etechRACING

FORMULA STUDENT TEAM

Newsletter

Autumn - 2019

Team 2019 | 2020

UNIVERSITAT POLITÈCNICA DE CATALUNYA
BARCELONATECH
Escola d'Enginyeria de Barcelona Est

EBBE is located in Sant Adrià del Besòs a neighbourhood in Barcelona. Is part of the Diagonal-Besòs Campus which was inaugurated in 2016-2017.

Its main purpose is to become a high-quality campus both nacional and international wise.

The school is maintaining EUETIB activities.

This campus holds 3500 students and 400 researchers and teachers.

The modern and new campus and facilities and the load of variation of Engineerings (Biomedical, Energy, Electronic, Electric, Materials, Chemistry and Mechanical) give the opportunity to educate big researchers groups and the formation of different associations formed by students.

In this associations, students ara able to put their knowledge learnt in class, in practice. Consequently, many useful professional habilities are learnt.

Is just what e-TechRacing is providing. Coming from a theoretical background, all team members are enabled to live out their goals. Futhermore, new extracurricular and technical concepts are acquired to achieve the team objective: The Competition.

Besides, all team members learn how to cooperate, develop and work on a prefessional enviroment with the same target

Feedback season 2018/19

One more year, after all the effort, arrived the competitions of Formula Student and the hour to pose at practice the realised all the year round. It arrived July and posed us course in Italy to take part at the international competition of the season. The competition started with the static proofs: Cost, Business and Design. At Cost and Business the results tracked the line of score of years before, instead, Design obtained 122 points of the 150 possible, grossing 34 points with regard to the anterior year and hears this the best Design of the history of e-*Tech. Before passing at the dynamic proofs, it is necessary to surpass Scrutineering and because of the characteristics of isolation of a component could not take part at the dynamic proofs. With the sentiment of impotence, decided to affront it as a a challenge. So we affront it Scrutineering mechanic to have guarantees at the hour to affront the following competition in Spain, to assure us an elder speeded up and corroborate that the mechanic conformed the valid rule.

Finally, we passed Pre-Scrutineering, Mechanical Scrutineering and the Tilt Test without jumps and returned to Spain with a desire to solve the problems and improve for the next competition. In late August, it was time to compete at home. Formula Student Spain is a more demanding competition and still the static tests followed the general line. With respect to the dynamic tests, although things did not turn out as we expected, after much effort we managed to compete and run the Endurance.

Projection for 2019/20

Once the competitions has finished, the season is over and the new goals for the 2019/2020 season have been marked. With more than half the workforce made up of new members, we have committed ourselves to a conservative mindset, without taking unnecessary risks and focusing mainly on consolidating the knowledge of the respective sub-departments. All of this, along with a lot of time spent documenting and learning by new members, and nurturing this new generation Team Building will be crucial to developing a more competitive car in future seasons. In addition, this season there has been a restructuring in some aspects, changing the tasks of some sub-departments or, for example, creating the new Powertrain department with the aim of improving communication between the involved electrical and mechanical sub-departments. With all these new features and many more, we are looking forward to the development of **ETR-06**!

Members 2019-2020

Directive

The board of directors is the responsable of the administration of the team and the project. Their objective is to ensure the correct functioning of all the departments of the team, this is why they have to work as one in all moment

Jordi Perez
Team Leader

Conrad Galli
Electronic Chief

Oriol Freixa
Powertrain Chief

Miquel Vilà
Mechanical Chief

Núria Bonaga
Operations Chief

Álvaro García
Marketing Chief

Dynamics

The Dynamics department has the aim to achieve the major gripping ability in every situation and that the driving of the race car becomes the more confortable to the pilot. The department is subdivided in Suspensions, Steering, VDC y Brakes & Wheels.

Suspension

Ivan Trigueros

Víctor Muñoz

Ernest Martínez

Raúl Pozas

Steering

Álvaro García

Sergi Rojo

VDC

Paula Cabra

Mario Sánchez

Brakes & Wheels


Núria Bonaga


Gerard Motta


Sergi Martínez


Marcel Muixella

Powertrain

The powertrain department is the one in charge of the transmission of the necessary power to the motored wheels. The department is divided in a electric subdivision, in charge of the battery package, motors and inversors, and a mechanical part in charge of the transmission and cooling.

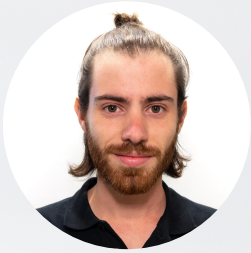
Cooling Systems


Arnau Gil


Ricardo Marquina


Miquel Vilà

Motors & Inverters


Jordi Cañellas

Packaging


Ivan González


Sergi Marin

Accumulator


Gerard Pou


Ariadna Madorell

Transmission


Nil Moreu


Oriol Freixa


Alessandro Sergio

Body

EThe body department is the responsable of the framework of the car. They study and design the monocoque to prevent its broke or some problem with it. Also, they are in charge of the ergonomy, essential for the pilot to feel confortable in the cockpit

Aerodynamics


Álvaro Altamirano


Pol Romero


Arnau Amores


Oriol Almendro


1ramzi Achak

Ergonomics


Alejandro Solís


Gerard Alsina

Monocoque


Jan Chamoun


Xavier Delgado


Nico Martín


Jordi Chaparro

Electronics

The electronics department is the one who has to guarantee that the electrical and electroinc system is safe and it works correctly.

