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EUROPEAN ATOMIC ENERGY COMMUNITY — EURATOM

DATA REDUCTION PROGRAMS FOR TOTAL CROSS SECTION EXPERIMENTS

by

G. NASTRI and H. SCHMID

1970

Joint Nuclear Research Center
Geel Establishment — Belgium

Central Bureau for Nuclear Measurements — CBNM

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Dead time and background corrections are performed and the statistical fluctuations of the experimental spectrum for the open beam are eliminated.

The reduced data can be plotted.

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ABSTRACT

The present set of data reduction programs (FORTRAN IV, IBM 1800 computer) calculates the transmission and the total neutron cross section for time-of-flight measurements.

Dead time and background corrections are performed and the statistical fluctuations of the experimental spectrum for the open beam are eliminated.

The reduced data can be plotted.

KEYWORDS

DATA PROCESSING
COMPUTERS
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CROSS SECTIONS
NUMERICALS
TRANSMISSION
TIME-OF-FLIGHT METHOD
MEASUREMENT
BEAM OPTICS

CONTENTS

DATA REDUCTION PROGRAMS FOR TOTAL CROSS SECTION EXPERIMENTS*)

Introduction

The set of 5 data reduction programs (FORTRAN IV - IBM 1800) described here performs the calculation of the transmission and of the total neutron cross section starting from the measured sample-in and sample-out time-of-flight spectra.
In this report the spectrum with the sample in the neutron beam is called IN spectrum whereas the spectrum with no sample in the neutron beam is called OUT spectrum.
The background is measured separately and introduced in the program as an analytical expression (cf. formula (4. 1)).
The 5 programs can deal with spectra containing up to 4096 channels using an IBM 1800 computer of 32 K core storage locations.
The operations performed by each program are described as follows:

- Progr. CHROD: dead time correction of the IN and OUT spectra.
- Progr. KOLAR: smoothing the dead time corrected OUT spectrum by the least squares method.
- Progr. CAOM: plotting the unsmoothed and smoothed OUT spectra.
- Progr. SITRA: evaluation of the transmission and total cross section.
- Progr. REPLO: plotting transmission and cross section.

1. Dead Time Correction (Progr. CHROD)

CHROD can be used with spectra divided into "sections" of different channel width W ("accordeon system"). The dead time corrected spectrum is

$$C_j = S_j \frac{X}{X - \sum_{i=j-NDT}^{j-1} S_i} + R \qquad (1.1)$$

where j and i are channel indices, S is the spectrum to be corrected, X the number of times all channels are cycled through (number of bursts) and R a rounding term (in general R = 0. 5).
The sum appearing in formula (1. 1) is performed over NDT channels preceding the j^{th} channel depending on the dead time

$$DT = W \cdot NDT \qquad (1.2)$$

When the range of channels covered by the dead time happens to contain the boundary between two sections of different W, the sum $\sum_{i=j-NDT}^{j-1} S_i$ of eq. (1. 1) is split in two terms giving the contribution from each of the two sections (see 10).

The statistical error of the spectrum not corrected for dead time is

$$\Delta S_i = \sqrt{S_i} \qquad (1.3)$$

Therefore the error of the dead time corrected spectrum is

$$\Delta C_j = \sqrt{S_j \left(\frac{\partial C_j}{\partial S_j}\right)^2 + \sum_{i=j-NDT}^{j-1} S_i \left(\frac{\partial C_j}{\partial S_i}\right)^2} \qquad (1.4)$$

according to the law of error propagation.

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*) Manuscript received on 18 November 1969.

This leads to the formula

$$\Delta C_j = \frac{X \cdot \left(S_j + \left(S_j/\left(X - \sum_{i=j-NDT}^{j-1} S_i\right)\right) \cdot \sum_{i=j-NDT}^{j-1} S_i \right)^{1/2}}{X - \sum_{i=j-NDT}^{j-1} S_i} \qquad (1.5)$$

The sum $\sum_{i=j-NDT}^{j-1} S_i$ is split at the boundary between two sections of different W as for eq. (1.1).
The execution of CHROD is necessary for writing the disk files to be read afterwards, even if no dead time correction is required.

2. Smoothing the OUT Spectrum (Progr. KOLAR)

This operation is performed on the dead time corrected OUT spectrum.
The fitting function included in KOLAR is a linear combination of Legendre polynomials up to the 9^{th} degree

$$C^{OUT} = \sum_{n=0}^{9} p_n \, y_n \qquad (2.1)$$

with

$$y_0 = 1 \; ; \qquad y_1 = x \; ; \qquad y_n = \frac{(2n-1)xy_{n-1} - (n-1)y_{n-2}}{n}$$

and

$$x = -1 + \frac{2(i - i_{min})}{i_{max} - i_{min}}$$

In the last expression i is the channel index corresponding to x and i_{max}, i_{min} are the boundary channels of the section or pseudosection (see below) dealt with.
The smoothing is performed by means of the least squares method [1].
The error of the smoothed spectrum C^{OUT} calculated channel by channel is

$$\Delta C^{OUT} = \sqrt{\sum_{l=0}^{9} \left(\frac{\partial C^{OUT}}{\partial p_l} \Delta p_l \right)^2 + 2 \sum_{l=0}^{9} \sum_{m=l+1}^{9} A_{l,m} \frac{\partial C^{OUT}}{\partial p_l} \cdot \frac{\partial C^{OUT}}{\partial p_m} \Delta p_l \, \Delta p_m} \qquad (2.2)$$

where $A_{l,m}$ is the correlation matrix calculated by the subroutine UENDS and $\Delta p_l, \Delta p_m$ are the errors of the parameters p_l and p_m.
In order to improve the fit, sometimes it is convenient to divide an accordeon section in "pseudosections" (see 11). The user must only introduce in the input data the pseudosections as real sections and define the initial delay, the channel width and all the other parameters as required for sections.
It is also possible to exclude groups of channels from the "zones of interest" i. e. from the set of channels used in the fit (see 11). This is accomplished by specifying an even number KNUM and KNUM boundary values called KCHAN(I) in the input data. Channels falling between the boundaries KCHAN(I), KCHAN (I+1) with I odd will be taken into account for the fit.
The user can drop channels at the edge of sections and pseudosections as well as in the middle (see 11).

The subroutine ENDN will broaden the section or pseudosection - if necessary on both sides - to reach the closest multiples of 128: the values of the fitting function will be extrapolated.
In this way complete records of 128 channels can be written on disk.

3. Plotting the OUT Spectrum (Progr. CAOM) (°)

The plot will show the dead time corrected OUT spectrum and the smoothed one overlaid. The execution of CAOM is optional.

4. Transmission and Cross Section (Progr. SITRA)

SITRA evaluates for each channel i the background B^{IN} for the sample IN run according to the formula

$$B_i^{IN} = s\, e^{ik} + B_0 \qquad (4.1)$$

and its error

$$\Delta B_i^{IN} = \sqrt{e^{2ik}(\Delta s^2 + i^2 s^2 \Delta k^2 + 2is\Delta s\Delta k\, C_{sk}) + \Delta B_0^2} \qquad (4.2)$$

where Δs, Δk, ΔB_0 are respectively the standard deviations of s, k, B_0 and where C_{sk} is the correlation coefficient between s and k.
The energy for the i^{th} channel of each accordeon section is calculated in the following way

$$E_i = \left(\frac{72.3 \cdot DIST}{DELAY + W.i}\right)^2 , \qquad (4.3)$$

where DELAY and W (initial delay and channel width) are the values for the accordeon section considered and DIST is the length of the neutron flight-path.

The transmission for the channel i is

$$T_i = \frac{k_1 (C_i^{IN} - k_2 B_i^{IN})}{C_i^{OUT} - k_3 B_i^{IN}} \qquad (4.4)$$

where the spectrum C^{IN} is dead time corrected and C^{OUT} is dead time corrected and smoothed. The normalization factors are defined as follows:

$$k_1 = \frac{LM^{OUT}}{LM^{IN}} ,$$

where LM indicates the preset local monitor count;

$$k_2 = 1 ; \qquad k_3 = \frac{B^{OUT}}{B^{IN}}$$

where B indicates the background spectrum.

(°) For what concerns the plot subroutines see [5]

The error in the transmission is

$$\Delta T_i = \left(\frac{(k_1 \Delta C_i^{IN})^2 + (T_i \Delta C_i^{OUT})^2}{(C_i^{OUT} - k_3 B_i^{IN})^2} + \right.$$

$$\left. + \left[k_1 \frac{k_3(C_i^{IN} - k_2 B_i^{IN}) - k_2(C_i^{OUT} - k_3 B_i^{IN})}{(C_i^{OUT} - k_3 B_i^{IN})^2} \Delta B_i^{IN} \right]^2 \right)^{1/2} \qquad (4.5)$$

The total cross section is

$$\sigma_i = \frac{-\ln T_i}{THICK} \qquad (4.6)$$

where THICK is the thickness of the sample expressed in atoms per barn.

The error in the cross section is

$$\Delta\sigma_i = \frac{\Delta T_i}{T_i \cdot THICK} \qquad (4.7)$$

5. Plotting Transmission and Cross Section (Progr. REPLO)

The execution of REPLO, plotting both the transmission and the total cross section is optional. The data required for the plot can be supplied in SITRA or directly in REPLO (see 9).

6. Operating Procedures

The IN and OUT spectra are taken either from tape or from cards. In the first case the tape is prepared by means of the program CATAP [2] before starting the data reduction. In the second case BCD cards, punched by the program KOCO must be supplied as specified in the input of CHROD(°) (see 9.1).
The data reduction programs must be run in the order: CHROD, KOLAR, CAOM, SITRA, REPLO. However, the programs doing plots, i.e. CAOM and REPLO can be skipped without affecting the execution of the other programs in the sequence.
The results of the programs CHROD, KOLAR and SITRA are stored on disk in order to be used by the programs following in the sequence. Therefore the data reduction procedure can be interrupted after the execution of each program and later on resumed.
This way errors appearing in one of the programs can easily be corrected.

(°) See appendix 1

SITRA can punch two types of cards to be used in programs performing numerical analysis of neutron resonances:
a) cards containing the transmission (FORMAT 8F9. 7, 2I4) [3].
b) cards containing the energy, the cross section and its error (FORMAT 3E15. 4, 25X, I10) [4].
The blank cards to be punched must be supplied at the end of the input for SITRA.
If both types of cards are required SITRA must be run two times.

7. Time Requirements

A complete reduction of a spectrum of 4096 channels without plots and punched cards takes 115 minutes on the IBM 1800 computer. It takes 45 minutes to punch 4096 cards.
Anyway the times used by CHROD (10'), KOLAR (60') and SITRA (45' without punched cards) are printed at the end of the corresponding output (approximative times).

8. Use of Disk Files

CHROD

Operat.	Disk File		Index(°)	Contents	Subrout.
write	1	IRMA	IA	Dead time corrected IN spectr.	OCTAL
"	2	GRACE	IB	Dead time corrected OUT spectr.	"
"	4	TIBER	I4	Dead time corrected IN error	"
"	5	PADUS	IE	Dead time corrected OUT error	"

KOLAR

read	2	GRACE	IB	Dead time correct. OUT spectr.	INPUT
"	5	PADUS	IE	Dead time correct. OUT error	"
write	3	ARNUS	IC	Smoothed OUT spectrum	ENDN
"	9	ERROR	I9	Smoothed OUT error	"
"	6	AGATA	IF	Miscellaneous data to be read by CAOM	UENDS

CAOM

read	6	AGATA	IF	Miscellaneous data from KOLAR	Main progr.
"	2	GRACE	IB	Dead time corrected OUT spectr.	"
"	3	ARNUS	IC	Smoothed OUT spectrum	"

(°) This index specifies the record number in the disk read/write statements.

SITRA

Operat.	Disk File		Index	Contents	Subrout.
read	3	ARNUS	IC	Smoothed OUT spectr.	Main progr.
"	9	ERROR	IE	Smoothed OUT error	"
"	1	IRMA	IA	Dead time corrected IN spectr.	"
"	4	TIBER	ID	Dead time corrected IN error	"
w. &r.	7	CLAES	IW	Transmission	"
"	10	CROS	IV	Cross section	"
"	11	DELES	IZ	Error in the cross section	"
write	8	PINCO	IG	Miscellaneous data	"

REPLO

read	8	PINCO	IG	Miscellaneous data	Main progr.
"	7	CLAES	IV	Transmission	"
"	10	CROS	IA	Cross section	"

9. Input Data

9.1. Program CHROD

1st card — FORMAT (20A4)

Column

1 - 72 — Alphanumerical information as TITLE

74 - 76 — ANAM = IN, for IN spectrum / OUT, for OUT spectrum

2nd card — FORMAT(I1, I4, I5, I2, E8.3, 10I5)

1 — KDEAD = 1, no dead time correction / 2, dead time correction requested

2 - 5 — ID — identification of the spectrum (ID ≠ 0)

6 - 10 — NPOIN — number of channels therein (NPOIN ≤ 4096)

11 - 12 — NR — number of sections of accordeon (NR ≤ 8)

13 - 20 — X — number of bursts (format E)

21 - 25 — IT =
(1, input spectr. from tape - output spectr. on disk
(2, " " " " - no output on disk
(3, input spectr. from cards - output on disk
(4, " " " " - no output on disk

26 - 30 — IC =
(1, punch and list the corrected spectrum
(2, punch only the corrected spectrum
(3, list only the corrected spectrum
(4, neither punch nor list the corrected spectrum

31 - 35)
.....) — IND(L) — the last channel of the L^{th} section of the accordeon system (L = 1, NR)
66 - 70)

3rd card	FORMAT (I1, F9.5, F10.5, 2F5.4, 8F5.0)	
1	IOROU =	1, when dealing with IN spectrum 2, when dealing with OUT spectrum
2 - 10	W	the width of the channels of the last section
11 - 20	DT	dead time (in the same unit of W)
21 - 25	ROUND	the rounding term in the formula NDT = DT/W + ROUND
26 - 30	R	the rounding term used in the expression of corrected spectrum (equation 1.1)
31 - 35) .....) 66 - 70)	YACT(L)	the ratio between the width of the channels of the L^{th} section and of the $(L-1)^{th}$ section (YACT(1) is read but not used; L = 1, NR)

The following cards must be introduced only if a magnetic tape must be read by the subroutine FLTPE (called by HROE), that is only if IT = 1, 2.

Optional card	FORMAT (I2, 1X, 2I1, I2, 4X, I4, I5)	
1 - 7	the complete identification of the spectrum (set the point in column 3)	
12 - 15	NFA = 1	
16 - 20	NTPA	the unit where the tape containing the spectrum must be mounted

If IT = 3, 4, the spectrum follows with FORMAT (6X, 8F7.0). Repeat the same scheme for IN and OUT spectra if required. Add three blank cards at the end of the whole input data.

Limitations and remarks

The dead time range cannot exceed the width of a section. In output W is the width of the channels of the first section. NPOIN must be a multiple of 128.

9.2. Program KOLAR

A. The following cards have to be entered for each accordeon section:

1st card	FORMAT (18A4, I3)	
Column		
1 - 72	TITLE	alphanumerical information
73 - 75	ITITL	not used

2nd card	FORMAT (24I3)	
1 - 3	NC	the number of cycles of least squares fit (NC = 1)
4 - 6	NV	the number of parameters to be varied (NV = 10)
7 - 9	NX = 1	

10 - 12	ID = 0	derivatives calculated by the subroutine CALCN
	1	derivatives calculated numerically
13 - 15	IW = 0	each observation has a different weight
	1	each observation has weight 1
16 - 18	IP = 0	
19 - 21	IT = 0	

3rd card — FORMAT (I3)

1 - 3	NP	the number of trial parameters to be read plus one (NP = 11)

4th card — FORMAT (8F9.4)

1 - 9) .....) 64 - 72)	P(I)	the Ith trial parameter (up to the 8th)

5th card — FORMAT (8F9.4)

1 - 9	P(9))	the last trial parameters
10 - 18	P(10))	
19 - 27	P(11)	the number of parameters read (P(11) = 10.)

6th card — FORMAT (20I5)

1 - 5	KNUM	the number of boundaries of interest zones (KNUM ≤ 12; KNUM must be an even number)
6 - 10) .....) 61 - 65)	KCHAN(I)	the Ith boundary between interest zones

N. B. See 2 for explanations.

7th card — FORMAT (72I1)

1 10	K(I)	All the values must be = 1 to show that all the parameters must be varied for the least squares fit (I = 1, 10)

Optional card — FORMAT (8E9.4) Only if ID=1)

1 - 9) .....) 64 - 72)	DP(I)	=0	the derivative with respect to the Ith parameter calculated by CALCN
		≠0	the increment of P(I) for the numerical calculation of the derivative (format E)

Insert two cards like that for entering up to 10 values of DP(I).

If data for another section of accordeon follow, insert a blank card before the new set (A); if no more sections must be treated go on with the following card (B).

B. Last input card (containing information for plotting OUT spectrum)

FORMAT (2I5, 6F10.0, 2I10)

1 - 5	KCHA1	$\neq 0$, first channel of the first section to be plotted
6 - 10	KCHA2	last channel of the last section to be plotted
11 - 20	W1	Maximum value of OUT spectrum to be plotted
21 - 30	W2	minimum value of OUT spectrum to be plotted
31 - 40	SIZX	Length of the x axis
41 - 50	SIZY	Length of the y axis
51 - 60	LOGX = 0	linear scale for x axis
	1	logarithmic scale for x axis
61 - 70	LOGY = 0	linear scale for y axis
	1	logarithmic scale for y axis

N. B. KCHA1-1 and KCHA2 must be multiple of 128.

9.3. Program CAOM

This program will be skipped if no plot of the unsmoothed and smoothed OUT spectrum is requested. The input includes only one card indicating in the columns 1-3 the tape unit for the plot in the form **I (I can be any integer in the range 0-3).

9.4. Program SITRA

SITRA requires the spectrum subdivided according to the accordeon sections determined only by the different width of the channels. No channel gaps between the different sections are allowed. Repeat the following set of input data (except the blank card required at the end) for each accordeon section. No more than 8 sections can be dealt with.

1st card FORMAT (18A4, 2I4)

Column		
1 - 72	TITLE	alphanumerical
73 - 76	ITILT	the first channel of this region
77 - 80	ITOT	the last channel of this region

N. B. ITITL-1 and ITOT must be multiple of 128.

2nd card FORMAT (3F10.0, 2E10.6, 2F10.0)

1 - 10	C1	k_1)
11 - 20	C2	k_2) with reference to the equation (4.4) of
21 - 30	C3	k_3) the transmission
31 - 40	S	s) with reference to the equation (4.1) of
41 - 50	C	k) the background (format E)
51 - 60	DS	the standard deviation of s
61 - 70	DC	the standard deviation of k

3rd card FORMAT (3F10.0, I5, 5X, 3F10.0)

1 - 10	BO	B_o as used in the background equation (4.1)
11 - 20	DBO	Standard deviation of BO
21 - 30	RHOSC	Correlation coefficient between s and k used for evaluating the error of the background (eq. 4.2)
31 - 35	KZQ	not used
41 - 50	DIST	length of flightpath in meters
51 - 60	DELAY	the delay in usec of the first channel of this

		accordeon section (channel ITITL)
61 - 70	WDH	channel width in /usec

4th card — FORMAT (F10.0)

1 - 10	THICK	thickness of the sample

5th card — FORMAT (4F10.0, 3I5)

1 - 10	SIZXT	length of energy axis for plotting the transmission
11 - 20	SIZYT	length of transmission axis
21 - 30	TMAX	upper limit of transmission
31 - 40	TMIN	lower limit of transmission
41 - 45	LOGET =	0 energy axis linear 1 energy axis logarithmical
46 - 50	LOGT =	0 transmission axis linear 1 transmission axis logarithmical
51 - 55	IPCH =	0 no punch 1 punch energy, cross section and its error 2 punch transmission (8 values per card)

6th card — FORMAT (4F10.0, 2I5)

1 - 10	SIZXS	length of energy axis for plotting the cross section
11 - 20	SIZYS	length of cross section axis
21 - 30	SMAX	upper limit of cross section
31 - 40	SMIN	lower limit of cross section
41 - 45	LOGES =	0 energy axis linear 1 energy axis logarithmical
46 - 50	LOGS =	0 cross section axis linear 1 cross section axis logarithmical

If the punch option is utilized, insert blank cards to be punched at the end of the input cards. Anyway, the last input card must be a blank card.

Remarks

The 5th and 6th data cards are required for each accordeon section. Nevertheless, only the information given for the last section will be saved on disk file 8 for possible use in REPLO. If some value of the transmission is not positive, SITRA will substitute it with the value 1. The corresponding value of the cross section will be SMAX, the maximum value foreseen for the cross section itself.

9.5. Program REPLO

REPLO is required only when the transmission and the cross sections have to be plotted.

1st card — selecting the tape for the plot

1 - 3	**I (I is any integer in the range 0-3)

A blank card concludes the input if REPLO receives data directly from SITRA through the disk file 8. (Such data are also printed in the last lines of the output of SITRA).
Instead of reading the disk file 8 REPLO can read the same data from cards.

