

Where it all comes together: What does a data scientist do in high-voltage battery production?

- Artificial intelligence and data analytics in high-voltage battery production
- AI-supported quality assurance for zero-defect manufacturing approach
- An interview with Patrick Zimmermann, data scientist and IT project manager

Munich. The high-voltage battery is a vital component of every electric vehicle. With the high-voltage batteries for the sixth generation (Gen6) of BMW eDrive, the BMW Group has made a big step in technology, delivering major improvements in energy density, charging speed and range. In readiness for series production, the BMW Group is currently building five assembly sites across three continents: in Irlbach-Straßkirchen (Lower Bavaria), Debrecen (Hungary), Shenyang (China), San Luis Potosí (Mexico) and Woodruff (USA). Before the series launch, production processes will be developed and tested at the BMW Group's pilot plants for high-voltage batteries in Parsdorf and Hallbergmoos, and at the Research and Innovation Centre (FIZ) in Munich. As a data scientist and IT project manager, Patrick Zimmermann is responsible for implementing the Industrial Internet of Things (IIoT) and data analytics in the high-voltage battery production of the BMW Group. His role is to weave all relevant software strands together.

Patrick, what do you do as a data scientist and IT project manager in high-voltage battery production?

Patrick Zimmermann (PZ): I coordinate an interdisciplinary team that oversees the entire data processing chain: from data provision at the manufacturing facilities to edge applications that transfer our production data to the cloud and to analytics platforms.

What kind of expertise do you need for that?

PZ: First and foremost, the job requires a solid understanding of the technologies used to manufacture our high-voltage batteries. For this latest generation, which uses the new cylindrical round cells, we've developed a completely new production process. Of course, strong IT knowledge is also essential – with a clear focus on the software architectures behind the data analytics and artificial intelligence. Understanding the individual software modules and interfaces is crucial for choosing the right solutions for our production from the wide range of technologies and applications available.

This means you always have your finger on the pulse and can anticipate IT trends?

PZ: Data analytics and AI for production are evolving at a tremendous pace right now. That's why it's important to keep an eye on new approaches and evaluate whether they're suitable for BMW. Or whether they could even replace existing solutions – perhaps by offering lower costs or enhanced features. Not every analysis or AI solution that performs well in a particular industry or use case can be directly applied to battery production.

Production of Gen6 high-voltage batteries is groundbreaking for the BMW Group. What, in your opinion, makes this project unique?

PZ: One unique aspect is the end-to-end responsibility – from data provision and data transfer to the cloud, all the way through to selective and even continuous analyses. We process both numerical data and visual representations from the equipment. Throughout the process, we maintain a consistent zero-defect approach to producing our high-voltage batteries. Highly intelligent, AI-supported quality checks are integrated into the production process to help us achieve this. We rely on OPC UA interface technology for plant connectivity. This enables us to model standardised digital twins directly at our plants, eliminating the need for additional data processing. Data is transferred to the BMW Group's clouds, using the same data structure across all production sites. This allows us to roll out standardised analysis dashboards worldwide and, for example, implement process optimisations more rapidly. We've already established this IT architecture at our high-voltage battery pilot plants. We have now been able to transfer our analysis dashboards to the first series production plants with minimal effort.

Entire new plants and assembly halls are being built for production of the new Gen6 high-voltage batteries. Is this beneficial for the IT structure?

PZ: Absolutely! Building several plants for Gen6 high-voltage batteries on greenfield sites gives us a whole new level of design freedom. This allows for much bigger leaps in IT, compared to integrating new solutions into existing plants – a so-called brownfield. I, for one, find it really exciting to help shape the Industrial Internet of Things and data analytics on such a large scale right from the start.

INFOBOX: How the BMW Group builds Gen6 high-voltage batteries

With its innovative production processes, BMW Group's pilot and series plants are setting new industry standards for battery production. Examples include, among the consistent zero-defect approach, the use of digital production twins for tasks such as employee training, as well as leveraging expanded AI databases to optimise supply and production logistics. All production steps undergo seamless in-line monitoring with comprehensive data storage, enabling maximum process stability and continuous data-based optimisation.

The BMW Group sources battery cells for its high-voltage batteries from leading cell manufacturers, who produce the cells to the company's specifications. The highest technical standards apply. Upon receipt of goods, additional measurements – such as voltage checks – are carried out. Next comes cell clustering, where the battery cells are connected to coolants. This step ensures optimal insulation and cooling of the cells. The cell clusters and cell contact system are then laser-cleaned and welded with pinpoint precision. The in-line inspection continuously monitors each weld seam in real time. An innovative foaming process follows, ensuring that all elements are protected as a mechanical unit. The foam thus guarantees the safety, stability and durability of the high-voltage battery. The housing is then closed, sealed and riveted. In the final assembly step, the Energy Master – the central control unit – is installed onto the high-voltage battery. A permanently elastic sealing adhesive is applied to ensure a reliable seal. Finally, each high-voltage battery undergoes a 100% end-of-line inspection to ensure quality, safety and function.

