E949 PNN2 status update
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Abstract

A global initialization routine was employed to remove ntuple-quantity disparages that arise when processing raw data versus skimmed data. Solution to the problem with Run 49302 Event 21915 is contained within this note. This event was observed to have different target reconstructions using the raw data file from tape and the skimmed data file.

1 Global Initialization Routine

The new routine is titled *nt_var_init.F*. This routine is called before *setup_pass1* is called within *dplot*.

1.1 Purpose

The purpose of *nt_var_init.F* is to remove differences that were observed when Joe compared ntuple output from raw and skimmed data files. As seen in Table 1, many variables were different using different data sets even though the individual events are identical. Unless these differences are removed we will not be able to rely on either raw or skimmed data sets.

The bottom section of Table 1 is removed when the error in *swathccd* is fixed, discussed later in this note. Also, other differences found by Joe has been resolved with a bug fix by Dima of TD/TDC routines.

Some differences are due to some 'local' routines not being call due to something not being satisfied. For example, if some pass1 cuts are not satisfied then *setup_pass2* is never called and so any ntuple variables that use quantities in pass2 will have stale information.

We currently have too many ntuple variables to quickly implement an initialization of all variables. However, anyone adding new variables to the ntuple should initialize the variables in *nt_var_init.F* and if needed locally as well. Also, if any discrepancies appear with a specific event using different data sets then these should also be added to remove differences. This way we will have greater confidence that bugs do not exist within the pass2 code.

2 Observation

Figure 1 shows how *swathccd* reconstructed the target from processing on the skimmed file. Observe the E=5.2MeV, t=22.93ns pion hit that is adjacent to the kaons hits

3 DeBugging

To track down the problem we were seeing, I placed debugging statements throughout *swathccd* . These statements are created so that future problems can be tracked down quickly and easily.

```
      integer swath_mess    !SwathCCD code
      data swath_mess /0/

*     Run/Evt constraints are not currently implemented in tgrecon
      integer mess_run_max,mess_run_min
      integer mess_evt_max,mess_evt_min
      logical mess_runevt

      data mess_runevt /.false./

      data mess_run_min /49302/
      data mess_run_max /49302/

      data mess_evt_min /21915/
      data mess_evt_max /21915/
```

To make debugging statements one should increase the value of `swath_mess` from 0 (no messages), 1 (error messages), 11 (everything). This method will allow diagnostics of how swath works along with an exhaustive information overload with just a turn of a dial.

If a debugger would like to look only at one event (or a range of events), make `mess_runevt` true and change the following to the range of events you are interested in $\texttt{mess\_run\_min} \leq run \leq \texttt{mess\_run\_max}; \texttt{mess\_evt\_min} \leq event \leq \texttt{mess\_evt\_max}$. This may be necessary if processing on a raw data file that has a large number of events such that it could make the log file excessively large.

If the debugger would like to add additional message statements add the following lines, such that XXX is the degree of error message (1 higher priority, 11 lower priority)

```
      IF (swath_mess.ge.XXX.and.swath_debug) THEN
         write(*,*)'description',variable1, variable2,...
      ENDIF
```

4 Code Fixes

In *swathccd* , the pion hits are classified into a cluster using geometry, energy, time, and distance from the UTC track. However, are not initially included and need to be added at a later stage when more information has been gathered by the routine. This processes is referred to as mending within the comments of *swathccd* .

The CWCCD(1-3,j,i) array is a lists of on the swath pion clusters (i), with j hits. The first index is the fiber number (1=row,2=column,3=hit number). CCWCCD() is a analogous array which is for opposite-side pions. CLUSTCCD is for the Kaon clusters. Hits are added and removed from these arrays throughout *swathccd* .

cwener(j,i), ccwener(j,i), kcandener(j,i) are arrays that have been added to keep track of the energy of the specific hits within the chosen cluster array. cwtimccd(), ccwtimccd() are to store the times of the hits.

