

# Know the TruState of Your Battery

**AI-powered Battery Insights** with non-invasive Electrical Impedance Spectrometry (EIS) enabling:



**Environmental Stewardship**



**Reliable Operation**



**Increased useable Capacity**



**Safe Operation**

Our TruState AI/EIS Technology performs **Precise Estimation** of:



**Remaining Life**



**Stress**



**Abnormal Conditions**



**Energy Stored**



## Remaining Life

Inaccurate estimation of remaining life (state of health) results in the operation of the battery past its end of life can lead to unsafe and unreliable operation.

## Stress

To achieve rated longevity, a battery stress must be minimized. To eliminate stress, the hottest spot inside the battery (the “hot spot”) must be within the battery’s temperature rating. However, external temperature sensors used for this purpose are inaccurate, causing degradation of the battery.

## Abnormal Conditions

To manage safety and limit warranty costs, a battery system must detect abnormal conditions (anomalies). Anomalies can lead to failures, including catastrophic events.

## Gauge of Energy Stored

Imprecise measurement of energy stored requires installation of excess capacity, with additional cost, to achieve reliable operation.

## Industry Terms:

Remaining Life = State of Health

Stress = State of Stress

Abnormal Conditions = State of Anomalies

Gauge of Energy Stored = State of Charge

## At a Glance: Difference between Conventional Measurement and Heimdalytics TruState Measurement:

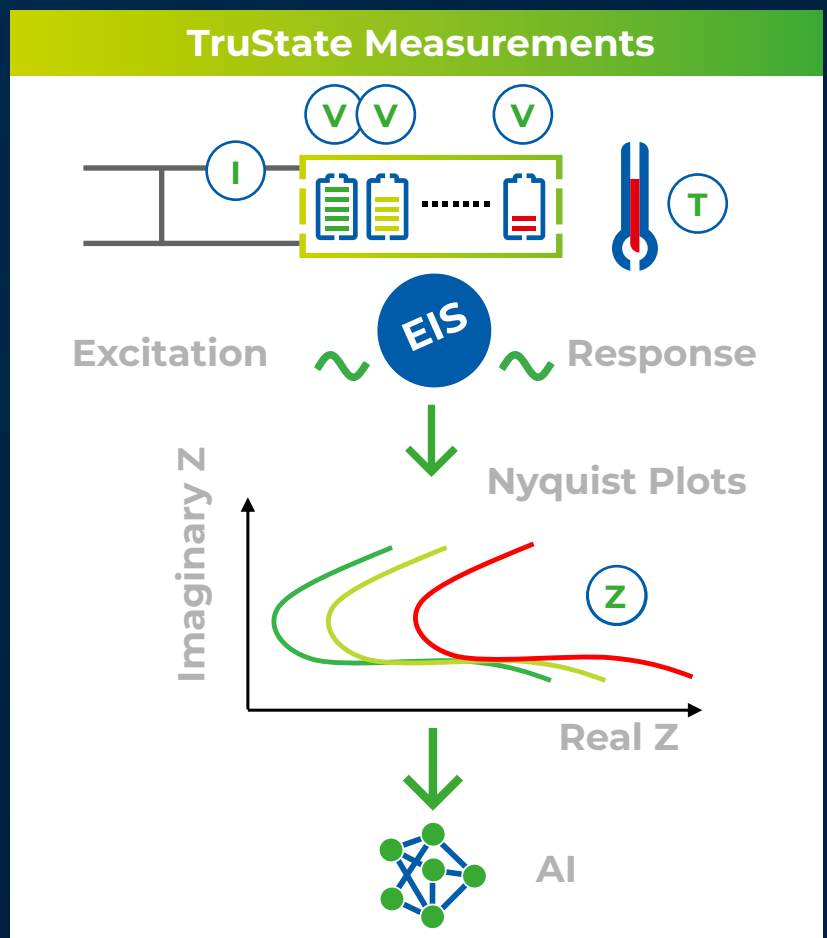
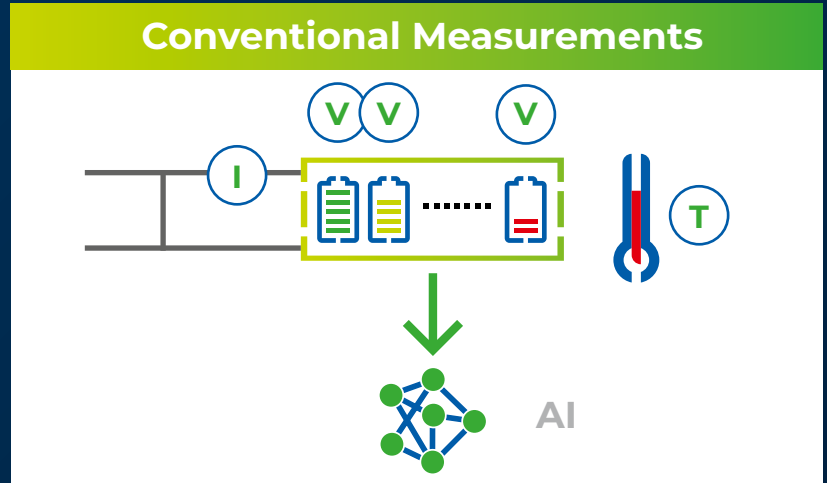
In **conventional measurement systems**, cell voltages, current, and external temperature form the data set processed/analysed by the AI. However, this measurement set is insufficient for the AI to perform its tasks accurately.

