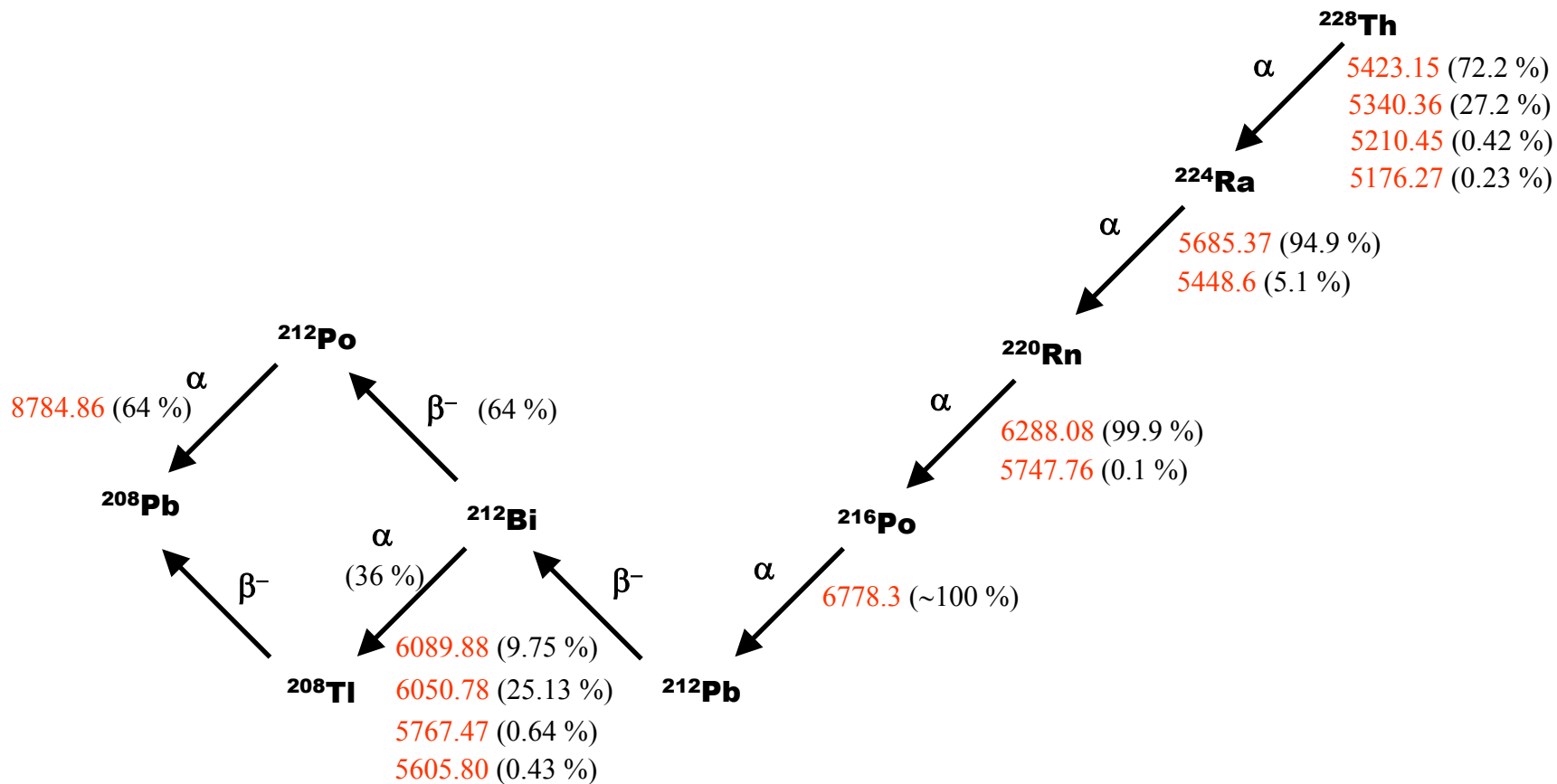


# $^{228}\text{Th}$ decay chain

Energies of main  $\alpha$  lines in keV



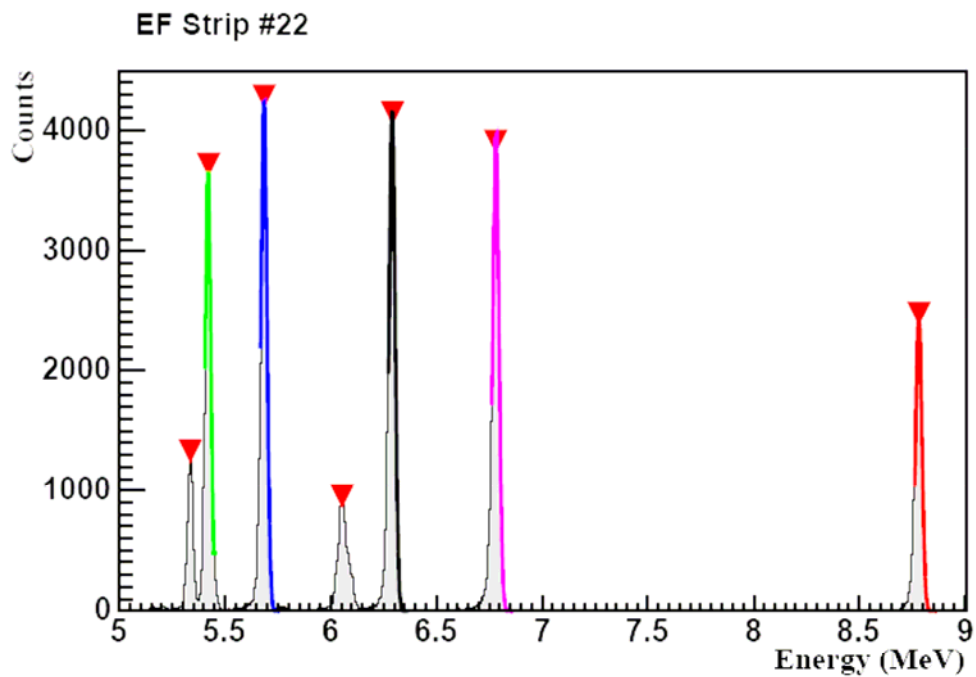


Figure 4.9: Energy spectrum of the  $^{228}\text{Th}$  alpha source on a single strip on the front of an E detector. The red triangles are locations of peaks found by the peak finding function. The colored lines on 5 of the eight peaks are Gaussian fits.

Table 4.1: The energy resolution for each peak in 4.9 given raw and after subtracting electronic noise. The alpha energy is given in MeV and the FWHM are given in keV

Peak Color	Energy	FWHM	FWHMcorr
green	5.423	31.6	26.6
blue	5.685	33.4	28.7
black	6.288	33.2	28.4
pink	6.778	35.2	30.7
red	8.784	33.8	29.1

Source: Wallace's Thesis, page 85.

The pin is a 0.5 " dowel pin. This pin is activated by electroplating the tip with daughter nuclei from a  $^{228}\text{Th}$  source. The source can be generated in 24 hours or less and then glued into the frame. There are three strong alpha lines from this source at 8.785 MeV, 6.050 MeV, and 6.089 MeV. The primary deposition on the pin is  $^{212}\text{Pb}$  which has a half-life of 10.6 hours. There is a small amount of  $^{224}\text{Ra}$  deposited on the pin as well. It has a half-life of 3.62 days. This adds three more alphas with energy of 5.685, 6.288, and 6.778 MeV. As there is no additional material between the radioactive nuclei and the surface this source can produce very sharp energy spectra.

