Step by Step Guidance to Conduct Various Procedures Related to the Calibration and Analysis of the BigBite Calorimeter (BBCAL)

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Abstract

This article will provide step by step guidance to carry out several procedures necessary for the testing, commissioning, and calibration of the BigBite calorimeter (BBCAL), using the analysis scripts existing in the BBCal_replay git repository. During run time, it is recommended to perform all analysis on Jefferson Lab's Hall A CH analysis machines, aonlX [X=1,2, or 3], as a-onl, where a cloned version of BBCal_replay repository is already existing. User just needs to execute "gobbcal" after connecting to aonlX as a-onl, to get to the repository. All the instructions in this article have been written assuming that the user is performing the analysis as a-onl@aonlX.

Contents

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1 Take Cosmic Run(s)

1. Load the desired HV setting to the JAVA GUI [see Instructions]. (Optional)
2. Set BBCAL discriminator thresholds [see Instructions] such that the BBCAL trigger rate is in range $150 - 250$ Hz [see Instructions].
3. Start a CODA run and record > 400K BBCAL triggers.
   - Pre-scale: ps1 = 0, rest = -1
   - Configuration: GEnII-NoSBSGems
4. Save the HV settings using JAVA GUI as **run_<runnum>_hv.set** [see Instructions].

2 Replay Cosmic Run(s)

1. login to aonlX [X=1,2,3] machine as user: "a-onl" //ssh -Y a-onl@aonlX
2. gobbcal //Sets the env variables and changes to right directory.
3. ./run_cosmic_replay.sh <runnum> <nevents> //Replays data

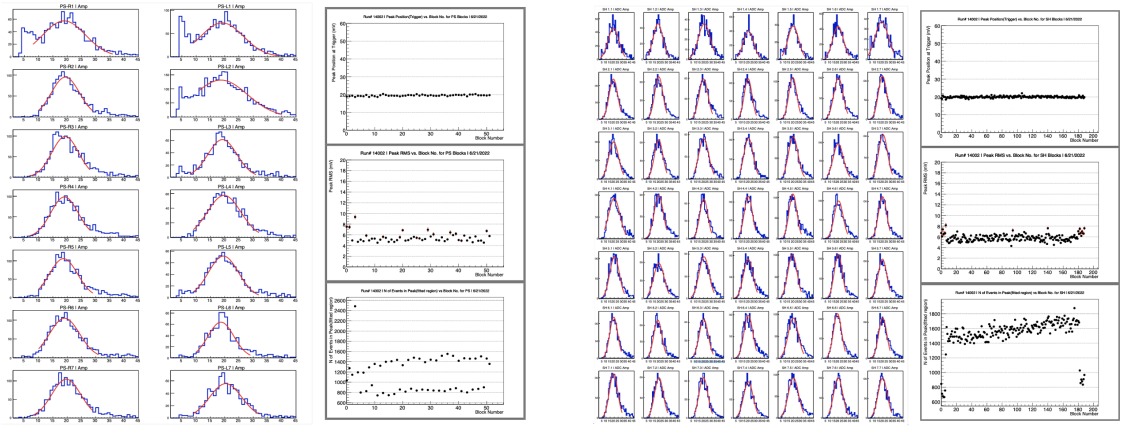
3 Analyze Cosmic Run(s)

It is recommended to use at least **400K** BBCAL triggers for analysis to get best results (see Sec. 1).

3.1 Quick Analysis (Ideal for Shift Crew)

1. Replay the cosmic run (see Sec. 2).
2. ./run_cosmic_analysis.sh <runnum> <nevents> //Starts analysis
   - First, **PS** analysis will be prompted.
     - After completion, one GUI with cosmic peaks for all PS blocks will pop up. User should check all the 52 plots. Any issues needs to be taken care of before moving to the next step. Possible issues:
       * Fitting is bad for one or more blocks - Try expert analysis (Sec. 3.2).
       * Empty histogram (one or more) - Call expert.
     - Three canvases with diagnostic plots will also pop up.
       * Peak position at Trigger vs. Blocks - All the data points should be within $\pm 10\%$ of the desired ADC peak position to ensure proper calibration.
       * Peak RMS vs. Blocks - All the data points should be within $\pm 4\%$ mV from each other. Slightly higher fluctuations at the edges are expected.
       * No. of Events in Peaks vs. Blocks - Should follow the trend shown in Fig. 1a.
   - Upon successful completion of PS analysis, **SH** analysis will be prompted.
     - After completion, one GUI with cosmic peaks for all SH blocks will pop up. User should check all the 189 plots. Any issues needs to be taken care of before moving to the next step. Possible issues:
       * Fitting is bad for one or more blocks - Try expert analysis (Sec. 3.2).
       * Empty histogram (one or more) - Call expert.
     - Three canvases with diagnostic plots will also pop up.

