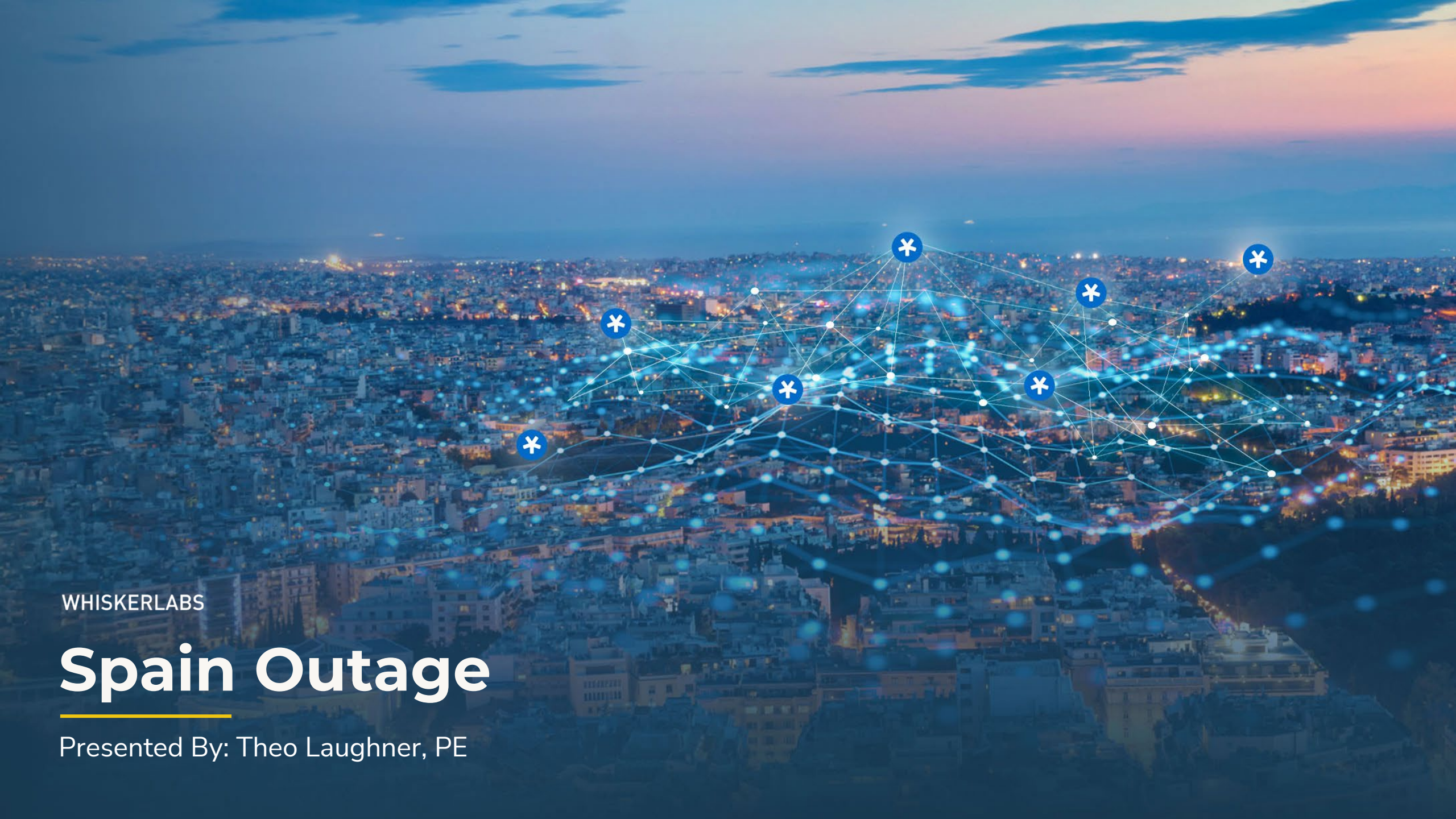


WHISKERLABS

Spain Outage

Presented By: Theo Laughner, PE

Agenda

Prevention is our purpose

- Event Summary
- Timeline
- Initial Theories
- Ting Overview
- Outage Data
- Summary

Event Summary

- On 28 April 2025, at 12:33 CEST, the power systems of Spain and Portugal experienced a total blackout.

- The following slides shows measurements collected by a distributed IOT sensor network. The sensors were connected in home electrical outlets.

- Voltage and frequency were captured for several hours prior to the grid failure at approximately 10:30 UTC.

Timeline*

UTC =CEST-2

- **12:03 – 12:07 CEST** – first period of oscillations in the grid detected and mitigated.
- **12:19 – 12:21 CEST** – second period of oscillations in the grid detected and mitigated. Since then the grid appeared stable, with no oscillations detected.
- **12:32:57 – 12:33:17 CEST** – a series of generation trips in southern Spain, the first near Granada, the second near Badajoz and the third near Seville causes a loss of 2200 MW in generation capacity.[24] Frequency decreased and voltage increased.
- **12:33:18 – 12:33:21 CEST** – grid frequency of the Iberian Peninsula drops below 48.0 Hz. Automatic load shedding is activated.
- **12:33:21 CEST** – AC lines between France and Spain tripped.
- **12:33:24 CEST** – grid collapsed completely, the HVDC between France and Spain tripped.
- **12:44 CEST** – first 400 kV Spain–France AC line is re-energised.
- **13:04 CEST** – Spain–Morocco interconnect re-energised
- **?? – 13:30 CEST** – Spanish hydro power stations capable of black start begin their black start procedures.
- **13:35 CEST** – AC line between Spain and France on the eastern coast is re-energised.
- **16:11 CEST** – first black start capable power plant in Portugal manages to start.
- **17:26 CEST** – second black start capable power plant in Portugal manages to start.
- **18:36 CEST** – 220 kV line between Spain and Portugal is re-energised.
- **21:35 CEST** – 400 kV line between Spain and southern Portugal is re-energised.
- **00:22 CEST** – grid fully restored in Portugal.
- **04:00 CEST** – grid fully restored in Spain.

