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FullJIM Beginner's Manual

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How to use a full simulator of JLC detector is
briefly explained in this manual.
This is an updated version of
JIM Users' Guide written by N.Hosoda et.al. in Japanese,
and
FullJIM Beginner's Manual written by Y.Fujii in Japanese.

I) Introduction

There are two kinds of simulators named JIM ; FastJIM and FullJIM. The FastJIM is a smearing simulator with exact detector parameters, but without any cracks. The FullJIM is a full simulator based GEANT321. This manual describes how to use the FullJIM briefly. Another manual will be prepared for the FastJIM.

The bank structure of the FullJIM is the same as that of FastJIM for the banks which exist in both system. Some banks exist only in one simulator. All hit-banks are co-existent, and in most cases, the same analysis program can run for both simulation.

Development of the FullJIM started just after the publishment of JLC-I. The designing and coding were mainly done by Dr.Hosoda (at Spring-8 at present), Dr.Kanzaki (KEK),and Dr.Nakamura (Kobe Univ.), with help of Dr.Watanabe (Kogakuin Univ.), Dr.Ishii (Kobe Univ.) and myself. The FullJIM has been used among the authors since then, but not by other people. At this occasion, this manual has been prepared so that non-authors can start using the FullJIM easily.

How to run the FullJIM was already described in "JIM Users' Guide" written by N.Hosoda. However after the guide was written, re-organization of banks, change of computer environments, and addition of new detectors, etc. took place. Those changes are updated in this manual. For the completeness unchanged information are also described. The description is changed to more easy expression so that beginners can use FullJIM.

Other manuals can be found on the web as;

http://www-jlc.kek.jp/subg/offl/index-e.html

'fastJIM Users Manual' and 'fullJIM Beginners Guide'
http://www-jlc.kek.jp/subg/cal/index-e.html
ccjlc:/proj/soft/users/template/fjim/doc/manual.ps
ccjlc:/proj/soft/users/template/jim/doc/manual.ps

II) Install

Source files, an executable module, data files, and Makefiles of FullJIM (simply JIM hereafter) can be found on ccjlc. The directory is

/proj/soft/users/template/jim/src.

Also manuals can be found in

/proj/soft/users/template/jim/doc.

The manual by A.Miyamoto about how to use ccjlc itself exists on the web as

http://www-jlc.kek.jp/subg/offl/ccjlc.html.

III) How to Execute

Following describes how to execute the existing JIM executable module. How to modify the source program and re-Make it should be asked for experienced person.

1) Copy the nine data files (input.dat, geant.dat, vxgeom.dat, ctgeom.dat, bcgeom.dat, ecgeom.dat, irgeom.dat, bmgeom.dat, lmgeom.dat) from /proj/soft/users/template/jim/src to your own working directory. If necessary, you can copy the executable also to your directory. Or you can directory execute the JIM in the template directory without copying to your directory. In this case, you always execute the most-updated version of JIM.

2) Edit input.dat and geant.dat according to your simulatiuon condition. Other **geom.dat files describes detector geometry parameters, and you do not have to modify them usually.
The contents of input.dat and geant.dat is described in Appendix-C.

3) Execute JIM as follows.
If you do not have your own copy of JIM in your directory, type as

/proj/soft/users/template/jim/src/jim < input.dat > output.dat
If you have your own copy, type just as jim < input.dat > output.dat

4) Depending on switches described in geant.dat, detector drawing and/or the event display could be diplayed on the screen. In this case, prompt of 'Hit Return' will be displayed on the screen and execution halts. Please hit the return key everytime requested..

5) When execution completes, bank files are made. The name of the bank file is that specified in input.dat.

The content of the bank is described in Appendix-B. Brief explanation of the bank-access routines are described in Appendix-D

IV) Overall Structure of JIM

Structure of the JIM is shown in Appendix-A. It shows only user routines. In the chart, $\longleftarrow$'name-of-file' indicates the reading of the input files, and $\longrightarrow$'name-of-bank' indicates output to the bank.

V) JIM Geometry

At present, following five detectors are simulated ; Vertex Detector (VX), Central Tracker (CT), Barrel Calorimeter (BC), EndCap Calorimeter (EC), and Beam Monitor (BM). Two letters in ( ) indicates prefix or sufix to specify the detectors. Geometries of Muon Chamber (MU) and Luminosity Monitor (LM) are already built in, but signals are not yet processed.

All the non-detector structures such as iron structure, solenoid, beam pipe, beam mask, Q-magnets, and supporting tubes are built-in with geometries described in JLC-I.

The coordinate is defined such that direction of e^- is positive-z axis.

VI) Event Generator

Events to simulate with JIM can be generated internally, or be read from external files. This is switched using KINE keyword written in the input file geant.dat.

1) Event Generation inside JIM

Using the first word of the KINE keyword (KINE(1) hereafter), what kind of event to generate is switched. The meaning of the KINE(1) is as follows.

KINE(1)=1 ; $e^+e^- \to q\bar{q}$ continuum production with LUND.

KINE(1)=2 ; $e^+e^- \to t\bar{t}$ continuum production with LUND. m_t is set 174GeV.

KINE(1)=3 ; $e^+e^- \to H^0 + X$ production with LUND. m_H is set 120GeV.

KINE(1)=4 ; generate single particle. See Appendix-C for detail.

KINE(1)=5 ; reads event from external file. See next subsection.

KINE(1)=6 ; generate plural particles. See Appendix-C for detail.

KINE(2) specifies the Center-of-Mass Energy in GeV in the cases of KINE(1)=1,2,3, and energy of generated particles in the cases of KINE(1)=4,6. Detailed description of the KINE keyword is given in Appendix-C.

The single-particle generator shall be deleted soon. Use of multi-particle generators is recommended.

Higgs mass is defined in gukine.f at present. This will be changed to be defined using a keyword later.

2) Read Event from External File

If KINE(1)=5 is specified, JIM reads event data from an external file. The structure of the external file should be the bank 'MCEVENT' described in the Appendix-B. The bank 'GENHEADER' should also be prepared.

Examples to generate such external files are in

/proj/phys/simu/jim/sample/lu2bnk.f and

/proj/soft/users/template/generator/pythgen.f

The structure is common for both FastJIM and for FullJIM. Thus the external file can be simulated with both. The name of the external file should be specified by the EVT keyword in the input.dat.

VII) ZBS Bank System

JIM uses a bank system ZBS, which Kanzaki-san made base on ZEBRA. A brief manual for JIM programmers can be obtained from Kanzaki-san. Usage of ZBS related to JIM users is described in Appendix-D.

VIII) Graphics

Keywords in geant.dat control the event display as described in Appendix-C.

If SWITCH(4)=1 is specified, event display appears for events specified with DEBUG keywords. Cut-off plane is specified with IGDW keyword ; IGDW=1,2, or 3 means cut-off plane is perpendicular to x,y, or z axis, respectively.

The keywords GDUV specify the position of the detector origin on the display window. If 'GDUV 10.0 10.0' is specified, detector origin locates at the center of teh display window, for example.

The keywords GSUV specify magnification factor of the display. If 'GSUV 0.01 0.01' is specified, detector of 20m-size is desplayed as 20cm-size drawing on the screen, which occupies just full area of the display window, for example.

Three-dimensional displays, blow-up view, cut-off view, etc. can be displayed with JIM++. Several templates for JIM++ kumacs also exist in the template area. Please refer to the GEANT manual for detailed usage.

IX) Input Data Cards

The data file input.data describes the input file names for detector geometries, bank names, GEANT control keywords, and so on. Please see Appendix-C for detail.

JIM is still under development. Information about updates, bug-reports etc. are announced to a mailing list 'jim@jlcux1.kek.jp'. If you want to register your mailing address to this mailing list, please send an e-mail to junichi.kanzaki@kek.jp.

