The EMC-RICH Trigger Physics Monitor

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I. INTRODUCTION

We report on the status of the EMC-Rich Trigger (ERT) physics monitor. The ERT physics monitor was implemented into the overall monitoring scheme for the PHENIX experiment. The experiment was carried out at the Brookhaven National Laboratory located in Upton, New York. The experiment used the Relativistic Heavy Ion Collider (RHIC), polarized proton (p-p) sources, and the PHENIX detector. The ERT physics monitor displayed distributions for various level 2 (lvl2) trigger information in the run two (RUN02) data-taking period. The lvl2 software trigger was based upon level 1 (lvl1) or hardware supported triggering information. The distributions included in the monitor were the Gamma 1 (G1), Gamma 2 (G2), 2x2, and the electron (EC) and phi candidate plots (PhiC), respectively. The G1 monitor showed the distribution for the coincidence between 4x4A of the electromagnetic calorimeter (EMC) and the Normalization Trigger Counters (NTC) detectors. The G2 plot provided the triggering distribution for the 4x4B trigger condition while the coincidence between NTC and the 2x2 trigger were provided in the 2x2 plot. The bottom plots showed the distributions for the electron and phi candidate triggers. In the following, a brief description of the data generating codes and ERT physics monitor will be presented along with an example of its display.

II. PRDF TO ASCII CODE

The ERT physics monitor receives its physical values from a Physics Raw Data File (PRDF). A flowchart of the PRDF to ASCII code is shown in Figure 1. There were two intermediate ASCII files. The first was named “resultTrigger.dat” and was obtained from a PRDF file located within the level 2 trigger framework. The event information, EMC tile energy (for the triggered Super Module “SM” and Large Deposition Energy “LDE”), and level 2 trigger electron candidate information were contained in the first ASCII file. During the run, the value of the LDE’s for the overlapping 4x4 tiles was greater than 1 GeV and was set to 0.3 GeV for the non-overlapping 2x2 tile. The second ASCII file was named “resultTrigger2.dat” and was constructed from the first ASCII file by a root macro, “calceff.C”. This file contained trigger quality values defined by the ratio of signal events (from the level 2 trigger) to triggered events. The G1, G2, and 2x2 thresholds for the EMC were set to 1.2 GeV, 2.0 GeV, and 0.7 GeV, respectively.

III. LAYOUT OF THE ERT MONITOR CODE

A flowchart of the essential elements of the ERT physics monitor code is shown in Figure 2. The code was designed to scan the “resultTrigger2.dat” ASCII file, tag the pre-defined flagged integer values, and draw the relevant physics information (described below). The integer value was assigned to a specific event identifier. Based on the identifier, the code assigned selected event information to variables which corresponded to specific trigger word hexagonal designations. For example, each stored piece of information was designated as either a G1, G2, 2x2, EC, or PhiC trigger word and the associated histogram was then filled. The respective trigger word flags were summed and stored so that the reference curve could be weighted (scaled) appropriately for each run. Thus, the distribution from each run was drawn and overlayed by the reference curve on a run-by-run basis.

IV. ERT PHYSICS MONITOR

The ERT physics monitor display contains two distributions in each panel for the G1, G2, and 2x2 cluster energies, respectively. Also, the monitor includes panels for the electron and phi candidate energy distributions. These plots are shown in Figure 3. The solid blue line is an example curve from a production run taken online while the dotted dark beige distribution was used as the reference curve (run 39994). In principle, the blue curve should have followed the general trend of the reference curve. If there were noticeable changes in the solid line with respect to the dotted, the shifter was to consult with the shift leader and notify an ERT expert immediately as provided in the ERT Standing Orders.

A. Threshold Settings

In each of the plots, a solid black vertical line is shown sandwiched between two dashed red lines. The black line was used to indicate the nominal gain threshold setting in each panel. A threshold smearing effect of $\pm$ 20% may have appeared in the distributions due to a non-uniformity in the gain control. Hence, the two red lines in each figure showed the nominal threshold range to about 1σ. Therefore, if the range in the peak value in each of the distributions fell within the threshold regions for the corresponding energy distributions, the plots were considered to be fine. Otherwise, there may have been a problem with one or all of the gain threshold settings. The threshold settings used for the RUN02 (p-p) data-taking period are listed in Table 1.