When a hit is added to (for example) CWCCD, cwener() and cwtimccd must also be updated with the correct energy and time. The following 4 segments of code did not have the line in which the energy of the hit was to be updated; These lines which were initially omitted are noted by the comment "6jan06 benjil". Without these lines included the energy used within *swathccd* is incorrect and so *swathccd* will chose to keep these hits or remove them from the final selection using incorrect information. The information within these energy arrays, since before now they were not initialized, are using stale information that is from some unknown previous event. Specifically, hits are required to pass a likelihood function within *swathccd* (based upon time, energy, distance from UTC track). The likelihood function will remove hits that do not appear to be pions. Since the likelihood function will have the wrong energy the hit may be kept or removed. (when it should not be)

- Segment 1

```
                  IF (NBRLIST(1,C).EQ.CLUSTCCD(1,K,II).AND.
     +                 NBRLIST(2,C).EQ.CLUSTCCD(2,K,II)) THEN
                     NMEMBCCD(II) = NMEMBCCD(II) + 1
                     CLUSTCCD(1,NMEMBCCD(II),II) = CCWCCD(1,J,I)
                     CLUSTCCD(2,NMEMBCCD(II),II) = CCWCCD(2,J,I)
                     CLUSTCCD(3,NMEMBCCD(II),II) = CCWCCD(3,J,I)
                     HITTIME(CCWCCD(1,J,I),CCWCCD(2,J,I),
     1                                  CCWCCD(3,J,I)) = CCWTIMCCD(J,I)
                     CCWCCD(1,J,I) = CCWCCD(1,ICCWCCD(I),I)
                     CCWCCD(2,J,I) = CCWCCD(2,ICCWCCD(I),I)
                     CCWCCD(3,J,I) = CCWCCD(3,ICCWCCD(I),I)
                     CCWTIMCCD(J,I) = CCWTIMCCD(ICCWCCD(I),I)
                     ccwener(j,i) = ccwener(ICCWCCD(I),I) !6jan06 benjil
                     ICCWCCD(I) = ICCWCCD(I) - 1
                     QKMEND = .TRUE.
                     GOTO 1045
                  ENDIF
```

- Segment 2

```
               IF(ABS(CCWTIMCCD(PMEND(I,L),L)-CWAVTIM(L)).LE.PIWINDOW)THEN
                  ICWCCD(L) = ICWCCD(L) + 1
                  CWCCD(1,ICWCCD(L),L) = CCWCCD(1,PMEND(I,L),L)
                  CWCCD(2,ICWCCD(L),L) = CCWCCD(2,PMEND(I,L),L)
                  CWCCD(3,ICWCCD(L),L) = CCWCCD(3,PMEND(I,L),L)
                  CWTIMCCD(ICWCCD(L),L) = CCWTIMCCD(PMEND(I,L),L)
```

```
               cwener(ICWCCD(L),L) = ccwener(pmend(i,L),L) !added 6jan06 benjil
               CCWCCD(1,PMEND(I,L),L) = CCWCCD(1,ICCWCCD(L),L)
               CCWCCD(2,PMEND(I,L),L) = CCWCCD(2,ICCWCCD(L),L)
               CCWCCD(3,PMEND(I,L),L) = CCWCCD(3,ICCWCCD(L),L)
               CCWTIMCCD(PMEND(I,L),L) = CCWTIMCCD(ICCWCCD(L),L)
               ccwener(pmend(i,L),L) = ccwener(iccwccd(L),L)
               ICCWCCD(L) = ICCWCCD(L) - 1
               QPMEND = .TRUE.
               If (swath_mess.ge.10.and.swath_debug) Then
                  write(*,*)'SW CCW->CW Mend ',i,npmend(L),
     +                 CWCCD(1,ICWCCD(L),L),
     +                 CWCCD(2,ICWCCD(L),L),CWCCD(3,ICWCCD(L),L)
               Endif

            ENDIF
```

