LA-NUREG-6818-MS
Informal Report

NRC-1 and UC-34c

C3

FPDCYS and FPSPEC: Computer Programs for Calculating Fission-Product Beta and Gamma Multigroup Spectra from ENDF/B-IV Data

Issued: May 1977

los alamos
scientific laboratory
of the University of California
LOS ALAMOS, NEW MEXICO 87545

UNITED STATES
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
CONTRACT W-7405-ENG. 36

This work supported by the US Nuclear Regulatory Commission, Division of Safeguards, Fuel Cycle and Environmental Research.

Printed in the United States of America. Available from
National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161
Price: Printed Copy $5.00 Microfiche $3.00

LA-NUREG-6818-MS
Informal Report
NRC-1 and UC-34c

los alamos
scientific laboratory
of the University of California
LOS ALAMOS, NEW MEXICO 87545

FPDCYS and FPSPEC: Computer Programs for Calculating Fission-Product Beta and Gamma Multigroup Spectra from ENDF/B-IV Data

M. G. Stamatelatos
T. R. England

Manuscript completed: May 1977
Issued: May 1977

Prepared for the US Nuclear Regulatory Commission
Office of Nuclear Regulatory Research

FPDCYS AND FPSPEC: COMPUTER PROGRAMS FOR CALCULATING FISSION-PRODUCT BETA AND GAMMA MULTIGROUP SPECTRA FROM ENDF/B-IV DATA

by

M. G. Stamatelatos and T. R. England

ABSTRACT

FPDCYS and FPSPEC are two FORTRAN computer programs used at the Los Alamos Scientific Laboratory (LASL), in conjunction with the CINDER-10 program, for calculating cumulative fission-product beta and/or gamma multigroup spectra in arbitrary energy structures, and for arbitrary neutron irradiation periods and cooling times. FPDCYS processes ENDF/B-IV fission-product decay energy data to generate multigroup beta and gamma spectra from individual ENDF/B-IV fission-product nuclides. FPSPEC further uses these spectra and the corresponding nuclide activities calculated by the CINDER-10 code to produce cumulative beta and gamma spectra in the same energy grids in which FPDCYS generates individual isotope decay spectra. The code system consisting of CINDER-10, FPDCYS, and FPSPEC has been used for comparisons with experimental spectra and continues to be used at LASL for generating spectra in special user-oriented group structures.

I. INTRODUCTION

A computer code system has been developed at the Los Alamos Scientific Laboratory (LASL) to calculate fission-product beta and gamma decay energies and spectra from thermal, fast, and 14-MeV neutron-induced fission of a number of important fissionable nuclides (including ^{232}Th, ^{233}U, ^{235}U, ^{238}U, ^{239}Pu, and ^{241}Pu). This system has been used for a wide range of neutron irradiation periods (10^{-4} to 10^{13} s) and for cooling times from fractions of one second to many years.[1-3] There are many reactor safety and safeguards areas and other applications where this type of information is of interest. In recent years, great emphasis has been placed on obtaining experimental and computational information of this kind at short cooling times for nuclear reactor safety studies of the hypothetical loss-of-coolant accident. In this connection, comparisons have been made between computational and experimental results, in the form of total decay heating and/or radiation (beta and/or gamma) spectra, measured at a number of research establishments (e.g., Los Alamos Scientific Laboratory, Oak Ridge National Laboratory, Intelcom Rad Tech, and the University of Illinois).[2-3] Such benchmark comparisons have demonstrated the accuracy of both the general computational methods and the specific input data. Subsequently, the code system and data have proved to be of use in nonreactor applications.

The most complete and up-to-date sources of fission-product data are the Evaluated Nuclear Data Files (ENDF/B) Version IV whose contents are summarized in Ref. 4. These files contain cross sections, fission-yield sets,and decay parameters for 824 important fission products. Spectral data (i.e., beta end-point energies and intensities, gamma line energies and intensities) exist for the most important decay-heat contributors among the 824 nuclides. Thus, beta spectral data exist for 163 fission products and gamma spectral data exist for 172 nuclides (nuclides emitting both beta and gamma radiation are included separately in both types of radiation counts).

The computer codes discussed in this report, FPDCYS and FPSPEC, are essentially designed to use ENDF/B-IV data.* Use of alternate data sets, depending upon their formats, would require some program input modifications. Beyond the input format, however, the programs are general and would need no further changes if used with fission-product files other than ENDF/B-IV.

FPDCYS and FPSPEC are part of a LASL computer system shown schematically in Fig. 1. The CINDER-10 code is the latest and most versatile version of a well-known fission-product and depletion code. The most recent documentation on the CINDER code is Ref. 5. The additional features of version 10 are discussed in Ref. 6. This code calculates fission-product and actinide concentrations, activities, gaseous contents, energy releases, effective group absorption cross sections, etc.,for any fissionable nuclide mixture irradiated in arbitrary neutron fluxes for arbitrary intervals of time and for arbitrary cooling times. The spectral codes discussed in this report utilize a small portion of the

*A single fission-product file in ENDF/B-IV format with corrections as in Ref. 4 was used.

CINDER-10 output, namely fission-product activities and total decay energies at the instant of time when corresponding spectra are sought.

CINDER-10 also incorporates a spectral subroutine capable of utilizing the multigroup data produced by the FPDCYS code. This feature has been used for few-group (~20) spectral calculations and also for multigroup calculations involving a limited number of nuclides. However, decay energies are the only major nuclide parameters that are usually not needed in calculations of the behavior of coupled nuclides. Therefore, to conserve computer storage, most spectral calculations have been made subsequent to the calculation of activities using the FPSPEC code. This also permits calculation of any number of spectral groupings for a single run of the CINDER-10 code.

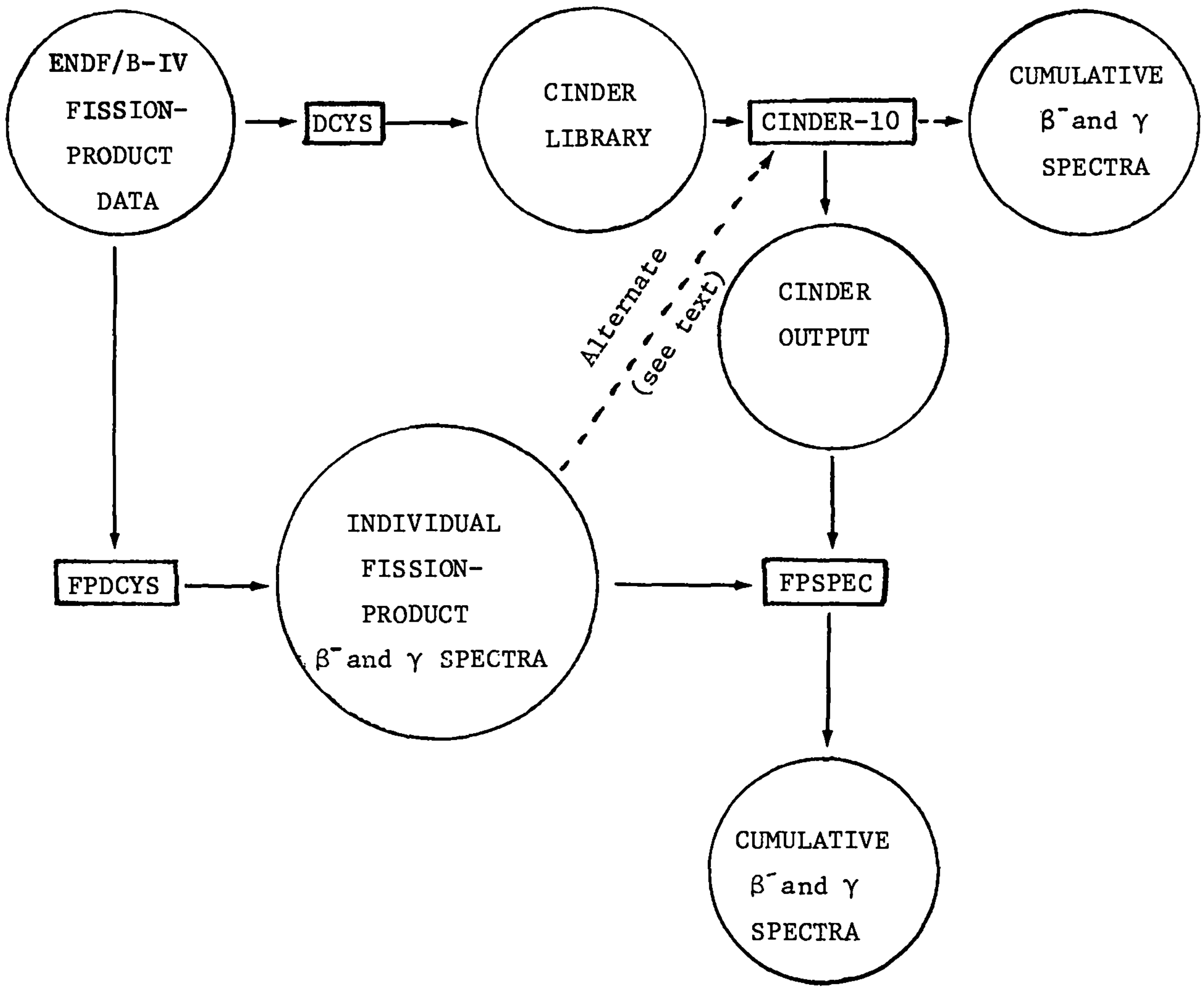


Fig. 1.

LASL Code System for generating multigroup β^- and γ fission-product spectra.

FPDCYS reads the same ENDF/B-IV fission-product file used for preparing the CINDER library to generate multigroup beta and gamma spectra for individual nuclides for which spectral data exist on the ENDF/B-IV file.

FPSPEC combines the individual spectra from FPDCYS and the nuclide activities from CINDER-10 to generate cumulative fission-product spectra for any irradiation and shutdown condition desired. Both the beta and the gamma spectra are generated in multigroup form of arbitrary size grid.

II. THE FPDCYS PROGRAM

The FPDCYS code incorporates a number of options for computing multigroup spectra of individual fission-product nuclides. There are four options for calculating beta spectra and two options for calculating gamma spectra. The beta-spectrum options are selected by a flag which controls the calling of one of the four beta-spectrum calculating routines, BETA1, BETA2, BETA3 or BETA4. Similarly, the gamma-spectrum option is selected by another flag which calls one of the two available gamma-spectrum calculating routines, GAMMA1 or GAMMA2. These options are discussed below and a flow diagram is shown in Fig. 2.

The probability of beta disintegration with total relativistic energy W, in electron rest energy units, in group i is

$$N_i(Z) = \int_{W_i}^{W_{i+1}} N(Z,W)\ dW \quad , \tag{1}$$

where W_i and W_{i+1} are the i-th group energy boundaries, Z is the atomic number, and N(W) dW is the probability of beta disintegration with energy in the W to W + dW interval:[7-8]

$$N(Z,W)\ dW = C|M|^2\ F(Z,W)\ K(W)\ W(W^2-1)^{\frac{1}{2}}\ (W_0-W)^2\ dW \quad , \tag{2}$$

where

F(Z,W) = electron density ratio or Fermi function,

C = a constant,

$|M|^2$ = the square modulus of the transition matrix element,

W_0 = maximum value of W,

K(W) = shape factor dependent upon the type of transition (allowed, forbidden unique, etc.).

The electron density ratio, F(Z,W), has a relativistic form,[7,8]

$$F_R(Z,W) = \frac{4(1+\frac{S}{2})}{|\Gamma(3+2S)|^2}\left(\frac{2R}{\lambda_C}\right)^{2S} e^{\pi y} \left(W^2-1\right)^S |\Gamma(1+S+iy)|^2 \quad , \tag{3}$$

where

$$S = (1-\alpha^2 Z^2)^{\frac{1}{2}}-1 \quad , \tag{4}$$

$$\lambda_C = \frac{\hbar}{m_e C} \simeq 386 \times 10^{-13} \text{ cm} \quad , \tag{5}$$

the rationalized wavelength of the electron,

$$\alpha = \frac{e^2}{\hbar C} \simeq \frac{1}{137} \quad , \tag{6}$$

the fine structure constant, and a nonrelativistic form,[7]

$$F_N = \frac{2\pi y}{1-\exp(-2\pi y)} \quad , \tag{7}$$

where

$$y = \alpha Z W \, (W^2-1)^{-\frac{1}{2}} \quad . \tag{8}$$

A well-known expression for R, the nuclear radius, is[9]

$$R = \left(1.123A^{\frac{1}{3}} - 0.941A^{-\frac{1}{3}}\right) \times 10^{-13} \text{ cm} \quad . \tag{9}$$

The difference among the four beta-spectrum subroutines given as options depends mainly on the way in which the Fermi function, F(Z,W), is represented and calculated.

Since the relativistic form of F(Z,W), Eq. (3), makes Eq. (1) nonintegrable analytically, one may resort to numerically integrating Eq. (1). Subroutine BETA2 provides a variable-grid Simpson integration method designed to iterate until the user-requested accuracy is achieved. This method is accurate but quite time-consuming especially when high accuracy (e.g., 0.01%) is requested.

Alternately, one may accelerate the integration of Eq. (1) by calculating F(Z,W) at a number of points per group and applying a histogram integration procedure. Subroutine BETA4 uses such a method with three equidistant points per group.

The remaining two options provided by subroutines BETA1 and BETA3 use approximations to F(Z,W) which make Eq. (1) analytically integrable.

Subroutine BETA1 uses a very simple approximation to F(Z,W) that proved to be of good accuracy and wide use in calculating average beta energies. This method, however, has produced considerably less accurate spectra. It uses a simplified version of the nonrelativistic form of F(Z,W), Eq. (7), namely,[10,11]

$$F(Z,W) \simeq 2\pi y \quad . \tag{10}$$

A new and better approximation to F(Z,W) is used in subroutine BETA3. It consists of replacing the relativistic form of F(Z,W), Eq. (3), by a polynomial expression in W:[11]

$$F(Z,W) \simeq \left(\frac{2R}{\lambda_C}\right)^{2S} \left(W^2-1\right)^{-\frac{1}{2}} \left[A_0(Z) + A_1(Z)\, W + A_2(Z)\, W^2\right] \quad , \tag{11}$$

where the A's are functions of the atomic number Z. For a more detailed discussion of this method, the reader should consult Ref. 11.

There are two options for calculating the gamma spectra. One, used in the GAMMA1 subroutine, consists of incorporating the unbroadened gamma lines weighted by their intensities into an arbitrary number of constant-width energy groups over the interval of interest.

When comparing calculated spectra with experimental ones, the latter have an inherent energy broadening which must be accounted for in calculations.

The energy dependence of the line broadening depends on the particular gamma spectrometer used. Line broadening of calculated gamma spectra is of little importance if the chosen energy grid is such that the detector resolution (Full Width at Half Maximum, FWHM) is small by comparison with the group width. If the reverse is true, the broadening can be applied to the multigrouped line data without great loss of accuracy. For intermediate cases, however, the gamma lines must be properly broadened before multigrouping. Such a procedure is offered in subroutine GAMMA2.

It is customary to assume that the energy resolution of a spectrometer is essentially Gaussian, i.e., that the gamma line at E_0 is represented by a Gaussian curve about E_0, the area under which equals the line intensity, I:

$$G = \frac{I}{\sqrt{2\pi}\,\sigma} \exp\left[-\frac{(E-E_0)^2}{2\sigma^2}\right] . \tag{12}$$

The FWHM of the Gaussian is related to σ by

$$\mathrm{FWHM} = \sigma\sqrt{8\,\ell n\,2} = 2.35482\,\sigma \quad , \tag{13}$$

Subroutine GAMMA2 broadens each line according to a prescribed energy dependence of σ (variable SIGMA in the program) and then proceeds with the multigrouping into the required fixed energy grid. Subroutine GAMMA2 contains a specific relationship between σ and energy but it must be replaced with the appropriate one specified for the gamma spectrometer under consideration.

III. THE FPSPEC PROGRAM

The FPSPEC program calculates aggregate beta and gamma fission-product spectra. The temporal activities of the 824 fission products on the ENDF/B-IV file are calculated by the CINDER-10 code at the desired irradiation and cooling times. The beta and gamma multigroup spectra of the individual fission products for which spectral data are available are provided by the FPDCYS code as discussed above.[12] CINDER-10 calculates concentrations, activities, and decay energies for the 824 fission products on the ENDF/B-IV file. The most important of these from the decay energy point of view (a total of 181) have either beta or gamma spectral data or both. These are the ones for which FPDCYS constructs

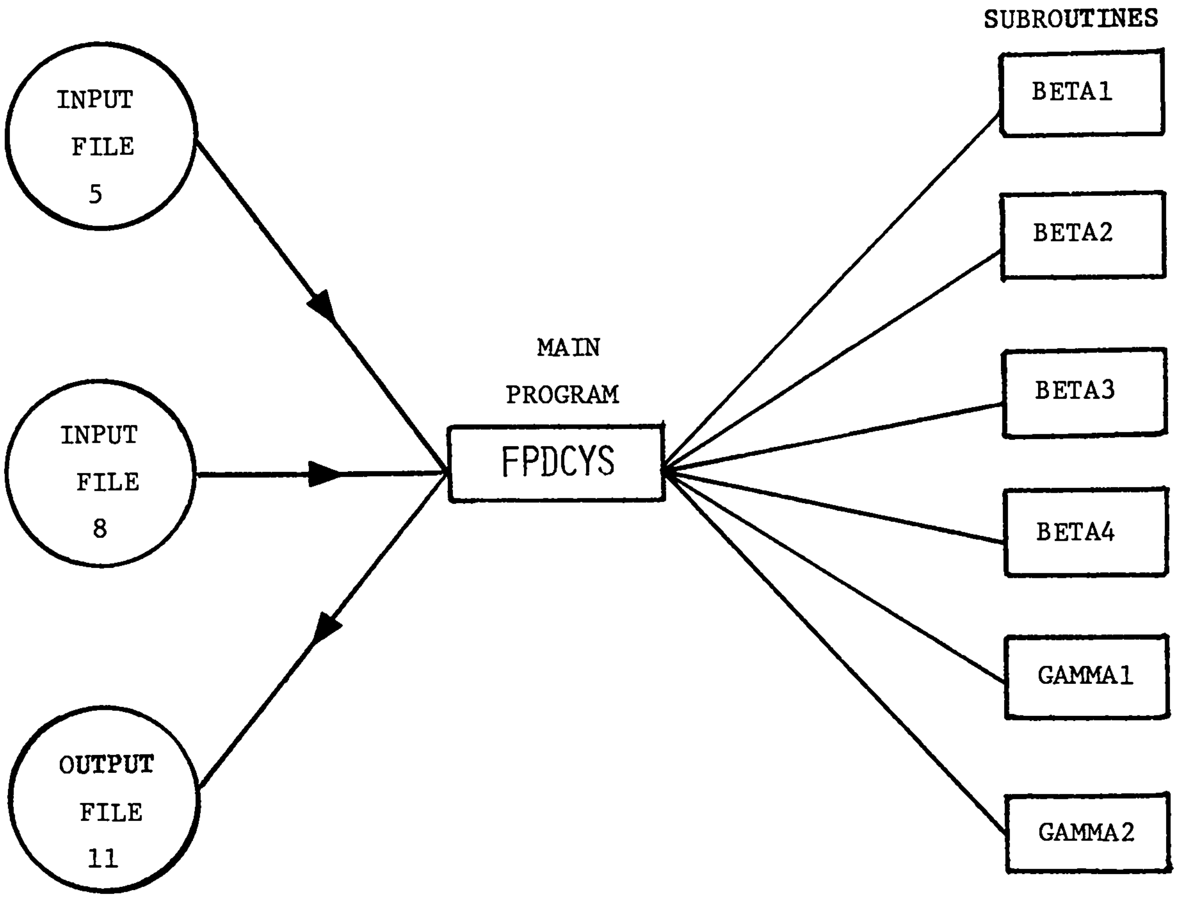


Fig. 2.

General Flow Diagram of the FPDCYS Program.

cumulative multigroup beta and/or gamma spectra.[12]

The FPSPEC program reads the output spectral file of FPDCYS and it then searches in the CINDER-10 output for activities of corresponding nuclides and for total beta and gamma decay energies of the decaying fission products among the 824 (some of them are stable). Cumulative beta and gamma spectra for the 181 fission products with spectral data on ENDF/B-IV are first obtained. These spectra are then normalized to the total beta or gamma energy release of all 824 fission products as calculated by CINDER-10 so that the spectra be representative of all 824 fission products. In other words, it is assumed that the fission products for which there are no spectral data in ENDF/B-IV yield the same cumulative spectral shape as those 181 for which there are spectral data in ENDF/B-IV. This assumption was seen to be an excellent approximation when calculated and experimental spectra were compared.[2]

The cumulative spectra calculated by FPSPEC are given both in terms of disintegrations (betas or gammas) per fission per energy bin and energy release (MeV) per fission per energy bin. The latter representation tends to emphasize the high-energy portion of the spectrum when plotted.

The output of FPSPEC also contains a summary of data either calculated in the code or extracted from the CINDER-10 output. All quantities qualified by the word "CINDER" are from the CINDER-10 code. All quantities qualified by the word "TOTAL" refer to all 824 fission products; the rest refer to the 181 fission products with spectral data in ENDF/B-IV.

The programming language in FPSPEC is standard ANSI FORTRAN. The plotting subroutines for paper output and for film called by FPSPEC are LASL library routines and can be replaced by comparable plotting routines. The two subroutines EXL and EXH, also called by the program, are used only to determine the line intensity for plotting on film.

A general flowchart of the FPSPEC program is shown in Fig. 3. Card input descriptions for both programs, FPDCYS and FPSPEC, are given in the following sections. Listings of the two codes as used at LASL are given in Appendices A and B. Sample outputs for the two programs are given in Appendices C and D.

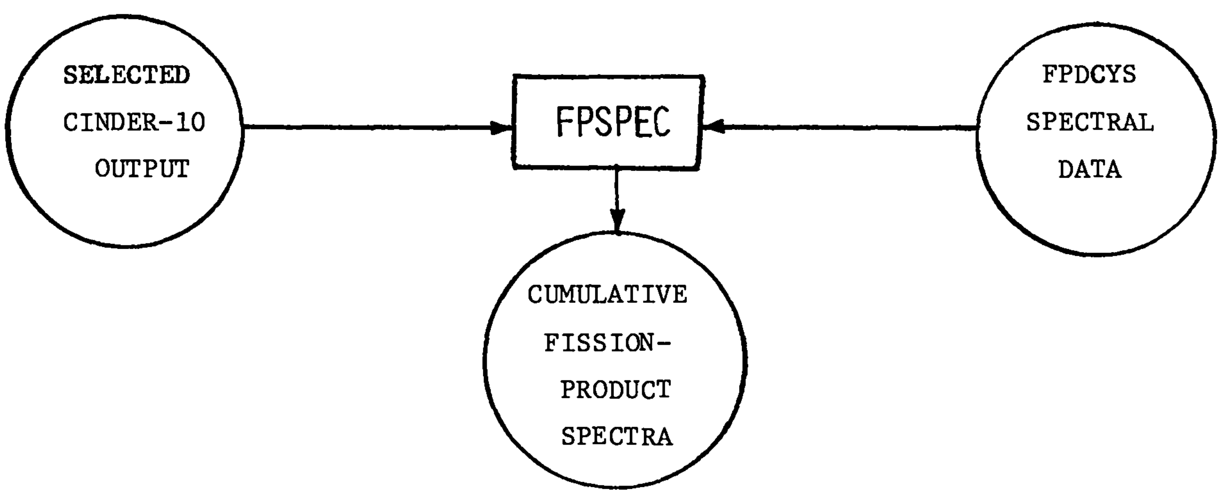


Fig. 3.
General Flow Diagram of the FPSPEC Program.

IV. CARD INPUT TO FPDCYS

Card No.	Format	Variable	Comments
1	1X,I4,6I5	MTOT	Total number of MATS to be read; MTOT = 1 gets special printout, normally 0.
		NXC	Number of cross-section cards (this option is not used, leave blank or 0).
		MTR1	First mass number on File 5, the fission-product file,
		MTR2	Last mass number on File 5,
		NPNCH	Index to get punch output of decay branching; normally 0,
		JOP1	Index not used in this version; use 0,
		JOP2	Index to get spectral data; use 1.
2	7I10	NTAPE	Index; NTAPE = 1 causes output spectral File 11 to be written,
		NBETS	Index; NBETS = 1 causes beta spectra to be calculated,
		NGAMS	Index; NGAMS = 1 causes gamma spectra to be calculated.
3	2I5	NBDB IBET	Number of beta-group boundaries, Index; if equal to 1, 2, 3, 4, subroutine BETA1, BETA2, BETA3 or BETA4, respectively, is called.
4	6E12.4	EBDB(I), I=1,NBDB	Energies of beta-group boundaries (eV).
5	2I5	NBDG	Number of gamma-group boundaries.
		IGAM	Index; if equal to 1, 2, subroutine GAMMA1 or GAMMA2, respectively, is called.
6	6E12.4	EBDG(I), I=1,NBDG	Energies of gamma-group boundaries (eV).

V. CARD INPUT TO FPSPEC

Card No.	Format	Variable	Comments
1	2I10	NPUN	Index controlling punch card output; if NPUN = 1, punch spectral output is produced.
		NGAS	Index; if NGAS = 1, beta and gamma spectra from gaseous fission products only are generated (noble gases and halogens).
2	2I10	NPLOT	Index; if NPLOT = 1, plots of spectra will be generated,
		IOPT	Index; set equal to 0.

Card No.	Format	Variable	Comments
3	2I10	ICOMPB	Index; if ICOMPB = 1, calculated and experimental beta spectra are compared,*
		ICOMPG	Index; if ICOMPG = 1, calculated and experimental gamma spectra are compared.*
4	2I10	NBPLT	Number of calculated beta spectral points to be plotted,
		NGPLT	Number of calculated gamma spectral points to be plotted. Omit this card if NPLOT ≠ 1.
5	I10	NBEXP	Number of experimental beta-group boundaries for comparison. Omit this card if ICOMPB ≠ 1.
6	I10	NGEXP	Number of experimental gamma-group boundaries for comparison. Omit this card if ICOMPG ≠ 1.
7	I10	NBXPLT	Number of experimental beta spectral points to be plotted. Omit this card if ICOMPB ≠ 1 and NPLOT ≠ 1.
8	I10	NGXPLT	Number of experimental gamma spectral points to be plotted. Omit this card if ICOMPG ≠ 1 and NPLOT ≠ 1.
9	E12.4	QLMPLT	Lower limit value for the ordinate when plotting spectra. Omit this card if NPLOT ≠ 1.
10	6E12.4	EGX(I), I=1,NGEXP	Experimental group-energy gamma boundaries (MeV).
11	6E12.4	GAMEXP(I), I=1,NGEXP-1	Experimental gamma spectral points (MeV/fission/MeV of scale).
12	6E12.4	GAMERR(I), I=1,NGEXP-1	Experimental gamma errors corresponding to GAMEXP(I). Omit cards 10-12 if ICOMPG ≠ 1.
13	6E12.4	EBX(I), I=1,NBEXP	Experimental group-energy beta boundaries (MeV).
14	6E12.4	BETEXP(I), I=1,NBEXP-1	Experimental beta spectral points (MeV/fission/MeV of scale).
15	6E12.4	BETERR(I), I=1,NBEXP-1	Experimental beta errors corresponding to BETEXP(I). Omit cards 13-15 if ICOMPB ≠ 1.

*Use nonunity index if experimental data are not input.

REFERENCES

1. M. G. Stamatelatos and T. R. England, "Fission-Product γ and (γ,n) Spectra and γ Decay Heat," Trans. Am. Nucl. Soc. 21, 508 (1975).

2. T. R. England and M. G. Stamatelatos, "Beta and Gamma Spectra and Total Decay Energies from Fission Products," Trans. Am. Nucl. Soc. 23, 493 (1976).

3. M. G. Stamatelatos and T. R. England, "Methods for Calculating Average Beta Energies and Beta Spectral Shapes," Trans. Am. Nucl. Soc. 23, 502 (1976).

4. T. R. England and R. E. Schenter, "ENDF/B-IV Fission-Product Files: Summary of Major Nuclide Data," Los Alamos Scientific Laboratory report LA-6116-MS (1975).

5. T. R. England, B. Wilczynski, and N. L. Whittemore, "CINDER-7: An Interim Report for Users," Los Alamos Scientific Laboratory report LA-5885-MS (April 1975).

6. T. R. England, M. G. Stamatelatos, and N. L. Whittemore, in "Applied Nuclear Data Research and Development," Los Alamos Scientific Laboratory report LA-6472-PR (1976) p. 60, and "Applied Nuclear Data Research and Development," Los Alamos Scientific Laboratory report LA-6266-PR (1976) p. 13.

7. R. D. Evans, The Atomic Nucleus, (McGraw-Hill Book Co., New York, 1955) p. 548-563.

8. E. J. Konopinski, The Theory of Beta Radioactivity, (Oxford University Press, Oxford, 1966) p. 12-18.

9. L. R. B. Elton, Nuclear Sizes, (Oxford University Press, London, 1961).

10. T. R. England, "An Investigation of Fission Product Behavior to Nuclear Reactors," Ph.D. Thesis, University of Wisconsin (1969).

11. M. G. Stamatelatos and T. R. England, "Beta-Energy Averaging and Beta Spectra," Los Alamos Scientific Laboratory report LA-6445-MS (1976).

12. T. R. England and M. G. Stamatelatos, "Multigroup Beta and Gamma Spectra of Individual ENDF/B-IV Fission-Product Nuclides," Los Alamos Scientific Laboratory report LA-NUREG-6622-MS (1976).

