JADE Computer Note 102

The New TP Program Version 9

C.K. Bowdery J.J. Pryce

August 11, 1988

1. Introduction

The TP program reconstructs and summarises JADE events, producing datasets containing a TPEV/1 bank (with global event information), a number of TPTR banks (each with details of one particle) and a number of TPVX banks (each with details of one vertex). The datasets will also contain raw and processed data banks as requested by the user.

The program has existed for many years. Version 8[1] was released in 1984 and has been the standard version up till now. It is documented in JCN 79 with the TP Banks being documented separately in JCN 80. A special Heidelberg version 8+ has been used recently, since version 8 has been virtually frozen during the development of a new version, which is the subject of this note.

Version 8 is a direct descendent of earlier versions of the program originally written by S. Yamada and E. Elsen. It was originally intended to be the ultimate version but various shortcomings in the program structure has made it unsuitable for adding new sections. Instead the program has been almost completely re-written along radically different lines.

The new program, to be known as Version 9 or TP9 for short, follows the philosophy of Structured Design (part of SASD) in consisting of a very large number[2] of small, 'weakly coupled' subroutines with 'strong cohesion'. However the nature of JADE programs, with the event data in a BOS common block, has meant that the

[1] The version numbers correspond roughly to the generation number of the multihadronic events the program produced.

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implementation is far from pure SASD with its afferent and efferent data flows. Nevertheless, it conforms to most of the 'design heuristics' that ensure reliability and ease maintenance problems.

Since it is a feature of SASD that a design can be evaluated using a number of graded criteria, it should be possible to evaluate the quality of TP9. Comments and criticism in this area (and all others) are thus welcome.

2. The Nature of the Program

The program normally runs as a batch job, reading events in from stream 1 and writing out 'accepted' events on stream 2 and 'rejected' events on stream 3. Whether events are rejected depends on whether the reduction option is specified (see later). Options, specified on data records, are read in from stream 5 (`G.SYSIN`) as with earlier versions of the program but their form is very different.

Printed output appears on stream 6 (`G.SYSOUT`), starting with a distinctive TP9 banner which can contain user-supplied text. This is followed by information about the sub-version number and date and recent TP news. Next the user options are listed. Assuming that there are no errors (which are clearly flagged and explained), the following pages contain printout pertaining to the event processing with special messages printed for the first event. The printout ends with an event termination message, various statistics and histograms and a final end-of-run message.

The TP bank output of TP9 is identical to that of TP8 so JCN 80 still applies. However note that some entries in the `TPTR` banks are still not filled, such as the errors on the particle direction cosines. This has been the case in all previous versions of the TP program but hopefully this will be rectified soon.

3. The TP9 Options

An interactive program has been developed to prompt the user for the required options for TP9. The output of the interactive program is the input for the batch job, which must be placed immediately after the `//G.SYSIN DD *` card of the JCL. The interactive program is very easy to use, being self-explanatory. A description of how to run the program will be given in a forthcoming JADE Computer Note.

For those users who choose to specify the TP9 options manually, the format of the

options, as read by TP9, will now be given. The first point to note is that no data records need be given but the program will then only delete all existing TPEV, TPTR and TPVX banks and create a new TPEV/1 bank for each event.

Secondly, the data records can be specified in any order since they identify themselves. Thirdly, the information in a record can appear anywhere and in any order except for the identification keyword which must come first. It can be preceded by blanks if so desired. All 80 columns of the record can be used.[3] Keywords must be separated by at least one blank. Fourthly, there are two basic types of data records: special records and group option records.

Special Records

There are four of these. All are optional and sensible defaults are taken if these records are not specified. One is identified with the word TPCONTROL, the second by SMEARINGDATE, the third by COMMENT and the last by TPEND. These words must appear as the first sequence of non-blank letters in the record. Except for COMMENT, only one of each special record may appear.

