



AWS + NVIDIA Environmental Hackathon @ NYC

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NVIDIA

WenMing Ye
Specialist Solution Architect
Amazon

Our Goal = Help the Caretakers

Claire

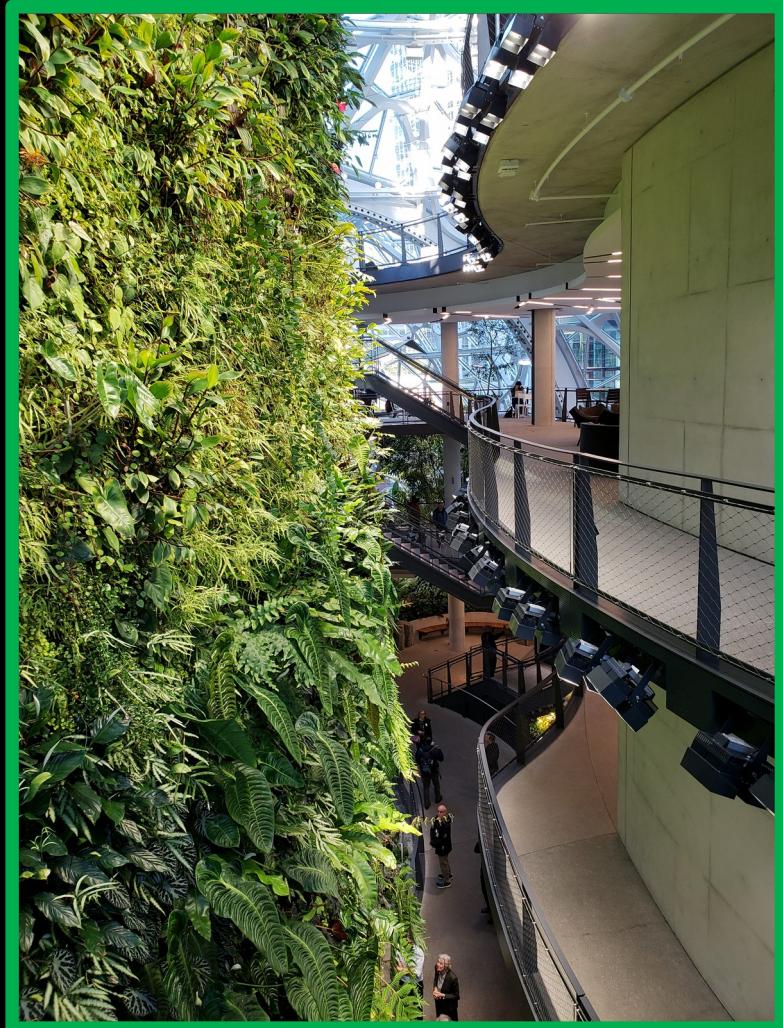


“ We take care of **40,000 plants**
from over **700 species!**”

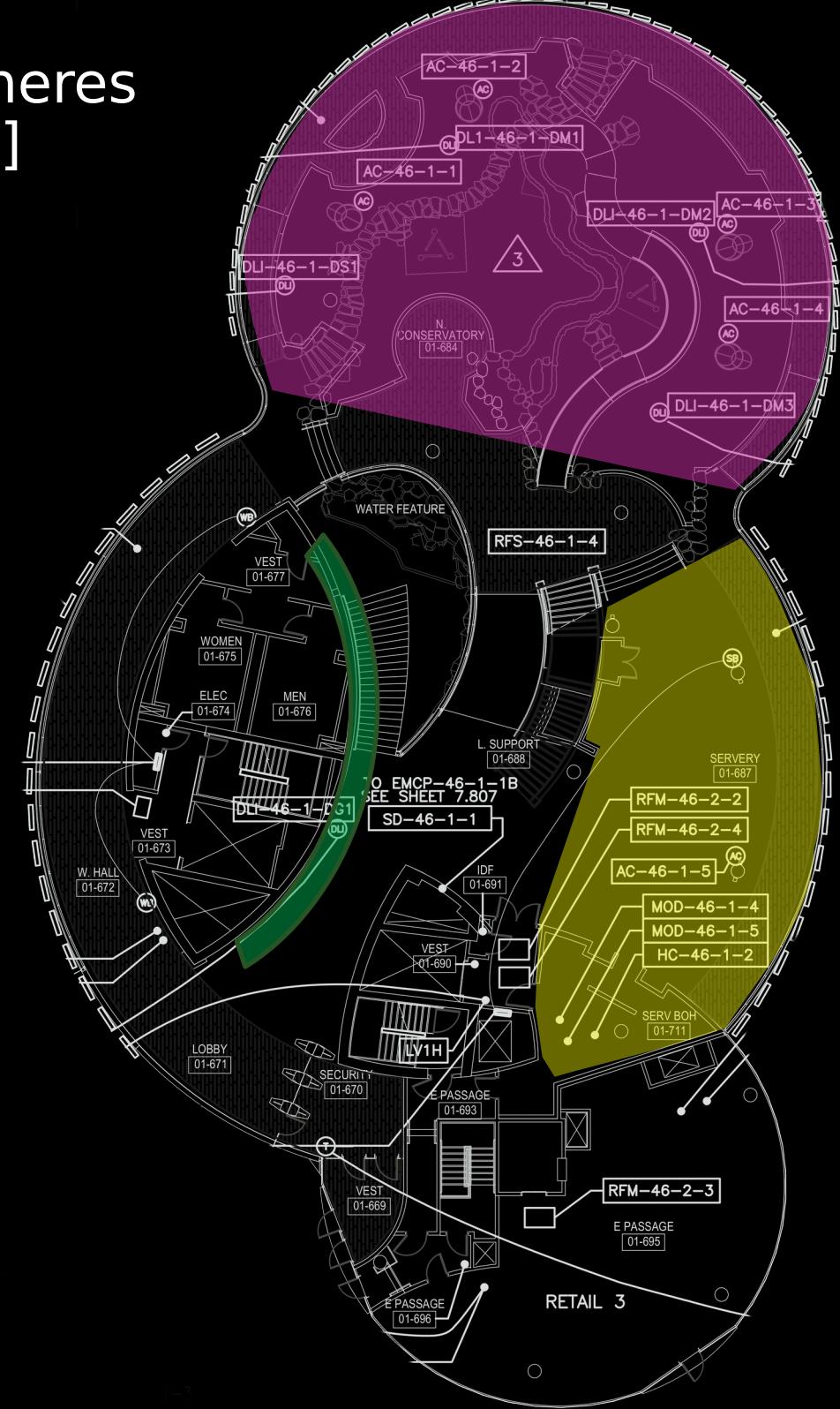
Ben



Inside the Spheres [1st floor]



