How to improve analysis in three-dimensional space

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Correlative characterization as driver for progress

Manufactured micro- and nano structures became indispensable in our daily lives. Thus, it is important to precisely characterize their properties. For this, correlative characterization of manufactured micro- and nano structures may gain more information. This can lead to a better understanding and further development of these structures.

Correlative characterization with different devices

Combining different characterization methods of different measurement devices is challenging. The process of interswitching the sample between the different devices can lead to deviations and cause a high amount of operating time.

CSM → VSI → AFM
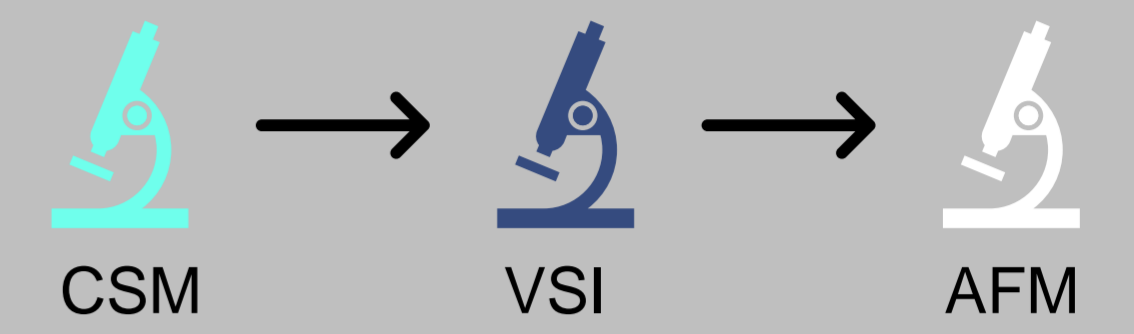
The place to be – The region of interest

The region of interest is a spot at the samples surface. Finding the region of interest again after switching the sample between the devices is crucial for a correlative characterization.

ROI representation

Its position must be described in a way that is not related to the coordinate system of the used measurement device.
Therefore, fiducial markers can be used. These fiducial markers should be placed at the sample or its holder in a way they are easy to find at the begin of a measurement.

