QC for Pixel Modules: Environment Monitoring

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LBL Instrumentation Meeting

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Pixel Module Quality Control

- LBL is responsible to deliver quad modules for the inner system. This includes assembly and testing of the modules.

- I am working on environment monitoring and control of the cooling unit for the electrical tests

- Relevant environmental variables are:
  - Temperature and humidity of the module
  - Power supply voltage and current

Pixel Module Quality Control

- Must be tested at temperatures from -35C to 30C
- Temperature must be controlled and monitored
    - Dew point must be monitored
- Power supplies must be monitored
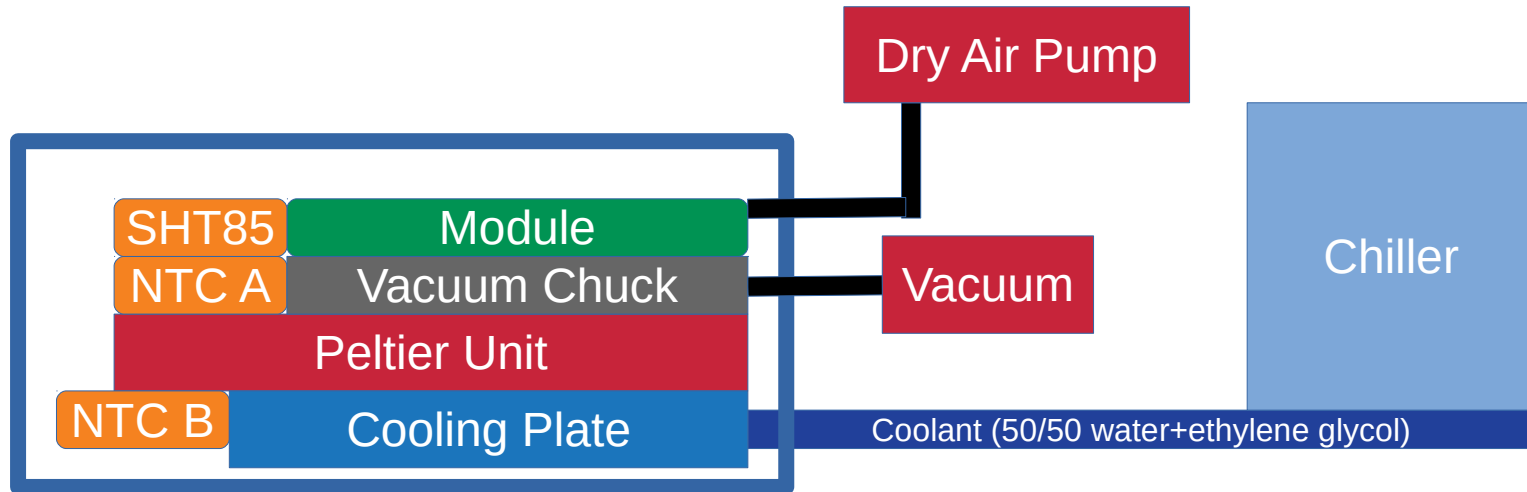- Process should be automatic