- Segment 3

```
            IF ( fib_e(KCAND(1,J,I),KCAND(2,J,I),KCAND(3,J,I))
     1  .GT. 0.5
  c again need substitute array
     +       .AND. ABS(SPR(KCAND(1,J,I),KCAND(2,J,I))).LE.SWIDTHR) THEN
               ICWCCD(I) = ICWCCD(I) + 1
               L = L + 1
               CWCCD(1,ICWCCD(I),I) = KCAND(1,J,I)
               CWCCD(2,ICWCCD(I),I) = KCAND(2,J,I)
               CWCCD(3,ICWCCD(I),I) = KCAND(3,J,I)
               CWTIMCCD(ICWCCD(I),I) = KCANDTIM(J,I)
               cwener(ICWCCD(I),I) = kcandener(J,I) !6jan06 benjil
               If (swath_mess.ge.10.and.swath_debug) Then
                  write(*,*)'SW KCand->Pi Mend ',i,j,l,NKCAND(I),
     +                 CWCCD(1,ICWCCD(I),I),CWCCD(2,ICWCCD(I),I),
     +                 CWCCD(3,ICWCCD(I),I),CWTIMCCD(ICWCCD(I),I)
               Endif
               KCAND(1,J,I) = KCAND(1,NKCAND(I),I)
               KCAND(2,J,I) = KCAND(2,NKCAND(I),I)
               KCAND(3,J,I) = KCAND(3,NKCAND(I),I)
               KCANDTIM(J,I) = KCANDTIM(NKCAND(I),I)
               kcandener(j,i)=kcandener(nkcand(i),i)
               NKCAND(I) = NKCAND(I) - 1
               KK = J
               GOTO 1050
            ENDIF
```

- Segment 4

```
                  IF (CROSS.LT.0..EQV.ICHARGE.GT.0) THEN
```

```
                        ICWCCD(I) = ICWCCD(I) + 1
                        CWCCD(1,ICWCCD(I),I) = IEL
                        CWCCD(2,ICWCCD(I),I) = IRO
                        CWCCD(3,ICWCCD(I),I) = 1   !? 1 in array....maybe wrong
                        CWTIMCCD(ICWCCD(I),I) = -999.
c     un-commented following line 6jan06 benjil
                        cwener(icwccd(i),i)=fib_e(iel,iro,1)
                        IF (swath_mess.ge.10.and.swath_debug) THEN
                           write(*,*)'SW Like +noTDC: ',i,
     +                          iro,iro,iel,icwccd(i)
                        ENDIF
                     ENDIF
```

Variable	raw	skimmed
dvb4d	0.00412	1.00000
rs_rate	0.00000	1.00000
nadpuld	1.00000	0.98568
adpuld	1.00000	0.32268
offadpul	0.57338	0.87574
tchimod	1.00000	0.99791
tchi5fib	1.00000	0.99791
tchi6fib	1.00000	0.99791
tchi7fib	1.00000	0.99791
TPI_TG	1.00000	0.99560
EPI_TG	1.00000	0.99560
SPR_TG	1.00000	0.99560
TGF_ARC	1.00000	0.99560
RANGE_TG	1.00000	0.99560
D_TO_FIB	1.00000	0.99560
ELPI_TG	1.00000	0.99560
ELPIP_TG	1.00000	0.99560
ITQPI	1.00000	0.99560
CCDTPI	1.00000	0.99560
CCDEPI	1.00000	0.99560
CCDHPI	1.00000	0.99560
CCDRPI	1.00000	0.99560
LCCDPI	1.00000	0.99560
CCD2L	1.00000	0.99656
TPVTG	1.00000	0.99360
EPVTG	1.00000	0.99360
ELEMPVTG	1.00000	0.99360
ELEMPPVTG	1.00000	0.99360
ITQG	1.00000	0.99360
CCDTPV	1.00000	0.99360
CCDEPV	1.00000	0.99360
CCDHPV	1.00000	0.99360
CCDRPV	1.00000	0.99360
LCCDPV	1.00000	0.99360

