Nuevas tecnologías e innovación en pruebas:

Tecnología inteligente para validación y test de sistemas industriales

measure IT
THE MEASUREMENT COMPANY

Test and Measurement Days

Barcelona, 14 Noviembre 2023

ASOINDEL
Advanced
Solutions
Integration &
Development

ASOINDEL Advanced SOlutions INtegration & DEveLopment

Since
2008

Located in
Santpedor - Barcelona

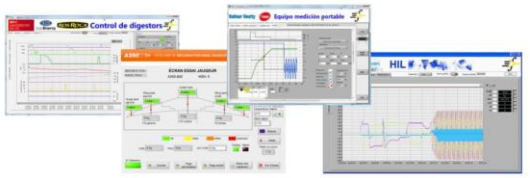
Partners

NI Alliance
Partner SILVER

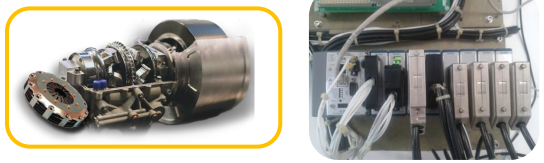
Accredited advisor
for Industry 4.0
by ACCIO

Engineering Software Solutions

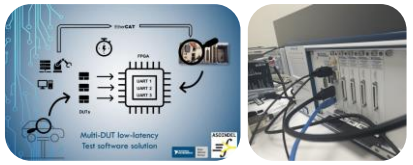
Data Analytics



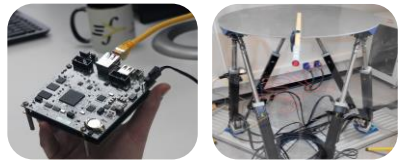
Hardware-in-the-loop



Automated test software platforms



Advanced Industrial control



Global solutions
+ 50 worldwide customers

6
Engineers

Specialties
Real Time
&
Embedded & FPGA
&
Noise & Vibration

LabVIEW certifications
2 CLA
1 CLED
1 CLD
2 CPIs

600 K€
Revenue

Our Team

- Telecommunications and Electronic engineers with more than 20 years' experience developing highly technical and innovative test solutions for automotive, aeronautic, railway, energy, mobility, electronics and geophysics sectors.
  - Founder & CEO: Jaume Martinez linkedin.com/in/jaume-martinez-martinez
  - CTO: Eudald Bellmunt linkedin.com/in/eudald-bellmunt-rey-b402703a
  - Business Development Manager: Marta Millan linkedin.com/in/marta-millan-a282098
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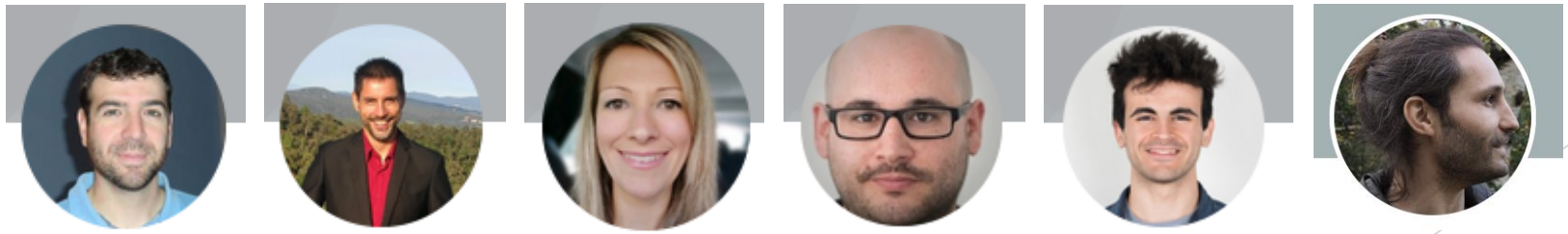
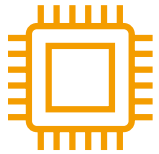
  - Software Developer: Pol Domènech linkedin.com/in/pol-domènech-08929246



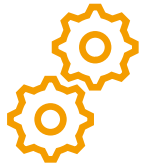
Advanced Engineering Software Solutions

- Measurement and on-board analysis: Brakes, EM measurement, Portable data recorder
- Noise analysis: Automotive



