DAD:
Dismount Alert Design

Addressing the issues with Dismount Zones across Rice University's campus

Our Team

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Electrical and Computer Engineering

What are Dismount Zones?

Dismount Zones are areas of high pedestrian foot traffic

- People riding vehicles must dismount when entering these dismount zones
- Dismount Zones commonly have sharp corners and blind spots

The goal of dismounting is to prevent injury to riders and pedestrians

Flaws of the Current System

Signboards

(Most common alerting mechanism)

- Frequently relocated or stolen
- Broken or have missing components
- Unclear perimeter of dismount zone

6/22 dismounted ~ 27%

Our team seeks to develop a technological system that would increase on-campus safety and decrease rider-related collisions.

Dismount Alert System Design Constraints

	Design Criteria	Target Value
Constraints	Abide by FCC Wireless Communication Regulations and US Privacy Protection Laws	0 infractions caused by the device.
	Abides by the Americans with Disabilities Act of 1990	0 infractions caused by the device.

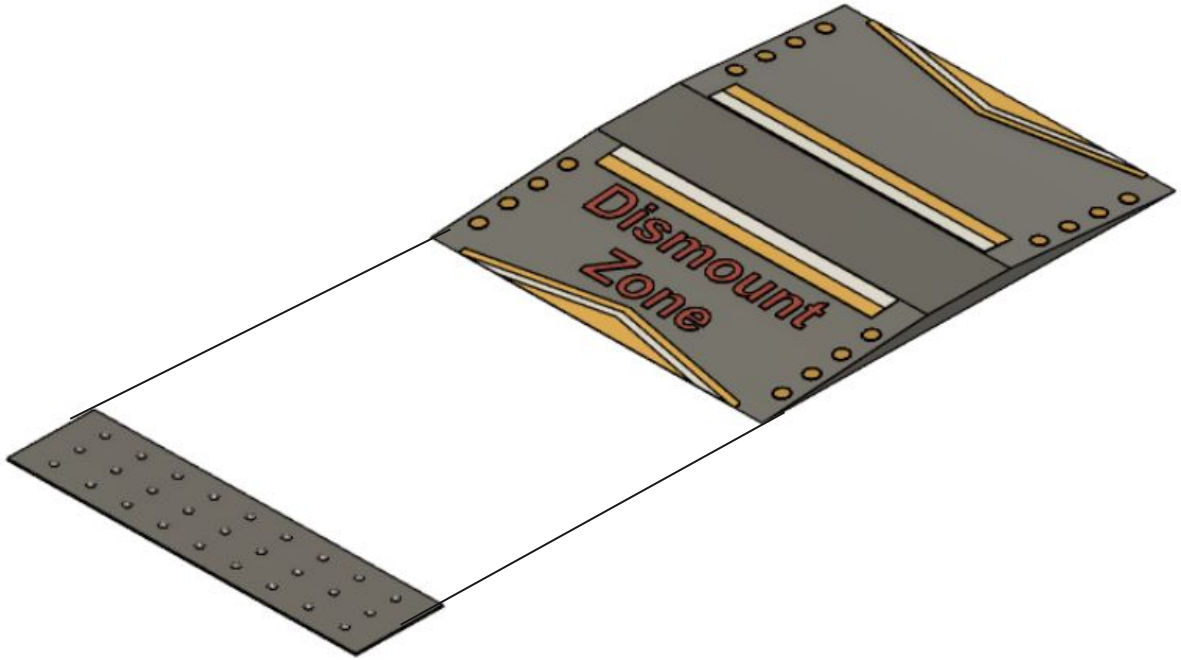
Dismount Alert System Design Objectives

	Design Criteria	Target Value
Objectives	Ease of Understanding the Alert System	Scores at least a 4 on user defined scale[1].
	Endurance	System can be submerged under water for 30 minutes, withstands all dust, and shows no decrease in effectively alerting users over a week of testing.
	Secure Technology	Removal time ≥1 hour without power tools and ≥30 minutes with power tools.
	Low Cost	Total cost of the system is ≤$150.
	Unobtrusive	From 8-10 meters away, the system is ≤50% in view.
	Reproducibility	System can be replicated with the given full set of instructions.

Design Objective User-Defined Scale

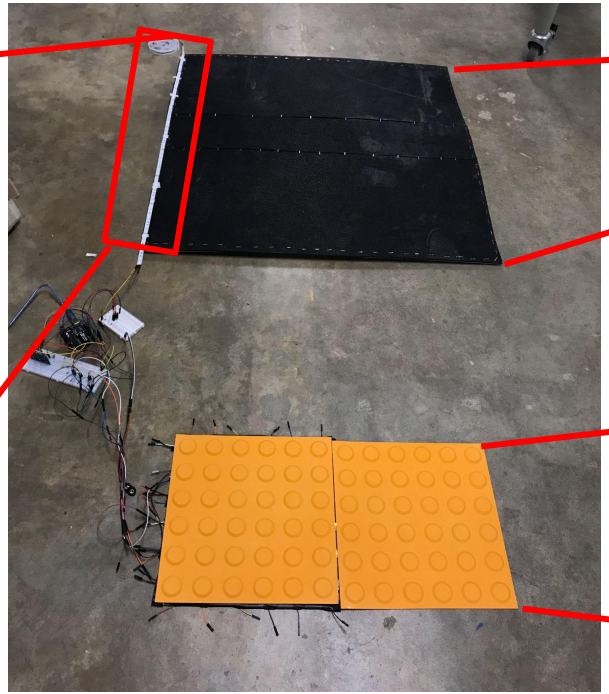
[1] Ease of Use User-Defined Scale	
5	The alert is intuitive for the user to understand.
4	**User understands the alert's meaning once told.**
3	User is aware of the alert's presence.
2	User is confused about the alert's function.
1	The alert is impossible for the user to understand.