Fiducial marker

ROI position
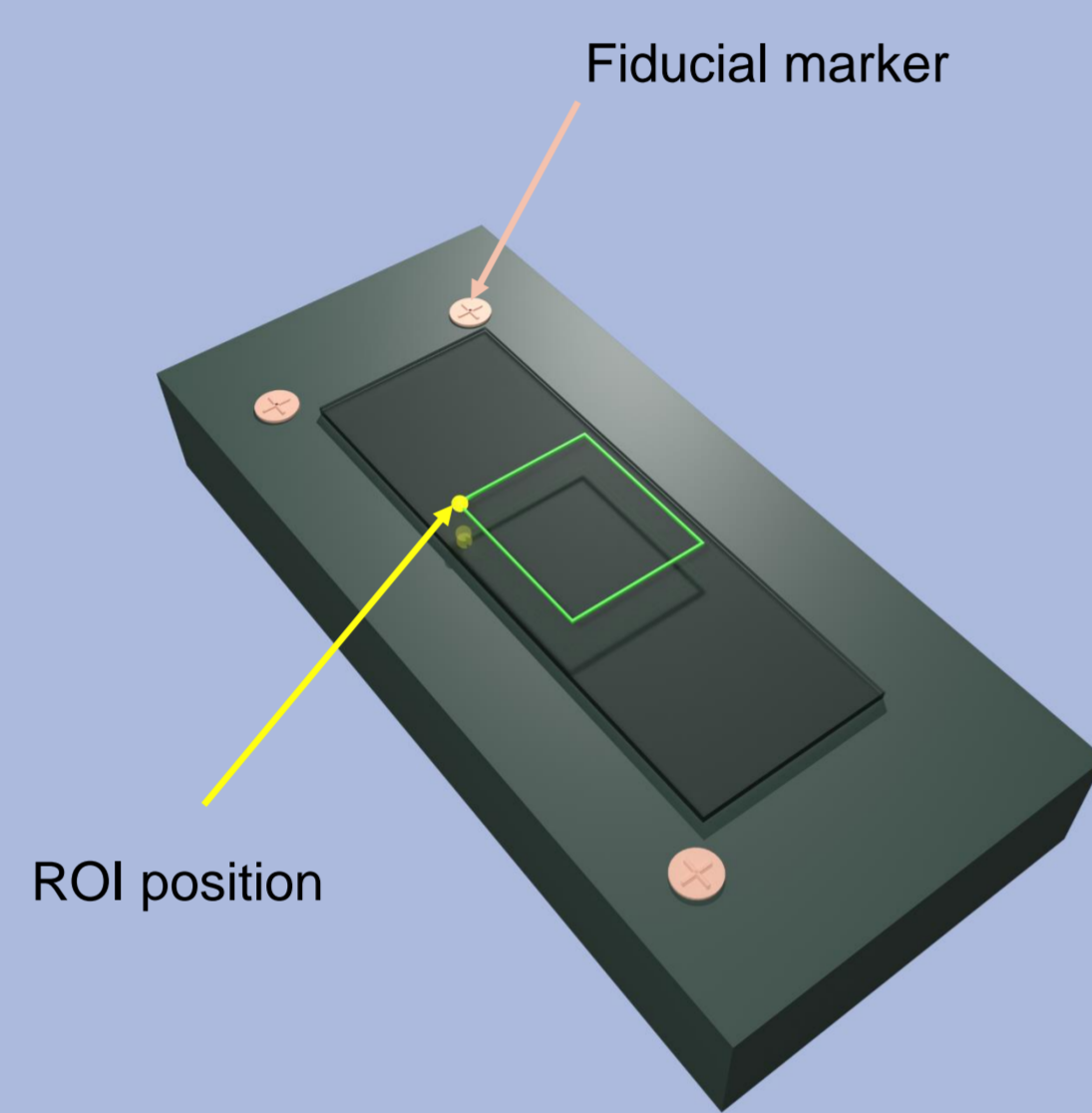
The description of an area with only one spot is not sufficient. The area can turn about this point.