Appendix-A Program Structure of FullJIM

```
------------------------------------------------------------------------------
                                                      Updated on 17-Nov-1998
------------------------------------------------------------------------------
main.f (for jim)   or   gxint321.f (for jim++)
   uginit.f
      alffrd.f ; Initialize FF and read file names <-- input.dat
      geffrd.f ; read GEANT control data           <-- geant.dat
      vxffrd.f ; read VTX geometry data            <-- vxgeom.dat
      ctffrd.f ; read CDC geometry data            <-- ctgeom.dat
      bcffrd.f ; read Barrel-CAL geometry data     <-- bcgeom.dat
      ecffrd.f ; read EndCap-CAL geometry data     <-- ecgeom.dat
      irffrd.f ; read IR  geometry data            <-- irgeom.dat
      bmffrd.f ; read Beam Monitor geometry data   <-- bmgeom.dat
      lmffrd.f ; read Luminosity Monitor geometry  <-- lmgeom.dat
      ugeom.f  ; calculate geometry. See Appendix-E for Rotaion Matrix definition.
         jimate.f, jitmed.f
         ctgeom.f
         bcgeom.f => further calls bcsub1.f,bcsub2.f,bcsub3.f
         ecgeom.f => further calls ecsub1.f,ecsub2.f
         vxgeom.f
         mugeom.f
         irgeom.f => further calls qcgeom.f, mkgeom.f, bpgeom.f
         sogeom.f
         bmgeom.f
         lmgeom.f
      jstpar.f ; save detector parameters to banks.
         gespar.f   --> 'MCGEPAR'
         vxspar.f   --> 'MCVXPAR'
         ctspar.f   --> 'MCCTPAR'
         bcspar.f   --> 'MCBCPAR'
         ecspar.f   --> 'MCECPAR'
         bmspar.f   --> 'MCBMPAR'
         lmspar.f   --> 'MCLMPAR'
      udraw.f ; Draw detector shape
      vxinit.f
  (grun)
      gukine.f ; Generate events to simulate.
         kilund.f
         kitop.f
         kihigs.f
         kising.f
         kifile.f  <-- reads 'MCEVENT' from an external file.
         kimult.f
         jkzfev.f   --> 'MCEVENT'
         uvtki.f    --> 'MCVERTEX' , 'MCTRACK'
      gutrev.f
         gutrak
            gustep.f ; swim a particle for one step.
               cthits.f ; accumulates CT hit signals.
               bchits.f ; accumulates BC hit signals.
               echits.f ; accumulates EC hit signals.
               vxhits.f ; accumulates VX hit signals.
               bmhits.f ; accumulates VX hit signals.
      gudigi.f ; quantize/merge hits and save into banks
         mcdigi.f   --> 'MCHEADER'
         ctdigi.f   --> 'MCCTHIT' , 'MCCTHIT-TRACK'
         bcdigi.f   --> 'MCBEHIT' , 'MCBHHIT'
         ecdigi.f   --> 'MCEEHIT' , 'MCEHHIT'
         vxdigi.f   --> 'MCVXHIT'
```

```
      bmdigi.f   --> 'MCBMHIT'
      bkdump.f
   guout.f ; fill histograms. See Appendix-E for Hist-ID definition.
      juanal.f
         ctanal.f  --> 'CTTRACK'
            ftcirc.f, ctslen.f, ftline.f
      jfilbk.f
         jfilhd.f  --> 'HEADER'
         jfiltk.f  --> 'TRACK'
      vxout.f
uglast.f
```