Living
Wall

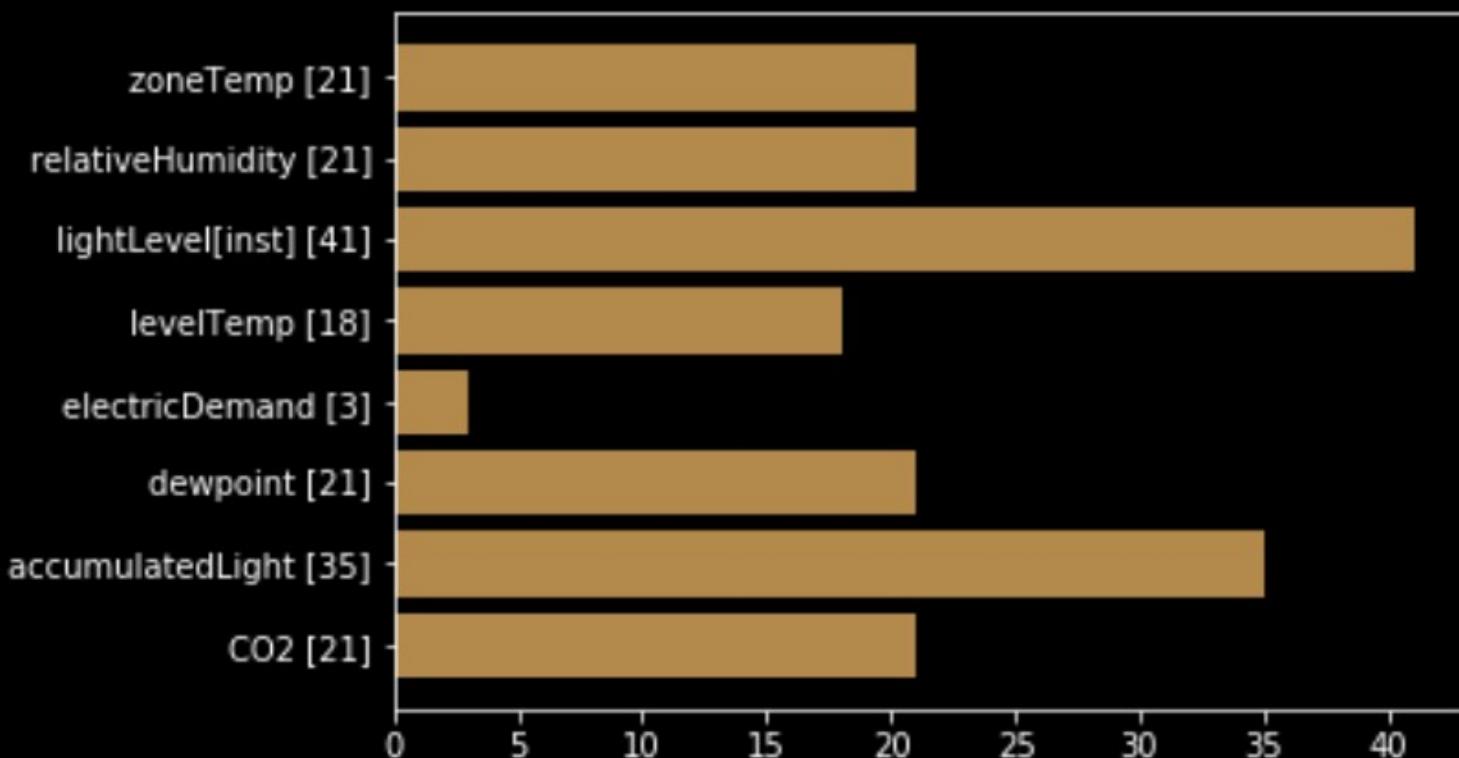


North Conservatory

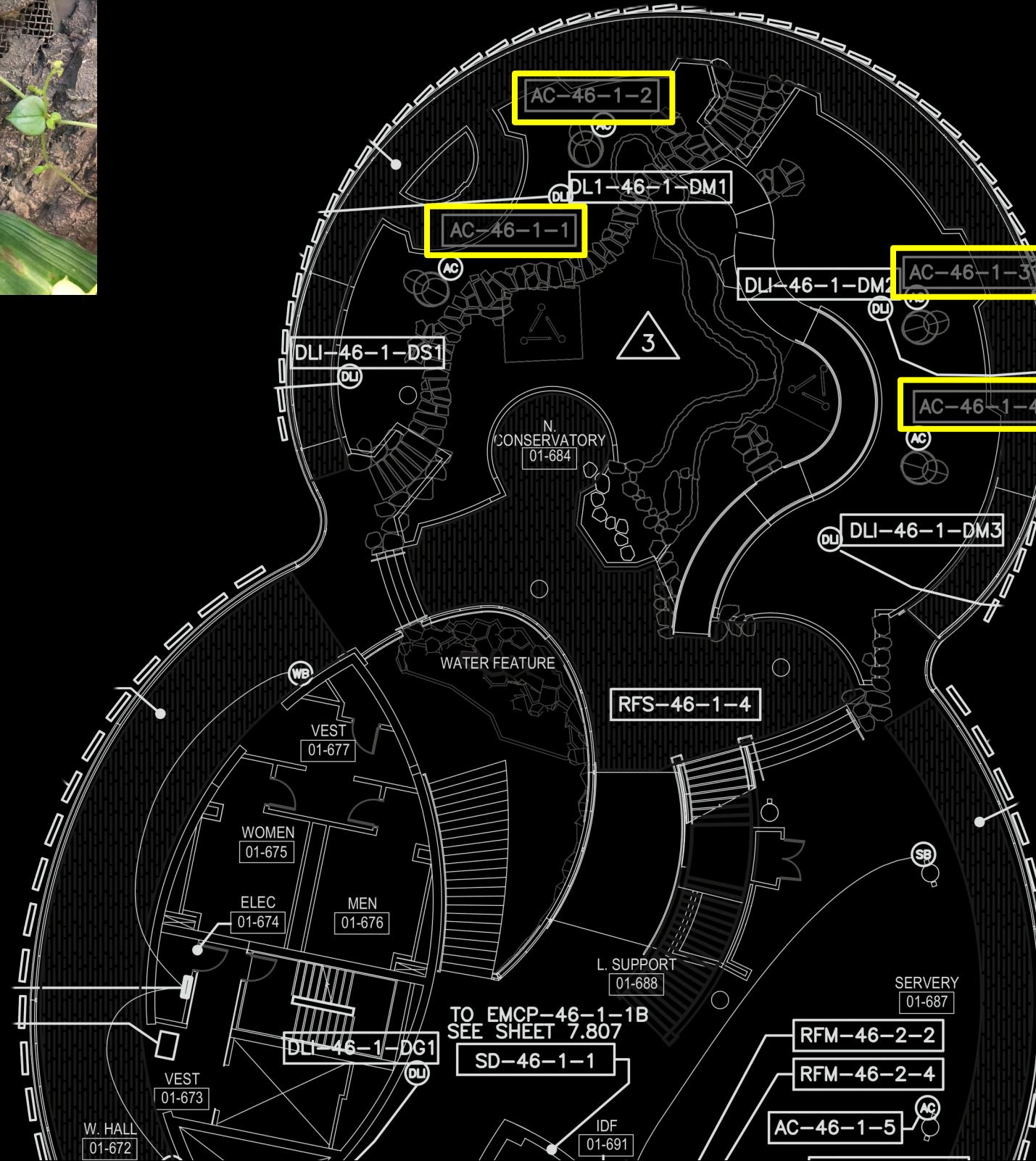
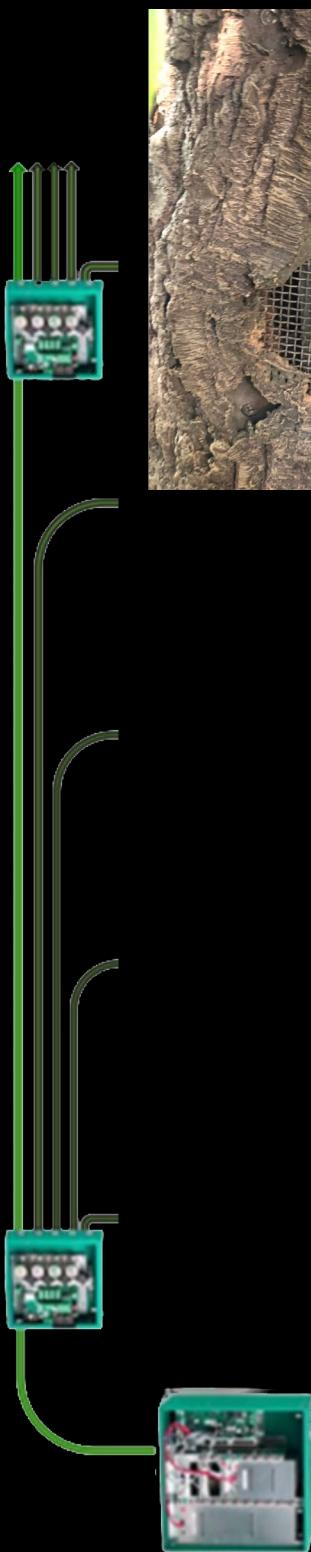


