Remote Wireless Sensors for Flooding Temperature and Power Analysis

Electrical Engineering, Undergraduate Student: Christian M. Torres Ortiz

Mentor, Ph.D. Student; Ali Mohammadkhorasani

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Why Remote Wireless Sensors?

[Fig.1] Sensor Systems in field location.

# Sensor Descriptions

- Rain Sensor

- Sonar Sensor

- Node Sensor
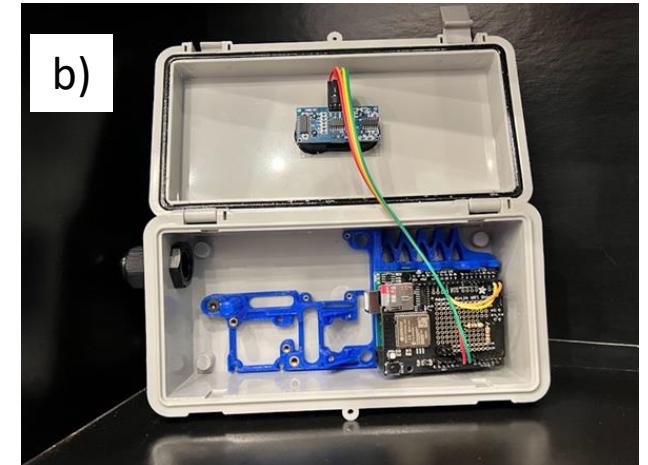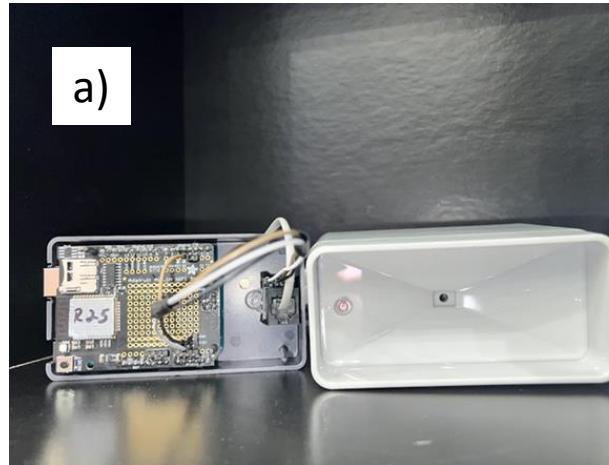
[Fig. 2-4] Sensors: a) Sonar; b) Rain; c) Node

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Systems Power

- Single 18v 25w solar panel per enclosure.

Solar Panel Measurements:

1. Voltage = 20v
2. Current = 1.1
3. Power = 20v * 1.1A
4. Power = 22w

[Fig. 5] Single Panel Set-Up.

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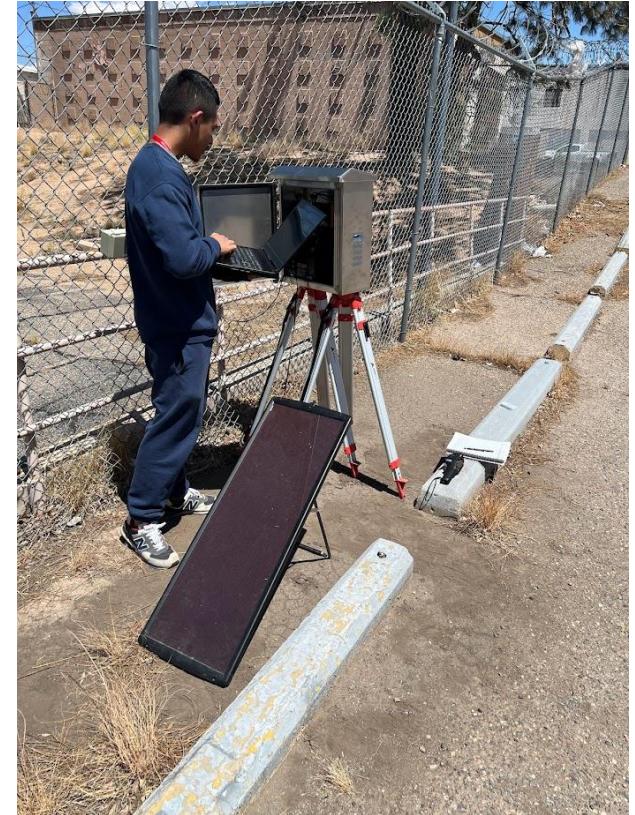
Overheating

