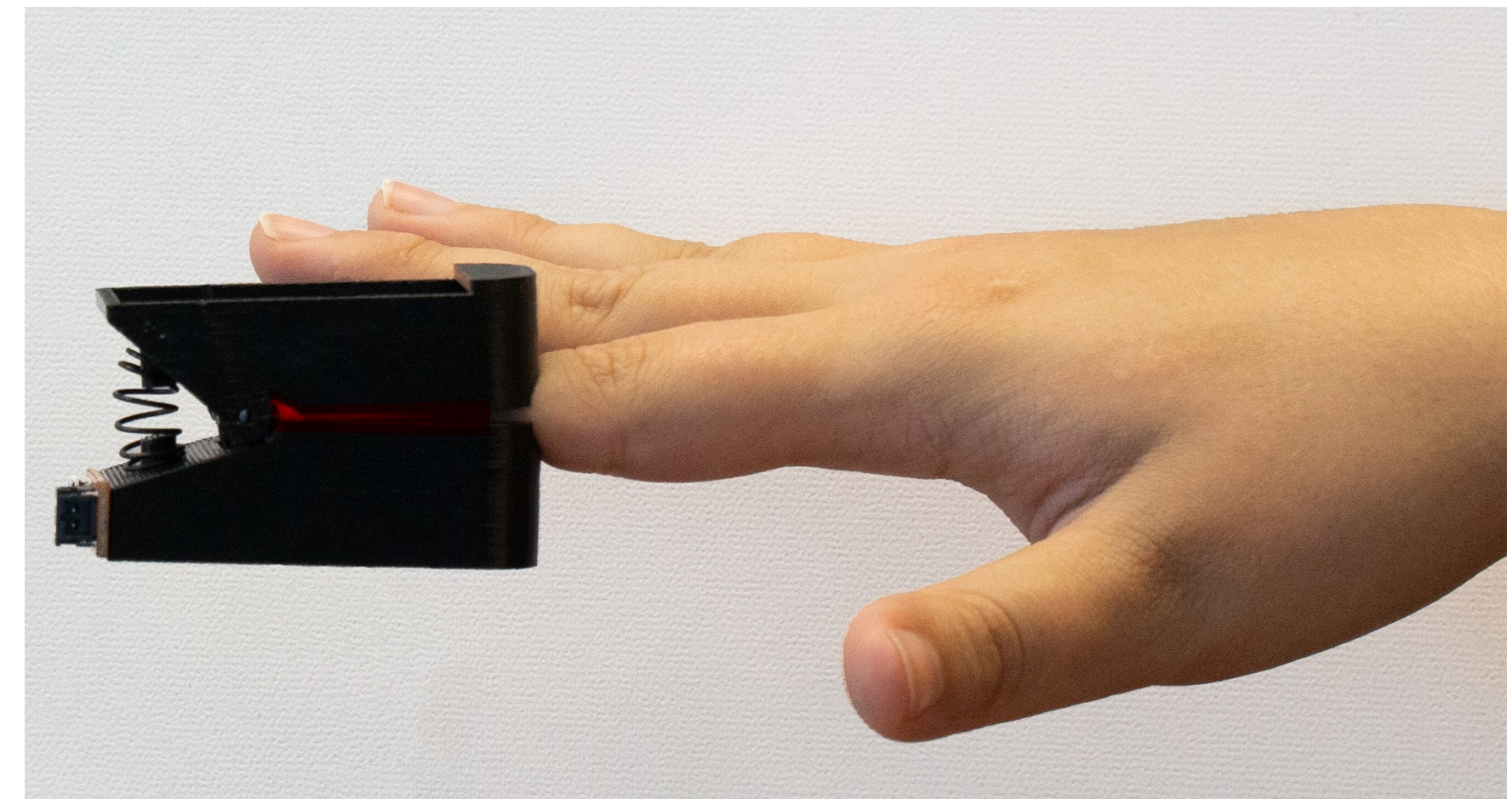


# Lumos: An Open-Source Device for Wearable Spectroscopy Research

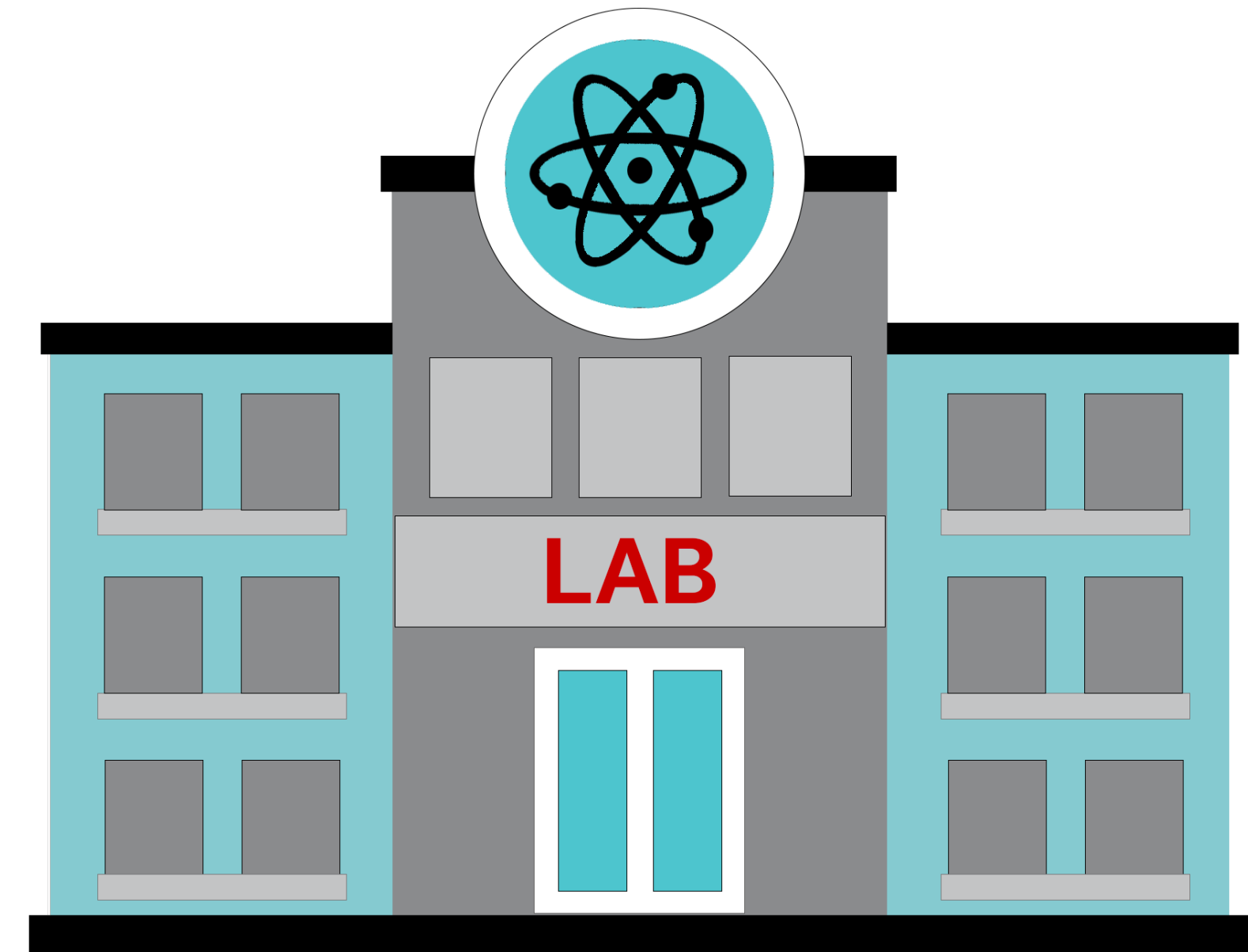
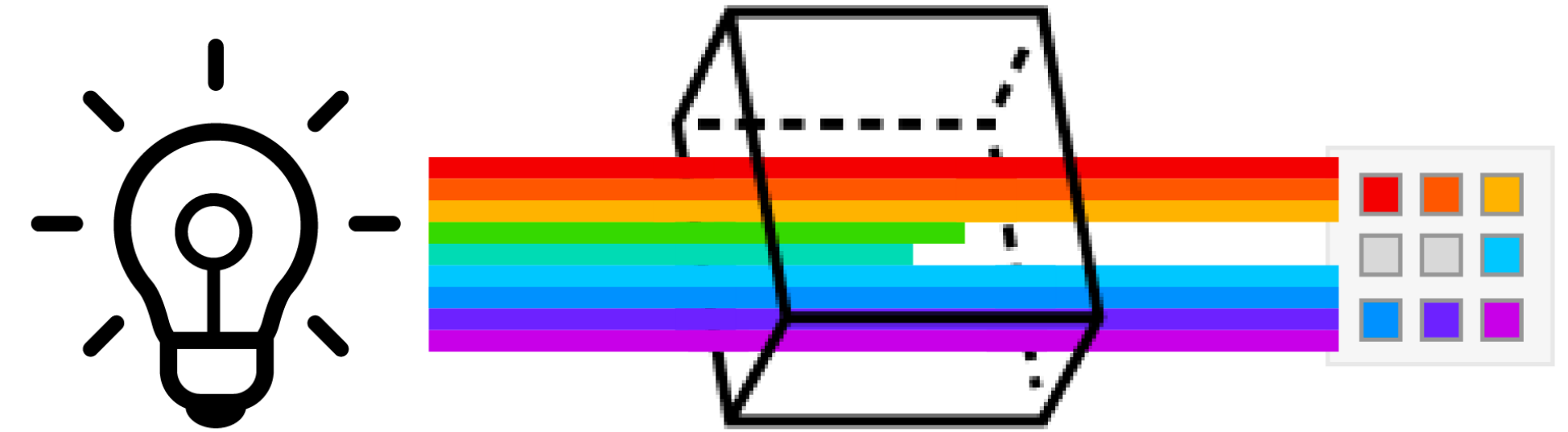
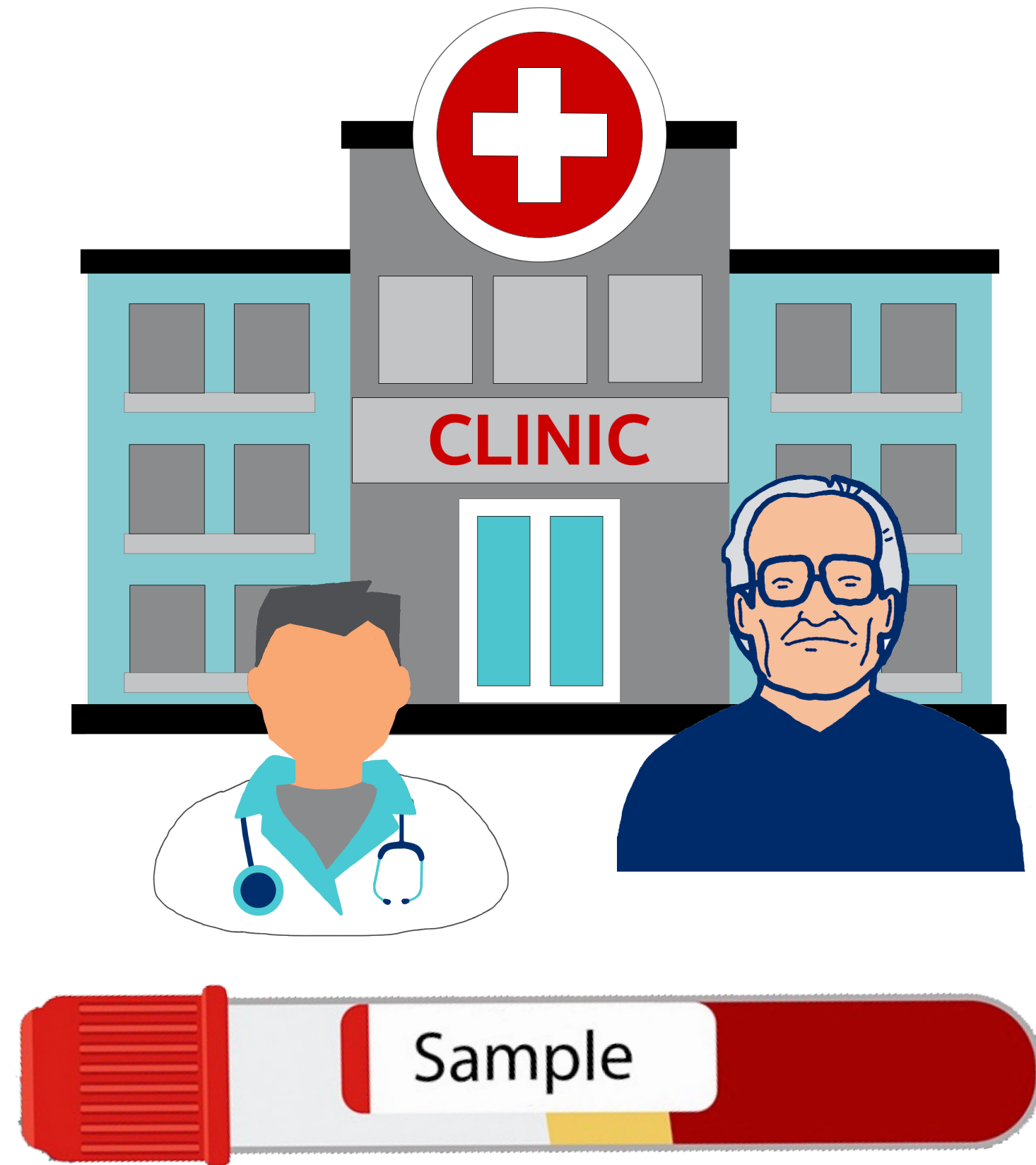