B. Summary Panel

A summary panel is located in the bottom right-hand corner of the monitor pop-up menu. In this panel, the current run number was shown along with the estimated ratios of the actual candidate events to all triggered events on a run-by-run basis. The reference levels (also obtained from run 39994) are listed below these estimated values. As a check, the estimates were compared to the reference values. In general, these values were typically close in proximity to one another (especially G1, G2, and 2x2); however, if there were any significant deviations from the reference values, the shifter was to consult the shift leader and notify an ERT expert. At the time of the p-p run, the electron candidate and phi candidate triggers were still under development; so, these values were strictly left for interpretation by the ERT experts only.

TABLES

TABLE I. Outline of the parameters for each threshold region.

Threshold Parameter	*Mode (Coinc or Single)*	*Threshold Region*
Gamma1 (G1)	4x4A*NTC	$(0.90 < E < 1.50)$ GeV
Gamma2 (G2)	4x4B	$(1.60 < E < 2.40)$ GeV
2x2	2x2*NTC	$(0.56 < E < 0.84)$ GeV

FIGURES

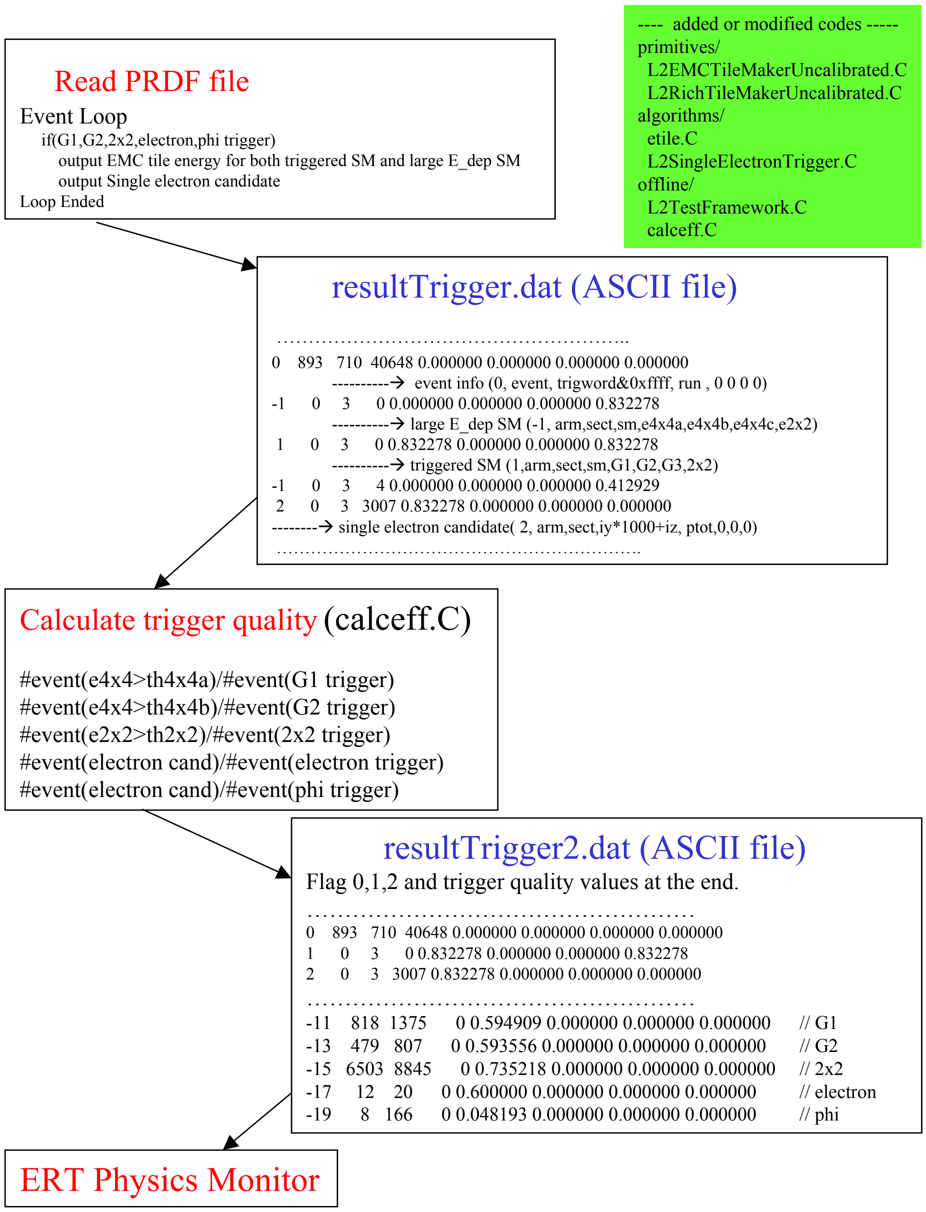

FIG. 1. ERT PRDF to ASCII code Flowchart.