* Peak position at Trigger vs. Blocks - All the data points should be within ±10% of the desired ADC peak position to ensure proper calibration.
* Peak RMS vs. Blocks - All the data points should be within ±4% mV from each other. Slightly higher fluctuations at the edges are expected.
* No. of Events in Peaks vs. Blocks - Should follow the trend shown in Fig. 1b.



(a) Pre-Shower (PS) (b) Shower (SH)

Figure 1: Cosmic peaks and diagnostic plots for PS and SH.

3.2 Expert Analysis

3.2.1 Why useful?

- PS and SH data can be analyzed separately.
- Gives option to analyze multiple runs.
- Histogram ranges can be modified.
- Provides option to choose diagnostic plots for ADC amplitude distributions at trigger or at FADC. [Quick analysis (Sec. 3.1) shows ADC amplitudes at trigger, by default.]

3.2.2 For Pre-Shower (PS)

1. Replay the cosmic run (or runs). (see Sec. 2)
2. Change directory to "BBCal_replay/macros"
3. root -l
4. .x PreShower_macros/bbps_cos_cal.C(<runnum>,<nevents>)
5. (Provide user inputs as per needs)

3.2.3 For Shower (SH)

1. Replay the cosmic run (or runs). (see Sec. 2)
2. Change directory to "BBCal_replay/macros"
3. root -l
4. .x Shower_macros/bbsh_cos_cal.C(<runnum>,<nevents>)
5. (Provide user inputs as per needs)

4 Generate Calibrated HVs using Cosmic Data (PMT Gain Matching)

4.1 Quick Analysis (Ideal for Shift Crew)

1. Replay and Analyze the cosmic run (see Sec. 2 & 3).
2. Make sure **run_<runnum>_hv.set** file exists either at "BBCal_replay/macros/hv_set" or at "/adaqfs/home/aslow/JAVA/slowc_bbcal/BBCAL/hv_set" (see Step 4 of Sec. 1).
3. gobbcal
4. ./get_calibrated_hv.sh <runnum> <desired_trigger_amp(mV)>
5. ** Diagnostic plots should pop up for both PS and SH. **If everything looks good,** then load the calibrated HV file to the HV control (JAVA) GUI. (see Instructions)

** Make sure there are no outliers in the "Absolute Shift (V)" plot [Page 2]. If there are, then verify the ADC amplitude distributions for those channels and take appropriate action.

4.2 Expert Analysis

4.2.1 Why useful?

- PS and SH data can be analyzed separately.
- Gives option to analyze multiple runs.

4.2.2 For Pre-Shower (PS)

1. Replay and Analyze the cosmic run (or runs). (see Sec. 2 & 3)
2. Change directory to "BBCal_replay/macros"
3. root -l
4. .x PreShower_macros/ps_HVUpdate_cosmic.C(<runnum>,<desired_trigger_amp(mV)>,<multiRun_flag>)
   - "multiRun_flag" takes binary input. [0 ⇒ Single run, 1 ⇒ Multiple Runs]
5. Diagnostic plots will pop up after successful execution. Make sure there are no outliers in the "Absolute Shift (V)" plot [Page 2]. If there are, then verify the ADC amplitude distributions for those channels and take appropriate action.

4.2.3 For Shower (SH)

1. Replay and Analyze the cosmic run (or runs). (see Sec. 2 & 3)
2. Change directory to "BBCal_replay/macros"
3. root -l
4. .x Shower_macros/sh_HVUpdate_cosmic.C(<runnum>,<desired_trigger_amp(mV)>,<multiRun_flag>)
   - "multiRun_flag" takes boolian input. [0 ⇒ Single run, 1 ⇒ Multiple Runs]
5. Diagnostic plots will pop up after successful execution. Make sure there are no outliers in the "Absolute Shift (V)" plot [Page 2]. If there are, then verify the ADC amplitude distributions for those channels and take appropriate action.

