

WHITEPAPER



BCN3D's signature IDEX Technology:
Doubling Productivity While Halving Costs



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BCN3D's signature IDEX Technology: Doubling Productivity While Halving Costs

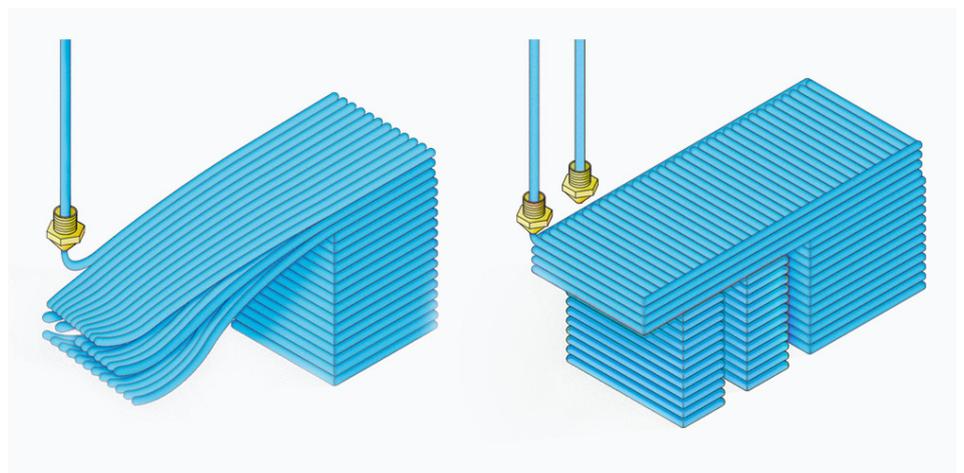
What is IDEX technology?

IDEX stands for Independent Dual Extrusion and refers to that technology that allows a 3D printer to work with both of its tool heads simultaneously and independently, resulting in many benefits throughout the entire printing process. It also offers the possibility to park the idle tool head aside when printing dual extrusion parts, which offers a cleaner solution, as it prevents the drip of molten plastic into the print.

The early days of 3D printing

Around 2007, a democratization process occurred in the 3D printing industry with the appearance of desktop 3D printers, much cheaper and easier to use for a wider audience than the industrial models that had been on the market until that point.

This started the wave of commercializing 3D printers for a wide range of purposes, as they increasingly became available to all kinds of individuals and companies who did not have a chance to dive into this new technology before due to its high prices. Nonetheless, most of these early machines only had one extruder, which caused several problems when printing models with overhangs shallower than 45° from the horizontal plate and complicated the possibilities of printing with more than one material.



IDEX Technology

When it comes to parts which, due to their geometry, need to count on a support material, in the case of printers that only have one extruder instead of a dual extruder system, once the part is printed, it is necessary to perform a manual and time-consuming operation to remove the supports. This process affects the quality surface between the model and the supports and also increases the chances of breaking the part. In addition, depending on the geometry of the model it can be impossible to totally remove the supports by hand.

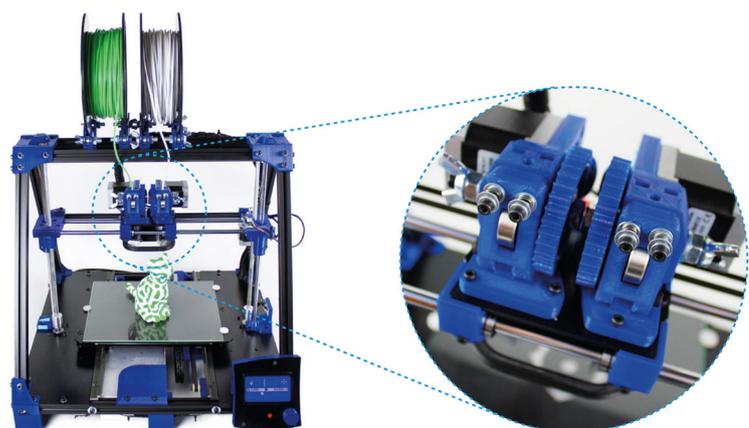
Around 2014, various companies started working on a solution for this common issue, which was partly solved by dual extruders. This marked a significant development in the 3D printing democratization process as, with the double extrusion system functioning well, desktop 3D printers now could print effectively with hydrosoluble support and achieve much more complex geometries.

