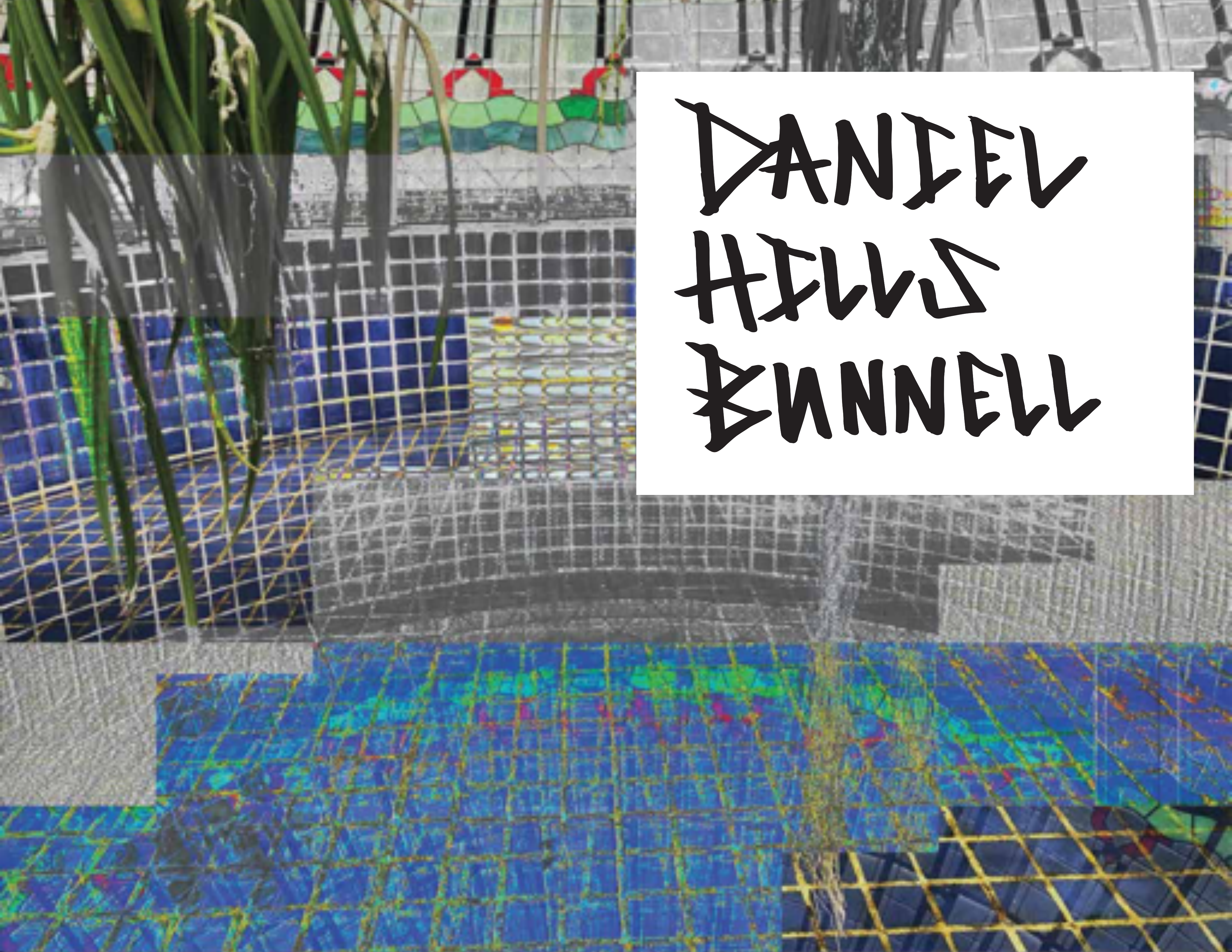
# DANIEL
# HELLS
# BUNNELL



# BIO

I am an engineer from Stanford University.

I work on projects to leverage technology for positive social impact.