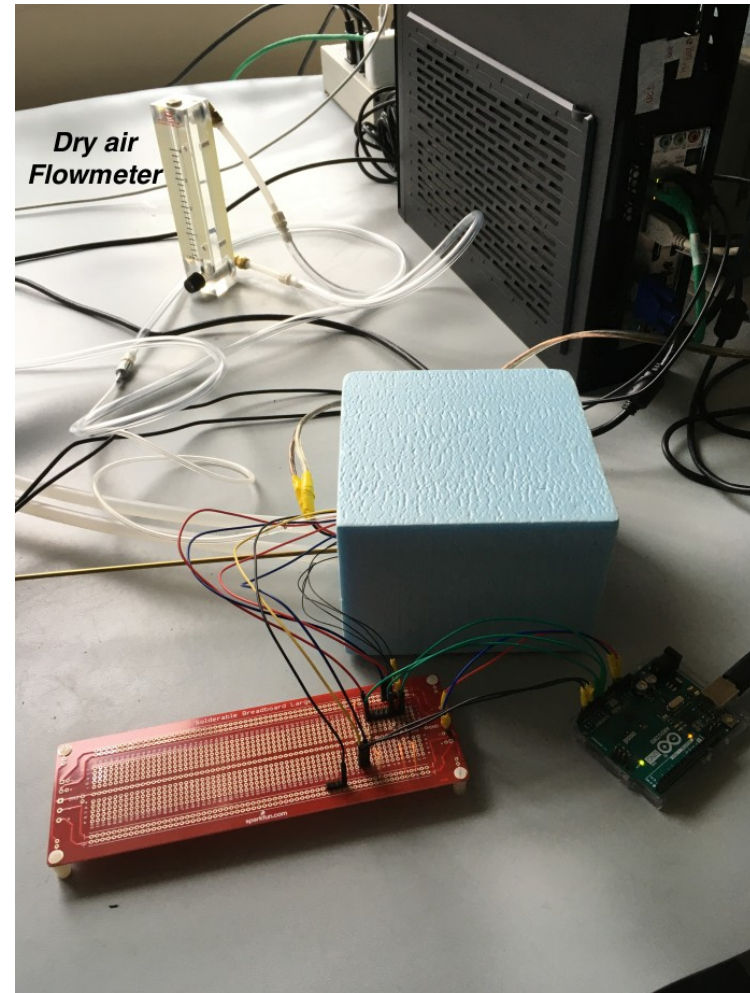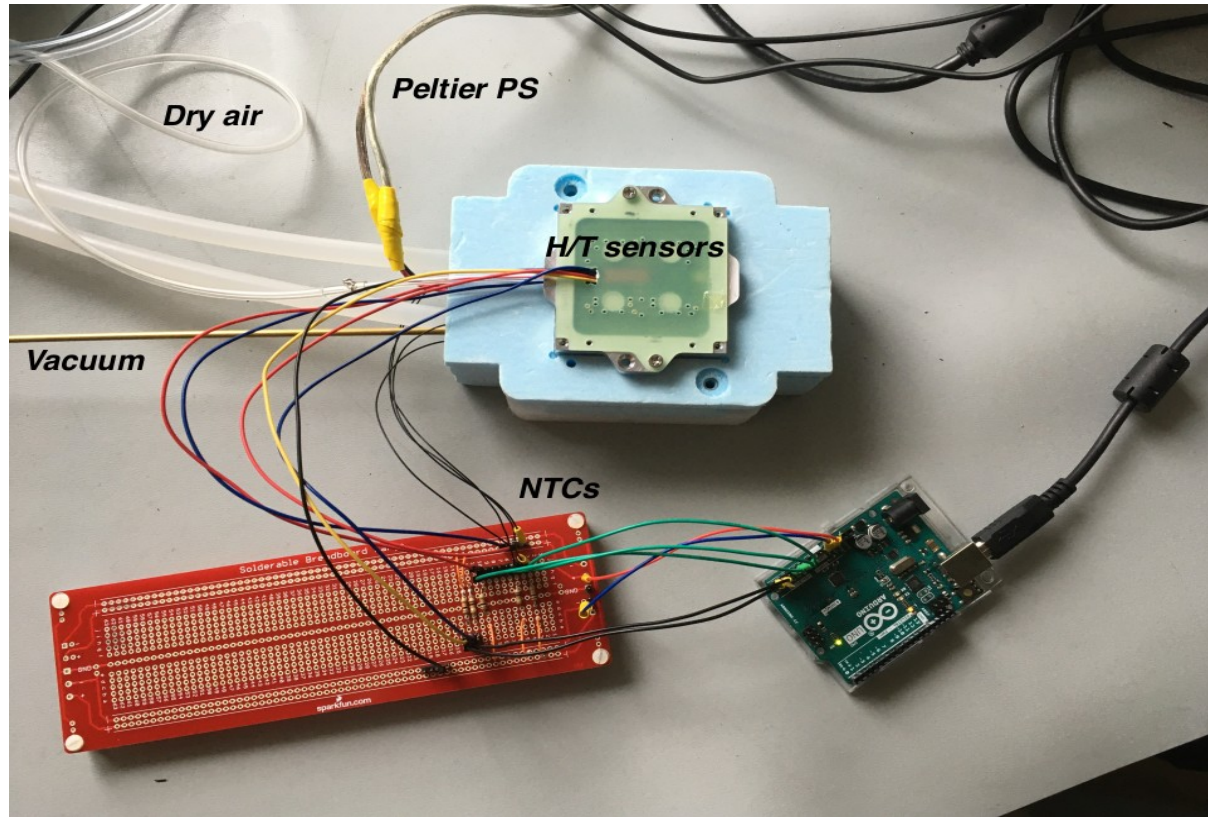# Hardware Setup

Peltier connected to module
- Quick, precise temperature control
- Controlled using input voltage
- Monitored by NTC A

Chiller and cooling plate
- Heat sink for Peltier
- Controlled via serial port
- Cooling plate monitored by NTC B

