Perfect alignment of a camera system

Context:

Often the camera based inspection system is simply screwed and the image simply adjusted on the monitor by slightly moving and tilting the camera. Let´s start with programming fun.... For non-demanding tasks, such as part presence applications, easy data matrix and code reading applications and the non-qualitative inspection of huge image details, this workflow might be ok.

With this approach it is almost guaranteed that the vision system is not perfectly perpendicular aligned to the inspection object, for example, what will:

- cause inaccuracies in measurement caused by a variable magnification, as the working distances vary in the center of the image and the image corners.
- create problems for part tracking algorithms and the proper alignment of inspection tools, as well as coordinate systems provide non-uniform results. This only will be better with the use of precise feeding systems, like rotary tables or complex image calibration algorithms to compensate non-linear distortions.

Fig.1a: Fig 1b:
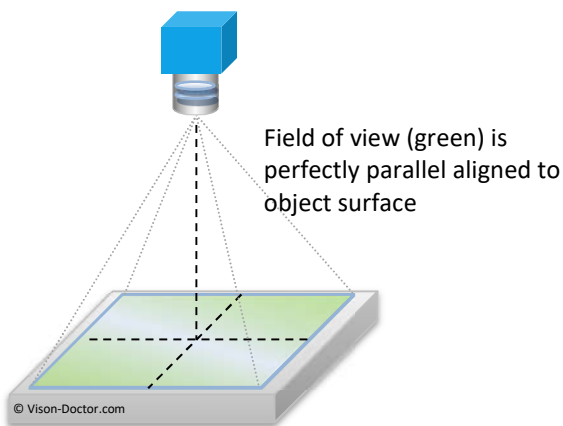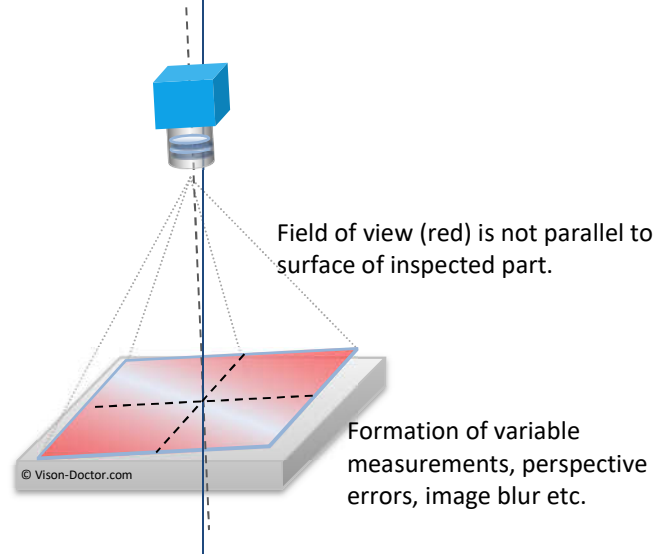
Perfectly aligned camera   **Tilted camera**

Field of view (green) is perfectly parallel aligned to object surface

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Field of view (red) is not parallel to surface of inspected part.

Formation of variable measurements, perspective errors, image blur etc.
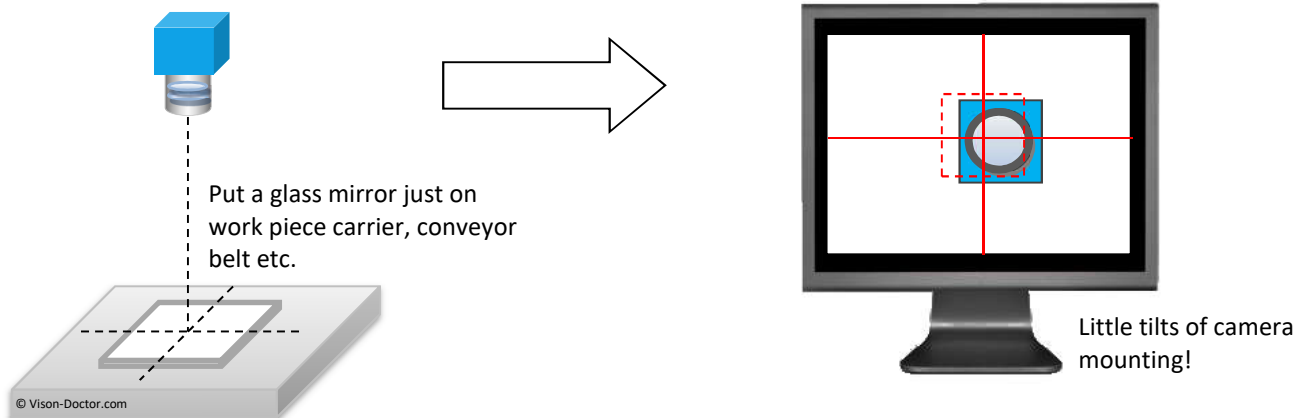
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Similarly, it can be assumed that the camera system was not exactly focused, which can lead to further blur and contrast loss, especially in the peripheral areas of the images. This approach will additionally limit the optical detection abilities of the machine vision system.

Tipp: The correct method, how to focus the lens is specially described in the document "Precise lens focusing".

Tips for proper adjustment of the camera

However, with which simple methods will we be able to determine whether a camera was mounted exactly vertical? The camera mount may indeed just be constructive about the inspected part, but smallest mechanical tilts of the mounting plate may cause bigger divergence effects due to the large working distances.

The „trick with the mirror“:

Put a glass mirror just on work piece carrier, conveyor belt etc.

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Little tilts of camera mounting!

A piece of mirror simplifies the alignment significantly. This is simply placed in the center of the image field of the camera. On the monitor can now be viewed the camera image reflection in the mirror.

At exactly vertical arrangement, the mirrored image is exactly in the center, at the smallest tilt of the camera the object moves out of the middle of the video image. A self-generated cross-hair or reference point in the center of the image display window helps with the exact alignment. At a resolution of 1600x1200 pixels, the center of the marker will be at x = 800, y = 600

This trick can be applied to back light applications. It may be necessary for these purposes, the focus and aperture of the lens to be changed, so you can see the reflection clearly. Stellen Sie daher die Optik erst im Anschluss korrekt ein. Therefore, set the proper focus and f-stop afterwards. . The correct focusing of the lens is specially described in the document "Precise lens focusing".

Use appropriate brackets for mounting!

With the help of a small XY axis, turntables, swivel or ball heads mounting position settings can be made much finer than a simple camera mount with one, two slots and slide blocks in the Bosch profile. Please plan to mount the camera on a solid and adjustable unit!