Cafe

Sensor Types



AirCuity Sensors



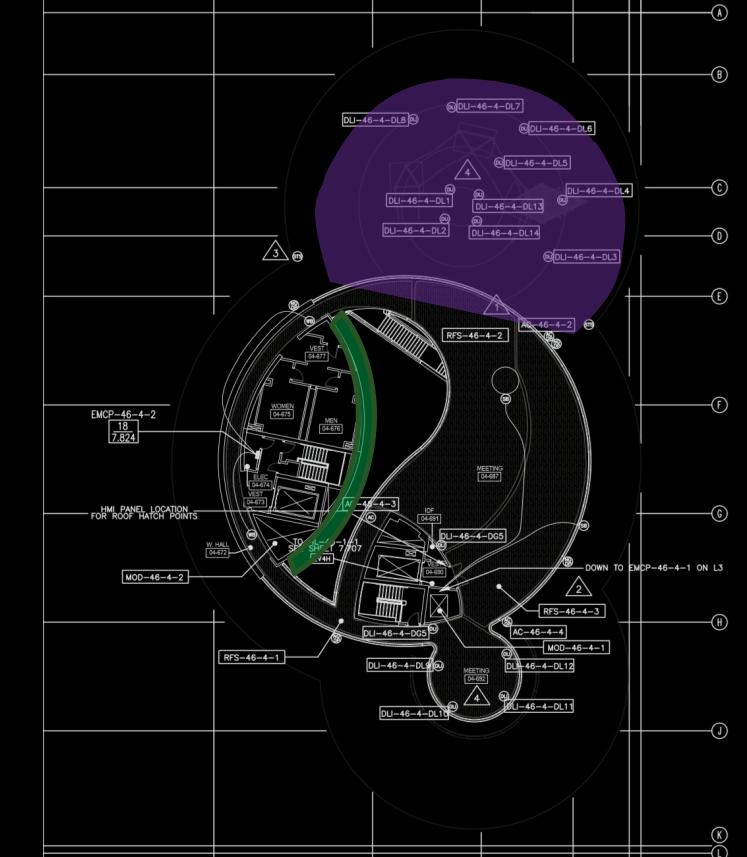
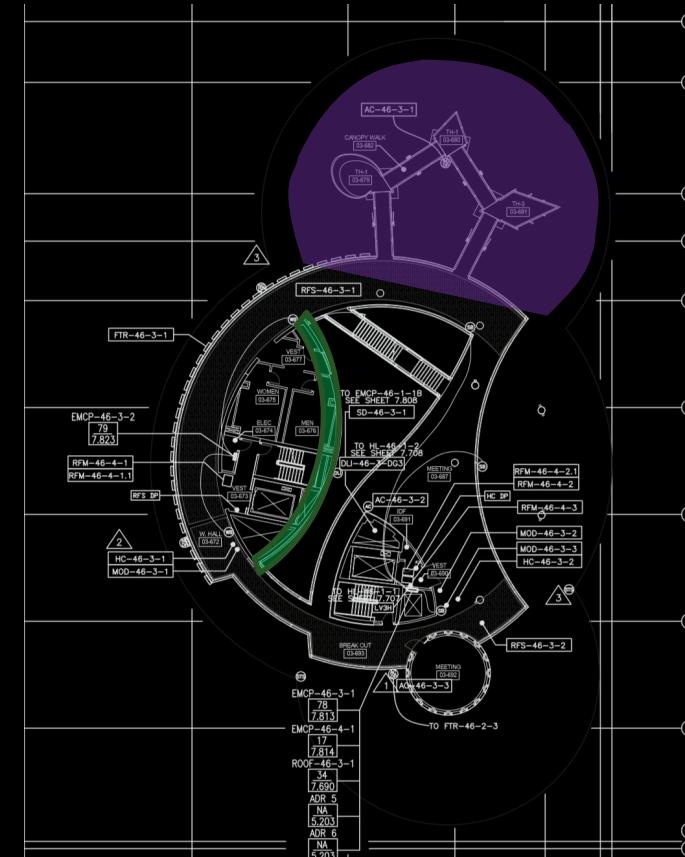
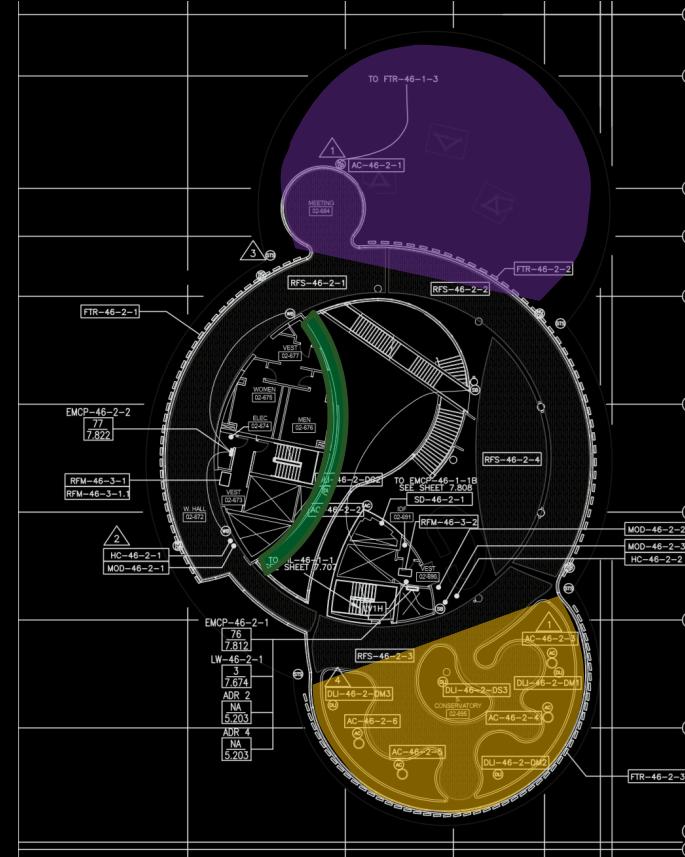
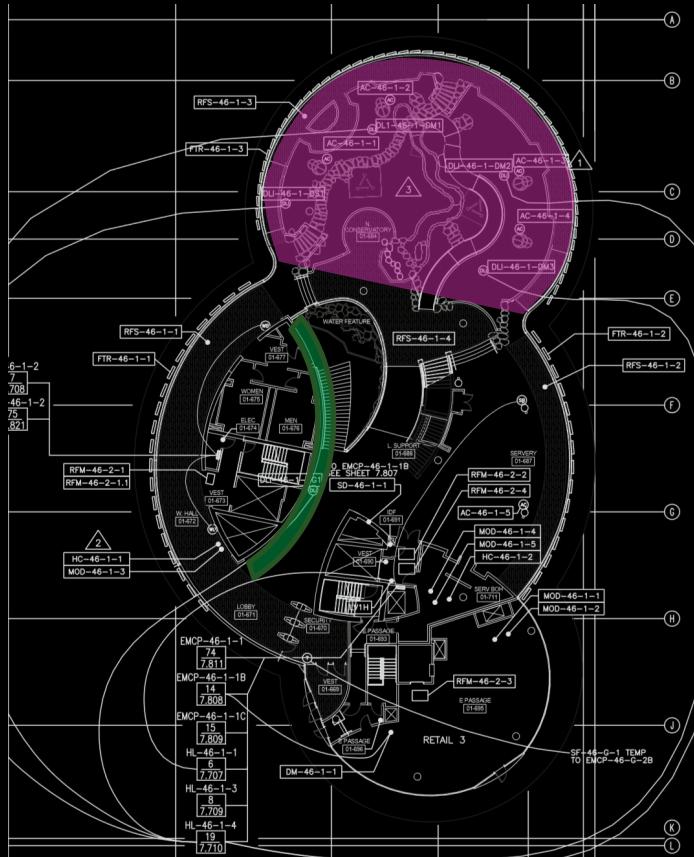
Sensor Zones

Living Wall [4 floors]

t,rh,d,co2 [X, AC-46-2-2, AC-46-3-2, AC-46-4-3]
 light level [DLI-46-1-DG1, DLI-46-2-DG2, DLI-46-3-DG3,
 DLI-46-4-DG5]

North Conservatory [1st floor]

t,rh,d,co2 [AC-46-1-1, AC-46-1-2, AC-46-1-3, AC-46-1-4]
 light level [DLI-46-1-DS1, DLI-46-1-DM2, DLI-46-1-DM3]



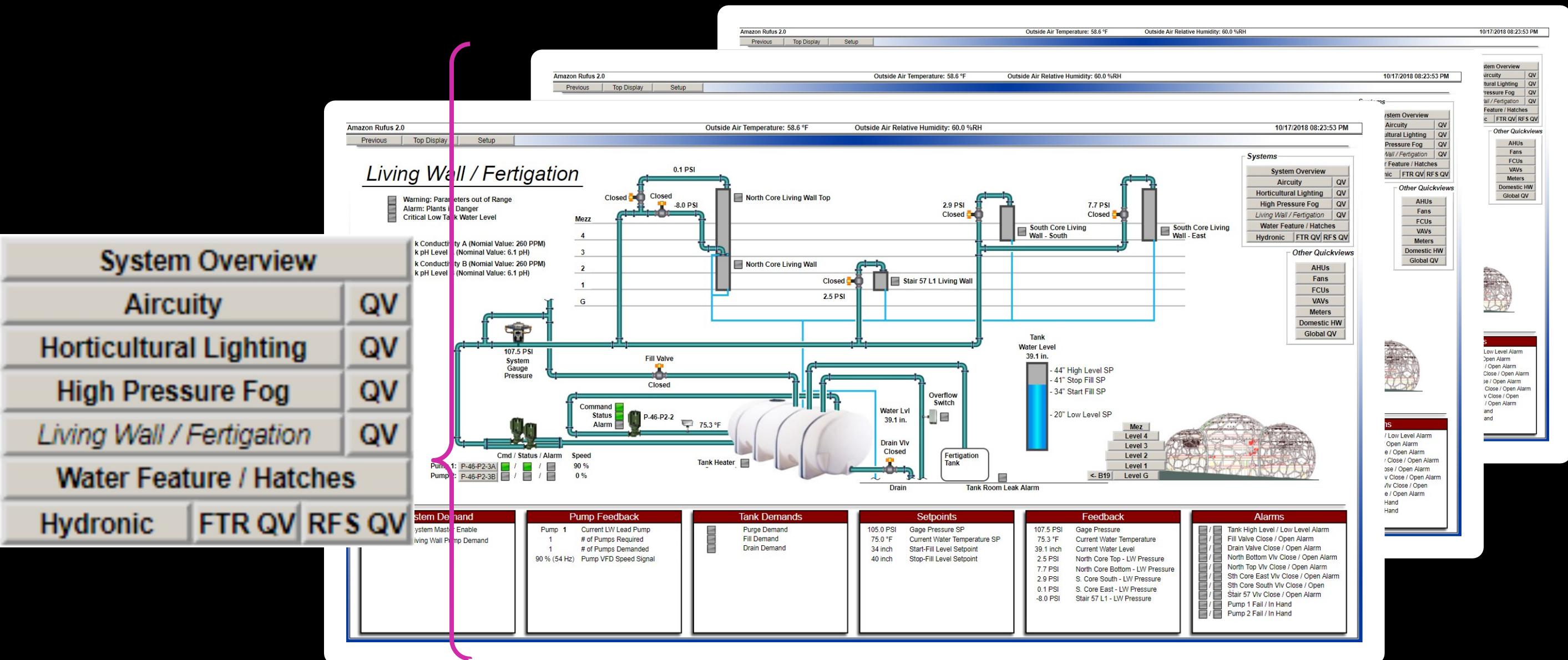
South Conservatory [2nd floor]

t,rh,d,co2 [AC-46-2-3, AC-46-2-4, AC-46-2-5, AC-46-2-6]
 light level [DLI-46-2-DM1, DLI-46-2-DM2, DLI-46-2-DM3]

