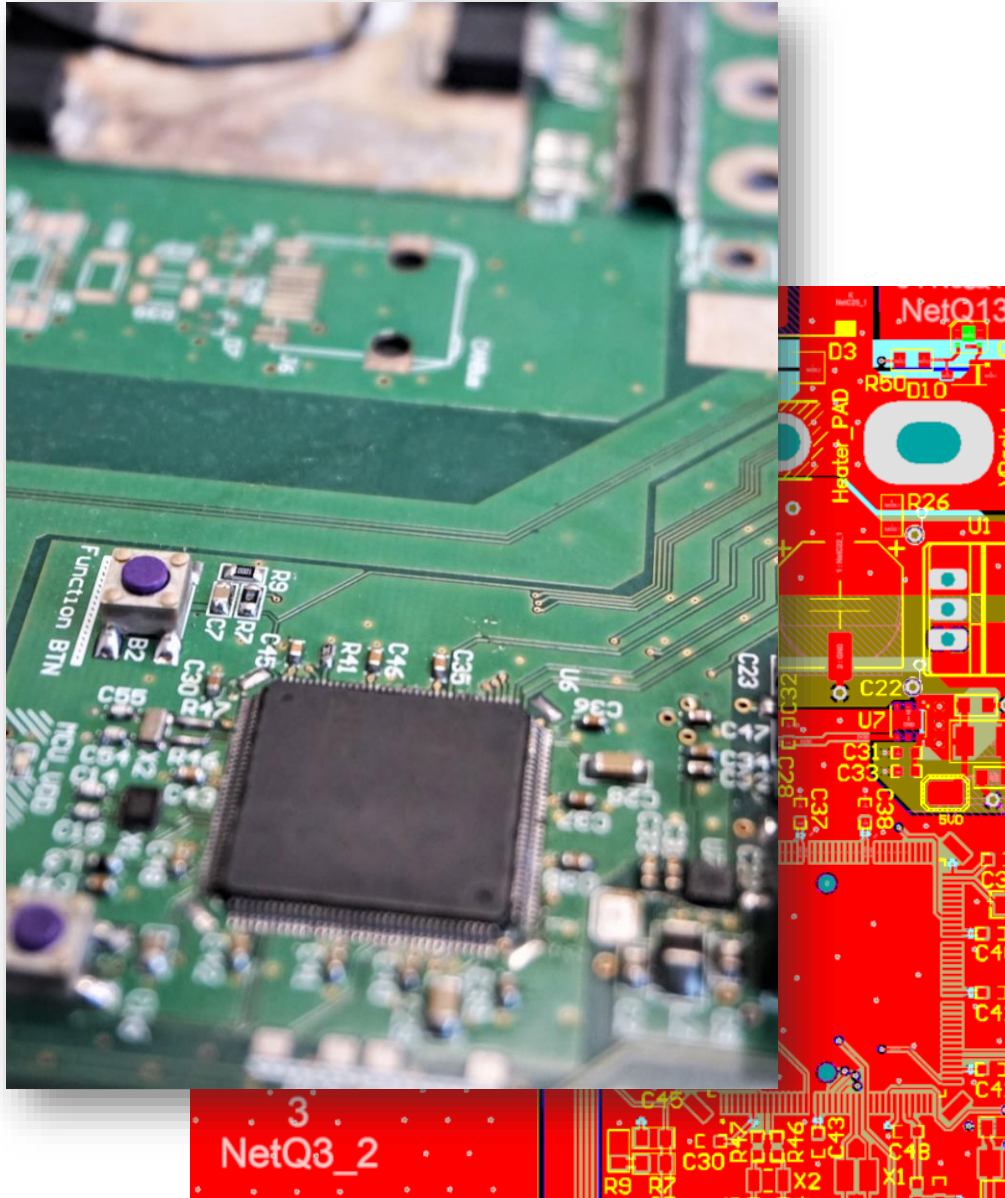




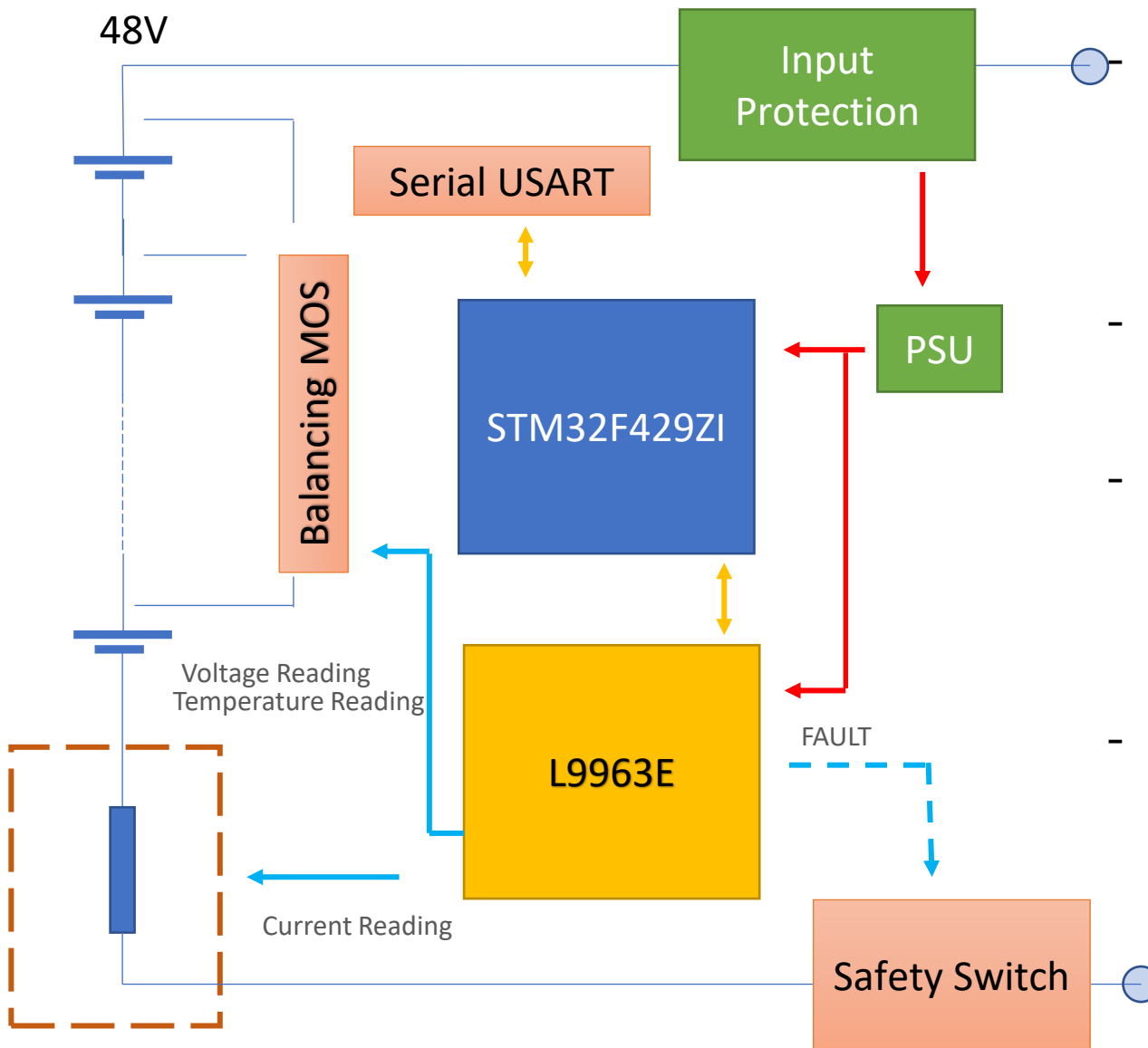
STM32 BMS platform for L9963E
Advanced Monitoring and balancing IC

