Fraunhofer
IWES

FRAUNHOFER INSTITUTE F0R WIND ENERGY AND ENERGY SYSTEM TECHNOLOGY IWES

Accelerated Development and Test of BMS Using an Emulation Based HIL

D. Schledde
Dr. M. Schwalm
C. Kettenring
M. Puchta

*Dr. B. Bock**
*B. Przybyl**
*Dr. A. Popov**
*Dr. M. Schugt**

**Scienlab electronic systems GmbH*

Contact:
dominik.schledde@iwes.fraunhofer.de
Phone +49 561 7294-247

Fraunhofer IWES | Kassel
Königstor 59
34119 Kassel / Germany

www.energiesystemtechnik.iwes.fraunhofer.de

www.battery-simulation.de

Testing a Battery Management Systems (BMS) with real Lithium-Ion Batteries (LIB) requires considerable conditioning efforts for each cell in terms of state and temperature, as well as precautions for the case of failures. To overcome these issues, a BMS Hardware-in-the-Loop (HIL) system was developed.

A BMS-HIL consists of an arbitrary number of Cell Emulators (CE), Current Sensor Emulators (CSE) and Temperature Sensor Emulators (TSE) with individual, programmable characteristics. Additional ports for control and communication purposes (e.g. Circuit Braker Emulator (CBE), CAN) and a variety of possible cell interconnections and circuits for failure scenarios are included. The simultaneous calculation of the cell models in real-time provides a precise representation of the bahaviour of the batteries. The model (ISETLIB) is based on the simulation of all relevant physical and electrochemical processes, offering a high accuracy over the entire operating range and a precise knowledge of each battery's state.

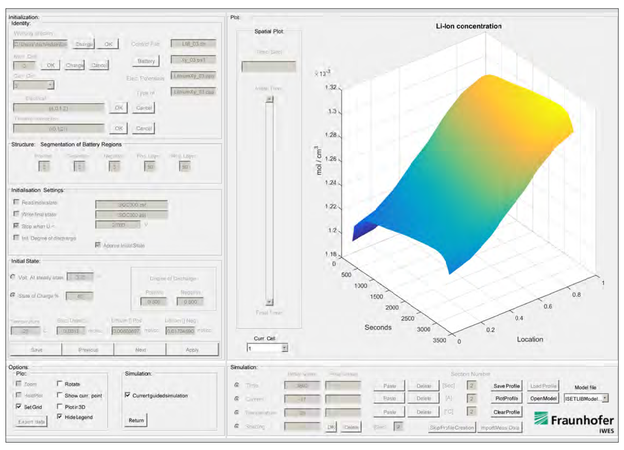

Fig: Simulation software ISET-LIB: Calculation of the Li-ion concentration over the entire cell

The structure of the model allows the consideration of production tolerances and aged batteries.

Thus emulator-based HIL environments accelerate the development and testing of a BMS since the conditions can be changed by software. Safety issues are avoided completely. In contrast to a real LIB, it can provide internal battery quantities, thus delivering a reference value for the BMS algorithms.

Fig: BMS-Slaves under test in the BMS-HIL at the Fraunhofer IWES

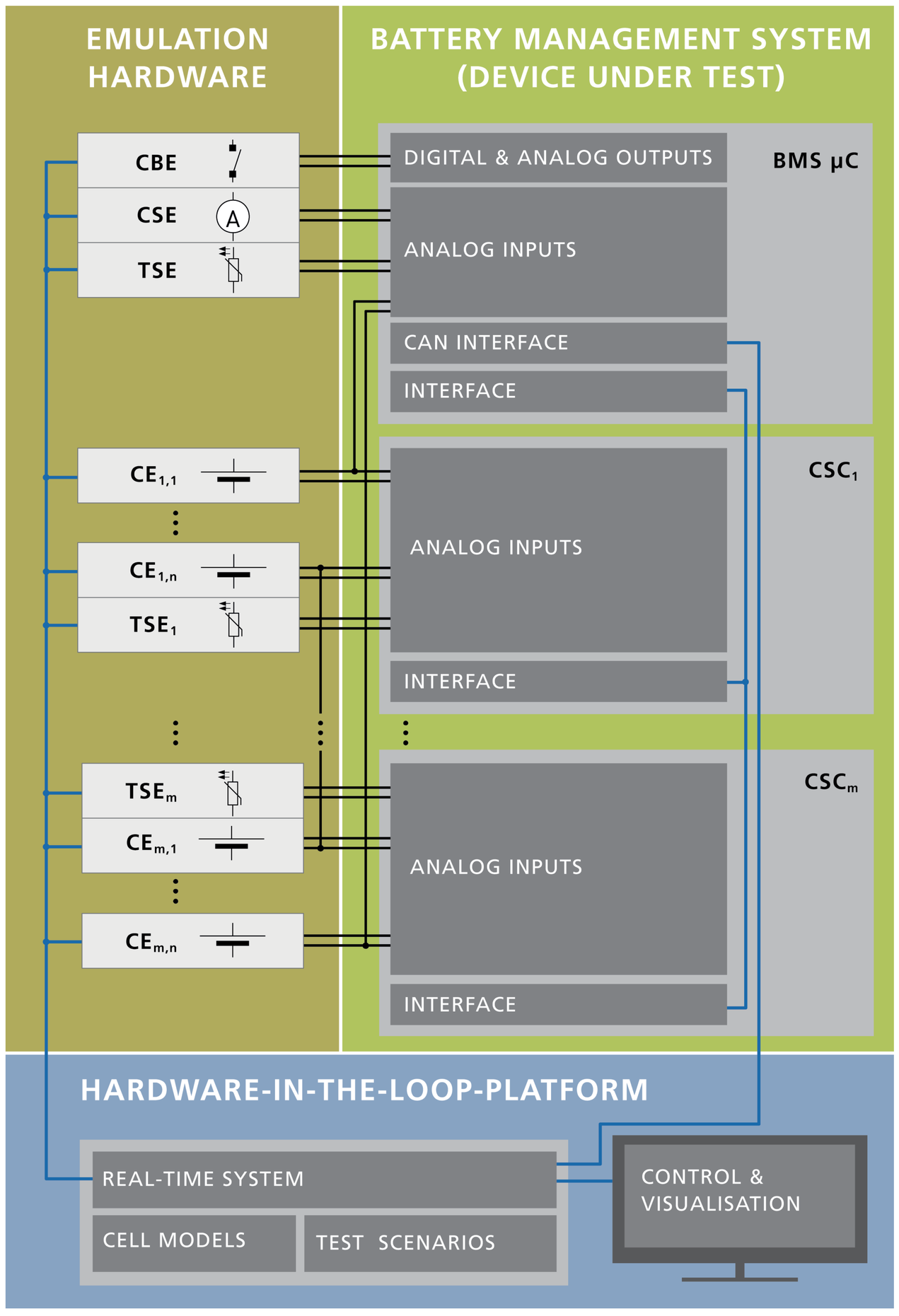

Fig: Concept of the BMS-HIL: Depicted in three parts: Emulation Hardware, HIL-Platform and BMS (device under test) with its cell supervisory circuits (CSC)

On behalf of:

Federal Ministry
for the Environment, Nature Conservation,
Building and Nuclear Safety

of the Federal Republic of Germany

scienlab
electronic systems

siem