2^{nd} card	(optional) FORMAT (16I5)		
1 - 5	KO	first channel to be plotted	
6 - 10	LM	total number of section to be plotted (LM ≤ 8)	
11 - 15	LOGET=	0 linear scale of x-axis 1 logarithmical scale of x-axis	) plot of
16 - 20	LOGT =	0 linear scale of y-axis 1 logarithmical scale of y-axis	) transmission
21 - 25	LOGES	) the same for the cross section	
26 - 30	LOGS		
31 - 35) .....) 66 - 70)	KK(L)	the last channel of the L^{th} region (L=1, LM)	

3^{rd} card	(optional) FORMAT (18A4)
1 - 72	TITLE, alphanumerical

4^{th} card	(optional) FORMAT (3A4)	
1 - 12	TITL1	alphanumerical

5^{th} card	(optional) FORMAT (3A4)	
1 - 12	TITL2	alphanumerical

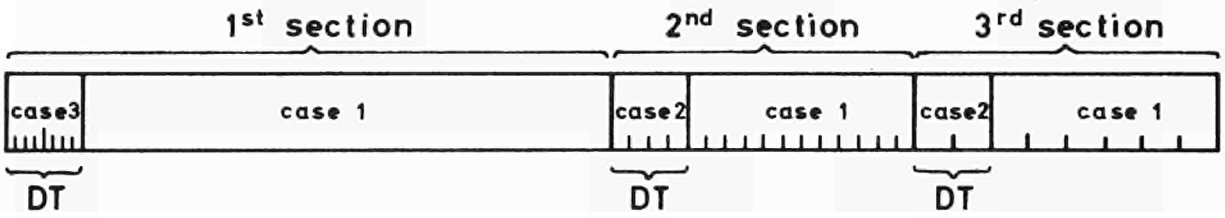
6^{th} card	(optional) FORMAT (8E10.4)	
1 - 10	SIZXT	length of x-axis) for the transmission
11 - 20	SIZYT	length of y-axis
21 - 30	SIZXS	) the same for the cross section
31 - 40	SIZYS	
41 - 50	TMAX	maximum value of the transmission
51 - 60	TMIN	minimum value of the transmission
61 - 70	SMAX	) the same for the cross section
71 - 80	SMIN	

7^{th} card	(optional) FORMAT(8E10.4)	
1 - 10	VI	the quantity $(72.3 * DIST)^2$, already calculated by SITRA
11 - 20	DELAY	the delay of the channel KO, the first to be plotted
21 - 30) .....) 71 - 80)	W(L)	channel width of the L^{th} section

N. B. If LM > 6, continue with the same FORMAT using another card.

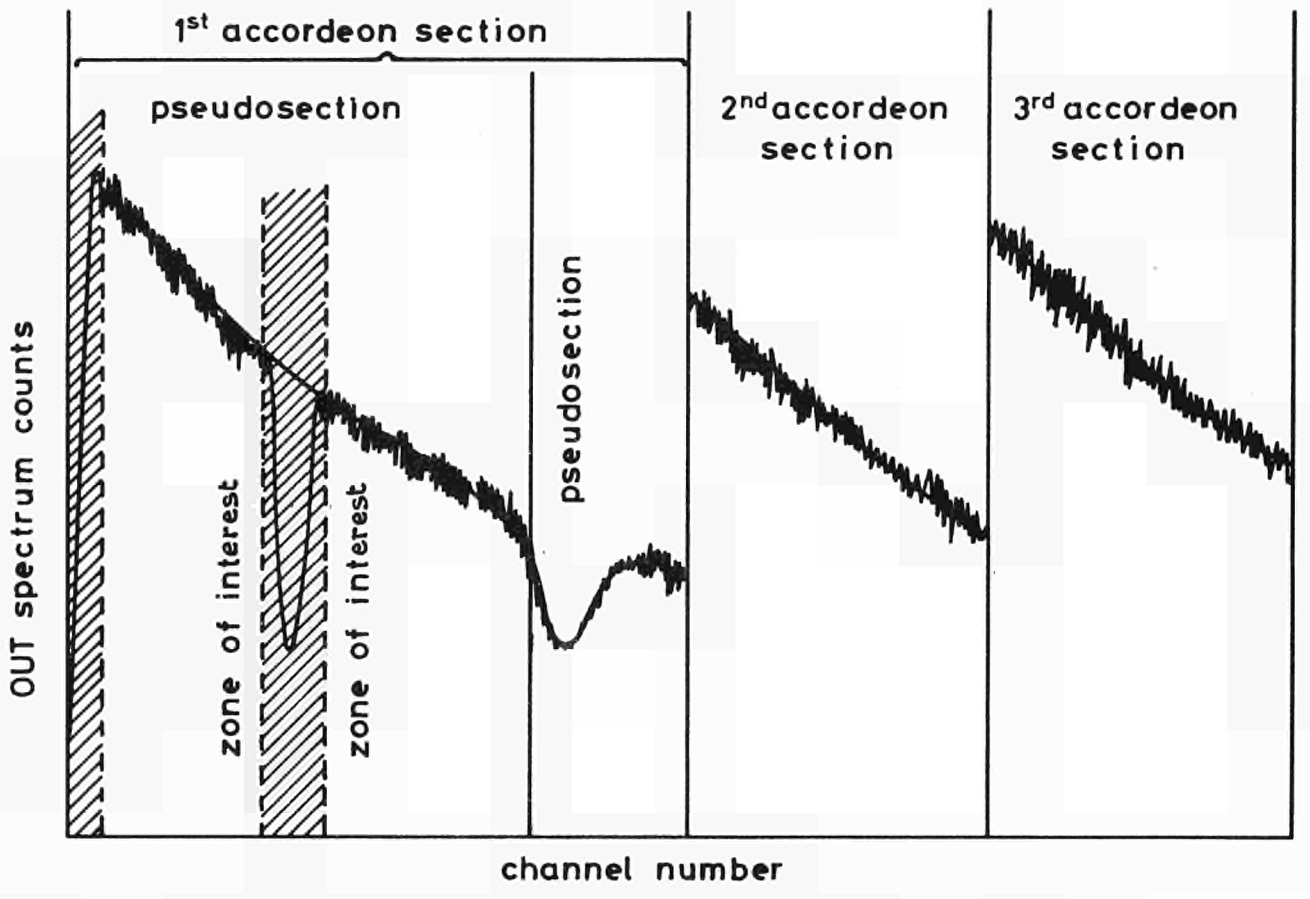
10. Scheme of Dead Time Correction (see 13)

An exemple of a spectrum with three accordeon sections is shown.



In the 3rd section the range of dead time DT covers 2 channels, in the 2nd region 4 channels and in the first region 8 channels.

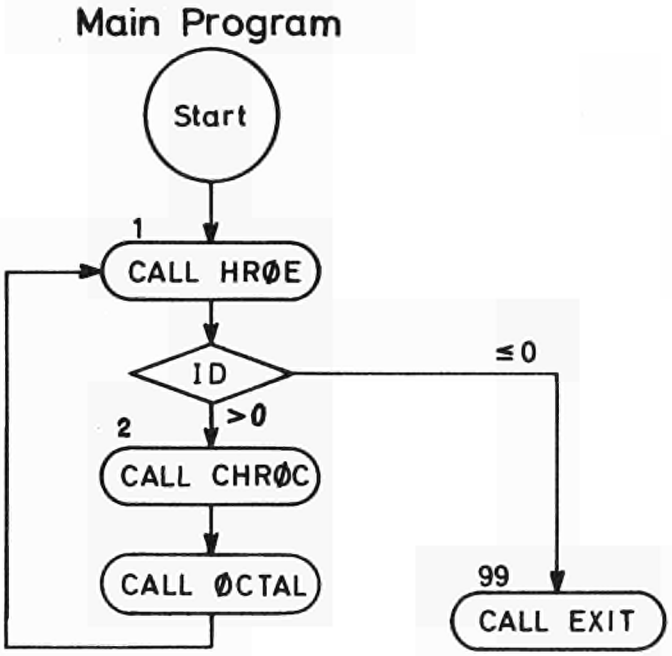
11. Scheme of Section, Pseudosections and Zones of Interest

