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State of the Art Measuring with Laser Technology

Program Director Disto and Lino

Content

- The life cycle of a building
- As-built measurements – challenges
- Measurement technologies for state-of-the-art measurements
- Important questions for the selection of the most suitable measurement solution

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A building is more than just an implemented construction plan

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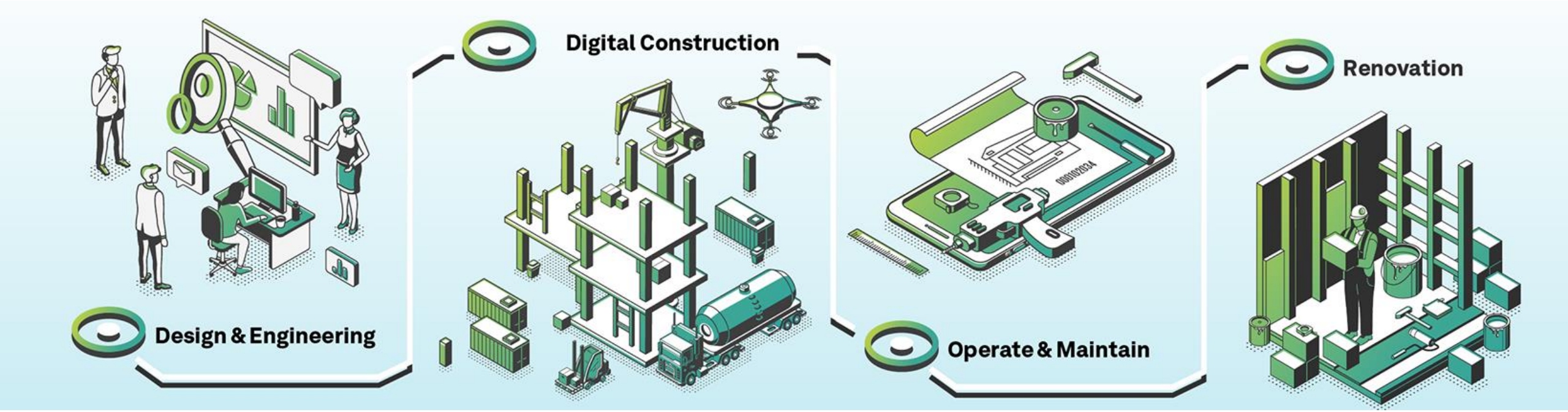
The life cycle of a building

Building in the context of the different life phases of a building



The construction of a building requires detailed planning of the design and construction work, taking into account existing factors (such as an existing building).

Execution must be precise, as complexity and influencing factors are always increasing. Progress must be precisely documented to prevent surprises later on.

The essential part of a building's life cycle is its use. Adjustments are also required during this period, which must be carried out and documented precisely.

In order to ensure sustainability in the face of increasingly scarce resources, it is important for buildings to be usable for a long time. Renovation means a life-prolonging measure of an existing building.

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The life cycle of a building

What is the driver for my future tasks?