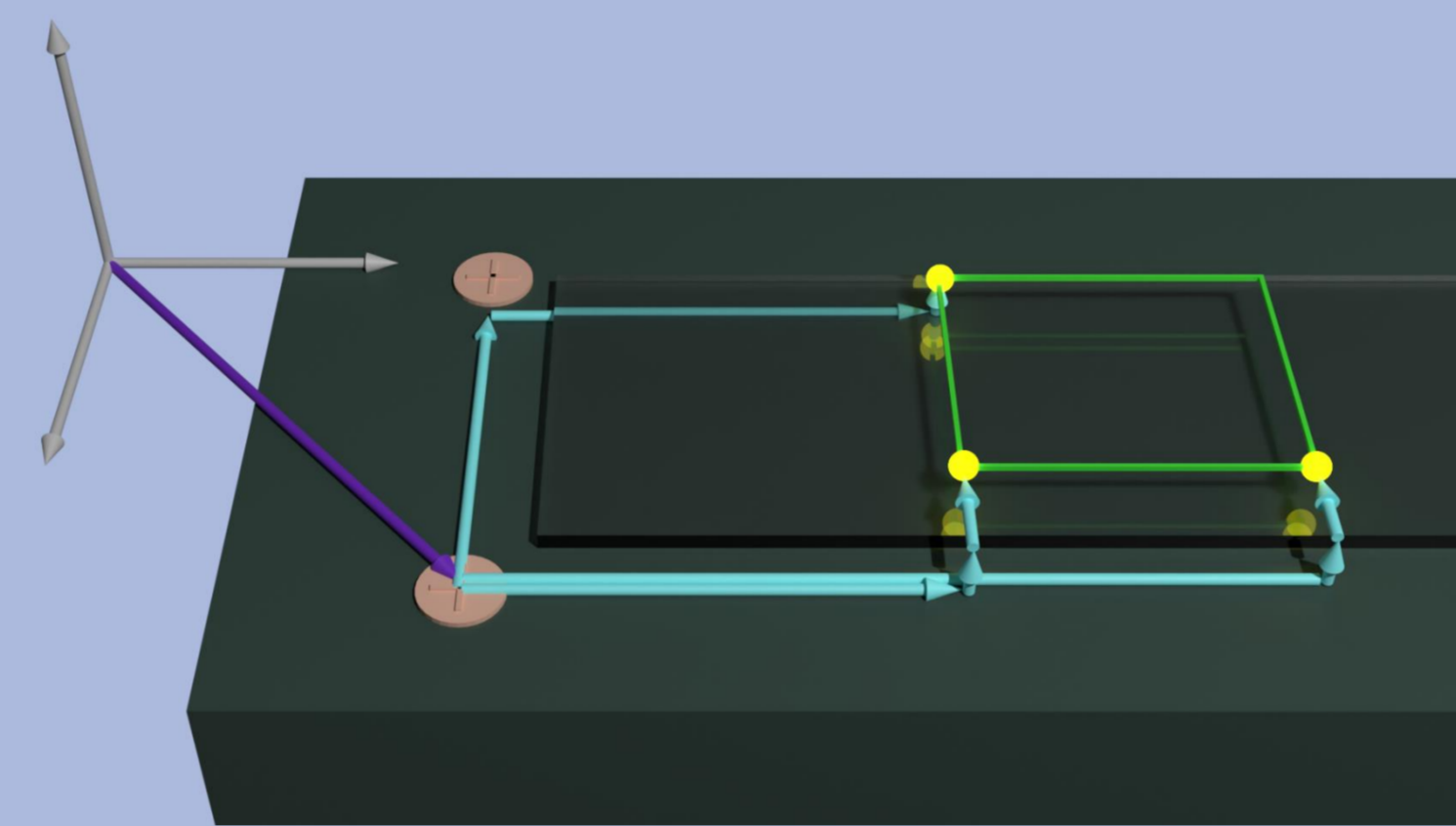
To define the region of interest precisely three paths of vectors are necessary, that are related to the fiducial markers