The TPCONTROL record specifies which event records are to be processed by TP9 and has the form:

```
TPCONTROL  { START i | SKIP j } { END k | PROCESS m }
```

where keywords in curly brackets, {}, are optional and can be omitted. The alternatives are separated by vertical bars. The letters i,j,k,m represent strings of integer digits. Examples of valid TPCONTROL records are:

```
TPCONTROL  START 15   PROCESS 100
```

This requests TP9 to start by processing event 15 on the input file (that is, the 15th event according to its position in the file) and finish after processing event 114 such that 100 events are processed. (Assuming there are at least 114 events to be read.)

```
TPCONTROL  END 2000
```

This causes a start at the first event and an end after event 2000 while the one below asks TP9 to skip over the first 100 events on the input file and process all the rest, starting at event 101.

```
TPCONTROL  SKIP 100
```

[3] If a number spans columns 73 to 80, it will be ignored.

If no TPCONTROL record is given or if the information is incomplete, the default start record is 1 and the default end record is 9999999.

The SMEARINGDATE record is a means of specifying a smearing date for Monte Carlo events in order to override the usage of the configuration date as the default smearing date. The format is:

```
SMEARINGDATE    { day   month   year }
```

where *day* and *month* are 1 or 2 digit numbers and *year* is a 4 digit number. All 3 arguments must be given or none at all (the latter case being equivalent to omitting this record). An example is:

```
SMEARINGDATE    14 10    1983
```

The COMMENT record provides a means of printing 4 lines of comments on the header pages of the TP output. If more than 4 COMMENT records (with non-blank information following) are found, they are ignored. The format is:

```
COMMENT   { text }
```

Examples are:

```
  COMMENT  Output dataset:  F22BOW.OUTPUT.A1
COMMENT       This is a test job.  Discard me.
COMMENT  --> Top secret output.  Not to be seen by MARK-J. <--
```

The first example shows that the word COMMENT does not have to start in column 1. The text here would be useful if the output is first written to a temporary dataset before copying to tape since the program will not know what the tape dataset is to be called. Please note that blanks appearing after the word COMMENT and before the comment text are copied to the output except for the first which must be there for syntax reasons. This allows comments to be aligned in columns if wanted, as shown in the second and third examples.

The TPEND record is useful for providing an end-of-file marker for the case when further records are appended to G.SYSIN for use by a later job step. If absent, option records will be read until a FORTRAN EOF occurs. The format is:

```
TPEND
```

Clearly a TPEND record, if present, must be the last option record to be specified, otherwise the following option records will not be read by the program.

Group Option Records

Read this section carefully. The program only performs the actions you ask for. That is, there are no default actions.

The Group Option records all have the same format, with the first keyword identifying which 'group' of options is being referred to. Basically a group corresponds to a subdetector but the options for refitting, charged track processing and overall event analysis are incorporated into their own groups. All the options for a particular group must be given on one record. The format is:

group { *option_keyword* } { *option_keyword* } { *option_keyword* } ...

with different *option_keywords* appearing any number of times (including zero), separated by at least one blank. For example:

```
MUON    ANALYSE   IFNOTDONE   TP   DELETE
```

where `MUON` is the *group* and `ANALYSE`, `IFNOTDONE`, `TP` and `DELETE` are *option_keywords*. The allowed values of *group* are:

`JETC` `VTXC` `TRACK` `TOF` `LG` `REFIT` `MUON` `TAGG` `DEDX` `CALCS`

which are self-explanatory except possibly `REFIT` (which deals with a refit of the Jet Chamber), `TRACK` (which summarises the latest `PATR` bank) and `CALCS` (which deals with global event calculations like sphericity and thrust plus event reduction).