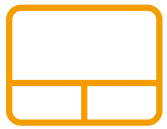
- Test Systems: Aerospace, Avionics, Automotive, Energy Storage (Ultra caps, Batteries), Industrial actuators, sensors
- Communications: Network analyzer, devices and instrumentation, industrial protocols, traceability

- Hardware in the loop: Aerospace, Railway, Electrical vehicle, Energy storage, Substations



- Remote monitoring and diagnosis: Predictive maintenance for industrial components, railroad
- Industrial control systems: Actuators, industrial process

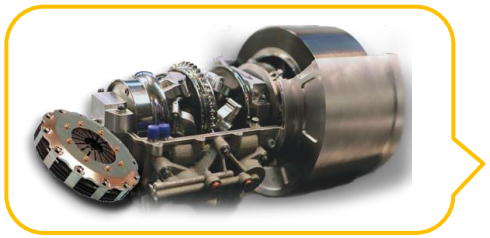
- Front End: HMI, Wizard



- Customized driver: Lidar, cRIO encoder, cRIO FO, BMS

Advanced Hardware-in-the-loop

Hardware-in-the-loop



Classical HIL approach

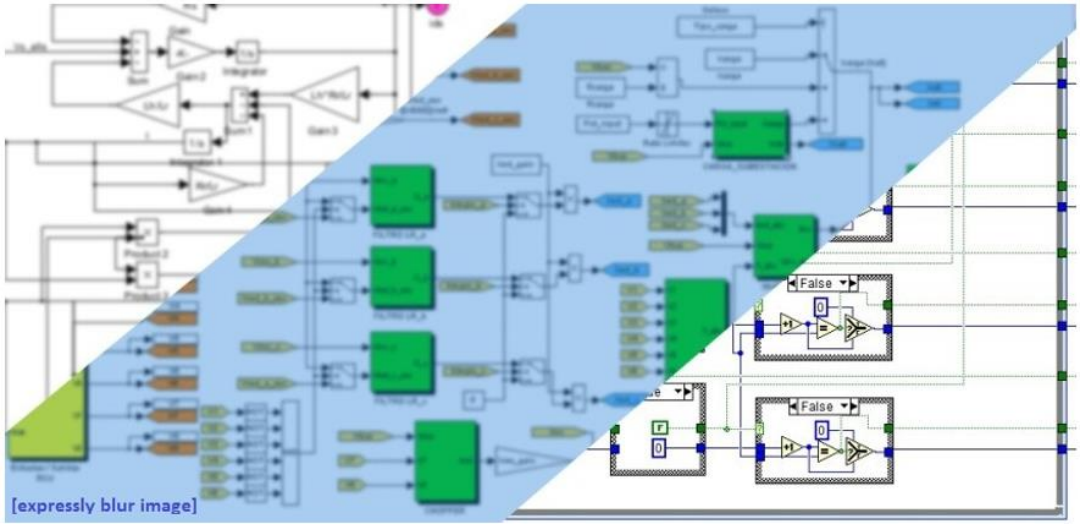
- Complete closed or ad-hoc solutions
- Focused on specific markets
- Complex and long learning curve
- Proprietary hardware-based solution
- High range cost

Our HIL approach

- Customized HIL platform: Modular and flexible
- Hardware abstraction layer (HAL)
- Easy to add new functionalities (models, tests, etc.)
- Multimodel compatibility: Electronic, mechanical, dynamic, etc.
- Real-time and deterministic execution
- Automated validation & test of industrial systems
- Easy-to-use for the final user
- Easy installation
- COTS hardware based (PXI or cRIO)
- Medium range cost

The Process

1. Model the physic system
2. Simulation and validation
3. Translate the model to the HIL
4. Simulate the HIL
5. Install
6. Run!



