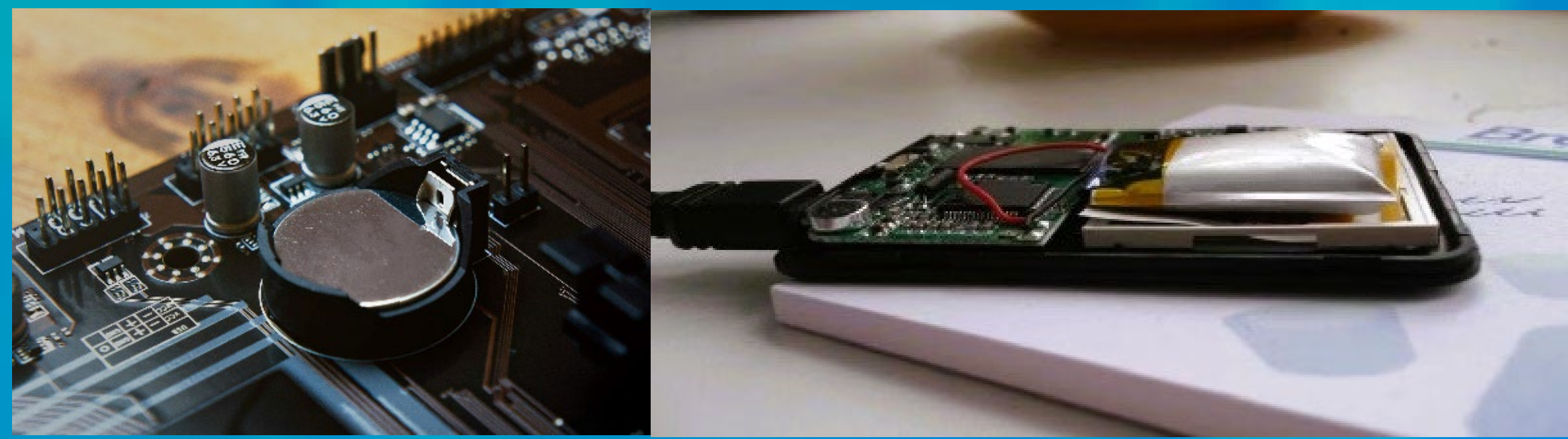


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### The Invention

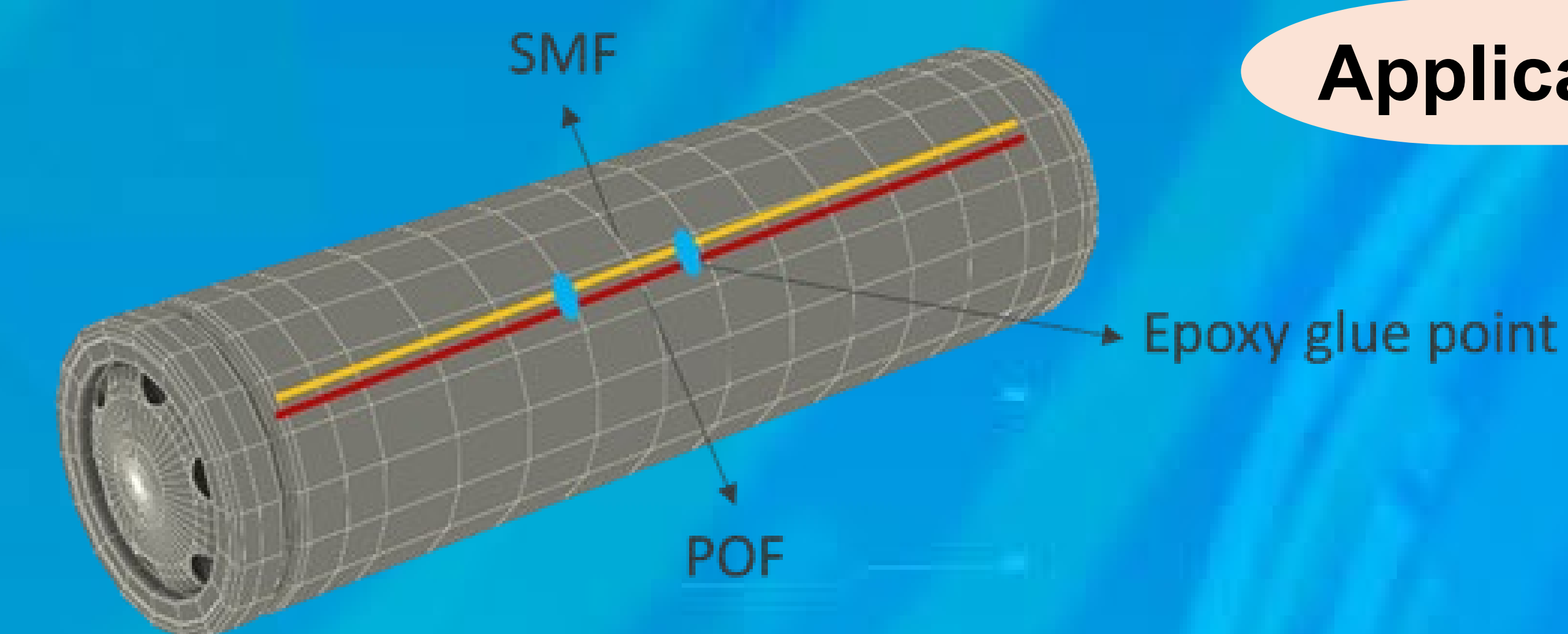
Stage 1a: Raw data acquisition – mount Fibre Bragg Grating (FBG) sensors on batteries and conduct cycling tests

