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R-0038

A HELIUM-3 PROPORTIONAL COUNTER TECHNIQUE

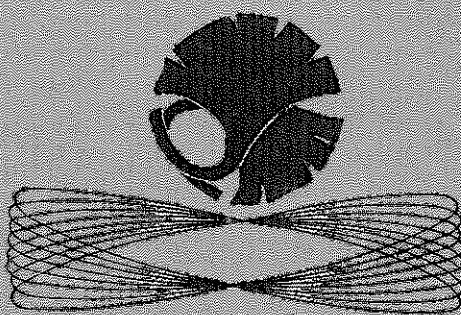
FOR ESTIMATING FAST AND INTERMEDIATE NEUTRONS

昭和 51 年度動力炉核燃料開発事業団受託研究  
中速中性子スペクトロメーター開発

Toshiso KOSAKO\*, Masaharu NAKAZAWA\*

Hiroaki WAKABAYASHI\*\*, and Akira SEKIGUCHI\*

November 1976



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## ABSTRACT

$^3\text{He}$  proportional counter was employed to determine the fast and intermediate neutron spectra of wide energy region. The mixed gas ( $^3\text{He}$ , Kr) type counter response and the spectrum unfolding code were prepared and applied to some neutron fields. The counter response calculation was performed by using the Monte Carlo code, paying regards to dealing of the particle range calculation of the mixed gas. An experiment was carried out by using the van de Graaff accelerator to check the response function. The spectrum unfolding code was prepared so that it may have the function of automatic evaluation of the higher energy spectrum's effect to the pulse hight distribution of the lower energy region. The neutron spectra of the various neutron fields were measured and compared with the calculations such as the discrete ordinate Sn calculations. It became clear that the technique developed here can be applied to the practical use in the neutron energy range from about 150 KeV to 5 MeV.

## Key Words

$^3\text{He}$ proportional counter	fast and intermediate neutrons
response function	Monte Carlo method
particle range	comparative evaluations
spectrum unfolding	neutron fields

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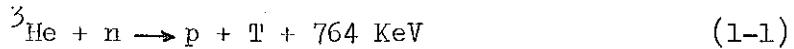
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Table. 2. Mixed Gas Parameters Used for the Stopping Power Calculation

## I. Introduction

### (1) The characteristics of helium-3 proportional counter

The exothermic nuclear reaction is used for the neutron detection in a helium-3 proportional counter.



To be used for a neutron spectrometer, a helium-3 counter has several advantages.

- 1) The Q-value of  $^3\text{He}$  (n, p) T reaction is relatively high (764 KeV), and the electric pulse height of detector created by this reaction is larger than those of  $\gamma$ -rays. Consequently, it becomes possible to measure neutron spectra without n- $\gamma$  discrimination which is indispensable for a proton-recoil counter.
- 2) It has a possibility of use in a wide energy range from 100 KeV to a few MeV. The lowest energy is limited by the thermal neutron peak, and the higher energy is by the decrease of efficiency. It is possible to extend the lower energy limit by using the rise time discrimination.
- 3) A helium-3 counter can be attained to a high efficiency from  $10^{-4}$  to  $10^{-3}$  depending primarily upon the amount of gas confined within the sensitive volume.
- 4) The  $^3\text{He}$  (n, p) T reaction cross section has nearly a constant value of about 0.8 barn between 300 KeV and 1.2 MeV. This fact is very convenient as a high energy region neutron spectrometer.
- 5) This spectrometer is prepared as a gas filled proportional counter having a rather good energy resolution of 4% to 10% (FWHM).

On the other hand, there are also some disadvantages for a helium-3 counter as a spectrometer.

- 6) High fluxes of low energy neutrons will not distort the spectrum observed for high energy neutrons, but the total count rate must be limited to several hundreds of CPS (counts per second) to avoid pulse pile-up effect since a proportional counter has a slow time response.

- 7) As  $^3\text{He}$  ( $n, p$ ) T reaction has a  $1/v$  type cross section in the lower energy region, the thermal and epi-thermal neutrons make large background counts as a high energy spectrometer. Although it can be reduced by a suitable shielding.
- 8) Helium-3 reacts with neutrons mainly through  $^3\text{He}$  ( $n, p$ ) T reaction. But the existence of the several competing reactions listed below makes the response function of the helium-3 counter complicated.

Those are the followings:

- i)  $^3\text{He}$  ( $n, n$ )  $^3\text{He}$  for all energy region

Helium-3 gets the kinetic energy below  $3/4 E_n$  from the elastic scattering with neutrons of energy  $E_n$ . This cross section is approximately twice as large as the  $^3\text{He}$  ( $n, p$ ) T reaction over the energy range from 300 KeV to 2.5 MeV.

- ii)  $^3\text{He}$  ( $n, d$ ) D for higher energy neutrons than 4.36 MeV

- iii)  $^3\text{He}$  ( $n, p, n$ ) D for higher energy neutrons than 7.32 MeV

- iv)  $^3\text{He}$  ( $n, p, 2n$ ) H for higher energy neutrons than 10.3 MeV

## (2) The need for the response function

The response function is the base of the data unfolding. Some works<sup>2, 6~9</sup> have been done concerning the response function of the helium-3 counter. In case of mono-gas type ( $^3\text{He}$  gas only) counter, the response function was prepared by Iijima et al.<sup>3</sup> through experiments and by Miura<sup>4</sup> through the Monte Carlo calculation. As for mixture gas type ( $^3\text{He}$  and Kr gas), Nishino et al.<sup>5</sup> acquired the response function experimentally in the energy range from 50 KeV to 4.95 MeV. But through the experience of the data unfolding, we made out that there exsist some problems in those response functions over 2 MeV.

The main theme of this work is to prepare the mixture gas type helium-3 counter response in the neutron energy range from 50 KeV to 15 MeV, and also to develope the spectrometer techniques in a wider energy region including the preparation of spectrm unfolding code.

## II. Specifications of the $^3\text{He}$ Counter

Used  $^3\text{He}$  counter is TEXLIUM 9341 type (supplied by Texas Nuclear Co.) and is filled with  $^3\text{He}$  (4 atm) and Kr (2 atm) gas. The kripton helps to reduce the range of the particles created by neutron reactions and decreases the wall effects of a detector. Then the applicable energy range can considerably extend itself with no need of combining several detectors covering different energy ranges.

The basic parameters of the TEXLIUM 9341  $^3\text{He}$  counter were listed in Table 1. The active length of the counter was estimated by the experiment being measured the spatially differential method, which employs beam neutrons for traverse. The structure of the detector determined by the experiment was illustrated in Fig. 2. This shows the active length of 15.24 cm is continued after the front insensitive length of 2.6 cm, and the last is 1.2 cm rear insensitive part.

### III. Calculation of the Response Function

#### (1) Method of the Monte Carlo calculation

To determine all the accurate response functions by experiments is practically limited due to availability of monoenergetic neutron sources. Therefore, the calculated response functions can be used in the interpolations of the several experimental values. Contrary, the experimental results can serve to estimate the accuracy of the calculation. In the present case, Monte Carlo code MCRI<sup>4</sup> was used to calculate the response of the  $^3\text{He}$  counter.

The total flow of the  $^3\text{He}$  counter calculation is given in Fig. 3. The basic data including reaction cross-sections and particle ranges must be prepared in advance to compute the response. Then the Monte Carlo calculation is put into practice, and the results were arranged to the response matrix for the spectral unfolding code. Data of the detector output were transformed to the neutron spectra through the unfolding code, after passing the PRE-DEALING subroutine.

The interactions taken into consideration are  $^3\text{He}$  (n, p) T,  $^3\text{He}$  (n, n) $^3\text{He}$ , and  $^3\text{He}$  (n, d) D reactions.<sup>10, 11, 12</sup> The differential cross sections of  $^3\text{He}$  (n, n) $^3\text{He}$  reaction was taken from the data in BNL 400 (3rd. Edition Vol. 1).<sup>13</sup>  $^3\text{He}$  (n, p) T and  $^3\text{He}$  (n, d) D reactions were assumed to be isotropic in the center-of-mass system. These cross sections are shown in Fig. 1. With the XSECT code, cross sections are compiled in the form of the cumulative distribution function (P) for the Monte Carlo calculation.

$$P_j = \sum_{i=1}^j \Sigma_i / \Sigma_T \quad (3-1)$$

where  $\Sigma_i$  = differential cross section of i group

$\Sigma_T$  = total cross section

Used Monte Carlo code is the MCRI code<sup>4</sup>, the revised version of the O5R code<sup>18</sup>. The random number is determined by the subroutine of the random number generation

in the O5R code.

$$X_n \equiv \lambda^n \pmod{p} \quad (3-2)$$

where  $X_n = n$  th random number

$$\lambda = 5^{17} \text{ (constant)}, P = 2^{45} \text{ (constant)}$$

The period of the random number is  $2^{45}$ .

Cylindrical geometry of the detector was permitted in the calculation, and the direction of the incident neutron beam must be parallel or perpendicular to the counter axis. The particle ranges in the counter filled with mixed gas ( $^3\text{He}$  and Kr) were calculated by using the improved method based on the Bethe's formula. The details are touched in the next paragraph.

The flow chart of the computer program is given in Fig. 4. In the Monte Carlo calculation, one particle history includes the generation of a neutron at its source, its random walk undergoing various scattering interactions in the counter, and its death, which terminates the history. A termination can occur when the particle is absorbed or leaves the geometric region of interest. At the last of the calculation the response function was smoothed by the Gaussian weighting.

$$\frac{\Gamma_0}{\sqrt{(E_n + Q)/Q}} \quad (3-3)$$

Where  $Q = Q$  -value of the reaction (764 KeV)

$E_n$  = neutron energy

$\Gamma_0$  = FWHM at thermal peak

This response function covers the energy range from 50 KeV to 15 MeV.

## (2) Particle range calculation

In calculating a helium-3 counter response, particle range data are needed to estimate the energy loss in the counter. The particles to be considered are proton, deuteron, triton and helium atoms. There exist some measured range data, but the data of mixture gas are very scarce. Furthermore, they can't be applied

to the calculation by the lack of fine continuous data extended over wide energy range. We cannot help obtaining the range data by integrating the stopping power given by the formula which is supported by the measured data.

Theoretical treatment of the stopping power was started by N. Bohr in 1913. After him, H. Bethe (1930) proceed to its quantum mechanical formulation and established the base of formulas widely used at present. It was expressed by the next formula.

$$-\frac{dE}{dx} = \frac{4\pi e^4 Z_1^2}{m v^2} \cdot N Z_2 \left[ \ln \frac{2mv^2}{I_2} - \ln(1-\beta^2) - \beta^2 \right] \quad (3-4)$$

where

i) for electron

$$e = \text{electron charge} \quad 4.802928 \times 10^{-10} \text{ esu}$$

$$m = \text{electron mass} \quad 9.1091 \times 10^{-28} \text{ g}$$

$$c = \text{light velocity} \quad 2.9979 \times 10^{10} \text{ cm/sec}$$

ii) for incident particle

$$E = \frac{1}{2} mv^2, \quad \text{kinetic energy}, \quad eZ_1 = \text{charge}$$

$$v = \text{velocity}, \quad \beta = v/c$$

iii) for absorber

$$Z_2 = \text{atomic number}, \quad N = \text{atomic density}$$

$$I_2 = \text{mean excitation energy}$$

Before going into the calculation, the dealing of the mixture gas must be considered. Fano<sup>14</sup> suggested the single gas approximation of the mixture gas by using effective parameters as described below. There is a mixture gas which contains various elements of the atomic number,  $Z_i$ , and the density,  $N_i$ . According to Bragg's additivity rule, the effective parameters of the mixture gas was determined in the next form.

$$NZ = \sum_i N_i Z_i \quad (3-5)$$

$$NS \ln I = \sum_i N_i Z_i \ln I_i \quad (3-6)$$

An effective mean exitation energy  $I$  is thereby defined through a logarithmic average over the  $I_i$  of its constituents atoms. The calculated results of the particle range by using Bethe's formula is given in Fig. 6. The range data was obtained by numerical integration of the inverse stopping power.

$$R = \int_0^E \left( \frac{dE}{dx} \right)^{-1} dE \quad (3-7)$$

The calculated range shows an unnatural drop in the energy region below a few MeV, and that does not agree with the experimental value. This is because the electron capturing effect was not considered in the formula.

Then the approximate semiempirical formula was employed, which was constructed by H. Sugiyama<sup>15</sup> on the basis of Bethe's formula. The stopping power is expressed by the next formula:

$$-\frac{dE}{dx} = W \frac{4\pi e^4 Z_1^{*2}}{mv^2} \cdot NZ_2^* \ln \frac{2mv^2}{I_2^*} \quad (3-8)$$

where  $M$  = mass of the incident ion. The effective parameters were decided as follows:

$$I_2^* = I_2 \left\{ 1 - \exp \left( -0.71 E^* / I_2 \right) \right\}, \quad E^* = E \cdot m/M$$

$$Z_2^* = Z_2 \left\{ 1 - \exp \left( -0.64 v_r^2 / Z_2^n \right) \right\}, \quad v_r = v/v_0, \quad v_0 = e^2/k$$

$$n = \frac{2}{3} + \frac{1}{3} \left\{ 1 - \exp \left( -145 \beta^2 \right) \right\}, \quad \beta = v/c$$

$$Z_1^* = Z_1 \left\{ 1 - \exp \left( -1.35 v_r^2 / Z_1^{\beta} \right) \right\}$$

$$\lambda = 0.81 - 0.04 \left\{ 1 - \exp \left( -0.2 v_r \right) \right\}$$

$$W^{-1} = 1 - \exp \left( -3.14 v_r / Z_1^{0.19} \right)$$

This method was checked by comparing the calculation with the experimental data in Ref. (15) in case of the  ${}^3\text{He}$  mono-gas, and a fairly good agreement was obtained. Then the calculation was performed by using the mixed gas parameters as shown in Table 2. The calculated stopping power of mixed gas is shown in Fig. 5, and the range in Fig. 6. It became evident that the curve of the range data were extended to the lower energy region.

From these results, the correction factor of the Bethe's result was nearly 50% at about 1 MeV, where the lower limit exists in case of Bethe's formula.

Consequently a fairly good result was obtained about the mixture gas of  $^3\text{He}$  4 atm and Kr 2 atm, and the result of the range data was used as an input to the Monte Carlo calculation to estimate the energy loss in the counter.

### 3) The calculated results

The response functions for the helium-3 counter were calculated by the Monte Carlo code, and the results are shown in Fig. 7 and 8. Each case was obtained after the trial of 20,000 - 100,000 histories. The neutron energy range is covered from 50 KeV to 15 MeV, and the results were arranged in the response matrix of  $80 \times 80$ . The typical result of the response functions is shown in Fig. 7. The incident energy is 4.95 MeV and the full peak of the  $^3\text{He}(\text{n}, \text{p})\text{T}$  reaction can be seen at the corresponding energy channel. Below the peak energy the continuous spectrum by wall and end effects is observed, and at the energy of  $3/4 E_n$  the recoil helium ( $^3\text{He}(\text{n}, \text{n})^3\text{He}$ ) edge suddenly rises. The peak near 1 MeV is a  $^3\text{He}(\text{n}, \text{d})\text{D}$  reaction peak which has a threshold energy of 4.36 MeV. Some calculated results of the 1, 5, 10 and 15 MeV incident neutrons are shown in Fig. 8. The followings can be seen from the same figure. As the incident neutron energy increases, the full peak of  $^3\text{He}(\text{n}, \text{p})\text{T}$  reaction decreases. And then the recoil helium pulse height distribution occupies the major part of the response function.

#### IV. Measurements of the Response Function

##### (1) Experimental procedures

The helium-3 counter used is 1 inch in diameter and 6 inch in active length, filled with  $^3\text{He}$  gas of 4 atm and Kr gas of 2 atm. (Texas Nuclear Co. Model 9341) It is covered with 0.5 mm thick cadmium in order to cut off thermal neutrons, and was wrapped by  $^{10}_4\text{C}$  powder with 5 cm thickness to absorb epi-thermal neutrons from the side. A block diagram of the measuring system is shown in Fig. 9. The energy resolution of the system was 5 ~ 10% in FWHM (= about 50 KeV) for thermal neutrons. In order to improve the energy resolution and the efficiency, the pulse-shaping (Gaussian type) time of the spectroscopy amplifier was set about 3 microseconds.

A van de Graaff accelerator in Electrotechnical Laboratory was used for obtaining a monochromatic neutrons. The flux has been calibrated by the international mutual comparison. 250 KeV neutrons were yielded by the  $\text{T} (\text{p}, \text{n})^3\text{He}$  reaction, and 565 KeV neutrons by the  $^7\text{Li} (\text{p}, \text{n})^7\text{Be}$  reaction. The absolute values of the neutron fluence are estimated by the standard fluence monitor of the long counter as follows:

$$E_n = 565 \text{ KeV}, \quad 2.27 \times 10^9 \text{ neutrons} / 1.80 \times 10^4 \text{ sec} / \text{steradian}.$$

$$E_n = 250 \text{ KeV}, \quad 3.04 \times 10^9 \text{ neutrons} / 2.43 \times 10^4 \text{ sec} / \text{steradian}.$$

14.1 MeV neutrons were supplied by a Cockcroft-Walton accelerater at FCA facility of JAERI (Japan Atomic Energy Research Institute), and the measurement was performed.

##### (2) Results

The measured response functions for 250 KeV, 565 KeV and 14.1 MeV neutrons are shown in Fig. 10 ~ 14.  $^3\text{He}$  counter was covered with a stainless cap to protect the edge of the anode wire. (see Fig. 2) The thickness of the cap is from 5 mm to 20 mm. So we must evaluate the cap's effect in case of the parallel

beam incidence. The evaluation was made simply by the attenuation formula,  $I = I_0 \exp(-\Sigma_t x)$ . The total cross section of iron was set at 3.5 barns in the fast energy region, and the atomic density of iron is  $8.48 \times 10^{22}$  (n / cm<sup>3</sup>). Then the intensity was degraded to 0.862, 0.743 and 0.552 with the increase of the thickness of 0.5, 1.0, 2.0 cm. The total decrease was 0.63 by the area weighted calculation. To ascertain the decreasing ratio, the experimental data of the parallel and perpendicular beam response were compared, and the correction factor were experimentally decided to be 0.51. The difference between the calculation and the experiment was caused probably by the multiple scattering effect and the geometrical difference.

Each measured response function was illustrated with the Monte Carlo calculated result and the reference experiment by Nishino et al.<sup>5</sup> Fig. 13 shows 565 KeV response.

The full energy peak overestimates 40% more than Nishino's response, 45% more than the present experiment. The causes for this discrepancy are thought as follows:

- i) the beam condition was not parallel. (3.58° open)
  - ii) The anisotropy of  $^3\text{He}$  (n, p) T reaction cross section was not considered in the input data.
  - iii) the smoothing of the response function was not necessarily enough. (this was not so serious because the window smoothed response was used in spectrum unfolding.)
- The accuracy of the response function was taken into consideration in spectrum unfolding.

Fig.12 shows the 250 KeV response. The same process was done, and the accuracy was estimated 10%. Fig. 14 shows the 14.1 MeV response. The comparison was done in a relative value, and a good agreement was obtained in the MeV region, but the remarkable disagreement below 1 MeV. This was considered to be due to the room returned background neutrons.

In the actual usage, the  $^3\text{He}$  counter is covered with 0.5 mm thick cadmium and  $\text{B}_4\text{C}$  powder with 5 cm thickness to absorb thermal and epi-thermal neutrons from

the side. The shielding property of  $B_4C$  powder is estimated as follows:

$\sim 0.2$ eV	100% absorption
$\sim 2$ KeV	50% absorption
$\geq 50$ KeV	0% absorption

This means the  $B_4C$  cylinder works as a shield for epi-thermal neutrons, but has almost no effect to the neutrons above 50 KeV. In the course of experiments, the attention must be paid to the pulse pile-up. Fig. 15 shows the properties of the pulse pile-up. The count rate of 2000 cps of thermal neutrons gives 2.5 decades smaller plateau pulse hight above the thermal peak, and 4 decades smaller plateau for 100 cps. This must be taken into consideration in analyzing the count rate of the intermediate energy range.

## V. Unfolding the Data of Pulse Height Distribution

The relation between the incident neutron spectrum and the pulse height distribution can be expressed as

$$C = A \cdot \Phi \quad (5-1)$$

where

$A$  = response matrix

$\Phi$  = neutron spectrum

$C$  = counting rate of the detector

The Gaussian smoothed spectrum ( $P$ ) is considered as an approximation of the neutron spectrum.

$$P = W \cdot \Phi \quad (5-2)$$

$W$  is called as the window matrix of Gaussian smoothing, and can be expressed by the linear combination of  $A$ .

$$W = \vec{u} A \quad (5-3)$$

Then the observed count can be expressed as,

$$\hat{P} = \vec{u} A \Phi \quad (5-4)$$

There is uncertainty associated with the observed distribution  $\hat{P}$ . Then the problem was set to minimize the difference between  $P$  and  $\hat{P}$ .

$$\text{min.} = W \Phi - \vec{u} A \Phi = \{W - \vec{u} A\} \frac{C}{A} \quad (5-5)$$

The ensemble of possible distribution of  $\vec{u}$  vector was decided by the least square method in the FERDO code. And the neutron spectrum can be obtained by tracing the reverse process.

In actual spectrum unfolding, the existence of higher energy neutrons sometimes becomes a serious problem. In case of the hard spectrum (rather amount of neutrons exist in 3 - 7 MeV region), it may not be a good method to do spectrum unfolding employing the large response matrix with wide energy range. The  $^3\text{He}$  ( $n, p$ ) T reaction cross section rapidly decreases above 3 MeV, but the recoil pulse height with maximum energy  $3/4 E_n$  remains in the lower energy channels. Consequently,

the low count rate in the higher channels sometimes a large effect in the lower spectrum. Then the large statistical fluctuations in the higher energy region (5 - 15 MeV) must be supplemented by the more accurate spectrum obtained using other method such as NE 213 scintillation counter. It is desirable to do spectrum unfolding after estimating the higher energy spectrum's effect on the pulse height distribution of the lower energy region.

Using the estimated guess spectrum of the higher energy region from the above treatment, PRE-DEALING subroutine in HE3.FERDO code constructs the guessed  $^3\text{He}$  pulse height distribution. And it subtracts the higher effects after the area normalization of both the measured and the guessed pulse height in the appointed channel width. Then the data flows into the FERDO main program and the experimental data was unfolded by the method above mentioned.

## VI. Spectrum Measurements in the Fast Reactor Experiments

The spectra were measured on various systems made up at the YAYOI fast neutron source reactor.

Fig.16 gives the pulse height distribution of the helium-3 counter at the YAYOI fast column. The measurement was done with a count rate less than a several hundreds of cps to avoid the pulse pile-up effect induced by the chance coincidence. So the reactor power level was held down to about a few watts. The energy range between 150 KeV and 5 MeV was determined and the result of analysis by the unfolding code system is given in Fig. 18 . The errors shown are due to the statistical errors of the counts.

When the neutron spectrum is hard such as YAYOI core, where the existence of the neutrons above 5 MeV can't be ignored, the higher energy spectrum has some effects to the lower pulse height distributions. Fig.16 shows the contribution of the higher spectrum above 4.5 MeV using the spectrum derived from NE 213 scintillation counter. Fig.17 shows the each pulse hight component which was constructed from the unfolded spectrum. It can be seen from these figures that the evaluation of the higher energy spectrum is inevitable for  $^3\text{He}$  counter spectrum unfolding of the fast reactor system. The calculated result was compared with the other results of the spectrometry in Fig.19. The mutual evaluation of the spectrometries makes the fast column a reference neutron field.

The technique described here was applied also to unfold the neutron spectrum data of measurement from such sources as the standard field in the YAYOI Octagonal Pb Pile, the neutron streaming experiment, the serpentine concrete transmission experiment. Fig.20~23 show the unfolded spectra for the above fields, although some of them have been published elsewhere.

## VII. Conclusions

It becomes clear that the mixed gas type  $^3\text{He}$  spectrometer technique developed here is useful for the measurement of fast and intermediate neutrons. The counter response was calculated by the Monte Carlo code taking into careful considerations on the range evaluation of ions, and the error of response functions are estimated by the experimental results using the monochromatic neutrons. This method was applied to various neutron fields, and the validity was proved by comparing the measured result with the calculated neutron spectra. A further improvement may be possible by using the rise time discrimination in expanding the lowe energy limit.

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Code," ORNL-3622 (1965)

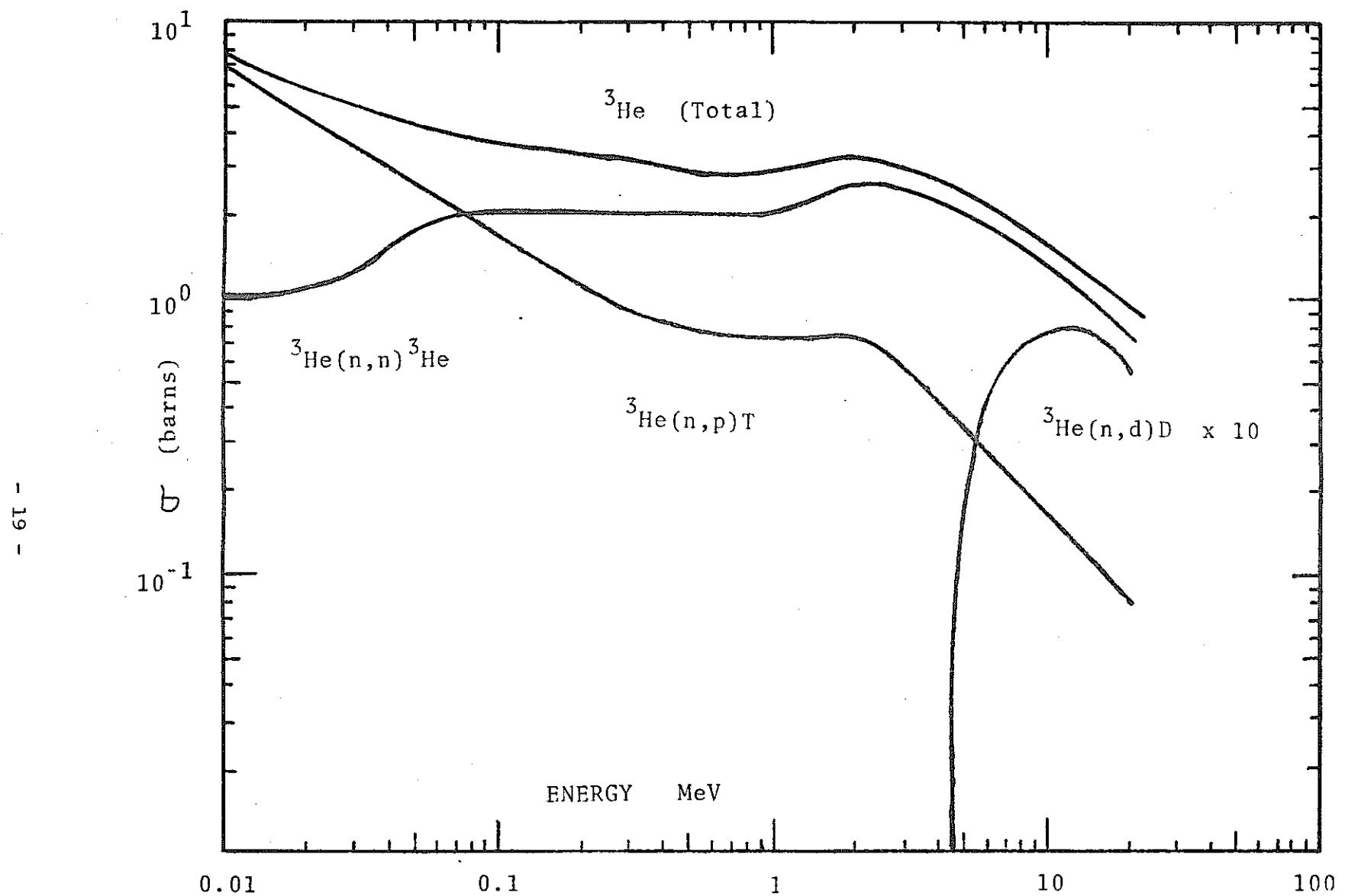


FIG. 1. NEUTRON CROSS SECTIONS OF HELIUM-3

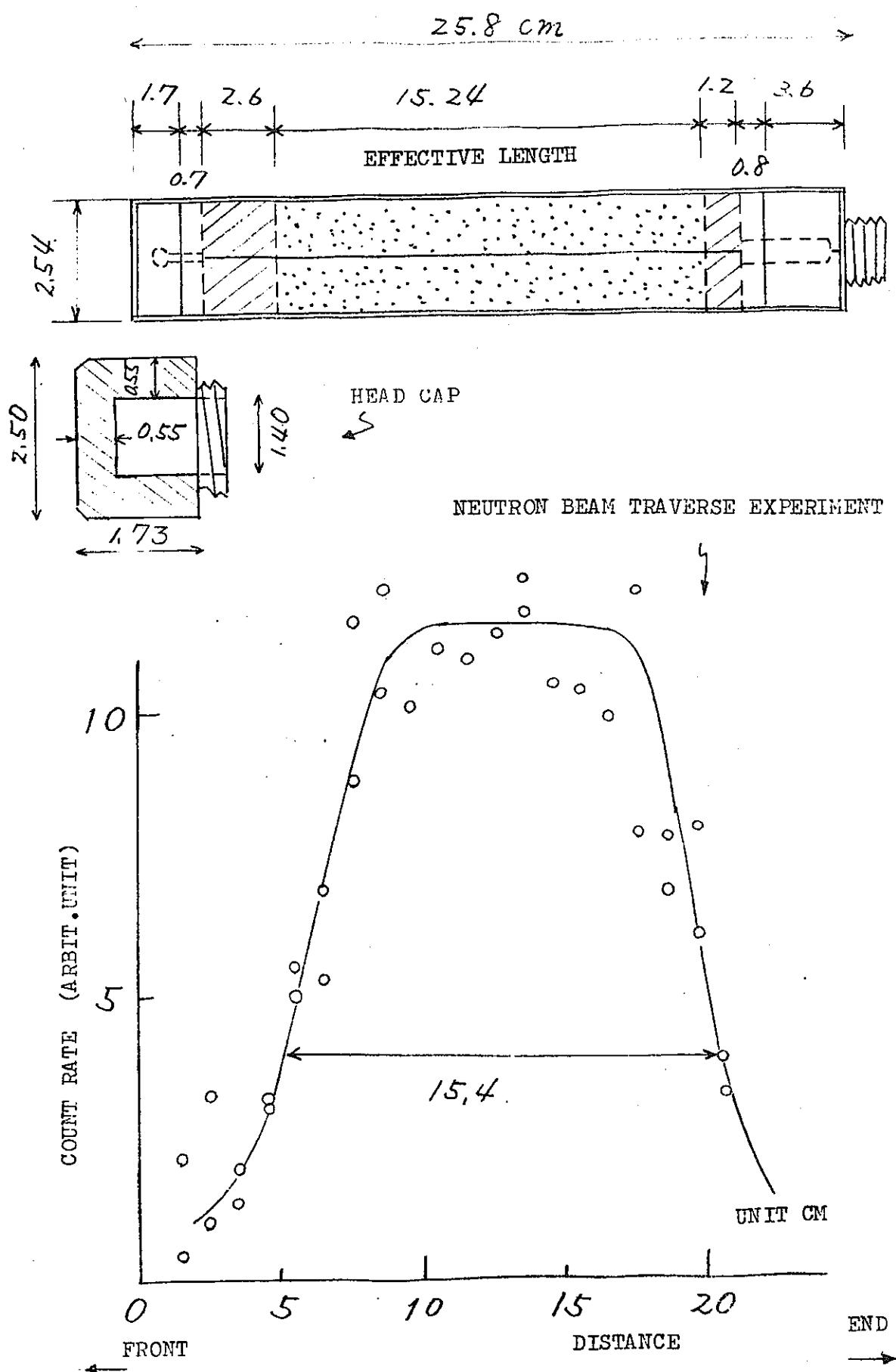


FIG.2. THE STRUCTURE OF THE HELIUM 3 COUNTER (TEXLIUM MODEL 9341)

