JADE Computer Note No. 11 a (Extension of Note No. 11)

P. Steffen - F 11 -
1.2.1979

Package of Subroutines for Users of BOS with Fixed Pointers

The following subroutines are available :

JBCRX	:	set max. length of array IDATA in /CDATA/
JBCBN	:	create name of BOS-bank with corresponding fixed pointer
JBCRE	:	create BOS-bank
JBCR0	:	create BOS-bank and initialize it to zero
JBCRA	:	create BOS-bank and fill it with data
JBDLS	:	delete single bank
JBDLM	:	delete all banks of given name
JBLOC	:	locate bank of given name (and number)

JBCRX : Initialization must be done by the

CALL JBCRX(NWMAX)

NWMAX = length of array IDATA

JBCBN : In addition to the general set of authorized bank names the user can specify up to ~~5~~ 4 additional bank names corresponding to the pointers IDATA (100) to IDATA (10~~4~~3) by the

CALL JBCBN (NA, IPNAME)

NA = name of the bank

IPNAME = 100 ... 10~~4~~3 : fixed pointer

If IPNAME < 100 : IPNAME = 100 assumed

If IPNAME > 10~~4~~3 : IPNAME = 10~~4~~3 assumed

This routine should be called in the initialization step of the users program. A second call with the same IPNAME will overwrite the previous setting.

JBLOC : The pointer to a selected bank of name NA and number NR can be obtained by the

```
CALL JBLOC (IND, NA, NR)

IND  =  pointer to selected bank (=0 if not existing)
```

This routine does not check if the requested name is an authorized one.

Up to now the following banks are authorized ones :

Bank Name	Pointer Array	Address in IDATA
TRIG	55	
SCAL	56	
LATC	57	
ATST	58	
ATOF	59	
ALGL	60	
JETC	61	
CONC	62	
MUEV	63	
	64	
	65	
	66	
	67	
	68	
JHTL	69	
PATR	70	
ZVTX	71	
LGCL	72	
MUR1	73	
MUR2	74	
ALGN	75	
TAGG	76	
	77	
	78	
	79	
	80	

JADE Computer Note No. 12

1. version 21.11.1978

changed 23.2.1979

P. Steffen

<u>Track Bank from Pattern Recognition Program</u>

- name of bank : 'PATR'
- pointer to the bank : IDATA(70) in COMMON/BCS/

- contents of bank 'PATR':

(1) : LO = length of event data (including this word): (=8)

(2) : number of tracks

(3) : LTR = length of data for each track (in 4 byte words): (=48)

(4) : error code (= 0 if everything ok)

(5) : number of hits in ID

(6) : " " uncorrelated hits in ID

(7) : " " " line elements in ID

(8) : not yet used

(LO + 1)
.
.
.
(LO + LTR) : data of 1. track

(LO + LTR + 1)
.
.
(LO + 2LTR) : data of 2. track

Fit Parameters

- circle fit in xy-plane (type = 1)

  P1 = curvature = R^{-1} $[mm^{-1}]$

  P2 = D_o - R [mm] D_o = distance (coordinate origin-centre of circle)

  P3 = angle of direction (coordinate origin-centre of circle)

  $\varepsilon\ [-\pi, +\pi]$

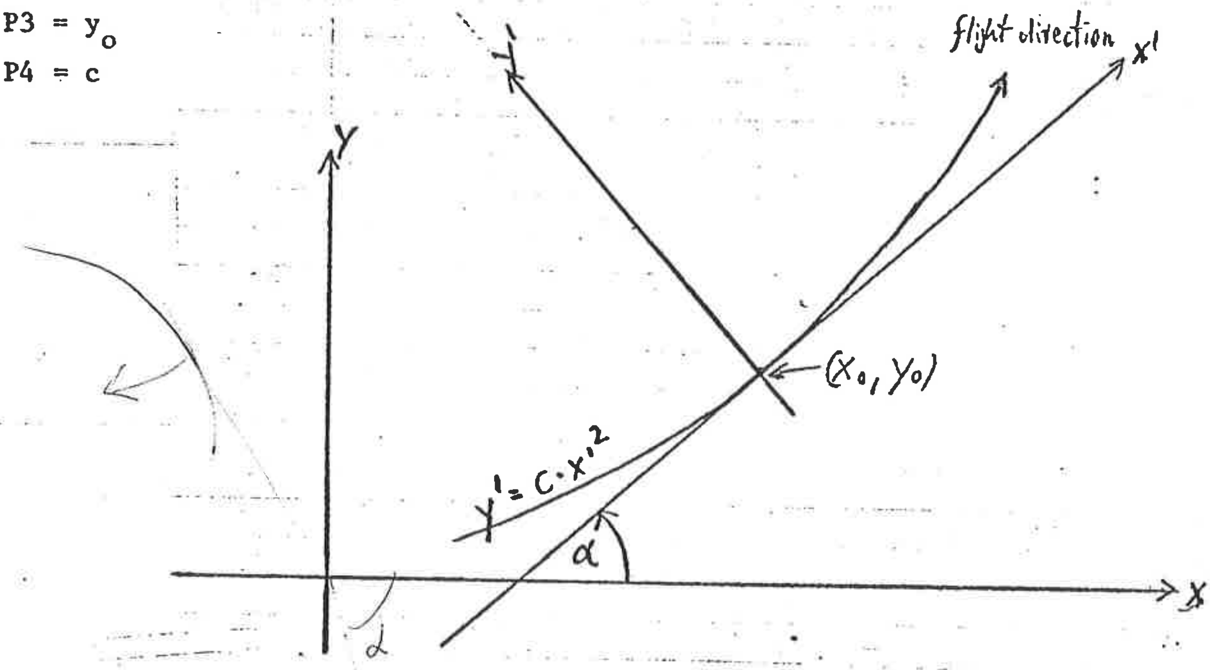
- parabola fit in xy-plane (type = 2): $y' = c \cdot x'^2$

  P1 = $\alpha\ \varepsilon [-\pi, +\pi]$

  P2 = x_o

  P3 = y_o

  P4 = c



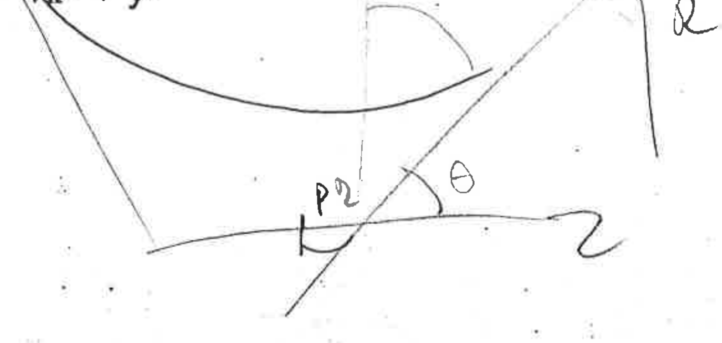
α = angle between y-axis and y'-axis

- straight line fit in rz-plane (type = 1)