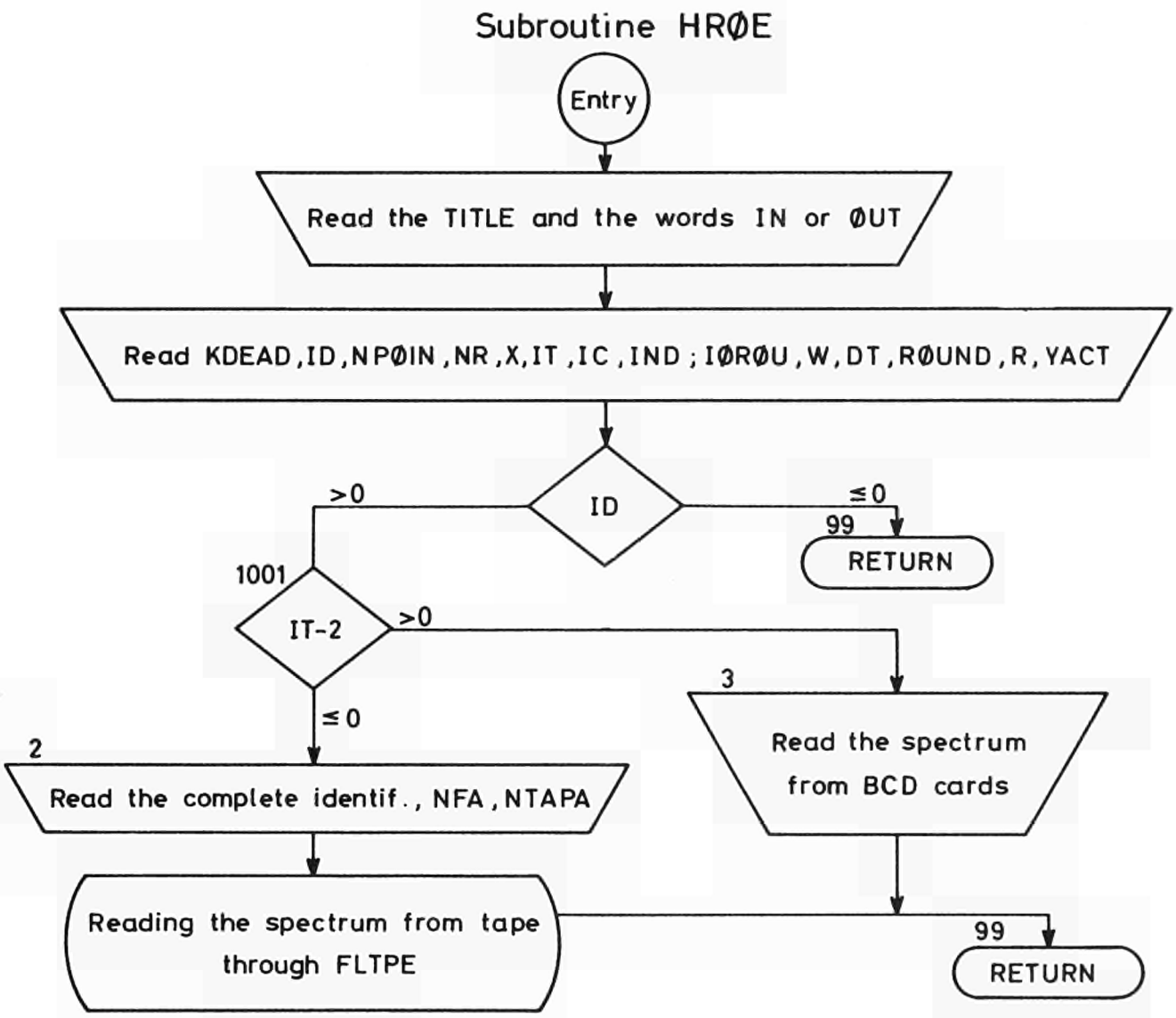


N.B. the continuous vertical lines represent multiples of 128

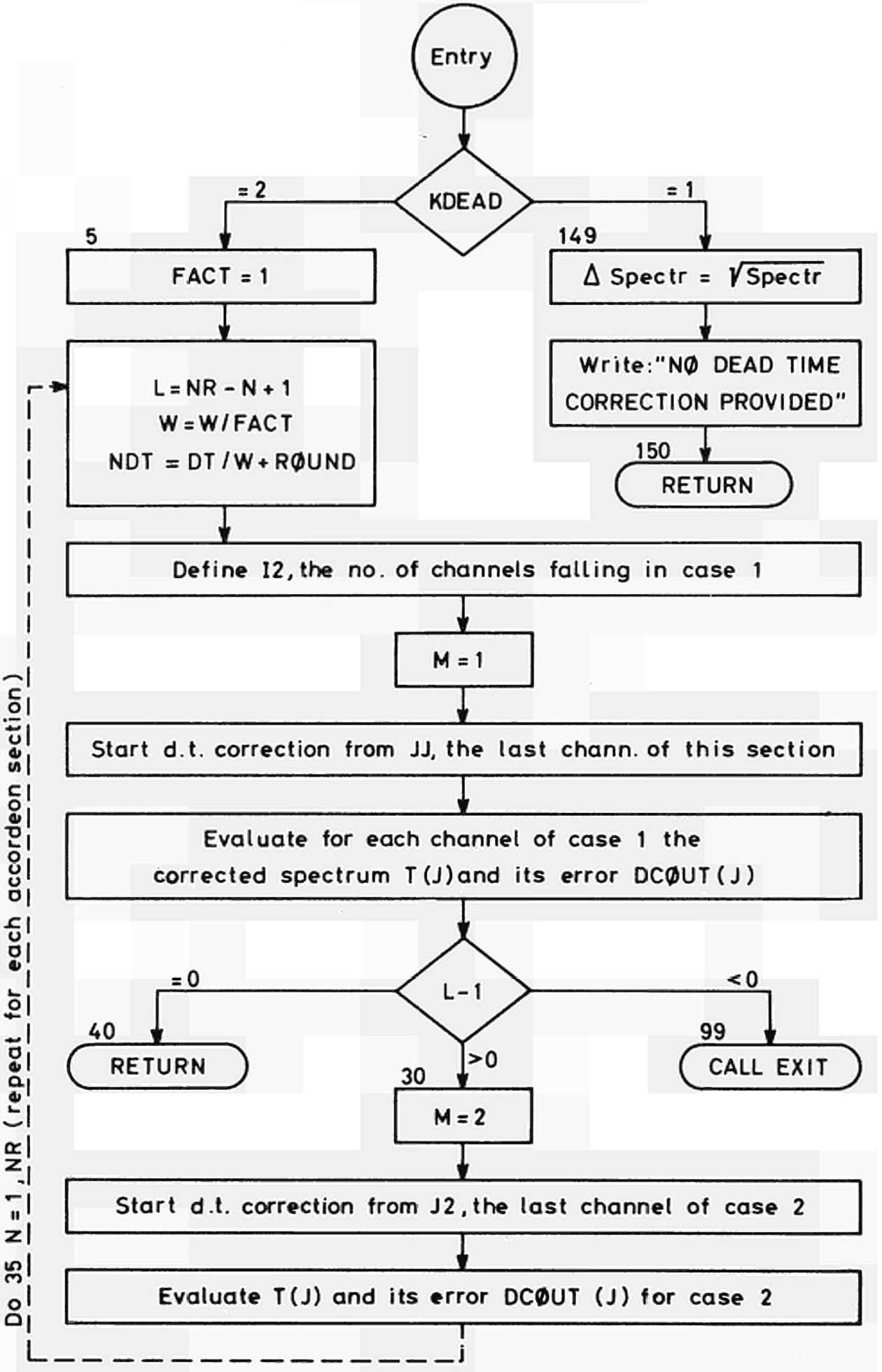
12. Block Diagrams

12.1 Program CHRØD

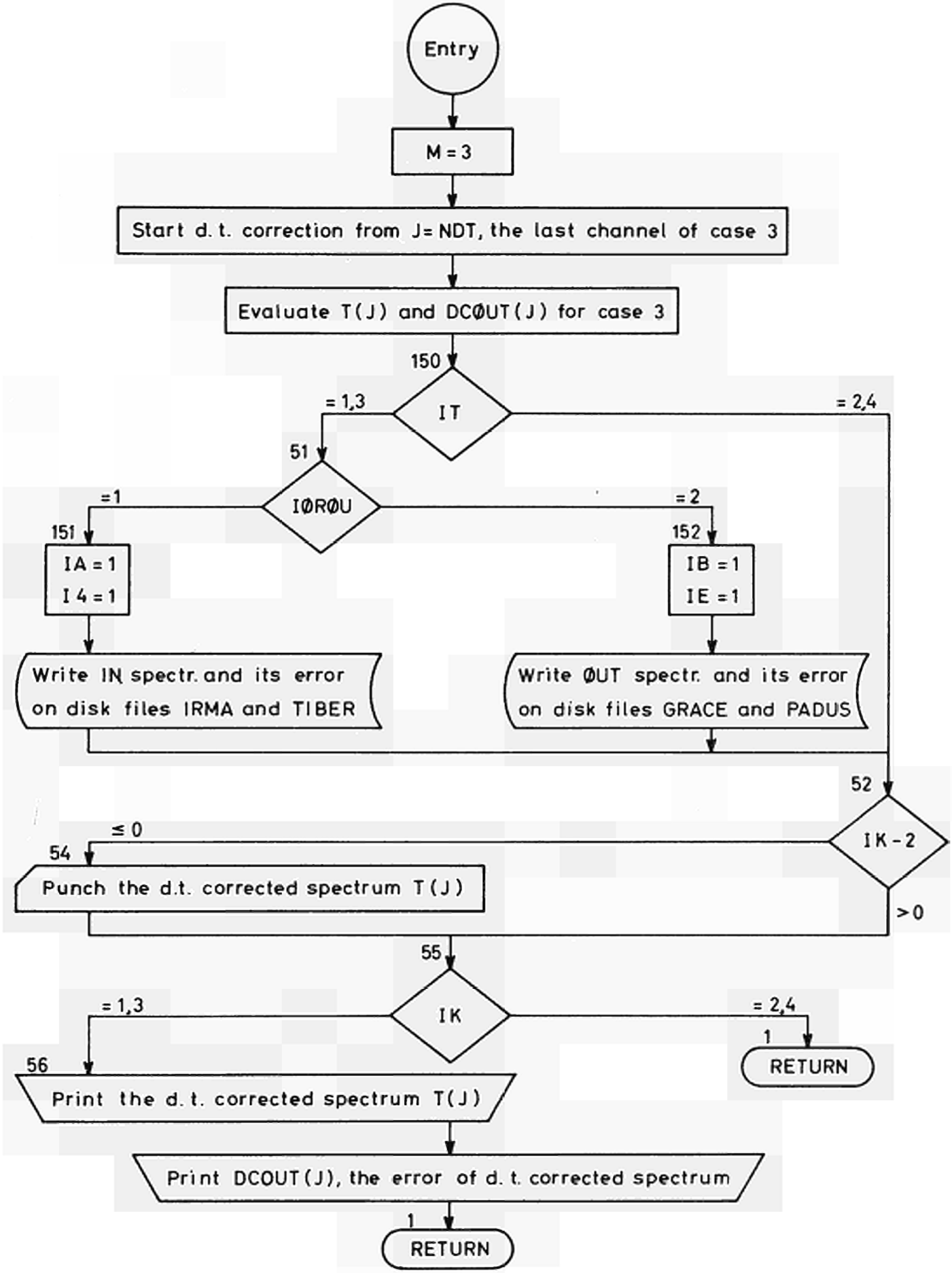




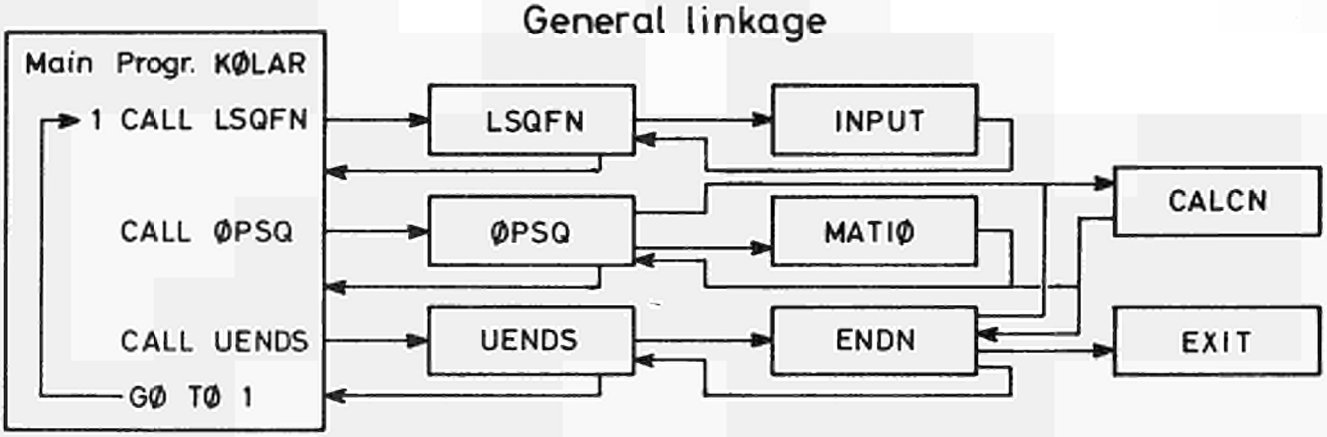
Subroutine CHRØC



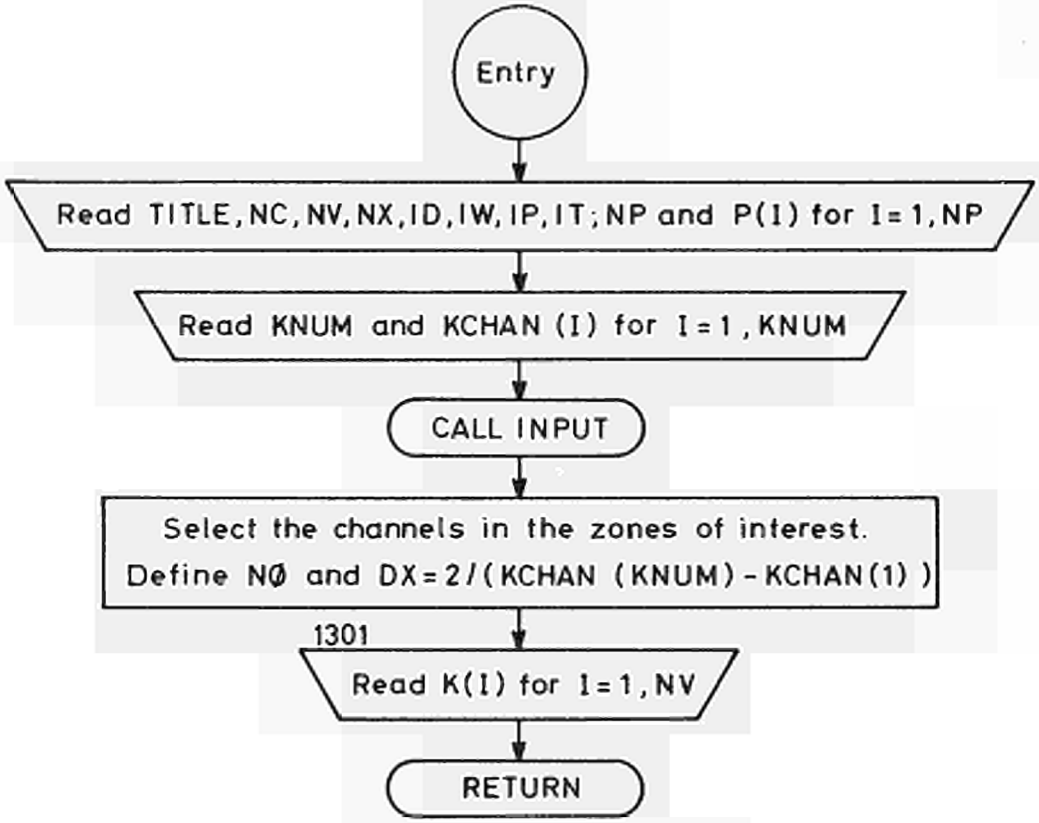
Subroutine ØCTAL



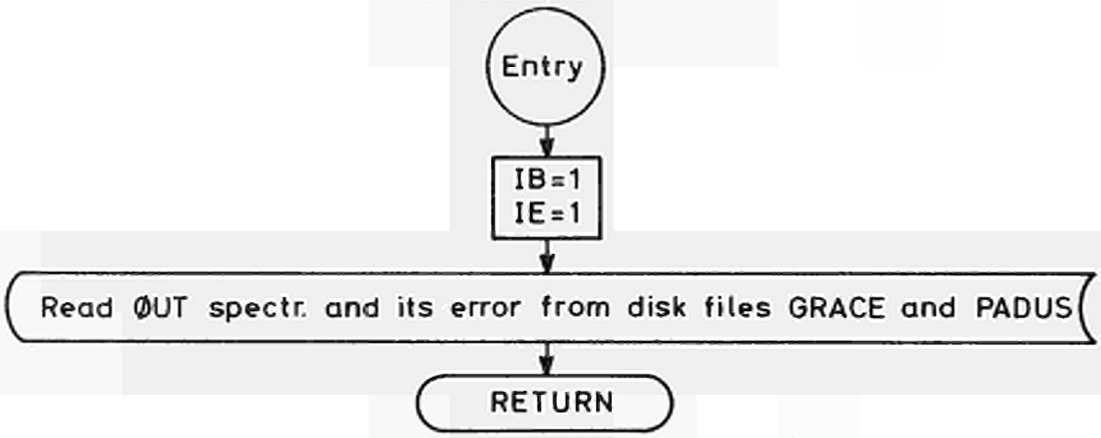
General linkage



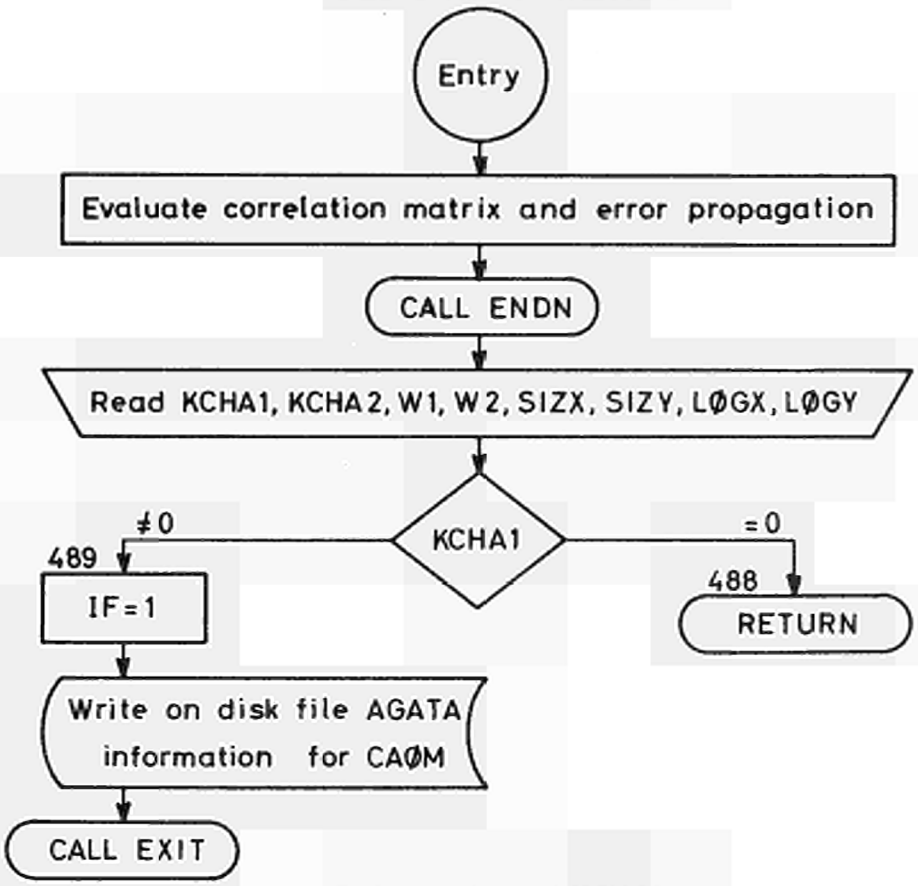
Subroutine LSQFN



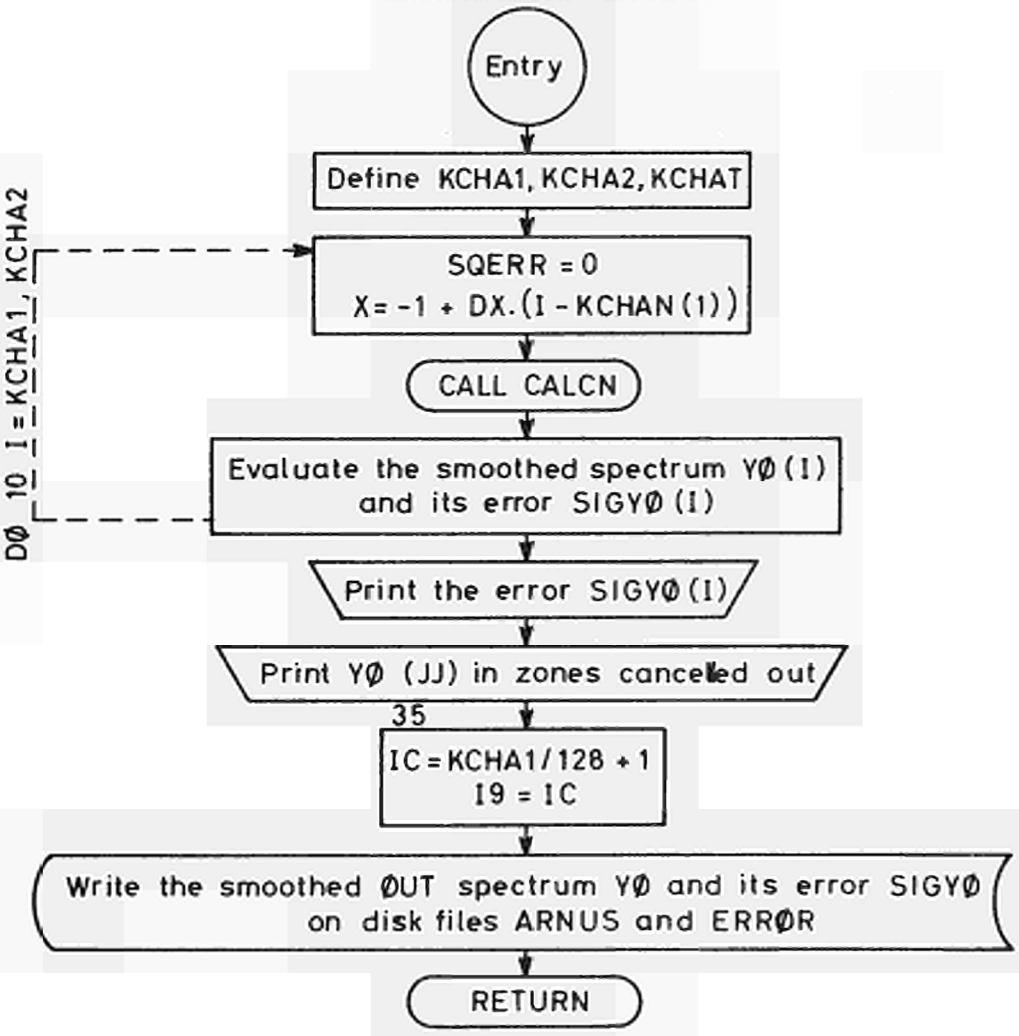
Subroutine INPUT

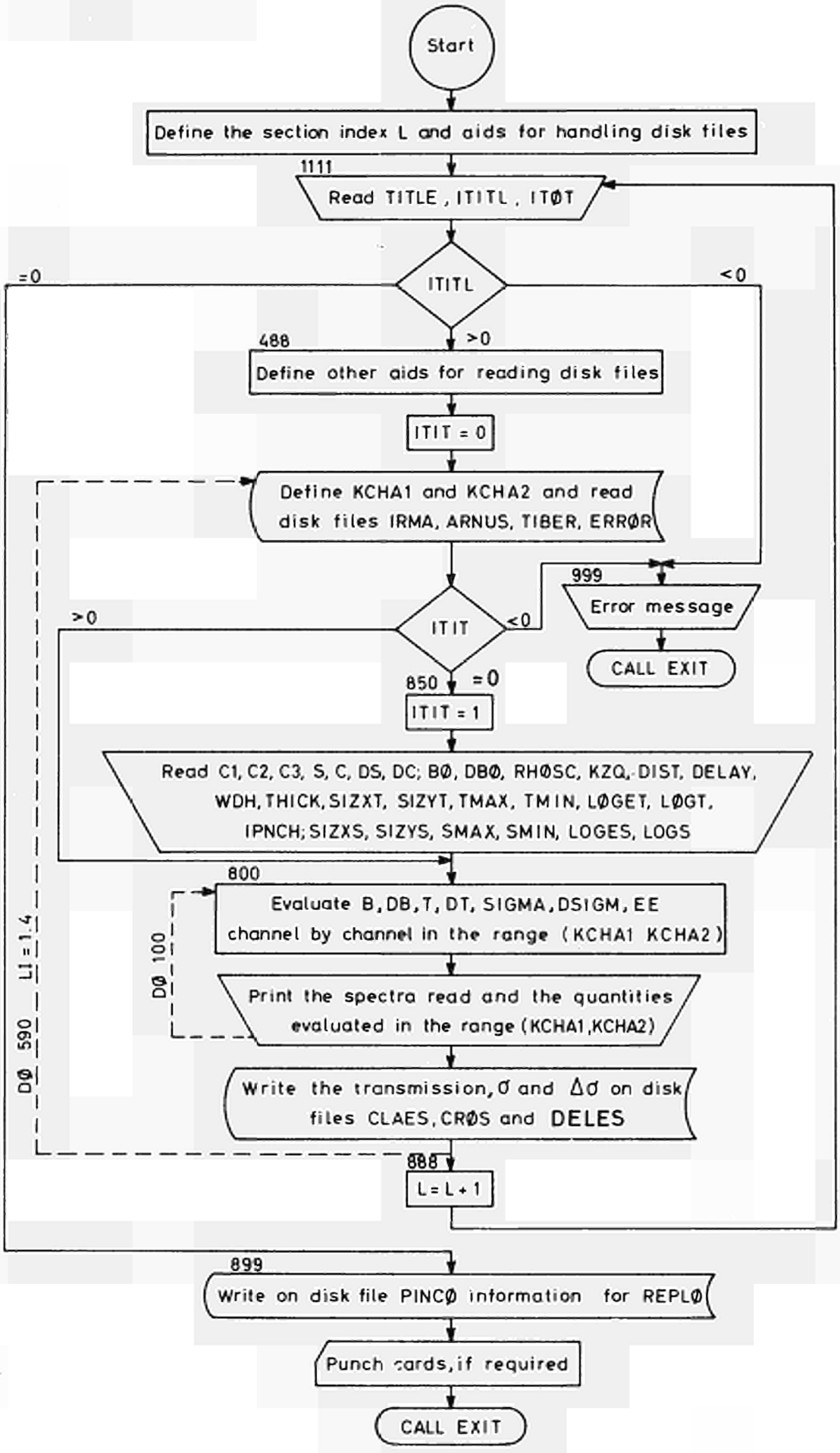


Subroutine UENDS



Subroutine ENDN




Start
Define the section index L and aids for handling disk files
1111
Read TITLE , ITITL , ITØT
ITITL
=0
<0
>0
488
Define other aids for reading disk files
ITIT = 0
Define KCHA1 and KCHA2 and read disk files IRMA, ARNUS, TIBER, ERRØR
999
Error message
CALL EXIT
ITIT
>0
<0
850
=0
ITIT = 1
Read C1, C2, C3, S, C, DS, DC; BØ, DBØ, RHØSC, KZQ, DIST, DELAY, WDH, THICK, SIZXT, SIZYT, TMAX, TMIN, LØGET, LØGT, IPNCH; SIZXS, SIZYS, SMAX, SMIN, LOGES, LOGS
800
Evaluate B, DB, T, DT, SIGMA, DSIGM, EE channel by channel in the range (KCHA1 KCHA2)
DØ 100
Print the spectra read and the quantities evaluated in the range (KCHA1, KCHA2)
Write the transmission, σ and Δσ on disk files CLAES, CRØS and DELES
DØ 590 L1 = 1.4
888
L = L + 1
899
Write on disk file PINCØ information for REPLØ
Punch cards, if required
CALL EXIT

```
// JOB    X     X     X                                                    CHROD001
// FOR CHROD                                                               CHROD002
*IOCS(CARD,1443PRINTER,DISK,MAGNETIC TAPE)                                 CHROD003
*LIST SOURCE PROGRAM                                                       CHROD004
*NON PROCESS PROGRAM                                                       CHROD005
*ONE WORD INTEGERS                                                         CHROD006
C       CHRONOS                                                            CHROD007
        DEFINE FILE 1(32,256,U,IA)                                         CHROD008
        DEFINE FILE 2(32,256,U,IB)                                         CHROD009
        DEFINE FILE 4(32,256,U,I4)                                         CHROD010
        DEFINE FILE 5(32,256,U,IE)                                         CHROD011
        COMMON KDEAD,ID,NPOIN,NR,X,IT,IC,IOROU,W,DT,ROUND,R,KPAGE,NDT      CHROD012
        COMMON IND(8),YACT(8),T(4129),TITLE(18)                            CHROD013
        COMMON DCOUT(4096),ANAM,I,J,K,L,M,I2,J2,JJ,INDEX,N,ND              CHROD014
        CALL CLOCK(IBEGT)                                                  CHROD015
      1 CALL HROE                                                          CHROD016
        IF(ID)99,99,2                                                      CHROD017
      2 CALL CHROC                                                         CHROD018
        CALL OCTAL                                                         CHROD019
        GO TO 1                                                            CHROD020
     99 CALL CLOCK(IENDT)                                                  CHROD021
        DELTT=IENDT-IBEGT                                                  CHROD022
        DELTT=DELTT*0.06                                                   CHROD023
        WRITE(6,7) DELTT                                                   CHROD024
      7 FORMAT(1HO,'THE TIME REQUESTED FOR RUNNING CHROD IN MINUTES IS',   CHROD025
       1F6.0)                                                              CHROD026
        CALL EXIT                                                          CHROD027
        END                                                                CHROD028

FEATURES SUPPORTED
 NONPROCESS
 ONE WORD INTEGERS
 IOCS

CORE REQUIREMENTS FOR CHROD
 COMMON   16544   INSKEL COMMON       0   VARIABLES      32   PROGRAM      72


 END OF COMPILATION
```

```
// FOR
*LIST SOURCE PROGRAM
*NON PROCESS PROGRAM
*ONE WORD INTEGERS
      SUBROUTINE  HROE                                                          HROE  001
      DIMENSION IDA(5)                                                          HROE  002
      DIMENSION          SCAL(24),IDSPC(16),SPECA(4129)                         HROE  003
      COMMON KDEAD,ID,NPOIN,NR,X,IT,IC,IOROU,W,DT,ROUND,R,KPAGE,NDT             HROE  004
      COMMON IND(8),YACT(8),T(4129),TITLE(18)                                   HROE  005
      COMMON DCOUT(4096),ANAM,I,J,K,L,M,I2,J2,JJ,INDEX,N,ND                     HROE  006
      EQUIVALENCE(SPECA(1),T(1))              ,(  T  (4097),SCAL(1)),           HROE  007
     1(  T  (4121),IDSPC(2))                                                    HROE  008
      KPAGE=1                                                                   HROE  009
      READ(5,111) (TITLE(I),I=1,18),ANAM                                        HROE  010
  111 FORMAT(20A4)                                                              HROE  011
      READ(5,44)KDEAD,ID,NPOIN,NR,X,IT,IC,(IND(L),L=1,NR)                       HROE  012
   44 FORMAT(I1,I4,I5,I2,E8.3,10I5)                                             HROE  013
      READ(5,444)IOROU,W,DT,ROUND,R,(YACT(L),L=1,NR)                            HROE  014
  444 FORMAT(I1,F9.5,F10.5,2F5.4,8F5.0)                                         HROE  015
      IF(ID)99,99,1001                                                          HROE  016
 1001 IF(IT-2)2,2,3                                                             HROE  017
    2 READ(5,45)(IDA(K),K=1,4),NFA,NTAPA                                       HROE  018
   45 FORMAT(5(I2,1X2I1,I2,4XI4,I5))                                            HROE  019
      IDA(5)=NFA                                                                HROE  020
      CALL FLTPE(IDA,SPECA,SCAL,IDSPC,NTAPA)                                    HROE  021
      RETURN                                                                    HROE  022
    3 READ(5,46)(T(I),I=1,NPOIN)                                                HROE  023
   46 FORMAT(6X,8F7.0)                                                          HROE  024
   99 RETURN                                                                    HROE  025
      END                                                                       HROE  026

FEATURES SUPPORTED
 NONPROCESS
 ONE WORD INTEGERS

CORE REQUIREMENTS FOR HROE
 COMMON  16544  INSKEL COMMON      0  VARIABLES     10  PROGRAM     216

 END OF COMPILATION
```

```
// FOR                                                                    CHROC000
*LIST SOURCE PROGRAM                                                      CHROC001
*NON PROCESS PROGRAM                                                      CHROC002
*ONE WORD INTEGERS                                                        CHROC003
      SUBROUTINE CHROC                                                    CHROC004
      COMMON KDEAD,ID,NPOIN,NR,X,IT,IC,IOROU,W,DT,ROUND,R,KPAGE,NDT       CHROC005
      COMMON IND(8),YACT(8),T(4129),TITLE(18)                             CHROC006
      COMMON DCOUT(4096),ANAM,I,J,K,L,M,I2,J2,JJ,INDEX,N,ND               CHROC007
      WRITE(6,112)(TITLE(I),I=1,18),KPAGE                                 CHROC008
  112 FORMAT (1H1,    18A4, 30X, 5HPAGE=,I3)                              CHROC009
C     KDEAD= 1      NO DEAD  TIME  CORRECTION PROVIDED                    CHROC010
C     KDEAD= 2      DEAD TIME CORRECTION  PROVIDED                        CHROC011
      GO TO(149,5),KDEAD                                                  CHROC012
                                                                          CHROC013
  149 DO 50 I=1,NPOIN                                                     CHROC014
      DCOUT(I)=SQRT(T(I))                                                 CHROC015
   50 CONTINUE                                                            CHROC016
      WRITE(6,9)                                                          CHROC017
    9 FORMAT (34HONO DEAD TIME CORRECTION PROVIDED )                      CHROC018
      GO TO 150                                                           CHROC019
                                                                          CHROC020
    5 FACT=1.                                                             CHROC021
      DO 35 N=1,NR                                                        CHROC022
      L=NR-N+1                                                            CHROC023
       W=W/FACT                                                           CHROC024
       NDT=DT/W+ROUND                                                     CHROC025
      IF(L-1)99,6,7                                                       CHROC026
    6 INDEX=IND(L)                                                        CHROC027
      GO TO 8                                                             CHROC028
    7 INDEX=IND(L)-IND(L-1)                                               CHROC029
    8 I2=INDEX-NDT                                                        CHROC030
      IF(I2)12,13,13                                                      CHROC031
   12 WRITE(6,42) L                                                       CHROC032
   42 FORMAT(1HO,'DEAD TIME RANGE LARGER THAN THE SECTION NUMBER',I4,     CHROC033
     1' - CALL EXIT')                                                     CHROC034
      CALL EXIT                                                           CHROC035
                                                                          CHROC036
C * * *                          CASE  NO. 1                              CHROC037
   13 M=1                                                                 CHROC038
      WRITE(6,999) KDEAD,ID,M,L,I,J,JJ,I2,J2,K                            CHROC039
  999 FORMAT(1HO,10I14)                                                   CHROC040
      J=IND(L)                                                            CHROC041
      J2=J                                                                CHROC042
      JJ=IND(L)                                                           CHROC043
      WRITE(6,47)L,M,JJ,J2,NR,I2,NDT                                      CHROC044
   47 FORMAT (11HOREGION NO.,I4,12H * * * CASE ,I4,56H - EXTREME CHANNELCHROC045
     1S FOR STARTING THE COMPUTATION ARE JJ=,I6,8H AND J2=,I6,6H - NR=,ICHROC046
     24,4H I2=,I6,11H * * * NDT=,I6)                                     CHROC047
      IF(I2)99,29,25                                                      CHROC048
   25 DO 28 K= 1,I2                                                       CHROC049
C EVALUATE THE PROBABILITY FOR EACH CHANNEL                               CHROC050
      JJ=J-1                                                              CHROC051
      P=X                                                                 CHROC052
      DO 23 I=1,NDT                                                       CHROC053
      P=P-T(JJ)                                                           CHROC054
      JJ=JJ-1                                                             CHROC055
   23 CONTINUE                                                            CHROC056
      A=T(J)                                                              CHROC057
      TTT=A/P                                                             CHROC058
      DCOUT(J)=SQRT(A+TTT*TTT*(X-P))*X/P                                  CHROC059
      T(J)=TTT*X+R                                                        CHROC060
```

```
      J=J-1                                                                    CHROC061
   28 CONTINUE                                                                 CHROC062
   29 WRITE(6,41)L,M,J,J2,P,JJ,NDT                                             CHROC063
   41 FORMAT (11HOREGION NO.,I4,12H * * * CASE ,I4,23H - EXTREME CHANNELCHROC064
     1S ARE ,I5,4H AND,I6,30H * * * THE LAST PROBABILITY IS,E12.4,10H * CHROC065
     2* * JJ=,I6,11H * * * NDT=,I6)                                            CHROC066
                                                                               CHROC067
      IF(L-1)99,40,30                                                          CHROC068
                                                                               CHROC069
C * * *                          CASE  NO. 2                                   CHROC070
   30 M=2                                                                      CHROC071
      WRITE(6,999) KDEAD,ID,M,L,I,J,JJ,I2,J2,K                                 CHROC072
      J=IND(L-1)+NDT                                                           CHROC073
      J2=J                                                                     CHROC074
      WRITE(6,47)L,M,JJ,J2,NR,I2,NDT                                           CHROC075
      DO 32 K=1,NDT                                                            CHROC076
C EVALUATE THE PROBABILITY FOR EACH CHANNEL                                    CHROC077
      JJ=IND(L-1)+1                                                            CHROC078
      ND=J-IND(L-1)-1                                                          CHROC079
      P=X                                                                      CHROC080
      DO 31 I=1,ND                                                             CHROC081
C CONTRIBUTION TO P FROM THE CURRENT SECTION                                   CHROC082
      P=P-T(JJ)                                                                CHROC083
      JJ=JJ+1                                                                  CHROC084
   31 CONTINUE                                                                 CHROC085
      IACT=YACT(L)                                                             CHROC086
      ND=(NDT-ND)*IACT                                                         CHROC087
      JJ=IND(L-1)                                                              CHROC088
      DO 33 I=1,ND                                                             CHROC089
C CONTRIBUTION TO P FROM THE PRECEDENT SECTION                                 CHROC090
      P=P-T(JJ)                                                                CHROC091
      JJ=JJ-1                                                                  CHROC092
   33 CONTINUE                                                                 CHROC093
      A=T(J)                                                                   CHROC094
      TTT=A/P                                                                  CHROC095
      DCOUT(J)=SQRT(A+TTT*TTT*(X-P))*X/P                                       CHROC096
      T(J)=TTT*X+R                                                             CHROC097
      J=J-1                                                                    CHROC098
   32 CONTINUE                                                                 CHROC099
      PP=P                                                                     CHROC100
      WRITE(6,41)L,M,J,J2,PP,JJ,NDT                                           CHROC101
      WRITE(6,34)L,YACT(L)                                                     CHROC102
   34 FORMAT(63H THE RATIO BETWEEN THE WIDTH OF THE CHANNELS OF THIS SECCHROC103
     1TION L=,I6,28H AND OF THE PRECEDENT ONE IS,F8.0)                         CHROC104
      FACT=YACT(L)                                                             CHROC105
   35 CONTINUE                                                                 CHROC106
                                                                               CHROC107
   40 RETURN                                                                   CHROC108
  150 RETURN                                                                   CHROC109
   99 CALL EXIT                                                                CHROC110
      END                                                                      CHROC111

FEATURES SUPPORTED
 NONPROCESS
 ONE WORD INTEGERS

CORE REQUIREMENTS FOR CHROC
 COMMON  16544  INSKEL COMMON      0  VARIABLES     -18  PROGRAM     934


 END OF COMPILATION
```

```
// FOR                                                                    OCTAL001
*LIST SOURCE PROGRAM                                                      OCTAL002
*NONPROCESS PROGRAM                                                       OCTAL003
*ONE WORD INTEGERS                                                        OCTAL004
      SUBROUTINE OCTAL                                                    OCTAL005
      COMMON KDEAD,ID,NPOIN,NR,X,IT,IK,IOROU,W,DT,ROUND,R,KPAGE,NDT       OCTAL006
      COMMON IND(8),YACT(8),T(4129),TITLE(18)                             OCTAL007
      COMMON DCOUT(4096),ANAM,I,J,K,L,M,I2,J2,JJ,INDEX,N,ND               OCTAL008
      GO TO (150,40),KDEAD                                                OCTAL009
C * * *                          CASE  NO. 3                              OCTAL010
   40 M=3                                                                 OCTAL011
      WRITE(6,6666) ID,KDEAD,IK,M,NDT,I,J,NPOIN,N,J2,NR,L,JJ,INDEX,K,IT,OCTAL012
     1I2,ND                                                               OCTAL013
 6666 FORMAT(1HO,'ID =',I5,'KDEAD =',2016)                                OCTAL014
      J=NDT                                                               OCTAL015
      J2=J                                                                OCTAL016
      WRITE(6,47)L,M,JJ,J2,NR,I2,NDT                                      OCTAL017
   47 FORMAT (11HOREGION NO.,I4,12H * * * CASE ,I4,56H - EXTREME CHANNELOCTAL018
     1S FOR STARTING THE COMPUTATION ARE JJ=,I6,8H AND J2=,I6,6H - NR=,IOCTAL019
     24,4H I2=,I6,11H * * * NDT=,I6)                                      OCTAL020
      DO 37 K=1,NDT                                                       OCTAL021
C EVALUATE THE PROBABILITY FOR EACH CHANNEL WITH A DECREASING NO. OF TEROCTAL022
      JJ=1                                                                OCTAL023
      ND=J-1                                                              OCTAL024
      P=X                                                                 OCTAL025
      DO 43 I=1,ND                                                        OCTAL026
      P=P-T(JJ)                                                           OCTAL027
      JJ=JJ+1                                                             OCTAL028
   43 CONTINUE                                                            OCTAL029
      A=T(J)                                                              OCTAL030
      TTT=A/P                                                             OCTAL031
      DCOUT(J)=SQRT(A+TTT*TTT*(X-P))*X/P                                  OCTAL032
      T(J)=TTT*X+R                                                        OCTAL033
      J=J-1                                                               OCTAL034
   37 CONTINUE                                                            OCTAL035
      WRITE(6,41)L,M,J,NDT,P,JJ,NDT,DCOUT(1)                             OCTAL036
   41 FORMAT (11HOREGION NO.,I4,12H * * * CASE ,I4,23H - EXTREME CHANNELOCTAL037
     1S ARE ,I5,4H AND,I6,30H * * * THE LAST PROBABILITY IS,E12.4,10H * OCTAL038
     2* * JJ=,I6,11H * * * NDT=,I6/1HO,'DCOUT(1)=',F7.0)                  OCTAL039
                                                                         OCTAL040
      DCOUT (  1)=SQRT (T(1))                                             OCTAL041
  150 GO TO(51,52,51,52),IT                                               OCTAL042
   51 GO TO(151,152),IOROU                                                OCTAL043
C          IN-SPECTRUM      SAVED   FOR   BEING   READ   IN   SITRA      OCTAL044
  151 IA=1                                                                OCTAL045
      I4=1                                                                OCTAL046
      WRITE(1'IA)(T(I1),I1=1, NPOIN)                                      OCTAL047
      WRITE(4'I4)(DCOUT(  I),I=1,NPOIN)                                   OCTAL048
      GO TO 52                                                            OCTAL049
C          OUT     SPECTRUM   SAVED     ON     DISK                      OCTAL050
  152 IB=1                                                                OCTAL051
      IE=1                                                                OCTAL052
      WRITE(2'IB) (T(I),I=1,NPOIN)                                        OCTAL053
      WRITE(5'IE) (DCOUT(I),I=1,NPOIN)                                    OCTAL054
   52 IF(IK-2)54,54,55                                                    OCTAL055
   54 WRITE(5,46) (T(I),I=1,NPOIN)                                        OCTAL056
   46 FORMAT(6X,8F7.0)                                                    OCTAL057
   55 GO TO(56,1,56,1),IK                                                 OCTAL058
   56 WRITE(6,48)ID,NPOIN,X,W,DT,ROUND                                    OCTAL059
   48 FORMAT(1HO,58X28HDEAD TIME CORRECTED SPECTRUM//34X3HID=,I5,8H  NPOOCTAL060
     1IN=,I5,4H  X=,E12.5,4H  W=,F8.4,5H  DT=,F9.3,8H  ROUND=,F7.3//)    OCTAL061
```

```
      DO 59 IC=1,NPOIN,16                                                    OCTAL062
      IE = IC+15                                                             OCTAL063
      IF (((IC-1)/848*848-IC+1) 58,57,58                                     OCTAL064
   57 WRITE(6,112)(TITLE(I),I=1,18),KPAGE                                    OCTAL065
      KPAGE = KPAGE+1                                                        OCTAL066
      WRITE(6,16)ANAM                                                        OCTAL067
   16 FORMAT(' COUNTS WITH SAMPLE ',A4)                                      OCTAL068
   58 WRITE(6,14)(    T(  ICC),ICC=IC,IE),IE                                OCTAL069
   14 FORMAT (1X,16F7.0,I12)                                                 OCTAL070
   59 CONTINUE                                                               OCTAL071
      DO 69 IC=1,NPOIN,16                                                    OCTAL072
      IE = IC +15                                                            OCTAL073
      IF((IC-1)/848*848-IC+1) 66,61,66                                       OCTAL074
   61 WRITE(6,112)(TITLE(I),I=1,18),KPAGE                                    OCTAL075
  112 FORMAT (1H1,    18A4, 30X, 5HPAGE=,I3)                                 OCTAL076
      KPAGE=KPAGE+1                                                          OCTAL077
      WRITE(6,15)ANAM                                                        OCTAL078
   15 FORMAT(' ERRORS OF THE COUNTS WITH SAMPLE  ',A4)                       OCTAL079
   66 WRITE             (6,14)(DCOUT  ( ICC),ICC=IC,IE),IE                   OCTAL080
   69 CONTINUE                                                               OCTAL081
    1 RETURN                                                                 OCTAL082
      END                                                                    OCTAL083

FEATURES SUPPORTED
 NONPROCESS
 ONE WORD INTEGERS

CORE REQUIREMENTS FOR OCTAL
 COMMON  16544  INSKEL COMMON      0  VARIABLES     20  PROGRAM     882


 END OF COMPILATION
```

```
// JOB    X      X      X                                                    KOLAR001
// FOR KOLAR                                                                KOLAR002
*IOCS(CARD,1443PRINTER,DISK)                                                KOLAR003
*LIST SOURCE PROGRAM                                                        KOLAR004
*ONE WORD INTEGERS                                                          KOLAR005
*NON PROCESS PROGRAM                                                        KOLAR006
C       KOLAR                                                               KOLAR007
        DEFINE FILE 2(32,256,U,IB)                                          KOLAR008
        DEFINE FILE 3(32,256,U,IC)                                          KOLAR009
        DEFINE FILE 5(32,256,U,IE)                                          KOLAR010
        DEFINE FILE 6(1,88,U,IF)                                            KOLAR011
        DEFINE FILE 9(32,256,U,I9)                                          KOLAR012
C * DISK FILE 2 GRACE * READ BY INPUT * CONTAINS O.T. CORRECTED NOT          KOLAR013
C                                SMOOTHED OUT                               KOLAR014
C * DISK FILE 5 PADUS * READ BY INPUT * CONTAINS ERROR OF THE PRECEDING     KOLAR015
C * DISK FILE 3 ARNUS * WRITTEN BY ENDN * OUT SMOOTHED SPECTRUM             KOLAR016
C * DISK FILE 9 ERROR * WRITTEN BY ENDN * OUT SMOOTHED SPECTRUM - ERROR     KOLAR017
C * DISK FILE 6 AGATA * WRITTEN BY ENDN * LINKAGE BETWEEN KOLAR AND CAOM    KOLAR018
      1 CALL LSQFN                                                          KOLAR019
        CALL  UPSQ                                                          KOLAR020
        CALL UENDS                                                          KOLAR021
        GO TO 1                                                             KOLAR022
        END                                                                 KOLAR023

FEATURES SUPPORTED
 NONPROCESS
 ONE WORD INTEGERS
 IOCS

CORE REQUIREMENTS FOR KOLAR
 COMMON       0  INSKEL COMMON       0  VARIABLES     36  PROGRAM       8

 END OF COMPILATION
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```
// FOR LSQFN                                                                LSQFN001
*LIST SOURCE PROGRAM                                                        LSQFN002
*ONE WORD INTEGERS                                                          LSQFN003
*NON PROCESS PROGRAM                                                        LSQFN004
      SUBROUTINE LSQFN                                                      LSQFN005
C     LSQFN                                                                 LSQFN006
CLSFT   LEAST SQUARE FIT   4096 OBSERVATIONS                                LSQFN007
      DIMENSION TITLE(18),P( 11)          ,YO(4129),SIGYO(4096),KI( 10)     LSQFN008
      DIMENSION DP( 10),SQSIG(2),AM(  55),V( 10),DC( 10),DV( 10),DD( 10)LSQFN009
      DIMENSION DIAG(10),PD(10),ROW(10) ,PERR(10),KCHAN(12)                 LSQFN010
      DIMENSION TITST(18)                                                   LSQFN011
      COMMON TITLE,P,XX,YO,SIGYO,KI,DP,SQSIG,AM,V,DC,DV,DD,DIAG,PD,ROW      LSQFN012
      COMMON NC,NV,NX,ID,IW,IP,IT,NP,ISENT,NU,NM,NCY,IC,SIG,YC              LSQFN013
      COMMON SQRTW,DY,WDY,DPK,PSAVE,YD,JK,ISING,II,IID,PDI,IJ,IJD,PDLD      LSQFN014
      COMMON SIGP,ISTOP,NT,NPCD  ,ISWI  ,PERR                               LSQFN015
      COMMON KCHAN,KNUM,KCHA1 ,KCHA2 ,KPAGE                                 LSQFN016
      COMMON DX,TITST                                                       LSQFN017
      COMMON IBEGT                                                          LSQFN018
   51 FORMAT(18A4,I3)                                                       LSQFN019
   52 FORMAT(1H118A4,18X,4HPAGE,I3)                                         LSQFN020
   53 FORMAT(24I3)                                                          LSQFN021
  540FORMAT(32HONUMBER OF CYCLES IN THIS JOB IS I2/37HONUMBER OF PARAMETLSQFN022
     1ERS TO BE VARIED IS I3/51HONUMBER OF INDEPENDENT VARIABLES PER OBSELSQFN023
     2RVATION IS I2)                                                        LSQFN024
   58 FORMAT(31HODERIVATIVES PROGRAMMED BY USER)                            LSQFN025
  590FORMAT(57HONUMERICAL DERIVATIVES UNLESS PARAMETER INCREMENT IS ZERLSQFN026
     1O)                                                                    LSQFN027
   61 FORMAT(31HOWEIGHTS TO BE SUPPLIED BY USER)                            LSQFN028
   62 FORMAT(34HOUNIT WEIGHTS TO BE SET BY PROGRAM)                         LSQFN029
   63 FORMAT(36HOPARAMETERS TO BE READ AS INPUT DATA)                       LSQFN030
  640FORMAT(34HOPARAMETERS TO BE TAKEN FROM CYCLEI2,16H OF PREVIOUS JOBLSQFN031
     1)                                                                     LSQFN032
   66 FORMAT(I3,77X/(8F9.4,8X))                                            LSQFN033
   67 FORMAT(29HONUMBER OF PARAMETERS READ IS I3)                           LSQFN034
   69 FORMAT(31HONUMBER OF OBSERVATIONS READ IS I6)                         LSQFN035
   70 FORMAT(72I1)                                                          LSQFN036
   71 FORMAT(8E9.4)                                                         LSQFN037
  920FORMAT(11H0INPUT DATA/30H0  I      P(I)  KI(I)      DP(I)/1H )       LSQFN038
   93 FORMAT(1H I3,F10.4,I4,3X,E11.4)                                       LSQFN039
