Interactive Monitoring Histograms Generator

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August 17, 2004

Abstract

I have written a program which may be used by JLab scientists as a standard way of analyzing the Monitoring Histograms. The user will be able to view any individual histogram or any combination of histograms. I have also designed a web-page which will allow easy viewing of all the histograms.

1 Introduction

The program, monitoring.c, consists of a graphical user interface which allows the user to interactively select which histograms he or she would like to view. The histograms are formatted with the proper labels, more accurate data fits, and legends which include the relevent details. The program was written using the ROOT Object-Oriented Data Analysis Framework. A script is provided to automatically generate proper html code to visualize plots. The web page takes the histograms produced by monitoring.c and displays them in an organized fashion to help the data analysis.

Outline The remainder of this CLAS note is organized as follows. Section 2 gives a detailed description of the program and how to use it. The web page and how it should be used together with the program is described in Section 3. The conclusions are given in Section 4.

2 The ROOT Program

It is possible that this program may be the new standard for the analysis of the monitoring histograms. It provides an easy way of producing pre-formatted histograms, together with more accurate fits to the data. These may be used for analysis, for use in papers, or for any other purpose they wish. The program was written using ROOT version 4.00.

2.1 Location of the Program

All the necesary files are in CVS. You can find them in the following location:
utilities/mon_root_histos
A list of all the files is given in the Appendix.

2.2 Executing and Using the Program

The software reads the histogram files generated during CLAS data processing. These are PAW hbook files that need to be converted to ROOT files with the untility "h2root." Since there could be hundreds of such files, the user is encouraged to put them in a subdirectory (i.e. "data").

This program can be executed by typing the following command:
root monitoring.c
inside the monitoring directory. The graphical user interface (GUI) will then be displayed on the screen. This interface is shown in Figure 1 below.

At the top of the window there is a button labeled "Load ROOT file." Before any histograms can be drawn the user must load a ROOT file. The dialog window that will appear after pressing this button is shown below in Figure 2. Once the ROOT file is loaded the histograms may be selected from the shutter window. Below the list of histograms are six buttons that may be selected. Each button is described below.

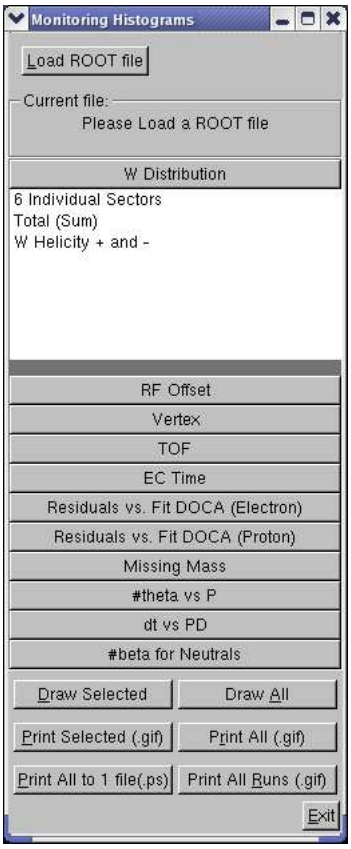

Figure 1: Graphical User Interface

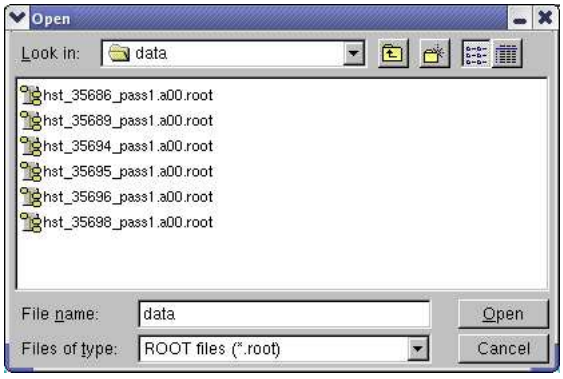

Figure 2: Dialog Window for Selecting the ROOT file

Draw Selected This button will draw the selected histogram on your screen. All the histograms currently able to be produced by the program are shown in Appendix A.

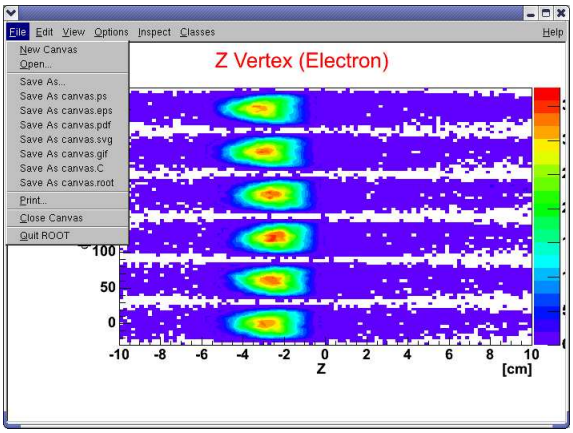

Figure 3: Options for Saving the Histogram

Draw All This button draws all the histograms for the selected run on your screen. The same options as the Draw Selected button are available for each histogram.

Print Selected (.gif) Clicking on this button will print the selected histogram. A pop-up window will appear asking the user to enter the run

number. This is shown in Figure 4. The run number will be used by the web page to organize the visualization.

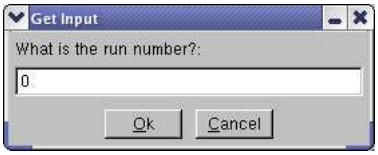

Figure 4: Dialog Window for Entering the Run Number

Print All (.gif) This will print all the histograms for the selected run. The pop-up window shown in Figure 4 will appear asking the user to enter the run number.

Print All to 1 file (.ps) This button creates one postscript file containing each histogram on its own page. The pop-up window shown in Figure 4 will appear asking the user to enter the run number.

Print All Runs (.gif) The user has to create a text file (possibly by writing a script) that will contain the run number in the first column, and the corresponding filename of the ROOT file in the second column. An example is shown below. When the user clicks on this button, a dialog window will appear asking the user to select the .txt file. Once the user does so, the program will create a folder named gif/. Inside this folder more folders will be created, the name of each being a run number. The corresponding histograms will then be printed inside each these folders.

The reason the user has to create this text file is that the run number is needed in order to organize the plots. The run number cannot be directly extracted from the filename, as this may change with the run period.

Example text file, ListOfRuns.txt:

```
35686   hst_35686_pass1.a00.root
35689   hst_35689_pass1.a00.root
35694   hst_35694_pass1.a00.root
35695   hst_35695_pass1.a00.root
35696   hst_35696_pass1.a00.root
35698   hst_35698_pass1.a00.root
```

3 The Web Page

The web page was created with html and javascript. Javascript was used to pass variables, such as the run number, between frames and to display the correct histograms when the mouse passes over their names.

At the top of the page, there is a drop-down menu from which the user can select a run number. The user then has a number of options accross the top of the page, such as SEB, EC Timing, Residuals, etc. Once one of these options is selected, a list of histograms related to this option appears along the left of the screen. The user then places the cursor over the histogram name on the left, and the histogram will appear in the center of the page. In order to see the histograms from another run, the user has to simply change the selected run number from the menu at the top of the screen. Images of the web page are shown in Figures 5 and 6.

