There are important numbers to be recorded which define the final T1, T2, T3 accept or postpone (AND/OR) conditions, such as multiplicity of TOF counters, total lead glass energy threshold, number of tracks in the inner and the muon detector etc. This trigger status information should only change before starting a new run. An extra run start bank will be created which will contain all the relevant information for the trigger in some 20 words. Its format will be described in a subsequent note.

Trigger output in the bank 'HEAD'

There are three words of general trigger information in the event header bank.

word (I * 2)	content
20	trigger action override and accept command word
21	trigger source and NIM-AND-OR command word
22	trigger action and logics condition of last accepted event

The words 20 and 21 are set by the person on shift and in general do not change within a run, while word 22 is event dependent. The bit content is the following:

TRIGGER ACTION OVERRIDE and ACCEPT COMMAND WORD (20)

BIT	CONTENT
0	T1 forced accept
1	" " postpone
2	" " reject
3	T2 forced accept
4	" " postpone
5	" " reject
6	T3 forced accept
7	" " reject
8	NO DL8 start & clear (Dead time is reduced)
9 10	HANDLE EVENT (2 bit binary no.) { 00 LAM, 01 NIM-PULSE, 10 Auto-reset, 11 Sit'n wait
11	All this is camac controlled (doesn't work)

T3 bank (name 'TRIG', number 3)

The length is fixed to 36 I * 2 words of unique format for all streets.

word	bits	content	
1	0,1	unused inputs	street 1
	2	T2 input	" "
	3	group 5	" "
	4	" 4	" "
	5	" 3	" "
	6	" 2	" "
	7	" 1	" "
	8	subtrigger 1	" "
	9	" 2	" "
	10	" 3	" "
	11	" 4	" "
	12 - 15	free	
2 - 36	dito	dito	street 2 - 36

The five groups G1 to G5 form a street through the muon detector which broadens to the outside. Within a group several muon chambers are OR'ed. Beside the edges there is a rough correspondence between group number and layer number of chambers, G1 being the innermost.
Form the five group signals within one street a set of four subtriggers is defined corresponding to momentum cutoff values of about 0.55, 0.8, 1.05 and 1.2 GeV/c.
A more detailed description of the muon trigger T3 is given in JADE Note No. 28.

T1 bank (name 'TRIG', number 1)

The length actually is 8 I * 2 words but may change in future.

word	bits	content
1	0 - 3	multiplicity* of beam-pipe-counters
	4 - 7	" of TOF counters
	8 - 11	" of BP counters through BP · TOF matrix
	12 - 15	" of TOF counters through BP · TOF matrix
2	0 - 6	TOF counters through matrix 1 - 7
	8 - 14	" " " " 8 - 14
3	0 - 6	" " " " 15 - 21
	8 - 14	" " " " 22 - 28
4	0 - 6	" " " " 29 - 35
	8 - 14	" " " " 36 - 42
5	0 - 15	PB counters " " 1 - 16
6	0 - 7	" " " " 17 - 24
7	0 - 7	output of the 8 coincidences of the final T1 AND/OR for ACCEPT
	8 - 15	as above for POSTPONE
8		free

* Coding of multiplicities: (modified BCD) (numbers greater than 7 are set to 7)

Bit	content
0	0
1	2^0
2	2^1
3	2^2

Result Banks

JHTL	Pointer : IDATA(69) Hit lable bank JADE computer note No. 21 (P. Steffen)
PATR	Pointer : IDATA(70) Track bank from pattern recognition program JADE computer note No. 12, version of 23/2/79 (P. Steffen)
ZVTX	Pointer : IDATA(71) z-vertex as computed by ZVERTF JADE computer note No. 17
LGCL	Pointer : IDATA(72) Lead glass cluster bank generated by LGANAL and updated by LGCDIR JADE computer note No. 14 (S. Yamada)
MUR1	Pointer : IDATA(73) Linear clusters in Mu-chambers JADE computer note No. 22 (J. Allison)
MUR2	Pointer : IDATA(74) Mu-hits connected to inner detector tracks JADE computer note No. 22 (J. Allison)
TPEV, TPVX, TPTR	Pointers : IDATA(91), 92, 93 These banks will contain information which is related to the TP-tapes JADE computer note in preparation (S. Yamada)
ALGN	Pointer : IDATA(75) Reorganized lead glass ADC-data according to clusters. ADC-data in MeV, gain corrected Format same as ALGL with calibration flag set JADE computer note No. 14 and 14a (S. Yamada)

ATAG

Pointer : IDATA(65)
Tagging System ADC data
(JADE computer note 16)

I*4		ATAG	
		0	
		0	
		Leng	No of I*4 data words
I*2		descriptor	
		0	
		Pointer 1	pointer to -z
		Pointer 2	pointer to +z
		Pointer 3	pointer to lumi.
		Pointer 4	pointer to first free location
	repeat	ADDR	
		DATA	ADC - Amplitude
		. . . .	

Address scheme :

0 - 95	- z
	0, 47, 48, 95 are empty
96 - 191	+ z
	96, 143, 144, 191 are empty
192 - 207	Lumi. counters
216 - 227	lead glass sums
228	lead glass sum - z
229	lead glass sum + z

JETC

Pointer : IDATA(61)
Jet Chamber data
(JADE computer note No. 5)

I*4		JETC	
		0	8 in MtC
		0	
		Leng	No. of I*4 data words
I*2		descriptor	
		0	
		Pointer 1	pointer to cell 1
		Pointer 2	pointer to cell 2
		. . .	
		Pointer 97	* New:
		Pointer 98	pointer to first free location
	repeat	ADDR	last 3 bits = hit no.
	repeat	Ampl.-	
	repeat	Ampl.+	
	repeat	Drift time	
		. . . .	

* New: Pointer to list of I x 2 words for cases where there are more than 8 hits: wire no, number of hits, wire no, number of hits etc

ATOF

Pointer : IDATA(59)
TOF-counter data
(JADE Note No. 32)

In contrast to what has been said in JADE note 32 the banks ATOF and ATBP will not be reformated, at least for the start of the experiment.

ATOF is a fixed length bank of 94 I*4 data words, i.e. 188 I*2 data words.

I*2
1. bank descriptor
2. 0
3-15 ADC : $1^- \ 1^+ \ 2^- \ 2^+ \ 3^- \ 3^+ \ 4^- \ 4^+ \ 5^- \ 5^+ \ 6^- \ 6^+ \ 0$
. . . . .
81-93 ADC : $37^- \ 37^+ \ 38^- \ 38^+ \ 39^- \ 39^+ \ 40^- \ 40^+ \ 41^- \ 41^+ \ 42^- \ 42^+ \ 0$
94-102 TDC : $1^- \ 1^+ \ 2^- \ 2^+ \ 3^- \ 3^+ \ 4^- \ 4^+ \ 0$
. . . . .
175-183 TDC : $37^- \ 37^+ \ 38^- \ 38^+ \ 39^- \ 39^+ \ 40^- \ 40^+ \ 0$
184-188 TDC : $41^- \ 41^+ \ 42^- \ 42^+ \ 0$

ATBP

Pointer : IDATA(64)
Beam pipe counter data
(JADE Note No. 32)

ATBP is a fixed length bank of 40 I*4 data words, i.e. 80 I*2 data words.

I*2
1 bank descriptor
2 0
3-15 ADC : $1^- \ 1^+ \ 2^- \ 2^+ \ 3^- \ 3^+ \ 4^- \ 4^+ \ 5^- \ 5^+ \ 6^- \ 6^+ \ 0$
. . . . .
42-54 ADC : $19^- \ 19^+ \ 20^- \ 20^+ \ 21^- \ 21^+ \ 22^- \ 22^+ \ 23^- \ 23^+ \ 24^- \ 24^+ \ 0$
55-63 TDC : 1 2 3 4 5 6 7 8 0
64-72 TDC : 9 10 11 12 12 14 15 16 0
73-80 TDC :17 18 19 20 21 22 23 24

I*4 word	Assignment		
73	Pointer to bank	MUR1	Mu results 1
74	" " "	MUR2	Mu results 2
75	" " "	+ALGN	lead glass ADC
76	" " "	+TAGG	Tagging results
77	" " "	+ACLS	Tagging ADC's
78	" " "	+TOFR	TOF-results
91	" " "	TPEV	general event information
92	" " "	TPVX	vertex information
93	" " "	TPTR	TP-track information

LATC (Jade Note 32 - Latches)

I*4 word	I*2 word	Type	Assignment	
1		I*4	'LATC'	
2		I*4	bank No. (= 3 for MtC)	
3		I*4	pointer to next bank	
4		I*4	No. of I*4 data words	
5	1	(I*2)	bank descriptor	
	2	(I*2)		
	3	I*2	bits 0 - 7	beam pipe counters 1 - 8
	4	↓	" 0 - 7	beam pipe counters 9 - 16
	5		" 0 - 7	beam pipe counters 17 - 24
	6		" 0 - 6	TOF counters 1 - 7
	7		" 0 - 6	TOF counters 8 - 14
	⋮			
	11		" 0 - 6	TOF counters 36 - 42

Header bank (JADE Note 24 and 32)

I*4 word	I*2 word	Type	Assignment	
1		I*4	HEAD	
2		I*4	bank No. (=1 for MtC)	
3		I*4	pointer to next bank	
4		I*4	No of I*4 data words = 100	
	1	I*2	identifier	descriptor
	2	I*2	0	
	3		second	time
	4		minute	
	5		hour	
	6		day	
	7		month	
	8		year	
	9		experiment number = 0 for MtC	
	10		run number	
	11		record number (counted from beginning of = event no.	
	12		record type	see below
	13		readout pattern	
	14		0	
	15		0	reserved for detector status
	16		0	
	17		0	
	18		0	
	19		0	
	20		0	
	21		trigger source	
	22		trigger action bits	

```
        -DINATES RELATIVE TO THE CHAMBER AS FOLLOWS..
       ICT=(HVDR*(ITD-HDTP))/1000
       ICL=(HLSF*(ITL-HLTP))/100
         WHERE ICT,ICL ARE COORDINATES IN MM,
         ITD IS DRIFT TIME IN TRANS. CLOCK UNITS, AND
         ITL IS LONG. TIME DIFF. IN LONG. CLOCK UNITS.
```

STATUS DATA FOR THE CHAMBERS

```
HMCSTA(ICHAM)     =0 IF CHAMBER OK
                  .NE.0 IF CHAMBER U/S FOR ANY REASON.
```

MACRO CMUTNY.

/CMUTNY/

CONDENSED MU-FILTER PAARAMETERS FOR USE BY APPROXIMATE SIGNAL TO COORDINATE CONVERSION SUBROUTINE MUTINY.

```
HPLANS       NO. OF CHAMBER PLANES.
HVDRAV       AVERAGE DRIFT VELOCITY.
HDTPAV       AVERAGE DRIFT TIME PEDESTAL.
HLTPAV       AVERAGE LONGITUDINAL TIME DIFFERENCE PEDESTAL.
HLSFAV       AVERAGE LONGITUDINAL SCALING FACTOR.
```

FOR EACH CHAMBER PLANE...

```
HLY          LAYER NUMBER.
HOR          ORIENTATION PARAMETER:
             =1, WIRES PARALLEL TO BEAM, AND NORMAL PARALLEL TO
                  X-AXIS - FACES 1(-X) AND 2(+X).
             =2, WIRES PARALLEL TO BEAM, AND NORMAL PARALLEL TO
                  Y-AXIS - FACES 3(-Y) AND 4(+Y).
             =3, WIRES VERTICAL, AND NORMAL PARALLEL TO Z-AXIS -
                  FACES 5(-Z) AND 6(+Z).
HC1          FIRST CHAMBER NUMBER.
HCN0         NORMAL        )
HCL0         LONGITUDINAL  )  COORDINATE OF 'ORIGIN' OF CHAMBER PLANE.
HCT0         TRANSVERSE    )
HSP          AVERAGE SPACING OF CHAMBERS.
```

(THE 'ORIGIN' IS AT ONE END OF THE WIRE OF THE FIRST CHAMBER IN THE PLANE. THE END IS THAT WITH THE LOWEST LONGITUDINAL COORDINATE.)

```
      COMMON /CMUTNY/HPLANS,HVDRAV,HDTPAV,HLTPAV,HLSFAV,
     * HLY(48),HOR(48),HC1(48),HCN0(48),HCL0(48),HCT0(48),HSP(48)
```

COMMON DESCRIPTIONS.

