

Digital twins in the service of safety

CAXperts UniversalPlantViewer brings the whole value of digital twins to BASF's operations in Antwerp.

As they are used in various forms, mostly with the intention of modeling a plant section including its piping and equipment, digital twins are not new to the process industry (1). Their importance has increased considerably over the years with the advent of Industry 4.0 initiatives. Unlike design models and their intrinsic schematic character, a digital twin enriched with additional information outside the engineering provides a very faithful representation of the real environment, for instance to study interactions between humans and machines. However, realistic scenarios can only be planned based on a digital twin in advance if all relevant 2D and 3D data are combined in a smart way: 2D data as expression for functional dependences and 3D models to provide reference for spatial orientation.

In respect of operational issues, digital twins have been developed to achieve consistent improvement in efficiency, minimize failure rates, and open up new business opportunities. Another application field is enhancing the safety of process plant operators and maintenance technicians by means of digital-based risk assessments (2).

So much for the theory. But what practical experience can be reported? "Here at BASF Antwerp, we are running a project called 'Antwerp 4.0' which, of course, is a subproject aligned with the global 'BASF 4.0' initiative. Within Antwerp 4.0, several workstreams are defined.

BASF's Antwerp site captured by plane

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“UniversalPlantViewer enables us to bring the full power of our 3D plant models closer to operations.”

Geert De Maesschalck

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“On the basis of CAXperts’ technology and integration scenarios, we are designing new use cases that no one had thought of before.”

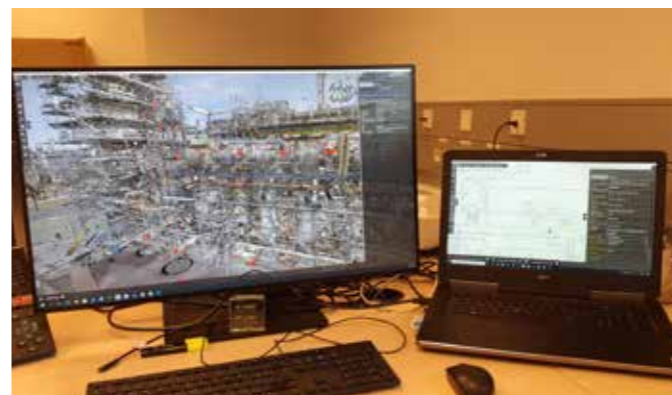
Vincent Janssens

One of these is called ‘Digital Operations’, and this is where our team has the lead. We are focusing on minimizing operational risk in permit management respectively document management. UniversalPlantViewer (UPV) from CAXperts is a crucial part of this,” explains Geert De Maesschalck, Expert Digital Operations with BASF, in an interview with our editors. As Mr De Maesschalck points out, a big part of this program is dedicated to digital twin scenarios in combination with UPV.

How far away are they from the vision of a digital twin? What really do you understand regard to that image of a plant? Simple enough questions, but not that easy to answer because of the site’s long history. More than 50 years ago, BASF set up shop in a strategic location in the port of Antwerp, a logistical heart of Europe. Over time, this site grew into BASF’s largest integrated production site in Belgium. “In terms of digitalization, we have four different levels with regard to the facilities – from beginners up to champions. For plants erected forty or more years ago, no 3D models at all are available – all the information is stored in filing cabinets full of paper,” says Mr De Maesschalck. You can find 3D models at different levels of maturity for newer plants, such as those manufacturing Saviva, which is built just five years ago. Saviva based on BASF’s droplet polymerization technology has been developed to provide outstanding absorption performance characterized by high capacity for superior leakage protection, long-term dryness and low rewet (3). “The Saviva plant is represented in a full as-designed 3D model and digital P&IDs, making it close to a ‘digital champion,’” the expert says. The other facilities reflect a broad spectrum of available digital data.

“Here in Antwerp, we generally differentiate between two types of digital twin: One is a digital representation that you can try to interact with. The other one stands for different workstreams of our digitalization strategy in terms of modeling what’s inside a plant when it is modernized. With the use of UPV, we are focusing on the interaction of humans with machines and other equipment, mainly to derive a total risk profile. Moreover, UPV’s deployment should enhance the efficiency of our maintenance process, our daily operation process, but also our engineering,” says Vincent Janssens, Mr De Maesschalck’s supervisor, clearly setting out priorities, before adding: “One of the biggest issues is always finding the right balance of effort compared to outcome in respect of different digital twin initiatives.”

UniversalPlantViewer in action



UniversalPlantViewer making intelligence visible

BASF is always looking for autonomous processes, but at the same time always keeps an eye on their feasibility. The good news: Use cases with UPV are increasing. But why introduce a new CAD viewer? Mr De Maesschalck answers: “The choice of UPV has been made solely on the basis that the use of CAD systems like PDMS, SmartPlant P&ID, or other design tools is too complex and its functions overly advanced for our operating personnel. Since they are involved in a lot of other tasks, it’s not their main role to learn how to handle a CAD system effectively.” The digitalization expert also points out that, besides the easy-to-use capabilities, crucial for BASF was how UPV is able to visualize the ‘intelligence’ of the CAD application, e.g. linked meta data within Smartplant P&IDs. “We want software that is as intuitive as Autodesk Navisworks but that is also able to process technical details rather than just graphic information. Otherwise, you cannot benefit from the knowledge captured in the engineering data in operations,” Mr De Maesschalck warns.