5 Generate ADC Gain Coefficients using Cosmic Data

Using a cosmic run taken with calibrated HV setting we can generate ADC gain coefficients (in GeV/pC) to put in the DB file, for both PS and SH. One needs to know at what value this calibrated HV setting aligns the ADC amplitudes at trigger (Trigger amplitude) to.

5.1 For Pre-Shower (PS)

1. Replay the cosmic run. (see Sec. 2)
2. Analyze it to ensure proper calibration. (see Sec. 3)
3. Change directory to "BBCal_replay/macros"
4. root -l
5. .x PreShower_macros/bbps_ampToint.C(<runnum>,<nevent>) //Generates ADC amp to int ratios for every block.
6. Again start from "BBCal_replay/macros"
7. root -l
8. .x Combined_macros/calculate_adcGain_cos.C //Asks for the following user inputs:
   i. Run Number? : <runnum>
   ii. Shower(SH) or PreShower(PS)? [SH=1, PS=0] : 0
   iii. Trigger amplitude? (mV) [Default: 25] : (Put trigger amp for the current run)
9. (End of execution summary on terminal should show the file name where the PS ADC gain coefficients have been written)
10. Put the gain coefficients to PS DB file (db_bb.ps.dat).

5.2 For Shower (SH)

1. Replay the cosmic run. [see Sec. 2]
2. Analyze it to ensure proper calibration. [see Sec. 3]
3. Change directory to "BBCal_replay/macros"
4. root -l
5. .x PreShower_macros/bbps_ampToint.C(<runnum>,<nevent>) //Generates ADC amp to int ratios for every block.
6. Again start from "BBCal_replay/macros"
7. root -l
8. .x Combined_macros/calculate_adcGain_cos.C //Asks for the following user inputs:
   i. Run Number? : <runnum>
   ii. Shower(SH) or PreShower(PS)? [SH=1, PS=0] : 1
   iii. Trigger amplitude? (mV) [Default: 25] : (Put trigger amp for the current run)
9. (End of execution summary on terminal should show the file names where the SH ADC gain coefficients have been written)
10. Put the gain coefficients to SH DB file (db_bb.sh.dat).

6 Generate ADC Time Offsets w.r.t. BBHodo Cluster tmean

As part of the BBCAL ADC time calibration we align the ADC time of every blocks with respect to the BigBite hodoscope cluster mean time. Following steps describe how to get the appropriate ADC time offsets for both PS and SH.

1. Replay the run (Must include BBHodo ".clus.tmean" variable and track variables "bb.tr.*")
2. Change directory to "BBCal_replay/macros"
3. Open and modify (if necessary) desired configuration file situated in "BBCal_replay/macros/Combined_macros/cfg/" directory.
   - Example configuration file: "BBCal_replay/macros/Combined_macros/cfg/atimeOff-example.cfg"
4. root -l
5. .x Combined_macros/bbcal_atime_offset.C("Combined_macros/cfg/<config_file_name>")
6. (After successful execution, list of output files (with location) will be displayed on the terminal.)
7. Check the files containing ADC time offsets for both SH & PS thoroughly for outliers.
8. Finally, put the new offsets in BBCAL DB files (db_bb.sh.dat & db_bb.ps.dat) with appropriate time stamp, under bb.sh.adc.timeoffset and bb.ps.adc.timeoffset parameters for SH and PS, respectively.

** Diagnostic plots from SBS-G_M^n/nTPE pre-pass2 calibration can be found here.

7 Generate α values for PMTs by Performing HV Scan

Knowing α values of the PMTs are necessary to be able to gain match them. We use multiple cosmic runs taken with slightly different HV settings to determine the α values for all the SH and PS PMTs. There are multiple steps to the process.

