Strategies for Scalable 800V Battery Pack Testing
Safety, Speed & Efficiency

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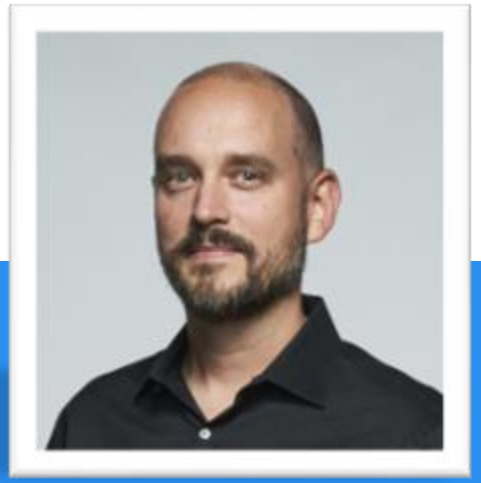
Strategies For Scalable 800 V Battery Pack Testing: Safety, Speed & Efficiency



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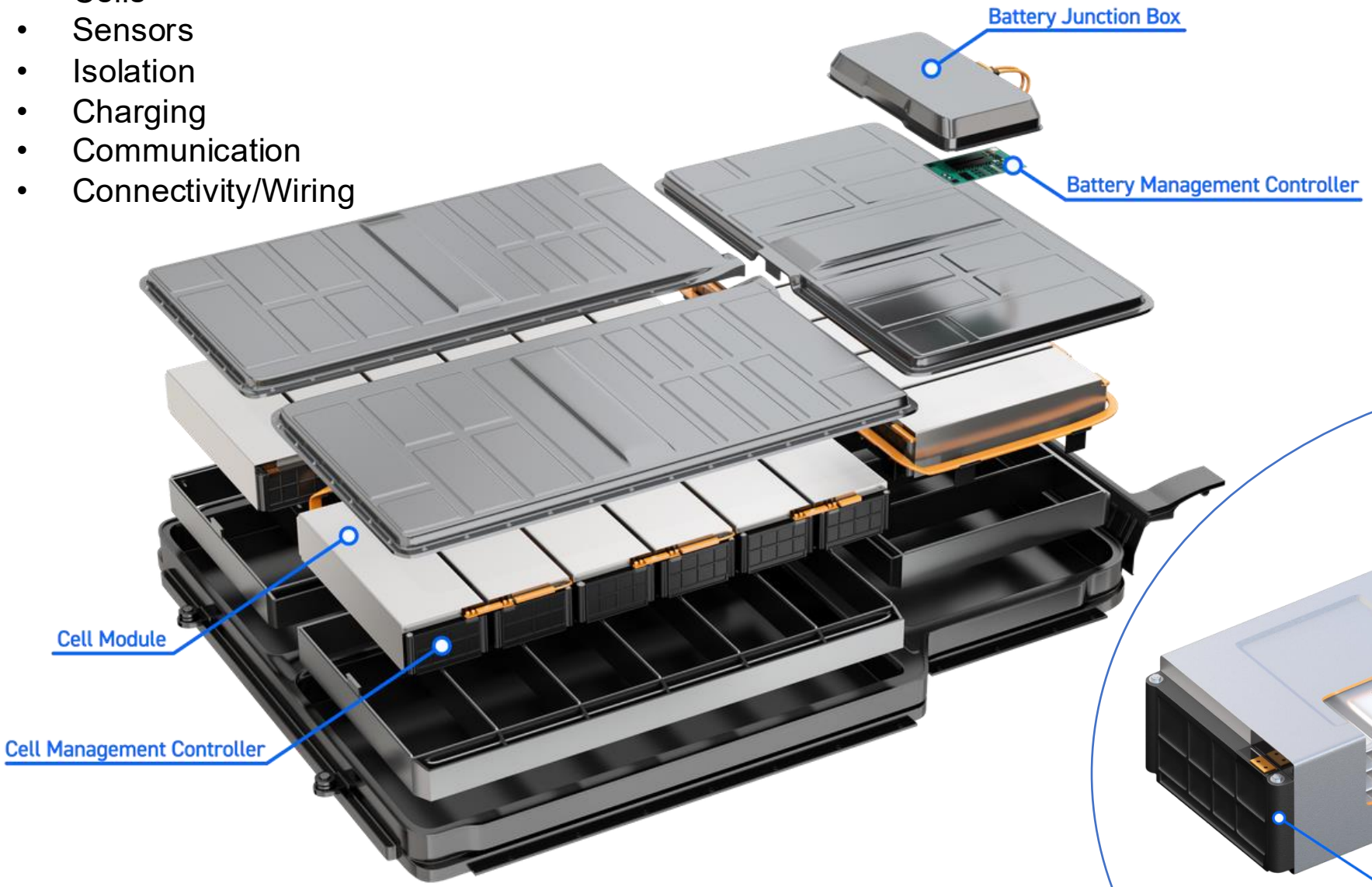
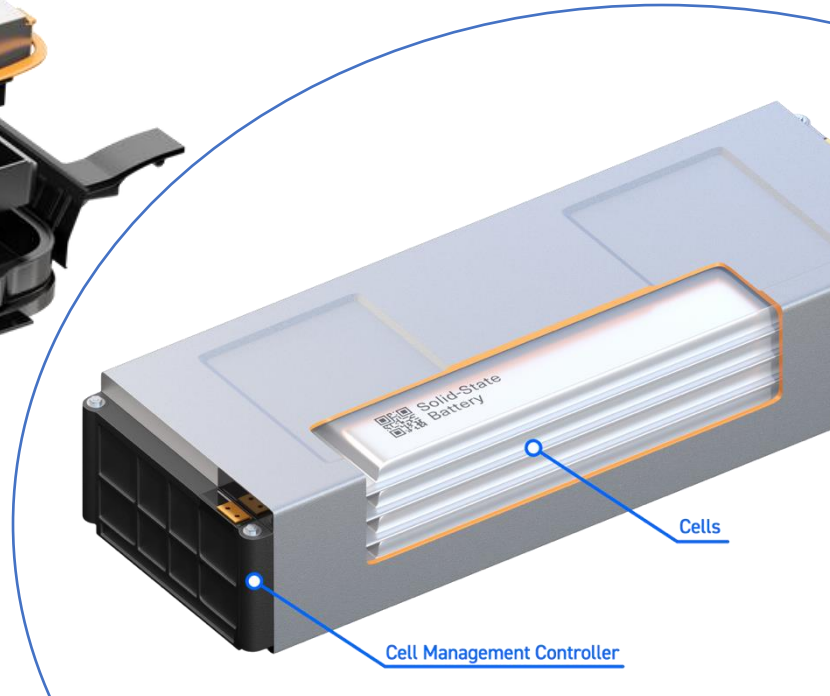
BMS Test System