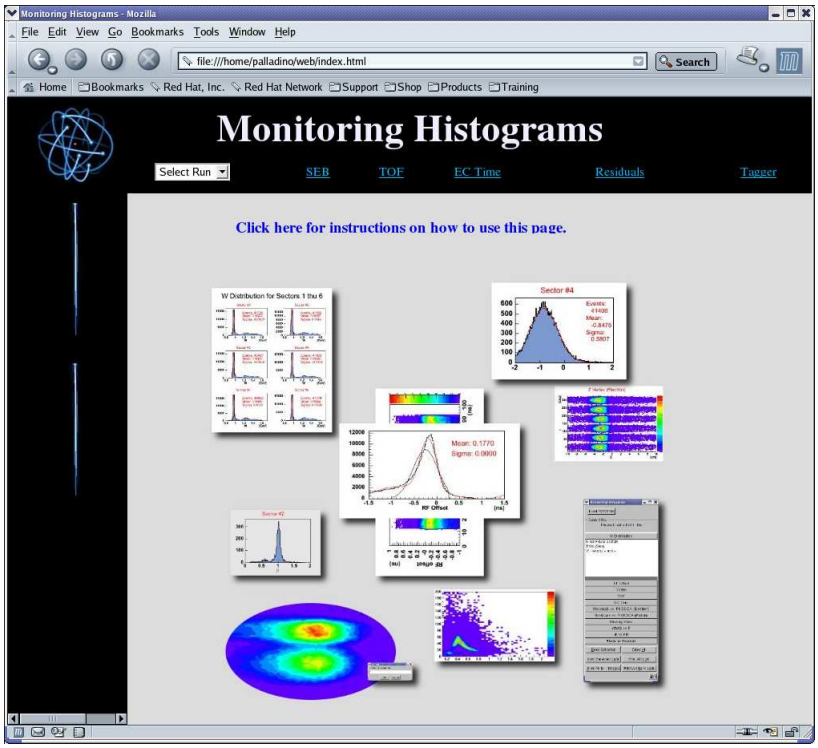

Figure 5: The Homepage

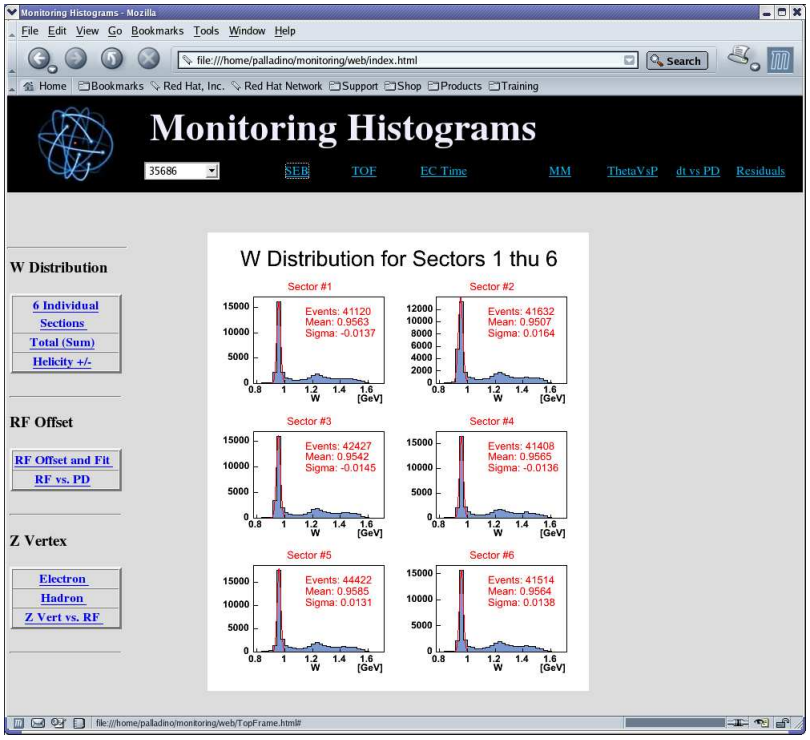

Figure 6: Viewing a Histogram on the Web

3.1 Making the Web Page / Adding Histograms

The histograms are located in a folder named gif/. Inside this folder are more folders, the name of each being a run number. When running the program monitoring.c, the user selects the button labeled "Print All Runs (.gif)," as described above. The user then replaces the folder gif/ in the web page directory with the new folder gif/ and all the new contents. Alternatively, the user may just take the selected run folders, containing the gifs, and add them the the existing gif/ folder for the web page.

Then the user must execute the shell script go_make_page. This will add the new runs to the drop-down menu on the web page, so that they can be seen from the internet. This script makes a list of all the runs the user has histograms for in their gif/ directory. It adds the proper html code to these numbers and produces a text file called top2.txt. Then the script concatenates this file with two other text files, called top1.txt and top3.txt, finally creating a new up-to-date file named TopFrame.html, which replaces

the old one.

3.2 Location of the Web Page

For an example of the web page, see:
/site/www/html/Hall-B/secure/g11/cooking/monitoring/mon_histos

A list of all the necessary files is given in Appendix B.

4 Conclusions

Since this was my first time programming with ROOT, the code may not be as elegant as possible. However the program works great. The histograms are beautiful. And the web page will no doubt help speed the analysis of the monitoring histograms in the future.

5 Acknowledgements

I would like to thank Dr. Maurizio Ungaro for the enormous amount of help he has given me on this project, and Professor Kyungseon Joo for my position here at JLab this summer.

APPENDIX A

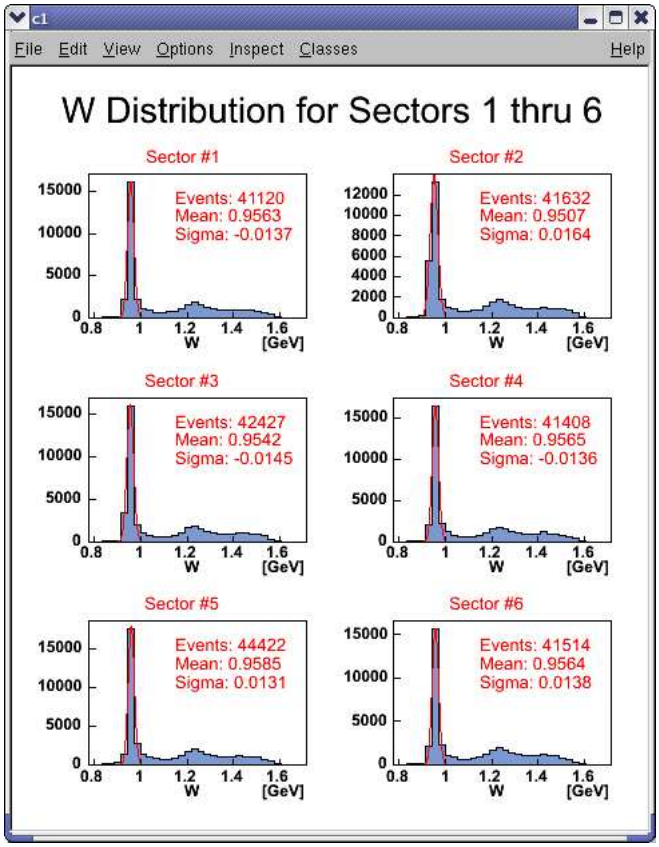

Figure 7: Invariant Mass distribution for the 6 sectors

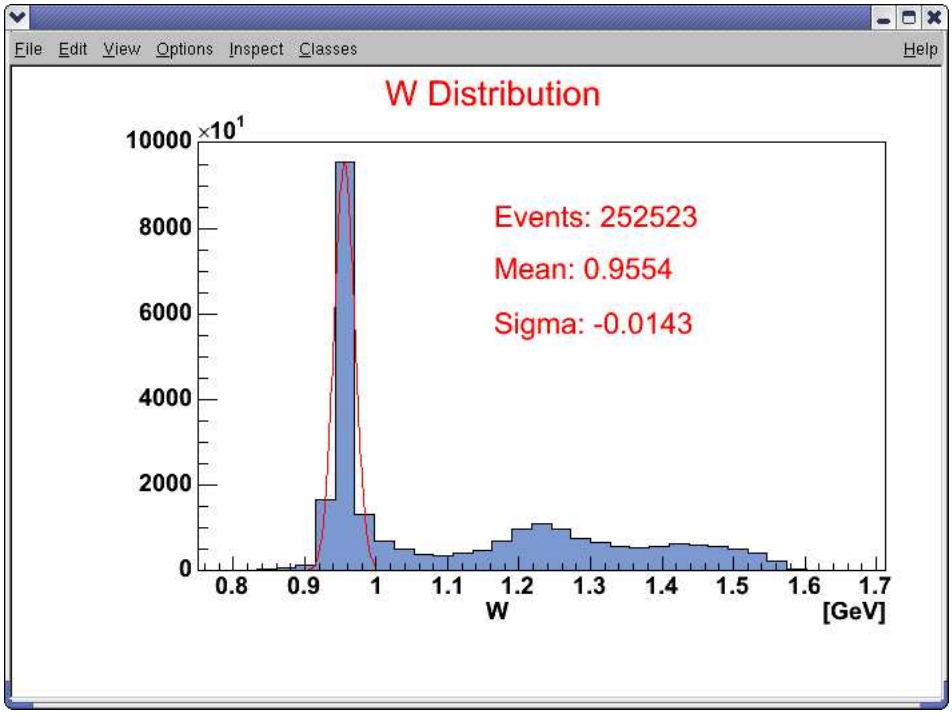

Figure 8: Invariant Mass distribution (Total of 6 sectors)