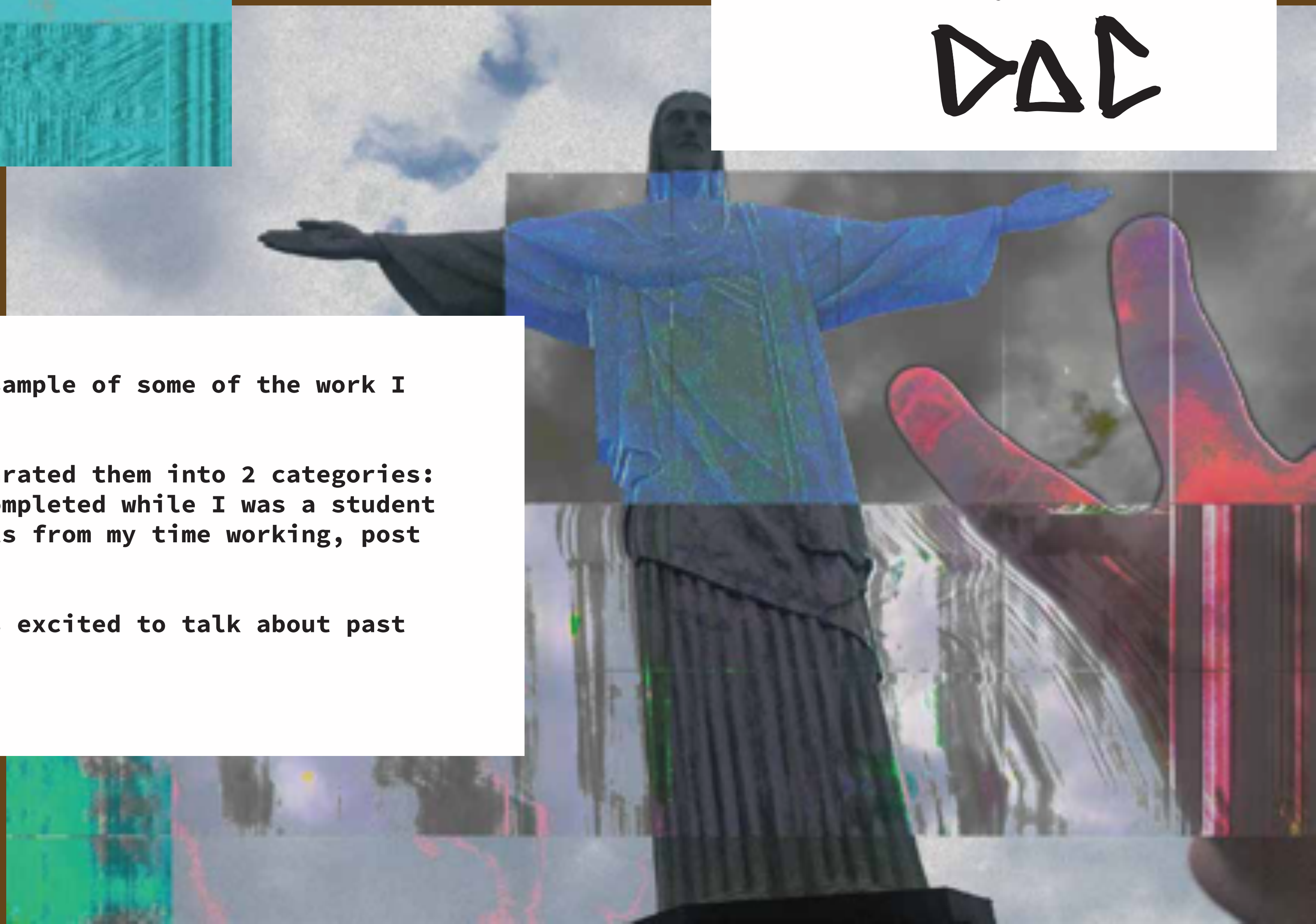
I have a strong background in hardware design and manufacturing.

I am experienced in CAD modeling, CNC milling, 3D printing, and data driven iterative prototyping.

I have worked in pathogen testing, autonomous vehicle design, sustainable construction, and DNA synthesis.

I am interested in working on mechanical problems to build a better sustainable world.

# ABOUT THIS DOC



Here is a sample of some of the work I have done.

I have separated them into 2 categories: projects completed while I was a student and projects from my time working, post graduation.

I am always excited to talk about past projects.