### Problems:

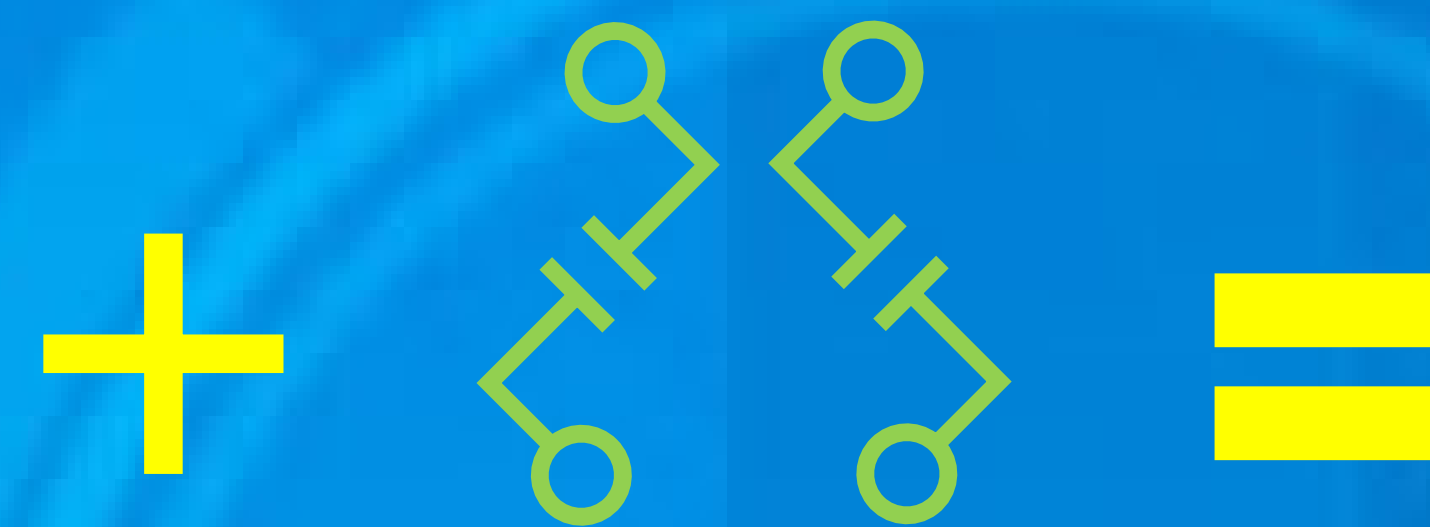
- ✓ Li-ion cells display noticeable physical deformation either due to defects or towards end of useful life. In particular, the cells swell and expand in size.
- ✓ The extent of this deformation, by the time it is discovered, is often variable.
- ✓ Damage to the components in proximity of the cells and perhaps even the whole device, may not often be discovered in time.

