Latest updates on Iulius 4.0

The Properzi program supporting the transition of users' facilities to digital factories

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Continuus-Properzi has always invested in innovations to provide better quality and improvements that meet the end users' needs. In the field of Industry 4.0, the company has developed a specific package of automation and information technology features to support and facilitate the transition of the end users' factories into digital factories, in order to achieve much higher performances from many points of view, including quality, consistency, OEE, savings and reactivity to new market challenges. The functions offered by the current Iulius 4.0 package and the latest additions and updates, valid for new plants as well as for existing ones through upgrading solutions are presented below.

Industry 4.0 in essence

Before outlining the Iulius 4.0 package, here is a brief introduction to several essential concepts regarding Industry 4.0. I4.0 is the process of introducing the latest automation and information technologies into factories, to transform them into fully digitalized entities. To achieve this, the factories essentially introduce intra-facility and inter-facility digital communications and functions, where:

- Intra-facility pertains to fully interfacing the automation of the production processes with the information system of the facility where they operate,
- Inter-facility is when the information system of the end user facility is fully capable of performing various tasks with the information systems of external plants (i.e. customers, suppliers, sister companies, public authorities, etc.).

The transformation of producers' factories into fully digitalized plants has high potential value because it results in very consistent benefits in various forms, such as improved performances, cost reduction, etc. Accordingly, it can be said that these benefits are highly welcome regardless of the particular industrial sector. Of course, at the same time, any sector has specific features to address in order to succeed in the transition to digital plants.

Iulius 4.0 – the I4.0 package specific for the Properzi metals producers

From the standpoint of non-ferrous metals producers, the plant digitalization requires the introduction of new automation and IT functions, designed to address the specific features inherent in Properzi technology and equipment, and those of their end users (e.g. rod producers, welding wire producers, ingot casters, etc.).

The Iulius 4.0 package complies exactly with the purpose of resolving all the above specificities, providing a complete set of functions fully integrated and ready-to-use. These greatly ease the non-ferrous metals producers' progress to the digital transition of their facilities. The package is advantageous for Properzi end user because:

- it drastically reduces the engineering hours and tuning period needed by the end user's IT department to integrate the line-specific process operations and controls in the factory procedures,
- the automation is specifically designed and engineered on the basis of Properzi's intimate knowledge of the Properzi equipment, process and technology,
- all of the actuators, sensors, programming, etc. are already implemented in order to capture and record all the information essential to the Properzi process, and to provide ready-made KPIs, dashboards and data to the end users' managers,
- the package provides ready-to-use data to implement business-intelligence functions in the IT system of the end users.

As a result, the end users benefit from ready-made functions that are directly applicable without any effort or uncertainty, at modest cost compared to the savings achieved.

Further, this allows the IT department of the end user to focus and concentrate resources on their core tasks, such as the aggregation of production and process information at the factory level, as well as the implementation of digitalized services across other factories such as sister companies, customers, suppliers, public authorities, etc.

As previously mentioned, Iulius 4.0 can also be applied to existing plants through selective upgrading of the equipment and automation, in order to implement all the features and functions, or just some of them, depending on the end users' goals.

The Iulius 4.0 program consists of functions divided into two major sets: Iulius 4.0 Ready and Iulius 4.0.

Iulius 4.0 Ready – the basic infrastructure essential for the I4.0

Iulius 4.0 Ready consists of the the basic and indispensable functions, summarized in the next three sections:

a. Wireless visibility of the plant's data through LAN automation

The first functionality is the ability to access the Local Area Network (LAN) of the automation system via WiFi, and to provide visibility of the plant's data through those systems.

For this purpose, the line's automation system is equipped with a Wi-Fi access point, and with PLCs, HMIs, controllers, etc. which are provided with digital network cards in order to constitute the LAN.

The main purpose of this ability is to provide access to the programming of PLCs, HMIs, drives, and other programmable devices present on the LAN, in order to monitor the program in execution, make minor changes or integrations, or to adjust parameters, through the programming software of the device that is preinstalled in the connected external Laptop.