Appendix-B Bank Structure of FullJIM

```
*********************************************************************
*
*     Banks described in this documents are ;
*           GENHEADER; Information of Generator.
*           MCHEADER ; Information of MC program and conditions.
*           MCEVENT  ; MC information on generated particles.
*           MCVERTEX ; List of vertices pointed by vertex pointer in MCTRACK.
*           MCTRACK  ; List of tracks with pointers to MCVERTEX and MCEVENT.
*           MCVXHIT  ; Data of VTX hits. Note that IR-study version exests.
*           MCCTHIT  ; Data of CDC hits. Note that IR-study version exests.
*           MCCTHIT-TRACK ; Pointer from track# to hit#.
*           CTTRACK  ; Results of track fitting
*           HEADER   ; Parameters used in track fitting
*           TRACK    ; Track parameters obtained by fitting
*           MCBEHIT  ; Data of Barrel-EM  CAL hits.
*           MCBHHIT  ; Data of Barrel-HAD CAL hits.
*           MCEEHIT  ; Data of EndCap-EM  CAL hits.
*           MCEHHIT  ; Data of EndCap-HAD CAL hits.
*           MCBMHIT  ; Data of Beam Monitor hits.
*           MCGEPAR  ; GEANT parameters.
*           MCVXPAR  ; VTX geometrical parameters.
*           MCCTPAR  ; CDC geometrical parameters.
*           MCBCPAR  ; Barrel CAL geometrical parameters.
*           MCECPAR  ; EndCap CAL geometrical parameters.
*           MCBMPAR  ; Beam Monitor geometrical parameters.
*           MCLMPAR  ; Luminosity Monitor geometrical parameters.
*
*           Updated on 13-Nov-1998, Y.Fujii
*                                   Added Beam & Lum Monitor Description
*           Updated on  3-Sep-1996, Y.Fujii
*
*********************************************************************
*     +------------------------+                                    *
*     | Bank Name  :  GENHEADER |                                   *
*     +------------------------+                                    *
*                                                                   *
*     Contents    : Information of Genarator
*     Created in  : Generator Program using KZBCR1. No action in jim *
*     Record Type : 1-dim. fixed length segment                     *
*     Version     : Release 1.0  1995-May-10                        *
*                                                                   *
*********************************************************************
*(1) Contents in the Master Segment
*----------------------------------------------------------------------
*  DATA                             CONTENTS
*----------------------------------------------------------------------
* CDATA(1)   Name of Generator ( CHARACTER*4 )
* IDATA(2)   Generater Version #
* IDATA(3)   DATE ( yymmdd )
* IDATA(4)   TIME ( hhmmss )
* IDATA(5)   Event #
* IDATA(6)   # of perticles
* IDATA(7)   Flug for Initial State Radiation
* IDATA(8)   Flug for Beam Schtrahlung
* RDATA(9)   CMS Energy
* RDATA(10)  Px of Positoron
* RDATA(11)  Py
* RDATA(12)  Pz
* RDATA(13)  Energy
```

```
* RDATA(14)  Helicity
* RDATA(15)  Px of Electron
* RDATA(16)  Py
* RDATA(17)  Pz
* RDATA(18)  Energy
* RDATA(19)  Helicity
*-----------------------------------------------------------------------
C
C
**********************************************************************
*     +------------------------+                                     *
*     | Bank Name  :  MCHEADER  |                                     *
*     +------------------------+                                     *
*                                                                    *
*     Contents    : Summary of information about a generated events  *
*                   at the event generator stage.                    *
*     Crearted in : mcdigi.f  using  KZBCR1                          *
*     Record Type : 1-dim. fixed length segment                      *
*     Version     : Release 1.0  1994-Jun-28                         *
*                                                                    *
**********************************************************************

(1) Contents in the Master Segment
    Master segment = segment # 0
----------------------------------------------------------------------
  DATA                            CONTENTS
----------------------------------------------------------------------
 IDATA(1)   Run number (=0 <-- Monte Carlo data)
 IDATA(2)   Event number
 IDATA(3)   Event type ( = KINE(1) in geant.dat )
 IDATA(4)   Radiative correction('off'=0,'on'=1)
 IDATA(5)   Total # of vertices in this event
 IDATA(6)   Total # of final tracks in this event
 IDATA(7)   Total # of all tracks in this event including unstables
  DATA(8)   Total energy of this event (GeV) ; presently 2*Ebeam
  DATA(9)   Magneic field (KGauss)
  DATA(10)  Beam energy (GeV)
----------------------------------------------------------------------

(2) Contents in the Data Segment
----------------------------------------------------------------------
  DATA                            CONTENTS
----------------------------------------------------------------------
 No entry in the data record
----------------------------------------------------------------------
*
*
**********************************************************************
*     +------------------------+                                     *
*     | Bank Name  :  MCEVENT   |                                     *
*     +------------------------+                                     *
*                                                                    *
*     Contents    : Information of all particles at the event        *
*                   generation stage are stored.  The history of an  *
*                   event (ex. the hadronization steps, decay chains *
*                   etc) can be traceable by this bank.              *
*                   See HEPEVT common of LUND74 manual for precise   *
*     Crearted in : jkzfev.f  using  KZBCR1                          *
*     Record Type : 1-dim. fixed length segment                      *
*     Version     : Release 1.0  1994-Jun-28                         *
```

```
*                                                                      *
************************************************************************

(1) Contents in the Master Segment
    Master segment = segment # 0
------------------------------------------------------------------------
  DATA                             CONTENTS
------------------------------------------------------------------------
 IDATA(1)   Event number
 IDATA(2)   Total number of particles generated in an event generator.
            The particles in intermediate states are also included.
------------------------------------------------------------------------

(2) Contents in the Data Segment
    Segment # = particle #
------------------------------------------------------------------------
  DATA                             CONTENTS
------------------------------------------------------------------------
 IDATA(1)    Status flag (1=stable, 2=decayed. ISTHEP in HEPEVT of LUND)
 IDATA(2)    Particle code (LUND code)
 IDATA(3)    Pointer to the position where the moter is stored.
 IDATA(4)    Pointer to the second mother ( used to specify mothers of string )
 IDATA(5)    Pointer to the position of the first daughter
 IDATA(6)    Pointer to the position of the last daughter
 IDATA(7)    Not Used
  DATA(8)    X-component of the momentum of i-th particle (GeV)
  DATA(9)    Y-component of the momentum of i-th particle (GeV)
  DATA(10)   Z-component of the momentum of i-th particle (GeV)
  DATA(11)   Total energy (GeV)
  DATA(12)   Mass (GeV)
  DATA(13)   Production vertex x position, in cm
  DATA(14)   Production vertex y position, in cm
  DATA(15)   Production vertex z position, in cm
  DATA(16)   Production time, in cm/c
  DATA(17)   Charge
  DATA(18)   Life (c*tau)
  DATA(19)   Not Used
  DATA(20)   Not Used
------------------------------------------------------------------------
*
*
*.***********************************************************************
*.     +------------------------+                                       *
*.     | Bank Name  :  MCVERTEX |                                       *
*.     +------------------------+                                       *
*.                                                                      *
*.     Contents    : List of Vertices                                   *
*.     Created in  : uvtki.f  using  KZBCR1                             *
*.     Record Type : 1-dim. variable length segment                     *
*.     Version     : Release 1.0  25-Mar-1996                           *
*.                                                                      *
*.***********************************************************************
*.
*.(1) Contents in the Master Segment
*.    Master segment = segment # 0
*.-----------------------------------------------------------------------
*.  DATA                             CONTENTS
*.-----------------------------------------------------------------------
*. IDATA(1)      # of vertecies
*.-----------------------------------------------------------------------
```

```
*.
*.(2) Contents in the Data Segment
*.    Segment # = serial number of vertices
*.------------------------------------------------------------------------
*.  DATA                            CONTENTS
*.------------------------------------------------------------------------
*. RDATA(1)      vertex X position in mm
*. RDATA(2)      vertex Y position in mm
*. RDATA(3)      vertex Z position in mm
*. RDATA(4)      production time in mm/c
*.------------------------------------------------------------------------
*.
*.
*.*********************************************************************
*.     +-----------------------+                                      *
*.     | Bank Name  :  MCTRACK  |                                      *
*.     +-----------------------+                                      *
*.                                                                    *
*.     Contents    : List of Tracks
*.     Created in  : uvtki.f  using  KZBCR1                           *
*.     Record Type : 1-dim. variable length segment                   *
*.     Version     : Release 1.0  25-Mar-1996                         *
*.                                                                    *
*.*********************************************************************
*.
*.(1) Contents in the Master Segment
*.    Master segment = segment # 0
*.-----------------------------------------------------------------------
*.  DATA                            CONTENTS
*.-----------------------------------------------------------------------
*. IDATA(1)      # of Tracks ( stable particle only. Even Ks is excluded.)
*.-----------------------------------------------------------------------
*.
*.(2) Contents in the Data Segment
*.------------------------------------------------------------------------
*.  DATA                            CONTENTS
*.------------------------------------------------------------------------
*. RDATA(1)      momentum px (GeV)
*. RDATA(2)      momentum py (GeV)
*. RDATA(3)      momentum pz (GeV)
*. RDATA(4)      energy   E  (GeV)
*. RDATA(5)      mass        (GeV)
*. IDATA(6)      particle ID (LUND code)
*. IDATA(7)      particle ID (GEANT code)
*. IDATA(8)      pointer to MCVERTEX serial vertex   number (=segment#)
*. IDATA(9)      pointer to MCEVENT  serial particle number (=segment#)
*.------------------------------------------------------------------------
*.
*.
**********************************************************************
*     +-----------------------+                                      *
*     | Bank Name  :  MCVXHIT  |                                      *
*     +-----------------------+                                      *
*                                                                    *
*     Contents    : List of vertex chamber hits on tracks which the  *
*                   JIM generated.                                   *
*.    Created in  : vxdigi.f  using  KZBCR1                          *
*     Record Type : 1-dim. fixed length segment                      *
*     Version     : Release 1.0  1994-Jul-07                         *
*     Version     : IR-study version has different bank copntents.   *
```

```
*                   1997-Feb-10                                    *
*                                                                  *
********************************************************************

(1) Contents in the Master Segment
    Master segment = segment # 0
--------------------------------------------------------------------
  DATA                              CONTENTS
--------------------------------------------------------------------
 IDATA(1)   Total number of generated tracks ( including unstables )
 IDATA(2)   Total number of hits
--------------------------------------------------------------------

(2) Contents in the Data Segment
    Segment # = hits #
--------------------------------------------------------------------
  DATA                              CONTENTS
--------------------------------------------------------------------
 IDATA(1)    Track # of i-th hit
 IDATA(2)    Layer # most inner=1,middle=2,outer=3
 IDATA(3)    Z direction cell # from +z side
 IDATA(4)    Phi direction cell # from phi=0
 IDATA(5)    Particle code (LUND code)
  DATA(6)    X position of hit (cm) ( not quantized by pixel size )
  DATA(7)    Y position of hit (cm) ( not quantized by pixel size )
  DATA(8)    Z position of hit (cm) ( not quantized by pixel size )
  DATA(9)    Momentum of i-th particle (GeV)
  DATA(10)   Energy loss (KeV)
* IR-study version has different structure after DATA(10)
  DATA(10)   Px of particle [GeV]
  DATA(11)   Py of particle [GeV]
  DATA(12)   Pz of particle [GeV]
 IDATA(13)   LUND Particle code of the mother particle
  DATA(14)   x-coordinate of the generated point
  DATA(15)   y-coordinate of the generated point
  DATA(16)   z-coordinate of the generated point
  DATA(17)   Px of particle at the generated point
  DATA(18)   Py of particle at the generated point
  DATA(19)   Pz of particle at the generated point
  DATA(20)   Energy loss (KeV) in the pixel
--------------------------------------------------------------------
*.
*.
********************************************************************
*     +-----------------------+                                    *
*     | Bank Name  :  MCCTHIT  |                                   *
*     +-----------------------+                                    *
*                                                                  *
*     Contents    : List of central tracker hits on tracks which the *
*                   JIM generated.                                 *
*.    Created in  : ctdigi.f  using  KZBCR1                        *
*     Record Type : 1-dim. fixed length segment                    *
*     Version     : Release 1.0  1994-Jun-28                       *
*     Version     : IR-study version has extended bank copntents.  *
*                   1997-Feb-10                                    *
*                                                                  *
********************************************************************

(1) Contents in the Master Segment
   Master segment = segment # 0
```

```
----------------------------------------------------------------------
  DATA                            CONTENTS
----------------------------------------------------------------------
 IDATA(1)   Total number of generated tracks (including unstables and neutrals)
 IDATA(2)   Total number of hits
----------------------------------------------------------------------

(2) Contents in the Data Segment
    Segment # = hits #
----------------------------------------------------------------------
  DATA                            CONTENTS
----------------------------------------------------------------------
 IDATA(1)    Track # of i-th hit
 IDATA(2)    Encoded Wire No.
             (wire# counted from inner side)*1000 + wire# counted from phi=0
  DATA(3)    Drift time
  DATA(4)    Energy Deposit (KeV)
 IDATA(5)    Left-right ambiguity (+1=+phi side of anode wire,-1=-phi)
 IDATA(6)    Particle code (LUND code)
  DATA(7)    Drift length (cm)
  DATA(8)    x position of hit (cm)
  DATA(9)    y position of hit (cm)
  DATA(10)   Z position of hit (cm)