MACRO CMUFRCH.

```
-------------START OF MACRO CMUFRCH-----------------------------------

/CMUCDV/,/CMUNIT/,/CMFFIX/,/CMFSUR/,/CMCFIX/,/CMCSUR/,/CMCELE/,/CMCSTA/
   ARE DESCRIBED ON 'F22ALL.JADEMUS(@MUINFOM)'. THEY CAN BE READ FROM
   THE APPROPRIATE MU CALIBRATION DATA EOS RECORD, E.G.,
   'F22ALL.MUCALIB.DATA0001' USING BREAD AND MUCON.

      COMMON /CMUCDV/NVERSN,DESCRP(15)

      COMMON /CMUNIT/HOVALL(6)

      COMMON/CMFFIX/HMFFIX(740)
      DIMENSION HFACE(82),HSECT(82),HLAYER(82),HNORM(82),HLONG(82),
     *          HTRANS(82),HAC(82),HAL(82),HUNIT(82)
      EQUIVALENCE (HMFFIX(1),NFRAMS),(HMFFIX(3),HFACE(1)),
     *            (HMFFIX(85),HSECT(1)),(HMFFIX(167),HLAYER(1)),
     *            (HMFFIX(249),HNORM(1)),(HMFFIX(331),HLONG(1)),
     *            (HMFFIX(413),HTRANS(1)),(HMFFIX(495),HAC(1)),
     *            (HMFFIX(577),HAL(1)),(HMFFIX(659),HUNIT(1))

      COMMON/CMFSUR/HMFSUR(492)
      DIMENSION HDIST(82),HANG(82),HCLLO(82),HCLHI(82),HCTLO(82),
     *          HCTHI(82)
      EQUIVALENCE (HMFSUR(1),HDIST(1)),(HMFSUR(83),HANG(1)),
     *            (HMFSUR(165),HCLLO(1)),(HMFSUR(247),HCLHI(1)),
     *            (HMFSUR(329),HCTLO(1)),(HMFSUR(411),HCTHI(1))

      COMMON/CMCFIX/HMCFIX(636)
      DIMENSION HFR(634)
      EQUIVALENCE (HMCFIX(1),NCHAMS),(HMCFIX(3),HFR(1))

      COMMON/CMCSUR/HMCSUR(1268)
      DIMENSION HD1(634),HCTW(634)
      EQUIVALENCE (HMCSUR(1),HCTW(1)),(HMCSUR(635),HD1(1))

      COMMON/CMCELE/HMCELE(4440)
      DIMENSION HDTP(634),HLTP(634),HLSF(4,634),HVDRFT(634)
      EQUIVALENCE (HMCELE(1),HVDR),(HMCELE(2),HDTP(1)),
     *            (HMCELE(636),HLTP(1)),(HMCELE(1270),HLSF(1,1)),
     *            (HMCELE(3806),HMCEDM),(HMCELE(3807),HVDRFT(1))

      COMMON/CMCSTA/HMCSTA(634)
-------------END OF MACRO CMUFRCH-------------------------------------
```

```
NVERSN           VERSION NUMBER.
DESCRP           DESCRIPTION.

HOVALL(IUNIT)    OVERALL TRANSLATION OF EACH UNIT ALONG RAILS.
                    IUNIT=1 - FAR SIDE (-X) WALL,
                    IUNIT=2 - NEAR SIDE (+X, RUCKSACK) WALL,
                    IUNIT=3 - MAGNET  (ALL TRANSLATIONS ARE RELATIVE TO
                              THIS SO HOVALL(3) SHOULD ALWAYS BE ZERO.)
                    IUNIT=4 - FAR SIDE (-X) ARCH,
                    IUNIT=5 - NEAR SIDE (+X) ARCH.
```

```
     SDL**2=DSRMS**2+DLRES**2+DPERRL**2,
     SDD**2=DSRMS**2+DRES**2+DPERRD**2,
   WHERE DSRMS IS THE RMS MULTIPLE SCATTERING DEFLECTION EXPECTED AT
                 THE CHAMBER,
         DLRES IS THE LONGITUDINAL (I.E. PARALLEL TO WIRE) RESOLUTION
                 EXPRESSED AS A STANDARD DEVIATION,
         DRES IS THE DRIFT DISTANCE RESOLUTION, ALSO A STANDARD DEVN.
         DPERRL/D ARE THE PROJECTION ERRORS IN THE WIRE/DRIFT
                 DIRECTIONS,
         F IS A FACTOR, SAY 3., TO COLLECT HITS WITHIN 3 STANDARD
                 DEVIATIONS.  F IS ADJUSTABLE.
FOR EACH INNER DETECTOR TRACK...
 WORD  TYPE  CONTENTS
    1  I*4   TRACK NUMBER.
    2  R*4   IDENTIFIER OF PROGRAM WHICH CREATED THIS INFORMATION (A
               4-CHARACTER ALPHANUMERIC WORD).
    3  I*4   DATE OF PRODUCTION, E.G. 790307 FOR 7TH MARCH 1979.
    4  I*4   NUMBER OF ASSOCIATED MUON HITS.
?   5  I*4   ACCEPTANCE FLAG, =0, SAFELY IN ACCEPTANCE,
?                             =1, NEAR EDGE OF ACCEPTANCE,
?                             =2, DEFINITELY OUTSIDE MUON ACCEPTANCE.
    6  I*4   QUALITY FLAG,
             =0, NO ASSOCIATED MUON CHAMBER HITS AND NONE EXPECTED.
             =1, CLEAN MUON, I.E. A CLEAN LINE OF HITS, THE LAST
                         OF WHICH CORRESPONDS TO AN AMOUNT OF
                         PENETRATED MATERIAL NOT MORE THAN THE
                         ULTIMATE RANGE OF A MUON WITH THE MOMENTUM
                         OF THIS INNER DETECTOR TRACK AND THERE ARE
                         NO CHAMBERS BEYOND THE LAST HIT WHICH FIRE.
?            =2, AS =1, BUT THE HITS USED ARE SHARED WITH ANOTHER
?                        TRACK, I.E. THERE IS AN AMBIGUITY.
?            =3, DIRTY MUON, I.E. AS =1, BUT MORE THAN 1 HITS
?                        WITHIN MULTIPLE SCATTERING CIRCLE IN AT LEAST
?                        ONE MUON CHAMBER LAYER.
             +10, I.E. ADD 10 IF THE HITS STOP SHORT OF WHAT
                         WOULD BE EXPECTED FOR A MUON, I.E. THERE EXIST
                         CHAMBERS BEYOND THE LAST WHICH WOULD FIRE.
?            +100, I.E. ADD 100 IF THE HITS EXTEND TOO FAR, I.E.
?                        THE LAST HIT CORRESPONDS TO AN AMOUNT OF
?                        MATERIAL PENETRATED WHICH IS SIGNIFICANTLY
?                        GREATER THAN THE EXPECTED RANGE.
   13  I*2   NUMBER OF TRACKS WITH SHARED HITS INSIDE MAGNET YOKE.
               (IF >3 SEE 'MUR2' BANK 2 FOR DETAILS.)
   14  I*2   TRACK NUMBER OF 1ST TRACK WITH SHARED HITS INSIDE YOKE.
   15  I*2   TRACK NUMBER OF 2ND TRACK WITH SHARED HITS INSIDE YOKE.
   16  I*2   TRACK NUMBER OF 3RD TRACK WITH SHARED HITS INSIDE YOKE.
   17  I*2   NUMBER OF TRACKS WITH SHARED HITS OUTSIDE MAGNET YOKE.
               (IF >3 SEE 'MUR2' BANK 2 FOR DETAILS.)
   18  I*2   TRACK NUMBER OF 1ST TRACK WITH SHARED HITS OUTSIDE YOKE.
   19  I*2   TRACK NUMBER OF 2ND TRACK WITH SHARED HITS OUTSIDE YOKE.
   20  I*2   TRACK NUMBER OF 3RD TRACK WITH SHARED HITS OUTSIDE YOKE.
?  11  R*4   CHI-SQUARED PROBABILITY OF BEING MUON.  THIS HAS MEANING
?              ONLY IF THE QUALITY FLAG (WORD 6) IS .LT. 10.
```

```
'MUR1' BANK 1 - MUON COORDINATE BANK.
FOR EACH HIT....
 WORD   TYPE   CONTENTS
   1    I*2    4*CHAMBER NUMBER + (HIT NUMBER -1)
   2    I*2    10*LAYER NUMBER + ORIENTATION PARAMETER  (I.E. 1, 2 OR 3
                 ACCORDING TO DIRECTION OF NORMAL OF CHAMBER PLANES.
                 X->1, Y->2, Z->3.  SEE CMUTNY DESCRIPTION.)
   3    I*2    X )
   4    I*2    Y ) 'LEFT' AMBIGUITY (MM).
   5    I*2    Z )
   6    I*2    X )
   7    I*2    Y ) 'RIGHT' AMBIGUITY (MM).
   8    I*2    Z )
? 'MUR1' BANK 2 - MUON CLUSTER ASSIGNMENT BANK.
? FOR EACH HIT A 2-BYTE WORD PACKED AS FOLLOWS...
?  NAME                 F   E   D   C   B   A
?  LAYOUT  M.S. I---I-I-----I-I-----I-I LEAST SIGNIFICANT END.
?  NO. OF BITS          3   1   5   1   5   1
?  NAME    BITS             CONTENTS
?   A      15 (L.S.)        =0 IF LONGITUDINAL MEASUREMENT DOUBTFUL..
?                           =1 IF LONGITUDINAL MEASUREMENT IS OK.
?   B  10-14                PRIMARY CLUSTER ASSIGNMENT (=0 IF UNASSIGNED).
?   C       9               =0 LEFT AMBIGUITY  ) (PRIMARY CLUSTER).
?                           =1 RIGHT AMBIGUITY )
?   D      4-8              SECONDARY CLUSTER ASSIGNMENT  (=0 IF UNASSIGNED).
?   E       3               =0 LEFT AMBIGUITY  ) (SECONDARY CLUSTER).
?                           =1 RIGHT AMBIGUITY )
?   F      0-2 (M.S.)       FREE.
 'MUR1' BANK 3 - MUON CLUSTER INFORMATION.   (NOTE. CLUSTER NUMBER IN
    WORD 27.)
 FOR EACH CLUSTER...
  WORD   TYPE   CONTENTS
    1    I*4    DATE OF PRODUCTION (E.G. 790110 FOR 10/1/79).
    2    R*4    IDENTIFIER OF PROGRAM WHICH CREATED CLUSTER (A 4 CHAR-
                  ACTER ALPHANUMERIC WORD).
    3    I*4    NO. OF HITS IN CLUSTER.
    4    I*4    CLUSTER NUMBER OF ALTERNATIVE CLUSTER (=0 IF NONE).
    5    I*4    =0, ONLY ONE LAYER IN CLUSTER (IF SO WORDS 9-14=0).
    6    R*4    XC )
    7    R*4    YC ) COORDS. OF 'CENTRE OF GRAVITY' (MM).
    8    R*4    ZC )
    9    R*4    DX )
   10    R*4    DY ) DIRECTION COSINES OF FITTED LINE.
   11    R*4    DZ )
   12    R*4    D1, DISTANCE TO 'FIRST' POINT (MM).
   13    R*4    D2, DISTANCE TO 'LAST' POINT (MM).
                  NOTE. ALGORITHM TO GET CORDINATES OF FIRST HIT IS...
                     X1=XC+D1*DX
                     Y1=YC+D1*DY
                     Z1=ZC+D1*DZ
                  AND SIMILARLY FOR LAST HIT.
```

DESCRIPTION OF MUON BANKS.