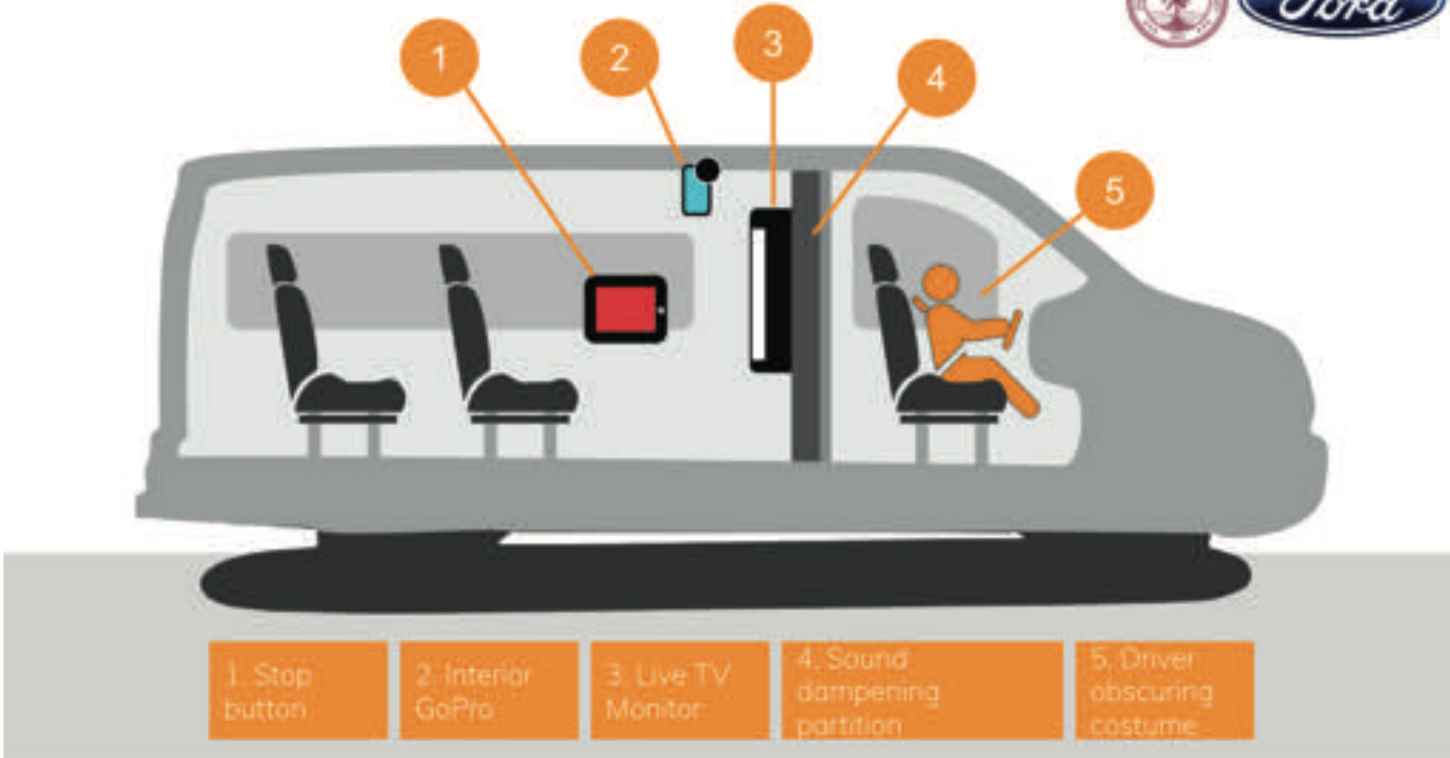

# AT SCHOOL

# FORD


Via Larry Leifer's design group at CDR led by Lauren Shluzas, I worked on an autonomous vehicle interaction study hosted at Ford Motors.

The aim of the study was to investigate interventions that might make passengers feel comfortable without a driver. Besides planning the study, I built out the interior of a transit van to imitate the experience of riding in a Level 5 autonomous vehicle.

# FORD



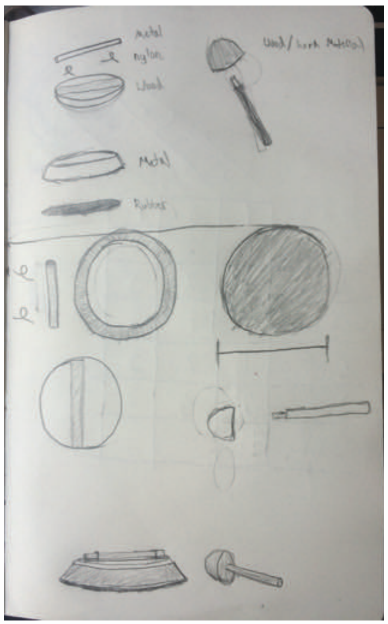

A monitor mounted to a sound proof barrier displayed a live feed from a go-pro on the hood of the vehicle and gave the sensation of looking out the front windshield. I operated the van normally from the other side of the barrier.

Test subjects believed the vehicle was driving itself. They were given varying degrees of information about their trip and basic controls on an iPad that alerted the driver (me) via audible commands.

Check out the paper here: https://dl.acm.org/doi/abs/10.1145/3409120.3410639

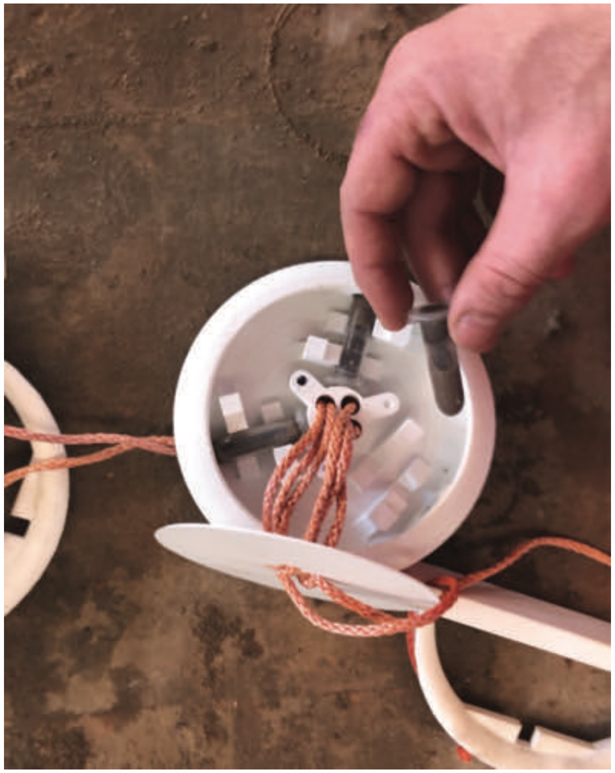
# ME 203

During my sophomore year, I designed and built a resonating chime tuned to 582Hz.  To complete the project I combined principles of acoustics with manufacturing techniques for wood and aluminum.  During this project I experimented with CNC milling and lathing in a variety of materials.



# EARTH ENABLE

Along with a team hosted at Stanford's Graduate School of Business, I designed an affordable, 3D printed centrifuge that could be used to build quality assurance protocols for a Rwandan flooring group. The floors were built from locally sourced materials as an alternative to concrete. o ensure the build integrity of this unique flooring, we had to develop novel tests which could be deployed easily in a rural setting



# EARTH ENABLE


Building off prototypes from bioengineer, Manu Prakash, I created a durable, hand-powered centrifuge designed for field use. This project took advantage of locally available materials and the emergence of 3D printing as a viable manufacturing method for functional products.

