DELPHI Collaboration **DELPHI 97-146 PROG-221**

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DELPHI ShortDST Content

Version 1.05

Description

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Abstract

ShortDST is the main data format of Delphi collaboration for the LEP1 data analysis since 1991. Its content may be subject to improvement and development. A regularly updated version of this note could be found at http://wwwcn.cern.ch/~spassoff/des/shortdes.ps

Contents

1 INTRODUCTION

The general structure of the DELPHI ShortDST data follows the rules of the ZEBRA I/O package FZ [1] and in this respect it is not different from the general structure of the other DELPHI data sets (RAW, TANAGRA, fullDST [3] etc.). For every data structure there are two logical records – a pilot record in integer format followed by a data record containing the actual data as ZEBRA banks. These records may be related either to event data or to status information.

The event data records provide all data relative to the events. In this case the pilot records held an event summary while the ZEBRA data records contain more detailed information about the events. The ShortDST event data are written in the form of a single ZEBRA structure – one pilot record followed by one data record.

Interleaved with the actual event data some status records are written out at each change of a run. They provide a technical information on the running conditions of the detector modules or software processors. The status records are valid for all the events which follow until another status record is encountered.

The DELPHI ShortDST content may be subject to improvement and development reflecting the increasing ability of the Delphi analysis software to identify particles and secondary interactions in a reliable way. With any important change of the content of the ShortDST its version number is changing as well. The present description indicates in a clear way the new material of each consecutive version.

Pilot Record

The ZEBRA pilot record is aimed to contain sufficient information to determine if the data contained in the ZEBRA data record which follows are of any use for a given topic of interest. It includes information about the status of the processing, the event quality and topoligy as well as its global physics characteristics. The ZEBRA I/O package [2] reads first the pilot record and allows the user to examine its contents and to decide whether to load into the memory or skip the following record containing the actual ZEBRA data banks. This feature speeds up considerably the scanning through a sequential medium if only few events have to be selected. Subsequently when the list of these events is known the direct access organization of the DELPHI ShortDST data should be used instead.

All pilot records, whether containing status information or event data, have the same structure. They are formatted as a set of "blocklets" which are the minimum units of information accessed by a standard software. Each blocklet consists of a set of actual data words surrounded by a 3-word header defining the size of the blocklet and the origin of its data, and a 1-word trailer. The definition of a blocklet leaves the possibility not only to create an arbitrary number of levels of nesting for the blocklets, but also to drop or add blocklets to the original content without disturbing the rest of the pilot record.

The blocklet header consists of the blocklet wordcount WC which is a single word giving the total number of the 32-bit words in the blocklet, and two words identifying the blocklet (identifier and sub-identifier), giving the type and the source of the data and reporting errors if any. The blocklet type can be identified as well by a mnemonic character name (e.g. DAS, DANA, LEP etc.) atributted to each combination of identifier and subidentifier. The blocklet trailer contains once again the wordcount WC (as the first word of the blocklet) which allows the scan of the pilot record in forward and backward direction.

After the end of the last blocklet the pilot record contains a *zero* to indicate the end of the record.

The ShortDST pilot record contains the following blocklets :

- DAS blocklet (0.0) written on the main Raw data pilot by the Data Aquisition System during the data taking and copied subsequently on the ShortDST. It contains the experiment, run, file (tape) and event number, as well as the event date and time defined by the on-line system (or by the simulation). The processing status describes the stages of processing through which the event has passed and the corresponding information which exists in the event record. Set to 0 by DAS it is updated at the processing stages. The calibration status gives the list of detector modules for which a calibration has been done by setting bits to 0 or 1. The last two words are not always present in the blocklet.

- VERS blocklet (1.0) written on the pilot during the ShortDST creation. It contains the version numbers of the main identification packages used to produce the ShortDST as well as the general data processing identifier.

- NTRI blocklet (2.0) containing a reduced version of the TRIG blocklet created by the TRIGGER system during the data aquisition.

- IDEN blocklet (7.0) written in the pilot during the ShortDST creation. It contains the global results (for the event as a whole) of the processors for the identification of the muons, electrons, hadrons and other particles.

- DANA blocklet (8.0) created by the DELANA reconstruction program and copied on the ShortDST pilot. It contains the main results of the event reconstruction including the event quality and topology, as well as flags classifying the event as belonging to a given type.

- TRGR blocklet (12.1) containing a higher level trigger information for T4 and T3 triggers. Created by the TRIGGER system during the data aquisition.

- DETP blocklet (13.5000) containing special information for the TPC detector.

- LEP blocklet (14.0) created by the Data Aquisition System and containing information about the configuration and the status of LEP at the moment of the data taking.

Pilot blocklet access

When reading the ShortDST the pilot record information is contained in the vector IPILOT of the sequence /PHCDE/ of the ZEBRA I/O package PHDST [2]. The users can easily access different pilot blocklets using PHDST tools.

The following pilot record access tools are most appropriate :

- **IPHPIL** – search a blocklet address in the PILOT record by the integer blocklet type. The function allows to find the address of a given blocklet using the numerical blocklet identifiers :

  IADDR = IPHPIL (IDN1, IDN2)

  where

Input :	IDN1	–	blocklet identifier
	IDN2	–	blocklet sub-identifier
Output:	IADDR	–	blocklet address in the pilot
			-1 = not found
			-13 = contradiction encountered

- **IPHPIC** – search a blocklet address in the PILOT record by the character blocklet type. The function allows to find the address of a given blocklet using the mnemonic names logically connected to the numerical blocklet types.

  IADDR = IPHPIC (CTYPE, DUMMY)

  where

Input :	CTYPE	–	character blocklet identifier
	DUMMY	–	not used
Output:	IADDR	–	blocklet address in the pilot
			-1 = not found
			-13 = contradiction encountered

The address IADDR is pointing in front of the respective blocklet in the vector IPILOT, i.e. IPILOT (IADDR + 1) = Wordcount

Data Record

The ShortDST data record has the form of a very simple ZEBRA structure. Each event has one DTOP bank supporting a linear chain of vertex banks PV at its first structural link. In the same way each PV bank is supporting a chain of PA banks with information for the particles going out from this vertex, one bank per particle.

Up to the version 1.02 there are only two vertices on the ShortDST data structure for the real data (see PV BANK, page 31) as on the original fullDST :

- primary vertex (as defined by DELANA [4]) collecting all well converging to it particles PA. This vertex is identified by no status bit of the respective PV bank set and a mass code of the origin particle Q(LPV + 4) = 0.
- dummy vertex collecting the rest of the particles PA which do not converge to the primary one. For this vertex the status bit 1 is set and the mass code is Q(LPA + 4) = 999.

Since version 1.03 additional PV-PA structures are created for many well identified secondary interactions and decays as photon conversion, secondary hadronic interaction, V0 decay etc. While the format of the new PV and PA banks corresponds to the general one they have some particularities :

- photon conversion - a new PV vertex is build up at the photon conversion point as well as a photon track PA between the primary vertex and the new one which becomes an end vertex of that track. The status bit 3 of the new PV bank is set to 1 to indicate that the vertex is secondary and the photon identification bits 19-25 of the PA mass ambiguity code (see PA BANK, page 33) have a value of 21 to 24 for photon converted in front of the TPC. The charged tracks PA from the photon conversion are moved from the primary or dummy vertex to the new one without any changes of their parameters.
- secondary hadronic interaction - a new PA bank is lifted with an end PV vertex in the interaction point. The PA banks of the outgoing particles are moved to this PV. The new end PV is flagged as an hadronic one by setting up the third status bit. The bits 19-25 of the mass ambiguity code of the incoming PA are equal to 120. The incoming PA bank contains only the extra-module MAIN(0).
- VD only track - created when there is at least one hit in each Vertex Detector layer and no measurements in any other detector. A new PA bank supported by the dummy PV vertex of the event is lifted containing the MAIN(0) and TRAC(8) extra-modules. It can be identified by the bits 19-25 of its mass ambiguity code which are equal to 75 if the Z information is measured, or 77 otherwise.

- VD only track with hadronic vertex - a combination of the previous two cases. The PA bank of the incoming particle to the secondary hadronic interaction is dropped when a VD only track is found to match better this interaction and its end vertex is moved to the VD only track. The mass ambiguity code bits 19-25 are then changed from 75 to 124 or from 77 to 126.

- V^0 decay - a new PA bank is lifted for the V_0 neutral track (K^0 or Λ^0) with an end PV vertex to it at the V_0 decay point. The PV bank status bits 2 is set as for a secondary vertex and the mass ambiguity code bits 19-25 have the value 111 for K^0 and 112 for Λ^0. The PA banks of the decay particles are moved to the new V^0 vertex bank without any change of their parameters.

  This modification of the structure is done only if the V_0 is defined as "very tight" (see V0ID BANK, page 75) and the charged outgoing tracks are not considered as candidates for a secondary interaction. On the other hand tracks identified by the DELPHI analysis software as electrons (mass ambiguity code bits 19-25 equal to 28, 29 or 30) are not considered as possible V^0 decay products.

- HAC only track - a neutral track created when there is an appropriate shower in the Hadron Calorimeter. A new PA bank supported by the dummy PV vertex of the event is lifted. It contains the MAIN(0) and TRAC(8) extra-modules and the mass ambiguity code bits 19-25 are equal to 115 (the track is created since the ShortDST version 1.02 with TANAGRA identifier 7777777).

The TANAGRA identifier of the new tracks is unique but negative to indicate that the track has been created on the ShortDST level. It is composed by the mass ambiguity code plus thousend multiplied by the sequential number of the track if there is more than one particle with the same code in the event.

The PA bank includes information from different processors or detectors. This information is organized inside the bank in separate linear sections following one after another and called extra-modules. Each PA extra-module has an unique numerical label and a corresponding mnemonic character name. It contains the results of one processor or detector having a distinct physical nature. This internal organization of the PA bank contents is similar to the the pilot record blocklets and allows the flexibility to add or drop modules without disturbing the rest of the bank.

The following PA extra-modules are written at present on the ShortDST :

- MAIN (0) – contains the main kinemathical characteristics of the track obtained by the DELANA reconstruction program.

- TRAC (8) – contains the main track parameters after fitting, including their weight matrix.

- EMNC (22) – contains condensed results of the electromagnetic calorimetry (HPC and EMF).
- HCNC (23) – contains condensed results of the hadron calorimetry (HCAL) after fixing (package HACFIX) and neutral shower correction (package HACCOR).
- MUID (24) – contains muon identification information after fixing (packages MUCFIX and MUFLAG).
- ELID (25) – contains electron identification information also after fixing (package ELEPHANT).
- HAID (26) – contains hadron identification information (package HADSIGN).
- MUFI (27) – contains the information from the muon chambers after muon refitting. It is written-out only for leptonic events.
- ELTR (28) – contains the track parameters (as module TRAC) refitted for the electron tracks.
- ODHI (29) – contains information for the Outer Detector hits.
- PHOT (30) – contains results of the photon and π^0 identification in HPC.
- OTRK (31) – contains the old parameters (as in modules MAIN and TRAC) of the tracks replaced by the ID−VD track search package IDVDANA.
- NMUS (32) – contains information from the surrounding muon chambers.
- SSTC (33) – contains condensed information from the STIC detector.
- HCRO (34) – contains HCAL cathode read-out information.

The extra-modules with labels between 22 and 40 are created during during the ShortDST production. The others are created at previous stages of data processing and copied to the ShortDST. While the extra-module MAIN is always present, as well as the extra-modules TRAC for the charged tracks, the others are written out only if the respective information exists.

Besides the PA bank several other banks are created or copied during the ShortDST production. They contain an information which could not be reffered to one PA track only and concerns the event as a whole. As for the PA bank their supporting bank is DTOP.

Some of the PA extra-modules (e.g. OTRK(31)) and banks (e.g. V0ID(22)) are temporarily created during the ShortDST production. This creation has found its natural place in the DELANA reconstruction program [4].

