

GreenTeam Uni Stuttgart e.V.

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Germany

www.greenteam-stuttgart.de

Speedgoat products used

- Baseline real-time target machine
- On-board EtherCAT Master
- On-board Real-time UDP
- IO613 CAN I/O module

MathWorks software used

- MATLAB®
- Simulink®
- MATLAB Coder™
- Simulink Coder™
- Simulink Real-Time™

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www.speedgoat.com/user-stories

GreenTeam Uni Stuttgart

Formula Student racing success achieved through powertrain innovation





GreenTeam Uni Stuttgart uses Speedgoat and Simulink Real-Time™ to accelerate the development of their fully-electric racing car. GreenTeam achieved several victories in the 2016/2017 season, including 1st place in the prestigious Hockenheim race.

GreenTeam Uni Stuttgart is a student organization that designs, builds, and tests fully-electric racing cars for the Formula Student Electric competition. Founded in 2009 at the University of Stuttgart in Germany, the team is composed of students from many different fields: mechanical and electrical engineering, business administration, humanities, and communication studies.

Formula Student Competition

Formula Student Electric is an international competition for fully-electric racing cars. It is one of three Formula Student Competitions, with the other

two competitions covering combustion and autonomous racing cars. The electric racing car competition challenges students to conceive, design, produce, develop, and compete with formula-style racing cars. In 2017, some 140 student teams competed in various locations worldwide.

The competition consists of several events divided into two main categories: dynamic and static. The static events cover aspects such as safety, business proposals, costs, marketing, engineering design, and sustainability. The dynamic events involve track tests to evaluate performance features such as acceleration, endurance, efficiency, and steady-state cornering.

Challenges

GreenTeam designed an innovative electrical powertrain requiring advanced control design. Nevertheless, implementing such Simulink-based control designs in their electronic control unit (ECU) proved challenging. Each small design change required multiple manual adjustments in the ECU. Furthermore, the computing power was insufficient for more advanced Simulink-based control designs.

To complete the powertrain development of their fully-electric racing car, the team required a quicker way of developing and testing their innovations on controls, power electronics and driving dynamics. The team realized that they needed a new ECU offering seamless integration with Simulink.

Using Speedgoat as an on-board ECU

To accelerate control system development from Simulink to hardware, GreenTeam decided to use the Speedgoat Baseline real-time target machine as the ECU. Sensors and actuators were interfaced using real-time UDP. New control algorithms could be auto-generated and deployed to the target machine at the click of a button. This allowed GreenTeam to focus on the control algorithms and powertrain innovations instead of ECU development.

Racing Success

GreenTeam developed various innovations such as a new direct torque control algorithm. Having also saved months of development by using the Speedgoat and Simulink Real-Time workflow, they were able to carry out comprehensive system tests ahead of schedule.

In August 2017, GreenTeam won the Formula Student Electric Germany and moved to 1st position in the worldwide ranking.

GreenTeam plans to continue using Speedgoat products to further improve the electrical powertrain and control designs.

Speedgoat's Value Contribution

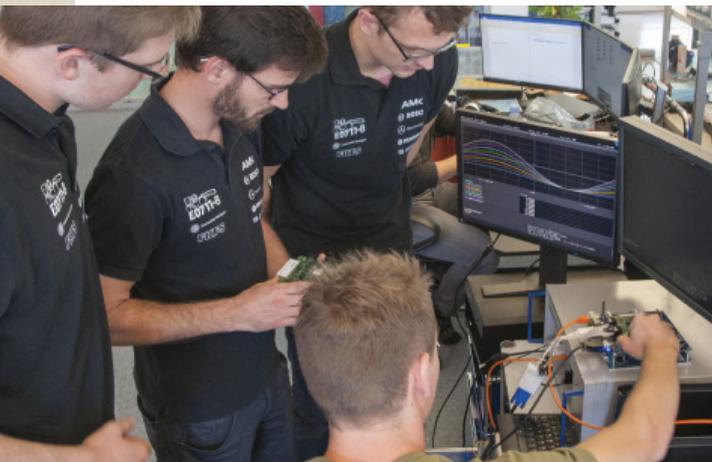
"The Speedgoat system worked out of the box. There were no hurdles in installation and we were up and running with it immediately.

Speedgoat systems allowed us to focus on control systems design instead of wasting time with ECU development."

– Mr. Zeil.



Fabian Zeil
Head of Electrics
GreenTeam Uni Stuttgart e.V.
Stuttgart



GreenTeam and Speedgoat engineers collaborate at Speedgoat headquarters in Switzerland



Track testing of the improved powertrain design