Amanda Watson  
Link Lab  
University of Virginia

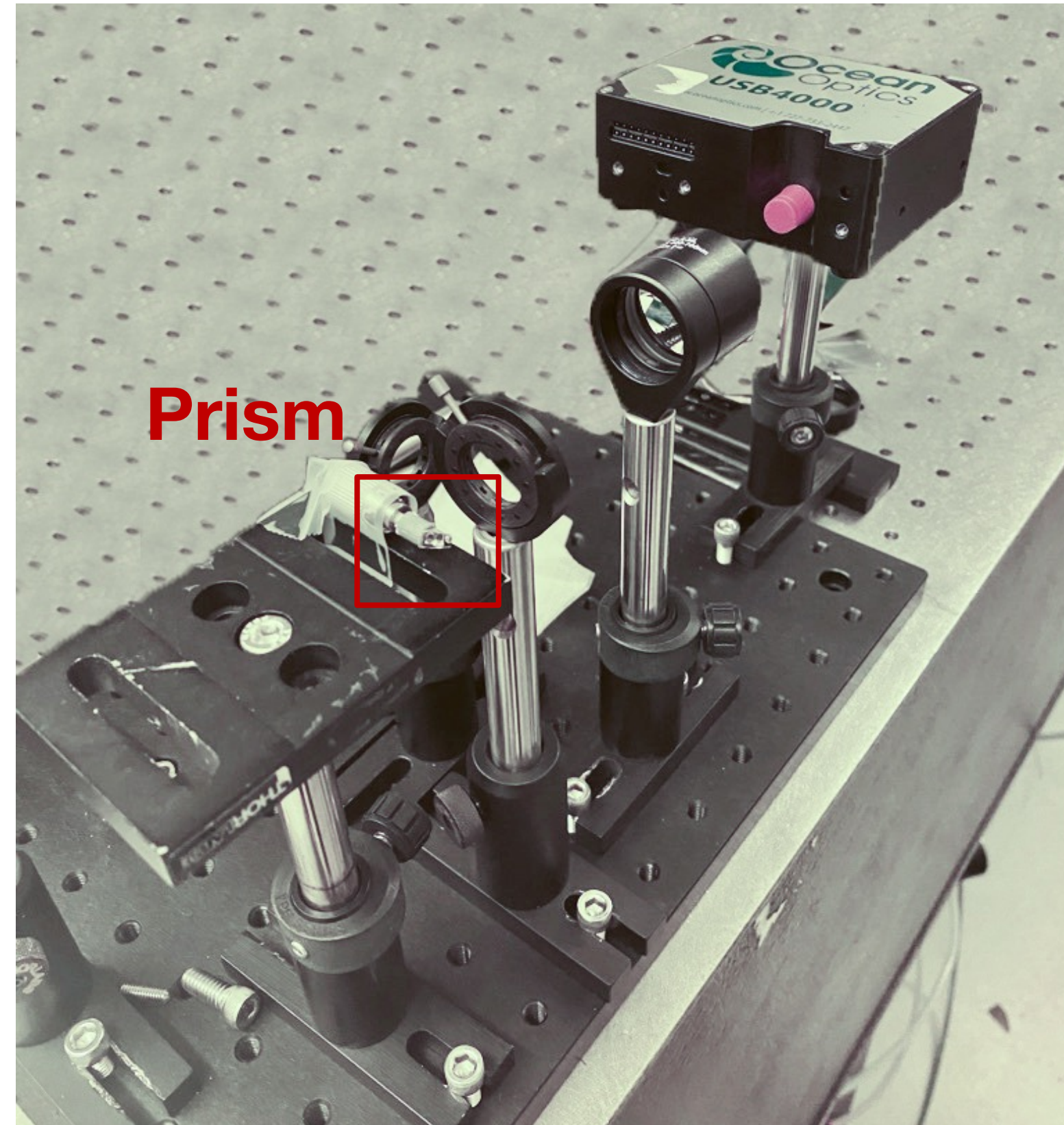




# Traditional Spectroscopy



# Technical Challenges



Footprint

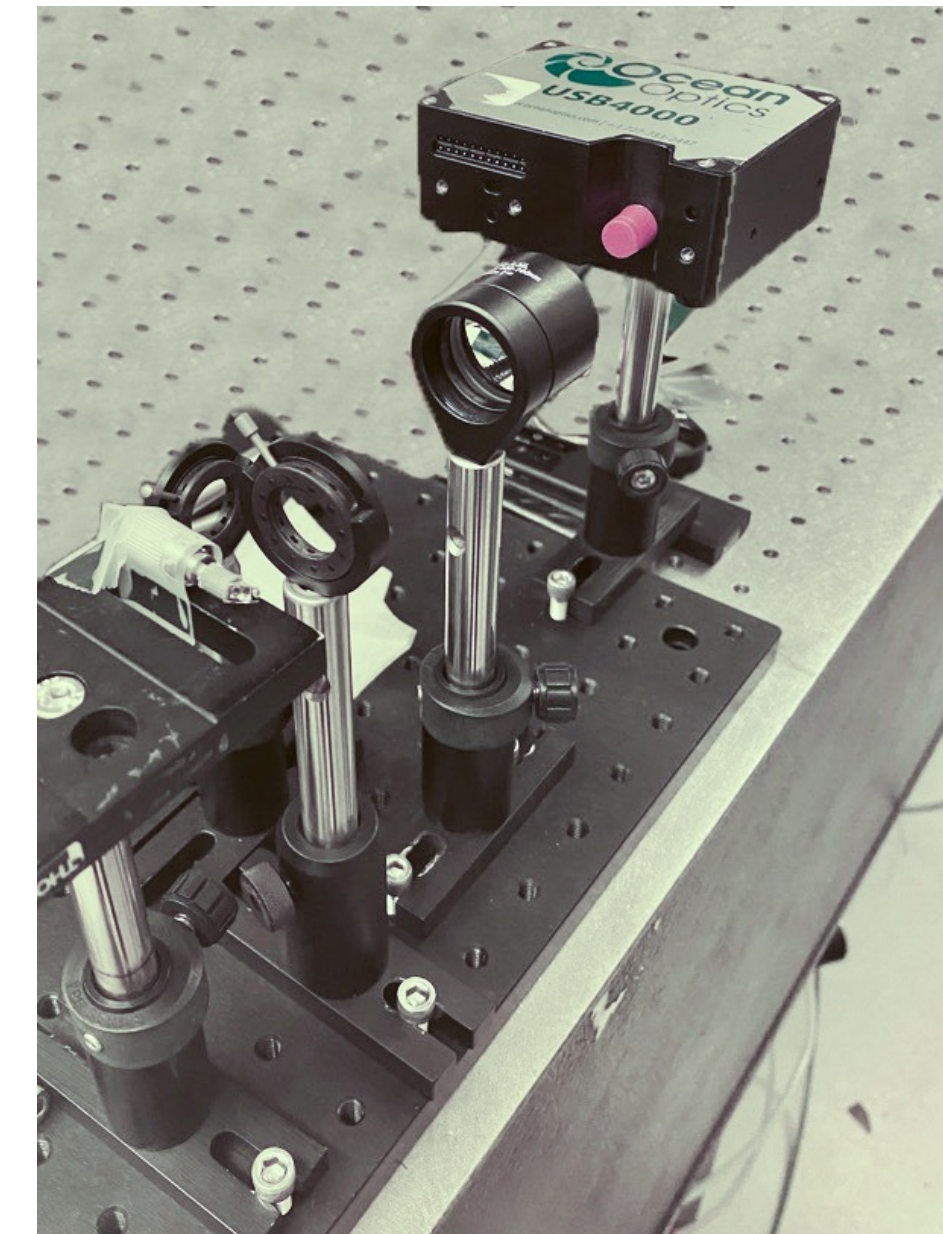
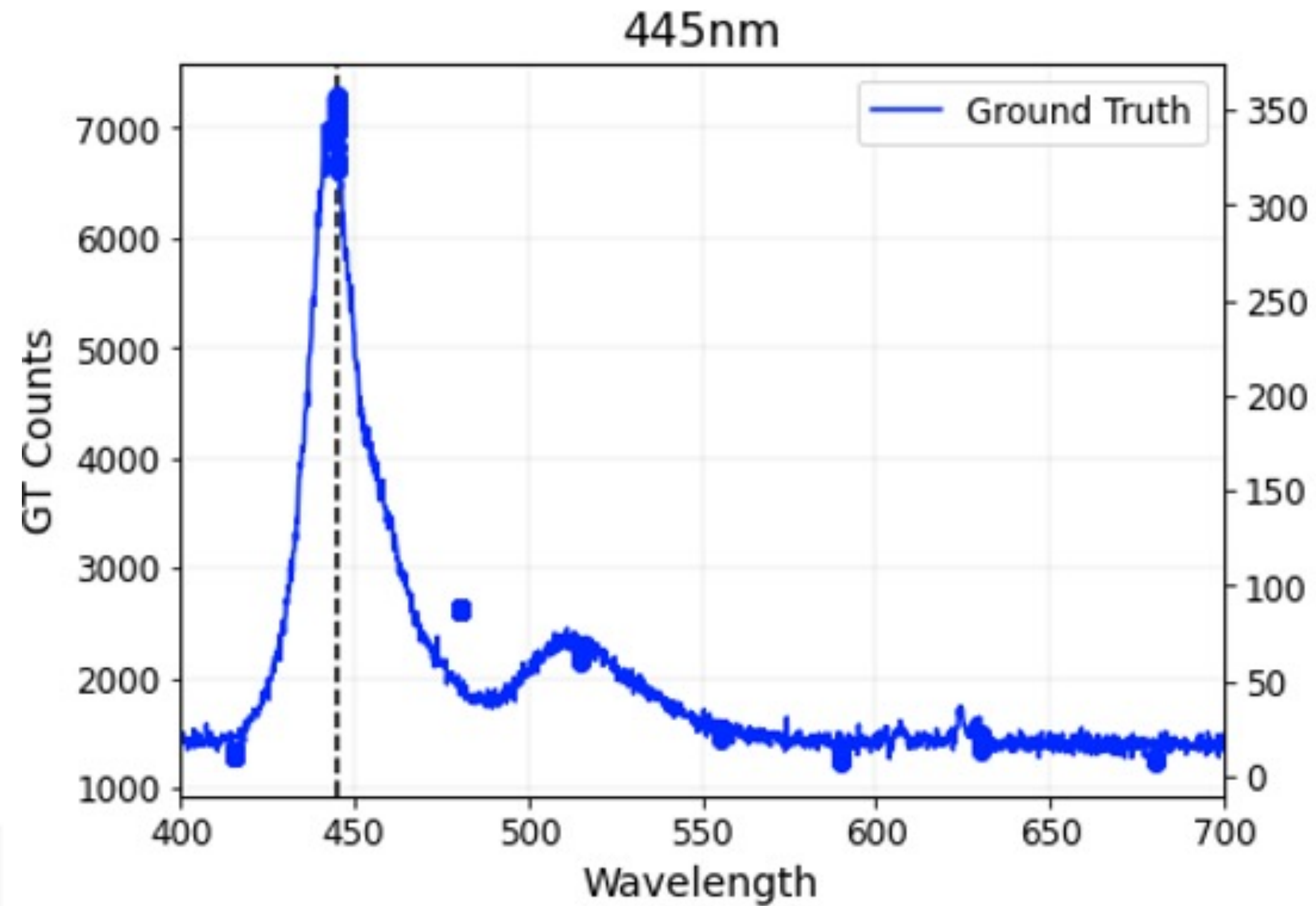
Environment