### Solution, Novelty and Impact:

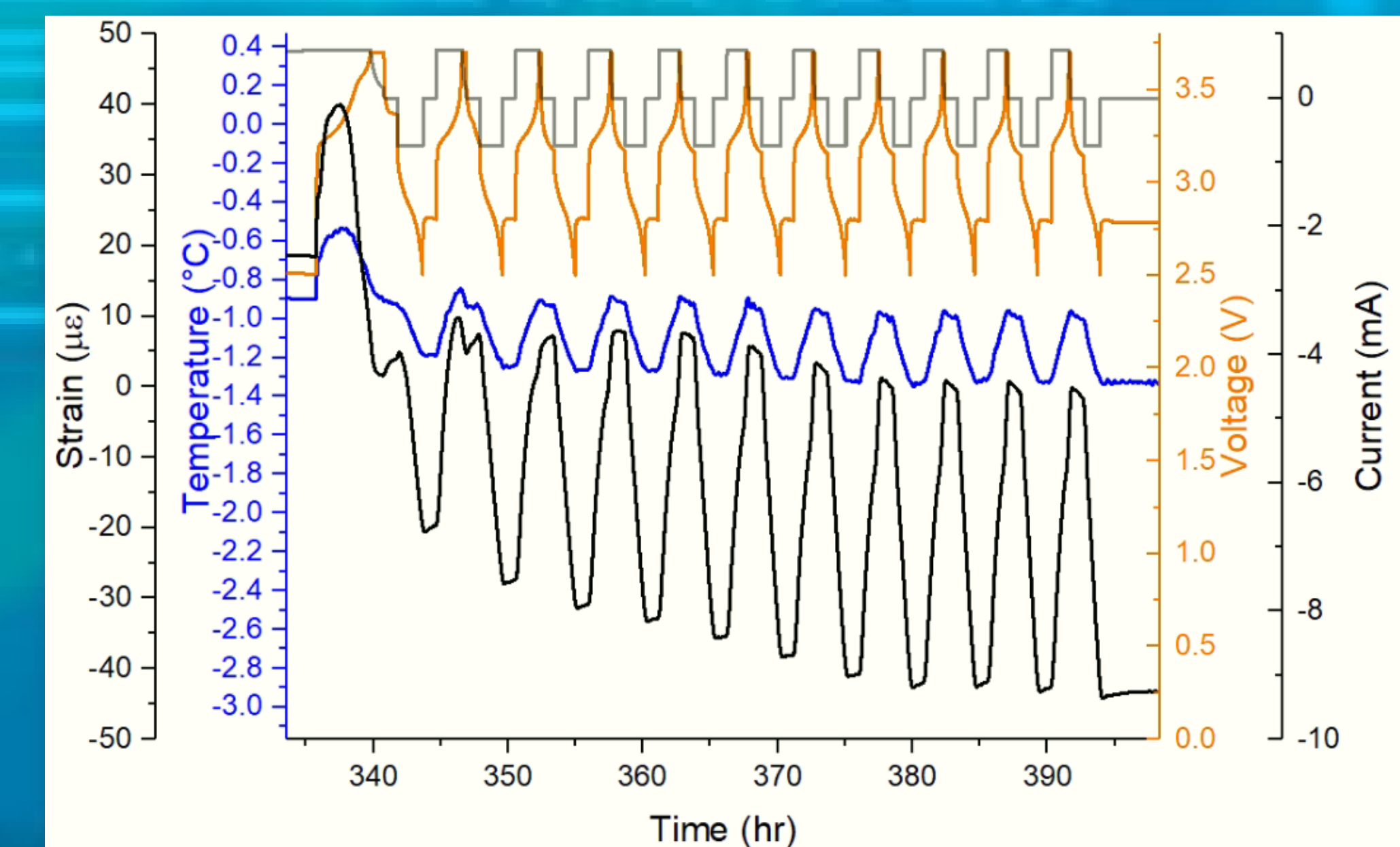
- ✓ Non-invasive optical sensing technology.
- ✓ Provide an early indication and detection of battery and cell defects/abnormality before battery failure.
- ✓ Provide a prediction of remaining useful life.
- ✓ Prevent accidents, such as fire and explosions caused by battery failure.