LISTING OF THE FPDCYS PROGRAM

```
      PROGRAM FPOCYS(INP,OUT,PUN,FSET5,FSET8,FSET11)
      DIMENSION H1(20),H2(5000),RTYP(100),RFS(100),Q(100),DQ(100),
     1BR(100),DBR(100),KDI(900),KZ(900),KMI(900),KS(900),
     2KKZC(200),KMC(200),KIC(200),AK4(200),RIK(200),BK1(200),
     3BK2(200),BK3(200),ES(900),PI(900),FICC(900),
     4KZCS(900),MCS(900),ICS(900),A4(900),RI(900),
     5B1(900),B2(900),B3(900),PEB(900),PEG(900),PEQ(900),
     6CQ(900),ENQ(900),LMAT(900),CYM1(900),CYM2(900),DELQ(900)
      DIMENSION EBDB(200),SPEBET(200),SORSB(200),RATEN(200),BETAS(200),
     1BETAES(200)
      DIMENSION EBDG(200),SPEGAM(200),SORSG(200),GAMASP(200),GAMAES(200)
      DIMENSION WTOT(200)
      DIMENSION EBD1(200),WMID(200),EBO2(200)
C------DCYS IS EXTRACTED FROM DCY8 CODE TO PROCESS FP DATA ONE
C-------- NUCLIDE AT A TIME.  USE DCY8 FOR MORE EXTENDED CAPABILITIES
C--------        8/75
C------N WILL BE USEO AS A COUNT OF MATS
C-------**SET MTOT=MAXIMUM MATERIAL USED FOR PRINT OF SAVED DATA ***
C-----KN WILL BE USED TO COUNT MATERIAL IN SAVE STATEMENTS (FOLLOWING
C-----STATEMENT 125 UP TO 3 DECAY MODES ASSUMED
C-----Z.A, AND STATE READ FROM FILE 8
C------X-SEC AND (N,GAMMA) BRANCHINGS READ FROM INPUT CARDS
C////////////// MODIFIED 7/30/75 (TO CAL EICC,ETC.) ////////////////////
C
C     CONTROL PARAMETERS READ FROM INPUT CARD
C     MTOT=TOTAL NUMBER OF MATS TO BE READ
C     NXC=NUMBER OF CROSS SECTION CARDS
C     MTR1=FIRST MASS NUMBER ON FILE 5
C     MTR2=LAST MASS NUMBER ON FILE 5
C     NPNCH=INDEX TO GE PUNCH OF DECAY BRANCHING NORMALLY 0
C      JOP1=INOEX NOT USED IN OCYS.  INSERT 0 FOR JOP1
C    JDP2=INDEX TO GET SPECTRAL DATA, Q, ICC,ETC (SEE INSERT AT STMT 48)
C     NOTE MTOT=0 GETS SPECIAL PRINT
C//////////////////////////////////////////////////////////////////////
      MTR=0
      N=0
      KN=0
      EREST=5.11006E+05
      DO 500 I=1,900
      PEB(I)=-0.0
      PEG(I)=-0.0
      PEQ(I)=-0.0
      CQ(I)=0.0
      ENQ(I)=0.0
      CYM1(I)=XXXXX
      CYM2(I)=XXXXX
      DELQ(I)=0.0
  500 CONTINUE
 2022 FORMAT(3E12.4)
C------READ CHARGE, MASS AND STATE 824 NUCLIDES
      READ (8,1000) (KZ(I),KMI(I),KS(I),I=1,824)
 1000 FORMAT(18X,I2,I3,I1,56X)
C------READ SIGMA2200,RI,(N,GAMMA), BRANCHING (BOTH GROUPS), AND CORRES-
C----------PONDING CHARGE MASS AND STATE, NXC NUCLIDES
C***** READ CONTROL CARD *****
      READ 1001,MTOT,NXC,MTR1,MTR2,NPNCH,JOP1,JDP2
 1001 FORMAT(1X,I4,6I5)
      READ 2101,NTAPE,NBETS,NGAMS
 2101 FORMAT(7I10)
```

```
      PROGRAM FPDCYS(INP,OUT,PUN,FSET5,FSET8,FSET11)
      DIMENSION H1(20),H2(5000),RTYP(100),PFS(100),Q(100),DQ(100),
     1BR(100),DBR(100),KDI(900),KZ(900),KMI(900),KS(900),
     2KKZC(200),KMC(200),KIC(200),AK4(200),RIK(200),BK1(200),
     3BK2(200),BK3(200),ES(900),PI(900),FICC(900),
     4KZCS(900),MCS(900),ICS(900),A4(900),RI(900),
     5B1(900),B2(900),B3(900),PEB(900),PEG(900),PEQ(900),
     6CQ(900),ENQ(900),LMAT(900),CYM1(900),CYM2(900),DELQ(900)
      DIMENSION EBDB(200),SPEBET(200),SORSB(200),RATEN(200),BETAS(200),
     1BETAES(200)
      DIMENSION EBDG(200),SPEGAM(200),SORSG(200),GAMASP(200),GAMAES(200)
      DIMENSION WTOT(200)
      DIMENSION EBD1(200),WMID(200),EBD2(200)
C------DCYS IS EXTRACTED FROM DCY8 CODE TO PROCESS FP DATA ONE
C-------- NUCLIDE AT A TIME,  USE DCY8 FOR MORE EXTENDED CAPABILITIES
C-------         8/75
C------N WILL BE USED AS A COUNT OF MATS
C-------**SET MTOT=MAXIMUM MATERIAL USED FOR PRINT OF SAVED DATA ***
C-----KN WILL BE USED TO COUNT MATERIAL IN SAVE STATEMENTS (FOLLOWING
C-----STATEMENT 125 UP TO 3 DECAY MODES ASSUMED
C-----Z,A, AND STATE READ FROM FILE 8
C------X-SEC AND (N,GAMMA) BRANCHINGS READ FROM INPUT CARDS
C////////////// MODIFIED 7/30/75 (TO CAL EICC,ETC.) /////////////////////
C
C     CONTROL PARAMETERS READ FROM INPUT CARD
C     MTOT=TOTAL NUMBER OF MATS TO BE READ
C     NXC=NUMBER OF CROSS SECTION CARDS
C     MTR1=FIRST MASS NUMBER ON FILE 5
C     MTR2=LAST MASS NUMBER ON FILE 5
C     NPNCH=INDEX TO GE PUNCH OF DECAY BRANCHING NORMALLY 0
C      JOP1=INDEX NOT USED IN DCYS.  INSERT 0 FOR JOP1
C    JDP2=INDEX TO GET SPECTRAL DATA, Q, ICC,ETC (SEE INSERT AT STMT 48)
C     NOTE MTOT=0 GETS SPECIAL PRINT
C//////////////////////////////////////////////////////////////////////
      MTR=0
      N=0
      KN=0
      EREST=5.11006E+05
      DO 500 I=1,900
      PEB(I)=-0.0
      PEG(I)=-0.0
      PEQ(I)=-0.0
      CQ(I)=0.0
      ENQ(I)=0.0
      CYM1(I)=XXXXX
      CYM2(I)=XXXXX
      DELQ(I)=0.0
  500 CONTINUE
 2022 FORMAT(3E12.4)
C------READ CHARGE, MASS AND STATE 824 NUCLIDES
      READ (8,1000) (KZ(I),KMI(I),KS(I),I=1,824)
 1000 FORMAT(18X,I2,I3,I1,56X)
C------READ SIGMA2200,RI,(N,GAMMA), BRANCHING (BOTH GROUPS), AND CORRES-
C----------PONDING CHARGE MASS AND STATE, NXC NUCLIDES
C***** READ CONTROL CARD *****
      READ 1001,MTOT,NXC,MTR1,MTR2,NPNCH,JOP1,JDP2
 1001 FORMAT(1X,I4,6I5)
      READ 2101,NTAPE,NBETS,NGAMS
 2101 FORMAT(7I10)
```

```
      IF(NTAPE.NE.1) GO TO 6773
      WRITE(11,6774)NBETS,NGAMS
 6774 FORMAT(2I10)
 6773 CONTINUE
      READ 2001,NBDB,IBET
      NBDM1=NBDB-1
      NINT=150/(NBDB-1)
      IBDB=1+(1+NINT)*(NBDB-1)
      IBDBM1=IBDB-1
 2001 FORMAT(2I5)
C     IF NTAPE = 1, TAPE11 IS WRITTEN.
C     IF NBETS = 1, BETA SPECTRA ARE CALCULATED.
C     IF NGAMS = 1, GAMMA SPECTRA ARE CALCULATED.
C     IF IBET = 1, BETA1 ROUTINE IS USED.
C     IF IBET = 2, BETA2 ROUTINE IS USED.
C     IF IBET = 3, BETA3 ROUTINE IS USED.
C     IF IBET = 4, BETA4 ROUTINE IS USED.
C     IF IGAM = 1, GAMMA1 ROUTINE IS USED.
C     IF IGAM = 2, GAMMA2 ROUTINE IS USED.
      READ 2002,(EBDB(I),I=1,NBDB)
 2002 FORMAT(6E12.4)
      QNINT=NINT+1
      DO 2023 I=1,NBDM1
      DLT=(EBDB(I+1)-EBDB(I))/QNINT
      JN1=(I-1)*(NINT+1)+1
      JN2=JN1+NINT
      IL=0
      DO 2023 II=JN1,JN2
      IL=IL+1
      QIL=IL-1
 2023 EBD1(II)=EBDB(I)+QIL*DLT
      EBD1(IBDB)=EBDB(NBDB)
      DO 2024 I=1,IBDB
 2024 EBD2(I)=EBD1(I)/EREST+1.
      DO 2025 I=1,IBDBM1
 2025 WMID(I)=0.5*(EBD2(I)+EBD2(I+1))
      READ 2001,NBDG,IGAM
      READ 2002,(EBDG(I),I=1,NBDG)
      NBDGM1=NBDG-1
      IF(NTAPE.NE.1) GO TO 6200
      WRITE(11,6210) NBDB,IBET
 6210 FORMAT(2I10)
      WRITE(11,6220)(EBDB(I),I=1,NBDB)
 6220 FORMAT(6E12.4)
      WRITE(11,6210)NBDG,IGAM
      WRITE(11,6220)(EBDG(I),I=1,NBDG)
 6200 CONTINUE
      PRINT 6201,IBET
 6201 FORMAT(1H1,10X,*METHOD *,I1,* FOR BETA SPECTRA*/)
      PRINT 6237,IGAM
 6237 FORMAT(1H ,10X,*METHOD *,I1,* FOR GAMMA SPECTRA*/)
      PRINT 8101
 8101 FORMAT(1H0,20X,*BETA ENERGY BOUNDARIES (EV)*)
      PRINT 8110
 8110 FORMAT(1H ,20X,*---------------------------*/)
      PRINT 8120,(EBDB(I),I=1,NBDB)
 8120 FORMAT(10E10.2)
      PRINT 8130
 8130 FORMAT(1H0,20X,*GAMMA ENERGY BOUNDARIES (EV)*)
      PRINT 8140
```

```
 8140 FORMAT(1H ,20X,*----------------------------*/)
      PRINT 8120,(FBDG(I),I=1,NBDG)
      PRINT 8150
 8150 FORMAT(1H0,////)
      DO 2003 I=1,NBDM1
      BETAS(I)=0.
 2003 BETAES(I)=0.
      DO 2004 I=1,NBDGM1
      GAMASP(I)=0.
 2004 GAMAES(I)=0.
C     READ 1003,(KKZC(I),KMC(I),KIC(I),AK4(I),RIK(I),BK1(I),BK2(I),
C    1BK3(I),I=1,NXC)
 1003 FORMAT(15X,I2,I3,I1,10X,E9.1,8X,E8.1,8X,3E5.1,1X)
 1006 CONTINUE
      PRINT 100
  100 FORMAT(1H1)
  102 CONTINUE
C------CONTROL IS RETURNED TO THIS POINT AFTER EACH PROCESSED MAT
      NEPB=0
      NEPG=0
      NEPBG=0
      NS=0
      PRINT 100
    1 CONTINUE
      N=N+1
      DO 2 I=1,20
      H1(I)=-1
    2 CONTINUE
      DO 3 I=1,5000
      H2(I)=-1
    3 CONTINUE
      DO 4 I=1,100
      RTYP(I)=-1.0
      RES(I)=-1.0
      Q(I)=-1.0
      DQ(I)=-1.0
      BR(I)=-1.0
      DBR(I)=-1.0
    4 CONTINUE
      MAT=0
      FQ=0.0
      MAT1=0
      MAT2=0
      MAT3=0
      MAT4=0
      MAT5=0
      MAT6=0
      MF=0
      MF1=0
      MF2=0
      MF3=0
      MF4=0
      MF5=0
      MF6=0
      LRP=0
      LFI=0
      NXC=0
      MF6=0
      MT=0
      MT1=0
```

```
      MT2=0
      MT3=0
      MT4=0
      MT5=0
      MT6=0
      NSEQ=0
      NSEQ1=0
      NSEQ2=0
      NSEQ3=0
      NSEQ4=0
      NSEQ5=0
      NSEQ6=0
      ZA=0.0
      ZA1=0.0
      AWR=0.0
      AWT=0.0
      AWRI=0.0
      AWR1=0.0
      C1=0.0
      C2=0.0
      L1=0
      L2=0
      N2=0
      N1=0
      LDD=0
      NXC=0
      LFP=0
      NWD=0
      NWC=0
      SYM1=-1
      SYM2=-1
      NAV1=-1
      NAV=-1
      ID=0
      LIS=-1
      NSP=-1
      NAV2=-1
      DEB=-0.0
      EB=-0.0
      DEG=-0.0
      EG=-0.0
      EA=-0.0
      T=-0.0
      DEA=-0.0
      DT=-0.0
      FQ=0.0
      TQ=0.0
      DTQ=0.0
C------READ TO FIRST MEND RECORD (ASSUMED TO BE FIRST CARD)
    5 CONTINUE
      READ(5,6) MAT1,MF1,MT1,NSEQ1
      IF(EOF,5)201,1213
 1213 CONTINUE
    6 FORMAT(66X,I4,I2,I3.I5)
 1111 CONTINUE
      MFT=MAT1+MF1+MT1
      ISEQ=ISEQ+1
      IF(MTOT.GT.0) GO TO 111
      IF(MFT.NE.0) PRINT 110,ISEQ,MAT1,MF1,MT1,NSEQ1
  111 CONTINUE
```

```
  110 FORMAT(1X,8H*** CARD,I6,15HNOT MEND RECORD,16H MAT,MF,MT,NSEQ=,I4,
     1I2,I3,I5)
      IF(MFT.NE.0) GO TO 5
    7 CONTINUE
C------READ FIRST RECORD AFTER MEND TO MT=451
      READ(5,8) C1,C2,L1,L2,N1,N2,MAT2,MF2,MT2,NSEQ2
      IF (EOF,5) 201,1300
 1300 CONTINUE
      ISEQ=ISEQ+1
    8 FORMAT(2E11.4,4I11,I4,I2,I3,I5)
      IF(MT2.NE.451) GO TO 7
      IF(MF2.NE.1) PRINT 40,ISEQ
C------SET ZA,AWR,MAT,MF,MT
      ZA=C1
      AWR=C2
      LRP=L1
      LFI=L2
      NXC=N2
      MAT=MAT2
      MF=MF2
      MT=MT2
      ID=10.0*ZA
C -----READ FIRST HOLLERITH CARD
      READ(5,8) C1,C2,L1,L2,N1,N2,MAT3,MF3,MT3,NSEQ3
      IF(EOF,5) 201,1301
 1301 CONTINUE
      ISEQ=ISEQ+1
      LDD=L1
      LFP=L2
      NWD=N1
C-------NWD=NO. HOLLERITH CARDS,17 WORDS PER CARD
C-------USE FIRST CARD TO DEFINE SYMBOL(SYM1,SYM2)
C-------AND REMAINING TITLE H1(I), AND USE H2(I) FOR
C-------REMAINING HOLLERITH INFO.
      NW=17*(NWD-1)
C----- READ REMAINING HOLLERITH
      READ(5,11) SYM1,SYM2,(H1(I),I=1,14)
      DECODE(5,2222,SYM1) IZEE
 2222 FORMAT(I2,3X)
      DECODE(5,2223,SYM2) IAAA
 2223 FORMAT(1X,I3,1X)
      DECODE(5,2224,SYM2) ATRAN
 2224 FORMAT(4X,A1)
      IF(EOF,5) 201,1302
 1302 CONTINUE
      ISEQ=ISEQ+1
   11 FORMAT(1X,2A5,(13A4,A2))
C  *** IF IH.GT.0 SKIP READ TO MT=0
      IH=1
      IF(IH.GT.0) GO TO 36
      READ(5,12) (H2(I),I=1,NW)
      IF(EOF,5) 201,1303
 1303 CONTINUE
      ISEQ=ISEQ+1
   12 FORMAT(16A4,A2)
   14 CONTINUE
      GO TO 39
   37 CONTINUE
   36 READ(5,38)MTT
      IF(EOF,5) 201,1304
```

```
 1304 CONTINUE
      ISEQ=ISEQ+1
   38 FORMAT(72X,I3)
      IF(MTT.NE.0) GO TO 37
   39 CONTINUE
C------READ TO MT=457
      READ(5,8) C1,C2,L1,L2,N1,N2,MAT5,MF5,MT5,NSEQ5
      IF(EOF,5) 201,1305
 1305 CONTINUE
      ISEQ=ISEQ+1
      IF(MT5.EQ.453) GO TO 36
      MTF5=MF5+MT5
      IF(MT5.NE.457) GO TO 116
  116 IF(MTF5.EQ.0) GO TO 16
      IF(MT5.NE.457) GO TO 39
      LIS=L1
      ID=(10.0*ZA+L1)
      IDE=10*ID
      NSP=N2
      IF(ZA.NE.C1) PRINT 40,ISEQ
   40 FORMAT(1H0,5HCARD ,I5,8HIN ERROR)
      IF(ZA.NE.C1) GO TO 900
C------READ HALFLIFE, NO. OF AVE. DECAY ENERGIES
      READ(5,45) T,DT,NAV2,NAV1
      IF(EOF,5) 201,1306
 1306 CONTINUE
      ISEQ=ISEQ+1
   45 FORMAT(2E11.4,22X,2I11)
C------READ AVERAGE DECAY ENERGIES
      READ(5,46) EB,DEB,EG,DEG,EA,DEA
      IF(EOF,5) 201,1307
 1307 CONTINUE
      ISEQ=ISEQ+1
   46 FORMAT(6E11.4)
C------READ NO. OF DECAY MODES
      READ(5,47) NDK
      IF(EOF,5) 201,1308
 1308 CONTINUE
      ISEQ=ISEQ+1
   47 FORMAT(55X,I11)
C---- -READ TYPE OF DECAY, ISOSTATES OF DAUGHTERS, Q AND BRANCHINGS
      READ(5,46) (RTYP(I),RFS(I),Q(I),DQ(I),BR(I),DBR(I),I=1,NDK)
      IF(EOF,5) 201,1309
 1309 CONTINUE
      ISEQ=ISEQ+1
C/////// INSERT 7/75 TO GET SPECTRAL DATA,ICC,ETC,WHEN JOP2=1 //////////
C     VARIBLES
C     ES(I)= GAMMA OR BETA END POINT ENERGIES
C     PI(I)= INTENSITIES
C     FICC(I)= ICC
C     F=NORMALIZATION
C     STYP= TYPE SPECTRA
C     NEP= NO ENERGY POINTS (CARDS) FOR SPECTRA
C     NSP= NO OF SPECTRA
C     NDK= NO OF DECAY MODES
C       QENDK=ENDF/B Q VALUE WEIGHTED BY BRANCHING FRACTION
C -----CAL QUANTITIES PER MODE (NO BRANCHING FRACT INCLUDED)----
C     ETG= TOTAL GAMMA E
C     EICC= INT,CONVERSION E
C     ETR= TOT TRANSITION E
```

```
C     FCE= ICC FRACTION OF TOT TRANSITION E
C     W= BETA E IN MC**2 UNITS.
C     WAV= BETA WEIGHTING FACTOR
C     EBN= BETA+ NEUTRINO E
C     EBA= AVE BETA E
C     QQ= Q VALUE
C    NEPB=RUNNING COUNT OF BETA END POINTS
C    NEPG=RUNNING COUNT OF GAMMA LINES
C    NEPBG=NEPB + NEPG = TOTAL COUNT OF LINES, BETA AND GAMMA
C       NOTE ENDF/B VALUES OF TOT E-GAMMA INCLUDES ICC ENERGY, THEREFORE
C             COMPARE WITH ETR, NOT ETG
C
C
C///////////////////////////////////////////////////////////////////////
      IF(JDP2.LE.0) GO TO 390
      IF(NSP.LE.0) GO TO 390
      NS=NS+1
      PRINT 292,NS
  292 FORMAT(1X,I4)
      PRINT 325,SYM1,SYM2,MAT5,NDK,NSP
  325 FORMAT(15X,2A5/16X,4HMAT=,I4/16X,4HNDK=,I3/16X,4HNSP=,I3)
      PRINT 2325,IDE
 2325 FORMAT(1H ,15X,*IDE=*,I10)
      IF(NTAPE.NE.1) GO TO 6100
      WRITE(11,6110)SYM1,SYM2,IDE,MAT5,NDK,NSP
 6110 FORMAT(2A5,4I10)
 6100 CONTINUE
      PRINT 297,EB,EG,EA,T
  297 FORMAT(1H0,7HE-BETA=,E11.4/1X,8HE-GAMMA=,E11.4/1X,
     18HE-ALPHA=,E11.4/1X,9HHALFLIFE=,E11.4)
      PRINT 298,(BR(I),I=1,NDK)
      QENDF=0.0
      PRINT 296,(Q(I),I=1,NDK)
  296 FORMAT(1X,11HQ-VALUE(S)=,3E11.4)
      DO 295 I=1,NDK
      QENDF=BR(I)*Q(I)+QENDF
      DELQ(NS)=BR(I)*DQ(I)+DELQ(NS)
  295 CONTINUE
      PRINT 294,QENDF,DELQ(NS)
  294 FORMAT(1X,11HWEIGHTED Q=,E11.4,4H(+/-,E11.4,1H))
  298 FORMAT(1X,11HBRANCHINGS=,3E11.4)
      QQ=0.0
      KSP=0
      LNSP=NSP
      NEP=0
      ETG=0.0
      ETR=0.0
      EICC=0.0
      FICC=0.0
      EBA=0.0
      EBN=0.0
      ETN=0.0
      FCE=0.0
      F=0.0
  299 CONTINUE
      KSP=KSP+1
      DO 300 I=1,700
      ES(I)=0.0
      PI(I)=0.0
      FICC(I)=0.0
```

```
  300 CONTINUE
      IF(NSP.EQ.0) GO TO 48
      READ(5,301) STYP,NEP,MAT8,MF8,MT8,NSEQ8
  301 FORMAT(E11.4,44X,I11,I4,I2,I3,I5)
      IF(NTAPE.NE.1) GO TO 6771
      WRITE(11,6772)STYP
 6772 FORMAT(F6.2)
 6771 CONTINUE
      READ(5,302) F
  302 FORMAT(E11.4,69X)
      DO 310 I=1,NEP
      READ(5,315) ES(I),PI(I),FICC(I)
  310 CONTINUE
  315 FORMAT(E11.4,11X,E11.4,11X,E11.4,25X)
      ISEQ= ISEQ+NEP+2
      IF(STYP.EQ.0.0)PRINT 326
  326 FORMAT(1H0,14HGAMMA SPECTRUM/1X,7(2H--))
      IF(STYP.EQ.1.0)PRINT 327
  327 FORMAT(1H0,13HBETA SPECTRUM/1X,7(2H--))
      IF(STYP.GT.1.0) PRINT 328, STYP
  328 FORMAT(1X,14HSPECTRUM TYPE=,E11.4/1X,13(2H--))
      PRINT 329, F,NEP
  329 FORMAT(1H0,21HNORMALIZATION FACTOR=,E11.4/1X, 14HNO. OF POINTS=,I4
     1)
  330 CONTINUE
      TNEP= TNEP+ NEP
      IF(NEP.GT.700)PRINT 331
  331 FORMAT(1X,16HNEP GT 700******)
      IF(NEP.GT.700) GO TO 48
C------CALCULATE GAMMA TRANSITION ENERGIES AND TABULATE
      IF(STYP.GT.0.0) GO TO 342
      DO 335 I=1,NEP
      ETG= ETG + F*ES(I)*PI(I)/100.0
      EICC= EICC+ F*ES(I)*PI(I)*FICC(I)/100.0
  335 CONTINUE
      ETR= ETG + EICC
      FCE= EICC/ETR
      NEPG=NEPG+NEP
      IF(FCE.GT.1.0E-10) NICC=NICC+1
      PRINT 337
  337 FORMAT(1H0,9X,7HE-GAMMA,2X,13HREL INTENSITY,12X,3HICC)
      PRINT 340,(I,ES(I),PI(I),FICC(I),I=1,NEP)
  340 FORMAT(1X,I4,1X,E11.4,4X,E11.4,4X,E11.4)
      IF(NGAMS.NE.1) GO TO 7101
      DO 338 I=1,NBDGM1
      SPEGAM(I)=0.
  338 SORSG(I)=0.
      SUMENG=0.
      IF(IGAM.EQ.1) CALL GAMMA1(ES,PI,NBDG,EBDG,SPEGAM,SORSG,NEP)
      IF(IGAM.EQ.2) CALL GAMMA2(ES,PI,NBDG,EBDG,SPEGAM,SORSG,NEP)
      DO 419 I=1,NBDGM1
  419 SUMENG=SUMENG+SORSG(I)
      PRINT 421,SUMENG
  421 FORMAT(1H0,50X,*THE SUM OF THE GAMMA ENERGY SPECTRUM IS *,E12.4)
      SUMENG=SUMENG*F/100.
      PRINT 9101
 9101 FORMAT(1H0,50X,*NORMALIZED GAMMA SPECTRUM*)
      PRINT 9110
 9110 FORMAT(1H ,50X,*-------------------------*)
      DO 9120 I=1,NBDGM1
```

```
      SPEGAM(I)=SPEGAM(I)*F/100.
 9120 SORSG(I)=SORSG(I)*F/100.
      PRINT 9140,(SPEGAM(K),K=1,NBDGM1)
 9140 FORMAT(1H ,50X,6E12.4)
      PRINT 9160
 9160 FORMAT(1H0,50X,*NORMALIZED GAMMA ENERGY SPECTRUM*)
      PRINT 9170
 9170 FORMAT(1H ,50X,*---------------------------------*)
      PRINT 9140,(SORSG(K),K=1,NBDGM1)
      IF(NTAPE.NE.1) GO TO 6300
      WRITE(11,6310)(SPEGAM(I),I=1,NBDGM1)
 6310 FORMAT(6E12.4)
      WRITE(11,6310)(SORSG(I),I=1,NBDGM1)
 6300 CONTINUE
      PRINT 3421,SUMENG
 3421 FORMAT(1H0,50X,*TOTAL GAMMA ENERGY EQUALS *,E12.4)
 7101 CONTINUE
      QQ= QQ +ETR
      PRINT 341,ETG,EICC,ETR,QQ
  341 FORMAT(1X,4HETG=,E11.4/,1X,5HEICC=,E11.4/1X,4HETR=,E11.4/1X,
     13HQQ=,E11.4)
      IF(NGAMS.NE.1) GO TO 7102
      IF(NTAPE.NE.1) GO TO 6400
      WRITE(11,6310)ETG,SUMENG
 6400 CONTINUE
      GAMPDF=100.*(1.-ETG/SUMENG)
      AGMPDF=ABS(GAMPDF)
      IF(AGMPDF.GE.1.0E-03) PRINT 3419,GAMPDF
 3419 FORMAT(1H0,10X,*(1 - ETG / ENERGY-SPECTRUM-SUM ) X 100 = *,E12.4/)
 7102 CONTINUE
      LNSP=LNSP-1
      IF(LNSP.EQ.0) GO TO 390
      GO TO 299
C------CAL BETA AND PRINT SPECTRUM
  342 CONTINUE
      IF(STYP.GT.1.0) GO TO 355
      PRINT 345
  345 FORMAT(1H0,10X,6HE-BETA,2X,13HREL INTENSITY)
      IF(NBETS.NE.1) GO TO 7103
      DO 343 I=1,NBDM1
      BETAS(I)=0.
  343 BETAES(I)=0.
      SUMENB=0.
      SUMX=0.
      SUMY=0.
 7103 CONTINUE
      DO 349 I=1,NEP
      PRINT 346,I,ES(I),PI(I)
      IF(PI(I).LE.1.0E-20) PI(I)=1.0E-20
      IF(PI(I).LE.1.0E-20) PRINT 3346
 3346 FORMAT(1H0,35X,*THE INTENSITY IS ZERO BUT IT IS SET TO 1.0E-20*/)
      IF(NBETS.NE.1) GO TO 7104
      EZ=ES(I)
      PK=PI(I)
 7104 CONTINUE
  346 FORMAT(1X,I4,1X,E11.4,4X,E11.4)
      IF(NBETS.NE.1) GO TO 7105
      WMAX=ES(I)/EREST+1.
      DO 348 J=1,NBDB
      WTOT(J)=EBDB(J)/EREST+1.
```

```
  348 RATEN(J)=(EROB(J)+EREST)/(ES(I)+EREST)
      IF(IBET.EQ.1) CALL BETA1(EZ,PK,NBOB,EBDB,SPEBET,PLAMDA,CRAT,SORSB,
     1RATEN,C2Z)
      ZEE=IZEE
      AAA=IAAA
      IF(IBET.EQ.2) CALL BETA2(EZ,PK,NBDB,EBDB,SPEBET,SDRSB,RATEN,C2Z,
     1WTDT,WMAX,ZEE,AAA)
      IF(IBET.EQ.3) CALL BETA3(EZ,PK,NBDB,EBDB,SPEBET,SORSB,RATEN,C2Z,
     1WTOT,ZEE,AAA,WMAX,A0,A1,A2)
      IF(IBET.EQ.4) CALL BETA4(EZ,PK,NBDB,EBDB,SPEBET,SORSB,RATEN,C2Z,
     1WTDT,WMAX,ZEE,AAA)
C     PUNCH 3355,SYM1,SYM2,C2Z,EZ,PK
 7105 CONTINUE
 3355 FORMAT(2A5,3E12.4)
 3344 FORMAT(2A5,E12.4)
      IF(NBETS.NE.1) GO TO 7106
      SUMX=SUMX+C2Z*PI(I)
      SUMY=SUMY+PI(I)
      DO 347 K=1,NBDM1
      BETAS(K)=BETAS(K)+SPEBET(K)
  347 BETAES(K)=BETAES(K)+SDRSB(K)
 7106 CONTINUE
  349 CONTINUE
      IF(NBETS.NE.1) GO TO 7107
      PRINT 344
  344 FORMAT(1H ,35X,*TOTAL BETA SPECTRUM*)
      PRINT 334,(BETAS(K),K=1,NBDM1)
  334 FORMAT(1H ,35X,6E12.4)
      PRINT 303
  303 FORMAT(1H ,35X,*TOTAL BETA ENERGY SPECTRUM*)
      PRINT 334,(BETAES(K),K=1,NBDM1)
      DO 353 I=1,NBDM1
  353 SUMENB=SUMENB+BETAES(I)
      PRINT 354,SUMENB
  354 FORMAT(1H0,35X,*THE SUM OF THE BETA ENERGY SPECTRUM IS *,E12.4)
      SUMENB=SUMENB*F/100.
      PRINT 9301
 9301 FORMAT(1H0,35X,*NORMALIZED TOTAL BETA SPECTRUM*)
      PRINT 9310
 9310 FORMAT(1H ,35X,*-------------------------------*)
      DO 9320 I=1,NBDM1
      BETAS(I)=BETAS(I)*F/100.
 9320 BETAES(I)=BETAES(I)*F/100.
      PRINT 9340,(BETAS(K),K=1,NBDM1)
 9340 FORMAT(1H ,35X,6E12.4)
      PRINT 9370
 9370 FORMAT(1H0,35X,*NORMALIZED TOTAL BETA ENERGY SPECTRUM*)
      PRINT 9380
 9380 FORMAT(1H ,35X,*--------------------------------------*)
      PRINT 9340,(BETAES(K),K=1,NBDM1)
      IF(NTAPE.NE.1) GO TO 6500
      WRITE(11,6310)(BETAS(I),I=1,NBDM1)
      WRITE(11,6310)(BETAES(I),I=1,NBDM1)
 6500 CONTINUE
      PRINT 3304,SUMENB
 3304 FORMAT(1H0,35X,*TOTAL BETA ENERGY EQUALS *,E12.4)
      C2ZAV=SUMX/SUMY
C     PUNCH 3344,SYM1,SYM2,C2ZAV
 7107 CONTINUE
      DO 350 I=1,NEP
```

```
      W= ES(I)/(.511E+6)
      WAV=(10.0+8.0*W+2.0*W**2)/(4.0*(10.0+5.0*W+W**2))
      EBN= ES(I)*PI(I)*F/100.0 +EBN
      EBA= EBA + ES(I)*PI(I)*F*WAV/100.0
  350 CONTINUE
      ETN=EBN-EBA
      QQ=QQ+EBN
      NEPB=NEPB+NEP
      PRINT 351,EBN,EBA,ETN,QQ
  351 FORMAT(1X,12HE-BETA+NWUT=,E11.4/1X,7HE-BETA=,E11.4/1X,
     111HE-NEUTRINO=,E11.4/1X,3HQQ=,E11.4)
      IF(NBETS.NE.1) GO TO 7108
      IF(NTAPE.NE.1) GO TO 6600
      WRITE(11,6310) EBA,SUMENB
 6600 CONTINUE
      BETPOF=100.*(1.-EBA/SUMENB)
      ABTPDF=ABS(BETPDF)
      IF(ABTPDF.GE.1.0E-03) PRINT 3334,BETPOF
 3334 FORMAT(1H0,10X,*(1 - E-BETA / ENERGY-SPECTRUM-SUM) X 100 = *,
     1E12.4/)
 7108 CONTINUE
      LNSP=LNSP-1
      IF(LNSP.EQ.0) GO TO 390
      GO TO 299
  355 IF(STYP.GT.1.0) PRINT 356
  356 FORMAT(1X,38H****** ANOTHER SPEC IS INCLUDED ******)
  390 IF(NSP.LE.0) GO TO 48
      FQ=(QQ-QENDF)/QENDF
      IF(EB.GT.0.0) PEB(NS)=100.0*(EBA-EB)/EB
      IF(EG.GT.0.0) PEG(NS)=100.0*(ETR-EG)/EG
      PEQ(NS)=100.0*FQ
      CQ(NS)=QQ
      ENQ(NS)=QENDF
      LMAT(NS)=MAT5
      CYM1(NS)=SYM1
      CYM2(NS)=SYM2
      PDQ=DELQ(NS)*100.0/QENDF
C
      IF(JDP2.LE.0) GO TO 48
C
      PRINT 357
  357 FORMAT(1H0,28HCALCULATED ENERGIES (ENDF/B))
      PRINT 358,EBA,EB,ETR,EG,ETG,ETN,EICC,FCE,QQ,QENDF,PDQ
  358 FORMAT(1X,9HAVE BETA=,E11.4,1X,1H(,E11.4,1H)/
     11X,17HAVE TRANSITION E=,E11.4,1X,1H(,E11.4,1H)/
     31X,10HTOT GAMMA=,E11.4/
     41X,11HE-NEUTRINO=,E11.4/
     51X,3HCE=,E11.4/
     61X,24HFRAC CONV E OF TOT TRAN=,E11.4/1X,
