WHITEPAPER

Exploring next-generation AI battery management systems with Infineon and Eatron technologies

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Abstract

As the mass adoption of battery technology and electric vehicles gains momentum, the requirements for exceptional battery performance, extended lifetime, and enhanced safety are becoming increasingly critical. In response to these demands, Infineon has partnered with Eatron Technologies to demonstrate Eatron's cutting-edge (artificial intelligence) AI-powered Intelligent Software Layer (ISL) for battery management systems (BMS). This innovative solution is designed to be more than just a temporary measure; it is a sustainable and evolving framework that optimizes battery performance through precise State of X (SoX) estimations, extracts maximum value from batteries with predictive remaining useful life (RUL), and increases safety with proactive Lithium Plating (LiP) detection. Eatron's adaptable AI infrastructure can continuously improve and advance battery management systems, ensuring optimal performance as battery technologies and electric vehicles (EVs) continue to evolve. With the integration of the AI-ISL advanced capabilities, a BMS can now offer up to 10% more range and over 20% longer battery life.

To fully realize the capabilities of these intelligent software advancements, Infineon's next-generation chipsets are equipped with state-of-the-art hardware features. From the TLE901x family of high accuracy battery monitoring and balancing ICs, to the programmable system on chip (PSoC™) 4 HV PA's innovative integrated programmable controllers, to the AURIX™ TC4x microcontroller (MCU) with its integrated Parallel Processing Unit (PPU), each component works harmoniously to unlock the full potential of the AI-powered Intelligent Software Layer (AI-ISL).

This white paper presents a proof of concept of an innovative AI-Battery Management System that enables advanced state estimation for State of Charge (SoC) and State of Health (SoH), remaining useful life (RUL) prediction, and Lithium Plating (LiP) detection allowing for real-time proactive management. It shows how to capitalize on the efficiency of the TC4x's integrated PPU to manage the complex architectures of 400-V and 800-V EV packs. Finally, it discusses system level implications of using embedded AI to propel the EV industry towards a future where performance, safety, and longevity are essential.

This collaboration stands as a testament to the synergy of AI and hardware as well as Eatron and Infineon's role at the forefront of BMS evolution, with its AI-powered pillars providing a robust framework for the future.

1. Introduction

Modern electric vehicle (EV) architectures are designed with meticulous attention to detail, incorporating both 400-V and 800-V systems to accommodate different performance and efficiency requirements. At the heart of these systems lies the battery pack, a complex arrangement of electrochemical cells that store and release electrical energy, providing the power source for EV propulsion and range capabilities.

1.1 Battery basics

At the most fundamental level, deconstructing the battery pack to its battery cells shows how these basic electrochemical units store and release electrical energy. Multiple serially connected battery cells assembled into a single unit form a module which serves as intermediate level of energy storage. Finally, multiple modules connected, typically in series, form a complete battery pack. The chosen configuration of the pack matches the specific energy (kWh) and power (kW) requirements of the EV. While the overall capacity of the pack (in ampere-hours, Ah) is a function of the number of cells connected in parallel, the total voltage of the pack is determined by the modules connected in series. Figure 1 visually demonstrates this concept.

