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The Online Monitoring for the PSI '94 Test Beam and the Cosmic Rays Stand of the Calorimeter

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Abstract

A user-friendly and interactive monitoring program has been developed for the PSI '94 Test Beam of the calorimeter. The consumer program has been written following the KLOE software guidelines and it is based on ANALYSIS_CONTROL, while the histograms presentation is done using PAW. The communication between the DAQ system and the monitoring task is established using a VMS Global Section while the communication between the consumer and the presenter makes use of a PAW Global Section.

These programs can be easily adapted to different needs; this has already been done for the Cosmic Rays Stand and for the tests of the chamber Proto 1. The usage of ANALYSIS_CONTROL allows a straightforward development of the consumer task by integrating the latest developments done offline.

1 The concept of consumer and presenter

The idea of a DAQ consumer is usually interpreted as a program able to get information online from the DAQ and perform some specific operations like histogramming, alarms, calibrations and so on.

For the Test Beam and the Cosmic Rays Stand (CRS) of the calorimeter we have developed two programs (TBMONI & CRSMON) having the task to book/fill the useful monitoring histograms. A different program – the PRESENTER – then allows to display them to the operator.

The least set of requirements we expect to be fulfilled by these programs are:

- To be flexible enough to quickly integrate what can be learn offline.
- To allow also not software experts to understand the detector behaviour by looking and manipulating histograms.

To satisfy the first request the consumer task has been written following the KLOE software guidelines[1] and has been based on ANALYSIS_CONTROL[2].

Communication between this program task and the DAQ system are established through a VMS Global Section while the sender-receiver process is based on the TCP-IP protocol[3].

The second request on the histograms presentation is satisfied by using PAW and its panels.

2 The consumer task

In this section we describe in details the CRSMON program since it will be used at CRS during the 1995 data taking. All the code is mantained on AXKLO1 in K$CRS area while a working copy is kept on AXRM05 machine. The executable image links together all the relevant modules developed offline[4] and the CRSMON module itself. Having correctly defined logicals by typing:

```
$ setup offline
$ setup CRS development
```

the declaration (CRSMON_JOB.UIC), the option (CRSMON.OPT) and the executable (CRSMON.EXE) files are in K$EXE area. The only differences to be kept in mind respect to the normal offline procedures are the following:

1. In the declaration file the line:
   `set utilities/hbk4='KLOE'`
   has to be substituted with:
   `set utilities/hbk4=ON`
   to advise A_C that a PAW Global Section named KLOE has to be used.

2. In the option file the lines
   `psect=event,page`
   `psect=smphor,page`
   `psect=pawc,page`
   have to be added in order to page align the commons in the Global Sections.

The CRSMON module books the required histograms at the initialization stage, fills them for each event by reading the information stored in the YBOS banks and then resets their content at the beginning of a new run. By the talk_to command the limits of the main histograms groups can be changed.

In order to use the program online just type:

```
$ run/nodeb k$exe:crsmon
ANA>> talk_to tbrmim io buffer return return
ANA>> begin
```

If instead you want to run on the disk file 'filename':

```
$ run/nodeb k$exe:crsmon
ANA>> talk_to tbrmim io disk 'filename' return return
ANA>> begin
```

The A_C driver allows a straightforward usage and development of the consumer task by simply integrating the latest offline developments. As an example a typical TDC distribution for a single calorimeter channel is reported in Fig. 1.a when the normal analysis path, given by the command

```
ANA>> use crhitm crtrak crsmon
```

is followed. The calibration pulses used at the CRS appear as peaks in this distribution. If the user wants to select them (take them out) from the plot he has just to use and activate the offline filter CRCALF with a select (veto) qualifier:

```
ANA>> use crcalf crhitm crtrak crsmon
ANA>> filter/specify crcalf 'qualifier'
ANA>> filter crcalf on
```

The plot in Fig. 1.b shows the TDC distribution for the same calorimeter channel when the filter is used as a veto.

3 PAW as the online presenter

PAW can be used as an online presenter on VMS systems using the mechanism of Global Section which allows two processes to access at the same time the same histograms. While the consumer runs and gradually fills the histograms, PAW can view and even reset them. The histograms are stored in a private common inside the Global Section called GlobName as specified by the consumer (we use GlobName = KLOE). To access the histograms inside PAW just type:

```
PAW > cd //KLOE
```

Since the histograms belong to the Global Section they cannot be modified by PAW but only by the consumer program.

A simple user interface for the presentation of histograms has been developed using the KUIP language inside PAW. In this way it is possible to create panels allowing to give commands by selecting buttons through the mouse. All the code defining the presenter for the CRS is contained in 6 macros which reside on AXRM05 machine in the area DISK$USER:[RUN.PRESENTER]. The macros are the following:

1.	CRS_SETUP.KUMAC	To define general aliases
2.	CRS_PRESENTER.KUMAC	To store the histograms limits in local arrays
3.	CRS_MAINPANEL.KUMAC	To create panels and to plot histograms
4.	CRS_SUBPANEL.KUMAC	
5.	CRS_SUBSUBPANEL.KUMAC	
6.	CRS_CHANGEHISTO.KUMAC	To work on histograms (modifying limits [1], zooming, rescaling ...)

