CHAPTER 1

PCA Science Monitoring User's Guide

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1.1 Introduction

1.1.1 Identification of Document

This is the User's Guide of the EDS/PCA Science data monitoring portion of the Science Monitoring Subsystem of the XTE SOF software project.

1.1.2 Scope of Document

This document is written for the end users. No system design or program methods are discussed.

1.1.3 Purpose and Objectives of Document

The purpose of this document is to provide end users (Instrument PI team members, Guest Observers, Duty Scientists, and Mission Operators. etc.) with step-by-step instructions explaining how to execute the software.

1.1.4 Document Status and Schedule

Development of the EDS/PCA Science Monitoring system started at the beginning of the Build 3. Currently, this document describes Build 3.3 capabilities of the system, and will be updated showing more functionality of the system as the build plan progresses and is implemented.

Following shows incremental update schedule.

1. March 31, 1994 - Build 3 document

- Monitor Standard Mode 1 Light Curve for detectors 1-5
- Monitor Standard Mode 1 Calibration
- Monitor Standard Mode 2 Spectra for detectors 1-5

2. October 15, 1994 - Build 3.3 document

- Monitor Standard Mode 2 Background Rates
- Usage of Top Level GUI
- Monitor Spectral Science - Base Mode

3. October 31, 1994 - Build 4 document

- Monitor Spectral Science - Colors Mode
- Monitor Spectral Science - Recommend Mode
- Monitor Spectral Science - History Mode

4. July 31, 1995 - Build 4.4.1 document

- Monitor Temporal Science -Power
- Monitor Temporal Science - Power History

5. After August 31, 1995 (Expected Launch Date)

- Maintenance only

1.1.5 Documentation Organization

1. Section 1 identifies general information about this document, such as scope, status, schedule and organization of this document.
2. Section 2 identifies any related document.
3. Section 3 describes overview of purpose and functions.
4. Section 4 lists installation guide.
5. Section 5 shows how to start the system and end it normally.
6. Section 6 describes step-by-step instruction to execute various functions currently implemented.
7. Section 7 will contain Error and Warning messages.
8. Section 8 will describe recovery procedures in case of abnormal termination.
9. Section 9 - Abbreviations and Acronyms
10. Section10 - Glossary
11. Section 11 - Notes
12. Section 12 - Appendices

1.2 Related Documentation

1.2.1 Parent Documents

None.

1.2.2 Applicable Documents

Design of the EDS/PCA Science Monitoring is greatly influenced by following.

Notes on EDS/PCA Science Monitoring for Build 3 by Barry Giles --- Jan. 1994

1.2.3 Information Documents

Science Monitoring (Build 3) by David Hon and Hwa-Ja Rhee --- Feb 25, 1994

PCA Science Monitoring by Hwa-Ja Rhee --- March, 1994

The two documents mentioned above describe the design of the Science Monitoring Subsystem more fully. The first one describes XTE SOF Science Monitoring Subsystem design, while the second document explains EDS/PCA portion of the system.

1.2.4 Overview of Purpose and Functions

Although the PCA Science Monitoring can stand alone, it was designed as one of the building blocks of the Science Monitoring Subsystem of the XTE SOF. The main purpose is to monitor real-time (or near real-time) PCU/EDS science data continuously during mission to insure that all detectors are working properly.

When fully implemented, this system will have the following functionalities:

- Monitor Standard Mode 1 Rates(Light Curves)
- Monitor Standard Mode 1 Calibrations
- Monitor Standard Mode 2 Spectra
- Monitor Standard Mode 2 Background Rates
- Monitor Temporal Science -Power
- Monitor Temporal Science -Power History
- Monitor Spectral Science - Base Mode
- Monitor Spectral Science - Colors Mode
- Monitor Spectral Science - Recommend Mode
- Monitor Spectral Science - History Mode
- TBD

1.3 Installation and Initialization

1.3.1 System (Hardware) Environment

The hardware used to develop this system is Sun 4 SPARC ipx station. Codes should be compatible on Solaris Operating System also.

1.3.2 Software Environment

Sun OS version 4.1.3 and Sun Solaris.

Roque Wave tools.h++ version 5.1 (Build 3.1 and earlier)

Roque Wave tools.h++ version 5.2 (Build 3.2)

Roque Wave tools.h++ version 6.0 (Build 3.3 and after)

TAE+ 5.3

AT&T CFront c++ compiler

CenterLine 2.0.4 by Object Center programming development environment

CenterLine 2.1 (Build 4 and after)

1.3.3 Installation

For each EDS/PCA mode, there will be a separate X-client program, a copy of whose executable program should be copied from $SOCHOME/bin/$ARCH in the XTE SOC to a directory in the user's path. It expects SOCHOME, SOCLOCAL and SOCOPS environment variables to be defined when it is executed.