New technologies

Energy efficiency

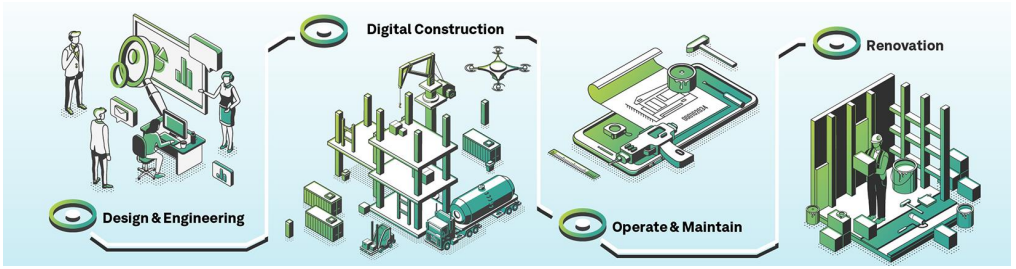
Resource scarcity

Investment object

Safety

Sustainability

Urbanization



Demo-graphic changes

Climate change

Change in use

Regulations and standards

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Determine the status quo

As-built measurements

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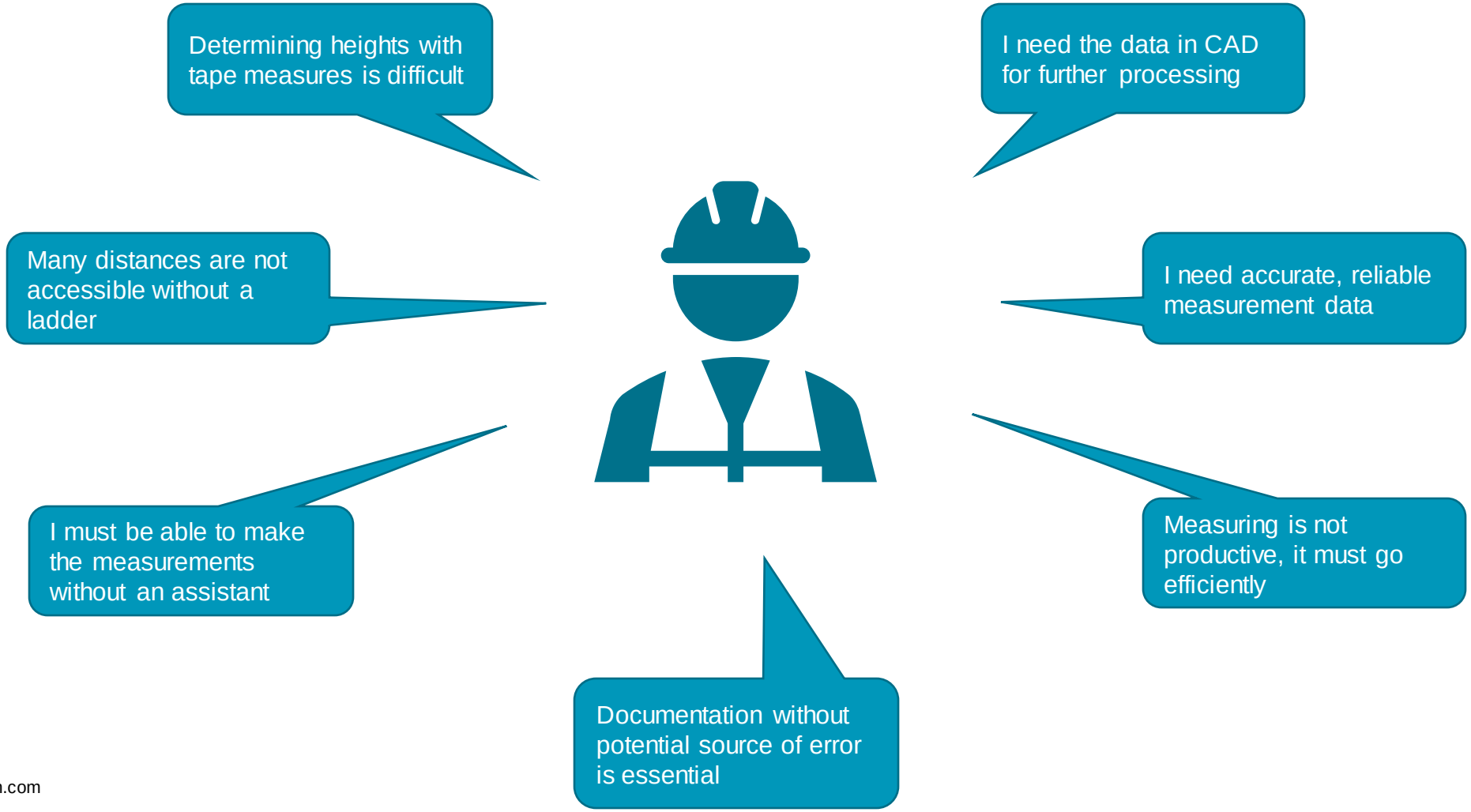
Challenges when measuring in existing buildings

From the user's point of view



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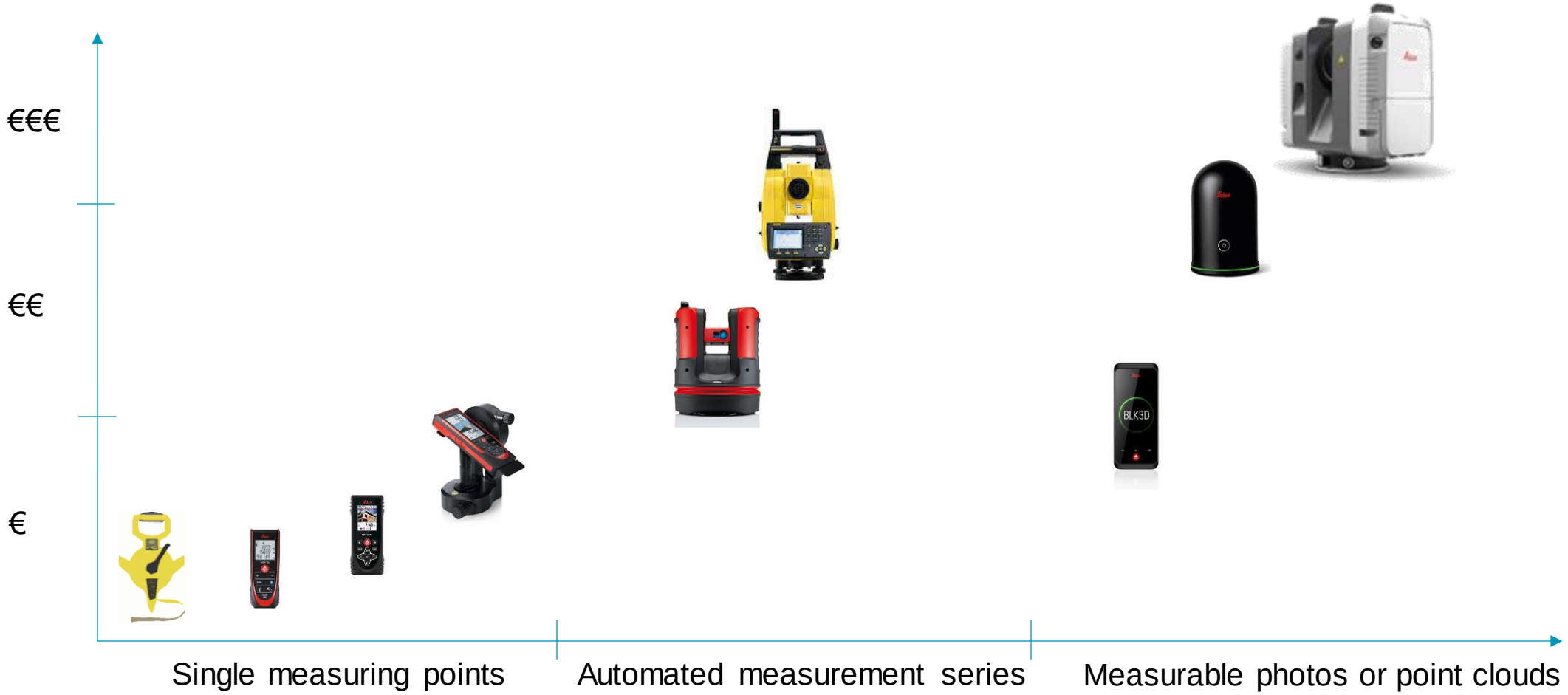
Possible measurement solutions

