This is the Title of the Experiment

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Abstract

The abstract should contain a brief statement of the physics issues the experiment was designed to address, a summary of the method and apparatus employed, and (most importantly) what was actually learned in this specific measurement. It should be only about 100 words long. It should state the final result or conclusion you reached, but have no derivations or references. A good strategy is to write the abstract after you have finished the rest of the report.
I  Introduction

In general, your report should be sufficiently detailed that a reader who is familiar with the basic physics concepts involved, but not with your specific experiment, can understand what you have done, why you have done it, and how this result helps to answer the primary question being asked. It is good practice to start with an outline, to make sure that your arguments follow each other, and that the structure of the paper will be clear to the reader.

In the introduction, you should focus on answering the question “What is the primary goal of this experiment?” Describe what you are trying to learn, and how you have tried to get at the physics that is of interest (but not necessarily experimental details). Identify the main physics concepts involved, indicating which laws are being tested or measured. In some cases, you might want to put this in a historical perspective, e.g., “This measurement first suggested the existence of the massless, neutral particle we now call the neutrino.” Be brief, and include only the most relevant ideas, but provide references [1] so the reader can find more detail if desired. This section might also include some minimal amount of theoretical derivation, if this helps motivate the particular measurement to be described.

II  Experimental Method and Techniques

II-A  General comments

Here you basically describe the apparatus and what you did with it. It is almost always useful to include sketches, drawings, schematics, or even photographs of the experimental setup that was used, indicating the interconnections with sufficient detail that the reader can understand their purpose and function. If specialized electronics were used, a block diagram of the layout is helpful. Provide all dimensions, mechanical, and electrical properties which are of importance in carrying out or analyzing this experiment.

Once the equipment is described, you should discuss the procedures that were followed to make use of this equipment. How were the specific measurements carried out? If some parts of the apparatus had settings that influence the results (gains, sizes, voltage levels, etc.), these values should all be noted. Which information was recorded? How many times and in what intervals? If several readings were combined into the result, indicate how that was done and what assumptions were made. If any serious problems with the equipment were encountered during the experiment, this is a good place to describe the problem and discuss the possible consequences and implications this might have for your results.

Include all relevant equations, and references as to where they were obtained. Make sure each variable is defined or explained in the text. Number the equations sequentially in the order in which they appear so you can refer to them (see Eq. 1) if needed. As an
example, you might (but probably won’t) refer to the pion scattering amplitude

\[ f_\pi = -g_0^2 \frac{\sigma_1 \sigma_2 q}{q^2 + m_\pi^2} \]  \tag{1}

where \( g_0 \) is the pion coupling constant, \( m_\pi \) is the pion rest mass, and \( q \) is the momentum transfer in the center of mass.

For data, ideas, or arguments which are not your own, such as Eq. 1, you need to mention the source \cite{2} by giving a reference. References are identified in the text by a number in \[.\] brackets (in the order of their occurrence), and are listed at the end of the report.

II-B Use of figures

As mentioned earlier, figures are important, and can usually convey information much more readily than text. Axes should be clearly labelled and the units should be given. Number the figures (in the order of their occurrence), so you can refer to them in the text by their number (see Fig. 1). If possible, incorporate the figures into the text, rather than placing them all at the very end of the report, since this makes for a more readable document.

Each figure should have a caption, describing briefly what is shown, but providing sufficient detail for the interested reader. A typical figure and caption are given below.

![Fig. 1. Displacement of the pendulum as a function of time. The data are from run #4. The solid curve is a fit using the equation for a damped harmonic oscillator, as discussed in the text (Eq. 3).](image)
III  Results

Give a representative sample of the basic measurements. If possible, use figures, graphs, and plots, rather than just tabulating numbers. What are your main conclusions, based on the “raw data?” Is anything obviously wrong or very surprising? Do any specific values that you measured look funny or out of line with the others? Are there any significant trends in the data? For all of these questions, keep in mind the uncertainties of the measurement. If possible, carefully distinguish between random and systematic errors, and describe where they arise and how you assessed their value(s). Indicate what mathematical procedures (fitting, etc.) were used to reduce the raw data to the final results and its uncertainty.

IV  Physics Discussion

Discuss your results in the context of what you expected. How good is the agreement, for example, between your results and a theoretical prediction? Again, a few good references [2] are usually called for to indicate the source of your theoretical comments. You might also compare your results to those obtained in previous measurements, giving credit to earlier researchers [1], and trying to account for any discrepancies that may arise. In a few cases, you may have been able to measure the same quantity several different ways; this is also a good means of evaluating your results. As before, in all such comparisons it is absolutely crucial that limitations due to experimental uncertainties be kept in mind.

V  Conclusions

This should be a very short summary of the most relevant results and insights you have gained from having carried out this experiment. You might also comment on the overall quality of the measurement, and suggest either interesting follow-up experiments that could be done, or methods for improving the existing measurement, such as specific changes in the equipment used or procedures followed.

References