The Selected Solution



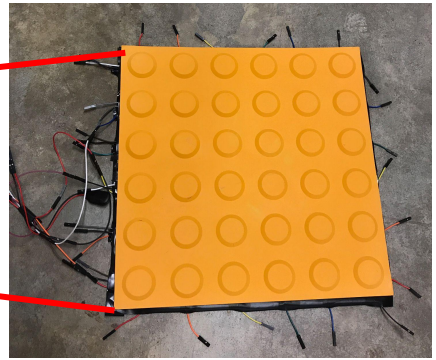
Our Prototype

LED Lights



Speed Hump

Truncated Domes Force Plate

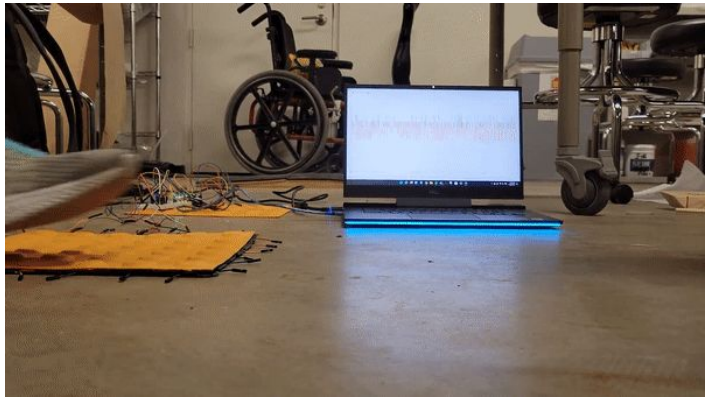


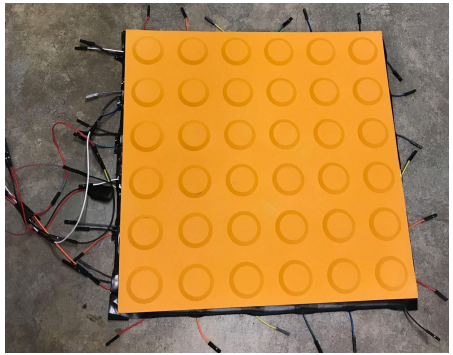
Prototypes: Speed Hump

Components/Materials	Purpose
Gym mat	Traction
Underside planks	Weight and Support
Hot glue	Attachment
Long staples and staple gun	Attachment