Performance versus budget



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Measurement solutions

An overview with the most important features

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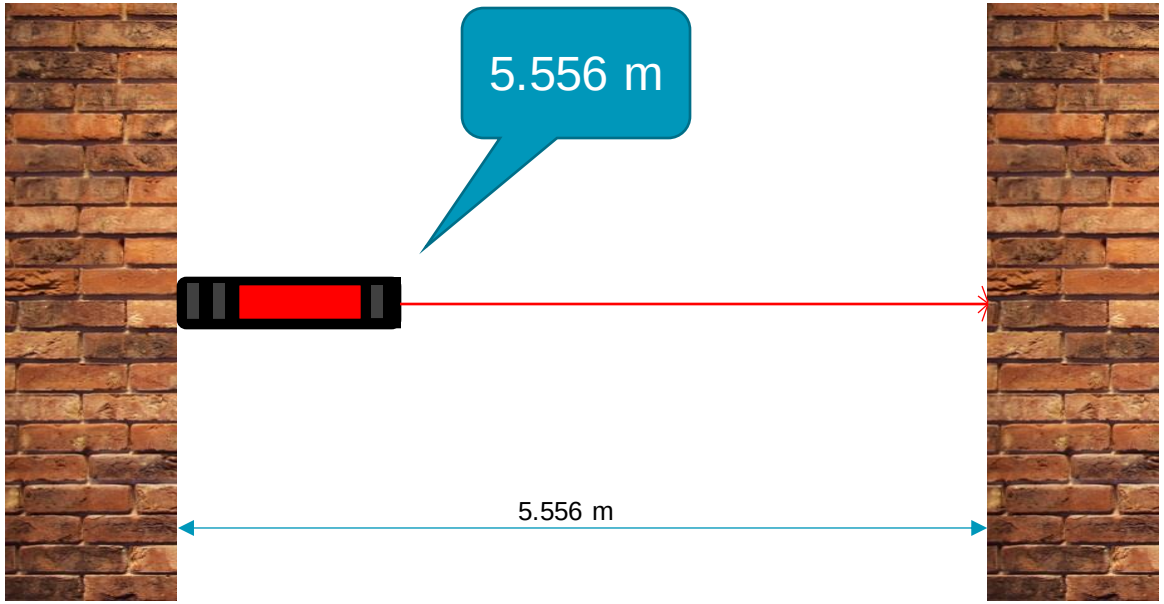
Measurement technologies for state-of-the-art measurements

Measuring a distance with a laser distance meter(LDM)



My advantages:

- Accuracy of up to 1mm possible
- No error due to " rolling off" a measuring tape to the target object
- No summation of multiple results when using multiple meter sticks
- Exact, pinpoint measurement possible, even on smaller targets
- Measuring without a measuring assistant to hold a tape measure

Restrictions:

- Measurement of very short distances is easier with tape measure
- Staking out dimensions is cumbersome

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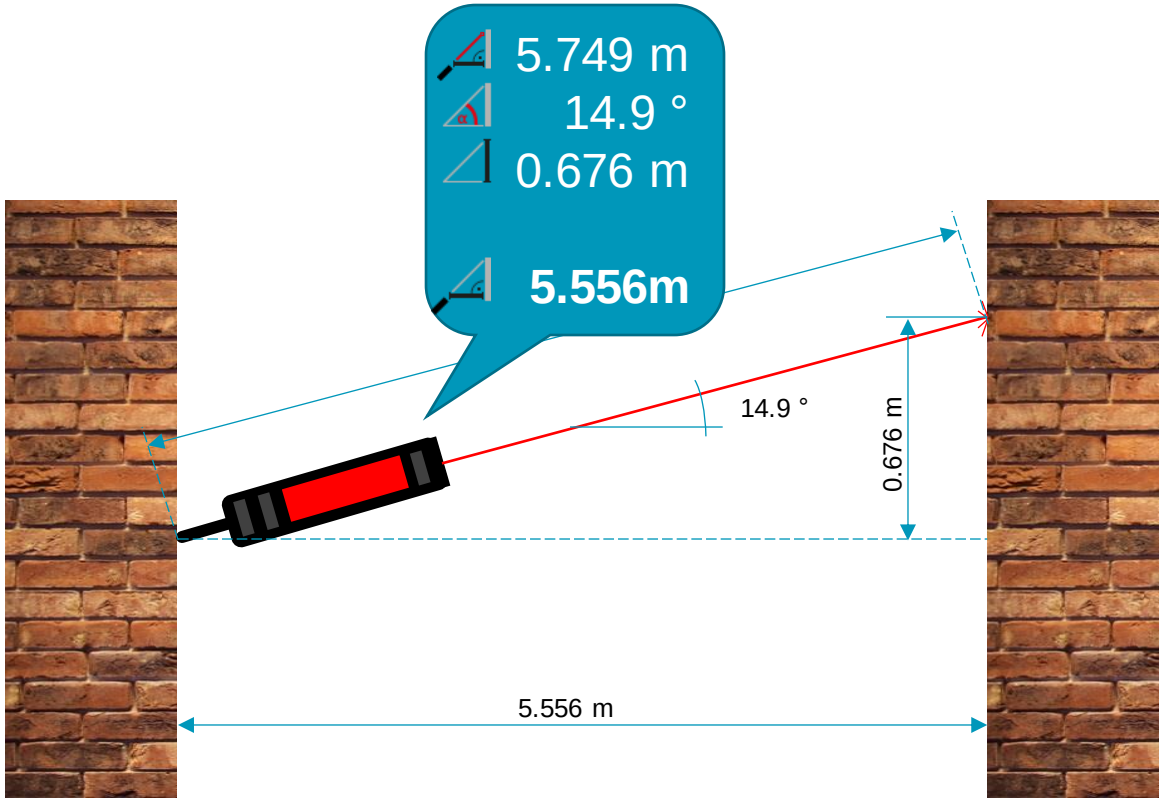
Measurement technologies for state-of-the-art measurements

