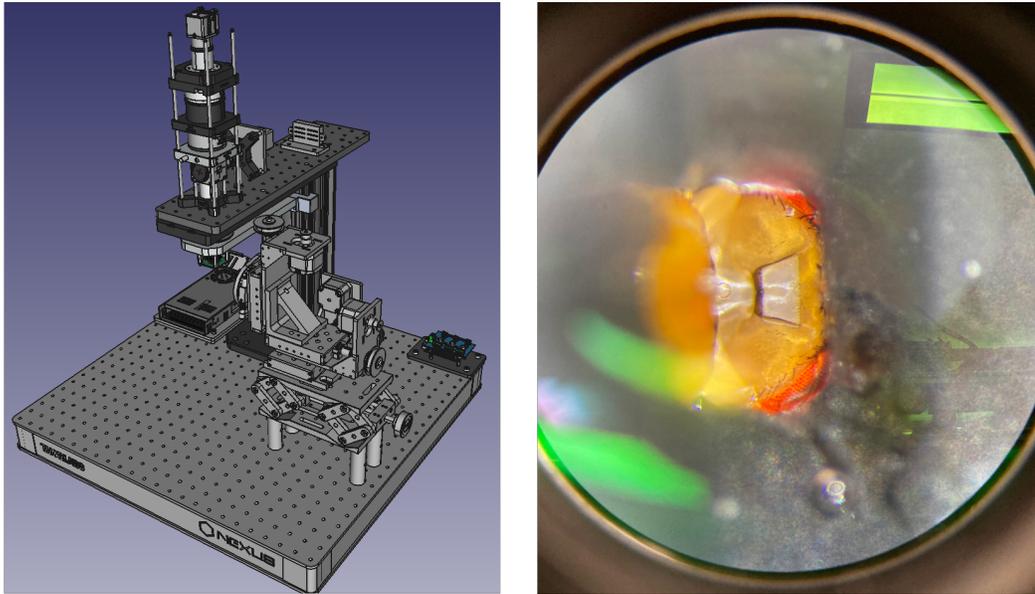
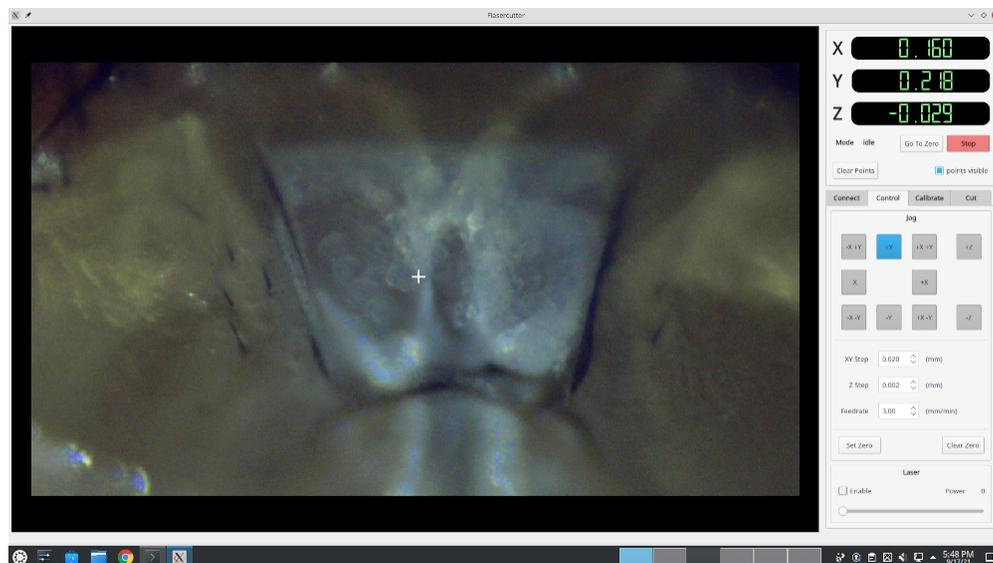


Selected Examples

Micro-scale laser cutter for physiological preparations



To facilitate physiological preparations for whole-cell electrophysiology and 2-photon functional imaging, I developed a micro-scale laser cutting device capable of etching a hole of arbitrary shape dimension on the exoskeleton of the fly. The laser can be programmed to follow any arbitrary 3D trajectory implemented by a set of computer-controlled, stepped motors linked via timing belts to the actuators of an XYZ translation stage. To accommodate changes in surface topography and the spatial heterogeneity of cuticle thickness, both the focus and point of the laser may be programmed to vary along the cutting trajectory. The cutting depth is automatically determined using an image processing technique called focus stacking. A graphical user interface for controlling the laser was developed in Python (shown below).

