

# 3D printing for design validation & for manufacturing end-use parts.

## ABOUT ETSEIB Motorsport

ETSEIB Motorsport, one of the most experienced teams in the Formula Student competition, uses 3D printing to revolutionize their day-to-day operations.

Formula Student is a competition between students from universities around the world that promotes excellence in engineering through a competition where team members design, build, test, and race a formula-type racing car.

The ETSEIB Motorsport team is made up of 40 industrial engineers from the Polytechnic University of Catalonia. This is the 10th consecutive year that they design a formula-type vehicle. For the first 4 years they made combustion cars and these past 6 years they have manufactured electric cars.

### COMPANY

ETSEIB Motorsport  
<https://etseib-motorsport.upc.edu/en/>

### INDUSTRY

Automotive, Engineering,  
Education.

### APPLICATION

Functional parts: Ends-use parts,  
functional validation.



# CHALLENGE

The Formula Student competition is held once a year, so teams must build a new car every year with very tight budgets. That is why the ETSEIB Motorsport team has relied on 3D printing technology. Thanks to this, the team has been able to speed up the design phase and to fabricate end-use pieces that are directly mounted on the car itself. This has allowed them to greatly reduce the car costs and shrink the lead times. They are now capable to iterate faster and get refined designs in a very straightforward workflow.



Cooling duct 3D printed on the BCN3D Sigmax with mirror mode in nylon, ideal to withstand high temperatures, vibrations and mechanical stresses.

# RESULT

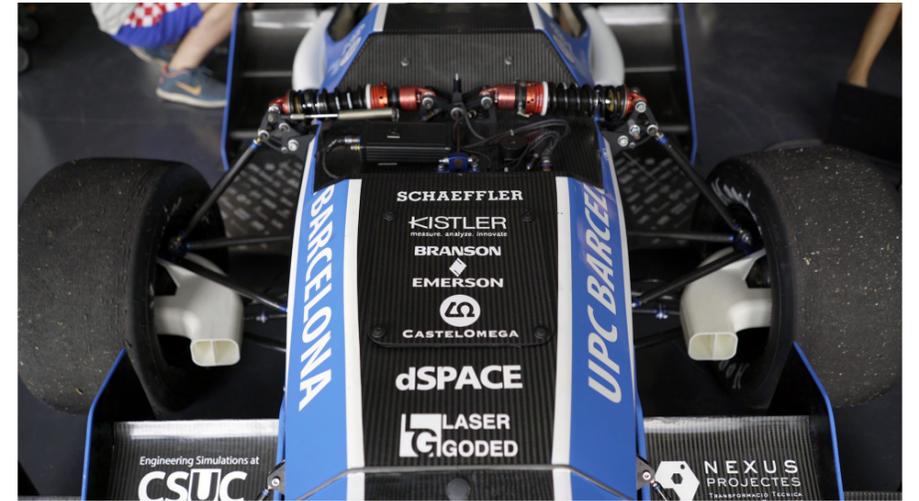
Since the ETSEIB Motorsport has incorporated 3D Printing FFF desktop technology into their day-to-day operations, their design and fabrication processes have improved drastically. Additive manufacturing has basically served them in three main areas:

- Improvement in the design validation stage:

Having a 3D printer in-house allows the engineers to print their CAD designs overnight, drastically reducing the validation and iteration time. This new procedure ensures the Formula team does not longer depend on external suppliers to fabricate their parts, allowing them to spend more time developing new ideas and concepts.

- Rapid manufacturing of cost-effective end-use parts:

3D printing has helped them to manufacture parts that are directly mounted on the car itself. Some of them are the brake ducts, several cable ties and they have even printed molds to make pieces of carbon fiber. Thanks to the BCN3D Sigmax 3D printer, the ETSEIB Motorsport team has been able to optimize their production and achieve greater efficiency.



- Reducing car cost and shrinking lead times:

Finally, desktop in-house 3D printing has allowed them to reduce the costs of the car. The team has been able to produce parts quicker and at a lower cost than using traditional fabrication methods, especially in the design of unique and complex pieces. More information regarding cost reduction in the following section.

Watch the video of the full story here: [Link](#)

# SOLUTION

The team at ETSEIB Motorsport chose the BCN3D Sigmax 3D printer due to its massive printing volume. This allowed them to easily place certain parts of the car on the printing platform.

