

3D Documentation

Industrial plants



FARO

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Introduction

Industrial plant design, construction and operations

FARO is the world's most trusted source for 3D measurement and documentation technology. The company meets 3D measurement needs with a complete family of portable solutions, such as the innovative FARO Laser Scanner Focus^{3D}.

The reliable 3D data generated with the Laser Scanner is ideal for designing, building, restructuring and extending technical and industrial plants such as refineries, power plants and production facilities. The FARO Focus^{3D} is the perfect solution for complex projects that require complete and accurate 3D data throughout the various phases of a plant life-cycle.

3D scanning technologies offer numerous economical and

technical benefits in industrial plant design, construction and operating phases. They minimize risks and guarantee more safety for the delivery, maintenance and management of projects, which often require significant investments.

The FARO Focus^{3D} is a small, compact laser scanner equipped with an integrated touch-screen that makes it simple and intuitive to use. The SCENE software from FARO for processing scanned data is compatible with all software applications currently used in the plant design and construction industry, such as AutoCAD Plant 3D, AVEVA PDMS and Intergraph PDS, or sector-specific software such as PointSense, ESA Pro and LFM.

The FARO Focus^{3D} counts numerous applications in the piping and industrial sectors. These include:

- **Monitoring construction projects:** complete documentation and supervision of all construction phases.
- **Digital factory:** plant layouts and structural models in 3D.
- **Asset management:** simplified plant management and maintenance in a virtual environment.
- **Refurbishments and extensions:** precise as-built documentation for plant upgrades.



Benefits

- Simple to compare project and as-built data during the construction and inspection process.
- Availability of digital data on current conditions throughout the structure's life-cycle.
- Improved planning and scheduling thanks to precise and reliable data.
- Reduction of errors that may be generated by traditional measurement methods.
- Reduction of project risks in time-sensitive situations.
- Optimized collaboration between project partners thanks to online documentation sharing.
- Easy verification and monitoring of health, safety and environmental directives.
- Directly processing data with all of the most widely used CAD programs.

Precision and detailed information

Scanning industrial plants with traditional methods is an expensive time consuming and complex enterprise. The fast and millimetre precise FARO Focus^{3D} allows fast and extremely reliable data generation.

Monitoring construction projects

Complete documentation and supervision of all construction phases

Laser scanner technology provides complete and accurate as-built documentation - including photorealistic images - of the current conditions of plants and structures that are under construction. This supports clear monitoring of all phases of a construction project and the creation of a common database that ensures better coordination between the parties involved.

Precise documentation can be used as a basis for updating designs, projects, drawings, code requirements and other standards.

Engineers and project managers can rapidly survey discrep-

ancies between the actual conditions of the plant under construction and its design. Based on this survey, differences can be corrected before moving on to the next phase. It is generally simpler and less costly to re-plan, for example, pipe routes on a computer screen than to cut and weld new reels in the field.

3D monitoring thus reduces possible risks and limits cost increases throughout the various project phases. Projects with complex schedules benefit from additional savings as a result of improved sequencing and coordination of construction activities.



Benefits

- Precise construction planning based on actual data.
- Construction monitoring using accurate data.
- Rapid and precise comparison between project and as-built data.
- Continuous control and documentation of construction progress for legal and technical requirements.
- Greater certainty of regulatory compliance for principals, design engineers and building contractors.

Easy to use

Even under extreme external conditions, the FARO Focus^{3D} gives you the opportunity to concentrate on your work, rather than on the device. In fact, the intuitive touch-screen control makes the FARO Focus^{3D} as easy to use as a digital camera. It is a stand-alone solution: there is no need for additional devices, laptops or external cables.

