A Short, and Interesting Title for your Lab Report

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Abstract

The aim of an abstract is to provide a succinct overview of the report. You have a few lines to convince a reader that it is worth the time to look in more detail at your report in order to understand how you made your measurements. You should not only say what it is that you have done, but to also highlight any conclusions that are made as the result of any work described in this report. You should be quantitative, so if you measured a quantity, then you should say what it is. We measure the speed of light in vacuum to be $c = (2.99 \pm 0.01) \times 10^8$ m/s, which is consistent with the literature.

Introduction

The introduction to a report is something that you use to help a reader understand the structure of what will follow. This would be an appropriate place in your report for you to put the work into context of the big picture. E.g. if you are measuring the speed of light – you may choose to mention Special Relativity, and the original historic tests of this quantity that you are repeating in the laboratory. If there are historical references, then you could quote them as Ref. [1,2]. Make sure that you always use numbers to refer to references, and that the list of references at the end of the report is a numbered list (see below).

It is bad form to use URLs from web sites as references. For example Ref. [3] may change from one day to the next, and you have no control over the authenticity of the material that you are intending to reference. If you want to quote some source, then make sure that you emphasise the text and place it in double quotes. For example as George Leigh Mallory noted "*Climbers are a only particularly foolish set of desperados*" [4]. One again it is bad form to copy long quotes from other sources, hence avoid doing so. If you don't cite the source, and emphasise the text, then your attempt at quotation would be plagiarism.

Theoretical Motivation

The theoretical motivation goes beyond any introduction to include a detailed treatise of the problem at hand. Include equations, where necessary numbering them so that you are able to refer to Eq. (1) which is Einstein's world famous mass-energy relationship:

$$E = mc^2. \qquad (1)$$

Note that punctuation doesn't stop just because you have an equation in the flow of the text. A theory section that does not properly explain what it is you are trying to test, and only relies on equations is badly written and of practically no use to a reader. You should make sure that you provide enough of a description to help the reader understand and encourage them to find out why it is that you have done what you have. Similarly writing that you did this experiment `*because you had to*' has no scientific value and therefore is inappropriate.

Experimental Setup

When describing the experimental setup you are using, you should always make sure that you include any relevant information in terms of model numbers of components, or types of equipment that you are using as your signal generator. For example, we used a Keithly 1776 DMM to measure voltage for our circuit. This level of information may seem pedantic, however it will give a reader the opportunity to re-create your results by performing a repeat experiment under circumstances that will be very close to the original. Similar if your results depend on the temperature of the environment make sure that you take note of this. As the saying goes, *'a picture tells a thousand words'*, so it may be necessary to refer to Figures in your report. When you do, refer to them by number, e.g. Figure (1), and indicate in the text and caption of the Figure what it is that the reader should take away with them.

Figure 1: A cross-sectional view of the silicon vertex detector from the BaBar experiment (See Ref [5]).

Note that the caption of the figure is written in such a way that usually one does not have to refer to the text to understand what this represents. In some complicated circumstances one might depart from this approach and refer to equations or other information described in the text. This is all with an aim of helping your reader understand what it is you have done.

Results and Discussion

Results should include a description of what it is you have measured. Where appropriate you should refer to Tables by number, and tabulate sets of common data. If for example you measure the length of a component of your experiment you can report this as x=(10.2±2) mm long. Note that a measurement *always* has a value, an error and units. The units are common both to the value and error, unless for some particular reason it is appropriate to quote the error as a percentage of the value. In which case you can say that x has been measured to 20%. When quoting errors always consider the appropriate number of significant figures required, and refer back to your notes if necessary. Table 1 shows the results of some dummy experiment.

The aim of the report is to tell a story to the reader. So when you include tables and figures, you should lead the reader through these logically and explain what any results mean. It is simply inappropriate to include only tables or figures without explanation of what the meaning is. If your text does not help the reader understand your results, you will have encouraged them to ignore your work and will have lost a citation. This is obviously not a desirable outcome.

	Measured Value (m)	Error (m)
Height	0.5	0.01
Length	2.7	0.01
Depth	3.1	0.01

Table 1: Some dummy data to illustrate how to comment about the table, and link the table from the text.

Having included a table of data, at some point it may become necessary to analyse the data, for example by fitting the data. If that is the case, make sure that any figures includes are referenced appropriately with captions, axis labels for both the ordinate and abscissa. You should also consider if it is necessary to include error bars on the data. The interpretation of any model fitted to data should then be discussed in the results section. As an example, Figure 2 shows the distribution of two populations of data (A and B) that are generated according to a uniform Gaussian distribution using ROOT [6]. Note here that the reference given for ROOT is a URL as that is appropriate in this particular instance.