The allowed values of *option_keyword* depend to some extent on the *group* but the basic list (common to almost all the groups) is:

`ANALYSE`	perform the relevant reconstruction task
`IFNOTDONE`	qualifier to `ANALYSE`; prevents re-analysis
`TP`	perform the summary; create or modify the TP banks
`DELETE`	delete detector results banks after summarising

The exact action for each group is specified later in the note. The important point to emphasise again is that the absence of these *option_keywords* implies that the corresponding actions are NOT done. In addition, please note that qualifiers, like `IFNOTDONE`, are meaningless without their associated verbs.[4]

[4]The qualifiers can appear anywhere in the record but it is good practice to place them immediately after the relevant verb.

A summary of all the legal *option_keywords* now follows. Note that a few of them are mutually exclusive.

```
JETC   RFICAL IFNORFICAL ZCAL OLDDEL ANALYSE IFNOTDONE ZVTX
VTXC   ANALYSE  COMFIT
REFIT  RFI IFNORFI STRONGVTX WEAKVTX ZS IFNOZS COMMONZVTX OLDPATR
TRACK  TP  VPROCESS  DELETE
DEDX   ANALYSE  TP
TOF    ANALYSE  IFNOTDONE  TP  DELETE
LG     LGCAL  IFNOLGCAL  ANALYSE  IFNOTDONE  TRACKMATCH  TP DELETE
MUON   ANALYSE  IFNOTDONE  TP  DELETE  FULL
TAGG   ANALYSE  IFNOTDONE  TP  DELETE
CALCS  SPHERICITY  THRUST  REDUCTION
```

4. What TP9 Does In Detail

The first action performed, after an event is read in, is the deletion of all existing TP banks followed by the creation of the TPEV/1 bank. Next the program performs (if requested) the following tasks, in the order given below:

- jet chamber basic processing including 'calibration'
- jet chamber track refitting (Spitzer routines)
- vertex chamber processing and combined fit with jet chamber
- copying charged tracks from lowest the PATR bank into TPTR banks
- primary vertex finding, the creation of the TPVX/1 bank and the adjustment of the direction cosines in the TPTR banks for tracks from the primary vertex
- deletion of some or all PATR banks
- TOF analysis, summary of results in TPTR banks and deletion of the TOFR bank
- LG 'calibration', analysis and cluster-track matching
- creation of photon summary TPTR banks and addition of cluster information to charged track TPTR banks
- deletion of LGCL bank

- muon filter analysis, addition of muon information to TPTR banks and MUR2 bank deletion
- tagging system analysis, creation of new TPTR banks and deletion of tagging results banks
- dE/dx analysis and addition of results to TPTR banks
- identification of particles in TPTR banks
- finding of charged decays, V^0's and converted photons, and creation of new TPVX and TPTR banks
- compilation of event statistics and copying them into the TPEV/1 bank
- computation of visible energies, sphericity and thrust, and histogramming them and other quantities
- flagging events that fail the reduction cuts
- writing out the event to the relevant dataset

4.1 Jet Chamber Processing

The actions performed are: calibration in $r\phi$ and z, deletion of all existing PATR banks,[5] PATRCO analysis and a fast z vertex search. All of these actions are optional with the option group name being JETC.

RFICAL	do $r\phi$ calibration of the Jet Chamber
IFNOFICAL	qualifier to RFICAL; prevents recalibration
ZCAL	do z calibration of Jet Chamber (no qualifier)
ANALYSE	call PATRCO to perform pattern recognition
IFNOTDONE	qualifier to ANALYSE; prevents re-analysis if a PATR exists
OLDDEL	qualifier to ANALYSE; delete existing PATR banks[5] first
ZVTX	do fast z vertex search

Note that RFICAL IFNORFICAL is a sensible choice if ANALYSE is specified.

[5]Except PATR/12

4.2 Charged Track Refitting

The actions performed are: Spitzer $r\phi$ and Spitzer zs refitting. All of the actions are optional with the option group name being REFIT. As always, the default actions are no actions, i.e. no vertex constraints are used in fits unless asked for explicitly. See Jade Computer Notes 94 and 95 for details about the refitting programs.