Battery Life

Form Factor



# Wearable Spectroscopy



Footprint

Environment

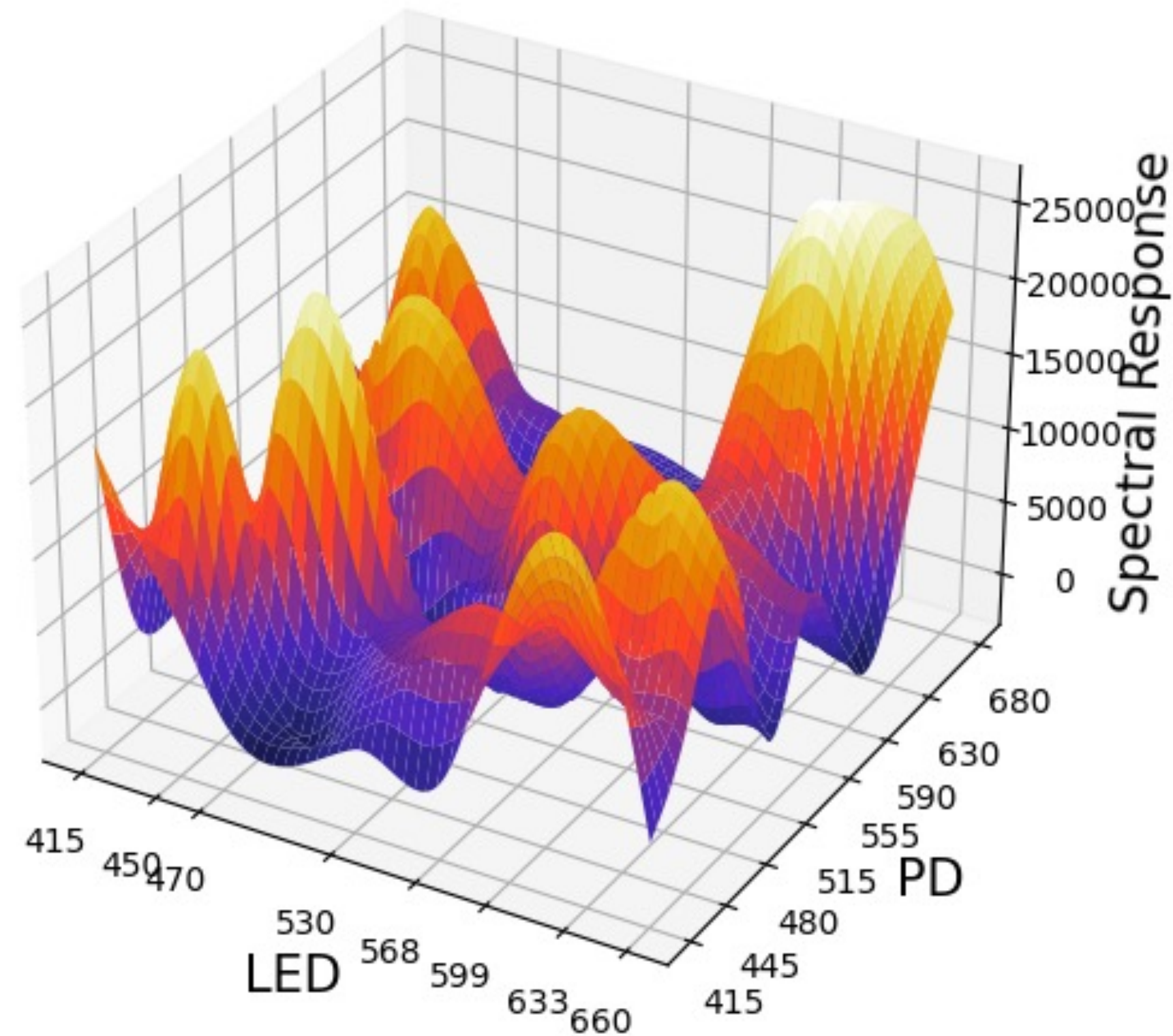
Battery Life

Form Factor

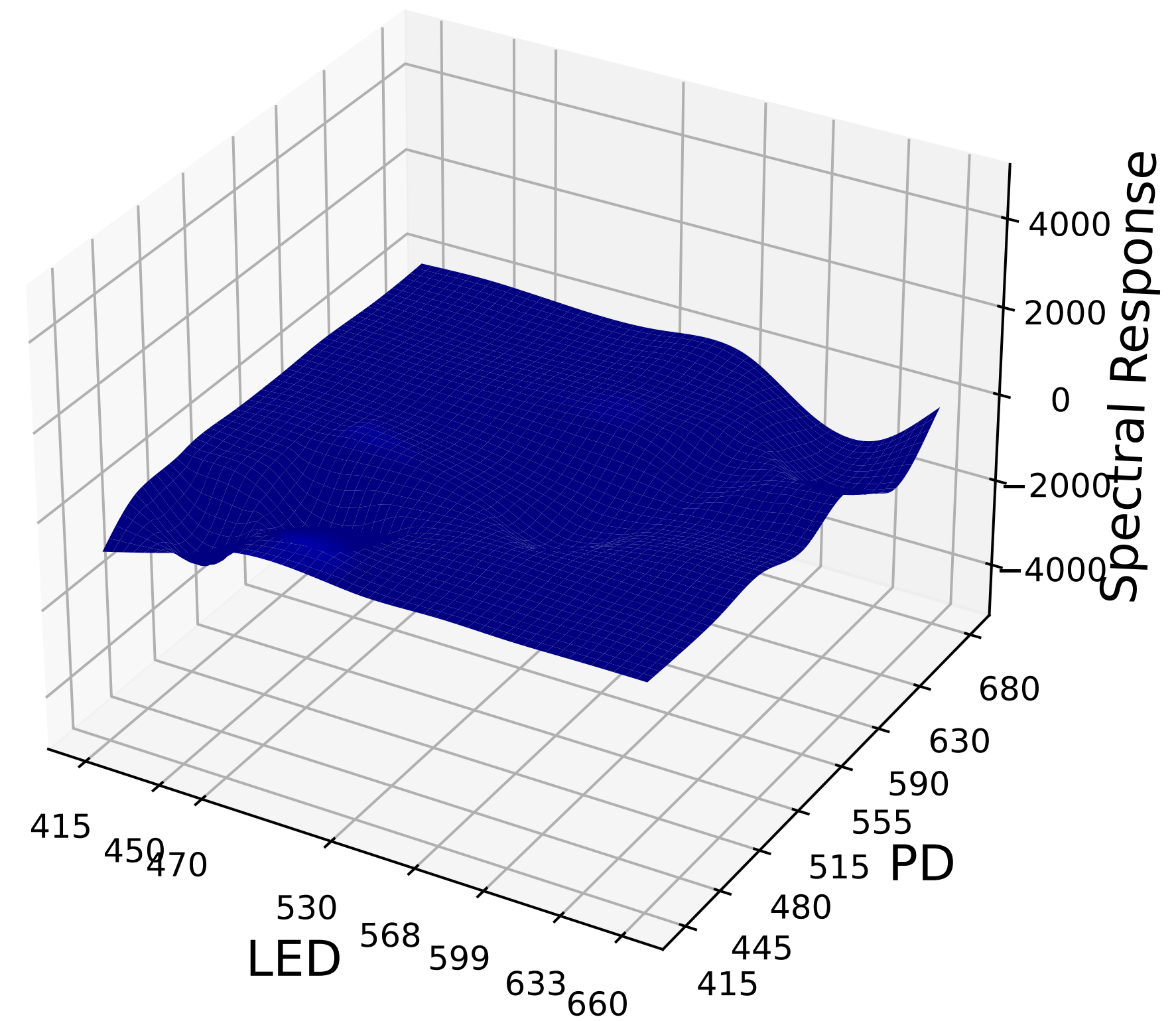


# Lumos Signal

No Medium



No Medium



Footprint

Environment

Battery Life

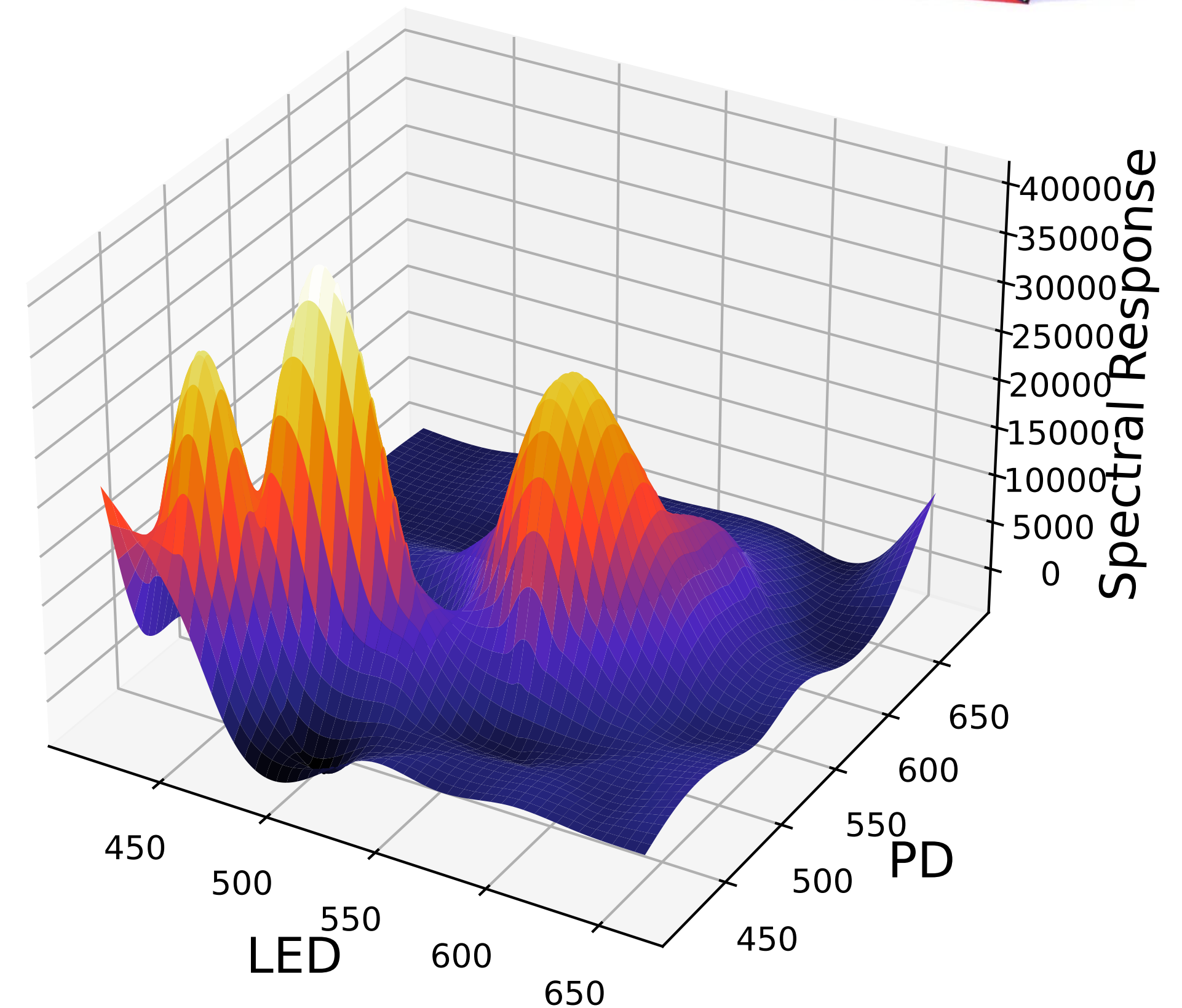
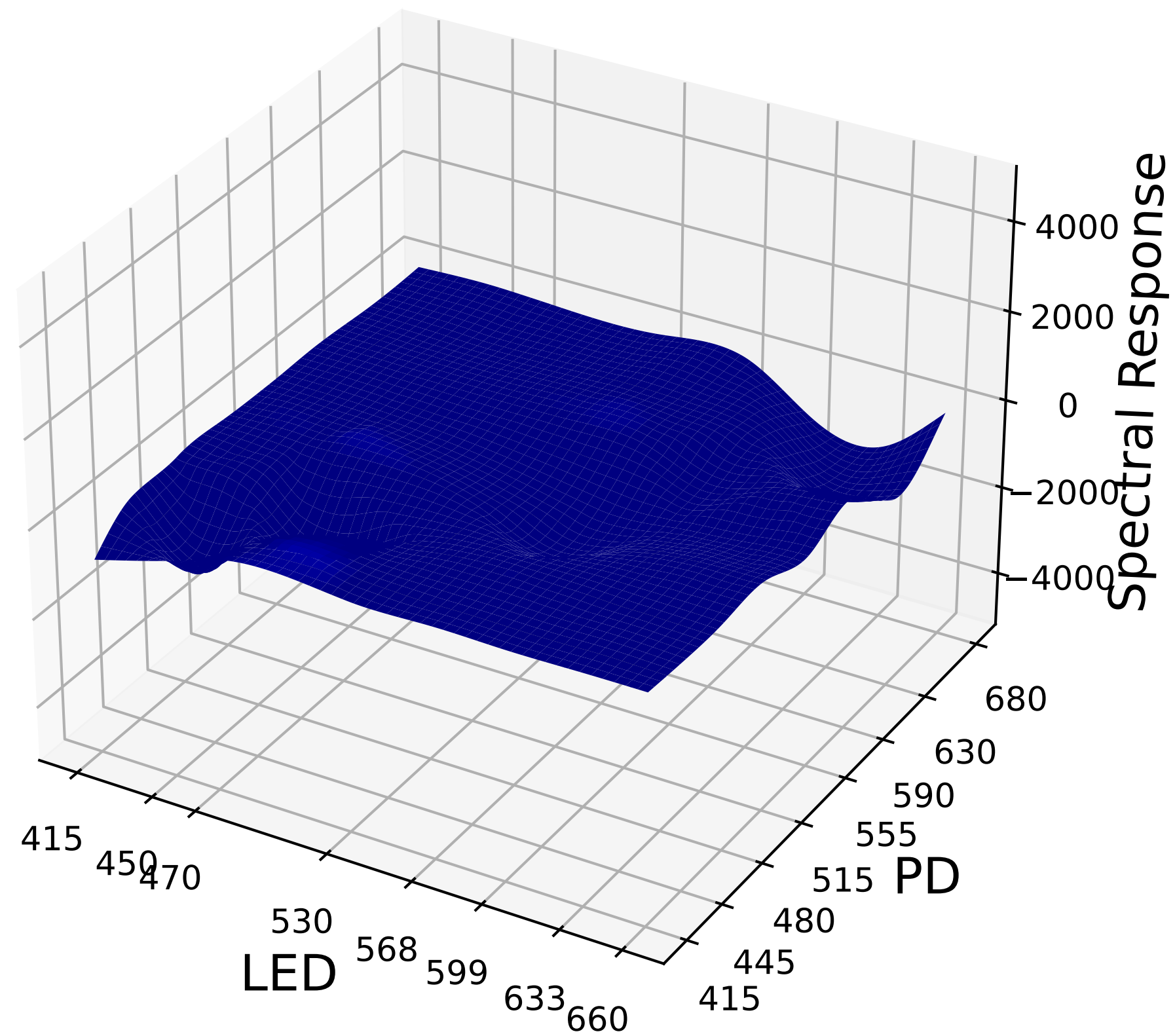
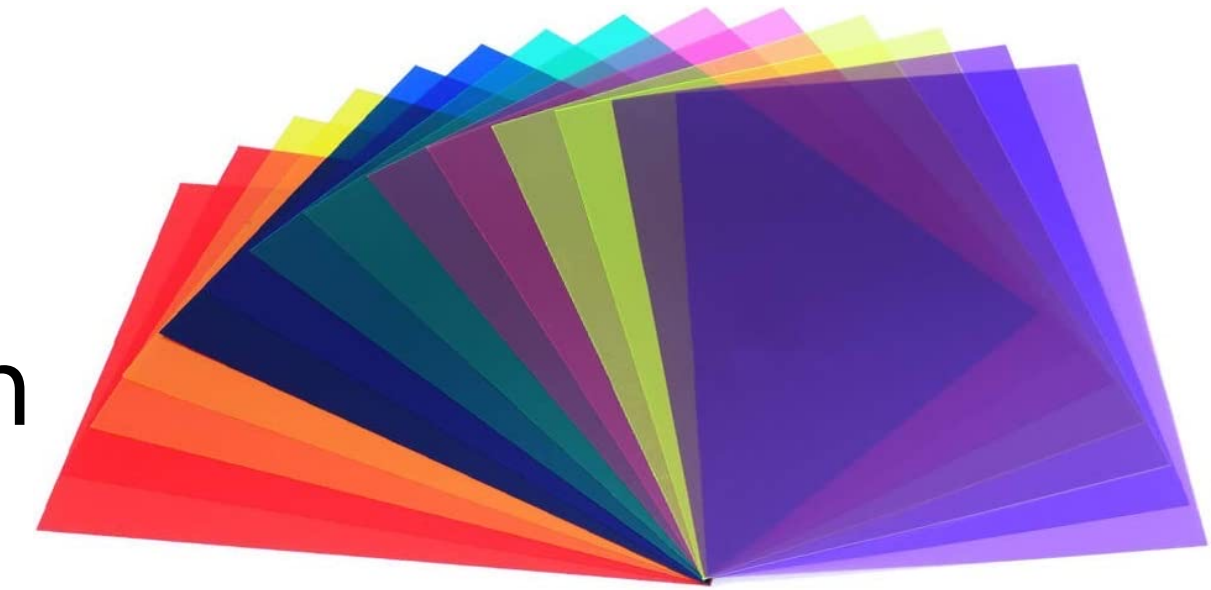
Form Factor