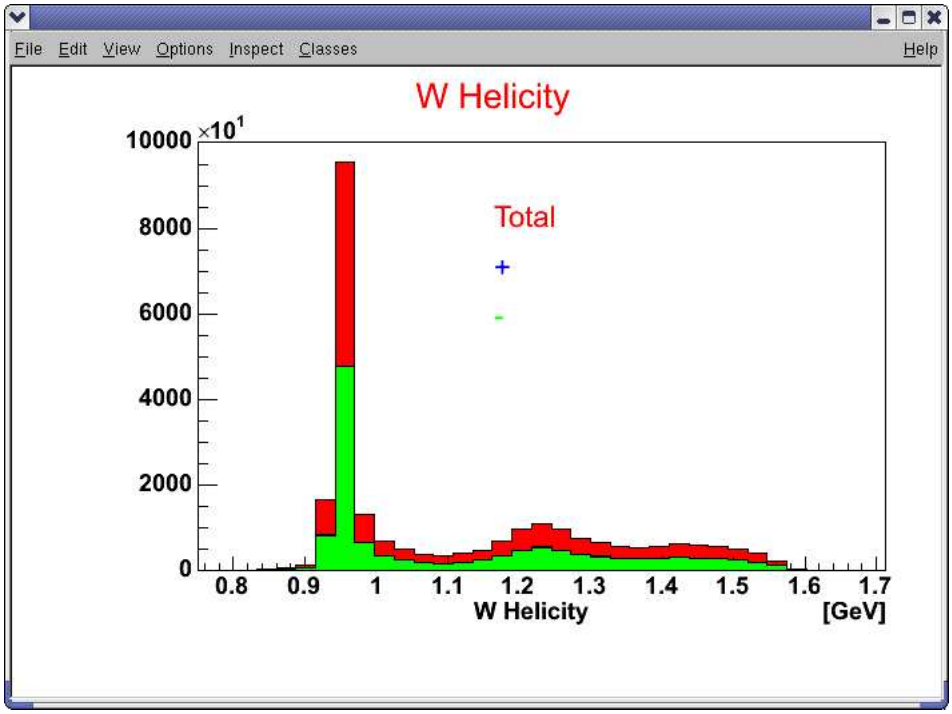

Figure 9: W Distribution for Helicity +, -, and Total

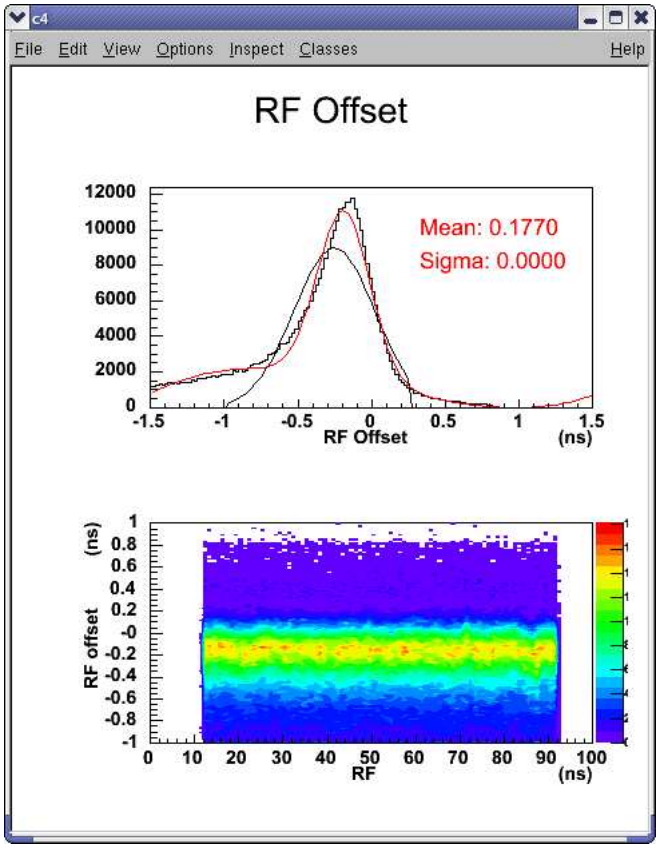

Figure 10: RF Offset

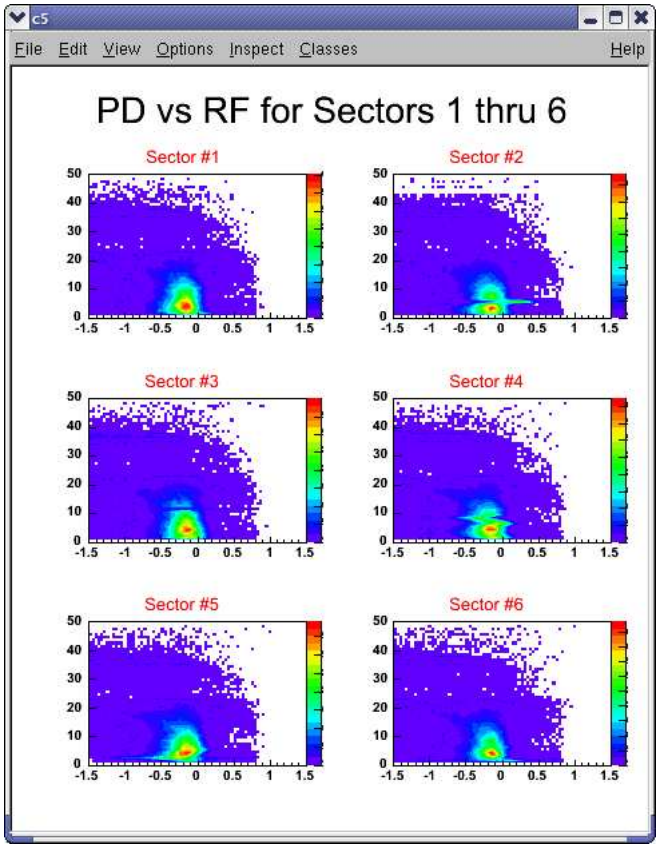

Figure 11: TOF Paddle versus RF Offset

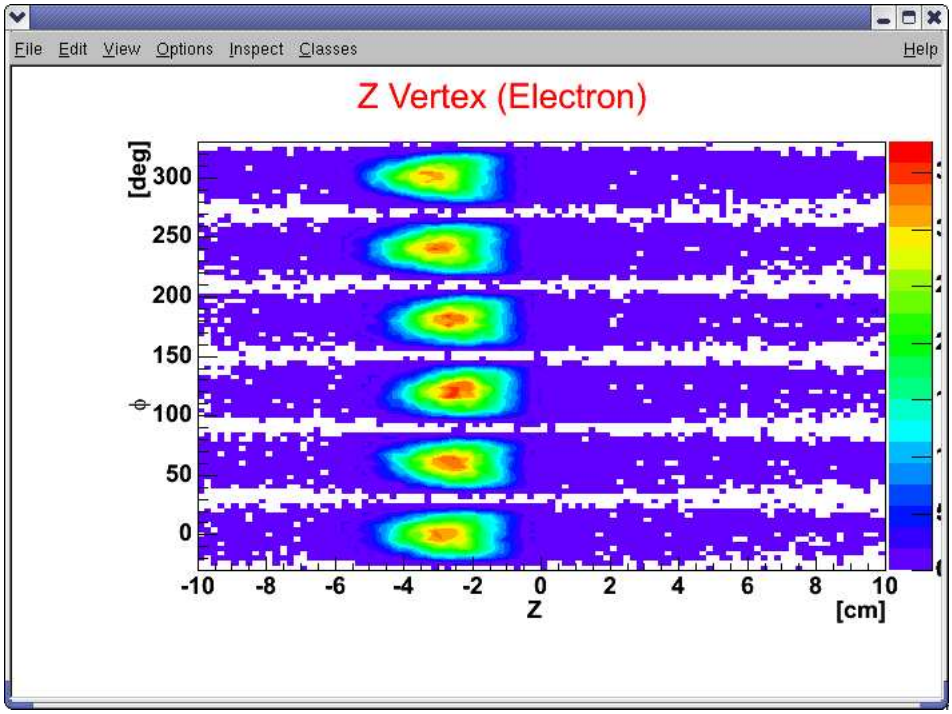

Figure 12: Phi versus Z Vertex Distribution for Electrons

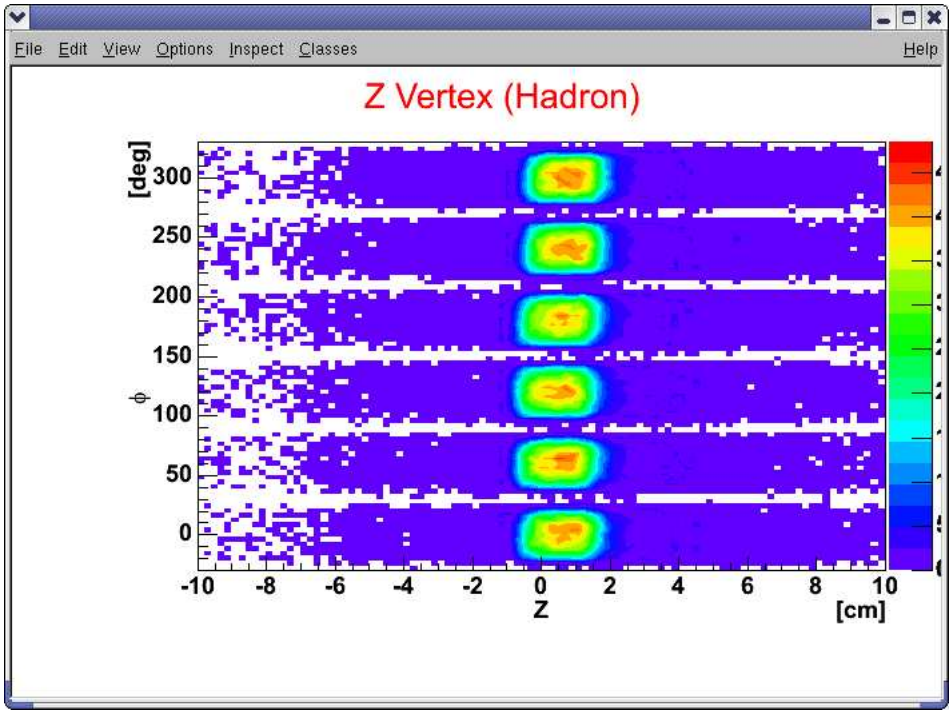