RFI	perform an $r\phi$ refit (defaults: *unconstrained* and *create new* PATR *bank*)
IFNORFI	qualifier to RFI; prevents refitting
STRONGVTX	qualifier to RFI; with *strong* vertex constraint
WEAKVTX	qualifier to RFI; with *weak* vertex constraint, i.e. vertex errors multiplied by 100
ZS	perform zs refit (defaults: *no common z vertex constraint* and *create new* PATR *bank*)
IFNOZS	qualifier to ZS; prevents refitting
COMMONZVTX	qualifier to ZS; with *common z vertex constraint*
OLDPATR	qualifier to RFI and ZS; *overwrite* existing PATR bank

4.3 Vertex Chamber Processing

The actions performed are: vertex chamber analysis (using the latest PATR bank, possibly created in the JETC or REFIT steps) followed by a combined fit with the jet chamber (COMFIT). Standard routines VTXCSF and VTXCSV are used. Both of these actions are optional with the option group name being VTXC.

ANALYSE	do vertex chamber analysis
COMFIT	perform a combined fit with jet chamber to make HWDS bank

4.4 Charged Track Summarising

The actions performed are: TP track summarising using the PATR bank with the lowest number to create a TPTR bank for every track found, vertex processing of every TPTR bank and the deletion of all PATR banks.[6] All of these actions are optional

[6]Not implemented in version 9.1

with the option group name being TRACK. The vertex processing action results in the PATR bank being analysed to find the primary vertex. A TPVX bank 1 is then created. The corresponding TPTR track numbers are added to the TPVX bank and the starting positions and direction cosine information in the TPTR banks are set accordingly. No correction for energy loss for each track is made, at present. All later vertex related tasks, such as decay finding, V^0 searches and converted photon searches are also dependent on the VPROCESS option in this section.

TP	perform a summary of the PATR bank with the lowest number; create TPTR banks as explained above
VPROCESS	perform vertex processing as explained above
DELETE	delete all PATR banks[7] after summarising (except PATR/12)

4.5 TOF Processing

The actions performed are: TOFINT analysis, summarising the results into the charged track TPTR banks (if present) and deletion of the TOFR bank. All of these actions are optional with the option group name being TOF.

ANALYSE	perform the TOF analysis (TOFINT)
IFNOTDONE	qualifier to ANALYSE; prevents re-analysis
TP	perform the summary; modify TPTR banks for charged tracks (if any)
DELETE	delete TOFR bank after summarising

4.6 LG Processing

The actions performed are: LG calibration (LGCALB), cluster finding (LGANAL), track-to-cluster matching by position (LGCDIR) and TP summarising which modifies some charged track TPTR banks and creates new neutral particle TPTR banks. All these actions are optional with the option group name being LG.

LGCAL	calibrate the LG system (LGCALB)
IFNOLGCAL	qualifier to LGCAL; prevents recalibration

[7]Not implemented in version 9.1

ANALYSE	perform the LG cluster finding analysis (LGANAL)
IFNOTDONE	qualifier to ANALYSE; prevents re-analysis
TRACKMATCH	join tracks and clusters (LGCDIR)
TP	perform the summary; modify TPTR banks for charged tracks (if any) and create new TPTR banks for neutrals
DELETE	delete the LGCL bank[8]

4.7 Muon Filter Processing

The actions performed are: muon analysis[9] (MUANA), TP summarising which modifies charged track TPTR banks and two levels of muon results bank deletion. All these actions are optional with the option group name being MUON.

ANALYSE	perform the muon filter calibration and analysis (MUANA)
IFNOTDONE	qualifier to ANALYSE; prevents recalibration and re-analysis
TP	perform the summary; modify TPTR banks for charged tracks (if any)
DELETE	delete MUR2 banks 5 and 6 at end
FULL	qualifier to DELETE; delete banks 2, 3 and 4 as well

4.8 Tagging System Processing

The actions performed are: tagging analysis (TAGAN), TP summarising which creates new TPTR banks and deletion of the ATAG and TAGG banks after summarising. All these actions are optional. The option group name is TAGG.

