3D Documentation

Architecture & Construction Markets

FARO®

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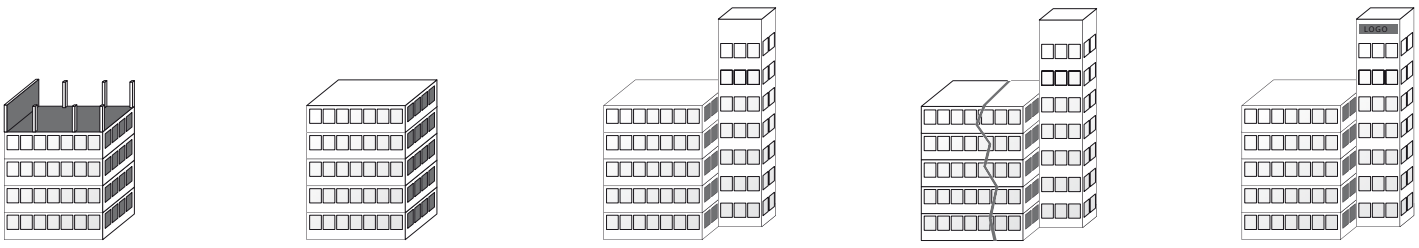
3D Documentation: Architecture & Construction Markets

Best-in-class tools

FARO® is the leading manufacturer of mobile systems for measurement, documentation and imaging. One of the most recent developments from FARO is the Focus^{3D}, an extremely powerful mobile laser scanner. It is especially suitable for architects, civil engineers, facility managers, construction contractors and surveyors. For them it is a tool for the rapid, complete and precise 3D documentation of the current status of buildings and building sites.

3D documentation using the FARO® Focus^{3D} Laser Scanner forms the optimum basis for the planning and execution of building projects as well as for the management of properties. Yet the Focus^{3D} has even more to offer: it supports quality assurance for building work, it brings down costs, it ensures greater legal certainty and it simplifies the everyday work of construction and real estate professionals. Thanks to its intuitive control concept with touchscreen display, the Focus^{3D} is as easy to operate as a digital camera.

Both the FARO Focus^{3D} and the companion SCENE software are compatible with all commonly used software applications in construction and surveying. The flexible interfaces of the SCENE software enable connection to AutoCAD Architecture or Revit as well as many other CAD applications such as Rhino, Microstation, Nemetschek, ArchiCAD and CAFM solutions. That makes the Focus^{3D} a key tool for the architectural and construction markets.



The Focus^{3D} supports the entire lifecycle of buildings with precise 3D data.

Key Benefits

- Rapid, simple and complete recording of the current status of buildings and building sites.
- Immediate processing of the data in all commonly used CAD programs.
- Simple variance comparison in the construction process and in the case of final building inspections.
- Greater transparency, greater legal certainty in claim management.
- Revolutionary price/performance ratio.
- Digital current data is available for the entire building lifecycle.
- Web-sharing tool facilitates working with parners.

Superb Mobility

The smallest and lightest laser scanner ever: measuring just 240 x 200 x 100mm and weighing only 5.2kg, the Focus^{3D} is compact and mobile.

Building Construction

Precise documentation, rapid variance comparison

Weighing just 5.2 kilograms, the Focus^{3D} Laser Scanner is ideal for mobile usage on the building site. It records foundation excavations, building shells and complete buildings in three dimensions – completely, quickly and cost-effectively. The precise calculation of dimensions and volumes makes it possible to conduct a variance comparison with ease, with the aid of CAD data. The options are rounded off by comprehensive and even photographic 3D documentation.

With its high level of precision, the device assists site managers, construction companies and finishing contractors with their construction quality assurance. For example, in checking the precise fit of facade elements and complex free-form components, in the case of shuttering elements in concrete constructions, in the positioning of structurally sensitive supports and in numerous other applications. Regular quality control with the Focus^{3D} ensures that everything runs more smoothly in construction and interior works, as countermeasures can be taken promptly when faults are detected. This helps to achieve cost-savings and creates greater legal certainty, for example with regard to delays or reworking. The laser scanner makes it easier to provide evidence that the work has been executed correctly, and particularly in the case of final inspections it enables rapid and precise variance comparison.