Prototypes: Truncated Domes & Electronics

Materials
Velostat
Copper wires



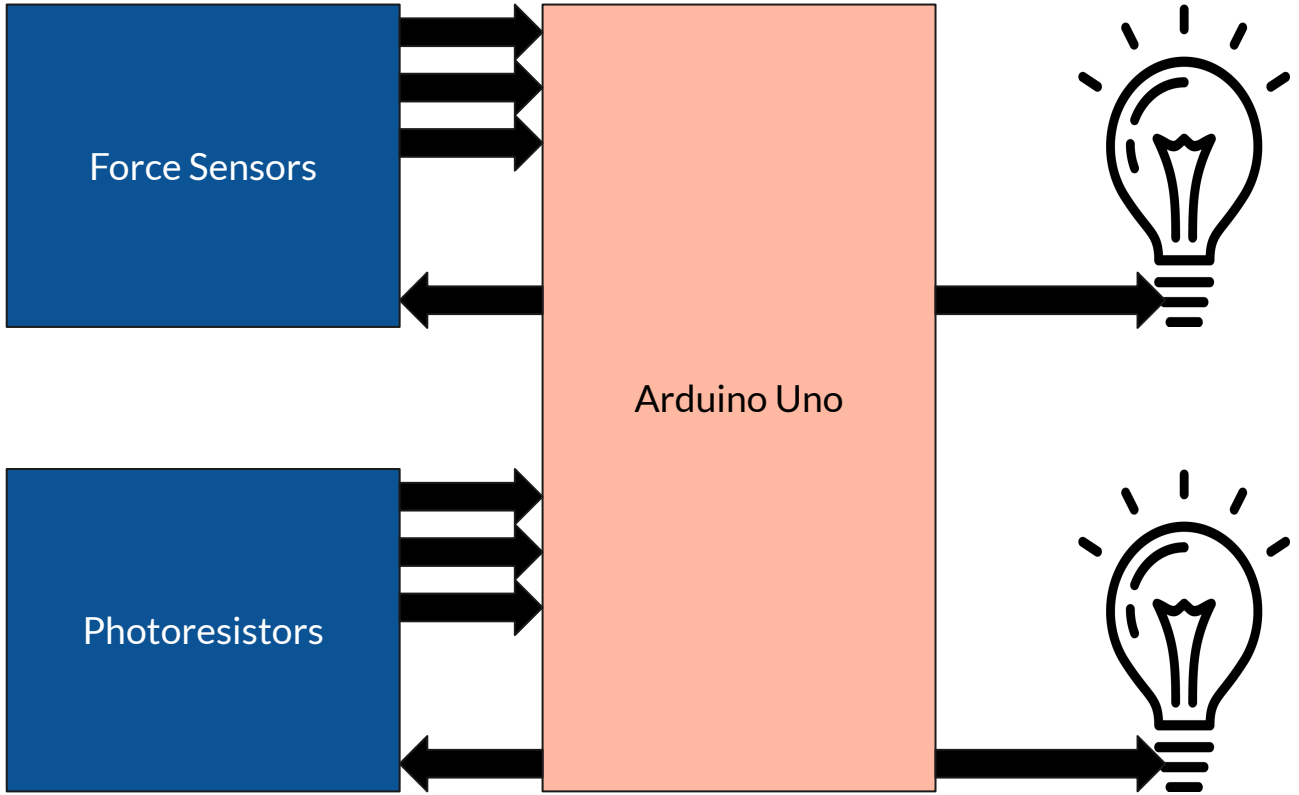


Top

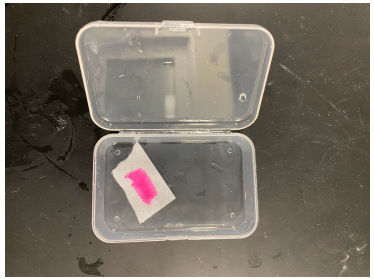
Inside

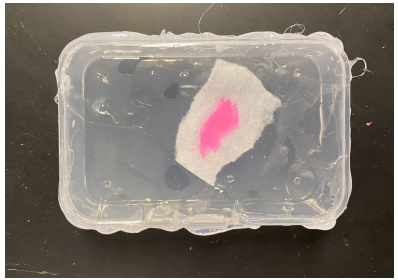
Electronics Box

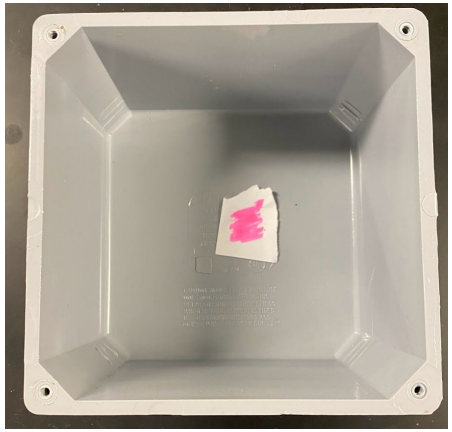
Electronics Overview



Testing Endurance — Waterproofing of Electronics Box



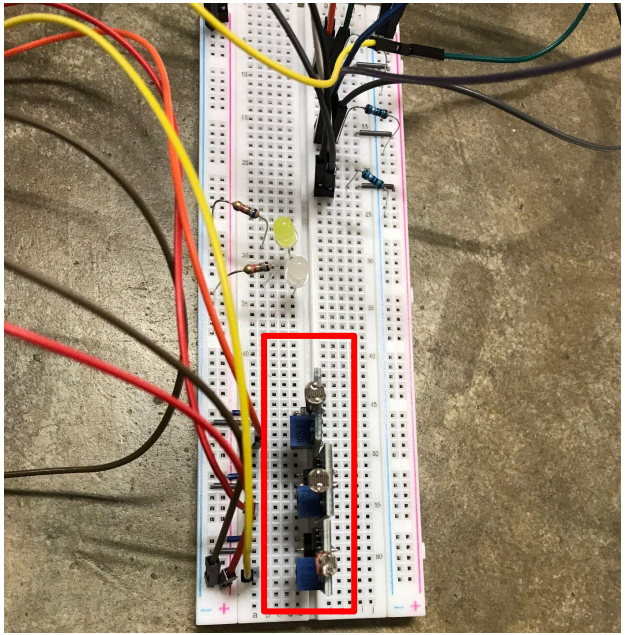




Endurance	System can be submerged under water for 30 minutes, withstands all dust, and shows no decrease in effectively alerting users over a week of testing.

Material	**Water Entry?**
Plastic Box (no sealant)	Yes
Plastic Box (hot glue)	Yes
IP57 Junction Box (rubber gasket)	No
IP57 Junction Box w/ knockouts	No

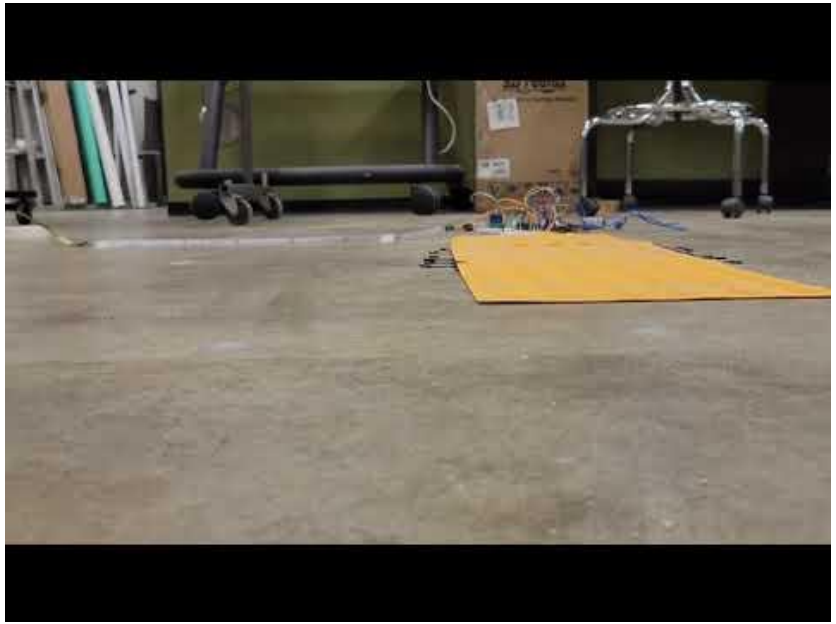
Testing Ease of Understanding — Light Sensor Functionality