Hardware Setup

Common Software Updates

- Chiller library in labRemote
  - An abstract chiller interface and implementation for specific our chiller
  - Communication via labRemote communication library
- DevCom classes in labRemote for NTC sensor
  - ADC interface for communication with Arduino analog pins
  - NTCSensor implementation of abstract ClimateSensor class
- New examples and Python bindings

Pixel Module QC Scripts

- Python and C++ script to control temperature
- Python scripts to monitor sensors/power supplies
    - Configurable via JSON files to specify
        - Which sensors/power supplies to monitor
        - Where data should go (console, CSV, InfluxDB)
    - Uses labRemote PS, DevCom, and DataSink libraries
    - Data in InfluxDB can be visualized using Grafana

Temperature Control

Peltier voltage controlled by a feedback loop (the PID loop) to reach and maintain target temperature
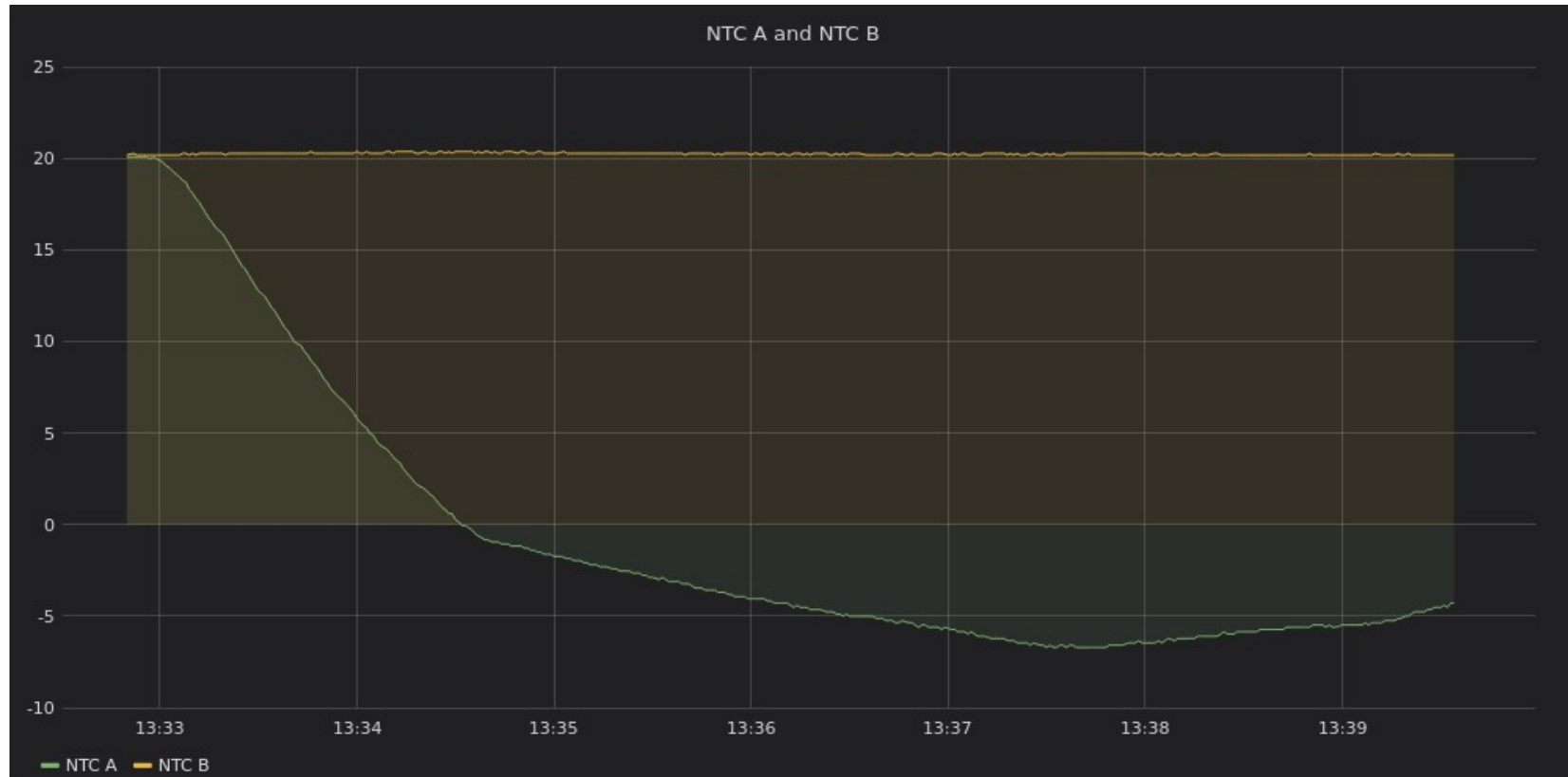