RAW DATA BANK 'MUEV'.

REAL DATA......

```
WORD    TYPE    CONTENTS
  1     I*2     ) BANK DESCRIPTOR - SEE JADE NOTE 32.
  2     I*2     )
  3     I*2     MARKER FOR FIRST CRATE (=F0N(HEX) = 3840+N FOR CRATE N
  .     I*2     REFERENCE SIGNAL (=E00(HEX)+IREF = 3584+IREF).
  .     I*2     4*CHAMBER NUMBER + (HIT NUMBER - 1).          )THESE
  .     I*2     DRIFT TIME                                    )3 WORDS
                  OR 2048+SINGLES COUNT.                      )REPEATED
  .     I*2     LONGITUDINAL TIME DIFFERENCE                  )FOR
                  OR 2048+TIME INTERVAL FOR SINGLES COUNT.    )EACH
                  (TIME INTERVAL IN UNITS OF 0.5 SECS.)       )HIT.
  .             .
  .     I*2     MARKER FOR NEXT CRATE, ETC.
```

MONTE CARLO DATA.....

AS REAL DATA, WITHOUT MARKERS AND REFERENCE SIGNAL WORDS. (REFERENCE SIGNAL ASSUMED ZERO.)

MUON RESULTS BANKS 'MUR1' (6 BANKS NUMBERED 0-5).

THESE BANKS REPRESENT THE RESULTS OF FOLLOWING 'PHILOSOPHY 1', I.E. OF OBTAINING AS MUCH INFORMATION AS POSSIBLE BY LOOKING AT THE MUON SIGNALS ALONE.

'MUR1' BANK 0 - GENERAL INFORMATION.

```
WORD  TYPE  CONTENTS
  1   I*4   NO. OF HITS.
  2   I*4   NO. OF CLUSTERS (TRACKS).
  3   I*4   NO. OF 2-BYTE WORDS PER HIT IN COORDINATE BANK.
  4   I*4   NO. OF 4-BYTE WORDS PER CLUSTER IN CLUSTER BANK.
  5   I*4   =1 IF MULINE HAS BEEN CALLED, I.E. IF AN ATTEMPT TO
                 CREATE CLUSTERS HAS BEEN MADE.    =0 OTHERWISE.
  6   I*4   =1 IF AN ATTEMPT TO JOIN CLUSTERS TO INNER DETECTOR
                 TRACKS HAS BEEN MADE.    =0 OTHERWISE.
  7   I*4   =1 IF AN ATTEMPT TO JOIN CLUSTERS TO LEAD-GLASS CLUSTERS
                 HAS BEEN MADE.    =0 OTHERWISE.
  8   I*4   DATE OF PRODUCTION OF COORDINATE BANK.
  9   I*4   CALIBRATION DATA ISSUE, I.E. IDENTIFIER OF CALIB. DATA
                 USED TO PRODUCE COORDINATES.
```

MONTE CARLO.

MONTE CARLO STATUS AT 9/1/79.

WRITTEN LARGELY BY DEREK STORK, UPDATED SOMEWHAT BY JOHN ALLISON, WHO NOW HOLDS DEREK STORK'S FILES. NOW FULLY INCORPORATED INTO THE JADE MONTE CARLO ON 'F11BAR.JADE.SOURCE' AND '.LOAD', AND MAINTAINED BY WULFRIN BARTEL AND ECKHARD ELSEN.

THERE ARE SOME MUON MONTE CARLO PRINTING ROUTINES ON 'F22ALL.MUMC.S' AND '.L' WHICH CAN BE CALLED FOR DIAGNOSTIC PURPOSES AND FOR OBTAINING FULL INFORMATION ABOUT THE TRACKS IN THE MUON FILTER AS GENERATED. SEE, E.G., 'F11BAR.JADE.SOURCE(ITEST8)' WHERE THE APROPRIATE STATEMENTS ARE COMMENTED OUT, OR 'F22ALL.MUMC.S(MUGEN)' WHERE THEY ARE OPERATIONAL. THE CORRESPONDING JCL IS IN 'F22ALL.MUMC.S(#MUGEN)'.

MUON ANALYSIS.

MUON ANALYSIS STATUS AT 02/07/79.

THE ANALYSIS CAN BE INVOKED BY 3 DRIVING ROUTINES AS FOLLOWS:

    CALL MUINI BEFORE THE EVENT LOOP.

    CALL MUANA IN THE EVENT LOOP TO ANALYSE DATA.

    CALL MUFINI AFTER PROCESSING TO GET STATISTICS, ETC.

THESE SUBROUTINES ARE DESCRIBED BELOW.

I)MUINI - THE MUON INITIALISATION ROUTIINE.

```
      CALL MUINI(LUNC,LUNE,IPRINT,&98)

WHERE LUNC IS THE LOGICAL UNIT NUMBER OF THE MUON CALIBRATION DATA SET
            (THE DATASET IS F22ALL.MUCALIB.DATAXXXX WHERE XXXX IS
            A SEQUENCE NUMBER, PRESENTLY 0001, AND IS PLATENFEST.)
            USUALLY LUNC=8. IF LUNC=0, MUINI ASSUMES THE DATA IS
            ALREADY IN BANKS IN /BCS/ AS THOUGH READ BY BREAD.
      LUNE IS THE LOGICAL UNIT NUMBER OF THE UPDATE DATA SET.
            (THE DATASET IS F22ALL.MUCALIB.UPDATEXX WHERE XX IS
            A SEQUENCE NUMBER, PRESENTLY 01, AND IS PLATENFEST.)
            USUALLY LUNE=9.  IF LUNE=0, MUINI ASSUMES THERE ARE NO
            UPDATES TO BE MADE.
      IPRINT=0 TO SUPPRESS PRINTING, OTHERWISE YOU GET ABOUT 10 PAGES
            OF MUON CAALIBRATION DATA.
      &98 IS AN ERROR RETURN LABEL.
```

```
12 R*4    INTEGRAL DL (=DISTANCE, MM).                              )(FROM        (6)
13 R*4    INTEGRAL DENSITY*DL (= MATERIAL TRAVERSED,                )(~~INTER-~~
            GM CM**-2).                                             )(~~ACTION~~ TRACK
14 R*4    INTEGRAL (-DE/DX)*DL (ENERGY LOSS, ASSUMING               )(~~POINT~~ VERTEX TO
            PARTICLE IS A MUON, GEV).                               )(LAST
15 R*4    INTEGRAL DL/(ABSORPTION LENGTH) ('NUMBER' OF              )(HIT.
            ABSORPTION LENGTHS) ASSUMING A PION.                    )(
16 R*4    ENERGY AT LAST HIT ASSUMING MUON (GEV).
17 R*4    INTEGRAL DL (=DISTANCE, MM).                              )(FROM  TRACK
18 R*4    INTEGRAL DENSITY*DL (= MATERIAL TRAVERSED,                )(~~INTER~~ VERTEX
            GM CM**-2).                                             )(~~ACTION~~
19 R*4    INTEGRAL (-DE/DX)*DL (ENERGY LOSS, ASSUMING               )(~~POINT~~ TO
            PARTICLE IS A MUON, GEV).                               )(POSSIBLE
20 R*4    INTEGRAL DL/(ABSORPTION LENGTH) ('NUMBER' OF              )(FURTHER
            ABSORPTION LENGTHS) ASSUMING A PION.                    )(HIT.
                                   (SAME AS 12-15 IF NO POSSIBLE FURTHER HIT.)
21 R*4    PROBABILTY OF PI->MU DECAY.
22 R*4    PROBABILTY OF NO NUCLEAR INTERACTION, ASSUMING A PION.
23 R*4    PROBABILTY OF PION PUNCHTHROUGH.            ?<-?
        'MUR1' BANK 2 — TRACK NO. - HIT NO. CORRELATION.
-----------------------------------------------------------------------
END OF BANK DESCRIPTIONS.
-----------------------------------------------------------------------
```

24 Prob K-decay
" to be μ
25 " " hadron
26 "

```
  24    R*4    ULTIMATE RANGE OF A MUON WITH MOMENTUM OF INNER DETECTOR
                  TRACK, IF ANY (GM CM**-2).
  25    R*4    RMS DRIFT DIRECTION DEVIATION.                    ) IGNORE IF
  26    R*4    RMS LONGITUDINAL (WIRE) DIRECTION DEVIATION.) WD 14.LE.0.
  27    I*4    CLUSTER NUMBER.

'MUR1' BANK 4 - THE POINTER LIST HCLP.
   HCLP(ICL) POINTS TO START OF INFORMATION IN HCLIST (BANK 5) FOR
     CLUSTER ICL.
   HCLP(NO. OF CLUSTERS +1) POINTS TO WORD AFTER THE LAST.

'MUR1' BANK 5 - THE HIT LIST HCLIST.
   THIS GIVES THE HITS BELONGING TO EACH CLUSTER.
   BANKS 4 AND 5 MAY BE USED IN CONJUNCTION TO FIND THE HITS BELONGING
     TO EACH CLUSTER AS FOLLOWS...
    NCLS = NO. OF CLUSTERS (WORD 2 OF BANK 0).
    NWHIT = NO. OF WORDS PER HIT (WORD 3 OF BANK 0).
    NWCL = NO. OF WORDS PER CLUSTER (WORD 4 OF BANK 0).
    IPCL = IP3, WHERE IP3 IS POINTER TO BANK 3.
    IP11 = 2*IP1, WHERE IP1 IS POINTER TO BANK 1.
    IP44 = 2*IP4, WHERE IP4 IS POINTER TO BANK 4.
    IP55 = 2*IP5, WHERE IP5 IS POINTER TO BANK 5.
BEGIN LOOP 1 - LOOP OVER CLUSTERS                          **** START LOOP 1
    DO 1000 ICL=1,NCLS
FIND HITS FOR THIS CLUSTER.  TO GET HITS OF SECONDARY CLUSTER USE
  THE POINTERS OF PRIMARY CLUSTER.
    JCL=ICL        IDATA
    IALT=IS(IPCL+4)
    IF(IALT.NE.0.AND.IALT.LT.ICL)JCL=IALT
    LP=HIS(IP44+JCL)
    LPNEXT=HIS(IP44+JCL+1)
START LOOP 2.                                          ***** START LOOP2.
2000 CONTINUE           HDATA
    IHIT=HIS(IP55+LP)
    IP=NWHIT*(IHIT-1)
NOW YOU CAN FIND HITS. ADD IP TO IP11 TO GET START OF COORDINATE DATA.
 (DON'T FORGET TO USE APPROPRIATE INFORMATION,E.G. AMBIGUITY FLAGS,
  FOR SECONDARY CLUSTERS, I.E. IF(JCL.LT.ICL) ).
    ....
    ....
END LOOP 2.                                            ***** END LOOP 2.
2001 CONTINUE
    LP=LP+1
    IF(LP.LT.LPNEXT)GO TO 2000
END LOOP 1.                                            ***** END LOOP 1.
1001 CONTINUE
    IPCL=IPCL+NWCL
1000 CONTINUE
```

```
MUON RESULTS BANKS 'MUR2' (3 BANKS NUMBERED 0-2).
   THESE BANKS REPRESENT THE RESULTS OF FOLLOWING 'PHILOSOPHY 2', I.E.
     OF FOLLOWING INNER DETECTOR TRACKS OUT.

'MUR2' BANK 0 - MUON GENERAL INFORMATION BANK.
 WORD   TYPE   CONTENTS
   1    I*4    NO. OF INNER DETECTOR TRACKS ACCORDING TO BANK 'PATR'.
   2    I*4    NO. OF 4-BYTE WORDS PER TRACK IN BANK 1.
```

3 NO of Track/hit

DESCRIPTION OF MUON BANKS.