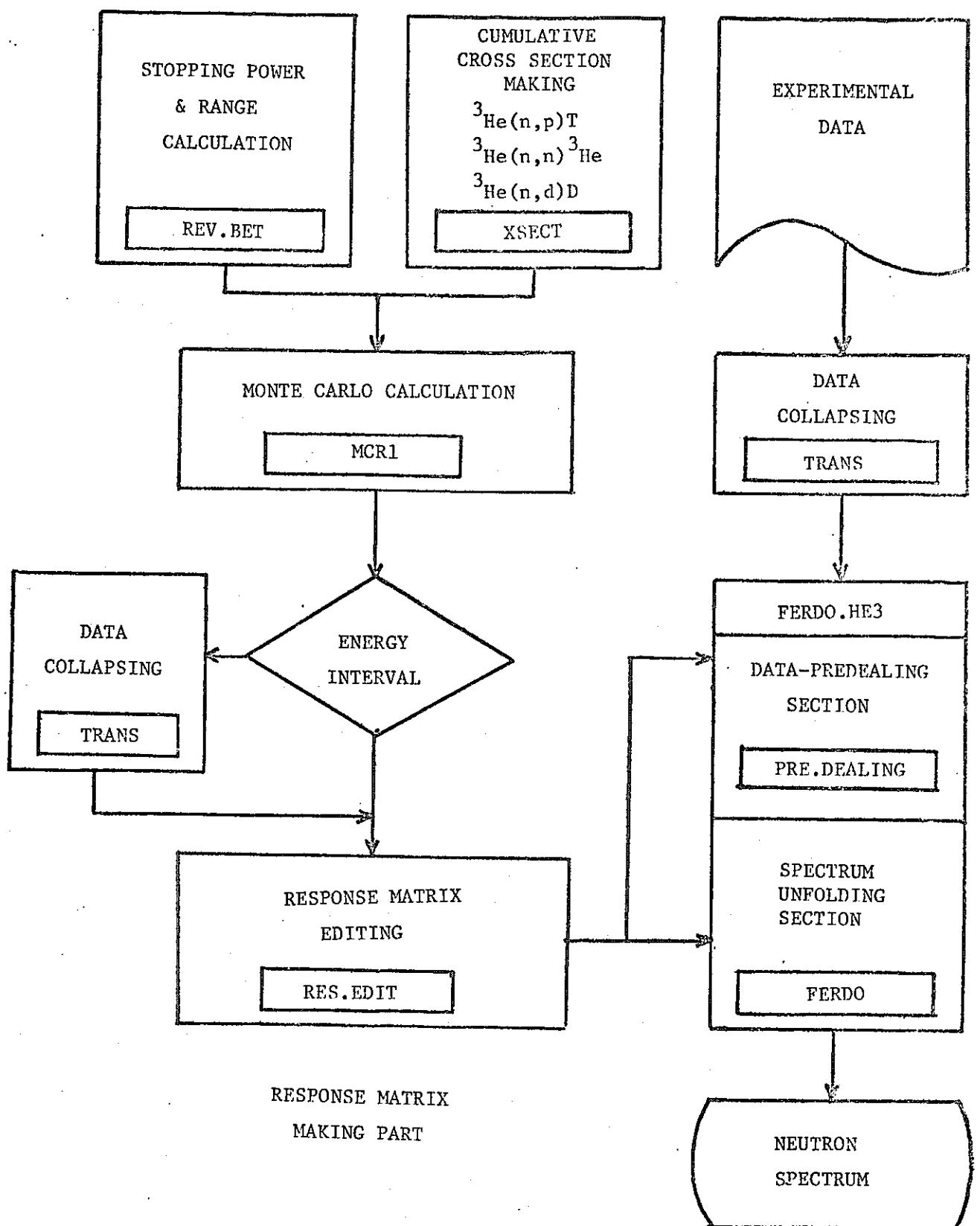


FIG. 3. THE TOTAL FLOW OF THE HELIUM-3 COUNTER CALCULATION

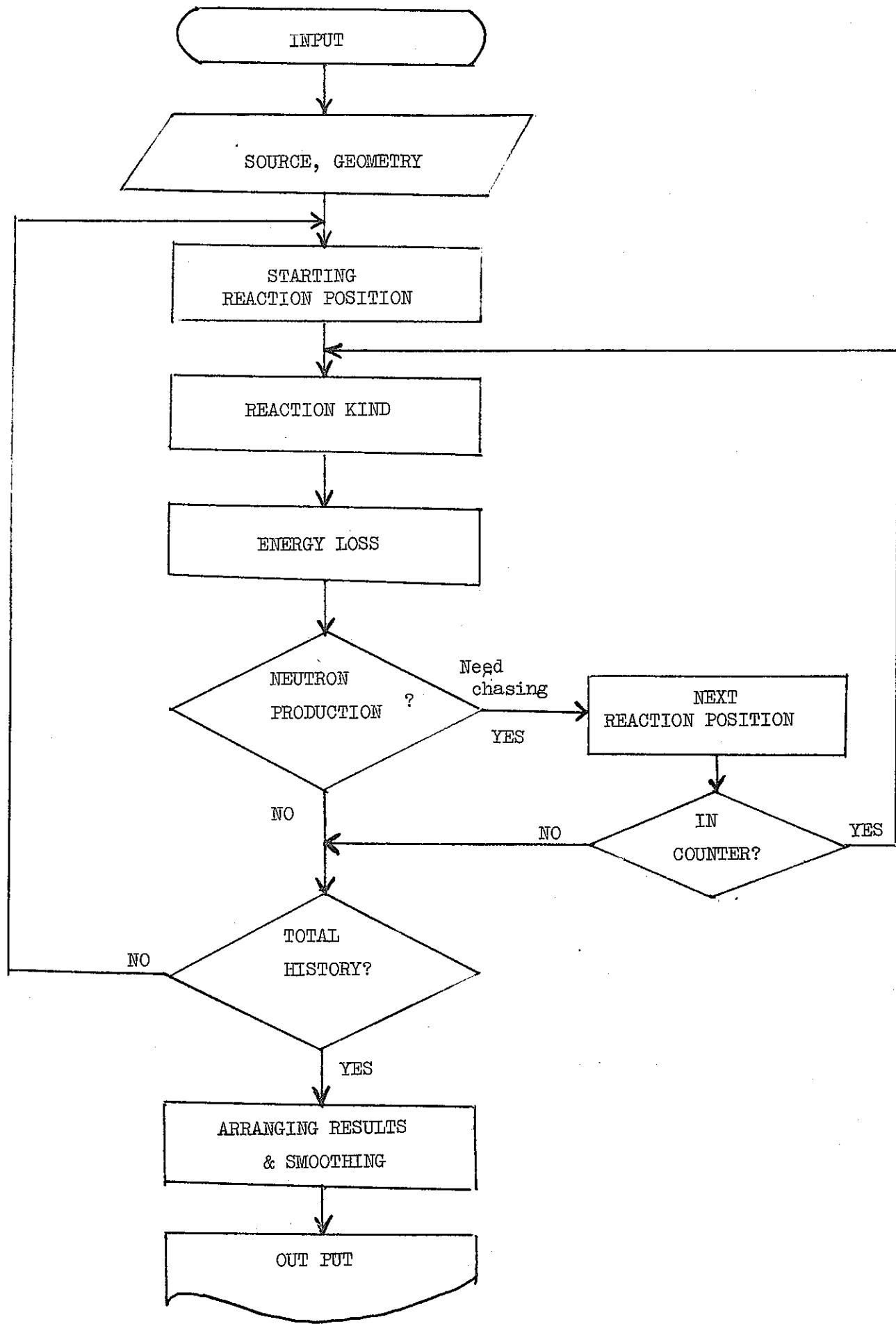


FIG. 4. THE FLOW CHART OF THE MCRL MONTE CARLO CODE

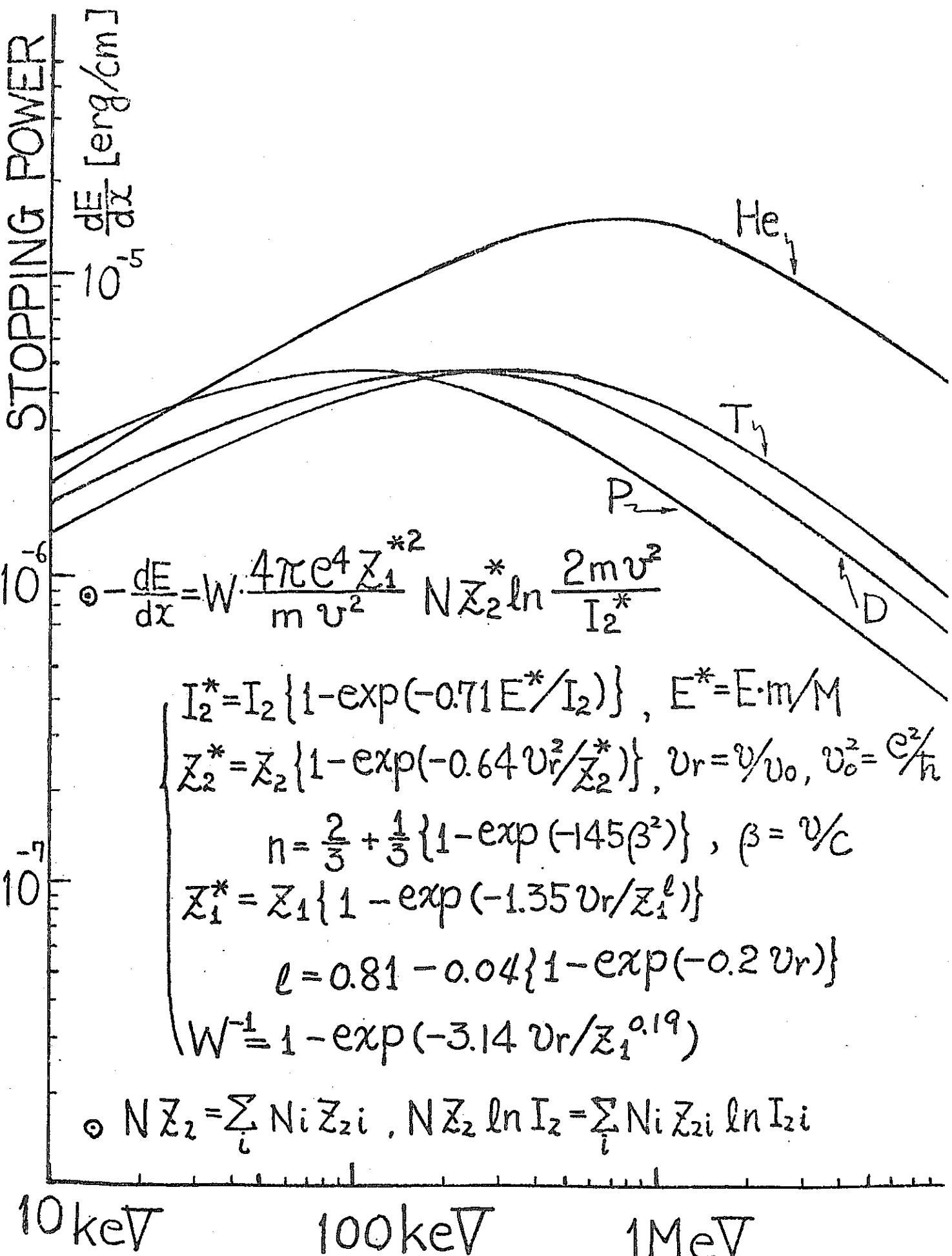


FIG.5. STOPPING POWER OF THE MIXTURE GAS OF  $^3\text{He}$ , 4 ATM. & Kr 2 ATM.

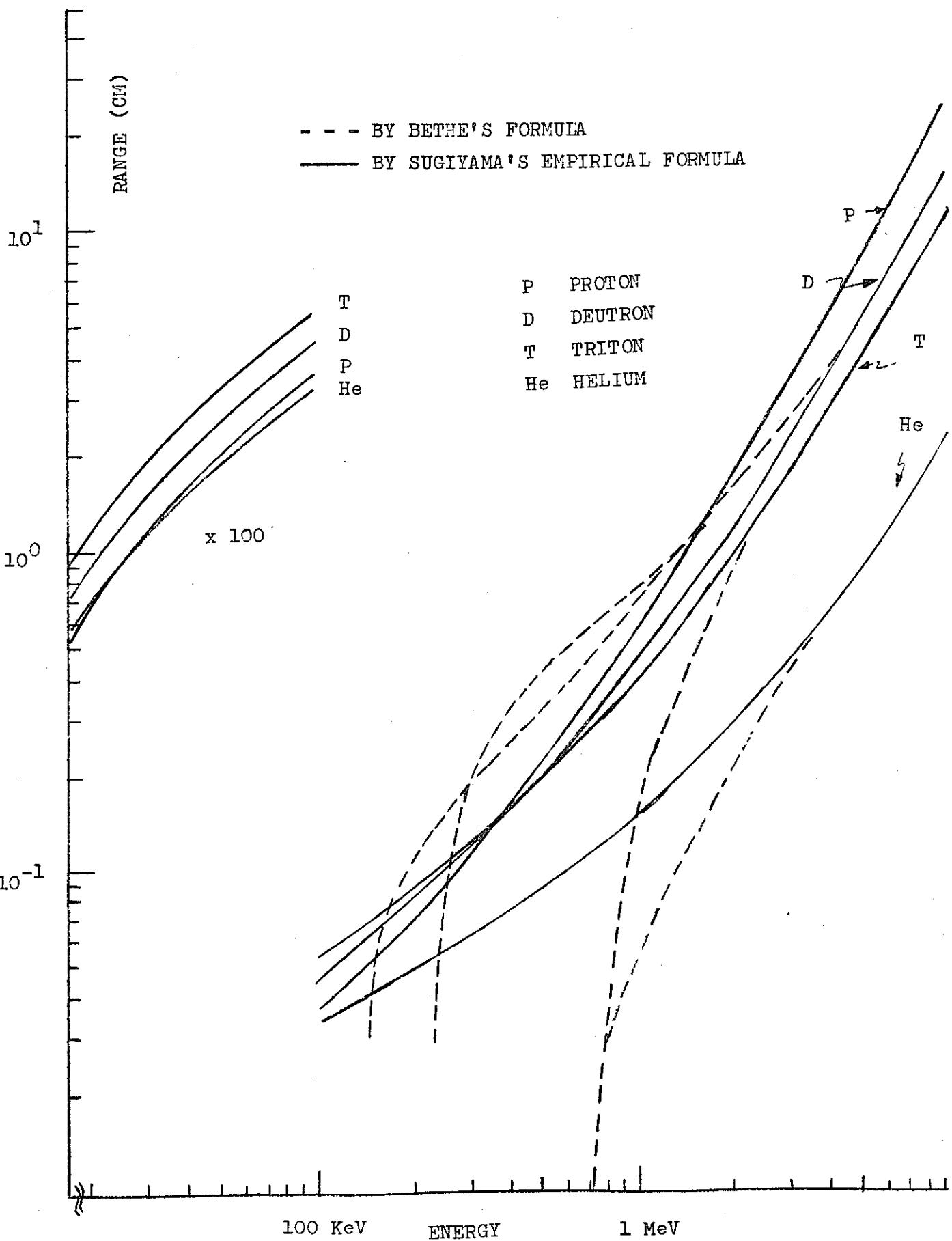


FIG.6. PARTICLE RANGE OF THE MIXTURE GAS OF  $^3\text{He}$ , 4 ATM. & Kr 2 ATM.

INCIDENT NEUTRON ENERGY

HELIUM-3 COUNTER

$E_n = 4.95$  MeV

50,000 HISTORY

TEXLIUM 9341

$^3\text{He}$  4 ATM. & Kr 2 ATM.

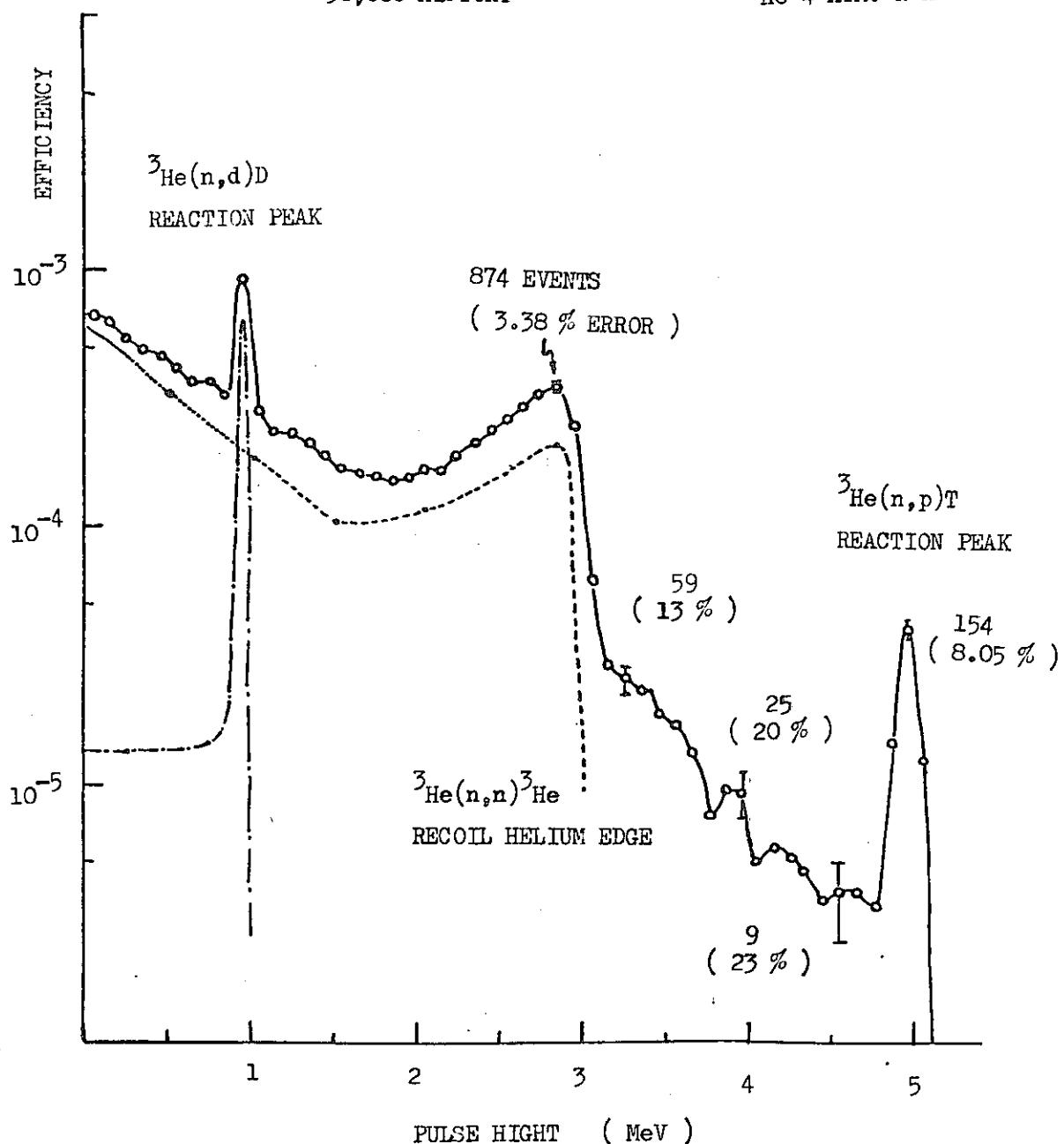


FIG. 7. TYPICAL RESPONSE FUNCTION OF THE HELIUM-3 COUNTER

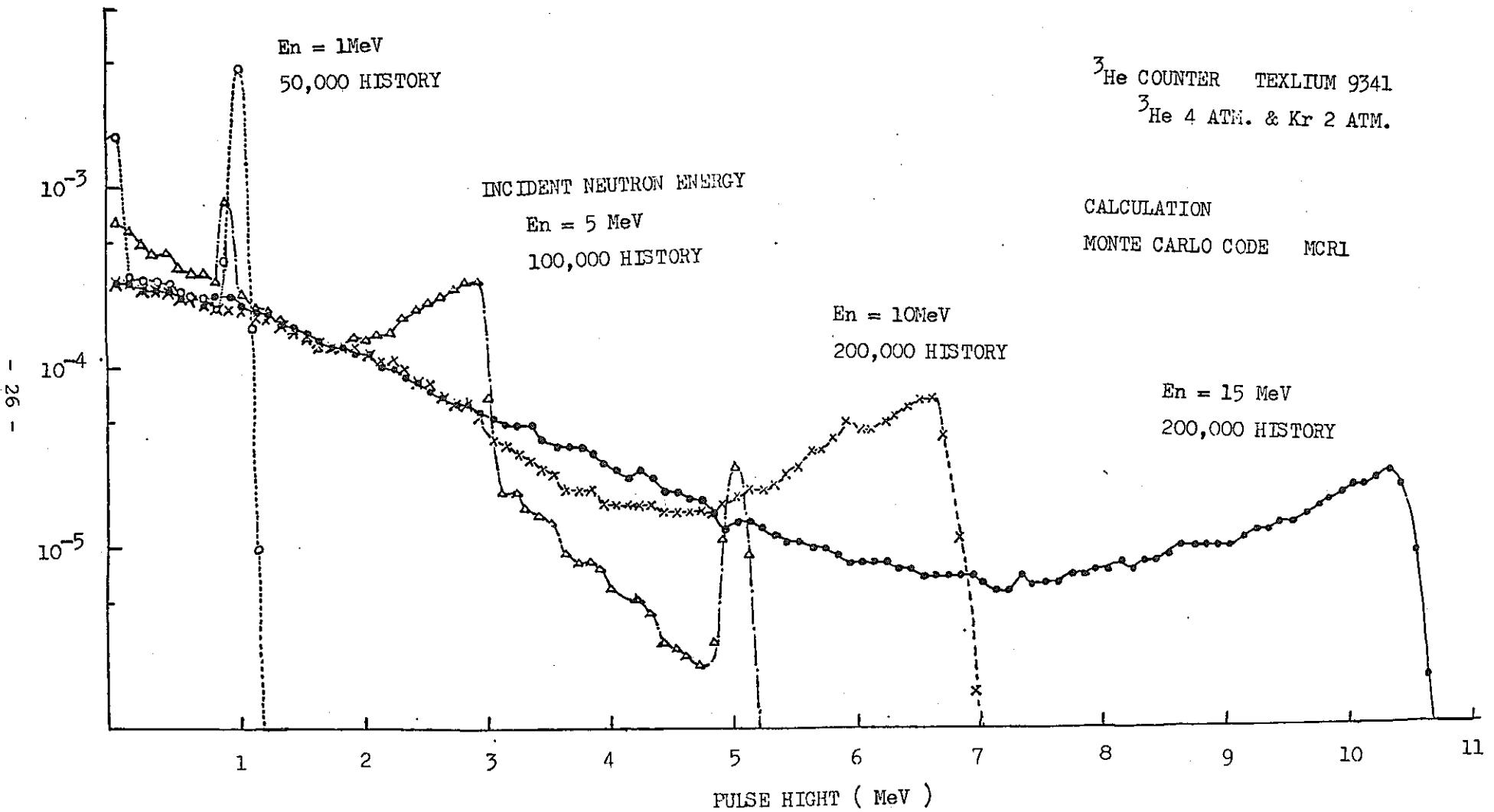


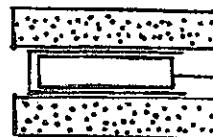
FIG.8. CALCULATED RESPONSE FUNCTIONS FOR THE HELIUM-3 COUNTER

127  
HELIUM-3 PROPORTIONAL COUNTER

( TEXLIUM-9341

${}^3\text{He}$  4 atm. Kr 2 atm

1"φ x 6" )



H. T.

PRE. AMP.

SPECTROSCOPY  
AMP.

PULSE HIGHT  
ANALYZER

FIG. 9. BLOCK DIAGRAM OF THE HELIUM-3 COUNTER

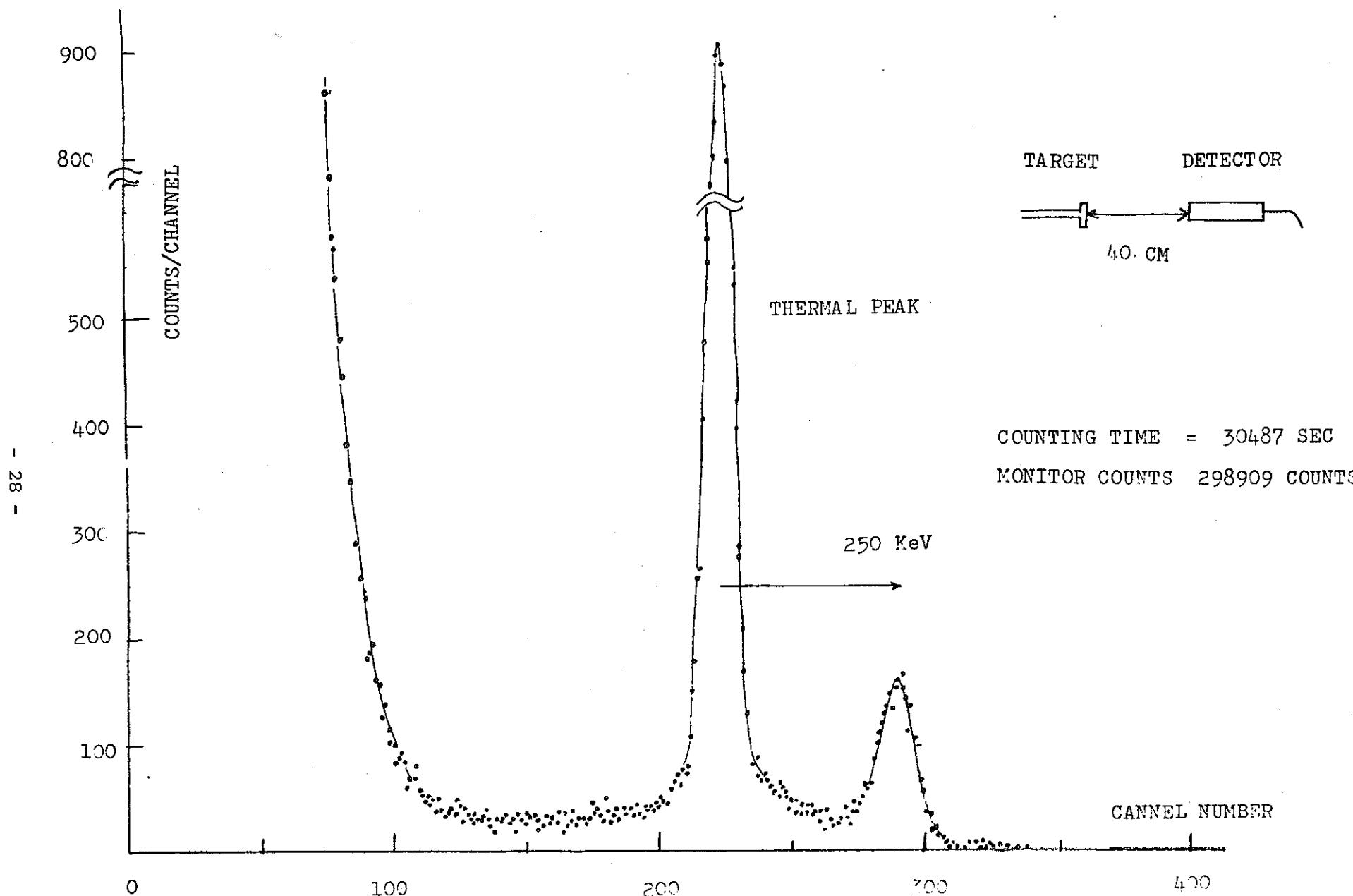


FIG.10. RAW DATA OF THE RESPONSE FUNCTION OF THE  $^3\text{He}$  COUNTER (  $E_n=250 \text{ KeV}$  )

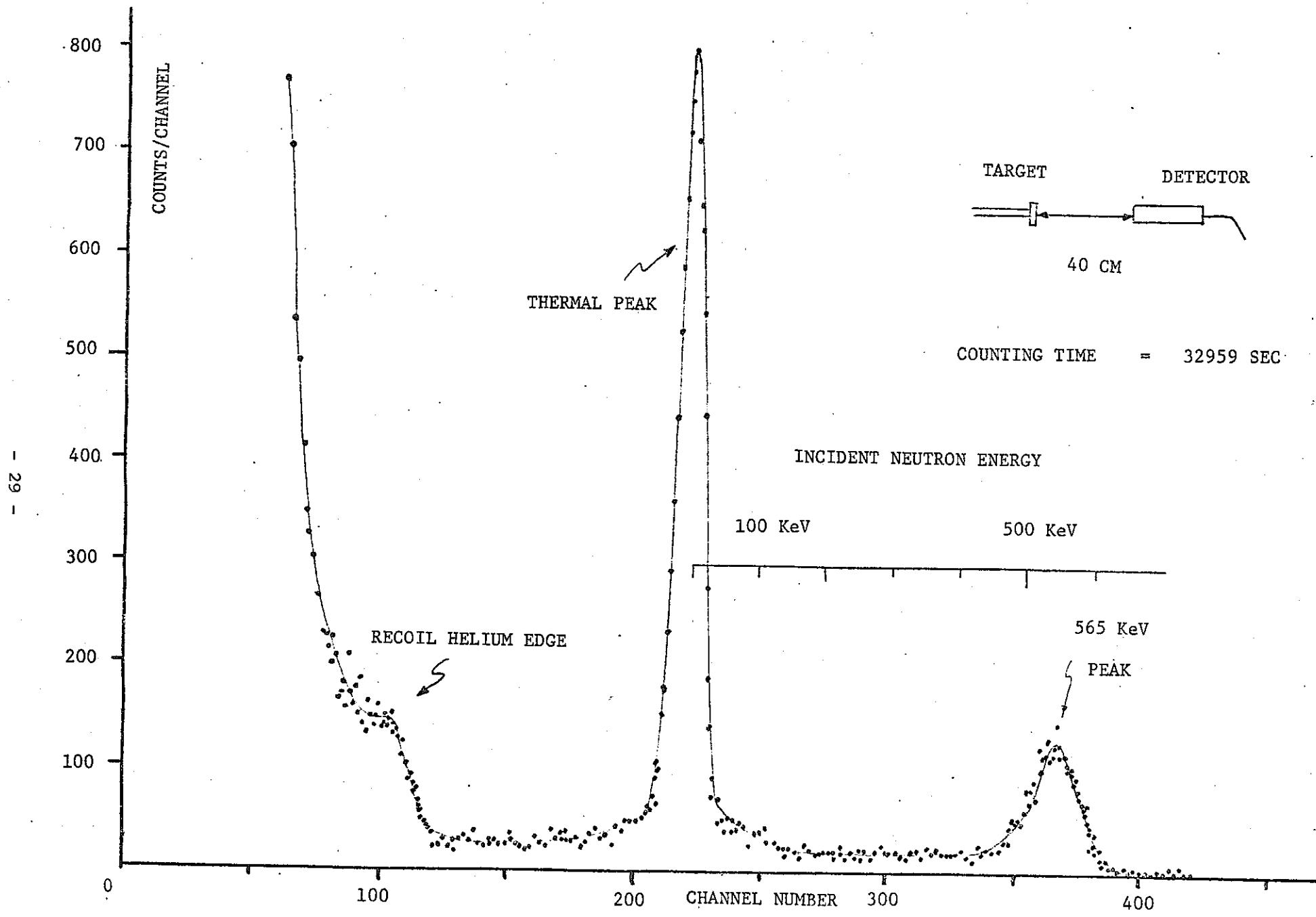


FIG.11. RAW DATA OF THE RESPONSE FUNCTION OF THE HELIUM-3 COUNTER (En = 565 KeV)

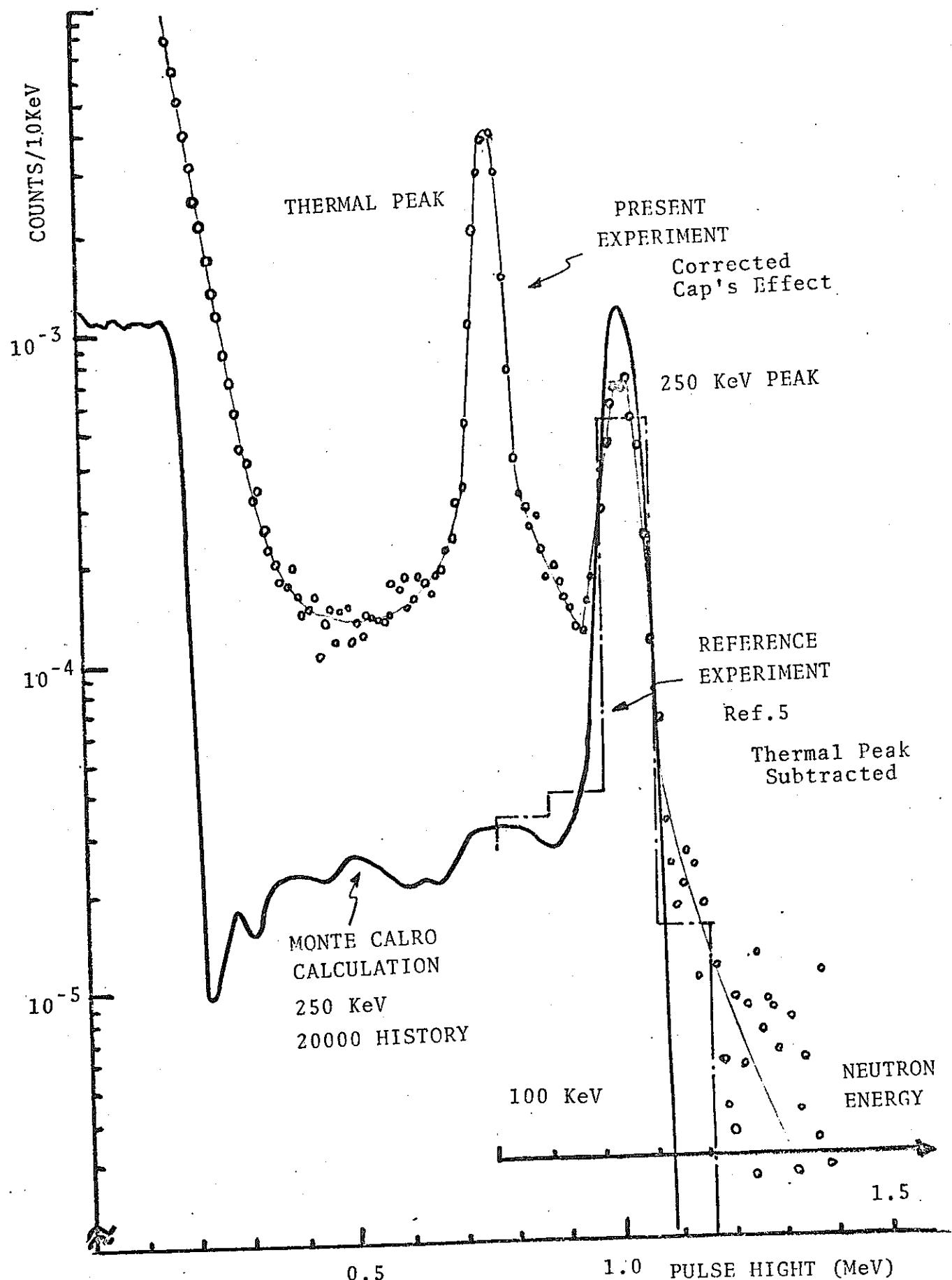


FIG. 12 COMPARISON OF CALCULATED AND MEASURED RESPONSE FUNCTION  
OF THE HELIUM-3 COUNTER (  $E_n = 250 \text{ KeV}$  )

