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# Key Considerations for EV Battery Testing & Validation

**May 24<sup>th</sup>, 03:30 PM**

Martin Weiss,

Product Director at NH Research (NHR)

# Key Considerations for EV Battery Testing & Validation



# Presenter: Martin Weiss



**Martin Weiss** - Product Director at NH Research

Martin has over 25 years of experience developing automated test systems for evaluating power electronics and battery systems.

As the Product Director at NH Research (NHR), Martin is responsible for the technical development and launch of new, industry-driven hardware and software test solutions. Previously, he worked as a Principal Design Engineer for high-tech companies including Vocollect, Marconi Communications, and Telxon.

# NH Research: Enabling Electrification

*Industry Leading EV Test Solutions*

## Over 50 years of experience

- ✓ Best in class performance
- ✓ Ease of use
- ✓ Modular & scalable solutions
- ✓ Reduced testing time
- ✓ Improved safety
- ✓ Energy savings



***Battery, DC, AC Test Solutions***

***Acquired by NI in Oct. 2021***



# Agenda

1. **Industry Trends Impacting Battery Test**
2. Testing & Validation Use Cases
3. Next Generation Battery Test Solutions



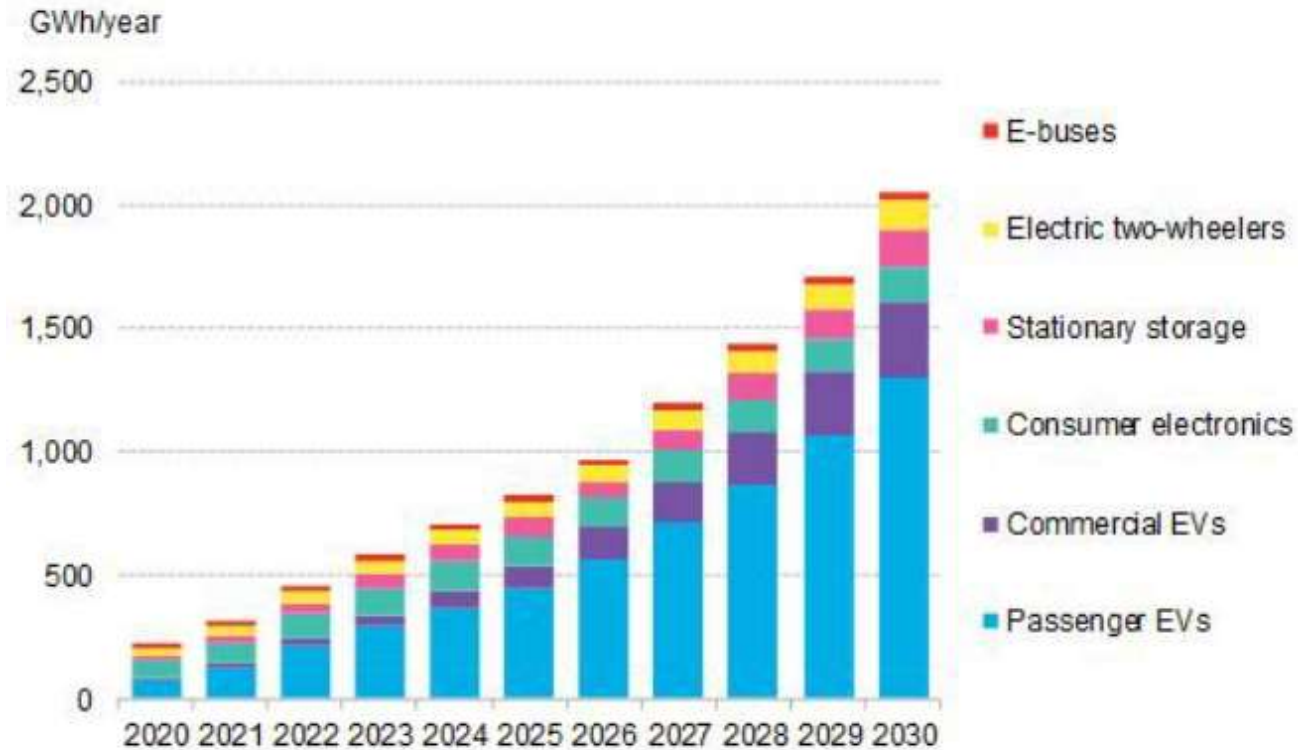
“Batteries have become the pivotal component for transportation electrification and storing clean energy.”