# Experimental Evaluation

No Medium

Green



Footprint

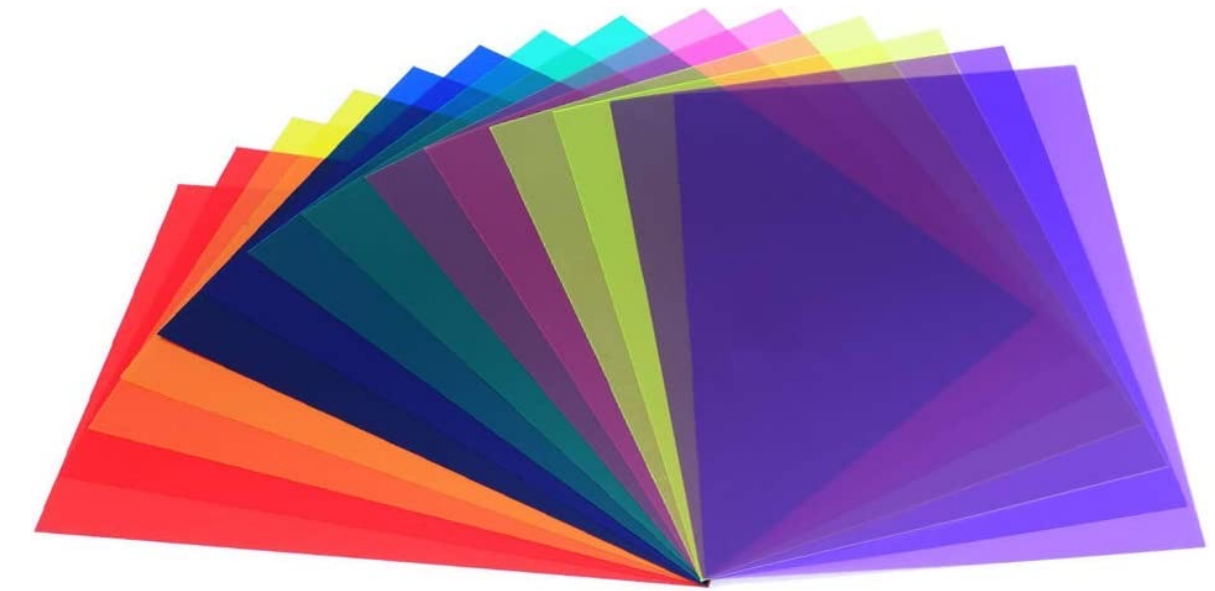
Environment

Battery Life

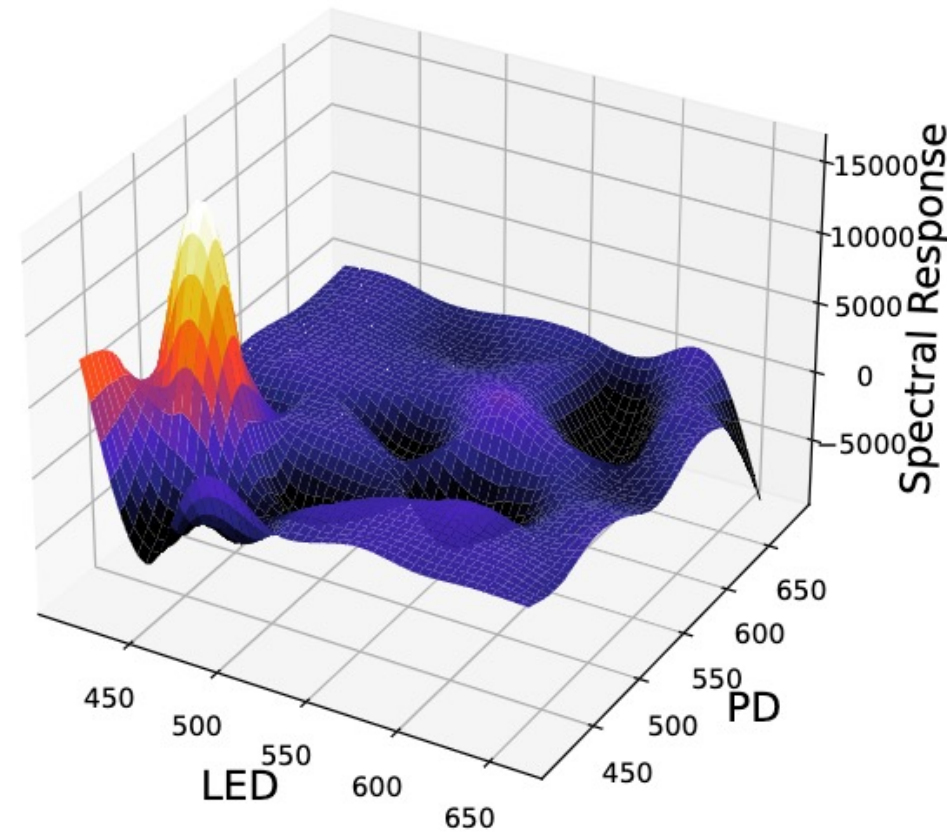
Form Factor



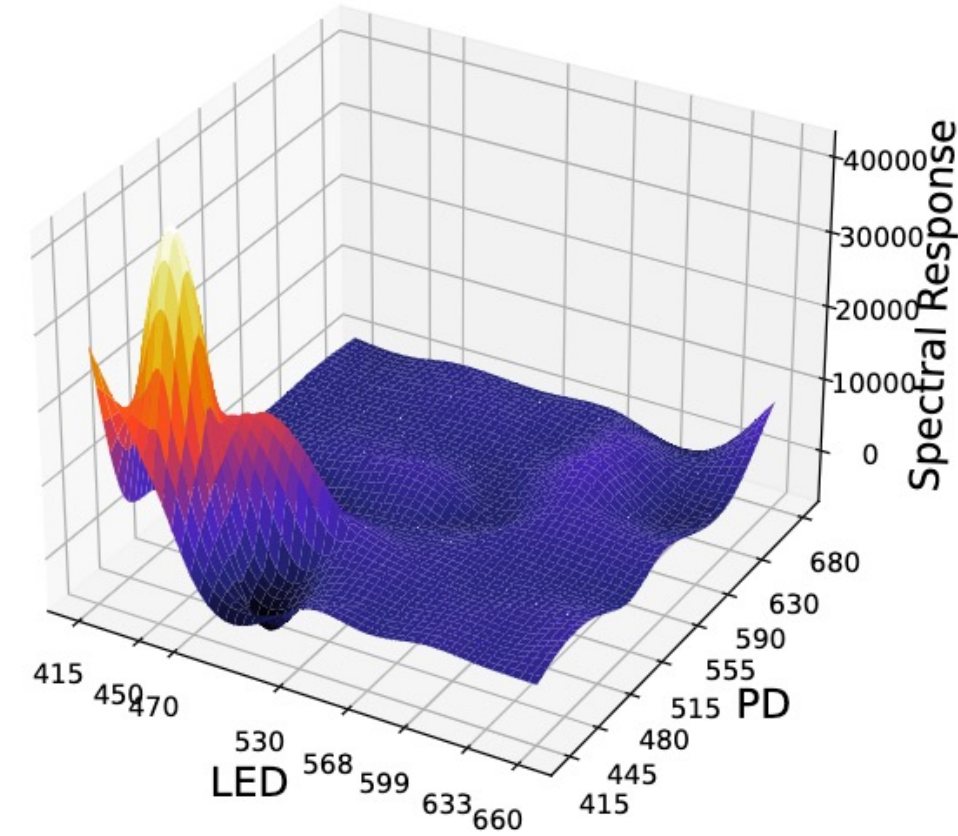
# Experimental Evaluation



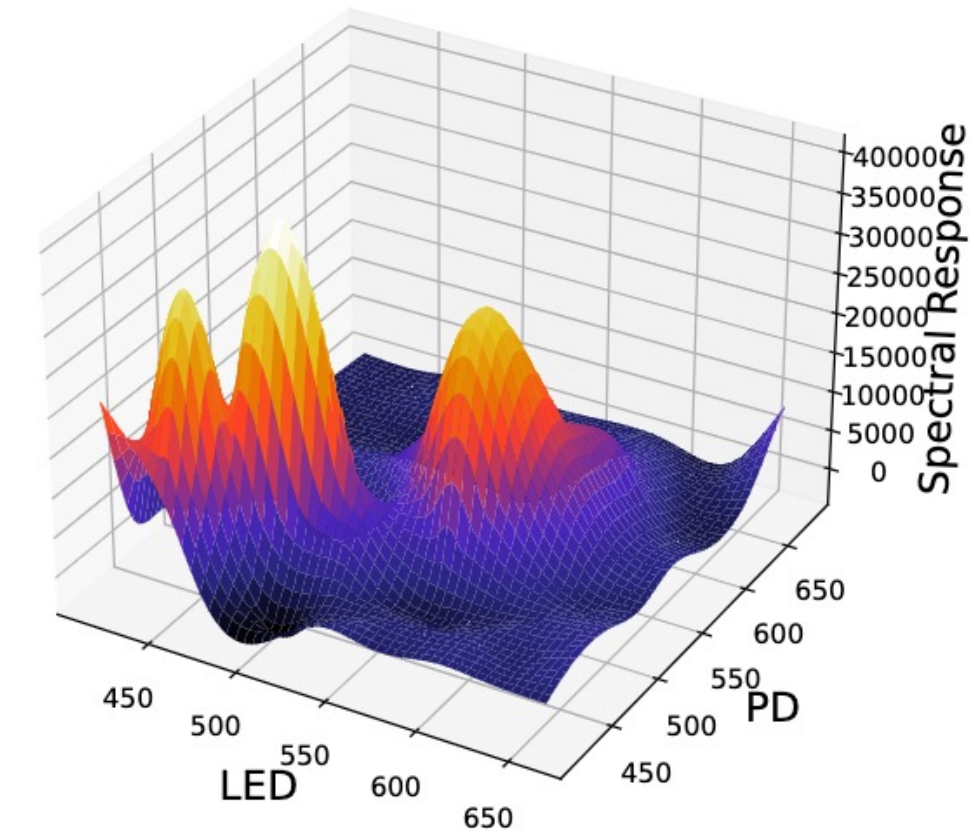
Purple



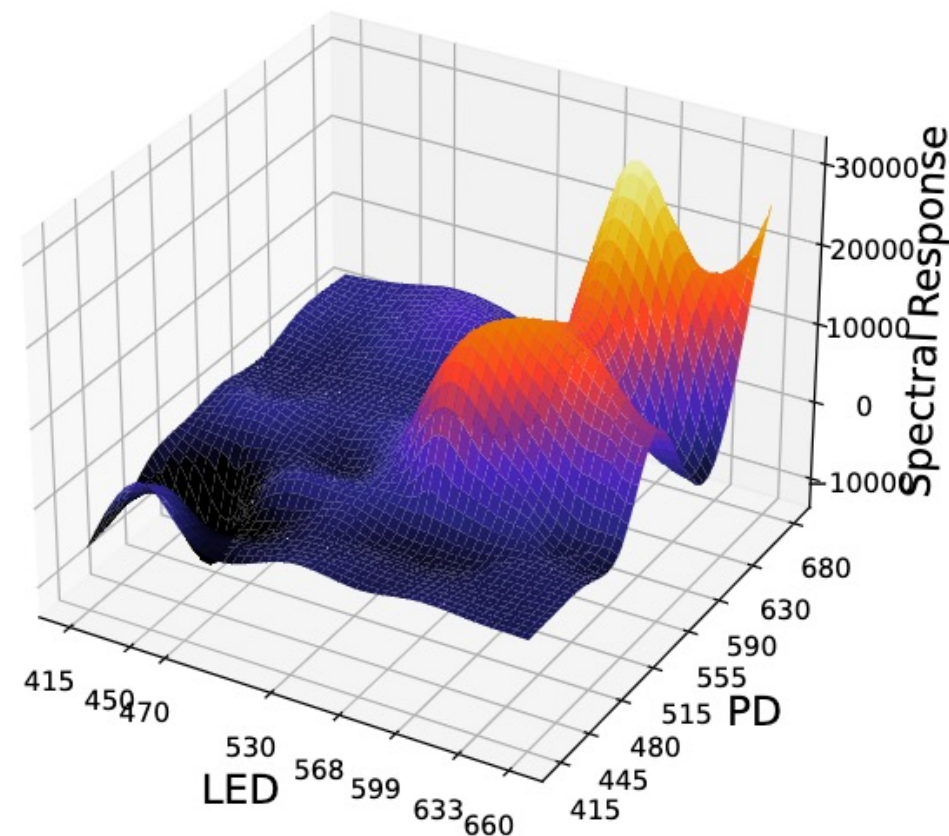
Blue



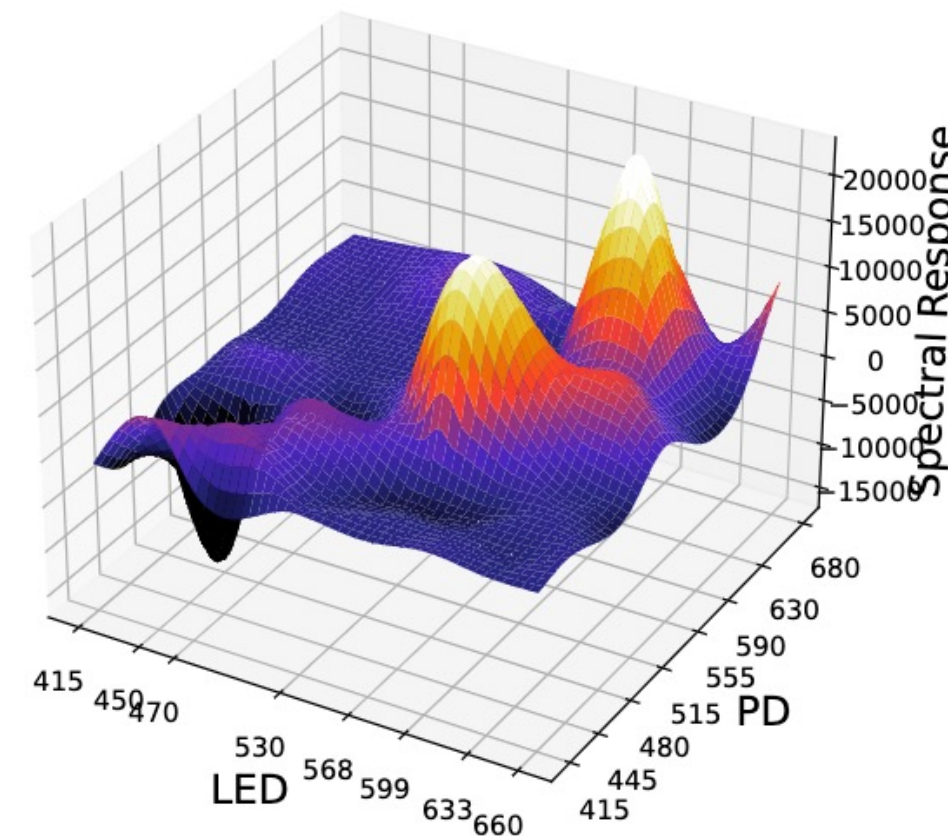