7.1 Step 1: Generating HV files for the scan

We want to scan BBCAL PMTs in a range for which the trigger amplitudes are within $10 - 30$ mV in order to make sure linear response. Hence, it is recommended to start with a HV setting that sets the trigger amplitudes for all the PMTs to ≈ 20 mV. Then, the plan would be to generate multiple HV set files by adding and subtracting up to 80 V to and from each HV channel. The granularity will depend on the circumstances. For instance, one could choose $(-80V, -50V, -25V, 25V, 50V, 80V)$ or $(-80V, -60V, -40V, -20V, -10V, 10V, 20V, 40V, 60V, 80V)$. The second set will definitely give more reliable α values. Follow the steps below to generate a HV file from another one, by adding or subtracting arbitrary numbers of choice from every channel:

1. Make sure the HV file that aligns the trigger amplitudes for all the BBCAL PMTs to ≈ 20 mV is saved at "BBCal_replay/macros/hv_set" in the format "hv_<runnum>_run.set".
2. Change directory to "BBCal_replay/macros"
3. root -l
4. .L Combined_macros/Shift_HV.C
5. Shift_HV(<runnum>,<HVShift>) //Use <HVShift>= $-x$ to subtract xV from every channel or, use <HVShift>= x to add xV to every channels.
6. (End of execution summary on terminal should show the generated HV file name.)

7.2 Step 2: Taking the Runs, Replay, & Analyze

1. Load one of the HV settings generated in the previous step.
2. Adjust BBCAL trigger threshold to get a trigger rate of ≈ 250 Hz.
3. Start a run using CODA.
4. Save the HV setting as **run_<runnum>_hv.set** either at "BBCal_replay/macros/hv_set" or at "/adaqfs/home/aslow/JAVA/slowc_bbcal/BBCAL/hv_set".
5. Take $\approx$ 500K BBCAL events.
6. Replay and then Analyze the run. [see Sec. 2 & 3]
7. ** Repeat instructions 1-6 for all the HV settings generate in Step 1.
8. If all the plots look good for all the runs, then proceed to the next step.

7.3 Step 3: Extracting α Values

7.3.1 For Shower (SH)

1. Change directory to "BBCal_replay/macros"
2. .L Shower_macros/HV_Peak_v2.C+

3. AddRun(<runnum_1>)
4. AddRun(<runnum_2>)
5. .. //Add all the runs taken in Step 2, one by one.
6. FitRuns(20)
7. (Peak at trigger vs HV plot for SH row 1 will pop up. Hit space bar to proceed.)
8. (Alpha values for all SH blocks gets saved in "Output/run_<runnum_first>_<runnum_last>_alpha.txt".)

7.3.2 For Pre-Shower (PS)

1. Change directory to "BBCal_replay/macros"
2. .L PreShower_macros/PreShower_HV_Peak_v2.C+
3. AddRun(<runnum_1>)
4. AddRun(<runnum_2>)
5. .. //Add all the runs taken in Step 2, one by one.
6. FitRuns(20)
7. (Peak at trigger vs HV plot for PS row 1 will pop up. Hit space bar to proceed.)
8. (Alpha values for all SH blocks gets saved in "Output/run_<runnum_first>_<runnum_last>_alpha_ps.txt".)

7.4 Step 4: Putting the Files with New α Values at the Right Place

1. Save the outputs of Step 3 in "BBCal_replay/golden" under appropriate sub-directory.
2. To use these new α values in order to generate calibrated HVs, one must edit "BBCal_replay/Shower_macros/sh_HVUpdate_cosmic.C" and "BBCal_replay/PreShower_macros/ps_HVUpdate_cosmic.C" scripts to link the .txt files generated in Step 3.

8 Check the Quality of PS Energy Calibration Using pion Peaks

Checking the alignment of pion peak positions across all the PS blocks is a powerful way to validate PS energy calibration. If overall PS energy calibration is good, then the pion peak positions should be within $\pm 10\%$ for all the blocks in the acceptance [see Fig. 2]. There is an abundance of pions in SBS experiments, which makes this method even more powerful. Even optics runs can be used to run this check.