     22HQ=,1X,E11.4,1H(,E11.4,3H+/-,F8.4,5H PCT))
      PRINT 5001,FQ
 5001 FORMAT(1X,3HFQ=,E11.4)
      IF(EICC.GT.1.0E-6) PRINT 5002,EICC,FCE
 5002 FORMAT(80X,13HEICC AND FCE=,2E11.4)
      IF(ABS((EBA-EB)/(EB+.0001)).GT.0.0001) PRINT 5010
 5010 FORMAT(50X,26HBETA ENERGIES DO NOT AGREE)
      IF(ABS((ETR-EG)/(EG+.0001)).GT.0.0001) PRINT 5011
 5011 FORMAT(50X,27HGAMMA ENERGIES DO NOT AGREE)
      TQ=ABS(QQ-QENDF)/(QENDF+0.0001)
      IF(TQ.GT.0.03) PRINT 5012
```

```
 5012 FORMAT(50X,32H***Q DIFFERENCE EXCEEDS 3 PCT***)
      IF(DELQ(NS).EQ.0.0) GO TO 5015
      DTQ=TQ*(QENDF+0.0001)
      IF(DTQ.GT.DELQ(NS)) PRINT 5014
      IF(DTQ.LE.DELQ(NS)) PRINT 5016
 5016 FORMAT(50X,34HQ DIFFERENCE IS WITHIN UNCERTAINTY)
 5014 FORMAT(50X,32HQ DIFFERENCE EXCEEDS UNCERTAINTY)
 5015 CONTINUE
      PRINT 5000
 5000 FORMAT(1H0,39(2H==))
C/////////////////////////////////////////////////////////////////////
   48 CONTINUE
C------SKIP REMAINDER OF 457 THRU MEND CARD
      READ(5,6) MAT6,MF6,MT6,NSEG6
      IF(EOF,5) 201,1310
 1310 CONTINUE
      ISEQ=ISEQ+1
      IF(MAT6.NE.MAT) PRINT 120,ISEQ,MAT6,MF6,MT6
  120 FORMAT(1X,36H***NO MEND CARD OR CARD ERROR, CARD ,I5,3X,I4,I2,I3)
      KFEND=MF6+MT6
      IF(KFEND.NE.0) GO TO 48
C----- PRINT DATA FOR THIS MAT IF MTOT .NE.0
C------NEXT CARD SOULD BE MEND
C------PRINT DATA FOR THIS MAT
C -****** CONTROL XFERRED BACK TO HERE FROM 16
  125 CONTINUE
C------AT THIS POINT ALL NUCLIDE DATA HAS BEEN READ FOR THIS MAT.
C------FOLLOWING VARIABLES ARE SAVED PER MAT.** NOTE THAT SAVE ASSUMES
C----------NDK.LE.4. ADD CHECK FOR THIS
      MTR=MTR+1
      KOI(MTR)=ID
      KR=KDI(MTR)-(10000*KZ(MTR)+10*KMI(MTR)+KS(MTR))
      IF(KR.EQ.0) GO TO 1010
      IF(MTOT.EQ.0) GO TO 1010
 1011 FORMAT(1X,27HINPUT AND TAPE ID NOT EQUAL,2I7)
 1010 CONTINUE
      IF(JOP2.LE.0)GO TO 360
      IF(N.EQ.MTOT.AND.JOP2.EQ.1) GO TO 221
  359 FORMAT(1H1,26HTOT NO OF SPECTRAL POINTS=, I6)
      IF(N.EQ.MTOT) GO TO 900
  360 CONTINUE
      IF(NSP.LE.0) NSP=0
      IF(NDK.LE.0) NDK=0
C------INSERT CROSS SECTIONS AND (N,GAMMA) BRANCHING RATIOS
      DO 1033 I=1,181
      NID=10000*KKZC(I)+10*KMC(I)+KIC(I)
      IF(NID.NE.ID) GO TO 1034
      KZCS(MTR)=KKZC(I)
      MCS(MTR)=KMC(I)
      ICS(MTR)=KIC(I)
      A4(MTR)=AK4(I)
      RI(MTR)=RIK(I)
      B1(MTR)=BK1(I)
      B2(MTR)=BK2(I)
      B3(MTR)=BK3(I)
 1034 CONTINUE
 1033 CONTINUE
  151 CONTINUE
C----------------------STORED DATA---------------------------------
C------FOLLOWING QUANTITIES ARE STORED IN THE ORDER FOUND ON
```

```
C------       THE BNL TAPE - INDEX MTR RUNS FROM 1 - 825 AND NUCLIDES
C------       ARE IN ORDER Z,A,I.  DO LOOP AT STATEMENT 263 ORDERS THE
C------       PRINT A,Z,I.  CROSS SECTIONS ARE APPROXIMATE.  NOTE IN
C------       FOLLOWING LIST, THE SUBSCRIPT IS OMITTED IF THERE IS A
C------       SINGLE SUBSCRIPT.
C---------------------------------------------------------------------
C------       SYMBOL              MEANING
C------       KDI                 NUMERICAL ID=10000*Z+10*A+I
C------       SM1,SM2             TOGETHER THESE GIVE THE ALPHANUMERIC
C------       SBR(I,MTR)          BRANCHING FRCATION, MODE I
C   CALCULATE PERCENT DEVIATIONS FROM ENDF/B
C      VALUES.
C       PER(I)= PERCENT OF AVERAGE BETA
C       PEG(I)=PERCENT OF AVERAGE GAMMA
C       PEQ(I)=PERCENT OF Q VALUE
C       CQ(I)=CALCULATED Q
C       ENQ(I)=ENDF/B Q
C       LMAT(I)=MAT NO.
C       CYM1(I)=HALF OF ID
C       CYM2(I)=HALF OF ID
C       DELQ(I)=UNCERTAINTY IN Q
C------------FOLLOWING VALUES ARE INSERTED ------
C------       WHEN THE NUCLIDE HAS A CROSS SECTION.
C------       OTHERWISE ALL VALUES ARE SET TO -0
C------       KZCS                Z OF CS NUCLIDE
C------       MCS                 A VALUE OF CS NUCLIDE
C------       ICS                 ISOMERIC STATE OF CS NUCLIDE
C------       A4                  2200 M/S CROSS SECTION
C------       RI                  RES. INT.
C------       B1,2,3              (N,GAMMA) BRANCHING TO GND, FIRST
C------                           AND SECOND ISOMERIC STAT OF
C------                           DAUGHTER.
C------
C---------------------------------------------------------------------
      IF(MTOT.GT.0) GO TO 200
      PRINT 10,SYM1,SYM2,ID,MAT
C------FOLLOWING PRINT OF REFS TEMPORARILY REMOVED
      PRINT 20,SYM1,SYM2,(H1(I),I=1,14)
C     PRINT 30,(H2(I),I=1,NW)
      PRINT 31,ZA,AWR,NDK,NSP
      TM=T/60.0
      TH=T/3600.0
      TD=T/86400.0
      Y=3.15569*(10**7)
      Y=3.15569E+7
      IF(T.LE.60.0)  GO TO 146
      IF(T.LE.3600.0)  GO TO 147
      IF(T.LE.86400.0)  GO TO 148
      IF(T.LE.Y) GO TO 149
      IF(T.GT.Y) GO TO 153
  146 PRINT 140,T
      GO TO 144
  147 PRINT 141,TM
      GO TO 144
  148 PRINT 142,TH
      GO TO 144
  149 PRINT 143,TD
      GO TO 144
  153 PRINT 152,TY
  144 CONTINUE
```

```
  140 FORMAT(1X,10HHALFLIFE= ,E12.5,1HS)
  141 FORMAT(1X,10HHALFLIFE= ,E12.5,1HM)
  142 FORMAT(1X,10HHALFLIFE= ,E12.5,1HH)
  143 FORMAT(1X,10HHALFLIFE= ,E12.5,1HD)
  152 FORMAT(1X,10HHALFLIFE= ,E12.5,1HY)
   31 FORMAT(1H0,4HZA= ,E11.4/
     11X,5HAWR= ,E11.4/
     21X,18HNO. OF DCY MODES= ,I3/
     31X,16HNO. OF SPECTRA= ,I5)
      PRINT 60,T,EB,EG,EA,DT,DEB,DEG,DEA
   60 FORMAT(1H0,34X,18HDECAY ENERGIES(EV)/
     14X,13HHALFLIFE(SEC),8X,4HBETA,7X,5HGAMMA,7X,5HALPHA/,4X,4E12,4/
     21X,3H+/-,4E12.4/)
C-----PRINT DECAY MODE DATA
      PRINT 80
   80 FORMAT(1H0,30X,15HDECAY MODE DATA/
     18X,4HMODE,2X,9HSTATE DTR,4X,7HQ VALUE,7X,4H+/-Q,3X,8HBR RATIO,6X,5
     2H+/-BR)
      PRINT 90,(RTYP(I),RFS(I),Q(I),DQ(I),BR(I),DBR(I),I=1,NDK)
   90 FORMAT(1X,6E11.4)
      PRINT 50
      GO TO 1
C-----CONTROL GOES TO THIS POINT (16) IF NEXT CARD HAS MF5 AND MT5=0
   16 CONTINUE
      IF(MTOT.GT.0) GO TO 125
C-----CHECK FOR FEND CARD.
      PRINT 10,SYM1,SYM2,ID,MAT
   10 FORMAT(1H0,10(2H- ),2A5,1X,10(2H- )/20X,4HID= ,I8/20X,5HMAT= ,I8//
     1)
      PRINT 20,SYM1,SYM2,(H1(I),I=1,14)
   20 FORMAT(1X,2A5,(13A4,A2))
   30 FORMAT(1X,(16A4,A2))
      PRINT 53
   53 FORMAT(1H0,15HNO MF=457 FOUND)
      PRINT 50
   50 FORMAT(1X,79(1H-)/1X,79(1H-)/)
C-----NEXT CARD SHOULD BE SEND. RETURNS TO 1
      GO TO 1
  200 CONTINUE
      IF(MTOT.EQ.0) GO TO 1
      IF(N.NE.MTOT) GO TO 1
  201 CONTINUE
C-----FOLLOWING STATEMENTS PRINT STORED DATA.
      PRINT 210
  210 FORMAT(1H0,15HRTYP=DECAY MODE/
     11X,30HRFS=ISOMERIC STATE OF DAUGHTER//
     25X,4HRTYP,14H MODE OF DECAY/
     36X,29H0.0 GAMMA (NOT USED FOR RTYP)/
     46X,8H1.0 BETA/
     56X,22H2.0 POSITRON AND/OR EC/
     66X,6H3.0 IT/
     76X,9H4.0 ALPHA/
     86X,29H5.0 DELAYED NEUTRONS AND BETA/
     96X,23H6.0 SPONTANEOUS FISSION)
  220 CONTINUE
      NPAGE=3
  221 CONTINUE
      IF(JOP2.EQ.0) GO TO 901
      PRINT 232
  232 FORMAT(1H1,17X,38HPERCENT DIFFERENCE OF CAL AND ENDF/B-4/8X,
```

```
    17HNUCLIDE,7X,4HBETA,6X,5HGAMMA,10X,1HQ,2X,3HMAT)
     PRINT 233,(I,CYM1(I),CYM2(I),PEB(I),PFG(I),PEQ(I),
    1LMAT(I),I=1,NS)
233 FORMAT(1X,I4,2X,2A5,3E11.4,I5)
     PUNCH 234,(I,LMAT(I),CYM1(I),CYM2(I),CQ(I),ENQ(I),PEQ(I),
    1I=1,NS)
234 FORMAT(1X,I4,I5,1X,2A5,3E11.4)
     PUNCH 232
     PUNCH 233,(I,CYM1(I),CYM2(I),PEB(I),PEG(I),PEQ(I),
    1LMAT(I),I=1,NS)
     NEPBG=NEPB+NEPG
     PRINT 231,NEPB,NFPG,NEPBG,NS,NICC
231 FORMAT(1H1,17HNO OF SPEC LINES=,I6,5H BETA,I6,6H TOTAL,I6,/1X,
    121HNO OF NUCS WITH SPEC=,I5/1X,
    217HNO NUCS WITH ICC=,I7)
900 CONTINUE
901 CONTINUE
     END


     SUBROUTINE BETA3(EX,PJ,NBOB,EBDB,SPEBET,SDRSB,RATEN,C2Z,W,Z,A,WMAX
    1,A0,A1,A2)
     DIMENSION EBDB(200),SPEBET(200),SORSB(200),RATEN(200),W(200)
     EREST=5.11006E+05
     AZRO=3.3321E-02+4.4126E-02*ZEE+9.3870E-05*ZEE**2+4.8527E-06*ZEE**3
    1+2.6034E-08*ZEE**4
     AONE=9.6243E-01+1.5766E-02*ZEE+4.3264E-04*ZEE**2+1.1359E-07*ZEE**3
    1+3.8335E-08*ZEE**4-2.8872E-10*ZEE**5
     ATWO=1.3837-6.9268E-03*ZEE-3.8474E-04*ZEE**2+
    16.0824*EXP(-2.8856E-04*(104.01-ZEE)**2)
     A0=3.*AZRO-4.*AONE+ATWD
     A1=-3.*AZRO+6.*AONE-2.*ATWO
     A2=AZRO-2.*AONE+ATWO
     ZALPHA=Z/137.04
     ZA2=ZALPHA*ZALPHA
     S=(1.-ZA2)**0.5-1.
     WZSQ=WMAX*WMAX
     CK1=A2
     CK2=A1-2.*A2*WMAX
     CK3=A0-2.*A1*WMAX+A2*WZSQ
     CK4=A1*WZSQ-2.*A0*WMAX
     CK5=A0*WZSQ
     WM3=WMAX*WZSQ
     WM4=WM3*WMAX
     WM5=WM4*WMAX
     WM6=WM5*WMAX
     WM7=WM6*WMAX
     FINT2=CK1*(WM6-1.)/6.+CK2*(WM5-1.)/5.+CK3*(WM4-1.)/4.
    1+CK4*(WM3-1.)/3.+CK5*(WZSQ-1.)/2.
     FINT1=CK1*(WM7-1.)/7.+CK2*(WM6-1.)/6.+CK3*(WM5-1.)/5.+
    1CK4*(WM4-1.)/4.+CK5*(WM3-1.)/3.
     EAV=EREST*(FINT1/FINT2-1.)
     PI=3.141592654
     SUMS=0.
     SUMES=0.
     TWOS=2.*S
     APWR=A**0.333333333333333
     R=1.123*APWR-0.941/APWR
     COMPTW=3.86144E+02
```

```
      TEMP2=(2.*R/COMPTW)**TWDS
      C1ZA=TEMP2
      NGPS=NBDB-1
      DO 10 I=1,NGPS
      IF(W(I).GT.WMAX) GO TO 5
      IF(W(I+1).GT.WMAX) W(I+1)=WMAX
      WI7=W(I+1)**7.-W(I)**7.
      WI6=W(I+1)**6.-W(I)**6.
      WI5=W(I+1)**5.-W(I)**5.
      WI4=W(I+1)**4.-W(I)**4.
      WI3=W(I+1)**3.-W(I)**3.
      WI2=W(I+1)**2.-W(I)**2.
      SPEBET(I)=(CK1*WI6/6.+CK2*WI5/5.+CK3*WI4/4.+
     1CK4*WI3/3.+CK5*WI2/2.)*C1ZA
      SORSB(I)=((CK1*WI7/7.+CK2*WI6/6.+CK3*WI5/5.+CK4*WI4/4.+
     1CK5*WI3/3.)*C1ZA-SPEBET(I))*EREST
      GO TO 6
    5 SPEBET(I)=0.
      SORSB(I)=0.
    6 CONTINUE
      SUMS=SUMS+SPEBFT(I)
      SUMES=SUMES+SORSB(I)
   10 CONTINUE
      C2Z=PJ/SUMS
      DO 15 I=1,NGPS
      SPEBET(I)=C2Z*SPEBFT(I)
   15 SORSB(I)=C2Z*SORSB(I)
      SUMS=SUMS*C2Z
      SUMES=SUMFS*C2Z
      TMPR1=ABS(1.-SUMS/PJ)
      IF(TMPR1-1.0E-06) 30,30,40
   40 PRINT 45,TMPR1
   45 FORMAT(1H ,*SP. NORM. WRONG,  TMPR1 = *,E12.4)
   30 CONTINUE
      TMPR2=ABS(1.-SUMES/EAV/PJ)
      IF(TMPR2-1.0E-06) 35,35,55
   55 PRINT 56,TMPR2
   56 FORMAT(1H ,*EN. SP. NORM. WRONG,  TMPR2 = *,E12.4)
   35 CONTINUE
      PRINT 50
   50 FORMAT(1H ,35X,*BETA SPECTRUM*)
      PRINT 65,(SPEBET(K),K=1,NGPS)
   65 FORMAT(1H ,35X,6E12.4)
      PRINT 80
   80 FORMAT(1H ,35X,*BETA ENERGY SPECTRUM*)
      PRINT 65,(SORSB(K),K=1,NGPS)
      PRINT 101,EAV
  101 FORMAT(1H ,35X,*AVERAGE BETA ENERGY = *,E12.4)
      RETURN
      END
```

```
      SUBROUTINE BETA4(EX,PJ,NBDB,EBDB,SPEBET,SORSB,RATEN,
     1C2Z,W,WMAX,Z,A,A0,A1,A2)
      DIMENSION EBDB(200),SPEBET(200),SORSB(200),RATEN(200),W(200)
C
C     ==================================================================
C
C     SAME AS BETA2 BUT USES THE MIDPOINTS , NOT NUMERICAL INTEGRATION
C
C     ==================================================================
C
      NGPS=NBDB-1
      EREST=5.11006E+05
      OVR3=1./3.
      AA=A
      APWR=A**OVR3
      R=1.123*APWR-0.941/APWR
      ALPHA=1./137.04
      ZALPHA=Z*ALPHA
      COMPTW=3.86144E+02
      S=(1.-ZALPHA*ZALPHA)**0.5-1.
      TWOS=S*2.
      AK2=(2.*R/COMPTW)**TWOS
      GMARG=3.+TWOS
      GM=GAM1(GMARG)
      GM2=GM*GM
      AK1=4.*(1.+S/2.)/GM2
      CONST=AK1*AK2
      SP1=S+1.
      SPH=S+0.5
      SUMN=0.
      SUMEN=0.
      DO 10 I=1,NGPS
      IF(W(I).GE.WMAX) GO TO 5
      IF(W(I+1).GT.WMAX) W(I+1)=WMAX
      W4=.5*(W(I)+W(I+1))
      W2=.5*(W(I)+W4)
      W6=.5*(W4+W(I+1))
      W1=.5*(W(I)+W2)
      W3=.5*(W2+W4)
      W5=.5*(W4+W6)
      W7=.5*(W6+W(I+1))
      DELW=W1-W(I)
      CALL FERMI(W1,ZALPHA,S,SP1,SPH,WMAX,CONST,PN1,PEN1,FZW1)
      CALL FERMI(W3,ZALPHA,S,SP1,SPH,WMAX,CONST,PN3,PEN3,FZW3)
      CALL FERMI(W5,ZALPHA,S,SP1,SPH,WMAX,CONST,PN5,PEN5,FZW5)
      CALL FERMI(W7,ZALPHA,S,SP1,SPH,WMAX,CONST,PN7,PEN7,FZW7)
      SPEBET(I)=DELW*(PN1+PN3+PN5+PN7)
      SORSB(I)=DELW*EREST*(PEN1+PEN3+PEN5+PEN7)
      GO TO 6
    5 SPEBET(I)=0.
      SORSB(I)=0.
    6 SUMN = SUMN+SPEBET(I)
   10 SUMEN = SUMEN+SORSB(I)
      EAV=SUMEN/SUMN
      ENPD=(1.-AVEN/EAV)*100.
      ENPDS=(1.-EAVS/EAV)*100.
      C2Z=PJ/SUMN
      DO 20 I=1,NGPS
      SPEBET(I)=SPEBET(I)*C2Z
   20 SORSB(I)=SORSB(I)*C2Z
      PRINT 50
   50 FORMAT (1H0,35X,*BETA SPECTRUM*)
      PRINT 65,(SPEBET(K),K=1,NGPS)
```

```
   65 FORMAT(1H ,35X,6E12.4)
      PRINT 80
   80 FORMAT(1H ,35X,*BETA ENERGY SPECTRUM*)
      PRINT 65,(SORSB(K),K=1,NGPS)
      PRINT 101,FAV
  101 FORMAT(1H ,35X,*AVERAGE BETA ENERGY = *,E12.4)
      RETURN
      END


      SUBROUTINE BETA1(EX,PJ,NBDB,EBDB,SPEBET,PLAMDA,CRAT,SORSB,RATEN,
     1C2Z)
      DIMENSION EBDB(200),SPEBET(200),SORSB(200),RATEN(200)
C
C     ================================================================
C
C     THIS SUBROUTINE CALCULATES BETA SPECTRA, BETA ENERGY SPECTRA,
C      THEORETICAL INTENSITIES AND NORMALIZATION FACTORS.
C     IT USES THE LOW BETA ENERGY APPROXIMATION FOR F(Z,W)
C     NBDB = NUMBER OF GROUP BOUNDARIES.
C     EBDB = ENERGIES OF GROUP BOUNDARIES.
C     SPEBET = BETA SPECTRUM.
C     SORSB = BETA ENERGY SPECTRUM.
C     NGPS = NUMBER OF ENERGY GROUPS.
C
C     ================================================================
C
      EREST=5.11006E+05
      EY=EX/EREST+1.
      SUM1=0.
      SUM2=0.
      SUM3=0.
      SUM4=0.
      EY2=EY*EY
      EY3=EY2*EY
      EY4=EY2*EY2
      EY5=EY2*EY3
      EY6=EY3*EY3
      EAV=(EY6-2.*EY5+5.*EY2-6.*EY+2.)/(EY5-10.*EY2+15.*EY-6.)/2.
      EAV=EAV*EREST
      TEMPQ=(1.-1./EY3)/3.+0.2*(1.-1./EY5)-0.5*(1.-1./EY4)
      NGPS=NBDB-1
      XGPS=NGPS
      DO 10 I=1,NGPS
      IF(RATEN(I).GE.1.) GO TO 5
      IF(RATEN(I+1).GT.1.) RATEN(I+1)=1.
      RI2=RATEN(I)*RATEN(I)
      RIP2=RATEN(I+1)*RATEN(I+1)
      RI3=RI2*RATEN(I)
      RIP3=RIP2*RATEN(I+1)
      RI4=RI2*RI2
      RIP4=RIP2*RIP2
      RI5=RI2*RI3
      RIP5=RIP2*RIP3
      RI6=RI3*RI3
      RIP6=RIP3*RIP3
      SPEBET(I)=((RIP3-RI3)/3.+0.2*(RIP5-RI5)-0.5*(RIP4-RI4))*PJ/TEMPQ
      SORSB(I)=((RIP6-RI6)/6.-(0.4+0.2/EY)*(RIP5-RI5)+
     1(0.25+1./2./EY)*(RIP4-RI4)-(RIP3-RI3)/EY/3.)/TEMPQ*EY*PJ
      SORSB(I)=SORSB(I)*EREST
      GO TO 6
```

```
    5 SPEBET(I)=0.
      SORSB(I)=0.
    6 CONTINUE
      SUM3=SUM3+SPEBET(I)
      SUM4=SUM4+SORSB(I)
   10 CONTINUE
      TEMP1=ABS(1.-SUM3/PJ)
      IF(TEMP1-1.0E-06) 30,30,40
   40 PRINT 45,TEMP1
   45 FORMAT(1H ,* SPECTRUM NORMALIZATION IS WRONG ,    TEMP1 = *,E12.4)
   30 CONTINUE
      TEMP2=ABS(1.-SUM4/EAV/PJ)
      IF(TEMP2-1.0E-06) 35,35,55
   55 PRINT 56,TEMP2
   56 FORMAT(1H ,* ENERGY SPECTRUM NORMALIZATION IS WRONG , TEMP2 = *,
     1E12.4)
   35 CONTINUE
      PRINT 50
   50 FORMAT(1H ,35X,*BETA SPECTRUM*)
      PRINT 65,(SPEBET(K),K=1,NGPS)
   65 FORMAT(1H ,35X,6F12.4)
      PRINT 80
   80 FORMAT(1H ,35X,*BETA ENERGY SPECTRUM*)
      PRINT 65,(SORSB(K),K=1,NGPS)
      C2Z=PJ/TEMPQ/EY5
      PLAMDA=C2Z*EY5*TEMPQ
      CONST=PJ/PLAMDA
      CRAT=CONST
      RETURN
      END


      SUBROUTINE BETA2(EX,PJ,NBDB,EBDB,SPEBET,SORSB,RATEN,
     1C2Z,W,WMAX,Z,A)
      DIMENSION EBDB(200),SPEBET(200),SORSB(200),RATEN(200),W(200)
C
C     ==================================================================
C
C     SAME AS BETA1 BUT USES THE RELATIVISTIC F(Z,W) EXPRESSION
C
C     ==================================================================
C
      NGPS=NBDB-1
      EREST=5.11006E+05
      OVR3=1./3.
      AA=A
      APWR=A**OVR3
      R=1.123*APWR-0.941/APWR
      ALPHA=7.2972E-03
      ZALPHA=Z*ALPHA
      COMPTW=3.86144E+02
      S=(1.-ZALPHA*ZALPHA)**0.5-1.
      TWOS=S*2.
      AK2=(2.*R/COMPTW)**TWOS
      GMARG=3.+TWOS
      GM=GAM1(GMARG)
      GM2=GM*GM
      AK1=4.*(1.+S/2.)/GM2
      CONST=AK1*AK2
      SP1=S+1.
      SPH=S+0.5
      SUMN=0.
      SUMEN=0.
```

```
      CONV=0.1
      DO 10 I=1,NGPS
      IF(W(I).GE.WMAX) GO TO 5
      A=W(I)
      IF(W(I+1).GT.WMAX) W(I+1)=WMAX
      B=W(I+1)
      CALL SIMPSN(A,B,1,CONV,QNTGRL,ZALPHA,S,SP1,SPH,WMAX,CONST)
      SPEBET(I)=QNTGRL
      CALL SIMPSN(A,B,2,CONV,QNTGRL,ZALPHA,S,SP1,SPH,WMAX,CONST)
      SORSB(I)=QNTGRL*EREST
      GO TO 6
    5 SPEBET(I)=0.
      SORSB(I)=0.
    6 SUMN = SUMN+SPEBET(I)
   10 SUMEN = SUMEN+SORSB(I)
      EAV=SUMEN/SUMN
      C2Z=PJ/SUMN
      DO 20 I=1,NGPS
      SPEBET(I)=SPEBET(I)*C2Z
   20 SORSB(I)=SORSB(I)*C2Z
      PRINT 50
   50 FORMAT (1H0,35X,*BETA SPECTRUM*)
      PRINT 65,(SPEBET(K),K=1,NGPS)
   65 FORMAT(1H ,35X,6E12.4)
      PRINT 80
   80 FORMAT(1H ,35X,*BETA ENERGY SPECTRUM*)
      PRINT 65,(SORSB(K),K=1,NGPS)
      PRINT 101,EAV
  101 FORMAT(1H ,35X,*AVERAGE BETA ENERGY = *,E12.4)
      RETURN
      END

      SUBROUTINE SIMPSN(A,B,IFLG,CONV,QNTGRL,ZALPHA,S,SP1,SPH,WMAX,
     1CONST)
      DX=(B-A)/2.
      CALL FERMI(B,ZALPHA,S,SP1,SPH,WMAX,CONST,PNB,PENB,FZWB)
      CALL FERMI(A,ZALPHA,S,SP1,SPH,WMAX,CONST,PNA,PENA,FZWA)
      IF(IFLG.EQ.1) FI1=PNB+PNA
      IF(IFLG.EQ.2) FI1=PENB+PENA
      APDX=A+DX
      CALL FERMI(APDX,ZALPHA,S,SP1,SPH,WMAX,CONST,PNQ,PENQ,FZWQ)
      IF(IFLG.EQ.1) FI2=PNQ
      IF(IFLG.EQ.2) FI2=PENQ
      FI3=0.
      FI=DX*(FI1+4.*FI2)/3.
    2 FI3=FI2+FI3
      FI2=0.
      TDX=DX
      DX=0.5*DX
      X=A+DX
    3 CALL FERMI(X,ZALPHA,S,SP1,SPH,WMAX,CONST,PNX,PENX,FZWX)
      IF(IFLG.EQ.1) FI2=FI2+PNX
      IF(IFLG.EQ.2) FI2=FI2+PENX
      X=X+TDX
      IF(X-B)3,3,4
    4 FIP=DX*(FI1+4.*FI2+2.*FI3)/3.
      QDIF=1.-FI/FIP
      IF(ABS(QDIF)-CONV)6,6,5
    5 FI=FIP
      GO TO 2
    6 QNTGRL=FIP
      RETURN
      END
```

```
      SUBROUTINE FERMI(WI,ZALPHA,S,SP1,SPH,WMAX,CONST,PNI,PENI,FZWI)
      COMPLEX QARG,QCE,QCX,LNGAM
      IF(WI.LE.1.0001) GO TO 10
      WI2M1=WI*WI-1.
      Y=ZALPHA*WI/WI2M1**0.5
      PIY=3.141592654*Y
      EPIY=EXP(PIY)
      QYW=WI2M1**S
      QXS=WI2M1**SPH
      QQ1=WMAX-WI
      QXZ=QQ1*QQ1
      QPROD=CONST*QXS*EPIY*QXZ*WI
      QARG=CMPLX(SP1,Y)
      QCX=LNGAM(QARG)
      QCE=CEXP(QCX)
      QGAM=CABS(QCE)
      QGAM2=QGAM*QGAM
      PNI=QPROD*QGAM2
      FZWI=CONST*QYW*EPIY*QGAM2
      GO TO 20
   10 TPZA=6.283185308*ZALPHA
      PNI=TPZA*CONST*WI*WI*(WMAX-WI)*(WMAX-WI)*((ZALPHA*ZALPHA+0.25)*WI*
     1WI-0.25)**S
      FZWI=1.0E+30
   20 PENI=PNI*(WI-1.)
      RETURN
      END

      SUBROUTINE GAMMA2(ES,PI,NBDG,EBDG,SPEGAM,SORSG,NEP)
      DIMENSION EBDG(200),SPEGAM(200),SORSG(200),ES(900),PI(900),
     1SPTMP1(80),SPTMP2(80)
C
C     ================================================================
C
C     SAME AS GAMMA1 BUT GIVES GAUSSIAN ENERGY SPREAD TO LINE SPECTRA.
C
C     ================================================================
C
      NGPS=NBDG-1
      NSTDEV=2
      STDEVN=NSTDEV
      DO 3 I=1,NGPS
      SPEGAM(I)=0.
    3 SORSG(I)=0.
      DO 10 J=1,NEP
      IF(PI(J)-1.0E-35)31,4,4
    4 SIGMA=.5742264BE-02*(ES(J)/1000.)+.679988668*(ES(J)/1000.)**0.5
      PIES=PI(J)*ES(J)
      IF(SIGMA) 23,23,5
    5 FWHM=2.35482*SIGMA
      ESPRED=STDEVN*FWHM*1000.
      EPSPRD=ES(J)+ESPRED
      EMSPRD=ES(J)-ESPRED
      SIGSQ2=SIGMA*SIGMA*2.
      DO 12 I=1,NBDG
      K=I-1
      IF(EBDG(I)-ES(J)) 12,13,13
   12 CONTINUE
   13 K1=K
      K2=K
   14 CONTINUE
      IF(EBDG(K1+1)-EPSPRD) 15,16,16
```

```
 15 K1=K1+1
    GO TO 14
 16 KUL=K1
    IF(KUL-NGPS) 17,17,18
 18 KUL=NGPS
 17 CONTINUE
    IF(EBDG(K2)-EMSPRD)9,9,8
  8 K2=K2-1
    GO TO 17
  9 KLL=K2
    IF(KLL-1) 19,20,20
 19 KLL=1
 20 SMNRM=0.
    SMNRME=0.
    JK1=0
    KMAX=KUL-KLL+1
    DO 120 I=1,KMAX
    SPTMP1(I)=0.
120 SPTMP2(I)=0.
    DO 21 JK=KLL,KUL
    DELTE=EBOG(JK+1)-EBDG(JK)
    EMID=EBDG(JK)+0.5*DELTE
    JK1=JK1+1
    EDIFSQ=(EMIO-ES(J))*(EMIO-ES(J))/1.0E+06
    EARG=EDIFSQ/SIGSQ2
    IF(EARG-1.0E-05)201,201,202
201 SPTMP1(JK1)=PI(J)*DELTE*(1.-EARG)
    GO TO 210
202 IF(EARG-670.)203,203,204
204 SPTMP1(JK1)=0.
    GO TO 210
203 SPTMP1(JK1)=PI(J)*DELTE*EXP(-EARG)
210 CONTINUE
    SMNRM=SMNRM+SPTMP1(JK1)
    SPTMP2(JK1)=SPTMP1(JK1)*EMID
 21 SMNRME=SMNRME+SPTMP2(JK1)
    JK1=0
    QNORM1=PI(J)/SMNRM
    QNORM2=PIES/SMNRME
    DO 22 JK=KLL,KUL
    JK1=JK1+1
    SPTMP1(JK1)=SPTMP1(JK1)*QNORM1
    SPTMP2(JK1)=SPTMP2(JK1)*QNORM2
    SPEGAM(JK)=SPEGAM(JK)+SPTMP1(JK1)
 22 SORSG(JK)=SORSG(JK)+SPTMP2(JK1)
    GO TO 31
 23 CONTINUE
    DO 24 I=1,NBOG
    KK=I-1
    IF(EBDG(I)-ES(J)) 24,25,25
 24 CONTINUE
 25 SPEGAM(KK)=SPEGAM(KK)+PI(J)
    SORSG(KK)=SORSG(KK)+PIES
 31 CONTINUE
 10 CONTINUE
    PRINT 40
 40 FORMAT(1H ,50X,*GAMMA SPECTRUM*/)
    PRINT 45,(SPEGAM(K),K=1,NGPS)
 45 FORMAT(1H ,50X,6E12.4)
    PRINT 50
 50 FORMAT(1H ,50X,*GAMMA ENERGY SPECTRUM*/)
    PRINT 45,(SORSG(K),K=1,NGPS)
    RETURN
    END
```

```
      SUBROUTINE GAMMA1(ES,PI,NBOG,EBDG,SPEGAM,SORSG,NEP)
      DIMENSION EBDG(200),SPEGAM(200),SORSG(200),ES(900),PI(900)
C
C     ==================================================================
C
C     THIS SUBROUTINE CALCULATES GAMMA SPECTRA AND GAMMA ENERGY SPECTRA.
C     NBDG = NUMBER OF GROUP BOUNDARIES.
C     NGPS= NUMBER OF ENERGY GROUPS.
C     EBDG = ENERGIES OF GROUP BOUNDARIES.
C     SPEGAM = GAMMA SPECTRUM.
C     SORSG = GAMMA ENERGY SPECTRUM.
C
C     ==================================================================
C
      NGPS=NBDG-1
      DO 10 J=1,NEP
      DO 12 I=1,NBDG
      K=I-1
      IF(EBDG(I)-ES(J)) 12,13,13
   12 CONTINUE
   13 SPEGAM(K)=SPEGAM(K)+PI(J)
      SORSG(K)=SORSG(K)+PI(J)*ES(J)
   10 CONTINUE
      PRINT 20
   20 FORMAT(1H ,50X,*GAMMA SPECTRUM*/)
      PRINT 35,(SPEGAM(K),K=1,NGPS)
   35 FORMAT(1H ,50X,6E12.4)
      PRINT 50
   50 FORMAT(1H ,50X,*GAMMA ENERGY SPECTRUM*)
      PRINT 35,(SORSG(K),K=1,NGPS)
      RETURN
      END
```