- Cells
- Sensors
- Isolation
- Charging
- Communication
- Connectivity/Wiring





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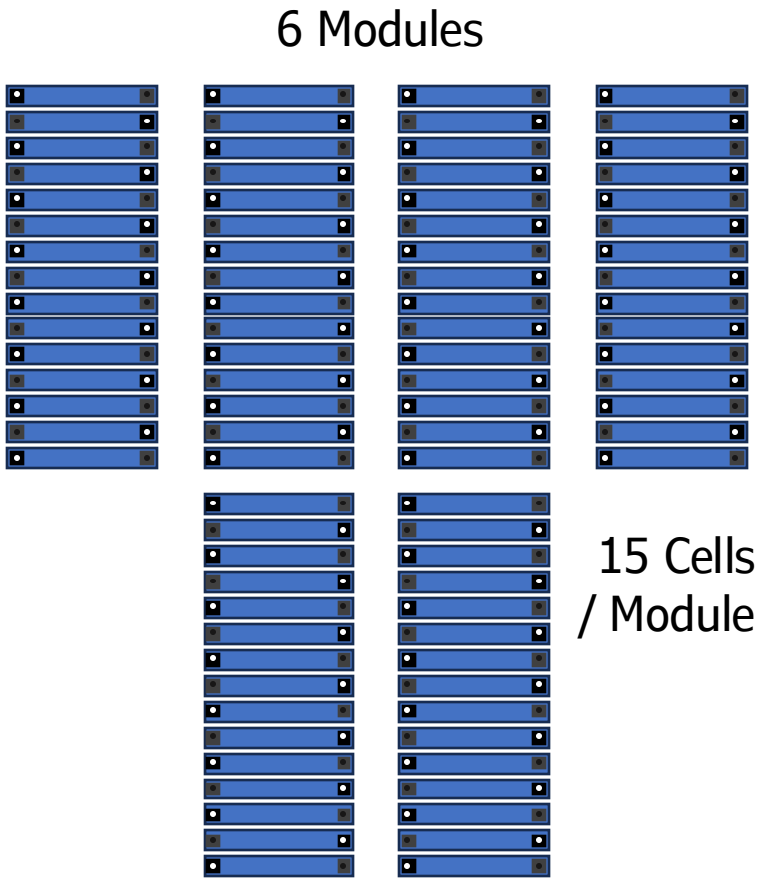
Traditional Battery Cell Simulation for 400 Volt System



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Legacy Solution

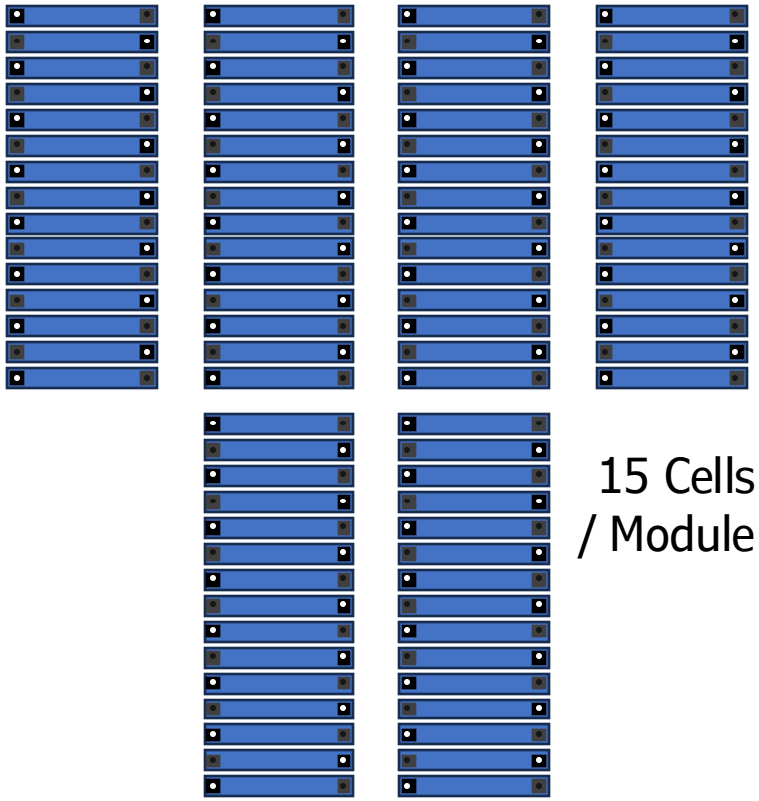
- 19” Racks
- 6-8 U Boxes
- At least 2 Boxes

SLSC boxes on top of PXI

90 cells at 4.2V in series = 378V

Modular Battery Cell Simulation for 400 Volt System

6 Modules



15 Cells / Module

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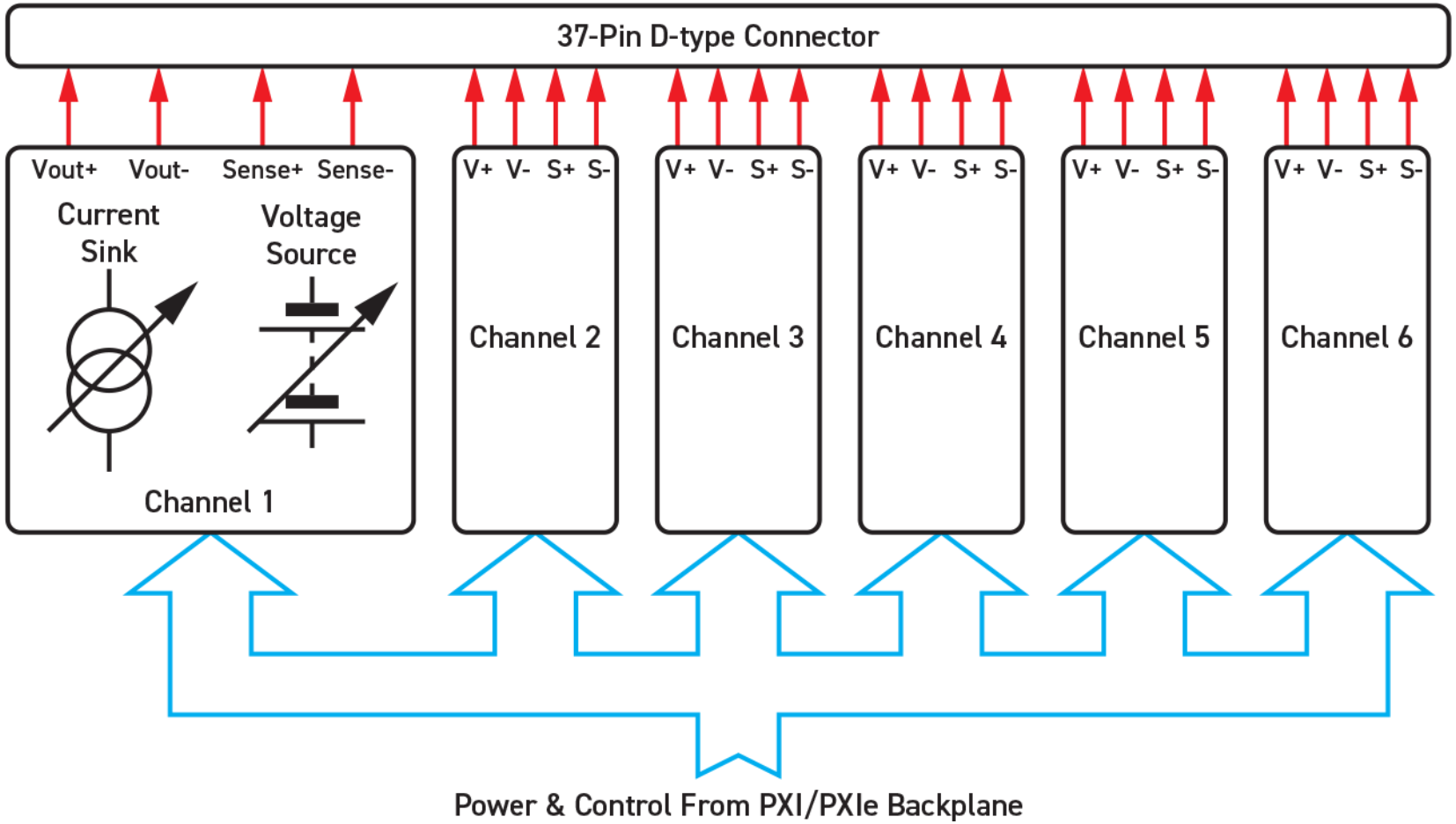
PXI Approach