# Battery Growth Industry Trends

Figure 25: Lithium-ion battery demand outlook



Source: BNEF. Note: See respective section for details.

# Industry Trends Driving Test Requirements

Higher energy demands  
need higher voltage levels ...



$$P = V \cdot I$$



E-Motorcycles



Electric Vehicles



E-Truck, E-Bus



Electric Flight

# Agenda

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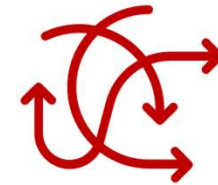
# Battery Test Challenges



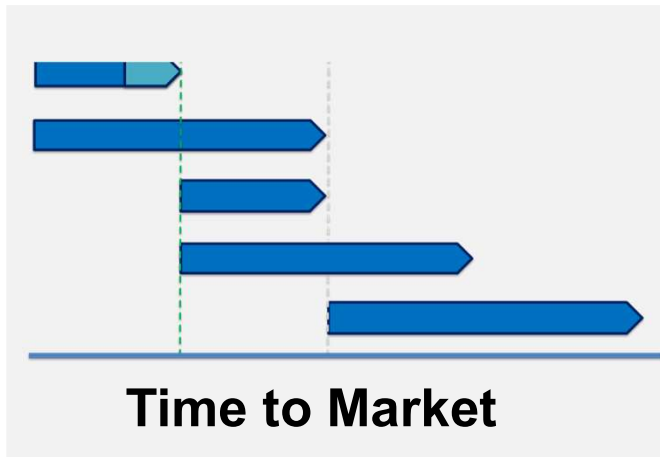
**Testing Batteries Take  
a Very Long Time**



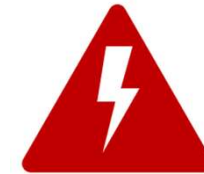
**Post Processing Data  
is Time-Intensive**



**Varying Test  
Parameters**



**Errors Lead to  
Re-running Tests**



**Batteries are  
Hazardous**

# Battery Testing Involves More Than Cycling





# Innovation: Enhancing EV Performance



Image Source: Tesla Roadster



Image Source: Jeep Wrangler



Image Source: Toyota

- **Pushing the Boundaries of EVs**
  - Performance
  - Reliability
  - Range
  
- **Examples of Performance Factors**
  - Motor size
  - Tire traction
  - Wind resistance
  - Vehicle weight
  - Battery maximum power

# Opportunity: Optimize BMS Control

Advanced BMS algorithms optimize peak performance by accounting for:

- State of charge (SOC)
- State of health (SOH)
- Additional parameters

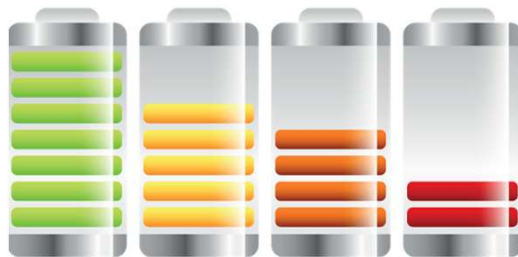
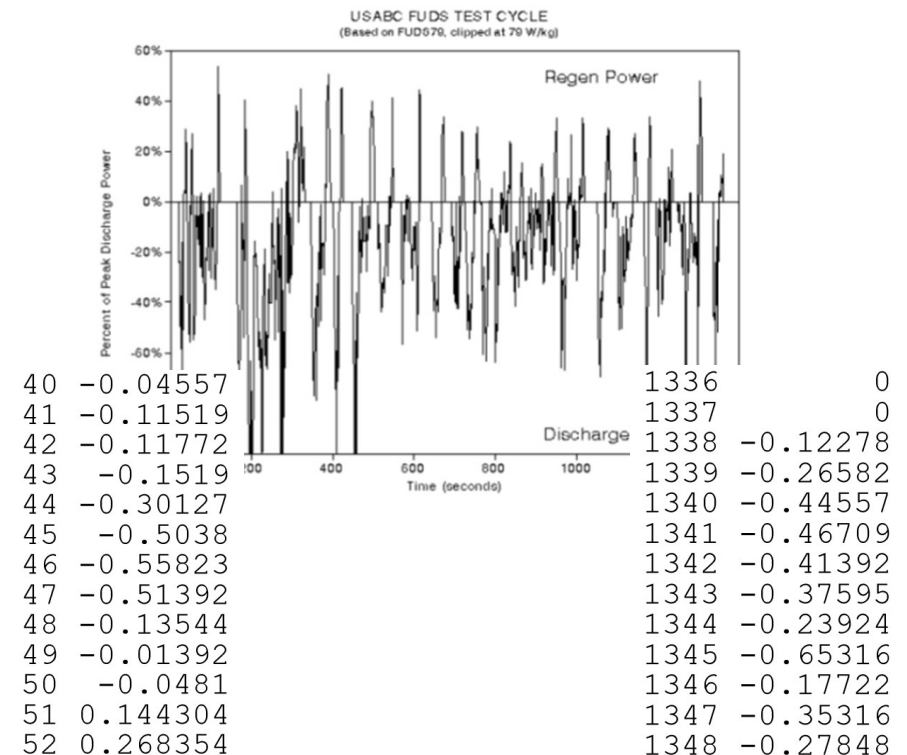
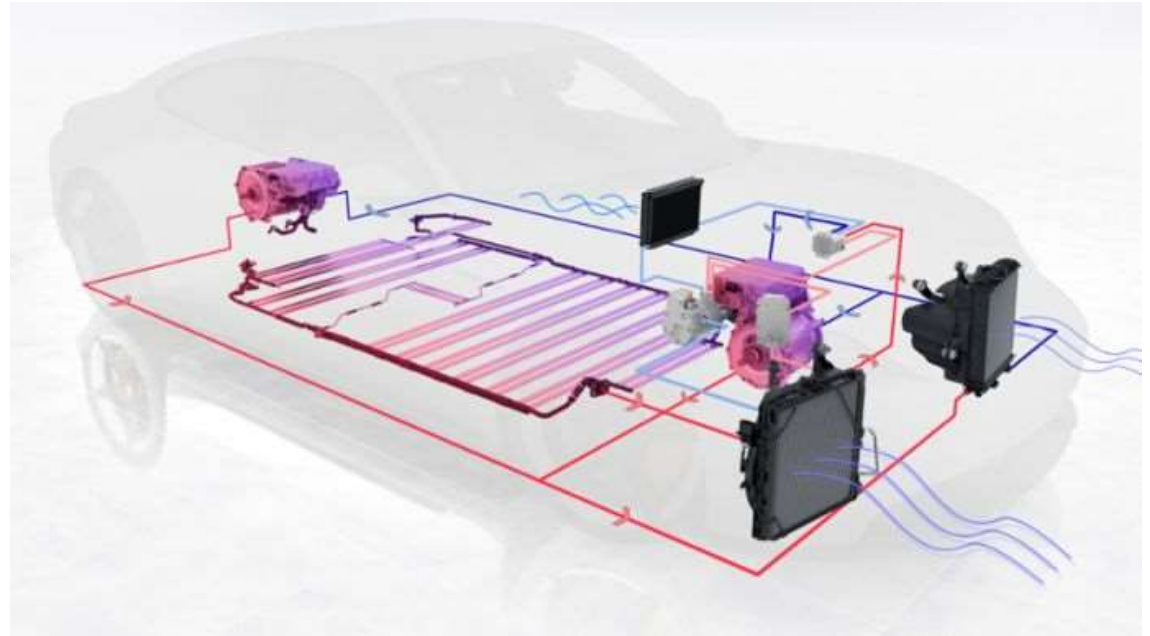


Image Source: <https://avt.inl.gov>



# Innovation in Thermal Management Systems



## The Porsche Taycan battery is integrated into EV Cooling System

- The battery provides both electrical and thermal storage

Source: Porsche - <https://newsroom.porsche.com/en/products/taycan/battery-18557.html>

# Opportunity: Emulate the Thermal System

## Real-world stress simulation

Can the battery endure..?

