Full-scale Battery Pack Degradation Monitoring

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Background

- Battery health is crucial for understanding the expected performance.
- Understanding how operation affects battery health allows for planning maintenance cycles.
- Testing and normal operation must be balanced so there is enough data without consuming too much of the battery's life.
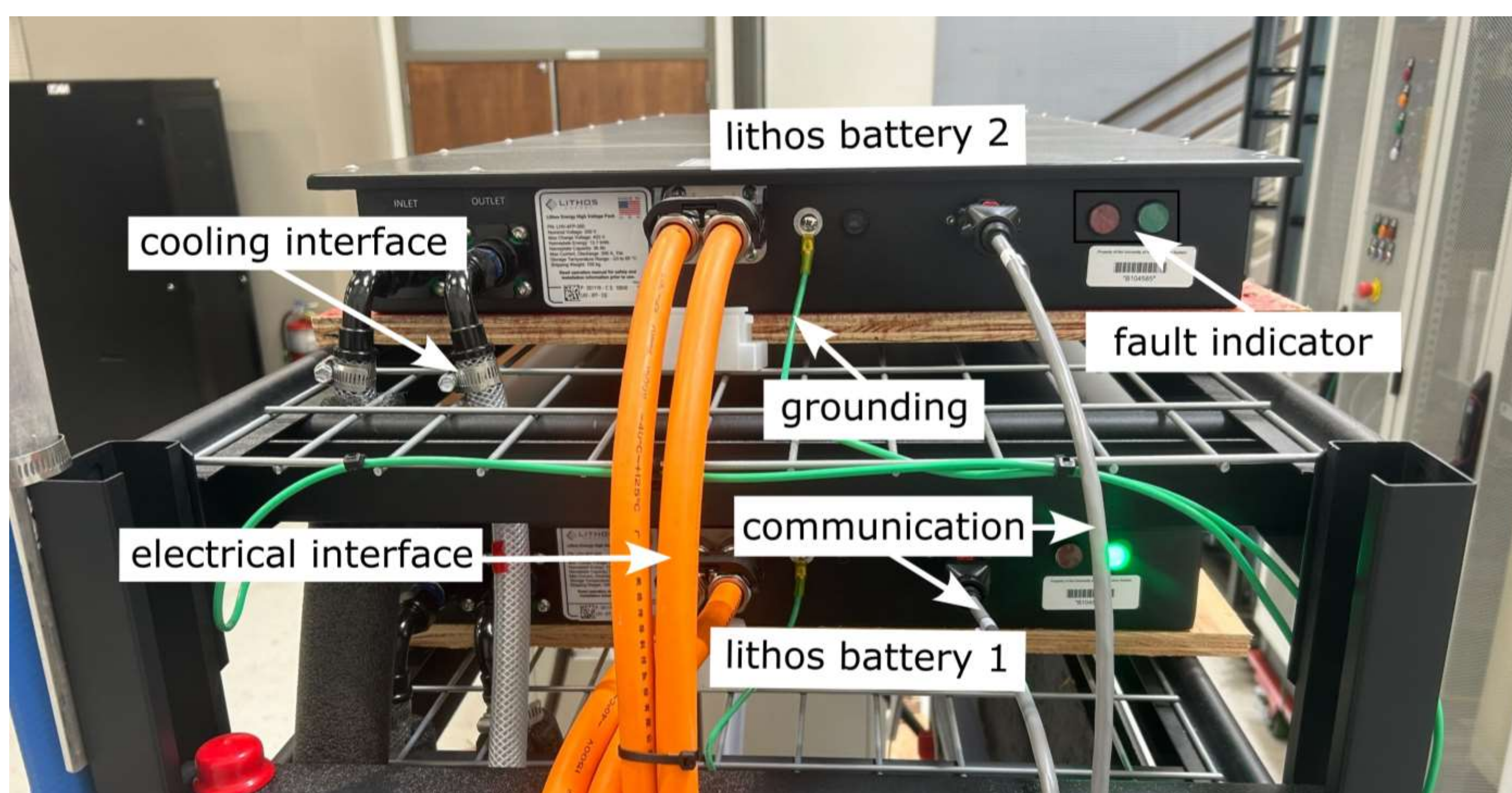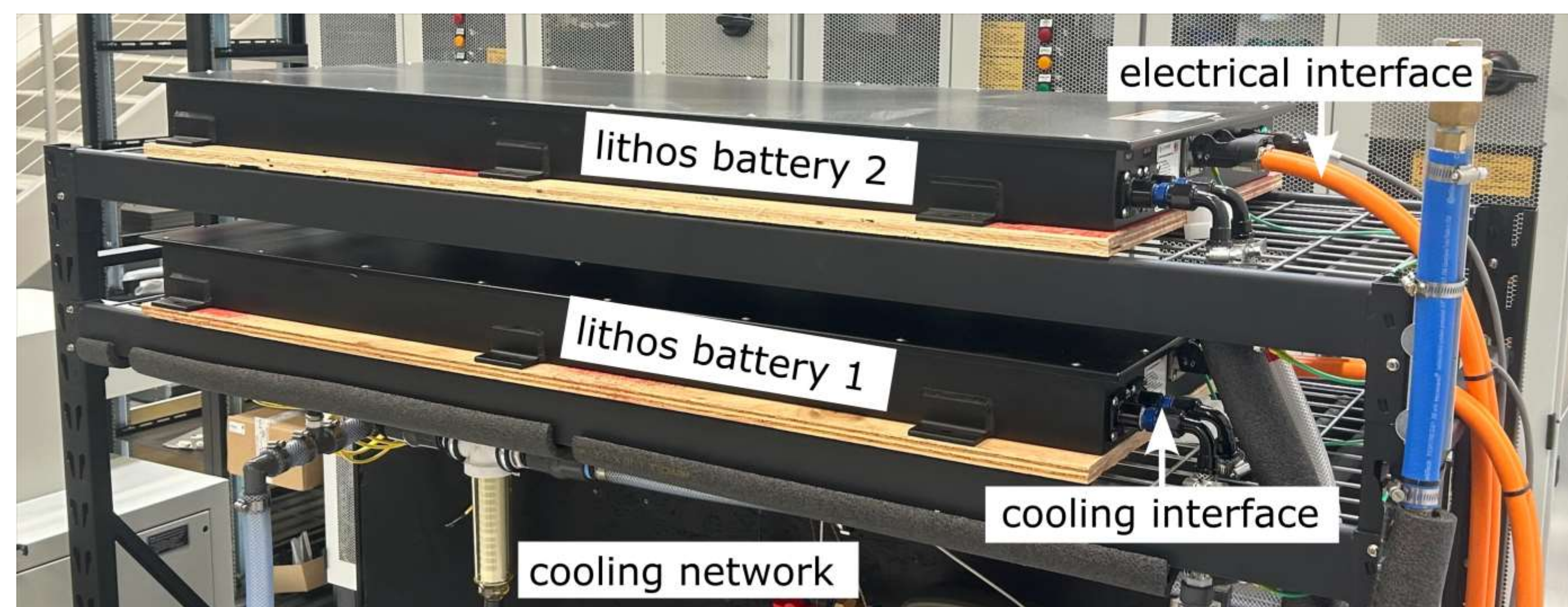
Side and front view of the Lithos batteries in the SCEPTRE testbed.