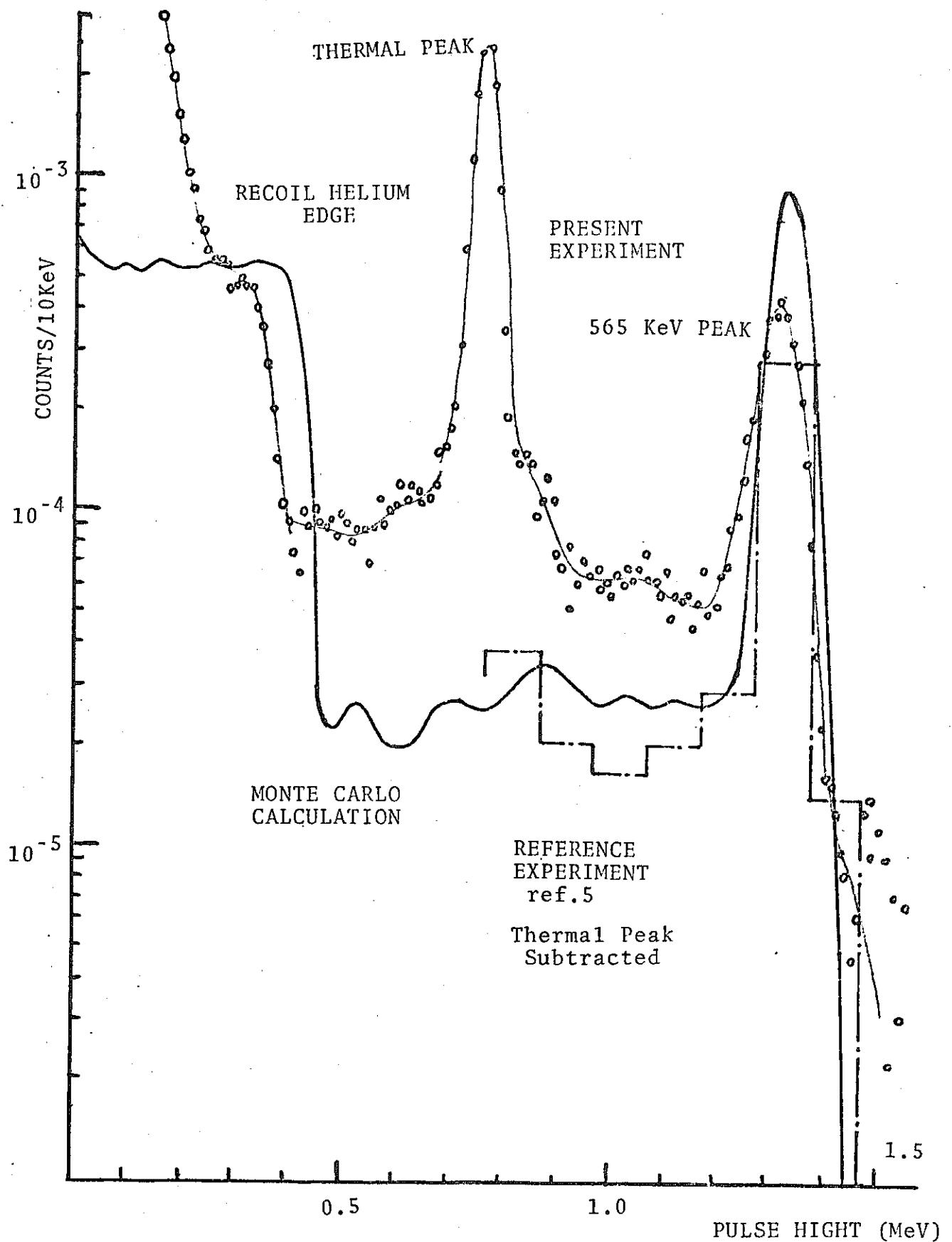


FIG. 13. COMPARISON OF CALCULATED AND MEASURED RESPONSE FUNCTION  
OF THE HELIUM-3 COUNTER (  $E_n = 565 \text{ KeV}$  )

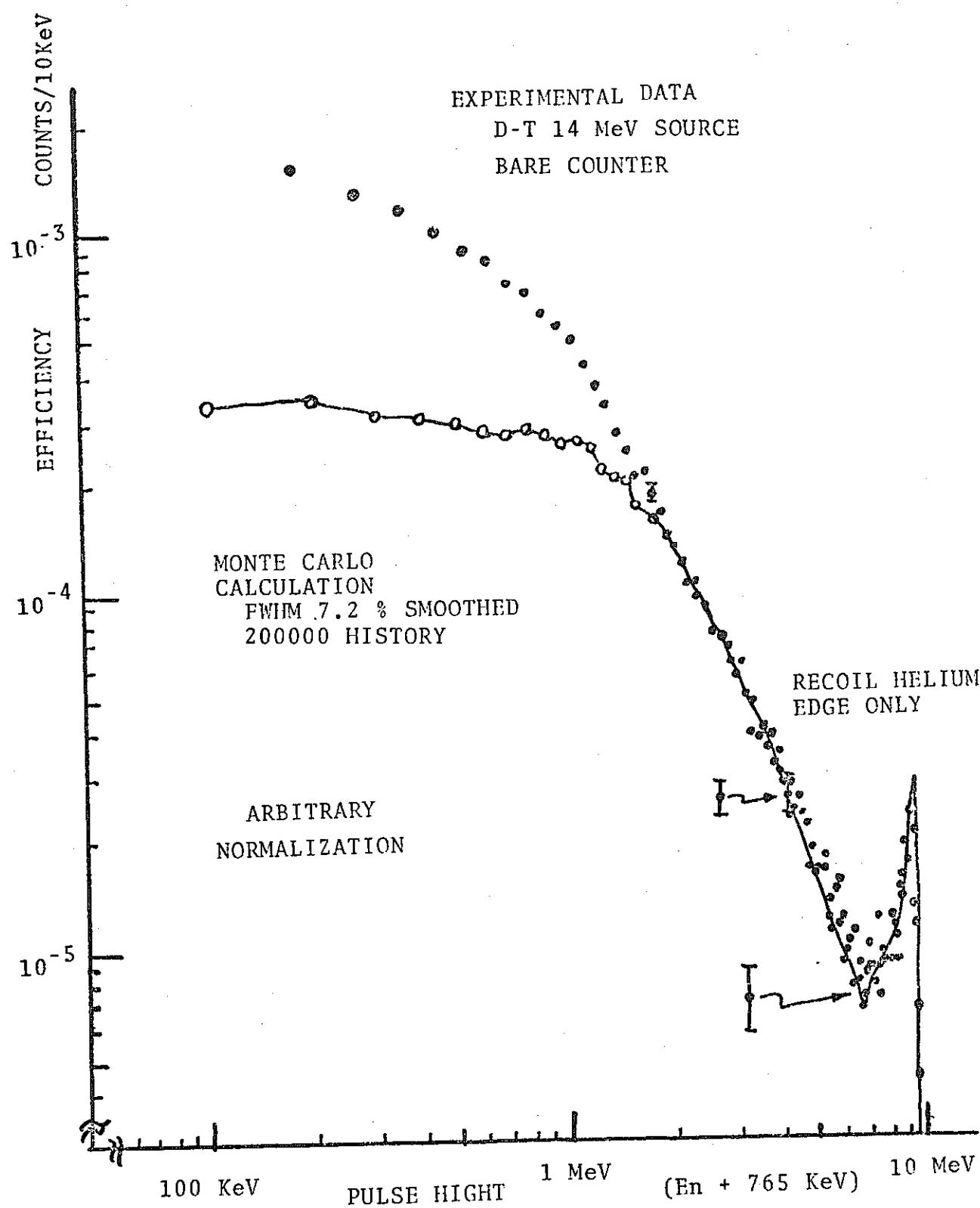


FIG. 14 COMPARISON OF CALCULATED AND MEASURED RESPONSE FUNCTION  
OF THE HELIUM - 3 COUNTER ( En = 14 MeV )

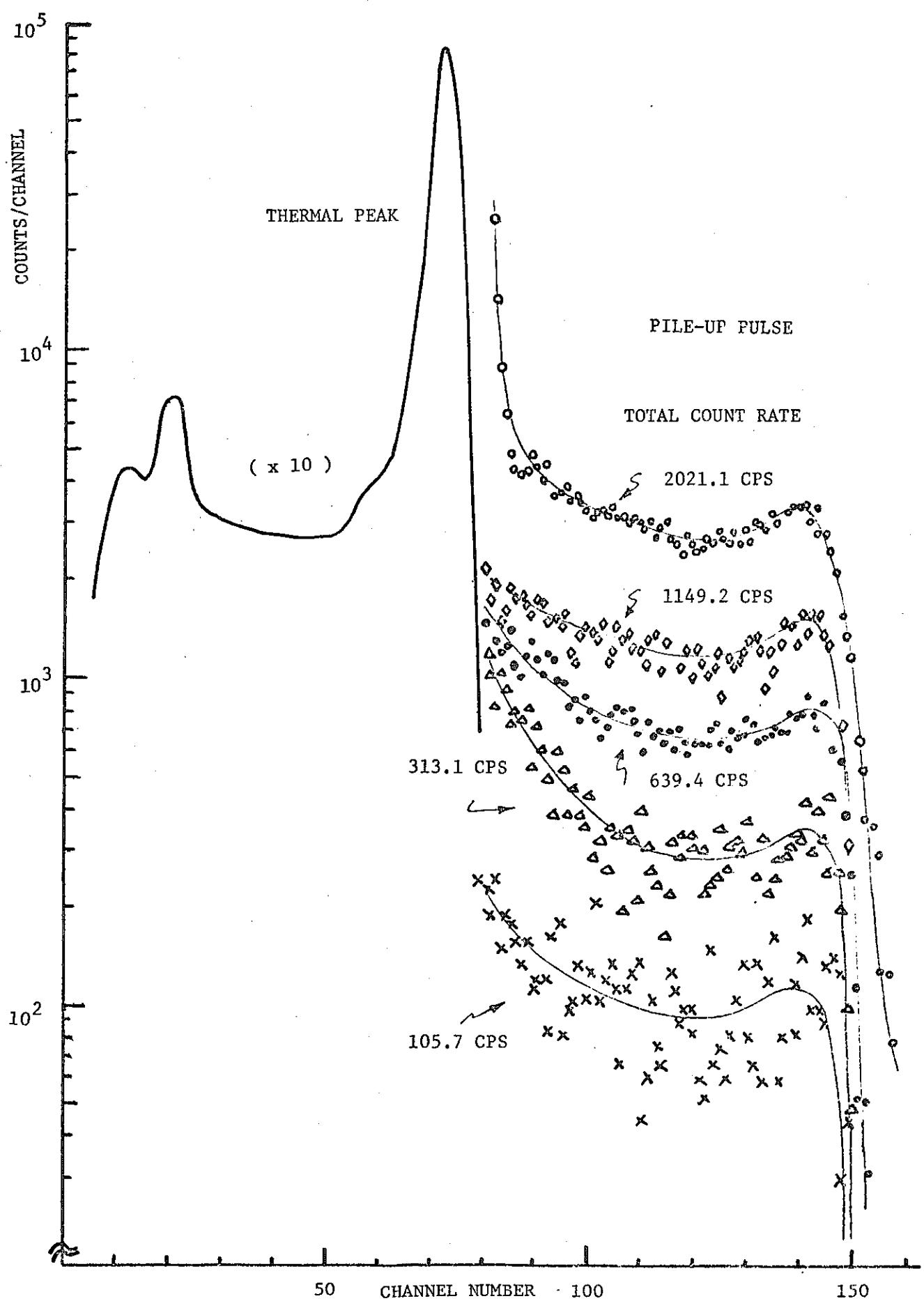


FIG. 15 PILE-UP PROPERTIES OF THE HELIUM-3 COUNTER

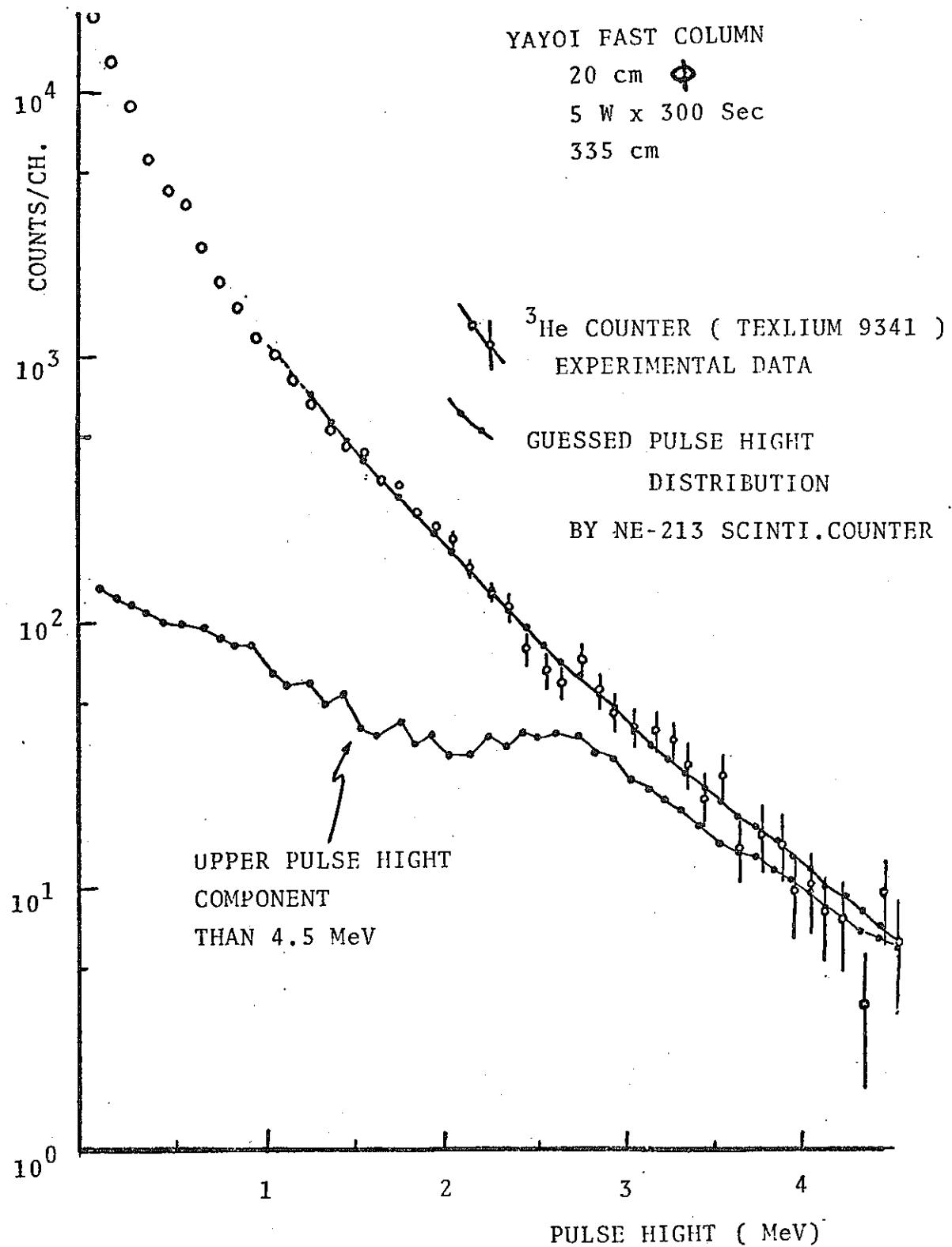


FIG. 16 PULSE HIGHT DISTRIBUTION OF THE HELIUM-3 COUNTER  
( YAYOI FAST COLUMN )

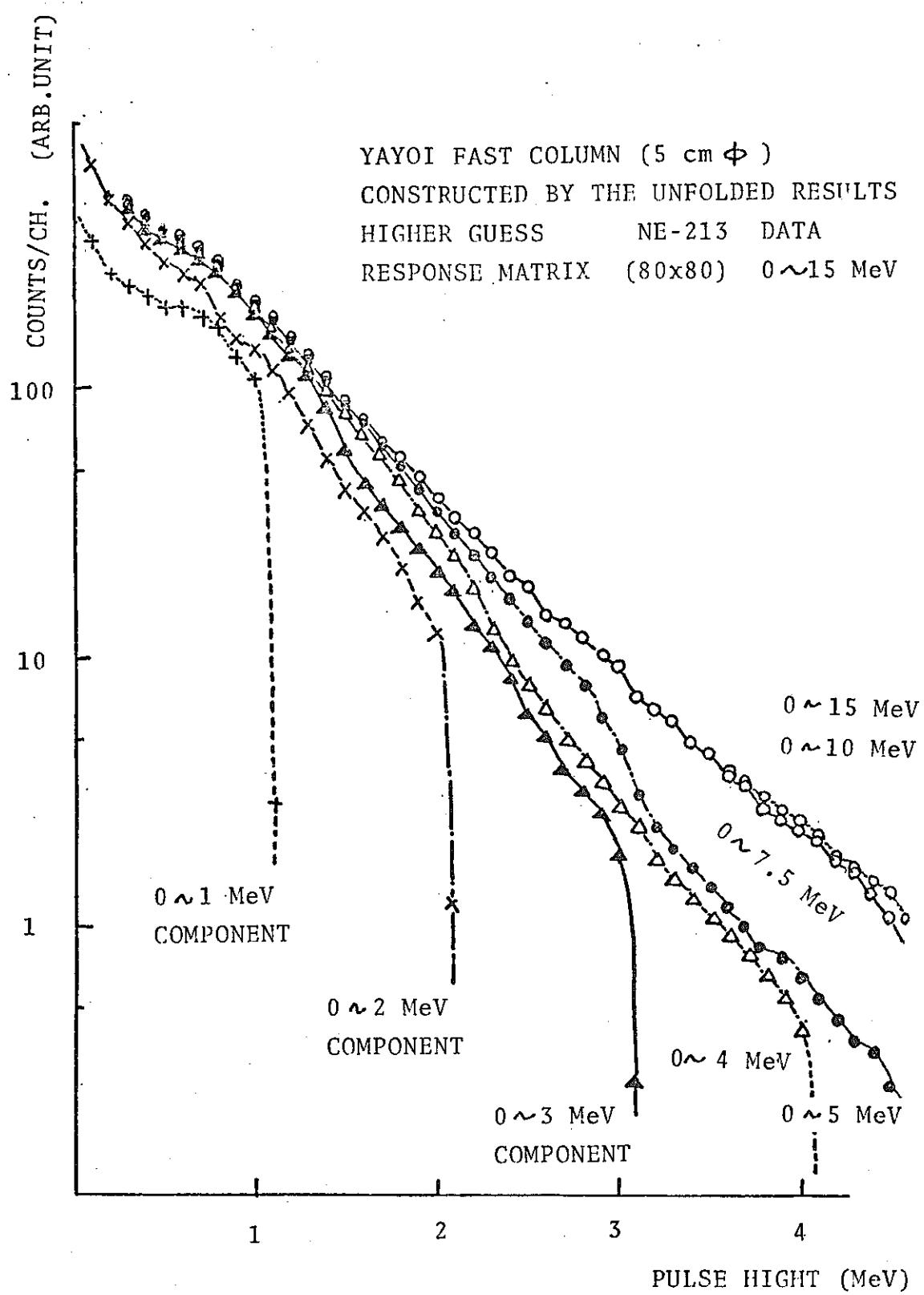


FIG. 17 GUESSED PULSE HIGHT DISTRIBUTION OF THE HELIUM-3 COUNTER  
( YAYOI FAST COLUMN )

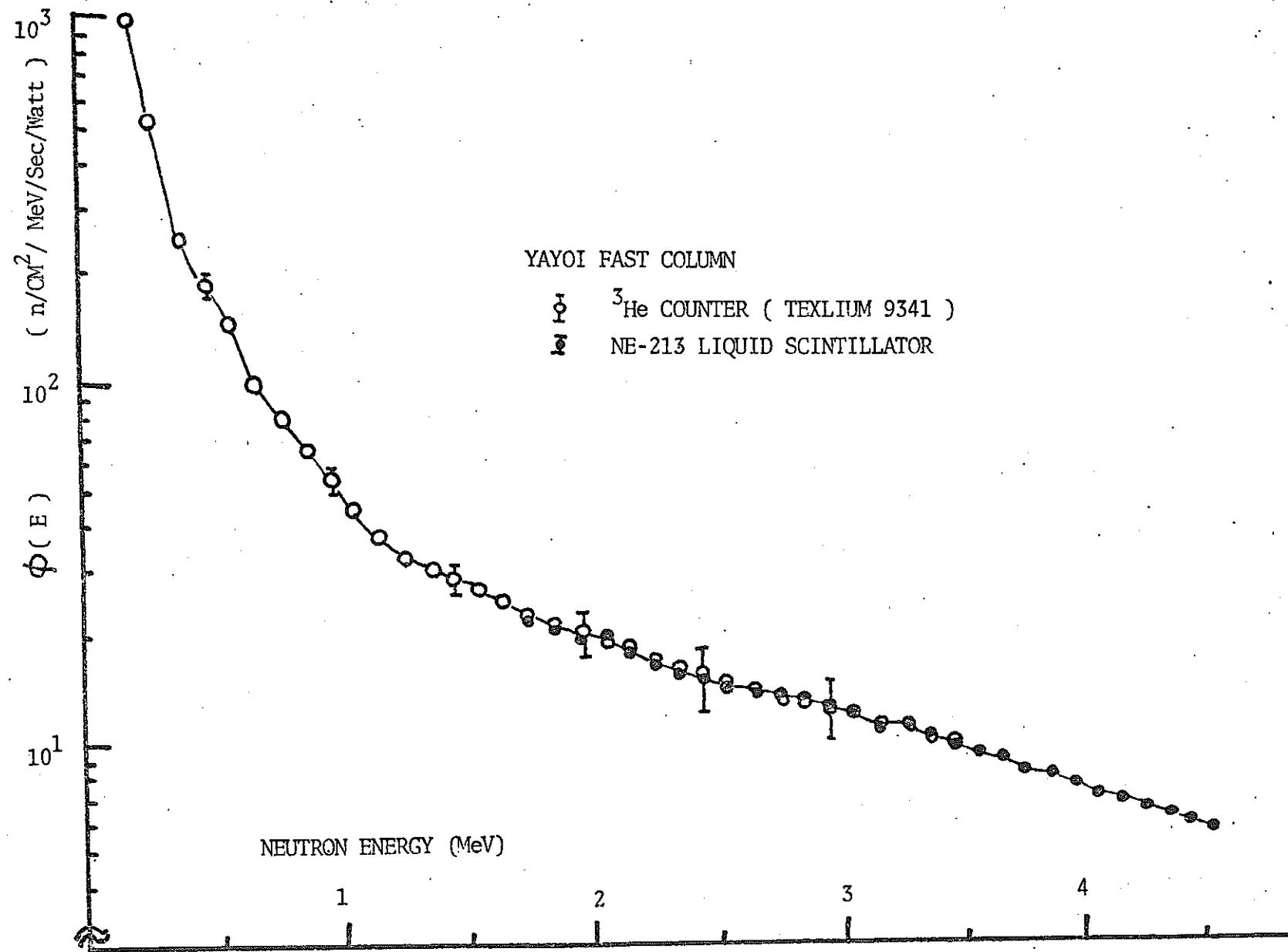


FIG. 18 FAST COLUMN NEUTRON SPECTRUM IN YAYOI BY HELIUM-3 COUNTER

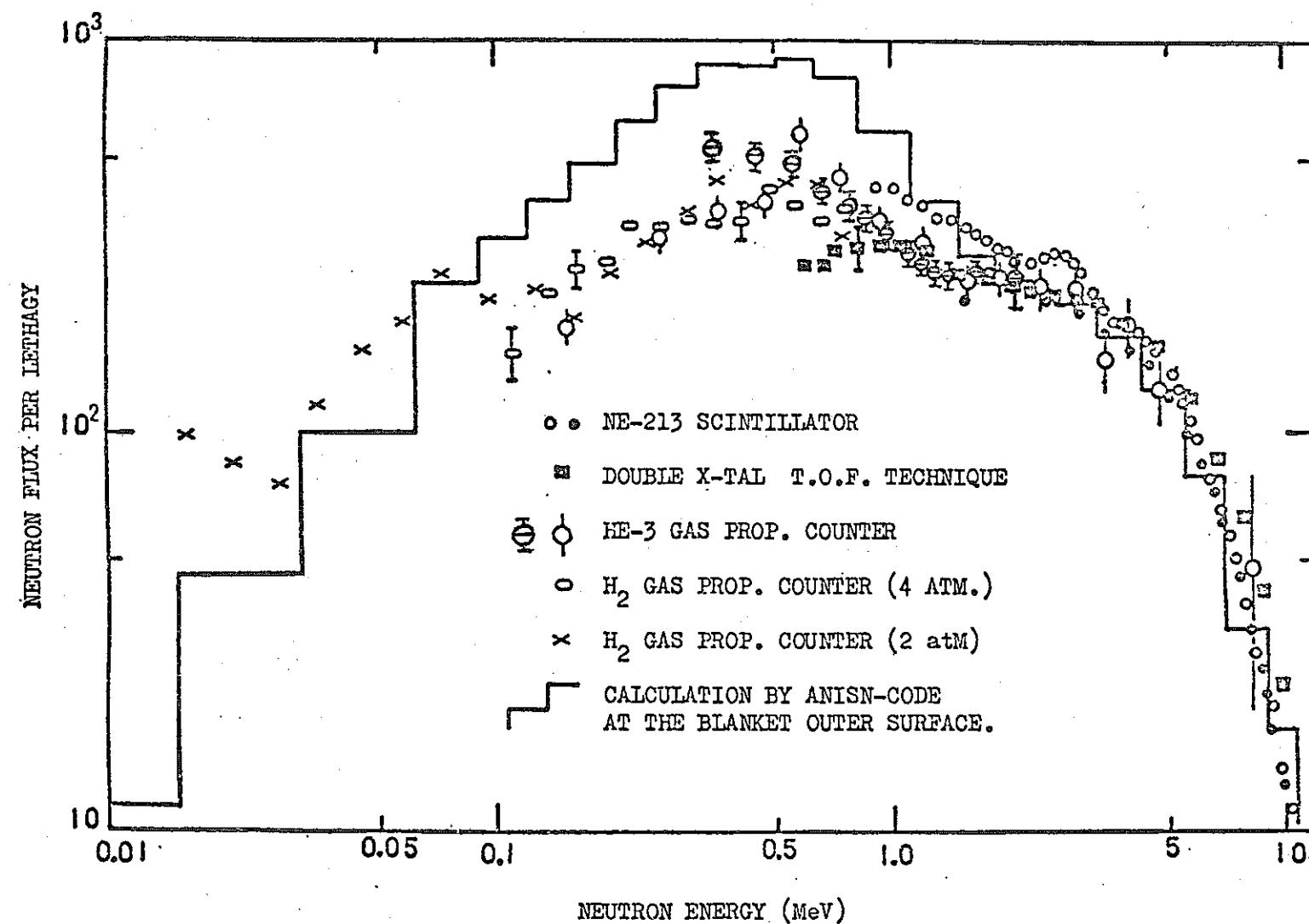


Fig 19 The Fast-Column Beam Neutron Spectrum  
in YAYOI on the 1 WATT OPERATION

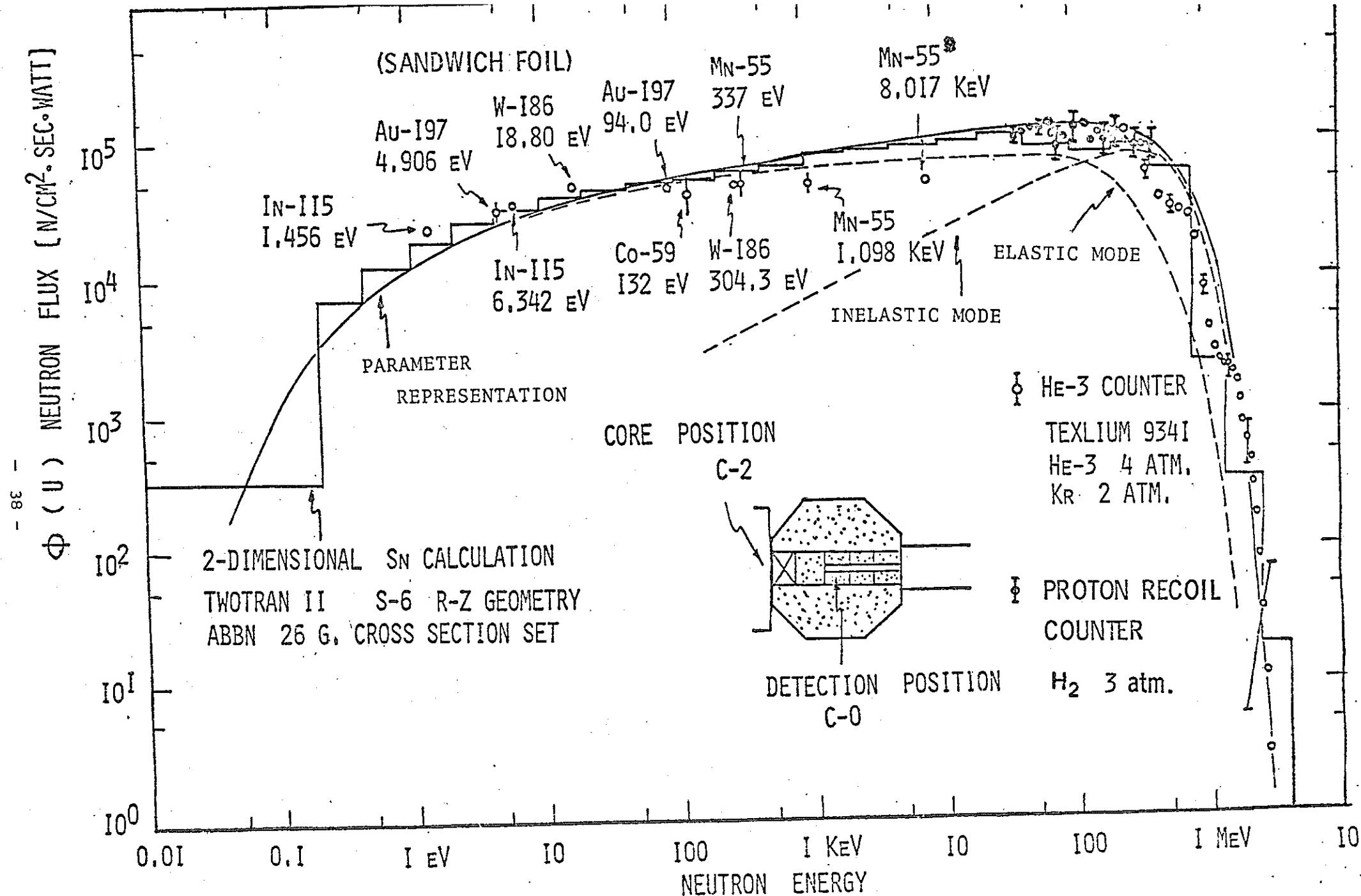


FIG. 20 CENTRAL NEUTRON STANDARD FIELD OF YAYOI OCTAGONAL PB-PILE

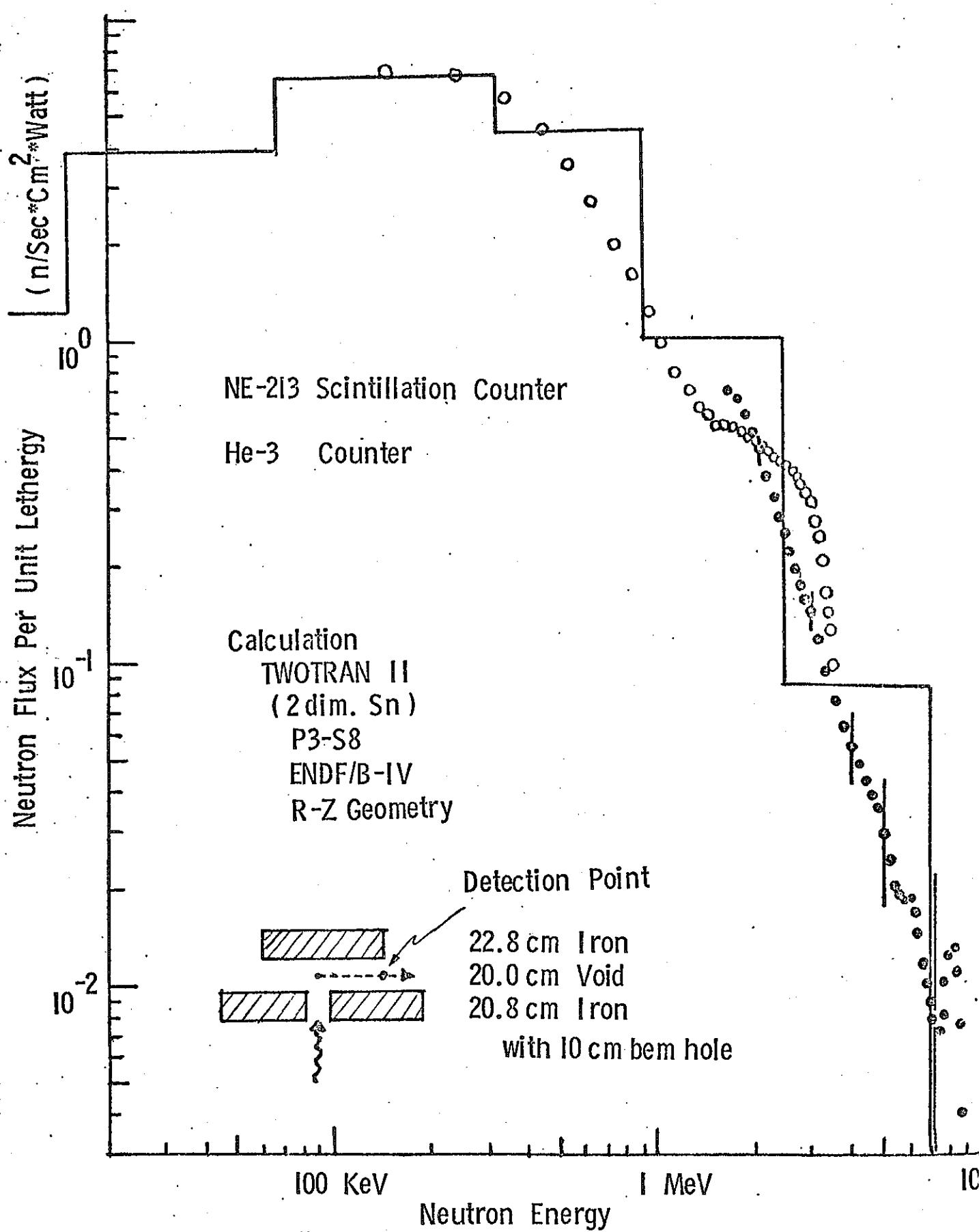


Fig. 21 Comparison of the Calculated and Measured Streaming Neutron Spectrum Through Iron Slit (with 10 cm Beam Hole)

