BATIXT

BATTERY INDEX TECHNOLOGY

GREATER COMPETENCY IN TESTING AND EVALUATION

NEXT GENERATION EIS SCANNING

FAST, ACCURATE AND RELEVANT

KNOWLEDGE IS POWER


R³ EIS
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R^3 EIS TECHNOLOGY FOR GREATER COMPETENCY

Electrochemical Impedance Spectroscopy (EIS) is renowned as a superior method for battery testing and plays a crucial role in battery testing and evaluation, offering a detailed, non-destructive approach to understanding the electrochemical processes within a battery. It offers unparalleled insight into the electrochemical processes that govern battery performance and safety. One of the major drawbacks with EIS has been the fact that it has been a slow method. Batixt innovation has addressed this problem. Batixt rapid EIS makes the technology more competent, relevant and useful in the context of battery testing and evaluation, not least when larger volumes of batteries need to be evaluated. For example, for the evaluation of second-life potential. Here are some of the questions test engineers can explore with our EIS technology:

- Assessing battery State of Health (SoH)
- State of Charge (SoC) estimation
- Performance characterisation
- Battery impedance profiling
- Detecting early-stage faults
- Understanding battery aging
- Electrode and electrolyte analysis
- Comparative testing and benchmarking
- Temperature and environmental impact testing
- Real-time monitoring in Battery Systems
- Modelling and predictive maintenance
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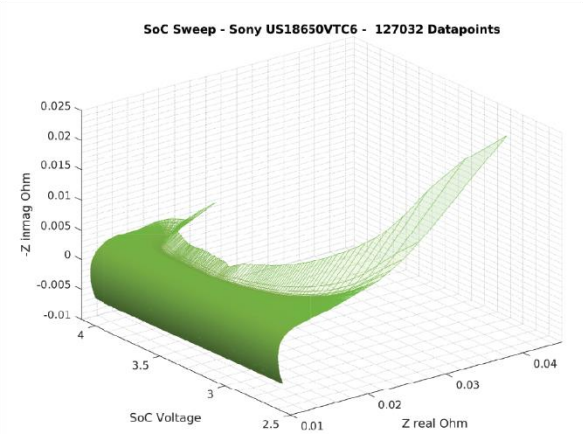
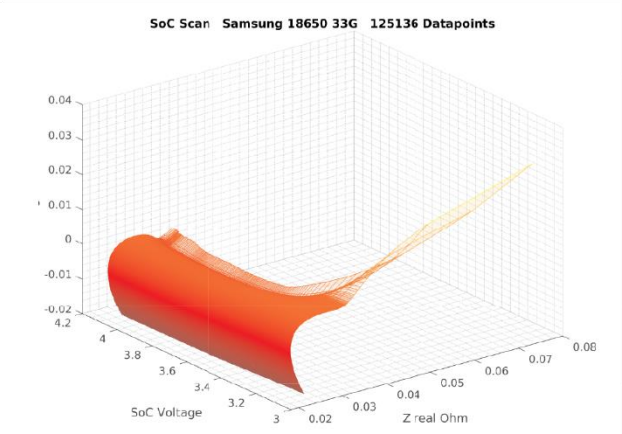
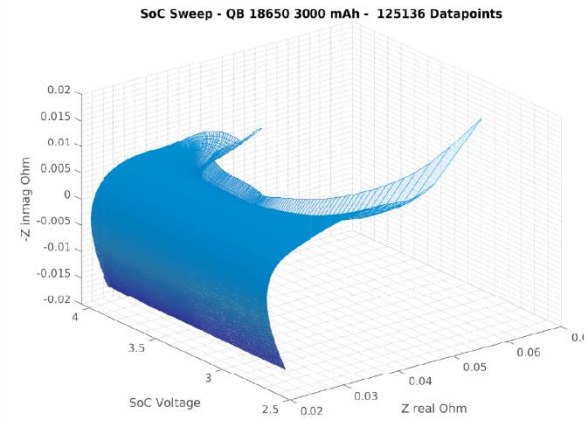
Batixt R^3 EIS technology goes so far beyond old generation EIS. It is simply Next Generation EIS. We have overcome the most significant problems with time consuming measurements, patchy results and contaminated EIS data. The data provided by Batixt EIS scanners will enable more advanced battery testing and evaluation with less effort.

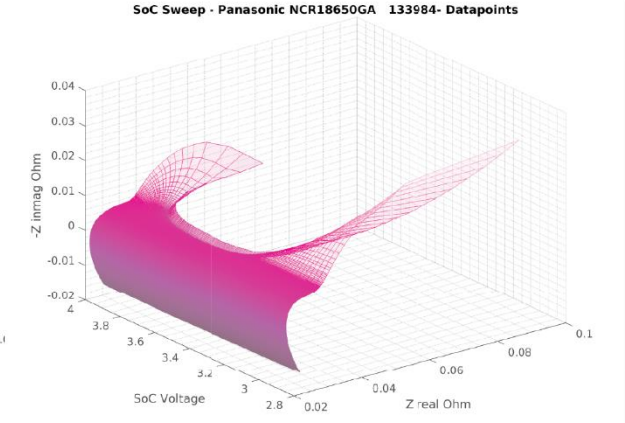
Batixt EIS scanners enable new and more relevant types of battery analysis. One scan with hundreds of frequencies only takes seconds and 200+ scans will give you a complete image of the battery's properties during an entire discharge or charge cycle in under 3 hours (see the graphs below). This is possible because, unlike previous generations of EIS, we measure all frequencies in parallel. This is a data set that is only possible to create with our EIS scanning equipment. This type of data, and the short time in which it is generated will give test facilities the boost they need to be faster and more competent.

