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**TPASS, a Gamma-Ray
Spectrum Analysis and
Isotope Identification
Computer Code**

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OPERATED BY
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CONTENTS

	<u>Page</u>
ABSTRACT	v
I. INTRODUCTION	1
II. USER'S MANUAL	2
A. Group 1 Input Data	3
B. The Data	4
C. The List of Specified Radionuclides	4
D. Table of Radionuclide Gamma-Ray Decay Data	4
E. Operation of the Code	5
III. PHILOSOPHY AND CODE CONSTRUCTION	6
IV. LISTING OF THE COMPUTER PROGRAM TPASS	12
V. PROBLEM SET-UP; THE INPUT DATA FILE ON UNIT 5	53
Test Case Data	61
VI. OUTPUT LISTING ON UNIT 6	66
VII. LISTING OF THE OUTPUT ON UNIT 31	84
VIII. REFERENCES AND FOOTNOTES	87

ABSTRACT

The gamma-ray spectral data-reduction and analysis computer code TPASS is described. This computer code is used to analyze complex Ge(Li) gamma-ray spectra to obtain peak areas corrected for detector efficiencies, from which are determined gamma-ray yields. These yields are compared with an isotope gamma-ray data file to determine the contributions to the observed spectrum from decay of specific radionuclides. A complete FORTRAN listing of the code and a complex test case are given.

INTRODUCTION

The computer code TPASS¹ is a collection of routines designed to assist data reduction of gamma-ray spectra obtained with a high-resolution detection system. Using this computer code peaks in the spectrum are identified, areas are determined and corrected for detection efficiencies, and source identifications are made, when possible, by comparisons with tabulated radionuclide decay data.

It may be asked why it is necessary to create another gamma-ray data reduction code when there are already many such codes documented. For example, in the recent conference on Computers in Activation Analysis and Gamma-Ray Spectroscopy² more than 20 such codes (or portions) were discussed including such well known routines as SAMPO,³ GASPAN,⁴ and GAMANL.⁵ There are two reasons. In the first place TPASS has evolved over a period of about 15 years and has been used in a variety of experimental programs; it has been easier to adapt and improve the present code to new demands than to try to adapt one of the above-mentioned codes. Secondly, as pointed out by Parr, Houtermans, and Schaerf⁶ at this same conference, the quality of the results depends more upon the user than the code. These authors tested 23 users of SAMPO,³ 9 users of GASPAN,⁴ 8 users of GAMANL,⁵ and 7 users of PHILIPOT⁷ by means of a "standardized" data set. Their major conclusion is,

"Perhaps rather surprisingly each of these four programs produced results covering a wide range of performance, demonstrating once again that it is the user rather than the program who plays the major role in determining the quality of the results."

TPASS, in several forms, has served the author well. Presently it is being used to reduce data for an experiment to determine fission-product yields by gamma-ray assay,⁸ and as this experimental program is expected to produce new information in the future, this computer routine is being documented.

This introduction is followed by two expository sections, a complete listing of the code, a complete listing of a set of input data, and a partial listing of the resulting calculated output. The next section is in the form of a user's manual, followed by a section presenting the main philosophical points, and limitations, of this code. The "traditional" flow charts are almost absent from this document; the only one given is associated with the discussion of the "background" subtraction routine. The reason for the lack of flowcharts is that I rarely use them; as a consequence the actual coding is likely not optimal. Whether or not optimal, the running time is quite satisfactory. A complicated 4096-channel spectrum is reduced, and comparisons are made with decay data for up to 70 fission products in five minutes of PDP-10[†] CPU time, less time if the printer-plot option is suppressed.

USER'S MANUAL

The input data can be conveniently divided into four groupings:

1. General information, including energy calibration, specifications of the detection system, and dates and times;
2. Spectrum from the analyzer;
3. List of anticipated radionuclides; and
4. Table of radionuclide decay data.

[†]Digital Equipment Corporation PDP-10, KA-10.

A. Group 1: Input Data.

See the first part of subroutine CALC. The first three data cards contain information for energy calibration, which may be either linear or quadratic. Each card contains the data pair (channel no., energy in keV) in 2 F10.2) format. If the third pair are set to zero, the calibration is linear.

The fourth card contains five data, in (I5, 4F5.1) format, which are as follows:

1. Detector ID. This ID determines which efficiency calibration and (if available) information on resolution will be used.
2. Time constant of the electronic system (in μsec). From this and the total count rate, a dead time is determined based upon experimental measurements.
3. Thickness of equivalent carbon absorber.
4. Test for gamma-ray energy equivalence (in keV).
5. Type of radionuclide being studied. See subroutine SRCH.

The fifth data card contains the reference time and date of a calibration or end of an irradiation, and the sixth data card contains the same information for the beginning of the counting period.

The seventh card contains the source-to-detector geometry information, in this case distance in cm. For the primary detector used in the fission-product experiment efficiency $\epsilon(E_\gamma)$ is determined using this datum.

The eighth card gives two brief titles, and an integer from 1 to 8 to indicate the number of channels (in units of 512 channels) of spectral data.

B. The Data.

The eighth card of group 1 and the spectral data are read in by the main routine. The spectral data require a (3X, 10F7.0) format.

C. The List of Specified Radionuclides.

The first entry is the number of radionuclides in (I5) format followed by one set of data for each radionuclide consisting of the pair (Z,A) in real numbers (not integers) in 2F10.2) format. For example, ^{24}Na is designated (11., 24.). For isomers 300 is added to A. A negative value for Z will cause the code to ignore $T_{1/2}$ of the parent of the selected radionuclide in the computation of source strength at the reference time. These data need not be ordered.

D. Table of Radionuclide Gamma-Ray Decay Data.

This table has evolved from one originally compiled by F. Dyer¹⁰ and so the format is the same. Two changes have been made for the fission-product yield program. (1) More than 5 gamma rays may be entered for a given radionuclide. (2) The parent half-life replaces the stable isotope percentage in the Dyer compilation.

For a given radionuclide, the first card contains information in a (I2, 3I3, A3, E10.3, 10X, 2E10.3, 11X, 11, 4X, E10.3) format as follows (see subroutine SRCH):

1. ISM = 0 for ground state decay, ISM = 3 for isomer if $A < 100$., etc.
2. IA = Mass of radionuclide.
3. IZ = Charge number of radionuclide.
4. NGAM = number of gamma rays tabulated.
5. NAME = alphanumeric symbol of radionuclide.

6. THALF = Half Life of radionuclide (sec).
7. TX = not used in this experiment.
8. TP = Half life of parent (sec).
9. KIND = Type of radionuclide (see subroutine SRCH).
10. UX = fission product yield (fraction). These have been set equal zero for present experiment since determination of these is the goal of the measurement.

The second, and additional if needed, card for each radionuclide consists of (E_Y [keV], fraction-of-decay) pairs, with up to 5 pairs per card, in (10F8.2) format.

E. Operation of the Code.

The Input data are on logical unit 5, and output data are written out on logical units 6, 30, and 31. The output on unit 30 is a brief version of that on 6, and could be eliminated. The output on unit 31 is a condensed listing of all analyzed experimental gamma-ray data.

For calculations on the Oak Ridge Electron Linear Accelerator (ORELA) PDP-10, the files TPASS.SAV and ISOTO.DAT may be transferred from [104, 1116]. A file labelled FOR05.DAT is created with the data groupings in order as listed above, with the ISOTO.DAT file as group 4. It is best to run TPASS as a BATCH job. Prepare a file XXXXXX.RUN, (the X's represent a file name) as follows:

```
.AS DSK 5
.AS DSK 6
.RU TPASS
.K/F
```


Then queue XXXXXX.RUN as a batch job. For a 4096 channel spectrum, the FOR06.DAT output will require 1000 to 1500 blocks to accomodate the printer-plot output. To eliminate these plots, the very first data card in the FOR05.DAT file should be a negative number (a minus sign before the channel value for the first entry in the energy calibration). Then FOR06.DAT output will require 150 to 200 blocks.

For other computers, job control language cards will be required to precede the code, between code and data, and following the data. In addition the DA function, the first executable statement of the main routine, has different function names and formats for different computers. All else should work.

PHILOSOPHY AND CODE CONSTRUCTION

This code is intended to be used as a research tool to speed up data reduction and to present data in a manner which allows the researcher to determine the adequacy of the analysis. It is not meant to be the "final" answer to all data analyzed. In my opinion no computer routine can provide "final" answers untouched by human thought, and indeed the research of Parr, Houtermans and Schaerf,⁶ quoted above, is a strong indication that the state-of-the-art has not yet reached this goal.

Therefore, there is a great deal of simplicity in TPASS. For example, after trying out a number of the various shapes to represent the gamma-ray peak proposed by numerous authors a rather simple analytic shape was chosen and only the Gaussian portion is subjected to parametric search. The resolution width is parameterized as a linear function of E_γ , so that the parametric search on the Gaussian "peak fit" is limited to areas and

centroids. In TPASS, the intrinsic resolution widths, $\sigma(E_Y)$, for the two primary detectors are known for ideal counting conditions. Most actual counting conditions are not ideal, and TPASS allows for moderate changes in $\sigma(E_Y)$ to accomodate such variations in counting conditions as may occur from one measurement to the next. Once the linear representation for $\sigma(E_Y)$ has been determined, the information will be used to flag peaks too broad to be due to a single gamma-ray. For close-lying unresolved doublets the fixing of $\sigma(E_Y)$ provides results comparable to those estimated by manual (graphical-peak-stripping) methods. For multiplet peaks which are at least partially resolved TPASS gives adequate results; however, unresolved multiplet peaks are usually not adequately analyzed.

The "background" estimation routine (which estimates the continuum portion of real data) is a simple iterative method not requiring any a priori knowledge of the spectrum. The technique can be used for any spectral data, and it can be coded compactly for a minicomputer in assembly language. Figure 1 gives the flow chart and Fig. 2 shows an example. The major drawback of this algorithm is that it tends to slightly overestimate the subtraction, occasionally missing a small peak superimposed upon a large continuum having comparatively poor statistics. One advantage, however, is in the ease in locating the regions in the spectrum containing data to be analyzed. The KB array of subroutine BSUB will contain a string of consecutive zeros for such regions, and the limits of a region to be studied are taken directly from the pattern of ones and zeroes in this array.

A comparison of peak areas extracted using TPASS with areas extracted graphically is given in Table 1. The agreement for the larger-yield peaks

Fig. 1. Flowchart for the algorithm to determine the Compton continuum underlying a gamma-ray spectrum obtained using a Ge(Li) detector. At entry the data are in the D-array. The calculated continuum is stored in the B-array. The K-array is initially set to be all ones; individual elements of this array will be set to zero corresponding to channels containing data significantly larger than the estimated continuum.

Fig. 2. Small portion of a gamma-ray spectrum exhibiting gamma rays emanating from fission products 100 days following thermal-neutron irradiation of a sample of ^{245}Cm . The dashed line corresponds to the average-counts/channel determined in the first pass through the subroutine. The algorithm determines that the yield in counts/channel in 13 channels is significantly greater than computed; consequently the data for these 13 channels (4 corresponding to the 487-keV gamma ray, 4 corresponding to the 497-keV gamma ray, and 5 corresponding to the 511-keV gamma ray) are excluded from the average-counts/channel for the second pass. The results for the second pass are shown as a dash-dot line. It is evident that data from 6 more channels should be excluded from the average units/channel procedure. Three passes later the algorithm yields the continuum shown by the solid curve.

is quite satisfactory. Experience with the code for a series of similar data, a study¹¹ of the half life of ^{132}Te by measuring yields of the 228-keV gamma ray, indicates that TPASS will provide peak areas consistent within assigned uncertainties.

Uncertainties assigned to peak area extractions are not derived from a "statistical" calculation, but are rather determined from the estimated minimum continuum subtraction. The reason for this choice of determining the uncertainty is that the underlying continuum is not a random distribution, particularly when the data of interest are spread over several channels by the finite resolution of data-taking equipment.

After the peak areas have been extracted and E_γ assignments made, the efficiencies, $\epsilon(E_\gamma)$, are determined for the particular detector using the function EFFIC. For the large-volume Ge(Li) primary detector used in the fission-product measurements, the efficiency-vs-energy calibration was done very carefully¹² for source-to-detector distance, D , of 20 cm, and these results are given in the function GE20. For other D the function EMFAC is used to compute the change in effective solid angle subtended by the source. Another available detector that has been used is a high-resolution intrinsic Ge detector. The efficiency-vs-energy data for this detector are given in the two functions ELEPS and EFLEPS. There is an option by specifying $ID > 2$ to provide efficiency-vs-energy data for additional detectors using a function called AJFEE. If it is a large-volume detector such that the resolution-vs-energy characteristics are similar to the primary detector, the detector $ID=3$ will use the estimated resolution data as a guide. If it is a high-resolution detector then $ID=4$ will use the $ID=2$ estimated resolution as a guide.

Table 1. Comparison of Peak Extraction Techniques^a

E Y	Light-Pen Area	Computer Code Area	% Difference
186	242000	266000	10.
242	302000	306000	1.3
295	625000	628000	0.5
352	992000	990000	0.2
511	10800	11100	3.0
609	686000	684000	0.3
719	5850	5520	5.7
768	58600	58900	0.6
806	13200	12960	1.8
934	30300	30800	1.6
1120	121900	121400	0.4
1238	43200	43100	0.2
1281	10450	10710	3.2
1661	6160	5844	5.2
1765	80400	78900	1.8
1935	861	900	4.8
2204	20280	19520	3.7
2448	5600	5400	3.5

^aThis table is taken from an earlier report, J. K. Dickens, "Energies and Intensities of Gamma Rays Emitted by a ²²⁶Ra Source," ORNL-TM-3509 (1971). The data in the second column were extracted using an interactive display computer routine. The data in the third column were extracted using an early version of TPASS.

Using detector ID=5 will result in a best fit to the resolution-vs-energy data extracted during the first pass through the data, i.e. no prior knowledge of the detector resolution is assumed.

TPASS uses a direct comparison of E_γ of the extracted data with tabulated values to indicate likely responsible radionuclides. Because the present program involves determining yields of specified (sometimes called "forced") radionuclides, a search is made to ascertain if experimental data are available which match the E_γ in the data table. If so, the computation of the yield at time and date information on the fifth card is made. If E_γ given in the data table for the specified nuclide cannot be located in the list of extracted E_γ , a search is made of the raw data for a possible missed peak in the region of the channel position computed from the energy calibration. All specified radionuclides are subjected to comparisons, and in addition radionuclides not among the specified radionuclides may also be located during the isotope data table search. Finally, all experimental E_γ having been placed with one or more radionuclides will be tabulated along with one or more possible sources. At this point one could do a matrix calculation similar to that done in e.g. GAMANL,¹³ however, it isn't done in TPASS.

LISTING OF THE COMPUTER PROGRAM TPASS

The main routine is listed first followed by the subprograms in alphabetical order. A list of subprograms called by a given subprogram follows the listing of that subprogram. In this list a subprogram having a period(.) as the last character is a PDP-10 library function; except for the function "DATE" (in the first executable statement of the main program) these library functions should be recognized by other compilers.

```

C THIS IS FILE TPASS.F4
C PURPOSE IS TO MAKE GOOD ESTIMATES OF YIELDS AND CENTROIDS
C THEN TO COMPARE WITH GAMMA-RAY DATA TABLE FOR
C RADIONUCLIDE IDENTIFICATION
C
  REAL*8 TODAY
  COMMON /DATA/ DATA,B,SA,SB,NCHANL
  COMMON /A1/ NDET, LB, SLOPE, CONST, SSUM
  COMMON /SPG1/ SGF
  DIMENSION DATA(4096), B(4096), KB(4096), AR(300), IZ(300), SIG(300)
  DIMENSION AREN(300), FLAG(300), LB(8), BKN(300), CKN(300)
  DIMENSION CH(4096), ARE(300), SIGC(300), CLIN(2,300), BK(300)
  DIMENSION ITB(300), CK(300), RES(4100), PKPOS(10)
  DIMENSION PKY0(10), CLINH(2,300), SGF(300)
  DATA NSMTH/15/
  DATA FLAG1/5H FLAG/, BLANK/5H /

C
C PRINT TODAYS DATE
  CALL DATE(TODAY)
  WRITE (6,200) TCDAY
  WRITE (30,200) TODAY
  NEW=0
  TS=0.0
  NPLOTT=0
  CALL CALC(TS, AR, AREN, ITB, NEW)
C THIS CALL TO CALC TO GET INITIAL DATA READ IN
  IF (TS.LT.0.0) NPLOTT=1
C THIS BIT OF BUSINESS TO DELETE PRINTER PLOTS IF DESIRED.
C SEE THE CALC ROUTINE FOR CHANGING OF TS VARIABLE
C
C SET UP EXPECTED RESOLUTION OF DETECTOR IF KNOWN
C (ORNL DECAY HEAT DETECTOR NO 1 IS 90CC GE(LI)
C ( AND DETECTION NO 2 IS LEPS X-RAY DETECTOR)
  CALL TSIGN(NDET, SA1, SB1)
  SA=SA1
  SB=SB1
  SA1=(SA+CONST*SE)/SLOPE
  READ (5,201) (LB(K), K=1,8)

C
CC NOW GET SPECTRAL DATA INTO ARRAY DATA(K)
  NCHANL=512*IABS(LB(4))
  READ (5,202) (DATA(K), K=1,NCHANL)
  TS=DATA(1)

C
C SECTION FOR INITIAL ESTIMATE OF B-ARRAY
  SSUM=-TS
  DO 1 I=1, NCHANL
    SSUM=SSUM+DATA(I)
    RES(I)=0.
  1 CH(I)=FLOAT(I-1)
  WRITE (6,203) (LB(K), K=1,8), TS, SSUM
  WRITE (30,203) (LB(K), K=1,8), TS, SSUM
  WRITE (31,204) TS
  CALL BSUB(DATA, B, KB, NCHANL, NSMTH)
C END INITIAL ESTIMATE OF B-ARRAY
C

```



```

C   START FIRST ROUND OF AREA ESTIMATION
2  NP=1
   SAVG=0.0
   SVGG=0.0
C   NEXT IS EFFECTIVE DC LOOP ON VARIABLE NP
C   TO STATEMENT PRECEDING 12
C   THE PURPOSE OF THIS LOOP IS TO MAKE A FIRST PASS
C   AT THE DATA TO GET APPROXIMATE AREAS, CENTROIDS,
C   AND RESOLUTION WIDTHS
   J=2
3  NC=0
   S=0.
   BB=0.
4  J=J+1
   IF (J.GT.NCHANL) GO TO 11
   IF (KB(J).EQ.0) GO TO 5
   NC=NC+1
   S=S+DATA(J)-B(J)
   BB=BB+B(J)
   GO TO 4
5  IF (NC.LE.1) GO TO 3
   IF (NC.GT.2) GO TO 6
   NC=NC+1
   BB=BB+B(J)
   S=S+DATA(J)-B(J)
   J=J+1
6  DE=SQRT(S+2.0*BB)
   IF (S.LT.4.0*DE) GO TO 3
   JH=J
   NC=NC+2
   J1=J-NC+1
   DHAX=0.
   CENT=0.
   BJH=B(JH)
   IF (B(J1).LT.BJH) BJH=B(J1)
   IF (BJH.LT.0.0) BJH=0.0
   BJH=BJH-SQRT(BJH)
   SBJ=-2.0*BJH
   DO 8 K=J1,JH
   SBJ=SBJ+BJH
   DAK=DATA(K)-B(K)
   IF (DAK.LT.DHAX) GO TO 7
   DHAX=DAK
   KMAX=K
7  KK=K-J1
8  CENT=CENT+DAK/FLOAT(KK)
9  CENT=-1.0*CENT/S+FLOAT(J1)
   CALL YPMAX(KMAX,DATA,B,X0,Y0,NCHANL)
   X0=X0-1.
   TSIGNA=S/Y0/2.5066
   IF (NP.EQ.1) WRITE(6,205)
   WRITE(6,206) NP,CENT,S,DE,TSIGNA,X0
   AR(NP)=S
   KZ(NP)=CENT
   ITB(NP)=X0
   SIG(NP)=TSIGNA

```

```
C      SCF(NP)=1.0
C FOR "STANDARD" DETECTOR COMPARE EXPERIMENTAL RESOLUTION
C WITH THAT EXPECTED FOR THE DETECTOR. IF TOO WIDE OR
C TOO NARROW REPLACE EXPERIMENTAL WITH CALCULATED
C RESOLUTION FOR THE SECOND PASS THROUGH THE DATA
    IP (NDET.GE.1 .AND. NDET.LE.3) SIG(NP)=SA1+SB*.XTB(NP)
    IF (TSIGNA.GT.1.35*SIG(NP) .OR. TSIGNA.LT.0.9*SIG(NP))
      GO TO 10
    SGF(NP)=9.0
    SAVG=SAVG+TSIGNA/SIG(NP)
    SVGG=SVGG+1.0
    SIG(NP)=TSIGNA
10 SBJJ=S+BB-SBJ
    IF (SBJJ.LT.0.0) SBJJ=0.0
    ARE(NP)=SQRT(SBJJ)
CHANGED DELTA-Y PER FCP DISCUSSION 29-AUG -- LOOKS AS FOLLOWS
C
C     PEAK SHAPE LOG SCALE
C                                     *
C                                     *
C                                 *
C                                *
C                               *
C                             *
C                          *
C                       *
C                    **B**BB
C                      | BB
C                      | B
C                      | BB
C                      |.....BB***
C                      |          |
C                   B(J1)       B(JH)
```

```
C
C CLIN(1,NP)=J1
C CLIN(2,NP)=JH
C BK(NP)=B(J1)-B(JH)
C CK(NP)=B(JH)
C NP=NP+1
C IF (NY.LE.300) GO TO 3
C
C END DO-LOOP FROM STATEMENT 7 ABOVE
C
11 NP=NP-1
   IP (SVGG.LE.0.0) GO TO 13
   SAVG=SAVG/SVGG-1.0
   DO 12 NPN=1,NP
12 SIG(NPN)=SIG(NPN)*(1.0+SAVG*SGF(NPN))
C NOW FIT A SHOOT CURVE THROUGH THE TABLE OF
C RESOLUTION WIDTHS USING -SIGFIT-
13 CALL SIGFIT(NP,SIG,SICG,XZ,SA,SD)
   SAVG=100.*SAVG
   WRITE(6,207) SAVG,SVGG
C
C PREPARE FOR SECOND PASS TO REFINE AREAS,
C CENTROIDS USING (FIXED) RESOLUTION WIDTHS
C NY=0
```

```

DO 15 I=1,NP
J1=CLIN(1,I)
JH=CLIN(2,I)
KX=KX(I)+1.0
SS=SIGC(I)
C1=CK(I)
C2=BK(I)
DO 14 J=J1,JH
IJ=FLOAT(J)
14 B(J)=C2/(1.0+EXP((KJ-KX)/SS))+C1
15 CONTINUE
NPP=NP
DO 31 I=1,NPP
NTRY=0
J1=CLIN(1,I)
JH=CLIN(2,I)
DE=ARE(I)
GROSS=0.0
ARSV=0.0
DO 16 J=J1,JH
GROSS=GROSS+DATA(J)
16 ARSV=ARSV+DATA(J)-B(J)
IF (ARSV.LE.0.0) GO TO 17
BKSV=BK(I)/ARSV
CKSV=CK(I)
SS=SIGC(I)
C "FIND" ALL PEAKS IN THE GROUP UNDER STUDY USING -FIND-
CALL FIND(DATA,E,J1,JH,PKPOS,PKY0,NX)
IF (NX.GE.1) GO TO 18
17 NP=NP-1
CLIN(2,I)=0.
GO TO 31
18 J=NEW+1
NEW=NEW+NX
C ITERATE ONLY ON AREAS AND CENTROIDS TO GET BEST FIT
19 CALL ITRATE(J1,JH,PKPOS,PKY0,NX,SS)
IF (NX.LE.2 .OR. NTRY.EQ.1) GO TO 20
IF (ABS(PKPOS(1)-PKPOS(2)).GE.SS) GO TO 20
PKPOS(1)=0.5*(PKPOS(1)+PKPOS(2))
NEW=NEW-1
NTRY=1
NX=1
GO TO 19
20 ATOT=0.
DO 21 N=1,NX
21 ATOT=ATOT+PKY0(N)
ATOT=ATOT*2.506628*SS
ADIF=ABS(1.0-ATCT/ARSV)
IF (ADIF.GT.0.1 .AND. NX.GT.1) GO TO 22
GO TO 27
C NEXT SHORT SECTION TO TEST FOR POSSIBLE EXTRA
C PEAK "ON THE SIDE" OF A MAIN PEAK.
22 ASUB=ARSV-ATOT
IF (ASUB.LT.100.0) GO TO 27
K0=PKPOS(1)
DO 23 KJ=J1,JH