  $z = P1 \cdot r + P2$ $r = \sqrt{x^2 + y^2}$

$d\theta$

$P1 = \frac{\Delta z}{\Delta r}$



Olsson

JADE Computer Note No. 12
1. version 21.11.1978
changed 23.2.1979
P. Steffen
changed 17.1.80, E. Elsen
updated 18.4.80, G.F. Pearce

Track Bank from Pattern Recognition Program

- name of bank : 'PATR'
- pointer to the bank : IDATA(70) in COMMON/BCS/

- contents of bank 'PATR':

(1) : LO = length of event data (including this word): (=8)
(2) : number of tracks
(3) : LTR = 48 or 62
(4) : PATREC history word (LOR of all track history words)
(5) : number of hits in ID
(6) : " " uncorrelated hits in ID
(7) : " " " line elements in ID
(8) : not yet used

(LO + 1)
.
.
.
(LO + LTR) : data of 1. track

(LO + LTR + 1)
.
.
(LO + 2LTR) : data of 2. track

(34)
(35)
(36) : cell numbers that contain hits of the track (in the same order as passed by the track)
(37)
(38)
(39)

(40) : pointer to corresponding lead glass cluster
(41) : " " " μ-chamber hits
(42) : " " " track bank in TP-bank
(43) : " " " TOF-bank

(44) : flag for additional information
> 0, if following 2 z-coordinates are filled.
= 2, if covariance matrix of helix fit is filled.

(45) : first valid z-coordinate
(46) : last valid z-coordinate

(47) : no. of hits associated with track

(48) : track history word (mainly for specialists - see appendix)
if idata (44), eq. 2

(49) : χ^2 of r-ϕ-fit (normalised to σ_o = 115μ)

(50) : cov (ϕ^2)

(51) : cov (ϕr_{min})

(52) : cov $(r_{min}2)$

(53) : cov (ϕk)

(54) : cov $(r_{min} k)$

(55) : cov (k^2)

(56) : χ^2 of r-z-fit (normalised to 20 mm)

(57) : cov (z_o^2)

(58) : cov $(z_o\ dz/dr)$

(59) : cov$((dz/dr)^2)$

(60) : date at which TP track fit was made

(61) : free for other use

(62) : "

Since the errors are not gaussian the variances are normalised to the ideal χ^2.

cov (r-ϕ) = cov (r-ϕ-fit) x χ^2/n-3

cov (r-z) = cov (r-z-fit) x χ^2/n-2

The original values for χ^2 are however given.

Track History Word

Using IBM notation (bit 31 = lowest order bit) this word is coded as follows:

Bit 31 set	→ Final PATREC fit in XY plane was bad.
" 30 "	→ It is still not certain on which side of the wire plane the track lies, even after the final fit in XY.
" 29 "	→ PATREC XY-FIT entered the single track element deleting mode in order to recover from an initially bad track fit.
" 28 "	→ PATREC XY-FIT entered the multiple track element deleting mode in order to recover from an initially bad track fit.
" 27 "	→ $\geqslant$ 3 hits which also belong to another track were attached to this track by the PATREC 'fit and fetch' program (PATROL).
" 26 "	→ A re-fit of the track called by the PATREC 'fit and fetch' program (PATROL) failed with a large χ^2. The last good fit to the track was restored.
" 25 "	→ Low transverse momentum (< 65 MeV/c).
" 24 "	→ Final PATREC fit in ZR plane was bad.
" 23 "	→ PATREC ZR-FIT rejected $\geqslant$ 3 of the hits from the track in order to obtain an acceptable fit.
" 22 "	→ No connection was made into ring 1 by the BACKTRACE program for this track (note that if such hits exist, they will not have been lost but will have been found by the PATROL program at a later stage in the pattern recognition).
" 21 "	→ No connection was made into ring 2 by the BACKTRACE program for this track even though both rings 1 and 3 were present. Again, if such hits exist, the PATROL program will have collected them.
" 20 "	→ The left/right ambiguity solution for this track determined by the BACKTRACE program did not agree with that determined from the wire staggering by the track element routine.
Bits 19 - 1	Not used.
Bit 0 set	→ Track was marked as bad by an 'event editor'.

JADE Computer Note No. 13

P. Steffen

20.11.1978

A Simple Way to Analyse JADE Data on Tapes

1. Copy the members 'JOB0' and 'USER0' from the library 'F11PRC.JADEGS' to your source library.

2. Change JOB0 on your library:
   - replace the identifier ('F11PST') in the first card by your own one
   - replace the library names 'F11PST.JADESR' and 'F11PST.JADELD' by your own source- and load-library names.

3. Change USER according to your problems and wishes (see comment cards in 'USER').
   The subroutine USER is called with different arguments at different stages of evaluation for each event, e.g.:

   after one event has been read,
   after reconstruction of the z-vertex,
   after pattern recognition,
   after leadglass analysis,
   after μ-chamber analysis.

JADE Computer Note 14
29.11.1978
S. Yamada

Lead Glass Cluster Bank Structure

The lead glass cluster analysis is made in two steps. The first is done by calling LGANAL which finds clusters and calculates their energies and absolute positions. After the step the order of the ADC data is changed so that those blocks which form a cluster are also grouped in the data array. The shuffled ADC data is copied into a new bank (ALGN). The cluster information is also written in a new bank (LGCL) together with an ADC map, which consists of pointers to the ADC data in the bank ALGN for each cluster. The second step is done by calling LGCDIR which connects the lead glass clusters with the inner chamber tracks and calculates the emission angles of the clusters. The new variables are added to the bank LGCL.

Pointers to the LG banks in the fixed header

Raw data (ALGL)	IHEADR(60)
shuffled data (CALGN)	IHEADR(75)
LG cluster data (LGCL)	IHEADR(72)

Structure of the LGCL Bank

(0) LNG: Length of the bank counting from IP1 Bos Length.
(1) IP1: pointer to the general information = 5
(2) IP2: pointer to the cluster map = 26
(3) IP3: pointer to the cluster information = (NCLST + 27)
(4) IP4: pointer to the (last word + 1)

/ General Information /

(5)	Identifier of the program	version no.
(6)		Bank generation date and time

(7) NCLST: No. of clusters
(8) NCLSB: " in the barrel part

(NCLST+25) MAP(NCLST): start position of the last cluster in the shuffled ADC data

(NCLST+26) MAP(NCLST+1): position of the last ADC data + 1

/ cluster information /

The cluster information for the n-th cluster can be fetched by means of the pointers IP3 and NWPCL.
IB = IP3 + (N-1) * NWPCL - 1

(IB + 1)	JPART:	LG detector part 0 for barrel, +/-1 for +/-Z E.C.
(IB + 2)	ENERGY:	cluster shower energy in GeV
(IB + 3)	σ(ENERGY):	expected error of the energy
(IB + 4)	PHI	for barrel cluster (X for E.C. cluster)
(IB + 5)	Z	PHI in radian, X,Y,Z in mm. (Y for E.C. cluster)
(IB + 6)	σ(PHI)	for barrel (σ(X) for E.C.)
(IB + 7)	σ(Z)	for barrel (σ(Y) for E.C.)
(IB + 8)*	NCH:	no. of connected charged tracks = 0 for γ's
(IB + 9)* (IB + 10)* (IB + 11)*	dx, dy, dz:	direction cosines measured from the event vertex
(IB + 12)* (IB + 13)* (IB + 14)*		cluster elipse eigenvalues to show the cluster structure. (These are still under study by R. Eichler.)
(IB + 15)		not yet used

The variables marked with a (*) are evaluated in the second step analysis.