Following shows major portion of RCS tree structure in the $SOCHOME directory for a reference. (Science Monitoring subdirectory is highlighted.)

/bin - all executables

/include - Header files

/lib - object libraries

/man - manual pages

/src/SciMonitoring/PCA - contains subdirectories for each standard mode source code, makefiles for corresponding X-client. Also there is one directory for the RT-client for common use for PCA monitoring.

1.4 Start-up and Terminate

Following environment variables should be set in the XTESOC to start execution properly.

setenv SOCHOME /socsoft/SOC-IntTestMaster (or your own)

setenv SOCLOCAL /socsoft/local (or your own)

setenv SOCOPS /socsoft/socops (or your own)

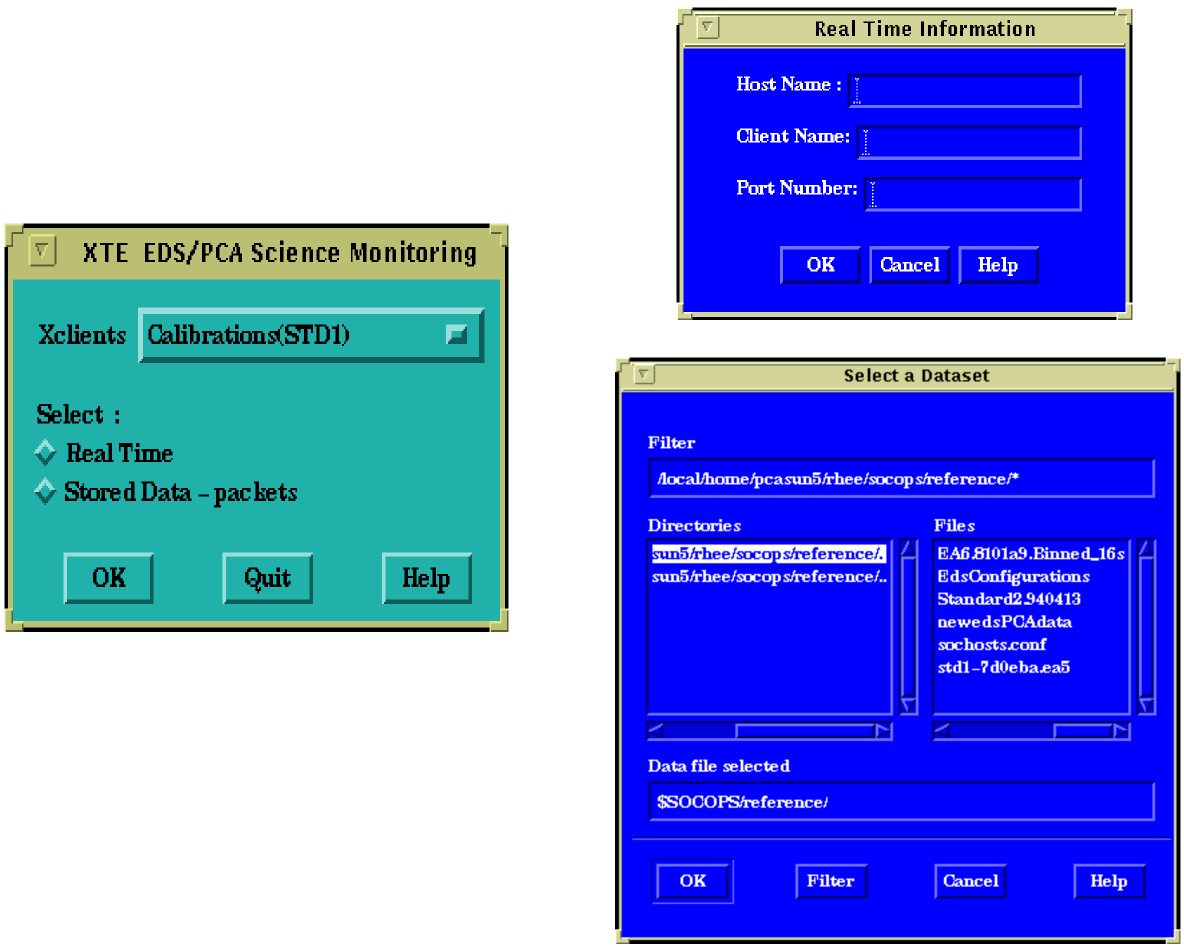
To start stand-alone PCA Science Monitoring, type following:

$SOCHOME/bin/$ARCH/pcaSM

Top level GUI(Graphical User Interface) window showing in Figure 1 will appear: (Detailed functionalities of the items on the GUI will be explained in the next section.)

