

Addendum to Test of the KamLAND Energy Calibration using ^{214}Bi

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Abstract

It was found that most events included in our previous Bi-Po analysis of the energy scale are in fact located along the detectors z-axis. This position bias means that the data presented in this note is to be considered an “on-axis” calibration.

Removal of near z-axis events greatly reduces the number of events available for the energy analysis. Analysis of the remaining off-axis events yields a fractional deviation of the measured from the expected mean energy of $(4.3 \pm 3.4)\%$. The uniformity of the energy scale, determined through the fluctuations of the observed energies around their mean is 5.7%. This loss in precision is due to the smaller event number.

1 Event Vertex Distribution

Figure 1 shows the vertex distribution of all events included in the previous study of the energy scale. Clearly most events are near the detectors z-axis. The uniformity argument derived from these events thus only applies to the vicinity of the z-axis.

Figure 2 shows the vertex distribution of those events remaining when a

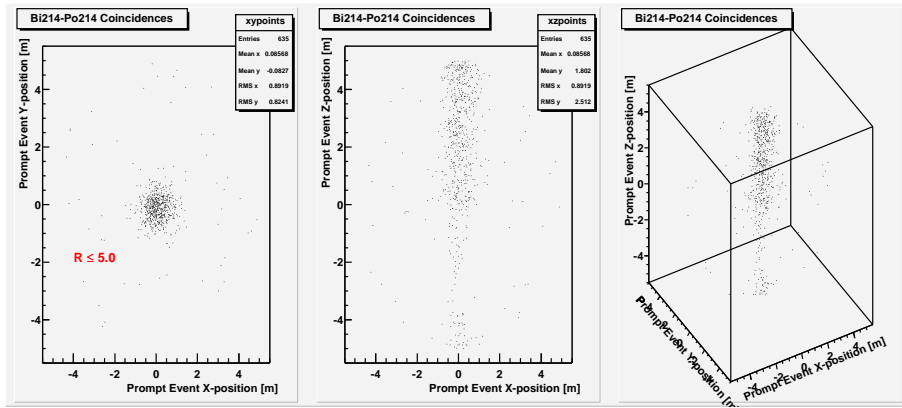


Figure 1: Vertex distribution of all events used in the original Bi-Po energy analysis.

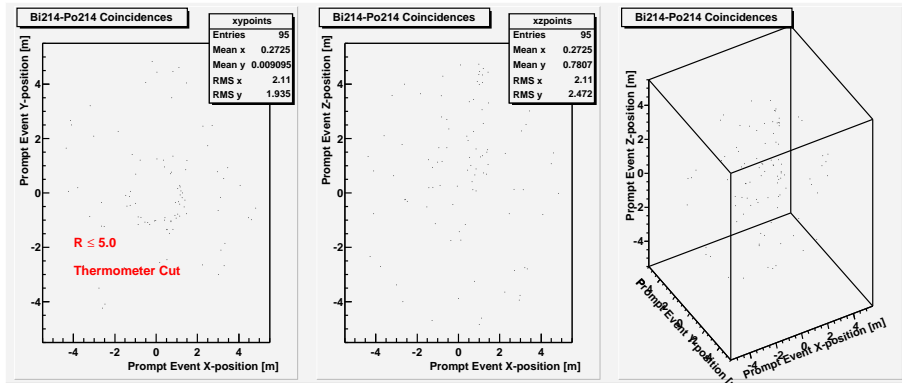


Figure 2: Vertex distribution of the events used in the Bi-Po energy analysis with the x-axis removed.

cylinder with 1 m radius around the z-axis is removed. This cut removes 85% of the Bi-Po coincidences. The same energy analysis was now performed with these true off-axis events. The result is shown in figure 3 in the format as in the original note. Although the statistical power of our analysis is greatly diminished the result is nevertheless similar to the previous finding. The energy scale shows a global offset of $(4.3 \pm 3.4)\%$ compared to the expected mean energy. The standard deviation of the energies around their mean is now 5.7%. This means that we can only claim uniformity of the energy scale

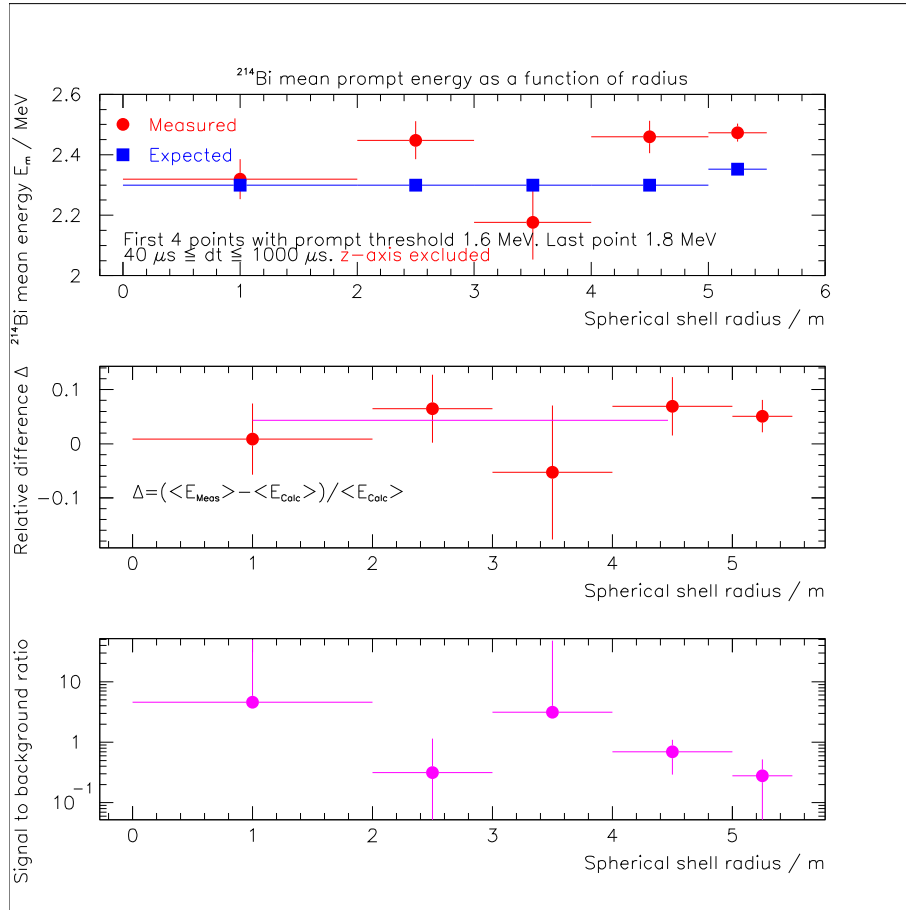


Figure 3: Comparison of measured (red) and calculated (blue) mean total energies for ^{214}Bi . For all but the 5.25 m point the energy thresholds were 1.6 MeV. To improve the signal to background ratio of the 5.25 m point an energy threshold of 1.8 MeV was used. The vicinity of the z-axis is removed. The lower part shows the associated signal to background ratios.

on this level, when properly averaging over the entire detector.