- 6 channels per PXI card
- 3 cards per cell module
- 18 total PXI cards

90 cells at 4.2V in series = 378V

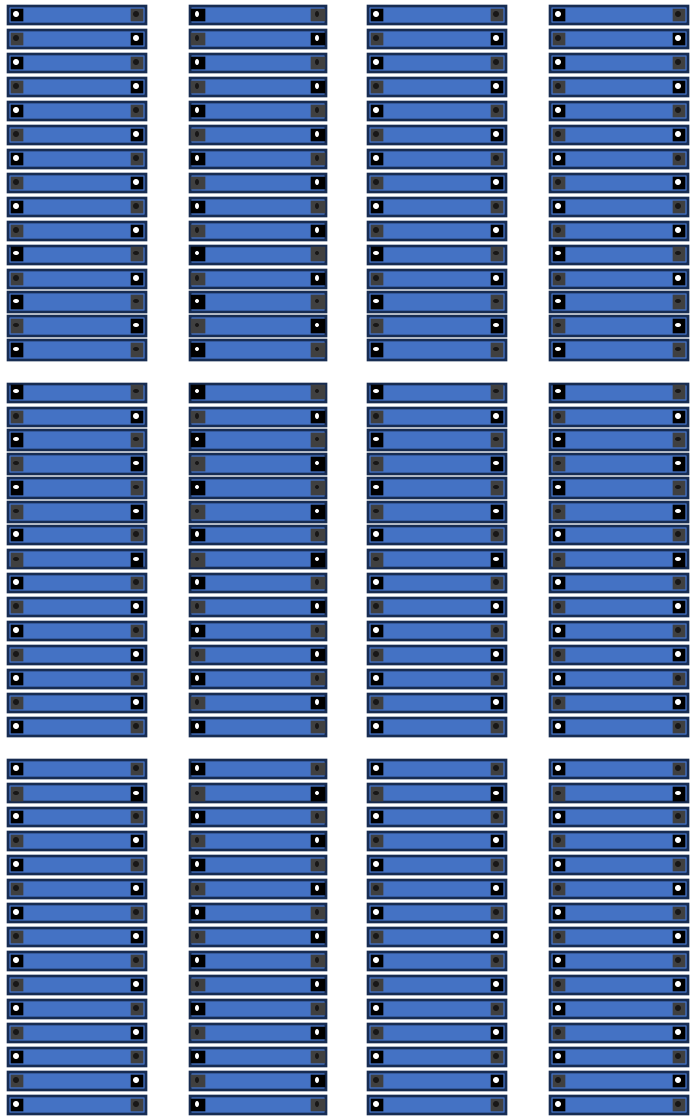
Six Channel Battery Simulator



800V Battery Simulation

12 Modules

15 Cells / Module



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PXI Approach

- 6 channels per PXI card
- 3 cards per cell module
- 18 total PXI cards

180 cells at 4.2V in series = 756V

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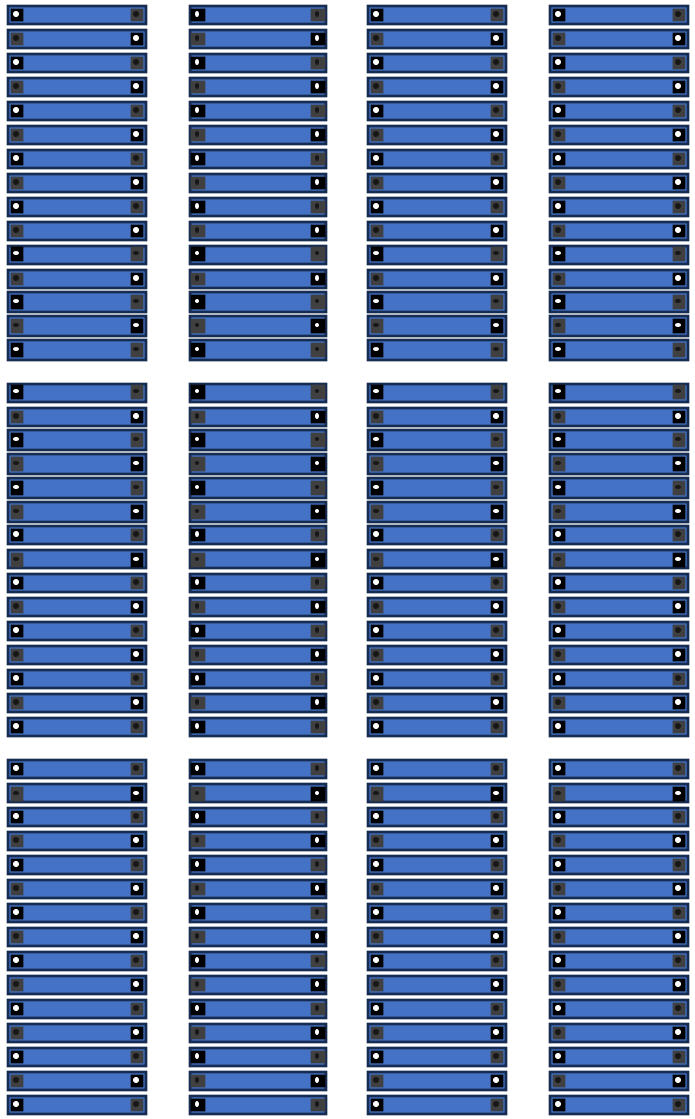
800V Battery Simulation

12 Modules

15 Cells / Module



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PXI Approach

- 6 channels per PXI card
- 3 cards per cell module
- 18 t[illegible] PXI card[illegible]