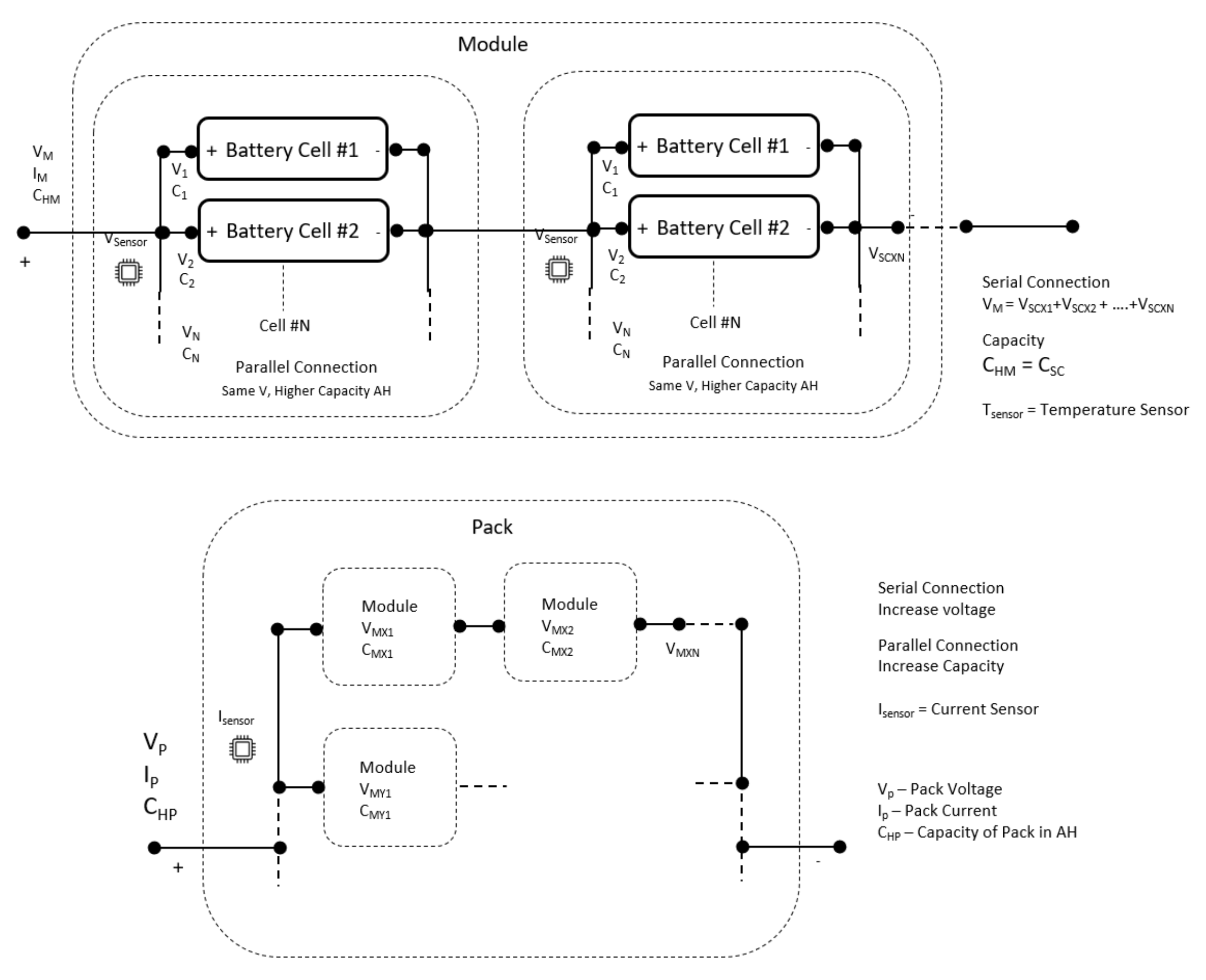

Figure 1 Overview cell connections in a modern EV from cell to module to battery pack.

Individual cells can vary in chemistry, capacity, and voltage. By connecting these cells in parallel, as illustrated in the Figure 1, the combined capacity (Ah) increases, providing a higher energy reserve while maintaining the same voltage level. This configuration is beneficial for extending the operational range of the EV by increasing the total available ampere-hours.

Eatron Technologies has adopted the lumped supercell model approach (Figure 2) to efficiently manage battery pack configurations. This approach simplifies the complex structure by treating a group of parallel-connected cells as a single entity – a supercell. Eatron's use of the supercell model provides detailed insight into each supercell's state and enables AI features.

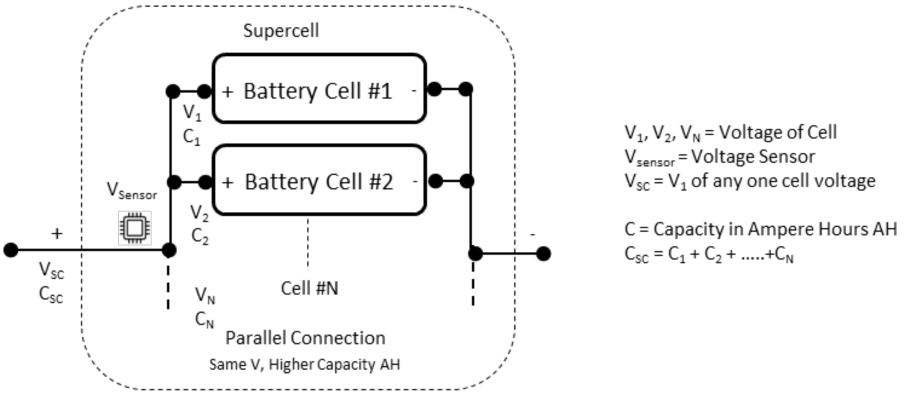

Figure 2 The lumped supercell concept.

1.2 Battery management system basics

An advanced battery management system (BMS) oversees the state, temperature, and health of a battery pack to optimize performance and longevity. The BMS ensures that each cell within the pack operates within its safe and efficient operating window, balancing the cells during charge and discharge cycles to maintain the pack's overall health. Figure 3 below provides a simplified overview of a Battery Management system based on Infineon hardware.

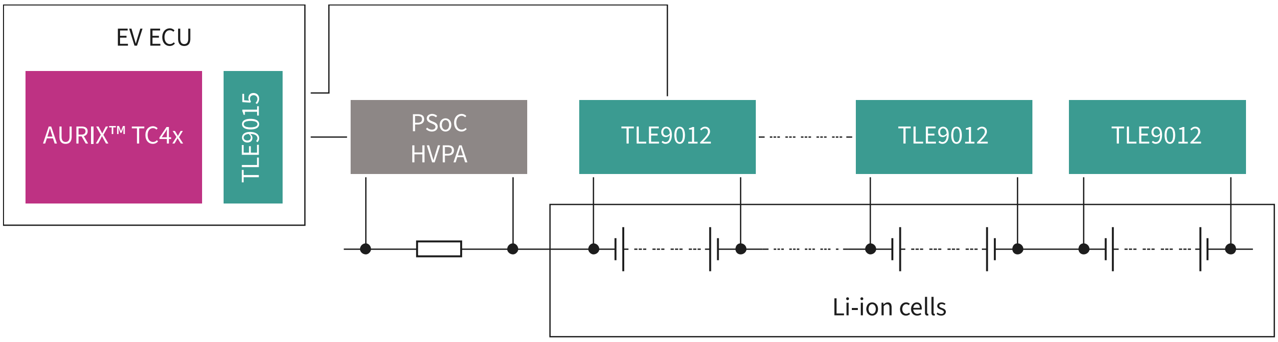

Figure 3 Simplified block diagram of the BMS solution.

For this proof-of-concept, Neutron Control's ECU8-based demonstrator was used as the hardware reference platform for development. Some of the components are described below.

