This isn't quite true... the energy calibrations exhibit very good stability as long as the settings of the pulse processing chain are kept constant. In field conditions things are a bit different.

Two-point Calibration of a Coaxial HPGe Detector

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Then why only use 2? Generally poor practice to undermine your experimental procedure without providing justification!

Introduction

High purity germanium (HPGe) detectors offer a means of high energy resolution gamma ray counting and are considered the gold standard for lab-scale gamma spectroscopy(citation). These detectors require constant crogenic cooling when in use to diminish thermal promotion of charge carriers to the conduction bandcitation. As a result of thermal cycling and drift in readout electronics, these detectors must be regularly energy calibrated. This is typically carried out using a number of check sources which span the range of gamma ray energies one is likely to encounter in everyday life (.05-2MeV).

While calibration can theoretically be carried out using a minimum of two distinct photopeaks, standard operating procedures in most cases call for at least three of such peaks spaced widely across the useful energy range. This approach minimizes error and provides information on the linearity of the detector's energy response.

In this lab, we process spectra from three distinct sources (cesium-137, americium-241 and barium-133) and use the channel numbers associated with the Cs and Am photopeaks to develop a two-point energy calibration model. We then apply this calibration to the barium-133 spectrum, which shows small errors (order of 1keV) in energy calibration in the 300-500keV range.

Good, but it doesn't hurt to be more specific; extrapolation, minimization with more data, etc.

Checkout the mhchem package for nuclide formatting in LaTeX

Methods

Coaxial HPGe spectra resulting from measurements of Co-60, Am-241, Cs-137,and Ba-133 check sources were provided to students via a publicly-accessible dropbox folder. Using MAKE and a python script, this data was downloaded and loaded into NumPy arrays for analysis. Peaks in the spectra corresponding to photopeaks of known energy were then picked out and

These are the colloquial values for full-energy peaks from these radionuclides, but for energy calibration we typically want to use more precise data - Using these values unnecessarily limits the precision to the order of 100eV, which is not good enough for many applications (NAA for instance)

A reference would be good here

fitted with a gaussian distribution using SciPy's curvefit tool. The channel location of the peaks resulting from this fitting process were used to create a calibration. To assure the utility of the calibration for common sources in the energy range of 60-600keV, the 661.7keV and 59.5keV lines from Cs-137 and Am-241 were used. For the sake of simplicity, this calibration was of the form:

$$E_x = a * x + b$$

(in which x denotes the channel index).This calibration (a = 0.28058369, b = 0.9339521) was then applied to the dataset gathered from a Ba-133 check source in order to determine the accuracy of the fit.

calibration model

Results and Discussion

The application of the calibration derived from the 59.5keV Am line and the 661.7keV Cs line to the Ba-133 dataset showed close agreement with data on the energy of the gamma rays emitted in its decay. The largest deviation was observed for the 356keV line, which is off by approximately 1keV. This is a surprisingly good result considering that this is a two-point calibration in a large-volume detector with known poor performance at low energies due to incomplete charge collection. Further research using a multiline calibration and more low-energy sources should provide more information about the reliability of this calibration at the extreme edges of this detector's useful energy range.

Careful... your numbers claim far too much precision for the measurement!

Again, if two is insufficient, why stop there? In 204 you are responsible for developing the methodology!

This is incorrect - the "true" gamma-ray energies used imply a precision on the order of 100 eV, and sub-keV should be easily achievable - likely an issue with the peak fitting methodology - for example, not accounting for background in your peak-fitting model

Not sure where this info is from; this data is actually from the vertical canberra, which exhibits the best (very near the Fano limit) of all of the HPGe's in 1110B

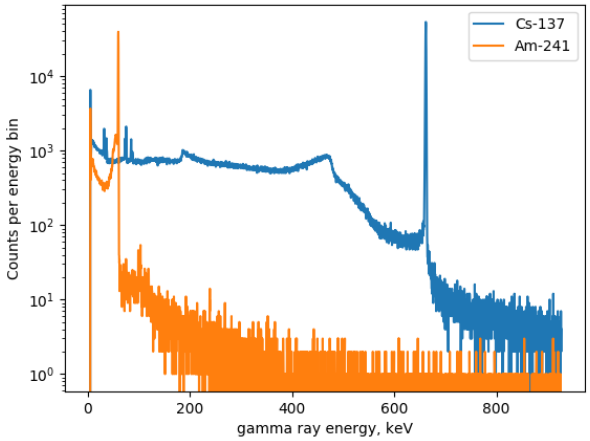

Figure 1: This histogram is the result of applying the two-point calibration derived from the 59.5keV and 661.7keV photopeaks to the Cs and Am data.

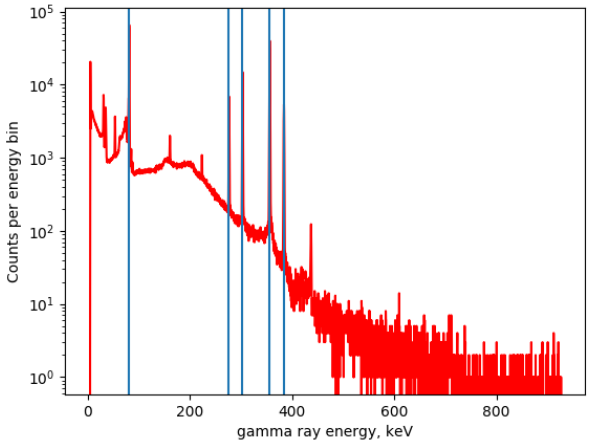

Figure 2: Applying the two-point calibration to the Ba-133 data as shown above gives excellent agreement with data from NNDC on the energies of the gamma rays emitted in its decay (indicated by vertical lines).