The centrifuges were introduced into EarthEnable's quality control process to maintain consistent materials qualities in their floors. EarthEnable has completed over 4,000 low cost, sustainable floors.

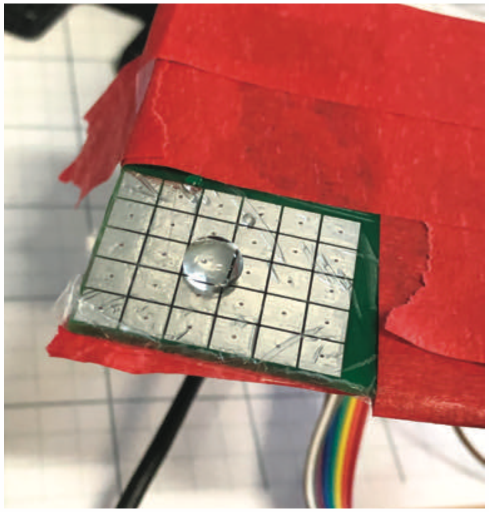
# AT WORK

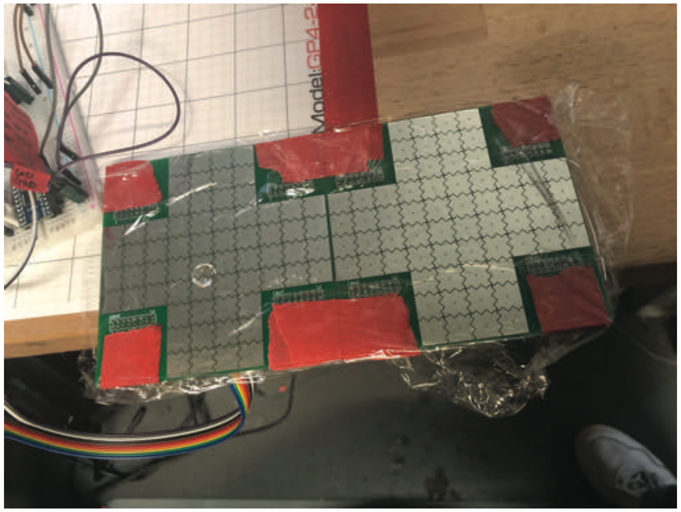
# EWOD

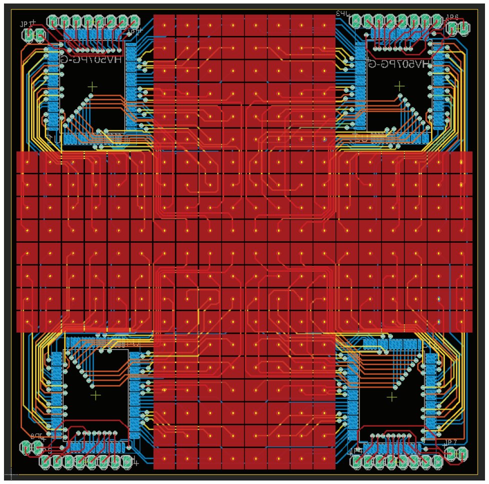
This is a prototype I made for a solid-state microfluidic device.

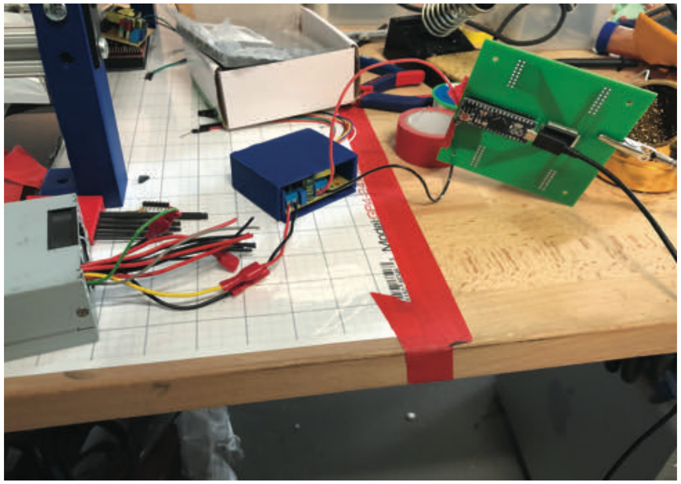
The system uses a micro controller, shift register, and high voltages to alter droplet surface tensions and transport drops of fluid without any moving parts.

I designed the circuit board myself so that the system could move droplets between interchangeable PCBs.