The **AURIX™ TC4x** microcontroller (MCU) with integrated Parallel Processing Unit (PPU) and common automotive interfaces (e.g., CAN, LIN, Ethernet, etc.) possesses the optimal compute, peripherals and safety support for advanced BMS solutions. The AURIX™ TC4x's integrated Parallel Processing Unit (PPU) hardware accelerator enables edge-based, real-time execution of typical electrochemical PP-p2D battery models and neural networks with an acceleration factor of up ~20x compared to TriCore™ scalar implementations. It addresses the scalability and computational challenges faced by conventional MCUs and enables on-the-fly and efficient parallel processing and execution of complex AI algorithms. With ASIL-D compliance per ISO 26262 and certified ISO 21434 security features, the MCU is a prime solution for both present and future BMS implementations.

The **TLE9012DQU** is a multi-channel (up to 12 cells in series) battery monitoring and balancing IC fulfilling four main functions: cell voltage measurement, temperature measurement, cell balancing, and isolated communications to the main battery controller. The device achieves best-in-class application reliability and robustness under noisy conditions, high accuracy (±0.2 mV at 25°C including soldering drift), as well as ISO 26262 Safety Element out of Context (SEooC) capability up to ASIL-D level — all ideal features for the BMS environment. Equipped with an independent 16-bit delta sigma analog-to-digital converter (ADC), the TLE9012DQU enables synchronous measurement of each cell to maximize its performance and ensure safe battery operation. Another unique aspect of the IC is its integrated current source which supports direct connection to negative temperature coefficient (NTC) sensors. The TLE9012DQU is just one device in a family of multi-channel battery monitoring ICs enabling scalability for feature upgrades (e.g TLE9016DQK or TLE9018DQK, 16-channel and 18-channel respectively.)

The **TLE9015DQU** is a dedicated isolated (iso) UART communication IC developed together with TLE9012DQU to operate either with capacitive or inductive isolation enabling the daisy-chain architecture. The device provides the dual UART ports for serial communication to the host microcontroller and dual iso UART ports for daisy-chain communication inside the battery pack. It supports up to 2 Mbit/s communication speeds and the ring mode/topology requires only 1 device in the daisy-chain. Stable capacitive-isolated communications are confirmed with various tests to provide the lowest cost of isolated communication while offering the functional redundancy via the ring topology.

The **PSoC™ 4 High Voltage (HV) Precision Analog (PA)** device with high-precision sigma delta ADCs (16-20 bits) provides precise and accurate battery monitoring (e.g., current sensing via shunt) for advanced applications like AI-based BMS solutions. The programmable system on chip (PSoC™) MCU supports synchronization with other BMS devices by communicating in the same daisy chain as the TLE9012DQU battery monitoring and cell balancing ICs. Also, the programmability of the PSoC™ 4 HV PA enables additional functionality to be integrated into a single IC, including pack-monitoring, contact-monitoring, isolation resistance, and pyro-fuse driving.

Eatron's **AI-ISL software solution** synergizes with Infineon's full BMS hardware enabling real-time advanced battery protection and predictive AI functions. Figure 4 shows an example of a high-voltage BMS software architecture that highlights the different components of a BMS stack in an AUTOSAR environment. Within the application software layer, the ISL software, (highlighted in green) integrates with traditional BMS functions, basic software for hardware abstraction (BSW), and runtime environment (RTE).