Model the physic system

- Use your favourite program to model the system:
  - Simulink (for “low level” equations)
  - Simulation Power Systems (“High level components”)
  - Starsim (LabVIEW-basded Electrical System simulation Software)
  - LabVIEW Control Design and Simulation Module
  - Others…

Simulation and Validation

- Run the model in the computer
  - Validate the response of the model
  - Evaluate the minimum fix-step size
  - Get valid traces for comparing HIL response to model simulation

Translate model to HIL

Depending on step time can be in:

Real-time processor (milliseconds)

FPGA (microseconds)

Implement with special attention to:

HIL loop time

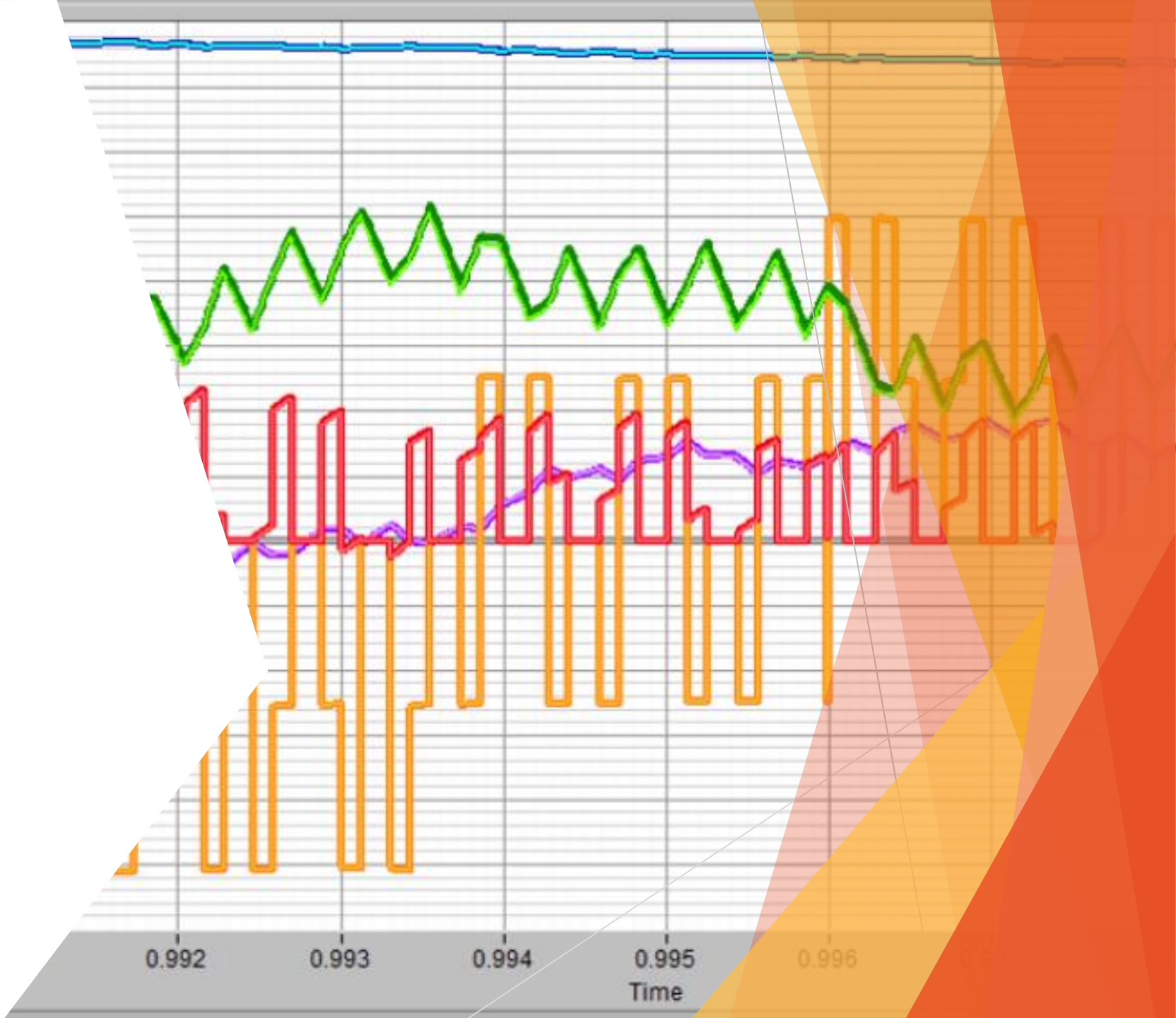
FPGA occupancy (slices and DSP)