Data Sheet Information:

- Operating Temperature: 55
- Charging Temperature: 40
- "Never expose batteries to temperatures above 60˚ centigrade"

[Fig. 6] Hotspot (Verizon Jetpack MiFi 8800L)

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Power Analysis

[Fig. 7] Sensor System.
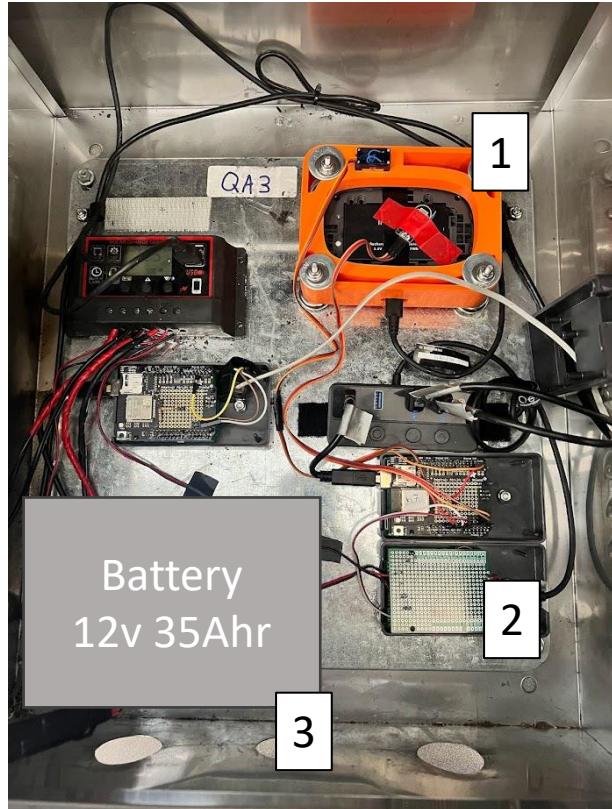
System Components:

1. Hotspot

2. Load Connection (Sensors)

3. Battery

System Power Consumption			
Item	**Voltage (V)**	**Current (A)**	**Power (W)**
Load	5	0.426	2.13
HotSpot	4.56	0.645	2.94

Battery Charging (8am-1pm)		
Voltage (V)	**Amp. Hr.**	**Pow. [(V*I)/5Hr]**
12	35	84

Total Power Needed		
Item	**Power**	**Total Pow.**
Load	2.13	
Hotspot	2.94	89.07
Battery	84	