NEW DATA FORMAT - MONTE CARLO AND RAW DATA - FROM MARCH 1979.

BANK NAME 'MUEV'
BANK NUMBER =0, RAW DATA,
=10, MONTE CARLO.

WORD	TYPE	CONTENTS	
1	I*2	}BANK DESCRIPTOR - SEE JADE NOTE 32.	
2	I*2	}	
3	I*2	4*CHAMBER NUMBER + (HIT NUMBER - 1).	)THESE 3 WORDS
4	I*2	DRIFT TIME.	)REPEATED FOR
5	I*2	LONGITUDINAL TIME DIFFERENCE.	)EACH HIT.

OLD MONTE CARLO DATA FORMAT - UP TO END OF FEB 1979.

'MUEV', BANK 10

WORD	TYPE	CONTENTS	
1	I*2	POINTER TO START OF FACE 1)	ALL THESE POINTERS
2	I*2	POINTER TO START OF FACE 2)	REFER TO INTEGER*2
3	I*2	POINTER TO START OF FACE 3)	WORDS RELATIVE TO
4	I*2	POINTER TO START OF FACE 4)	WORD 9. I.E. POINTER
5	I*2	POINTER TO START OF FACE 5)	=1 MEANS WORD 9.
6	I*2	POINTER TO START OF FACE 6)	
7	I*2	POINTER TO WORD AFTER LAST.)	
8	I*2	0	
9	I*2	4*CHAMBER NUMBER + (HIT NUMBER - 1).	)THESE 3 WORDS
10	I*2	DRIFT TIME.	)REPEATED FOR
11	I*2	LONGITUDINAL TIME DIFFERENCE.	)EACH HIT.

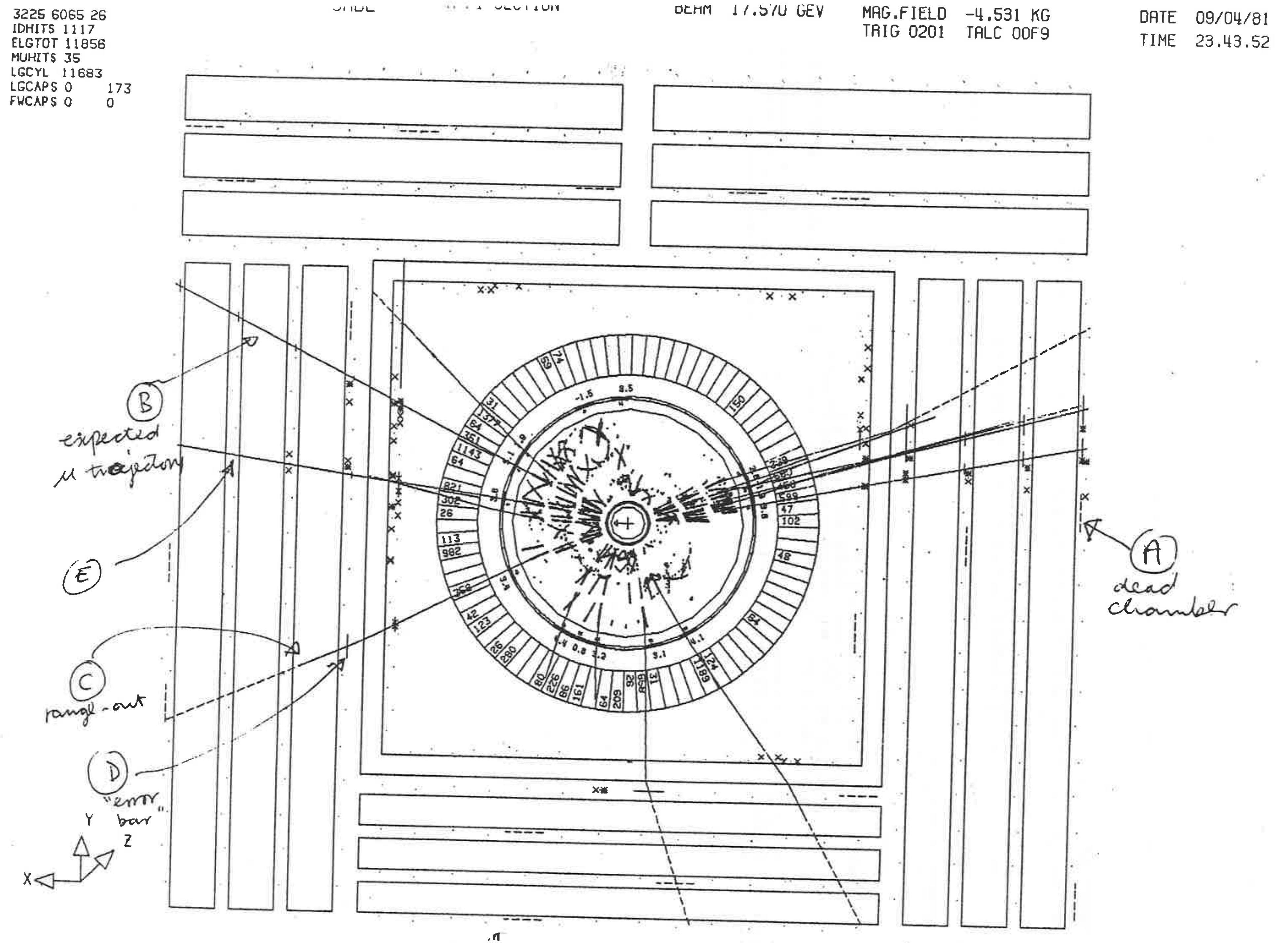
MUON RESULTS BANKS 'MUR1' (6 BANKS NUMBERED 0-5).
THESE BANKS REPRESENT THE RESULTS OF FOLLOWING 'PHILOSOPHY 1', I.E. OF OBTAINING AS MUCH INFORMATION AS POSSIBLE BY LOOKING AT THE MUON SIGNALS ALONE.

'MUR1' BANK 0 - MUON GENERAL INFORMATION BANK.

WORD	TYPE	CONTENTS
1	I*4	NO. OF HITS.
2	I*4	NO. OF CLUSTERS (TRACKS).
3	I*4	NO. OF 2-BYTE WORDS PER HIT IN COORDINATE BANK.
4	I*4	NO. OF 4-BYTE WORDS PER CLUSTER IN CLUSTER BANK.
5	I*4	=1 IF MULINE HAS BEEN CALLED, I.E. IF AN ATTEMPT TO CREATE CLUSTERS HAS BEEN MADE. =0 OTHERWISE.
6	I*4	=1 IF AN ATTEMPT TO JOIN CLUSTERS TO INNER DETECTOR TRACKS HAS BEEN MADE. =0 OTHERWISE.
7	I*4	=1 IF AN ATTEMPT TO JOIN CLUSTERS TO LEAD-GLASS CLUSTERS HAS BEEN MADE. =0 OTHERWISE.

'MUR1' BANK 1 - MUON COORDINATE BANK.
FOR EACH HIT....

WORD	TYPE	CONTENTS
1	I*2	4*CHAMBER NUMBER + (HIT NUMBER -1)
2	I*2	10*LAYER NUMBER + ORIENTATION PARAMETER (I.E. 1, 2 OR 3 ACCORDING TO DIRECTION OF NORMAL OF CHAMBER PLANES. X->1, Y->2, Z->3. SEE CMUTNY DESCRIPTION.)
3	I*2	X)
4	I*2	Y) 'LEFT' AMBIGUITY (MM).
5	I*2	Z)
6	I*2	X)
7	I*2	Y) 'RIGHT' AMBIGUITY (MM).
8	I*2	Z)



3225 6065 26
IDHITS 1117
ELGTOT 11856
MUHITS 35
LGCYL 11683
LGCAPS 0 173
FWCAPS 0 0
BEAM 17.570 GEV
MAG.FIELD -4.531 KG
TRIG 0201 TALC 00F9
DATE 09/04/81
TIME 23.43.52
A
dead chamber
B
expected μ trajectory
E
C
range-out
D
"error bar"
X
Y
Z

