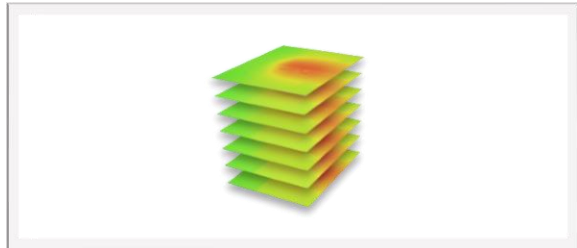
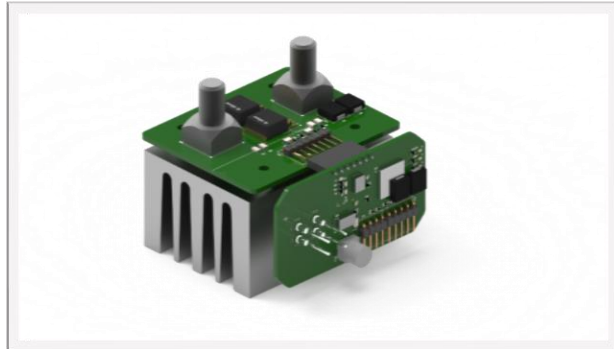


*Starter Switch Unit, first version:
Simulation stacked, max. 229°C*



*Starter Switch Unit, new concept:
Simulation stacked, max. 103°C*

Arrabona Racing Team uses PCB Investigator Physics for thermal simulation

The history of **Arrabona Racing Team** started in January 2014 with the goal to be an active participant of the 2014 Formula Student season. **Formula Student** is a student **engineering competition**, where student teams from around the world design, build, test and race their racing cars. To reach their goals, they need to organize their working processes the same way as if they were employees in a real company.

The team basically has two main departments. On the one hand, there is a department responsible for designing, manufacturing, building, testing and preparing the car for the races. On the other hand, it is necessary to have a management department which deals with money, sponsors, advertisements and does all the background work.



In the first season Arrabona Racing Team became the first Hungarian Formula Student team who managed to be the overall winner of a competition. This momentum was carried through for three more



years. In 2018, they took part in three competitions. They started out in Formula Student East in Zalaegerszeg, Hungary, then travelled to Red Bull Ring, Spielberg, for their first international competition.

The season's highlight and most competitive event was Formula Student Germany, where 58 other combustion teams challenged them in the various event disciplines. The development and the preparation have paid off. Overall, they came in 18th position, reached 88 more points than last year. They were the 8th best at Cost Event and the Engineering Design presentation finished in 13th place.

Challenges of the Electronics Department - Support from PCB Investigator Physics

Dániel Vass, electronics department:

"The use of PCB-Investigator Physic was a huge improvement in our design process. Even if it is possible to design a power electronics with conventional calculations, finally the most accurate thermal behavior is provided by simulations. With the help of this powerful tool, we are sure that our brandnew race car's, ART_06's, power electronics will perform perfectly in any conditions"

The duty of **electronics department** is to develop and manufacture all the electronic devices of the race car as well as developing unique software used by the team. **Designing and making the power electronics**, their unique data collecting system as well as creating the electrical harness connecting all of this together, this is all done by using **CAD software**.

Since the third generation, the main power electronics device in their race cars is the **Power Distribution Unit**. The year 2019 brings a significant change in terms of power distribution as fuse and relay pairs are replaced with **MOSFET** switching elements. These high-side MOSFETs have the capability to measure the current flowing through them. This allows a **more advanced monitoring of the car's electrical behavior**. Another change in the system: They replace the stock starter motor relay with a self-developed device, called **Starter Switch Unit**. This device can **carry 150 Amps constant** starter current and up to **420 Amps in-rush current peak**.

These new developments require to take care of the thermal behavior of the PCBs. That is where **PCB-Investigator Physics** comes into play.

They measured the **load currents** prior the design period. Data from these measurements were the input of **voltage drop** and **thermal simulation** in **PCB-Investigator Physics**. In close **cooperation with experts of EasyLogix**, simulation models were built up, **steady state simulations for worst case scenarios as well as transient simulations for normal operation of the devices**. By drawing conclusions from simulation results, they **reshaped the boards or even changed to a whole new concept** and made simulations again. Several iterations were made until the boards reached their final shape and electrical layout.