Data structure access

When reading the ShortDST the data record information is contained in the ZEBRA storage residing in the /PHCDE/ sequence of the ZEBRA I/O package PHDST [2]. The users can access different banks using the ZEBRA structural links, e.g. the primary vertex is at address LPV = LQ(LDTOP–1) and each consecutive vertex (if any) at LPV = LQ(LPV) along the linear chain of vertex banks. The particle banks PA are supported by the vertex from which they are comming out and their address is LPA = LQ(LPV–1) the next particle from the same vertex being at LPA = LQ(LPA).

The PA bank extra-modules can be accessed using the PHDST tools :

- **LPHPA** – get the address of a PA bank extra-module using the character module type (name). The calling syntax of this function is :

  L = LPHPA (CHID, LPA, NUM)

  where

Input :	CHID	–	character string specifying the extra-module name
	LPA	–	ZEBRA address of the PA bank
	NUM	–	module number (if many)
Output:	L	–	address of the extra-module = 0 if not found

- **LPHPAN** – get the address of a PA bank extra-module using its label number. The calling syntax of this function is :

  L = LPHPAN (LPA, NUM)

  where

Input :	LPA	–	ZEBRA address of the PA bank
	NUM	–	module label number
Output:	L	–	address of the extra-module = 0 if not found

The address L is pointing in front of the respective extra-module in the Q vector of ZEBRA, i.e. Q (L + 1) = Label of the module.

Status Records

Status records are written out by DAS for a change of run or file, and by the off-line to indicate the start/end of a program run. The start records provide information remaining unchanged for all events which follow until a new start record is encountered. The end records point out the end of validity of the current start information and contain some statistics related to the events since the last start record.

On the ShortDST the following status records are written :

- SOR (Start Of Run), start status at each start of a new DAS run
- BOF (Begining Of File), start status at each start of a new file (tape)
- SOS (Start Of Simulation), start status for simulation
- EOS (End Of Simulation), end status for simulation

Record type access

The different data and status records are distinguished by the record identifier contained in the word 4 of their first Pilot blocklet (DAS) which is always present. The integer identifier could be converted into a character name by the PHDST function :

- **PHRTY** – get character record type

Example:

```
      SUBROUTINE USER02
*
      IMPLICIT NONE
+CDE, PHCDE.
      CHARACTER*4 PHRTY
      CHARACTER*4 RECTYP
      ...............
*
*--   Check the record type
      RECTYP = PHRTY()
      IF ( RECTYP .NE. 'DST' ) RETURN
      ...............
      END
```

PILOT RECORD
DAS blocklet(0.0)

+1	Wordcount		(12 or 14)
+2	Identifier (bits 1- 4)		(0)
	Error code (bits 5-32)		(usualy FF10)
+3	Sub-identifier		(0)
+4	Record type :	1 RAW (Raw Data)	
		2 SIM (Simulation)	
		3 TAN (Tanagra)	
		4 INT (Intermediate)	
		5 DST (or ShortDST)	
		11 SOR (Start Of Run)	
		16 SOS (Start Of Simulation)	
		61 BOF (Beginning of file)	
+5	Experiment number		
+6	Run number		
+7	File sequence number		
+8	T2 (trigger level 2) event number		
+9	Event number		
+10	Event date (format 'yymmdd')		
+11	Event time (format 'hhmmss')		
+12	Processing status (if wordcount >12)		
+13	Calibration status (if wordcount >12)		
+14	Wordcount		(12 or14)

PILOT RECORD
VERS blocklet(1.0)

+1	Wordcount	(8)
+2	Identifier (bits 1- 4)	(0)
	Error code (bits 5-32)	(usualy FF10)
+3	Sub-identifier	(0)
+4	bits 1-10 : DSTFIX version number	
	11-20 : AABTAG version number	
	21-30 : RECV0 version number	
+5	bits 1-10 : MUFLAG version number	
	11-20 : ELEPHANT version number	
	21-30 : HADIDENT version number	
+6	bits 1-10 : HACCOR version number	
	11-20 : DEDXID version number	
	21-30 : not used	
+7	Processing identifier 'YYLN' where :	
	YY is the year of data taking	
	L is the Full DST version letter	
	N is the Short DST version number	
+8	Wordcount	(8)

PILOT RECORD
NTRI blocklet(2.0)

+1	Wordcount	(23)
+2	Identifier (bits 1- 4)	(2)
	Error code (bits 5-32)	(usualy FF10)
+3	Sub-identifier	(0)
+4	PYTHIA 2nd level : input 1 from receiver	
+5	PYTHIA 2nd level : input 2 from receiver	
+6	PYTHIA 2nd level : input 3 from receiver	
+7	PYTHIA 2nd level : input 4 from receiver	
+8	Results from C after scaling, 2nd level	
+9	Trigger pattern, 2nd level	
+10	Trigger pattern, 2nd level	
+11	Trigger pattern, 2nd level	
+12	Trigger pattern, 2nd level	
+13	Majority pattern, 2nd level	
+14	Majority pattern, 2nd level	
+15	Output T3 trigger pattern	
+16	Output T3 trigger pattern	
+17	Output T3 trigger pattern	
+18	Output T3 trigger pattern	
+19	Output T3 majority pattern	
+20	Output T3 majority pattern	
+21	Output T3 DF pattern	
+22	Bunch number from VSAT (bits 1-30)	
	Trigger level 4 status flag (bits 31-32) :	
	0 – not operational	
	1 – operational	
	2 – status unknown	
+23	Wordcount	(23)

PILOT RECORD
IDEN blocklet(7.0)

+1	Wordcount		(19)
+2	Identifier (bits 1- 4)		(7)
	Error code (bits 5-32)		(usualy FF10)
+3	Sub-identifier		(0)
+4	Short DST version number +		
	1000×date of production ('yymmdd')		
+5	Processing status bits (set to 1 or 0) :		
	bits 1 :	DSTFIX fixing code run	
	2 :	Muon identification code run	
	3 :	Electron identification code run	
	4 :	Hadron identification cod run	
	5 :	B tagging code run	
	6-32 :	free	
+6	Hadron selection bits (set to 0 or 1) :		
	bits 1 :	team 4 selection, number of charged tracks ≥ 5	
	2 :	team 4 selection, charged energy ≥ 0.12 E(LEP)	
	3 :	free	
	4 :	free	
	5 :	open selection, number of charged tracks ≥ 5	
	6 :	open selection, charged energy ≥ 0.10 E(LEP)	
	7 :	open selection, event thrust axes ≤ 0.95	
	8 :	free	
	9 :	Pch $\geq$0.2 GeV, number of charged tracks ≥ 7	
	10 :	Pch $\geq$0.2 GeV, charged energy ≥ 0.15 E(LEP)	
	11 :	Pch $\geq$0.2 GeV, Ech + Eneut ≥ 0.30 E(LEP)	
	12 :	Pch $\geq$0.2 GeV, Efor, Eback ≥ 0.03 E(LEP)	
	13 :	Pch $\geq$0.4 GeV, number of charged tracks ≥ 7	
	14 :	Pch $\geq$0.4 GeV, charged energy ≥ 0.15 E(LEP)	
	15 :	Pch $\geq$0.4 GeV, Ech + Eneut ≥ 0.30 E(LEP)	
	16 :	Pch $\geq$0.4 GeV, Efor, Eback ≥ 0.03 E(LEP)	
	7-32 :	free	

PILOT RECORD
IDEN blocklet(7.0)

cont.

+7	Muon identification (bitted word) :
	bits 1- 3 : number of muons (OR of all types, P > 2 GeV)
	4- 6 : number of muons loose, standard and tight
	7- 9 : number of muons loose
	10-12 : number of muons standard
	13-15 : number of muons tight
	16-18 : number of muons hadronic
	19-25 : most energetic muon momentum × 10, all types
	25-32 : most energetic muon momentum × 10, standard
+8	Electron identification (bitted word) :
	bits 1- 3 : number of electrons (OR of all types, P > 1 GeV)
	4- 6 : number of electrons loose
	7- 9 : number of electrons standard
	10-12 : number of electrons tight
	13-15 : number of electrons loose, standard and tight
	19-25 : most energetic electron momentum × 10, all types
	26-32 : most energetic electron momentum × 10, all types
+9	Hadron identification (bitted word) :
	bits 1- 3 : number of kaons loose
	4- 6 : number of kaons standard
	7- 9 : number of kaons tight
	10-12 : number of protons loose
	13-15 : number of protons standard
	16-18 : number of protons tight
	19-25 : most energetic Kaon momentum × 10, all types
	26-32 : most energetic Proton momentum × 10, standard
+10	V^0 reconstruction bits :
	bits 1- 4 : number of V^0 tight
	5- 9 : number of V^0 loose
	10-32 : free
+11	Charged multiplicity in hemispheres :
	bits 1- 6 : multiplicity in hemisphere 1
	7-23 : multiplicity in hemisphere 2
	13-32 : free

PILOT RECORD
IDEN blocklet(7.0)

cont.

+12	Energy in hemisphere 1, method 1 (Calorimeters)	$\times 10^5$	
+13	Energy in hemisphere 1, method 2 (Ch.tr.,neut.sh.)	$\times 10^5$	
+14	Energy in hemisphere 2, method 1 (Calorimeters)	$\times 10^5$	
+15	Energy in hemisphere 2, method 2 (Ch.tr.,neut.sh.)	$\times 10^5$	
+16	X)		
+17	Y) $\Rightarrow$ components of the missing P		
+18	Z)		
+19	Wordcount		(19)

PILOT RECORD
DANA blocklet(8.0)

+1	Wordcount	(54)
+2	Identifier (bits 1- 4)	(8)
	Error code (bits 5-32)	(usualy FF10)
+3	Sub-identifier	(0)
+4	Detectors in the central partition (bitted word)	
+5	Reconstruction status bits − each bit indicates which detector/processor has been processed in DELANA :	

bits 4 : VD	bits 14 : HAB	bits 24 : SAT
5 : ID	15 : MUB	25 : LUM
6 : TPC	18 : MUS	26 : FCB
7 : RIB	19 : STIC	27 : EMF
9 : OD	21 : FCA	30 : HOF
10 : HPC	22 : RIF	31 : MUF
12 : TOF	23 : HAF	

+6 Run statistics :

bits 1-16 : number of Z^0 hadronic so far in the run

17-32 : number of Bhabha so far in the run

+7 Atmospheric presure

+8 X)

+9 Y) > coordinates of primary vertex (in μm)

+10 Z)

+11 Event topology at primary vertex (bitted word) :

bits 1- 8 : neutrals

9-16 : gammas

17-24 : negative particles

25-32 : positive particles

+12 Not yet set

+13 Energy in the Center of Mass from LEP (in MeV)

+14 Date of processing ('yymmdd')

+15 Time of processing ('hhmmss')

+16 Magnetic filed measured (bitted word) :

bits 1-24 : magnet power supply current (Amps)

: or field (Gauss)

25 : 0 if the current measured

1 if the field measured

+17 Outer detector time flag :

−1 unknown

0 event in time with BCO

1 cosmic (not in time with BCO)

PILOT RECORD
DANA blocklet(8.0)

cont.

+18 DELANA tagging bits :

bits 1 = 1 if hadronic Z^0
2 = 1 if leptonic Z^0
3 = 1 if ambiguous Z^0
4 = 1 if cosmic or beam gas
5 = 1 if SAT bhabha
6 = 1 if calibration
7 = 1 if unknown
11 = 1 if single e^+ or e^- (low energy)
12 = 1 if compton
13 = 1 if STP event 2 tracks Barrel
14 = 1 if STP event 2 elm.showers Barrel
15 = 1 if STP event 2 tracks Forward
16 = 1 if STP event 2 elm.showers Forward
17 = 1 if Forward e^+e^- without tracks
18 = 1 if Extra Tau event
19-24 = 1 special flags for teams
25-32 = 0 free

+19 DELANA cradle date

+20 Reserved

+21 LEP status

+22 LEP colimator status

+23 Status of Data Base and related information (bitted word) :

bits 1 = 1 data base available
2 = 1 trigger partition available
3 = 1 discrepency in FILL number
4 = 1 discrepency in LEP status
5 = 1 discrepency in colimator status
6 = 1 Ebeam from data base
7 = 1 Ebeam from first estimate in Trigger Partition
8 = 1 Ebeam from final estimate in Trigger Partition
9 = 1 Ebeam from data cards
10 = 1 Magnet current from data base
11 = 1 Magnet current from Trigger Partition
12 = 1 Magnet current from data cards
13-32 = 0 free

PILOT RECORD
DANA blocklet(8.0)

cont.