### Application: Battery fault detection



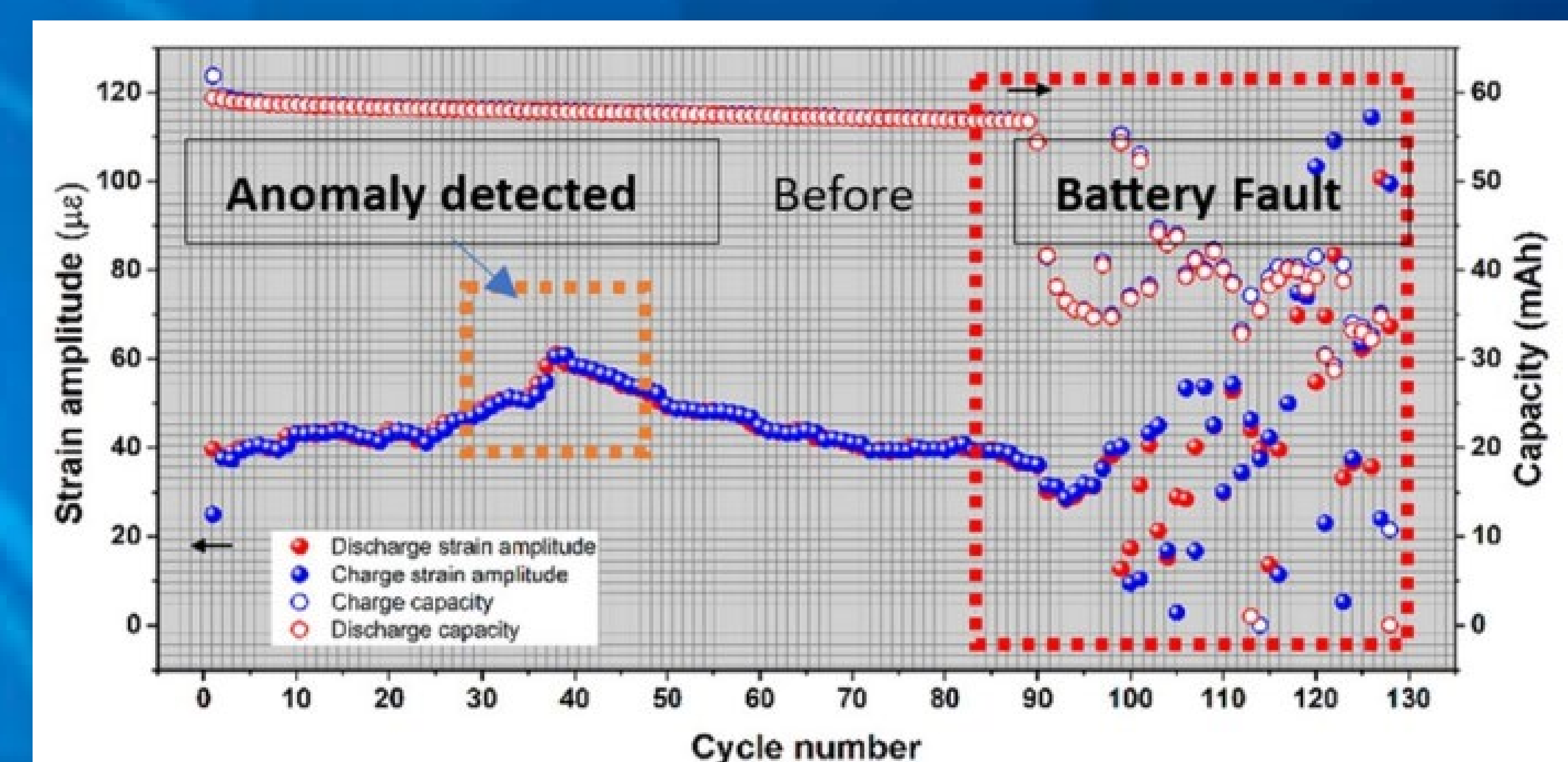
Stage 1b: Decoupling of raw optical signals from the FBG sensors into physical parameters (strain and temperature)