To terminate, click on ***Quit*** button at the bottom.

FIGURE 1 PCA Science Monitoring Top Level GUI (Graphical User Interface)



1.5 Functions and Their Operation

1.5.1 Purpose of functions

The main purpose of this subsystem is to monitor EDS/PCA Science data in real-time/ near real-time. Standard Mode 1 and Mode 2 are implemented for Build 3 and other Modes will be added as the build plan progresses.

1.5.2 Step by step instructions using user interface

1.5.2.1 To start PCA Science Monitoring, Type:

$SOCHOME/bin/$ARCH/pcaSM

The left window (***Start*** Window) showing in Figure 1 will appear.

1. Select a Display Xclient from *option Menu.*
2. Select ***Real Time*** or ***Stored Data*** depending on the kind of data you want to monitor.

- If ***Real Time*** is selected, the panel titled ***Real Time Information*** will appear. Type necessary information such as ***Host Name, Client Name*** and ***Port Number*** onto the keyin fields. when finished, Click on ***OK*** button. This panel will be iconified.
- If ***Stored Data*** is selected, the panel titled ***Select a Dataset*** will appear. Click on the dataset you want to monitor. This data should be in the form of Archived data *packets*, not *partitions* or *objects.* You may change the directory by changing filter if your data are in different directory. Currently, default directory is $SOCOPS/reference. Click on ***OK***, this panel will be iconified also.

(note: step 1 and step 2 may be interchangeable)

3. click on ***OK*** button in the ***Start*** window, Xclient panel of your choice should appear after some seconds. For example, if you selected ***Spectra(STD2)***, Xclient showing in Figure 2 will appear.

1.5.2.2 Standard Mode1 Calibration and Standard Mode2 Energy Spectra

These two Xclients have similar user interface look and button functionalities. Therefore only one (pcastd2/StdMode2, see Figure 2) is explained here in detail.

Also, I would like to mention that, although it is more convenient running these Xclients from the PCA Science Monitoring top level GUI (*pcaSM*), these and other Xclients mentioned following sections can be invoked independently.

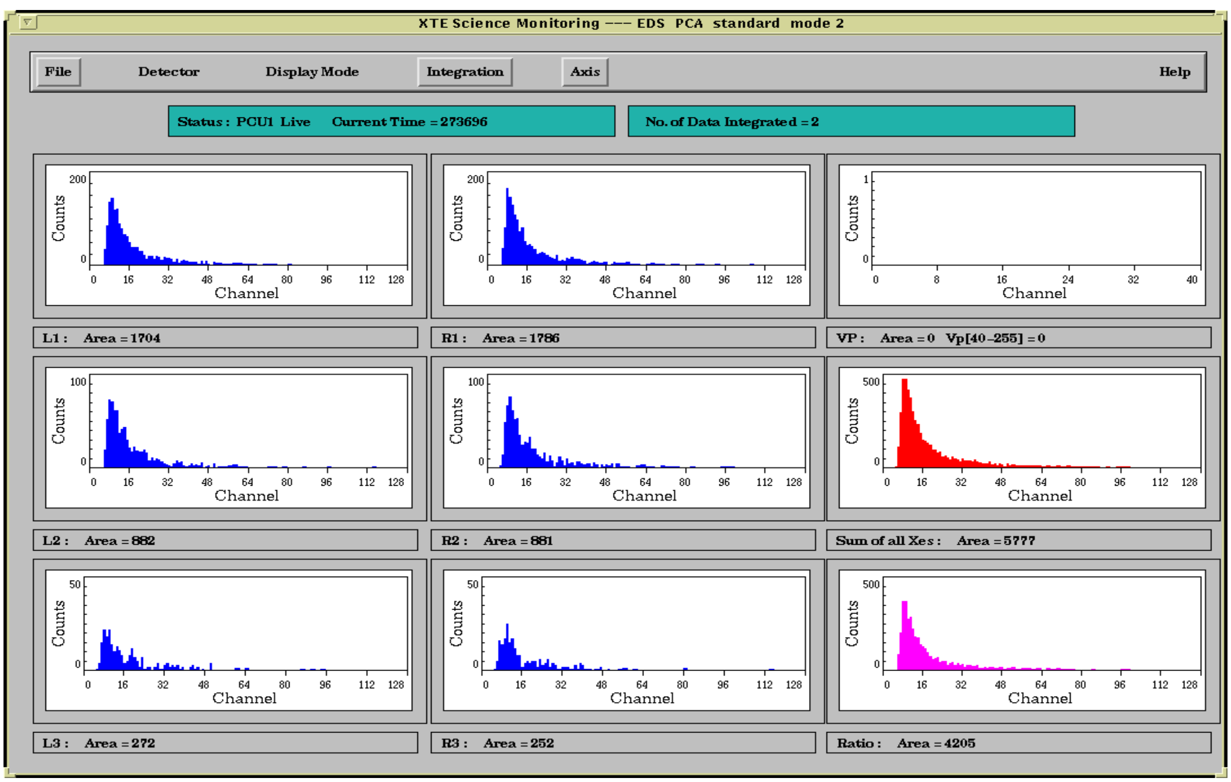
- To monitor data from dataset, type
  cat $SOCOPS/reference/newedsPCAdata*[1] | *$SOCHOME/bin/$ARCH/pcaRtClient -read-from-stdin -display-client $SOCHOME/bin/$ARCH/pcastd2[2]
  ($ARCH should be set 'SunOS4' or 'SunOS5')
  (1: replace dataset name with the one to be monitored)