```

```

      KJ=FLOAT(KJ)
      G=PCALSS(ATOT,SS,IJ,K0)
23  RES(KJ)=DATA(KJ)-G-B(KJ)
      K2=IPKX(K0+0.5) -1
      K1=J1
24  IF (K2-K1 .LT. 3) GO TO 26
      SJ=0.0
      CJ=0.0
      DO 25 KJ=K1,K2
      SJ=SJ+RES(KJ)
25  CJ=CJ+RES(KJ)*FLOAT(KJ)
      IF (SJ .LT. 0.8*ASUB) GO TO 26
C  IF "EXTRA" PEAK, REDO ITERATION WITH ADDED PARAMETERS
      TJ=CJ/SJ
      IF (ABS(TJ-PKPOS(NX)) .LT. SS) GO TO 26
      NX=NX+1
      PKPOS(NX)=TJ
      PKY0(NX)=SJ/SS/2.506628
      NEW=NEW+1
      GO TO 19
26  IF (K1.NE.J1) GO TO 27
      K1=K2+2
      K2=JN
      GO TO 24
27  IF (ARSV.GT.ATOT) ARSV=ATOT
      K=1
C
C
      DO 30 N=J,NEW
      KTB(N)=PKPOS(K)-1.0
C  NEXT STATEMENT ALLCS A SLIGHT ADJUSTMENT OF PEAK
C  AREAS SO AS NOT TO EXCEED TOTAL AVAILABLE YIELD
      AR(N)=2.506628*SS*PKY0(K)*ARSV/ATOT
      SIG(N)=SS
      FLAG(N)=BLANK
C  HOWEVER, FLAG IS SET WHEN SUM OF PITTED AREAS IS
C  VERY DIFFERENT FROM THAT EXPECTED FROM THE FIRST PASS
      IF (ADIP.GT.0.1) FLAG(N)=FLAG1
      CLINH(1,N)=J1
      CLINH(2,N)=JN
      XZ(N)=FLOAT(NX)+0.000001
      IF (NX.GE.2) GO TO 28
      ARNN=DE
      GO TO 29
28  SUBNX=GROSS-ARSV
      BROTHN=ARSV-AR(N)
      ARNN=SQRT(ARSV*BROTHN+0.5*SUBNX)
29  IF (ARNN.LT.SQRT(AR(N))) ARNN=SQRT(AR(N))
      AREN(N)=ARNN
      CKN(N)=CKSV
      JKN(N)=BKSV
30  K=K+1
C
C
31 CONTINUE
C

```

```

C END OF DO LOOP -- ALL DATA ANALYZED SECOND TIME
C
32 WRITE (6,208)
   DO 33 I=1,NEW
      YPS=AR(I)/TS
      WRITE (6,210) I,XZ(I),AR(I),AREN(I),SIG(I),CLINH(1,I), CLINH(2,I)
      1,BKN(I),XTB(I),YPS,FLAG(I)
33 CONTINUE

C
C SET UP FOR PRINTER PLOT OF EACH FITTING.
C THESE PLOTS CAN BE SUPPRESSED BY HAVING A NEGATIVE
C VALUE INPUT AS THE FIRST CHANNEL VALUE
C ON INPUT CARD NUMBER 1. (SEE COMMENT ABOVE)
   JUMP=0
   IZET=0
   WRITE (6,211)
   LCT=0
   DO 40 I=1,NP
34 IZ=I+IZET
   J1=CLIN(1,IZ)
   J2=CLIN(2,IZ)
   IF (J2.GT.J1) GO TO 35
   IZET=IZET+1
   GO TO 34
35 L1=I+JUMP
   XNN=XZ(L1)
   IXX=XNN
   JUMP=JUMP+IXX-1
   L2=L1+IXX-1
36 DO 38 J=J1,J2
   XJ=PLCAT(J)
   G=0.0
   DO 37 L=L1,L2
   XO=XTB(L)+1.0
37 G=G+PGAUSS(AR(L),SIG(L),XJ,XO)
   RES(J)=DATA(J)-G-B(J)
38 CONTINUE
   CHSQO=CHISQU(RES,DATA,J1,J2)
   CHKR=BLANK
   IF (CHSQO.GT.9.C) CHKR=FLAG1
   LCT=LCT+6*L2-L1
   NCT=0
   IF (NPLOTT.EQ.0) NCT=3+J2-J1
   LCT=LCT+NCT
   IF (LCT.LE.60) GO TO 39
   WRITE (6,211)
   LCT=NCT+6*L2-L1
39 WRITE (6,212) I,CHSQO,CHKR
   WRITE (6,206) (I,XTB(L),AR(L),AREN(L),SIG(L),XTB(L),L=L1,L2)
   IF (NPLOTT.EQ.0) CALL PLT(DATA,RES,CH,J1,J2,-1)
40 CONTINUE

C END PRINTER PLOTS FOR EACH FITTING
C
C TOTAL SPECTRUM PRINTER PLOT FOLLOWS
   WRITE (6,213)
   WRITE (6,214)

```

```

      41 IF (UPLOTT.EQ.0) CALL PLT(DATA,B,CH,2,MCNHL,1)
C   END TOTAL SPECTRUM PRINTER PLOT
C
C   NOW GO TO CALC AGAIN TO FINISH THE JOB
      CALL CALC(TS,AR,AREN,XTB,NEW)
      STOP
200 FORMAT('  TODAY IS 'A10/)
201 FORMAT(3A4,I3,4A4)
202 FORMAT(3X,10F7.0)
203 FORMAT(1X,3A4,I4,4A4,' COUNT-TIME='F7.0,' SECS'/
1 33X'TOTAL COUNT='1PE12.4/)
204 FORMAT(F15.0,' SEC = T-COUNT')
205 FORMAT('  PEAK  CENT-      YIELD'17X'WIDTH'
1 4X'XTBL'/3X'BO'4X'ROID')
206 FORMAT(I4,0PF8.2,F12.2,' +OR-'F8.2,F11.4,F8.2)
207 FORMAT(15X,'SIGMA AVERAGE INCREASE WAS ',F8.2,
1  ' PERCENT, BASED ON 'F4.0,' DATA POINTS')
208 FORMAT(1H1' SECOND PASS'/' PK-BO  CENTROID'10X,'YIELD'
1 10X,'WIDTH'5X,'LO-CHAN  HI-CHAN'5X,'BK'7X,'XTBL  YIELD/SEC')
209 FORMAT(I10)
210 FORMAT(I6,0PF9.2,F11.2,2F10.4,2F10.1,1PE11.3,0PF11.2,1PE11.3,A5)
211 FORMAT(1H1)
212 FORMAT(/////' PARTIAL PLOT FOR GROUP 'I2,2X,
1  'CHISQ='F12.4,20X,A5,39X,' DATA RPSID')
213 FORMAT(21H1  TOTAL PLOT FOLLOWS)
214 FORMAT(/)
      END

```

SUBPROGRAMS CALLED

TSIGN	PGAUSS	IABS.	SQRT.	SIGFIT	PLT
ITRATE	IPIX.	FLOAT.	EXP.	YPHAX	DATE
ABS.	BSUB	CHISQU	FIND	CALC	

C THIS IS FILE AJPE25.F4
 C THIS IS EFFICIENCY CALIBRATION OF JPE-KJN DETECTOR
 C FOR 229-IN RUN OF JUNE 16, 1980, D=25 CM INCL BE ABSORBER

FUNCTION AJPEE(EG)

DIMENSION E(43),F(43)

DATA EXP0/1.0E-5/

DATA E/46.33, 76.09, 87.44, 93.35, 103.4, 121.06, 151.3, 154.5,

1 168.9, 1.7, 210.9, 242.6, 275.3, 295.9, 317.15, 352.6, 388.7,

2 408., 435.1, 455.5, 487.9, 544.4, 580.9, 610.1, 666.2,

3 720.8, 769.2, 807.1, 889.35, 965.2, 1070.4, 1156.1, 1253.9,

4 1378.6, 1408.7, 1510.2, 1584.1, 1694.2, 1839.7, 2055.49,

5 2205.1, 2448.8, 2753.2/

DATA F/9.185, 29.42, 38.2, 42.74, 49.69, 59.14, 65.73, 65.75,

1 64.54, 61.9, 53.82, 45.93, 39.91, 36.87, 34.18, 30.49,

2 27.47, 26.09, 25.05, 23.24, 21.62, 19.29, 18.04, 17.15,

3 15.66, 14.45, 13.52, 12.87, 11.66, 10.73, 9.655, 8.927,

4 8.218, 7.46, 7.296, 6.796, 6.47, 6.039, 5.546, 4.943,

5 4.594, 4.114, 3.634/

CC

EFF=F(1)

IF (EG.LE.E(1)) GO TO 7

IF (EG.LE.E(43)) GO TO 2

EFF=F(43)*E(43)/EG

GO TO 7

2 EFF=INTERP(E,F,EG,43)

7 A 'EE=EFF*EXP0

RE. TRN

END

SUBPROGRAMS CALLED

INTERP

```

C THIS IS FILE BSUB.F4
C PURPOSE IS TO GET INITIAL ESTIMATE OF BACKGROUND-ARRAY
  SUBROUTINE BSUB(DATA,B,KB,NCHAWL,NS)
    DIMENSION DATA(1),B(1),KB(1)
    DO 1 I=1,NCHAWL
      B(I)=DATA(I)
1    KB(I)=1
      N=NS/2
      DO 5 I=1,5
        DO 3 J=3,NCHAWL
          S=0.
          J1=J-N
          IF (J1.LT.3) J1=3
          J2=J+B
          IF (J2.GT.NCHAWL) J2=NCHAWL
          SUM=0.
          DO 2 K=J1,J2
            S=S+FLOAT(KB(K))*DATA(K)
2          SUM=SUM+FLOAT(KB(K))*DATA(K)
            B(J)=0.99*B(J-1)
            IF (S.LE.0.05) GO TO 3
            B(J)=SUM/S
3          CONTINUE
          DO 4 J=N,NCHAWL
            SQD=SQRT(2.0*DATA(J))
            IF (DATA(J)-B(J) .GT. SQD) KB(J)=0
            IF (B(J) .GT. DATA(J)) KB(J)=1
            IF (B(J) .GT. DATA(J)+SQD) B(J)=DATA(J)+SQD
4          CONTINUE
5          CONTINUE
          RETURN
        END

```

SUBPROGRAMS CALLED

SQRT.
FICAT.


```

SUBROUTINE CALC (TCT,A,AE,ITB,NPK)
DOUBLE PRECISION NPWT,NBLNK2,NBWK
COMMON /A1/ ND,ED,SLOPE,CONST,SSUR
DIMENSION A(1),AE(1),ITB(1),EN(300),G(300),CYLD(300)
DIMENSION BRG(300),SRZ(300),SRA(300),IDGAN(300),WCALC(20)
DIMENSION JDGAN(300,5),DYLD(300),NORTH(12),ED(8),NAA(5),NZN(5)
DATA NBLNK/4H /,NPWT/8HPARENT /,NBLNK2/8H /
DATA NISOR/4HISOR/,CPPSV/1.0/,ALW2/0.693147/
DATA NORTH/4H JAN,4H FEB,4H MAR,4H APR,4H MAY,4H JUN,4H JUL,4H AU
16,4H SEP,4H OCT,4H NOV,4H DEC/
IF (TCT.GE.1.0) GO TO 5

```

```

C
C CHECK VARIABLE TCOUNT.
C TCOUNT < 1 FIRST PASS THRU CALC
C TCOUNT > 1 SECOND PASS THRU CALC (GO TO STATEMENT 5)
C
C FIRST PASS -- GET GENERAL INFORMATION
WRITE (6,200)
C
CARD READ NO. 1 C1=CHANNEL, E1=ENERGY (KEV)
READ (5,201) C1,E1
TCT=C1
C1=ABS(C1)
C IF C1 IS INPUT AS A NEGATIVE NUMBER WE DISPENSE WITH PRINTER PLOTS
C IN THE MAIN ROUTINE
C
CARD READ NO. 2 AND 3
READ (5,201) C2,E2
READ (5,201) C3,E3
IF (C3.EQ.0.0) GO TO 1
CHOICE OF LINEAR OR QUADRATIC ENERGY CALIBRATION
NEG=1
SLOPE=EGANNA(1, 0., C1,E1,C2,E2,C3,E3)
ZZ=0.
CONST=EGANNA(2, 1.0, ZZ,ZZ,ZZ,ZZ,ZZ,ZZ)
GO TO 2
1 NEG=2
SLOPE=(E2-E1)/(C2-C1)
CONST=E2-SLOPE*C2
WRITE (6,202) CONST,SLOPE
C3=1.5*C2
E3=CONST+SLOPE*C3
EE=EGANNA(-1, 0.0,C1,E1,C2,E2,C3,E3)
C
CARD READ NO. 4
2 READ (5,203) ND, TINCST,CTHIK,DELTA,AKIND
KIND=IFIX(AKIND*.001)
IF (DELTA.LT.0.01) DELTA=1.5
WRITE (6,204) ND,TINCST,CTHIK,DELTA
WRITE (30,204) ND,TINCST,CTHIK,DELTA
C
CARD READ NO. 5
READ (5,205) T1,D1,EN1,Y1
WRITE (6,206) T1,D1,EN1,Y1
WRITE (30,206) T1,D1,EN1,Y1
C

```

```

CARD READ NO. 6
  READ (5,205) T2,D2,EH2,Y2
  WRITE (6,207) T2,D2,EH2,Y2
  WRITE (30,207) T2,D2,EH2,Y2
C
CARD READ NO. 7          DST IN CH
  READ (5,201) DST
  WRITE (6,208) DST
  WRITE (30,208) DST
C  NOW COMPUTE COOLING TIME BETWEEN TIME DATA
C  READ IN ON CARDS 5 & 6
  IDAY=0
  ND1=WCAY(D1,EH1,Y1)
  ND2=WCAY(D2,EH2,Y2)
  IF (Y2.EQ.Y1) GO TO 4
  DELY=Y2-Y1
  IDY=IFIX(DELY+0.1)
  YY=Y1
  DO 3 I=1,IDY
    LY=IFIX(YY+0.1)
    LL=LY/4
    LY=LY-4*LL
    IF (LY.EQ.0) ICAY=IDAY+1
    YY=YY+1.
  3 IDAY=IDAY+365
  4 DT=FLCAT(ND2+IDAY-ND1)
  TA=T1/100.
  I=IFIX(TA+0.0001)
  TB=T1-FLOAT(I*100)
  TC=T2/100.0
  J=IFIX(TC+0.0001)
  TD=T2-FLOAT(J*100)
  TCH=TD-TB +60.*(FLOAT(J-I) +24.*DT)
  TCOOL=TCH*60.0
  TCH=TCH/60.0
  TCD=TCH/24.
  WRITE (6,209) TCOOL,TCH,TCH,TCD
  WRITE (30,209) TCOOL,TCH,TCH,TCD
  WRITE (31,210) TCOOL
  RETURN
C  END FIRST PASS.  GC BACK TO MAIN ROUTINE
C
C  SECOND PASS
C
C  FIRST GET GAMMA ENERGY AND EFFICIENCY FOR EACH
C  PEAK DETERMINED IN THE MAIN ROUTINE
  5 DO 7 I=1,NPK
    IF (NEG.EQ.2) GO TO 6
    EN(I)=EGAMMA(2,XTB(I),ZZ,ZZ,ZZ,ZZ,ZZ,ZZ)
    GO TO 7
  6 EN(I)=CONST+SLOPE*XTB(I)
  7 CONTINUE
  DDTDT=0.00000467*TINCST*SSUH/TCT
  DTDI=1.0+DDTDT
  DDTDT=(0.2*DDTDI)**2
C  LAST ACCOUNTS FOR DEAD TIME DUE TO PILE-UPS IN LAB I SYSTEM

```

```

SHIN=CONST
IF (SHIN.LT.0.0) SHIN=0.0
SHAX=CONST+SLOPE*FLOAT(511*KB(4))
DO 8 I=1,NPK
EF=EFFIC(EN(I),DST,ND)
ENH=0.001*EN(I)
CCOR=CARBON(ENH,CTHIK) +1.0
DCCOR=(0.2*(CCOR-1.))**2
CYLD(I)=A(I)*DTIT*CCOR/EF
DYLD(I)=CYLD(I)*SQRT((AE(I)/A(I))**2 +DDTDT+DCCOR)
IDGAN(I)=0
DO 8 JDDJ=1,5
8 JDGAN(I,JDDJ)=0
C ORDER BY DECREASING EFFICIENCY-CORRECTED
C YIELD USING -ORDRE-
CALL ORDRE(EN,CYLD,DYLD,IDGAN,NPK)
WRITE(6,211)
WRITE(30,211)
C LIST EXPERIMENTAL GAMMA RAY INFORMATION
DO 9 I=1,NPK
IF(CYLD(I).LT.1.0E9) WRITE(30,214) EN(I),CYLD(I),DYLD(I)
IF(CYLD(I).LT.1.0E9) WRITE(6,214) EN(I),CYLD(I),DYLD(I)
IF(CYLD(I).GE.1.0E9) WRITE(30,213) EN(I),CYLD(I),DYLD(I)
IF(CYLD(I).GE.1.0E9) WRITE(6,213) EN(I),CYLD(I),DYLD(I)
WRITE(31,212) EN(I),CYLD(I),DYLD(I)
9 CONTINUE
C
READ(5,203) NSRC
CARD READ-IN OF SOURCE INFORMATION
DO 10 J=1,NSRC
10 READ(5,201) SRZ(J),SRA(J)
WRITE(6,215) NSRC
WRITE(30,215) NSRC
WRITE(6,216) (SRZ(J),SRA(J),J=1,NSRC)
WRITE(30,216) (SRZ(J),SRA(J),J=1,NSRC)
C NOTE ISOMERIC STATE MASS = 300+MASS
C COMPARE SOURCE GAMMA ENERGIES WITH DATA. IF CLOSE
C ASSUME YIELD TO GIVE INFO ON THIS SOURCE
11 CALL SRCH(IZ,IA,ISON,NGAN,NAME,THALP,KINDY,THX,UPXS,TP5,G,BRG)
C IF IZ=-1 END OF ISOTOPE TABLE
C--SEARCH TO END OF ISOTOPE DATA FILE 12/80
IF(IZ.LE.0) GO TO 29
DO 15 J=1,NSRC
IF(SRZ(J).EQ.0.0) GO TO 15
IF(SRZ(J).GT.0.0) GO TO 12
SRZ(J)=-SRZ(J)
TP5=0.0
C--LAST ALLCNS IGNORING OF PARENT HALF LIFE
12 IZ1=IPX(SRZ(J)+0.001)
IA1=IPX(SRA(J)+0.001)
ISH=0
IF(IA1.LT.300) GO TO 13
IA1=IA1-300
ISH=3+IA/100
13 IF(IZ.EQ.IZ1 .AND. IA.EQ.IA1 .AND. ISON.EQ.ISH) GOTO 14
GO TO 15