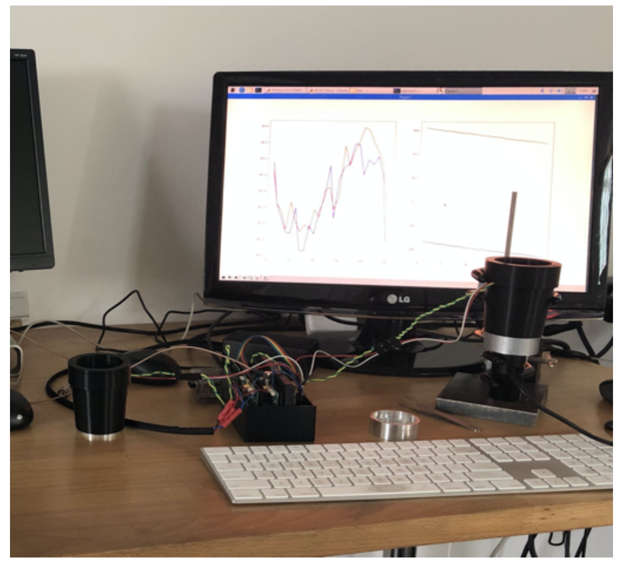








# GREEN LOGIC



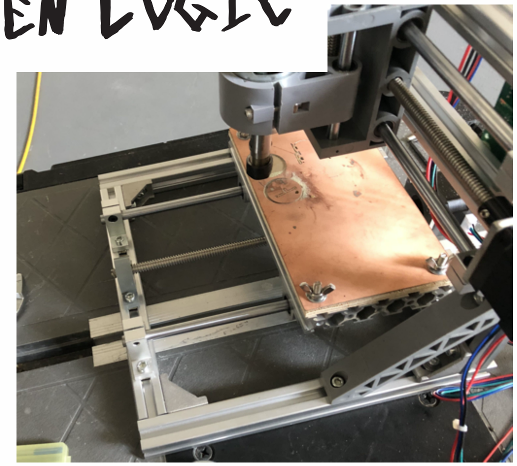
For this project, I worked with the brilliant biochemist, Rick Zuzow, to design a testing setup to detect faint light signals from luminescent bacteria. This was my first experience with precession engineering. Preventing inadvertent light leaks proved challenging and required a heightened attention to detail.

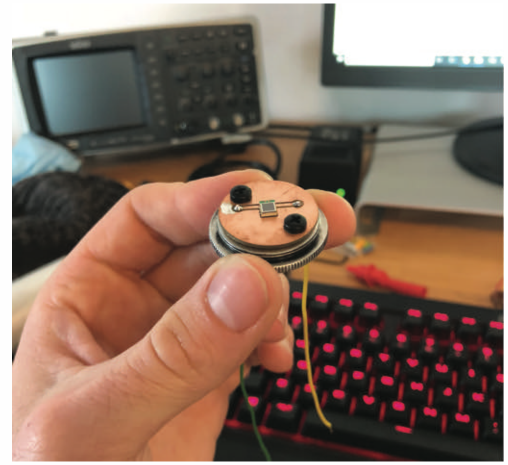
# GREEN LOGIC

To detect the photons emitted by the bacteria, I wanted the enclosure to reflect as much light as possible. The assembly also had to block all environmental leaks to prevent excessive noise in signal detection.

I cut the top piece of the aluminum enclosure to tight tolerances on the lathe. The bottom piece had a parabolic shape to reflect light towards the sensor, which was milled with a Tormach CNC. I then polished the interiors of both pieces to a mirror finish.