LISTING OF THE FPSPEC PROGRAM

```
      PROGRAM FPSPEC(INP,OUT,PUN,FSET5,FSET6,FILM)
      DIMENSION EBDB(200),EBDG(200),SPEGAM(200),SORSG(200),BETAS(200),
     1BETAES(200),TSPB(200),TSPEB(200),TSPG(200),TSPEG(200),DUM1(500),
     2DUM2(500),HL(50)
      DIMENSION EBDBM(200),EBOGM(200),GAMEXP(200),BETEXP(200)
      DIMENSION GMEXP1(200),TSPEG1(200)
      DIMENSION GAMERR(200),GAMPER(200),GAMMER(200)
      DIMENSION BETERR(200),BETPER(200),BETMER(200)
      DIMENSION XEN(3),YSP(3),EBX(200),EGX(200),EGXM(200)
      DIMENSION EBXM(200)
      DIMENSION TI(10),ABSIS(10),DRDIN(10)
C
C     EBOB - BETA ENERGY GROUP BOUNDARIES
C     EBDG - GAMMA ENERGY GROUP BOUNDARIES
C     SPEGAM - GAMMA SPECTRUM
C     SORSB - GAMMA ENERGY SPECTRUM
C     BETAS - BETA SPECTRUM
C     BETAES - BETA ENERGY SPECTRUM
C     TSPB - TOTAL BETA SPECTRUM
C     TSPEB - TOTAL BETA ENERGY SPECTRUM
C     TSPG - TOTAL GAMMA SPECTRUM
C     TSPEG - TOTAL GAMMA ENERGY SPECTRUM
C     IF NPUN 1, SOME DATA ARE PUNCHED
C     NBPLT - NUMBER OF BETA GROUPS PLOTTED
C     NGPLT - NUMBER OF GAMMA GROUPS PLOTTED
C     IF NPLOT = 1,PLOTTING IS DONE.
C     IF ICOMPB = 1, COMPARISON OF BETA SPECTRA WITH EXPERIMENT
C     IF ICOMPG = 1, COMPARISON OF GAMMA SPECTRA WITH EXPERIMENT
C     GAMEXP - EXPERIMENTAL GAMMA SPECTRUM FOR COMPARISON
C     GAMERR - ERRORS OF EXPERIMENTAL GAMMA SPECTRUM
C     BETEXP - EXPERIMENTAL BETA SPECTRUM FOR COMPARISON
C     NGEXP - NUMBER OF EXPERIMENTAL GAMMA GROUPS
C     NBEXP - NUMBER OF EXPERIMENTAL BETA GROUPS
C     ID AND IOE ARE MAT IDENTIFICATION NUMBERS
C     IF STYP = 0. GAMMA SPECTRUM IS PROVIDED ON INPUT TAPE
C     IF STYP = 1.0 GAMMA SPECTRUM IS PROVIDED ON INPUT TAPE
C     NSP IS THE NUMBER OF SPECTRA PER NUCLIDE ON INPUT TAPE
C     IF NBETS = 1,BETA SPECTRA ARE INPUT FOR EACH ISOTOPE
C     IF NGAMS = 1, GAMMA SPECTRA ARE INPUT FOR EACH ISOTOPE
C     GPS - GAMMAS PER SECOND (181 F.P.)
C     BPS - BETAS PER SECOND (181 F.P.)
C     GMEVPS - GAMMA MEV PER SECOND (181 F.P.)
C     BMEVPS - BETA MEV PER SECONO (181 F.P.)
C     CGMVPS - CINDER GAMMA MEV PER SECOND (181 F.P.)
C     CBMVPS - CINDER BETA MEV PER SECOND (181 F.P.)
C     GMEVPF - GAMMA MEV/FISSION (181 F.P.)
C     BMEVPF - BETA MEV/FISSION (181 F.P.)
C     CGMVPF - CINDER GAMMA MEV/FISSION (181 F.P.)
C     CBMVPF - CINDER BETA MEV/FISSION (181 F.P.)
C     TTOT - TOTAL TIME (IN-FLUX AND SHUTDOWN)
C     TOCY - TIME SINCE LAST POWER STEP
C     DENS - ISOTOPE ATOMIC DENSITY
C     BETE - TOTAL CINDER MEV/FISSION (BETA) INCLUDING DENSITY
C     GAME - TOTAL CINDER MEV/FISSION (GAMMA) INCLUDING DENSITY
C     BPGE - BETA PLUS GAMMA TOTAL CINDER MEV/FISSION INCLS. DENS.
C     IF NGAS = 1, GASEOUS F. P. ARE CALCULATED
C     IBCT = BETA ISOTOPE COUNT (181 F.P.)
C     IGCT = GAMMA ISOTOPE COUNT (181 F.P.)
C     IGASB = BETA GAS ISOTOPE COUNT (181 F.P.)
```

```
C       IGASG = GAMMA GAS ISOTOPE COUNT (181 F.P.)
C       NGSBT = BETA GAS ISOTOPE COUNT (825 F.P.)
C       NGSGT = GAMMA GAS ISOTOPE COUNT (825 F.P.)
C       SMGASB = BETA GASEOUS MEV / FISSION (181 F.P.)
C       SMGASG = GAMMA GASEOUS MEV / FISSION (181 F.P.)
C       TGASB = BETA GASEOUS MEV / FISSION (825 F.P.)
C       TGASG = GAMMA GASEOUS MEV / FISSION (825 F.P.)
C       ACT - ACTIVITY
C
        CALL EXH
        READ 10,NPUN,NGAS
        READ 10,NPLOT,IOPT
        READ 10,ICOMPB,ICOMPG
        IF(NPLOT.EQ.1)READ 10,NBPLT,NGPLT
        IF(ICOMPB.EQ.1)READ 10,NBEXP
        IF(ICOMPG.EQ.1)READ 10,NGEXP
        IF(ICOMPB.EQ.1.AND.NPLOT.EQ.1) READ 10,NBXPLT
        IF(ICOMPG.EQ.1.AND.NPLOT.EQ.1) READ 10,NGXPLT
        IF(NPLOT.EQ.1)READ 20,QLMPLT
        IOPT=0
        IF(ICOMPG.NE.1) GO TO 3
        READ 20,(EGX(I),I=1,NGEXP)
        DO 7421 I=1,NGEXP
 7421   EGX(I)=EGX(I)*1.0E+06
        NGEXM1=NGEXP-1
        DO 7321 I=1,NGEXM1
        EGXM(I)=0.5*(EGX(I)+EGX(I+1))/1.0E+06
 7321   CONTINUE
        NGEXP=NGEXM1
        READ 20,(GAMEXP(I),I=1,NGEXP)
        READ 20,(GAMERR(I),I=1,NGEXP)
        DO 2 I=1,NGEXP
        GAMERR(I)=ABS(GAMERR(I))
        GAMPER(I)=GAMEXP(I)+GAMERR(I)
        GAMMER(I)=GAMEXP(I)-GAMERR(I)
    2   CONTINUE
        SMEXPG=0.
    3   CONTINUE
        IF(ICOMPB.NE.1) GO TO 4
        READ 20,(EBX(I),I=1,NBEXP)
        NBEXM1=NBEXP-1
        DO 7121 I=1,NBEXP
 7121   EBX(I)=EBX(I)*1.0E+06
        EBXM(1)=(EBX(1)+EBX(2))*0.5
        DO 7122 I=2,NBEXM1
 7122   EBXM(I)=EBXM(I-1)+0.5*(EBX(I+1)-EBX(I-1))
        NBEXP=NBEXM1
        NBEXP1=NBEXP+1
        READ 20,(BETEXP(I),I=1,NBEXP)
        READ 20,(BETERR(I),I=1,NBEXP)
        DO 6101 I=1,NBEXP
        BETPER(I)=BETEXP(I)+BETERR(I)
 6101   BETMER(I)=BETEXP(I)-BETERR(I)
        SMEXPB=0.
    4   CONTINUE
        READ(5,10)NBETS,NGAMS
        READ(5,10)NBDB,IBET
   10   FORMAT(2I10)
        FACTR=1.0E+06
        IBCT=0
```

```
      IGCT=0
      IGASB=0
      IGASG=0
      NGSBT=0
      NGSGT=0
      SMGASB=0.
      SMGASG=0.
      TGASB=0.
      TGASG=0.
      BSUM1=0.
      GSUM1=0.
      NBDM1=NBDB-1
      READ(5,20)(EBDB(I),I=1,NBDB)
   20 FORMAT(6E12.4)
      DENB=EBDB(2)-EBDB(1)
      DO 6109 I=1,NBEXP
      BETEXP(I)=BETEXP(I)/1.0E+06*DENB
      BETERR(I)=BETERR(I)/1.0E+06*DENB
      BETPER(I)=BETPER(I)/1.0E+06*DENB
 6109 BETMER(I)=BETMER(I)/1.0E+06*DENB
      PRINT 2001
 2001 FORMAT(1H0,35X,*BETA ENERGY BOUNDARIES (EV)*/)
      PRINT 220,(EBDB(I),I=1,NBDB)
      IF(NPUN.EQ.1) PUNCH 5101
 5101 FORMAT(1H ,*BETA ENERGY BOUNDARIES (EV)*)
      IF(NPUN.EQ.1) PUNCH 873,(EBDB(I),I=1,NBDB)
      IF(ICOMPB.EQ.1) PRINT 5001
 5001 FORMAT(1H0,35X,*EXPERIMENTAL BETA ENERGY POINTS (EV)*/)
      IF(ICOMPB.EQ.1) PRINT 220,(EBXM(I),I=1,NBEXP)
      IF(ICOMPB.EQ.1.AND.NPUN.EQ.1) PUNCH 5102
 5102 FORMAT(1H ,*EXPERIMENTAL BETA ENERGY POINTS (EV)*)
      IF(ICOMPB.EQ.1.AND.NPUN.EQ.1) PUNCH 873,(EBXM(I),I=1,NBEXP)
      READ(5,10) NBDG,IGAM
      READ(5,20)(EBDG(I),I=1,NBDG)
      DENG=EBDG(2)-EBDG(1)
      DO 7621 I=1,NGEXP
      GAMEXP(I)=GAMEXP(I)*DENG/1.0E+06
      GAMERR(I)=GAMERR(I)*DENG/1.0E+06
      GAMPER(I)=GAMPER(I)*DENG/1.0E+06
 7621 GAMMER(I)=GAMMER(I)*DENG/1.0E+06
      PRINT 2002
 2002 FORMAT(1H0,35X,*GAMMA ENERGY BOUNDARIES (EV)*/)
      PRINT 220,(EBDG(I),I=1,NBDG)
      IF(NPUN.EQ.1) PUNCH 5103
 5103 FORMAT(1H ,*GAMMA ENERGY BOUNDARIES (EV)*)
      IF(NPUN.EQ.1) PUNCH 873,(EBDG(I),I=1,NBDG)
      IF(ICOMPG.EQ.1) PRINT 5002
 5002 FORMAT(1H0,35X,*EXPERIMENTAL GAMMA ENERGY POINTS (MEV)*/)
      IF(ICOMPG.EQ.1) PRINT 220,(EGX(I),I=1,NGEXP)
      IF(ICOMPG.EQ.1.AND.NPUN.EQ.1) PUNCH 5104
 5104 FORMAT(1H ,*EXPERIMENTAL GAMMA ENERGY POINTS (MEV)*)
      IF(ICOMPG.EQ.1.AND.NPUN.EQ.1) PUNCH 873,(EGX(I),I=1,NGEXP)
      NBDGM1=NBDG-1
      IF(ICOMPG.NE.1) GO TO 21
      DO 6 I=1,NGEXP
      SMEXPG=SMEXPG+GAMEXP(I)*(EGX(I+1)-EGX(I))/DENG
      EGX(I)=EGXM(I)
    6 GMEXP1(I)=SMEXPG
   21 CONTINUE
      IF(ICOMPB.NE.1) GO TO 22
```

```
      DO 7 I=1,NBEXP
    7 SMEXPB=SMEXPB+BETEXP(I)*(EBX(I+1)-EBX(I))/DENB
   22 CONTINUE
      DO 105 I=1,NBDM1
      TSPB(I)=0.
  105 TSPEB(I)=0.
      DO 106 I=1,NBDGM1
      TSPG(I)=0.
  106 TSPEG(I)=0.
      IF(NGAS.NE.1) GO TO 1001
      DO 1002 I=1,7
      READ(6,110) DUM
 1002 CONTINUE
      READ(6,120)(HL(I),I=1,10)
      READ(6,120)(HL(I),I=1,10)
      READ(6,120)(HL(I),I=1,10)
 1003 READ(6,130)ID,GAS,AID,DENS,ACT,BETE,GAME,BPGE
      IF(EOF,6)1001,1004
 1004 IF(GAS.NE.5H GAS ) GO TO 1003
      NGSBT=NGSBT+1
      NGSGT=NGSGT+1
      TGASB=TGASB+BETE
      TGASG=TGASG+GAME
      GO TO 1003
 1001 CONTINUE
      REWIND 6
    1 READ(5,30)SYM1,SYM2,IDE,MAT5,NDK,NSP
      IF(EOF,5)200,35
   35 READ(5,40)STYP
      READ(6,110)TTOT
  110 FORMAT(1X,E12.6)
      READ(6,110)TDCY
      READ(6,110)FPS
      READ(6,110)DELT
      READ(6,110)BETOT
      READ(6,110)GAMTOT
      READ(6,110)SUMBG
      READ(6,120)(HL(I),I=1,10)
      READ(6,120)(HL(I),I=1,10)
      READ(6,120)(HL(I),I=1,10)
  120 FORMAT(10A8)
   30 FORMAT(2A5,4I10)
   40 FORMAT(F6.2)
      IF(NBETS.EQ.1.AND.STYP.EQ.1.0) GO TO 80
      GO TO 90
   80 READ(5,20)(BETAS(I),I=1,NBDM1)
      READ(5,20)(BETAES(I),I=1,NBDM1)
      READ(5,20)EBA,SUMENB
      DO 81 I=1,NBDM1
   81 BETAES(I)=BETAES(I)/1.0E+06
      IBCT=IBCT+1
      TMPSB=0.
      DO 83 I=1,NBDM1
   83 TMPSB=TMPSB+BETAES(I)
      GO TO 100
   90 DO 95 I=1,NBDM1
      BETAS(I)=0.
   95 BETAES(I)=0.
      TMPSB=0.
  100 CONTINUE
```

```
      IF(STYP.EQ.1.0.AND.NSP.NE.2) GO TO 60
      IF(STYP.EQ.0.0.AND.NSP.NE.2) GO TO 107
      READ(5,40)STYP
  107 IF(NGAMS.EQ.1.AND.STYP.EQ.0.0) GO TO 50
      GO TO 60
   50 READ(5,20)(SPEGAM(I),I=1,NBDGM1)
      READ(5,20)(SORSG(I),I=1,NBDGM1)
      READ(5,20)ETG,SUMENG
      DO 52 I=1,NBDGM1
   52 SORSG(I)=SORSG(I)/1.0E+06
      IGCT=IGCT+1
      TMPSG=0.
      DO 53 I=1,NBDGM1
   53 TMPSG=TMPSG+SORSG(I)
      GO TO 70
   60 DO 65 I=1,NBDGM1
      SPEGAM(I)=0.
   65 SORSG(I)=0.
      TMPSG=0.
   70 CONTINUE
  125 READ(6,130)IO,GAS,AIO,DENS,ACT,BETE,GAME,BPGE
  130 FORMAT(1X,I7,A5,A2,5(1X,E12.6))
      IF(ID.NE.IOE) GO TO 125
      IF(IOPT.NE.1) GO TO 139
      IF(ACT.LT.1.0E-35) GO TO 139
      BETEE=BETE/ACT
      GAMEE=GAME/ACT
      IF(BETEE.EQ.0.0) GO TO 138
      ABDB=ABS(1.-TMPSB/BETEE)*100.
      IF(ABDB.GT.1.0E-02) PRINT 131,SYM1,SYM2,IDE,ABDB,TMPSB,BETEE
  131 FORMAT(1H ,5X,*ISOTOPE *,A5,A5,*  ,ID = *,I7,* HAS *,F9.3,* PERCEN
     1T DIFFERENCE IN BETA ENERGY, I.E. *,E12.4,* VS. *,E12.4)
  138 CONTINUE
      IF(GAMEE.EQ.0.0) GO TO 139
      ABDG=ABS(1.-TMPSG/GAMEE)*100.
      IF(ABDG.GT.1.0E-02) PRINT 132,SYM1,SYM2,IDE,ABDG,TMPSG,GAMEE
  132 FORMAT(1H ,5X,*ISOTOPE *,A5,A5,*  ,ID = *,I7,* HAS *,F9.3,* PERCEN
     1T DIFFERENCE IN GAMMA ENERGY, I.E. *,E12.4,* VS. *,E12.4)
  139 CONTINUE
      IF(NGAS.EQ.1.AND.GAS.NE.5H GAS ) GO TO 199
      IF(NGAS.NE.1) GO TO 169
      IGASB=IGASB+1
      IGASG=IGASG+1
      SMGASB=SMGASB+BETE
      SMGASG=SMGASG+GAME
  169 CONTINUE
      BSUM1=BSUM1+BETE
      GSUM1=GSUM1+GAME
      DO 140 I=1,NBDM1
      TSPB(I)=TSPB(I)+BETAS(I)*ACT
  140 TSPEB(I)=TSPEB(I)+BETAES(I)*ACT
      DO 150 I=1,NBDGM1
      TSPG(I)=TSPG(I)+SPEGAM(I)*ACT
  150 TSPEG(I)=TSPEG(I)+SORSG(I)*ACT
  199 CONTINUE
      REWIND 6
      GO TO 1
  200 GPS=0.
      BPS=0.
      GMEVPS=0.
```

```
      BMEVPS=0.
      DO 300 I=1,NBDM1
      BPS=BPS+TSPB(I)
  300 BMEVPS=BMEVPS+TSPEB(I)
      DO 310 I=1,NBOGM1
      GPS=GPS+TSPG(I)
  310 GMEVPS=GMEVPS+TSPEG(I)
      BMEVPF=BMEVPS/FPS
      GMEVPF=GMEVPS/FPS
      GPF=GPS/FPS
      BPF=BPS/FPS
      PBET=100.*(1.-BMEVPF/BETOT)
      PGAM=100.*(1.-GMEVPF/GAMTOT)
      CBMVPS=BSUM1
      CGMVPS=GSUM1
      CBMVPF=CBMVPS/FPS
      CGMVPF=CGMVPS/FPS
      PBC=100.*(1.-BMEVPF/CBMVPF)
      PGC=100.*(1.-GMEVPF/CGMVPF)
      PRINT 210,TTOT,TDCY
  210 FORMAT(1H1,5X,*TOTAL BETA SPECTRUM AT *,E12.6,* SEC. TOTAL AND *,
     1E12.6,* SEC. DECAY (BETAS/SEC)*/)
      PRINT 220,(TSPB(I),I=1,NBDM1)
  220 FORMAT(1H ,6E15.5)
      PRINT 230,TTOT,TDCY
  230 FORMAT(1H0,5X,*TOTAL BETA ENERGY SPECTRUM AT *,E12.6,* SEC. TOTAL
     1AND *,E12.6,* SEC. DECAY (MEV/SEC)*/)
      PRINT 220,(TSPEB(I),I=1,NBDM1)
      PRINT 240,TTOT,TDCY
  240 FORMAT(1H0,5X,*TOTAL GAMMA SPECTRUM AT *,E12.6,* SEC. TOTAL AND *,
     1E12.6,* SEC. DECAY (GAMMAS/SEC)*/)
      PRINT 220,(TSPG(I),I=1,NBOGM1)
      PRINT 250,TTOT,TDCY
  250 FORMAT(1H0,5X,*TOTAL GAMMA ENERGY SPECTRUM AT *,E12.6,* SEC. TOTAL
     1 AND *,E12.6,* SEC. DECAY (MEV/SEC)*/)
      PRINT 220,(TSPEG(I),I=1,NBDGM1)
      PRINT 251
  251 FORMAT(1H0,///)
      DO 252 I=1,NBDM1
      TSPB(I)=TSPB(I)/FPS
  252 TSPEB(I)=TSPEB(I)/FPS
      DO 253 I=1,NBOGM1
      TSPG(I)=TSPG(I)/FPS
  253 TSPEG(I)=TSPEG(I)/FPS
      PRINT 320,TTOT,TDCY
  320 FORMAT(1H0,5X,*TOTAL BETA SPECTRUM AT *,E12.6,* SEC. TOTAL AND *,
     1E12.6,* SEC. DECAY (BETAS/FISSION)*/)
      PRINT 220,(TSPB(I),I=1,NBDM1)
      PRINT 330,TTOT,TDCY
  330 FORMAT(1H0,5X,*TOTAL BETA ENERGY SPECTRUM AT *,E12.6,* SEC. TOTAL
     1AND *,E12.6,* SEC. DECAY (MEV/FISSION)*/)
      PRINT 220,(TSPEB(I),I=1,NBDM1)
      PRINT 340,TTOT,TDCY
  340 FORMAT(1H0,5X,*TOTAL GAMMA SPECTRUM AT *,E12,6,* SEC. TOTAL AND *,
     1E12,6,* SEC. DECAY (GAMMAS/FISSION)*/)
      PRINT 220,(TSPG(I),I=1,NBDGM1)
      PRINT 350,TTOT,TDCY
  350 FORMAT(1H0,5X,*TOTAL GAMMA ENERGY SPECTRUM AT *,E12.6,* SEC. TOTAL
     1 AND *,E12,6,* SEC. DECAY (MEV/FISSION)*/)
      PRINT 220,(TSPEG(I),I=1,NBOGM1)
```

```
      PRINT 251
      PRINT 400,FPS
  400 FORMAT(1H1,20X,*FISSIONS / SEC = *,E12.6)
      PRINT 401,BPS
  401 FORMAT(1H0,20X,*BETAS / SEC = *,E12.6)
      PRINT 410,BPF
  410 FORMAT(1H0,20X,*BETAS / FISSION = *,E12.6)
      PRINT 420,BMEVPS
  420 FORMAT(1H0,20X,*BETA MEV / SEC = *,E12.6)
      IF(ICOMPB.NE.1) GO TO 422
      PRINT 421,SMEXPB
  421 FORMAT(1H0,20X,*EXPERIMENTAL BETA MEV / FISSION = *,E12.6)
  422 CONTINUE
      PRINT 430,BMEVPF
  430 FORMAT(1H0,20X,*BETA MEV / FISSION = *,E12.6)
      PRINT 415,CBMVPF,PBC
  415 FORMAT(1H0,5X,*CINDER BETA MEV / FISSION = *,E12,6,
     1*    PERCENT DIFFERENCE = *,E12,6)
      PRINT 510,GPS
  510 FORMAT(1H0,20X,*GAMMAS / SEC = *,E12,6)
      PRINT 520,GPF
  520 FORMAT(1H0,20X,*GAMMAS / FISSION = *,E12,6)
      PRINT 530,GMEVPS
  530 FORMAT(1H0,20X,*GAMMA MEV / SEC = *,E12,6)
      IF(ICOMPG.NE.1) GO TO 532
      PRINT 531,SMEXPG
  531 FORMAT(1H0,20X,*EXPERIMENTAL GAMMA MEV / FISSION = *,E12,6)
  532 CONTINUE
      PRINT 540,GMEVPF
  540 FORMAT(1H0,20X,*GAMMA MEV / FISSION = *,E12.6)
      PRINT 535,CGMVPF,PGC
  535 FORMAT(1H0,5X,*CINDER GAMMA MEV / FISSION = *,E12.6,
     1*    PERCENT DIFFERENCE = *,E12,6)
      PRINT 610,BETOT,PBET
  610 FORMAT(1H0,5X,*CINDER TOTAL BETA MEV / FISSION = *,E12.6,
     1*    PERCENT DIFFERENCE = *,E12.6)
      PRINT 620,GAMTOT,PGAM
  620 FORMAT(1H0,5X,*CINDER TOTAL GAMMA MEV / FISSION = *,E12.6,
     1*    PERCENT DIFFERENCE = *,E12,6)
      PRINT 630,IBCT,IGCT
  630 FORMAT(1H0,20X,*BETA COUNT = *,I3,*    ,GAMMA COUNT = *,I3)
      IF(NGAS.NE.1) GO TO 671
      PRINT 670,IGASB,IGASG
  670 FORMAT(1H0,20X,*BETA GAS COUNT = *,I3,*    ,GAMMA GAS COUNT = *,I3)
      PRINT 689,NGSBT,NGSGT
  689 FORMAT(1H0,20X,*BETA TOTAL GAS COUNT = *,I3,*   , GAMMA TOTAL GAS C
     1OUNT = *,I3)
      SMGASB=SMGASB/FPS
      SMGASG=SMGASG/FPS
      TGASB=TGASB/FPS
      TGASG=TGASG/FPS
      PRINT 674,SMGASB
      PRINT 675,SMGASG
      PRINT 672,TGASB
      PRINT 673,TGASG
  672 FORMAT(1H0,5X,*CINDER TOTAL GAS BETA MEV / FISSION = *,E12,6)
  673 FORMAT(1H0,5X,*CINDER TOTAL GAS GAMMA MEV / FISSION = *,E12,6)
  674 FORMAT(1H0,5X,*CINDER GAS BETA MEV / FISSION = *,E12,6)
  675 FORMAT(1H0,5X,*CINDER GAS GAMMA MEV / FISSION = *,E12,6)
  671 CONTINUE
```

```
      RATB=BMEVPF/BETOT
      RATBC=CBMVPF/BETOT
      RATG=GMEVPF/GAMTOT
      RATGC=CGMVPF/GAMTOT
      IF(ICOMPG.NE.1) GO TO 631
      RATEXG=SMEXPG/GAMTOT
      RATXG1=SMEXPG/GMEVPF
      RATXEC=RATEXG/GMEVPF*CGMVPF
  631 CONTINUE
      IF(ICOMPB.NE.1) GO TO 632
      RATEXB=SMEXPB/BMEVPF*RATBC
  632 CONTINUE
      PRINT 710,RATB
  710 FORMAT(1H0,5X,*RATIO OF BETA MEV / FISSION TO TOTAL CINDER BETA ME
     1V / FISSION = *,E12.6)
      PRINT 720,RATBC
  720 FORMAT(1H0,5X,*RATIO OF CINDER BETA MEV / FISSION TO TOTAL CINDER
     1BETA MEV / FISSION = *,E12.6)
      PRINT 730,RATG
  730 FORMAT(1H0,5X,*RATIO OF GAMMA MEV / FISSION TO TOTAL CINDER GAMMA
     1MEV / FISSION = *,E12.6)
      PRINT 740,RATGC
  740 FORMAT(1H0,5X,*RATIO OF CINDER GAMMA MEV / FISSION TO TOTAL CINDER
     1 GAMMA MEV / FISSION = *,E12.6)
      IF(ICOMPG.NE.1) GO TO 742
      PRINT 741,RATEXG
  741 FORMAT(1H0,5X,*RATIO OF EXPERIMENTAL GAMMA MEV / FISSION TO TOTAL
     1CINDER GAMMA MEV / FISSION = *,E12.6)
      PRINT 747,RATXEC
  747 FORMAT(1H0,5X,*RATIO OF EXPERIMENTAL GAMMA MEV / FISSION TO TOTAL
     1CINDER GAMMA MEV / FISSION (EXCLUDING CONVERSION ELECTRONS) = *,
     2E12.6)
      PRINT 746,RATXG1
  746 FORMAT(1H0,5X,*RATIO OF EXPERIMENTAL GAMMA MEV / FISSION TO TOTAL
     1MEV / FISSION = *,E12.6)
  742 CONTINUE
      IF(ICOMPB.NE.1) GO TO 744
      PRINT 743,RATEXB
  743 FORMAT(1H0,5X,*RATIO OF EXPERIMENTAL BETA MEV / FISSION TO TOTAL B
     1ETA MEV / FISSION = *,E12.6)
  744 CONTINUE
      PRINT 793
  793 FORMAT(1H0,///,5X,*NB. TOTAL REFERS TO ALL 825 FISSION PRODUCTS,
     1THE REST REFER TO THE 181 FISSION PRODUCTS*)
      PRINT 794
  794 FORMAT(1H0,5X,*THE FOLLOWING SPECTRA ARE NORMALIZED TO THE TOTAL C
     1INDER-CALCULATED GAMMA AND BETA MEV/FISSION*,/,5X,* FOR ALL 825 FI
     2SSION PRODUCTS*///)
      IF(NGAS.EQ.1) RATB=TGASB/SMGASB
      IF(NGAS.EQ.1) RATGC=TGASG/SMGASG
      DO 810 I=1,NBDM1
      EBDBM(I)=0.5*(EBDB(I)+EBDB(I+1))/1.0E+06
      TSPB(I)=TSPB(I)/RATB
  810 TSPEB(I)=TSPEB(I)/RATB
      SMGCS=0.
      DO 820 I=1,NBDGM1
      EBDGM(I)=0.5*(EBDG(I)+EBDG(I+1))/1.0E+06
      TSPG(I)=TSPG(I)/RATGC
      TSPEG(I)=TSPEG(I)/RATGC
      SMGCS=SMGCS+TSPEG(I)
```

```
 820 TSPEG1(I)=SMGCS
     PRINT 830,TTOT,TDCY
 830 FORMAT(1H1,5X,*NORMALIZED BETA SPECTRUM AT *,E12.6,* SEC. TOTAL AN
    1D *,E12.6,* SEC. DECAY (BETAS/FISSION)*/)
     PRINT 220,(TSPB(I),I=1,NBDM1)
     PRINT 840,TTOT,TDCY
 840 FORMAT(1H0,5X,*NORMALIZED BETA ENERGY SPECTRUM AT *,E12.6,* SEC. T
    1OTAL AND *,E12.6,* SEC. DECAY (MEV/FISSION)*/)
     PRINT 220,(TSPEB(I),I=1,NBDM1)
     IF(NPUN.EQ.1) PUNCH 4010,TTOT,TDCY
4010 FORMAT(1H ,*BETA MEV/FISSION AT *,E12.6,* SEC. TOTAL AND *,E12.6,
    1* SEC. DECAY*)
     IF(NPUN.EQ.1) PUNCH 873,(TSPEB(I),I=1,NBDM1)
     IF(ICOMPB.NE.1) GO TO  841
     PRINT 842,TTOT,TDCY
 842 FORMAT(1H0,5X,*EXPERIMENTAL BETA ENERGY SPECTRUM AT *,E12.6,* SEC.
    1 TOTAL AND *,E12.6,* SEC. DECAY (MEV/FISSION)*/)
     PRINT 220,(BETEXP(I),I=1,NBEXP)
     PRINT 4963
4963 FORMAT(1H0,5X,*EXPERIMENTAL BETA ERRORS (MEV/FISSION)*/)
     PRINT 220,(BETERR(I),I=1,NBEXP)
     IF(NPUN.EQ.1) PUNCH 4020
4020 FORMAT(1H ,*EXPERIMENTAL BETA MEV/FISSION*)
     IF(NPUN.EQ.1) PUNCH 873,(BETEXP(I),I=1,NBEXP)
     IF(NPUN.EQ.1) PUNCH 4961
4961 FORMAT(1H ,*EXPERIMENTAL BETA ERRORS(MEV/FISSION)*)
     IF(NPUN.EQ.1) PUNCH 873,(BETERR(I),I=1,NBEXP)
 841 CONTINUE
     PRINT 850,TTOT,TDCY
 850 FORMAT(1H0,5X,*NORMALIZED GAMMA SPECTRUM AT *,E12.6,* SEC. TOTAL A
    1ND *,E12.6,* SEC. DECAY (GAMMAS/FISSION)*/)
     PRINT 220,(TSPG(I),I=1,NBOGM1)
 872 FORMAT(1H ,*GAMMAS/FISSION AT *,E12.6,* SEC. TOTAL AND *,E12.6,
    1* SEC. DECAY*)
 873 FORMAT(6E12.6)
     PRINT 860,TTOT,TDCY
 860 FORMAT(1H0,5X,*NORMALIZED GAMMA ENERGY SPECTRUM AT *,E12.6,* SEC.
    1TOTAL AND *,E12.6,* SEC. DECAY (MEV/FISSION)*/)
     IF(NPUN.EQ.1) PUNCH 7836,TTOT,TDCY
7836 FORMAT(1H ,*GAMMA MEV/FISS. AT *,E12.6,* SEC. TOTAL AND *,E12.6,
    1*SEC. DECAY*)
     IF(NPUN.EQ.1) PUNCH 873,(TSPEG(I),I=1,NBDGM1)
     PRINT 220,(TSPEG(I),I=1,NBOGM1)
     PRINT 859,TTOT,TDCY
 859 FORMAT(1H0,5X,*NORMALIZED SUM GAMMA ENERGY SPECTRUM AT *,E12.6,* S
    1EC. TOTAL AND *,E12.6,* SEC. DECAY (MEV/FISSION)*/)
     PRINT 220,(TSPEG1(I),I=1,NBDGM1)
     IF(ICOMPG.NE.1) GO TO 862
     PRINT 861,TTOT,TDCY
 861 FORMAT(1H0,5X,*EXPERIMENTAL GAMMA ENERGY SPECTRUM AT *,E12.6,* SEC
    1. TOTAL AND *,E12.6,* SEC. DECAY (MEV/FISSION)*/)
     PRINT 220,(GAMEXP(I),I=1,NGEXP)
     IF(NPUN.EQ.1) PUNCH 3001
3001 FORMAT(1H ,*EXPERIMENTAL GAMMA MEV/FISSION*)
     IF(NPUN.EQ.1) PUNCH 873,(GAMEXP(I),I=1,NGEXP)
     IF(NPUN.EQ.1) PUNCH 3002
3002 FORMAT(1H ,*EXPERIMENTAL GAMMA ERRORS*)
     IF(NPUN.EQ.1) PUNCH 873,(GAMERR(I),I=1,NGEXP)
     PRINT 858,TTOT,TDCY
 858 FORMAT(1H0,5X,*EXPERIMENTAL SUM GAMMA ENERGY SPECTRUM AT *,E12.6,*
```

```
    1 SEC. TOTAL AND *,E12.6,* SEC. DECAY (MEV/FISSIDN)*/)
      PRINT 220,(GMEXP1(I),I=1,NGEXP)
      PRINT 857,TTOT,TDCY
  857 FORMAT(1H0,5X,*ERRORS OF EXPERIMENTAL GAMMA ENERGY SPECTRUM AT *,
     1E12.6,* SEC. TOTAL AND *,E12.6,* SEC. DECAY (MEV/FISSION)*/)
      PRINT 220,(GAMERR(I),I=1,NGEXP)
  862 CONTINUE
      IF(NPLOT.NE.1) GO TO 901
      DO 957 I=1,NBEXP
  957 EBX(I)=EBXM(I)
      ENCODE(10,5511,ATTOT)TTOT
 5511 FORMAT(1PE10.3)
      ENCODE(10,5511,ATDCY)TDCY
      DO 6553 I=1,NBEXP
 6553 EBX(I)=EBX(I)/1.0E+06
      BMIN=QLMPLT
      DO 910 I=1,NBDM1
      IF(TSPB(I).LT.BMIN) TSPB(I)=BMIN
  910 CONTINUE
      BEMIN=QLMPLT
      DO 920 I=1,NBOM1
      IF(TSPEB(I).LT.BEMIN) TSPEB(I)=BEMIN
      IF(ICOMPB.NE.1) GO TO 911
  911 CONTINUE
  920 CONTINUE
      IF(ICOMPB.NE.1) GO TO 994
      DO 993 I=1,NBEXP
      IF(BETMER(I),LT.BEMIN) BETMER(I)=BEMIN
      IF(BETEXP(I).LT.BEMIN) BETEXP(I)=BEMIN
      IF(BETPER(I).LT.BEMIN) BETPER(I)=BEMIN
  993 CONTINUE
  994 CONTINUE
      GMIN=QLMPLT
      DO 930 I=1,NBDGM1
      IF(TSPG(I).LT.GMIN) TSPG(I)=GMIN
  930 CONTINUE
      GEMIN=QLMPLT
      GEMIN1=QLMPLT
      DO 940 I=1,NBDGM1
      IF(TSPEG(I).LT.GEMIN) TSPEG(I)=GEMIN
      IF(TSPEG1(I).LT.GEMIN1) TSPEG1(I)=GEMIN1
  940 CONTINUE
      IF(ICOMPG.NE,1) GO TO 931
      DO 946 I=1,NGEXP
      IF(GAMEXP(I).LT,GEMIN) GAMEXP(I)=GEMIN
      IF(GMEXP1(I).LT.GEMIN1) GMEXP1(I)=GEMIN1
      IF(GAMMER(I),LT.GEMIN) GAMMER(I)=GEMIN
      IF(GAMPER(I).LT.GEMIN) GAMPER(I)=GEMIN
  946 CONTINUE
  931 CONTINUE
      TI(1)=10HBETAS PER
      TI(2)=10HFISSION AT
      TI(3)=ATTOT
      TI(4)=10H S. TOTAL,
      TI(5)=ATDCY
      TI(6)=10H S. DECAY
      ABSIS(1)=3HMEV
      ORDIN(1)=8HSPECTRUM
      CALL PLOSB(EBDRM,TSPB,+NBPLT,-1,+1,+478,0.,0.,0.,
     1TI,60,ABSIS,3,ORDIN,8)
```

```
      CALL PLOTM(EBDBM,TSPB,+NBPLT,-1,0,+103,0.,10.,10.,
     1TI,60,ABSIS,3,ORDIN,8)
      TI(1)=10H BETA MEV/
      IF(ICOMPB.NE.1) GO TO 951
      TI(7)=10H, CALC. VS
      TI(8)=6H. EXP.
      NBPLX=NBXPLT
      IF(NBPLX.GT.NBEXP) NBPLX=NBEXP
      CALL PLOSB(EBDBM,TSPEB,+NBPLT,-1,-1,+47B,0.,0.,0.,
     1TI,76,ABSIS,3,ORDIN,8)
      CALL PLOSB(EBX,BETEXP,+NBPLX,-1,+1,-11B,0.,0.,0.,
     1TI,76,ABSIS,3,ORDIN,8)
      CALL PLOTM(EBDBM,TSPEB,+NBPLT,-1,0,+103,0.,10.,10.,
     1TI,76,ABSIS,3,ORDIN,8)
      DO 4321 IP=1,NBPLX
      XEN(1)=EBX(IP)-1.0E-10
      XEN(2)=EBX(IP)
      XEN(3)=EBX(IP)+1.0E-10
      YSP(1)=BETMER(IP)
      YSP(2)=BETEXP(IP)
      YSP(3)=BETPER(IP)
      CALL PLOTM(XEN,YSP,+3,-1,+1,-38,0.,10.,10.,TI,76,ABSIS,3,ORDIN,8)
 4321 CONTINUE
      GO TO 953
  951 CONTINUE
      CALL PLOSB(EBDBM,TSPEB,+NBPLT,-1,+1,+47B,0.,0.,0.,
     1TI,60,ABSIS,3,ORDIN,8)
      CALL PLOTM(EBDBM,TSPEB,+NBPLT,-1,0,+103,0.,10.,10.,
     1TI,60,ABSIS,3,ORDIN,8)
  953 CONTINUE
      TI(1)=10H GAMMAS /
      CALL PLOSB(EBDGM,TSPG,+NGPLT,-1,+1,+47B,0.,0.,0.,
     1TI,60,ABSIS,3,ORDIN,8)
      CALL PLOTM(EBDGM,TSPG,+NGPLT,-1,0,+103,0.,10.,10.,
     1TI,60,ABSIS,3,ORDIN,8)
      TI(1)=10HGAMMA MEV/
      IF(ICOMPG.NE.1) GO TO 941
      NGPLX=NGXPLT
      IF(NGPLX.GT.NGEXP) NGPLX=NGEXP
      CALL PLOSB(EBDGM,TSPEG,+NGPLT,-1,-1,+47B,0.,0.,0.,
     1TI,76,ABSIS,3,ORDIN,8)
      CALL PLOSB(EGX,GAMEXP,NGPLX,-1,+1,-11B,0.,0.,0.,
     1TI,76,ABSIS,3,ORDIN,8)
      CALL PLOTM(EBDGM,TSPEG,+NGPLT,-1,0,+103,0.,10.,10.,
     1TI,76,ABSIS,3,ORDIN,8)
      DO 4001 IP=1,NGPLX
      XEN(1)=EGX(IP)-1.0E-10
      XEN(2)=EGX(IP)
      XEN(3)=EGX(IP)+1.0E-10
      YSP(1)=GAMMER(IP)
      YSP(2)=GAMEXP(IP)
      YSP(3)=GAMPER(IP)
      CALL PLOTM(XEN,YSP,+3,-1,+1,-38,0.,10.,10.,
     1TI,76,ABSIS,3,ORDIN,8)
 4001 CONTINUE
      GO TO 942
  941 CONTINUE
      CALL PLOSB(EBDGM,TSPEG,+NGPLT,-1,+1,+47B,0.,0.,0.,
     1TI,60,ABSIS,3,ORDIN,8)
      CALL PLOTM(EBDGM,TSPEG,+NGPLT,-1,0,+103,0.,10.,10.,
```

```
   1TI,60,ABSIS,3,ORDIN,8)
942 CONTINUE
    TI(2)=10H SUM GAMMA
    TI(3)=10H MEV/FIS.
    TI(4)=10HCALCULATED
    IF(ICOMPG.NE.1) GO TO 961
    TI(5)=10H (-) AND E
    TI(6)=10HXPERIMENTA
    TI(7)=5HL (*)
    CALL PLOTM(ERDGM,TSPEG1,+NGPLT,-1,0,+103,0.,10.,10.,
   1TI,65,ABSIS,3,ORDIN,8)
    CALL PLOTM(EGX,GMEXP1,+NGPLX,-1,+1,-103,0.,10.,10.,
   1TI,65,ABSIS,3,ORDIN,8)
    GO TO 962
961 CALL PLOTM(ERDGM,TSPEG1,+NGPLT,-1,0,+103,0.,10.,10.,
   1TI,40,ABSIS,3,ORDIN,8)
962 CONTINUE
901 CONTINUE
    END

    SUBROUTINE EXL
    CALL VBFS(1,2050058)
    RETURN
    END

    SUBROUTINE EXH
    CALL VBFS(1,2050078)
    RETURN
    END
```