BMS


Conrad Galli


Stephanie Arana

Sensorica


Maria Regalado


Anna Creus

PCB's


Mar Bueno

ECU


Alex Tolosa

Harness


Gerard Pérez

Operations Department

The Operations department is responsable of the logistics of all the tasks related wih te team, intern or external. They organize the shifting and the transport of the car to the competitions, events or places

Núria Bonaga

Sergi Martínez

Nil Moreu

Marketing Department

From the Marketing department is managed the tracking and the relation with our sponsors and the public relations of the team in general. It is in charge of the web page and the social networks of the team, the publications and the difusion of news related with the team and the sponsors

Paula Cabra

Jordi Cañellas

Ariadna Gòdia

Gerard Alsina

Álvaro García

Ariadna Madorell

DESIGN STAGE

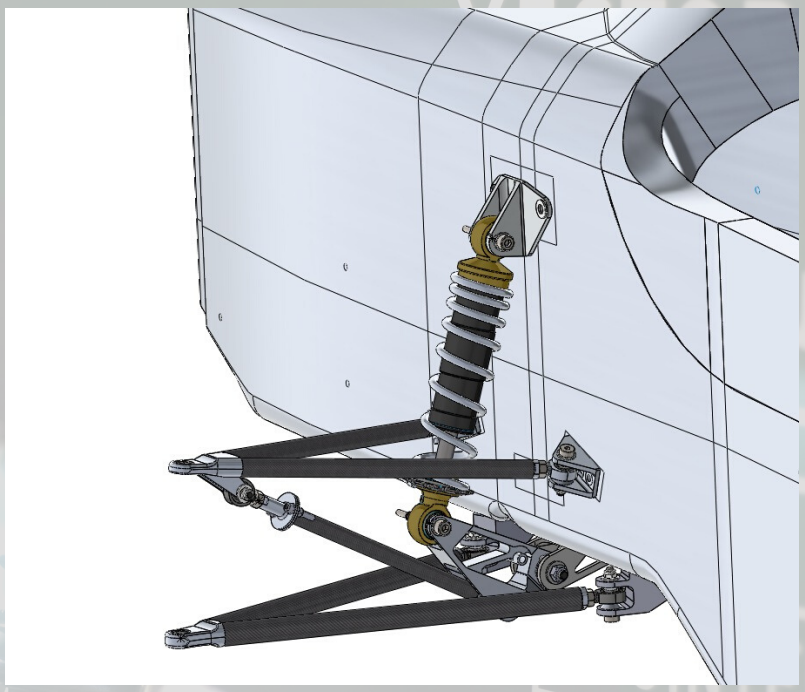
DYNAMICS

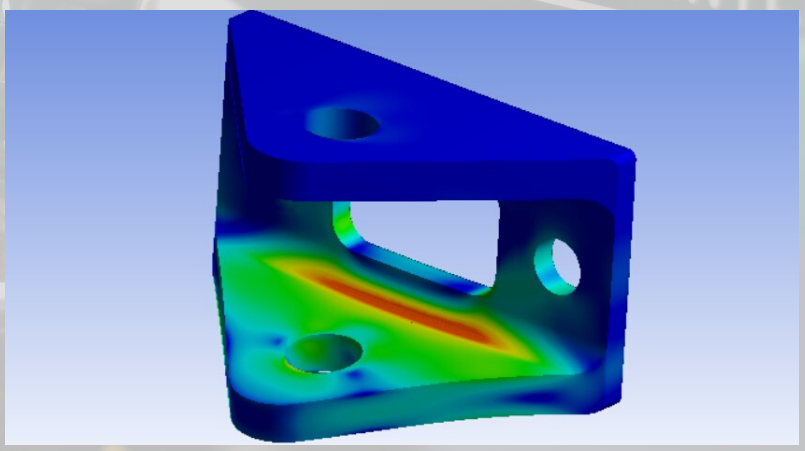
SUSPENSIONS

A new geometry was designed keeping the attachment points in the monocoque, which required a redesign of all the machined parts, these are supports and links, which have been studied and subsequently optimized.

However, the triangulation of the rocker has been modified to improve the load transmission between the wheel and the spring-damper assembly. In addition, based on the work done last season, a new rocker concept has been designed, changing from a two-plate rocker to a monoblock, which is lighter and more reliable.

On the dynamic side, the shock absorber model has been changed to a smaller and more configurable one, as well as other data, such as the spring constants that will be mounted on the car this season.





