Big Bite High Voltage Adjustments using Cosmic Ray Data

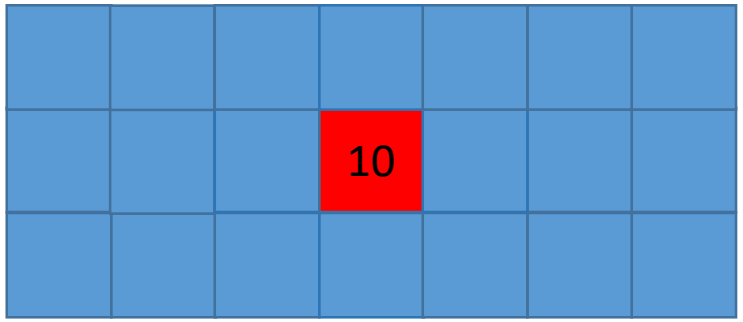
William Tireman
Northern Michigan University

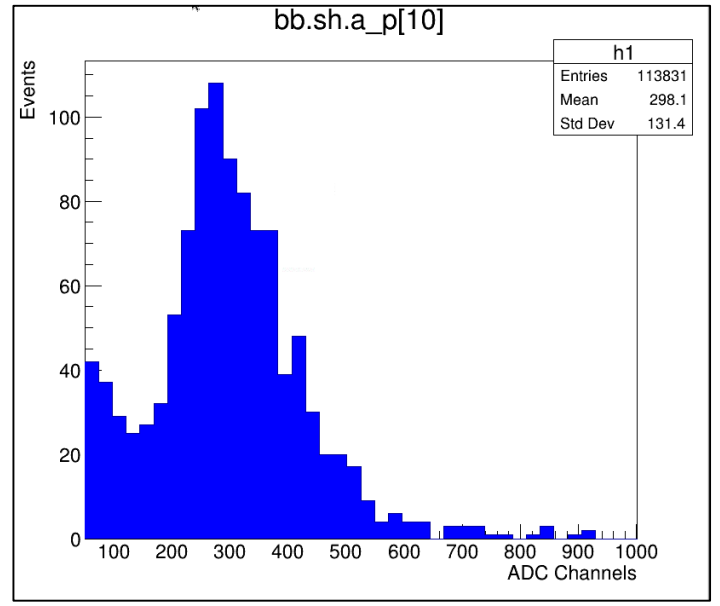
- Outline
  - Purpose of the scripts
  - General scheme for performing high voltage adjustment
  - Final Product and Diagnostic histograms
  - Operational usage

Purpose of scripts

- Using cosmic ray data
  - Fill Big Bite shower and preshower ADC histograms using reasonable cuts
  - Fit ADC histograms and extract the cosmic ray peak location
  - Use the current peak location to predict the HV change necessary to move cosmic peak to a target ADC channel
  - Write out a new HV settings file
  - Generate a few diagnostic plots