Battery Voltage
(June 5th – June 13th)
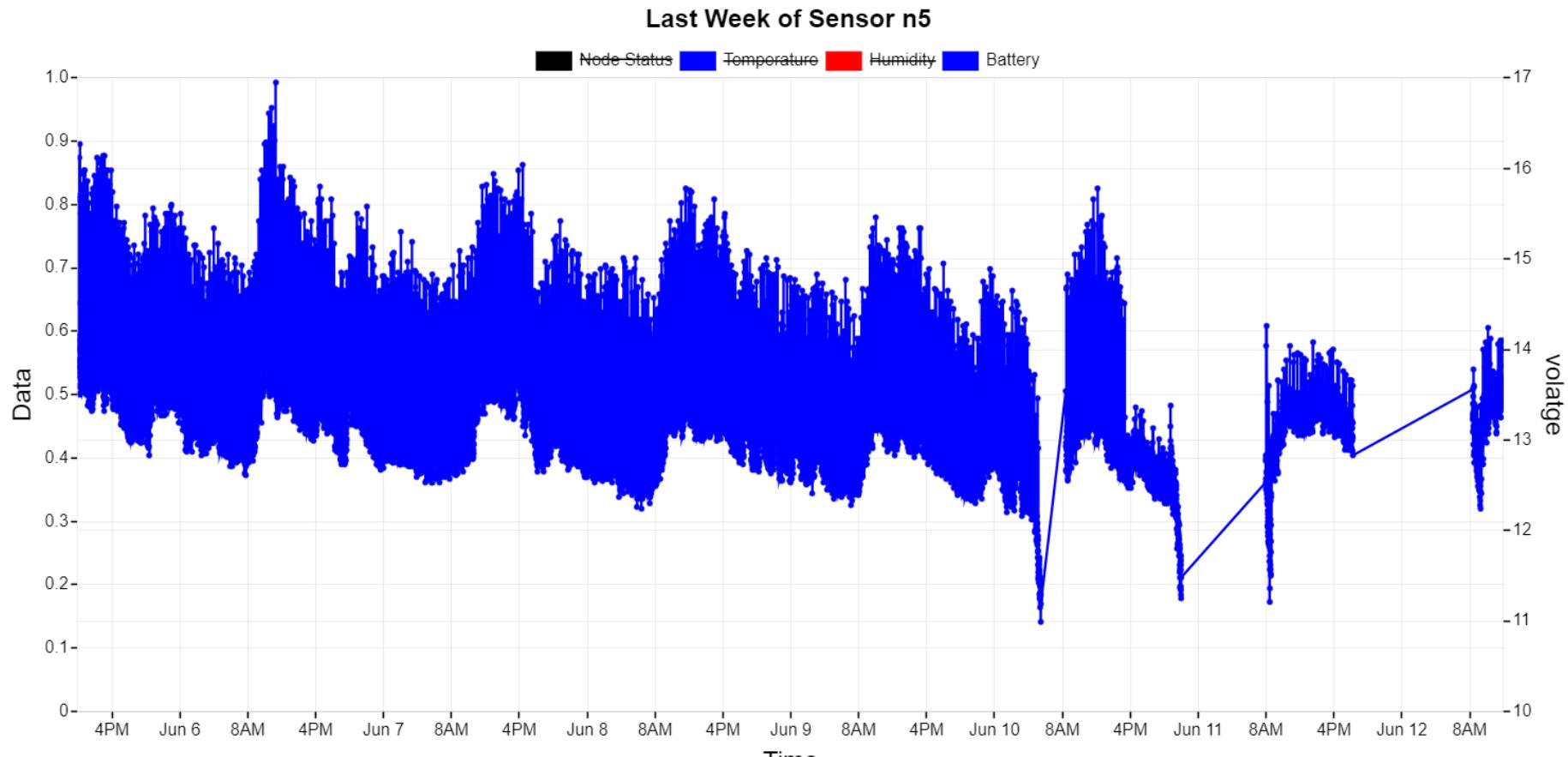
[Fig. 8] Battery Voltage Decrease (Time vs Voltage).

Parallel Panel Connection

Power Equation:

- $(P * n) = V * I$
- $I = (P * n)/V$
- I= (25w*4)/18v
- I = 5.55A

"n" is equal to the number of panels in the parallel configuration.

