in Table 1. The data taken were reduced using the best efficiency and background subtraction techniques available at the time. However, since there had been over a four-year lapse since the data were taken on the first contract and a two-year lapse since the second contract to the initiation of the present program, it was felt desirable to reevaluate and update all the spectral data in a consistent manner using the latest available techniques.

The spectral data were taken in three separate energy regions: fast, intermediate, and thermal. The reason for this separation is that each energy region required a different neutron detector.

This final report has been separated into these same groupings. Section II, describes the calculations, Section III discusses the reevaluation of the fast neutron spectral data, Section IV gives the reevaluation of the intermediate neutron spectral data, Section V discusses the reevaluation of the thermal neutron spectral data, and Section VI compares calculations and experiments for all the data generated under Contracts NAS3-4214 and NAS3-6217. Appendix A contains the geometry input to O5R,

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Appendix B lists the KINNY program and input instructions, Appendix C gives the subroutine SOURCE listing, Appendix D provides the ACTIFK user subroutines, and Appendix E is a detailed listing of all spectral data generated under both Contracts NAS3-4214 and NAS3-6217, and the O5R and IDF calculations made under the present contract, NAS3-11228.

Table 1

SUMMARY OF DATA TAKEN UNDER CONTRACTS NAS3-4214 AND NAS3-6217

Contract NAS3-4214

A. Fast Neutron Spectrum Measurements

Angular neutron flux from 15 to 0.5 MeV for angles of 0^o, 15^o, 37^o, 53^o, and 78^o and liquid hydrogen thicknesses of 2.5, 4.5, 7.0, 10.5, and 13.0 in. and with the liquid hydrogen dewar empty.

Contract NAS3-6217

A. Fast Neutron Spectrum Measurements

Angular neutron flux from 15 to 0.5 MeV at 0^o for liquid hydrogen thicknesses of 2.5, 7.0, and 13.0 in. and for the empty dewar; and at 37^o for liquid hydrogen thicknesses of 2.5, 4.5, 10.5 and for the empty dewar.

B. Intermediate Neutron Spectrum Measurements

Angular neutron flux from 1.5 MeV to 500 eV for angles of 5^o, 15^o, 37^o, 53^o and 78^o and liquid hydrogen thicknesses of 2.5, 4.5, and 7.0 in. Empty dewar measurements were made at 5^o, 15^o, 37^o, and 78^o.

C. Thermal Neutron Spectrum Measurements

Angular neutron flux from 10 eV to 0.0005 eV for angles of 37^o and 78^o and liquid hydrogen thicknesses of 2.5, 4.5, 7.0, 10.5 and 13.0 in.

2. THEORETICAL ANALYSIS OF THE FAST AND INTERMEDIATE FLUXES

2.1 INTRODUCTION

The Monte Carlo method exemplified by the code O5R[3] was selected for the analysis of the liquid hydrogen experiment because of its flexibility in describing the source and material geometry and because of its ability to consider separately the direct and scattered components. This allows the formulation of estimators which approximate the collimated detector.

The experiment was performed for thicknesses of 2.5, 4.5, 7.0, 10.5, and 13 inches of liquid hydrogen between the source and precollimator. For the analysis reported here representative thicknesses of 2.5, 4.5, and 13 inches were selected by mutual agreement with the contracting agency.

Described in Section 2.1 below are the procedures used in the implementation of the O5R Program in calculating collision histories in the fast and intermediate energy region. Analysis of these histories is discussed in Section 2.3 and the results are presented in Section 2.4.

2.2 DESCRIPTION OF THE O5R PROBLEM

2.2.1 GEOMETRY OF MATERIALS

Figure 1 shows the sector boundaries used in the mathematical description of the dewar and the materials assigned to each of these sectors. This is a plan view of the cylindrically symmetric arrangement. Not all space within the enclosing parallelopiped is accounted for in this projection. Between the outer cylinder, which forms the central part of the dewar, and the corners of the parallelopiped there are four segments of space assigned as external void. The O5R listing of this description of the geometry is given in Appendix A for the 13-inch configuration.

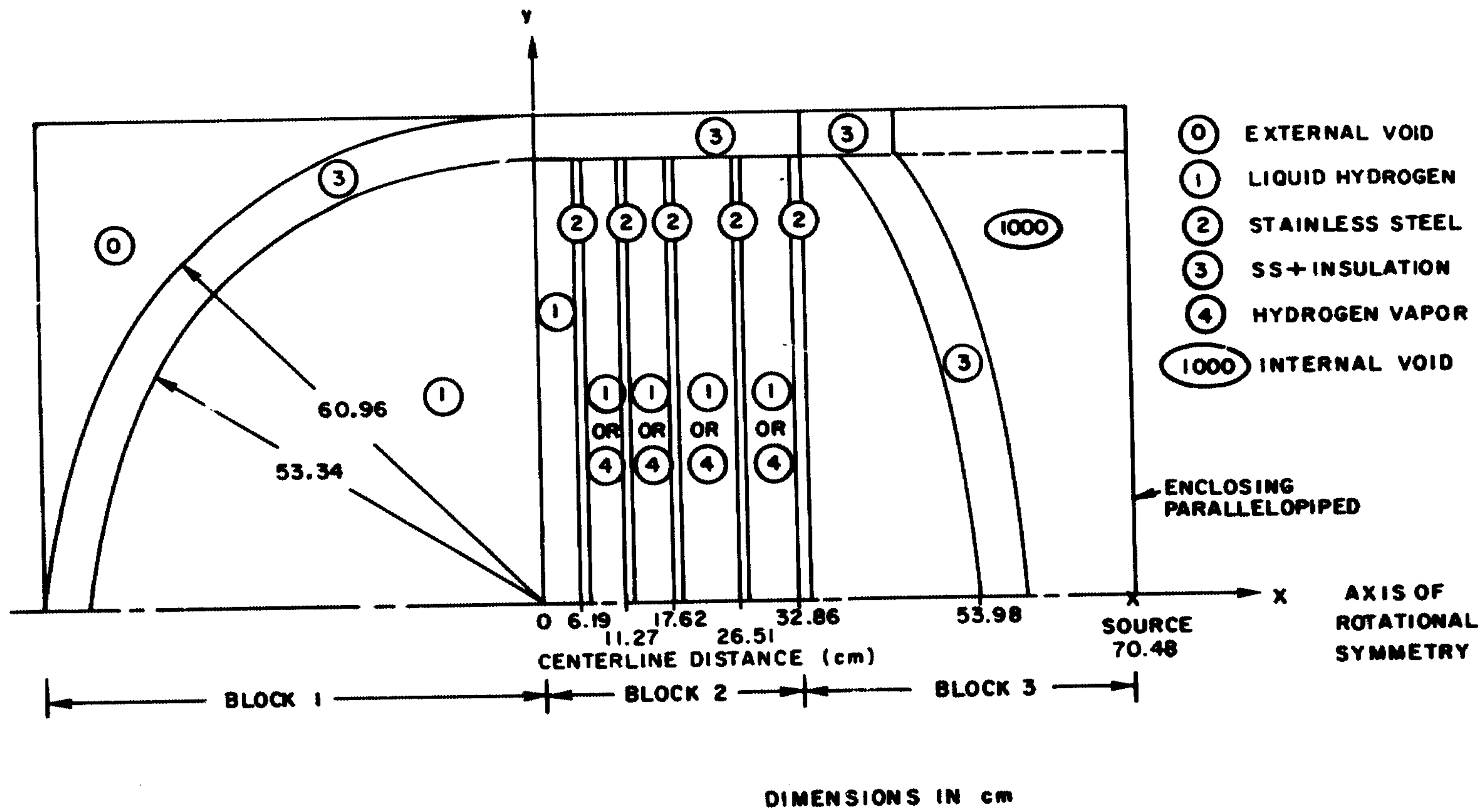


Figure 1. O5R geometry.

The material compositions are presented in Table 2 in terms of atomic density.

Hydrogen vapor is assumed to fill all of the internal compartments of the dewar not filled with liquid hydrogen. The LH_2 vapor at atmospheric pressure and at the boiling point temperature has a density which is 1.57% of the liquid density. A summary of the materials encountered along the dewar centerline in Table 3 shows that the vapor adds an equivalent of .736 cm of LH_2 to the 2.5-inch LH_2 configuration and an equivalent 3.28 cm to the 13-inch LH_2 configuration.

2.2.2 CROSS SECTIONS

Since in the dewar geometry there is a total thickness of 1.431 cm of stainless steel between the source and the precollimator it was decided that inelastic events should be treated exactly by the code. This decision greatly complicated the cross section preparation (roughly doubled the amount of cross section input) and the coding required to track particles and analyze collisions. The approach was deemed necessary, however, because the probability of successive collisions was very sensitive to the energy lost in the first collision. The inelastic events are a significant fraction of the total cross section in all of the primary constituents of stainless steel at energies above 3 MeV.

All of the more important cross sections were taken from the ENDF/B files. These include hydrogen, iron, nickel, and chromium. Cross sections for silicon, aluminum, and boron (constituents of the insulation material) were either not available or had insufficient detail in ENDF. Consequently, these were taken from the Gulf General Atomic standard cross section library. In the case of silicon, these cross sections were evaluated at Gulf General Atomic[4] for submission to ENDF.

The ENDF cross sections and Legendre coefficients were input to the O5R cross section handling programs to generate the PHI tape used directly in the calculations. Some difficulties were encountered, however,

Table 2

DEWAR MATERIAL COMPOSITIONS

	Material	$\rho(g/cm^3)$	Atom Density ($atoms/cm^3 \times 10^{-24}$)
1	Liquid Hydrogen	.071	H .042425
2	Stainless Steel	7.9	Fe .05901
			Ni .008529
			Cr .01851
3	Insulation plus Stainless Steel Homogenized	.7063	B 2.78×10^{-4}
			Al 5.65×10^{-4}
			Si 3.26×10^{-4}
			Fe 4.815×10^{-3}
			Cr 1.51×10^{-3}
			Ni 6.955×10^{-4}
4	Hydrogen Vapor	.0011147	H 6.6607×10^{-4}

Note on Material 3: 90 layers of borosilicate glass, each 1.71×10^{-3} g/cm^2

90 layers of Al foil, each 2.144×10^{-3} g/cm^2

2 layers of Stainless Steel, each 2.55 g/cm^2 homogenized over a depth of 7.62 cm

in the case of the inelastic cross sections. The lowest energy point used in reporting some of the cross sections was at some point above the inelastic threshold scattering rather than being at the threshold. This, coupled with the method of interpolation in O5R occasionally resulted in finite cross sections for an event at energies below the threshold. To overcome this difficulty an auxiliary program was written to redefine the ENDF data at points near the threshold.

An additional complication in the cross section preparation arose because of deficiencies in the ENDF/B data for Ni. There was no scattering

Table 3

DEWAR CENTERLINE MATERIALS
(Between the Source and Precollimator)

Dewar Configuration Name	LH_2 Depth (cm)	Vapor Depth (cm)	Equiv. LH_2 Total			Dewar Materials (g/cm^2)	
			In.	cm	g/cm^2	Steel	Insulation
2.5 in.	6.19	46.99	2.72	6.926	0.491	11.52	0.35
4.5	11.11	42.07	4.63	11.77	0.831	↓	↓
10.5	26.03	27.15	10.42	26.456	1.88	↓	↓
13.0	32.22	20.96	12.8	32.548	2.31	↓	↓

energy law given for the (n,2n) reaction and the law given for inelastic scattering was found to be in error. The assistance of Dr. Marvin Drake was obtained to formulate nuclear temperature models for these two reactions. The formulation is the standard ENDF/B scattering energy law[5] (LF = 7) with a nuclear temperature given by $\theta = 422\ E^{0.5}$ for inelastic scattering and by $\theta = 302\ E^{0.5}$ for the (n, 2n) reaction.

The order of anisotropy included in the neutron scattering angular distributions was P9 except for B (P6), Al (P8), and Si (P8).

2.2.3 SOURCE

The mathematical description of the neutron source was modeled after the 7.62-cm water-cooled depleted uranium target used in the second series of liquid hydrogen experiments.[2] The hemisphere-integrated spectrum given off by this target is shown in Fig. 2.[6] The spectrum and intensity of the source were assumed invariant with angle within the approximately 65-degree half-angle conical intercept of the dewar.

To reduce the computer running time required to obtain good averages of the scattered flux, the source was biased both in angle and in energy. The energy biasing for the 2.5- and 4.5-inch slabs was obtained by generating neutrons with equal probability in each of the source energy

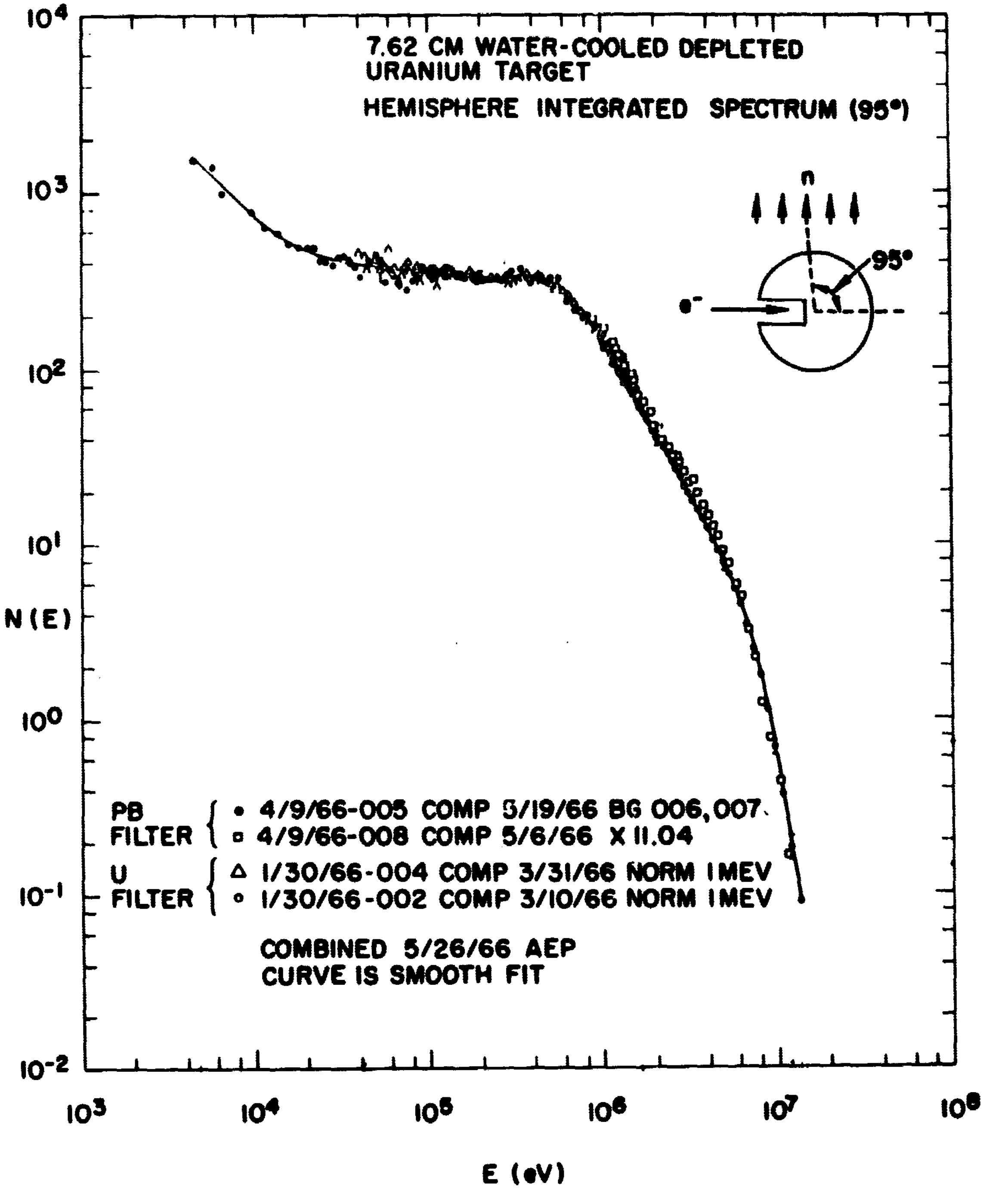


Figure 2. Hemisphere-integrated flux spectrum.

groups. This should provide approximately equal convergence of each of the groups for a thin shield. The cumulative distribution for neutrons above 4×10^3 eV is shown in Fig. 3 for both the unbiased and biased sources. These plots refer only to the relative number of source particles generated. The weights are adjusted so that the weight generated in any group is the same in either the biased or unbiased condition.

In the 13-inch LH_2 configuration an adjoint calculation was performed using the 1DF transport code[7] as a means of estimating the optimum source biasing. The solution of the 1DF adjoint problem gives only the approximate importance because of the inadequacies of a one-dimensional representation of the experimental geometry. The calculation is nevertheless worthwhile since it can add considerably to the efficiency of the Monte Carlo runs. The hydrogen slabs were represented in 1DF as being infinite and a neutron source was input with an energy distribution which is the inverse of the distribution used in the experiment. The energy distribution of the penetrating radiation is then an indication of the optimum input source for the Monte Carlo calculations. Slight adjustments were made in the O5R energy groups to conform to the 1DF fine group structure boundaries. The result of this calculation indicated use of the cumulative probability and weighting factors given in Table 4.

Source particles below 0.2 MeV were ignored in the O5R calculations of the thick slab because their impact on leakage through the slab would not be significant. Angular biasing was used to force more of the neutrons into the important central portions of the dewar. The extent of the distortion from an isotropic distribution and the associated weighting are summarized below:

Polar Angle	Unbiased $P(\theta)$	Biased $P(\theta)$	Weight Adjustment
10°	0.02631	0.1	0.2631
20°	0.104454	0.3	0.3907
65°	1.0	1.0	1.278

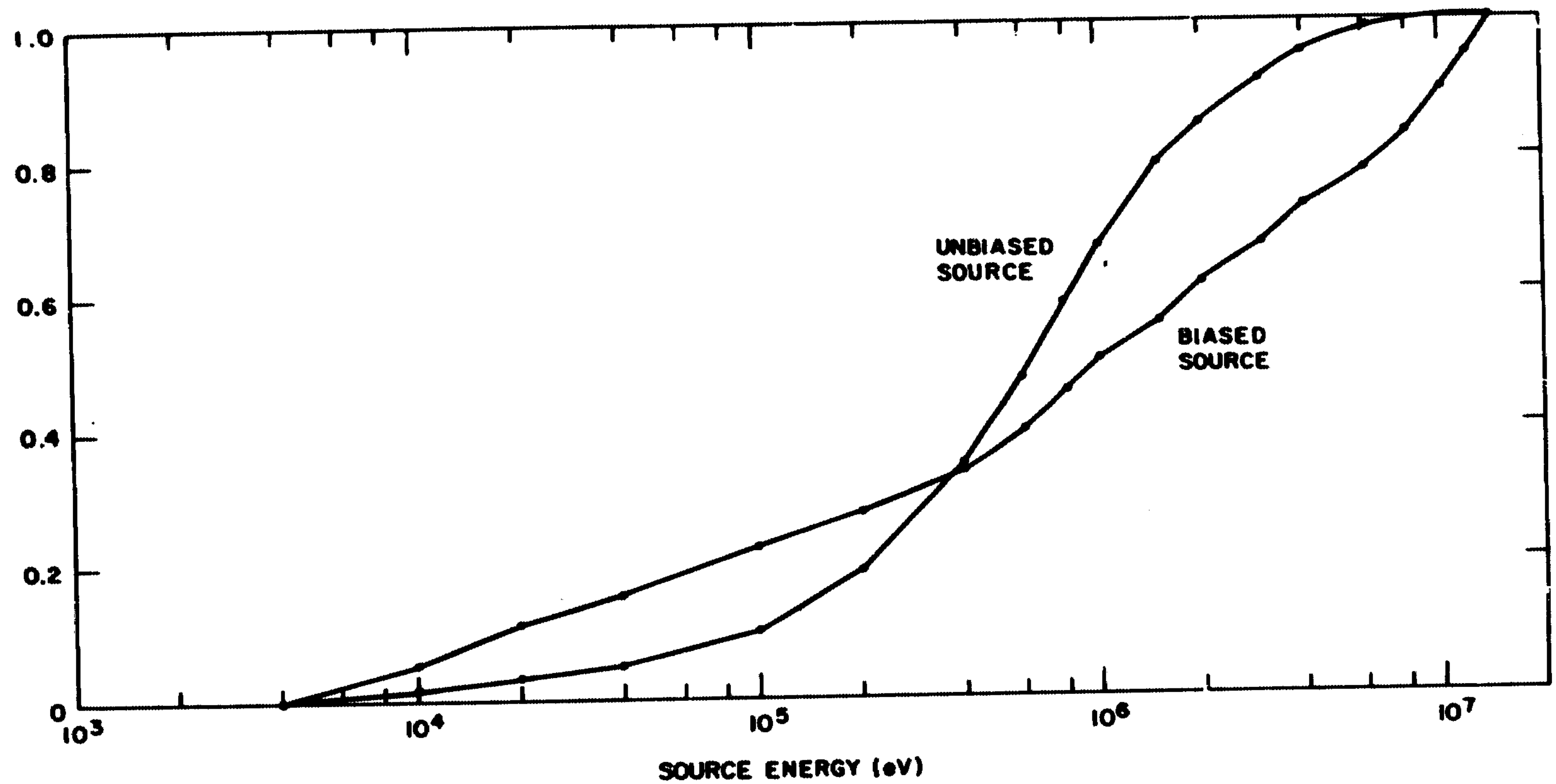


Figure 3. Cumulative distribution for neutrons.

Table 4

ENERGY BIASING FOR 13 INCH LH_2 ANALYSIS

Group E Upper (eV)	P(E)*	Weight Adjustment Factor
2.0 E5	0.02194	7.34
4.0 E5	0.04127	10.14
6.0 E5	0.06411	5.55
8.0 E5	0.08605	4.44
1.0 E6	0.10797	3.476
1.5 E6	0.15185	2.656
2.0 E6	0.19573	1.255
3.0 E6	0.25812	1.048
4.0 E6	0.32211	5.0704×10^{-1}
6.0 E6	0.42274	3.159×10^{-1}
8.0 E6	0.52337	9.678×10^{-2}
1.0 E7	0.624	3.285×10^{-2}
1.2 E7	0.812	5.185×10^{-3}
1.4 E7	1.0	2.93×10^{-3}

*P(E) is the cumulative probability of neutrons being generated with energy less than, or equal to, the energy of the group upper bound.

The probability allotment for each increment is interpolated linearly with the cosine of the angle within the bounding values. Although neutrons are not generated outside the 65° cone the answers are all normalized to one 4π isotropic neutron at the source. To prevent round-off problems at the boundary passing through the source, the initial position of the particles was set on the surface of a 1-cm sphere.

2.2.4 IMPLEMENTATION OF O5R

There are a variety of routines which the O5R user must provide to match his specific problem requirements. Only two of these special routines, KINNY and SOURCE, were required in this calculation although a variety of other minor modifications were made to increase operating efficiency on the GGA Univac 1108 computer.

KINNY is the subroutine which treats nonelastic events. The version used in this analysis treats discrete-level inelastic scattering, unresolved level scattering using an evaporation model, and (n, 2n) and (n, 3n) processes. The program listing and input specifications are given in Appendix B. The KINNY subroutine receives information on the pre-collision neutron parameters, the species collided with, and the point of collision. It then calculates postcollision parameters based on the collision energetics for the specific collision type. Scattered angular distributions may be either isotropic or anisotropic in the center of mass system in accordance with options selected in the O5R input. Use is made of standard random number routines in selecting the polar and azimuthal scattering angle. When the incident energy exceeds the threshold, a given level may be excited. For this option postcollision parameters are calculated by subroutine LEVEL. Unresolved level scattering is handled in subroutine EVAPMD.

Subroutine SOURCE was written to generate source neutrons at a point from input cumulative distributions in energy and angle. Weighting factors are input corresponding to each bin so that energy and angle biasing may be employed. This listing is given in Appendix C. Input quantities are: Card A (6E10.2) x, y, z, NMEM, NMED, NREG

1-3	x, y, and z coordinates of the source point.
4	The number of neutron histories to be generated.
5	The number of the medium corresponding to the location of the source point.

6 The number of the region corresponding to the location of the source point.

Card B (2I10) MTHET, MEGR

1 The maximum number of boundaries of the angle bins used in the problem ≤ 21.

2 The maximum number of energy bin boundaries ≤ 41.

Card C (7E10.2) THET(I)

The angle bounds beginning with the bound on or nearest the x axis in the negative x direction. Units are in radians.

Card D (7E10.2) PTHET(I)

The cumulative probability of generating a neutron at angles between the x axis (or the bound nearest the x axis) and the bound THET(I). These probability values should be adjusted to reflect the biased condition if angular biasing is used.

Card E (7E10.2) WTHET(I)

The (MTHET-1) weight constants which apply to the polar angle bins. All WTHET(I) = 1 if biasing is not used.

Card F (7E10.2) EBNDS(J)

The (MEGR) bounding values of the energy groups beginning with the lowest energy. Units are eV.

Card G (7E10.2) POFE(J)

The cumulative probability of neutrons being generated with an energy less than EBNDS(J). There are MEGR of these values which always begin with 0 and end with 1.

Card H (7E10.2) EWT(J)

The (MEGR-1) weights associated with the energy bins listed with the lowest energy bin first.

The implementation of this subroutine to obtain particular source biasing conditions is discussed in the preceding section.

In assembling and checking out the O5R program for these calculations it became apparent that reductions in run time would be required if all of the calculations were to be performed within the budgeted computer time. One of the basic constraints was the small amount of core space for storing the parameters of neutrons currently being tracked. The program flow is set up so that neutrons are generated in batches and each batch is traced successively through the energy supergroups until all neutrons are degraded below the minimum energy of interest in the problem. Thus cross section data for only one supergroup has to be in the core. Collision parameters can be stored on tape as generated but the post-collision particle parameters must be maintained in the core for every particle in the batch.

After some mapping of the program it was possible to store the parameters for 1000 particles. Calculations could then be performed in 1000 particles batches if no splitting was allowed but this number would have to be reduced considerably if the splitting option was used because each split resulted in two or more neutrons which must be tracked. The liquid hydrogen calculation was first modeled with the intent of using the splitting and russian roulette options in O5R but it was found that the batch size had to remain so small that no real computing economy could be realized. On a larger computer the variance of the calculated values could have been reduced by judicious use of weight limiting regions.

The program was found to be inefficient on the GGA Univac 1108 machine since a significant fraction of the program run time is taken up with input/output (I/0) functions. Most of these were handled by FORTRAN reading to and from tape using a 256-word buffer size. Some of the options that were tried which netted small, but not really significant gains, were: (1) transferring from tape to drum using FORTRAN and a 256-word buffer; and (2) using NTRAN with a 256-word buffer on drum storage. A third option which did result in significant run time savings was changing the buffer size from 256 to 10,000. The O5R PHI and cross section tapes were rewritten (by program modification) to conform with this buffer size and were then transferred to drum. This operation allowed much quicker transfer rate between the tape and drum and between the drum and core.

The result was about a factor of two reduction in run time per history. This allowed about two times as many histories to be run per unit time, or a factor of $1/\sqrt{2}$ reduction in the uncertainty of the answer.

In larger machines where I/0 functions are billed at a much lower rate, and central processor time is billed separately, the savings described above would not be realized. In the Gulf General Atomic UNIVAC machine however, the central processor is tied up during I/0 operations and any improvement in these is reflected directly in the run time and computing costs.

NTRAN is a special feature of UNIVAC systems that allows for variable buffer lengths and parallel I/0 and computing operations. The variable buffer size is used in the input and the parallel feature is advantageous in writing collision history information while calculations continue.

Checkout of the program consisted of small batch runs where collision parameters and intermediate quantities are printed out to determine that:

1. Source particles are being properly selected and weighted
2. Cross section values are being correctly determined
3. Path length is selected properly.

In addition the PICTURE routine was run to check that the geometry was being interpreted by GEOM as was intended. This proved to be a useful operation in that small regions between the outer cylinder of the dewar and the enclosing paralellopiped which had not been described were later included in the model.

2.3 ANALYSIS OF THE O5R COLLISION HISTORIES

2.3.1 THE ACTIFK PROGRAM

Analysis of the O5R collision tapes was performed using the ACTIFK[8] code. ACTIFK, as distributed by the radiation shielding information center, will only calculate neutron dose at a point, but by suitable modification, it can be made to perform a wide variety of analysis tasks. The code package includes the same geometry routine as in the O5R code and is similar to O5R in the provisions for cross section handling. Existing routines perform many of the coding details connected with tape reading, computation of storage requirements for input data, transmission of data to the appropriate subroutines at the proper time, and other tasks.

Modifications of the code were of two basic types: some of the routines were modified to fit the different format for data storage in our modified version of O5R; and subroutines connected with analysis of the histories were removed and replaced in their entirety. Included in the latter category were:

STBATCH - A routine which is called at the beginning of each batch of neutron histories to initialize quantities being calculated. In addition, it reads input associated with the user routines on the first call.

SDATA - A routine which calculates any quantity desired from the source particle parameters. In the LH_2 analysis, SDATA was used to calculate the uncollided flux.

RELCOL - A routine which calculates any desired quantity from real collision parameters. This is the heart of the ACTIFK program as used in this project. All last flight estimators were calculated here as well as the calculation of an input source for the thermal calculations.

ENDBATCH - At the end of each batch of neutrons this routine is called to do any desired calculations such as averaging or normalizations which are more economical to do here rather than including them in the calculation of the contribution from each collision.

ENDRUN - A routine which is called after all collisions have been processed. Final answers and statistical quantities are calculated here and printed out.

Each of these routines may call upon a variety of built-in routines such as the geometry package, routines for calculating attenuation along the flight path and for calculations of total or differential scattering cross sections. The listing of these routines is given in Appendix D.

2.3.2 FLUX ESTIMATORS

The mathematical formulations of the various estimators used in the collision tape analysis are described below.

2.3.2.1 Energy-Angle Flux

In estimating the energy-angle flux, a unit detector was assumed to be positioned at the center of the entrance to the precollimator and an estimate was made of the contribution to the flux at this point resulting from each collision point of interest. It will be recalled from the geometry description that the precollimator begins at the x = 0 plane and extends in the negative x direction. Thus only collisions whose x coordinate was positive were sampled.

The first steps in determining the energy-angle flux estimate are to calculate the distance, R, from the collision point to the detector and the angle of scatter, θ, between the precollision particle direction and the collision point-detector axis. The next parameters determined are the energy after scatter for the particular scatter angle and scattering species, the differential angle scattering cross section per steradian about the θ direction, and the attenuation, e^{-b_1}, of the neutron after it scatters. The postcollision attenuation coefficient, b_1, is simply the integral of the total cross section times the path length along R. The contribution to the flux is then given by

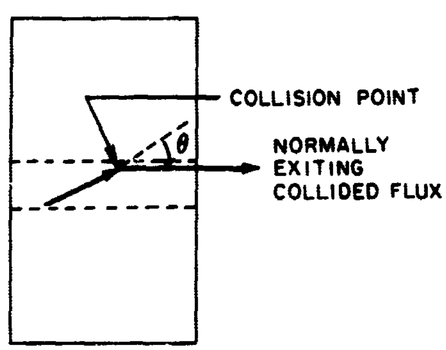
$$F_s = \frac{WT_1}{R^2} \left(\frac{d\sigma_s}{d\Omega}\right)_{E,\theta} e^{-b_1}$$

where WT_1 is the weight of the incident particle reduced by $\sigma_s(E)/\sigma_T(E)$ at the energy of the incident neutron. The contributions to flux at the detector are then sorted into an input energy and angle bin structure. Contributions accumulate in each bin and are averaged and normalized at the end of the batch. Normalizations of the flux in a given bin includes dividing by the number of neutrons processed and multiplying by a source solid angle normalization factor which accounts for the fact that source particles are generated only over a portion of space but normalization is per source particle in any direction. Other normalizations account for the desired units on the calculated quantities. These involved multiplying by $\bar{E}/\Delta E$ where $\bar{E}$ is the bin average energy and ΔE is the bin width, and dividing by the solid angle increment of the angle bins. Thus,units of the flux were $E \cdot \Phi(E)$ (eV * neutrons * cm^{-2} * $ster^{-1}$ * eV^{-1}).

2. 3. 2. 2 Normally Exiting Collided Flux

Special problems are encountered in attempting to analyze time-of-flight experiments because of the narrow collimation of the detector. The behavior of the scattered flux with angles greater than a few degrees is generally a smoothly varying function which can be approximated by a reasonable number of angular bins. The scattering flux exiting per unit solid angle near the slab normal, however, is generally a more rapidly varying function. Thus to be sure of analytically duplicating the drift tube angular resolution one would need an angular bin only a few minutes wide. To obtain a sufficient number of collisions inside the material within a cone this narrow would require prohibitive run times. To increase the efficiency for estimating the near normal flux a new type of estimator was formulated and incorporated into the analysis routine.

The geometry of the slab and flight path involved in this estimator is given below.



The assumption is made that the distribution of scattered radiation exiting the slab does not vary significantly for any location on the surface within a radius of 5 cm from the geometry centerline. Each collision lying inside the cylinder formed by the 5-cm radius is then sampled to determine its contribution per unit solid angle to the flux exiting normally through the circle on the surface formed by the 5-cm radius. This exiting flux is then normalized by dividing by the area of the circle. It should be noted that the estimate is not made to a point detector on the surface but rather on a per unit solid angle basis. The assumption made here is that the depth of the shield is negligible with respect to the distance to the detector. Thus the estimator for the normal scattered flux would be

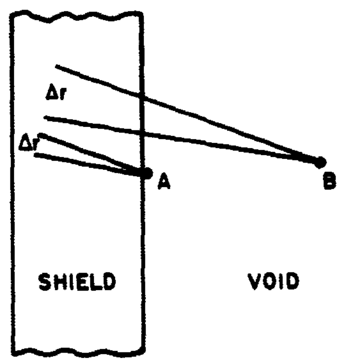
$$F_{ns} = \frac{WT_1}{25\pi} \left(\frac{d\sigma_s}{d\Omega}\right)_{\theta,E} e^{-b_1}$$

where θ is the angle between the incident direction and the slab normal, b_1, is summed along a normally exiting ray, and the other terms are as defined above. If desired, a weighting factor may be used to account for the difference in solid angle intercept of the drift tube detector due to depth within the slab. If the drift tube is 50 meters long and the collision occurs at a depth x from the exit face then the weighting factor would be $\left(\frac{50}{50+x}\right)^2$. For a slab depth of 30 cm this factor deviates from 1 by about 1% at most.

2.3.2.3 Special Angle Flux Estimator

The technique described above for determining the normally exiting collided flux also proved useful in estimating the flux at exact angles. Better statistics were obtained using the estimator than using the angular increment approach (2.3.2.1 above) in some cases. In this case collisions were sampled if they occurred inside a region within a 5 cm radius (measured in the x plane) from a line inclined at the angle of interest and passing through the center of the exit face. The collision is sampled only if its x coordinate is positive, as in the previously discussed estimator.

A modified version of ACTIFK was written which incorporated or'' a 37° and 78° angular estimator of this type. Scattered fluxes calculated with this program were found to be in agreement with the point detector values at the same angle for high energies and were found to be converged at lower energies than for the alternate estimator. Some insight as to why this trend exists may be obtained from considering the problem of calculating the flux within a given angle increment at the two points A and B as shown below.



For the same angular increment a larger portion of the shield is viewed from point B and therefore more collisions will contribute to the angular flux. This becomes increasingly important at lower energies where collisions lying very near the surface are of importance. A higher collision density would be required to get adequate data at point A because, as one approaches the surface inside the angle increment, the available collision volume disappears rapidly. This is similar to the problem of attempting to estimate the flux at very small exit angles and the solution worked out is similar to the normally exiting estimator.

2.3.2.4 Source for Thermal Calculations

In the O5R program neutron histories were terminated when the energy fell below .075 eV. An analysis program was written to obtain an input source for the S_n calculation of thermal flux based on the Monte Carlo collision histories. Each collision was tested to determine whether the energy before collision is greater than 1 eV and whether the energy after collision is below 1 eV. If either of these tests fail the collision is rejected. If both conditions are met the position of the collision and the neutron energy after collision are stored. By summing the postcollision weights of such particles over appropriate increments of space and energy, a source term was formulated for input to the 1DF S_n transport code. Although this source is distributed in energies below 1 eV the total is equal to the spatial density of particles falling through 1 eV and this is the only source of neutrons at lower energies.

2.3.2.5 Uncollided Flux

For each source particle noted on the O5R collision tape the ACTIFK routine calls SDATA and calculates the uncollided contribution to the flux at the detector centered on the exit face of the LH_2 slabs.

In normalizing the uncollided and the normally exiting collided flux it became apparent that the detector at the end of the drift tube views the exiting flux in a different manner than a unit detector positioned at the entrance to the precollimator (as approximated by the last flight estimator). There are two important factors in the normalization. The first one is that the collimator allows the detector to view only a portion of the source so only that fraction should be considered as the source for the uncollided flux. The second factor is that the scattered flux is calculated on a per unit solid angle basis so that the direct radiation must be in these same units before the two components can be added to get the total normally exiting flux.

In the first case an adjustment factor of 0.0841 was included to account for the portion of the source viewed directly. The second adjustment (due to angularity) may be made by multiplying the normal uncollided estimator by the ratio

$$\frac{R_{S-E}^{2} \, R_{E-D}^{2}}{R_{S-D}^{2}}$$

where the values of R are separation distances from source to exit face, exit face to detector, and source to detector, respectively.

Thus the uncollided flux estimator

$$\Phi_u = \frac{w}{4\pi R_{X-E}^2} e^{-b_1}; \; b_1 = \sum \Sigma_i t_i$$

is changed to

$$\Phi_{nu} = \frac{w(0.0822)}{4\pi} e^{-b_1} = w \cdot 6.55 \cdot 10^{-3} \cdot e^{-b_1}$$

The normalized uncollided flux as calculated with this estimator may be added numerically to the normally exiting collided flux to get the total normally exiting flux as seen by a detector at the end of the flight path.

It is important that these normalization be noted by anyone desiring to compare other calculations with these on an absolute basis.

2.3.3 STATISTICS

There is provision in the ACTIFK program for printing onto a "statistical tape" the contribution to each quantity being calculated due to each source neutron. This tape can then be utilized to calculate the standard distribution or variance of the data. This provision was deleted in our analysis because of the added requirements for core storage and run time which it imposes. Instead a variance of individual batch averages about the entire run average was calculated. While this quantity is not a true variance of the data it does serve to indicate the degree of convergence of the batch averages.

2.4 RESULTS OF THE FAST AND INTERMEDIATE ENERGY NEUTRON CALCULATION

Fast and intermediate energy calculations were performed for the empty dewar and for LH_2 thicknesses of 2.5, 4.5 and 13 inches preceding the precollimator. Ten thousand histories were run for the empty dewar calculation; twenty thousand histories were run for the 2.5- and 4.5-inch configurations; and thirty thousand histories were run for the 13-inch case. First flights were stretched in the 13-inch case and contracted in the empty dewar case - both with appropriate adjustments in particle weight.

Results for these four configurations are shown in Figs. 4 through 7.

2.5 DESCRIPTION OF THE THERMAL NEUTRON CALCULATIONS

It is possible in the O5R calculations to continue tracing the neutrons until they reach thermal energy. One could then allow for upscattering and diffusion at thermal energy or switch to a single velocity model upon reaching the thermal region. This first and more exact treatment was ruled out because of the excessively long computing times it requires. The second approach was ruled out because the results would be in terms of an integral over the thermal group which is not useful for the intended purpose of comparison with the experimental spectra.

It was decided instead to trace the neutrons down to 0.75 eV and use the spectrum of neutrons degraded through 1 eV as the source term for a one-dimensional S_n treatment. This approach proved to be successful in that the source obtained from the O5R calculations did provide thermal spectra which are essentially in agreement with the experiment.

In the implementation of the 1DF program[7] for calculating the angular thermal flux along the dewar centerline use was made of the cross sections resulting from the theoretical work of Koppel and Young.[9] Scattering kernels calculated by Naliboff[10] for liquid para-hydrogen and liquid ortho-hydrogen were prepared as a cross section library tape by the WTFG3[11] code to make them compatible with the format used by the GGC-3[12] cross section averaging program. GGC-3 was then used to prepare the group-averaged cross-section data employed in 1DF. This

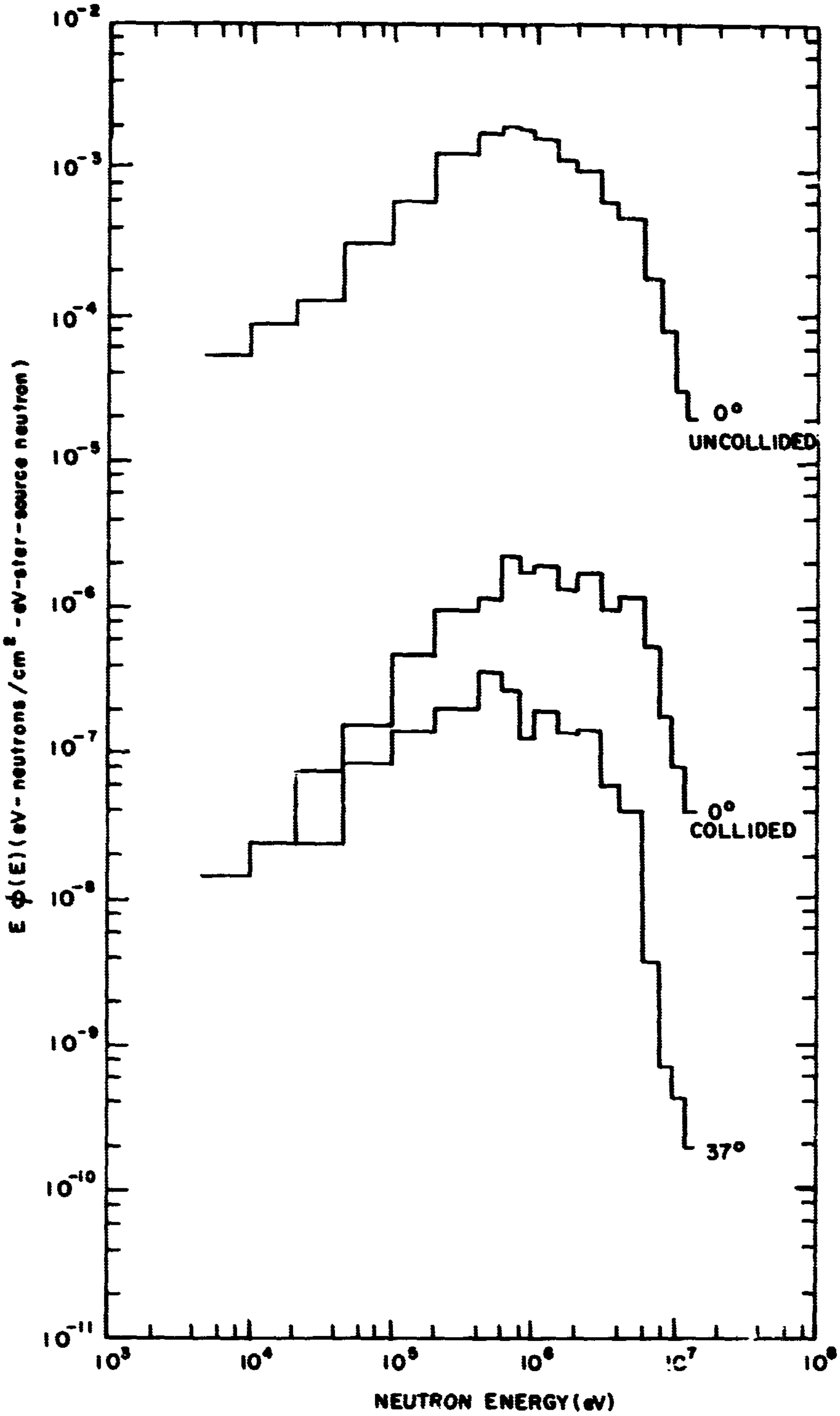


Figure 4. O5R Monte Carlo results for neutrons penetrating the empty liquid hydrogen dewar.

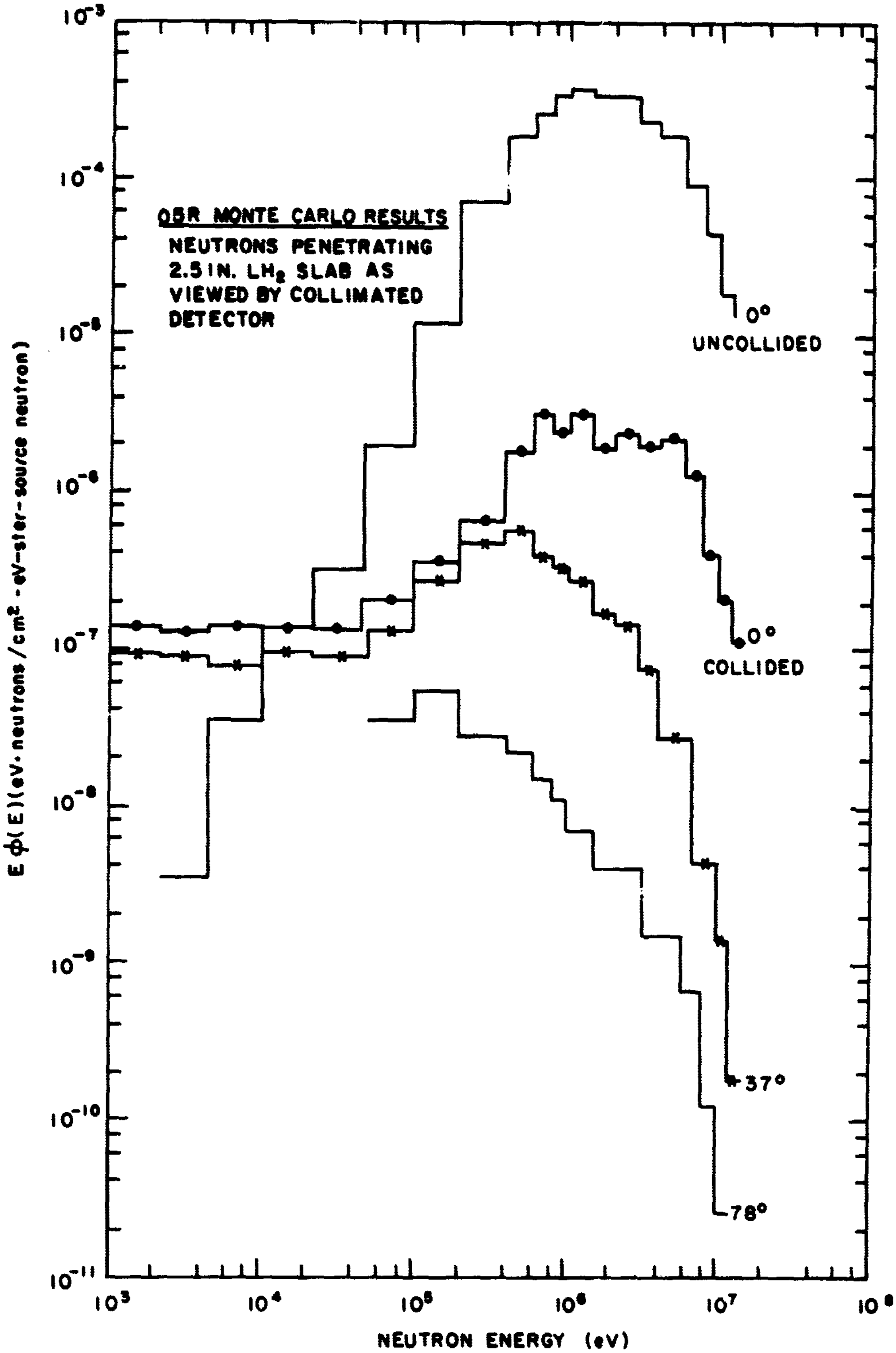


Figure 5. O5R Monte Carlo results for neutrons penetrating a 2.5-in. liquid hydrogen slab as viewed by a collimated detector.

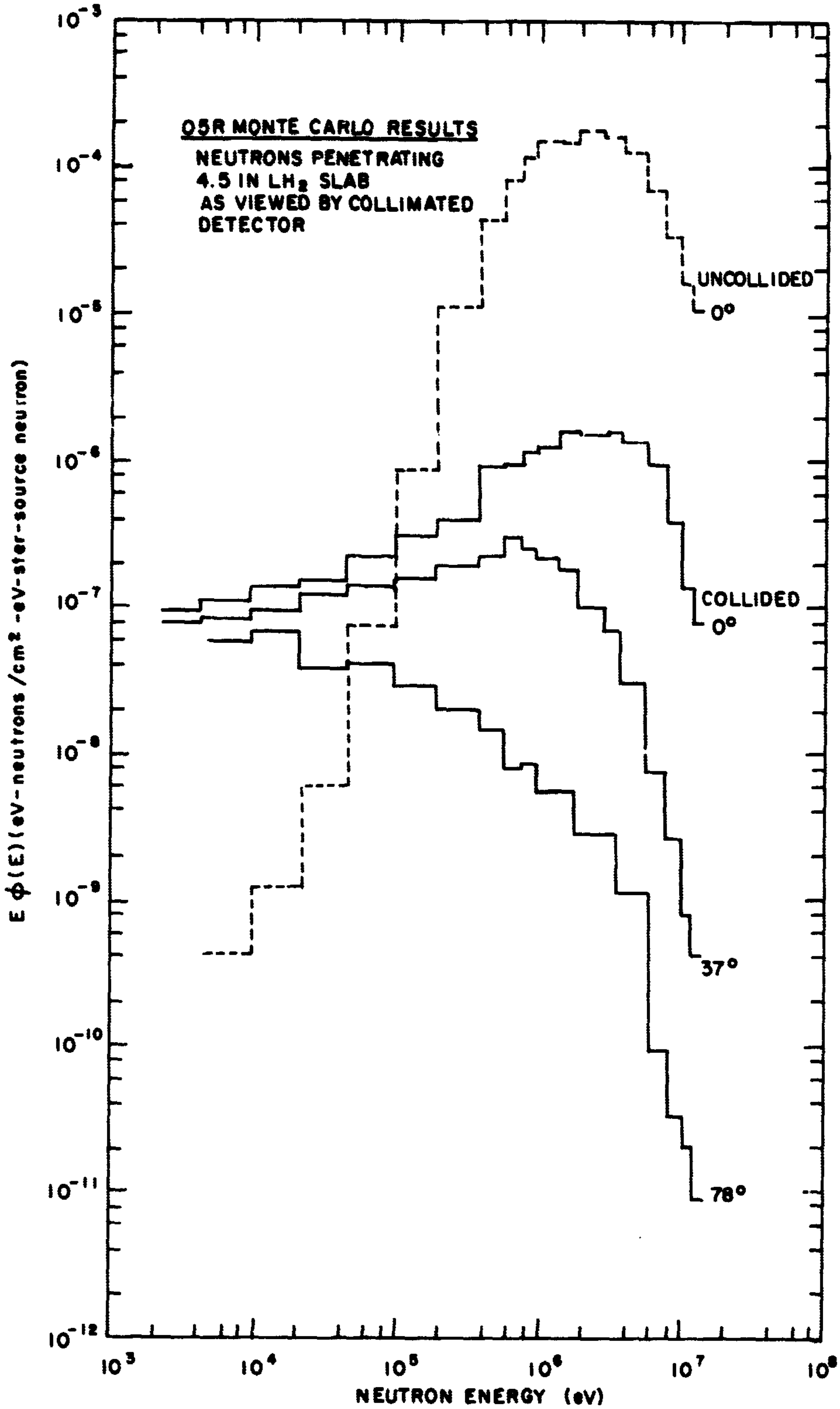


Figure 6. O5R Monte Carlo results for neutrons penetrating a 4.5-in. liquid hydrogen slab as viewed by a collimated detector.

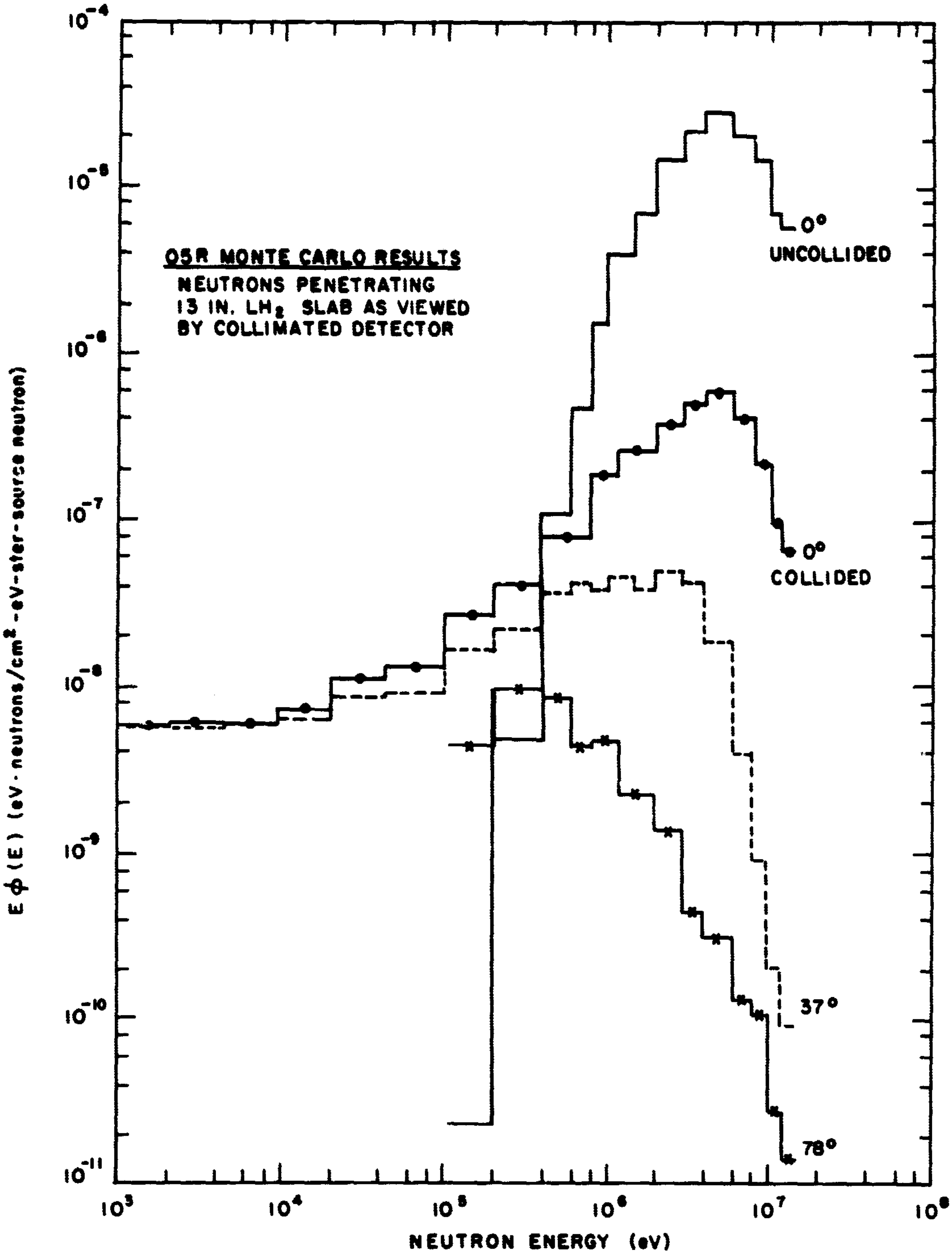


Figure 7. O5R Monte Carlo results for neutrons penetrating a 13.0-in. liquid hydrogen slab as viewed by a collimated detector.

approach is similar to that used in a previous analysis[2] of the hydrogen data for obtaining group-averaged data for the S_n transport code GAPLSN.[13] GAPLSN, which was in use at GGA at the time of the other study, uses a cross section input format which differs from that in 1DF; consequently, group averaged data generated in the prior study could not be used directly.

In the input to the 1DF calculations the angular distribution of the source term below 1 eV was considered to be isotropic. Spectral intensities corresponding to the plots in Fig. 8 were input at closely spaced mesh intervals. An infinite slab approximation was used. A radial buckling of .0019 cm^{-2} was used in all three cases. The calculations used a P_1 expansion of cross sections with 46 energy groups and an S_8 quadrature. The results of these calculations are tabulated in Appendix E and shown in Figs. 42, 43, 46, 52, 53 and 56.

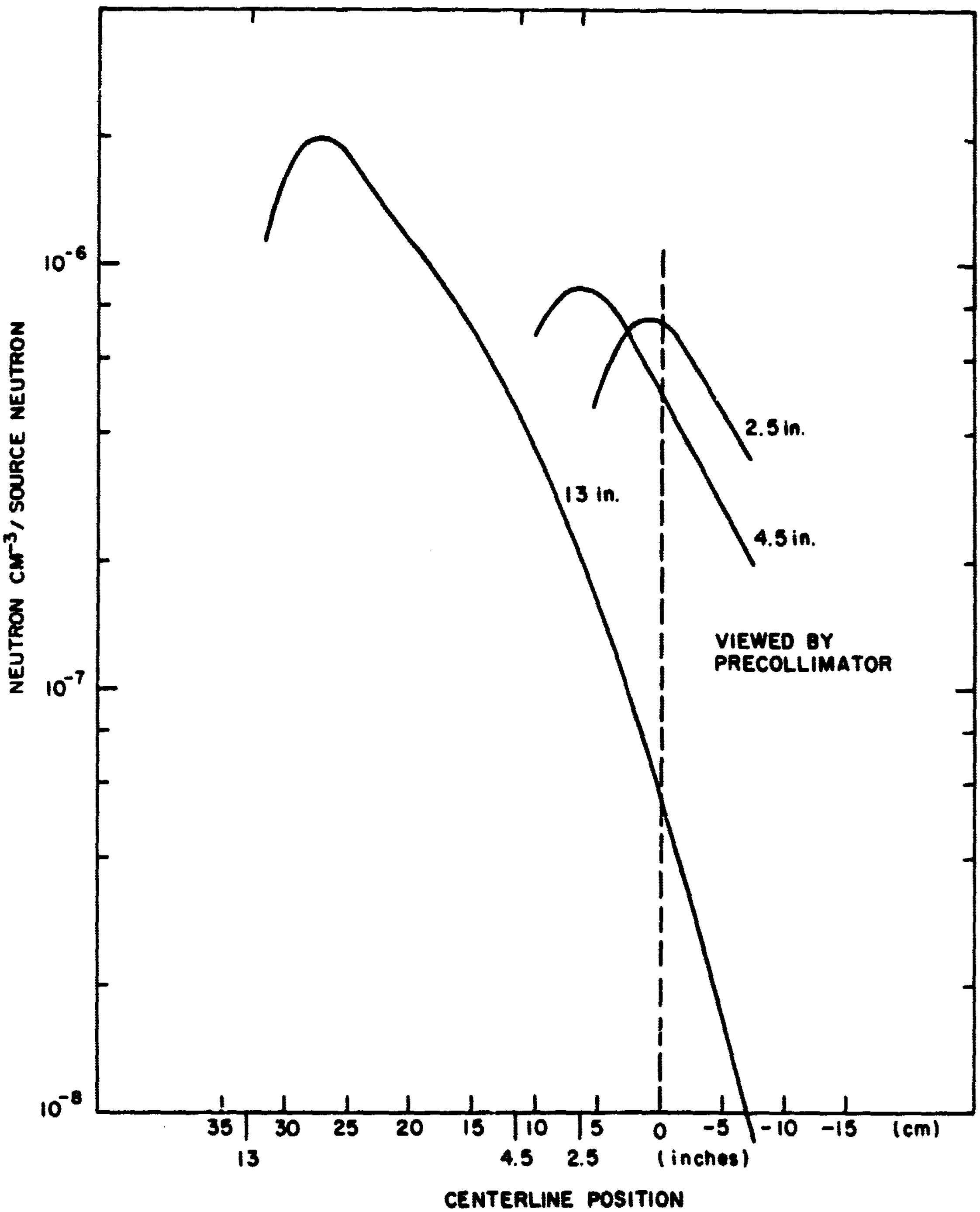


Figure 3. Density of neutrons degraded through 1 eV as a function of position along the dewar centerline. The abscissa show the distance from the probe tube base. Curves for different thicknesses of liquid hydrogen in front of the probe base are shown.

3. REEVALUATION OF THE FAST NEUTRON SPECTRAL DATA

3.1 REASONS FOR REEVALUATION OF FAST NEUTRON SPECTRAL DATA

As may be seen in Table 1, some measurements made during the first contract period were repeated during the second one. There were inconsistencies in these data since some were measured with different detectors, reduced with different efficiencies from different references and utilized different neutron sources. Therefore, it was felt worthwhile to reexamine details of the data reduction process, use the latest efficiencies, and reduce all the fast neutron spectral data in a consistent manner.

3.2 FACTORS WHICH INFLUENCE REDUCTION OF THE FAST NEUTRON SPECTRAL DATA

3.2.1 INTRODUCTION

The spectral measurements are made by the time-of-flight technique. In this technique a pulse of neutrons are injected into the liquid hydrogen dewar. A probe tube samples the neutron spectrum at the chosen position by allowing those neutrons with the proper angle to escape down the probe tube. The neutrons are timed over a flight path of fixed length and are detected at the end of their flight by various neutron detectors selected for each energy range of interest. The fiducial point or reference time for the flight time is the gamma-flash or bremsstrahlung burst produced when the electron beam strikes the high-Z metal target producing a burst of photoneutrons or photofission neutrons.

3.2.2 DETECTOR EFFICIENCIES FOR FAST NEUTRON DETECTORS

3.2.2.1 Description of Detector and Method of Operation

Three different fast neutron detectors were used on the two programs. They are primarily characterized by the volume of the scintillator liquid and the surface upon which the neutron beam impinges. These detectors are listed below:

1. Fast Neutron Detector - (2.0-in. diameter by 2.5-in. high) NE-211 liquid scintillator mounted with the axis perpendicular to the neutron beam.

2. Fast Neutron Detector - 5.0-in. diameter by 5.0-in. high) NE-211 liquid scintillator mounted with the axis perpendicular to the neutron beam.

3. Fast Neutron Detector - (5.0-in. diameter by 5.0-in. long) NE-211 liquid scintillator mounted with the axis parallel to the neutron beam.

Fast detectors (1) and (2) were used on the first program and detectors (1) and (3) on the second program.

The fast neutron detector is composed of a liquid scintillator viewed by a 14-stage photomultiplier tube. The scintillator, (NE-211*), consists of xylene, activators, and POPOP as a wave shifter and is contained in a right cylindrical glass container. The composition of the NE-211 is stated by the manufacturer to be $CH_{1.21}$.

The neutrons interact with the hydrogen nuclei in the xylene producing recoil protons in the scintillator. Recoil carbon nuclei, and alpha particles from (n,α) reactions in carbon also occur. The energy spectrum of the recoil protons extends from zero to a maximum energy equal to that of the incident neutrons. The theoretical shape of the proton recoil spectrum is shown in Fig. 9; the experimentally obtained pulse height distribution is shown on a linear proton energy scale. The energy from the

*Manufactured by Nuclear Enterprises, Ltd., Winnipeg, Canada

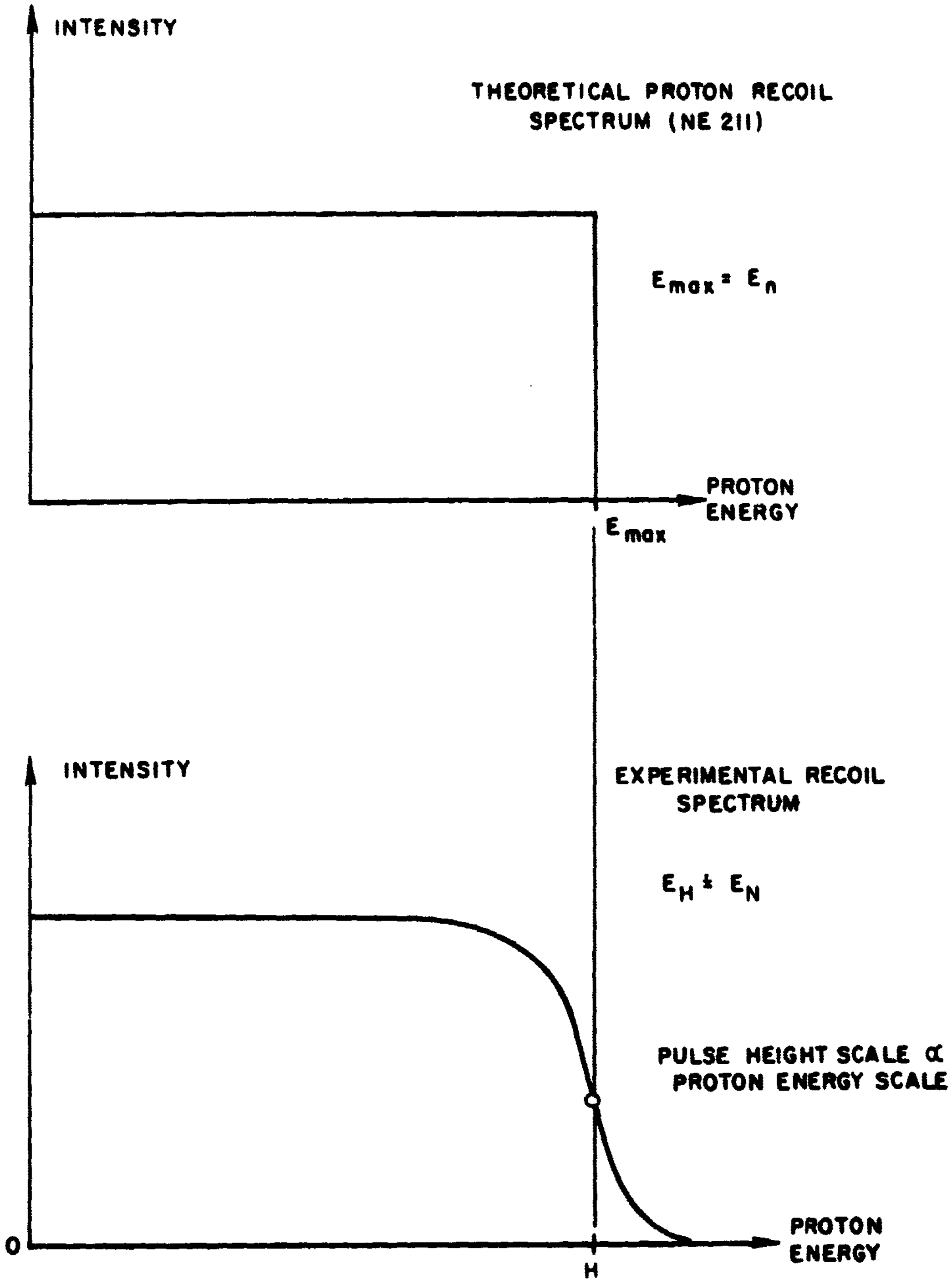


Figure 9. Typical proton recoil spectrum (NE-211).

recoil protons is transferred to the electronic states of the molecules in the scintillator. De-excitation of the molecule takes place by the emission of ultraviolet light. The POPOP wave shifter absorbs the ultraviolet light and re-emits it in the frequency range appropriate for detection by a photomultiplier tube. The recoil carbon nuclei and alpha particles from reactions in carbon can also cause scintillations, although the light output per unit energy deposited is less than for protons.

3.2.2.2 Fast Neutron Detector Efficiency

3.2.2.2.1 Batchelor's Efficiency

The efficiency of any neutron detector is the number of counts per neutron incident on the detector, —front surface in our case. The relative efficiency of the scintillation detector versus neutron energy must be known to convert the counting rate to neutron flux.

For the first program, a 2-in. by 2-1/2 in. detector was chosen originally, because a detector of the same size and composition had been calibrated by Batchelor, et al,[14] and was the best available efficiency at the time. The efficiency was both calculated by Monte Carlo methods and measured on a Van de Graaf accelerator. Once the efficiency of the 2-in. by 2-1/2 in. detector was known, the efficiency of the 5 in. x 5 in. vertically mounted detector was obtained by direct comparison.

The minimum pulse height accepted by the electronic circuitry is determined by the discriminator bias. At neutron energies near the bias energy, the detector efficiency is changing rapidly and is quite sensitive to the bias (it would be desirable to set the bias as low as possible and use the detector only for energies well above it). In order to use the Batchelor's efficiency the bias has to be the same as was used in his efficiency measurements. Originally, we attempted to adjust the bias so that the efficiency went to zero at the same energy as a linear extrapolation of Batchelor's curve would give, about 220 neutron keV. According to Batchelor's equations this was equivalent to 48.7 electron keV.

To determine the bias setting at 48.7 electron keV, reference was made to the Compton edge of the pulse height distribution taken with a ^{137}Cs source. A typical pulse height distribution for a Compton spectrum is shown in Fig. 10. In terms of the gamma-ray energy E_γ, the energy of the maximum Compton electron energy E_c is determined as follows:

$$E_c = E_\gamma \left[1 + \frac{m_0 c^2}{2E_\gamma} \right]^{-1}$$

where $m_0c^2 = 0.511$ MeV. The electron energy E_c (was chosen) for these early measurements, as the pulse height at which the intensity of the pulses had fallen to approximately two-thirds of its value at the "Compton peak".

The efficiency given by Batchelor, et al.,[14] had a number of deficiencies, however. Pulse height resolution was not taken into account and the measured and calculated efficiencies deviated drastically below 1 or 2 MeV. The method of setting the bias was never explained satisfactorily even after private communications with one of the authors. The Van de Graaf calibrations were suspect because of sizeable collimator scattering corrections.[14]

3.2.2.2.2 Efficiency due to Verbinski, et al.

In 1964, shortly after the final report for the first program was published, Verbinski, et al.,[15] published efficiency calculations for a 2 x 2 in. and 5 x 5 in. NE-213 liquid scintillator detector. These scintillators were adopted as standards since the calculations had been checked against measurements on a Van de Graaf accelerator.[16] In addition, a reproducible bias was defined for these calculations.

Verbinski's calibration combined the best features of a series of measurements and of Monte Carlo calculations of pulse-height spectra for monoenergetic neutrons incident on an organic liquid scintillator.

In his calculations the half-height of the abrupt edge near the maximum pulse height (labeled H in Fig. 10) was assumed to correspond to the maximum hydrogen recoil energy and a trial function of proton light L_p versus neutron energy was constructed. This relationship was then used in a Monte Carlo calculation and the calculated pulse-height distributions were convoluted with a Gaussian smearing function until they matched the measured pulse-height distributions. The Monte Carlo calculations were then repeated with the correct $L_p(E)$ function especially for the low-energy neutrons where the assumption that the half-height corresponds to the maximum recoil energy is not accurate. Values for similar functions for alpha particles and carbon-recoil ions $L_\alpha(E)$ and $L_c(E)$ were also calculated but with less accuracy than $L_p(E)$. The final Monte Carlo calculations utilized the corrected $L_p(E)$, $L_\alpha(E)$ and $L_c(E)$ and the experimental pulse-height spectra were normalized to the calculated curves in the proton-recoil plateau, the experimental data thereby being converted to absolute differential efficiency. Integration of the absolute differential efficiency above the bias level represents the counting efficiency at the given bias setting. Details of the efficiency calculations and efficiency tables have been published in Refs. 15 and 17.