# GREEN LOGIC

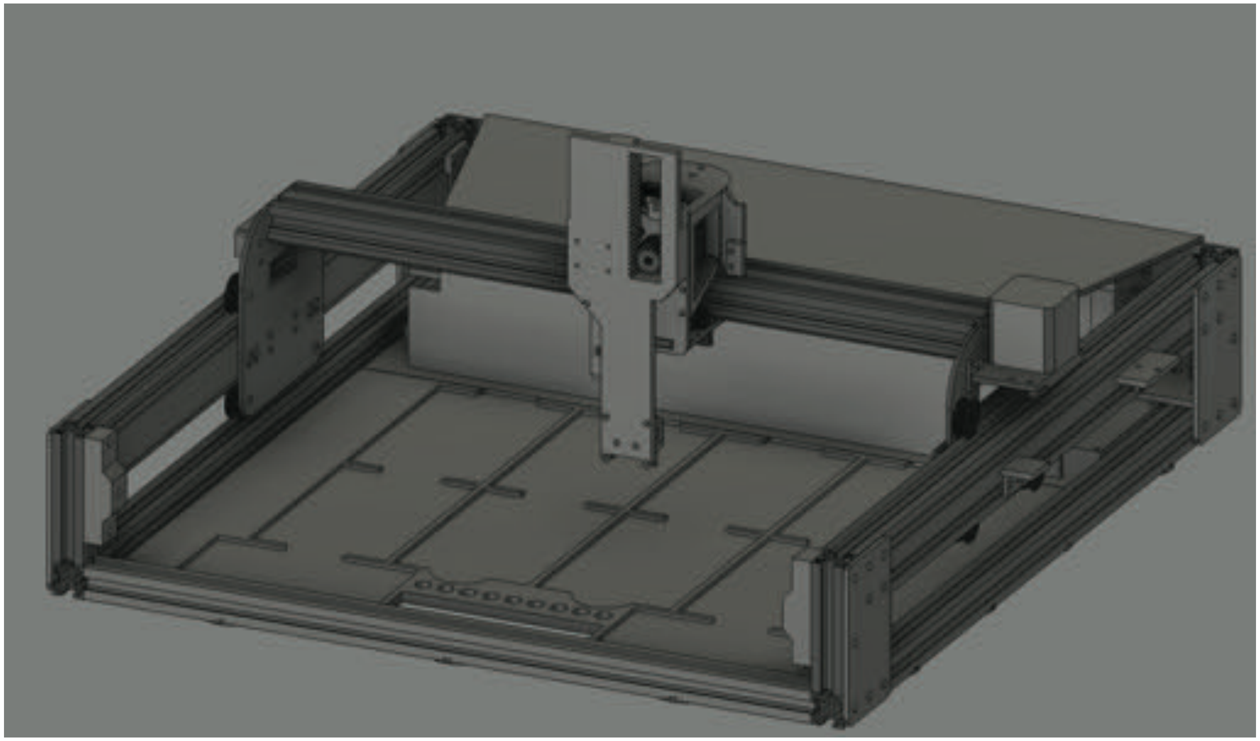




To mount the photon sensor, I fabricated a custom break out board that I could fasten to a lens backing. I had to position the sensor at the focal point to ensure that any light in the chamber would be detected.

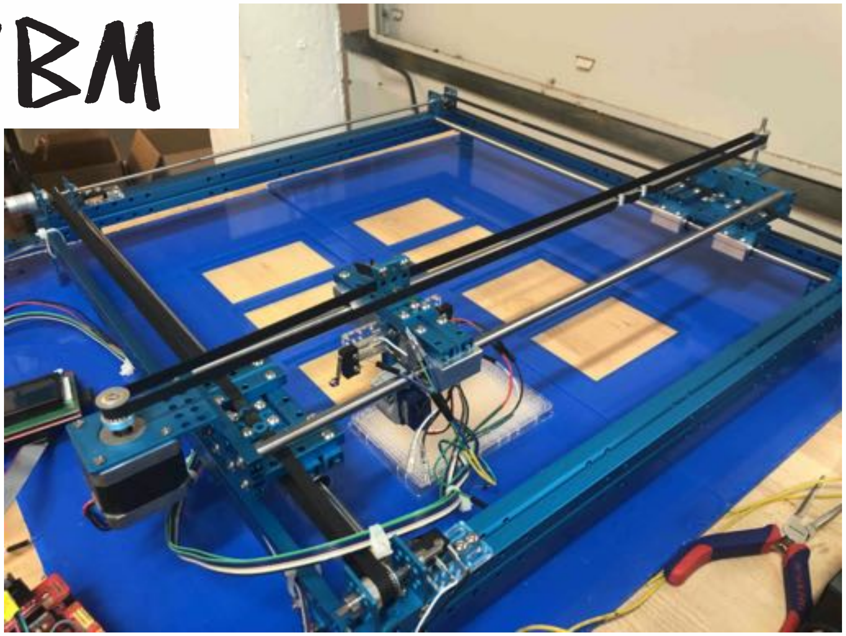
The light source was very faint! So, in order for this to work, everything had to be positioned with extreme precision.

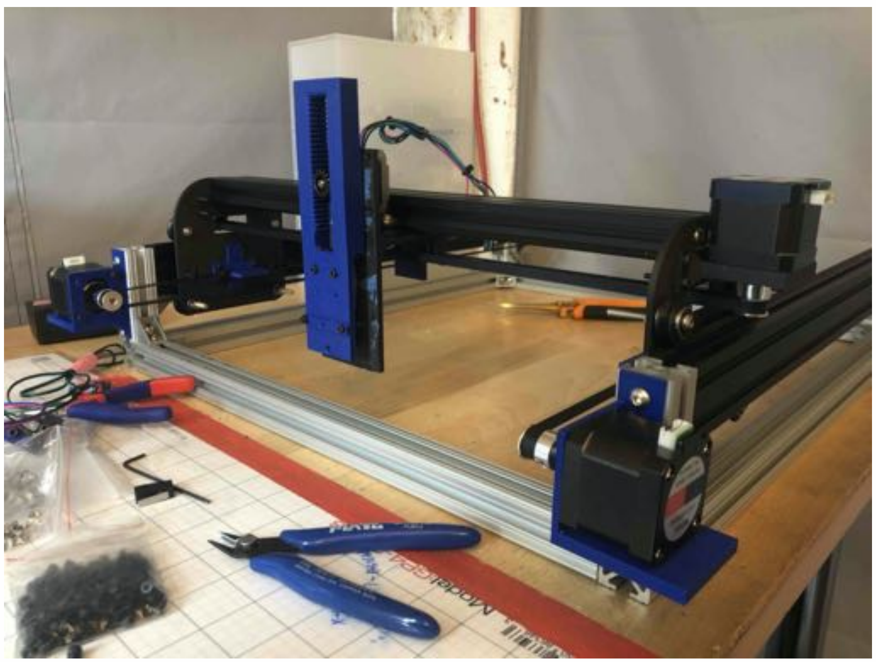
# UBM



My longest running project was designing and building a DNA synthesizer with a fantasitc team of biologists at UBM. This device takes much inspiration from the Cartesian movement of 3D printers and other CNC bioware like OpenTrons. Synthetic DNA/RNA is critical in the development of vaccines and medicine. By moving temperature controlled needles to wells of reagents, specified sequences of DNA and RNA are synthesized.