   94 FORMAT(51HOCORRECTED PARAMETERS NOT TO BE SAVED FOR LATER USE)        LSQFN040
   95 FORMAT(51HOCORRECTED PARAMETERS TO BE WRITTEN ON PRIVATE TAPE)        LSQFN041
C                                                                           LSQFN042
      CALL CLOCK(IBEGT)                                                     LSQFN043
      KPAGE=1                                                               LSQFN044
C     READ TITLE AND CONTROL CARD                                           LSQFN045
      READ (5,51) (TITLE(I),I =1,18),ITITL                                 LSQFN046
      DO 2 I=1,18                                                           LSQFN047
    2 TITST(I)=TITLE(I)                                                     LSQFN048
      WRITE(6,52) (TITLE(I),I=1,18),KPAGE                                  LSQFN049
C                                                                           LSQFN050
C                                                                           LSQFN051
      KPAGE=KPAGE+1                                                         LSQFN052
      READ (5,53) NC,NV,NX,ID,IW,IP,IT                                      LSQFN053
      WRITE(6,54) NC,NV,NX                                                  LSQFN054
C                                                                           LSQFN055
      IF(ID)206,204,206                                                     LSQFN056
C                                                                           LSQFN057
  204 WRITE(6,58)                                                           LSQFN058
         GO TO 207                                                          LSQFN059
C                                                                           LSQFN060
  206 WRITE(6,59)                                                           LSQFN061
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C                                                                       LSQFN062
  207 IF(IW)210,208,210                                                 LSQFN063
C                                                                       LSQFN064
  208 WRITE(6,61)                                                       LSQFN065
         GO TO 211                                                      LSQFN066
C                                                                       LSQFN067
  210 WRITE(6,62)                                                       LSQFN068
C                                                                       LSQFN069
  211 IF(IP)212,212,214                                                 LSQFN070
C                                                                       LSQFN071
  212 WRITE(6,63)                                                       LSQFN072
         GO TO 215                                                      LSQFN073
C                                                                       LSQFN074
  214 WRITE(6,64)IP                                                     LSQFN075
C                                                                       LSQFN076
  215 IF(IT-1)216,218,218                                               LSQFN077
C                                                                       LSQFN078
  216 WRITE(6,94)                                                       LSQFN079
         GO TO 301                                                      LSQFN080
C                                                                       LSQFN081
  218 WRITE(6,95)                                                       LSQFN082
C                                                                       LSQFN083
C      READ TRIAL PARAMETERS                                            LSQFN084
C                                                                       LSQFN085
  301 READ(5,66) NP,(P(I),I=1,NP)                                       LSQFN086
C                                                                       LSQFN087
C                                                                       LSQFN088
C                                                                       LSQFN089
      WRITE(6,67)NP                                                     LSQFN090
C                                                                       LSQFN091
      READ(5,6) KNUM,(KCHAN(I),I=1,KNUM)                                LSQFN092
    6 FORMAT(2015)                                                      LSQFN093
      CALL INPUT                                                        LSQFN094
C                                                                       LSQFN095
      NO=0                                                              LSQFN096
      DO 4 J=1,KNUM,2                                                   LSQFN097
      J1=KCHAN(J)                                                       LSQFN098
      J2=KCHAN(J+1)                                                     LSQFN099
      I1=NO+1                                                           LSQFN100
      NO=NO+J2-J1+1                                                     LSQFN101
      DO 5 I=I1,NO                                                      LSQFN102
      YO(I)=YO(J1)                                                      LSQFN103
      SIGYO(I)=SIGYO(J1)                                                LSQFN104
    5 J1=J1+1                                                           LSQFN105
    4 CONTINUE                                                          LSQFN106
      DX=J2-KCHAN(1)                                                    LSQFN107
      DX=2./DX                                                          LSQFN108
      WRITE(6,69) NO                                                    LSQFN109
C                                                                       LSQFN110
C      READ KEY INTEGERS AND PARAMETER INCREMENTS IF SPECIFIED          LSQFN111
      IF(NC)1601,1601,1301                                              LSQFN112
C                                                                       LSQFN113
 1301 READ(5,70) (KI(I),I=1,NP)                                         LSQFN114
      IF(ID)1501,1611,1501                                              LSQFN115
C                                                                       LSQFN116
 1501 READ(5,71) (DP(I),I=1,NP)                                         LSQFN117
         GO TO 1621                                                     LSQFN118
C                                                                       LSQFN119
 1601    DO 1602 I=1,NP                                                 LSQFN120
C                                                                       LSQFN121
 1602       KI(I)=0                                                     LSQFN122
```

```
C                                                                               LSQFN123
 1611    DO 1612 I=1,NP                                                         LSQFN124
C                                                                               LSQFN125
 1612       DP(I)=0.0                                                           LSQFN126
C                                                                               LSQFN127
 1621 NM=(NV*(NV+1))/2                                                          LSQFN128
      SQSIG(1)=0.0                                                              LSQFN129
C                                                                               LSQFN130
C     PUT OUT TRIAL PARAMETERS, KEY INTEGERS, AND PARAMETER INCREMENTS          LSQFN131
      WRITE(6,92)                                                               LSQFN132
      DO 1653 I=1,NP                                                            LSQFN133
 1653 WRITE(6,93) I,P(I),KI(I),DP(I)                                            LSQFN134
      RETURN                                                                    LSQFN135
      END                                                                       LSQFN136

FEATURES SUPPORTED
 NONPROCESS
 ONE WORD INTEGERS

CORE REQUIREMENTS FOR LSQFN
 COMMON  16916  INSKEL COMMON      0  VARIABLES      8  PROGRAM     886


 END OF COMPILATION
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```
// FOR                                                                          INPUT001
*LIST SOURCE PROGRAM                                                           INPUT002
*ONE WORD INTEGERS                                                             INPUT003
*NONPROCESS PROGRAM                                                            INPUT004
      SUBROUTINE INPUT                                                         INPUT005
      DIMENSION TITLE(18),P( 11)           ,YO(4129),SIGYO(4096),KI( 10)       INPUT006
      DIMENSION DP( 10),SQSIG(2),AM(  55),V( 10),DC( 10),DV( 10),DD( 10)       INPUT007
      DIMENSION DIAG(10),PD(10),ROW(10) ,PERR(10),KCHAN(12)                    INPUT008
      DIMENSION TITST(18)                                                      INPUT009
      COMMON TITLE,P,XX,YO,SIGYO,KI,DP,SQSIG,AM,V,DC,DV,DD,DIAG,PD,ROW         INPUT010
      COMMON NC,NV,NX,ID,IW,IP,IT,NP,ISENT,NO,NM,NCY,IC,SIG,YC                 INPUT011
      COMMON SQRTW,DY,WDY,DPK,PSAVE,YD,JK,ISING,II,IID,PDI,IJ,IJD,POLD         INPUT012
      COMMON SIGP,ISTOP,NI,NPCD  ,ISWI     ,PERR                               INPUT013
      COMMON KCHAN,KNUM,KCHA1 ,KCHA2 ,KPAGE                                    INPUT014
      COMMON DX,TITST                                                          INPUT015
      IB=1                                                                     INPUT016
      IE=1                                                                     INPUT017
      READ (2'IB) (YO(I),I=1,4096)                                             INPUT018
      READ (5'IE) (SIGYO(I),I=1,4096)                                          INPUT019
   19 RETURN                                                                   INPUT020
      END                                                                      INPUT021

FEATURES SUPPORTED
 NONPROCESS
 ONE WORD INTEGERS

CORE REQUIREMENTS FOR INPUT
 COMMON   16914  INSKEL COMMON       0  VARIABLES       4  PROGRAM      62


 END OF COMPILATION
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// FOR                                                                    OPSQ 001
*ONE WORD INTEGERS                                                        OPSQ 002
*LIST SOURCE PROGRAM                                                      OPSQ 003
*NONPROCESS PROGRAM                                                       OPSQ 004
      SUBROUTINE  OPSQ                                                    OPSQ 005
C                                                                         OPSQ 006
      DIMENSION TITLE(18),P( 11)           ,YO(4129),SIGYO(4096),KI( 10) OPSQ 007
      DIMENSION DP( 10),SQSIG(2),AM(  55),V( 10),DC( 10),DV( 10),DD( 10)OPSQ 008
      DIMENSION DIAG(10),PD(10),ROW(10) ,PERR(10),KCHAN(12)               OPSQ 009
      DIMENSION TITST(18)                                                 OPSQ 010
      COMMON TITLE,P,XX,YO,SIGYO,KI,DP,SQSIG,AM,V,DC,DV,DD,DIAG,PD,ROW    OPSQ 011
      COMMON NC,NV,NX,ID,IW,IP,IT,NP,ISENT,NO,NM,NCY,IC,SIG,YC            OPSQ 012
      COMMON SQRTW,DY,WDY,DPK,PSAVE,YD,JK,ISING,II,IID,PDI,IJ,IJD,POLD    OPSQ 013
      COMMON SIGP,ISTOP,NT,NPCD  ,ISWI  ,PERR                             OPSQ 014
      COMMON KCHAN,KNUM,KCHA1 ,KCHA2 ,KPAGE                               OPSQ 015
      COMMON DX,TITST                                                     OPSQ 016
C                                                                         OPSQ 017
   52 FORMAT(1H1,18A4,18X,4HPAGE,I3)                                      OPSQ 018
                                                                          OPSQ 019
   72 FORMAT(46HOCALCULATED Y BASED ON PARAMETERS BEFORE CYCLE,I2)        OPSQ 020
  730FORMAT(60HO    Y(OBS)    Y(CALC)    OBS-CALC   SIG(O)    (O-C)/SIG(O)OPSQ 021
     1X(I)/1H )                                                           OPSQ 022
   79 FORMAT(1X,F10.0,5F10.4,F10.0)                                       OPSQ 023
  800FORMAT(51HOAGREEMENT FACTORS BASED ON PARAMETERS BEFORE CYCLE I2/2OPSQ 024
     10HOSUM(W*(O-C)**2) IS E11.4/35HOSQRTF(SUM(W*(O-C)**2)/(NO-NV)) IS OPSQ 025
     2F10.4)                                                              OPSQ 026
  810FORMAT(60HOESTIMATED AGREEMENT FACTORS BASED ON PARAMETERS AFTER COPSQ 027
     1YCLE I2/20HOSUM(W*(O-C)**2) IS E11.4/35HOSQRTF(SUM(W*(O-C)**2)/(NOPSQ 028
     2-NV)) IS F10.4)                                                     OPSQ 029
  830FORMAT(62H MATRIX HAS A ZERO DIAGONAL ELEMENT CORRESPONDING TO PAROPSQ 030
     1AMETERI3,16H OF THOSE VARIED)                                       OPSQ 031
   85 FORMAT(40H SINGULARITY RETURN FROM MATRIX INVERTER)                 OPSQ 032
  860FORMAT(37HOPARAMETERS AFTER LEAST SQUARES CYCLE12/82HO              OPSQ 033
     1     OLD                  CHANGE              NEW                 EROPSQ 034
     2ROR/1H )                                                            OPSQ 035
   88 FORMAT(1H I3,F20.4,20X,F20.4)                                       OPSQ 036
   89 FORMAT(1H I3,4F20.4)                                                OPSQ 037
                                                                          OPSQ 038
                                                                          OPSQ 039
C                                                                         OPSQ 040
      NCY=NC+1                                                            OPSQ 041
C     START LOOP TO PERFORM NC CYCLES AND ONE FINAL CALCULATION OF Y      OPSQ 042
      DO 8501 IC=1,NCY                                                    OPSQ 043
C                                                                         OPSQ 044
C        CLEAR ARRAYS AM AND V EXCEPT ON LAST CYCLE                       OPSQ 045
         IF(IC-NCY)1851,2001,2001                                         OPSQ 046
C                                                                         OPSQ 047
 1851       DO 1852 I=1,NM                                               OPSQ 048
C                                                                         OPSQ 049
 1852          AM(I)=0.0                                                 OPSQ 050
C                                                                         OPSQ 051
            DO 1902 I=1,NV                                                OPSQ 052
 1902          V(I)=0.0                                                  OPSQ 053
C                                                                         OPSQ 054
C        INITIALIZE FOR CYCLE IC AND PUT OUT CAPTION FOR LIST OF Y(CALC)  OPSQ 055
 2001    SQSIG(2)=SQSIG(1)                                                OPSQ 056
         SIG=0.0                                                          OPSQ 057
      WRITE(6,52) (TITLE(I),I=1,18)                                       OPSQ 058
         KPAGE=KPAGE+1                                                    OPSQ 059
      WRITE(6,72) IC                                                      OPSQ 060
      WRITE(6,73)                                                         OPSQ 061
                                                                          OPSQ 062
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C         START LOOP THROUGH NO OBSERVATIONS                                    OPSQ 064
      I1=1                                                                      OPSQ 065
      DO 4LJ=1,KNUM,2                                                           OPSQ 066
      J1=KCHAN(LJ)                                                              OPSQ 067
      J2=KCHAN(LJ+1)                                                            OPSQ 068
      XX=J1                                                                     OPSQ 069
      I2=I1+J2-J1                                                               OPSQ 070
C                                                                               OPSQ 071
      DO 5 I=I1,I2                                                              OPSQ 072
      X=-1.+DX*(XX-KCHAN(1))                                                    OPSQ 073
C           ENTER USERS SUBROUTINE TO COMPUTE Y(CALC) AND DERIVATIVES           OPSQ 074
      CALL CALCN(X      ,YC,P,DC)                                               OPSQ 075
C                                                                               OPSQ 076
C           OBTAIN WEIGHT AND CALCULATE QUANTITIES FROM Y(OBS)-Y(CALC)          OPSQ 077
            IF(IW)2601,2501,2601                                                OPSQ 078
C                                                                               OPSQ 079
 2501          SQRTW=1.0/SIGYO(I)                                               OPSQ 080
               GO TO 2701                                                       OPSQ 081
 2601          SIGYO(I)=1.0                                                     OPSQ 082
C                                                                               OPSQ 083
               SQRTW=1.0                                                        OPSQ 084
C                                                                               OPSQ 085
 2701       DY=YO(I)-YC                                                         OPSQ 086
            WDY=SQRTW*DY                                                        OPSQ 087
            SIG=SIG+WDY*WDY                                                     OPSQ 088
C                                                                               OPSQ 089
C           PUT OUT Y(CALC) AND OTHER INFORMATION FOR ONE OBSERVATION           OPSQ 090
      IF(IC-1)2751,2751,2750                                                    OPSQ 091
 2750 WRITE               (6,79)YO(I),YC,DY,SIGYO(I),WDY,X   ,XX               OPSQ 092
C                                                                               OPSQ 093
      IF(((I -55)/55)*55-I +55) 2751,2752,2751                                  OPSQ 094
 2752 WRITE(6,52) (TITLE(II),II=1,18),KPAGE                                     OPSQ 095
         KPAGE=KPAGE+1                                                          OPSQ 096
      WRITE(6,73)                                                               OPSQ 097
C           BY-PASS DERIVATIVE AND MATRIX SET-UP ON FINAL CALC OF Y             OPSQ 098
 2751       IF(IC-NCY)3001,5101,5101                                            OPSQ 099
C                                                                               OPSQ 100
C              START LOOP TO STORE AN ARRAY OF NV DERIVATIVES                   OPSQ 101
 3001          J=1                                                             OPSQ 102
               DO 4101 K=1,NP                                                  OPSQ 103
C                                                                               OPSQ 104
                  IF(KI(K))4101,4101,3201                                       OPSQ 105
C                                                                               OPSQ 106
 3201                IF(ID)3401,3301,3401                                      OPSQ 107
C                                                                               OPSQ 108
C                     OBTAIN DERIVATIVE FROM THOSE PROGRAMMED BY USER           OPSQ 109
 3301                 DV(J)=SQRTW*DC(K)                                         OPSQ 110
                      GO TO 4001                                                OPSQ 111
C                                                                               OPSQ 112
C                                                                               OPSQ 113
C                     OBTAIN DERIVATIVE NUMERICALLY UNLESS PARAMETER            OPSQ 114
C                                                    INCREMENT IS ZERO          OPSQ 115
 3401                 DPK=DP(K)                                                 OPSQ 116
                      IF(DPK)3601,3301,3601                                     OPSQ 117
C                                                                               OPSQ 118
 3601                    PSAVE=P(K)                                             OPSQ 119
                         P(K)=PSAVE+DPK                                         OPSQ 120
      CALL CALCN(X      ,YD,P,DD)                                               OPSQ 121
                         DV(J)=SQRTW*(YD-YC)/DPK                                OPSQ 122
                         P(K)=PSAVE                                             OPSQ 123
C                                                                               OPSQ 124
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 4001              J=J+1                                                    OPSQ 125
 4101              CONTINUE                                                 OPSQ 126
C                  END LOOP TO OBTAIN DERIVATIVES                           OPSQ 127
C                                                                           OPSQ 128
C                START LOOP TO STORE MATRIX AND VECTOR.                     OPSQ 129
C                1604 OR GLS STORAGE SCHEME IS REVERSE OF 7090 OR GLS       OPSQ 130
                 JK=1                                                       OPSQ 131
                 DO 5001 J=1,NV                                             OPSQ 132
C                                                                           OPSQ 133
                    TEMP=DV(J)                                              OPSQ 134
                    IF(TEMP)4501,4401,4501                                  OPSQ 135
C                                                                           OPSQ 136
C                      BY-PASS IF DERIVATIVE IS ZERO                        OPSQ 137
 4401                  JK=JK+NV+1-J                                         OPSQ 138
                       GO TO 5001                                           OPSQ 139
C                                                                           OPSQ 140
 4501                  DO 4801 K=J,NV                                       OPSQ 141
C                                                                           OPSQ 142
                          AM(JK)=AM(JK)+TEMP*DV(K)                          OPSQ 143
                          JK=JK+1                                           OPSQ 144
 4801                     CONTINUE                                          OPSQ 145
C                                                                           OPSQ 146
                       V(J)=V(J)+TEMP*WDY                                   OPSQ 147
 5001                  CONTINUE                                             OPSQ 148
 5101            CONTINUE                                                   OPSQ 149
      XX=XX+1.                                                              OPSQ 150
    5 CONTINUE                                                              OPSQ 151
                                                                            OPSQ 152
    4 I1=I2+1                                                               OPSQ 153
C                  END LOOP TO STORE MATRIX AND VECTOR                      OPSQ 154
C                                                                           OPSQ 155
      NO=I2                                                                 OPSQ 156
      NX=ISWI                                                               OPSQ 157
C                END LOOP THROUGH NO OBSERVATIONS                           OPSQ 158
C                                                                           OPSQ 159
C        COMPUTE AND PUT OUT AGREEMENT FACTORS                              OPSQ 160
         SQSIG(1)=SQRT (SIG/FLOAT (NO-NV))                                  OPSQ 161
      WRITE(6,80) IC,SIG,SQSIG(1)                                           OPSQ 162
C                                                                           OPSQ 163
C        BY-PASS MATRIX INVERSION AND PARAMETER OUTPUT ON FINAL CYCLE       OPSQ 164
         IF(IC-NCY)5401,8701,8701                                           OPSQ 165
C                                                                           OPSQ 166
C           START LOOP TO TEST FOR ZERO DIAGONAL ELEMENT                    OPSQ 167
 5401       ISING=0                                                         OPSQ 168
            II=1                                                            OPSQ 169
            IID=NV                                                          OPSQ 170
            DO 5801 I=1,NV                                                  OPSQ 171
C                                                                           OPSQ 172
               IF(AM(II))5701,5601,5701                                     OPSQ 173
C                                                                           OPSQ 174
 5601          ISING=1                                                      OPSQ 175
      WRITE(6,83) I                                                         OPSQ 176
C                                                                           OPSQ 177
 5701       II=II+IID                                                       OPSQ 178
            IID=IID-1                                                       OPSQ 179
 5801       CONTINUE                                                        OPSQ 180
C           END LOOP TO TEST FOR ZERO DIAGONAL ELEMENT                      OPSQ 181
C                                                                           OPSQ 182
C           TERMINATE JOB IF ZERO DIAGONAL ELEMENT WAS FOUND                OPSQ 183
            IF(ISING)10301,6001,10301                                       OPSQ 184
C                                                                           OPSQ 185
```

```
C                ENTER SUBROUTINE TO REPLACE MATRIX WITH INVERSE          OPSQ 186
 6001            CALL MATIO (AM,NV,ISING)                                 OPSQ 187
                 IF(ISING)6201,6301,6201                                  OPSQ 188
C                                                                         OPSQ 189
C                   TERMINATE JOB IF SINGULAR MATRIX WAS FOUND            OPSQ 190
 6201 WRITE(6,85)                                                         OPSQ 191
10301 CALL  EXIT                                                          OPSQ 192
C                                                                         OPSQ 193
C                   START LOOP FOR MATRIX VECTOR MULTIPLICATION FOR       OPSQ 194
C                                                    PARAMETER CHANGES    OPSQ 195
 6301               DO 7201 I=1,NV                                        OPSQ 196
C                                                                         OPSQ 197
                       PDI=0.0                                           OPSQ 198
                       IJ=I                                              OPSQ 199
                       IJD=NV-1                                          OPSQ 200
                       DO 7001 J=1,NV                                    OPSQ 201
C                                                                         OPSQ 202
                          PDI=PDI+AM(IJ)*V(J)                            OPSQ 203
                          IF(J-I)6701,6801,6901                          OPSQ 204
C                                                                         OPSQ 205
 6701                        IJ=IJ+IJD                                    OPSQ 206
                             IJD=IJD-1                                    OPSQ 207
                             GO TO 7001                                   OPSQ 208
C                                                                         OPSQ 209
C                            SAVE DIAGONAL ELEMENTS OF INVERSE MATRIX     OPSQ 210
 6801                        DIAG(I)=AM(IJ)                               OPSQ 211
C                                                                         OPSQ 212
 6901                        IJ=IJ+1                                      OPSQ 213
 7001                        CONTINUE                                     OPSQ 214
C                                                                         OPSQ 215
      PD(I)=PDI                                                           OPSQ 216