To define the right aliases add in your PAWLOGON or type in the PAW session

```
PAW > exec disk$user:[run.presenter]crs_setup
```

while to start the monitoring inside PAW give the command

```
PAW > presenter
```

and the main menu (Fig. 2) pops up. From that moment on you can play around using only the mouse[2]. The last button of the menu (BACK TO PAW) brings back to the normal PAW prompt and keyboard input. Just typing

```
PAW > mainpanel
```

it is possible to restore the main menu and the mouse usage.

A description of the CRS panels will be given in the next section; here we describe in details one of them in order to explain the main ideas. The subpanel ADC HISTOS (Fig. 3) can be selected clicking with the mouse the appropriate button in the main panel; in this way the histograms of pulse height for all the 120 PMs of a calorimeter module are available to the user. The histograms are organized as 4 groups of 15 channels for each side, each group consisting of 3 phi columns[3]. Clicking one of these buttons the display of the group is activated and the panel gets enriched of options for histograms manipulation (Fig. 4). Aside from the option TOTAL RESET which fully zeroes the PAW Global Section, two types of operations are possible. The first ones regard a single histogram while the second ones work on the global page. Both types of commands are listed below.

[1] As already remarked, modifications of the histograms limits can be done only by the consumer. We have therefore adopted the strategy to book histograms with a huge number of bins in order to enlarge the region selected by the user.

[2] All the normal operations are performed with the left mouse button.

[3] PHI 1-3 A means phi coordinate from 1 to 3, side A. A description of the coordinate system can be found in ref. [5]

Single histogram commands:

LOCATE Moving the mouse in your favorite histogram and clicking inside it, displays the histogram identifier the x and y positions of the cursor together with the correspondent bin number. This operation can be repeated as many times as needed. To terminate it just push the right mouse button.

ZOOM HISTO To enable this command it is necessary to select a specific histogram clicking with the mouse inside it. Once the selection is activated another click on the right mouse button displays the histogram full page (Fig. 5) and allows the PAW zoom procedure to start. When the zoom operation is closed the panel in Fig. 6 appears allowing to go back both to the previous and to the main panel.

RESCALE HISTO It works as the ZOOM option but saves in memory the last definition of the histogram limits.

Global page commands:

UPDATE HISTOS Refresh the histograms content adding the statistics collected from the consumer since the last display.

STATISTICS ON/OFF Toggle between the two options. When the option is ON the usual PAW statistics box is displayed.

RESET HISTOS SCALE Allows, after a rescale operation, to restore the default histograms limits.

PS FILE Save in a file called PAW.PS the current screen page.

4 The CRS presenter panels

Aside the calorimeter module itself, the CRS uses a trigger and tracking system composed by a set of 12 scintillation counters and 4 planes of Iarocci's tubes readout both in y and z coordinates[5, 6]. The panels are therefore organized in two main categories:

1. Calorimeter panels:

   - ADC/TDC/PED HISTOS
     Each of these panels gives informations on signals arriving from the 120 calorimeter PMs as already explained in sec. 3 for the ADC case. The TDC page contains the distributions of arrival times as recorded by the

TDC while the PED page displays the PM pulse height in a region around zero allowing to check the zero subtraction.

- ADC/TDC/PED SUMMARY
  These pages allow to quickly identify dead channels by looking at the histograms of the mean and sigma of the ADC distributions as function of the channel number (Fig. 7).
- ADC-ADC/ADC-TDC CORRELATION
  These pages are again useful on searching for calorimeter dead channels. For example the ADC-TDC correlation of a cell helps to disentangle if the PMs, the TDC or the ADC are dead.

2. Trigger and tracking panels:

   - SCINTILLATORS HISTOS
     Scintillation counters are read out in both sides. Distributions of each TDC signal and of the difference of the two sides (Fig. 8) allow to check the counters behaviour. A frequency map of the fired counters is also available.
   - STRIP/HIT/FIT HISTOS
     The strips average behaviour is controlled by an hit frequency map both in the y and z coordinate. In Fig. 9 the frequency maps for the z-strips are shown, in the first plot an evident “hot” strip can be observed.
     The results of the tracking reconstruction are reported in the FIT panel; as an example in Fig. 10 the slopes in the x-z and x-y planes are shown together with the azimuthal and polar angles respect to the normal of the calorimeter surface.

Acknowledgement

We would like to thank first of all H. Beker for showing us the usage of KUIP panels in PAW. We want also to thank F. Donno and F. Pelucchi for the help given in the offline reconstruction and C. Bini, R. Haydar,L. Keeble, S. Wolfle for the nice work done on the development of the CRS offline tools.

References

[1] F. Donno, F. Pelucchi *Guidelines for Writing or Modifying KLOE Software*, KLOE Note No. 73, November 1993.

[2] KLOE$DOC:A_C.MEM.

[3] The sender receiver program has been in a status of continuous development since the PSI'94 test beam. The job was mostly done by H. Beker,M.C. Ferrer, A. Martini, E. Pasqualucci. The last working version has an x-motif interface (x-receiver) implemented by W. Grandegger.
The library to write consumer task is receiver.olb(?) and the right calls to this library has been implemented in A_C TBRMIM input module by F. Donno.

[4] A. Anelli et al.: KLOE Note in writing.

[5] A. Andryakov et al.: *KLOE Metric*, KLOE Note No. 115, September 1994.

[6] H. Beker et al.: KLOE Note in writing.