Olsson

JADE Computer Note 14a

23.2.1979

S. Yamada

Earlier usage changed

Because of the format change and to cooperate with the LG counter calibration the input data format for the LG analysis subroutine LGANAL is changed. We should foresee that either converted or non-converted LG-ADC data may come to IBM depending on the NORD status. The data is also calibrated by L.H. O'Neill's scheme before analysis starts. The process flows as below.

Raw data format (see JADE Note No. 32)

Form.(1) Not converted

Int x 4	ALGL	
	0	
	0	
	LNG	
Int x 2	B.descr.	< 100
	0	
	ADDR	
	DATA DATA ⋮	
	ADDR	
	DATA	

Form.(2) converted

ALGL	
0	
0	
LNG	
B.descr.	≤ 100
0	
POINTER	= 1
"	
"	
"	
ADDR	
DATA	
ADDR	
DATA	
ADDR	
DATA	

There is an IBM subroutine LGCDCN which converts the data format from (1) to (2) if necessary by checking the NORD conversion flag in the BANK descriptor. The conversion can be done in a separate job together with the inner chamber reformatting or in a data reduction job before the lead glass calibration/analysis by calling LGCDCN.

The L.H. O'Neill's calibration system will accept the format (2) and a new LG bank 'ALGN'/1 will be generated, which will contain the ADC values in the unit of MeV. The format is same to (2) except the bank name/number. The second word of the bank descriptor will contain the calibration data code.

The LGANL needs about 0.5 msec to locate a cluster and ~0.4 msec to calculate its position.

There are sum changes to the /cluster information/ of the 'LGCL'/1 bank described in the page 3 of the computer note 14.

IDATA(IB + 8)$^{+}$ NCH = (number of contected charged tracks)+100
+ the index of the 1st one in 'PATR'.
= 0 for γ

IDATA(IB + 15) number of the edge lead glasses in the cluster.
If it is not 0, the energy may be inaccurate.