                       SIG=SIG-PDI*V(I)                                   OPSQ 217
 7201                  CONTINUE                                           OPSQ 218
C                      END LOOP FOR MATRIX VECTOR MULTIPLICATION          OPSQ 219
C                                                                         OPSQ 220
C                   RECOMPUTE AGREEMENT FACTOR USING MODIFIED SIG         OPSQ 221
                    SQSIG(1)=SQRT (SIG/FLOAT (NO-NV))                     OPSQ 222
C                                                                         OPSQ 223
C                   PUT OUT CAPTION FOR LIST OF CORRECTED PARAMETERS      OPSQ 224
      WRITE(6,52) (TITLE(I),I=1,18),KPAGE                                 OPSQ 225
         KPAGE=KPAGE+1                                                    OPSQ 226
      WRITE(6,86)IC                                                       OPSQ 227
C                   START LOOP TO CORRECT AND PUT OUT PARAMETERS          OPSQ 228
C                                                                         OPSQ 229
                    J=1                                                   OPSQ 230
                    DO 8001 I=1,NP                                        OPSQ 231
C                                                                         OPSQ 232
                       IF(KI(I))7601,7601,7701                            OPSQ 233
 7601 WRITE(6,88) I,P(I),P(I)                                             OPSQ 234
                          GO TO 8001                                      OPSQ 235
C                                                                         OPSQ 236
C                                                                         OPSQ 237
 7701                     POLD=P(I)                                       OPSQ 238
                          P(I)=POLD+PD(J)                                 OPSQ 239
                          SIGP=SQRT (DIAG(J))*SQSIG(1)                    OPSQ 240
                          PERR(J)=SIGP                                    OPSQ 241
      WRITE(6,89) I,POLD,PD(J),P(I),SIGP                                  OPSQ 242
                          J=J+1                                           OPSQ 243
C                                                                         OPSQ 244
 8001                  CONTINUE                                           OPSQ 245
C                      END LOOP TO CORRECT AND PUT OUT PARAMETERS         OPSQ 246
```

```
C
C                    PUT OUT ESTIMATED AGREEMENT FACTORS                        OPSQ 247
      WRITE(6,81) IC,SIG,SQSIG(1)                                               OPSQ 248
C                                                                               OPSQ 249
C                                                                               OPSQ 250
C                       END LOOP THROUGH NC CYCLES AND FINAL CALC OF Y          OPSQ 251
 8501                   CONTINUE                                                OPSQ 252
C                                                                               OPSQ 253
C                                                                               OPSQ 254
C                                                                               OPSQ 255
C                                                                 OR END JOB    OPSQ 256
 8701 RETURN                                                                    OPSQ 257
      END                                                                       OPSQ 258
                                                                                OPSQ 259

FEATURES SUPPORTED
 NONPROCESS
 ONE WORD INTEGERS

CORE REQUIREMENTS FOR OPSQ
 COMMON   16914  INSKEL COMMON       0  VARIABLES      22  PROGRAM    1372

 END OF COMPILATION
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```
// FOR                                                                    MATI0001
*LIST SOURCE PROGRAM                                                      MATI0002
*ONE WORD INTEGERS                                                        MATI0003
*NONPROCESS PROGRAM                                                       MATI0004
      SUBROUTINE MATIO(AM,N,NFAIL)                                        MATI0005
      DIMENSION AM(55)                                                    MATI0006
C                                                                         MATI0007
C     ********** SEGMENT 1 OF CHOLESKI INVERSION **********              MATI0008
C     ***** FACTOR MATRIX INTO LOWER TRIANGLE X TRANSPOSE *****          MATI0009
      K=1                                                                 MATI0010
      IF(N-1)10,8,9                                                       MATI0011
    8 AM(1)=1.0/AM(1)                                                     MATI0012
      GO TO 204                                                           MATI0013
C     ***** LOOP M OF A(L,M) *****                                        MATI0014
    9 DO 7 M=1,N                                                          MATI0015
      IMAX=M-1                                                            MATI0016
C     ***** LOOP L OF A(L,M) *****                                        MATI0017
      DO 6 L=M,N                                                          MATI0018
      SUMA=0.0                                                            MATI0019
      KLI=L                                                               MATI0020
      KMI=M                                                               MATI0021
      IF(IMAX)23,23,1                                                     MATI0022
C     *****SUM OVER I=1,M-1 A(L,I)*A(M,I) *****                           MATI0023
    1 DO 2 I=1,IMAX                                                       MATI0024
      SUMA=SUMA+AM(KLI)*AM(KMI)                                           MATI0025
      J=N-I                                                               MATI0026
      KLI=KLI+J                                                           MATI0027
    2 KMI=KMI+J                                                           MATI0028
C     *****TERM=C(L,M)-SUM *****                                          MATI0029
   23 TERM=AM(K)-SUMA                                                     MATI0030
      IF(L-M)3,3,5                                                        MATI0031
    3 IF(TERM)10,10,4                                                     MATI0032
C     ***** A(M,M)=SQRT(TERM) *****                                       MATI0033
    4 DENOM=SQRT (TERM)                                                   MATI0034
      AM(K)=DENOM                                                         MATI0035
      GO TO 6                                                             MATI0036
   10 NFAIL= K                                                            MATI0037
      GO TO 300                                                           MATI0038
C     ***** A(L,M)=TERM/A(M,M) *****                                      MATI0039
    5 AM(K)=TERM/DENOM                                                    MATI0040
    6 K=K+1                                                               MATI0041
    7 CONTINUE                                                            MATI0042
C                                                                         MATI0043
C     ********** SEGMENT 2 OF CHOLESKI INVERSION **********              MATI0044
C     *****INVERSION OF TRIANGULAR MATRIX*****                            MATI0045
      AM(1)=1.0/AM(1)                                                     MATI0046
      KDM=1                                                               MATI0047
C     ***** STEP L OF B(L,M) *****                                        MATI0048
      DO 104 L=2,N                                                        MATI0049
      KDM=KDM+N-L+2                                                       MATI0050
C     ***** RECIPROCAL OF DIAGONAL TERM *****                             MATI0051
      TERM = 1.0/AM(KDM)                                                  MATI0052
      AM(KDM)=TERM                                                        MATI0053
      KMI=0                                                               MATI0054
      KLI=L                                                               MATI0055
      IMAX=L-1                                                            MATI0056
C     ***** STEP M OF B(L,M) *****                                        MATI0057
      DO 103 M=1,IMAX                                                     MATI0058
      K=KLI                                                               MATI0059
C     ***** SUM TERMS *****                                               MATI0060
      SUMA=0.0                                                            MATI0061
      DO 102 I=M,IMAX                                                     MATI0062
      II=KMI+I                                                            MATI0063
```

```
      SUMA=SUMA-AM(KLI)*AM(II)                                          MATI0064
  102 KLI=KLI+N-I                                                       MATI0065
C     ***** MULT SUM * RECIP OF DIAGONAL *****                          MATI0066
      AM(K)=SUMA*TERM                                                   MATI0067
      J=N-M                                                             MATI0068
      KLI=K+J                                                           MATI0069
  103 KMI=KMI+J                                                         MATI0070
  104 CONTINUE                                                          MATI0071
C                                                                       MATI0072
C     ********** SEGMENT 3 OF CHOLESKI INVERSION **********             MATI0073
C     *****PREMULTIPLY LOWER TRIANGLE BY TRANSPOSE*****                 MATI0074
      K=1                                                               MATI0075
      DO 203 M=1,N                                                      MATI0076
      KLI=K                                                             MATI0077
      DO 202 L=M,N                                                      MATI0078
      KMI=K                                                             MATI0079
      IMAX=N-L+1                                                        MATI0080
      SUMA=0.0                                                          MATI0081
      DO 201 I=1,IMAX                                                   MATI0082
      SUMA=SUMA+AM(KLI)*AM(KMI)                                         MATI0083
      KLI=KLI+1                                                         MATI0084
  201 KMI=KMI+1                                                         MATI0085
      AM(K)=SUMA                                                        MATI0086
  202 K=K+1                                                             MATI0087
  203 CONTINUE                                                          MATI0088
  204 NFAIL=0                                                           MATI0089
  300 RETURN                                                            MATI0090
      END                                                               MATI0091

FEATURES SUPPORTED
 NONPROCESS
 ONE WORD INTEGERS

CORE REQUIREMENTS FOR MATIO
 COMMON       0  INSKEL COMMON       0  VARIABLES      18  PROGRAM     510

 END OF COMPILATION
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// FOR                                                                    UENDS001
*ONE WORD INTEGERS                                                        UENDS002
*LIST SOURCE PROGRAM                                                      UENDS003
*NON PROCESS PROGRAM                                                      UENDS004
      SUBROUTINE UENDS                                                    UENDS005
      DIMENSION TITLE(18),P( 11)          ,YO(4129),SIGYO(4096),KI( 10)   UENDS006
      DIMENSION DP( 10),SQSIG(2),AM(  55),V( 10),DC( 10),DV( 10),DD( 10)UENDS007
      DIMENSION DIAG(10),PD(10),ROW(10) ,PERR(10),KCHAN(12)               UENDS008
      DIMENSION TITST(18)                                                 UENDS009
      COMMON TITLE,P,XX,YO,SIGYO,KI,DP,SQSIG,AM,V,DC,DV,DD,DIAG,PD,ROW    UENDS010
      COMMON NC,NV,NX,ID,IW,IP,IT,NP,ISENT,NO,NM,NCY,IC,SIG,YC            UENDS011
      COMMON SQRTW,DY,WDY,DPK,PSAVE,YD,JK,ISING,II,IID,PDI,IJ,IJD,POLD    UENDS012
      COMMON SIGP,ISTOP,NT,NPCD  ,ISWI  ,PERR                             UENDS013
      COMMON KCHAN,KNUM,KCHA1 ,KCHA2 ,KPAGE                               UENDS014
      COMMON DX,TITST                                                     UENDS015
      COMMON IBEGT                                                        UENDS016
   52 FORMAT(1H1 18A4,18X,4HPAGE,I3)                                      UENDS017
   97 FORMAT(19HOCORRELATION MATRIX)                                      UENDS018
   98 FORMAT(1HOI3,10F12.7/(1H 3X,10F12.7))                               UENDS019
   99 FORMAT(' PROPAGATION OF ERRORS')                                    UENDS020
      IF(NC)10301,10301,8801                                              UENDS021
C                                                                         UENDS022
C        CALCULATE AND PUT OUT CORRELATION MATRIX                         UENDS023
 8801 WRITE(6,52) (TITLE(I),I=1,18)                                       UENDS024
      KPAGE=KPAGE+1                                                       UENDS025
      WRITE(6,97)                                                         UENDS026
      DO 9101 I=1,NV                                                      UENDS027
C                                                                         UENDS028
      DIAG(I)=1.0/SQRT (DIAG(I))                                          UENDS029
 9101 CONTINUE                                                            UENDS030
C                                                                         UENDS031
      IJ=1                                                                UENDS032
      DO 10201 I=1,NV                                                     UENDS033
C                                                                         UENDS034
      DO 9601 J=1,NV                                                      UENDS035
C                                                                         UENDS036
      ROW(J)=0.0                                                          UENDS037
 9601 CONTINUE                                                            UENDS038
C                                                                         UENDS039
      DO 10001 J=I,NV                                                     UENDS040
C                                                                         UENDS041
      ROW(J)=AM(IJ)*DIAG(I)*DIAG(J)                                       UENDS042
      AM(IJ)=ROW(J)                                                       UENDS043
      IJ=IJ+1                                                             UENDS044
10001 CONTINUE                                                            UENDS045
C                                                                         UENDS046
      WRITE (6,98)I,(ROW(J),J=1,NV)                                       UENDS047
10201 CONTINUE                                                            UENDS048
C                                                                         UENDS049
      WRITE(6,52)(TITLE(I),I=1,18),KPAGE                                  UENDS050
      KPAGE=KPAGE+1                                                       UENDS051
      WRITE(6,99)                                                         UENDS052
      IJ=1                                                                UENDS053
      DO 10200 I=1,NV                                                     UENDS054
      DO 10101 J=1,NV                                                     UENDS055
10101 ROW(J)=0.                                                           UENDS056
      DO 10102 J=I,NV                                                     UENDS057
      ROW(J)=AM(IJ)*PERR(I)*PERR(J)                                       UENDS058
      IF(I-J)10105,10104,10105                                            UENDS059
10105 ROW(J)=2.*ROW(J)                                                    UENDS060
10104 AM(IJ)=ROW(J)                                                       UENDS061
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10102 IJ=IJ+1                                                          UENDS062
10200 WRITE(6,98) I,(ROW(J),J=1,NV)                                    UENDS063
C                                                                      UENDS064
C                                                                      UENDS065
10301 CALL ENDN                                                        UENDS066
      READ(5,2)KCHA1,KCHA2,W1,W2,SIZX,SIZY,LOGX,LOGY                   UENDS067
    2 FORMAT(2I5,4F10.0,2I10)                                          UENDS068
      CALL CLOCK(IENDT)                                                UENDS069
      DELTT=IENDT-IBEGT                                                UENDS070
      DELTT=DELTT*0.06                                                 UENDS071
      WRITE(6,7) DELTT                                                 UENDS072
    7 FORMAT(1HO,'THE TIME REQUESTED BY KOLAR FOR DEALING WITH THIS SECTUENDS073
     1ION OR PSEUDOSECTION IS ',F6.0,' MINUTES')                       UENDS074
      IF(KCHA1)489,488,489                                             UENDS075
  488 RETURN                                                           UENDS076
  489 IF=1                                                             UENDS077
      WRITE(6'IF)(TITST(I),I=1,18),(TITLE(I),I=1,18),KCHA1,KCHA2,      UENDS078
     1SIZX,SIZY,W1,W2,LOGX,LOGY,XX,YO(1)                               UENDS079
      WRITE(6,490)(TITST(I),I=1,18),(TITLE(I),I=1,18),KCHA1,KCHA2,     UENDS080
     1SIZX,SIZY,W1,W2,LOGX,LOGY,XX,YO(1)                               UENDS081
  490 FORMAT(18A4/18A4/2I12/4E18.7/2I10,2E18.7)                        UENDS082
      CALL EXIT                                                        UENDS083
      END                                                              UENDS084

FEATURES SUPPORTED
 NONPROCESS
 ONE WORD INTEGERS

CORE REQUIREMENTS FOR UENDS
 COMMON  16916  INSKEL-COMMON       0  VARIABLES     20  PROGRAM     692


 END OF COMPILATION
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// FOR                                                                                                ENDN 001
*LIST SOURCE PROGRAM                                                                                  ENDN 002
*ONE WORD INTEGERS                                                                                    ENDN 003
*NONPROCESS PROGRAM                                                                                   ENDN 004
      SUBROUTINE ENDN                                                                                 ENDN 005
      DIMENSION DP( 10),SQSIG(2),AM(  55),V( 10),DC( 10),DV( 10),DD( 10)                              ENDN 006
      DIMENSION TITLE(18),P( 11)          ,YO(4129),SIGYO(4096),KI( 10)                               ENDN 007
      DIMENSION DIAG(10),PD(10),ROW(10) ,PERR(10),KCHAN(12)                                           ENDN 008
      DIMENSION TITST(18)                                                                             ENDN 009
      COMMON TITLE,P,XX,YO,SIGYO,KI,DP,SQSIG,AM,V,DC,DV,DD,DIAG,PD,ROW                                ENDN 010
      COMMON NC,NV,NX,ID,IW,IP,IT,NP,ISENT,NO,NM,NCY,IC,SIG,YC                                        ENDN 011
      COMMON SQRTW,DY,WDY,DPK,PSAVE,YD,JK,ISING,II,IID,PDI,IJ,IJD,POLD                                ENDN 012
      COMMON SIGP,ISTOP,NT,NPCD  ,ISWI  ,PERR                                                         ENDN 013
      COMMON KCHAN,KNUM,KCHA1 ,KCHA2 ,KPAGE                                                           ENDN 014
      COMMON DX,TITST                                                                                 ENDN 015
      KCHA1=KCHAN(1)                                                                                  ENDN 016
      KCHA2=KCHAN(KNUM)                                                                               ENDN 017
      KCHAT=(KCHA1-1)/128                                                                             ENDN 018
      KCHAT=KCHA1-KCHAT*128-1                                                                         ENDN 019
      KCHA1=KCHA1-KCHAT                                                                               ENDN 020
      KCHAT=KCHA2/128                                                                                 ENDN 021
      KCHAT=KCHA2-KCHAT*128                                                                           ENDN 022
      IF(KCHAT)4,4,3                                                                                  ENDN 023
    3 KCHA2=(KCHA2/128+1)*128                                                                         ENDN 024
    4 CONTINUE                                                                                        ENDN 025
      DO 10 I=KCHA1,KCHA2                                                                             ENDN 026
      SQERR =0.                                                                                       ENDN 027
      X=I-KCHAN(1)                                                                                    ENDN 028
      X=X*DX-1.                                                                                       ENDN 029
      CALL CALCN(X     ,YC,P,DC)                                                                      ENDN 030
C                                                                                                     ENDN 031
C     Y - CALCULATED STORED ON MATRIX Y - OBSERVED                                                    ENDN 032
C                                                                                                     ENDN 033
      YO(I)=YC                                                                                        ENDN 034
      J=1                                                                                             ENDN 035
      DO 9  K=1,NP                                                                                    ENDN 036
      IF (KI(K))9,9,6                                                                                 ENDN 037
    6 IF(ID)7,8,7                                                                                     ENDN 038
    8 DV(J)=DC(K)                                                                                     ENDN 039
      GO TO 11                                                                                        ENDN 040
    7 DPK= DP(K)                                                                                      ENDN 041
      IF (DPK)  12,8,12                                                                               ENDN 042
   12 PSAVE = P(K)                                                                                    ENDN 043
      P(K)=PSAVE+DPK                                                                                  ENDN 044
      CALL CALCN(X     ,YD,P,DD )                                                                     ENDN 045
      DV(J)=(YD-YC)/DPK                                                                               ENDN 046
      P(K)=PSAVE                                                                                      ENDN 047
   11 J=J+1                                                                                           ENDN 048
    9 CONTINUE                                                                                        ENDN 049
      JK=1                                                                                            ENDN 050
      DO 13 J=1,NV                                                                                    ENDN 051
      TEMP=DV(J)                                                                                      ENDN 052
      IF(TEMP)14,15,14                                                                                ENDN 053
   15 JK=JK+NV+1-J                                                                                    ENDN 054
      GOTO 13                                                                                         ENDN 055
   14 DO 16 K=J,NV                                                                                    ENDN 056
      SQERR =SQERR +AM(JK)*TEMP*DV(K)                                                                 ENDN 057
   16 JK=JK+1                                                                                         ENDN 058
   13 CONTINUE                                                                                        ENDN 059
      IF( SQERR )17,18,18                                                                             ENDN 060
   17 WRITE(6,19)                                                                                     ENDN 061
```

```
   19 FORMAT('HOSQUARE OF ERROR LESS THAN ZERO, JOB FINISHED FOR THIS REENDN 062
     1ASON'//)                                                          ENDN 063
   18 SIGYO(I)=SQRT (SQERR )                                            ENDN 064
   10 CONTINUE                                                          ENDN 065
      WRITE(6,20)(TITLE(IQZ),IQZ=1,18),KPAGE                            ENDN 066
   20 FORMAT(1H1,18A4,18X,4HPAGE,I3)                                    ENDN 067
      WRITE(6,21)                                                       ENDN 068
   210FORMAT(55HOLISTING OF THE ERRORS OF Y-CALCULATED FOR ALL CHANNELS ENDN 069
     1//)                                                               ENDN 070
      KCHA3=KCHA2-9                                                     ENDN 071
      K=1                                                               ENDN 072
      DO 23 J=KCHA1,KCHA3,10                                            ENDN 073
      JE=J+9                                                            ENDN 074
      WRITE(6,22)              J,( SIGYO (I),I=J,JE)                    ENDN 075
      IF(((K-55)/55)*55-K+55) 33,24,33                                  ENDN 076
   24 WRITE(6,20)(TITLE(IQZ),IQZ=1,18),KPAGE                            ENDN 077
         KPAGE=KPAGE+1                                                  ENDN 078
      WRITE(6,21)                                                       ENDN 079
   33 K=K+1                                                             ENDN 080
   23 CONTINUE                                                          ENDN 081
   22 FORMAT ( I5,10F12.4                                               ENDN 082
      IF(JE-KCHA2)91,92,91                                              ENDN 083
   91 J=JE+1                                                            ENDN 084
      WRITE (6,22)             J,( SIGYO(I),I=J,KCHA2 )                 ENDN 085
   92 IF(KNUM - 2 ) 94,94,95                                            ENDN 086
   95 WRITE(6,20)(TITLE(IQZ),IQZ=1,18),KPAGE                            ENDN 087
         KPAGE=KPAGE+1                                                  ENDN 088
      WRITE(6,93)                                                       ENDN 089
   930FORMAT (49 HOLISTING OF Y-CALCULATED IN   ZONES CANCELLED OUT  /  ENDN 090
     1    /  60HO   Y(OBS)   Y(CALC)   OBS-CALC  SIG(O)   (O-C)/SIG(O) ENDN 091
     2X(I)/1H )                                                         ENDN 092
      KNUM1=KNUM-1                                                      ENDN 093
      K=1                                                               ENDN 094
      DO 98 J=2,KNUM1,2                                                 ENDN 095
      JJ1=KCHAN(J)                                                      ENDN 096
      JJ2=KCHAN(J+1)                                                    ENDN 097
      DO 96 JJ=JJ1,JJ2                                                  ENDN 098
      X=JJ-KCHAN(1)                                                     ENDN 099
      X=X*DX-1.                                                         ENDN 100
      XX=JJ                                                             ENDN 101
      WRITE(6,97)YO(JJ),X   ,XX                                         ENDN 102
