Class of Fisica delle Radiazioni ionizzanti

Training session on gamma spectrometry

Goal: to identify an unknown radioactive isotope and to quantify its activity.

Equipment: HPGe detector with built-in preamplifier, linear amplifier, ADC, multi-channel analyzer.

Execution steps:

- 1) Fix the gain of the main amplifier to have approximatively $E_{\gamma} = 3$ MeV at full scale
- 2) Find the energy calibration of the system detector + electronics (available isotopes: ⁶⁰Co, ¹³³Ba, ¹³⁷Cs)
- 3) Measure the detection efficiency vs. gamma energy
- 4) Acquire a spectrum of the gamma emitted by the unknown sample: identify the isotope and calculate its activity
- 5) Check in a background spectrum the possible presence of peaks emitted by the unknown isotope and the need of any background subtraction
- 6) Calculate the sensitivity for the unknown isotope assuming a measuring time of 48 hours.

<u>Useful information</u>: the certified activity (accuracy = 5%) of the three calibration sources, at the date of February 1^{st} 1990, is:

$${}^{60}\text{Co} = 1.21 \ \mu\text{Ci}$$

 ${}^{133}\text{Ba} = 1.23 \ \mu\text{Ci}$
 ${}^{137}\text{Cs} = 1.25 \ \mu\text{Ci}$

While their decay schemes are given in the following pictures:









The unknown isotope must be searched in the following set:







⁵⁷Co: Half-life = 270 d



⁶⁵Ni: Half-life = 2.56 h