Figure 13: Phi versus Z Vertex Distribution for Hadrons

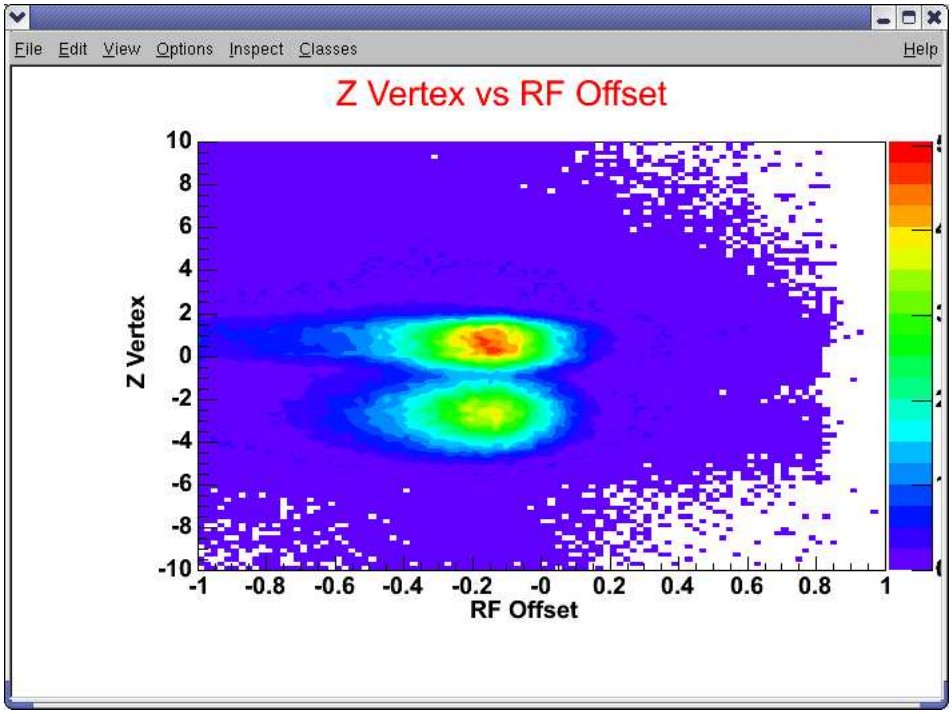

Figure 14: Z Vertex versus RF

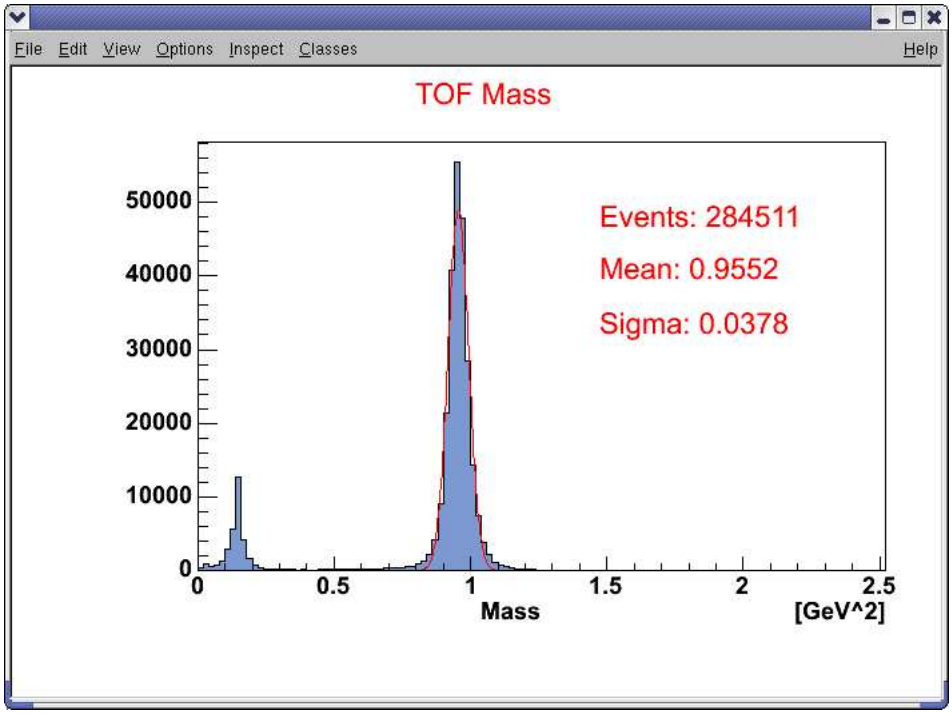

Figure 15: Time of Flight Mass

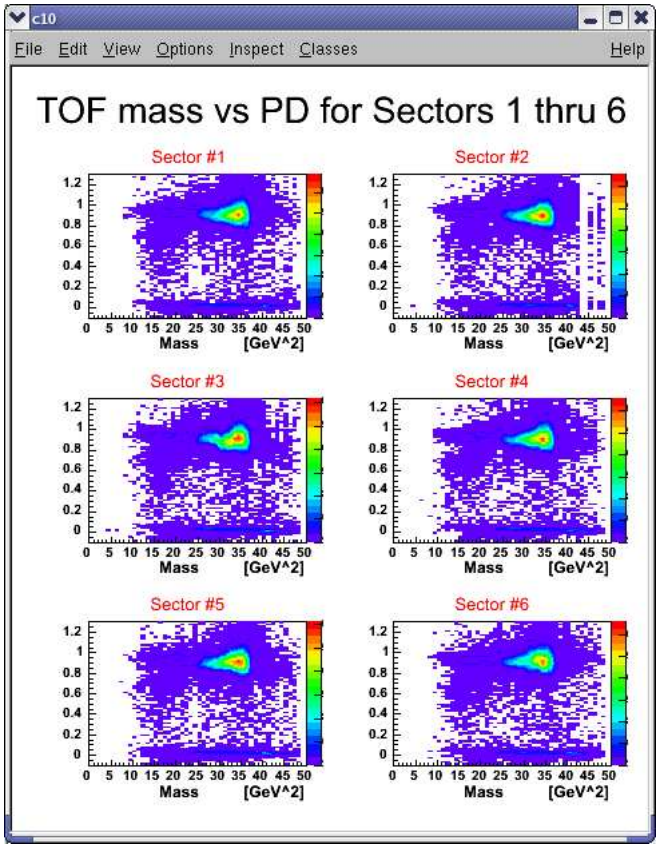

Figure 16: Time of Flight Mass versus PD

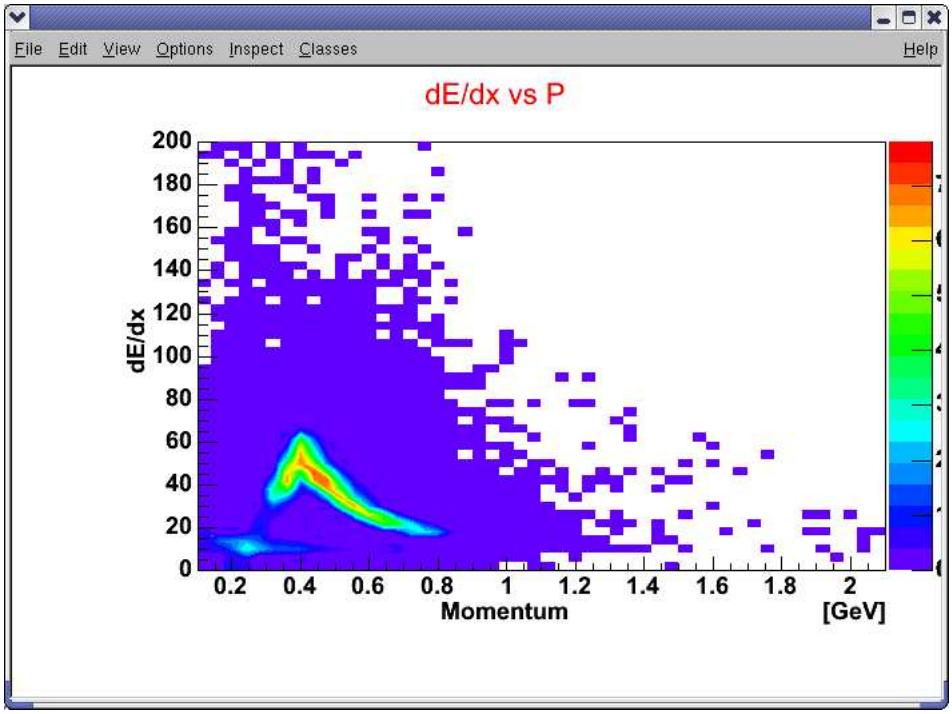

Figure 17: dE/dx for TOF versus Momentum (Total)