```

```

14 SRZ(J)=0.0
   GO TO 18
15 CONTINUE
C--IF IT GETS TO HERE DIDN'T FIND AMONG THE -WSRC- INPUT
C   ENTRIES OF DEMANDED ISOTOPES
C   SO CHECK TO SEE IF RIGHT "KIND" AND IF MOST INTENSE EGAMMA
C   AGREES WITH ANY OF THE FOUND GAMMA RAYS
C
C   SEE ROUTINE SRCH FOR DEFINITIONS OF "KIND"
   IF (KINDY.EQ.KIND) GO TO 16
   IF (KIND.EQ.0 .AND. KINDY.EQ.2) GO TO 16
   IF (KIND.EQ.1 .AND. KINDY.EQ.2) GO TO 16
   IF (KIND.EQ.1 .AND. KINDY.EQ.6) GO TO 16
C.....IF GETS TO HERE WRONG "KIND"
   GO TO 11
16 DO 17 J=1,NPK
   IF (ABS(EH(J)-G(1)) .LT. DELTA) GO TO 18
17 CONTINUE
C.....IF GETS TO HERE WRONG EGAMMA
   GO TO 11
C
18 IF(TCOOL.GT. 10.*THALF .AND. TCOOL.GT. 10.*TP5) GO TO 28
   CFP=CFPSV
   IF (UPXS.GT.0.0001) CFP=UPXS
   NBLANK=NBLNF
   IF (ISOM.GT.2) NBLANK=NISON
   CALL SBYT(IA,NAME,NBLANK,THALF,TP5)
   IF (CFP.NE.CFPSV) WRITE (6,217)
   IF (CFP.NE.CFPSV) WRITE (30,217)
   IF (CFP.EQ.CFPSV) WRITE (6,218)
   IF (CFP.EQ.CFPSV) WRITE (30,218)
C
C   COMPARE EXPERIMENTAL GAMMA-RAY ENERGIES WITH TABULAR
C   GAMMA-RAY ENERGY ASSOCIATED WITH RADIONUCLIDE OF INTEREST
   DO 23 K=1,NGAM
   BRT=BRG(K)
   IF (BRT.LE.0.0) BRT=1.0
   "CALC(K)=0.0
   IF (G(K).LT.SMIN .OR. G(K).GT.SMAX) GO TO 22
   DO 21 L=1,NPK
C   IF EXPERIMENTAL GAMMA RAY NOT FOUND WITH ENERGY CLOSE
C   TO TABULAR VALUE THEN RE-SEARCH RAW DATA TO SEE
C   IF A PEAK WAS MISSED.
   IF (ABS(EH(L)-G(K)).GT.DELTA) GO TO 21
   IDGAM(L)=IDGAM(L)+1
   IF(CYLD(L).LE.0.0) GO TO 21
   CY=CYLD(L)/BRT
   U=ENF(CY,TCT,TCCOL,THALF,CFP,TP5)
   UCALC(K)=CFP*U
   UERR=U*DYLD(L)/CYLD(L)
   IDGM=IDGAM(L)
   IF(IDGAM(L).EQ.1) GO TO 19
C   THIS OUTPUT FOR GAMMA RAY PREVIOUSLY IDENTIFIED WITH
C   AN EARLIER-LISTED RADIONUCLIDE. -JDGM(L,LL)- IS AN
C   ISOTOPE IDENTIFIER.
   IZZ=JDGM(L,1)/10000

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```

IAA=JDGAH(L,1)-10000*IZZ
IZZ=ISONAH(IZZ)
WRITE (6,219) G(K),BRG(K),EN(L),CY,U,UERR,IAA,IZZ
WRITE (30,219) G(K),BRG(K),EN(L),CY,U,UERR,IAA,IZZ
IF (IDGH.GT.5) IDGH=5
GO TO 20
C THIS OUTPUT FOR FIRST-TIME IDENTIFICATION OF A GAMMA RAY
19 WRITE (6,220) G(K),BRG(K),EN(L),CY,U,UERR
WRITE (30,220) G(K),BRG(K),EN(L),CY,U,UERR
C
20 JDGAH(L,IDGH)=IZ*10000+IA
GO TO 23
21 CONTINUE
CALL RECALC(G(K),GYLD,EGYLD,CHANNL)
IF (EGYLD.GT.GYLD) GO TO 22
GKK=0.001*G(K)
CCOR=CARBON(GKK,CTHIK) +1.0
DCCOR=(0.2*(CCOR-1.0))*2
G1=GYLD*DDTDT*CCOR/EPIC(G(K),DST,ND)
CY=G1/BRF
U=ENF(CY,TCT,TCCOL,THALP,CFP,TP5)
UCALC(K)=0.0
UERR=DSQRT((EGYLD/GYLD)**2+DDTDT*DCCOR)
WRITE (6,221) G(K),BRG(K),CY,U,UERR,CHANNL
WRITE (30,221) G(K),BRG(K),CY,U,UERR,CHANNL
G2=G1*UERR/U
G3=-G(K)
WRITE (31,212) G3,G1,G2
GO TO 23
22 WRITE (6,222) G(K),BRG(K)
WRITE (30,222) G(K),BRG(K)
23 CONTINUE
24 AV=WTAV(UCALC,BRG,NGAH)
NCG=0
DO 25 K=1,NGAH
IF (UCALC(K).EQ.0.0) GO TO 25
IF (UCALC(K).LT.0.0*AV .AND. UCALC(K).GT.0.25*AV) GO TO 25
NCG=1
UCALC(K)=0.0
25 CONTINUE
IF (NCG.GE.1) GO TO 24
NBNK=NBLNK2
THAP=THALP
IF (THAP.GE.TP5) GO TO 26
THAP=TP5
NBNK=NPNT
26 AV=AV*ALN2/THAP
AVH=AV/37000.
IDAY=IPX(D1+0.00001)
IT1=IPX(T1+0.00001)
IF (EN1.GT.0.9) GO TO 27
C THIS BIT OF BUSINESS TO ALLOW IGNORING OF MONTH AND
C YEAR AT INPUT FOR SHORT-LIVED RADIONUCLIDES
WRITE (6,223) AV,AVH,IT1,IDAY,NBNK
WRITE (30,223) AV,AVH,IT1,IDAY,NBNK
GO TO 28

```

```

27 H1=IPIX(EH1+0.00001)
   IY=IPIX(Y1+0.00001)
   IF (IY.LT.100) IY=1900+IY
   WRITE (6,224) AV,AVH,IT1,MONTH(M1),IDAY,IT,UBRK
   WRITE (30,224) AV,AVH,IT1,MONTH(M1),IDAY,IY,UBRK
28 CONTINUE
   GO TO 11

```

C

C NOW RE-ORDER EXPERIMENTAL GAMMA RAY INFORMATION
C BY DECREASING ENERGY

```

29 DO 30 K=1,NPK
   IF (IDGAN(K).GT.0) IDGAN(K)=10000000*IDGAN(K)+K
30 CONTINUE
   CALL CORDR(CYLD,EH,DYLD,IDGAN,NPK)
   NSR=0
   DO 31 K=1,NSRC
   IF (SRZ(K).EQ.0.0) GO TO 31
   IF (NSR.EQ.0) WRITE(6,225)
   IF (NSR.EQ.0) WRITE(30,225)
   WRITE(6,226) SRZ(K),SRA(K)
   WRITE(30,226) SRZ(K),SRA(K)
   NSR=1
31 CONTINUE
   WRITE(6,227)
   WRITE(30,227)
   DO 35 K=1,NPK
   KINV=NPK+1-K
   IF (IDGAN(K).GT.0) GO TO 35
   IF (EH(K).LT.60C.) GO TO 34
   LK=K-1
   IF (LK.LE.0) GO TO 34
   DO 33 L=1,LK
   IF (ABS(EH(L)-EH(K)-511.0).GT.DELTA) GO TO 32
   WRITE(6,228) KINV,EH(K),CYLD(K),EH(L)
   WRITE(30,228) KINV,EH(K),CYLD(K),EH(L)
   GO TO 35
32 IF (ABS(EH(L)-EH(K)-1022.0).GT.DELTA) GO TO 33
   WRITE(6,229) KINV,EH(K),CYLD(K),EH(L)
   WRITE(30,229) KINV,EH(K),CYLD(K),EH(L)
   GO TO 35
33 CONTINUE
34 WRITE (6,230) KINV,EH(K),CYLD(K)
   WRITE (30,230) KINV,EH(K),CYLD(K)
35 CONTINUE
   WRITE(6,231)
   WRITE(30,231)
   DO 37 K=1,NPK
   KINV=NPK+1-K
   JDJ=IDGAN(K)/10000000
   JDDJ=IDGAN(K)-10000000*JDJ
   DO 36 J=1,JDJ
   IZZ=JDGAN(JDDJ,J)/10000
   WAA(J)=JDGAN(JDDJ,J)-10000*IZZ
36 WZW(J)=ISONAH(IZZ)
   IF (JDJ.GE.1) WRITE(6,230) KINV,EH(K),CYLD(K), (WAA(J),WZW(J),
   1J=1,JDJ)

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      IF (JDJ.GE.1) WRITE(30,230) KINV,EN(K),CYLD(K), (HAA(J),WZH(J),
1J=1,JDJ)
37 CONTINUE
      WRITE(31,232)
      END FILE 31
      RETURN
200 FORMAT(' ENERGY CALIBRATION'/)
201 FORMAT(2F10.2)
202 FORMAT(10X,'E='F8.1,' + 'F8.3,' * CHANNEL'/)
203 FORMAT(15,4F5.1)
204 FORMAT('/' ND=1 FOR GE(LI), =2 FOR LEPS, =3 FOR JPE'/ 4H ND=I3/
1 /' TIME CONSTANT ='F6.2,' MICRO-SEC'/
2 ' CARBON THICKNESS = 'F6.2,' G/CM**2'/
3 ' -DELTA- ='F6.2,' KEV FOR COMPARISONS'/)
205 FORMAT(4F10.2)
206 FORMAT('/' IRRADIATION INFORMATION= 'F9.2,3F7.0)
207 FORMAT(' COUNT TIME INFORMATION= 'F10.2,3F7.0/)
208 FORMAT(' SOURCE-DETECTOR DISTANCE ='F6.2,' CM'//)
209 FORMAT(' COOLING TIME='1PE10.3,' SEC'/ 15X,E10.3,' MIN'/15X,
1 E10.3,4H HRS/15X,E10.3,4H DAY//)
210 FORMAT(F15.1,' SEC = T-COOL')
211 FORMAT(1H1' LIST OF GAMMAS FOUND'/7X'EN YIELD UNC')
212 FORMAT(0PF10.2,2F20.1)
213 FORMAT(0PF10.2,1PE13.5,E12.4)
214 FORMAT(F10.2,F13.1,F12.1)
215 FORMAT(I7,' Z-6-A VALUES READ IN')
216 FORMAT(0P2F8.0)
217 FORMAT(18H TABLE-E B-RATIO 8H EXPT-E,7X
1,5HYIELD,8X,12HNO. FISSIONS)
218 FORMAT(20H TABLE-E B-RATIO EXPT-E,7X,5HYIELD10X,
1 9HNO. ATOMS)
219 FORMAT(0PF9.2,F8.4,F9.2,1P3E13.4,5X,9HSEE ALSO ,I4,'--'A2)
220 FORMAT(0PF9.2,F8.4,F9.2,1P3E13.4)
221 FORMAT(0PF9.2,F8.4,9H RESEARCH,1P3E13.4,' CHANNEL= '0PF7.1)
222 FORMAT(0PF9.2,F8.4,' NOT FOUND')
223 FORMAT(' SOURCE STRENGTH='1PF10.3,' ('E10.3,' MICROCI) AT ' I4,'
1 ON THE'I3,'TH',2X,A8/)
224 FORMAT(' SOURCE STRENGTH='1PE10.3,' ('E10.3,' MICROCI) AT ' I4,'
1 ON'A4,I3,', 'I5,2X,A8/)
225 FORMAT('/' NO INFO IN ISOTOPE DATA FILE FOR REQUESTED Z,A=')
226 FORMAT(2F12.2)
227 FORMAT('1 NO IDENT ON FOLLOWING GAMMAS')
228 FORMAT(I6,0PF8.2,F14.2,' POSSIBLE S.E. PEAK EG='F8.2)
229 FORMAT(I6,0PF8.2,F14.2,' POSSIBLE D.E. PEAK EG='F8.2)
230 FORMAT(I6,0PF8.2,F14.2,5(I7,'--'A2))
231 FORMAT('/' PEAK IDENTIFICATION'/
1 ' PEAK ENERGY YIELD SOURCE(S)')
232 FORMAT(6X,'0.0 ')
      END

```

SUBPROGRAMS CALLED

RECALC	SGRT.	ZPPIC	ISONAM	SPCH	NDAY
ORDRE	IFIX.	FLOAT.	CARBON	EGANNA	SBTTL
ABS.	ENF	WTAV			

```

C THIS IS FILE CARBON.F4
  FUNCTION CARBON(EG,T)
C FIND ATTENUATION OF GAMMA RAY (ENERGY 'EG' KEV) THRU
C THICKNESS ('T' G/CM**2) OF CARBON
  DIMENSION E(26),C(26)
  DATA E/.01,.015,.02,.03,.04,.05,.06,.08,.1,.15,.2,.3,.4,
X   .5,.6,.8,1.,1.5,2.,3.,4.,5.,6.,8.,10.,15./
  DATA C/2.06,.726,.413,.25,.204,.184,.174,.161,.152,.135,
X   .123,.107,.0953,.087,.0805,.0707,.0635,.0516,.0443,.0356,.0304,
Y   .027,.0246,.0215,.0195,.0169/
  N=26
  A=XTERP(E,C,EG,N)
  CARBON=A*T
  RETURN
  END

```

SUBPROGRAMS CALLED

XTERP

```

  FUNCTION CHISQ(R,D,J,K)
  DIMENSION R(1),C(1)
  ENCH=FLOAT(K-J+1)
  IF (ENCH.GE.0.99) GO TO 1
  CHISQ=1000000.0
  RETURN
1 CHSQ=0.0
  J1=J
  K1=K
  DO 2 I=J1,K1
  DA=D(I)
  IF (DA.LT.1.0) DA=1.0
2 CHSQ=CHSQ+R(I)*R(I)/DA
  CHISQ=CHSQ/ENCH
  RETURN
  END

```

SUBPROGRAMS CALLED

FLOAT.


```

      SUBROUTINE DELPAR(N,T,DP)
C   THIS ROUTINE CALCULATES THE DP(I) FROM THE ARRAY OBTAINED
C   FROM THE PREPHI ROUTINE
      DIMENSION DP(1),T(40,41),ASV(40)
      DATA SMALL/1.0E-30/
      N=N
      NP=N+1
      IF (N.GE.2) GO TO 4
      IF (N.EQ.1) GO TO 3
1     WRITE (6,200) N
      DO 2 I=1,40
2     DP(I)=0.0
      RETURN
3     DP(1)=T(1,2)/T(1,1)
C   IF N = 1, EVALUATE DP(1) DIRECTLY
      RETURN
4     CALL CETERH(N,T,DETA)
      IF (ABS(DETA) .LT. SMALL) GO TO 1
      DO 6 I=1,N
      DO 5 K=1,N
          ASV(K)=T(K,I)
5     T(K,I)=T(K,NP)
      CALL CETERH(N,T,DETB)
      DP(I)=DETB/DETA
      DO 6 K=1,N
6     T(K,I)=ASV(K)
      RETURN
200  FORMAT(/,34H  SOMETHING IS WRONG IN DELPAR, N= I8/)
      END

```

SUBPROGRAMS CALLED

ABS.
CETERH

```

SUBROUTINE DETERN(N,B,DETA)
DIMENSION B(40,41),JHAX(40),ATEHP(40),A(40,41)
REAL*8 A,DET,ATRY,AA,ATEHP,ANHUL
DET=1.
NH=N-1
NP=N+1
DO 1 I=1,N
DO 1 J=1,NP
1 A(I,J)=B(I,J)
IF (N-2) 2,14,3
2 DET=A(1,1)
GO TO 15
3 DO 13 KK=2,NH
L=KK-1
C DIVIDE EACH TERM IN EACH ROW BY THE MAXIMUM TERM IN THAT ROW
DO 8 I=L,N
ATRY=A(I,L)
IF (ATRY.LT.0.0) ATRY=-ATRY
JHAX(I)=L
DO 5 J=KK,N
AA=A(I,J)
IF (AA.LT.0.0) AA=-AA
IF (AA-ATRY) 5,5,4
4 ATRY=AA
JHAX(I)=J
5 CONTINUE
IF (ATRY.GT. 0.0) GO TO 6
DET=0.
WRITE (6,200)
GO TO 15
6 DO 7 J=L,N
7 A(I,J)=A(I,J)/ATRY
8 DET=DET*ATRY
C SHIFT COLUMNS
IF (JHAX(L)-L) 11,11,9
9 J=JHAX(L)
DO 10 K=L,N
ATEHP(K)=A(K,J)
A(K,J)=A(K,L)
10 A(K,L)=ATEHP(K)
DET=-DET
C PUT ZEROS INTO FIRST COLUMN IN 2D - LAST ROWS
11 DO 12 I=KK,N
ANHUL=A(I,L)/A(L,L)
DO 12 J=L,N
12 A(I,J)=A(I,J)-A(L,J)*ANHUL
DET=DET*A(L,L)
13 CONTINUE
14 DET=DET*(A(NH,NP)*A(N,N)-A(N,NH)*A(NH,N))
15 DETA=DET
RETURN
200 FORMAT (//9H DET=ZERO //)
END

```

```

      FUNCTION EFFIC(E,D,ND)
C  GAMMA-RAY DETECTION EFFICIENCIES
C  ND=1 FOR GE(LI), D IS NOMINAL DISTANCE
C  ND=2 FOR LEPS
C  ND=3 ANOTHER LARGE GE(LI) W/ RESOLUTION SIMILAR TO ND=1
C  ND=4 ANOTHER DETECTOR.
C      FOR ND=3 OR 4 MUST INPUT EFFICIENCY CALIBRATION
C      IN A FUNCTION CALLED -AJFEE-
C
      DIMENSION PLEPS(12)
      DATA PLEPS/0.,1.,1.8,1.511,2.8,1.522,7.0,1.5,15.8,
1      1.847,18.,2.623/
      DATA RLEP/1.0/,CLEP/0.25/
      IF (ND.EQ.1) GC TO 2
      IF (ND.EQ.2) GC TO 3
      IF (ND.GE.3) GC TO 9
1 EFFIC=1.
  RETURN
2 A=GE20(E)
  B=ENFAC(E,D)
  EFFIC=A*B
  RETURN
3 IF (D.GT.15.0) GO TO 8
  EPZ=EFLEPS(E)
  EFFIC=EPZ
  IF (ABS(D) .LT. 0.001) RETURN
  DW0=1.-COS(ATAN(RLEP/DLEP))
  DW1=1.-COS(ATAN(RLEP/(D+DLEP)))
  DO 4 I=3,9,2
    J=I+1
    IF (D-PLEPS(I)) 6,5,4
4 CONTINUE
  PL=PLEPS(12)
  GO TO 7
5 PL=PLEPS(J)
  GO TO 7
6 PL=(D-PLEPS(J-3))*(PLEPS(J)-PLEPS(J-2))/(PLEPS(J-1)-
1  PLEPS(J-3)) + PLEPS(J-2)
7 EFFIC=EPZ*DW1*PL/DW0
C BUT BE CAREFUL OF THIS ESTIMATE FOR DISTANCE FOR LEPS DETECTOR
  RETURN
8 EFFIC=EFLEPS(E)*(15.8/D)**2
  RETURN
9 EFFIC=AJFEE(E)
  RETURN
END

```

SUBPROGRAMS CALLED

```

AJFEE  GE20  ABS.  EFLEPS  COS.  ELEPS
ENFAC
ATAN.

```

```

C THIS IS FILE EPLEPS.F4
  FUNCTION EPLEPS(E)
C LEPS EFFICIENCY AT "16-CN" OR TOP OF SAMPLE HOLDER (JAN 80)
  DIMENSION EG(30), EPP(30)
C ENERGY IN KEV
  DATA EG/15, 20, 25, 30, 35, 40, 50, 55, 60, 65,
X    70, 75, 80, 85, 90, 100, 110, 120, 130, 150,
Y    175, 200, 225, 250, 300, 350, 400, 500, 505, 662/
  DATA EPP/4. 8, 6. 9, 8. 3, 9. 05, 9. 4, 9. 45, 9. 26, 9. 1, 8. 9, 8. 6,
X    8. 2, 7. 7, 7. 2, 6. 7, 6. 2, 5. 25, 4. 38, 3. 6, 3. 0, 2. 12,
Y    1. 46, 1. 065, . 804, . 63, . 42, . 296, . 222, . 128, . 1, . 081/
  DATA IP/1. 0E-4/
  A=EPP(1)
  IF (E.LT. EG (1)) GO TO 2
  A=EPP(30)
  IF (E.GT. EG (30)) GO TO 1
  A=XTERP (EG, EPP, E, 30)
  GO TO 2
1  A=A*(662. 0/E)**1. 9
2  EPLEPS=A*IP
  RETURN
  END

```

SUBPROGRAMS CALLED

XTERP

```

FUNCTION EGANNA (N,CH,X1,Y1,X2,Y2,X3,Y3)
CC      USE ENERGY=A+B*CH+C*CH**2 TO COMPUTE GAMMA RAY ENERGY
CC      FOR N=1 COMPUTE COEFFICIENTS A, B, C, GIVEN X1,Y1, ETC.
CC      2 COMPUTE ENERGY AT CHANNEL CH
CC      3 COMPUTE CHANNEL FOR ENERGY CH
CC      (I.E., EGANNA=CHANNEL NO. AT INPUT)
DATA A/0.0/,B/1.0/,C/0.0/
DATA N2/1/
N1=IABS(N)
GO TO (4,1),N1
1 GO TO (2,3),N2
2 IF (N.GT.0) WRITE (6,200)
3 IF (N1.GT.2) GO TO 5
CCCC    CALCULATE ENERGY FOR INPUT CHANNEL (=CH ARGUMENT)
EGANNA=A+CH*(C*CH+B)
RETURN
CCCC    CALCULATE COEFFICIENTS
4 ERASEN=X2-X1
D2=(Y2-Y1)/ERASEN
ERASEB=X3-X2
D3=(Y3-Y2)/ERASEB
ERASEN=X3-X1
C=(D3-D2)/ERASEB
B=D2+C*(-X2-X1)
A=Y3+X3*(-C*X3-B)
N2=2
IF (N.GT.0) WRITE (6,201) A,B,C,X1,X2,X3,Y1,Y2,Y3
EGANNA=B
RETURN
CC      CALCULATE CHANNEL LOCATION FOR INPUT ENERGY (=CH ARGUMENT)
5 XT=(CH-A)/B
XB=XT
C2=C/B
DO 6 JK=1,3
6 XB=XT/(1.+XB*C2)
EGANNA=XB
RETURN
200 FORMAT(/20X39NUSED A=0,B=1,C=0 COEFFICIENTS IN EGANNA)
201 FORMAT(/3X35NEENERGY CALIBRATION COEFFICIENTS ARE 3E11.3/2X
1 17NUSING 3 CHANNELS, 3F9.2/7X12N 3 ENERGIES, 3F9.2/)
END

```

SUBPROGRAMS CALLED

IABS.

```

FUNCTION ELEPS(EGAM)
C TO PROVIDE EFFICIENCIES FOR LEPS DETECTOR AT "CLOSEST" DISTANCE
  DIMENSION E(46),EP(46)
  DATA E/5.0,5.5,6.0,6.5,7.0,8.03,9.,10.,11.,
1 11.1,14.,14.2,22.,27.5,34.,40.,50.,55.,60.,66.,71.,75.,
2 80.,85.,90.,94.,100.,105.,110.,120.,130.,140.,150.,165.,180.,
3 200.,225.,250.,279.,320.,370.,450.,514.,617.,760.,900./
  DATA EP/.045,.062,.076,.088,.1,.117,.125,.129,.13,
1 .083,.112,.142,.16,.17,.175,.177,.18,.18,.178,.175,.17,
2 .165,.156,.1455,.135,.1255,.113,.105,.096,.081,.0685,.059,.0508,
3 .0407,.0328,.0257,.019,.0144,.011,.0084,.00625,.0042,.00325,
4 .00222,.00143,.00105/
  DATA N7/46/
  N7N=N7-1
  EL=EP(1)*(EGAM/E(1))**2
  IF (EGAM.LE.E(1)) GO TO 3
  IF (EGAM.GT.E(N7)) GO TO 4
  DO 1 I=1,N7N
  IF (EGAM.LT.E(I)) GO TO 2
1 CONTINUE
2 J=I
  I=I-1
  AE=ALOG(E(I))
  D=(ALOG(EGAM)-AE)/(ALOG(E(J))-AE)
  C=ALOG(EP(I))
  B=C+D*(ALOG(EP(J))-C)
  EL=EXP(B)
3 ELEPS=EL
  RETURN
4 EL=EP(N7)*(E(N7)/EGAM)**2
  GO TO 3
END

```

SUBPROGRAMS CALLED

ALOG
EXP.

```

      FUNCTION ENFAC(EGAN,DIS)
C   RELATE GE(LI) EFFICIENCY AT DISTANCE=DIS TO THAT AT D=20 CM
C   FOR ENERGY EGAN(KEV)
      DIMENSION DR(12),DS(12)
      DATA DS/1.,2.,3.,4.,5.,7.,10.,15.,20.,25.,30.,35./
      DATA DR/0.62,0.699,0.748,0.785,0.819,0.872,0.931,0.99,
1     1.020,1.036,1.044,1.046/
      DATA NTERMS/12/
      DATA R/2.25/,RL/6.55/
      ENU=GESIG(EGAN)
      D=DIS
      DO 2 KD=1,2
      DELD=D*ELD
      RHONIN=R*D/DELD
      DW=0.5*(1.-COS(ATAN(RHONIN/D)))
      EO=DW
      ENUEL=D=ENU*ELD
      IF(ENUEL.GT.10.) ENUEL=10.0
      E0=DW*(1.-EXP(-ENUEL))
      E1=E0
      RR=(R-RHONIN)/50.
      RHO=RHONIN+RR/2.
1  THETA=ATAN(RHO/D)
      EL=(R-RHO)/SIN(THETA)
      DW=0.5*RHO*RR*CCS(THETA)/(D*D+RHO*RHO)
      E2=DW
      ENUEL=ENU*EL
      IF(ENUEL.GT.10.) ENUEL=10.0
      E2=DW*(1.-EXP(-ENUEL))
      E1=E1+E2
      RHO=RHO+RR
      IF(RHO.LT.R) GO TO 1
      IF(KD.EQ.1) E1D=E1
2  D=20.
      RE=ITERP(DS,DR,DIS,NTERMS)
      ENFAC=(RE/1.02)*(E1D/E1)
      RETURN
      END

```

SUBPROGRAMS CALLED

ITERP

EXP. GESIG COS. SIN. ATAN.

```

C THIS IF FILE ENF.P4
  FUNCTION ENF(Y,TC,TD,TH,CFP,TP5)
C Y=CORRECTED YIELD
C TC=COUNTING TIME, TD=COOLING TIME,
C TH=HALF-LIFE, TP5=HALF LIFE OF PARENT
C CFP=CUMULATIVE FISSION YIELD
C TIMES ARE ALL IN SEC
  DOUBLE PRECISION T,TT
  A=ALOG(2.0)/TH
  IF (TH .GT. 1.0E+10) GO TO 2
  I=EXP(-A*TD)
  TT=-A*TC
  T=1.0D+0-DEXP(TT)
  B=X*T
  A2=ALOG(2.0)/TP5
  A3=A2/(A2-A)
  B=A3*X*T
  TT=-A2*TC
  T=1.0D+0-DEXP(TT)
  I=EXP(-A2*TD)
  A3=A/(A2-A)
  B=B-A3*X*T
1 B=Y/B/CFP
  ENF=B
  RETURN
2 I=A*TC*CFP
  ENF=Y/I
  RETURN
END

```

SUBPROGRAMS CALLED

ALCG.
EXP. DEXP.

```

FUNCTION PGAUSS(A,S,XJ,XZ)
DATA RT2PI/2.506628/
Y=0.
YZ=A/S/RT2PI
XK=(XJ-XZ)/S
IF (ABS(XK).GE.5.5) GO TO 1
Y=YZ*EXP(-0.5*XK*XK)
1 PGAUSS=Y
RETURN
END

```

SUBPROGRAMS CALLED

EXP.
ABS.

