BigBite Shower and Preshower
Cosmic Calibration

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Outline

• Filling the SH/PS ADC histograms
• Procedure to fit the cosmic peaks
• Formula used to get HV correction
• Preliminary Results
Filling the SH/PS ADC Histograms & Fitting the Cosmic Peaks

- Primarily using the macro written by William Tireman.
- The following cuts on the ADC values have been implemented:
  - The vertical neighbors require ADC > 50.
  - The horizontal neighbors require ADC < 50.
  - For PS we ignore the cuts on horizontal neighbors.
- We do fit the peaks using Gaussian in two steps:
  - First, find the bin with maximum content and fit it.
  - Then fit again in a narrow range.
    - $\pm 1.5\sigma$ from the peak for SH and $\pm 1.2\sigma$ from the peak for PS.

*Picture Credit: William Tireman*
Preliminary Results: Cosmic Peaks in BB Shower Blocks : Run 170
Preliminary Results: Cosmic Peaks in BB PreShower Blocks : Run 170
High Voltage Correction

• Using the following formula to predict the HV correction required to change the peak location to a target ADC channel:

\[
HV \text{ Correction} = \left( \frac{Target \ Channel}{Correct \ Channel \ at \ which \ the \ Peak \ is \ located} \right)^{0.1}
\]

• Right now, the target channel is set at 100.
Generating Diagnostic Plots

• I start by taking a cosmic run for 2 hours.
• Then analyze the data using the procedure explained earlier to get HV corrections.
• Load up the corrected HV and take the next run for another two hours.
• Make a few diagnostic plots to see how well the scheme worked.
• Then repeat the same process again.
Peak Position vs. Shower Blocks

Run# 169_0 | Peak Position vs. Block No. for SH Detectors | 03/04/2021

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Peak Position vs. Shower Blocks

Run# 170_0 | Peak Position vs. Block No. for SH Detectors | 03/04/2021
Peak Position vs. Shower Blocks

Run# 173_0 | Peak Position vs. Block No. for SH Detectors | 03/06/2021
Peak Position vs. Shower Blocks : Evolution in 4 Iterations
Peak RMS vs. Shower Blocks

Run# 168_0 | Peak RMS vs. Block No. for SH Detectors | 03/04/2021
Peak RMS vs. Shower Blocks

Run# 169_0 | Peak RMS vs. Block No. for SH Detectors | 03/04/2021

[Graph showing peak RMS vs. shower block number]
Peak RMS vs. Shower Blocks

Run# 170_0 | Peak RMS vs. Block No. for SH Detectors | 03/04/2021
Peak RMS vs. Shower Blocks

Run# 173_0 | Peak RMS vs. Block No. for SH Detectors | 03/06/2021
Peak RMS vs. Shower Blocks: Evolution in 4 Iterations
High Voltage vs. Shower Blocks

Run# 168_0 | HV vs. Block No. for SH Detectors | 03/04/2021
High Voltage vs. Shower Blocks

Run# 169_0 | HV vs. Block No. for SH Detectors | 03/04/2021
High Voltage vs. Shower Blocks

Run# 170_0 | HV vs. Block No. for SH Detectors | 03/04/2021
High Voltage vs. Shower Blocks

Run# 173_0 | HV vs. Block No. for SH Detectors | 03/06/2021

[Graph showing a scatter plot with High Voltage on the y-axis and Block Number on the x-axis, depicting data points scattered across the graph.]
High Voltage vs. Shower Blocks: Evolution in 4 Iterations

Run# 168_0 | HV vs. Block No. for SH Detectors | 03/04/2021

Run# 169_0 | HV vs. Block No. for SH Detectors | 03/04/2021

Run# 170_0 | HV vs. Block No. for SH Detectors | 03/04/2021

Run# 173_0 | HV vs. Block No. for SH Detectors | 03/08/2021
No. of Events in the Peak (Fitted Region) vs. Shower Blocks
Peak Position vs. PreShower Blocks: Evolution in 3 Iterations
Peak RMS vs. PreShower Blocks : Evolution in 3 Iterations
High Voltage vs. PreShower Blocks: Evolution in 3 Iterations

Run# 168_0 | HV vs. Block No. for PS Detectors | 03/04/2021
Run# 169_0 | HV vs. Block No. for PS Detectors | 03/04/2021
Run# 170_0 | HV vs. Block No. for PS Detectors | 03/04/2021
No. of Events in the Peak (Fitted Region) vs. PreShower Blocks
Future Work

• Try to troubleshoot noisy PreShower channels.
• Continue the study for a few more iterations for both SH and PS.

Thank you for your attention!
Questions?
Reason Behind Significantly Diff. HVs for PMTs in SH Blocks 160-189

• The blocks in the top layers of the SH detector (~ 160-189) were replaced by PS blocks.

• The PS PMTs have different specifications than the SH PMTs.

• The picture on the shows the two different kind of modules installed in the SH detector.