However, BCN3D took it a step further, working on the development of its signature IDEX technology, with the idea to provide users not only with dual extrusion but with the possibility of using two independent extruders in the same machine.

How did IDEX come to be?

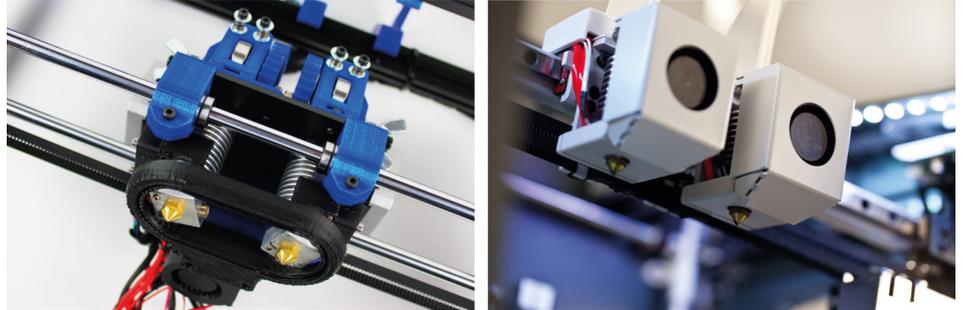
Back in 2013, when BCN3D Technologies was called RepRapBCN and was part of the Politechnical University of Catalunya, the BCN3D+, a modular 3D printer, was developed. It was very well-received on the market as it allowed for a relatively easy extruder change. In 2014, the team working on this 3D printer developed dual extruders for it. This offered the possibility of printing with two different materials or two different colors. The system was a dual extruder over the same tool head, which had certain inconveniences. First of all, it was difficult to calibrate, which resulted in worse user experience and end pieces of lower quality than those obtained with a single extruder. Moreover, the tool head with two extruders carried too much weight when moving around, which also deteriorated the pieces. Also, the melted plastic from the idle tool head would often drip on the piece being printed, damaging the end result.

In spite of these issues, the team quickly grasped the importance of being able to print with two different materials at the same time, especially when printing geometrically complex pieces. The dual extruders developed for BCN3D+ were the first step in the right direction, but there was still a place for development.

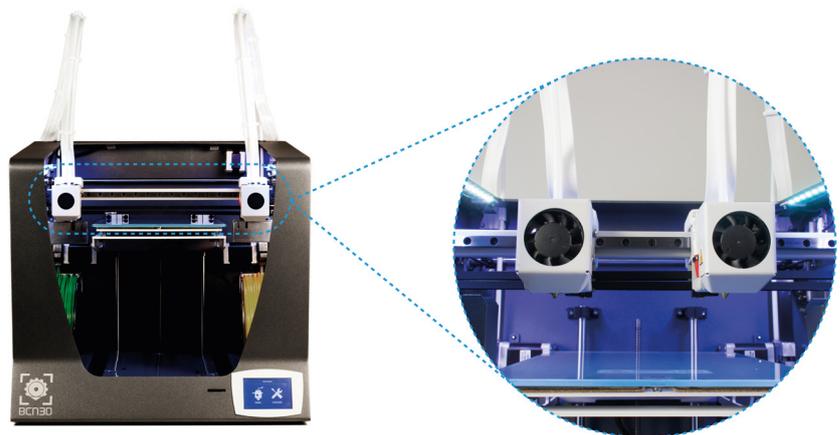


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The struggles experienced while printing with their first dual extrusion system sparked the idea of trying to develop a form of independent dual extrusion, a technology that could potentially provide a solution for all the problems experienced. This first trial turned out to ease significantly the process of calibrating the extruders, it prevented the filament dripping from the idle extruder on the piece being printed and it provided more flexibility when printing different materials.



After such positive results, the team at BCN3D focused on developing and perfecting this technology further, with the aim of providing a complete independent dual extrusion solution, which was introduced in 2015 with the [BCN3D Sigma](#).