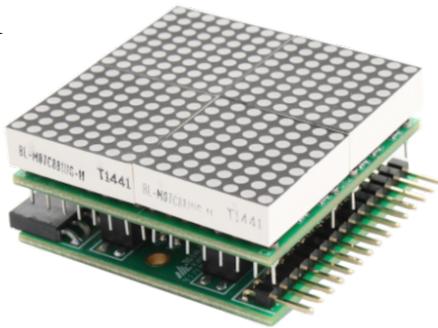


https://github.com/wilddickson/flasercutter_hardware

https://github.com/wilddickson/flasercutter_software

Modular displays for neuroscience applications

A



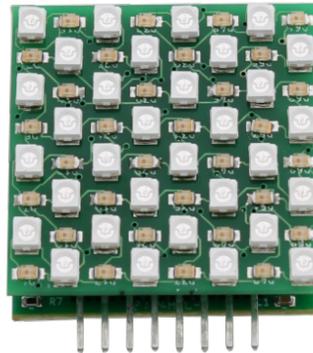
B



C



D



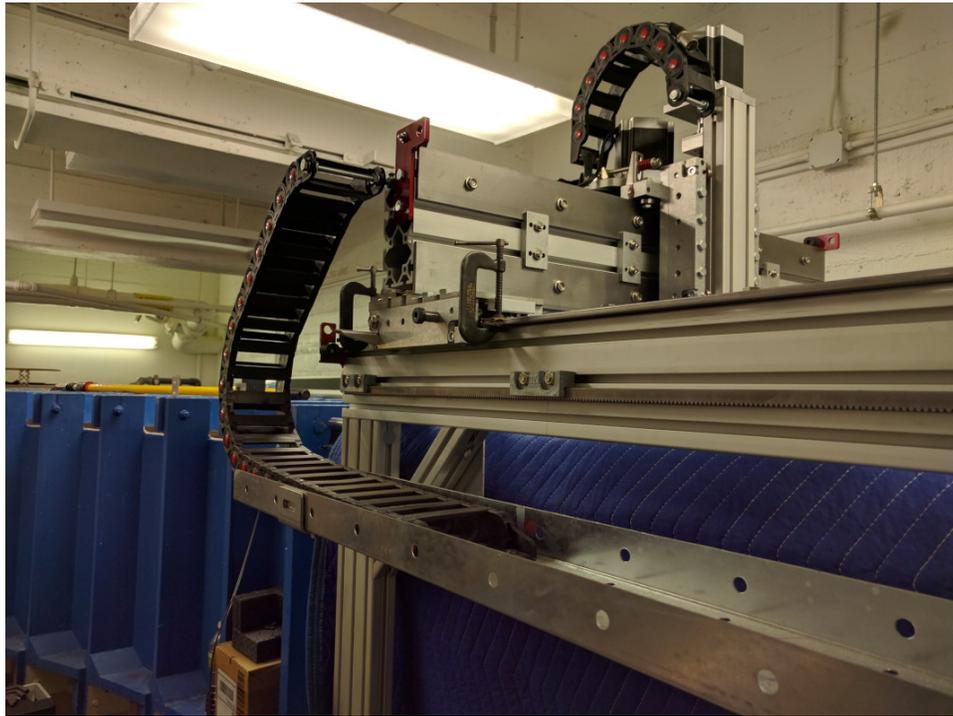
A.) Ultra-fast high-density visual display panel for studying insect visual systems.

B.) High-density visual display panel with 3 LED matrices removed showing underlying PCB