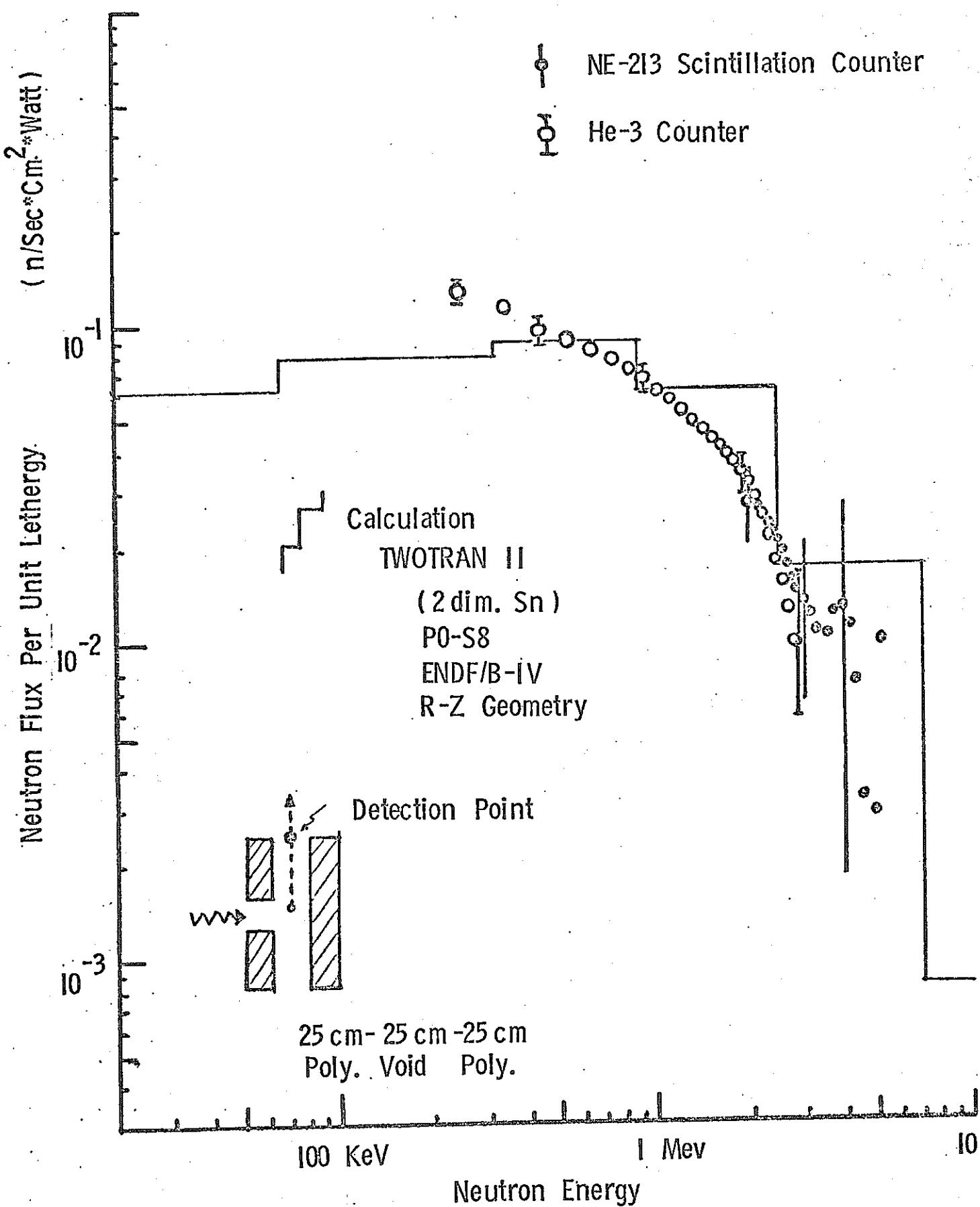


Fig. 22 Comparison of the Calculated and Measured  
Streaming Neutron Spectrum Through Polyethylene Slit

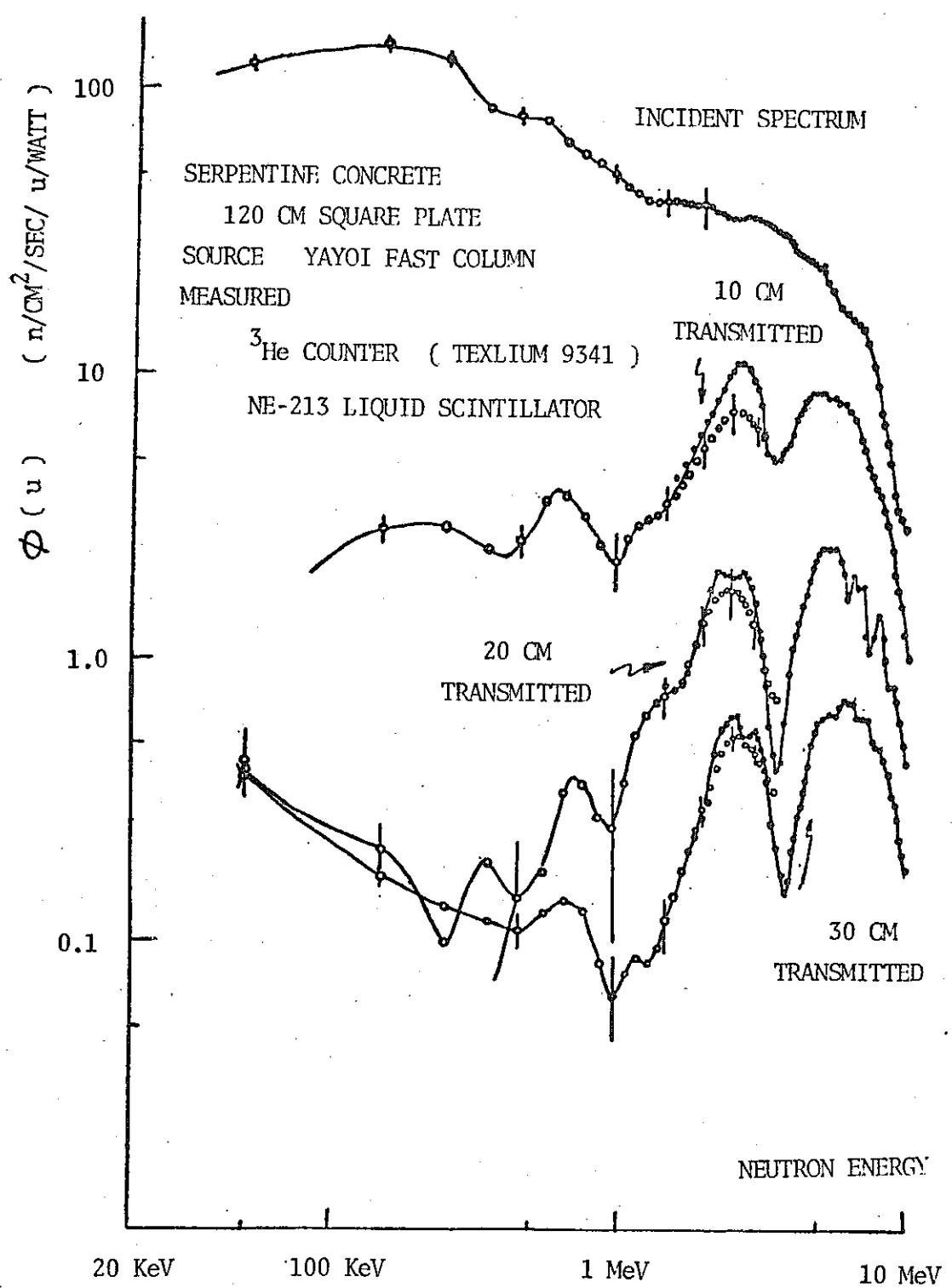


FIG. 23 PENETRATED NEUTRON SPECTRA THROUGH SERPENTINE CONCRETE

Table 1. The Parameters of the Helium-3 Counter (TEXLIUM-9341)

1. Filling Gas	$^3\text{He}$ gas	4 atm.	$1.0747 \times 10^{20} \text{n/cm}^3$
	Kr gas	2 atm.	$5.3737 \times 10^{19} \text{n/cm}^3$
2. Mechanical			
outer diameter	(stainless)	1 "	(inch) (2.54 cm)
inner diameter	(steel)	0.964 "	(2.44 cm)
total length		10.18 "	(25.86 cm)
active length		6 "	(15.24 cm)
anode wire	(tungsten)	0.002 "	( $5.08 \times 10^{-3}$ cm)
3. Operating			
high tension		$\lesssim 1900$ V	(used 1750V)
plateau		$\sim 500$ V	
rise time		a few tens of microseccons	
gamma ray sensitivity		several R per hour	

Table 2. Mixed Gas Parameters Used for the Stoppeing Power Calculation

Gas	$^3\text{He}$ gas (4atm)	Kr(2 atm) gas	$^3\text{He}(4 \text{ atm}) + \text{Kr}(2 \text{ atm})$
mean exitation energy I	$42 \pm 3$ (eV)	360 (eV)	290.38 (eV)
atomic density N	$1.0747 \times 10^{20}$ (atoms/cm <sup>3</sup> )	$5.3737 \times 10^{19}$ (atoms/cm <sup>3</sup> )	$1.6121 \times 10^{19}$ (atoms/cm <sup>3</sup> )
atomic number Z	2	36	13.33

## APPENDIX A

The response matrix for the  $^3\text{He}$  counter (TEXLIUM 9341,  $^3\text{He}$  4 atm Kr 2 atm) was obtained by the Monte Carlo calculation, and it was tabulated as follows. The covered energy range is from 50 KeV to 15 MeV, and the matrix was composed of 80 rows by 80 columns. The column represents the incident neutron energy, and the raw the corresponding pulse height channel. The response matrix table shown in the accompanying sheets will be read as follows:

Incident Neutron Energy				
	(E-1)	(E-2)	(E-80)	
(p-1)	1.85400E-02, 3.70880E-04, ...	3.19776E-04		(line 1-16)
(p-2)	0.00000E-01, 9.97540E-03, ...	3.20683E-04		(line 17-32)
"	:	:	:	
"	:	:	:	
(p-80)	0.00000E-01	0.00000E-01,	0.00000E-01	(line 1265-1280)
Pulse Height				

The energy interval ( $\Delta E$ ), and the mean energy of channel i ( $E_i$  in MeV) are as follows:

channel	energy	$\Delta E$	$E_i$
1 - 49 ch.	50 KeV - 4.85 KeV	100 KeV	0.05 + 0.10 · (i-1)
50 ch.	5.01 MeV	255 KeV	5.01 MeV
51 - 69 ch.	5.25 MeV - 9.75 MeV	250 KeV	5.25 + 0.25 · (i-51)
70 ch.	10.06 MeV	375 KeV	10.06 MeV
71 - 80 ch.	10.25 MeV - 14.75 MeV	500 KeV	10.25 + 0.50 · (i-71)

Note that the each component of the matrix shows the total efficiency for designated energy interval, not the one of the unit interval.

3.86029E-04	3.69226E-04	3.68495E-04	3.59561E-04	3.53806E-04	HE3R	61	1.85400E-02	3.70880E-04	2.75540E-04	2.56500E-04	2.94010E-04	HE3R	1
3.38039E-04	3.23402E-04	3.11131E-04	2.97625E-04	2.93312E-04	HE3R	62	3.08920E-04	3.02480E-04	3.36180E-04	3.13480E-04	3.06820E-04	HE3R	2
3.24421E-04	3.20725E-04	3.10639E-04	2.98818E-04	2.95785E-04	HE3R	63	1.92690E-03	5.09300E-03	3.80530E-03	3.01920E-03	2.29450E-03	HE3R	3
3.03694E-04	3.04230E-04	3.02901E-04	3.05707E-04	3.03876E-04	HE3R	64	2.00760E-03	1.62750E-03	1.38850E-03	1.15280E-03	1.06980E-03	HE3R	4
0.00000E-01	0.00000E-01	0.00000E-01	5.99810E-06	7.38090E-03	HE3R	65	9.29970E-04	8.88400E-04	8.61130E-04	8.27630E-04	8.08250E-04	HE3R	5
3.41040E-04	2.56240E-04	2.85340E-04	2.97080E-04	2.99190E-04	HE3R	66	7.76380E-04	8.02460E-04	7.85710E-04	7.77040E-04	7.91890E-04	HE3R	6
3.04240E-04	3.02490E-04	2.94910E-04	3.01520E-04	2.77830E-04	HE3R	67	7.94370E-04	7.90160E-04	7.80420E-04	8.04160E-04	7.99680E-04	HE3R	7
4.11380E-04	2.84080E-03	2.82460E-03	2.25090E-03	1.80370E-03	HE3R	68	7.96080E-04	8.09550E-04	8.10510E-04	8.13090E-04	7.92730E-04	HE3R	8
1.36110E-03	1.16380E-03	1.02020E-03	8.41970E-04	7.92050E-04	HE3R	69	7.73850E-04	7.45660E-04	7.69220E-04	7.64520E-04	7.27550E-04	HE3R	9
7.08060E-04	6.35060E-04	5.90470E-04	5.41470E-04	5.13160E-04	HE3R	70	7.43620E-04	7.15870E-04	6.84440E-04	6.74150E-04	6.67741E-04	HE3R	10
4.59710E-04	4.50580E-04	4.71000E-04	4.63990E-04	4.56170E-04	HE3R	71	6.72061E-04	6.28836E-04	5.91901E-04	5.69225E-04	5.54270E-04	HE3R	11
4.54110E-04	4.54510E-04	4.50410E-04	4.51220E-04	4.60950E-04	HE3R	72	5.30297E-04	4.93155E-04	4.69864E-04	4.56828E-04	4.41015E-04	HE3R	12
4.71490E-04	4.65730E-04	4.48110E-04	4.49180E-04	1.17210E-03	HE3R	73	4.34689E-04	4.17338E-04	4.01062E-04	3.84964E-04	3.77180E-04	HE3R	13
4.57080E-04	4.47310E-04	4.47240E-04	4.56900E-04	4.61744E-04	HE3R	74	3.69359E-04	3.6604E-04	3.54936E-04	3.48684E-04	3.40902E-04	HE3R	14
4.71241E-04	4.57169E-04	4.58069E-04	4.35363E-04	4.26010E-04	HE3R	75	3.52396E-04	3.48019E-04	3.44403E-04	3.45447E-04	3.44716E-04	HE3R	15
4.20731E-04	4.24402E-04	4.03688E-04	3.81362E-04	3.77270E-04	HE3R	76	3.42346E-04	3.35021E-04	3.34437E-04	3.22295E-04	3.19776E-04	HE3R	16
3.733631E-04	3.67236E-04	3.56413E-04	3.40335E-04	3.21699E-04	HE3R	77	0.00000E-01	9.97540E-03	3.23340E-04	2.85190E-04	2.71130E-04	HE3R	17
3.23288E-04	3.16280E-04	3.07369E-04	2.97783E-04	2.88538E-04	HE3R	78	2.66500E-04	2.91820E-04	2.87690E-04	3.02220E-04	2.92030E-04	HE3R	18
2.97728E-04	3.00671E-04	3.03046E-04	2.95987E-04	2.95809E-04	HE3R	79	2.92000E-04	4.67540E-04	3.76850E-03	3.79640E-03	2.83530E-03	HE3R	19
2.91163E-04	2.88837E-04	2.95483E-04	2.95083E-04	2.93983E-04	HE3R	80	2.31990E-03	1.91690E-03	1.57840E-03	1.23100E-03	1.09930E-03	HE3R	20
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	1.95920E-05	HE3R	81	9.20220E-04	8.74040E-04	8.14600E-04	7.23250E-04	6.96270E-04	HE3R	21
7.02960E-03	3.66770E-04	2.60170E-04	2.48050E-04	2.68820E-04	HE3R	82	6.70830E-04	6.55530E-04	6.64410E-04	6.75020E-04	6.74890E-04	HE3R	22
2.57730E-04	2.73460E-04	2.85610E-04	2.80070E-04	2.65570E-04	HE3R	83	6.80690E-04	6.94820E-04	6.83410E-04	6.77760E-04	6.66720E-04	HE3R	23
2.53400E-04	2.38230E-04	1.88530E-03	2.66240E-03	2.19960E-03	HE3R	84	6.84320E-04	6.78520E-04	6.77880E-04	6.68940E-04	6.72780E-04	HE3R	24
1.78180E-03	1.44940E-03	1.20360E-03	9.68580E-04	8.45810E-04	HE3R	85	6.79130E-04	6.82090E-04	6.68060E-04	6.75360E-04	6.45950E-04	HE3R	25
6.97500E-04	6.72790E-04	6.34600E-04	5.48670E-04	5.24880E-04	HE3R	86	6.32780E-04	6.28100E-04	6.31610E-04	6.36210E-04	6.34381E-04	HE3R	26
4.64606E-04	4.45530E-04	4.25400E-04	4.11420E-04	4.24890E-04	HE3R	87	6.05407E-04	5.74895E-04	5.63954E-04	5.47562E-04	5.24744E-04	HE3R	27
4.14660E-04	4.22480E-04	4.11590E-04	4.10060E-04	4.07100E-04	HE3R	88	4.92740E-04	4.75499E-04	4.69102E-04	4.55238E-04	4.30776E-04	HE3R	28
4.15050E-04	4.11260E-04	4.31000E-04	4.27080E-04	4.02370E-04	HE3R	89	4.04443E-04	3.94422E-04	3.90845E-04	3.81150E-04	3.70430E-04	HE3R	29
1.10900E-03	4.19310E-04	4.15150E-04	4.14010E-04	4.10567E-04	HE3R	90	3.59217E-04	3.48147E-04	3.34809E-04	3.24144E-04	3.16559E-04	HE3R	30
4.26723E-04	4.33968E-04	4.06483E-04	4.13829E-04	4.17290E-04	HE3R	91	3.38899E-04	3.41539E-04	3.35890E-04	3.30424E-04	3.24519E-04	HE3R	31
3.97543E-04	3.80938E-04	3.76984E-04	3.75712E-04	3.54983E-04	HE3R	92	3.24116E-04	3.33467E-04	3.35576E-04	3.28117E-04	3.20683E-04	HE3R	32
3.40826E-04	3.34147E-04	3.37155E-04	3.35885E-04	3.26846E-04	HE3R	93	0.00000E-01	7.13500E-09	8.07870E-03	2.84320E-04	2.37680E-04	HE3R	33
3.08135E-04	2.99176E-04	2.92233E-04	2.86901E-04	2.84543E-04	HE3R	94	2.52480E-04	2.64010E-04	2.81030E-04	2.94550E-04	3.13090E-04	HE3R	34
2.91167E-04	2.84660E-04	2.84572E-04	2.94279E-04	2.92631E-04	HE3R	95	3.02570E-04	3.18710E-04	3.05630E-04	2.55730E-03	3.58130E-03	HE3R	35
2.87884E-04	2.87991E-04	2.76807E-04	2.78468E-04	2.84211E-04	HE3R	96	2.91210E-03	2.32130E-03	1.90580E-03	1.44630E-03	1.23560E-03	HE3R	36
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R	97	9.91810E-04	9.03480E-04	8.32660E-04	7.48100E-04	7.10230E-04	HE3R	37
4.13650E-05	6.71860E-03	3.78740E-04	2.62580E-04	2.64920E-04	HE3R	98	6.40430E-04	6.31230E-04	6.18880E-04	5.85380E-04	5.93930E-04	HE3R	38
2.56490E-04	2.65400E-04	2.73140E-04	2.51690E-04	2.46880E-04	HE3R	99	5.70720E-04	5.73240E-04	5.94490E-04	5.95370E-04	5.96100E-04	HE3R	39
2.40580E-04	2.42560E-04	2.43820E-04	1.06300E-03	2.62320E-03	HE3R	100	5.94150E-04	6.09540E-04	6.11250E-04	6.09980E-04	6.01320E-04	HE3R	40
2.07980E-03	1.75500E-03	1.45590E-03	1.16750E-03	9.56300E-04	HE3R	101	6.06390E-04	6.11730E-04	6.07860E-04	5.88490E-04	5.47850E-04	HE3R	41
7.90340E-04	6.97870E-04	6.32840E-04	5.55280E-04	5.22120E-04	HE3R	102	5.58810E-04	5.56240E-04	5.68740E-04	5.58970E-04	5.43639E-04	HE3R	42
4.46390E-04	4.11570E-04	4.13620E-04	3.97610E-04	3.93640E-04	HE3R	103	5.40576E-04	5.40855E-04	5.26980E-04	4.99016E-04	4.92951E-04	HE3R	43
3.61830E-04	3.55170E-04	3.71390E-04	3.74920E-04	3.74430E-04	HE3R	104	4.81525E-04	4.68135E-04	4.41405E-04	4.21422E-04	4.12149E-04	HE3R	44
3.73220E-04	3.84640E-04	3.82660E-04	3.81840E-04	3.61210E-04	HE3R	105	4.04415E-04	3.92892E-04	3.80987E-04	3.64196E-04	3.48030E-04	HE3R	45
3.74750E-04	1.07050E-03	4.03950E-04	3.76330E-04	3.72248E-04	HE3R	106	3.38915E-04	3.34580E-04	3.29954E-04	3.24766E-04	3.13012E-04	HE3R	46
4.13059E-04	3.90109E-04	3.94155E-04	3.88903E-04	3.75240E-04	HE3R	107	3.25420E-04	3.14324E-04	3.18319E-04	3.27522E-04	3.24019E-04	HE3R	47
3.74227E-04	3.72262E-04	3.58830E-04	3.44300E-04	3.37973E-04	HE3R	108	3.18473E-04	3.11125E-04	3.07659E-04	3.06556E-04	3.13453E-04	HE3R	48
3.34333E-04	3.21540E-04	3.09383E-04	3.00611E-04	3.00676E-04	HE3R	109	0.00000E-01	0.00000E-01	7.37840E-07	7.66630E-03	3.02490E-04	HE3R	49
3.00765E-04	2.93075E-04	2.81577E-04	2.71939E-04	2.62797E-04	HE3R	110	2.53530E-04	2.69060E-04	2.81200E-04	2.91260E-04	2.97580E-04	HE3R	50
2.75689E-04	2.89477E-04	2.77906E-04	2.74319E-04	2.75863E-04	HE3R	111	3.16570E-04	3.05180E-04	2.93250E-04	2.77300E-04	1.44740E-03	HE3R	51
2.84855E-04	2.84565E-04	2.83423E-04	2.78488E-04	2.72508E-04	HE3R	112	3.60080E-03	2.91290E-03	2.30220E-03	1.73150E-03	1.49230E-03	HE3R	52
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R	113	1.16780E-03	1.03090E-03	9.23920E-04	7.66580E-04	7.06330E-04	HE3R	53
0.00000E-01	6.95650E-05	6.39040E-03	4.01720E-04	2.45340E-04	HE3R	114	6.37140E-04	6.13350E-04	5.85190E-04	5.48620E-04	5.40430E-04	HE3R	54
2.43380E-04	2.44830E-04	2.21150E-04	2.49570E-04	2.65530E-04	HE3R	115	5.19870E-04	5.24510E-04	5.08930E-04	5.19560E-04	5.11230E-04	HE3R	55
2.47420E-04	2.22380E-04	2.18570E-04	2.04420E-04	3.65670E-04	HE3R</td								

2.03790E-04	1.99030E-04	1.89250E-04	1.67130E-04	2.12440E-04	HE3R	181	3.52250E-04	3.52810E-04	3.46600E-04	3.46020E-04	3.43630E-04	HE3R	121
1.04160E-03	1.44940E-03	1.30730E-03	1.05850E-03	9.21030E-04	HE3R	182	3.45550E-04	3.36690E-04	1.00990E-03	3.73220E-04	3.70852E-04	HE3R	122
7.19540E-04	6.23850E-04	5.49730E-04	4.84710E-04	4.66540E-04	HE3R	183	3.60879E-04	3.66195E-04	3.66210E-04	3.50008E-04	3.52182E-04	HE3R	123
3.80020E-04	3.52720E-04	3.35770E-04	3.21790E-04	3.04400E-04	HE3R	184	3.39123E-04	3.29197E-04	3.39770E-04	3.38714E-04	3.22573E-04	HE3R	124
2.70890E-04	2.63430E-04	2.56880E-04	2.52410E-04	2.45360E-04	HE3R	185	3.08260E-04	3.03018E-04	3.03853E-04	2.90173E-04	2.77903E-04	HE3R	125
2.30990E-04	2.28670E-04	2.35580E-04	2.33480E-04	2.28130E-04	HE3R	186	2.71199E-04	2.66090E-04	2.65157E-04	2.66217E-04	2.57294E-04	HE3R	126
2.87166E-04	2.51835E-04	2.61967E-04	2.48120E-04	2.58097E-04	HE3R	187	2.54577E-04	2.54505E-04	2.71562E-04	2.68198E-04	2.65650E-04	HE3R	127
2.47461E-04	2.42682E-04	2.53329E-04	2.39307E-04	2.28334E-04	HE3R	188	2.62432E-04	2.62377E-04	2.75802E-04	2.76044E-04	2.79565E-04	HE3R	128
2.43704E-04	2.46042E-04	2.33939E-04	2.21407E-04	2.27488E-04	HE3R	189	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R	129
2.31689E-04	2.23196E-04	2.15758E-04	2.07871E-04	2.02264E-04	HE3R	190	0.00000E-01	0.00000E-01	1.01240E-04	6.01550E-03	4.02490E-04	HE3R	130
2.10611E-04	2.11378E-04	2.09823E-04	2.23707E-04	2.30450E-04	HE3R	191	2.27230E-04	2.25640E-04	2.36950E-04	2.35790E-04	2.34810E-04	HE3R	131
2.33502E-04	2.51452E-04	2.46938E-04	2.45273E-04	2.34870E-04	HE3R	192	2.48620E-04	2.46780E-04	2.14290E-04	1.98130E-04	1.87650E-04	HE3R	132
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R	193	2.04000E-04	1.37190E-03	1.99850E-03	1.61790E-03	1.39630E-03	HE3R	133
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R	194	1.11010E-03	9.68300E-04	8.27650E-04	6.79190E-04	6.27400E-04	HE3R	134
3.28850E-10	2.06320E-04	4.08690E-03	4.02770E-04	1.69750E-04	HE3R	195	4.86070E-04	4.45520E-04	4.22750E-04	4.06060E-04	3.79770E-04	HE3R	135
1.66120E-04	1.69800E-04	1.76200E-04	1.62170E-04	1.62220E-04	HE3R	196	3.46130E-04	3.47410E-04	3.48180E-04	3.35760E-04	3.37340E-04	HE3R	136
1.58420E-04	1.60890E-04	1.60570E-04	1.70790E-04	1.76160E-04	HE3R	197	3.35880E-04	3.26100E-04	3.21030E-04	3.33440E-04	3.08310E-04	HE3R	137
2.09740E-04	6.82250E-04	1.45250E-03	1.18340E-03	1.06720E-03	HE3R	198	3.05580E-04	3.11640E-04	3.17000E-04	9.68720E-04	3.30676E-04	HE3R	138
8.14610E-04	6.97850E-04	6.27890E-04	5.57900E-04	5.04180E-04	HE3R	199	3.30632E-04	3.27372E-04	3.27100E-04	3.34903E-04	3.26087E-04	HE3R	139
4.12630E-04	3.69190E-04	3.43690E-04	3.22670E-04	3.17840E-04	HE3R	200	3.25547E-04	3.28628E-04	3.10121E-04	2.99676E-04	3.07995E-04	HE3R	140
2.66030E-04	2.56950E-04	2.57510E-04	2.51820E-04	2.25830E-04	HE3R	201	3.04224E-04	2.89026E-04	2.75214E-04	2.73767E-04	2.73644E-04	HE3R	141
2.12770E-04	2.17040E-04	2.11900E-04	2.09160E-04	2.20191E-04	HE3R	202	2.67325E-04	2.58114E-04	2.47335E-04	2.40844E-04	2.43990E-04	HE3R	142
7.72001E-04	2.36578E-04	2.27722E-04	2.37734E-04	2.24809E-04	HE3R	203	2.53801E-04	2.46387E-04	2.42263E-04	2.57342E-04	2.64170E-04	HE3R	143
2.29778E-04	2.33877E-04	2.21797E-04	2.22042E-04	2.25146E-04	HE3R	204	2.55937E-04	2.57451E-04	2.59898E-04	2.66747E-04	2.79754E-04	HE3R	144
2.19201E-04	2.08637E-04	2.19995E-04	2.24588E-04	2.10104E-04	HE3R	205	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R	145
2.03633E-04	2.03538E-04	2.07291E-04	2.00710E-04	2.00013E-04	HE3R	206	0.00000E-01	0.00000E-01	0.00000E-01	1.33090E-04	5.57330E-03	HE3R	146
1.91960E-04	2.04673E-04	2.05050E-04	2.07883E-04	2.20028E-04	HE3R	207	4.31040E-04	2.27070E-04	2.17330E-04	2.24580E-04	2.06030E-04	HE3R	147
2.50430E-04	2.36346E-04	2.15493E-04	2.10249E-04	2.19763E-04	HE3R	208	2.09630E-04	2.06860E-04	2.23530E-04	2.14660E-04	1.94400E-04	HE3R	148
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R	209	1.92930E-04	2.11400E-04	8.33760E-04	1.87560E-03	1.58570E-03	HE3R	149
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R	210	1.29290E-03	1.13780E-03	9.60190E-04	7.77470E-04	6.81740E-04	HE3R	150
0.00000E-01	6.07230E-10	2.12040E-04	3.56920E-03	4.00160E-04	HE3R	211	5.53960E-04	5.00070E-04	4.43650E-04	4.26670E-04	4.14130E-04	HE3R	151
1.57690E-04	1.64350E-04	1.53300E-04	1.59950E-04	1.61110E-04	HE3R	212	3.49070E-04	3.31190E-04	3.13480E-04	3.21200E-04	3.21410E-04	HE3R	152
1.62980E-04	1.53660E-04	1.66290E-04	1.58260E-04	1.54060E-04	HE3R	213	3.00850E-04	2.98600E-04	3.11300E-04	3.00400E-04	2.76230E-04	HE3R	153
1.63050E-04	1.82940E-04	3.02660E-04	1.14070E-03	1.16430E-03	HE3R	214	2.75370E-04	2.79940E-04	2.81670E-04	2.95330E-04	9.30667E-04	HE3R	154
9.01830E-04	8.24550E-04	7.00280E-04	6.27940E-04	5.61830E-04	HE3R	215	2.99867E-04	3.01922E-04	3.09554E-04	3.00621E-04	3.04284E-04	HE3R	155
4.66860E-04	4.17710E-04	3.78210E-04	3.32520E-04	3.08680E-04	HE3R	216	2.99117E-04	2.95020E-04	2.94978E-04	2.90741E-04	2.73932E-04	HE3R	156
2.76410E-04	2.50160E-04	2.45210E-04	2.37340E-04	2.20610E-04	HE3R	217	2.70777E-04	2.76105E-04	2.73133E-04	2.62415E-04	2.50369E-04	HE3R	157
2.06470E-04	2.04610E-04	1.99900E-04	1.99840E-04	2.03616E-04	HE3R	218	2.48471E-04	2.43855E-04	2.40413E-04	2.31406E-04	2.26745E-04	HE3R	158
2.20456E-04	2.29667E-04	2.09642E-04	2.02309E-04	2.15080E-04	HE3R	219	2.28253E-04	2.44682E-04	2.42272E-04	2.33188E-04	2.35857E-04	HE3R	159
2.06385E-04	2.12795E-04	2.18815E-04	2.07023E-04	2.00534E-04	HE3R	220	2.53092E-04	2.58655E-04	2.58750E-04	2.66511E-04	2.86684E-04	HE3R	160
2.02091E-04	2.03905E-04	2.03300E-04	2.02930E-04	2.11592E-04	HE3R	221	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R	161
2.04953E-04	1.93156E-04	1.84427E-04	1.90178E-04	1.93031E-04	HE3R	222	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R	162
1.78412E-04	1.83524E-04	2.00912E-04	2.08045E-04	2.22967E-04	HE3R	223	5.14990E-03	4.28050E-04	1.97940E-04	2.01040E-04	2.01860E-04	HE3R	163
2.17438E-04	2.16416E-04	2.06921E-04	1.98390E-04	1.89248E-04	HE3R	224	1.91400E-04	2.11710E-04	2.04090E-04	2.10580E-04	2.22500E-04	HE3R	164
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R	225	1.96990E-04	1.88240E-04	1.98620E-04	3.40100E-04	1.51970E-03	HE3R	165
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R	226	1.48250E-03	1.31250E-03	1.12370E-03	9.32200E-04	7.89550E-04	HE3R	166
0.00000E-01	0.00000E-01	1.34160E-09	2.13940E-04	3.14150E-03	HE3R	227	6.26810E-04	5.67610E-04	5.33930E-04	4.86580E-04	4.16460E-04	HE3R	167
3.68550E-04	1.44520E-04	1.41000E-04	1.41870E-04	1.39390E-04	HE3R	228	3.70500E-04	3.42980E-04	3.25630E-04	3.08160E-04	2.89450E-04	HE3R	168
1.48310E-04	1.52870E-04	1.36820E-04	1.34660E-04	1.51720E-04	HE3R	229	2.73770E-04	2.7900UE-04	2.72180E-04	2.74230E-04	2.70580E-04	HE3R	169
1.51620E-04	1.43390E-04	1.44970E-04	1.86800E-04	8.12030E-04	HE3R	230	2.67230E-04	2.59840E-04	2.59510E-04	2.60450E-04	2.77671E-04	HE3R	170
1.04460E-03	9.03900E-04	8.10330E-04	7.19160E-04	6.39690E-04	HE3R	231	2.72080E-04	2.81416E-04	2.74521E-04	2.89766E-04	2.73970E-04	HE3R	171
4.95790E-04	4.43420E-04	4.03590E-04	3.85480E-04	3.44270E-04	HE3R	232	2.77541E-04	2.73202E-04	2.67396E-04	2.64821E-04	2.74027E-04	HE3R	172
2.88890E-04	2.59240E-04	2.53700E-04	2.35820E-04	2.18660E-04	HE3R	233	2.57592E-04	2.51904E-04	2.48825E-04	2.51698E-04	2.45731E-04	HE3R	173
1.95470E-04	1.83250E-04	1.86190E-04	1.89290E-04	1.81459E-04	HE3R	234	2.37286E-04	2.26326E-04	2.22943E-04	2.28443E-04	2.25384E-04	HE3R	174
1.61851E-04	6.89945E-04	1.78619E-04	1.92410E-04	1.81410E-04	HE3R	235	2.19938E-04	2.17241E-04	2.29509F-04	2.31235E-04	2.30563E-04		