The Focus^{3D} also supports all the installation work that is carried out on the finished building shell. In this work only precise actual values can ensure the quality of execution.

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Key Benefits

- Enables precise construction planning on the basis of actual data.
- Monitoring of execution during construction on the basis of actual data.
- Rapid and precise variance comparison in final building inspections.
- Seamless monitoring of construction progress for legal and technical documentation.
- Greater legal certainty for developers, planners and contractors.

Practical Application

"We often carry out 3D documentation right from the construction phase. Our clients want to be able to access precise, three-dimensional actual data at a later date, such as volumes or dimensions, by means of laser scanning, for example to demonstrate any deviations from the original order in the work carried out. The data material also forms a valid basis for the preparation of invoices."

Andreas Landau, Engineer, Steinbacher Consulting & Engineering Co.

Right from the excavation phase, the Focus[3D] delivers a high degree of transparency for everyone involved. Comparison of scans before and after excavation makes it possible to calculate precisely the volume. In the case of the construction project pictured here, it is 768 cubic meters.

Easy to Operate

Thanks to its intuitive control concept with touch-screen display, the Focus^{3D} is as easy to operate as a digital camera. The device also operates fully independently – no additional equipment, cables or laptops are required.

Facility Management

Efficient processes

Three-dimensional building data offers facility managers valuable assistance – from technical facility management through to property management. With the Focus^{3D} the required data can be recorded with ultimate ease and immediately used for the digital 3D documentation of properties and installations.

In this way it is easy to document any changes to the existing building. The data can be loaded into commonly used CAFM programs via a CAD interface and are immediately available to a wide range of facility management processes.

3D documentation with the FARO Laser Scanner also forms an ideal planning basis for structural alterations and redevelopment measures for existing buildings. The scan data provides an accurate three-dimensional model of the actual status of the building. As a result, for example, facility managers can run through the usage options for rooms even before planning actually begins. Changes to technical equipment, such as pipes, air ducts and electrical supply lines, can be depicted and checked in advance in the virtual model. This offers a stable basis for replanning.

FARO - Jürgen Krämer

Key Benefits

- Changes to an existing building can be very easily documented.
- Ideal basis for the planning of building work.
- The recorded actual data is available for CAD applications and CAFM programs.

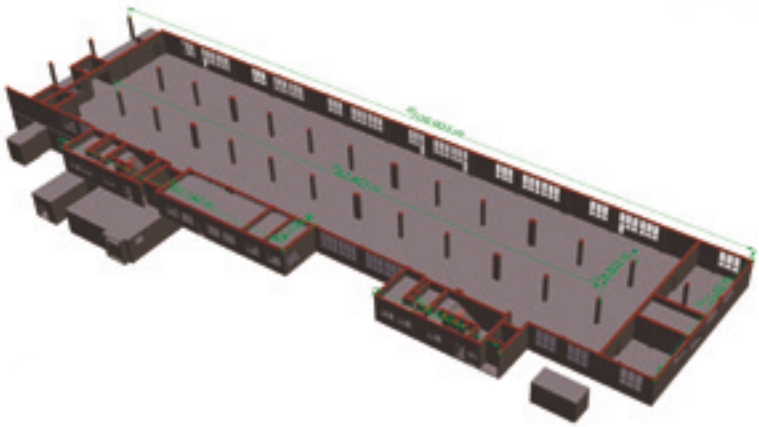
Norbert Wüsteney, Engineer, Wüsteney

The Focus[3D] accurately records the inventory data that is needed by facility managers – be it the structural situation in a production plant or the building services equipment in an office block. The data can be used with all popular CAD applications.