C.) Visual display panels based on the Maxim MAX6960 Graphic LED driver IC

D.) Custom mixed green/UV LED display panel

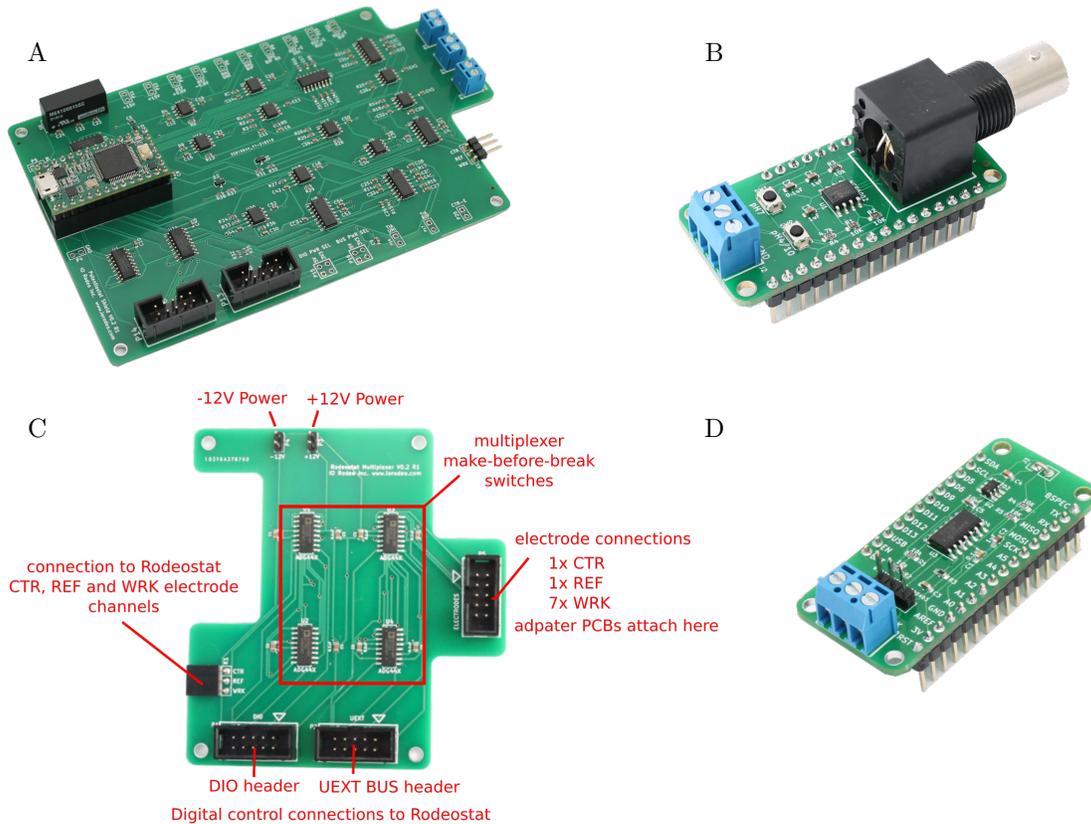
5-axis robotic gantry for NOAH water tunnel



- Real-time 5-axis robotic system for control of models in the NOAH water tunnel
- Developed the mechanics, electronics, and firmware/software for the system
- 6-axis sensor for measuring forces and torque
- Captive trajectory capability - where the motion of the system is determined by the real-time integration of a dynamic model which uses measured forces/torques as input