Light Sensors (photoresistors)

Light Exposure	Activated Light?
Indoor: Full light exposure	No
Indoor: Shadow	Yes
Indoor: Complete Darkness	Yes
Outdoor: Light (12:00 pm)	No
Outdoor: Mostly Dark (6:00 pm)	Yes
Outdoor: Dark (9:00 pm)	Yes

Testing Ease of Understanding — Force-Activated Light Functionality



Testing Condition	Tests Conducted	Activated Light?
Exposed Sensor	15	No
Sensor with Truncated Dome Attached	50	No
160 lb Person Stepping On Sensor	20	Yes
200 lb Person Stepping on Sensor	50	Yes

Testing of Endurance — Compressive Resistance

Weight	Break?
~100-200 lb person stand	No
~100-200 lb person jump	No
3 people (over 500 lb) stand	No
3 people (over 500 lb) jump	No
~100-200 lb person + wheelchair	No
~100-200 lb person + scooter	No
~100-200 lb person + bike	No
2 people + golf cart	TBD

Testing Traction—Efficacy of Gym Mat

Test	Slippage?
No mat: Shoes - dry	Yes
No mat: Wheels - dry	Yes
Mat: Shoes - dry	No
Mat: Shoes - wet	No
Mat: Wheels - dry	No
Mat: Wheels - wet	No

Testing Unobtrusiveness (+Ease of Understanding)

27%

Dismounted w/ sandwich board

48%

Dismounted w/ floor sign

- Height: 40” → 1”
- Scan landscape: ¼ as visible as sandwich board
- Unobtrusive (less visible), but more effective

Progress Towards Design Criteria

Design Criteria	Met with testing?
Ease of Understanding	Yes
Endurance	Yes
Secure Technology	TBD
Low Cost	Yes
Unobtrusive	Yes
Reproducibility	TBD

Successes and Limitations

Successes:

- Achieves intended functionality (alert mechanism)
- ADA accessible
- Efficient production
- Cost effective (<$150)

Limitations:

- Materials may not be able to withstand heavier weight
- No mounting mechanism yet
- Efficacy & effect unknown (user testing)
- No indication of “Dismount”
- Need full assembly
- Need more user input/ user testing for prototype

Preview of Future Plans

Ease of Understanding:

- User testing
- Distinguish between pedestrian and riders

Endurance:

- Waterproofing: junction box with knockouts
- Compression tests with golf cart

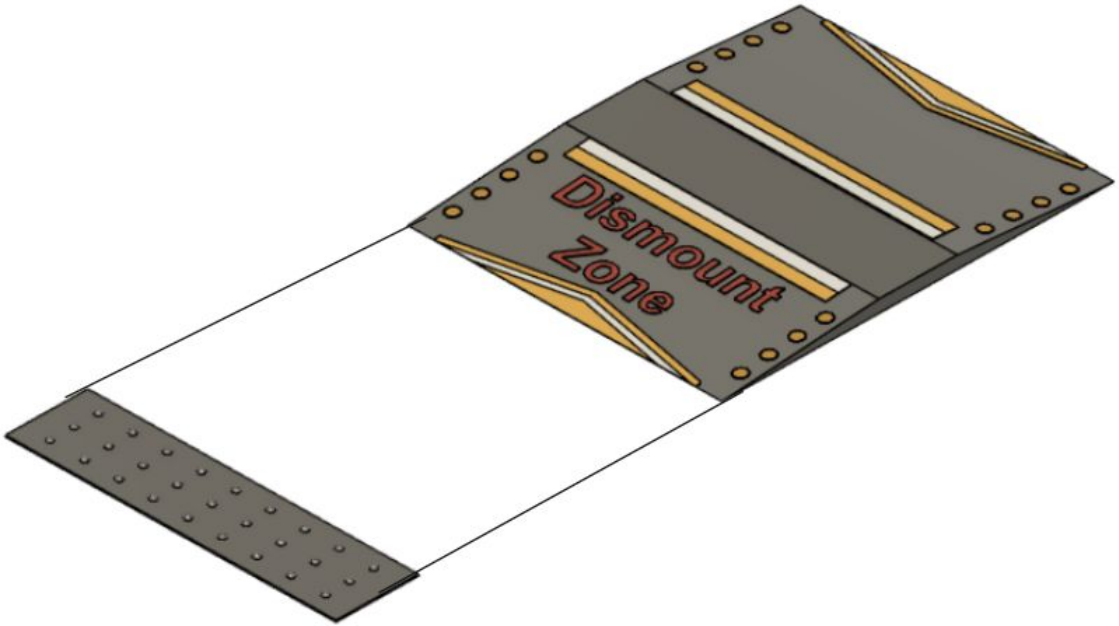
Security:

- Mounting mechanism

Aesthetics:

- Add lights
- Implement lighting that says “Dismount”

Summary & Conclusion



Final Design:

- Ridged Speed Hump
- ADA Accessible
- Alerting Mechanisms
  - Ridged Tactile Design
  - Active Lighting System

Addresses the Problem and Flaws of Current System:

- Promotes safety within Dismount Zones
- Clearly delineates Dismount Zones
- Not easily stolen or relocated

Thank You!