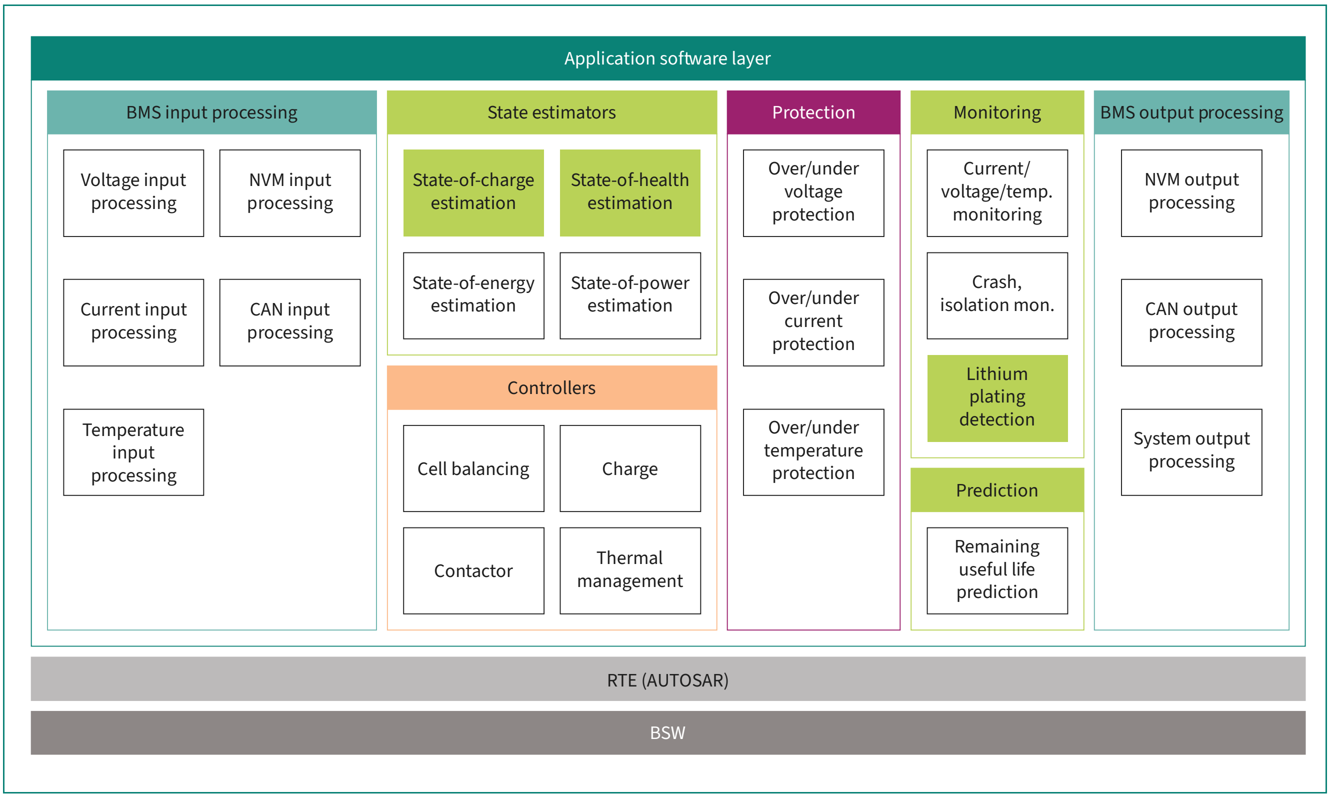

Figure 4 Overview of modern BMS software stack.

2. Advanced SoX for increased performance

Harnessing the full power of a battery pack is a complex endeavor, rife with challenges, particularly in accurately gauging State of Charge (SoC) and State of Health (SoH). These estimations are crucial for optimizing the performance and longevity of electric vehicle batteries. The primary hurdle is achieving the precision necessary to extract maximum utility from battery packs under varying operational conditions. SoC and SoH estimations face inherent difficulties due to the non-linear behavior of batteries, the variability of operational conditions, and the degradation over time. Despite these difficulties, battery packs are one of the most expensive components of an EV – costing thousands to replace, and thus extracting maximum accuracy is a key.

Eatron is able to achieve < 1% SoC and < 2% SoH accuracy for both Nickel Manganese Cobalt (NMC) and Lithium Iron Phosphate (LFP) lithium-ion chemistries compared to industry solutions using traditional methods which achieve 3% for NMC and 5% for LFP SoC and < 5% for the SoH. At the core of Eatron's approach is its proprietary cell characterization protocols. By implementing Design of Experiments (DOE) such as Hysteresis, Open Circuit Voltage (OCV), and Pulse tests, Eatron gathers precise data essential for accurate cell models and subsequent algorithm tuning. The aim is to parameterize Eatron's Physics Inspired Electro-Thermal Equivalent Circuit cell model with the assistance of a highly automated toolchain, ensuring meticulously calibration of the SoX function to reflect real-world conditions. Calibration of the Extended Kalman Filter matrices—integral to accurate state estimation—executes with precision, considering the unique application, inherent sensor noise, and the required filter adaptation speed.

2.1 Processor-in-the-loop results on Infineon hardware

Infineon's hardware compliments Eatron's algorithms to bring advanced SoX solutions to life and into the vehicle, ensuring that the electric vehicles operate in complete safety, without compromising on efficiency.

Table 1 shows the accuracy of the SoC and SoH estimations running on AURIX™ TC4x MCU using data from dynamic discharge cycles in a cell testing lab conditioned to 25 °C. The processor-in-the-loop (PiL) results on AURIX™ TC4x shows advanced real time computation capabilities with impressive calculation accuracy and low latency.

Table 1 SoC and SoH results on Infineon hardware for 12 NMC cells

Model	Target accuracy	PiL[1] accuracy (MAE[2])	Execution time[3] [ms]
SoC	1%	0.32%	0.288
SoH	2%	0.26%	0.026

1) Processor-in-the-loop test on TC4x
2) Mean Absolute Error
3) Based on 12 cells

3. Remaining useful life prediction

Remaining Useful Life (RUL) refers to the estimated duration or cycles left before an EV battery, reaches the end of its useful life, which is marked by SoH reaching 80%. This estimation is crucial for maintenance, safety, viability and economic feasibility of EVs. However, prediction of RUL of EV batteries is complicated by the inherent difficulty of modelling the nonlinear path of battery degradation. The task requires a nuanced approach to model the varied influences on battery longevity, from operational habits to environmental conditions. RUL estimation is not just a mere prediction of end-of-life but a complex puzzle comprising numerous dynamic factors that traditional method, like univariate SoH trend prediction, struggle to solve with precision.

Eatron addresses these RUL challenges by capitalizing on the AURIX™ TC4x's integrated PPU to deploy advanced AI algorithms capable of interpreting the complex interplay of factors affecting battery health. Combining Convolutional Neural Networks (CNN) with Recurrent Neural Networks (RNN), the AI solution goes beyond simple historical data analysis; it adapts to the uniqueness of each battery's life story, accounting for the entire use-case scenarios from charge cycles to users' behaviors. The AI models are trained on comprehensive datasets that include lab-controlled aging patterns and real-world operational (field) data to ensure that predictions are grounded in reality — yet sensitive to the variabilities of everyday use.

3.1 Processor-in-the-loop results on Infineon hardware

The implementation of Eatron's AI-driven RUL prediction onto the AURIX™ TC4x's integrated PPU marks a significant leap forward in BMS capability. The PPU, with its specialized parallel architecture, enables real-time predictive analytics previously relegated to the realm of high-performance computing environments or the cloud. This synergy ensures that accurate, real-time RUL estimations become an integral part of the BMS, enhancing the decision-making process for battery maintenance, warranty provisions, and second-life applications.