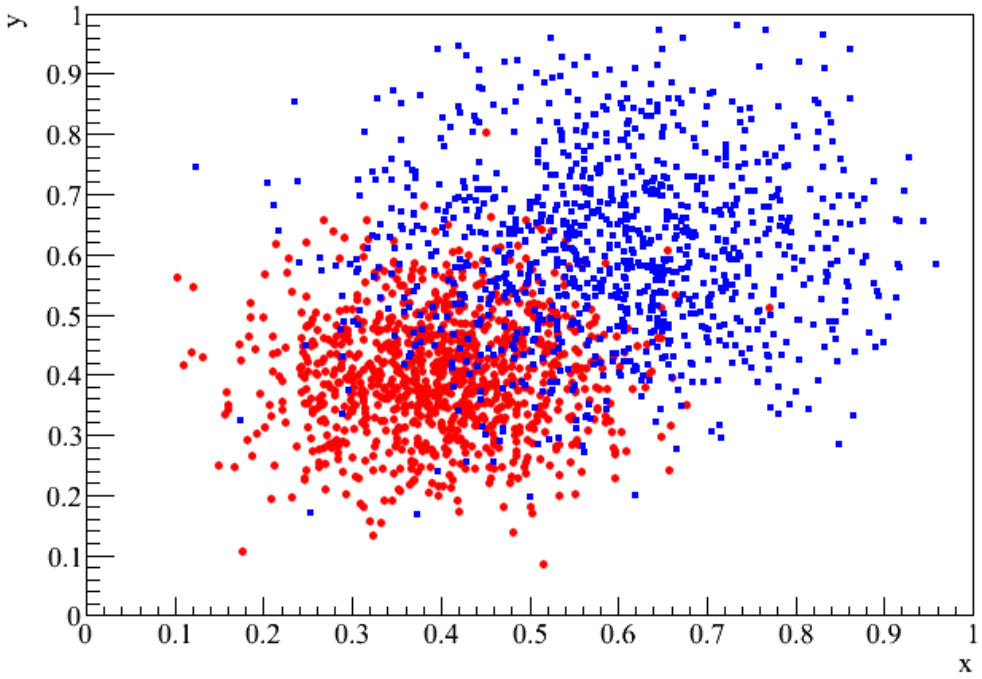

Figure 2: Distributions (red) A and (blue) B generated in x and y from random Gaussian distributions with different means and widths. Note that in general it is better to use different marker or line styles to refer to different populations of data or fit hypotheses, as will become apparent if you choose to print this test report off on a black and white printer.

One last point that should be made is that in addition to the suggested reading on style and report writing, you can find suitable information online. One particularly thorough reference is the American Physical Society (APS) style guide [7]. If you are interested in the finer points on how to prepare a report with a legitimate scientific style, please take a look at that.

Conclusions

Often the second section of an article that is read is a conclusion – so that a reader may better understand what it is that you have achieved and for them to decide if it is worth the effort in going through the whole article in detail. You should encapsulate a summary of any and all conclusions that you are able to make within this section. As with the abstract, you should be quantitative in your conclusions. We measure the speed of sound in air to be 330 ± 30 m/s.

There is no excuse for not running the spell checker on your report. Finally – you should refer to the suggested texts on style and preparing a report, and give your report a final proof-read before submitting it.

References

[1] A. Very-Clever-Person, Some Journal Ref. (1910).
[2] A. Person, B. Person, and C. Person, Some Other Journal Ref. (2008).
[3] URLs should be avoided unless you have no other choice. Wiki pages are not good references, and you should source original or library quality references as appropriate.
[4] G. L. Mallory, Climber's Club Journal, March 1914.
[5] B. Aubert et al., (BaBar Collaboration) Nucl. Instrum. Methods A **479**, 1 (2002).
[6] The ROOT Framework, *http://root.cern.ch/drupal/*.
[7] APS Style guide is available online at *forms.**aps**.org/author/**styleguide**.pdf.*

Appendix A

Appendices are optional, and are a good location to place very detailed information that would otherwise disrupt the flow of your report. For example if you have a mathematical derivation, this might be an appropriate way of documenting that work so that people can see what you have done, but not forcing all readers to get bogged down with the detail.

In addition to using the suggested texts to develop a feeling of how one might write a report, one can always look at preprints or articles to see how they are set up and how scientists prepare reports for publication. In doing so you will find good and bad styles, however the exercise of browsing archives can help you decide what you like and dislike about a particular style. A good place to start might be the arXiv:hep-ex preprint archive: http://arxiv.org/list/hep-ex/new.