Required information

The three needed positions can be given to the software by the operator or can be extracted automatically out of the measurement result files.
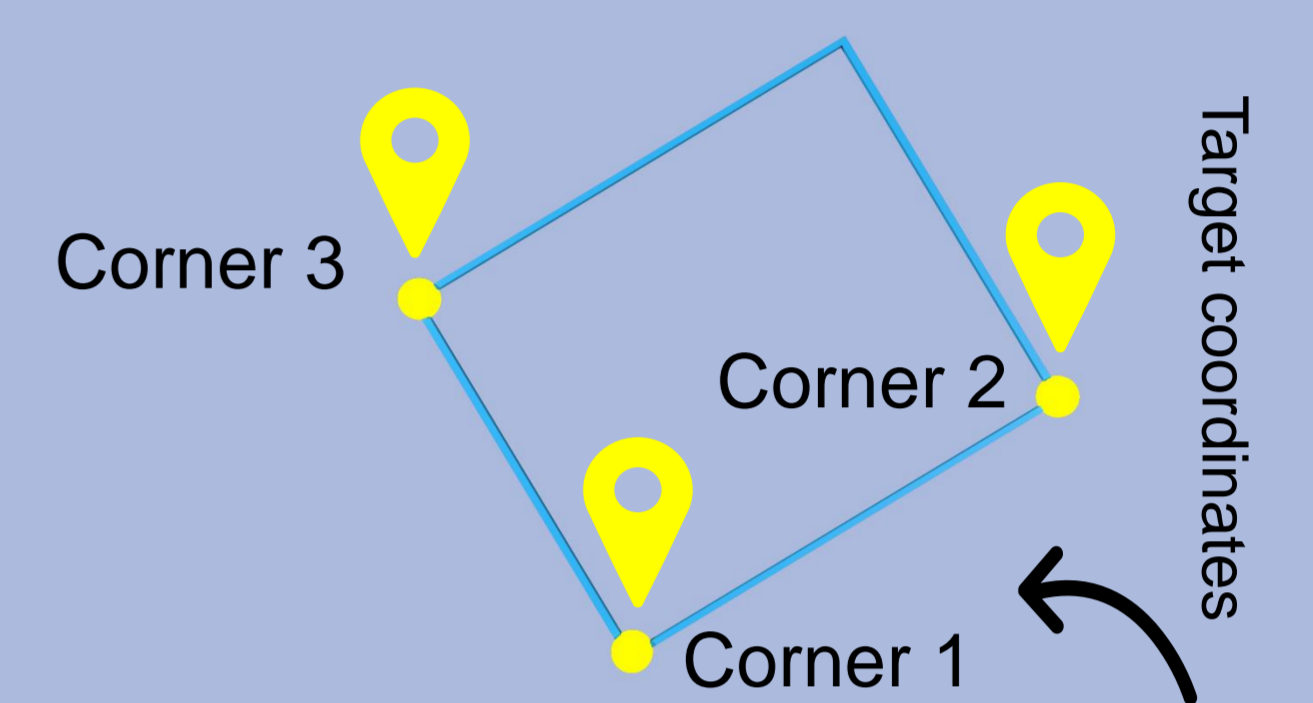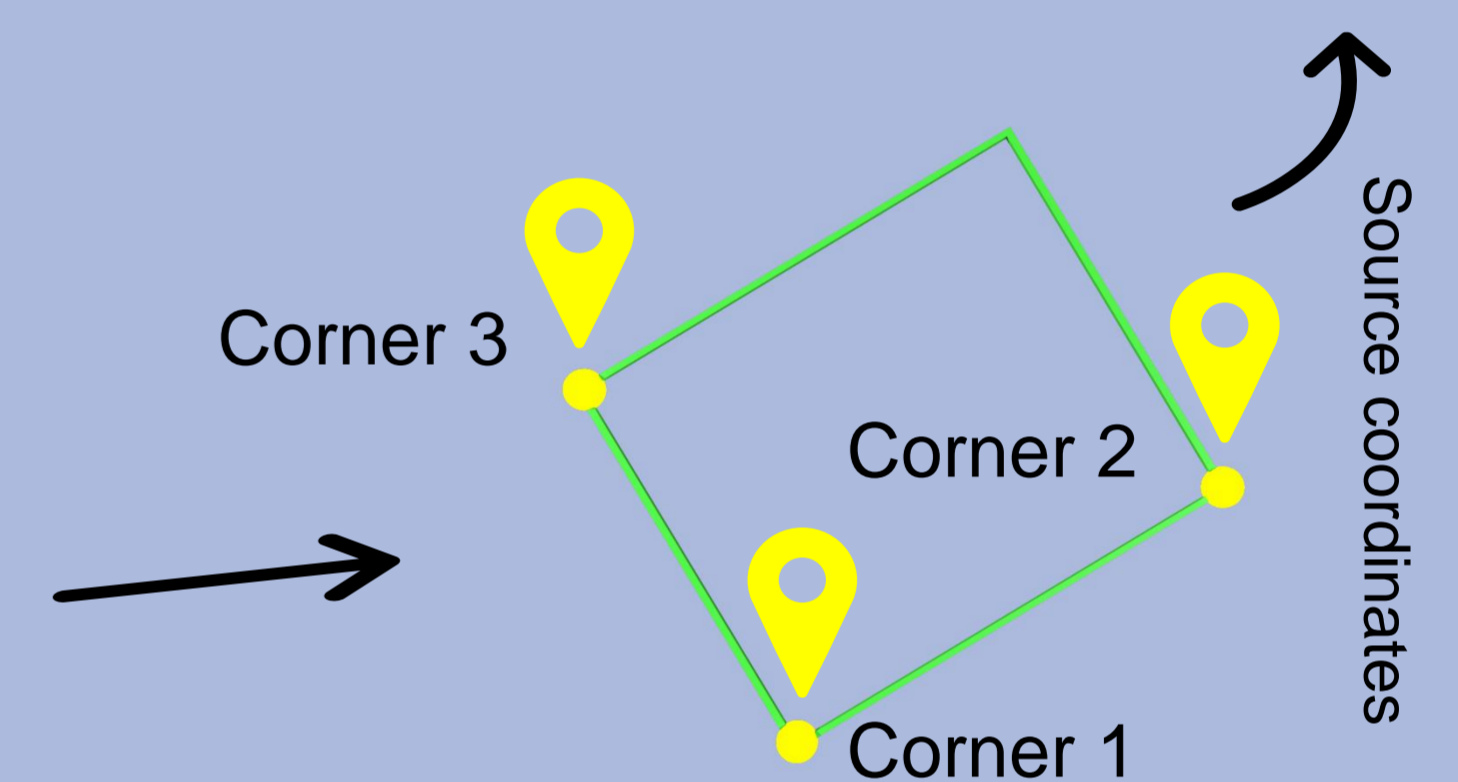
Manual way