By tapping into the power of the PPU, the computational intensity of AI-based RUL prediction becomes manageable within the BMS ecosystem, even while scaling to hundreds of cells – as seen in real life HV vehicles (and expanded on in section 5). This allows for a degree of accuracy and timeliness in prediction that sets new standards for battery management solutions.

Table 2 displays the PiL accuracy metrics of the implemented RUL solution using an aging dataset collected across 12 LG M50 cells at 25 C. The average life expectancy of the cells under standard usage conditions is approximately 1000 cycles. This dataset comprises various charge/discharge experiments conducted at different temperatures. To evaluate the performance of the solution, three different predictions were executed: early life, mid-life, late life corresponding to 100, 500, and 900 cycles, respectively. As anticipated, the model produces more accurate predictions when provided with greater historical information from the cell.

Table 2 RUL estimation results on Infineon hardware

Condition	Generalized[1)] target accuracy [Cycle error from true EoL[3)]]	PiL[2)] accuracy [Cycle error from true EoL[3)]]
100 – Early Life	100	15.7
500 – Mid Life	50	6.8
900 – Late Life	10	2.4

1) Comprehensive RUL target across universal operational conditions, various domains

2) Processor-in-the-loop test on TC4x

3) End-of-Life of battery as represented by SoH of 80%

4. Lithium plating detection

Lithium Plating (LiP) detection stands as a formidable challenge in the battery management landscape, often manifesting during fast charging at low temperatures. It signifies the deposition of metallic lithium on the anode surface, potentially precipitating dendrite growth and risking catastrophic failure modes including thermal runaway. Traditional electrochemical equations for LiP formation are staggeringly complex, especially when it comes to parameterizing and maintaining these for the multitude of cells within a battery pack. The intricacy of these equations, coupled with the diverse operational conditions, makes this approach less feasible in practice.

Artificial intelligence offers a compelling pathway to navigate this challenge, capable of discerning intricate patterns within the hyperspace of battery operational data. Eatron Technologies leverages a convolution and recurrent based neural network to penetrate the veil of LiP's complex behavior, employing a novel machine learning pipeline that synergizes deep battery expertise with sophisticated signal processing for feature extraction.

4.1 Processor-in-the-loop results on Infineon hardware

The value of this AI algorithm can be fully extracted by utilizing the AURIX™ TC4x microcontroller. The integrated PPU enables efficient feature extraction as well as optimized and accurate inference to enable a machine learning framework meticulously designed to combat overfitting. This ensures the AI system remains versatile and adaptive to new data, thereby significantly enhancing its predictive maintenance capabilities and further highlights Eatron's emphasis on safety and operational integrity.

Table 3 illustrates the performance of the Lithium Plating detection algorithm on four validation packs not previously encountered during the model's training. True Positives (TPs), represent the instances where the algorithm correctly identified Lithium Plating. This is a crucial metric, as it reflects the system's ability to detect genuine faults, which is paramount for maintaining battery health and safety. Conversely, False Positives (FPs), denote the occurrences where the algorithm mistakenly flagged healthy cells as faulty. Minimizing FPs is critical in this context to prevent unnecessary maintenance interventions and to preserve user confidence in the system. The balance between TP and FP is especially significant in LiP detection due to the severe consequences of undetected faults and the disruptions caused by false alarms.

Table 3 Lithium plating detection results across four unseen packs on Infineon hardware

Level of detection	Detection rate TP	False alarm rate FP
Module	90%	0%
Pack	100%	0%

The data shows that the model's impressive accuracy at the module and pack levels, with detection rates reaching 90% and 100%, respectively — a feature that can significantly improve Original Equipment Manufacturers (OEMs) strategies. Detection rates at higher aggregation levels ensures that even if some faulty cells evade individual detection, they are still caught at the module or pack level, safeguarding the system's overall reliability. The high accuracy in these samples also demonstrates the model's ability to generalize effectively to handle real-world scenarios.

The detection of LiP is a critical objective for OEMs, not only to safeguard the operational health of battery packs but also to devise charging strategies that do not compromise battery longevity. This approach ensures that EV batteries operate within their optimal health range, thereby extending their service life and maintaining performance standards set by manufacturers.

5. Leveraging PPU on AURIX™ TC4x MCU for real-world deployment

This section delves into extracting maximum value using the AURIX™ TC4x MCU and discusses the benefits of the PPU for edge AI applications. Moreover, it expands the PiL test results, scales to an 800-V architecture with realistic Application Software (ASW) to demonstrate real-world integration of AI-ISL, and showcases the advantages of AURIX™ TC4x with PPU.

Figure 5 displays a high-level architecture block diagram of the AURIX™ TC4x MCU with IP blocks utilized in the AI-ISL based BMS solution highlighted.