Peltier Current and Voltage
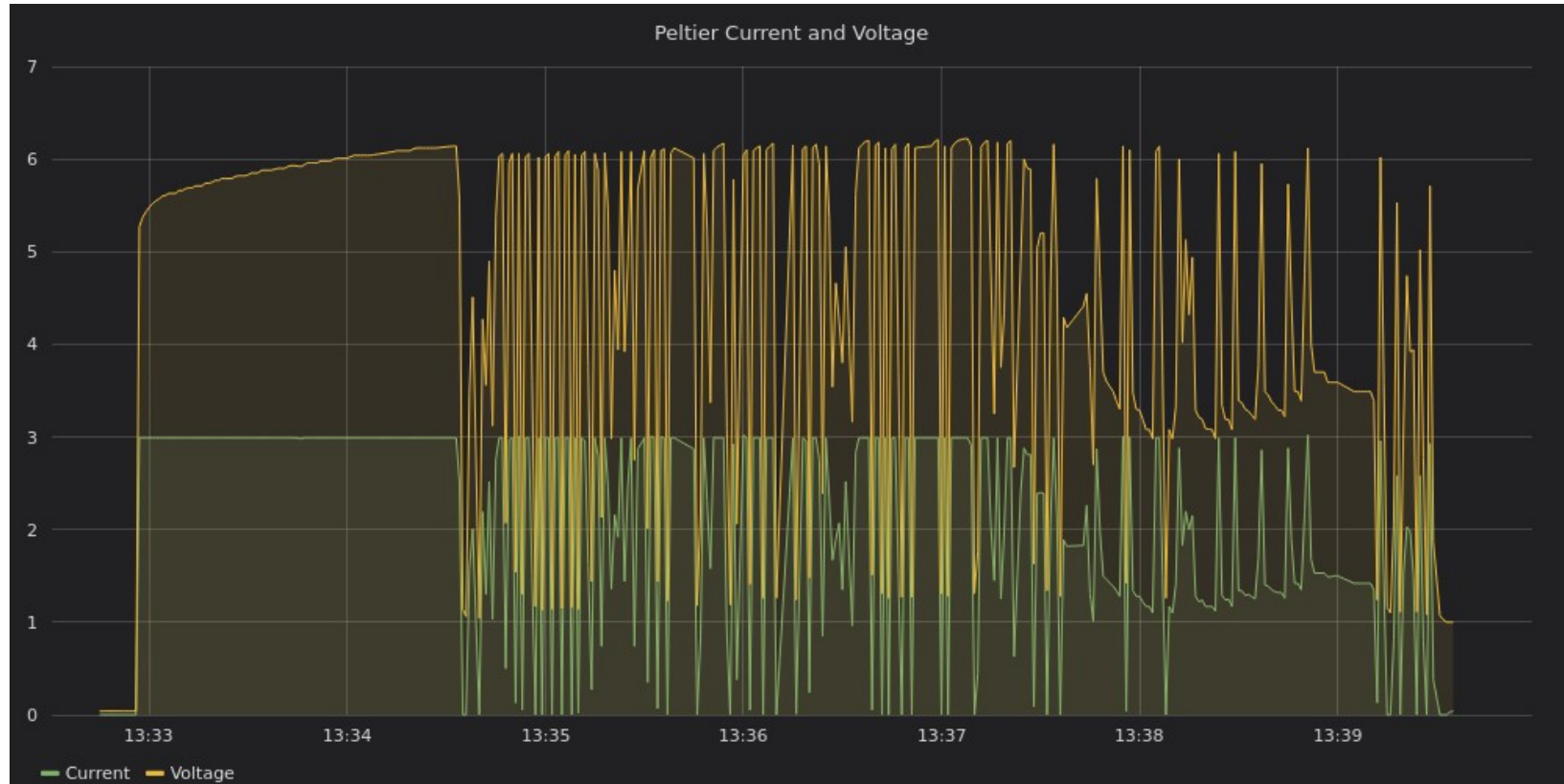
Temperature Control

NTC A connected to module
NTC B connected to cooling plate

Chiller set to 20C (will be colder in future)

Target temperature is -5C

Temperature is overshot: may need to adjust PID loop parameters

Conclusion and Next Steps

- I am working on software development to control and monitor environmental variables for Pixel Module QC
  - New classes in labRemote, accessible via Python bindings
  - Monitoring scripts for sensors and power supplies
- Next steps
  - Finish creating Python bindings for DevCom sensors
  - Finish automating temperature control process
  - Finalize visualization using Grafana
  - Check that performance of the cooling unit meets our needs for QC