Helping users in BMS systems integration



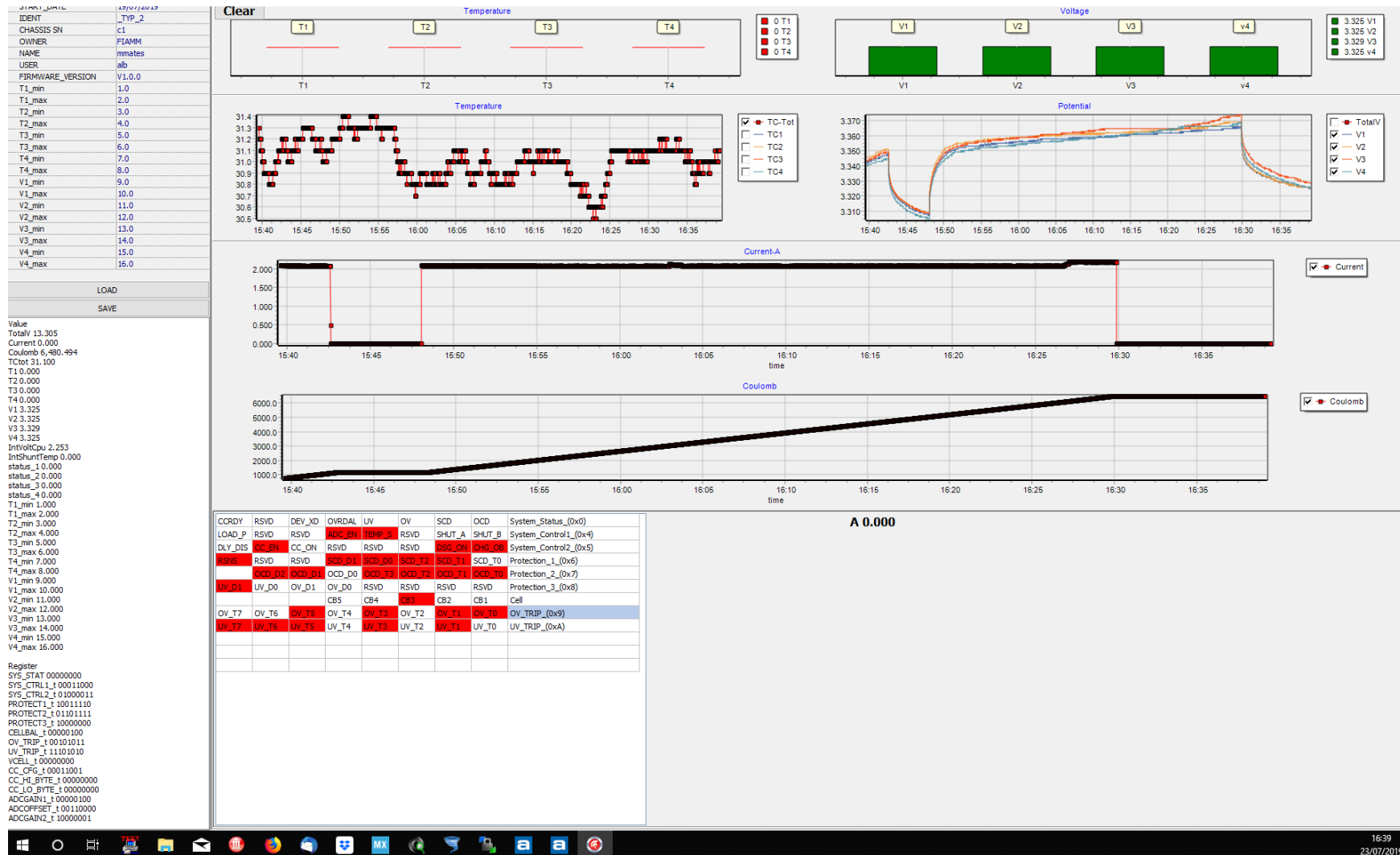
- The STM32F4 MCU platform has optimal features to implement BMS systems that are both performing and cost-effective in applications outside the automotive environment
- In MMI we are combining our experience to a general purpose BMS software platform in order to allow users to test application prototypes in the fastest way
- Both firmware modules and the supporting programs are ready for cut-and-paste in the final application and are, furthermore, based on royalty-free algorithms on the advanced features that have been implemented (SOC/SOH metering, balancing strategies)