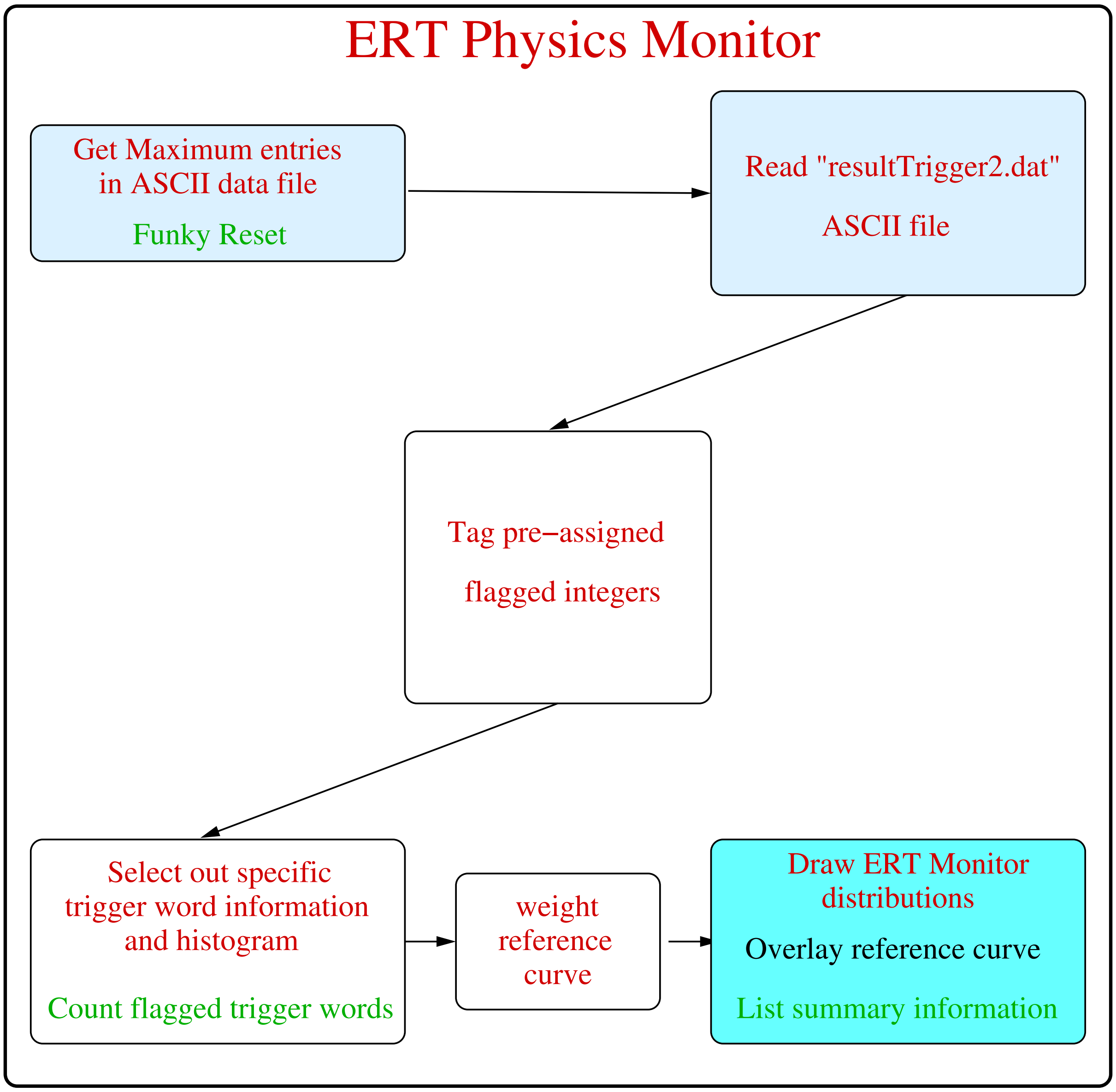

FIG. 2. ERT ASCII to Physics Monitor Flowchart.

