Jonah Lee – Project Portfolio

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Pictured: UBC Solar's 3rd Generation Solar Car, 'Brightside'

UBC Solar
'Sunbeam': Live data analysis pipeline

June 2025

To create a **live strategy dashboard** with actionable data visualizations, I **automated calculations** of power, battery state-of-charge, driving efficiency, track localization and more. Our data pipeline runs in real time using **radio telemetry** data from our Solar car's sensors.

Github: github.com/UBC-Solar/sunbeam

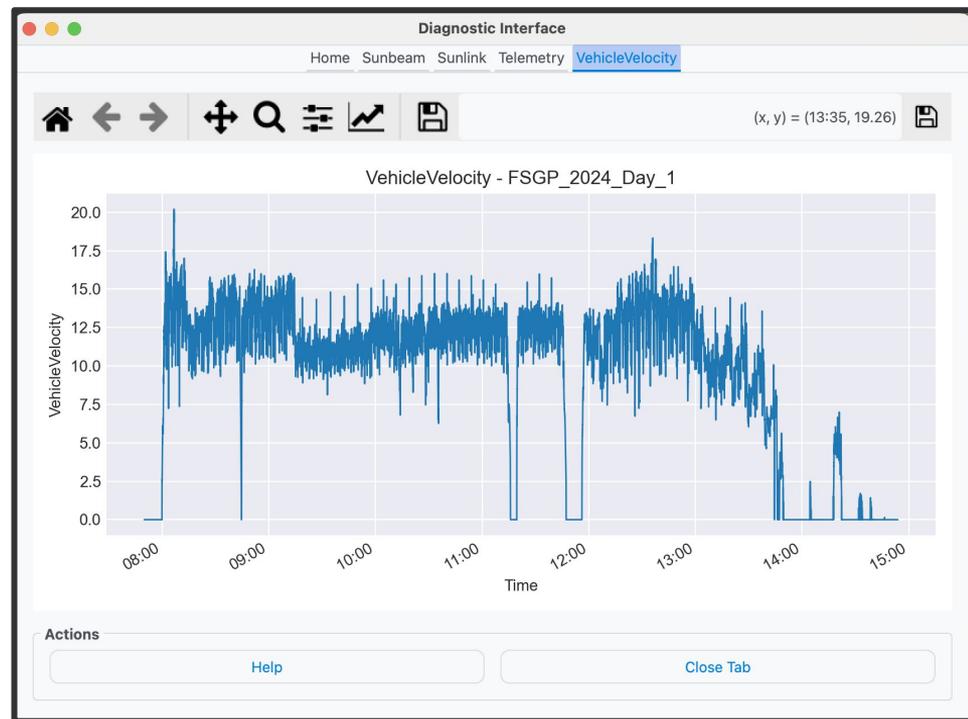# UBC Solar | 'Sunbeam': Live data analysis pipeline

Our Solar Car, Brightside

1. Radio Telemetry

2. Sunbeam Data Pipeline

3. Live Visualization

Diagnostic Interface

Home   Sunbeam   Sunlink   Telemetry   **VehicleVelocity**

(x, y) = (13:35, 19.26)

VehicleVelocity - FSGP_2024_Day_1

Actions

Help

Close Tab

UBC Solar Efficiency Correlation Report

Nov. 2024

Using over **800 km** of telemetry data from our car's sensors, I synthesized results from our race at the **2024 Formula Sun Grand Prix and American Solar Challenge** to analyze which factors affect our car's performance.
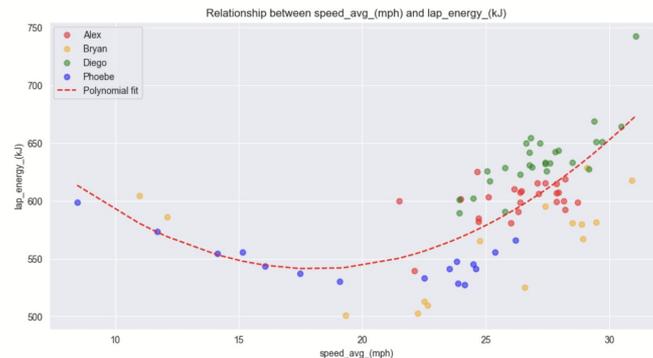
We quantified how **speed**, **corner cutting**, **acceleration** and other factors impact our **energy efficiency**.