1.46089E-04	1.42797E-04	1.37883E-04	1.47149E-04	1.42426E-04	HE3R 301	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 241
1.40658E-04	1.33995E-04	1.43783E-04	1.43724E-04	1.39307E-04	HE3R 302	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 242
1.38074E-04	1.54497E-04	1.45232E-04	1.37532E-04	1.44947E-04	HE3R 303	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	2.85220E-09	2.13870E-04
1.42555E-04	1.40211E-04	1.47441E-04	1.49542E-04	1.45356E-04	HE3R 304	2.75210E-03	3.33540E-04	1.26770E-04	1.31730E-04	1.34650E-04	HE3R 244
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 305	1.36600E-04	1.37100E-04	1.40820E-04	1.44460E-04	1.29310E-04	HE3R 245
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 306	1.33430E-04	1.39810E-04	1.35800E-04	1.37430E-04	1.68780E-04	HE3R 246
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 307	4.95000E-04	1.03230E-03	9.17900E-04	7.99740E-04	7.14010E-04	HE3R 247
0.00000E-01	0.00000E-01	2.70250E-08	1.78550E-04	1.53780E-03	HE3R 308	5.60670E-04	5.10350E-04	4.37510E-04	4.04160E-04	3.71570E-04	HE3R 248
2.59200E-04	1.15550E-04	1.06620E-04	1.05610E-04	1.05480E-04	HE3R 309	3.06640E-04	2.67610E-04	2.54700E-04	2.39840E-04	2.12400E-04	HE3R 249
1.17380E-04	1.11260E-04	1.09160E-04	1.04780E-04	1.04180E-04	HE3R 310	1.89400E-04	1.85990E-04	1.74320E-04	1.67740E-04	1.65030E-04	HE3R 250
1.03640E-04	9.65220E-05	9.09540E-05	7.62710E-05	1.06000E-04	HE3R 311	1.44412E-04	1.82044E-04	1.64750E-04	1.63670E-04	1.66768E-04	HE3R 251
1.92480E-04	6.04810E-04	6.68320E-04	5.92500E-04	4.97690E-04	HE3R 312	1.67529E-04	1.73577E-04	1.75011E-04	1.72625E-04	1.75079E-04	HE3R 252
4.37500E-04	3.93490E-04	3.36160E-04	2.92120E-04	2.52410E-04	HE3R 313	1.79787E-04	1.69014E-04	1.74345E-04	1.80725E-04	1.74919E-04	HE3R 253
2.13950E-04	1.97640E-04	1.79090E-04	1.72750E-04	1.54954E-04	HE3R 314	1.72731E-04	1.67075E-04	1.73847E-04	1.68245E-04	1.71064E-04	HE3R 254
1.11302E-04	1.07545E-04	1.01782E-04	5.10307E-04	1.17355E-04	HE3R 315	1.53401E-04	1.76883E-04	1.82335E-04	1.92405E-04	1.87514E-04	HE3R 255
1.16214E-04	1.19648E-04	1.22233E-04	1.22780E-04	1.23655E-04	HE3R 316	1.84991E-04	1.74096E-04	1.70238E-04	1.77277E-04	1.81369E-04	HE3R 256
1.21557E-04	1.35471E-04	1.27674E-04	1.26377E-04	1.33887E-04	HE3R 317	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 257
1.33453E-04	1.26795E-04	1.24253E-04	1.35335E-04	1.38383E-04	HE3R 318	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 258
1.32203E-04	1.38926E-04	1.33787E-04	1.30359E-04	1.29424E-04	HE3R 319	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	5.72680E-09	HE3R 259
1.36386E-04	1.33999E-04	1.34643E-04	1.38648E-04	1.36350E-04	HE3R 320	2.10020E-04	2.38690E-03	3.22410E-04	1.23280E-04	1.23030E-04	HE3R 260
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 321	1.23000E-04	1.18500E-04	1.20100E-04	1.21100E-04	1.27280E-04	HE3R 261
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 322	1.21100E-04	1.20680E-04	1.26880E-04	1.20200E-04	1.30180E-04	HE3R 262
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 323	1.55930E-04	2.53450E-04	8.51010E-04	9.01030E-04	7.61920E-04	HE3R 263
0.00000E-01	0.00000E-01	3.90720E-08	1.67800E-04	1.67800E-04	HE3R 324	6.32250E-04	5.53810E-04	4.81390E-04	4.26610E-04	3.90440E-04	HE3R 264
1.31920E-03	2.36950E-04	9.32030E-05	9.04430E-05	8.52620E-05	HE3R 325	3.06090E-04	2.85510E-04	2.70300E-04	2.46250E-04	2.17680E-04	HE3R 265
8.68470E-05	9.81160E-05	9.40450E-05	9.43320E-05	9.00490E-05	HE3R 326	1.83910E-04	1.76690E-04	1.69360E-04	1.63160E-04	1.50965E-04	HE3R 266
8.72060E-05	7.93150E-05	8.21020E-05	8.54710E-05	7.84040E-05	HE3R 327	1.34178E-04	1.31734E-04	1.95292E-04	1.53769E-04	1.46965E-04	HE3R 267
7.63230E-05	1.25370E-04	4.54280E-04	6.44640E-04	5.98710E-04	HE3R 328	1.55203E-04	1.55445E-04	1.61319E-04	1.64714E-04	1.62534E-04	HE3R 268
4.74990E-04	4.42570E-04	3.82230E-04	3.34510E-04	2.81500E-04	HE3R 329	1.58335E-04	1.64556E-04	1.59155E-04	1.57591E-04	1.67592E-04	HE3R 269
2.36030E-04	2.10150E-04	1.91770E-04	1.76380E-04	1.58131E-04	HE3R 330	1.64955E-04	1.57510E-04	1.55819E-04	1.60543E-04	1.60374E-04	HE3R 270
1.15839E-04	1.02452E-04	9.74600E-05	1.41507E-04	1.02805E-04	HE3R 331	1.53705E-04	1.55108E-04	1.86839E-04	1.74383E-04	1.65420E-04	HE3R 271
1.09602E-04	1.07191E-04	1.15992E-04	1.07433E-04	1.15788E-04	HE3R 332	1.67381E-04	1.66305E-04	1.63212E-04	1.61456E-04	1.64018E-04	HE3R 272
1.14374E-04	1.13958E-04	1.18477E-04	1.20214E-04	1.19235E-04	HE3R 333	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 273
1.20780E-04	1.24293E-04	1.22021E-04	1.20180E-04	1.27595E-04	HE3R 334	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 274
1.29294E-04	1.24773E-04	1.25454E-04	1.20876E-04	1.18043E-04	HE3R 335	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 275
1.24264E-04	1.28711E-04	1.24578E-04	1.19896E-04	1.29966E-04	HE3R 336	1.05540E-08	2.01900E-04	2.05390E-03	3.05330E-04	1.19790E-04	HE3R 276
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 337	1.13720E-04	1.07010E-04	1.20910E-04	1.15400E-04	1.01720E-04	HE3R 277
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 338	1.07560E-04	1.12560E-04	1.08000E-04	1.26850E-04	1.26330E-04	HE3R 278
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 339	1.21240E-04	1.31380E-04	1.66360E-04	6.06160E-04	8.65960E-04	HE3R 279
0.00000E-01	0.00000E-01	0.00000E-01	5.45030E-08	1.54503E-04	HE3R 340	7.14180E-04	5.97800E-04	5.54120E-04	4.80250E-04	4.18430E-04	HE3R 280
1.54690E-04	1.11250E-03	2.11940E-04	8.19210E-05	8.10890E-05	HE3R 341	3.44470E-04	3.09920E-04	2.79300E-04	2.60550E-04	2.27760E-04	HE3R 281
8.43850E-05	8.01030E-05	9.24720E-05	9.31360E-05	8.98500E-05	HE3R 342	1.94920E-04	1.75880E-04	1.61620E-04	1.57230E-04	1.45228E-04	HE3R 282
7.14060E-05	7.14520E-05	7.81020E-05	7.40720E-05	7.07670E-05	HE3R 343	1.23799E-04	1.20721E-04	5.75059E-04	1.35626E-04	1.38439E-04	HE3R 283
7.00000E-05	6.53440E-05	1.05240E-04	2.98850E-04	6.13920E-04	HE3R 344	1.37524E-04	1.43760E-04	1.48018E-04	1.42336E-04	1.52228E-04	HE3R 284
5.46670E-04	4.71080E-04	4.17880E-04	3.80530E-04	3.25320E-04	HE3R 345	1.53553E-04	1.48175E-04	1.56080E-04	1.49639E-04	1.47521E-04	HE3R 285
2.71860E-04	2.38960E-04	2.07610E-04	1.89500E-04	1.68073E-04	HE3R 346	1.54803E-04	1.57331E-04	1.46224E-04	1.44108E-04	1.45408E-04	HE3R 286
1.19323E-04	9.78874E-05	9.48439E-05	8.96982E-05	1.47205E-04	HE3R 347	1.46544E-04	1.61564E-04	1.58362E-04	1.61775E-04	1.52932E-04	HE3R 287
9.22213E-05	1.01593E-04	9.96008E-05	1.07240E-04	1.02290E-04	HE3R 348	1.49346E-04	1.58892E-04	1.53779E-04	1.54112E-04	1.50342E-04	HE3R 288
1.04888E-04	1.09974E-04	1.04926E-04	1.07340E-04	1.10471E-04	HE3R 349	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 289
1.16909E-04	1.09148E-04	1.18913E-04	1.17383E-04	1.17402E-04	HE3R 350	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 290
1.15673E-04	1.08927E-04	1.06348E-04	1.16476E-04	1.12664E-04	HE3R 351	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 291
1.09884E-04	1.16955E-04	1.19424E-04	1.17191E-04	1.12693E-04	HE3R 352	0.00000E-01	1.75720E-08	1.90580E-04	1.76840E-03	2.87260E-04	HE3R 292
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 353	1.18520E-04	1.14750E-04	1.16340E-04	1.14780E-04	1.30020E-04	HE3R 293
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 354	1.15010E-04	1.09710E-04	1.16490E-04	1.10590E-04	1.09410E-04	HE3R 294
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 355	1.10110E-04	1.02560E-04	9.79390E-05	1.33050E-04	1.93540E-04	HE3R 295
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 356	7.49440E-04	7.03580E-04	5.78210E-04	5.27640E-04	4.91710E-04	HE3R 296
7.16690E-08	1.38060E-04	9.50880E-04	1.88800E-04	7.55480E-05	HE3R 357	3.82810E-04	3.43520E-04	3.00830E-04	2.77070E-04	2.39130E-04	HE3R 297
7.84480E-05	7.93110E-05	7.92370E-05									





0.00000E-01	0.0000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 661	7.22410E-06	8.95090E-06	8.42490E-06	7.53310E-06	7.84740E-06	HE3R 601
0.00000E-01	0.0000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 662	8.86700E-06	1.06990E-05	1.08950E-05	1.16260E-05	9.77837E-06	HE3R 602
0.00000E-01	0.0000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 663	1.33137E-05	1.39618E-05	1.43441E-05	1.31192E-04	1.99430E-04	HE3R 603
0.00000E-01	0.0000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 664	1.50431E-04	1.18136E-04	9.05500E-05	6.64838E-05	5.47798E-05	HE3R 605
0.00000E-01	0.0000E-01	0.00000E-01	0.00000E-01	1.65510E-10	3.84190E-07	HE3R 665	1.36744E-04	4.71710E-05	4.11016F-05	3.73541E-05	3.15716E-05	HE3R 606
2.43780E-05	7.89150E-05	2.52250E-05	5.26670E-06	4.97800E-06	HE3R 666	2.91715E-05	2.52738E-05	2.60247E-05	2.30879E-05	2.34511E-05	HE3R 607	
5.60200E-06	6.45490E-06	7.51420E-06	6.64430E-06	6.61542E-06	HE3R 667	1.98878E-05	2.04904E-05	2.43810F-05	2.52293E-05	2.87463E-05	HE3R 608	
6.22625E-06	8.13471E-06	8.37234E-06	1.00656E-05	1.10021E-05	HE3R 668	2.82555E-05	3.40722E-05	3.19763E-05	3.62292E-05	3.82522E-05	HE3R 609	
7.98747E-05	1.76880E-04	1.34353E-04	9.90438E-05	7.85443E-05	HE3R 669	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 610	
6.10519E-05	4.77433E-05	5.93437E-05	3.58629E-05	3.00110E-05	HE3R 670	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 611	
2.80293E-05	2.30764E-05	2.06796E-05	2.01384E-05	1.88197E-05	HE3R 671	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 612	
1.52552E-05	1.47259E-05	1.64085E-05	1.69746E-05	2.17693E-05	HE3R 672	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 613	
2.08541E-05	2.55429E-05	2.61414E-05	2.98170E-05	2.86157E-05	HE3R 673	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 614	
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 674	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 615	
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 675	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 616	
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 676	8.26550E-11	3.45160E-07	3.09190E-05	1.15590E-04	3.26770E-05	HE3R 617	
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 677	7.45730E-06	8.73450E-06	8.08710E-06	8.53380E-06	7.77840E-06	HE3R 618	
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 678	7.54170E-06	7.12200E-06	7.07090E-06	8.70690E-06	9.96414E-06	HE3R 619	
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 679	1.11766E-05	2.12165E-05	1.36341E-05	3.28936E-05	2.02272E-04	HE3R 620	
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 680	1.67928E-04	1.3160E-04	1.00027E-04	7.24451E-05	5.63113E-05	HE3R 621	
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	2.12860E-10	HE3R 681	6.99460E-05	6.57746E-05	3.93122E-05	3.66009E-05	3.14899E-05	HE3R 622	
3.70290E-07	2.14220E-05	7.59630E-05	2.34100E-05	4.70720E-06	HE3R 682	2.83006E-05	2.39792E-05	2.32506E-05	2.12746E-05	2.21962E-05	HE3R 623	
4.89310E-06	5.18050E-06	5.40290E-06	6.15640E-06	6.42250E-06	HE3R 683	1.81982E-05	1.89405E-05	2.23710E-05	2.09437E-05	2.64247E-05	HE3R 624	
5.82384E-06	5.78386E-06	7.51154E-06	8.62736E-06	9.37846E-06	HE3R 684	2.83644E-05	3.12920E-05	3.12984E-05	3.10999E-05	3.71806E-05	HE3R 625	
1.93899E-05	1.66768E-04	1.50514E-04	1.14185E-04	8.77501E-05	HE3R 685	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 626	
6.81459E-05	5.40899E-05	8.73144E-05	3.96323E-05	3.10591E-05	HE3R 686	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 627	
2.69242E-05	2.34911E-05	2.03708E-05	1.99873E-05	1.86626E-05	HE3R 687	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 628	
1.38321E-05	1.44166E-05	1.62854E-05	1.57785E-05	1.99329E-05	HE3R 688	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 629	
1.94906E-05	2.21853E-05	2.44269E-05	2.52930E-05	2.90592E-05	HE3R 689	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 630	
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 690	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 631	
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 691	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 632	
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 692	0.00000E-01	1.12230E-05	3.50490E-07	2.91720E-05	1.07180E-04	HE3R 633	
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 693	3.03680E-05	7.00850E-06	7.24840E-06	7.96370E-06	7.57510E-06	HE3R 634	
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 694	7.30960E-06	6.57140E-06	5.84290E-06	6.67530E-06	8.76666E-06	HE3R 635	
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 695	1.00964E-05	1.10743E-05	1.18523E-05	1.26214E-05	1.03892E-04	HE3R 636	
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 696	1.88350E-04	1.41060E-04	1.10895E-04	8.16611E-05	6.18714E-05	HE3R 637	
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 697	5.09465E-05	1.12462E-04	3.96211E-05	3.42925E-05	3.13595E-05	HE3R 638	
2.42550E-10	3.55570E-07	2.11220E-05	6.93800E-05	2.05120E-05	HE3R 698	2.72919E-05	2.46801E-05	2.08062E-05	2.01383E-05	1.98195E-05	HE3R 639	
4.42740E-06	4.64490E-06	4.51080E-06	4.86850E-06	5.48678E-06	HE3R 699	1.62314E-05	1.83323E-05	1.81973E-05	2.26577E-05	2.27672E-05	HE3R 640	
5.63050E-06	5.44413E-06	6.40606E-06	7.45755E-06	8.01670E-06	HE3R 700	2.69327E-05	2.75161E-05	3.04575E-05	2.99883E-05	3.24405E-05	HE3R 641	
8.32527E-06	5.96788E-05	1.68020E-04	1.25979E-04	9.64723E-05	HE3R 701	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 642	
7.39405E-05	5.87859E-05	5.76330E-05	5.04673E-05	3.40697E-05	HE3R 702	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 643	
2.79226E-05	2.28445E-05	2.07781E-05	1.91413E-05	1.82304E-05	HE3R 703	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 644	
1.36200E-05	1.41233E-05	1.39442E-05	1.58913E-05	1.73056E-05	HE3R 704	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 645	
2.02259E-05	1.91723E-05	2.31304E-05	2.39962E-05	2.68564E-05	HE3R 705	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 646	
0.00000E-01	0.0300E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 706	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 647	
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 707	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 648	
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 708	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 649	
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 709	9.21310E-05	2.60870E-05	5.94890E-06	5.79810E-06	6.86520E-06	HE3R 650	
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 710	7.12600E-06	6.66880E-06	7.31090E-06	6.72140E-06	6.85308E-06	HE3R 651	
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 711	7.86678E-06	9.80617E-06	1.00540E-05	1.12975E-05	2.60135E-05	HE3R 652	
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 712	1.83708E-04	1.58262E-04	1.24293E-04	9.01778E-05	6.89386E-05	HE3R 653	
0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 713	5.63100E-05	6.55662E-05	4.30467E-05	3.54897E-05	3.00616E-05	HE3R 654	
0.00000E-01	2.75120E-10	3.81570E-07	1.97330E-05	5.73840E-05	HE3R 714	2.70792E-05	2.39284E-05	2.05199E-05	1.91675E-05	1.84728E-05	HE3R 655	
1.90120E-05	4.54850E-06	3.50260E-06	3.82170E-06	3.73481E-06	HE3R 715	1.63479E-05	1.69591E-05	1.66769E-05	2.12594E-05	2.02083E-05	HE3R 656	
4.59995E-06	5.19032E-06	5.52693E-06	6.39389E-06	7.61833E-06	HE3R 716	2.47616E-05	2.72613E-05	2.78471E-05	3.08822E-05	2.95277E-05	HE3R 657	
8.01164E-06	1.34972E-05	1.52449E-04	1.39047E-04	1.04974E-04	HE3R 717	0.00000E-01	0.00000E-01					

1.25803E-04	9.61424E-05	7.40502E-05	5.83272E-05	5.48092E-05	HE3R 781	0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.02000E-01	HE3R 721
4.56523E-05	3.04054E-05	2.62906E-05	2.11114E-05	1.74795E-05	HE3R 782	0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 722
1.27956E-05	1.24551E-05	1.20038E-05	1.23833E-05	1.25972E-05	HE3R 783	0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 723
1.40940E-05	1.36274E-05	1.57621E-05	1.63657E-05	1.80083E-05	HE3R 784	0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 724
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 785	0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 725
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 786	0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HF3R 726
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 787	0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 727
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 788	0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 728
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 789	0.00000E-01	0.01000E-01	3.44780E-10	3.86550E-07	1.66090E-05	HE3R 729	
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 790	5.21690E-05	1.73250E-05	3.34900E-06	2.95650E-06	3.38010E-06	HE3R 730	
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 791	3.81929E-06	4.73886E-06	4.96234E-06	5.40207E-06	6.44611E-06	HE3R 731	
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 792	6.60428E-06	7.6420E-06	4.20196E-05	1.52710E-04	1.17295E-04	HE3R 732	
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 793	9.31547E-05	7.32055E-05	5.55014E-05	5.44241E-05	3.84820E-05	HE3R 733	
7.55265E-06	5.45478E-06	6.12508E-06	6.35403E-06	7.47988E-06	HE3R 794	3.28265E-05	2.50542E-05	2.03267E-05	1.91271E-05	1.74746E-05	HE3R 734	
8.12915E-06	8.82705E-06	1.10931E-05	1.12007E-05	3.58786E-05	HE3R 795	1.33225E-05	1.27159E-05	1.28433E-05	1.39159E-05	1.49703E-05	HE3R 735	
2.25624E-04	2.55918E-04	1.94790E-04	1.55919E-04	1.22777E-04	HE3R 796	1.62552E-05	1.88675E-05	1.74282E-05	2.19184E-05	2.20476E-05	HE3R 736	
1.24272E-04	8.42030E-05	6.45385E-05	5.32583E-05	4.54583E-05	HE3R 798	0.00000E-01	0.03000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 737
3.17444E-05	5.26452E-05	2.61964E-05	2.49342E-05	2.65038E-05	HE3R 799	0.00000E-01	0.03000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 738
2.71758E-05	2.98011E-05	2.92881E-05	3.49323E-05	3.48998E-05	HE3R 800	0.00000E-01	0.03000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 739
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 801	0.00000E-01	0.03000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 740
0.00000E-01	0.03000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 802	0.00000E-01	0.03000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 741
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 803	0.00000E-01	0.03000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 742
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 804	0.00000E-01	0.03000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 743
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 805	0.00000E-01	0.03000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 744
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 806	1.54090E-05	4.72170E-05	1.56430E-05	3.07970E-06	3.02075E-06	HE3R 745	
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 807	3.35736E-06	3.77080E-06	4.98418E-06	5.06622E-06	5.37128E-06	HE3R 746	
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 808	5.99295E-06	6.78132E-06	7.47823E-06	1.27215E-04	1.31133E-04	HE3R 747	
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 809	1.00630E-04	7.94965E-05	6.08222E-05	4.69527E-05	4.84491E-05	HE3R 748	
0.00000E-01	0.01000E-01	0.00000E-01	5.32010E-10	8.39996E-06	HE3R 810	3.30530E-05	2.68656E-05	2.17718E-05	1.82002E-05	1.75021E-05	HE3R 750	
4.30269E-05	4.63600E-06	5.01308E-06	5.60516E-06	6.31397E-06	HE3R 811	1.28019E-05	1.20043E-05	1.24766E-05	1.28039E-05	1.40447E-05	HE3R 751	
7.19414E-06	8.16016E-06	8.13705E-06	9.04457E-06	1.06503E-05	HE3R 812	1.47214E-05	1.77636E-05	1.72870E-05	1.90163E-05	2.15005E-05	HE3R 752	
2.62192E-05	1.78488E-04	2.59176E-04	2.11145E-04	1.69969E-04	HE3R 813	0.00000E-01	0.03000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 753
1.37932E-04	1.32977E-04	9.35514E-05	7.27105E-05	5.90372E-05	HE3R 814	0.00000E-01	0.03000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 754
3.55939E-05	3.19648E-05	2.75544E-05	2.747471E-05	2.54306E-05	HE3R 815	0.00000E-01	0.03000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 755
2.72677E-05	2.75115E-05	3.01575E-05	3.04777E-05	3.69581E-05	HE3R 816	0.00000E-01	0.03000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 756
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 817	0.00000E-01	0.03000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 757
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 818	0.00000E-01	0.03000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 758
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 819	0.00000E-01	0.03000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 759
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 820	0.00000E-01	0.03000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 760
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 821	0.00000E-01	0.03000E-01	0.00000E-01	0.00000E-01	4.25410E-10	HE3R 761	
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 822	3.51220E-07	1.42900E-05	4.36070E-05	1.49680E-05	2.86350E-06	HE3R 762	
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 823	3.31631E-06	3.42259E-06	4.31354E-06	4.70285E-06	4.93968E-06	HE3R 763	
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 824	5.64244E-06	6.24563E-06	6.17254E-06	3.53645E-05	1.41839E-04	HE3R 764	
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 825	1.11704E-04	9.00060E-05	6.77104E-05	5.30713E-05	6.82098E-05	HE3R 765	
2.67757E-06	3.30895E-05	4.84423E-06	3.53717E-06	4.58144E-06	HE3R 826	3.60722E-05	2.79347E-05	2.47314E-05	1.92135E-05	1.68641E-05	HE3R 766	
5.09529E-06	5.57959E-06	6.11273E-06	6.73821E-06	7.91500E-06	HE3R 827	1.222254E-05	1.20783E-05	1.20165E-05	1.29964E-05	1.31572E-05	HE3R 767	
8.83868E-06	1.28964E-05	9.83469E-05	2.34647E-04	2.12525E-04	HE3R 828	1.39804E-05	1.50681E-05	1.74798E-05	1.64450E-05	2.03114E-05	HE3R 768	
1.70815E-04	1.37581E-04	1.28272E-04	9.32478E-05	7.44917E-05	HE3R 829	0.00000E-01	0.03000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 769
4.14678E-05	3.36757E-05	3.01379E-05	2.55780E-05	2.57006E-05	HE3R 831	0.00000E-01	0.03000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 770
2.49941E-05	2.62134E-05	2.53425E-05	2.85032E-05	2.98634E-05	HE3R 832	0.00000E-01	0.03000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 771
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 833	0.00000E-01	0.03000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 772
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 834	0.00000E-01	0.03000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 773
0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 835	0.00000E-01	0.03000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 774
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0.00000E-01	0.01000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 837	0.00000E-0						

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	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 902	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	2.50001E-65	HE3R 842
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 903	2.09303E-12	6.03226E-06	2.91561E-05	2.96506E-06	3.13609E-06	HE3R 843
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 904	3.30877E-06	3.76808E-06	4.42963E-06	4.93127E-06	5.27338E-06	HE3R 844
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 905	5.93963E-06	6.83378E-06	7.08440E-06	4.68764E-05	1.89408E-04	HE3R 845
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 906	2.15656E-04	1.66412E-04	1.35565E-04	1.25603E-04	9.51978E-05	HE3R 846
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 907	5.01311E-05	3.69070E-05	2.97736E-05	2.68267E-05	2.41874E-05	HE3R 847
	3.30541E-06	1.43507E-05	1.50951E-06	1.14648E-06	1.54921E-06	HE3R 908	2.37858E-05	2.26123E-05	2.48015E-05	2.49560E-05	2.61314E-05	HE3R 848
	1.54579E-06	1.52688E-06	1.95552E-06	2.26030E-06	2.94257E-06	HE3R 909	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 849
	2.93548E-06	2.83431E-06	3.36347E-06	1.46629E-05	1.04881E-04	HE3R 910	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 850
	9.66296E-05	6.99286E-05	4.99661E-05	4.65532E-05	2.89397E-05	HE3R 911	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 851
	2.53685E-05	2.26998E-05	1.86247E-05	1.90509E-05	1.91024E-05	HE3R 912	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 852
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 913	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 853
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 914	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 854
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 915	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 855
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 916	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 856
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 917	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 857
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 918	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 858
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 919	0.00000E-01	3.34403E-10	1.96066E-06	2.30168E-05	3.89063E-06	HE3R 859
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 920	2.56662E-06	2.49067E-06	3.07487E-06	3.79048E-06	4.14224E-06	HE3R 860
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 921	4.11261E-06	4.85454E-06	5.76167E-06	5.91138E-06	1.85200E-05	HE3R 861
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 922	1.31283E-04	2.02290E-04	1.66965E-04	1.35591E-04	1.22698E-04	HE3R 862
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 923	5.71228E-05	4.44208E-05	3.29128E-05	2.74164E-05	2.58591E-05	HE3R 863
	5.98019E-10	1.14418E-06	1.11473E-05	1.93325E-06	1.28322E-06	HE3R 924	2.19782E-05	2.25671E-05	2.31731E-05	2.33534E-05	2.28168E-05	HE3R 864
	1.14002E-06	9.86490E-07	1.38869E-06	1.67412E-06	1.80084E-06	HE3R 925	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 865
	1.99069E-06	2.42286E-06	2.64358E-06	3.17116E-06	6.14789E-06	HE3R 926	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 866
	1.02679E-04	8.54545E-05	5.87227E-05	4.50670E-05	3.65424E-05	HE3R 927	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 867
	2.76890E-05	2.25841E-05	2.17117E-05	1.75306E-05	1.86205E-05	HE3R 928	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 868
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 929	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 869
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 930	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 870
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 931	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 871
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 932	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 872
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 933	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 873
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 934	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 874
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 935	0.00000E-01	2.50001E-65	1.41932E-12	4.40795E-06	1.96826E-05	HE3R 875
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 936	1.97399E-06	2.14517E-06	2.37777E-06	2.72143E-06	2.67595E-06	HE3R 876
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 937	3.16925E-06	3.69902E-06	3.75436E-06	4.52467E-06	4.77137E-06	HE3R 877
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 938	5.77085E-06	7.63101E-05	1.80848E-04	1.66542E-04	1.35177E-04	HE3R 878
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 939	6.79097E-05	5.04679E-05	3.85600E-05	3.04538E-05	2.52142E-05	HE3R 879
	2.50001E-65	3.62447E-12	2.43563E-06	9.95869E-06	7.83254E-07	HE3R 940	2.31862E-05	2.11651E-05	2.05294E-05	2.02171E-05	2.17970E-05	HE3R 880
	6.50556E-07	1.00871E-06	1.18696E-06	1.25237E-06	1.29314E-06	HE3R 941	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 881
	1.55582E-06	1.75619E-06	2.22263E-06	2.26889E-06	2.62927E-06	HE3R 942	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 882
	2.27565E-05	1.02589E-04	7.04072F-05	5.08607E-05	4.10329E-05	HE3R 943	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 883
	3.24183E-05	2.44994E-05	2.25386E-05	1.94112E-05	1.68941E-05	HE3R 944	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 884
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 945	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 885
	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 946	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 886
	0.00000E-01	0.06000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 947	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 887
	0.00000E-01	0.02000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 948	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 888
	0.00000E-01	0.02000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 949	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 889
	0.00000E-01	0.02000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 950	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 890
	0.00000E-01	0.02000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 951	0.00000E-01	0.00000E-01	0.00000E-01	0.00000E-01	4.62010E-10	1.45116E-06
	0.00000E-01	0.02000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 952	1.59327E-05	2.67691E-06	2.05801E-06	1.86475E-06	2.08566E-06	HE3R 892
	0.00000E-01	0.02000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 953	2.58288E-06	2.80609E-06	2.87686E-06	3.05323E-06	3.25864E-06	HE3R 893
	0.00000E-01	0.03000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 954	3.62485E-06	4.25819E-06	3.63129E-05	1.47727E-04	1.65860E-04	HE3R 894
	0.00000E-01	0.03000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 955	8.50094E-05	5.74219E-05	4.56500E-05	3.40322E-05	2.66845E-05	HE3R 895
	0.00000E-01	0.03000E-01	0.00000E-01	0.00000E-01	0.00000E-01	HE3R 956	2.32877E-05	2.19168E-05	1.85313E-05	2.04738E-05	1.95688E-05	HE3R 896
	1.2											







APPENDIX B

- (1) Control card information of the TRANSFER code
- (2) Program list of the TRANS code
- (3) Input example of the TRANS code
- (4) Output example of the TRANS code
- (5) Control card information of the HE3-FERDO code
- (6) Program list of the HE3-FERDO code
- (7) Input example of the HE3-FERDO code
- (8) Output example of the HE3-FERDO code

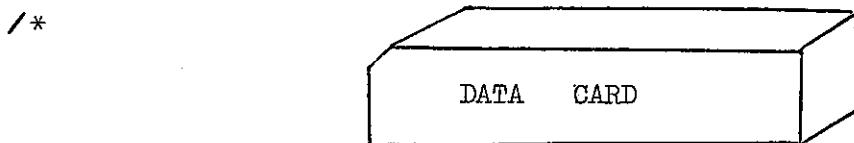
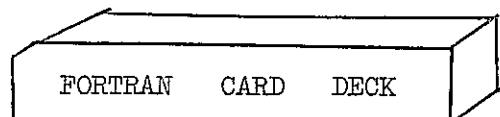
(1) Control card information of the TRANSFER code.