APPENDIX C

SAMPLE OUTPUT FROM THE FPDCYS PROGRAM

METHOD 4 FOR BETA SPECTRA

METHOD 2 FOR GAMMA SPECTRA

BETA ENERGY BOUNDARIES (EV)

0.	.10E+06	.20E+06	.30E+06	.40E+06	.50E+06	.60E+06	.70E+06	.80E+06	.90E+06
.10E+07	.11E+07	.12E+07	.13E+07	.14E+07	.15E+07	.16E+07	.17E+07	.18E+07	.19E+07
.20E+07	.21E+07	.22E+07	.23E+07	.24E+07	.25E+07	.26E+07	.27E+07	.28E+07	.29E+07
.30E+07	.31E+07	.32E+07	.33E+07	.34E+07	.35E+07	.36E+07	.37E+07	.38E+07	.39E+07
.40E+07	.41E+07	.42E+07	.43E+07	.44E+07	.45E+07	.46E+07	.47E+07	.48E+07	.49E+07
.50E+07	.51E+07	.52E+07	.53E+07	.54E+07	.55E+07	.56E+07	.57E+07	.58E+07	.59E+07
.60E+07	.61E+07	.62E+07	.63E+07	.64E+07	.65E+07	.66E+07	.67E+07	.68E+07	.69E+07
.70E+07	.71E+07	.72E+07	.73E+07	.74E+07	.75E+07				

GAMMA ENERGY BOUNDARIES (EV)

0.	.50E+05	.10E+06	.15E+06	.20E+06	.25E+06	.30E+06	.35E+06	.40E+06	.45E+06
.50E+06	.55E+06	.60E+06	.65E+06	.70E+06	.75E+06	.80E+06	.85E+06	.90E+06	.95E+06
.10E+07	.10E+07	.11E+07	.11E+07	.12E+07	.13E+07	.13E+07	.13E+07	.14E+07	.14E+07
.15E+07	.15E+07	.16E+07	.16E+07	.17E+07	.18E+07	.18E+07	.18E+07	.19E+07	.19E+07
.20E+07	.20E+07	.21E+07	.21E+07	.22E+07	.23E+07	.23E+07	.23E+07	.24E+07	.24E+07
.25E+07	.25E+07	.26E+07	.26E+07	.27E+07	.28E+07	.28E+07	.28E+07	.29E+07	.29E+07
.30E+07	.30E+07	.31E+07	.31E+07	.32E+07	.33E+07	.33E+07	.33E+07	.34E+07	.34E+07
.35E+07	.35E+07	.36E+07	.36E+07	.37E+07	.38E+07	.38E+07	.38E+07	.39E+07	.39E+07
.40E+07	.40E+07	.41E+07	.41E+07	.42E+07	.43E+07	.43E+07	.43E+07	.44E+07	.44E+07
.45E+07	.45E+07	.46E+07	.46E+07	.47E+07	.48E+07	.48E+07	.48E+07	.49E+07	.49E+07
.50E+07	.50E+07	.51E+07	.51E+07	.52E+07	.53E+07	.53E+07	.53E+07	.54E+07	.54E+07
.55E+07	.55E+07	.56E+07	.56E+07	.57E+07	.58E+07	.58E+07	.58E+07	.59E+07	.59E+07
.60E+07	.60E+07	.61E+07	.61E+07	.62E+07	.63E+07	.63E+07	.63E+07	.64E+07	.64E+07
.65E+07	.65E+07	.66E+07	.66E+07	.67E+07	.68E+07	.68E+07	.68E+07	.69E+07	.69E+07
.70E+07	.70E+07	.71E+07	.71E+07	.72E+07	.73E+07	.73E+07	.73E+07	.74E+07	.74E+07
.75E+07									

4

33-AS- 82
MAT= 75
NDK= 1
NSP= 2
IDE= 3308200

E-BETA= .3211E+07
E-GAMMA= .2881E+06
E-ALPHA=-0.
HALFLIFE= .1900E+02
BRANCHINGS= .1000E+01
Q-VALUE(S)= .7200E+07
WEIGHTED Q= .7200E+07(+/- .2000E+06)

BETA SPECTRUM

NORMALIZATION FACTOR= .1000E+01
NO. OF POINTS= 5

	E-BETA	REL INTENSITY
1	.2700E+07	.1000E+01

BETA SPECTRUM

.1830E-01	.2452E-01	.3082E-01	.3686E-01	.4247E-01	.4751E-01
.5185E-01	.5541E-01	.5811E-01	.5990E-01	.6073E-01	.6061E-01
.5954E-01	.5755E-01	.5470E-01	.5105E-01	.4671E-01	.4179E-01
.3642E-01	.3076E-01	.2498E-01	.1929E-01	.1389E-01	.9025E-02
.4949E-02	.1938E-02	.2884E-03	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.			

BETA ENERGY SPECTRUM

.9606E+03	.3728E+04	.7755E+04	.1295E+05	.1915E+05	.2617E+05
.3374E+05	.4159E+05	.4941E+05	.5691E+05	.6377E+05	.6970E+05
.7441E+05	.7767E+05	.7929E+05	.7910E+05	.7704E+05	.7309E+05
.6734E+05	.5994E+05	.5117E+05	.4143E+05	.3121E+05	.2117E+05
.1210E+05	.4923E+04	.7575E+03	0.	0.	0.
0.	0.	0.	0.	0.	0.

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.			

AVERAGE BETA ENERGY = .1136E+07

2 .2900E+07 .2000E+01

BETA SPECTRUM

.3115E-01	.4198E-01	.5308E-01	.6389E-01	.7412E-01	.8354E-01
.9194E-01	.9916E-01	.1050E+00	.1095E+00	.1124E+00	.1137E+00
.1135E+00	.1117E+00	.1083E+00	.1036E+00	.9744E-01	.9013E-01
.8179E-01	.7263E-01	.6286E-01	.5276E-01	.4260E-01	.3271E-01
.2344E-01	.1516E-01	.8277E-02	.3229E-02	.4789E-03	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.			

BETA ENERGY SPECTRUM

.1637E+04	.6384E+04	.1336E+05	.2244E+05	.3343E+05	.4602E+05
.5983E+05	.7442E+05	.8932E+05	.1040E+06	.1180E+06	.1308E+06
.1418E+06	.1507E+06	.1570E+06	.1605E+06	.1607E+06	.1577E+06
.1512E+06	.1415E+06	.1288E+06	.1133E+06	.9577E+05	.7680E+05
.5736E+05	.3860E+05	.2189E+05	.8848E+04	.1353E+04	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.			

AVERAGE BETA ENERGY = .1232E+07

3 .5500E+07 .5000E+01

BETA SPECTRUM

.1665E-01	.2322E-01	.3044E-01	.3807E-01	.4601E-01	.5415E-01
.6241E-01	.7070E-01	.7894E-01	.8706E-01	.9498E-01	.1026E+00
.1100E+00	.1169E+00	.1234E+00	.1295E+00	.1350E+00	.1400E+00
.1443E+00	.1481E+00	.1512E+00	.1537E+00	.1554E+00	.1565E+00
.1569E+00	.1566E+00	.1557E+00	.1540E+00	.1517E+00	.1487E+00

.1451E+00	.1409E+00	.1362E+00	.1308E+00	.1250E+00	.1188E+00
.1121E+00	.1050E+00	.9769E-01	.9010E-01	.8232E-01	.7444E-01
.6651E-01	.5862E-01	.5085E-01	.4328E-01	.3600E-01	.2910E-01
.2268E-01	.1684E-01	.1169E-01	.7338E-02	.3895E-02	.1480E-02
.2146E-03	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.			

BETA ENERGY SPECTRUM

.8791E+03	.3537E+04	.7669E+04	.1339E+05	.2077E+05	.2985E+05
.4063E+05	.5309E+05	.6716E+05	.8277E+05	.9979E+05	.1181E+06
.1375E+06	.1579E+06	.1790E+06	.2007E+06	.2228E+06	.2450E+06
.2671E+06	.2888E+06	.3100E+06	.3304E+06	.3497E+06	.3679E+06
.3845E+06	.3994E+06	.4125E+06	.4235E+06	.4323E+06	.4387E+06
.4426E+06	.4439E+06	.4425E+06	.4383E+06	.4313E+06	.4215E+06
.4090E+06	.3938E+06	.3760E+06	.3558E+06	.3333E+06	.3089E+06
.2826E+06	.2549E+06	.2262E+06	.1969E+06	.1673E+06	.1382E+06
.1099E+06	.8332E+05	.5900E+05	.3776E+05	.2042E+05	.7902E+04
.1164E+04	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.			

AVERAGE BETA ENERGY = .2494E+07

4 .6600E+07 .1200E+02

BETA SPECTRUM

.2503E-01	.3513E-01	.4636E-01	.5837E-01	.7102E-01	.8419E-01
.9776E-01	.1116E+00	.1256E+00	.1397E+00	.1538E+00	.1677E+00
.1814E+00	.1948E+00	.2077E+00	.2203E+00	.2323E+00	.2437E+00
.2544E+00	.2645E+00	.2737E+00	.2822E+00	.2898E+00	.2966E+00
.3024E+00	.3073E+00	.3112E+00	.3142E+00	.3162E+00	.3171E+00
.3171E+00	.3161E+00	.3141E+00	.3112E+00	.3072E+00	.3024E+00
.2966E+00	.2899E+00	.2824E+00	.2741E+00	.2650E+00	.2551E+00
.2446E+00	.2335E+00	.2218E+00	.2097E+00	.1971E+00	.1841E+00
.1709E+00	.1575E+00	.1440E+00	.1304E+00	.1170E+00	.1037E+00
.9072E-01	.7812E-01	.6603E-01	.5455E-01	.4381E-01	.3393E-01
.2504E-01	.1728E-01	.1079E-01	.5695E-02	.2153E-02	.3107E-03
0.	0.	0.	0.	0.	0.
0.	0.	0.			