Digital factory

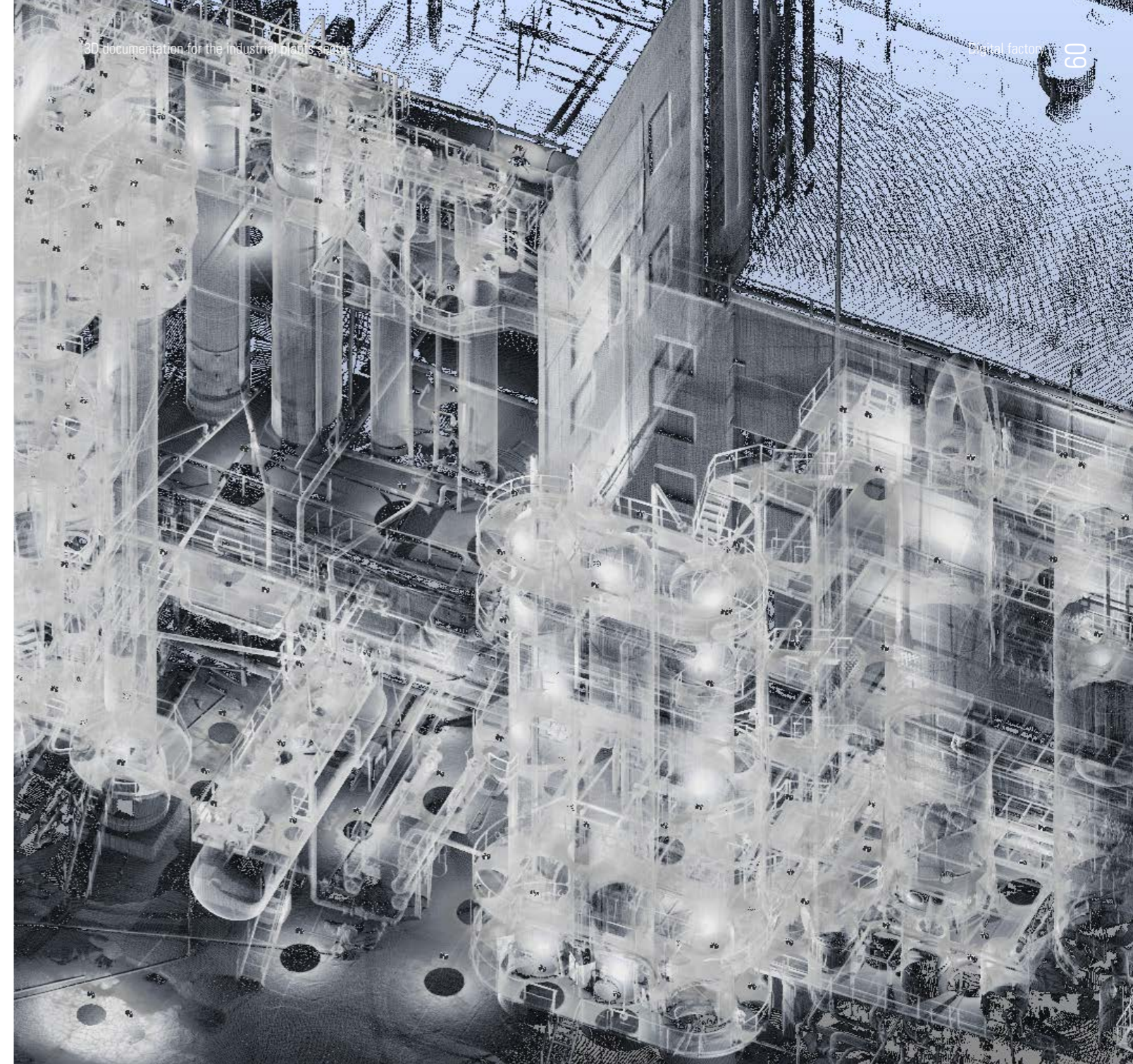
Plant layouts and structural models in 3D

The FARO Focus^{3D} supports the creation of 3D models that can be used in designs, simulations and feasibility studies. In fact, data captured via 3D scanning can be used to virtually process structural models and plant layouts in CAD environment.

Simulations on existing plants can be done if changes or additions need to be made. Feasibility and efficiency can then be assessed within a virtual environment, decreasing the possibility of errors and ensuring savings of time and money.

Precise and detailed data on specific parts or components, such as pipes and valves, can be used to reconstruct and pre-integrate them into an already existing plant or a structure under construction.

The possibility of documenting an entire plant in digital format supports engineers in creating a complete and precise model. This can be used as basis for the reconstruction of an existing structure in a new location.



Benefits

- Project time reduction thanks to feasibility studies in CAD environments.
- Error reduction by checking new configurations and installations in virtual environments.
- Saving time and money by reconstructing already existing plants and structures in new locations.

Affordable

FARO Focus^{3D} is a powerful, compact tool for 3D documentation within a broad range of applications. This versatility and the beneficial price/quality ratio make it an extremely attractive solution. A 3D laser scanner has never been so affordable.

Asset management

Simplified plant management and maintenance in a virtual environment

Laser scanning provides complete and precise 3D documentation which supports the different activities linked to managing and maintaining production plants and structures.

3D point clouds can be converted into smart models with the use of modern infrastructure management software. Users can not only view the position of parts and components, but also their comprehensive details.