Practical Application

"We had our factory buildings recorded by means of laser scanning years ago, as the basis for construction plans. We rescan individual sections as required, in order to keep the existing CAD plans and models up to date. The precise data is a great advantage in our work. In layout planning, for example, clearance heights or gate widths can be calculated with great accuracy right here on the computer."

Robert Burian, Specialist Facility Management (CAD), MANN+HUMMEL



Economical

The Focus^{3D} is a powerful and compact tool. It provides 3D documentation for a very large number of applications. It also boasts an impressively favorable price/performance ratio. A 3D laser scanner has never been so affordable.

Building Renovation

Fast and precise: measurement with the Focus^{3D}

Measurement forms one of the key steps when renovating an existing building. It is the basis for the design and planning of a building project, and then for its execution. The quality of the recorded data is correspondingly important.

The Focus^{3D} provides many advantages in building renovation. Working with the laser scanner speeds up measurement in many cases, and hence can save costs. Data acquisition is extremely precise and usually more complete than with conventional processes. This ensures a greater degree of certainty in planning and execution.

The digital measurement data is available for further processing in all commonly used CAD applications, from the design process at the architect‘s through to construction and production planning in companies carrying out the work, such as in the metal-working industry. With digital measurement, all drawn plans can be refined. The level of detail can also be defined relatively freely when working with the Focus^{3D} and can even be subsequently further refined. The data acquired on site is evaluated in the office. This enables better time and cost planning for measurement work, and has the advantage that it is possible to take measurements in buildings which are in use, without interrupting operations for long periods of time.

The Focus^{3D} also scores well in the monitoring of the execution process. When continuously deployed it enables 3D documentation of the construction progress. It records the area and thickness of clad, plastered or tiled wall and ceiling surfaces as well as of screed flooring or other floor coverings. In this way surface dimensions and volumes remain transparent, even after the work is completed. Disputed finished work dimensions such as varying plaster thicknesses can be reconstructed as needed with the aid of the building structure dimensions.

Once the building project has been completed, the 3D documentation with the actual data is available for further applications. This delivers some major advantages for facility management in particular.

FARO, Jürgen Kraemer

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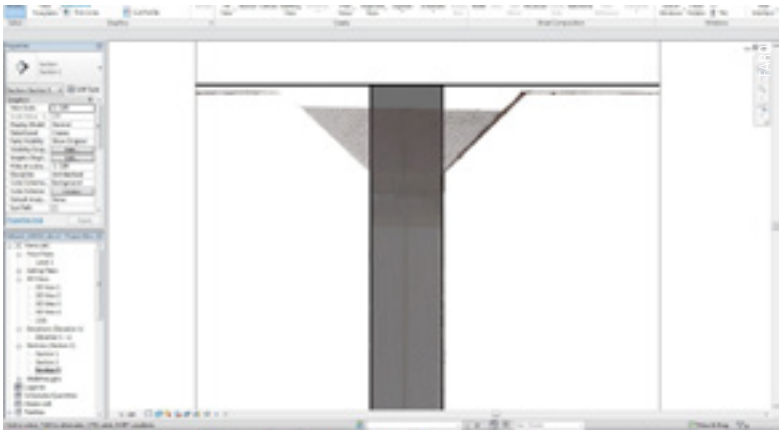
Key Benefits

- Fast and hence cost-effective measurement, rapid preparation of plans.
- The precise data represents an outstanding basis for planning and construction. This precision ensures higher quality in the implementation of the project.
- An ideal process, particularly when there are no up-to-date plans.
- Rapid and precise variance comparison in final building inspections.
- 3D documentation creates greater certainty for everyone involved.

