

Plug-in Electric Vehicle Charging Characteristics

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Outline

- Electric Vehicle Supply Equipment
- Charging System Topologies
- Charging Characteristics
- Vehicle Voltage Response

Some Electric Vehicle Supply Equipment Samples



Level 1 AC - Cord Set
120V charging



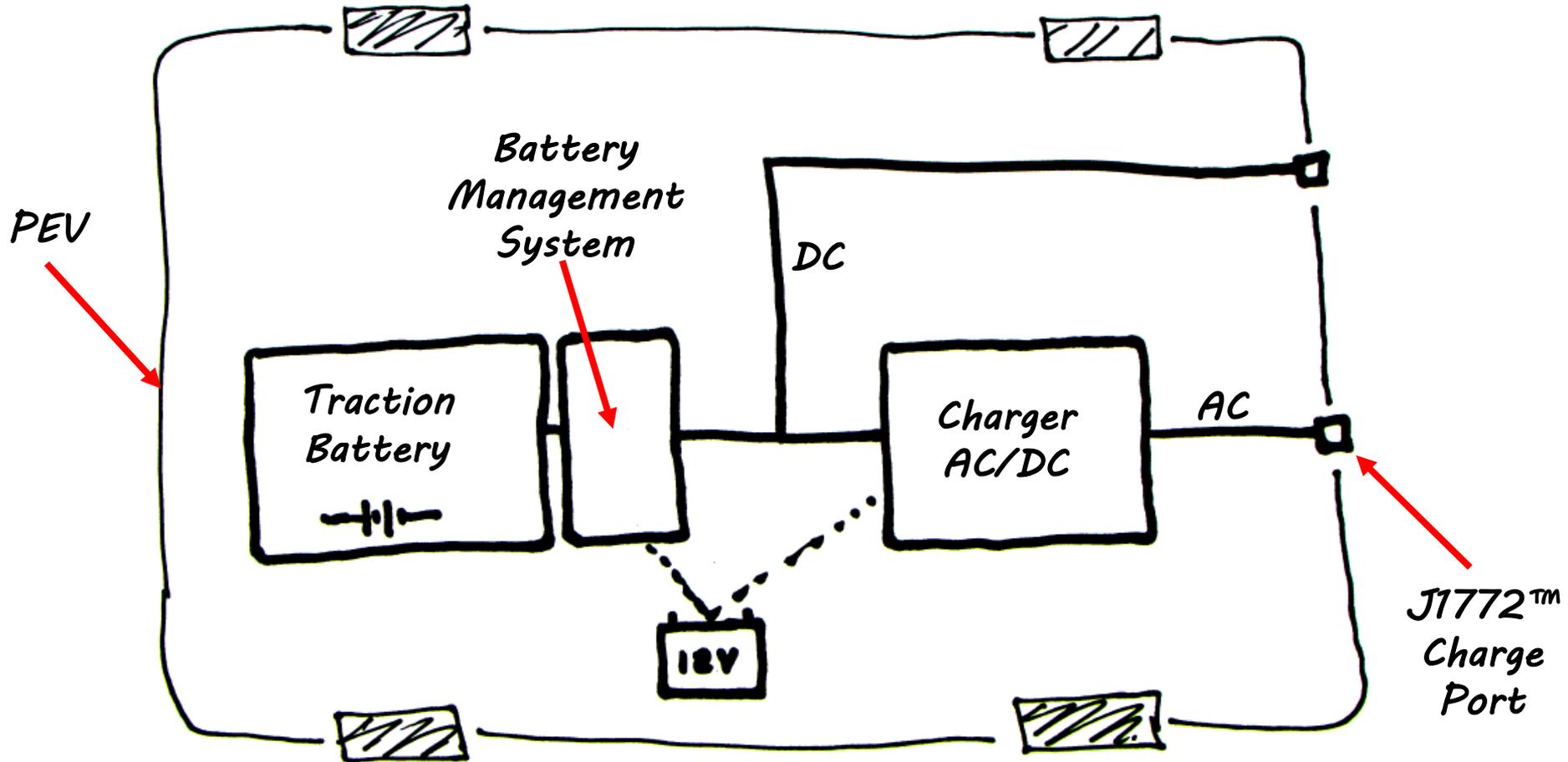
DC Fast

208/480V 3phase input

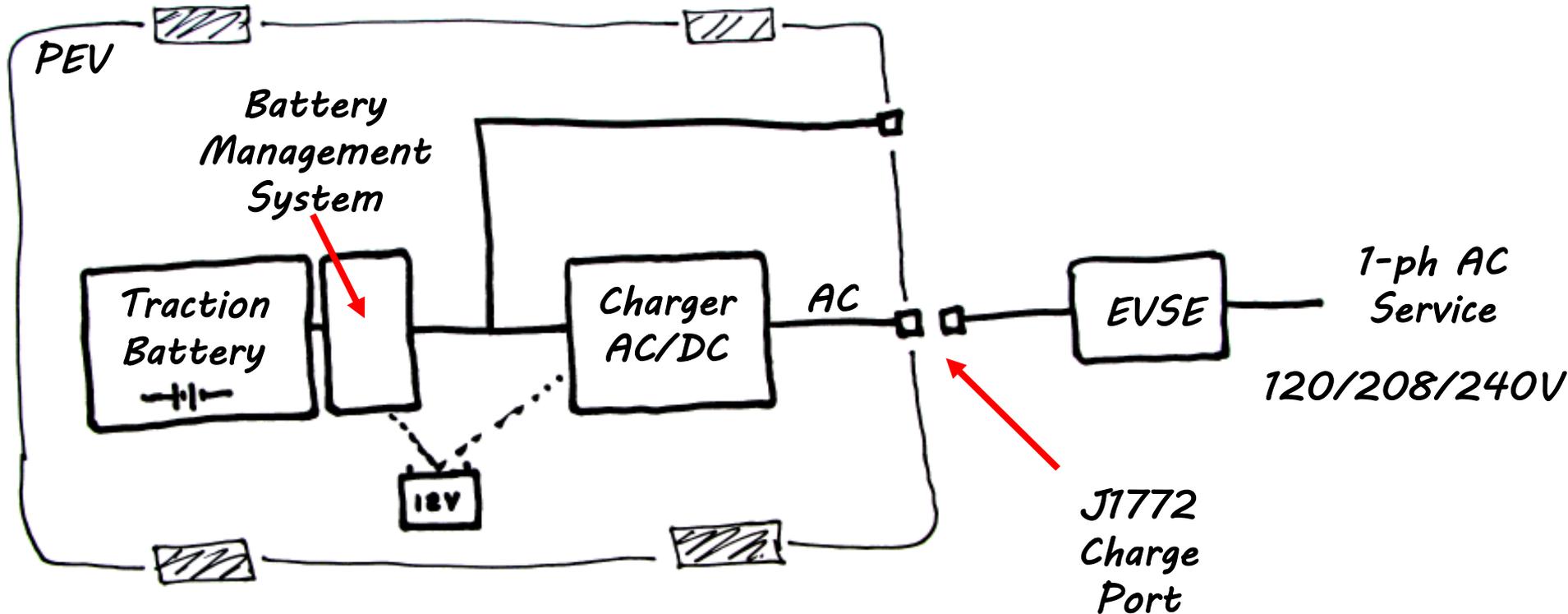


Level 2 AC
208/240V charging

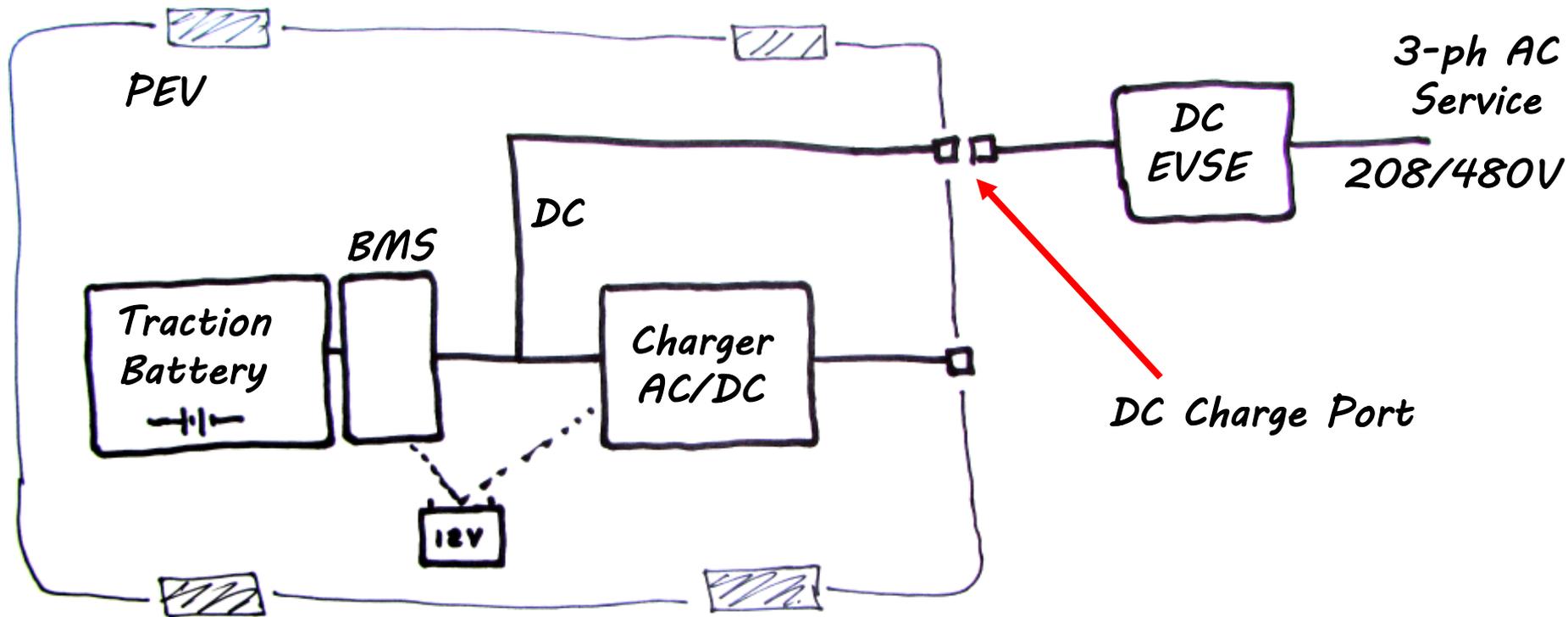
Plug-in Vehicle On-board System Topology