BETA ENERGY SPECTRUM

.1323E+04	.5353E+04	.1168E+05	.2052E+05	.3206E+05	.4641E+05
.6365E+05	.8382E+05	.1069E+06	.1328E+06	.1616E+06	.1929E+06
.2268E+06	.2630E+06	.3013E+06	.3415E+06	.3833E+06	.4265E+06
.4708E+06	.5158E+06	.5612E+06	.6068E+06	.6522E+06	.6970E+06
.7409E+06	.7836E+06	.8248E+06	.8640E+06	.9011E+06	.9356E+06
.9673E+06	.9958E+06	.1021E+07	.1042E+07	.1060E+07	.1073E+07
.1083E+07	.1087E+07	.1087E+07	.1083E+07	.1073E+07	.1059E+07

.1040E+07	.1016E+07	.9871E+06	.9539E+06	.9162E+06	.8745E+06
.8288E+06	.7795E+06	.7269E+06	.6717E+06	.6141E+06	.5548E+06
.4943E+06	.4335E+06	.3730E+06	.3136E+06	.2562E+06	.2018E+06
.1515E+06	.1062E+06	.6737E+05	.3613E+05	.1386E+05	.2028E+04
0.	0.	0.	0.	0.	0.
0.	0.	0.			

AVERAGE BETA ENERGY = .3033E+07

5 .7200E+07 .8000E+02

BETA SPECTRUM

.1330E+00	.1871E+00	.2476E+00	.3127E+00	.3815E+00	.4536E+00
.5283E+00	.6051E+00	.6833E+00	.7624E+00	.8420E+00	.9214E+00
.1000E+01	.1078E+01	.1155E+01	.1230E+01	.1302E+01	.1372E+01
.1439E+01	.1503E+01	.1564E+01	.1621E+01	.1674E+01	.1722E+01
.1767E+01	.1806E+01	.1841E+01	.1872E+01	.1897E+01	.1917E+01
.1933E+01	.1943E+01	.1948E+01	.1947E+01	.1942E+01	.1931E+01
.1915E+01	.1894E+01	.1869E+01	.1838E+01	.1803E+01	.1763E+01
.1719E+01	.1671E+01	.1618E+01	.1562E+01	.1503E+01	.1440E+01
.1374E+01	.1306E+01	.1235E+01	.1163E+01	.1088E+01	.1013E+01
.9367E+00	.8601E+00	.7835E+00	.7075E+00	.6325E+00	.5590E+00
.4875E+00	.4185E+00	.3527E+00	.2906E+00	.2328E+00	.1798E+00
.1324E+00	.9114E-01	.5675E-01	.2989E-01	.1127E-01	.1624E-02
0.	0.	0.			

BETA ENERGY SPECTRUM

.7032E+04	.2852E+05	.6240E+05	.1100E+06	.1722E+06	.2501E+06
.3440E+06	.4544E+06	.5814E+06	.7249E+06	.8847E+06	.1060E+07
.1251E+07	.1456E+07	.1675E+07	.1906E+07	.2149E+07	.2402E+07
.2663E+07	.2932E+07	.3206E+07	.3485E+07	.3766E+07	.4048E+07
.4328E+07	.4607E+07	.4880E+07	.5148E+07	.5407E+07	.5657E+07
.5895E+07	.6119E+07	.6330E+07	.6523E+07	.6699E+07	.6855E+07
.6991E+07	.7104E+07	.7195E+07	.7261E+07	.7302E+07	.7317E+07
.7305E+07	.7267E+07	.7201E+07	.7108E+07	.6987E+07	.6839E+07
.6664E+07	.6463E+07	.6237E+07	.5986E+07	.5713E+07	.5418E+07
.5104E+07	.4773E+07	.4426E+07	.4067E+07	.3699E+07	.3325E+07
.2949E+07	.2574E+07	.2204E+07	.1845E+07	.1501E+07	.1177E+07
.8800E+06	.6149E+06	.3885E+06	.2076E+06	.7937E+05	.1158E+05
0.	0.	0.			

AVERAGE BETA ENERGY = .3328E+07

TOTAL BETA SPECTRUM

.2242E+00	.3120E+00	.4083E+00	.5098E+00	.6151E+00	.7230E+00
.8323E+00	.9419E+00	.1051E+01	.1159E+01	.1264E+01	.1366E+01
.1465E+01	.1559E+01	.1649E+01	.1734E+01	.1814E+01	.1888E+01
.1956E+01	.2019E+01	.2077E+01	.2129E+01	.2175E+01	.2217E+01
.2254E+01	.2287E+01	.2317E+01	.2343E+01	.2365E+01	.2383E+01
.2395E+01	.2400E+01	.2398E+01	.2389E+01	.2374E+01	.2352E+01
.2324E+01	.2289E+01	.2249E+01	.2202E+01	.2150E+01	.2093E+01
.2030E+01	.1963E+01	.1891E+01	.1815E+01	.1736E+01	.1653E+01

.1568E+01	.1480E+01	.1391E+01	.1300E+01	.1209E+01	.1118E+01
.1028E+01	.9382E+00	.8495E+00	.7620E+00	.6763E+00	.5929E+00
.5125E+00	.4358E+00	.3635E+00	.2963E+00	.2349E+00	.1801E+00
.1324E+00	.9114E-01	.5675E-01	.2989E-01	.1127E-01	.1624E-02
0.	0.	0.			

TOTAL BETA ENERGY SPECTRUM

.1183E+05	.4753E+05	.1029E+06	.1793E+06	.2776E+06	.3985E+06
.5418E+06	.7073E+06	.8942E+06	.1101E+07	.1328E+07	.1572E+07
.1832E+07	.2106E+07	.2392E+07	.2688E+07	.2993E+07	.3304E+07
.3620E+07	.3938E+07	.4257E+07	.4577E+07	.4895E+07	.5210E+07
.5523E+07	.5833E+07	.6140E+07	.6444E+07	.6742E+07	.7031E+07
.7304E+07	.7559E+07	.7793E+07	.8004E+07	.8190E+07	.8350E+07
.8482E+07	.8585E+07	.8658E+07	.8699E+07	.8708E+07	.8684E+07
.8628E+07	.8538E+07	.8414E+07	.8258E+07	.8071E+07	.7852E+07
.7603E+07	.7326E+07	.7023E+07	.6696E+07	.6347E+07	.5981E+07
.5600E+07	.5206E+07	.4799E+07	.4381E+07	.3956E+07	.3527E+07
.3100E+07	.2680E+07	.2271E+07	.1881E+07	.1515E+07	.1179E+07
.8800E+06	.6149E+06	.3885E+06	.2076E+06	.7937E+05	.1158E+05
0.	0.	0.			

THE SUM OF THE BETA ENERGY SPECTRUM IS .3187E+09

NORMALIZED TOTAL BETA SPECTRUM

.2242E-02	.3120E-02	.4083E-02	.5098E-02	.6151E-02	.7230E-02
.8323E-02	.9419E-02	.1051E-01	.1159E-01	.1264E-01	.1366E-01
.1465E-01	.1559E-01	.1649E-01	.1734E-01	.1814E-01	.1888E-01
.1956E-01	.2019E-01	.2077E-01	.2129E-01	.2175E-01	.2217E-01
.2254E-01	.2287E-01	.2317E-01	.2343E-01	.2365E-01	.2383E-01
.2395E-01	.2400E-01	.2398E-01	.2389E-01	.2374E-01	.2352E-01
.2324E-01	.2289E-01	.2249E-01	.2202E-01	.2150E-01	.2093E-01
.2030E-01	.1963E-01	.1891E-01	.1815E-01	.1736E-01	.1653E-01
.1568E-01	.1480E-01	.1391E-01	.1300E-01	.1209E-01	.1118E-01
.1028E-01	.9382E-02	.8495E-02	.7620E-02	.6763E-02	.5929E-02
.5125E-02	.4358E-02	.3635E-02	.2963E-02	.2349E-02	.1801E-02
.1324E-02	.9114E-03	.5675E-03	.2989E-03	.1127E-03	.1624E-04
0.	0.	0.			

NORMALIZED TOTAL BETA ENERGY SPECTRUM

.1183E+03	.4753E+03	.1029E+04	.1793E+04	.2776E+04	.3985E+04
.5418E+04	.7073E+04	.8942E+04	.1101E+05	.1328E+05	.1572E+05
.1832E+05	.2106E+05	.2392E+05	.2688E+05	.2993E+05	.3304E+05
.3620E+05	.3938E+05	.4257E+05	.4577E+05	.4895E+05	.5210E+05
.5523E+05	.5833E+05	.6140E+05	.6444E+05	.6742E+05	.7031E+05
.7304E+05	.7559E+05	.7793E+05	.8004E+05	.8190E+05	.8350E+05
.8482E+05	.8585E+05	.8658E+05	.8699E+05	.8708E+05	.8684E+05
.8628E+05	.8538E+05	.8414E+05	.8258E+05	.8071E+05	.7852E+05

.7603E+05	.7326E+05	.7023E+05	.6696E+05	.6347E+05	.5981E+05
.5600E+05	.5206E+05	.4799E+05	.4381E+05	.3956E+05	.3527E+05
.3100E+05	.2680E+05	.2271E+05	.1881E+05	.1515E+05	.1179E+05
.8800E+04	.6149E+04	.3885E+04	.2076E+04	.7937E+03	.1158E+03
0.	0.	0.			

TOTAL BETA ENERGY EQUALS .3187E+07

E-BETA+NWUT= .6912E+07
E-BETA= .3211E+07
E-NEUTRINO= .3701E+07
QQ= .6912E+07

(1 - E-BETA / ENERGY-SPECTRUM-SUM) X 100 = -.7458E+00

GAMMA SPECTRUM

NORMALIZATION FACTOR= .1142E+00
NO. OF POINTS= 9

	E-GAMMA	REL INTENSITY	ICC
1	.6548E+06	.1000E+03	0.
2	.1076E+07	.5600E+01	0.
3	.1731E+07	.1680E+02	0.
4	.2514E+07	.8800E+01	0.
5	.2590E+07	.8000E+01	0.
6	.2605E+07	.1040E+02	0.
7	.2834E+07	.9600E+01	0.
8	.3149E+07	.8000E+01	0.
9	.3666E+07	.8000E+01	0.

GAMMA SPECTRUM

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	.8081E-01
.3673E+02	.6278E+02	.4035E+00	.9748E-05	0.	0.
.2983E-05	.7105E-02	.7772E+00	.3905E+01	.9011E+00	.9551E-02
.4649E-05	0.	0.	0.	0.	0.
0.	.2040E-02	.1825E+00	.2953E+01	.8642E+01	.4575E+01
.4380E+00	.7586E-02	.2376E-04	0.	0.	0.
0.	0.	0.	.1903E-04	.1799E-02	.5916E-01
.6836E+00	.2955E+01	.6018E+01	.8200E+01	.6645E+01	.2352E+01
.7295E+00	.1955E+01	.3596E+01	.2689E+01	.8122E+00	.1218E+00
.2497E+00	.1180E+01	.2580E+01	.2560E+01	.1152E+01	.2354E+00
.2182E-01	.9632E-03	.1435E-02	.2306E-01	.1968E+00	.8802E+00
.2064E+01	.2538E+01	.1636E+01	.5529E+00	.9797E-01	.9102E-02
.4433E-03	.1132E-04	0.	0.	0.	0.

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

GAMMA ENERGY SPECTRUM

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	.4633E+05
.2289E+08	.4225E+08	.2916E+06	.7532E+01	0.	0.
.2760E+01	.6928E+04	.7967E+06	.4198E+07	.1014E+07	.1122E+05
.5696E+01	0.	0.	0.	0.	0.
0.	.3213E+04	.2966E+06	.4946E+07	.1491E+08	.8120E+07
.7994E+06	.1422E+05	.4574E+02	0.	0.	0.
0.	0.	0.	.4329E+02	.4182E+04	.1405E+06
.1658E+07	.7314E+07	.1519E+08	.2112E+08	.1744E+08	.6293E+07
.1988E+07	.5424E+07	.1016E+08	.7732E+07	.2376E+07	.3622E+06
.7554E+06	.3629E+07	.8064E+07	.8128E+07	.3717E+07	.7709E+06
.7254E+05	.3251E+04	.4914E+04	.8015E+05	.6936E+06	.3147E+07
.7483E+07	.9327E+07	.6094E+07	.2087E+07	.3747E+06	.3527E+05
.1740E+04	.4500E+02	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

THE SUM OF THE GAMMA ENERGY SPECTRUM IS .2523E+09

NORMALIZED GAMMA SPECTRUM

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	.9228E-04
.4195E-01	.7170E-01	.4607E-03	.1113E-07	0.	0.
.3407E-08	.8114E-05	.8876E-03	.4459E-02	.1029E-02	.1091E-04
.5309E-08	0.	0.	0.	0.	0.

0.	.2330E-05	.2084E-03	.3372E-02	.9869E-02	.5224E-02
.5002E-03	.8663E-05	.2714E-07	0.	0.	0.
0.	0.	0.	.2173E-07	.2054E-05	.6756E-04
.7807E-03	.3375E-02	.6872E-02	.9365E-02	.7589E-02	.2686E-02
.8331E-03	.2232E-02	.4107E-02	.3071E-02	.9275E-03	.1390E-03
.2852E-03	.1348E-02	.2947E-02	.2924E-02	.1316E-02	.2688E-03
.2492E-04	.1100E-05	.1639E-05	.2634E-04	.2247E-03	.1005E-02
.2357E-02	.2898E-02	.1868E-02	.6314E-03	.1119E-03	.1039E-04
.5063E-06	.1293E-07	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

NORMALIZED GAMMA ENERGY SPECTRUM

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	.5290E+02
.2614E+05	.4825E+05	.3330E+03	.8602E-02	0.	0.
.3152E-02	.7912E+01	.9098E+03	.4794E+04	.1158E+04	.1282E+02
.6504E-02	0.	0.	0.	0.	0.
0.	.3670E+01	.3387E+03	.5649E+04	.1702E+05	.9273E+04
.9129E+03	.1624E+02	.5224E-01	0.	0.	0.
0.	0.	0.	.4944E-01	.4776E+01	.1605E+03
.1893E+04	.8352E+04	.1735E+05	.2411E+05	.1992E+05	.7186E+04
.2270E+04	.6194E+04	.1160E+05	.8830E+04	.2713E+04	.4137E+03
.8627E+03	.4144E+04	.9209E+04	.9282E+04	.4244E+04	.8804E+03
.8285E+02	.3712E+01	.5612E+01	.9153E+02	.7921E+03	.3593E+04
.8545E+04	.1065E+05	.6959E+04	.2384E+04	.4280E+03	.4028E+02
.1987E+01	.5139E-01	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

TOTAL GAMMA ENERGY EQUALS .2881E+06

```
ETG=  .2881E+06
EICC= 0.
ETR=  .2881E+06
QQ=  .7200E+07

CALCULATED ENERGIES (ENDF/B)
AVE BETA=  .3211E+07 (  .3211E+07)
AVE TRANSITION E=  .2881E+06 (  .2881E+06)
TOT GAMMA=  .2881E+06
E-NEUTRINO=  .3701E+07
CE= 0.
FRAC CONV E OF TOT TRAN= 0.
Q=   .7200E+07(  .7200E+07+/-  2.7778 PCT)
FQ=  .1225E-04
                                                Q DIFFERENCE IS WITHIN UNCERTAINTY

================================================================================
   5
              33-AS- 82M
               MAT=  76
               NDK=  1
               NSP=  2
               IDE=   3308210

E-BETA=  .1819E+07
E-GAMMA=  .2995E+07
E-ALPHA=-0.
HALFLIFE=  .1330E+02
BRANCHINGS=  .1000E+01
Q-VALUE(S)=  .7200E+07
WEIGHTED Q=  .7200E+07(+/-  .2000E+06)

BETA SPECTRUM
-------------

NORMALIZATION FACTOR=  .1000E+01
NO. OF POINTS=   4
        E-BETA  REL INTENSITY
  1   .3100E+07      .1400E+02

                                     BETA SPECTRUM
                                        .1872E+00  .2535E+00  .3222E+00  .3899E+00  .4550E+00  .5162E+00
                                        .5721E+00  .6216E+00  .6639E+00  .6983E+00  .7241E+00  .7409E+00
                                        .7485E+00  .7469E+00  .7361E+00  .7163E+00  .6880E+00  .6517E+00
                                        .6082E+00  .5584E+00  .5033E+00  .4440E+00  .3821E+00  .3190E+00
                                        .2563E+00  .1959E+00  .1397E+00  .9001E-01  .4896E-01  .1903E-01
                                        .2815E-02  0.          0.          0.          0.          0.
```

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.			

BETA ENERGY SPECTRUM

.9844E+04	.3856E+05	.8108E+05	.1370E+06	.2053E+06	.2844E+06
.3722E+06	.4666E+06	.5646E+06	.6636E+06	.7604E+06	.8521E+06
.9357E+06	.1008E+07	.1067E+07	.1110E+07	.1135E+07	.1140E+07
.1125E+07	.1088E+07	.1031E+07	.9542E+06	.8592E+06	.7491E+06
.6274E+06	.4990E+06	.3699E+06	.2472E+06	.1393E+06	.5596E+05
.8518E+04	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.			

AVERAGE BETA ENERGY = .1328E+07

2 .3700E+07 .2400E+02

BETA SPECTRUM

.2121E+00	.2903E+00	.3733E+00	.4575E+00	.5412E+00	.6228E+00
.7010E+00	.7745E+00	.8423E+00	.9033E+00	.9567E+00	.1002E+01
.1038E+01	.1065E+01	.1082E+01	.1090E+01	.1087E+01	.1075E+01
.1053E+01	.1022E+01	.9825E+00	.9344E+00	.8789E+00	.8167E+00
.7488E+00	.6763E+00	.6003E+00	.5223E+00	.4435E+00	.3657E+00
.2904E+00	.2196E+00	.1551E+00	.9894E-01	.5334E-01	.2056E-01
.3019E-02	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.			

BETA ENERGY SPECTRUM

.1117E+05	.4418E+05	.9399E+05	.1608E+06	.2442E+06	.3432E+06
.4562E+06	.5815E+06	.7164E+06	.8586E+06	.1005E+07	.1152E+07
.1298E+07	.1438E+07	.1569E+07	.1689E+07	.1794E+07	.1881E+07
.1948E+07	.1993E+07	.2014E+07	.2009E+07	.1977E+07	.1919E+07
.1834E+07	.1724E+07	.1590E+07	.1436E+07	.1263E+07	.1078E+07
.8853E+06	.6912E+06	.5035E+06	.3310E+06	.1837E+06	.7279E+05
.1095E+05	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.			

AVERAGE BETA ENERGY = .1617E+07

3 .4300E+07 .4700E+02

BETA SPECTRUM

.2889E+00	.3987E+00	.5170E+00	.6392E+00	.7632E+00	.8870E+00
.1009E+01	.1127E+01	.1240E+01	.1347E+01	.1446E+01	.1536E+01
.1616E+01	.1686E+01	.1745E+01	.1791E+01	.1826E+01	.1847E+01
.1856E+01	.1852E+01	.1836E+01	.1807E+01	.1765E+01	.1712E+01
.1648E+01	.1573E+01	.1489E+01	.1397E+01	.1296E+01	.1190E+01
.1078E+01	.9635E+00	.8466E+00	.7294E+00	.6138E+00	.5018E+00
.3953E+00	.2966E+00	.2079E+00	.1317E+00	.7055E-01	.2703E-01
.3948E-02	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.			

BETA ENERGY SPECTRUM

.1523E+05	.6071E+05	.1302E+06	.2247E+06	.3444E+06	.4888E+06
.6567E+06	.8462E+06	.1055E+07	.1280E+07	.1519E+07	.1767E+07
.2021E+07	.2277E+07	.2530E+07	.2777E+07	.3013E+07	.3233E+07
.3434E+07	.3612E+07	.3763E+07	.3884E+07	.3971E+07	.4023E+07
.4037E+07	.4012E+07	.3946E+07	.3840E+07	.3694E+07	.3510E+07
.3288E+07	.3034E+07	.2750E+07	.2443E+07	.2117E+07	.1780E+07
.1442E+07	.1111E+07	.7999E+06	.5198E+06	.2853E+06	.1119E+06
.1669E+05	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.			

AVERAGE BETA ENERGY = .1908E+07

4 .5400E+07 .1400E+02

BETA SPECTRUM

.4884E-01	.6805E-01	.8917E-01	.1114E+00	.1345E+00	.1582E+00
.1822E+00	.2062E+00	.2301E+00	.2535E+00	.2763E+00	.2982E+00
.3192E+00	.3389E+00	.3574E+00	.3744E+00	.3899E+00	.4036E+00
.4156E+00	.4257E+00	.4340E+00	.4402E+00	.4445E+00	.4467E+00
.4469E+00	.4450E+00	.4412E+00	.4353E+00	.4276E+00	.4179E+00
.4064E+00	.3932E+00	.3784E+00	.3621E+00	.3444E+00	.3254E+00
.3053E+00	.2842E+00	.2624E+00	.2400E+00	.2172E+00	.1943E+00

.1714E+00	.1488E+00	.1267E+00	.1055E+00	.8532E-01	.6655E-01
.4945E-01	.3435E-01	.2157E-01	.1146E-01	.4356E-02	.6319E-03
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.			

BETA ENERGY SPECTRUM

.2578E+04	.1037E+05	.2246E+05	.3918E+05	.6073E+05	.8721E+05
.1186E+06	.1549E+06	.1957E+06	.2410E+06	.2902E+06	.3431E+06
.3991E+06	.4577E+06	.5184E+06	.5805E+06	.6434E+06	.7064E+06
.7690E+06	.8303E+06	.8897E+06	.9465E+06	.1000E+07	.1050E+07
.1095E+07	.1135E+07	.1169E+07	.1197E+07	.1218E+07	.1233E+07
.1240E+07	.1239E+07	.1230E+07	.1213E+07	.1188E+07	.1155E+07
.1114E+07	.1066E+07	.1010E+07	.9478E+06	.8796E+06	.8060E+06
.7281E+06	.6470E+06	.5637E+06	.4797E+06	.3966E+06	.3160E+06
.2397E+06	.1699E+06	.1089E+06	.5894E+05	.2283E+05	.3366E+04
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.			

AVERAGE BETA ENERGY = .2445E+07

TOTAL BETA SPECTRUM

.7371E+00	.1011E+01	.1302E+01	.1598E+01	.1894E+01	.2184E+01
.2464E+01	.2729E+01	.2977E+01	.3202E+01	.3403E+01	.3577E+01
.3722E+01	.3837E+01	.3920E+01	.3972E+01	.3991E+01	.3978E+01
.3933E+01	.3859E+01	.3755E+01	.3625E+01	.3471E+01	.3295E+01
.3100E+01	.2891E+01	.2671E+01	.2444E+01	.2217E+01	.1993E+01
.1778E+01	.1576E+01	.1380E+01	.1190E+01	.1012E+01	.8477E+00
.7036E+00	.5808E+00	.4703E+00	.3717E+00	.2878E+00	.2213E+00
.1753E+00	.1488E+00	.1267E+00	.1055E+00	.8532E-01	.6655E-01
.4945E-01	.3435E-01	.2157E-01	.1146E-01	.4356E-02	.6319E-03
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.			

TOTAL BETA ENERGY SPECTRUM

.3882E+05	.1538E+06	.3277E+06	.5617E+06	.8546E+06	.1204E+07
.1604E+07	.2049E+07	.2532E+07	.3044E+07	.3575E+07	.4115E+07
.4654E+07	.5181E+07	.5685E+07	.6156E+07	.6585E+07	.6961E+07
.7276E+07	.7524E+07	.7698E+07	.7793E+07	.7808E+07	.7741E+07
.7594E+07	.7370E+07	.7075E+07	.6720E+07	.6315E+07	.5876E+07
.5422E+07	.4964E+07	.4484E+07	.3987E+07	.3488E+07	.3008E+07
.2567E+07	.2177E+07	.1810E+07	.1468E+07	.1165E+07	.9179E+06
.7448E+06	.6470E+06	.5637E+06	.4797E+06	.3966E+06	.3160E+06
.2397E+06	.1699E+06	.1089E+06	.5894E+05	.2283E+05	.3366E+04

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.			

THE SUM OF THE BETA ENERGY SPECTRUM IS .1813E+09

NORMALIZED TOTAL BETA SPECTRUM

.7371E-02	.1011E-01	.1302E-01	.1598E-01	.1894E-01	.2184E-01
.2464E-01	.2729E-01	.2977E-01	.3202E-01	.3403E-01	.3577E-01
.3722E-01	.3837E-01	.3920E-01	.3972E-01	.3991E-01	.3978E-01
.3933E-01	.3859E-01	.3755E-01	.3625E-01	.3471E-01	.3295E-01
.3100E-01	.2891E-01	.2671E-01	.2444E-01	.2217E-01	.1993E-01
.1778E-01	.1576E-01	.1380E-01	.1190E-01	.1012E-01	.8477E-02
.7036E-02	.5808E-02	.4703E-02	.3717E-02	.2878E-02	.2213E-02
.1753E-02	.1488E-02	.1267E-02	.1055E-02	.8532E-03	.6655E-03
.4945E-03	.3435E-03	.2157E-03	.1146E-03	.4356E-04	.6319E-05
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.			

NORMALIZED TOTAL BETA ENERGY SPECTRUM

.3882E+03	.1538E+04	.3277E+04	.5617E+04	.8546E+04	.1204E+05
.1604E+05	.2049E+05	.2532E+05	.3044E+05	.3575E+05	.4115E+05
.4654E+05	.5181E+05	.5685E+05	.6156E+05	.6585E+05	.6961E+05
.7276E+05	.7524E+05	.7698E+05	.7793E+05	.7808E+05	.7741E+05
.7594E+05	.7370E+05	.7075E+05	.6720E+05	.6315E+05	.5876E+05
.5422E+05	.4964E+05	.4484E+05	.3987E+05	.3488E+05	.3008E+05
.2567E+05	.2177E+05	.1810E+05	.1468E+05	.1165E+05	.9179E+04
.7448E+04	.6470E+04	.5637E+04	.4797E+04	.3966E+04	.3160E+04
.2397E+04	.1699E+04	.1089E+04	.5894E+03	.2283E+03	.3366E+02
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.			

TOTAL BETA ENERGY EQUALS .1813E+07

E-BETA+NWUT= .4099E+07
E-BETA= .1819E+07
E-NEUTRINO= .2280E+07
QQ= .4099E+07

(1 - E-BETA / ENERGY-SPECTRUM-SUM) X 100 = -.3560E+00

GAMMA SPECTRUM

NORMALIZATION FACTOR= .7128E+00
NO. OF POINTS= 13

	E-GAMMA	REL INTENSITY	ICC
1	.3435E+06	.8000E+02	0.
2	.5605E+06	.2160E+02	0.
3	.6548E+06	.1000E+03	0.
4	.8155E+06	.1200E+02	0.
5	.8187E+06	.3280E+02	0.
6	.9027E+06	.3200E+01	0.
7	.1076E+07	.1520E+02	0.
8	.1080E+07	.4080E+02	0.
9	.1541E+07	.1120E+02	0.
10	.1718E+07	.4800E+01	0.
11	.1731E+07	.4560E+02	0.
12	.1896E+07	.5040E+02	0.
13	.2355E+07	.6400E+01	0.