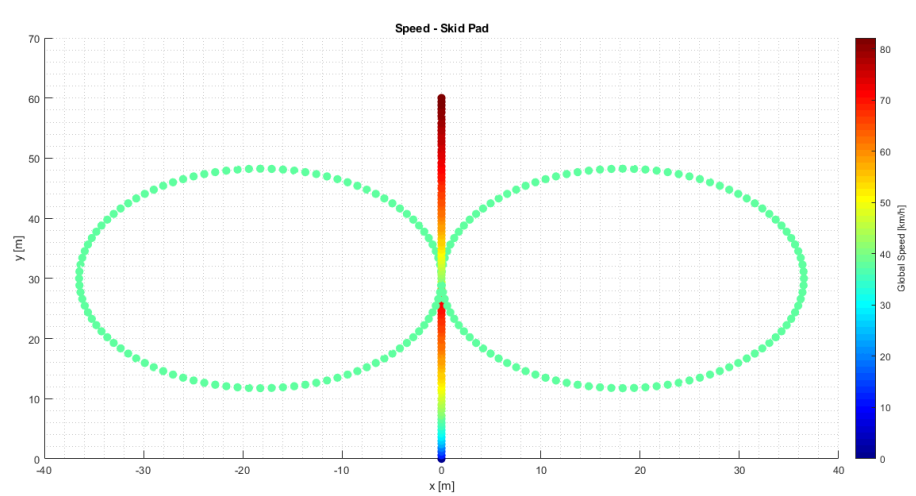
Geometry: Raúl Pozas / Mechanical Design: Víctor Muñoz y Ernest Marítnez / **Dynamic:** Iván Trigueros

VDC (VEHICLE DYNAMICS CONTROL)

Two main programs are used to perform the simulations: Torque Vectoring and Laptime. To develop Torque Vectoring we use the Matlab module: Simulink and to develop Laptime we use Matlab and IPG CarMaker, a software that simulates the car on the track.

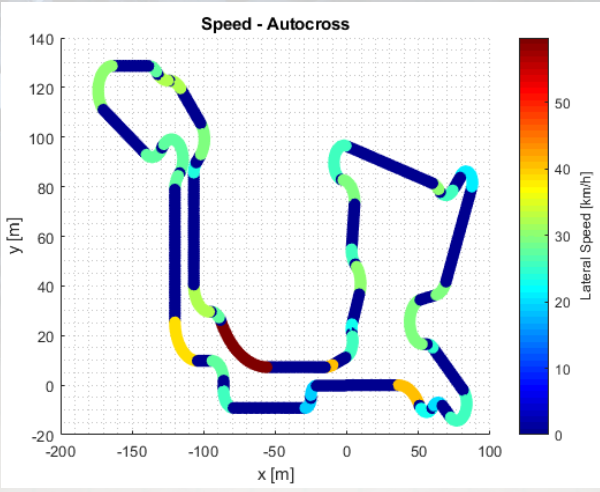
```
struct with fields:

                DE: 70
                CR: 80
                BP: 50
                AC: 17.941
                SP: 39.055
                AX: 13.633
                EN: 78.658
                EF: 0
     Static_points: 200
    Dynamic_points: 149.29
        TEAM_SCORE: 349.29
```



Torque Vectoring is the program used to control the torque received by the wheels. There are four different modes that are triggered by which signals are received from the sensors. In addition to calculating the torque that the wheels will receive, different temperatures and powers of the car's electronic components are monitored for safety and compliance. Also note that last season and part of it will be working on the control of wheel slippage through tire constants and torque self-regulation to optimize the results on the track.

The goal of **Laptime** is to find the time the car will make in a lap and then compare it with the time obtained on the track. To do this, Matlab and IPG Carmaker enter all the parameters of the car, the environment and the track. The VDC department is also responsible for recreating the runs and tests that run in the Formula Student competitions to get an idea of the time and the points that will be achieved. In addition they get two types of graphs: some that compare different variables of the car and others that visually show the speeds and accelerations obtained at each point of the circuit.