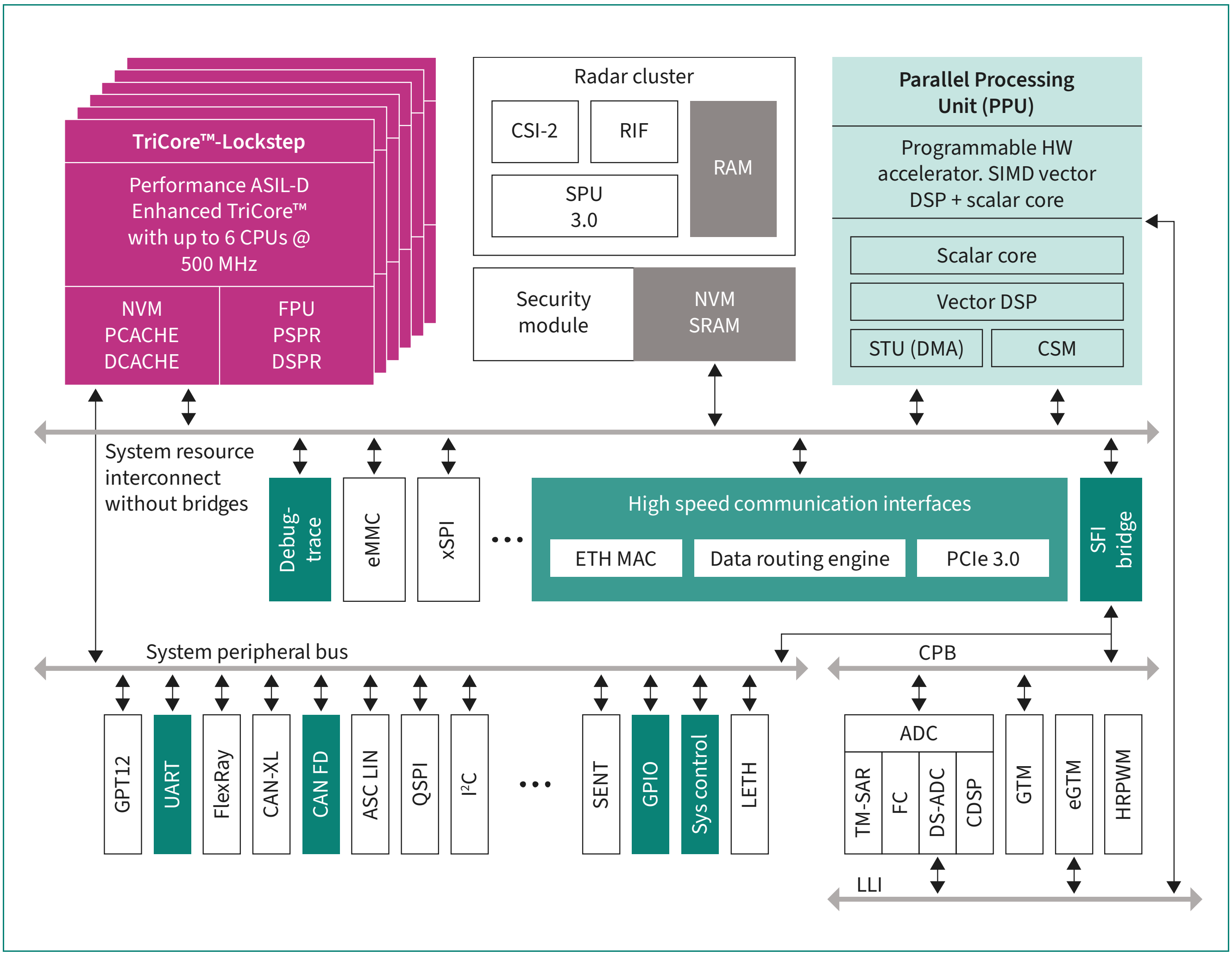

Figure 5

AI-based solutions are decomposed as two different functions: feature extraction and inference. Both LiP detection and RUL prediction algorithm require high frequency data during feature extraction to capture the essence of the voltage, current and temperature measurements. However, inference frequency can be scheduled less frequently since it evolves slowly. Inference refers to the execution of the neural networks that contains thousands of weights learnt during training.

Figure 6 shows a decomposition of elements for the different algorithms implemented on the TC4x MCU as well as the frequency requirements of each algorithm.