VS.

**Heimdalytics "TruState" measurement system** combines conventional measurements with Impedance over a range of frequencies. Cell impedances are measured using electrical impedance spectrometry (EIS) at the cell level. Expanding the data set with impedance is sufficient for the AI to perform its tasks accurately. Cell impedances as a function of frequency are stored in the form of a Nyquist Plot, which contains valuable information.

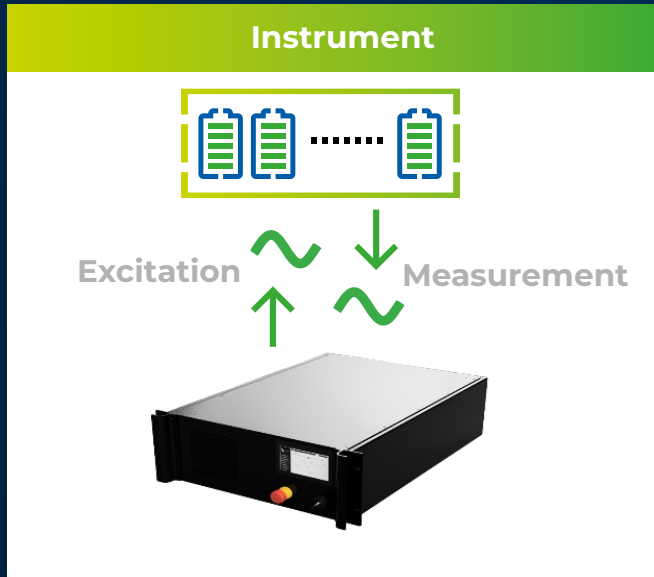
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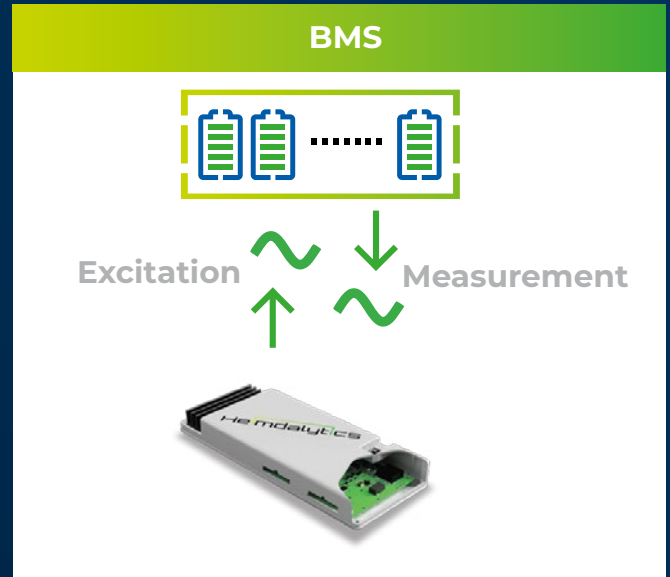
**Improve and Expand the Estimation of your Battery's State.**

Our TruState EIS/AI Technology is in the form of **two products**



### TruState Instrument

Our TruState Instrument is an offline means to accurately predict a battery's remaining life (ie state of health). The instrument also incorporates a capacity test feature. It is a fully integrated instrument with EIS excitation and measurement units, processing and controls, and a charge/discharge power supply.



### TruState BMS

Our TruState Battery Management System (BMS) is an online means to accurately predict a battery's remaining life (ie state of health), stored energy (i.e. state of charge), level of stress (internal temperature), and development of abnormal conditions (pending failures).

The BMS is configured such that each battery module has a measurement unit (BMU), and there can be one or more excitation units (BXUs) per string of battery modules.

**Know the TruState  
of Your Battery**



**Proactively Manage Your Battery Modules  
with TruState EIS/AI Technology**