(1) Card deck input example

```
// KOSAKO: JOB    0638013001,          C      continuation
          PW = *****                      C      72 column
          JC = A, MC = T

// CODE MIX
      ---(H and EL codes are acceptable)---

// FORTCLG (SOURCE)
      ---(FORTRAN compile, link and go)---
```



/\*

(2) Job size information

- i) Program size 17 KB
- ii) Used core (in case of exercise) 32 KB
- iii) Used time (HITAC 8800/8700) 5.1 sec
- iv) Out put page (in case of ex.) 14 pages

(2) Program list of the TRANS code

```

C *SUBROUTINE OF SPECTRUM TRANSFER,(REVISED EDITION)
C   *PEAK NUMBER , LESS THAN 5,
C   *ZP1(I)*PEAK CH.NO, SET IN OBJECTIVE SPECTRUM,*  

C     *INITIAL PEAK POSITION SET. *
C   *ZP2(I)*PEAK CH.NO, SET IN TRANSFERED SPECTRUM.*  

C     *AFTER TRANSFERED POSITION SET *
C   *S1 (I)*INITIAL SPECTRUM ---- TRANSFERED SPECTRUM
C *NOTICE*****  

C   *MIN  *MINIMUM CH. NO. IN INITIAL SPECTRUM.
C   *MAX  *MAXIMUM CH. NO. IN INITIAL SPECTRUM.
C
C
C DIMENSION ZP1(10),ZP2(10),TIT(20),FMT(5)
C DIMENSION S1(1000),SS(2000)
C COMMON /BLOCK1/WW,WS1(1000)
C COMMON /BLOCK3/IKIND
C
C *IN CASE OF (TRANS) ONLY USE ,
C YOU MAY INPUT (DATA STATEMENT) IN THIS PLACE.
C
C
C 15
C 88
C
C LQQ=1000
10 CONTINUE
WW=0.0
READ(5,58) TIT
TIJ=4HLAST
IF(TIJ,EQ,TIJ) GO TO 11
L=TIT(20)
READ(5,60) (ZP1(I),I=1,L)
READ(5,60) (ZP2(I),I=1,L)
READ(5,60) ELABIN
READ(5,60) ELABTR
READ(5,61) ISN
IF(ISN,GT,LQQ) WRITE(6,56)
READ(5,61) MIN,MAX,IIIP,IKIND
READ(5,57) FMT
FMT1=4HDATA
IF(FMT1,EQ,FMT1) GO TO 13
READ(5,FMT) (S1(I),I=1,ISN)
13 WRITE(6,59) TIT
DO 12 I=1,L
WRITE(6,65) I,ZP1(I),I,ZP2(I)
12 CONTINUE
WRITE(6,68) ELABIN,ELABTR
WRITE(6,66) ISN,MIN,MAX
WRITE(6,64) (S1(I),I=1,ISN)
SSUM=0.0
DO 9 I=1,ISN
9 SSUM=SSUM+S1(I)
WRITE(6,67) SSUM
56 FORMAT(1H ,30H***WARNING*** DIM,OVER
57 FORMAT(5A4)

```

```

C*****TRANSFER CODE MANUAL
C*****THIS IS A MULTI-CHANNEL DATA PRESSING AND EXPANDING PROGRAM.
C
C *****INPUT FORMAT
C
C   *CARD 1 (19A4,F4.0) TIT(20)
C     TIT(1--17) TITLE COLUMN
C     ***  

C     TIT  GRAPZ CONTROL ****=YES
C     TIT(18) ORIGINAL DATA PLOTTING
C     TIT(19) TRANSFERED DATA PLOTTING
C     TIT(20) COUPLED PEAK NO, (=L) LESS THAN 5
C
C   *CARD 2 (5F12.0) (ZP1(I),I=1,L)
C     (5F12.0) (ZP2(I),I=1,L)
C     ZP1(I) INITIAL PEAK POSITION
C     ZP2(I) TRANSFERED PEAK POSITION
C
C   *CARD 2-SP1 (5F12.0) ELABIN
C     (5F12.0) ELABTR
C     ELABIN INITIAL LABEL CH.NO. E.G. C060 DATA CH.NO.
C     ELABTR TRANSFERD LABEL CH.NO. E.G. C060 FUND.CH.NO.
C     *** IF YOO DO NOT WANT THIS ROLE, YOU SHOULD FILL
C           ELABIN=ZP1(2) , ELABTR=ZP2(2) .
C
C   *CARD 3 (12I6) ISN
C     ISN MAX,CH.NO. OF M,C,A.
C
C   *CARD 4 (12I6) MIN,MAX,IIIP,IKIND
C     MIN USED MIN.CH.NO. OF INITIAL SPECTRUM.
C     MAX USED MAX.CH.NO. OF INITIAL SPECTRUM.
C     IIIP 0--NO PUNCH 2--PUNCH OUT
C           3--FILE ( FILE NO. 02 )
C           4--COMMON TRANS+FERDO
C     IKIND 0--TRANS ONLY
C           1--HE3 6IN#1IN PHI TEXLUM 9341
C           IN KOSAKO80 RESPONSE
C           2--NE213 2IN# 2IN PHI IN SENKEN RESPONSE
C
C   *CARD 5 (5A4) FMT(1--5)
C     FMT FORMAT E.G. (10F7.0)
C     FMT(1)=4HDATA ESCAPE ROOT ( CARD 6 )
C
C   *CARD 6 (MFT) S1(I),I=1,ISN
C     S1 INITIAL SPECTRUM
C
C     *IF IIIP = 4 ,FERDO INPUT IS CONTINUED
C     ***  

C     *CARD1--CARD6 CONTINUED
C     ***  

C     ***INCASE OF END , (A4)=LAST *** CARD IS NEEDED.
C
C
C

```

```

58 FORMAT(19A4,F4.0)
59 FORMAT(1H1,20A4//)
60 FORMAT(5F12.0)
61 FORMAT(12I6)
64 FORMAT(1H ,1P5E12.5)
65 FORMAT(1H ,4HZP1(,I2,2H)=,F12.6,5X,4HZP2(,I2,2H)=,F12.6)
66 FORMAT(1H ,4HISN=,I6,5X,4HMIN=,I6,5X,4HMAX=,I6/)
67 FORMAT(1H ,6HTOTAL=,F12.2)
68 FORMAT(1H ,7HELABIN=, F12.6,3X, 7HELABTR=,F12.6)
C *
C *GRAPH MAKING
GPZ1=4H*****  

GPZ2=TIT(18)
IF(GPZ2,NE,GPZ1) GO TO 2
W=0.0
T=0.0
DT=0.0
MIN=1
ICNT=0
CALL GRAPZ(MAX,MAX,TIT,W,T,DT,MIN,MAX,ICNT,S1,MAX,S1)
2 CONTINUE
C *
AABB1=0.0
AABB2=0.0
AABB3=0.0
AABB4=0.0
AABB5=0.0
DO 71 I=1,L
AABB1=ZP1(I)*ZP1(I)+AABB1
AABB2=ZP1(I)*ZP2(I)+AABB2
AABB3=ZP1(I)      +AABB3
AABB4=ZP2(I)      +AABB4
AABB5=1.0          +AABB5
71 CONTINUE
AAUP =(AABB2-AABB1)*AABB5-(AABB4+AABB3)*AABB3
BBUP =(AABB4-AABB3)*AABB1-(AABB2-AABB1)*AABB3
AABBCM=AABB1*AABB5+AABB3*AABB3
AA=AAUP/AABBCM
BB=BBUP/AABBCM
C
AA1=AA+1.0
YFAT=ELABTR/( AA1*ELABIN + BB )
AA1=AA1*YFAT
BB =BB *YFAT
AA =AA1-1.0
C
LQQ2=2*LQQ
DO 70 I=1,LQQ2
SS(I)=0.0
70 CONTINUE
DO 72 N=MIN,MAX
XN2=(1.0+AA)*FLOAT(N)+BB
XN2L=XN2-1.0*(1.0+AA)
XN2U=XN2
IXN2L=XN2L
IF(XN2L,LT,0.0) IXN2L=IXN2L-1
IXN2U=XN2U
IF(XN2U,LT,0.0) IXN2U=IXN2U-1
J=IXN2U-IXN2L
IF(J,LE,2) GO TO 80
WRITE(6,100)
100 FORMAT(//1H ,5X,100(1H#),
1 /1H ,5X,31HTRANSFER PARAMETER IS HAZARD,)
80 IF(J,NE,0) GO TO 81
SMAE=0.0
SNAKA=0.0
SAT0=S1(N)
GO TO 82
81 PN1=(FLOAT(IXN2L)+1.0)-XN2L
PN2=XN2U-(FLOAT(IXN2U))
SMAE=(PN1/(1.0+AA))*S1(N)
SAT0=(PN2/(1.0+AA))*S1(N)
IF(J,NE,1) GO TO 83
SNAKA=SMAE
SMAE=0.0
GO TO 82
83 SNAKA=S1(N)-SMAE-SAT0
82 L1=IXN2U+LQQ/2
SS(L1-1)=SMAE +SS(L1-1)
SS(L1 )=SNAKA*SS(L1 )
SS(L1+1)=SAT0 +SS(L1+1)
72 CONTINUE
C *THE DECISION OF BOTH LIMIT.
XN2MIN=(1.0+AA)*FLOAT(MIN)+BB
XN2MAX=(1.0+AA)*FLOAT(MAX)+BB
N2MIN=XN2MIN+1.0
N2MAX=XN2MAX
MIN=N2MIN
MAX=N2MAX
IF(MIN,LT,1.0) MIN=1
IF(MAX,GT,LQQ) MAX=LQQ
DO 73 N=1,LQQ
73 S1(N)=0.0
DO 74 N=MIN,MAX
S1(N)=SS(N+LQQ/2)
74 CONTINUE
WRITE(6,200) AA,BB,MIN,MAX
200 FORMAT(1H1//,5X,32H * TRANSFER(REVISED) OF SPECTRUM,
1 /1H ,10X,18HTRANSFER PARAMETER
2 /1H ,15X, 7HY=A*X+B ,
3 /1H ,15X, 9HA=AA+1.0=E15.7, 6H + 1.0,
4 3X, 4HB=BB ,E15.7,
5 / 1H ,15X,11HMIN,CH,NO.=,15,5X,11HMAX,CH,NO.,,15//)
WRITE(6,62) (S1(I):I=1,MAX)
62 FORMAT(1H ,5E12.5)
C *
C *GRAPH MAKING
GPZ1=4H*****  


```

```

213 CONTINUE
N=N+5
212 CONTINUE
IF(NI.NE.0) WRITE(6,209) NI
209 FORMAT(//1H,'MAXIMUM S1(I) I=',I6)
S1(70)=S1(70)+S1(99)*0.25+S1(100)+S1(101)+S1(102)+S1(103)*0.5
N=102
N1=0
DO 210 I=71,80
A=0.0
DO 211 K=1,6
N=N+1
A=A+S1(N)
211 CONTINUE
S1(I)=A-(S1(N-5)+S1(N))*0.5
N=N-1
IF(NI.NE.0) GO TO 215
IF(N.LE.MAX) GO TO 214
N1=N1+1
IF(N1.NE.1) GO TO 214
N1=1
214 CONTINUE
215 CONTINUE
210 CONTINUE
IF(NI.NE.0) WRITE(6,209) NI
C *PUNCHING
IF(IIIP-2,NE.0) GO TO 143
K=7
144 WRITE(K,204)
204 FORMAT(10H START )
WRITE(6,205)
205 FORMAT(//1H 'PUNCH DATA'//)
145 CONTINUE
WRITE(K,206) (S1(I),I=1,80)
206 FORMAT(1P5E12.5)
IF(K.EQ.6) GO TO 141
IF(K.EQ.2) GO TO 146
C *FILE
143 CONTINUE
K=2
IF(IIIP-3,EQ.0) WRITE(6,207)
207 FORMAT(//1H 'FILE DATA FILE NO.= 2'//)
IF(IIIP-3,NE.0) GO TO 145
C *TRANS-FERDO
146 CONTINUE
IF(IIIP-4,EQ.0) WRITE(6,208)
208 FORMAT(//1H 'TRANS-FERDO COMMON DATA, DIMENSION WS1(I)'//)
IF(IIIP-4,NE.0) GO TO 147
DO 22 I=1,80
WS1(I)=S1(I)
22 CONTINUE
WW=4.0
CALL FERDO
GPZ2=T1*(1.0)
IF(GPZ2,NE,GPZ1) GO TO 120
W=0.0
T=0.0
DT=0.0
MIN=1
ICNT=0
CALL GRAPZ(MAX,MAX,TIT,W,T,DT,MIN,MAX,ICNT,S1,MAX,S1)
120 CONTINUE
C *
C *DATA OUT PUT
C *
C *NE 213 SENKEN RESPONSE
IF(IKIND,EQ.0) WRITE(6,201)
IF(IKIND,EQ.1) WRITE(6,202)
IF(IKIND,EQ.2) WRITE(6,203)
201 FORMAT(1H1,'TRANSFERRED DATA ONLY')
202 FORMAT(1H1,'HE-3 KOSAKO80 RESPONSE')
203 FORMAT(1H1,'NE 213 SENKEN RESPONSE'
1 S1(I)--(6,7,8,...,69,70,72,74,76,--98,100)///)
1 IF(IIIP-2,NE.2) GO TO 140
1 IF(IIIP-2) 192,182,192
182 WRITE(7,63) (S1(I),I=6,70),(S1(2*I),I=36,50)
63 FORMAT(5(1PE12.5))
192 IF(IIIP-3) 193,183,193
183 WRITE( 2,63)(S1(I),I=6,70),(S1(2*I),I=36,50)
193 IF(IIIP-4) 161,194,141
194 DO 20 I=6,70
20 WS1(I-5)=S1(I)
DO 21 I=72,100,2
I1=I/2+30
WS1(I1)=S1(I)
21 CONTINUE
WH=4.0
CALL FERDO
GO TO 141
140 CONTINUE
C *HE-3 KOSAKO80 RESPONSE
IF(IKIND,NE.1) GO TO 141
C *DATA PROCESS
S1(50)=S1(50)+S1(51)+S1(52)*0.25
N=52
N1=0
N1=0
DO 212 I=51,69,2
S1(I)=S1(N)*0.75+S1(N+1)+S1(N+2)*0.75
S1(I+1)=S1(N+2)*0.25+S1(N+3)+S1(N+4)+S1(N+5)*0.25
IF(N.LE.MAX) GO TO 213
N1=N1+1
IF(N1.NE.1) GO TO 213
N1=I

```

```

C   SUBROUTINE GRAPZ(IC,ICG,TIT,W,T,DT,MIN,MAX,ICONT,X,IYDIM,Y)
C   #GRAPH * SEMI-LOG ( FOR MCPHA )
C   DIMENSION TIT(20),Y(IYDIM), YAX(101),X(IC)
C   IF(IYDIM.GT.500) WRITE(6,255)
C   IF(IC .GT. 500) WRITE(6,255)
255 FORMAT(1H ,45H*****WARNING***** DIM,SIZE GREATER THAN 500    )
C   XY0* () BLANK
C   XY1* (-) MINUS
C   XY2* (.) PIRIOD
C   XY3* (I)
C   XY4* (*) STAR
C   XY5* (T)
      Y0=1H
      Y1=1H-
      Y2=1H,
      Y3=1HI
      Y4=1H#
      Y5=1HT
C   *SETTING OF CONSTANTS
      I0=IC/ICG
      CON=0.43429448
      J1=1
      J2=(CON*HALOG(2.0))/0.04+0.5
      J3=(CON*HALOG(3.0))/0.04+0.5
      J4=(CON*HALOG(4.0))/0.04+0.5
      J5=(CON*HALOG(5.0))/0.04+0.5
      J6=(CON*HALOG(6.0))/0.04+0.5
      J7=(CON*HALOG(7.0))/0.04+0.5
      J8=(CON*HALOG(8.0))/0.04+0.5
      J9=(CON*HALOG(9.0))/0.04+0.5
      IF(ICONT.NE.0) GO TO 301
      DO 16 I=1,IYDIM
      IF(Y(I).LE.0.0) Y(I)=1.0E-70
16  CONTINUE
      IF(IC.EQ.ICG) GO TO 11
      DO 12 I=1,ICG
      I1=I0*I
      I2=I0*(I-1)
      I3=I1
      D=0.0
      13 D=D+Y(I3)
      I3=I3-1
      IF(I3.LE.I2) GO TO 14
      GO TO 13
14  Y(I)=D
12  CONTINUE
      MIN=MIN/I0+1
      MAX=MAX/I0
11  CONTINUE
C   *YMAX-RESEARCH
      YMAX=Y(MIN)
      DO 2 I=MIN,MAX
2   IF(Y(I).GT.YMAX) YMAX=Y(I)
C   *YMIN-RESEARCH

```

```

C   *WRITE
147 K=6
      GO TO 145
141 CONTINUE
      GO TO 10
11  CONTINUE
      STOP
      END

C   *DUMMY SUBROUTINE FERDO
      SUBROUTINE FERDO
      RETURN
      END

```

```

I1=1
I2=(CONHALOG(2.0))/0.04+0.5
I5=(CONHALOG(5.0))/0.04+0.5
I8=(CONHALOG(8.0))/0.04+0.5
8 YAX(I1)=Y2
IF(I1.EQ.101) GO TO 9
YAX(I2)=Y2
YAX(I5)=Y2
YAX(I8)=Y2
I1=I1+25
I2=I2+25
I5=I5+25
I8=I8+25
GO TO 8
9 CONTINUE
YAX(1)=Y3
IF(Y(K),GT,0.0) GO TO 20
P2=FLOAT(MINY)
GO TO 21
20 P2=(CONHALOG(Y(K))*P1)/0.04
21 IP2=P2+0.5
IF(IP2.LE,0) IP2=1
IF(IP2.GT,101) IP2=101
YAX(IP2)=Y4
KK=I0*K
WRITE(6,203) KK,X(KK),YAX
203 FORMAT(1H ,16,1X,1PE10.3,1X,101A1)
90 CONTINUE
301 CONTINUE
RETURN
END

          YMIN=YMAX
          DO 3 I=MIN,MAX
          IF(Y(I),EQ,0.0) GO TO 3
          IF(Y(I),LT,YMIN) YMIN=Y(I)
3 CONTINUE
C   *SETTING OF CO-ORDINATES
      MINY=CON*(~100.0)
      MAXY=CON*HALOG(YMAX)+1.0
      MINY=MAXY-4
      IF(YMIN.GT,0.0) MINY=CON*HALOG(YMIN)
C   *TITLE , CONDITION AND Y-AX WRITING
      WRITE(6,201) TIT,W,T,DT,MINY,MAXY
201 FORMAT(1H1,///1H ,20X,20A4,//1H ,10X,2HW=:E15.7+5X,2HT=:E15.7,5X,
      1 3HDT=:E15.7,///1H ,14X,3H10(,I4,1H),97X,3H10(,I4,1H))
C   *
      DO 4 I=1,101
4 YAX(I)=Y1
      I1=J1
      I2=J2
      I3=J3
      I4=J4
      I5=J5
      I6=J6
      I7=J7
      I8=J8
      I9=J9
5 YAX(I1)=Y5
IF(I1.EQ.101) GO TO 6
YAX(I2)=Y2
YAX(I3)=Y2
YAX(I4)=Y2
YAX(I5)=Y2
YAX(I6)=Y2
YAX(I7)=Y2
YAX(I8)=Y2
YAX(I9)=Y2
I1=I1+25
I2=I2+25
I3=I3+25
I4=I4+25
I5=I5+25
I6=I6+25
I7=I7+25
I8=I8+25
I9=I9+25
GO TO 5
6 CONTINUE
WRITE(6,202) YAX
202 FORMAT(1H ,6HCH,NO:,12X,101A1)
C   *PLOTTING
      P1=FLOAT(MAXY)-4.0
      DO 90 K=1,ICG
      DO 7 I=1,101
7 YAX(I)=Y0

```

760629 D-OPE 3M FROM SURFACE 1 WATT@2400.5 SEC HE-3 CD+B4C \*\*\*\*\* 2  
76.0 152.0  
0.0 7.64  
152.0  
7.64  
500

114.	94.	101.	102.	75.	79.	94.	83.	83.	64.76D-3M1-26
84.	69.	69.	82.	71.	81.	55.	80.	47.	63.76D-3M1-27
67.	60.	53.	60.	61.	59.	54.	62.	45.	52.76D-3M1-28
50.	52.	54.	66.	56.	44.	42.	41.	45.	46.76D-3M1-29
39.	44.	42.	47.	47.	36.	39.	41.	41.	36.76D-3M1-30
51.	46.	41.	41.	31.	33.	39.	30.	38.	31.76D-3M1-31
36.	25.	27.	32.	25.	26.	28.	35.	35.	25.76D-3M1-32
40.	18.	26.	24.	29.	29.	29.	22.	31.	24.76D-3M1-33
25.	18.	28.	26.	22.	18.	13.	26.	21.	24.76D-3M1-34
22.	22.	18.	20.	13.	15.	27.	12.	24.	18.76D-3M1-35
12.	11.	12.	13.	18.	20.	16.	18.	15.	14.76D-3M1-36
13.	24.	10.	10.	12.	13.	11.	17.	14.	13.76D-3M1-37
10.	16.	12.	11.	15.	12.	10.	9.	8.	12.76D-3M1-38
15.	11.	12.	19.	10.	13.	10.	9.	10.	9.76D-3M1-39
11.	7.	12.	7.	2.	7.	8.	13.	9.	5.76D-3M1-40
9.	4.	1.	6.	12.	10.	4.	8.	11.	10.76D-3M1-41
6.	9.	2.	7.	6.	6.	7.	5.	4.	5.76D-3M1-42
6.	4.	6.	8.	5.	7.	3.	8.	4.	5.76D-3M1-43
7.	4.	5.	4.	6.	6.	9.	6.	2.	12.76D-3M1-44
6.	6.	2.	5.	7.	3.	3.	5.	4.	8.76D-3M1-45
0.	3.	3.	1.	0.	1.	5.	1.	4.	2.76D-3M1-46
6.	7.	1.	3.	5.	6.	3.	3.	3.	6.76D-3M1-47
3.	1.	2.	5.	0.	1.	3.	2.	1.	2.76D-3M1-48
1.	3.	1.	3.	2.	3.	3.	0.	2.	4.76D-3M1-49
2.	3.	0.	2.	3.	0.	0.	1.	3.	4.76D-3M1-50

### (3) Input example of the TRANS code

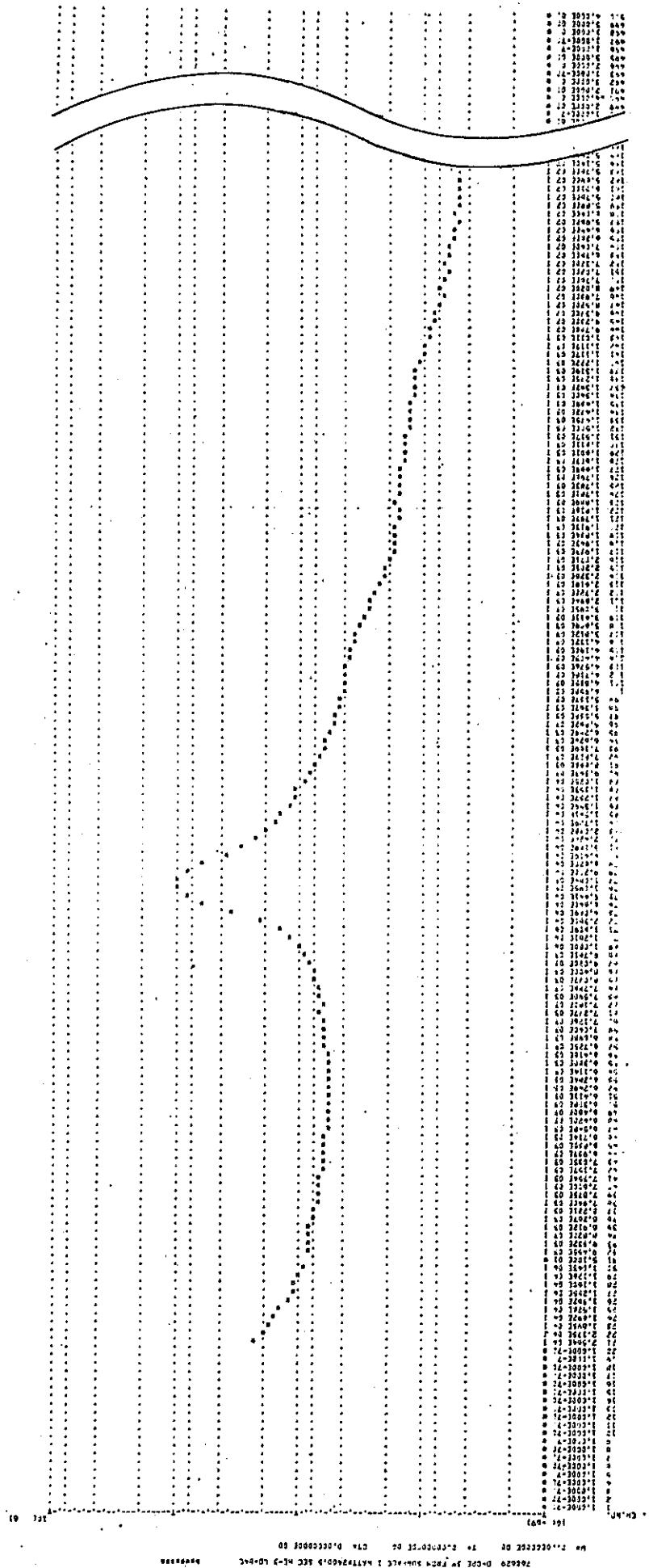
(4) Output example of the TRANS code

760629 D-OPE 3M FROM SURFACE 1 WATT\*2400.5 SEC HE-3 CD+B4C

ZP1( 1)= 76.000000 ZP2( 1)= 0.000000  
ZP1( 2)= 152.000000 ZP2( 2)= 7.640000  
ELABIN= 152.000000 ELABTR= 7.640000  
ISN= 500 MIN= 1 MAX= 500

0.00000E 00 0.00000E 00 0.00000E 00 0.00000E 00 0.00000E 00  
0.00000E 00 0.00000E 00 0.00000E 00 0.00000E 00 0.00000E 00  
0.00000E 00 0.00000E 00 0.00000E 00 0.00000E 00 0.00000E 00  
0.00000E 00 0.00000E 00 0.00000E 00 0.00000E 00 0.00000E 00  
0.25637E 05 0.21755E 05 0.18955E 05 0.16918E 05 0.15260E 05  
0.13618E 05 0.12550E 05 0.11596E 05 0.11262E 05 0.10429E 05  
0.51000E 02 0.94550E 04 0.93320E 04 0.88200E 04 0.89120E 04  
0.82670E 04 0.82210E 04 0.79400E 04 0.78750E 04 0.76000E 04  
0.73540E 04 0.71570E 04 0.70350E 04 0.69370E 04 0.68350E 04  
0.67140E 04 0.65480E 04 0.64200E 04 0.64800E 04 0.63080E 04  
0.64110E 04 0.62490E 04 0.62840E 04 0.61140E 04 0.63800E 04  
0.64160E 04 0.67250E 04 0.66980E 04 0.70400E 04 0.71260E 04  
0.72770E 04 0.71800E 04 0.75900E 04 0.77860E 04 0.80770E 04  
0.84000E 04 0.90200E 04 0.97610E 04 0.10796E 05 0.12807E 05  
0.16092E 05 0.23805E 05 0.40688E 05 0.66396E 05 0.94409E 05  
0.10953E 06 0.10841E 06 0.92003E 05 0.66201E 05 0.44188E 05  
0.31694E 05 0.24240E 05 0.20379E 05 0.17287E 05 0.15410E 05  
0.13591E 05 0.12373E 05 0.11531E 05 0.10253E 05 0.93430E 04  
0.86660E 04 0.78270E 04 0.71690E 04 0.66240E 04 0.62890E 04  
0.58620E 04 0.55380E 04 0.53670E 04 0.51370E 04 0.49580E 04  
0.48150E 04 0.47180E 04 0.45760E 04 0.44030E 04 0.41900E 04  
0.41120E 04 0.38120E 04 0.36090E 04 0.34110E 04 0.30950E 04  
0.28940E 04 0.27200E 04 0.26190E 04 0.23280E 04 0.22010E 04  
0.20710E 04 0.19330E 04 0.19430E 04 0.18340E 04 0.19130E 04  
0.17930E 04 0.18160E 04 0.18890E 04 0.17810E 04 0.17830E 04  
0.17960E 04 0.16690E 04 0.16070E 04 0.16010E 04 0.16110E 04  
0.15170E 04 0.15000E 04 0.14750E 04 0.14720E 04 0.14390E 04  
0.13400E 04 0.13620E 04 0.12750E 04 0.13190E 04 0.12220E 04  
0.11170E 04 0.11170E 04 0.10110E 04 0.97300E 03 0.92300E 03  
0.93700E 03 0.85200E 03 0.79300E 03 0.80200E 03 0.77600E 03  
0.70200E 03 0.73200E 03 0.67500E 03 0.70400E 03 0.62600E 03  
0.64500E 03 0.59600E 03 0.60400E 03 0.58900E 03 0.57800E 03  
0.60100E 03 0.56900E 03 0.57600E 03 0.51400E 03 0.52900E 03  
0.50200E 03 0.53500E 03 0.46900E 03 0.44400E 03 0.44700E 03  
0.49600E 03 0.44600E 03 0.42800E 03 0.41800E 03 0.36000E 03  
0.30000E 00 0.30000E 00 0.30000E 00 0.30000E 00 0.30000E 00  
0.10000E 01 0.50000E 01 0.50000E 01 0.29600E 03 0.29600E 01  
0.60000E 01 0.70000E 01 0.70000E 01 0.24200E 03 0.24200E 01  
0.60000E 01 0.30000E 01 0.30000E 01 0.16000E 01 0.16000E 01  
0.30000E 01 0.10000E 01 0.20000E 01 0.10000E 01 0.20000E 01  
0.10000E 01 0.30000E 01 0.20000E 01 0.10000E 01 0.20000E 01  
0.10000E 01 0.30000E 01 0.10000E 01 0.30000E 01 0.20000E 01  
0.30000E 01 0.30000E 01 0.00000E 00 0.20000E 01 0.40000E 01  
0.20000E 01 0.30000E 01 0.00000E 00 0.20000E 01 0.30000E 01  
0.00000E 00 0.00000E 00 0.10000E 01 0.30000E 01 0.40000E 01

TOTAL= 1485256.00



\* TRANSFER(REVISED) OF SPECTRUM  
TRANSFER PARAMETER

Y=A\*X+B

A=AA+1.0= -0.8994724E 00 + 1.0 B=BB -0.7640200E 01  
MIN.CH.NO.= 1 MAX.CH.NO.= 42

0.43259E 06 0.86027E 05 0.47780E 05 0.28971E 05 0.18444E 05  
0.15280E 05 0.11333E 05 0.73801E 04 0.56916E 04 0.44611E 04  
0.33785E 04 0.27429E 04 0.20665E 04 0.18133E 04 0.15709E 04  
0.12684E 04 0.11290E 04 0.95970E 03 0.77388E 03 0.62372E 03  
0.54731E 03 0.43545E 03 0.40383E 03 0.31592E 03 0.28345E 03  
0.25403E 03 0.19959E 03 0.15898E 03 0.15418E 03 0.12965E 03  
0.12034E 03 0.98120E 02 0.73371E 02 0.77071E 02 0.56521E 02  
0.51850E 02 0.59745E 02 0.31584E 02 0.29864E 02 0.36647E 02  
0.17039E 02 0.21046E 02

760629 D-OPE 3M FROM SURFACE 1 WATTX2400.5 SEC HE-3 CD+B4C

\*\*\*\*\*

W= 0.000000E 00

T= 0.000000E 00

DT= 0.000000E 00

CH.NO.	10( 1)	10( 6)
1	4.326E 05 I	.
2	8.603E 04 I	.
3	4.778E 04 I	.
4	2.897E 04 I	.
5	1.844E 04 I	.
6	1.528E 04 I	*
7	1.133E 04 I	.
8	7.380E 03 I	.
9	5.692E 03 I	.
10	4.461E 03 I	.
11	3.378E 03 I	.
12	2.743E 03 I	.
13	2.066E 03 I	.
14	1.813E 03 I	.
15	1.571E 03 I	.
16	1.268E 03 I	.
17	1.129E 03 I	.
18	9.597E 02 I	.
19	7.759E 02 I	.
20	6.237E 02 I	.
21	5.473E 02 I	.
22	4.355E 02 I	.
23	4.038E 02 I	.
24	3.159E 02 I	*
25	2.834E 02 I	*
26	2.540E 02 I	.
27	1.996E 02 I	.
28	1.590E 02 I	*
29	1.542E 02 I	*
30	1.297E 02 I	*
31	1.203E 02 I	*
32	9.812E 01 *	.
33	7.337E 01 *	.
34	7.707E 01 *	.
35	5.652E 01 *	.
36	5.185E 01 *	.
37	5.975E 01 *	.
38	3.158E 01 *	.
39	2.986E 01 *	.
40	3.665E 01 *	.
41	1.704E 01 *	.
42	2.105E 01 *	.