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Dr. Kececi
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Lea Aden Lueck
Joseph Young
Chris Hong and Anyssa Castorina

RICE UNIVERSITY
Mobility Safety

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Oshman Engineering Design Kitchen

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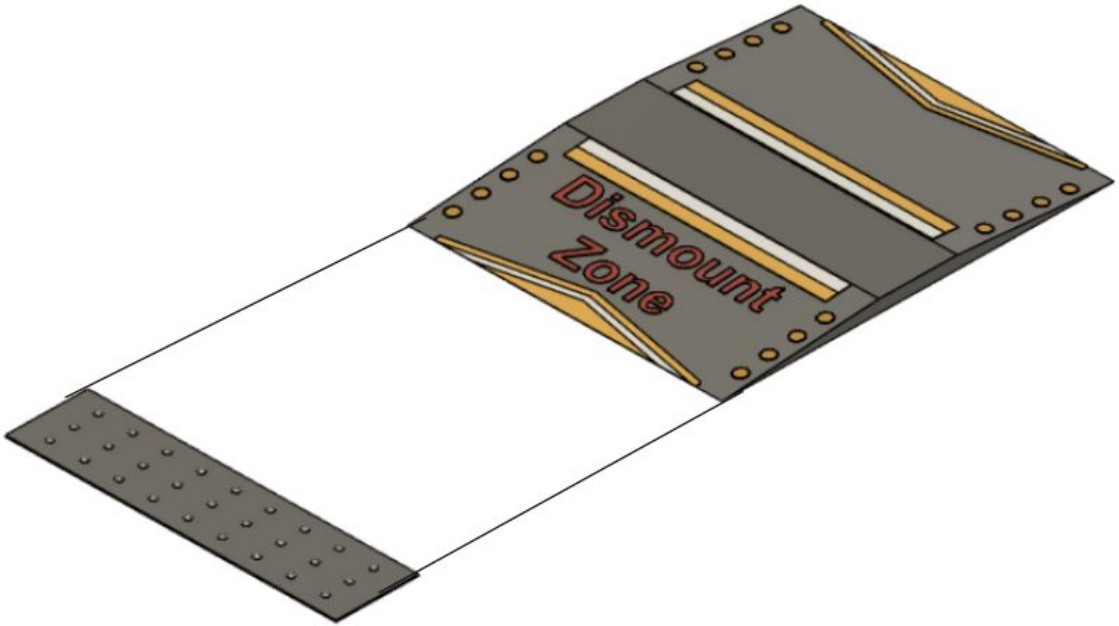