  DATA(11)   Time of flight (nsec)
  DATA(12)   X-component of the momentum of i-th particle (GeV)
  DATA(13)   Y-component of the momentum of i-th particle (GeV)
  DATA(14)   Z-component of the momentum of i-th particle (GeV)
* Following contents are only for IR-study version
 IDATA(15)   LUND Particle code of Mother particle
  DATA(16)   x position of origin of the particle which generated the hit
  DATA(17)   y position of origin of the particle which generated the hit
  DATA(18)   Z position of origin of the particle which generated the hit
  DATA(19)   X-component of the momentum at the origin of the particle
  DATA(20)   Y-component of the momentum at the origin of the particle
  DATA(21)   Z-component of the momentum at the origin of the particle
----------------------------------------------------------------------
*.
*.
**********************************************************************
*     +-----------------------------+                                *
*     | Bank Name  :  MCCTHIT-TRACK  |                               *
*     +-----------------------------+                                *
*                                                                    *
*     Contents    : Pointer from track# to hit # on a track.         *
*.                  List of serial hit # of N-hits on i-th track     *
*.    Created in  : ctdigi.f  using  KZBCR0                          *
*     Record Type : 1-dim. fixed length segment                      *
*     Version     : Release 1.0  1996-Mar-28                         *
*                                                                    *
**********************************************************************

(1) Contents in the Master Segment
   Master segment = segment # 0
----------------------------------------------------------------------
  DATA                            CONTENTS
----------------------------------------------------------------------
 IDATA(1)   Total number of tracks (including unstables and neutrals)
----------------------------------------------------------------------

(2) Contents in the Data Segment
```

```
    Segment # = track #
----------------------------------------------------------------------
  DATA                            CONTENTS
----------------------------------------------------------------------
 IDATA(N)    List of serial hit # of N-hits on this track (track#=seg#)
----------------------------------------------------------------------
*.
*.
**********************************************************************
*     +-----------------------+
*     | Bank Name  :  CTTRACK  |
*     +-----------------------+
*                                                                    *
*     Contents    : Results of r-phai and r-z track fitting          *
*.    Created in  : ctanal.f  using  KZBCR1                          *
*     Record Type : 1-dim. fixed length segment                      *
*     Version     : Release 0.0  1996-Mar-13 ; tentative version     *
*                                                                    *
**********************************************************************

(1) Contents in the Master Segment
   Master segment = segment # 0
----------------------------------------------------------------------
  DATA                            CONTENTS
----------------------------------------------------------------------
 IDATA(1)   Total number of tracks (stable charged only)
----------------------------------------------------------------------

(2) Contents in the Data Segment
    Segment # = track #
----------------------------------------------------------------------
  DATA                            CONTENTS
----------------------------------------------------------------------
  DATA(1)
  DATA(2)
  DATA(3)
  DATA(4)
  DATA(5)
  DATA(6)
  DATA(7)
  DATA(8)
  DATA(9)
  DATA(10)
  DATA(11)
  DATA(12)
  DATA(13)  r-phai fit ; Closest approach to the Z-axis
  DATA(14)  r-phai fit ; Phai angle of the center of the track circle
  DATA(15)  r-phai fit ; signed 1/R, R=radius of the track circle
  DATA(16)  r-phai fit ; reduced chi-sqr
 IDATA(17)  r-phai fit ; number of hits
  DATA(18)  r-z    fit ; z0 = intercept of fitted line
  DATA(19)  r-z    fit ; slope of fitted line
  DATA(20)  r-z    fit ; reduced chi-sqr
 IDATA(21)  r-z    fit ; number of hits
  DATA(22)  r-phai fit ; Error Matrix
  DATA(23)                //
  DATA(24)                //
  DATA(25)  r-z    fit ; Error Matrix
  DATA(26)                //
  DATA(27)  r-phai fit ; Error Matrix
```

```
  DATA(28)                //
  DATA(29)
  DATA(30)
  DATA(31)  r-phai fit ; Error Matrix
  DATA(32)
  DATA(33)
  DATA(34)
  DATA(35)
  DATA(36)  r-z    fit ; Error Matrix
----------------------------------------------------------------------
*.
*.
**********************************************************************
*     +-----------------------+
*     | Bank Name  :  HEADER  |
*     +-----------------------+
*                                                                    *
*     Contents    : Parameters refered in tracking                   *
*.    Created in  : jfilhd.f  using  KZBCR1                          *
*     Record Type : 1-dim. fixed length segment                      *
*     Version     : Release 0.0  1996-Mar-13 ; tentative version     *
*                                                                    *
**********************************************************************

(1) Contents in the Master Segment
   Master segment = segment # 0
----------------------------------------------------------------------
  DATA                              CONTENTS
----------------------------------------------------------------------
 IDATA(1) = 0
 IDATA(2) = 0
 IDATA(3)   Event Number
  DATA(4)   Beam Energy
  DATA(5)   Magnetic Field
 IDATA(6)-IDATA(20) = 0
----------------------------------------------------------------------
*.
*.
**********************************************************************
*     +----------------------+
*     | Bank Name  :  TRACK  |
*     +----------------------+
*                                                                    *
*     Contents    : Fitted results of track parameters               *
*.    Created in  : jfiltk.f  using  KZBCR1                          *
*     Record Type : 1-dim. fixed length segment                      *
*     Version     : Release 0.0  1996-Mar-13 ; tentative version     *
*                                                                    *
**********************************************************************

(1) Contents in the Master Segment
   Master segment = segment # 0
----------------------------------------------------------------------
  DATA                              CONTENTS
----------------------------------------------------------------------
 IDATA(1) = Number of tracks (stable charged only)
 IDATA(2)-IDATA(5) = 0
----------------------------------------------------------------------

(2) Contents in the Data Segment
```

```
   Segment # = track #
----------------------------------------------------------------------
  DATA                            CONTENTS
----------------------------------------------------------------------
  DATA(1)   Px of the track
  DATA(2)   Py
  DATA(3)   Pz
  DATA(4)   P
  DATA(5)   Charge
  DATA(6)   r-phai fit ; Closest approach to the Z-axis
  DATA(7)   r-phai fit ; Phai angle of the center of the track circle
  DATA(8)   r-phai fit ; reduced chi-sqr
 IDATA(9)   r-phai fit ; number of hits
  DATA(10)  r-z    fit ; z0 = intercept of fitted line
  DATA(11)  r-z    fit ; reduced chi-sqr
 IDATA(12)  r-z    fit ; number of hits
  DATA(13)  = 0
  DATA(14)  serial track number
  DATA(15)-DATA(20) = 0
----------------------------------------------------------------------
*.
*.
*.*********************************************************************
*.     +-----------------------+                                      *
*.     | Bank Name  :  MCBEHIT  |                                     *
*.     +-----------------------+                                      *
*.                                                                    *
*.     Contents    : List of Barrel Calorimeter hits on tracks which  *
*.                   the JIM generated.                               *
*.     Created in  : bcdigi.f  using  KZBCR0
*.     Record Type : 1-dim. variable length segment                   *
*.     Version     : Release 1.0  1995-Apr-21                         *
*.                                                                    *
*.*********************************************************************
*.
*.(1) Contents in the Master Segment
*.    Master segment = segment # 0
*.---------------------------------------------------------------------
*.  DATA                            CONTENTS
*.---------------------------------------------------------------------
*. IDATA(1)   Total number of hit blocks
*.---------------------------------------------------------------------
*.
*.(2) Contents in the Data Segment
*.    Segment # = hits #
*.---------------------------------------------------------------------
*.  DATA                            CONTENTS
*.---------------------------------------------------------------------
*. IDATA(1)      Cell Id # (1000*ITHETA+IPHI)
*.  DATA(2)      Total Energy of the Cell ( GeV )
*.  DATA(3)      Time of Flight ( psec )
*. IDATA(4)      # of Contributed Track
*.
*. IDATA(3*I+2)  Contributed Track #  |
*.  DATA(3*I+3)  Deposit Energy       + I = 1, 5
*.  DATA(3*I+4)  Time of Flight       |       Variable Length
*.---------------------------------------------------------------------
*.
*.
*.*********************************************************************
```

```
*.     +-----------------------+                                      *
*.     | Bank Name  :  MCBHHIT  |                                     *
*.     +-----------------------+                                      *
*.                                                                    *
*.     Contents    : List of Barrel Calorimeter hits on tracks which  *
*.                   the JIM generated.                               *
*.     Created in  : bcdigi.f  using  KZBCR0
*.     Record Type : 1-dim. fixed length segment                      *
*.     Version     : Release 1.0  1995-Apr-21                         *
*.                                                                    *
*.*******************************************************************
*.
*.(1) Contents in the Master Segment
*.    Master segment = segment # 0
*.-------------------------------------------------------------------
*.  DATA                            CONTENTS
*.-------------------------------------------------------------------
*. IDATA(1)   Total number of hit blocks
*.-------------------------------------------------------------------
*.
*.(2) Contents in the Data Segment
*.    Segment # = hits #
*.-------------------------------------------------------------------
*.  DATA                            CONTENTS
*.-------------------------------------------------------------------
*. IDATA(1)        Cell # (1000*ITHETA+IPHI)
*.  DATA(2)        Deposit Energy in PMT1 ( GeV )
*.  DATA(3)        Deposit Energy in PMT2 ( GeV )
*.  DATA(4)        Time of Flight ( nsec )
*. IDATA(5)        # of Contributed Track
*.
*. IDATA(4*I+2)    Contributed Track #     |
*.  DATA(4*I+3)    Deposit Energy (PMT1)   + I = 1,5
*.  DATA(4*I+4)    Deposit Energy (PMT2)   |    Variable Length
*.  DATA(4*I+5)    Time of Flight          |
*.-------------------------------------------------------------------
*.
*.
*.*******************************************************************
*.     +-----------------------+                                      *
*.     | Bank Name  :  MCEEHIT  |                                     *
*.     +-----------------------+                                      *
*.                                                                    *
*.     Contents    : List of Endcap Calorimeter hits on tracks.       *
*.     Created in  : ecdigi.f  using  KZBCR0
*.     Record Type : 1-dim. variable length segment                   *
*.     Version     : Release 1.0  1995-Apr-21                         *
*.                                                                    *
*.*******************************************************************
*.
*.(1) Contents in the Master Segment
*.   Master segment = segment # 0
*.-------------------------------------------------------------------
*.  DATA                            CONTENTS
*.-------------------------------------------------------------------
*. IDATA(1)   Total number of hit blocks
*.-------------------------------------------------------------------
*.
*.(2) Contents in the Data Segment
*.   Segment # = hits #
```

```
*.---------------------------------------------------------------------
*.  DATA                            CONTENTS
*.---------------------------------------------------------------------
*. IDATA(1)      Cell Id # (1000*IR+IPHI)
*.  DATA(2)      Total Energy of the Cell ( GeV )
*.  DATA(3)      Time of Flight ( psec )
*. IDATA(4)      # of Contributed Track
*.
*. IDATA(3*I+2)  Contributed Track #  |
*.  DATA(3*I+3)  Deposit Energy       + I = 1, 5
*.  DATA(3*I+4)  Time of Flight       |       Variable Length
*.---------------------------------------------------------------------
*.
*.********************************************************************
*.     +-------------------------+                                    *
*.     | Bank Name  :  MCEHHIT  |                                    *
*.     +-------------------------+                                    *
*.                                                                    *
*.     Contents    : List of Endcap Calorimeter hits on tracks.       *
*.     Created in  : ecdigi.f  using  KZBCR0
*.     Record Type : 1-dim. variable length segment                   *
*.     Version     : Release 1.0  1995-May-5                          *
*.                                                                    *
*.********************************************************************
*.
*.(1) Contents in the Master Segment
*.    Master segment = segment # 0
*.---------------------------------------------------------------------
*.  DATA                            CONTENTS
*.---------------------------------------------------------------------
*. IDATA(1)   Total number of hit blocks
*.---------------------------------------------------------------------
*.
*.(2) Contents in the Data Segment
*.    Segment # = hits #
*.---------------------------------------------------------------------
*.  DATA                            CONTENTS
*.---------------------------------------------------------------------
*. IDATA(1)        Cell # (1000*IR+IPHI)
*.  DATA(2)        Deposit Energy in PMT1 ( GeV ) ; EC-HAD cells are also
*.  DATA(3)        Deposit Energy in PMT2 ( GeV ) ; read-out with 2-PMTs.
*.  DATA(4)        Time of Flight ( nsec )
*. IDATA(5)        # of Contributed Track
*.
*. IDATA(4*I+2)    Contributed Track #     |
*.  DATA(4*I+3)    Deposit Energy (PMT1)   + I = 1,5
*.  DATA(4*I+4)    Deposit Energy (PMT2)   |    Variable Length
*.  DATA(4*I+5)    Time of Flight          |
*.---------------------------------------------------------------------
*.
*.
*.********************************************************************
*.     +-------------------------+                                    *
*.     | Bank Name  :  MCBMHIT  |                                    *
*.     +-------------------------+                                    *
*.                                                                    *
*.     Contents    : List of Beam Monitor hits                        *
*.     Created in  : bmdigi.f  using  KZBCR1                          *
*.     Record Type : 1-dim. fixed length segment                      *
*.     Version     : Release 1.0  1996-Aug-29                          *
```

```
*.                                                                      *
*.**********************************************************************
*.
*.(1) Contents in the Master Segment
*.    Master segment = segment # 0
*.----------------------------------------------------------------------
*.  DATA                             CONTENTS
*.----------------------------------------------------------------------