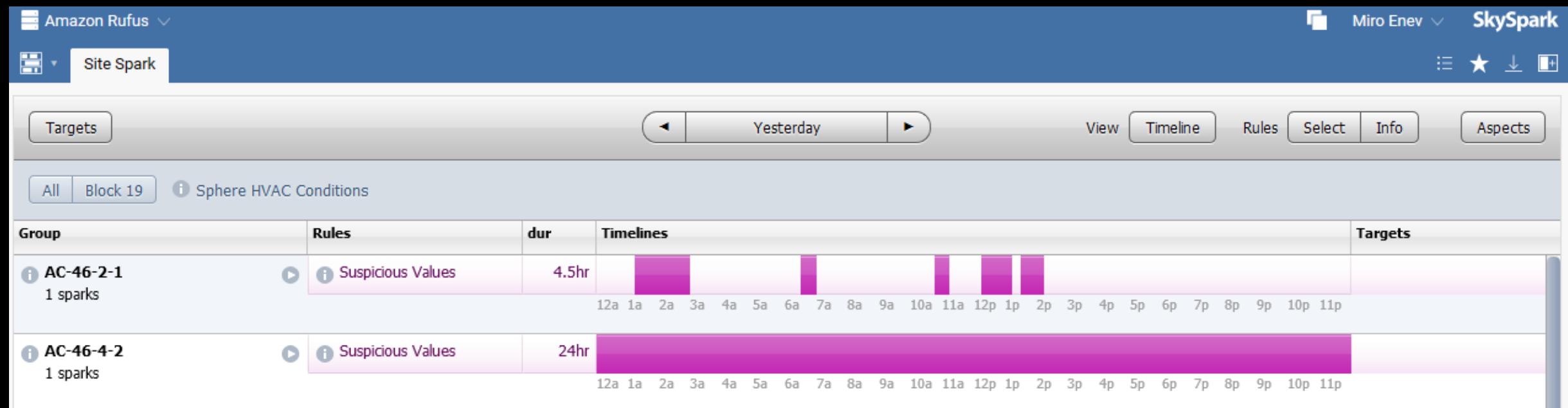
Canopy [3 floors above N. Conservatory]

t,rh,d,co2 [AC-46-2-1, AC-46-3-1, AC-46-4-2]
 light level [DLI-46-4-DL1, DLI-46-4-DL2, DLI-46-4-DL3,
 DLI-46-4-DL4, DLI-46-4-DL5, DLI-46-4-DL6,
 DLI-46-4-DL7, DLI-46-4-DL8,
 DLI-46-4-DL13, DLI-46-4-DL14]

Challenge 1: Lots of Systems to Manage



Challenge 2: Too Many Suspicious Values



fit_suspiciousValue

```
fit_suspiciousValue(thePoint, sparkDate, duration: 30min, negativeThreshold: 0, airTempHighLimit:  
140, waterTempHighLimit: 180, steamTempHighLimit: 250)
```

This point has data values that are less than zero, suspicious temperature values if the point is a temperature sensor or null data values.

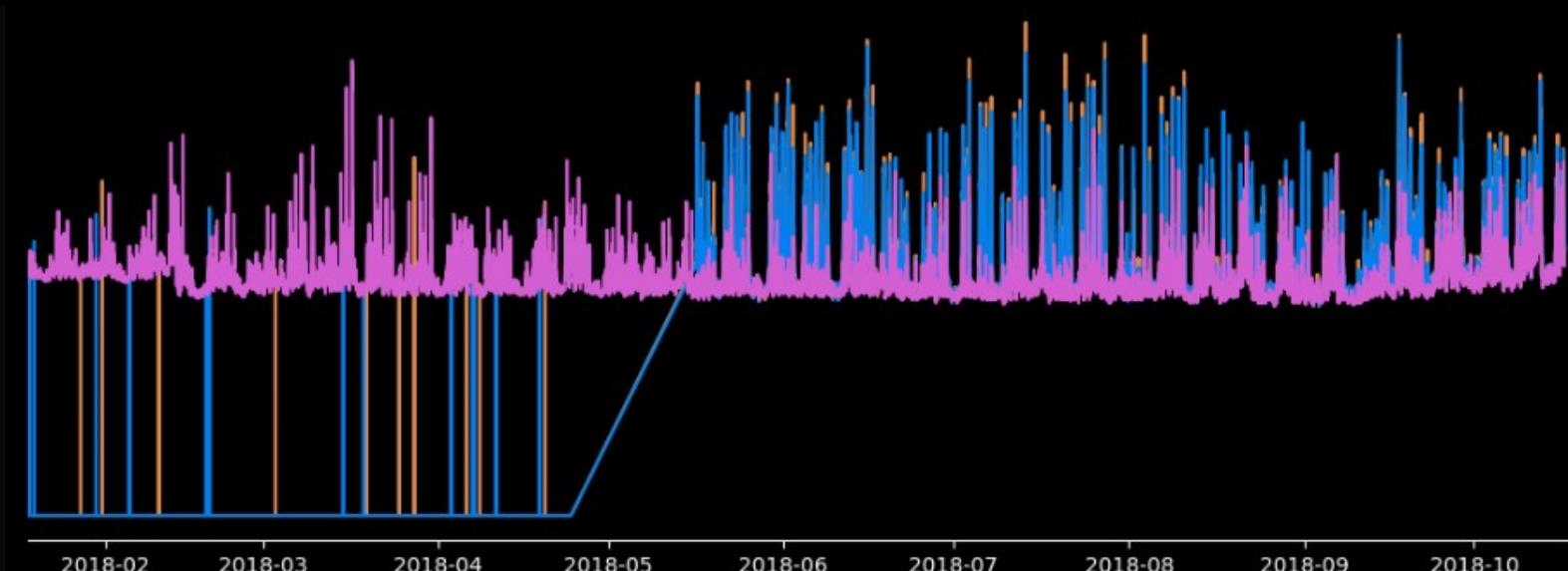
Parameters (Default):

- duration (30min) : The duration of the spark condition before firing a spark.
- negativeThreshold (0) : The buffer of allowed negative numbers. Any negative numbers above this value are not analyzed. Used to disregard sensors that show slightly negative values when off.
- airTempHighLimit (140) : The maximum allowed air temperature. Any air temp value above this limit will produce a spark.
- waterTempHighLimit (180) : The maximum allowed water temperature. Any water temp value above this limit will produce a spark.
- steamTempHighLimit (250) : The maximum allowed steam temperature. Any steam temp value above this limit will produce a spark.