Initial Theories →

*Source: Wikipedia

Initial Theories

- Cybersecurity Attack
- “Rare Atmospheric Phenomenon” – Extereme temperature variations in Spain’s interior.
- “Induced Atmospheric Vibration” which would have caused “synchronization failures between the electrical system”.

Ting Overview

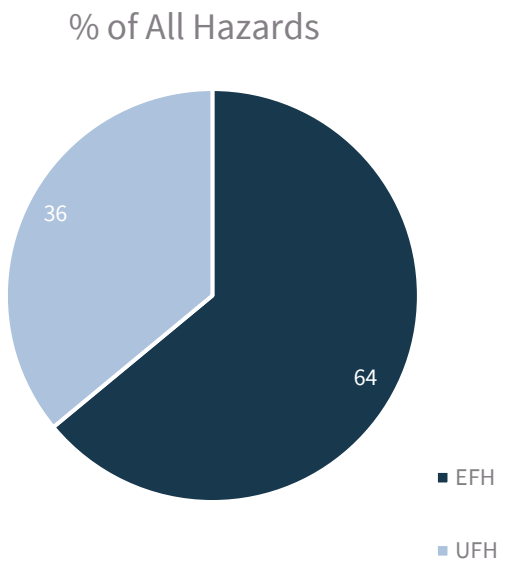
Protecting homes and building from the devastating impacts of electrical fires

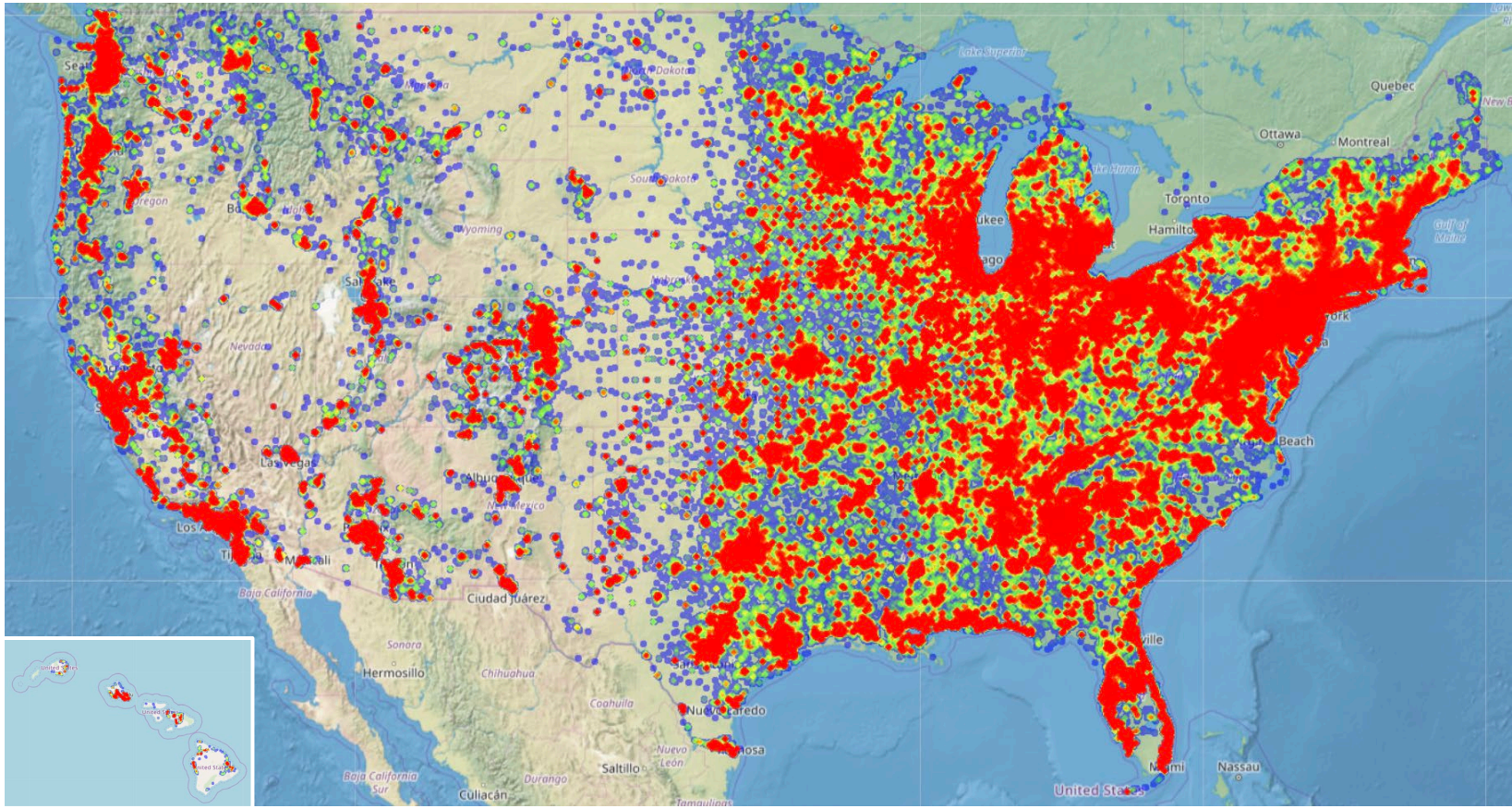
Sophisticated AI and machine learning platform measuring:

- Voltage
- Frequency
- Total Harmonic Distortion (THD)
- Arcing

Protecting Homes

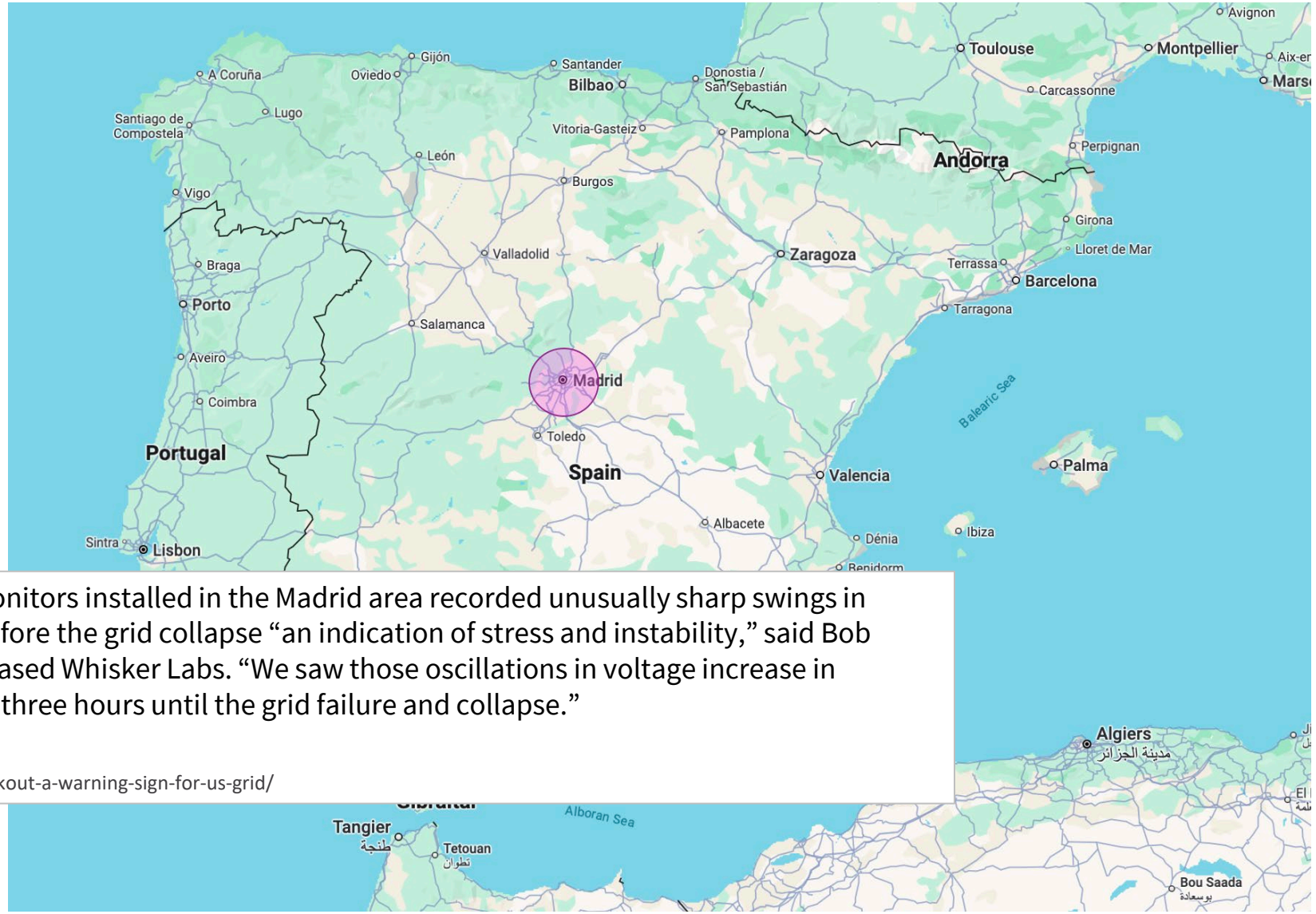
- Installed in 1.2M homes
- 22,000 saves
- 80% Fire Prevention Efficiency