*. IDATA(1)   Total number of tracks
*. IDATA(2)   Total number of hits
*.----------------------------------------------------------------------
*.
*.(2) Contents in the Data Segment
*.    Segment # = hit #
*.----------------------------------------------------------------------
*.  DATA                             CONTENTS
*.----------------------------------------------------------------------
*. IDATA(1)   track number responsible to this hit
*. IDATA(2)   detector/layer(1F,2F,1B,2B) number of this hit
*. IDATA(3)   pixel number in theta direction
*. IDATA(4)   pixel number in phai direction
*. IDATA(5)   particle number
*.  DATA(6)   x coordinate of this hit [cm]
*.  DATA(7)   y coordinate of this hit [cm]
*.  DATA(8)   z coordinate of this hit [cm]
*.  DATA(9)   p of particle generated this hit [GeV]
*.  DATA(10)  Px of particle [GeV]
*.  DATA(11)  Py of particle [GeV]
*.  DATA(12)  Pz of particle [GeV]
*. IDATA(13)  particle number of previous track
*.  DATA(14)  vertex position in x
*.  DATA(15)  vertex position in y
*.  DATA(16)  vertex position in z
*.  DATA(17)  momentum-x at vertex position
*.  DATA(18)  momentum-y at vertex position
*.  DATA(19)  momentum-z at vertex position
*.  DATA(20)  energy deposit to this pixel [keV]
----------------------------------------------------------------------
*.
*.
*.**********************************************************************
*.     +-------------------------+                                      *
*.     | Bank Name  :  MCGEPAR   |                                      *
*.     +-------------------------+                                      *
*.                                                                      *
*.     Contents    : Information of GEANT Parameters are stored.       *
*.     Created in  : gespar.f  using  KZBCR1
*.     Record Type : 1-dim. fixed length segment                        *
*.     Version     : Release 1.0  1995-May-10                           *
*.                                                                      *
*.**********************************************************************
*.
*.(1) Contents in the Master Segment
*.    Master segment = segment # 0
*.----------------------------------------------------------------------
*.  DATA                             CONTENTS
*.----------------------------------------------------------------------
*. IDATA(1)  GEANT Version #
*. IDATA(2)  IPAIR = Control Variable for the e-pair production.
*. IDATA(3)  ICOMP = Control Variable for the Compton scattering
```

```
*. IDATA(4)  IPHOT = Control Variable for the photoelectric effect
*. IDATA(5)  IPFIS = Control Variable for the gamma induced nuclear fission
*. IDATA(6)  IDRAY = Control Variable for the delta-ray producton process
*. IDATA(7)  IANNI = Control Variable for the positoron annichilation prosecc
*. IDATA(8)  IBREM = Control Variable for the bremsstrahlung process
*. IDATA(9)  IHADR = Control Variable for the hadronic interaction process
*. IDATA(10) IMUNU = Control Variable for the mu-nuclear interaction process
*. IDATA(11) IDCAY = Control Variable for the decay in flight process
*. IDATA(12) ILOSS = Control Variable for the energy loss process
*. IDATA(13) IMULS = Control Variable for the energy loss process
*. RDATA(14) CUTGAM= Kinetic Energy cut Threshold for gamma
*. RDATA(15) CUTELE= Kinetic Energy cut Threshold for electron
*. RDATA(16) CUTNEU= Kinetic Energy cut Threshold for newtral hadron
*. RDATA(17) CUTHAD= Kinetic Energy cut Threshold for charged hadron
*. RDATA(18) CUTMUO= Kinetic Energy cut Threshold for muon
*. RDATA(19) BCUTE = Kinetic Energy cut Threshold for electron brems.
*. RDATA(20) BCUTM = Kinetic Energy cut Threshold for muon brems.
*. RDATA(21) DCUTE = Kinetic Energy cut Threshold for electron delta ray
*. RDATA(22) DCUTM = Kinetic Energy cut Threshold for muon or hadron delta ray
*. RDATA(23) PPCUTM= Total Energy cut Threshold for e-pair production by muon
*. RDATA(24) TOFMAX= TOF cut
*.-----------------------------------------------------------------------
*.
*.
*.*******************************************************************
*.     +-------------------------+                                 *
*.     | Bank Name  :  MCVXPAR   |                                 *
*.     +-------------------------+                                 *
*.                                                                 *
*.     Contents    : Information of VTX Parameters are stored.     *
*.     Created in  : vxspar.f  using  KZBCR1
*.     Record Type : 1-dim. fixed length segment                   *
*.     Version     : Release 1.0  1995-May-10                      *
*.                                                                 *
*.*******************************************************************
*.
*.(1) Contents in the Master Segment
*.    Master segment = segment # 0
*.-----------------------------------------------------------------------
*.  DATA                            CONTENTS
*.-----------------------------------------------------------------------
*. IDATA(1)   Number of Layers
*.  DATA(2)   Depletion Layer Thickness
*.  DATA(3)   Pixel Size (cm)
*.  DATA(4)   Radial Position of the 1st Layer
*.  DATA(5)   Radial Position of the 2nd Layer
*.  DATA(6)   Radial Position of the 3rd Layer
*.  DATA(7)   Half Z-Length of the 1st Layer
*.  DATA(8)   Half Z-Length of the 2nd Layer
*.  DATA(9)   Half Z-Length of the 3rd Layer
*.  DATA(10)  Silicon Thickness
*.-----------------------------------------------------------------------
*.
*.
*.*******************************************************************
*.     +-------------------------+                                 *
*.     | Bank Name  :  MCCTPAR   |                                 *
*.     +-------------------------+                                 *
*.                                                                 *
*.     Contents    : Information of CDC Parameters are stored.     *
```

```
*.     Created in  : ctspar.f  using  KZBCR1
*.     Record Type : 1-dim. fixed length segment                     *
*.     Version     : Release 1.0  1995-May-10                        *
*.                                                                   *
*.*******************************************************************
*.
*.(1) Contents in the Master Segment
*.    Master segment = segment # 0
*.---------------------------------------------------------------------
*.  DATA                            CONTENTS
*.---------------------------------------------------------------------
*. IDATA(1)   Number of Super-Layers
*. IDATA(2)   Number of Anode-Wires in a Cell
*.  DATA(3)   Outer Radius (cm)
*.  DATA(4)   Inner Radius (cm)
*.  DATA(5)   Half Z-Length of Outer CFRP Wall (cm)
*.  DATA(6)   Z-coodinate of an Endplate Point used to define EP Shape
*.  DATA(7)   R-coodinate of an Endplate Point used to define EP Shape
*.  DATA(8)   Length of super cell for phi direction (cm)
*.  DATA(9)   Length of super cell for R direction   (cm)
*.  DATA(10)  Thickness of CFRP Wall (cm)
*.  DATA(11)  Thickness of Endplate  (cm)
*.---------------------------------------------------------------------
*.
*.
*.*******************************************************************
*.     +-------------------------+                                   *
*.     | Bank Name  :  MCBCPAR   |                                   *
*.     +-------------------------+                                   *
*.                                                                   *
*.     Contents    : Information of Barrel Calorimeter Geometrical   *
*.                   Parameters are stored.                          *
*.     Created in  : bcspar.f  using  KZBCR0
*.     Record Type : 1-dim. fixed length segment                     *
*.     Version     : Release 1.0  1995-Apr-18                        *
*.                                                                   *
*.*******************************************************************
*.
*.(1) Contents in the Master Segment
*.    Master segment = segment # 0
*.---------------------------------------------------------------------
*.  DATA                            CONTENTS
*.---------------------------------------------------------------------
*. IDATA(1)   FLAG to select calorimeter type (See bcsub?)
*. IDATA(2)   # of Towrs in Theta Direction
*. IDATA(3)   # of Towrs in Phi Direction
*.  DATA(4)   Half Length of Calorimeter System in Z Axis.
*.  DATA(5)   ....................
*.  DATA(6)   Thickness of EM Scintillator Plate.
*.  DATA(7)   Thickness of HAD Scintillator Plate.
*.  DATA(8)   Depth of a Calorimeter Towor.
*.  DATA(9)   Size of Calorimeter Towor.
*.  DATA(10)  Depth of EM part
*.  DATA(11)  Tickness of WLS Plate.
*.  DATA(12)  Tilt Angle of Tower in Phi axis.
*.---------------------------------------------------------------------
*.
*.(2) Contents in the Data Segment
*.    Total # of segment = 6
*.---------------------------------------------------------------------
```

```
*. Subsegment #   TYPE   # DATA        Comment
*.----------------------------------------------------------------
*.       1          R    2*NPHI     EM Cal X Position
*.       2          R    2*NPHI     EM Cal Y Position
*.       3          R    2*NTHE     EM Cal Z Position
*.       4          R    NPHI       HAD Cal X Position
*.       5          R    NPHI       HAD Cal Y Position
*.       6          R    NTHE       HAD Cal Z Position
*.----------------------------------------------------------------------
*.  DATA                            CONTENTS
*.------------------------------------------------------------------------
*.  DATA(1)   Position of Calorimeter Cell.
*.------------------------------------------------------------------------
*.
*.**********************************************************************
*.     +-------------------------+                                     *
*.     | Bank Name  :  MCECPAR   |                                     *
*.     +-------------------------+                                     *
*.                                                                     *
*.     Contents    : Information of Endcap Calorimeter Geometrical    *
*.                   Parameters are stored.                            *
*.     Created in  : ecspar.f  using  KZBCR0
*.     Record Type : 1-dim. fixed length segment                       *
*.     Version     : Release 1.0  1995-Apr-18                          *
*.                                                                     *
*.**********************************************************************
*.
*.(1) Contents in the Master Segment
*.    Master segment = segment # 0
*.------------------------------------------------------------------------
*.  DATA                            CONTENTS
*.------------------------------------------------------------------------
*. IDATA(1)   FLAG to select calorimeter type (See bcsub?)
*. IDATA(2)   Number of Divisions in R-direction (=NRdiv)
*. IDATA(3)   Inner Radius of EC CAL Front Face
*.  DATA(4)   Outer Radius of EC CAL Front Face
*.  DATA(5)   Inner Radius of EC CAL Rear  Face
*.  DATA(6)   Outer Radius of EC CAL Rear  Face
*.  DATA(7)   Z-position of EC Front Face
*.  DATA(8)   Depth of a Calorimeter Towor.
*.  DATA(9)   Depth of EM part
*.  DATA(10)  Thickness of EM  Scintillator Plate.
*.  DATA(11)  Thickness of HAD Scintillator Plate.
*.  DATA(12)  Size of Calorimeter Towor.
*.------------------------------------------------------------------------
*.
*.(2) Contents in the Data Segment
*.    Total # of segment = Number of R-divisions (=NRdiv)
*.------------------------------------------------------------------------
*. Subsegment #   TYPE   # DATA        Comment
*.----------------------------------------------------------------
*.       1          R    NPHI       Number of Division in Phai of 1st  ring.
*.       i          R    NPHI       Number of Division in Phai of i-th ring.
*.   NRdiv          R    NPHI       Number of Division in Phai of last ring.
*.----------------------------------------------------------------------
*.  DATA                            CONTENTS
*.------------------------------------------------------------------------
*.  DATA(1)   Position of Calorimeter Cell.
*.------------------------------------------------------------------------
*.
```

```
*.
*.*******************************************************************
*.     +-------------------------+                                 *
*.     | Bank Name  :  MCBMPAR   |                                 *
*.     +-------------------------+                                 *
*.                                                                 *
*.     Contents    : Information of Beam Moniotor Parameters       *
*.     Created in  : bmspar.f  using  KZBCR1
*.     Record Type : 1-dim. fixed length segment                   *
*.     Version     : Release 1.0  1996-Aug-29                      *
*.                                                                 *
*.*******************************************************************
*.
*.(1) Contents in the Master Segment
*.    Master segment = segment # 0
*.--------------------------------------------------------------------
*.  DATA                            CONTENTS
*.--------------------------------------------------------------------
*. IDATA(1)   Number of Layers
*. IDATA(2)   Number of Pixels in r  -direction for Beam Monitor#1
*. IDATA(3)   Number of Pixels in phi-direction for Beam Monitor#1
*. IDATA(4)   Number of Pixels in r  -direction for Beam Monitor#2
*. IDATA(5)   Number of Pixels in phi-direction for Beam Monitor#2
*.  DATA(6)   Silicon Thickness
*.  DATA(7)   Pixel Size (cm) of Beam Monitor #1
*.  DATA(8)   Pixel Size (cm) of Beam Monitor #2
*.  DATA(9)   Inner Radius (cm) of Beam Monitor #1
*.  DATA(10)  Inner Radius (cm) of Beam Monitor #2
*.  DATA(11)  Outer Radius (cm) of Beam Monitor #1
*.  DATA(12)  Outer Radius (cm) of Beam Monitor #2
*.  DATA(13)  Z-position (cm) of the beam Monitor #1
*.  DATA(14)  Z-position (cm) of the beam Monitor #1
*.--------------------------------------------------------------------
*.
*.
*.*******************************************************************
*.     +-------------------------+                                 *
*.     | Bank Name  :  MCLMPAR   |                                 *
*.     +-------------------------+                                 *
*.                                                                 *
*.     Contents    : Information of Luminosity Monitor Parameters.  *
*.     Created in  : lmspar.f  using  KZBCR1
*.     Record Type : 1-dim. fixed length segment                   *
*.     Version     : Release 1.0  1997-Feb-4                       *
*.                                                                 *
*.*******************************************************************
*.
*.(1) Contents in the Master Segment
*.    Master segment = segment # 0
*.--------------------------------------------------------------------
*.  DATA                            CONTENTS
*.--------------------------------------------------------------------
*.  DATA(1)   Theta angle of the inner edge of the LUM Monitor
*.  DATA(2)   Theta angle of the outer edge of the LUM Monitor
*.  DATA(3)   Theta angle of the inner edge of the LUM-support
*.  DATA(4)   Theta angle of the outer edge of the LUM-support
*.  DATA(5)   Theta angle of the inner edge of the LUM Inner Mask
*.  DATA(6)   Theta angle of the outer edge of the LUM Inner Mask
*.  DATA(7)   Theta angle of the inner edge of the LUM Carbon Mask
*.  DATA(8)   Theta angle of the outer edge of the LUM Carbon Mask
```

```
*.  DATA(9)   Z-position  of the front face of the LUM Monitor
*.  DATA(10)  Z-position  of the rear  face of the LUM Monitor
*.  DATA(11)  Z-position  of the front face of the LUM-support
*.  DATA(12)  Z-position  of the rear  face of the LUM-support
*.  DATA(13)  Z-position  of the front face of the LUM Inner Mask
*.  DATA(14)  Z-position  of the rear  face of the LUM Inner Mask
*.  DATA(15)  Z-position  of the front face of the LUM Carbon Mask
*.  DATA(16)  Z-position  of the rear  face of the LUM Carbon Mask
*.  DATA(17)  Inner Radius of inner edge of the LUM Carbon Mask
*.------------------------------------------------------------------------
*.
*.
*.************************************************************************
```