Measuring a distance using an LDM with integrated tilt sensor



My advantages:

- Accurate result, as errors are compensated when targeting at a slight angle (Smart Horizontal Mode)
- Measuring over obstacles (e.g. furniture or passers-by) (Smart Horizontal Mode)
- Provides multiple measurement results with only one measurement
- Indirect measurement of heights and lengths in one measuring direction

Restriction:

- Measurements in the 45° range somewhat less accurate

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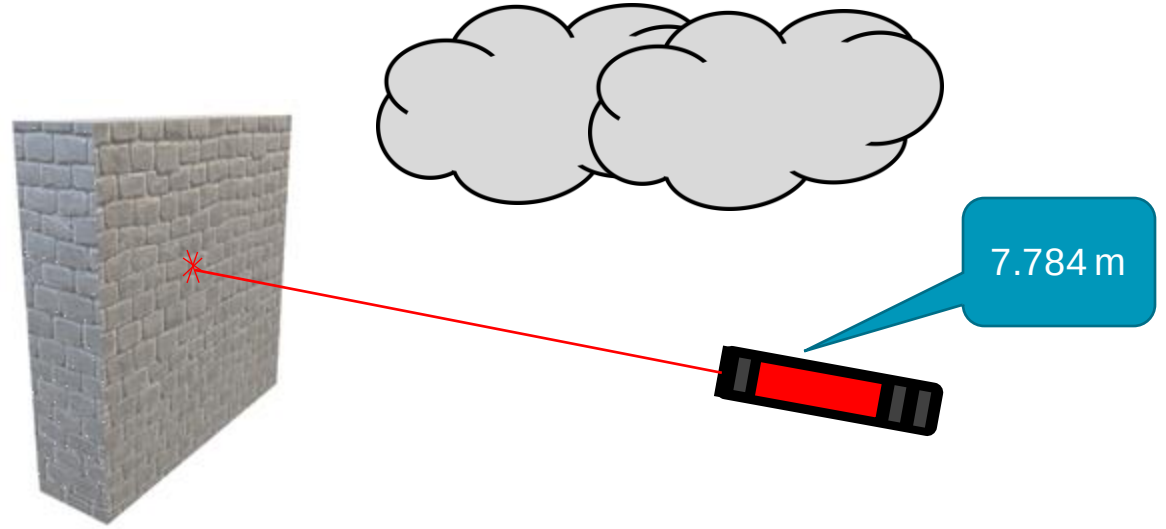
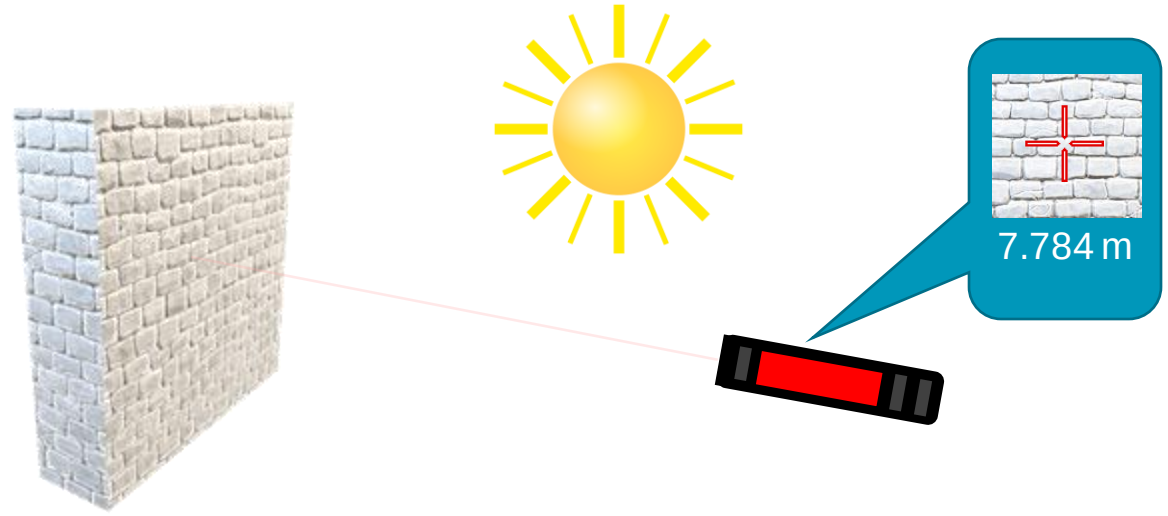
Measurement technologies for state-of-the-art measurements

Measuring and aiming with digital Pointfinder





My advantages:

- Accurate aiming possible even in sunlight
- Reliable measurement even outdoors
- Zoom for measurements even over longer distances

Restriction:

- In case of strong light on display, it must be shaded

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Measurement technologies for state-of-the-art measurements

Measuring a distance by means of point-to-point (P2P) measurement

My advantages:

- Measurement even of widths or diagonals in areas that are difficult to access
- Measurement of roofs without having to climb on them or by counting the roof tiles
- Convenient measurement of any distance between two measuring points from one position

Restrictions:

- Measurement requires stable stand or better a tripod
- Measurements slightly less accurate (5mm@5m resp. 10mm@10m)

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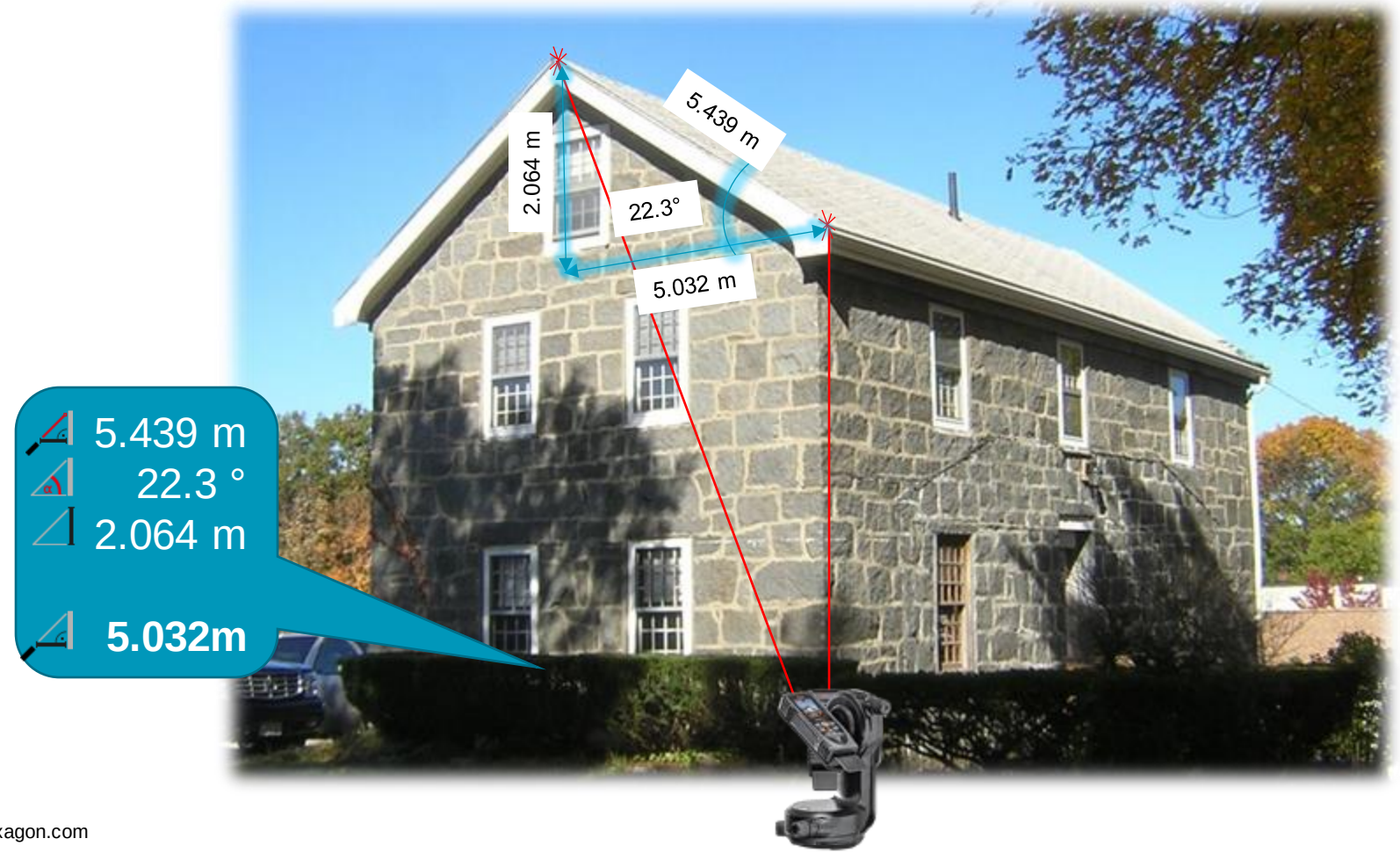
Measurement technologies for state-of-the-art measurements

Measuring a distance by means of point-to-point (P2P) measurement of a leveled device



My advantages:

- Convenient measurement of any distances, heights and inclinations between two measuring points from one position
- Measurement on objects that are difficult to access
- Capturing of measuring points for a CAD file (2D and 3D)

Restrictions:

- Measurement requires stable stand or better a tripod
- Measurements slightly less accurate (5mm@5m resp. 10mm@10m)

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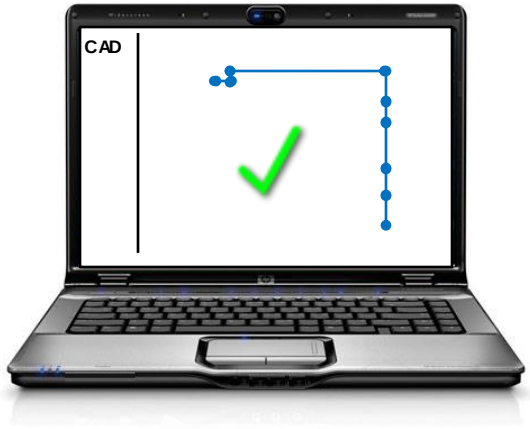
Measurement technologies for state-of-the-art measurements