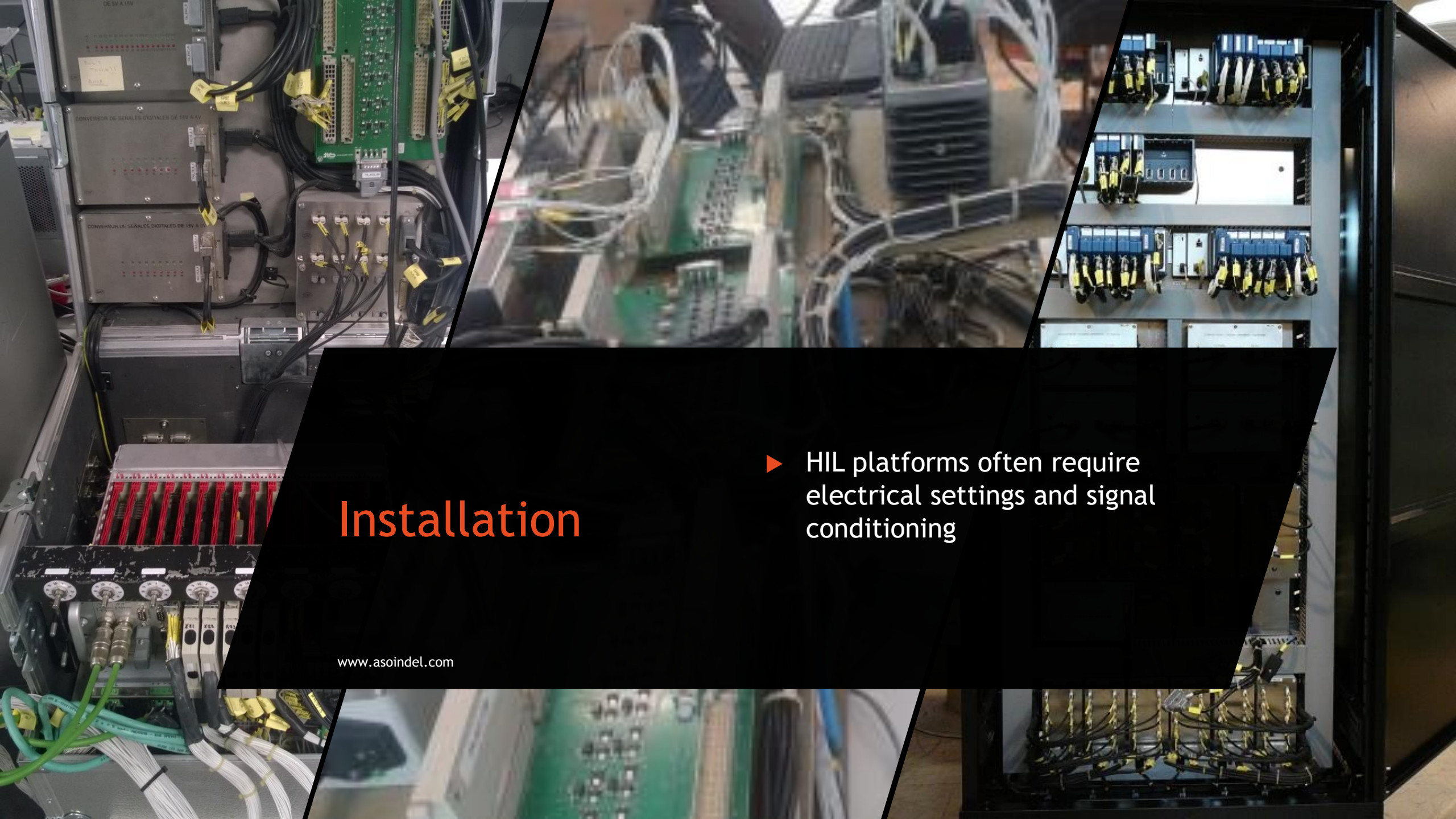
Floating point or Fixed-point implementation (accuracy and range)

Code optimization

Simulate the HIL

- Run the HIL in the final implementation
- Use same control signals as in original model
- Compare responses with the model