Source: [Wallace's Thesis, page 122.](#)

# CERTIFICATE OF CALIBRATION ALPHA STANDARD SOURCE

**Radionuclide:** Th-228  
**Half-life:** 698.2 ± 0.6 days  
**Catalog No.:** AF-228-A2  
**Source No.:** B7-613

**Customer:** MICHIGAN STATE UNIVERSITY  
**P.O. No.:** C59621  
**Reference Date:** 1-May-04 12:00 PST  
**Contained Radioactivity:** 1.219  $\mu$ Ci 45.10 kBq  
(Th-228 only)

**Physical description:**

A. Capsule type:	A-2
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxide
C. Active diameter/volume:	5 mm
D. Backing:	Platinum clad nickel
E. Cover:	Approximately 50 $\mu$ g Au/cm <sup>2</sup>

CAUTION!  
DELICATE SURFACE  
DO NOT WIPE  
ACTIVE AREA

**Radioimpurities:**

None detected other than daughters

**Method of Calibration:**

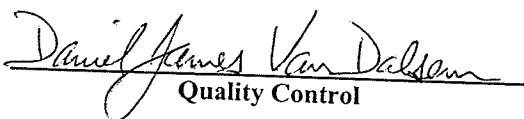
This source was assayed using an alpha spectrometry surface barrier detector against a standard of similar isotopic composition and geometric configuration.

**Uncertainty of Measurement:**

A. Type A (random) uncertainty:	± 0.7 %
B. Type B (systematic) uncertainty:	± 3.0 %
C. Uncertainty in aliquot weighing:	± 0.0 %
D. Total uncertainty at the 99% confidence level:	± 3.1 %

**Notes:**

- See reverse side for leak test(s) performed on this source.
- IPL participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (As in NRC Regulatory Guide 4.15).
- Nuclear data was taken from IAEA-TECDOC-619, 1991.
- This source has a working life of 2 years.

  
Quality Control

3-May-04  
Date Signed

IPL Ref. No.: 1048-82