FIGURE 1.

```
                -DINATES RELATIVE TO THE CHAMBER AS FOLLOWS..
               ICT=(HVDR*(ITD-HDTP))/1000
               ICL=(HLSF*(ITL-HLTP))/100
                WHERE ICT,ICL ARE COORDINATES IN MM.
                ITD IS DRIFT TIME IN TRANS. CLOCK UNITS, AND
                ITL IS LONG. TIME DIFF. IN LONG. CLOCK UNITS.

 STATUS DATA FOR THE CHAMBERS

 HMCSTA(ICHAM)      =0 IF CHAMBER OK
                    .NE.0 IF CHAMBER U/S FOR ANY REASON.
-----------------------------------------------------------------------
MACRO CMUTNY
   /CMUTNY/


 CONDENSED MU-FILTER PAARAMETERS FOR USE BY APPROXIMATE SIGNAL TO
   COORDINATE CONVERSION SUBROUTINE MUTINY.

 HPLANS       NO. OF CHAMBER PLANES.
 HVDRAV       AVERAGE DRIFT VELOCITY.
 HDTPAV       AVERAGE DRIFT TIME PEDESTAL.
 HLTPAV       AVERAGE LONGITUDINAL TIME DIFFERENCE PEDESTAL.
 HLSFAV       AVERAGE LONGITUDINAL SCALING FACTOR.

 FOR EACH CHAMBER PLANE...

 HLY          LAYER NUMBER.
 HOR          ORIENTATION PARAMETER:
              =1, WIRES PARALLEL TO BEAM, AND NORMAL PARALLEL TO
                    X-AXIS - FACES 1(-X) AND 2(+X).
              =2, WIRES PARALLEL TO BEAM, AND NORMAL PARALLEL TO
                    Y-AXIS - FACES 3(-Y) AND 4(+Y).
              =3, WIRES VERTICAL, AND NORMAL PARALLEL TO Z-AXIS -
                    FACES 5(-Z) AND 6(+Z).
 HCI          FIRST CHAMBER NUMBER.
 HCNO         NORMAL        )
 HCLO         LONGITUDINAL  )  COORDINATE OF 'ORIGIN' OF CHAMBER PLANE.
 HCTO         TRANSVERSE    )
 HSP          AVERAGE SPACING OF CHAMBERS.

   (THE 'ORIGIN' IS AT ONE END OF THE WIRE OF THE FIRST CHAMBER IN THE
 PLANE.  THE END IS THAT WITH THE LOWEST LONGITUDINAL COORDINATE.)

     COMMON /CMUTNY/HPLANS,HVDRAV,HDTPAV,HLTPAV,HLSFAV,
    * HLY(48),HOR(48),HCI(48),HCNO(48),HCLO(48),HCTO(48),HSP(48)
-----------------------------------------------------------------------
-----------------------------------------------------------------------
```

```
     HMCELE(4440)                                              2220 WORDS
     DIMENSION HMCELE(4440)
     EQUIVALENCE ( HMCELE(1),MUCAL(1588) )
C ********* N.B. HMCELE IS JUST A 'FILLER' . *********
     DIMENSION HDTP(634),HLTP(634),HLSF(4,634),HVDRFT(634)
     EQUIVALENCE (HMCELE(1),HVDR),(HMCELE(2),HDTP(1)),
    *            (HMCELE(636),HLTP(1)),(HMCELE(1270),HLSF(1,1)),
    *            (HMCELE(3806),HMCEDM),(HMCELE(3807),HVDRFT(1))
-----------------------------------------------------3807 WORDS SO FAR

     HMCSTA(634)                                                317 WORDS
     DIMENSION HMCSTA(634)
     EQUIVALENCE ( HMCSTA(1),MUCAL(3808) )
-----------------------------------------------------4124 WORDS SO FAR

     HFILDA(72)                                                  36 WORDS
     DIMENSION HFILDA(72)
     EQUIVALENCE ( HFILDA(1),MUCAL(4125) )
     INTEGER*2 HBLLO(6),HBLHI(6),HBTLO(6),HBTHI(6),HBNLIM(36)
     INTEGER*4 IFCIND(6)
     INTEGER*2 HFILDA
     EQUIVALENCE (HBLLO(1),HFILDA(1)),(HBLHI(1),HFILDA(7)),
    *            (HBTLO(1),HFILDA(13)),(HBTHI(1),HFILDA(19)),
    *            (HBNLIM(1),HFILDA(25)),(IFCIND(1),HFILDA(61))
-----------------------------------------------------4160 WORDS SO FAR

     HYKNMI(4),HYKNMO(4),HYKLDM(4),HYKTDM(4),BYOKE, 10 WORDS
     IYKIND
     DIMENSION HYKNMI(4),HYKNMO(4),HYKLDM(4),HYKTDM(4)
     INTEGER*2 HYKTDM,HYKLDM,HYKNMI,HYKNMO
     EQUIVALENCE ( HYKNMI(1),MUCAL(4161) ),
    *            ( HYKNMO(1),MUCAL(4163) ),
    *            ( HYKLDM(1),MUCAL(4165) ),
    *            ( HYKTDM(1),MUCAL(4167) ),
    *            ( BYOKE,MUCAL(4169) ),( IYKIND,MUCAL(4170) )
-----------------------------------------------------4170 WORDS SO FAR

    IZEII,IZEIO,IREP1,IREP2,IREP3,IREP4,IXYEP5,           15 WORDS
    IZOEP1,IZOEP2,IZOEP3,IZOEP4,IZOEP5,CAEP2,
    IEPIND,IEPSCT

     EQUIVALENCE ( IZEII,MUCAL(4171) ),( IZEIO,MUCAL(4172) ),
    *            ( IREP1,MUCAL(4173) ),( IREP2,MUCAL(4174) ),
    *            ( IREP3,MUCAL(4175) ),( IREP4,MUCAL(4176) ),
    *            ( IXYEP5,MUCAL(4177) ),( IZOEP1,MUCAL(4178) ),
    *            ( IZOEP2,MUCAL(4179) ),( IZOEP3,MUCAL(4180) ),
    *            ( IZOEP4,MUCAL(4181) ),( IZOEP5,MUCAL(4182) ),
    *            ( CAEP2,MUCAL(4183) ),( IEPIND,MUCAL(4184) ),
    *            ( IEPSCT,MUCAL(4185) )
-----------------------------------------------------4185 WORDS SO FAR
```

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NVERSN              VERSION NUMBER.
DESCRP              DESCRIPTION.

HOVALL(IUNIT)       OVERALL TRANSLATION OF EACH UNIT ALONG RAILS.
                      IUNIT=1 - FAR SIDE (-X) WALL.
                      IUNIT=2 - NEAR SIDE (+X, RUCKSACK) WALL.
                      IUNIT=3 - MAGNET  (ALL TRANSLATIONS ARE RELATIVE TO
                                THIS SO HOVALL(3) SHOULD ALWAYS BE ZERO.)
                      IUNIT=4 - FAR SIDE (-X) ARCH.
                      IUNIT=5 - NEAR SIDE (+X) ARCH.
```

```
*MUR2* BANK 2 - MUON HIT - INNER DETECTOR TRACK CORRELATION.
    NTPH I*2 WORDS PER HIT.  (NTPH IS THE NUMBER OF TRACKS PER HIT
    ALLOCATED IN THIS BANK, AND IS GIVEN IN WORD 3 OF BANK 0.)
FOR EACH MUON HIT....
WORD  TYPE  CONTENTS
  1   I*2   1ST INNER DETECTOR TRACK NUMBER TO WHICH THIS HIT IS
            *ASSOCIATED*    (=0 IF NONE).
  2   I*2   2ND INNER DETECTOR TRACK NUMBER ETC. (=0 IF NONE).
  .          .
=4 NTPH  I*2   NTPH*TH INNER DETECTOR TRACK NUMBER ETC. (=0 IF NONE.
              = -(TRACK NUMBER) IF MORE THAN NTPH TRACKS
              ASSOCIATED WITH THIS HIT).

*MUR2* BANK 3 - MUON HIT AMBIGUITY FLAGS.  FOR EACH ENTRY IN BANK 2
   THERE IS AN ENTRY HERE.  THE AMBIGUITY FLAG IS...
  0/-1/+1. BOTH/LEFT/RIGHT AMBIGUITY IS *ASSOCIATED* WITH THE TRACK
     -2/+2. LEFT/RIGHT AMBIGUITY IS *ASSOCIATED* WITH THE TRACK
            AND ALSO IN THE BEST HIT/(L/R) PERMUTATION :
        +3. BAD HIT WHICH IS *ASSOCIATED* WITH THE TRACK
            AND ALSO IN THE BEST HIT/(L/R) PERMUTATION .

*MUR2* BANK4 -- X.Y.Z COORDINATES OF 5 POINTS ON EXTRAPOLATED TRACK
                IE  R*4 WORDS FOR EACH INNER DETECTOR TRACK
 THE POINTS ARE AS FOLLOWS :
  WORDS                            POINT
 -----------                --------------------------
  1 . 2 . 3                 LAST POINT ON INNER DETECTOR FIT
  4 . 5 . 6                 POINT WHERE TRACK INTERSECTS COIL OR LEAVES
                            MAGNETIC FIELD
  7 . 8 . 9                 POINT WHERE TRACK LEAVES YOKE OR END PLUG
 10 . 11 . 12               POINT WHERE TRACK STOPS -- IF IT STOPS BEFORE
                            LEAVING DETECTOR
 13 . 14 . 15               POINT WHERE TRACK LEAVES THE DETECTOR . OR . IN
                            THE CASE OF A STOPPING TRACK . THE POINT WHERE
                            IT WOULD HAVE LEFT DETECTOR . HAD IT NOT STOPPED

*MUR2* BANK 5 - PARAMETERS OF ERROR ELLIPSES ON FACES OF INTERCEPTED
                MUON CHAMBER PLANES.  (GET THE NUMBER OF WORDS FROM
                THE BANK HEADER.)

WORD HALF-WORD    DESCRIPTION
---- ---------    -----------
1.2.3             X.Y.Z OF CENTRE OF ELLIPSE.                      )(
        7 I*2     INNER DETECTOR TRACK NUMBER.                     )( 7
        8         ORIENTATION OF CHAMBER PLANE. =1.2.3 FOR         )( WORDS
                    NORMALS IN X.Y.Z DIRECTIONS RESPECTIVELY.      )( RE-
  5               VT. VARIANCE IN DRIFT DIRECTION.                 )( PEAT-
  6               VL. VARIANCE IN LONGITUDINAL DIRECTION.          )( ED.
  7               CTL. COVARIANCE.                                 )(
FOR AN EXAMPLE OF CODE USED TO RECONSTRUCT ELLIPSES FROM THIS
  INFORMATION SEE *F22ALL.JADEMUS(MULDSP)*.

*MUR2* BANK 6 - IS A LIST OF BAD CHAMBERS IN I*2 WORDS.
----------------------------------------------------------------------
END OF BANK DESCRIPTIONS. --------------------------------------------
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  13    I*2    NUMBER OF TRACKS WITH SHARED HITS INSIDE MAGNET YOKE.
                 (IF >3 SEE 'MUR2' BANK 2 FOR DETAILS.)
  14    I*2    TRACK NUMBER OF 1ST TRACK WITH SHARED HITS INSIDE YOKE.
  15    I*2    TRACK NUMBER OF 2ND TRACK WITH SHARED HITS INSIDE YOKE.
  16    I*2    TRACK NUMBER OF 3RD TRACK WITH SHARED HITS INSIDE YOKE.
  17    I*2    NUMBER OF TRACKS WITH SHARED HITS OUTSIDE MAGNET YOKE.
                 (IF >3 SEE 'MUR2' BANK 2 FOR DETAILS.)
  18    I*2    TRACK NUMBER OF 1ST TRACK WITH SHARED HITS OUTSIDE YOKE.
  19    I*2    TRACK NUMBER OF 2ND TRACK WITH SHARED HITS OUTSIDE YOKE.
  20    I*2    TRACK NUMBER OF 3RD TRACK WITH SHARED HITS OUTSIDE YOKE.
  11    R*4    CHI-SQUARED PROBABILITY OF BEING MUON.  (ONLY FILLED IF
                 IF THE QUALITY FLAG (WORD 6) IS .GT.0.)
  12    R*4    INTEGRAL DL (=DISTANCE, MM).                          )(FROM
  13    R*4    INTEGRAL DENSITY*DL (= MATERIAL TRAVERSED.            )(VERTEX
                 GM CM**-2).                                         )(TO
  14    R*4    INTEGRAL (-DE/DX)*DL (ENERGY LOSS. ASSUMING           )(LAST
                 PARTICLE IS A MUON. GEV).                           )(ASSOC'D
  15    R*4    INTEGRAL DL/(ABSORPTION LENGTH) ('NUMBER' OF          )(HIT.
                 ABSORPTION LENGTHS) ASSUMING A PION.                )(
  16    R*4    ENERGY AT LAST HIT ASSUMING MUON (GEV).
  16    R*4    INTEGRAL DL (=DISTANCE. MM).                          )(FRO
  17    R*4    INTEGRAL DENSITY*DL (= MATERIAL TRAVERSED.            )(VERTEX TO
  18    R*4      GM CM**-2).                                         )(END OF
  19    R*4    INTEGRAL (-DE/DX)*DL (ENERGY LOSS. ASSUMING           )(TRACK.I.E.
                 PARTICLE IS A MUON. GEV).                           )(STOPPING
  20    R*4    INTEGRAL DL/(ABSORPTION LENGTH) ('NUMBER' OF          )(POINT OR
                 ABSORPTION LENGTHS) ASSUMING A PION.                )(EDGE OF
                                                                     )(DETECTOR.
  21    R*4    PROBABILTY OF PI->MU DECAY BEFORE                )(
                 PION-NUCLEAR INTERACTION.                      )(
  22    R*4    PROBABILTY OF PION PENETRATION. I.E.             )(  AT
               PROBABILTY OF NO PION-NUCLEAR INTER-             )(  LAST
                 ACTION AND NO PI-> MU DECAY.                   )(  ASSOC-
  23    R*4    PROBABILTY OF PION 'PUNCHTHROUGH'.I.E.           )(  IATED
               PROBABILTY OF PION INTERACTION AND               )(  HIT
                 SUBSEQUENT DETECTION OF SECONDARIES.           )(
                 (IF P.GE.5 GEV/C THEN 0.01 ELSE 0).            )(
  24    R*4    PROBABILTY OF K->MU DECAY.                       )(
  25    R*4    PROBABILTY OF BEING A MUON.
                 IF (WORD 6) .GT. 0 .AND .LT.100. PROBABILITY = 1.
                   (I.E. CLEAN OR INEFFICIENT. PROVIDED THE INEFFICIENCY
                   IS NOT IN THE LAST LAYER. IT'S 'GOOD'.)
                 IF (WORD 6) .GT. 100. PROBABILTY = 0.05 (A NOMINAL
                   INNEFICIENCY TO ACCOUNT FOR THE POSSIBILITY OF A
                   FURTHER CHAMBER FIRING). BECAUSE INEFFICIENCY IS IN
                   LAST LAYER.
?                IF DIRTY (MOD(WORD 6.10).GE.5). MULTIPLY BY A FACTOR
?                  .LT.1. BECAUSE IT MAY BE A NUCLEAR INTERACTION.
  26    R*4    PROBABILTY OF BEING A PION.
                 = (WORD 22) + (WORD 23) + (WORD 21)
?                IF DIRTY. MULTIPLY BY A FACTOR .GT. 1 BECAUSE IT MAY
?                  BE A NUCLEAR INTERACTION.
? 27    I*4    CLUSTER NUMBER OF ASSOCIATED MUON CLUSTER RECORDED IN
?                MUON RESULTS BANKS 'MUR1'. (=-1 IF MORE THAN 1 CLUSTERS
?                ARE ASSOCIATED.  IN THIS CASE SEE 'MUR2' BANK 2 AND
?                'MUR1' BANK 2.)
? 28    I*4    NO. OF HITS EXTRA TO ASSOCIATED CLUSTER.)(=0 FOR
? 29    I*4    NO. OF HITS IN ASSOCIATED CLUSTER BUT    )(COMPLETE
?                NOT FOUND HERE.                          )(CORRESPONDENCE.
```