See the full report: [Github: UBC Solar Efficiency Correlation Report](#)
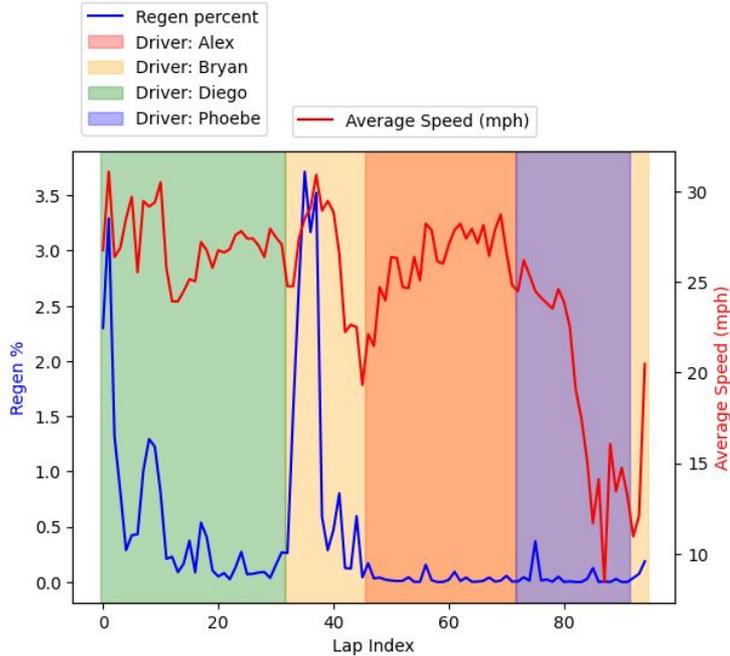
Lap Average Speed vs. Lap Energy

We observe a maximum efficiency at ~20 mph.

This balances motor efficiency (better at high speeds) and aerodynamic efficiency (better at low speeds)
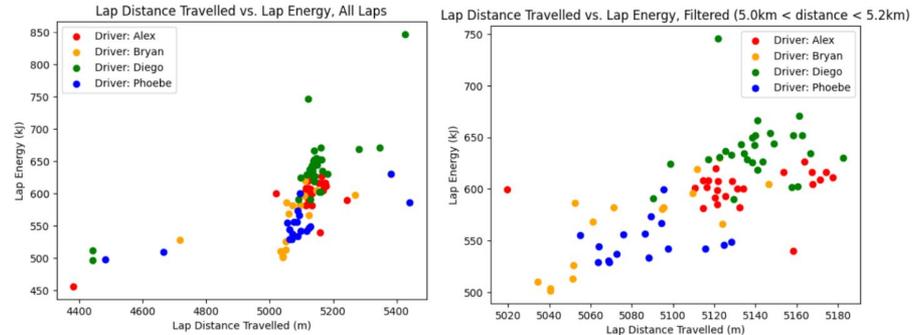
UBC Solar | Efficiency Correlation Report

Conclusion: Regenerative braking energy is minimal, but increased at higher speeds

Conclusion: Some laps were shorter due to better racing lines, resulting in increased efficiency