Automated way

	X-Value	Y-Value	Z-Value
Corner 1			
Corner 2			
Corner 3			

Corner 3 — Corner 2 — Corner 1 — Target coordinates

After that, the coordinates can be calculated to find the ROI in the target coordinate system
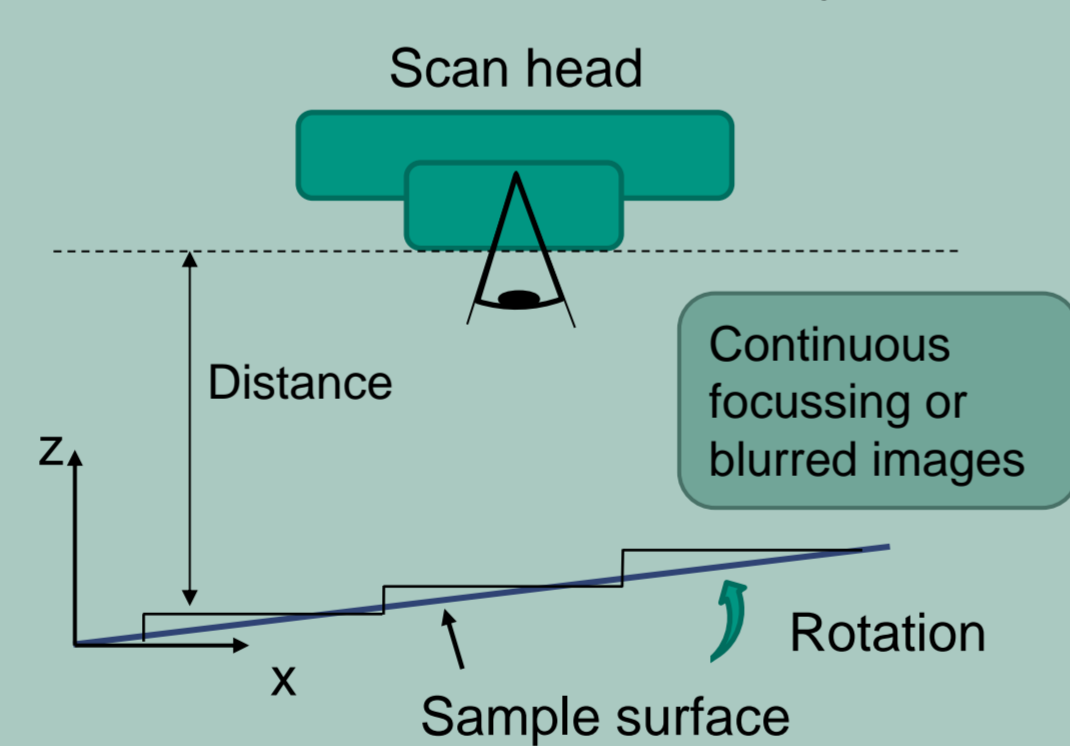
Corner 3 — Corner 2 — Corner 1 — Source coordinates

Where is what - Spatial orientation in space

The samples orientation in the measurement device is crucial for the measurement results. A misalignment of the sample related to its orientation in the measurement device used before can cause uncertainties, deviations or even unusable results.

