|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Collection Time (s) | Pulser Setting | Peak Count | Peak Channel | Peak Energy (MeV) | Standard Deviation (channels) | Standard Deviation (keV) |
| 600 | 0.5 V 5x attenuation | 1 | 451 | 0.1072 | 17.0092 | 4.0397 |
| 600 | 1.5 V 5x attenuation | 2 | 1352 | 0.3212 | 17.0943 | 4.0599 |
| 600 | 2.5 V 5x attenuation | 3 | 2262 | 0.5373 | 17.3825 | 4.1283 |
| 600 | 3.5 V 5x attenuation | 4 | 3178 | 0.7548 | 17.4077 | 4.1343 |
| 600 | 4.5 V 5x attenuation | 5 | 4081 | 0.9693 | 17.1836 | 4.0811 |
| 600 | 5.5 V 5x attenuation | 6 | 4990 | 1.1852 | 16.8353 | 3.9984 |
| 600 | 6.5 V 5x attenuation | 7 | 5908 | 1.4032 | 17.1118 | 4.064 |
| 600 | 7.5 V 5x attenuation | 8 | 6813 | 1.6181 | 16.9742 | 4.0314 |
| 600 | 8.5 V 5x attenuation | 9 | 7726 | 1.8350 | 17.1966 | 4.0842 |

HPGe Detector Electronics Resolution as a Function of Energy

Figure 1: Summary of statistical variation in energy resolution as a function of energy due only to HPGe detector electronics.

Methodology

Attached ORTEC 419 Precision Pulse Generator to TEST input of HPGe detector (closed-end coaxial 83 mm diameter 84.5 mm length). This detector had MCB gain centroid channel of 7647. A bias of 2998.8 V was used. The amplifier on the detector was set to (x5)(x1.6502)(x1.00002x), with 1.10x PUR guard. A filter was used with rise time of 5.6, flat time of .8, and BLR mode set to AUTO. The pulser was set to AC frequency with internal reference voltage, positive polarity, and minimum rise time. Specific pulse height settings for each run are given in Figure 1. Each run was taken for 10 minutes (600 seconds), with cumulative time approximating 115 minutes. As such, the background acquisition without a test source or any actual source was taken for an interval of 115 minutes.

Each pulser acquisition resulted in a narrow Gaussian signal, which is superimposed upon any background associated with the detector configuration. The background signal was subtracted from the data and the data was calibrated () so that Gaussian parameters of each peak could be calculated in units of energy rather than channel. The background removed and calibrated spectrum is visualized in Figure 2. Matlab’s fit function was used to fit a single Gaussian to each peak. The resulting standard deviation (with 95% confidence interval) is visualized in Figure 3 as a function of energy.



Figure 2: Energy spectrum resulting from pulser signal, indicating the inherent energy spread of the detector electronics. Each run was conducted for 10 minutes, with 60 Hz frequency pulser signal of varying amplitude.



Figure 3: Calculated Gaussian standard deviation for each pulser peak. Values and confidence intervals result from Matlab Gaussian fit to each peak.