1. Replay the run.
2. Change directory to "BBCal_replay/macros"
3. Open "PreShower_macros/setup_pion_peak_bbps.txt"
4. (Modify the setup file according to your need)
5. root -l
6. .x PreShower_macros/pion_peak_bbps.C("PreShower_macros/setup_pion_peak_bbps.txt")
7. (One GUI and a few summary plots should pop up, upon proper execution)

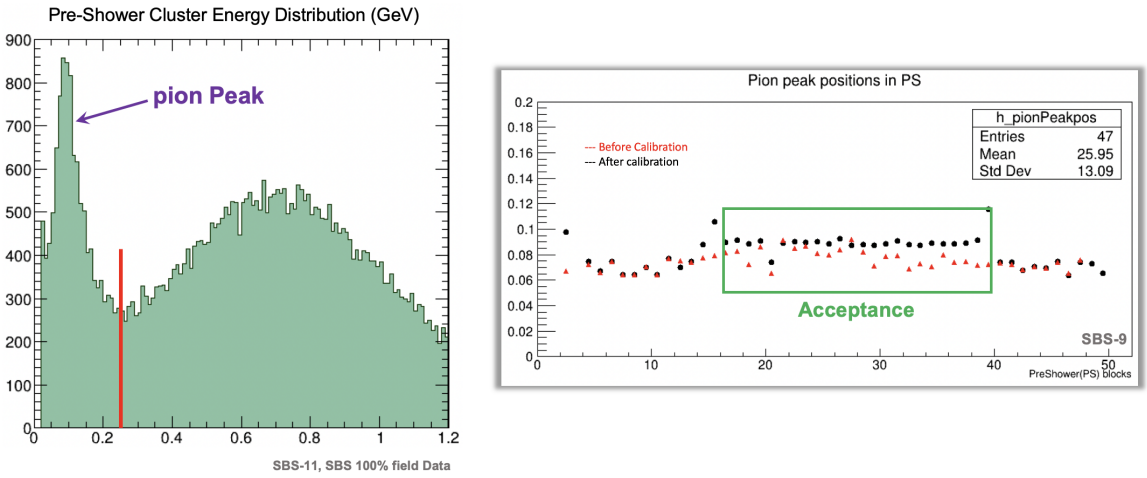


Figure 2: Left: Pre-Shower cluster energy distribution. Right: Pion peak position vs. PS blocks.

9 Check the Quality of SH Energy Calibration by Plotting either E/p per SH Blocks or SH Energy per SH Blocks

Checking the alignment of E/p peak positions across all the SH blocks is a powerful way to validate SH energy calibration.

1. Replay the run (Make sure track variables are present in the tree).
2. Change directory to "BBCal_replay/macros"
3. Open "Shower_macros/setup_clust_eng_bbsh.txt"
4. (Modify the setup file according to your need) //"E_or_EovP" = 0 (or, 1) gives SH cluster energy (or, E/p) per SH block.
5. root -l
6. .x Shower_macros/clust_eng_bbsh.C("Shower_macros/setup_clust_eng_bbsh.txt")
7. (One GUI with all the plots should pop up, upon proper execution)

10 Event Display to Look at SH and PS Clusters along with Track Position

1. Replay the run [Use standard replay to get track variables].
2. Change directory to "BBCal_replay/macros"
3. root -l
4. .x Event_disp_macros/bbcal_clustD.C("<rootfile_w_fullpath>",<eventcuts>,<runnum>)
5. Click "Next Entry" on the GUI
6. (Navigation tabs on the event display GUI are self-explanatory)

** This script takes two more arguments (4th & 5th), which can be useful sometimes. Here is a brief description:

- <gt1ClInfo> : Set to 1, if "*.clus.*" variables are present in the tree.
- <ADCpBlk> : Set to 1, if "*.a*" (such as *.a_c, *.a_p, etc.) variables are present in the tree.

11 Event Display to look at FADC Waveforms

SH and PS both use FADCs to digitize data and we store the full FADC waveforms for all the events. The scripts discussed below generate event displays which show the waveforms for every SH and PS blocks.