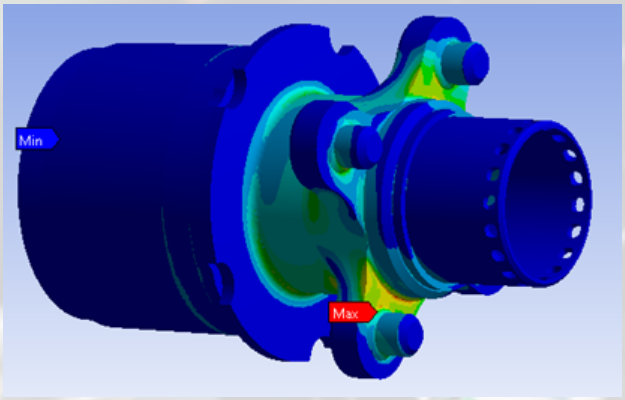


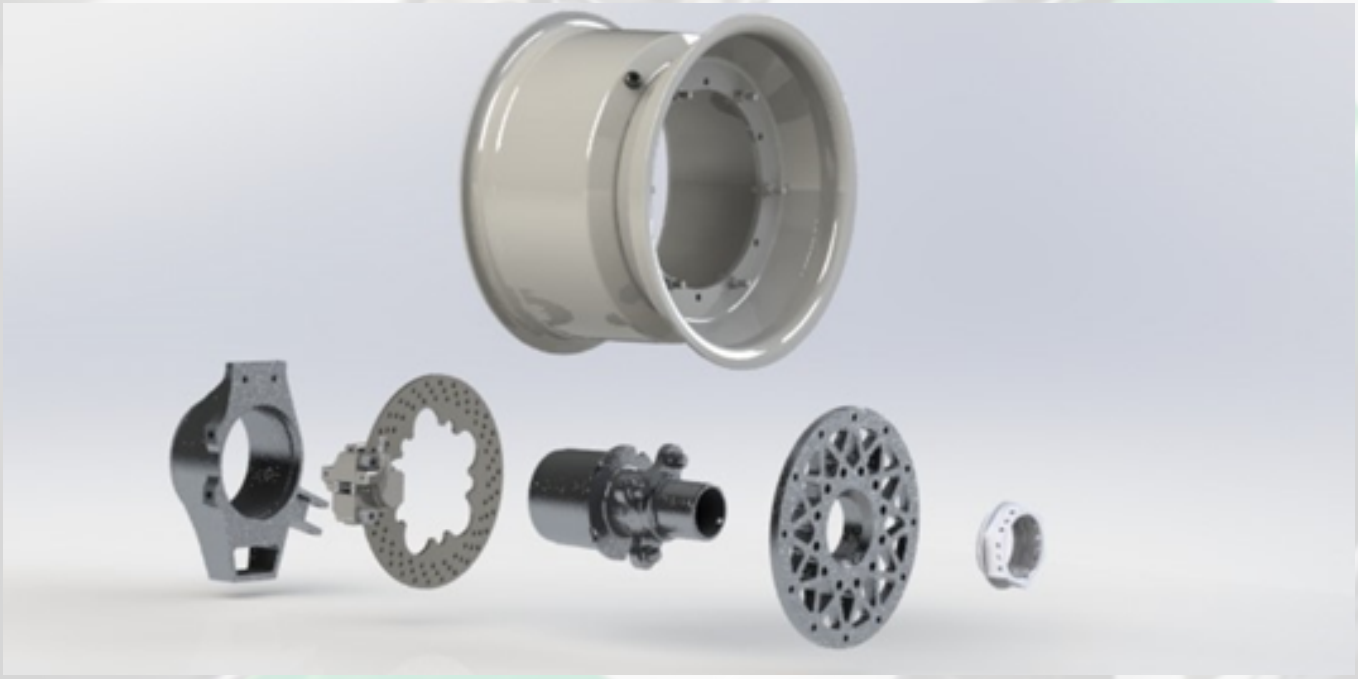
Torque Vectoring: Mario Sánchez / **Laptime:** Paula Cabra

BRAKES & WHEELS

This year the department has decided to change the rim fastening system. Last season, the same hub was also a part of the tire that was screwed directly into the two-part Keizer rims in order to save component parts and at the same time reduce the weight of the system. On paper it seemed good but in truth it turned out to be impractical because if you had to replace the tires or simply dismantle them in order to access the suspensions and try different "set-ups" it took too long for the bushes to attach. with the rims it was made by means of six bolts. Finally, mounting / disassembling a wheel should be more practical and faster.

It is for these reasons that this season we take a step forward and implement a mono-female system compatible with the rims that the team already has. In this way the rim is independent of the hub, which means that we need to make another piece between the rims and the hub, but it will give us the advantage of a greater ease of assembly / disassembly, since there will be only one female and not those of the previous design.



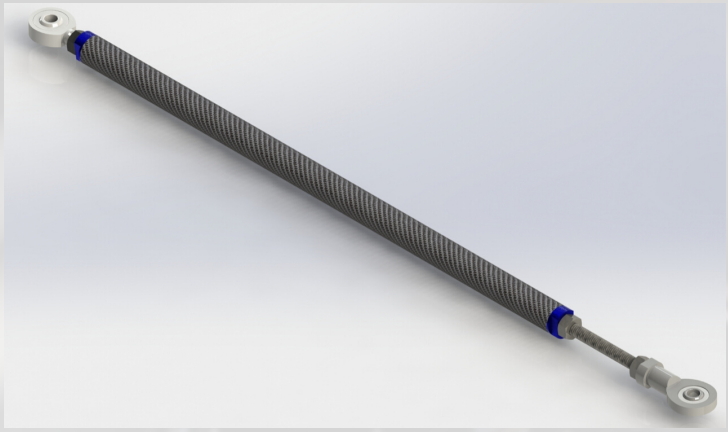


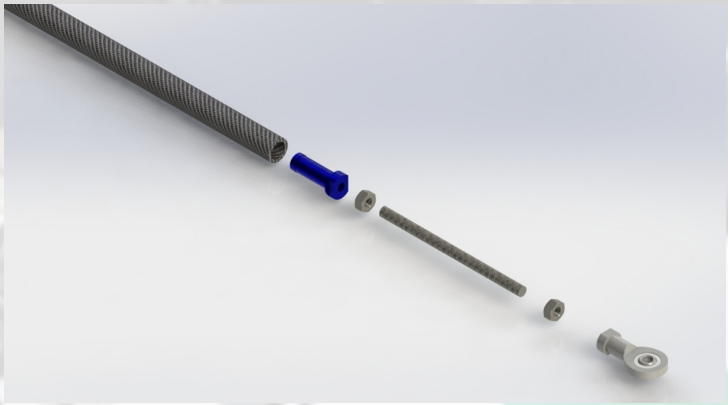
New hub: Marcel Muxella i Gerard Motta / **Rims:** Sergi Martinez / **Brake Study:** Núria Bonaga

STEERING

Aquesta temporada els nous membres del departament de steering s'han centrat en solucionar els problemes presents en l'anterior temporada.