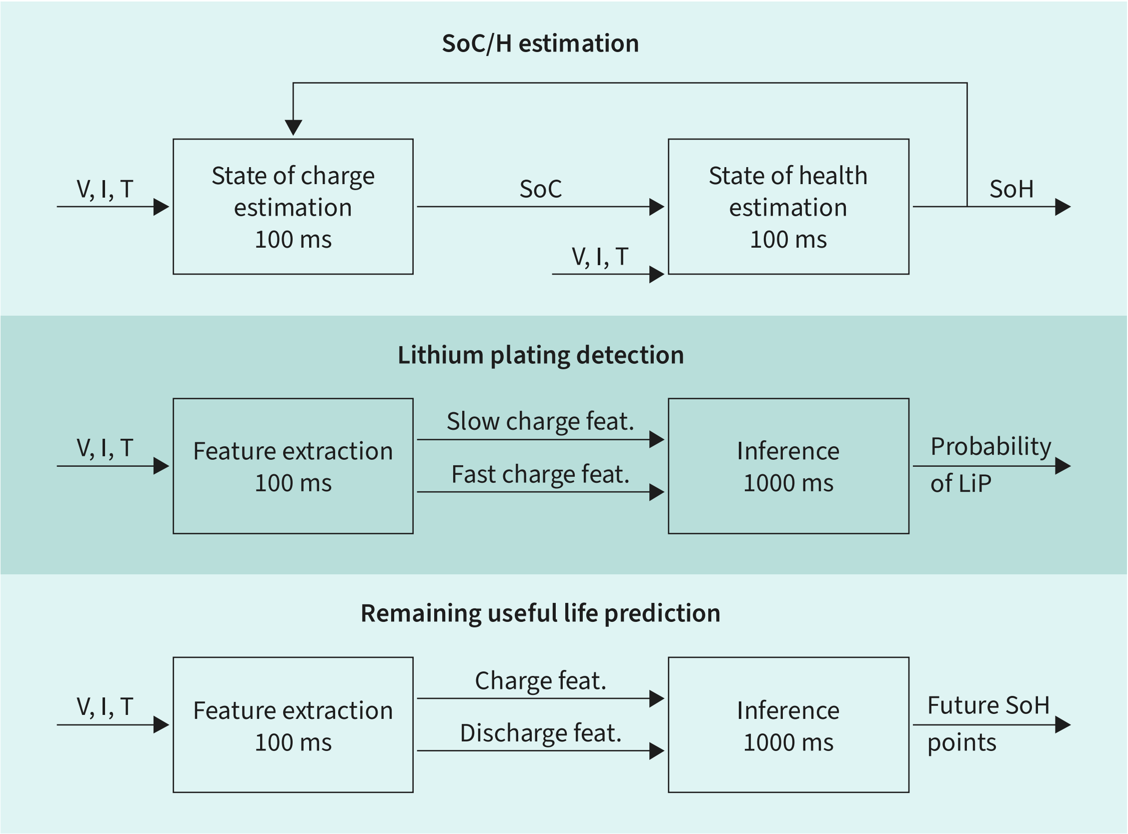

Figure 6 **Algorithm decompositions based on the operation frequency.**

5.1 Power of compute acceleration with PPU from PiL results

The processor-in-the-loop results shown in Table 4 below captures the enhanced performance of neural networks execution on the PPU compared to TriCore™ based implementations. The inference times for Lithium Plating detection and remaining useful life prediction for 12 cells on the PPU show an almost 30-fold acceleration factor when compared to the TriCore™. The dramatic increase in performance of neural networks is one of the key advantages of the integrated PPU.

The benefits of the PPU are not confined to neural network computations alone. They extend to any computationally intensive task that can be parallelized, such as feature extraction. The LiP detection feature extraction showcases this with its execution time being reduced from 3.18 milliseconds to just 1.48 milliseconds, underscoring the PPU's ability to handle parallelizable computations with superior efficiency. These significant reductions in processing time for both neural network-based tasks and general parallelizable computations underscore the substantial benefits offered by Infineon's specialized hardware.

Table 4 **PPU acceleration factor**

Inference (INF)/ Feature Extraction (FE) functions	TriCore™ MCU Execution [ms]	PPU Execution [ms]
Clock frequency (MHz)	400	400
LiP Detection INF (12 cells)	60.8	2.25
RUL INF (12 cells)	109.2	3.8
LiP Det. FE (12 cells)	3.18	1.48
RUL FE (12 cells)	0.067	Identical

5.2 Increasing ease of deploying edge-based AI and models

Extracting performance and efficiency from the AURIX™ TC4x Parallel Processing Unit (PPU) is straightforward as a result of the dedicated software tool chain designed to improve ease of use and accelerate time to market. Model-based development in Simulink by AURIX™ Mathworks Hardware Support Package and Synopsis Metaware toolchain enables model optimization and integration for the chip's hardware. This minimizes custom coding, enables quicker integration, faster iteration of AI capabilities, and streamlines the overall development process.

Neural networks grapple with the constraints of embedded hardware resources in embedded applications, network pruning and quantization stand out as critical methodologies. Pruning trims down the network by removing less impactful neurons, which simplifies the computational load, whereas quantization reduces numerical precision to conserve memory and expedite inference. Utilizing tools within the PPU framework enhance these optimization processes reducing the need for manual efforts to consider memory footprint, execution strategy, and HW or compiler architecture.

The toolchain is a huge advantage and instrumental in condensing neural network models to fit within limitations of an embedded system without significantly compromising performance, streamlining the operation of neural networks on the PPU with minimal manual input required.

5.3 Scaling up to the 800-V architecture with complete BMS SW stack

Scaling the solution to a real-world high voltage (HV) use cases such as an 800-V architecture within a BMS is not without its challenges. When transitioning from benchmarking on an evaluation board with a small subset of cells to a full-scale, real-world application, the complexity increases substantially. An 800-V system typically comprises around 200 supercells arranged in series, which equates to a computational demand up to 25 times greater than the smaller systems used for initial benchmarks. This increase in scale requires a chipset capable of handling extensive computations efficiently while also managing the larger memory footprint needed for the full BMS software suite – this is where the AURIX™ TC4x family of MCUs with integrated PPU shines.

In a typical HV BMS software integration, AUTOSAR stack, basic software stack, low level drivers, and functional safety checkers can consume a majority of available compute of an entire CPU on a standard single or dual-CPU based MCU (e.g. AURIX™ TC365). Therefore, even though a CPU-only approach may provide a solid foundation for SoC and SoH estimations, it is challenging to fit advanced AI functionality into the same device due to additional processing power, execution time, and memory requirements.

Adding additional CPU cores is not an efficient way to address this as neural networks used in AI typically take advantage of hardware parallelization and vector operation support to accelerate performance, which are all features not normally available on a CPU. It is apparent when looking at metrics in table 4 that hardware accelerators like the PPU provides much more efficient execution of AI functions and this becomes increasingly important when scaled to high voltage systems (200+ cells) where computational demand grows significantly and scheduling and timing constraints in real time systems become more complicated. Also, without the SW toolchain of the PPU, substantial expertise in embedded-AI is required to optimize C code and weights (quantization) of the neural networks with in-house efforts. This issue is amplified in high voltage systems as inefficiencies in hand written c-code compound as the number of cells and calculation iterations increase.

As such, it is highly challenging to run AI-based diagnostics like LiP and RUL along with a base BMS stack on a CPU only solution. The AURIX™ TC4x with integrated PPU provides clear value by minimizing the computational challenges of incorporating AI and advanced algorithms and effortlessly scales across numerous cells (more than 200 in typical 800 V system) in high-voltage battery systems, a computationally demanding task when attempted for every supercell.