Green



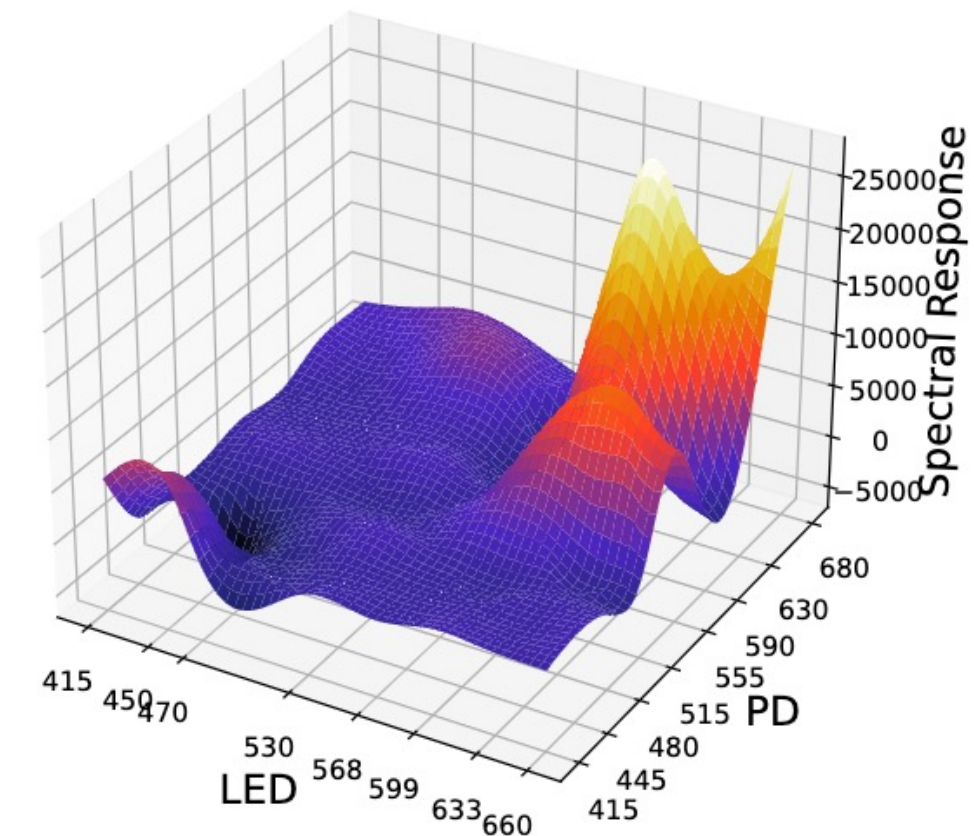
Yellow



Orange



Red



Footprint

Environment

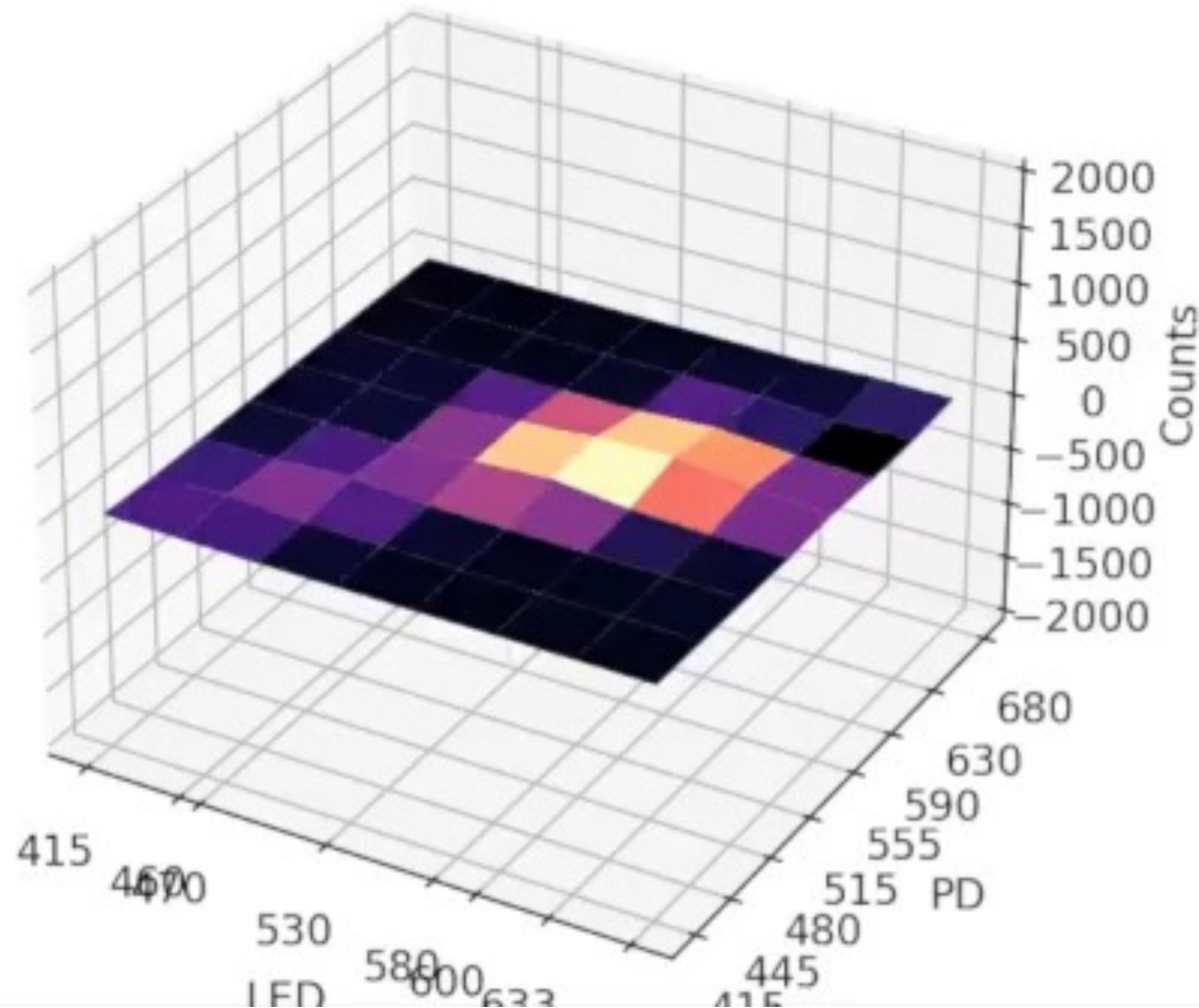
Battery Life

Form Factor

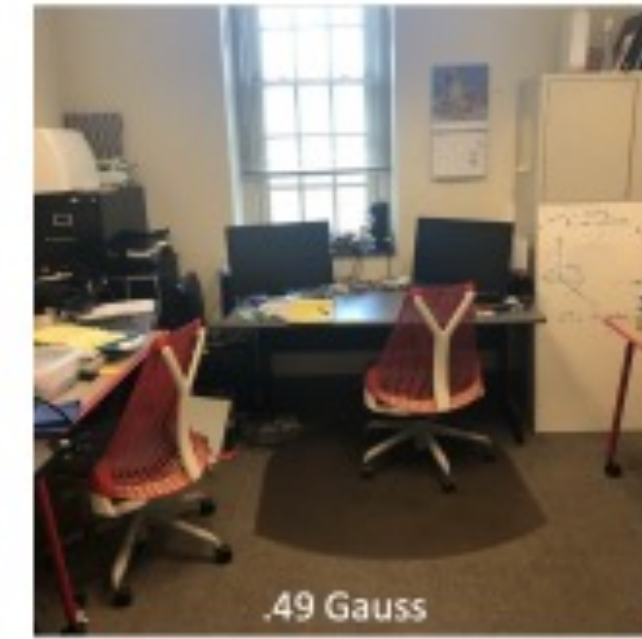


# Removal of Environment

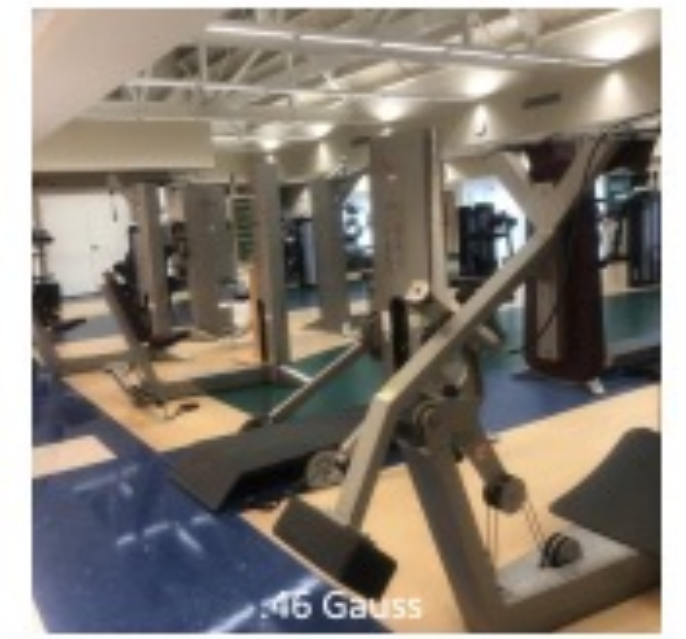
## Dynamic Environments



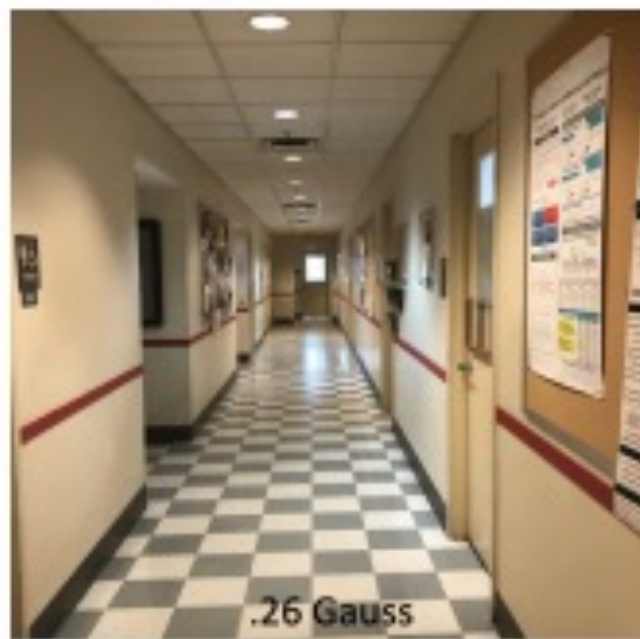
(a) Outside



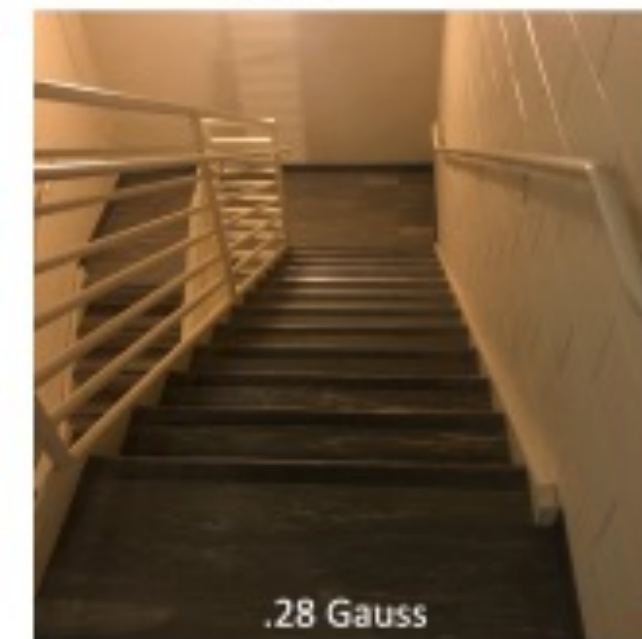