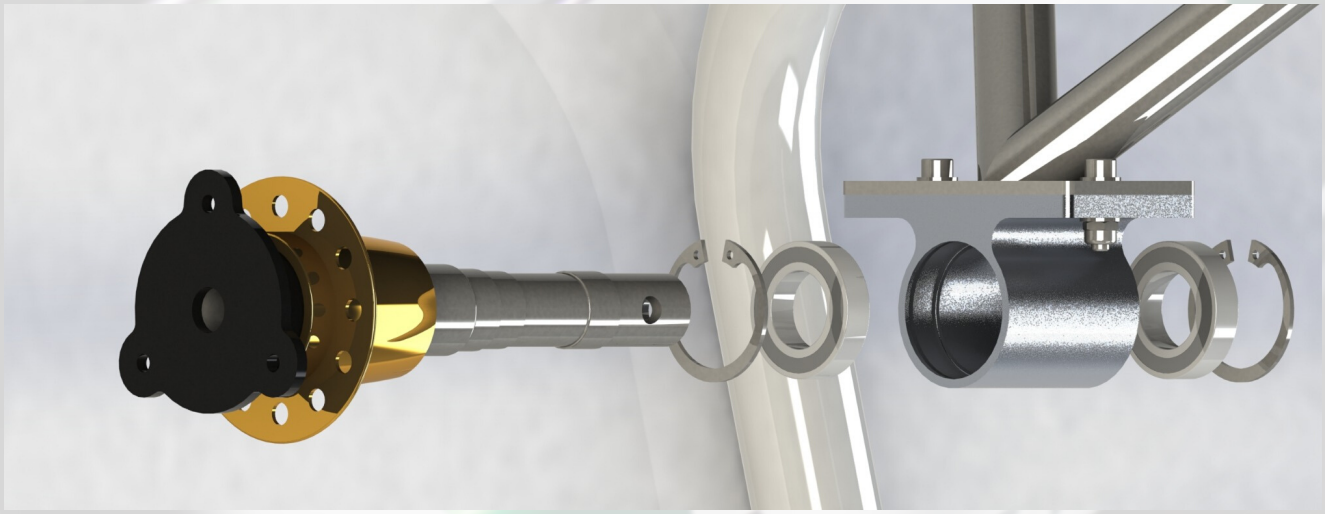
Una de les preocupacions era el joc que presentava la direcció, el qual la normativa exigeix un joc màxim. Per això, s'han redissenyat les cotes del pinyó i la cremallera, ajustant també les seves toleràncies.





Una altra millora ha estat la implementació d'una vareta roscada al braç de direcció per a agilitzar els temps entre canvis i canvis de configuracions dinàmiques per exemple als tests. Anteriorment l'ajust es realitzava a partir de dos contra rosques a costat i costat del braç, la qual cosa requería de molt de temps per a una correcta precisió. Aquesta solució suposa un gran estalvi de temps a un preu força econòmic.

Finalment, s'està treballant en un nou suport amb cargols per a facilitar el muntatge/desmuntatge en cas que altres departaments necessitin treballar a l'interior del monocasc. De cara a fabricació estem estudiant diferents esquelets de soldadura perquè a l'hora de soldar l'estructura del suport resulti el més precisa i senzilla possible.