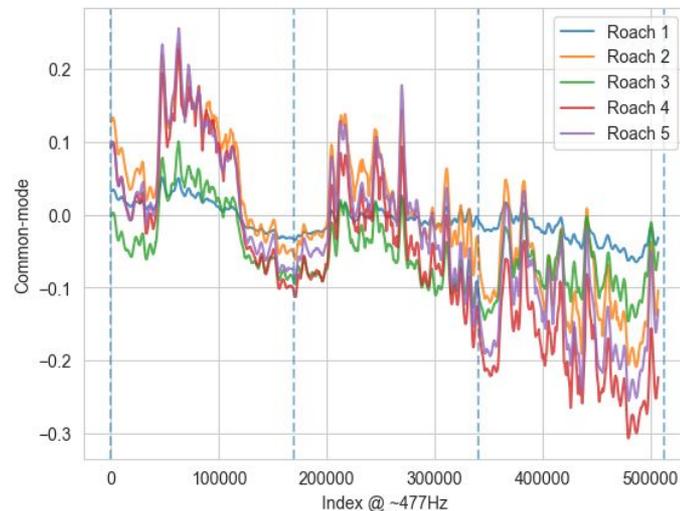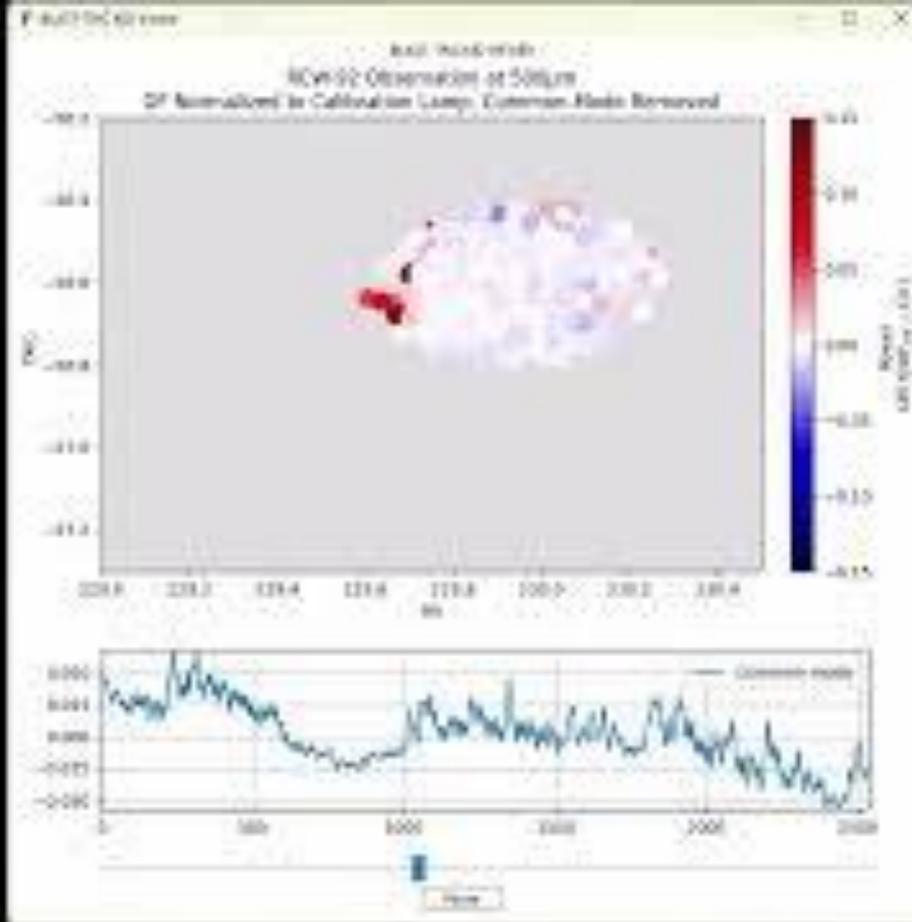# UBC Astronomy Kinetic Inductance Detector Signal Analysis

Feb. 2025

Kinetic Inductance Detectors (KIDs) are extremely sensitive detectors that are used in the **Fred Young Submillimeter Telescope** for detecting light. In this project, **I analyzed the signal behaviour** of this relatively new class of detectors to understand how to perform **'map-making'** from their data, i.e., how to produce images of the sky.

Presentation Slides: Common-Mode Comparison, KID Viewer

Source: https://github.com/jonahjlee/map_making_blasttng_jl

Time-domain average signals from various detector arrays (AKA 'Roaches')

YouTube: Kinetic Inductance Detector Signal Visualizer (made with Python/Tkinter)

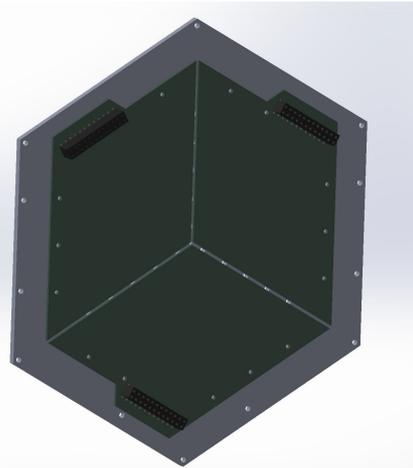# UBC Astronomy Detector LED Mapping Circuit Board Design

Feb. 2025

Due to the manufacturing process of a Kinetic Inductance Detector array, a **'mapping' calibration step** must be performed, to map the physical location of each detector to its resonant frequency. I designed the hardware for this stage on Canada's 850GHz instrument, which includes two components:

1. An **LED matrix Printed Circuit Board** (PCB) with over 5000 densely packed LEDs, designed to operate at cryogenic temperatures
2. An **aluminium collimator** used to focus the light from each LED onto a single detector

Presentation Slides (long!): 850GHz LED Array
Source code / CAD: Github: CCAT 850Ghz LED Mapping

