<table>
<thead>
<tr>
<th>Time</th>
<th>Advanced Fuel Gauge</th>
<th>Battery Charging</th>
<th>Pack Protection and Balancing</th>
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</thead>
<tbody>
<tr>
<td>9 – 9:50 a.m.</td>
<td>Keynote Session Battery Technology Development Trends: Today's State of the Art and Future Directions (Presented by Dr. Yevgen Barsukov)</td>
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<td>9:50 – 10 a.m.</td>
<td>Break</td>
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<td>10 – 11:30 a.m.</td>
<td>Pack Manufacturers Open Discussion Forum / Q&amp;A</td>
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<td>11:30 a.m. – 1 p.m.</td>
<td>Demos Available</td>
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<tr>
<td>12 – 1 p.m.</td>
<td>Lunch</td>
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<tr>
<td>1 – 1:50 p.m.</td>
<td>Selecting a Battery Gauge / Monitoring Solution - Understanding all the Choices</td>
<td>Battery Charging for Ultra-Low-Power and Wearable Applications</td>
<td>Precision / Low-Cost Pack Protector for Single-Cell Applications</td>
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<td>1:50 – 2 p.m.</td>
<td>Break</td>
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<tr>
<td>2 – 2:50 p.m.</td>
<td>Analyzing Accuracy of a Battery Fuel Gauge System</td>
<td>Power System Design for Energy Harvesting</td>
<td>Precision Monitoring and Safety for Large Battery Pack Applications</td>
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<td>2:50 – 3 p.m.</td>
<td>Break</td>
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<td>3:50 – 4 p.m.</td>
<td>Break</td>
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<td>4 – 4:50 p.m.</td>
<td>Dynamic Voltage Correlation Algorithm: Accurate Gauging without Current Sensing</td>
<td>Battery Charging Features and Design Considerations for Industrial Applications</td>
<td>Active Cell Balancing Solution for Large Battery Packs</td>
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<td>5 – 6 p.m.</td>
<td>Demos Available</td>
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<td>6 – 7 p.m.</td>
<td>Happy Hour</td>
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<td>7 – 8:30 p.m.</td>
<td>Dinner</td>
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Battery Management Deep Dive 2014

Tuesday, October 21 – Fundamentals and Overview

An Inside Look at Lithium-Ion Cell Materials, Design, Assembly and Function
For most users of lithium-ion cell technology, the environment inside the cell can or pouch is a “black box” that is most often treated as an electrical circuit element responsible for providing power to a device. In fact, the inside of a lithium-ion cell is a complex system that relies on chemistry, metallurgy, polymer science and mechanical engineering to bring together the components of a small chemical reactor. In this presentation we will explore the assembly of a lithium-ion cell, beginning at the molecular level, with the intent of providing a fundamental understanding of how the parts become the whole and define the operational characteristics of the cell.

Introduction to Battery Charger Principles and Wireless Power
The basic concepts associated with battery charging circuits will be reviewed, starting with the basic algorithm used for charging a Li-ion battery. Typical decisions in the design of a charging circuit include whether to use a linear or switch-mode power stage; power path management techniques, and hardware-or software-controlled charging systems. The basic concepts of wireless power for battery charging will also be reviewed.

Hands-On Lab Session: TI Gauge Development Kit
This session will demonstrate how the TI Gauge Development Kit (“GDK”) and Battery Management Studio software can be used to quickly get started with characterizing your battery and programming the fuel gauge for it. The GDK is a single printed circuit board (PCB) equipped with a programmable load, programmable charger, an optional on-board fuel gauge and an integrated PC interface.

Wednesday, October 22 – Advanced Fuel Gauge

Battery Technology Development Trends: Today’s State of the Art and Future Directions
Lithium-ion and other battery types continue to evolve and improve in response to the needs of new and diverse applications. Power levels can vary from microwatts in wearable devices and remote sensors all the way to kilowatts in electric vehicles and megawatts in grid storage applications. In our keynote address, Dr. Barsukov will provide an update on the current trends and advances in battery chemistry. New and promising technologies and expected performance enhancements will be reviewed.

Pack Manufacturer’s Open Forum
In this session, representatives from battery pack assembly and design specialists will have a moderated Q&A discussion with audience members. Discussion topics could include battery safety, manufacturing methods, compliance testing, battery pack architectures, and more

Selecting a Battery Gauge / Monitoring Solution - Understanding all the Choices
This presentation will review the practical aspects of choosing a specific solution for your battery monitoring and protection requirements. Tradeoffs such as Cost vs. Performance, Algorithm types (CEDV vs. IT vs. DVC), and hardware architecture (ROM/FLASH, current sensing) will be discussed.

Analyzing Accuracy of a Battery Fuel Gauge System
Any battery gauge/monitoring system should provide accurate results. Data sheets for fuel gauge IC devices may present a number representing “typical” accuracy such as 1% or 10%. This topic will investigate how accuracy of a fuel gauge can be properly characterized and understood across a few typical application cases.

