LGD Calibration Procedure

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This document describes the procedure of calibrating one LGD calibration group using the E852 LGD calibration software (bass-o-matic and friends). The Postscript version of this document can be obtained from *here* <lgdCalibration.ps>

Contents

1 Introduction

... (explain about the stripping, the .mst, .dst and .cal files, about .gz).

The following steps have to be followed to process one LGD calibration group:

- select a calibration group (and the corresponding range of runs that will be calibrated)
- determine which tapes contain the data to be stripped,
- strip the data off the tapes,
- process the monitoring information,
- run the calibrator

- tar the stripped data to 8mm tape
- check the results

The rest of the document talks about each step in more detail.

2 How to select a calibration group?

First, create the annotated list of runs by running one of the 'lgdAnnotate-XXXX.sh' programs (lgdAnnotate-1994.sh, lgdAnnotate-1994-133.sh or lgdAnnotate-1995.sh).

After running, either of the above programs will create a file called 'lgdCalibrations_XXXX.list', where XXXX will change from program to program.

The file will contain lines similar to what is shown below-

```
--------------------------------------------------------------------------------
 12021 Cm         7284    Sun May 29 03:51:38 1994     586980 MPS Field:  Full  1-3-3
--------------------------------------------------------------------------------
 12021 CmB        7298    Mon May 30 00:13:27 1994     509517 MPS Field:  Full  1-3-3
```

this is what you see:

- horizontal line - more than 15 minutes between runs
- '12021' - calibration group
- 'C' - this group is calibrated
- 'm' - this run has monitoring information
- 'B' - this is the base run for this calibration group
- '7298' - run number
- the rest- same as the output of 'triggersX'

Now that you can look at the list of all runs and calibration groups, pick any calibration group that is not yet calibrated.

The order in which the groups are calibrated is not important- each group is calibrated independantly from all other groups.

For the purpose of this document, assume we will be calibrating group 12021.

3 Where is the data?

Now we will copy the data that will be used to calibrate the LGD from tape to disk.

First we need to find on which tapes the data is located. Run:

```
lgdFindTapes.perl 12021
```

where 12021 is our calibration group number. The program will read the LGD calibration database (using *calGroup-II*), the tape database (using *whichtape1*), grok for a while and at the very end print something like this:

```
...
Save the strip database...
Tape: /tape12301.sdb, events: 174218 (  7284:174218)
Tape: /tape12302.sdb, events: 198389 (  7284:4486  7284:193903)
Tape: /tape12309.sdb, events: 842025 (  7282:241276  7298:77514  7298:307985  7299:46940  7299:145672  7301:22638)
Tape: /tape12310.sdb, events: 337151 (  7282:65047  7298:125251  7299:146853)
Tape: /tape12318.sdb, events: 209290 (  7284:209290)
Tape: /tape12319.sdb, events: 25754 (  7284:25754)
Group: 12021, Tapes: 6, Events: 1786827
```

which is the list of tapes that contain data from runs the are part of the LGD calibration group 12021.

The standard calibration procedure needs at least 2000000 (2 million) events to calibrate an LGD group. The total number of available events on the 6 tapes is 1786827 (last line of the 'lgdFindTapes.perl' output), so we will have to strip all the 6 tapes.

4 How to strip the data?

We are goind to strip 2 million events from the tapes we have just selected.

First, make sure that there is enough disk space available. The rule of thumb is that 2 million .dst and .cal events will take about 2 Gbytes of disk space and 5000 .mst events will take about 100 Mbytes of disk space in the mst directory.

At BNL we are using two disks: /s/s12/e852/lgd_1995 and /s/s4/e852/lgd_1995. All the .mst files are stored on /s/s12. Normally /s/s4 has 4 Gbytes and /s/s12 3 Gbytes of free space.

Now that we have disk space, we can start the stripping. Multiple stripping jobs can run at the same time. Mount the input tape on a tape drive and run:

```
strip-1995 -E -g12021 < /dev/dlt2v
```

here '-E' tells the program to eject the tape at the end, '-g12021' tells the program to ignore all data that is not part of group 12021, '¡ /dev/dlt2v' redirects the standard input from the tape device with the input tape.