+24	MUB information
+25	MUB information
+26	VD status word (bitted) :
	bits 1- 4 : status flag 1
	5- 8 : status flag 2
	9-32 : detector user bits
+27	ID status word (bitted) :
	bits 1- 4 : status flag 1
	5- 8 : status flag 2
	9-32 : detector user bits
+28	TPC status word (bitted) :
	bits 1- 4 : status flag 1
	5- 8 : status flag 2
	9-32 : detector user bits
+29	RIB status word (bitted) :
	bits 1- 4 : status flag 1
	5- 8 : status flag 2
	9-32 : detector user bits
+30	free
+31	OD status word (bitted) :
	bits 1- 4 : status flag 1
	5- 8 : status flag 2
	9-32 : detector user bits
+32	HPC status word (bitted) :
	bits 1- 4 : status flag 1
	5- 8 : status flag 2
	9-32 : detector user bits
+33	HPC information
+34	TOF status word (bitted) :
	bits 1- 4 : status flag 1
	5- 8 : status flag 2
	9-32 : detector user bits
+35	HAB status word (bitted) :
	bits 1- 4 : status flag 1
	5- 8 : status flag 2
	9-32 : detector user bits
+36	HAB information

PILOT RECORD
DANA blocklet(8.0)

cont.

+37	MUB status word (bitted) : bits 1- 4 : status flag 1 5- 8 : status flag 2 9-32 : detector user bits
+38	MUB information
+39	MUB information
+40	MUB information
+41	VSAT status word (bitted) : bits 1- 4 : status flag 1 5- 8 : status flag 2 9-32 : detector user bits
+42	HAC status word (bitted) : bits 1- 4 : status flag 1 5- 8 : status flag 2 9-32 : detector user bits
+43	FCA status word (bitted) : bits 1- 4 : status flag 1 5- 8 : status flag 2 9-32 : detector user bits
+44	RIF status word (bitted) : bits 1- 4 : status flag 1 5- 8 : status flag 2 9-32 : detector user bits
+45	HAF status word (bitted) : bits 1- 4 : status flag 1 5- 8 : status flag 2 9-32 : detector user bits
+46	SAT status word (bitted) : bits 1- 4 : status flag 1 5- 8 : status flag 2 9-32 : detector user bits
+47	VSAT status word (bitted) : bits 1- 4 : status flag 1 5- 8 : status flag 2 9-32 : detector user bits

PILOT RECORD
DANA blocklet(8.0)

cont.

+48	FCB status word (bitted) :	
	bits 1- 4 : status flag 1	
	5- 8 : status flag 2	
	9-32 : detector user bits	
+49	EMF status word (bitted) :	
	bits 1- 4 : status flag 1	
	5- 8 : status flag 2	
	9-32 : detector user bits	
+50	FCB information	
+51	SAT information	
+52	HOF status word (bitted) :	
	bits 1- 4 : status flag 1	
	5- 8 : status flag 2	
	9-32 : detector user bits	
+53	MUF status word (bitted) :	
	bits 1- 4 : status flag 1	
	5- 8 : status flag 2	
	9-32 : detector user bits	
+54	Wordcount	(54)

PILOT RECORD
TRGR blocklet(12.1)

+1	Wordcount	(7)
+2	Identifier (bits 1- 4)	(12)
	Error code (bits 5-32)	(usualy FF10)
+3	Sub-identifier	(1)
+4	T4 tag :	
	bits 1 : T4 HPC	
	5 : T4 EMF	
	9 : T4 TPC	
	13 : T4 STIC	
	17 : Team tag	
	21 : T3 tag	
	25 : T4 Pass	
	29 : T4 Delana	
	or	
	1-32 : = 0 if no Tag set by T4	
	1-32 : =-1 if T4 not there	
+5	T3 single gamma bits :	
	bits 2 : Bhabha	
	15-16 : Single Gamma	
	or	
	1-32 : =-1 if no T3 Trigger bank	
+6	T3 TPC tag :	
	bits 1- 8 : HAD tag	
	9-16 : LEP tag	
	17-24 : LLB tag	
	25-32 : TPC tag	
	or	
	1-32 : =-1 if no T3 Trigger bank	
+7	Wordcount	(7)

PILOT RECORD
DETP blocklet(13.5000)

Since the version 1.04

+1	Wordcount	(7)
+2	Identifier (bits 1- 4)	(0)
	Error code (bits 5-32)	(usualy FF10)
+3	Sub-identifier	(5000)
+4	Pressure in the TPC	
+5	Normalization used for the integerated dE/dx	
+6	Ratio (int.amplitude / max.amplitude)	
+7	Wordcount	(7)

PILOT RECORD
LEP blocklet(14.0)

+1	Wordcount	(variable)
+2	Identifier (bits 1- 4)	(14)
	Error code (bits 5-32)	(usualy FF10)
+3	Sub-identifier	(0)
+4	Date of last update ('yymmdd')	
+5	Time of last update ('hhmmss')	
+6	Fill number	
+7	LEP status as given by the machine (from 1 to 9)	
+8	LEP status derived from current, energy and collimator (DELPHI evaluation) : 1 = No beam 2 = Setup 3 = Physics 4 = End of fill 5 = Unknown	
+9	Time of last change of LEP status ('hhmmss')	
+10	Collimators setting : 0 = Unknown 1 = Open 2 = Coarse 3 = Fine	
+11	Number of positron bunches in the machine	
+12	Actual ring energy in MeV	
+13	Flip coil energy	
+14	Current in the main coil (Amps)	
+15	Field in mids-NRM probe (Gauss)	
+16	Horizontal (X) beta value	
+17	Vertical (Y) beta value	
+18	X)	
+19	Y) $\Rightarrow$ Beam position (to be implemented)	
+20	Z)	
+21		
+22		
+23		

PILOT RECORD
LEP blocklet(14.0)

cont.

+24	Positron stack current (μ amps)
+25	Positron stack current (μ amps)
+26	Positron stack current (μ amps)
+27	Positron stack current (μ amps)
+28	Electron stack current (μ amps)
+29	Electron stack current (μ amps)
+30	Electron stack current (μ amps)
+31	Electron stack current (μ amps)

If LEP works in a bunch mode –

For cosmic data:

+32	1 – no measurement available (-9999) or 2 – the crossing time in nsec. measured
+33	Crossing time wrt BCO from TOF
+34	Crossing time wrt BCO from OD
+35	Crossing time wrt BCO from FCB
+36	Crossing time wrt BCO from HOF
+37	Crossing time wrt BCO from ID straws

For physics data:

+32	Interacting bunch (used in DELANA)	
+33	Bunch number from ID	
+34	Bunch number from FCB	
+35	Bunch number from FCA	
+36	Bunch number from TOF	
+37	Bunch number from OD	
+38	Bunch number from HOF	
+39	Bunch number from STIC	
+40	Bunch number from ID straws	
+41	Bunch number from DAS	
+42	Interval between bunches from DAS	
+43	not used	
+44	Wordcount	(variable)

DTOP BANK

29	Structural links
0	Reference links
5	Data (format 4I −1B)

Link LDTOP

LINKS

0	Next DTOP bank (DFIX bank)
-1	PV banks from reconstruction
-4	Initial e^+e^- system
-5	Final e^+e^- system (after gamma radiation)
-6	$l\bar{l}$ or $q\bar{q}$ system before gluon radiation
-14	HPC trigger bank
-21	Micro Vertex Detector hits
-22	Reconstructed V0's
-23	Unassociated TE's from OD, FCA and FCB
-24	Reconstructed photons
-25	B tagging information
-26	New tracks from VD-ID pattern recognition
-27	Reconstructed V^0's tracks
-28	New simulated PV list
-29	New simulated ST list
-30	Energy flow information
-31	Reconstructed D*'s

STATUS BITS

bit 1 = 1 if a D^* canditate is tagged in the event
from the channel $D^* \to D^0\pi$, $D^0 \to K\pi$
2 = 1 if the event contains a $(K\pi)\pi$ baclground
combination to D^*
3 = 1 if a D^0 canditate is tagged in the event
from the channel $D^0 \to K\pi$
4 = 1 if the event contains a $(K\pi)$ background
combination to D^0
5 = 1 if a loose D_s canditate is tagged in the event
from the channel $D_s \to K^+K^-\pi$
6 = 1 if a tight D_s canditate is tagged in the event
from the channel $D_s \to K^+K^-\pi$

DTOP BANK

cont.

DATA	CONTENT					
+1	Date of processing (format 'yymmdd')					
+2	Time of processing (format 'hhmm')					
+3	Version numer of PXDST $\times$ 100					
+4	Laboratory identifier[1]:					

WIEN	BELG	NBI	HELS	CCPN	CDF	LAL
LPNH	SACL	STRA	LYON	GREN	MARS	BAST
KARL	WUPP	LIVE	OXFO	RAL	ATHE	ANTU
DEMO	BOLO	GENO	MILA	PADU	ROMA	TRIE
TORI	NIKH	BERG	OSLO	CRAC	WARS	SANT
VALE	LUND	STOC	UPPS	AMES	SERP	DUBN
LISB	PRAG	BRAT	SNAK	FARM	CERN	LJUB
BRAZ						

+5 List of activated Extra Modules (bitted word):

bits		
8 :	TRAC	Track parameters
22 :	EMNC	Electromagnetic new calorimetry
23 :	HCNC	Hadron calorimeter new calorimetry
24 :	MUID	Muon identification
25 :	ELID	Electron identification
26 :	HAID	Hadron identification
27 :	MUFI	Muon track refitting
28 :	ELTR	Electron track refitting
29 :	ODHI	Outer detector hits
30 :	PHOT	Photon identification
31 :	OTRK	Old tracks replaced by OD-VD
32 :	NMUS	New surounding muon chambers

[1] The conversion of the hollerith laboratory identifier to a character variable can be done using the CERNLIB routine CFROMI

DTOP BANK

cont.

For Monte Carlo data[2] :

+6	Incoming electromagnetic	energy for HPC
+7	Outgoing electromagnetic	energy for HPC
+8	Incoming muon	energy for HPC
+9	Outgoing muon	energy for HPC
+10	Incoming hadronic	energy for HPC
+11	Outgoing hadronic	energy for HPC
+12	Incoming electromagnetic	energy for EMF
+13	Outgoing electromagnetic	energy for EMF
+14	Incoming muon	energy for EMF
+15	Outgoing muon	energy for EMF
+16	Incoming hadronic	energy for EMF
+17	Outgoing hadronic	energy for EMF
+18	Incoming electromagnetic	energy for COI
+19	Outgoing electromagnetic	energy for COI
+20	Incoming muon	energy for COI
+21	Outgoing muon	energy for COI
+22	Incoming hadronic	energy for COI
+23	Outgoing hadronic	energy for COI
+24	Incoming electromagnetic	energy for HAB
+25	Outgoing electromagnetic	energy for HAB
+26	Incoming muon	energy for HAB
+27	Outgoing muon	energy for HAB
+28	Incoming hadronic	energy for HAB
+29	Outgoing hadronic	energy for HAB
+30	Incoming electromagnetic	energy for HAF
+31	Outgoing electromagnetic	energy for HAF
+32	Incoming muon	energy for HAF
+33	Outgoing muon	energy for HAF
+34	Incoming hadronic	energy for HAF
+35	Outgoing hadronic	energy for HAF

[2] For the Real data these words are set to zero.