S.C. Measurements

- P= 22.08v * 4.429A
- P= 97.79W
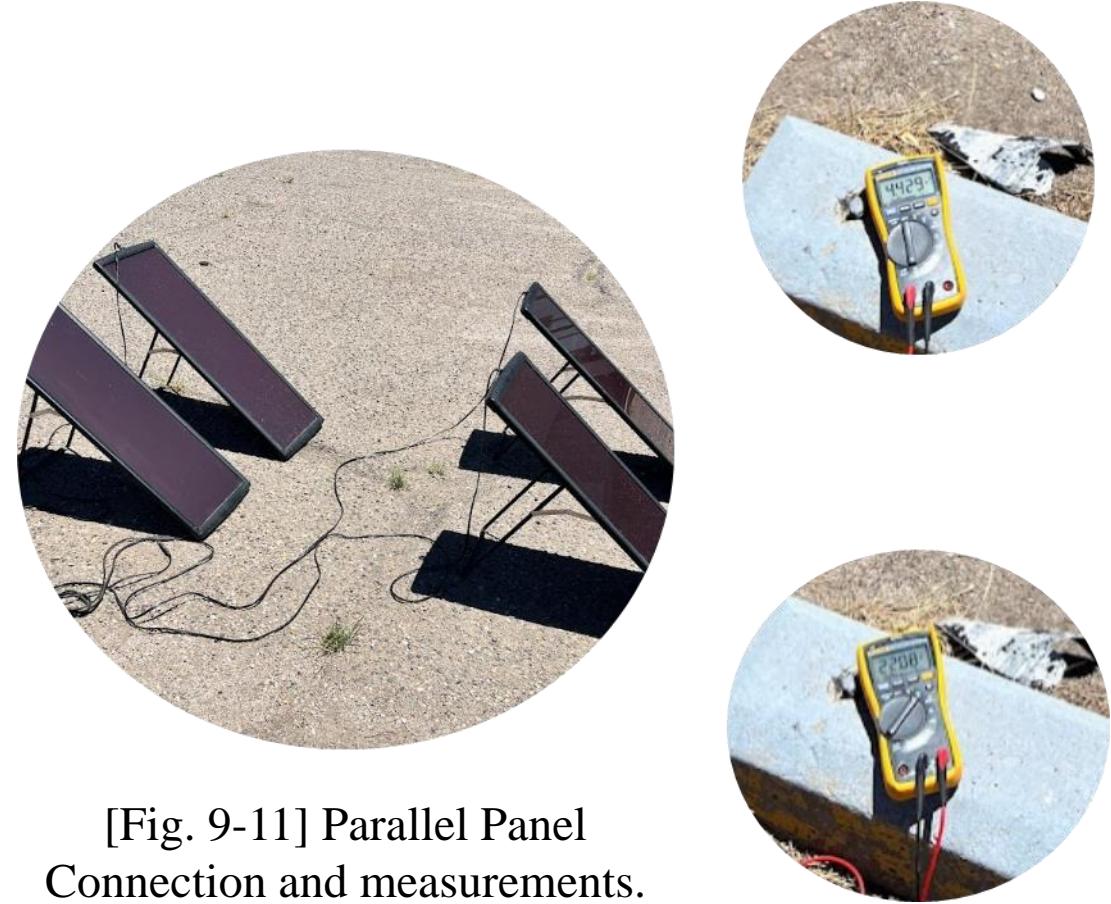
[Fig. 9-11] Parallel Panel Connection and measurements.

Experiment #1: Enclosure Under Shade

[Fig. 12] Box 1 (Shaded) and Box 2 (Exposed).

Types of Enclosure:

1. Shaded Enclosure

2. Exposed Enclosure

Shaded Enclosure Test			
Time	Shade Temp.	Direct Temp.	Difference
1:00 PM	33	38.5	-5.5
2:00 PM	35	40	-5
3:00 PM	33	42.5	-9.5
4:00 PM	34.5	43	-8.5
5:00 PM	37	40	-3

Temperature Difference		
Direct Avg.	Shaded Avg.	Difference
40.8	34.5	-6.3
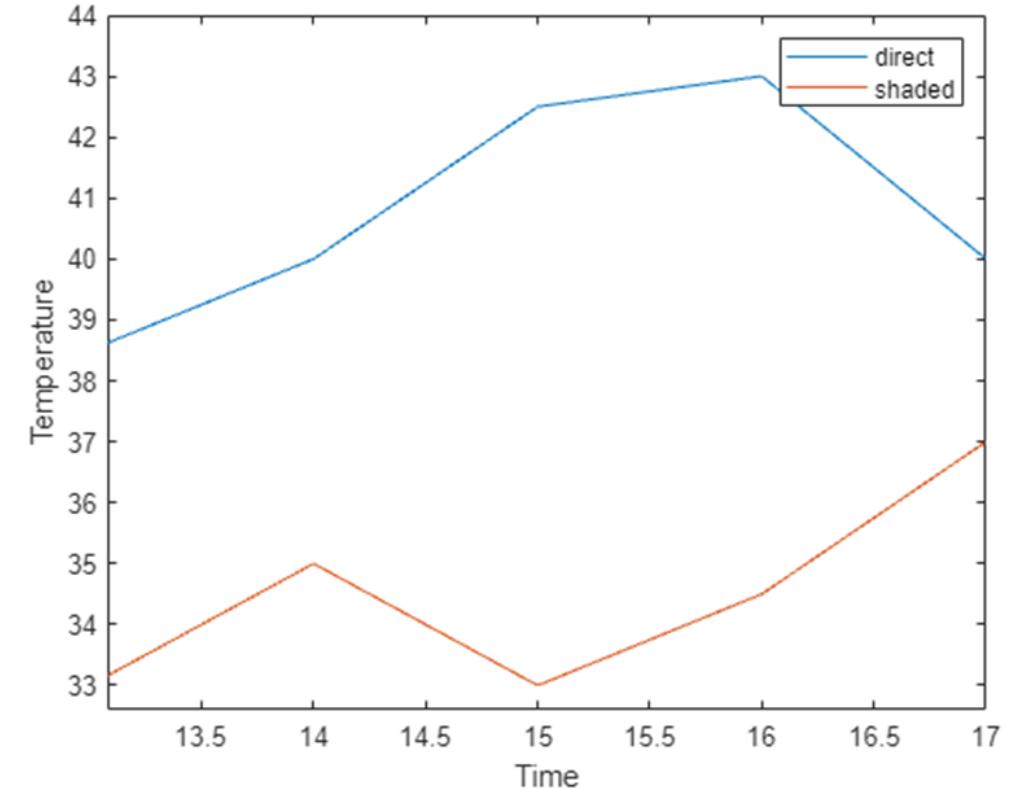
[Fig. 13] Overall temperature for Reference and Shaded Enclosures.