Developing IDEX towards low volume batch production

Between 2015-2017, the team at BCN3D saw IDEX technology as mainly an aid for 3D printing hydrosoluble supports. However, as Fused Filament Fabrication started to gain popularity and it started to be used more and more in the production of not only prototypes but also end-use parts, the team realized the further opportunities provided by this technology to be used in order to significantly increase the efficiency of our 3D printers.

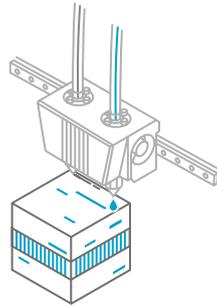
In 2018, when launching the [BCN3D Sigmax](#), the company also presented the Duplication and Mirror 3D printing modes, which are unique features of their 3D printers and key in the high productivity provided by the BCN3D printers.

IDEX Technology

How does IDEX technology work?

Conventional dual extruder 3D printers usually have a series of mechanical axes: X, Y, and Z that position the tool head and the piece that is being printed spatially, while the fourth, E axis, is responsible for the progress of the filament in the extruder.

IDEX technology allows for these axes to be doubled. Therefore, a 3D printer equipped with this technology has X0, X1, Z, E0, and E1 axes as well, besides the aforementioned ones. This essentially means that the printer keeps sharing the Y and Z axes, while both extruders have their own X and E axes, which makes it possible to print with two tool heads independently.

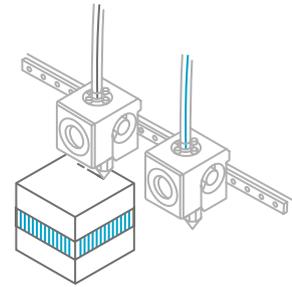


Parallel

Two print heads placed together in the same carriage.

Regular Dual Extrusion Architecture

- Since it is close to the part that is being printed, the inactive nozzle can **drop molten plastic** while waiting.
- The **high mass** of two print heads implies **high inertias** when moving at high speed from one point to another, which leads to **less accuracy**.
- **Standard production potential**. The two print heads are driven by the same motor, only one part at a time can be printed.



Independent Dual Extruder (IDEX)

Two print heads moving independently in the X-axis.

Advanced Dual Extrusion Architecture

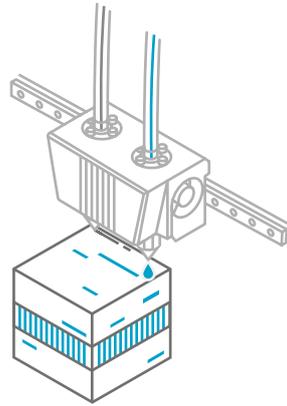
- There is **no cross-contamination between materials** as the idle print head remains parked, preventing the dripping of molten plastic into the part.
- Reduces the floating mass, which **increases the printer's accuracy**.
- **High production potential**. Since there are two independent Extrusion Systems, the printer has the production capability of two machines by printing with the 2 heads simultaneously.

Due to the peculiarities of Fused Filament Fabrication, as mentioned before, certain complex geometries with overhangs require additional support structures to be successfully printed. Fused Filament Fabrication or FFF is an additive manufacturing process that deposits a thermoplastic material layer-by-layer in order to build a piece. This technology manufactures strong, durable, and dimensionally stable objects with great accuracy. However, 3D printing pieces using FFF technology using one- or double extruders results in various post-processing problems when printed with the same material.

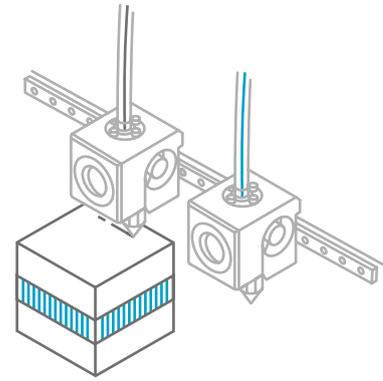
IDEX technology is BCN3D's unique approach to avoid this issue. Having two independent extruders offer the user the ability to print, not only with soluble supports but also multi-material objects, print in two different colors, or even combine different nozzle sizes to get more resistant parts or cut down the printing process.

