HellermannTyton × SIMCON

SIMULATION OPTIMIZES PRECISION PART FOR AN ALL-ELECTRIC SPORTS CAR

How HellermanTyton achieved a lighter design for a premium electric sports car’s charging socket holder, using simulation

From left, HellermannTyton's Hagen Spieß (Head of Product Development), Amadeus Langeloh (Design Engineer), and Oliver Rühmkorf (Product Development / CAD-Administration). Image credits: HellermannTyton

It's good to be good, but it's better to be better

HellermannTyton strives for true excellence. Customers know that they deliver the very highest quality and efficiency standards. As a result, HellermannTyton is routinely involved in the most ambitious customer projects, where rigorous quality standards must be met on tight timelines, while managing cost.

The question is, how do they do it? The answer, it turns out, is multi-faceted. HellermannTyton combines a culture of excellence with a pioneering way of working. The result is a simultaneous engineering approach, supported by cutting-edge simulation technology.

In this article, we will focus on how this culture of excellence and way of working are reflected in the design of plastic injection-molded parts. We will illustrate this way of working using an example: a charging socket holder, designed for a premium sports car manufacturer.

Working together, not one after the other

Hagen Spieß, head of product development, explains the underlying philosophy:

> *"We take a **simultaneous engineering** approach. This means we make sure that our injection molding teams are cross-functional. The work is organized by customer and product, not by department. We make sure that the part engineers, mold engineers, machine setters and quality managers in a project work together, rather than one after the other."*

Thus, one of the core principles is a front-loaded and cross-functional way of working. At HellermannTyton, "downstream" team

members who operate the machines and measure product quality are already involved "upstream", during part and mold design. **Amadeus Langeloh**, one of the key team members who focuses on part design, explains:

"This is actually crucial. It helps us avoid predictable mistakes, because we've reflected manufacturing concerns early on, before we physically build the mold. It also increases buy-in of the entire team, because everyone has a chance to influence the design. The result is that we need fewer corrections after the mold is built, and the issues that do remain are usually less expensive to fix."

Digital tools to support cross-functional work

This approach is underpinned by smart use of simulation technology. The simulations predict and visualize results, before you incur the cost and time investment of building the real mold. The visualizations are used as a communication and discussion device, to evaluate different design options. The results facilitate decision-making in the cross-functional product teams, because they show the consequences of different options.

"This way, we can test and discuss different options digitally. It's cheaper and much faster to modify a virtual design, than it is to change a physical mold made of steel."

Now we turn to the component example mentioned above.

The goal: reduce part weight, by substituting metal with plastic

In this project, HellermannTyton worked on the charging socket holder for a premium sports car. Specifically, the ambition was a weight reduction by more than 50%, while continuing to meet all functional, geometric, and stability requirements. In electric vehicles, weight is particularly crucial since less weight means increased range.

Challenges: stability and geometric accuracy

"A weight reduction can of course be achieved by replacing the metal construction with a fiber-reinforced plastic construction. The challenge, then, is to make sure the stability and precision requirements are met with this different material", explains Amadeus Langeloh. *"Stability is particularly crucial for this part because it can be subject to sudden strong forces – for example, if a user trips over the charging cable."*

Furthermore, **geometric accuracy** is essential. Since the part connects the charging socket to the chassis of the vehicle, it needs to conform perfectly to both the socket and the connection points on the chassis. This means that **shrinkage and warpage** need to be anticipated and managed.

Simulating to optimize geometry and mechanical properties

In order to optimize for these two challenges, HellermannTyton deployed a combination of plastic injection molding simulation and finite element method (FEM) simulation. Amadeus Langeloh, who led part design for the project, worked closely with the mold maker on the design of the cooling system. He also convened cross-functional meetings with the machine setting and quality management colleagues to discuss the main issues.