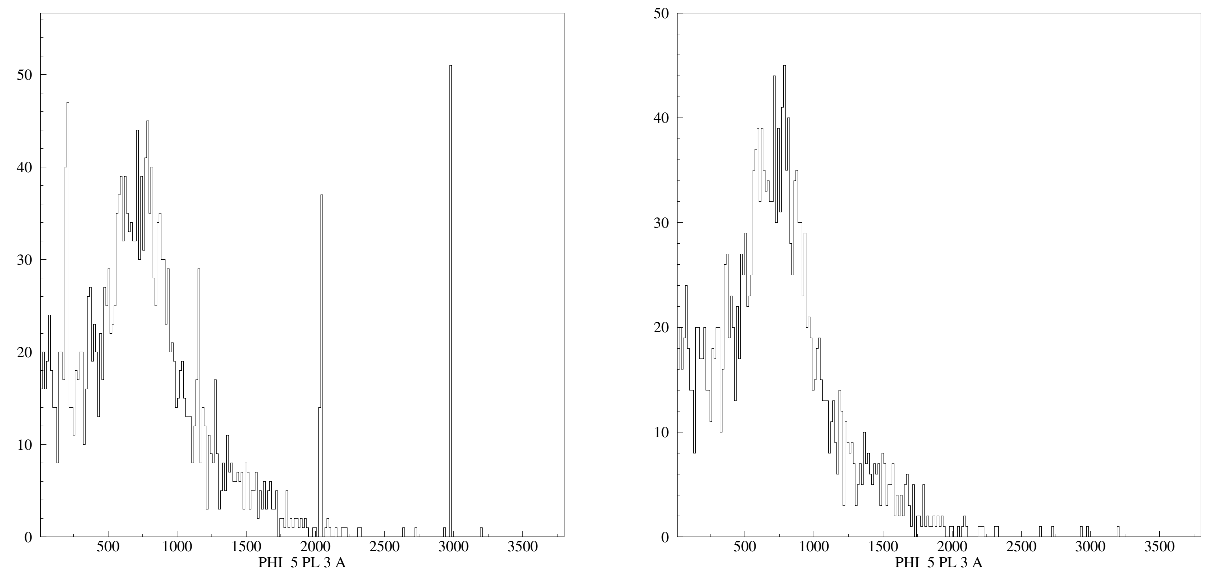

Figure 1: Distribution of a TDC calorimeter channel without (a) and with (b) the veto filter.

ADC HISTOS	ADC SUMMARY
TDC HISTOS	TDC SUMMARY
PED HISTOS	PED SUMMARY
SCINTILLATORS HISTOS	ADC-ADC CORRELATION
STRIP HISTOS	ADC-TDC CORRELATION
HIT HISTOS	FIT PARAMETERS
	BACK TO PAW

Figure 2: Main panel.

<table>
<tr><td colspan="4">ADC HISTOS</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>PHI 1-3 A</td><td>PHI 1-3 B</td><td></td><td></td></tr>
<tr><td>PHI 4-6 A</td><td>PHI 4-6 B</td><td></td><td></td></tr>
<tr><td>PHI 7-9 A</td><td>PHI 7-9 B</td><td></td><td></td></tr>
<tr><td>PHI 10-12 A</td><td>PHI 10-12 B</td><td></td><td></td></tr>
<tr><td></td><td></td><td>BACK TO MAINPANEL</td><td>BACK TO PAW</td></tr>
</table>

Figure 3: ADC histograms panel.

ADC HISTOS			
PHI 1-3 A	PHI 1-3 B	UPDATE HISTOS	ZOOM HISTO
PHI 4-6 A	PHI 4-6 B	TOTAL RESET	RESCALE HISTO
PHI 7-9 A	PHI 7-9 B	LOCATE	RESET HISTOS RANGE
PHI 10-12 A	PHI 10-12 B	STATISTICS ON	PS FILE
		BACK TO MAINPANEL	BACK TO PAW

