Fall 2019 NE 427
Full lab report guidelines

1 Submission information

Full reports for the range-energy lab (Lab #5) are due on 11/18 at 11:59 pm on Canvas.

1.1 Format

- The file format should be in pdf.

- **Do not write your name in the name of the file, or on the main pages of the report.**

- The file naming convention should be:
  Lab{number}_{your campus ID number}_{submission date, in YYMMDD}

    Example: Lab5_123456789_191111

- Start a new page at the end of the report and provide your name, and the name of your lab partner.

- Report should not exceed 15 pages, exclusive of the last page identifying your name, and should be in 12-point Times New Roman font with 1-inch margins.

2 Checklist

The full report for the range-energy experiment has similar expectations regarding data reporting and analysis outlined in the document "Lab report guidelines". Grading will be out of 100 points, and please go through the following checklist prior to submission:

☐ *Title* summarizing lab activities

☐ *Abstract* (5 points) covering the motivation of the experiment, the general approach, as well as main results and/or conclusion.

☐ *Introduction* (15 points) with the motivation and purpose of the work and covers the relevant background information (*e.g.*, physics and relevant formulas describing radiation-matter interactions)

☐ *Approach* (20 points) providing written description of the experiments and schematic of the setups. Relevant experiment parameters and settings (*e.g.*, discussion of how pressure is measured in the alpha-range lab and converted to effective distance between the source and detector, overall amplifier gains, applied voltages) should be included.

☐ *Results* (35 points) with the relevant data and analyses, *with brief descriptions of how they are derived.* Should include:

  ☐ Spectra illustrating the variation in energy/pulse height distribution of alpha particles at the detector as a function of chamber pressure.

  ☐ Plots of peak position and width (in channel number) as a function of chamber pressure.

☐ Plot of mean energy (E) as a function of effective distance (in cm or mg/cm^2).

☐ Plot of mean stopping power $\langle -\frac{dE}{dx} \rangle$ (in either MeV/cm or MeV/mg-cm^2) as a function of mean energy.

☐ Plot of detector count rate as a function of effective distance and calculation of the mean or extrapolated range.

☐ NaI scintillator spectra for the following conditions: Au-198 no absorber, Au-198 with Al absorber (at one thickness), Au-198 with Pb absorber (at one thickness), and background. Indicate on the spectrum the range of channels used to integrate counts in the photopeak.

☐ Plots of photopeak count rate as a function of Al absorber thickness (in g/cm^2), with and without background correction.

☐ Plots of photopeak count rate as a function of Pb absorber thickness (in g/cm^2), with and without background correction.

☐ Fitted line and equation on the background-corrected gamma attenuated curve by the Al absorber, and calculation of the associated mass attenuation coefficient ((g/cm^2)$^{-1}$).

☐ Fitted line and equation on the background-corrected gamma attenuated curve by the Rb absorber, and calculation of the associated mass attenuation coefficient ((g/cm^2)$^{-1}$).

☐ *Discussion* (20 points) which explains the results and their significance. Topics that should be addressed include (see "Analysis and discussion" section in lab manual):

☐ Change in peak shape and energy as a function of chamber pressure

☐ Dependence of mean stopping power on mean energy and effective distance.

☐ Comparison of the mean/extrapolated range obtained from your data with accepted values, and explanation of their differences.

☐ Explanation of why a collimated source is desired for the gamma attenuation measurement.

☐ Comparisons of the attenuation coefficients for Al and Pb obtained from your data with published values, and explanation of their differences.

☐ Description on how an alternative approach of measuring background data for the gamma attenuation experiments.

☐ Overall summary on your experiments.

☐ *References* with format of your choice (as long as there is consistency).

☐ *Proper reporting techniques* (point contribution included in the above). Please check that all presented figures, tables, and data sets satisfy the following:

☐ have estimated uncertainties/error bars.

☐ have clearly labeled axes with the appropriate units.

☐ contain individual data points that are clearly shown.

☐ include relevant experimental parameters (*e.g.*, experimental conditions, instrument settings) under which the data was taken in either the caption or text.

☐ *Formatting and language* (5 points). Please proofread your document for typos and grammatical errors.

3 Examples

In general, articles in the jorunal *Nuclear Instruments and Methods in Physics Research* provide examples of the organization, formatting, and level of detail applicable to this full report. An example article titled "Energy resolution of scintillation detectors" has been posted on Canvas.