

## Alpha Spectroscopy Notes

The goal of this lab is to try and understand the properties of alpha radiation and to get experience working with vacuum. In addition, you will get experience with widely used electronics including a multi-channel analyzer. You will be carrying out labs as described in the other hand-outs, these are experiments 4 and 5 from ORTEC. Note that some of the equipment is different than that mentioned in the writeup.

Notes:

Use  $^{241}\text{Am}$  as the alpha source not Po.

Use at least four different thicknesses of Ni foils.

Use the detector provided. You need to provide a bias of 50V to the detector; too high a voltage can destroy the detector.

Experiments to do:

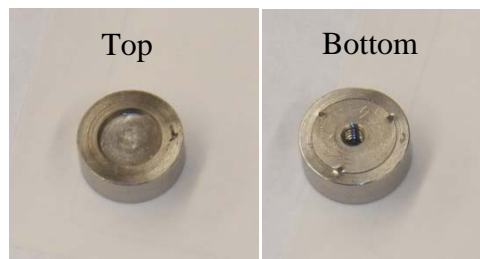
1) You will do the work described in sections 4.1, 4.3, 5.1 and 5.2 on the Ortec lab handouts. You do not need to answer all the questions posed in the writeup or do exactly the same procedure given in the writeup, but should use them as a guide for your work. We will use nickel foil and air for the attenuation measurements in 5.1 and 5.2.

For section 4.1: The purpose of this part of the lab is to make sure that you setup and are using the equipment properly. You do not need to do everything in this section, just enough to be confident you know what you are doing. You also do not need to follow the exact procedure listed in the other sections. You should include this part in your lab book, but should not include this section in the writeup you turn in.

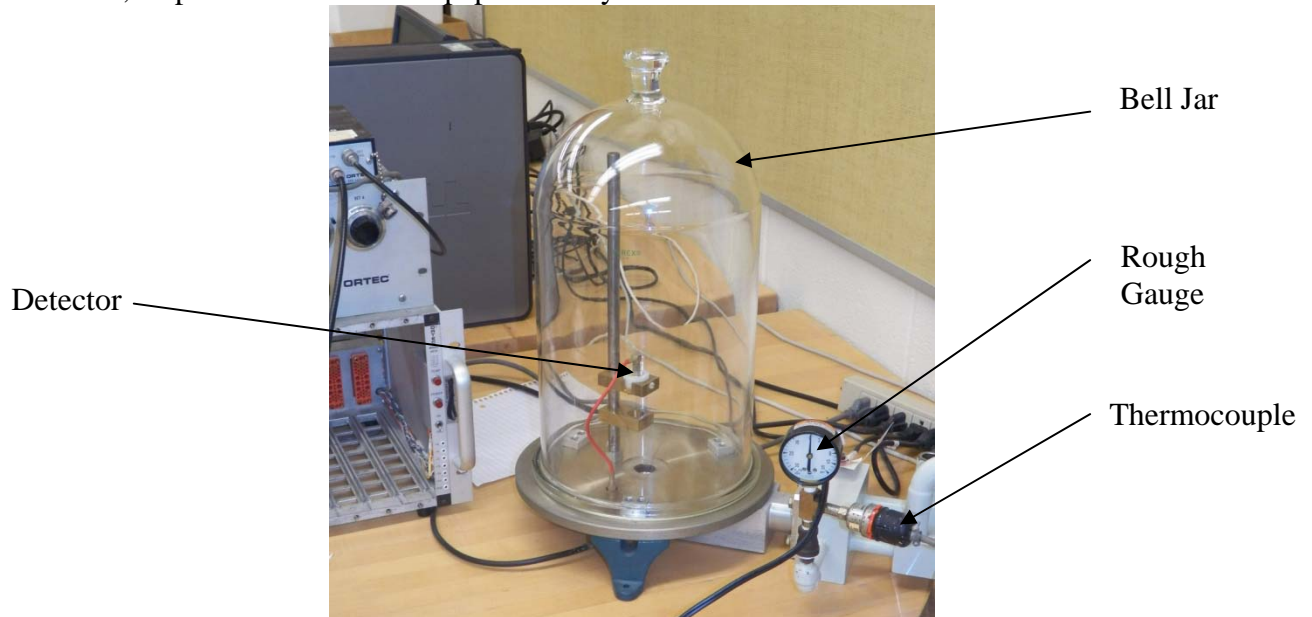
2) You should also take a spectrum from radium or another sample. Find the decay chain and compare the energy of the alpha particles that you see with the expected values. Remember that with a radioactive material you may be looking not only at decays from the sample, but from other elements further down in the decay chain.

Apparatus

1) The alpha source is shown below – be sure to put it in properly. Having the source in upside down is a common problem. The alpha particles come through a thin window on the top.



The apparatus is contained in a bell jar which is pumped with the attached vacuum pump. There are two pressure gauges a rough gauge and a thermocouple (which is only accurate at lower pressures). To maintain the vacuum, the bottom of the bell jar has to remain clean, so put it down on clean paper when you remove it.



For your protection, cover the bell jar with the protective metal cover before pumping down; this will prevent glass shards from flying in the (unlikely) event the jar shatters under vacuum.

In your writeup:

- 1) Look up general information on the properties of alpha radiation and include these in your introduction.
- 2) Include a short description of how the detector works.
- 3) Based on your measurements, discuss how dangerous alpha radiation is compared to gamma radiation. Can you think of a case when you would have to worry about radiation damage from alpha radiation?