Furthermore, thanks to Independent Dual Extruder (IDEX) system and its mirror mode, the engineers are able to print symmetrical pieces at the same time, like this cooling duct for the brake disc. This is of great use in the automotive field since many of the pieces are symmetrical.

Finally, the hotend family has allowed them to choose a hotend suitable for each moment. For small parts that need a lot of precision, they used  $\varnothing 0.4$  mm size nozzles. However, for larger pieces that are going to be subjected to mechanical stress, they used bigger nozzles such as  $\varnothing 0.8$ mm or  $\varnothing 1.0$ mm.



# COSTS

By implementing 3D printing technology into their workflow, the team has saved thousands of euros in the car development. The initial investment in the BCN3D Sigmoid 3D printer was fully paid back during the first months of usage.

Two specific cases have been analyzed in order to show some of the savings thanks to 3D printing.

## 1. 3D printed cooling brake ducts for the brake discs.

One key aspect of any formula car is the refrigeration of the brake discs of the front wheels. For this reason, two cooling ducts (symmetrical between them) are placed in each front wheel of the car in order to reduce the disc temperature to the maximum.



Before introducing desktop FFF 3D printing into their day-to-day operations, the ETSEIB Motorsport used to manufacture these cooling ducts with SLS 3D printing technology and were made by an external supplier. This process, apart from being expensive, supposed that each piece was delivered in about 3-4 days. This meant that the engineers could not make many redesigns of the duct since the time dedicated to the design of the car was limited.

Now, thanks to in-house desktop 3D printing they are able to produce the 2 cooling brake ducts in one print thanks to the mirror mode of the BCN3D Sigmoid. Furthermore, they are able to manufacture the pieces overnight and have it during the next day.

This allows them to achieve a more optimized design geometry through several 3D printed iterations. This increases the cooling efficiency of the brake discs during the race.

	External Supplier SLS	BCN3D printers
Design iterations / part	3	12
Delivery time / iteration	3-4 days	1 day
Cost / iteration	280,00 €	3,00 €

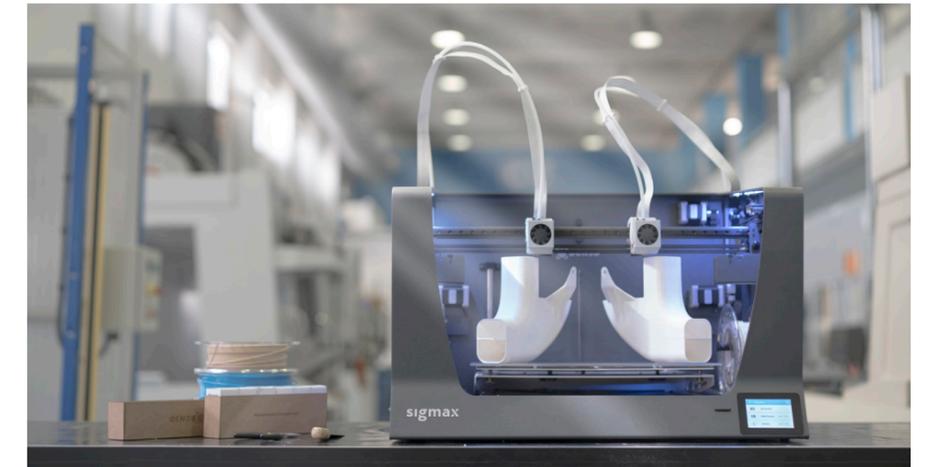
## 2. Carbon fiber steering wheels made from 3D printed molds.

One of the new utilities introduced by the team this last year has been the manufacture of 3D printed molds to make pieces in carbon fiber through a vacuum bagging process. This mold used to be made in wood through a milling process. However, this process was very expensive and the delivery time of the mold was very high.



By using the BCN3D Sigmoid and thanks to their big printing volume, they were able to manufacture the molds for the steering wheel at a lower cost and with a minimum time in comparison with the previously used method.

	External CNC machining	In-house BCN3D Printers
Delivery time	2 months	2 days
Cost	400,00 €	5,00 €



### About BCN3D technologies

BCN3D Technologies is one of the leading manufacturers of desktop FFF 3D printers worldwide. Based in Barcelona, the activity of BCN3D began in 2012 and its aim is to help innovators and creatives to change the world, by offering them the best possible experience to materialize their unique ideas.

<https://www.bcn3dtechnologies.com>

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