Appendix-C Input Keywords of FullJIM

```
---------------------------------------------------------------------------
                                                       Updated on 17-Nov-1998
---------------------------------------------------------------------------
input.dat ; File Names for Parameter Input. Names are user-re-definable.

Keyword   Parameter     Meaning
GEAN    'geant.dat'   file which contains GEANT control parameters
VX      'vxgeom.dat'  file which contains Vertex geometry parameters
CT      'ctgeom.dat'  file which contains CentralTracker geometry parameters
BC      'bcgeom.dat'  file which contains Barrel Cal geometry parameters
EC      'ecgeom.dat'  file which contains Endcap Cal geometry parameters
IR      'irgeom.dat'  file which contains Interaction Region geometry parameters
BM      'bmgeom.dat'  file which contains Beam Monitor geometry parameters
LM      'lmgeom.dat'  file which contains Luminosity Monitor geometry parameters
PS      'jim.ps'      Postscript file to output graphics
BNK     'jim.bnk'     Output bank file name
HBK     'jim.hbook'   HBOOK output file name
EVT     'higgs.evn'   Input 4-vector file that is created by other generator.

---------------------------------------------------------------------------
geant.dat ; GEANT Control Keywords

Keyword   Meaning
TRIGGER   Number of event to simulate.
DEBUG     control event range/frequency for debug output.
          (1) First event to debug.
          (2) Last event to debug.
          (3) Frequency control to specify every N event.
SWITCH    control debug output type.
          (3)=1 write each parameter and swimming process.
          (4)=1 draw detctor and display events.
          (5)=1 dump bank contents.

KINE      control event source to simulate,
    KINE(1) ; Event Generator Code (integer)
           =1 KILUND Generates e+e- --> Hadrons with the LUND generator.
                     CMS Energy is set by 2nd variable on KINE data card.
           =2 KITOP  Generates a TOP quark event with LUND generator.
                     TOP MASS is set at 174 GeV.
           =3 KIHIGS Generates a HIGGS event. (Not Available Yet)
           =4 KISING Call single particle generator (useful for debugging
                      and testing)
           =5 KIFILE Reads Event from FILE Specified in 'input.dat'
           =6 KIMULT Call plural particle generator
    KINE(2) ; Center of mass Energy (GeV) in all cases.

    when KINE(1)=5 then
         KINE(2)=Void since CM Energy is read from the input file.
         KINE(3)=Number of events to skip.

    when KINE(1)=4 then
         KINE(2)=Center of mass Energy (GeV) as in other cases.
         KINE(3)=particle code (LUND) + 1000*Icon
                 Icon=0 ; fixed direction,
                 Icon=1 ; random direction range from 9deg. to 171deg.
                 Icon=2 ; random direction range from 40deg. to 140deg.
         KINE(4)=theta angle when Icon=0
         KINE(5)=phi   angle when Icon=0
```

```
    when KINE(1)= 6 then
         KINE(2)= Center of mass Energy (GeV) as in other cases.
         KINE(3)= particle code (LUND; ex. 11=e-,13=mu-,22=gamma etc.)
         KINE(4)= Nunber of particles per event
         KINE(5)= THETA-min
         KINE(6)= THETA-max
         KINE(7)= PHAI-min
         KINE(8)= PHAI-max
         KINE(9)= X-coordinate for Generation Vertex
         KINE(10)=Y-coordinate for Generation Vertex
         KINE(11)=Z-coordinate for Generation Vertex

TIME    CPU-time check parameters. Total Sec, Job-stop Sec, Checking Frequency.
CUTS    cut-off energy (GeV) to terminate particle swim.
IGDW    event display axis control. IGDW=1 cut perpendicular to x-axis, 2=y, 3=z
GDUV    location of detector origin on the display window.
GSUV    scale factor to display
GDCT    Location of cut-off plane for cross section view
IGPR    Graphics output ; 1=output to PS file & screen, 0=screen, -1=PS file
MFLD    Magnetic field (KiroGauss)
IGAT    GEANT tracking parameter control word = IGAUTO in /GCTRAK/

----------------------------------------------------------------------------
vxgeom.dat ; Vertex Detector Geometry Data

Keyword   Parameter      Meaning
SITK      300E-4         Si thickness (cm)
DLTK       30E-4         Depletion Layer thickness (cm)
PXCL       25E-4         Pixcel size (cm)
NLAY        3            Number of layers
RVX       2.5  4.0  7.5  Radius of each layer (cm)
ZVX       7.5 15.0 22.5  Half Z length of each layer (cm)

----------------------------------------------------------------------------
ctgeom.dat ; Central Tracker Geometry Data

Keyword  Parameter    Meaning
CTMO       230.0     Outer radius (cm)
CTMI        30.0     Inner radius (cm) In IR-study, this is set to 45cm.
CTMZ       230.0     half Z length of outer CFRP wall (cm)
EPX1       213.0     Z point of end-plate (cm)
EPY1        70.0     R point of end-plate (cm)
                    :Define end-plate curve to calculate hyperboric curve
                     that pass (CTMZ,CTMO) and (EPX1,EPY1).
NSCE          20     # of super-layers
NDCE           5     # of anode wires in a super cell
PLSC         5.0     Half-size of a super cell along phi direction (cm)
RLSC         7.0     Size of a super cell along R direction (cm)
RLUN         1.4     Space between axial super-layer and stereo super-layer (cm)
TCYL         0.5     Thickness of CFRP wall (cm)
TENP         5.0     Thickness of end-plate (cm)

----------------------------------------------------------------------------
bcgeom.dat ; Barral Calorimeter Geometry Data

Keyword  Parameter    Meaning
BCSW                  Module Size Definition Method
          BCSW=1      DTHETA constant option.
          BCSW=2      DZ constant option.
          BCSW=3      Module size constant option
```

```
BRIN       250.0      Inner radius (cm)
BZL        800.0      Full Z-Length (cm) ; only to define BC master volume.
BZI        350.0      Half Z-length at the inner surface of BC.
BTSE         0.1      Thickness of EM-Scintillator (cm)
BTSH         0.2      Thickness of HAD-Scintillator (cm)
BBL        140.0      Depth of Tower (cm)
BBS         20.0      Tower Size at the inner surface (cm).
BDEM        20.0      Depth of EM part (cm)
BNTH        25        # of division in THETA direction
BNPH        64        # of division in PHI direction
BTLG         0.5      Tickness of WLS plate (cm).
BTLT         3.0      Telt Angle in phi (degree).

Note) Some parameters are not used depending on which BCSW are specified.

---------------------------------------------------------------------------
ecgeom.dat ; Endcap Calorimeter Geometry Data

Keyword  Parameter    Meaning
BCSW                  Phai-division Method
          BCSW=1      Divide into 16 at the center ring
          BCSW=2      Divide into 16 at the inner-most ring
ERI1        25.0      Inner radius at the front face(cm). 45cm for IR-study.
ERO1       230.0      Outer radius at the front face (cm)
ERI2        25.0      Inner radius at the the rear end (cm). 45cm for IR-study.
ERO2       300.0      Outer radius at the the rear end (cm)
EZI        300.0      Z Positoin of Front Face (cm).
EBL        140.0      Total Thickness ( cm )
EDEM        20.0      Depth of EM part ( cm )
ETSE         0.1      Thickness of EM-Scintillator (cm)
ETSH         0.2      Thickness of HAD-Scintillator (cm)
EBSZ        20.0      Block Size at the front face (cm)


            |<---------------->| RO1EC
            |              |<->| RI1EC
            |              |   |
            ----------------   |   ---------------       ------
           /      EM       |   |   |             \  DEMEC |  |
          / -------------- |   |   |-------------- \      --- |
         /                 |   |   |                \         | BLEC
        /       HAD        |   |   |                 \        |
       /                   |   |   |                  \       |
      ----------------------   |   --------------------   ------
       |                   |   |
       |                   |<->| RI2EC
       |<--------------------->| RO2EC


---------------------------------------------------------------------------
irgeom.dat ; Interaction Region Geometry Data
             QC=Q-Magnet, MK=Mask, BP=Beam Pipe,
             ST=Support Tube, CS=Compensation Solenoid

Keyword Parameter      Meaning
CROS 0.004          Crossing Angle (rad)
                       +value = rotate toward +x direction.
QCXY    (x,y)*8sets    Coordinate of 7-points indicating pole shape
                       and outer octagon radius.
QC1Z 250.0 490.0  Z location of QC1 front and rear face
```

```
QC2Z 520.0 760.0  Z location of QC2 front and rear face
QCLX 5.300 9.000  X coordinates of QC coil
QCLY 0.500 2.100  Y coordinates of QC coil
MKTH 0.150 0.200  Theta range (rad) of mask cone
MKR1 3.500          Inner radius of mask (cm) at front face of cone
MKR2 25.00          Outer radius of mask (cm) at rear end of cone
MKZ3 180.0          Z(cm) location of mask cylindorical part end point
BPRI 0.500 5.000  Inner radii (cm) of central(Be) and outer(Al) beam pipe
BPTK 0.050 0.100  Thickness(cm) of central(Be) and outer(Al) beam pipe
BPZP z1 z2 z3       Central part ends at z1, z2~z3=Al part, z1~z2=connecting cone.
STUB r1 r2 z        Inner and Outer radii, and half-z length of support tube.
CSRZ r1 r2 z1 z2    Inner and Outer radii, and z-range of compensation solenoid

----------------------------------------------------------------------------
bmgeom.dat ; Beam Monitor Geometry Data. BM is a silcon-pixel disks.

Keyword Parameter      Meaning
BMTK    300E-4         Thickness of silicon (cm)
BMPX    50E-4  50E-4   Pixel sizes (R and Phai). (cm)
BMLY    2              Number of Layers.
RIBM    3.0     3.0    Inner Radii of disks.
ROBM    12.0    12.0   Outer Radii of disks.
ZBM     100.0   101.0  Z-coorinate of disks.

----------------------------------------------------------------------------
lmgeom.dat ; Luminosity Monitor Geometry Data.
             Presently just a conical tungsten bulk.

Keyword Parameter      Meaning
LMT1    0.050   0.150  Theta corresponding to inner- and outer-edge of LM.
LMZ1    163.0   178.0  Z-positions         of front  and rear faces of LM.
LMT2    0.050   0.150  Theta corresponding to inner- and outer-edge of support.
LMZ2    178.0   180.0  Z-positions         of front  and rear faces of support.
LMT3    0.      0.050  Theta corres. to inner- and outer-edge of inner mask.
LMZ3    50.0     70.0  Z-positions   of front  and rear faces of inner mask.
LMR3    2.0            Inner Radius of inner edge of the LUM Carbon Mask.
LMT4    0.050   0.150  Theta corres. to inner- and outer-edge of carbon mask.
LMZ4    163.0   163.0  Z-positions   of front  and rear faces of carbon mask.

----------------------------------------------------------------------------
```