To strip the whole tape (not just one group), omit the -g switch.

To strip only the monitoring data (only .mst files), specify the '-B' switch.

It takes about 2-3 hours to strip 2 Mevents from a typical DLT-2000 tape.

After the stripper is done, the following files and directories will be created:

- monitoring data (.mst files): into the ./mst/Run*RUNNO.TAPENO.SEQNO*.mst file.
- neutral data (.dst files): into the ./data.*GROUP*/Run*RUNNO.TAPENO.SEQNO*.dst.gz file (compressed with 'gzip').
- charged data (.cal files): into the ./data.*GROUP*/Run*RUNNO.TAPENO.SEQNO*.cal.gz file (also compressed with 'gzip').

5 How to process the monitoring data?

Now we are ready to process the monitoring data through the 'caviar-o-matic' program.

'caviar-o-matic' will calculate the ADC pedestals and threshols and the response of the wall to the laser pulses.

To process the monitoring data, run:

```
lgdRunMon.perl firstRun lastRun
```

where 'firstRun' and 'lastRun' are the first and last runs in the calibration group. Do not ask why the program does not just take the calibration group as the argument- just lookup the run numbers in your 'lgdCalibrations-XXXX.list' file and move on.

This program will look for monitoring data in the .mst/ directory.

It will run 'caviar-o-matic' with the right flags to update the pedestals and monitoring data.

So far, this is the first program that actually updates the LGD calibration database file *$E852_CONFIG/maps/lgd3053.Map*

Now, if everyting worked right, we can rerun the 'lgdAnnotate-XXXX.sh' program and see 'm' appear in the 'Flags' field for the runs that we have just processed.

6 How to run the calibrator?

Very simple: to run the calibrator, execute:

```
lgdFirstPass.perl 12021 \&
```

This will start 'bass-o-matic-1995' with the "right" switches and print the name of the log file. The calibration progress can be monitored by tailing the log file.

The calibrator will read the data from the 'data.*GROUP*' directory and write into the 'info.*GROUP*' directory.

A bunch of files will be created in the 'info.*GROUP*' directory:

- first.histograms — histograms, viewable by Hist,
- first.log — log file
- first.cc.NNN — calibration data, with NNN being the iteration number.

bass-o-matic-1995 will proceed through many steps:

1. start with "flat" calibrations
2. process 10000 events to find the pi0 peak ("search pass")
3. scale the "flat" calibrations to move the pi0 peak to it's nominal position (mass of the pi0)
4. 8 "combined E" passes- process 2000000 events and calculate new calibrations
5. 4 "single E" passes- process 2000000 events and produce new slopes, intercepts and linear correlations for each block.

At the very end, the 'lgdFirstPass.perl' will run 'lgdCCtoMap-II' to store the calibrations into the map.

Now, if everything worked right, if you rerun the 'lgdAnnotate-XXXX.sh' program, our calibration group ought to have 'C' in the 'Flags' field.

We are almost done- only a couple of things left to do.

7 Examine calibration results

While 'bass-o-matic' grinds through the data, it accumulates a few histograms. After it is done, we should have a look at some of them to make sure everything worked right. Actually 'Hist' can display the histograms in real time as the data is being processed.

The histograms of special interest are listed below, in the order they appear in the list: (NN in the histogram names is the iteration number)

- **"1 pi0 mass"**
- **"2 pi0 width"**
- **"3 cc width"**
- **"5300 Mass w**cuts 2 Gamma"/

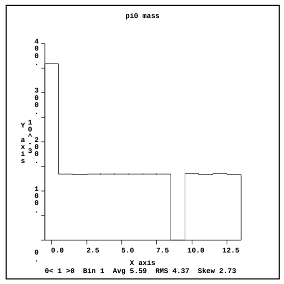

Figure 1: "1 pi0 mass"