To help achieve the mechanical robustness requirements, a material with a high share of glass fibers was chosen. HellermannTyton used SIMCON's plastic injection molding simulation CADMOULD, to evaluate the

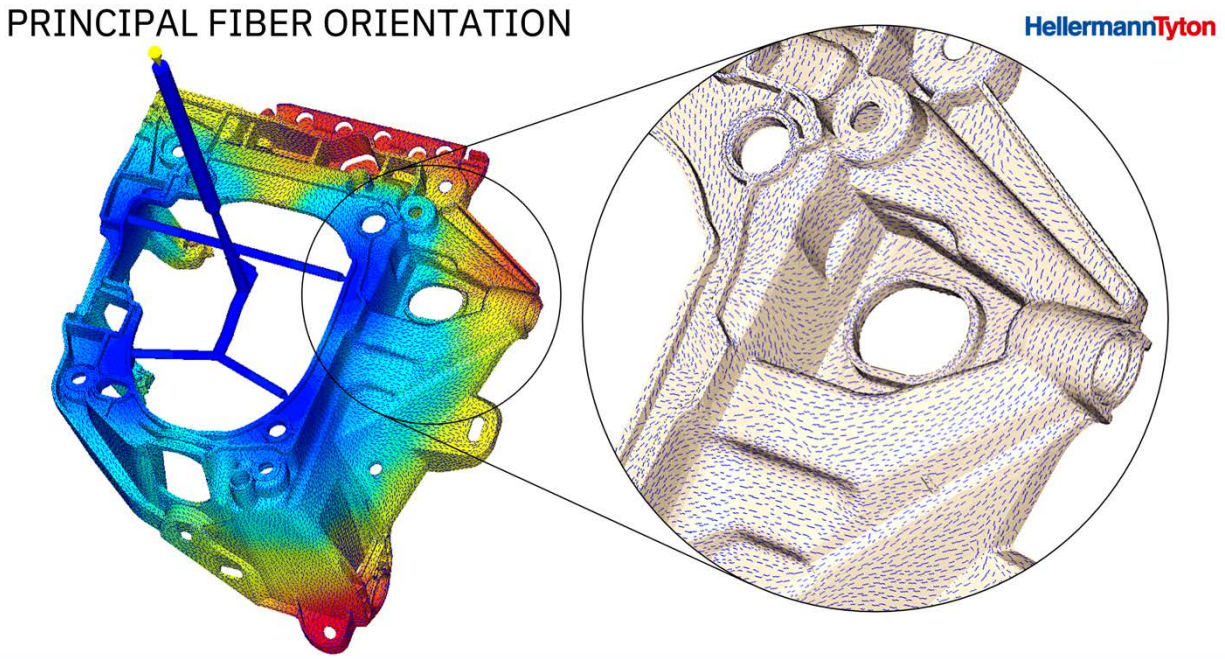

Figure 1: CADMOULD fiber orientation results were analyzed using FEM software, to evaluate mechanical properties. Image credit: HellermannTyton

location of weld lines and compute fiber orientation.

CADMOULD's shrinkage and warpage simulations of the initial part design, however, showed that there was significant warpage at the connection points. Warpage in these locations is unacceptable, because this is where the part connects to other parts of the vehicle. To find a better solution, Amadeus Langeloh designed a few alternative rib structures, as well as special mold cores with very high thermal conductivity (copper/beryllium alloy), to reduce warpage in the critical part connection areas. These variants were simulated using CADMOULD, in order to check their effect and pick the best solution. With this combination of designing and then testing variants in simulation, a design could be found that avoided the warpage.

Always simulate variants

This illustrates a key princ sful simulation: **never simulate just one variant**. It is better to invest the speed and agility of simulation into systematically testing multiple design variants and picking the best option.

> Product developer **Oliver Rühmkorf** puts it like this: *"It's important to avoid tunnel vision if you want to get the best results. Don't get too fixated on your initial design – try a few alternatives. Iterate. Use the simulation as a tool to evaluate many options. Don't just use it to confirm or verify a single, particular design option. By evaluating many variants, you can really let the simulation help you have better-informed, insightful and constructive discussions with your colleagues!"*

Thus, simulation, used in the right way, can be a valuable tool to find better alternatives, and improve cross-functional decision-