The 'LGCL' /1 bank will be printed in an easy-to-see format by calling PRLGCL.

```
 JADE COMPUTER NOTE 14C

2. JULY  1980      Y.WATANABE


 ANALYSIS PROGRAM FOR LEAD GLASS (LG) COUNTERS.
   (PLEASE DISCARD THE ONE ISSUED ON 27/6/80. SOME MISTAKES ARE
    CORRECTED AND MORE INFORMATION IS GIVEN HERE)

A SMALL CHANGE HAS BEEN MADE TO THE LG LIBRALY JADELG.SOURCE/LOAD.
THE NUMBER OF WORDS/CLUSTER IS NOW 16, BUT THERE SHOULD BE NO PROBLEM
AS LONG AS THE RIGHT WORD FOR IT IS USED IN THE PROGRAM.

THIS CHANGE IS TO ACCOMODATE A REQUEST TO INCLUDE UNCORRECTED ENERGY
IN TO THE BANK. FOR MONTE CARLO DATA, THIS WORD CONTAINS UNSMEARED
ENERGY WHEN SMEARING IS DONE AT THE LG ANALYSIS STAGE, WHICH IS
THE NORMAL PRACTICE FROM NOW ON.

THE STRUCTURE OF THE LIBRARY ,SOME DESCRIPTION OF TECHNIQUES USED IN
THE PROGRAM AND THAT OF INPUT/OUTPUT BANKS ARE GIVEN BELOW.


1. THE STRUCTURE OF THE LIBRARY

IT CONSISTS OF BANCH OF SUBROUTINES, WHICH CAN BE DIVIDED INTO 4 GROUPS.
EACH OF THE GROUPS CAN BE REPRESENTED BY ONE SUBROUTINE.

 A. SUBROUTINE LGINIT

     FUNCTION     LOAD IN VARIOUS CONSTANTS AND CUTS.
                  (IN THE FORM OF BLOCK DATA).
                  SHOULD BE CALLED AT THE BEGINNING.
                  THE SET CONSTANTS CAN BE OVERRIDDEN BY
                  SETTING TO DESIRED VALUES AFTERWARD.

 B. SUBROUTINE LGCALB(*)

     INPUT  BANK 'ALGL'/0 (RAW PULSE HEIGHTS)
     OUTPUT BANK 'ALGN'/1 (UNIT IS IN MEV)

     FUNCTION     CONVERTS ADC PULSE HEIGHTS TO MEV.
                  SUBTRACT SOME COUNTS FROM SPINNING BLOCKS AND
                  WHEN CRATES OR ADC MODULES FIRE. (LGERSE)
                  (NOW USES L.H.O'NEILL'S SHEME OF CONSTANTS)

     ERROR RETURN OCCURS IF THE INPUT DATA ARE ABNORMAL.

 C. SUBROUTINE LGANAL

     INPUT  BANK 'ALGN'/1
     OUTPUT BANK 'LGCL'/1 (SOME PART IS TO BE FILLED BY LGCDIR)

     FUNCTION     FINDS CLUSTERS AND STORES THE INFORMATION
                  IN 'LGCL'/1.
                  THE BANK 'ALGN'/1 IS REORDERED IN FAVOR OF
                  CLUSTERS.

$
 D. SUBROUTINE LGCDIR(NPPATR,NPALGN,NPLGCL)

      WHERE THE ARGUMENTS ARE POINTERS TO THE CORRESPONDING BANKS.

     INPUT  BANK 'LGCL'/1
     OUTPUT BANK 'LGCL'/1 (I.E. JUST MODIFIES THE CONTENTS)
     FUNCTION     LINKS TRACKS FOUND IN THE JET CHAMBER
                  TO LG CLUSTERS
                  PERFORMS ENERGY CORRECTION FOR DATA(J.C.NOTE#35)
                  AND ENERGY SMEARING FOR MC DATA. (LGESMR)
                  CALCULATES THE DIRECTION COSINES TAKING
                  INTO ACCOUNT THE EVENT VERTEX AND SHOWER
                  DEPTH.
```



```
        LGCDIR CAN BE CALLED INDEPENDENT OF LGANAL FOR ONCE
        ANALYSED DATA.

2. SHORT DESCRIPTION OF CLUSTER FINDING

    A. THE LIST IN 'ALGN'/1 IS ORDERED FROM THE HIGHEST ENERGY

    B. TAKE THE BLOCK WITH THE HIGHEST ENERGY AS A PARENT.
       CALL THIS BL1.  E(BL1) > ITH (DEFAULT IS 45 MEV)

    C. LOOK FOR A NEIGHBOR IN THE LIST. IF FOUND MOVE IT TO THE NEXT
       TO BL1.  CALL THIS BL2 (NEIGHBORS ARE ADJUCENT COUNTERS)

    D. FOR EACH BL2, LOOK FOR A NEIGHBOR OF BL2.  CALL THIS BL3.

    F. INCLUDE BL3 IRRESPECTIVE OF THE ENERGY IF E(BL2) > E(BL1)/5.
       INCLUDE BL3 IF E(BL3) < E(BL1)/2. .AND. E(BL3) < E(BL2)*3.
       IF INCLUDED TO THE FAMILY, MOVE IT NEXT TO BL2.

    G. FIND ALL NEIGHBORS OF BL2 ( GO TO C ;BL3 IS NOW BL2)

    H. AFTER ALL NEIGHBORS OF BL1 FAMILY IS FOUND, REPEAT ABOVE
       FOR UNASSIGNED BLOCKS IN THE LIST ( GO TO B )

    NOTE. DETECTOR IS DIVIDED INTO 3 PARTS; BARREL, -Z AND +Z
          END CAPS, AND CLUSTER SEARCH IS MADE SEPARATELY.


3. CALUCULATION OF CLUSTER POSITION

     THE COORDINATES (PHI,Z) FOR BARREL AND (X,Y) FOR END CAP  ARE
     OBTAINED BY WEIGHTED AVERAGE.

       X = SUM (XI*EI**0.33) / SUM(EI**0.33)    (SIMILAR FOR PHI)
       Y = SUM (YI*EI**0.33) / SUM(EI**0.33)    (    "      "   Z )

     THEN THE DIRECTION COSINE IS CALUCUATED TAKING THE SHOWER
     DEPTH AND THE EVENT VERTEX(IF 'TPVX' IS THERE) INTO ACCOUNT.

       DEPTH = 22.39*LN(E/E0) (MM)     E0=4.979MEV FOR E+-,
                                       E0=1.725MEV FOR GAMMA.
        OR    = HALFWAY THROUGH THE LEAD GLASS
                IF E<600 MEV OR E/P < 0.75
              ("IDENTIFIED" AS A NONSHOWERING CHARGED PARTICLE)

     TO OBTAIN THE DIRECTION COSINE, E.G. FOR A BARREL CLUSTER,
     THE ADDITIONAL PARAMETER R IS ITTERATIVELY SEARCHED FOR,
     FIXING (PHI,Z), UNTIL THE DEPTH REACHES TO THE EXPECTED VALUE.
$

4. 'ALGN'/1 BANK

  WORD   TYPE  CONTENTS

    0     I*4  THE LENGTH OF THE BANK
    1#    I*2  >100
          I*2  10003 FOR DATA .
               FOR MONTE CARLO DATA, 1=ENERGY UNSMEARED, 2=SMEARED
               AT THE GENERATION STAGE.  ADD 4 IF SMEARING IS DONE
               BY LGESMR IN LGCDIR.
    2     I*2  POINTER=1
          I*2  POINTER TO ADDRESS OF THE DATA ( -Z END CAP)
    3     I*2  POINTER TO ADDRESS OF THE DATA ( +Z END CAP)
          I*2  POINTER TO THE LAST WORD+1
    4     I*2  ADC CHANNEL NUMBER (0 THROUGH 2879)
          I*2  THE PULSE HEIGHT IN MEV.
    5     I*2  ADC CHANNEL NUMBER (0 THROUGH 2879)
          I*2  THE PULSE HEIGHT IN MEV.
           "         "
```

```
         "          "

         ( ALL NONZERO BLOCKS
             IN THE ORDER OF THE BLOCK NUMBERS (AFTER LGCALB)
             IN FAVOR OF CLUSTERS FOUND         (AFTER LGANAL)

AN EXAMPLE  FOR THE DATA LOOK AS FOLLOWS,

   ADC  MEV   ADC  MEV   ADC  MEV   ADC  MEV   ADC  MEV
   912 4886   880  540   913  194   911  162   944  113
   881   81   879   71 /2257 3879  2289 1227  2256   92
  2225   38  2290   86  2288   76 /2400   15//2715 1661
  2720 1370//2810   76 /2800   15

 POINTERS(WORD#2-5) HAVE THE VALUES OF  1,29,33,37
        (/ INDICATES THE BOUNDARY OF CLUSTERS ( 4 CLUSTERS FOUND) AND
        // INDICATES THE BOUNDARY OF DETECTOR PARTS)


5. 'LGCL'/1 BANK

   THE FORMAT OF THE BANK IS GIVEN BELOW FOR CONVENIENCE.IT IS
   ESSENTIALLY THE SAME AS THE ONE DESCRIBED IN J.C.NOTE 14 - 14B.

  WORD   TYPE  CONTENTS

     0    I*4  THE LENGTH OF THE BANK
     1     "   IP1= 5;THE POINTER TO THE GENERAL INFORMATION