To use these tables, it is essential that the bias be defined in terms of a reproducible, standard pulse height or "light unit" chosen as the extrapolated end point of the Compton edge from the 1.17 MeV and 1.33 MeV gammas of Co-60 shown as "E" in Fig. 10. This unit is approximately equal to the light produced by 1.25-MeV electrons according to the prescription of Flynn, et al.,[18] or 13 percent above the 1.28-MeV Compton edge half-height for Verbinski's system. The latter relationship, which uses the ^{22}Na gamma-ray pulse height spectrum, was chosen to allow reproduction of the experimental measurements and communication in the calibration procedures to other laboratories.[17]

The bias in terms of a fraction of the standard light unit is dependent upon the resolution of the detector. The pulse height resolution of two

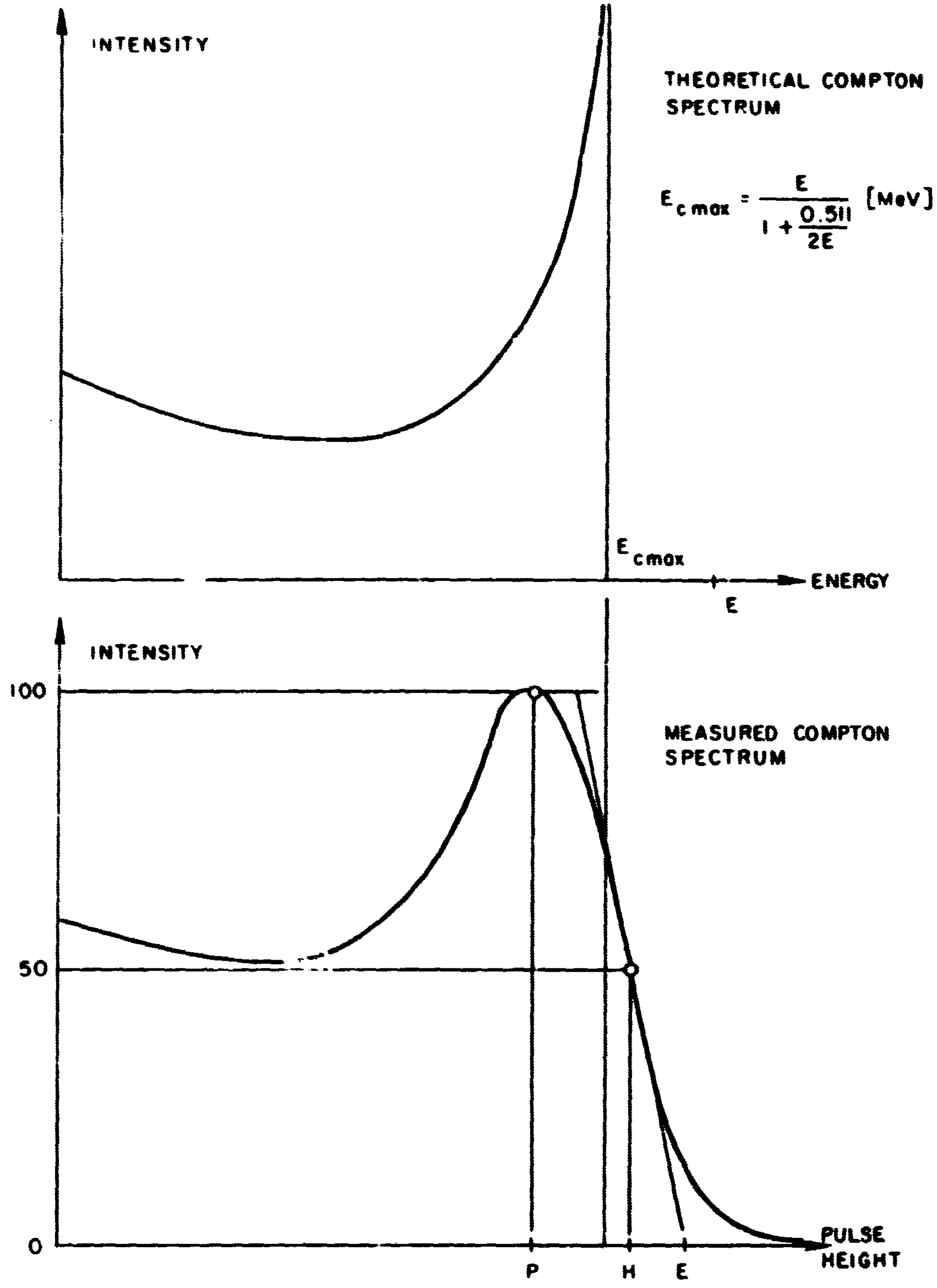


Figure 10. Typical Compton electron spectrum.

scintillation detectors is almost never the same. The resolution being a function of the photoelectron statistics, which are dependent on the light output of the scintillator, light collection efficiency, and quantum efficiency of the photocathode. The use of the 1.28-MeV Compton edge half-height removes somewhat the sensitivity of the bias upon the resolution of the detector as opposed to the extrapolated end point (labeled E in Fig. 10).

3.2.2.2.3 Detector Bias

The standard light unit has fluctuated somewhat, and during the second contract was defined as the half-height of the Compton edge from the 1.17 MeV and 1.33 MeV gammas of Co-60.[2] The efficiency of the detector is a sensitive function of the bias especially near the bias energy. Therefore, it was necessary to reevaluate the data from the second program as well as the first based upon the present definition of the standard light unit. To implement this it was necessary to obtain the relationship between the actual bias based upon the Compton edge from Cs-137 and the standard light unit related to the Compton edge from Cs-137 and the standard light unit related to the Compton edge from Na-22 as mentioned above.

No measurements were taken and therefore none are available for the experimental relationship between the Compton edges from Cs-137 and Na-22. However, the relationship between pulse height and energy has been measured for a liquid scintillator by Flynn, et al.,[18] and extended by Horrocks.[19] The half-height of the upper edge of the pulse height distribution was identified with the Compton energy (actually the half-height is some 4 ± 1% higher than E_c). For energies below ~100 keV photopeaks are observed, but at a few hundred keV and above, gamma-ray sources give essentially a Compton distribution. For gamma-ray energies above about 800 keV, Flynn and Horrocks were able to fit their data by a linear expression

$$L = \frac{E_c(\text{keV}) - 18}{0.34} \qquad (E \geq 80\ \text{keV})$$

where L is the relative light output and E_c is the maximum Compton electron energy. If we substitute E_c = 1061 keV for ^{22}Na, then L_{22} = 3068 and if we substitute E_c = 478 keV for ^{137}Cs we get L_{137} = 1353.9. The ratio of the relative light output for the two gamma rays is

$$\frac{L_{22}}{L_{137}} = \frac{3067.6}{1353.9} = 2.266$$

The bias level based on ^{137}Cs would then be

$$L_B = \frac{C_B}{C_{137}}$$

where C_B is the bias channel and C_{137} is the channel number for the half-height of the Compton energy for the Cs-137 gamma ray. The light output definitions are shown schematically in Fig. 11 as would be measured by a pulse height analyzer. The channel for the standard light unit, C_{SLU}, would be

$$C_{SLU} = (C_{137})(2.266)(1.13) = 2.870\ C_{137}$$

and the bias level based on the standard light unit would be

$$L_B = \frac{C_B}{2.870\ C_{137}} = 0.3484\ \frac{C_B}{C_{137}} .$$

Although the relative light output is undoubtedly a sensitive function of the resolution of the detector, the ratio of the relative light output for the two gamma rays is not nearly as sensitive and any error resulting in this ratio is certain to be a second order effect.

In the same manner, if we substitute E_c = 1038 keV for ^{60}Co, then L_{60} = 3000 and L_B based on the standard light unit instead of the half-height of the Compton edge would be

$$\frac{L_{22}}{L_{60}} = \frac{3068}{3000} = 1.022$$

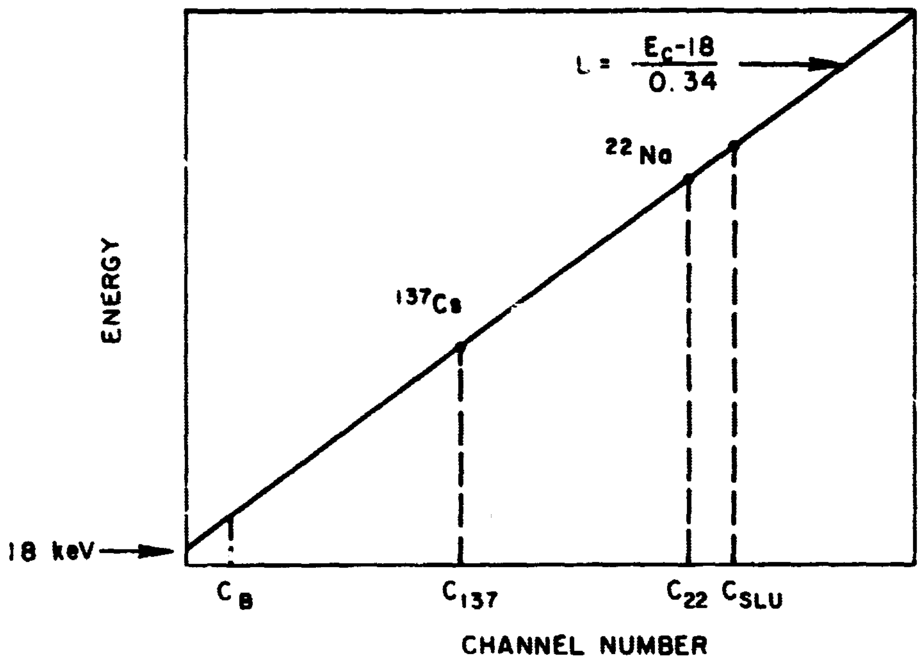


Figure 11. Light output versus energy.

and

$$C_{SLU} = (C_{60})\ (1.022)\ (1.13)$$

so that

$$L_B = \frac{C_B}{(C_{60})\ (1.022)\ (1.13)} = \frac{C_B}{C_{60}\ 1.155}$$

$$L_B = 0.8658 \frac{C_B}{C_{60}} \quad .$$

3.2.2.2.4 Efficiencies for the Three Fast Neutron Detectors

In summary, the efficiencies for the three detectors noted in Section 3.1 were obtained as follows. The efficiency for the fast neutron Detector 1 was taken from the tabulated values by Verbinski, et al.,[15] after determining the bias level in terms of the standard light unit. The detector is 2-1/2 in. high whereas Verbinski's standard detector was 2 in. This, however, changes the amplitude of the efficiency and not the shape, i.e., the relative efficiency remains the same, and since experiment and calculation are normalized to each other only the relative efficiency is necessary. The efficiency for Detector 3 was taken from tabulated values published earlier by Verbinski, et al.,[15] calculated for a similar detector after determining the bias in terms of the standard light unit. A small correction was necessary to correct for the difference in the light curves which had been changed since the earlier tabulations were published.[20] The efficiency of Detector 2 was determined by two separate methods: The first method was by comparison with Detector 1 using data taken during the first contract. The second method used the fact that Detectors 2 and 3 were similar in that the liquid scintillator was the same but they differed insomuch as the neutron beam impinges perpendicular to the scintillator axis in one case and parallel to the scintillator axis in the other. Nevertheless, recent experiments conducted at Gulf General

Atomic[21] indicated that this detector was isotropic when biased at 0.25-light units which corresponds to about 1.3 MeV neutron energy, and therefore the efficiency is independent of the direction the neutron impinges upon the scintillator. Therefore, the efficiency can be obtained as for Detector 3 from the tabulated values published by Verbinski, et al.[17]

The efficiency for Detector 1, which is tabulated in Table 5 and shown in Fig. 12, was 0.02746 standard light units and was used to reduce the data taken on 7-31-64. Figure 13 compares the two detector efficiencies used to reduce the zero-degree spectral data of 7-31-64. The data, due to Batchelor, et al.,[14] were used during the first contract period. The data, due to Verbinski, et al.,[17] corresponding to a bias value of 0.02746 standard light units, were used under the present program. The two curves have been amplitude normalized at 1 MeV. The efficiencies agree in shape from 0.7 to 2.5 MeV and differ by only 18 percent at 15 MeV. The efficiency for Detector 2, which is tabulated in Table 6 and shown in Fig. 14, was 0.032 standard light units and was used to reduce data taken on 8-1-64, 8-3-64, 8-5-64, and 8-7-64. The detector was maintained at the same bias on all four days and therefore the same efficiency could be used. A comparison of the efficiencies for this detector by the two different methods described above is shown in Fig. 15. The first method is based on the efficiency of the 2 x 2.5 in. detector biased at 0.02746 standard light units and multiplied by the efficiency ratio of the 5 x 5 in. to the 2 x 2.5 in. detectors. The second method is based on a bias of 0.032 standard light units and taken from Verbinski's tabulations corrected for the change in light tables. The agreement is very good down to about 1 MeV verifying the isotropy of the detector down to this energy. Even at 0.8 MeV the disagreement is only about 30 percent. The efficiency labeled 0.032 standard light units was used since the uncertainty in the ratio of the two detectors increases at the lower energies and the uncertainty in the efficiency becomes so large at energies below 0.8 MeV that it is not very useful. Detector 3 which was used for measuring the data on 2-24-66 was

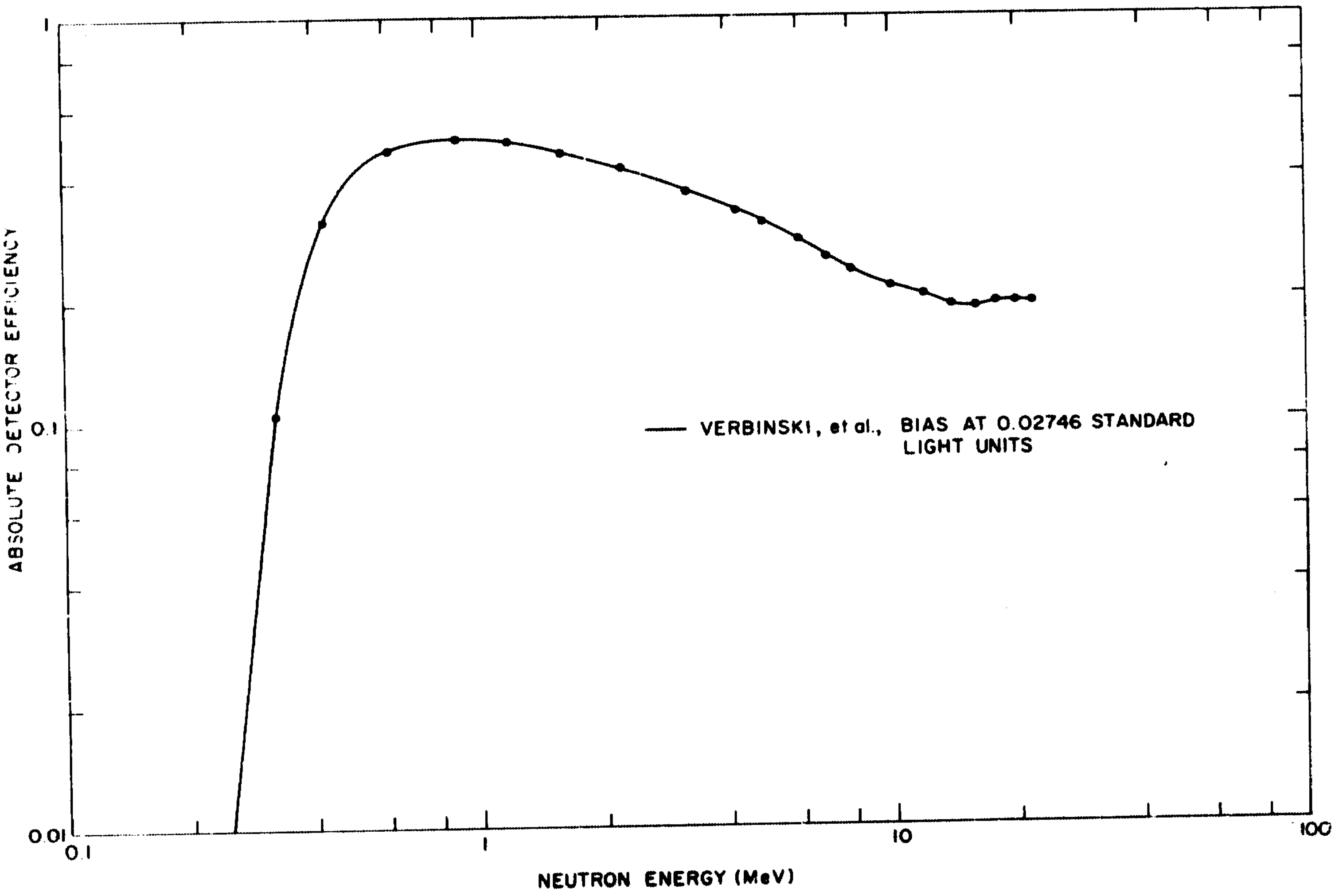


Figure 12. Efficiency for 2 x 2.5-in. detector biased at 0.02746 standard light units.

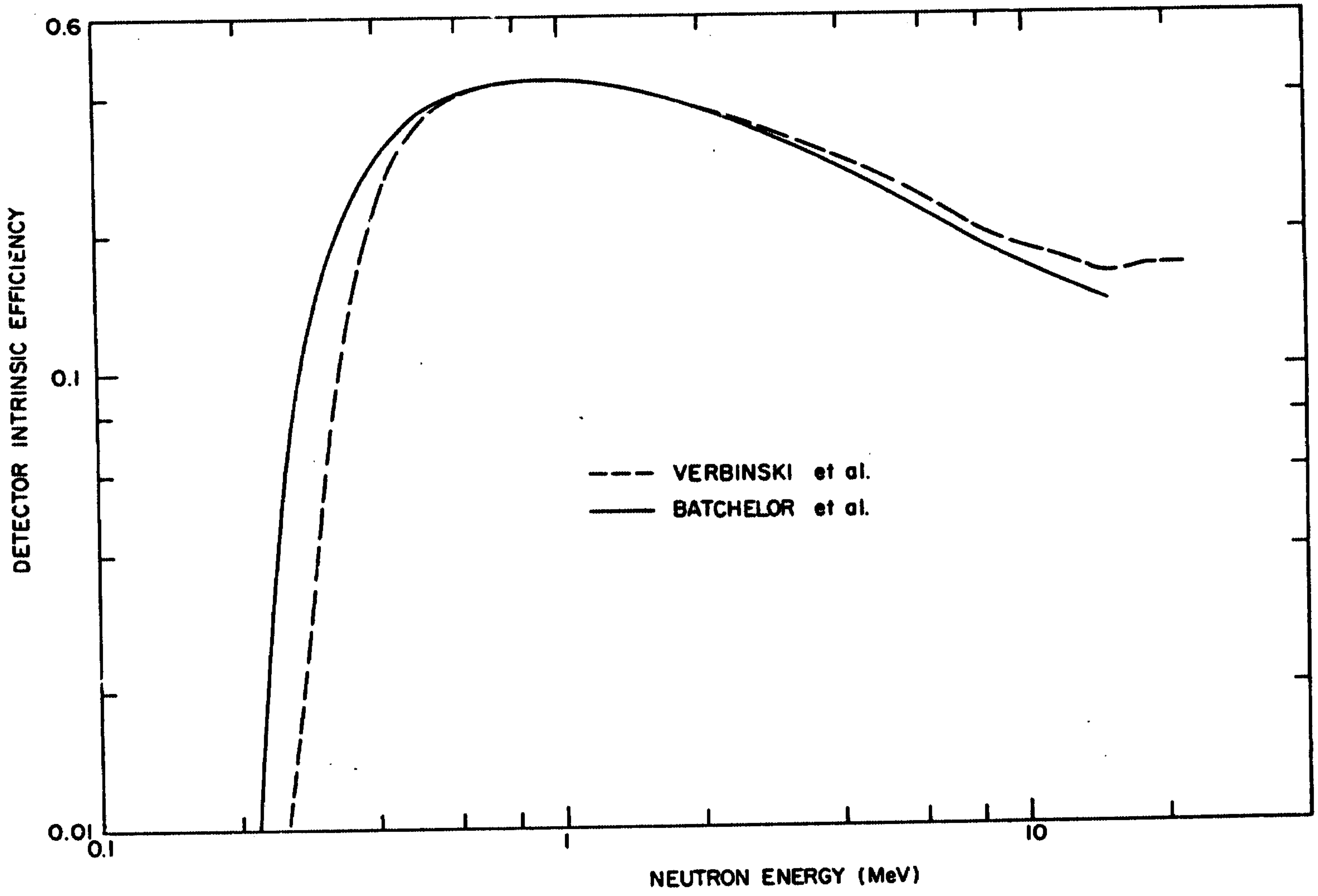


Figure 13. Comparison of the detector efficiencies used to reduce the data of 7-31-64 on the first and present contracts.

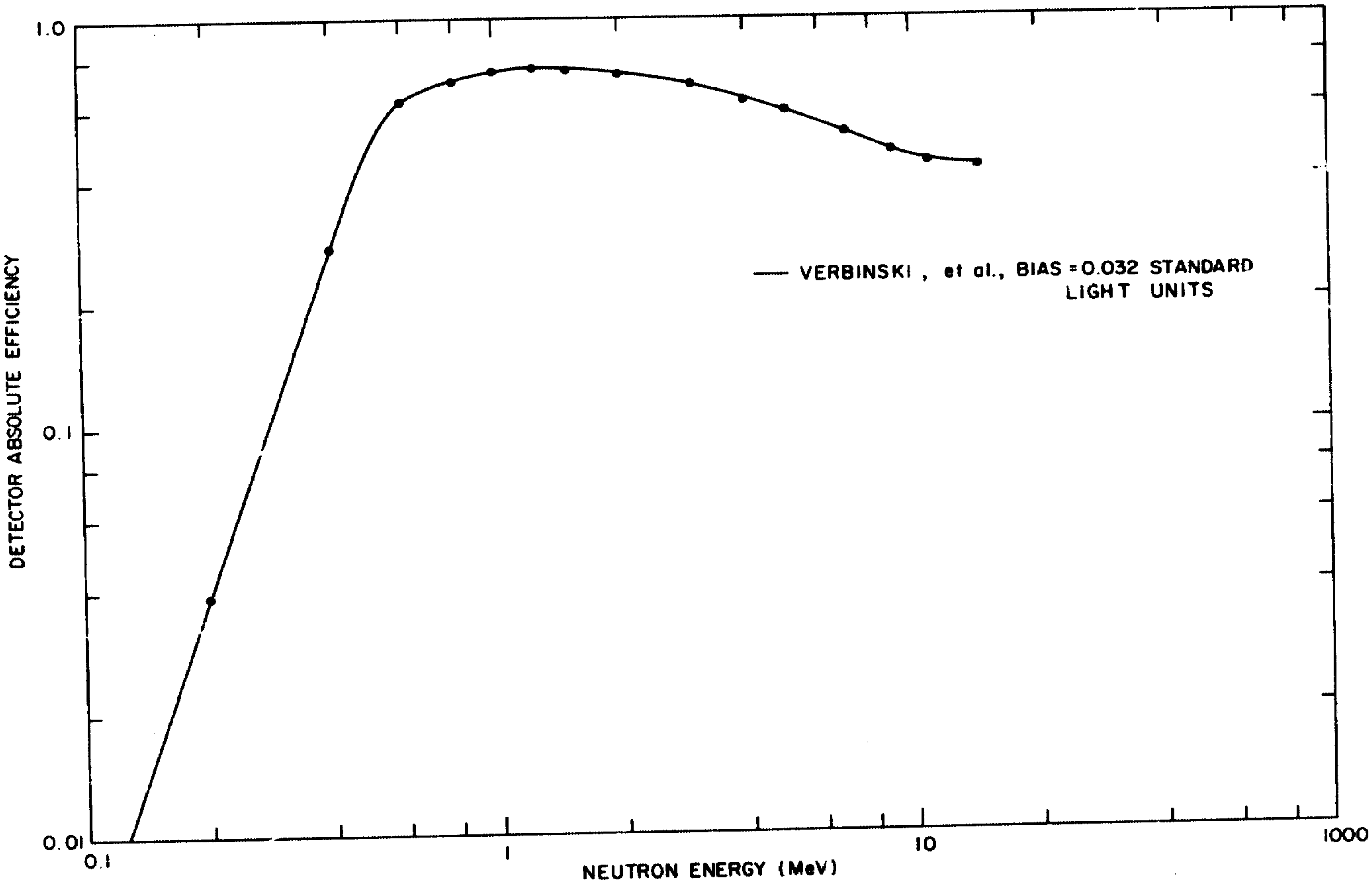


Figure 14. Efficiency for the 5 x 5-in. vertical detector biased at 0.032 standard light units.

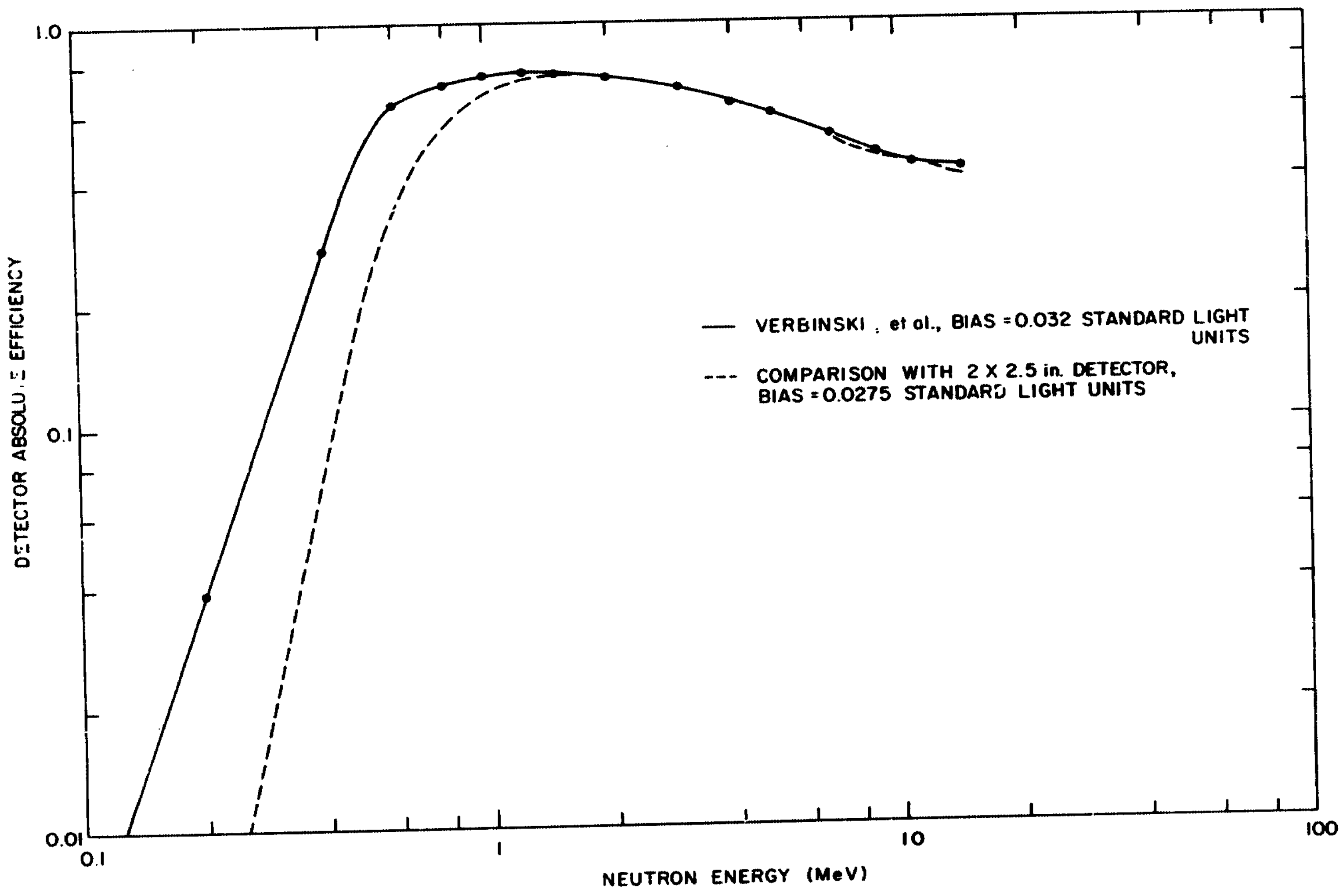


Figure 15. Efficiency of the 5 x 5-in. vertical detector by two different methods.

Table 5

TABULATED EFFICIENCY FOR THE 2 x 2.5 IN. NE-211 LIQUID SCINTILLATOR BIASED AT 0.02746 STANDARD LIGHT UNITS

Energy	Absolute Detector Efficiency	Energy	Absolute Detector Efficiency	Energy	Absolute Detector Efficiency
.247	.01	.62	.470	3.75	.35
.260	.0155	.64	.475	4.0	.34
.270	.022	.66	.48	4.25	.33
.280	.03	.68	.485	4.5	.323
.290	.04	.70	.49	4.75	.315
.300	.054	.74	.495	5.0	.308
.310	.072	.78	.498	5.25	.300
.320	.105	.82	.50	5.5	.293
.340	.140	.86	.50	5.75	.285
.36	.190	.90	.50	6.0	.28
.37	.210	.95	.50	6.4	.27
.38	.230	1.0	.50	6.8	.259
.39	.250	1.1	.495	7.2	.248
.40	.270	1.2	.495	7.4	.245
.41	.285	1.4	.477	7.6	.242
.43	.32	1.6	.462	7.8	.239
.45	.35	1.8	.450	8.0	.235
.47	.375	2.0	.437	8.4	.230
.50	.405	2.25	.424	8.8	.225
.52	.423	2.5	.405	9.2	.22
.54	.44	2.75	.392	9.6	.217
.56	.45	3.0	.38	10.0	.214
.58	.458	3.25	.371	10 5	.212
.60	.465	3.5	.359	11.0	.21

Table 5

TABULATED EFFICIENCY FOR THE 2 x 2.5 IN. NE-211 LIQUID SCINTILLATOR BIASED AT 0.02746 STANDARD LIGHT UNITS (cont)

Energy	Absolute Detector Efficiency	Energy	Absolute Detector Efficiency	Energy	Absolute Detector Efficiency
11.5	.206	13.5	.194	15.5	.188
12.0	.205	14.0	.192	16.0	.190
12.5	.200	14.5	.190	16.5	.190
13.0	.197	15.0	.189	17.0	.192

Table 6

TABULATED EFFICIENCY FOR THE 5 x 5 IN. VERTICAL NE-211 LIQUID SCINTILLATOR BIASED AT 0.032 STANDARD LIGHT UNITS

Energy (MeV)	Absolute Detector Efficiency	Energy (MeV)	Absolute Detector Efficiency	Energy (MeV)	Absolute Detector Efficiency
.13	.0103	.55	.573	.88	.720
.14	.0141	.56	.587	.90	.725
.16	.0206	.57	.600	.92	.73
.18	.0288	.58	.610	.94	.733
.20	.0386	.59	.620	.98	.738
.22	.0505	.60	.628	1.00	.745
.24	.065	.61	.635	1.1	.750
.26	.081	.62	.640	1.2	.753
.28	.101	.63	.645	1.4	.757
.30	.123	.64	.65	1.6	.750
.32	.147	.65	.655	1.8	.740
.34	.174	.66	.66	2.0	.732
.36	.205	.67	.663	2.2	.725
.38	.238	.68	.666	2.4	.72
.40	.275	.69	.67	2.6	.705
.42	.318	.70	.675	2.8	.700
.44	.362	.72	.68	3.0	.689
.46	.407	.74	.69	3.2	.68
.48	.448	.76	.695	3.4	.665
.50	.488	.78	.700	3.6	.65
.51	.504	.80	.702	3.8	.645
.52	.525	.82	.707	4.0	.632
.53	.540	.84	.715	4.2	.625
.54	.558	.86	.718	4.4	.617

Table 6

TABULATED EFFICIENCY FOR THE 5 x 5 IN. VERTICAL NE-211 LIQUID SCINTILLATOR BIASED AT 0.032 STANDARD LIGHT UNITS (cont)

Energy (MeV)	Absolute Detector Efficiency	Energy (MeV)	Absolute Detector Efficiency	Energy (MeV)	Absolute Detector Efficiency
4.6	.605	7.4	.510	10.5	.445
4.8	.60	7.6	.502	11.0	.438
5.0	.592	7.8	.498	11.5	.436
5.2	.583	8.0	.493	12.0	.432
5.4	.577	8.2	.488	12.5	.430
5.6	.569	8.4	.482	13.0	.430
5.8	.560	8.6	.478	13.5	.430
6.0	.553	8.8	.472	14.0	.430
6.2	.548	9.0	.468	14.5	.430
6.4	.540	9.2	.463	15.0	.430
6.6	.533	9.4	.460	15.5	.430
6.8	.528	9.6	.458	16.0	.430
7.0	.522	9.8	.453	16.5	.430
7.2	.515	10.0	.451		

0.040 "cobalt units", and this was accomplished by splitting the 60 keV gamma-ray from ^{241}Am. Shortly thereafter a similar detector was calibrated using a Van de Graaf accelerator, and the best fit to the data points was for an efficiency whose bias was 0.040 "cobalt units".[16] This efficiency is given in Table 7 and shown in Fig. 16.

The efficiency for Detector 1 was based on a bias of 0.04233 standard light units and was used to reduce the data on 2-26-66. This efficiency is given in Table 8 and shown in Fig. 17.

3.3 OTHER FACTORS WHICH INFLUENCE REDUCTION OF FAST NEUTRON DATA

After the data were reduced with the correct efficiency, there still remained an inconsistency in the data taken during the first and second contracts. As a first step in determining the reasons for this inconsistency, two fast neutron spectra for the water-cooled source were compared. These spectra were from the same neutron source but were taken by two different detectors on successive days. The data labeled 1-29-66, T4, and tabulated in Appendix A were taken with the same detector used to make spectral measurements on both the first and second programs. The data labeled 1-30-66, T2, were reported by Profio, et al.,[6] and were taken with an early 2-in. x 2-in. detector, modeled after Verbinski, et al.[15] The spectra shown in Fig. 18 are the same down to about 1.5 MeV, below which the difference is related to bias uncertainties. The data labeled 1-29-66, T4 were reduced with an efficiency corrected for the new standard light unit definition whereas the other data were not corrected. Both sets of data are hemisphere integrated spectra, i.e., the collimation was large enough to view the entire surface of the spherical source. The spectra in Fig. 19, which are tabulated in Appendix E, are a comparison of the fast neutron spectra for the air-cooled and water-cooled sources. Here the collimator was only 0.87 in. in diam and the source was viewed through the

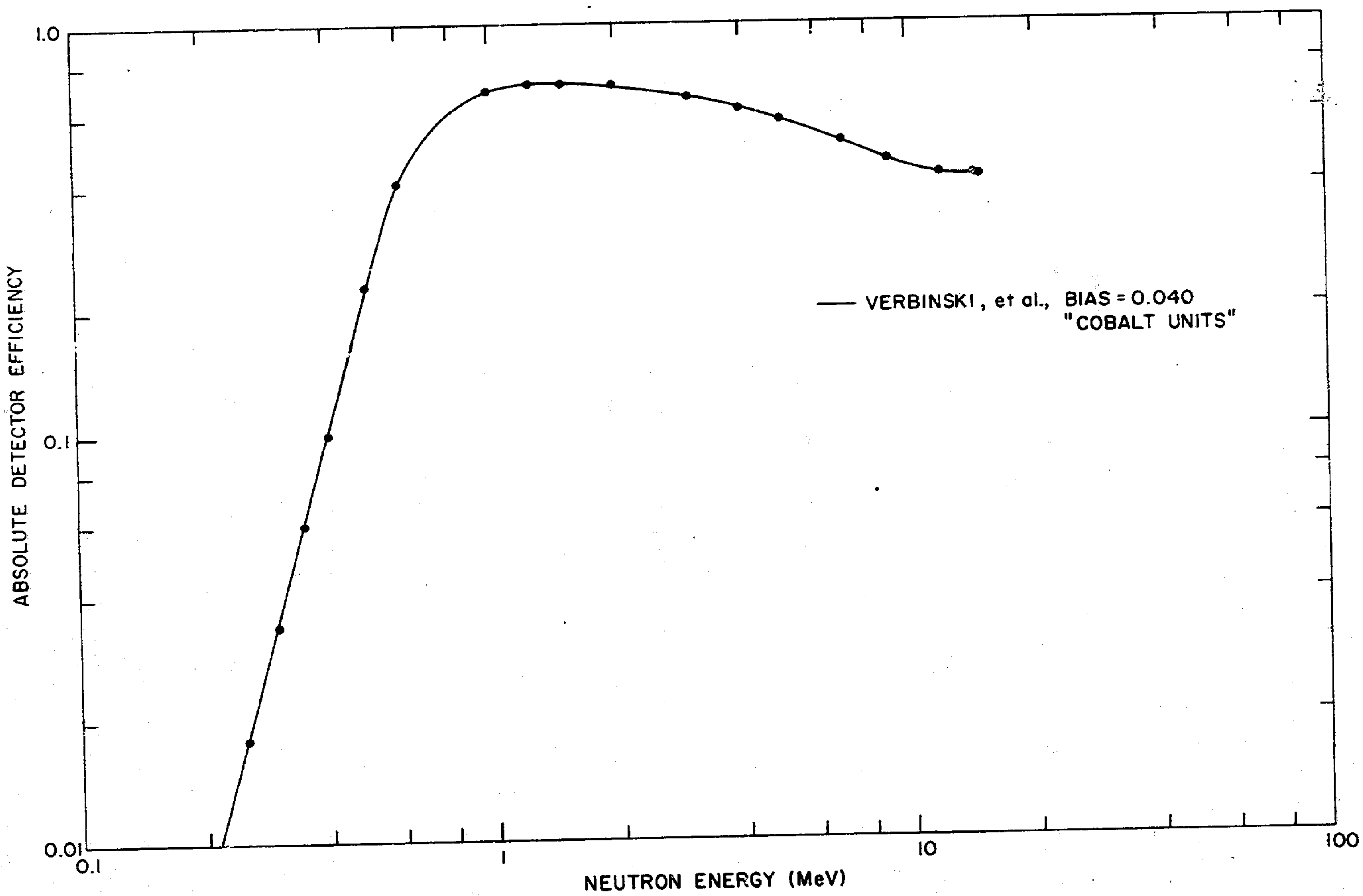


Figure 16. Efficiency of the 5 x 5-in. horizontal detector biased at 0.040 "cobalt units".

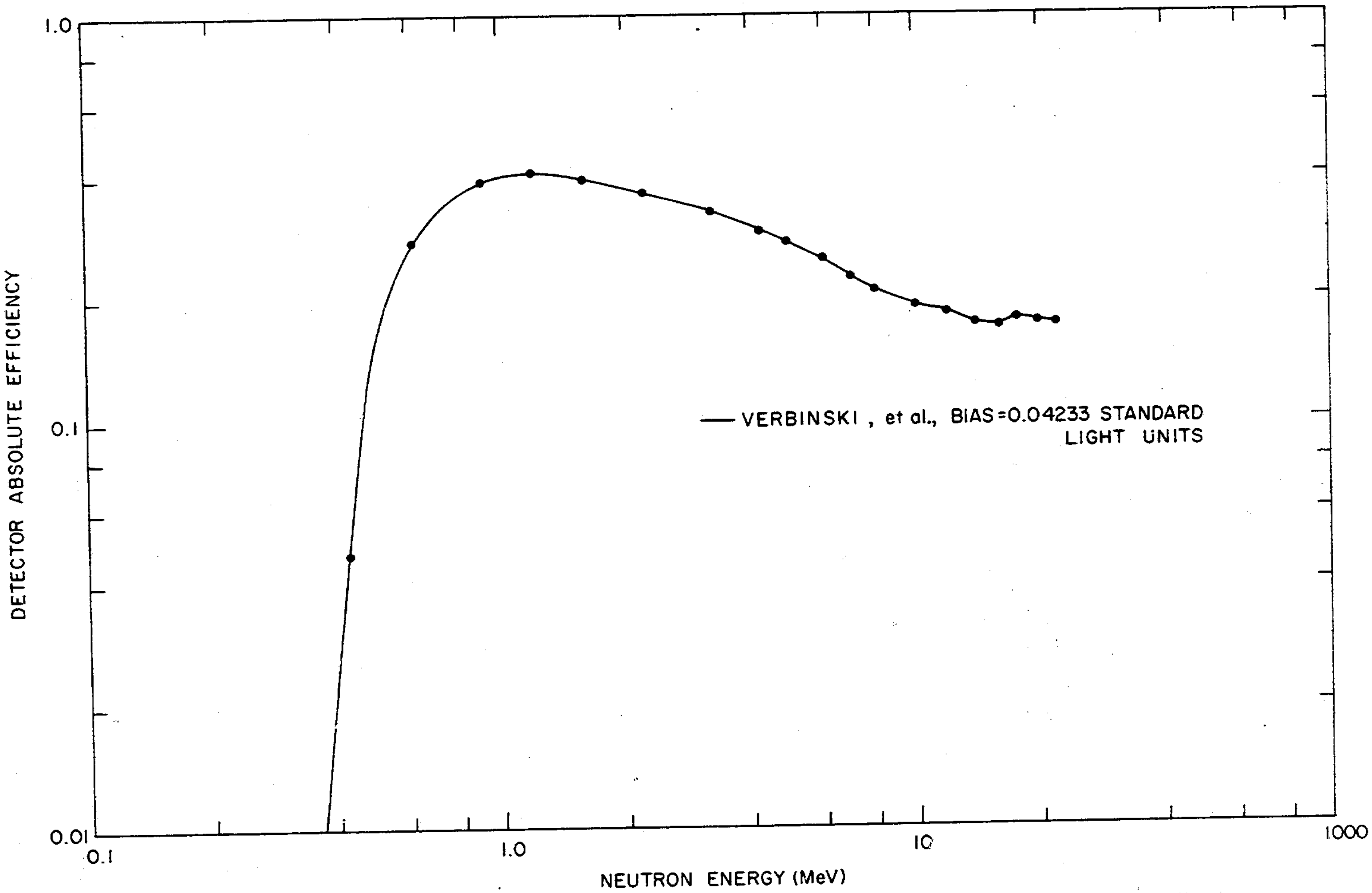


Figure 17. Efficiency for the 2 x 2.5-in. detector biased at 0.04233 standard light units.

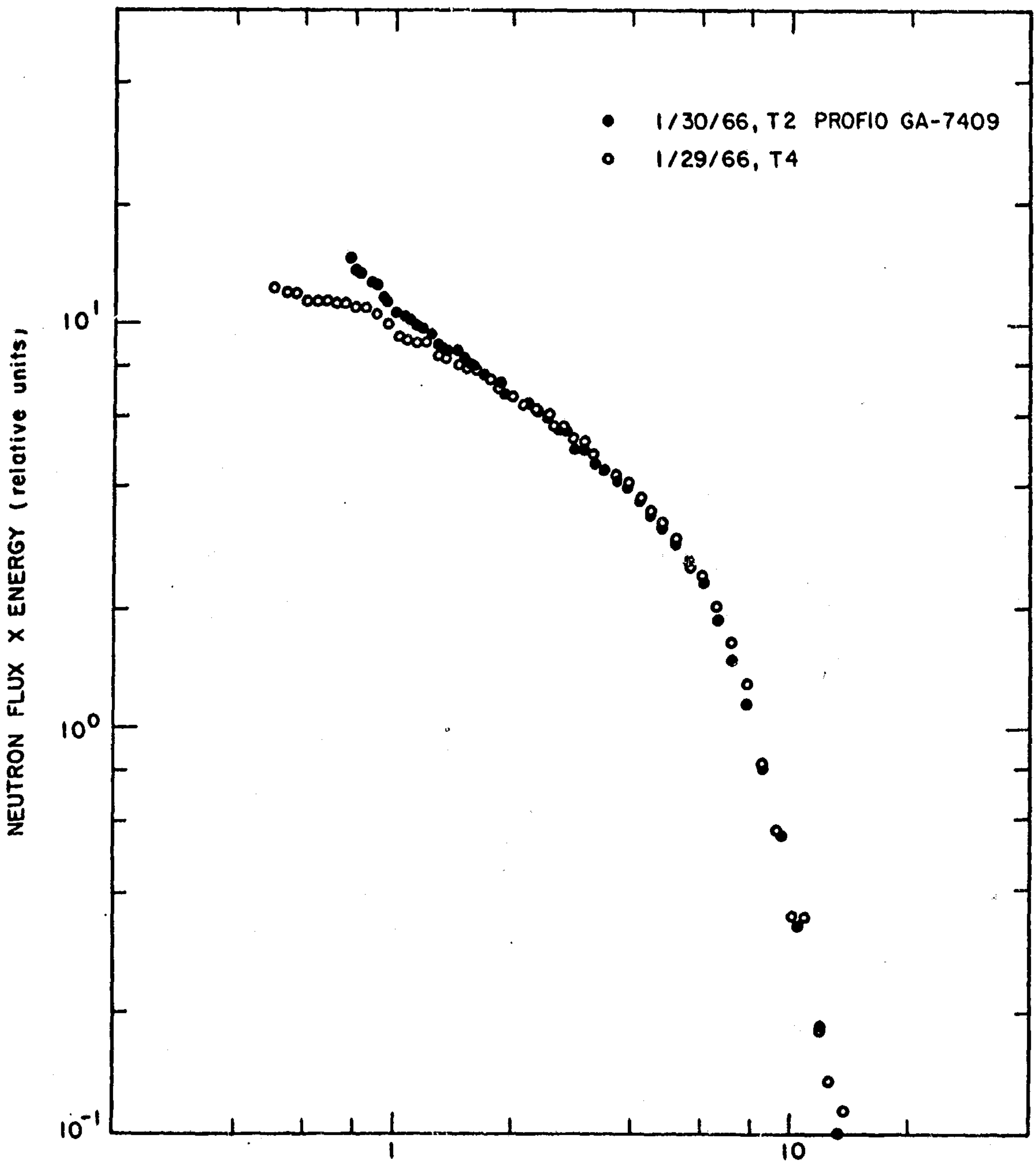


Figure 18. Comparison of the fast neutron spectra measured using two different detectors for the water-cooled source.

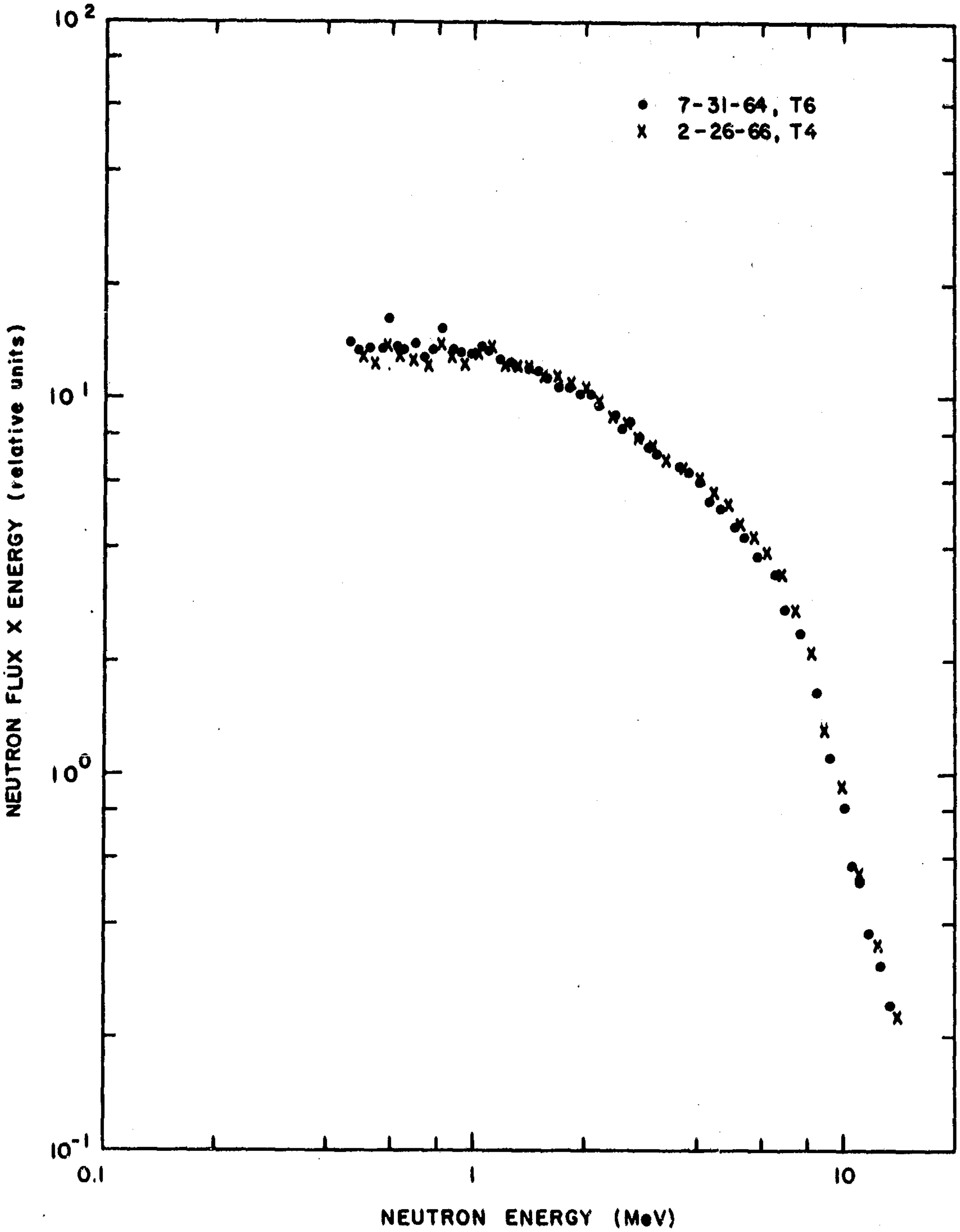


Figure 19. Comparison of neutron spectra from the air-cooled and water-cooled fast neutron source for the first and second programs.

Table 7

TABULATED EFFICIENCY FOR THE 5 x 5 IN. HORIZONTAL NE-211 LIQUID SCINTILLATOR BIASED AT 0.04 "COBALT UNITS"

Energy (MeV)	Absolute Detector Efficiency	Energy (MeV)	Absolute Detector Efficiency
21.0	.410	1.25	.717
20.0	.412	1.0	.690
19.0	.414	0.8	.600
18.0	.416	0.6	.410
17.0	.418	0.5	.230
16.0	.420	0.4	.100
15.0	.422	0.35	.060
14.4	.422	0.30	.034
11.0	.427	0.25	.018
9.0	.461	0.20	.0077
7.0	.515	0.18	.0051
5.0	.583	0.17	.0041
4.0	.618	0.16	.0032
3.0	.665	0.15	.0026
2.0	.709	0.10	.0011
1.5	.717		

Table 8

TABULATED EFFICIENCY FOR THE 2 x 2.5 IN. NE-211 LIQUID SCINTILLATOR BIASED AT 0.04233 STANDARD LIGHT UNITS

Energy (MeV)	Absolute Detector Efficiency	Energy (MeV)	Absolute Detector Efficiency	Energy (MeV)	Absolute Detector Efficiency
.37	.0116	.61	.270	1.1	.410
.38	.015	.62	.278	1.2	.411
.39	.0195	.63	.285	1.4	.407
.40	.0253	.64	.290	1.6	.397
.41	.0315	.65	.297	1.8	.388
.42	.0400	.66	.303	2.0	.379
.43	.05	.67	.307	2.2	.369
.44	.063	.68	.314	2.4	.360
.45	.079	.69	.318	2.6	.352
.46	.096	.70	.324	2.8	.344
.47	.114	.72	.342	3.0	.337
.48	.129	.76	.350	3.2	.329
.49	.144	.78	.359	3.4	.322
.50	.158	.80	.364	3.6	.315
.51	.173	.82	.370	3.8	.308
.52	.185	.84	.377	4.0	.302
.53	.198	.86	.381	4.2	.296
.54	.209	.88	.385	4.4	.290
.55	.218	.90	.390	4.6	.284
.56	.228	.92	.394	4.8	.279
.57	.238	.94	.398	5.0	.274
.58	.247	.96	.400	5.2	.268
.59	.254	.98	.402	5.4	.274
.60	.263	1.00	.404	5.6	.258

Table 8

TABULATED EFFICIENCY FOR THE 2 x 2.5 IN. NE-211 LIQUID SCINTILLATOR BIASED AT 0.04233 STANDARD LIGHT UNITS (cont)

Energy (MeV)	Absolute Detector Efficiency	Energy (MeV)	Absolute Detector Efficiency	Energy (MeV)	Absolute Detector Efficiency
5.8	.254	8.4	.205	12.5	.181
6.0	.250	8.6	.202	13.0	.178
6.2	.245	8.8	.201	13.5	.175
6.4	.240	9.0	.199	14.0	.173
6.6	.235	9.2	.197	14.5	.172
6.8	.230	9.4	.196	15.0	.171
7.0	.227	9.6	.194	15.5	.171
7.2	.223	9.8	.193	16.0	.172
7.4	.219	10.0	.192	16.5	.173
7.6	.216	10.5	.190	17.0	.176
7.8	.213	11.0	.188	17.5	.178
8.0	.210	11.5	.187	18.0	.177
8.2	.208	12.0	.185	18.5	.176

empty liquid hydrogen dewar. The data have been corrected for the transmission of the dewar. The main difference between these spectra and those in Fig. 18 is that the hemisphere integrated spectrum is softer in the lower energy region due to the inclusion of large angle scatterings from the spherical surface. Figure 19 shows a reasonable agreement between the source spectra measured during the first and second programs. The data were taken one and a half years apart, as noted by the dates on the figure. For the 2-26-66, T4 data, there was a 3.144-cm thick gamma-ray filter of uranium which was not present for the 7-31-64, T6 data. As shown later, the uranium filter does not alter the spectral shape. The fast neutron sources were different on the two program periods. The physical difference in the sources for the two programs was the use of air cooling for the first and water-cooling for the second. The data shown in Fig. 20 provide a comparison of the hemisphere integrated fast neutron spectra for the air-cooled and water-cooled sources. The data for the air-cooled source, 5-23-64, T4, which are tabulated in Appendix E, are some of the first taken at this facility for the 3.0-in. diam uranium source. Though the statistics are not good, it can still be seen that the agreement in spectral shape between the air- and water-cooled sources is reasonable. Therefore, it can be safely concluded that the sources for the two contracts were identical in the fast neutron region, the same conclusion stated in the final report of the second contract.[2]

Since it was now obvious that source differences could not cause the observed spectral disagreements in the two data sets, other factors in the data reduction were closely examined.

The fast neutron flight path was approximately fifty meters long and although evacuated contained various materials such as mylar and aluminum windows, air, stainless steel from the walls of the dewar, and helium contained in the probe tube. These materials caused at the most a 20 percent correction due to their transmission and therefore even if the cross sections had been in error by 10 percent this would have accounted

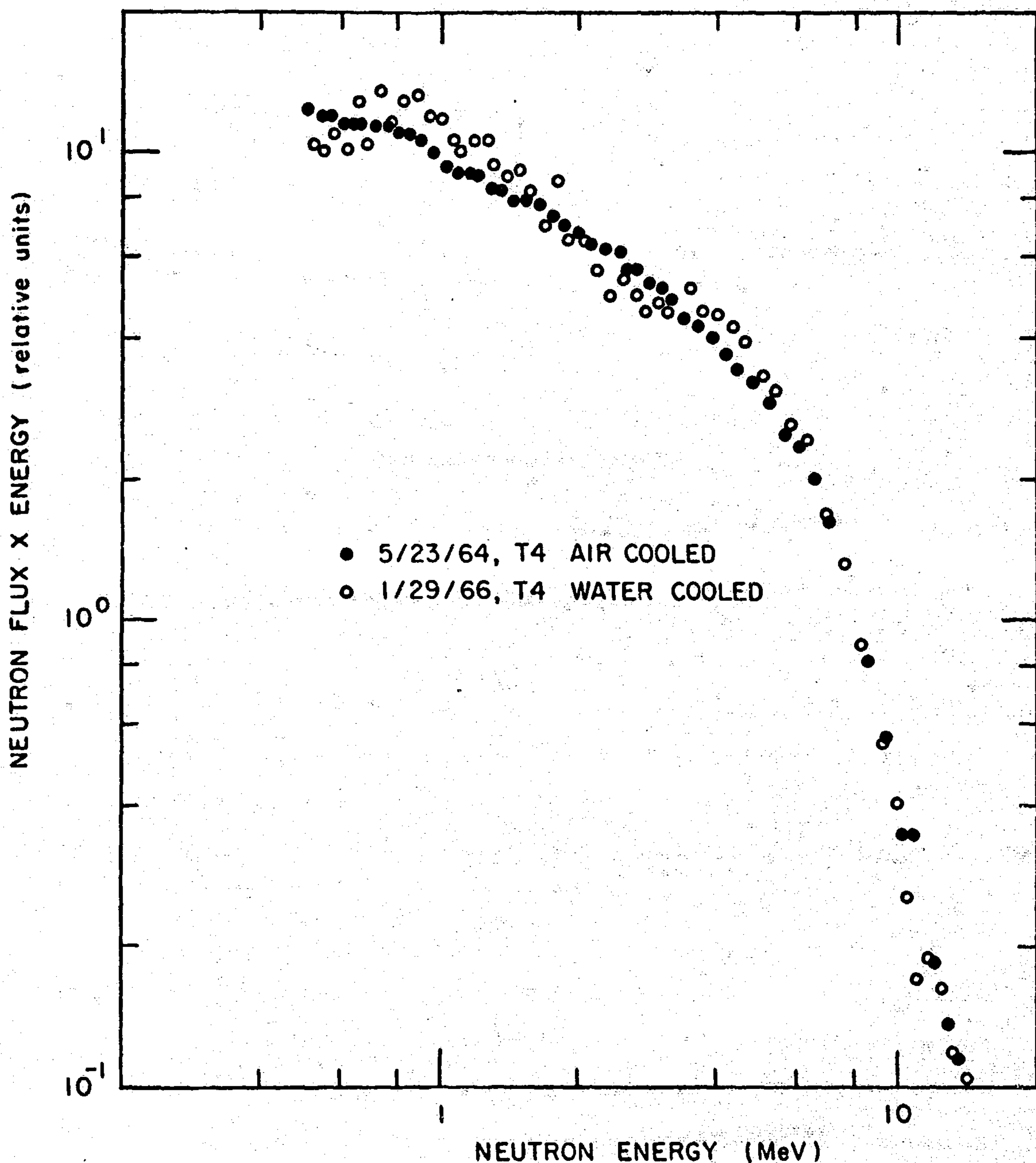


Figure 20. Comparison of neutron spectra from the air-cooled and water-cooled fast neutron source.

for at most a 2-percent transmission error. The thicknesses of the flight path materials were also examined to determine if the proper thickness had been used to reduce the data.

One of the major differences between the first and second programs was the insertion of 3.144-cm of uranium into the flight path. The purpose of the uranium was to act as a filter since the uranium suppresses the bremsstrahlung flash with only about a 40 percent correction for neutron transmission. To determine if the uranium filter influenced the data reduction techniques, the same source spectrum was measured with and without the uranium filter. As can be seen in Fig. 21, the filter did not influence the spectral shape for this test case.

The bremsstrahlung burst produced when the pulsed electron beam strikes the target is quite intense and if nothing were done to prevent its influence a loss of important data would result at early times and high neutron energies. However, since the photomultiplier is offgated during this period of time and the gain reduced by about a factor of a hundred, the effect is considerably reduced. Even so, some of this burst is detected since the detector is gamma sensitive, and appears as gamma rays decaying in an exponential manner. The technique for removal of these gamma rays is to fit the decay to an exponential and subtract it as a time-dependent background. The extent of this effect is determined by the electron beam current and pulse width. However, in this case the effect was small and influenced the spectra, if any, above about 10 MeV neutron energy. Only the data from the first contract had to be corrected since the uranium filter eliminated this problem in the second program.

The efficiency of the fast neutron detector decreases to zero around 0.2 MeV (see Figs. 12 to 15). The multichannel analyzer, however, continues to collect data after the neutron detector efficiency of the detector has stopped. The data obtained in the channels after this point, contain the ambient background of the detector as well as any time-dependent and

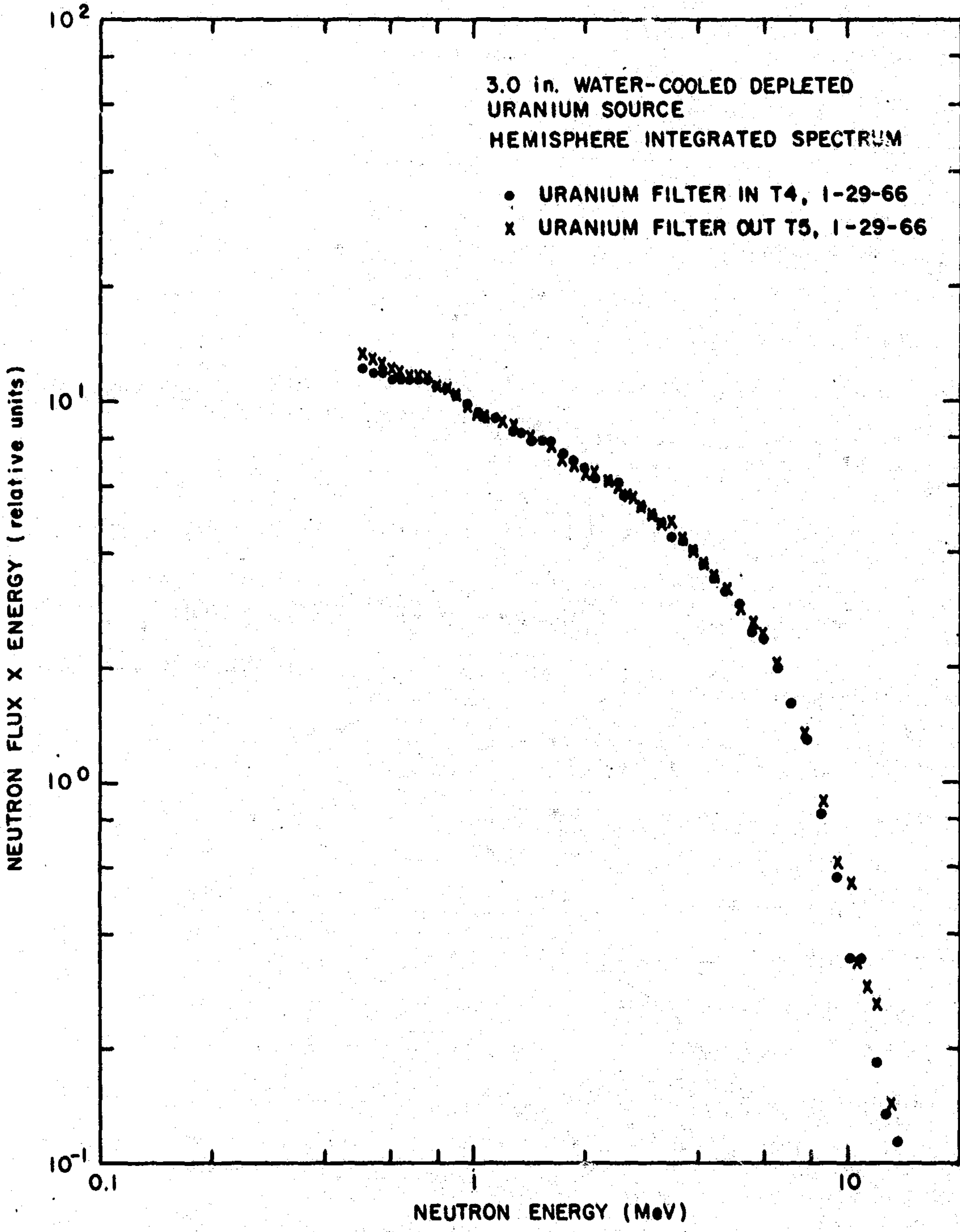


Figure 21. Fast neutron source spectrum measured with and without a gamma filter in flight path.

time-independent gamma rays. This background is removed from the signal prior to analysis by the data reduction code.

The uncertainty in the bias affects the spectral data below about 0.8 MeV and the uncertainty in removing the short lived gamma rays influences the spectral data above 10 MeV. Another effect, referred to as the fiducial point (zero time) can affect the spectral data above about 6 MeV. The fiducial point is determined by allowing the detector to see the bremsstrahlung flash and subtracting the flight time of the gamma rays. This requires that the offgate on the detector be removed during the burst since the purpose of the gate is to help suppress this flash.[16] This procedure is straightforward as long as the uranium filter is not present in the flight path as was the case for the first program. It becomes somewhat more complicated when uranium is in the flight path since the uranium also suppresses the bremsstrahlung flash making the exact channel number of the flash more difficult to determine. We had previously shown that the spectra were the same for the air- and water-cooled sources and therefore the source spectra through the LH_2 dewar for the two programs should be the same. Examination of the early-time behavior of these two source spectra indicated that the fiducial channel had been measured incorrectly.

The difference amounted to a shift in the fiducial point of four channels or 125 nsec. This shift has been incorporated into the zero-degree data of 2-26-66 and for the 37-degree data of 2-24-66. The resulting data for the 37-degree data are compared in Figs. 22 to 24. The two sets have been shape normalized. This correction brings the second set of data into agreement with the first and therefore makes both sets of data consistent.

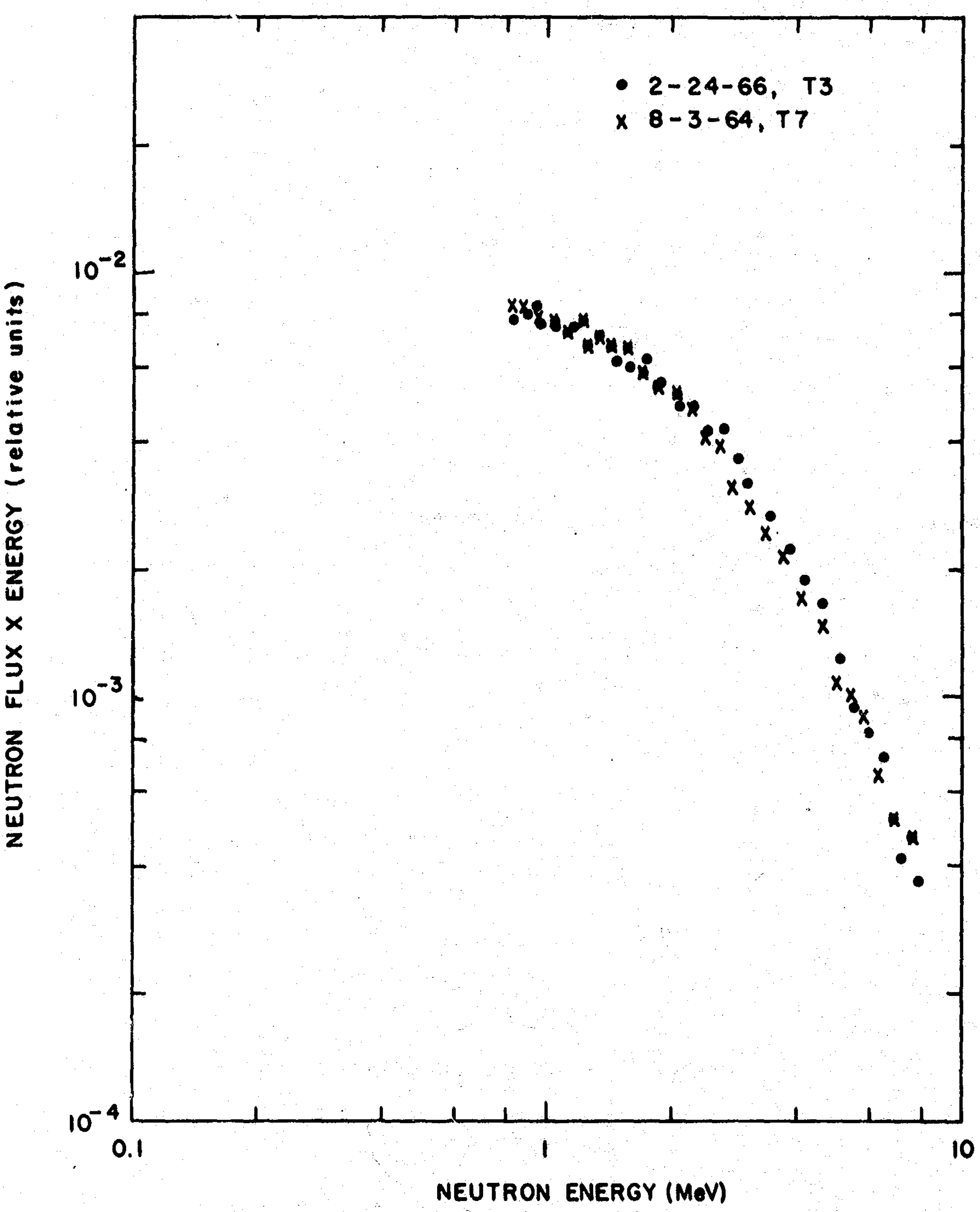


Figure 22. Comparison of the spectral data for the 2.5-in. thickness of LH_2 at 37° taken under the first and second programs.

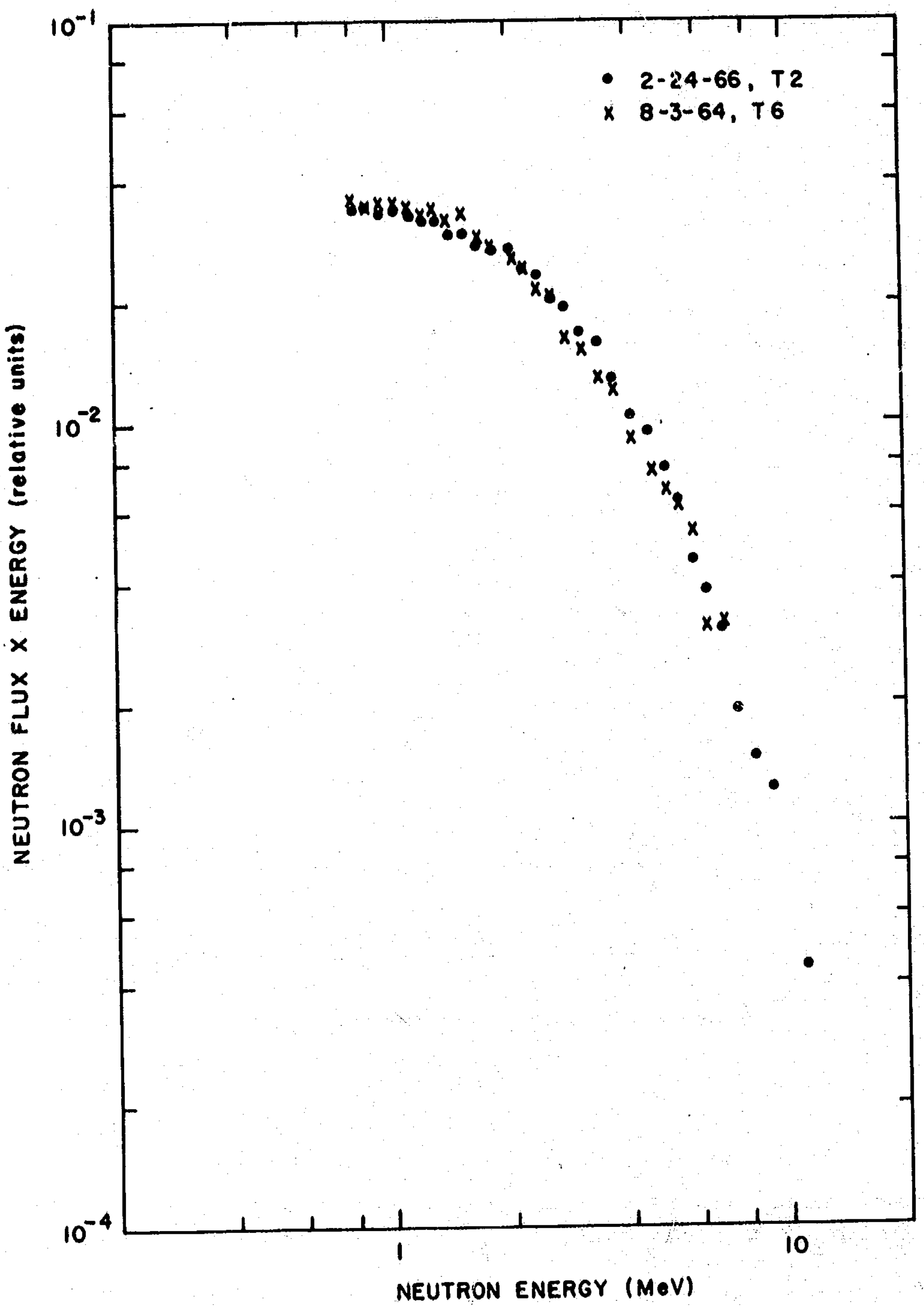


Figure 23. Comparison of the spectral data for the 4.5-in. thickness of LH_2 at 37° taken under the first and second programs.

