



Alpha spectroscopy with multi- segmented Si detectors

PURPOSE

Familiarize the student with charged particle detection using a Silicon detector. The student is expected to acquire a spectrum using an alpha particle source and then calibrate the spectrum. Finally the student will determine the thickness of a Au foil by measuring the energy loss of the alpha particles through the foil.

BIBLIOGRAPHY

1. - Chapters 10,11,12 and 14 from W.R. Leo: "Techniques for Nuclear and Particle Physics Experiments"
2. - SRIM : <http://www.srim.org/SRIM/SRIMLEGL.htm>
3. - G. Knoll: "Radiation Detection and Measurement", Chapter 2, Part I- 'Interaction of heavy charged particles'

MATERIALES

The following materials are available to the student:

1. – High-vacuum chamber
2. – DSSSD (double-sided silicon strip detector)
3. – Radioactive alpha particle sources (^{148}Gd y ^{241}Am)
4. – NIM crate
5. – High voltage source
6. – Preamplifier + Amplifier
7. – Trigger system (NIM – logic modules)
8. – VME crate (CPU + SAC + ADC + TDC + Scaler)
9. – Oscilloscope
10. – PC and DAQ

PROCEDURE

1. - Experimental setup. Determine the main characteristics of the Si detector. Understand the vacuum system (rough pump, turbo pump, etc.).
2. - Study the cabling and draw the trigger logic.

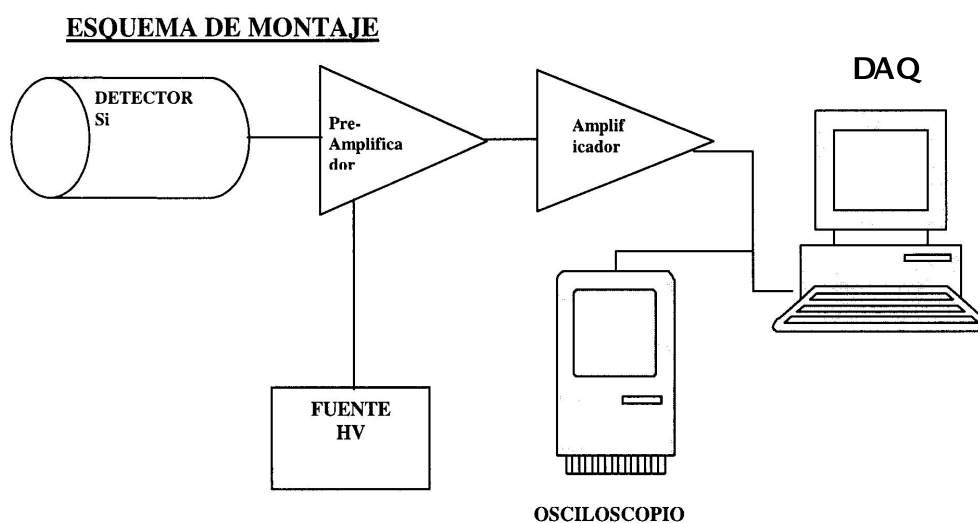


3. - Take data of the ^{148}Gd y ^{241}Am without the Au foil in place in order to get two points to calibrate the different strips of the detector. The Si strip detector has a linear behaviour so that the calibration is simply of the form: $Energy = a \times channel + b$ [KeV] where the channel of the histogram is proportional to the voltage output of the detector. To obtain the calibration it is sufficient to do a linear fit of the two peaks with energies of 3.18 MeV (^{148}Gd) and 5.48 MeV (^{241}Am).
4. - Use the SRIM program (available for free at <http://www.srim.org/SRIM/SRIMLEGL.htm>) to determine the thickness of the gold foil. This can be deduced from the energy loss suffered by the alpha particles as they go through the Au foil.

REPORT

To evaluate the overall completion of the laboratory exercise the student should hand-in a lab report before the end of May, to be sent to the following email address: olof.tengblad@csic.es. This report should explain the procedure followed during the exercise as well as include the following:

1. **Calibrated spectrum** for the ^{148}Gd y ^{241}Am sources in energy and channel number, and energy spectrum of the ^{148}Gd source with the Au foil in place (it is not necessary to show all 32 spectra for each strip. It is sufficient to just include one horizontal and one vertical band).
2. **Draw** the electronic logic of the acquisition system.
3. **Calculate** the thickness of the Au foil from the energy loss using SRIM.



Very schematic set-up, please improve it!