DFIX BANK

0	Structural links
0	Reference links
5	Data (format 4I −1B)

Link LDFIX = LQ(LDTOP)

DATA	CONTENT
+1	Date of processing (format 'yymmdd')
+2	Time of processing (format 'hhmmss')
+3	Version numer of DSTFIX × 100
+4	Laboratory identifier of DSTFIX processing (as in DTOP bank)
+5	List of activated Fixing processors (bitted word):

bits		bits	
1 :	VD	9 :	HPCC
2 :	ID	10 :	HPCN
3 :	TPC	11 :	EMFC
4 :	OD	12 :	EMFN
5 :	FCA	13 :	HACB
6 :	FCB	14 :	HACF
7 :	RIB	15 :	MUB
8 :	RIF	16 :	MUF

PV BANK

1	Structural links
1	Reference links
16	Data (format 3B −F)

Link LPV = LQ(LDTOP-1)

LINKS

0	Next PV bank
-1	PA of the outgoing particles
-2	PA of the incoming particles

STATUS BITS

bits 1 = 1 if a dummy vertex
2 = 1 if a secondary vertex
3 = 1 if a secondary hadronic vertex
4 = 1 if a vertex with simulation data

If a D^0 or D^* is tagged :
5 = 1 if a K from D^0 is linked to this vertex

If a D_s is tagged :
5 = 1 if a K from Φ is linked to this vertex

DATA CONTENT

+1	TANAGRA identifier of the TV bank
+2	Number of the outgoing particles
+3	Number of the degrees of freedom
+4	Mass code of the origin particle
	Special cases: 0. for primary vertex
	999. for dummy vertex
+5	X)
+6	Y) > vertex coordinates
+7	Z)
+8	χ^2 of the vertex fit

PV BANK

cont.

+9	xx)	
+10	xy)	
+11	yy) >	error matrix
+12	xz)	
+13	yz)	
+14	zz)	

If tracks attached to this vertex
are found to form a D^0 or D^* candidate :

+15 (Kπ) mass of D^0 candidate
+16 (K$\pi\pi$ − Kπ) mass difference of D^* candidate

If tracks attached to this vertex
are found to form a D_s candidate :

+15 (K^+K^-) mass of Φ candidate
+16 ($K^+K^-\pi$) mass of D^* candidate

PA BANK

0	Structural links
4	Reference links
N	Data (format 3B $*$I $-$F)

Link LPA = LQ(LPV-1)

LINKS

0	Next PA bank
-1	PV bank of the end vertex (if any)
-2	Matching simulated PA (if any)

STATUS BITS

bits 1 = 1 if the track is discarded
2 = 1 if the correlation matrix is given
3 = 1 if the track has an unresolved TE
4 = 1 if the track is made with overlapping showers
5 = 1 if the track contains results from CCA
6 = 1 if the track is given by the forward combined fit
7 = 1 if the energy is obtained from substraction in the calorimeters
8 = 1 if the match with simulated track is good
9 = 1 if the match is O.K., ambiguity solved
10 = 1 if matched with showers
11 = 1 if unmatched track
12 = 1 if remaining TER from calorimeters
13 = 1 if remaining TER from OD not associated to TKX (this track is attached to a dummy vertex)
14 = 1 when multiple scattering from the first measured point is included
15 = 1 for a track tagged as a V^0 branch candidate by the TPCANA algorithm

If a D^0 or D^* is tagged :

16-17 = 1 if the track is a K candidate from a $D^0 \to K\pi$
= 2 if the track is a π candidate from a $D^0 \to K\pi$
= 3 if the track is a π candidate from a $D^* \to D^0\pi$

PA BANK

cont.

If a D_s is tagged :

bits 16-17 = 1 if the track is a K^+ candidate from a $\Phi \to K^+K^-$
= 2 if the track is a K^- candidate from a $\Phi \to K^+K^-$
= 3 if the track is a π candidate from a $D_s \to \Phi\pi$

DATA	CONTENT
+1	TANAGRA identifier of the TA bank, or Label for simulated tracks
+2	Detector used in the reconstruction (bitted word) :

bits 4 : VD	bits 14 : HAB	bits 24 : SAT
5 : ID	15 : MUB	25 : LUM
6 : TPC	18 : MUS	26 : FCB
7 : RIB	19 : STIC	27 : EMF
9 : OD	21 : FCA	30 : HOF
10 : HPC	22 : RIF	31 : MUF
12 : TOF	23 : HAF	

+3 Mass ambiguity code (bitted word) :

Muon identification

bits 1 = 1 very loose μ
2 = 1 loose μ
3 = 1 standard μ
4 = 1 tight μ
5 = 1 HCAL μ
6 = 0 free

Electron identification

7- 9 = 0 no identification run on this track
= 1 identified NOT to be an electron
= 2 very loose electron
= 3 loose electron
= 4 standard electron
= 5 tight electron

PA BANK

cont.

Electron from γ-convertion (veto)

bits 10-12 = 0 no identification run on this track
= 1 loose electron
= 2 standard electron
= 3 tight electron

Kaon signature with RICH

13-15 = 0 no measurement available
= 1 track compatible with π
= 2 loose K
= 3 standard K
= 4 tight K

Proton signature with RICH

16-18 = 0 no measurmenet available
= 1 track compatible with π
= 2 loose proton
= 3 standard proton
= 4 tight proton

HPC photon identification

19-25 = 1 good HPC photon
= 6 HPC shower, failed transverse profile cuts
= 7 HPC shower, failed longitudinal profile cuts
= 8 HPC shower, failed both cuts

HPC photon with linked OD shower TE

=11 HPC good photon
=16 HPC shower, failed transverse profile cuts
=17 HPC shower, failed longitudinal profile cuts
=18 HPC shower, failed both cuts

Photon converted in front of the TPC

=21 convertion from 2 TPC tracks (type I pair)
=22 convertion from 2 TPC tracks (type II pair)
=23 convertion from 2 TPC tracks (type III pair)
=24 convertion from 1 TPC track (type I pair)

PA BANK

cont.

Electron from converted photon
19-25 = 28 electron forming a single track converted photon
= 29 electron forming a double track converted photon

Electron radiation
= 30 electron radiating a photon in front of TPC
= 40 electron radiating a photon behind the TPC

Photon from electron radiation behind TPC
= 39 photon linked to electron

Photon from electron radiation in front of TPC
= 49 photon linked to electron

Photon converted behind of the TPC
= 50 convertion from 2 OD TEs with a HPC link
= 51 convertion from 2 OD TEs one with HPC
= 52 convertion from 2 OD TEs without HPC link
= 53 convertion from 1 OD TE with a HPC link
= 56 as 53 but failed transverse profile cuts
= 57 as 53 but failed longitudinal profile cuts
= 58 as 53 but failed both cuts
= 59 shower linked to a OD TEs used in (50)-(58)

Photon which is part of a shower cluster
= 61 HPC good photon
= 66 HPC shower, failed transverse profile cuts
= 67 HPC shower, failed longitudinale profile cuts
= 68 HPC shower, failed both cuts
= 69 HPC shower, rejected (from curling electron)

VD only track
= 75 VD only track, Z information measured
= 77 VD only track, Z information not measured

Incoming track to hadronic interaction
=120 track to a secondary hadronic interaction (not seen)
=124 VD only track to hadronic interaction, Z measured
=126 VD only track to hadronic interaction, Z not measured

PA BANK

cont.

		Shower unambiguously identified as a clean π^0
	19-25 =101	good π^0 (unlikely to be a single photon)
		Neutral tracks
	=111	K^0 to a V^0 decay
	=112	Λ^0 to a V^0 decay
	=115	track to a shower in HAC
	26-28 = 0	free
	29 = 0	dE/dx defined
	30-32 = 0	free
+4	Number of information modules (main + extra)	
+5	Length of the main module (= 27 or 32)	
	For each extra-module	
+1	Length of the extra-module	

PA MODULES
MAIN MODULE (0)

Up to the version 1.03

LENGTH: 27 words

CONTENT

+1	Label of the module (=0)
+2	Particle mass
+3	Px)
+4	Py) $\Rightarrow$ At the closest distance approach to the vertex
+5	Pz)
+6	E, energy
+7	P, momentum (absolute value)
+8	Charge (0=neutral, 1=positive, 2=negative, 3=undefined)
+9	Track length (negative if incoming particle)
+10	Mass code
+11	Impact parameter (with sign): If VC is the distance of the vertex to the curvature center and R the curvature radius with sign opposite to the charge sign, then rp = sign(R)*(|R|-VC)
+12	Error on the impact parameter
+13	not used (=-1.)
+14	not used (= 0.)
+15	not used (=-1.)
+16	χ^2 of the fit of the TK without VD hits
+17	Number of degrees of freedom without VD hits
+18	χ^2 of the VD hits associated with the track
+19	Error on E
+20	Z impact parameter = ZP - ZV, where ZP is the z coordinate of the track extrapolation at the closest distance approach to the vertex in R-Rϕ plane
+21	Error on ZP
+22	Polar angle of the point of closest approach to the vertex
+23	X)
+24	Y) $\Rightarrow$ Coordinates of the first measured point of the track
+25	Z)
+26	χ^2 of the fit of the TK
+27	Number of degrees of freedom

PA MODULES
MAIN MODULE (0)

Since the version 1.04

LENGTH: 32 words

CONTENT

+1	Label of the module (=0)
+2	Particle mass
+3	Px)
+4	Py) ⇒ At the closest distance approach to the vertex
+5	Pz)
+6	E, energy
+7	P, momentum (absolute value)
+8	Charge (0=neutral, 1=positive, 2=negative, 3=undefined)
+9	Track length (negative if incoming particle)
+10	Mass code
+11	Impact parameter (with sign): If VC is the distance of the vertex to the curvature center and R the curvature radius with sign opposite to the charge sign, then rp = sign(R)*(|R|-VC)
+12	Error on the impact parameter
+13	Error matrix on Px, Py, Pz (at the beam pipe inner surface)
⋮	⋮
+18	Error matrix on Px, Py, Pz
+19	Error on E
+20	Z impact parameter = ZP - ZV, where ZP is the z coordinate of the track extrapolation at the closest distance approach to the vertex in R-Rϕ plane
+21	Error on ZP
+22	Polar angle of the point of closest approach to the vertex
+23	X)
+24	Y) ⇒ Coordinates of the first measured point of the track
+25	Z)
+26	χ^2 of the fit of the TK with VD hits
+27	Number of degrees of freedom with VD hits
+28	Module number of the track
+29	Track type (V0, had. interaction etc.)
+30	not used

PA MODULES
MAIN MODULE (0)

Since the version 1.05

+31 χ^2 of the VD hits associated with the track

+32 Ambiguity track processor word :

$$
\begin{array}{rl}
n1 = & \text{number of potential PA's having} \\
 & \text{the same TPC TE} \\
+ \quad 100 \times n2 = & \text{number of potential PA's having} \\
 & \text{at least one VD or TPC TE in common} \\
+ \quad 10000 \times n3 = & \text{the largest number of PA's which} \\
 & \text{could be chosen from the n2 possibilities,} \\
 & \text{so that any TE is assigned to only one PA} \\
+ \ 100000 \times n4 = & \text{number of ways to choose the n3} \\
 & \text{unique solutions from the n2 poosibilities}
\end{array}
$$

PA MODULES
MTPC MODULE (7)

Since the version 1.04

LENGTH: 29 words

CONTENT

+1	Label of the module (=7)
+2	dE/dx measured in the TPC – mean value of the 80% lowest amplitude (ampl.= maximum of the wire cluster) normalized to 1. for the MIPs
+3	σ of the 80% truncated Landau distribution
+4	dE/dx measured in the TPC – mean value of the 65% lowest amplitude (= maximum of the wire cluster) normalized to 1. for the MIPs
+5	σ of the 65% truncated Landau distribution
+6	dE/dx measured in the TPC – mean value of the 80% lowest amplitude (ampl.= integral of the wire cluster) normalized to 1. for the MIPs
+7	Number of pad points in the track + 100×TPC sector number of the track start + 10000×TPC sector number of the track end
+8	Number of wires crossed by the track + 1000×Number of hits with a "close cluster" + 1000000×method used for dE/dx calculation (=1 good hits only, =2 hits from TPC edge included)
+9	Number of wires considered in the dE/dx calculation + 1000×Number of usable hits at the TPC edge
+10	bits 1- 8 : Number of wires with saturated amplitude before truncation 9-16 : Number of empty hits kept before truncation 17-20 : Sector of the last wire seen (selected or not)
+11	Mean gap (cm) after 80% truncation
+12	Mean distance of the track (cm) to the edges of the sector in Rϕ plane (after 80% truncation)
+13	Number of wires used in the Z fit of the track
+14	χ^2 of the Z fit
+15	Track bit pattern for V^0 : bits 1-16 : pad rows hit by the track 17-20 : number of the first pad row if V^0 flagged : or 0 if no V^0 detected with this track

PA MODULES
MTPC MODULE (7)

cont.