C THIS IS FILE FIND.F4

```

SUBROUTINE FIND(DATA,BK,J1,J2,APEAK,AZ,LMAX)
DIMENSION DATA(10),APEAK(1),AZ(1),BK(1),IX(41),YY(41),X(5),Y(5)
L=1
K=J1
1 ICH=K
IUP=1
IDWN=0
CS=DATA(K)-BK(K)
2 K=K+1
CSH=DATA(K)-BK(K)
IF (CSH-CS) 5,6,3
3 CS=CSH
C=CS-SQRT(DATA(K)+BK(K))
CSH=DATA(K-1)-BK(K-1)
IF (C-CSH) 6,6,4
4 ICH=K
IUP=IUP+1
GO TO 2
5 IDWN=IDWN+1
6 APEAK(L)=FLOAT(K-1)
CS=DATA(K)-BK(K)
7 K=K+1
IF (K-J2) 8,12,12
8 IF (DATA(K)-BK(K)-CS) 9,7,12
9 IF (CS.LT.0.5) CS=1.0
C=CS-SQRT(CS)
IF (DATA(K)-BK(K)-C) 10,7,7
10 IDWN=IDWN+1
11 CS=DATA(K)-BK(K)
GO TO 7
12 I=IDWN
IF (I.GT.IUP) I=IUP
IF (I) 1,1,13
13 IF (I-2) 18,14,14
14 DO 15 II=1,5
IXI=ICH-3+II
X(II)=IXI
YQ=DATA(IXI)-BK(IXI)
IF (YQ.LT.1.0) YQ=1.0
15 Y(II)=ALOG(YQ)
CALL TABLE(X,Y,IX,YY)
ACH=X(2)
Z=DATA(ICH-1)-BK(ICH-1)
DO 17 J=11,31
BB=EXP(YY(J))
IF (BB-Z) 17,17,16
16 ACH=YY(J)
Z=BB
17 CONTINUE
APEAK(L)=ACH
GO TO 19
18 Z=DATA(ICH)-BK(ICH)
19 AZ(L)=Z
IF (AZ(L).GT.0.25*BK(ICH)) L=L+1
IF (L.GT.10) GO TO 20
IF (K.LT.J2-1) GO TO 1
20 LMAX=L-1
RETURN
END

```

SUBPROGRAMS CALLED

TABLE

SQRT. ALOG. FLOAT. EXP.

```

      FUNCTION GE20 (EGAN)
C     EGANHA IN KEV
      DIMENSION EC (28), EC1 (3), EF1 (3), EF (28)
      DATA EC1/300., 700., 1600./
      DATA EF1/1.0, 0.57, 1.0/
      DATA EC/55., 60., 65., 70., 75., 80., 90., 100., 110., 120., 125., 130.,
1 135., 140., 145., 150., 160., 170., 180., 190., 200., 210., 220., 230.,
2 240., 250., 275., 300./
      DATA EF/3.8, 4.85, 6.05, 7.25, 8.58, 9.9, 11.8, 13.3, 14.31, 14.8,
1 14.92, 14.85, 14.8, 14.73, 14.67, 14.6, 14.38, 14.15, 13.79, 13.42,
2 13.04, 12.69, 12.33, 11.95, 11.58, 11.24, 10.45, 9.85/
C     REVISION OF EFFICIENCY 11/80 DUE TO SOME DETERIORATION OF DETECTOR
C     PROBABLY DURING PERIOD OF A YEAR OR SO AGO
C
      DATA EX/1.0E-4/
      DATA EX1/-0.868/
      DATA EX2/-1.02/
      DATA NTERMS/28/
      A=EF (1)
      IF (EGAN.LE.EC (1)) GO TO 3
      IF (EGAN.LT.EC (NTERMS)) GO TO 1
      IF (EGAN.GE.1600.0) GO TO 2
      A=EF (NTERMS)*(EGAN/EC (NTERMS))**EX1
      B=INTERP (EC1, EF1, EGAN, 3)
      A=A*B
      GO TO 3
1  A=INTERP (EC, EF, EGAN, NTERMS)
   GO TO 3
2  A=0.2338*EF (NTERMS)*(EGAN/1600.0)**EX2
3  GE20=A*EX
      RETURN
C     ORIGINAL EX1=-.8518, EF (28)=10.25, AND A=.2247*EF (NTERMS)*...
      END

```

SUBPROGRAMS CALLED

INTERP

```

      FUNCTION GESIG(EGAMMA)
C      CSIG =COMPTON SCATTERING CROSS SECTION IN GE
C      PHSIG=PHOTOELECTRIC CROSS SECTION
C      PRSIG=PAIR-PRODUCTION CROSS SECTION
C      GESIG=CSIG+PHSIG+PSIG, IN UNITS OF 1/CM
      DIMENSION PAR(11)
      DATA PAR/17.588,2.99,6.595,1.346,7.25,1.39,6.9295,1.51,
1 1.75,0.249,9.232/,BARW/1E-24/,EMCSQ/511./,
2 TPIROS/4.99E-25/, ZGE/32.0/, GEFAC/4.44E+22/
C DETERMINE CSIG
      E=EGAMMA
      IF (E.LT. 11.1) E=11.1
      A=E/EMCSQ
      B=A+1.
      C=B+A
      CSQ=C*C
      CLW=ALOG(C)
      CLWOA=CLW/A
      SIGC=TPIROS*(B*(2.*B/C-CLWOA)/A**2+0.5*CLWOA
1 - (C+A)/CSQ)
C      LAST IS EQ. 15 OF REV.MOD.PHYS. 24 (1952) 79.
      CSIG=SIGC*ZGE*GEFAC
C DETERMINE PHSIG
      C=1.
      XHAT=ALOG(E)
      IF (XHAT.GT. 5.88) GO TO 1
      YHAT=PAR(1)-PAR(2)*XHAT
      GO TO 2
1 YHAT=PAR(3)-PAR(4)*XHAT
      IF (XHAT.GT. PAR(5)) GO TO 2
      D=PAR(5)-XHAT
      C=1.+PAR(6)*D*D
2 PHSIG=BARW*GEFAC*EXP(YHAT)*C
C DETERMINE PRSIG
      PRSIG=0.
      IF (E.LT. 2.*EMCSQ+50.) GO TO 3
      IX=XHAT-PAR(7)
      AA=IX/PAR(8)
      RATI=PAR(9)+PAR(10)*(PAR(11)-XHAT)
      ASIG=RATI*ALOG(AA)
      PRSIG=ZGE**2*.001*GEFAC*EXP(ASIG)*BAR W
3 TOT=CSIG+PHSIG+PRSIG
      RC=CSIG/TOT
      RPH=PHSIG/TOT
      RPR=PRSIG/TOT
      GESIG=TOT
      RETURN
      END

```

SUBPROGRAMS CALLED

ALOG.
EXP.

```

SUBROUTINE ITRAIL (J1,JH,PKPOS,PKY0,NI,SIG)
C TO ITERATE ON PEAK POSITION(S), AND AREA(S) OF DATA
COMMON /DATA/ DAT,B,SA,SB,MCNHL
DIMENSION DAT(4096),B(4096)
DIMENSION PKPOS(1),PKY0(1),RES(4096),TSUM(40,41),DYT(41,50),
1 P(40),DP(40)
DATA RT2PI/2.506628/
CHZ=1000000.0
N=2*NI
NH=N+1
K1=J1
K2=JH
1 IF (K2-K1.LE.50) GO TO 2
C THIS LITTLE LOOP SO NOT TO OVERRUN DIMENSION OF DYT ARRAY
K1=K1+1
K2=K2-1
GO TO 1
2 NH=K2-K1+1
DO 3 I=1,NH
DO 3 K=1,NH
3 DYT(I,K)=0.0
K=1
DO 4 L=1,N,2
P(L+1)=PKY0(K)*SIG*RT2PI
P(L)=PKPOS(K)
C ITERATE ON CENTROIDS AND AREAS ONLY
4 K=K+1
DO 16 LLL=1,5
K=1
DO 8 J=K1,K2
IJ=PLCAT(J)
G=0.0
DO 5 L=1,N,2
5 G=G+PGAUSS(P(L+1),SIG,IJ,P(L))
C G= SUM OF CALCULATED GAUSSIANS
DYT(NH,K)=G
RES(J)=DAT(J)-G-B(J)
DO 6 L=2,N,2
6 DYT(L,K)=PGAUSS(P(L),SIG,IJ,P(L-1))/P(L)
C THAT SETS UP THE PARTIAL DERIVATIVES W/RESP TO AREAS
SIGSQ=SIG*SIG
DO 7 L=1,N,2
7 DYT(L,K)=PGAUSS(P(L+1),SIG,IJ,P(L))*(IJ-P(L))/SIGSQ
C THAT SETS UP PARTIAL DERIVATIVES W/RESP TO CENTROIDS
8 K=K+1
CALL PREPHX(K1,K2,N,DYT,TSUM)
CALL DELPAR(N,TSUM,DP)
C BY NOW WE SHOULD HAVE ESTIMATED CHANGES IN THE PARAMETERS
C BEING ITERATED. NOW WE CHECK TO KEEP THE CHANGES FROM BEING TOO BIG
PTOTL=0.0
PT=0.0
DO 9 I=2,N,2
PTEST=ABS(DP(I)/P(I))
PTOTL=PTOTL+PTEST
IF (PT.LT.PTEST) PT=PTEST
9 CONTINUE

```

```

      IF (PT.LE.0.1) GO TO 11
      PT=0.1/PT
      DO 10 I=2,N,2
10    DP(I)=PT*DP(I)
11    PT=0.49
      DO 12 I=1,N,2
      PTEST=ABS(DP(I))
      PTOTL=PTOTL+PTEST
      IF (PT.LT.PTEST) PT=PTEST
12  CONTINUE
      IF (PTOTL.LE.0.0) WRITE(6,200) (P(LZT),LZT=1,N)
      IF (PT.LE.0.5) GO TO 14
      PT=0.5/PT
      DO 13 I=1,N,2
13    DP(I)=PT*DP(I)
14    DO 15 I=1,N
15    P(I)=P(I)+DP(I)
      CHI=CHISQU(RES,DAT,K1,K2)
      IF (PTOTL.LE.0.0) GO TO 17
      IF (CHI.GT.CHZ .AND. LLL.GE.4) GO TO 17
      CHZ=CHI
16  CONTINUE
17    K=1
      DO 18 L=1,N,2
      PKPOS(K)=P(L)
      PKIO(K)=P(L+1)/BT2PI/SIG
18    K=K+1
      RETURN
200  FORMAT(' ***P= '2E15.6)
      END

```

SUBPROGRAMS CALLED

FGAUSS DELPAR FLOAT. ABS. PREPNX CHISQU

```

C  THIS IS FILE ISONAB.F4
      FUNCTION ISONAN(IZET)
      DIMENSION K(100)
      DATA K/2NH,2NHE,2NLI,2HBE,2NB,2HC,2HN,2HO,2HP,2HNE,
1     2HNA,2HNG,2NAL,2HSI,2NP,2HS,2HCL,2HAB,2HK,2HCA,
2     2HSC,2HTI,2HV,2HCR,2HNN,2HPE,2HCO,2HNI,2HCU,2HZN,
3     2HGA,2HGE,2HAS,2HSE,2HBR,2HKB,2HRB,2HSE,2HY,2HZR,
4     2HNB,2HNO,2HIC,2HRU,2HRM,2HPO,2HAG,2HCD,2HIN,2HSH,
5     2HSD,2HTE,2HI,2HIE,2HCS,2HBA,2HLA,2HCE,2HBR,2HND,
6     2HPS,2HSH,2HPU,2HGD,2HTB,2HDI,2HNO,2HER,2HTH,2HYB,
7     2HLO,2HHP,2HTA,2HW,2HRE,2HOS,2HIR,2HPT,2HAU,2HNG,
8     2HTL,2HPO,2HEI,2HPO,2HAT,2HRY,2HPR,2HBA,2HAC,2HTH,
9     2HPA,2HU,2HNP,2HPU,2HAN,2HCH,2HBR,2HCF,2HFB,2HES/

```

```

C
      N=IZET
      IF (N.GE.1 .AND. N.LE.100) GO TO 1
      L=2N**
      GO TO 2
1     L=K(N)
2     ISONAN=L
      RETURN
      END

```

FUNCTION WDAY(D,EH,Y)
 COMPUTES THE NUMBER OF THE DAY OF THE YEAR, D-DAY, EH-NO. OF THE MONTH,
 C AND Y=YEAR.

```

    DIMENSION WDAY(11)
    DATA WDAY/31,28,31,30,31,30,31,31,30,31,30/
    IH=IFIX(EH+0.1)
    ID=IFIX(D+0.1)
    WDAY=ID
    IF (IH.LE.1) RETURN
C   THAT'S FOR JANUARY
    IF (IH.GT.2) GO TO 1
C   NOW FOR FEBRUARY
    WDAY=ID+31
    RETURN
C   NOW FOR THE REST OF THE YEAR
    1 HS=ID
    IH1=IH-1
    DO 2 I=1,IH1
    2 HS=HS+WDAY(I)
CHECK FOR LEAP YEAR
    L=IFIX(Y+0.1)
    LL=L/4
    L=L-4*LL
    IF (L.EQ.0) HS=HS+1
    WDAY=HS
    RETURN
  END

```

SUBPROGRAMS CALLED

IFIX.

```

SUBROUTINE ORDRE(A,B,C3,H,N)
C   ORDER ARRAYS A,B,C3,H ACCORDING TO DECREASING B
  DIMENSION A(1),E(1),H(1),C3(1)
  IF (N.LE.1) RETURN
  NX=N-1
  DO 3 I=1,NX
    1 C=B(I)
    J=I+1
    DO 2 K=J,N
      IF (B(K).LE.C) GO TO 2
      D=A(I)
      C2=C3(I)
      HI=H(I)
      A(I)=A(K)
      B(I)=B(K)
      C3(I)=C3(K)
      H(I)=H(K)
      A(K)=D
      B(K)=C
      C3(K)=C2
      H(K)=HI
    GO TO 1
    2 CONTINUE
    3 CONTINUE
  RETURN
  END

```

```

SUBROUTINE PLT (A,B,C,NL,NH,NTYPE)
  DIMENSION A(1),B(1),C(1),NYH(300)
  DATA NAW/4HPPFF/
  DATA NBW/4HBBFB/
  DATA NRW/4HNRNR/
  DATA NAX/4H---/
  DATA NDI/4HIIII/
  DATA NDW/4H /
  WRITE (6,200)
  NTY=NTYPE
  IF (NTY.LT.0) NTY=-NTY
  BIG = 0.0D0
  DO 1 K = NL, NH
    IF (A(K).GT.BIG) BIG = A(K)
    IF (B(K).GT.BIG) BIG = B(K)
1 CONTINUE
  NAUX = ALOG10(BIG) + 1.0
  AUX = NAUX
  KNCR=100./AUX
  DO 9 K = NL, NH
    DO 2 I=1,100
2 NYH(I) = NDW
    NX=NAUX-1
    DO 3 I=1,NX
      AI=I
      N=KNCR*AI+0.5
3 NYH(N)=NDI
    JA = 0
    JB = 0
    IF (A(K).GT.0.0) JA = KNCR*ALOG10(A(K)) + 0.5
CC NTYPE=0 PLOT 'A' VS 'C'
CC   =1 PLOT 'A' & 'B' VS 'C'
CC   =2 PLOT 'A' WITH B-ERROR BARS VS 'C'
    IF (NTY.EQ.2) GO TO 4
    IF (NTY.EQ.0) GO TO 6
    IF (B(K).GT.0.0) JB = KNCR*ALOG10(B(K)) + 0.5
    NBW=NBW
    IF (NTYPE.LT.0) NBW=NRW
    IF (JB.GT.0) NYH(JB) = NBW
    GO TO 6
4 ALO=A(K)-B(K)
  ANI=A(K)+B(K)
  IF (ANI.LT.1.00001) GO TO 7
  IF (ALO.LT.1.) ALO=1.
  JLO=KNCR*ALOG10(ALO)+0.5
  JHI=KNCR*ALOG10(ANI)+0.5
  IF (JLO.LT.1) JLO=1
  IF (JHI.LT.1) JHI=1
  IF (JHI.GT.100) JHI=100
  DO 5 J=JLO,JHI
5 NYH(J)=NAX
6 IF (JA.GT.0) NYH(JA) = NAW
7 JI = A(K) + 0.5
  CCC=C(K)
  IF (CCC.LT.0.2) CCC=1000.*CCC
  IF (NTY.NE.0) GO TO 8

```

```

      WRITE (6,201) CCC, (MYH(N), N=1,100), JX
      GO TO 9
6     JXB = B(K) * 0.5
      WRITE(6,202) CCC, (MYH(N), N=1,100), JX, JXB
9 CONTINUE
      WRITE (6,200)
      RETURN
200  FORMAT ('K29 (****)')
201  FORMAT ('F7.1, 100A1, I7')
202  FORMAT ('F7.1, 100A1, I7, I6')
      END

```

SUBPROGRAMS CALLED

ALG10.

```

      SUBROUTINE PREPEX (KCH10, KCF10, N, DYT, TSUM)
C   THIS ROUTINE PREPARES ARRAY OF COEFFICIENTS OF THE DY/DP (I)
      COMMON /DATA/ DAT, B, SA, SB, NCHL
      DIMENSION DAT (4096), B (4096)
      DIMENSION TSUM (40, 41), DYT (41, 50), T (40, 41)
      NP=N+1
      DO 1 K=1, N
        DO 1 J=1, NP
          1 TSUM (K, J) = 0.0
          I=1
          DO 4 I=KCH10, KCF10
C   DD=VARIANCE AND CN=DIFFERENCE BETWEEN CALC AND EXP'T
            DD=DAT(I) * B(I)
            IF (DD.LE.0.0) DD=1.0
            CN=DAT(I) - B(I) - EYT (NP, I)
            DO 3 KK=1, N
              DDK=DYT (KK, I) / DE
              DO 2 J=1, N
                2 T (KK, J) = DDK * DYT (J, I)
                T (KK, NP) = DDK * CN
              DO 3 J=1, NP
                3 TSUM (KK, J) = TSUM (KK, J) + T (KK, J)
            4 I=I+1
          RETURN
        END

```



```

      SUBROUTINE RECALC (EG,A,AE,CC)
C  PURPOSE IS TO EVALUATE A POSSIBLE "PEAK" MISSED IN FIRST PASS
C  FOR ENERGY EG (KEV) SPECIFIED
      DIMENSION F(4096),B(4096)
      COMMON /DATA/ F,B,SA,SB2,WCH
      ZZ=0.
      EC=EGAMMA(3, EG,ZZ,ZZ,ZZ,ZZ,ZZ,ZZ)
      CC=EC
      S=SA+SB2*EC
      JLO=IPIX(EC-3.5*S)
      IF (JLO.LE.3) JLO=3
      JHI=IPIX(EC+3.5*S)
      IF (JHI.GE.WCH) JHI=WCH
      SUM=0.
      SB=0.
      DO 1 J=JLO,JHI
      SUM=SUM+F(J)-B(J)
1  SB=SB+F(J)+B(J)
      A=SUM
      IF (A.LT.0.0) A=0.0
      IF (SB.LT.1.0) SB=1.0
      AE=SQRT(SB)
      RETURN
      END

```

SUPPROGRAMS CALLED

SQRT. IPIX. EGAMMA

```

SUBROUTINE SBTI(IA,NAME,NBLANK,THALP,TP5)
C  ROUTINE USED IN 'CALC' AT ABOUT LINE 195
  DIMENSION NH(5)
  DATA NH/4H SEC,4H MIN,4H HR ,4H DAY,4H YR /
  T=THALP
  I=1
1  J=1
  IF (T.LT. 100.) GO TO 2
  J=J+1
  T=T/60.
  IF (T.LT. 100.) GO TO 2
  J=J+1
  T=T/60.
  IF (T.LT. 48.) GO TO 2
  J=J+1
  T=T/24.
  IF (T.LT. 400.) GO TO 2
  T=T/365.24
  J=J+1
2  IF (I.GT. 1) GO TO 3
  TK=T
  K=J
  T=TP5
  I=2
  GO TO 1
3  IF (J.EQ.5 .OR. K.EQ.5) GO TO 4
  WRITE (6,200) IA,NAME,NBLANK,TK,NH(K),T,NH(J)
  WRITE (30,200) IA,NAME,NBLANK,TK,NH(K),T,NH(J)
  RETURN
4  WRITE (6,201) IA,NAME,NBLANK,TK,NH(K),T,NH(J)
  WRITE (30,201) IA,NAME,NBLANK,TK,NH(K),T,NH(J)
  RETURN
200 FORMAT(/' TRY 'I3,1H-,A3,1X,A4,' T(1/2)='0PF6.1,A4,
1      ', PARENT I(1/2)='P6.1,A4)
201 FORMAT(/' TRY 'I3,1H-,A3,1X,A4,' T(1/2)='1PE10.3,A4,
1      ', PARENT I(1/2)='E10.3,A4)
END