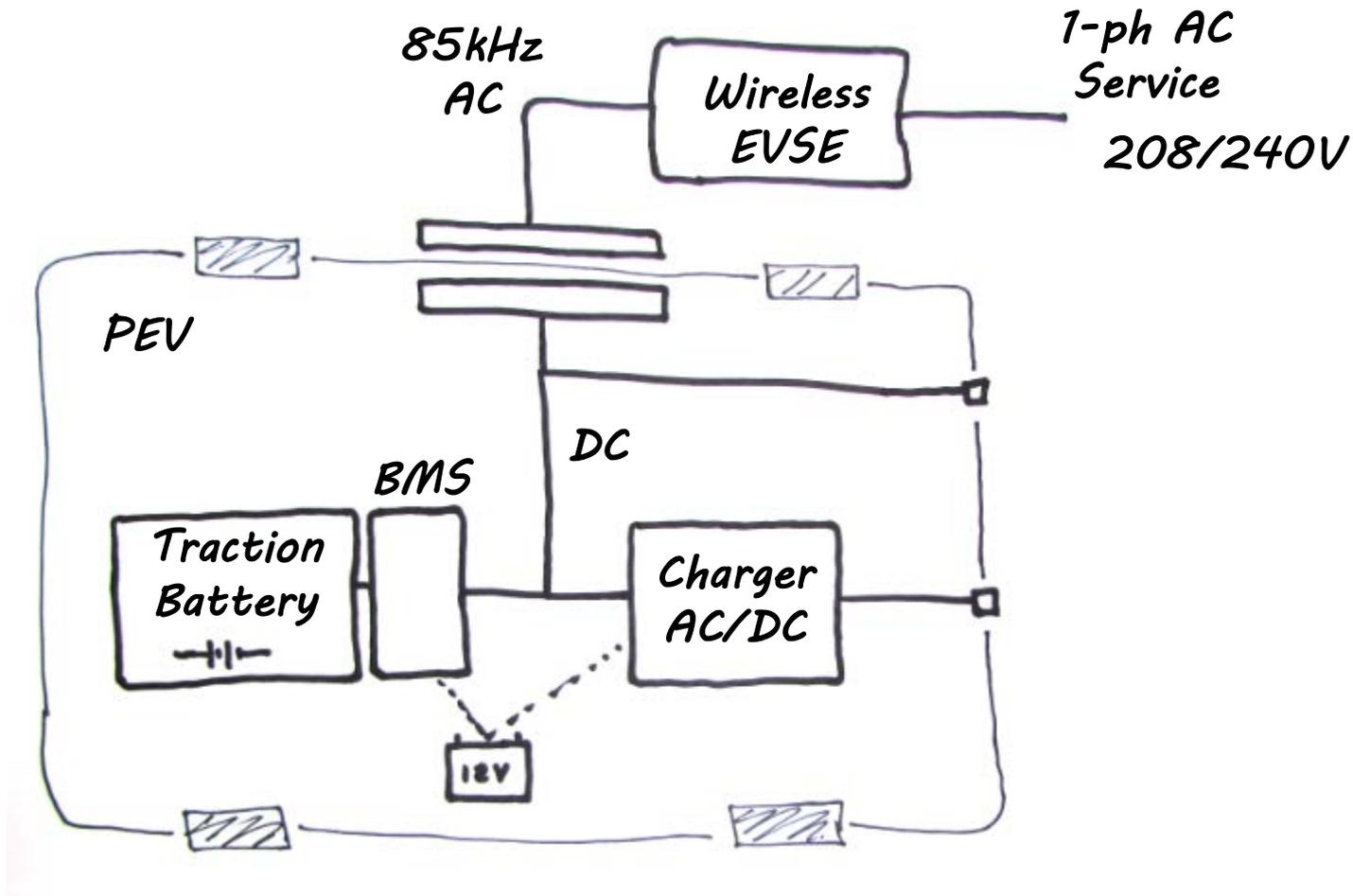
Topology and Nomenclature – AC Charging



DC Charging

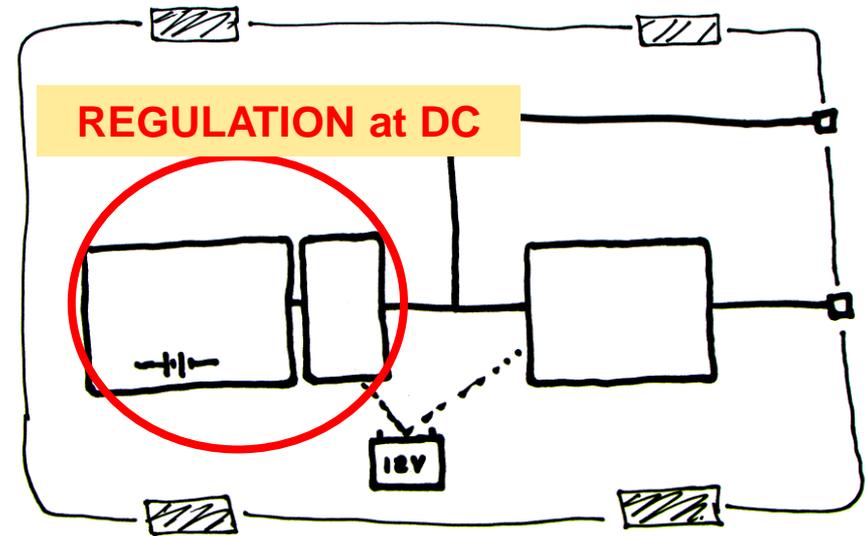


