

Powerful visualization for premium tire production at Pirelli Deutschland GmbH – Breuberg location

Company Profile:

Tires are high-tech products – that is particularly true for high and highest performance tires used in sports and race cars. Pirelli has been synonymous for quality and reliability in that specialist market segment for decades. This premium claim has been the Italian rubber items manufacturer's credo since its inception in Milan in 1872.

Approximately 2,300 employees at the German location in Breuberg, Odenwald, manufactured close to eight million tires in 2012 alone. Worldwide, Pirelli Group operates 19 tire factories, employs over 37,000 permanent staff, and produces premium performance road products for cars, trucks, and motorbikes, and specialist tires for Formula 1 and the international GP2 event series. Pirelli is furthermore the exclusive provider for the FIM Superbike and FIA Rallye Championships.

Breuberg, located around 30 kilometers east of Darmstadt, is home to the head office of Pirelli Deutschland GmbH, and doubles as the manufacturing and development location for Pirelli car and motorbike tires (Fig. 1) in partnership with



Fig. 1: The Pirelli location in Breuberg, Odenwald.

the group headquarters in Milan. Two adjacently located facilities in Breuberg have been manufacturing a variety of high-performance (HP) and ultra high-performance (UHP) tires up to 21 inches (and larger on request) since the 1980s. The facilities supply OEMs of many German and international premium vehicles, as well as trade partners and Pirelli warehouses nationally and internationally. In 2013, Pirelli celebrated its 50-year anniversary in Germany, although rubber products have been manufactured at the Breuberg facility for over 110 years.





Challenges:

On the topic of tires, most drivers simply think "black and round." In reality, there is a lot more to a Pirelli tire. Tires are the result of complex structures, and are manufactured from a large number of components in a highly complex production process. This fact alone makes a tire a high-tech product that requires a lot of know-how and experience in its manufacture.

The interpretation and visualization of the multitude of process and product data for these complex processes requires intelligent tools – specifically when applied to a wide range of products. Proficy™ HMI/SCADA iFIX® has been fulfilling this challenge successfully at Pirelli for many years, and has consequently become the "Pirelli Standard" worldwide.

Tire Creation

The delivery of various raw materials marks the starting point of the highly complex manufacturing process: Natural rubber and an array of synthetic rubbers, additives, fillers, and tension elements like steel mesh and textile materials.

At the so-called raw materials and semi-finished product stage, mixtures and semi-finished products are created for the actual tire manufacture. The first step is the creation of various rubber mixes in the mixing room, which are then compacted into flat, wide rubber sheets for further processing. Semi-finished sheets of pure natural rubber are manufactured in extruder systems.

That is how e.g. side wall segments and the running strip are made, which will later become the trademark Pirelli tire tread. Other semi-finished products, in which various materials are combined, are created in calenders. That is the case for the casings and the belt package, for which steel wire and synthetic fibers with ultra high tensile strength are coated with rubber to guarantee a sound bonding of the individual semi-finished products in the finished tire.

Depending on the desired tire size, the extruded or calendered materials are cut to size as a final preparatory work step. In traditional manufacturing processes, the initial material preparation phase is followed by a picking stage across several stations, i.e. the assembly of the individual semi-finished products to create a green tire.

The green tire is then forwarded to a heated full mould – the hot press – where the tire is vulcanized in an exactly defined thermal program. Polymer chains bond the various rubber types as part of this irreversible vulcanization – a permanently elastic tire is formed from the malleable rubber. This process step gives the tire its final shape. After leaving the hot press, the tire is now on its way to a final quality check, after which it is palletized and sent to the warehouse (Fig. 2, right).