+16	Mean distance between wire clusters in Z (= average distance with n closest clusters, see +8)
+17	Contribution of the empty hits to the dE/dx 80%
+18	bits 1- 8 : First non empty wire seen for the track 9-12 : Sector of the first wire seen 13-20 : Last wire seen for the track (selected or not)
+19	Average undershoot correction for dE/dx 80%
	Information to compute the momenta of the Landau distribution up to order 3 :
+20	(dE/dx) / (gap correction)
+21	(dE/dx) / (gap correction)$^{1/2}$
+22	$(dE/dx)^2$ / (gap correction)
+23	(dE/dx) / (gap correction)$^{1/3}$
+24	$(dE/dx)^2$ / (gap correction)$^{2/3}$
+25	$(dE/dx)^3$ / (gap correction)
	For modules longer than 25 words :
+26	Number of hits common to 2 tracks + 1000×Number of saturated hits (full Landau)
+27	dE/dx full Landau for common hits of 2 tracks
+28	Corresponding σ
	or
+26	Average gap of the cluster contributing to the dE/dx 80%
+27	dE/dx 80% for common hits of 2 tracks
+28	Corresponding σ
+29	Index of the current track + 1000×Index of the track with common hits
	The last word is positive or negative depending on the content of the words 26 to 28

PA MODULES
TRAC MODULE (8)

LENGTH: 21 words

CONTENT

+1	Label of the module (=8)	
+2	ε impact parameter	
+3	z impact parameter	
+4	θ angle	
+5	ϕ angle	
+6	1./R (R - radius of the curvature)	
+7	Weight matrix for these parameters :	$\varepsilon - \varepsilon$
+8		$\mathrm{z} - \varepsilon$
+9		$\mathrm{z} - \mathrm{z}$
+10		$\varepsilon - \theta$
+11		$\mathrm{z} - \theta$
+12		$\theta - \theta$
+13		$\varepsilon - \phi$
+14		$\mathrm{z} - \phi$
+15		$\theta - \phi$
+16		$\phi - \phi$
+17		$\varepsilon - 1/\mathrm{R}$
+18		$\mathrm{z} - 1/\mathrm{R}$
+19		$\theta - 1/\mathrm{R}$
+20		$\phi - 1/\mathrm{R}$
+21		$1/\mathrm{R} - 1/\mathrm{R}$

PA MODULES
SAT MODULE (18)

LENGTH: variable

CONTENT

+1	Label of the module (=18)
+2	Number of associated shower N_s
	For each shower
+1	Length of the shower information
+2	Z coordinate of the shower
	For each SAT module contributing to the shower
+1	R coordinate of the module
+2	$R\phi$ coordinate of the module
+3	Energy deposited in the module

PA MODULES
EMNC MODULE (22)

LENGTH: variable

CONTENT

+1	Label of the module (=22)
+2	Number of associated shower +
	100 $\times$ Detector identifier (9 = HPC, 26 = EMF)
	For each shower :
+1	Energy of the shower
+2	X)
+3	Y) > coordinate of the shower
+4	Z)
	HPC information
+5	Number of layer hit in this shower
+6	Layer pattern (bitted word) :
	bits 1 = 1 if hit in layer 1
	2 = 1 if hit in layer 2
	3 = 1 if hit in layer 3
	4 = 1 if hit in layer 4
	5 = 1 if hit in layer 5
	6 = 1 if hit in layer 6
	7 = 1 if hit in layer 7
	8 = 1 if hit in layer 8
	9 = 1 if hit in layer 9
	10 = 1 if hit in layer 10
	For each layer :
+1	Energy deposited in the layer
	EMF information
+5	Number of associated showers
	For each shower :
+6	Address of the central counter of the shower
+7	Number of hitted blocks

PA MODULES
EMNC MODULE (22)

cont.

+6	Block pattern (bitted word) :
	bits 1 = 1 if hit in block 1
	2 = 1 if hit in block 2
	3 = 1 if hit in block 3
	4 = 1 if hit in block 4
	5 = 1 if hit in block 5
	6 = 1 if hit in block 6
	7 = 1 if hit in block 7
	8 = 1 if hit in block 8
	9 = 1 if hit in block 9
	10 = 0 free
	11 = 1 if hit in block 1 and 2 of external frame
	12 = 1 if hit in block 3 and 4 of external frame
	13 = 1 if hit in block 5 and 6 of external frame
	14 = 1 if hit in block 7 and 8 of external frame
	15 = 1 if hit in block 9 and 10 of external frame
	16 = 1 if hit in block 11 and 12 of external frame
	17 = 1 if hit in block 13 and 14 of external frame
	18 = 1 if hit in block 15 and 16 of external frame
	For each block
+1	Energy deposited in the block(s)
	or
	ERROR FLAG = -9999. if a non existing glass
	= -999. if a dead sting glass
	= -998. if a glass killed by EMFANA
	= 1000. + Energy if noisy glass

PA MODULES
HCNC MODULE (23)

LENGTH: variable

CONTENT

+1	Label of the module (=23)
+2	Number of associated shower
	For each shower :
+1	Energy of the shower
+2	X)
+3	Y) > coordinate of the shower
+4	Z)
+5	Number of layers hit in this shower
	For each layer :
+1	Energy deposited in the layer
+2	Number of active channels in the layer + 1000 $\times$ layer number

PA MODULES
MUID MODULE (24)

Up to the version 1.04

LENGTH: variable

CONTENT

+1	Label of the module (=24)
+2	Global tag (bitted word) :
	bits 1 = 1 if very loose refit
	2 = 1 if loose and standard refit
	3 = 1 if tight refit
	4 = 1 if very loose tag
	5 = 1 if loose tag
	6 = 1 if standard tag
	7 = 1 if tight tag

Very loose refit information (always present) :

+1	Hit pattern (bit 8 set if MUB, unset if MUF)		
+2	Global χ^2		
+3	Hit pattern with inefficiencies (different from 1. for Monte Carlo)		
+4	Hit pattern with ambiguities		
+5	R / x	)	
+6	Rϕ / y	)	Position and direction
+7	z	)	of the fitted track in MUB/MUF
+8	θ	)	at the inner MUC layer
+9	ϕ	)	

Loose and standard refit information (if bit 2 set) :

+1	Hit pattern (bit 8 set if MUB, unset if MUF)		
+2	Global χ^2		
+3	Extrapolation χ^2		
+4	Global azimuthal χ^2		
+5	Extrapolation azimuthal χ^2		
+6	Extrapolation polar χ^2		
+7	R / x	)	
+8	Rϕ / y	)	Position and direction
+9	z	)	of the fitted track in MUB/MUF
+10	θ	)	at the inner MUC layer
+11	ϕ	)	

PA MODULES
MUID MODULE (24)

cont.

	Tight refit information (if bit 3 set) :		
+1	Hit pattern (bit 8 set if MUB, unset if MUF)		
+2	Global χ^2		
+3	Extrapolation χ^2		
+4	R / x	)	
+5	Rϕ / y	)	Position and direction
+6	z	)	of the fitted track in MUB/MUF
+7	θ	)	at the inner MUC layer
+8	ϕ	)	

PA MODULES
MUID MODULE (24)

Since the version 1.05

LENGTH: variable

CONTENT

+1	Label of the module (=24)
+2	Global tag (bitted word) :
	bits 1 = 1 if very loose refit
	2 = 1 if loose and standard refit
	3 = 1 if tight refit
	4 = 1 if very loose tag
	5 = 1 if loose tag
	6 = 1 if standard tag
	7 = 1 if tight tag

	Very loose refit information (always present) :	
+1	Hit pattern (bit 9 set if MUB, bit 10 set if MUF, neither if SMC)	
+2	Global χ^2	
+3	Hit pattern with inefficiencies (different from 1. for Monte Carlo)	
+4	Hit pattern with ambiguities	
+5	R / x)	
+6	Rϕ / y)	Position and direction
+7	z)	of the fitted track in MUB/MUF/SMC
+8	θ)	at the inner MUC layer
+9	ϕ)	

	Loose and standard refit information (if bit 2 set) :	
+1	Hit pattern (bit 9 set if MUB, bit 10 set if MUF, neither if SMC)	
+2	Global χ^2	
+3	Extrapolation χ^2	
+4	Global azimuthal χ^2	
+5	Extrapolation azimuthal χ^2	
+6	Extrapolation polar χ^2	
+7	R / x)	
+8	Rϕ / y)	Position and direction
+9	z)	of the fitted track in MUB/MUF/SMC
+10	θ)	at the inner MUC layer
+11	ϕ)	

PA MODULES
MUID MODULE (24)

cont.

	Tight refit information (if bit 3 set) :		
+1	Hit pattern (bit 9 set if MUB, bit 10 set if MUF, neither if SMC)		
+2	Global χ^2		
+3	Extrapolation χ^2		
+4	R / x	)	
+5	Rϕ / y	)	Position and direction
+6	z	)	of the fitted track in MUB/MUF/SMC
+7	θ	)	at the inner MUC layer
+8	ϕ	)	
	Unassociated TE information		
+1	Unassociated TE word		

PA MODULES
ELID MODULE (25)

LENGTH: 40 words

CONTENT

+1	Label of the module (=25)
+2	Number of words + 1000.*Det.id. (9-HPC,26-EMF)
+3	1000*Vers.No. + 100.*ITAG + 10.*IVETO
+4	Electron probabilty from the HPC
+5	Gamma conversion radius from PXVETO
+6	Probability from the shower fit
+7	Fitted shower energy (not properly calibrated)
+8	HPC-crack flag (0=No,1=ϕ,2=θ,3=ϕ,θ)
+9	E_shower/P_track (fixed flat at 1 for electrons)
+10	Z (extrapolation) - Z (HPC)
+11	Phi(extrapolation) - Phi(HPC) (direction)
+12	Z position at HPC boarder from TRK-EXTRAP
+13	Probablity for radiated photon behind the TPC
+14	Probability that next shower found is from this track
+15	Probability that OD-TE found is from this track
+16	TANAGRA photon identifier (radiation behind TPC)
+17	Tanagra identifier of the next shower
+18	Probability from E/P
+19	Probability from Z(TPC) - Z(HPC)
+20	RICH tag
+21	Probablity for radiated photon in front of the TPC
+22	TANAGRA photon identifier (radiation in front of TPC)
+23	Phi(extrapolation) - Phi(HPC) (position)
+24	Normalized curvature change between ID/TPC
+25	Normalized curvature change between TPC/OD
+26	χ^2 of curvature change fit between ID/TPC
+27	χ^2 of curvature change between fit TPC/OD
+28	Fixed HPC_energy + nonlinearity corrections
+29	Best estimate for electron energy at vertex
+30	Electron Px fixed
+31	Electron Py fixed
+32	Electron Pz fixed

PA MODULES
ELID MODULE (25)

cont.