A reference design fits all



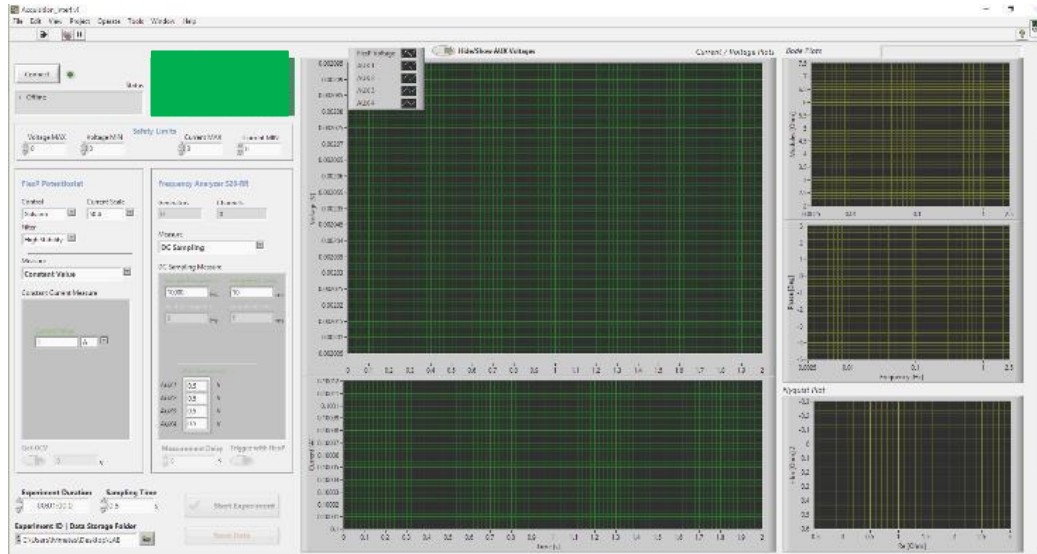
- The STM32F429ZI Microcontroller which includes the fundamental BMS features applied to a module up to 48V
- We use the ST existing demo boards as the fastest shortcut to a physical prototype
- The platform also features a software interface that lets the user test the main BMS strategies directly on a Battery Pack
- Our platform caters to all needs ranging from full Automotive grade, with the SPC57x, to industrial grade using an STM32 : the L9963E system architecture efficiently covers both fields