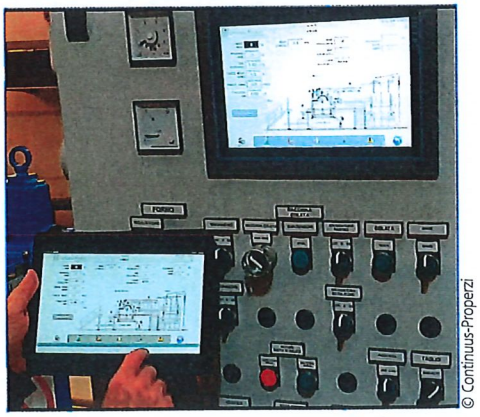

Fig. 1: HMI pages on tablet

Since this connection is wireless, it enables the external Laptop to reach more easily any programmable device on the LAN from the most convenient position.

b. Access to HMIs from on-site mobiles

This functionality provides real-time access to the pages of all the HMIs supplied from on-site mobile devices of the end user through the Wi-Fi wireless access point, regardless of position within the plant. It purposely provides the operators with the freedom to monitor the line from anywhere within the plant, at any time.

On the operator's mobile, the HMI pages become accessible in reading mode, so any changes that are made to the HMI screen are reflected on the mobile tablet connected wirelessly through the Wi-Fi access point. In this case the tablet is simply being used to monitor in real-time what is occurring on the Line.

c. Remote technical assistance via Internet

Thanks to dedicated network components and a connection to an Internet provider, the automation LAN of the plant is also accessible via Internet.

This is the last of the Iulius 4.0 'Ready' functions, which mainly facilitates the ability to provide technical assistance from any remote location via the Internet, and also allows the two previously described functions, a. and b., to be executed remotely.

The remote technical assistance consists in enabling access via Internet to the programmable devices of the line, to monitor the program in execution for diagnostic purposes and to adjust the operating parameters. It also allows engineers, duly authorized by the end user, to make changes or add features when requested.

Upon the end user's request and the enabling of the internet connection, Properzi's service technicians, regardless of whether they are in-house at Properzi HQ or off-site, connect to the end user's line through a dedicated server in order to provide remote technical assistance. This all takes place through secure communication methods protected by firewalls, VPNs, and modern security systems. Indeed any authorized personnel can do this from any remote location.

The hardware package for the remote assistance also includes a set of video cameras and related audio-visual accessories to support in a much more comfortable and effective way the interaction among the on-site and off-site technicians. With this audio-visual package, all the technicians can remain in live session while sharing on their monitors the multiple views of the various areas of interest of the line, such as machinery parts, HMI pages, PLC programming, windows of video conference participants, etc. In this manner, they are able to carry out in virtual mode practically the same activities as are traditionally carried out in person at the end user's site.

Fig. 2: Remote assistance engineers in live session

Fig. 2 shows assistance engineers during a remote commissioning session. Two of them are at Properzi HQ while one, on the end user's staff (at bottom right), is on-site at his factory. Note that for effective interaction, all of the participants are connected to one another in video conference; they can see the same various windows depicted, and can share from their respective PCs or mobile devices additional images of interest at any time.

Compared to the direct intervention of a Properzi technician on-site at the customer's plant location, remote assistance grants decidedly superior timeliness at lower cost, thanks to a shorter lead-time for the availability of a service engineer; moreover, travel time is eliminated.

Iulius 4.0 – the most valuable advanced package for the I4.0

The Iulius 4.0 package, which is more and more frequently requested as the market realizes the benefits I4.0 can provide, consists of the additional most advanced set of functions summarized in the next five topics, from d. to h.

These have the purpose of acting as a powerful tool, making the control and optimization of the Line easier, more effective, and more efficient for quality, production, and maintenance operators. To implement these advanced functions, it is necessary to have a Scada system.

d. Scada system

Scada stands for Supervisory Control And Data Acquisition system; it is the Iulius 4.0 platform for the relevant data management and storage. Its general purpose is to provide monitoring and control functions in order to continuously improve and maintain the process performances of the line.