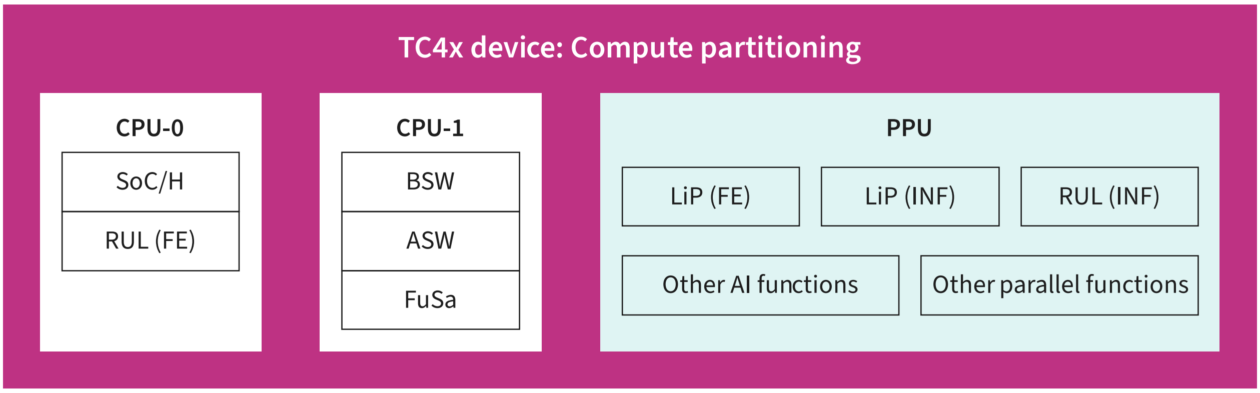

Figure 7 **Sample integration of AI-ISL features in a real BMS solution for HV EV batteries (200 cells) on a AURIX™ TC4x device.**

5.4 ISO 26262 Functional safety considerations

The integration of the functional safety (FuSa) concept is particularly critical depending on the application. At a system level it is crucial to assess whether malfunctions of features can lead to a violation of safety goals. At a component level, final ASIL ratings might vary based on the decomposition and the sensor and hardware architecture.

For this PoC, all functionalities including SoC/H, LiP detection and RUL are designed as quality management (QM) components with the following assumptions of use:

- The software serves non-critical functions within the system, such as monitoring and estimation rather than directly controlling safety-critical aspects like braking or steering in an automotive context.
- Limited Impact on Safety: The software's failure or inaccuracy doesn’t directly jeopardize the safety of the overall system or users. Its functionality doesn't involve critical safety-related decisions.
- Secondary Supportive Role: The software provides auxiliary support or supplementary information but doesn't directly influence primary safety-critical functions or decision-making processes.
- Absence of Critical Control Authority: The software lacks direct control authority over safety-critical components or processes. It provides estimations or information but doesn’t govern critical operations.

The AURIX™ TC4x and the integrated PPU is fully ASIL-D compliant per ISO 26262 and has been evaluated per the SAFE AI framework (per Fraunhofer IKS assessment) to ensure compliance with AI regulations and standards at the application level. This provides additional flexibility for progression and enables development of safety critical AI-ISL functions without a need to change hardware platforms.

6. Conclusion

In conclusion, this collaboration between Infineon and Eatron presents a prototype of an innovative AI-battery management system that enables advanced state estimation for State of Charge (SoC) and State of Health (SoH), Remaining Lifetime (RUL) prediction and Lithium Plating Detection allowing for real-time proactive management. Combining Eatron's innovate AI-ISL software approach with Infineon's state-of-the-art hardware, all target metrics were achieved and verified during processor-in-the-loop testing

The use of Infineon's AURIX™ TC4x MCU with integrated PPU into battery management systems represents a substantial leap forward in addressing two of the most pressing challenges in battery technology: Lithium Plating detection and remaining useful life estimation. Leveraging a cohesive SW ecosystem for efficient implementation, Eatron's algorithms are to achieve 90% module-level Lithium plating detection accuracy and < 100 cycle early life RUL prediction accuracy across generalized conditions. These prediction capabilities are crucial for preventing the onset of battery failures, enhancing safety, and maintaining performance by providing insight into the health and longevity of each cell within a battery pack. This empowers more informed decisions regarding maintenance, usage, and warranty management.

The PPU's specialized hardware accelerates the computation required for these advanced diagnostic tools, making it feasible to process large datasets and perform complex calculations in real-time. This is particularly beneficial for electric vehicles, where timely and accurate battery diagnostics are vital for reliable and efficient operation. Moreover, running AI-ISL functions in the edge for every single cell as opposed to transferring the data to the cloud and running AI solutions in the cloud would also reduce cloud communication bandwidth leading to additional savings. Therefore, the advent of the PPU not only enhances the current state-of-art for battery management systems but also paves the way for the adoption of these key technologies that are essential for the advancement of battery capabilities and the overall performance of electric vehicles.

The AI-powered BMS solution not only enhances safety through early detection of issues like Lithium Plating but also extends the battery's usable life through sophisticated, lifetime prediction algorithms, ensuring vehicles operate at peak efficiency while minimizing the total cost of ownership. Eatron software, in concert with Infineon's hardware, is reshaping the future BMS in the ever-evolving landscape of electric vehicle technology.

Published by
Infineon Technologies AG
Am Campeon 1-15, 85579 Neubiberg
Germany

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Public

Version: V1.0_EN
Date: 08/2024

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