Plant management personnel, who may even be located off-site, can manage various assets, organise maintenance processes, plan maintenance work and manage training activities directly from their desktops.

In case of problems or emergencies, all of the appropriate information can be found immediately, thus facilitating rapid and efficient problem-identification, often without requiring physical presence at the plant.



Benefits

- Remote plant management and maintenance drastically reduce time spent on on-site inspections.
- Better control over costs and schedules in situations requiring repair work.
- Reliable as-built documentation simplifies and speeds up the training of plant personnel.

Collaboration

SCENE WebShare Cloud is a cloud-based hosting solution for easy and secure sharing of scan data via the Internet, improving collaboration amongst project partners.

Refurbishments and extensions

Precise as-built documentation for plant upgrades

Plants often need to be changed, restructured or expanded due to changing market requirements, unforeseen situations, new procurement sources, regulatory updates or technical innovations. It is important for companies to manage these changes effectively and efficiently to minimise shut-down time and associated costs.

When work is carried out on existing plants, such as in revamping or brownfield projects, there are often discrepancies between actual installation conditions and the original plant design.

The FARO Focus^{3D} creates an exact digital copy of actual con-

ditions, which can be used as a basis for changes. Thanks to precise and complete 3D documentation operators can identify conflicts between proposed designs and actual conditions, and check any critical measurements and specifications relating to installations and components such as motors, pumps, valves, pipe systems, etc.

The areas requiring revamping work can be processed and updated by using geometrical models and photo-realistic images with colour information from scan data. 3D data can also be processed by specialised software to accurately explore and assess different design options.



Benefits

- Complete and precise as-built data to document actual plant conditions.
- Easy identification of interferences between original design and actual conditions.
- Increase in productivity and reduction of costs by limiting changes on the field.

Portable, light and compact

Measuring only 24 x 20 x 10 cm and weighing just 5 kg, the FARO Focus^{3D} is a lightweight device that can be easily moved and placed in each new scanning position with minimal effort. This is important for fast work even when scanning complex structures like industrial plants.

Regulatory compliance

Precise data to support safety regulation compliance

Industrial plants are often complex and dangerous environments. This is why they are subject to increasing levels of regulation and control by governments and public entities. This requires creation and updating of as-built and the “as-maintained” documentation of production facilities.

3D laser scanning has shown itself to be a well-established technology for providing high quality and complete documentation of plant structures, which is needed to satisfy compliance requirements under health, safety and environmental protection directives.

Ensuring maximum safety

It is often important to limit exposure to risks among workers responsible for surveying as part of documentation, revamping and extension projects.

The speed of the Laser Scanner Focus^{3D} considerably reduces the time of exposure to potentially dangerous areas compared to traditional methods. It is also unnecessary to return to the location more than once, because the quality and quantity of the data captured are more than sufficient: this also translates into a drastic reduction of costs linked to surveying activities.

As additional benefit the required plant shut-down time decreases significantly.

In recent years, partly as a result of certain accidents, the oil and gas industry has sought out new methods for reducing work in the field under extreme conditions. Dimensional controls with 3D scanning has been recognised as a suitable method for limiting hazardous operations, such as cutting and welding pipes. Laser scanning has also been used to effectively assess damage caused to off-shore platforms by weather events, such as hurricanes.



Benefits

- Document plant compliance with safety regulations.
- Rapid and precise support for assessing damaged areas which conceal potential risks.
- Project risk reduction when site access is hazardous or expensive, or in time-sensitive situations.
- Greater speed and safety compared to manual surveying methods.

FARO Laser Scanner Focus^{3D}

Five steps of 3D documentation



1. Setup

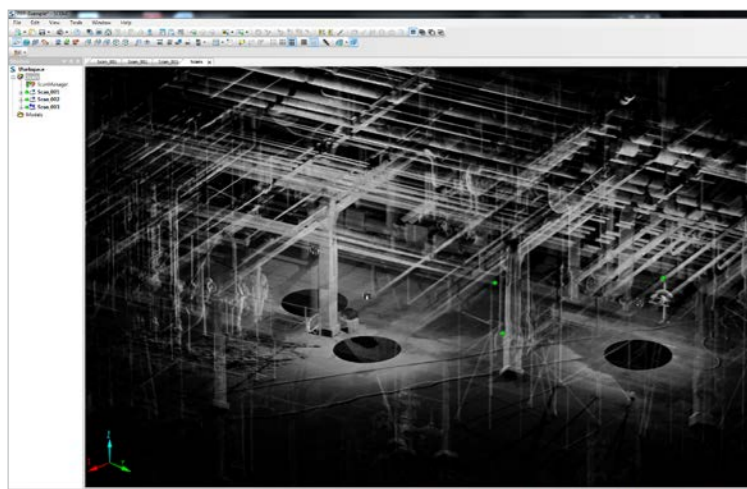
After only two minutes setup time, the FARO Focus^{3D} is ready to scan: It can be easily and quickly mounted on a tripod – just like a normal camera. No external devices such as laptops or batteries are required. Before the first scan is started, the coordinates have to be defined. Registration markers are easily positioned, so that the individual scans can subsequently be combined.