Instant feedback seeing the system at work



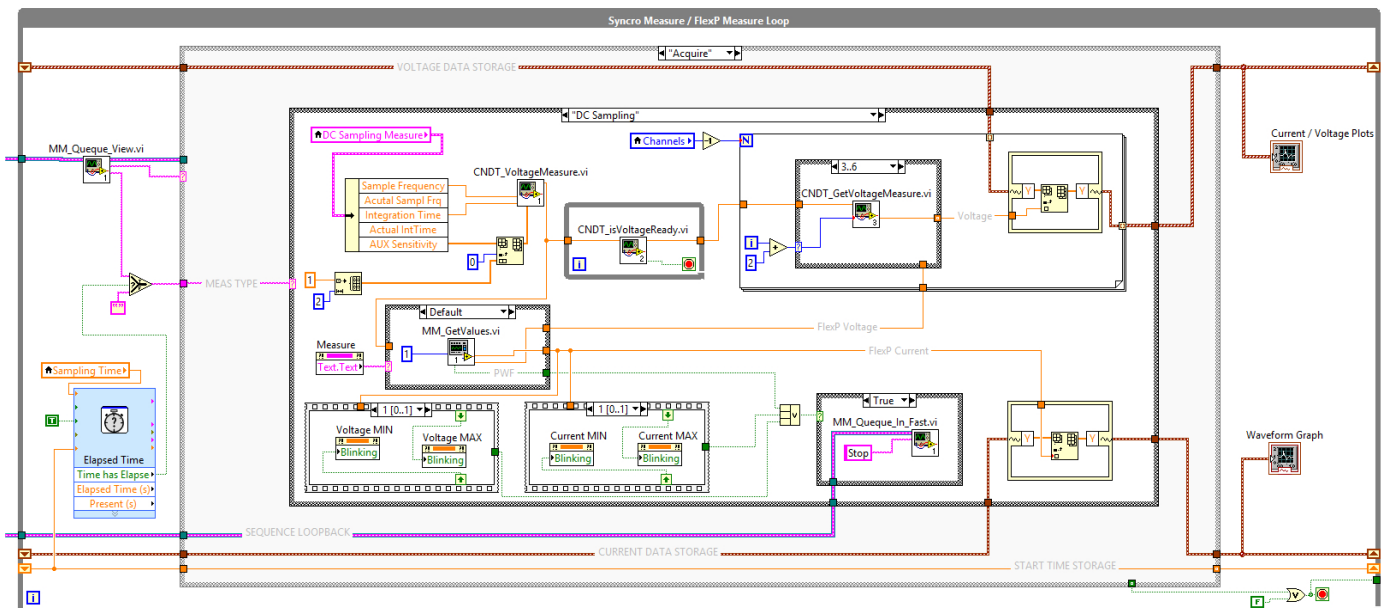
In addition to the routines, external programs let the user twist and tune all BMS parameters and evaluate the effects in a highly interactive environment

Giving engineers «Carte Blanche» to play with the system



Our solutions range extends also to custom-made programs in LabView. The purpose is to teach our customers how to manage the equipment while allowing them to integrate it with other hardware or testing equipment. Innovative algorithms can then be tested and improved with very little development time and effort.

Our solutions also include some tutorial examples to illustrate safety and balancing techniques



All critical aspects implemented and ready to use



Function Block Implemented

_ AFE Reading Function block for reading the current Status of the AFE

- Total Stack Voltage, Intermediate Cell Voltages, Coulomb Counting reading, Temperature Sensor with high rate refresh up to AFE specs
- AFE STATUS check for Threshold Errors (OV, UV, OCD, OCC) identification and Automatic Safety Switch Device drive intervention when exceeding threshold safety values

_ BMS Safety Management Function block for Safety Management

- Low level threshold securities requested from AFE for fast intervention, i.e. (OV, UV, OCD, OCC).
- Check for correct Temperature safety with 4 different operating modes for Charging / Discharging
- High level safety checks with direct intervention on Safety Switch Device, i.e. Over Charge / Battery cells Out-of-Balance
- Self-Diagnostic on Safety Switch Device status, FW code for re-activation after failure / error concentrated in single condition in order to avoid random Safety Switch Activation
- AFE communication diagnostic

All the critical aspects implemented (cont')

Function Block Implemented

_ SOC / SOH Calculation Function block with SOC / SOH Algorithm

- SOC algorithm for batteries with different chemistries with self-check for cumulative error consistency
- SOH algorithm for batteries with different chemistries
- Calculations performed at high speed to match AFE performances

_ Balancing strategies Function block with balancing procedures

- Efficient balancing techniques during charge
- Soft power-in / fade out phases during full charge procedure

_ PC Host UART Communication

- Asynchronous 115KBs UART Com which allows 10 complete sampling data / sec for live debug
- CAN communication module
- TCP-IP or UDP communication module
- MODBUS and MODBUS over TCP or UDP to match industrial environment