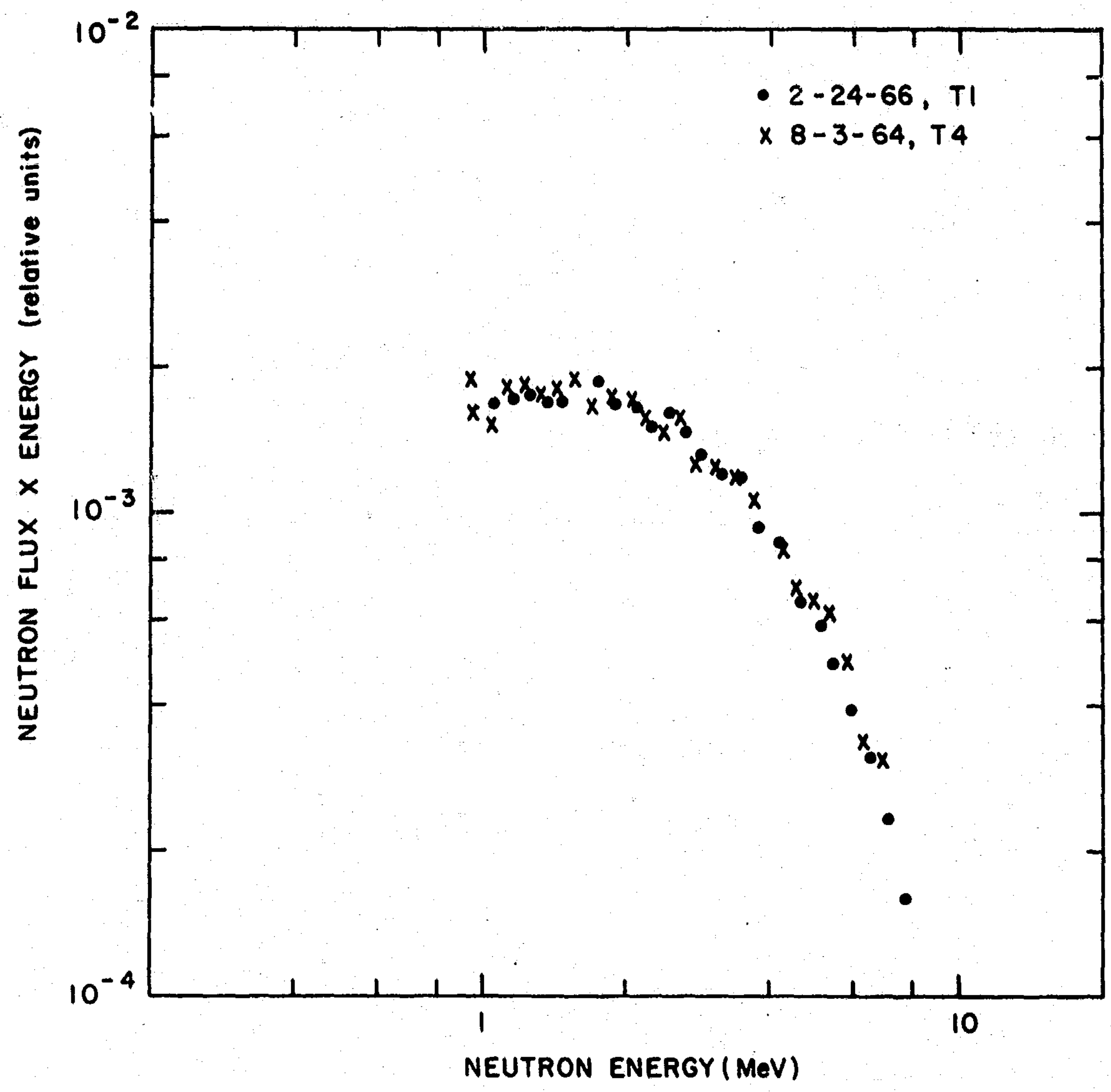


Figure 24. Comparison of the spectral data for the 10.5-in. thickness of LH_2 at 37° taken under the first and second programs.

4.0 REEVALUATION OF THE INTERMEDIATE NEUTRON SPECTRAL DATA

4.1 INTRODUCTION

The intermediate neutron energy detector[22] consisted of a NE-226 liquid scintillator counting capture gamma rays from a disk of boron carbide loaded with paraffin wax. The bias was determined as a fraction of the Compton energy for ^{60}Co and ^{137}Cs; it was 150 keV. The biasing procedure was similar to that for the fast neutron detector.

4.2 INTERMEDIATE NEUTRON ENERGY DETECTOR EFFICIENCY

The detector and its efficiency calibration are discussed in Ref. 22 and the efficiency used in the LH_2 data reduction is tabulated in Table 9 and shown in Fig. 25. Because of the response to transmitted high-energy neutrons via inelastic scattering in fluorine, and uncertainties in the boron cross section and branching ratio at high energies, the efficiency of the detector is not expected to be very accurate above 2 MeV.

4.3 OTHER FACTORS WHICH INFLUENCE REDUCTION OF INTERMEDIATE NEUTRON ENERGY DATA

The intermediate neutron flight path was approximately sixteen meters long and evacuated. The intermediate neutron detector was sensitive to thermal neutron captures consequently, a 0.175-in-thick boron filter was used to prevent pulsing overlap. The flight-path windows were mylar and a one-inch thickness of lead was placed into the flight path to minimize the effect of capture gammas. Both mylar and lead were chosen for use in the flight path since they contain a minimum of resonances in the intermediate neutron region. The fiducial point (zero time) was determined in a manner similar to that for the fast neutron

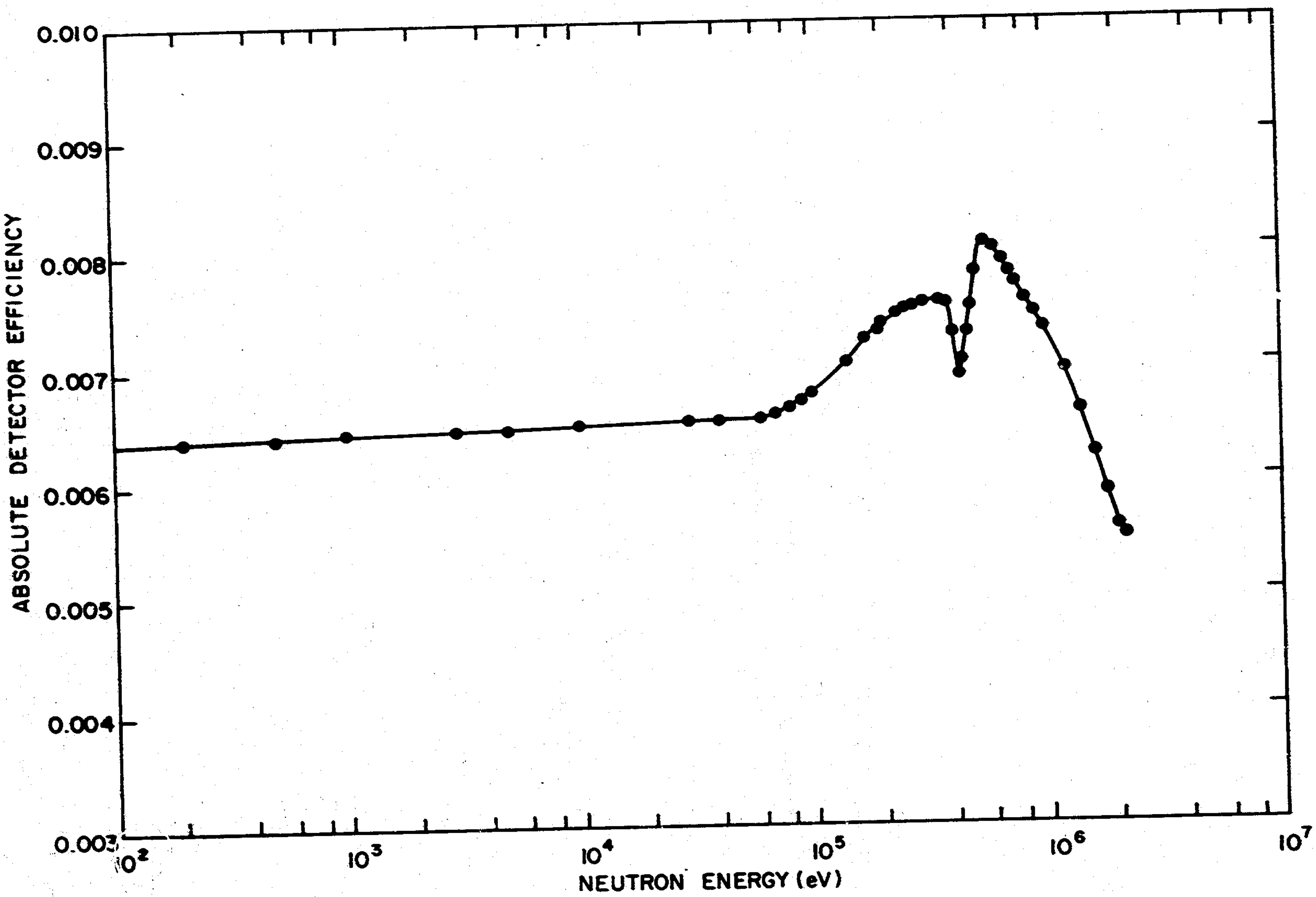


Figure 25. Efficiency of the intermediate neutron energy detector.

Table 9

ABSOLUTE DETECTOR EFFICIENCY FOR THE INTERMEDIATE NEUTRON ENERGY DETECTOR

Energy	Absolute Detector Efficiency	Energy	Absolute Detector Efficiency
1×10^2	.00636	3.0×10^5	.00753
2×10^2	.00638	3.3×10^5	.00754
5×10^2	.00640	3.50×10^5	.00755
1×10^3	.00643	3.60×10^5	.00754
3×10^3	.00645	3.70×10^5	.00753
5×10^3	.00647	3.75×10^5	.007525
1×10^4	.00649	3.80×10^5	.00752
3×10^4	.00652	3.85×10^5	.00745
4×10^4	.006525	3.90×10^5	.00738
5×10^4	.006535	4.0×10^5	.00727
$5x5 \times 10^4$	.00654	4.1×10^5	.00705
6.0×10^4	.00655	4.15×10^5	.00698
6.5×10^4	.00656	4.2×10^5	.00691
7.0×10^4	.00658	4.25×10^5	.00690
8.0×10^4	.00663	4.3×10^5	.00692
9.0×10^4	.00669	4.35×10^5	.00696
1.0×10^5	.00675	4.4×10^5	.00702
1.1×10^5	.00681	4.6×10^5	.00728
1.4×10^5	.00702	4.8×10^5	.00750
1.7×10^5	.00722	5.0×10^5	.00780
1.9×10^5	.00730	5.2×10^5	.00798
2.0×10^5	.00735	5.3×10^5	.00801
2.3×10^5	.00743	5.4×10^5	.00803
2.5×10^5	.00747	5.5×10^5	.00805
2.7×10^5	.00750	5.6×10^5	.00804
2.9×10^5	.00752	5.7×10^5	.008035

Table 9

ABSOLUTE DETECTOR EFFICIENCY FOR THE INTERMEDIATE NEUTRON ENERGY DETECTOR (cont)

Energy	Absolute Detector Efficiency	Energy	Absolute Detector Efficiency
5.8×10^5	.008025	9.0×10^5	.00742
6.0×10^5	.008000	9.4×10^5	.00737
6.2×10^5	.00797	9.8×10^5	.00729
6.6×10^5	.00789	1.20×10^6	.00694
7.0×10^5	.0078	1.4×10^6	.00659
7.4×10^5	.00772	1.6×10^6	.00621
7.8×10^5	.00765	1.8×10^6	.00588
8.2×10^5	.00756	2.0×10^6	.00558
8.6×10^5	.00749	2.1×10^6	.0055

detectors. In this case, however, the one-inch of lead did not suppress the bremsstrahlung flash as much as did the 1.238-in. of uranium nor was there any real need since data above 2 MeV were not very accurate as explained earlier.

The background removal was broken down into two parts. The first part was background composed of ambient, time independent gamma-rays or long lived gamma-rays and both were referred to as ambient. The second part was a time-dependent gamma-ray background produced by the capture of thermal neutrons in the LH_2. The energy of the capture gamma ray was 2.1 MeV and decayed exponentially with the thermal neutron dieaway of the LH_2 in the dewar. Both backgrounds were removed from the signal during the analysis by the data reduction code.

5. REEVALUATION OF THE THERMAL NEUTRON SPECTRAL DATA

5.1 INTRODUCTION

The thermal neutron energy detector consisted of a bank of 32 BF_3 counters mounted with their axis perpendicular to the beam.

5.2 THERMAL NEUTRON ENERGY DETECTOR EFFICIENCY

Details of the detector and its efficiency are discussed in Ref. 23. The detector efficiency used in the LH_2 data reduction is tabulated in Table 10 and shown in Fig. 26.

5.3 OTHER FACTORS THAT INFLUENCE REDUCTION OF THERMAL NEUTRON DATA

The mean emission time or the mean time for a neutron of a particular energy to be emitted plays an important part in the data reduction. The mean emission time is the amount of time a neutron spends in the LH_2 assembly before it is emitted. Since the fiducial point for the flight time is the bremsstrahlung burst the flight time appears longer than it actually is and must be corrected for the mean emission time. The current data reduction code simply subtracts the mean emission time from the flight time. This is only an approximation[24], however, an improved method could not be calculated due to the two-dimensional geometry of the LH_2. The mean emission times used to reduce the thermal LH_2 data are shown in Fig. 27. The value of the asymptotic mean emission time or dieaway was obtained from the time-dependent capture gammas since their decay time is equal to the dieaway.

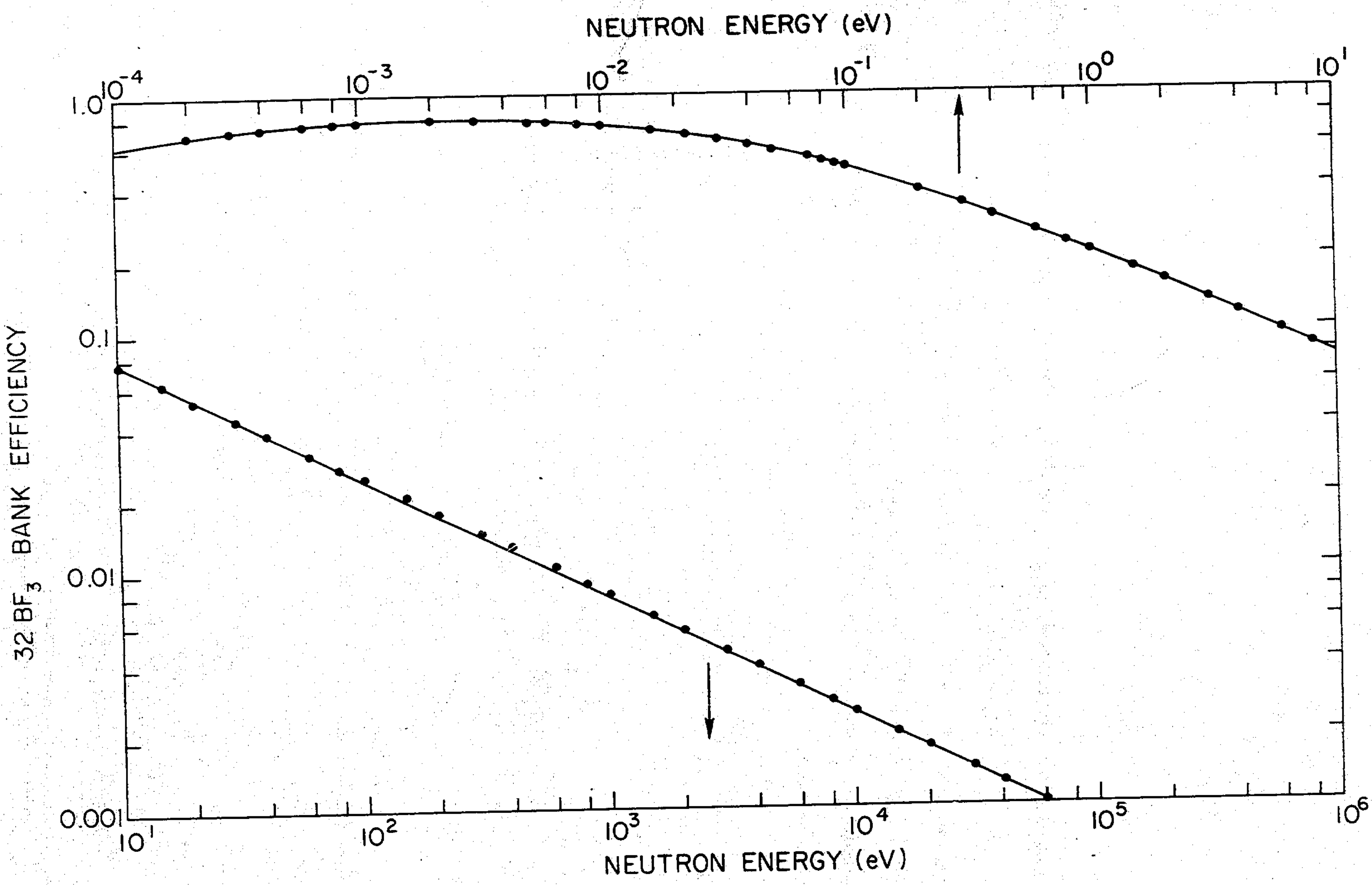


Figure 26. Efficiency of the thermal neutron detector.

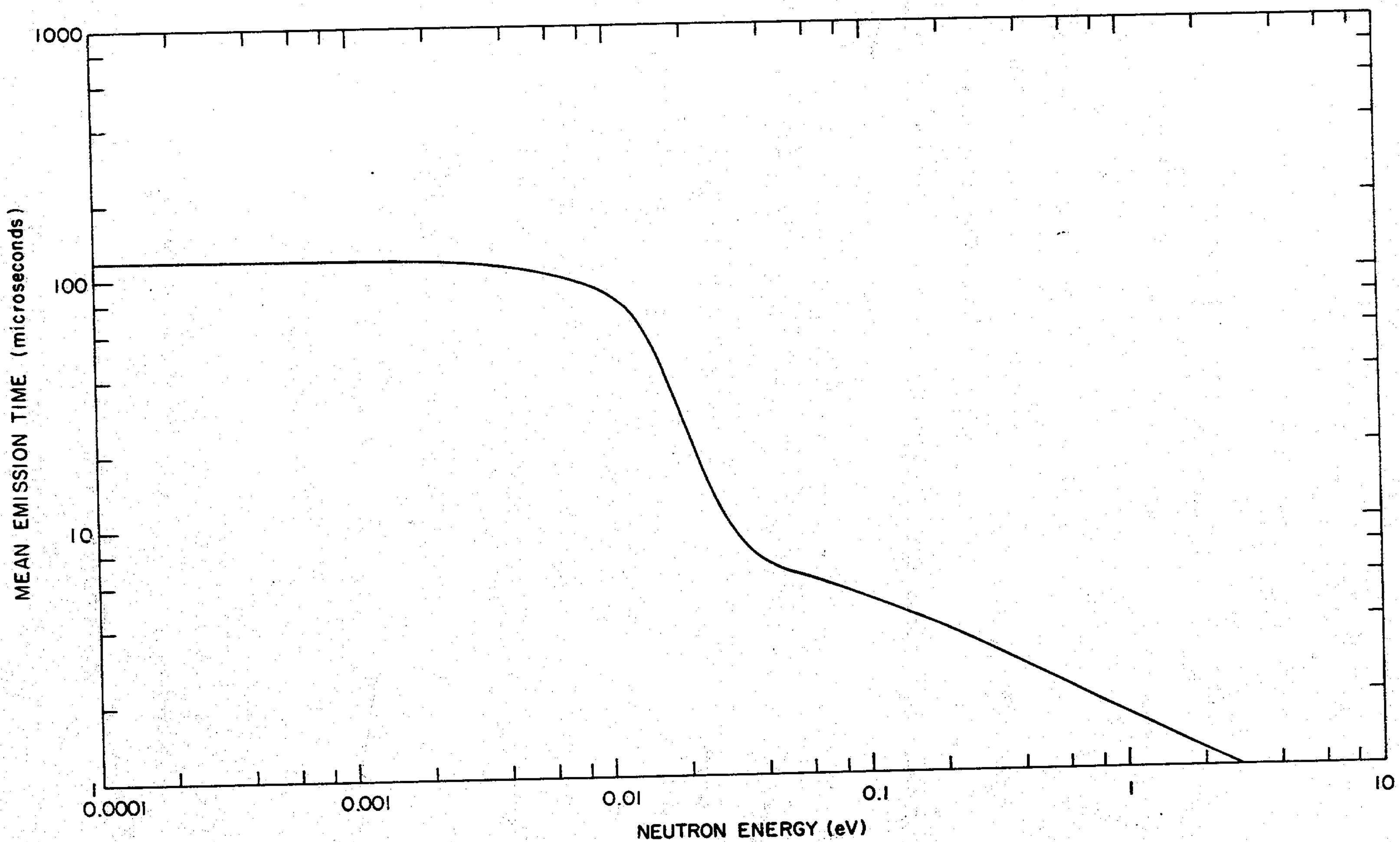


Figure 27. Mean emission time used to reduce the thermal LH_2 data.

Table 10

TABULATED EFFICIENCY OF THE THERMAL NEUTRON DETECTOR

Energy (eV)	Efficiency	Energy (eV)	Efficiency
1×10^{-4}	.6255	3.0×10^{-2}	.6510
1.5×10^{-4}	.6682	3.5×10^{-2}	.6323
2.0×10^{-4}	.6941	4.0×10^{-2}	.6150
3.0×10^{-4}	.7247	4.5×10^{-2}	.5995
4.0×10^{-4}	.7423	5.0×10^{-2}	.5862
6.0×10^{-4}	.7617	5.5×10^{-2}	.5728
8.0×10^{-4}	.7721	6.0×10^{-2}	.5600
1.0×10^{-3}	.7784	7.0×10^{-2}	.5393
1.5×10^{-3}	.7864	8.0×10^{-2}	.5213
2.0×10^{-3}	.7897	9.0×10^{-2}	.5048
3.0×10^{-3}	.7909	1.0×10^{-1}	.4897
4.0×10^{-3}	.7885	1.5×10^{-1}	.4327
4.5×10^{-3}	.7865	2.0×10^{-1}	.3935
5.0×10^{-3}	.7736	3.0×10^{-1}	.3411
5.5×10^{-3}	.7771	4.0×10^{-1}	.3064
6.0×10^{-3}	.7736	6.0×10^{-1}	.2616
6.5×10^{-3}	.7624	8.0×10^{-1}	.2329
7.0×10^{-3}	.7660	1.0×10^{0}	.2123
8.0×10^{-3}	.7629	1.5×10^{0}	.1787
9.0×10^{-3}	.7579	2.0×10^{0}	.1576
1.0×10^{-2}	.7519	3.0×10^{0}	.1316
1.3×10^{-2}	.7284	4.0×10^{0}	.1156
1.6×10^{-2}	.7078	6.0×10^{0}	.09591
1.9×10^{-2}	.6884	8.0×10^{0}	.08388
2.2×10^{-2}	.6777	1.0×10^{1}	.07554
2.5×10^{-2}	.6673	1.5×10^{1}	.06235

Table 10

TABULATED EFFICIENCY OF THE THERMAL NEUTRON DETECTOR (cont)

Energy (eV)	Efficiency	Energy (eV)	Efficiency
2.0×10^1	.05435	1.0×10^4	.002533
3.0×10^1	.04472	1.5×10^4	.002069
4.0×10^1	.03891	2.0×10^4	.001792
6.0×10^1	.03195	3.0×10^4	.001464
8.0×10^1	.02776	4.0×10^4	.001268
1.0×10^2	.02489	6.0×10^4	.001035
1.5×10^2	.02039	8.0×10^4	.0008967
2.0×10^2	.01770	1.0×10^5	.0008021
3.0×10^2	.01449	1.5×10^5	.0006550
4.0×10^2	.01257	2.0×10^5	.0005673
6.0×10^2	.01028	3.0×10^5	.0004632
8.0×10^2	.008911	4.0×10^5	.0004012
1.0×10^3	.007976	6.0×10^5	.000327598
1.5×10^3	.006520	8.0×10^5	.000283710
2.0×10^3	.005650	1.0×10^6	.000207197
3.0×10^3	.004617	1.5×10^6	.000179459
4.0×10^3	.004001	2.0×10^6	.000146509
6.0×10^3	.003268	3.0×10^6	.000126880
8.0×10^3	.002821	4.0×10^6	.000103617

The background was measured by placing a B-10 filter over the entrance of the collimator and this was subtracted from the signal during data reduction.

The flight path materials were one wall of the stainless steel dewar at liquid hydrogen temperature of 20.4°K (.0726 in. thick) one wall of the stainless steel dewar at room temperature (.0789 in. thick) helium in the probe tube at 20.4°K, mylar flight path windows, and air. The thermal neutrons were timed over an evacuated 16-meter flight path. These cross sections are fairly well known except for the stainless steel where the cross section is not known below 0.01 eV and very certainly not for temperatures of 20.4°K. It was clear from the experimental data that there was significant Bragg scattering by the stainless steel walls. Equally clear, however, was the fact that such Braff scattering would not be well described by the sum of the Bragg scattering of the stainless steel constituents,--iron, chromium, and nickel. The procedure used was therefore as follows:

1. The stainless steel was initially assumed to consist of the sum of its constituents which were described as 1/v absorbers with free atom scattering.

2. Several test cases of LH_2 data were reduced using the cross sections of Item 1. Where peaks occurred due to Bragg scattering, the flux above the peak was extended to just below it and the difference related to a constant change in cross section. These differences were obtained for each Bragg peak and averaged over the several test cases.

3. The cross sections for stainless steel, Item 1, were modified by the subtraction of their respective energies and below of the cross section differences from Item 2. All the LH_2 data were then reduced with this same cross section set.

6. DISCUSSION OF COMPARISON OF CALCULATIONS AND EXPERIMENT

6.1 MONITORS AND NORMALIZATION OF EXPERIMENTS AND CALCULATIONS

Each set of data, e.g., fast, intermediate, and thermal, was normalized to the neutron source intensity as measured by adjacent aluminum foil monitors. However, since each neutron energy region used a different detector system, the fast neutron data does not directly normalize to the intermediate energy region nor the intermediate to the thermal neutron energy region. Also, the solid angle to the front surface of the LH_2 varied as the thickness of LH_2 was varied due to the way in which the thickness changes were made. In view of these changes in geometry, it would be more appropriate to renormalize for each thickness over the entire energy range since the aluminum foil monitors do not track for different thicknesses. This method was attempted and discarded after some inconsistencies arose.

Another method of normalization which is perhaps not as good, is to normalize the fast and intermediate neutron energy range in the energy region where there is generally an adequate overlap. There is a gap between the intermediate and thermal energy regions, and the normalization in these energy regions was through their connection by a $1/E$ flux which appears to be established from 1 eV to 10^4 eV.

It is also necessary to normalize the calculations with the experiment and since fast and intermediate energy regions were calculated as one, these were normalized to the experiment by shape normalization. In the thermal region, the calculations and experiment were normalized in the $1/E$ region. In summary, the fast and intermediate experimental data were normalized in their overlap region and the calculation shape normalized to the experiment. The thermal experimental neutron data were normalized to their calculations in the 1/E energy region. The thermal experimental data and calculations were normalized to the fast and intermediate experimental data and calculations in the 1/E energy region. All of the experimental data taken under both contracts and the calculations made under the second contract are given in Appendix E. In all cases, the fast neutron experimental data were the invariant and all other data normalized to them. The normalization factors are given for the experiments and calculations in Tables 11 and 12, respectively. To use these two tables, multiply the data listed under the column labeled "description" and tabulated in Appendix E by the normalization factor to match the corresponding fast neutron energy region.

6.2 DISCUSSION OF REEVALUATED DATA AND CALCULATIONS

All of the reevaluated data have been tabulated in Appendix E. They are also displayed graphically in Figs. 28 through 56. For the 0^{o} angle, measurements were made for only the fast neutron energy region, and at 5^{o} for the intermediate neutron energy region. For 15, 37, 53, and 78^{o}, measurements were made for both the fast and intermediate regions. For 37 and 78^{o} angles, measurements were made from 10 MeV to .0005 eV. A gap in the data for these angles usually extends from 10 eV to 10^3 or 10^4 eV. This gap exists because no neutrons could be observed statistically above the time-dependent capture gammas. The 0^{o} data for the 7.0, 10.5, and 13.0 in. thicknesses for the first program (7-31-64) are unsatisfactory: all of them give the same result. These were the first three measurements made and could have been caused by inexperience in transferring the LH_2 from compartment to compartment.

In a discussion of the experimental data, it is important to note some of the details surrounding the measurements. The fast neutron source intensity was limited since it could only accept 250 watts of electron beam power dictated by the air-cooling of the uranium target. In many cases, especially at large angle and thickness the signal-to-background

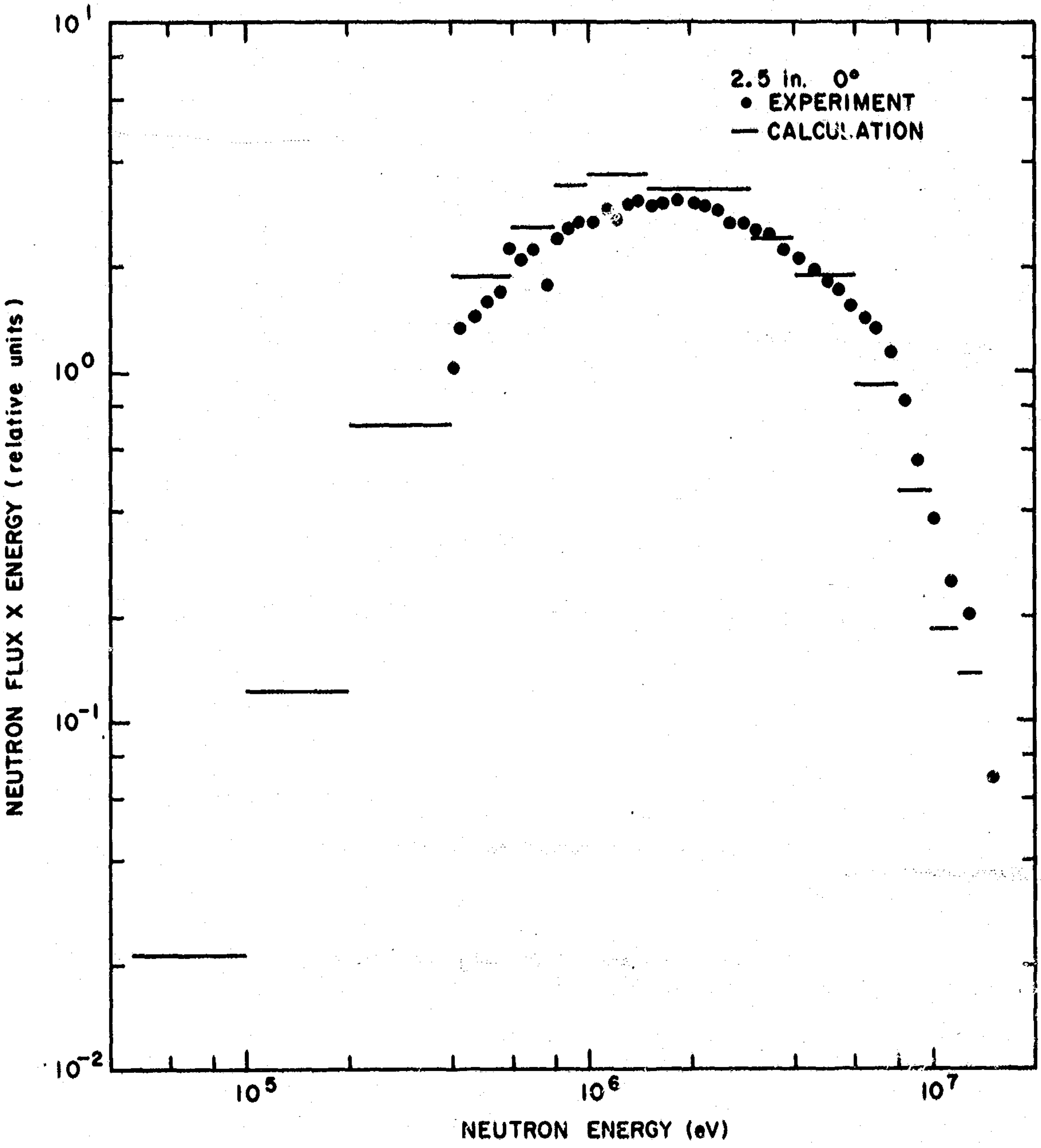


Figure 28. Fast neutron spectrum for a 2.5-in. thickness of LH_2 at 0°.

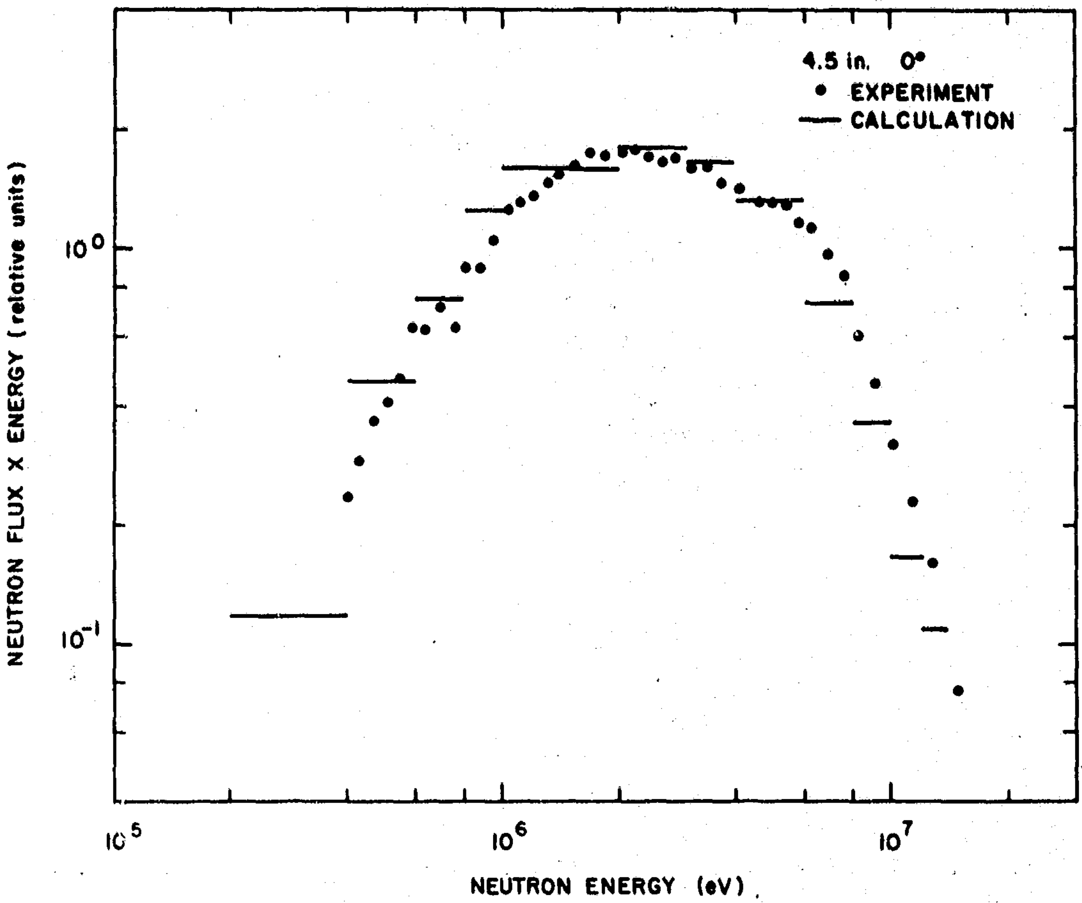


Figure 29. Fast neutron spectrum for a 4.5-in. thickness of LH_2 at 0°.

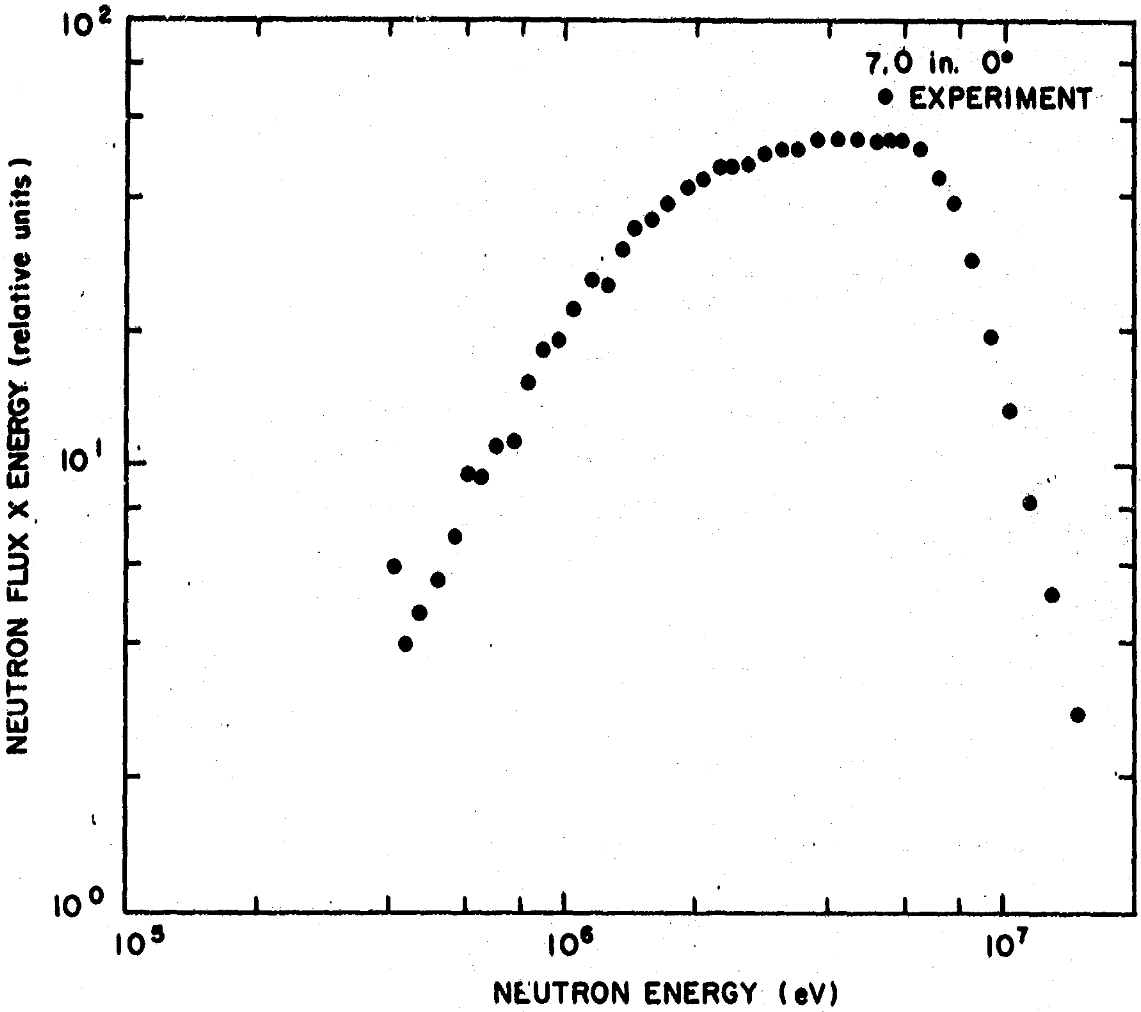


Figure 30. Fast neutron spectrum for a 7.0-in. thickness of LH_2 at 0°.

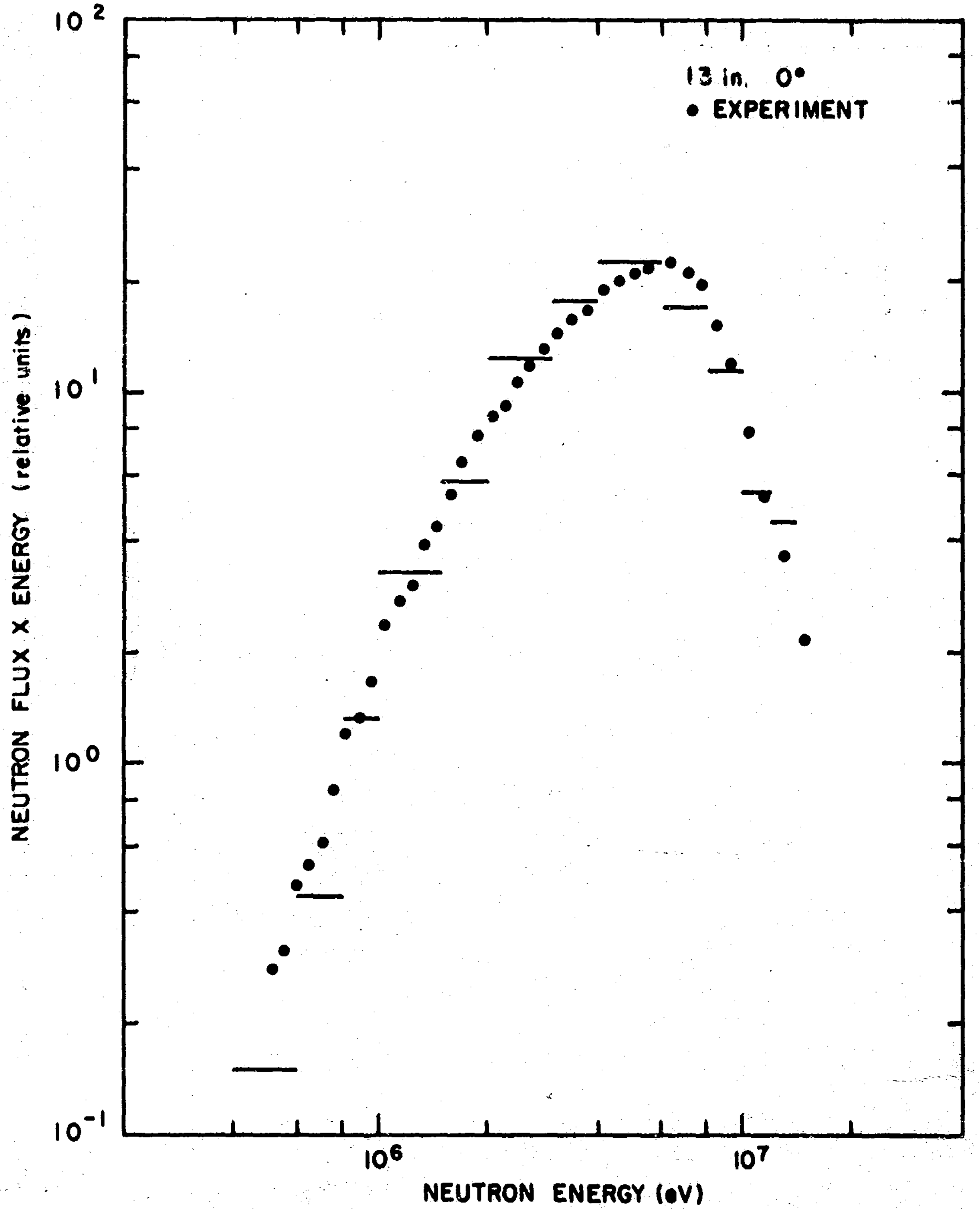


Figure 31. Fast neutron spectrum for a 13.0-in. thickness of LH_2 at 0°.

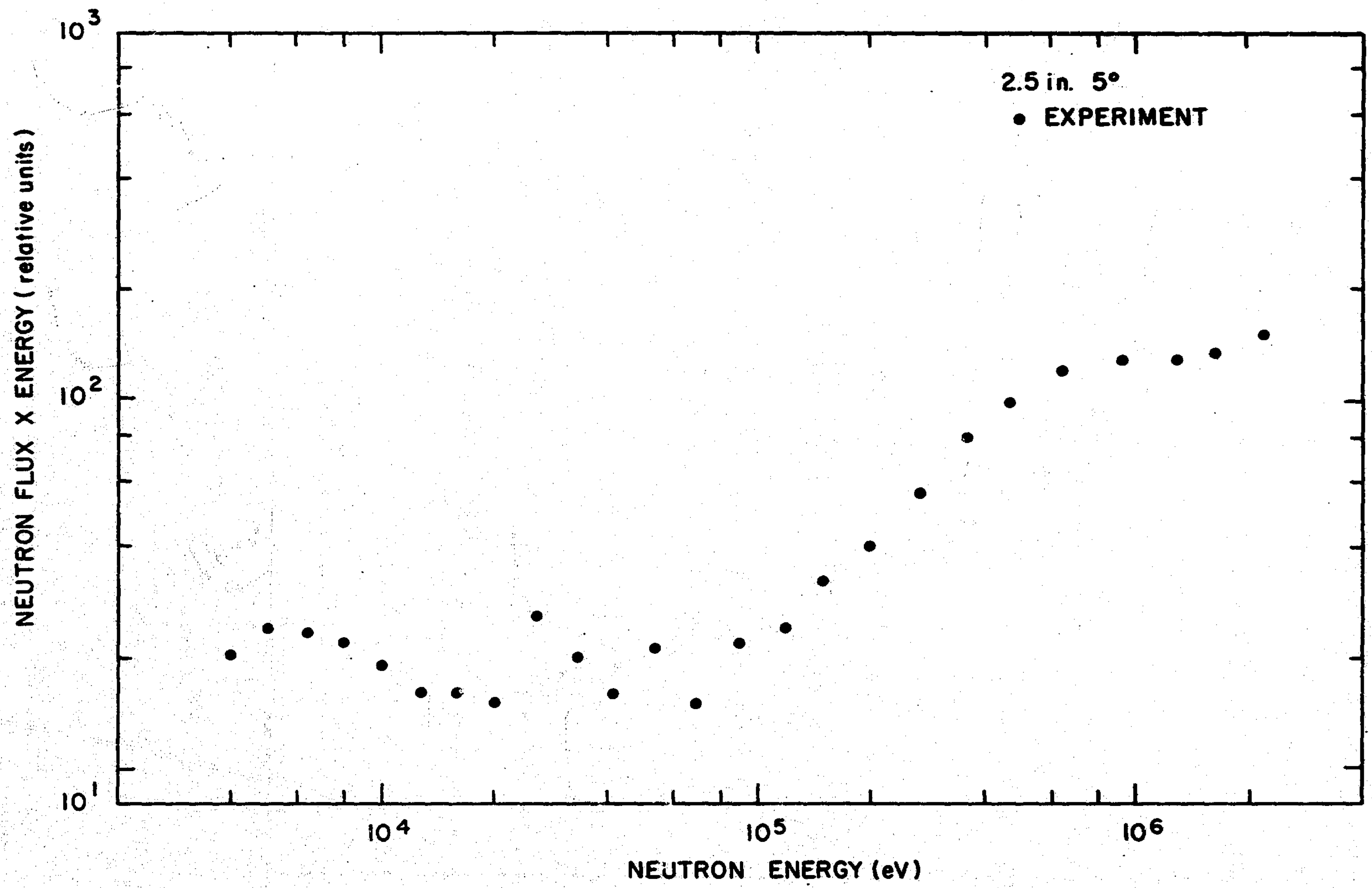


Figure 32. Intermediate neutron spectrum for a 2.5-in. thickness of LH_2 at 5°.

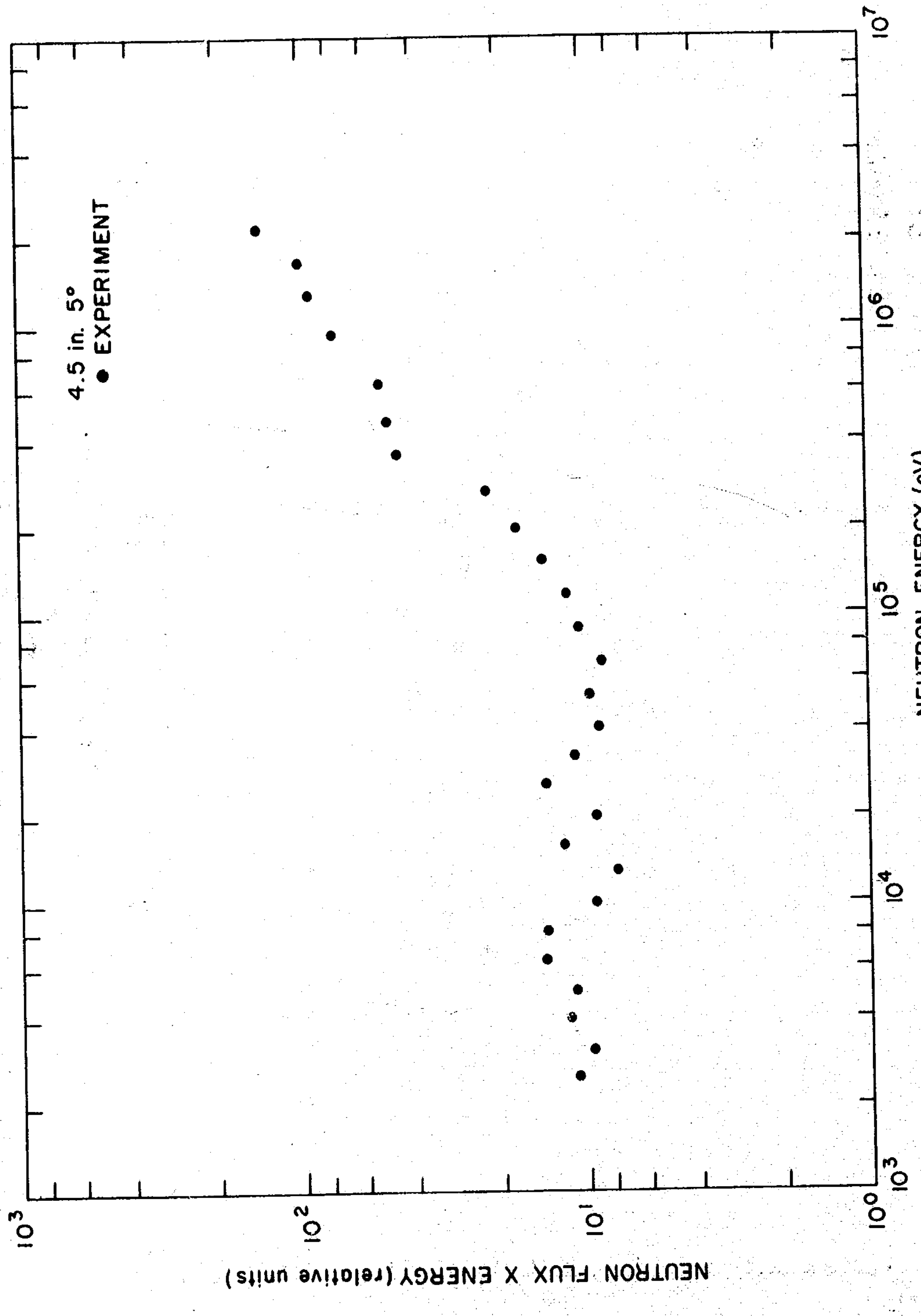


Figure 33. Intermediate neutron spectrum for a 4.5-in. thickness of LH_2 at 5°.

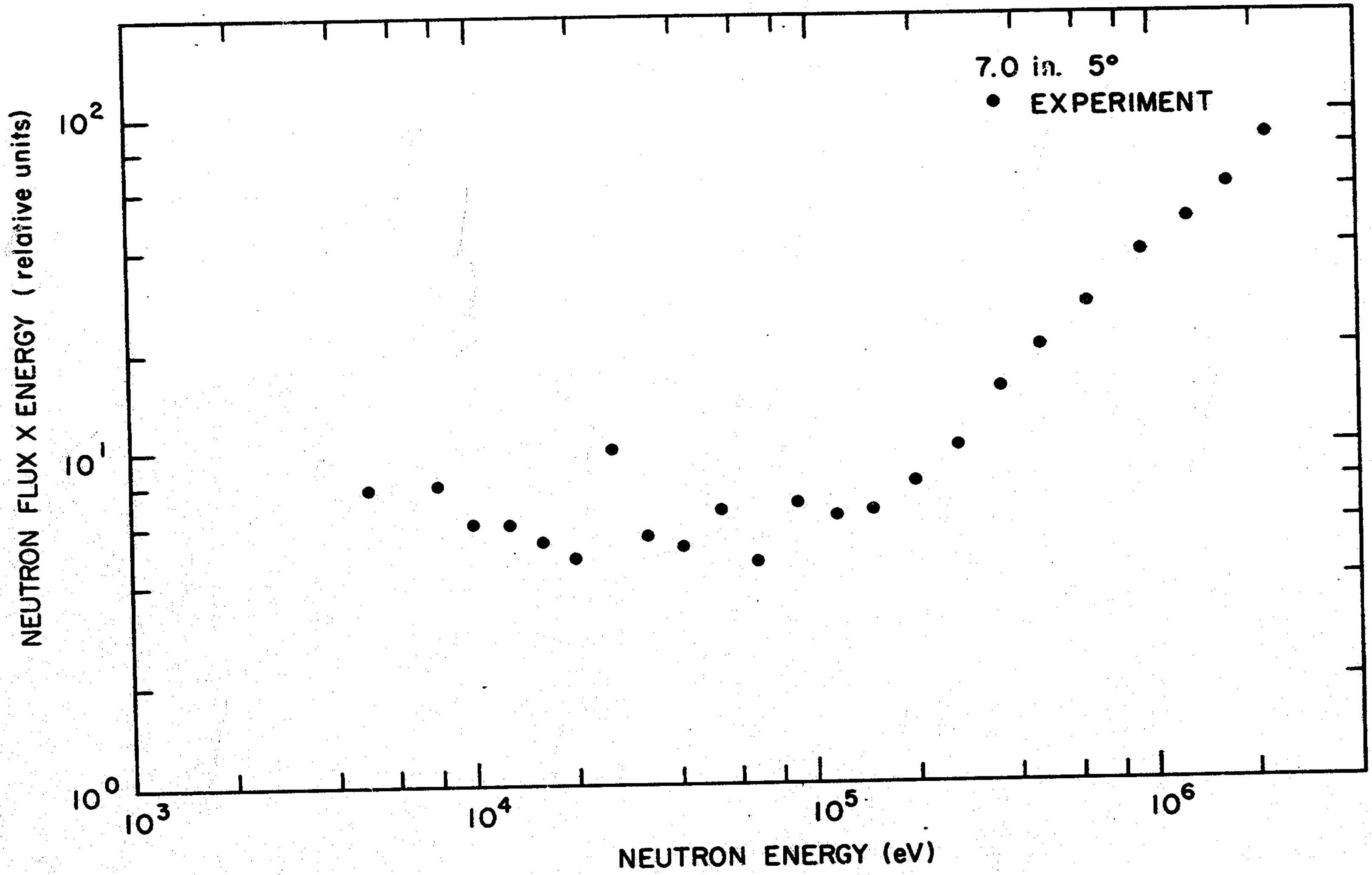


Figure 34. Intermediate neutron spectrum for a 7.0-in. thickness of LH_2 at 5°.

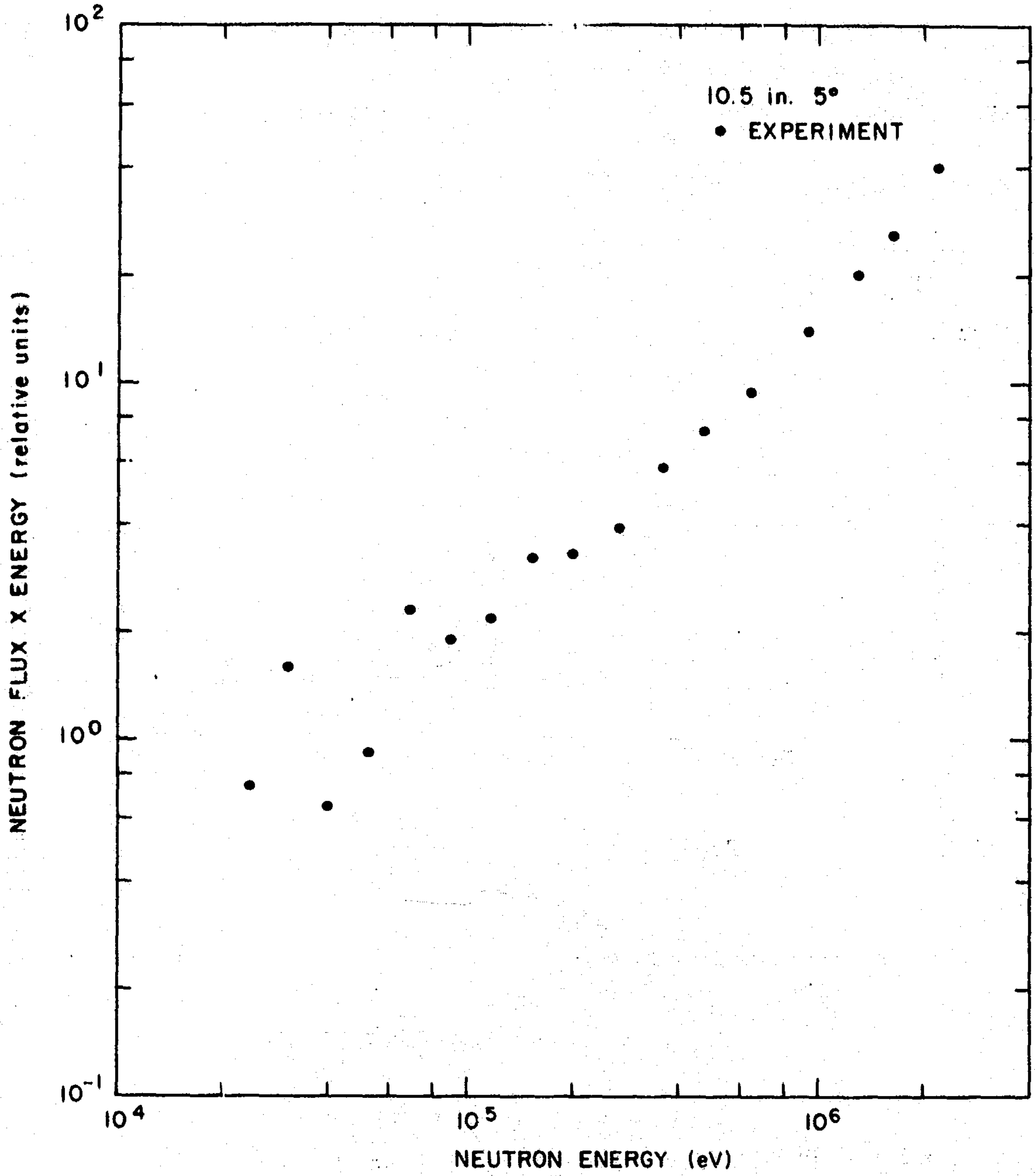


Figure 35. Intermediate neutron spectrum for a 10.5-in. thickness of LH_2 at 5°.

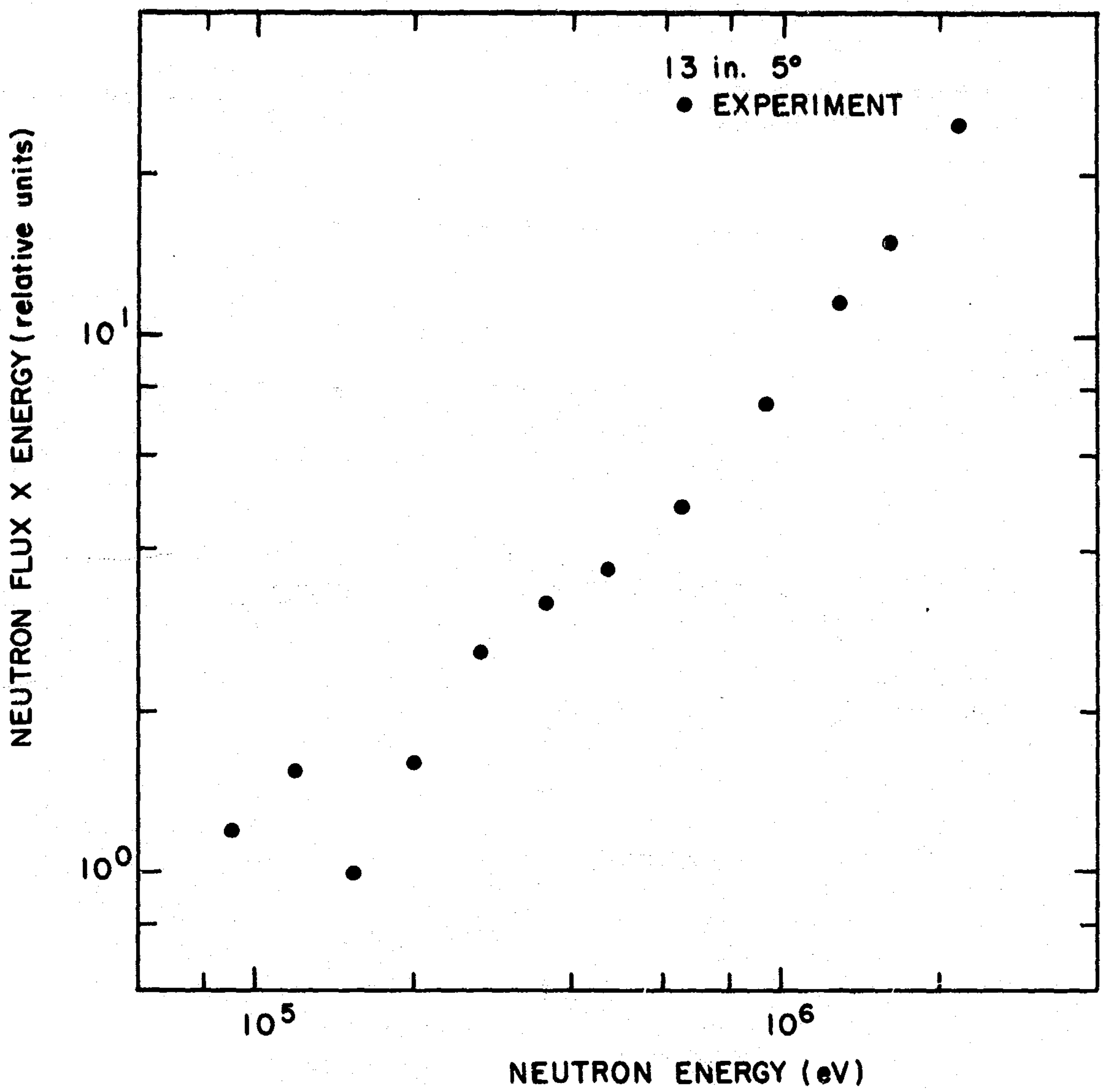


Figure 36. Intermediate neutron spectrum for a 13.0-in. thickness of LH_2 at 5°.

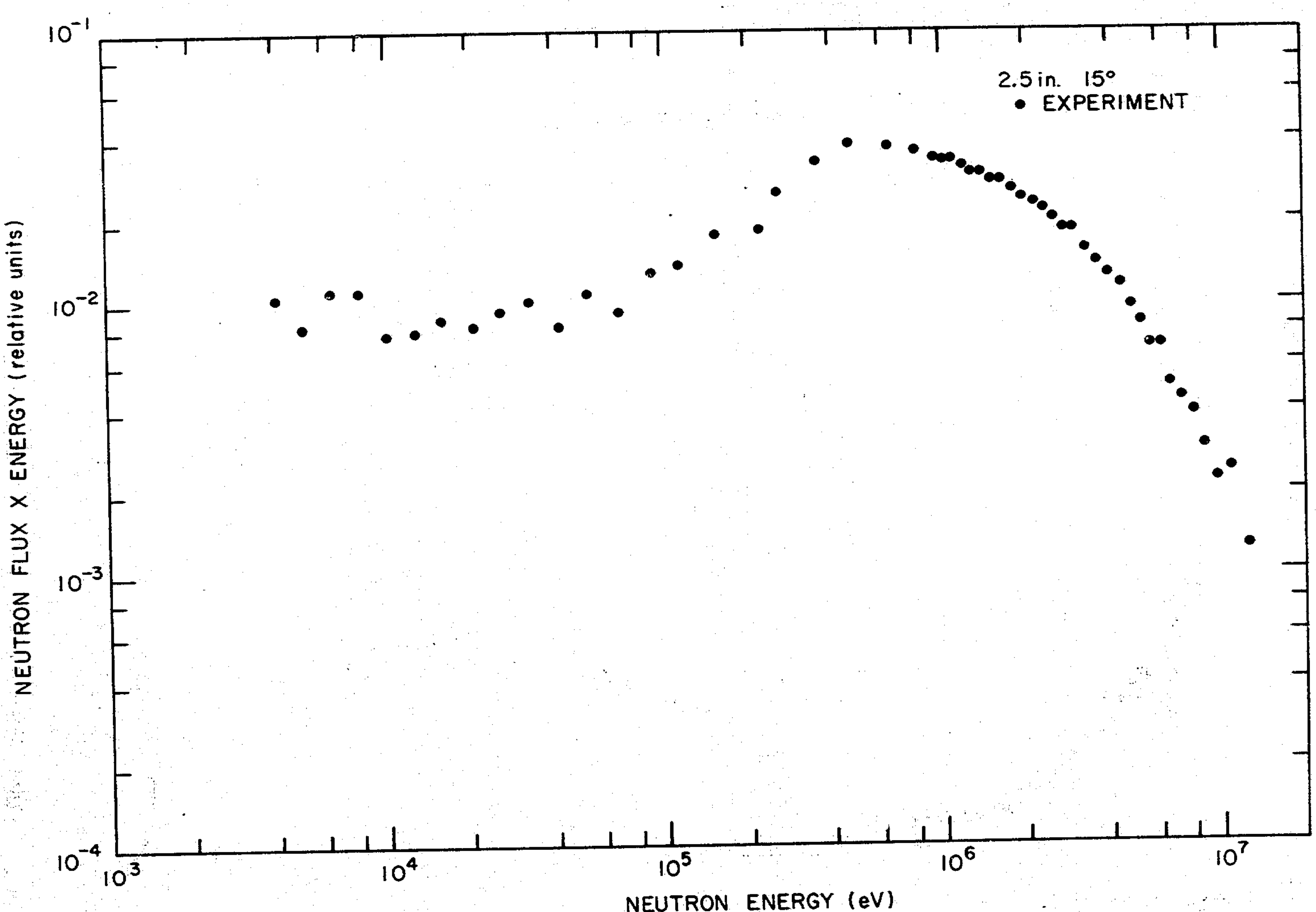


Figure 37. Neutron spectrum for a 2.5-in. thickness of LH_2 at 15°.

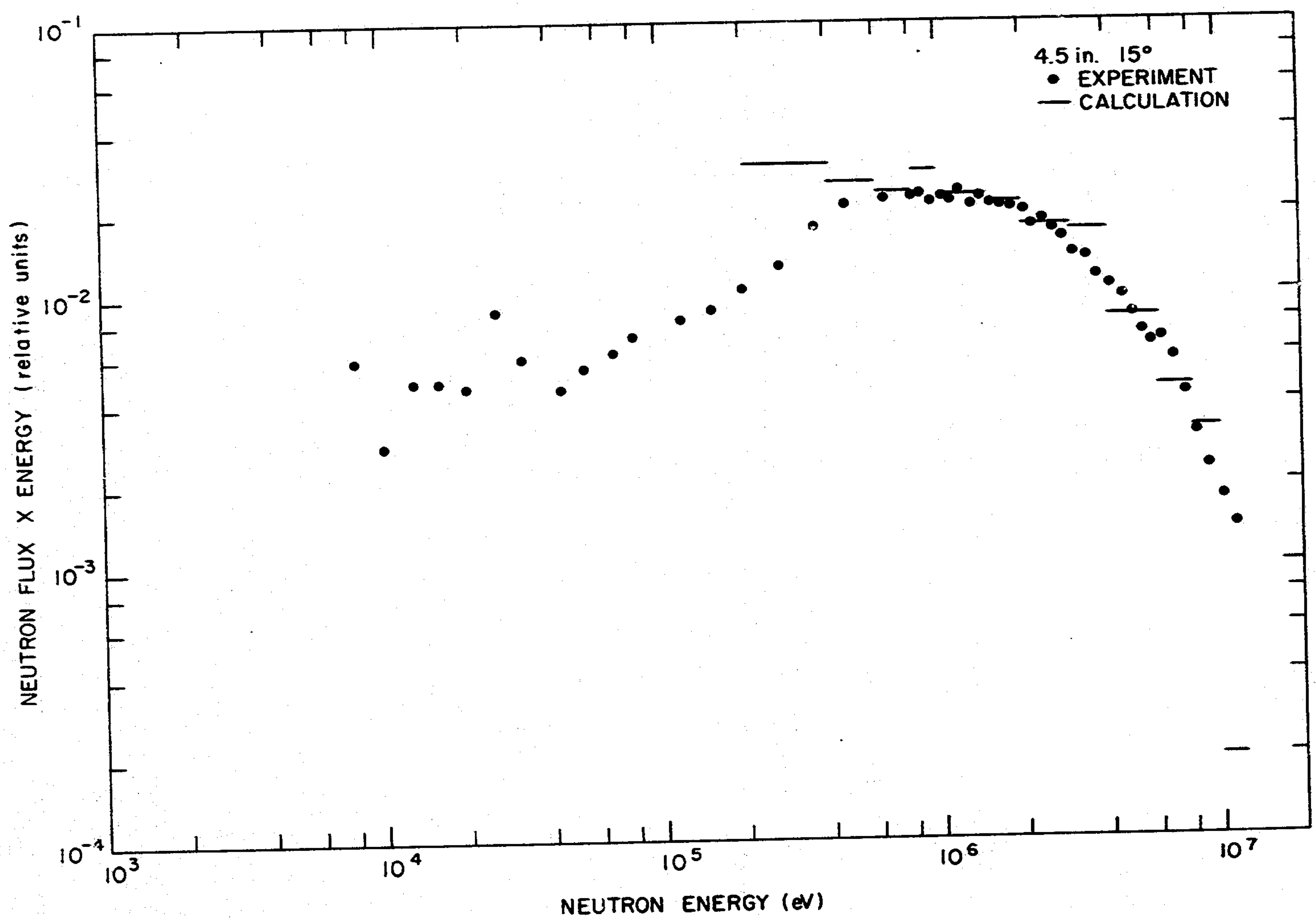


Figure 38. Neutron spectrum for a 4.5-in. thickness of LH_2 at 15°.

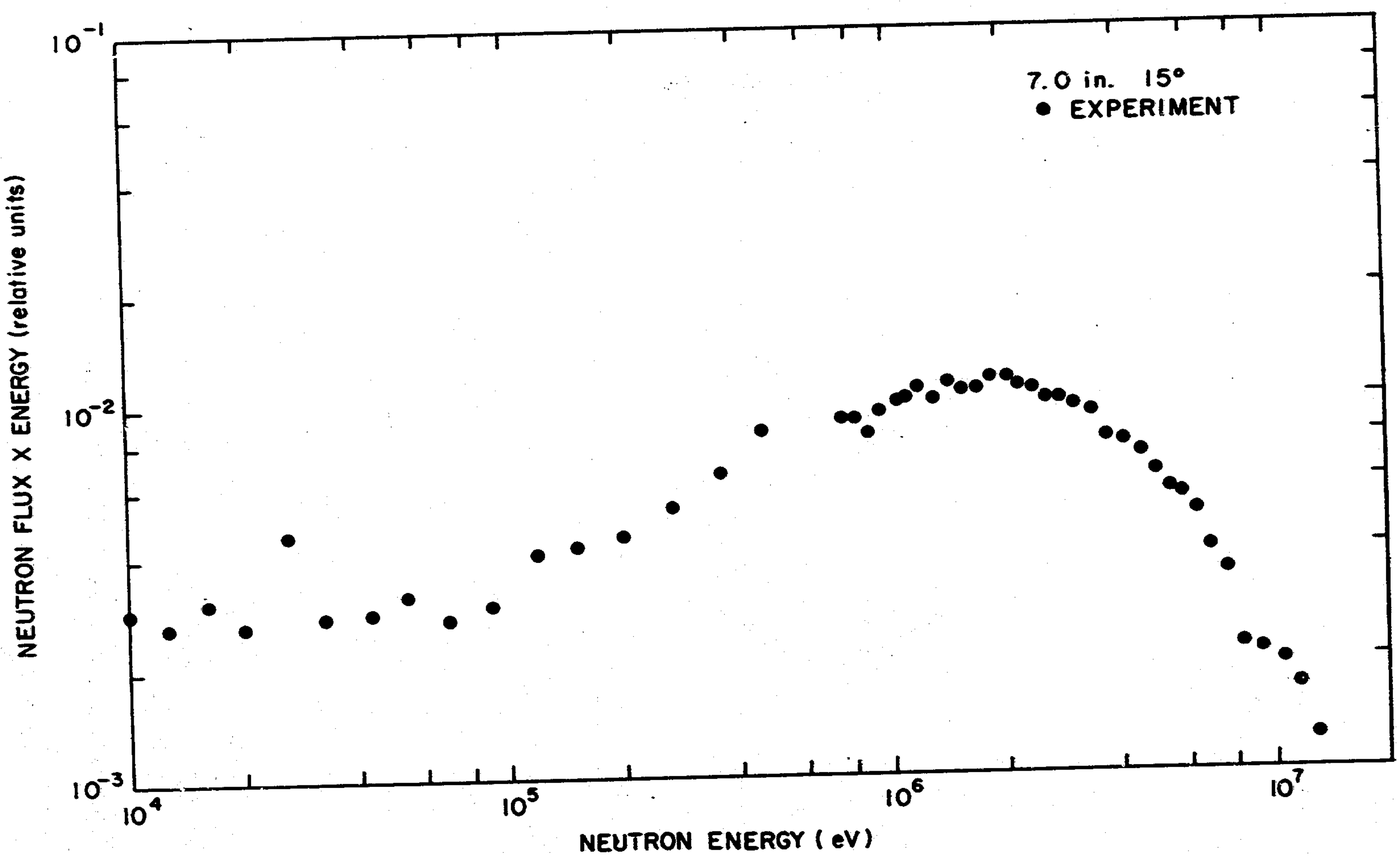


Figure 39. Neutron spectrum for a 7.0-in. thickness of LH_2 at 15°.

