Tips for writing a good lab report

Doing an experiment and obtaining the results is only a half of the experimentalist's job (some may say – the fun half). An equally important part is presenting the results to the scientific community in the most clear and convincing manner. There is no magic recipe of writing "the perfect" report, but any good report (and in a future a manuscript) aims to be:

- self-contained. A reader must be able to find all the relevant information or references to the relevant information and reasoning to validate your conclusions.
- concise. The information should be presented in the efficient and easy to understand way (for example, graphs rather than long tables of data) and contain well-developed explanations.
- well-organized. A reader should be able to quickly find the information he or she may be interested in.

General guidelines for the report composition

Since the lab reports for this class are longer and more elaborate, you have to adjust the report structure to present your work on each experiment most efficiently. For example, if the experiment includes several fairly independent parts, it may make sense to present

Header

- Title
- Author (or authors on any normal year)
- Submission date
- Abstract. This should be a brief (100 words) statement of the experiment goal(s) and your conclusions. Be sure to include your major, most important results, along with their associated errors.

Introduction

- How this lab is fits in the overall physics context, i.e. big picture
- What is its significance in the development of modern physics
- Where this effect/these techniques are used

Theory

- Include the working equations that you will be using but do not include lengthy derivations.
- Include a few sentences on where the equations come from and what they are dependent on, (assumptions, conservation laws, etc.), and also cite a reference where the derivations may be found.

Experimental apparatus and procedure

- A block diagram of the experiment. Make sure to explain the major pieces of equipment and their functionalities.
- Short description of the data acquisition procedure. Include non-changing settings. You should have enough detail so that one familiar with physics but not with the particular experiment at hand could reproduce your experiment if necessary.
- Connection between measured values and parameters in the theoretical formulae

Results and Data analysis

- This section (or sections) should be the main part of your report, and it will take the most time and effort. So start early!
- Do not simply present a graph or calculation and move on to the next thing. Every result should be discussed and put into the context. Do you measurements agree with the theoretical predictions? Do you observe the expected trend? You have to walk your readers through the analysis, not just expect them to make all the conclusions independently.

- Majority of data will be presented as graphs, so it will be important to make them as clear and easy to read as possible. Make sure to include axes labels, scales, legends, etc. Error bars/bands should be included if at all possible.
- All the results should contain the error analysis. Include the limiting factors for your measurements and identify the leading causes for systematic and random errors. Make sure that for every uncertainty of the final number you report, it is clear where this uncertainty came from.
- It is possible that the measured results will not agree with the theory. Present your best explanation of why that may have happened and how it can be mediated (and if time/resources permit, try to improve it).

Conclusions

- Short recap of the results and the analysis: did experiment work, matched the theory or not, If you have an expected value, did it match or not, if there is a discrepancy, what is the source of it.
- If applicable, include possible future work.

Bibliography

- Please use APS-style citations: A. Author, B. Author, and C. Author, "Title of the paper," *Journal* **vol**, pages (year).