      IF(((K-55)/55)*55-K+55) 41,42,41                                  ENDN 103
   42 WRITE(6,20)(TITLE(IQZ),IQZ=1,18),KPAGE                            ENDN 104
         KPAGE=KPAGE+1                                                  ENDN 105
      WRITE(6,93)                                                       ENDN 106
   41 K=K+1                                                             ENDN 107
   96 CONTINUE                                                          ENDN 108
   97 FORMAT ( 10X,F10.0,30X, F10.4,F10.0)                              ENDN 109
   98 WRITE(6,99)                                                       ENDN 110
   99 FORMAT(1HO)                                                       ENDN 111
C           OUT  SMOOTHED   SPECTRUM SAVED FOR USE IN CAUM AND SITRA    ENDN 112
   94 IC=KCHA1-(KCHA1/128)*128                                          ENDN 113
      IF(IC-1)30,35,30                                                  ENDN 114
   30 WRITE(6,31)                                                       ENDN 115
   31 FORMAT(1HO,'ERROR DETECTED IN ENDN *** KCHA1-1 IS NOT A MULTIPLE OENDN 116
     1F 128')                                                           ENDN 117
      CALL EXIT                                                         ENDN 118
   35 IC=KCHA1/128+1                                                    ENDN 119
      I9=IC                                                             ENDN 120
      WRITE(3'IC)     (YO(I),I=KCHA1,KCHA2)                             ENDN 121
      WRITE(9'I9)(SIGYO(I),I=KCHA1,KCHA2)                               ENDN 122
```

```
      RETURN                                                    ENDN 123
      END                                                       ENDN 124

FEATURES SUPPORTED
 NONPROCESS
 ONE WORD INTEGERS

CORE REQUIREMENTS FOR ENDN
 COMMON  16914  INSKEL COMMON       0  VARIABLES      20  PROGRAM    1002

 END OF COMPILATION
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```
// FOR                                                                    CALCN002
*LIST SOURCE PROGRAM                                                      CALCN003
*NONPROCESS PROGRAM                                                       CALCN004
*ONE WORD INTEGERS                                                        CALCN005
      SUBROUTINE CALCN(X,Y,P,D)                                           CALCN006
      DIMENSION P(11),D(10)                                               CALCN007
C                                                                         CALCN008
C                    LEGENDRE    POLYNOMS                                 CALCN009
C                                                                         CALCN010
    2 D(1)=1.                                                             CALCN011
      D(2)=X                                                              CALCN012
C           MAX  NO.  OF  P(I)  = 10    THEIR NO. IS GIVEN IN P(11)       CALCN013
      K=P(11)-2.                                                          CALCN014
      Y=P(1)+P(2)*X                                                       CALCN015
      DO  10  N=1,K                                                       CALCN016
      FN=N                                                                CALCN017
      D(N+2)=(1./(FN+1.))*((2.*FN+1.)*X*D(N+1)-FN*                        CALCN018
     1D(N))                                                               CALCN019
   10 Y=Y+D(N+2)*P(N+2)                                                   CALCN020
      RETURN                                                              CALCN021
      END                                                                 CALCN022

FEATURES SUPPORTED
 NONPROCESS
 ONE WORD INTEGERS

CORE REQUIREMENTS FOR CALCN
 COMMON       0  INSKEL COMMON       0  VARIABLES      12  PROGRAM     138


 END OF COMPILATION
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```
// JOB    X          X                                                                    CAOM 001
// FOR CAOM                                                                              CAOM 002
*IOCS(CARD,1443PRINTER,DISK)                                                             CAOM 003
*LIST SOURCE PROGRAM                                                                     CAOM 004
*ONE WORD INTEGERS                                                                       CAOM 005
*NONPROCESS PROGRAM                                                                      CAOM 006
C       CAOM                                                                             CAOM 007
        EXTERNAL CALCF                                                                   CAOM 008
        DEFINE FILE 2(32,256,U,IB)                                                       CAOM 009
        DEFINE FILE 3(32,256,U,IC)                                                       CAOM 010
        DEFINE FILE 6(1,88,U,IF)                                                         CAOM 011
        DIMENSION EBCX(3),EBCY(2)                                                        CAOM 012
        COMMON YO(4096),TITLE(18),TITST(18)                                              CAOM 013
        DATA EBCX/' NO.','NEL ','CHAN'/,EBCY/'NTS ',' COU'/                              CAOM 014
        IF=1                                                                             CAOM 015
        READ (6'IF)(TITST(I),I=1,18),(TITLE(I),I=1,18),KCHA1,KCHA2,                      CAOM 016
      1SIZX,SIZY,W1,W2,LOGX,LOGY,XX,YO(1)                                                CAOM 017
        WRITE(6,12)SIZX,SIZY,W1,W2,LOGX,LOGY                                             CAOM 018
   120FORMAT(7HOSIZX = F10.2,3H CM, 5X,6HSIZY = F10.2,3H CM,5X,7HH-MAX =                 CAOM 019
        1 F10.2,5X, 7HH-MIN = F10.2/7HOLOGX = I2,5X,6HLOGY = I2)                         CAOM 020
        IB=KCHA1/128+1                                                                   CAOM 021
        IC=KCHA1/128+1                                                                   CAOM 022
C READ UNSMOOTHED        AND  SMOOTHED   OUT  SPECTRA                                    CAOM 023
        READ(2'IB)(  YO(I),I=KCHA1,KCHA2)                                                CAOM 024
        WRITE(6,13)(TITLE(I),I=1,18)                                                     CAOM 025
    13  FORMAT(' PLOTTING THE UNSMOOTHED SPECTRUM * * *'//18A4//)                        CAOM 026
        DO 11 I=  1,4096                                                                 CAOM 027
        IF(YO(I)-W1)8,8,9                                                                CAOM 028
     9  YO(I)=W1                                                                         CAOM 029
     8  IF(YO(I)-W2)10,11,11                                                             CAOM 030
    10  YO(I)=W2                                                                         CAOM 031
    11  CONTINUE                                                                         CAOM 032
        WRITE(6,21)                                                                      CAOM 033
    21  FORMAT(1HO,'STEP 1')                                                             CAOM 034
        CALL FINIM (0.,2.)                                                               CAOM 035
        WRITE(6,22)                                                                      CAOM 036
    22  FORMAT(1HO,'STEP 2')                                                             CAOM 037
        J=KCHA2 -KCHA1 +1                                                                CAOM 038
        CALL DESLF(X,YO(KCHA1),J  ,1,1,1,0,0,SIZX,SIZY,LOGX,LOGY,1,0,                    CAOM 039
      1EBCX(3),-12,EBCY(2),8,0,CALCF)                                                    CAOM 040
        WRITE(6,23)                                                                      CAOM 041
    23  FORMAT(1HO,'STEP 3')                                                             CAOM 042
        CALL FINIM(0,0)                                                                  CAOM 043
        SIZY=-SIZY                                                                       CAOM 044
                                                                                         CAOM 045
        READ(3'IC)(YO(I),I=KCHA1,KCHA2)                                                  CAOM 046
        WRITE(6,3)(TITLE(I),I=1,18)                                                      CAOM 047
     3  FORMAT(' PLOTTING THE SMOOTHED SPECTRUM * * *'//18A4//)                          CAOM 048
        DO 7 I=KCHA1,KCHA2                                                               CAOM 049
        IF(YO(I)-W1)4,4,5                                                                CAOM 050
     5  YO(I)=W1                                                                         CAOM 051
     4  IF(YO(I)-W2)6,7,7                                                                CAOM 052
     6  YO(I)=W2                                                                         CAOM 053
     7  CONTINUE                                                                         CAOM 054
        WRITE(6,24)                                                                      CAOM 055
    24  FORMAT(1HO,'STEP 4')                                                             CAOM 056
        I=KCHA2 -KCHA1 +1                                                                CAOM 057
        CALL DESLF  (X          ,YO( KCHA1 ),I,1,1,1,0,0,SIZX,SIZY,LOGX,                 CAOM 058
      1LOGY,1,0,EBCX(3),-12,EBCY(2),8,0,CALCF)                                           CAOM 059
        WRITE(6,25)                                                                      CAOM 060
    25  FORMAT(1HO,'STEP 5')                                                             CAOM 061
        SIZY=-SIZY+4.                                                                    CAOM 062
        CALL FINIM (0,SIZY)                                                              CAOM 063
```

```
      CALL FINTR                                                        CAOM 064
      WRITE(6,26)                                                       CAOM 065
   26 FORMAT(1H0,'STEP 6')                                              CAOM 066
      CALL EXIT                                                         CAOM 067
      END                                                               CAOM 068

FEATURES SUPPORTED
 NONPROCESS
 ONE WORD INTEGERS
 IOCS

CORE REQUIREMENTS FOR CAOM
 COMMON    8264  INSKEL COMMON       0  VARIABLES      54  PROGRAM      636

 END OF COMPILATION
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```
// FOR CALCF                                                          CALCF001
*LIST SOURCE PROGRAM                                                  CALCF002
*NON PROCESS PROGRAM                                                  CALCF003
*ONE WORD INTEGERS                                                    CALCF004
      SUBROUTINE CALCF(X,NI,IF)                                       CALCF005
      X=NI                                                            CALCF006
      RETURN                                                          CALCF007
      END                                                             CALCF008

FEATURES SUPPORTED
 NONPROCESS
 ONE WORD INTEGERS

CORE REQUIREMENTS FOR CALCF
 COMMON       0  INSKEL COMMON       0  VARIABLES       0  PROGRAM      16

 END OF COMPILATION
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// JOB    X          X                                                    SITRA001
// FOR SITRA                                                              SITRA002
*IOCS(CARD,1443PRINTER,DISK)                                             SITRA003
*ONE WORD INTEGERS                                                       SITRA004
*NON PROCESS PROGRAM                                                     SITRA005
*LIST SOURCE PROGRAM                                                     SITRA006
CT5     LINAC EXPERIMENTS       TRANSMISSION AND SIGMA-TOTAL             SITRA007
      DEFINE FILE 1(32,256,U,IA)                                         SITRA008
      DEFINE FILE 3(32,256,U,IC)                                         SITRA009
      DEFINE FILE 4(32,256,U,ID)                                         SITRA010
      DEFINE FILE 7(32,256,U,IW)                                         SITRA011
      DEFINE FILE 8(1,98,U,IG)                                           SITRA012
      DEFINE FILE 9(32,256,U,IE)                                         SITRA013
      DEFINE FILE10(32,256,U,IV)                                         SITRA014
      DEFINE FILE 11(32,256,U,IZ)                                        SITRA015
      DIMENSION A(20),W(8),KK(8)                                         SITRA016
      COMMON    TITLE(18),TITL1(18),TITL2(18),CIN(1024),DCIN(1024),      SITRA017
     1                                        COUT(1024),DCOUT(1024)     SITRA018
C                                                                        SITRA019
      CALL CLOCK(IBEGT)                                                  SITRA020
      KPAGE=1                                                            SITRA021
C      *  *  DEFINE  L , THE  INDEX  OF  ACCORDEON  SECTION              SITRA022
      L=1                                                                SITRA023
C    *  *  *  DEFINE  THE  AIDS  FOR  HANDLING DISK  FILES              SITRA024
      IV=1                                                               SITRA025
      IW=1                                                               SITRA026
      IG=1                                                               SITRA027
      IZ=1                                                               SITRA028
                                                                         SITRA029
                                                                         SITRA030
C      RESTART  FROM  HERE  FOR  EACH  SECTION OF  ACCORDEON             SITRA031
 1111 READ(5,60)(TITLE(I),I=1,18),ITITL,ITOT                            SITRA032
   60 FORMAT (18A4,2I4)                                                  SITRA033
      IF(ITITL) 999,899,488                                              SITRA034
  488 WRITE(6,1)(TITLE(I),I=1,18),KPAGE                                  SITRA035
    1 FORMAT (1H1//1X, 18A4, 30X,4HPAGE I3//)                            SITRA036
      KA=ITITL                                                           SITRA037
      KB=ITOT                                                            SITRA038
      K2=ITOT                                                            SITRA039
      KK(L)=ITOT                                                         SITRA040
      NA=(KA-1)/1024+1                                                   SITRA041
      NB=(KB-1)/1024+1                                                   SITRA042
      ND=NB-NA                                                           SITRA043
      ITIT=0                                                             SITRA044
      IA=KA/128+1                                                        SITRA045
      ID=KA/128+1                                                        SITRA046
      IC=KA/128+1                                                        SITRA047
      IE=KA/128+1                                                        SITRA048
      WRITE(6,2)                                                         SITRA049
    2 FORMAT( 38HODISK WITH SPECTRUM-IN IDENTIFIED BY 1)                 SITRA050
      WRITE(6,61)                                                        SITRA051
   61 FORMAT(' DISK WITH BACKGROUND SMOOTHED BY LEAST SQUARE FIT         SITRA052
     1 IDENTIFIED BY  3')                                                SITRA053
                                                                         SITRA054
                                                                         SITRA055
      DO 590 LI=1,4                                                      SITRA056
C    *  *  *  THE  PARTITIONS  OF ACCORD. SECTIONS FOR  READING         SITRA057
C      PORTIONS OF THE SPECTRA  WHICH CAN FIND ROOM IN THE MEMORY  *  *  SITRA058
      KCHA1=KA                                                           SITRA059
      KCHA2=KB                                                           SITRA060
      IF(NA-LI)502,501,590                                               SITRA061
C CASE OF NA=LI  * * * NO PRECEDING SMOOTHED SPECTRUM TO BE SKIPPED      SITRA062
                                                                         SITRA063
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  501 KCHA1=KCHA1-1024*(LI-1)                                                    SITRA064
      IF(ND)999,511,512                                                          SITRA065
  511 KCHA2=KCHA2-1024*(LI-1)                                                    SITRA066
      GO TO 799                                                                  SITRA067
  512 KCHA2=1024                                                                 SITRA068
      GO TO 799                                                                  SITRA069
C CASE OF NA LESS THAN NB * * * PRECEEDING PARTS OF SMOOTHED SPECTRUM            SITRA070
C     TO BE SKIPPED EXIST                                                        SITRA071
  502 IF(NB-LI)888,503,504                                                       SITRA072
  503 KCHA2=KCHA2-1024*(LI-1)                                                    SITRA073
      GO TO 505                                                                  SITRA074
  504 KCHA2=1024                                                                 SITRA075
  505 KCHA1=1                                                                    SITRA076
  799 WRITE(6,4)KCHA1,KCHA2                                                      SITRA077
    4 FORMAT(1H0,'PORTION DEALT WITH BEGINNING WITH CHANNEL',I5,2X,              SITRA078
     1'UNTIL CHANNEL',I5,'  ONLY RELATIVE INDICES'///)                          SITRA079
      READ(1'IA)( CIN (I),I=KCHA1,KCHA2)                                        SITRA080
      READ(4'ID) (DCIN (I),I=KCHA1,KCHA2)                                       SITRA081
      READ(3'IC) (COUT(I),I=KCHA1,KCHA2)                                        SITRA082
      READ(9'IE)(DCOUT(I),I=KCHA1,KCHA2)                                        SITRA083
      IF(ITIT)999,850,800                                                       SITRA084
                                                                                SITRA085
                                                                                SITRA086
  850 ITIT=1                                                                    SITRA087
      READ(5,3)C1,C2,C3,S,C,DS,DC,BO,DBO,RHOSC,KZQ,DIST,DELAY,WDH,THICK         SITRA088
    3 FORMAT(3F10.0,2E10.6,2F10.0/3F10.0,I5,5X,3F10.0/F10.0)                    SITRA089
      WRITE              (6, 72) DIST, DELAY, WDH       ,THICK                  SITRA090
  720FORMAT(15  HOFLIGHT PATH = F10.2,7H METERS/9H DELAY = E11.5,10H MI         SITRA091
     1CROSEC./17H CHANNEL WIDTH = ,E11.5, 10H MICROSEC./                  12    SITRA092
     2H THICKNESS = E12.5,8H AT/BARN    )                                       SITRA093
      WRITE(6,32)C1,C2,C3                                                       SITRA094
  320FORMAT (57HOTRANSMISSION TO BE COMPUTED AFTER THE FOLLOWING FORMUL         SITRA095
     1A //10X,41HT = K1 ( C    - K2 * B )/( C     - K3 * B )/20X,2HIN,          SITRA096
     2                                                  15X,3HOUT//10X          SITRA097
     3,10HWITH K1 = , F10.4,5X, 5HK2 = ,F10.4,5X,5HK3 =   F10.4//)              SITRA098
     4                                                                          SITRA099
      WRITE              (6,33)S,C,BO                                          SITRA100
  330FORMAT (54HOBACKGROUND) WAS COMPUTED AFTER THE FOLLOWING FORMULA           SITRA101
     1/10X,27HB(I) = S * EXPF(C * I) + BO//10X, 9HWITH S = E20.4,5X,            SITRA102
     24HC = ,E14.6,5                                                            SITRA103
     3X,19HI = CHANNEL NUMBER ,5X, 4HBO = F10.4)                                SITRA104
      WRITE              (6,34)DS,DC,RHOSC     ,DBO                           SITRA105
  340FORMAT (27HOSTANDARD DEVIATION OF S = F10.4/27HOSTANDARD DEVIATIONSITRA106
     1 OF K = F10.4/33HOCORRELATION FACTOR OF S AND K = F10.4/28HOSTANDASITRA107
     2RD DEVIATION OF BO =  F10.4)                                              SITRA108
      READ            (5,5)SIZXT,SIZYT,TMAX,TMIN,LOGET,LOGT,IPNCH               SITRA109
    5 FORMAT( 4F 10.0,8I5)                                                      SITRA110
      WRITE              (6,6)SIZXT,SIZYT,TMAX,TMIN                            SITRA111
   60FORMAT (1H0/1X, 55HINPUT DATA FOR PLOTTING THE TRANSMISSION AGAINSSITRA112
     1T ENERGY/10X, 25HLENGTH OF ENERGY-AXIS IS F10.4/10X, 31 HLENGTH OFSITRA113
     2 TRANSMISSION-AXIS IS F10.4/10X, 52 HUPPER LIMIT OF TRANSMISSION-VSITRA114
     3ALUES TO BE PLOTTED IS F10.4/10X,52HLOWER LIMIT OF TRANSMISSION-VASITRA115
     4LUES TO BE PLOTTED IS F10.4)                                              SITRA116
      IF(LOGT) 9,10,11                                                          SITRA117
    9 WRITE(6,12)                                                               SITRA118
   12 FORMAT (1H0// 1X,28 HERROR IN INPUT DATA  - EXIT.)                        SITRA119
      CALL EXIT                                                                 SITRA120
   10 WRITE(6,13)                                                               SITRA121
   13 FORMAT (36 HOTRANSMISSION-AXIS IS PLOTTED LINEAR)                         SITRA122
      GO TO 14                                                                  SITRA123
   11 WRITE(6,71)                                                               SITRA124
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   71  FORMAT ( 41 HOTRANSMISSION-AXIS IS PLOTTED LOGARITHMIC )          SITRA125
   14 IF(LOGET) 9,15,17                                                  SITRA126
   15 WRITE(6,16)                                                        SITRA127
   16 FORMAT ( 51HOENERGY-AXIS IN TRANSMISSION-PLOT IS PLOTTED LINEAR    SITRA128
     9)                                                                  SITRA129
      GO TO 18                                                           SITRA130
   17 WRITE(6,19)                                                        SITRA131
  190FORMAT (56  HOENERGY-AXIS IN TRANSMISSION-PLOT IS PLOTTED LOGARITHSITRA132
     1MIC)                                                               SITRA133
   18 READ           (5,5)SIZXS,SIZYS,SMAX,SMIN,LOGES,LOGS               SITRA134
      WRITE            (6,20) SIZXS,SIZYS,SMAX,SMIN                     SITRA135
  200FORMAT (1HO/1X, 56HINPUT DATA FOR PLOTTING OF SIGMA-OBSERVED AGAINSITRA136
     1ST ENERGY/10X,25HLENGTH OF ENERGY-AXIS IS F10.4/10X,24HLENGTH O F SITRA137
     2SIGMA-AXIS IS F10.4/10X, 45HUPPER LIMIT OF SIGMA-VALUES TO BE PLOTSITRA138
     3TED IS F 10.4/10X,45 HLOWER LIMIT OF SIGMA-VALUES TO BE PLOTTED ISSITRA139
     4 F10.4)                                                            SITRA140
      IF(LOGS) 9, 21, 22                                                 SITRA141
   21 WRITE(6,81)                                                        SITRA142
   81 FORMAT (29 HOSIGMA-AXIS IS PLOTTED LINEAR)                         SITRA143
      GO TO 24                                                           SITRA144
   22 WRITE(6,25)                                                        SITRA145
   25 FORMAT (34 HOSIGMA-AXIS IS PLOTTED LOGARITHMIC )                   SITRA146
   24 IF(LOGES) 9, 26, 27                                                SITRA147
   26 WRITE(6,28)                                                        SITRA148
   28 FORMAT (45 HOENERGY-AXIS IN SIGMA-OBSERVED PLOT IS LINEAR)         SITRA149
      GO TO 1010                                                         SITRA150
   27 WRITE(6,30)                                                        SITRA151
   30 FORMAT(50HOENERGY-AXIS IN SIGMA-OBSERVED PLOT IS LOGARITHMIC)      SITRA152
                                                                         SITRA153
 1010 SS=S*S                                                             SITRA154
      DDS=DS*DS                                                          SITRA155
      DDC=DC*DC                                                          SITRA156
      DCS2    = 2.*S*DS*DC*RHOSC                                         SITRA157
      VI=72.3 * DIST                                                     SITRA158
      VI=VI*VI                                                           SITRA159
      KPAGE= 2                                                           SITRA160
                                                                         SITRA161
      IF(L-1)999,489,499                                                 SITRA162
  489 K1=ITITL                                                           SITRA163
      KO= ITITL                                                          SITRA164
      KOO=KO -1                                                          SITRA165
      DELAA=DELAY                                                        SITRA166
  499 W(L)=WDH                                                           SITRA167
                                                                         SITRA168
                                                                         SITRA169
  800 DO 100 I= KCHA1,  KCHA2                                            SITRA170
C   JI, FI   IS   THE  ABSOLUTE  INDEX  OF  THE  CHANNEL                 SITRA171
      JI=I+(LI-1)*1024                                                   SITRA172
      FI=JI                                                              SITRA173
      A3=EXP (C*FI)                                                      SITRA174
      B        = S*A3+BO                                                 SITRA175
      DB=SQRT (A3*A3*(    DDS+SS *FI *FI *DDC + DCS2  *FI) +DBO*DBO)     SITRA176
      FI=JI-KOO-1                                                        SITRA177
C    NOW FI IS THE RELATIVE INDEX REQUIRED FOR EVALUATING THE ENERGY     SITRA178
      IF ((I-KCHA1 )/50* 50-I +KCHA1 ) 101,102,101                       SITRA179
  102 WRITE(6,1)(TITLE(IBZ),IBZ=1,18),KPAGE                              SITRA180
      KPAGE =KPAGE +1                                                    SITRA181
      WRITE(6,103)                                                       SITRA182
 1030FORMAT(4X,1HC,7X,2HDC,6X,1HC,6X,2HDC,9X,1HB,8X,2HDB,6X,12HTRANSMISSITRA183
     1SION,3X,12HD-TRANSMISS.,4X, 10HSIGMA-OBS.,4X,12HD-SIGMA-OBS.,4X,6HSITRA184
     2E (EV),4X,5HCHAN./5X,2HIN,7X,2HIN,5X,3HOUT,5X,3HOUT//)             SITRA185
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  101 EA=DELAY+FI*WDH                                                    SITRA186
      EE=VI/(EA*EA)                                                      SITRA187
      A1= COUT(I)-C3*B                                                   SITRA188
      IF(ABS (A1)-0.1E-20) 110, 110, 111                                 SITRA189
  110 WRITE              (6, 131)CIN(I),DCIN(I),COUT(I),DCOUT           SITRA190
     1(I),B,DB,EE,I                                                      SITRA191
  131 FORMAT (1X, 2(F8.0,F8.1), 2F10.3, 4(5X,4H****,5X),                 SITRA192
     1E14.5,I7)                                                          SITRA193
      DCOUT(I)=SMIN                                                      SITRA194
      DCIN(I)= TMAX                                                      SITRA195
      COUT(I)=0                                                          SITRA196
      CIN(I)=EE                                                          SITRA197
      GO TO 100                                                          SITRA198
  111 A2= CIN(I) - C2* B                                                 SITRA199
      T = C1*A2/A1                                                       SITRA200
      DTCIN= C1/A1                                                       SITRA201
      DTCOU = -T/A1                                                      SITRA202
      DTB=C1* (A2* C3-A1*C2) /(A1*A1)                                    SITRA203