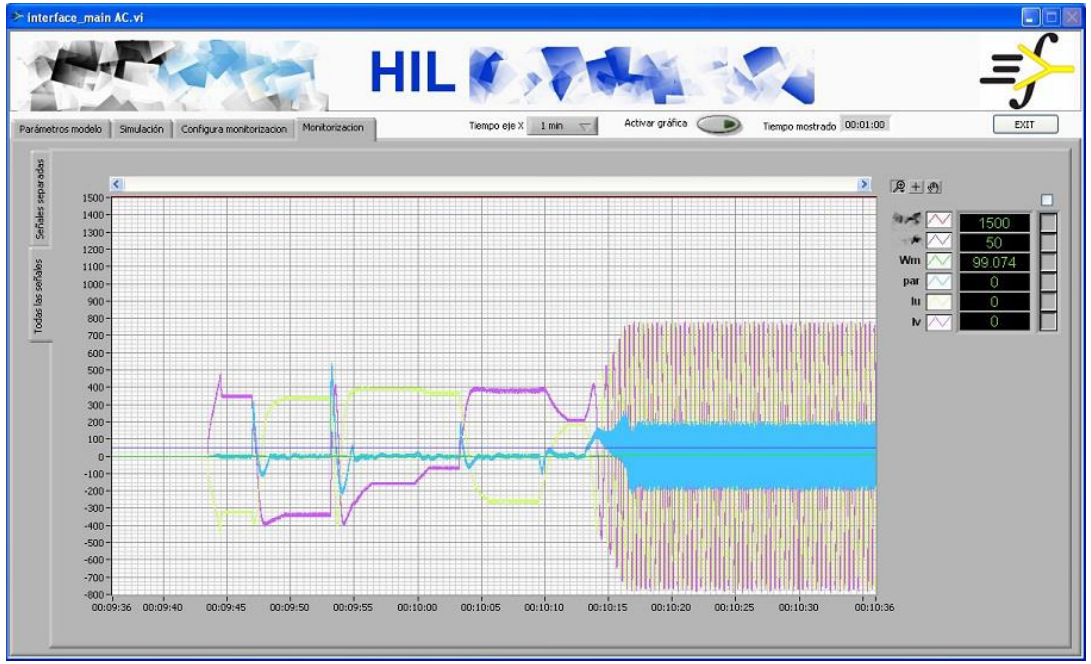


Installation

- HIL platforms often require electrical settings and signal conditioning

Run!

- The HIL is ready to Run:
  - Change parameters of the model
  - Insert perturbations or failures in real time
  - Viewer Real-time data and traces
  - Store results for off-line analysis

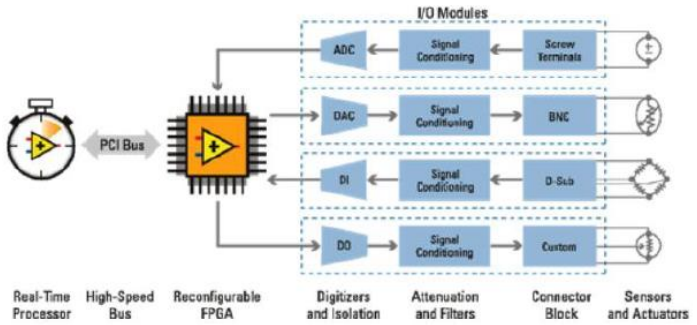


Utilities

- Signal validation
- Function validation
- Control algorithms development
- Parameters tunning
- Verify response to failure situations
- Regression test

Other characteristics

- Parametrize your model to modelize different physical systems
- Change parameters on the fly to simulate failure modes or conditions changes
- Automatize simulations and create sequences of steps
- Add industrial communications (CANopen, etc)
- Implement signal conditioning by Hardware / software
- Low cost of COTS hardware based on RIO family (National Instruments)



Automated Validation & Test Solution

Advanced HIL platform

- Open control interface for automated validation
- Customized model library
- Hardware abstraction layer
- Functionalities:
  - Parametrize model for different physical systems
  - Change parameters on the fly
  - Simulate failure modes or conditions changes
  - Automatize simulations and create sequences of steps
- Industrial standard communications (CANopen, etc)
- Implement signal conditioning by Hardware / Software

Automated Test platform

- Global architecture for validation & test
- Developed specifically for each customer
- Customized test library and measurements
- Modular and decoupled from test bench:
  - Industrial communications
  - Sequence editor
  - Test monitoring
- Automated test execution & control
- Results processing & analysis
- Acceptance Test Report generation

Application: Electric Vehicle HIL

The Challenge:
Developing a rapid-response, hardware-in-the-loop (HIL) system for several complex models, created in MathWorks, Inc. Simulink® software, to achieve simulation loop speeds under 20 µs.