+33	Probability from ϕ-direction mismatch
+34	Combined dE/dX and HPC probability
+35	Probability from dE/dX for electron
+36	Probability from dE/dX for pion
+37	Rotation angle from shower analysis
+38	Significance of 2-peak shower substructure
+39	Momentum from track refit + addition of radiation
+40	Phi position at HPC boarder from TRK-EXTRAP

PA MODULES
HAID MODULE (26)

LENGTH: variable

CONTENT

+1	Label of the module (=26)		
+2	Number of ionization	data	+
	$10 \times$ number of RICH(gas)	data	+
	$100 \times$ number of RICH(liquid)	data	+
	$1000 \times$ number of VD (dE/dx)	data	+
	$10000 \times$ number of RINGSCAN	data	+
	$100000 \times$ number of RICH status	data	
	$1000000 \times$ number of TPC (dE/dx)	data	

Ionization information

+3	dE/dx measured value normalized to 1 for MIP's
+4	Width of dE/dx Landau distribution (NOT dE/dx error)
+5	Number of wires used for the dE/dx measurement
+6	Mean distance between the wires for the track (gap)
+7	Tagging word (bitted) :

Kaon signature with dE/dx

bits 1- 3 = 0 no measurement available
= 1 compatible with a π
= 2 loose K
= 3 standard K
= 4 tight K

Proton signature with dE/dx

bits 4- 6 = 0 no measurement available
= 1 compatible with a π
= 2 loose proton
= 3 standard proton
= 4 tight proton

Used for combined tag

bits 7-10 = 1 dE/dx only
= 2 RICH gas
= 3 RICH liquid

Pion signature with RICH

bits 11-13 = 0 no measurement available
= 1 not a π
= 3 a π

+8 Combined kaon tag + $100 \times$ combined proton tag

PA MODULES
HAID MODULE (26)

cont.

RICH gas information

+1	Measured Cherenkov angle	
+2	σ of the Cherenkov angle per photon	
+3	Number of photoelectrons in ring +	
	500 $\times$ (expected number of phototelectrons $\times$ 10)	
+4	Quality flag (bitted word) :	
	RING (>1 photons)	VETO ($\leq$ 1 photon)
	bits 1= extrapolation to RICH	bits 1= idem
	2= acceptance theta	2= idem
	3= run selection, no trip	3= idem
	4= good ring cuts	4= $\leq$ 3 photons in bands
	5= tight ring cuts	5= as 4 and no trip
	6= hits on track(s)	6= idem

RICH liquid information

+1	Measured Cherenkov angle	
+2	σ of the Cherenkov angle per photon	
+3	Number of photoelectrons in ring +	
	500 $\times$ (expected number of phototelectrons $\times$ 10)	
+4	Quality flag (bitted word) :	
	RING (BRICH >3 photons)	VETO (BRICH $\leq$3 photons)
	(FRICH >2 photons)	(FRICH $\leq$2 photons)
	bits 1= extrapolation to RICH	bits 1= idem
	2= acceptance theta	2= idem
	3= run selection, no trip	3= idem
	4= good ring cuts	4= as 2 and hits
	5= tight ring cuts	5= as 4 and $\chi^2 > 9$
	6= hits on track(s)	6= idem

Since the version 1.03

VD ionization information

+1	dE/dx value measured with VD only
+2	Number of VD hits in the measurement

PA MODULES
HAID MODULE (26)

cont.

RINGSCAN information

+1	Tagging word (bitted) :		
	bits	1- 2 = 1	loose e
		= 2	standard e
		= 3	tight e
		3 = 1	local maximum for probability
		4 = 1	8 (3) and more photoelectrons around this hypothesis for $p<2.5$ ($p>2.5$)
		5- 6 = 1	loose μ
		= 2	standard μ
		= 3	tight μ
		7 = 1	local maximum for probability
		8 = 1	8 (3) and more photoelectrons around this hypothesis for $p<2.5$ ($p>2.5$)
		9-10 = 1	loose π
		= 2	standard π
		= 3	tight π
		11 = 1	local maximum for probability
		12 = 1	8 (3) and more photoelectrons around this hypothesis for $p<2.5$ ($p>2.5$)
		13-14 = 1	loose K
		= 2	standard K
		= 3	tight K
		15 = 1	local maximum for probability
		16 = 1	8 (3) and more photoelectrons around this hypothesis for $p<2.5$ ($p>2.5$)
		17-18 = 1	loose p
		= 2	standard p
		= 3	tight p
		19 = 1	local maximum for probability
		20 = 1	8 (3) and more photoelectrons around this hypothesis for $p<2.5$ ($p>2.5$)
+2	bits	1-13	mean θ angle in liquid
		14-24	logarithm of the maximum probablity
+3	bits	1-13	mean θ angle in gas
		14-24	logarithm of the maximum probablity

PA MODULES
HAID MODULE (26)

cont.

+1 **RICH status** (bitted word) :

bits 1 = 1 no liquid in the barrel for this period
2 = 1 no liquid in the forward for this period
3 = 1 do not use the gas for this track
4 = 1 do not use the liquid for this track
5 = 1 absorption length between 2 and 5 m. (doubt for gas)
6 = 1 no hit in the tube (doubt for veto)
7 = 1 no ionization around this track (doubt for veto)
8 = 1 no hit in this tube and 2 neighbours (doubt for liquid)
9 = 1 track close to midwall (important for liquid)
10 = 1 liquid affected by HV trip
11 = 1 LTD overflow or DAS problem for gas
12 = 1 LTD overflow or DAS problem for liquid
13 = 1 the gas info was killed by RICFIX
14 = 1 the liquid info was killed by RICFIX

Since the version 1.05

dE/dx error information

+1 Momentum of the track in TPC

+2 Error of the track momentum in TPC

PA MODULES
MUFI MODULE (27)

LENGTH: variable

CONTENT Muon Chambers information after refitting

+1	Label of the module (=27)
+2	Detector identifier (14=MUB, 17=MUS, 30=MUF)
+3	Number of associated layers
+4	Number of degrees of freedom
+5	Global χ^2
+6	X coordinate in the first layer
+7	Y coordinate in the first layer
+8	Expected number of missing layers
+9	χ^2 fir the MU chambers alone
+10	X (extrapolated − fitted)
+11	Y (extrapolated − fitted)
+12	θ (extrapolated − fitted)
+13	ϕ (extrapolated − fitted)
+14	Error on X (extrapolated − fitted)
+15	Error on Y (extrapolated − fitted)
+16	Error on θ (extrapolated − fitted)
+17	Error on ϕ (extrapolated − fitted)
+18	Layer hit pattern (bitted word) − each bit set indicates a layer hit
	Layer information for MUB and MUS :
+1	Submodule identifier TER(2)
+2	χ^2 of the layer
+3	R measured
+4	Rϕ(fitted) − Rϕ(measured)
+5	Z (fitted) − Z (measured)
+6	Error on Rϕ
+7	Error on Z
+8	Rϕ measured
+9	Z measured
+10	Status of the TER bank after EMMASS : 0. − deactive, 1. − active

PA MODULES
MUFI MODULE (27)

cont.

Layer information for MUF :

+1	Submodule identifier 100×TER(2) + TER(36)
+2	χ^2 of the layer
+3	X (fitted) − X (measured)
+4	Y (fitted) − Y (measured)
+5	Z measured
+6	Error on X
+7	Error on Y
+8	X measured
+9	Y measured
+10	Status of the TER bank after EMMASS : 0. − deactive, 1. − active

Information for refit :
(T1/T2 stands for $R\phi/Z$ (MUB) or X/Y (MUF))

+1	T3 fit	)	
+2	dT1 − dT1	)	
+3	dT1 − dT2	)	
+4	dT2 − dT2	)	Covariance matrix of TKX
+5	dT1 − dθ	) >	at the closest reference surface
+6	dT2 − dθ	)	to the interaction point
+7	dθ − dθ	)	
+8	dT1 − dφ	)	
+9	dT2 − dφ	)	
+10	dθ − dφ	)	
+11	dφ − dφ	)	

PA MODULES
ELTR MODULE (28)

LENGTH: 21 words

CONTENT Extra-module TRAC(8) refitted for the electron tracks

+1	Label of the module (=8)	
+2	ε impact parameter	
+3	z impact parameter	
+4	θ angle	
+5	ϕ angle	
+6	1./R (R - radius of the curvature)	
+7	Weight matrix for these parameters :	$\varepsilon - \varepsilon$
+8		$z - \varepsilon$
+9		$z - z$
+10		$\varepsilon - \theta$
+11		$z - \theta$
+12		$\theta - \theta$
+13		$\varepsilon - \phi$
+14		$z - \phi$
+15		$\theta - \phi$
+16		$\phi - \phi$
+17		$\varepsilon - 1/R$
+18		$z - 1/R$
+19		$\theta - 1/R$
+20		$\phi - 1/R$
+21		$1/R - 1/R$

PA MODULES
ODHI MODULE (29)

LENGTH: 3 words

CONTENT Outer Detector hits information

+1	Label of the module (=29)
+2	Number of OD hits with azimuthal angle $\phi < 5^0$ from the TK angle extrapolated at the OD surface
+3	Spread of these hits around the center of gravity

PA MODULES
PHOT MODULE (30)

LENGTH: 6 or 33 words

CONTENT Photon and π^0 identification in HPC

+1	Label of the module (=30)
+2	Length of photon part + 100 $\times$ length of π^0 part
	Photon information
+3	Energy weighted depth
+4	1000 $\times$ number of clusters + 100 $\times$ first layer number + 10 $\times$ number of layers + maximum number of consecutive layers
+5	Transverse shower fluctuation measure
+6	Longitudinal shower fit (reserved for)
	π^0 information
+7	Mass of HPCANA tensor fit
+8	Rotation angle of HPCANA tensor fit
+9	1-st eigenvalue of HPCANA tensor
+10	2-nd eigenvalue of HPCANA tensor
+11	Number of connected maxima in HPCANA
+12	Number of accepted maxima in HPCANA
+13	Realtive energy of the first Gaussian
+14	Position of the first Gaussian
+15	Width of the first Gaussian
+16	Position of the second Gaussian
+17	Width of the second Gaussian
+18	Fitted mass
+19	1-st eigenvalue
+20	2-nd eigenvalue
+21	Rotation angle
+22	θ of the shower center
+23	ϕ of the shower center
+24	θ of the shower
+25	ϕ of the shower
+26	Number of OD links + 100 $\times$ number of stray showers

PA MODULES
PHOT MODULE (30)

cont.

Since the version 1.05

π^0/photon information

+27	Number of weighted HPC hits in the main peak after the π^0 mass constrained fit
+28	Number of weighted HPC hits in the second peak after the π^0 mass constrained fit
+29	χ^2 of the π^0 mass constrained fit
+30	Number of fitted bins (degrees of freedom) of the π^0 mass constrained fit
+31	χ^2 of the photon constrained fit
+32	Gaussian width of the photon shower shape in ϕ
+33	Gaussian width of the photon shower shape in θ

PA MODULES
OTRK MODULE (31)

LENGTH: 47 words

CONTENT Old track parameters replaced by the ID-VD track search

+1	Label of the module (=31)
	PA module MAIN section
+2	Particle mass
+3	Px)
+4	Py) > At the closest distance approach to the vertex
+5	Pz)
+6	E, energy
+7	P, momentum (absolute value)
+8	Charge (0=neutral, 1=positive, 2=negative, 3=undefined)
+9	Mass code
+10	Track length (negative if incoming particle)
+11	Impact parameter (with sign): If VC is the distance of the vertex to the curvature center and R the curvature radius with sign opposite to the charge sign, then rp = sign(R)*(|R|-VC)
+12	Error on the impact parameter
+13	not used (=-1.)
+14	not used (= 0.)
+15	not used (=-1.)
+16	χ^2 of the fit of the TK without VD hits
+17	Number of degrees of freedom without VD hits
+18	χ^2 of the VD hits associated with the track
+19	Error on E
+20	Z impact parameter = ZP - ZV, where ZP is the z coordinate of the track extrapolation at the closest distance approach to the vertex in R-Rϕ plane
+21	Error on ZP
+22	Polar angle of the point of closest approach to the vertex
+23	X)
+24	Y) > Coordinates of the first measured point of the track
+25	Z)
+26	χ^2 of the fit of the TK
+27	Number of degrees of freedom

PA MODULES
OTRK MODULE (31)

cont.