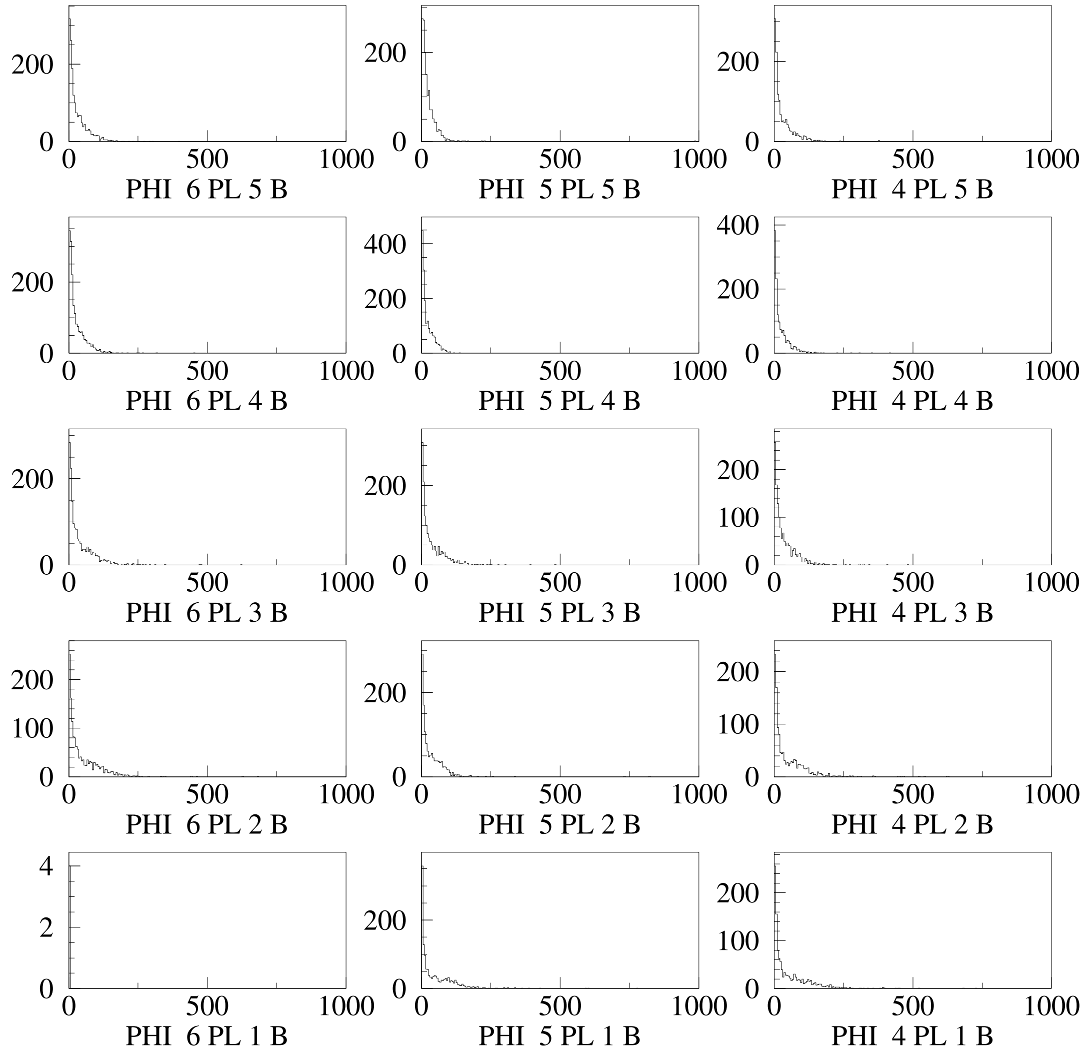

Figure 4: ADC page histograms.

ADC HISTOS			
PHI 1-3 A	PHI 1-3 B	UPDATE HISTOS	ZOOM HISTO
PHI 4-6 A	PHI 4-6 B	TOTAL RESET	RESCALE HISTO
PHI 7-9 A	PHI 7-9 B	LOCATE	RESET HISTOS RANGE
PHI 10-12 A	PHI 10-12 B	STATISTICS ON	PS FILE
		BACK TO MAINPANEL	BACK TO PAW