The Solution:
Using NI CompactRIO with LabVIEW FPGA programming for a highly deterministic calculation speed and high-speed simulated hardware response.

The Result:
"Thanks to CompactRIO and LabVIEW FPGA programming, we implemented a complex HIL system that makes highly dynamic responses to differential equations in microseconds, and in the case of the engine model, in up to just 1 µs (…) All entires and exists correspond to the real physical system, except for signal levels that adapt through customized electronics. Digital signals are managed in tens of ns"

Read complete case

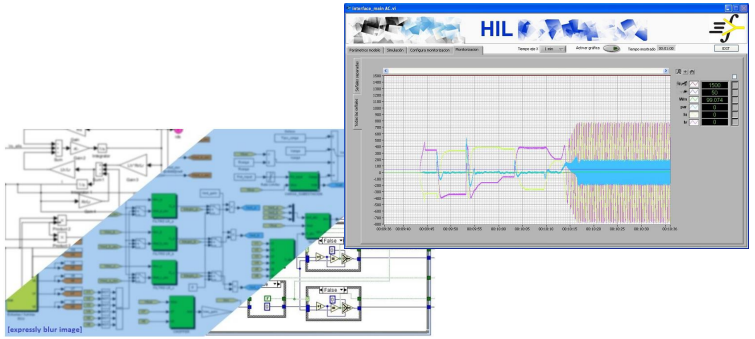
Advanced Energy Storage Applications

Automated test

- UltraCaps test
- Module test
- Module array test
- Battery balancing process

Hardware-in-the-loop

- uCs module HIL
- Mixed accumulation system HIL

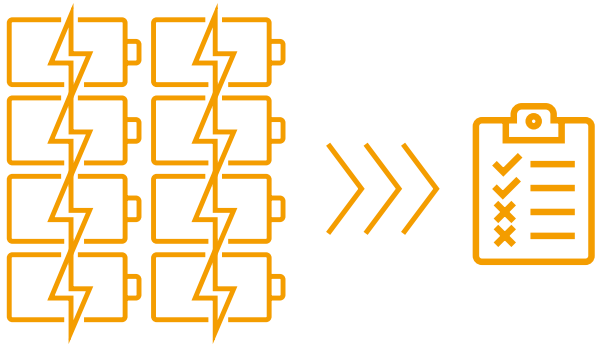


Module array automated test

Goal: Automated test for Ucs/Battery module arrays

Target: Railway industry

Solution: LabVIEW RT + PXI Platform



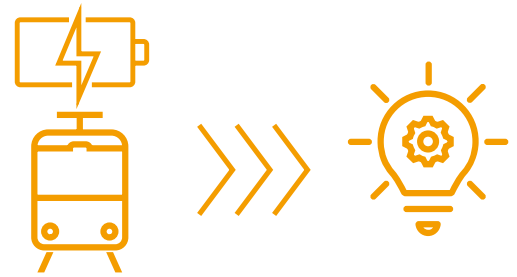
- 3-in-1 testing solution:
  - Measurements
  - Functional test
  - Running-in (Operating hours)
- State of charge (SoC) measurement and analysis
- Test parameters measurement (ESR, C, Rc, T, V, Is, R)
- CANopen communication implemented for BMS and Chiller

Mixed accumulation system HIL

Goal: uCs+Battery electric tram system hardware-in-the-loop

Target: Railway industry

Solution: LabVIEW RT + cRIO Platform



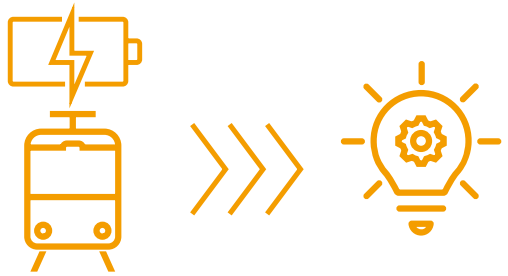
- Trams equipped with fast-charged at stops or without catenary
- Battery systems modelled and implemented in FPGA
- Implemented specific SoC table for each chemical cell type
- Combined with traction HIL and Vehicle seismic mass model implementation to simulate complete tram behavior
- Highly dynamic response: simulation loops speed under 20 µs
- LabVIEW FPGA programming for a highly deterministic calculation