- Thermal Cycling Stress
- Performance Degradation
- Sealing and Reliability

## Reduce testing time

- Use the emulated thermal system to get the battery to temperature faster and safer in order to test.



# Agenda

1. Industry Trends Impacting Battery Test
2. Testing & Validation Use Cases
3. **Next Generation Battery Test Solutions**





# NHR + NI = Open, Flexible & Complete Test Solutions

## Advantages:

- Reduce time to market & improve engineering productivity
- Confidently test today's technologies AND tomorrow's innovations
- Decrease capital & operating expenses (CAPEX/OPEX)
- Improve safety & reduce risk



# Wide Operating Range



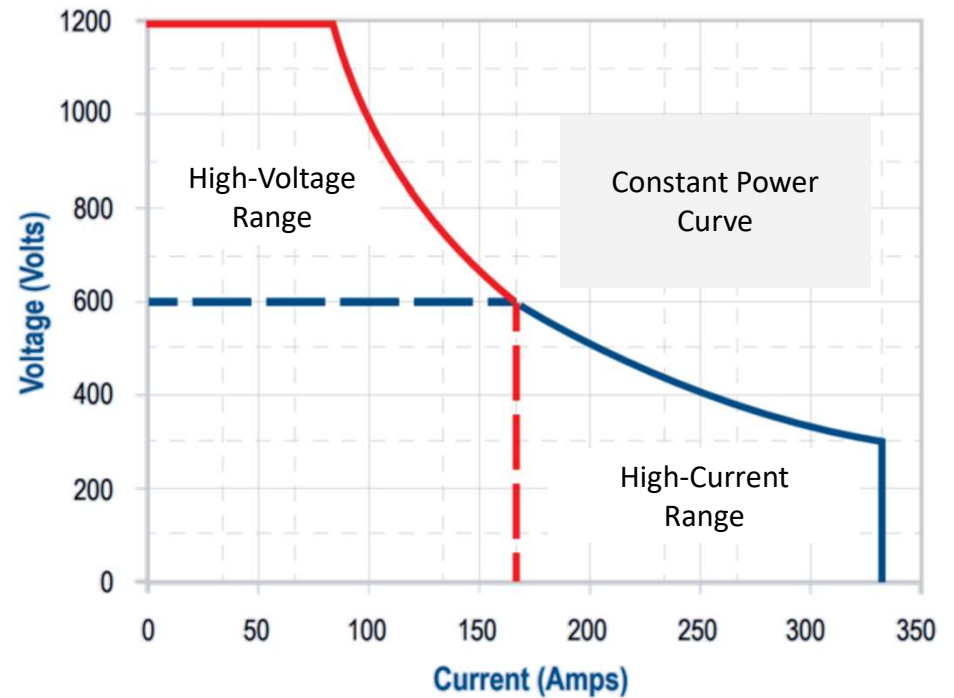
Image: Courtesy of Volkswagen Group (Porsche)