```
MUON RESULTS BANKS 'MUR2' (7 BANKS NUMBERED 0-6).
---------------------------------------------------

     THESE BANKS REPRESENT THE RESULTS OF FOLLOWING 'PHILOSOPHY 2', I.E.
     OF FOLLOWING INNER DETECTOR TRACKS OUT.  SEE JADE NOTES 47 & 68 FOR
     SOME DETAILS OF THE METHODS USED.

  'MUR2' BANK 0 - GENERAL INFORMATION.
   WORD  TYPE  CONTENTS
    1    I*4   NO. OF INNER DETECTOR TRACKS ACCORDING TO BANK 'PATR'.
    2    I*4   NO. OF 4-BYTE WORDS PER TRACK IN BANK 1.
    3    I*4   NTPH. NO. OF TRACKS PER HIT ALLOCATED IN BANKS 2 AND 3.
    4    I*4   NPL.NO. OF STORED POINTS PER EXTRAPOLATED TRACK(SET TO 5)

  'MUR2' BANK 1 - MUON INFORMATION FOR EACH INNER DETECTOR TRACK.
     GENERAL TERMS......
   'ASSOCIATED', MEANS A HIT WITHIN 3 STANDARD DEVIATIONS OF THE
           EXTRAPOLATED INNER DETECTOR TRACK.
   'STANDARD DEVIATION' IS THE COMBINATION OF
           A) INNER DETECTOR TRACK FITTING ERRORS.
           B) MULTIPLE COULOMB SCATTERING.
           C) MU CHAMBER MEASURING ERRORS.
   'INEFFICIENT LAYER' IS ONE IN WHICH THERE ARE NO ASSOCIATED MUON
           HITS AND NO DEAD CHAMBERS WITHIN 3 STANDARD DEVIATIONS. (THE
           CHAMBERS INSIDE THE YOKE COUNT AS ONE LAYER.)
*          IF, IN THE DRIFT DIRECTION, THE EXPECTED TRAJECTORY GOES WITHIN
*          3 SIGMA OF THE EDGE OF THE SENSITIVE REGION OF A LAYER, AND NO
*          ASSOCIATED HIT IS FOUND, THE LAYER IS NOT CALLED INEFFICIENT.
*          ( FOR THIS PURPOSE , SIGMA IS TAKEN FROM PATREC + MULTIPLE
*            SCATTERING ERRORS ONLY. )
   'CHI-SQUARED' IS CALCULATED FROM THE DEVIATIONS OF THE 'ASSOCIATED'
           MUON HITS. THE CORRELATIONS OF DEVIATIONS ARE TAKEN INTO
           ACCOUNT. IN THE CASE OF THE END-WALLS, THE CORRELATION BETWEEN
           DRIFT AND LONGITUDINAL DEVIATIONS IS ALSO TAKEN INTO ACCOUNT.
           (THIS ARISES BECAUSE OF THE CYLINDRICAL SYMMETRY OF THE INNER
           DETECTOR VIS-A-VIS THE RECTANGULAR SYMMETRY OF THE MUON
           DETECTOR.)  BAD COORDINATES ARE GIVEN 'MAXIMUM' MEASURING
           ERRORS.
   'DRIFT CHI-SQUARED' IS CALCULATED USING ONLY THE DRIFT COORDINATES
*          AS FOLLOWS :  ONLY ONE ASSOCIATED HIT PER CHAMBER LAYER
*          IS USED IN THIS CALCULATION - - - IF A TRACK HAS MORE
*          THAN ONE ASSOCIATED HIT IN A CHAMBER LAYER, ALL PERMUTATIONS
*          OF HITS ARE TRIED. WITHIN EACH HIT PERMUTATION, THE LEFT/RIGHT
*          AMBIGUITIES ARE PERMUTED TO FIND THE FIND THE BEST L/R
*          PERMUTATION. 'DRIFT CHI-SQUARED' IS THAT OF THE BEST HIT/(L/R)
*          PERMUTATION .
   'LONGITUDINAL CHI-SQUARED' IS THE CHI-SQUARED OF THE BEST LEFT/RIGHT
           DRIFT DEVIATIONS AND LONGITUDINAL DEVIATIONS TOGETHER.

    CHI-SQUARED IS CALCULATED ONLY FOR THOSE TRACKS WHICH PASS THE
  FOLLOWING BASIC CRITERIA :
   A) 2 OR MORE LAYERS WITH ASSOCIATED HITS OUTSIDE THE YOKE :
   B) NOT MORE THAN 1 INEFFICIENT LAYER WITHIN THE RANGE OF THE MUON,
      INCLUDING INEFFICIENCY OF THE LAYER INSIDE THE YOKE ( WHICH IS
      CONSIDERED AS ONLY ONE LAYER). (THE MUON RANGE IS CALCULATED
      FROM DE/DX.  DEAD CHAMBERS ARE ALLOWED FOR.)
  TRACKS WHICH PASS THESE CRITERIA ARE CONSIDERED TO BE MUON CANDIDATES.
  FOR PHYSICS ANALYSIS,WE ALSO REQUIRE THAT THE TRACK DOES NOT HAVE AN
  INEFFICIENCY IN THE LAST INTERCEPTED LAYER ...SEE WORD 6 OF MUR2/1
  BELOW.
```

```
*MURI* BANK 3 - MUON CLUSTER INFORMATION.   (NOTE. CLUSTER NUMBER IN
   WORD 30.)
FOR EACH CLUSTER...
 WORD   TYPE   CONTENTS
   1    I*4    DATE CF PRODUCTION (E.G. 791010 FOR 10/10/79).
   2    R*4    IDENTIFIER OF PROGRAM WHICH CREATED CLUSTER (A 4 CHAR-
                 ACTER ALPHANUMERIC WORD).
   3    I*4    NO. OF HITS IN CLUSTER.
   4    I*4    CLUSTER NUMBER OF ALTERNATIVE CLUSTER (=0 IF NONE).
   5    I*4    =0. ONLY ONE LAYER IN CLUSTER (IF SO WORDS 9-14=0).
   6    R*4    XC )
   7    R*4    YC ) COORDS. OF *CENTRE OF GRAVITY* (MM).
   8    R*4    ZC )
   9    R*4    DX )
  10    R*4    DY ) DIRECTION COSINES OF FITTED LINE.
  11    R*4    DZ )
  12    R*4    D1. DISTANCE TO *FIRST* POINT (MM).
  13    R*4    D2. DISTANCE TO *LAST* POINT (MM).
                 NOTE. ALGORITHM TO GET CORDINATES OF FIRST HIT IS...
                    X1=XC+D1*DX
                    Y1=YC+D1*DY
                    Z1=ZC+D1*DZ
                 AND SIMILARLY FOR LAST HIT.
  14    R*4    RMS DEVIATION FOR *GOOD* CLUSTER - SEE ALSO WORDS 25,26.
               =0. IF MULINA (AMBIGUITY RESOLVING ROUTINE) NOT CALLED.
               =-1. IF IT FAILS ACCEPTANCE CRITERIA.
               =-2. IF IT HAS MORE THAN 2 ACCEPTABLE AMBIGIUTY
                              PERMUTATIONS.
               =-9999. IF MULINA HAS TAKEN NO ACTION. E.G. IF ONLY 1
                  LAYER. OR TOO MANY AMBIGUITIES. OR ONLY 2 LAYERS AND
                  TOC MANY AMBIGUITIES.
               NOTE THAT IF THIS WORD.LE.0 THEN WORDS 6-11 CONTAIN THE
                 THE RESULTS OF FITTING PRIOR TO CALL TO MULINA. I.E.
                 L AND R HITS OF UNRESOLVED HITS USED WITH EQUAL WEIGHT
                 (ALTHOUGH WITH LOWER WEIGHT THAN RESOLVED HITS).
  15    R*4    INTEGRAL DL (=DISTANCE. MM).                    )(FROM
  16    R*4    INTEGRAL DENSITY*DL (= MATERIAL TRAVERSED.      )(INTER-
                 GM CM**-2).                                   )(ACTION
  17    R*4    INTEGRAL (-DE/DX)*DL (ENERGY LOSS. MINIMUM      )(POINT TO
                 IONISING PARTICLE. GEV).                      )(LAST
  18    R*4    INTEGRAL DL/(ABSORPTION LENGTH) (*NUMBER* OF    )(POINT IN
                 ABSORPTION LENGTHS) ASSUMING A PION.          )(CLUSTER.
  19    R*4    MU *GOODNESS* PARAMETER (VERY CRUDE AT THIS STAGE).
  20    R*4    HADRON *LEAK* PROBABILTY. EXP(-(NO. OF ABSN. LENGTHS)).
  21    I*4    ASSOCIATED INNER DETECTOR TRACK NO.. IF ANY.
  22    I*4    ASSOCIATED LEAD GLASS CLUSTER NO.. IF ANY.
  23    R*4    DISTANCE BETWEEN PROJECTIONS OF THE MU-TRACK AND THE
                 INNER DETECTOR TRACK. IF ANY. AT THE POSITION OF THE
                 FLUX RETURN YOKE.
  24    R*4    ULTIMATE RANGE OF A MUON WITH MOMENTUM OF INNER DETECTOR
                 TRACK. IF ANY (GM CM**-2).
  25    R*4    RMS DRIFT DIRECTION DEVIATION.                ) IGNORE IF
  26    R*4    RMS LONGITUDINAL (WIRE) DIRECTION DEVIATION.) WD 14.LE.0.
  27    R*4    TOTAL WEIGHT OF X COORDINATES
  28    R*4    TOTAL WEIGHT OF Y COORDINATES
  29    R*4    TOTAL WEIGHT OF Z COORDINATES
  30    I*4    CLUSTER NUMBER.