https://github.com/iorodeo/noah_motion_system

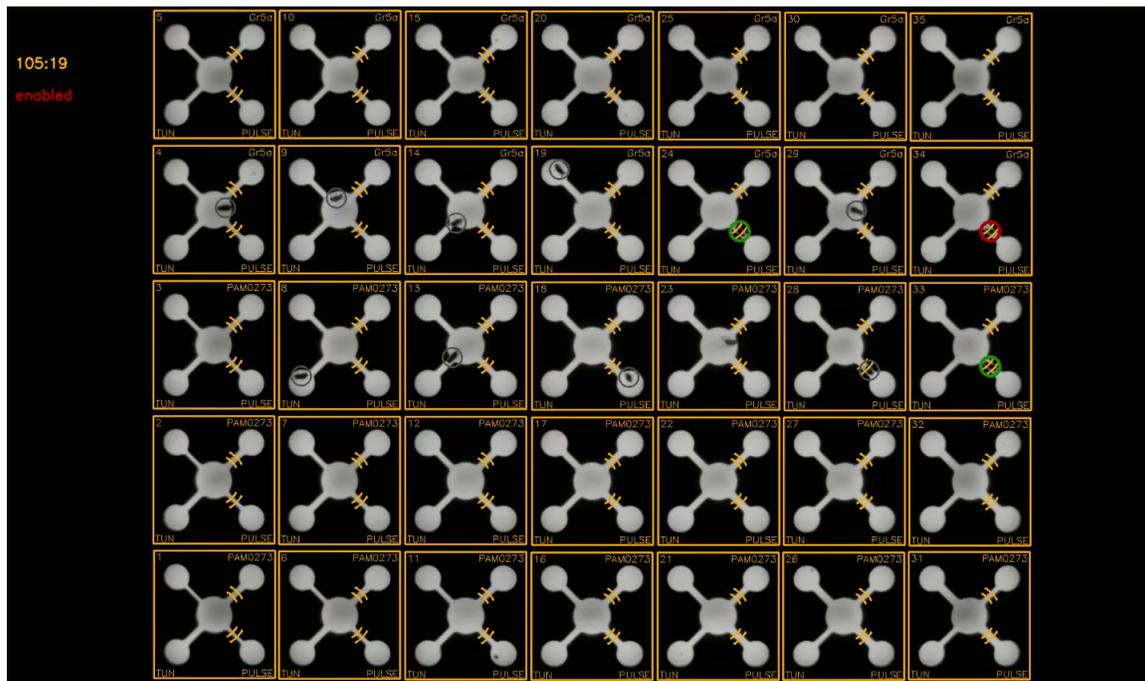
Electrochemical sensors



- A.) Low cost potentiostat with programmable voltage and current ranges
- B.) PH Sensor, in featherwing form factor, with optional temperature compensation
- C.) Make-before-break multiplexer potentiostat front end
- D.) Ultra low cost miniature potentiostat in featherwing form factor for embedded systems

<https://github.com/iorodeo/potentiostat>
https://github.com/iorodeo/ph_featherwing
https://github.com/iorodeo/rodeostat_featherwing
https://github.com/iorodeo/ph_meter_firmware
https://github.com/iorodeo/rodeostat_featherwing_example

Puzzleboxes: a high-throughput walking arena

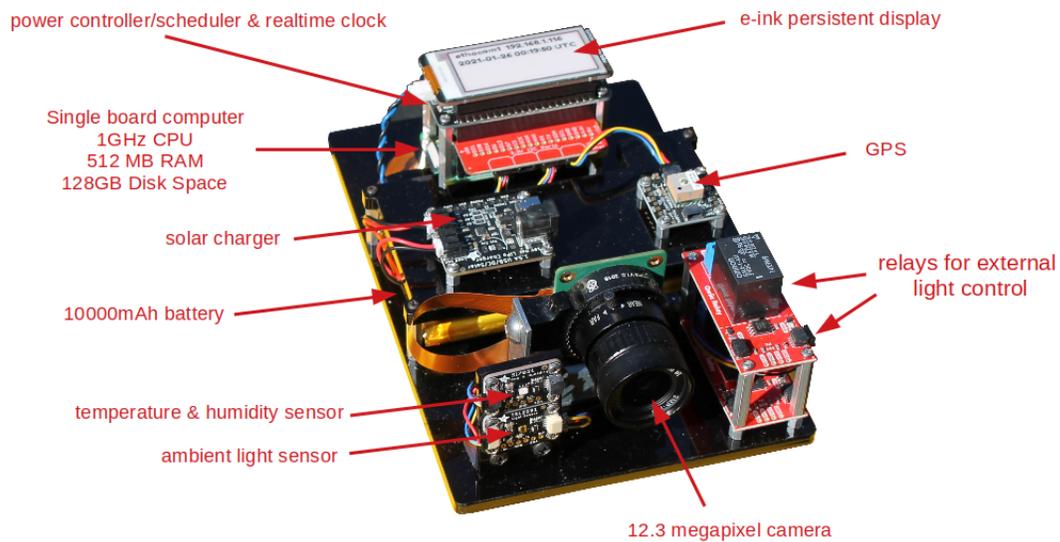


- Software (ROS Package) and hardware for a high-throughput walking arena
- 7x5 grid of 35 individual arenas
- Real-time tracking of individual flies and actuation of stimuli
- The software enables all of the arenas to be run in parallel
- Each arena has its own individually controllable LED which provide a fictitious food stimulus
- The software provides a flexible frame work for exploration of experimental protocols
- The user can configure the setup of the trials using a google docs spread sheet and .yaml file