FARO, Jürgen Krämer



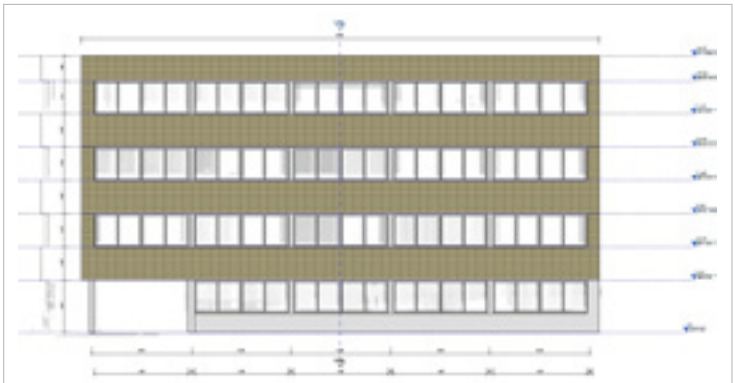
Monitoring and quality control during the construction phase. Dimensions can be checked directly in the scans. The superimposition of the execution plan with the scan of the existing building allows a detailed comparison.

Practical Application

"3D documentation enables our architects' office to carry out the rapid, precise, and comprehensive inventory of a complex structure and of its entire surroundings. No other process is capable of providing such a wealth of visual and geometrical data. 3D documentation has become indispensible for us in the context of building renovation."

Johannes Rechenbach, Architect,
Laser Scanning Architecture


Johannes Rechenbach, Laser Scanning Architecture


Johannes Rechenbach, Laser Scanning Architecture

Accurate Recording

The high-level precision of laser measurement and the tremendous speed when scanning surfaces are key to the high-quality 3D documentation achieved with the Focus^{3D}.

Monument Protection

Ideal basis for the planning of building work

Monuments, churches, bridges, historical town houses and much more: construction jobs also regularly occur at protected buildings. Often, however, there are no adequate building plans on which to base future plans to modernise or renovate.

The Focus^{3D} enables the comprehensive 3D documentation of historical buildings. The laser scanner speeds up on site measurement and as a result of its precision it enhances the quality of planning and execution. Data can also be recorded on site and then processed at a later date in the office, with varying degrees of detail for further planning - for example in CAD applications. The type of measurement often demanded by planning authorities for building applications, which takes into account any deformation, can easily be produced with the laser scanner. Multiple measurements of the property are no longer necessary, as the data generated by the Focus^{3D} comprehensively records the building and its surroundings.

Furthermore, 3D documentation is eminently suitable for the reconstruction of design features and structural conditions.

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Key Benefits

- Rapid preparation of plans provides cost-effective measurements.
- The degree of measurement detail can be easily defined according to the project.
- Precision ensures high quality during the project implementation compared to traditional methods.

Norbert Wüsteney, Engineer, Wüsteney

Norbert Wüsteney, Engineer, Wüsteney

Practical Application

"We always use the FARO Laser Scanner for recording historical buildings. In that way we get high-quality, detailed 3D data. With it we can achieve high-quality measurement even in inaccessible areas."

Norbert Wüsteney, Engineer, Esslingen Co.

The Focus^{3D} brings a high degree of benefits to the surveying process. It not only enables the rapid and precise measurement of historical buildings; the highly-detailed 3D documentation of sensitive pieces of stucco decoration is also possible.

Extremely Powerful

The Focus^{3D} is a very powerful tool for the rapid, complete and precise documentation of the current status of buildings and building sites.

Building Damage

3D documentation improves safety

Damage to buildings can cause substantial economic losses to property owners. It can also reduce a property's current and future value.

The FARO Laser Scanner is an outstanding tool for the rapid 3D documentation of building damage – for example after the collapse of a building structure or after ground movement. The Focus^{3D} captures highly accurate spatial data and provides 3D photo documentation at the same time.

The data from the Focus^{3D} forms the basis for comprehensive evidential documentation and the calculation of property damages. When further processed for CAD applications, the data can be directly used for the actual planning of renovation measures.