- EFH – Hazards inside home
- UFH – Hazards outside home

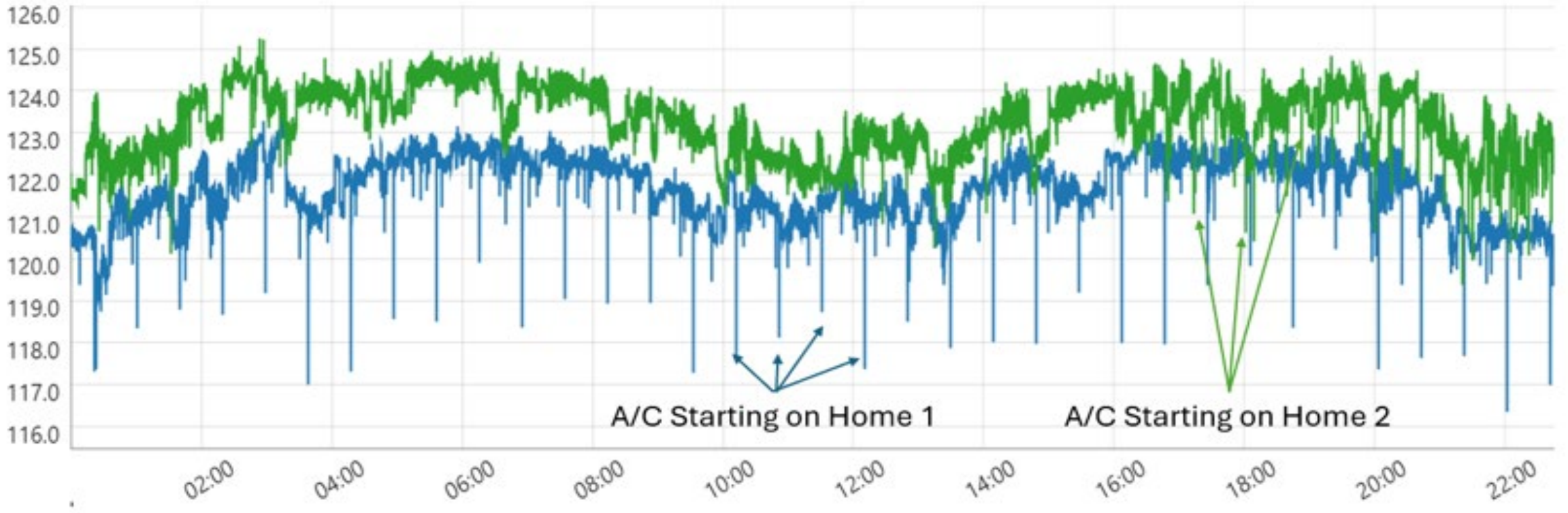
European Deployment - Spain



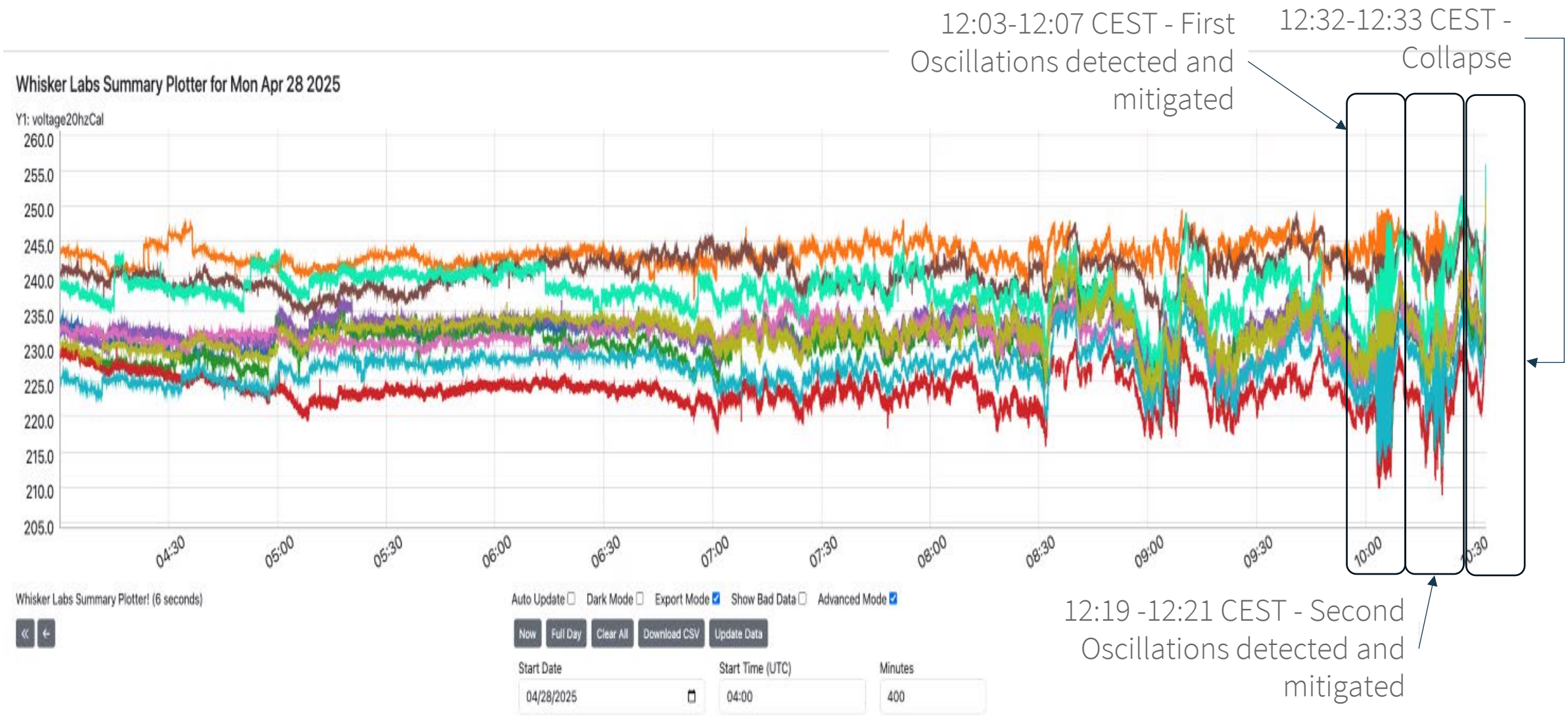
A U.S. technology company that has monitors installed in the Madrid area recorded unusually sharp swings in voltage levels beginning three hours before the grid collapse “an indication of stress and instability,” said Bob Marshall, chief executive of Maryland-based Whisker Labs. “We saw those oscillations in voltage increase in frequency and amplitude over the next three hours until the grid failure and collapse.”

https://www.eenews.net/articles/europes-massive-blackout-a-warning-sign-for-us-grid/

