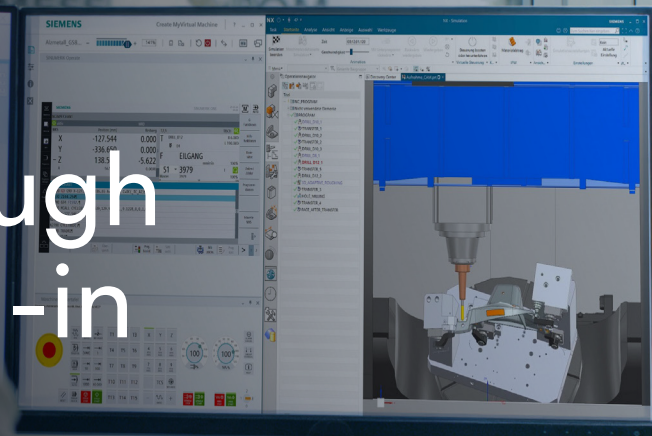


Advantage through virtual parts run-in



Virtual run-in on the digital twin yields substantial productivity gains:

HANOMAG Aluminium Solutions GmbH refines aluminum components for the automotive industry through heat treatment and mechanical processing in Kassel and Baunatal, Germany. The d.u.h.Group used Siemens Xcelerator software to create the complete digital twin of the machinery. This enabled HANOMAG Aluminium Solutions to create and optimize NC programs on the computer model in parallel with production. This reduced machine downtime during part run-in by 90 percent and increased the reliability of quotation calculations with reliable preview data.

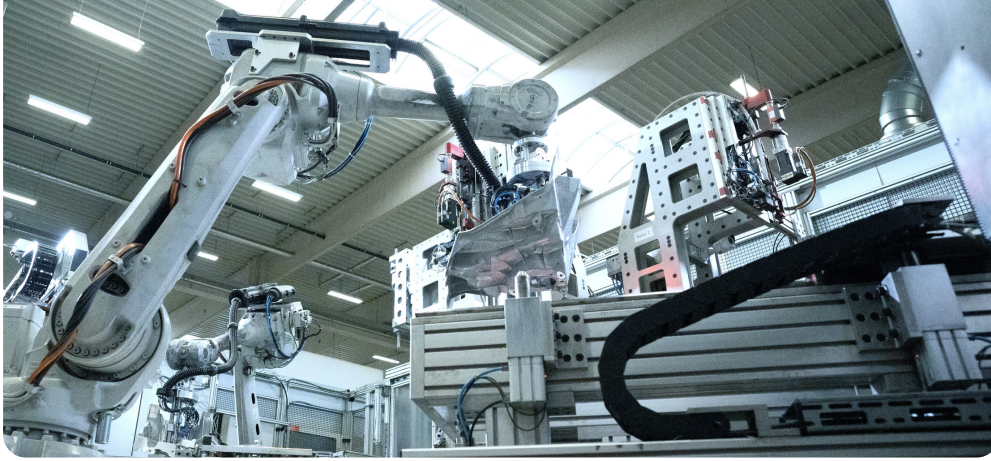
The demands placed on new products are increasing, and so is their complexity. In the automotive industry in particular, there is a conflict of objectives between higher speeds and vehicle weights on one hand and the need to reduce energy and raw material consumption on the other. This can only be resolved with consistent lightweight construction. In addition to the structural design, the choice of materials is an important lever.

Due to its low density and good strength properties, aluminum is a preferred material in the aerospace industry as well as for the construction of rail and road vehicles.

The lightweight metal is used in numerous areas of vehicle construction, from combustion engines and electric motors to chassis and structural components, doors and body parts. Both cast and formed components are used.



HANOMAG Aluminium Solutions GmbH is a provider of heat treatment and mechanical processing with locations in Kassel and Baunatal. Part of the Hanomag Lohnhärterei Group since 2021, the company is a contract manufacturer for prototypes, pre-series and large series and a reliable partner primarily for the automotive industry. Its roughly 330 employees generate an annual turnover of around 47.4 million Euros.



At its production plants in Kassel and Baunatal, Germany, HANOMAG Aluminium Solutions GmbH mechanically processes aluminum components primarily for the automotive industry.