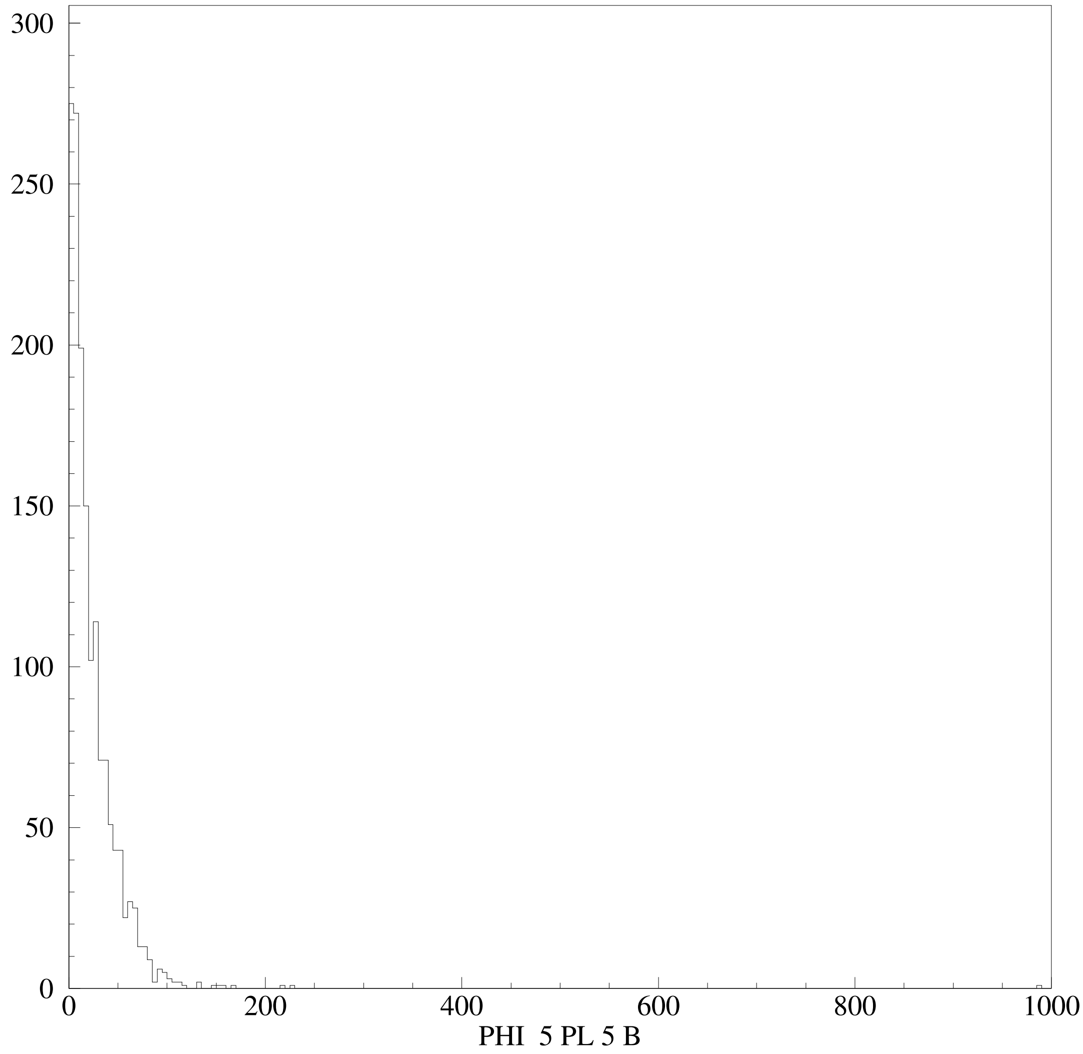

Figure 5: Single ADC histogram.

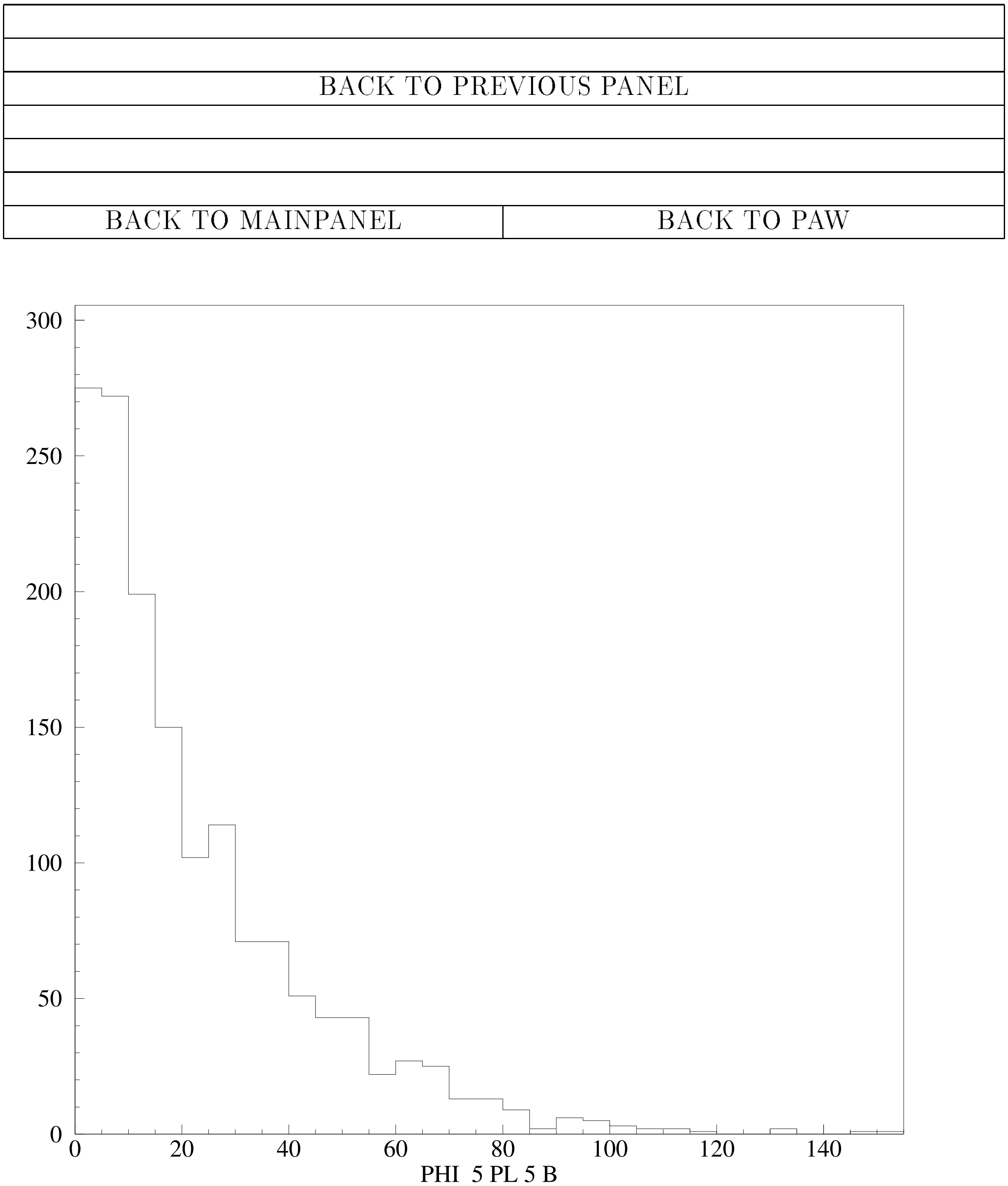

Figure 6: Zoomed ADC histogram.