**800 VDC**



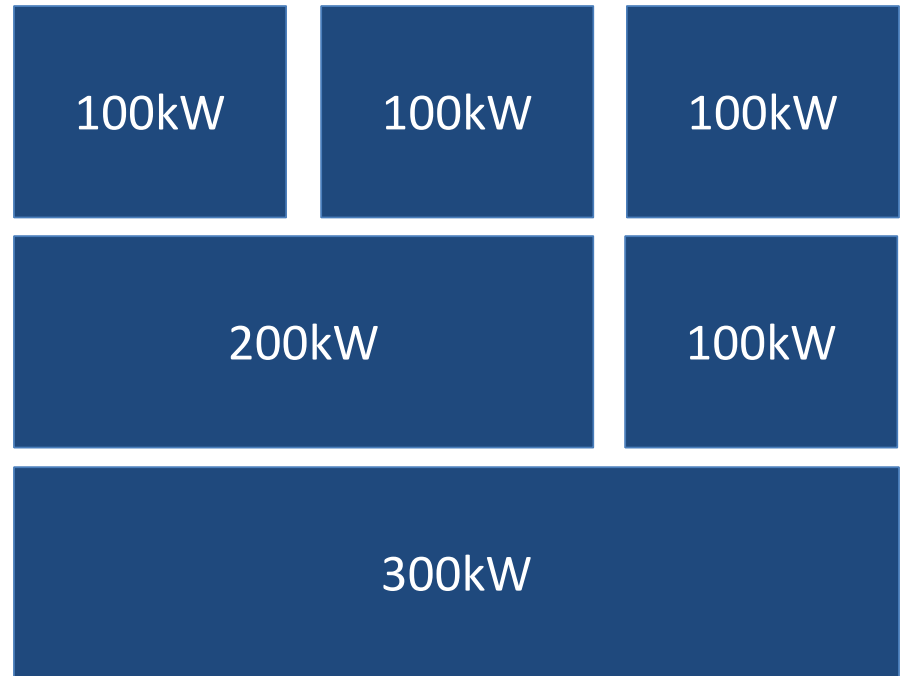
Image: Courtesy of Tesla Motors

**<500 VDC**



**NHR 9300 Series**

# Modular & Scalable Power



**You Control Size to Maximize Use In Test!**

# Comparing Battery Test Approaches

Manual

Source & Load

Automated System

NI + NHR Solutions



**Manual**



**Source & Load**



**Automated System**

**NI + NHR**

Open and flexible HW + SW  
reduces time to market.

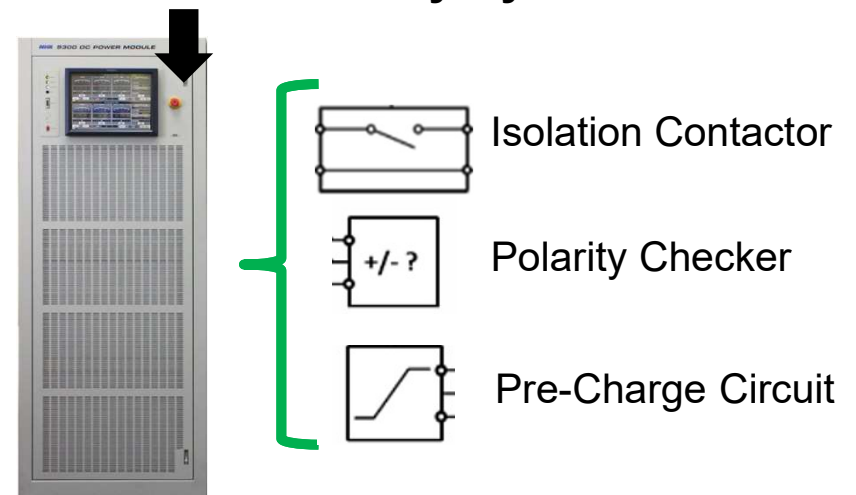
## Traditional Methods

- Limited test profiles, control, flexibility, time-to-results
- Expandability is often limited to “options” at purchase
- Difficult if not impossible to integrate other parts

# Keep it Simple, Use a Battery Cycler

- Battery cyclers are designed to test batteries.
  - High precision
  - Low leakage current
  - Built-in safety
  - Future-proofing: expandable power
- Not all battery cyclers are created equal.
  - Fixed vs. Flexible
- Build your own solutions (is generally bad):
  - Power supply issues
  - Complex HW/SW integration
  - Safety features (requires add-ons)
  - Time-consuming to develop

## NHR Battery Cycler

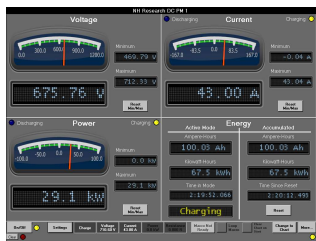


Battery testing starts faster with a *battery cycler*.