ANALYSE	perform the tagging system calibration and analysis (TAGAN)
IFNOTDONE	qualifier to ANALYSE; prevents recalibration and re-analysis
TP	perform the summary; create new TPTR banks
DELETE	delete ATAG and TAGG banks

[8]Not implemented in version 9.1
[9]Including (re)calibration

4.9 dE/dx Processing

The actions performed are: dE/dx analysis and TP summarising which modifies the TPTR banks of charged tracks. Since there is no DEDX bank, both actions must be performed or neither of them. The option group name is DEDX.

ANALYSE	perform the dE/dx analysis of Jet Chamber tracks (DEDXBN)
TP	perform the summary; modify TPTR banks for charged tracks

4.10 Particle Identification

An attempt is made to identify the particles in the event using information determined from the muon filter, LG detector, Jet Chamber (dE/dx) and the TOF counters. Searches for V^0 particles, converted photons and tracks with kinks are also performed, depending on the VPROCESS keyword specified as part of the TRACK group of options. The TPEV and TPTR banks are updated and new TPTR and TPVX banks created when new particles are found.

4.11 Event Analysis

Two actions occur that are not optional. They are the calculation of visible energy (charged and neutral) from the TPTR banks (which is written into the TPEV/1 bank and the histogramming of certain quantities.

The optional actions (grouped together under the name CALCS) are the calculations of sphericity and thrust and determining whether an event is to be accepted or rejected. This reduction process depends on the code incorporated into the reduction routine. The default code is for multihadronic event selection (MCREDU).

SPHERICITY	calculate sphericity (SPHERI)
THRUST	calculate thrust (THRUST)
REDUCTION	perform the desired reduction

5. Warning and Error Messages

At present the messages printed by the TP routines[10] are rather terse and give only a short traceback from the routine that detected the error or generated the warning. This is often enough to determine the cause of the problem. However this should be improved in later versions when experience provides information on why the errors occur. Since there are some routines from version 8 linked in, there may be error messages printed in the old TP8 style.

Please report occurrences of errors and warnings so that the program can be changed to remove unnecessary messages or provide more user-friendly ones.

6. Running the Program

At DESY, a standard job exists to run the program which only requires the addition of the option records ('cards'). As stated before, these can be added by hand or by using the output from the interactive options generator. The standard JCL member is called `#RUNTP9` and lives on `F22BOW.TP9.S`, the source library for TP9. Another member, `#RUNTP9C`, includes a tape-to-disk copy step before the TP step. The Siemens FORTRAN77 load library is called `F22BOW.TP9.L` and there is also an IBM FORTVS load library called `F22BOW.TP9.VSL`.

Note that there is a problem with FORTVS `BLOCK DATA` linking so members `TPDICT` and `TPBD01` should be explicitly `INCLUDE`d in the link step if the FORTVS library is used.

Running TP9 at RAL will involve using copied FORTVS load modules from DESY. When the program is ready an announcement will be made. Note, a VAX version of the interactive options program exists and can be used in conjuction with remote job submission to RAL from the Manchester and Lancaster VAXes. Usage at Heidelberg is still to be decided. Please ask for the latest information.

Finally, as always, be aware that future improvements might entail larger region sizes or library changes so always check the standard JCL members before submitting long production jobs.

[10] With the exception of the options handling routines

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Special Records

There are four of these. All are optional and sensible defaults are taken if these records are not specified. One is identified with the word TPCONTROL, the second by SMEARINGDATE, the third by COMMENT and the last by TPEND. These words must appear as the first sequence of non-blank letters in the record. Except for COMMENT, only one of each special record may appear.

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[3] If a number spans columns 73 to 80, it will be ignored.