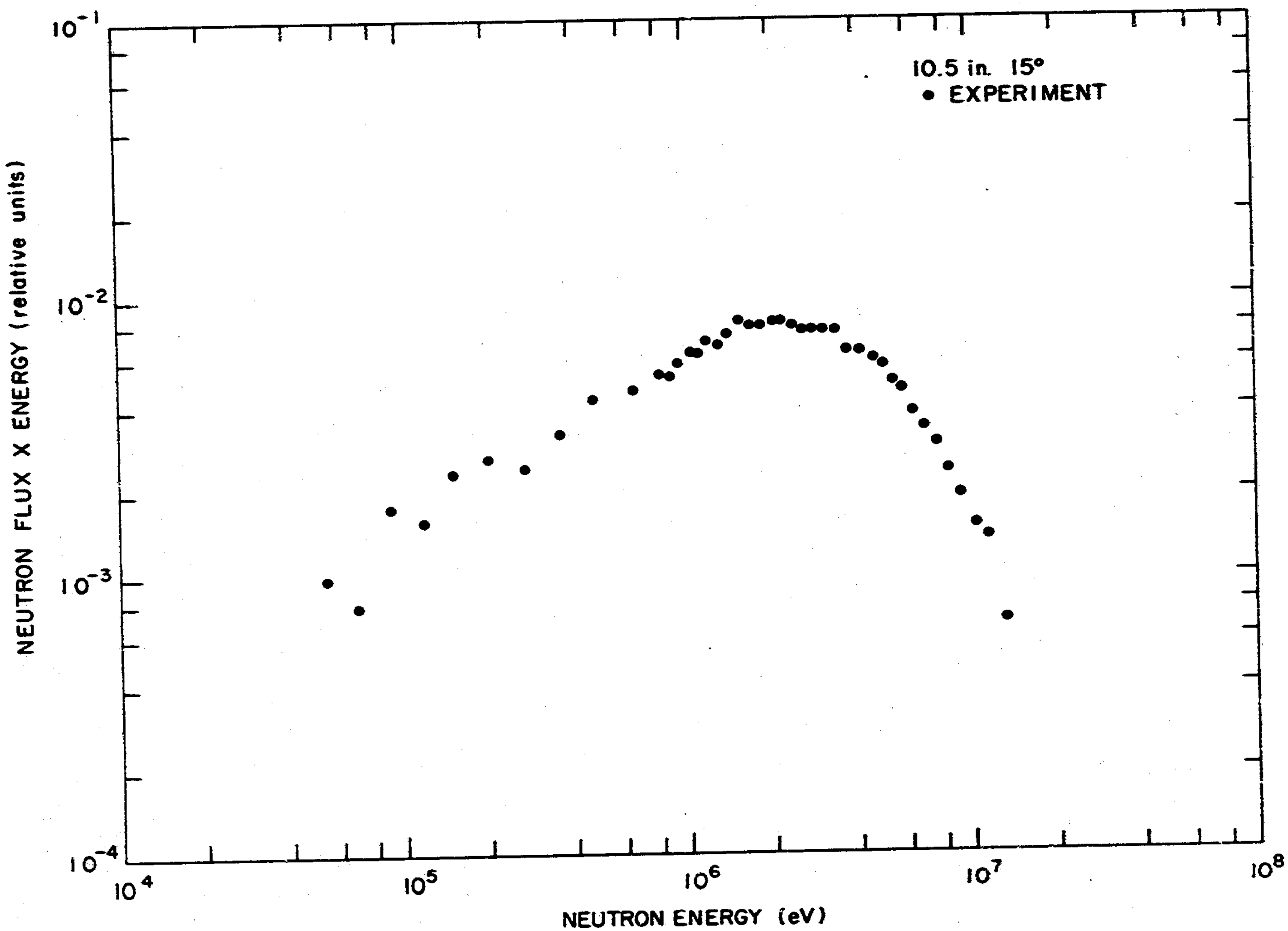


Figure 40. Neutron spectrum for a 10.5-in. thickness of LH_2 at 15°.

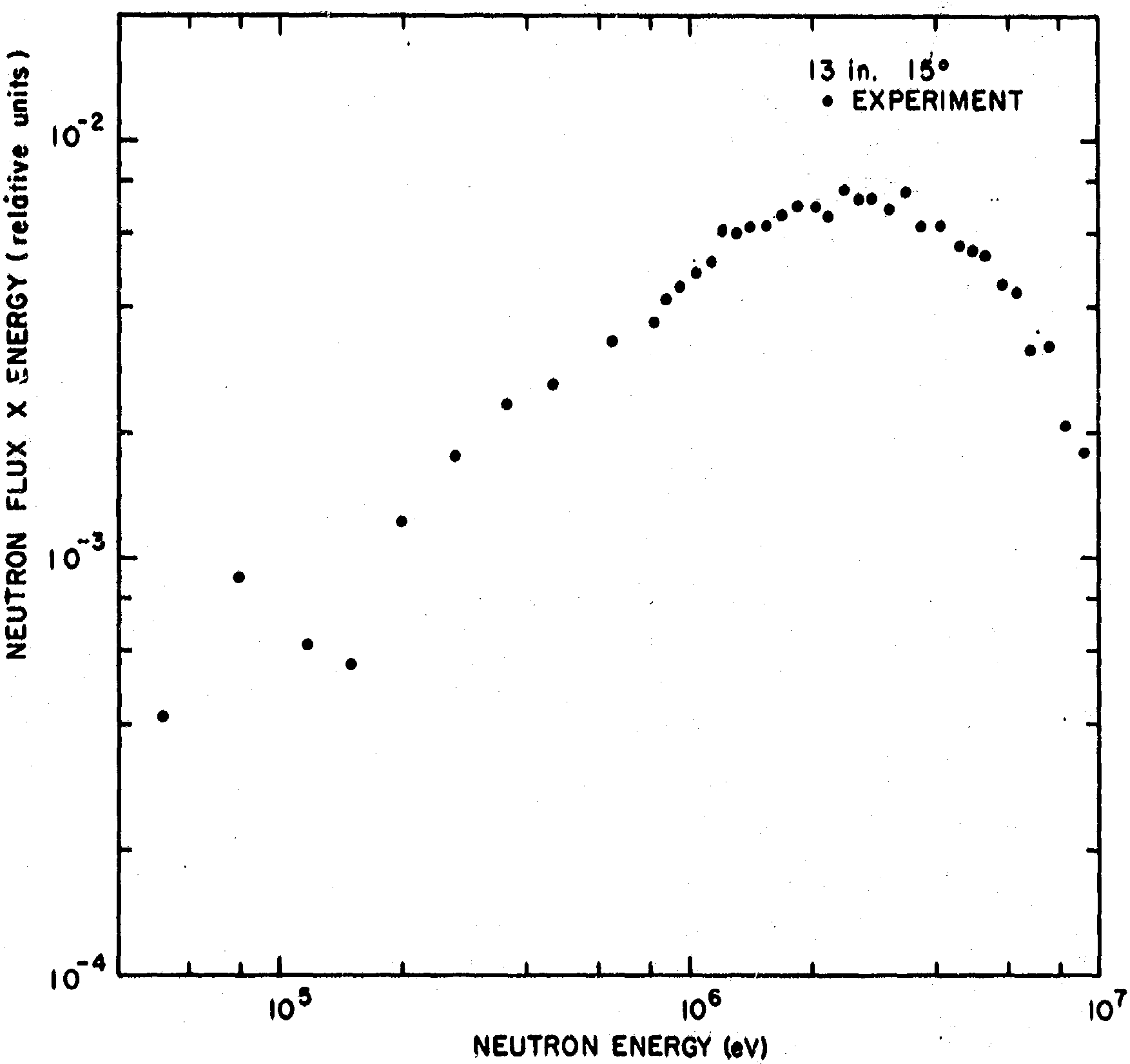


Figure 41. Neutron spectrum for a 13.0-in. thickness of LH_2 at 15°.

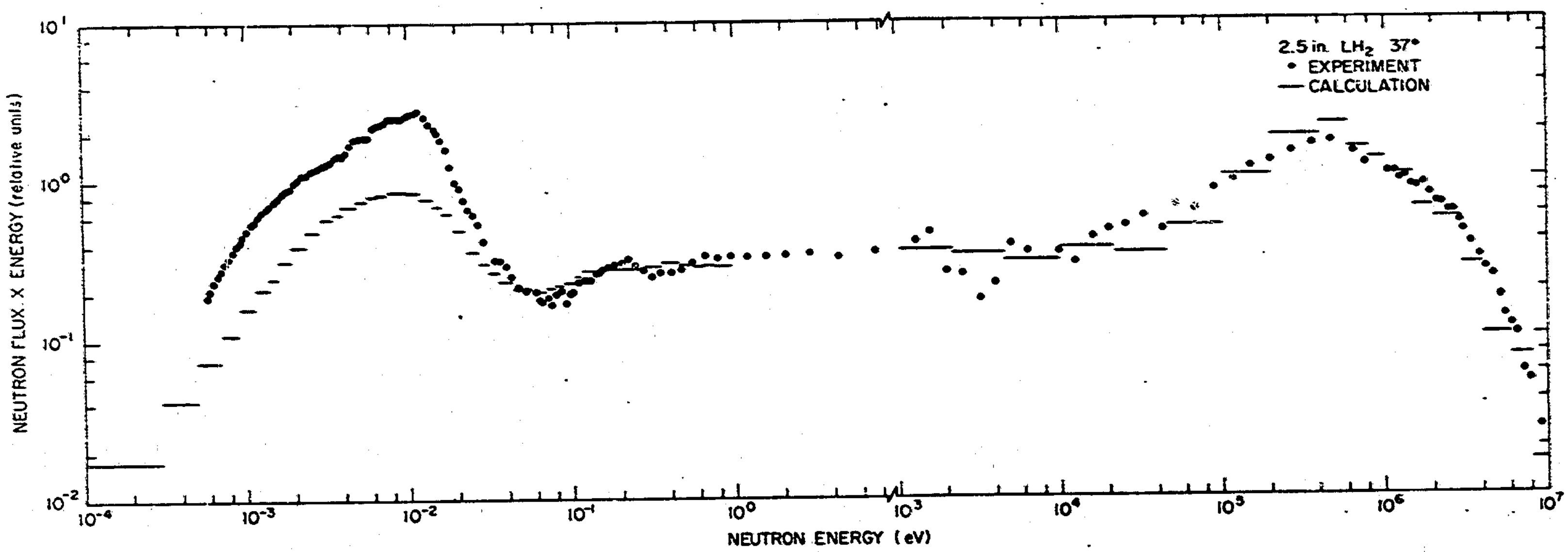


Figure 42. Neutron spectrum for a 2.5-in. thickness of LH_2 at 37^{o}.

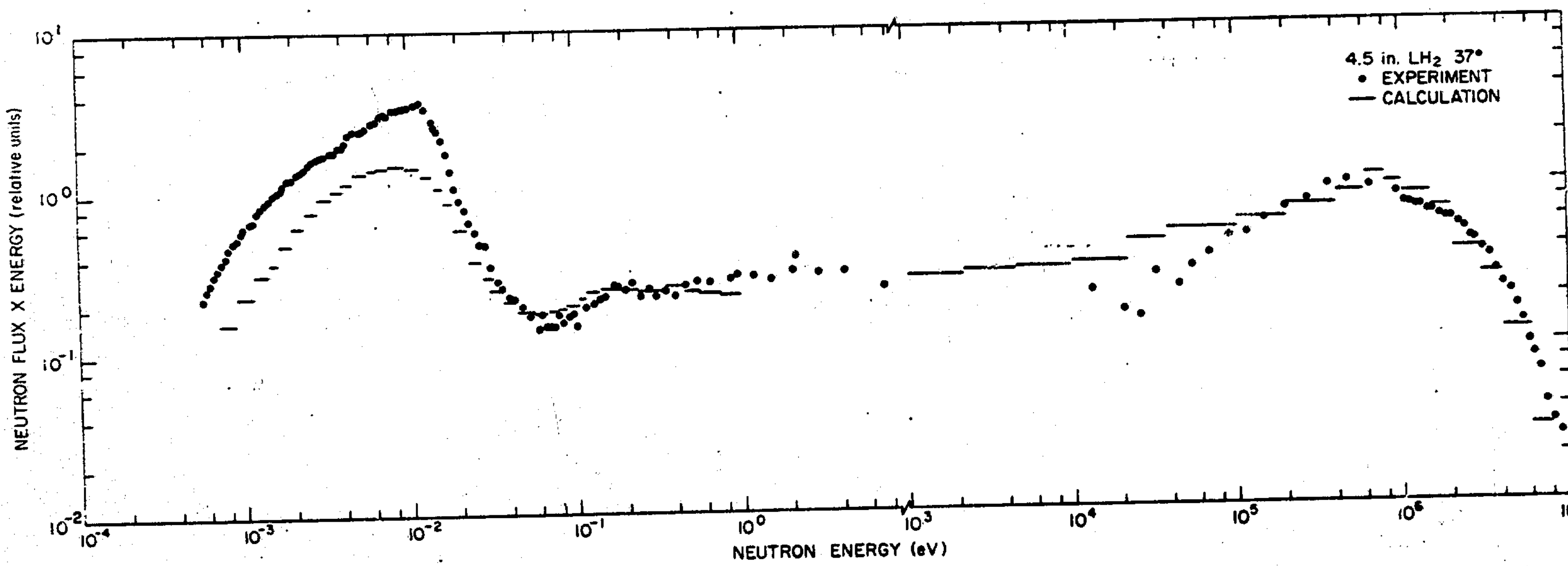


Figure 43. Neutron spectrum for a 4.5-in. thickness of LH_2 at 37^o.

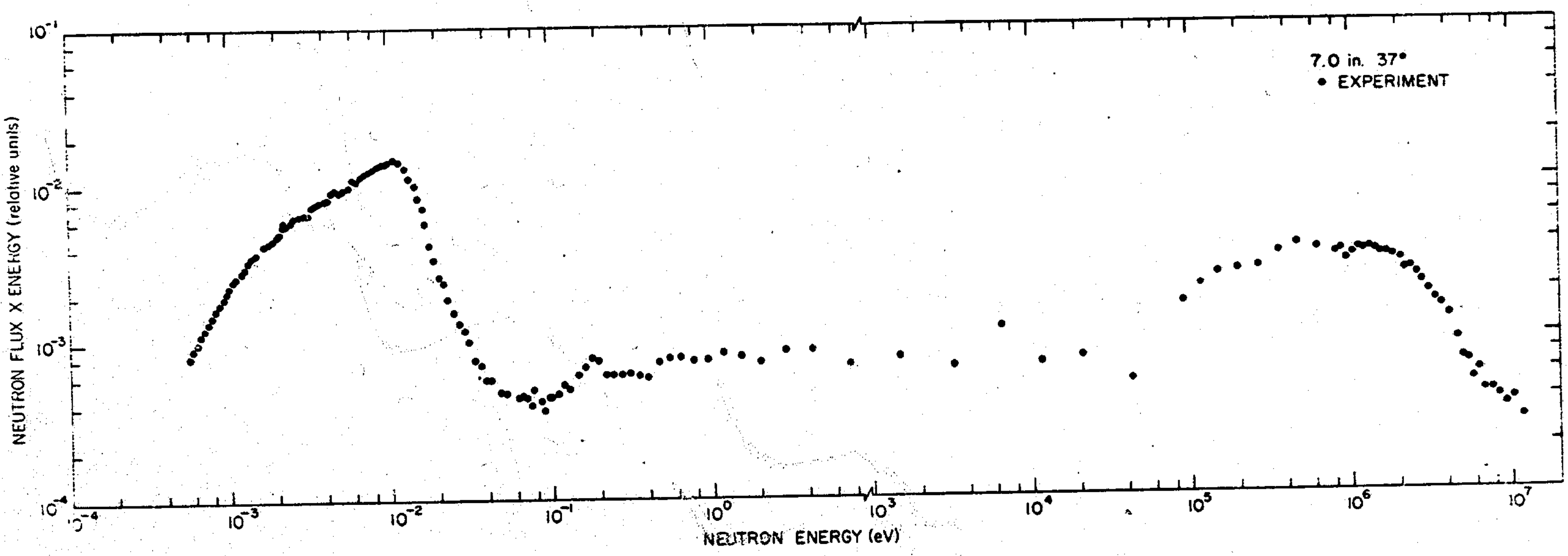


Figure 44. Neutron spectrum for a 7.0-in. thickness of LH_2 at 37^o.

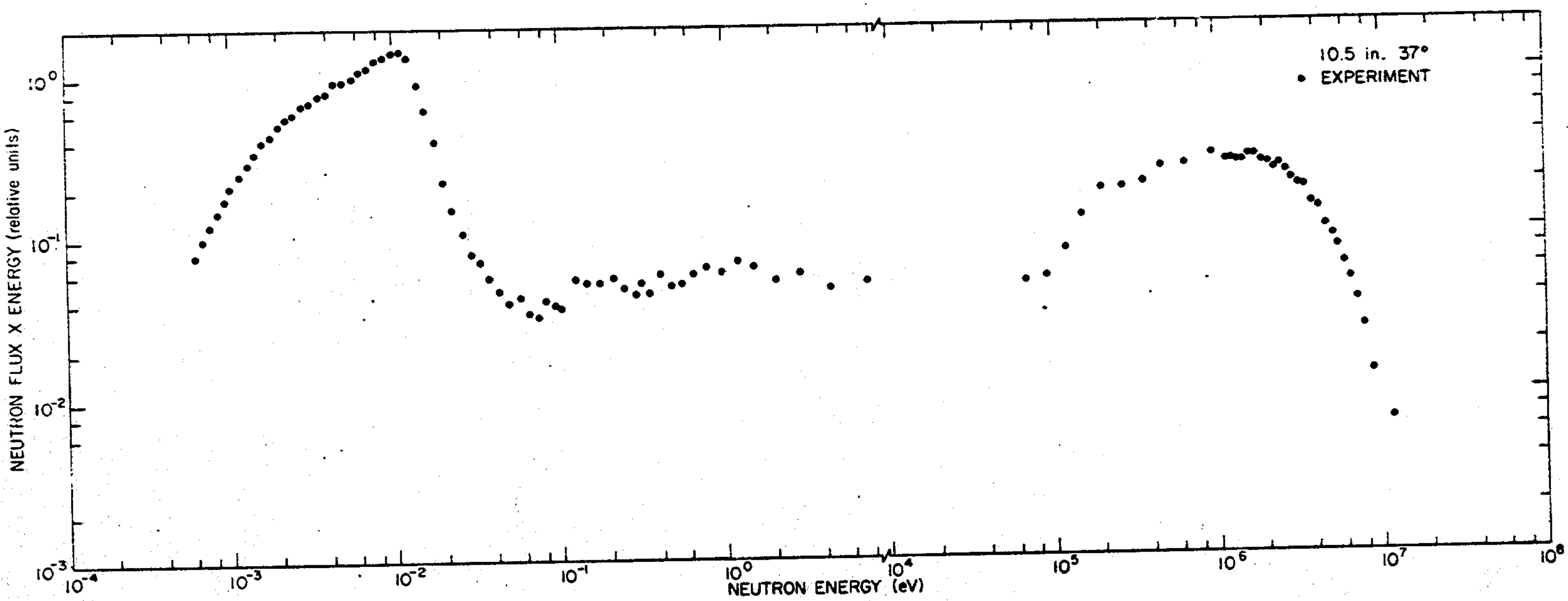


Figure 45. Neutron spectrum for a 10.5-in. thickness of LH_2 at 37°.

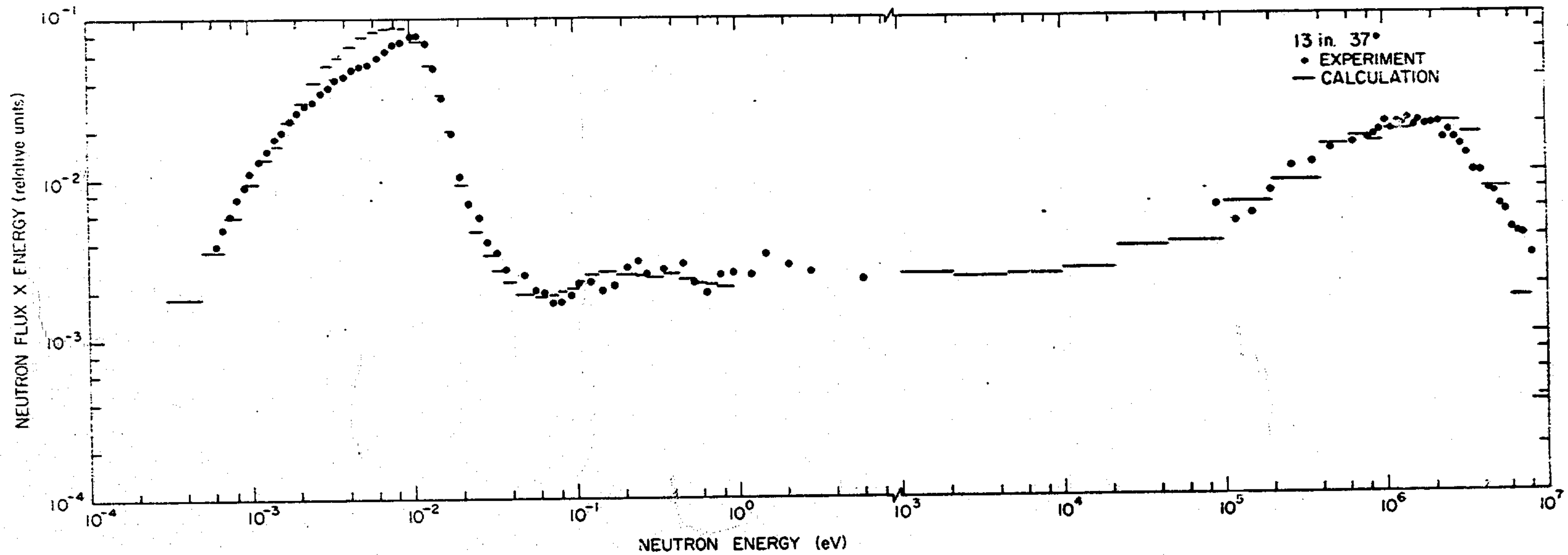


Figure 46. Neutron spectrum for a 13.0-in. thickness of LH_2 at 37^o.

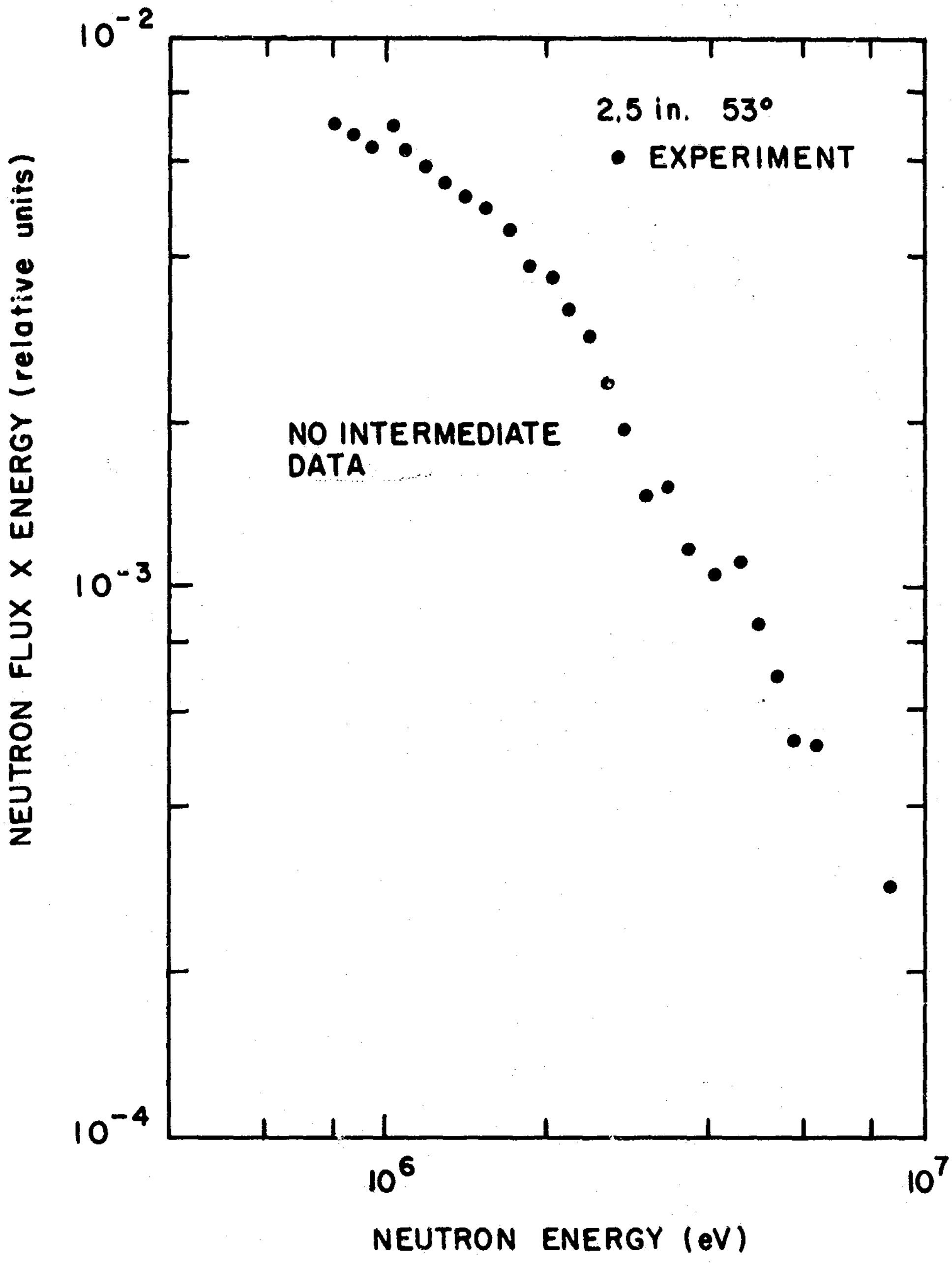


Figure 47. Neutron spectrum for a 2.5-in. thickness of LH_2 at 53°.

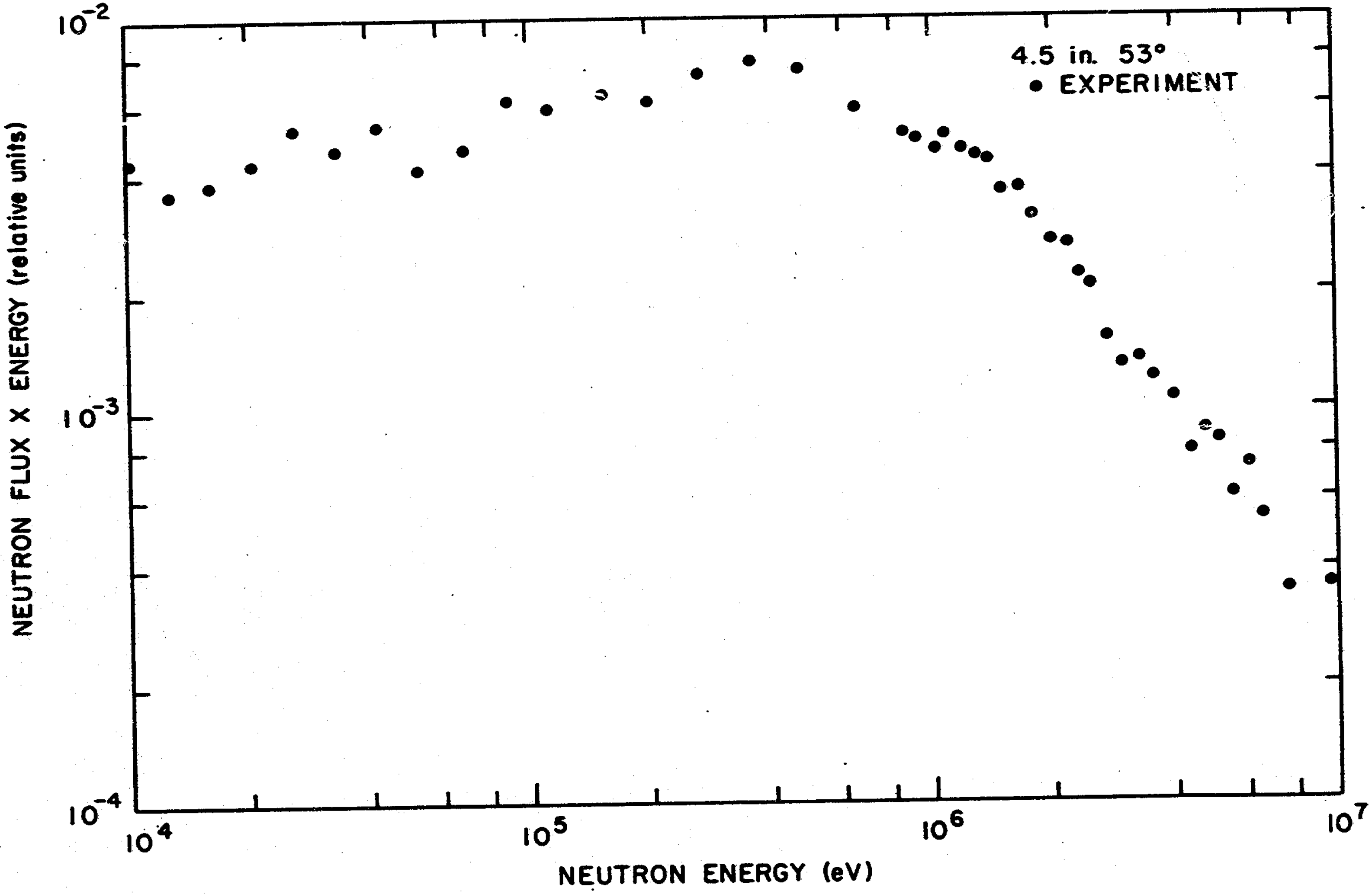


Figure 48. Neutron spectrum for a 4.5-in. thickness of LH_2 at 53^{o}.

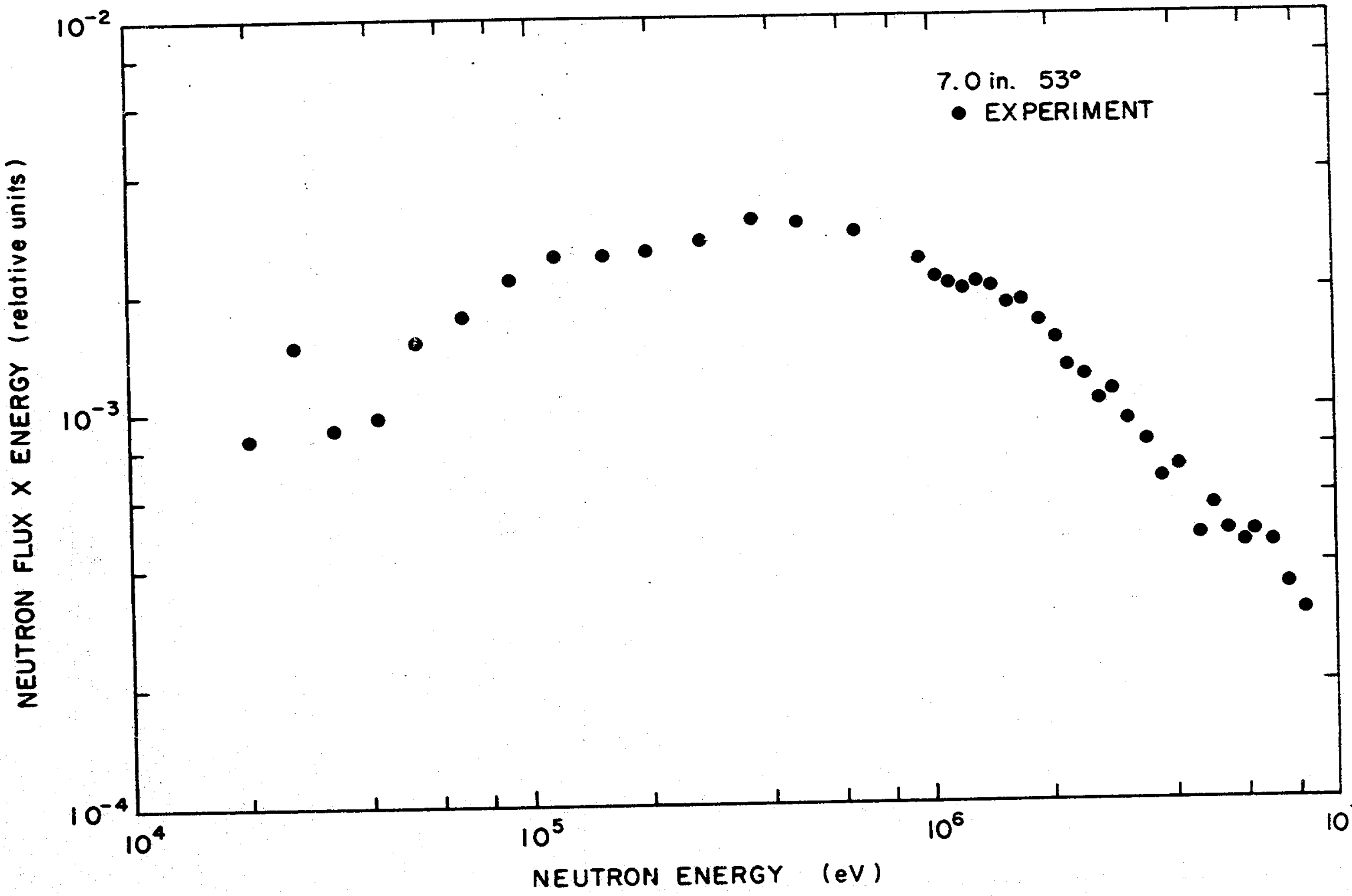


Figure 49. Neutron spectrum for a 7.0-in. thickness of LH_2 at 53°.

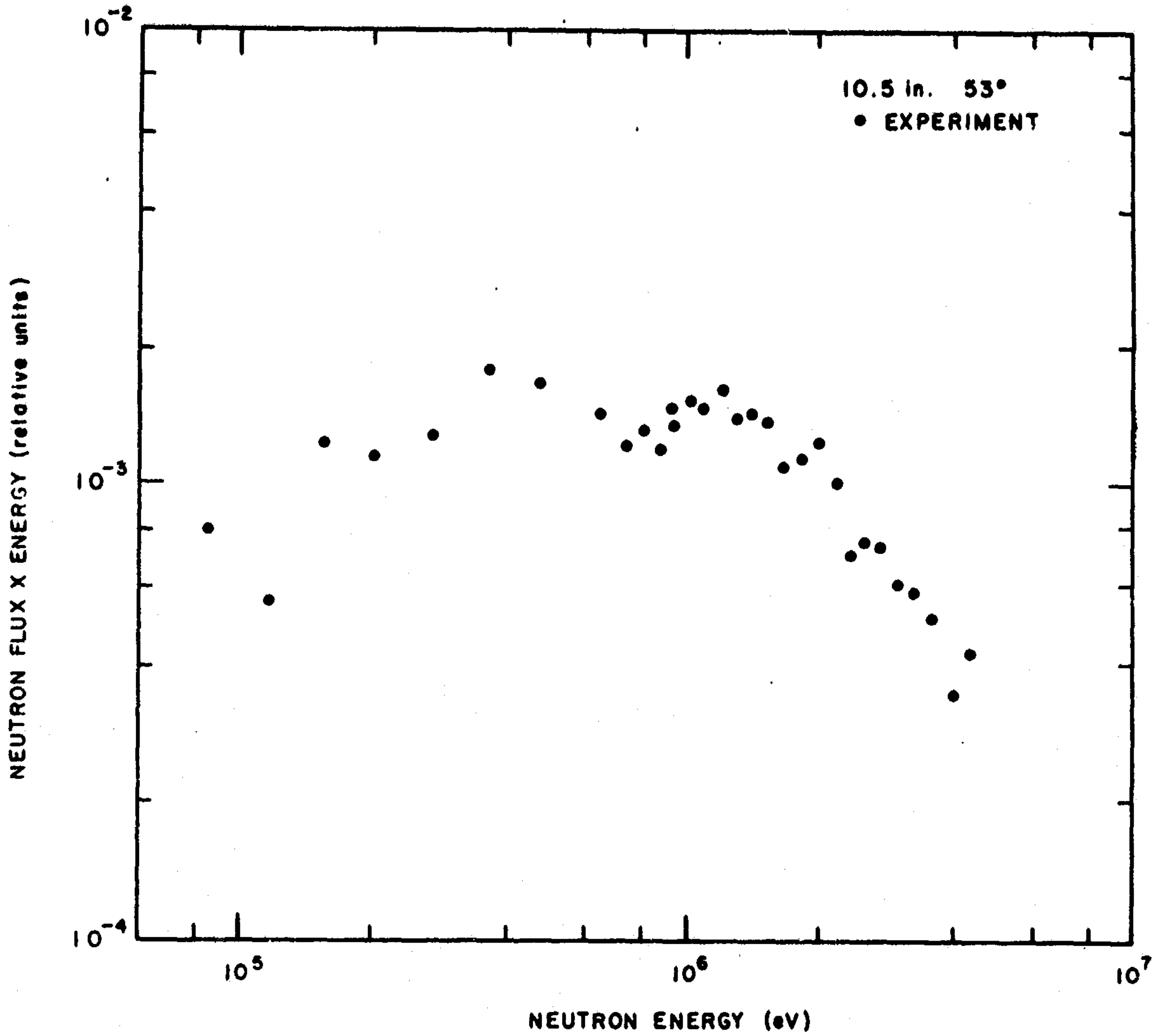


Figure 50. Neutron spectrum for a 10.5-in. thickness of LH_2 at 53°.

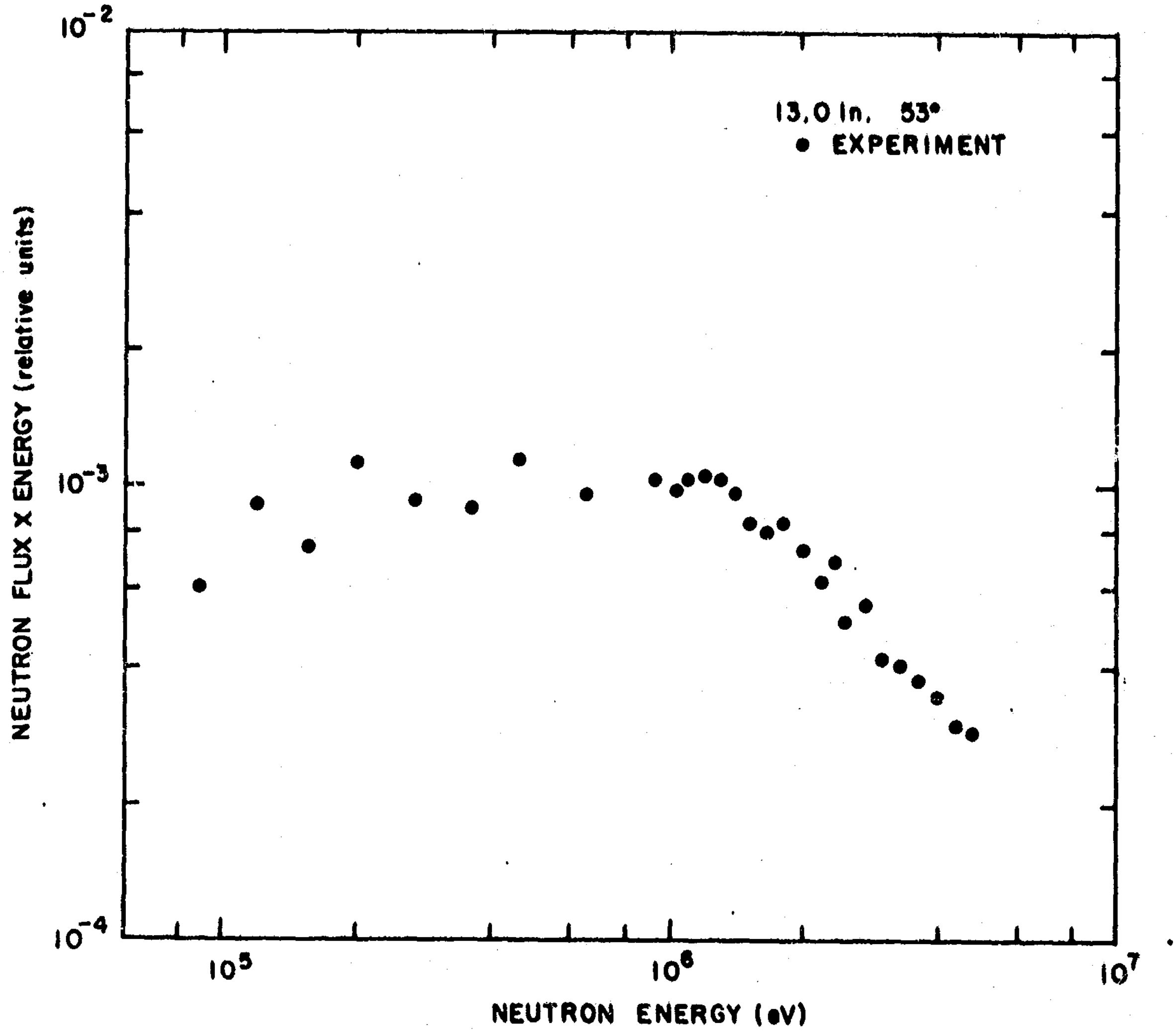


Figure 51. Neutron spectrum for a 13.0-in. thickness of LH_2 at 53°.

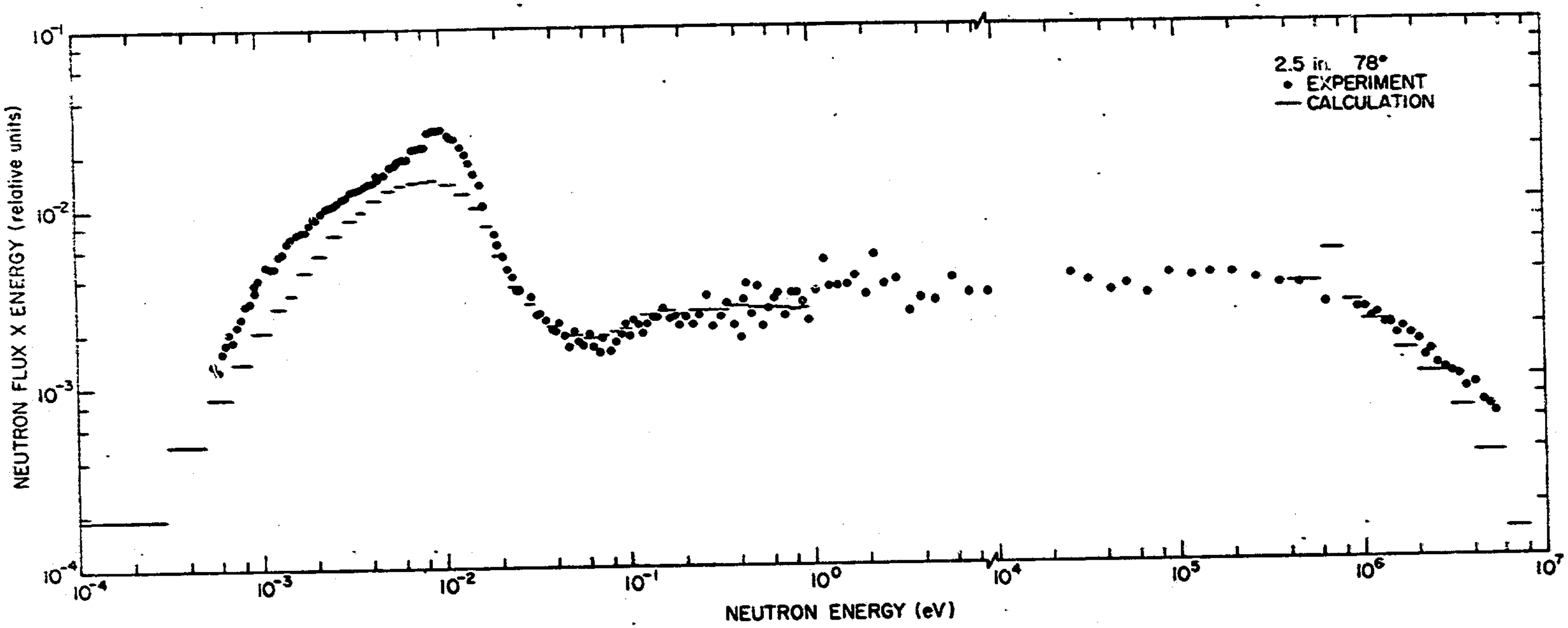


Figure 52. Neutron spectrum for a 2.5-in. thickness of LH_2 at 78°.

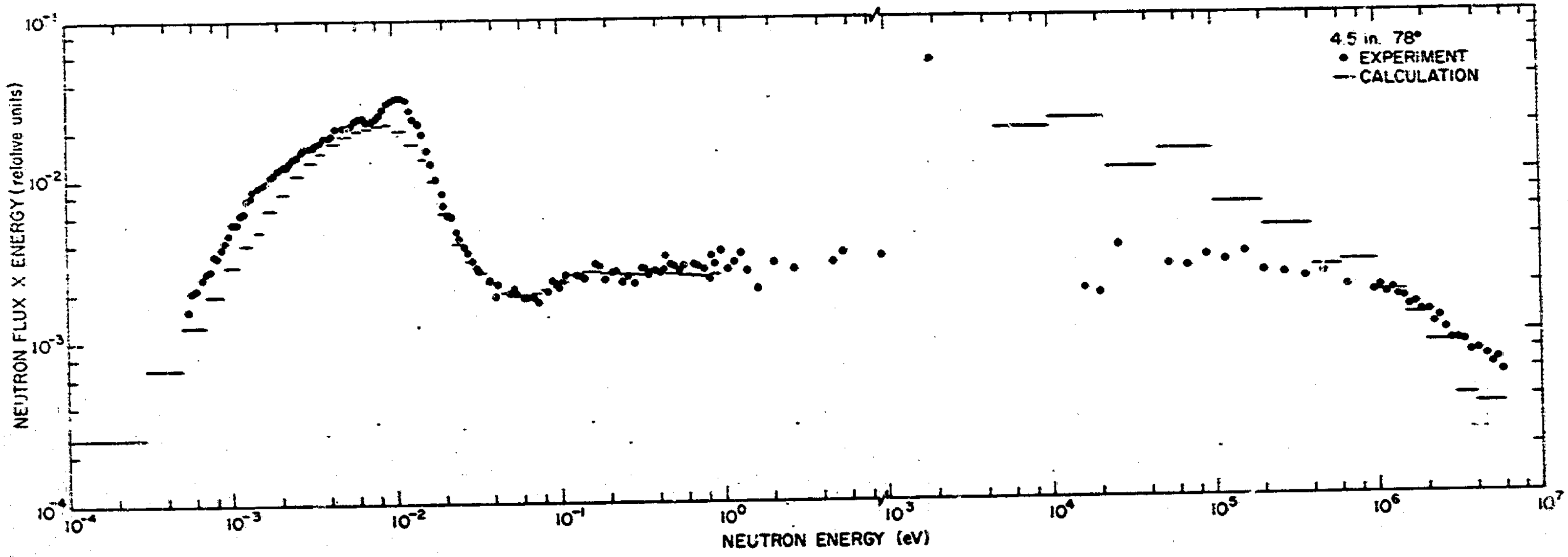


Figure 53. Neutron spectrum for a 4.5-in. thickness of LH_2 at 78°.

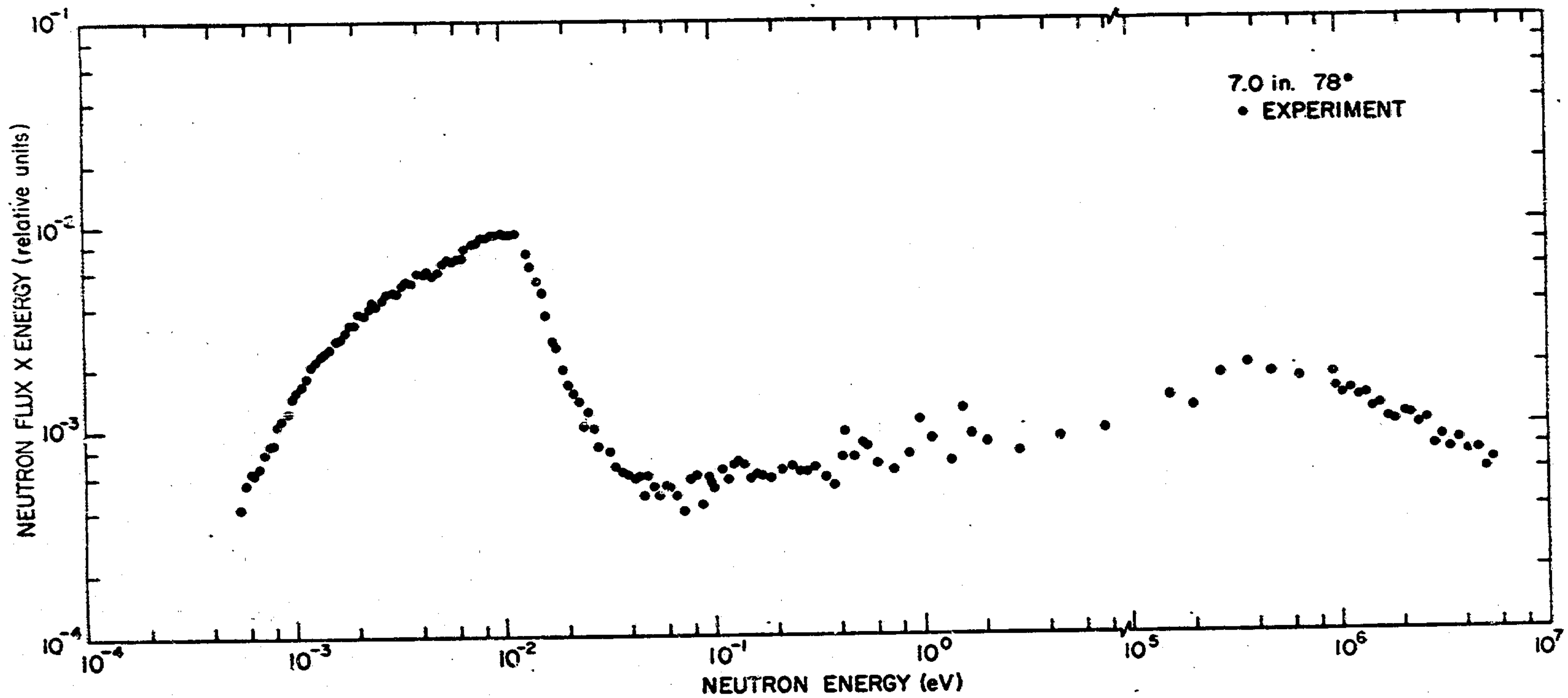


Figure 54. Neutron spectrum for a 7.0-in. thickness of LH_2 at 78°.

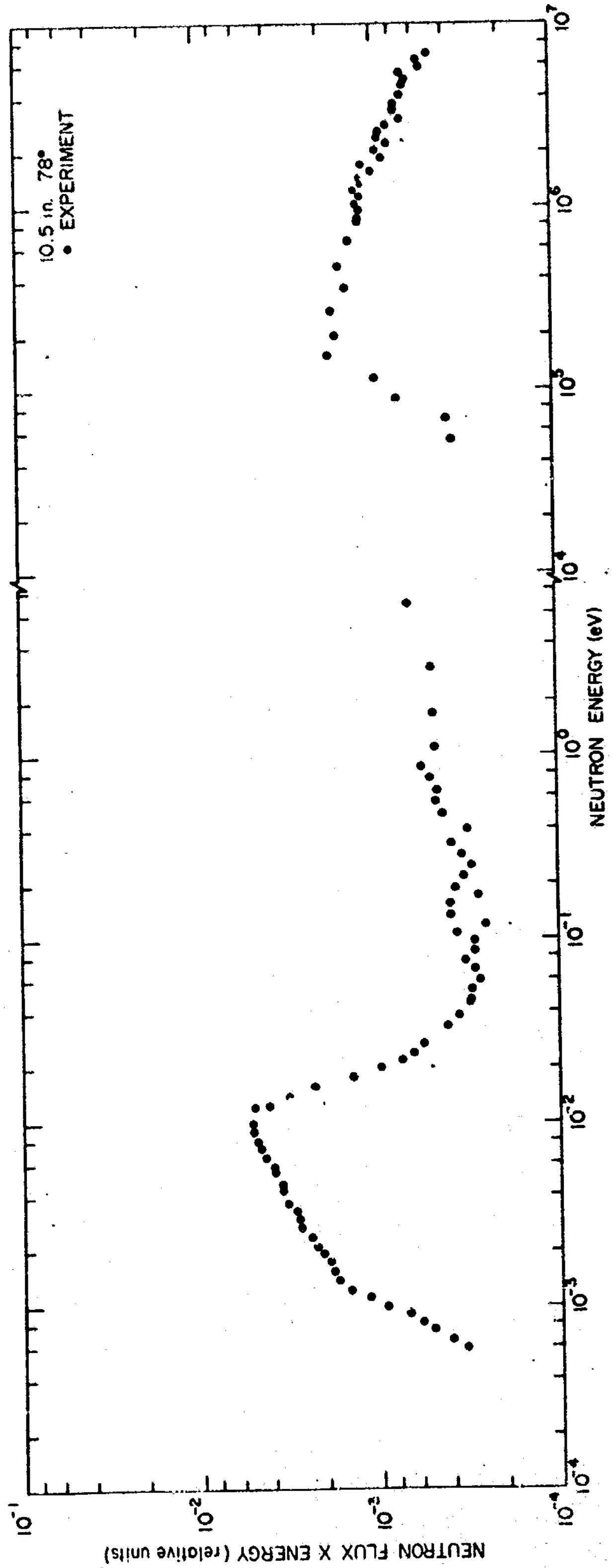


Figure 55. Neutron spectrum for a 10.5-in. thickness of LH_2 at 78^o.

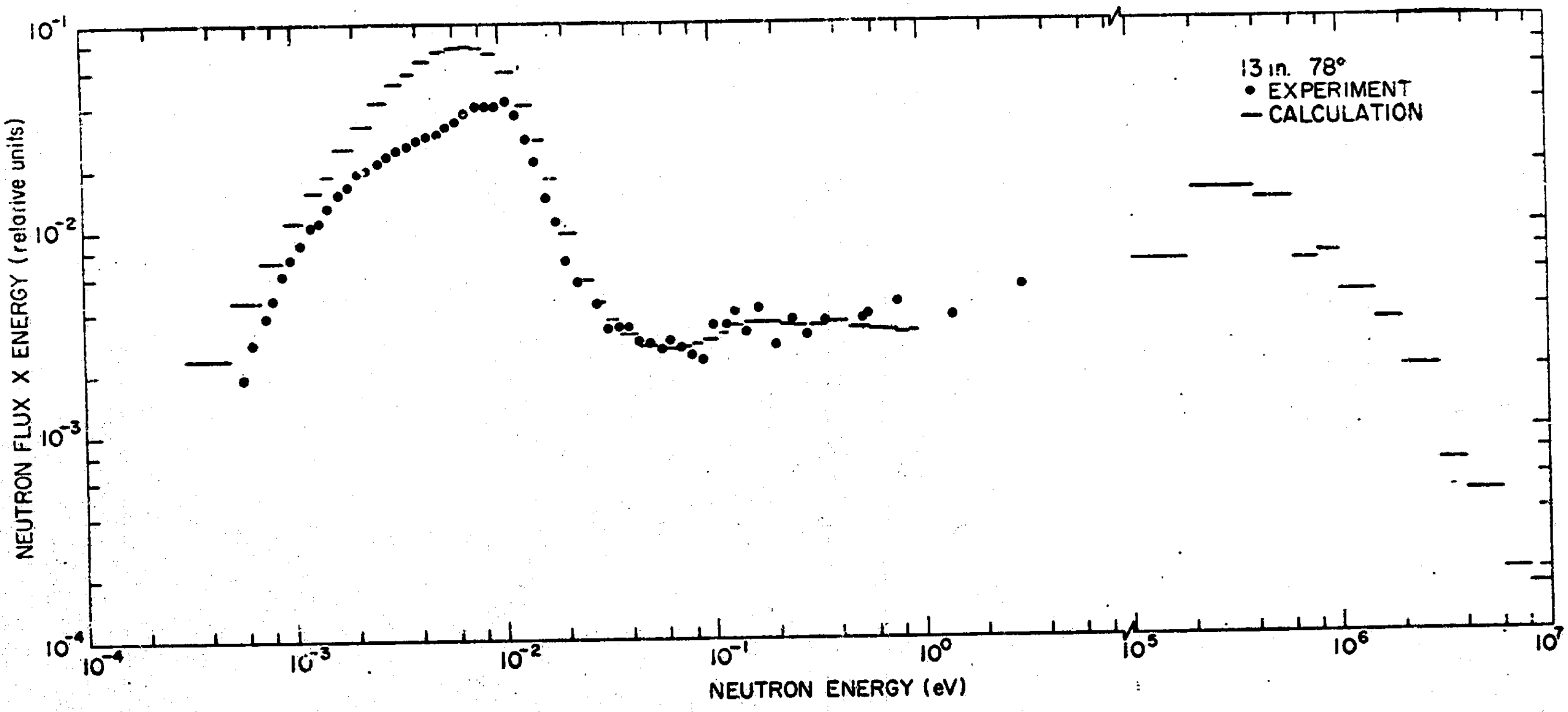


Figure 56. Neutron spectrum for a 13.0-in. thickness of LH_2 at 78^o.

Table 11

NORMALIZATION FACTORS FOR THE EXPERIMENTAL DATA

A. Intermediate Neutron Energy Region

Description		Normalization Factor First Program	Normalization Factor Second Program
2.5-in.	15^o	9.34×10^{-4}	
	37^o	6.06×10^{-4}	8.4×10^{-2}
	53^o	No Data	
	78^o	3.96×10^{-4}	
4.5-in.	15^o	8.84×10^{-4}	
	37^o	5.95×10^{-4}	7.2×10^{-2}
	53^o	8.0×10^{-4}	
	78^o	3.57×10^{-4}	
7.0-in.	15^o	6.45×10^{-4}	
	37^o	5.00×10^{-4}	
	53^o	5.78×10^{-4}	
	78^o	5.56×10^{-4}	
10.5-in.	15^o	7.1×10^{-4}	
	37^o	4.76×10^{-4}	7.57×10^{-2}
	53^o	5.26×10^{-4}	
	78^o	4.76×10^{-4}	
13.0-in.	15^o	9.7×10^{-4}	
	37^o	6.37×10^{-4}	
	53^o	4.17×10^{-4}	
	78^o	3.85×10^{-4}	

B. Thermal Neutron Energy Region

Description		Normalization Factor First Program	Normalization Factor Second Program
2.5-in.	37^o	3.8×10^{-3}	5.5×10^{-1}
	78^o	3.8×10^{-3}	
4.5-in.	37^o	4.9×10^{-3}	6.0×10^{-1}
	78^o	4.9×10^{-3}	
7.0-in.	37^o	2.5×10^{-3}	
	78^o	2.5×10^{-3}	
10.5-in.	37^o	2.4×10^{-3}	4.0×10^{-1}
	78^o	2.5×10^{-3}	
13.0-in.	37^o	3.0×10^{-2}	
	78^o	3.0×10^{-2}	

Table 12

NORMALIZATION FACTORS FOR THE CALCULATIONS

A. Intermediate Neutron Energy Region

Description		Normalization Factor First Program	Normalization Factor Second Program
2.5-in.	0°	1.00×10^{4}	9.26×10^{5}
	37°		3.82×10^{6}
	78°	9.53×10^{4}	
4.5-in.	0°	1.03×10^{4}	
	15°	6.76×10^{4}	
	37°		3.80×10^{6}
	78°	3.3×10^{5}	
13.0-in.	0°		7.87×10^{5}
	37°	4.08×10^{5}	
	78°	1.56×10^{6}	

B. Thermal Neutron Energy Region

Description		Normalization Factor
2.5-in.	37°	6.54
	78°	8.85
4.5-in.	37°	7.0
	78°	10.4
13.0-in.	37°	29.0
	78°	40.0

ratio was low and in general the better data are therefore at small angles and thicknesses. During the second program, a water-cooled uranium target was developed and the fast intensity increased by a factor of six since the source could accept 1500 watts of electron beam power. This increase in neutron intensity is reflected in the comparison of the fast neutron data for the two contracts.

The measurements were made on a one-shot basis due to the tremendous detail and preparations required to handle the 150 gallons of liquid hydrogen within the LINAC facility under limited funding. It was not possible to review the data until after the experiment was completely finished. It would certainly have been desirable to have reviewed preliminary measurements before taking the complete data set. Only a few measurements were remeasured and these were all in the fast neutron energy region.

In considering the massive amount of experimental data and comparison of some of the data with calculations, a few general observations can be made. First, the Monte Carlo calculations suffer from poor statistics in precisely the same way as do the measurements. Since in the fast neutron energy region the flux is in the forward direction, few neutrons are scattered at large angles and the source intensity becomes quite degraded by the thickness of LH_2, resulting in even less neutrons at large thicknesses and also larger angles. The agreement between calculation and experiment, in shape at 37^o is good for all the thicknesses compared, even out to the 13.0-in. thickness. The agreement is not nearly as favorable at 78^o at these same thicknesses. The data taken at 13.0-in. and 78 degrees are so unsatisfactory that they have not been presented. In at least one situation, there is a very good comparison between calculation and experiment; in the fast-intermediate neutron energy region this is for the 2.5-in. 37^o data. Here the agreement is good between 10^6 to 10^3 eV. This is also a situation where the statistics are the best for both experiment and calculation. The agreement between the thermal neutron calculations and experiment are favorable in half of the cases compared but vary considerably in the remainder. These disagreements occur at an energy where the transport cross section changes drastically from about 20 to 1 barn in the energy region from .04 to .01. This also leaves open the question of the applicability of a one-dimensional calculation below 0.01 eV since the transverse leakage becomes large. The buckling or source distribution for LH_2 was not measured and is therefore not well known. Due to the small transport cross section below 0.01 eV the calculations are quite sensitive to the buckling and therefore small changes in the buckling result in large changes in the flux.

We have recommended that the 2.5- and 4.5-in. thicknesses of LH_2 for the 37° angle be submitted as a benchmark problem to the ANS-6 Standards Committee, American Nuclear Society. The reason for this selection was that the statistics for the Monte Carlo calculations were best for the 37° and 78° angles, and calculations were performed for only 2.5, 4.5, and 13.0-in. data. Of these, the calculational and experimental statistics were best for the 2.5- and 4.5-in. thicknesses at the 37° angle.