# The Power of Choice: Multiple Control Options

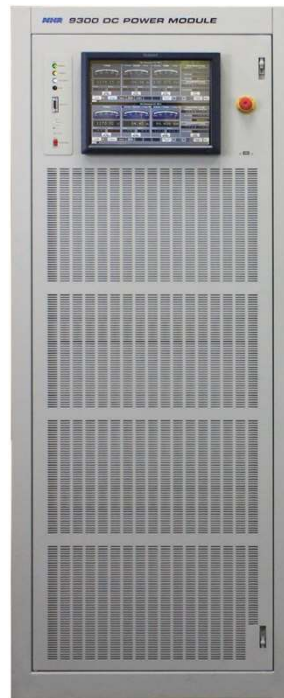
*NI BTS / Enerchron® Software - Work with your favorite Integrator - Write your own software*



Touch I/F



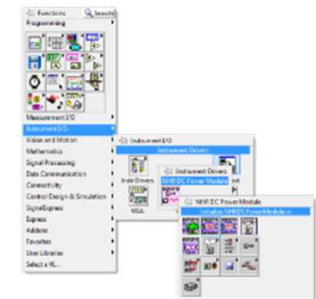
Remote



A screenshot of the NI BTS or Enerchron software interface showing a test procedure table. The table has columns for 'Label', 'Action', and 'Action Date'. It lists several procedures, including 'Procedure 1.2.7', 'Procedure 1.2.8', 'Procedure 1.2.9', 'Procedure 1.2.10', 'Procedure 1.2.11', and 'Procedure 1.2.12'. The 'Action' column contains details about the test, such as '490x Operation Discharge @ A=48' and 'Set Variables U60 = (DC PM 2/Voltage V)'.

	Label	Action	Action Date
7	Procedure 1.2.7	490x Operation Discharge @ A=48	
8	Procedure 1.2.8	Set Variables U60 = (DC PM 2/Voltage V)	
9	Procedure 1.2.9	490x Operation Discharge @ A=300	
10	Procedure 1.2.10	Set Variables U61 = (DC PM 2/Voltage V)	
11	Procedure 1.2.11	Set Variables Uin = int(Cycle_Count)/1, Uin = int(Cycle_Count)/1	
12	Procedure 1.2.12	490x Operation Stand By	
13	Procedure 1.2.13	Set Variables U61 = int(Cycle_Count)/1, U61 = int(Cycle_Count)/1	