*MURI* BANK 4 - THE POINTER LIST HCLP.
   HCLP(ICL) POINTS TO START OF INFORMATION IN HCLIST (BANK 5) FOR
      CLUSTER ICL.
   HCLP(NO. OF CLUSTERS +1) POINTS TO WORD AFTER THE LAST.

*MURI* BANK 5 - THE HIT LIST HCLIST.
   THIS GIVES THE HITS BELONGING TO EACH CLUSTER.
   BANKS 4 AND 5 MAY BE USED IN CONJUNCTION TO FIND THE HITS BELONGING
```

MUON RESULTS BANKS 'MUR1' (8 BANKS NUMBERED 0-7).

THESE BANKS REPRESENT THE RESULTS OF FOLLOWING 'PHILOSOPHY 1'. I.E. OF OBTAINING AS MUCH INFORMATION AS POSSIBLE BY LOOKING AT THE MUON SIGNALS ALONE.

'MUR1' BANK 0 - GENERAL INFORMATION.

WORD	TYPE	CONTENTS
1	I*4	NO. OF HITS.
2	I*4	NO. OF CLUSTERS (TRACKS).
3	I*4	NO. OF 2-BYTE WORDS PER HIT IN COORDINATE BANK.
4	I*4	NO. OF 4-BYTE WORDS PER CLUSTER IN CLUSTER BANK.
5	I*4	=1 IF MULINE HAS BEEN CALLED. I.E. IF AN ATTEMPT TO CREATE CLUSTERS HAS BEEN MADE. =0 OTHERWISE.
6	I*4	=1 IF AN ATTEMPT TO JOIN CLUSTERS TO INNER DETECTOR TRACKS HAS BEEN MADE. =0 OTHERWISE.
7	I*4	=1 IF AN ATTEMPT TO JOIN CLUSTERS TO LEAD-GLASS CLUSTERS HAS BEEN MADE. =0 OTHERWISE.
* 8	I*4	DATE OF VERSION OF SIGNAL-COORDINATE CONVERSION ROUTINE.
9	I*4	CALIBRATION DATA ISSUE. I.E. IDENTIFIER OF CALIB. DATA USED TO PRODUCE COORDINATES.

'MUR1' BANK 1 - MUON COORDINATE BANK.
FOR EACH HIT....

WORD	TYPE	CONTENTS
1	I*2	4*CHAMBER NUMBER + (HIT NUMBER -1)
2	I*2	10*LAYER NUMBER + ORIENTATION PARAMETER (I.E. 1, 2 OR 3 ACCORDING TO DIRECTION OF NORMAL OF CHAMBER PLANES. X->1, Y->2, Z->3. SEE CMUTNY DESCRIPTION.)
3	I*2	X)
4	I*2	Y) 'LEFT' AMBIGUITY (MM).
5	I*2	Z)
6	I*2	X)
7	I*2	Y) 'RIGHT' AMBIGUITY (MM).
8	I*2	Z)
9	I*2	POINTER TO RAW DATA

THE FOLLOWING CALIBRATION DATA HAVE BEEN PROVIDED TO THE O'NEILL SYSTEM :

DATASET NUMBER	RUN NUMBERS	COMMENTS
0004	0000 - 2047	DATA UNRELIABLE : ALL CHAMBERS 'OFF' UP TO 13.00 26.10.79
0005	2047 - 2185	336 CHAMBERS IN THE BARREL FACES 'ON' 17.09 26.10.79 TO 00.05 03.11.79
0006	2186 - 2402	349 CHAMBERS IN THE BARREL FACES 'ON' 00.18 03.11.79 TO 23.19 18.11.79
0007	2403 - 2746	477 CHAMBERS IN THE BARREL FACES AND THE ENDWALLS 'ON' 23.31 18.11.79 TO 23.59 31.12.79
0008	2747 - 3015	592(OUT OF 622 INSTALLED) CHAMBERS 'ON' 00:00 01.01.80 TO 04.24 10.03.80
0009	3016 - 3316	597/622 CHAMBERS 'ON' 04.51 10.03.80 TO 20.35 03.04.80
0010	3317 - 3584	597/622 CHAMBERS 'ON' 09.30 11.04.80 TO 20.30 13.05.80
0011	3585 - 3614	ALL CHAMBERS OFF WATER LEAK 20.30 13.05.80 TO 22.54 16.05.80
0012	3615 - 3727	586/622 CHAMBERS 'ON' 22.55 16.05.80 TO 18.39 23.05.80
0013	3730 - 4891	592/622 CHAMBERS 'ON' 07.03 17.06.80 TO 23:59 10.09.80
0014	4993 - 5326	575/622 CHAMBERS 'ON' 00:00 11.09.80 TO 23:59 17.10.80
0015	5327 - 5567	578/622 CHAMBERS 'ON' 00:00 18.10.80 TO 23:59 31.10.80
0016	5568 - NOW	576/622 CHAMBERS 'ON' 00:00 01.11.80 TO NOW.

N.B. 'OFF' AND 'ON' REFER TO THE STATE OF A SOFTWARE SWITCH: FOR ANY GIVEN DATASET.THE SET OF CHAMBERS OFF IN THE NW HALL IS A SUBSET OF THOSE SWITCHED 'OFF'., BUT GENERALLY CORRESPONDS FAIRLY CLOSELY. HOLES IN RUN NUMBER SEQUENCE CORRESPOND TO JUNK DATA CALIBRATION RUNS ETC.

* HIT/(L/R) PERMUTATION FOR THE TRACK.

DESCRIPTION OF MUON BANKS

RAW DATA BANK 'MUEV':

REAL DATA......

```
WORD   TYPE    CONTENTS
 1     I*2     } BANK DESCRIPTOR - SEE JADE NOTE 32.
 2     I*2     }
 3     I*2     MARKER FOR FIRST CRATE (=F0N(HEX) = 3840+N FOR CRATE "
 .     I*2     REFERENCE SIGNAL (=E00(HEX)+IREF = 3584+IREF) IF REAL
                 HITS FOLLOW.
 .     I*2     4*CHAMBER NUMBER + (HIT NUMBER - 1).             }THESE
 .     I*2     DRIFT TIME                                       }3 WORDS
                 OR 2048+SINGLES COUNT.                         }REPEATED
 .     I*2     LONGITUDINAL TIME DIFFERENCE                     }FOR
                 OR 2048+TIME INTERVAL FOR SINGLES COUNT.       }EACH
                 (TIME INTERVAL IN UNITS OF 0.5 SECS.)          }HIT.
 .             .
 .             .
 .     I*2     IN CASE OF ERRORS, CRATE MARKER D0N(HEX) = 3328+N,
                 FOLLOWED BY....
 .     I*2     STATUS WORD.
 .             .
 .             .
 .             .
 .     I*2     END OF CRATE MARKER F00(HEX) = 3840.
 .     I*2     MARKER FOR NEXT CRATE.  ETC.
```

NOTE : WITHIN A CRATE, CHAMBER NUMBER INCREASES. IF A CHAMBER HAS MORE THAN ONE HIT, THE HITS ARE RECORDED HERE IN REVERSE ORDER I.E. THE LAST PHYSICAL HIT APPEARS FIRST IN THIS BANK.

MONTE CARLO DATA......

* THE NEW MONTE-CARLO PRODUCES A MUEV BANK WITH THE SAME FORMAT AS THAT
* OF THE REAL DATA.

2)MUANAL. THIS LOCKS FOR 'LINEAR CLUSTERS', I.E. TRACKS, IN THE MUON FILTER. IT FOLLOWS 'PHILOSOPHY 1', I.E. GATHERS AS MUCH INFORMATION AS POSSIBLE BY LOOKING IN THE MUON FILTER ALONE. IT USES 'MUR1' BANKS 0,1,& 2. IT UPDATES 'MUR1' BANK 0,1,& 2. IT CREATES 'MUR1' BANKS 3,4,5,6,AND 7 (SEE BELOW).

3)MUANAJ. THIS ATTEMPTS TO JOIN MUON CLUSTERS TO INNER DETECTOR AND LEAD-GLASS CLUSTERS. IT USES THE 'MUR1' BANKS AND UPDATES 'MUR1' BANKS 0 AND 3 (SEE BELOW).

4)MUANAF. THIS ADCPTS 'PHILOSOPHY 2', I.E. FOLLOWS EACH INNER DETECTOR TRACK CUT THROUGH THE MUON FILTER. CREATES 'MUR2'.
***NOTE : PHILOSOPHY 2 USES THE PATR BANK WITH LOWEST BANK NO.
I.E. GENERALLY THE MOST RECENT PATR BANK.

THE ABOVE CAN BE SUMMARISED BY THE FOLLOWING TABLE.

ROUTINE	USES	CREATES	COMMENTS
MUANAC	MUEV	MUR1/0,1,2	SIGNAL TO COORD CONVERSION
MUANAF	PATR,MUR1/C,1,2	MUR2/0,1,2,3,4,5,6	PHILOSOPHY 2
*(MUANAL	MUR1/0,1,2	MUR1/3,4,5,6,7	PHILOSOPHY 1)*
*(MUANAJ			JOINS PHIL1 TO ID,ETC.)*

* MUANAL,MUANAJ NCT CURRENTLY GUARANTEED - COMMENTED OUT OF MUANA
* AND ONLY AVAILABLE ON F22ALL.MUSEFULS/L.

-------------END OF DESCRIPTION OF MUON ANALYSIS. ---------------

MONTE CARLO

```
*MONTE CARLO STATUS AT 10/04/81 :      **********************************
*                                                                       *
*  A NEW MONTE-CARLO HAS BEEN WRITTEN FOR TRACKING PARTICLES THROUGH    *
*  THE MU-FILTER. DETAILS OF THIS WILL BE MADE AVAILABLE SOON.          *
*************************************************************************
```

MUON ANALYSIS

```
MUON ANALYSIS STATUS AT 10/04/81 :

*************************************************************************
* THE PHILOSOPHY 1 ROUTINES (MUANAL.MUANAJ) ARE CURRENTLY COMMENTED    *
* OUT IN THE STANDARD DRIVING ROUTINE MUANA.  09/04/81.                *
*************************************************************************

     THE CALLING SEQUENCE IS NOW AS FOLLOWS:
 1) CALL MUINI                                   - AT START OF OPERATIONS.
 2) FILL MUON CALIBRATION DATA AREAS             - BEFORE ANY PROCESSING.
    (THIS CAN BE DONE WITH O'NEILL SYSTEM OR WITH MUCON.)
 3) CALL MUREG(IPRINT) (USUALLY IPRINT=0)     -        DITTO.
 4) CALL MUANA(0) IF 'PATR' ABSENT OR
    CALL MUANA(1) IF 'PATR' PRESENT              - IN EVENT LOOP.
    (MUANA IS DESCRIBED IN MORE DETAIL BELOW.)
 5) CALL MUFINI                                  - AT END.