      DT1=DTCIN*DCIN(I)                                                  SITRA204
      DT2=DTCOU*DCOUT(I)                                                 SITRA205
      DT3=DTB*DB                                                         SITRA206
      DT=SQRT(DT1*DT1+DT2*DT2+DT3*DT3)                                   SITRA207
      IF(T) 120,120,125                                                  SITRA208
 1200WRITE              (6,132)CIN(I),DCIN(I),COUT(I),DCOUT  (I),B,DB,T,DSITRA209
     1T,EE,JI                                                            SITRA210
 1320FORMAT (1X, 2(F8.0,F8.1),2F10.3,2E14.4,2(5X,4H**** ,5X),E14.5, I7)SITRA211
      DCIN(I)=1.                                                         SITRA212
      DCOUT(I)=SMAX                                                      SITRA213
      COUT(I)=0                                                          SITRA214
      CIN(I)=EE                                                          SITRA215
      GO TO 100                                                          SITRA216
  125 SIGMA=-ALOG (T)/THICK                                              SITRA217
      DSIGM = DT/T/THICK                                                 SITRA218
     0WRITE              (6, 130)CIN(I),DCIN(I),COUT(I),DCOUT (I),B,DB,T,DSITRA219
     1T,SIGMA,DSIGM ,EE,JI                                               SITRA220
  130 FORMAT (1X, 2(F8.0,F8.1), 2F10.3, 4E14.4,E14.5,I7)                 SITRA221
C                                                                        SITRA222
C     ENERGY STORED IN  CIN                                              SITRA223
C     DELTA SIGMA STORED IN COUT                                         SITRA224
C     SIGMA STORED ON DCOUT                                              SITRA225
C     TRANSMISSION STORED ON DCIN                                        SITRA226
C                                                                        SITRA227
      CIN(I)=EE                                                          SITRA228
      COUT(I)=DSIGM                                                      SITRA229
      DCOUT(I)=SIGMA                                                     SITRA230
      DCIN(I)= T                                                         SITRA231
  100 CONTINUE                                                           SITRA232
                                                                         SITRA233
      DO  200 I=KCHA1, KCHA2                                             SITRA234
      IF(DCIN(I)-TMAX) 140,140,150                                       SITRA235
  150 DCIN(I)=TMAX                                                       SITRA236
  140 IF(DCIN(I)-TMIN) 180,190,190                                       SITRA237
  180 DCIN(I)=TMIN                                                       SITRA238
  190 IF(DCOUT(I)-SMAX) 210,210,220                                      SITRA239
  220 DCOUT(I)= SMAX                                                     SITRA240
  210 IF(DCOUT(I)-SMIN) 240,200,200                                      SITRA241
  240 DCOUT(I)= SMIN                                                     SITRA242
  200 CONTINUE                                                           SITRA243
                                                                         SITRA244
C        KCHAN(1)-1   AND  KCHAN(KNUM)  ARE  EITHER  ZERO   OR  MULTIPLESITRA245
C     OF 128                                                             SITRA246
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      N2=KCHA1-1                                                                SITRA247
      DO 808 JI=KCHA1,KCHA2,128                                                 SITRA248
      N1=N2+1                                                                   SITRA249
      N2=N2+128                                                                 SITRA250
      WRITE(7'IW)(DCIN (I),I=N1,N2)                                             SITRA251
      WRITE(10'IV)(DCOUT(I),I=N1,N2)                                            SITRA252
      WRITE(11'IZ)(COUT(I),I=N1,N2)                                             SITRA253
  808 CONTINUE                                                                  SITRA254
  590 CONTINUE                                                                  SITRA255
                                                                                SITRA256
                                                                                SITRA257
  888 LM=L                                                                      SITRA258
      KOO=KK(L)                                                                 SITRA259
      L=L+1                                                                     SITRA260
      GO TO 1111                                                                SITRA261
C                                                                               SITRA262
C     GO BACK TO 1111 FOR EACH SECTION  OF ACCORDEON                            SITRA263
                                                                                SITRA264
                                                                                SITRA265
                                                                                SITRA266
  899 WRITE(8'IG) (TITLE(I),I=1,18),(TITL1(I),I=1,3),(TITL2(I),I=1,3),          SITRA267
     1KO,LM,LOGET,LOGT,LOGES,LOGS,(KK(L),L=1,8),                                SITRA268
     2              SIZXT,SIZYT,SIZXS,SIZYS,TMAX,TMIN,SMAX,SMIN,                SITRA269
     3             VI,DELAA,(W(L),L=1,8)                                        SITRA270
      WRITE(6,660)(TITLE(I),I=1,18),(TITL1(I),I=1,3),(TITL2 (I),I=1,3),         SITRA271
     1KO,LM,LOGET,LOGT,LOGES,LOGS,(KK(L),L=1,8),                                SITRA272
     2              SIZXT,SIZYT,SIZXS,SIZYS,TMAX,TMIN,SMAX,SMIN,                SITRA273
     3             VI,DELAA,(W(L),L=1,8)                                        SITRA274
  660 FORMAT(18A4/3A4/3A4/14I10/(6F16.7))                                       SITRA275
                                                                                SITRA276
      KCHA1=KO                                                                  SITRA277
      KPUNC=1                                                                   SITRA278
      IW=1                                                                      SITRA279
      IV=1                                                                      SITRA280
      IZ=1                                                                      SITRA281
      IF(IPNCH-1)  99,1000,1003                                                 SITRA282
                                                                                SITRA283
                                                                                SITRA284
C                                                                               SITRA285
 1003 DO 901 LI=1,LM                                                            SITRA286
      KCHA2=KK(LI)                                                              SITRA287
      NA=(KCHA1-1)/1024                                                         SITRA288
      NB=(KCHA2-1)/1024                                                         SITRA289
      KA=KCHA1-NA*1024                                                          SITRA290
      ND=NB-NA                                                                  SITRA291
                                                                                SITRA292
 1079 IF(ND)9999,1080,1081                                                      SITRA293
 1080 KB=KCHA2-NB*1024                                                          SITRA294
      GO TO 1083                                                                SITRA295
 1081 KB=1024                                                                   SITRA296
 1083 READ(7'IW)(DCIN(I),I=KA,KB)                                               SITRA297
      DO 1004 I=KA,KB,8                                                         SITRA298
      II=I+7                                                                    SITRA299
      JJ=II+NA*1024                                                             SITRA300
      READ(5,1011) A                                                            SITRA301
 1011 FORMAT(20A4)                                                              SITRA302
      CALL CARDT(A,J)                                                           SITRA303
      IF(J-2)1005,777,777                                                       SITRA304
  777 WRITE(6,666)                                                              SITRA305
      PAUSE                                                                     SITRA306
                                                                                SITRA307
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 1005 WRITE(5,1006)(DCIN(III),III=I,II),JJ,KPUNC                        SITRA308
 1006 FORMAT(8F9.7,2I4)                                                 SITRA309
      KPUNC=KPUNC+1                                                     SITRA310
 1004 CONTINUE                                                          SITRA311
      IF(ND)9999,1091,1090                                              SITRA312
 1090 ND=ND-1                                                           SITRA313
      KA=1                                                              SITRA314
      NA=NA+1                                                           SITRA315
      GO TO 1079                                                        SITRA316
                                                                        SITRA317
 1091 CONTINUE                                                          SITRA318
      KCHA1=KK(LI)+1                                                    SITRA319
  901 CONTINUE                                                          SITRA320
      GO TO 99                                                          SITRA321
                                                                        SITRA322
C                                                                       SITRA323
 1000 CONTINUE                                                          SITRA324
      KOO=KO-1                                                          SITRA325
      DELAY=DELAA                                                       SITRA326
                                                                        SITRA327
      DO 900 LI=1,LM                                                    SITRA328
      KCHA2=KK(LI)                                                      SITRA329
      NA=(KCHA1-1)/1024                                                 SITRA330
      NB=(KCHA2-1)/1024                                                 SITRA331
      KA=KCHA1-NA*1024                                                  SITRA332
      ND=NB-NA                                                          SITRA333
                                                                        SITRA334
 1179 IF(ND)9999,1180,1181                                              SITRA335
 1180 KB=KCHA2-NB*1024                                                  SITRA336
      GO TO 1183                                                        SITRA337
 1181 KB=1024                                                           SITRA338
 1183 READ(10'IV)(DCOUT(I),I=KA,KB)                                     SITRA339
      READ(11'IZ)( COUT(I),I=KA,KB)                                     SITRA340
      DO 1104 I=KA,KB                                                   SITRA341
      II=I+NA*1024                                                      SITRA342
C   FI   IS  THE  RELATIVE  CHANNEL  INDEX                              SITRA343
      FI=II-KOO-1                                                       SITRA344
      EA=DELAY+FI*W(LI)                                                 SITRA345
      EE=VI/(EA*EA)                                                     SITRA346
      READ(5,1011) A                                                    SITRA347
      CALL CARDT(A,J)                                                   SITRA348
      IF(J-2)1012,771,771                                               SITRA349
  771 WRITE(6,666)                                                      SITRA350
  666 FORMAT(1HO,'INSERT CARDS TO BE PUNCHED'//////)                    SITRA351
      PAUSE                                                             SITRA352
 1012 WRITE(5,1001) EE    ,DCOUT(I),COUT(I),II                         SITRA353
 1001 FORMAT(3E15.4,25X,I10)                                            SITRA354
 1104 CONTINUE                                                          SITRA355
      IF(ND)9999,1191,1190                                              SITRA356
 1190 ND=ND-1                                                           SITRA357
      KA=1                                                              SITRA358
      NA=NA+1                                                           SITRA359
      GO TO 1179                                                        SITRA360
                                                                        SITRA361
 1191 CONTINUE                                                          SITRA362
      DELAY=EA+W(LI)                                                    SITRA363
      KOO=KK(LI)                                                        SITRA364
      KCHA1=KK(LI)+1                                                    SITRA365
  900 CONTINUE                                                          SITRA366
                                                                        SITRA367
                                                                        SITRA368
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      99 CALL CLOCK(IENDT)                                                                  SITRA369
         DELTT=IENDT-IBEGT                                                                  SITRA370
         DELTT=DELTT*0.06                                                                   SITRA371
         WRITE(6,7) DELTT                                                                   SITRA372
       7 FORMAT(1H0,'THE TIME REQUESTED FOR RUNNING SITRA IN MINUTES IS',                   SITRA373
        1F6.0)                                                                              SITRA374
         CALL EXIT                                                                          SITRA375
     999 WRITE(6,1199)                                                                      SITRA376
    9999 WRITE(6,1199)                                                                      SITRA377
    1199 FORMAT(' ERROR IN SITRA ')                                                         SITRA378
         CALL EXIT                                                                          SITRA379
         END                                                                                SITRA380
                                                                                            SITRA381
                                                                                            SITRA382

FEATURES SUPPORTED
 NONPROCESS
 ONE WORD INTEGERS
 IOCS

CORE REQUIREMENTS FOR SITRA
 COMMON    8300  INSKEL COMMON       0  VARIABLES     260  PROGRAM    3366

 END OF COMPILATION
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```
// JOB    X     X     X                                                    REPL0001
// FOR REPLO                                                              REPL0002
*IOCS(CARD,1443PRINTER,DISK)                                              REPL0003
*ONE WORD INTEGERS                                                        REPL0004
*LIST SOURCE PROGRAM                                                      REPL0005
*NON PROCESS PROGRAM                                                      REPL0006
C REPLO                                                                   REPL0007
      EXTERNAL CALCE                                                      REPL0008
      DEFINE FILE10(32,256,U,IA)                                          REPL0009
      DEFINE FILE 7(32,256,U,IV)                                          REPL0010
      DEFINE FILE 8(1,98,U,IG)                                            REPL0011
C     DIMENSION EBOX(2),EBOY(3)                                           REPL0012
C     DIMENSION EBCX(3),EBCY(3)                                           REPL0013
      COMMON VI,DELAY,W(8),KCHA1,LM,KO                                    REPL0014
      COMMON    TITLE(18),TITL1(18),TITL2(18),DCIN(4096),                 REPL0015
     1W(8),KK(8)                                                          REPL0016
C     DATA EBCX/'(EV)','ERGY','  EN'/,EBCY/'OBS.','GMA-','  SI'/          REPL0017
C     DATA EBOX/' RGY',' ENE'/,EBOY/'SION','SMIS','TRAN'/                 REPL0018
      DATA EBOX/'(EV)'/,EBOY/'TRAN'/                                      REPL0019
      DATA EBCX/'(EV)'/,EBCY/'SIGM'/                                      REPL0020
      IA=1                                                                REPL0021
      IV=1                                                                REPL0022
      IG=1                                                                REPL0023
      CALL FINIM (0.,2.)                                                  REPL0024
      READ(5,661)KO,LM,LUGET,LOGT,LOGES,LOGS,(KK(L),L=1,8)                REPL0025
  661 FORMAT(16I5)                                                        REPL0026
      IF(KO)664,664,662                                                   REPL0027
  662 READ(5,663) (TITLE(I),I=1,18),(TITL1(I),I=1,3),(TITL2(I),I=1,3),    REPL0028
     1             SIZXT,SIZYT,SIZXS,SIZYS,TMAX,TMIN,SMAX,SMIN,         REPL0029
     2            VI,DELAY,(W(L),L=1,LM)                                REPL0030
  663 FORMAT(18A4/3A4/3A4/(8E10.4))                                       REPL0031
      GO TO 665                                                           REPL0032
  664 READ (8'IG) (TITLE(I),I=1,18),(TITL1(I),I=1,3),(TITL2(I),I=1,3),    REPL0033
     1KO,LM,LUGET,LOGT,LOGES,LOGS,(KK(L),L=1,8),                          REPL0034
     2             SIZXT,SIZYT,SIZXS,SIZYS,TMAX,TMIN,SMAX,SMIN,         REPL0035
     3            VI,DELAY,(W(L),L=1,8)                                 REPL0036
  665 WRITE(6,660)(TITLE(I),I=1,18),(TITL1(I),I=1,3),(TITL2 (I),I=1,3),  REPL0037
     1KO,LM,LOGET,LOGT,LOGES,LOGS,(KK(L),L=1,8),                          REPL0038
     2             SIZXT,SIZYT,SIZXS,SIZYS,TMAX,TMIN,SMAX,SMIN,         REPL0039
  9993               VI,DELAY,(W(L),L=1,LM)                             REPL0040
  660 FORMAT(18A4/3A4/3A4/14I10/(6F16.7))                                 REPL0041
      KCHA1=KO                                                            REPL0042
      KCHA2=KK(LM)                                                        REPL0043
      J= KCHA2-KCHA1+1                                                    REPL0044
      KA=KO                                                               REPL0045
C                              FIRST  PLOT                                REPL0046
      N2=KA-1                                                             REPL0047
      DO  708JI=KCHA1,KCHA2,128                                           REPL0048
      N1=N2+1                                                             REPL0049
      N2=N2+128                                                           REPL0050
      READ(7'IV)(DCIN (I),I=N1,N2)                                        REPL0051
  708 CONTINUE                                                            REPL0052
      WRITE(6,1)                                                          REPL0053
    1 FORMAT(1HO,'STEP 1')                                                REPL0054
     OCALL DESLF  (X ,        DCIN(KCHA1 ),J,1,1,1,0,0,SIZXT,SIZYT,LOGEREPL0055
     1T,LOGT,1,0,EBOX,-4,EBOY,4,0,CALCE)                                  REPL0056
      WRITE(6,2)                                                          REPL0057
    2 FORMAT(1HO,'STEP 2')                                                REPL0058
      TITL1(1)=TITLE(3)                                                   REPL0059
      TITL1(2)=TITLE(2)                                                   REPL0060
      TITL1(3)=TITLE(1)                                                   REPL0061
      X= SIZXT/4.                                                         REPL0062
      CALL SYMBL (X,SIZYT, 0.75,0., TITL1 (3),12)                         REPL0063
```

```
      IF(SIZYT-34.) 250,250,260                                                  REPL0064
  260 S= SIZXT+4.                                                                REPL0065
      CALL  FINIM (S,0.)                                                         REPL0066
      GOTO 270                                                                   REPL0067
  250 S= SIZYT +3.                                                               REPL0068
      CALL FINIM (0.,S)                                                          REPL0069
C                              SECOND PLOT                                       REPL0070
      N2=KA-1                                                                    REPL0071
      DO 718JI=KCHA1,KCHA2,128                                                   REPL0072
      N1=N2+1                                                                    REPL0073
      N2=N2+128                                                                  REPL0074
      READ(10'IA)(DCIN (I),I=N1,N2)                                              REPL0075
  718 CONTINUE                                                                   REPL0076
      WRITE(6,3)                                                                 REPL0077
    3 FORMAT(1HO,'STEP 3')                                                       REPL0078
  2700CALL DESLF  (X ,          DCIN (KCHA1 ),J,1,1,1,0,0,SIZXT,SIZYT,LOGEREPL0079
     1 S,LOGS,1,0,EBCX,-4,EBCY,4,0,CALCE)                                        REPL0080
      WRITE(6,4)                                                                 REPL0081
    4 FORMAT(1HO,'STEP 4')                                                       REPL0082
      TITL1(1)=TITLE(6)                                                          REPL0083
      TITL1(2)=TITLE(5)                                                          REPL0084
      TITL1(3)=TITLE(4)                                                          REPL0085
      X= SIZXS/4.                                                                REPL0086
      CALL SYMBL (X, SIZYS,0.75, 0., TITL1 (3), 12)                              REPL0087
      CALL FINIM (0., SIZYS)                                                     REPL0088
      CALL FINTR                                                                 REPL0089
      CALL EXIT                                                                  REPL0090
      END                                                                        REPL0091

FEATURES SUPPORTED
 NONPROCESS
 ONE WORD INTEGERS
 IOCS

CORE REQUIREMENTS FOR REPLO
 COMMON    8334  INSKEL COMMON       0  VARIABLES      70  PROGRAM     854


 END OF COMPILATION
```

```
// FOR                                                                    CALCE001
*LIST SOURCE PROGRAM                                                      CALCE002
*ONE WORD INTEGERS                                                        CALCE003
*NON PROCESS PROGRAM                                                      CALCE004
      SUBROUTINE CALCE(X,NI,IF)                                           CALCE005
C    CALCE * * * ENERG EVALUATED AS X                                     CALCE006
      COMMON VI,DELAY,WDH,KCHA1 ,LM,KOO                                   CALCE007
      COMMON    TITLE(18),TITL1(18),TITL2(18),DCIN(4096),                 CALCE008
     1W(8),KK(8)                                                          CALCE009
      DO 700 L=1,LM                                                       CALCE010
      ITEK=NI-KK(L)+KCHA1 -1                                              CALCE011
      IF(ITEK)701,701,700                                                 CALCE012
  700 CONTINUE                                                            CALCE013
    9 WRITE(6,8) NI,L,LM,KCHA1,KOO,(KK(I),I=1,8),WDH,DELA,FI,EA           CALCE014
    8 FORMAT(1HO,'ERROR IN CALCE',13I5, 4E12.4)                           CALCE015
      CALL EXIT                                                           CALCE016
  701 L=L                                                                 CALCE017
      WDH=W(L)                                                            CALCE018
      DELA=DELAY                                                          CALCE019
      IF(L-1)9,10,11                                                      CALCE020
   10 KO=KOO                                                              CALCE021
      GO TO 13                                                            CALCE022
   11 KO=KK(L-1)+1                                                        CALCE023
      DELA=DELA+W(1)*(KK(1)-KOO+1)                                        CALCE024
      IF(L-2) 13,13,702                                                   CALCE025
  702 LL=L-1                                                              CALCE026
      DO 12 J=2,LL                                                        CALCE027
      DELA=DELA+W(J)*(KK(J)-KK(J-1))                                      CALCE028
   12 CONTINUE                                                            CALCE029
   13 FI=NI+KCHA1-1-KO                                                    CALCE030
      EA=DELA +FI*WDH                                                     CALCE031
      X=VI/(EA*EA)                                                        CALCE032
      RETURN                                                              CALCE033
      END                                                                 CALCE034

FEATURES SUPPORTED
 NONPROCESS
 ONE WORD INTEGERS

CORE REQUIREMENTS FOR CALCE
 COMMON    8334  INSKEL COMMON       0  VARIABLES      16  PROGRAM     248


 END OF COMPILATION
```

```
// JOB    X     X     X
// XEQ CHROD
*FILES(1,IRMA,2),(4,TIBER,2),(2,GRACE,2),(5,PADUS,2)
*LOCALHROE,CHROC,OCTAL
*CCEND
                              65EV-800EV PU241 IN                                IN
28111 4096 3  2.04+8           1     3 2048 3072 4096
1     0.32       1.28  0.5  0.5          2.    2.
01.8111          1     1
                              65EV-800EV PU241 OUT                               OUT
28211 4096 3  0.51+8           1     3 2048 3072 4096
2     0.32       1.28  0.5  0.5          2.    2.
01.8211          1     1


// JOB    X     X     X
// XEQ KOLAR
*FILES(2,GRACE,2),(3,ARNUS,2),(9,ERROR,2),(5,PADUS,2),(6,AGATA,2)
*LOCAL(LSQFN,INPUT),(OPSQ,MATIO),(OENDS,ENDN)
*CCEND
                              65EV-800EV PU241 I            L.SQ.FIT
  1 10   1   0   0   0   0
 11
1.          1.          1.          1.          1.          1.          1.
1.          1.          10.
    2  257 1664
11111111111000000

                              65EV-800EV PU241 II           L.SQ.FIT
  1 10   1   0   0   0   0
 11
1.          1.          1.          1.          1.          1.          1.
1.          1.          10.
    2 1665 1920
11111111111000000

                              65EV-800EV PU241 III          L.SQ.FIT
  1 10   1   0   0   0   0
 11
1.          1.          1.          1.          1.          1.          1.
1.          1.          10.
    2 1921 2048
11111111111000000
    1 4096     10000.          0.          30.          20.          0          0
// JOB    X     X     X
// XEQ CAUM
*FILES(2,GRACE,2),(3,ARNUS,2),(6,AGATA,2)
*CCEND
**3
// JOB    X     X     X
// XEQ SITRA
*FILES(1,IRMA,2),(9,ERROR,2),(3,ARNUS,2),(4,TIBER,2)
*FILES(7,CLAES,2),(10,CROS,2)
*FILES(8,PINCO,2)
*FILES(11,DELES,2)
*CCEND
     PU-241    TOTAL  CROSS SECTION  65EV-800EV                              19212048
.25          1.          .26          3090.          -.613-0420.
                                                  100.59     403.24     .080
.001731
20.          20.          1.0          0.01            0     0     1
20.          20.          1000.        0.1             0     0
```

```
// JOB    X     X     X
// XEQ REPLO
*FILES(7,CLAES,2),(10,CROS,2)
*FILES(8,PINCO,2)
*CCEND
**3
```