NI BTS or Enerchron

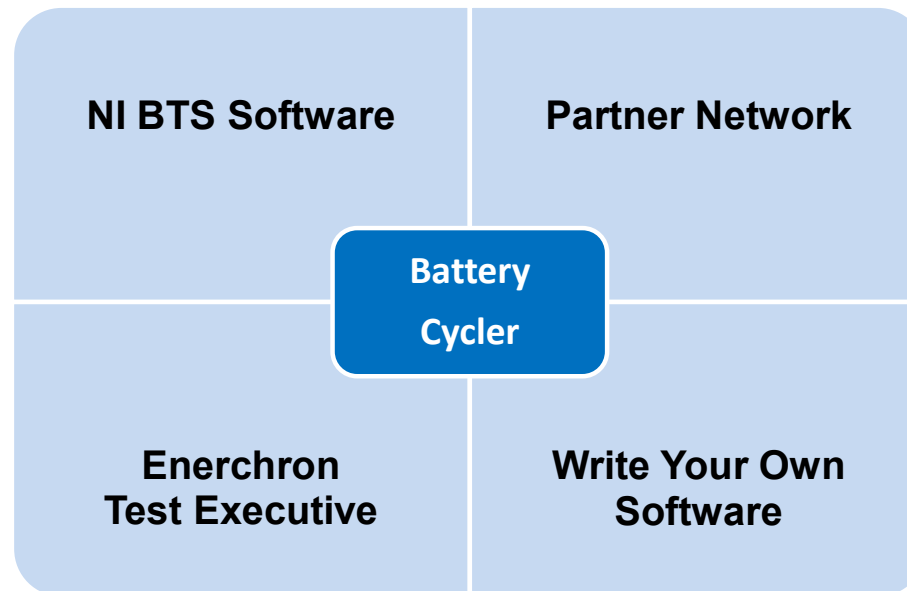


NI LabVIEW

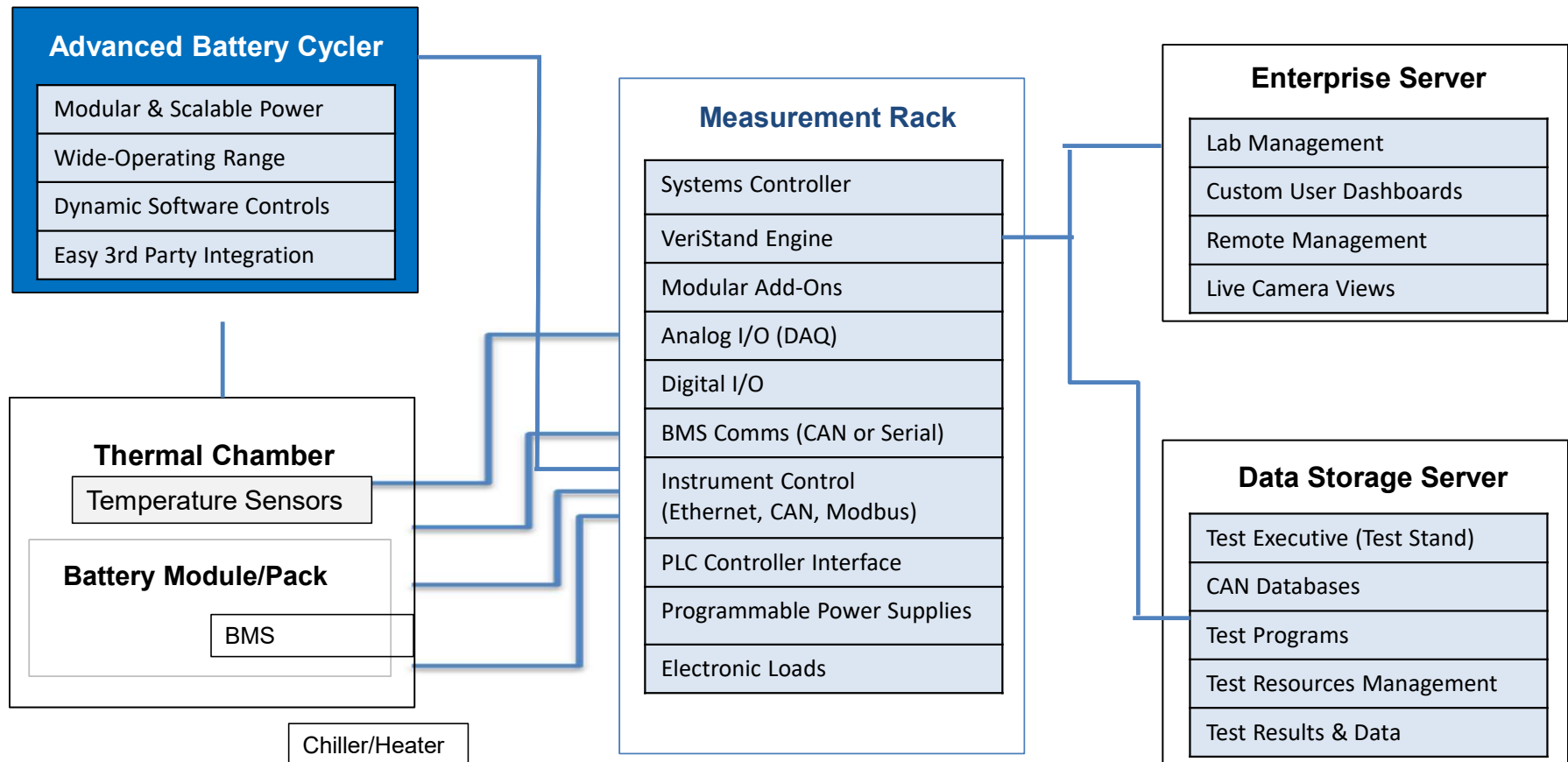
# Accelerate Battery Test Automation

*NI BTS – Work with your Partner – Enerchron® Test Executive – Write your own Software*