180 cells at 4.2V in series = 756V

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Reasons Doubling Chassis Won't Work at 800V

- Stringent Requirements:
  - Budget
  - Test Optimization
  - Reuse Test Equipment
- Safety: Exposure to HV

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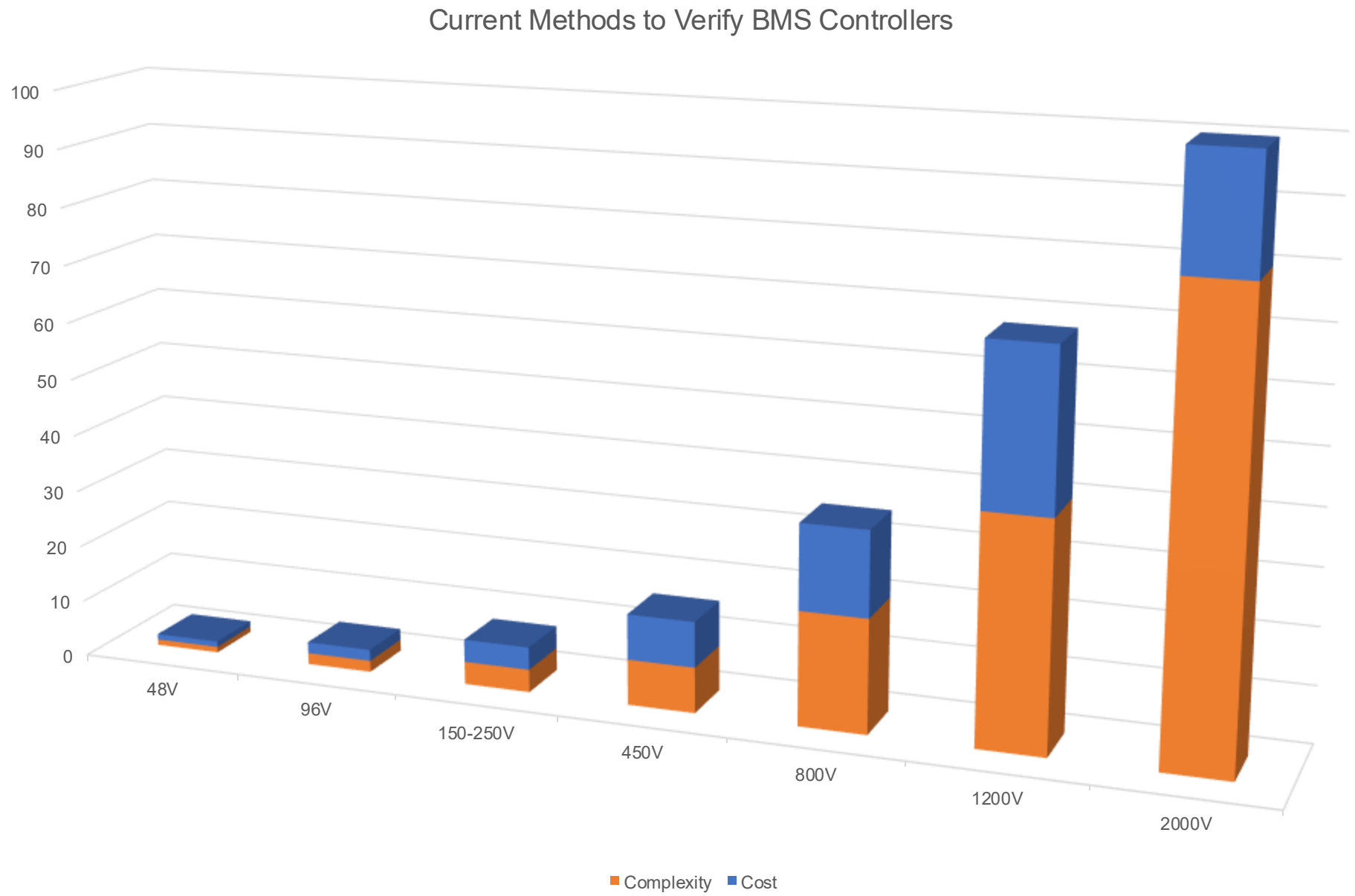
Why Migration is Less Feasible at 800V

- Adds Complexity
- Number of Channels
- Wiring
- Budget Constraints
- Cost Scrutiny
- Safety