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APPENDIX A

GEOMETRY INPUT TO O5R (13 INCHES OF LH_2 BETWEEN THE SOURCE AND COLLIMATOR)

```
    2      MALE
ZONE X BNDS    -.60960+02,     .70480+02
ZONE Y BNDS    -.60960+02,     .60960+02
ZONE Z BNDS    -.60960+02,     .60960+02

ZONE         1     1     1
BLOCKX BNDS    -.60960+02,     .00000    ,     .33020+02,     .70480+02
BLOCKY BNDS    -.60960+02,     .60960+02
BLOCKZ BNDS    -.60960+02,     .60960+02

BLOCK        1     1     1
MEDIA                 1,     3,     0
SURFACES              1,     2
SECTOR -1  0
SECTOR  1 -1
SECTOR  0  1

BLOCK        2     1     1
MEDIA                 1,     2,     1,     2,     1,     2,     1,     2,     1,     2,
   3,     0
SURFACES              3,     4,     5,     6,     7,     8,     9,    10,    11,    12,
  13
SECTOR -1   0  -1   0   0   0   0   0   0  -0  -0
SECTOR -1   0   1  -1   0   0   0   0   0  -0  -0
SECTOR -1   0   0   1  -1   0   0   0   0  -0  -0
SECTOR -1   0   0   0   1  -1   0   0   0  -0  -0
SECTOR -1   0   0   0   0   1  -1   0   0  -0  -0
SECTOR -1   0   0   0   0   0   1  -1   0  -0  -0
SECTOR -1   0   0   0   0   0   0   1  -1  -0  -0
SECTOR -1   0   0   0   0   0   0   0   1  -1  -0
SECTOR -1   0   0   0   0   0   0   0   0   1  -1
SECTOR -1   0   0   0   0   0   0   0   0   0   1
SECTOR  1  -1   0   0   0   0   0   0   0   0   0
SECTOR  0   1   0   0   0   0   0   0   0   0   0

BLOCK        3     1     1
MEDIA                 4,     3,     3, 1000, 1000, 1000
SURFACES              3,     4,    14,    15,    16
SECTOR -1   0  -1   0   0
SECTOR -1   0   1  -1   0
SECTOR  1  -1   0   0  -1
SECTOR -1   0   0   1   0
SECTOR  1  -1   0   0   1
SECTOR  0   1   0   0   0

   16      TOTAL SURFACES
   .10000+01XSQ       .10000+01YSQ       .10000+01ZSQ       -.28452+04      $
   .10000+01XSQ       .10000+01YSQ       .10000+01ZSQ       -.37161+04      $
   .10000+01YSQ       .10000+01ZSQ      -.28452+04      $
   .10000+01YSQ       .10000+01ZSQ      -.37161+04      $
   .10000+01X        -.61900+01      $
   .10000+01X        -.63500+01      $
   .10000+01X        -.11270+02      $
   .10000+01X        -.11430+02      $
   .10000+01X        -.17620+02      $
   .10000+01X        -.17780+02      $
   .10000+01X        -.26510+02      $
   .10000+01X        -.26670+02      $
   .10000+01X        -.32960+02      $
   .10000+01XSQ       .10000+01YSQ       .10000+01ZSQ       .10668+03X
  -.86724+04      $
   .10000+01XSQ       .10000+01YSQ       .10000+01ZSQ       .10668+03X
  -.10366+05      $
   .10000+01X        -.46280+02      $
```

APPENDIX B

KINNY PROGRAM LISTING

```
      SUBROUTINE EVAP(EO,EP,THETA,ELO)
C     ELO EQUALS LOWEST ENERGY
C     PICK FROM X*EXP(-X) BY KAHNS METHOD, EXAMPLE 15
C     INSTEAD OF PICKING FROM EXR(-X), X INFINITE, PICK
C     FROM EXP TRUNCATED AT XMAX, REJECT VALUE X IF THE SUM OF
C     OF THE TWO VALUES IS GREATER THAN XMAX.
      XMAX=(EO-ELO)/THETA
*DIAGNOSTIC*  THE TEST FOR EQUALITY BETWEEN NON-INTEGERS MAY NOT BE MEANINGFUL.
      IF(XMAX.LE.0.0) CALL ERROR
    2 R1=AMOD(EXPRNF(R),XMAX)
      R2=AMOD(EXPRNF(R),XMAX)
      X=R1+R2
      IF(X-XMAX)1,1,2
    1 EP=X*THETA
      RETURN
      END
      FUNCTION CHOS(R,P,Q,NPQ)
      DIMENSION P(1), Q(1)
C        INTERPOLATES FROM HIGH TO LOW RANGES ONLY
      DO 10 I=2,NPQ
*DIAGNOSTIC*  THE DO-INDEX,I,IS DEFINED WITHIN THE LOOP.
      I=I
*DIAGNOSTIC*  THE TEST FOR EQUALITY BETWEEN NON-INTEGERS MAY NOT BE MEANINGFUL.
      IF(P(I).LE.R) GO TO 20
   10 CONTINUE
      CALL ERROR
   20 CHOS=Q(I)+(R-P(I))*(Q(I)-Q(I-1))/(P(I)-P(I-1))
      IF(CHOS.LT.0.0) CALL ERROR
      RETURN
      END
      SUBROUTINE ERROR
      COMMON /INELC/ SP,UP,VP,WP,E,S,NINLS,IN,
     A NR(10),G(8,5),NE(8,5),EL(125,8,5),SIGL(125,8,5),
     B NU(10),ELAW(2,10),NLAW(2,10),NENG(1),ENG(1,1),
     C NETAB1(1,1),ETAB1(1,1,1),PTAB1(1,1,1),
     D NETAB2(1),ETAB2(1,1),PTAB2(1,1),
     E FM(2,10),EA(2,10),EB(10),TA(10),TB(10),TC(10),
     F NAPP(10),NMEDE(2,10),NELE(2,10)
      WRITE (6,8000)
 8000 FORMAT (22H1AN ERROR HAS OCCURRED)
      WRITE(6,301) SP,UP,VP,WP,E,S,IN
      RETURN
  301 FORMAT(1P6E12.5,I10)
      END
```

```
          SUBROUTINE ELAWS(SPDSQ,WATE)
    C
          COMMON /INELC/ SP,UP,VF,WP,E,S,NINLS,IN,
         A NR(10),G(8,5),NE(8,5),LL(125,8,5),SIGL(125,8,5),
         B NU(10),ELAW(2,10),NLAW(2,10),NENG(1),ENG(1,1),
         C NETAB1(1,1),ETAB1(1,1,1),PTAB1(1,1,1),
         D NETAB2(1),ETAB2(1,1),PTAB2(1,1),
         E FM(2,10),EA(2,10),EB(10),TA(10),TB(10),TC(10),
         F NAPP(10),NMODE(2,10),NELE(2,10)
          IL=1
          IF(NU(IN).EQ.1) GO TO 200
          NS=NU(IN)
          DO 105 IL=1,NS
*DIAGNOSTIC*  THE DO-INDEX,IL,IS DEFINED WITHIN THE LOOP.
          IL=IL
*DIAGNOSTIC*  THE TEST FOR EQUALITY BETWEEN NON-INTEGERS MAY NOT BE MEANINGFUL.
          IF(ELAW(IL,IN).LE.E) GO TO 200
      105 CONTINUE
          CALL ERROR
      200 NL=NLAW(IL,IN)
          GO TO (11,22,33,44), NL
    C        TABULATED VALUES
       11 NEL=NENG(IN)
          DO 10 IE=1,NEL
*DIAGNOSTIC*  THE DO-INDEX,IE,IS DEFINED WITHIN THE LOOP.
          IE=IE
*DIAGNOSTIC*  THE TEST FOR EQUALITY BETWEEN NON-INTEGERS MAY NOT BE MEANINGFUL.
          IF(ENG(IE,IN).LE.E) GO TO 30
       10 CONTINUE
          CALL ERROR
       30 P=FLTRN(R)
       21 EP=CHOS(P,PTAB1(1,IE,IN),ETAB1(1,IE,IN),NETAB1(IE,IN))
          GO TO 100
       22 P=FLTRN(R)
          EP=CHOS(P,PTAB2(1,IN),ETAB2(1,IN),NETAB2(IN))*E
          GO TO 100
    C        EVAPORATION
       33 THETA=TA(IN)+TB(IN)*SQRT(E)+TC(IN)*E
          CALL EVAP(E,EP,THETA,ELAW(IL,IN))
          GO TO 100
       44 JJJ=1
*DIAGNOSTIC*  THE TEST FOR EQUALITY BETWEEN NON-INTEGERS MAY NOT BE MEANINGFUL.
          IF(FLTRN(DUM).GE.0.5) JJJ=2
          EP=EA(JJJ,IN)
      100 SP=SQRT(EP*1.913220E+12)
      300 IF(SP.GT.S) CALL ERROR
          WATE=WATE*FM(IL,IN)
          RETURN
          END
```

```
      SUBROUTINE LEVELS(SPDSQ,BETA)
C
      COMMON /INELC/ SP,UP,VP,WP,E,S,NINLS,IN,
     A NR(10),Q(8,5),NE(8,5),EL(125,8,5),SIGL(125,8,5),
     B NU(10),ELAW(2,10),NLAW(2,10),NENG(1),ENG(1,1),
     C NETAB1(1,1),ETAB1(1,1,1),PTAB1(1,1,1),
     D NETAB2(1),ETAB2(1,1),PTAB2(1,1),
     E FM(2,10),EA(2,10),EB(10),TA(10),TB(10),TC(10),
     F NAPP(10),NMEDE(2,10),NELE(2,10)
      DIMENSION PTAB(10)
      IL=1
      IF(NR(IN).EQ.1) GO TO 80
      SPT=0.
      NS=NR(IN)
C        FORM CPDF TABLE
      DO 50 I=1,NS
      NEM=NE(I,IN)
      PTAB(I)=0.0
      IF(E.GT.EL(1,I,IN).OR.E.LT.EL(NEM,I,IN)) GO TO 50
      PTAB(I)=CHOS(E,EL(1,I,IN),SIGL(1,I,IN),NE(I,IN))
      SPT=SPT+PTAB(I)
   50 CONTINUE
*DIAGNOSTIC*  THE TEST FOR EQUALITY BETWEEN NON-INTEGERS MAY NOT BE MEANINGFUL.
      IF(SPT.EQ.0.0) GO TO 80
      DO 60 I=1,NS
      PTAB(I)=PTAB(I)/SPT
   60 CONTINUE
      DO 65 I=2,NS
      PTAB(I)=PTAB(I)+PTAB(I-1)
   65 CONTINUE
C        CHOOSE LEVEL
  100 R=FLTRN(R)
      DO 70 IL=1,NS
*DIAGNOSTIC*  THE DO-INDEX,IL,IS DEFINED WITHIN THE LOOP.
      IL=IL
*DIAGNOSTIC*  THE TEST FOR EQUALITY BETWEEN NON-INTEGERS MAY NOT BE MEANINGFUL.
      IF(R.LE.PTAB(IL)) GO TO 80
   70 CONTINUE
      CALL ERROR
C        CHECK FOR INSUFFICIENT CMS ENERGY
   80 IF(SPDSQ.LT.Q(IL,IN)/BETA) GO TO 90
      SP=BETA*SQRT(SPDSQ-Q(IL,IN)/BETA)
      RETURN
   90 CALL ERROR
      GO TO 100
      END
```

```
      SUBROUTINE DCS(U,V,W)
C        COMPUTES NEW DIRECTIONS COSINES
      COMMON /INELC/ SP,UP,VP,WP,E,S,NINLS,IN,
     A NR(10),Q(8,5),NE(8,5),EL(125,8,5),SIGL(125,8,5),
     B NU(10),ELAW(2,10),NLAW(2,10),NENG(1),ENG(1,1),
     C NETAB1(1,1),ETAB1(1,1,1),PTAB1(1,1,1),
     D NETAB2(1),ETAB2(1,1),PTAB2(1,1),
     E FM(2,10),EA(2,10),EB(10),TA(10),TB(10),TC(10),
     F NAPP(10),NMEDE(2,10),NELE(2,10)
      COMMON/SNGLES /BLZON,EBOT,ECUT,EGROUP,EINC,EMONO,ESOUR,
     1ETAPE,ETA,ETATH,ETAUSD,ETOP,FONE,FTOTL,FWATE,ITERS,ITSTR,
     2LELEM,LF,MARK,MAXGP,MEDIA,MGPREG,MFISTP,MXREG,N,NCOLPR,
     3NWPCOL,NCONT1,NCONT2,NCONTP,NEWNM,NFISH,NFONE,NFPT,NGEOM,
     4NGROUP,NGWT,NHISMX,NHISTR,NIINC,NFINC,NPINC,NITS,NKILL,
     5NLAST,NGLAST,NSIGL,NPLAST,NLEFT,NMEM,NMOST,NOEL,NPCOF,
     6NPTAPE,NQUIT,NROOM,NSOUR,NSPLT,NSTAPE,NSTRT,NTHERM,NTHRML,
     7NTYPE,OLDWT,PSIE,SPOLD,THETM,TNUC,UINP,UOLD,VINP,VOLD,
     8WATEF,WINP,WOLD,WTAVR,WTHIR,WTLOR,WTRED,WTSTRT,XOLD,XSTRT,
     9YOLD,YSTRT,ZOLD,ZSTRT,UNUSED(10)
C        CALL GETMU FOR SCATTERING ANGLE
      CALL GETMU(COSPOL)
C        GETMU RETURNS LF (SCATTERING DISTRIBUTION)
      IF(LF.NE.0) GO TO 10
C        ISOTROPIC SCATTERING
      CALL GTISO(UP,VP,WP)
      RETURN
C        ANISOTROPIC SCATTERING
   10 SINPOL=SQRT(1.-COSPOL**2)
      CTHETA=U/S
      STHETA=SQRT(1.-CTHETA**2)
      IF(STHETA.GT.0.0) GO TO 1
      COSPHI=1.
      SINPHI=0.
      GO TO 2
    1 ST=S*STHETA
      COSPHI=V/ST
      SINPHI=W/ST
    2 CALL AZIRN(SINAZI,COSAZI)
      C1=COSAZI*SINPOL
      C2=SINAZI*SINPOL
      C3=STHETA*COSPOL
C        DIRECTION COSINES
      UP=CTHETA*COSPOL-C1*STHETA
      VP=C3*COSPHI+CTHETA*COSPHI*C1-SINPHI*C2
      WP=C3*SINPHI+CTHETA*SINPHI*C1+COSPHI*C2
      RETURN
      END
```

```
      READ(5,103) (ETAB1(L,K,I),PTAB1(L,K,I),L=1,NTAB1)
      WRITE(6,309) ENG(K,I),(ETAB1(L,K,I),PTAB1(L,K,I),L=1,NTAB1)
   17 CONTINUE
      GO TO 20
   22 READ(5,102) FM(J,I),NETAB2(I)
      WRITE(6,308) FM(J,I)
      NTAB2=NETAB2(I)
      READ(5,103) (ETAB2(L,I),PTAB2(L,I),L=1,NTAB2)
      WRITE(6,310) (ETAB2(L,I),PTAB2(L,I),L=1,NTAB2)
      GO TO 20
   33 READ(5,104) FM(J,I)
      WRITE(6,308) FM(J,I)
      READ(5,104) TA(I),TB(I),TC(I)
      WRITE(6,311) TA(I),TB(I),TC(I)
      GO TO 20
   44 READ(5,104) FM(J,I)
      WRITE(6,308) FM(J,I)
      READ(5,104) EA(J,I),EB(I)
      WRITE(6,312) EA(J,I),EB(I)
   20 CONTINUE
  100 CONTINUE
      RETURN
   10 FORMAT(5A6,4I5)
   90 FORMAT(6I5)
  102 FORMAT(E10.4,I10)
  103 FORMAT(6E12.5)
  104 FORMAT(3E10.4)
  301 FORMAT(///12X,18H**SCATTERER NUMBER ,I3, 2H,  5A6, 2H**            )
 3011 FORMAT( 7H0MEDIUM ,I2, 9H, ELEMENT ,I2                             )
  303 FORMAT(//12X,18HDISCRETE LEVEL(S) /                                )
  304 FORMAT(3H0Q( ,I2, 1H) ,1PE12.5, 3H EV                              )
  305 FORMAT(50H0E (EV), SIGMAS (BARNS) IN PAIRS, E (HIGH TO LOW) /
     A(3(1P2E12.5,2X))                                                   )
  306 FORMAT(//12X,22HNON-DISCRETE LEVEL(S) /                            )
  307 FORMAT(20H0   ELAW LOWER LIMIT ,1PE12.5, 3H EV ,6X, 4H LAW ,I2,
     A 1H, 5A6                                                           )
  308 FORMAT(14H0WEIGHT FACTOR , 1PE12.5  )
  309 FORMAT(5H0ELOW , 1PE12.5, 3H EV , 6X, 22HP(E,) CONSTANT OVER E /
     A 45H0E' (EV), P(E') IN PAIRS, E' (HIGH TO LOW)        /
     B(3(1P2E12.5,2X))                                                   )
  310 FORMAT(48H0(E'/E), P(E'/E) IN PAIRS, (E'/E) (HIGH TO LOW) /
     A(3(1P2E12.5,2X))                                                   )
  311 FORMAT(2H0A ,1PE12.5, 3H EV , 3X,1HB ,E12.5, 10H (EV)**1/2 ,
     A 3X,1HC , E12.5                                                    )
  312 FORMAT(3H0A1 ,1PE12.5, 3H EV , 3X,2HB1 ,E12.5                      )
      END
```

```
      SUBROUTINE INELIN
C        READS INPUT FROM TAPE 5 (STANDARD)
      COMMON /INELC/ SP,UP,VP,WP,E,S,NINLS,IN,
     A NR(10),Q(8,5),NE(8,5),EL(125,8,5),SIGL(125,8,5),
     B NU(10),ELAW(2,10),NLAW(2,10),NENG(1),ENG(1,1),
     C NETAB1(1,1),ETAB1(1,1,1),PTAB1(1,1,1),
     D NETAB2(1),ETAB2(1,1),PTAB2(1,1),
     E FM(2,10),EA(2,10),EB(10),TA(10),TB(10),TC(10),
     F NAPP(10),NMEDE(2,10),NELE(2,10)
      DIMENSION COMM(12), NALAW(5,4), LABEL(5)
      DATA (NALAW(I,1),I=1,5)/ 30H TABULATED E, VS P(E,)
      DATA (NALAW(I,2),I=1,5)/ 30H TABULATED E,/E VS P(E,/E)
      DATA (NALAW(I,3),I=1,5)/ 30H EVAPORATION MODEL
      DATA (NALAW(I,4),I=1,5)/ 30H E,=A1+B1*E
      READ (5,101) COMM,NINLS
      WRITE (6,201) COMM,NINLS
  101 FORMAT(11A6,A4,I10)
  201 FORMAT(1H1,36X,11A6,A4 //
     A 36X,30HNUMBER OF INELASTIC SCATTERERS ,I3
      DO 100 I=1,NINLS
      READ(5,10) LABEL,NR(I),NU(I),NAPP(I)
      NAP=NAPP(I)
      READ(5,90) (NMEDE(J,I),NELE(J,I),J=1,NAP)
      WRITE(6,301) I,LABEL
      DO 23 J=1,NAP
      WRITE(6,3011) NMEDE(J,I),NELE(J,I)
   23 CONTINUE
      IF(NR(I).EQ.0) GO TO 15
      WRITE(6,303)
      JR=NR(I)
      DO 5 J=1,JR
      READ(5,102) Q(J,I),NE(J,I)
      WRITE(6,304) J,Q(J,I)
      Q(J,I)=Q(J,I)*1.9132201E+12
      IF(NE(J,I).EQ.0) GO TO 5
      KE=NE(J,I)
      READ(5,103) (EL(K,J,I),SIGL(K,J,I),K=1,KE)
      WRITE(6,305) (EL(K,J,I),SIGL(K,J,I),K=1,KE)
    5 CONTINUE
      GO TO 100
   15 JU=NU(I)
      WRITE(6,306)
      DO 20 J=1,JU
      READ(5,102) ELAW(J,I),NLAW(J,I)
      NL=NLAW(J,I)
      WRITE(6,307) ELAW(J,I),NL,(NALAW(L,NL),L=1,5)
      GO TO (11,22,33,44), NL
   11 READ(5,102) FM(J,I), NENG(I)
      WRITE(6,308) FM(J,I)
      NEL=NENG(I)
   16 DO 17 K=1,NEL
      READ(5,102) ENG(K,I),NETAB1(K,I)
      NTAB1=NETAB1(K,I)
```

```
      SUBROUTINE KINNY(SPDSQ,U,V,W,WATE,NMED,LELEM)
      COMMON /INELC/ SP,UP,VP,WP,E,S,NINLS,IN,
     A NR(10),Q(8,5),NE(8,5),EL(125,8,5),SIGL(125,8,5),
     B NU(10),ELAW(2,10),NLAW(2,10),NENG(1),ENG(1,1),
     C NETAB1(1,1),ETAB1(1,1,1),PTAB1(1,1,1),
     D NETAB2(1),ETAB2(1,1),PTAB2(1,1),
     E FM(2,10),EA(2,10),EB(10),TA(10),TB(10),TC(10),
     F NAPP(10),NMEDE(2,10),NELE(2,10)
C        ALPHA, BETA
   20 CALL AB(ALPHA,BETA,LELEM,NMED)
C        CHOOSE SCATTERER INDEX
      DO 30 IN=1,NINLS
*DIAGNOSTIC*  THE DO-INDEX,IN,IS DEFINED WITHIN THE LOOP.
      IN=IN
      NAP=NAPP(IN)
      DO 25 J=1,NAP
      IF(NMEDE(J,IN).EQ.NMED.AND.NELE(J,IN).EQ.LELEM) GO TO 40
   25 CONTINUE
   30 CONTINUE
      CALL ERROR
   40 E=SPDSQ/1.9132201E+12
      S=SQRT(SPDSQ)
C        NEW DIRECTION COSINES
      CALL DCS(U,V,W)
      IF(NR(IN).EQ.0) GO TO 150
C        RESOLVED LEVELS
      CALL LEVELS(SPDSQ,BETA)
      U=ALPHA*U+UP*SP
      V=ALPHA*V+VP*SP
      W=ALPHA*W+WP*SP
      GO TO 300
C        UNRESOLVED LEVELS
  150 CALL ELAWS(SPDSQ,WATE)
      U=UP*SP
      V=VP*SP
      W=WP*SP
  300 SPDSQ=U**2+V**2+W**2
*DIAGNOSTIC*  THE TEST FOR EQUALITY BETWEEN NON-INTEGERS MAY NOT BE MEANINGFUL.
      IF(SPDSQ.EQ.0.0) CALL ERROR
      RETURN
      END

      SUBROUTINE AB(A,B,L,N)
      COMMON/MDELEM/ ALPHA(30,8),BETA(30,8),LF1(30,8)
      A=ALPHA(L,N)
      B=ABS(BETA(L,N))
      RETURN
      END
```

Input to the inelastic routine is given in the following table:

Card	Format	Symbol	Description
1	I5	NINLS	Number of inelastic scatterers (separate nuclides - each nuclide can have several inelastic processes).

Repeat Cards 2-6 for $I = 1$, NINLS

Card	Format	Symbol	Description
2	6I5	I	Scatterer number
		NID(I, 1)	Nuclide number (LELM) in which I^{th} scatterer is found.
		NID(I, 2)	Medium number in which I^{th} scatterer is found.
		NID(I, 3)	Nuclide number in which I^{th} scatterer is found.
		NID(I, 4)	Medium number in which I^{th} scatterer is found.
			(Two pairs of nuclide and medium numbers are read in case the same nuclide is found in several places.)
		NR(I)	Number of resolved levels
		NU(I)	Number of unresolved processes
		NE(I)	Number of energies in level cross section tables (same energy mesh for all processes of same nuclide) NE(I) = 0 for 1 level
3	7E10.4	(EVAP(I, J)),	Energy for switching from one evaporation-like process to another, both represented by the same level cross section table.
	TA(I, J),	$(cm/sec)^2$	Coefficients for expressing the energy dependence of the nuclear temperature, $T = TA + \sqrt{E} \cdot TB + E \cdot TC$.
	TB(I, J),	$(cm/sec)^2/\sqrt{eV}$	
	TC(I, J),	$(cm/sec)^2/eV$	
		FM(I, J)	Factor multiplying weight of neutron produced in J^{th} process.

Card	Format	Symbol	Description
		EA(I, J), EB(I, J), (J=1, NU(I)+NR(I))	Coefficients for expressing the final energy in terms of the initial energy for process J when initial energy is less than EVAP(I, J), $E_{final} = EA + E_{initial} \cdot EB$
4	7E10.4	(Q(I, J), J=1, NR(I) +NU(I))	Q values for level J. Q is read for both resolved and unresolved processes, with Q = 0 to signal an unresolved process.
5	7E10.4	(EL(K, I), K=1 NE(I))	Energy table for cross section tables for scatterer I. (omit if NE(I) = 0).
6	7E10.4	(SIGL(K, J, I), K=1, NE(I)) (J=1, NR(I)+NU(I))	Level cross section tables (omit if NE(I) = 0)

APPENDIX C

SUBROUTINE SOURCE LISTING

```
00101        SUBROUTINE SOURCE (SPOSQ,U,V,W,X,Y,Z,WATE,N,NMEM,NREG,NREG)
00103        DIMENSION   THET(21),PTHET(21),WTHET(20),EBNDS(41),POFE(41)
00103       1EWT(40), COSTH(21), DELMUP (20), DELLOP(40)
00104        DATA  IT/1/
00106        IF(IT.EQ.0) GO TO 16
00110        IT=0
00111        READ 145 , X1,Y1,Z1
00116        READ 150, MTHET, MEGR
00122        MEGRP = MEGR-1
00123        MTHEP=MTHET-1
00124        READ 145, (THET(I), I=1,MTHET)
00132        READ 145, (PTHET(I), I=1,MTHET)
00140        READ 145, (WTHET(I)  I=1,MTHEP)
00146        READ 145, (EBNDS(J), J=1,MEGR)
00154        READ 145, (POFE(J), J=1,MEGR)
00162        READ 145, (EWT (J),  J=1,MEGRP)
00170      1 DO 10 I=1,MTHET
00173        COSTH(I) = COS(THET(I))
00174     10 CONTINUE
00176        DO 11  I=2,MTHET
00201        DELMUP(I)=(COSTH(I)-COSTH(I-1))/(PTHET(I)-PTHET(I-1))
00202     11 CONTINUE
00204        DO15  J=2,MEGR
00207        DELLOP(J)= ( EBNDS(J)- EBNDS(J-1)) / (POFE(J)-POFE(J-1))
00210     15 CONTINUE
00210  C   SELECT THETA FROM CUM THETA
00212     16 R=FLTRNF(DUMMY)
00213        DO 20 I=2,MTHET
[redacted]
00217        IF (PTHET(I)-R)  20,30,40
00222     20 CONTINUE
00224     30 TOT=THET(I)
00225        WATE=WTHET(I)
00226        COSTHI = COSTH(I)
00227        GO TO 80
00227  C  INTERPOLATE BETWEEN THETA BOUNDS
00230     40 COSTHT = (R-PTHET(I-1))*DELMUP(I) +COSTH(I-1)
00231        SINTHT= SQRT(1-COSTHT**2)
00232        WATE= WTHET(I-1)
00232  C     SELECT PHI
00233     80 CALL AZIRN(SINPHI,COSPHI)
00233  C     DIRECTION COSINES
00234        U=COSTHT
00235        V=COSPHI*SINTHT
00236        W=SINPHI*SINTHT
00237        X=X1+U
00240        Y=Y1+V
00241        Z=Z1+W
00241  C     CLASSIFY NREG  FOR NEG HEMISPHERE
00242        IF(U+.98481) 81,81,82
00245     81 NREG=1.0
00246        GO TO 85
00247     82 IF(U+.93969) 83,83,84
00252     83 NREG=2
00253        GO TO 85
00254     84 NREG=3
00254  C     SELECT E FROM CUM E
00255     85 R=FLTRNF(DUMMY)
00256        DO100 J=2,MEGR
[redacted]
00262        IF(POFE(J)-R)  100,120,130
00265    100 CONTINUE
00267    120 ENER= EBNDS(J)
00270        WATE=WATE* EWT(J-1)
00271        GO TO 140
00271  C      INTERPOLATE BETWEEN ENERGY BOUNDS
00272    130 ENER =        (R-POFE(J-1))*DELLOP(J)  +EBNDS(J-1)
00273        WATE= WATE* EWT(J-1)
00274    140 SPOSQ= ENER * 1.913220092E12
00275    145 FORMAT (7E10.2)
00276    150 FORMAT (7I10)
00277        RETURN
00300        END
```

APPENDIX D

ACTIFK USER ROUTINES

```
00101          SUBROUTINE STBTCH
00103          COMMON/NEW/MAXE,MAXX,MCSLB,NEUB..,NDXX ,ELB,SANOR,XLO,XU
00104          COMMON/NEW/CSLB(10),DELE(30),ELO(25),ENOR(25),EUB(30),
00104         1FL2X1(1,10,30),FL2X2(1,10,30),FLUX(1,10,30),FLUX2(1,10,30,10),
00104         2SIGMAP(30),SIGMAU(30),SIGMAS(15,25),SIGMA2(1,10,30),SRS(15,25),
00104         3SRS2(15,25),STER(10),TCSLB(10),UNFLUX(30),UN1FL(30,10),UN2FL(30),
00104         4XPFLUX(30),XP1FL(30,10),XP2FL(30),XX(15),SRS1(15,25,10)
00105          COMMON/UNCOL/UNDOSE(10)
00106          COMMON/DET/NODET,XD(10),YD(10),ZD(10)
00107          COMMON/CPLIST/NCOLL(1),NAME(1),S12(1),U(1),V(1),W(1),
00107         A X(1),Y(1),Z(1),WATE(1),SPOLD(1),UOLD(1),VOLD(1),WOLD(1),
00107         B OLDWT(1),NGRP(1),LELEM(1),NMED(1),DUM(18)
00110          COMMON/ASINGL  /NSTRT,NITS,NBIN,NETAPE,ETOP,EBOT,ECUT,NXTAPE,NYTAP
00110         1E,NFTAP1, NFTAP2, NFTAP  ,MEDIA,NHISTR,NHISMX,NWPCOL,NSGP,NCOLPR,N
00110         2ANISO  ,NOSGP,NLAST,KTH,NGROUP,LBATCH,NVAR,NF,NL,IB,NCPSR2,NCPNGP,
00110         3NCPELM ,NCPMED,NTYPE,DOSE,NRSUM,NZRO,NBSUM,NYTABL ,NGEOM,NM,MGZ,NO
00110         4NEUT,NYSUM,NZR,IVAR
00111          COMMON STORAG(7000)
00112          DATA IFIRST/0/
00114          IF(IFIRST) 1,1,2
00117        1 IFIRST=1
00120          CALL OSRSET(NHISTR,NHISMX,NWPCO ,NCOLPR)
00121          READ(5,100) NODET,(XD(I),YD(I),ZD(I),I=1,NODET)
00132          NDXX=NODET
00133      100 FORMAT(I5/(6E10.5))
00134          READ(5,10) NEUBM,MCSLB,ELB,SANOR
00142       10 FORMAT(2I6,2E12.8)
00143          READ(5,20) (EUB(MDE),MDE=1,NEUBM)
00151          READ(5,20) (DELE(MDE),MDE=1,NEUBM)
00157          READ(5,20) (TCSLB(NEWMU),NEWMU=1,MCSLB)
00165          READ(5,20) (CSLB(NEWMU),NEWMU=1,MCSLB)
00173       20 FORMAT(6E12.8)
00174          READ(5,30) MAXE,MAXX,XLO,XU
00202       30 FORMAT(2I6,2E6.4)
00203          READ(5,20)(ELO(J),J=1,MAXE)
00211          READ(5,20) (XX(I),I=1,MAXX)
00217          READ(5,20) (ENOR(J),J=1,MAXE)
00225          WRITE (6,101) NODET,(XD(I),YD(I),ZD(I),I=1,NODET)
00236      101 FORMAT(24H0THE NO OF DETECTORS IS ,I5/37H0THE X,Y,Z COORDINATES AR
00236         1E AS FOLLOWS/1H /(1H ,3(E11.5,3X)))
00237          DO 19 I=1,NODET
00242       19 UN DOSE(I)=0.
00244        2 CONTINUE
00245          DO 200 J=1,MAXE
00250          DO 200 I=1,MAXX
00253      200 SRS(I,J)=0
00256          DO 210 I=1,NODET
00261          DO 210 NEWMU=1,MCSLB
00264          DO 210 MDE=1,NEUBM
00267      210 FLUX(I,NEWMU,MDE)=0.0
00273          DO 220 MDE=1,NEUBM
00276          XPFLUX(MDE)=0.0
00277      220 UNFLUX(MDE)=0.0
00301          RETURN
00302          END
```

Identification of Input Read by STBTCH for use in ACTIFK uses routines. This input follows the normal ACTIFK input.

Card 1	I6	NEUBM	Max number of energy upper bounds
	I6	MCSLB	Max number of lower bounds of cos θ (polar angle at exit face)
	E12.8	ELB	Lower bound of energy group structure
	E12.8	SANOR	Solid angle normalization factor to account for source generating angles
Card 2	6E12.8	EUB	Upper energy bounds
Card 3	6E12.8	DELE	Energy group normalization constants. In this calculation DELE = $\Delta E/\overline{E}$ for each group
Card 4	6E12.8	TCSLB	Average angle for polar angle increments
Card 5	6E12.8	CSLB	Cosine of upper angle increment bound (Lower value of cos θ for the increment)

Cards 6 through 9 pertain only to the 1 ev source calculation.

Card 6	I6	MAXE	Number of energy groups
	I6	MAXX	Number of thickness increments
	E6.4	XLO	Lowest value of x increment bound
	E6.4	XU	Highest value of x increment bound
Card 7	6E12.8	ELO	Lower bounds of energy groups in ev high to low
Card 8	6E12.8	XX	Values of upper bounding x planes low to high in cm
Card 9	6E12.8	ENOR	Normalization factors to be applied to energy groups.

```
00101            SUBROUTINE SDATA
00103            COMMON/NEW/MAXE,MAXX,MCSLB,NEUB,,NDXX ,ELB,SANOR,XLO,XU
00104            COMMON/NEW/CSLB(10),DELE(30),ELO(25),ENOR(25),EUB(30),
00104           1FL2X1(1,10,30),FL2X2(1,10,30),FLUX(1,10,30),FLUX2(1,10,30,10),
00104           2SIGMAP(30),SIGMAU(30),SIGMAS(15,25),SIGMA2(1,10,30),SRS(15,25),
00104           3SRS2(15,25),STER(10),TCSLB(10),UNFLUX(30),UN1FL(30,10),UN2FL(30),
00104           4XPFLUX(30),XP1FL(30,10),XP2FL(30),XX(15),SRS1(15,25,10)
00105            COMMON/CPLIST/NCOLL(1),NAME(1),S12(1),U(1),V(1),W(1),
00105           A X(1),Y(1),Z(1),WATE(1),SPOLD(1),UOLD(1),VOLD(1),WOLD(1),
00105           B OLDWT(1),NGRP(1),LELEM(1),NMED(1),DUM(1A)
00106            COMMON/UNCOL/UNDOSE(10)
00107            COMMON/DET/NODET,XDET(10),YDET(10),ZDET(10)
00110            COMMON/ASINGL  /NSTRT,NITS,NBIN,NETAPE,ETOP,EBOT,ECUT,NXTAPE,NYTAP
00110           1E,NFTAP1, NFTAP2, NFTAP  ,MEDIA,NHISTR,NHISMX,NWPCOL,NSGP,NCOLPR,N
00110           2ANISO  ,NDSGP,NLAST,KTH,NGROUP,IBATCH,NVAR,NF,NL,IB,NCPSR2,NCPNGP,
00110           3NCPELM ,NCPMED,NTYPE,DOSE,NRSUM,NZRO,NBSUM,NYTABL ,NGEOM,NM,MGZ,NO
00110           4NEUT,NYSUM,NZR,IVAR
00111            SPD2=S12(KTH)
00112            IF(SPD2-ECUT) 2,1,1
00115          1 XA=X(KTH)
00116            YA=Y(KTH)
00117            ZA=Z(KTH)
00120            EUC=  SPD2/1.91322009E12
00121            DO 3 MDE=1,NEUBM
00124            IF(EUB(MDE)-EUC)  3,4,4
00127          3 CONTINUE
00131          4 XD= XDET(1)
00132            YD= YDET(1)
00133            ZD= ZDET(1)
00134            A=XD-XA
00135            B=YD-YA
00136            C=ZD-ZA
00137            SD2=A*A+B*B+C*C
00140            SD=SQRT(SD2)
00141            CALL EUCLID (61.0,0.,0.,0.,0.,0 ,SD,SPD2,ARG,0)
00142            UNFLUX(MDE) =UNFLUX(MDE) + WATE(KTH)*(6.55E-3)*EXP(ARG)
00143          2 RETURN
00144            END
```

```
00101          SUBROUTINE RELCOL
00103          COMMON/CPLIST/NCOLL(1),NAME(1),S12(1),U(1),V(1),W(1),
00103         A X(1),Y(1),Z(1),WATE(1),SPOLD(1),UOLD(1),VOLD(1),WOLD(1),
00103         B OLDWT(1),NGRP(1),LELEM(1),NMED(1),DUM(18)
00104          COMMON/DET/NODET,XDET(10),YDET(10),ZDET(10)
00105          COMMON/AMEDEL  /ALFA(32,8),BETA(32,8),ALPBET  (32,8),
00105         1LF1(32,8),ASSES(32,8)
00106          COMMON/ASINGL  /NSTRT,NITS,NBIN,NETAPE,ETOP,EBOT,ECUT,NXTAPE,NYTAP
00106         1E,NFTAP1, NFTAP2, NFTAP  ,MEDIA,NHISTR,NHISMX,NWPCOL,NSGP,NCOL[illegible]
00106         2ANISO  ,NDSGP,NLAST,KTH,NGROUP,LBATCH,NVAR,NF,NL,IB,NCPSB2,NCPNGP,
00106         3NCPELM ,NCPMED,NTYPE,DOSE,NRSUM,NZRO,NBSUM,NYTABL ,NGEOM,NM,MGZ,NO
00107          COMMON/NEW/MAXE,MAXX,MCSLB,NEUBM,NDXX ,ELB,SANOR,XLO,XU
00110          COMMON/NEW/CSLB(10),DELE(30),ELO(25),ENOR(25),EUB(30),
00110         1FL2X1(1,10,30),FL2X2(1,10,30),FLUX(1,10,30),FLUX2(1,10,30,10),
00110         2SIGMAP(30),SIGMAU(30),SIGMAS(15,25),SIGMA2(1,10,30),SRS(15,25),
00110         3SRS2(15,25),STER(10),TCSLB(10),UNFLUX(30),UN1FL(30,10),UN2FL(30),
00110         4XPFLUX(30),XP1FL(30,10),XP2FL(30),XX(15),SRS1(15,25,10)
00111          NN=NAME(KTH)
00112          XA=X(KTH)
00113          YA=Y(KTH)
00114          ZA=Z(KTH)
00115          WT1=WATE(KTH)
00116          IF(  S12(KTH)-1.91322E12) 1,10,10
00121        1 IF(SPOLD(KTH)-1.91322E12) 10,2,2
00124        2 IF(XA-XLO) 10,3,3
00127        3 IF(XA-XU) 4,4,10
00132        4 RA=YA*YA+ZA*ZA
00133          IF(RA-100.) 5,5,10
00136        5 DO 6 I=1,MAXX
00141          IF(XX(I)-XA) 6,7,7
00144        6 CONTINUE
00146        7 EVA=  S12(KTH)/1.913220092E12
00147          DO 8 J=1,MAXE
00152          IF(ELO(J)-EVA) 9,9,8
00155        8 CONTINUE
00157        9 SRS(I,J)=SRS(I,J)+WT1
00160       10 IF(XA) 400,400,11
00163       11 SB=SQRT(SPOLD(KTH))
00164          JELEM=LELEM(KTH)
00165          MED=NMED(KTH)
00166          WT1=WATE(KTH)
```

```
00167        XMASS=ASSES(JELEM,MED)
00170        DO 180 I=1,NODET
00173        XD=XDET(I)
00174        YD=YDET(I)
00175        ZD=ZDET(I)
00176        A=XD-XA
00177        B=YD-YA
00200        C=ZD-ZA
00201        SD2=A*A+B*B+C*C
00202        SD=SQRT(SD2)
00203     16 COSLB=(A*UOLD(KTH)+B*VOLD(KTH)+C*WOLD(KTH))/(SD*SB)
00204        IF(XMASS) 35,35,30
00207     30 CALL ELAS(COSLB,VA2,FMU)
00210        GO TO 40
00211     35 CALL NONLAS(COSLB,VA2,FMU)
00212     40 IF(FMU) 180,180,45
00215     45 EVA=VA2/1.91322009E12
00216        IF(EVA-ELB) 180,50,50
00221     50 CALL EUCLID(XA,YA,ZA,XD,YD,ZD,SD,VA2,ARG,0)
00222        COSE=A/SD
00223        DO 60 NEWMU=1,MCSLB
00226        IF(CSLB(NEWMU)-COS E) 65,65,60
00231     60 CONTINUE
00233     65 DO 70 MDE=1,NEUBM
00236        IF(EUB(MDE)-EVA) 70,75,75
00241     70 CONTINUE
00243        IF(1.-SD2) 75,75,73
00246     73 SD2=0.4
00247     75 FLUX(I,NEWMU,MDE)=FLUX(I,NEWMU,MDE)+WT1*EXP(ARG)*(FMU/SD2)
00250    180 CONTINUE
00252        IF((YA**2+ZA**2)-25.) 200,200,400
00255    200 COSLB=-UOLD(KTH)/SB
00256        XD=0.
00257        YD=Y(KTH)
00260        ZD=Z(KTH)
00261        SD=X(KTH)
00262        IF(XMASS)  220,220,210
00265    210 CALL ELAS(COSLB,VA2,FMU)
00266        GO TO 240
00267    220 CALL NONLAS(COSLB,VA2,FMU)
00270    240 IF(FMU) 400,400,245
00273    245 IF(VA2-ECUT) 400,250,250
00276    250 CALL EUCLID (XA,YA,ZA,XD,YD,ZD,SD,VA2,ARG,0)
00277        EVA=VA2/1.91322009E12
00300        DO 270 MDE=1,NEUBM
00303        IF(EUB(MDE)-EVA) 270,275,275
00306    270 CONTINUE
00310    275 XPFLUX(MDE)=XPFLUX(MDE)+WT1*EXP(ARG)*FMU/78.53975
00311    400 RETURN
00312        END
```

```
00101          SUBROUTINE ENDBAT
00103          COMMON/ASINGL  /NSTRT,NITS,NRIN NETAPE,ETOP,EBOT,ECUT,NXTAPE,NYTAP
00103         1E,NFTAP1, NFTAP2, NFTAP  ,MEDIA,NHISTR,NHISMX,NWPCOL,NSGP,NCOLPR,N
00103         2ANISO  ,NDSGP,NLAST,KTH,NGROUP,LBATCH,NVAR,NF,NL,IB,NCPSA2,NCPNGP,
00103         3NCPELM ,NCPMED,NTYPE,DOSE,NRSUM,NZRO,NBSUM,NYTABL ,NGEOM,NM,MGZ,NO
00103         4NEUT,NYSUM,NZR,IVAR
00104          COMMON STORAG(1)
00105          COMMON/NEW/MAXE,MAXX,MCSLB,NEUBM,NODET,ELB,SANOR,XLO,XU
00106          COMMON/NEW/CSLB(10),DELE(30),ELO(25),ENOR(25),EUB(30),
00106         1FL2X1(1,10,30),FL2X2(1,10,30),FLUX(1,10,30),FLUX2(1,10,30,10),
00106         2SIGMAP(30),SIGMAU(30),SIGMAS(15,25),SIGMA2(1,10,30),SRS(15,25),
00106         3SRS2(15,25),STER(10),TCSLB(10),UNFLUX(30),UN1FL(30,10),UN2FL(30),
00106         4XPFLUX(30),XP1FL(30,10),XP2FL(30),XX(15),SRS1(15,25,10)
00107          IF(LBATCH.GT.1) GO TO 25
00111          DO 10  NEWMU=2,MCSLB
00114          STER(NEWMU)= (CSLB(NEWMU-1)-CSLB(NEWMU))*2* 3.14159
00115       10 CONTINUE
00117          STER(1)=  -CSLB(1)*2* 3.14159
00120       25 DO 50 I=1,NODET
00123          DO 40 NEWMU=1,MCSLB
00126          DO 30 MDE=1, NEUBM
00131       30 FLUX2 (I,NEWMU,MDE,LBATCH)= FLUX(I,NEWMU,MDE)* (SANOR/NSTRT)/
00131         1(STER(NEWMU)*DELE(MDE))
00133       40 CONTINUE
00135       50 CONTINUE
00137          DO 55 MDE=1,NEUBM
00142          XP1FL(MDE,LBATCH)=  XPFLUX(MDE)* SANOR/(NSTRT *DELE(MDE))
00143       55 UN1FL(MDE,LBATCH)=  UNFLUX(MDE)/(DELE(MDE)*NSTRT)
00145          DO 80 I=1,MAXX
00150          DO 60 J=1,MAXE
00153       60 SRS1(I,J,LBATCH)=  SRS(I,J)* SANOR / (NSTRT * ENOR(J))
00155       80 CONTINUE
00157          WRITE(6,100) LBATCH
00162      100 FORMAT(1H1,50X,7HLBATCH= I4/50X,
00162         A35HNEUTRON SOURCE FALLING THROUGH 1 EV
00162         1/50X,31HNEUTRONS/CM3 -SOURCE NEUTRON
00162         2/1H0,9X,12HLOWER ENERGY,30X,17HDEL X UPPER LIMIT)
00163          IB=1
00164          IE=MIN0(MAXX,7)
00165      105 WRITE(6,110) (XX(I),I=IB,IE)
00173          DO120 J=1,MAXE
00176      120 WRITE(6,130) ELO(J),(SRS1(I,J,LBATCH),I=IB,IE)
00206      110 FORMAT(1H0,20X,1P7E15.5)
00207      130 FORMAT(1H0,5X,1P8E15.5)
00210          IF(MAXX.EQ.IE) GO TO 140
00212          IB=8
00213          IE=MAXX
00214          GO TO 105
00215      140 CONTINUE
00216          DO 240 I=1,NODET
00221          WRITE(6,200) I
00224      200 FORMAT(1H1,40X,17HENERGY ANGLE FLUX
00224         8/20X,52H(NEUTS  /CM2-STERADIAN-MEV-SOURCE NEUTRON) X EAVE
```

ENDBAT/ S

```
00224          3/20X,34H(AS VIEWED BY COLLIMATED DETECTOR)
00224          2/40X,11HDETECTOR NO,I3
00224          3/1H0,5X,12HUPPER ENERGY,15X,15H ANGLE(AVERAGE))
00225           JB=1
00226           JE=MIN0(MCSLB,7)
00227      205 WRITE(6,210) (TCSLB(J),J=JB,JE)
00235      210 FORMAT(1H0,13X,1P7E14.5)
00236          DO 220 MDE=1,NEUBM
00241      220 WRITE(6,230) EUB(MDE),(FLUX2(I,J,MDE,LBATCH),J=JB,JE)
00251      230 FORMAT(1X,1P8E14.5)
00252          IF(JE.EQ.MCSLB) GO TO 250
00254           JB=8
00255           JE=MCSLB
00256           GO TO 205
00257      240 CONTINUE
00261      250 CONTINUE
00262          WRITE(6,300)
00264      300 FORMAT(1H1,30X,32HNORMALLY EXITING UNCOLLIDED FLUX
00264         2/20X,52H(NEUTS  /CM2-STERADIAN-MEV-SOURCE NEUTRON) X EAVE
00264          3/20X,34H(AS VIEWED BY COLLIMATED DETECTOR)
00264         2/1H0,5X,12HUPPER ENERGY, 5X,4HFLUX)
00265          DO 310 MDE=1,NEUBM
00270      310 WRITE(6,320)EUB(MDE),UNIFL(MDE,LBATCH)
00275      320 FORMAT(1X,1P2E15.5)
00276          WRITE(6,400)
00300      400 FORMAT(1H1,30X,30HNORMALLY EXITING COLLIDED FLUX
00300         1/20X,52H(NEUTS  /CM2-STERADIAN-MEV-SOURCE NEUTRON) X EAVE
00300         2/1H0,5X,12HUPPER ENERGY, 5X,4HFLUX)
00301          WRITE(6,410) (EUB(K),XP1FL(K,LBATCH),K=1,NEUBM)
00310      410 FORMAT(1X,1P2E15.5)
00311       11 RETURN
00312          END
```

```
00101        SUBROUTINE ENDRUN
00103        DIMENSION NSTOR(1)
00104        COMMON STORAG(1)
00105        EQUIVALENCE(NSTOR(1),STORAG(1))
00105  C ****BEWARE - THIS ASINGL IS NOT THE SAME AS OTHERS
00106        COMMON/ASINGL  /NSTRT,NITS,NBIN NETAPE,ETOP,EBOT,ECUT,NXTAPE,NYTAP
00106       1E,NFTAP1, NFTAP2, NFTAP   ,MEDIA,NHISTR,NHISMX,NWPCOL,NSGP,NCOLPR,N
00106       2ANISO  ,NDSGP,NLAST,KTH,NGROUP,LBATCH,NVAR,NF,NL,IB,NCPSR2,NCPNGP,
00106       3NCPELM ,NCPMED,NTYPE,DOSF,NRSUM,N7RO,NRSUM,NYTABL ,NGEOM,NM,MGZ,YO
00106       4NEUT,NYSUM,N7R,IVAR
00107        COMMON/NEW/MAXE,MAXX,MCSLB,NEUBM,NODET,ELB,SANOR,XLO,XU
00110        COMMON/NEW/CSLB(10),DELE(30),ELB(25),ENOR(25),EUB(30),
00110       1FL2X1(1,10,30),FL2X2(1,10,30),FLUX(1,10,30),FLUX2(1,10,30,10),
00110       2SIGMAP(30),SIGMAU(30),SIGMAS(15,25),SIGMA2(1,10,30),SRS(15,25),
00110       3SRS2(15,25),STER(10),TCSLB(10),UNFLUX(30),UN1FL(30,10),UN2FL(30),
00110       4XPFLUX(30),XP1FL(30,10),XP2FL(30),XX(15),SRS1(15,25,10)
00111        COMMON/NEW2/XP2FLS(30),UN2FLS(30),FL2X2S(1,10,30),SRS2S(15,25)
00112        DO 30 MDE=1,NEUBM
00115        DO 20 NEWMU=1,MCSLB
00120        DO 10 I=1,NODET
00123        FL2X1 (I,NEWMU,MDE)=0
00124     10 FL2X2 (I,NEWMU,MDE)=0
00126     20 CONTINUE
00130     30 CONTINUE
00132        DO 50 MDE=1,NEUBM
00135        XP2FL(MDE)=0
00136        XP2FLS(MDE)=0.0
00137        UN2FLS(MDE)=0.0
00140     40 UN2FL(MDE)=0
00141     50 CONTINUE
00143        DO 100  MDE=1,NEUBM
00146        DO 60  LBATCH =1,NITS
00151        XP2FL(MDE)=XP2FL(MDE)+ XP1FL(MDE,LBATCH)/NITS
00152        XP2FLS(MDE)=XP2FLS(MDE)+XP1FL(MDE,LBATCH)*XP1FL(MDE,LBATCH)
00153        UN2FLS(MDE)=UN2FLS(MDE)+UN1FL(MDE,LBATCH)*UN1FL(MDE,LBATCH)
00154     60 UN2FL(MDE)=UN2FL(MDE)+ UN1FL(MDE,LBATCH)/NITS
00156        DO 90  I=1,NODET
00161        DO 80 NEWMU=1,MCSLB
00164        DO 70  LBATCH=1,NITS
00167        FL2X2(I,NEWMU,MDE) =FL2X2(I,NEWMU,MDE)+ FLUX2(I,NEWMU,MDE,LBATCH)/
00167       1NITS
00170        FL2X2S(I,NEWMU,MDE)=FL2X2S(I,NEWMU,MDE)+FLUX2(I,NEWMU,MDE,LBATCH)
00170       1**2
00171     70 FL2X1(I,NEWMU,MDE) =FL2X1(I,NEWMU,MDE)+ FLUX2(I,NEWMU,MDE,LBATCH)*
00171       1STER(NEWMU)*DELE(MDE)/NITS
```

```
00173        80 CONTINUE
00175        90 CONTINUE
00177       100 CONTINUE
00201           DO 130  MDE=1,NEUBM
00204           DO 120  NEWMU=1,MCSLB
00207           DO 110  I= 1, NODET
00212           SIGMA2(I,NEWMU,MDE)=SQRT((FL2X2S(I,NEWMU,MDE)/NITS)-
00212          1                      (FL2X2(I,NEWMU,MDE)**2))
00213       110 CONTINUE
00215       120 CONTINUE
00217           SIGMAP(MDE)= SQRT((  XP2FLS(MDE)           /NITS) -(XP2FL(MDE)**2))
00220           SIGMAU(MDE)= SQRT(( UN2FLS(MDE)           /NITS) -(UN2FL(MDE)**2))
00221       130 CONTINUE
00223           DO160  I=1,MAXX
00226           DO150  J=1,MAXE
00231           SRS2S(I,J)=0.0
00232           SRS2 (I,J)=0
00233           DO140  LBATCH=1,NITS
00236       140 SRS2(I,J)= SRS2(I,J)+SRS1(I,J,LBATCH)/NITS
00240           SIGMAS(I,J)=SQRT((SRS2(I,J)/NITS)-(SRS2(I,J)**2))
00241       150 CONTINUE
00243       160 CONTINUE
00245           WRITE(10) NEUBM,MCSLB,MAXX,MAXE
00253           DO 240 I=1,NODET
00256           WRITE(6,201) I
00261       201 FORMAT(1H1,40X,17HENERGY ANGLE FLUX
00261          2/20X,52H(NEUTS  /CM2-STERADIAN-MEV-SOURCE NEUTRON) X EAVE
00261          1/45X,13HDETECTOR NO, I2,
00261          2/2H0 ,12HUPPER ENERGY,50X,13HAVERAGE ANGLE)
00262           JB=1
00263           JE=MIN0(MCSLB,7)
00264       205 WRITE(6,210) (TCSLB(J),J=JB,JE)
00272       210 FORMAT(15X,1P7E14.5)
00273           DO 225 MDE=1,NEUBM
00276           WRITE(6,220) EUB(MDE),(FL2X2(I,J,MDE),J=JB,JE)
00305           WRITE(10) (FL2X2(I,J,MDE),J=JB,JE)
00313       220 FORMAT(1X,1P8E14.5)
00314       225 WRITE(6,230) (SIGMA2(I,J,MDE),J=JB,JE)
00323       230 FORMAT(15X,1P7E14.5)
00324           IF(JE.EQ.MCSLB) GO TO 240
00326           JB=8
00327           JE=MCSLB
00330           GO TO 205
00331       240 CONTINUE
00333           DO 640 I=1,NODET
00336           WRITE(6,601) I
00341       601 FORMAT(1H1,40X,17HENERGY ANGLE FLUX
00341          2/20X,37HNEUTRONS/CM2-SOURCE NEUTRON-INCREMENT
00341          3/45X,11HDETECTOR NO ,I3
00341          4/1H0,12HUPPER ENERGY,50X,13HAVERAGE ANGLE)
00342           JB=1
00343           JE=MIN0(MCSLB,7)
00344       605 WRITE(6,210) (TCSLB(J),J=JB,JE)
00352           DO 625 MDE=1,NEUBM
```

```
00355        625 WRITE(6,220) EUB(MDE),(FL2X1(I,J,MDE),J=JB,JE)
00365            IF(JE.EQ.MCSLB) GO TO 640
00367            JB=8
00370            JE=MCSLB
00371            GO TO 605
00372        640 CONTINUE
00374            WRITE(6,300)
00376        300 FORMAT(1H1,40X,32HNORMALLY EXITING UNCOLLIDED FLUX
00376           1/20X,52H(NEUTS   /CM2-STERADIAN-MEV-SOURCE NEUTRON) X EAVE
00376           2/1H0,12HUPPER ENERGY,10X,4HFLUX,10X,5HSIGMA)
00377            WRITE(6,310)(EUB(MDE),UN2FL(MDE),SIGMAU(MDE),MDE=1,NEUBM)
00407        310 FORMAT(1X,1P3E14.5)
00410            WRITE(6,400)
00412        400 FORMAT(1H1,40X,30HNORMALLY EXITING COLLIDED FLUX,
00412           2/20X,52H(NEUTS   /CM2-STERADIAN-MEV-SOURCE NEUTRON) X EAVE
00412           2/1H0,12HUPPER ENERGY,10X,4HFLUX,10X,5HSIGMA)
00413            WRITE(6,410) (EUB(MDE),XP2FL(MDE),SIGMAP(MDE),MDE=1,NEUBM)
00423            WRITE(10) (XP2FL(MDE), MDE=1,NEUBM )
00431        410 FORMAT(1X,1P3E15.5)
00432            WRITE(6,500)
00434        500 FORMAT(1H1,30X,35HNEUTRON SOURCE FALLING THROUGH 1 EV
00434           1/50X,31HNEUTRONS/CM3 -SOURCE NEUTRON
00434           2/1H0,12HLOWER ENERGY,40X,18H DEL X UPPER LIMIT)
00435            JB=1
00436            JE=MIN0(MAXX,7)
00437        505 WRITE(6,510) (XX(J),J=JB,JE)
00445        510 FORMAT(15X,1P7E14.5)
00446            DO 525 J=1,MAXE
00451            WRITE(6,520) ELO(J),(SRS2(I,J),I=JB,JE)
00460            WRITE(10) (SRS2(I,J),I=JB,JE)
00466        520 FORMAT(1X,8E14.5)
00467        525 WRITE(6,530)(SIGMAS(I,J),I=JB,JE)
00476        530 FORMAT(15X,1P7E14.5)
00477            IF(JE.EQ.MAXX) GO TO 540
00501            JB=8
00502            JE=MAXX
00503            GO TO 505
00504        540 CONTINUE
00505        200 RETURN
00506            END
```

APPENDIX E

TABULATED DATA OF THE SPECTRAL MEASUREMENT

RUN 4 5-23-64 TABLE E1 COMPUTED 3-25-69

HEMISPHERE INTEGRATED FAST NEUTRON SOURCE SPECTRUM FOR A 3 INCH AIR COOLED DEPLETED URANIUM SPHERE BIAS = .0189 STANDARD LIGHT UNITS
ENERGY RESOLUTION FOR GROUPING = .05 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
1.5476+07	3.5121-10	5.4353-03	1.4979-01
1.4032+07	5.3253-10	7.4725-03	1.7607-01
1.31[illegible]6+07	6.3987-10	8.4373-03	1.7087-01
1.2414+07	9.3325-10	1.1585-02	1.4111-01
1.17[illegible]6+07	1.1353-09	1.3292-02	1.2782-01
1.10[illegible]0+07	1.0906-09	1.2062-02	1.3337-01
1.0465+07	1.7490-09	1.8303-02	1.0898-01
9.9163+06	2.8972-09	2.8730-02	8.7644-02
9.17[illegible]5+06	4.2591-09	3.9079-02	5.3658-02
8.3049+06	7.6233-09	6.3311-02	4.3161-02
7.5526+06	1.2519-08	9.4551-02	3.6778-02
6.89[illegible]1+06	1.7281-08	1.1921-01	3.3859-02
6.3251+06	2.7341-08	1.7293-01	2.8615-02
5.82[illegible]7+06	3.2223-08	1.8756-01	2.8157-02
5.37[illegible]3+06	4.1299-08	2.2195-01	2.6907-02
4.9774+06	4.8283-08	2.4032-01	2.6926-02
4.6228+06	6.0213-08	2.7835-01	2.5740-02
4.3049+06	7.0628-08	3.0405-01	2.5116-02
4.01[illegible]6+06	8.0392-08	3.2306-01	2.4572-02
3.70[illegible]0+06	8.7102-08	3.2750-01	2.4366-02
3.5256+06	1.0408-07	3.6694-01	2.2958-02
3.3124+06	1.0306-07	3.4138-01	2.3098-02
3.11[illegible]0+06	1.0299-07	3.2112-01	2.3336-02
2.9402+06	1.1519-07	3.3868-01	2.2552-02
2.7772+06	1.1743-07	3.2613-01	2.1353-02
2.6274+06	1.3329-07	3.5021-01	2.0566-02
2.4894+06	1.5643-07	3.8942-01	2.0536-02
2.36[illegible]0+06	1.4541-07	3.4346-01	1.9845-02
2.2165+06	1.7843-07	3.9549-01	1.5894-02
2.05[illegible]5+06	2.2415-07	4.6141-01	1.5058-02
1.9168+06	2.4236-07	4.6456-01	1.4611-02
1.7892+06	3.4344-07	6.1448-01	1.3466-02
1.67[illegible]0+06	2.9652-07	4.9637-01	1.4485-02
1.56[illegible]5+06	3.7457-07	5.8789-01	1.3496-02
1.4745+06	4.4461-07	6.5558-01	1.2944-02
1.3679+06	4.6915-07	6.3725-01	1.3506-02
1.30[illegible]7+06	5.1326-07	6.7170-01	1.3171-02
1.2361+06	6.1906-07	7.6522-01	1.2983-02
1.1694+06	6.5014-07	7.6027-01	1.3296-02
1.1079+06	6.4085-07	7.1000-01	1.3387-02
1.0512+06	7.1610-07	7.5276-01	1.2983-02
9.90[illegible]6+05	8.5590-07	8.4773-01	1.1617-02
9.2715+05	9.0597-07	8.3997-01	1.1689-02

UN 4 -25-64 TABLE E1 COMPUTED 3-25-69
ONTINUED

EMISPHERE INTEGRATED FAST NEUTRON SOURCE SPECTRUM FOR A 3 INCH AIR
OOLED DEPLETED URANIUM SPHERE BIAS = .0189 STANDARD LIGHT UNITS
NERGY RESOLUTION FOR GROUPING = .05 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
8.6972+05	1.0859-06	9.4443-01	1.1161-02
8.1746+05	1.1404-06	9.3223-01	1.2721-02
7.6978+05	1.0585-06	8.1481-01	1.3600-02
7.2615+05	1.3233-06	9.6091-01	1.2615-02
6.8613+05	1.0826-06	7.4280-01	1.3765-02
6.4935+05	1.4262-06	9.2607-01	1.3187-02
6.1541+05	1.1683-06	7.1898-01	1.4629-02
5.8409+05	1.3313-06	7.7760-01	1.4683-02
5.5167+05	1.2911-06	7.1226-01	1.4037-02
5.1866+05	1.4149-06	7.3385-01	1.4931-02

RUN T4   1-29-69   TABLE E2   COMPUTED 3-25-69

HEMISPHERE INTEGRATED FAST NEUTRON SOURCE SPECTRUM FOR A 3 INCH WATER
COOLED DEPLETED URANIUM SPHERE   BIAS = .0335 STANDARD LIGHT UNITS
1.238 INCH URANIUM FILTER AT 16 METER POSITION OF 50 METER FLIGHT PATH

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
1.5363+07	3.7643-09	5.7906-02	1.9457-01
1.4429+07	6.0731-09	8.7629-02	1.5736-01
1.3561+07	8.3848-09	1.1371-01	1.3689-01
1.2769+07	1.0626-08	1.3568-01	1.2370-01
1.2045+07	1.5431-08	1.8587-01	1.0521-01
1.1380+07	1.7761-08	2.0212-01	1.0188-01
1.0769+07	3.2358-08	3.4846-01	7.8248-02
1.0206+07	3.4376-08	3.5084-01	7.8976-02
9.4458+06	5.9629-08	5.6324-01	4.5055-02
8.5516+06	9.7046-08	8.2990-01	3.7998-02
7.7786+06	1.6666-07	1.2964+00	3.1150-02
7.1059+06	2.2804-07	1.6204+00	2.8414-02
6.5169+06	3.0551-07	1.9910+00	2.6166-02
5.9962+06	3.9620-07	2.3765+00	2.4350-02
5.5390+06	4.5490-07	2.5197+00	2.3969-02
5.1360+06	5.7416-07	2.9458+00	2.2504-02
4.7658+06	6.8444-07	3.2619+00	2.1670-02
4.4385+06	7.8044-07	3.4640+00	2.1346-02
4.1439+06	9.0116-07	3.7343+00	2.0617-02
3.8776+06	1.0492-06	4.0684+00	1.9946-02
3.6362+06	1.1893-06	4.3245+00	1.9479-02
3.4167+06	1.3026-06	4.4506+00	1.9236-02
3.2164+06	1.5307-06	4.9233+00	1.8259-02
3.0333+06	1.7048-06	5.1712+00	1.7827-02
2.8654+06	1.8428-06	5.2804+00	1.7665-02
2.7110+06	2.1019-06	5.6983+00	1.7011-02
2.5658+06	2.2193-06	5.7009+00	1.7071-02
2.4375+06	2.5023-06	6.0994+00	1.6521-02
2.2875+06	2.7192-06	6.2202+00	1.3410-02
2.1246+06	3.0115-06	6.3982+00	1.3302-02
1.9725+06	3.4047-06	6.7362+00	1.3004-02
1.8469+06	3.8125-06	7.0413+00	1.2847-02
1.7281+06	4.2670-06	7.3738+00	1.2620-02
1.6204+06	4.7873-06	7.7573+00	1.2441-02
1.5224+06	5.1970-06	7.9119+00	1.2356-02
1.4331+06	5.5368-06	7.9348+00	1.2428-02
1.3514+06	6.1577-06	8.3215+00	1.2293-02
1.2765+06	6.6327-06	8.4666+00	1.2202-02
1.2076+06	7.4355-06	8.9791+00	1.2027-02
1.1442+06	7.9788-06	9.1293+00	1.2158-02
1.0857+06	8.4477-06	9.1717+00	1.2462-02
1.0230+06	9.1876-06	9.3989+00	1.0992-02
9.5765+05	1.0499-05	1.0054+01	1.0805-02

RUN 14 1-29-68 TABLE E2 COMPUTED 3-25-69
CONTINUED

HEMISPHERE INTEGRATED FAST NEUTRON SOURCE SPECTRUM FOR A 3 INCH WATER COOLED DEPLETED URANIUM SPHERE BIAS = .0335 STANDARD LIGHT UNITS
1.238 INCH URANIUM FILTER AT 16 METER POSITION OF 50 METER FLIGHT PATH

NEUTRON ENERGY (E.V)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
8.9838+05	1.1794-05	1.0595+01	1.0779-02
8.4444+05	1.3030-05	1.1003+01	1.0913-02
7.9522+05	1.4021-05	1.1150+01	1.1220-02
7.5018+05	1.5090-05	1.1320+01	1.1538-02
7.0886+05	1.6026-05	1.1360+01	1.1951-02
6.7087+05	1.7126-05	1.1489+01	1.2354-02
6.3585+05	1.8137-05	1.1532+01	1.2825-02
6.0350+05	1.9085-05	1.1518+01	1.3374-02
5.7002+05	2.1034-05	1.1990+01	1.2592-02
5.3594+05	2.2491-05	1.2054+01	1.3702-02
5.0473+05	2.4479-05	1.2356+01	1.4838-02

RUN T5 1-29-66 TABLE E3 COMPUTED 4-24-69

HEMISPHERE INTEGRATED FAST NEUTRON SOURCE SPECTRUM FOR A 3 INCH WATER COOLED DEPLETED URANIUM SPHERE BIAS = .0335 STANDARD LIGHT UNITS
NO URANIUM FILTER AT 16 METER POSITION OF 50 METER FLIGHT PATH

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
1.5415+07	1.6951-09	2.6130-02	1.5481-01
1.3165+07	3.2161-09	4.2340-02	1.1924-01
1.2045+07	6.4432-09	7.7608-02	1.1455-01
1.13[illegible]0+07	7.5310-09	8.5703-02	1.0859-01
1.0759+07	9.2234-09	9.9327-02	1.0068-01
1.0206+07	1.5680-08	1.6003-01	7.8833-02
9.4458+06	1.9342-08	1.8270-01	5.2392-02
8.5516+06	3.0750-08	2.6296-01	4.3637-02
7.77[illegible]0+06	5.0817-08	3.9529-01	3.5600-02
7.1059+06	6.7200-08	4.7752-01	3.2133-02
6.51[illegible]9+06	9.2072-08	6.0002-01	2.8517-02
5.99[illegible]2+06	1.1908-07	7.1427-01	2.6022-02
5.5390+06	1.3879-07	7.6876-01	2.5009-02
5.13[illegible]0+06	1.6534-07	8.4829-01	2.3865-02
4.7058+06	1.9962-07	9.5135-01	2.2641-02
4.43[illegible]3+06	2.3134-07	1.0262+00	2.2023-02
4.1439+06	2.6597-07	1.1022+00	2.1258-02
3.8776+06	3.0967-07	1.2002+00	2.0555-02
3.6362+06	3.5471-07	1.2898+00	1.9973-02
3.4167+06	4.2085-07	1.4379+00	1.8973-02
3.21[illegible]4+06	4.3984-07	1.4147+00	1.9139-02
3.03[illegible]3+06	4.9437-07	1.4996+00	1.8654-02
2.8654+06	5.4861-07	1.5720+00	1.8291-02
2.7110+06	6.0987-07	1.6534+00	1.7886-02
2.56[illegible]8+06	6.5903-07	1.6929+00	1.7809-02
2.4375+06	7.1307-07	1.7381+00	1.7681-02
2.2875+06	8.0010-07	1.8302+00	1.4192-02
2.12[illegible]6+06	9.0930-07	1.9319+00	1.3994-02
1.97[illegible]5+06	9.7840-07	1.9358+00	1.4119-02
1.84[illegible]9+06	1.1017-06	2.0347+00	1.4006-02
1.72[illegible]1+06	1.2056-06	2.0834+00	1.4002-02
1.62[illegible]4+06	1.3749-06	2.2279+00	1.3777-02
1.52[illegible]4+06	1.5251-06	2.3216+00	1.3607-02
1.4331+06	1.6666-06	2.3887+00	1.3659-02
1.3514+06	1.8161-06	2.4543+00	1.3768-02
1.27[illegible]5+06	1.9919-06	2.5427+00	1.3582-02
1.2076+06	2.1248-06	2.5659+00	1.3720-02
1.1442+06	2.3583-06	2.6984+00	1.3590-02
1.0857+06	2.5251-06	2.7415+00	1.3799-02
1.0230+06	2.6519-06	2.7129+00	1.2339-02
9.57[illegible]5+05	3.0165-06	2.8888+00	1.2091-02
8.9838+05	3.4332-06	3.0843+00	1.1899-02
8.4444+05	3.7704-06	3.1839+00	1.2010-02

RUN 15 1-29-68 TABLE E3 COMPUTED 4-24-69
CONTINUED

HEMISPHERE INTEGRATED FAST NEUTRON SOURCE SPECTRUM FOR A 3 INCH WATER COOLED DEPLETED URANIUM SPHERE BIAS = .0335 STANDARD LIGHT UNITS
NO URANIUM FILTER AT 16 METER POSITION OF 50 METER FLIGHT PATH

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
7.95[illegible]2+05	4.1657-06	3.3126+00	1.2121-02
7.5018+05	4.5367-06	3.4033+00	1.2319-02
7.03[illegible]6+05	4.7919-06	3.3968+00	1.2718-02
6.70[illegible]7+05	5.1675-06	3.4667+00	1.3015-02
6.55[illegible]5+05	5.5286-06	3.5154+00	1.3367-02
6.0350+05	5.9287-06	3.5780+00	1.3757-02
5.70[illegible]2+05	6.5002-06	3.7052+00	1.2919-02
5.3594+05	7.1240-06	3.8180+00	1.3781-02
5.0483+05	7.7954-06	3.9354+00	1.4823-02

RUN 6 7-31-64 TABLE E4 COMPUTED 3-25-69

FAST NEUTRON SOURCE SPECTRUM MEASURED THROUGH THE EMPTY LH2 DEWAR AT 0 DEGREES---SPECTRUM HAS BEEN CORRECTED FOR TRANSMISSION OF DEWAR
DETECTOR BIAS = .0276 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
1.5045+07	6.4851-09	9.7568-02	1.6045-01
1.3231+07	1.8335-08	2.4259-01	1.1325-01
1.2450+07	2.5001-08	3.1141-01	9.2327-02
1.1748+07	3.2214-08	3.7845-01	7.9731-02
1.1099+07	4.6853-08	5.2002-01	6.5738-02
1.0501+07	5.4956-08	5.7709-01	6.1989-02
9.9513+06	8.2839-08	8.2436-01	5.1388-02
9.2082+06	1.2139-07	1.1178+00	3.1305-02
8.3343+06	1.9889-07	1.6577+00	2.5878-02
7.5800+06	3.1702-07	2.4030+00	2.1699-02
6.9234+06	4.0205-07	2.7836+00	2.0316-02
6.3485+06	5.3926-07	3.4235+00	1.8336-02
5.8423+06	6.5265-07	3.8130+00	1.7500-02
5.3944+06	7.9741-07	4.3015+00	1.6508-02
4.9961+06	9.2842-07	4.6385+00	1.5996-02
4.6403+06	1.0940-06	5.0765+00	1.5360-02
4.3212+06	1.2510-06	5.4058+00	1.4983-02
4.0340+06	1.4770-06	5.9582+00	1.4315-02
3.7744+06	1.6985-06	6.4108+00	1.3847-02
3.5392+06	1.8828-06	6.6636+00	1.3653-02
3.3252+06	2.1146-06	7.0315+00	1.3271-02
3.1301+06	2.2997-06	7.1983+00	1.3087-02
2.9517+06	2.5478-06	7.5203+00	1.2753-02
2.7881+06	2.8470-06	7.9377+00	1.2626-02
2.6377+06	3.3192-06	8.7551+00	1.2457-02
2.4992+06	3.3645-06	8.4086+00	1.2789-02
2.3713+06	3.8517-06	9.1335+00	1.2174-02
2.2253+06	4.3050-06	9.5799+00	9.7654-03
2.0666+06	4.9811-06	1.0294+01	9.7418-03
1.9244+06	5.3992-06	1.0390+01	9.6664-03
1.7963+06	6.0323-06	1.0836+01	9.4059-03
1.6806+06	6.3445-06	1.0663+01	9.5186-03
1.5758+06	7.1585-06	1.1280+01	9.6113-03
1.4805+06	8.0858-06	1.1971+01	9.6502-03
1.3935+06	8.6055-06	1.1992+01	9.5437-03
1.3140+06	9.3501-06	1.2286+01	9.6913-03
1.2411+06	1.0081-05	1.2512+01	9.9165-03
1.1741+06	1.0963-05	1.2872+01	9.5537-03
1.1124+06	1.1975-05	1.3321+01	9.6592-03
1.0555+06	1.3209-05	1.3942+01	9.9096-03
9.9449+05	1.3275-05	1.3202+01	8.5635-03
9.3095+05	1.4406-05	1.3411+01	8.2774-03
8.7327+05	1.5536-05	1.3567+01	8.7935-03

RUN 6 7-31-64 TABLE E4 COMPUTED 3-25-69
CONTINUED

FAST NEUTRON SOURCE SPECTRUM MEASURED THROUGH THE EMPTY LH2 DEWAR AT 0 DEGREES---SPECTRUM HAS BEEN CORRECTED FOR TRANSMISSION OF DEWAR
DETECTOR BIAS = .0276 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
8.20[illegible]1+05	1.8495-05	1.5181+01	9.0575-03
7.7294+05	1.7481-05	1.3512+01	1.0316-02
7.2914+05	1.7816-05	1.2990+01	9.9119-03
6.8896+05	2.0232-05	1.3939+01	9.2634-03
6.52[illegible]1+05	2.0792-05	1.3557+01	9.8141-03
6.1795+05	2.2428-05	1.3859+01	9.7495-03
5.8650+05	2.8307-05	1.6602+01	9.4103-03
5.5595+05	2.4255-05	1.3436+01	9.9231-03
5.20[illegible]1+05	2.6044-05	1.3564+01	1.0486-02

RUN 14 2-26-66 TABLE E5 COMPUTED 5-15-69

FAST NEUTRON SOURCE SPECTRUM MEASURED THROUGH THE EMPTY LH2 DEWAR AT 0 DEGREES---SPECTRUM HAS BEEN CORRECTED FOR TRANSMISSION OF DEWAR
DETECTOR BIAS = .04233 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
1.3927+07	1.0052-06	1.3999+01	1.0344-01
1.2336+07	1.7534-06	2.1630+01	7.4800-02
1.1002+07	3.0335-06	3.3375+01	5.8704-02
9.8742+06	5.8396-06	5.7661+01	4.5244-02
8.9111+06	9.1743-06	8.1753+01	3.9143-02
8.0824+06	1.6270-05	1.3150+02	3.1889-02
7.3641+06	2.3002-05	1.6939+02	2.8971-02
6.7375+06	3.1114-05	2.0963+02	2.6865-02
6.1876+06	3.9179-05	2.4242+02	2.5681-02
5.7023+06	4.6582-05	2.6562+02	2.5033-02
5.2720+06	5.4737-05	2.8857+02	2.4306-02
4.8887+06	6.6221-05	3.2373+02	2.3357-02
4.4673+06	7.8953-05	3.5271+02	1.8563-02
4.0279+06	9.3502-05	3.7662+02	1.8100-02
3.6504+06	1.1106-04	4.0541+02	1.7587-02
3.3235+06	1.2719-04	4.2272+02	1.7138-02
3.0387+06	1.5336-04	4.6602+02	1.6098-02
2.7889+06	1.7587-04	4.9048+02	1.5863-02
2.5688+06	2.0970-04	5.3868+02	1.5577-02
2.3737+06	2.3619-04	5.6064+02	1.5094-02
2.2000+06	2.7518-04	6.0540+02	1.4697-02
2.0210+06	3.2415-04	6.5511+02	1.2412-02
1.8413+06	3.6734-04	6.7638+02	1.2051-02
1.6846+06	4.1805-04	7.0425+02	1.1764-02
1.5471+06	4.6169-04	7.1428+02	1.2066-02
1.4258+06	5.2655-04	7.5075+02	1.1979-02
1.3182+06	5.7778-04	7.6163+02	1.2019-02
1.2223+06	6.2631-04	7.6554+02	1.2250-02
1.1267+06	7.4457-04	8.3891+02	1.0639-02
1.0328+06	8.0135-04	8.2763+02	1.1432-02
9.5016+05	8.0421-04	7.6413+02	1.1325-02
8.7787+05	9.0968-04	7.9785+02	1.1777-02
8.1211+05	1.0524-03	8.5466+02	1.2580-02
7.4875+05	1.0212-03	7.6462+02	1.3029-02
6.8755+05	1.1498-03	7.9064+02	1.2520-02
6.3570+05	1.2668-03	8.0277+02	1.3366-02
5.8588+05	1.4797-03	8.6693+02	1.4185-02
5.4327+05	1.3989-03	7.5998+02	1.7377-02
5.0221+05	1.6156-03	8.1137+02	1.8779-02

RUN 6 7-31-64 TABLE E6 COMPUTED 5-5-69

FAST NEUTRON SPECTRUM FOR EMPTY DEWAR AT 0 DEGREES USING 2-IN. NE-211 DETECTOR BIAS = .2746 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
1.5045+07	4.3562-09	6.5539-02	1.6045-01
1.2844+07	1.4214-08	1.8256-01	7.1867-02
1.1423+07	2.5219-08	2.8808-01	5.0799-02
1.0226+07	4.2726-08	4.3692-01	3.9583-02
9.2082+06	7.3448-08	6.7632-01	3.1305-02
8.3348+06	1.1758-07	9.8001-01	2.5878-02
7.5800+06	1.8356-07	1.3914+00	2.1699-02
6.9234+06	2.2885-07	1.5846+00	2.0316-02
6.3485+06	3.0250-07	1.9204+00	1.8336-02
5.8423+06	3.6326-07	2.1223+00	1.7500-02
5.3944+06	4.4184-07	2.3835+00	1.6508-02
4.9961+06	5.1211-07	2.5586+00	1.5996-02
4.5592+06	6.2246-07	2.8379+00	1.2494-02
4.1045+06	7.8561-07	3.2245+00	1.1813-02
3.7147+06	9.5869-07	3.5612+00	1.1340-02
3.3779+06	1.1670-06	3.9420+00	1.0859-02
3.0849+06	1.3438-06	4.1455+00	1.0650-02
2.8284+06	1.6050-06	4.5396+00	1.0291-02
2.6026+06	1.8195-06	4.7354+00	1.0311-02
2.4029+06	2.0856-06	5.0115+00	1.0051-02
2.2253+06	2.4536-06	5.4600+00	9.7654-03
2.0424+06	2.8296-06	5.7792+00	8.4166-03
1.8591+06	3.3465-06	6.2215+00	8.2299-03
1.6995+06	3.7968-06	6.4527+00	8.2486-03
1.5596+06	4.2117-06	6.5685+00	8.4346-03
1.4363+06	4.9916-06	7.1694+00	8.2893-03
1.3270+06	5.6433-06	7.4887+00	8.2822-03
1.2298+06	6.0202-06	7.4036+00	8.5808-03
1.1328+06	7.3322-06	8.3059+00	7.4002-03
1.0378+06	7.9832-06	8.2850+00	7.6213-03
9.5418+05	8.8463-06	8.4410+00	7.5459-03
8.8031+05	9.4998-06	8.3628+00	7.7694-03
8.1470+05	1.0074-05	8.2073+00	8.2329-03
7.5616+05	8.6284-06	6.5245+00	9.3321-03
6.9886+05	1.1760-05	8.2186+00	7.6293-03
6.4338+05	1.2730-05	8.1902+00	7.9636-03
5.9426+05	1.5319-05	9.1035+00	7.8029-03
5.5056+05	1.3779-05	7.5862+00	9.0750-03
5.0850+05	1.4173-05	7.2070+00	9.1843-03

RUN 5 7-31-64 TABLE E7 COMPUTED 5-5-69

FAST NEUTRON SPECTRUM FOR 2.5 INCHES LH2 AT 0 DEGREES USING A NE-211 DETECTOR BIAS = .02746 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
1.5045+07	4.5957-09	6.9142-02	1.4347-01
1.2844+07	1.5898-08	2.0419-01	5.9501-02
1.1423+07	2.2206-08	2.5366-01	4.8403-02
1.0226+07	3.7598-08	3.8448-01	3.7121-02
9.2082+06	6.2209-08	5.7283-01	2.9914-02
8.3348+06	1.0099-07	8.4173-01	2.4502-02
7.5800+06	1.5259-07	1.1566+00	2.0920-02
6.9234+06	1.9471-07	1.3481+00	1.9350-02
6.3485+06	2.2895-07	1.4535+00	1.8562-02
5.8423+06	2.6972-07	1.5758+00	1.7887-02
5.3944+06	3.1813-07	1.7161+00	1.7144-02
4.9961+06	3.6647-07	1.8309+00	1.6679-02
4.5592+06	4.3123-07	1.9661+00	1.3257-02
4.1045+06	5.2105-07	2.1386+00	1.2813-02
3.7147+06	6.0687-07	2.2543+00	1.2607-02
3.3779+06	7.4316-07	2.5103+00	1.2046-02
3.0849+06	8.3657-07	2.5807+00	1.1965-02
2.8284+06	9.6401-07	2.7266+00	1.1778-02
2.6026+06	1.0454-06	2.7208+00	1.2078-02
2.4029+06	1.2098-06	2.9070+00	1.1722-02
2.2253+06	1.3566-06	3.0188+00	1.1671-02
2.0424+06	1.4952-06	3.0538+00	1.0290-02
1.8591+06	1.6765-06	3.1168+00	1.0342-02
1.6995+06	1.8345-06	3.1177+00	1.0553-02
1.5596+06	1.9329-06	3.0146+00	1.1068-02
1.4363+06	2.1821-06	3.1342+00	1.1139-02
1.3270+06	2.2804-06	3.0261+00	1.1564-02
1.2298+06	2.2471-06	2.7635+00	1.2447-02
1.1328+06	2.5693-06	2.9105+00	1.1058-02
1.0378+06	2.6233-06	2.7225+00	1.1726-02
9.5418+05	2.8168-06	2.6877+00	1.1767-02
8.6031+05	2.9505-06	2.5974+00	1.2229-02
8.1470+05	2.9517-06	2.4047+00	1.3312-02
7.5616+05	2.3675-06	1.7902+00	1.5552-02
6.9386+05	3.2155-06	2.2472+00	1.2692-02
6.4338+05	3.2994-06	2.1228+00	1.3549-02
5.9426+05	3.8523-06	2.2893+00	1.3421-02
5.5056+05	3.1062-06	1.7101+00	1.6432-02
5.0350+05	3.1473-06	1.6004+00	1.6698-02
4.6821+05	3.0925-06	1.4482+00	1.9347-02
4.3271+05	3.1469-06	1.3617+00	2.2755-02
4.0192+05	2.5600-06	1.0266+00	2.8972-02