UBC Astronomy | LED Mapping Circuit Board Design

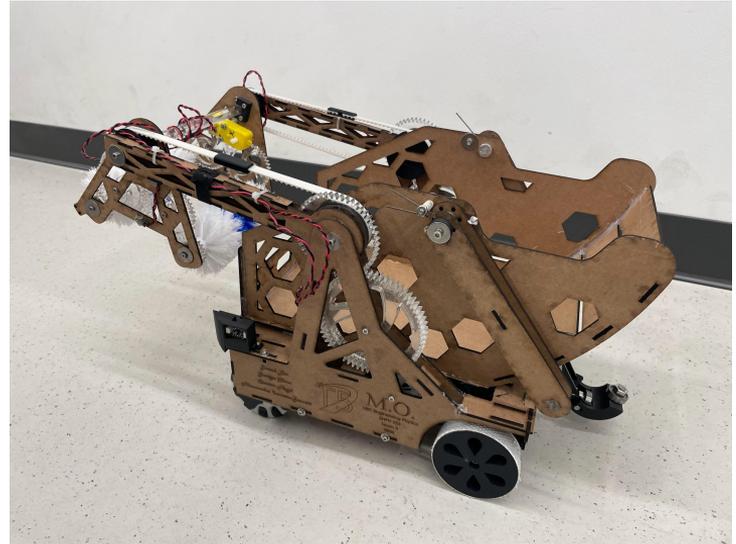Check out my slides for lots more detail: Google Slides | 850GHz LED Array

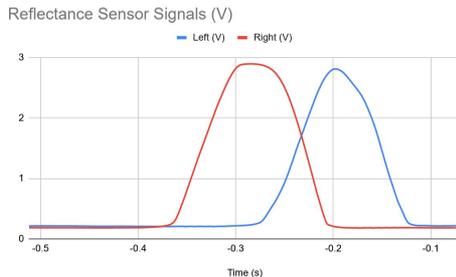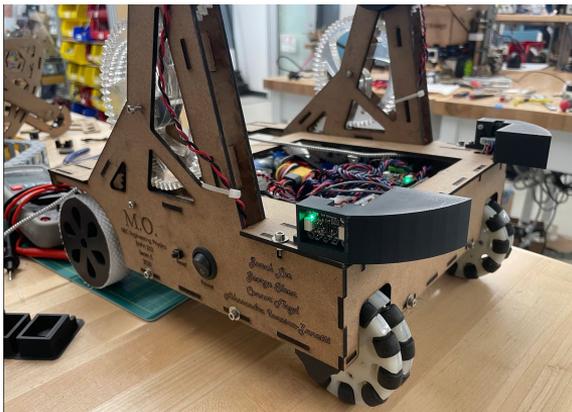# Engineering Physics Autonomous Robot Competition

Summer 2025

On a team of four, I built and developed an **autonomous robot** designed to search for 'pets' on a preset course and return them safely to the starting point.

I focused on the **firmware** for our autonomous robot "MO", developing complex routines in **FreeRTOS** and designing behaviour to work with a variety of **sensors and actuators**.
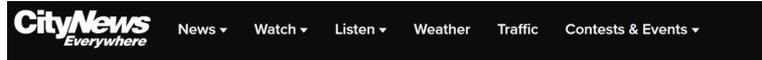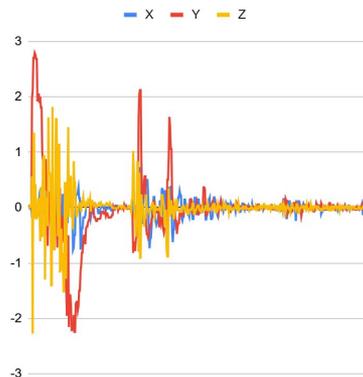
See our source code: ENPH 253 Firmware | Github

Engineering Physics | Robot Competition

Reflectance Sensor Signals (V)

driveCentimeters @ 20cm and 0.5s, linear acceleration data

jonahjlee
295 commits 10,876 ++ 7,969 --

UBC Engineering Physics students race to save 'pets' with robots

For the last two months, 15 teams of UBC engineering physics students have been building automated robots from scratch. Now they are putting their creations to the test in an exercise that shows their ability to save pets from a burning building.

We're on the news!
https://vancouver.citynews.ca/2025/08/07/vancouver-ubc-robots-engineering-physics/

UBC Solar
Toyota GR Presents: "Hack the Track"

November 2025

- 30-day Hackathon hosted by Toyota
- Developed a full-stack driver insights application for Toyota GR cup races
- Stream telemetry data to simulate real-time applications into PostgreSQL DB
- Used a Recursive Neural Network to analyse actual and simulated racing lines, providing actionable feedback to drivers

See our submission: Submission page | Github

UBC Solar | Hack The Track