Using PAW for simple beamtest analysis

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This note is a cookbook for the persons willing to use the HBOOK Ntuples made for a quick analysis of the beamtest data, without understanding the details of PAW.

0.1 Finding the data

The data are stored as column-wise ntuples, so far they can be found in the */nfs/slac/g/glast/ntuples* directory. Their names are typically cwn_run*runnumber*.hbook. Thus they are accessible to everyone having a SLAC account.

0.2 Starting the PAW session

0.2.1 Does PAW exist?

On your favorite UNIX/Linux machine, check that paw exists: type *which paw*, and if it knows PAW skip to the next section. Otherwise you have to include the binary file in your *PATH*. Just say *setenv PATH /cern/pro/bin:$PATH*, and then you should be able to run PAW.

0.2.2 Running PAW and loading the ntuple

Now type *paw*. The graphics window should appear on your screen.

To get the ntuple into PAW you have to do the following:

PAW> h/file 22 /nfs/slac/g/glast/ntuples/cwn_run*runnumber*.hbook

PAW> nt/pri 10

The last command shows the structure of the ntuple, with all the variables and the number of entries (i.e. recorded events). The most important is to notice here the different *BLOCKS* that are used: there is one for every subsystem plus one for the End Station A (ESA) data.

0.2.3 The tracker data

All the X-measuring planes are in the xtrak$[i, j]$ variable, and the Y-measuring planes are in the ytrak$[i, j]$ variable. The values inside these variables are *strip hit indexes*, and a raw conversion factor is the distance between strips which is of the order of 200 μm.

- The i index is the **plane idex**, the upper-most plane having the highest index;
- The j index is the **hit index.**

So ytrak[i, j] will give the index of the j^{th} strip that was hit in plane i measuring Y (or oriented along X). For an event, the value of j is the same for all the planes oriented along the same direction. The maximum value of j is 64 strips.

To make a histogram of *all* the strips that were hit in plane n for a given *spill-number* you have to do:

PAW> nt/plot 10.xtrak(n,:) spillnum=*spillnumber*

To see the full histogram for all the events, just remove the spillnum=*spillnumber* statement.

0.2.4 Calorimeter data

The calorimeter logs are identified by a number between 1 and 80, their side by **p**lus (+) or **m**inus (-), and the gain by low energy with gain (**lex**), low energy (**le**), high energy with gain (**hex**) and high energy (**he**). So the variable pcalle(i) identifies the low energy channel on the plus side of log number i.

0.2.5 ACD data

The anti-coincidence data is composed of 24 PMT values, of which only 16 should be active. Thus acdadc(i) identifies PMT numer i. Every PMT has an associated boolean which is acdhit(i), set to 1 if the discriminator fired on that event.

0.2.6 ESA data

A long list of ESA data is available. It includes a.o. the ESA position estimation for charged particles (the *xbeam* and *ybeam* variables), the estimated momentum of the radiated photon (the *mom(i)* array), the corrected time-of-flight *tofc* and the Čerenkov counter ADC value *cadc* useful for **particle ID** in the hadron beam.

0.2.7 Correlation plots

A good estimator of event sync is to check **expected correlations** in the data. Here are some examples:

- For charged particle runs

  1. Check the correlation between the top most strips and the ESA position estimation. Do something like:

     PAW> nt/plot 10.xtrak(16,:)%xbeam

     see figure 1.

  2. Look for a correlation between the ACD tile that is expected to be hit and the sum of digitized values in the calorimeter:

     PAW> nt/plot 10.acdadc(i)%toten(3)

     (see figure 2).

- For photon runs

  Check that the energy in the calorimeter is proportional to the estimated momentum:

  PAW> nt/plot 10.mom(1)%toten(i) onegoodg

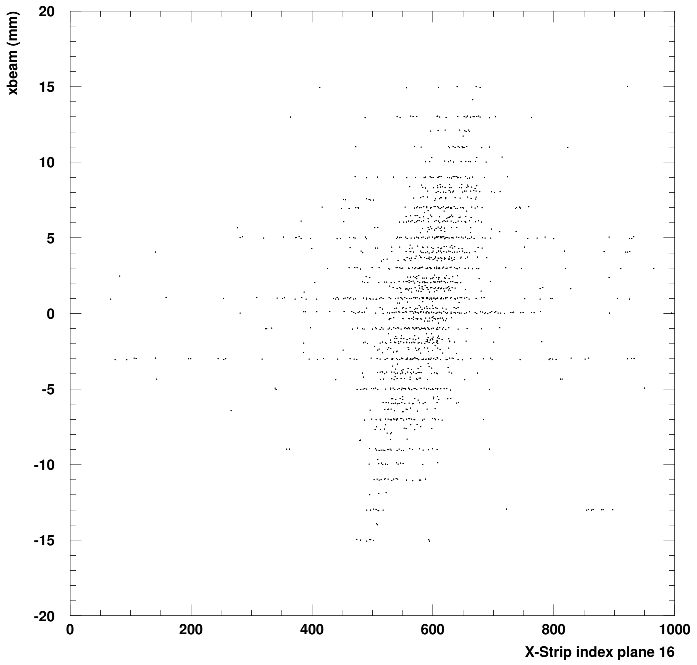

Figure 1: The xbeam position versus the X-strip index of layer 16.