Auxiliary Converter Test Bench

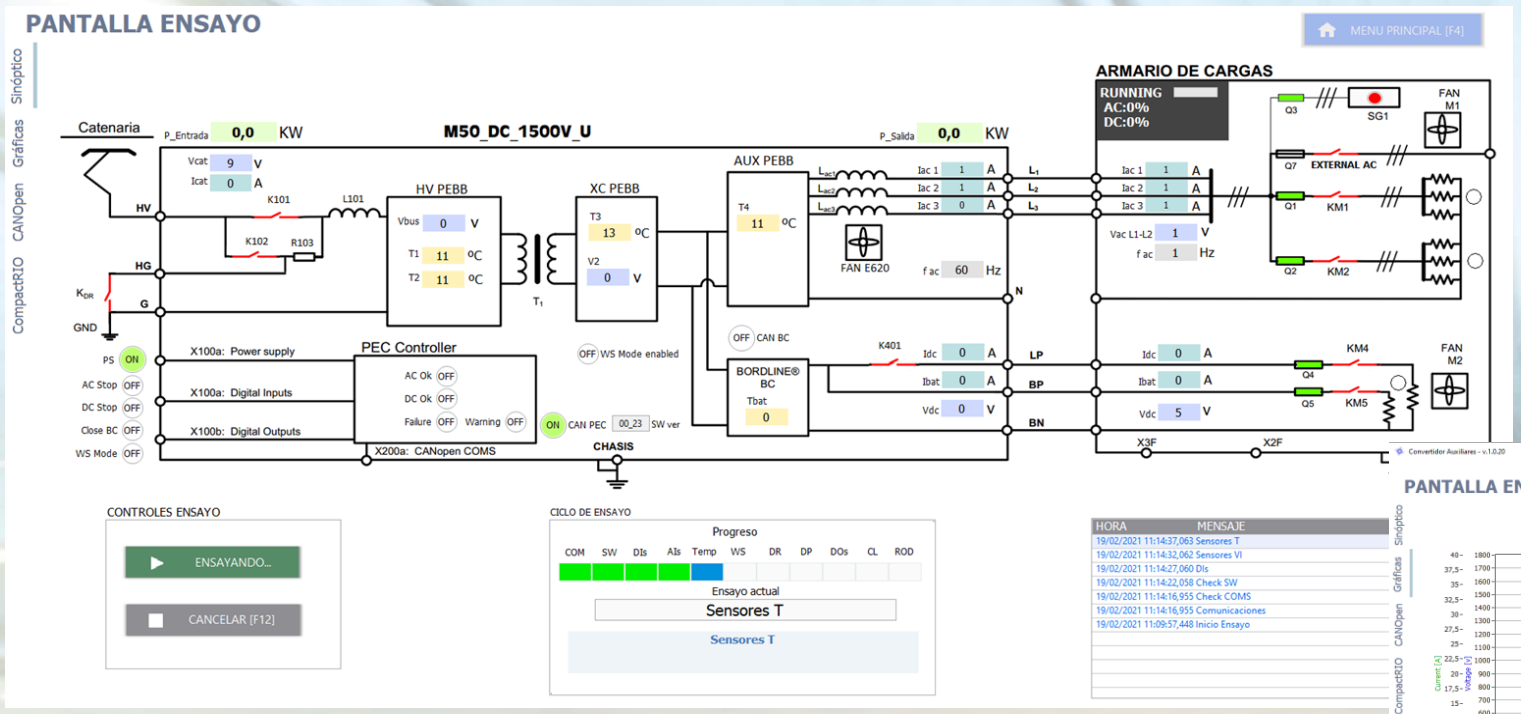
Goal: Test solution for DUTs 1500VDC with 54KVA 3 phase AC