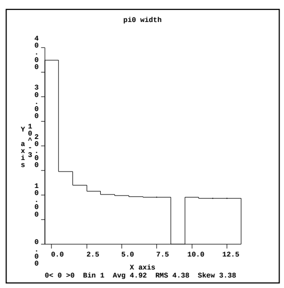

Figure 2: "2 pi0 width"

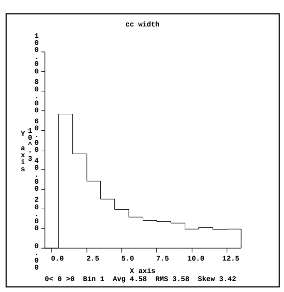

Figure 3: "3 cc width"

- **"13100 tag hadrons: X-distance"**
- **"13200 tag hadrons: Y-distance"**
- **"13300 tag hadrons: XY-distance"**
- **"3xxxx missing mass"**
- **"40NN chisq"**
- **"11NN 2-gamma eff. mass, 2 gamma events"**
- **"12NN 2-gamma eff. mass, 3 gamma events"**
- **"14NN pi0-pi0 eff. mass, 4 gamma events"**
- **" 6NN new**old CC"/
- **"20NN 2 gamma eff mass, 1-3-3"**
- **"21NN 2 gamma eff mass, 1-3-3 PS"**
- **"22NN 2 gamma eff mass, 1-1-1"**
- **"23NN 2 gamma eff mass, neutral"**
- **"24NN 2 gamma eff mass, 0-2-2"**
- **"25NN 2 gamma eff mass, 0-4-4"**

The best way to see if everything is okey is to compare them with the histograms from some other, already calibrated group.

There are a few things to watch for, though:

- the pi0 mass: the pi0 mass should not jump around and stay within 1 MeV from the nominal pi0 mass.
- hadron rejection: both X and Y "distance" histograms should peak at zero and be symmetrical. An assymetry in the histograms means that the LGD is "in the wrong place", that is, the LGD position encoders are not calibrated correctly. This condition should be immediately fixed by changing the offset (in cm) of the LGD position encoders. This procedure is not documented here. Sorry.
- missing mass plots: should peak at the mass of the proton/neutron squared (approximately 0.88 GeV^2).
- 2 gamma effective mass plots: you should see the "pi0" peak at the pi0 mass and the "eta" peak at the eta mass. The eta peak is expected to be sharper in the all neutral data. There ought to be no "extra" peaks.
- pi0-pi0 eff mass: in the all-neutral data, the "K-short" and "f2" peaks should be clearly visible. If there is no all-neutral data in the calibration data set, the "f2" peak will be gone but the "K-short" peak should still be visible.

Once all the histograms look right, the group can be considered "calibrated".

8 Tar the stripped data to 8 mm tape

After all the work stripping the data tapes, it is reasonable to save the stripped data on an 8mm tape, just in case we will want to recalibrate this group.

Label an empty 8mm tape as "LGD group *GROUP*", mount it on a tape drive (say, /dev/mx1v) and execute:

```
lgdToTape.perl 12021 /dev/mx1v \&
```

The 'lgdToTape.perl' program will execute the tar command and create a log file in 'info.*GROUP*/tar-c.list'. After 'tar' finishes, do not forget to check the log file for tape I/O errors.

This step can actually be done in parallel with running the calibrator, so as soon as 'bass-o-matic' finishes and after we have looked at the resulting histograms, the files in 'data.*GROUP*' can be removed to make space for the next calibration group.

9 Notes on housekeeping

Keep the files in the info.XXX directories- they might be useful later, especially the histogram files. If disk space is a concern, compress them, but do *NOT* delete them- they do not use *that* much space.

The above procedures say naught about what to do with the .mst files. Basically they are not needed after they are processed through 'caviar-o-matic'. However after all that hard work sent stripping them, it seems to be a waste to just delete them. Tar them to a tape and keep that tape with the other calibration tapes.

As promised, this is all. Now you can delete the files in 'data.*GROUP* (you have saved them on an 8mm, did you?) and go ahead to calibrate the next group.