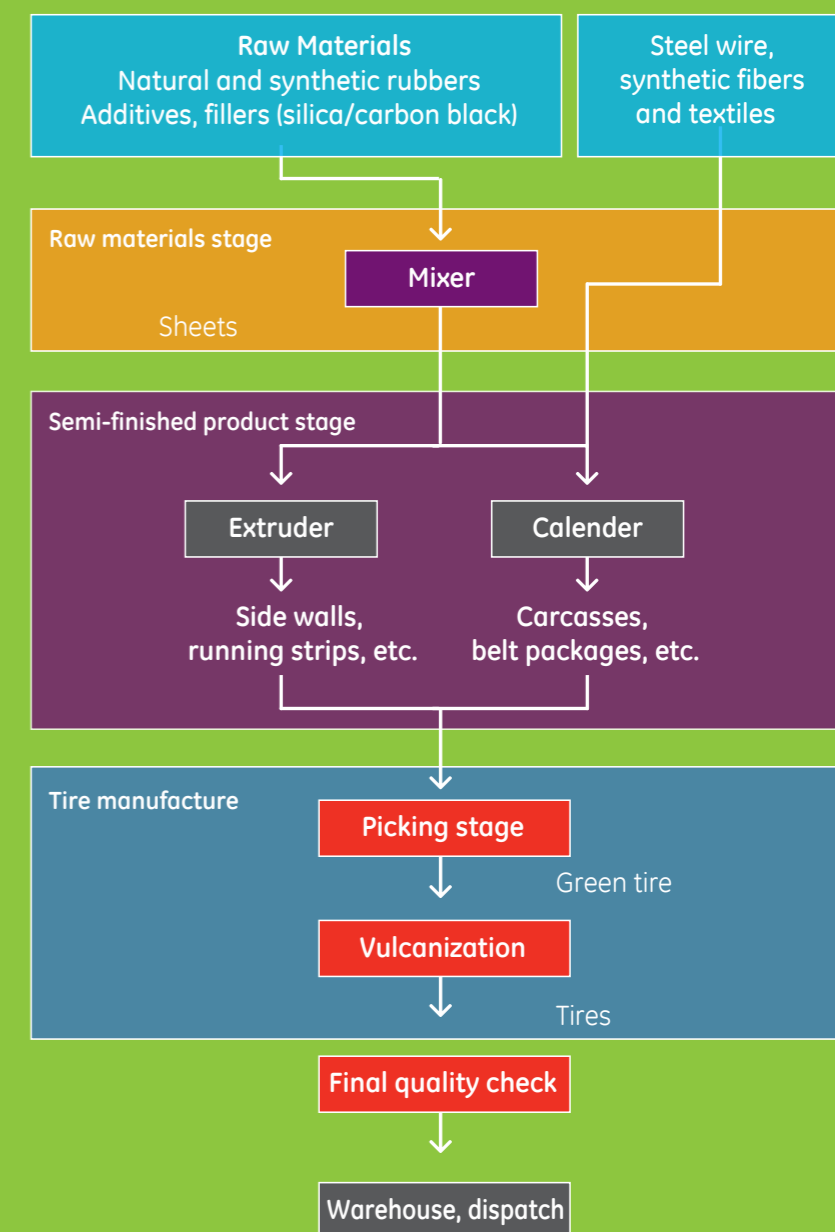


Fig. 2: Schematics of the traditional tire manufacturing processes at Pirelli in Breuberg.

GE Intelligent Platforms

The GE Solution:

Pirelli developed the MIRST™ technology (Modular Integrated Robotized System) about 15 years ago, and implemented it in 2000. The technology represents an important milestone in modern tire production, and has completely revolutionized process workflows. A specifically developed, integrated Manufacturing Execution System (MES) coordinates the MIRST™ overall process – from the initial, order-focused deployment plan to batch planning and monitoring of the recipe and robot control. (Fig. 3).

Each individual tire is accompanied by an extensive data package, which seamlessly documents its entire history of origin, the raw materials used, and the process parameters applied in the construction process. "The documentation for every single tire would easily cover a few pages," explains Beck, Director of Change Management and Internal & Facility Communication at Pirelli Deutschland GmbH. At the next-generation production facility in Breuberg, each tire is additionally marked with a barcode, which creates a digital connection to its "own" data package. This procedure facilitates the seamless tracking of each tire all the way back to the raw materials used in its production. Each individual batch of raw and auxiliary materials is uniquely identified with barcode labels.

"Quality is the central claim of our tires as a premium product," underlines Beck. Each production run is therefore finalized with the visual inspection of each tire by an



Fig. 3: Robotized tire production with MIRST™ technology: Unrivaled precision at breathtaking speeds with a very small footprint

experienced expert when it is removed from the hot press. This visual check, just like the subsequent fully automated measurements check, is captured in the tire's individual documentation. The measurements check involves an inspection of the tire's most important quality criteria like its geometry, and any imbalance or force variations – in short: the so-called tire uniformity.

On a single production day, several million individual bits of information are therefore generated from product documentation alone. In addition to that, there are reams of system and process parameters. The visualization

system Proficy HMI/SCADA – iFIX is directly responsible for the generation of readily available, clear, concise, and requirement-specific data for the staff at Pirelli.

To this end, the system utilizes the data stored in the Proficy Historian database. "iFIX can be implemented seamlessly as part of a real-time data system. It offers standard interfaces for a variety of control systems and excellent future-compatibility," says Erdal Kara, Senior Strategic Account Manager Germany at GE's Intelligent Platforms business, about the advantages of this robust SCADA system.



Results and Benefits:



Fig. 4: Everything at a glance: Bernhard Munzert viewing a Proficy HMI/SCADA iFIX-generated real-time overview of the MIRS™ production processes in Breuberg.

"An important advantage of iFIX – particularly in view of the need for processing high data volumes – is the system's distinctive real-time capability," stresses Kara. Highly performant algorithms in conjunction with state-of-the-art hardware ensure a true "online" view of running production.