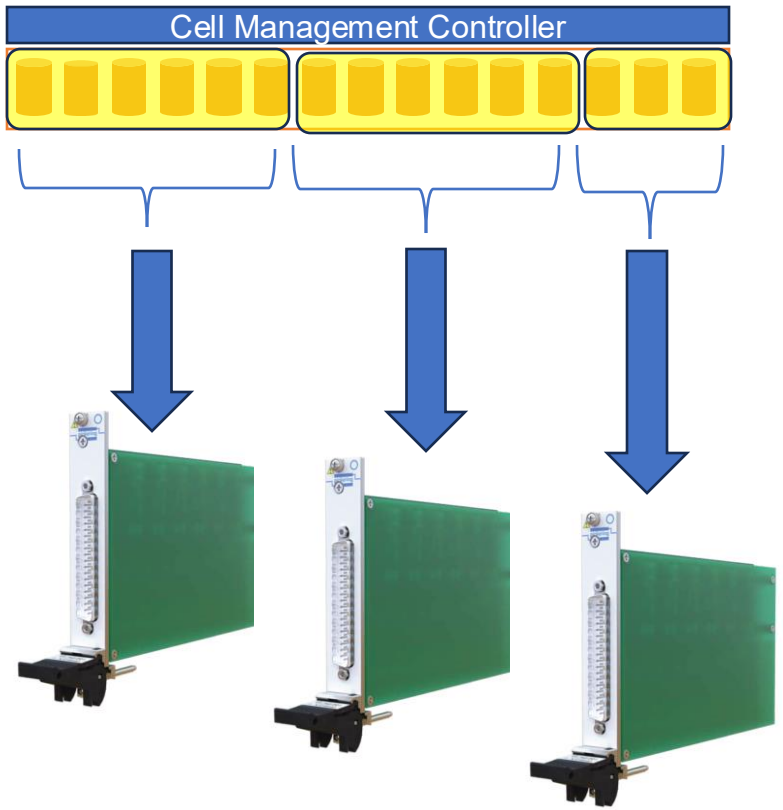
Exponential Growth in Complexity & Cost

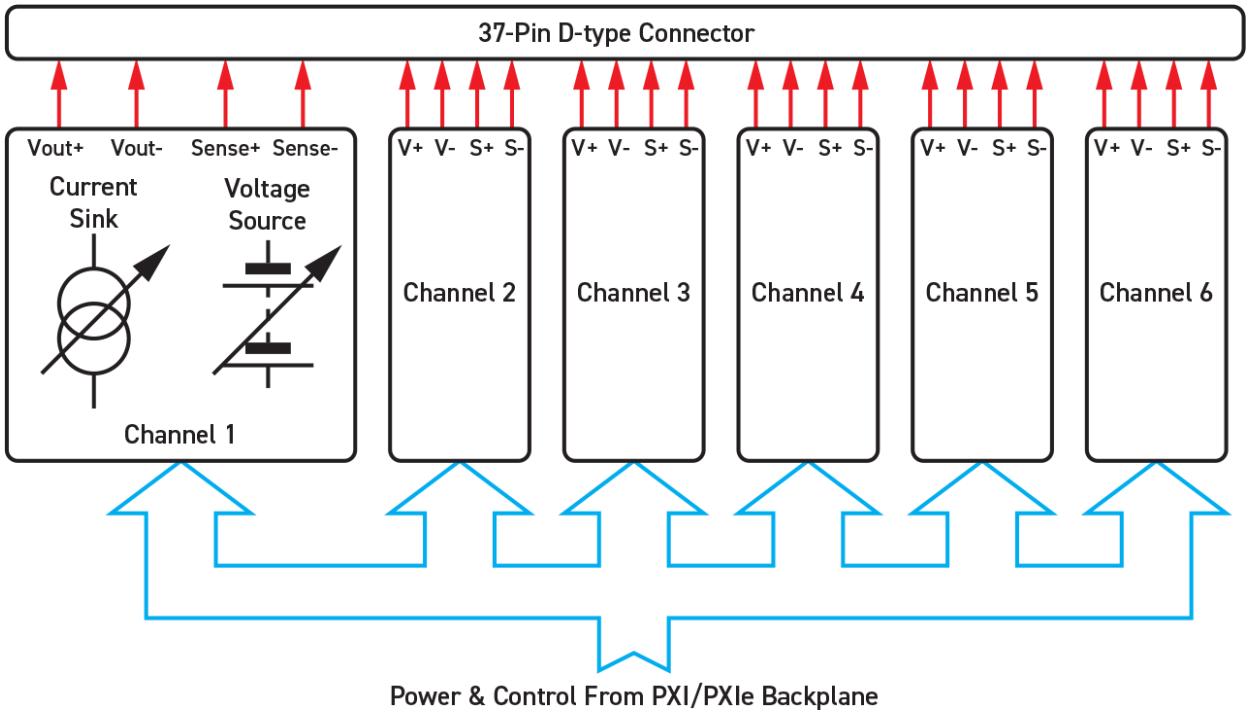


Exponential Growth in Complexity & Cost

Battery Pack Management Controller

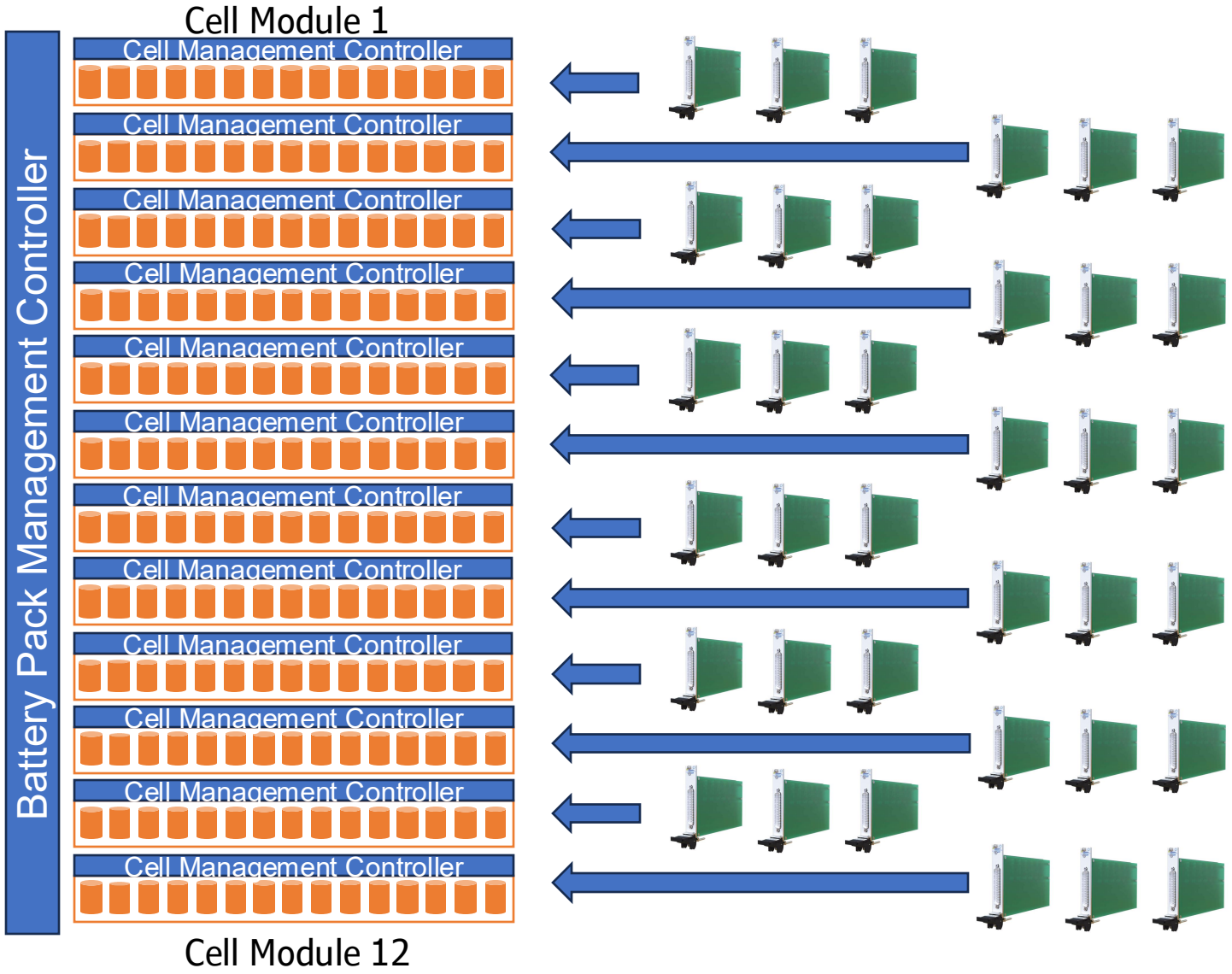
Cell Module 1





Testing each Cell Management Controller requires 3off 6-channel 300mA PXI Cell Simulators to simulate the module's 15 series-connected cells.