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SMEARINGDATE    { day  month  year }
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where *day* and *month* are 1 or 2 digit numbers and *year* is a 4 digit number. All 3 arguments must be given or none at all (the latter case being equivalent to omitting this record). An example is:

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The first example shows that the word COMMENT does not have to start in column 1. The text here would be useful if the output is first written to a temporary dataset before copying to tape since the program will not know what the tape dataset is to be called. Please note that blanks appearing after the word COMMENT and before the comment text are copied to the output except for the first which must be there for syntax reasons. This allows comments to be aligned in columns if wanted, as shown in the second and third examples.

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group { *option_keyword* } { *option_keyword* } { *option_keyword* } ...

with different *option_keywords* appearing any number of times (including zero), separated by at least one blank. For example:

```
MUON    ANALYSE   IFNOTDONE   TP   DELETE
```

where MUON is the *group* and ANALYSE, IFNOTDONE, TP and DELETE are *option_keywords*. The allowed values of *group* are:

JETC VTXC TRACK TOF LG REFIT MUON TAGG DEDX CALCS

which are self-explanatory except possibly REFIT (which deals with a refit of the Jet Chamber), TRACK (which summarises the latest PATR bank) and CALCS (which deals with global event calculations like sphericity and thrust plus event reduction).

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REFIT  RFI IFNORFI STRONGVTX WEAKVTX ZS IFNOZS COMMONZVTX OLDPATR
TRACK  TP  VPROCESS  DELETE
DEDX   ANALYSE  TP
TOF    ANALYSE  IFNOTDONE  TP  DELETE
LG     LGCAL  IFNOLGCAL  ANALYSE  IFNOTDONE  TRACKMATCH  TP DELETE
MUON   ANALYSE  IFNOTDONE  TP  DELETE  FULL
TAGG   ANALYSE  IFNOTDONE  TP  DELETE
CALCS  SPHERICITY  THRUST  REDUCTION
```

4. What TP9 Does In Detail

The first action performed, after an event is read in, is the deletion of all existing TP banks followed by the creation of the TPEV/1 bank. Next the program performs (if requested) the following tasks, in the order given below:

- jet chamber basic processing including 'calibration'
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- copying charged tracks from lowest the PATR bank into TPTR banks
- primary vertex finding, the creation of the TPVX/1 bank and the adjustment of the direction cosines in the TPTR banks for tracks from the primary vertex
- deletion of some or all PATR banks
- TOF analysis, summary of results in TPTR banks and deletion of the TOFR bank
- LG 'calibration', analysis and cluster-track matching
- creation of photon summary TPTR banks and addition of cluster information to charged track TPTR banks
- deletion of LGCL bank

- muon filter analysis, addition of muon information to TPTR banks and MUR2 bank deletion
- tagging system analysis, creation of new TPTR banks and deletion of tagging results banks
- dE/dx analysis and addition of results to TPTR banks
- identification of particles in TPTR banks
- finding of charged decays, V^0's and converted photons, and creation of new TPVX and TPTR banks
- compilation of event statistics and copying them into the TPEV/1 bank
- computation of visible energies, sphericity and thrust, and histogramming them and other quantities
- flagging events that fail the reduction cuts
- writing out the event to the relevant dataset

4.1 Jet Chamber Processing

The actions performed are: calibration in $r\phi$ and z, deletion of all existing PATR banks,[5] PATRCO analysis and a fast z vertex search. All of these actions are optional with the option group name being JETC.

RFICAL	do $r\phi$ calibration of the Jet Chamber
IFNOFICAL	qualifier to RFICAL; prevents recalibration
ZCAL	do z calibration of Jet Chamber (no qualifier)
ANALYSE	call PATRCO to perform pattern recognition
IFNOTDONE	qualifier to ANALYSE; prevents re-analysis if a PATR exists
OLDDEL	qualifier to ANALYSE; delete existing PATR banks[5] first