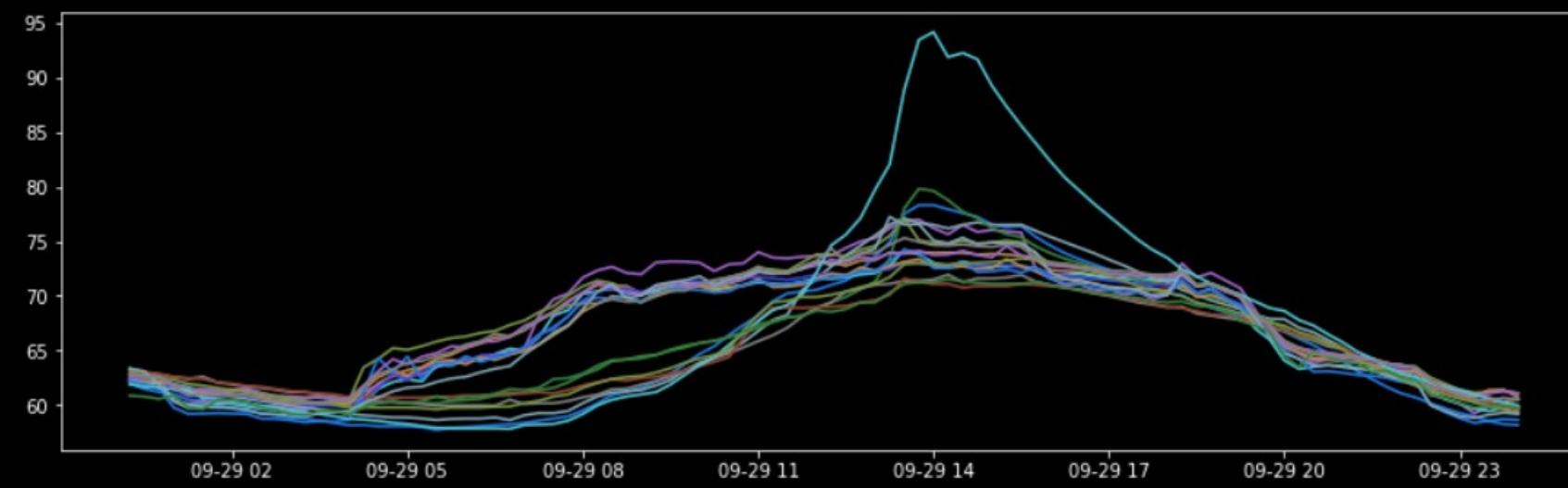
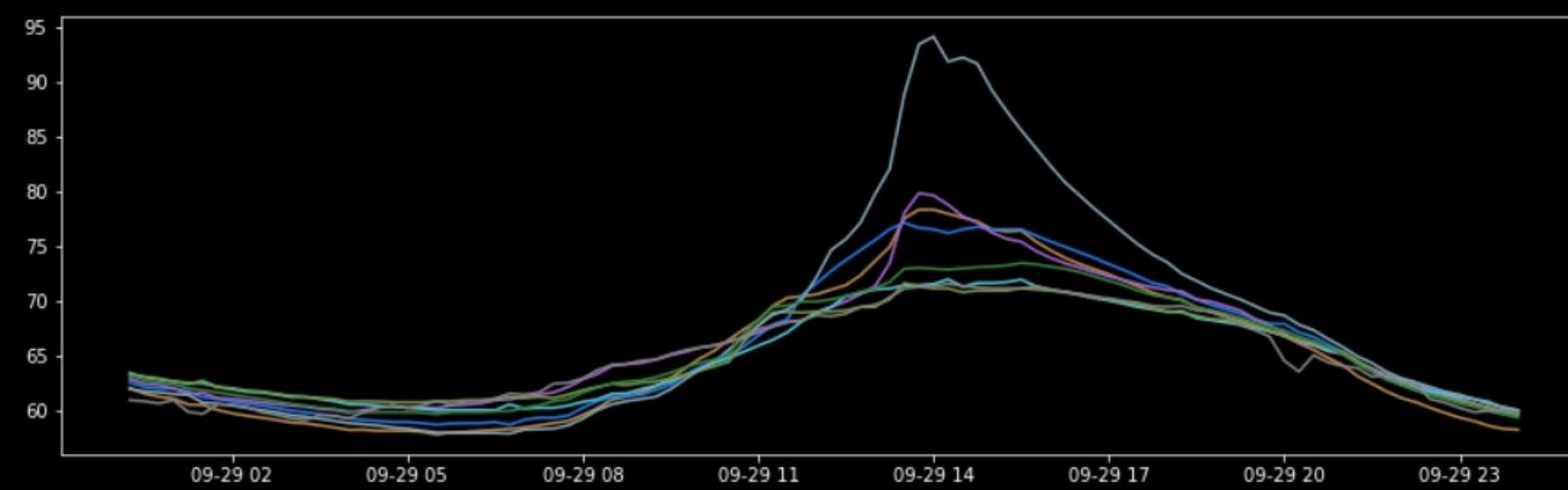
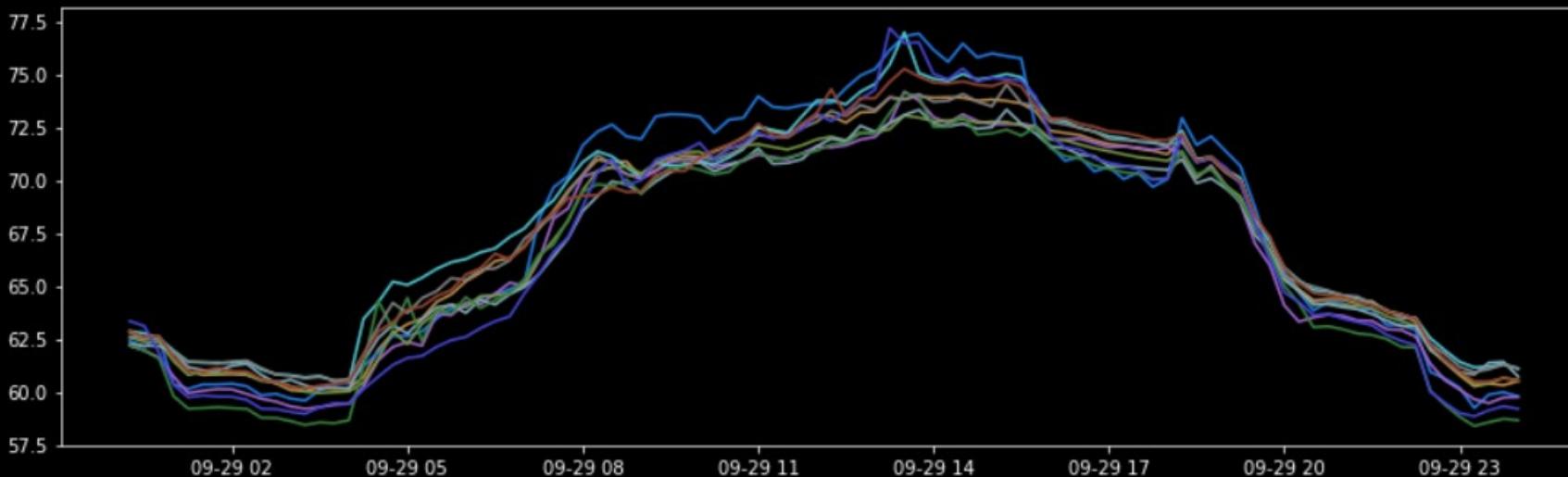
Pseudocode: Find periods of time a number point with history data, that is not calculated and not outside air temperature is null and/or less than 0 for 30 minutes. In addition, find periods of time when a temperature sensor returns a value higher than 140 for "air" tags, 180 for "water" tags, or 250 for "steam" tags for 30 minutes.

AI to Assist the caretakers

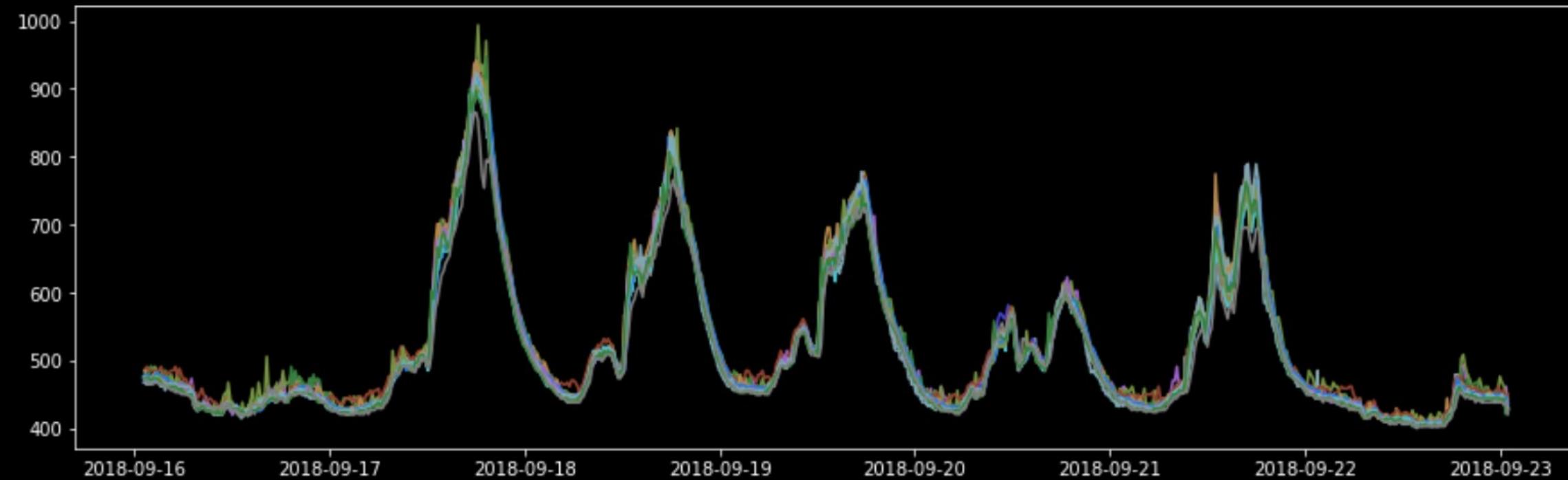
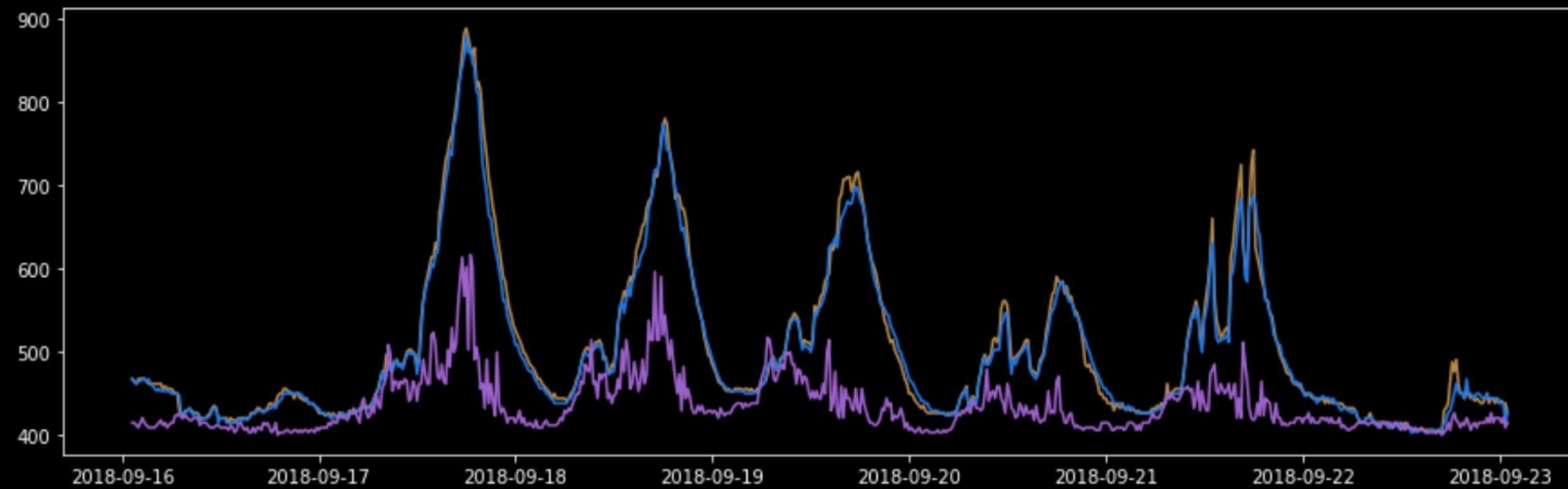
- Accurate Alerts [low false alarm rate]
- Real-time & Low Cost
- Enable Current/Future Science
- Scalability & Availability of Technology