Exponential Growth in Complexity & Cost



Testing the 800V BMS with a 1:1 simulator-to-cell mapping requires 3 off 6-channel 300mA Cell Simulators to simulate each module's 15 cells, 36 cell simulators to simulate the complete 12 module pack, and a maximum working voltage of 800V. The simulators require 2 x 21-slot PXI chassis:

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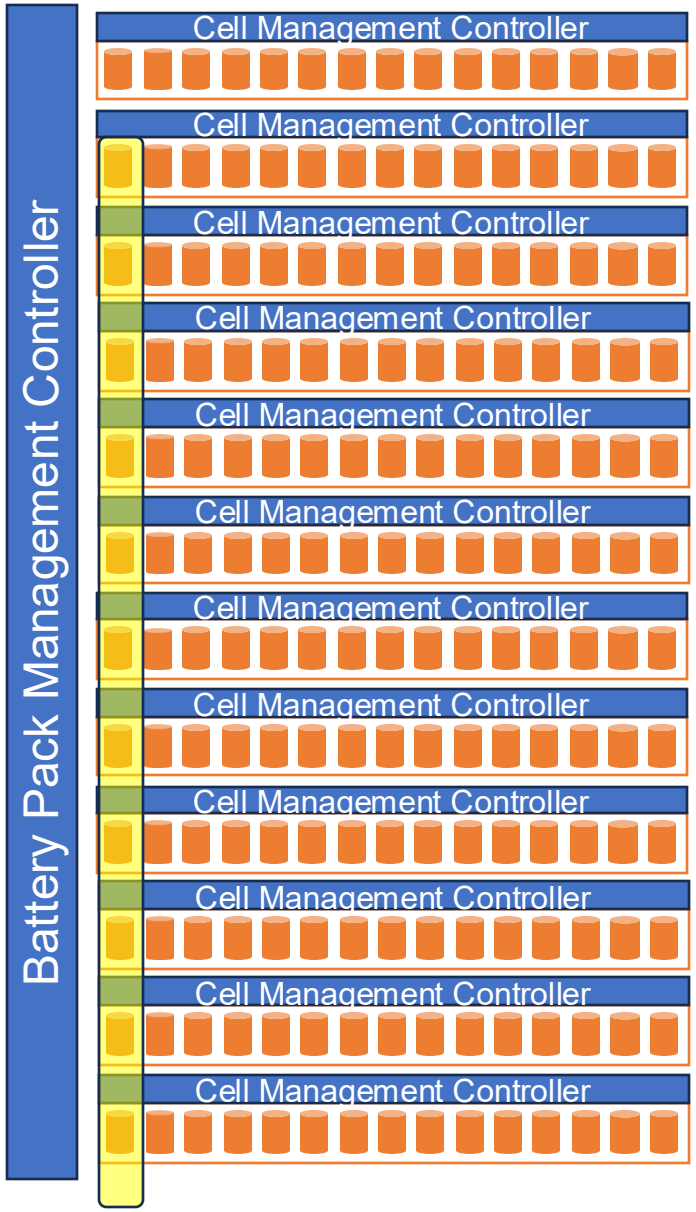
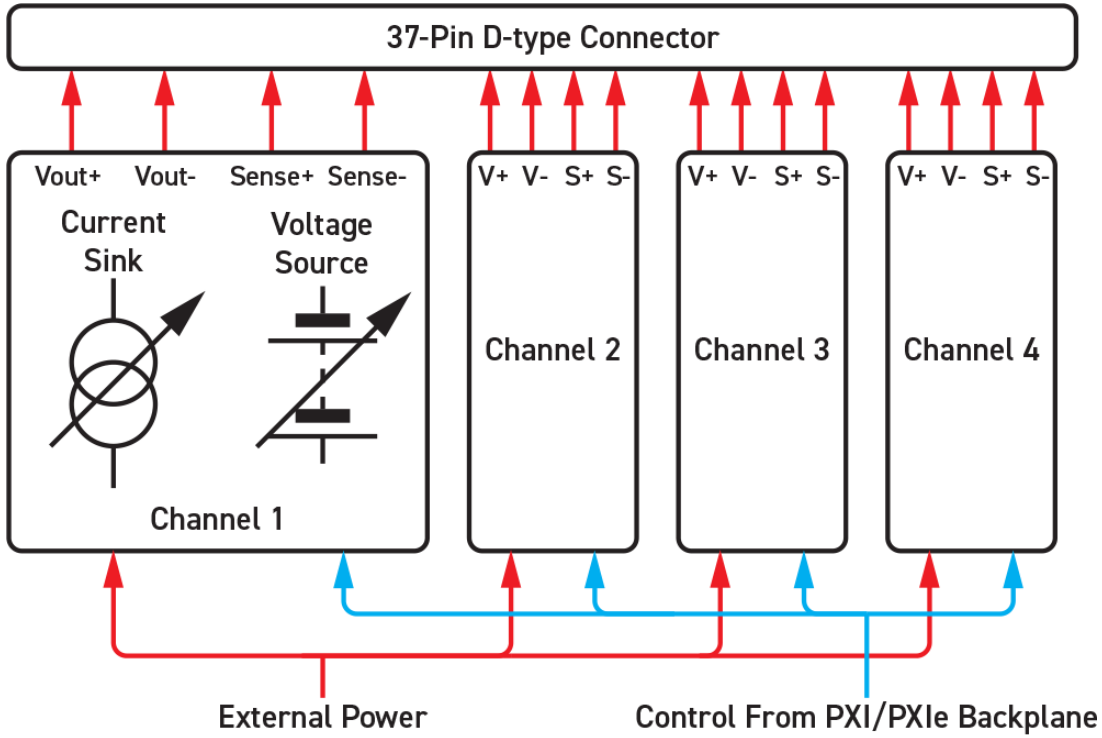
Exponential Growth in Complexity & Cost

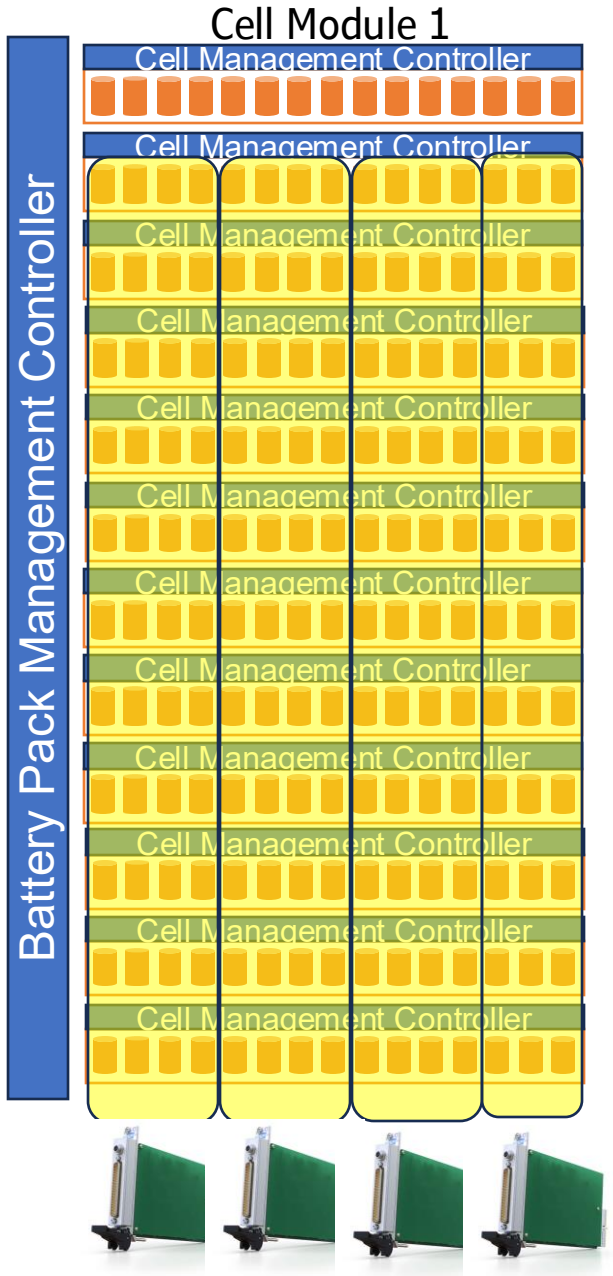




4-Channel Battery Simulator - Part No. 41/43-754-011

Using a 5A cell simulator, each channel can simulate up to 16 cells in parallel while still providing the required 300mA balancing current for each.