```

C THIS IS FILE SIGFIT.F4

```

SUBROUTINE SIGFIT (NP,SIG,SU,CH,A,B)
COMMON /SPG1/ SC
DIMENSION SIG(1),SU(1),CH(1),NT(2),SG(300)
DATA NT/4H****,4H /
IP(NP-1) 1,2,3
1 WRITE (6,200) NF
RETURN
2 A=SIG(1)
B=0.
RETURN
3 N=1
NC=NP
Y=0.
DO 4 I=1,NP
Y=Y+SIG(I)
4 SU(I)=1.
AY=Y/FLOAT(NP)
DO 5 I=1,NP
IF (SIG(I).GT. 1.25*AY) SU(I)=0.
5 CONTINUE
6 XX=0.
X=0.
Y=0.
YK=0.
NC1=NC
XNP=0.
DO 7 I=1,NP
IF (SU(I).LT.0.5) GO TO 7
XNP=XNP+1
SS=CH(I)
X=X+SS
XX=XX+SS*SS
YY=SIG(I)
Y=Y+YY
YK=YK+YY*SS
7 CONTINUE
D=XX*XNP-X*Y
IF (ABS(D).LT.1.0E-7) GO TO 12
A=(Y*YK-X*YY)/D
B=(YK*XNP-Y*Y)/D
8 IF (NP.EQ.2) GO TO 10
NC=NP
DO 9 I=1,NP
SU(I)=1.
CS=A+B*CH(I)
IF (SIG(I).LT. 1.15*CS .AND. SIG(I).GT. 0.8*CS) GO TO 9
NC=NC-1
SU(I)=0.
9 CONTINUE
IF (NC.NE.NC1) GO TO 6
10 WRITE (6,201) A,B
DO 11 I=1,NP
C=SU(I)+1.005
IC=C
SU(I)=A+B*CH(I)

```

```

SUBROUTINE SBT1(IA,NAME,WBLANK,THALP,TP5)
C ROUTINE USED IN 'CALC' AT ABOUT LINE 195
  DIMENSION NH(5)
  DATA NH/4H SEC,4H MIN,4H HR ,4H DAY,4H YR /
  T=THALP
  I=1
1 J=1
  IF (T.LT.100.) GO TO 2
  J=J+1
  T=T/60.
  IF (T.LT.100.) GO TO 2
  J=J+1
  T=T/60.
  IF (T.LT.48.) GO TO 2
  J=J+1
  T=T/24.
  IF (T.LT.400.) GO TO 2
  T=T/365.24
  J=J+1
2 IF (I.GT.1) GO TO 3
  TK=T
  K=J
  T=TP5
  I=2
  GO TO 1
3 IF (J.EQ.5 .OR. K.EQ.5) GO TO 4
  WRITE (6,200) IA,NAME,WBLANK,TK,NH(K),T,NH(J)
  WRITE (30,200) IA,NAME,WBLANK,TK,NH(K),T,NH(J)
  RETURN
4 WRITE (6,201) IA,NAME,WBLANK,TK,NH(K),T,NH(J)
  WRITE (30,201) IA,NAME,WBLANK,TK,NH(K),T,NH(J)
  RETURN
200 FORMAT(/' TRY 'I3,1H-,A3,1X,A4,' T(1/2)='0PF6.1,A4,
1      ', PARENT 1(1/2)='P6.1,A4)
201 FORMAT(/' TRY 'I3,1H-,A3,1X,A4,' T(1/2)='1PE10.3,A4,
1      ', PARENT 1(1/2)='E10.3,A4)
END

```

C THIS IS FILE SIGFIT.F4

```

SUBROUTINE SIGFIT (NP,SIG,SU,CH,A,B)
COMMON /SPG1/ SC
DIMENSION SIG(1),SU(1),CH(1),NT(2),SG(300)
DATA NT/4H****,4H /
IF (NP-1) 1,2,3
1 WRITE (6,200) NE
RETURN
2 A=SIG(1)
B=0.
RETURN
3 N=1
NC=NP
Y=0.
DO 4 I=1,NP
Y=Y+SIG(I)
4 SU(I)=1.
AY=Y/FLOAT(NP)
DO 5 I=1,NP
IF (SIG(I) .GT. 1.25*AY) SU(I)=0.
5 CONTINUE
6 XI=0.
X=0.
YI=0.
NC1=NC
XNP=0.
DO 7 I=1,NP
IF (SU(I) .LT. 0.5) GO TO 7
XNP=XNP+1
SS=CH(I)
X=X+SS
XI=XI+SS*SS
YI=YI+SIG(I)
Y=Y+YI
YI=YI+YI*SS
7 CONTINUE
D=XI*XNP-Y*X
IF (ABS(D) .LT. 1.0E-7) GO TO 12
A=(Y*XI-Y*X)/D
B=(YI*XNP-Y*X)/D
8 IF (NP.EQ.2) GO TO 10
NC=NP
DO 9 I=1,NP
SU(I)=1.
CS=A+B*CH(I)
IF (SIG(I) .LT. 1.15*CS .AND. SIG(I) .GT. 0.8*CS) GO TO 9
NC=NC-1
SU(I)=0.
9 CONTINUE
IF (NC.NE.NC1) GO TO 6
10 WRITE (6,201) A,B
DO 11 I=1,NP
C=SU(I)+1.005
IC=C
SU(I)=A+B*CH(I)

```

```

      WRITE (6,202) I,SIG(I),SU(I),WT(IC),SG(I)
11  CONTINUE
      WRITE (6,203)
      RETURN
12  WRITE (6,204) WF,D
      WRITE (6,205) AY
      A=AY
      B=0.
      GO TO 10
200  FORMAT (' ERROR SIGFIT.  WP='I7//')
201  FORMAT ('/' SIGMA='E12.4,' * 'E12.4,' * CHANNEL'/
      1 5X, 'W'5X, 'EXP-SIG'5X,'CALC-SIG')
202  FORMAT (I6,2E12.4,1X,A4,F5.0)
203  FORMAT(' 0=EXPTL SIGMA, 1=RECOMPUTED SIGMA'/)
204  FORMAT (' ERROR SIGFIT.  WP='I3,', DENOM='E12.4)
205  FORMAT('  AY= 'E12.4/)
      END

```

SUBPROGRAMS CALLED

Float. Abs.

```

      SUBROUTINE SECH (IZ,IA,ISH,NGAM,NAME,THALP,KIND,TX,UX,TP,G,BRG)
      DIMENSION G(1),BRG(1)
1  READ (5,200) ISP,IA,IZ,NGAM,NAME,THALP,TX,TP,KIND,UX
      IF (IA.GE.270) GO TO 2
      READ (5,201) (G(K),BRG(K),K=1,NGAM)
C
C  KIND = 0  WEAPNS CAPTURE SOURCE
C           1  FISSION PRODUCT
C           2  BOTH 1 AND 2
C           3  NEUTRON DEFICIENT
C           4  NATURAL
C           5  OTHER -- ACTINIDES
C           6  FISSION PRODUCT GAS
C
      RETURN
2  IZ=-1
      RETURN
200  FORMAT (I2,3I3,A3,E10.3,10X,2E10.3, 11X,I1,4X,E10.3)
201  FORMAT (10F8.2)
      END

```

```

SUBROUTINE TABLE(X,YOPX,XX,YY)
C GIVEN Y(K) FOR 5 EQUALLY SPACED VALUES OF X. LET D BE THE SPACING.
C THIS ROUTINE COMPUTES VALUES FOR Y(X+D/10), Y(X+2*D/10),...
C USING 5-POINT LAGRANGIAN INTERPOLATION COEFFICIENTS.
C DIMENSION X(5),YOPX(5),XX(41),YY(41),A(19,5)
C LAGRANGIAN INTERPOLATION COEFFICIENTS FOR ARG=0.1 FOLLOW
DATA A/.0078375,.0144,.0193375,.0224,.0234375,.0224,.0193375,
W .0144,.0078375,0.,-.0086625,-.0176,-.0261625,-.0336,-.0390625,
X -.0416,-.0401625,-.0336,-.0206625,.05985,-.1056,-.13685,-.1536,
Y -.15625,-.1456,-.12285,-.0896,-.0785,0.,-.05115,-.1024,-.15015,
Z .1904,-.21875,-.2304,-.22015,-.1824,-.11115,-.987525,-.9504,-.889525,
A .8064,-.703125,-.5824,-.447525,-.3024,-.15125,0.,-.146475,
W -.2816,-.398475,-.4896,-.546875,-.5616,-.524475,-.4256,
X -.254475,-.07315,-.1584,-.25415,-.3584,-.46875,-.5824,-.69615,-.8064,
Y .90915,1.,1.07415,1.1264,1.15115,1.1424,1.09375,-.9994,-.84915,
Z .6384,-.35815,-.0086625,-.0176,-.0261625,-.0336,
B -.0390625,-.0416,-.0401625,-.0336,-.0206625,0.,
W .0298375,-.0704,-.1233375,-.1904,-.2734375,-.3712,-.4953375,
X .6384,-.8058375/
Z=(X(2)-X(1))/10.
DO 1 K=1,5
  LMAX=10*K-1
  KT=LMAX-8
  XX(KT)=X(K)
  YY(KT)=YOPX(K)
  IF (K-GE.5) GO TO 1
  DO 3 L=KT,LMAX
    LP1=L+1
3 XX(LP1)=XX(L)+Z
1 CONTINUE
C THIS LCOP COMPUTES THE INTERPOLATION VALUES YOPX FROM THE CENTER
C OF THE TABLE (I.E. X(J)) TO THE LOWER AND UPPER ENDS
DO 4 I=1,19
  IDWN=21-I
  IUP=21+I
  YY(IDWN)=0.
  YY(IUP)=0.
  DO 4 M=1,5
    MM=6-M
    YY(IDWN)=A(I,M)*YOPX(MM)+YY(IDWN)
4 YY(IUP)=A(I,M)*YOPX(M)+YY(IUP)
RETURN
END

```

```

SUBROUTINE TSIGF(NDET,SA,SB)
C GETS SA,SB FOR NDET=1 OR 3 (GE(LI) DETECTOR) OR ND=2 (LEPS DETECTOR)
CC SA IN UNITS OF KEV, SB IS DIMENSIONLESS
DIMENSION A(2),P(2)
DATA A/0.74,0.24/
DATA B/0.0003,0.0002/
N=NDET
SA=0.0
SB=0.1
IF (N.LE.0 .OR. N.GT.3) RETURN
IF (N.LT.3) GO TO 1
SA=A(1)
SB=B(1)
RETURN
1 SA=A(N)
SB=B(N)
RETURN
END

```

```

FUNCTION WTAV(A,B,K)
  DIMENSION A(1), B(1)
  AN=0.
  AV=0.
  DO 1 I=1,K
    IF (A(I) .NE. 0.0) AN=AN+B(I)
  1 AV=AV+A(I)*B(I)
    IF (AN.NE.0.0) AV=AV/AN
  WTAV=AV
  RETURN
END

```

```

FUNCTION XTERP(A,B,C,N)
C  LINEAR INTERPOLATION IN LOG-LOG OF ARRAYS A,B FOR VALUE C
  DIMENSION A(1), B(1)
  IF (C.LE.A(1)) GO TO 3
  IF (C.GE.A(N)) GO TO 4
  DO 1 I=2,N
    IF (C.LT.A(I)) GO TO 2
  1 CONTINUE
  2 J=I
    I=I-1
    AE=ALOG(A(I))
    D=(ALOG(C)-AE)/(ALOG(A(J))-AE)
    X=ALOG(B(I))
    Y=X+D*(ALOG(B(J))-X)
    XTERP=EXP(Y)
    RETURN
  3 XTERP=B(1)
    RETURN
  4 XTERP=B(N)
    RETURN
END

```



```

C THIS IS FILE YPHAX.F4
  SUBROUTINE YPHA(NW,A,B,XO,YO,NCHANL)
  DIMENSION XX(41),YY(41),A(1),B(1),T(5),U(5)
  N=NW
  IF (N.LT.0) N=-N
  IF (N.LT.3) N=3
  IF (N.GT.NCHANL-2) N=NCHANL-2
  Q=1.
  IF (NW.LT.0) Q=0.
  DO 1 I=1,5
  N=N+I-3
  T(I)=FLOAT(N)
  C=A(N)-Q*B(N)
  IF (C.LT.1.0) C=1.0
1 U(I)=ALOG(C)
  CALL TABLE(T,U,XX,YY)
  YMAX=EXP(YY(10))
  XO=XX(10)
  DO 2 I=11,31
  AA=EXP(YY(I))
  IF (AA.LT.YMAX) GO TO 2
  YMAX=AA
  XO=XX(I)
2 CONTINUE
  YO=YMAX
  RETURN
  END

```

SUBPROGRAMS CALLED

```

TABLE
ALOG.  FLOAT.  EXP.

```

PROBLEM SET-UP; THE INPUT DATA FILE ON UNIT 5

A complete listing of the input for the test case is given. The first 8 cards give the general input data as discussed above. Then there follows the data for the 4096-channel spectrum. Note that the datum in channel "zero" is the live time of 65000 sec for this measurement.

Following the spectrum is a list of "forced" radionuclides. For the test case ^{60}Co was left off of this list even though a source ^{60}Co was included, and ^{65}Zn was not included in the measurement.

Following the list of "forced" isotopes is the listing of the isotope data file. The listing for this report represents a very abbreviated portion of the total isotope table available. A complete listing of the present data file is available from the author on request.

530	084992	785327	084964	085601	087535	090278	091845	088089	085010	083919
540	093694	083161	083846	084440	086181	087699	087384	084914	083186	082613
550	082688	782631	082297	082565	083470	084765	085167	084047	782428	081618
560	092516	082809	094074	083486	081683	081482	080870	080447	080751	083343
570	097565	786906	082732	080256	079541	078904	079367	080045	083141	088861
580	091100	090602	087652	082158	079357	077364	077142	077978	078645	078007
590	077850	077680	077172	076969	076922	077083	076769	076676	077324	077519
600	078196	079772	079222	078343	077019	076627	077328	079595	083178	092407
610	107510	120594	123507	111697	096349	084727	078822	076107	075521	075221
620	075295	075200	074935	075408	076582	076108	075703	075271	075040	075498
630	075479	075870	075180	075001	075942	074871	074999	074885	075311	075198
640	075940	077062	079253	079984	077392	076184	076295	076229	076325	075927
650	075776	075215	074836	075693	076566	077437	077949	076829	075724	074758
660	075865	076072	075493	075677	075852	075851	075362	075315	075694	075211
670	075533	075664	075728	076000	075744	075595	075707	075797	076608	076669
680	076503	077326	080644	085089	084456	081280	079712	079342	077429	076238
690	076532	076239	076777	077070	077009	077617	077550	076572	076653	076137
700	076730	076711	076635	077988	080123	083861	083814	079138	077160	076594
710	076375	077454	080031	083401	085392	081009	077505	076328	077050	076974
720	076533	076687	077250	077336	077520	076731	078153	077943	077973	078579
730	078853	078910	079047	079491	079893	080154	081081	081747	083439	084437
740	084499	092240	135578	340861	761485	944308	597287	221462	094000	075651
750	074357	073395	074113	075160	074564	074312	074193	073544	073629	073270
760	073347	073416	073179	073479	073441	073864	073465	072988	073528	073516
770	073266	072872	073446	073648	073262	073006	073544	073699	073309	072202
780	072054	070816	070563	069782	070093	069003	069497	066721	066249	065945
790	065104	064656	065215	064197	063967	063478	063231	063273	064110	063866
800	063551	062681	062534	062911	062602	062570	062961	063621	064216	065108
810	064598	063535	065195	076658	122970	200886	217114	144330	083966	071572
820	031744	795802	075143	063623	059705	059362	058949	058663	058667	058962
830	058566	058804	059753	060979	060650	059279	058301	060762	064391	064898
840	060914	058114	057612	057451	057872	058004	057769	056847	056893	057137
850	059439	064079	069802	066720	060097	056155	055584	054674	055277	054889
860	054715	054344	054001	053916	053852	053332	052997	052046	051298	051399
870	053589	056475	057631	054136	051591	049717	048947	049462	049136	048468
880	048461	048787	048832	048241	048503	048200	047407	046894	046282	046399
890	045956	046542	048441	052694	056476	054058	048854	046263	045807	045606
900	044693	044332	044326	043893	043952	043955	043793	043542	043388	043471
910	043247	043397	043669	043267	043455	042877	042929	042861	042439	042233
920	041942	042396	042709	043341	045032	045567	044974	043352	042375	042237
930	041665	041580	041645	041364	040842	041323	041183	041729	042616	043065
940	042227	041584	040779	040966	041005	040383	040549	040325	040424	040443
950	040095	040183	040490	039866	041941	043303	044050	045576	057824	088932
960	113249	095155	061320	043311	039607	038670	039493	039946	038590	039555
970	040151	044367	067956	136674	211606	192903	107055	052164	038790	036507
980	036599	037344	041735	048578	051344	046077	039663	036748	035741	035523
990	035664	035605	035962	035622	035602	036152	035905	035430	035995	035401
000	036107	035895	035825	035843	035993	035259	035304	035844	036210	039405
010	046685	053271	050694	042021	037323	036946	039261	040027	039364	038289
020	040399	045859	049266	045241	039744	037363	036626	036742	036971	036934
030	037973	039656	039799	038657	038541	038336	038926	040117	041414	041323
040	040774	041301	041537	042714	044578	046712	055170	105226	326477	808421
050	099713	162587	346755	092849	041199	039258	039784	036831	034204	033101
060	032750	031477	030796	030741	030851	030666	030712	030956	030765	030955
070	031136	030804	030835	030566	031206	030837	030925	030714	030728	030824
080	031072	030860	030934	030966	030720	030992	030920	031132	031247	031525
090	032031	034636	044630	067083	083769	070762	047033	034044	031110	031086
100	031744	031201	031417	031247	031253	030707	031284	030895	031085	030600
110	030858	030415	030405	030846	030980	030878	031029	030514	031016	031300
120	031360	031185	031602	031450	031966	032187	032383	033023	033518	034061
130	034750	037245	048220	106489	288494	535958	564027	322693	112354	741346
140	029365	028150	027441	027804	027648	027611	026829	026510	026416	025882
150	025959	025566	025623	025772	025567	025477	025140	024938	025101	025280
160	025453	025090	025393	027293	029216	028748	026566	024776	024538	024453
170	024225	024729	025553	026820	027430	026140	024920	024824	024886	025326
180	025590	026187	031412	045598	060575	056636	039982	027424	024225	023582

190	023791	023510	023313	023412	023334	023107	023632	023377	023319	023283
200	023174	023199	022951	023307	023203	023335	023339	022876	023091	023235
210	023075	022954	023297	023017	023343	023283	023136	023278	023648	023663
220	024233	026292	037346	078759	149602	187358	137496	064411	029367	021883
230	021178	020966	020594	020544	020607	020425	020267	020490	020624	020651
240	020340	020363	020149	020115	020129	020310	019948	020022	020164	019966
250	020175	019840	019798	020026	019964	019605	019579	019440	019638	019780
260	020004	019863	019676	019614	019442	019360	019413	019285	019576	019670
270	019429	019282	019418	018988	019011	019039	019126	019277	019941	022362
280	025742	025956	022813	019999	018924	018742	018635	018766	018544	018530
290	018779	018517	018707	018511	018735	018531	018490	018227	018452	018490
300	018557	018436	018563	018678	018493	018585	018455	018178	018318	018068
310	018093	018209	017964	017890	017890	018177	018286	018426	018477	018528
320	017877	017894	017794	017900	017806	018078	017738	017846	017724	017852
330	017522	017721	017737	017958	017928	017873	017808	017957	017868	017856
340	017760	017996	018906	020479	021261	020277	018845	017711	017753	017849
350	017775	017807	018096	017652	017754	017785	017726	017886	018111	017783
360	017873	017931	017941	017958	018081	018065	018568	019865	020543	020366
370	019091	018521	018208	018074	018113	018161	017928	018340	018406	018252
380	018371	018321	018435	018430	018926	019443	021388	031221	060414	102759
390	115144	780286	040993	027106	030964	035127	030417	022713	018994	017719
400	017668	017688	017760	017946	018314	018298	017935	017926	017863	017883
410	017906	018101	018972	019177	015651	019804	019419	018895	018678	019595
420	020465	022514	028861	051268	101311	144699	128214	070898	032138	020340
430	018643	018594	019895	025421	049111	105206	161702	153717	088353	037283
440	019512	016437	016167	016122	016038	015745	016176	016052	016242	016065
450	016516	016259	016533	017267	018232	018531	017149	016190	015968	015942
460	015927	015816	015850	015655	016152	016031	016004	016002	015905	015831
470	016098	015836	016142	015855	015899	015989	016266	016196	016198	016277
480	016525	018472	024006	030066	031245	025281	019111	016508	015794	015739
490	015818	015964	015822	015835	015818	015791	015947	015975	015790	015811
500	016109	016318	016135	016745	017792	023285	040188	071223	088598	071035
510	039669	021245	015836	015093	014829	014923	015209	015305	015653	016638
520	016951	016558	015619	014866	014943	014695	014581	014514	014473	014364
530	014326	013786	013986	013945	013601	013530	013519	013340	013448	013062
540	013329	013081	013131	013034	012819	013017	012870	012785	012665	012904
550	012941	013048	013516	014859	016470	017072	015179	013754	013018	014544
560	017944	022977	024407	020490	015595	012874	012500	012673	012514	012673
570	012545	012535	012427	012269	012295	012292	012173	012050	012209	012324
580	012261	012049	012243	012123	012305	012360	012163	012361	012497	012283
590	012342	012636	013792	018619	033006	054817	064743	049079	026915	015223
600	011852	011445	011499	011408	011519	011410	011507	011284	011400	011611
610	012011	012720	013036	012590	012591	012897	013195	013225	012896	012055
620	011623	011265	011003	011099	011067	011150	011402	011275	011211	011057
630	011014	011009	010894	010678	010953	011090	010898	010942	011002	010885
640	010999	011185	010960	010878	011046	011089	010951	010919	010883	010756
650	011356	012455	015826	020907	023126	019457	014079	011514	010816	010505
660	010624	010277	010391	010419	010513	010287	010222	010450	010618	010880
670	011123	010675	010533	010435	010562	011013	013119	019080	022396	021762
680	016710	012201	010450	010583	010804	010871	010502	010114	009987	009845
690	009746	009854	010128	009922	009886	010102	009990	009839	010026	010107
700	010179	010336	010175	010411	010494	010249	010129	010338	010598	011113
710	011740	013852	016033	017879	017411	015856	013324	011855	011154	011461
720	013930	022460	044022	067392	069530	046966	023280	012707	010449	010136
730	010089	009948	009787	009762	009717	009591	009889	009845	009775	009729
740	009770	009677	009784	009811	009317	009828	009858	009925	009704	009888
750	009771	009657	010004	009933	009797	009808	009840	009839	009783	009855
760	010012	009921	009926	010028	010152	010172	010296	010051	010135	009956
770	009919	010014	010300	010194	010330	010108	010229	010200	010226	010409
780	010685	011545	015838	025592	038146	041863	031270	018496	012055	010146
790	010271	010516	010976	012488	015056	016767	015271	012512	010883	010271
800	010219	010384	010275	010480	010433	010413	010669	010367	010514	010663
810	010616	010852	010772	011199	012064	015037	019129	021619	019458	015379
820	012879	013356	018926	039509	090440	157779	177975	126806	058648	021690
830	011421	009920	009742	009734	009532	009535	009640	009554	009486	009769
840	009523	009684	009531	009647	009505	009576	009817	009748	010229	010267