3D documentation can also be employed for preventative purposes. Particularly in cases of insurance-related or legal disputes, it provides a higher degree of security for developers and construction companies. This applies for example to evidential documentation before possible structural changes to a building as a result of extensions, neighbouring building projects or tunnel construction.

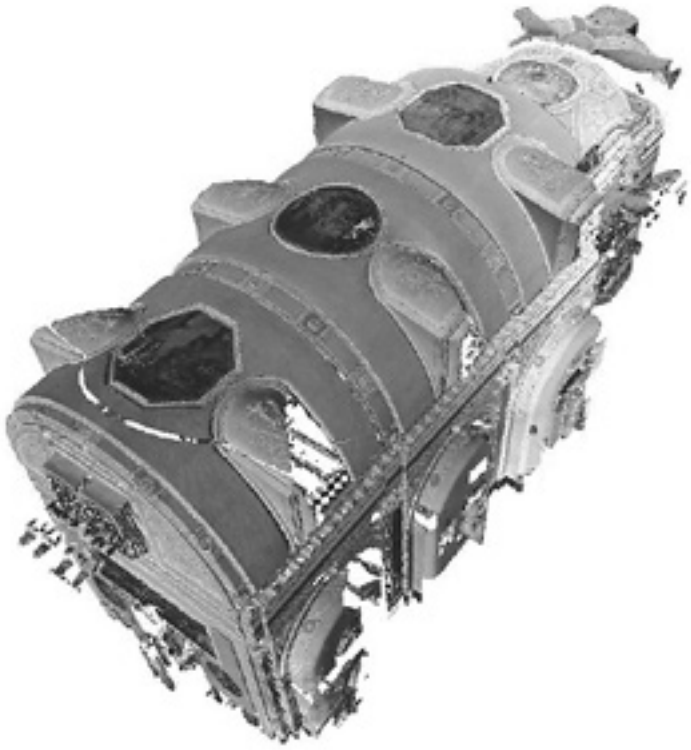
The laser scanner can also be used for continuous monitoring, for example in order to document changes during ongoing construction work or for the purpose of deformation monitoring as a basis for the structural evaluation of building components. The Focus^{3D} also supports the rapid and cost-effective testing of the specified load capacity of the supporting structures, as well as checking for wear.

The strengths of the Focus^{3D} include the simple and rapid calculation of the evenness of building components. With the help of the scan data it is possible to analyse and color-code the deformation inside a wall, the deflection of ceilings or the curvature of floor surfaces.

University of Bergamo, Faculty of Engineering

Key Benefits

- Greater legal certainty for developers and contractors.
- Comprehensive and objective evidential documentation.
- Ideal for the determination of existing damage, but can also be used preventatively and for continuous monitoring.

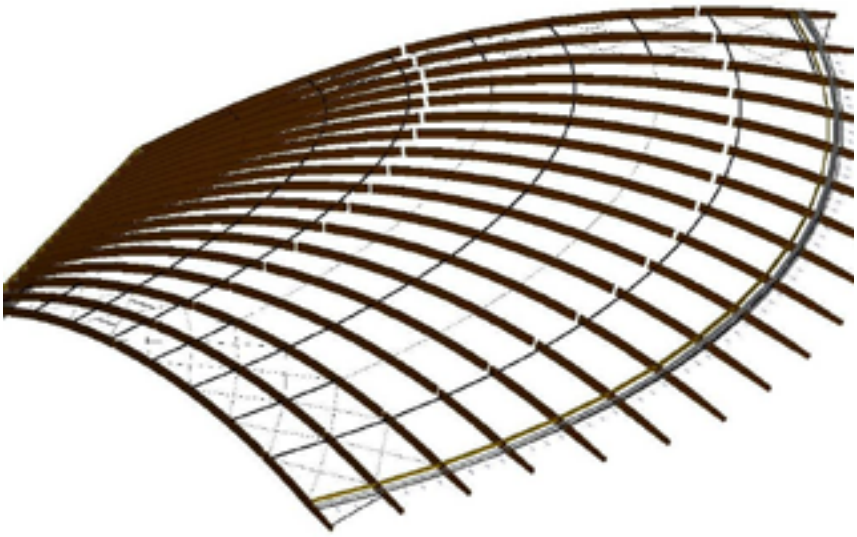


A church after an earthquake: The Focus^{3D} delivers precise 3D documentation of the damage and supports the planning of the complex renovation measures.