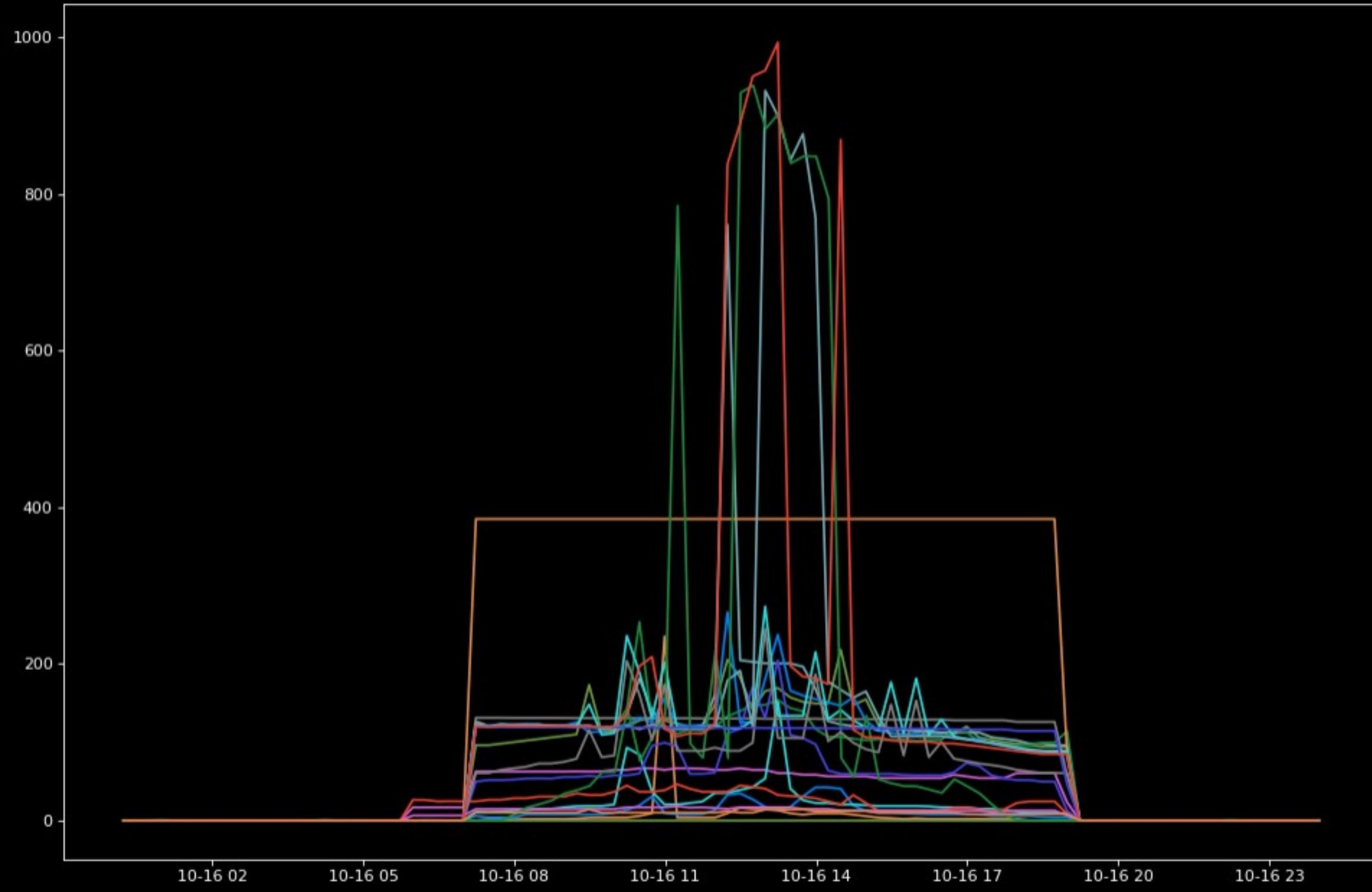
Temperature



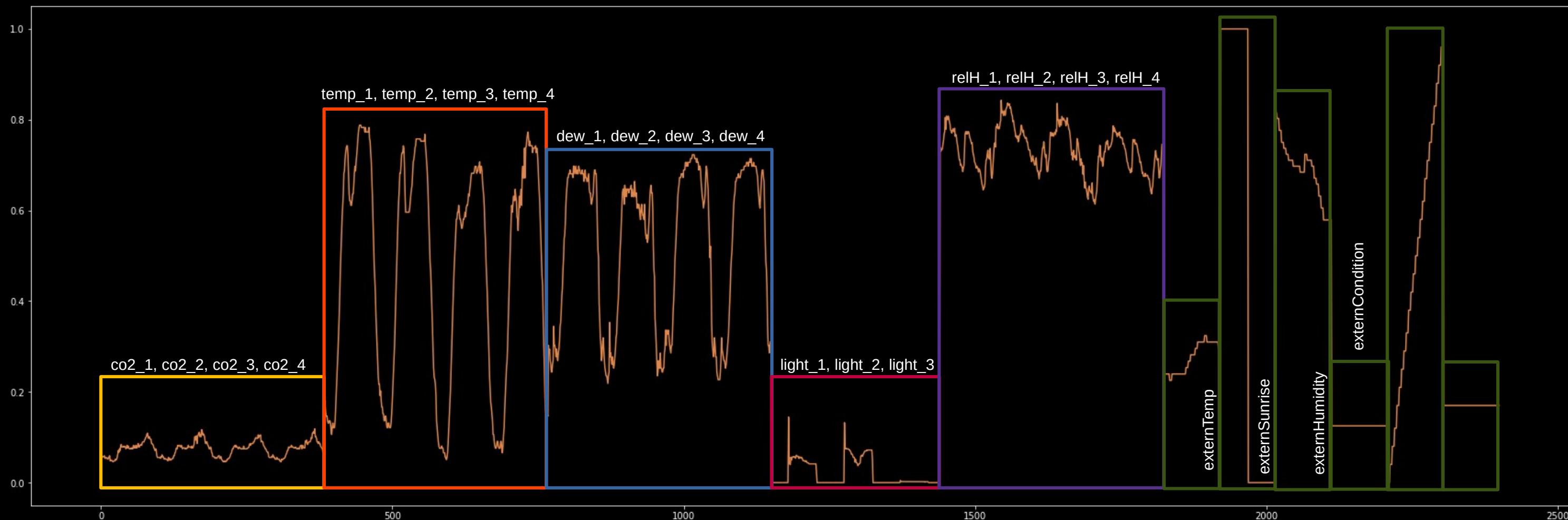
CO₂



Inst Light Levels

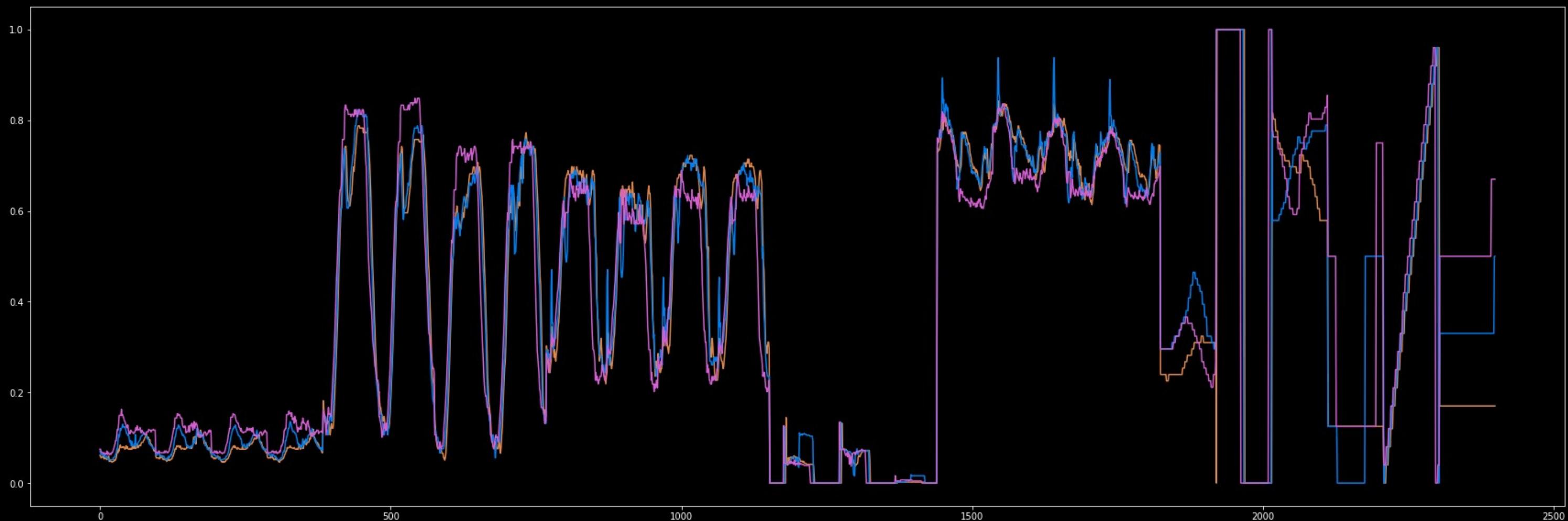


One Day Sample Data



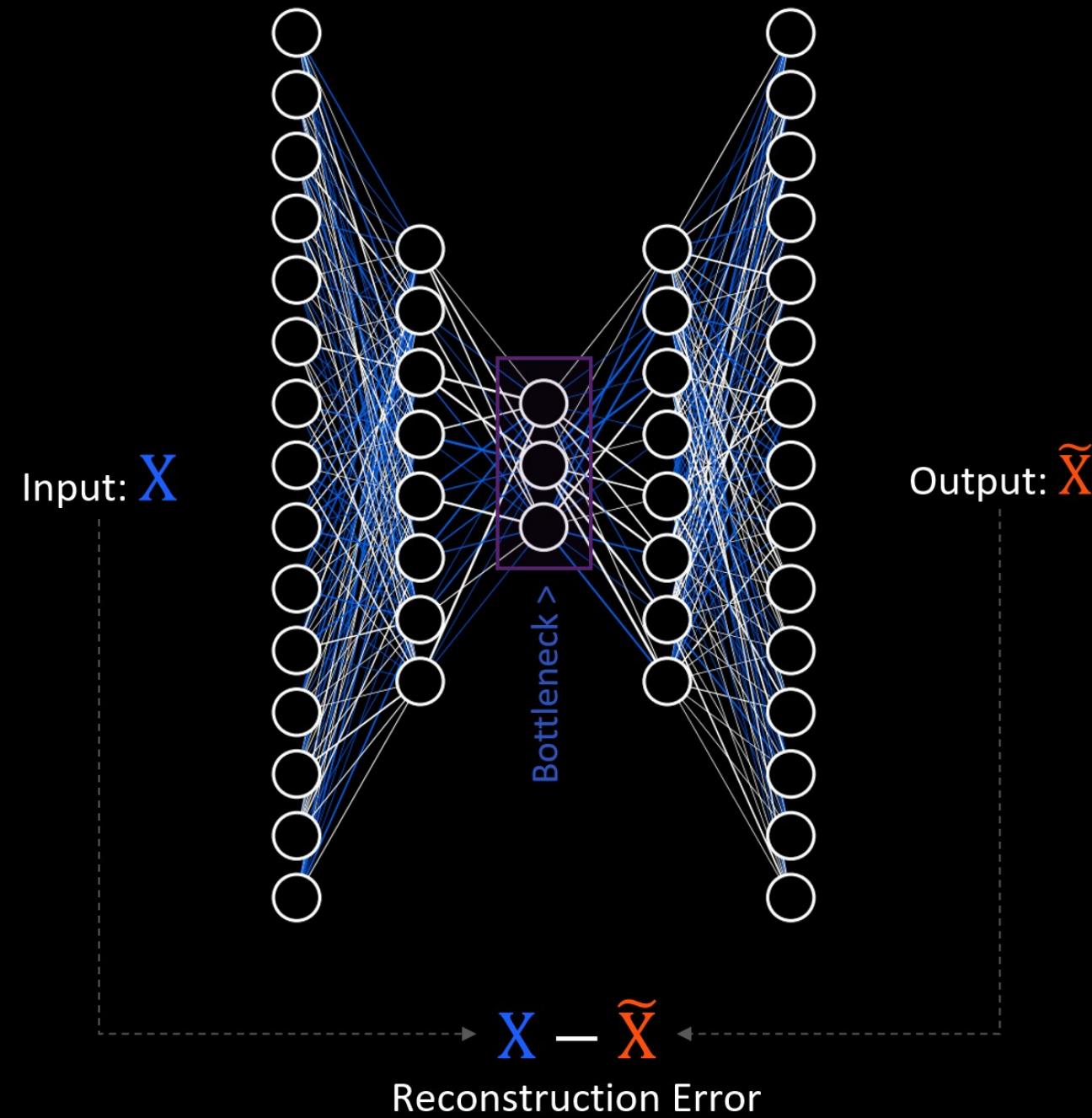
```
sensorList = ('co2_1','co2_2', 'co2_3', 'co2_4',
    'temp_1', 'temp_2', 'temp_3', 'temp_4',
    'dew_1','dew_2', 'dew_3', 'dew_4',