(b) Lab



(c) Gymnasium



(d) Hallway



(e) Stairwell



(f) Elevator

Footprint

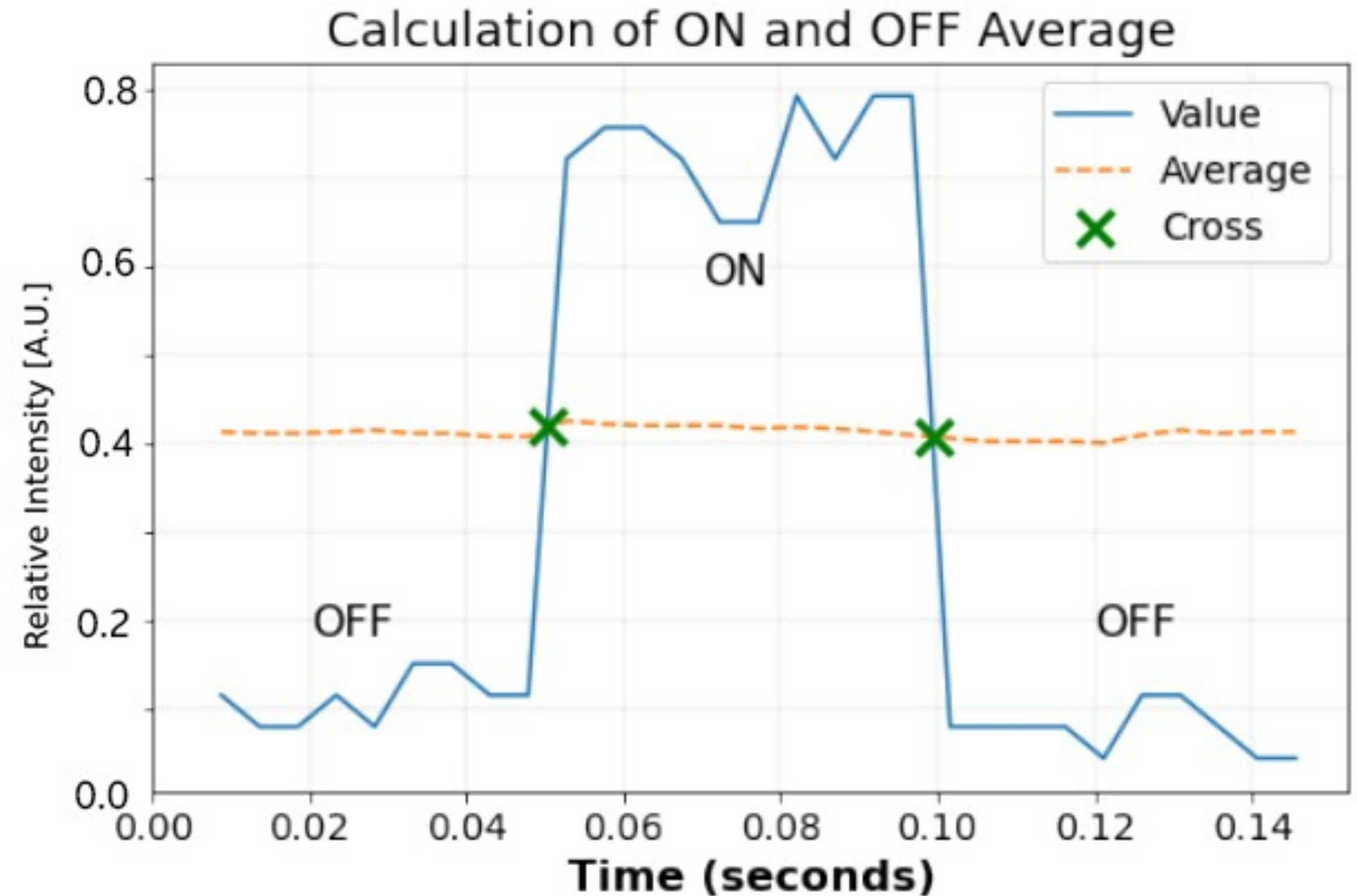
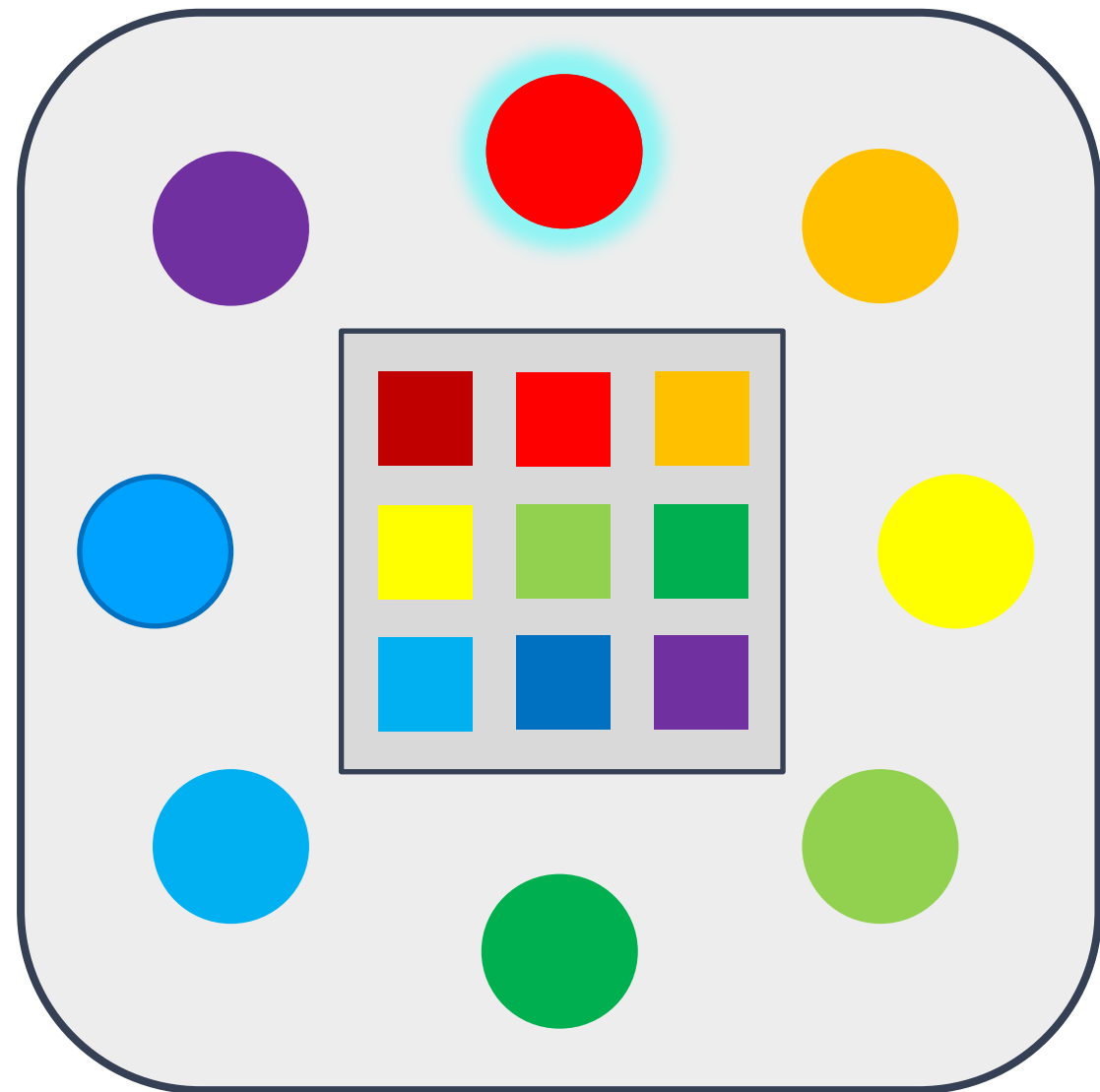
Environment

Battery Life

Form Factor



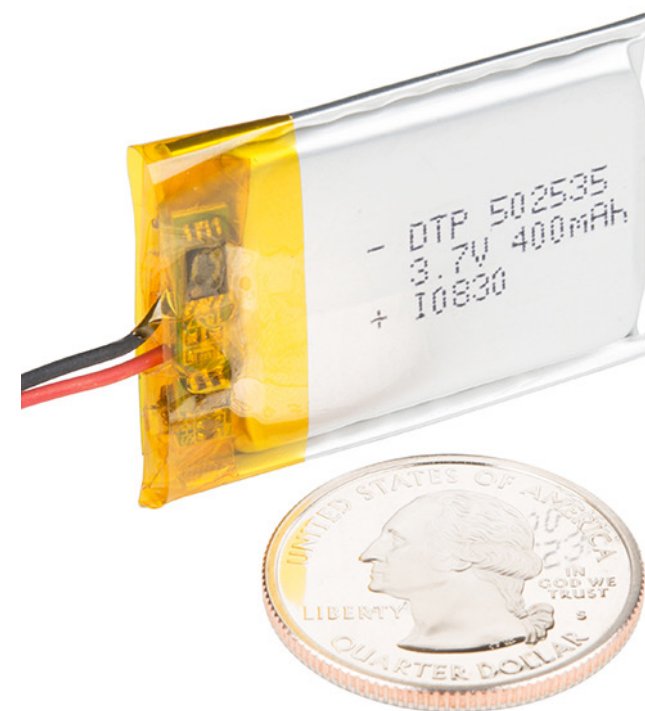
# Removal of Environment



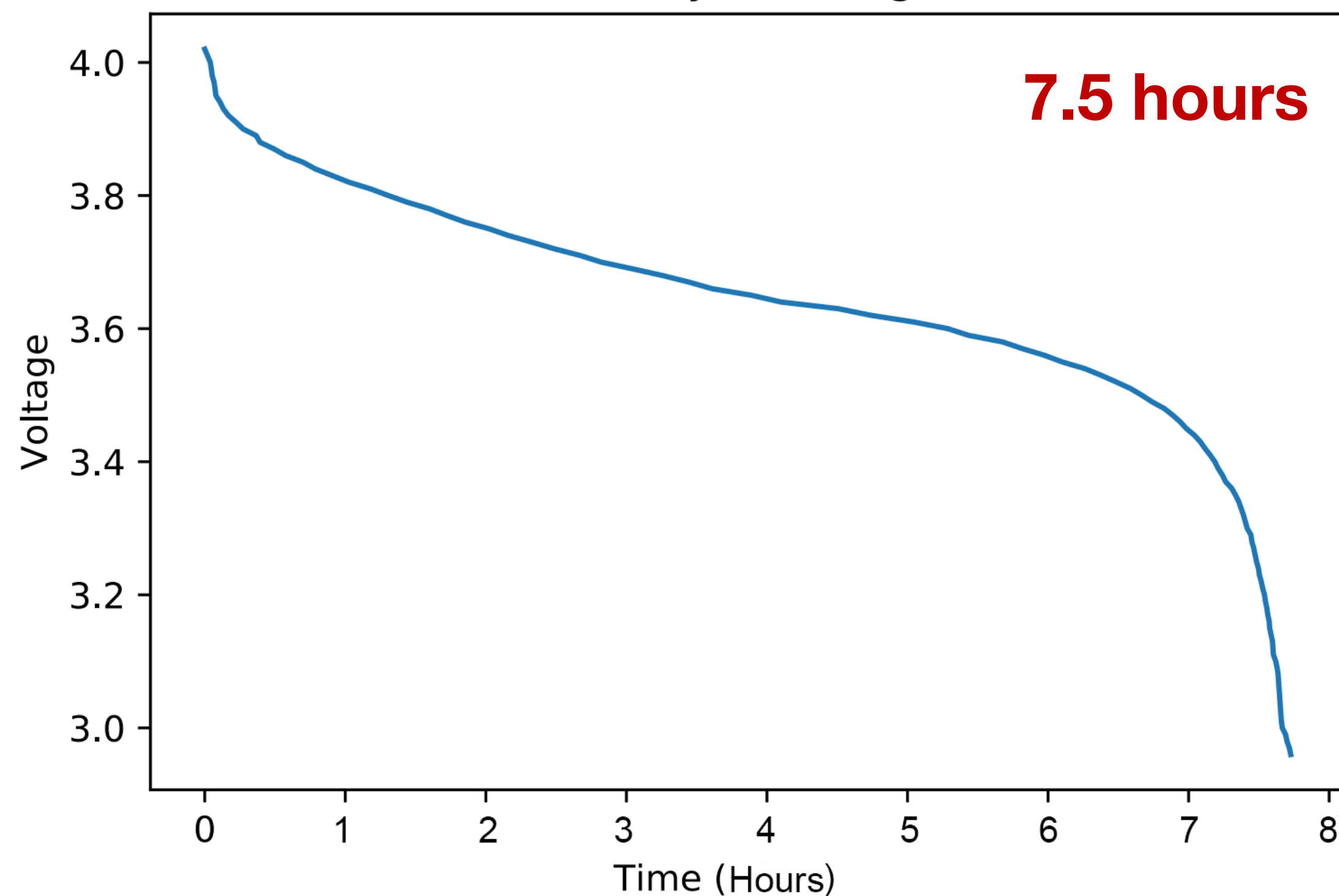
Off: Environmental Reading  
On: Environmental + Lumos Reading