RUN 4 7-31-64 TABLE E8 COMPUTED 5-5-69

FAST NEUTRON SPECTRUM FOR 4.5 INCHES LH_2 AT 0 DEGREES USING A NE-211
DETECTOR BIAS = .02746 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
1.5045+07	5.0759-09	7.6367-02	1.3828-01
1.2844+07	1.2700-08	1.6312-01	7.6884-02
1.1425+07	2.0139-08	2.3005-01	5.7243-02
1.0225+07	3.1293-08	3.2000-01	4.6296-02
9.2082+06	5.0098-08	4.6131-01	3.7855-02
8.3348+06	7.2502-08	6.0429-01	3.2869-02
7.5800+06	1.1297-07	8.5631-01	2.7575-02
6.9234+06	1.4002-07	9.6941-01	2.5873-02
6.3485+06	1.7713-07	1.1245+00	2.3901-02
5.8425+06	1.9956-07	1.1659+00	2.3552-02
5.3944+06	2.3927-07	1.2907+00	2.2383-02
4.9961+06	2.6052-07	1.3016+00	2.2385-02
4.5592+06	2.8699-07	1.3084+00	1.8363-02
4.1045+06	3.4980-07	1.4358+00	1.7675-02
3.7147+06	3.9310-07	1.4602+00	1.7691-02
3.3779+06	4.7688-07	1.6109+00	1.6961-02
3.0849+06	5.1598-07	1.5917+00	1.7157-02
2.8284+06	5.9409-07	1.6803+00	1.6871-02
2.6026+06	6.3955-07	1.6645+00	1.7342-02
2.4029+06	7.0951-07	1.7049+00	1.7170-02
2.2255+06	8.0266-07	1.7862+00	1.6995-02
2.0424+06	8.5416-07	1.7445+00	1.5213-02
1.8591+06	9.2668-07	1.7228+00	1.5507-02
1.6995+06	1.0294-06	1.7495+00	1.5660-02
1.5596+06	1.0360-06	1.6157+00	1.6775-02
1.4363+06	1.0816-06	1.5535+00	1.7523-02
1.3270+06	1.1138-06	1.4780+00	1.8279-02
1.2298+06	1.0899-06	1.3404+00	1.9707-02
1.1328+06	1.1473-06	1.2997+00	1.8208-02
1.0376+06	1.1136-06	1.1557+00	1.9759-02
9.5418+05	1.0838-06	1.0341+00	2.0768-02
8.6031+05	1.0170-06	8.9528-01	2.2754-02
8.1470+05	1.1002-06	8.9633-01	2.3719-02
7.5616+05	8.2925-07	6.2705-01	2.8645-02
6.9886+05	1.0186-06	7.1186-01	2.4513-02
6.4338+05	9.6515-07	6.2096-01	2.7193-02
5.9426+05	1.0661-06	6.3354-01	2.7657-02
5.5056+05	8.6107-07	4.7407-01	3.3850-02
5.0850+05	8.0806-07	4.1090-01	3.5836-02
4.6831+05	7.9098-07	3.7042-01	4.1801-02
4.3271+05	6.7381-07	2.9156-01	5.4570-02
4.0102+05	5.8468-07	2.3447-01	6.8430-02

RUN 6 -1-64 TABLE E9 COMPUTED 5-13-69

FAST NEUTRON SPECTRUM FOR EMPTY DEWAR AT 15 DEGREES USING 5-IN. NE-211
DETECTOR BIAS = .032 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
1.1151+07	1.2578-10	1.4026-03	1.9638-01
9.2082+06	3.5202-10	3.2415-03	1.3140-01
8.3348+06	4.7760-10	3.9807-03	1.1220-01
7.5800+06	7.8135-10	5.9226-03	8.9178-02
6.9234+06	1.0720-09	7.4219-03	7.9343-02
6.3485+06	1.4673-09	9.3152-03	7.0627-02
5.8423+06	1.7747-09	1.0368-02	6.7366-02
5.3944+06	2.1839-09	1.1781-02	6.3272-02
4.9961+06	2.1665-09	1.0824-02	6.6805-02
4.5592+06	2.8048-09	1.2788-02	5.0724-02
4.1045+06	3.6649-09	1.5043-02	4.7207-02
3.7147+06	4.7814-09	1.7761-02	4.3992-02
3.3779+06	5.6693-09	1.9150-02	4.2729-02
3.0849+06	7.0295-09	2.1685-02	4.0334-02
2.8284+06	8.7144-09	2.4648-02	3.8301-02
2.6026+06	1.0513-08	2.7361-02	3.7459-02
2.4029+06	1.2576-08	3.0219-02	3.5745-02
2.2253+06	1.4179-08	3.1553-02	3.5745-02
2.0424+06	1.7243-08	3.5217-02	3.0150-02
1.8591+06	1.9994-08	3.7171-02	2.9761-02
1.6995+06	2.4895-08	4.2309-02	2.8513-02
1.5596+06	2.7744-08	4.3270-02	2.9086-02
1.4363+06	3.1453-08	4.5176-02	2.9297-02
1.3270+06	3.7409-08	4.9642-02	2.8606-02
1.2298+06	4.4743-08	5.5025-02	2.8094-02
1.1328+06	4.6780-08	5.2992-02	2.6186-02
1.0378+06	5.4029-08	5.6071-02	2.6087-02
9.5418+05	6.0087-08	5.7334-02	2.5886-02
8.8031+05	7.2784-08	6.4072-02	2.5195-02
8.1470+05	8.1355-08	6.6280-02	2.6079-02
7.5616+05	8.8191-08	6.6687-02	2.5195-02
6.9886+05	8.8637-08	6.1945-02	2.5002-02
6.4336+05	8.2177-08	5.2871-02	2.8107-02
5.9426+05	8.8334-08	5.2493-02	2.9199-02
5.5056+05	8.7609-08	4.8234-02	3.2951-02
5.0850+05	8.8047-08	4.4772-02	3.4492-02

RUN 7 -1-64 TABLE E10 COMPUTED 5-13-69

FAST NEUTRON SPECTRUM FOR 2.5 INCHES LH2 AT 15 DEGREES USING A NE-211
DETECTOR BIAS = .032 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
1.2476+07	1.0012-10	1.2493-03	1.8314-01
1.0890+07	2.2533-10	2.4336-03	1.1328-01
9.6972+06	2.2761-10	2.2072-03	1.1583-01
8.7552+06	3.3187-10	2.9056-03	9.6688-02
7.9440+06	4.8758-10	3.8733-03	8.2728-02
7.2400+06	6.0355-10	4.3701-03	7.7732-02
6.6250+06	7.5302-10	4.9900-03	7.2934-02
6.0875+06	1.1350-09	6.9093-03	6.1904-02
5.6117+06	1.2274-09	6.8878-03	6.2370-02
5.1895+06	1.6129-09	8.3701-03	5.6890-02
4.8133+06	1.9870-09	9.5640-03	5.3383-02
4.3996+06	2.5662-09	1.1290-02	4.0653-02
3.9640+06	3.1605-09	1.2541-02	3.8983-02
3.5970+06	3.8855-09	1.3976-02	3.7399-02
3.2757+06	4.7175-09	1.5453-02	3.5694-02
2.9956+06	6.1754-09	1.8499-02	3.2830-02
2.7300+06	6.7054-09	1.8440-02	3.3430-02
2.5334+06	8.0202-09	2.0318-02	3.2655-02
2.3414+06	9.3016-09	2.1779-02	3.1642-02
2.1704+06	1.0704-08	2.3232-02	3.1595-02
1.9941+06	1.2219-08	2.4366-02	2.7259-02
1.8172+06	1.4367-08	2.6108-02	2.6776-02
1.6628+06	1.7064-08	2.8374-02	2.6246-02
1.5273+06	1.8403-08	2.8107-02	2.7209-02
1.4077+06	2.1056-08	2.9641-02	2.7219-02
1.3016+06	2.3024-08	2.9968-02	2.7866-02
1.2071+06	2.6033-08	3.1424-02	2.8019-02
1.1128+06	2.9783-08	3.3143-02	2.4870-02
1.0232+06	3.2601-08	3.3260-02	2.5418-02
9.3863+05	3.4575-08	3.2455-02	2.5779-02
8.6657+05	3.9500-08	3.4230-02	2.5995-02
8.0246+05	4.4962-08	3.6080-02	2.6585-02

AST NEUTRON SPECTRUM FOR 4.5 INCHES LH_2 AT 15 DEGREES USING A NE-211
ETECTOR BIAS = .032 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
NERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
1.1423+07	1.2048-10	1.3762-03	1.9678-01
1.0226+07	1.7264-10	1.7654-03	1.3976-01
9.2062+06	2.4940-10	2.2965-03	1.0760-01
8.3348+06	3.6375-10	3.0318-03	8.7870-02
7.5800+06	5.6085-10	4.2512-03	7.2044-02
6.9234+06	8.2538-10	5.7144-03	6.1325-02
6.3485+06	1.0641-09	6.7554-03	5.6426-02
5.8423+06	1.1184-09	6.5340-03	5.7899-02
5.3944+06	1.3123-09	7.0791-03	5.5833-02
4.9961+06	1.6643-09	8.3150-03	5.1783-02
4.5592+06	2.1175-09	9.6541-03	3.9629-02
4.1045+06	2.5302-09	1.0385-02	3.8639-02
3.7147+06	3.1210-09	1.1594-02	3.7043-02
3.3779+06	4.0295-09	1.3611-02	3.4388-02
3.0849+06	4.5283-09	1.3969-02	3.4108-02
2.8284+06	5.6506-09	1.5982-02	3.2266-02
2.6026+06	6.5482-09	1.7042-02	3.2149-02
2.4029+06	7.7278-09	1.8569-02	3.0913-02
2.2253+06	7.9948-09	1.7791-02	3.2317-02
2.0424+06	9.8821-09	2.0183-02	2.6988-02
1.8591+06	1.0988-08	2.0428-02	2.7267-02
1.6995+06	1.2368-08	2.1019-02	2.7441-02
1.5596+06	1.3626-08	2.1251-02	2.8160-02
1.4363+06	1.5680-08	2.2521-02	2.8104-02
1.3270+06	1.5970-08	2.1192-02	2.9772-02
1.2298+06	1.9280-08	2.3711-02	2.9035-02
1.1328+06	1.9759-08	2.2383-02	2.7330-02
1.0378+06	2.1619-08	2.2436-02	2.8007-02
9.5418+05	2.2870-08	2.1822-02	2.8480-02
8.8031+05	2.6363-08	2.3208-02	2.8399-02
8.1470+05	2.8162-08	2.2944-02	3.0108-02

RUN 5 8-1-64 TABLE E12 COMPUTED 5-13-69

FAST NEUTRON SPECTRUM FOR 7.0 INCHES LH_2 AT 15 DEGREES USING A NE-211
DETECTOR BIAS = .032 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
1.2844+07	9.5154-11	1.2222-03	1.5405-01
1.1423+07	1.4858-10	1.6972-03	1.0145-01
1.0226+07	1.9178-10	1.9611-03	8.5949-02
9.2082+06	2.2827-10	2.1020-03	8.1290-02
8.3348+06	2.6733-10	2.2281-03	7.8287-02
7.5800+06	4.6162-10	3.4991-03	6.1069-02
6.9234+06	5.6931-10	3.9416-03	5.7558-02
6.3485+06	7.8342-10	4.9735-03	5.1120-02
5.8423+06	9.5675-10	5.5896-03	4.8530-02
5.3944+06	1.0654-09	5.7472-03	4.8079-02
4.9961+06	1.2752-09	6.3710-03	4.6006-02
4.5592+06	1.5582-09	7.1041-03	3.5953-02
4.1045+06	1.8685-09	7.6693-03	3.4890-02
3.7147+06	2.1300-09	7.9123-03	3.4932-02
3.3779+06	2.7500-09	9.2892-03	3.2374-02
3.0849+06	3.1189-09	9.6215-03	3.1926-02
2.8284+06	3.5187-09	9.9523-03	3.1813-02
2.6026+06	3.8322-09	9.9737-03	3.2753-02
2.4029+06	4.4740-09	1.0751-02	3.1622-02
2.2253+06	4.9497-09	1.1015-02	3.1959-02
2.0424+06	5.6523-09	1.1544-02	2.7778-02
1.8591+06	6.1191-09	1.1376-02	2.8465-02
1.6995+06	6.3470-09	1.0787-02	2.9915-02
1.5596+06	6.8601-09	1.0699-02	3.1058-02
1.4363+06	7.6964-09	1.1054-02	3.1391-02
1.3270+06	7.5635-09	1.0037-02	3.3876-02
1.2298+06	8.7883-09	1.0808-02	3.3723-02
1.1328+06	8.8597-09	1.0036-02	3.2107-02
1.0378+06	9.5270-09	9.8871-03	3.3233-02
9.5418+05	9.8000-09	9.3510-03	3.4323-02
8.6031+05	9.3556-09	8.2358-03	3.8009-02
8.1470+05	1.0889-08	8.8713-03	3.8452-02

RUN 4 6-1-64 TABLE E13 COMPUTED 5-13-69

FAST NEUTRON SPECTRUM FOR 10.5 INCHES LH2 AT 15 DEGREES USING A NE-211
DETECTOR BIAS = .032 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
1.3256+07	5.1957-11	6.8874-04	1.7482-01
1.1423+07	1.2067-10	1.3784-03	9.7811-02
1.0226+07	1.4920-10	1.5257-03	8.5994-02
9.2082+06	2.1072-10	1.9404-03	7.2657-02
8.3346+06	2.8718-10	2.3936-03	6.4003-02
7.5800+06	3.9380-10	2.9850-03	5.7017-02
6.9234+06	4.8751-10	3.3752-03	5.3522-02
6.3485+06	6.0979-10	3.8713-03	5.0094-02
5.8423+06	8.0097-10	4.6795-03	4.5626-02
5.3944+06	9.2480-10	4.9887-03	4.4352-02
4.9961+06	1.1399-09	5.6951-03	4.1806-02
4.5592+06	1.3307-09	6.0669-03	3.3375-02
4.1045+06	1.5714-09	6.4498-03	3.2744-02
3.7147+06	1.7391-09	6.4602-03	3.3282-02
3.3779+06	2.2656-09	7.6530-03	3.0681-02
3.0849+06	2.4734-09	7.6302-03	3.0900-02
2.8284+06	2.6981-09	7.6313-03	3.1351-02
2.6026+06	2.9323-09	7.6316-03	3.2315-02
2.4029+06	3.2871-09	7.8986-03	3.1870-02
2.2253+06	3.6962-09	8.2252-03	3.1935-02
2.0424+06	4.0343-09	8.2397-03	2.8420-02
1.8591+06	4.2355-09	7.8742-03	2.9599-02
1.6995+06	4.6349-09	7.8770-03	3.0281-02
1.5596+06	5.3454-09	8.3367-03	3.0308-02
1.4363+06	5.1975-09	7.4652-03	3.3123-02
1.3270+06	5.0944-09	6.7603-03	3.5844-02
1.2296+06	5.6674-09	6.9698-03	3.6550-02
1.1328+06	5.5573-09	6.2953-03	3.5299-02
1.0378+06	6.0983-09	6.3288-03	3.6179-02
9.5418+05	6.0845-09	5.8057-03	3.8073-02
8.8031+05	5.9347-09	5.2244-03	4.1574-02
8.1470+05	6.5247-09	5.3157-03	4.3701-02

RUN 3 5-1-64 TABLE E14 COMPUTED 5-13-69

FAST NEUTRON SPECTRUM FOR 13.0 INCHES LH2 AT 15 DEGREES USING A NE-211
DETECTOR BIAS = .032 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
9.2082+06	1.9585-10	1.8034-03	9.0085-02
8.3348+06	2.5027-10	2.0860-03	8.2665-02
7.5800+06	4.3113-10	3.2680-03	6.4463-02
6.9234+06	4.6454-10	3.2162-03	6.5477-02
6.3485+06	6.8656-10	4.3586-03	5.5869-02
5.8423+06	7.8478-10	4.5849-03	5.4855-02
5.3944+06	9.9545-10	5.3699-03	5.0579-02
4.9961+06	1.1073-09	5.5322-03	5.0323-02
4.5592+06	1.2414-09	5.6598-03	4.1135-02
4.1045+06	1.5329-09	6.2918-03	3.9416-02
3.7147+06	1.7066-09	6.3395-03	3.9818-02
3.3779+06	2.2641-09	7.6479-03	3.6367-02
3.0849+06	2.2212-09	6.8522-03	3.8792-02
2.8294+06	2.5765-09	7.2874-03	3.8003-02
2.6026+06	2.7939-09	7.2714-03	3.9355-02
2.4029+06	3.1938-09	7.6744-03	3.8307-02
2.2255+06	2.9779-09	6.6267-03	4.2553-02
2.0424+06	3.4182-09	6.9813-03	3.6781-02
1.8591+06	3.7583-09	6.9871-03	3.7388-02
1.6995+06	3.9759-09	6.7570-03	3.8989-02
1.5596+06	4.0609-09	6.3334-03	4.1786-02
1.4363+06	4.3318-09	6.2218-03	4.3550-02
1.3270+06	4.5939-09	6.0961-03	4.5141-02
1.2298+06	4.9417-09	6.0773-03	4.6916-02
1.1328+06	4.5902-09	5.1998-03	4.7079-02
1.0378+06	4.6897-09	4.8670-03	5.0153-02
9.5418+05	4.7537-09	4.5359-03	5.2513-02
8.8031+05	4.7131-09	4.1490-03	5.7191-02
8.1470+05	4.5733-09	3.7259-03	6.4941-02

RUN 8 [illegible]-3-64 TABLE E15 COMPUTED 5-5-69

FAST NEUTRON SPECTRUM FOR EMPTY DEWAR AT 37 DEGREES USING 5-IN. NE-211
DETECTOR BIAS = .032 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
9.2082+06	6.7007-11	6.1701-04	1.4411-01
8.3348+06	9.8832-11	8.2374-04	1.2175-01
7.5800+06	1.4484-10	1.0979-03	1.0465-01
6.9234+06	1.6581-10	1.1480-03	1.0296-01
6.3485+06	1.9936-10	1.2656-03	9.8412-02
5.8423+06	2.7090-10	1.5827-03	8.8030-02
5.3944+06	3.3546-10	1.8096-03	8.2218-02
4.9961+06	3.8307-10	1.9139-03	8.0870-02
4.5592+06	4.6127-10	2.1030-03	6.3418-02
4.1045+06	5.5588-10	2.2816-03	6.1711-02
3.7147+06	7.2791-10	2.7040-03	5.7313-02
3.3779+06	9.5852-10	3.2378-03	5.2466-02
3.0849+06	1.1331-09	3.4955-03	5.0752-02
2.8284+06	1.3035-09	3.6868-03	4.9987-02
2.6026+06	1.7509-09	4.5569-03	4.6171-02
2.4029+06	2.1957-09	5.2760-03	4.2993-02
2.2253+06	2.4269-09	5.4006-03	4.3437-02
2.0424+06	2.9650-09	6.0557-03	3.6528-02
1.8591+06	3.3426-09	6.2142-03	3.6577-02
1.6995+06	4.0077-09	6.8111-03	3.5682-02
1.5596+06	4.8831-09	7.6157-03	3.4765-02
1.4363+06	5.7444-09	8.2507-03	3.4332-02
1.3270+06	6.2679-09	8.3175-03	3.5041-02
1.2298+06	7.6311-09	9.3847-03	3.4033-02
1.1328+06	8.2679-09	9.3659-03	3.1177-02
1.0378+06	1.0066-08	1.0446-02	3.0169-02
9.5418+05	9.1920-09	8.7708-03	3.3061-02
8.8031+05	1.1099-08	9.7706-03	3.2177-02
8.1470+05	1.2944-08	1.0545-02	3.2654-02

RUN 7 8-3-64 TABLE E16 COMPUTED 5 [illegible] 9

FAST NEUTRON SPECTRUM FOR 2.5 INCHES LH2 AT 37 DEGREES USING A NE-211
DETECTOR BIAS = .032 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
7.5860+06	6.2476-11	4.7357-04	1.4306-01
6.9234+06	7.5667-11	5.2387-04	1.3284-01
6.3485+06	1.0424-10	6.6177-04	1.1520-01
5.8423+06	1.5410-10	9.0030-04	9.6195-02
5.3944+06	1.8868-10	1.0178-03	8.9728-02
4.9961+06	2.1780-10	1.0882-03	8.7579-02
4.5592+06	3.2167-10	1.4666-03	6.1335-02
4.1045+06	4.2158-10	1.7304-03	5.6670-02
3.7147+06	5.8677-10	2.1797-03	5.0592-02
3.3779+06	7.2505-10	2.4491-03	4.7979-02
3.0849+06	9.1976-10	2.8374-03	4.4543-02
2.8234+06	1.1089-09	3.1364-03	4.2881-02
2.6026+06	1.5008-09	3.9060-03	3.9301-02
2.4029+06	1.7048-09	4.0965-03	3.8509-02
2.2253+06	2.1539-09	4.7931-03	3.6295-02
2.0424+06	2.5469-09	5.2018-03	3.0993-02
1.8591+06	2.9200-09	5.4286-03	3.0773-02
1.6995+06	3.4518-09	5.8663-03	3.0221-02
1.5596+06	4.2297-09	6.5966-03	2.9326-02
1.4365+06	4.7312-09	6.7954-03	2.9711-02
1.3270+06	5.3350-09	7.0795-03	2.9829-02
1.2295+06	6.2325-09	7.6647-03	2.9632-02
1.1328+06	6.4923-09	7.3545-03	2.7652-02
1.0378+06	7.5225-09	7.8069-03	2.7474-02
9.5418+05	8.3293-09	7.9477-03	2.7270-02
8.8031+05	9.5896-09	8.4418-03	2.7199-02
8.1470+05	1.0370-08	8.4484-03	2.8700-02

RUN 6 [illegible]-3-64 TABLE E17 COMPUTED 5-5-6[illegible]

FAST NEUTRON SPECTRUM FOR 4.5 INCHES LH_2 AT 37 DEGREES USING A NE-211
DETECTOR BIAS = .032 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
1.0825+07	2.2234-11	2.4068-04	1.9393-01
9.2082+06	3.6321-11	3.3445-04	1.7303-01
8.3348+06	4.3785-11	3.6494-04	1.5520-01
7.5800+06	7.2088-11	5.4643-04	1.1492-01
6.9234+06	7.8349-11	5.4244-04	1.1433-01
6.3485+06	8.3160-11	5.2794-04	1.1697-01
5.8423+06	1.5433-10	9.0164-04	8.4420-02
5.3944+06	1.8990-10	1.0244-03	7.8616-02
4.9961+06	2.2692-10	1.1337-03	7.4946-02
4.5592+06	2.7928-10	1.2733-03	5.8048-02
4.1045+06	3.7499-10	1.5391-03	5.2918-02
3.7147+06	5.5499-10	2.0616-03	4.5698-02
3.3779+06	6.4336-10	2.1732-03	4.4822-02
3.0849+06	8.3951-10	2.5898-03	4.0994-02
2.8244+06	9.7284-10	2.7516-03	4.0195-02
2.6026+06	1.3689-09	3.5627-03	3.6103-02
2.4029+06	1.5219-09	3.6570-03	3.5733-02
2.2253+06	1.8495-09	4.1157-03	3.4382-02
2.0424+06	2.1393-09	4.3693-03	2.9681-02
1.8591+06	2.5013-09	4.6502-03	2.9198-02
1.6995+06	2.8905-09	4.9124-03	2.9001-02
1.5396+06	3.5952-09	5.6071-03	2.7943-02
1.4363+06	3.8049-09	5.4650-03	2.9173-02
1.3270+06	4.3613-09	5.7874-03	2.9026-02
1.2296+06	4.5597-09	5.6075-03	3.0580-02
1.1328+06	5.1208-09	5.8008-03	2.7395-02
1.0378+06	5.6862-09	5.9011-03	2.7825-02
9.5418+05	6.1588-09	5.8766-03	2.7955-02
8.8031+05	6.5809-09	5.7932-03	2.8988-02
8.1470+05	7.4036-09	6.0317-03	3.0023-02

RUN 5 8-3-64 TABLE E18 COMPUTED 5-5-69

FAST NEUTRON SPECTRUM FOR 7.0 INCHES LH2 AT 37 DEGREES USING A NE-211
DETECTOR BIAS = .032 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
9.2082+06	3.8209-11	3.5184-04	1.5875-01
8.3348+06	4.7705-11	3.9761-04	1.4157-01
7.5800+06	5.7683-11	4.3724-04	1.3205-01
6.9234+06	6.1950-11	4.2890-04	1.3415-01
6.3485+06	9.2215-11	5.8543-04	1.1081-01
5.8423+06	8.7227-11	5.0961-04	1.2226-01
5.3944+06	1.2340-10	6.6567-04	1.0399-01
4.9961+06	1.3819-10	6.9041-04	1.0289-01
4.5592+06	2.0121-10	9.1736-04	7.2262-02
4.1045+06	3.1498-10	1.2928-03	5.9936-02
3.7147+06	4.0990-10	1.5227-03	5.5673-02
3.3779+06	4.8944-10	1.6533-03	5.3585-02
3.0849+06	6.1314-10	1.8915-03	4.9959-02
2.8284+06	7.7556-10	2.1936-03	4.6721-02
2.6026+06	9.1258-10	2.3751-03	4.6077-02
2.4029+06	1.0978-09	2.6379-03	4.3826-02
2.2253+06	1.1456-09	2.5493-03	4.5694-02
2.0424+06	1.4670-09	2.9962-03	3.7347-02
1.8591+06	1.7055-09	3.1707-03	3.6840-02
1.6995+06	1.9323-09	3.2839-03	3.6965-02
1.5596+06	2.1156-09	3.2995-03	3.8148-02
1.4363+06	2.3886-09	3.4307-03	3.8427-02
1.3270+06	2.7106-09	3.5970-03	3.8484-02
1.2298+06	2.8723-09	3.5324-03	4.0236-02
1.1328+06	3.1444-09	3.5620-03	3.6630-02
1.0378+06	3.1771-09	3.2972-03	3.9185-02
9.5418+05	3.1573-09	3.0126-03	4.1307-02
8.8031+05	3.9269-09	3.4569-03	3.9456-02
8.1470+05	4.1107-09	3.3490-03	4.2580-02

RUN 4 [illegible]-3-64 TABLE E19 COMPUTED 5-5-69

FAST NEUTRON SPECTRUM FOR 10.5 INCHES LH2 AT 37 DEGREES USING A NE-211
DETECTOR BIAS = .032 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
7.5800+06	4.4233-11	3.3529-04	1.4820-01
6.9234+06	4.5085-11	3.1214-04	1.5722-01
6.3485+06	5.3230-11	3.3793-04	1.5062-01
5.8423+06	8.4256-11	4.9225-04	1.1778-01
5.3944+06	1.1542-10	6.2262-04	1.0164-01
4.9961+06	1.3237-10	6.6133-04	9.9277-02
4.5592+06	1.5389-10	7.0162-04	7.8870-02
4.1045+06	2.0476-10	8.4044-04	7.2029-02
3.7147+06	2.8649-10	1.0642-03	6.3483-02
3.3779+06	3.5363-10	1.1945-03	5.9869-02
3.0849+06	4.0226-10	1.2409-03	5.8856-02
2.8214+06	4.4997-10	1.2727-03	5.8856-02
2.6026+06	6.1706-10	1.6060-03	5.3306-02
2.4029+06	6.1643-10	1.4812-03	5.5923-02
2.2253+06	7.1449-10	1.5900-03	5.5091-02
2.0424+06	8.4178-10	1.7193-03	4.6979-02
1.8591+06	9.3165-10	1.7320-03	4.7756-02
1.6495+06	9.7697-10	1.6638-03	5.0086-02
1.5596+06	1.2105-09	1.8879-03	4.8186-02
1.4363+06	1.2587-09	1.8079-03	5.0961-02
1.3270+06	1.3379-09	1.7754-03	5.3068-02
1.2296+06	1.5191-09	1.8682-03	5.3729-02
1.1328+06	1.6184-09	1.8333-03	4.9690-02
1.0378+06	1.4611-09	1.5163-03	5.7343-02
9.5418+05	1.6917-09	1.6142-03	5.5318-02

RUN 3 8-3-64 TABLE E20 COMPUTED 5-5-69

FAST NEUTRON SPECTRUM FOR 13.0 INCHES LH2 AT 37 DEGREES USING A NE-211
DETECTOR BIAS = .032 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
7.9440+06	3.8649-11	3.0703-04	1.5271-01
7.2406+06	5.6688-11	4.1046-04	1.2452-01
6.6266+06	6.2461-11	4.1390-04	1.2446-01
6.0875+06	7.2629-11	4.4213-04	1.2017-01
5.6117+06	1.0195-10	5.7211-04	1.0163-01
5.1895+06	1.1970-10	6.2118-04	9.7994-02
4.8133+06	1.5607-10	7.5121-04	8.7115-02
4.3996+06	1.7673-10	7.7754-04	7.0943-02
3.9680+06	2.5048-10	9.9390-04	6.1814-02
3.5970+06	2.7665-10	9.9511-04	6.2847-02
3.2757+06	3.9239-10	1.2854-03	5.4137-02
2.9956+06	4.8924-10	1.4656-03	5.0601-02
2.7500+06	5.8695-10	1.6141-03	4.8755-02
2.5334+06	7.1838-10	1.8199-03	4.6890-02
2.3414+06	6.9761-10	1.6334-03	5.0166-02
2.1704+06	9.2801-10	2.0142-03	4.5867-02
1.9941+06	1.0035-09	2.0011-03	4.0896-02
1.8172+06	1.0734-09	1.9506-03	4.2224-02
1.6626+06	1.2476-09	2.0745-03	4.1755-02
1.5273+06	1.2511-09	1.9108-03	4.5443-02
1.4077+06	1.5382-09	2.1653-03	4.3566-02
1.3016+06	1.5406-09	2.0052-03	4.7117-02
1.2071+06	1.6906-09	2.0407-03	4.8265-02
1.1128+06	1.6687-09	1.8569-03	4.6782-02
1.0202+06	1.9911-09	2.0313-03	4.5562-02
9.3868+05	1.9364-09	1.8177-03	4.8910-02
8.6657+05	1.9588-09	1.6974-03	5.3072-02
8.0246+05	2.0683-09	1.6597-03	5.7354-02

RUN 9 8-5-64 TABLE E21 COMPUTED 5-13-69

FAST NEUTRON SPECTRUM FOR EMPTY DEWAR AT 53 DEGREES USING 5-IN. NE-211
DETECTOR BIAS = .032 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
8.4092+06	6.6338-11	5.5785-04	1.8414-01
6.6266+06	1.6946-10	1.1229-03	1.7759-01
6.0875+06	2.1950-10	1.3362-03	1.5617-01
5.6117+06	2.1082-10	1.1831-03	1.6697-01
5.1895+06	2.8170-10	1.4619-03	1.4704-01
4.8133+06	3.5508-10	1.7091-03	1.3455-01
4.3998+06	4.5627-10	2.0074-03	1.0156-01
3.9680+06	5.6459-10	2.2403-03	9.6772-02
3.5970+06	6.8649-10	2.4693-03	9.3170-02
3.2757+06	9.3969-10	3.0781-03	8.2970-02
2.9956+06	1.1878-09	3.5582-03	7.7313-02
2.7500+06	1.5238-09	4.1904-03	7.2303-02
2.5334+06	1.7144-09	4.3433-03	7.2868-02
2.3414+06	2.0778-09	4.8650-03	6.8959-02
2.1704+06	2.9753-09	6.4576-03	6.1293-02
1.9941+06	2.9939-09	5.9701-03	5.6473-02
1.8172+06	3.7375-09	6.7918-03	5.3955-02
1.6628+06	4.2687-09	7.0980-03	5.3799-02
1.5273+06	6.1302-09	9.3627-03	4.8036-02
1.4077+06	6.3756-09	8.9749-03	5.0416-02
1.3016+06	7.1811-09	9.3469-03	5.0936-02
1.2071+06	8.7508-09	1.0563-02	4.9243-02
1.1128+06	1.0186-08	1.1335-02	4.3210-02
1.0202+06	1.0311-08	1.0519-02	4.6044-02
9.3868+05	1.1379-08	1.0681-02	4.5707-02
8.6657+05	1.2148-08	1.0527-02	4.7688-02
8.0246+05	1.6073-08	1.2898-02	4.5330-02

RUN 8 8-5-64 TABLE E22 COMPUTED 5-13-69

FAST NEUTRON SPECTRUM FOR 2.5 INCHES LH2 AT 53 DEGREES USING A NE-211
DETECTOR BIAS = .032 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
8.6949+06	3.2943-11	2.8644-04	1.7962-01
6.3465+06	8.1840-11	5.1956-04	1.7353-01
5.8423+06	8.9490-11	5.2283-04	1.6906-01
5.3944+06	1.2888-10	6.9523-04	1.3498-01
4.9961+06	1.7230-10	8.6083-04	1.1710-01
4.5592+06	2.4523-10	1.1181-03	8.1320-02
4.1045+06	2.5978-10	1.0663-03	8.4599-02
3.7147+06	3.1869-10	1.1838-03	8.0345-02
3.3779+06	4.5276-10	1.5294-03	6.9528-02
3.0849+06	4.8255-10	1.4886-03	7.0930-02
2.8284+06	6.8795-10	1.9458-03	6.1520-02
2.6026+06	9.1978-10	2.3938-03	5.6575-02
2.4029+06	1.1955-09	2.8727-03	5.1200-02
2.2253+06	1.4440-09	3.2133-03	4.9257-02
2.0424+06	1.7845-09	3.6447-03	4.1030-02
1.8591+06	2.0708-09	3.8498-03	4.0493-02
1.6995+06	2.6262-09	4.4632-03	3.8175-02
1.5596+06	3.1597-09	4.9279-03	3.7476-02
1.4363+06	3.5866-09	5.1514-03	3.7687-02
1.3270+06	4.0887-09	5.4257-03	3.7529-02
1.2298+06	4.7585-09	5.8520-03	3.7321-02
1.1328+06	5.5270-09	6.2610-03	3.2907-02
1.0378+06	6.6517-09	6.9031-03	3.2073-02
9.5418+05	6.7069-09	6.3996-03	3.3488-02
8.8031+05	7.5580-09	6.6534-03	3.3791-02
8.1470+05	8.5353-09	6.9537-03	3.4790-02

RUN 7 8-5-64 TABLE E23 COMPUTED 5-13-69

FAST NEUTRON SPECTRUM FOR 4.5 INCHES LH2 AT 53 DEGREES USING A NE-211
DETECTOR BIAS = .032 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
9.7508+06	3.6479-11	3.5570-04	1.9428-01
7.5923+06	4.5425-11	3.4488-04	1.8717-01
6.6266+06	8.1369-11	5.3920-04	1.6967-01
6.0875+06	1.1830-10	7.2015-04	1.3545-01
5.6117+06	1.0800-10	6.0606-04	1.4984-01
5.1895+06	1.6224-10	8.4194-04	1.1980-01
4.8133+06	1.8434-10	8.8728-04	1.1654-01
4.3996+06	1.7861-10	7.8581-04	1.0425-01
3.9680+06	2.7015-10	1.0720-03	8.6605-02
3.5970+06	3.3792-10	1.2155-03	8.1081-02
3.2757+06	4.1191-10	1.3493-03	7.6549-02
2.9956+06	4.3770-10	1.3112-03	7.8503-02
2.7500+06	5.6002-10	1.5401-03	7.2697-02
2.5334+06	8.3386-10	2.1125-03	6.2356-02
2.3414+06	9.5562-10	2.2375-03	6.0649-02
2.1704+06	1.2245-09	2.6577-03	5.6698-02
1.9941+06	1.3591-09	2.7102-03	4.9838-02
1.8172+06	1.7541-09	3.1876-03	4.6349-02
1.6628+06	2.2099-09	3.6746-03	4.3822-02
1.5273+06	2.3993-09	3.6645-03	4.5398-02
1.4077+06	3.1500-09	4.4343-03	4.1990-02
1.3016+06	3.4215-09	4.4534-03	4.3172-02
1.2071+06	3.8837-09	4.6880-03	4.3413-02
1.1128+06	4.4787-09	4.9839-03	3.8293-02
1.0202+06	4.5446-09	4.6364-03	4.0923-02
9.3868+05	5.2428-09	4.9213-03	3.9635-02
8.6657+05	5.8875-09	5.1019-03	4.0393-02
8.0246+05	6.3174-09	5.0695-03	4.2760-02

RUN 5 8-5-64 TABLE E24 COMPUTED 5-13-69

FAST NEUTRON SPECTRUM FOR 7.0 INCHES LH2 AT 53 DEGREES USING A NE-211
DETECTOR BIAS = .032 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
9.9935+06	2.7746-11	2.7728-04	1.5654-01
8.3348+06	3.7028-11	3.0862-04	1.7688-01
7.5800+06	4.7476-11	3.5987-04	1.4478-01
6.9234+06	6.4846-11	4.4895-04	1.1556-01
6.3485+06	7.6421-11	4.8516-04	1.0584-01
5.8423+06	7.8505-11	4.5865-04	1.0894-01
5.3944+06	8.9330-11	4.8188-04	1.0446-01
4.9961+06	1.1466-10	5.7285-04	9.2653-02
4.5592+06	1.0509-10	4.7913-04	8.7009-02
4.1045+06	1.7343-10	7.1184-04	6.6713-02
3.7147+06	1.8139-10	6.7381-04	7.0535-02
3.3779+06	2.4631-10	8.3201-04	6.1918-02
3.0849+06	3.0347-10	9.3617-04	5.7641-02
2.8284+06	3.9266-10	1.1106-03	5.2435-02
2.6026+06	4.0612-10	1.0570-03	5.6429-02
2.4029+06	5.0494-10	1.2133-03	5.1703-02
2.2253+06	5.7838-10	1.2871-03	5.1257-02
2.0424+06	7.4339-10	1.5183-03	4.1349-02
1.8591+06	9.0380-10	1.6803-03	3.9626-02
1.6995+06	1.1118-09	1.8895-03	3.7885-02
1.5596+06	1.2022-09	1.8750-03	3.9508-02
1.4363+06	1.4269-09	2.0495-03	3.8658-02
1.3270+06	1.5990-09	2.1219-03	3.8908-02
1.2298+06	1.6507-09	2.0300-03	4.1685-02
1.1328+06	1.8363-09	2.0802-03	3.7683-02
1.0378+06	2.1031-09	2.1826-03	3.7683-02
9.5418+05	2.1666-09	2.0673-03	3.9084-02
8.8031+05	2.1603-09	1.9017-03	4.2676-02
8.1470+05	2.5082-09	2.0434-03	4.3406-02

RUN 4 8-5-64 TABLE E25 COMPUTED 5-13-69

FAST NEUTRON SPECTRUM FOR 10.5 INCHES LH2 AT 53 DEGREES USING A NE-211
DETECTOR BIAS = .032 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
4.3996+06	9.6552-11	4.2479-04	1.6514-01
3.9680+06	8.6996-11	3.4520-04	1.9503-01
3.5970+06	1.4163-10	5.0944-04	1.5060-01
3.2757+06	1.7854-10	5.8484-04	1.3711-01
2.9956+06	2.0107-10	6.0233-04	1.3602-01
2.7500+06	2.6887-10	7.3939-04	1.1998-01
2.5334+06	2.9800-10	7.5495-04	1.2309-01
2.3414+06	3.0032-10	7.0317-04	1.3003-01
2.1704+06	4.6639-10	1.0123-03	1.0549-01
1.9941+06	6.3173-10	1.2597-03	8.1433-02
1.8172+06	6.3073-10	1.1462-03	8.8719-02
1.6628+06	6.6733-10	1.1096-03	9.2751-02
1.5273+06	9.1070-10	1.3909-03	8.3493-02
1.4077+06	1.0116-09	1.4240-03	8.5138-02
1.301[illegible]06	1.0841-09	1.4111-03	8.8718-02
1.2071+06	1.3472-09	1.6262-03	8.4032-02
1.1128+06	1.3302-09	1.4802-03	8.1496-02
1.0202+06	1.5236-09	1.5544-03	8.1740-02
9.3868+05	1.4581-09	1.3687-03	8.9205-02
8.6657+05	1.3927-09	1.2069-03	1.0101-01
8.0246+05	1.6564-09	1.3292-03	1.0189-01

RUN 3   8-4-64   TABLE E26   COMPUTED 5-13-69

FAST NEUTRON SPECTRUM FOR 13.0 INCHES LH2 AT 53 DEGREES USING A NE-211
DETECTOR BIAS = .032 STANDARD LIGHT UNITS   0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07   LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
6.2194+06	3.7430-11	2.3279-04	1.6371-01
5.6117+06	5.3525-11	3.0037-04	1.6674-01
5.1895+06	6.5930-11	3.4214-04	1.5360-01
4.8133+06	6.0746-11	2.9239-04	1.7307-01
4.3996+06	6.7976-11	2.9907-04	1.4174-01
3.9680+06	8.8119-11	3.4966-04	1.2909-01
3.5970+06	1.0528-10	3.7869-04	1.2465-01
3.2757+06	1.2387-10	4.0576-04	1.1987-01
2.9956+06	1.4095-10	4.2223-04	1.1766-01
2.7500+06	2.0154-10	5.5423-04	1.0047-01
2.5334+06	2.0093-10	5.0904-04	1.0987-01
2.3414+06	2.9211-10	6.8395-04	9.0861-02
2.1704+06	2.8463-10	6.1776-04	1.0094-01
1.9941+06	3.6728-10	7.3239-04	8.0398-02
1.8172+06	4.5711-10	8.3066-04	7.6173-02
1.6628+06	4.8258-10	8.0243-04	7.9687-02
1.5273+06	5.4238-10	8.2838-04	8.1374-02
1.4077+06	6.8619-10	9.6595-04	7.6173-02
1.3016+06	7.8576-10	1.0227-03	7.5968-02
1.2071+06	8.6888-10	1.0488-03	7.7655-02
1.1128+06	9.2656-10	1.0311-03	7.2025-02
1.0202+06	9.6123-10	9.8065-04	7.6528-02
9.3868+05	8.9663-10	8.4165-04	8.4761-02
8.6657+05	9.1196-10	7.9028-04	9.2386-02
8.0246+05	1.0739-09	8.6176-04	9.3432-02

RUN 8   8-7-64   TABLE E27   COMPUTED 5-7-69

FAST NEUTRON SPECTRUM FOR EMPTY DEWAR AT 78 DEGREES USING 5-IN. NE-211
DETECTOR BIAS = .032 STANDARD LIGHT UNITS   0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07   LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
9.0886+06	5.2629-11	4.7832-04	1.8953-01
6.7766+06	1.1804-10	7.9991-04	1.5415-01
6.0875+06	1.7609-10	1.0719-03	1.5081-01
5.6117+06	2.2654-10	1.2713-03	1.3473-01
5.1895+06	2.5589-10	1.3279-03	1.3092-01
4.8133+06	3.2014-10	1.5409-03	1.2064-01
4.3996+06	3.7026-10	1.6290-03	9.6601-02
3.9680+06	4.6669-10	1.8518-03	9.0837-02
3.5970+06	5.7781-10	2.0784-03	8.6807-02
3.2757+06	5.7754-10	1.8918-03	9.1641-02
2.9956+06	7.6439-10	2.2898-03	8.3307-02
2.7500+06	9.6135-10	2.6437-03	7.8545-02
2.5334+06	1.2163-09	3.0814-03	7.4520-02
2.3414+06	1.3653-09	3.1967-03	7.3506-02
2.1704+06	1.8691-09	4.0567-03	6.6816-02
1.9941+06	2.1711-09	4.3294-03	5.7083-02
1.8172+06	2.3936-09	4.3496-03	5.8035-02
1.6628+06	2.9001-09	4.8223-03	5.6088-02
1.5273+06	3.0649-09	4.6810-03	5.8729-02
1.4077+06	3.7828-09	5.3250-03	5.6624-02
1.3016+06	4.7220-09	6.1462-03	5.4008-02
1.2071+06	5.2544-09	6.3426-03	5.4895-02
1.1128+06	6.3693-09	7.0878-03	4.7160-02
1.0202+06	6.3790-09	6.5079-03	5.0654-02
9.3868+05	6.8827-09	6.4607-03	5.0850-02
8.6657+05	7.6223-09	6.6053-03	5.2074-02
8.0246+05	9.8943-09	7.9398-03	4.9831-02

RUN 7 -7-64 TABLE E28 COMPUTED 5-7-6

FAST NEUTRON SPECTRUM FOR 2.5 INCHES LH2 AT 78 DEGREES USING A NE-211
DETECTOR BIAS = .032 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
5.3944+06	1.1670-10	6.2953-04	1.1777-01
4.9961+06	1.3523-10	6.7562-04	1.1297-01
4.5592+06	1.5716-10	7.1652-04	8.9952-02
4.1045+06	2.1946-10	9.0077-04	7.9382-02
3.7147+06	2.2950-10	8.5252-04	8.3391-02
3.3779+06	2.9522-10	9.9722-04	7.6618-02
3.0849+06	3.3548-10	1.0349-03	7.5155-02
2.8284+06	3.8816-10	1.0979-03	7.4160-02
2.6026+06	4.5071-10	1.1730-03	7.3391-02
2.4029+06	5.7831-10	1.3896-03	6.6656-02
2.2253+06	5.8612-10	1.3043-03	7.1047-02
2.0424+06	7.7965-10	1.5924-03	5.6620-02
1.8591+06	9.3371-10	1.7359-03	5.4699-02
1.6995+06	1.0959-09	1.8625-03	5.3846-02
1.5596+06	1.1185-09	1.7444-03	5.7796-02
1.4363+06	1.3668-09	1.9631-03	5.5845-02
1.3270+06	1.4934-09	1.9817-03	5.7154-02
1.2298+06	1.8549-09	2.2812-03	5.4620-02
1.1328+06	1.9168-09	2.1714-03	5.1612-02
1.0378+06	2.3482-09	2.4370-03	4.9490-02

RUN 6 -7-64 TABLE E29 COMPUTED 5-7-69

FAST NEUTRON SPECTRUM FOR 4.5 INCHES LH2 AT 78 DEGREES USING A NE-211
DETECTOR BIAS = .032 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
5.8423+06	9.6543-11	5.6403-04	1.3199-01
5.3944+06	1.2567-10	6.7791-04	1.1612-01
4.9961+06	1.2853-10	6.4215-04	1.2064-01
4.5592+06	1.5620-10	7.1215-04	9.3240-02
4.1045+06	1.8593-10	7.6315-04	9.0310-02
3.7147+06	2.0130-10	7.4777-04	9.3630-02
3.3779+06	2.5749-10	8.6978-04	8.5630-02
3.0849+06	2.9035-10	8.9570-04	8.4728-02
2.8284+06	3.1521-10	8.9154-04	8.6152-02
2.6026+06	4.0546-10	1.0553-03	8.0747-02
2.4029+06	5.1588-10	1.2396-03	7.3062-02
2.2253+06	4.9977-10	1.1121-03	8.0496-02
2.0424+06	6.6290-10	1.3539-03	6.3729-02
1.8591+06	7.2782-10	1.3531-03	6.4990-02
1.6995+06	8.8732-10	1.5080-03	6.2303-02
1.5596+06	9.3892-10	1.4643-03	6.5917-02
1.4363+06	1.1291-09	1.6217-03	6.3975-02
1.3270+06	1.2603-09	1.6724-03	6.4477-02
1.2298+06	1.5011-09	1.8461-03	6.3484-02
1.1328+06	1.5391-09	1.7435-03	6.0129-02
1.0378+06	1.8421-09	1.9117-03	5.8649-02
9.5418+05	1.8962-09	1.8093-03	6.0856-02
8.8031+05	1.9100-09	1.6814-03	6.5950-02
8.1470+05	2.3470-09	1.9121-03	6.4659-02

RUN 5 -7-64 TABLE E30 COMPUTED 5-7-69

FAST NEUTRON SPECTRUM FOR 7.0 INCHES LH_2 AT 78 DEGREES USING A NE-211
DETECTOR BIAS = .032 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
5.3944+06	1.2436-10	6.7085-04	9.3993-02
4.9961+06	1.1995-10	5.9928-04	1.0218-01
4.5592+06	1.6450-10	7.4999-04	7.3221-02
4.1045+06	1.7913-10	7.3524-04	7.5096-02
3.7147+06	2.2769-10	8.4580-04	7.0222-02
3.3779+06	2.2688-10	7.6638-04	7.5168-02
3.0849+06	2.8507-10	8.7941-04	6.9384-02
2.82[illegible]4+06	2.7903-10	7.8921-04	7.5540-02
2.6026+06	3.9828-10	1.0366-03	6.6164-02
2.4029+06	4.2075-10	1.0110-03	6.7570-02
2.2253+06	4.9793-10	1.1080-03	6.5623-02
2.0424+06	5.5216-10	1.1277-03	5.7980-02
1.8591+06	5.6322-10	1.0471-03	6.1901-02
1.6995+06	6.2935-10	1.0696-03	6.2687-02
1.5596+06	7.9618-10	1.2417-03	5.9208-02
1.4363+06	8.4141-10	1.2085-03	6.2573-02
1.3270+06	1.0629-09	1.4105-03	5.8350-02
1.2298+06	1.1065-09	1.3608-03	6.2234-02
1.1328+06	1.2989-09	1.4714-03	5.4454-02
1.0378+06	1.3414-09	1.3921-03	5.8171-02
9.5418+05	1.5781-09	1.5058-03	5.5380-02

RUN 4 [illegible]-7-64 TABLE E31 COMPUTED 5-7-69

FAST NEUTRON SPECTRUM FOR 10.5 INCHES LH2 AT 78 DEGREES USING A NE-211
DETECTOR BIAS = .032 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (E[illegible])	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
6.9234+06	6.9825-11	4.8343-04	1.4249-01
6.34[illegible]5+06	8.7279-11	5.5409-04	1.2554-01
5.8423+06	9.2658-11	5.4134-04	1.2632-01
5.3944+06	1.2742-10	6.8735-04	1.0715-01
4.99[illegible]1+06	1.2912-10	6.4510-04	1.1208-01
4.5592+06	1.4534-10	6.6263-04	9.0617-02
4.1045+06	1.6546-10	6.7913-04	9.0354-02
3.7147+06	1.9865-10	7.3793-04	8.7504-02
3.3779+06	2.2098-10	7.4645-04	8.7385-02
3.0849+06	2.2058-10	6.8047-04	9.3405-02
2.8244+06	2.9212-10	8.2623-04	8.3826-02
2.6025+06	3.4892-10	9.0810-04	8.1959-02
2.4099+06	3.6317-10	9.2072-04	8.1698-02
2.2253+06	3.7121-10	8.2605-04	9.0176-02
2.0424+06	4.7253-10	9.6510-04	7.3250-02
1.8591+06	4.7512-10	8.8330-04	7.8915-02
1.6995+06	6.6657-10	1.1328-03	6.9058-02
1.5596+06	6.5373-10	1.0196-03	7.6962-02
1.4365+06	8.0482-10	1.1560-03	7.3432-02
1.3270+06	8.5212-10	1.1308-03	7.6546-02
1.2298+06	1.0071-09	1.2385-03	7.5733-02
1.1328+06	1.0293-09	1.1660-03	7.1897-02
1.0378+06	1.1754-09	1.2198-03	7.2237-02
9.5416+05	1.2389-09	1.1821-03	7.4010-02
8.80[illegible]1+05	1.3836-09	1.2180-03	7.5133-02
8.1470+05	1.4774-09	1.2036-03	8.0841-02

RUN 3 -7-64 TABLE E32 COMPUTED 5-7-69

FAST NEUTRON SPECTRUM FOR 13.0 INCHES LH2 AT 78 DEGREES USING A NE-211
DETECTOR BIAS = .032 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
5.6184+06	1.1814-10	6.6376-04	1.9938-01
4.7339+06	1.2535-10	5.9339-04	1.9545-01
3.9725+06	1.7036-10	6.7676-04	1.8161-01
3.3811+06	2.0531-10	6.9417-04	1.8402-01
2.8728+06	2.0500-10	5.8892-04	1.9022-01
2.5005+06	3.1870-10	7.9691-04	1.9928-01
2.2267+06	3.6265-10	8.0751-04	1.8388-01
1.9712+06	3.8658-10	7.6203-04	1.9636-01
1.7385+06	4.8304-10	8.3977-04	1.7640-01
1.5596+06	6.8207-10	1.0638-03	1.9233-01
1.4084+06	5.9466-10	8.3752-04	1.9019-01
1.1883+06	4.6923-10	5.5759-04	1.9937-01
9.8732+05	7.5067-10	7.4115-04	1.9570-01
8.6033+05	1.1227-09	9.6589-04	1.8445-01

RUN T4 [illegible]-26-66 TABLE E33 COMPUTED 4-30-69

FAST NEUTRON SPECTRUM FOR EMPTY DEWAR AT 0 DEGREES USING 2-IN. NE-211
DETECTOR BIAS = .04233 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
1.3927+07	6.7078-07	9.3420+00	1.0344-01
1.2356+07	1.1407-06	1.4072+01	7.4800-02
1.1002+07	1.9153-06	2.1072+01	5.8704-02
9.8742+06	3.5870-06	3.5419+01	4.5244-02
8.9111+06	5.5044-06	4.9050+01	3.9143-02
8.0824+06	9.5435-06	7.7134+01	3.1889-02
7.3641+06	1.3242-05	9.7515+01	2.8971-02
6.7575+06	1.7624-05	1.1874+02	2.6865-02
6.1876+06	2.1912-05	1.3558+02	2.5681-02
5.7023+06	2.5928-05	1.4785+02	2.5033-02
5.2720+06	3.0309-05	1.5979+02	2.4306-02
4.8867+06	3.6635-05	1.7910+02	2.3357-02
4.4673+06	4.3759-05	1.9548+02	1.8563-02
4.0279+06	5.2053-05	2.0966+02	1.8100-02
3.6534+06	6.2260-05	2.2727+02	1.7587-02
3.3235+06	7.2175-05	2.3987+02	1.7138-02
3.0307+06	8.9145-05	2.7088+02	1.6098-02
2.7839+06	1.0136-04	2.8268+02	1.5863-02
2.5608+06	1.1659-04	2.9950+02	1.5577-02
2.3737+06	1.3474-04	3.1983+02	1.5094-02
2.2000+06	1.5617-04	3.4357+02	1.4697-02
2.0210+06	1.8237-04	3.6857+02	1.2412-02
1.8413+06	2.1656-04	3.9875+02	1.2051-02
1.6846+06	2.5255-04	4.2545+02	1.1764-02
1.5471+06	2.7225-04	4.2120+02	1.2066-02
1.4256+06	3.0687-04	4.3754+02	1.1979-02
1.3182+06	3.4117-04	4.4973+02	1.2019-02
1.2223+06	3.6841-04	4.5031+02	1.2250-02
1.1267+06	4.5123-04	5.0840+02	1.0639-02
1.0328+06	4.6736-04	4.8269+02	1.1432-02
9.5016+05	5.2763-04	5.0133+02	1.1325-02
8.7707+05	5.6767-04	4.9789+02	1.1777-02
8.1211+05	5.9509-04	4.8328+02	1.2580-02

RUN T3   2-20-66   TABLE E34   COMPUTED 4-30-69

FAST NEUTRON SPECTRUM FOR 2.5 INCHES LH_2 AT 0 DEGREES USING A NE-211
DETECTOR BIAS = .04233 STANDARD LIGHT UNITS   0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07   LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
1.3922+07	4.4194-07	6.1527+00	6.4243-02
1.2332+07	7.5498-07	9.3104+00	5.0765-02
1.0999+07	1.4916-06	1.6406+01	3.8693-02
9.6709+06	2.7133-06	2.6783+01	3.1272-02
8.9031+06	4.6089-06	4.1057+01	2.6069-02
8.0796+06	6.3692-06	5.5500+01	2.3122-02
7.3616+06	9.2457-06	6.8063+01	2.1428-02
6.7351+06	1.2355-05	8.3212+01	1.9920-02
6.1654+06	1.5409-05	9.5311+01	1.9051-02
5.7004+06	1.6210-05	1.0380+02	1.8636-02
5.2702+06	1.9816-05	1.0443+02	1.8773-02
4.8870+06	2.3057-05	1.1268+02	1.8416-02
4.4657+06	2.6839-05	1.1985+02	1.4878-02
4.0265+06	2.9965-05	1.2065+02	1.4996-02
3.6491+06	3.5538-05	1.2968+02	1.4676-02
3.3223+06	4.1758-05	1.3873+02	1.4254-02
3.0376+06	4.6884-05	1.4241+02	1.4072-02
2.7679+06	5.2767-05	1.4711+02	1.3977-02
2.5678+06	5.8314-05	1.4974+02	1.4029-02
2.3726+06	6.5628-05	1.5620+02	1.3803-02
2.1992+06	7.5689-05	1.6646+02	1.3531-02
2.0202+06	8.0724-05	1.6308+02	1.1994-02
1.8407+06	9.2049-05	1.6943+02	1.1925-02
1.6860+06	1.0137-04	1.7071+02	1.2007-02
1.5466+06	1.0155-04	1.5706+02	1.2823-02
1.4253+06	1.1293-04	1.6096+02	1.2846-02
1.3177+06	1.1575-04	1.5252+02	1.3455-02
1.2219+06	1.1920-04	1.4565+02	1.4076-02
1.1262+06	1.4229-04	1.6025+02	1.2401-02
1.0324+06	1.4130-04	1.4588+02	1.3635-02
9.4901+05	1.5046-04	1.4291+02	1.3936-02
8.7675+05	1.6308-04	1.4298+02	1.4468-02
8.1101+05	1.6296-04	1.3229+02	1.5857-02

FAST NEUTRON SPECTRUM FOR 7.0 INCHES LH_2 AT 0 DEGREES USING A NE-211
DETECTOR BIAS = .04233 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
1.4836+07	1.8905-07	2.8047+00	6.2633-02
1.3091+07	3.9275-07	5.1415+00	4.2367-02
1.1637+07	7.1945-07	8.3722+00	3.2481-02
1.0412+07	1.2856-06	1.3386+01	2.6196-02
9.3710+06	2.1206-06	1.9872+01	2.2223-02
8.4787+06	3.4302-06	2.9084+01	1.8960-02
7.7081+06	5.0944-06	3.9268+01	1.6804-02
7.0379+06	6.2589-06	4.4050+01	1.6319-02
6.4515+06	7.9306-06	5.1164+01	1.5551-02
5.9355+06	9.1868-06	5.4528+01	1.5372-02
5.4790+06	9.9163-06	5.4331+01	1.5604-02
5.0732+06	1.0643-05	5.3994+01	1.6047-02
4.6282+06	1.1696-05	5.4131+01	1.3313-02
4.1654+06	1.3077-05	5.4471+01	1.3496-02
3.7688+06	1.4381-05	5.4199+01	1.3728-02
3.4262+06	1.5052-05	5.1571+01	1.4174-02
3.1283+06	1.6509-05	5.1645+01	1.4173-02
2.8676+06	1.7609-05	5.0496+01	1.4426-02
2.6382+06	1.8038-05	4.7588+01	1.5068-02
2.4355+06	1.9293-05	4.6984+01	1.5256-02
2.2549+06	2.1042-05	4.7448+01	1.5263-02
2.0692+06	2.1215-05	4.3898+01	1.3938-02
1.8832+06	2.2561-05	4.2487+01	1.4323-02
1.7212+06	2.2840-05	3.9312+01	1.5022-02
1.5793+06	2.2618-05	3.5721+01	1.6078-02
1.4542+06	2.2855-05	3.3236+01	1.6919-02
1.3434+06	2.2777-05	3.0599+01	1.7848-02
1.2448+06	2.0349-05	2.5330+01	2.0055-02
1.1466+06	2.2789-05	2.6130+01	1.8116-02
1.0502+06	2.1449-05	2.2526+01	2.0421-02
9.6551+05	1.9964-05	1.9275+01	2.2360-02
8.9067+05	2.0403-05	1.8172+01	2.3695-02
8.2420+05	1.8733-05	1.5440+01	2.7037-02

RUN T1 -26-66 TABLE E36 COMPUTED 4-30-69

FAST NEUTRON SPECTRUM FOR 13.0 INCHES LH2 AT 0 DEGREES USING A NE-211
DETECTOR BIAS = .04233 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
1.4836+07	1.4695-07	2.1802+00	4.8429-02
1.3091+07	2.7952-07	3.6592+00	3.5237-02
1.1637+07	4.5809-07	5.3308+00	2.8780-02
1.0412+07	7.5169-07	7.8266+00	2.4369-02
9.3710+06	1.2728-06	1.1927+01	2.0419-02
8.4777+06	1.7893-06	1.5171+01	1.8656-02
7.7031+06	2.5701-06	1.9811+01	1.6809-02
7.0379+06	3.0141-06	2.1213+01	1.6683-02
6.4515+06	3.4777-06	2.2436+01	1.6638-02
5.9355+06	3.7804-06	2.2439+01	1.6962-02
5.4790+06	4.0114-06	2.1978+01	1.7330-02
5.0732+06	4.1862-06	2.1237+01	1.8040-02
4.6282+06	4.3619-06	2.0188+01	1.5334-02
4.1654+06	4.5627-06	1.9005+01	1.6034-02
3.7688+06	4.4574-06	1.6799+01	1.7240-02
3.4262+06	4.6230-06	1.5839+01	1.7838-02
3.1233+06	4.6673-06	1.4601+01	1.8542-02
2.8676+06	4.5749-06	1.3119+01	1.9628-02
2.6382+06	4.4990-06	1.1869+01	2.0853-02
2.4353+06	4.3645-06	1.0629+01	2.2131-02
2.2549+06	4.0862-06	9.2140+00	2.3845-02
2.0652+06	4.1350-06	8.5561+00	2.1654-02
1.8832+06	4.0795-06	7.6825+00	2.3029-02
1.7212+06	3.8023-06	6.5445+00	2.5090-02
1.5793+06	3.3813-06	5.3401+00	2.8266-02
1.4542+06	3.0226-06	4.3955+00	3.1582-02
1.3434+06	2.9078-06	3.9063+00	3.3833-02
1.2446+06	2.4590-06	3.0610+00	3.8966-02
1.1466+06	2.4238-06	2.7791+00	3.7490-02
1.0502+06	2.2790-06	2.3934+00	4.2164-02
9.6551+05	1.7317-06	1.6720+00	5.1130-02
8.9067+05	1.5090-06	1.3440+00	5.8768-02
8.2420+05	1.4717-06	1.2130+00	6.4880-02

RUN T5 2-24-66 TABLE E37 COMPUTED 4-14-69

FAST NEUTRON SPECTRUM FOR EMPTY DEWAR AT 37 DEGREES USING 5-IN. NE-211
DETECTOR BIAS = .0447 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
1.0240+07	2.8976-09	2.9671-02	1.8187-01
8.9850+06	5.0621-09	4.5483-02	1.7756-01
8.1454+06	8.2147-09	6.6912-02	1.4683-01
7.4182+06	1.5971-08	1.1848-01	1.1179-01
6.7845+06	1.9160-08	1.2999-01	1.0976-01
6.2282+06	3.0418-08	1.8945-01	9.2909-02
5.7378+06	3.0808-08	1.7677-01	9.9062-02
5.3032+06	4.8923-08	2.5945-01	8.2829-02
4.9161+06	5.5742-08	2.7403-01	8.1718-02
4.4909+06	6.9955-08	3.1416-01	6.3888-02
4.0477+06	7.5987-08	3.0757-01	6.5791-02
3.6671+06	1.0989-07	4.0298-01	5.8132-02
3.3377+06	1.4669-07	4.8961-01	5.3086-02
3.0508+06	1.6445-07	5.0170-01	5.2498-02
2.7994+06	2.1378-07	5.9846-01	4.8405-02
2.5778+06	2.8487-07	7.3434-01	4.4206-02
2.3815+06	2.7034-07	6.4381-01	4.7523-02
2.2068+06	3.2248-07	7.1165-01	4.5751-02
2.0268+06	3.9686-07	8.0436-01	3.7746-02
1.8462+06	4.5655-07	8.4288-01	3.7454-02
1.6888+06	5.5223-07	9.3261-01	3.6018-02
1.5506+06	6.3830-07	9.8975-01	3.5856-02
1.4288+06	7.5938-07	1.0850+00	3.4798-02
1.3208+06	9.3333-07	1.2327+00	3.3227-02
1.2245+06	9.2272-07	1.1299+00	3.5426-02
1.1285+06	1.0442-06	1.1784+00	3.2110-02
1.0343+06	1.2430-06	1.2856+00	3.2176-02
9.5145+05	1.2923-06	1.2296+00	3.3372-02
8.7815+05	1.4630-06	1.2847+00	3.4041-02
8.1300+05	1.8958-06	1.5413+00	3.2758-02

FAST NEUTRON SPECTRUM FOR 2.5 INCHES LH2 AT 37 DEGREES USING A NE-211
DETECTOR BIAS = .0447 STANDARD LIGHT UNITS   0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07   LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
9.0021+06	2.9506-09	2.6562-02	1.4588-01
7.7691+06	6.7115-09	5.2142-02	1.4220-01
7.0906+06	8.3162-09	5.8967-02	1.3690-01
6.4973+06	1.5832-08	1.0287-01	1.0383-01
5.9755+06	1.9308-08	1.1537-01	1.0065-01
5.5141+06	2.4171-08	1.3328-01	9.5514-02
5.1042+06	3.4423-08	1.7570-01	8.4089-02
4.6549+06	5.0760-08	2.3628-01	6.0162-02
4.1879+06	6.3792-08	2.6715-01	5.7714-02
3.7878+06	8.3231-08	3.1526-01	5.3907-02
3.4424+06	1.0977-07	3.7787-01	4.9568-02
3.1422+06	1.4528-07	4.5650-01	4.4997-02
2.8796+06	1.7942-07	5.1666-01	4.2530-02
2.6486+06	2.3045-07	6.1037-01	3.9659-02
2.4444+06	2.4870-07	6.0792-01	4.0071-02
2.2629+06	2.9870-07	6.7593-01	3.8215-02
2.0761+06	3.3307-07	6.9149-01	3.3305-02
1.8891+06	4.0926-07	7.7313-01	3.1920-02
1.7262+06	5.2121-07	8.9971-01	2.9902-02
1.5835+06	5.4134-07	8.5721-01	3.1443-02
1.4579+06	6.0765-07	8.8589-01	3.1537-02
1.3466+06	7.4088-07	9.9767-01	3.0132-02
1.2476+06	7.7210-07	9.6327-01	3.1366-02
1.1489+06	9.2576-07	1.0636+00	2.7482-02
1.0522+06	1.0053-06	1.0578+00	2.8938-02
9.6721+05	1.1094-06	1.0730+00	2.9146-02
8.9211+05	1.2719-06	1.1347+00	2.9384-02
8.2544+05	1.3387-06	1.1050+00	3.1431-02
7.6597+05	1.5982-06	1.2242+00	3.1794-02

RUN 12 2-24-66 TABLE E39 COMPUTED 4-14-69

FAST NEUTRON SPECTRUM FOR 4.5 INCHES LH2 AT 37 DEGREES USING A NE-211
DETECTOR BIAS = .0447 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
1.0846+07	8.8068-10	9.5519-03	1.9996-01
8.9850+06	2.9685-09	2.6672-02	1.6618-01
8.1454+06	3.9092-09	3.1842-02	1.5448-01
7.4182+06	5.5735-09	4.1345-02	1.3681-01
6.7843+06	9.7664-09	6.6258-02	1.0806-01
6.2282+06	1.3182-08	8.2100-02	9.9310-02
5.7378+06	1.7070-08	9.7944-02	9.3157-02
5.3032+06	2.5511-08	1.3529-01	7.9838-02
4.9161+06	3.3446-08	1.6442-01	7.3182-02
4.4909+06	4.5333-08	2.0359-01	5.4781-02
4.0477+06	5.5694-08	2.2543-01	5.2841-02
3.6671+06	7.5853-08	2.7816-01	4.8171-02
3.3377+06	1.0262-07	3.4251-01	4.3570-02
3.0508+06	1.1944-07	3.6439-01	4.2306-02
2.7934+06	1.5141-07	4.2386-01	3.9478-02
2.5778+06	1.6893-07	4.3547-01	3.9509-02
2.3815+06	2.1095-07	5.0238-01	3.6897-02
2.2068+06	2.4026-07	5.3021-01	3.6357-02
2.0268+06	2.8776-07	5.8323-01	3.0418-02
1.8462+06	3.1768-07	5.8650-01	3.0834-02
1.6848+06	3.5295-07	5.9606-01	3.0937-02
1.5506+06	4.1645-07	6.4575-01	3.0446-02
1.4288+06	4.4757-07	6.3949-01	3.1162-02
1.3208+06	5.2403-07	6.9214-01	3.0503-02
1.2245+06	5.6456-07	6.9130-01	3.1147-02
1.1285+06	6.2335-07	7.0345-01	2.8583-02
1.0343+06	7.0066-07	7.2469-01	2.9487-02
9.5145+05	7.6208-07	7.2508-01	2.9839-02
8.7815+05	8.5584-07	7.5156-01	3.0597-02
8.1300+05	9.0541-07	7.3610-01	3.2697-02

RUN T1 [illegible]-24-66 TABLE E40 COMPUTED 4-14-69

FAST NEUTRON SPECTRUM FOR 10.5 INCHES LH2 AT 37 DEGREES USING A NE-211
DETECTOR BIAS = .0447 STANDARD LIGHT UNITS 0.87 INCH PRECOLLIMATOR
ENERGY RESOLUTION FOR GROUPING = .07 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
8.7701+06	1.5037-09	1.3188-02	1.8171-01
7.7691+06	3.2099-09	2.4938-02	1.5201-01
7.0906+06	5.1451-09	3.6482-02	1.2434-01
6.4973+06	7.5588-09	4.9112-02	1.0865-01
5.9755+06	1.0213-08	6.1028-02	9.8501-02
5.5141+06	1.3928-08	7.6800-02	8.8927-02
5.1042+06	1.7761-08	9.0656-02	8.2744-02
4.6549+06	2.2142-08	1.0307-01	6.4482-02
4.1879+06	3.2594-08	1.3650-01	5.6561-02
3.7878+06	3.9004-08	1.4774-01	5.5014-02
3.4424+06	5.4055-08	1.8608-01	4.9162-02
3.1422+06	6.0734-08	1.9084-01	4.8525-02
2.8796+06	7.1260-08	2.0520-01	4.7112-02
2.6486+06	8.7349-08	2.3135-01	4.4798-02
2.4444+06	1.0230-07	2.5006-01	4.3390-02
2.2629+06	1.0521-07	2.3808-01	4.4888-02
2.0761+06	1.2497-07	2.5945-01	3.7799-02
1.8891+06	1.4174-07	2.6776-01	3.7719-02
1.7262+06	1.6961-07	2.9278-01	3.6402-02
1.5835+06	1.8613-07	2.9474-01	3.7247-02
1.4579+06	1.8461-07	2.6914-01	3.9960-02
1.3466+06	1.9656-07	2.6469-01	4.0913-02
1.2476+06	2.2236-07	2.7742-01	4.0845-02
1.1489+06	2.3801-07	2.7345-01	3.7921-02
1.0522+06	2.5068-07	2.6377-01	4.0821-02
9.6721+05	2.6983-07	2.6098-01	4.1691-02

INTERMEDIATE NEUTRON SPECTRUM FOR 13.0-INCHES LH2 AT 78 DEGREES USING
A DETECTOR COMPOSED OF A B4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2195+06	7.8376-07	1.7394+00	5.9038-02
1.6615+06	1.1650-06	1.9356+00	5.5910-02
1.2903+06	1.3750-06	1.7742+00	6.0423-02
9.3676+05	2.4979-06	2.3399+00	3.7910-02
6.4729+05	4.0026-06	2.5908+00	3.7377-02
4.7399+05	5.8988-06	2.7960+00	4.0200-02
3.6206+05	7.2113-06	2.6109+00	4.7151-02
2.7195+05	9.5700-06	2.5959+00	4.1569-02
2.0029+05	1.3610-05	2.7259+00	4.7853-02
1.5394+05	1.9808-05	3.0492+00	5.2948-02
1.1794+05	2.2934-05	2.7048+00	5.4265-02