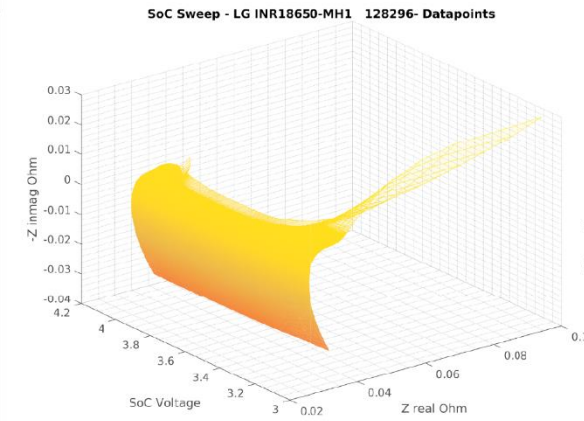
RESULTS FROM BATIXT FIRST EIS SCANNER – CLARITY

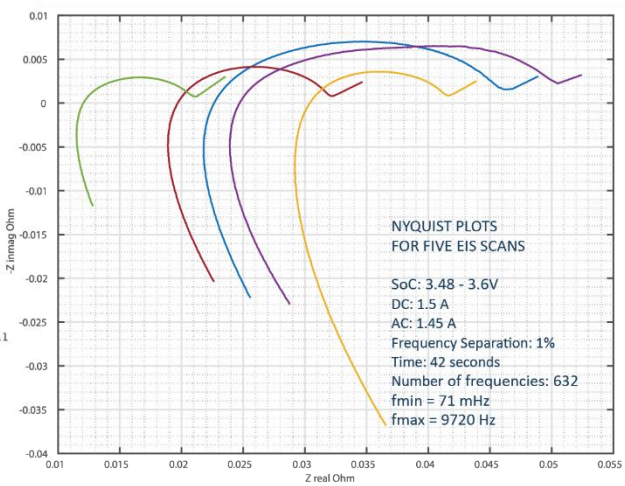












EIS STATE OF CHARGE SWEEPS

198 - 212 EIS Scans/Sweep
632 Frequencies/Scan
42 Seconds/Scan
2h 42/53min Total Sweep Time
fmin = 71 mHz, fmax = 9905 Hz

BATTERIES TESTED

- Sony US18650VTC6 3000mAh
- Samsung INR18650-33G, 3150mAh
- QB 18650, 3000mAh
- Panasonic NCR18650GA, 3300mAh
- LG INR18650-MH1, 3200mAh

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HOW BATIXT EIS SCANNING TECHNOLOGY WORKS

Batixt EIS scanners use a galvanostatic measurement method, applying a specially designed "Lix" signal to the battery. The signal is comprised of a large number of sinusoidal (sin(t)) signals on top of a DC step (Heavyside function). All the signals are active during the entire measurement. The signal is typically (= default on the Clarity instrument today) based on 200.000 samples per second, in and out sample rate. We have 16 bits going out and 18 bits on the inputs.

The usual length of the signal is based on a power of 2 to make the FFT run fast. Other lengths will run slower but can be selected freely. Sample rate will remain at maximum for times up to 300 seconds then the rate will be reduced to keep data volume limited. For a 42 second scan the signal length is 2 to the power of 23 = 8.388.608 (41.94 seconds at 200k s/sec).

In a 42 second scan we have 71 mHz as the lowest frequency and 10kHz as the highest. This gives us a factor of 10 between the highest frequency used and the Nyquist frequency (That is half the sample rate). The length of the signal determines the lowest frequency of which there is 3 full periods. At 300 seconds you would get 10mHz as the lowest frequency. In the 42 second scan (actually any scan) you can select the separation of frequencies, from coarse which gives you about 150 frequences to a maximum of 50000+ frequences.

The power of the signal is measured in Amperes. For a 18650 battery (3-3.5 Ah) a typical value would be 1.25 A DC component and 1.20A amplitude for the LIX signal. This will provide very high-quality data (see graphs below).

The LIX signal is designed so that we can separate the step-response from the sinusoidal responses, the data for the two are provided separately. Staying away from zero current is motivated by the difficulty in designing a current driver that is clean enough for the measurement accuracy that we are striving for and also the battery step response/relaxation that happens at zero Amperes. It is better to determine this data and present separately, than having it mixed into the data, as is the case with old generation EIS that gravitates around zero current.

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