Experiment #2: Enclosures and Process

[Fig. 14] Reference Enclosure

[Fig. 15] Reference Enclosure (Overall Temp.)

[Fig. 16] Shield Enclosure (Overall Temp.)

[Fig. 17] Shield Enclosure (Overall Temp.)

[Fig. 18] Reference Enclosure (Hotspot Temp.)

[Fig. 19] Shield Enclosure (Hotspot Temp.)

Temperature Measurements and Results

Deflector Test (Overall)			
Time	**Reference**	**Shield**	**Difference**
9:00	30.95	31	0.05
10:00	44	41	-3
11:00	44.6	42.65	-1.95
12:00	44.75	39.9	-4.85
13:00	46	43.5	-2.5
14:00	42.85	43.35	0.5
15:00	44.7	39.7	-5
16:00	41.1	39.65	-1.45
17:00	38.1	37.05	-1.05
18:00	37.45	32.9	-4.55

Avg. Temperature Decrease (Overall)		
Reference	**Shield**	**Decrease**
41.45	39.07	-2.38
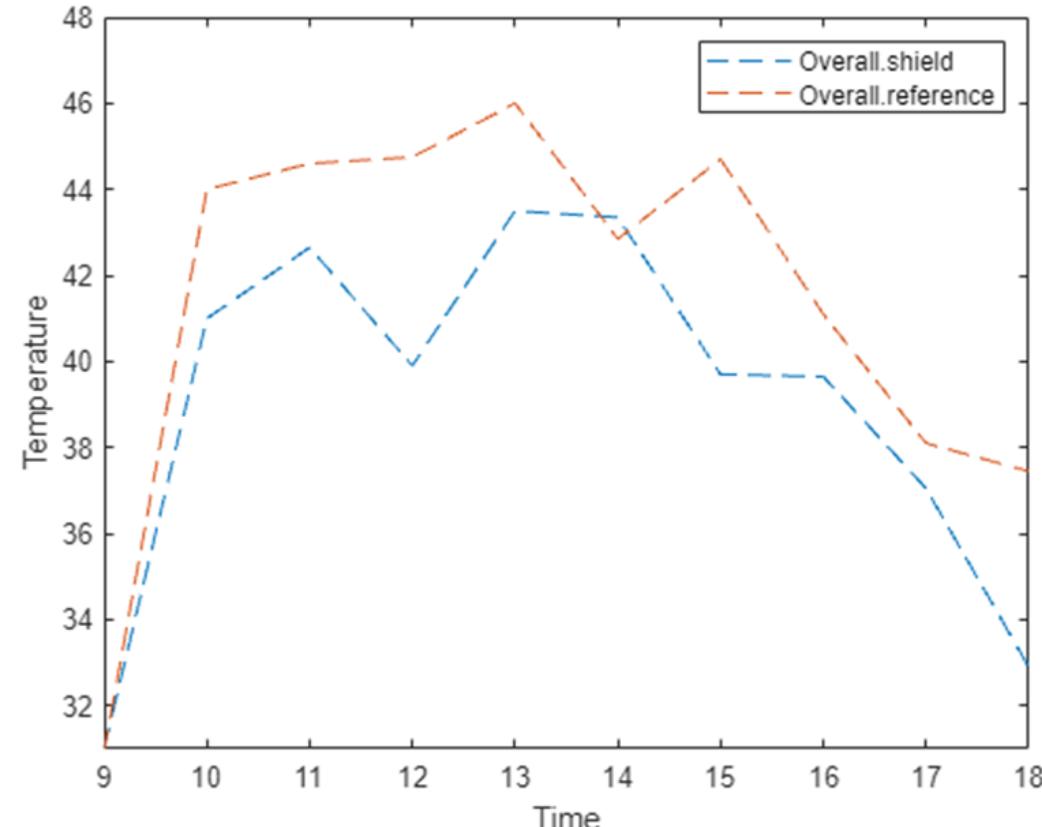
[Fig. 20] Reference and Shielded enclosure (Overall Temperature).