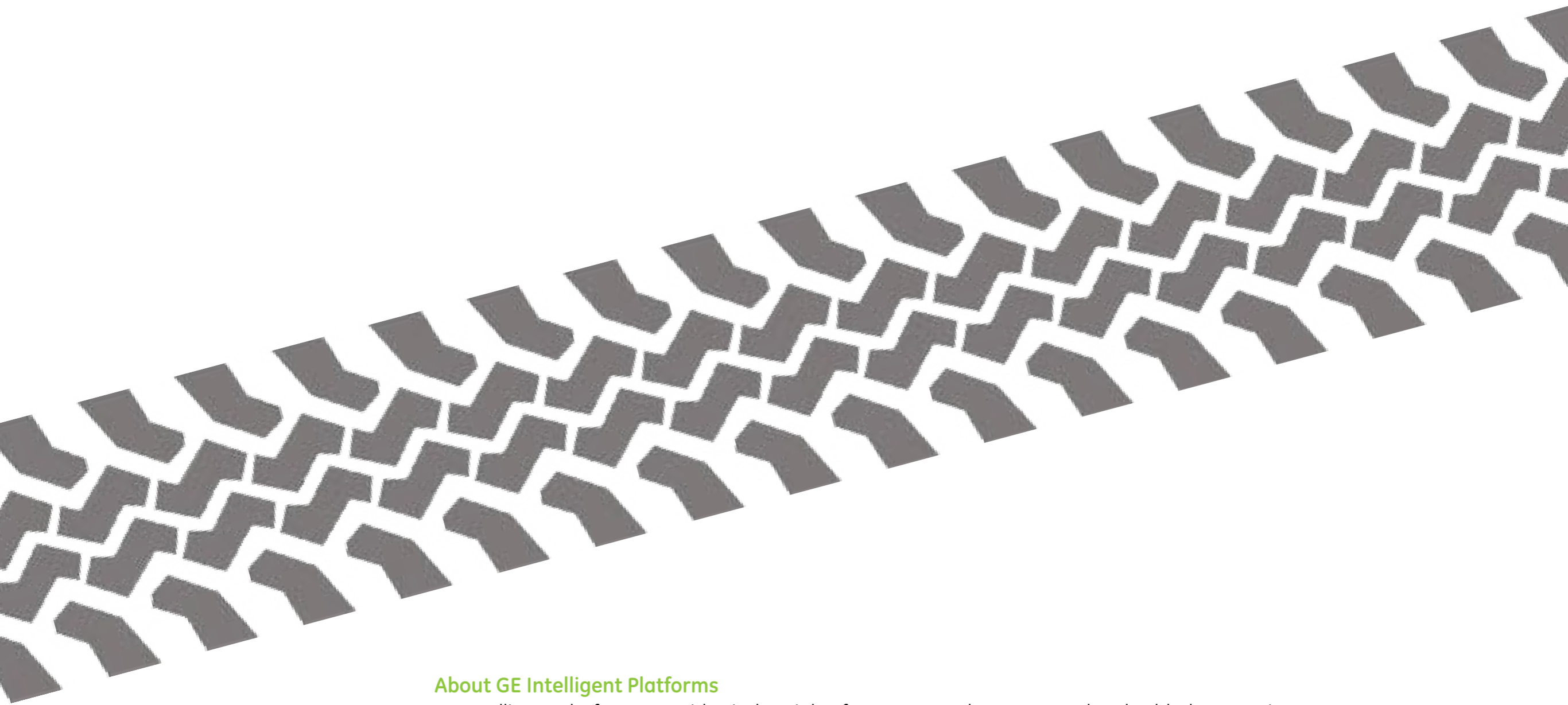
The large, clearly structured displays of Proficy iFIX have become indispensable for the work crews over the years, as it offers a meaningful overview of the highly complex production facility. "Not one of us would want to work with the small, locally installed, low-resolution monitors again. Back in the day, that was all the machines usually had to offer.

Besides, they only provided information in the proprietary format of each manufacturer," explains Munzert. The introduction of iFIX has also made operation a whole lot simpler: The tiresome and error-prone input of numbers via keypads has now been replaced with mouse clicks in a pull-down menu. Munzert has nothing but praise for the great flexibility of the Intelligent Platforms staff, and the competent support provided across the system's entire lifecycle (Fig. 4).



"Ever since the introduction of Proficy - iFIX at Pirelli, the system has been great to work with, which has encouraged us to expand the system further and further to include new machines over time."

**—Bernhard Munzert,
Automation and
Control Systems at Pirelli**



About GE Intelligent Platforms

GE Intelligent Platforms provides industrial software, control systems and embedded computing platforms to optimize our customers' assets and equipment. Our goal is to help our customers grow the profitability of their businesses through high performance solutions for today's connected world. We work across industries including power, manufacturing, water, mining, oil & gas, defense and aerospace. A division of GE, we are headquartered in Charlottesville, VA.

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