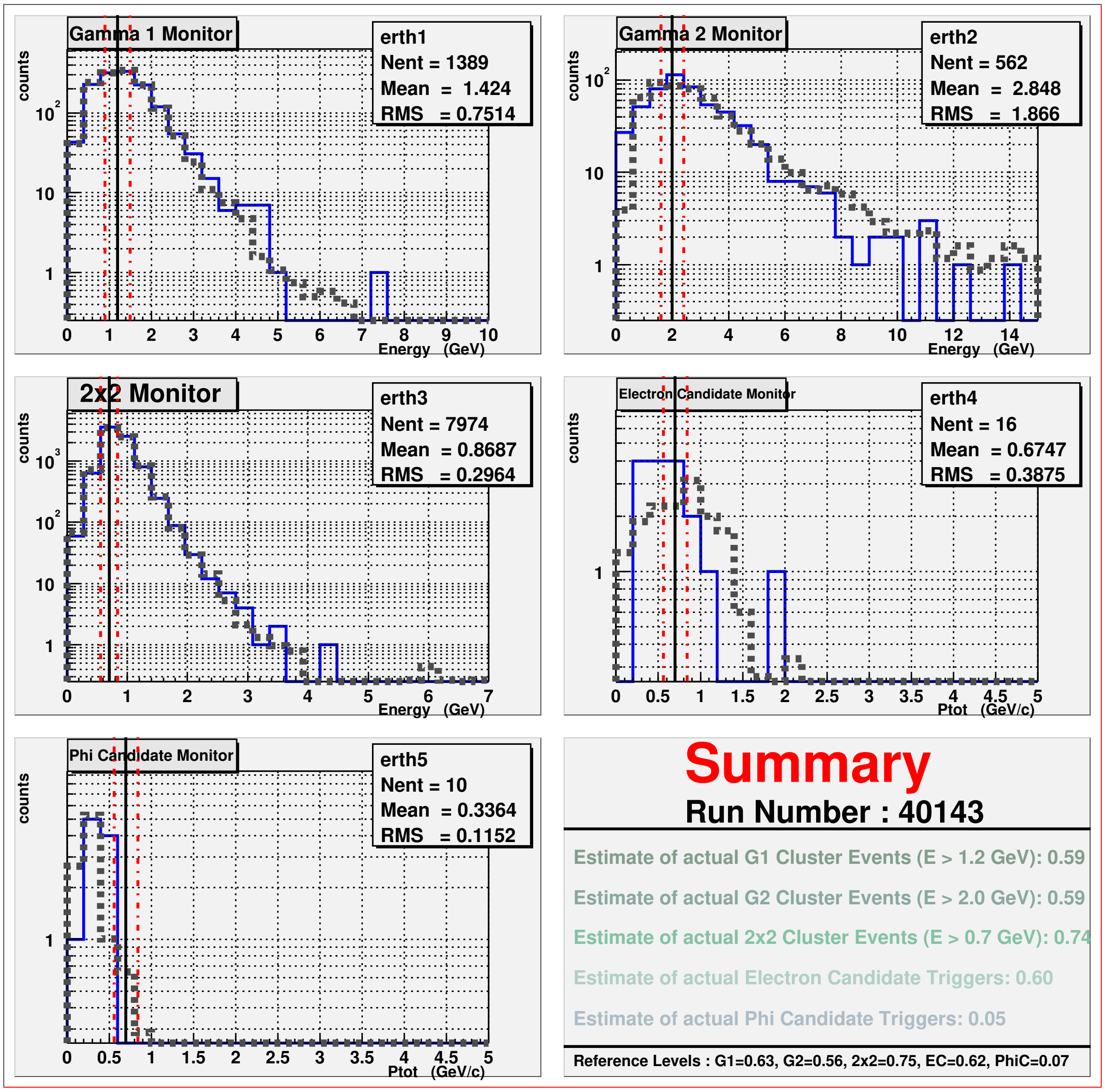

FIG. 3. ERT Physics Monitor Pop-Up Menu.