Wireless Charging

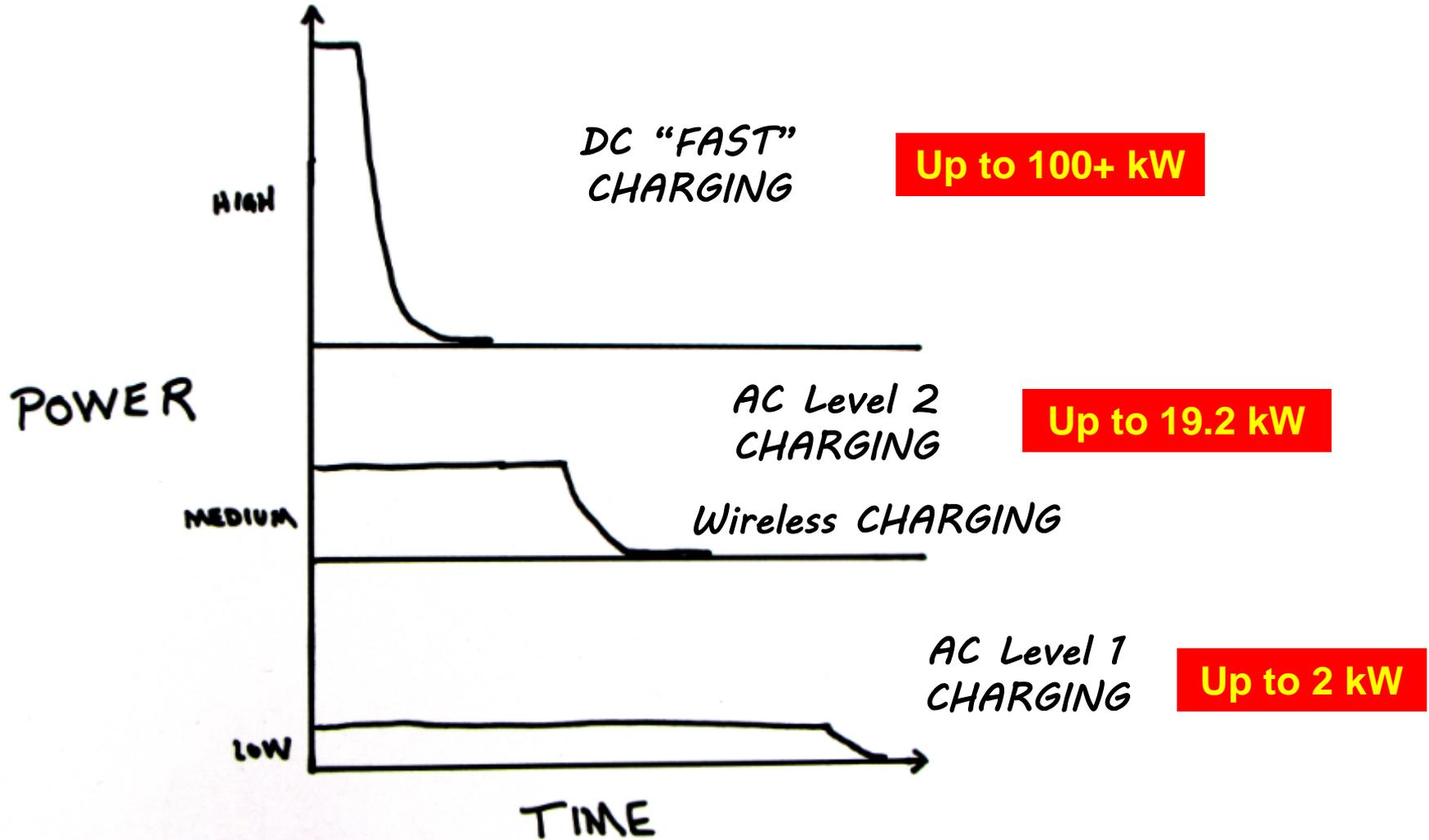


No Matter the Charging Technology...