    'instLight_1', 'instLight_2', 'instLight_3',
    'relH_1', 'relH_2', 'relH_3', 'relH_4',
    'externTemp_1',
    'externSunrise_1',
    'externHumid_1',
    'externCondition_1',
    ) + day and hour index
```

3 Day Sample Data



Deep Learning @ Spheres

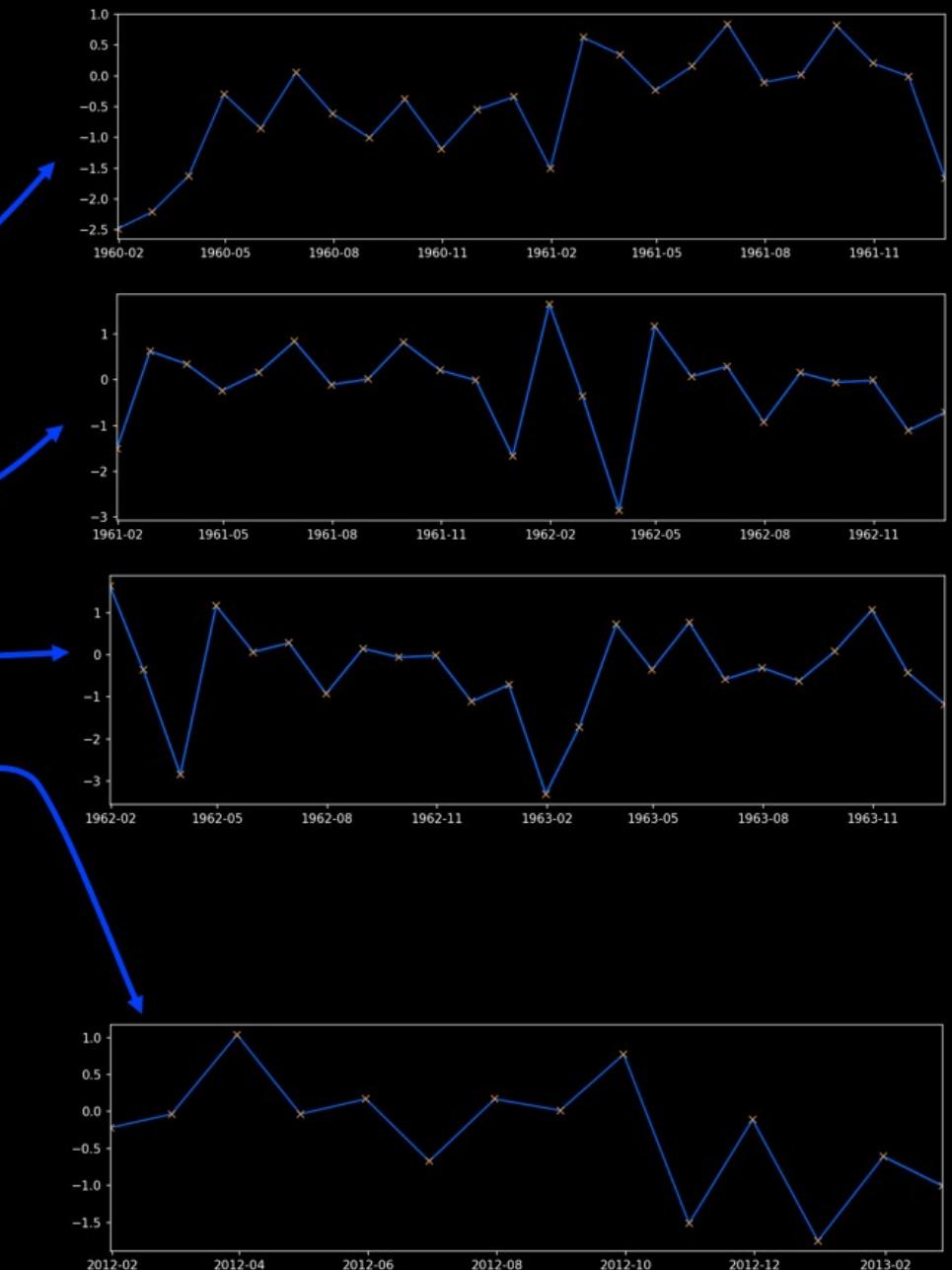
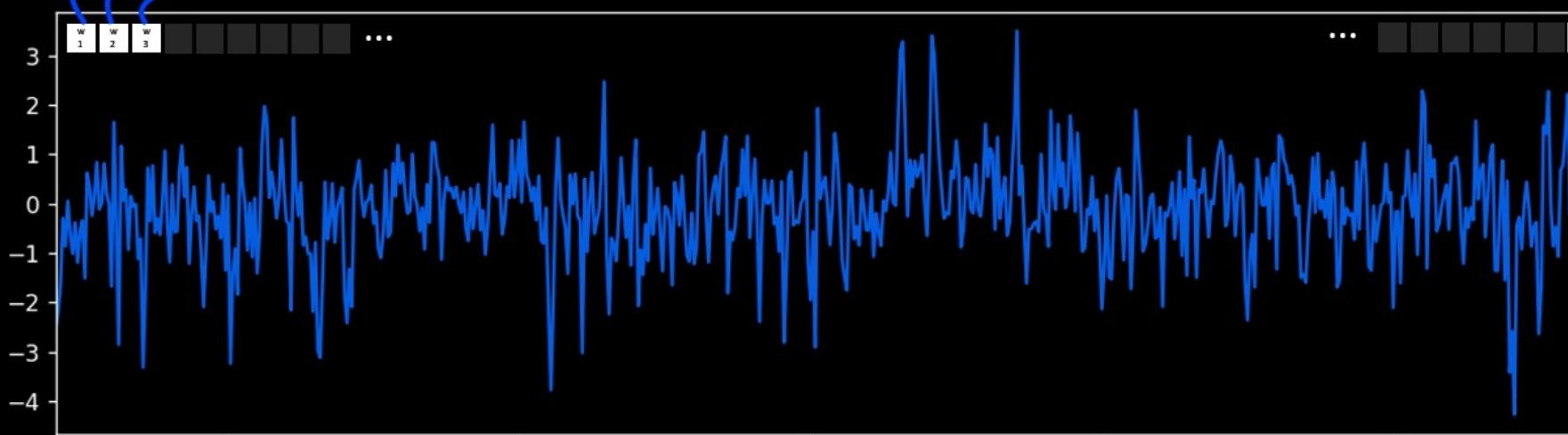
[AutoEncoder Network]