	PA module TRAC section	
+1	ε impact parameter	
+2	z impact parameter	
+3	θ angle	
+4	ϕ angle	
+5	1./R (R - radius of the curvature)	
+6	Weight matrix for these parameters :	$\varepsilon - \varepsilon$
+7		$z - \varepsilon$
+8		$z - z$
+9		$\varepsilon - \theta$
+10		$z - \theta$
+11		$\theta - \theta$
+12		$\varepsilon - \phi$
+13		$z - \phi$
+14		$\theta - \phi$
+15		$\phi - \phi$
+16		$\varepsilon - 1/R$
+17		$z - 1/R$
+18		$\theta - 1/R$
+19		$\phi - 1/R$
+20		$1/R - 1/R$

PA MODULES
NMUS MODULE (32)

LENGTH: variable

CONTENT Surounding Muon Chamber information

+1	Label of the module (=32)
+2	Detector identifier (=17)
+3	Number of associated layers
+4	Number of degrees of freedom
+5	Global χ^2
+6	X coordinate in the first layer
+7	Y coordinate in the first layer
+8	Expected number of missing layers
+9	χ^2 fir the MU chambers alone
+10	X (extrapolated − fitted)
+11	Y (extrapolated − fitted)
+12	θ (extrapolated − fitted)
+13	ϕ (extrapolated − fitted)
+14	Error on X (extrapolated − fitted)
+15	Error on Y (extrapolated − fitted)
+16	Error on θ (extrapolated − fitted)
+17	Error on ϕ (extrapolated − fitted)
+18	Layer hit pattern (bitted word) − each bit set indicates a layer hit
	For each layer
+1	Submodule identifier
+2	χ^2 of the layer
+3	R measured
+4	Rϕ(fitted) − Rϕ(measured)
+5	Z (fitted) − Z (measured)
+6	Error on Rϕ
+7	Error on Z
+8	Rϕ measured
+9	Z measured
+10	Status of the TER bank after EMMASS : 0. − deactive, 1. − active

PA MODULES
NMUS MODULE (32)

cont.

	Information for refit		
+1	T3 fit	)	
+2	dRϕ − dRϕ	)	
+3	dRϕ − dZ	)	
+4	dZ − dZ	)	Covariance matrix of TKX
+5	dRϕ − dθ	) >	at the closest reference surface
+6	dZ − dθ	)	to the interaction point
+7	dθ − dθ	)	
+8	dRϕ − dφ	)	
+9	dZ − dφ	)	
+10	dθ − dφ	)	
+11	dφ − dφ	)	

PA MODULES
SSTC MODULE (33)

LENGTH: variable

CONTENT Shortened STIC information

+1	Label of the module (=33)
	Up to the version 1.02
+2	Number of associated showers + 100 $\times$ length of the shower information
	For each shower
+1	Energy of the shower (GeV)
+2	R (cm)
+3	R $\times$ ϕ (cm $\times$ radian)
+4	Detector identification code : bits 1-12 = 1 if STIC_A (at z=$-$220. cm) = 2 if STIC_C (at z=+220. cm) Charge tag from the veto : bits 13-24 = 0 no information available = 1 for neutrals = 2 for charged
	Since the version 1.03
+2	Number of associated showers
	For each shower
+1	Length of the shower information
+2	Cluster quality flag + 10 $\times$ number of hits for this shower
	For each hit
+1	Tower hit information : bits 1- 8 : tower θ + 10 $\times$ ϕ 9-22 : deposeted energy (in 10 MeV units)
+1	Veto counter signal 1000 $\times$ S(1)left + S(1)center
+2	Veto counter signal 1000 $\times$ S(1)righ + S(2)left
+3	Veto counter signal 1000 $\times$ S(2)center + S(2)right
+4	Veto counter hit pattern for plane 1 (bits 1-16)
+5	Veto counter hit pattern for plane 2 (bits 1-16)

PA MODULES
HCRO MODULE (34)

Since the version 1.05

LENGTH: 8 or 13 words

CONTENT HCAL cathode read-out information

+1	Label of the module (=34)
+2	Number of words + 1000 $\times$number of assigned hits
+3	Mean distance (with sign) between the hits and the track
+4	RMS of the mean distance
+5	Number of hits in planes 1 - 5
+6	Number of hits in planes 6 - 10
+7	Number of hits in planes 11 - 15
+8	Number of hits in planes 16 - 20
	If the track is identified as muon :
+9	Muon identification flags :
	1 = loose μ
	2 = standard μ
	3 = tight μ
+10	ϕ angle of the matching TE
+11	χ^2 of the matching
+12	Dispersion of the number of near-by hits
+13	Number of points used in the fit +
	Maximum layer number of hits in the fit $\times$ 100 +
	Minimum layer number of hits in the fit $\times$ 10000 +
	Number of degrees of freedom in the fit $\times$ 1000000

$\boxed{\textbf{INITIAL } e^+e^- \textbf{ BANK}}$

0	Structural links
0	Reference links
9	Data (format −F)

Link LPIEE = LQ(LDTOP-4)

DATA	CONTENT
	Simulated initial state of the e^+e^- system from the beam definition
+1	Px)
+2	Py) > of the system
+3	Pz)
+4	E
+5	P
+6	$\cos(\vartheta)$
+7	φ
+8	Code of particle 1 (DELPHI convention)
+9	Code of particle 2 (DELPHI convention)

$\boxed{\textbf{FINAL } e^+e^- \textbf{ BANK}}$

0	Structural links
0	Reference links
9	Data (format −F)

Link LPFEE = LQ(LDTOP-5)

DATA	CONTENT
	Simulated final state of the e^+e^- system after emitting a bremsstrahlung photon
+1	Px)
+2	Py) > of the system
+3	Pz)
+4	E
+5	P
+6	$\cos(\vartheta)$
+7	φ
+8	Code of particle 1 (DELPHI convention)
+9	Code of particle 2 (DELPHI convention)

INITIAL $l\bar{l}$ / $q\bar{q}$ BANK

0	Structural links
0	Reference links
9	Data (format $-$F)

Link LPIQL = LQ(LDTOP-6)

DATA	CONTENT
	Simulated initial state of the $l\bar{l}$ or $q\bar{q}$ system before gluon radiation
+1	Px)
+2	Py) > of the system
+3	Pz)
+4	E
+5	P
+6	$\cos(\vartheta)$
+7	φ
+8	Code of particle 1 (DELPHI convention)
+9	Code of particle 2 (DELPHI convention)

HPC trigger BANK

0	Structural links
0	Reference links
$2N_m+2$	Data (format –I)

Link LHPT1 = LQ(LDTOP-14)

DATA	CONTENT[1]
+1	Global word count
+2	Number of modules with data N_m
	For each module with data :
+1	Module number[2]
+2	A.D.C content of that module[3]

[1]The bank is not written out for events in which none of the scintillators is above the threshold.

[2]The module numbers range from 1 to 144 for the HPC scintillators, from 145 to 168 for the 90^0 counters, and from -11 to 0 for the spare channels. Each 90^0 counter module covers 15^0 in ϕ starting at 262.5^0.

[3]The ADC content is pedestal-substracted.

μVD Hits BANK

0	Structural links
N_a	Reference links
N	Data (format 1I−F)

Link LMVDH = LQ(LDTOP-21)

LINKS

0	Next μVD Hits bank
$-N_a$	PA bank associated to the hit N_a[1]

DATA	CONTENT
+1	Number of hits N_h + 1000×number of words per hit
	Then for each hit N_h [2] *:*
+1	Module number with the sign of Z
+2	Local X or Z (since 94) coordinate − In case of multiplexed area local Z of the hits if associated, otherwise local Z corresponding to the smallest $\|Z\|$ in DELPHI frame
+3	R coordinate (from TE if associated) − the sign "+" indicates $R\phi$ − the sign "−" indicates RZ
+4	$R\phi$ or Z (since 94) coordinate − the sign of Z from TE if associated, or estimated if not associated
+5	Signal to noise ratio of the hit

[1] The number of the reference links is equal to the number of the associated VD hits only.

[2] The VD hits in the bank are ordered - all associated hits are coming first followed by the unassociated ones.

$\boxed{\text{V0ID BANK}}$

0	Structural links
$2N_{V^0}$	Reference links
N	Data (format 1I-F)

Link LV0ID = LQ(LDTOP-22)

LINKS

	PA banks of the i-th V^0 decay products
−L1	LQ(LV0ID − 2∗I + 1)
−L2	LQ(LV0ID − 2∗I)

DATA	CONTENT
+1	Number of reconstructed V^0's N_{V^0}
	For each reconstructed V^0 :
+1	bits 1-10 : Number of words
	11-14 : Number of hypothesis
	15-20 : Tagging flag : 0 – loose V^0
	1 – tight V^0
	– very tight V^0 :
	2 – K^0 background
	3 – Λ background
	22 – K^0
	33 – Λ
+2	V^0 momentum (GeV/c)
+3	Probability of χ^2 (from PXFVTX fit)
+4	X)
+5	Y) > coordinates of V0 vertex (cm)
+6	Z)
+7	Flight distance in XY (XYZ since 94) normalized to its error
+8	Angle (in radians) in XY with respect
	to the line joining to the primary vertex
+9	|p+| coordinate x after the fit (GeV/c)
+10	|p+| coordinate y after the fit (GeV/c)
+11	|p+| coordinate z after the fit (GeV/c)
+12	|p−| coordinate x after the fit (GeV/c)
+13	|p−| coordinate y after the fit (GeV/c)
+14	|p−| coordinate z after the fit (GeV/c)
+15	V^0 suggested mass (GeV/c^2), negative if antiparticle

V0ID BANK

cont.

Up to the version 1.02

	For each hypothesis :	
+1	bits 1-10 :	Number of words
	11-16 :	Kind of fit :
		1 – VTX fit, no mass constraint
		2 – VTX+DIR fit, no mass constraint
		11 – VTX fit, K^0 mass constraint
		12 – VTX+DIR fit, K^0 mass constraint
		21 – VTX fit, Λ mass constraint
		22 – VTX+DIR fit, Λ mass constraint
		31 – VTX fit, $\bar{\Lambda}$ mass constraint
		32 – VTX+DIR fit, $\bar{\Lambda}$ mass constraint
		-1 – fit failed or low probability
	17-23 :	Hypothesis probability $\times$ 100
+2	X)	
+3	Y) > fitted coordinates of the V^0 vertex (cm)	
+4	Z)	
+5	Px)	
+6	Py) > fitted momenta of the V^0 (GeV/c)	
+7	Pz)	
	–	
	Impacts for noDIR fits only	
+8	Impact in xy projection (cm)	
+9	Error of xy impact (cm)	
+10	Impact in z (cm)	
+11	Error of z impact (cm)	

Unassociated TE BANK

0	Structural links
0	Reference links
N	Data (format 1I –F)

Link LUTER = LQ(LDTOP-23)

DATA	CONTENT
+1	Number of TE's in OD + Number of TE's in FCA×100 + Number of TE's in FCB×10000
	For each unassociated TE
+1	Data descriptor and measurement code : bits 1 = 0 if coordinates are given as x, y, z = 1 if coordinates are given as R, RΦ, z 2 = 0 if standard coordinates (as above) = 1 if non-standard coordinates (u,v,z) 3 = 1 if coordinate 1 is measured 4 = 1 if coordinate 2 is measured 5 = 1 if coordinate 3 is measured 6 = 1 if t_1 (x or RΦ) is measured 7 = 1 if t_2 (y or z) is measured 8 = 1 if θ is measured 9 = 1 if ϕ is measured 10 = 1 if 1/P is measured 11 = 1 if 1/Pt is measured
+2	Coordinate 1 : x or R)
+3	Coordinate 2 : y or RΦ) of TE reference point
+4	Coordinate 3 : z)
+5	θ angle
+6	ϕ angle
+7	1/P or 1/Pt momentum at TE reference point
+8	Length of the Track Element

PXPC BANK

Up to the version 1.02

0	Structural links
$3N_{ph}$	Reference links
N	Data (format 1I / 1I 8F)

Link LPHOT = LQ(LDTOP-24)