ZVTX	do fast z vertex search

Note that RFICAL IFNORFICAL is a sensible choice if ANALYSE is specified.

[5] Except PATR/12

4.2 Charged Track Refitting

The actions performed are: Spitzer $r\phi$ and Spitzer zs refitting. All of the actions are optional with the option group name being REFIT. As always, the default actions are no actions, i.e. no vertex constraints are used in fits unless asked for explicitly. See Jade Computer Notes 94 and 95 for details about the refitting programs.

RFI	perform an $r\phi$ refit (defaults: *unconstrained* and *create new* PATR *bank*)
IFNORFI	qualifier to RFI; prevents refitting
STRONGVTX	qualifier to RFI; with *strong* vertex constraint
WEAKVTX	qualifier to RFI; with *weak* vertex constraint, i.e. vertex errors multiplied by 100
ZS	perform zs refit (defaults: *no common z vertex constraint* and *create new* PATR *bank*)
IFNOZS	qualifier to ZS; prevents refitting
COMMONZVTX	qualifier to ZS; with *common z vertex constraint*
OLDPATR	qualifier to RFI and ZS; *overwrite* existing PATR bank

4.3 Vertex Chamber Processing

The actions performed are; vertex chamber analysis (using the latest PATR bank, possibly created in the JETC or REFIT steps) followed by a combined fit with the jet chamber (COMFIT). Standard routines VTXCSF and VTXCSV are used. Both of these actions are optional with the option group name being VTXC.

ANALYSE	do vertex chamber analysis
COMFIT	perform a combined fit with jet chamber to make HWDS bank

4.4 Charged Track Summarising

The actions performed are: TP track summarising using the PATR bank with the lowest number to create a TPTR bank for every track found, vertex processing of every TPTR bank and the deletion of all PATR banks.[6] All of these actions are optional

[6]Not implemented in version 9.1

with the option group name being TRACK. The vertex processing action results in the PATR bank being analysed to find the primary vertex. A TPVX bank 1 is then created. The corresponding TPTR track numbers are added to the TPVX bank and the starting positions and direction cosine information in the TPTR banks are set accordingly. No correction for energy loss for each track is made, at present. All later vertex related tasks, such as decay finding, V^0 searches and converted photon searches are also dependent on the VPROCESS option in this section.

TP	perform a summary of the PATR bank with the lowest number; create TPTR banks as explained above
VPROCESS	perform vertex processing as explained above
DELETE	delete all PATR banks[7] after summarising (except PATR/12)

4.5 TOF Processing

The actions performed are: TOFINT analysis, summarising the results into the charged track TPTR banks (if present) and deletion of the TOFR bank. All of these actions are optional with the option group name being TOF.

ANALYSE	perform the TOF analysis (TOFINT)
IFNOTDONE	qualifier to ANALYSE; prevents re-analysis
TP	perform the summary; modify TPTR banks for charged tracks (if any)
DELETE	delete TOFR bank after summarising

4.6 LG Processing

The actions performed are: LG calibration (LGCALB), cluster finding (LGANAL), track-to-cluster matching by position (LGCDIR) and TP summarising which modifies some charged track TPTR banks and creates new neutral particle TPTR banks. All these actions are optional with the option group name being LG.

LGCAL	calibrate the LG system (LGCALB)
IFNOLGCAL	qualifier to LGCAL; prevents recalibration

[7]Not implemented in version 9.1

ANALYSE	perform the LG cluster finding analysis (LGANAL)
IFNOTDONE	qualifier to ANALYSE; prevents re-analysis
TRACKMATCH	join tracks and clusters (LGCDIR)
TP	perform the summary; modify TPTR banks for charged tracks (if any) and create new TPTR banks for neutrals
DELETE	delete the LGCL bank[8]

4.7 Muon Filter Processing

The actions performed are: muon analysis[9] (MUANA), TP summarising which modifies charged track TPTR banks and two levels of muon results bank deletion. All these actions are optional with the option group name being MUON.

ANALYSE	perform the muon filter calibration and analysis (MUANA)
IFNOTDONE	qualifier to ANALYSE; prevents recalibration and re-analysis
TP	perform the summary; modify TPTR banks for charged tracks (if any)