APPENDIX 1 - PROGRAM KOCO

This program reads one or more spectra from a tape prepared by the program CATAP [2] already quoted (see 6), and punches BCD cards according to the FORMAT (2X, I4, 8I7, 10X, I8).

Input

Repeat the following card for each spectrum to be punched:

Columns	FORTRAN Symbol	FORMAT (4I4, I2, 1X, 2I1, I2)
1 - 4	ITOT	total number of channels (ITOT ≤8192)
5 - 8	NTAPA	unit for the tape to be read (NTAPA ≠ 2)
9 - 12	ID = 1	if total number of channels in the range 1 - 4096
	ID = 2	if total number of channels in the range 4097 - 8192
13 - 16	IDV	the last four digits of the identification of the spectrum
17 - 25		the complete identification with the point in the column 19

Add blank cards to be punched at the end of the input cards (the first blank card is just to be read).

Operations and limitations

A scratch tape must be mounted on the unit 2. Each spectrum cannot contain more than 8192 channels.

Acknowledgments

The authors thank their colleagues, Mr. Carraro, Mr. Dufrasne, Mr. Horstmann and Mr. Kolar for the help in testing the programs and for useful discussions.

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[5] H. Schmid, EUR. 4225. e (1969)

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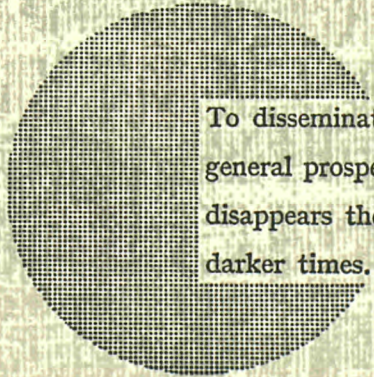

To disseminate knowledge is to disseminate prosperity — I mean general prosperity and not individual riches — and with prosperity disappears the greater part of the evil which is our heritage from darker times.

Alfred Nobel

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