Specialized Aluminum parts processing

HANOMAG Aluminium Solutions GmbH (HANOMAG Aluminium) specializes in the finishing of Aluminum components, primarily for the automotive industry. It has been part of the Hanomag Lohnhärtereie Group since 2021 and operates 26 chamber and continuous furnaces at its Kassel and Baunatal sites. The cylinder heads, engine blocks, subframes and housing parts heat-treated there are also mechanically processed on an impressive machine park with almost 40 4-axis and 5-axis CNC machining centers, all of which are equipped with modern SINUMERIK controls. In addition, measurements are also carried out on coordinate measuring machines during production.

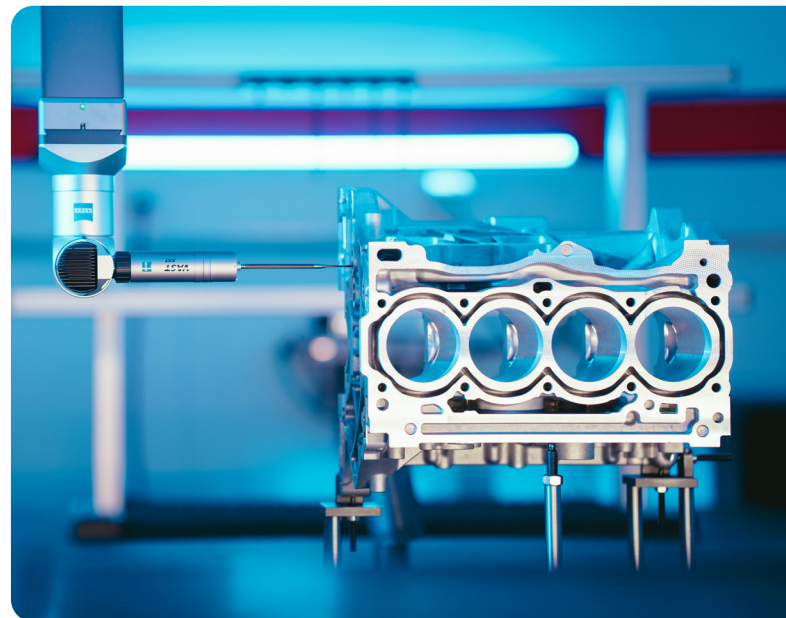
“In three- to four-shift operation, we process aluminum parts in different quantities, from prototypes to pre-series to large series,” explains Dominik Köhler, production manager Kassel at HANOMAG Aluminium. “The components often go through all processing steps until they are ready for installation, but some are only pre-machined.”

Parts run-up is a productivity factor

The processing intensity of the parts varies greatly; the parts have processing times of between 75 and 540 seconds. Their average production period is around seven years, with a downward trend. “This is not the only reason why it is important for us

as a contract manufacturer to reduce the retooling and run-in times when changing components,” says Dominik Köhler. “It was equally important for our management to obtain reliable forecasts of the exact processing times at an early stage as a basis for binding proposals.”

The production manager was aware that it would not be easy to achieve these goals with the previous processes. “The machine programs were created and, above all, optimized on the machines,” he reports. “Running-in a new part typically blocked the machine concerned, including the operators, for 15 shifts or five days.”



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Aiming at digitalizing production

This gave Dominik Köhler the notion of carrying out these activities in parallel with productive machine operations as far as possible. He approached all major CAM software vendors. Among them was Siemens Digital Industries Software, manufacturer of the industry-leading Siemens Xcelerator™ business platform comprising software, hardware and services to cover the entire product life cycle and the associated process chain. This includes the NX™ software for computer-aided design (CAD) and manufacturing (CAM).

As most of the downtime was not caused by programming, but by successive optimizations, purchasing CAM software alone would not be sufficient. A major digitization step was required to facilitate carrying out most of the component run-in in realistic simulation on a machine-specific computer model.



Until recently, the machine programs were created and optimized on the machines. Running-in a new part typically blocked the machines concerned and their operators for 15 shifts.

The Task:

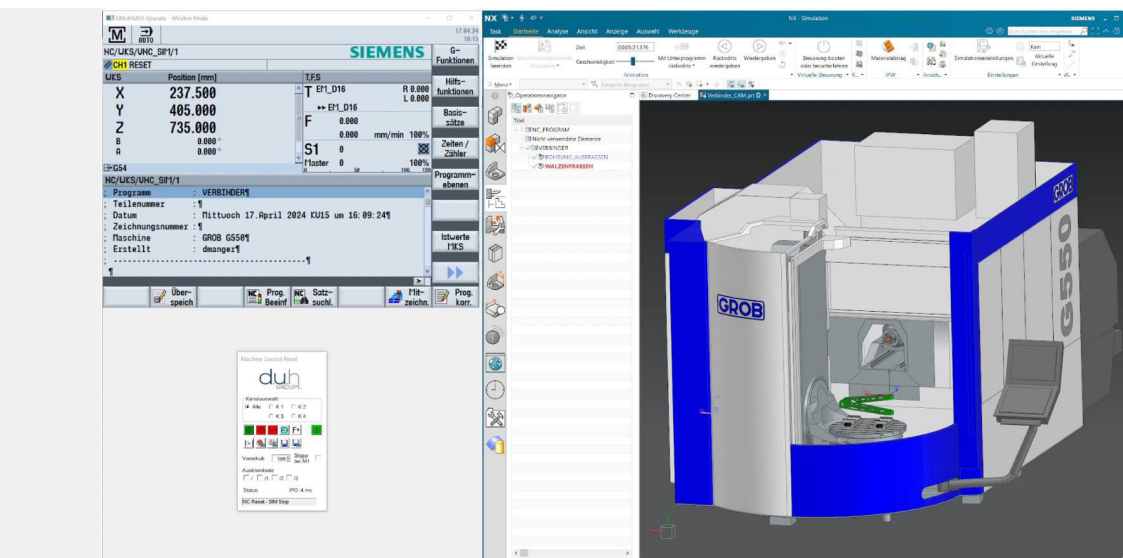
- ➔ Reduce unproductive downtimes
- ➔ Avoid machine idling
- ➔ Increase quotation calculation reliability

Programming while machining

For project realization, the software manufacturer referred HANOMAG Aluminium Solutions to d.u.h.Group GmbH. A long-standing Platinum Smart Expert Partner of Siemens Digital Industries Software, this mid-sized German company offers its customers tailored solutions to improve the efficiency of their processes and to drive their digital transformation. In addition to software implementation, consulting and training, this also includes software customizing and software development.

For HANOMAG Aluminum Solutions, d.u.h.Group's manufacturing software specialists created five post-processors for use with NX CAM. These are configurable and can therefore cover the entire machine park in both the Kassel and Baunatal plants. Using these, programs can be created in parallel with production based on the parts' 3D models.

These are supplied by customers in various file formats. "The ability to import all common formats and thus avoid the loss of accuracy when using neutral formats was one of the criteria for choosing NX CAM," Dominik Köhler reports. "Another was the software's ability to handle the often very large data volumes due to the variety of machining operations." In addition, NX CAM also provides functions for the automated creation of recurring machining steps based on geometry properties.



To facilitate carrying out NC programming and the running-in process in parallel to production, d.u.h.Group's digitization experts created the complete digital twin of all of the machine tools.

A virtual machine park

The digitization experts at d.u.h.Group created the complete digital twin of all of the machine tools. This facilitates carrying out not only NC programming but also the running-in process in the office in parallel to production.

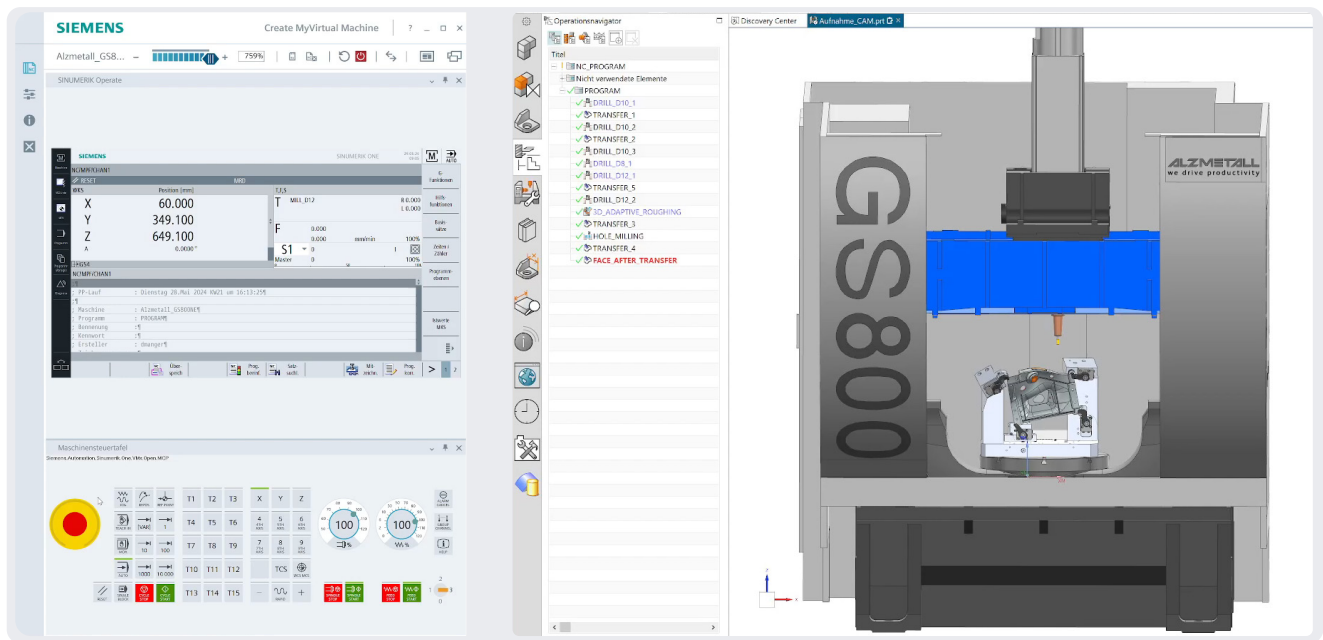
Using the 3D design data of the machines provided by the manufacturers allows generating a very good computer model of the machine. This, however, cannot take into account the real time behavior of the control electronics. Therefore, the machining process cannot be simulated with sufficient precision to provide a representative result that can be directly transferred to real operation. The software developers at d.u.h.Group took the opportunity to add the Siemens Virtual NC Controller Kernel (VNCK) to NX CAM. This allows the virtual machines to be operated and the machining simulation to be carried out using the real control software.