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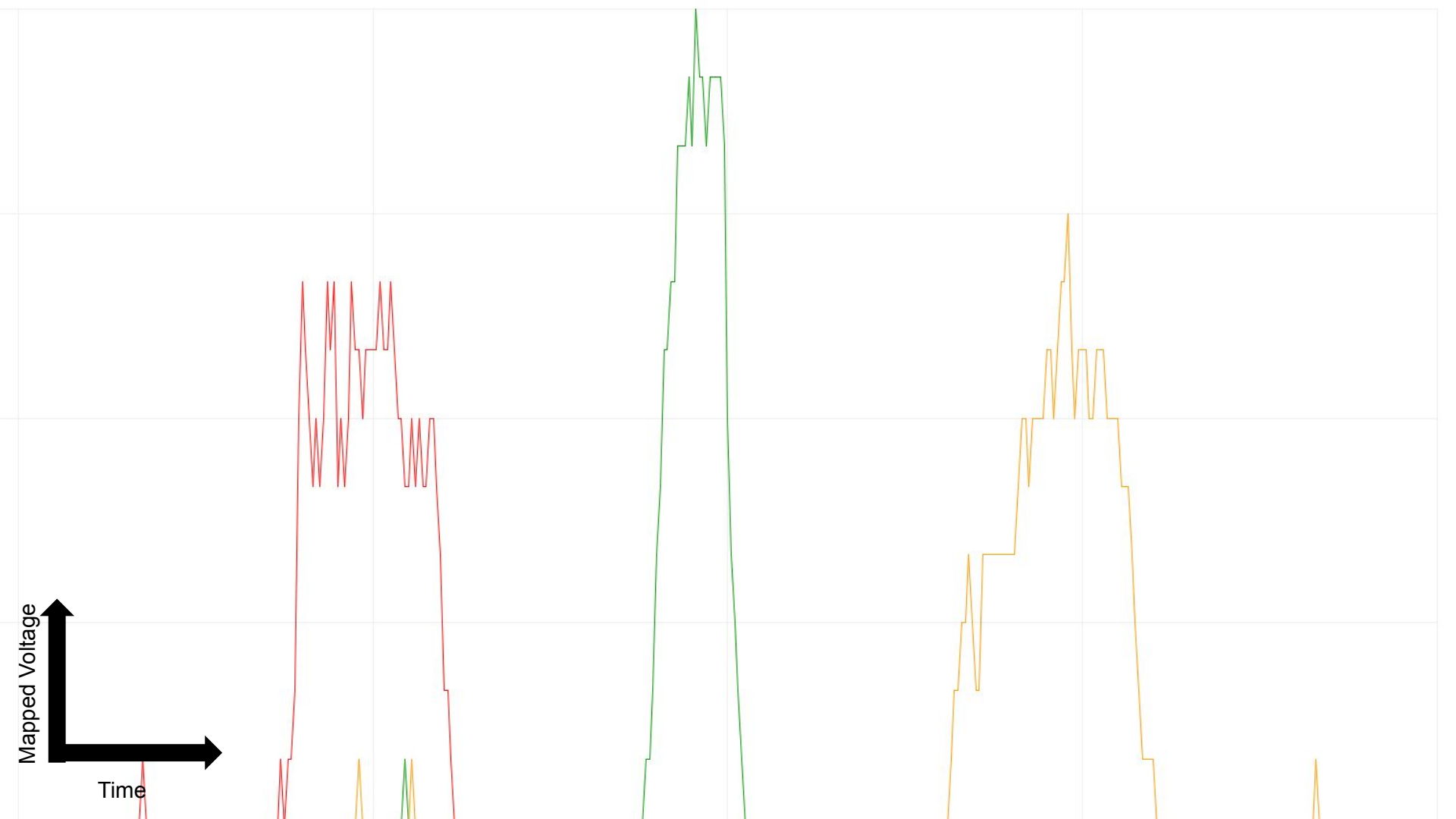
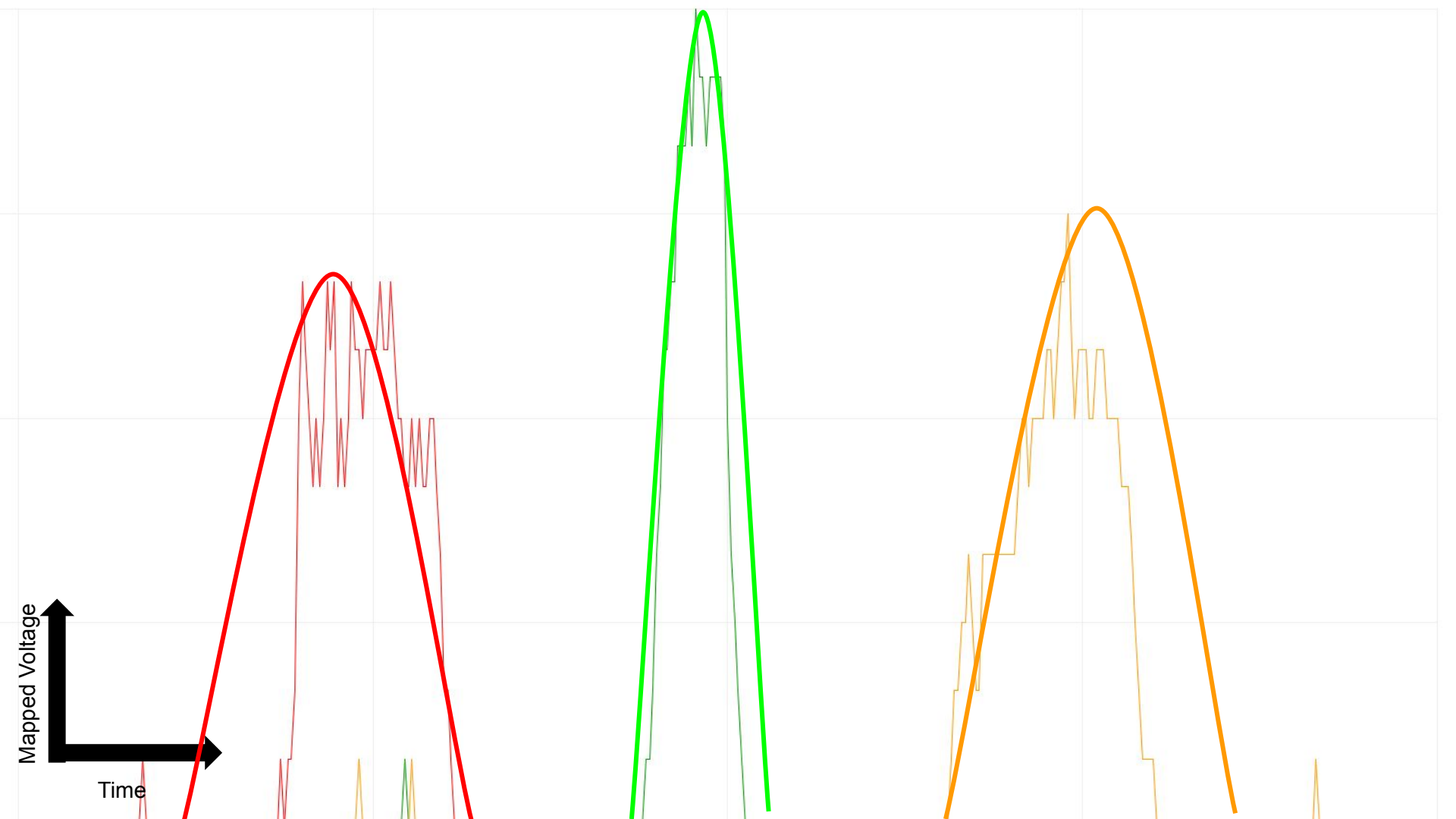