GAMMA SPECTRUM

0.	0.	0.	0.	0.	.2352E-02
.6576E+02	.1424E+02	.2389E-04	.1276E-02	.4232E+01	.1736E+02
.3682E+02	.6278E+02	.4265E+00	.7603E+01	.3496E+02	.3639E+01
.1726E+01	.9745E-01	.6439E+01	.3853E+02	.1084E+02	.1435E+00
.8942E-04	0.	0.	.1152E-03	.3057E-01	.1121E+01
.5680E+01	.3986E+01	.1007E+01	.9349E+01	.2593E+02	.1352E+02
.6576E+01	.2172E+02	.1921E+02	.3703E+01	.1554E+00	.1420E-02
.1286E-04	.1480E-02	.5372E-01	.6142E+00	.2213E+01	.2513E+01
.8992E+00	.1014E+00	.3602E-02	.4033E-04	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

GAMMA ENERGY SPECTRUM

0.	0.	0.	0.	0.	.6655E+03
.2199E+08	.5494E+07	.1045E+02	.6009E+03	.2202E+07	.9896E+07
.2294E+08	.4225E+08	.3083E+06	.5884E+07	.2880E+08	.3181E+07
.1596E+07	.9500E+05	.6601E+07	.4142E+08	.1220E+08	.1687E+06
.1096E+03	0.	0.	.1585E+03	.4357E+05	.1653E+07
.8662E+07	.6277E+07	.1637E+07	.1566E+08	.4474E+08	.2400E+08
.1200E+08	.4073E+08	.3698E+08	.7313E+07	.3147E+06	.2946E+04
.2732E+02	.3220E+04	.1195E+06	.1397E+07	.5146E+07	.5969E+07
.2181E+07	.2509E+06	.9095E+04	.1038E+03	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

THE SUM OF THE GAMMA ENERGY SPECTRUM IS .4201E+09

NORMALIZED GAMMA SPECTRUM

0.	0.	0.	0.	0.	.1677E-04
.4687E+00	.1015E+00	.1703E-06	.9096E-05	.3016E-01	.1237E+00
.2625E+00	.4475E+00	.3040E-02	.5420E-01	.2492E+00	.2594E-01
.1230E-01	.6946E-03	.4590E-01	.2746E+00	.7728E-01	.1023E-02
.6374E-06	0.	0.	.8214E-06	.2179E-03	.7990E-02
.4049E-01	.2841E-01	.7180E-02	.6664E-01	.1849E+00	.9639E-01
.4687E-01	.1548E+00	.1369E+00	.2639E-01	.1108E-02	.1012E-04
.9164E-07	.1055E-04	.3829E-03	.4378E-02	.1578E-01	.1791E-01
.6409E-02	.7227E-03	.2568E-04	.2875E-06	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

NORMALIZED GAMMA ENERGY SPECTRUM

0.	0.	0.	0.	0.	.4743E+01
.1567E+06	.3916E+05	.7446E-01	.4283E+01	.1570E+05	.7054E+05
.1635E+06	.3012E+06	.2197E+04	.4194E+05	.2053E+06	.2267E+05
.1138E+05	.6772E+03	.4705E+05	.2953E+06	.8695E+05	.1202E+04
.7809E+00	0.	0.	.1129E+01	.3105E+03	.1179E+05
.6175E+05	.4475E+05	.1167E+05	.1116E+06	.3189E+06	.1711E+06
.8554E+05	.2903E+06	.2636E+06	.5213E+05	.2243E+04	.2100E+02
.1947E+00	.2295E+02	.6520E+03	.9961E+04	.3668E+05	.4254E+05
.1554E+05	.1789E+04	.6483E+02	.7402E+00	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

TOTAL GAMMA ENERGY EQUALS .2995E+07

ETG= .2995E+07
EICC= 0.
ETR= .2995E+07
QQ= .7094E+07

CALCULATED ENERGIES (ENDF/B)
AVE BETA= .1819E+07 (.1819E+07)
AVE TRANSITION E= .2995E+07 (.2995E+07)
TOT GAMMA= .2995E+07
E-NEUTRINO= .2280E+07
CE= 0.
FRAC CONV E OF TOT TRAN= 0.
Q=   .7094E+07(.7200E+07+/- 2.7778 PCT)
FQ= -.1477E-01

Q DIFFERENCE IS WITHIN UNCERTAINTY

APPENDIX D

SAMPLE OUTPUT FROM THE FPSPEC PROGRAM

BETA ENERGY BOUNDARIES (EV)

0.	.10000E+06	.20000E+06	.30000E+06	.40000E+06	.50000E+06
.60000E+06	.70000E+06	.80000E+06	.90000E+06	.10000E+07	.11000E+07
.12000E+07	.13000E+07	.14000E+07	.15000E+07	.16000E+07	.17000E+07
.18000E+07	.19000E+07	.20000E+07	.21000E+07	.22000E+07	.23000E+07
.24000E+07	.25000E+07	.26000E+07	.27000E+07	.28000E+07	.29000E+07
.30000E+07	.31000E+07	.32000E+07	.33000E+07	.34000E+07	.35000E+07
.36000E+07	.37000E+07	.38000E+07	.39000E+07	.40000E+07	.41000E+07
.42000E+07	.43000E+07	.44000E+07	.45000E+07	.46000E+07	.47000E+07
.48000E+07	.49000E+07	.50000E+07	.51000E+07	.52000E+07	.53000E+07
.54000E+07	.55000E+07	.56000E+07	.57000E+07	.58000E+07	.59000E+07
.60000E+07	.61000E+07	.62000E+07	.63000E+07	.64000E+07	.65000E+07
.66000E+07	.67000E+07	.68000E+07	.69000E+07	.70000E+07	.71000E+07
.72000E+07	.73000E+07	.74000E+07	.75000E+07		

GAMMA ENERGY BOUNDARIES (EV)

0.	.50000E+05	.10000E+06	.15000E+06	.20000E+06	.25000E+06
.30000E+06	.35000E+06	.40000E+06	.45000E+06	.50000E+06	.55000E+06
.60000E+06	.65000E+06	.70000E+06	.75000E+06	.80000E+06	.85000E+06
.90000E+06	.95000E+06	.10000E+07	.10500E+07	.11000E+07	.11500E+07
.12000E+07	.12500E+07	.13000E+07	.13500E+07	.14000E+07	.14500E+07
.15000E+07	.15500E+07	.16000E+07	.16500E+07	.17000E+07	.17500E+07
.18000E+07	.18500E+07	.19000E+07	.19500E+07	.20000E+07	.20500E+07
.21000E+07	.21500E+07	.22000E+07	.22500E+07	.23000E+07	.23500E+07
.24000E+07	.24500E+07	.25000E+07	.25500E+07	.26000E+07	.26500E+07
.27000E+07	.27500E+07	.28000E+07	.28500E+07	.29000E+07	.29500E+07
.30000E+07	.30500E+07	.31000E+07	.31500E+07	.32000E+07	.32500E+07
.33000E+07	.33500E+07	.34000E+07	.34500E+07	.35000E+07	.35500E+07
.36000E+07	.36500E+07	.37000E+07	.37500E+07	.38000E+07	.38500E+07
.39000E+07	.39500E+07	.40000E+07	.40500E+07	.41000E+07	.41500E+07
.42000E+07	.42500E+07	.43000E+07	.43500E+07	.44000E+07	.44500E+07
.45000E+07	.45500E+07	.46000E+07	.46500E+07	.47000E+07	.47500E+07
.48000E+07	.48500E+07	.49000E+07	.49500E+07	.50000E+07	.50500E+07
.51000E+07	.51500E+07	.52000E+07	.52500E+07	.53000E+07	.53500E+07
.54000E+07	.54500E+07	.55000E+07	.55500E+07	.56000E+07	.56500E+07
.57000E+07	.57500E+07	.58000E+07	.58500E+07	.59000E+07	.59500E+07
.60000E+07	.60500E+07	.61000E+07	.61500E+07	.62000E+07	.62500E+07
.63000E+07	.63500E+07	.64000E+07	.64500E+07	.65000E+07	.65500E+07
.66000E+07	.66500E+07	.67000E+07	.67500E+07	.68000E+07	.68500E+07
.69000E+07	.69500E+07	.70000E+07	.70500E+07	.71000E+07	.71500E+07
.72000E+07	.72500E+07	.73000E+07	.73500E+07	.74000E+07	.74500E+07
.75000E+07					

EXPERIMENTAL GAMMA ENERGY POINTS (MEV)

.50000E+05	.60000E+05	.70000E+05	.80000E+05	.90000E+05	.10000E+06
.11000E+06	.12000E+06	.13000E+06	.14000E+06	.15000E+06	.16000E+06
.17000E+06	.18500E+06	.20000E+06	.21500E+06	.23000E+06	.24500E+06
.26000E+06	.27500E+06	.29000E+06	.30500E+06	.32000E+06	.33500E+06
.35000E+06	.36500E+06	.38000E+06	.39500E+06	.41000E+06	.42500E+06
.44000E+06	.45500E+06	.47000E+06	.48500E+06	.50000E+06	.51500E+06
.53000E+06	.55000E+06	.57000E+06	.59000E+06	.61000E+06	.63000E+06
.65000E+06	.67000E+06	.69000E+06	.71000E+06	.73000E+06	.75000E+06
.77000E+06	.79000E+06	.81000E+06	.83000E+06	.85000E+06	.87000E+06
.89000E+06	.91000E+06	.93000E+06	.95000E+06	.97500E+06	.10000E+07
.10260E+07	.10480E+07	.10760E+07	.11000E+07	.11240E+07	.11520E+07
.11720E+07	.12020E+07	.12280E+07	.12620E+07	.12880E+07	.13220E+07
.13480E+07	.13820E+07	.14080E+07	.14420E+07	.14680E+07	.15020E+07
.15230E+07	.15620E+07	.15980E+07	.16420E+07	.16780E+07	.17220E+07
.17580E+07	.18020E+07	.18380E+07	.18820E+07	.19180E+07	.19620E+07
.19980E+07	.20420E+07	.20780E+07	.21220E+07	.21580E+07	.22020E+07
.22380E+07	.22820E+07	.23180E+07	.23620E+07	.23980E+07	.24520E+07
.24980E+07	.25520E+07	.25980E+07	.26520E+07	.26980E+07	.27520E+07
.27980E+07	.28520E+07	.28980E+07	.29520E+07	.29980E+07	.30620E+07
.31180E+07	.31820E+07	.32380E+07	.33020E+07	.33580E+07	.34220E+07
.34780E+07	.35420E+07	.35980E+07	.36620E+07	.37180E+07	.37820E+07
.38380E+07	.39020E+07	.39680E+07	.40420E+07	.41080E+07	.41820E+07
.42480E+07	.43220E+07	.43880E+07	.44620E+07	.45280E+07	.46020E+07
.46680E+07	.47420E+07	.48080E+07	.48820E+07	.49480E+07	.50220E+07
.50980E+07	.51820E+07	.52580E+07	.53420E+07	.54180E+07	.55020E+07
.55780E+07	.56620E+07	.57380E+07	.58220E+07	.58980E+07	.59920E+07
.60780E+07	.61720E+07	.62580E+07	.63520E+07	.64380E+07	.65320E+07
.66180E+07	.67120E+07	.67980E+07	.69020E+07	.69980E+07	.71020E+07
.71980E+07	.73020E+07	.73980E+07	.75020E+07	.75980E+07	.77020E+07
.77980E+07					

TOTAL BETA SPECTRUM AT .194700E+03 SEC. TOTAL AND .184700E+03 SEC. DECAY (BETAS/SEC)

.20306E+19	.22104E+19	.22942E+19	.22955E+19	.22398E+19	.21612E+19
.20671E+19	.19704E+19	.18839E+19	.18023E+19	.17160E+19	.16240E+19
.15304E+19	.14366E+19	.13427E+19	.12491E+19	.11592E+19	.10760E+19
.99805E+18	.92757E+18	.86179E+18	.79878E+18	.73926E+18	.68281E+18
.62937E+18	.57909E+18	.53168E+18	.48648E+18	.44372E+18	.40360E+18
.36522E+18	.32806E+18	.29241E+18	.25860E+18	.22674E+18	.19665E+18
.16675E+18	.14332E+18	.12060E+18	.10072E+18	.83425E+17	.68783E+17
.57020E+17	.48218E+17	.41490E+17	.35853E+17	.30899E+17	.26420E+17
.22436E+17	.18924E+17	.15786E+17	.12926E+17	.10372E+17	.81518E+16
.62998E+16	.48233E+16	.36369E+16	.26917E+16	.19033E+16	.12636E+16

.78890E+15	.48186E+15	.30139E+15	.22938E+15	.18859E+15	.15078E+15
.11629E+15	.85413E+14	.58658E+14	.36352E+14	.19043E+14	.71201E+13
.10200E+13	.15557E+05	.52437E+04			

TOTAL BETA ENERGY SPECTRUM AT .194700E+03 SEC. TOTAL AND .184700E+03 SEC. DECAY (MEV/SEC)

.10322E+18	.33262E+18	.57386E+18	.80316E+18	.10073E+19	.11880E+19
.13428E+19	.14771E+19	.16007E+19	.17115E+19	.18011E+19	.18669E+19
.19122E+19	.19387E+19	.19462E+19	.19354E+19	.19120E+19	.18823E+19
.18458E+19	.18082E+19	.17661E+19	.17169E+19	.16629E+19	.16042E+19
.15416E+19	.14763E+19	.14086E+19	.13375E+19	.12643E+19	.11903E+19
.11136E+19	.10331E+19	.95013E+18	.86608E+18	.78194E+18	.69786E+18
.61567E+18	.53730E+18	.46416E+18	.39770E+18	.33775E+18	.28534E+18
.24225E+18	.20970E+18	.18458E+18	.16309E+18	.14362E+18	.12546E+18
.10880E+18	.93656E+17	.79696E+17	.66549E+17	.54434E+17	.43594E+17
.34326E+17	.26760E+17	.20540E+17	.15469E+17	.11128E+17	.75146E+16
.47695E+16	.29616E+16	.18826E+16	.14563E+16	.12160E+16	.98752E+15
.77285E+15	.57648E+15	.40133E+15	.25261E+15	.13414E+15	.50812E+14
.73695E+13	.11420E+06	.39004E+05			

TOTAL GAMMA SPECTRUM AT .194700E+03 SEC. TOTAL AND .184700E+03 SEC. DECAY (GAMMAS/SEC)

.17436E+19	.24139E+19	.96633E+18	.20927E+19	.19007E+19	.23658E+19
.24165E+19	.15948E+19	.19107E+19	.19700E+19	.69994E+18	.25335E+19
.20641E+19	.12123E+19	.23971E+19	.75825E+18	.22801E+19	.17123E+19
.17087E+19	.18108E+19	.11083E+19	.10121E+19	.11006E+19	.72772E+18
.69881E+18	.11250E+19	.15862E+19	.11341E+19	.18900E+19	.10476E+19
.54293E+18	.42354E+18	.35990E+18	.39653E+18	.36280E+18	.30823E+18
.24994E+18	.23412E+18	.25723E+18	.34355E+18	.30929E+18	.20320E+18
.18164E+18	.19427E+18	.22136E+18	.25056E+18	.23942E+18	.20947E+18
.18819E+18	.18805E+18	.27972E+18	.31240E+18	.21415E+18	.15558E+18
.17529E+18	.17119E+18	.13246E+18	.11095E+18	.82042E+17	.59005E+17
.56993E+17	.55397E+17	.49969E+17	.44470E+17	.49592E+17	.85962E+17
.14021E+18	.16328E+18	.13814E+18	.12119E+18	.14821E+18	.17552E+18
.15168E+18	.94253E+17	.55196E+17	.43102E+17	.39098E+17	.32999E+17
.27396E+17	.32851E+17	.60736E+17	.10372E+18	.12512E+18	.10396E+18
.72593E+17	.68238E+17	.84553E+17	.87464E+17	.62626E+17	.32465E+17
.17753E+17	.17614E+17	.21590E+17	.19917E+17	.12118E+17	.49304E+16
.17579E+16	.13934E+16	.21713E+16	.31174E+16	.40492E+16	.57792E+16
.87894E+16	.11603E+17	.12204E+17	.10867E+17	.93325E+16	.81487E+16
.68623E+16	.53658E+16	.38371E+16	.23687E+16	.11556E+16	.41654E+15
.10682E+15	.19173E+14	.24490E+13	.83958E+12	.44343E+13	.22560E+14
.84063E+14	.22883E+15	.45499E+15	.66129E+15	.70193E+15	.54431E+15
.30834E+15	.12760E+15	.38599E+14	.85254E+13	.13758E+13	.16224E+12
.13975E+11	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

TOTAL GAMMA ENERGY SPECTRUM AT .194700E+03 SEC. TOTAL AND .184700E+03 SEC. DECAY (MEV/SEC)

.21215E+17	.18309E+18	.11463E+18	.37668E+18	.42397E+18	.64477E+18
.77999E+18	.59841E+18	.80973E+18	.93061E+18	.36837E+18	.14606E+19
.12922E+19	.81873E+18	.17377E+19	.58786E+18	.18825E+19	.14988E+19
.15823E+19	.17656E+19	.11360E+19	.10879E+19	.12380E+19	.85512E+18
.85596E+18	.14343E+19	.21017E+19	.15594E+19	.26933E+19	.15455E+19
.82787E+18	.66709E+18	.58483E+18	.66419E+18	.62584E+18	.54711E+18
.45611E+18	.43898E+18	.49517E+18	.67851E+18	.62633E+18	.42163E+18
.38620E+18	.42253E+18	.49255E+18	.57005E+18	.55667E+18	.49752E+18
.45630E+18	.46541E+18	.70632E+18	.80440E+18	.56203E+18	.41613E+18
.47768E+18	.47505E+18	.37421E+18	.31903E+18	.23998E+18	.17551E+18
.17240E+18	.17032E+18	.15616E+18	.14119E+18	.15992E+18	.28148E+18
.46622E+18	.55119E+18	.47315E+18	.42118E+18	.52246E+18	.62738E+18
.54991E+18	.34644E+18	.20560E+18	.16272E+18	.14954E+18	.12786E+18
.10752E+18	.13059E+18	.24442E+18	.42273E+18	.51618E+18	.43406E+18
.30674E+18	.29168E+18	.36558E+18	.38271E+18	.27707E+18	.14527E+18
.80341E+17	.80586E+17	.99848E+17	.93100E+17	.57269E+17	.23540E+17
.84832E+16	.67939E+16	.10694E+17	.15511E+17	.20341E+17	.29332E+17
.45033E+17	.60043E+17	.63779E+17	.57336E+17	.49711E+17	.43798E+17
.37217E+17	.29379E+17	.21206E+17	.13204E+17	.65012E+16	.23632E+16
.61170E+15	.11072E+15	.14266E+14	.49317E+13	.26284E+14	.13478E+15
.50648E+15	.13902E+16	.27870E+16	.40841E+16	.43678E+16	.34151E+16
.19503E+16	.81366E+15	.24795E+15	.55201E+14	.89772E+13	.10669E+13
.92609E+11	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

TOTAL BETA SPECTRUM AT .194700E+03 SEC. TOTAL AND .184700E+03 SEC. DECAY (BETAS/FISSION)

.82035E-03	.89299E-03	.92683E-03	.92739E-03	.90485E-03	.87310E-03
.83509E-03	.79602E-03	.76110E-03	.72810E-03	.69327E-03	.65611E-03
.61828E-03	.58040E-03	.54246E-03	.50465E-03	.46831E-03	.43471E-03
.40321E-03	.37473E-03	.34816E-03	.32270E-03	.29866E-03	.27585E-03
.25426E-03	.23395E-03	.21479E-03	.19654E-03	.17926E-03	.16305E-03
.14755E-03	.13253E-03	.11813E-03	.10447E-03	.91600E-04	.79447E-04
.68172E-04	.57902E-04	.48722E-04	.40691E-04	.33703E-04	.27788E-04
.23036E-04	.19480E-04	.16762E-04	.14485E-04	.12483E-04	.10674E-04
.90640E-05	.76451E-05	.63775E-05	.52222E-05	.41903E-05	.32933E-05
.25451E-05	.19486E-05	.14693E-05	.10874E-05	.76894E-06	.51048E-06
.31871E-06	.19467E-06	.12176E-06	.92667E-07	.76189E-07	.60914E-07
.46979E-07	.34506E-07	.23698E-07	.14686E-07	.76934E-08	.28765E-08
.41206E-09	.62848E-17	.21184E-17			

TOTAL BETA ENERGY SPECTRUM AT .194700E+03 SEC. TOTAL AND .184700E+03 SEC. DECAY (MEV/FISSION)

.41701E-04	.13438E-03	.23184E-03	.32447E-03	.40692E-03	.47994E-03
.54249E-03	.59673E-03	.64669E-03	.69145E-03	.72764E-03	.75424E-03
.77253E-03	.78324E-03	.78626E-03	.78191E-03	.77244E-03	.76046E-03
.74571E-03	.73051E-03	.71351E-03	.69361E-03	.67179E-03	.64807E-03
.62280E-03	.59641E-03	.56906E-03	.54036E-03	.51078E-03	.48089E-03
.44991E-03	.41737E-03	.38385E-03	.34989E-03	.31590E-03	.28193E-03
.24873E-03	.21707E-03	.18752E-03	.16067E-03	.13645E-03	.11528E-03
.97869E-04	.84718E-04	.74569E-04	.65887E-04	.58022E-04	.50686E-04
.43956E-04	.37836E-04	.32197E-04	.26885E-04	.21991E-04	.17612E-04
.13867E-04	.10811E-04	.82981E-05	.62495E-05	.44957E-05	.30359E-05
.19269E-05	.11965E-05	.76057E-06	.56834E-06	.49127E-06	.39895E-06
.31223E-06	.23289E-06	.16214E-06	.10205E-06	.54192E-07	.20528E-07
.29772E-38	.46137E-16	.15757E-16			

TOTAL GAMMA SPECTRUM AT .194700E+03 SEC. TOTAL AND .184700E+03 SEC. DECAY (GAMMAS/FISSION)

.70440E-03	.97519E-03	.39039E-03	.84544E-03	.76786E-03	.95579E-03
.97623E-03	.64429E-03	.77191E-03	.79587E-03	.28277E-03	.10235E-02
.83388E-03	.48978E-03	.96841E-03	.30633E-03	.92115E-03	.69177E-03
.69029E-03	.73157E-03	.44774E-03	.40887E-03	.44462E-03	.29399E-03
.28232E-03	.45451E-03	.64080E-03	.45818E-03	.76355E-03	.42323E-03
.21934E-03	.17111E-03	.14540E-03	.16019E-03	.14657E-03	.12452E-03
.10097E-03	.94582E-04	.10392E-03	.13879E-03	.12495E-03	.82091E-04
.73382E-04	.78485E-04	.89426E-04	.10122E-03	.96726E-04	.84626E-04
.76027E-04	.75971E-04	.11301E-03	.12621E-03	.86516E-04	.62852E-04
.70814E-04	.69161E-04	.53515E-04	.44823E-04	.33145E-04	.23838E-04
.23025E-04	.22380E-04	.20187E-04	.17966E-04	.20035E-04	.34728E-04
.56643E-04	.65966E-04	.55807E-04	.48961E-04	.59876E-04	.70910E-04
.61279E-04	.38078E-04	.22299E-04	.17413E-04	.15795E-04	.13332E-04
.11068E-04	.13272E-04	.24537E-04	.41904E-04	.50549E-04	.41999E-04
.29327E-04	.27568E-04	.34159E-04	.35335E-04	.25301E-04	.13116E-04
.71721E-05	.71159E-05	.87224E-05	.80464E-05	.48954E-05	.19919E-05
.71018E-06	.56294E-06	.87721E-06	.12594E-05	.16358E-05	.23348E-05
.35509E-05	.46874E-05	.49302E-05	.43904E-05	.37703E-05	.32920E-05
.27723E-05	.21678E-05	.15502E-05	.95693E-06	.46688E-06	.16828E-06
.43155E-07	.77459E-08	.98940E-09	.33919E-09	.17914E-08	.91143E-08
.33961E-07	.92445E-07	.18381E-06	.26716E-06	.28357E-06	.21990E-06
.12457E-06	.51550E-07	.15594E-07	.34442E-08	.55583E-09	.65545E-10
.56460E-11	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

TOTAL GAMMA ENERGY SPECTRUM AT .194700E+03 SEC. TOTAL AND .184700E+03 SEC. DECAY (MEV/FISSION)

.85707E-05	.73968E-04	.46311E-04	.15218E-03	.17128E-03	.26048E-03
.31511E-03	.24175E-03	.32713E-03	.37596E-03	.14882E-03	.59006E-03
.52122E-03	.33076E-03	.70203E-03	.23749E-03	.76053E-03	.60550E-03
.63842E-03	.71330E-03	.45894E-03	.43951E-03	.50016E-03	.34546E-03
.34580E-03	.57945E-03	.84009E-03	.63000E-03	.10881E-02	.62439E-03
.33446E-03	.26950E-03	.23627E-03	.26833E-03	.25284E-03	.22103E-03
.18427E-03	.17734E-03	.20005E-03	.27411E-03	.25303E-03	.17034E-03
.15594E-03	.17070E-03	.19899E-03	.23030E-03	.22489E-03	.20099E-03
.18034E-03	.18802E-03	.28535E-03	.32497E-03	.22706E-03	.16811E-03
.19208E-03	.19192E-03	.15118E-03	.12889E-03	.96951E-04	.70905E-04
.69650E-04	.68808E-04	.63087E-04	.57038E-04	.64608E-04	.11372E-03
.18835E-03	.22268E-03	.19115E-03	.17015E-03	.21107E-03	.25346E-03
.22216E-03	.13996E-03	.83063E-04	.65738E-04	.60412E-04	.51656E-04
.43438E-04	.52759E-04	.98744E-04	.17078E-03	.20853E-03	.17536E-03
.12392E-03	.11784E-03	.14769E-03	.15461E-03	.11193E-03	.58687E-04
.32457E-04	.32556E-04	.40338E-04	.37612E-04	.23136E-04	.95102E-05
.34272E-05	.27447E-05	.43202E-05	.62666E-05	.82176E-05	.11850E-04
.18193E-04	.24257E-04	.25766E-04	.23164E-04	.20083E-04	.17694E-04
.15036E-04	.11869E-04	.85671E-05	.53345E-05	.26264E-05	.95472E-06
.24712E-06	.44729E-07	.57635E-08	.19924E-08	.10618E-07	.54451E-07
.20461E-06	.56163E-06	.11259E-05	.16499E-05	.17646E-05	.13797E-05
.78789E-06	.32871E-06	.10017E-06	.22301E-07	.36267E-08	.43102E-09
.37414E-10	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

FISSIONS / SEC = .247528E+22

BETAS / SEC = .428766E+20

BETAS / FISSION = .173219E-01

BETA MEV / SEC = .536854E+20

BETA MEV / FISSION = .216886E-01

CINDER BETA MEV / FISSION = .220944E-01 PERCENT DIFFERENCE = .183656E+01

GAMMAS / SEC = .580429E+20

GAMMAS / FISSION = .234490E-01

GAMMA MEV / SEC = .580977E+20

EXPERIMENTAL GAMMA MEV / FISSION = .294231E-01

GAMMA MEV / FISSION = .234712E-01

CINDER GAMMA MEV / FISSION = .234867E-01 PERCENT DIFFERENCE = .660528E-01

CINDER TOTAL BETA MEV / FISSION = .296158E-01 PERCENT DIFFERENCE = .267668E+02

CINDER TOTAL GAMMA MEV / FISSION = .298372E-01 PERCENT DIFFERENCE = .213359E+02

BETA COUNT = 163 ,GAMMA COUNT = 172

RATIO OF BETA MEV / FISSION TO TOTAL CINDER BETA MEV / FISSION = .732332E+00

RATIO OF CINDER BETA MEV / FISSION TO TOTAL CINDER BETA MEV / FISSION = .746034E+00

RATIO OF GAMMA MEV / FISSION TO TOTAL CINDER GAMMA MEV / FISSION = .786641E+00

RATIO OF CINDER GAMMA MEV / FISSION TO TOTAL CINDER GAMMA MEV / FISSION = .787161E+00

RATIO OF EXPERIMENTAL GAMMA MEV / FISSION TO TOTAL CINDER GAMMA MEV / FISSION = .986122E+00

RATIO OF EXPERIMENTAL GAMMA MEV / FISSION TO TOTAL CINDER GAMMA MEV / FISSION
(EXCLUDING CONVERSION ELECTRONS) = .986774E+00

RATIO OF EXPERIMENTAL GAMMA MEV / FISSION TO TOTAL MEV / FISSION = .125359E+01

NB. TOTAL REFERS TO ALL 825 FISSION PRODUCTS. THE REST REFER TO THE 181 FISSION PRODUCTS

THE FOLLOWING SPECTRA ARE NORMALIZED TO THE TOTAL CINDER-CALCULATED GAMMA AND BETA MEV/FISSION
FOR ALL 825 FISSION PRODUCTS

NORMALIZED BETA SPECTRUM AT .194700E+03 SEC. TOTAL AND .184700E+03 SEC. DECAY (BETAS/FISSION)

.11202E-02	.12194E-02	.12656E-02	.12663E-02	.12356E-02	.11922E-02
.11403E-02	.10870E-02	.10393E-02	.99422E-03	.94667E-03	.89591E-03
.84426E-03	.79253E-03	.74073E-03	.68910E-03	.63948E-03	.59359E-03
.55058E-03	.51170E-03	.47541E-03	.44065E-03	.40782E-03	.37668E-03
.34720E-03	.31946E-03	.29330E-03	.26837E-03	.24478E-03	.22265E-03
.20148E-03	.18098E-03	.16131E-03	.14266E-03	.12508E-03	.10849E-03
.93089E-04	.79065E-04	.66530E-04	.55564E-04	.46022E-04	.37944E-04
.31456E-04	.26600E-04	.22888E-04	.19779E-04	.17045E-04	.14575E-04
.12377E-04	.10439E-04	.87084E-05	.71309E-05	.57219E-05	.44970E-05
.34753E-05	.26608E-05	.20063E-05	.14849E-05	.10500E-05	.69706E-06
.43520E-06	.26582E-06	.16626E-06	.12654E-06	.10404E-06	.83178E-07
.64150E-07	.47119E-07	.32359E-07	.20054E-07	.10505E-07	.39278E-08
.56267E-09	.85818E-17	.28927E-17			

NORMALIZED BETA ENERGY SPECTRUM AT .194700E+03 SEC. TOTAL AND .184700E+03 SEC. DECAY (MEV/FISSION)

.56943E-04	.18349E-03	.31657E-03	.44307E-03	.55566E-03	.65536E-03
.74078E-03	.81484E-03	.88305E-03	.94417E-03	.99359E-03	.10299E-02
.10549E-02	.10695E-02	.10736E-02	.10677E-02	.10548E-02	.10384E-02
.10183E-02	.99751E-03	.97430E-03	.94713E-03	.91733E-03	.88494E-03
.85043E-03	.81439E-03	.77706E-03	.73786E-03	.69748E-03	.65665E-03
.61435E-03	.56991E-03	.52414E-03	.47778E-03	.43136E-03	.38498E-03
.33964E-03	.29640E-03	.25606E-03	.21939E-03	.18632E-03	.15741E-03
.13364E-03	.11568E-03	.10182E-03	.89968E-04	.79230E-04	.69211E-04
.60022E-04	.51666E-04	.43964E-04	.36712E-04	.30029E-04	.24049E-04
.18936E-04	.14762E-04	.11331E-04	.85337E-05	.61389E-05	.41455E-05
.26311E-05	.16338E-05	.10386E-05	.80338E-06	.67082E-06	.54477E-06
.42634E-06	.31802E-06	.22140E-06	.13935E-06	.73999E-07	.28031E-07
.40654E-08	.63000E-16	.21516E-16			

NORMALIZED GAMMA SPECTRUM AT .194700E+03 SEC. TOTAL AND .184700E+03 SEC. DECAY (GAMMAS/FISSION)

.89486E-03	.12389E-02	.49595E-03	.10740E-02	.97548E-03	.12142E-02
.12402E-02	.81849E-03	.98063E-03	.10111E-02	.35923E-03	.13003E-02
.10593E-02	.62221E-03	.12303E-02	.38916E-03	.11702E-02	.87881E-03
.87693E-03	.92938E-03	.56881E-03	.51943E-03	.56484E-03	.37349E-03
.35865E-03	.57741E-03	.81406E-03	.58206E-03	.97000E-03	.53767E-03
.27865E-03	.21737E-03	.18471E-03	.20351E-03	.18620E-03	.15819E-03
.12828E-03	.12016E-03	.13202E-03	.17632E-03	.15874E-03	.10429E-03
.93224E-04	.99707E-04	.11361E-03	.12859E-03	.12288E-03	.10751E-03
.96584E-04	.96512E-04	.14356E-03	.16033E-03	.10991E-03	.79847E-04
.89962E-04	.87861E-04	.67985E-04	.56943E-04	.42107E-04	.30283E-04
.29250E-04	.28432E-04	.25646E-04	.22824E-04	.25452E-04	.44118E-04
.71958E-04	.83803E-04	.70897E-04	.62200E-04	.76066E-04	.90083E-04
.77848E-04	.48374E-04	.28328E-04	.22121E-04	.20066E-04	.16936E-04
.14060E-04	.16860E-04	.31171E-04	.53234E-04	.64216E-04	.53354E-04
.37257E-04	.35022E-04	.43395E-04	.44889E-04	.32142E-04	.16662E-04
.91114E-05	.90399E-05	.11081E-04	.10222E-04	.62191E-05	.25304E-05
.90221E-06	.71515E-06	.11144E-05	.15999E-05	.20782E-05	.29661E-05
.45110E-05	.59548E-05	.62632E-05	.55775E-05	.47897E-05	.41822E-05
.35219E-05	.27539E-05	.19693E-05	.12157E-05	.59311E-06	.21378E-06
.54823E-07	.98403E-08	.12569E-08	.43090E-09	.22758E-08	.11579E-07
.43144E-07	.11744E-06	.23351E-06	.33940E-06	.36025E-06	.27935E-06
.15825E-06	.65488E-07	.19810E-07	.43755E-08	.70612E-09	.83267E-10
.71726E-11	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

NORMALIZED GAMMA ENERGY SPECTRUM AT .194700E+03 SEC. TOTAL AND .184700E+03 SEC. DECAY (MEV/FISSION)

.10888E-04	.93968E-04	.58832E-04	.19332E-03	.21760E-03	.33092E-03
.40032E-03	.30712E-03	.41558E-03	.47762E-03	.18906E-03	.74961E-03
.66215E-03	.42019E-03	.89186E-03	.30171E-03	.96616E-03	.76922E-03
.81104E-03	.90617E-03	.58304E-03	.55834E-03	.63540E-03	.43887E-03
.43931E-03	.73613E-03	.10787E-02	.80035E-03	.13823E-02	.79322E-03
.42489E-03	.34237E-03	.30015E-03	.34088E-03	.32120E-03	.28079E-03
.23409E-03	.22530E-03	.25414E-03	.34823E-03	.32145E-03	.21639E-03
.19810E-03	.21686E-03	.25279E-03	.29257E-03	.28570E-03	.25534E-03
.23419E-03	.23886E-03	.36250E-03	.41284E-03	.28845E-03	.21357E-03
.24516E-03	.24381E-03	.19206E-03	.16374E-03	.12317E-03	.90077E-04
.88483E-04	.87413E-04	.80146E-04	.72461E-04	.82078E-04	.14447E-03
.23928E-03	.28289E-03	.24284E-03	.21616E-03	.26814E-03	.32199E-03
.28223E-03	.17780E-03	.10552E-03	.83513E-04	.76747E-04	.65623E-04
.55183E-04	.67024E-04	.12544E-03	.21696E-03	.26492E-03	.22277E-03
.15743E-03	.14970E-03	.18763E-03	.19642E-03	.14220E-03	.74555E-04
.41234E-04	.41359E-04	.51245E-04	.47782E-04	.29392E-04	.12082E-04
.43538E-05	.34868E-05	.54883E-05	.79610E-05	.10440E-04	.15054E-04
.23112E-04	.30816E-04	.32733E-04	.29427E-04	.25513E-04	.22479E-04
.19101E-04	.15078E-04	.10884E-04	.67769E-05	.33366E-05	.12129E-05
.31394E-06	.56824E-07	.73218E-08	.25311E-08	.13490E-07	.69174E-07
.25994E-06	.71349E-06	.14304E-05	.20961E-05	.22417E-05	.17527E-05
.10039E-05	.41759E-06	.12726E-06	.28331E-07	.46074E-08	.54756E-09
.47530E-10	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.