Intelligent Battery Management and the MaxLife™ Algorithm for Extending Battery CycleLife with Fast Charge Time
By using an intelligent gas gauge device to adaptively control the charging circuit, the charge algorithm can be optimized to provide the fastest possible charge time on each cycle, while minimizing cell capacity degradation over multiple charges and discharges. This presentation focuses on the interaction between the gauge and charger, highlighting their interoperability, current system implementation and outlook on future improvements.

Dynamic Voltage Correlation Algorithm: Accurate Gauging without Current Sensing
The Dynamic Voltage Correlation (DVC) algorithm allows simple and accurate gauging of single-cell Li-ion batteries without the use of a precision shunt-sensing resistor (which is required in conventional coulomb-counting types of gauges). The bq27621 device implements this new algorithm and allows basic fuel gauging with a minimum of user configuration. This presentation will provide a background in how the DVC algorithm works and will also provide instruction on how to set up and interface a DVC-type gauge in your system.

Wednesday, October 22 – Battery Charging

Battery Charging for Ultra-Low-Power and Wearable Applications
The growing popularity of ultra-low power and wearable devices presents new challenges for battery charger design. This topic explores the special requirements for charging very small batteries and presents solutions for accurate charge control and termination at low current levels (from a few milliamps to a few hundred milliamps) with minimum PCB space.

Power System Design for Energy Harvesting
TI has developed a family of high efficiency nano-power converters and energy management devices to allow the use of a diverse range of energy harvesting transducers as power sources. This presentation focuses on the key issues related to the design of a power conversion system for energy harvesting applications, including the power budget analysis and energy storage capacity calculations required to design a reliable system.

Design Trends and Considerations for Single-Cell Battery Fast Charging
This presentation focuses on key factors for battery charging systems used in portable devices that must also provide power other devices (such as USB On-the-go). Advanced battery charging techniques to maximize input power are presented including USB Battery Charging identification, input power optimization, and adaptive thermal management. The challenge for the industry to go beyond standard USB Charging is also discussed. Furthermore, the USB On-the-Go requirements to turn every handheld accessory into a portable power source will be discussed.

Battery Charging Features and Design Considerations for Industrial Applications
Battery chargers are widely used for portable industrial applications such as point of sale, data backup solutions and robotics. Various charging features benefit different applications from the optimization perspectives of performance, cost, solution size and so on. This presentation explains how to select different charger topologies, control interfaces and charging profiles based on the application requirements. The major benefits and design considerations of some key charging features are also demonstrated with charger electrical characterization data for given applications.

Wednesday, October 22 – Pack Protection and Balancing

Precision / Low-Cost Pack Protectors for Single Cell Applications
Portable applications using single-cell Li-ion batteries now can range from tiny wearable devices with batteries smaller than 50 mAh all the way up to tablets and industrial terminals with battery capacities far exceeding 5000 mAh. As a result, power requirements and use models for “single-cell” applications can vary greatly. This presentation will review new TI solutions for single-cell pack protection and show how to scale the protection levels accordingly for your cell type and application case.
Battery Management Deep Dive 2014 (continued)

Wednesday, October 22 – Pack Protection and Balancing

Precision Monitoring and Safety for Large Battery Pack Applications
The growing use of Li-Ion cells in industrial and medium-voltage applications (previously powered by NiCd or Lead-Acid batteries) has created a need for precision pack protection and monitoring in for larger packs. This presentation explores the details of implementing a solution for battery packs ranging from 5-series up to 15-series Li-Ion cells.

Application Tips for NexFET™ High-Performance MOSFET Devices in Portable Systems
Power MOSFET devices are essential components in any portable power system. There are two primary use cases: first, the use of MOSFETs as load switches or safety-disconnect devices in battery packs, and secondly, as power switching components in high-frequency switch-mode DC-DC power converters. This presentation will help system designers to understand the best practices associated with power MOSFET selection, driver circuits, and application in portable products. The special characteristics and performance of NexFET™ devices will be explained.

Active Cell Balancing Solution for Large Battery Packs
Cell-balancing is a crucial need in any multi-cell battery pack. The vast majority of balancing circuits use a simple passive / dissipative approach equivalent to placing a linear regulator across each cell in a multi-cell pack. Relatively small balancing currents ranging from a few milliamps up to 100 mA may be used with each cell. With larger, high power applications, however, this simple approach cannot provide the performance needed to quickly re-balance large cells that may have significant mismatch. The high-current "active balancing" approach as implemented in the EMB1499 / EMB1428 chipset takes a switch-mode approach and efficiently transfers energy from a high cell back in to the rest of the pack. The architecture of this system provides higher overall efficiency than the traditional charge-shuttling approach used in typical active balancing systems seen previously.