IDEX Technology

The two extruders are controlled independently so that when one extruder is not being used it can be kept away from the printing area to prevent the plastic from oozing onto the object and spoiling the final result.



Conventional dual extruder system (Cross contamination)



IDEX Independent dual extruder system

The benefits of IDEX technology

As a double extrusion system, IDEX allows users to print more complex pieces by using hydrosoluble supports and to combine materials to obtain different mechanical properties and colors in one single print.

The possible combinations are:

- Multi-colour: Mixing two different colors of the same material.
- Multi-material: Work with two different materials in a single print.
- Soluble supports: Using dissolvable supports for complex geometries.

Most dual extrusion desktop 3D printers have both tool heads in the same carriage, but BCN3D printers can control both tool heads independently thanks to the unique IDEX technology.

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The benefits of IDEX do not only lie in combining different materials, but they are also significant when it comes to reducing costs. IDEX technology reduces the cost of machinery in half, as, with the same number of 3D printers, the final customer can get twice as many printed parts as they would get with other dual extrusion machines, thanks to BCN3D's signature Duplication- and Mirror modes.

Duplication mode prints the same model with both tool heads simultaneously, while Mirror mode prints the model and its symmetrical part at once, which doubles the printing capacity and can lead to an increase in iteration speed and shorter design times.

Furthermore, IDEX technology also reduces the cost of maintenance and downtime in half, as to keep a 3D printer in an optimal condition standard maintenance must be followed. Since there are no extra actions or maintenance costs when compared to any other 3D printers when investing time in maintenance in a BCN3D printer you are indeed obtaining double production at the same cost.

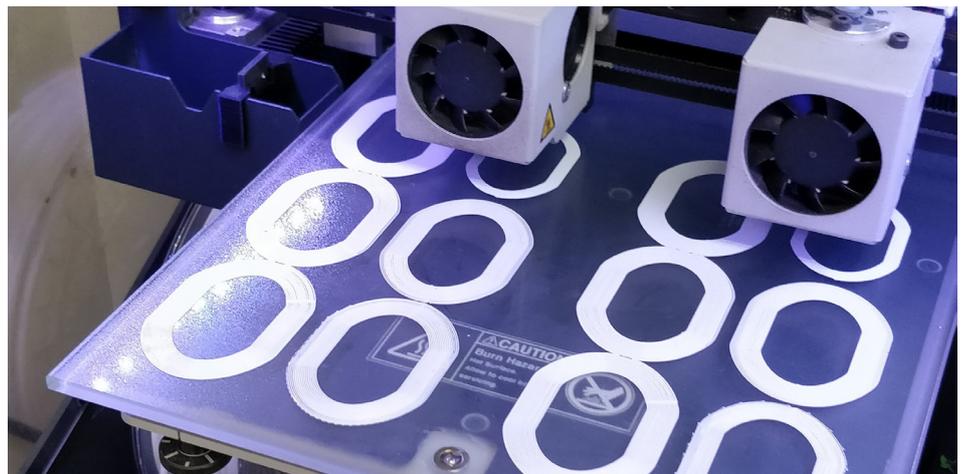
As the aforementioned examples show, it is clear that IDEX technology is the most cost-effective and the fastest solution for low-volume batch production.

IDEX technology: making a difference by increasing our customers' productivity

Thanks to the many benefits provided by this unique technology, we have received a significant amount of positive feedback from companies benefiting from IDEX during the last years.

For example, [Domestic Data Streamers](#), an independent data design studio located in Barcelona, has reported that our IDEX technology is effectively cutting their production time in half through the use of the Duplication printing mode. This enables them to test and adjust their parts in the beta phase of production, [facilitating to quickly improve their designs](#) while keeping their tight deadlines.