### HE-3 KOSAKOBO RESPONSE

MAXIMUM S1(I) I= 51

```

MAXIMUM S1(I) I= 51
4.32588E 05 8.60269E 04 4.77801E 04 2.89706E 04 1.84442E 04
1.52799E 04 1.13333E 04 7.38112E 03 5.69155E 03 4.46167E 03
3.37846E 03 2.74285E 03 2.06645E 03 1.81330E 03 1.57089E 03
1.26838E 03 1.12896E 03 9.59699E 02 7.73881E 02 6.23720E 02
5.47308E 02 4.35453E 02 4.03829E 02 3.15925E 02 2.83447E 02
2.5427E 02 1.99588E 02 1.58978E 02 1.54181E 02 1.29654E 02
1.20342E 02 9.81199E 01 7.33713E 01 7.70708E 01 5.65211E 01
5.18500E 01 5.97451E 01 3.15844E 01 2.98038E 01 3.65469E 01
1.70389E 01 2.10461E 01 0.00000E-01 0.00000E-01 0.00000E-01
0.00000E-01 0.10000E-01 0.00000E-01 0.00000E-01 0.00000E-01
0.00000E-01 0.80000E-01 0.00000E-01 0.00000E-01 0.00000E-01
0.00000E-01 0.40000E-01 0.00000E-01 0.00000E-01 0.00000E-01
0.00000E-01 0.10000E-01 0.00000E-01 0.00000E-01 0.00000E-01
0.00000E-01 0.10000E-01 0.00000E-01 0.00000E-01 0.00000E-01
0.00000E-01 0.60000E-01 0.00000E-01 0.00000E-01 0.00000E-01
0.00000E-01 0.20000E-01 0.00000E-01 0.00000E-01 0.00000E-01

```

## (5) Control card information of the HE3.FERDO code

### (1) Card deck input example

continuation

// KOSAKO: JOB 0638013001, 72 column

OW = \*\*\*\*\* C

JC = B, MC = T C

// CODE MIX

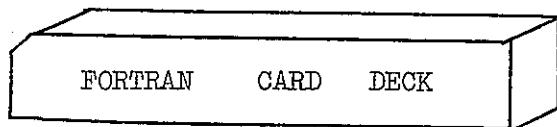
--- (H and EL codes are acceptable)---

// FT01FO01: DTF FN = HE3RES. KOSAKO80

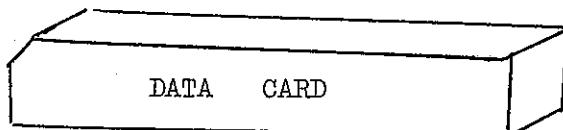
---(definition of the response matrix file)---

FORTCLG (SOURCE)

(FORTRAN compile, link and go)



/\*



//END

### (2) Job size information

- i) Program size 45 KB
- ii) Used core (in case of excercise) 73 KB
- iii) Used time (HITAC 8800/8700) 15.1 sec
- iv) Out put page (in case of ex.) 37 pages

(6) Program list of the HE3.FERDO code

```

C *HE-3 COUNTER FERDO INPUT PROGRAM (SUBTRACTION)
DIMENSION A(80,80),C(80),D(80),G(80),F(80)
DIMENSION TIT(20),EMID(80),TIT2(20),FORM(5)
DIMENSION B(500)
COMMON /BLOCK1/WW,WS1(500)
EQUIVALENCE (B(1),WS1(1))
MS=80
MS1=45
READ(5,50) TIT
50 FORMAT(20A4)
READ(5,12) IGZ
READ(5,12) INORM1,INORM2,IMOD,AN33
12 FORMAT(3I6,F12.0)
READ(5,50) TIT2
READ(5,10) (G(I),I=1,MS)
10 FORMAT(10F6.0)
LMAX=MS
I1 =LMAX
I2 =LMAX
I3=1
I4 =LMAX
I5=0
I6=LMAX
X1=0.0
X2=0.0
X3=0.0
C *ENERGY SETTING
EMID(1)=0.05
DO 15 I=1,48
15 EMID(I+1)=EMID(I)+0.10
EMID(50)=5.00
DO 16 I=50,68
16 EMID(I+1)=EMID(I)+0.25
EMID(70)=10.00
DO 17 I=70,79
17 EMID(I+1)=EMID(I)+0.5
C *
IF(IGZ.EQ.1)
*CALL GRAPZ(I1,I2,TIT2,X1,X2,X3,I3,I4,I5,EMID,I6,G)
WRITE(6,51)
51 FORMAT(//1H , 'GUESSED SPECTRUM')
WRITE(6,60) (G(I),I=1,MS)
60 FORMAT(1H ,1P10E12.5)
WRITE(6,14)
14 FORMAT(1H ,1H*)
READ(5,58) FORM
58 FORMAT(5A4)
READ(5,FORM) (B(I),I=1,MS)
IF(IGZ.EQ.1)
*CALL GRAPZ(I1,I2,TIT,X1,X2,X3,I3,I4,I5,EMID,16,B)
WRITE(6,52)
52 FORMAT(//1H , 'HE-3 INPUT DATA')
WRITE(6,60) (B(I),I=1,MS)
WRITE(6,14)

```

\*\*\*\*\*HE-3 FERDO INPUT PROGRAM MANUAL  
\*\*\*\*\*INPUT FORMAT  
C  
C \*CARD 1 ( 20A4 ) TIT  
C TIT TITLE CARD  
C  
C \*CARD 2 ( I6 ) IGZ  
C IGZ GRAPH CONTROL 0 NO 1 YES  
C  
C \*CARD 3 ( 3I6,F12.0 ) INORM1,INORM2,IMOD,AN33  
C INORM1,INORM2 NORMALIZING CHANNEL RANGE  
C BETWEEN DATA AND GUESS.  
C IMOD GUESSED DATA IS USED  
C FROM THE UPPER RANGE OF THIS CHANNEL  
C A33 NORMALIZING FACTOR  
C  
C \*CARD 4 ( 20A4 ) TIT2  
C TIT2 TITLE OF THE GUESSED SPECTRUM  
C  
C \*CARD 5 ( 10F6.0 ) ( G(I),I=1,MS )  
C G(I) GUESSED SPECTRUM  
C MS RESPONSE MATRIX SIZE  
C  
C \*CARD 6 ( 5A4 ) FORM(5)  
C FORM DATA FORMAT  
C  
C \*CARD 7 ( FORM ) ( B(I),I=1,MS )  
C B(I) INPUT HE-3 DATA  
C  
C \*FERDO INPUT IS CONTINUED.

```

      WRITE(6,55)
55 FORMAT(//1H , 'LOWER PART GUESSED PULSE HIGHT')
      WRITE(6,60) (F(I),I=1,MS)
      WRITE(6,14)
      IF(IGZ.EQ.1)
      *CALL GRAPZ(I1,I2,TIT,X1,X2,X3,I3,I4,I5,EMID,I6,B)
      WRITE(6,56)
56 FORMAT(//1H , '(INPUT HE-3)-(GUESSES PULSE HIGHT UPPER 45 CH.)')
      WRITE(6,60) (B(I),I=1,MS)
      WRITE(6,14)
      MS2=MS1+1
      DO 44 I=MS2,MS
      B(I)=0.0
44 CONTINUE
      IF(IGZ.EQ.1)
      *CALL GRAPZ(I1,I2,TIT,X1,X2,X3,I3,I4,I5,EMID,I6,B)
      WRITE(6,57)
57 FORMAT(//1H , '(INPUT HE-3)-(GUESSED PULSE HIGHT UPPER',
      * ' 45 CH.) AND ZERO SETTING IN CASE OF NEGATIVE VALUE')
      WRITE(6,60) (B(I),I=1,MS)
      IF(IMOD.EQ.0) GO TO 66
      DO 65 I=IMOD,MS
      B(I)=F(I)
65 CONTINUE
66 CONTINUE
      IF(IGZ.EQ.1)
      *CALL GRAPZ(I1,I2,TIT,X1,X2,X3,I3,I4,I5,EMID,I6,B)
      IF(IMOD.NE.0) WRITE(6,64) IMOD
64 FORMAT(1H , ' GUESSED PULSE HIGHT IS USED. CH.NO. ',
      * ' HIGHER THAN ',I6)
      WRITE(6,60) (B(I),I=1,MS)
      WRITE(6,69) AN3
69 FORMAT(//1H , 'NORM. INFORMATION',/, ' AN3= ',1PE12.5)
      IF(AN3.NE.0.0) WRITE(6,68) AN34
68 FORMAT(//1H , ' AN3 DATA IS GIVEN OLD DATA= ',1PE12.5)
      WRITE(6,13) INORM1,INORM2
13 FORMAT(1H , ' INORM1= ',I6,' INORM2= ',I6)
      CALL FERDO
      STOP
      END

      DO 20 I=1,MS
      READ(1,21) (A(I,J),J=1,MS)
21 FORMAT(5E12.5)
20 CONTINUE
      REWIND 1
      DO 30 I=1,MS
      DO 31 J=1,MS
      A(I,J)=A(I,J)*G(J)
31 CONTINUE
30 CONTINUE
      MM1=MS-1
      DO 36 I=1,MS
      DO 32 J=1,MM1
      A(I,J+1)=A(I,J)+A(I,J+1)
32 CONTINUE
36 CONTINUE
      DO 33 I=1,MS
      C(I)=A(I,MS)-A(I,MS1)
      D(I)=A(I,MS)
      F(I)=A(I,MS1)
33 CONTINUE
      *NORMALIZATION
      AN1=0.0
      AN2=0.0
      DO 42 I=INORM1,INORM2
      AN1=AN1+B(I)
      AN2=AN2+D(I)
42 CONTINUE
      AN3=AN1/AN2
      IF(AN3.EQ.0.0) GO TO 67
      AN34=AN3
      AN3=AN33
67 CONTINUE
      DO 43 I=1,MS
      C(I)=C(I)*AN3
      D(I)=D(I)*AN3
      F(I)=F(I)*AN3
      B(I)=B(I)-C(I)
      IF(B(I).LT.0.0) B(I)=0.0
43 CONTINUE
      IF(IGZ.EQ.1)
      *CALL GRAPZ(I1,I2,TIT2,X1,X2,X3,I3,I4,I5,EMID,I6,D)
      WRITE(6,53)
53 FORMAT(//1H , 'GUESSED PULSE HIGHT')
      WRITE(6,60) (D(I),I=1,MS)
      WRITE(6,14)
      IF(IGZ.EQ.1)
      *CALL GRAPZ(I1,I2,TIT2,X1,X2,X3,I3,I4,I5,EMID,I6,C)
      WRITE(6,54)
54 FORMAT(//1H , 'HIGHER PART GUESSED PULSE HIGHT')
      WRITE(6,60) (C(I),I=1,MS)
      WRITE(6,14)
      IF(IGZ.EQ.1)
      *CALL GRAPZ(I1,I2,TIT2,X1,X2,X3,I3,I4,I5,EMID,I6,F)

```

```

C *CARD-8-A (14,4A4) L,FMT(4)
C   *L  DATA READING FILE NUMBER  NORMALLY 5
C   *FMT  DATA READING FORMAT
C *CARD-8-B (FMT> (S(J),J=1,NR)
C   *S(J) DATA ERROR  +- REAL NUMBER NOT PER CENT

C *CARD-9  (6F12.0) WATT,TIME
C   *WATT  REACTOR POWER
C   *TIME  MEASURED TIME SEC

C *CARD-10 (20A4) IDENT(1--20)
C **LAST BLANK CARD
C **IN CASE OF CONTINUATION IDENT(1)= CONT
C **AND CARD 1--10 IS CONTINUED,

```

```

C   *FERDO PROGRAM MANUAL
C *CARD-1 (20A4) IDENT(1--20)
C   *IDENT  IDENTIFICATION
C   *IDENT(18 ,19 ) GRAPZ CONTROL ****YES
C   *     * 18 ORIGINAL DATA 19 RESULT

C *CARD-2 (8I10) NR,NC,NW,NUMBER
C   *NR  DATA NUMBER    I E.G. 80
C   *NC  ENERGY GROUP   J E.G. 37
C   *NW  WINDOW NUMBER   K E.G. 80
C   *NGO DATA SERIES CONTROL
C   * 1002 RES.-SAME   WINDOW--CHANGE DATA--CHANGE
C   * 1002 CARDS 4,5,6,7,8,9,10 IS NEEDED.
C   * 1003 RES.-SAME   WINDOW--SAME DATA--CHANGE
C   * 1003 CARDS 6,7,8,9,10 IS NEEDED.
C   * 1004 RES.-SAME   WINDOW--CHANGE DATA--SAME
C   * 1004 CARDS 4,5,9,10 IS NEEDED.
C   *-1004 RES.--SAME   WINDOW WIDTH --CHANGE DATA--SAME
C   *-1004 CARDS 4,10 IS NEEDED.

C *CARD-3 (5F12.5) A(1--NR,1--NC)
C   * A(1,1),A(1,2),-A(1,NC)
C   * A(2,1),A(2,2),-A(2,NC) ---
C   ***IF YOU WANT TO USE DATA FILE, YOU SHOULD FILL
C   *THE FIRST COLUMN WITH NEGATIVE NUMBER. E.G. -1.0
C   ***FILE READING NUMBER (1)

C *CARD-4 (F12.0,16) BW,IBW
C   *BW  WINDOW SETTING PARAMETER, NORMALLY 1.0
C   *IW  LE 0 -- NO WINDOW WRITING GT 0 --W-WRITING

C *CARD-5 (5F12.0) E(1--NC)
C   *E  ENERGY MESH INPUT

C *CARD-6 (E12.5) FMULTI
C   *FMULTI  NORMALLY 1.0

C *CARD-7 (T4,4A4) L,FMT(1--4)
C   **YOU MUST SET THE NO. OF FILE.
C   **L  DATA READING FILE NUMBER  NORMALLY 5
C   *FMT DATA FORMAT
C   *** FMT(1)=DIRT  DIRECT READING
C   *** IF IIIP=4 IN (TRANS) CODE (COMMON USE),
C   * THIS CARD SHOULD BE SET BY BLANK ONE.

C *CARD-8 (FMT) A(1--NR)
C   *A  SPECTRAL RAW DATA
C   *** IF IIIP=4 IN (TRANS) CODE (COMMON USE),
C   *THIS CARD IS NOT NEEDED.

C   *NEXTCARDS ARE NEEDED,ONLY WHEN FMULTI = 100.0
C   *IF YOU DO NOT WANT AUTOMATIC DATA ERROR SETTING,
C   *YOU MUST SET FMULTI = 100.0
C   *THEN *CARD-8-A* AND *CARD-8-B* INPUTS ARE NEEDED.

```

```

MIN=1
ICONT=0
CALL GRADZ(NW,NW,IDENT,WATT,TIME,DT,MIN,EW,ICONT,EW,NW,B)
311 CONTINUE
C   *
C   CALCULATE N VECTOR
C
1004 DO 20 J=1,NC
    Q(J)=1.0E35
    DO 20 I=1,NR
        IF(A(I,J))10,20,10
10 QMIN=(AMAX1(R(I),0.0)+S(I))/A(I,J)
        IF(Q(J)-QMIN)20,22,15
15 Q(J)=QMIN
20 CONTINUE
C
C   CALCULATE HT
C
    DO 25 I=1,NR
    DO 25 J=1,NC
        IF(S(I).NE.0.0) GO TO 21
        HT(I,J)=0.
        GO TO 25
21 HT(I,J)=(Q(J)*A(I,J))/S(I)
25 CONTINUE
    CALL GINV(HT,MR,NR,NC,TAW/SQRT(FLOAT(NC)),UGIN,ATEMP)
    DO 50 I=1,NR
    DO 50 J=1,NC
        IF(S(I).NE.0.0) GO TO 26
        HT(I,J)=0.
        GO TO 50
26 HT(I,J)=(Q(J)*HT(I,J))/S(I)
50 CONTINUE
C
C   BEGIN WINDOW LOOP
C
    WRITE(6,906) (IDENT(J),J=1,20)
    WRITE(6,922) BW
    WRITE(6,917)
    DO 500 K=1,NW
    DO 60 I=1,NC
        UT(I)=0.0
60 CONTINUE
    DO 100 J=1,NC
        IF(W(K,J))70,100,70
70 DO 80 I=1,NC
        UT(I)=UT(I)+W(K,J)*HT(I,J)
80 CONTINUE
100 CONTINUE
    USSUM=0.0
    UTB=0.0
    DO 150 I=1,NC
        UTB=UTB+UT(I)*B(I)

```

```

SUBROUTINE FFRDO
C FERDO-F1 MAIN
    DIMENSION A(160,80),B(160),S(160),W(160,80),HT(160,80),Q(80),
    1   UT(160),UGIN(80,80),ATEMP(80),IDENT(20),DE(80),EW(160)
    DIMENSION AERR1(160),AERR2(160),APHIL0(160),APHIUP(160),AUTB(160)
    COMMON /BLOCK1//WW,WS1(1000)
    COMMON /BLOCK3//IKIND
C
C   *INSERT THESE CARDS IN CASE OF ONLY FERDO USE
C*****  

C***** FERDO MAIN PROGRAM *****  

    WW=0.0  

    WW=4.0  

C   * WW=0.0  DO NOT USE COMMON  

    IKIND=1  

C   * IKIND=1  HE3  

C*****  

C
    MR=160
1000 READ (5,905) (IDENT(I),I=1,20)
    READ (5,901) NR,NC,NW,NGO
    I1004=0
    IF(NGO.NE.-1004) GO TO 251
    NGO =1004
    I1004=1
251 CONTINUE
    TAW=0.3
    IF(NGO.EQ.1002) GO TO 1002
    IF(NGO.EQ.1004) GO TO 1002
    1001 CALL AREAD(A,MR,NR,NC,NW)
C***ONLY HE-3***  

    NR=45
    NC=45
    NW=45
C*****  

    IF(NGO.EQ.1003) GO TO 1003
1002 CALL WREAD(W,MR,NC,NW,DE,EW,BW,IBW,I1004)
    IF(IBW.LE.0) GO TO 210
    WRITE(6,923) BW
    DO 5 J=1,NC
        5 WRITE(6,916) J,(W(I,J),I=1,NW)
210 CONTINUE
1003 WRITE (6,906) (IDENT(I),I=1,20)
    WRITE (6,902) NR,NC,NW
    IF(NGO.EQ.1004) GO TO 1004
    CALL BSREAD(B,S,MR,NR,NC)
    WRITE(6,908) (I,B(I),S(I),I=1,NR)
C
C   *GRAPH CONTROL
    IGPZ1=4*****
    IGPZ2=IDENT(18)
    IF(IGPZ2.NE.IGPZ1) GO TO 311
    DT=0.0

```

```

902 FORMAT(1H0,5X,19HNUMBER OF ROWS    =,I5/6X,19HNUMBER OF ,
19HCOLUMNS =,I5/6X,19HNUMBER OF WINDOWS =,I5)
904 FORMAT(1H ,18,F9.3,1P6E17.7)
905 FORMAT(20A4)
906 FORMAT(1H1,20A4)
907 FORMAT(1H0,2X,6HWINDOW,3X,6HE(MEV),6X,4HERR1,13X,4HERR2,
113X,3HPLD,14X,3HPUP,14X,6HPHAI-E,10X,6HPHAI-U)
908 FORMAT(1H0,3(5X,2HNR,5X,5HCOUNT,8X,4HS.D.,8X)/3(17,
1     1P2E13.4,4X))
910 FORMAT(1H ,2HJ=,I2/10(E12.5,1X))
920 FORMAT(6F12.0)
921 FORMAT( /1H ,5HWATT=,F12.6,5HTIME=,F12.6 )
922 FORMAT( /1H ,20HWINDOW PARAMETER BW=  ,1PE12.4/ )
923 FORMAT( /1H,20HWINDOW PARAMETER BW=  ,1PE12.4//)
READ(5,905) (IDENT(I),I=1,20)
IIF1=4HCONT
IF(IDENT(1),EQ,IIF1) GO TO 1000
RETURN
END

```

7  
4

```

USSUM=USSUM+(UT(I)*S(I))**2
150 CONTINUE
WUAQ=0.0
DO 200 J=1,NC
SUM=0.0
DO 175 I=1,NR
SUM=SUM+UT(I)*A(I,J)
175 CONTINUE
WUAQ=WUAQ+(Q(J)*(W(K,J)-SUM))*#2*FLOAT(NC)/(TAW*TAW)
200 CONTINUE
TTSQ=SQRT(1.0+TAW*TAW)
RAD=SQRT(USSUM+WUAQ)*TTSQ
PHIUP=UTB+RAD
PHILO=UTB-RAD
ERR1=TTSQ*SQRT(USSUM)
ERR2=TTSQ*SQRT(WUAQ)
AERR1(K)=ERR1
AERR2(K)=ERR2
APHIUP(K)=PHIUP
APHILO(K)=PHILO
AUTB(K)=UTB
AUTBLE=EW(K)*AUTB(K)
WRITE (6,904) K,EW(K),ERR1,ERR2,PHILO,PHIUP,UTB ,AUTBLE
500 CONTINUE
IF(11004,ER, 1) GO TO 250
READ(5,920) WATT,TIME
250 CONTINUE
WRITE(6,906) (IDENT(J),J=1,20)
WRITE(6,921) WATT ,TIME
WRITE(6,922) BW
WRITE(6,907)
DO 30 I=1,NW
AERR1(I)=AERR1(I)/WATT/TIME
AERR2(I)=AERR2(I)/WATT/TIME
APHILO(I)=APHILO(I)/WATT/TIME
APHIUP(I)=APHIUP(I)/WATT/TIME
AUTB(I)=AUTB(I)/WATT/TIME
AUTBLE=EW(I)*AUTB(I)
WRITE(6,904) I,EW(I),AERR1(I),AERR2(I),APHILO(I),APHIUP(I),
1           AUTB(I),AUTBLE
30 CONTINUE
C   *
C   *GRAPH CONTROL
IGPZ1=4H*****
IGPZ2=IDENT(19)
IF(IGPZ2.NE.IGPZ1) GO TO 310
DT=0.0
MIN=1
ICONT=0
CALL GRAPZ(NW,NW,IDENT,WATT,TIME,DT,MIN,NW,ICONT,EW,NW,AUTB)
310 CONTINUE
C   *
C   901 FORMAT(8I10)

```

```

C
C      NORMALIZE THE COLUMN I OF THE COMBINED MATRIX
C
11 DOT = 0.0
  DOT2 = 0.0
  DO 12 K = 1,NR
12 DOT = A(K,I)*A(K,I) + DOT
  DO 14 K = 1,I
14 DOT2 = U(K,I)*U(K,I) + DOT2
  DOT = DOT + DOT2*Tausq
  DOT = SQRT(DOT)
  DO 17 K = 1,I
17 IF(DOT.NE.^0.0) GO TO 17
  U(K,I)=0.0
  GO TO 18
17 U(K,I) = U(K,I)/DOT
18 DO 19 K=1,NR
  IF(DOT.NE.^0.0) GO TO 19
  A(K,I)=0.0
  GO TO 20
19 A(K,I) = A(K,I)/DOT
20 CONTINUE
C
C      CALCULATION OF THE TRANSPOSE OF THE TRANSFORMATION
C      MATRIX T(TRANS.) = A * U(TR.)
C
  DO 50 I = 1,NR
  DO 45 J = 1,NC
  Atemp(J) = 0.0
  DO 45 K = J,NC
  Atemp(J) = A(I,K)*U(J,K) + Atemp(J)
45 CONTINUE
  DO 50 J = 1,NC
  A(I,J) = Atemp(J)
50 CONTINUE
  RETURN
  END

```

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```

C
C      SUBROUTINE GINV
C
C      SUBROUTINE GINV(A,MR,NR,NC,TAU,U,ATEMP)
C
C      UPON ENTRY A = A MATRIX WITH NR ROWS AND NC COLUMNS
C      AFTER THE RETURN THE ORIGINAL A IS DESTROYED AND THE ARRAY A
C      CONTAINS THE TRANSPOSE OF T THE TRANSFORMATION MATRIX
C      (X = T*B) WHICH SOLVES THE PAIR OF EQUATIONS
C
C          A*X = B     AND     TAU X = 0
C
C          IN THE LEAST SQUARE SENSE.
C
C      MR = 1ST DIMENSION NO. OF ARRAY A IN THE CALLING PROGRAMS
C      TAU IS A NONNEGATIVE CONSTANT WHICH CONTROLS THE ERROR
C      PROPAGATION OF THE TRANSFORMATION MATRIX. IF TAU = 0. THEN THE
C      RESULTING TRANSFORMATION MATRIX IS THE ORDINARY LEAST SQUARES
C      TRANSFORMATION MATRIX. (THE INVERSE IF NR = NC)
C      ATEMP AND U ARE USED FOR WORKING SPACE BY THE ALGORITHM AND DO NOT
C      NECESSARILY CONTAIN ANY RELAVANT NUMBERS AT THE CONCLUSION,
C      ATEMP MUST BE DIMENSIONED AT LEAST NC BY THE CALLING PROGRAMS
C      U MUST BE DIMENSIONED AT LEAST NC*NC BY THE CALLING PROGRAMS
C      NO. OF MULTIPLICATION = NC**2 (5/2 NR + 2/3 NC)
C
C      DIMENSION A(MR,NC),U(80,NC),ATEMP(NC)
C      TAUSQ = TAU**2
C
C      PLACE UNIT MATRIX IN U
C      DO 5 I = 1,NC
C          DO 4 J = 1,NC
4 U(I,J) = 0.0
5 U(I,I) = 1.0
C
C      ORTHOGONALIZE COMBINED MATRIX (A ABOVE U) BY GRAMM-SCHMIDT-HILBERT
C      METHOD WITH FIRST NR ROWS WEIGHTED WITH 1 AND THE OTHER
C      NC ROWS WEIGHTED WITH 1/TAU. THEN REORTHOGONALIZE TO
C      LESSEM ROUNDOFF ERROR.
C
C      DO 20 I = 1,NC
II = I-1
IF (II) 2,11,2
2 DO 10 LL = 1,2
  DO 10 J=1,II
    DOT = 0.0
    DOT2 = 0.0
    DO 3 K = 1,NR
3 DOT = A(K,I)*A(K,J) + DOT
    DO 6 K = 1,J
6 DOT2 = U(K,I)*U(K,J) + DOT2
    DOT = DOT + DOT2*Tausq
    DO 8 K = 1,J
8 U(K,I) = U(K,I) - DOT*U(K,J)
    DO 10 K = 1,NR
10 A(K,I) = A(K,I) - DOT*A(K,J)

```

```

C
C      SUBROUTINE WREAD
C
SUBROUTINE WREAD(W,NR,NC,NW,E,EW,BW,IBW,I1004)
DIMENSION W(NR,NC),E(NC),EW(NW)
READ(5,10) BW,IBW
10 FORMAT(F12.0,I6)
IF(I1004.EQ.1) GO TO 20
READ(5,30) (E(I),I=1,NC)
30 FORMAT(5F12.0)
20 CONTINUE
DO 40 J=1,NC
EW(J)=E(J)
EC=E(J)
SIGMA=BW*E(J)
DO 40 I=1,NW
W(I,J)=0.39894*(1.0/SIGMA)*EXP(-(EC-E(I))**2/(2.0*SIGMA**2))
40 CONTINUE
RETURN
END

```

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```

C
C      SUBROUTINE AREAD
C
SUBROUTINE AREAD (A,MR,NR,NC,NW)
DIMENSION A(MR,NC)
READ(5,10) (A(I,J),J=1,5)
10 FORMAT(5E12.5)
IF(A(1,1)) 20,30,30
20 CONTINUE
REWIND 1
DO 25 I=1,NR
25 READ(1,10) (A(I,J),J=1,NC)
GO TO 40
30 READ(5,10) (A(I,J),J=6,NC)
DO 35 I=2,NR
35 READ(5,10) (A(I,J),J=1,NC)
40 RETURN
END

```

```

C
C      SUBROUTINE BSREAD
C
SUBROUTINE BSREAD (B,S,MR,NR,NC)
DIMENSION B(MR),S(MR),FMT(4)
COMMON /BLOCK1/WW,WS1(1000)
READ(5,1) FMULTI
1 FORMAT(E12.5)
IF(FMULTI.EQ.0.0) FMULTI=1.0
READ(5,3) L,FMT
3 FORMAT(14,4A4)
IF(WW.NE.4.0) GO TO 12
DO 13 I=1,MR
13 B(I)=WS1(I)
GO TO 14
12 CONTINUE
READ(L,FMT) (B(I),I=1,NR)
14 CONTINUE
IF(FMULTI.NE.100.0) GO TO 15
READ(5,3) L,FMT
READ(L,FMT) (S(J),J=1,NR)
GO TO 16
15 CONTINUE
DO 11 J=1,NR
S(J)=SQRT(FMULTI*B(J))
11 CONTINUE
16 CONTINUE
RETURN
END

```

(7) Input example of the HE3.FERDO code

760629 D-OPE 3M FROM SURFACE 1 WATT\*2400.5 SEC HE-3 CD+B4C \*\*\*\*\* 2  
 1  
 20 27 35  
 GUESSED SPECTRUM U-235 FISSION SPECTRUM  
 180. 250. 270. 270. 250. 280. 285. 265. 230. 210.  
 190. 175. 160. 140. 120. 110. 102. 95. 88. 84.  
 82. 75. 70. 65. 62. 60. 58. 57. 55. 52.  
 50. 47. 45. 43. 41. 39. 37. 35. 33. 31.  
 29. 28. 27. 26. 25. 24. 23. 22. 21. 45.  
 50. 40. 35. 30. 28. 26. 24. 22.5 19. 15.  
 12.5 10. 8.7 7.5 6.0 4.5 3.8 3.5 3.2 4.22  
 4.28 2.98 2.07 1.53 1.10 0.774 0.562 0.415 0.298 0.200  
 (SF12.0)  
 4.32588E 05 8.60269E 04 4.77801E 04 2.89706E 04 1.84442E 04  
 1.52799E 04 1.13333E 04 7.38012E 03 5.69155E 03 4.46107E 03  
 3.37846E 03 2.74285E 03 2.06645E 03 1.81330E 03 1.57089E 03  
 1.26838E 03 1.12896E 03 9.59699E 02 7.73881E 02 6.23720E 02  
 5.47308E 02 4.35453E 02 4.03829E 02 3.15925E 02 2.83447E 02  
 2.54027E 02 1.99588E 02 1.58978E 02 1.54181E 02 1.29654E 02  
 1.20342E 02 9.81199E 01 7.33713E 01 7.70708E 01 5.65211E 01  
 5.18500E 01 5.97451E 01 3.15844E 01 2.98638E 01 3.66469E 01  
 1.70389E 01 2.10461E 01 0.00000E-01 0.00000E-01 0.00000E-01  
 0.00000E-01 0.00000E-01 0.00000E-01

760629 D-OPE 3M FROM SURFACE 1 WATT\*2400.5 SEC HE-3 CD+B4C \*\*\*\*\* 2  
 80 80 80  
 -1.0  
 0.3

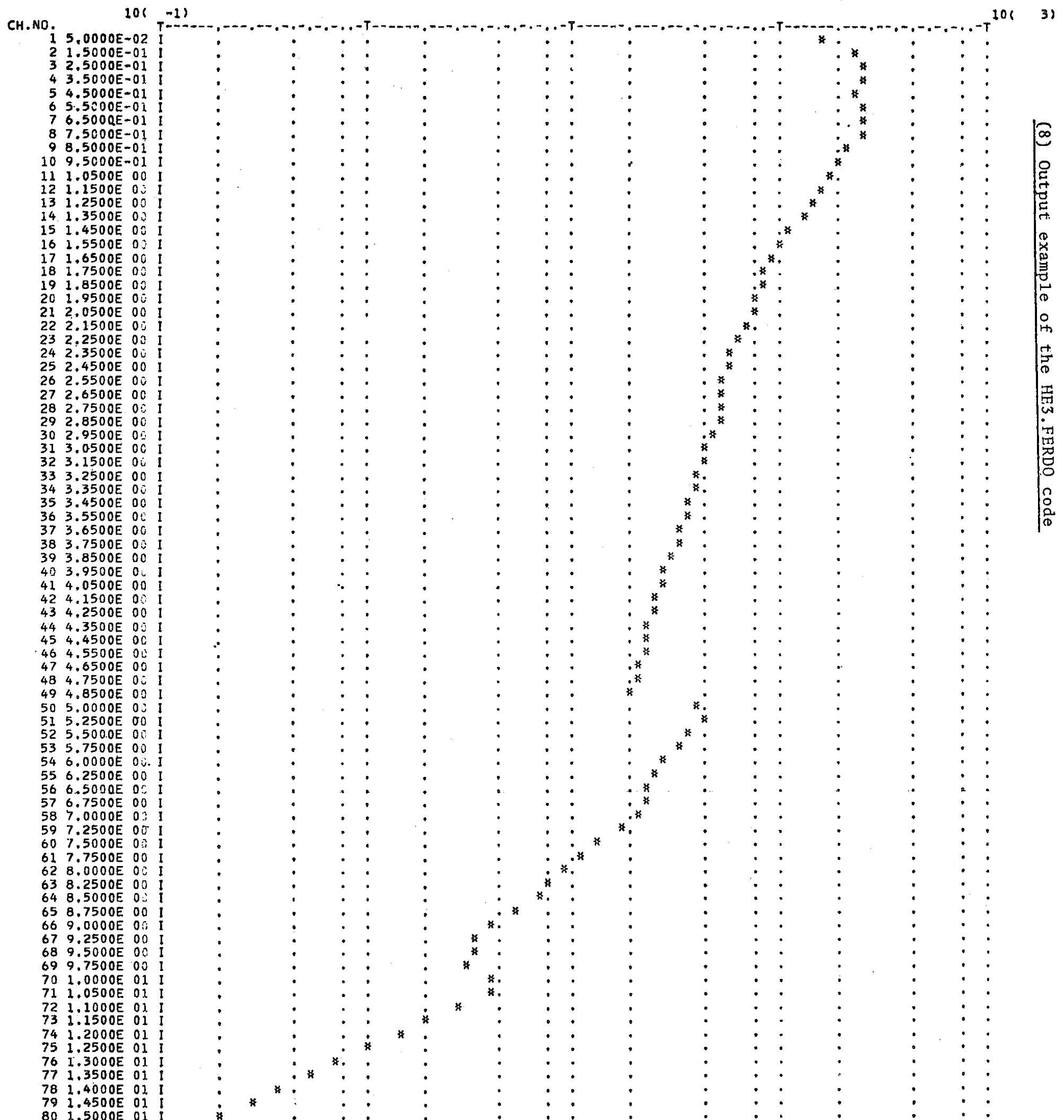
0.05	0.15	0.25	0.35	0.45	
0.55	0.65	0.75	0.85	0.95	HE3REM01
1.05	1.15	1.25	1.35	1.45	HE3REM02
1.55	1.65	1.75	1.85	1.95	HE3REM03
2.05	2.15	2.25	2.35	2.45	HE3REM04
2.55	2.65	2.75	2.85	2.95	HE3REM05
3.05	3.15	3.25	3.35	3.45	HE3REM06
3.55	3.65	3.75	3.85	3.95	HE3REM07
4.05	4.15	4.25	4.35	4.45	HE3REM08
1.0					HE3REM09

1.0 2400.5

(8) Output example of the HE3.FERDO code

GUESSED SPECTRUM U-235 FISSION SPECTRUM

W= 0.0000000E 00 T= 0.0000000E 00 DT= 0.0000000E 00



GUESSED SPECTRUM

1.80000E 02	2.50000E 02	2.70000E 02	2.70000E 02	2.50000E 02	2.80000E 02	2.85000E 02	2.65000E 02	2.30000E 02	2.10000E 02
1.90000E 02	1.75000E 02	1.60000E 02	1.40000E 02	1.20000E 02	1.10000E 02	1.02000E 02	9.50000E 01	8.80000E 01	8.40000E 01
8.20000E 01	7.50000E 01	7.00000E 01	6.50000E 01	6.20000E 01	6.00000E 01	5.80000E 01	5.70000E 01	5.50000E 01	5.20000E 01
5.00000E 01	4.70000E 01	4.50000E 01	4.30000E 01	4.10000E 01	3.90000E 01	3.70000E 01	3.50000E 01	3.30000E 01	3.10000E 01
2.90000E 01	2.80000E 01	2.70000E 01	2.60000E 01	2.50000E 01	2.40000E 01	2.30000E 01	2.20000E 01	2.10000E 01	4.50000E 01
5.00000E 01	4.03000E 01	3.50000E 01	3.00000E 01	2.80000E 01	2.60000E 01	2.40000E 01	2.25000E 01	1.90000E 01	1.50000E 01
1.25000E 01	1.05000E 01	8.70000E 00	7.50000E 00	6.00000E 00	4.50000E 00	3.80000E 00	3.50000E 00	3.20000E 00	4.22000E 00
4.28000E 00	2.98000E 00	2.07000E 00	1.53000E 00	1.10000E 00	7.74000E-01	5.62000E-01	4.15000E-01	2.98000E-01	2.00000E-01