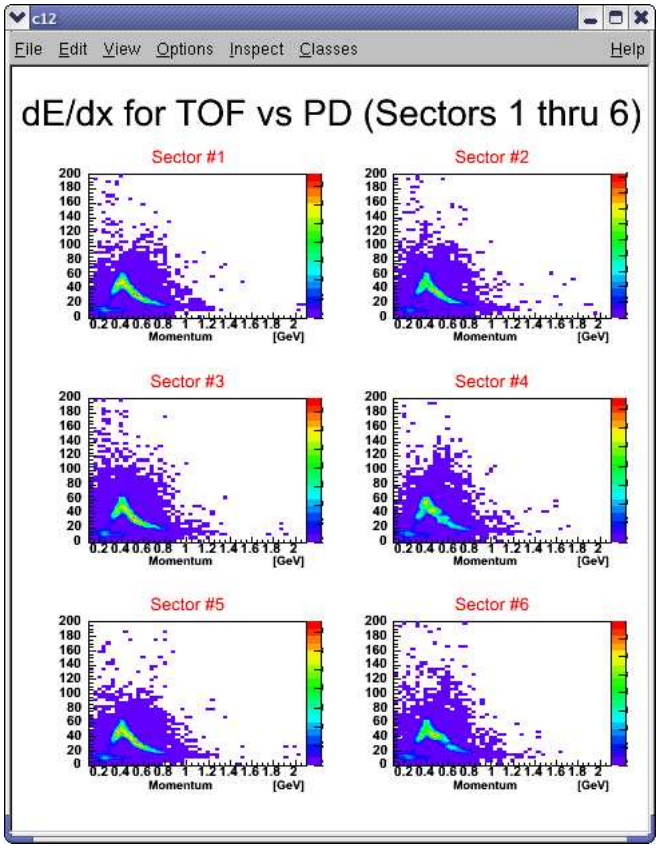

Figure 18: dE/dx for TOF versus Momentum for the 6 Sectors

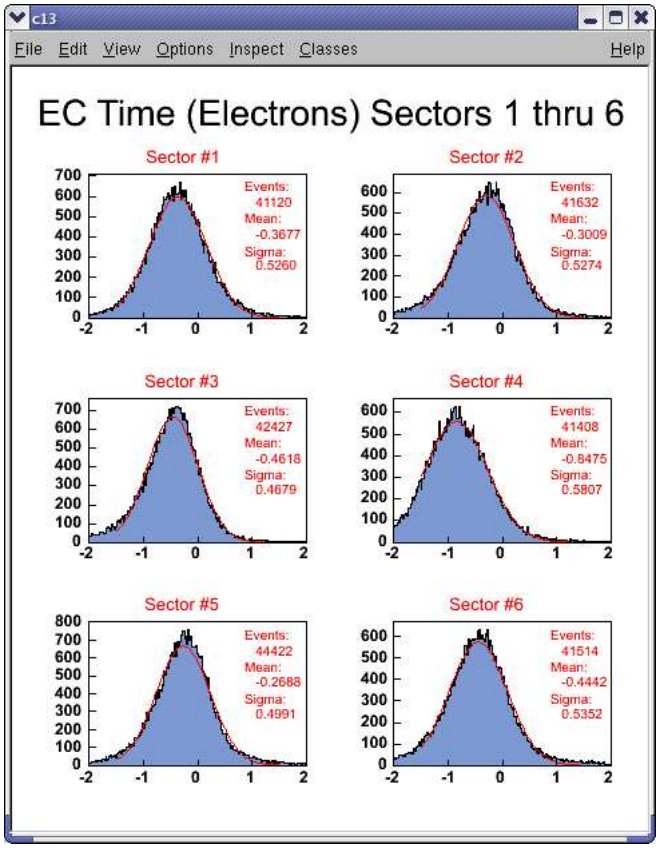

Figure 19: ECt - TOFt for Electrons

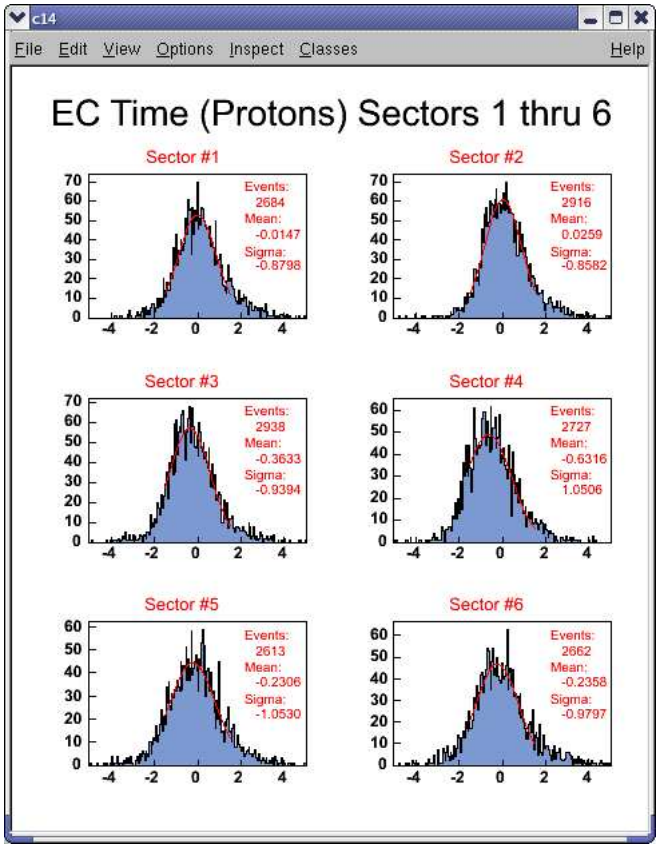

Figure 20: ECt - TOFt for Protons

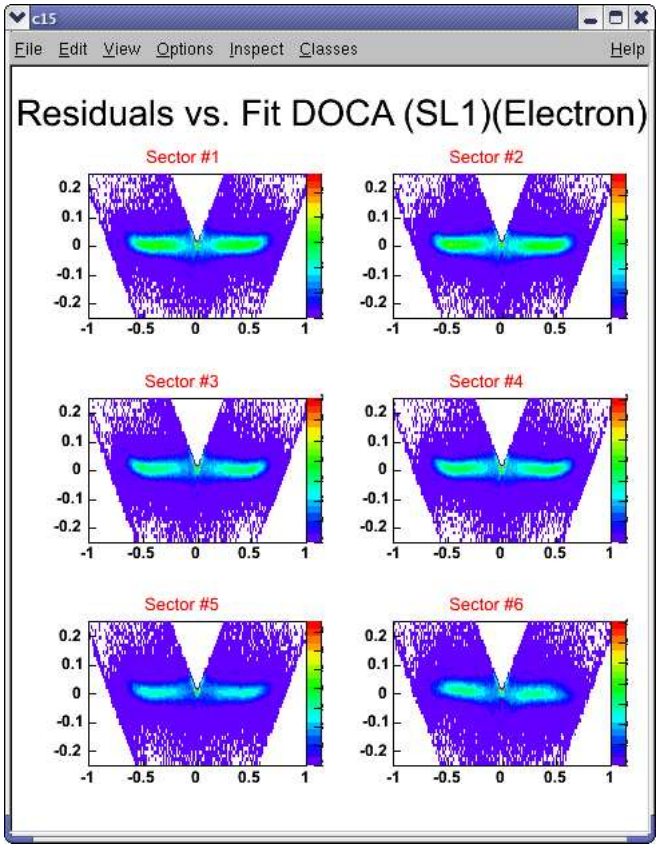

Figure 21: Residuals versus fit DOCA for Electrons (Super Layer 1)

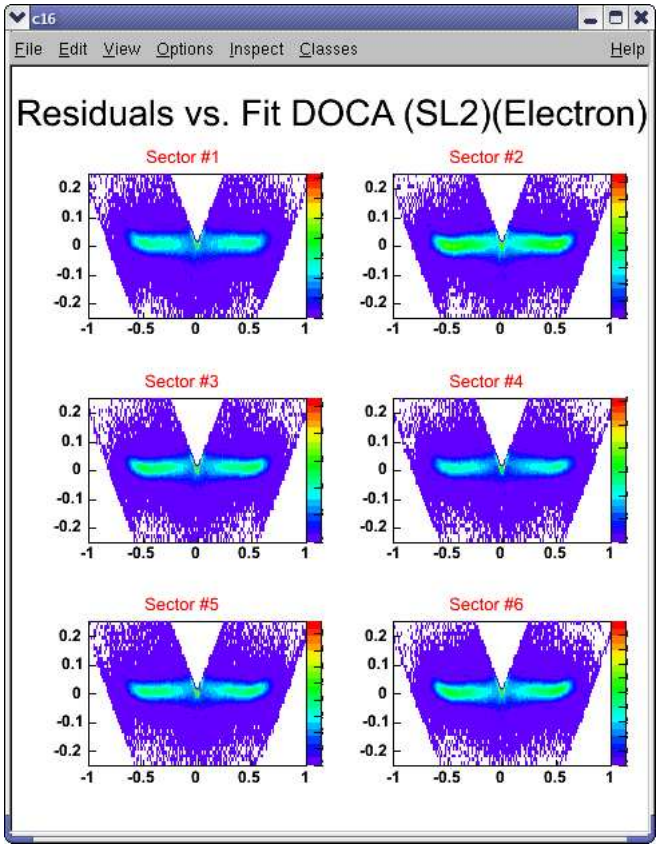

Figure 22: Residuals versus fit DOCA for Electrons (Super Layer 2)

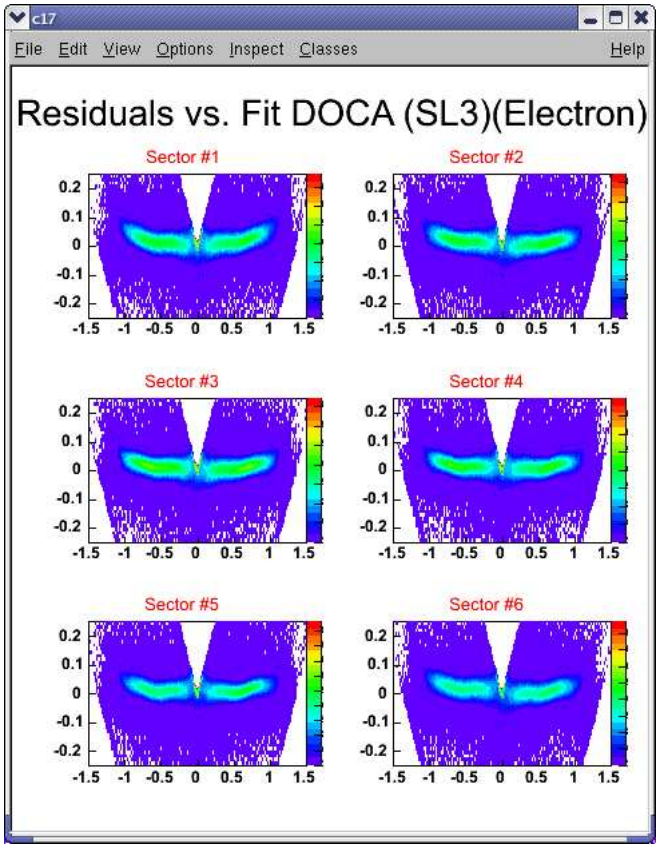

Figure 23: Residuals versus fit DOCA for Electrons (Super Layer 3)

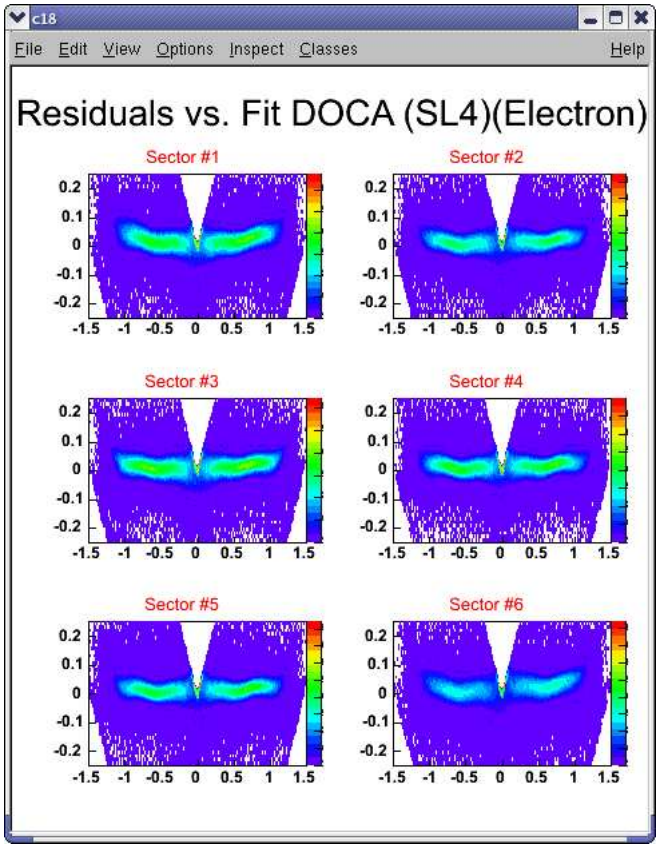

Figure 24: Residuals versus fit DOCA for Electrons (Super Layer 4)