## Open and Complete Solutions



# NI's Battery Test System (BTS) Scalable Architecture



## NI + NHR Key Advantages

- **Future-proof** design with modular and scalable power up to 2.4MW
- **Advanced Hardware Performance** to optimize test and validation
- **Powerful Software Control** to get your testing started quickly
- **Integration & Integrator-Friendly** adds customization to your test setup
- **Flexible, Open Test Platform** to evolve with your future battery test requirements

We got you covered with our  
Battery Test Expertise and Network of  
Solutions Partners!



Your Partner in Test

# Access Battery Test Resources

Visit us at <http://nhresearch.com>



## The Fundamentals of Battery Module/Pack Test

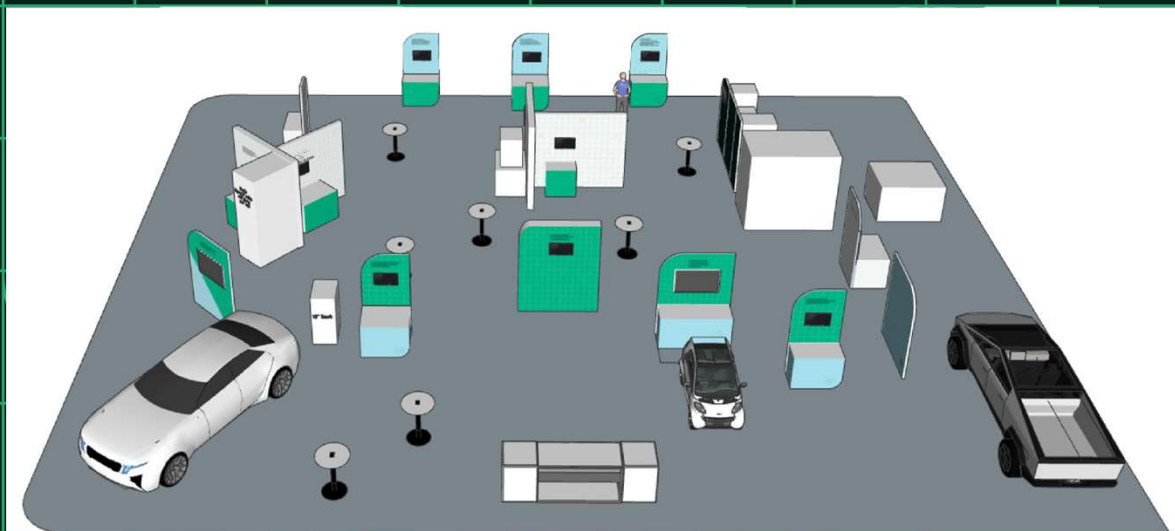


	THE EVOLUTION OF BATTERY TEST APPROACHES		
	Manual	Automated Source/Load	NHR's Next-Generation
Wide Operating Range	+	+	●
Modular, Scalable Power	+	+	●
Fast Data Rate & Accuracy (V, I, DC, OR, C/P)	+	+	●
Layers of Built-in Safety	+	+	●
Choice of Software Options	+	+	●
Easy & Powerful Software	+	+	●
Easy Third-Party Integration	+	+	●
Multiple Control Options (V, I, DC, OR, C/P)	+	+	●
Built-in Measurements	+	+	●
Regenerative Energy Savings	+	+	●
Reduced Testing Time	+	+	●

- [NHR's 9200/9300 Battery Test Solutions](#)
- [Download The Fundamentals of Battery Test White Paper](#)
- [Schedule a consultation](#)



## EXPERIENCE LOUNGE



**BATTERY TEST SYSTEM DEMO**  
**NHR Power Electronics**



**Questions?**  
**Thank you for attending**

**For more resources**

Visit: <http://nhresearch.com>

Call: **949-474-3900**

Email: **sales@nhresearch.com**



***...Your Partner in Test***