Thursday, October 23 – Advanced Fuel Gauge

Battery State of Health vs. State of Charge: Understanding the Key Parameters for Standby Power Battery Pack Applications
The traditional approach to battery fuel gauging will "learn" the actual effective capacity of a battery based on repeated discharge and charging cycles that occur in everyday use. In applications where the battery pack is used for backup power only, these discharge cycles may only rarely (or never) occur in practice. Additionally, the concept of "battery state of health" is a critical parameter as the end-user may need to know when the battery pack needs to be replaced in order to maintain reliable backup power for critical applications. This presentation reviews the key issues associated with using rechargeable batteries for standby power backup applications (such as UPS or memory retention in PCs and servers).

Battery Management Architecture for Automotive / EV Applications
The battery-management system (BMS) is a key element in the overall Electric or Hybrid-Electric Vehicle architecture. An intelligent implementation will extend not only the battery's lifetime but also the possible range of a vehicle in fully electric drive mode, which is a key selling point to end users. The BMS modules require battery supervision and battery cell-balancing features often connected through different communication paths to ensure system redundancy. Built-in temperature management is also an important feature for a system's lifetime and safety. The complete BMS represents a highly safety-critical function; therefore, reliable communication and accurate data measurement are necessities. This presentation will explain the typical architectural choices and possible implementations of EV/HEV battery management.

Taking your Fuel Gauge from Design to Production (Including bqPRODUCTION Software Tools)
Developing a fuel gauge solution typically involves some initial time at the lab bench to characterize the cell type and application's load profile, which enables the system design engineer to determine the parameters to be programmed into the fuel gauge's FLASH data parameters (which are customized to a specific application and cell type). Once this is complete, it may still be a challenge to set up a process that facilitates both accurate and fast gauge programming as needed in a high-volume production environment. This presentation will provide guidelines and demonstrate new tools from TI to simplify the transition from the engineering lab bench to the factory.

Thursday, October 23 – Wireless Power

Tools For Developing Wireless Power Applications with TI Transmitter and Receiver Solutions
Designing wireless power receivers and transmitters requires the proper selection and tuning of various circuit components. This presentation will walk through various tools available on the receiver and transmitter and how these tools can be used to design standards compliant receivers and transmitters. The tools include FOD component selection and design process.

Performance Impact of Magnetic Components and Shielding in Wireless Power for Wearable Applications
Real-life examples of different coils used in wireless power receivers will be examined in terms of their impact on overall system performance. In addition to the receiver coil inductance, the shield design also plays a significant role in system efficiency and minimization of loss in a wireless power system. Additionally, the effective inductance of these components can change based on operating conditions in a wireless power application. This presentation will provide the guidelines for proper design of receiver coils and shield structures while focused on wearable applications.

Architecture and Design of 10W Wireless Power Solution
System performance and design tips for implementation of a 10-Watt inductively coupled wireless power system will be demonstrated in this session. Examples of TX and RX coils that have been successfully tested in the 10W application will be provided.

Thursday, October 23 – Low-Power Circuit Design

DCS-Control™ Power Converters for Low-Power RF Applications
Previous generations of power save modes were known for good efficiency but perhaps poor noise performance. The variable operating frequency, which sometimes dipped into the audible range, forced designers to disable these power save modes to achieve sufficient RF performance. The DCS-Control topology has been designed with RF-quality noise performance in mind with a predictable operating frequency and single switching pulses in power save mode. This presentation gives an overview of the DCS-Control topology and shows how it extends the battery life of RF systems, such as all types of sensor nodes in the IoT.

Optimized MSP Programming Across Active and Low-Power Modes
Realizing an ultra-low-power (ULP) system design to conserve every nanoamp possible is rarely an easy task to achieve. Such an effort requires detailed knowledge of everything your MCU architecture offers in the way of enabling ULP as well as the features of any external components. This course gives practical instructions of how to use the integrated features of the MSP MCU family to realize an ultra-low-power application. Special focus is given to specific ULP features, coding techniques that reduce the power of your embedded application as well as innovative tools to optimize your application's energy consumption.

High Efficiency Buck-Boost and Boost-Bypass Converter Architecture
Portable applications like tablets and smartphones need smallest solution size and highest efficiency. New advancements in control topology and packaging enable this pairing in the TPS630250 and TPS63050 buck-boost converters and the TPS61280A boost-bypass converter. Powering a 3.3-V rail from a single-cell lithium ion battery, these buck-boost converters deliver over 90% efficiency (97% peak) for the full load range with a solution size as small as 33 mm². The TPS61280A boost-bypass converter enables over 98% efficiency at full power in bypass mode. The low noise buck-boost or boost-bypass operation makes them a perfect fit for wireless and industrial applications, such as smartphones, tablets, EPOS, and other portable handheld devices.