<https://github.com/wilddickson/puzzleboxes>

https://github.com/wilddickson/puzzleboxes_launch

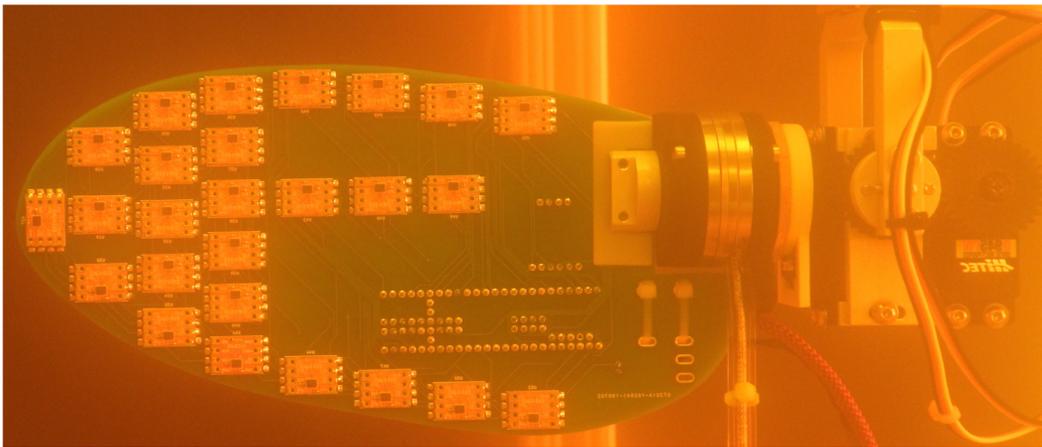
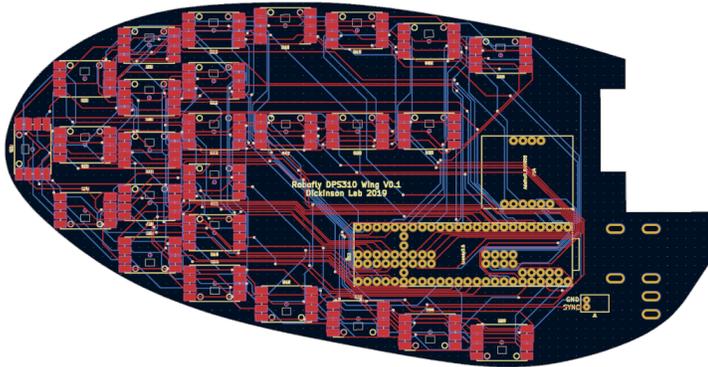
Ethocam: a remote camera system for monitoring ant colonies



- Raspberry Pi Zero W with High Quality Camera
- 6W solar panel, 10000mAh battery, and solar charger
- Light level, temperature, and humidity sensors
- Power scheduler for periodic filming interspersed with very low power sleep
- GPS module for recording location information
- Relay for controlling IR light banks for filming at night

<https://github.com/willdickson/ethocam>

DSP310 robofly wing

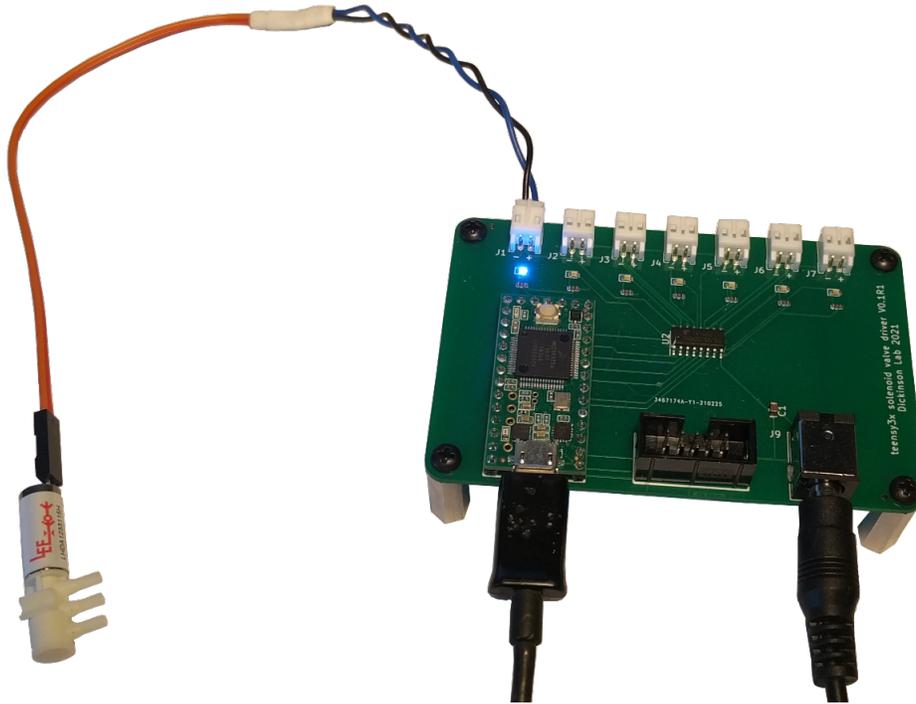


- Measures the pressure distribution on dynamically scaled flapping robotic model
- 52 integrated DPS310 digital pressure sensors on front and back surfaces
- Firmware and software provided for streaming data to host PC