Preparing Data for Model Training

Split into sliding windows
[heavily overlapped]

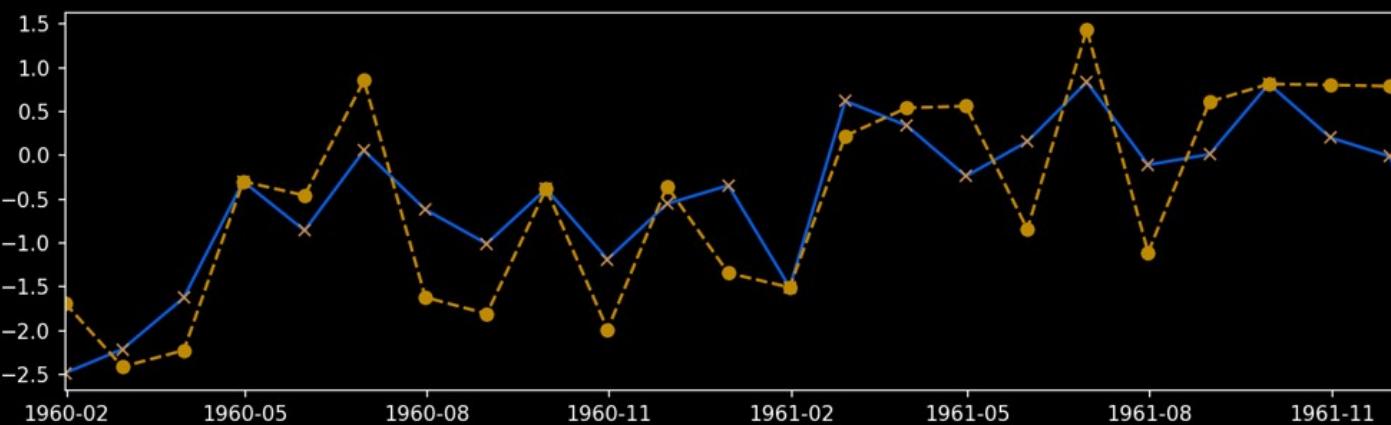
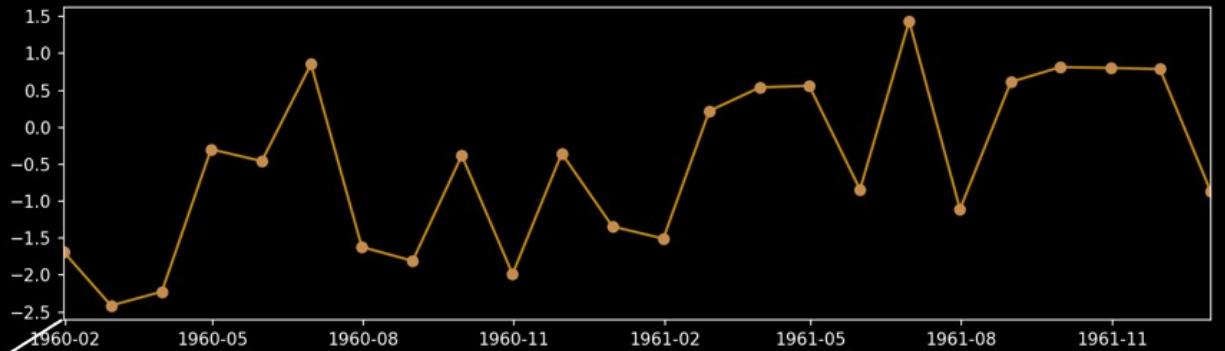
Z Normalization



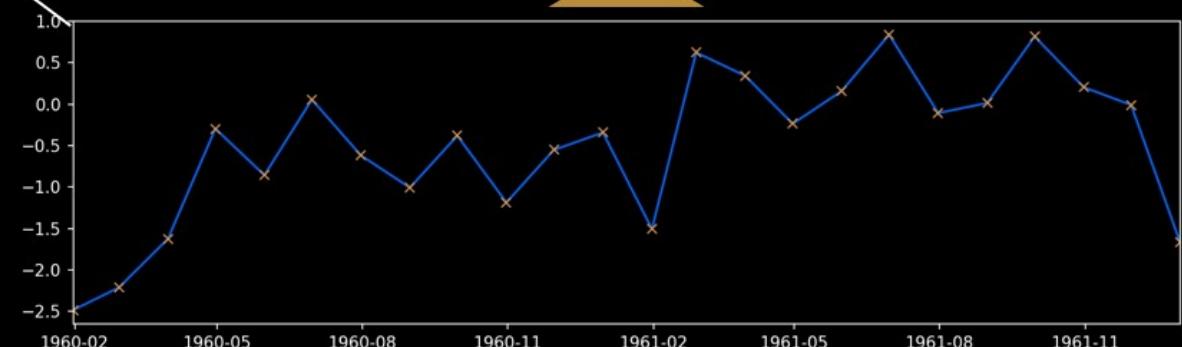
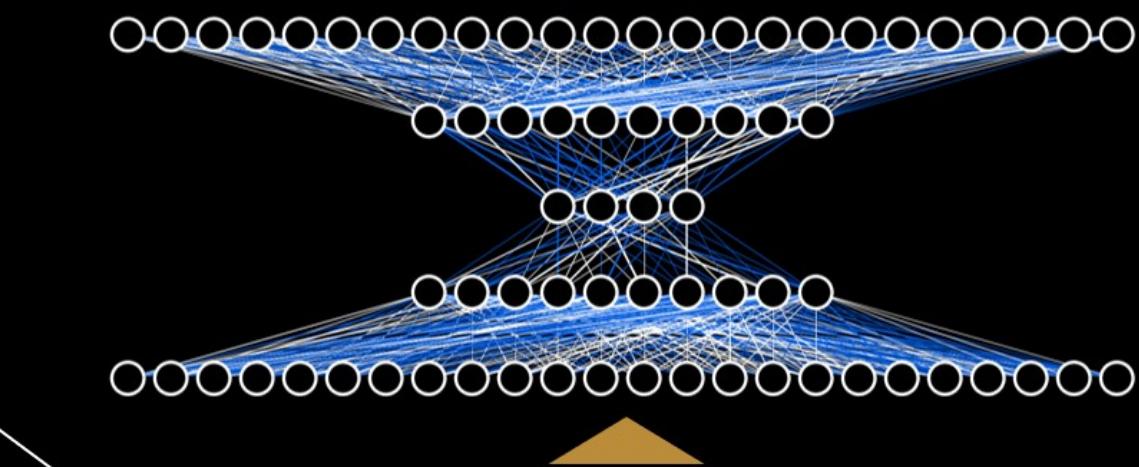
Detecting Anomalies

Reconstruction error (RE) as a proxy to outliers
Whenever RE is high, get an alert

Output (Reconstruction)



Reconstruction vs Input



Input

Multi Sensor Models

[AutoEncoder Network]