ADC SUMMARY	
UPDATE HISTOS	ZOOM HISTO
TOTAL RESET	RESCALE HISTO
LOCATE	RESET HISTOS RANGE
STATISTICS ON	PS FILE
BACK TO MAINPANEL	BACK TO PAW

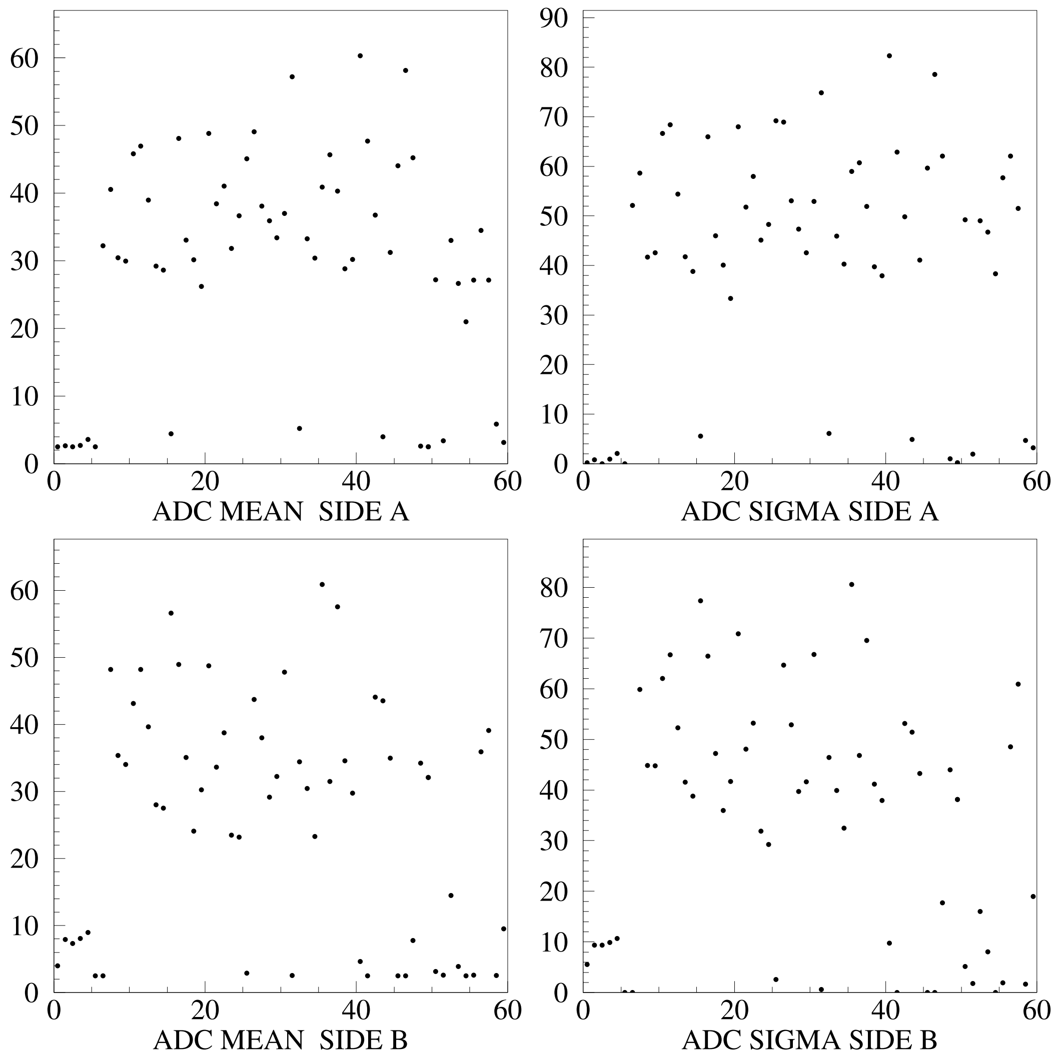

Figure 7: ADC summary histograms.

SCINTILLATORS HISTOS		
SIDE A	UPDATE HISTOS	ZOOM HISTO
SIDE B	TOTAL RESET	RESCALE HISTO
SIDE A-SIDE B	LOCATE	RESET HISTOS RANGE
SCINT MAP	STATISTICS ON	PS FILE
STRIP TRIGGER	BACK TO MAINPANEL	BACK TO PAW