Target: Railway industry

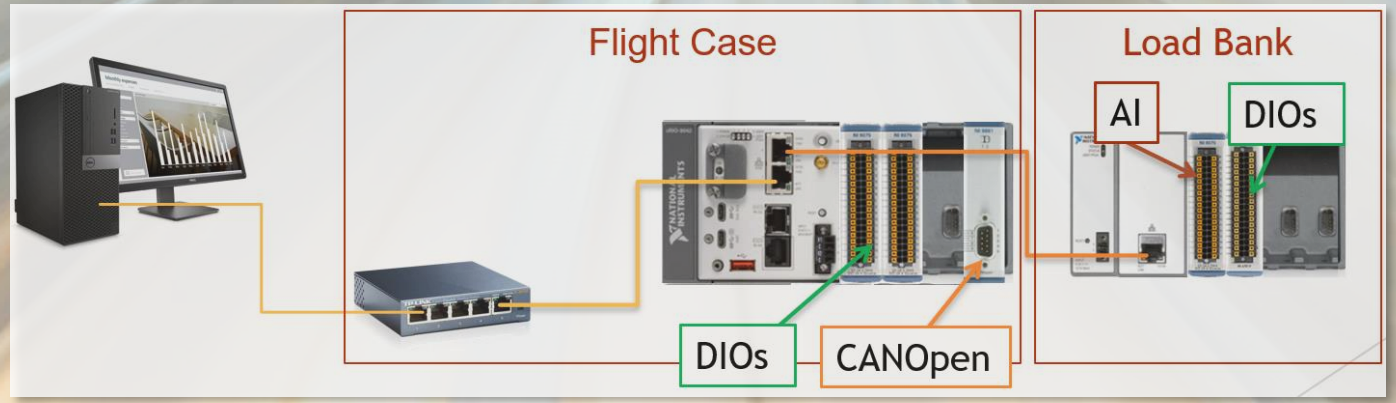
Solution: LabVIEW RT + cRIO Platform



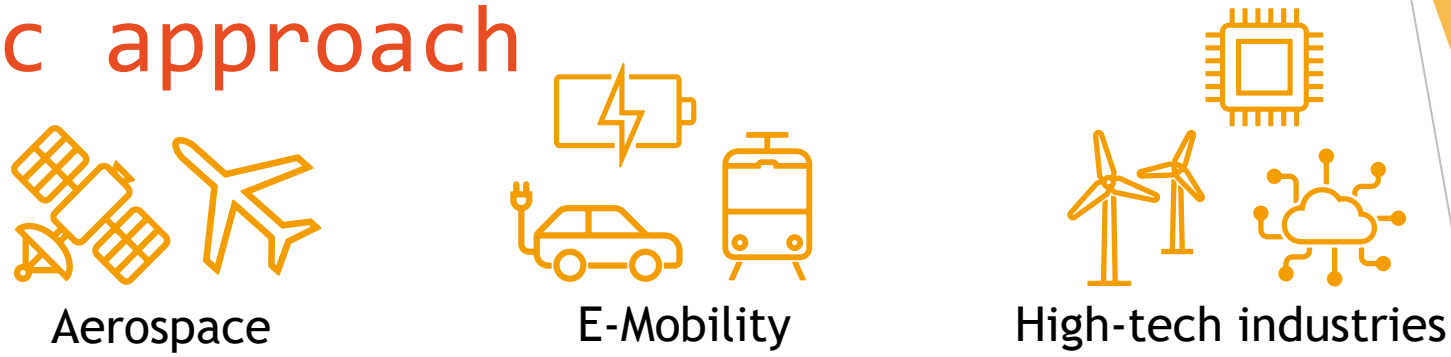
- Acquisition, test control and simulation of several load and operational working conditions for DUT validation.
- Low voltage, digital signals and high voltage testing to check DUT performance operation, applying several resistive loads configuration.
- Auxiliar converter key parameters monitoring and testing, through a smart, friendly, and intuitive HMI interface for real-time test condition supervision.
- CANOpen communication to emulate control signals from train on-board unit.



Automated Test Solution for Auxiliary Converters in Railway Industry



Strategic approach



Validation

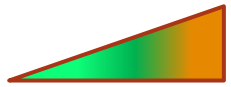
HIL Solutions

Test

Test Solutions

Custom development

LV RT & FPGA



Customization level


Know-How
Reports
PAC
Skill
Control
Real Time
ATE
Communications
Test
Noise
HIL
PXI
Acquistion
Projects
Embedded
LabVIEW
Vibration
Solutions
Satisfaction
FPGA
CompactRIO