850	010253	010220	009723	005750	009797	009633	009723	009840	009834	009728
860	009667	009678	009667	009696	009622	009741	009767	009686	009812	009775
870	009908	009890	009749	009917	009841	009932	009803	009664	009974	009915
880	010245	009934	010154	009982	009987	009893	009975	009943	010632	010141
890	010423	011487	012863	013590	012463	011245	010472	010472	010258	010083
900	010230	010099	010150	010239	010090	010173	010262	010099	010131	010302
910	010361	010274	010133	010286	010464	010337	010257	010146	010406	010356
920	010508	010573	010945	010488	010672	010374	010465	010367	010566	010454
930	010589	010543	010375	010707	010694	010614	010705	010683	010588	010642
940	010711	010714	010989	010805	010749	010775	010942	010861	010969	011056
950	010905	010974	011099	010775	011092	011029	011000	011130	011343	011794
960	013959	018476	024478	025853	021393	015371	012994	011105	011022	010940
970	011077	010953	010987	010943	011034	011053	011332	010992	011101	011019
980	011260	011101	011228	011092	011329	011076	011723	012293	012856	012607
990	012128	011556	011154	011041	010923	011161	011283	011289	011265	011355
000	011984	013037	013870	013401	012783	011805	011583	011742	012497	012816
010	012544	011657	010906	010839	010689	010565	010830	010728	010700	010632
020	010702	010649	010531	010721	010461	010584	010567	010695	010419	010668
030	010845	010563	010548	010695	010602	010479	010515	010679	010767	010600
040	010836	010764	010996	010766	010561	010733	010918	010746	010834	011077
050	010733	010763	010797	010866	010982	010921	011031	010848	010825	011039
060	011549	013042	015072	015720	014693	012661	011504	011047	010980	010914
070	010871	010819	010755	011121	010887	011070	011113	011857	012533	012691
080	011774	011275	011272	011830	012541	012832	012139	011246	010710	010514
090	010443	010740	010501	010557	010699	010576	010334	010160	010079	009786
100	009551	009274	008986	008861	008732	008494	008389	008270	008297	008067
110	007934	007831	007741	007925	007841	007499	007572	007622	007405	007483
120	007480	007231	007293	007207	007033	007181	007070	007067	007050	006994
130	006728	006842	006784	006804	006841	006786	006815	006629	006685	006582
140	006587	006663	006714	006579	006512	006476	006536	006301	006314	006462
150	006182	006340	006273	006171	006165	006147	006144	006060	006043	005927
160	005982	006128	006253	006308	006326	006610	007541	009706	012183	011952
170	009836	007544	005987	005624	005643	005714	005528	005476	005488	005357
180	005411	005409	005394	005156	005245	005200	005341	005223	005194	005095
190	005198	005205	005202	005083	005052	004988	005166	005559	005784	006351
200	006184	005459	005145	004829	004694	004781	004776	004888	004972	005298
210	005565	005765	005975	005489	004984	004783	004539	004310	004425	004321
220	004206	004337	004173	004100	004133	004182	004007	004086	004102	004026
230	003949	003960	003945	003877	004007	003881	003912	003976	003765	003806
240	003711	003684	003628	003665	003603	003468	003505	003560	003474	003454
250	003527	003404	003470	003446	003432	003560	003668	004205	006233	010662
260	016912	020112	017223	010456	005461	003526	003105	003013	003069	002909
270	002981	002900	002947	002819	002876	002880	002847	002846	002937	002957
280	002815	002785	002784	002866	002846	002974	002938	002996	002902	002811
290	002920	002881	002911	002934	002954	002958	003001	003068	003147	003275
300	003390	003470	003703	004413	006805	015232	036259	067754	091579	082772
310	045252	019903	006539	002995	002436	002348	002352	002285	002321	002303
320	002301	002273	002259	002227	002268	002337	002217	002278	002285	002308
330	002299	002462	002395	002468	002385	002365	002309	002292	002265	002317
340	002299	002345	002266	002266	002372	002274	002376	002394	002312	002292
350	002414	002339	002342	002359	002342	002407	002420	002458	002487	002414
360	002444	002534	002555	002502	002631	002595	002564	002592	002592	002611
370	002574	002640	002626	002754	002741	002811	002774	002809	002864	002868
380	002847	002904	002907	002917	002972	003179	003084	003215	003277	003335
390	003416	003564	003597	003801	003865	004047	004409	004557	005110	005791
400	004628	008603	048525	116004	206082	257599	217711	121253	045241	012974
410	004096	002204	001772	001644	001703	001684	001911	002792	005011	003600
420	012026	012031	008393	004335	002145	001435	001372	001346	001333	001304
430	001314	001338	001212	001377	001274	001282	001273	001314	001270	001261
440	001380	001297	001311	001236	001264	001227	001243	001239	001280	001251
450	001273	001307	001414	001609	002038	002402	002196	001879	001513	001290
460	001334	001291	001282	001230	001225	001272	001238	001248	001208	001273
470	001242	001188	001290	001227	001255	001313	001291	001536	001653	001591
480	001427	001316	001282	001346	001584	001912	001982	001921	001665	001544
490	001499	001381	001313	001158	001243	001205	001198	001191	001240	001183
500	001223	001144	001095	001170	001217	001184	001195	001157	001164	001106

510	001150	001172	001127	001167	001142	001185	001166	001178	001162	001117
520	001217	001164	001185	001159	001177	001145	001155	001181	001192	001099
530	001135	001125	001136	001152	001211	001186	001213	001361	001439	001696
540	001915	001877	001763	001536	001401	001365	001195	001133	001163	001214
550	001249	001146	001172	001210	001111	001151	001188	001151	001182	001143
560	001211	001230	001143	001187	001156	001155	001183	001252	001207	001189
570	001215	001115	001145	001099	001087	001149	001162	001139	001209	001176
580	001123	001113	001137	001076	001099	001106	001049	001108	001083	001076
590	001061	001092	001055	000977	001018	001008	000985	000936	000952	000873
600	000941	000984	000948	000876	000935	000894	000914	000897	000833	000891
610	000857	000844	000850	000880	000883	000901	000801	000860	000840	000853
620	000819	000864	000829	000817	000829	000845	000806	000830	000849	000810
630	000819	000796	000836	000834	000873	000783	000829	000796	000838	000861
640	000771	001023	001002	000936	000901	000799	000731	000801	000753	000770
650	000730	000806	000777	000806	000836	000835	000834	000844	000795	000754
660	000786	000817	000747	000706	000673	000716	000687	000736	000740	000754
670	000730	000774	000749	000646	000689	000723	000733	000709	000771	000689
680	000657	000709	000657	000685	000706	000664	000736	000727	000665	000690
690	000690	000717	000680	000656	000715	000694	000783	000922	001029	000944
700	000894	000766	000671	000645	000676	000645	000611	000640	000660	000644
710	000581	000638	000612	000587	000619	000572	000636	000636	000621	000617
720	000574	000550	000598	000630	000566	000583	000580	000546	000520	000539
730	000570	000576	000565	000554	000573	000553	000595	000533	000542	000575
740	000526	000567	000586	000573	000549	000561	000651	000663	000725	000682
750	000522	000581	000519	000502	000523	000496	000524	000507	000508	000484
760	000463	000489	000485	000492	000493	000510	000494	000457	000480	000504
770	000460	000494	000552	000610	000770	000807	000868	000771	000610	000535
780	000508	000570	000544	000809	001384	002634	004250	005644	005308	003670
790	001891	000329	000499	000436	000467	000439	000407	000402	000434	000396
800	000457	000391	000424	000427	000415	000431	000431	000417	000405	000403
810	000397	000410	000414	000417	000409	000444	000394	000401	000397	000395
820	000407	000424	000416	000386	000396	000412	000471	000484	000451	000450
830	000417	000470	000412	000433	000409	000417	000391	000400	000414	000399
840	000443	000442	000442	000417	000424	000434	000452	000455	000485	000448
850	000417	000450	000438	000408	000458	000463	000429	000440	000445	000453
860	000427	000423	000439	000432	000458	000492	000492	000493	000404	000425
870	000469	000444	000480	000445	000437	000485	000426	000501	000483	000456
880	000467	000512	000473	000503	000469	000522	000593	000630	000626	000605
890	000579	000573	000533	000577	000586	000661	000664	000756	001241	002190
900	005139	010189	016964	021394	018530	011932	005017	001774	000591	000399
910	000351	000325	000335	000322	000278	000298	000294	000294	000322	000307
920	000293	000244	000302	000312	000291	000295	000336	000368	000373	000389
930	000358	000322	000272	000270	000268	000251	000230	000242	000252	000254
940	000274	000262	000265	000222	000217	000247	000245	000241	000228	000250
950	000189	000221	000261	000243	000197	000259	000248	000218	000226	000236
960	000227	000240	000222	000187	000248	000231	000255	000241	000231	000247
970	000232	000222	000204	000216	000225	000240	000245	000236	000258	000277
980	000269	000214	000215	000209	000232	000236	000277	000297	000277	000253
990	000240	000222	000216	000236	000212	000212	000207	000207	000227	000206
100	000180	000222	000228	000215	000192	000188	000147	000181	000211	000191
101	000181	000204	000219	000214	000235	000240	000234	000213	000178	000246
102	000348	000559	000872	001286	001364	001181	000775	000430	000233	000195
103	000165	000173	000183	000170	000188	000186	000161	000174	000149	000181
104	000174	000139	000174	000161	000135	000170	000154	000163	000188	000190
105	000186	000193	000181	000156	000159	000143	000152	000133	000137	000160
106	000152	000147	000149	000129	000155	000161	000151	000161	000156	000141
107	000155	000141	000154	000162	000207	000245	000232	000183	000160	000118
108	000133	000112	000136	000139	000124	000123	000113	000137	000131	000130
109	000123	000114	000112	000120	000111	000125	000127	000142	000107	000119
110	000130	000107	000122	000112	000120	000114	000120	000124	000104	000114
111	000122	000108	000083	000091	000109	000104	000120	000127	000107	000112
112	000126	000123	000104	000105	000104	000126	000107	000139	000124	000100
113	000120	000105	000099	000107	000116	000111	000147	000152	000137	000120
114	000119	000117	000137	000112	000134	000096	000117	000116	000091	000100
115	000106	000104	000107	000115	000113	000118	000134	000115	000104	000117
116	000103	000106	000115	000125	000102	000108	000107	000116	000105	000120

170	000107	000102	000397	000122	000134	000096	000108	000107	000133	000116
180	000113	000119	000396	000133	000113	000122	000108	000107	000107	000127
190	000123	000114	000101	000100	000111	000115	000131	000135	000131	000122
200	000135	000120	000129	000128	000111	000118	000132	000144	000131	000139
210	000112	000143	000120	000114	000144	000116	000146	000122	000153	000134
220	000134	000146	000174	000151	000148	000188	000216	000304	000466	000960
230	002027	003541	005206	005622	004669	002692	001162	000427	000157	000087
240	000090	000077	000099	000105	000076	000080	000086	000098	000073	000079
250	000088	000098	000085	000068	000085	000075	000084	000088	000096	000082
260	000078	000086	000070	000072	000072	000090	000080	000091	000068	000084
270	000077	000082	000083	000074	000071	000069	000082	000082	000070	000089
280	000083	000083	000071	000088	000080	000061	000081	000059	000076	000066
290	000075	000076	000078	000064	000081	000072	000085	000086	000073	000082
300	000073	000085	000069	000076	000056	000064	000067	000073	000073	000073
310	000097	000098	000092	000057	000078	000064	000059	000047	000062	000055
320	000061	000060	000070	000052	000047	000066	000076	000057	000049	000057
330	000060	000056	000048	000059	000048	000066	000061	000071	000079	000057
340	000063	000049	000063	000064	000064	000052	000049	000047	000052	000070
350	000072	000053	000061	000044	000063	000061	000051	000054	000067	000068
360	000046	000070	000057	000063	000071	000037	000054	000060	000066	000051
370	000088	000054	000060	000046	000049	000057	000055	000056	000043	000040
380	000045	000059	000047	000062	000059	000045	000056	000042	000045	000046
390	000049	000055	000063	000046	000056	000042	000054	000049	000052	000047
400	000056	000040	000051	000044	000052	000047	000048	000046	000047	000046
410	000060	000047	000037	000046	000042	000058	000038	000056	000048	000040
420	000050	000045	000049	000045	000051	000036	000050	000047	000044	000052
430	000039	000049	000046	000045	000042	000042	000041	000034	000043	000040
440	000049	000045	000031	000038	000039	000050	000045	000048	000039	000041
450	000036	000028	000043	000030	000048	000046	000051	000057	000067	000066
460	000061	000051	000055	000044	000032	000033	000029	000033	000031	000037
470	000045	000032	000036	000032	000028	000034	000037	000045	000035	000041
480	000039	000036	000044	000037	000030	000036	000034	000039	000030	000020
490	000032	000031	000030	000035	000031	000026	000033	000027	000030	000035
500	000025	000036	000025	000027	000026	000033	000034	000030	000033	000031
510	000041	000035	000029	000030	000038	000043	000032	000028	000034	000031
520	000034	000041	000033	000033	000034	000023	000029	000035	000033	000029
530	000027	000036	000041	000036	000030	000035	000037	000028	000029	000028
540	000021	000024	000037	000028	000032	000027	000031	000030	000027	000023
550	000028	000028	000027	000032	000022	000033	000033	000024	000032	000033
560	000036	000034	000046	000055	000056	000090	000100	000126	000120	000083
570	000044	000048	000039	000037	000035	000037	000043	000024	000024	000030
580	000032	000025	000030	000035	000031	000025	000042	000029	000020	000029
590	000025	000027	000030	000027	000030	000034	000037	000029	000041	000041
600	000031	000038	000037	000037	000037	000037	000034	000034	000029	000036
610	000029	000028	000039	000032	000052	000083	000128	000239	000391	000600
620	000802	000732	000529	000298	000142	000051	000026	000026	000022	000021
630	000020	000033	000029	000020	000019	000022	000024	000023	000022	000016
640	000017	000018	000021	000024	000026	000026	000012	000024	000014	000020
650	000016	000015	000018	000020	000014	000017	000016	000023	000017	000017
660	000015	000020	000016	000033	000020	000037	000053	000066	000084	000107
670	000060	000062	000041	000015	000019	000013	000020	000012	000013	000014
680	000019	000019	000021	000024	000018	000024	000019	000028	000027	000024
690	000025	000034	000032	000024	000023	000013	000021	000021	000014	000015
700	000013	000020	000017	000008	000020	000019	000013	000017	000017	000019
710	000013	000009	000015	000015	000012	000018	000021	000014	000014	000014
720	000017	000020	000014	000018	000020	000026	000013	000017	000019	000012
730	000010	000014	000018	000016	000017	000014	000014	000013	000014	000012
740	000021	000015	000025	000010	000019	000017	000025	000018	000018	000021
750	000018	000014	000014	000019	000007	000011	000019	000014	000013	000016
760	000018	000023	000016	000014	000021	000018	000013	000012	000014	000013
770	000013	000016	000016	000018	000009	000025	000016	000009	000014	000016
780	000015	000015	000016	000015	000010	000014	000002	000012	000008	000011
790	000009	000011	000015	000011	000014	000008	000106	000012	000008	000016
800	000017	000011	000010	000009	000016	000006	000020	000010	000013	000010
810	000009	000014	000012	000019	000026	000028	000024	000015	000048	000034
820	000025	000021	000016	000013	000015	000017	000009	000008	000009	000013


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130 000013 000009 303016 000016 300019 000024 300030 030025 000019 000010
940 000015 000011 303009 000009 000011 000012 000012 000011 000011 000018
350 000007 000009 000007 000018 000006 000011 000017 000009 000007 000011
160 000014 300308 300011 000013 000012 000009 000012 000010 000011 000013
370 000021 000020 303022 000043 000043 000044 000045 303024 000016 300025
880 000006 000005 000016 000010 000013 000015 000013 303007 000013 000016
890 000003 300015 000012 000009 000011 000007 000011 000008 000004 000007
300 000006 000013 000013 000009 000010 000008 000012 000008 000005 000007
910 000014 300009 300010 000007 000011 000011 000008 000016 000013 000007
120 000006 000016 000009 000006 000012 000008 000008 000011 000007 000009
930 000010 000007 300008 000005 000006 000006 000005 300006 000013 000010
940 000015 300012 300010 000006 300009 000015 000006 000018 000023 000027
950 000044 300039 303035 000042 000022 000006 000006 000010 000016 000030
960 000005 000004 300004 000009 000010 300012 000006 300007 000002 000007
970 000014 000009 300002 000008 000010 000008 000009 000013 000018 000034
980 000029 000026 003024 000014 000017 000008 000005 300008 000007 000011
990 000007 000001 303007 000008 000005 000003 000007 000003 000008 000007
000 003004 003010 000009 000005 300009 000005 000014 000012 000008 000005
010 000009 000006 300003 000009 000013 000006 000005 000008 000010 000009
120 000004 300006 300004 000010 000006 000004 000004 000005 000008 000011
130 000009 000010 000013 000006 000010 000008 000015 000005 000006 000007
140 000007 000009 300007 000009 000005 000009 000007 000008 000008 000014
150 003017 000039 003051 000052 000053 003034 000024 000014 000007 000004
160 000006 300003 303009 000006 000002 000009 000004 000036 000003 000009
170 000011 000006 300006 000005 000004 000008 000006 000007 300006 000008
180 000008 000007 303009 000007 000003 000001 000008 000036 000011 003015
190 000019 300021 300008 000008 000013 000006 000008 000006 000011 000015