RUN T4 3-16-66 TABLE E42 COMPUTED 6-23-69

INTERMEDIATE NEUTRON SPECTRUM FOR 10.5-INCHES LH2 AT 78 DEGREES USING
A DETECTOR COMPOSED OF A B4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2193+06	9.3969-07	2.0855+00	5.3202-02
1.6615+06	1.3237-06	2.1993+00	5.1757-02
1.2953+06	1.7317-06	2.2344+00	5.3127-02
9.3676+05	2.7989-06	2.6219+00	3.5610-02
6.4729+05	4.3555-06	2.8193+00	3.5232-02
4.7399+05	7.2567-06	3.4396+00	3.5930-02
3.6206+05	8.4649-06	3.0648+00	4.2930-02
2.7125+05	1.3116-05	3.5577+00	3.5313-02
2.0029+05	1.7120-05	3.4290+00	4.2111-02
1.5394+05	1.9074-05	2.9363+00	5.3082-02
1.1794+05	1.7564-05	2.0715+00	5.9954-02
9.0133+04	1.8250-05	1.6449+00	7.9255-02
6.9295+04	1.2668-05	8.7783-01	9.8295-02
5.3520+04	1.3868-05	7.4222-01	1.1215-01

RUN TO 3-17-66 TABLE E43 COMPUTED 6-23-69

INTERMEDIATE NEUTRON SPECTRUM FOR 7.0-INCHES LH2 AT 78 DEGREES USING A DETECTOR COMPOSED OF A B4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2193+06	8.6982-07	1.9304+00	7.0817-02
1.6615+06	1.0840-06	1.8011+00	7.3245-02
1.2903+06	2.1274-06	2.7450+00	6.1383-02
9.3076+05	3.5000-06	3.2787+00	4.0629-02
6.4729+05	4.8208-06	3.1205+00	4.3282-02
4.7399+05	7.2387-06	3.4311+00	4.6186-02
3.6206+05	1.0343-05	3.7448+00	4.9703-02
2.7125+05	1.2015-05	3.2591+00	4.7235-02
2.0029+05	1.1169-05	2.2370+00	6.8168-02
1.5394+05	1.6439-05	2.5306+00	7.1211-02

RUN 18   5-17-66   TABLE E44   COMPUTED 6-23-69

INTERMEDIATE NEUTRON SPECTRUM FOR 4.5-INCHES LH2 AT 78 DEGREES USING
A DETECTOR COMPOSED OF A B4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20   LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2193+06	1.5914-06	3.5318+00	6.0802-02
1.6615+06	2.6315-06	4.3722+00	5.4595-02
1.2905+06	3.1735-06	4.0948+00	5.8371-02
9.3676+05	6.0092-06	5.6292+00	3.6037-02
6.4729+05	8.5819-06	5.5550+00	3.7477-02
4.7399+05	1.3980-05	6.6264+00	3.8125-02
3.6206+05	1.9688-05	7.1282+00	4.1812-02
2.7125+05	2.8705-05	7.7862+00	3.5567-02
2.0029+05	3.9501-05	7.9117+00	4.1867-02
1.5394+05	5.8880-05	9.0640+00	4.4879-02
1.1794+05	6.9386-05	8.1834+00	4.5175-02
9.0135+04	9.5521-05	8.6096+00	5.2058-02
6.9295+04	1.0851-04	7.5192+00	5.0998-02
5.3520+04	1.4357-04	7.6839+00	5.6033-02
4.1726+04	9.2440-05	3.8573+00	7.5378-02
3.2775+04	2.2923-04	7.5130+00	6.8843-02
2.6004+04	4.0517-04	1.0536+01	6.3693-02
2.0504+04	2.5258-04	5.1789+00	6.7574-02
1.6143+04	3.4120-04	5.5080+00	7.1338-02

INTERMEDIATE NEUTRON SPECTRUM FOR 2.5-INCHES LH2 AT 78 DEGREES USING A DETECTOR COMPOSED OF A B4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2193+06	2.0287-06	4.5023+00	5.2559-02
1.6615+06	2.5927-06	4.3078+00	5.3683-02
1.2903+06	3.9860-06	5.1431+00	5.0833-02
9.3676+05	6.7189-06	6.2940+00	3.3095-02
6.4729+05	1.0566-05	6.8393+00	3.3077-02
4.7399+05	1.7953-05	8.5095+00	3.3260-02
3.6206+05	2.3844-05	8.6330+00	3.7113-02
2.7125+05	3.4792-05	9.4373+00	3.1560-02
2.0029+05	5.2284-05	1.0472+01	3.5245-02
1.5394+05	6.5740-05	1.0120+01	4.1451-02
1.1794+05	8.2961-05	9.7844+00	3.9873-02
9.0133+04	1.2451-04	1.1222+01	4.4281-02
6.9295+04	1.1371-04	7.8795+00	4.8679-02
5.3520+04	1.6546-04	8.8554+00	4.9938-02
4.1728+04	1.9643-04	8.1966+00	4.9938-02
3.2775+04	2.8321-04	9.2822+00	5.6433-02
2.6004+04	4.5747-04	1.1896+01	6.1780-02

RUN T11 3-17-66 TABLE E46 COMPUTED 6-26-69

INTERMEDIATE NEUTRON SPECTRUM FOR EMPTY LH2 DEWAR AT 78 DEGREES USING
A DETECTOR COMPOSED OF A B4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2193+06	2.8859-06	6.4047+00	1.5659-01
1.6615+06	5.8645-06	9.7439+00	1.2157-01
1.2903+06	7.9884-06	1.0307+01	1.2245-01
9.3676+05	1.3182-05	1.2348+01	8.0380-02
6.4729+05	2.3055-05	1.4923+01	7.5104-02
4.7399+05	4.1197-05	1.9527+01	7.2351-02
3.6236+05	4.9607-05	1.7961+01	8.8214-02
2.7125+05	6.7753-05	1.8378+01	7.8724-02
2.0029+05	7.2941-05	1.4609+01	1.0901-01
1.5594+05	7.1045-05	1.0937+01	1.6253-01
1.1794+05	1.2732-04	1.5016+01	1.2838-01
8.5115+04	1.1037-04	9.3941+00	1.9376-01
4.6376+04	1.6648-04	7.7207+00	1.9943-01

RUN T14 5-17-66 TABLE E47 COMPUTED 6-23-69

INTERMEDIATE NEUTRON SPECTRUM FOR 13.0-INCHES LH2 AT 53 DEGREES USING A DETECTOR COMPOSED OF A B4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20 LARGEST FRACTIONAL ERROR = .50

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2193+06	5.0523-07	1.1213+00	9.0167-02
1.6615+06	1.3032-06	2.1653+00	6.4820-02
1.2903+06	1.6530-06	2.1329+00	6.7574-02
9.3676+05	2.6546-06	2.4867+00	4.4901-02
6.4729+05	3.5846-06	2.3203+00	4.8737-02
4.7399+05	5.8418-06	2.7690+00	5.0315-02
3.6206+05	5.9623-06	2.1587+00	6.3372-02
2.7125+05	8.2502-06	2.2379+00	5.4965-02
2.0029+05	1.3776-05	2.7592+00	5.8222-02
1.5394+05	1.1457-05	1.7637+00	8.5436-02
1.1794+05	1.8850-05	2.2232+00	7.1796-02

RUN T15 3-17-66 TABLE E48 COMPUTED 6-23-69

INTERMEDIATE NEUTRON SPECTRUM FOR 10.5-INCHES LH2 AT 53 DEGREES USING A DETECTOR COMPOSED OF A B4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20 LARGEST FRACTIONAL ERROR = .50

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2193+06	8.0943-07	1.7964+00	5.5806-02
1.6615+06	1.3043-06	2.1671+00	5.0761-02
1.2903+06	2.0666-06	2.6665+00	4.7346-02
9.3676+05	3.0128-06	2.8223+00	3.3201-02
6.4729+05	4.1904-06	2.7124+00	3.5285-02
4.7399+05	6.7843-06	3.2157+00	3.5940-02
3.6206+05	9.2968-06	3.3660+00	3.9772-02
2.7125+05	8.9633-06	2.4313+00	4.1089-02
2.0029+05	1.1090-05	2.2212+00	5.0233-02
1.5394+05	1.5236-05	2.3454+00	5.6769-02
1.1794+05	9.0766-06	1.0705+00	8.1541-02
8.5115+04	1.7618-06	1.4996-01	1.8078-01

RUN T16 5-17-66 TABLE E49 COMPUTED 6-23-69

INTERMEDIATE NEUTRON SPECTRUM FOR 7.0-INCHES LH2 AT 53 DEGREES USING
A DETECTOR COMPOSED OF A B4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20 LARGEST FRACTIONAL ERROR = .50

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2193+06	1.1152-06	2.4750+00	4.8570-02
1.6615+06	1.6868-06	2.8026+00	4.5601-02
1.2903+06	2.9732-06	3.8363+00	4.0327-02
9.3676+05	4.5147-06	4.2292+00	2.7844-02
6.4729+05	7.7350-06	5.0068+00	2.6530-02
4.7399+05	1.1319-05	5.3651+00	2.8550-02
3.6206+05	1.4975-05	5.4218+00	3.2062-02
2.7125+05	1.7753-05	4.8155+00	3.0073-02
2.0029+05	2.2311-05	4.4687+00	3.6768-02
1.5394+05	2.9050-05	4.4720+00	4.2808-02
1.1794+05	3.7628-05	4.4378+00	4.1079-02
9.0135+04	4.2764-05	3.8544+00	5.2016-02
6.9295+04	4.5003-05	3.1185+00	5.2668-02
5.3520+04	4.9431-05	2.6455+00	6.5724-02
4.1728+04	4.2422-05	1.7702+00	7.3841-02
3.2775+04	4.9112-05	1.6096+00	1.0758-01
2.6004+04	9.9692-06	2.5924-01	1.0827-01
2.0504+04	7.4593-05	1.5295+00	8.2423-02

RUN T17   3-17-66   TABLE E50   COMPUTED 6-25-69

INTERMEDIATE NEUTRON SPECTRUM FOR 4.5-INCHES LH2 AT 53 DEGREES USING
A DETECTOR COMPOSED OF A B4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20   LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2193+06	1.5728-06	3.4905+00	6.2932-02
1.6615+06	2.4709-06	4.1054+00	5.7977-02
1.2903+06	4.0822-06	5.2673+00	5.2963-02
9.3676+05	6.8812-06	6.4460+00	3.4690-02
6.4729+05	1.1514-05	7.4529+00	3.3352-02
4.7399+05	1.9868-05	9.4172+00	3.3150-02
3.6206+05	2.6787-05	9.6985+00	3.6911-02
2.7125+05	3.3897-05	9.1946+00	3.3567-02
2.0029+05	3.8654-05	7.7420+00	4.3093-02
1.5394+05	5.2602-05	8.0976+00	4.8832-02
1.1794+05	6.3271-05	7.4622+00	4.8912-02
9.0133+04	8.6425-05	7.7897+00	5.6705-02
6.9295+04	8.5820-05	5.9469+00	5.9080-02
5.3320+04	9.9784-05	5.3404+00	7.0273-02
4.1728+04	1.6165-04	6.7453+00	5.8926-02
3.2775+04	1.8016-04	5.9047+00	7.6923-02
2.6004+04	2.5641-04	6.6677+00	7.8934-02
2.0584+04	2.6490-04	5.4315+00	6.6667-02
1.6143+04	3.0067-04	4.8537+00	7.9682-02
1.2732+04	3.5760-04	4.5530+00	7.7152-02
1.0033+04	5.4921-04	5.5377+00	7.6584-02

RUN 120   3-18-66   TABLE E51   COMPUTED 6-25-69

INTERMEDIATE NEUTRON SPECTRUM FOR 13.0-INCHES LH2 AT 37 DEGREES USING
A DETECTOR COMPOSED OF A B4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20   LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2193+06	1.3988-06	3.1044+00	5.8026-02
1.6615+06	1.9028-06	3.1615+00	5.7448-02
1.2903+06	2.4501-06	3.1614+00	5.9444-02
9.3676+05	3.1504-06	2.9512+00	4.4108-02
6.4729+05	3.7396-06	2.4206+00	5.0637-02
4.7399+05	4.6842-06	2.2203+00	5.9028-02
3.6206+05	5.1583-06	1.8676+00	7.2932-02
2.7125+05	5.2125-06	1.4139+00	7.4744-02
2.0029+05	6.0379-06	1.2093+00	9.2450-02
1.5394+05	5.7820-06	8.9008-01	1.2804-01
1.1794+05	6.6435-06	7.8353-01	1.3245-01
9.0133+04	1.1554-05	1.0414+00	1.3131-01

RUN T21 [illegible]-18-66 TABLE E52 COMPUTED 6-25-69

INTERMEDIATE NEUTRON SPECTRUM FOR 10.5-INCHES LH2 AT 37 DEGREES USING
A DETECTOR COMPOSED OF A B4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20 LARGEST FRACTIONAL ERROR = .[illegible]0

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2193+06	1.4952-06	3.3183+00	5.3683-02
1.6615+06	2.1660-06	3.5988+00	5.1503-02
1.29[illegible]3+06	2.8912-06	3.7305+00	5.2342-02
9.3676+05	4.2230-06	3.9559+00	3.6637-02
6.4729+05	5.3629-06	3.4714+00	4.0656-02
4.7399+05	6.9532-06	3.2957+00	4.6274-02
3.6266+05	7.3386-06	2.6570+00	5.8722-02
2.7125+05	9.1592-06	2.4844+00	5.3916-02
2.0029+05	1.2215-05	2.4465+00	6.4820-02
1.5394+05	1.1179-05	1.7209+00	8.5749-02
1.1794+05	8.7418-06	1.0310+00	1.1111-01

INTERMEDIATE NEUTRON SPECTRUM FOR 7.0-INCHES LH2 AT 37 DEGREES USING A DETECTOR COMPOSED OF A B4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2193+06	2.6225-06	5.8201+00	4.0791-02
1.6615+06	3.6953-06	6.1397+00	3.9684-02
1.2903+06	5.0556-06	6.5232+00	3.9841-02
9.3676+05	8.0513-06	7.5421+00	2.6688-02
6.4729+05	1.1046-05	7.1500+00	2.8421-02
4.7399+05	1.6097-05	7.6298+00	3.0817-02
3.6206+05	1.9165-05	6.9389+00	3.6564-02
2.7125+05	2.0490-05	5.5579+00	3.6084-02
2.0029+05	2.6767-05	5.3612+00	4.3193-02
1.5394+05	3.3323-05	5.1297+00	5.1164-02
1.1794+05	3.6616-05	4.3185+00	5.4074-02
7.9714+04	4.0494-05	3.2279+00	7.2212-02
4.2674+04	2.5263-05	1.0781+00	1.4942-01
2.0684+04	7.2430-05	1.5126+00	1.2632-01
1.1408+04	1.2376-04	1.4119+00	1.3079-01
6.4860+03	3.2284-04	2.0939+00	1.2403-01
3.2489+03	4.1225-04	1.3394+00	1.4592-01
1.4888+03	1.0360-04	1.5424-01	1.0311-01

RUN T23 3-18-66 TABLE E54 COMPUTED 6-25-69

INTERMEDIATE NEUTRON SPECTRUM FOR 4.5-INCHES LH_2 AT 37 DEGREES USING A DETECTOR COMPOSED OF A B_4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2193+06	3.3158-06	7.3588+00	3.4155-02
1.6615+06	4.8715-06	8.0940+00	3.2544-02
1.2903+06	7.7933-06	1.0056+01	3.0217-02
9.3676+05	1.2462-05	1.1674+01	2.0289-02
6.4729+05	1.9706-05	1.2755+01	2.0111-02
4.7399+05	2.9217-05	1.3849+01	2.1595-02
3.6206+05	3.6859-05	1.3345+01	2.4842-02
2.7125+05	3.9148-05	1.0619+01	2.4689-02
2.0029+05	4.7760-05	9.5659+00	3.0350-02
1.5394+05	5.3260-05	8.1988+00	3.8473-02
1.1794+05	5.6141-05	6.6213+00	4.0696-02
9.0133+04	7.2778-05	6.5597+00	4.8633-02
6.9295+04	7.3637-05	5.1027+00	5.0125-02
5.3520+04	7.8903-05	4.2229+00	6.1898-02
4.1728+04	7.6689-05	3.2001+00	6.6637-02
3.2775+04	1.1953-04	3.9176+00	7.3681-02
2.6004+04	7.9942-05	2.0788+00	1.1918-01
2.0504+04	1.1647-04	2.3881+00	8.1759-02
1.3592+04	2.2542-05	3.0639-01	1.8634-01

RUN T24   3-19-66   TABLE E55   COMPUTED 6-25-69

INTERMEDIATE NEUTRON SPECTRUM FOR 2.5-INCHES LH2 AT 37 DEGREES USING A DETECTOR COMPOSED OF A B4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20   LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2193+06	3.7510-06	8.3246+00	3.0236-02
1.6615+06	5.8636-06	9.7424+00	2.7931-02
1.2903+06	8.6057-06	1.1104+01	2.7079-02
9.3676+05	1.5113-05	1.4157+01	1.7351-02
6.4729+05	2.6723-05	1.7298+01	1.6294-02
4.7399+05	4.3041-05	2.0401+01	1.6804-02
3.6206+05	5.3733-05	1.9455+01	1.9424-02
2.7125+05	6.3274-05	1.7163+01	1.8317-02
2.0029+05	7.5816-05	1.5185+01	2.2843-02
1.5394+05	9.2041-05	1.4169+01	2.7437-02
1.1794+05	9.5349-05	1.1245+01	2.9460-02
9.0133+04	1.1785-04	1.0622+01	3.5847-02
6.9295+04	1.0842-04	7.5130+00	3.9193-02
5.3520+04	1.4971-04	8.0125+00	4.2524-02
4.1728+04	1.3448-04	5.6116+00	4.7522-02
3.2775+04	2.1051-04	6.8995+00	5.3164-02
2.6004+04	2.3146-04	6.0189+00	6.6285-02
2.0504+04	2.7273-04	5.5921+00	4.9975-02
1.6143+04	3.2157-04	5.1911+00	5.7620-02
1.2732+04	2.7559-04	3.5088+00	6.6082-02
1.0083+04	4.1143-04	4.1484+00	6.2403-02
8.0292+03	8.9448-04	7.1820+00	6.1476-02
6.3844+03	6.6970-04	4.2756+00	7.8039-02
5.0443+03	9.2974-04	4.6899+00	6.4712-02
4.0034+03	6.5301-04	2.6143+00	8.7171-02
3.1979+03	6.7609-04	2.1621+00	8.9016-02
2.5453+03	1.2145-03	3.0913+00	7.3403-02
2.0248+03	1.5519-03	3.1423+00	7.4702-02
1.6149+03	3.3079-03	5.3419+00	5.7774-02
1.2884+03	3.7758-03	4.8647+00	6.3500-02
1.0274+03	5.0866-03	5.2260+00	6.1176-02

5 AT INTERNAL SEQUENCE NUMBER 0103,LOCATION 014000

RUN T25   3-19-66   TABLE E56   COMPUTED 6-26-69

INTERMEDIATE NEUTRON SPECTRUM FOR EMPTY LH2 DEWAR AT 37 DEGREES USING
A DETECTOR COMPOSED OF A B4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20   LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2193+06	4.1621-06	9.2369+00	4.8031-02
1.6615+06	5.6333-06	9.3597+00	4.7652-02
1.2903+06	9.8531-06	1.2713+01	4.1844-02
9.3676+05	1.6989-05	1.5915+01	2.6923-02
6.4729+05	3.0533-05	1.9764+01	2.4919-02
4.7399+05	4.7619-05	2.2571+01	2.6161-02
3.6206+05	5.4326-05	1.9669+01	3.2146-02
2.7125+05	6.2574-05	1.6973+01	3.1217-02
2.0029+05	7.6451-05	1.5312+01	3.9984-02
1.5394+05	9.2589-05	1.4253+01	5.0364-02
1.1794+05	9.0770-05	1.0705+01	6.0165-02
9.0133+04	9.2417-05	8.3298+00	8.9214-02
6.9295+04	8.8992-05	6.1667+00	1.0779-01
5.3520+04	9.3607-05	5.0098+00	1.6213-01

RUN T27 3-19-66 TABLE E57 COMPUTED 6-25-69

INTERMEDIATE NEUTRON SPECTRUM FOR 13.0 INCHES LH2 AT 15 DEGREES USING A DETECTOR COMPOSED OF A B4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20 LARGEST FRACTIONAL ERROR = .50

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2193+06	3.3517-06	7.4364+00	4.1024-02
1.6615+06	3.6272-06	6.0266+00	4.5539-02
1.2903+06	4.0365-06	5.2083+00	5.0689-02
9.3676+05	4.9664-06	4.6523+00	3.8738-02
6.4729+05	4.9986-06	3.2355+00	4.7815-02
4.7399+05	5.3978-06	2.5585+00	5.9613-02
3.6206+05	6.4674-06	2.3416+00	7.1175-02
2.7125+05	6.2803-06	1.7035+00	7.4003-02
2.0029+05	6.4152-06	1.2849+00	9.7312-02
1.5394+05	3.4941-06	5.3788-01	1.7514-01
1.1794+05	5.1171-06	6.0351-01	1.6485-01
8.0627+04	1.0975-05	8.8488-01	1.3063-01
5.2539+04	7.9295-06	4.1661-01	1.9389-01

RUN 128   3-19-66   TABLE E58   COMPUTED 6-25-69

INTERMEDIATE NEUTRON SPECTRUM FOR 10.5-INCHES LH2 AT 15 DEGREES USING
A DETECTOR COMPOSED OF A B4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20   LARGEST FRACTIONAL ERROR = .50

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2193+06	5.2632-06	1.1681+01	3.1114-02
1.6615+06	6.0893-06	1.0117+01	3.3408-02
1.2903+06	7.6946-06	9.9283+00	3.4900-02
9.3676+05	9.2142-06	8.6315+00	2.6958-02
6.4729+05	1.0079-05	6.5240+00	3.2075-02
4.7399+05	1.2944-05	6.1353+00	3.7242-02
3.6266+05	1.2655-05	4.5819+00	4.8622-02
2.7125+05	1.2750-05	3.4584+00	4.9447-02
2.0029+05	1.8436-05	3.6925+00	5.5815-02
1.5394+05	2.1255-05	3.2720+00	6.9505-02
1.1794+05	1.8737-05	2.2098+00	8.0064-02
9.0133+04	2.7645-05	2.4917+00	9.2848-02
6.9295+04	1.5795-05	1.0945+00	1.2309-01
5.3520+04	2.5811-05	1.3814+00	1.2039-01

INTERMEDIATE NEUTRON SPECTRUM FOR 7.0-INCHES LH2 AT 15 DEGREES USING
A DETECTOR COMPOSED OF A B4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2193+06	7.6968-06	1.7082+01	2.4508-02
1.6615+06	9.5726-06	1.5905+01	2.5384-02
1.2903+06	1.3299-05	1.7160+01	2.5295-02
9.3676+05	1.7061-05	1.5982+01	1.8869-02
6.4729+05	2.2325-05	1.4451+01	2.0616-02
4.7399+05	2.7470-05	1.3021+01	2.4163-02
3.6206+05	2.7507-05	9.9592+00	3.1469-02
2.7125+05	3.0076-05	8.1581+00	3.0836-02
2.0029+05	3.4075-05	6.8249+00	3.9445-02
1.5394+05	4.2837-05	6.5943+00	4.6845-02
1.1794+05	5.2758-05	6.2223+00	4.6245-02
9.0133+04	5.5025-05	4.9596+00	6.0237-02
6.9295+04	6.1278-05	4.2463+00	6.0467-02
5.3520+04	9.0832-05	4.8613+00	6.3823-02
4.1728+04	1.0734-04	4.4791+00	6.1039-02
3.2775+04	1.3298-04	4.3584+00	7.4247-02
2.6004+04	2.7400-04	7.1251+00	7.2112-02
2.0504+04	2.0008-04	4.1024+00	6.6785-02
1.6143+04	2.9084-04	4.6950+00	6.9656-02
1.2732+04	3.2258-04	4.1071+00	6.9505-02
1.0083+04	4.5461-04	4.5838+00	7.0552-02

RUN T30 3-19-66 TABLE E60 COMPUTED 6-25-69

INTERMEDIATE NEUTRON SPECTRUM FOR 4.5-INCHES LH2 AT 15 DEGREES USING A DETECTOR COMPOSED OF A B4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2193+06	1.0042-05	2.2286+01	2.0879-02
1.6615+06	1.3651-05	2.2681+01	2.0690-02
1.2933+06	1.8198-05	2.3481+01	2.1054-02
9.3676+05	2.6722-05	2.5032+01	1.4728-02
6.4729+05	3.9390-05	2.5497+01	1.5139-02
4.7399+05	5.1753-05	2.4530+01	1.7231-02
3.6206+05	5.4321-05	1.9667+01	2.1811-02
2.7125+05	5.3511-05	1.4515+01	2.2445-02
2.0029+05	5.9721-05	1.1962+01	2.9148-02
1.5394+05	6.6722-05	1.0271+01	3.6418-02
1.1794+05	7.9209-05	9.3419+00	3.6418-02
9.0133+04	8.8681-05	7.9931+00	4.6474-02
6.9295+04	1.0078-04	6.9836+00	4.5980-02
5.3520+04	1.1609-04	6.2131+00	5.4074-02
4.1728+04	1.2484-04	5.2093+00	5.5902-02
3.2775+04	2.0426-04	6.6946+00	6.3628-02
2.6004+04	4.2270-04	1.0992+01	6.0746-02
2.0504+04	2.5787-04	5.2874+00	5.8222-02
1.6143+04	3.4236-04	5.5267+00	6.2137-02
1.2732+04	4.3640-04	5.5562+00	5.8621-02
1.0083+04	3.4141-04	3.4424+00	7.6923-02
8.0292+03	8.3904-04	6.7368+00	7.1247-02

RUN 131 3-19-66 TABLE E61 COMPUTED 6-25-69

INTERMEDIATE NEUTRON SPECTRUM FOR 2.5-INCHES LH2 AT 15 DEGREES USING A DETECTOR COMPOSED OF A B4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (E.V)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2193+06	1.1944-05	2.6507+01	1.9178-02
1.6615+06	1.7263-05	2.8682+01	1.8437-02
1.2903+06	2.4867-05	3.2086+01	1.8055-02
9.3676+05	3.9231-05	3.6750+01	1.2222-02
6.4729+05	6.3238-05	4.0933+01	1.1997-02
4.7399+05	8.6830-05	4.1157+01	1.3413-02
3.6206+05	9.4568-05	3.4239+01	1.6642-02
2.7125+05	9.9767-05	2.7062+01	1.6590-02
2.0029+05	1.1147-04	2.2326+01	2.1313-02
1.5394+05	1.2374-04	1.9049+01	2.7013-02
1.1794+05	1.2640-04	1.4908+01	2.9283-02
9.0133+04	1.5289-04	1.3780+01	3.5529-02
6.9295+04	1.4622-04	1.0132+01	3.8462-02
5.3520+04	2.2105-04	1.1831+01	3.9778-02
4.1728+04	2.1294-04	8.8856+00	4.3121-02
3.2775+04	3.4614-04	1.1345+01	4.7576-02
2.6004+04	3.9697-04	1.0323+01	5.8763-02
2.0504+04	4.3541-04	8.9276+00	4.4614-02
1.6143+04	5.7987-04	9.3608+00	4.8269-02
1.2732+04	6.5459-04	8.3342+00	4.8679-02
1.0083+04	8.1467-04	8.2143+00	5.0912-02

RUN T32 3-19-66 TABLE E62 COMPUTED 6-26-69

INTERMEDIATE NEUTRON SPECTRUM FOR EMPTY LH2 DEWAR AT 15 DEGREES USING A DETECTOR COMPOSED OF A B4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2193+06	1.6361-05	3.6310+01	2.7542-02
1.6615+06	2.6492-05	4.4016+01	2.4903-02
1.2903+06	4.1581-05	5.3652+01	2.3312-02
9.3676+05	7.1919-05	6.7371+01	1.5079-02
6.4729+05	1.2516-04	8.1015+01	1.4245-02
4.7399+05	1.8072-04	8.5659+01	1.5602-02
3.6206+05	2.0780-04	7.5236+01	1.9035-02
2.7125+05	2.1973-04	5.9602+01	1.9248-02
2.0029+05	2.4182-04	4.8434+01	2.5823-02
1.5394+05	2.6231-04	4.0380+01	3.4448-02
1.1794+05	2.5482-04	3.0053+01	4.0775-02
9.0133+04	2.2340-04	2.0136+01	6.8904-02
6.9295+04	1.7205-04	1.1922+01	9.9403-02
5.3520+04	1.7082-04	9.1423+00	1.5523-01

RUN T54 3-19-66 TABLE E63 COMPUTED 6-25-69

INTERMEDIATE NEUTRON SPECTRUM FOR 13.0-INCHES LH2 AT 5 DEGREES USING
A DETECTOR COMPOSED OF A B4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2193+06	1.1224-05	2.4909+01	2.0562-02
1.6615+06	9.0043-06	1.4961+01	2.6525-02
1.2903+06	9.1241-06	1.1773+01	3.0945-02
9.3676+05	8.0994-06	7.5872+00	2.7633-02
6.4729+05	7.5152-06	4.8645+00	3.5861-02
4.7399+05	7.8788-06	3.7345+00	4.6048-02
3.6206+05	8.8334-06	3.1982+00	5.6024-02
2.7125+05	9.6784-06	2.6253+00	5.5140-02
2.0029+05	8.3118-06	1.6648+00	8.0090-02

RUN T37 3-19-66 TABLE E64 COMPUTED 6-25-69

INTERMEDIATE NEUTRON SPECTRUM FOR 10.5-INCHES LH2 AT 5 DEGREES USING
A DETECTOR COMPOSED OF A B4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2193+06	1.7968-05	3.9876+01	1.6054-02
1.6615+06	1.5375-05	2.5546+01	2.0064-02
1.2903+06	1.5195-05	1.9606+01	2.3714-02
9.3676+05	1.4902-05	1.3960+01	2.0152-02
6.4729+05	1.4496-05	9.3831+00	2.5554-02
4.7399+05	1.5581-05	7.3852+00	3.2168-02
3.6206+05	1.5991-05	5.7897+00	4.1225-02
2.7125+05	1.4420-05	3.9114+00	4.4473-02
2.0029+05	1.6578-05	3.3204+00	5.6469-02
1.5394+05	2.0715-05	3.1889+00	6.7481-02
1.1794+05	1.8780-05	2.2149+00	7.7429-02
9.0133+04	2.1198-05	1.9106+00	9.5001-02
6.9295+04	3.3913-05	2.3500+00	8.1379-02
5.2329+04	1.7742-05	9.2842-01	1.5394-01
3.9998+04	1.6186-05	6.4741-01	1.7100-01
3.1022+04	5.1468-05	1.5966+00	1.4374-01
2.4332+04	3.0573-05	7.4390-01	1.7303-01

RUN 738   3-19-66   TABLE E65   COMPUTED 6-25-69

INTERMEDIATE NEUTRON SPECTRUM FOR 7.0-INCHES LH2 AT 5 DEGREES USING
A DETECTOR COMPOSED OF A B4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20   LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2193+06	3.7881-05	8.4069+01	1.1386-02
1.6615+06	3.6564-05	6.0751+01	1.3419-02
1.2903+06	3.6872-05	4.7576+01	1.5721-02
9.3676+05	4.0105-05	3.7569+01	1.2721-02
6.4729+05	4.1194-05	2.6664+01	1.5715-02
4.7399+05	4.3075-05	2.0417+01	1.9960-02
3.6206+05	4.0324-05	1.4600+01	2.6958-02
2.7125+05	3.8531-05	1.0452+01	2.8061-02
2.0029+05	4.0178-05	8.0473+00	3.7987-02
1.5394+05	4.2063-05	6.4752+00	4.8679-02
1.1794+05	5.3738-05	6.3379+00	4.7673-02
9.0133+04	7.5891-05	6.8403+00	5.3452-02
6.9295+04	6.6402-05	4.6013+00	6.0302-02
5.3520+04	1.1890-04	6.3635+00	5.7073-02
4.1723+04	1.2337-04	5.1480+00	5.9976-02
3.2775+04	1.6778-04	5.4990+00	7.0888-02
2.6004+04	3.8027-04	9.8885+00	6.5233-02
2.0504+04	2.3259-04	4.7690+00	6.3888-02
1.6143+04	3.3438-04	5.3979+00	6.7884-02
1.2732+04	4.8086-04	6.1223+00	5.9976-02
1.0083+04	6.0766-04	6.1270+00	6.5653-02

RUN T39   3-20-66   TABLE E66   COMPUTED 6-25-69

INTERMEDIATE NEUTRON SPECTRUM FOR 4.5-INCHES LH2 AT 5 DEGREES USING A DETECTOR COMPOSED OF A B4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20   LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2193+06	6.3007-05	1.3983+02	1.0180-02
1.6615+06	6.3979-05	1.0630+02	1.1720-02
1.2903+06	7.1352-05	9.2065+01	1.3077-02
9.3076+05	8.2228-05	7.7028+01	1.0331-02
6.4729+05	9.6217-05	6.2280+01	1.1951-02
4.7399+05	1.0369-04	4.9148+01	1.5033-02
3.6206+05	9.0210-05	3.2661+01	2.1011-02
2.7125+05	8.2735-05	2.2442+01	2.2345-02
2.0029+05	8.6166-05	1.7258+01	3.0072-02
1.5394+05	8.8236-05	1.3583+01	3.9442-02
1.1794+05	9.8555-05	1.1624+01	4.0879-02
9.0133+04	1.2775-04	1.1514+01	4.8314-02
6.9295+04	1.2750-04	8.8351+00	5.1031-02
5.3520+04	1.8208-04	9.7449+00	5.4636-02
4.1728+04	2.1661-04	9.0387+00	5.2228-02
3.2775+04	3.3961-04	1.1131+01	6.3423-02
2.6004+04	5.4201-04	1.4094+01	6.5067-02
2.0504+04	4.5213-04	9.2705+00	5.4011-02
1.6143+04	7.7213-04	1.2464+01	5.2030-02
1.2732+04	6.1396-04	7.8169+00	6.1663-02
1.0023+04	9.3353-04	9.4128+00	5.9804-02
8.0292+03	1.7790-03	1.4284+01	6.1757-02
6.3844+03	2.3274-03	1.4859+01	5.7890-02
5.0445+03	2.2053-03	1.1124+01	5.8461-02
4.0034+03	2.9155-03	1.1672+01	5.7054-02
3.1979+03	3.0388-03	9.7178+00	6.0366-02
2.5453+03	4.6162-03	1.1750+01	5.3513-02

RUN 140   5-20-66   TABLE E67   COMPUTED 6-25-69

INTERMEDIATE NEUTRON SPECTRUM FOR 2.5-INCHES LH2 AT 5 DEGREES USING
A DETECTOR COMPOSED OF A B4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20   LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2193+06	6.6963-05	1.4861+02	1.3061-02
1.6015+06	8.1334-05	1.3514+02	1.3707-02
1.2903+06	1.0398-04	1.3417+02	1.4254-02
9.3676+05	1.3856-04	1.2980+02	1.0475-02
6.4729+05	1.8546-04	1.2005+02	1.1305-02
4.7399+05	2.2414-04	1.0624+02	1.3389-02
3.6206+05	2.1746-04	7.8734+01	1.7707-02
2.7125+05	2.0569-04	5.5793+01	1.8544-02
2.0029+05	2.0227-04	4.0513+01	2.5598-02
1.5394+05	2.0782-04	3.1992+01	3.3518-02
1.1794+05	2.0542-04	2.4227+01	3.6840-02
9.0133+04	2.4770-04	2.2326+01	4.5464-02
6.9295+04	2.1242-04	1.4720+01	5.1400-02
5.3520+04	4.0307-04	2.1572+01	4.7864-02
4.1728+04	3.8274-04	1.5971+01	5.2044-02
3.2775+04	6.0674-04	1.9886+01	5.6870-02
2.6004+04	1.0092-03	2.6243+01	5.9245-02
2.0564+04	7.5372-04	1.5454+01	5.3255-02
1.6143+04	9.9425-04	1.6050+01	5.9623-02
1.2732+04	1.2670-03	1.6131+01	5.6344-02
1.0083+04	1.8698-03	1.8853+01	5.4579-02
8.0292+03	2.7694-03	2.2236+01	6.3577-02
6.3644+03	3.6300-03	2.3175+01	6.0623-02
5.0443+03	4.6895-03	2.3655+01	5.2472-02
4.0034+03	5.1318-03	2.0545+01	5.6174-02

RUN T41 3-20-66 TABLE E68 COMPUTED 6-26-69

INTERMEDIATE NEUTRON SPECTRUM FOR EMPTY LH2 DEWAR AT 5 DEGREES USING
A DETECTOR COMPOSED OF A B4C-PARAFFIN DISK AND A NE-226 SCINTILLATOR
ENERGY RESOLUTION FOR GROUPING = .20 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2193+06	1.3428-04	2.9801+02	1.4053-02
1.6615+06	1.8080-04	3.0040+02	1.4035-02
1.2903+06	2.5306-04	3.2652+02	1.3979-02
9.3676+05	3.9741-04	3.7228+02	9.5155-03
6.4729+05	6.0293-04	3.9027+02	9.6834-03
4.7399+05	8.1769-04	3.8758+02	1.0986-02
3.6206+05	8.8149-04	3.1915+02	1.3931-02
2.7125+05	8.9888-04	2.4382+02	1.4408-02
2.0029+05	9.4854-04	1.8998+02	1.9874-02
1.5394+05	9.9949-04	1.5386+02	2.7165-02
1.1794+05	9.5729-04	1.1290+02	3.3093-02
9.0123+04	7.3398-04	6.6156+01	6.4617-02
6.9295+04	4.9731-04	3.4461+01	1.2473-01

THERMAL NEUTRON SPECTRUM FOR 13.0-INCHES LH2 AT 37 DEGREES USING
A BANK OF 32 VERTICAL BF3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .10 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.9551+01	4.7553-03	1.4052-01	1.3600-01
5.8599+00	1.3709-02	8.0333-02	1.7443-01
2.8966+00	3.1325-02	9.0736-02	1.9061-01
2.0592+00	4.9775-02	1.0250-01	1.5751-01
1.5387+00	7.6603-02	1.1787-01	1.3001-01
1.1931+00	7.3554-02	8.7757-02	1.6894-01
9.5213-01	9.5398-02	9.0831-02	1.4894-01
7.7739-01	1.1209-01	8.7138-02	1.5679-01
6.4672-01	1.0464-01	6.7673-02	1.9323-01
5.4641-01	1.4403-01	7.8699-02	1.5435-01
4.6776-01	2.2330-01	1.0445-01	1.2014-01
4.0493-01	2.3114-01	9.3596-02	1.2219-01
3.5398-01	2.6520-01	9.3875-02	1.1708-01
3.1257-01	2.1440-01	6.6908-02	1.6028-01
2.7719-01	3.2424-01	8.9876-02	1.1516-01
2.4744-01	4.2481-01	1.0528-01	1.0243-01
2.1224-01	4.5307-01	9.6160-02	7.6070-02
1.7515-01	4.1989-01	7.3544-02	9.5818-02
1.4699-01	4.8165-01	7.0798-02	1.0239-01
1.2512-01	6.4352-01	8.0517-02	8.0728-02
1.0778-01	7.0864-01	7.6377-02	8.1716-02
9.3822-02	7.0057-01	6.5729-02	9.8002-02
8.2406-02	7.1742-01	5.9120-02	1.0633-01
7.2953-02	7.9420-01	5.7939-02	1.0703-01
6.5038-02	1.0528+00	6.8472-02	9.3503-02
5.6879-02	1.2339+00	7.0183-02	7.4452-02
4.8918-02	1.7586+00	8.6027-02	5.7204-02
4.2519-02	2.2702+00	9.6527-02	5.4755-02
3.7333-02	2.5358+00	9.4593-02	5.6139-02
3.2995-02	3.7132+00	1.2252-01	4.8426-02
2.9395-02	4.8183+00	1.4163-01	4.6064-02
2.5914-02	7.6048+00	1.9707-01	3.2659-02
2.2637-02	1.0913+01	2.4704-01	3.0291-02
1.9954-02	1.7809+01	3.5536-01	2.5180-02
1.7730-02	3.8062+01	6.7484-01	1.8502-02
1.5868-02	7.0934+01	1.1256+00	1.4481-02
1.4112-02	1.1826+02	1.6689+00	1.0849-02
1.2471-02	1.9696+02	2.4563+00	9.1535-03
1.1094-02	2.4878+02	2.7600+00	8.8861-03
9.9278-03	2.7186+02	2.6990+00	9.2182-03
8.8451-03	2.8610+02	2.5306+00	8.9723-03
7.8507-03	3.0856+02	2.4224+00	9.5071-03
7.0141-03	3.1800+02	2.2305+00	1.0202-02

RUNS R1,R2 2-20-66 | TABLE E69 | 4-3-69
CONTINUED

THERMAL NEUTRON SPECTRUM FOR 13.0-INCHES LH2 AT 37 DEGREES USING
A BANK OF 32 VERTICAL BF3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .10   LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
6.2510-03	3.2484+02	2.0306+00	9.6608-03
5.55[illegible]7-03	3.2866+02	1.8269+00	9.8819-03
4.9750-03	3.5084+02	1.7454+00	1.0235-02
4.4471-03	3.8907+02	1.7302+00	8.7702-03
3.9708-03	3.8801+02	1.5407+00	9.2258-03
3.5442-03	4.0821+02	1.4468+00	9.3653-03
3.1627-03	4.1571+02	1.3148+00	1.0193-02
2.8235-03	4.2217+02	1.1920+00	1.0575-02
2.5218-03	4.3102+02	1.0869+00	1.1551-02
2.2545-03	4.4582+02	1.0051+00	1.1949-02
2.0172-03	4.4935+02	9.0643-01	1.3135-02
1.8073-03	4.4957+02	8.1251-01	1.3859-02
1.6211-03	4.3624+02	7.0719-01	1.5675-02
1.4564-03	4.2798+02	6.2331-01	1.6750-02
1.3051-03	4.0071+02	5.2297-01	1.8063-02
1.1674-03	3.8767+02	4.5257-01	1.9316-02
1.0466-03	3.6321+02	3.8014-01	2.1951-02
9.4057-04	3.3754+02	3.1748-01	2.4192-02
8.4446-04	3.0924+02	2.6114-01	2.6892-02
7.5778-04	2.8058+02	2.1262-01	2.9996-02
6.79[illegible]8-04	2.5011+02	1.7004-01	3.3606-02
6.1010-04	2.2081+02	1.3472-01	3.7429-02

RUNS R4,R5 2-20-68 TABLE E70 4-3-69

THERMAL NEUTRON SPECTRUM FOR 10.5-INCHES LH_2 AT 37 DEGREES USING
A BANK OF 32 VERTICAL BF_3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .10 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.9551+01	4.9491-03	1.4625-01	1.3992-01
7.3472+00	1.7665-02	1.2979-01	1.6337-01
4.3725+00	2.6577-02	1.1621-01	1.7447-01
2.8966+00	5.0471-02	1.4619-01	1.3171-01
2.0592+00	6.4930-02	1.3370-01	1.3701-01
1.5387+00	1.0471-01	1.6112-01	1.0777-01
1.1931+00	1.4653-01	1.7482-01	9.6796-02
9.5213-01	1.6099-01	1.5328-01	1.0736-01
7.7739-01	2.0620-01	1.6030-01	9.7757-02
6.4672-01	2.2638-01	1.4640-01	1.0352-01
5.4641-01	2.3196-01	1.2675-01	1.1341-01
4.6776-01	2.6657-01	1.2469-01	1.1388-01
4.0493-01	3.6339-01	1.4715-01	9.1560-02
3.5398-01	3.1094-01	1.1007-01	1.1687-01
3.1207-01	4.1755-01	1.3030-01	1.0364-01
2.7719-01	4.1037-01	1.1375-01	1.0787-01
2.4784-01	4.8027-01	1.1903-01	9.9124-02
2.1224-01	6.5919-01	1.3991-01	6.4350-02
1.7515-01	7.5432-01	1.3212-01	6.6741-02
1.4699-01	8.8692-01	1.3037-01	6.7764-02
1.2512-01	1.1014+00	1.3781-01	6.0815-02
1.0778-01	8.4685-01	9.1273-02	8.0226-02
9.3822-02	1.0185+00	9.5558-02	7.6555-02
8.2406-02	1.2405+00	1.0222-01	7.4797-02
7.2953-02	1.0919+00	7.9657-02	9.4511-02
6.5038-02	1.2922+00	8.4042-02	9.1225-02
5.6879-02	1.8713+00	1.0644-01	5.9024-02
4.8918-02	2.0207+00	9.8849-02	6.5804-02
4.2519-02	2.7149+00	1.1543-01	5.8603-02
3.7303-02	3.8009+00	1.4178-01	5.2277-02
3.2995-02	5.3803+00	1.7752-01	4.6125-02
2.9395-02	6.7892+00	1.9957-01	4.3349-02
2.5914-02	1.0321+01	2.6746-01	3.2899-02
2.2637-02	1.6675+01	3.7747-01	2.7805-02
1.9954-02	2.7987+01	5.5845-01	2.3564-02
1.7730-02	5.6590+01	1.0033+00	1.7710-02
1.5866-02	1.0255+02	1.6273+00	1.4171-02
1.4112-02	1.6556+02	2.3364+00	1.0820-02
1.2471-02	2.7083+02	3.3775+00	9.2717-03
1.1094-02	3.3374+02	3.7025+00	9.0805-03
9.9278-03	3.6583+02	3.6319+00	9.4246-03
8.8451-03	3.8952+02	3.4453+00	9.1170-03
7.8507-03	4.1620+02	3.2675+00	9.6878-03

RUNS R4,R3 2-20-66 TABLE E70 4-3-69
CONTINUED

THERMAL NEUTRON SPECTRUM FOR 10.5-INCHES LH2 AT 37 DEGREES USING
A BANK OF 32 VERTICAL BF3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .10 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
7.0141-03	4.1461+02	2.9081+00	1.0564-02
6.2510-03	4.4575+02	2.7864+00	9.7751-03
5.5587-03	4.5030+02	2.5031+00	9.9988-03
4.9750-03	4.7394+02	2.3579+00	1.0426-02
4.4471-03	5.3435+02	2.3763+00	8.8599-03
3.9708-03	5.2537+02	2.0861+00	9.4177-03
3.5442-03	5.5303+02	1.9600+00	9.5039-03
3.1627-03	5.6781+02	1.7956+00	1.0336-02
2.8235-03	5.9158+02	1.6703+00	1.0574-02
2.5218-03	6.0835+02	1.5341+00	1.1489-02
2.2545-03	6.2379+02	1.4063+00	1.1957-02
2.0172-03	6.2507+02	1.2609+00	1.3170-02
1.8073-03	6.2181+02	1.1238+00	1.3953-02
1.6211-03	6.2595+02	1.0147+00	1.5355-02
1.4564-03	5.9131+02	8.6118-01	1.6749-02
1.3051-03	5.5895+02	7.2949-01	1.8161-02
1.1674-03	5.3922+02	6.2949-01	1.9582-02
1.0466-03	5.0891+02	5.3263-01	2.2227-02
9.4057-04	4.7584+02	4.4756-01	2.4506-02
8.4446-04	4.3994+02	3.7151-01	2.7253-02
7.5778-04	4.0051+02	3.0350-01	3.0572-02
6.7988-04	3.6096+02	2.4541-01	3.4460-02
6.1010-04	3.2025+02	1.9538-01	3.8976-02

RUNS R5,R6 2-20-66 TABLE E71 6-3-69

THERMAL NEUTRON SPECTRUM FOR 7.0-INCHES LH_2 AT 37 DEGREES USING
A BANK OF 32 VERTICAL BF_3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .05 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
4.4266+01	5.6329-03	2.4935-01	1.0590-01
1.4836+01	1.8468-02	2.7399-01	1.0947-01
7.3472+00	3.8537-02	2.8314-01	1.0472-01
4.3725+00	7.8919-02	3.4507-01	8.0759-02
2.8966+00	1.1774-01	3.4105-01	7.8016-02
2.0592+00	1.4215-01	2.9272-01	8.6454-02
1.5357+00	2.0884-01	3.2134-01	7.7697-02
1.1931+00	2.8751-01	3.4303-01	7.0601-02
9.5213-01	3.2361-01	3.0812-01	7.4908-02
7.7739-01	3.8815-01	3.0174-01	7.4797-02
6.4672-01	4.9433-01	3.1969-01	7.0158-02
5.4641-01	5.8042-01	3.1715-01	6.8216-02
4.6776-01	6.5308-01	3.0548-01	6.7009-02
4.0493-01	5.9703-01	2.4176-01	8.4235-02
3.5398-01	6.9457-01	2.4586-01	7.7856-02
3.1207-01	8.1578-01	2.5458-01	7.2923-02
2.7719-01	9.0263-01	2.5020-01	7.5615-02
2.4784-01	1.2098+00	2.9984-01	6.7418-02
2.2292-01	1.3479+00	3.0047-01	6.4343-02
2.0157-01	1.5185+00	3.0608-01	6.5500-02
1.8315-01	1.7842+00	3.2678-01	6.0897-02
1.6715-01	1.6784+00	2.8054-01	6.7976-02
1.5315-01	1.6359+00	2.5054-01	7.4694-02
1.4074-01	1.1952+00	1.6833-01	9.7436-02
1.2995-01	1.5709+00	2.0414-01	8.1324-02
1.2028-01	1.7935+00	2.1572-01	8.2960-02
1.1165-01	1.6665+00	1.8606-01	8.7953-02
1.0392-01	1.7729+00	1.8424-01	8.8129-02
9.6961-02	1.8953+00	1.8377-01	9.2243-02
9.0682-02	1.6328+00	1.4807-01	1.0421-01
8.4992-02	1.9960+00	1.6964-01	9.6224-02
7.9820-02	2.5892+00	2.0667-01	8.2751-02
7.5107-02	2.1772+00	1.6352-01	1.0347-01
7.0800-02	2.4871+00	1.7609-01	9.3534-02
6.6851-02	2.7103+00	1.8119-01	9.5225-02
6.3224-02	2.8382+00	1.7944-01	9.2457-02
5.9883-02	3.3534+00	2.0081-01	8.5372-02
5.6801-02	3.2853+00	1.8661-01	9.6415-02
5.2632-02	3.5996+00	1.8945-01	6.6815-02
4.7720-02	4.0468+00	1.9311-01	6.4130-02
4.3466-02	5.3322+00	2.3177-01	5.6968-02
3.9759-02	5.8873+00	2.3407-01	5.7847-02
3.6508-02	8.0895+00	2.9533-01	5.1259-02

RUNS R5,R6 2-20-66 TABLE E71 4-3-69
CONTINUED

THERMAL NEUTRON SPECTRUM FOR 7.0-INCHES LH2 AT 37 DEGREES USING
A BANK OF 32 VERTICAL BF3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .05 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
3.3642-02	9.4226+00	3.1700-01	5.0914-02
3.1152-02	1.3164+01	4.0943-01	4.4424-02
2.8841-02	1.6759+01	4.8335-01	4.0948-02
2.6820-02	2.0170+01	5.4096-01	3.9527-02
2.5007-02	2.5287+01	6.3235-01	3.6338-02
2.3375-02	3.2813+01	7.6700-01	3.3609-02
2.1990-02	4.4103+01	9.6586-01	3.0053-02
2.0562-02	5.2065+01	1.0706+00	2.9236-02
1.9346-02	7.0922+01	1.3721+00	2.6067-02
1.8236-02	9.4324+01	1.7201+00	2.3547-02
1.7223-02	1.3627+02	2.3470+00	2.0377-02
1.6295-02	1.8034+02	2.9386+00	1.8360-02
1.5441-02	2.1761+02	3.3601+00	1.7321-02
1.4653-02	2.7541+02	4.0356+00	1.6013-02
1.3752-02	3.2513+02	4.4712+00	1.2600-02
1.2769-02	4.1816+02	5.3395+00	1.1750-02
1.1886-02	4.8682+02	5.7863+00	1.1463-02
1.1088-02	5.2885+02	5.8639+00	1.1595-02
1.0367-02	5.4618+02	5.6622+00	1.1985-02
9.7118-03	5.7201+02	5.5552+00	1.2330-02
9.1168-03	6.0384+02	5.5051+00	1.2590-02
8.5733-03	6.2934+02	5.3955+00	1.2933-02
8.0776-03	6.3289+02	5.1122+00	1.3524-02
7.6238-03	6.5446+02	4.9895+00	1.3908-02
7.2063-03	6.6623+02	4.8011+00	1.4419-02
6.8219-03	6.7335+02	4.5935+00	1.4856-02
6.4676-03	6.6980+02	4.3320+00	1.5150-02
6.0887-03	7.2519+02	4.4155+00	1.2602-02
5.6939-03	6.8500+02	3.9003+00	1.3031-02
5.3362-03	7.0533+02	3.7638+00	1.3638-02
5.0110-03	7.4272+02	3.7218+00	1.3845-02
4.7149-03	8.1170+02	3.8271+00	1.2726-02
4.4443-03	8.2771+02	3.6786+00	1.2546-02
4.1963-03	7.9864+02	3.3513+00	1.2892-02
3.9655-03	8.2060+02	3.2566+00	1.3240-02
3.7587-03	8.4987+02	3.1944+00	1.3605-02
3.5650-03	8.5690+02	3.0548+00	1.4185-02
3.3647-03	8.8069+02	2.9633+00	1.3135-02
3.1610-03	8.7784+02	2.7749+00	1.3855-02
2.9753-03	9.2402+02	2.7492+00	1.4234-02
2.8054-03	9.3275+02	2.6167+00	1.4896-02
2.6497-03	9.4033+02	2.4916+00	1.5576-02
2.5065-03	9.5848+02	2.4024+00	1.6177-02

RUNS R5,R6 2-20-66 TABLE E71 4-3-69
CONTINUED

THERMAL NEUTRON SPECTRUM FOR 7.0-INCHES LH2 AT 37 DEGREES USING
A BANK OF 32 VERTICAL BF3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .05 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.3747-03	9.5968+02	2.2790+00	1.6962-02
2.2530-03	9.9282+02	2.2368+00	1.7464-02
2.1293-03	9.7750+02	2.0819+00	1.6892-02
2.0063-03	1.0084+03	2.0232+00	1.7571-02
1.8933-03	9.7184+02	1.8400+00	1.8775-02
1.7896-03	9.8588+02	1.7643+00	1.9628-02
1.6941-03	9.9383+02	1.6836+00	2.0480-02
1.6061-03	1.0120+03	1.6254+00	2.1275-02
1.5184-03	9.7182+02	1.4756+00	2.1182-02
1.4316-03	9.7701+02	1.3987+00	2.2288-02
1.3520-03	9.6659+02	1.3068+00	2.3622-02
1.2789-03	9.5977+02	1.2274+00	2.4675-02
1.2116-03	9.4803+02	1.1486+00	2.6078-02
1.1494-03	9.3450+02	1.0741+00	2.7550-02
1.0881-03	9.1665+02	9.9741-01	2.7341-02
1.0276-03	8.9472+02	9.1959-01	2.9125-02
9.7243-04	8.7470+02	8.5058-01	3.0980-02
9.2141-04	8.5129+02	7.8439-01	3.3005-02
8.7430-04	8.2836+02	7.2424-01	3.5113-02
8.2814-04	8.0225+02	6.6438-01	3.5345-02
7.8310-04	7.7429+02	6.0635-01	3.7862-02
7.4183-04	7.4297+02	5.5101-01	4.0630-02
7.0336-04	7.1597+02	5.0360-01	4.3439-02
6.6615-04	6.8436+02	4.5589-01	4.4256-02
6.3024-04	6.5203+02	4.1080-01	4.7624-02
5.9679-04	6.1679+02	3.6809-01	5.1276-02
5.6610-04	5.8184+02	3.2938-01	5.5062-02

THERMAL NEUTRON SPECTRUM FOR 4.5-INCHES LH2 AT 37 DEGREES USING
A BANK OF 32 VERTICAL BF3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .05 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
4.4266+01	7.1965-03	3.1856-01	8.8753-02
1.4836+01	2.7567-02	4.0898-01	7.6827-02
7.3472+00	5.6235-02	4.1317-01	7.5219-02
4.3725+00	1.1704-01	5.1176-01	5.9180-02
2.8966+00	1.7272-01	5.0030-01	5.8721-02
2.0592+00	2.5539-01	5.2590-01	5.4019-02
1.5387+00	3.0201-01	4.6470-01	6.0406-02
1.1931+00	4.1282-01	4.9254-01	5.2289-02
9.5213-01	5.2061-01	4.9569-01	5.3609-02
7.7739-01	6.0786-01	4.7254-01	5.4765-02
6.4672-01	6.9868-01	4.5185-01	5.3603-02
5.4641-01	8.4918-01	4.6400-01	5.1980-02
4.6776-01	9.1158-01	4.2640-01	5.4700-02
4.0493-01	9.1746-01	3.7151-01	6.1639-02
3.5398-01	1.1522+00	4.0786-01	5.4128-02
3.1267-01	1.2006+00	3.7467-01	5.9590-02
2.7719-01	1.5333+00	4.2502-01	5.2391-02
2.4734-01	1.5177+00	3.7615-01	5.8797-02
2.2292-01	2.0537+00	4.5781-01	5.1128-02
2.0157-01	2.0730+00	4.1785-01	5.4305-02
1.8315-01	2.3928+00	4.3824-01	5.1466-02
1.6715-01	2.5700+00	4.2958-01	5.2229-02
1.5315-01	2.4499+00	3.7520-01	5.6925-02
1.4064-01	2.5840+00	3.6393-01	5.8349-02
1.2995-01	2.6034+00	3.3831-01	6.1013-02
1.1597-01	2.7381+00	3.1754-01	6.8354-02
1.0392-01	2.3637+00	2.4564-01	7.4100-02
9.6981-02	3.0026+00	2.9114-01	6.7636-02
9.0062-02	3.1900+00	2.8928-01	6.9156-02
8.4992-02	3.1039+00	2.6381-01	7.3171-02
7.9820-02	3.6854+00	2.9417-01	6.9940-02
7.5167-02	3.2458+00	2.4378-01	7.4860-02
7.0880-02	3.4496+00	2.4423-01	7.7521-02
6.6851-02	3.6691+00	2.4528-01	7.7725-02
6.3224-02	4.5991+00	2.9077-01	6.9086-02
5.9863-02	4.6028+00	2.7563-01	7.0896-02
5.6801-02	5.9379+00	3.3728-01	6.1119-02
5.2632-02	5.6194+00	2.9576-01	4.9236-02
4.7720-02	6.9466+00	3.3149-01	4.6431-02
4.3466-02	8.4894+00	3.6900-01	4.4095-02
3.9759-02	9.4922+00	3.7740-01	4.4868-02
3.6518-02	1.1777+01	4.2995-01	4.1766-02
3.3642-02	1.4079+01	4.7365-01	4.0292-02

THERMAL NEUTRON SPECTRUM FOR 4.5-INCHES LH2 AT 37 DEGREES USING
A BANK OF 32 VERTICAL BF3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .05 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
3.1102-02	1.8840+01	5.8596-01	3.6693-02
2.8841-02	2.7831+01	8.0267-01	3.1004-02
2.6820-02	3.0053+01	8.0602-01	3.1493-02
2.5007-02	3.8721+01	9.6830-01	2.9148-02
2.3375-02	4.8204+01	1.1268+00	2.7242-02
2.1960-02	5.9630+01	1.3059+00	2.5902-02
2.0562-02	7.4349+01	1.5288+00	2.4215-02
1.9346-02	9.4387+01	1.8260+00	2.2319-02
1.8236-02	1.2767+02	2.3282+00	2.0087-02
1.7223-02	1.7369+02	2.9915+00	1.7859-02
1.6295-02	2.2[illegible]7+02	3.6121+00	1.6444-02
1.5441-02	2.6[illegible]9+02	4.1133+00	1.5588-02
1.4653-02	3.0265+02	4.4378+00	1.5188-02
1.3752-02	3.4833+02	4.7902+00	1.2116-02
1.2769-02	4.5289+02	5.7830+00	1.1228-02
1.1886-02	5.1540+02	6.1260+00	1.1104-02
1.1088-02	5.3714+02	5.9558+00	1.1450-02
1.0367-02	5.7552+02	5.9664+00	1.1615-02
9.7118-03	6.0580+02	5.8834+00	1.1897-02
9.1168-03	6.1918+02	5.6449+00	1.2355-02
8.5733-03	6.4454+02	5.5258+00	1.2707-02
8.0776-03	6.8866+02	5.5627+00	1.2879-02
7.6238-03	6.9035+02	5.2631+00	1.3461-02
7.2063-03	7.3587+02	5.3029+00	1.3653-02
6.8219-03	7.3283+02	4.9993+00	1.4174-02
6.4676-03	7.2596+02	4.6952+00	1.4463-02
6.0827-03	7.6119+02	4.6347+00	1.2232-02
5.6939-03	7.4982+02	4.2694+00	1.2401-02
5.3362-03	7.6807+02	4.0986+00	1.2986-02
5.0110-03	8.1618+02	4.0899+00	1.3132-02
4.7149-03	8.7463+02	4.1238+00	1.2206-02
4.4443-03	8.7768+02	3.9007+00	1.2114-02
4.1963-03	8.4281+02	3.5367+00	1.2490-02
3.9685-03	8.5086+02	3.3766+00	1.2943-02
3.7587-03	8.7841+02	3.3017+00	1.3328-02
3.5650-03	8.9143+02	3.1779+00	1.3816-02
3.3647-03	9.0911+02	3.0589+00	1.2842-02
3.1610-03	9.2293+02	2.9174+00	1.3450-02
2.9753-03	9.6485+02	2.8707+00	1.3839-02
2.8054-03	1.0032+03	2.8144+00	1.4284-02
2.6497-03	1.0349+03	2.7422+00	1.4762-02
2.5065-03	1.0256+03	2.5707+00	1.5568-02
2.3747-03	1.0159+03	2.4125+00	1.6404-02

RUNS R8,R7 2-20-66 TABLE E72 4-3-69
CONTINUED

THERMAL NEUTRON SPECTRUM FOR 4.5-INCHES LH2 AT 37 DEGREES USING
A BANK OF 32 VERTICAL BF3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .05 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.2530-03	1.0359+03	2.3339+00	1.7039-02
2.1298-03	1.0733+03	2.2859+00	1.6021-02
2.0063-03	1.0488+03	2.1042+00	1.7152-02
1.8933-03	1.0989+03	2.0805+00	1.7550-02
1.7896-03	1.0888+03	1.9485+00	1.8519-02
1.6941-03	1.0869+03	1.8413+00	1.9498-02
1.6061-03	1.0947+03	1.7582+00	2.0380-02
1.5184-03	1.0825+03	1.6437+00	1.9968-02
1.4316-03	1.0691+03	1.5305+00	2.1202-02
1.3520-03	1.1013+03	1.4890+00	2.1991-02
1.2789-03	1.0888+03	1.3925+00	2.3064-02
1.2116-03	1.0768+03	1.3047+00	2.4362-02
1.1494-03	1.0633+03	1.2222+00	2.5717-02
1.0881-03	1.0440+03	1.1360+00	2.5513-02
1.0278-03	1.0220+03	1.0504+00	2.7143-02
9.7243-04	9.9926+02	9.7171-01	2.8875-02
9.2141-04	9.7546+02	8.9880-01	3.0722-02
8.7430-04	9.5116+02	8.3160-01	3.2659-02
8.2814-04	9.2136+02	7.6302-01	3.2880-02
7.8310-04	8.9105+02	6.9778-01	3.5199-02
7.4163-04	8.6002+02	6.3782-01	3.7682-02
7.0338-04	8.2858+02	5.8281-01	4.0310-02
6.6615-04	7.9331+02	5.2846-01	4.1064-02
6.3004-04	7.5577+02	4.7617-01	4.4223-02
5.9679-04	7.1924+02	4.2924-01	4.7528-02
5.6610-04	6.7671+02	3.8309-01	5.1156-02

THERMAL NEUTRON SPECTRUM FOR 2.5-INCHES LH2 AT 37 DEGREES USING
A BANK OF 32 VERTICAL BF3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .05 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
4.4266+01	1.1523-02	5.1008-01	5.8015-02
1.4836+01	3.7294-02	5.5329-01	5.9157-02
7.3472+00	8.7031-02	6.3943-01	5.0552-02
4.3725+00	1.3469-01	5.8893-01	5.4650-02
2.8966+00	2.1691-01	6.2830-01	4.9565-02
2.0592+00	2.9785-01	6.1333-01	4.7870-02
1.5387+00	3.8808-01	5.9714-01	4.7515-02
1.1931+00	4.9902-01	5.9538-01	4.6917-02
9.5213-01	6.2649-01	5.9650-01	4.4865-02
7.7739-01	7.4522-01	5.7933-01	4.5806-02
6.4672-01	9.3617-01	6.0544-01	4.1845-02
5.4641-01	1.0047+00	5.4898-01	4.6850-02
4.6776-01	1.0402+00	4.8656-01	4.9028-02
4.0493-01	1.1733+00	4.7510-01	4.9260-02
3.5398-01	1.3284+00	4.7023-01	4.9554-02
3.1207-01	1.4146+00	4.4145-01	5.0456-02
2.7719-01	1.7502+00	4.8514-01	4.7658-02
2.4784-01	2.1201+00	5.2545-01	4.3496-02
2.2292-01	2.6071+00	5.8117-01	4.1896-02
2.0157-01	2.6667+00	5.3753-01	4.4452-02
1.8315-01	2.9116+00	5.3326-01	4.4858-02
1.6715-01	3.0531+00	5.1033-01	4.4198-02
1.5315-01	3.2191+00	4.9301-01	4.6295-02
1.4084-01	3.3121+00	4.6648-01	4.7514-02
1.2995-01	3.2699+00	4.2492-01	5.0168-02
1.2028-01	3.5137+00	4.2263-01	5.0729-02
1.1165-01	3.6912+00	4.1212-01	5.2385-02
1.0392-01	3.3993+00	3.5326-01	5.7381-02
9.6961-02	3.6499+00	3.5390-01	5.5903-02
9.0682-02	3.4773+00	3.1533-01	6.4638-02
8.4992-02	4.3450+00	3.6929-01	5.5407-02
7.9820-02	4.3788+00	3.4952-01	5.7854-02
7.5107-02	4.0935+00	3.0745-01	6.4554-02
7.0800-02	4.6855+00	3.3173-01	6.1975-02
6.6851-02	4.6633+00	3.1175-01	6.1306-02
6.3224-02	5.0646+00	3.2020-01	6.4934-02
5.9883-02	6.0847+00	3.6437-01	5.7847-02
5.6801-02	6.3817+00	3.6249-01	5.7802-02
5.2632-02	6.9156+00	3.6398-01	4.2634-02
4.7720-02	8.0984+00	3.8646-01	4.1097-02
4.3460-02	1.0388+01	4.5152-01	3.7446-02
3.9759-02	1.3058+01	5.1917-01	3.4909-02
3.6508-02	1.5464+01	5.6456-01	3.4282-02

THERMAL NEUTRON SPECTRUM FOR 2.5-INCHES LH2 AT 37 DEGREES USING
A BANK OF 32 VERTICAL BF3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .05 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
3.3642-02	1.7111+01	5.7565-01	3.4288-02
3.1102-02	2.2749+01	7.0754-01	3.0892-02
2.8841-02	2.9855+01	8.6105-01	2.8432-02
2.6820-02	3.5849+01	9.6147-01	2.7145-02
2.5007-02	4.4842+01	1.1214+00	2.5451-02
2.3375-02	5.2983+01	1.2385+00	2.4569-02
2.1900-02	6.4661+01	1.4161+00	2.3222-02
2.0562-02	7.9143+01	1.6273+00	2.1914-02
1.9346-02	9.4333+01	1.8250+00	2.1062-02
1.8236-02	1.2411+02	2.2633+00	1.9142-02
1.7223-02	1.7022+02	2.9317+00	1.6961-02
1.6295-02	2.0040+02	3.2655+00	1.6315-02
1.5441-02	2.3334+02	3.6030+00	1.5618-02
1.4653-02	2.6559+02	3.8917+00	1.5266-02
1.3752-02	3.0236+02	4.1581+00	1.2219-02
1.2769-02	3.6185+02	4.6205+00	1.1804-02
1.1886-02	4.1196+02	4.8966+00	1.1657-02
1.1088-02	4.3289+02	4.7999+00	1.1966-02
1.0367-02	4.6537+02	4.8245+00	1.2133-02
9.7118-03	4.7781+02	4.6404+00	1.2591-02
9.1168-03	4.9685+02	4.5297+00	1.2975-02
8.5733-03	5.2755+02	4.5228+00	1.3192-02
8.0776-03	5.5334+02	4.4697+00	1.3507-02
7.6238-03	5.7865+02	4.4115+00	1.3830-02
7.2063-03	5.8732+02	4.2324+00	1.4372-02
6.8219-03	6.0874+02	4.1528+00	1.4616-02
6.4676-03	6.1465+02	3.9753+00	1.4776-02
6.0887-03	6.4064+02	3.9007+00	1.2535-02
5.6939-03	5.9941+02	3.4130+00	1.3025-02
5.3362-03	6.5030+02	3.4701+00	1.3302-02
5.0110-03	6.7641+02	3.3895+00	1.3550-02
4.7149-03	7.0932+02	3.3444+00	1.2737-02
4.4443-03	6.9017+02	3.0673+00	1.2838-02
4.1963-03	6.6419+02	2.7871+00	1.3208-02
3.9685-03	6.7090+02	2.6625+00	1.3689-02
3.7587-03	7.1343+02	2.6816+00	1.3895-02
3.5650-03	7.1823+02	2.5605+00	1.4474-02
3.3647-03	7.1347+02	2.4006+00	1.3642-02
3.1610-03	7.5503+02	2.3866+00	1.3972-02
2.9753-03	7.7847+02	2.3162+00	1.4494-02
2.8054-03	7.8959+02	2.2151+00	1.5125-02
2.6497-03	8.1179+02	2.1510+00	1.5647-02
2.5065-03	8.3829+02	2.1012+00	1.6201-02

RUNS R9,R10 2-20-66 TABLE E73 4-3-69
CONTINUED

THERMAL NEUTRON SPECTRUM FOR 2.5-INCHES LH2 AT 37 DEGREES USING
A BANK OF 32 VERTICAL BF3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .05 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.3747-03	8.5139+02	2.0218+00	1.6838-02
2.2530-03	8.8006+02	1.9828+00	1.7349-02
2.1298-03	8.7971+02	1.8736+00	1.6643-02
2.0063-03	8.8754+02	1.7807+00	1.7458-02
1.8933-03	8.5674+02	1.6221+00	1.8731-02
1.7896-03	8.8606+02	1.5857+00	1.9341-02
1.6941-03	8.9360+02	1.5138+00	2.0256-02
1.6061-03	8.8600+02	1.4230+00	2.1303-02
1.5184-03	8.9600+02	1.3605+00	2.0618-02
1.4316-03	8.9296+02	1.2784+00	2.1909-02
1.3520-03	8.9144+02	1.2052+00	2.3018-02
1.2789-03	9.0071+02	1.1519+00	2.3781-02
1.2116-03	8.9468+02	1.0840+00	2.5060-02
1.1494-03	8.8460+02	1.0168+00	2.6432-02
1.0881-03	8.7367+02	9.5064-01	2.6139-02
1.0278-03	8.5850+02	8.8237-01	2.7749-02
9.7243-04	8.4189+02	8.1868-01	2.9465-02
9.2141-04	8.2574+02	7.6085-01	3.1266-02
8.7430-04	8.0881+02	7.0714-01	3.3149-02
8.2814-04	7.8678+02	6.5156-01	3.3288-02
7.8310-04	7.6503+02	5.9909-01	3.5519-02
7.4163-04	7.4089+02	5.4947-01	3.7935-02
7.0338-04	7.1489+02	5.0284-01	4.0517-02
6.6615-04	6.9009+02	4.5970-01	4.1069-02
6.3004-04	6.6141+02	4.1671-01	4.4051-02
5.9679-04	6.3157+02	3.7691-01	4.7199-02
5.6610-04	5.9882+02	3.3899-01	5.0537-02