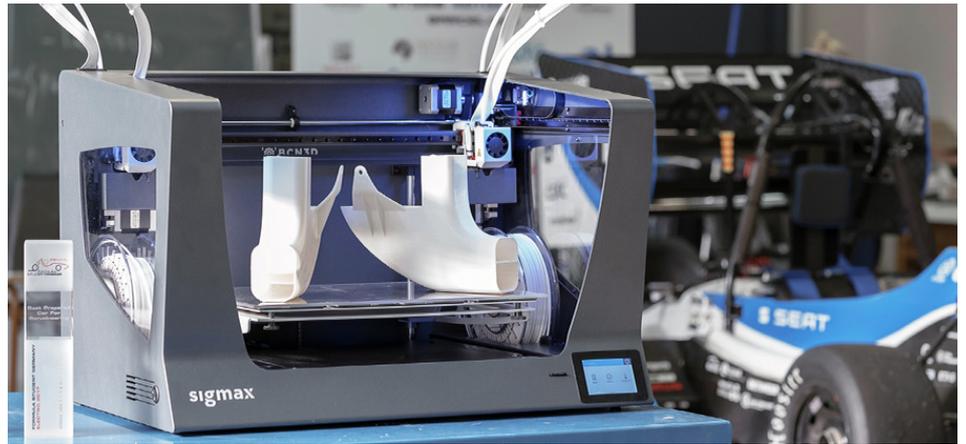
[Tensabelt](#), a company specializing in the production of queue management systems, such as barriers, cones, and roll-up belts, is also benefiting from IDEX on a daily basis, where they use additive manufacturing for [prototyping](#) and [producing tooling](#). As their product catalog consists mainly of smaller pieces which they 3D print, they take advantage of the IDEX technology and produce these parts in series of 12 or 24 units. "When prototyping with the printer or upon receiving a bigger order, IDEX technology is efficiently reducing our production time in half", confirms Josep María Salvador, Responsible of the Technological Department at Tensabelt.



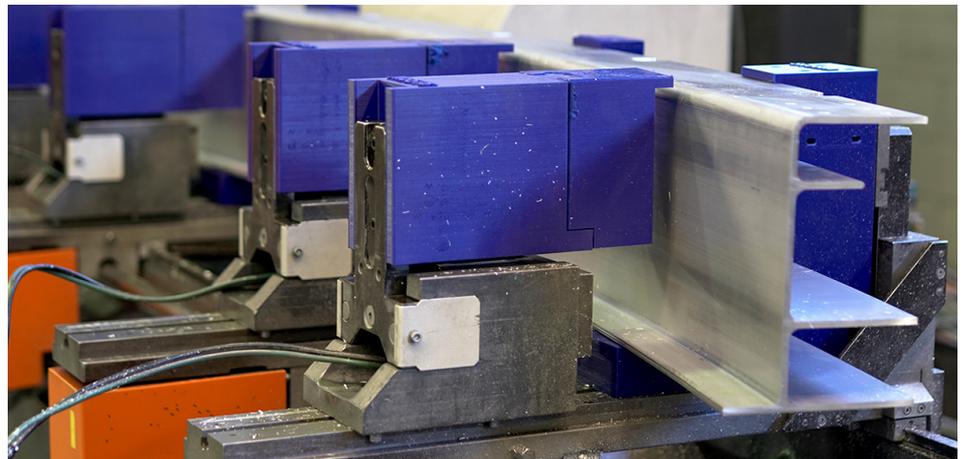
ETSEIB Motorsport, a team of engineering students at the Polytechnical University of Catalunya, also benefits hugely from BCN3D's IDEX technology. The team designs and fabricates vehicles suitable for the Formula Student Competition, for which [they 3D print numerous end-use pieces](#).

As their racing cars consist of many symmetrical parts, they fabricate them using the Mirror 3D printing mode, provided by IDEX, which helps them to significantly shorten their production process. Some of the most important pieces that they 3D print this way are parts of the vehicle's suspension and the cylinder liners.