The Digital Construction Site



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Specific software solution or plugins for generic CAD programs

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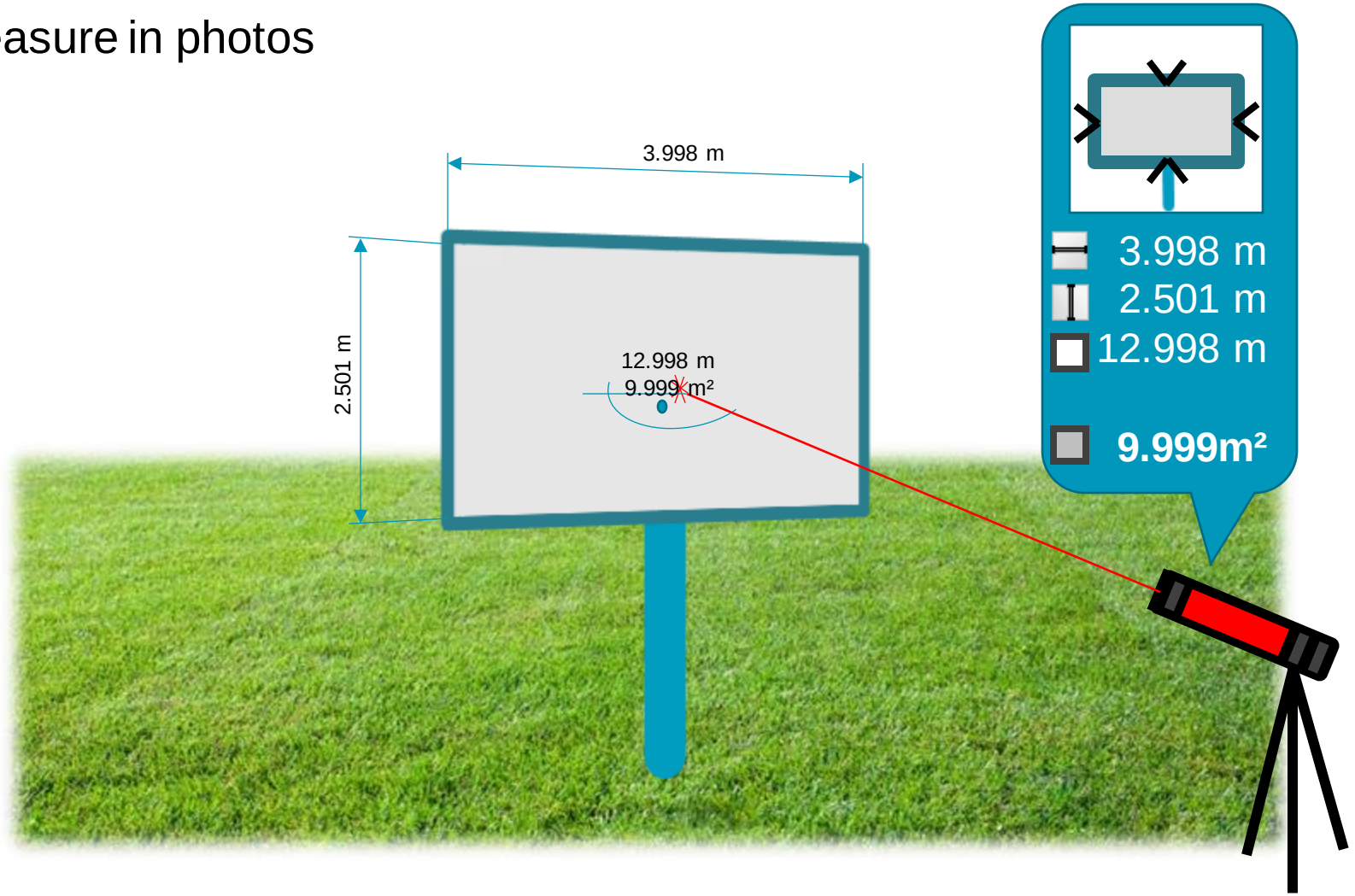
Measurement technologies for state-of-the-art measurements

Measure in photos



My advantages:

- Easily measure widths, heights, areas and diameters with only one measurement
- Documentation of the measurement possible by saving the photo
- Slope when aiming is taken into account for calculation

Restrictions:

- Measurement requires stable stand or better a tripod
- Measurements are slightly less accurate (approx. 1-2% deviation of measured sizes)