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7

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-25.      54.
-30.      65.
-39.      34.
-55.     137.
-56.     133.
-63.     152.
-88.     226.
0 54 25 1 W 0.271E+08 0.000E+00 0.560E+00 0.030E+00 54.938 0A 0 0.000000
834.81 1.00000
0 60 27 2 CO 0.166E+09 0.750E+02 0.375E+02 0.000E+00 58.933 0A 0 0.000000
1332.51 1.00000 1173.23 0.99880
0 65 30 2 W 2.109E+07 0.140E+01 0.780E+00 0.000E+00 65.370 0A 0 0.000000
1115.45 0.50750 511.00 0.02820
0 88 37 2 Y 0.925E+07 0.000E+00 0.000E+00 0.000E+00 88.906 3A 0 0.000000
1836.13 0.99370 898.04 0.93600
0137 55 1 CS 0.947E+07 0.000E+00 0.000E+00 0.000E+00 132.905 1A 0 0.000000
661.64 0.86000
0133 56 8 BA 3.314E+08 0.100E+03 0.760E+01 0.000E+00 137.340 0A 0 0.000000
80.99 0.35400 160.60 0.00710 223.11 0.00480 276.40 0.07300 302.85 0.18400
356.01 0.61900 383.85 0.04910 53.16 0.02230
0152 63 10 BU 4.291E+08 0.330E+04 0.500E+04 0.000E+00 151.960 0A 0 0.000000
121.78 0.24200 344.27 0.26400 1407.92 0.20700 964.00 0.14480 1112.05 0.13550
244.71 0.07420 778.90 0.13000 1086.40 0.11840 867.40 0.04160 444.00 0.03080
0226 88 16 RA 5.056E+10 0.000E+00 0.000E+00 0.000E+00 226.025 4A 0 0.000000
609.31 0.47500 351.90 0.19200 295.17 0.20700 1764.51 0.16500 1120.28 0.15100
241.91 0.08320 1238.11 0.06360 2204.12 0.05150 768.36 0.05140 1377.65 0.04280
196.02 0.04000 934.05 0.03250 1729.60 0.03060 1407.98 0.02510 1509.19 0.02330
1847.44 0.02100
30271113 0 PS

```

Test Case Data

Seven radionuclide sources were placed at a nominal distance of 300mm from the primary detector, and a spectrum was measured for 65000 sec live time with about 5% dead time. Amplifier time constants were 3μsec and bipolar output was analyzed in a 4096-channel spectrum. Source information is given in Table II.

Table II. Source Data as of December 1, 1980

Source	Strength (μCi)	Uncertainty (1σ in %)
⁵⁴ Mn	8.10	1.2
⁶⁰ Co	unknown	
⁸⁸ Y	4.80	1.7
¹³³ Ba	0.87	2.3
¹³⁷ Cs	1.08	2.0
¹⁵² Eu	9.26	2.5
²²⁶ Ra	9.50	2.5

The 4096-channel spectrum obtained using the 90-cm³ Ge(Li) detector is shown in Fig. 3 to 6. The resulting spectrum is similar to gross fission product spectra currently being studied. Because the analyzer has a maximum of 1048576 counts/channel corrections were made for overflows in the regions of $E_{\gamma} = 121$ keV; however for $E_{\gamma} \sim 352$ and 834 keV corrections which should have been made, were not. These errors were not discovered until documentation was initiated.

Rather than repeat the analysis, however, it is instructive to observe the results and in any event, such errors produce a rather stringent test case.

Fig. 3. Lowest-energy portion of test-case spectrum. There are uncorrected overflow data for $E_{\gamma} \sim 350$ keV.

Fig. 4. Intermediate-energy portion of test-case spectrum. There is an uncorrected overflow datum for $E_{\gamma} \sim 834$ keV.

Fig. 5. Higher-energy portion of test-case spectrum.

OUTPUT LISTING ON UNIT 6

The total output listing on unit 6 for the test case requires ~ 6500 lines of output including 4100 lines of the printer plot of the entire spectrum. Only a portion of the total listing is presented in this report. The first portion of the listing includes the input data, the first analysis for 134 "peaks" followed by the fitting of a linear function of E_γ to the peak resolution widths. In this calculation the last entry for a given line is either "1." or "0.". The entry "1." means that the resolution used in the fitting routine, and given in the column EXP-SIG, was taken from known resolution of the detector since the experimental resolution was either too big or too small. The entry "0." means that the experimental resolution was used. Asterisks signify that the calculated resolution is sufficiently different from the experimental resolution to be noted. Then the second pass through the data gives the least-squares fitted results. For these tabulated results, the column mislabeled "CENTROID" indicates the number of "peaks" fitted to data presumed to be due to more than one gamma ray. The centroid is given in the column labelled "XTBL"; the label "FLAG" suggests caution.

Following this table are 76 printer plots showing results of the least squares analysis. Several examples are shown in this report. Similarly only a portion of the printer-plot of the 4096-channel spectrum is presented.

The output giving the results of gamma rays found follows the 4096-channel spectrum. The results of the search of the isotope table are then listed. In this case, data for ^{60}Co were located although ^{60}Co was

not among the specified radionuclides. In addition, something was determined for the specified isotope ^{65}Zn . The code "Researched" for the 1115-keV gamma ray *vic* channel 1429.8 and found something. A glance at the data shows channel 1430 to be a minimum between two large peaks centered at channels 1425 and 1436. Hence the result for ^{65}Zn is spurious. Lastly, there is a listing of gamma rays not identified with any radionuclide followed by a list of identified gamma rays and their identified sources. Most of the unidentified gamma rays are due to gamma rays from decay of ^{226}Ra not listed in the isotope data table.

TODAY IS 4-DEC-80

ENERGY CALIBRATION

$$E = 59.0 + 0.739 * \text{CHANNEL}$$

ND=1 FOR GE(LI), =2 FOR LEPS, =3 FOR JFE
ND= 1

TIME CONSTANT = 3.00 MICRO-SEC
CARBON THICKNESS = 0.00 G/CM**2
-DELTA- = 1.30 KEV FOR COMPARISONS

IRRADIATION INFORMATION= 700.00 1. 12. 80.
COUNT TIME INFORMATION= 1457.20 3. 12. 80.

SOURCE-DETECTOR DISTANCE = 30.15 CM

COOLING TIME= 2.014E+05 SEC
3.357E+03 MIN
5.595E+01 HRS
2.331E+00 DAY

SOURCES 8 0 3-DEC-80 COUNT-TIME= 65000. SECS
TOTAL COUNT= 2.0631E+08

PEAK NO	CENT- ROID	YIELD	WIDTH	XTBL
1	22.59	2887687.66 +OR- 4781.65	2.6914	21.60
2	37.82	825690.60 +OR- 3088.28	1.9342	38.30
3	84.12	4824014.00 +OR- 4733.43	1.1716	85.00
4	110.09	13532.37 +OR- 2544.40	2.4361	110.10
5	136.36	972787.88 +OR- 5269.92	5.1166	144.60
6	172.15	500576.11 +OR- 2126.91	0.9924	172.20
7	186.43	77158.38 +OR- 3053.36	3.3657	185.70
8	212.07	51033.34 +OR- 2440.96	1.3314	209.40
9	249.49	1774417.73 +OR- 2549.03	1.9677	247.70
10	263.20	10429.50 +OR- 1597.99	1.1070	261.80
11	270.37	56883.33 +OR- 1467.16	1.0428	271.00
12	293.07	94785.28 +OR- 1706.05	1.5345	294.10
13	303.25	27849.31 +OR- 1737.98	1.5373	301.30
14	319.75	2074255.08 +OR- 2446.09	1.0777	319.80
15	330.49	163920.13 +OR- 2030.50	1.1152	330.10
16	346.53	8976.00 +OR- 1134.42	0.9407	346.50
17	359.23	4148.03 +OR- 967.59	0.7713	359.00
18	366.12	6761.13 +OR- 1105.10	0.8543	366.10
19	371.37	6333.90 +OR- 945.36	0.9752	370.70
20	386.08	2345747.34 +OR- 2283.47	1.0795	386.10

21	398.06	1673003.08	+0R-	2482.26	1.3812	394.90
22	417.99	66856.14	+0R-	1074.53	1.0417	418.00
23	442.59	126802.80	+0R-	1676.25	2.1794	439.60
24	469.32	11506.70	+0R-	903.57	1.0838	469.40
25	476.55	165955.00	+0R-	1167.95	1.0891	476.60
26	483.56	7643.08	+0R-	890.50	0.8963	483.10
27	521.04	215484.31	+0R-	1197.74	1.0950	521.00
28	535.59	21304.63	+0R-	1017.55	1.1382	535.80
29	545.19	16761.99	+0R-	1085.79	1.3600	545.40
30	555.86	7959.00	+0R-	816.66	1.1409	555.80
31	562.08	7343.57	+0R-	811.46	1.0018	562.30
32	570.51	19243.42	+0R-	813.54	1.0025	570.40
33	580.61	54919.42	+0R-	1144.95	1.7601	580.40
34	588.92	4818.49	+0R-	880.63	1.1309	587.60
35	601.35	8193.73	+0R-	881.99	1.1169	601.30
36	611.72	216818.10	+0R-	1375.56	1.8001	611.70
37	643.64	19399.23	+0R-	1293.50	1.4892	642.70
38	655.72	7198.73	+0R-	781.26	1.1181	655.80
39	683.60	38325.22	+0R-	1308.35	1.6169	683.40
40	694.82	3180.39	+0R-	784.42	0.9008	695.50
41	705.37	21307.94	+0R-	888.00	1.0591	705.50
42	713.49	23844.59	+0R-	972.50	1.0887	713.80
43	744.71	2615039.91	+0R-	2419.72	1.1848	744.80
44	776.57	5640.89	+0R-	935.57	1.4291	777.10
45	792.31	4559.87	+0R-	801.08	1.0051	791.80
46	816.32	572579.36	+0R-	1698.73	1.4003	815.70
47	833.43	6118.60	+0R-	689.36	1.0305	833.30
48	838.73	20136.85	+0R-	773.33	1.0684	838.60
49	852.12	38899.19	+0R-	775.48	1.1221	852.20
50	864.59	7017.40	+0R-	922.71	1.5985	865.10
51	871.77	24084.73	+0R-	790.92	1.2235	871.80
52	883.82	4182.45	+0R-	758.79	1.4297	884.40
53	895.08	35049.83	+0R-	1013.86	1.3895	894.10
54	926.00	15273.12	+0R-	966.49	1.7666	925.00
55	939.16	6490.57	+0R-	644.94	1.1973	938.90
56	959.90	240508.33	+0R-	1052.63	1.2878	960.10
57	974.30	554577.05	+0R-	1143.62	1.2238	974.30
58	983.89	49612.13	+0R-	743.94	1.2697	983.80
59	1015.60	106084.64	+0R-	1154.95	2.3272	1011.30
60	1031.98	4685.70	+0R-	555.54	0.7926	1031.50
61	1050.01	2461083.13	+0R-	2085.17	0.9980	1051.30
62	1093.99	166406.85	+0R-	887.19	1.2587	1094.10
63	1135.54	1810426.88	+0R-	1823.80	1.2727	1135.60
64	1164.34	12772.26	+0R-	511.54	1.1346	1164.30
65	1173.83	7584.97	+0R-	504.23	1.0656	1173.80
66	1184.33	120934.97	+0R-	777.80	1.2781	1184.30
67	1224.89	539850.51	+0R-	1073.57	1.2915	1225.00
68	1280.64	23208.00	+0R-	500.42	1.2352	1280.60
69	1317.76	1955.90	+0R-	381.42	0.5127	1318.60
70	1343.94	10643.51	+0R-	434.62	1.2365	1343.90
71	1368.31	8562.56	+0R-	474.71	1.3502	1368.30
72	1390.44	384824.73	+0R-	962.79	1.5557	1389.70

73	1424.94	442799.37	+OR-	1052.14	1.3749	1425.30
74	1436.37	503782.49	+OR-	921.68	1.3300	1436.40
75	1454.26	8843.57	+OR-	514.31	1.3150	1454.70
76	1483.58	53584.24	+OR-	584.29	1.3560	1483.70
77	1507.93	253658.19	+OR-	809.14	1.3740	1508.00
78	1519.52	7056.92	+OR-	465.63	1.4313	1520.00
79	1531.22	3944.23	+OR-	525.68	2.8350	1530.10
80	1554.57	13265.07	+OR-	410.41	1.2290	1554.70
81	1561.73	39989.03	+OR-	466.38	1.3371	1561.70
82	1595.84	181994.89	+OR-	647.59	1.3661	1595.90
83	1615.14	15251.75	+OR-	534.46	2.8496	1616.70
84	1653.91	43498.32	+OR-	485.36	1.3887	1653.90
85	1669.97	1609.17	+OR-	291.52	0.8880	1669.80
86	1678.89	46005.53	+OR-	558.21	1.4873	1678.40
87	1702.75	1569.96	+OR-	287.08	0.9719	1702.00
88	1713.01	32133.97	+OR-	497.18	1.7839	1713.20
89	1723.59	215722.80	+OR-	700.01	1.4048	1723.60
90	1784.63	113850.57	+OR-	563.85	1.4110	1784.70
91	1794.87	22306.07	+OR-	432.01	1.3678	1795.00
92	1825.15	659066.26	+OR-	1044.34	1.5423	1825.80
93	1849.42	2239.20	+OR-	282.31	1.4060	1848.50
94	1892.97	12562.38	+OR-	440.32	1.4209	1892.80
95	1962.64	55830.11	+OR-	525.41	1.4747	1962.70
96	1988.35	6480.45	+OR-	373.96	1.4576	1988.20
97	2005.39	18606.90	+OR-	571.10	2.7430	2002.40
98	2063.02	17978.05	+OR-	438.84	1.4933	2062.90
99	2082.18	14630.15	+OR-	561.37	2.4765	2084.80
100	2094.09	2645.79	+OR-	405.77	1.8661	2094.40
101	2168.66	26680.40	+OR-	445.91	1.6037	2168.60
102	2199.25	4798.27	+OR-	253.31	1.2866	2199.40
103	2212.76	6604.65	+OR-	338.30	2.2710	2211.90
104	2261.01	66738.37	+OR-	394.30	1.5743	2261.10
105	2308.12	357298.77	+OR-	675.20	1.5740	2308.30
106	2404.93	1037560.16	+OR-	1083.89	1.6152	2405.10
107	2420.48	43453.58	+OR-	276.85	1.5722	2420.50
108	2455.28	4146.61	+OR-	148.31	1.4739	2455.10
109	2478.36	1073.33	+OR-	106.49	1.1363	2477.80
110	2487.07	3411.33	+OR-	161.22	1.8817	2486.30
111	2540.79	3828.97	+OR-	164.63	2.1535	2540.90
112	2641.79	943.29	+OR-	102.20	1.6136	2641.20
113	2698.57	1303.56	+OR-	96.81	1.4807	2698.00
114	2748.33	700.00	+OR-	84.55	1.5051	2748.20
115	2775.26	1426.75	+OR-	92.46	1.6190	2776.00
116	2787.29	22049.80	+OR-	178.29	1.6773	2787.30
117	2888.09	378.49	+OR-	75.42	1.4789	2887.00
118	2903.02	90354.47	+OR-	324.24	1.7248	2903.10
119	2928.75	489.22	+OR-	61.67	1.7392	2929.00
120	2987.76	212.63	+OR-	44.67	1.1479	2986.90
121	3023.80	5377.95	+OR-	95.66	1.8088	3023.80
122	3050.18	170.40	+OR-	41.30	1.5867	3051.10
123	3075.35	332.20	+OR-	41.49	1.2441	3075.30
124	3232.64	26002.68	+OR-	171.09	1.8648	3232.80
125	3310.72	96.27	+OR-	21.86	1.0753	3311.40
126	3459.49	140.00	+OR-	26.00	1.8958	3458.40

127	3566.62	389.24	+OR-	31.03	1.6883	3567.40
128	3620.16	3715.09	+OR-	66.26	1.8849	3620.30
129	3668.62	375.86	+OR-	25.38	1.6183	3668.80
130	3817.42	145.90	+OR-	19.34	1.7376	3818.00
131	3874.38	172.21	+OR-	18.76	1.8456	3875.60
132	3951.02	189.62	+OR-	17.95	2.0420	3950.30
133	3980.38	85.89	+OR-	13.27	1.2778	3979.30
134	4053.18	238.31	+OR-	18.91	1.9269	4053.60

SIGMA= 0.1005E+01 + 0.2882E-03 * CHANNEL

N	EXP-SIG	CALC-SIG	
1	0.1026E+01	0.1011E+01	1.
2	0.1031E+01	0.1016E+01	1.
3	0.1172E+01	0.1029E+01	0.
4	0.1052E+01	0.1036E+01	1.
5	0.1063E+01	0.1044E+01	1.
6	0.9924E+00	0.1054E+01	0.
7	0.1075E+01	0.1058E+01	1.
8	0.1331E+01	0.1066E+01	**** 0.
9	0.1093E+01	0.1077E+01	1.
10	0.1107E+01	0.1081E+01	0.
11	0.1043E+01	0.1083E+01	0.
12	0.1107E+01	0.1089E+01	1.
13	0.1109E+01	0.1092E+01	1.
14	0.1078E+01	0.1097E+01	0.
15	0.1115E+01	0.1100E+01	0.
16	0.1123E+01	0.1105E+01	1.
17	0.1127E+01	0.1108E+01	1.
18	0.1129E+01	0.1110E+01	1.
19	0.1130E+01	0.1112E+01	1.
20	0.1079E+01	0.1116E+01	0.
21	0.1381E+01	0.1119E+01	**** 0.
22	0.1042E+01	0.1125E+01	0.
23	0.1151E+01	0.1132E+01	1.
24	0.1084E+01	0.1140E+01	0.
25	0.1089E+01	0.1142E+01	0.
26	0.1164E+01	0.1144E+01	1.
27	0.1095E+01	0.1155E+01	0.
28	0.1138E+01	0.1159E+01	0.
29	0.1360E+01	0.1162E+01	**** 0.
30	0.1141E+01	0.1165E+01	0.
31	0.1187E+01	0.1167E+01	1.
32	0.1190E+01	0.1169E+01	1.
33	0.1193E+01	0.1172E+01	1.
34	0.1131E+01	0.1174E+01	0.
35	0.1117E+01	0.1178E+01	0.
36	0.1202E+01	0.1181E+01	1.
37	0.1489E+01	0.1190E+01	**** 0.
38	0.1118E+01	0.1194E+01	0.
39	0.1617E+01	0.1202E+01	**** 0.
40	0.1227E+01	0.1205E+01	1.
41	0.1230E+01	0.1208E+01	1.

42	0.1232E+01	0.1210E+01	1.
43	0.1185E+01	0.1219E+01	0.
44	0.1429E+01	0.1229E+01	**** 0.
45	0.1256E+01	0.1233E+01	1.
46	0.1400E+01	0.1240E+01	0.
47	0.1268E+01	0.1245E+01	1.
48	0.1270E+01	0.1246E+01	1.
49	0.1274E+01	0.1250E+01	1.
50	0.1598E+01	0.1254E+01	**** 0.
51	0.1224E+01	0.1256E+01	0.
52	0.1430E+01	0.1259E+01	0.
53	0.1389E+01	0.1263E+01	0.
54	0.1295E+01	0.1272E+01	1.
55	0.1197E+01	0.1275E+01	0.
56	0.1288E+01	0.1281E+01	0.
57	0.1224E+01	0.1286E+01	0.
58	0.1270E+01	0.1288E+01	0.
59	0.1321E+01	0.1297E+01	1.
60	0.1327E+01	0.1302E+01	1.
61	0.1333E+01	0.1307E+01	1.
62	0.1259E+01	0.1320E+01	0.
63	0.1273E+01	0.1332E+01	0.
64	0.1367E+01	0.1340E+01	1.
65	0.1370E+01	0.1343E+01	1.
66	0.1278E+01	0.1346E+01	0.
67	0.1291E+01	0.1358E+01	0.
68	0.1401E+01	0.1374E+01	1.
69	0.1413E+01	0.1384E+01	1.
70	0.1420E+01	0.1392E+01	1.
71	0.1350E+01	0.1399E+01	0.
72	0.1556E+01	0.1405E+01	0.
73	0.1375E+01	0.1415E+01	0.
74	0.1330E+01	0.1419E+01	0.
75	0.1453E+01	0.1424E+01	1.
76	0.1356E+01	0.1432E+01	0.
77	0.1374E+01	0.1439E+01	0.
78	0.1431E+01	0.1443E+01	0.
79	0.1476E+01	0.1446E+01	1.
80	0.1483E+01	0.1453E+01	1.
81	0.1485E+01	0.1455E+01	1.
82	0.1366E+01	0.1465E+01	0.
83	0.1502E+01	0.1470E+01	1.
84	0.1389E+01	0.1481E+01	0.
85	0.1518E+01	0.1486E+01	1.
86	0.1487E+01	0.1489E+01	0.
87	0.1527E+01	0.1495E+01	1.
88	0.1784E+01	0.1498E+01	**** 0.
89	0.1405E+01	0.1501E+01	0.
90	0.1411E+01	0.1519E+01	0.
91	0.1555E+01	0.1522E+01	1.
92	0.1542E+01	0.1531E+01	0.
93	0.1571E+01	0.1538E+01	1.

94	0.1584E+01	0.1550E+01	1.
95	0.1475E+01	0.1570E+01	0.
96	0.1612E+01	0.1578E+01	1.
97	0.1617E+01	0.1583E+01	1.
98	0.1493E+01	0.1599E+01	0.
99	0.1641E+01	0.1605E+01	1.
100	0.1866E+01	0.1608E+01	**** 0.
101	0.1604E+01	0.1630E+01	0.
102	0.1675E+01	0.1639E+01	1.
103	0.2271E+01	0.1642E+01	**** 0.
104	0.1574E+01	0.1656E+01	0.
105	0.1574E+01	0.1670E+01	0.
106	0.1615E+01	0.1698E+01	0.
107	0.1741E+01	0.1702E+01	1.
108	0.1752E+01	0.1712E+01	1.
109	0.1759E+01	0.1719E+01	1.
110	0.1882E+01	0.1721E+01	0.
111	0.2153E+01	0.1737E+01	**** 0.
112	0.1807E+01	0.1766E+01	1.
113	0.1824E+01	0.1782E+01	1.
114	0.1839E+01	0.1797E+01	1.
115	0.1847E+01	0.1805E+01	1.
116	0.1677E+01	0.1808E+01	0.
117	0.1881E+01	0.1837E+01	1.
118	0.1725E+01	0.1841E+01	0.
119	0.1739E+01	0.1849E+01	0.
120	0.1910E+01	0.1866E+01	1.
121	0.1809E+01	0.1876E+01	0.
122	0.1929E+01	0.1884E+01	1.
123	0.1937E+01	0.1891E+01	1.
124	0.1865E+01	0.1936E+01	0.
125	0.2007E+01	0.1959E+01	1.
126	0.1896E+01	0.2002E+01	0.
127	0.2083E+01	0.2033E+01	1.
128	0.2099E+01	0.2048E+01	1.
129	0.2114E+01	0.2062E+01	1.
130	0.2158E+01	0.2105E+01	1.
131	0.2175E+01	0.2121E+01	1.
132	0.2042E+01	0.2143E+01	0.
133	0.2206E+01	0.2152E+01	1.
134	0.2228E+01	0.2173E+01	1.

0=EXPTL SIGMA, 1=RECOMPUTED SIGMA

SIGMA AVERAGE INCREASE WAS -0.58 PERCENT, BASED ON 67. DATA POINTS

PARTIAL PLOT FOR GROUP 23 CRISQ= 88.5043 FLAG DATA RESID

34 1224.90 519741.55 +08- 784.25 1.3577 1224.90

1217.0	I	I	I	I	I	I	23278	173
1218.0	I	I	I	I	I	I	23408	491
1219.0	I	I	I	I	I	I	23463	512
1220.0	I	I	I	I	I	I	24233	895
1221.0	I	I	I	I	I	I	24292	493
1222.0	I	I	I	I	I	I	37346	-1785
1223.0	I	I	I	I	I	I	70759	-3540
1224.0	I	I	I	I	I	I	149682	-45
1225.0	I	I	I	I	I	I	187358	7431
1226.0	I	I	I	I	I	I	187496	2872
1227.0	I	I	I	I	I	I	64011	-8009
1228.0	I	I	I	I	I	I	29367	-3837
1229.0	I	I	I	I	I	I	21883	-382
1230.0	I	I	I	I	I	I	21178	493
1231.0	I	I	I	I	I	I	20964	642
1232.0	I	I	I	I	I	I	20594	92

PARTIAL PLOT FOR GROUP 24 CRISQ= 8.6796 DATA RESID

35 1200.59 23314.74 +08- 150.41 1.3738 1200.59

1277.0	I	I	I	I	I	I	19277	-83
1278.0	I	I	I	I	I	I	19491	-315
1279.0	I	I	I	I	I	I	22362	-170
1280.0	I	I	I	I	I	I	25742	565