     2     "   IP2=26;THE POINTER TO THE CLUSTER MAP
     3     "   IP3   ;THE POINTER TO THE CLUSTER INFORMATION(NCLST+27)
     4     "   IP4   ;THE POINTER TO THE LAST WORD +1

$
  /GENERAL INFORMATION/

  WORD   TYPE  CONTENTS

  IP1     I*4  VERSION# OF THE PROGRAM.
  IP1+ 1   "   THE DATE AND TIME OF THE BANK GENERATION.
  IP1+ 2   "   #CLUSTERS      TOTAL (NCLST)
  IP1+ 3   "        "         BARREL
  IP1+ 4   "        "         Z<0 ENDCAP
  IP1+ 5   "        "         Z>0 ENDCAP
  IP1+ 6  R*4  SHOWER ENERGY TOTAL
  IP1+ 7   "        "         BARREL
  IP1+ 8   "        "         Z<0 ENDCAP
  IP1+ 9   "        "         Z>0 ENDCAP
  IP1+10  I*4  #PHOTONS
  IP1+11  R*4  PHOTON ENERGY TOTAL
  IP1+12   "        "         BARREL
  IP1+13   "        "         Z<0 ENDCAP
  IP1+14   "        "         Z>0 ENDCAP
  IP1+15  I*4  ERROR FLAG. 0=NO ERROR, 1=NOT CALIBRATED, 2=NOT ENOUGH
               SPACE TO COPY INPUT DATA,1024=FORMAT CONVERSION NOT DONE
               ADD 10 IF TOO MANY CLUSTERS FOUND
               ADD 100 IF NOT ENOUGH SPACE IN /BCS/
  IP1+16   "   THE STAGE OF ANALYSIS 1=LGANAL, 2=LGCDIR.
  IP1+17   "   THE VERSION # FOR THE ENERGY CORRECTION.
  IP1+18   "   1 IF TRACK CONNECTION IS DONE.
  IP1+19   "   FLAG=HDATA(2*NPVRTX+2) SEE J.C.NOTE FOR TP.
  IP1+20#  "   #WORDS/CLUSTER (NWPCL=16 CHANGED FROM 15)

       # INDICATES MODIFICATION


  /CLUSTER MAP/

  WORD      TYPE  CONTENTS
```



```
  IP2       I*2   H(1);THE START ADDRESS OF CLUSTER 1 IN RESHUFFLED
                     'ALGN'/1 BANK.
             "    H(2);THE LAST  ADDRESS
  IP2+1      "      . . . . . . . .
   .         "      . . . . . . . .
   .         "      . . . . . . . .
  IP2+NCLST  "    H(1);POINTS TO THE LAST ADC DATA +1

  FOR THE ABOVE EXAPMLE, THE VALUES OF H(1),... ARE
    1,7, 8,13, 14,16, 17,17, 19,0   RESPECTIVELY

$
  /CLUSTER INFORMATION/

   IB = IP3 + (N-1) * NWPCL - 1 (ADD ABSOLUTE POINTER TO THIS)

  WORD   TYPE  CONTENTS

  IB+ 1   I*4  DETECTOR PART; 0=BARREL, +/-1=+/1 Z END CAP
  IB+ 2   R*4  CLUSTER ENERGY IN GEV.
  IB+ 3    "   EXPECTED SIGMA OF THE ENERGY
  IB+ 4    "   PHI/X FOR BARREL/ENDCAP (RAD./MM)
  IB+ 5    "   Z  /Y FOR BARREL/ENDCAP (IN MM)
  IB+ 6    "   SIGMA(PHI)/SIGMA(X) FOR BARREL/ENDCAP (IN MM)
  IB+ 7    "   SIGMA(  Z)/SIGMA(Y) FOR BARREL/ENDCAP (IN MM)
  IB+ 8#  I*4  (#CONNECTED TRACKS)*100+1ST TRACK#, 0= A PHOTON
  IB+ 9   R*4  DX
  IB+10    "   DY  FROM EVENT VERTEX (SHOWER DEPTH CONSIDERED)
  IB+11    "   DZ
  IB+12    "   EW(2)/EW(1)                     (SIGX**2    SIGXY)
  IB+13    "   EW(2)+EW(1)  EIGEN VALUES OF   (SIGXY     SIGY**2)
  IB+14    "   THE ANGLE OF EIGEN VECTOR
  IB+15    "   THE FRACTION OF ENERGY IN THE EDGE BLOCKS.
                (IF IT IS >0.5, SAY, THE ENERGY OF THE CLUSTER COULD
                 BE GROSSLY UNDERESTIMATED)
  IB+16#   "   THE ENERGY OBTAINED BY ADDING THE BLOCKS.
                 (I.E. UNCORRECTED ENERGY FOR DATA, AND UNSMEARED FOR MC)

       # INDICATES MODIFICATION.
          (IN THE PATR BANK OF THE SMALLEST NR, 40TH WORD NOW CONTAINS
           THE CLUSTER NUMBER THAT IS CONNECTED TO THE TRACK.
           THIS CONNECTION IS DEFINED TO BE UNIQUE.)

#######################################################################
 NOTE THAT THE ADDRESS IS ONLY RELATIVE. ONE HAS TO ADD THE POINTER
 TO THE BANK TO GET A CORRECT ADDRESS.
#######################################################################

***********************************************************************

 ******TO OBTAIN THIS PRINT OUT, SUB 'JADELG.SOURCE(#PRJNOT)'******

*JADE*JADE*JADE*JADE*JADE*JADE*JADE*JADE*JADE*JADE*JADE*JADE*JADE*JADE
```

```
 JADE COMPUTER NOTE 14D
                                         16. MAY  1984     S.YAMADA


 ANALYSIS PROGRAM FOR LEAD GLASS (LG) COUNTERS.
   ( REVISED VERSION OF THE JADE COMP.NOTES 14,14A,14B,14C
     BY S.YAMADA AND Y.WATANABE
    UPDATED AND MORE INFORMATION IS GIVEN HERE)

A SMALL CHANGE HAS BEEN MADE TO THE LG LIBRALY JADELG.SOURCE/LOAD.
THE NUMBER OF WORDS/CLUSTER IS NOW 16, BUT THERE SHOULD BE NO PROBLEM
AS LONG AS THE RIGHT WORD FOR IT IS USED IN THE PROGRAM.

THIS CHANGE IS TO ACCOMODATE A REQUEST TO INCLUDE UNCORRECTED ENERGY
IN TO THE BANK. FOR MONTE CARLO DATA, THIS WORD CONTAINS UNSMEARED
ENERGY WHEN SMEARING IS DONE AT THE LG ANALYSIS STAGE, WHICH IS
THE NORMAL PRACTICE FROM NOW ON.

THE STRUCTURE OF THE LIBRARY ,SOME DESCRIPTION OF TECHNIQUES USED IN
THE PROGRAM AND THAT OF INPUT/OUTPUT BANKS ARE GIVEN BELOW.


1. THE STRUCTURE OF THE LIBRARY

IT CONSISTS OF BANCH OF SUBROUTINES, WHICH CAN BE DIVIDED INTO 4 GROUPS.
EACH OF THE GROUPS CAN BE REPRESENTED BY ONE SUBROUTINE.

 A. SUBROUTINE LGINIT

    FUNCTION    LOAD IN VARIOUS CONSTANTS AND CUTS.
                (IN THE FORM OF BLOCK DATA).
                SHOULD BE CALLED AT THE BEGINNING.
                THE SET CONSTANTS CAN BE OVERRIDDEN BY
                SETTING TO DESIRED VALUES AFTERWARD.

 B. SUBROUTINE LGCALB(*)

    INPUT  BANK 'ALGL'/0 (RAW PULSE HEIGHTS)
    OUTPUT BANK 'ALGN'/1 (UNIT IS IN MEV)

    FUNCTION    CONVERTS ADC PULSE HEIGHTS TO MEV.
                SUBTRACT SOME COUNTS FROM SPINNING BLOCKS AND
                DELETE BAD AND/OR NON-EXISTING CHANNELS
                WHEN THEY FIRE. (LGERSE)
                (NOW USES L.H.O'NEILL'S SCHEME OF CONSTANTS)

    ERROR RETURN OCCURS IF THE INPUT DATA ARE ABNORMAL.

 C. SUBROUTINE LGANAL

    INPUT  BANK 'ALGN'/1
    OUTPUT BANK 'LGCL'/1 (SOME PART IS TO BE FILLED BY LGCDIR)

    FUNCTION    FINDS CLUSTERS AND STORES THE INFORMATION
                IN 'LGCL'/1.
                THE BANK 'ALGN'/1 IS REORDERED IN SUCH A WAY
                THAT HITS BELONGING TO A CLUSTER ARE GROUPED TOGETHER.

$
 D. SUBROUTINE LGCDIR(NPPATR,NPALGN,NPLGCL)

      WHERE THE ARGUMENTS ARE POINTERS TO THE CORRESPONDING BANKS.

    INPUT  BANK 'LGCL'/1
    OUTPUT BANK 'LGCL'/1 (I.E. JUST MODIFIES THE CONTENTS)
    FUNCTION    LINKS TRACKS FOUND IN THE JET CHAMBER
                TO LG CLUSTERS
                PERFORMS ENERGY CORRECTION FOR DATA(J.C.NOTE#35)
```



```
                AND ENERGY SMEARING FOR MC DATA. (LGESMR)