Mapped Voltage
Time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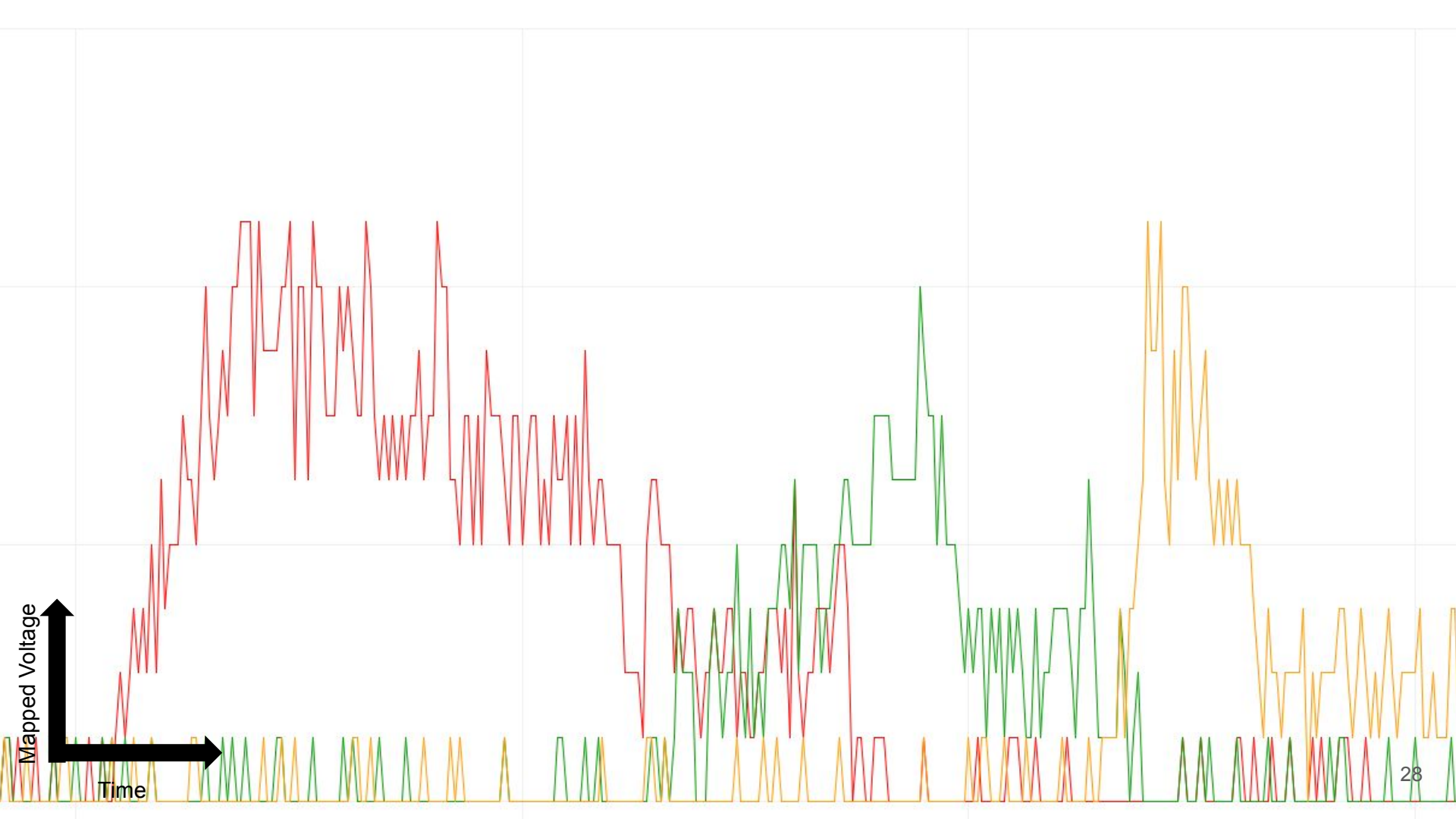
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