(2: replace program names appropriately... other names are; pcastd1CalS, pcastd1LC, pca2Rate, pcaSBase, pcaSColor, pcaSRecom, and pcaSHist.)

- To monitor real-time data, real-time server should be running.
  Then, type
  $SOCHOME/bin/$ARCH/pcaRtClient -host hostname[1]-name client-name[1] -display-client $SOCHOME/bin/$ARCH/pcastd2[2]
  (1: replace appropriately)
  (2: replace appropriately)
  ($ARCH should be set 'SunOS4' or 'SunOS5')

- Once Xclient panel displays, open various pulldown menus and click on various menu buttons.

FIGURE 2 STANDARD MODE 2 SPECTRA SCIENCE MONITORING PANEL



Following explains items in the Pulldown Menu of the Figure 2 User Interface

File

- Freeze - freezes graphics display. This is a toggle switch, each click freezes or unfreezes
- Save(in ascii) - creates ascii file for the plotted data on the screen.
- PostScript- generate *.ps file for the plot. one postscript file for each Xworkspace window.
- Quit - terminates execution

Detector

- PCU 1- select PCU1 data to display
- PCU 2- select PCU2 data to display
- PCU 3- select PCU3 data
- PCU 4- select PCU4 data
- PCU 5- select PCU5 data
- Sum - calculates sum of all PCU detectors for display

Display Mode

- Live - displays data as one partition of data comes in
- Integ - displays accumulated data.
- Late Data - if set, start monitoring over due data. Whenever incoming partition is late, a window pops up.
- Strip Chart - if set, difference of MET is showing in strip chart graph.

Integration

- start - starts integration of all detectors and all layers
- stop - stops integration of all data.
- clear - resets integration counter and all integration arrays to zeros.

Axis

- Xaxis

  min - Xaxis channel number range is set to max (256).

  zoom - Xaxis channel number range is doubly expanded (max is 256)

  ZOOM - Xaxis channel number range is halved (min is 32)

  MAX - Xaxis channel number range is set to min (32), i.e. fully zoomed.
- Yaxis

  LinearFree - Each layer's scale is individually calculated in linear scale

  LinearFixed - Each layer's maximum and minimum values are combined and fixed to calculate common linear scale.

  LogFree - Each layer's scale is individually calculated in log scale.

  LogFixed - Similar convention as above to calculate log scale.

1.5.2.3 Standard Mode1 Light Curve

Following explains items in the Pulldown Menu of Standard Mode 1 Light Curve Xclient User Interface

File

These are explained in previous section.

- Freeze
- Save(in ascii)
- PostScript
- Quit

Select

- Sum All Good Xenon - displays sum of Xenon data from all 5 detectors.
- Sum All Very Large Events - displays sum of Very Large Event
- Sum All Propane Events - displays sum of all Propane data from all 5 detectors.
- Sum All Other Events - displays all other events not included above.
- PCU1 - isolates and displays PCU1 Xenon data.
- PCU2 - isolates and displays PCU2 Xenon data.
- PCU3 - isolates and displays PCU3 Xenon data.
- PCU4 - isolates and displays PCU4 Xenon data.
- PCU5 - isolates and displays PCU5 Xenon data.
- All 5 PCUs - displays all 5 individual PCU's Xenon data.