DELETE	delete MUR2 banks 5 and 6 at end
FULL	qualifier to DELETE; delete banks 2, 3 and 4 as well

4.8 Tagging System Processing

The actions performed are: tagging analysis (TAGAN), TP summarising which creates new TPTR banks and deletion of the ATAG and TAGG banks after summarising. All these actions are optional. The option group name is TAGG.

ANALYSE	perform the tagging system calibration and analysis (TAGAN)
IFNOTDONE	qualifier to ANALYSE; prevents recalibration and re-analysis
TP	perform the summary; create new TPTR banks
DELETE	delete ATAG and TAGG banks

[8]Not implemented in version 9.1
[9]Including (re)calibration

4.9 dE/dx Processing

The actions performed are: dE/dx analysis and TP summarising which modifies the TPTR banks of charged tracks. Since there is no DEDX bank, both actions must be performed or neither of them. The option group name is DEDX.

ANALYSE	perform the dE/dx analysis of Jet Chamber tracks (DEDXBN)
TP	perform the summary; modify TPTR banks for charged tracks

4.10 Particle Identification

An attempt is made to identify the particles in the event using information determined from the muon filter, LG detector, Jet Chamber (dE/dx) and the TOF counters. Searches for V^0 particles, converted photons and tracks with kinks are also performed, depending on the VPROCESS keyword specified as part of the TRACK group of options. The TPEV and TPTR banks are updated and new TPTR and TPVX banks created when new particles are found.

4.11 Event Analysis

Two actions occur that are not optional. They are the calculation of visible energy (charged and neutral) from the TPTR banks (which is written into the TPEV/1 bank and the histogramming of certain quantities.

The optional actions (grouped together under the name CALCS) are the calculations of sphericity and thrust and determining whether an event is to be accepted or rejected. This reduction process depends on the code incorporated into the reduction routine. The default code is for multihadronic event selection (MCREDU).

SPHERICITY	calculate sphericity (SPHERI)
THRUST	calculate thrust (THRUST)
REDUCTION	perform the desired reduction

5. Warning and Error Messages

At present the messages printed by the TP routines[10] are rather terse and give only a short traceback from the routine that detected the error or generated the warning. This is often enough to determine the cause of the problem. However this should be improved in later versions when experience provides information on why the errors occur. Since there are some routines from version 8 linked in, there may be error messages printed in the old TP8 style.

Please report occurrences of errors and warnings so that the program can be changed to remove unnecessary messages or provide more user-friendly ones.

6. Running the Program

At DESY, a standard job exists to run the program which only requires the addition of the option records ('cards'). As stated before, these can be added by hand or by using the output from the interactive options generator. The standard JCL member is called `#RUNTP9` and lives on `F22BOW.TP9.S`, the source library for TP9. Another member, `#RUNTP9C`, includes a tape-to-disk copy step before the TP step. The Siemens FORTRAN77 load library is called `F22BOW.TP9.L` and there is also an IBM FORTVS load library called `F22BOW.TP9.VSL`.

Note that there is a problem with FORTVS `BLOCK DATA` linking so members `TPDICT` and `TPBD01` should be explicitly `INCLUDE`d in the link step if the FORTVS library is used.

Running TP9 at RAL will involve using copied FORTVS load modules from DESY. When the program is ready an announcement will be made. Note, a VAX version of the interactive options program exists and can be used in conjuction with remote job submission to RAL from the Manchester and Lancaster VAXes. Usage at Heidelberg is still to be decided. Please ask for the latest information.

Finally, as always, be aware that future improvements might entail larger region sizes or library changes so always check the standard JCL members before submitting long production jobs.

[10] With the exception of the options handling routines