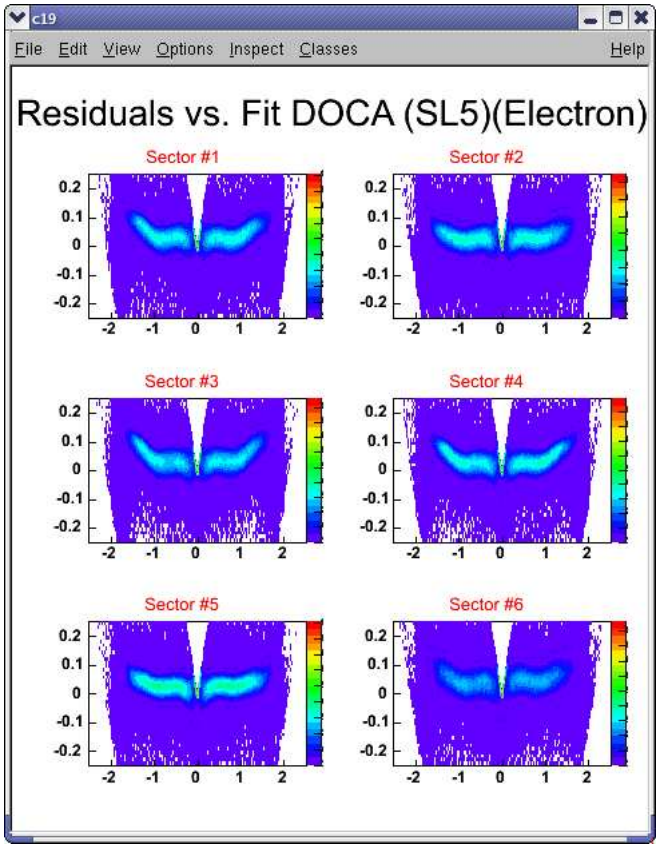

Figure 25: Residuals versus fit DOCA for Electrons (Super Layer 5)

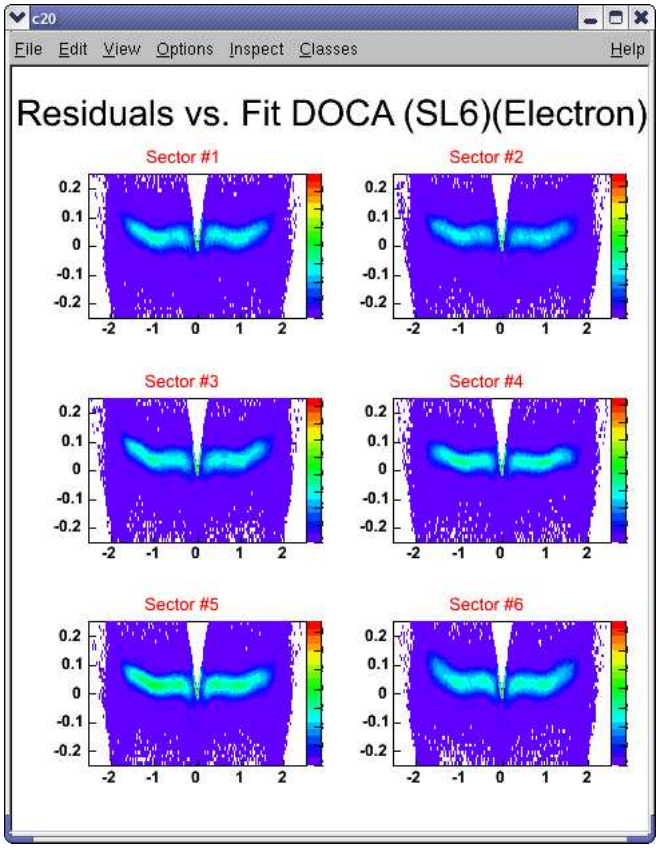

Figure 26: Residuals versus fit DOCA for Electrons (Super Layer 6)

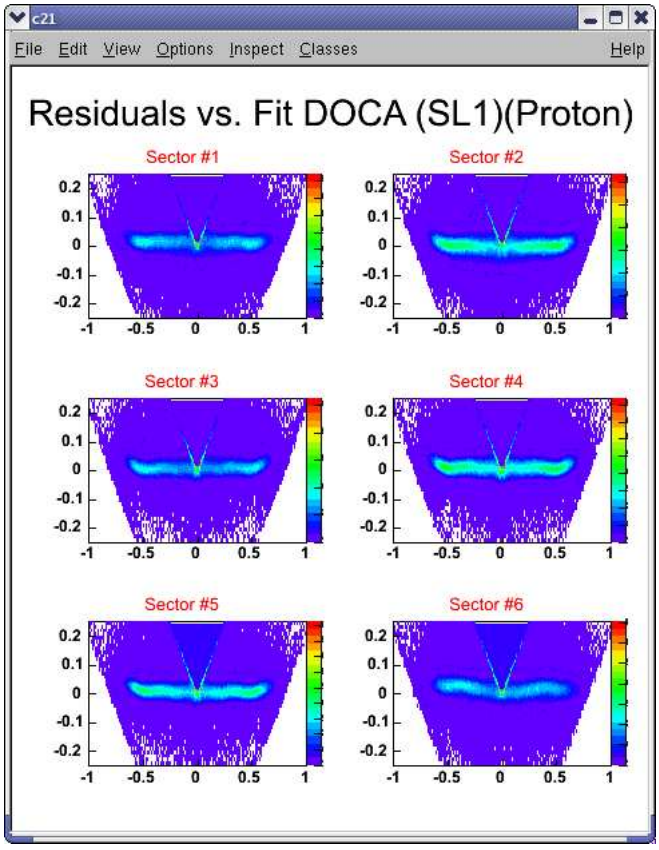

Figure 27: Residuals versus fit DOCA for Protons (Super Layer 1)

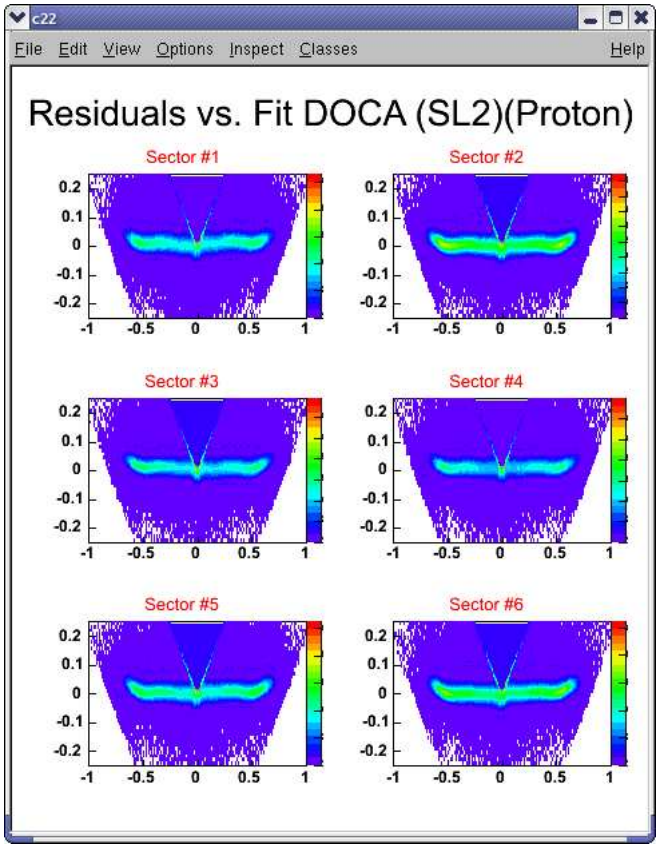

Figure 28: Residuals versus fit DOCA for Protons (Super Layer 2)

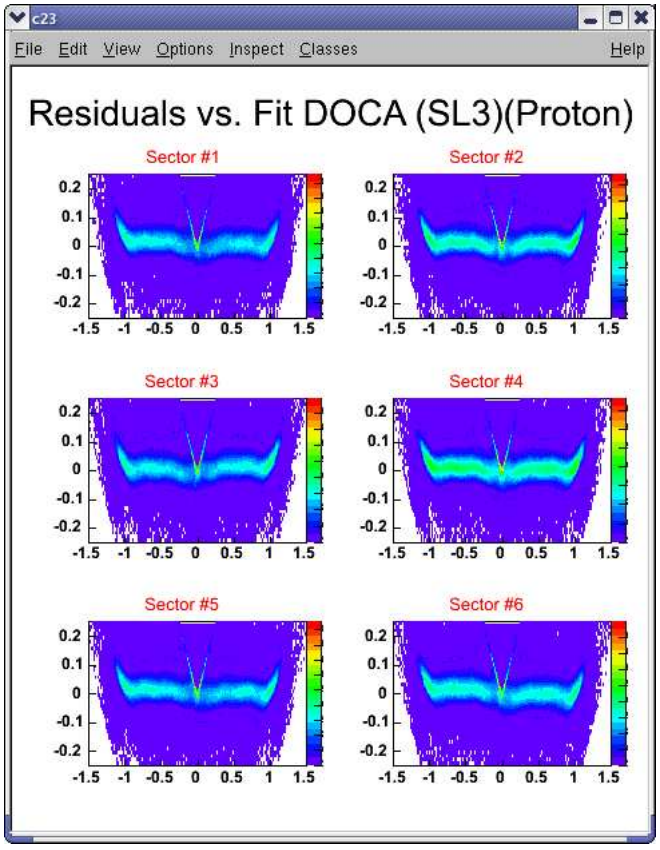

Figure 29: Residuals versus fit DOCA for Protons (Super Layer 3)

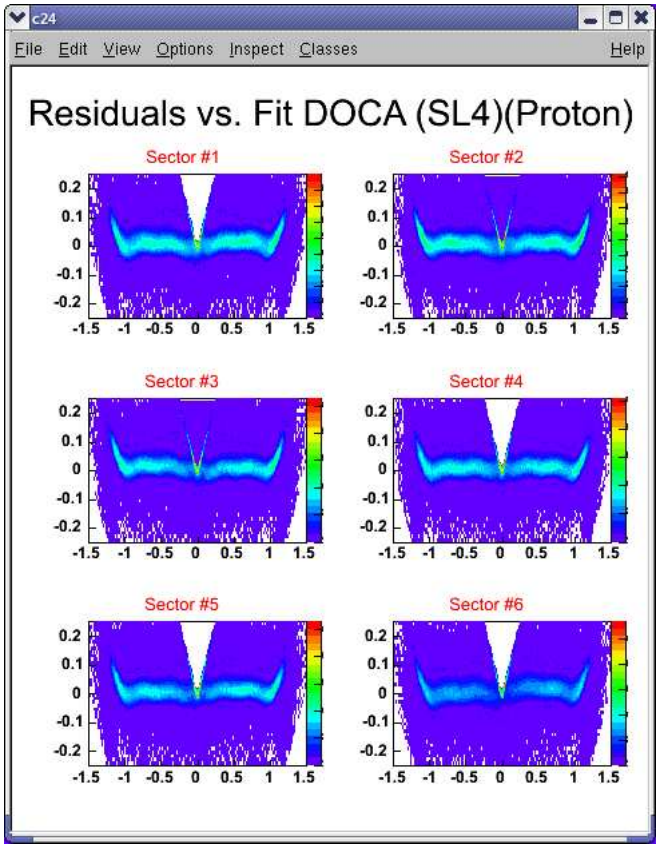

Figure 30: Residuals versus fit DOCA for Protons (Super Layer 4)