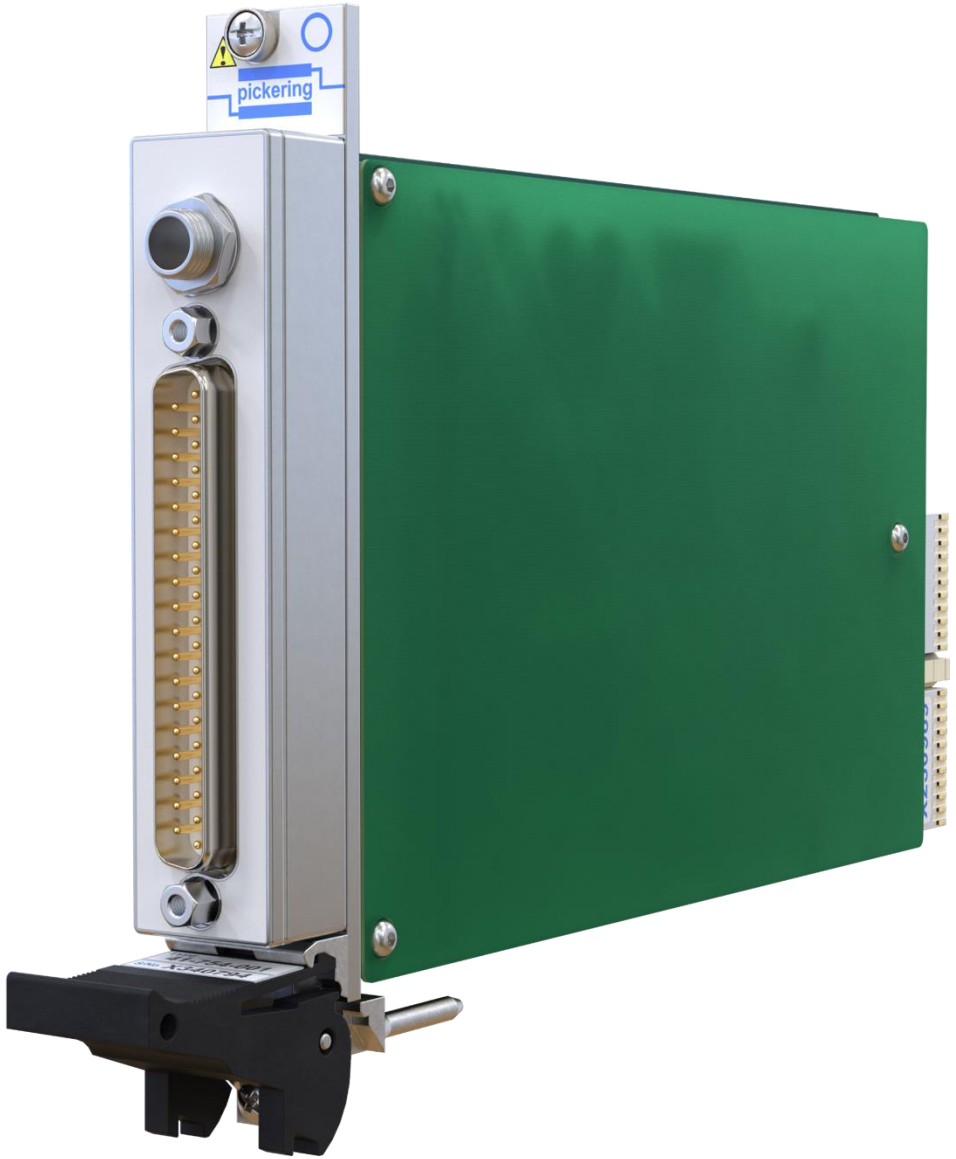
Exponential Growth in Complexity & Cost



Retain three 300mA cell simulators for a single cell module for charging/discharging and individual cell balancing.

Test all other cells in parallel using 4off, 4-channel 5A cell simulators. The maximum working voltage is now only 63V, the maximum voltage of each cell module.

This strategy only requires a single 8-slot PXI chassis:



5000mA Bat Sim Overview

- Available as PXI or PXIe
- Up to 4 channels per module
- Voltage & Current Readback
- Independent Sense Connections
- Ideal for Battery Stack Emulation
- 1000V Isolation to Ground
  - 750V Isolation Channel to Channel
- Up to 5A Source per Channel
  - Current Sink 7W[1] (Continuous)
    - 40W Absolute Surge[2]
- Up to 8V per Channel (programmable)
- Comms Interface: PXI/Ethernet
- Hardware Interlock