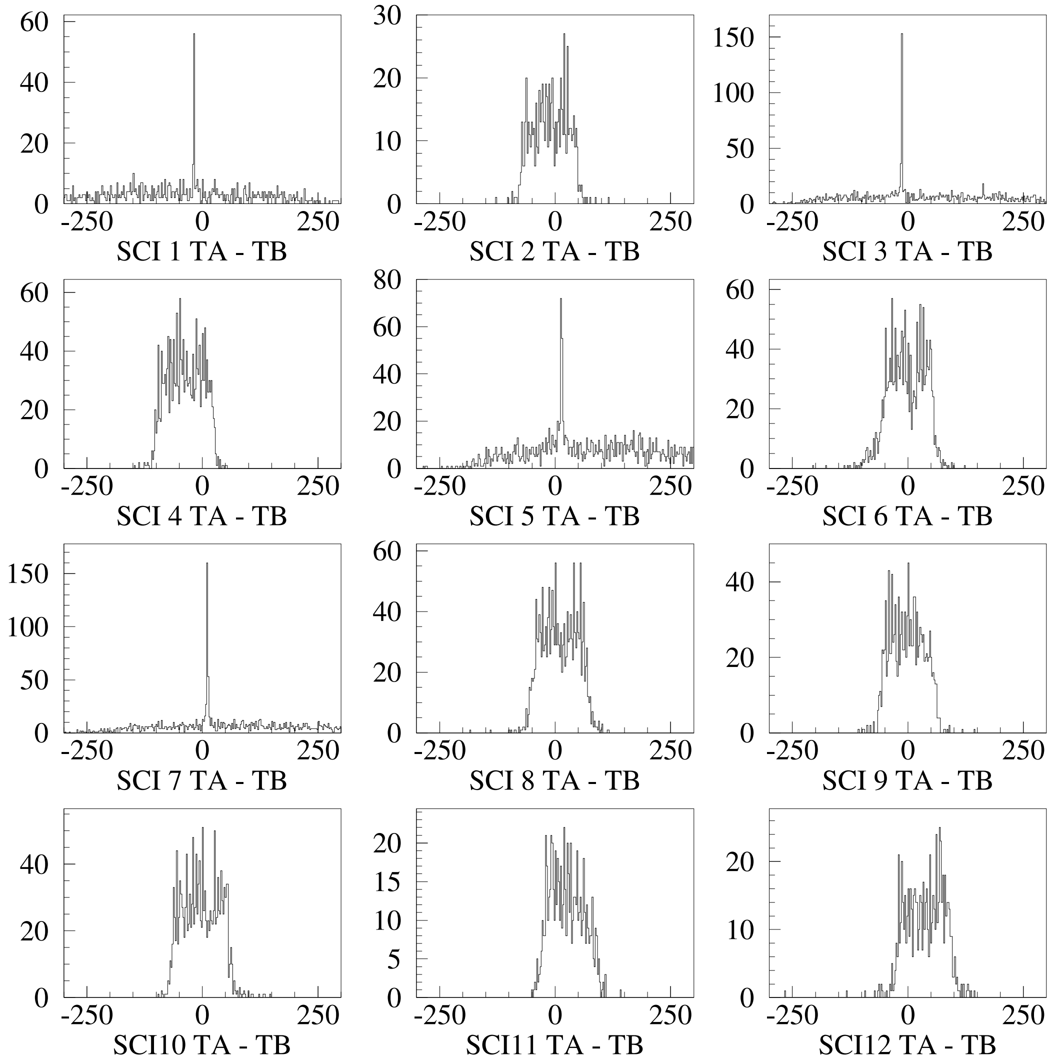

Figure 8: Scintillators time difference.

HIT HISTOS		
Y AND Z POSITION	UPDATE HISTOS	ZOOM HISTO
Y CLUSTER LENGTH VS POS	TOTAL RESET	RESCALE HISTO
Z CLUSTER LENGTH VS POS	LOCATE	RESET HISTOS RANGE
Y STRIPS HIT MAP	STATISTICS ON	PS FILE
Z STRIPS HIT MAP	BACK TO MAINPANEL	BACK TO PAW