     THE ABOVE ARE INCORPORATED INTO THE STANDARD SUPERVISOR.IF YOU
ELECT TO USE IT. THERE EXIST THE FOLLOWING TO ASSIST MU PROGRAM
DEVELOPMENT ( IN SOURCE/LOAD LIBRARIES F22ALL.MUSEFULS/MUSEFULL ) :
 1) A SPECIAL VERSION OF USER IN MEMBER MUSER.
 2) SUBROUTINE MU0 WHICH IS CALLED AT START OF OPERATIONS.MU0 READS A
     PARAMETER CARD WHICH (AMONG OTHER THINGS) SPECIFIES THE PRINT
     PARAMETER IPRINT. WHICH IS USED AS FOLLOWS...
       IPRINT .LE. 0 SUPPRESSES ALL PRINTING. (THIS IS THE NORMAL CASE
                     FOR GRAPHICS. STANDARD ANALYSIS.ETC.)
       IPRINT .GE. 1 TO GET ERROR MESSAGES.
       IPRINT .GE. 2 TO GET NORMAL MUON MESSAGES.
       IPRINT .GE. 4 TO GET PHILOSOPHY 2 RESULTS PRINTING.
       IPRINT .GE. 10 TO GET CALIBRATION DATA PRINTING.
 3) SUBROUTINE MU1 WHICH IS CALLED JUST AFTER NEW CALIBRATION DATA HAVE
     BEEN READ IN AND WHICH WILL READ A PRIVATE SET OF CALIBRATION DATA
     IF REQUESTED. OR ALTERNATIVELY A SET OF UPDATES.
 4) SUBROUTINE MU2 WHICH IS CALLED JUST AFTER THE EVENT HAS BEEN READ
     AND WHICH ALLOWS EVENT SELECTION.
 5) SUBROUTINE MU8 WHICH IS CALLED AFTER MU PROCESSING IS COMPLETE.
 6) SUBROUTINE MU99 WHICH IS CALLED AT END.
 7) A SPECIMEN SET OF JCL IN MEMBER #MUTEST WHICH USES ALL OF THESE
     FACILITIES.
  =====
  NOTE: THE FOLLOWING ARE ALSO AVAILABLE ON F22ALL.MUSEFULS/L :
  =====
  1) A SOMEWHAT SIMPLIFIED VERSION OF #MUTEST IS TO BE FOUND IN
     MEMBER #USERA.IT CONTAINS A DATA INPUT FILE.A DATA OUTPUT FILE.AND
     LARRY'S CALIBRATION DATASETS.ALL THE RELEVENT LOAD LIBRARIES ARE
     ALREADY LINKED IN.

  2) MEMBER USERA CONTAINS A SPECIAL VERSION OF USER.THIS VERSION OF
     USER CONTAINS THE TIME OF FLIGHT PROGRAMS WHICH PRODUCE THE 'TOFR'
     RESULTS BANK , CALLS ONLY THOSE PROGRAMS WHICH ARE NEEDED FOR
     PHIL.2 AND BYPASSES THE CALL TO MUANA AT LEVEL 8 IN THE SUPERVISOR.
     ( SEE BELOW )
  =======================================================================
```

Olsson

JADE Computer Note No. 21

7.3.1979
P. Steffen
(amended 17.5.79)

Hit Label Bank created by PATREC

- Name of the bank : 'JHTL'
- Pointer to the bank : IDATA(69) in COMMON / BCS /
- Contents of the bank :
  Bank descriptor (I4),
  One Integer*2 word for each hit in the same order as the hits in the bank 'JETC'

	B2	B1	R/L	Track No.	R/L	Track No.	Z
not yet used			2. Track		1. Track		

$$Z = \begin{cases} 1 & \text{if z - coordinate is good} \\ 0 & \text{if z - coordinate is bad (overlapping tracks)} \end{cases}$$

Not yet checked?

$$R/L = \begin{cases} 1 & \text{if right solution is selected} \\ 0 & \text{if left solution is selected} \end{cases}$$

(high ϕ
low ϕ)

Track No. and R/L-bit of the second track is only set if the hit corresponds to two different tracks (at a kink or at a crossing point of tracks).

B1 = 1 : hit is in bad agreement with fitted curve

B2 = 1 : hit has been correlated with track by pattern recognition program, but it has been excluded from the fit

Convention : If a hit corresponds to two tracks and if it is in bad agreement only with one of the fits, the bad correlation is eliminated.

0 0 good agreem., in fit
1 0 excluded from fit, but in good agreem.
0 1 in fit but bad agreement
1 1 bad agreement, excluded

2) A FORTRAN routine CLOC should be written - according to BOS specifications - which locates a given bank in the data COMMON:

```
CALL CLOC (IND,NA,NR)
    where  NA = name of the bank       (4HJETC)
           NR = number of the bank     (1)
          IND = pointer to the bank    (= 0, if bank does not exist)
```

This routine must be optimized by someone who knows the details of the first data reduction step. In any case calls to CLOC should be minimized. The routine should be appended to the standard libraries.

3) The total length variable now at the beginning of CDATA must be removed if BOS is to work. The length should be maintained as the last pointer in the fixed pointer array.

4) In all existing analysis routines, references to the fixed pointer table should be replaced by calling CLOC:

```
      BEFORE                                  AFTER
.                                    .
.                                    .
C PICKUP 'MUEV' POINTER.             C PICK UP 'MUEV' POINTER.
IP=IDATA(63)           ←CHANGE→      CALL CLOC(IP,4HMUEV,1)
IF(IP.EQ.0)GO TO 20                  IF(IP.EQ.0)GO TO 20
.                                    .
.                                    .
C PICK UP MU DATA.                   C PICK UP MU DATA.
I=IDATA(IP+5)                        I=IDATA(IP+5)
.                                    .
.                                    .
```

5) When the location of all data in the NORD output format has been settled, a routine should be written, to be called in the standard analysis sequence, or used as a separate program, which creates the fixed pointer table and simultaneously does all necessary reformatting of e.g. the jet chamber data. (Since a rough estimate indicates JADE will write only about one condensed IBM tape per day and the number of tapes is not threatening to get out of hand, it may be desirable to create a new generation of tapes immediately following the condensed tapes - first generation to be kept -

BANK Created by the Z-Vertex Reconstruction (ZVERTF)

- Name of the bank : 'ZVTX'
- pointer to the bank : IDATA(71) in COMMON /CDATA/ BCS
- contents of the bank :

(1) : Z(vertex) in mm

(2) : σ of the z-distribution

(3) : σ_z = error of z = $\sigma\sqrt{n}$? vertauscht

(4) : number of hits in peak of z-distribution

(5) : number of background hits

(6) : IFLAG = -2 if < 10 hits in first ring
= -1 if < 5 hits in peak of histrogram
= 0 if peak to background ratio < 2.0
= 1 if good z-vertex has been obtained.

$$\left.\begin{array}{l} Z_v = 0 \\ \sigma = \sigma_z = 10^6 \end{array}\right) \text{ if IFLAG} < 0.$$

type	word	contents	meaning
I x 2	1	ADC-value of the A-counter #1	
		ADC-value of the B-counter #1	
	⋮		
	8	ADC-value of the A-counter #8	
		ADC-value of the B-counter #8	
	9	IACC	0, if no luminosity trigger 1, if luminosity trigger 2, if accident luminosity trigger
		IL	0, if lumonitors did not fire j, if the jth lumonitor combination had been fired
	10	ILULAT	16 bit word for luminosity scintillators latches
		not yet used	

B.2.5 Track information bank, TAGG/4

type	word	contents	meaning
I x 4	IND4 -3	TAGG	
	-2	4	
	-1	NP4	
	0	NW4	

The track information for the m-th track can be obtained by means of NWPTR:

ID = (M-1) x NWPTR

type	word	contents	meaning
I x 2	+(ID+1)	ITRACK	no. of the track
		IX	= 1, if track points to intersection region = 0, if track does not
	(ID+2)	IC	= 0, if track does not have an associated Pb-glass cluster = ICLUS, the number of the associated cluster
		IS	= 0, if lumonitors did not fire on this track = i, if track should have fired the i-th lumonitor combination
	(ID+3)	IF	= 0, if lumonitors did not fire on this track = j, if the j-th lumonitor combination had been fired
		not yet used	

type	word	contents	meaning
R x 4	28	ACOLAN	acollinearity angle (in radian) between tracks (or clusters) with highest energy in each part of the detector (ACOLAN = 2π, if there are tracks/clusters only in one part of the detector)
	29	ETOT	total energy in GeV
	30	ETOTZM	" " in the -Z-part
	31	ETOTZP	" " " " +Z-part
	32	ENTOT	" " of clusters without tracks and lumonitors
	33	ENTOTM	" " " " without tracks and lumonitors in the -Z-part
	34	ENTOTP	" " " " without tracks and lumonitors in the +Z-part

B.2.2 Cluster map bank, TAGG/1

type	word	contents	meaning
I x 4	IND1-3	TAGG	
	-2	1	
	-1	NP1	
	0	NW1	
I x 2	1	HMAP(1,1)	first index of the first cluster in the reordered ADC-data (bank ACLS)
		HMAP(2,1)	last index of the first cluster...
	:	:	
	NW1 =NCLST	HMAP(1,NW1)	first index of the last cluster in the reordered ADC-data
		HMAP(2,NW1)	last index of the last cluster in the reordered ADC-data

B.2.3 Cluster information bank, TAGG/2

type	word	contents	meaning
I x 4	IND2-3	TAGG	
	-2	2	
	-1	NP2	
	0	NW2	

The cluster information for the n.th cluster can be obtained by means of NWPCL:

$$IB = (N-1) \times NWPCL$$

B.1 Format of tagging lead-glass cluster bank, ACLS

This bank contains the addresses and energy values in GeV of the lead-glass ADCs, reordered in such a way that blocks belonging to the same cluster are grouped together.
Of each cluster the block with the maximum energy deposited in will be the first in the data belonging to that cluster.

type	word	contents	meaning
I x 4	INDC-3	ACLS	name of the bank
	-2	0	no. of the bank
	-1	NP	pointer to the next bank of same name
	0	NW	number of data words in the bank
I x 2	+1	identifier of the program	version no. bank generation date and time, according to: ddmmy, e.g. 31129 means: 31.12.79
	+2	IPM	pointer to the first data word in the -Z-part (always +1)
		IPZ	pointer to the first data word in the -Z-part
	+3	0	empty
		IPL	pointer to the last data word +1
	+4		ADC-address ADC-content in GeV
	:		
	+NW		ADC-address ADC-content in GeV

B.2 Format of tagging system banks, TAGG

B.2.1 General information bank, TAGG/0

type	word	contents	meaning
I x 4	INDØ-3	TAGG	name of the bank
	-2	Ø	no. of the bank
	-1	NPØ	pointer to the next bank of same name
	0	NWØ	number of data words in the bank
	1	Identifier of the program	version no. bank generation date and time, according to: ddmmy, e.g. 31120 means: 31.12.1980

A.3 Format of tagging ADCs bank, ATAG
(see also JADE-note no. 32)

type	word	contents	meaning
I x 4	INDA-3	ATAG	name of the bank
	-2	0	no. of the bank
	-1	NP	pointer to the next bank of same name
	0	NW	number of data words in the bank
I x 2	+1	IB	bank descriptor
		0	empty
	+2	IPM	pointer to the first data word in the -Z-part (always +1)
		IPZ	pointer to the first data word in the +Z-part
	+3	IPL	pointer to the first data word of the luminosity scintillators
		ILAST	pointer to the last data word +1
	+4		ADC-address
			ADC-content
	⋮		
	+NW		ADC-address
			ADC-content

ADC-addresses 0 to 95 correspond to the lead glass blocks on the -Z-side (blocks 0, 47, 48, and 95 are ficticious);
ADC-addresses 96 to 191 correspond to the lead glass blocks on the +Z-side (blocks 96, 143, 144, and 191 are ficticious);
ADC-addresses 192 bo 207 correspond to the 16 luminosity counter scintillators, 1A, ..., 8A, 1B, ..., 8B;
ADC-addresses 216 to 227 correspond to the 12 tagging lead glass sums, 1S, 2S, AS, ..., 7S, 8S, DS;
ADC-addresses 228 and 229 correspond to the tagging lead glass sums on the -Z-side, SMZ, and on the +Z-side, SPZ, respectively.