NORMALIZED SUM GAMMA ENERGY SPECTRUM AT .194700E+03 SEC. TOTAL AND .184700E+03 SEC. DECAY (MEV/FISSION)

.10888E-04	.10486E-03	.16369E-03	.35701E-03	.57461E-03	.90552E-03
.13058E-02	.16130E-02	.20285E-02	.25062E-02	.26952E-02	.34448E-02
.41070E-02	.45272E-02	.54190E-02	.57207E-02	.66869E-02	.74561E-02
.82672E-02	.91733E-02	.97564E-02	.10315E-01	.10950E-01	.11389E-01
.11828E-01	.12564E-01	.13643E-01	.14443E-01	.15826E-01	.16619E-01
.17044E-01	.17386E-01	.17686E-01	.18027E-01	.18348E-01	.18629E-01
.18863E-01	.19089E-01	.19343E-01	.19691E-01	.20012E-01	.20229E-01
.20427E-01	.20644E-01	.20897E-01	.21189E-01	.21475E-01	.21730E-01
.21964E-01	.22203E-01	.22566E-01	.22979E-01	.23267E-01	.23481E-01
.23726E-01	.23970E-01	.24162E-01	.24325E-01	.24449E-01	.24539E-01
.24627E-01	.24714E-01	.24795E-01	.24867E-01	.24949E-01	.25094E-01
.25333E-01	.25616E-01	.25859E-01	.26075E-01	.26343E-01	.26665E-01
.26947E-01	.27125E-01	.27230E-01	.27314E-01	.27391E-01	.27456E-01
.27512E-01	.27579E-01	.27704E-01	.27921E-01	.28186E-01	.28409E-01
.28566E-01	.28716E-01	.28903E-01	.29100E-01	.29242E-01	.29317E-01

.29358E-01	.29399E-01	.29450E-01	.29498E-01	.29528E-01	.29540E-01
.29544E-01	.29548E-01	.29553E-01	.29561E-01	.29571E-01	.29586E-01
.29610E-01	.29640E-01	.29673E-01	.29703E-01	.29728E-01	.29751E-01
.29770E-01	.29785E-01	.29796E-01	.29802E-01	.29806E-01	.29807E-01
.29807E-01	.29807E-01	.29807E-01	.29807E-01	.29807E-01	.29807E-01
.29808E-01	.29808E-01	.29810E-01	.29812E-01	.29814E-01	.29816E-01
.29817E-01	.29817E-01	.29817E-01	.29817E-01	.29817E-01	.29817E-01
.29817E-01	.29817E-01	.29817E-01	.29817E-01	.29817E-01	.29817E-01
.29817E-01	.29817E-01	.29817E-01	.29817E-01	.29817E-01	.29817E-01
.29817E-01	.29817E-01	.29817E-01	.29817E-01	.29817E-01	.29817E-01

EXPERIMENTAL GAMMA ENERGY SPECTRUM AT .194700E+03 SEC. TOTAL AND .184700E+03 SEC. DECAY (MEV/FISSION)

.14185E-04	.60665E-04	.83500E-04	.78200E-04	.13292E-03	.12118E-03
.91050E-04	.10812E-03	.12600E-03	.13593E-03	.13213E-03	.14808E-03
.22246E-03	.30671E-03	.29084E-03	.27757E-03	.21098E-03	.22367E-03
.28132E-03	.30204E-03	.38898E-03	.39297E-03	.32040E-03	.31909E-03
.35392E-03	.36567E-03	.43981E-03	.54235E-03	.50865E-03	.47034E-03
.46875E-03	.43243E-03	.33663E-03	.27489E-03	.27185E-03	.31084E-03
.37975E-03	.45341E-03	.61385E-03	.77050E-03	.67685E-03	.46976E-03
.38065E-03	.46121E-03	.69360E-03	.82260E-03	.74865E-03	.60115E-03
.54920E-03	.61400E-03	.77215E-03	.90930E-03	.88510E-03	.79275E-03
.77175E-03	.76620E-03	.76250E-03	.83495E-03	.82375E-03	.68960E-03
.59705E-03	.54925E-03	.60265E-03	.62075E-03	.59555E-03	.57265E-03
.53355E-03	.54110E-03	.55185E-03	.60775E-03	.76855E-03	.72200E-03
.67180E-03	.93370E-03	.11149E-02	.93180E-03	.55045E-03	.44048E-03
.52210E-03	.44148E-03	.35761E-03	.39729E-03	.36805E-03	.42224E-03
.43788E-03	.38265E-03	.36053E-03	.26156E-03	.30991E-03	.40722E-03
.33330E-03	.32325E-03	.33075E-03	.28176E-03	.29139E-03	.32097E-03
.27402E-03	.27523E-03	.31005E-03	.27370E-03	.23340E-03	.20282E-03
.28722E-03	.31415E-03	.27606E-03	.29358E-03	.26955E-03	.21615E-03
.22908E-03	.19523E-03	.13967E-03	.12329E-03	.10072E-03	.11283E-03
.11177E-03	.12286E-03	.13875E-03	.19866E-03	.17970E-03	.15160E-03
.21621E-03	.20884E-03	.13041E-03	.10861E-03	.86185E-04	.61055E-04
.79625E-04	.65485E-04	.67750E-04	.16402E-03	.14552E-03	.73235E-04
.10123E-03	.11660E-03	.79725E-04	.27329E-04	.46334E-04	.71535E-04
.24634E-04	.16947E-04	.34339E-04	.27978E-04	.22420E-04	.15854E-04
.35980E-04	.62075E-04	.38637E-04	.23963E-04	.28810E-04	.14838E-04
.24545E-05	.18045E-05	-.11555E-05	-.28347E-05	.64305E-05	.19246E-04
.17272E-04	.90115E-05	.43751E-05	-.49705E-06	-.16056E-05	.90955E-06
-.78090E-06	-.93615E-06	.48880E-05	.81430E-05	.47634E-05	-.17327E-05
-.42328E-05	-.13787E-05	-.15781E-07	-.41644E-06	-.32327E-06	.43910E-07
.27612E-06					

EXPERIMENTAL SUM GAMMA ENERGY SPECTRUM AT .194700E+03 SEC. TOTAL AND .184700E+03 SEC. DECAY (MEV/FISSION)

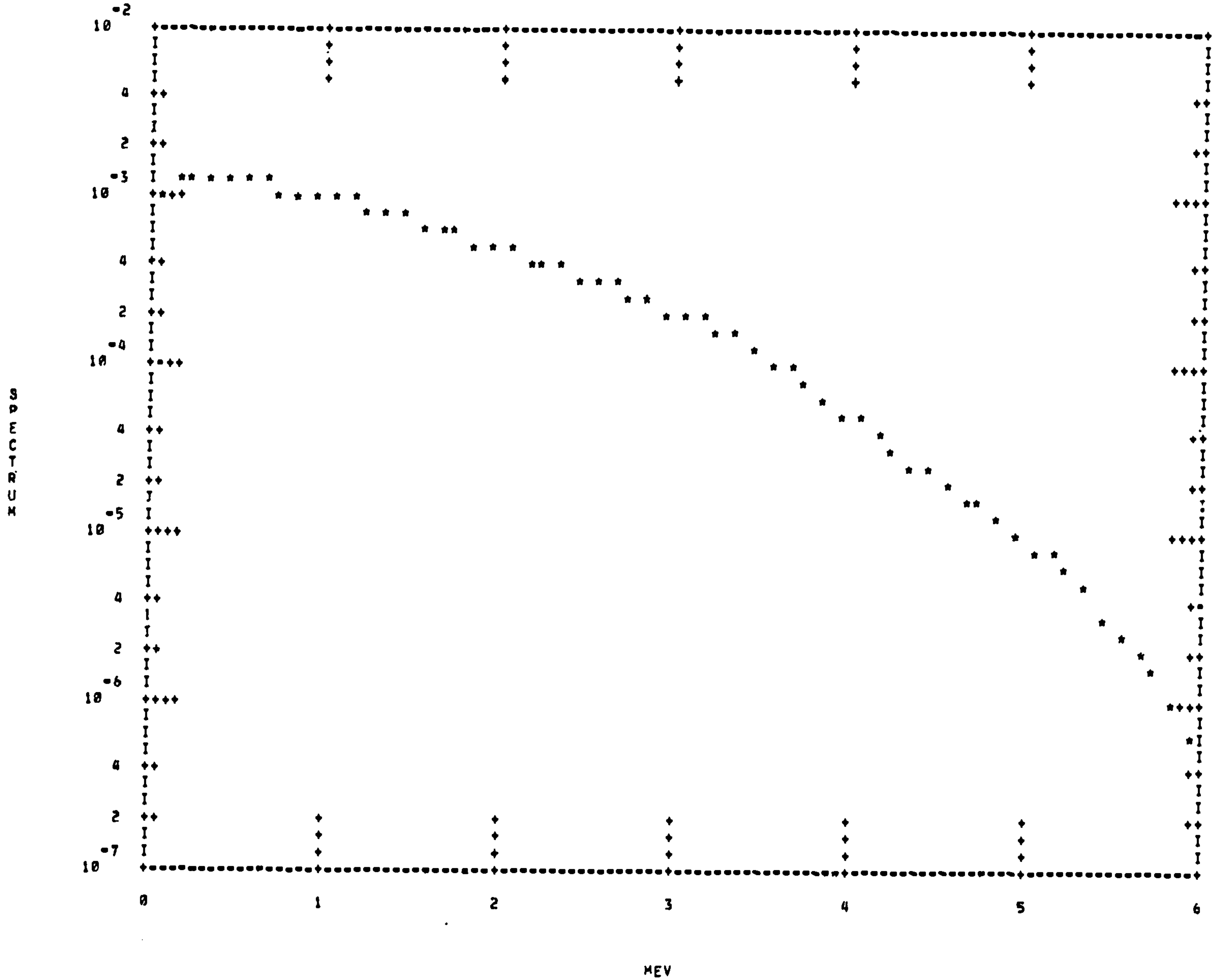
.28371E-05	.14970E-04	.31670E-04	.47310E-04	.73894E-04	.98131E-04
.11634E-03	.13797E-03	.16317E-03	.19035E-03	.21678E-03	.24640E-03
.31314E-03	.40515E-03	.49240E-03	.57568E-03	.63897E-03	.70607E-03
.79047E-03	.88108E-03	.99777E-03	.11157E-02	.12118E-02	.13075E-02
.14137E-02	.15234E-02	.16553E-02	.18180E-02	.19706E-02	.21117E-02
.22524E-02	.23821E-02	.24831E-02	.25656E-02	.26471E-02	.27404E-02
.28923E-02	.30736E-02	.33192E-02	.36274E-02	.38981E-02	.40860E-02
.42383E-02	.44228E-02	.47002E-02	.50292E-02	.53287E-02	.55692E-02
.57888E-02	.60344E-02	.63433E-02	.67070E-02	.70611E-02	.73782E-02
.76869E-02	.79933E-02	.82983E-02	.87158E-02	.91277E-02	.94863E-02
.97492E-02	.10057E-01	.10346E-01	.10644E-01	.10977E-01	.11206E-01
.11526E-01	.11806E-01	.12183E-01	.12499E-01	.13022E-01	.13397E-01
.13854E-01	.14340E-01	.15098E-01	.15582E-01	.15957E-01	.16186E-01
.16541E-01	.16859E-01	.17173E-01	.17459E-01	.17783E-01	.18087E-01
.18472E-01	.18748E-01	.19065E-01	.19254E-01	.19526E-01	.19820E-01
.20113E-01	.20346E-01	.20637E-01	.20840E-01	.21096E-01	.21327E-01
.21568E-01	.21766E-01	.22039E-01	.22236E-01	.22488E-01	.22675E-01
.22985E-01	.23274E-01	.23572E-01	.23842E-01	.24133E-01	.24332E-01
.24580E-01	.24759E-01	.24910E-01	.25024E-01	.25153E-01	.25279E-01
.25422E-01	.25560E-01	.25737E-01	.25960E-01	.26190E-01	.26360E-01
.26636E-01	.26870E-01	.27037E-01	.27159E-01	.27269E-01	.27337E-01
.27439E-01	.27526E-01	.27626E-01	.27843E-01	.28058E-01	.28155E-01
.28304E-01	.28458E-01	.28576E-01	.28612E-01	.28681E-01	.28775E-01
.28812E-01	.28834E-01	.28885E-01	.28922E-01	.28955E-01	.28979E-01
.29040E-01	.29134E-01	.29199E-01	.29235E-01	.29284E-01	.29306E-01
.29311E-01	.29313E-01	.29311E-01	.29307E-01	.29319E-01	.29352E-01
.29385E-01	.29400E-01	.29408E-01	.29408E-01	.29405E-01	.29406E-01
.29405E-01	.29403E-01	.29413E-01	.29429E-01	.29439E-01	.29435E-01
.29427E-01	.29424E-01	.29424E-01	.29423E-01	.29422E-01	.29423E-01
.29423E-01					

ERRORS OF EXPERIMENTAL GAMMA ENERGY SPECTRUM AT .194700E+03 SEC. TOTAL AND .184700E+03 SEC. DECAY

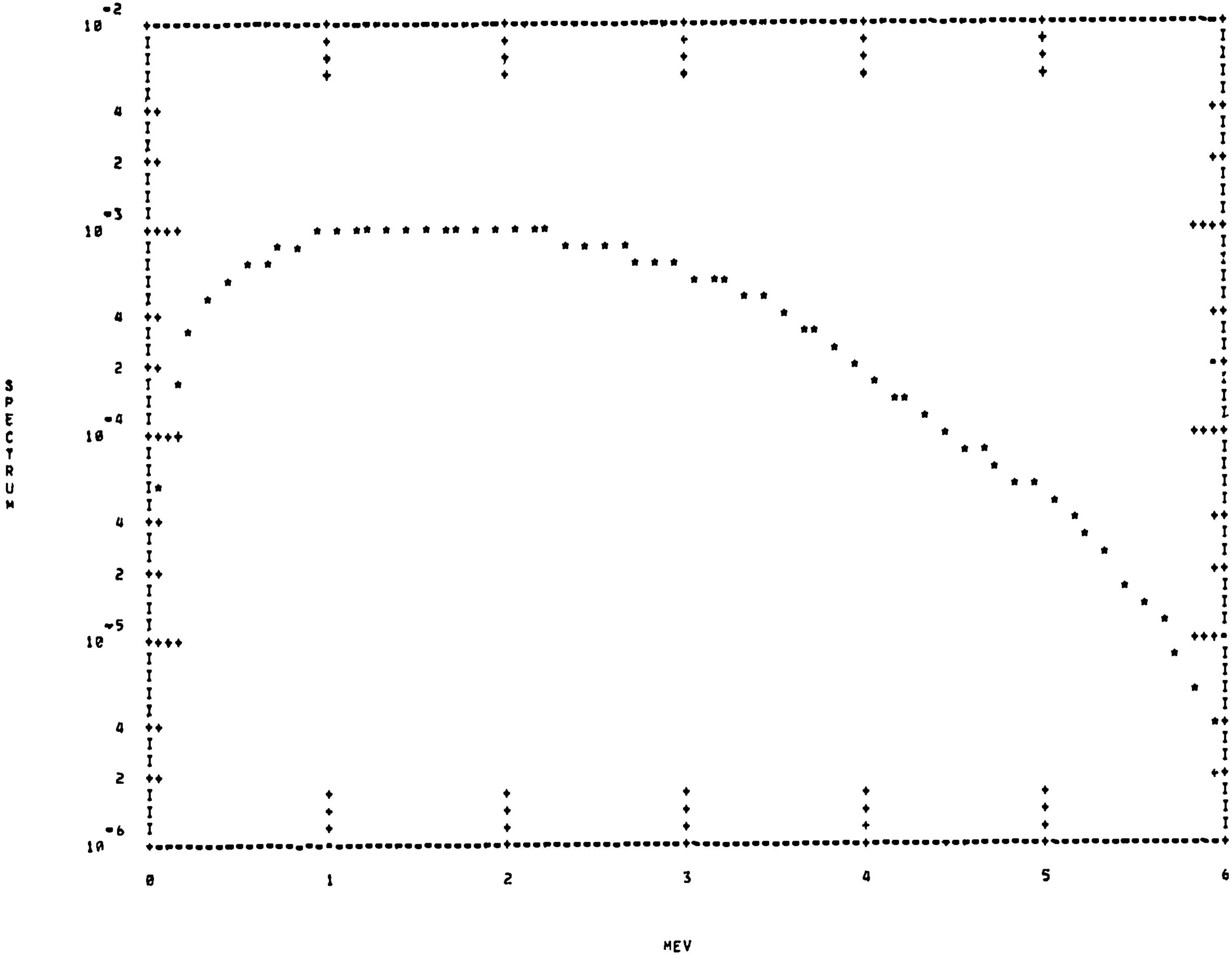
(MEV/FISSION)

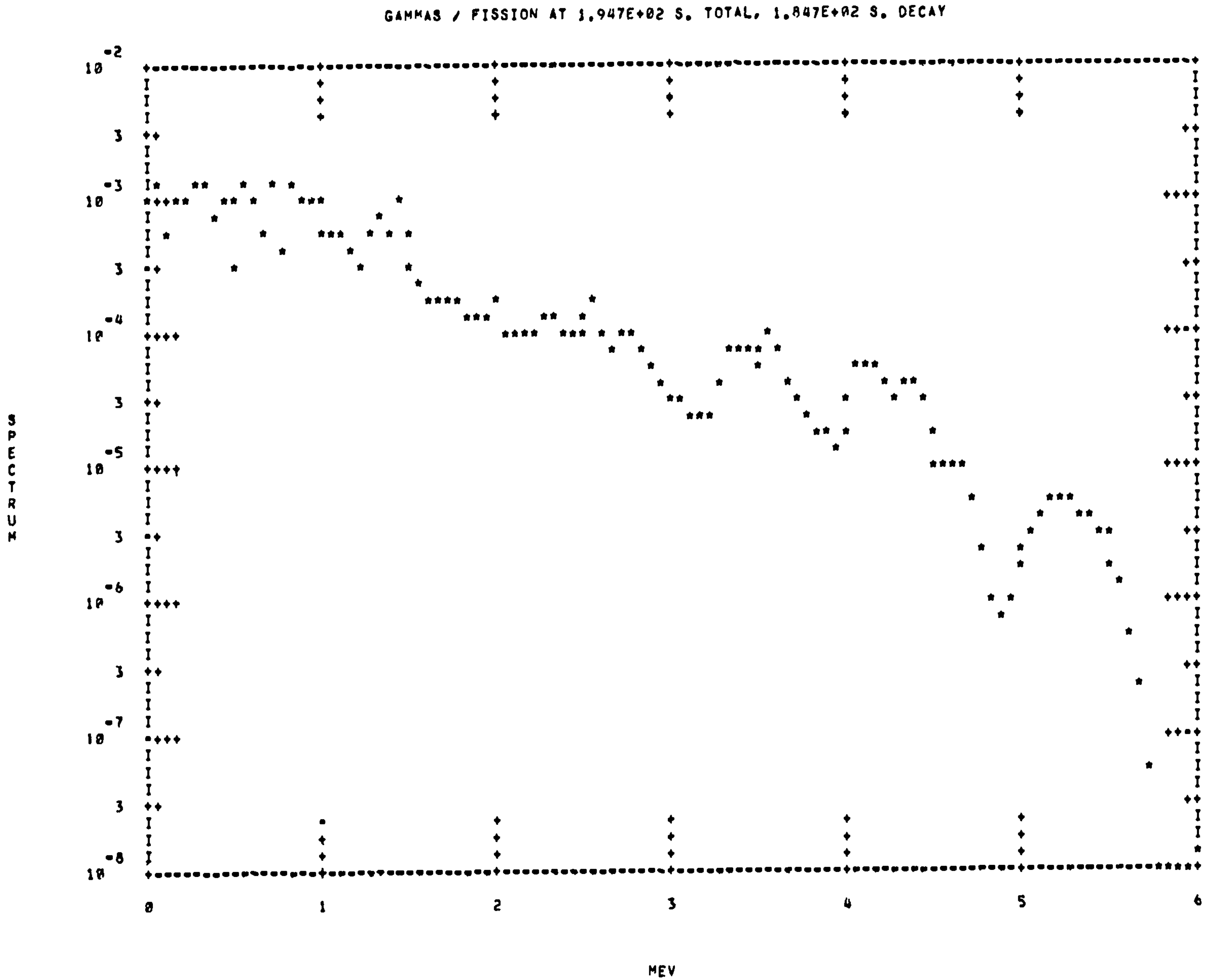
.25245E-05	.36302E-05	.43762E-05	.47628E-05	.54765E-05	.55930E-05
.57480E-05	.64010E-05	.69705E-05	.76185E-05	.80340E-05	.89060E-05
.89075E-05	.98030E-05	.99220E-05	.10285E-04	.10280E-04	.10445E-04
.11384E-04	.12208E-04	.13573E-04	.14028E-04	.13916E-04	.14236E-04
.14932E-04	.15514E-04	.16950E-04	.18210E-04	.18422E-04	.17862E-04
.15349E-04	.14734E-04	.14010E-04	.13765E-04	.14286E-04	.16088E-04
.16465E-04	.16996E-04	.19449E-04	.21430E-04	.20806E-04	.18453E-04
.17633E-04	.18932E-04	.21554E-04	.23682E-04	.23051E-04	.20868E-04
.22520E-04	.21746E-04	.24121E-04	.26404E-04	.26602E-04	.25160E-04
.24082E-04	.24372E-04	.24620E-04	.25522E-04	.25642E-04	.24118E-04
.22952E-04	.23443E-04	.24851E-04	.25224E-04	.24343E-04	.24315E-04
.24719E-04	.24593E-04	.26176E-04	.28889E-04	.32462E-04	.33208E-04
.31702E-04	.33015E-04	.34900E-04	.31173E-04	.26321E-04	.31221E-04
.34350E-04	.32706E-04	.31063E-04	.31028E-04	.33801E-04	.43239E-04
.49914E-04	.41769E-04	.33511E-04	.28246E-04	.30070E-04	.32340E-04
.31362E-04	.30728E-04	.31447E-04	.31351E-04	.33299E-04	.32301E-04
.32186E-04	.32056E-04	.30615E-04	.31138E-04	.31080E-04	.30277E-04
.32151E-04	.32616E-04	.31915E-04	.36558E-04	.40193E-04	.40307E-04
.32723E-04	.26713E-04	.24570E-04	.24990E-04	.23571E-04	.24457E-04
.23252E-04	.23772E-04	.23549E-04	.25963E-04	.25493E-04	.23494E-04
.26948E-04	.27977E-04	.24708E-04	.22426E-04	.21425E-04	.20361E-04
.22023E-04	.19744E-04	.20348E-04	.23604E-04	.23688E-04	.20123E-04
.21846E-04	.21198E-04	.18640E-04	.15485E-04	.14490E-04	.17748E-04
.15091E-04	.15566E-04	.15552E-04	.13934E-04	.14286E-04	.12814E-04
.13042E-04	.13872E-04	.12031E-04	.11616E-04	.10278E-04	.99675E-05
.81535E-05	.74145E-05	.67290E-05	.57525E-05	.55980E-05	.69855E-05
.57830E-05	.45861E-05	.44776E-05	.44743E-05	.41131E-05	.58410E-05
.36341E-05	.22235E-05	.47630E-05	.44845E-05	.46359E-05	.38902E-05
.20578E-05	.47622E-05	.30849E-05	.24801E-05	.22389E-05	.20970E-05
.18585E-05					

BETAS PER FISSION AT 1.947E+02 S. TOTAL, 1.847E+02 S. DECAY

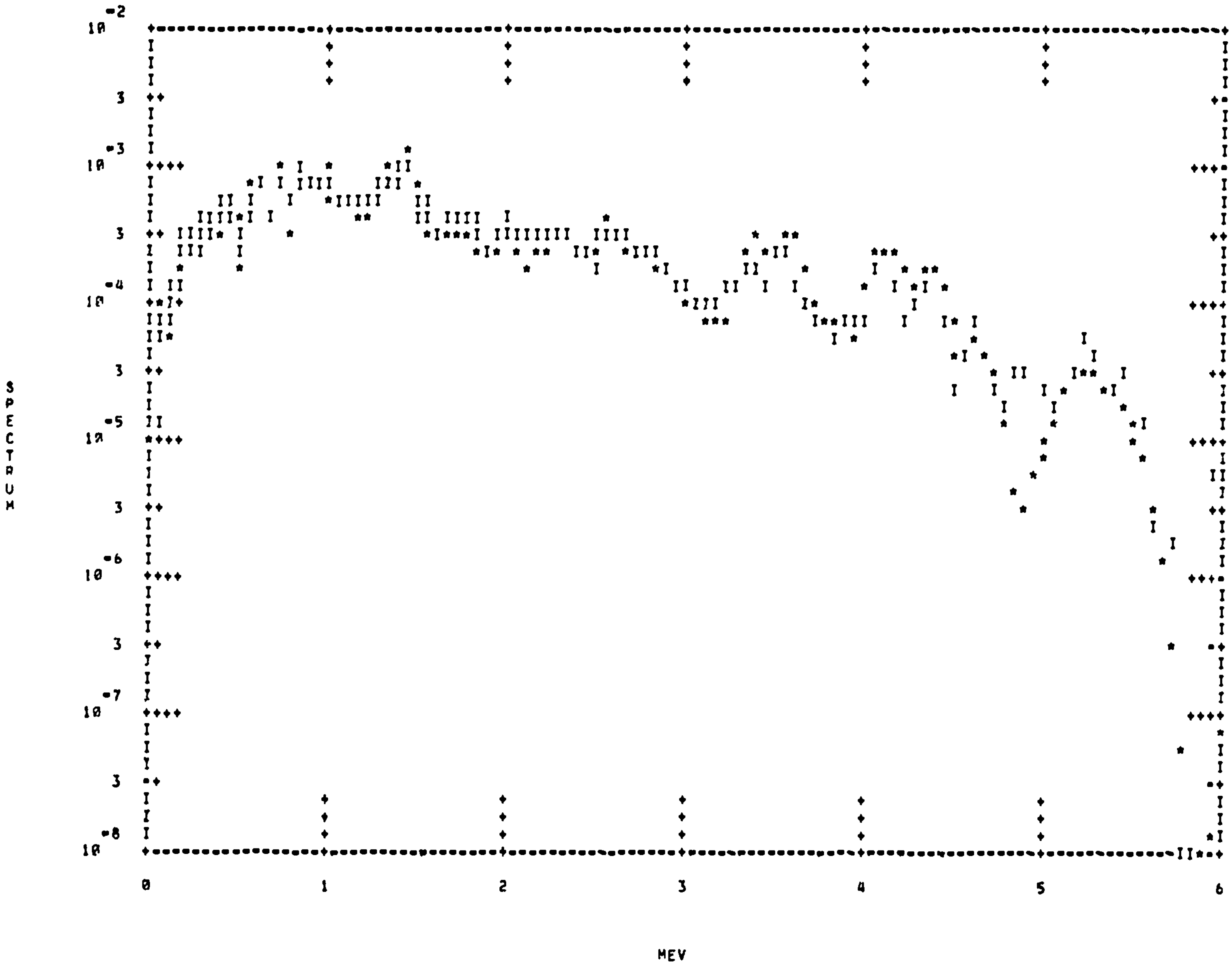


BETA MEV/FISSION AT 1.947E+02 S. TOTAL, 1.847E+02 S. DECAY




GAMMAS / FISSION AT 1.947E+02 S. TOTAL, 1.847E+02 S. DECAY
SPECTRUM
MEV
10^-2
10^-3
10^-4
10^-5
10^-6
10^-7
10^-8
3
0
1
2
3
4
5
6

GAMMA MEV/FISSION AT 1.947E+02 S. TOTAL, 1.847E+02 S. DECAY



☆ U.S. GOVERNMENT PRINTING OFFICE:1977—777-018/65