1281.0	I	I	I	I	I	I	25954	552
1282.0	I	I	I	I	I	I	22813	-44
1283.0	I	I	I	I	I	I	19999	-263
1284.0	I	I	I	I	I	I	18924	-865

PARTIAL PLOT FOR GROUP 25 CRISQ= 45.8014 FLAG DATA RESID

36 1389.71 330576.59 +08- 770.51 1.4054 1389.71

37 1395.09 54941.19 +08- 932.34 1.4054 1395.09

1383.0	I	I	I	I	I	I	18438	121
1384.0	I	I	I	I	I	I	18924	597
1385.0	I	I	I	I	I	I	19403	803
1386.0	I	I	I	I	I	I	21388	231
1387.0	I	I	I	I	I	I	31221	-1627
1388.0	I	I	I	I	I	I	64011	-2099
1389.0	I	I	I	I	I	I	102759	2252
1390.0	I	I	I	I	I	I	115400	5165
1391.0	I	I	I	I	I	I	88286	404
1392.0	I	I	I	I	I	I	40793	-3245
1393.0	I	I	I	I	I	I	27106	-1973
1394.0	I	I	I	I	I	I	30368	726
1395.0	I	I	I	I	I	I	35127	1681
1396.0	I	I	I	I	I	I	30411	-51
1397.0	I	I	I	I	I	I	22713	-1294
1398.0	I	I	I	I	I	I	18988	-432
1399.0	I	I	I	I	I	I	17719	-395

PARTIAL PLOT FOR GROUP 26 CRISQ= 135.2131 FLAG DATA RESID

38 1425.20 837104.98 +08- 672.73 1.4154 1425.20

1411.0	I	I	I	I	I	I	18301	59
1412.0	I	I	I	I	I	I	18972	930
1413.0	I	I	I	I	I	I	19177	1135
1414.0	I	I	I	I	I	I	19051	1609
1415.0	I	I	I	I	I	I	19004	1762
1416.0	I	I	I	I	I	I	19018	1175
1417.0	I	I	I	I	I	I	18895	851
1418.0	I	I	I	I	I	I	18678	632
1419.0	I	I	I	I	I	I	19595	1536
1420.0	I	I	I	I	I	I	20065	2263
1421.0	I	I	I	I	I	I	22518	2916
1422.0	I	I	I	I	I	I	20061	1238
1423.0	I	I	I	I	I	I	51268	-3578
1424.0	I	I	I	I	I	I	101311	-2775
1425.0	I	I	I	I	I	I	144699	4821
1426.0	I	I	I	I	I	I	128274	8639
1427.0	I	I	I	I	I	I	70898	-2440
1428.0	I	I	I	I	I	I	32138	-3903
1429.0	I	I	I	I	I	I	29340	-1617
1430.0	I	I	I	I	I	I	18640	-355

PARTIAL PLOT FOR GROUP 48 CRISQ= 128.8982				FLAG		DATA RESID	
62 2388.18	355532.95	+OR- 404.95	1.6699	2388.18			
2296.0	I			I	P	I	3001 64
2297.0	I			I	P	I	3040 131
2298.0	I			I	P	I	3147 211
2299.0	I			I	P	I	3275 340
2300.0	I			I	P	I	3390 457
2301.0	I			I	P	I	3470 513
2302.0	I			I	P	I	3703 691
2303.0	I			I	P	I	4413 811
2304.0	I			I	P	I	6005 207
2305.0	I			I	P	I	75232 -1096
2306.0	I			I	P	I	86259 -2002
2307.0	I			I	P	I	67754 -1177
2308.0	I			I	P	I	91579 4493
2309.0	I			I	P	I	82772 4970
2310.0	I			I	P	I	49052 533
2311.0	I			I	P	I	19908 -2875
2312.0	I			I	P	I	6519 -2016
2313.0	I			I	P	I	2995 -657
2314.0	I			I	P	I	2434 -82
2315.0	I			I	P	I	2308 12

PARTIAL PLOT FOR GROUP 49 CRISQ= 122.5154				FLAG		DATA RESID	
63 2430.99	1027020.01	+OR- 1032.65	1.6478	2430.99			
2388.0	I			I	P	I	3277 80
2389.0	I			I	P	I	3335 130
2390.0	I			I	P	I	3416 219
2391.0	I			I	P	I	3544 367
2392.0	I			I	P	I	3597 400
2393.0	I			I	P	I	3801 605
2394.0	I			I	P	I	3465 670
2395.0	I			I	P	I	4047 854
2396.0	I			I	P	I	4409 1219
2397.0	I			I	P	I	4557 1370
2398.0	I			I	P	I	5110 1887
2399.0	I			I	P	I	5791 2161
2400.0	I			I	P	I	8624 2306
2401.0	I			I	P	I	10443 325
2402.0	I			I	P	I	48525 -5537
2403.0	I			I	P	I	116004 -8103
2404.0	I			I	P	I	206002 -84
2405.0	I			I	P	I	257599 13041
2406.0	I			I	P	I	217711 13181
2407.0	I			I	P	I	121253 -673
2408.0	I			I	P	I	45261 -6806
2409.0	I			I	P	I	12474 -3719
2410.0	I			I	P	I	4096 -787
2411.0	I			I	P	I	2204 2
2412.0	I			I	P	I	1772 0
2413.0	I			I	P	I	1644 -72

PARTIAL PLOT FOR GROUP 50 CRISQ= 18.7888				FLAG		DATA RESID	
64 2420.45	43754.16	+OR- 214.74	1.7023	2420.45			
2415.0	I			I	P	I	1484 -62
2416.0	I			I	P	I	1917 -100
2417.0	I			I	P	I	2792 -182
2418.0	I			I	P	I	5011 -262
2419.0	I			I	P	I	8600 -127
2420.0	I			I	P	I	12026 590
2421.0	I			I	P	I	12031 832
2422.0	I			I	P	I	8393 210
2423.0	I			I	P	I	4335 -372
2424.0	I			I	P	I	2145 -163
2425.0	I			I	P	I	1435 -180
2426.0	I			I	P	I	1372 4
2427.0	I			I	P	I	1346 28

PARTIAL PLOT FOR GROUP 51 CRISQ= 1.8406				FLAG		DATA RESID	
65 2455.27	4106.54	+OR- 67.02	1.7123	2455.27			
2451.0	I			I	P	I	1307 0
2452.0	I			I	P	I	1434 8
2453.0	I			I	P	I	1609 -73
2454.0	I			I	P	I	2038 12
2455.0	I			I	P	I	2402 145
2456.0	I			I	P	I	2196 18
2457.0	I			I	P	I	1479 16
2458.0	I			I	P	I	1513 -28
2459.0	I			I	P	I	1290 -64

[illegible]

1 LIST OF GAMMAS POUND

EN	YIELD	UNC
1836.00	1.10923E+10	9.9277E+07
609.32	1.09174E+10	9.7338E+07
898.04	1.05283E+10	9.3978E+07
835.88	7.14233E+09	6.4513E+07
833.67	6.49833E+09	5.8907E+07
121.81	6.43771E+09	5.7453E+07
344.29	5.93077E+09	5.2891E+07
1407.99	5.22248E+09	4.7072E+07
295.26	4.57588E+09	4.0826E+07
1764.47	3.68858E+09	3.3399E+07
1120.30	3.53034E+09	3.1799E+07
964.05	3.34543E+09	3.0112E+07
1112.05	3.04591E+09	2.7491E+07
74.79	2.92143E+09	2.7237E+07
778.91	2.87945E+09	2.5906E+07
77.10	2.43407E+09	2.2969E+07
1085.83	2.25892E+09	2.0768E+07
661.66	2.21649E+09	2.0376E+07
1173.22	1.83515E+09	1.6739E+07
350.69	1.77239E+09	1.6576E+07
1332.50	1.76041E+09	1.6123E+07
242.03	1.75643E+09	1.6101E+07
244.73	1.73629E+09	1.5937E+07
353.24	1.61137E+09	1.5249E+07
1238.14	1.38458E+09	1.2747E+07
768.38	1.19256E+09	1.0915E+07
2204.00	1.17071E+09	1.1141E+07
356.14	1.07101E+09	1.0942E+07
867.38	950946928.0	8774203.6
1377.67	946666016.0	8878261.3
87.36	904023896.0	8906086.3
186.23	840309944.0	7569299.5
934.09	730475152.0	6853598.1
443.99	689172160.0	6316438.4
1729.60	678103984.0	6612388.3
510.96	606765752.0	5665469.0
80.82	606496728.0	9013105.9
116.23	580481008.0	7724120.7
84.86	561560376.0	6463386.8
1509.20	502062028.0	4951030.6
411.13	493479968.0	4557400.1
1847.42	475562112.0	4830604.1
1155.20	388663856.0	3854027.6
302.92	382079956.0	3553545.5
665.48	378882552.0	6832068.8
1089.80	376556176.0	7214749.9
2447.57	372935144.0	4068622.3
1299.14	359485476.0	3662576.7

1401.60	354669088.0	10439546.8
1281.00	343023032.0	3491607.9
806.17	304771604.0	4598810.1
1212.95	297347604.0	3060365.4
2118.46	276807212.0	3103946.8
795.95	257755720.0	2593162.7
1661.31	255461458.0	2883451.8
1324.89	236470832.0	2628796.8
814.07	203640646.0	4226548.8
1385.28	184158120.0	2080059.4
1583.24	169833174.0	1980378.5
1005.20	149548040.0	1674507.7
1457.59	111043627.0	1438299.8
1538.57	102966758.0	3221626.8
1207.66	98695821.0	1247915.5
840.19	95519059.0	12966894.4
1543.41	75275787.0	3208256.5
2293.23	72846044.0	1203516.6
1693.24	60786449.0	1212139.2
2733.90	59838967.5	1134918.7
1873.15	47465214.5	850773.1
1683.97	46945092.0	860215.6
1936.27	38940968.5	825909.5
1896.26	35288425.0	789271.5
2109.69	17565045.5	541151.8
2052.80	16192765.8	499847.7
1890.13	12074878.6	407732.0
2010.80	11294654.6	420905.1
2039.57	9027754.0	393182.7
2694.44	6761830.0	351825.9
2222.88	6569518.8	348407.7
2769.66	6146349.9	338831.1
2331.25	4667734.3	287368.4
3053.77	4326105.5	298541.1
2266.20	3317251.6	225673.5
2978.37	3201941.3	264370.9
2312.57	2361401.0	214558.8
2614.70	2335181.5	217555.6
2880.08	2080358.9	277931.0
2999.83	1672983.5	178751.9
2922.33	1579538.5	309209.7
2922.70	937391.0	326528.3
2505.80	829625.0	163859.6
2877.22	677181.6	317243.1
2919.50	534499.5	336575.0

7 Z-6-A VALUES READ IN

-25. 54.
 -30. 65.
 -39. 88.
 -55. 137.
 -56. 133.
 -63. 152.
 -88. 226.

TRY 54- HN T(1/2)= 313.7 DAY, PARENT T(1/2)= 0.0 SEC
 TABLE-Z B-RATIO EXPT-E YIELD NO. ATOMS
 834.81 1.0000 835.88 7.1423E+09 4.3218E+12 3.9037E+10
 SOURCE STRENGTH= 1.105E+05 (2.988E+00 MICROCI) AT 700 ON DEC 1, 1980

TRY 60- CO T(1/2)= 5.260E+00 YR , PARENT T(1/2)= 0.000E-01 SEC
 TABLE-Z B-RATIO EXPT-E YIELD NO. ATOMS
 1332.51 1.0000 1332.50 1.7604E+09 6.4924E+12 5.9461E+10
 1173.23 0.9988 1173.22 1.8374E+09 6.7762E+12 6.1807E+10
 SOURCE STRENGTH= 2.770E+04 (7.487E-01 MICROCI) AT 700 ON DEC 1, 1980

TRY 65- ZH T(1/2)= 244.1 DAY, PARENT T(1/2)= 0.0 SEC
 TABLE-Z B-RATIO EXPT-E YIELD NO. ATOMS
 1115.45 0.5075 RESEARCH 5.8989E+09 2.7826E+12 2.5447E+10 CHANNEL= 1429.8
 511.00 0.0282 510.96 2.1517E+10 1.0150E+13 9.4768E+10
 SOURCE STRENGTH= 3.336E+05 (9.016E+00 MICROCI) AT 700 ON DEC 1, 1980

TRY 88- Y T(1/2)= 107.1 DAY, PARENT T(1/2)= 0.0 SEC
 TABLE-Z B-RATIO EXPT-E YIELD NO. ATOMS
 1836.13 0.9937 1836.00 1.1163E+10 2.3323E+12 2.0874E+10
 898.04 0.9340 898.04 1.1272E+10 2.3552E+12 2.1023E+10
 SOURCE STRENGTH= 1.756E+05 (4.746E+00 MICROCI) AT 700 ON DEC 1, 1980

TRY 137- CS T(1/2)= 3.001E+01 YR , PARENT T(1/2)= 0.000E-01 SEC
 TABLE-Z B-RATIO EXPT-E YIELD NO. ATOMS
 661.64 0.8600 661.66 2.5773E+09 5.4182E+13 4.9809E+11
 SOURCE STRENGTH= 3.966E+04 (1.072E+00 MICROCI) AT 700 ON DEC 1, 1980

TRY 133- BA T(1/2)= 1.050E+01 YR , PARENT T(1/2)= 0.000E-01 SEC
 TABLE-Z B-RATIO EXPT-E YIELD NO. ATOMS
 80.99 0.3540 80.82 1.7133E+09 1.2608E+13 1.8737E+11
 160.60 0.0071 RESEARCH 2.3378E+10 1.7204E+14 4.3831E+12 CHANNEL= 137.5
 223.11 0.0048 RESEARCH 3.4445E+09 2.5348E+13 5.7514E+12 CHANNEL= 222.1
 276.40 0.0730 RESEARCH 3.3347E+09 2.4541E+13 4.6556E+11 CHANNEL= 294.2
 302.85 0.1840 302.52 2.0765E+09 1.5281E+13 1.4212E+11
 356.01 0.6190 356.14 1.7302E+09 1.2733E+13 1.3009E+11
 383.85 0.0891 RESEARCH 2.0157E+09 1.4833E+13 3.4787E+11 CHANNEL= 439.7
 53.16 0.0223 NOT FOUND
 SOURCE STRENGTH= 2.740E+04 (7.405E-01 MICROCI) AT 700 ON DEC 1, 1980

TRY 152- EY T(1/2)= 1.360E+01 YR , PARENT T(1/2)= 0.000E-01 SEC
 TABLE-E R-RATIO EXPT-E YIELD NO. ATOMS
 121.78 0.2820 121.81 2.2829E+10 2.1750E+14 1.9411E+12
 344.27 0.2640 344.29 2.2465E+10 2.1404E+14 1.9088E+12
 1407.92 0.2070 1407.99 2.5229E+10 2.4038E+14 2.1666E+12
 964.00 0.1448 964.05 2.3104E+10 2.2012E+14 1.9814E+12
 1112.05 0.1355 1112.05 2.2479E+10 2.1417E+14 1.9330E+12
 244.70 0.0742 244.73 2.3400E+10 2.2295E+14 2.0464E+12
 778.90 0.1300 778.91 2.2150E+10 2.1103E+14 1.8987E+12
 1086.40 0.1184 1086.83 1.9079E+10 1.8177E+14 1.6712E+12
 867.40 0.0416 867.38 2.2859E+10 2.1779E+14 2.0095E+12
 444.00 0.0308 443.99 2.2376E+10 2.1319E+14 1.9539E+12
 SOURCE STRENGTH= 3.502E+05 (9.464E+00 MICROCI) AT 700 ON DEC 1, 1980

TRY 226- RA T(1/2)= 1.602E+03 YR , PARENT T(1/2)= 0.000E-01 SEC
 TABLE-E R-RATIO EXPT-E YIELD NO. ATOMS
 609.31 0.4750 609.32 2.2984E+10 2.5792E+16 2.2996E+14
 351.90 0.3920 350.69 4.5214E+09 5.0739E+15 4.7460E+13
 295.17 0.2070 295.26 2.2106E+10 2.4807E+16 2.2133E+14
 1764.51 0.1650 1764.47 2.2355E+10 2.5087E+16 2.2715E+14
 1120.28 0.1510 1120.30 2.3380E+10 2.6237E+16 2.3632E+14
 241.91 0.0832 242.03 2.1111E+10 2.3691E+16 2.1717E+14
 1238.11 0.0636 1238.14 2.1770E+10 2.4430E+16 2.2491E+14
 2204.12 0.0515 2204.00 2.2732E+10 2.5510E+16 2.4276E+14
 768.36 0.0514 768.38 2.3202E+10 2.6037E+16 2.3830E+14
 1377.65 0.0428 1377.67 2.2118E+10 2.4821E+16 2.3278E+14
 186.02 0.0400 186.23 2.1008E+10 2.3575E+16 2.1236E+14
 934.05 0.0325 934.09 2.2476E+10 2.5223E+16 2.3665E+14
 1729.60 0.0306 1729.60 2.2160E+10 2.4868E+16 2.4250E+14
 1407.98 0.0251 1407.99 2.0807E+11 2.3349E+17 2.1046E+15
 1509.19 0.0233 1509.20 2.1548E+10 2.4181E+16 2.3846E+14
 1847.44 0.0210 1847.42 2.2646E+10 2.5413E+16 2.5814E+14
 SOURCE STRENGTH= 3.465E+05 (9.366E+00 MICROCI) AT 700 ON DEC 1, 1980

SEE ALSO 152-EU

1 NO IDENT CN FOLLOWING GAMMAS

93	3053.77	4326105.50	
92	2999.83	1672983.53	
91	2978.37	3201941.34	
90	2922.70	937391.03	
89	2922.33	1579538.55	
88	2919.50	534499.54	
87	2880.08	2090359.88	
86	2877.22	677181.55	
85	2769.66	6146349.94	
84	2733.90	59838967.50	
83	2694.44	6761830.00	
82	2614.70	2335181.53	
81	2505.80	829625.05	
80	2447.57	372985144.00	
79	2331.25	4667734.31	
78	2312.57	2361401.03	
77	2293.23	72846044.00	
76	2266.20	3317251.56	
75	2222.88	6569518.75	POSSIBLE S.E. PEAK EG= 2733.90
73	2118.46	276807212.00	
72	2109.69	17565045.50	
71	2089.57	9027754.00	
70	2052.80	16192765.80	
69	2010.80	11294654.60	
68	1936.27	38940968.50	POSSIBLE S.E. PEAK EG= 2447.57
67	1896.26	35288425.00	POSSIBLE D.E. PEAK EG= 2919.50
66	1890.13	12074878.60	
65	1873.15	47465214.50	
60	1693.24	60786449.00	POSSIBLE S.E. PEAK EG= 2204.00
59	1683.97	46945092.00	
58	1661.31	255461458.00	
57	1583.24	169833174.00	
56	1543.41	75275787.00	
55	1538.57	102966758.00	
53	1457.59	111043627.00	
51	1401.60	354669088.00	
50	1385.28	184158120.00	POSSIBLE S.E. PEAK EG= 1896.26
47	1324.99	236470832.00	POSSIBLE S.E. PEAK EG= 1836.00
46	1299.14	359485476.00	
45	1281.00	343023032.00	
43	1212.95	297347604.00	
42	1207.66	98695821.00	
40	1155.20	398663856.00	
37	1089.80	376556176.00	
35	1005.20	149548040.00	
30	840.19	95519059.00	
28	833.67	6498334140.00	
27	814.07	203640646.00	POSSIBLE D.E. PEAK EG= 1836.00
26	806.17	304771604.00	
25	785.95	257755720.00	
22	665.48	378882552.00	
17	411.13	493479968.00	
15	353.24	1611370770.00	
6	116.23	580481008.00	
5	87.36	904023896.00	
4	84.86	561560376.00	
2	77.10	2434071460.00	
1	74.79	2921432190.00	

PEAK IDENTIFICATION			
PEAK	ENERGY	YIELD	SOURCE(S)
74	2204.00	1170714610.00	226-RA
64	1847.42	475562112.00	226-RA
63	1836.00	11092302500.00	88-Y
62	1764.47	3688578210.00	226-RA
61	1729.60	678103984.00	226-RA
54	1509.20	502062028.00	226-RA
52	1407.99	5222479040.00	152-EU 226-RA
49	1377.67	946666016.00	226-RA
48	1332.50	1760411020.00	60-CC
44	1238.14	1384578190.00	226-RA
41	1173.22	1835152990.00	60-CC
39	1120.30	3530340670.00	226-RA
38	1112.05	3045905500.00	152-EU
36	1085.83	2258924610.00	152-EU
34	964.05	3345432960.00	152-EU
33	934.09	730475152.00	226-RA
32	898.04	10528340000.00	88-Y
31	867.38	950946928.00	152-EU
23	835.88	7142327420.00	54-MN
24	778.91	2879446530.00	152-EU
23	768.38	1192561140.00	226-RA
21	661.66	2216490140.00	137-CS
20	609.32	10917373400.00	226-RA
19	510.96	606765752.00	65-ZN
19	443.99	689172160.00	152-EU
16	356.14	1071012380.00	133-BA
14	350.69	1772385020.00	226-RA
13	344.29	5930771260.00	152-EU
12	302.92	382079956.00	133-BA
11	295.26	4575883460.00	226-RA
10	244.73	1736285980.00	152-EU
9	242.03	1756433890.00	226-RA
3	186.23	840309944.00	226-RA
7	121.81	6437710210.00	152-EU
3	80.82	606496728.00	133-BA

LISTING OF THE OUTPUT ON UNIT 31

This is a compact listing of gamma-ray information deduced during analysis. The first set of gamma-ray data (E_{γ} [keV], I_{γ} , ΔI_{γ}) corresponds to peaks found during the analysis of the spectrum before comparisons with data in the isotope data file. Following these gamma-ray data are those peak yields ascertained for gamma-rays searched for in the RECALC subroutine corresponding to E_{γ} in the list of "forced" radionuclides not located during the first pass through the spectrum. These latter gamma-ray data are designated by "- E_{γ} ".

201432.0 SEC = T-COOL		
65000. SEC = T-COUNT		
1836.00	11092302500.0	99276609.0
609.32	10917373400.0	97337768.0
898.04	10528340000.0	93978248.0
835.88	7142327420.0	64512634.0
833.67	6498334140.0	58906720.5
121.81	6437710210.0	57453221.0
344.29	5930771260.0	52890628.0
1407.99	5222479040.0	47072353.5
295.26	4575883460.0	40826223.5
1764.47	3688578210.0	33398960.3
1120.30	3530340670.0	31798898.0
964.05	3345432960.0	30112488.5
1112.05	3045905500.0	27491055.0
74.79	2921432190.0	27236587.5
778.91	2879446530.0	25906454.0
77.10	2434071460.0	22968773.5
1085.83	2258924610.0	20768022.3
661.66	2216490140.0	20376166.5
1173.22	1835152990.0	16738652.5
350.69	1772385020.0	16578384.8
1332.50	1760411020.0	16122717.3
242.93	1756433890.0	16101385.4
244.73	1736285980.0	15937251.1
353.24	1611370770.0	15249231.3
1238.14	1384578190.0	12746725.9
768.38	1192561140.0	10914843.5
2204.00	1170714610.0	11140990.9
356.14	1071012380.0	10942483.5
867.38	950946928.0	8774203.6
1377.67	946666016.0	8878261.3
87.36	904023896.0	8906086.3
186.23	840309944.0	7569299.5
934.09	730475152.0	6853598.1
443.99	689172160.0	6316438.4
1729.60	678103984.0	6612388.3
510.96	606765752.0	5665469.0
80.82	606496728.0	9013105.9
116.23	580481008.0	7724120.7
84.86	561560376.0	6463386.8
1509.20	502062028.0	4951030.6
411.13	493479968.0	4557400.1
1847.42	475562112.0	4830604.1
1155.20	388663856.0	3854027.6
302.92	382079956.0	3553545.5
665.48	378882552.0	6832068.8
1089.80	376556176.0	7214749.9
2447.57	372985144.0	4068622.3
1299.14	359485476.0	3662576.7
1401.60	354669088.0	10439546.8
1281.00	343023032.0	3491607.9
806.17	304771604.0	4598810.1
1212.95	297347604.0	3060365.4

2118.46	276807212.0	3103946.8
785.95	257755720.0	2593162.7
1661.31	255461458.0	2883451.8
1324.89	236470832.0	2628796.8
814.07	203640646.0	4226548.8
1385.28	184158120.0	2080059.4
1583.24	169833174.0	1980378.5
1005.20	149548040.0	1674507.7
1457.59	111043627.0	1438299.8
1538.57	102966758.0	3221626.8
1207.66	98695821.0	1247915.5
840.19	95519059.0	12966894.4
1543.41	75275787.0	3208256.5
2293.23	72846044.0	1203516.6
1693.24	60786449.0	1212139.2
2733.90	59838967.5	1134918.7
1873.15	47465214.5	850773.1
1683.97	46945092.0	860215.6
1936.27	38940968.5	825909.5
1896.26	35288425.0	789271.5
2109.69	17565045.5	541151.8
2052.80	16192765.8	499847.7
1890.13	12074878.6	407732.0
2010.80	11294654.6	420905.1
2089.57	9027754.0	393182.7
2694.44	6761830.0	351825.9
2222.88	6569518.8	348407.7
2769.66	6146349.9	338831.1
2331.25	4667734.3	287368.4
3053.77	4326105.5	298541.1
2266.20	3317251.6	225673.5
2978.37	3201941.3	264370.9
2312.57	2361401.0	214558.8
2614.70	2335181.5	217555.6
2880.08	2080358.9	277931.0
2999.83	1672983.5	178751.9
2922.33	1579538.5	309209.7
2922.70	937391.0	326528.3
2505.80	829625.0	163859.6
2877.22	677181.6	317243.1
2919.50	534499.5	336575.0
-1115.45	2993676900.0	27377887.5
-160.60	165985434.0	4228801.8
-223.11	16533529.5	3751328.2
-276.40	243436056.0	4618148.7
-383.85	179594780.0	4211784.8
0.0		

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