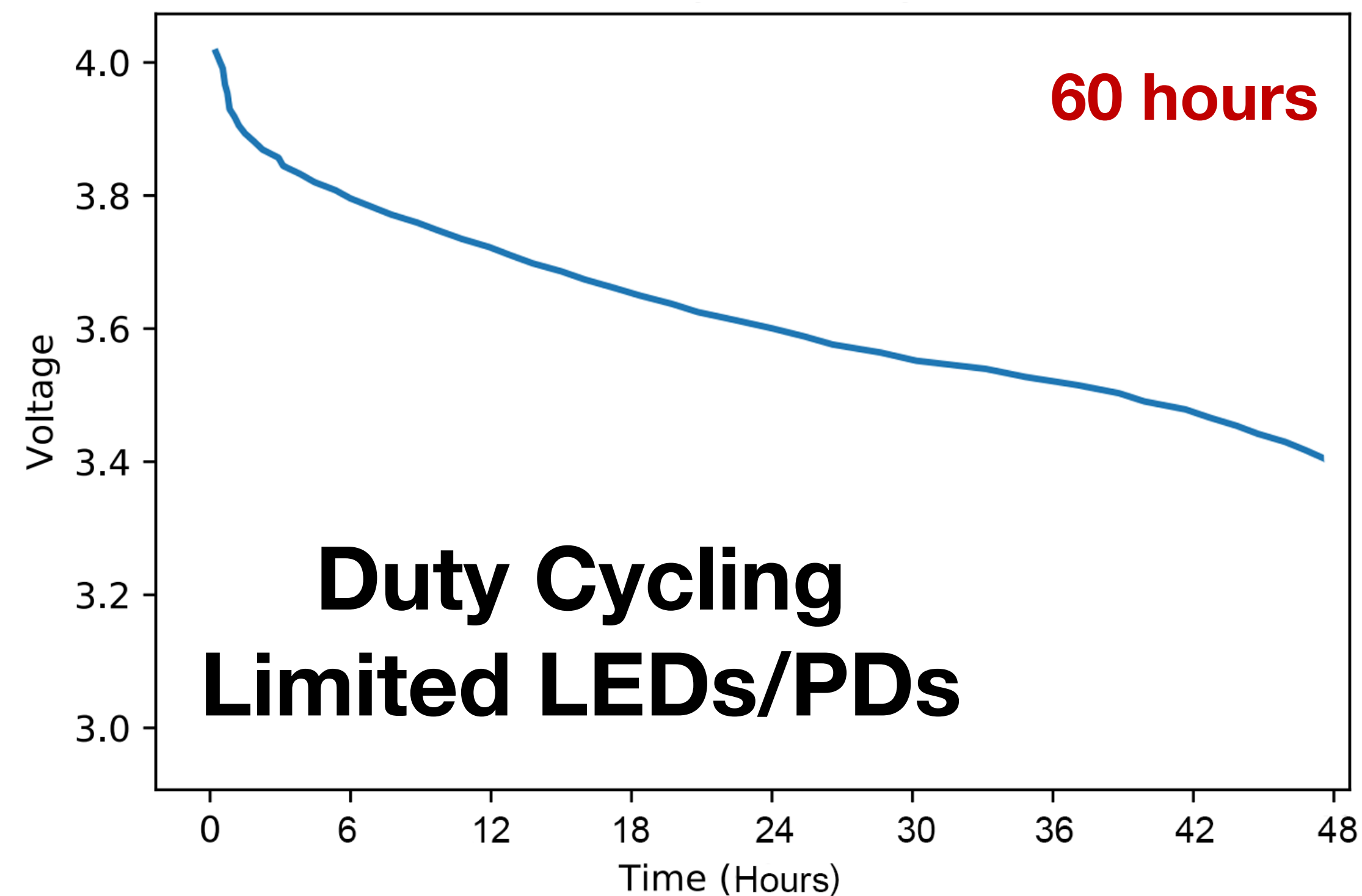
# Battery Life



### Max LED/PD Usage



### Max Battery Life



Footprint

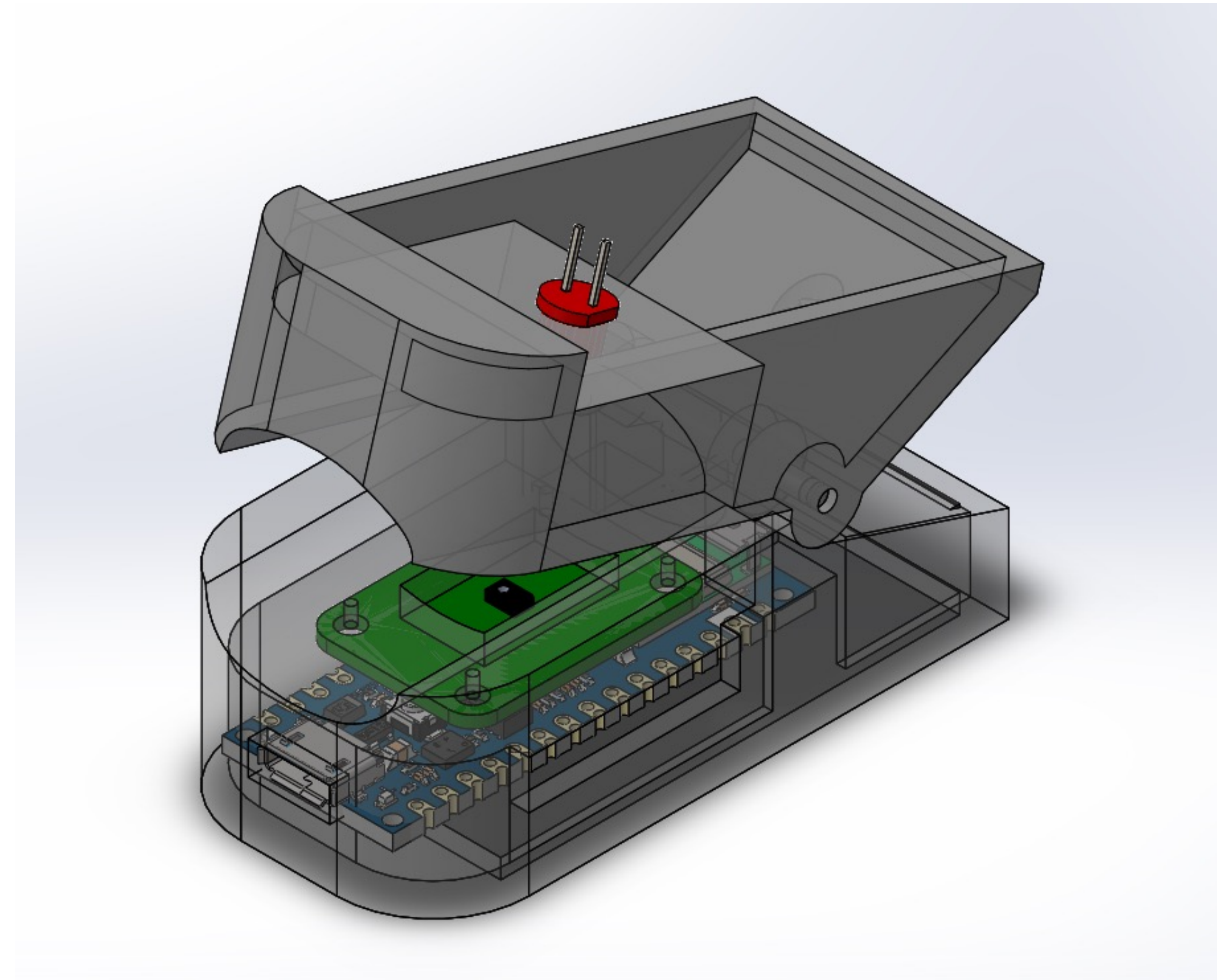
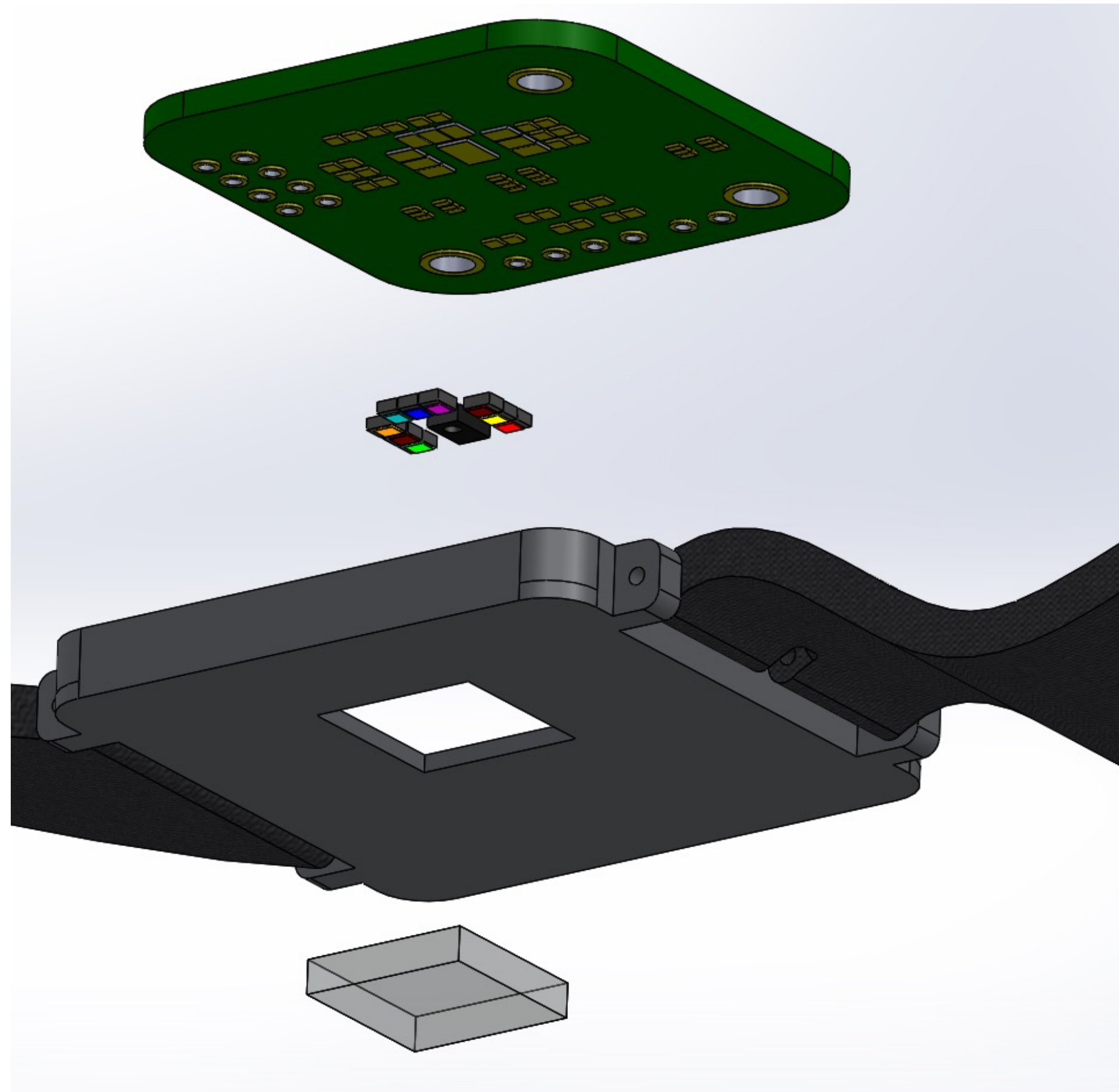
Environment