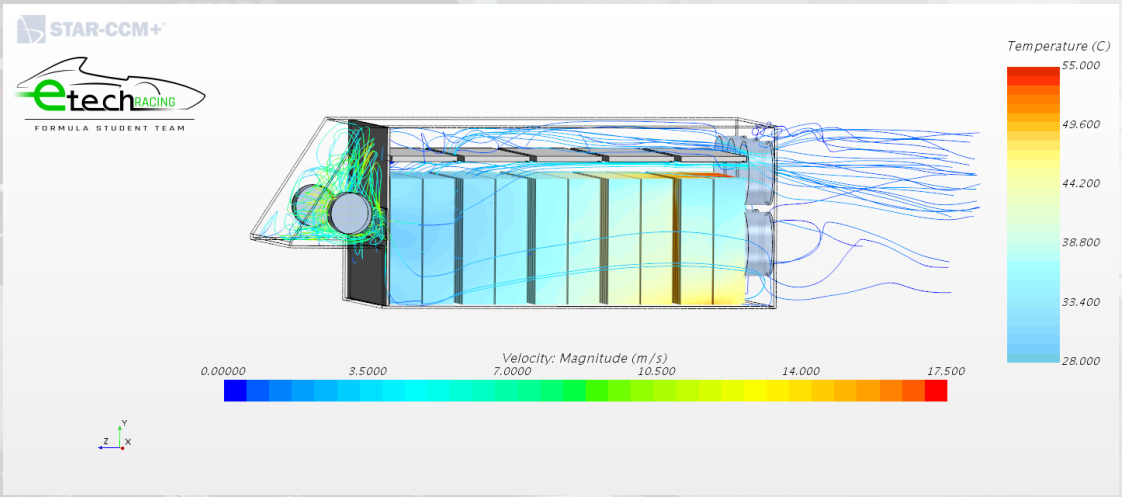


Sergi Rojo i Álvaro García

POWERTRAIN

COOLING SYSTEMS

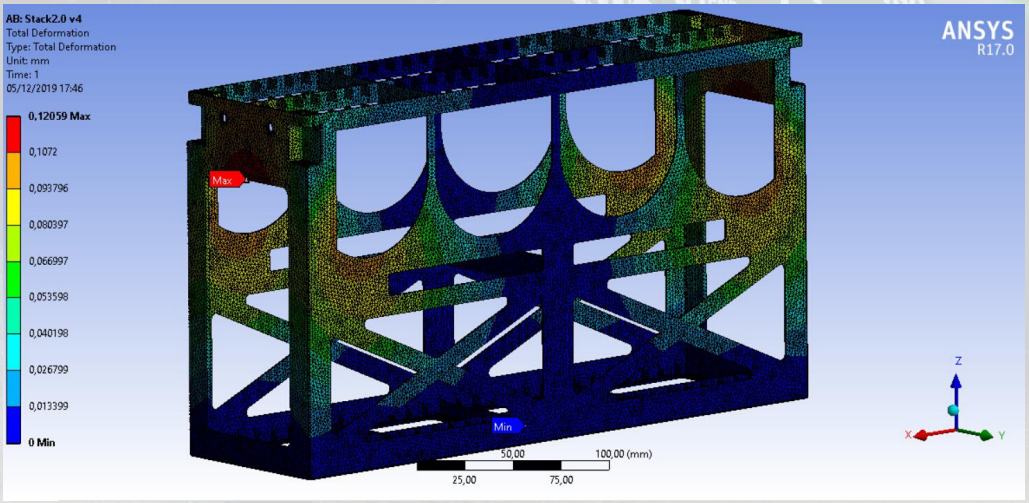
It is being optimized by performing various simulations that involve testing different configurations and components, both outside the package designing pontoons, ducts and fans, as well as inside, where the air flow will be directed to the most convenient to maintain the ideal temperature in the battery pack. On the other hand, new components are being chosen to suit our needs in the inverter cooling circuit, to ensure their optimum operation.



Arnau Gil, Ricardo Marquina i Miquel Vilà

ACCUMULATOR

Work is underway on optimizing the accumulator. To begin with, the stack has been redesigned to make it more robust and durable, and to better circulate the airflow through cooling. In addition, the model of maintenance plugs and fuses has been changed, and this has forced the sandwich plate to change. We are also working on modeling the battery to better understand the behavior of cells.



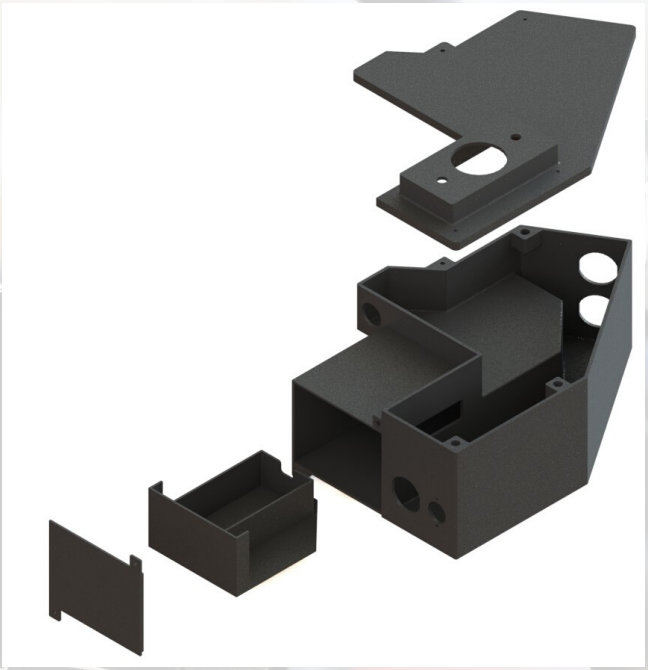
Ariadna Madorell

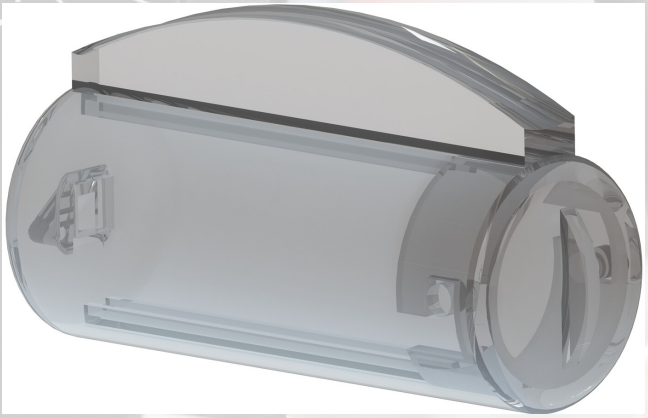
PACKAGING

All protective boxes for electronic and electrical systems are being designed to reduce weight compared to the previous season and to comply with all regulatory requirements of the current competition.