2. Recording data

The project can be created in advance on the PC in the office and the individual settings pre-defined. Alternatively both can be carried out directly on the FARO Focus^{3D} with its easy-to-use touchscreen. The FARO Focus^{3D} is well-known for its short measuring times: it takes between two and fifteen minutes for a 360-degree scan, depending on the required resolution, depth of detail, colour or black-and-white scan.

3. Data analysis in SCENE

The individual scans of a project can be combined almost automatically with the help of the registration markers and the SCENE software. In SCENE it is also possible to remove any irrelevant scan information and reduce the data volume. The compass integrated in the FARO Focus^{3D}, the GPS, the altitude sensor and the dual-axis compensator greatly reduce manual post-processing.

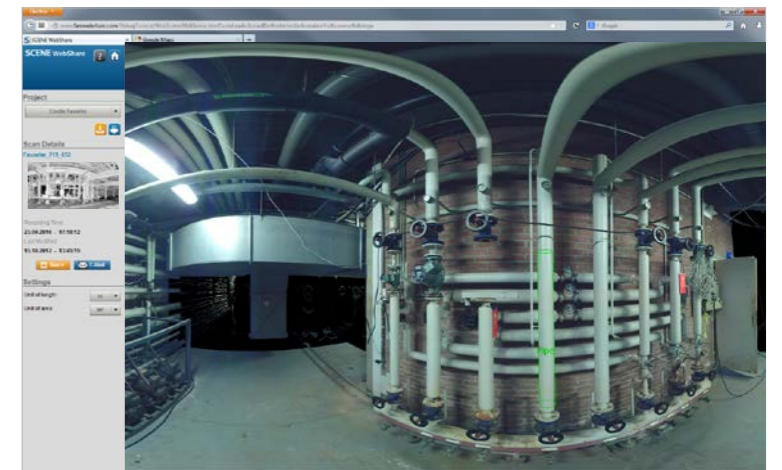


4. Wide-ranging applications

The SCENE software enables the scan data to be transferred to all commonly available CAD software solutions for the design and the construction of plants and facilities. The scan data is thus available for 2D applications and 3D visualisations of all kinds.

5. Global collaboration

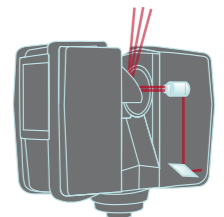
With SCENE WebShare Cloud, laser scans and additional information such as CAD drawings, photographs or floor plans can quickly be shared via the internet with the push of a button. That makes collaboration with others involved in the project much easier. WebShare access is carried out via a standard internet browser. Direct measurements can also be done there. In this way all the project partners can work on data simultaneously, which significantly speeds up the processes.



Measuring method

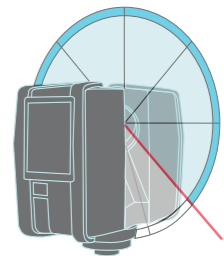
Distance

The laser scanner transmits a laser beam, which is reflected by an object back to the scanner. The distance is measured with millimetre precision by means of the phase difference between the transmitted and received beams.



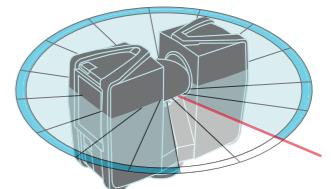
Vertical angle

The mirror directs the laser beam through the space in a vertical direction. The angle is recorded at the same time as the distance measurement.



Horizontal angle

The laser scanner turns horizontally through 360° while scanning. The horizontal angle is recorded at the same time as the distance measurement.



Defining the 3D coordinates

Distance, vertical angle and horizontal angle result in polar coordinate (d, α, β), which are converted into cartesian coordinates (x, y, z).