                CALCULATES THE DIRECTION COSINES TAKING
                INTO ACCOUNT THE EVENT VERTEX AND SHOWER
                DEPTH.

     LGCDIR CAN BE CALLED INDEPENDENT OF LGANAL FOR ONCE
     ANALYSED DATA.


2. SHORT DESCRIPTION OF CLUSTER FINDING

    A. THE LIST IN 'ALGN'/1 IS ORDERED FROM THE HIGHEST ENERGY

    B. TAKE THE BLOCK WITH THE HIGHEST ENERGY AS A PARENT.
       CALL THIS BL1.  E(BL1) > ITH (DEFAULT IS 45 MEV)

    C. LOOK FOR A NEIGHBOR IN THE LIST. IF FOUND MOVE IT TO THE NEXT
       TO BL1.  CALL THIS BL2 (NEIGHBORS ARE ADJUCENT COUNTERS)

    D. FOR EACH BL2, LOOK FOR A NEIGHBOR OF BL2.  CALL THIS BL3.

    F. INCLUDE BL3 IRRESPECTIVE OF THE ENERGY IF E(BL2) > E(BL1)/5.
       IF NOT,INCLUDE BL3 IF E(BL3) < E(BL1)/2 .AND. E(BL3) < E(BL2)*3.
       IF INCLUDED TO THE FAMILY, MOVE IT NEXT TO BL2.

    G. FIND ALL NEIGHBORS OF BL2 ( GO TO C ;BL3 IS NOW BL2)

    H. AFTER ALL NEIGHBORS OF BL1 FAMILY IS FOUND, REPEAT ABOVE
       FOR UNASSIGNED BLOCKS IN THE LIST ( GO TO B )

    NOTE. DETECTOR IS DIVIDED INTO 3 PARTS; BARREL, -Z AND +Z
          END CAPS, AND CLUSTER SEARCH IS MADE SEPARATELY.
    THE THRESHOLDS USED IN THE CLUSTER SEARCH ARE STORED IN THE
    COMMON /CLGPRM/ ITH, MAXCLS, IRLTHD, IRLTH2, IRLTH3.
                   (45MEV)        5       2       3  <--- DEFAULT
    THESE VALUES CAN BE CHANGED BY USERS AFTER CALLING LGINIT.

3. CALUCULATION OF CLUSTER POSITION

     THE COORDINATES (PHI,Z) FOR BARREL AND (X,Y) FOR END CAP  ARE
     OBTAINED BY WEIGHTED AVERAGE. THE EXPONENT IN THE WEIGHT
     WAS DETERMINED BY R.EICHLER IN ORDER TO OBTAIN THE BEST
     PI-0 INVARIANT MASS BY A 3-DIMENSIONAL MONTE CARLO SHOWER
     USING THE A.SATO'S SHOWER PROGRAM.

       X = SUM (XI*EI**0.33) / SUM(EI**0.33)    (SIMILAR FOR PHI)
       Y = SUM (YI*EI**0.33) / SUM(EI**0.33)    (   "      "   Z )

     THEN THE DIRECTION COSINE IS CALUCUATED TAKING THE SHOWER
     DEPTH AND THE EVENT VERTEX(IF 'TPVX' IS THERE) INTO ACCOUNT.
$
       DEPTH = 22.39*LN(E/E0) (MM)      E0=4.979MEV FOR E+-,
                                        E0=1.725MEV FOR GAMMA.
        OR   = HALFWAY THROUGH THE LEAD GLASS
                 IF E<600 MEV OR E/P < 0.75
              ("IDENTIFIED" AS A NONSHOWERING CHARGED PARTICLE)

     TO OBTAIN THE DIRECTION COSINE, E.G. FOR A BARREL CLUSTER,
     THE ADDITIONAL PARAMETER R IS ITTERATIVELY SEARCHED FOR,
     FIXING (PHI,Z), UNTIL THE DEPTH REACHES TO THE EXPECTED VALUE.

     A FURTHER CORRECTION OF THE DIRECTION IS APPLIED AS A FUNCTION
     OF THE HIT POSITION AND THE ENERGY. THE CORRECTION FUNCTION WAS
     OBTAINED BY A MONTE CARLO METHOD.


4. 'ALGN'/1 BANK

  WORD   TYPE  CONTENTS
```

```
     0    I*4  THE LENGTH OF THE BANK
     1#   I*2  >100
          I*2  10003 FOR DATA .
               FOR MONTE CARLO DATA, 1=ENERGY UNSMEARED, 2=SMEARED
               AT THE GENERATION STAGE.  ADD 4 IF SMEARING IS DONE
               BY LGESMR IN LGCDIR.
     2    I*2  POINTER=1
          I*2  POINTER TO ADDRESS OF THE DATA ( -Z END CAP)
     3    I*2  POINTER TO ADDRESS OF THE DATA ( +Z END CAP)
          I*2  POINTER TO THE LAST WORD+1
     4    I*2  ADC CHANNEL NUMBER (0 THROUGH 2879)
          I*2  THE PULSE HEIGHT IN MEV.
     5    I*2  ADC CHANNEL NUMBER (0 THROUGH 2879)
          I*2  THE PULSE HEIGHT IN MEV.
           "        "
           "        "

          ( ALL NONZERO BLOCKS
              IN THE ORDER OF THE BLOCK NUMBERS (AFTER LGCALB)
              IN FAVOR OF CLUSTERS FOUND        (AFTER LGANAL)

AN EXAMPLE  FOR THE DATA LOOK AS FOLLOWS,

   ADC  MEV    ADC  MEV    ADC  MEV    ADC  MEV    ADC  MEV
   912 4886    880  540    913  194    911  162    944  113
   881   81    879   71 /2257 3879   2289 1227   2256   92
  2225   38   2290   86   2288   76 /2400   15//2715 1661
  2720 1370//2810   76 /2800   15

 POINTERS(WORD#2-5) HAVE THE VALUES OF  1,29,33,37
        ( // INDICATES THE BOUNDARY OF DETECTOR PARTS )
        ( / INDICATES THE BOUNDARY OF CLUSTERS IN ONE PART. )
        ( IN TOTAL 6 CLUSTERS ARE FOUND )
$
5. 'LGCL'/1 BANK

   THE FORMAT OF THE BANK IS GIVEN BELOW FOR CONVENIENCE.IT IS
   ESSENTIALLY THE SAME AS THE ONE DESCRIBED IN J.C.NOTE 14 - 14B.

  WORD   TYPE  CONTENTS

     0    I*4  THE LENGTH OF THE BANK
     1     "   IP1= 5;THE POINTER TO THE GENERAL INFORMATION
     2     "   IP2=26;THE POINTER TO THE CLUSTER MAP
     3     "   IP3   ;THE POINTER TO THE CLUSTER INFORMATION(NCLST+27)
     4     "   IP4   ;THE POINTER TO THE LAST WORD +1


  /GENERAL INFORMATION/

  WORD   TYPE  CONTENTS

  IP1     I*4  VERSION# OF THE PROGRAM.
  IP1+ 1   "   THE DATE AND TIME OF THE BANK GENERATION.
  IP1+ 2   "   #CLUSTERS       TOTAL (NCLST)
  IP1+ 3   "       "           BARREL
  IP1+ 4   "       "           Z<0 ENDCAP
  IP1+ 5   "       "           Z>0 ENDCAP
  IP1+ 6  R*4  SHOWER ENERGY TOTAL
  IP1+ 7   "       "           BARREL
  IP1+ 8   "       "           Z<0 ENDCAP
  IP1+ 9   "       "           Z>0 ENDCAP
  IP1+10  I*4  #PHOTONS
  IP1+11  R*4  PHOTON ENERGY TOTAL
  IP1+12   "       "           BARREL
  IP1+13   "       "           Z<0 ENDCAP
  IP1+14   "       "           Z>0 ENDCAP
  IP1+15  I*4  ERROR FLAG. 0=NO ERROR, 1=NOT CALIBRATED, 2=NOT ENOUGH
```



```
                SPACE TO COPY INPUT DATA,1024=FORMAT CONVERSION NOT DONE
                ADD 10 IF TOO MANY CLUSTERS FOUND
                ADD 100 IF NOT ENOUGH SPACE IN /BCS/
  IP1+16    "   THE STAGE OF ANALYSIS 1=LGANAL, 2=LGCDIR.
  IP1+17    "   THE VERSION # FOR THE ENERGY CORRECTION.
  IP1+18    "   1 IF TRACK CONNECTION IS DONE.
  IP1+19    "   FLAG=HDATA(2*NPVRTX+2) SEE J.C.NOTE FOR TP.
  IP1+20#   "   #WORDS/CLUSTER (NWPCL=16 CHANGED FROM 15)
       # INDICATES MODIFICATION


  /CLUSTER MAP/

  WORD       TYPE  CONTENTS

  IP2         I*2  H(1);THE START ADDRESS OF CLUSTER 1 IN RESHUFFLED
                     'ALGN'/1 BANK.
               "   H(2);THE LAST  ADDRESS
  IP2+1        "     . . . . . . . . .
    .          "     . . . . . . . . .
    .          "     . . . . . . . . .
  IP2+NCLST    "   H(1);POINTS TO THE LAST ADC DATA +1
```