# UBM





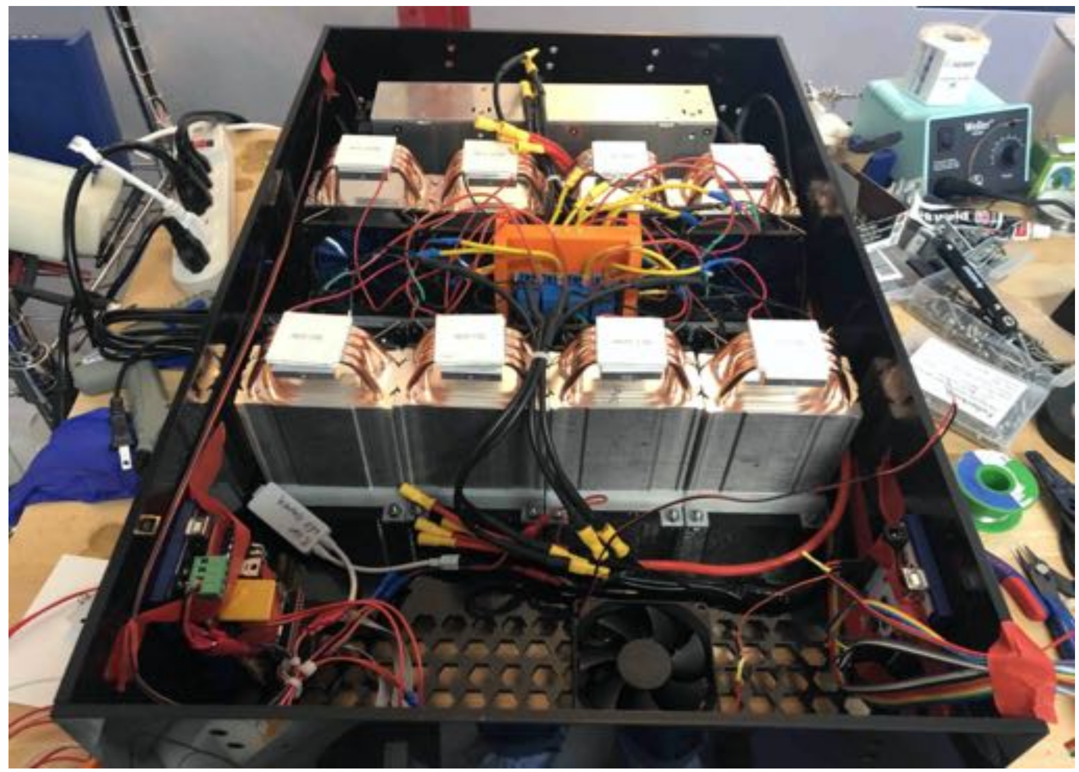
This was a long and complicated project. I iterated across a number of gantry designs to build the most reliable, economical machine.  I learned how to select stepper motors, microcontrollers, and how to design for speed and reliability.

Adjusting to evolving design requirements forced me to get creative about the layout and footprint of different prototypes. Here are a couple samples of some rapid prototyping I did for this project.

