LABCAR on Track

To reduce the risk of cost overruns and potential adjustments, early validation during the simulation process is a must. It is also important to have the right tool to perform this validation. With the increasing number of control units in train subsystems, Alstom Transport began looking for several tools able to validate the subsystem before its first integration in the train takes place. Alstom Transport selected ETAS LABCAR Hardware-in-the-Loop system to validate an auxiliary train subsystem, knowing ETAS is a global leader in providing tools and solutions for the development of embedded software in the automotive industry.

Train Subsystem Control Unit

The control unit is seen as a modular electronic control unit (ECU) able to control several different devices (such as genset, powertrain, and air conditioning). This means a dedicated HiL is mandatory for validating device behavior in advance and for checking communication networks – currently SAE J1939 as well as Common Industrial Protocol (CIP) and Multifunction Vehicle Bus (MVB).

Project challenges

Alstom is developing the application software for the TSSCU ECU. The first challenge was to create a tool for carrying out Model-in-the-Loop (MiL) tests. This was possible by integrating a model of the ECU software and a Dymola plant model using the experiment environment ETAS LABCAR-OPERATOR and the RTPC (Real-Time PC) real-time simulation target from ETAS. Alstom's second challenge was then to perform Hardware-in-the-Loop (HiL) testing on the complete LABCAR bench with the real TSSCU hardware as a unit under test.

An extremely stable and reliable VME architecture with high-end I/O boards has been designed for this purpose. ETAS has developed a specific and flexible load box concept for the project, including a wiring harness. The final setup was performed together with the

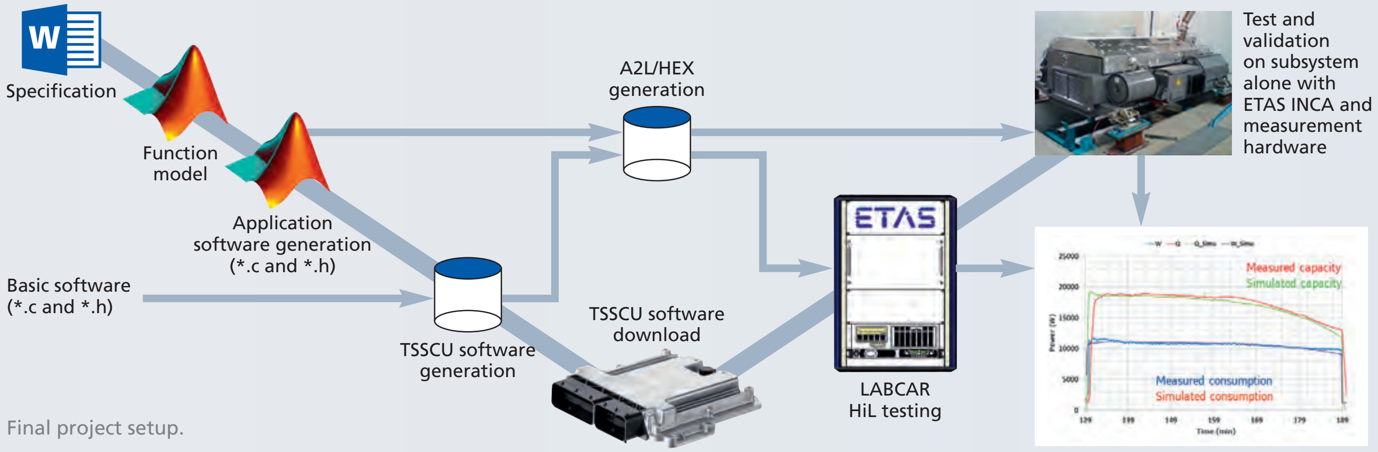
AUTHORS

Hervé Scelers is Subsystem Control and Validation Manager at **Alstom Transport** in Reichshoffen, France.

Julien Mothré is Field Application Engineer for test and validation systems at **ETAS** in Saint-Ouen, France.

ETAS Hardware-in-the-Loop system validates train subsystem

In the railway industry, simulation is the key to developing and validating new products because the possibility to validate a train subsystem exists only during the period when the first production train is being built. Indeed, although all hardware components can be validated on the supplier bench, the validation of the subsystem control can only be performed on the train. Once the first train has been completed, any modifications or additional sensors or actuators may have a negative impact on the time to market and may result in a significant retrofit.



Final project setup.

In addition to LABCAR, Alstom Transport required a robust measurement tool chain. Parts of data acquisition and calibration are now performed using INCA and measurement hardware such as ES592, ES720, ES411 from ETAS.

customer at the customer's site in coaching mode. Thanks to the support offered by ETAS France, Alstom has now received the necessary know-how to manage and maintain both the current and further configurations on its own.

Summary

- Tests were performed to compare HiL test system results against the real subsystem results. These indicated that Alstom Transport has reached its target since simulations predicted the real behavior of the subsystem.
- Thanks to active coaching of Alstom Transport associates during the project development phase, users can now handle the system on their own. The next HiL upgrade has been fully managed by Alstom with minimum interaction with ETAS help desk support.
- During the specification phase and HiL setup, ETAS and Alstom collaborated to create a modular and scalable architecture.
- Alstom's investment in ETAS technology is guaranteed for future ECU generations, such as Multifunction Vehicle Bus (MVB) and Common Industrial Protocol (CIP) due to ETAS' openness to third-party hardware and protocols.

About Alstom Transport

Alstom Transport develops and markets a complete range of rolling stock (train) systems, signaling systems, and services for the railway industry. Notable products include series production of the TGV (high-speed trains), with over 650 train sets sold in the last 25 years, as well as the AGV (Automotrice à grande vitesse), unveiled in February 2008 and in service with NTV in Italy since 2012. Alstom products also include trams (1,900 Citadis low-floor trams in more than 50 cities around the world), metro and regional trains (1,200 Coradia commuter trains operating in nine countries), and suburban trains (4,600 X'Trapolis single deck electric trains operating in countries such as Australia, Spain, and South Africa).