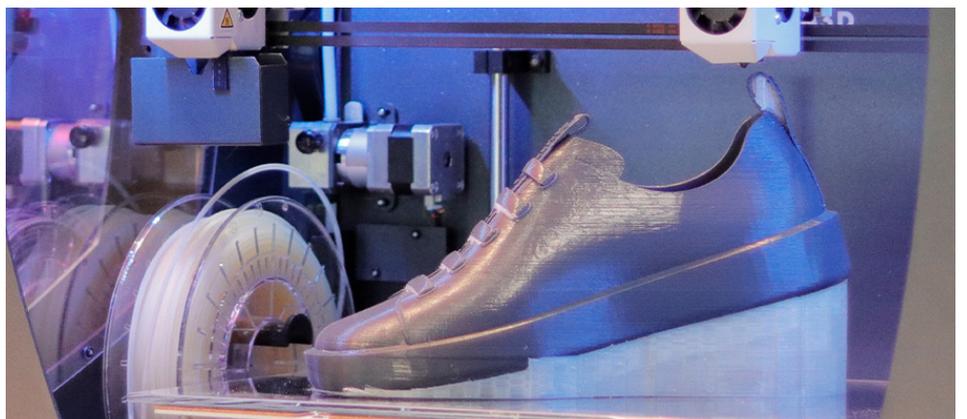
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[Tecalum Industrial](#) also uses the Duplication mode for their benefit when [3D printing their customized clamps, toolings, jigs and fixtures](#). *"We benefit greatly from IDEX technology, as most of the time we need 2 or 4 pieces of the same clamps, so with the independent dual extruder system we are able to reduce production time in half"* confirms Marc Linares, Production Engineer at Tecalum.



Last but not least, [Camper](#), a contemporary footwear brand based in Spain but shipping shoes worldwide also puts IDEX to use on a daily basis. For them, [developing tangible models in-house through 3D printing](#) has significantly accelerated the process of launching a new collection, while offering them greater freedom to try riskier, more complex designs. *"Because of the Independent Dual Extrusion System of our BCN3D printers, we can use water-soluble material, which allows for more complex geometric shapes and reduces design time for the whole collection"* states Jordi Guirado, Product Engineer at Camper.