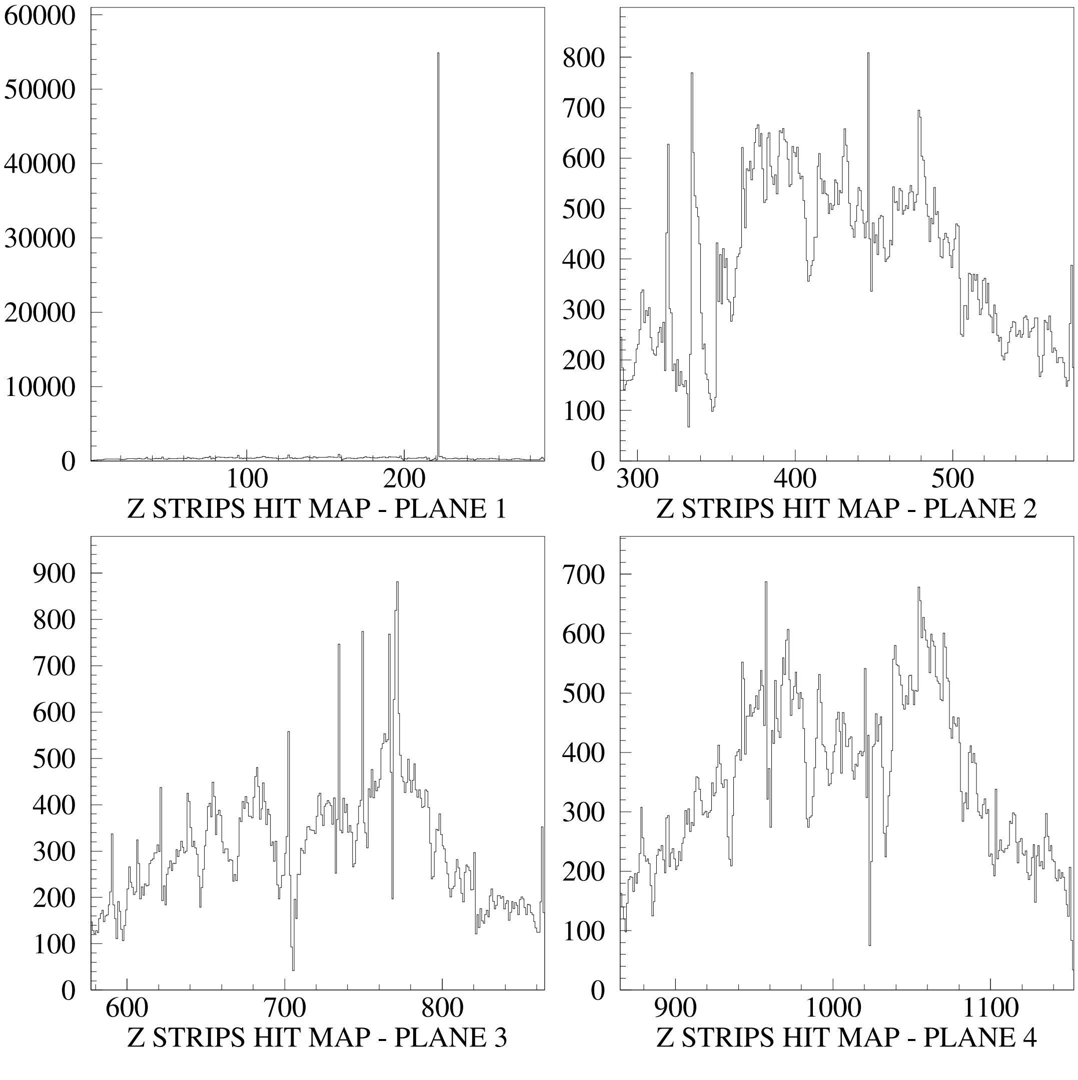

Figure 9: Frequency maps for the z-strips.

FIT HISTOS		
CHI2	UPDATE HISTOS	ZOOM HISTO
INTERCEPT	TOTAL RESET	RESCALE HISTO
SLOPES	LOCATE	RESET HISTOS RANGE
	STATISTICS ON	PS FILE
	BACK TO MAINPANEL	BACK TO PAW

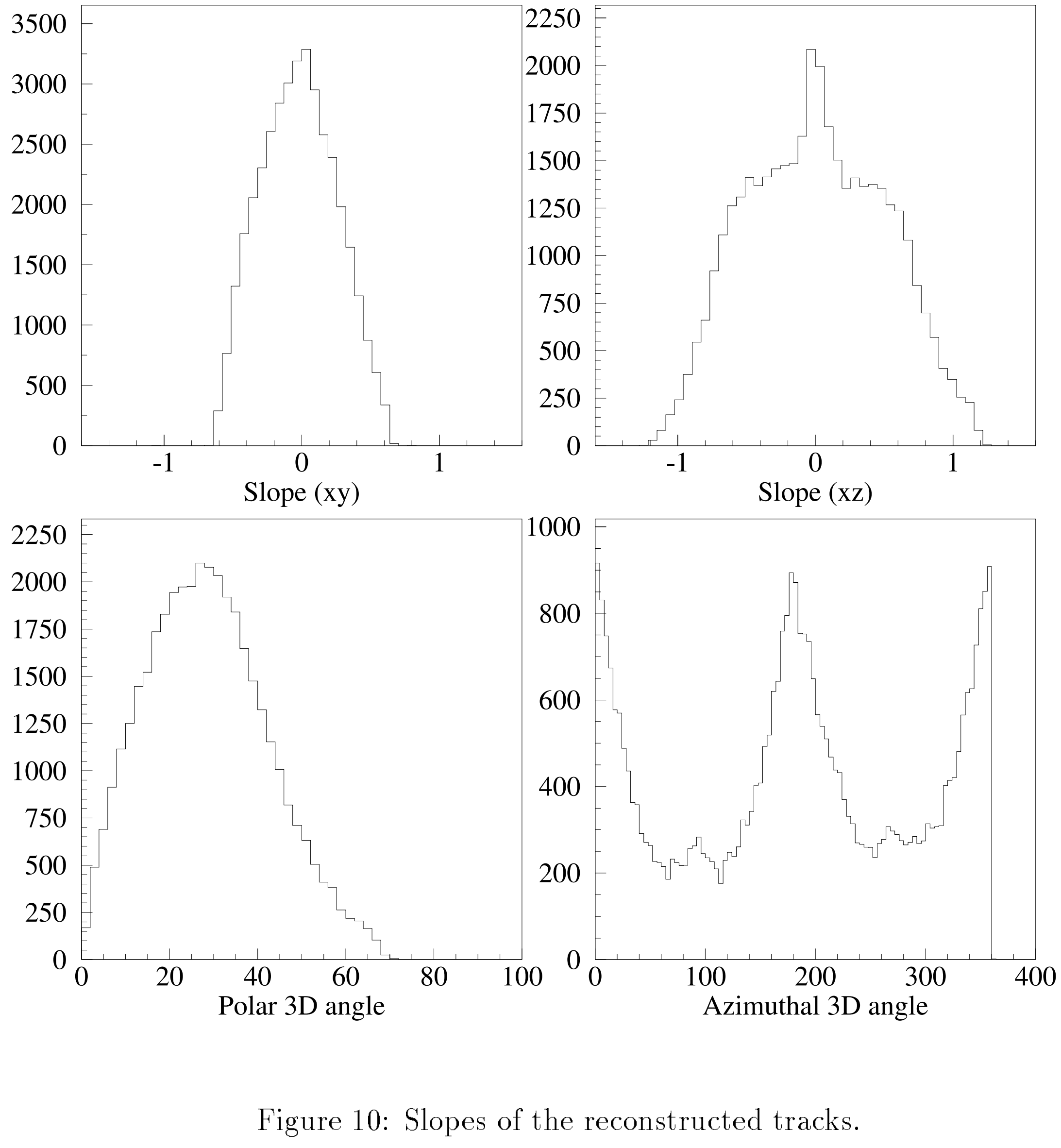

Figure 10: Slopes of the reconstructed tracks.