"Our CAM experts created complete digital twins of the machine tools," says André Fehn, presales and CAM team leader at d.u.h.Group. "These act as true-to-life digital representations of the movements of the actual machine tools with the exact speeds, accelerations, tool changes and cycle times."

With services such as staff training, installation and infrastructure optimization as well as the integration of customer processes, they also ensured a quick and smooth transition. Creating, checking and optimizing the complex machining processes are now carried out at two computer workstations instead of directly at the machines. The simulation of manually generated NC code is also possible, as is direct feedback to the part design.

Solution:

- ➔ NC programming conversion to CAM using Siemens NX
- ➔ Postprocessors for the entire machine park
- ➔ Creation of the digital machine tool twin by adding the Siemens Virtual NC Controller Kernel (VNCK) to NX CAM
- ➔ Conversion to run-in parallel to machining time on the digital twin



Thanks to the Siemens Virtual NC Controller Kernel (VNCK), the run-in process for new parts at HANOMAG Aluminum Solutions takes place on the computer model based on the real control software. The simulation of manually generated NC code is also possible, and so is direct feedback to the part design.

Substantial productivity gains

The NX CAM simulation based on the digital twin of the entire machine park has revolutionized the run-in process for new parts at HANOMAG Aluminium Solutions. This process now resembles virtual commissioning in that the start-up is first carried out on the computer model. This helps prevent collisions, reduce risk and avoid rejects.

No sooner than the virtual run-in on the digital twin has been successfully completed, the workpieces are transferred to the real machines. Although final optimizations are still carried out there, the time required directly at the machine has been reduced from 15 shifts to one. “The savings amount to over 90 percent or around 11,000 Euros per component,” emphasizes Dominik Köhler. “This alone has paid for the investment within a year.”

The exact calculation of cycle times made possible by virtual run-in has also greatly increased the accuracy and reliability of the quotation calculation. In a highly competitive market, this is a contribution to the company's competitiveness not to be underestimated.



Using NX CAM simulation based on the digital twin of the entire machine park, the run-in process for new parts at HANOMAG Aluminum Solutions is carried out almost entirely on the computer model. This has reduced the time required directly at the machine from 15 shifts to one.

Benefits:

- ➔ Optimization of existing programs and test runs at the office workstation rather than at the machine
- ➔ Automation of processes in NX CAM through automatic tool measurement and tool correction
- ➔ Reduction of the machine downtimes during part run-in from 15 shifts to one
- ➔ Around 11,000 Euros savings for each new part
- ➔ More accurate, reliable data for calculating quotations



“The investment in Siemens NX CAM and the digital twin of our machinery based on VNCK has paid for itself in less than a year thanks to the largely parallel component start-up.”

Dominik Köhler | Production Manager Kassel
HANOMAG Aluminium Solutions GmbH



“Our CAM experts created complete digital twins of the machine tools. This enables a true-to-life digital representation of the movements of the actual machine tools.”



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d.u.h.Group GmbH