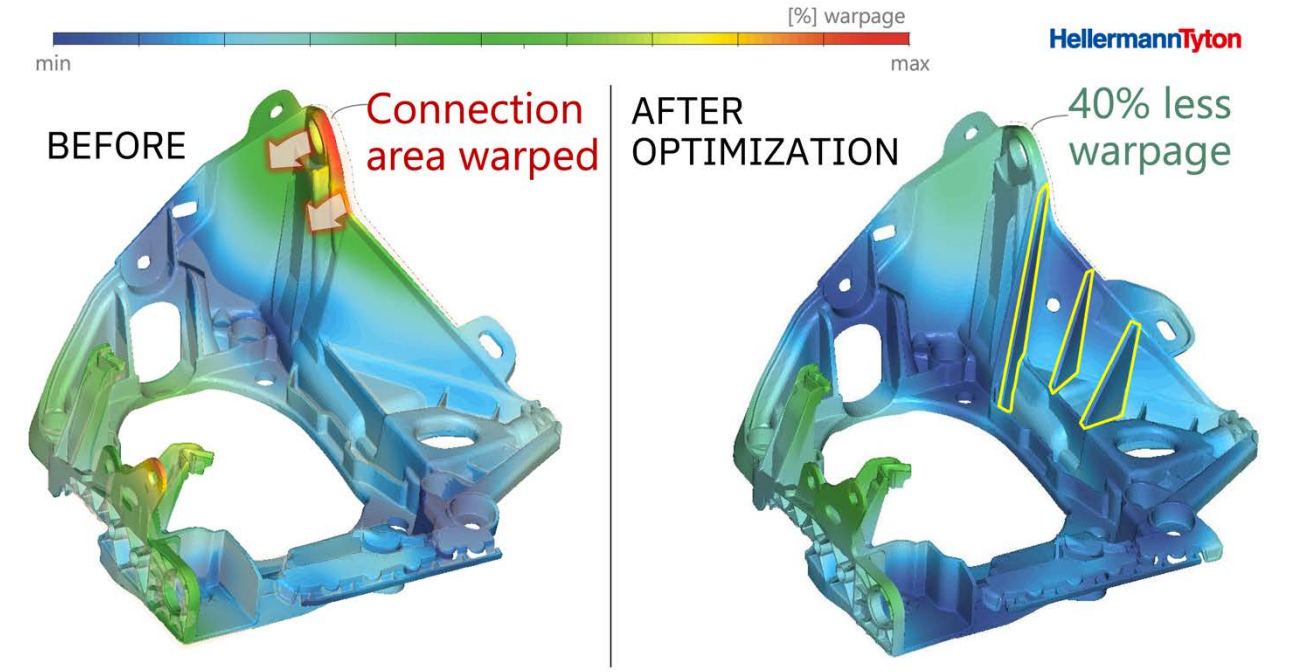

Figure 2: CADMOULD was used to test shrinkage and warpage effects of different design variants. By systematically testing multiple alternatives, HellermannTyton could find a better part design (several geometric changes, including the ribs, marked in yellow), which met both the mechanical, and the geometric requirements. Image credit: HellermannTyton

making. Of course, to get these benefits, you need to run many simulations. As Amadeus Langeloh says:

> *"It's important that your simulation software is fast enough to run multiple simulations quickly. Otherwise, you won't be able to compare enough variants, and so it will be less likely that you find the best possible solution. In fact, the superior combination of accuracy and speed, enabled by CADMOULD's proprietary 3D-F simulation algorithm are one of the main reasons why HellermannTyton works with CADMOULD."*

The result: 60% weight reduction

This part is an example of the distinctive results that HellermannTyton can achieve for their customers.

The smart, iterative and cross-functional way of working helped HellermannTyton evaluate many design alternatives quickly and efficiently. The end result reduced part weight by 60%, while continuing to meet the customer's rigorous quality standards.

If you would like to adopt this way of working...

HellermannTyton is successful with this way of working because they have cultivated the right mindset, processes and digital tools.

If you, too, would like to build this skillset, SIMCON is happy to share best practices in simulation and be a sparring partner during your transition. For more than 30 years, we have been working closely with our customers to optimize their plastic injection molding projects. Our service engineers have run thousands of challenging projects and can support you with advice or full-on simulation as a service if you are crunched for capacity. We offer software, services and trainings to get you started and deepen your team's skillset. Follow the links on the next page to get started if you are interested!

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Talk to one of our experts today!

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