Appendix-D ZBS routines to access BANKs

```
C***********************************************************************
C
C     Bank data generated by fjim are obtained in your analysis
C     routine by calling following routines.
C     See document 'BANK' for detailed bank data configuration.
C
C     UPDATED on 3-Sep-1996,  Y.Fujii
C
C***********************************************************************
C
C     Following routines are described in order of execution.
C          KZINIT ; Initialization
C          JUALLC ; File Alloaction
C          KZFILE ; File Open
C          KZREAD ; Read One Event from the file to a Bank.
C          KZGET0 ; Read Data from the Bank to Local Buffer.
C          KZGET1 ; Read Data from the Bank to Local Buffer.
C          KZGET2 ; Read Data from the Bank to Local Buffer.
C          KZECLR ; Clear Bank.
C          KZEND  ; Termination
C
C          KZNSEG ; Get number of total segments in a bank
C          KZNSSG ; Get number of total sub-segments in a segment of a bank
C          KZLSEG ; Get length of a segment of a bank
C
C***********************************************************************
C     Initialization
C
C          CALL KZINIT ; argument = NONE. Call First.
C
C***********************************************************************
C     File Allocation
C
C          CALL JUALLC(LU,'file-name',1,IERR)
C                      LU    = Logical Unit Number
C                     'file-name' = Bank-file name which fjim generated.
C                      IERR  = Error code.
C
C***********************************************************************
C     Open File
C
C          CALL KZFILE(LU)
C                      LU = Logical Unit Number declared in JUALLC.
C
C***********************************************************************
C     Dummy Read of Parameter Record. Need to do once before reading event.
C
C          CALL KZREAD(LU,IERR)
C                      LU    = Logical Unit Number declared in JUALLC.
C                      IERR  = Error code. 0=Normal End, 1=END of FILE, 2=Error.
C
C***********************************************************************
C
C +do i=1,Nevent ; Repeat calling following routines for Nevent times.
C |
C |     CALL KZREAD(LU,IERR) ; Read one event from the file. See below.
C |
C |     CALL KZGET           ; Read data records from the bank. See below.
C |
```

```
C |     CALL KZECLR          ; Clear the bank. See below.
C |
C +enddo
C
C***********************************************************************
C     Ending Process
C
C          CALL KZEND(0)
C
C***********************************************************************
C
C     Following routines should be called each event.
C
C***********************************************************************
C     Read Event Data from a file to a bank. Do once a event.
C
C          CALL KZREAD(LU,IERR)
C                       LU    = Logical Unit Number declared in JUALLC.
C                       IERR  = Error code. 0=Normal End, 1=END of FILE, 2=Error.
C
C***********************************************************************
C     Get Data from the bank to local buffers.
C     Do as many times as you need to get all your necessary data.
C
C          CALL KZGET1('MCEVENT',ISEG,NWORD,BUFFER)
C                          input,input,input,output
C              'MCEVENT' ; BANK name. See BANK document for contents.
C               ISEG     ; Segment number. 0=master segment.
C               NWORD    ; Number of words to read out.
C               BUFFER(NOWRD) ; Local buffer to store data.
C                                An array bigger than or equal to NWORD.
C
C     And similarly, for other banks,
C          CALL KZGET1('GENHEADER',ISEG,NWORD,BUFFER)
C          CALL KZGET1('MCHEADER',ISEG,NWORD,BUFFER)
C          CALL KZGET1('MCEVENT',ISEG,NWORD,BUFFER)
C          CALL KZGET1('MCVERTEX',ISEG,NWORD,BUFFER)
C          CALL KZGET1('MCTRACK',ISEG,NWORD,BUFFER)
C          CALL KZGET1('MCVXHIT',ISEG,NWORD,BUFFER)
C          CALL KZGET1('MCCTHIT',ISEG,NWORD,BUFFER)
C          CALL KZGET0('MCBEHIT',ISEG,NWORD,BUFFER)
C          CALL KZGET0('MCEEHIT',ISEG,NWORD,BUFFER)
C          CALL KZGET0('MCBHHIT',ISEG,NWORD,BUFFER)
C          CALL KZGET0('MCEHHIT',ISEG,NWORD,BUFFER)
C          CALL KZGET1('MCGEPAR',ISEG,NWORD,BUFFER)
C          CALL KZGET1('MCVXPAR',ISEG,NWORD,BUFFER)
C          CALL KZGET1('MCCTPAR',ISEG,NWORD,BUFFER)
C          CALL KZGET0('MCECPAR',ISEG,NWORD,BUFFER)
C          CALL KZGET0('MCBCPAR',ISEG,NWORD,BUFFER)
C
C     There are three routines to get data ; KZGET0, KZGET1, KZGET2.
C     Banks which are created with KZBCR0 should be read with KZGET0.
C     Banks which are created with KZBCR1 should be read with KZGET1.
C     Banks which are created with KZBCR2 should be read with KZGET2.
C     Thus you should use KZGET0/1 in the way as shown above.
C
C     See sample programs getxxx.f saved in /proj/soft/users/template/analysis.
C
C***********************************************************************
C     User Analysis Routines shoule be called here, after
```

```
C     KZGET routines and before KZECLR routines.
C***********************************************************************
C     Clear the bank.
C
C          CALL KZECLR ; No argument.
C
C***********************************************************************
C     Utility Routines
C
C     KZNSEG('BANK NAME',Nseg) ; Nseg=number of total segments in 'BANK NAME'.
C     KZNSSG('BANK NAME',Iseg,Nsubseg) ; Nsubseg=number of total sub-segments
C                                         in a segment Iseg of 'BANK NAME'.
C     KZLSEG('BANK NAME',Iseg,Lseg) ; Lseg=Length of a segment Iseg of 'BANK NAME'.
C
C***********************************************************************
```