At present, the Brake Light, TSAL (Tractive System Active Light), HV box, ADCAN, accelerometer and Datalogger have been redesigned. All these boxes are designed in such a way that they improve their waterproofness and also began with the mechanical study simulation with the ANSYS program.

For all the pieces designed, CAD has been chosen that most closely matches our criteria so that they can have the best possible performance. This coming week we will design the Dash so that it is properly integrated into the monocoque and we will do mechanical studies to confirm that it is a good design. Similarly, it has also been thought to integrate the strip in a monocoque for better performance.



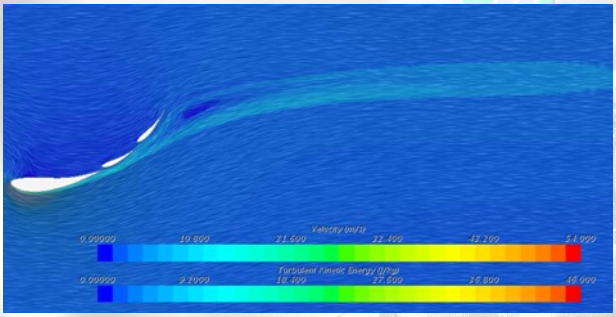


Sergi Marín i Iván González

BODY

AERODYNAMICS

During this season we have tried to evaluate the behavior of our old aerodynamic package. Because it was aerodynamics focused on maximum aerodynamic loading, the dynamic effect that was generated with the rest of the car was not taken too seriously. That said, there were two options, either optimize a package with a low efficiency base, or redesign the aerodynamics for better dynamic goals.



Finally, it was decided to make a general redesign of the aerodynamics, seeking the highest aerodynamic load, but focusing the load on the rear of the car.

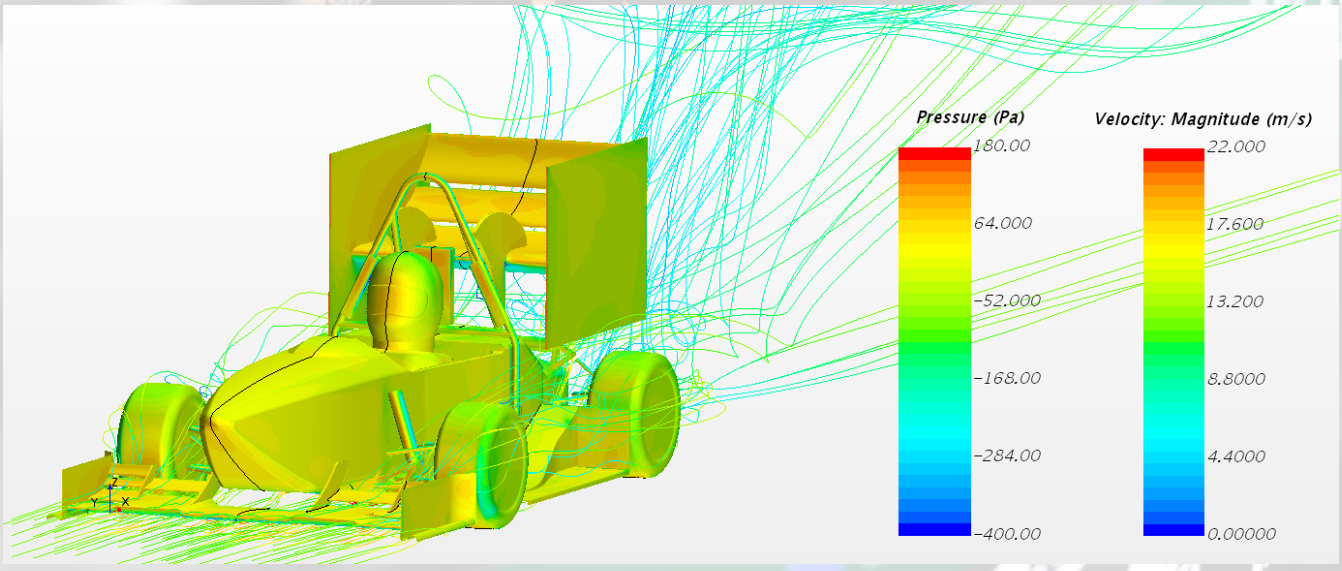
Focusing on a more efficient rear spoiler and side spoiler that can pull most air from the rear wheel. In addition, the joint study with the refrigeration department has been expanded to find a new position for radiators, where they reach more flow.