Lithos Testbed Batteries

- The SCEPTRE testbed contains two 12.7 kWh Lithos batteries that provide energy storage to the testbed.
- In the testbed environment it's important to understand where the battery is in its lifecycle to make notes about its performance at different life cycles.
- The current testbed configuration allows for 10kW to be drawn from each battery controlled by power

Methodology

- The Lithos batteries are used for several tests on the testbed and its activity is recorded on a historian server.
- A data parsing script was developed to take these parameters and determine how much energy had been used by this routine operation. (Seen on the right.)
- Every 25 equivalent cycles of battery will go through a load profile to determine new capacity and open circuit voltages.
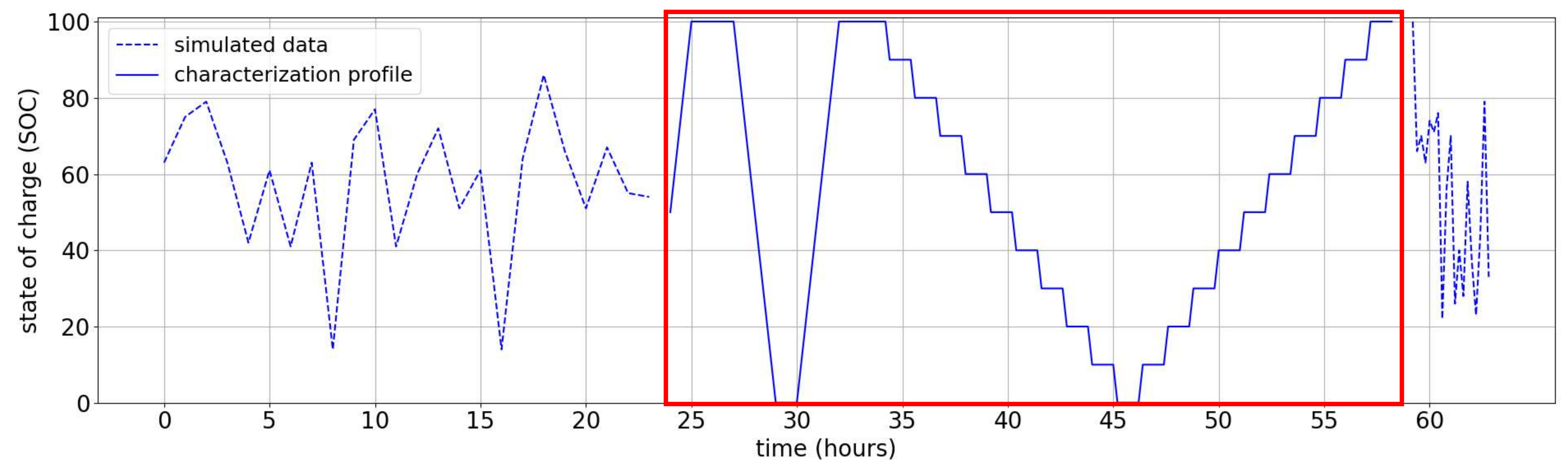
Battery Characterization Profile:
1. Full charge to 100% SOC at 0.5 C
2. 1 hour rest
3. Full discharge to 0% SOC at 0.5 C
4. 1 hour rest
5. Full charge to 100% SOC at 0.5 C
6. 1 hour rest
7. Using the new capacity, 10% SOC discharge at 0.5 C
8. 30-minute rest
9. Repeat step 7 & 8 until 0% SOC
10. 10% SOC charge at 0.5 C
11. 30-minute rest
12. Repeat steps 9 & 10 until 100% SOC

