Project Proposals for Physics 118

Your projects for this course will be based on a proposal you design and pitch in two formats. First, there is a written proposal, to be turned in online (Due April 16 at 11:59 pm). Second, on Tuesday April 21, each student will give a 5-minute presentation in class (12:30pm, Knudsen 6107) describing your proposal to the class.

Written proposals

The purpose of the written proposal is to describe what you want to make, how you will make it, and what diagnostics you will use to evaluate its performance. **The proposal needs to convince your reader that your plan is feasible.** Your proposal should contain the following sections:

Introduction The project itself should be described in succinct, scientific prose. You should motivate your project in the context of a feasible application in physics research, where your project would aid with the measurement or control of some physics experiment. The requirements of this application should be clearly stated, even if only to point out that you need to make your project flexible in some parameter because the requirements are unknown. You goal in this section, as with all writing in a lab report, is to communicate this information to the reader in the clearest, most efficient possible way.

Design Your project may not be *fully* designed at this point, but you should outline the basics and clearly point out which aspects are known and which will need to be determined. I expect circuit diagrams in this section, even if all of the details are not yet worked out. If you are starting from another person's design, you need to clearly give them credit, and clearly describe how your project will differ and what new aspects you will be designing yourself. Part of convincing your reader that your plan is feasible may be to clearly describe aspects of this project that have been worked out by other people. This section may involve a few levels of figures, where some projects would start with a block diagram, and then each block would have a circuit diagram, for instance. You need

to demonstrate that you understand the basics of how your circuits work, and the description should be targeted at a reader who knows basic electronics (standard circuit elements), but maybe not all of the special ways they are being combined for your project. If your project involves a lot of code, you should include some way of outlining what the code will do, such as block diagrams or pseudocode.

Parts List and Budget This is, from a practical perspective, the most important part of your proposal. You need to list the parts you need with specificity (DigiKey part numbers, for instance) so that your TA can help you purchase what you need. Any elements that you know you need, but do not yet know with specificity at the part number level will need to be accompanied by a description of when and how you will determine what to buy for this part. Your parts list should include the cost, so that it serves as a budget for your project. Please include the total cost of your project in this section.

Evaluation Metrics Arguably the most important part of this course is that you come up with plans to quantify how well your circuit works and test them. The more metrics you have, the better. A proposal that gets a very high grade would be one with a few very specific measurements that quantify how well it works, including measurements that would take place before the end of the course. You can describe the types of plots you want to include in your final report, for instance. This section ties into the next.

Timeline You must produce a detailed timeline describing when each part of your project should be completed, and how you will define "completed." These are sometimes called "milestones" in research proposals, and the more of these you have, the better your grade is going to be on this proposal. Please present a timeline in a table, which you can then describe in more detailed prose after the table. You should note that **there is a mid-term progress report due on Thursday, May 7**, so you will need to clearly state what progress you will have made by then and how you will show in your progress report that you have met this goal.

Proposal Presentation

The purpose of your presentation is to communicate to the rest of the class what your project is, the basics of how it will work, how you will measure its performance, and

how it might fit into a research context. This whole thing needs to last no longer than 5 minutes (you will be timed), so the amount of detail is going to be fairly limited. You will be required to put together slides for your presentation using, for instance, Power Point or some equivalent. This may be the first time you have had to give a presentation like this, so it will give you a bit of perspective for preparing your final presentation at the end of the quarter. Students are strongly encouraged to practice! A good rule of thumb is that you will use 1 slide per minute, so you may not want to bother with too much with things like "outline of this talk" slides. You will be graded both on the quality of your slides and how effectively you were able to communicate your project to the audience.

Example Project Ideas

Optical power meter for lasers (display readout, audio readout)

RF Network analyzer (with DDS, antenna analyzer)

Temperature controller (or other PID controller)

Precision current or voltage source (cryogenic temperature sensor, ion traps)

Spectrum analyzer (audio, RF with DDS)

Programmable function generator (multiple waveforms, user interface, computer control)

Web-connected sensor (temperature, humidity, etc.)

Phase-locked loop (frequency doubler, tripler)

Diode laser controller (current, piezo, "feed-forward")

Multi-channel voltage or current sensor (displays and computer readout)

Precision amplifier (audio, voltage)

Event detector (Geiger counter)

Fast switching high current or voltage (magnetic coils, ion traps)