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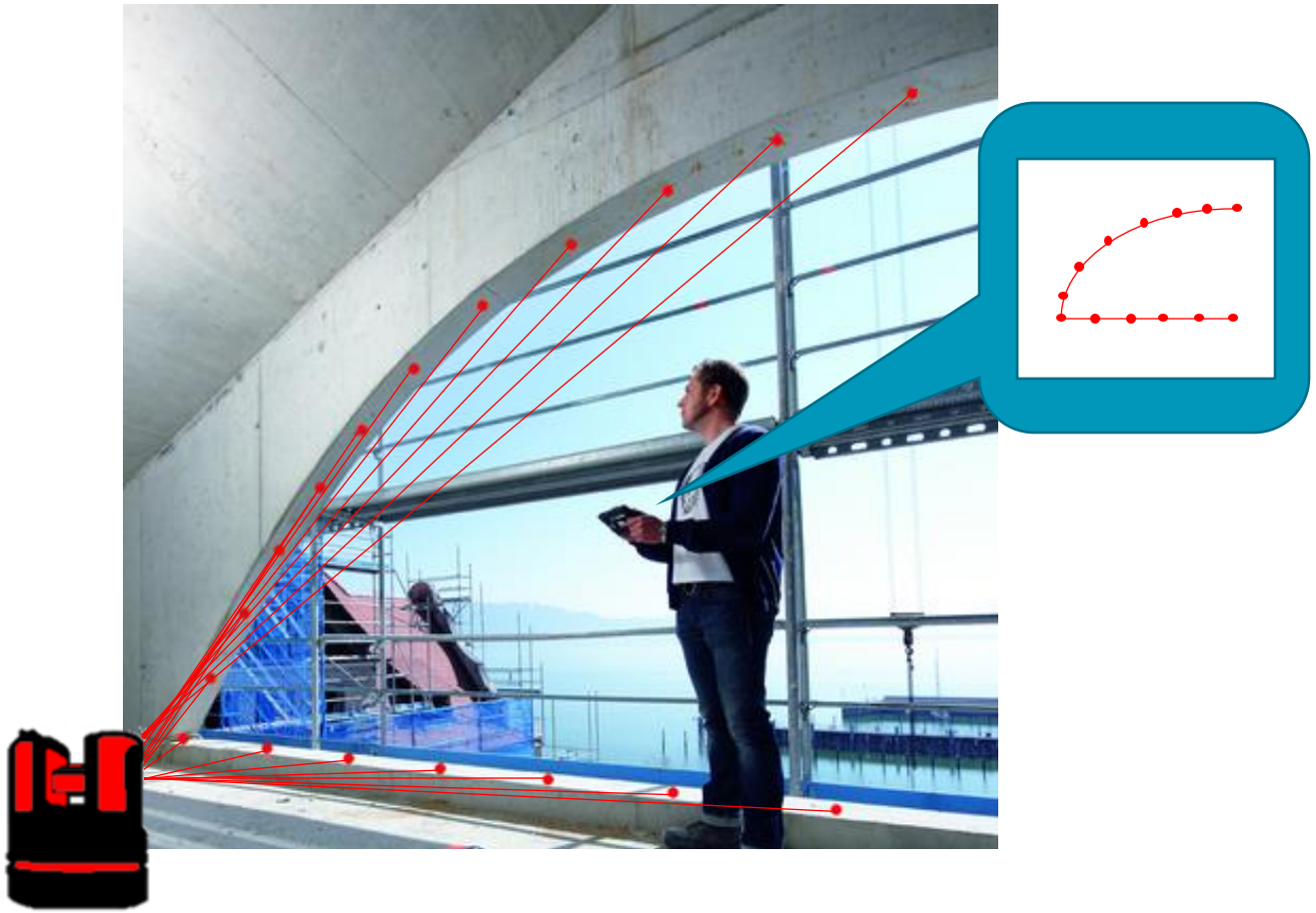
Measurement technologies for state-of-the-art measurements

Measuring and CAD documentation in one - 3D measuring stations



My advantages:

- Fast and automated capture of geometries
- Control via tablet
- High precision also for indirect measurements (1mm@10m)
- Saving in CAD-compatible data formats
- Further plans or capture of complex geometries possible by repositioning the device

Restriction:

- Setup requires some time
- Tablet required on construction site

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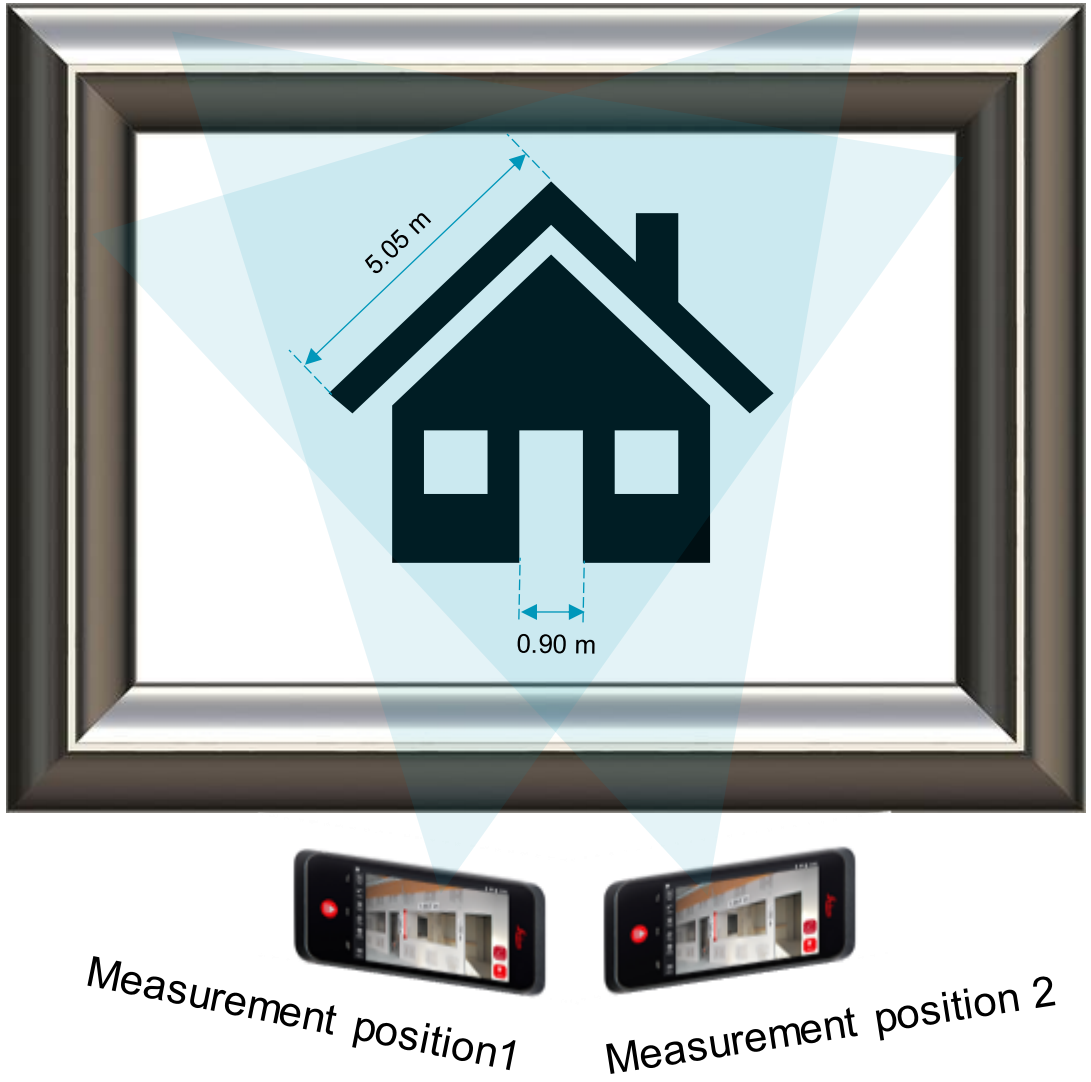
Measurement technologies for state-of-the-art measurements