Scanning probe microscopy

Approximation of the former measurement path

z- rotation

Optical microscopy

Scan head

Distance

Continuous focussing or blurred images
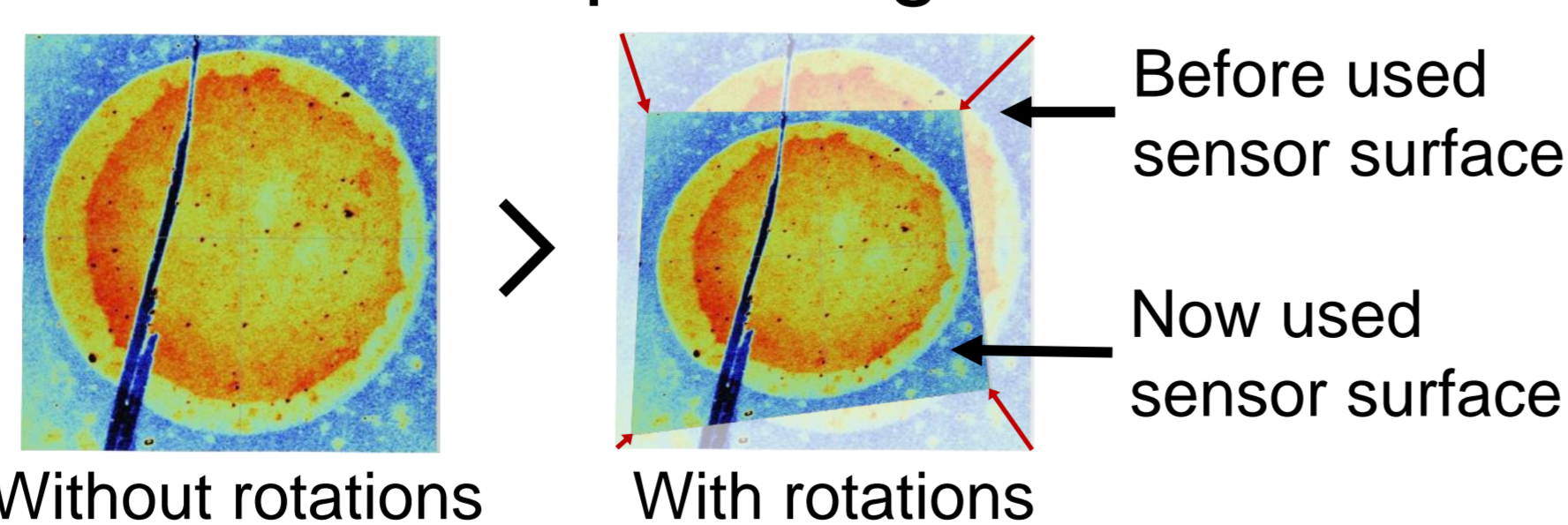
Rotation