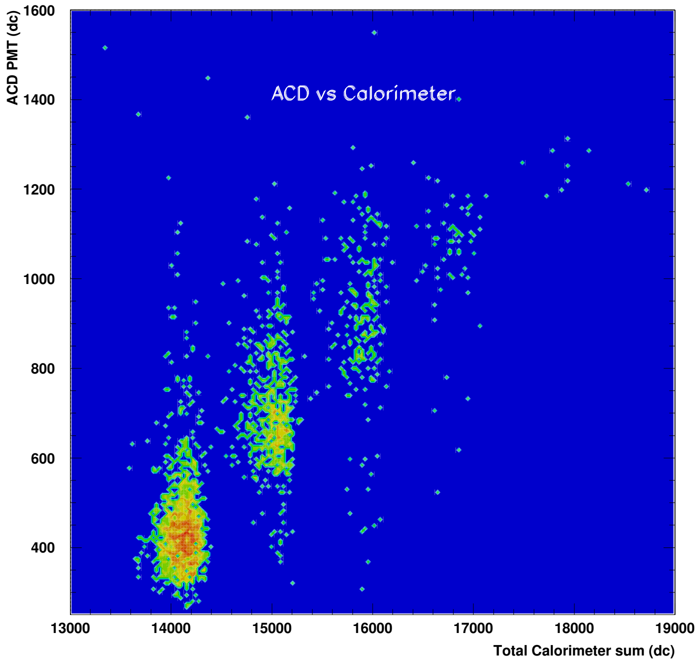

Figure 2: The acdadc(13) value versus the total energy toten(3) of the calorimeter (in dc). A clear separation of each multiple positron spill is seen in both subsystems.

0.2.8 Pedestals, noisy strips

If not using a specific pedestal run, the study of this is possible with charged particle runs, since you just have to plot the subsystem you want with a cut on the total energy so that it is below the 1 positron peak. Look at this distribution by typing

PAW> nt/plot 10.toten(i)

(see Fig 3) and find the value A of *toten(i)* that is below the first peak. Then, to plot the ACD pedestals for instance, one could do

PAW> nt/plot 10.acdadc(j) toten(i)$<$ A

where i is the ACD PMT number, j the chosen energy channel of the calorimeter sum, and A your cut value. Same thing for the tracker strips.

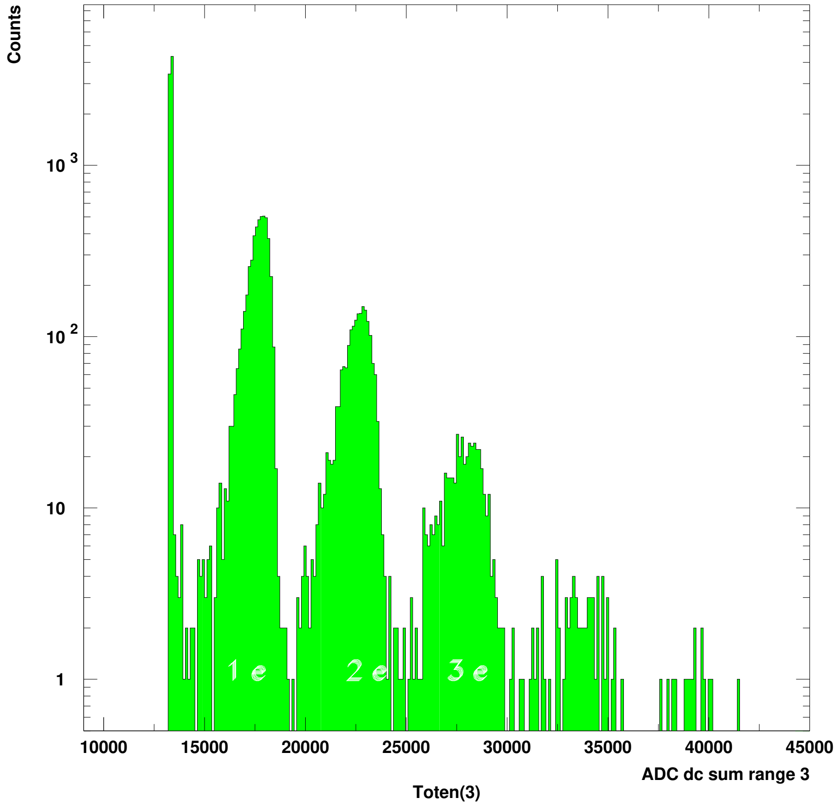

Figure 3: The toten(3) distribution for a 20 GeV electron run. The cut to apply here to get the ACD PMT 13 pedestal would be PAW> nt/plot 10.acdadc(13) toten(3)¡14950

0.3 For more..

Go to http://wwwinfo.cern.ch/asd/paw/index.html

To read the data with a C program, or for some PAW macros: www.slac.stanford.edu/ berrie/index.html