Scada consists of a set of industrial PCs at one or multiple stations, which interface two parts through an Ethernet network: the LAN of the Properzi line, and the IT system of the end user's facility.

Examples of Scada functions are:

- Generation of traceability data such as metal codes, casting numbers, production lots, product numbers, weights, etc.
- Production and quality reports,
- Processing of set point controls,
- Data acquisition in trends and logs.

Scada is the most frequently preferred solution by the end users since it allows them possession of the data collected in their facility. As an alternative, edge computing solutions can be implemented but the collected data in this case reside in a cloud.

One may ask: "Why does Iulius 4.0 use a Scada system as its supporting platform?" This is essentially because it provides a ready-to-use IT system partially directly available for the end user's IT, with all the automation-related specificities already embedded and operational. This is achieved thanks to the following main characteristics:

- Computing at automation level, of all necessary I4.0 data,
- Computing at Scada level, of all necessary

I4.0 data that is fully coordinated with the data coming from the automation system,

- Internal data storage capacity, in performance-related databases,
- Database export and data exchanging interface ready-to-use by the end user's IT system.

e. Scada pages on end user's mobiles

The working principle of this functionality is that it brings also the content of the Scada pages to the end user's mobile devices. This works either locally through the on-site Wi-Fi connection, or remotely through the Internet connection from any off-site location.

In this way the operator can consult at any time and from anywhere the status of the line by navigating the Scada pages of interest (synoptics, recipes, trends, reports, etc.) as if he were on site, subject only to a slightly longer latency in the data refreshing time, as per Internet connection's speed, but practically with the same effectiveness.

This function is designed for managers of the line, with the aim of providing them with a simple, objective and agile tool for remaining always up-to-date with what is happening in the plant at any time and from any place; this puts them much more at ease since they know they have everything under control.

Furthermore, to provide even more effective support, the information brought to mobile devices is specifically tailored for each of them in a few highly effective dashboard pages. This introduces the next functionality.

f. KPIs dashboards – for the managers of the end user

In order to make quick and effective decisions, the plant's management team needs to know, in real time, the KPIs: the set of most important process variables and parameters significant to the Line's status and performances, in relation to their specific role within the organization. Indeed, the KPIs are computed for each of the managers' roles, which most frequently are the five shown in Fig. 3.

In Fig. 3, each individual manager is an example of the types of data and information that are most frequently summarized for the plant management team in order to support their individual decision-making processes. For each type of line, there will be specific corresponding KPIs depending on the type of product made.

