List of preparatory questions

These questions may serve you as a rough guideline for preparation of the experiment.

1. Introduction and motivation

- What are the important differences between fundamental noise sources and other kinds of noise?
- What measures are there for electrical noise and in what contexts are they useful?
- What are the physical origins of Johnson noise and shot noise?
- How can noise be used to measure the fundamental constants k_{B} and e?

2. Planning the experiment

2.1. Electronics

- What do you have to take into consideration when choosing the gain?
- What is the difference between DC- and AC-coupling? Which option is to be preferred in these experiments and why?
- What would be a reasonable choice for the integration time of the time-averaging module?
- We assume that every component except the filter are frequency-independent. When does this assumption break down? (Consider for example the parasitic capacitances of about 10 pF in each resistor)

2.2. Johnson noise measurements

- How does amplifier noise arise in these measurements and how can we determine it in the two measurement procedures (Noise vs resistance and noise vs bandwidth)?

2.3. Shot noise measurements

- Should one first test the circuit with the bulb or with the LEDs? Why?
- What is the advantage of using the transimpedence amplifier to measure the photocurrent?
- How can you determine the amplifier noise?
- Which other sources of noise can obscure the shot noise signal?