

Guide for Writing 493L Lab Reports

General Style: Lab reports should follow the style of a scientific journal article. Reports should be written such that any physicist could pick up your report and understand the motivation, methods and results without any prior knowledge specific to the 493L class. It should never be apparent that you have followed a lab manual in performing the experiments or reporting the results. Do not use fonts smaller than 10 or larger than 12. Do not use margins less than 0.5 inch.

Length: All reports are limited to 4 pages including figures and references. Not every piece of data that was collected needs to be shown explicitly in the report. Consider combining plots when possible.

Sections of the Manuscript

Abstract: The abstract is a brief statement of your methodology and results. If the result was the measurement of a specific quantity, such as the muon lifetime, the value should be included in the abstract along with an estimate of the uncertainty of the value. If the paper describes the demonstration of a technique, such as speed measurement by optical techniques, specific values measured are not of general interest and should not be included in the abstract. The abstract should never begin with "In this experiment we..." or "The purpose of this experiment was..."

Introduction: The introduction should contain background and motivation for the experiment as well as a summary of the experimental approach. Include a summary of the relevant physics and include equations if they are fundamental to the physics or measurement. Most of the references in a paper are found in the introduction section.

Methods: The methods section describes how the data was collected. If there is not a separate analysis section, methods of analysis should be included here. The methods section should not contain theory, motivation, specific results, or discussion of results. Instrumentation used must include a manufacturer and part number or indicate if it was fabricated by the researcher. Example: "The setup consisted of two PMT detectors (Hamamatsu model 555)." Instruments or equipment that is ubiquitous and performs a common task doesn't need the make/model information. For example if an oscilloscope was used to look at a waveform, the specific oscilloscope information isn't needed. However, if the oscilloscope is used to take a measurement (like delay times for calibration in the muon decay experiment), it should include make and model.

Calibration: This section could be included as a subset of **Methods**, in which case do not include specific results. If your experiment warrants a separate calibration section, include the calibration procedure and results.

Data: Give the specific conditions under which your data was collected (**Methods** already describes how data was collected). Show the results of your measurements using plots and perhaps tables.

Analysis: Describe how your data was analyzed to get the results from your data. Show relevant equations. Identify the dominant sources of error and describe the methodology of your error analysis. Include how you have treated both systematic and statistical errors. Sometimes **Analysis** is included in the **Methods** section, and other times warrants its own section.

Results: Describe the results of the data analysis along with the results of the error calculations.

Discussion: Compare your results with expected or past results. Explain the relevance or significance of your results. Comment on limitations of the experiment. Suggest improvements for future work.

Conclusion: Summarize the experimental approach, the primary result and why anyone should care.

The sections **Data, Analysis, Results, Discussion** and **Conclusion** are sometimes grouped together in different ways (e.g. **Results and Discussion**) depending on the particular journal guidelines and needs of the particular study. You may do so in your lab report as you see fit.

Other Comments

Figures: Figures must be labeled with a figure number and the figure numbers must increment in the order in which the figures appear in the text. All figures must be referenced from the text. All figures must include a caption with enough detail that the main concept of the figure is understandable from just the figure and caption. Plots must have axis labels. The text of the caption should be delineated from the main text. Do not include figure titles- the information will be included in the caption. The font size for axis labels and numbers must be large enough to be legible (equivalent to 8 point font in text or larger). Figures used from other sources must be accompanied by the appropriate reference. No hand drawn figures are allowed.

Use of tables: Use of a table should be avoided if possible. If the elements of a data set are connected in some way, usually a plot would be preferred. For example, if you have a calibration data set where you expect points to follow a linear relationship, show the results in a plot, not a table.

References: References should be cited in the main text and the list of references should appear at the end of the manuscript.

Use a space between value and unit: "Data was collected for 10 s." not "Data was collected for 10s."

Avoid the word 'this'.