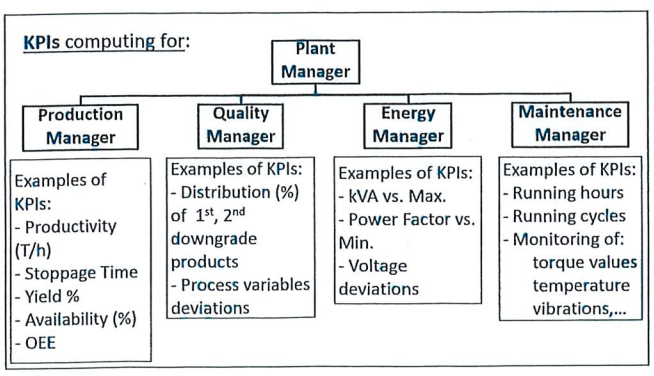

Fig. 3: KPIs for the line managers

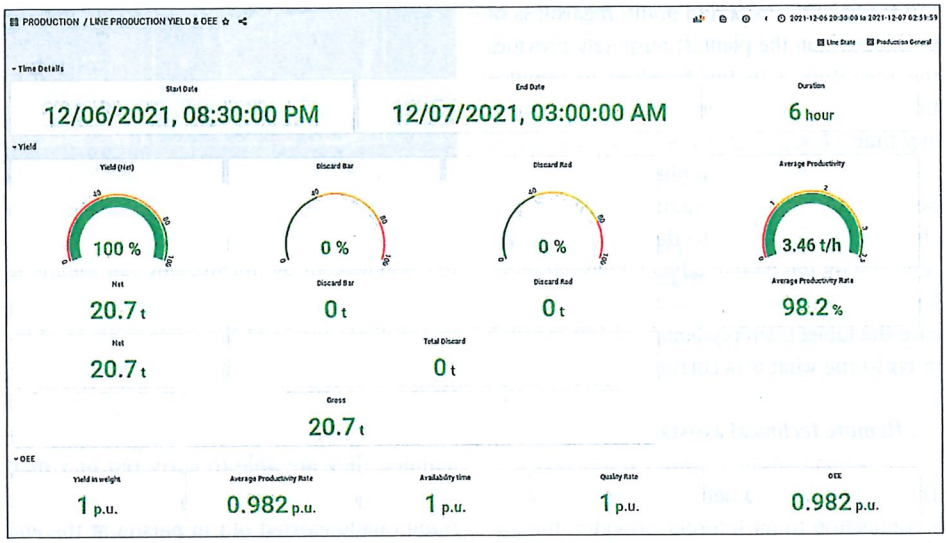

Fig. 4: A dashboard page for the production manager

To summarize the desired KPIs the automation system acquires the instrumental data from the LAN, stores them in the Scada database, which then processes, re-aggregates, and presents those data with values and graphs to each of the managers. The resulting KPIs are grouped in specific dashboard pages, individually accessible to each of the managers by the respective PC for continuous availability.

To complete this functionality and make it as timely and effective as possible, two further features are added to the aforementioned dashboard pages, allowing managers to no longer have to continually monitor site operations to make sure everything is proceeding smoothly. In this way, they can benefit from time saved in monitoring the plant, and gain time to address other more important and challenging activities. The Iulius 4.0 system itself will monitor the process for them and provide alerts when something deviates from the pre-established limits, through the following two features.

1. Automatic transmission of an email message, automatically generated when a process variable, selected among the most significant ones of the production process, exceeds a preset limit threshold. In the example below, an email alerts the QA Manager on his tablet in real-time of a molten metal over-temperature condition.

Furthermore, provision is also made for emails containing reports. For instance, every time a cast ends a new casting report can automatically be issued.

2. Transfer of KPIs dashboards to end us-

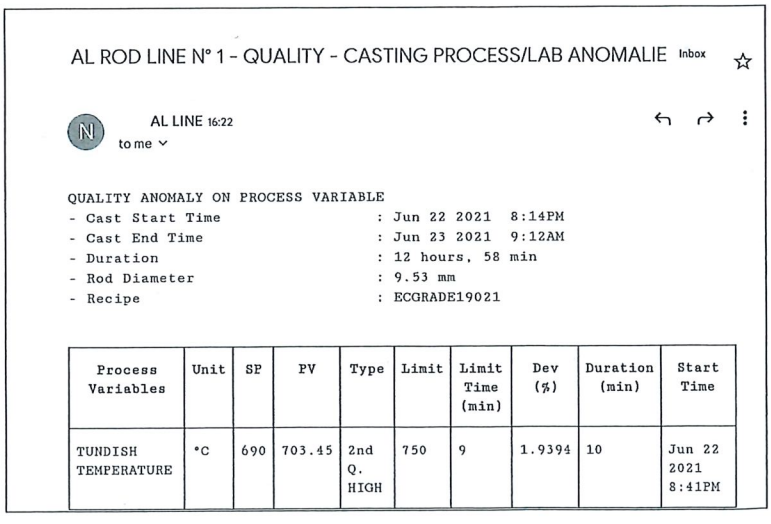

Fig. 5: Email on tablet

er's mobile devices. For instance, in Fig. 6 the QA manager selects the production period of a coils' batch of interest, touches a button to update the dashboard, and the specific KPIs regarding the quality of these coils appears. The green, yellow, and red needle indicators show the number of 1st quality coils, 2nd quality coils, and downgraded coils.