NCLST+1 !

```
  FOR THE ABOVE EXAPMLE, THE VALUES OF H(1),... ARE
    1,7, 8,13, 14,16, 17,17, 19,0    RESPECTIVELY
$
  /CLUSTER INFORMATION/

   IB = IP3 + (N-1) * NWPCL - 1 (ADD ABSOLUTE POINTER TO THIS)

  WORD   TYPE  CONTENTS

  IB+ 1   I*4  DETECTOR PART; 0=BARREL, +/-1=+/1 Z END CAP
  IB+ 2   R*4  CLUSTER ENERGY IN GEV.
  IB+ 3    "   EXPECTED SIGMA OF THE ENERGY
  IB+ 4    "   PHI/X FOR BARREL/ENDCAP (RAD./MM)
  IB+ 5    "   Z  /Y FOR BARREL/ENDCAP (IN MM)
  IB+ 6    "   SIGMA(PHI)/SIGMA(X) FOR BARREL/ENDCAP (IN MM)
  IB+ 7    "   SIGMA(  Z)/SIGMA(Y) FOR BARREL/ENDCAP (IN MM)
  IB+ 8#  I*4  (#CONNECTED TRACKS)*100+1ST TRACK#, 0= A PHOTON
  IB+ 9   R*4  DX
  IB+10    "   DY  FROM EVENT VERTEX (SHOWER DEPTH CONSIDERED)
  IB+11    "   DZ
  IB+12    "   EW(2)/EW(1)                  (SIGX**2    SIGXY)
  IB+13    "   EW(2)+EW(1)  EIGEN VALUES OF  (SIGXY    SIGY**2)
  IB+14    "   THE ANGLE OF EIGEN VECTOR
  IB+15    "   THE FRACTION OF ENERGY IN THE EDGE BLOCKS.
               (IF IT IS >0.5, SAY, THE ENERGY OF THE CLUSTER COULD
                BE GROSSLY UNDERESTIMATED)
  IB+16#   "   THE ENERGY OBTAINED BY ADDING THE BLOCKS.
                (I.E. UNCORRECTED ENERGY FOR DATA, AND UNSMEARED FOR MC)

       # INDICATES MODIFICATION.
          (IN THE PATR BANK OF THE SMALLEST NR, 40TH WORD NOW CONTAINS
           THE CLUSTER NUMBER THAT IS CONNECTED TO THE TRACK.
           THIS CONNECTION IS DEFINED TO BE UNIQUE.)


$
 6  DUMP UTILITIES

       THE BOS BANK /ALGL/,/ALGN/ AND /LGCL/ CAN BE PRINTED
       BY SUBROUTINES  PRALGN AND PRLGCL.


    SUBROUTINE PRALGN(LORN,J,MM)
      DUMP THE LEAD GLASS ADC BANK('ALGN') TO LP

    ARGUMENTS (ALL ARE INPUT)
      LORN=0  FOR 'ALGL'/0,  LORN=1 FOR 'ALGN'/1
```

```
      THE ADDRESS PART IS DECODED ACCORDING TO THE INPUT J
      J=0, NO DECODING
      J=1,FOR INPUT CODE I.E. CRATE-SLOT-SUBADDRESS
      J=2,FOR POSITION CODE I.E. IPHI-IZ FOR THE BARREL PART
                            I.E. TOP/BOTTOM-NUM FOR THE ENDCAP
      MM IS NO. OF DATA TO BE PRINTED IN A LINE. (5--10 ARE RECOMENDED)
      THIS ARGUMENT IS PREPARED TO USE THE SUBROUTINE BOTH FOR
      LP AND OTHER DISPLAY DEVICES.


      SUBROUTINE PRLGCL

      PRINT THE BANK /LGCL/.
      THE CLUSTER HIT MAP, GENERAL INFORMATION AND EACH CLUSTER DATA
      ARE PRINTED.

$
 6. COMMON /CWORK/

    THE SUBROUTINE LGANAL USES THE COMMON /CWORK/, WHICH IS COPIED INTO
    THE BOS BANK /LGCL/. THE SUBROUTINE LGCDIR USES THE COMMON
    AGAIN IN LINKING THE INNER CHAMBER TRACK TO THE LG CLUSTERS.
    TO MAKE THE LINK, ALL INNER CHAMBER TRACKS ARE EXTENDED TO THE
    LEAD GLASS COUNTERS AND HIT BLOCKS ARE LISTED. POSSIBLE CLUSTERS
    DUE TO CHARGED TRACKS ARE GENERATED AND MATCHING OF THE COUNTERS
    BETWEEN THE OBSERVED CLUSTERS ARE EXAMINED. AFTER THE ANALYSIS
    THE EXPECTED LG HITS BY CHARGED TRACKS AND
    THE LINK TABLES BETWEEN THE OBSERVED LG CLUSTERS AND CHARGED TRACKS
    ARE KEPT IN THE WORK COMMON, WHICH CAN BE USED IMMEDIATELY AFTER
    THE LGCDIR-CALL IF DETAILED LINK INFORMATION IS REQUIRED.

      THE STRUCTURE OF THE COMMON
                    (  USED IN LGCDIR PART OF ANALYSIS )
      COMMON /CWORK/ NCHCLS,NPOINT,MAPCCL(101),HCLADR(1600),
     $               NCHCL2,HCLIST(4,100),  NCLST2,HCLLSO(4,80)

       NCHCLS   NUMBER OF EXPECTED CLUSTERS DUE TO CHARGED PARTICLES.
       NPOINT   TOTAL NUMBER OF HIT COUNTERS
       MAPCCL   MAP OF THE CHARGED TRACK CLUSTERS, ONLY START ADDRESS
                IS STORED.
       HCLADR   COUNTER ADDRESSES
       NCHCL2   =NCHCLS
       HCLIST(1,K)    NUMBER OF CONNECTED CLUSTERS FOR THE K-TH TRACK
             (2-4,K)  THE CLUSTER NUMBERS OF THE OBSERBED CLUSTERS
                      WHICH ARE LINKED TO THE K-TH TRACK.
       NCLST2   =NCLST
       HCLLSO(1,L)    NUMBER OF LINKED TRACKS FOR THE L-TH CLUSTER
             (2-4,L)  THE TRACK NUMBERS OF THE TRACKS WHICH ARE
                      LINKED TO THE CLUSTER

       UP TO 3 LINKS ARE STORED IN THE TABLE
       NOTE THAT IN THE /LGCL/ ONLY ONE OF THEM (THE HIGHEST ENERGY
       CLUSTER) IS STORED.
       THIS TABLE CAN BE PRINTED BY SUBROUTINE PRITOL.

           SUBROUTINE PRITOL(MODE)

       MODE=1, HIT MAP AND ADDRESS ONLY
           =2, LINK TABLES ONLY
           >2, BOTH
```