THERMAL NEUTRON SPECTRUM FOR 13.0-INCHES LH2 AT 78 DEGREES USING
A BANK OF 32 VERTICAL BF3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .10 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
3.0003+00	6.1019-02	1.8308-01	1.9445-01
1.3923+00	9.3118-02	1.2965-01	1.9650-01
7.7346-01	1.9215-01	1.4862-01	1.7823-01
5.4761-01	2.4748-01	1.3552-01	1.7184-01
4.1874-01	3.0088-01	1.2599-01	1.8855-01
3.3945-01	3.6137-01	1.2267-01	1.8298-01
2.8074-01	3.8193-01	1.0722-01	1.9377-01
2.4084-01	5.1873-01	1.2493-01	1.7293-01
2.0160-01	4.6804-01	9.4357-02	1.6825-01
1.6757-01	8.6111-01	1.4430-01	1.1383-01
1.4637-01	7.4839-01	1.0954-01	1.4946-01
1.2895-01	1.0585+00	1.3649-01	1.1275-01
1.1447-01	1.0400+00	1.1905-01	1.3589-01
1.0229-01	1.1551+00	1.1816-01	1.3331-01
9.0819-02	8.8620-01	8.0484-02	1.6708-01
8.0161-02	1.1727+00	9.4005-02	1.3762-01
7.1275-02	1.2852+00	9.1603-02	1.3534-01
6.3788-02	1.6098+00	1.0269-01	1.2124-01
5.6853-02	1.5937+00	9.0607-02	1.2418-01
5.0489-02	1.8915+00	9.5500-02	1.1542-01
4.5137-02	2.2016+00	9.9374-02	1.0360-01
4.0258-02	2.8989+00	1.1670-01	7.9742-02
3.5832-02	3.2864+00	1.1776-01	7.8700-02
3.2101-02	3.5805+00	1.1494-01	8.6667-02
2.8724-02	5.2324+00	1.5030-01	6.0286-02
2.5678-02	6.8742+00	1.7652-01	5.5489-02
2.2954-02	8.4571+00	1.9412-01	5.0181-02
2.0519-02	1.1982+01	2.4586-01	4.7114-02
1.8357-02	1.8422+01	3.3817-01	3.5973-02
1.6438-02	3.0492+01	5.0123-01	2.8761-02
1.4737-02	5.0851+01	7.4939-01	2.2572-02
1.3219-02	7.3081+01	9.6606-01	2.0595-02
1.1865-02	1.0585+02	1.2559+00	1.7546-02
1.0611-02	1.3268+02	1.4079+00	1.6226-02
9.5008-03	1.4836+02	1.4095+00	1.6546-02
8.5217-03	1.6651+02	1.4189+00	1.6535-02
7.6293-03	1.8293+02	1.3956+00	1.6527-02
6.8439-03	1.9004+02	1.3006+00	1.7651-02
6.1534-03	1.9259+02	1.1851+00	1.7205-02
5.5266-03	2.0307+02	1.1223+00	1.7063-02
4.9607-03	2.1441+02	1.0636+00	1.6958-02
4.4522-03	2.2721+02	1.0116+00	1.5565-02
3.9964-03	2.3556+02	9.4139-01	1.5474-02

RKNS T1,T2 2-22-66 TABLE E74 4-3-69
CONTINUED

THERMAL NEUTRON SPECTRUM FOR 13.0-INCHES LH2 AT 78 DEGREES USING
A BANK OF 32 VERTICAL BF3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .10 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
3.5885-03	2.5291+02	9.0757-01	1.5977-02
3.2242-03	2.5961+02	8.3703-01	1.6839-02
2.8992-03	2.7707+02	8.0328-01	1.7434-02
2.6040-03	2.8355+02	7.3836-01	1.8615-02
2.3369-03	2.9435+02	6.8787-01	1.9457-02
2.1007-03	3.1286+02	6.5722-01	2.0120-02
1.8880-03	3.0629+02	5.7828-01	2.1798-02
1.6969-03	3.0946+02	5.2512-01	2.3954-02
1.5258-03	2.9706+02	4.5325-01	2.5613-02
1.3706-03	2.7690+02	3.7952-01	3.0328-02
1.2305-03	2.9573+02	3.6390-01	3.0282-02
1.1045-03	2.6750+02	2.9545-01	3.4781-02
9.9159-04	2.5307+02	2.5094-01	4.1954-02
8.9057-04	2.3808+02	2.1203-01	4.5196-02
8.0035-04	2.0455+02	1.6371-01	5.6531-02
7.1985-04	1.8082+02	1.3016-01	6.9326-02
6.4740-04	1.5019+02	9.7233-02	9.0561-02
5.8174-04	1.1192+02	6.5108-02	1.5564-01

THERMAL NEUTRON SPECTRUM FOR 10.5-INCHES LH2 AT 78 DEGREES USING
A BANK OF 32 VERTICAL BF3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .10 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
6.7179+00	4.1298-02	2.7744-01	1.7707-01
3.0003+00	6.9553-02	2.0868-01	1.7535-01
1.6674+00	1.2212-01	2.0362-01	1.7586-01
1.1173+00	1.7728-01	1.9807-01	1.5997-01
8.6186-01	2.7293-01	2.3523-01	1.6985-01
7.3981-01	2.8596-01	2.1156-01	1.8129-01
6.4198-01	2.9432-01	1.8895-01	1.9911-01
5.6234-01	3.5072-01	1.9722-01	1.7712-01
4.8257-01	3.7427-01	1.8061-01	1.5314-01
3.9649-01	3.2328-01	1.2818-01	1.8451-01
3.3080-01	4.9296-01	1.6307-01	1.5035-01
2.8694-01	4.9833-01	1.4299-01	1.6980-01
2.5126-01	4.9987-01	1.2560-01	1.8003-01
2.2184-01	6.2275-01	1.3815-01	1.5652-01
1.9730-01	7.9241-01	1.5634-01	1.3327-01
1.7662-01	6.5330-01	1.1539-01	1.8622-01
1.5643-01	1.0776+00	1.6357-01	1.0752-01
1.3725-01	1.2095+00	1.6600-01	1.0315-01
1.2139-01	8.7348-01	1.0603-01	1.6706-01
1.0812-01	1.3843+00	1.4967-01	1.0449-01
9.6922-02	1.2520+00	1.2135-01	1.2771-01
8.6315-02	1.4199+00	1.2256-01	1.1604-01
7.6417-02	1.7802+00	1.3604-01	9.8875-02
6.8130-02	1.7600+00	1.1991-01	1.1146-01
6.0497-02	1.8941+00	1.1459-01	9.5718-02
5.3530-02	2.3505+00	1.2582-01	9.2328-02
4.7701-02	2.6834+00	1.2800-01	8.7910-02
4.2776-02	3.0310+00	1.2965-01	8.4469-02
3.8266-02	3.8406+00	1.4696-01	8.0291-02
3.4157-02	5.0543+00	1.7264-01	6.7754-02
3.0458-02	5.1541+00	1.5698-01	7.1666-02
2.7136-02	8.5725+00	2.3262-01	5.1295-02
2.4336-02	1.0933+01	2.6607-01	5.0479-02
2.1820-02	1.4315+01	3.1235-01	4.3216-02
1.9562-02	2.0691+01	4.0476-01	3.8093-02
1.7549-02	3.3098+01	5.8084-01	3.0307-02
1.5675-02	6.0420+01	9.4708-01	2.2939-02
1.4017-02	9.5044+01	1.3322+00	1.9820-02
1.2545-02	1.3718+02	1.7209+00	1.6999-02
1.1237-02	1.8479+02	2.0765+00	1.5850-02
1.0076-02	2.1491+02	2.1654+00	1.5357-02
9.0104-03	2.3365+02	2.1053+00	1.5422-02
8.0719-03	2.4512+02	1.9786+00	1.6534-02

RUNS T4,T3 2-22-66 TABLE E75 4-3-69
CONTINUED

THERMAL NEUTRON SPECTRUM FOR 10.5-INCHES LH2 AT 78 DEGREES USING
A BANK OF 32 VERTICAL BF3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .10 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
7.2469-03	2.6441+02	1.9162+00	1.6617-02
6.4963-03	2.7406+02	1.7804+00	1.6710-02
5.8183-03	2.8162+02	1.6385+00	1.6126-02
5.2083-03	3.0314+02	1.5788+00	1.6357-02
4.6622-03	3.1378+02	1.4629+00	1.5389-02
4.1747-03	3.5044+02	1.4630+00	1.4320-02
3.7401-03	3.6733+02	1.3739+00	1.4815-02
3.3531-03	3.6460+02	1.2225+00	1.5939-02
3.0089-03	3.9054+02	1.1751+00	1.6567-02
2.7031-03	4.2066+02	1.1371+00	1.7056-02
2.4263-03	4.2006+02	1.0192+00	1.8049-02
2.1768-03	4.2924+02	9.3437-01	1.9384-02
1.9564-03	4.4139+02	8.6354-01	2.0575-02
1.7583-03	4.5583+02	8.0149-01	2.1526-02
1.5781-03	4.2251+02	6.6676-01	2.3947-02
1.4173-03	4.3720+02	6.1964-01	2.5844-02
1.2741-03	3.9579+02	5.0428-01	2.9249-02
1.1448-03	3.9192+02	4.4867-01	3.1674-02
1.0286-03	3.8151+02	3.9242-01	3.5105-02
9.2445-04	3.1668+02	2.9275-01	4.3502-02
8.3121-04	2.9150+02	2.4230-01	4.9007-02
7.4704-04	2.9314+02	2.1899-01	5.3082-02
6.7128-04	2.4625+02	1.6530-01	6.6028-02
6.0332-04	2.3351+02	1.4088-01	7.6139-02

THERMAL NEUTRON SPECTRUM FOR 7.0-INCHES LH2 AT 78 DEGREES US[illegible]
A BANK OF 32 VERTICAL BF3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .05 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
2.0529+01	1.9918-02	4.0890-01	1.9396-01
1.0615+01	3.7893-02	4.0223-01	1.7735-01
6.4805+00	6.0661-02	3.9311-01	1.6620-01
4.3672+00	8.2041-02	3.5829-01	1.7580-01
2.9361+00	1.0717-01	3.1466-01	1.5322-01
2.0855+00	1.6350-01	3.4098-01	1.5686-01
1.7428+00	2.1726-01	3.7864-01	1.8352-01
1.5618+00	2.5820-01	4.0326-01	1.7403-01
1.3413+00	2.0693-01	2.7756-01	1.7658-01
1.1105+00	3.2208-01	3.5767-01	1.2654-01
9.7308-01	4.6998-01	4.5733-01	1.3962-01
8.6186-01	3.5187-01	3.0326-01	1.4259-01
7.1452-01	3.5435-01	2.5319-01	1.3588-01
6.0019-01	4.5992-01	2.7604-01	1.4189-01
5.4435-01	6.1194-01	3.3311-01	1.5819-01
5.1160-01	6.6575-01	3.4060-01	1.5756-01
4.6806-01	6.2388-01	2.9201-01	1.2399-01
4.2931-01	9.1272-01	3.9184-01	1.3131-01
4.0626-01	7.2343-01	2.9390-01	1.7211-01
3.7520-01	5.7292-01	2.1496-01	1.6261-01
3.3882-01	6.9378-01	2.3507-01	1.4075-01
3.0749-01	8.6219-01	2.6511-01	1.2769-01
2.8031-01	8.9879-01	2.5194-01	1.2402-01
2.5658-01	9.7585-01	2.5038-01	1.2354-01
2.3574-01	1.1351+00	2.6759-01	1.2403-01
2.1734-01	1.1645+00	2.5309-01	1.1611-01
2.0101-01	1.3458+00	2.7052-01	1.0939-01
1.8645-01	1.2331+00	2.2991-01	1.3363-01
1.7343-01	1.3391+00	2.3224-01	1.2819-01
1.6172-01	1.5096+00	2.4413-01	1.2361-01
1.5115-01	1.5393+00	2.3267-01	1.3067-01
1.4159-01	1.9112+00	2.7061-01	1.0771-01
1.3291-01	2.1393+00	2.8433-01	1.0493-01
1.2500-01	2.1547+00	2.6934-01	1.1110-01
1.1778-01	1.8907+00	2.2269-01	1.2705-01
1.1116-01	2.3090+00	2.5667-01	1.0664-01
1.0509-01	1.9040+00	2.0009-01	1.3575-01
9.9498-02	2.2271+00	2.2159-01	1.1269-01
9.4346-02	2.5194+00	2.3770-01	1.1621-01
8.8467-02	1.9768+00	1.7488-01	1.2173-01
8.2088-02	2.9810+00	2.4470-01	8.6930-02
7.6374-02	3.0098+00	2.2987-01	9.3653-02
7.1238-02	2.2917+00	1.6326-01	1.1550-01

RUNS T5,T6 2-22-66 TABLE E76 4-3-69
CONTINUED

THERMAL NEUTRON SPECTRUM FOR 7.0-INCHES LH2 AT 78 DEGREES USING
A BANK OF 32 VERTICAL BF3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .05 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
6.6602-02	2.8548+00	1.9014-01	1.0355-01
6.2404-02	3.3586+00	2.0959-01	9.9696-02
5.8590-02	3.5986+00	2.1084-01	9.2356-02
5.5116-02	3.4583+00	1.9061-01	1.0059-01
5.1943-02	4.1955+00	2.1793-01	9.3400-02
4.9036-02	4.8811+00	2.3935-01	9.0651-02
4.6366-02	4.1593+00	1.9285-01	1.1171-01
4.3908-02	5.4013+00	2.3716-01	9.3544-02
4.1643-02	5.5655+00	2.3176-01	9.7585-02
3.9220-02	6.2175+00	2.4385-01	7.8769-02
3.6697-02	6.8749+00	2.5229-01	7.6987-02
3.4410-02	7.7738+00	2.6750-01	7.6543-02
3.2332-02	9.8208+00	3.1753-01	6.5241-02
3.0437-02	9.6644+00	2.9416-01	7.0903-02
2.8706-02	1.1531+01	3.3101-01	6.6287-02
2.7120-02	1.4924+01	4.0474-01	6.1942-02
2.5663-02	1.7380+01	4.4602-01	5.8545-02
2.4323-02	1.6640+01	4.0473-01	6.2606-02
2.3086-02	2.3813+01	5.4975-01	5.3581-02
2.1808-02	2.7054+01	5.8999-01	4.5820-02
2.0509-02	3.2212+01	6.6064-01	4.4011-02
1.9324-02	4.1017+01	7.9261-01	4.0786-02
1.8241-02	5.5054+01	1.0042+00	3.6317-02
1.7250-02	6.3155+01	1.0894+00	3.5513-02
1.6341-02	9.0495+01	1.4788+00	3.0764-02
1.5503-02	1.2135+02	1.8813+00	2.7391-02
1.4654-02	1.4569+02	2.1349+00	2.3806-02
1.3805-02	1.8502+02	2.5542+00	2.2070-02
1.3023-02	2.2341+02	2.9095+00	2.0879-02
1.2305-02	2.5879+02	3.1844+00	2.0219-02
1.1644-02	3.1497+02	3.6675+00	1.9094-02
1.1032-02	3.2828+02	3.6216+00	1.9466-02
1.0467-02	3.4786+02	3.6411+00	1.9665-02
9.9013-03	3.7922+02	3.7548+00	1.8183-02
9.3407-03	3.8487+02	3.5950+00	1.8881-02
8.8264-03	4.0643+02	3.5873+00	1.9176-02
8.3518-03	4.1962+02	3.5046+00	1.9737-02
7.9160-03	4.4350+02	3.5107+00	2.0011-02
7.5127-03	4.4458+02	3.3400+00	2.0889-02
7.1136-03	4.6138+02	3.2821+00	2.0021-02
6.7215-03	4.7354+02	3.1829+00	2.0402-02
6.3609-03	4.4028+02	2.8006+00	2.1435-02
6.0286-03	4.6516+02	2.8043+00	2.0739-02

RUNS T5,T6 2-22-66 TABLE E76 4-3-69
CONTINUED

THERMAL NEUTRON SPECTRUM FOR 7.0-INCHES LH2 AT 78 DEGREES USING
A BANK OF 32 VERTICAL BF3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .05 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
5.7214-03	4.7823+02	2.7361+00	2.0508-02
5.4201-03	5.0786+02	2.7527+00	1.9664-02
5.1260-03	5.2287+02	2.6802+00	2.0355-02
4.8553-03	4.9330+02	2.3951+00	2.0921-02
4.6056-03	5.0712+02	2.3356+00	1.9734-02
4.3625-03	5.6245+02	2.4537+00	1.8003-02
4.1267-03	5.6232+02	2.3205+00	1.8305-02
3.9094-03	5.8869+02	2.3014+00	1.8654-02
3.7088-03	5.7182+02	2.1208+00	1.9822-02
3.5144-03	6.1463+02	2.1601+00	1.9096-02
3.3265-03	6.1770+02	2.0548+00	1.9909-02
3.1533-03	6.0801+02	1.9172+00	2.0977-02
2.9932-03	6.3483+02	1.9002+00	2.1466-02
2.8386-03	6.5007+02	1.8453+00	2.1303-02
2.6897-03	6.5272+02	1.7556+00	2.2251-02
2.5522-03	6.5033+02	1.6598+00	2.3440-02
2.4199-03	7.1238+02	1.7239+00	2.2329-02
2.2928-03	6.8998+02	1.5820+00	2.3827-02
2.1756-03	6.8316+02	1.4863+00	2.5151-02
2.0631-03	7.5102+02	1.5494+00	2.4280-02
1.9553-03	6.7296+02	1.3158+00	2.6833-02
1.8558-03	7.1614+02	1.3290+00	2.7248-02
1.7605-03	6.8309+02	1.2026+00	2.8521-02
1.6695-03	6.7177+02	1.1215+00	2.9866-02
1.5826-03	6.9963+02	1.1072+00	3.0050-02
1.4998-03	7.2371+02	1.0854+00	3.0744-02
1.4234-03	6.7065+02	9.5460-01	3.3383-02
1.3506-03	6.9353+02	9.3668-01	3.3616-02
1.2812-03	6.7351+02	8.6290-01	3.5804-02
1.2152-03	6.8647+02	8.3420-01	3.6468-02
1.1525-03	6.2732+02	7.2299-01	3.9867-02
1.0930-03	6.0709+02	6.6355-01	4.1444-02
1.0366-03	6.0633+02	6.2852-01	4.3507-02
9.8310-04	5.8743+02	5.7750-01	4.6417-02
9.3241-04	5.2997+02	4.9415-01	5.0986-02
8.8444-04	5.1128+02	4.5220-01	5.3602-02
8.3902-04	4.9994+02	4.1946-01	5.7071-02
7.9607-04	4.3529+02	3.4652-01	6.3655-02
7.5542-04	4.5103+02	3.4072-01	6.6951-02
7.1701-04	4.3717+02	3.1346-01	6.8884-02
6.7993-04	3.8494+02	2.6173-01	7.7183-02
6.4495-04	3.7707+02	2.4319-01	8.4495-02
6.1195-04	4.0857+02	2.5002-01	8.2127-02

RUNS T5,T6 2-22-66 TABLE E76 4-3-69
CONTINUED

THERMAL NEUTRON SPECTRUM FOR 7.0-INCHES LH2 AT 78 DEGREES USING
A BANK OF 32 VERTICAL BF3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .05 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
5.8082-04	3.8558+02	2.2395-01	9.0969-02
5.5146-04	2.9785+02	1.6425-01	1.0706-01

THERMAL NEUTRON SPECTRUM FOR 4.5-INCHES LH2 AT 78 DEGREES USING
A BANK OF 32 VERTICAL BF3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .05 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
1.6646+01	4.9230-02	8.1948-01	1.7743-01
1.2074+01	7.1103-02	8.5850-01	1.6009-01
8.1679+00	8.2318-02	6.7237-01	1.4263-01
5.2680+00	1.3204-01	6.9559-01	1.2561-01
3.6794+00	1.7064-01	6.2785-01	1.3359-01
2.7146+00	2.0722-01	5.6252-01	1.3626-01
2.0855+00	2.9458-01	6.1435-01	1.2006-01
1.6523+00	2.6347-01	4.3533-01	1.5728-01
1.4075+00	3.9253-01	5.5249-01	1.6933-01
1.2750+00	5.5359-01	7.0583-01	1.3752-01
1.1604+00	5.4281-01	6.2988-01	1.4797-01
1.0605+00	5.2602-01	5.5784-01	1.5935-01
9.7308-01	7.5999-01	7.3953-01	1.2158-01
8.9592-01	6.8137-01	6.1045-01	1.4298-01
8.2781-01	5.8140-01	4.8129-01	1.7097-01
7.6696-01	7.4208-01	5.6915-01	1.4562-01
7.1267-01	8.2921-01	5.9095-01	1.3866-01
6.6393-01	1.0620+00	7.0509-01	1.2039-01
6.2003-01	9.9271-01	6.1551-01	1.2879-01
5.8034-01	1.0374+00	6.0204-01	1.3541-01
5.4435-01	1.0282+00	5.5970-01	1.4051-01
5.1160-01	1.1619+00	5.9443-01	1.3255-01
4.8172-01	1.2509+00	6.0258-01	1.1834-01
4.5439-01	1.4970+00	6.8022-01	1.1474-01
4.2931-01	1.3409+00	5.7566-01	1.2932-01
4.0626-01	1.3231+00	5.3752-01	1.3141-01
3.8501-01	1.4506+00	5.5850-01	1.3253-01
3.5632-01	1.4697+00	5.2368-01	9.6078-02
3.2259-01	1.7857+00	5.7605-01	8.7691-02
2.9343-01	1.5644+00	4.5904-01	1.0214-01
2.6805-01	1.9024+00	5.0994-01	9.2322-02
2.4583-01	1.9402+00	4.7696-01	1.0395-01
2.2626-01	2.4277+00	5.4929-01	8.7614-02
2.0893-01	2.5890+00	5.4092-01	8.4904-02
1.9353-01	2.5036+00	4.8452-01	9.2978-02
1.7976-01	3.3087+00	5.9477-01	8.1152-02
1.6742-01	3.6670+00	6.1393-01	7.9505-02
1.5630-01	3.5594+00	5.5633-01	8.7095-02
1.4625-01	3.3740+00	4.9345-01	9.0712-02
1.3715-01	3.7033+00	5.0791-01	9.0414-02
1.2886-01	3.9345+00	5.0700-01	8.7546-02
1.2131-01	4.3965+00	5.3334-01	8.6485-02
1.1440-01	4.6026+00	5.2654-01	8.7640-02

THERMAL NEUTRON SPECTRUM FOR 4.5-INCHES LH2 AT 78 DEGREES USING
A BANK OF 32 VERTICAL BF3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .05 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
1.0806-01	4.5269+00	4.8918-01	9.1354-02
1.0223-01	4.2637+00	4.3588-01	9.5670-02
9.6871-02	4.7562+00	4.6074-01	9.5246-02
9.1919-02	5.2695+00	4.8437-01	9.1131-02
8.6261-02	4.8216+00	4.1592-01	8.4443-02
8.0114-02	5.3996+00	4.3258-01	7.9809-02
7.4602-02	4.8467+00	3.6157-01	8.9407-02
6.9641-02	5.5432+00	3.8603-01	8.3004-02
6.5157-02	5.8645+00	3.8211-01	8.9606-02
6.1092-02	6.3045+00	3.8515-01	8.6544-02
5.7396-02	7.0559+00	4.0498-01	8.4357-02
5.4027-02	8.1249+00	4.3896-01	7.8773-02
5.0946-02	7.9657+00	4.0582-01	8.4448-02
4.8121-02	8.5655+00	4.1218-01	8.3450-02
4.5524-02	8.9266+00	4.0637-01	8.8012-02
4.3133-02	1.0814+01	4.6644-01	7.9114-02
4.0926-02	9.5118+00	3.8928-01	9.0554-02
3.8565-02	1.2914+01	4.9803-01	6.5036-02
3.6104-02	1.5433+01	5.5719-01	6.2200-02
3.3872-02	1.6674+01	5.6478-01	6.3128-02
3.1842-02	1.8520+01	5.8971-01	6.3032-02
2.9990-02	2.1760+01	6.5258-01	5.9023-02
2.8297-02	2.9101+01	8.2347-01	5.3427-02
2.6744-02	2.9844+01	7.9815-01	5.5317-02
2.5317-02	3.5459+01	8.9772-01	5.1656-02
2.4005-02	4.1282+01	9.9097-01	4.9284-02
2.2649-02	5.4946+01	1.2445+00	4.0048-02
2.1273-02	5.7576+01	1.2248+00	4.1252-02
2.0022-02	7.1121+01	1.4240+00	3.8246-02
1.8880-02	9.0853+01	1.7153+00	3.5615-02
1.7834-02	1.2123+02	2.1620+00	3.1938-02
1.6877-02	1.5466+02	2.6102+00	2.9447-02
1.5998-02	1.9732+02	3.1567+00	2.6915-02
1.5109-02	2.6473+02	3.9998+00	2.2095-02
1.4220-02	3.2438+02	4.6127+00	2.0901-02
1.3406-02	3.6875+02	4.9435+00	2.0427-02
1.2657-02	4.3964+02	5.5645+00	1.9501-02
1.1968-02	5.3487+02	6.4013+00	1.8477-02
1.1332-02	5.9708+02	6.7661+00	1.8193-02
1.0744-02	6.1821+02	6.6420+00	1.8594-02
1.0157-02	6.5002+02	6.6023+00	1.7497-02
9.5749-03	6.8318+02	6.5414+00	1.7844-02
9.0418-03	6.9368+02	6.2721+00	1.8510-02

THERMAL NEUTRON SPECTRUM FOR 4.5-INCHES LH2 AT 78 DEGREES USING A BANK OF 32 VERTICAL BF3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .05 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
8.5502-03	7.1231+02	6.0904+00	1.9084-02
8.0985-03	7.6678+02	6.2098+00	1.9230-02
7.6818-03	7.7059+02	5.9195+00	1.9994-02
7.2695-03	7.9571+02	5.7844+00	1.9262-02
6.8646-03	8.2933+02	5.6930+00	1.9555-02
6.4927-03	7.6848+02	4.9895+00	2.0709-02
6.1501-03	8.1191+02	4.9933+00	2.0201-02
5.8338-03	8.3204+02	4.8540+00	1.9864-02
5.5238-03	8.3075+02	4.5889+00	1.9357-02
5.2213-03	8.4767+02	4.4259+00	2.0284-02
4.9431-03	8.5248+02	4.2139+00	2.0644-02
4.6866-03	8.3866+02	3.9305+00	1.9886-02
4.4372-03	9.7549+02	4.3284+00	1.7519-02
4.1954-03	9.2355+02	3.8747+00	1.8159-02
3.9728-03	9.4739+02	3.7638+00	1.8675-02
3.7673-03	1.0022+03	3.7756+00	1.8974-02
3.5684-03	9.8928+02	3.5301+00	1.9065-02
3.3762-03	1.0197+03	3.4427+00	1.9627-02
3.1991-03	1.0270+03	3.2855+00	2.0500-02
3.0356-03	1.0663+03	3.2369+00	2.1018-02
2.8778-03	1.1159+03	3.2113+00	2.0573-02
2.7258-03	1.0935+03	2.9807+00	2.1787-02
2.5855-03	1.1128+03	2.8771+00	2.2571-02
2.4507-03	1.1498+03	2.8178+00	2.2361-02
2.3213-03	1.1313+03	2.6261+00	2.3679-02
2.2018-03	1.1518+03	2.5360+00	2.4554-02
2.0873-03	1.2049+03	2.5150+00	2.4302-02
1.9777-03	1.1911+03	2.3556+00	2.5595-02
1.8765-03	1.2008+03	2.2533+00	2.6692-02
1.7796-03	1.2063+03	2.1467+00	2.7044-02
1.6871-03	1.1763+03	1.9845+00	2.8658-02
1.6016-03	1.1917+03	1.9086+00	2.9818-02
1.5199-03	1.2218+03	1.8570+00	2.9942-02
1.4420-03	1.2169+03	1.7548+00	3.1602-02
1.3677-03	1.1938+03	1.6328+00	3.2332-02
1.2970-03	1.1845+03	1.5363+00	3.4415-02
1.2298-03	1.0539+03	1.2961+00	3.7049-02
1.1660-03	1.0971+03	1.2792+00	3.7911-02
1.1055-03	1.0062+03	1.1124+00	4.1012-02
1.0481-03	1.0616+03	1.1127+00	4.1645-02
9.9373-04	9.5557+02	9.4958-01	4.5240-02
9.4223-04	9.0651+02	8.5414-01	4.8931-02
8.9351-04	8.7005+02	7.7740-01	5.0918-02

RUNS T8,T7 2-22-66 TABLE E77 4-3-69
CONTINUED

THERMAL NEUTRON SPECTRUM FOR 4.5-INCHES LH2 AT 78 DEGREES USING
A BANK OF 32 VERTICAL BF3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .05 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
8.4740-04	8.0940+02	6.8589-01	5.6094-02
8.0381-04	8.8079+02	7.0799-01	5.5973-02
7.6258-04	7.3799+02	5.6278-01	6.3522-02
7.2362-04	7.6947+02	5.5680-01	6.3525-02
6.8680-04	7.5125+02	5.1596-01	6.8992-02
6.5201-04	6.5281+02	4.2564-01	7.7682-02
6.1848-04	7.0255+02	4.3451-01	7.8420-02
5.8686-04	6.9913+02	4.1029-01	8.1218-02
5.5704-04	5.7986+02	3.2301-01	9.8534-02

THERMAL NEUTRON SPECTRUM FOR 2.5-INCHES LH2 AT 78 DEGREES USING
A BANK OF 32 VERTICAL BF3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .05 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
1.2710+02	8.4956-03	1.0798+00	1.6050-01
3.1811+01	3.2547-02	1.0354+00	1.3090-01
1.4360+01	5.1421-02	7.3841-01	1.5132-01
9.1557+00	9.0583-02	8.2935-01	1.7632-01
7.1800+00	1.1527-01	8.2764-01	1.6774-01
5.7810+00	1.7330-01	1.0018+00	1.3255-01
4.7550+00	1.6147-01	7.6779-01	1.7368-01
3.9795+00	1.9946-01	7.9375-01	1.6311-01
3.3792+00	1.9683-01	6.6513-01	1.9144-01
2.9051+00	3.3909-01	9.8509-01	1.2299-01
2.5241+00	3.7090-01	9.3619-01	1.2361-01
2.2137+00	6.2562-01	1.3849+00	6.5803-02
1.9572+00	4.2528-01	8.3236-01	1.3577-01
1.7428+00	5.9887-01	1.0437+00	1.0573-01
1.5618+00	5.9958-01	9.3642-01	1.1519-01
1.4075+00	6.5654-01	9.2408-01	1.1364-01
1.2750+00	5.6839-01	7.2470-01	1.4378-01
1.1604+00	1.1360+00	1.3182+00	7.0036-02
1.0605+00	9.0393-01	9.5862-01	1.0472-01
9.7308-01	6.1080-01	5.9436-01	1.6134-01
8.9592-01	8.5065-01	7.6211-01	1.2410-01
8.2781-01	1.0238+00	8.4751-01	1.1421-01
7.6696-01	1.1002+00	8.4381-01	1.0920-01
7.1267-01	8.9519-01	6.3798-01	1.4497-01
6.6393-01	1.2796+00	8.4956-01	1.0946-01
6.2003-01	1.2856+00	7.9711-01	1.1208-01
5.8034-01	1.2194+00	7.0767-01	1.2437-01
5.4435-01	1.0170+00	5.5360-01	1.5995-01
5.1160-01	1.8168+00	9.2947-01	7.9635-02
4.8172-01	1.3407+00	6.4584-01	1.4294-01
4.5439-01	2.1657+00	9.8407-01	8.0025-02
4.2931-01	1.7967+00	7.7134-01	1.1085-01
4.0626-01	1.2012+00	4.8800-01	1.7151-01
3.8501-01	1.4518+00	5.5896-01	1.3803-01
3.5632-01	2.1221+00	7.5615-01	7.1134-02
3.2259-01	1.9919+00	6.4257-01	8.8014-02
2.9343-01	1.8898+00	5.5452-01	9.9368-02
2.6805-01	3.0538+00	8.1857-01	6.1012-02
2.4583-01	2.6484+00	6.5106-01	7.2171-02
2.2626-01	2.5726+00	5.8208-01	8.8572-02
2.0893-01	3.0128+00	6.2946-01	8.5546-02
1.9353-01	3.4816+00	6.7379-01	7.9449-02
1.7976-01	3.5538+00	6.3883-01	8.2381-02

RUNS T9, T10 2-22-66 TABLE E78 4-3-69
CONTINUED

THERMAL NEUTRON SPECTRUM FOR 2.5-INCHES LH2 AT 78 DEGREES USING
A BANK OF 32 VERTICAL BF3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .05 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
1.6742-01	3.6003+00	6.0276-01	8.3792-02
1.5630-01	4.5589+00	7.1256-01	7.1466-02
1.4625-01	4.4246+00	6.4710-01	8.3847-02
1.3715-01	4.7003+00	6.4465-01	7.7101-02
1.2886-01	4.5031+00	5.8027-01	8.4281-02
1.2131-01	4.2687+00	5.1784-01	9.4287-02
1.1440-01	5.1342+00	5.8735-01	8.2796-02
1.0806-01	5.7438+00	6.2068-01	7.8546-02
1.0223-01	4.8912+00	5.0003-01	9.9328-02
9.6871-02	6.0664+00	5.8766-01	8.0928-02
9.1919-02	5.5607+00	5.1113-01	8.7321-02
8.6261-02	5.2875+00	4.5611-01	8.5649-02
8.0114-02	5.0774+00	4.0677-01	9.1207-02
7.4602-02	6.4842+00	4.8373-01	7.8080-02
6.9641-02	5.9864+00	4.1690-01	8.8655-02
6.5157-02	6.5488+00	4.2670-01	8.6842-02
6.1092-02	8.4631+00	5.1703-01	7.4211-02
5.7396-02	7.9763+00	4.5781-01	7.9282-02
5.4027-02	8.6943+00	4.6973-01	7.6715-02
5.0946-02	1.0435+01	5.3162-01	7.1643-02
4.8121-02	9.0746+00	4.3668-01	8.7700-02
4.5524-02	1.1160+01	5.0805-01	7.7872-02
4.3133-02	1.4058+01	6.0636-01	7.2997-02
4.0926-02	1.2969+01	5.3077-01	7.4949-02
3.8565-02	1.4380+01	5.5456-01	6.6742-02
3.6104-02	1.7105+01	6.1756-01	6.0011-02
3.3872-02	2.0150+01	6.8252-01	5.8830-02
3.1842-02	2.0942+01	6.6684-01	6.1253-02
2.9990-02	2.8026+01	8.4050-01	5.2896-02
2.8297-02	3.0051+01	8.5035-01	5.4916-02
2.6744-02	3.4018+01	9.0978-01	5.3224-02
2.5317-02	3.5850+01	9.0761-01	5.3988-02
2.4005-02	4.5694+01	1.0969+00	4.8941-02
2.2649-02	5.3470+01	1.2110+00	4.2378-02
2.1273-02	6.7321+01	1.4321+00	3.9361-02
2.0022-02	8.2526+01	1.6523+00	3.6769-02
1.8880-02	1.0208+02	1.9273+00	3.4507-02
1.7834-02	1.1899+02	2.1221+00	3.2873-02
1.6877-02	1.6907+02	2.8534+00	2.8774-02
1.5998-02	2.2795+02	3.6467+00	2.5677-02
1.5109-02	2.7176+02	4.1060+00	2.2271-02
1.4220-02	3.3873+02	4.8167+00	2.1005-02
1.3406-02	3.9520+02	5.2981+00	2.0176-02

RUNS T9, T10 2-22-66 TABLE E78 4-3-69
CONTINUED

THERMAL NEUTRON SPECTRUM FOR 2.5-INCHES LH2 AT 78 DEGREES USING
A BANK OF 32 VERTICAL BF3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .05 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
1.2657-02	4.5810+02	5.7982+00	1.9576-02
1.1968-02	5.5216+02	6.6083+00	1.8543-02
1.1332-02	5.9359+02	6.7266+00	1.8655-02
1.0744-02	6.3719+02	6.8460+00	1.8730-02
1.0157-02	6.3130+02	6.4121+00	1.8142-02
9.5749-03	6.6179+02	6.3366+00	1.8565-02
9.0418-03	6.9825+02	6.3134+00	1.8907-02
8.5502-03	7.1986+02	6.1549+00	1.9453-02
8.0985-03	7.1171+02	5.7638+00	2.0357-02
7.6818-03	7.5384+02	5.7908+00	2.0606-02
7.2695-03	7.9095+02	5.7498+00	1.9840-02
6.8646-03	8.1502+02	5.5948+00	2.0210-02
6.4927-03	7.6547+02	4.9700+00	2.1255-02
6.1501-03	8.1118+02	4.9888+00	2.0765-02
5.8338-03	8.1994+02	4.7834+00	2.0483-02
5.5238-03	8.2892+02	4.5788+00	1.9825-02
5.2213-03	8.6008+02	4.4907+00	2.0642-02
4.9431-03	8.5706+02	4.2365+00	2.1093-02
4.6866-03	8.3674+02	3.9215+00	2.0426-02
4.4372-03	9.3670+02	4.1563+00	1.8227-02
4.1954-03	8.9321+02	3.7474+00	1.8904-02
3.9728-03	9.2160+02	3.6613+00	1.9366-02
3.7673-03	9.4000+02	3.5413+00	2.0086-02
3.5684-03	9.6036+02	3.4269+00	1.9778-02
3.3762-03	9.8041+02	3.3101+00	2.0534-02
3.1991-03	1.0282+03	3.2893+00	2.0973-02
3.0356-03	1.0400+03	3.1570+00	2.1793-02
2.8778-03	1.0707+03	3.0813+00	2.1607-02
2.7258-03	1.0791+03	2.9414+00	2.2537-02
2.5855-03	1.0914+03	2.8218+00	2.3423-02
2.4507-03	1.1407+03	2.7955+00	2.3112-02
2.3213-03	1.1597+03	2.6920+00	2.4147-02
2.2018-03	1.1331+03	2.4949+00	2.5450-02
2.0873-03	1.1052+03	2.3069+00	2.6021-02
1.9777-03	1.2157+03	2.4043+00	2.5920-02
1.8765-03	1.1601+03	2.1769+00	2.8073-02
1.7796-03	1.1360+03	2.0216+00	2.8618-02
1.6871-03	1.1654+03	1.9661+00	2.9620-02
1.6016-03	1.2390+03	1.9844+00	2.9800-02
1.5199-03	1.1953+03	1.8167+00	3.1043-02
1.4420-03	1.1930+03	1.7203+00	3.2358-02
1.3677-03	1.1209+03	1.5331+00	3.4248-02
1.2970-03	1.1303+03	1.4660+00	3.5708-02

RUNS T9, T10 2-22-66 TABLE E78 4-3-69
CONTINUED

THERMAL NEUTRON SPECTRUM FOR 2.5-INCHES LH2 AT 78 DEGREES USING
A BANK OF 32 VERTICAL BF3 DETECTORS
ENERGY RESOLUTION FOR GROUPING = .05 LARGEST FRACTIONAL ERROR = .20

NEUTRON ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)	RELATIVE UNCERTAINTY
1.2298-03	1.0226+03	1.2576+00	3.8340-02
1.1660-03	1.0683+03	1.2456+00	3.9339-02
1.1055-03	1.1456+03	1.2665+00	3.9173-02
1.0481-03	1.0065+03	1.0549+00	4.4263-02
9.9373-04	9.5686+02	9.5086-01	4.5962-02
9.4223-04	8.6832+02	8.1816-01	5.1971-02
8.9351-04	9.1386+02	8.1654-01	5.1233-02
8.4740-04	9.1441+02	7.7487-01	5.3068-02
8.0381-04	8.1298+02	6.5348-01	5.8197-02
7.6258-04	7.6551+02	5.8376-01	6.4161-02
7.2362-04	6.7362+02	4.8744-01	7.1764-02
6.8680-04	7.7919+02	5.3515-01	6.8151-02
6.5201-04	7.2431+02	4.7226-01	7.4809-02
6.1848-04	6.7865+02	4.1974-01	8.0100-02
5.8686-04	5.6748+02	3.3303-01	9.5678-02
5.5704-04	6.3997+02	3.5649-01	9.4360-02

TABLE E79

05R MONTE CARLO RESULTS FOR A 2.5-INCH THICKNESS OF LIQUID HYDROGEN NORMALIZED TO ONE SOURCE NEUTRON FOR THE UNCOLLIDED FLUX AT 0 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
1.40+07	1.06-12	1.38-05
1.20+07	1.68-12	1.85-05
1.00+07	5.11-12	4.60-05
8.00+06	1.31-11	9.20-05
6.00+06	3.80-11	1.90-04
4.00+06	6.86-11	2.40-04
3.00+06	1.36-10	3.40-04
2.00+06	1.95-10	3.41-04
1.50+06	2.98-10	3.72-04
1.00+06	3.83-10	3.45-04
8.00+05	3.71-10	2.60-04
6.00+05	3.70-10	1.85-04
4.00+05	2.37-10	7.10-05
2.00+05	7.87-11	1.18-05
1.00+05	2.70-11	1.97-06
4.60+04	9.47-12	3.22-07
2.20+04	2.17-12	3.48-08
1.00+04	4.66-11	3.40-07

TABLE E80

OSR MONTE CARLO RESULTS FOR A 2.5-INCH THICKNESS OF LIQUID HYDROGEN NORMALIZED TO ONE SOURCE NEUTRON FOR THE COLLIDED FLUX AT 0 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
1.40+07	8.62-15	1.12-07
1.20+07	1.91-14	2.10-07
1.00+07	4.50-14	4.05-07
8.00+06	1.86-13	1.30-06
6.00+06	4.40-13	2.20-06
4.00+06	5.77-13	2.02-06
3.00+06	9.60-13	2.40-06
2.00+06	1.09-12	1.91-06
1.50+06	2.56-12	3.20-06
1.00+06	2.68-12	2.41-06
8.00+05	4.57-12	3.20-06
6.00+05	3.60-12	1.80-06
4.00+05	1.83-12	5.50-07
2.00+05	2.40-12	3.60-07
1.00+05	2.81-12	2.05-07
4.60+04	3.82-12	1.30-07
2.20+04	8.25-12	1.32-07
1.00+04	1.92-11	1.40-07
4.60+03	3.85-11	1.31-07
2.20+03	8.56-11	1.37-07

TABLE E81

05R MONTE CARLO RESULTS FOR A 2.5-INCH THICKNESS OF LIQUID HYDROGEN NORMALIZED TO ONE SOURCE NEUTRON FOR AN ANGLE OF 37 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
1.40+07	1.38-17	1.80-10
1.20+07	1.27-16	1.40-09
1.00+07	4.89-16	4.40-09
8.00+06	2.86-15	2.00-08
6.00+06	5.40-15	2.70-08
4.00+06	2.14-14	7.50-08
3.00+06	5.80-14	1.45-07
2.00+06	9.71-14	1.70-07
1.50+06	2.20-13	2.75-07
1.00+06	3.78-13	3.40-07
8.00+05	5.71-13	4.00-07
6.00+05	1.14-12	5.70-07
4.00+05	1.60-12	4.80-07
2.00+05	1.81-12	2.71-07
1.00+05	1.78-12	1.30-07
4.60+04	2.64-12	8.97-08
2.20+04	6.06-12	9.70-08
1.00+04	1.10-11	8.00-08
4.60+03	2.65-11	9.00-08
2.20+03	5.94-11	9.50-08

TABLE E82

O5R MONTE CARLO RESULTS FOR A 2.5-INCH THICKNESS OF LIQUID HYDROGEN NORMALIZED TO ONE NEUTRON FOR AN ANGLE OF 78 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
1.40+07	2.00-18	2.60-11
1.20+07	1.09-17	1.20-10
1.00+07	7.44-17	6.70-10
8.00+06	2.14-16	1.50-09
6.00+06	8.00-16	4.00-09
4.00+06	2.03-15	7.10-09
3.00+06	4.44-15	1.11-08
2.00+06	8.63-15	1.51-08
1.50+06	1.77-14	2.21-08
1.00+06	3.18-14	2.86-08
8.00+05	7.84-14	5.49-08
6.00+05	7.20-14	3.60-08

TABLE E83

05R MONTE CARLO RESULTS FOR A 4.5-INCH THICKNESS OF LIQUID HYDROGEN NORMALIZED TO ONE NEUTRON FOR THE UNCOLLIDED FLUX AT 0 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
1.40+07	8.08-13	1.05-05
1.20+07	1.45-12	1.60-05
1.00+07	3.89-12	3.50-05
8.00+06	1.00-11	7.00-05
6.00+06	2.58-11	1.29-04
4.00+06	4.60-11	1.61-04
3.00+06	6.96-11	1.74-04
2.00+06	8.69-11	1.52-04
1.50+06	1.24-10	1.55-04
1.00+06	1.33-10	1.20-04
8.00+05	1.01-10	7.10-05
6.00+05	8.80-11	4.40-05
4.00+05	3.67-11	1.10-05
2.00+05	5.67-12	8.50-07
1.00+05	1.06-12	7.75-08
4.60+04	1.79-13	6.08-09
2.20+04	7.56-14	1.21-09
1.00+04	5.89-14	4.30-10

TABLE E84

05R MONTE CARLO RESULTS FOR A 4.5-INCH THICKNESS OF LIQUID HYDROGEN NORMALIZED TO ONE NEUTRON FOR THE COLLIDED FLUX AT 0 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
1.40+07	6.08-15	7.90-08
1.20+07	1.27-14	1.40-07
1.00+07	4.44-14	4.00-07
8.00+06	1.43-13	1.00-06
6.00+06	2.82-13	1.41-06
4.00+06	4.51-13	1.58-06
3.00+06	6.40-13	1.60-06
2.00+06	8.86-13	1.55-06
1.50+06	1.00-12	1.25-06
1.00+06	1.33-12	1.20-06
8.00+05	1.41-12	9.90-07
6.00+05	1.90-12	9.50-07
4.00+05	1.33-12	4.00-07
2.00+05	2.07-12	3.11-07
1.00+05	3.15-12	2.30-07
4.60+04	4.71-12	1.60-07
2.20+04	8.75-12	1.40-07
1.00+04	1.52-11	1.11-07
4.60+03	2.86-11	9.71-08
2.20+03	5.87-11	9.40-08

TABLE E85

05R MONTE CARLO RESULTS FOR A 4.5-INCH THICKNESS OF LIQUID HYDROGEN
NORMALIZED TO ONE NEUTRON FOR AN ANGLE OF 37 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
1.40+07	3.23-17	4.20-10
1.20+07	7.27-17	8.00-10
1.00+07	3.00-16	2.70-09
8.00+06	1.11-15	7.80-09
6.00+06	6.40-15	3.20-08
4.00+06	2.03-14	7.10-08
3.00+06	4.08-14	1.02-07
2.00+06	1.03-13	1.81-07
1.50+06	1.78-13	2.22-07
1.00+06	2.87-13	2.58-07
8.00+05	4.21-13	2.95-07
6.00+05	4.56-13	2.28-07
4.00+05	6.37-13	1.91-07
2.00+05	1.07-12	1.60-07
1.00+05	1.89-12	1.38-07
4.60+04	3.56-12	1.21-07
2.20+04	5.50-12	8.80-08
1.00+04	1.12-11	8.20-08
4.60+03	2.35-11	8.00-08
2.20+03	4.69-11	7.50-08

TABLE E86

O5R MONTE CARLO RESULTS FOR A 4.5-INCH THICKNESS OF LIQUID HYDROGEN
NORMALIZED TO ONE NEUTRON FOR AN ANGLE OF 78 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
1.40+07	6.90-19	8.97-12
1.20+07	1.77-18	1.95-11
1.00+07	3.67-18	3.30-11
8.00+06	1.30-17	9.12-11
6.00+06	2.18-16	1.09-09
4.00+06	3.49-16	1.22-09
3.00+06	1.04-15	2.60-09
2.00+06	2.23-15	3.90-09
1.50+06	4.34-15	5.42-09
1.00+06	9.33-15	8.40-09
8.00+05	1.20-14	8.40-09
6.00+05	1.58-14	7.90-09
4.00+05	4.73-14	1.42-08
2.00+05	1.30-13	1.95-08
1.00+05	5.75-13	4.20-08
4.60+04	9.56-13	3.25-08
2.20+04	4.19-12	6.70-08
1.00+04	8.15-12	5.95-08

TABLE E87

05R MONTE CARLO RESULTS FOR A 13.0-INCH THICKNESS OF LIQUID HYDROGEN NORMALIZED TO ONE NEUTRON FOR THE UNCOLLIDED FLUX AT 0 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
1.40+07	4.32-13	5.62-06
1.20+07	6.18-13	6.80-06
1.00+07	1.58-12	1.42-05
8.00+06	3.01-12	2.11-05
6.00+06	5.60-12	2.80-05
4.00+06	6.14-12	2.15-05
3.00+06	6.04-12	1.51-05
2.00+06	3.95-12	6.92-06
1.50+06	3.10-12	3.88-06
1.00+06	1.66-12	1.49-06
8.00+05	6.57-13	4.60-07
6.00+05	2.20-13	1.10-07
4.00+05	1.60-14	4.80-09
2.00+05	1.73-16	2.60-11

TABLE E88

O5R MONTE CARLO RESULTS FOR A 13.0-INCH THICKNESS OF LIQUID HYDROGEN NORMALIZED TO ONE NEUTRON FOR THE COLLIDED FLUX AT 0 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
1.40+07	4.93-15	6.41-08
1.20+07	8.64-15	9.50-08
1.00+07	2.33-14	2.10-07
8.00+06	5.86-14	4.10-07
6.00+06	1.16-13	5.80-07
4.00+06	1.43-13	5.00-07
3.00+06	1.48-13	3.70-07
2.00+06	1.43-13	2.50-07
1.50+06	1.66-13	2.10-07
1.00+06	2.01-13	1.81-07
8.00+05	1.36-13	9.50-08
6.00+05	1.54-13	7.70-08
4.00+05	1.37-13	4.10-08
2.00+05	1.72-13	2.58-08
1.00+05	1.78-13	1.30-08
4.60+04	3.24-13	1.10-08
2.20+04	4.63-13	7.41-09
1.00+04	8.36-13	6.10-09
4.60+03	1.85-12	6.30-09
2.20+03	3.62-12	5.80-09

TABLE E89

O5R MONTE CARLO RESULTS FOR A 13.0-INCH THICKNESS OF LIQUID HYDROGEN NORMALIZED TO ONE NEUTRON FOR AN ANGLE OF 37 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
1.40+07	7.00-18	9.10-11
1.20+07	1.84-17	2.02-10
1.00+07	1.00-16	9.00-10
8.00+06	5.71-16	4.00-09
6.00+06	3.80-15	1.90-08
4.00+06	1.20-14	4.20-08
3.00+06	1.96-14	4.90-08
2.00+06	2.06-14	3.60-08
1.50+06	3.54-14	4.42-08
1.00+06	4.22-14	3.80-08
8.00+05	5.86-14	4.10-08
6.00+05	7.20-14	3.60-08
4.00+05	7.27-14	2.18-08
2.00+05	1.07-13	1.61-08
1.00+05	1.26-13	9.20-09
4.60+04	2.59-13	8.80-09
2.20+04	4.06-13	6.50-09
1.00+04	8.25-13	6.02-09
4.60+03	1.70-12	5.78-09
2.20+03	3.87-12	6.20-09

TABLE E90

05R MONTE CARLO RESULTS FOR A 13.0-INCH THICKNESS OF LIQUID HYDROGEN NORMALIZED TO ONE NEUTRON FOR AN ANGLE OF 78 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
1.40+07	1.12-18	1.45-11
1.20+07	2.55-18	2.80-11
1.00+07	1.20-17	1.08-10
8.00+06	1.84-17	1.29-10
6.00+06	6.30-17	3.15-10
4.00+06	1.29-16	4.50-10
3.00+06	5.20-16	1.30-09
2.00+06	1.26-15	2.20-09
1.50+06	2.42-15	3.03-09
1.00+06	5.22-15	4.70-09
8.00+05	6.14-15	4.30-09
6.00+05	1.70-14	8.50-09
4.00+05	3.23-14	9.70-09
2.00+05	2.93-14	4.40-09

TABLE E91

O5R MONTE CARLO RESULTS FOR A 2.5-INCH THICKNESS OF LIQUID HYDROGEN NORMALIZED TO ONE NEUTRON FOR AN ANGLE OF 5 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
1.40+07	2.15-15	2.80-08
1.20+07	5.55-15	6.10-08
1.00+07	1.33-14	1.20-07
8.00+06	6.43-14	4.50-07
6.00+06	1.16-13	5.80-07
4.00+06	2.49-13	8.70-07
3.00+06	4.04-13	1.01-06
2.00+06	6.29-13	1.10-06
1.50+06	1.60-12	2.00-06
1.00+06	1.03-12	9.30-07
8.00+05	2.29-13	1.60-07
6.00+05	1.70-12	8.50-07
4.00+05	8.33-13	2.50-07

TABLE E92

O5R MONTE CARLO RESULTS FOR A 2.5-INCH THICKNESS OF LIQUID HYDROGEN NORMALIZED TO ONE NEUTRON FOR AN ANGLE OF 15 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
1.40+07	7.50-17	9.75-10
1.20+07	6.33-16	6.96-09
1.00+07	7.36-16	6.62-09
8.00+06	8.63-16	6.04-09
6.00+06	1.58-14	7.92-08
4.00+06	2.61-14	9.14-08
3.00+06	1.05-13	2.63-07
2.00+06	1.27-13	2.23-07
1.50+06	2.42-13	3.02-07
1.00+06	3.50-13	3.15-07
8.00+05	2.14-12	1.50-06
6.00+05	9.18-13	4.59-07
4.00+05	4.70-13	1.41-07

TABLE E93

05R MONTE CARLO RESULTS FOR A 2.5-INCH THICKNESS OF LIQUID HYDROGEN NORMALIZED TO ONE NEUTRON FOR AN ANGLE OF 53 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
1.40+07	8.08-18	1.05-10
1.20+07	2.18-17	2.40-10
1.00+07	6.78-17	6.10-10
8.00+06	6.86-17	4.80-10
6.00+06	5.20-16	2.60-09
4.00+06	2.51-15	8.80-09
3.00+06	9.60-15	2.40-08
2.00+06	7.43-15	1.30-08
1.50+06	2.16-14	2.70-08
1.00+06	6.44-14	5.80-08
8.00+05	8.57-14	6.00-08
6.00+05	1.80-13	9.00-08
4.00+05	4.33-13	1.30-07
2.00+05	1.07-12	1.60-07

TABLE E94

05R MONTE CARLO RESULTS FOR A 4.5-INCH THICKNESS OF LIQUID HYDROGEN NORMALIZED TO ONE NEUTRON FOR AN ANGLE OF 5 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
1.40+07	1.77-15	2.30-08
1.20+07	3.45-15	3.80-08
1.00+07	1.07-14	9.60-08
8.00+06	3.14-14	2.20-07
6.00+06	8.60-14	4.30-07
4.00+06	2.03-13	7.10-07
3.00+06	3.00-13	7.50-07
2.00+06	3.60-13	6.30-07
1.50+06	4.64-13	5.80-07
1.00+06	3.67-13	3.30-07
8.00+05	5.00-13	3.50-07
6.00+05	5.60-13	2.80-07

TABLE E95

O5R MONTE CARLO RESULTS FOR A 4.5-INCH THICKNESS OF LIQUID HYDROGEN NORMALIZED TO ONE NEUTRON FOR AN ANGLE OF 15 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
1.40+07	1.00-16	1.30-09
1.20+07	2.64-16	2.90-09
1.00+07	5.22-15	4.70-08
8.00+06	9.57-15	6.70-08
6.00+06	2.40-14	1.20-07
4.00+06	7.14-14	2.50-07
3.00+06	1.04-13	2.60-07
2.00+06	1.83-13	3.20-07
1.50+06	2.72-13	3.40-07
1.00+06	4.67-13	4.20-07
8.00+05	5.00-13	3.50-07
6.00+05	7.60-13	3.80-07
4.00+05	1.50-12	4.50-07

TABLE E96

O5R MONTE CARLO RESULTS FOR A 4.5-INCH THICKNESS OF LIQUID HYDROGEN NORMALIZED TO ONE NEUTRON FOR AN ANGLE OF 53 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
1.40+07	1.85-18	2.40-11
1.20+07	6.82-18	7.50-11
1.00+07	5.56-17	5.00-10
8.00+06	1.36-16	9.50-10
6.00+06	9.80-16	4.90-09
4.00+06	1.94-15	6.80-09
3.00+06	2.60-15	6.50-09
2.00+06	2.17-15	3.80-09
1.50+06	2.64-15	3.30-09
1.00+06	6.78-15	6.10-09
8.00+05	7.14-15	5.00-09
6.00+05	9.20-15	4.60-09

TABLE E97

05R MONTE CARLO RESULTS FOR A 13.0-INCH THICKNESS OF LIQUID HYDROGEN NORMALIZED TO ONE NEUTRON FOR AN ANGLE OF 5 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
1.40+07	2.05-15	2.67-08
1.20+07	2.80-15	3.08-08
1.00+07	7.70-15	6.93-08
8.00+06	2.70-14	1.89-07
6.00+06	1.14-13	5.70-07
4.00+06	7.71-14	2.70-07
3.00+06	5.64-14	1.41-07
2.00+06	9.49-14	1.66-07
1.50+06	9.84-14	1.23-07
1.00+06	7.00-14	6.30-08
8.00+05	7.91-14	5.54-08
6.00+05	7.00-14	3.50-08
4.00+05	9.67-14	2.90-08

TABLE E98

05R MONTE CARLO RESULTS FOR A 13.0-INCH THICKNESS OF LIQUID HYDROGEN NORMALIZED TO ONE NEUTRON FOR AN ANGLE OF 15 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
1.40+07	2.52-16	3.27-09
1.20+07	1.24-15	1.36-08
1.00+07	4.67-15	4.20-08
8.00+06	1.27-14	8.90-08
6.00+06	2.32-15	1.16-08
4.00+06	4.91-14	1.72-07
3.00+06	3.92-14	9.80-08
2.00+06	6.86-14	1.20-07
1.50+06	1.39-13	1.74-07
1.00+06	1.88-14	1.69-08
8.00+05	3.10-14	2.17-08
6.00+05	5.66-14	2.83-08
4.00+05	4.07-14	1.22-08

TABLE E99

RESULTS OF IDF TRANSPORT CALCULATIONS OF THERMAL NEUTRON FLUX FOR A 2.5-INCH THICKNESS OF LIQUID HYDROGEN AT AN ANGLE OF 38 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
9.50-01	8.83-02	7.95-02
8.50-01	9.74-02	7.79-02
7.50-01	1.14-01	7.97-02
6.50-01	1.32-01	7.89-02
5.50-01	1.61-01	8.03-02
4.50-01	2.09-01	8.38-02
3.50-01	2.48-01	7.82-02
2.80-01	2.98-01	7.75-02
2.40-01	3.44-01	7.74-02
2.10-01	3.94-01	7.68-02
1.80-01	4.83-01	7.72-02
1.40-01	5.82-01	7.42-02
1.15-01	6.14-01	6.75-02
1.05-01	6.45-01	6.24-02
8.85-02	7.18-01	5.98-02
7.80-02	7.85-01	5.75-02
6.85-02	9.00-01	5.62-02
5.65-02	1.15+00	5.75-02
4.35-02	1.63+00	6.46-02
3.57-02	2.18+00	7.30-02
3.13-02	2.86+00	8.37-02
2.73-02	4.01+00	1.00-01
2.25-02	6.63+00	1.36-01
1.84-02	1.00+01	1.73-01
1.62-02	1.29+01	1.96-01
1.43-02	1.65+01	2.16-01
1.18-02	2.17+01	2.32-01
9.60-03	2.63+01	2.38-01
8.45-03	2.98+01	2.36-01
7.40-03	3.33+01	2.31-01
6.45-03	3.72+01	2.25-01
5.65-03	4.13+01	2.14-01
4.70-03	4.58+01	1.96-01
3.85-03	4.79+01	1.74-01
3.40-03	5.07+01	1.59-01
2.85-03	5.16+01	1.34-01
2.35-03	5.06+01	1.09-01
1.95-03	4.95+01	8.79-02
1.60-03	4.53+01	6.79-02
1.40-03	4.61+01	5.88-02
1.15-03	4.30+01	4.40-02
9.00-04	3.81+01	3.05-02
7.00-04	3.42+01	2.05-02

TABLE E99

CONTINUED

RESULTS OF 1DF TRANSPORT CALCULATIONS OF THERMAL NEUTRON FLUX FOR A 2.5-INCH THICKNESS OF LIQUID HYDROGEN AT AN ANGLE OF 38 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
5.00-04	2.94+01	1.17-02
3.00-04	2.40+01	4.80-03
1.00-04	1.17+01	5.84-04

TABLE E100

RESULTS OF 1DF TRANSPORT CALCULATIONS OF THERMAL NEUTRON FLUX FOR A 2.5-INCH THICKNESS OF LIQUID HYDROGEN AT AN ANGLE OF 77.4 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
9.50-01	8,89-02	8.00-02
8.50-01	9,79-02	7.83-02
7.50-01	1,14-01	8.01-02
6.50-01	1,32-01	7.92-02
5.50-01	1,61-01	8.07-02
4.50-01	2,11-01	8.43-02
3.50-01	2,49-01	7.84-02
2.80-01	2,99-01	7.79-02
2.40-01	3,46-01	7.79-02
2.10-01	3,97-01	7.74-02
1.80-01	4,87-01	7.80-02
1.40-01	5,87-01	7.48-02
1.15-01	6,17-01	6.79-02
1.05-01	6,47-01	6.26-02
8.85-02	7,20-01	5.99-02
7.80-02	7,87-01	5.76-02
6.85-02	9,02-01	5.64-02
5.65-02	1,16+00	5.79-02
4.35-02	1,66+00	6.56-02
3.57-02	2,25+00	7.53-02
3.13-02	3,00+00	8.80-02
2.73-02	4,38+00	1.09-01
2.25-02	8,05+00	1.65-01
1.84-02	1,42+01	2.45-01
1.62-02	2,02+01	3.08-01
1.43-02	2,81+01	3.67-01
1.18-02	3,93+01	4.21-01
9.60-03	4,88+01	4.40-01
8.45-03	5,51+01	4.37-01
7.40-03	6,10+01	4.22-01
6.45-03	6,72+01	4.07-01
5.65-03	7,35+01	3.80-01
4.70-03	7,96+01	3.40-01
3.85-03	8,12+01	2.94-01
3.40-03	8,46+01	2.64-01
2.85-03	8,37+01	2.18-01
2.35-03	7,98+01	1.71-01
1.95-03	7,59+01	1.35-01
1.60-03	6,73+01	1.01-01
1.40-03	6,73+01	8.57-02
1.15-03	6,09+01	6.24-02
9.00-04	5,21+01	4.17-02
7.00-04	4,51+01	2.70-02

CONTINUED

TABLE E100

RESULTS OF 1DF TRANSPORT CALCULATIONS OF THERMAL NEUTRON FLUX FOR A 2.5-INCH THICKNESS OF LIQUID HYDROGEN AT AN ANGLE OF 77.4 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
5.00-04	3.70+01	1.48-02
3.00-04	2.85+01	5.70-03
1.00-04	1.33+01	6.64-04

TABLE E101

RESULTS OF IDF TRANSPORT CALCULATIONS OF THERMAL NEUTRON FLUX FOR A 4.5-INCH THICKNESS OF LIQUID HYDROGEN AT AN ANGLE OF 38 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
9.50-01	5.93-02	5.34-02
8.50-01	6.60-02	5.28-02
7.50-01	7.81-02	5.46-02
6.50-01	9.15-02	5.49-02
5.50-01	1.14-01	5.69-02
4.50-01	1.52-01	6.07-02
3.50-01	1.82-01	5.72-02
2.80-01	2.22-01	5.76-02
2.40-01	2.59-01	5.84-02
2.10-01	2.99-01	5.84-02
1.80-01	3.71-01	5.93-02
1.40-01	4.48-01	5.72-02
1.15-01	4.70-01	5.17-02
1.05-01	4.92-01	4.76-02
8.85-02	5.45-01	4.54-02
7.80-02	5.95-01	4.36-02
6.85-02	6.83-01	4.27-02
5.65-02	8.79-01	4.39-02
4.35-02	1.27+00	5.04-02
3.57-02	1.76+00	5.89-02
3.13-02	2.40+00	7.03-02
2.73-02	3.60+00	8.95-02
2.25-02	6.87+00	1.40-01
1.84-02	1.21+01	2.10-01
1.62-02	1.70+01	2.60-01
1.43-02	2.33+01	3.04-01
1.18-02	3.20+01	3.42-01
9.60-03	3.96+01	3.57-01
8.45-03	4.49+01	3.56-01
7.40-03	4.99+01	3.45-01
6.45-03	5.53+01	3.35-01
5.65-03	6.08+01	3.15-01
4.70-03	6.64+01	2.84-01
3.85-03	6.84+01	2.48-01
3.40-03	7.15+01	2.24-01
2.85-03	7.14+01	1.86-01
2.35-03	6.86+01	1.47-01
1.95-03	6.57+01	1.17-01
1.60-03	5.88+01	8.82-02
1.40-03	5.90+01	7.52-02
1.15-03	5.38+01	5.51-02
9.00-04	4.63+01	3.71-02
7.00-04	4.03+01	2.42-02

TABLE E101

CONTINUED

RESULTS OF 1DF TRANSPORT CALCULATIONS OF THERMAL NEUTRON FLUX FOR A 4.5-INCH THICKNESS OF LIQUID HYDROGEN AT AN ANGLE OF 38 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
5.00-04	3.32+01	1.33-02
3.00-04	2.56+01	5.11-03
1.00-04	1.18+01	5.92-04

TABLE E102

RESULTS OF IDF TRANSPORT CALCULATIONS OF THERMAL NEUTRON FLUX FOR A 4.5-INCH THICKNESS OF LIQUID HYDROGEN AT AN ANGLE OF 77.4 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
9.50-01	5.42-02	4.88-02
8.50-01	6.00-02	4.80-02
7.50-01	7.05-02	4.93-02
6.50-01	8.20-02	4.92-02
5.50-01	1.01-01	5.05-02
4.50-01	1.33-01	5.34-02
3.50-01	1.59-01	5.02-02
2.80-01	1.93-01	5.03-02
2.40-01	2.25-01	5.07-02
2.10-01	2.60-01	5.06-02
1.80-01	3.21-01	5.14-02
1.40-01	3.89-01	4.96-02
1.15-01	4.11-01	4.52-02
1.05-01	4.32-01	4.18-02
8.85-02	4.81-01	4.00-02
7.80-02	5.27-01	3.86-02
6.85-02	6.05-01	3.78-02
5.65-02	7.79-01	3.90-02
4.35-02	1.12+00	4.45-02
3.57-02	1.54+00	5.15-02
3.13-02	2.08+00	6.09-02
2.73-02	3.09+00	7.69-02
2.25-02	5.96+00	1.22-01
1.84-02	1.13+01	1.96-01
1.62-02	1.71+01	2.61-01
1.43-02	2.52+01	3.28-01
1.18-02	3.71+01	3.97-01
9.60-03	4.73+01	4.27-01
8.45-03	5.38+01	4.26-01
7.40-03	5.96+01	4.13-01
6.45-03	6.58+01	3.98-01
5.65-03	7.18+01	3.72-01
4.70-03	7.75+01	3.31-01
3.85-03	7.87+01	2.85-01
3.40-03	8.17+01	2.55-01
2.85-03	8.03+01	2.09-01
2.35-03	7.58+01	1.63-01
1.95-03	7.16+01	1.27-01
1.60-03	6.30+01	9.45-02
1.40-03	6.26+01	7.98-02
1.15-03	5.62+01	5.76-02
9.00-04	4.76+01	3.81-02
7.00-04	4.07+01	2.44-02

TABLE E102

CONTINUED

RESULTS OF IDF TRANSPORT CALCULATIONS OF THERMAL NEUTRON FLUX FOR A 4.5-INCH THICKNESS OF LIQUID HYDROGEN AT AN ANGLE OF 77.4 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
5.00-04	3.30+01	1.32-02
3.00-04	2.50+01	5.01-03
1.00-04	1.15+01	5.77-04

TABLE E103

RESULTS OF 1DF TRANSPORT CALCULATIONS OF THERMAL NEUTRON FLUX FOR A 13.0-INCH THICKNESS OF LIQUID HYDROGEN AT AN ANGLE OF 38 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
9.50-01	3.58-03	3.22-03
8.50-01	4.02-03	3.22-03
7.50-01	4.80-03	3.36-03
6.50-01	5.70-03	3.42-03
5.50-01	7.20-03	3.60-03
4.50-01	9.78-03	3.91-03
3.50-01	1.18-02	3.72-03
2.80-01	1.46-02	3.80-03
2.40-01	1.73-02	3.89-03
2.10-01	2.01-02	3.92-03
1.80-01	2.51-02	4.02-03
1.40-01	3.05-02	3.89-03
1.15-01	3.19-02	3.50-03
1.05-01	3.31-02	3.21-03
8.85-02	3.66-02	3.05-03
7.80-02	4.16-02	3.05-03
6.85-02	4.68-02	2.93-03
5.65-02	5.73-02	2.86-03
4.35-02	7.49-02	2.97-03
3.57-02	1.04-01	3.47-03
3.13-02	1.43-01	4.19-03
2.73-02	2.09-01	5.21-03
2.25-02	3.50-01	7.16-03
1.84-02	8.19-01	1.42-02
1.62-02	2.05+00	3.13-02
1.43-02	3.99+00	5.21-02
1.18-02	7.38+00	7.90-02
9.60-03	1.25+01	1.13-01
8.45-03	1.67+01	1.33-01
7.40-03	1.96+01	1.36-01
6.45-03	2.21+01	1.33-01
5.65-03	2.49+01	1.29-01
4.70-03	2.80+01	1.20-01
3.85-03	2.90+01	1.05-01
3.40-03	2.83+01	8.85-02
2.85-03	2.99+01	7.78-02
2.35-03	2.86+01	6.16-02
1.95-03	2.61+01	4.63-02
1.60-03	2.32+01	3.48-02
1.40-03	1.95+01	2.48-02
1.15-03	1.99+01	2.04-02
9.00-04	1.77+01	1.42-02
7.00-04	1.49+01	8.91-03

TABLE E103

CONTINUED

RESULTS OF 1DF TRANSPORT CALCULATIONS OF THERMAL NEUTRON FLUX FOR A 13.0-INCH THICKNESS OF LIQUID HYDROGEN AT AN ANGLE OF 38 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
5.00-04	1.36+01	5.45-03
3.00-04	1.38+01	2.77-03
1.00-04	1.95+01	9.73-04

TABLE E104

RESULTS OF IDF TRANSPORT CALCULATIONS OF THERMAL NEUTRON FLUX FOR A 13.0-INCH THICKNESS OF LIQUID HYDROGEN AT AN ANGLE OF 77.4 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
9.50-01	3.01-03	2.70-03
8.50-01	3.34-03	2.67-03
7.50-01	3.95-03	2.76-03
6.50-01	4.62-03	2.77-03
5.50-01	5.73-03	2.87-03
4.50-01	7.64-03	3.06-03
3.50-01	9.20-03	2.90-03
2.80-01	1.12-02	2.92-03
2.40-01	1.32-02	2.97-03
2.10-01	1.53-02	2.98-03
1.80-01	1.90-02	3.03-03
1.40-01	2.32-02	2.95-03
1.15-01	2.45-02	2.70-03
1.05-01	2.58-02	2.49-03
8.85-02	2.87-02	2.39-03
7.80-02	3.15-02	2.31-03
6.85-02	3.62-02	2.26-03
5.65-02	4.68-02	2.34-03
4.35-02	6.79-02	2.69-03
3.57-02	9.37-02	3.14-03
3.13-02	1.28-01	3.76-03
2.73-02	1.96-01	4.87-03
2.25-02	4.09-01	8.37-03
1.84-02	9.03-01	1.56-02
1.62-02	1.57+00	2.40-02
1.43-02	2.70+00	3.52-02
1.18-02	4.80+00	5.13-02
9.60-03	6.94+00	6.26-02
8.45-03	8.36+00	6.62-02
7.40-03	9.67+00	6.70-02
6.45-03	1.10+01	6.65-02
5.65-03	1.23+01	6.34-02
4.70-03	1.35+01	5.76-02
3.85-03	1.38+01	5.00-02
3.40-03	1.43+01	4.47-02
2.85-03	1.40+01	3.64-02
2.35-03	1.31+01	2.82-02
1.95-03	1.23+01	2.18-02
1.60-03	1.07+01	1.60-02
1.40-03	1.05+01	1.34-02
1.15-03	9.31+00	9.54-03
9.00-04	7.76+00	6.21-03
7.00-04	6.55+00	3.93-03

TABLE E104

CONTINUED

RESULTS OF 1DF TRANSPORT CALCULATIONS OF THERMAL NEUTRON FLUX FOR A 13.0-INCH THICKNESS OF LIQUID HYDROGEN AT AN ANGLE OF 77.4 DEGREES

UPPER ENERGY (EV)	NEUTRON FLUX (RELATIVE UNITS)	FLUX*ENERGY (RELATIVE UNITS)
5.00-04	5.21+00	2.09-03
3.00-04	3.88+00	7.76-04
1.00-04	1.76+00	8.81-05