As a further instance, Fig. 7 shows a dashboard with the KPIs for a plant manager.

As can be guessed from the two previous examples, the elaboration of the indicators for each of the managers can only take place taking into account the specifics of the type of plant/process concerned. This is done through the digital acquisition of the data read from sensors and installed devices by the automation, their processing, and their exchange/transmission via LAN and Internet.

This task is so dependent on the specifics of the Properzi lines, that in order to be efficient it must be performed in an environment where the functions of automation and those of Scada are closely coordinated with each other. In this way, Scada becomes the first element of the IT system, with the computed data ready to be utilized by the end user, with all the automation and IT specifics already addressed in its programming.

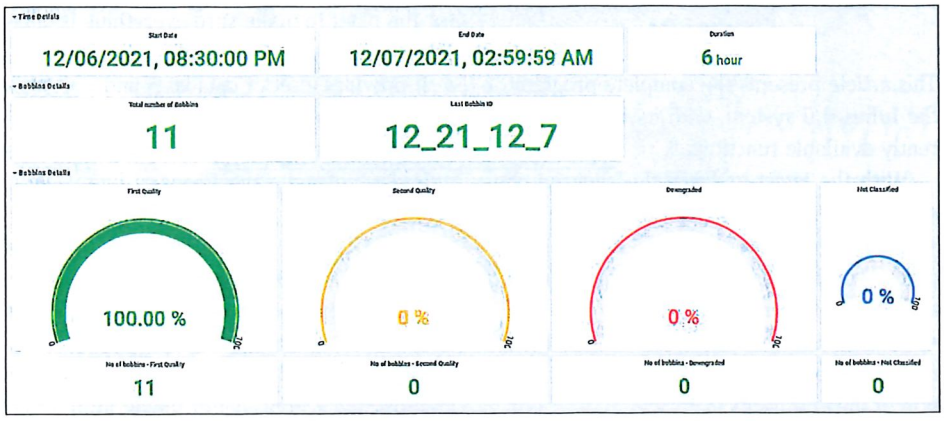

Fig. 6: Quality dashboard page on mobile

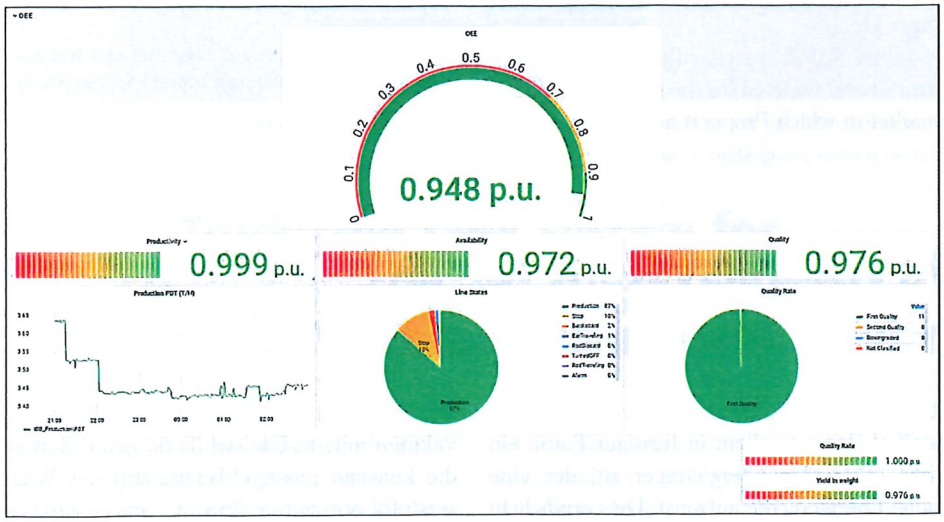

Fig. 7: Dashboard page for the line manager

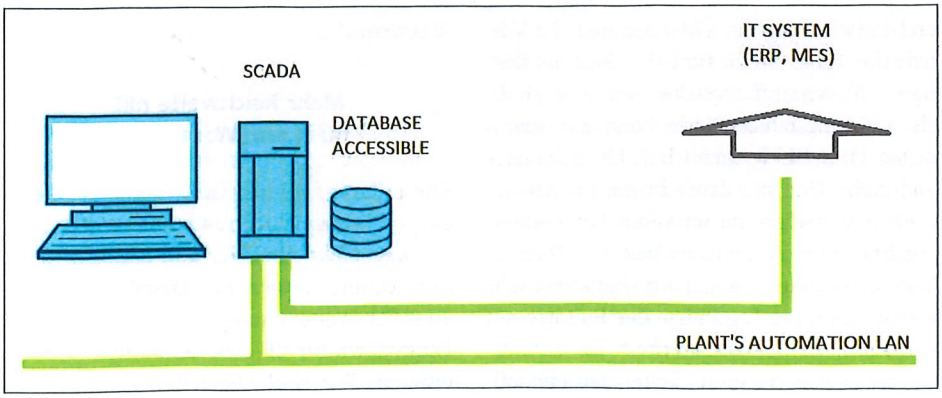

Fig. 8: Interface between Scada and user's IT

f.1. New features of the KPI dashboards

As the previous images have shown, one of the latest updates consists in the completely renewed dashboard pages with:

- New enhanced graphics, with a wider range of graphic elements to show the data, featured by the capability of being automatically scaled to the screen size of the mobile device in use,
- New searching and filtering functions, making it much simpler and immediate to search or filter data according to an assigned criterion, and with added features to compare different production periods, castings, shifts, type of products, etc.

g. Database for the end user's IT system

This function consists in generating an additional database to export and share data with the IT system of the end users.

Mainly the data in this database provide the end user with the possibility to combine, at factory level, the Properzi line data with the data coming from other lines or systems present at the same production site, for a general grouping of KPIs, or for implementing other new supervision or previously unforeseen functions.

These databases are accessed in Scada through an Ethernet port dedicated to data exchange with the end user's IT system.

To populate the new database, the Scada takes data from its internal database, and writes them in a well-diffused and effective standard, such as SQL server, for easy interfacing by the IT system of the end users. The database contains essentially two groups of data:

- Those containing the most significant line's process variables, just scaled and on a time basis, and
- Those where the Line's KPIs have been computed and stored.

The two above databases provide the end user with not only the possibility of implementing supervision functions at factory level, as mentioned above, but also with other more advanced ones, for instance in the fields of factory's KPIs, big data analysis and artificial intelligence. →

h. New interface with the end user's MES system

This function consists of a new interface, ready created with a set of ready-to-use data, which Iulius 4.0 instantaneously exchanges with the MES, the Manufacturing Execution System program that runs in the end user's IT. The MES has the main task of planning the line's production, improving and optimizing that of the overall facility.

The data exchanges between the Iulius 4.0 and the MES through this interface are of specific interest for the end users in order to digitally integrate their Properzi line with the logistical system, or with the supply chain in their factory, and/or with other lines present at the same production site.

Without entering into detail, it can be considered that these data exchanges mainly concern production plans, order plans, order completion, etc.

Through them, in combination with the KPIs, the email alerts, and reports computed by the Iulius 4.0 system, the production planning, tuning and control by the factory managers becomes much easier, more flexible and effective.

The data exchanges of this MES interface are carried out through a very common and effective protocols (such as OPC), which simplify the implementation on the end user side. Furthermore, the interface also makes use of several stored data to keep track of the exchanges with the MES system, and this is done with added extended tables (in the context of the previous function g.).

Naturally, this is a standardized solution so as to be ready-to-use for the end users. But if requested it can also be customized (i.e. additional data can be included, for different database standards, or different communication protocols).

Conclusions

This article presents the complete program of the Iulius 4.0 system, with its full set of currently available functions.

With the latest updates, the package now also includes two new features:

- Completely redesigned KPIs dashboard pages, with new highly improved graphics and searching or filtering capabilities,
- A new interface with the MES system ready-to-use for easy and immediate integration in the end user's factory.