Future Testing

- Samsung 30Q 18650 batteries, equivalent to those inside the Lithos battery packs are being characterized with different depth of discharge to understand how operation effects performance.
- By understanding how batteries degrade at different SOCs we can expand the model to track more accurate equivalent cycles.
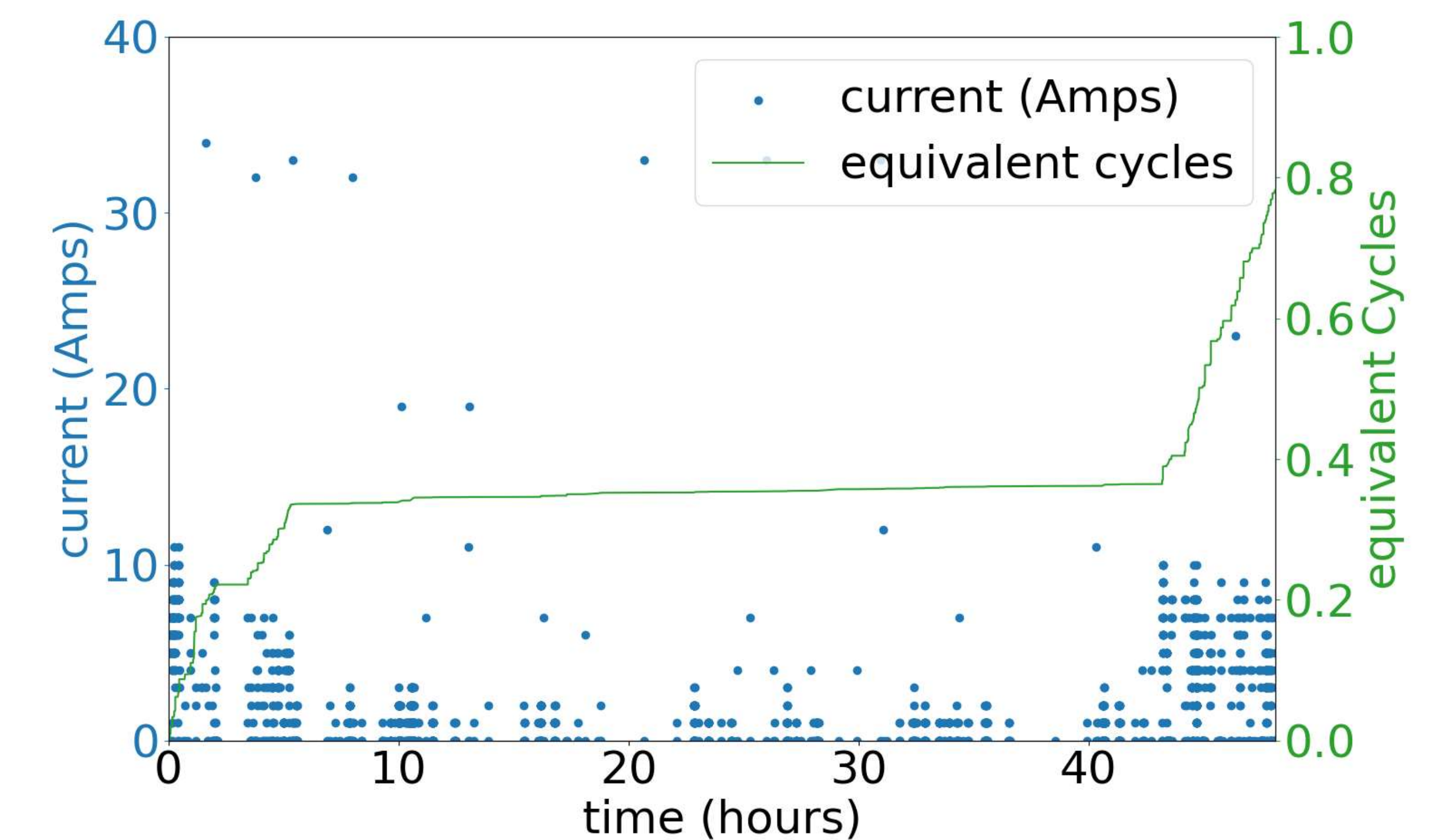
The equivalent cycles calculated over sample data.

Battery operation followed by characterization profile outlined in red.

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