Table 1: Sample Ntuple differences

Ntuple Var	Raw file	Skim file
itgqualt2(1-6)	-1,-1,-1,0,0,0	-1,-1,-1,0,0,0
npi_tg	15	16
npvtg	17	16
npi_tg	5	5
epi_tg(16)	–	5.25978
tpi_tg(16)	–	22.9252
epvtg(.)	5.27601	–
tpvtg(.)	24.4963	–

Table 2: Ntuple quantities for Run=49302 event=21915

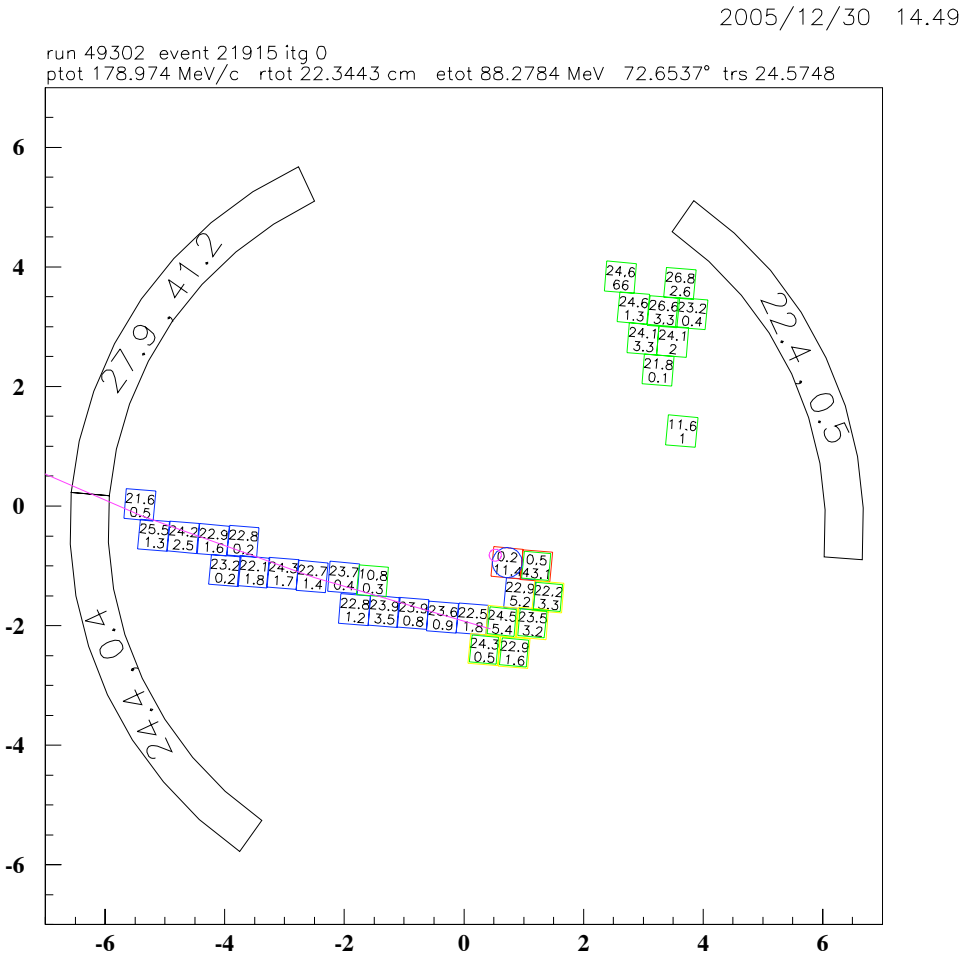

Figure 1: Target reconstruction of Run=49302 Event=21915 from raw file. pion hits are blue, photon veto hits are green, opposite-side pions are yellow, kaon hits are red. Times (ns) are on top and energies (MeV) are on bottom