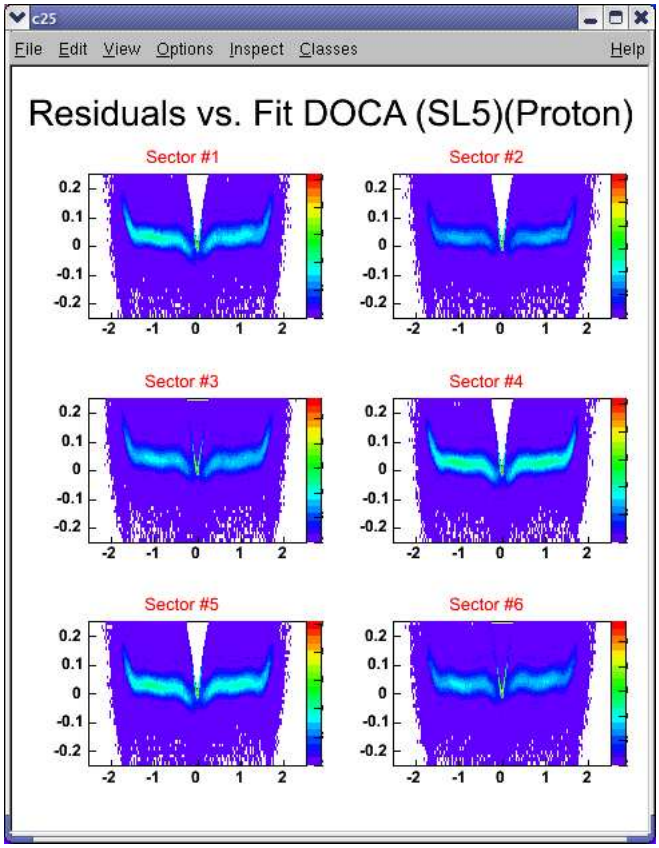

Figure 31: Residuals versus fit DOCA for Protons (Super Layer 5)

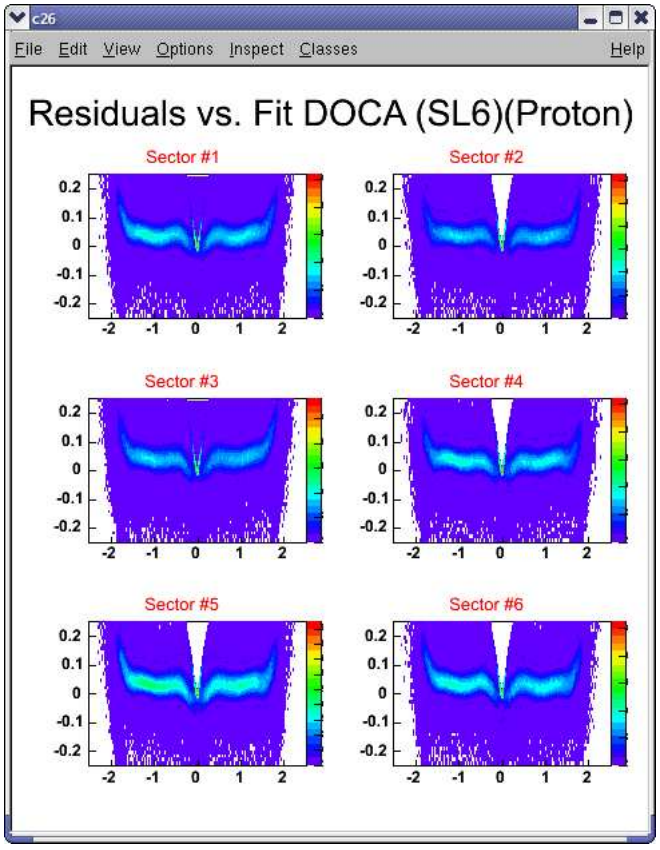

Figure 32: Residuals versus fit DOCA for Protons (Super Layer 6)

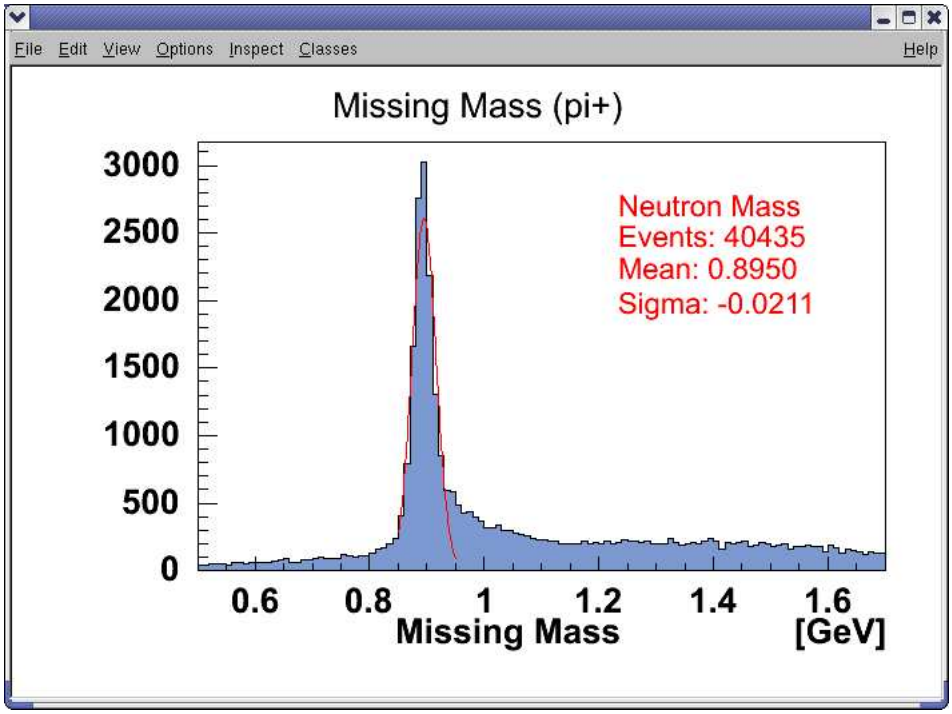

Figure 33: Missing Mass

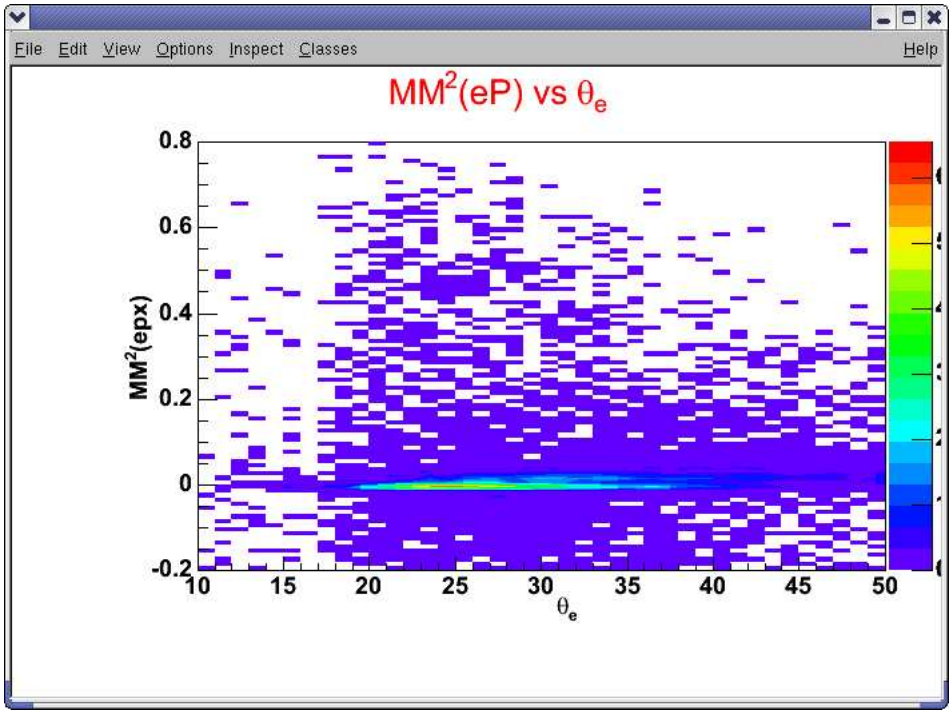

Figure 34: eP Missing Mass versus Theta

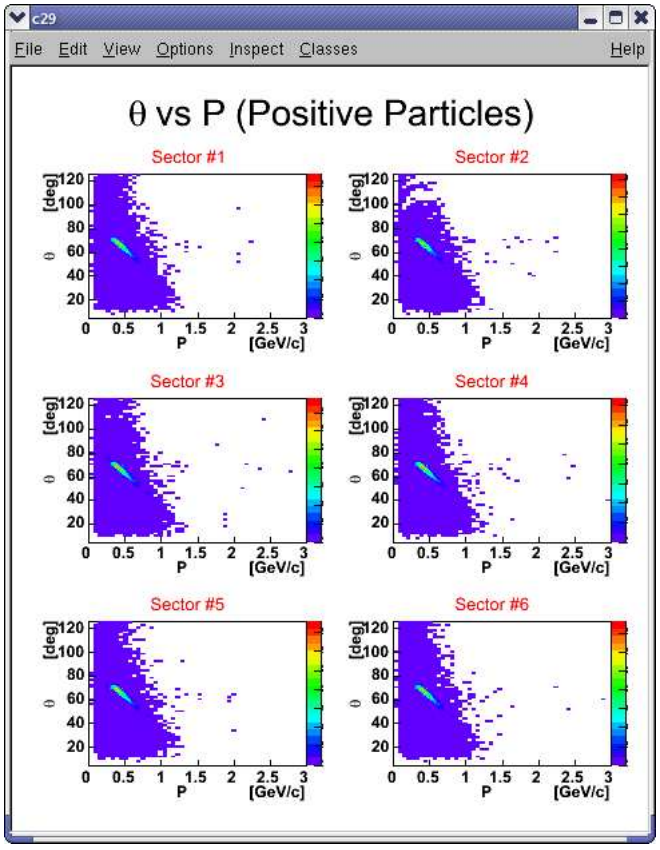

Figure 35: Theta versus Momentum (Positive)