Appendix-E Coding Rules of FullJIM

```
                                                         Updated on 17-Nov-1998
-------------------------------------------------------------------------------
1) Detector Name Abbreviation

   All the detectors and structures have their own abbreviation of two characters.
Presently followings are already defined.

   VX ; Vertex Detector
   CT ; Central Tracker
   BC ; Barrel Calorimeter
   EC ; Endcap Calorimeter
   PS ; PreShower Detector of EM CAL
   SP ; Silicon Pad of EM CAL
   MU ; Muon Detector
   BM ; Beam Monitor
   LM ; Luminosity Monitor

   IR ; Interaction Region
     QC ; IR Q-magnets
     MK ; Masks
     BP ; Beam Pipe
     CS ; Compensation Solenoids
     ST ; Support Tube

   SO ; Superconducting Solenoid

   Common areas and subroutines should be named as CTxxxx where xxxx is arbitrary.
On th contraly global variables should be named as xxxxCT. This is to leave option
to use the first character of variables to indicate Integer or Real.

   Volumes names are also recommended to use these abbreviation characters.  However
volumes names can only have four characters, and sometimes you need to use all four
of them. Thus you should be very careful to avoid duplicate naming.

2) Histogram Identifyer

   HBOOK ID numbers should be numbered as follows.

   System use = 1xxx
   VX related = 3xxx
   CT related = 4xxx
   BC related = 5xxx
   EC related = 6xxx
   MU related = 7xxx
   IR related = 8xxx

3) Rotation Matrix

   Rotation matrix numbers should be numbered as follows.

   System use = 1xxx
   VX related = 3xxx
   CT related = 10000-40000
   BC related = 5xxx
   EC related = 6xxx
   MU related = 7xxx
   IR related = 8xxx
```