Temperature Measurements and Results

Fig 21. Reference and Shielded enclosure (Hotspot Temperature).
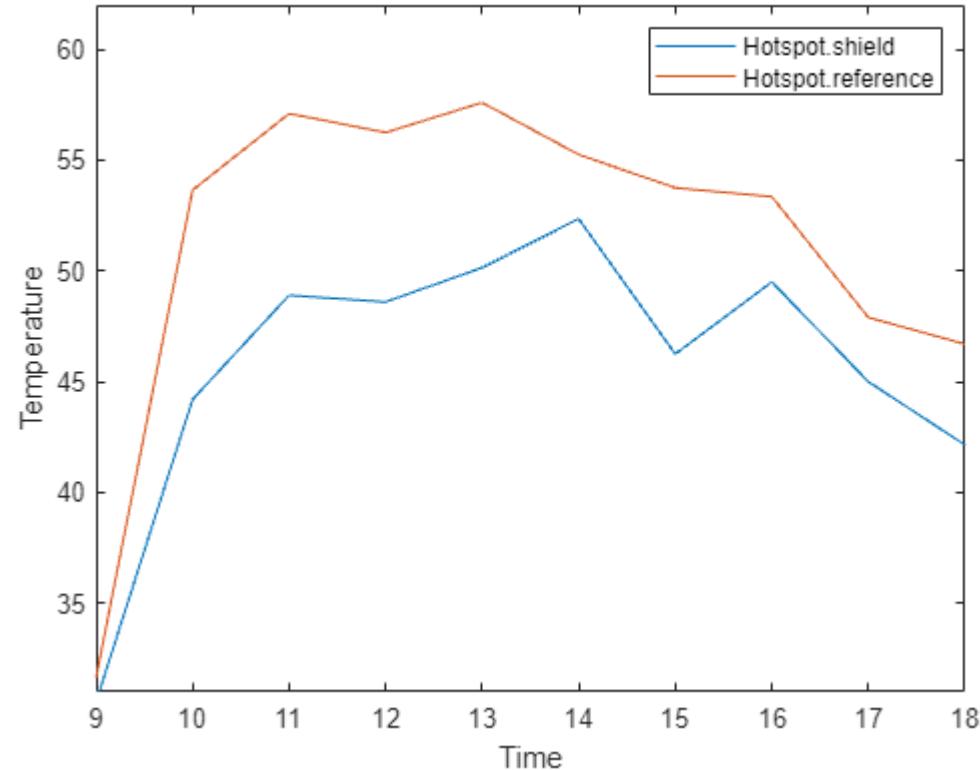
Deflector Test (Hotspot)			
Time	**Reference**	**Shield**	**Difference**
9:00	31.65	30.55	-1.1
10:00	53.65	44.2	-9.45
11:00	57.1	48.9	-8.2
12:00	56.25	48.6	-7.65
13:00	57.6	50.15	-7.45
14:00	55.25	52.35	-2.9
15:00	53.75	46.25	-7.5
16:00	53.35	49.5	-3.85
17:00	47.9	45	-2.9
18:00	46.7	42.15	-4.55

Avg. Temperature Decrease (Hotspot)		
Reference	**Shield**	**Decrease**
51.32	45.77	-5.56

Future Research

- Incorporate relay timers

- Internal fan cooling

- Power analysis using 170w panels

- Battery Duration Test

Thank You!

Any Questions?

Email: ctorresortiz1342@unm.edu