Sample surface
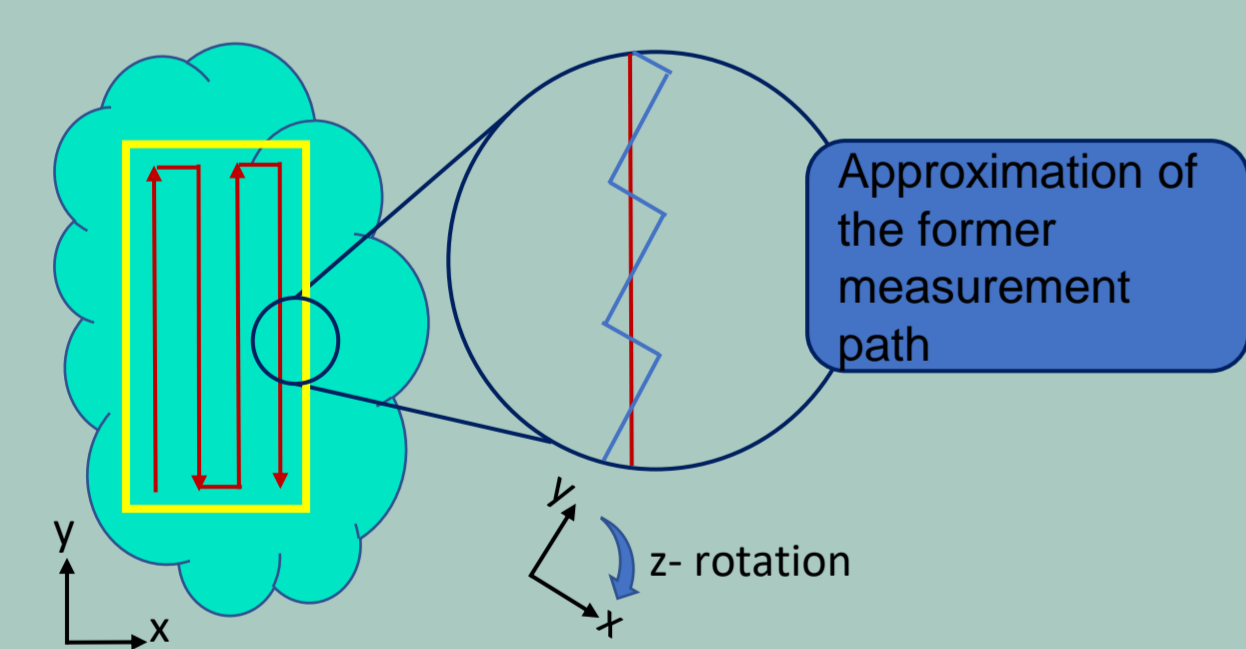
Rotations about all three axles

The largest distortion effect occurs with rotations about all coordinate axes at the same time.

The combination also results in a reduced sensor area that is available for the measurement what reduces results quality and resolution.

Effect on a sample image

Before used sensor surface

Now used sensor surface

Without rotations

With rotations
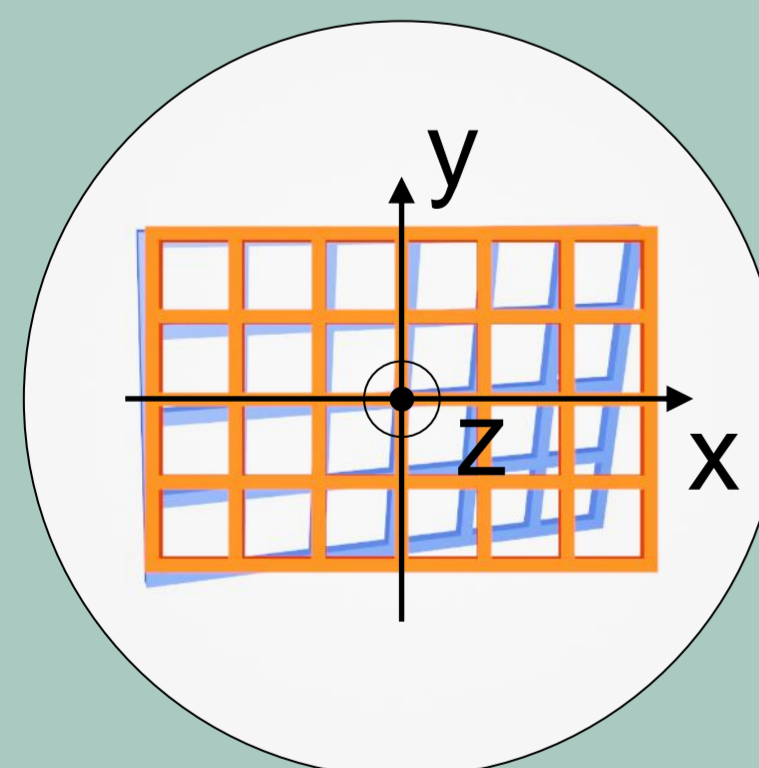
Important point of view

Moreover, the rotation can cause a wrong result. The rotation of the sample can change what the sensor may be able to detect.
A turned sample can change the visible surface of the sample. The top view shows the sensors view.

The visible geometry in the centre is a circle.

The visible geometry in the centre now is more like a line.