https://github.com/willdickson/dps310_wing

https://github.com/willdickson/dps310_wing_software

7-Channel solenoid valve driver



- Based on the TBD62003A DMOS transistor array IC
- Built-in clamp diodes for switching inductive loads
- Can switch up to 500mA per channel and handle up to 50V
- Firmware and Software (Python library) is provided to control valves from host PC

<https://github.com/willdickson/switchx7>

https://github.com/willdickson/teensy3x_solenoid_driver

Solar powered VOC (Volatile Organic Compound) sensor for field applications



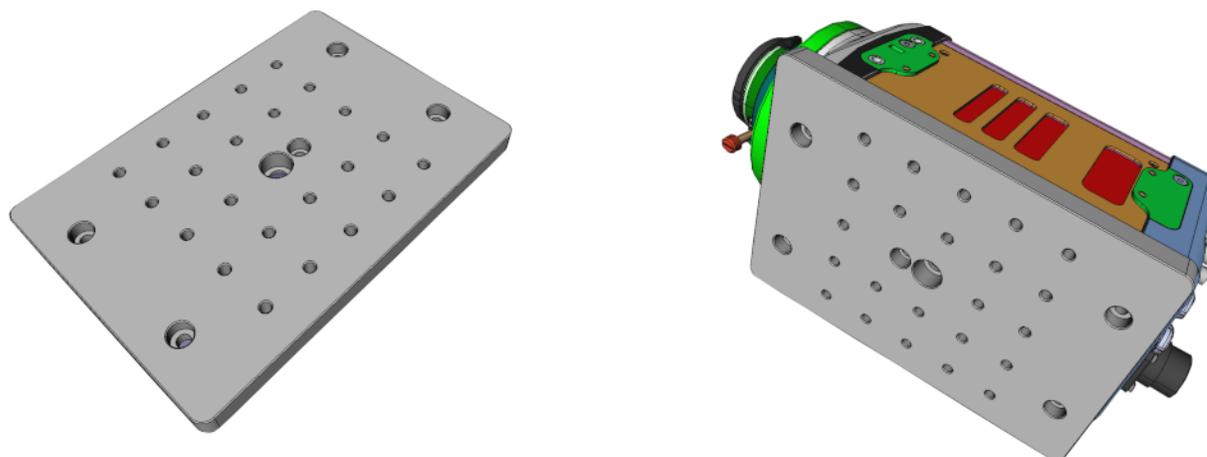
- BOSCH BME688 VOC gas, temperature, pressure and humidity sensor
- ATSAM51 microcontroller and 160x128 color TFT display (PyGamer)
- 6W solar panel, 6600mAh battery and solar charger
- Low power GPS module with built-in antenna
- Firmware logs gas sensor and location data to micro SD card

https://github.com/iorodeo/voc_sensor_test

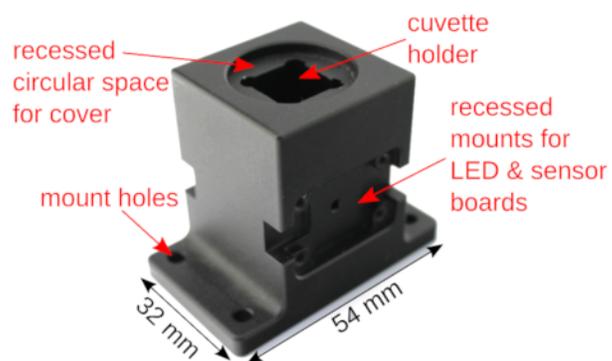
https://github.com/iorodeo/se120_voc_mount

Miscellaneous mechanical designs

A



B



C



D



- A.) Fastcam Nova S camera mount plate
- B.) Colorimeter cuvette holder
- C.) Enclosure for 96-well LED plate
- D.) Colorimeter filter mount