

LLS - Low Light Signal Measurements

Signature Sheet

Student's Name _____ Partner's Name _____

Suggested reading to start with (see the end of the manual for more):

1. 111B LLS Manual
2. About Lock-In Amplifiers: Application Note # 3" [About Lock-ins](#)
3. R. Ramirez, "[The FFT: Fundamentals and Concepts](#)"; Prentice-Hall, 1985, pp. 3-16 & 115-123.
4. 111B LLS Experiment Videos [Low Light Signal Measurements](#) and the [Light Sources and Detectors](#). Note: In order to view the private Youtube videos hosted by the university, you must be signed into your berkeley.edu Google account.

Pre-Lab Discussion Questions

It is your responsibility to discuss this lab with an instructor before your first day of your scheduled lab period. This signed sheet must be included as the first page of your report. Without it you will lose grade points. You should be prepared to discuss at least the following before you come to lab:

1. What is the purpose of having the SR760 FFT Spectrum Analyzer? What mathematical operation does it perform on an input signal? Give several examples of what goes in and what comes out.
2. Why don't we just put a filter in front of our photodiode which only passes light at the frequency given off by the LED (e.g. 635 nm)?
3. Explain how chopping the steady-state signal from the LED helps you to recover the signal from the LED.
4. Explain the working principle of lock-in amplifiers. You can first assume that the input signal is an arbitrary signal expressed by a Fourier Series, and assume your reference signal is a unit sine wave at targeted frequency. Show how the target frequency component of the input signal is extracted. Consider how the phase difference between the input and reference signal and lock-in settings such as the SLOPE and TIME CONSTANT affect the result. (Hint: Think about the relation between X, Y, and R).

Staff Signature _____ Date _____

Completed before the first day of lab? (Circle one) Yes / No

Mid-Lab Discussion Questions

1. Before beginning Experiment X, you should have produced a plot of the Johnson noise signal using the measurements obtained in Experiment IX.

Staff Signature _____ Date _____

Completed before proceeding with Experiment X? (Circle one) Yes / No

Checkpoint Signatures

1. Fourier Components

Staff Signature _____

2. Slope/Oct and Time Constant

Staff Signature _____

3. 1/f Noise

Staff Signature _____

4. Capacitive Noise

Staff Signature _____

5. Johnson-Noise Measurement

Staff Signature _____

