PHSX815_Project1:
The Grad Student Forgot to Label the Nanowires Again

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February 7, 2023

1 Introduction

It can be taken for granted that atoms are spheres. Round, hard, sticky spheres. All this to say that when one spherical atom touches another spherical atom, they stick together. This can be tricky when you want to stack atoms. If one atom touches another atom at some angle other than directly overhead, the stacked atoms will not be perfectly straight. This means that the resulting nanowire of atoms will be skewed. The extent to which this nanowire is skewed will help determine the type of deposition that was used to fabricate it.

Different methods of fabrication can be used to create these nanowire. This includes sputtering, atomic-layer deposition (ALD), chemical and plasma etching, and DNA origami. Each fabrication method comes with its own benefits and challenges. However, each method does create a different kinds of skewness in the resulting nanowires. Using sputtering to fabricate nanowires results in wires that are equally skewed in all directions. In other words, the next atom deposited on a nanowire through sputtering is equally likely to form any angle between -90°to +90°. ALD on the other hand is much more precise. The angle that next deposited atom makes with the previously deposited atoms is usually 0°, but there is slight variation that doesn't usually exceed 10°. Etching the results in nanowires that are randomly distributed, but only between -45°to +45°. DNA origami on the other hand results in something that generally just spirals. In other words you will have skewed results only between 10-60°with an average of 35°.

This is useful to know because often you will come across some nanowires that a graduate student has forgotten to label in their haste to get to bed before tomorrow comes. This then requires an analysis of how skewed the nanowires are to determine what fabrication method was used to make them. After determining how skewed the wires are it is possible to predict what the other properties of the nanowires should be. These measurements can be made using an electron microscope. This will be done for the latest batch of unlabeled nanowires found on the labratory benchtop.

This paper is organized as follows: Sec. 2 explains the hypotheses we are testing to see which what deposition is being used to fabricate the nanowires. A description of the computer simulation developed to simulate these possibilities is provided in Sec. 3, with an analysis of the outputs included in Sec. 4. Finally, conclusions are presented in Sec. 5.

2 Hypotheses to Explain the Unlabeled Nanowires

Feedback on how to discuss this would be helpful.

Figure 1: Fabrication methods used to deposit nanowires. The plasma chamber for sputtering is seen on the left. A diagram of a single strand of DNA folded into a nanowire using the appropriate oligonucleotides is seen on the right. (These are currently placeholder cats).

3 Code and Experimental Simulation

Feedback on how to discuss code in a paper would be helpful

Let's look at some simulated data:

If I need to cite a reference, I can add it to my `main.bib` file and cite it like this [1]

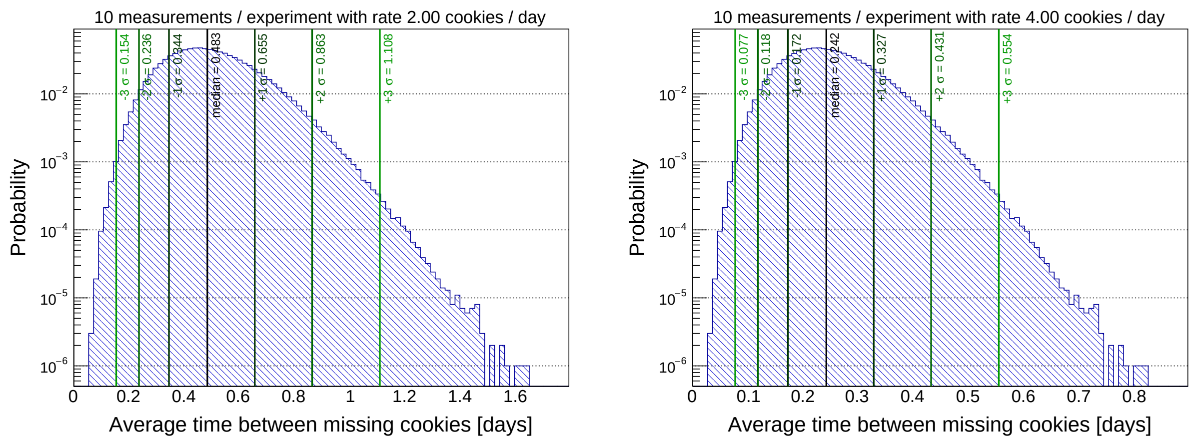

Figure 2: Simulations of the average time recorded in between missing cookies for two different hypotheses. (Left) Average time between missing cookies for dogs eating cookies (rate parameter $= 2$ cookies/day). (Right) Average time between missing cookies for aliens eating cookies (rate parameter $= 4$ cookies/day). Each entry corresponds to one simulated experiment, with 10 time measurements averaged per experiment. There are 1 million experiments simulated for each hypothesis. Shown in the figures are the median expected average time, along with the 1, 2, and 3 σ confidence intervals (symmetric around the median)

4 Analysis

5 Conclusion

Here are the references

[1] G. J. Feldman and R. D. Cousins, *Unified approach to the classical statistical analysis of small signals*, *Phys. Rev. D* **57** (Apr, 1998) 3873–3889.