Hi, I'm Daniel.

Science rules!

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Education:
B.Sc. in Science from York University, Physics stream.
Graduated in the fall of 2021.

SafeSump Inc.

CEO/CTO of four-year project to design and produce a failure-resistant water pump system. Funded by a $37,500 Ontario Centres of Excellence grant (2017-2020) followed by a $75,000 government contract (2018-2020).

Broad overview of skills gained:

- **Electronics**: Production electronics design and design-for-manufacturing; rapid prototyping of ultrasonic and capacitive sensors, among others
- **Software and firmware**: Version control. Frontend and backend server programming; Linux administration, programming of production utilities and scripts. Writing and maintaining a 30k SLOC codebase of C, Python and C++.
- **Soft skills**: Pair programming, time management, writing.

Viral electroporation

A 10-month attempt to follow up experimentally on previous research regarding the dielectric properties of viruses, in the hopes of harnessing a phenomenon known as irreversible membrane electroporation, via optimized Brillouin precursors.

This required some literature review and a degree of care in experimental design, but also required several specialized pieces of equipment:

A custom, inexpensive synchronous photon-counting fluorescence system, allowing amplification-free quantification of ds-DNA at sub-nanogram resolution.

Development of an inexpensive 12 GHz microwave absorption spectrometer (albeit unused in the final experiment)

Electromagnetic modelling of tissue and experimental system parameters via FDTD; sub-nanosecond kilovolt pulse generation; numerical optimization of dispersive pulses.

Data was collected on the model organism bacteriophage T4, necessitating wet-lab techniques.

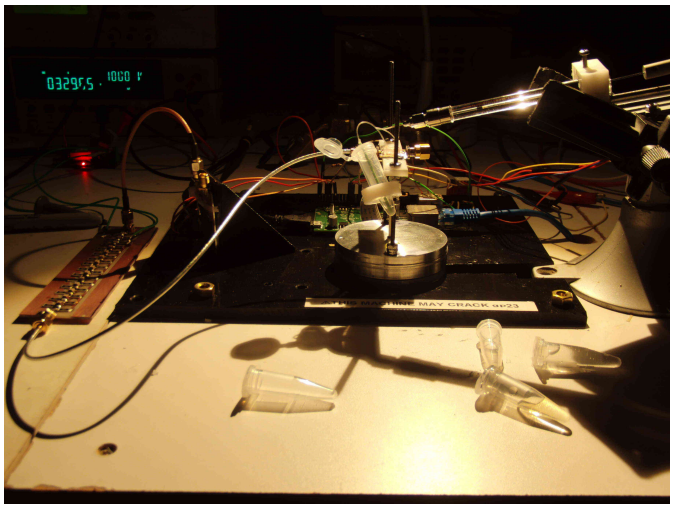
Due to several missteps in design on my part, however, the study was thoroughly inconclusive. A report on the same is due to be edited.

Broad overview of skills gained:

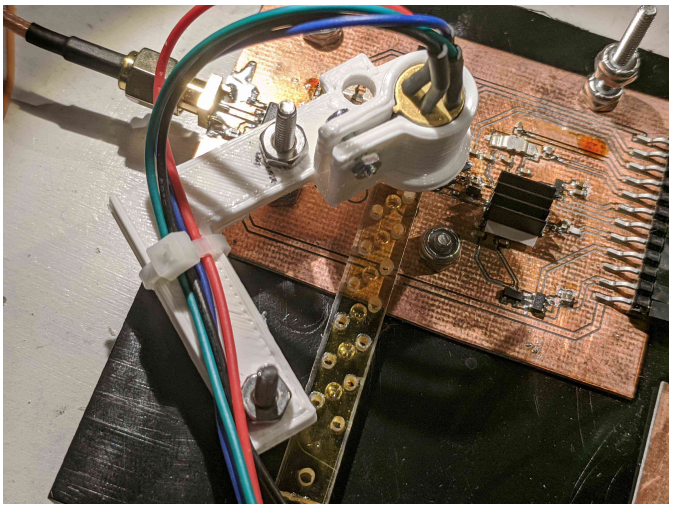
- **Documentation**: LaTeX, Jupyter notebooks, Mathematica, Reference management
- **Software**: Data analysis and automation; Python, C++, and a smattering of many others
- **Simulation**: Several dozen toolchains were in use, ranging from modified open-source electromagnetic simulation systems to molecular dynamics with GROMACS.
- **Electronics**: Microwave electronics design, PCB design with KiCAD
- **Fabrication**: Electronics prototyping, CNC mill and lathe operation, micromachining, microfluidics

Vacuum systems

A 2-year attempt to develop a high-current ion beam lithography system, involving the ion-beam simulation tools noted in the cover letter and several custom solvers.