11.1 For Pre-Shower (PS)

1. Replay the run with following options:
   i. In the replay script set "SetStoreRawHits" to kTRUE for "SBSBBTotalShower" object. Suppose "ts" is an object of "SBSBBTotalShower", in that case one needs to add the following two lines:
   ts → SetStoreRawHits(kTRUE);
   ts → GetPreShower() → SetStoreRawHits(kTRUE);
   ii. In "replay_BBCAL.odef" file, add the following line:
   block bb.ps.*samp*
   block bb.ps.a_*
   block bb.ps.adc*
2. Change directory to "BBCal_replay/macros"
3. root -l
4. .x Event_disp_macros/display_ps.C("<rootfile_w_fullpath>",<eventcuts>,<runnum>)
5. Click "Next Entry" on the GUI
6. (Navigation tabs on the event display GUI are self-explanatory)

11.2 For Shower (SH)

1. Replay run with following options:
   i. In the replay script set "SetStoreRawHits" to kTRUE for "SBSBBTotalShower" object. Suppose "ts" is an object of "SBSBBTotalShower", in that case one needs to add the following two lines:
   ts → SetStoreRawHits(kTRUE);
   ts → GetShower() → SetStoreRawHits(kTRUE);
   ii. In "replay_BBCAL.odef" file, add the following line:
   block bb.sh.*samp*
   block bb.sh.a_*
   block bb.sh.adc*
2. Change directory to "BBCal_replay/macros"
3. root -l

4. .x Event_disp_macros/display_sh.C("<rootfile_w_fullpath>",<eventcuts>,<runnum>)
5. Click "Next Entry" on the GUI
6. (Navigation tabs on the event display GUI are self-explanatory)

12 Generate ADC Gain Coefficients using H_2 Data (Energy Calibration using Beam)

Cosmic calibration gives us a good start but eventually we need to calibrate BBCAL energy using H_2 data against track momentum. This gives us the expected resolution. Once optics is properly calibrated we can trust the track momentum enough to go ahead with this calibration procedure.

1. Replay the H_2 run (s) using standard replay machinery. Make sure track variables (bb.tr.*) are present in the tree.
2. Change directory to "BBCal_replay/macros"
3. Open and modify (if necessary) desired configuration file situated in "BBCal_replay/macros/Combined_macros/cfg/" directory.
   - Example configuration file: "BBCal_replay/macros/Combined_macros/cfg/example.cfg"
4. root -l
5. .x Combined_macros/bbcal_eng_calib_w_h2.C("Combined_macros/cfg/<config_file_name>")
6. (After successful execution, list of output files (with location) will be displayed on the terminal.)
7. Check the files containing ADC gain coefficients for SH & PS thoroughly. If entry for any channel is -1000, replace that with the old ADC gain coefficient of that channel.
8. Finally, put the new offsets in BBCAL DB files (db_bb.sh.dat & db_bb.ps.dat) with appropriate time stamp, under bb.sh.adc.gain and bb.ps.adc.gain parameters for SH and PS, respectively.

** Diagnostic plots from SBS-G_M^n/nTPE pre-pass2 calibration can be found here.

13 Generate Quality Assurance (QA) Plots for BBCAL Energy Calibration

Run this procedure to check the quality of BBCAL energy calibration easily. A bunch of diagnostic plots get generated after successful execution.

1. Replay the H_2 run (s) using standard replay machinery. Make sure track variables (bb.tr.*) are present in the tree.
2. Change directory to "BBCal_replay/macros"
3. Open "Combined_macros/setup_qualityA_plots_BBCAL.cfg"
4. Modify the configuration file according to your need. (Recommended settings for all the SBS configurations are already present in the file. Choose the right one, copy it and paste at the top of the file)
5. root -l
6. .x Combined_macros/qualityA_plots_BBCAL.C
7. (Several diagnostic plots should pop up) [see EXAMPLEs]

14 Check ADC time alignment and generate ADC time offset for every SH and PS block using Cosmic data

It is possible to align ADC time for all the SH and PS blocks, with respect to a target ADC time value, using cosmic data. This procedure is not mandatory to do during commissioning. But looking at the time peaks for individual SH and PS blocks one can get an idea about the magnitude of trigger jitters [The necessary BBCAL cluster ADC time offset correction for analysis has been explained in Sec. 6].