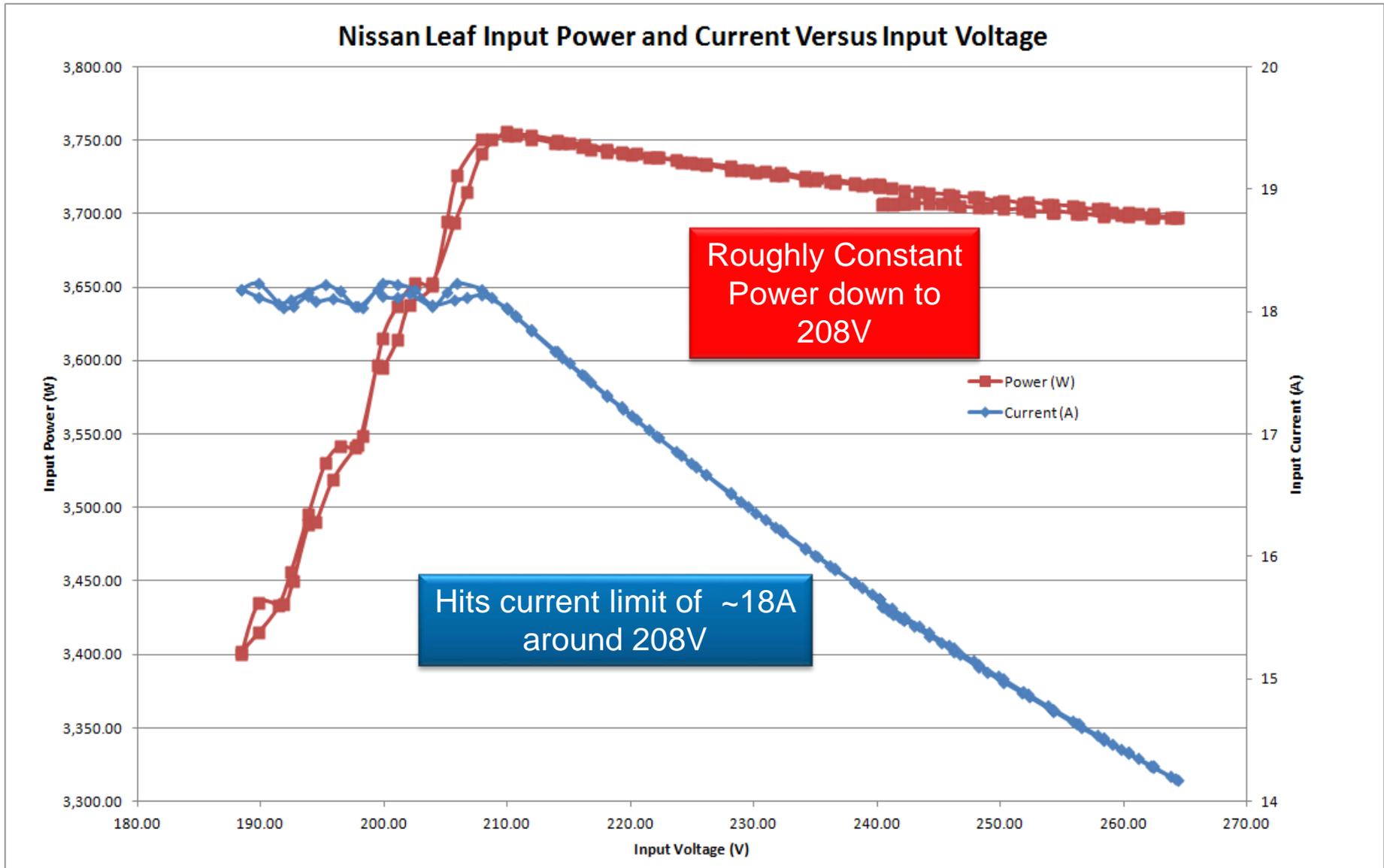
- Regulation is at the battery (DC load side)
 - V and I controlled by Battery Management System
 - From AC input, generally looks like a constant power load with a current limit
- Standards, wire sizing, etc..
 - Based on input current
- Response to off-normal conditions mix of:
 - OEM designed charge management
 - Third party charge station design (AC, DC Wireless)