Play of colors

There is no question that UPV does this excellently, as both interlocutors assure our editors. The use cases currently focus on the use of 2D data, “because our key document for operation is the P&ID.” One application based on UPV is about coloring. “Let’s assume a specific fluid runs through an ensemble of pipes, steam, hydrogen, or whatever. In UPV, we can colorize all the affected pipes with just one click of a button,” says Mr De Maesschalck enthusiastically. Mr Janssens puts this success into perspective: “Typically what happens is that when a young operator comes into one of our facilities for the first time, he goes on a tour with a printed P&ID in his hands and starts marking up with a pen those lines in it that correspond to the pipes he identifies in reality. This procedure can be now automated in terms of coloring. For this use case there are filter layers and other search capabilities embedded in UPV. You can select items in the schematic and have them depicted in the 3D model where available. This kind of training material makes it easy to get to know the facility. And it’s really fun! You can view all the equipment in the 2D/3D documentation that you pass on your inspection tour.” It sounds a bit low tech but it is very useful in the operations and maintenance world, as Mr Janssens assures us. And indeed, the staff’s acceptance is very high.

Bridging the gap between generations – digitalization at your fingertips

Younger colleagues are instantly enthusiastic about the deployment of UPV, you just have to work with mobile devices. “The older people first try to figure out why they should be bothering with it in the first place. This generation is much more rational, searching for the usefulness behind it. In contrast, the younger ones tend to approach the matter emotionally. Without any shyness, they become experienced with UPV, appreciating both its look and feel. You need to explain to the older people why it is important,” says Mr Janssens, sharing his experience in dealing with cross-generation usage of the viewer. Clearly, in both age groups there are those that take one approach and those that take the other: baby boomers wearing smartwatches and trying to adopt new technologies in their work-life balance. And among the digital natives there are always those who tend to look for the challenges in a new technology. In any case, as the supervisor points out: “We really take care to minimize the change process. We try to introduce new UPV-based use cases without changing the work processes, otherwise it is too much for the staff.” In these disruptive times, people are still willing to embrace change, but only to a certain extent – step-by-step approaches should dictate all digitalization efforts.

Safer at work

Another cluster of use cases is the aforementioned risk assessment. Permits fall into the category of risk assessment, in a dedicated structured way. There are members of the staff who initiate an activity. They have counterparts on the maintenance side who take over the order and assign the corresponding measures executed by the technicians. The work could be handed over to third party contractors, too.

During the preparation phase, the responsible person used to mark up all the necessary procedures in a separate document, e.g. for pending pump maintenance. Subsequently, in this document, the permit would be recorded something like this: All liquid must be drained out, then the pressure must be released, followed by further instructions. This used to be purely paper-based, but now “we are bringing together the world of the P&IDs and the world of the permits: With a click on the different elements in the P&ID needed for the preparation of a maintenance task, these objects are formed as entity and handed over to execution. Merging this information with physical objects in the field and depicting it in UPV reduces any risk quite tremendously,” emphasizes Mr Janssens.

Later on, after pre-work checking and measures in the field have been completed, UPV ensures that the serviced system is returned to its original state by showing corresponding instructions. For example, a hint pops up that it is important not to forget to close a valve again. “We have integrated the power of our Smart-Plant P&ID database at functional locations and implemented mechanisms to make sure that everything is set back to normal when the job is done. UPV guides the technician to all the positions involved in the task,” Mr Janssens explains.

The permit request comes out of the SAP system, including the whole maintenance tree, and is loaded into the permit management software. All the elements that belong to a permit are selected in UPV. So, there is a hand-shake operation between these two software packages.

Inspiration from both sides

What has been the experience with CAXperts as the provider of the amazing UniversalPlantViewer technology and as a travel companion on the digitalization journey? Geert De Maesschalck is really excited: “Our collaboration has been great! Right from the beginning when I started working on our digitalization program, we have been in close contact with the vendor. UPV is



Saviva is a breakthrough innovation for superabsorbents based on BASF's pioneering droplet polymerization technology. It is produced at the Antwerp site

not a finished tool kit where ‘you buy use cases and then try to apply them to your processes’. The partnership with CAXperts has been more oriented to co-development. By sharing our own experiences in CAXperts’ program, we can enable other clients to benefit, too. And vice versa, to some extent, we can influence their roadmap to match our needs.” The comments of Mr De Maesschalck’s boss confirm this view: “They are willing to listen to us, and to carefully consider use cases we are looking at. UniversalPlantViewer is an invaluable aid to leverage the whole potential of the digital twin to serve our personnel in operations.” (bv)

References

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