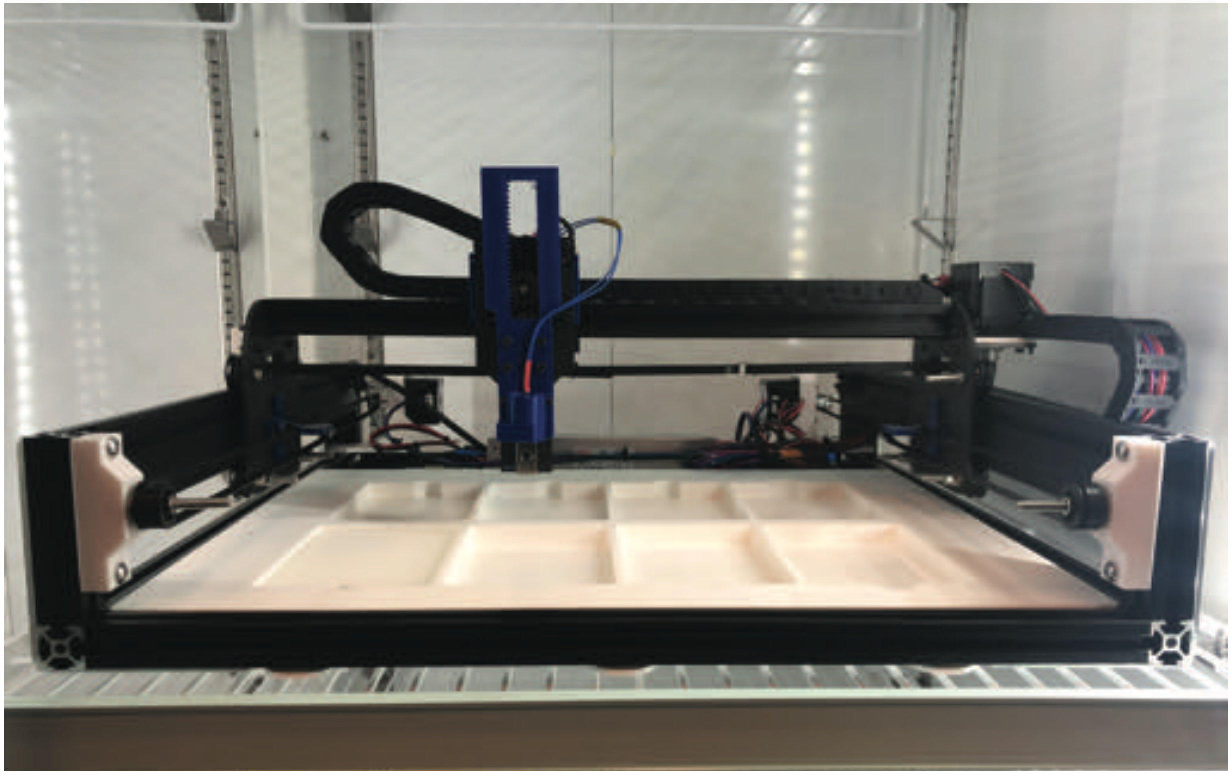
# VBM

This was also one of my first lessons in overengineering. One of my constraints was that I had to keep our reagents bellow dewpoint. I designed and built an elaborate Peltier cooling system that kept 8 different wellplates below 4 degrees C.

As proud as I was that my design could fit within the original footprint, my solution was ineffficent and expensive...

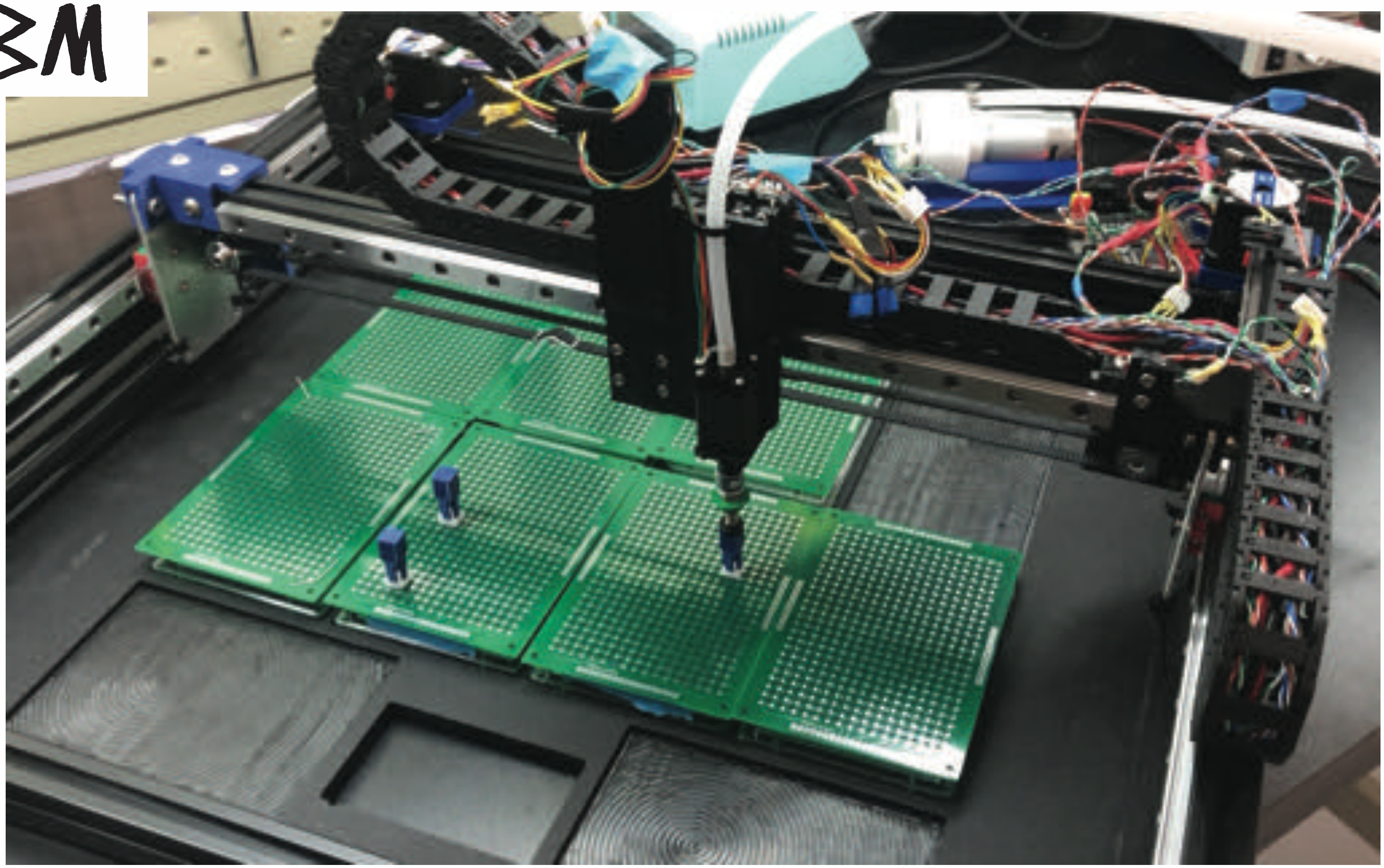


VBM



So instead we decided to build the machine to fit in a fridge.  An elegant solution if I don’t say so myself. This adjustment radically decreased our unit price and power consumption.

# UBM



The final iteration of our design moved multiple DNA building sites across tens of thousands of wells. Each site was equipped with a heater that made a connection on a custom PCB to maintain cycle constraints. This feature quadrupled the synthesis throughput of a single machine and ultimately lowered our price/strand even futher.

More to come...

danielhb.com