Bottom 3 rows of Shower Detectors

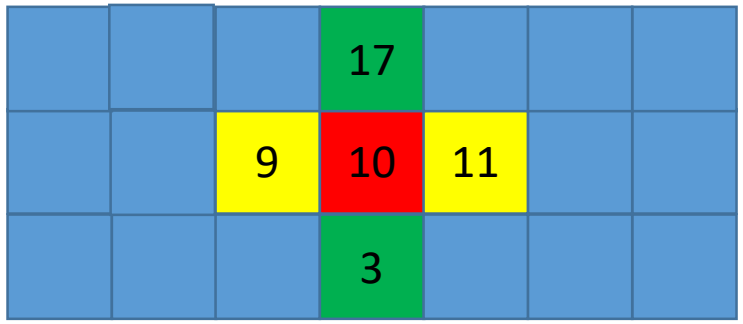


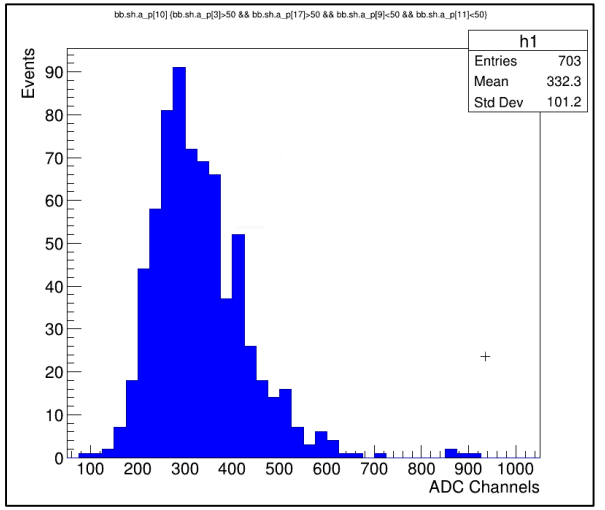


General scheme for performing HV adjustment

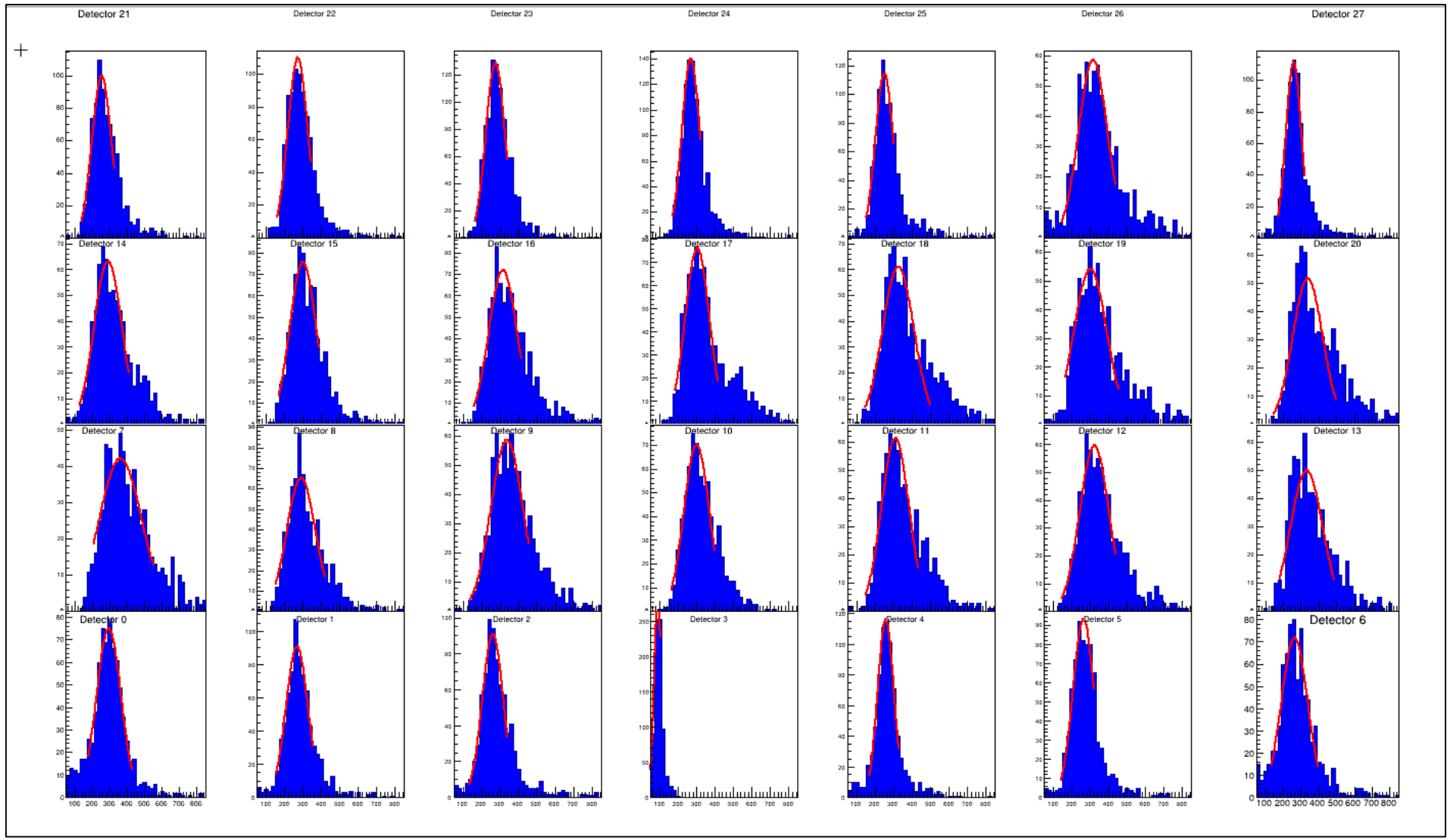
- Fill ADC histograms for each detector cutting on nearest neighbors
  - Vertical neighbors require ADC > 50
  - Horizontal neighbors require ADC < 50
  - Use 40 bins to produce an easy to recognize peak
- Fit with Gaussian using tallest bin as guess for peak channel
- Fit a 2nd time with Gaussian using limited bin range
  - +2σ above and -1σ below tallest bin for **shower**
  - +1σ above and -0.4σ below tallest bin for **preshower**
- Extract final fit parameters