Practical Application

"Laser scanners are ideal for the continuous monitoring of damage to buildings. For example, we monitor movements of supporting columns and as a result of the scans we have also been able to detect the reasons for the damage. When new roofs are fitted we check with the scanner to see whether there is any distortion of the supporting structure."

Andreas Landau, Engineer, Steinbacher Consulting & Engineering Co.



Extended Range

Thanks to its mid and long range distances (130m and 330m) and the comprehensive options for data processing in commonly available CAD and other software solutions, the Focus^{3D} proves to be an efficient aid for real estate professionals.

Real Estate Transactions

Major advantages for technical due diligence and marketing

In the context of real estate transactions the condition of buildings can be precisely analysed and assessed. This relates to the building itself, the technical equipment and any necessary modernization or renovation measures so the new owners are able to assess the necessary investments required.

The Focus^{3D} delivers comprehensive 3D documentation to meet these requirements and assists in the valuation of properties by rapidly recording their current condition. The 3D building data can be exchanged with ease and discussed by the parties involved at various locations by means of WebShare.

The Focus^{3D} also offers great potential for the marketing of real estate. Clear, three-dimensional building models can be created with the help of the scan data. It is also possible to achieve attractive visual effects. For example, with the SCENE software for the laser scanner it is possible to generate views and perspectives of a building from freely selectable vantage points. Bird's-eye views are also possible. Virtual three-dimensional fly-through videos can be easily produced with Pointools software.

As all the measuring points are present in the digital model with precise three-dimensional coordinates, it is no problem with a suitable hardware package to achieve stereoscopic 3D navigation. These wide-ranging options can be of great assistance in marketing. Virtual 360° panoramic views provide investors with a valuable decision-making aid which can be retrieved from the internet at any time and in any place.

Key Benefits

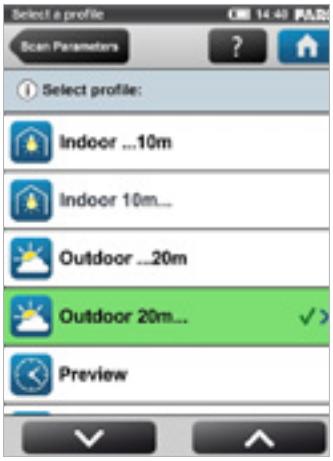
- Comprehensive 3D documentation as the basis for property valuation.
- Data can be used immediately for subsequent building work.
- Attractive visualisations for real estate marketing.

FARO Laser Scanner Focus^{3D}

Five steps of 3D documentation

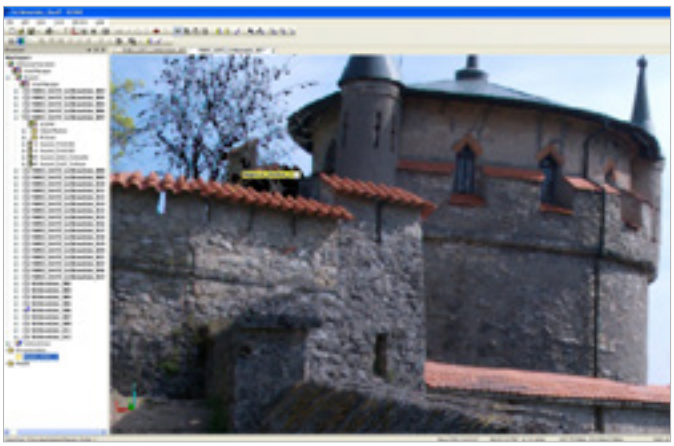
1. Setup

After only two minutes setup time, the 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 Focus^{3D} with its easy-to-use touchscreen. The 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 Focus^{3D}, the altitude sensor and the dual-axis compensator greatly reduce manual post-processing.