The BMW Group

With its four brands BMW, MINI, Rolls-Royce and BMW Motorrad, the BMW Group is the world's leading premium manufacturer of automobiles and motorcycles and also provides premium financial services. The BMW Group production network comprises over 30 production sites worldwide; the company has a global sales network in more than 140 countries.

In 2024, the BMW Group sold over 2.45 million passenger vehicles and more than 210,000 motorcycles worldwide. The profit before tax in the financial year 2024 was € 11.0 billion on revenues amounting to € 142.4 billion. As of 31 December 2024, the BMW Group had a workforce of 159,104 employees.

The economic success of the BMW Group has always been based on long-term thinking and responsible action. Sustainability is a key element of the BMW Group's corporate strategy and covers all products from the supply chain and production to the end of their useful life.

www.bmwgroup.com

LinkedIn: <http://www.linkedin.com/company/bmw-group/>

YouTube: <https://www.youtube.com/bmwgroup>

Instagram: <https://www.instagram.com/bmwgroup>

Facebook: <https://www.facebook.com/bmwgroup>

X: <https://www.x.com/bmwgroup>

BMW Group Latin America

BMW Group is a leader in premium individual mobility technology products and services in Latin America, where it markets its three brands: BMW, MINI, and BMW Motorrad. BMW is the top-selling premium automotive brand in Latin America, with more than one in three vehicles sold in the region. In 2024, the brand has sold 42,886 units. MINI has sold 6,383 units in the same period. BMW Motorrad has sold 27,742 motorcycles in the region, setting a sales record. BMW is the best-selling premium brand in Brazil, Mexico, and Importer Markets. BMW Motorrad has achieved record sales and now has three of its 15 main global markets in Latin America: Brazil, Mexico, and Importer Markets. BMW Group's Open Technology Approach enables a gradual transition to electromobility, offering customers the choice between battery-electric, plug-in hybrid, or combustion powertrains. More than 20% of BMW Group's sales in Latin America consist of electric or plug-in hybrid vehicles. BMW Group has delivered approximately 80,000 personal or corporate charging units across the region.

The Group has 5,000 employees in the Latin American region. Its sales offices are located in Argentina, Brazil, and Mexico (where the regional office is based). BMW Group's production plants in the region are located in Brazil and Mexico. Brazil operates two plants: one in Araquari, Santa Catarina, focused on automobile production, where BMW X5 PHEV production began in 2024. The other plant in Manaus, Amazonas, is the first facility to manufacture motorcycles outside of Germany. In Mexico, a one-billion-dollar investment was announced in July 2014 for the construction and operation of a BMW Group plant in San Luis Potosí. This production site began operations in 2019 with the production of the BMW 3 Series; in 2021, an expansion was announced to include the manufacturing of the BMW 2 Series Coupé, and in 2022, the BMW M2, both exported worldwide. Starting in 2027, the San Luis Potosí Plant will incorporate electric vehicle and battery production with an \$800 million investment.

As additional information, Brazil has an engineering team to support global developments, regional challenges, and customer support organization, providing consumer assistance.

For additional information please contact:

Corporate Communications – BMW Group Latin America

Joao Veloso

joao.veloso@bmw.com.mx

Juan Bernardo Vázquez Mellado

bernardo.vazquezmelladobmw.com.mx

Julián Argüelles

julian.arguelles@bmw.com.mx

Erika Ferrer

erika.ferrer@bmw.com.mx

Corporate Communications – BMW Group Plant San Luis Potosí (México)

Elizabeth Arreguín

elizabeth.arreguin@bmw.com.mx

Miroslava Rivas

miroslava.rivas@bmw.com.mx

Corporate Communications – BMW Group Argentina

Gonzalo Di Gregorio

gonzalo.di-gregorio@partner.bmw.com.ar

Corporate Communications – BMW Group Brazil

Fabiano Severo

fabiano.severo@bmw.com.br

Paula Cichini

paula.cichini@bmw.com.br

Regional Public Relations Agency – INK PR

INK PR - BMW Group Latin America

BMWGroupLatAm@inkpr.com.mx

BMW Group Plant San Luis Potosí (México) Public Relations Agency – INK PR

INK PR - BMW Group Plant SLP

plantabmwslp@inkpr.com.mx

BMW Group Brazil – Public Relations Agency JeffreyGroup

JeffreyGroup - BMW Group Brazil

grupobmw@jeffreygroup.com

BMW Group PressClub

www.press.bmwgroup.com/mx.html

www.press.bmwgroup.com/latin-america-caribbean?language=es

www.press.bmwgroup.com/argentina/

www.press.bmwgroup.com/brazil/