More than 350 two-dimensional simulations of the wing profiles and their different configurations have been performed for the front wing and the rear wing.

Simulations of the whole car have just begun, analyzing the interaction of these profiles with the rest of the car and to ensure that the distribution of aerodynamic load in our car is adequate.

So far, we have worked closely with the CSUC, as it is great to have more computing power in the design phase, for more simulations.

In addition, the Saertex, Sakaiovex and TeXtreme fibers that were provided last year in combination with our Uneco epoxy resin have also begun to be tested.



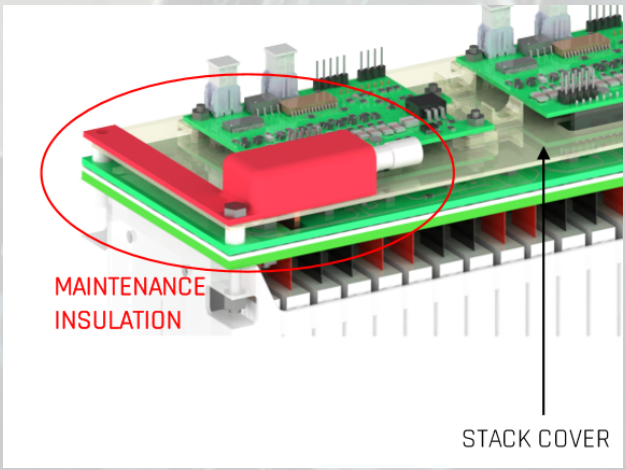
Simulation Model: Oriol Almendro i Arnau Amores / **2D Simulations:** Álvaro Altamirano i Pol Romero

ELECTRONICS

BMS

It monitors the state of the cells in a battery. It is a system designed to be used in Li-ion cell batteries to control them in the "Safe Operation Area". This area is comprised of voltage, current and temperature limits. If the cell does not work within these limits, it could lose capacity, life cycles and even be dangerous by triggering unwanted chemical reactions.

The BMS follows the structure of the previous season. After the problems that arose last season the department has focused on the improvement of the system as well as the drafting of a departmental report that delves into all aspects of the BMS. This documentation is intended for future additions to the team where anyone without prior knowledge in electronics and programming can follow the process of designing, manufacturing and improving it.

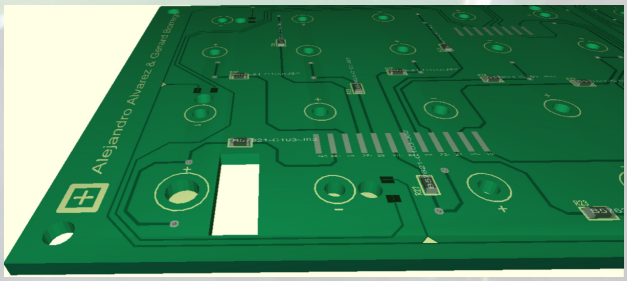


In the hardware section the PCBs (Master and Slave) of the BMS will not have major changes, only the change of some components, but the essence of the design remains the same.

One of the improvements that the BMS department has made is the modification of some connectors along the power path. The redesigned PCB is the sandwich, it contains the resistances (NTC) that allow the BMS to read the temperatures of the cells in addition it has changed the fuses of this one.

In the software section we work with the program of the previous season. There are no errors in the code, but you need to optimize the process.

The members of the department work together to learn and implement their knowledge in order to achieve a more optimized program.



Conrad Galli i Stephanie Arana

eTech Racing
FORMULA STUDENT TEAM

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PRINCIPAL

VM MOTORS
VERNIS

PLATINUM

BOSCH
LEMO
ETAS
SCHAEFFLER

GOLD

SIEMENS
CSUC
NEXUS PROJECTES
VECTOR
Applus laboratories
ENGINYERS BCN
COL·LEGI D'ENGINYERS GRADUATS I ENGINYERS TÈCNICS INDUSTRIALS DE BARCELONA
Gurit
[z]inkers
INTECH3D
PRO CIRCUITS
EL PARC del Fòrum BARCELONA
Applus IDIADA

SILVER

PREMA
RÜCKER LYPSA EDAG GROUP
FICOSA
ceys lo arregla todo
CITCEA
AIRTECH EUROPE Sarl Vacuum Bagging & Composite Tooling Materials
Euro Models
Moldea
GRIÑÓ ROTAMIK
aluNID
BALENTEC Balmaña Enginyeria Tecnològica S.L.
TRESDENOU
RÖSLER finding a better way ...
ROHDE&SCHWARZ

BRONZE

molex
SAERTEX
GJM
HAAS
ollé
WE WÜRTH ELEKTRONIK
BANDAS INDUSTRIALES
SCAN&PRINT
Milwaukee
MECANIZADOS MATARO S.L.
ALEX
SAKAI OVEX
MENAES S.L.
Enginyers Industrials de Catalunya
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SOFTWARE

AsorCAD
IPG AUTOMOTIVE
CD-adapco
MathWorks
Altium
VR&D