760629 D-DPE 3M FROM SURFACE 1 WATT\*2400.5 SEC HE-3 CD+B4C

\*\*\*\*\* 2

W= 0.000000E 00 T= 0.000000E 00 DT= 0.000000E 00

CH.NO.	10( 2)	10( 6)
1	5.0000E-02 I	
2	1.5000E-01 I	
3	2.5000E-01 I	
4	3.5000E-01 I	
5	4.5000E-01 I	
6	5.5000E-01 I	
7	6.5000E-01 I	
8	7.5000E-01 I	
9	8.5000E-01 I	
10	9.5000E-01 I	
11	1.0500E 00 I	
12	1.1500E 00 I	
13	1.2500E 00 I	
14	1.3500E 00 I	
15	1.4500E 00 I	
16	1.5500E 00 I	
17	1.6500E 00 I	
18	1.7500E 00 I	
19	1.8500E 00 I	
20	1.9500E 00 I	
21	2.0500E 00 I	
22	2.1500E 00 I	
23	2.2500E 00 I	
24	2.3500E 00 I	
25	2.4500E 00 I	
26	2.5500E 00 I	
27	2.6500E 00 I	
28	2.7500E 00 I	
29	2.8500E 00 I	
30	2.9500E 00 I *	
31	3.0500E 00 I *	
32	3.1500E 00 *	
33	3.2500E 00 *	
34	3.3500E 00 *	
35	3.4500E 00 *	
36	3.5500E 00 *	
37	3.6500E 00 *	
38	3.7500E 00 *	
39	3.8500E 00 *	
40	3.9500E 00 *	
41	4.0500E 00 *	
42	4.1500E 00 *	
43	4.2500E 00 *	
44	4.3500E 00 *	
45	4.4500E 00 *	
46	4.5500E 00 *	
47	4.6500E 00 *	
48	4.7500E 00 *	
49	4.8500E 00 *	
50	5.0000E 00 *	
51	5.2500E 00 *	
52	5.5000E 00 *	
53	5.7500E 00 *	
54	6.0000E 00 *	
55	6.2500E 00 *	
56	6.5000E 00 *	
57	6.7500E 00 *	
58	7.0000E 00 *	
59	7.2500E 00 *	
60	7.5000E 00 *	
61	7.7500E 00 *	
62	8.0000E 00 *	
63	8.2500E 00 *	
64	8.5000E 00 *	
65	8.7500E 00 *	
66	9.0000E 00 *	
67	9.2500E 00 *	
68	9.5000E 00 *	
69	9.7500E 00 *	
70	1.0000E 01 *	
71	1.0500E 01 *	
72	1.1000E 01 *	
73	1.1500E 01 *	
74	1.2000E 01 *	
75	1.2500E 01 *	
76	1.3000E 01 *	
77	1.3500E 01 *	
78	1.4000E 01 *	
79	1.4500E 01 *	
80	1.5000E 01 *	

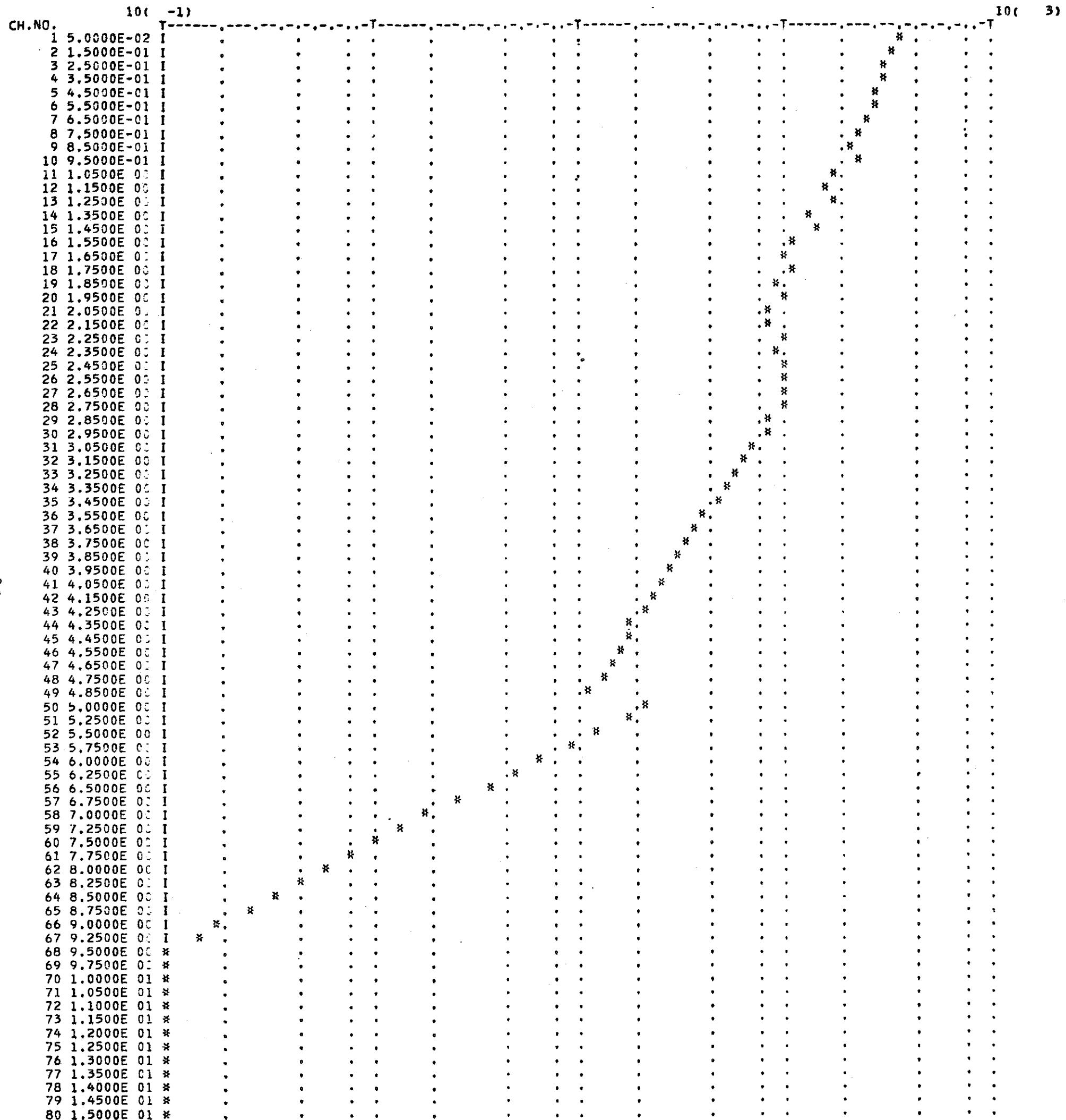
## HE-3 INPUT DATA

4.32588E 05 8.6269E 04 4.77801E 04 2.89706E 04 1.84442E 04 1.52799E 04 1.13333E 04 7.38012E 03 5.69155E 03 4.46107E 03  
 3.37846E 03 2.74285E 03 2.06645E 03 1.81330E 03 1.57089E 03 1.26838E 03 1.12896E 03 9.59699E 02 7.73881E 02 6.23720E 02  
 5.47308E 02 4.35453E 02 4.03829E 02 3.15925E 02 2.83447E 02 2.54027E 02 1.99588E 02 1.58978E 02 1.54181E 02 1.29654E 02  
 1.20342E 02 9.81199E 01 7.33713E 01 7.70708E 01 5.65211E 01 5.18500E 01 5.97451E 01 3.15844E 01 2.98638E 01 3.66469E 01  
 1.70389E 01 2.1461E 01 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70  
 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70  
 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70  
 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70

\*

## GUESSED SPECTRUM U-235 FISSION SPECTRUM

W= 0.000000E 00 T= 0.000000E 00 DT= 0.000000E 00



## HIGHER PART GUESSED PULSE HIGHT

3.97049E 02	3.71821E 02	3.41253E 02	3.18777E 02	2.95229E 02	2.96979E 02	2.78319E 02	2.57837E 02	2.37568E 02	2.40275E 02
1.86278E 02	1.71333E 02	1.92493E 02	1.45183E 02	1.55994E 02	1.18123E 02	1.09972E 02	1.22233E 02	1.00373E 02	1.09588E 02
9.28358E 01	9.32182E 01	1.06569E 02	1.00969E 02	1.12391E 02	1.09215E 02	1.11725E 02	1.09783E 02	9.44929E 01	9.07896E 01
7.32432E 01	6.98503E 01	6.27389E 01	5.62917E 01	5.05156E 01	4.47562E 01	3.98653E 01	3.78012E 01	3.37080E 01	3.06599E 01
2.78411E 01	2.44964E 01	2.31637E 01	1.98350E 01	1.88584E 01	1.72250E 01	1.59588E 01	1.39265E 01	1.19904E 01	2.21275E 01
1.86389E 01	1.30841E 01	9.63613E 00	6.86591E 00	5.25409E 00	3.94261E 00	2.75140E 00	1.98325E 00	1.48024E 00	1.09259E 00
8.45710E-01	6.11525E-01	4.90122E-01	3.58836E-01	2.70335E-01	1.99309E-01	1.52297E-01	1.07415E-01	8.15293E-02	6.39790E-02
2.56103E-02	1.12976E-03	2.70856E-04	4.38040E-06	1.00000E-70	1.00000E-70	1.00000E-70	1.00000E-70	1.00000E-70	1.00000E-70

\*

GUESSED SPECTRUM U-235 FISSION SPECTRUM

W= 0.000000E 00 T= 0.000000E 00 DT= 0.000000E 00

**LOWER PART GUESSED PULSE HIGHT**

760629 D-OPE 3M FROM SURFACE 1 WATT\*2400.5 SEC HE-3 CD+B4C

\*\*\* 2

W= 0.000000E 00 T= 0.000000E 00 DT= 0.000000E 00

T= 0.000000E 00

DT= 0.000000E 00

760629 D-OPE 3M FROM SURFACE 1 WATT\*2400.5 SEC HE-3 CD+B4C

\*\*\*\*\* 2

W= 0.000000E 00 T= 0.000000E 00 DT= 0.000000E 00

CH.NO.	10( 2)	10( 6)
1	5.0000E-02 I	
2	1.5000E-01 I	
3	2.5000E-01 I	
4	3.5000E-01 I	
5	4.5000E-01 I	
6	5.5000E-01 I	
7	6.5000E-01 I	
8	7.5000E-01 I	
9	8.5000E-01 I	
10	9.5000E-01 I	
11	1.0500E 00 I	
12	1.1500E 00 I	
13	1.2500E 00 I	
14	1.3500E 00 I	
15	1.4500E 00 I	
16	1.5500E 00 I	
17	1.6500E 00 I	
18	1.7500E 00 I	
19	1.8500E 00 I	
20	1.9500E 00 I	
21	2.0500E 00 I	
22	2.1500E 00 I	
23	2.2500E 00 I	
24	2.3500E 00 I	
25	2.4500E 00 I	*
26	2.5500E 00 I	*
27	2.6500E 00 *	
28	2.7500E 00 *	
29	2.8500E 00 *	
30	2.9500E 00 *	
31	3.0500E 00 *	
32	3.1500E 00 *	
33	3.2500E 00 *	
34	3.3500E 00 *	
35	3.4500E 00 *	
36	3.5500E 00 *	
37	3.6500E 00 *	
38	3.7500E 00 *	
39	3.8500E 00 *	
40	3.9500E 00 *	
41	4.0500E 00 *	
42	4.1500E 00 *	
43	4.2500E 00 *	
44	4.3500E 00 *	
45	4.4500E 00 *	
46	4.5500E 00 *	
47	4.6500E 00 *	
48	4.7500E 00 *	
49	4.8500E 00 *	
50	5.0000E 01 *	
51	5.2500E 00 *	
52	5.5000E 00 *	
53	5.7500E 00 *	
54	6.0000E 00 *	
55	6.2500E 00 *	
56	6.5000E 00 *	
57	6.7500E 00 *	
58	7.0000E 00 *	
59	7.2500E 00 *	
60	7.5000E 00 *	
61	7.7500E 00 *	
62	8.0000E 00 *	
63	8.2500E 00 *	
64	8.5000E 00 *	
65	8.7500E 00 *	
66	9.0000E 00 *	
67	9.2500E 00 *	
68	9.5000E 00 *	
69	9.7500E 00 *	
70	1.0000E 01 *	
71	1.0500E 01 *	
72	1.1000E 01 *	
73	1.1500E 01 *	
74	1.2000E 01 *	
75	1.2500E 01 *	
76	1.3000E 01 *	
77	1.3500E 01 *	
78	1.4000E 01 *	
79	1.4500E 01 *	
80	1.5000E 01 *	

(INPUT HE-3)-(GUESSED PULSE HIGHT UPPER 45 CH.) AND ZERO SETTING IN CASE OF NEGATIVE VALUE

4.32191E 05 8.56560E 04 4.74390E 04 2.86518E 04 1.81490E 04 1.49829E 04 1.10550E 04 7.12228E 03 5.45398E 03 4.22079E 03  
 3.19218E 03 2.57252E 03 1.87396E 03 1.66812E 03 1.41490E 03 1.15026E 03 1.01899E 03 8.37466E 02 6.73508E 02 5.14132E 02  
 4.54472E 02 3.42235E 02 2.97260E 02 2.14956E 02 1.71056E 02 1.44812E 02 8.78631E 01 4.91952E 01 5.96881E 01 3.88644E 01  
 4.70988E 01 2.82696E 01 1.06324E 01 2.07791E 01 6.00552E 00 7.09377E 00 1.98798E 01 1.00000E-70 1.00000E-70 1.00000E-70 5.98701E 00  
 1.00000E-70  
 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70  
 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70  
 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70 1.00000E-70

760629 D-OPE 3M FROM SURFACE 1 WATT\*2400.5 SEC HE-3 CD+B4C

2

W= 0.000000E 00 T= 0.000000E 00 DT= 0.000000E 00

10( 2) 10( 6)

CH.NO.	DATA
1	5.0000E-02 I
2	1.5000E-01 J
3	2.5000E-01 I
4	3.5000E-01 I
5	4.5000E-01 I
6	5.5000E-01 I
7	6.5000E-01 I
8	7.5000E-01 I
9	8.5000E-01 I
10	9.5000E-01 I
11	1.0500E 00 I
12	1.1500E 01 I
13	1.2500E 00 I
14	1.3500E 00 I
15	1.4500E 00 I
16	1.5500E 00 I
17	1.6500E 00 I
18	1.7500E 00 I
19	1.8500E 00 I
20	1.9500E 00 I
21	2.0500E 00 I
22	2.1500E 00 I
23	2.2500E 00 I
24	2.3500E 00 I
25	2.4500E 00 I
26	2.5500E 00 I
27	2.6500E 00 *
28	2.7500E 00 *
29	2.8500E 00 *
30	2.9500E 00 *
31	3.0500E 00 *
32	3.1500E 00 *
33	3.2500E 00 *
34	3.3500E 00 *
35	3.4500E 00 *
36	3.5500E 00 *
37	3.6500E 00 *
38	3.7500E 00 *
39	3.8500E 00 *
40	3.9500E 00 *
41	4.0500E 00 *
42	4.1500E 00 *
43	4.2500E 00 *
44	4.3500E 00 *
45	4.4500E 00 *
46	4.5500E 00 *
47	4.6500E 00 *
48	4.7500E 00 *
49	4.8500E 00 *
50	5.0000E 00 *
51	5.2500E 00 *
52	5.5000E 00 *
53	5.7500E 00 *
54	6.0000E 00 *
55	6.2500E 00 *
56	6.5000E 00 *
57	6.7500E 00 *
58	7.0000E 00 *
59	7.2500E 00 *
60	7.5000E 00 *
61	7.7500E 00 *
62	8.0000E 00 *
63	8.2500E 00 *
64	8.5000E 00 *
65	8.7500E 00 *
66	9.0000E 00 *
67	9.2500E 00 *
68	9.5000E 00 *
69	9.7500E 00 *
70	1.0000E 01 *
71	1.0500E 01 *
72	1.1000E 01 *
73	1.1500E 01 *
74	1.2000E 01 *
75	1.2500E 01 *
76	1.3000E 01 *
77	1.3500E 01 *
78	1.4000E 01 *
79	1.4500E 01 *
80	1.5000E 01 *

**NORM. INFORMATION**

AN3= 1.38281E 03

INORM1= 2 INORM2=

760629 D-DPE 3M FROM SURFACE 1 WATT#2400.5 SEC HE-3 CD+B4C

\*\*\*\*\* 2

NUMBER OF ROWS = 45  
NUMBER OF COLUMNS = 45  
NUMBER OF WINDOWS = 45

NR	COUNT	S.D.	NR	COUNT	S.D.	NR	COUNT	S.D.
1	4.3219E 25	6.5741E 02	2	8.5656E 04	2.9267E 02	3	4.7439E 04	2.1781E 02
4	2.8652E 34	1.6927E 02	5	1.8149E 04	1.3472E 02	6	1.4983E 04	1.2240E 02
7	1.1055E 04	1.0514E 02	8	7.1223E 03	8.4394E 01	9	5.4540E 03	7.3851E 01
10	4.2208E 23	6.4968E 01	11	3.1922E 03	5.6499E 01	12	2.5725E 03	5.0720E 01
13	1.8740E 03	4.3289E 01	14	1.6681E 03	4.0843E 01	15	1.4149E 03	3.7615E 01
16	1.1503E 03	3.3915E 01	17	1.0190E 03	3.1922E 01	18	8.3747E 02	2.8939E 01
19	6.7351E 02	2.5952E 01	20	5.1413E 02	2.2674E 01	21	4.5447E 02	2.1518E 01
22	3.4223E 02	1.8517E 01	23	2.9726E 02	1.7241E 01	24	2.1496E 02	1.4661E 01
25	1.7106E 02	1.3079E 01	26	1.4481E 02	1.2034E 01	27	8.7863E 01	9.3735E 00
28	4.9195E 01	7.8139E 00	29	5.9688E 01	7.7258E 00	30	5.8864E 01	6.2341E 00
31	4.7099E 01	6.8629E 00	32	2.8270E 01	5.3169E 00	33	1.0632E 01	3.2607E 00
34	2.0779E 01	4.5534E 00	35	1.9465E 01	4.4119E 00	36	1.6497E 01	4.0617E 00
37	1.3624E 01	3.6911E 00	38	1.1178E 01	3.3433E 00	39	9.7044E 00	3.1152E 00
40	8.2506E 00	2.8724E 00	41	6.5788E 00	2.5649E 00	42	5.3526E 00	2.3136E 00
43	4.6843E 00	2.1644E 00	44	4.0059E 00	2.0015E 00	45	2.7075E 00	1.6454E 00

760629 D-OPE 3M FROM SURFACE 1 WATT\*2400.5 SEC HE-3 CD+B4C

\*\*\*\*\* 2

W= 0.000000E 00 T= 0.000000E 00 DT= 0.000000E 00

CH.NO.	10( 2)	10( 6)
1	5.0000E-02	I
2	1.5000E-01	I
3	2.5000E-01	I
4	3.5000E-01	I
5	4.5000E-01	I
6	5.5000E-01	I
7	6.5000E-01	I
8	7.5000E-01	I
9	8.5000E-01	I
10	9.5000E-01	I
11	1.0500E 0	I
12	1.1500E 0	I
13	1.2500E 0	I
14	1.3500E 0	I
15	1.4500E 0	I
16	1.5500E 0	I
17	1.6500E 0	I
18	1.7500E 0	I
19	1.8500E 0	I
20	1.9500E 0	I
21	2.0500E 0	I
22	2.1500E 0	I
23	2.2500E 0	I
24	2.3500E 0	I
25	2.4500E 0	I
26	2.5500E 0	I
27	2.6500E 0	*
28	2.7500E 0	*
29	2.8500E 0	*
30	2.9500E 0	*
31	3.0500E 0	*
32	3.1500E 0	*
33	3.2500E 0	*
34	3.3500E 0	*
35	3.4500E 0	*
36	3.5500E 0	*
37	3.6500E 0	*
38	3.7500E 0	*
39	3.8500E 0	*
40	3.9500E 0	*
41	4.0500E 0	*
42	4.1500E 0	*
43	4.2500E 0	*
44	4.3500E 0	*
45	4.4500E 0	*

760629 D-OPE 3M FROM SURFACE 1 WATTX2400.5 SEC HE-3 CD+B4C

\*\*\*\*\* 2

WINDOW PARAMETER BW= 3.0000E-01

WINDOW	E(MEV)	ERR1	ERR2	PLO	PUP	PHAI-E	PHAI-U
1	0.05	1.009534E 06	8.5159648E 03	6.0627540E 03	5.0828058E 08	6.0727962E 08	3.0363968E 07
2	0.15	3.0281931E 05	3.2521934E 03	8.1232000E 07	8.1837680E 07	8.1534848E 07	1.2230225E 07
3	0.25	1.9725962E 05	1.2905159E 03	4.2638912E 07	4.3033424E 07	4.2636176E 07	1.0709044E 07
4	0.35	1.6407875E 05	1.3903372E 03	2.9637984E 07	2.9966160E 07	2.9802080E 07	1.0430728E 07
5	0.45	1.4174312E 05	1.2767659E 03	1.9257288E 07	1.9541392E 07	1.9399648E 07	8.7298410E 06
6	0.55	1.2729475E 05	1.0573015E 03	1.3977250E 07	1.4232449E 07	1.4105150E 07	7.7578320E 06
7	0.65	1.1717075E 05	1.0161228E 03	1.0491773E 07	1.0726124E 07	1.0618949E 07	6.8958160E 06
8	0.75	1.0699781E 05	9.7759692E 02	7.9504690E 06	8.1644740E 06	8.0574720E 06	5.0431040E 06
9	0.85	9.5789000E 04	9.7176147E 02	6.0397330E 06	5.2313200E 06	6.1355270E 06	5.2151980E 06
10	0.95	8.3962187E 04	9.0135400E 02	4.6771220E 06	4.8450560E 06	4.7610890E 06	4.5230340E 06
11	1.05	7.2385251E 04	8.0322363E 02	3.7357550E 06	3.8805340E 06	3.8081450E 06	3.9985520E 06
12	1.15	6.2078036E 04	6.8611523E 02	3.0820450E 06	3.2062080E 06	3.1441270E 06	3.6157440E 06
13	1.25	5.3944312E 04	5.6528976E 02	2.6140490E 06	2.7219440E 06	2.6679970E 06	3.3349960E 06
14	1.35	4.8435508E 04	4.4113867E 02	2.2663930E 06	2.3632680E 06	2.3148310E 06	3.1250220E 06
15	1.45	4.5385765E 04	3.5038867E 02	1.9989993E 06	2.0897740E 06	2.0443870E 06	2.9643600E 06
16	1.55	4.4165566E 04	2.9053491E 02	1.7855190E 06	1.8748520E 06	1.8306860E 06	2.8375630E 06
17	1.65	4.4028094E 04	2.6628320E 02	1.6120851E 06	1.7001420E 06	1.6561140E 06	2.7325870E 06
18	1.75	4.4368559E 04	2.7614258E 02	1.4643160E 06	1.5530550E 06	1.5086860E 06	2.6402000E 06
19	1.85	4.4787762E 04	3.1052881E 02	1.3357450E 06	1.4253220E 06	1.3875340E 06	2.5539880E 06
20	1.95	4.5046977E 04	3.5151001E 02	1.22171750E 06	1.3118120E 06	1.2667640E 06	2.4701890E 06
21	2.05	4.5006855E 04	3.8716943E 02	1.1194480E 06	1.2094650E 06	1.1644570E 06	2.3871370E 06
22	2.15	4.4586235E 04	4.1216040E 02	1.0273218E 06	1.1164980E 06	1.0719100E 06	2.3046060E 06
23	2.25	4.3742375E 04	4.2988916E 02	9.4432919E 05	1.0318181E 06	9.887369E 05	2.2231650E 06
24	2.35	4.2463035E 04	4.3266528E 02	8.6970419E 05	9.5463462E 05	9.1216944E 05	2.1435980E 06
25	2.45	4.0764418E 04	4.3683179E 02	8.0273576E 05	8.8426862E 05	8.4350187E 05	2.0665790E 06
26	2.55	3.8689227E 04	4.3004346E 02	7.4259287E 05	8.2007606E 05	7.8138450E 05	1.9925300E 06
27	2.65	3.6303859E 04	4.2015137E 02	6.8879619E 05	7.6140875E 05	7.2510250E 05	1.9215210E 06
28	2.75	3.3693538E 04	3.9847656E 02	6.4026569E 05	7.0765762E 05	6.7396169E 05	1.8533940E 06
29	2.85	3.0957327E 04	3.7508887E 02	5.9634212E 05	6.5826069E 05	6.2730144E 05	1.7878090E 06
30	2.95	2.8199652E 04	3.4420850E 02	5.5632512E 05	6.1272862E 05	5.8452687E 05	1.7243540E 06
31	3.05	2.5527235E 04	3.1116602E 02	5.1958987E 05	5.7054769E 05	5.4511881E 05	1.6626120E 06
32	3.15	2.3038453E 04	2.7589771E 02	4.8560231E 05	5.3168250E 05	5.0864244E 05	1.6022230E 06
33	3.25	2.0819715E 04	2.3977810E 02	4.5391369E 05	4.9555587E 05	4.7473481E 05	1.5428880E 06
34	3.35	1.8935535E 04	2.0430951E 02	4.2416394E 05	4.6203725E 05	4.4310062E 05	1.4843870E 06
35	3.45	1.7421514E 04	1.7368864E 02	3.9677362E 05	4.5091831E 05	4.1349600E 05	1.4265610E 06
36	3.55	1.6278032E 04	1.4436194E 02	3.6944200E 05	4.0199744E 05	3.8571875E 05	1.3693010E 06
37	3.65	1.5471335E 04	1.2053670E 02	3.4412700E 05	3.7506856E 05	3.5959781E 05	1.3125310E 06
38	3.75	1.4935859E 04	1.0194949E 02	3.2005050E 05	3.4992294E 05	3.3498675E 05	1.2562000E 06
39	3.85	1.4595934E 04	8.9847687E 01	2.9715931E 05	3.2635775E 05	3.1175856E 05	1.2002700E 06
40	3.95	1.4384922E 04	8.3752472E 01	2.7541787E 05	3.0418819E 05	2.8980306E 05	1.1447220E 06
41	4.05	1.423333E 04	8.4593689E 01	2.5479269E 05	2.8325387E 05	2.6972331E 05	1.0895440E 06
42	4.15	1.4087016E 04	8.6052704E 01	2.3525075E 05	2.6342531E 05	2.4933806E 05	1.0347528E 06
43	4.25	1.3921737E 04	9.0917923E 01	2.1675425E 05	2.4459844E 05	2.3067637E 05	9.8037456E 05
44	4.35	1.3714191E 04	9.5462891E 01	1.9926569E 05	2.2669475E 05	2.1298025E 05	9.2646412E 05
45	4.45	1.3453340E 04	9.9189636E 01	1.8274937E 05	2.0965681E 05	1.9620312E 05	8.7310381E 05

760629 D-OPE 3M FROM SURFACE 1 WATTx2400.5 SEC HE-3 CD+84C \*\*\*\*\* 2

WATT= 1.000000 TIME= 2400.500000

WINDOW PARAMETER BW= 3.0000E-31

WINDOW	E(MEV)	ERR1	ERR2	OLD	PUP	PHAI-E	PHAI-U
1	0.050	4.1697705E-02	3.5475788E-00	2.5256337E-05	2.5339744E-05	2.5298604E-05	1.2649020E-04
2	0.150	1.2614842E-02	1.3547974E-00	3.3239613E-04	3.4391930E-04	3.3965775E-04	5.0948633E-03
3	0.250	8.2174377E-01	5.3760290E-01	1.7762512E-04	1.7926855E-04	1.7844667E-04	4.4611719E-03
4	0.350	6.8351898E-01	5.7918644E-01	1.2346586E-04	1.2483297E-04	1.2414945E-04	4.3452305E-03
5	0.450	5.9047333E-01	5.3187495E-01	8.7224453E-03	5.1415469E-03	8.0815011E-03	3.6366748E-03
6	0.550	5.3028427E-01	4.4045049E-01	5.8228926E-03	5.9289492E-03	5.8759161E-03	3.2317549E-03
7	0.650	4.8810974E-01	4.1913050E-01	4.3776612E-03	4.4682852E-03	4.4194727E-03	2.8726570E-03
8	0.750	4.4573135E-01	4.0724719E-01	3.3120054E-03	3.4011555E-03	3.3565816E-03	2.5174353E-03
9	0.850	3.9903763E-01	4.0481627E-01	2.5160310E-03	2.5958425E-03	2.5559371E-03	2.1725464E-03
10	0.950	3.4976944E-01	3.7548590E-01	1.9483948E-03	2.0183528E-03	1.9833745E-03	1.8842048E-03
11	1.050	3.0154236E-01	3.3460677E-01	1.5562412E-03	1.6165522E-03	1.5853965E-03	1.6657166E-03
12	1.150	2.5860474E-01	2.8582180E-01	1.2839177E-03	1.3356416E-03	1.3097811E-03	1.5062463E-03
13	1.250	2.2472117E-01	2.3548800E-01	1.0689602E-03	1.1339070E-03	1.1114333E-03	1.3892922E-03
14	1.350	2.0177246E-01	1.8376946E-01	9.4413354E-02	9.8448975E-02	9.6431211E-02	1.3018215E-03
15	1.450	1.8906799E-01	1.4596486E-01	8.3274268E-02	8.7055762E-02	8.5165039E-02	1.2348928E-03
16	1.550	1.8398483E-01	1.2103099E-01	7.4422778E-02	7.8102539E-02	7.6262671E-02	1.1820715E-03
17	1.650	1.8341217E-01	1.1592818E-01	6.7156201E-02	7.0824487E-02	6.8993354E-02	1.1383406E-03
18	1.750	1.8483047E-01	1.1503541E-01	6.1000439E-02	6.4697144E-02	6.2848814E-02	1.0998540E-03
19	1.850	1.8657669E-01	1.2936002E-01	5.5644434E-02	5.9376025E-02	5.7510254E-02	1.0639397E-03
20	1.950	1.8765656E-01	1.4643198E-01	5.0894165E-02	5.4647437E-02	5.2770825E-02	1.0290308E-03
21	2.050	1.8748947E-01	1.6128695E-01	4.6633936E-02	5.1383862E-02	4.8578945E-02	9.9443311E-02
22	2.150	1.8573746E-01	1.7169768E-01	4.2796143E-02	4.6511060E-02	4.4653613E-02	9.6005249E-02
23	2.250	1.8222113E-01	1.7908317E-01	3.9338433E-02	4.2983447E-02	4.1161157E-02	9.2612598E-02
24	2.350	1.7689240E-01	1.8023962E-01	3.6230103E-02	3.9768140E-02	3.7999121E-02	8.9297925E-02
25	2.450	1.6981629E-01	1.8197531E-01	3.3440338E-02	3.5836841E-02	3.5138574E-02	8.6089478E-02
26	2.550	1.6117142E-01	1.7914742E-01	3.0939057E-02	3.4162695E-02	3.2551913E-02	8.3004810E-02
27	2.650	1.5123457E-01	1.7502666E-01	2.8693848E-02	3.1718754E-02	3.0216299E-02	8.0046680E-02
28	2.750	1.4036070E-01	1.6599727E-01	2.6672168E-02	2.9479590E-02	2.8075879E-02	7.7208667E-02
29	2.850	1.2896174E-01	1.5625447E-01	2.4842412E-02	2.7421812E-02	2.6132114E-02	7.4476489E-02
30	2.950	1.1747407E-01	1.4339030E-01	2.3175385E-02	2.2525341E-02	2.4351212E-02	7.1833105E-02
31	3.050	1.0634048E-01	1.2962550E-01	2.1645168E-02	2.3772134E-02	2.2713553E-02	6.9261084E-02
32	3.150	9.5973558E-00	1.1493343E-01	2.0229214E-02	2.2148822E-02	2.1189020E-02	6.6745386E-02
33	3.250	8.6730738E-00	9.9857569E-02	1.8909131E-02	2.0643860E-02	1.9776497E-02	6.4273608E-02
34	3.350	7.8881626E-00	8.5111201E-02	1.7669815E-02	1.9247542E-02	1.8458679E-02	6.1836572E-02
35	3.450	7.2574472E-00	7.2355151E-02	1.6499429E-02	1.7951189E-02	1.7225411E-02	5.9427661E-02
36	3.550	6.7811213E-00	6.0138273E-02	1.5390126E-02	1.6746404E-02	1.6068266E-02	5.7042334E-02
37	3.650	6.4446268E-00	5.0213162E-02	1.4335637E-02	1.5624600E-02	1.4980121E-02	5.4677417E-02
38	3.750	6.2219782E-00	-4.2470105E-02	1.3332658E-02	1.4577084E-02	1.3954874E-02	5.2330762E-02
39	3.850	6.0816212E-00	3.7428737E-02	1.237959E-02	1.3595407E-02	1.2987233E-02	5.0000830E-02
40	3.950	5.9924688E-00	3.4889594E-02	1.1473354E-02	1.2671867E-02	1.2072612E-02	4.7686792E-02
41	4.050	5.9280710E-00	3.5240028E-02	1.0614149E-02	1.1799786E-02	1.1216949E-02	4.5388208E-02
42	4.150	5.8683672E-00	3.5847824E-02	9.8000717E-01	1.0973767E-02	1.0386922E-02	4.3105713E-02
43	4.250	5.7995396E-00	3.7874576E-02	9.0295456E-01	1.0189476E-02	9.6095123E-01	4.0840405E-02
44	4.350	5.7130556E-00	3.9767917E-02	8.3010071E-01	9.4436462E-01	8.8723282E-01	3.8594629E-02
45	4.450	5.6043901E-00	4.1320406E-02	7.6129700E-01	8.7338806E-01	8.1734265E-01	3.6371729E-02

760629 D-OPE 3M FROM SURFACE 1 WATT\*2400.5 SEC HE-3 CD+B4C

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W= C.1000000E 01 T= 0.2400500E 04 DT= 0.0000000E 00

CH.NO.	10( 2)	10( 6)
1	5.0000E-02 I	T-----
2	1.5000E-01 I	.
3	2.5000E-01 I	.
4	3.5000E-01 I	.
5	4.5000E-01 I	.
6	5.5000E-01 I	*
7	6.5000E-01 I	.
8	7.5000E-01 I	*
9	8.5000E-01 I	.
10	9.5000E-01 I	*
11	1.0500E 00 I	.
12	1.1500E 00 I	*
13	1.2500E 00 I	.
14	1.3500E 00 I	*
15	1.4500E 00 I	.
16	1.5500E 00 I	*
17	1.6500E 00 I	.
18	1.7500E 00 I	*
19	1.8500E 00 I	.
20	1.9500E 00 I	*
21	2.0500E 00 I	.
22	2.1500E 00 I	*
23	2.2500E 00 I	.
24	2.3500E 00 I	*
25	2.4500E 00 I	.
26	2.5500E 00 I	*
27	2.6500E 00 I	.
28	2.7500E 00 I	*
29	2.8500E 00 I	.
30	2.9500E 00 I	*
31	3.0500E 00 I	.
32	3.1500E 00 I	*
33	3.2500E 00 I	.
34	3.3500E 00 I	*
35	3.4500E 00 I	.
36	3.5500E 00 I	*
37	3.6500E 00 I	*
38	3.7500E 00 I	*
39	3.8500E 00 I	*
40	3.9500E 00 I	*
41	4.0500E 00 *	.
42	4.1500E 01 *	.
43	4.2500E 00 *	.
44	4.3500E 01 *	.
45	4.4500E 00 *	.