**Battery Life**

Form Factor



# Form Factor Design



Footprint

Environment

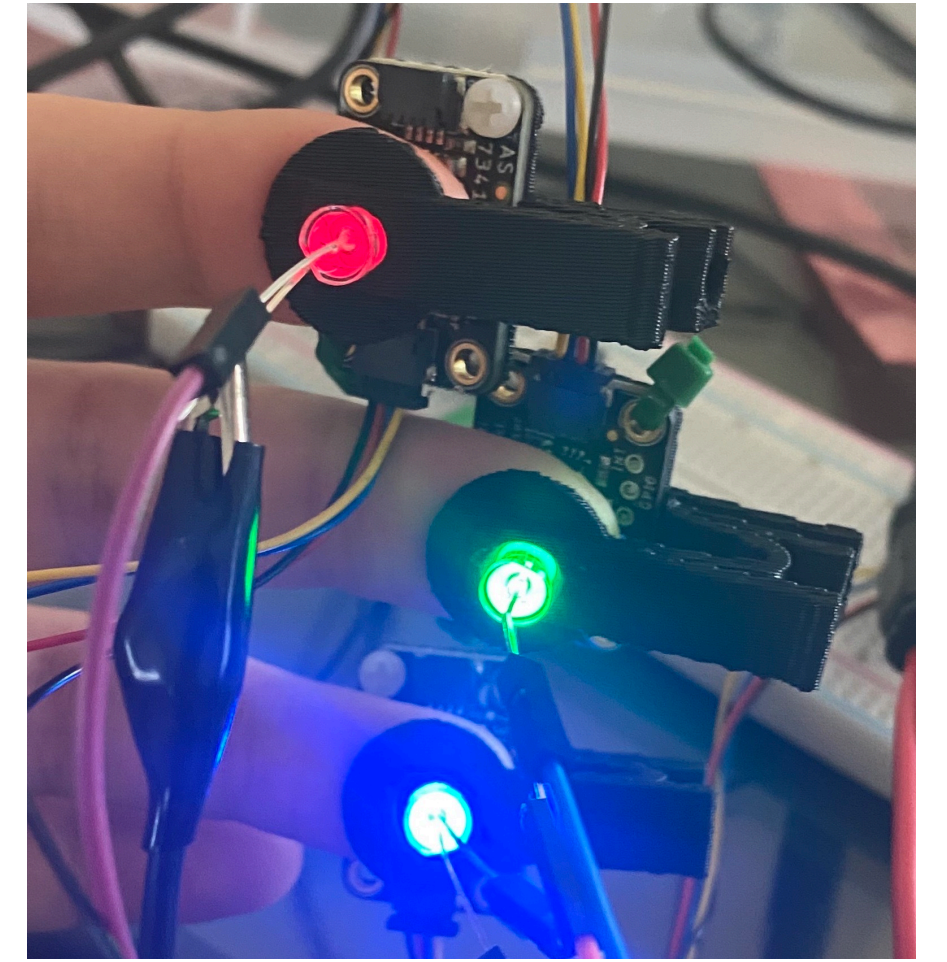
Battery Life

**Form Factor**

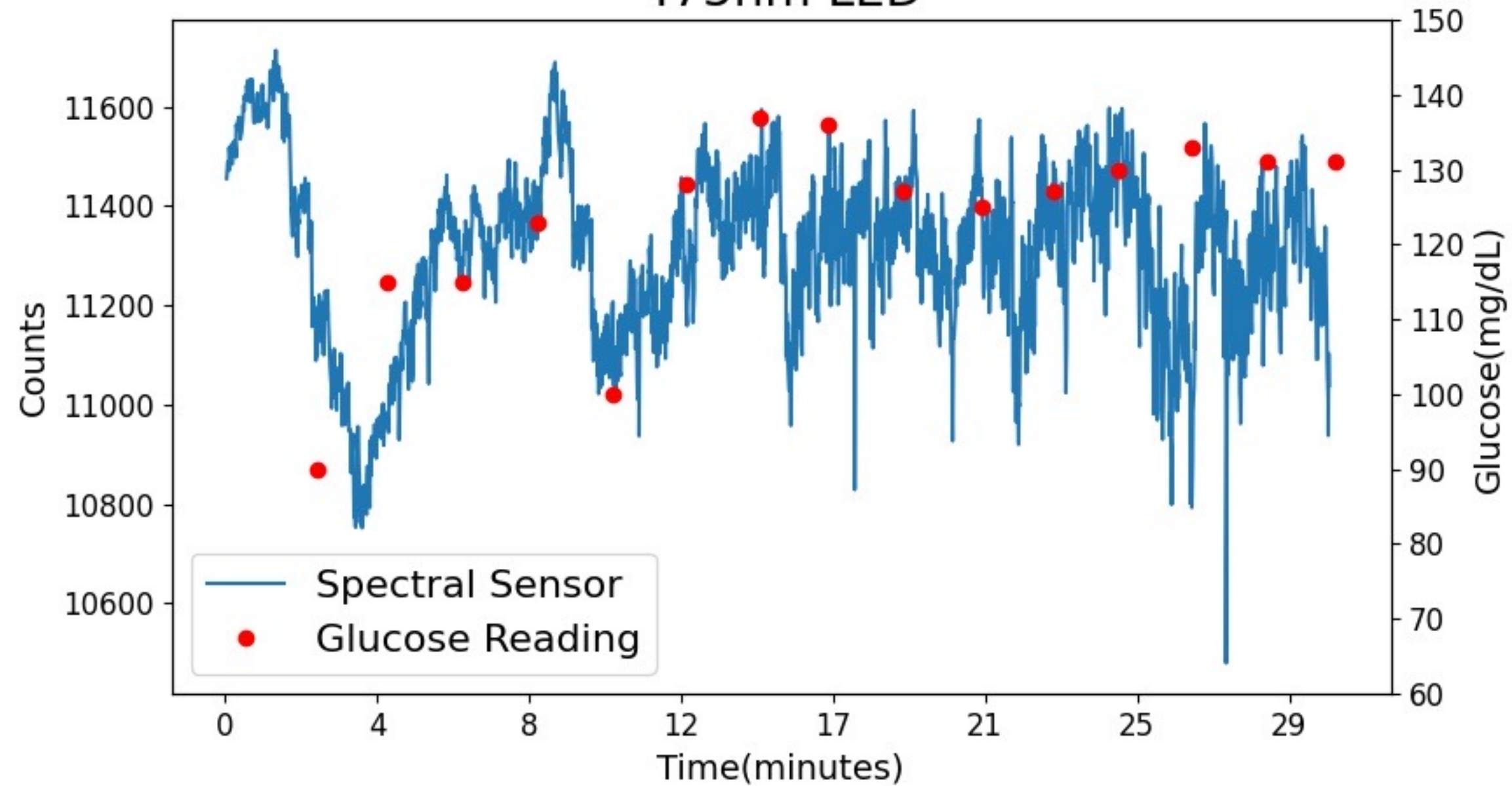


# Applications – Glucose Monitoring

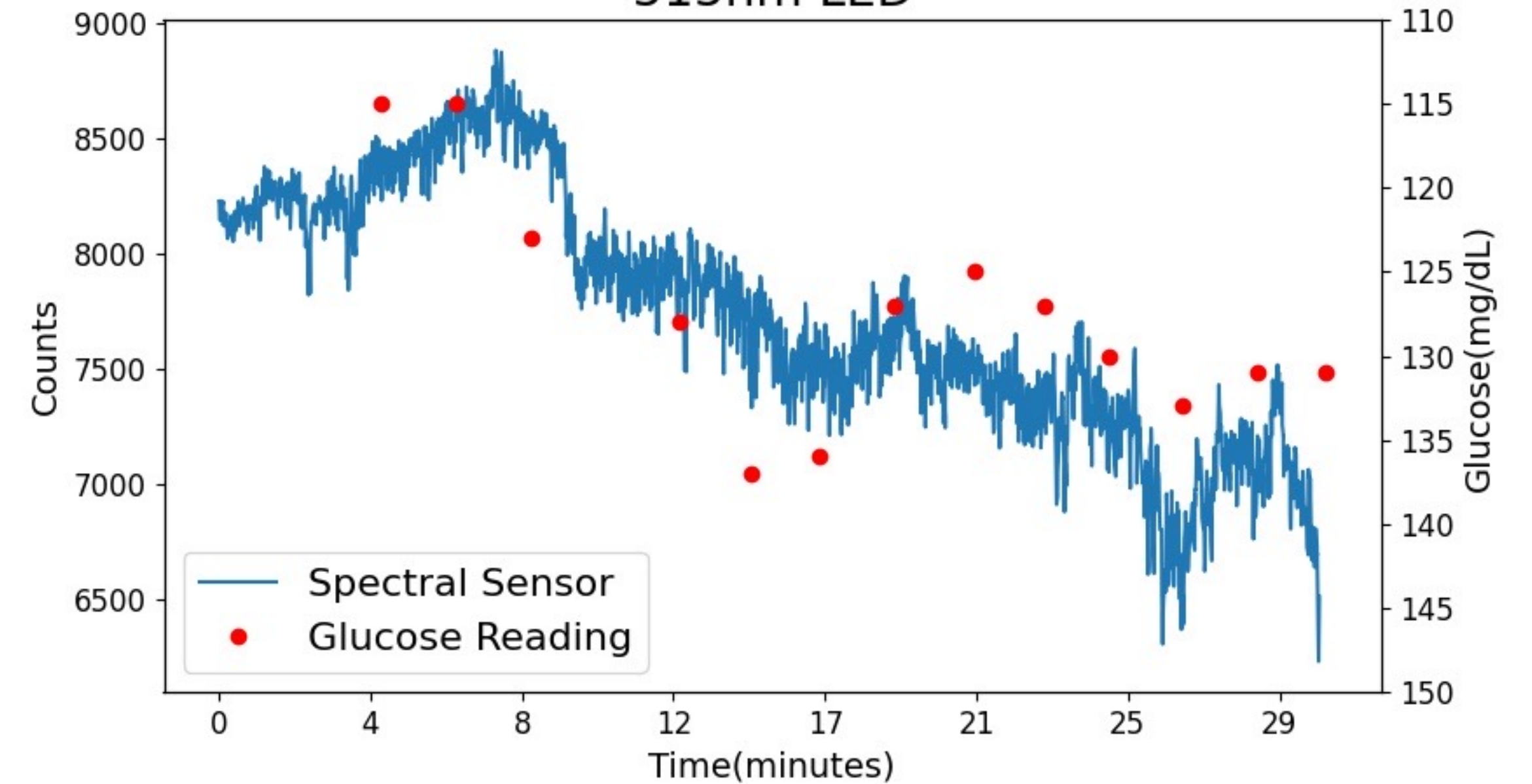
## Using Individual LEDs



475nm LED



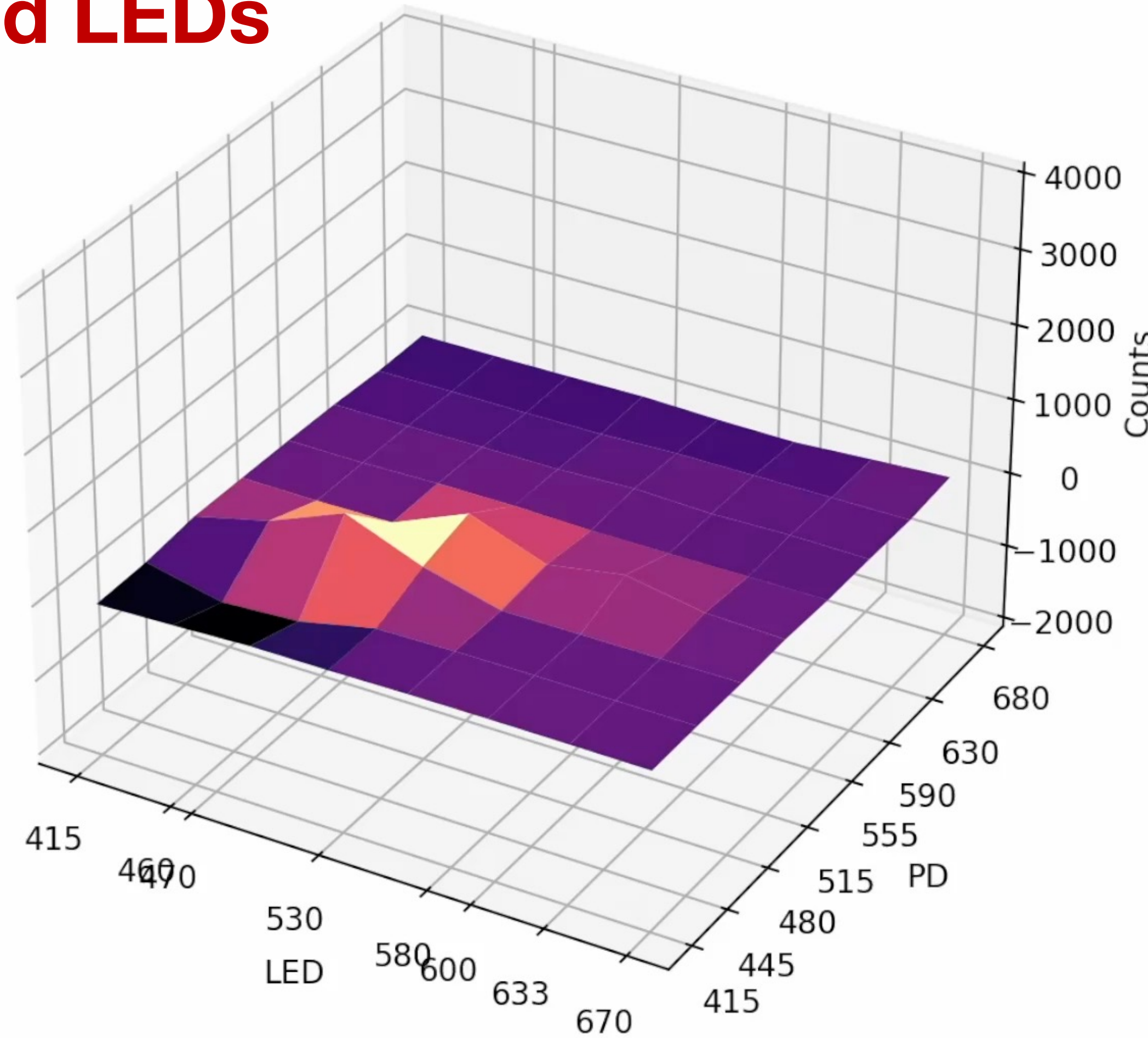
515nm LED





# Applications – Glucose Monitoring

Using all PDs and LEDs

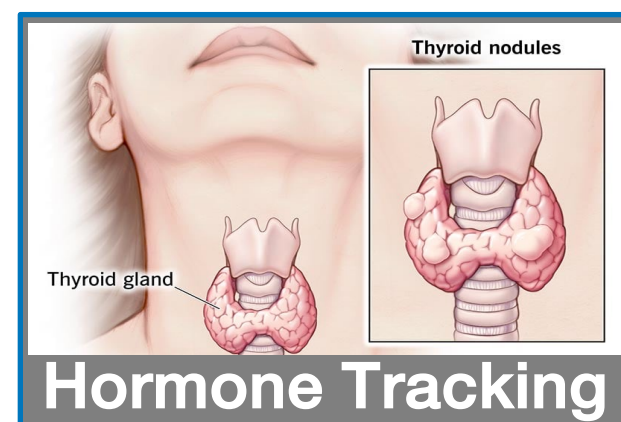
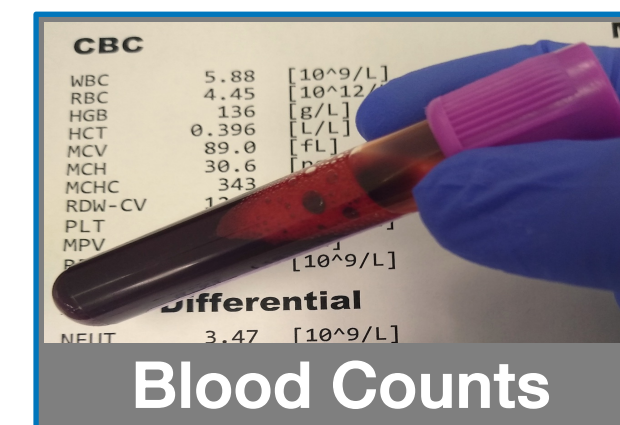
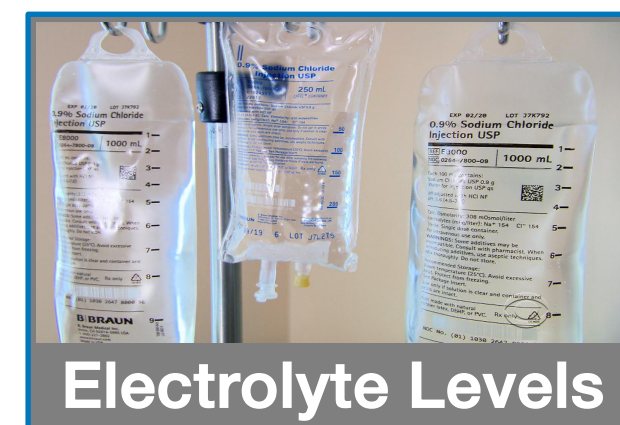
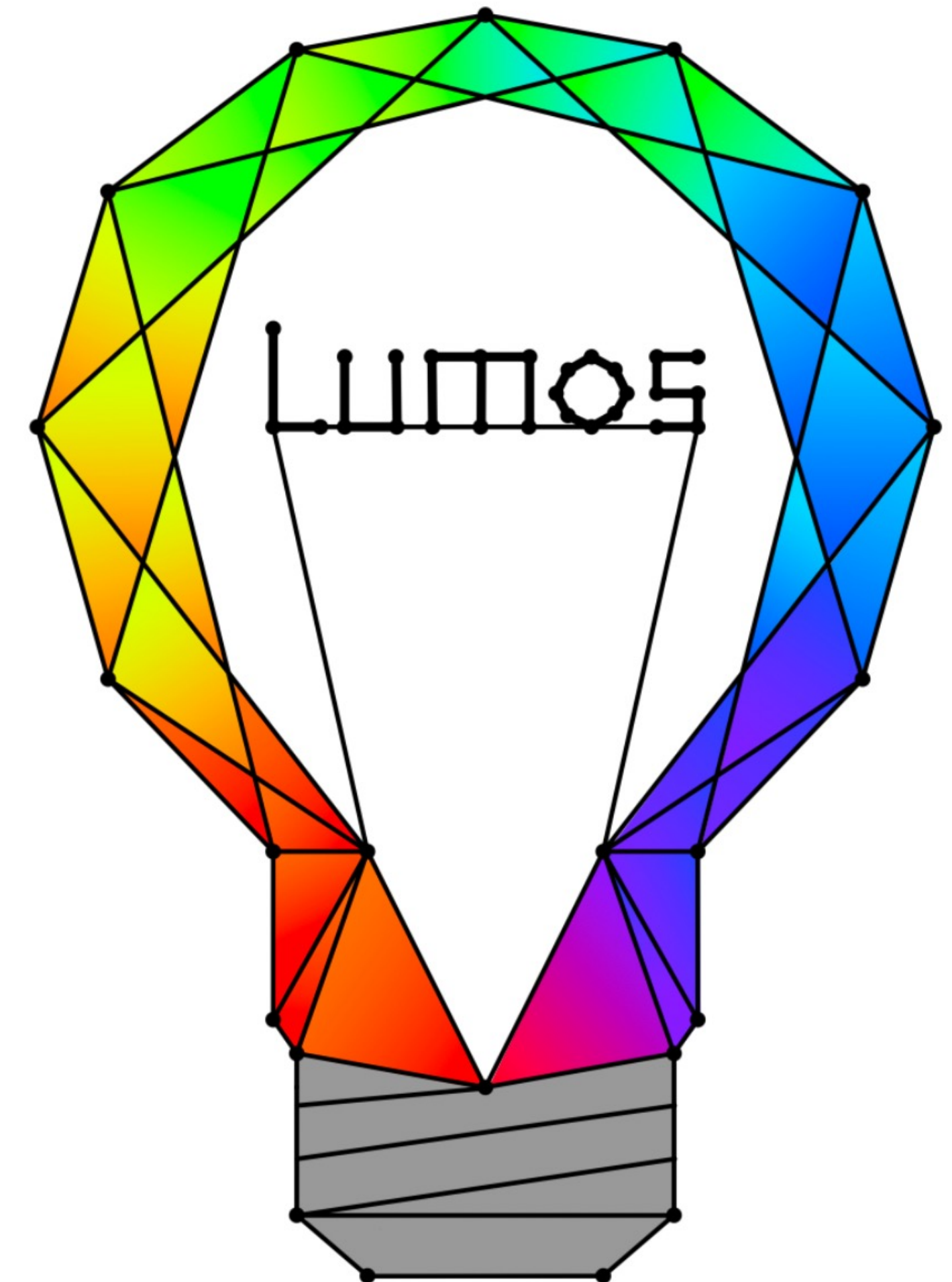


1.25 Hour Timelapse



# Conclusion and Future Work

- Lumos is a wearable optical spectrometer that is enabling noninvasive biomarker monitoring
- Future Work:
  - Optimization of battery life vs sensing fidelity
  - Simultaneous sensing of biomarkers
- Applications:





**Thank You!**



**UVA ENGINEERING**

**LINK LAB**