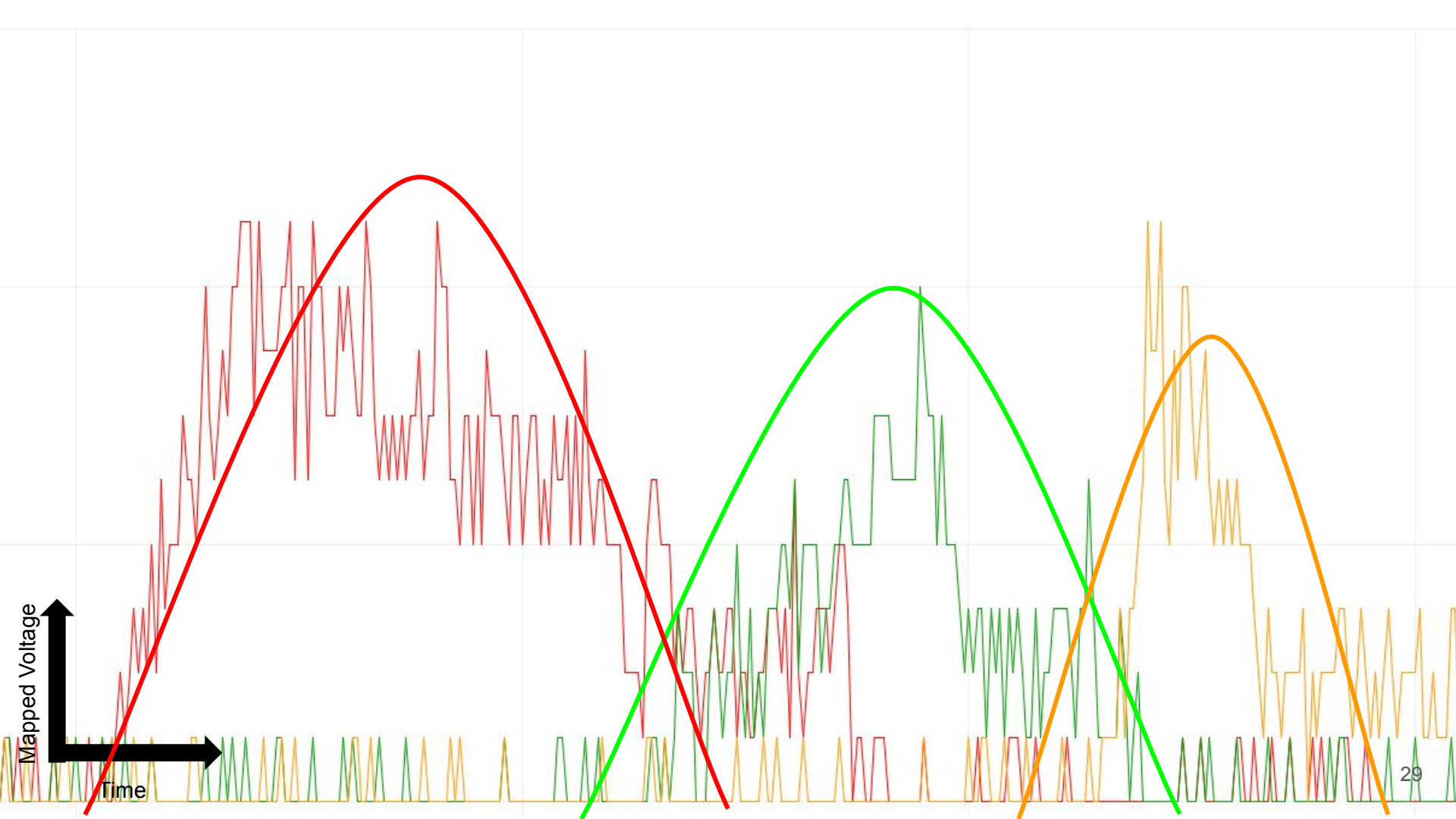
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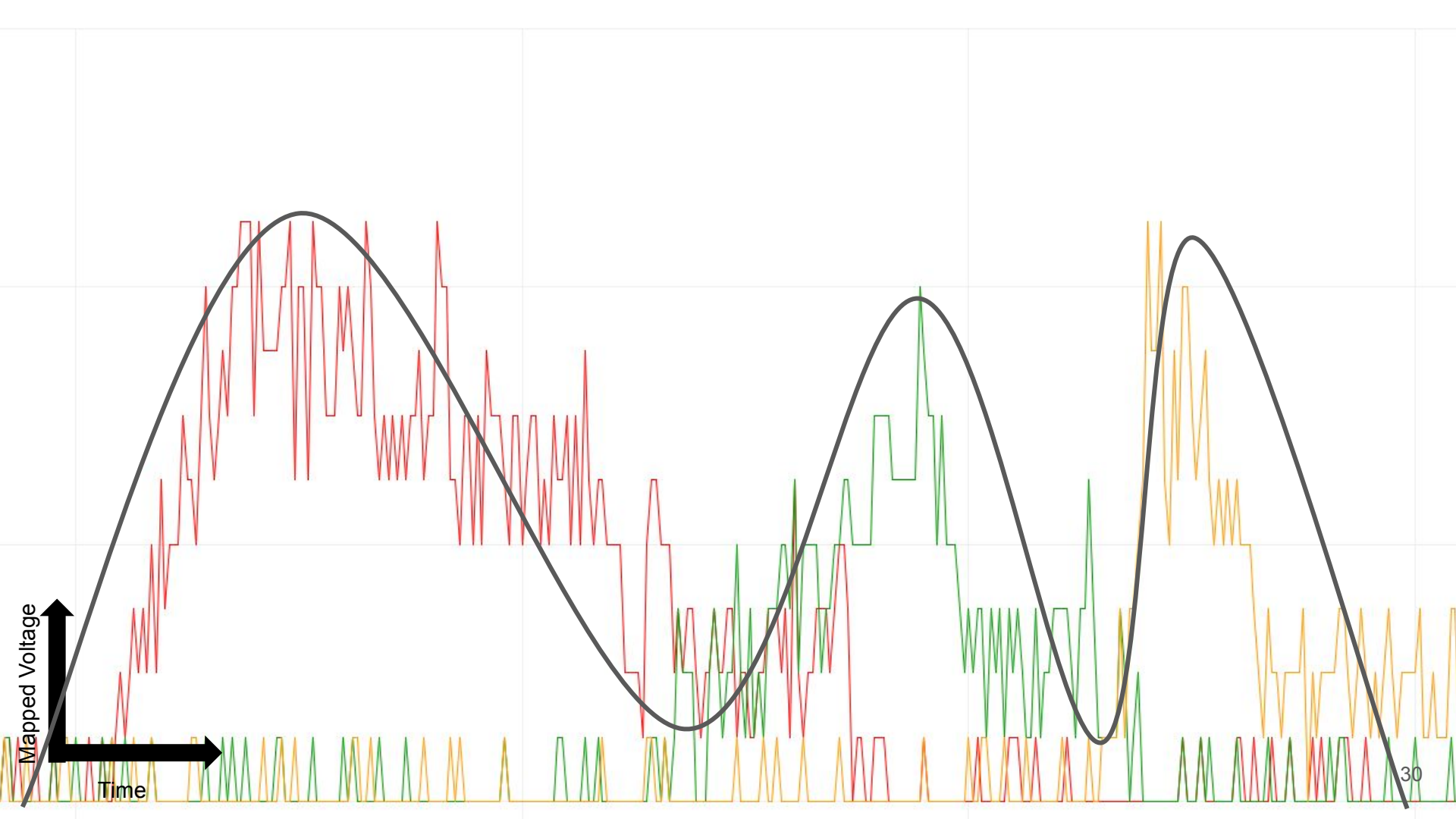
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