Bottom 3 rows of Shower Detectors





General scheme for performing HV adjustment (2)



General scheme for performing HV adjustment (3)

- The cosmic peak channel is used to compute the HV adjustment
- Adjustable ***Target channel*** is currently set to 100
- Power law is to keep change from being too large (diverging as well)
- Results written to basic ASCii files (1 for shower and 1 for preshower)

$$HV\ Correction = \left(\frac{Target\ Channel}{Peak\ Channel}\right)^{0.10}$$

General scheme for performing HV adjustment (4)

- Fit results for shower detectors (example)
- Good/Bad is triggered by a change greater than +/- 20%

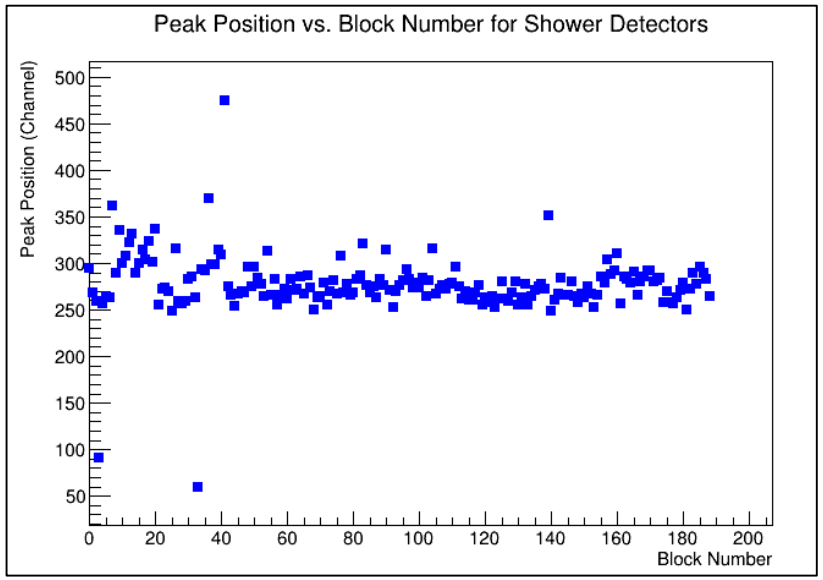
Run Number: 287 Desired Peak Position: 100

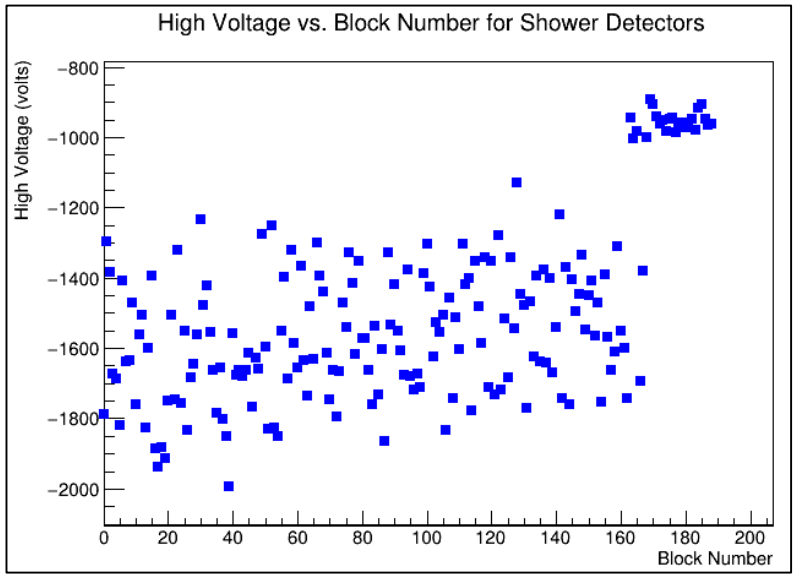
Block	Statistics	Peak Position	Peak Width	HV Correction	good/bad?
0	75.03	295.26	70.22	0.8974	Good
1	91.00	267.80	58.99	0.9062	Good
2	91.11	259.55	56.71	0.9090	Good
3	282.02	90.57	20.23	1.0099	Good
4	116.15	256.71	43.62	0.9100	Good
5	93.04	264.42	57.34	0.9073	Good
6	71.90	263.22	73.45	0.9078	Good
7	42.07	361.71	121.75	0.8794	Good
8	65.41	289.93	77.96	0.8990	Good
9	58.74	335.84	86.90	0.8859	Good
10	70.38	300.54	68.53	0.8958	Good
11	61.35	307.46	74.68	0.8938	Good
12	59.65	322.65	78.96	0.8895	Good
13	49.96	331.21	89.87	0.8871	Good
14	63.27	290.10	79.35	0.8990	Good
15	75.77	300.22	70.99	0.8959	Good
16	72.00	314.16	76.18	0.8918	Good
17	76.17	304.19	66.22	0.8947	Good
18	61.12	323.62	85.05	0.8892	Good
19	54.06	301.07	88.85	0.8956	Good
20	51.65	337.15	84.19	0.8856	Good