Yaxis

- Linear - actualMin - ymin is actual minimum data value.
- Linear - zeroMin - minimum plot value is forced to be zeros in linear scale.
- Log - actualMin - ymin is actual minimum value of light curve array
- Log - zeroMin - minimum value is forced to be zeros. (in Log scale)

Statistics

- totalCounts - calculates total area under the curve in number of total Counts regardless of binsize.
- counts/sec - total counts is adjusted by dividing by total time accumulated.

Options

- X1 (125ms bins) - data are in 125 ms bins (original light curve binsize)
- X2 (250ms bins) - data are compressed into 250 ms bins.
- X4 (500ms bins) - data are compressed into 500 ms bins.
- X8 (1s bins) - data are compressed into 1 second bins.

- X16 (2s bins) - data are compressed into 2 second bins.
- X32 (4s bins) - data are compressed into 1024 4 second bins.
- X64 (8s bins) - data are compressed into 8 second bins.
- X128 (16s bins) - data are compressed into 16 second bins.

Display

- with Gaps - checks data MET gaps, display data showing gap.
- without Gaps - ignore time gaps for data display.
- Late Data
- Strip Chart

1.5.2.4 Standard Mode2 Background Rates

Following explains items in the Pulldown Menu of Standard Mode 2 Background Rates monitoring Xclient User Interface

File

These are explained in previous section.

- Freeze
- Save(in ascii)
- PostScript
- Quit

Detector

- PCU 1- select PCU1 data to display
- PCU 2- select PCU2 data to display
- PCU 3- select PCU3 data
- PCU 4- select PCU4 data
- PCU 5- select PCU5 data

Yaxis

- Linear - actualMin - ymin is actual minimum data value.
- Linear - zeroMin - minimum plot value is forced to be zeros in linear scale.
- Log - actualMin - ymin is actual minimum value of the data array
- Log - zeroMin - minimum value is forced to be zeros. (0.1 in Log scale.)

Statistics

- totalCounts - calculates total area under the curve in number of total Counts regardless of binsize.
- counts/sec - total counts is adjusted by dividing by total time accumulated.

Display

- with Gaps - checks data MET gaps, display data showing gap.
- without Gaps - ignore time gaps for data display.
- Late Data
- Strip Chart

In addition to Main Menu items, there are 29 push button items from which user should select up to 10 items (5 from each group) to monitor.

Group 1

- VLE rate - any event with VLE flag set
- Vp & L1
- Vp & R1
- Vx & L1
- Vx & L2
- Vx & L3
- Vx & R1
- Vx & R2
- Vx & R3
- L1 & R1
- L2 & R2
- L3 & R3

Group 2

- 3 Discr - any 3 discriminators
- 4 Discr - any 4 discriminators
- 5 Discr
- 6 Discr
- 7 Discr
- 8 Discr
- Calib Rate - any event with Alpha set, but not VLE
- Low E Veto - low energy Veto events
- Med E Veto - medium energy Veto events
- High E Veto - high energy Veto events
- Vp + one LLD - Vp + one LLD in lower xenon layers
- L1 & L2
- R1 & R2
- R2 & R3
- L2 & L3
- Other 2 LLD - other 2 LLD events
- Event w/no LLd - events with no LLD

1.5.2.5 Spectral Science Mode - Base

Following explains items in the Pulldown Menu of the Spectral Science Mode - Base, a variation of the Standard Mode 2, Xclient User Interface.

File

These are explained previously.

- Freeze
- Save(in ascii)
- PostScript
- Quit

Layer

- All - counts from all layers are added to calculate detector counts
- Sub.3 - L1+R1+L2+R2-(2*(L3+R3)) formula is used to calculate each detector counts

Combine

- Raw - add all PCUs "as is" after adding layers.
- Corrected - after adding layers, GAIN/OFFSET is applied to each detectors before adding all PCUs.

Display

- Live - displays data as one partition of data comes in
- Integ - displays accumulated data
- Late Data - explained previously
- Strip Chart - explained previously

Integration

- start - starts integration of all detectors and all layers
- stop - stops integration of all data.
- clear - resets integration counter and all integration arrays to zeros.