14.1 For Pre-Shower (PS)

1. Replay the cosmic run. (see Sec. 2)
2. Change directory to "BBCal_replay/macros"
3. Open "PreShower_macros/setup_ps_atime_align_cosmic.txt"
4. (Modify the setup file according to your need)
5. root -l
6. .x PreShower_macros/ps_atime_align_cosmic.C("PreShower_macros/setup_ps_atime_align_cosmic.txt")
7. (End of execution summary on terminal should show the file names where the PS time offsets have been written)
8. Put the ADC time offsets to PS DB file (db bb.ps.dat)

14.2 For Shower (SH)

1. Replay the cosmic run. (see Sec. 2)
2. Change directory to "BBCal_replay/macros"
3. Open "Shower_macros/setup_sh_atime_align_cosmic.txt"
4. (Modify the setup file according to your need)
5. root -l
6. .x Shower_macros/sh_atime_align_cosmic.C("Shower_macros/setup_sh_atime_align_cosmic.txt")
7. (End of execution summary on terminal should show the file names where the SH time offsets have been written)
8. Put the ADC time offsets to SH DB file (db bb.sh.dat)

A Steps to Calibrate BBCAL with Different BB and/or SBS Field Settings to Mitigate Fringe Field Effect

The effect of SBS magnet's fringe field on BBCAL PMTs is significant. Follow the steps below for mitigation: 2

1. Load HV setting that aligns the trigger amplitudes for all the BBCAL PMTs to 25mV for both BB and SBS magnets OFF settings. E.g. hv_calibrated_run_1462_25mV_09_18_2022.set.
2. Turn BB and/or SBS magnets ON to their desired settings.
3. Take a cosmic run for calibration (see Sec. 1).
4. Replay the run (see Sec. 2).
5. Analyze (see Sec. 3).
6. Decide on the trigger amplitude set value so that saturation in electronics can be avoided for the highest energy elastic electrons 1.
    - Try to choose either 10, 15, 20, or 25mV as trigger amplitude. This will make calculations easier. For instance, if calculation shows that maximum trigger amplitude allowed to avoid saturation is 13mV for some configuration, then choose 10mV. Or, if the maximum trigger amplitude turns out to be 23mV, then it is fine to choose either 20, 15, or 10mV but it would be the best to choose 20mV. This is because around 20mV PMT response is optimal. So, we would like to stay near that region if possible.
7. Generate calibrated HVs to align trigger amplitudes to the decided value (see Sec. 4).
8. Stop the ongoing run (if any) and load the newly generated calibrated HV. Post a log entry about the HV change.
9. (Mission accomplished! Great Job! BBCAL trigger should be well calibrated now even with the presence of fringe field. So, it is fine to start recording data for the experiment. Following steps can be performed while experimental data taking is ongoing.)
10. Put appropriate gain coefficients (depending on the trigger amplitude chosen in Step 6) in the DB files:
    i. For Pre-Shower (PS): Copy the gain coefficients from "BBCal_replay/golden/preshower/ps_standard_ADCgains_cosmics.txt" and paste in "db_bb.ps.dat" file with appropriate time stamp.
    ii. For Shower (SH): Copy the gain coefficients from "BBCal_replay/golden/shower/sh_standard_ADCgains_cosmics.txt" and paste in "db_bb.sh.dat" file with appropriate time stamp.
    - In case there is time to take another cosmic run with the HV setting generated in Step 7, skip copying the gain coefficients from standard files as mentioned above. Use the run to generate new gain coefficients for both SH and PS instead (see Sec. 5).
11. Post another detailed log entry with all the analysis plots.

B Useful Links

This section contains a collection of links to various important BBCAL related documents, talks, wiki pages, and reports (on calibration and others).

B.1 Documents

1. Study of the Linear Region of Operation for all the Electronic Modules involved in BigBite Calorimeter Circuit. LINK
2. Study to gain match BBCal signals arriving before Discriminator using a pulser (Trigger to FADC ADC amplitude ratios). LINK

B.2 Talks

1. Plan to mitigate SBS fringe field effect on BBCAL PMTs. LINK
2. SBS BBCAL. LINK

B.3 Wiki

1. Various Maps and Layouts for BBCAL. LINK
2. Shift Crew How-to Wiki Page for BBCAL. LINK

B.4 Reports

1. Report on BBCAL readiness for GEnII run. LINK
2. Report on BBCAL energy calibration readiness for SBS-G_M^n/nTPE pass2 cooking. LINK
3. Report on BBCAL ADC time alignment readiness for SBS-G_M^n/nTPE pass2 cooking. LINK