4. Wide Range Applications

The SCENE software enables the scan data to be transferred to all commonly available CAD software solutions for architecture, construction engineering, preservation of sites of historic interest, surveying and tunnel construction. The scan data is thus available for 2D applications and 3D visualisations of all kinds.

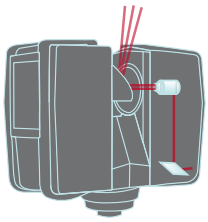
5. Global Collaboration

With SCENE WebShare, 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

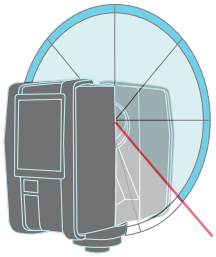
Distance

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.



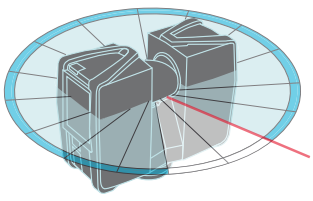
Vertical Angle

The mirror directs the laser beam through the space in a 300° 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).

Technical Information

FARO Laser Scanner Focus^{3D} X Series

- Size: 240 x 200 x 100mm; weight: 5.2kg
- Range of Focus^{3D} X 130: 0.6–130m
- Range of Focus^{3D} X 330: 0.6–330m
- Scan duration, standard scan: b/w: approx. 2 min, color: approx. 5 min
- Systematic distance error: ± 2mm
- Can be operated without any external devices
- Intuitive touch-screen
- Integrated color camera with automatic, parallax-free color overlay for photo-realistic 3D color scans
- High-performance lithium-ion battery for recordings up to 4.5 hours; charging while in operation possible
- SD card for easy and secure data transfer to the PC
- Outdoor scanning capability in direct sunlight
- Integrated GPS receiver helps correlate scans during post-processing
- 50% noise reduction for extraordinary scan quality
- Integrated compass, altitude sensor and dual-axis compensator simplify the combination of scans
- WLAN: Scans can be started, stopped, displayed and downloaded from a distance
- Seamless integration into AutoCAD Architecture, Autodesk REVIT, Bentley MicroStation, Nemetschek Allplan, ArchiCAD, Rhino, AutoCAD Civil 3D, PolyWorks Surveyor, Carlson, MicroSurvey, JRC 3D Reconstructor, ATS RR Tunnel, Amberg TMS, AVEVA PDMS, Intergraph PDS, AutoCAD Plant 3D and many others

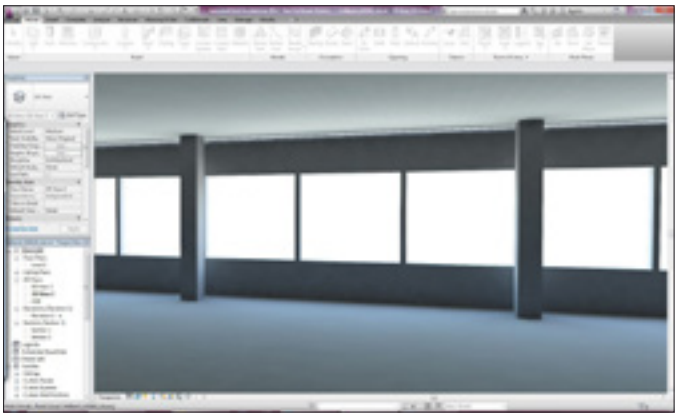
FOCUS^{3D} X 330

FOCUS^{3D} X 130

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 Autodesk Revit, AutoCAD Architecture and Bentley MicroStation). There the scan data can be immediately used to produce plans of existing buildings or for the planning of conversions and extensions.