(a)



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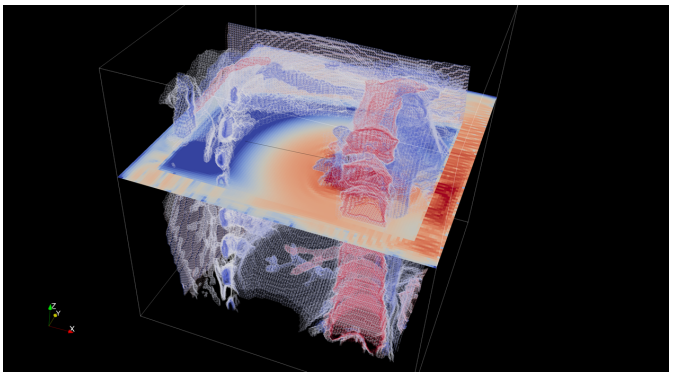
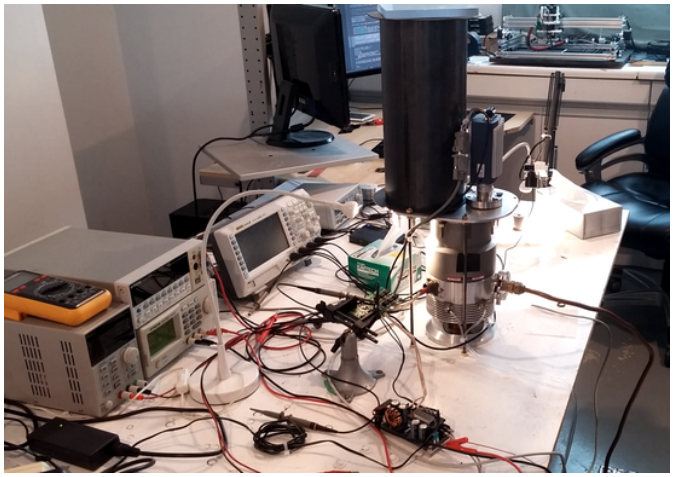


(d)

(a) The sub-nanosecond pulse generator and microfluidic exposure cell designed to induce electroporation.
(b) A 12 GHz microwave absorption spectrometer.
(c) The very pretty opalescent blue culture caused by E. coli B trying to metabolize lactose in an indicator for the enzyme β-galactosidase.
(d) An FDTD simulation of electromagnetic interaction with tissue.



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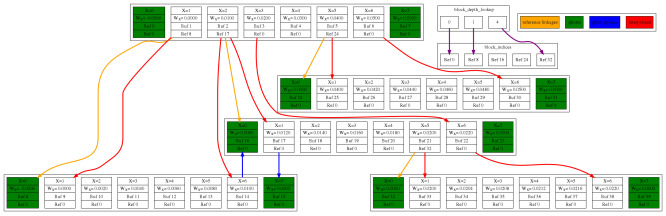

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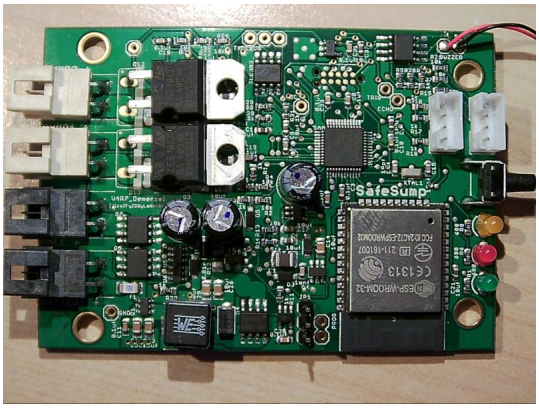
Bespoke high vacuum system. GPU-accelerated multigrid data structure and electrostatics solver for particle-in-cell ion beam simulation



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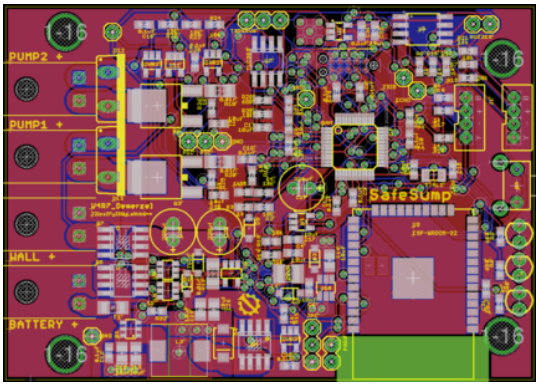

(h)

Figure 1: Redundant controller with a 120 Mhz Atmel ARM processor, running ~10k lines of high-reliability firmware.