Measurement of any distance by photogrammetry



My advantages:

- Measure any distance in a photo
- Easiest documentation with dimensions by creating photos
- Subsequent measurement in the photos possible
- Measurements that were not immediately considered important can also be determined later in the office
- Through stereo camera at short distances photo from one measuring position sufficient

Restriction:

- Measurement deviations increase at greater distances

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Measurement technologies for state-of-the-art measurements

Scanning at the touch of a button

My advantages:

- Millions of measurement points in a few minutes
- Recording of a point cloud allows later processing in the office
- Simple documentation also for later follow-up measurement

Restrictions:

- Post-processing in the office through point cloud costly
- Powerful computer required
- Large amounts of data

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Questions about the selection of the appropriate solution

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The questions you should ask yourself before purchasing a measuring device

- **Do I need the measurement solutions also for outdoor measurements under the influence of sunlight?**

  - According to a recent study, more than 90% of all users of handheld distance meters also measure outdoors at least from time to time. 50% state that they measure equally often indoors and outdoors. Alternative solutions such as carrying out measurements at dusk is certainly only a limited alternative to professional targeting aids.

The questions you should ask yourself before purchasing a measuring device

- **What measurement accuracies are required for me?**

  - It is important to understand the issue of accuracy with indirect measurement methods! Here there are big differences between the different technologies.
  - In addition to the technology used, the accuracy of devices also depends strongly on the measurement conditions. In particular, the nature of the target surface, ambient light conditions (e.g. sunshine), ambient temperatures and, of course, distance have a major influence on this. **ISO 16331-1** for handheld distance meters takes up exactly this issue and ensures that accuracies are specified objectively and according to real conditions.

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The questions you should ask yourself before purchasing a measuring device

- **What measurement tasks do I need to solve? Are the distances to be measured easily accessible or do I need measuring methods with tilt sensor or even P2P measuring functions or photogrammetric devices?**

  - Unfortunately, accidents at work happen very often and sometimes have dramatic consequences! There are very safe solutions, especially for measuring, which make climbing ladders or roofs for measuring unnecessary in most cases. You should take the topic of personal responsibility and responsibility for your employees seriously in every respect!

The questions you should ask yourself before purchasing a measuring device

- **Do I perform comprehensive construction documentation with taking photos, which I want (or even need) to archive for later tasks?**

- Who does not know this. At the end of your work or during important tasks, you take a few photos with your camera or cell phone for documentation. Perhaps one still holds a meter stick into the photo so that one could later draw conclusions about distances in the photo. These photos are then archived in case of damage, consequential damage, product liability or for a later reconstruction. Now imagine that you could make exact measurements in exactly those photos. This can be done easily and relatively inexpensively with the help of photogrammetric devices. Note that if you do not do this, you may regret it later!

The questions you should ask yourself before purchasing a measuring device

- **What happens with the measurement data? Do I want to create plans or transfer the data to my software via a wireless interface?**

  - Especially to document the as-built, it is important to digitize the measurements and make them available for further use. This can be to create an offer, to design a plan in CAD, to document work progress or to create a correct invoice. A quick hand sketch is quickly lost during such work or the noted measurements were written down incorrectly. For example, a 5.142m quickly becomes 5.124m due to a mistake in the numbers when writing it down, and the prepared glass is then 18mm too short.

The questions you should ask yourself before purchasing a measuring device

- **How much time does the measuring solution save me? How much damage on the construction site could I have prevented by using an adequate measuring solution over the last few years? How big is the risk of a measurement error due to incorrect equipment (personal injury, material damage, consequential damage)?**

  - Most of the time, a simple laser distance meter is already paid for by saving a few man-hours. Productivity in a business is important, because today almost every craft complains about a lack of employees! For complex tasks such as the creation of a template, the purchase of a more complex and expensive device is often worthwhile after just one job. Especially if you take into account the risk of an incorrectly prefabricated part!

The questions you should ask yourself before purchasing a measuring device

- **What budget do I have available?**

- Of course, an important question, but it is essential to deal with the previous topics beforehand. The worst investment is the one which does not provide you with the right measurement solution!

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Thank you for your attention!

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