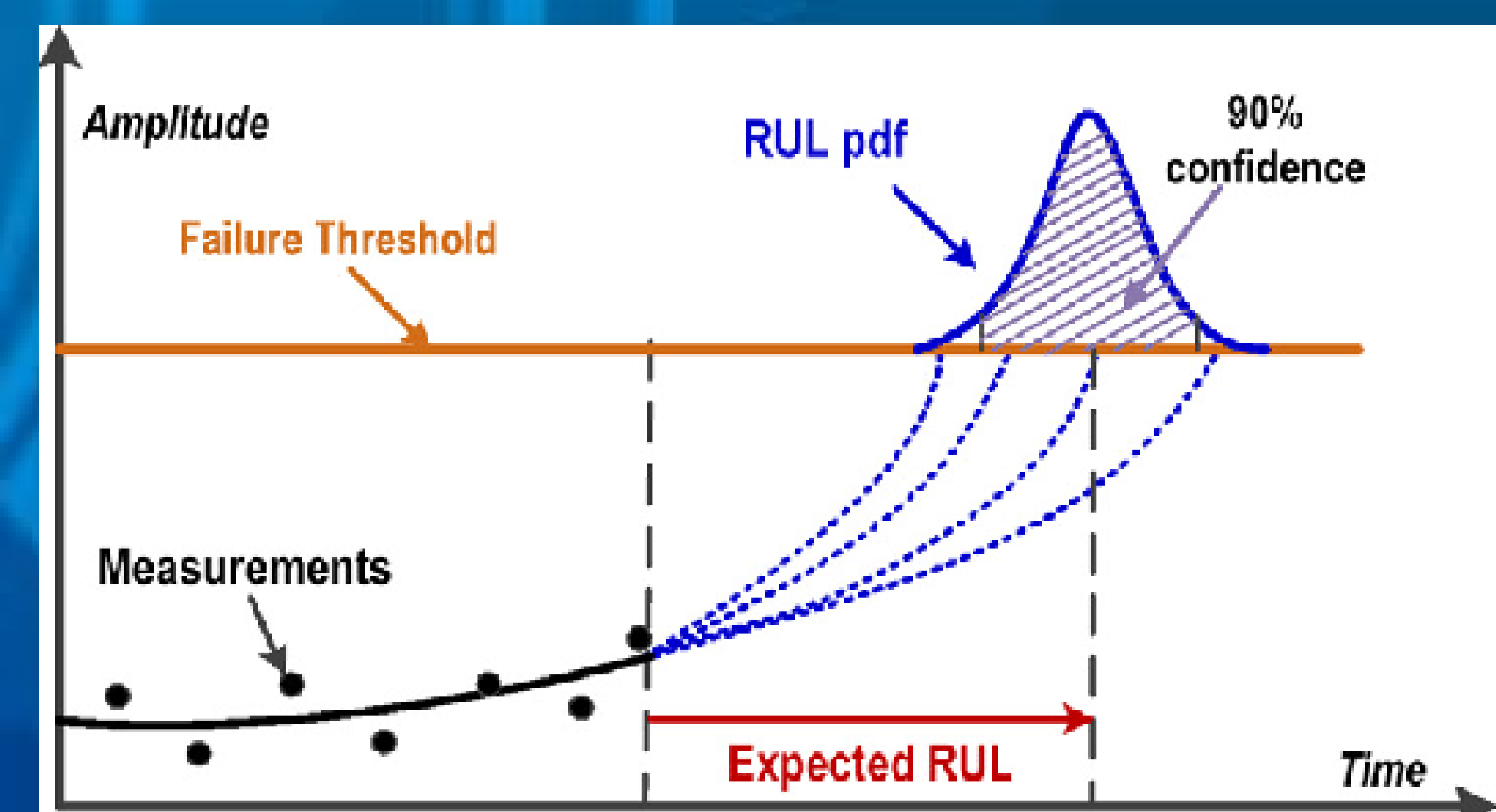
Stage 2:  
Provide health indicators  
and advance warning of  
anomalies

### Achieved Outcomes:

- ✓ Anomalies or the end-of-life of batteries can be predicted early and accurately before catastrophic failure occurs.



**Solution Output:**  
Consistent anomaly detection  
and prediction of remaining useful life



### Patent details

Title: A System and Method to Monitor Lithium-ion Battery for Degradation Estimation and Fault Detection.

Registered region and date: Hong Kong, 01/08/23. Patent No: HK30088739

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