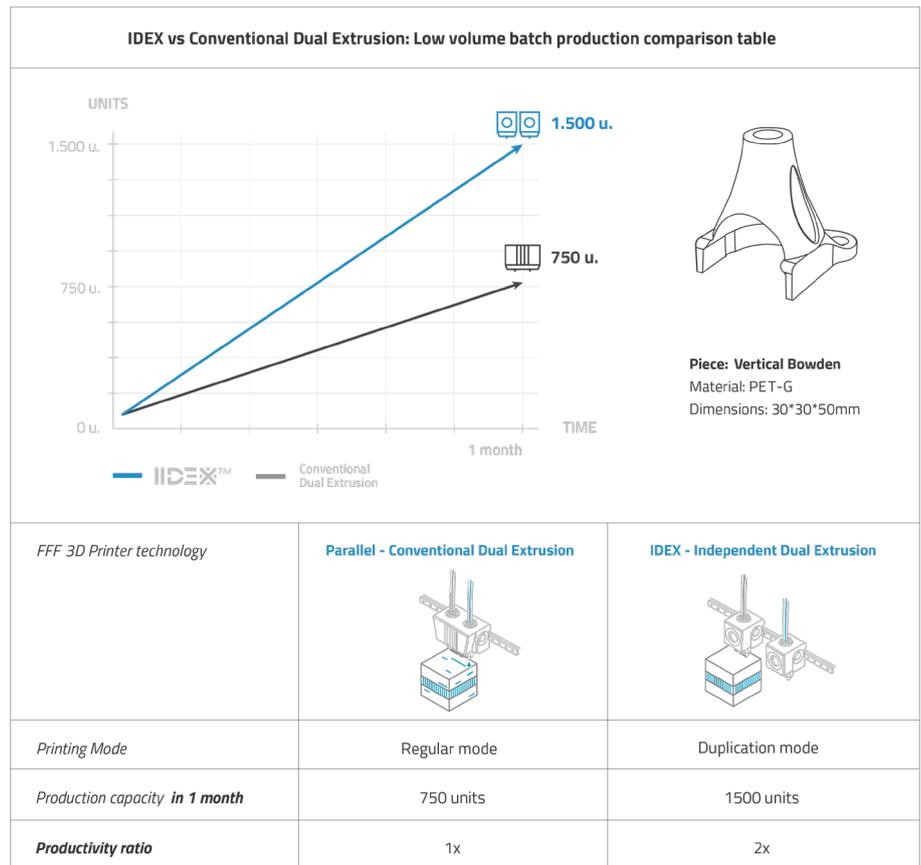


IDEX Technology

In-house success using IDEX

Being in the 3D printing business, we are proud to put into practice all our solutions in-house in order to optimize our own production processes to the maximum. We benefit from using IDEX at the BCN3D Print Farm, where we [manufacture up to 47 parts for our Sigma and Sigmax machines](#).

One of the pieces that are produced at the BCN3D Print Farm is the Vertical Bowden, which helps to maintain the Teflon tube in place. Thanks to the duplication mode, BCN3D can produce 1,500 vertical Bowden's in a month, instead of the 750 units that could be printed using conventional dual extrusion printers.

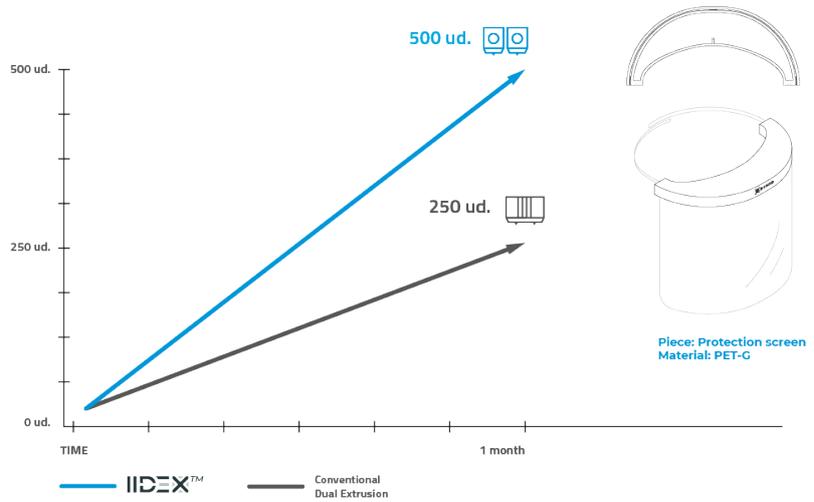


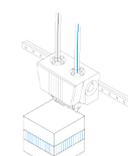
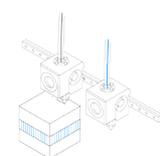
IDEX technology has also revolutionized the BCN3D production workflow during the recent Covid-19 crisis. We worked together with healthcare providers and government organizations to [design, prototype, and produce protective equipment for healthcare staff at more than 50 hospitals and health centers](#) across all of Spain.

One of the pieces that were produced at the BCN3D Print Farm was the Protective Face Shield. Thanks to the duplication mode, at BCN3D we could produce 500 of these parts per machine in a month, instead of the 250 units per machine that would have been printed using conventional dual extrusion 3D printers. The face shield's print time would have been 1 hour and 40 minutes, however, we reduced this time to 50 minutes, thanks to IDEX.

IDEX Technology

IDEX vs Conventional Dual Extrusion:
Low volume batch production comparison table



FFF 3D Printer technology	Parallel - Conventional Dual Extrusion	IDEX - Independent Dual Extrusion
		
Printing mode	Regular mode	Duplication mode
Production capacity in 1 month	250 units	500 units
Productivity ratio	1x	2x

BCN3D was the pioneer of IDEX technology, revolutionizing the 3D printing industry by offering many customers worldwide an easy and effective way of doubling productivity while keeping costs low. Could IDEX do the same for you? [Reach out today!](#)

Maximizing productivity with the most versatile 3D printers

If you are considering implementing 3D printing technologies into your workflow, ask for a BCN3D Sample Part in the following link in order to see the results of a professional FFF 3D Printer [Request a Free sample >](#)

Explore more about 3D printing. [Learn more >](#)

Wondering what's new in the 3D printing world? [Use Cases >](#)

Request a quote for a professional desktop 3D printer. [Request a quote >](#)