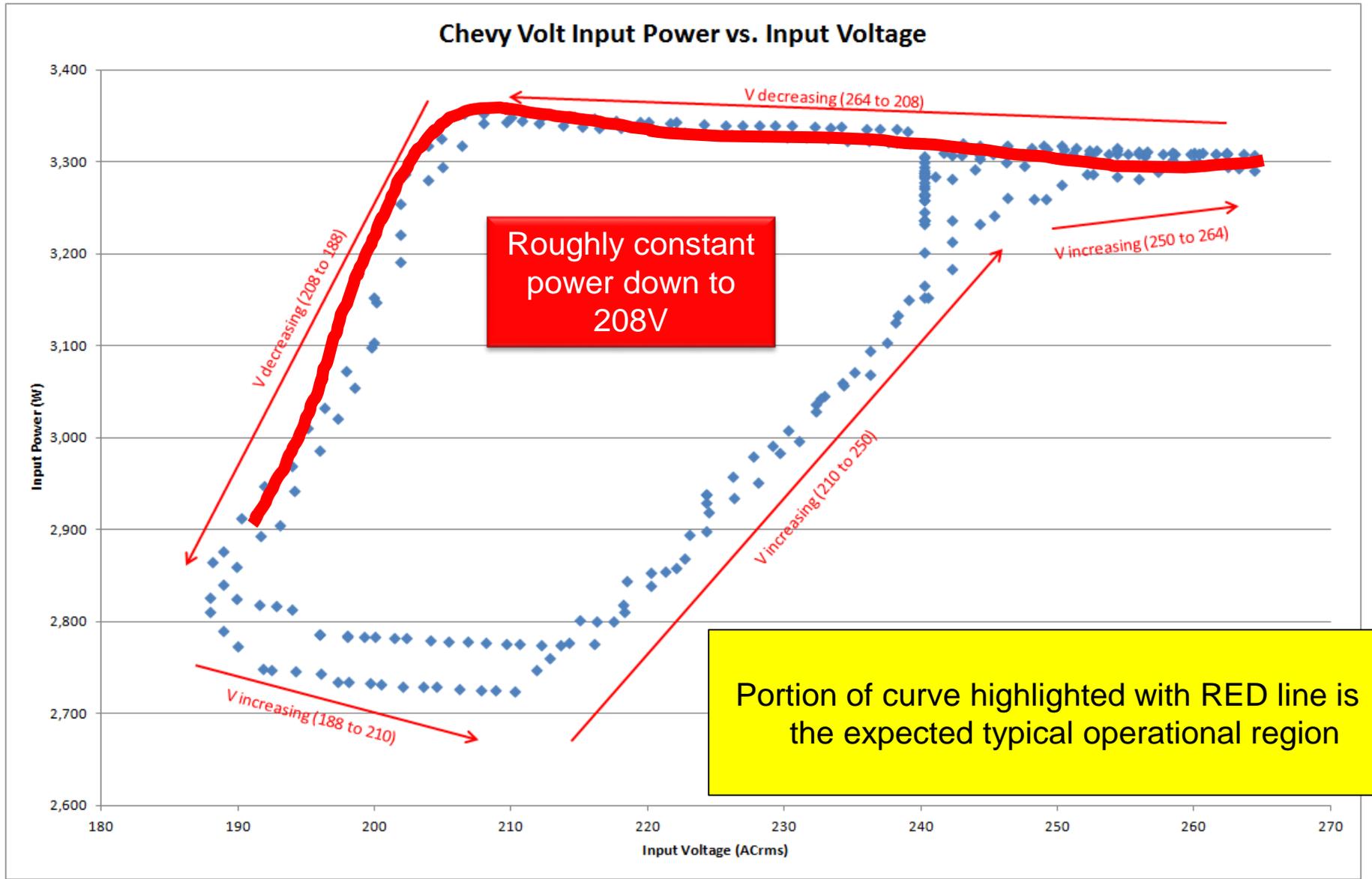
Power versus Time



EPRI 2011 Nissan Leaf Data

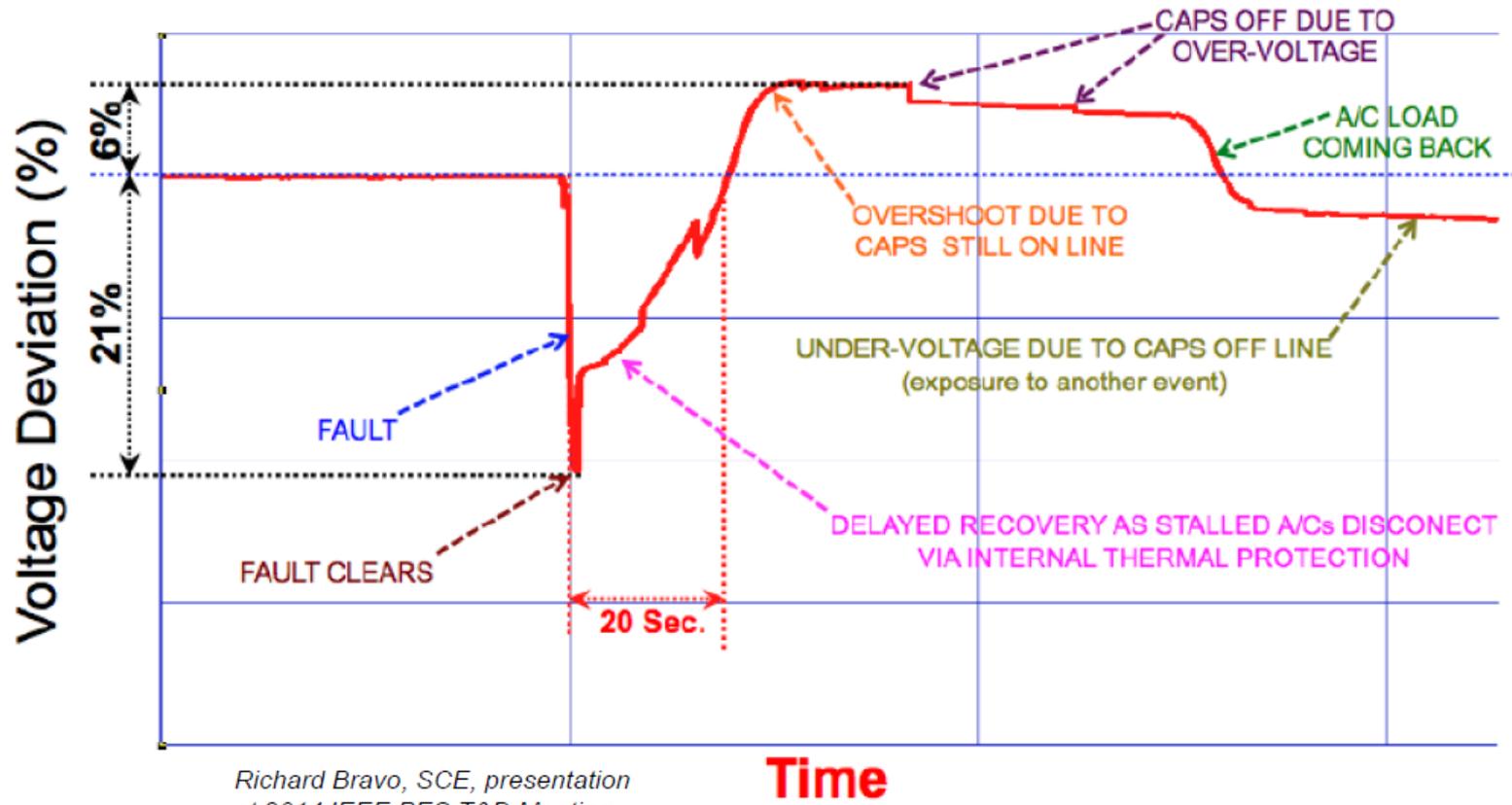


EPRI 2011 Chevy Volt



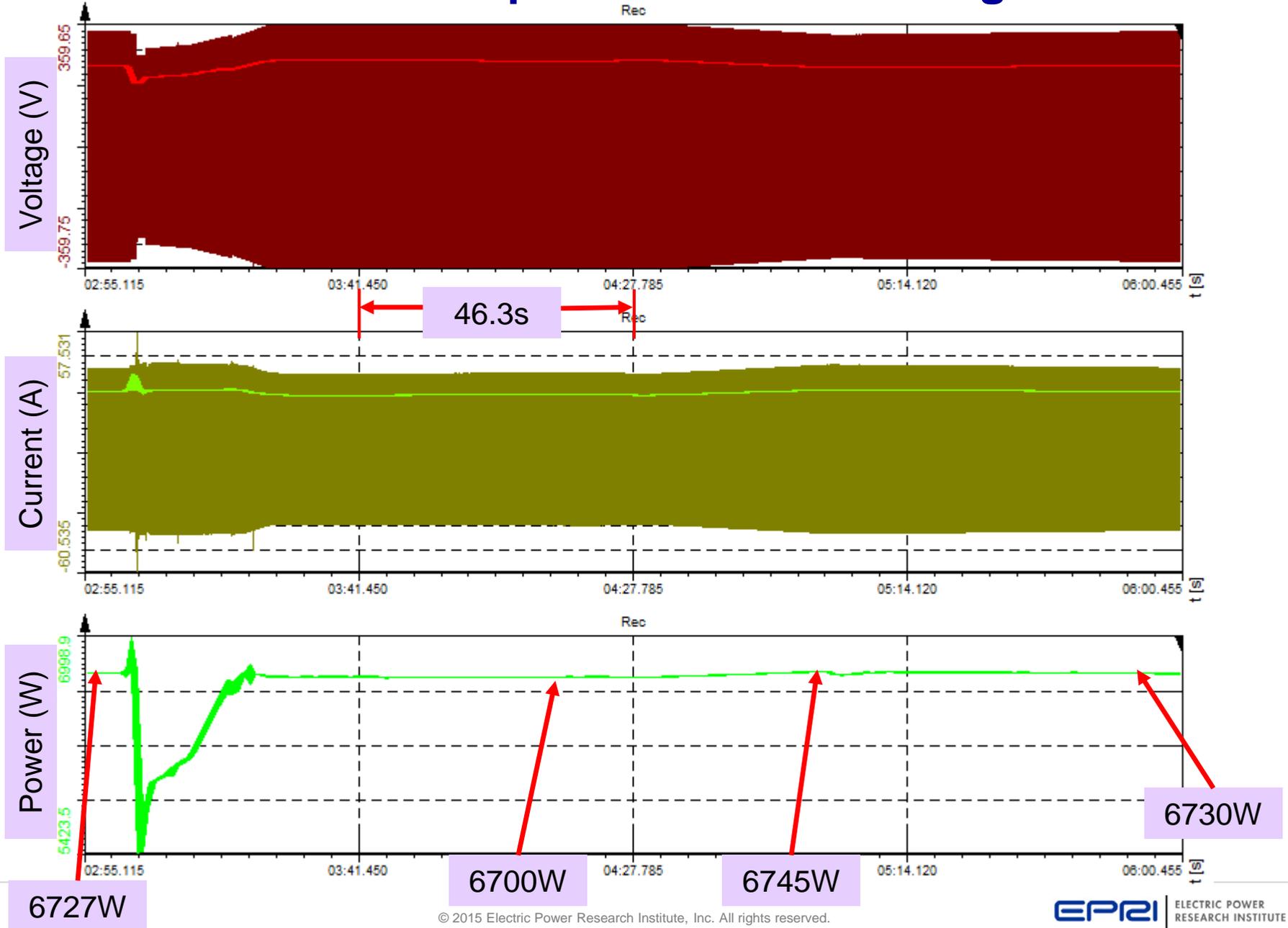