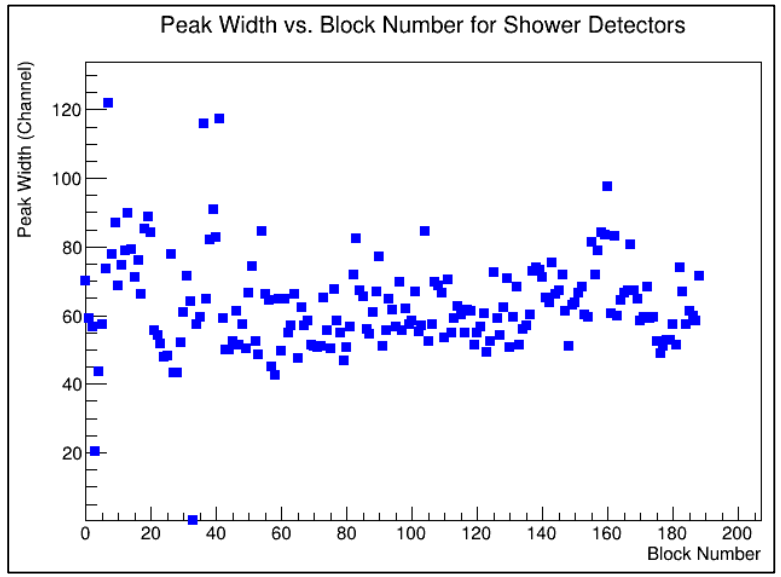
General scheme for performing HV adjustment (5)

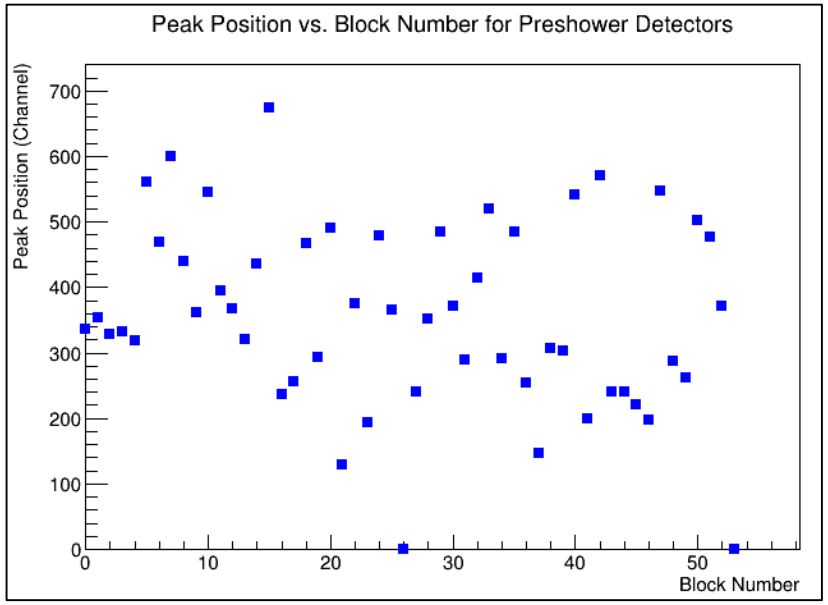
- Second script reads in fit results and current HV settings file
- Applies the HV correction factors and writes a new HV settings file
- New file will need to be applied by the User
- **Prior to applying the new HV file, the User should review the fit results file! HV values should be check to be sure they are reasonable**