Along with the Iulius 4.0 description the advantages for the Properzi end users have been highlighted. The most significant advantages are:

- Iulius 4.0 is specifically designed, engineered and realized for the non-ferrous metal market in which Properzi has been active for more than 70 years
- Together with the IT functions provided, it also includes all the concerned automation advantages,
- It captures and records all of the data that are essential for the process concerned, to provide ready-made KPIs and dashboards to the end users' managers on their PCs and mobile devices,
- It automatically generates emails containing alerts and reports on the managers' mobile devices, relieving them from having to monitor the plant to make sure everything is operating smoothly,
- It provides a set of databases and interfaces ready-made for the end user's IT, to drastically reduce resources, costs, and the time required to integrate the Properzi line in their digital factory.

All of this, in cascade fashion, produces benefits for various performance aspects, such as product quality on a more consistent basis, increased Overall Equipment Efficiency (OEE), easier and more timely identification of corrective actions, better yields, more timely decisions, etc.

Author

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Lkw-Kryotanksystem für LH_2 im intensiven Testeinsatz bei OEM

Das von der Salzburger Aluminium Group (SAG) zusammen mit Daimler Truck entwickelte erste LH_2-Kryotanksystem für flüssigen Wasserstoff ist im mit Brennstoffzellen betriebenen Mercedes-Benz GenH_2 Truck-Prototyp im intensiven Testeinsatz.

Die Entwicklungspartnerschaft beider Unternehmen im Bereich Kryotanksysteme für Flüssigwasserstoff-betriebene Lkw geht in die nächste Phase. Das von österreichischen Ingenieuren entwickelte erste LH_2-Speicher für Brennstoffzellen-Lkw ist auf der Daimler Truck Teststrecke im intensiven Testeinsatz. Das SAG-System zeichnet sich aus durch kompaktes Design, großes Füllvolumen, technische Verlässlichkeit und hohe Reichweite.

SAG sieht in grünem Wasserstoff einen Schlüssel zur CO_2-neutralen Mobilität. Das Unternehmen verweist darauf, dass Wasserstoff (LH_2), vor allem in flüssiger Form, ein sehr effizienter Energieträger ist, der eine hohe Energiedichte aufweist. Dies ermöglicht eine größere Tankmenge und damit verbunden eine höhere Reichweite von Fahrzeugen.

Johannes Winklhofer, Leiter Forschung und Entwicklung bei SAG, benennt die Vorteile des Tanksystems für LH_2: „Nur mit flüssigem Wasserstoff erreichen wir eine ähnliche Leistungsfähigkeit wie beim konventionellen Diesel-Lkw, nämlich 1.000 Kilometer und mehr. Und nur damit ist die Praxistauglichkeit vor allem im schweren Fernverkehr gegeben. Die Zusammenarbeit mit Daimler läuft sehr erfolgreich und wir sind schon sehr gespannt auf die Ergebnisse der Einsätze auf der Daimler Truck Teststrecke."

Das von SAG entwickelte bauraumoptimierte LH_2-Tanksystems ermöglicht ein hohes Transportvolumen. Der doppelwandige, vakuumisolierte Edelstahltank, gewährleistet die konstant niedrige Temperatur des Wasserstoffs auf minus 253 °C. Ein spezielles Ventilsystem, das für diese extrem niedrige Temperatur ausgelegt ist, sichert eine zuverlässige Versorgung der Brennstoffzelle mit Wasserstoff.

Mehr Reichweite mit flüssigem Wasserstoff

Karin Exner-Wöhrer, CEO der SAG, führt aus: „Wir entwickeln seit mehr als zehn Jahren Kryotanks für LNG und konnten so als Entwicklungspartner für Daimler Truck in vergleichsweise kurzer Zeit ein komplettes Tanksystem für LH_2 entwerfen und prototypisieren. Wir sind überzeugt, dass flüssiger Wasserstoff ein Game Changer in der klima-