This Sample Waveform was Used

What Happens During a FIDVR Event?



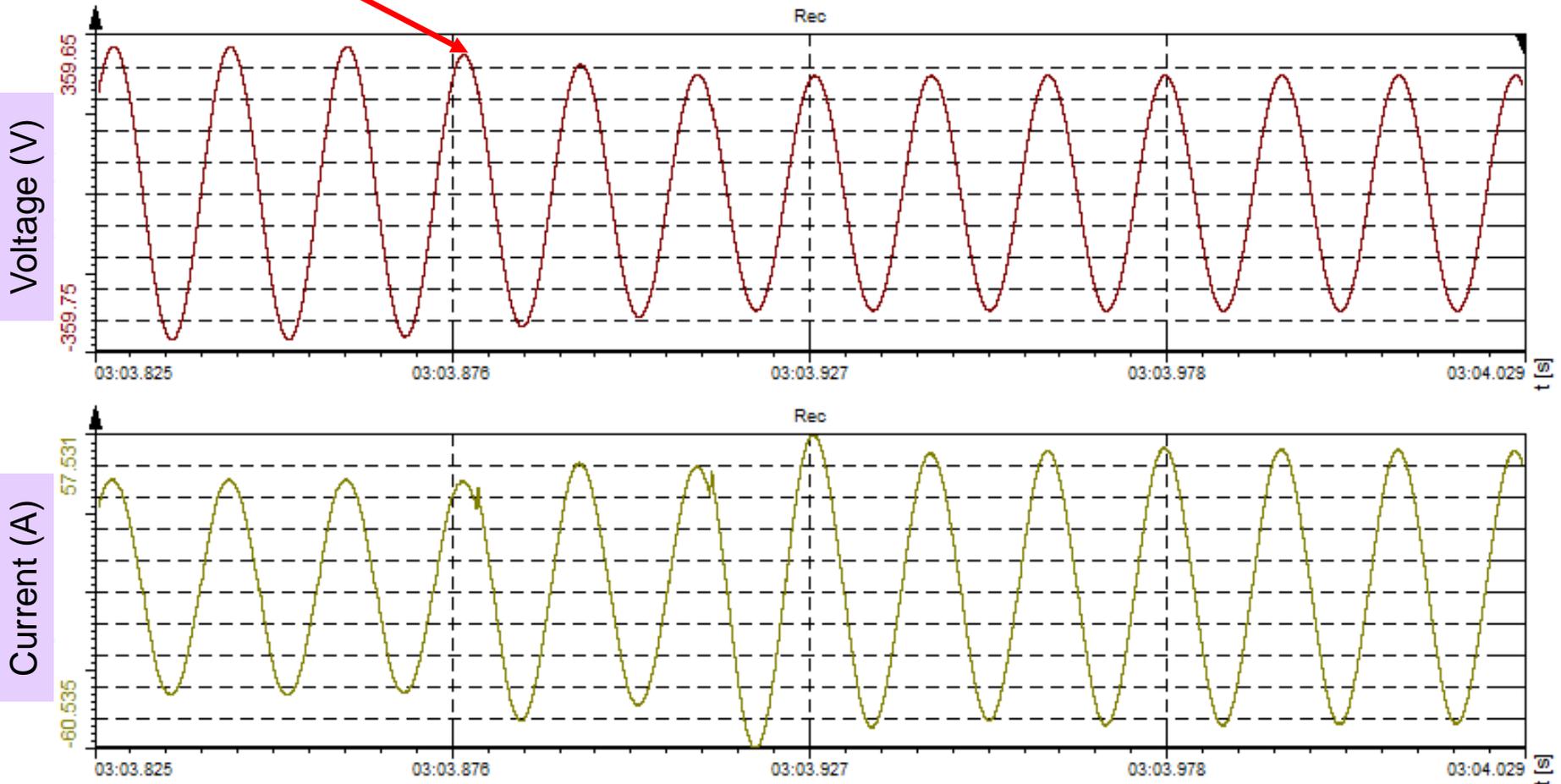
Richard Bravo, SCE, presentation
at 2014 IEEE PES T&D Meeting

2013 Nissan Leaf – Response to FIDVR Voltage Profile



2013 Nissan Leaf – Response to FIDVR Voltage Profile - 2

Voltage Reduction





Together...Shaping the Future of Electricity