LINKS

	PA banks of the i-th photon decay products
−L1	LQ(LPHOT − 3∗I + 2)
−L2	LQ(LPHOT − 3∗I + 1)
	PA bank of simulated photon (if any)
−L3	LQ(LPHOT − 3∗I)

DATA	CONTENT
+1	Number of converted photons N_{ph}
	For each converted photon :
+1	PXPHOT code −
	Photon converted in front of TPC (mass code 21) :
	−21 – conversion from 2 TPC tracks (type I pair)
	−22 – conversion from 2 TPC trakcs (type II pair)
	−23 – conversion from 2 TPC tracks (type III pair)
	−24 – conversion from 1 TPC track (type I pair)
+2	Px)
+3	Py) > of the converted photon
+4	Pz)
+5	Energy of the photon
+6	Photon track length from Beam Spot to convertion
+7	X)
+8	Y) > position of the conversion vertex
+9	Z)

B tagging BANK

0	Structural links
0	Reference links
30	Data (format −F)

Link LBTAG = LQ(LDTOP-25)

DATA	CONTENT
+1	X)
+2	Y) > coordinates of the Beam position
+3	Z)
+4	X)
+5	Y) > sizes of the the Beam spot (σ)
+6	Z)
+7	bits 1- 8 : Reconstructed primary vertex multiplicity 9-16 : Number of degrees of freedom of the vertex fit
+8	X)
+9	Y) > coordinates of the reconstructed primary vertex fit
+10	Z)
+11	χ^2 of the priamry vertex fit
+12	xx)
+13	xy)
+14	yy) > primary vertex covariance matrix
+15	xz)
+16	yz)
+17	zz)
+18	B tag probability for tracks with neg. imp. parameter
+19	B tag probability for tracks with pos. imp. parameter
+20	B tag probability for all tracks
+21	B tag hemisphere 1 probability for neg. imp. parameters
+22	B tag hemisphere 2 probability for neg. imp. parameters
+23	B tag hemisphere 1 probability for pos. imp. parameters
+24	B tag hemisphere 2 probability for pos. imp. parameters
+25	B tag hemisphere 1 probability for all tracks
+26	B tag hemisphere 2 probability for all tracks
+27	X)
+28	Y) > components of thrust axis vector
+29	Z)
+30	Thrust value

NTRK BANK

Up to the version 1.02

0	Structural links
0	Reference links
N	Data (format 1I –F)

Link LNTRK = LQ(LDTOP-26)

DATA	CONTENT
+1	Number of new tracks from ID-VD pattern recognition
	For each new track :
	PA module MAIN
+1	Particle mass
+2	Px)
+3	Py) > At the closest distance approach to the vertex
+4	Pz)
+5	E, energy
+6	P, momentum (absolute value)
+7	Charge (0=neutral, 1=positive, 2=negative, 3=undefined)
+8	Track length (negative if incoming particle)
+9	Mass code
+10	Impact parameter (with sign): If VC is the distance of the vertex to the curvature center and R the curvature radius with sign opposite to the charge sign, then rp = sign(R)*(|R|-VC)
+11	Error on the impact parameter
+12	not used (=-1.)
+13	not used (= 0.)
+14	not used (=-1.)
+15	χ^2 of the fit of the TK without VD hits
+16	Number of degrees of freedom without VD hits
+17	χ^2 of the VD hits associated with the track
+18	Error on E
+19	Z impact parameter = ZP - ZV, where ZP is the z coordinate of the track extrapolation at the closest distance approach to the vertex in R-Rϕ plane

NTRK BANK

cont.

+20	Error on ZP
+21	Polar angle of the point of closest approach to the vertex
+22	X)
+23	Y) > Coordinates of the first measured point of the track
+24	Z)
+25	χ^2 of the fit of the TK
+26	Number of degrees of freedom
	PA module TRAC
+1	ε impact parameter
+2	z impact parameter
+3	θ angle
+4	ϕ angle
+5	1./R (R - radius of the curvature)
+6	Weight matrix for these parameters : $\varepsilon - \varepsilon$
+7	$z - \varepsilon$
+8	$z - z$
+9	$\varepsilon - \theta$
+10	$z - \theta$
+11	$\theta - \theta$
+12	$\varepsilon - \phi$
+13	$z - \phi$
+14	$\theta - \phi$
+15	$\phi - \phi$
+16	$\varepsilon - 1/R$
+17	$z - 1/R$
+18	$\theta - 1/R$
+19	$\phi - 1/R$
+20	$1/R - 1/R$

V0TK BANK

0	Structural links
0	Reference links
N	Data (format 1I −F)

Link LV0TK = LQ(LDTOP-27)

DATA	CONTENT	
+1	Number of reconstructed V^0's	
+2	Number of words per V^0 neutral track	
	For each reconstructed V^0:	
+1	ε impact parameter	
+2	z impact parameter	
+3	θ angle	
+4	ϕ angle	
+5	Weight matrix for these parameters :	$\varepsilon - \varepsilon$
+6		$z - \varepsilon$
+7		$z - z$
+8		$\varepsilon - \theta$
+9		$z - \theta$
+10		$\theta - \theta$
+11		$\varepsilon - \phi$
+12		$z - \phi$
+13		$\theta - \phi$
+14		$\phi - \phi$

PVS BANK

0	Structural links
0	Reference links
N	Data (format ∗I / 2I 4F)

Link LPVS = LQ(LDTOP-28)

DATA	CONTENT		
+1	Number of simulated vertices		
	For each simulated vertex :		
+1	bits 1- 8 :	Index of outgoing PA	
	9-16 :	Index of incoming PA	
	For each simulated vertex :		
+1	TANAGRA identifier of the TV bank		
+2	bits 1- 9 :	Number of outgoing particles	
	10 :	Status bits −	dummy vertex
	11 :		secondary vertex
	12 :		secondary hadronic vertex
	13 :		vertex with simulation data
+3	Mass code of the origin particle		
	Special cases :	0.	for primary vertex
		999.	for dummy vertex
+4	X)		
+5	Y) > coordinates of the vertex		
+6	Z)		

STSH BANK

0	Structural links
NPA	Reference links
N	Data (format *I −F)

Link LSTSH = LQ(LDTOP-29)

LINKS	
	Reconstructed PA bank of the i-th ST track
−L	LQ(LSTSH − I)

DATA	CONTENT
+1	Total number of SH and ST tracks + 4
+2	Number of SH tracks without matching ST's × 1000 + Number of words for each SH
+3	Number of SH tracks with matching ST's × 1000 + Number of words for each STSH
+4	Number of ST tracks without matching SH's × 1000 + Number of words for each ST
+5	Type of continuum event generated with matrix element option (MSTJ(120) in LUND)

For each SH non associated with ST

+1	bits	1- 8 :	Index of daugther particle
		9-16 :	Index of mother particle
		17-24 :	Index of sister particle

For each SH associated with ST

+1	bits	1- 8 :	Index of daugther particle
		9-16 :	Index of mother particle
		17-24 :	Index of sister particle
+2	bits	1- 8 :	Index of end vertex PV in bank PVS(28)
		9-16 :	Index of PV in bank PVS(28)

For each ST non associated with SH

+1	bits	1- 8 :	Index of end vertex PV in bank PVS(28)
		9-16 :	Index of PV in bank PVS(28)

STSH BANK

cont.

	For each SH non associated with ST
+1	Particle mass code
+2	Particle mass value
+3	Px
+4	Py
+5	Pz
+6	E
+7	Charge from LUND
+8	K(I,1) = 10000×KS + KH (LUND convention)
+9	KF (LUND convention)
+10	z of fragmentation
+11	Decay mode in LUND

	For each associated SH and ST
+1	Mass label
+2	Particle mass
+3	Px
+4	Py
+5	Pz
+6	E
+7	Track length
+8	Mass code
+9	Impact parameter in Rϕ
+10	Impact parameter in Z
+11	ϕ polar angle at closest approach
+12	Charge from LUND
+13	K(I,1) = 10000×KS + KH (LUND convention)
+14	KF (LUND convention)
+15	z of fragmentation
+16	Decay mode in LUND

STSH BANK

cont.

	For each ST non associated with SH
+1	Mass label
+2	Particle mass
+3	Px
+4	Py
+5	Pz
+6	E
+7	Charge (DELPHI convention)
+8	Track length
+9	Mass code
+10	Impact parameter in Rϕ
+11	Impact parameter in Z
+12	ϕ polar angle at closest approach

EFLO BANK

0	Structural links
0	Reference links
N	Data (format −F)

Link LEFLO = LQ(LDTOP-30)

DATA	CONTENT
	Energy flow information
	Global variables for the event
+1	Number of global event words
+2	Normally computed total energy
+3	Total energy where jet energies are forced to E_{beam}
+4	Total energy at less than 40° to the beam pipe
+5	Missing energy
+6	Angle wrt the beam of thrust (in degrees)
+7	Total unassociated elm. energy in the event
+8	Total unassociated had. energy in the event
+9	Had. energy excess in charged showers
+10	Elm. energy excess in charged showers
+11	Total energy excess in charged showers
+12	Estimate of energy in FCA/FCB
+13	Total charged energy
+14	$M^2_{missing}$ restricted to select "good" events
+15	Thrust
	Jet analysis
+1	Number of jets found +
	100 × number of words per jet
	For each jet
+1	Multiplicity (including neutrals)
+2	Momentum in x direction, in GeV/c
+3	Momentum in y direction, in GeV/c
+4	Momentum in z direction, in GeV/c
+5	Energy, in GeV
+6	Invariant mass, in GeV/c^2
+7	Elm. shower energy, in GeV
+8	Had. shower energy, in GeV

EFLO BANK

cont.

JETSET-like track information

+1	Number of charged tracks + 1000 $\times$ number of showers + 1000000 $\times$ number of Elephant neutral tracks +
+2	Number of words per track
	For each track
+1	Px, momentum in the x direction, in GeV/c
+2	Py, momentum in the y direction, in GeV/c
+3	Pz, momentum in the z direction, in GeV/c
+4	E, energy, in GeV
+5	m, mass, in GeV/c^2
+6	Electromagnetic energy of the track
+7	Hadronic energy of the track
+8	charge (Delphi convention)

DSTR BANK

0	Structural links
$5N_{D^*}$	Reference links
N	Data (format 1I−F)

Link LDSTR = LQ(LDTOP-31)

LINKS	
	PA banks of the i-th D^* decay products
−L1	LQ(LDSTR − 5∗I + 4) to slow π
−L2	LQ(LDSTR − 5∗I + 3) to K from D^0
−L3	LQ(LDSTR − 5∗I + 2) to π from D^0
−L4	LQ(LDSTR − 5∗I + 1) to π from D^0 (if any)
−L5	LQ(LDSTR − 5∗I) to π from D^0 (if any)

DATA	CONTENT
	Reconstructed D^* candidates
+1	Number of reconstructed D^* + 100×number of words per D^*
	For each D^* candidate
+1	D^* candidate type : 1 D^* normal 11 D^0 mass side band 21 (D^*−D^0) mass side band
+2	D^* momentum
+3	Probability of the D^0 vertex fit
+4	X)
+5	Y) ⇒ coordinates of the D^0 vertex
+6	Z)
+7	XY flight distance of the D^0 vertex
+8	cos(θ) of K in the D^0 rest frame
+9	D^0 mass (negative for antiparticle)
+10	(D^*−D^0) mass
+11	Px)
+12	Py) ⇒ refitted momentum of the slow π
+13	Pz)
+14	Px)
+15	Py) ⇒ refitted momentum of the K from D^0
+16	Pz)

DSTR BANK

cont.

+17	Px	)
+18	Py	) ⇒ refitted momentum of the π from D^0
+19	Pz	)
+20	Px	)
+21	Py	) ⇒ refitted momentum of the π from D^0 (if any)
+22	Pz	)
+23	Px	)
+24	Py	) ⇒ refitted momentum of the π from D^0 (if any)
+25	Pz	)

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"DELPHI DST Content, Version 3.36", Y.Sacquin, **DELPHI 94-161 PROG 210 Rev 1**, 20 December 1996

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