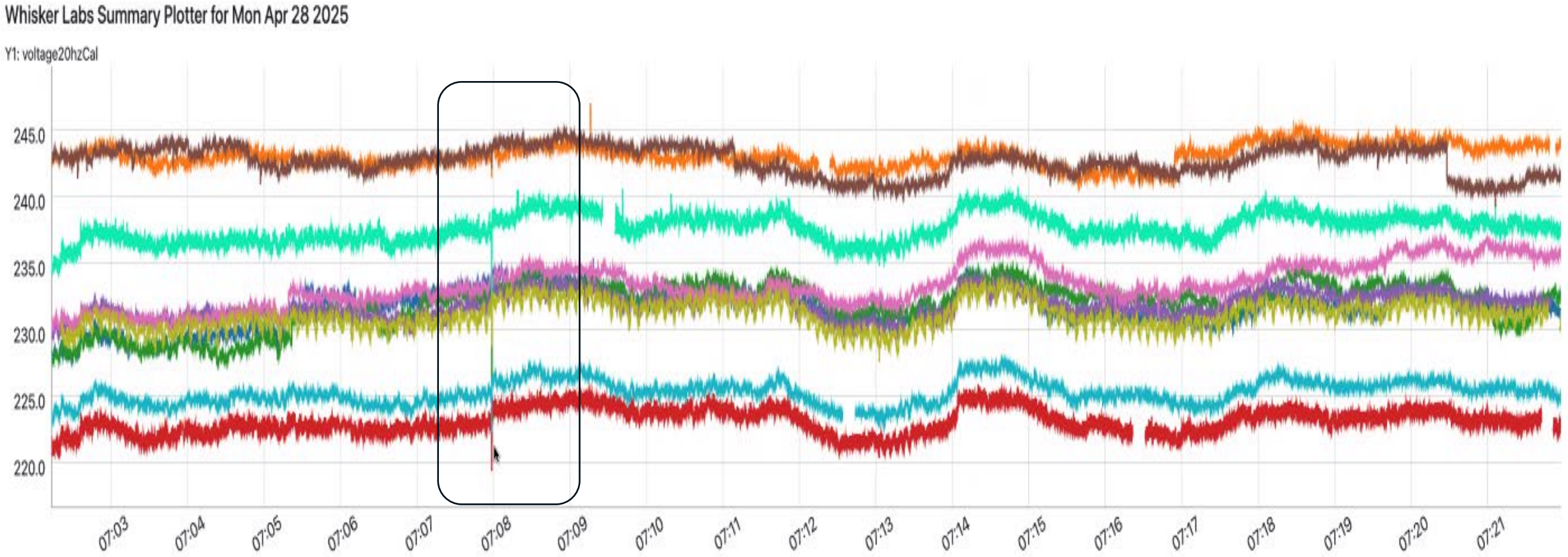
Detecting Grid Events



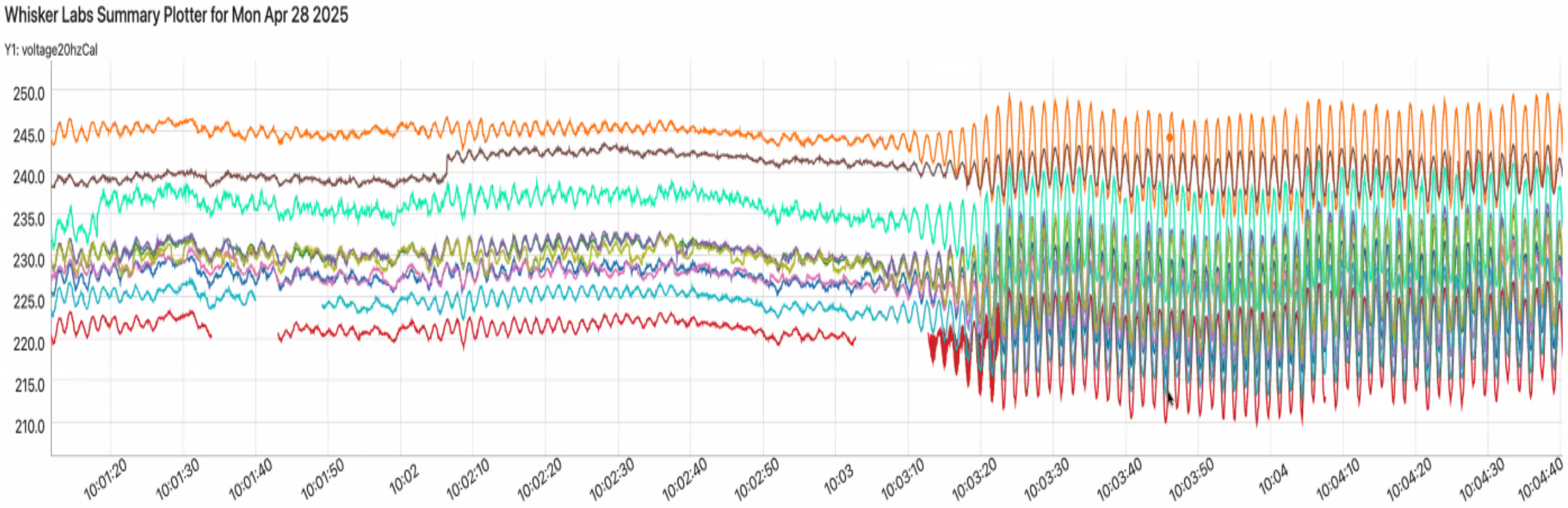
Spain Outage - Voltage



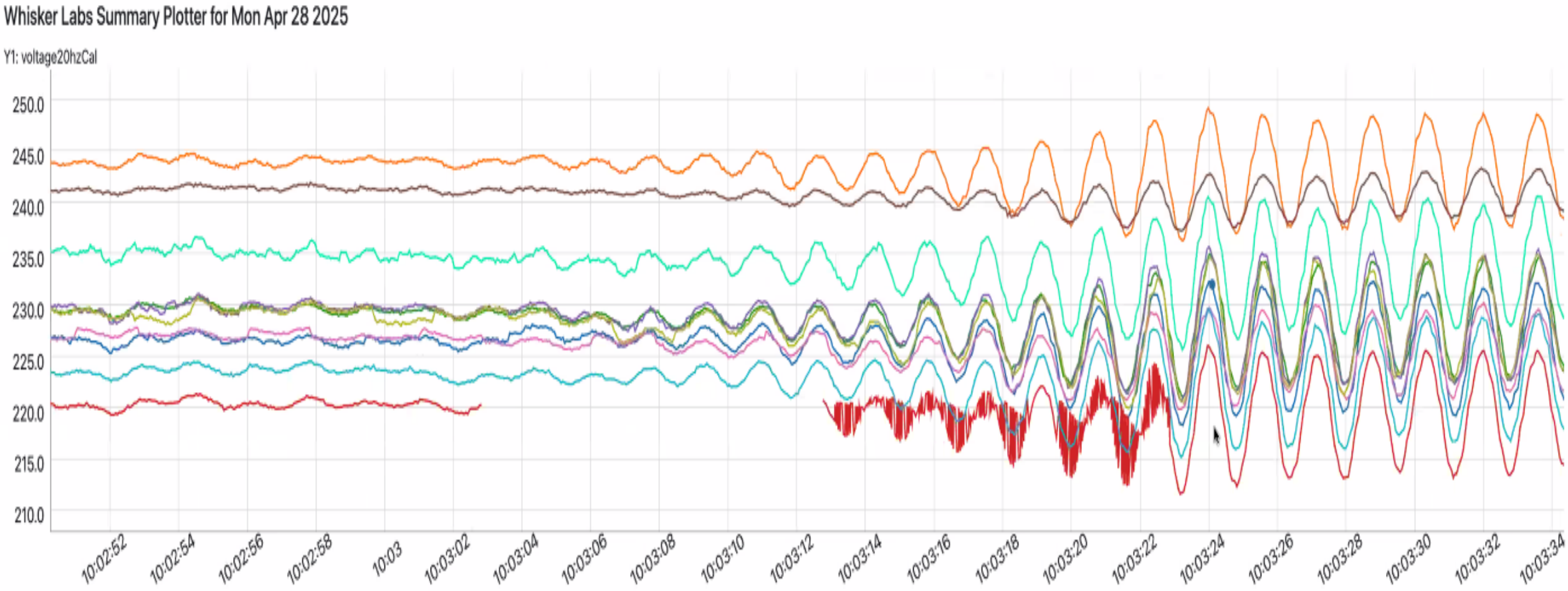
Spain Outage - Voltage



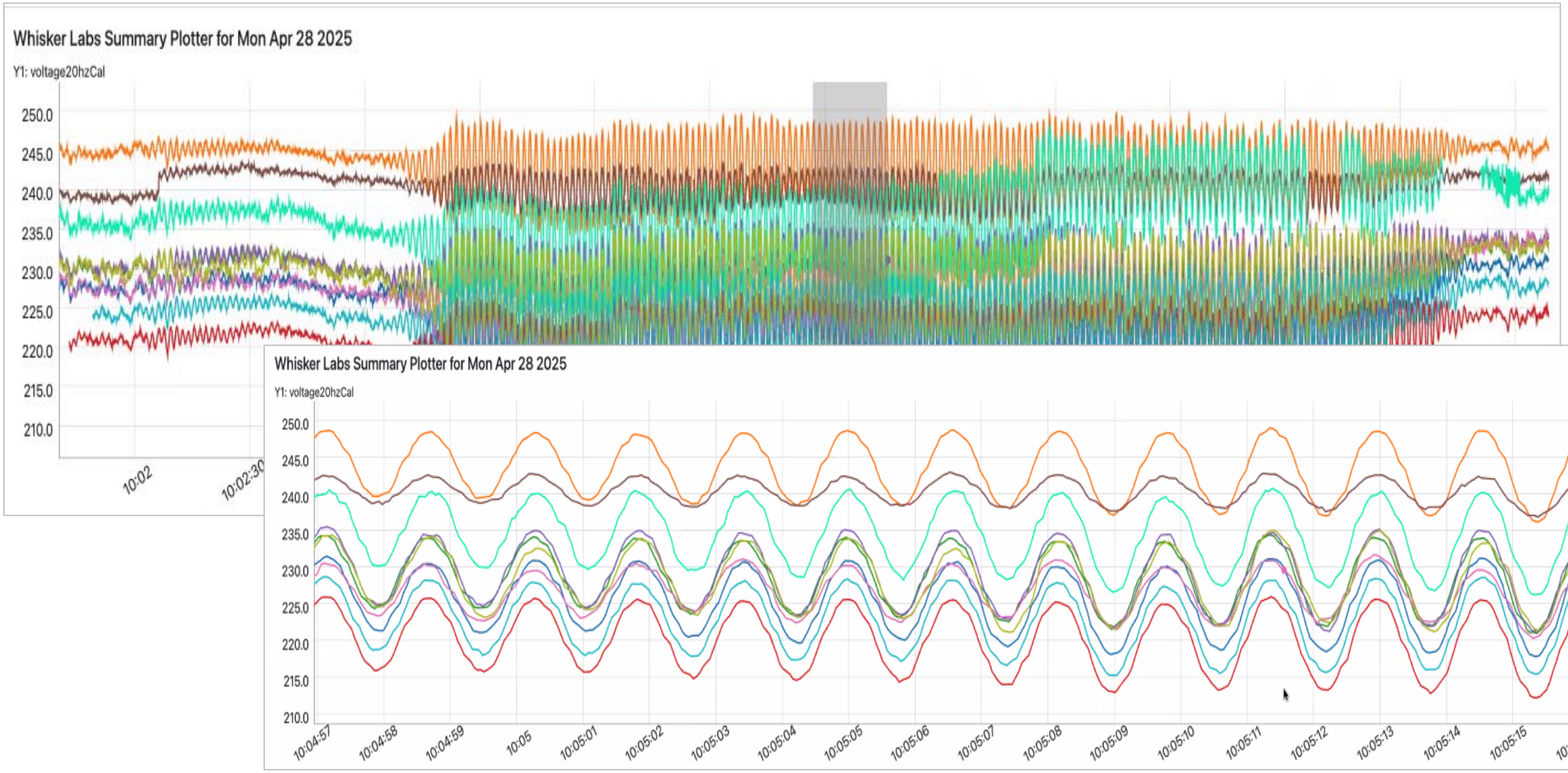
Spain Outage - Voltage



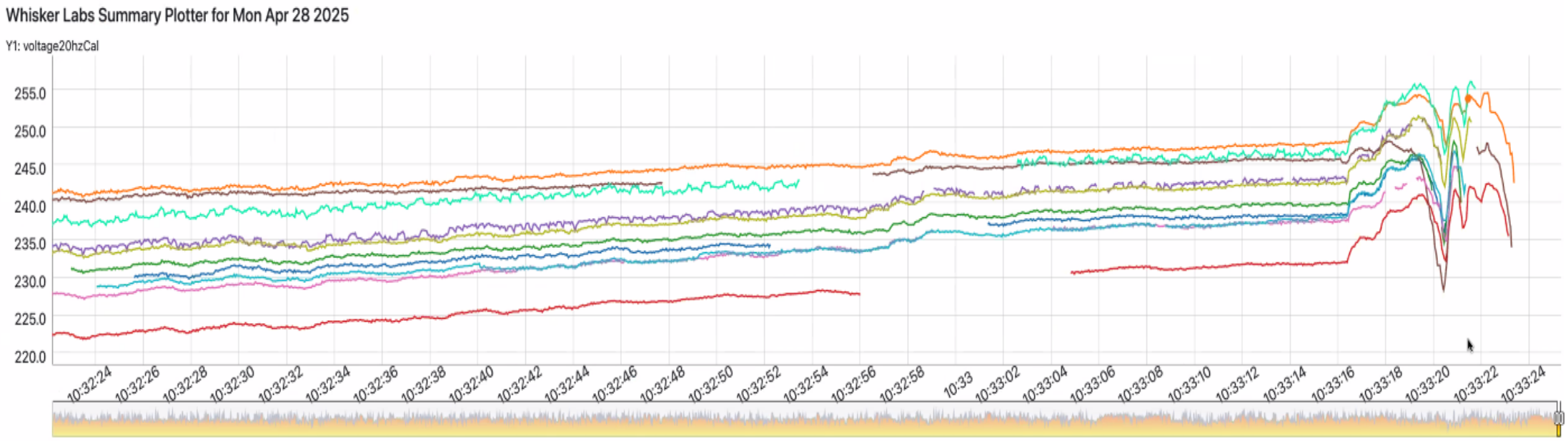