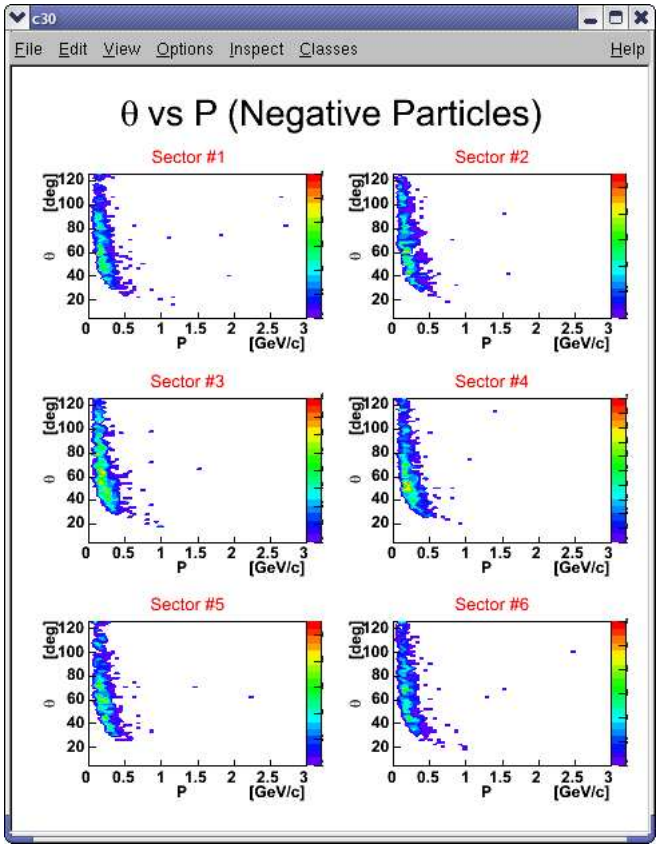

Figure 36: Theta versus Momentum (Negative)

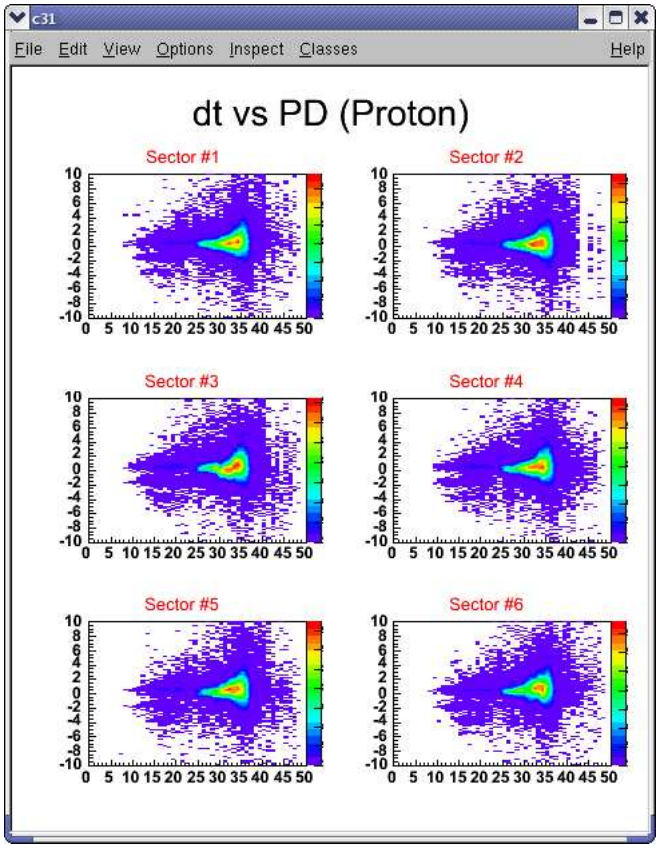

Figure 37: dt versus PD (Proton)

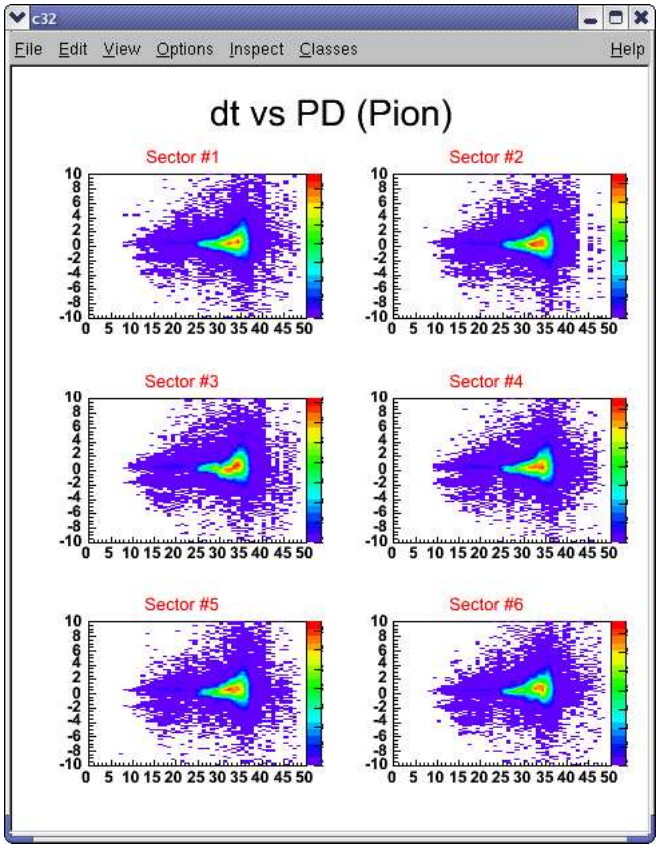

Figure 38: dt versus PD (pion)

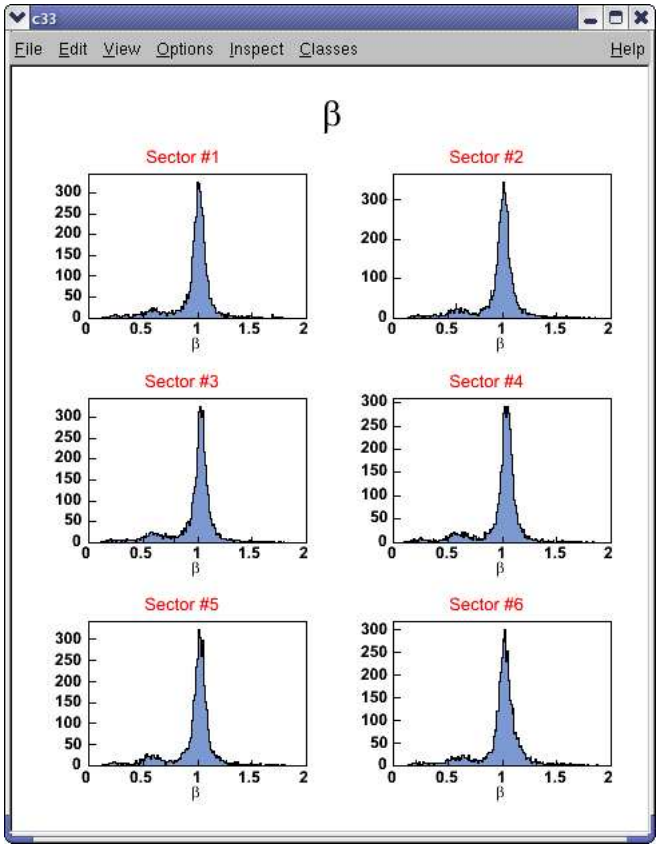

Figure 39: Beta Distribution for Neutrals

APPENDIX B

Below is a list of all the files for the program:

- monitoring/
  - data/
    - your ROOT files
  - hbook_files/
    - your HBOOK files
  - utils/
    - ClickID.c
    - FileDialog.c
    - init_gui.c
    - init_histos.c
    - PrintAllRuns.c
    - PrintCanvas.c
    - show_all.c
    - show_dtVsPD.c
    - show_ECtime.c
    - show_MM.c
    - show_residuals_e.c
    - show_residuals_p.c
    - show_RF.c
    - show_ThetaVsP.c
    - show_TOFmass.c
    - show_vertex.c
    - show_W.c
    - utils.c
  - definitions.h
  - TSystem.h
  - monitoring.c

Below is a list of all the files for the web page:

- web/
  - gif/
    - 35686/ (for example)
    - ⋮
    - 98682/ (for example)
  - images/
    - atom.jpg
    - electron2.JPG
  - left/
    - leftFrame.html
    - leftFrameDC.html
    - leftFrameDT.html
    - leftFrameEC.html
    - leftFrameMM.html
    - leftFrameRES.html
    - leftFrameSEB.html
    - leftFrameTheta.html
    - leftFrameTOF.html
  - mainFrame.html
  - TopFrame.html
  - top1.txt
  - top3.txt
  - instructions.html
  - go_make_page