Top view

Side view
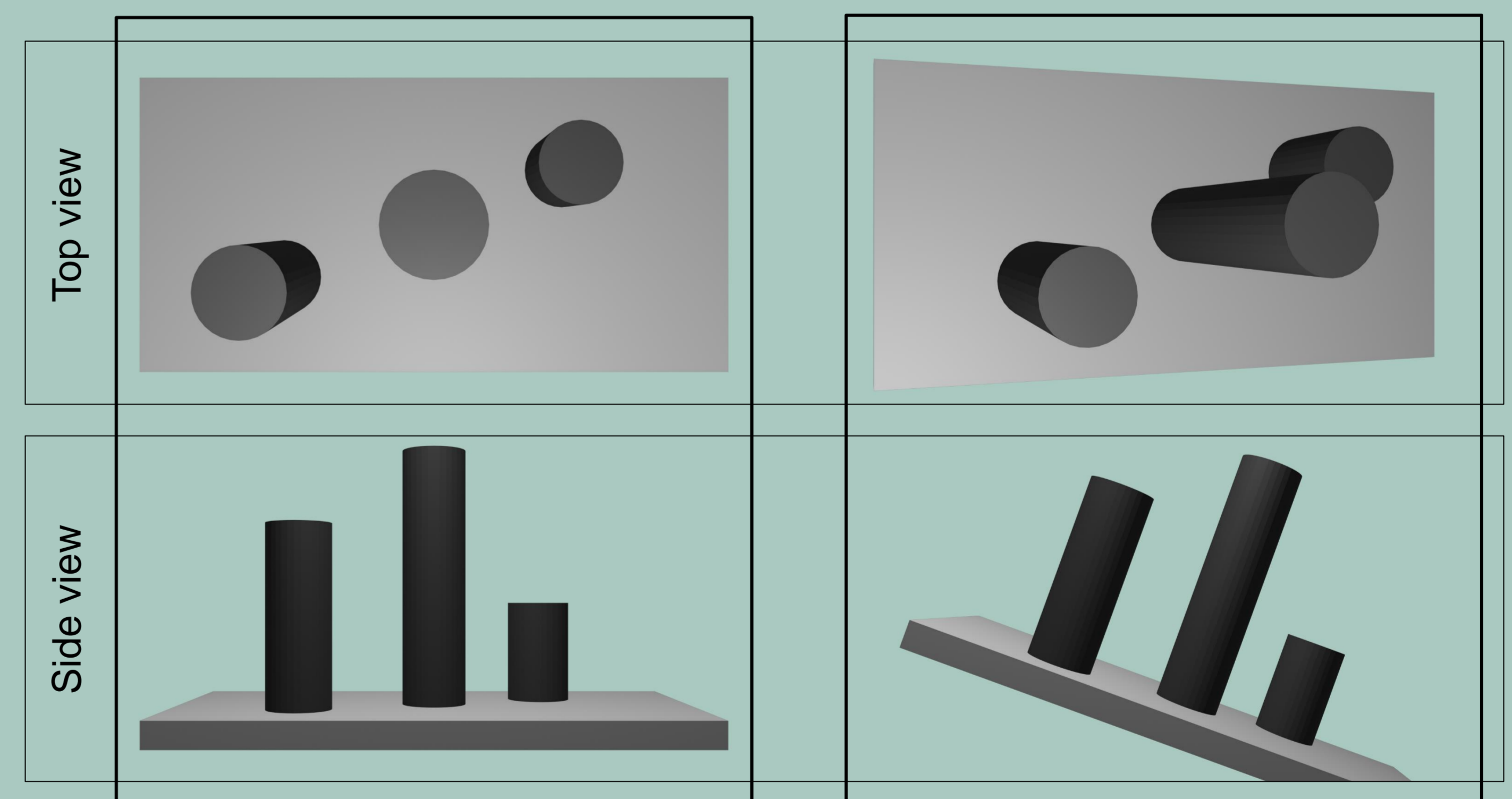
The sample is aligned to the coordinate axles of the measurement device.

The sample is tilted to the right about one axis of the measurement device

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