Spain Outage - Voltage

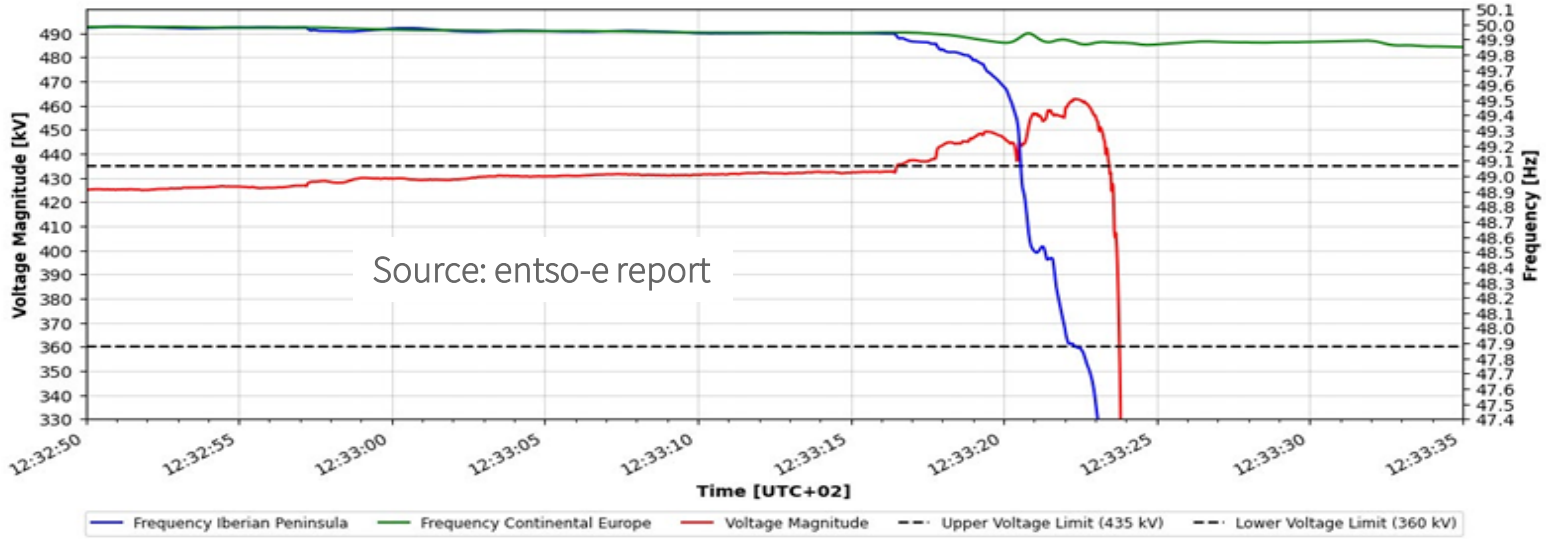


Spain Outage - Voltage



Spain Outage - Voltage

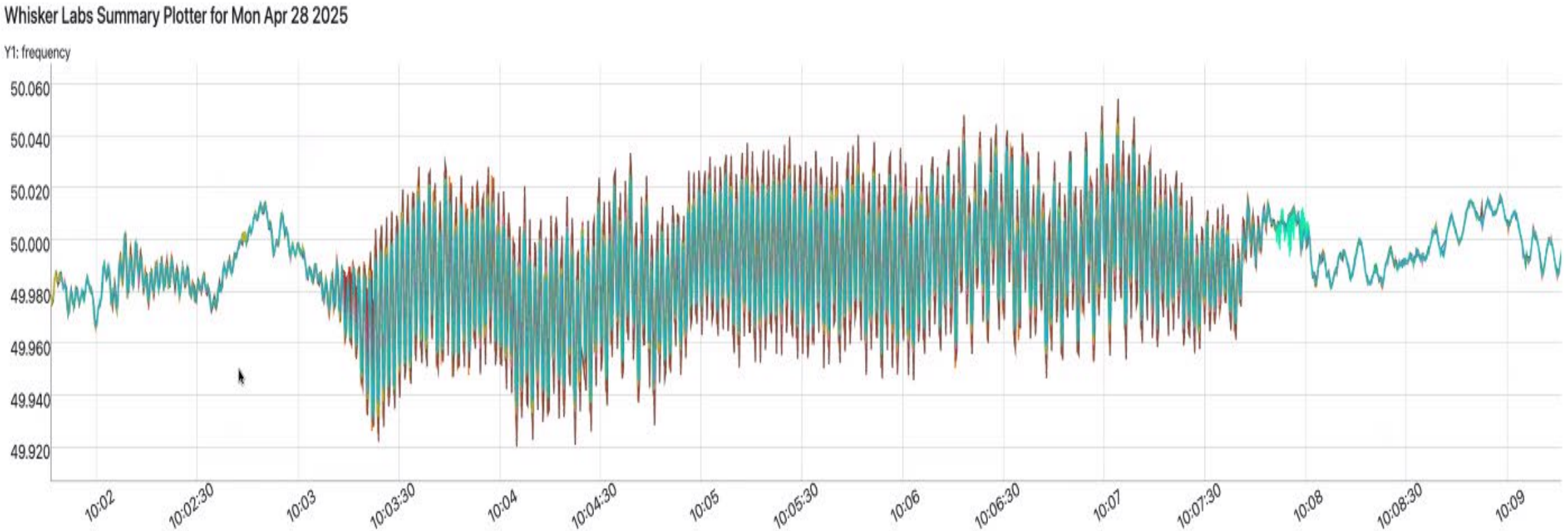




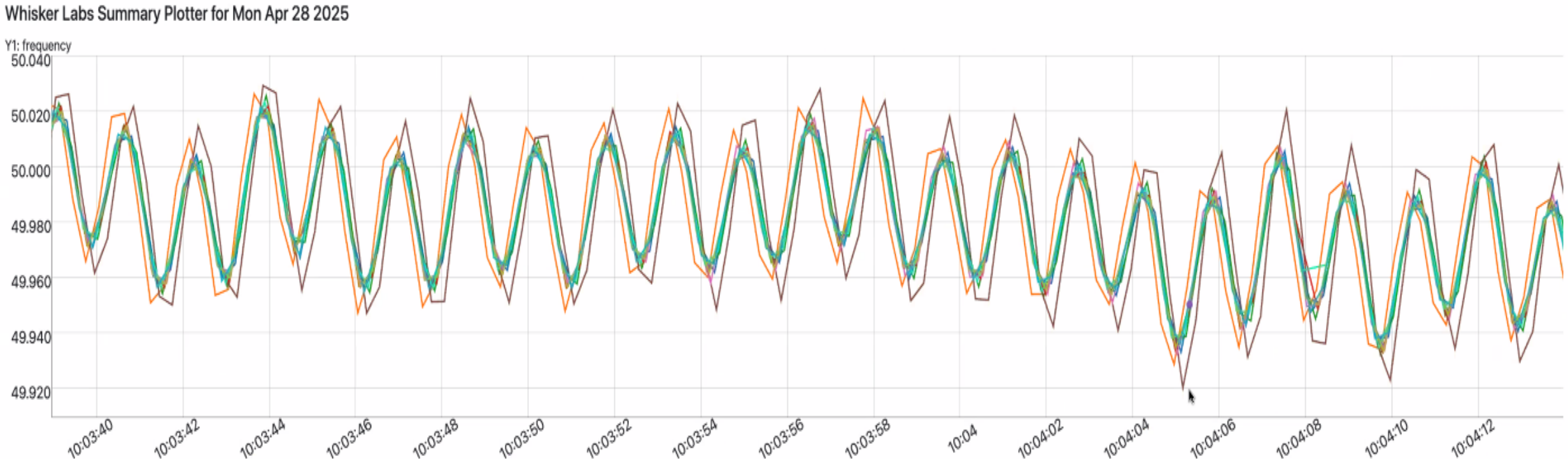
Source: entso-e report

Spain Outage - Frequency

Spain Outage - Frequency



Spain Outage - Frequency



Wrap Up

- Most severe blackout on the European power system in over 20 years.
- Root cause analysis is still under investigation.
- Entso-E expert panel convened May 12, 2025.
- Entso-E published a factual report on October 3, 2025.

  https://eepublicdownloads.blob.core.windows.net/public-cdn-container/clean-documents/Publications/2025/entso-e_incident_report_ES-PT_April_2025_06.pdf
- Initial theories ranged from cyber attack to weather.
- Ting sensor data quickly showed this was not a weather sourced event.


Powerful insights that ignite a safer future
THANK YOU