Axis

- Xaxis

  min - Xaxis channel number range is set to max (256).

  zoom - Xaxis channel number range is doubly expanded (max is 256)

  ZOOM - Xaxis channel number range is halved (min is 32)

  MAX - Xaxis channel number range is set to min (32), i.e. fully zoomed.
- Yaxis

Linear - Displays data in linear scale

Log - Displays data in log scale

Statistics

- TotalCounts - calculates total area under the curve in number of total Counts regardless of binsize.
- Counts/sec - total counts is adjusted by dividing by total time accumulated.

1.5.2.6 Spectral Science Mode - Recommend

This Xclient has very similar look and exactly same Pulldown Menu items of Base Spectral Science Mode. Only difference is that each spectrum is divided into 6 predefined regions for monitoring with separate statistics for each region. Currently, 6 different color bands represent...

- ch # 0 - 13
- ch # 14 -17
- ch # 18 -23
- ch # 24 - 35
- ch # 36 - 49
- ch # 50 - 249

1.5.2.7 Spectral Science Mode - Colors vs. Time

This one also has exactly same Pulldown Menu items as Base Spectral Science Mode, which explained already in previous section. In this monitoring mode, a user may specify two or three separate regions, from which ratios of two adjacent area are calculated and displayed in strip chart plot. In addition to this strip chart, this mode has two additional Push buttons.

Push Buttons:

- Adjust Color Bands - When pressed, a panel contains 6 sliding scales will appear. Each scale is represented for max and min of each color region. To suppress third region, simply make the redmax smaller than redmin.
- Clear Strip Chart - Clears existing strip chart lines and restarts. This is useful when ratio values change drastically after reset the color band(s).

1.5.2.8 Spectral Science Mode - History

Although appearance is little different, this Xclient has same set of menu items. This mode displays up to 200 spectra in image form. Intensity of each spectrum is also displayed in strip chart plot.

1.5.2.9 Temporal Science Mode - Power

The Power is calculated as follow.

1. Start with ‘Light Curve’ vector with N=1024 bins.

2. Sum all counts in the 1024 bins. (= SUM)
3. Take FFT of all N points. This returns (N/2 + 1) length vector with both Real and Imaginary parts.
4. The Power at each point = ($real^2$ + $imaginary^2$)
5. Leahy method is used for the normalization.
   $P(i) = 2.0 * | X(i)^2 | / SUM$
   (where i = 0, 1, 2........ N/2 and X (i) = Fourier Amplitudes)

Following explains items in the Pulldown Menu of the Temporal Science - Power, a variation of Standard Mode 1, Xclient User Interface.

File

These are explained in previous section.

- Freeze
- Save(in ascii)
- PostScript
- Quit

Select

- Sum All Good Xenon - displays sum of Xenon data from all 5 detectors.
- Sum All Very Large Events - displays sum of Very Large Event
- Sum All Propane Events - displays sum of all Propane data from all 5 detectors.
- Sum All Other Events - displays all other events not included above.
- PCU1 - isolates and displays PCU1 Xenon data.
- PCU2 - isolates and displays PCU2 Xenon data.
- PCU3 - isolates and displays PCU3 Xenon data.
- PCU4 - isolates and displays PCU4 Xenon data.
- PCU5 - isolates and displays PCU5 Xenon data.
- All 5 PCUs - displays all 5 individual PCU's Xenon data.

Yaxis

- Linear - actualMin - ymin is actual minimum data value.
- Linear - zeroMin - minimum plot value is forced to be zeros in linear scale.
- Log - actualMin - ymin is actual minimum value of light curve array
- Log - zeroMin - minimum value is forced to be zeros. (in Log scale)

Display

- Live - displays data as one partition of data comes in
- Integ & Ave- displays accumulated and averaged data
- Late Data - explained previously
- Strip Chart - explained previously

Intg & Ave

- start - starts integration and average of all detector data.
- stop - stops integration and average of all data.
- clear - resets integration counter and all integration arrays to zeros.

1.6 Error and Warning Messages

TBD

1.7 Recovery Steps

TBD

1.8 Abbreviations and Acronyms

The abbreviations and acronyms section contains an alphabetized list of the definitions for abbreviations and acronyms used in this document.

EDS - Experiment Data System

PCA - Proportional Counter Array

PCU - Proportional Counter Unit

PI - Principal Investigator

SOF - Science Operation Facility

XTE - X-ray Timing Explorer

1.9 Glossary

1.10 Notes

1.11 Appendices