JADE Computer Note 15

P. Dittmann
W. Yen

January 31st, 1979

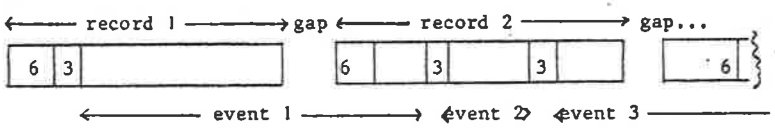
Data Acquisition System: Physical record format on Tape

This note describes the physical record format on tapes written by the data acquisition system, i.e. how the events are compressed into fixed length records. The event format itself will be described in another note. First, we describe the record structure, then FORTRAN subroutines which write and read these tapes.

A. Record structure

Each physical record starts with a header of 6 words, the logical records ("events") with additional 3 words.

In this paragraph: all words are 16-bit words (I * 2), all pointers count 16-bit words!



Word	Mn.	Value	
1	LREC	2048	record length
2	LH	6	record header length
3	NREC		current record number
4	LS		pointer to location before first event in record
	special cases:		
	LS = 0		no event starts in this record
	LS = LH		event starts immediately after record header
5	NRUN		run number
6			for future use
LS+1	LEVT		event length (incl. these 3 words)
	special cases:		
	LEVT = -1		no more events in this record
	LEVT = 0		end of data
+2	ITYP		event identifier
+3	NEVT		current event number

The event following NEVT is formatted according to a future note.

B. Subroutines to read and write the tapes

Write at the NORD: tapes and disc-files are written by the data acquisition system. A user routine to write tapes in the described format can be written on request.

Read at the NORD: SUBROUTINE YREAD on JADE-library. The description is in the Jade-lib folder.

Write at the IBM: SUBROUTINE WNORD, source on F11DIT.JUNK(MCTONORD). The source contains the description. This routine is slow, and used only in special cases, like transfer of M-C-events to the NORD.

Read at the IBM: To read a NORD tape at IBM we need

1. Two libraries:
   F22 YEN.JADE.L and RØ2BUT.CERNLIB
2. JCL for the input tape:

```
//GO.FTnnFØØ1 DD DSN=xx,DISP=SHR,UNIT=TAPE,VOL=SER=yy,
//DCB=(RECFM=F,BLKSIZE=4096,DEN=3),LABEL=(,NL)
```

   where nn = LUN = input unit
   xx = any name such as F22YEN.NORD1Ø
   yy = Tape name such as F22BØ1

3. The following statements in the main program:

```
INTEGER*2 IARR(N1)
EQUIVALENCE (IARR(5),ID(1))
COMMON/CDATA/LENG,IDDI(2),ID(5000)
COMMON/CMNP/IRUN,IREC,ISTAT,IFLAG,NWPR
```

where $N_1 = 2^* N_2 + 4$
N_2 = the maximum length of an event in I*4 words
ISTAT = the status word
= 1 normal termination of an event
= 2 zero event length
= 3 read error
= 4 end of file (one end of file)
= 7 end of tape or end of data (two end of files)