Product information

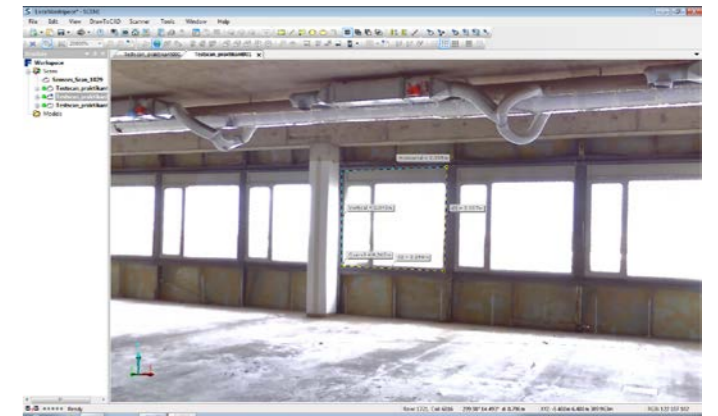
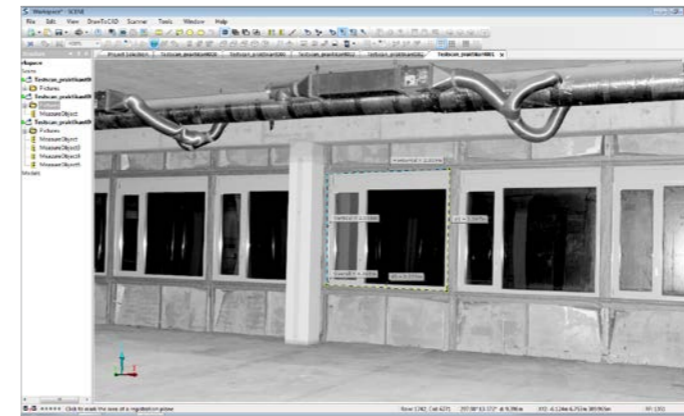
FARO Laser Scanner Focus^{3D} X 330 and Focus^{3D} X 130

- Range: Focus^{3D} X 330: 0.6m – 330m; Focus^{3D} X 130: 0.6 – 130m
- Size: 24 x 20 x 10cm;
- Weight: 5.2kg
- Scan duration, standard scan: b/w: approx. 2min, colour: approx. 5min
- Systematic distance error: ± 2mm
- Can be operated without any external devices
- Intuitive touchscreen
- Integrated colour camera with automatic, parallax-free colour overlay for photo-realistic 3D colour scans
- High-performance lithium-ion battery for recordings up to 5 hours; charging while in operation possible
- SD-card for easy and secure data transfer to the PC
- GPS, integrated compass, altitude sensor and dual-axis compensator simplify the combination of scans
- Seamless integration into AutoCAD Plant 3D, AVEVA PDMS, Intergraph PDS and many others applications.

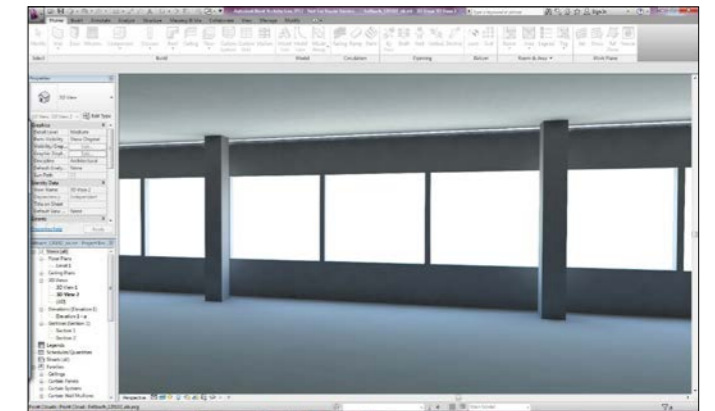


SCENE to CAD

From the production of a point cloud to the CAD model



The individual scans of a project can be automatically combined in the SCENE software. The recorded scenery can be viewed in three dimensions in SCENE and measurements can be taken with simple tools directly in the scan data. All the scans are also available in colour and as high-contrast intensity images. In SCENE it is also possible to remove any irrelevant scan information and reduce the data volume.



After the scan data has been prepared in SCENE, it can be transferred with no difficulty to a large number of commonly available CAD systems such as AutoCAD Plant 3D, AVEVA PDMS e Intergraph PDS or industry-specific software such as PointSense, ESA Pro and LFM. There the scan data can be immediately used to produce as-built plans or for the planning of conversions and extensions.



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