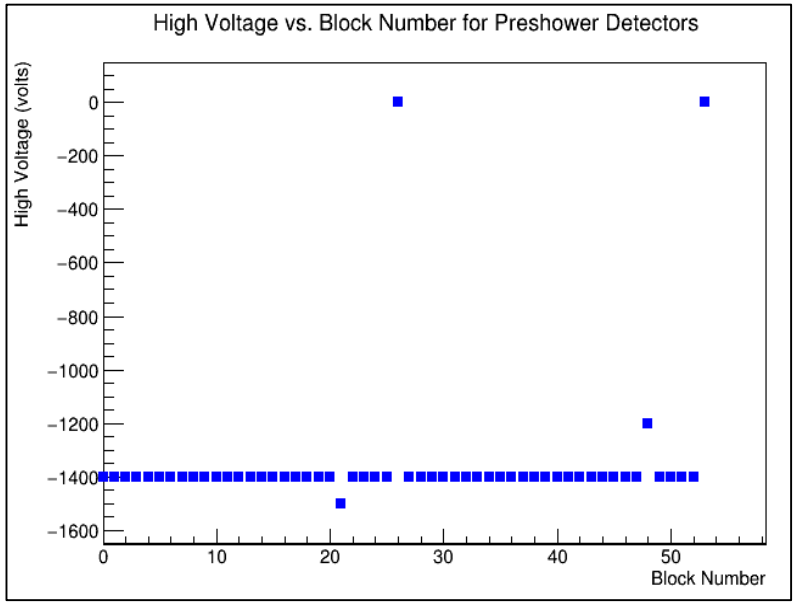
Diagnostic Histograms – Run 287 (Shower) and 310 (Preshower)

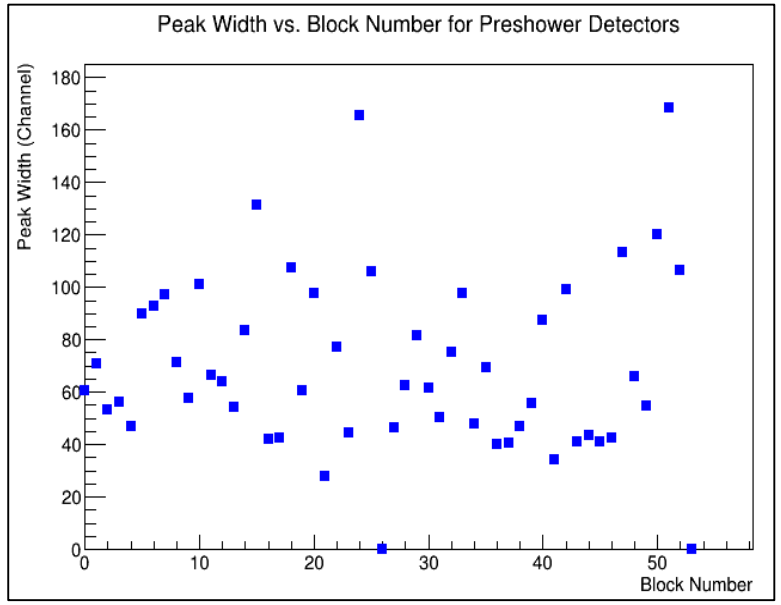












Operational usage

- How to find and use the scripts is covered in a informational document
- I am available to consult on usage, script design, and further development of the scripts

Summary

- Two ROOT scripts fit cosmic ray data and generate an adjusted HV settings file
  - Purpose is to adjust HV so that the cosmic ray peak occurs in approximately the same bin for each detector
  - This is done by computing the HV correction factor and adjusting the HV settings file
- ADC histograms for individual detectors are filled by placing cuts on neighboring detectors to isolate cosmic ray pass through events
- Histograms are fitted with a Gaussian function through a 2-step process
  - First pass fits the entire spectrum around tallest bin; parameters are extracted
  - Second pass fits a limited region around the tallest bin where the peak is Gaussian shaped
- Fit parameters extracted, HV correction factor calculated, values written to a file
- Second script reads in fit values, HV correction, and original HV settings file
- Outputs new HV file and generates diagnostic plots