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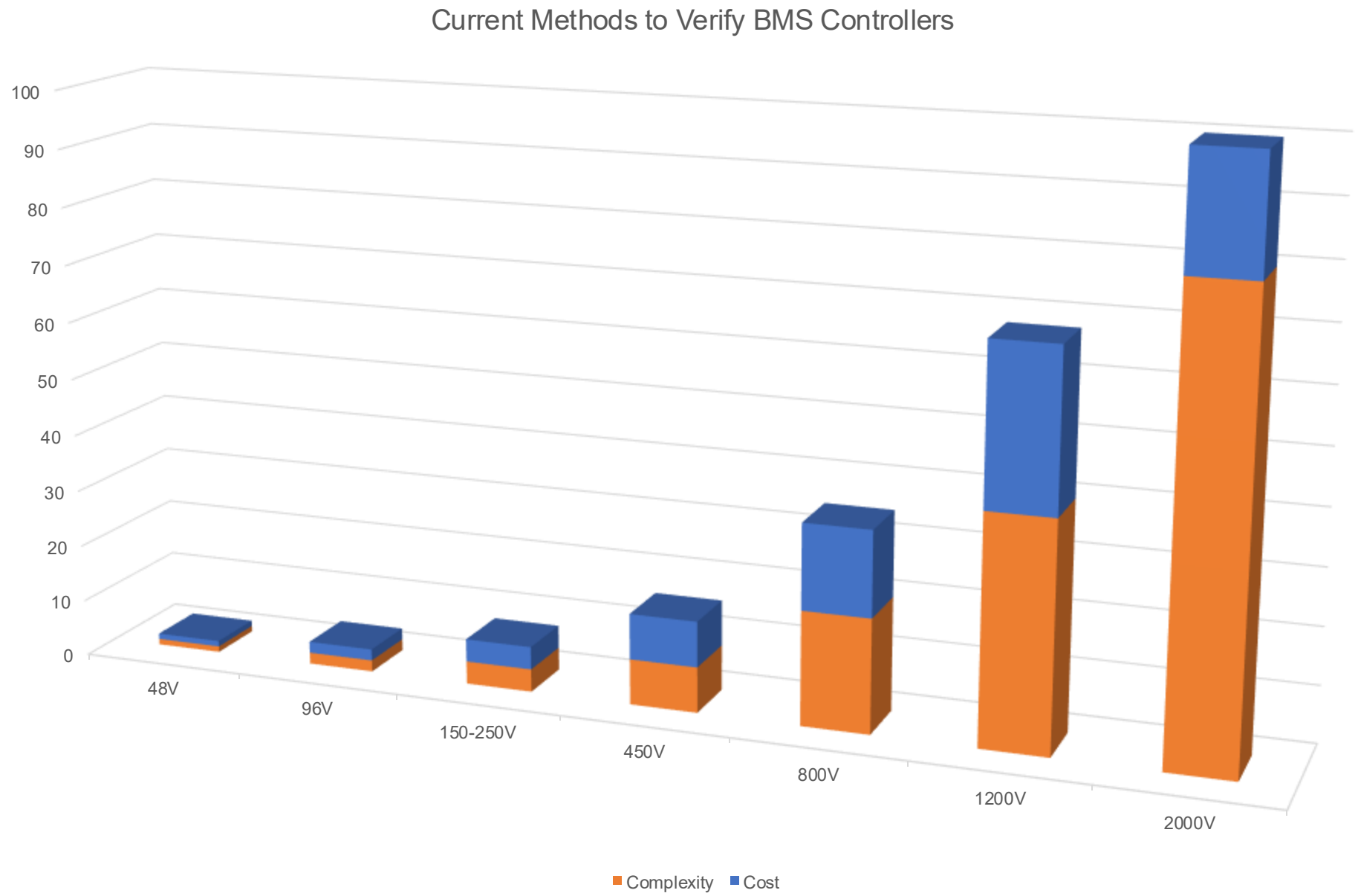
Exponential Growth in Complexity & Cost



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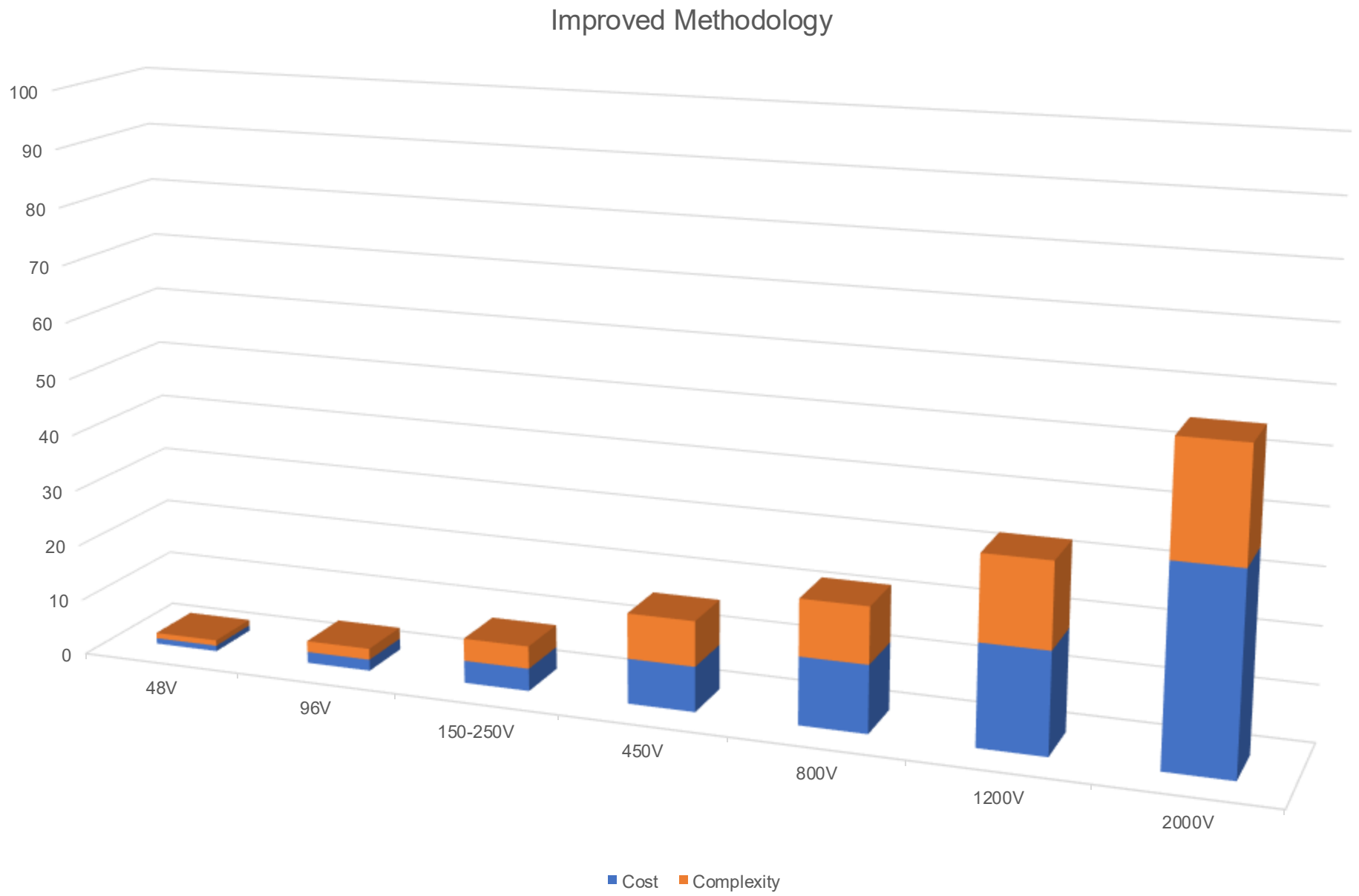
Flattened Growth in Complexity & Cost



Configurations for a Typical 800V Battery Electric Vehicle

300mA Configuration

2x 21-Slot PXIe Hybrid Chassis
24x 300mA Battery Simulator Module (6ch)
12x 300mA Battery Simulator Module (4ch)

VS

1x 8-Slot PXIe Hybrid Chassis
4x 5A Battery Simulator Module (4ch)
2x 300mA Battery Simulator Module (6ch)
1x 300mA Battery Simulator Module (4ch)

5A Configuration

Each Configuration Can Simulate 180 Cells

Q&A

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