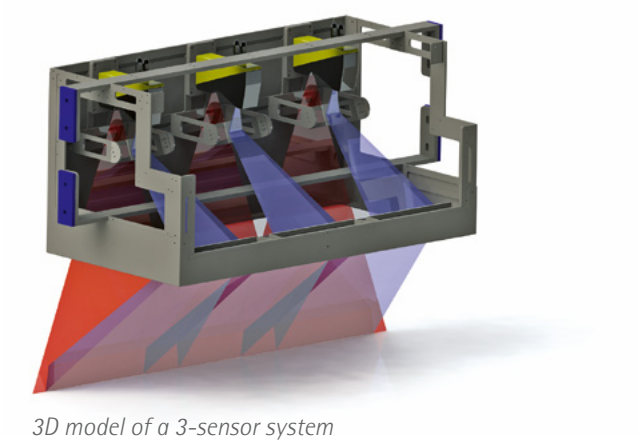
3D Mould break check

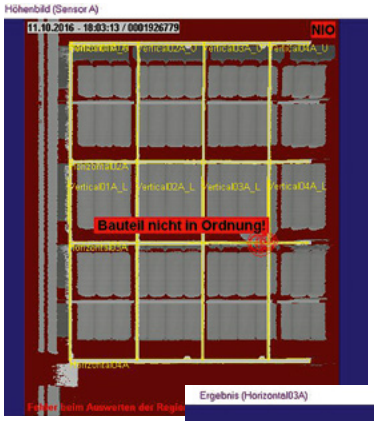
In sweets production, polycarbonate moulds are subjected to systematic wear and tear. Strong mechanical and thermal stresses lead to the moulds becoming brittle whereby parts can deform and break away. For inline recognition of break-away pieces from the ridges on the backside, and thus removing defective moulds directly from the process, Bi-Ber offers reliable 3D vision systems.



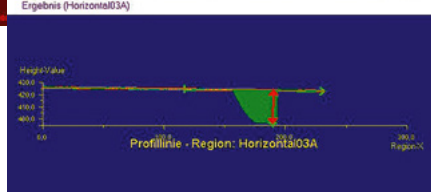
3D model of a 3-sensor system

How it works: Triangulation process

The system uses the triangulation method and consists of a stainless steel housing with up to three Cognex 3D sensors DS1300R, an encoder for detecting the mould transport speed, a photoelectric barrier as trigger and a Panel PC with installed software for evaluation and documentation. Each sensor has a recording width of 340 mm and views the mould at an angle of 45°. The sensors calculate the height data of a profile line from the position of the laser line. The sequenced profile lines produce a 3D profile that is checked for flaking and deformations.



Sensor height image



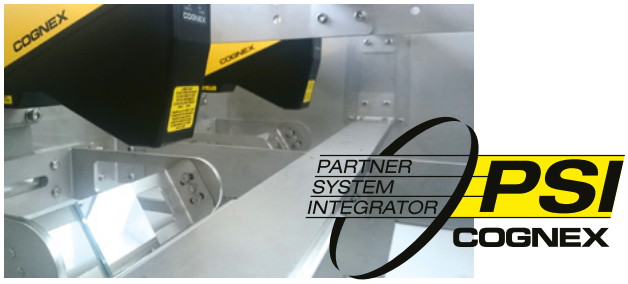
NOK (Not OK) profile line

Flexibly adaptable – System variants

The system can be freely dimensioned and be geometrically adapted individually to the respective plant. Various system with 1, 2 or 3 sensors are available:

- examination of moulds in longitudinal or transverse transport
- monitoring widths up to 900 mm
- optional integration of RFID readers for mould ID

All straight-line ridges are testable, curves are approximated by straight-line segments. The software can handle various mould colours, automatic type changes are possible too.

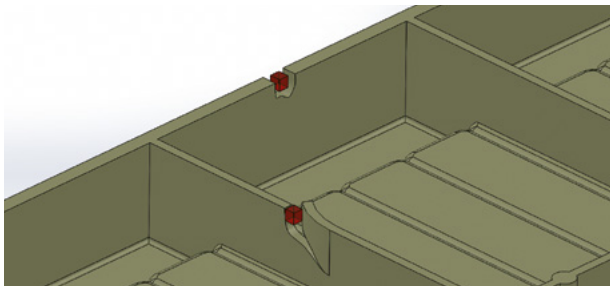


Interior view of a housing with 2 sensors

Checking accuracy under production conditions

There are basically two types of defects on the moulds: Flaking – material is missing along a ridge. Deformation – the material is still present, this is a precursor of flaking. Both types of defects are detected by the system.

In laboratory tests with perfect mould transport conditions, a clearly recognisable defect in the size of a cube with 2 mm edge length has been detected. Various factors under real production conditions (rolling, vibration, sliding, pollution of moulds, etc.) lead to reliably detectable defects in the size of a cube with 3 mm edge length for both defect types. Real defects are usually significantly larger.



Schematic representation of the defect types: flaking (rear), deformation (front)

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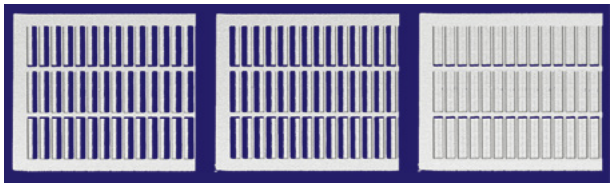
bi-ber Bilderkennungssysteme

Mould break check with 3D Reflex system

Mould break check with 3D Reflex System

Current 3D mould break inspection systems can inspect inline the fragile ridges on the back side of chocolate moulds for chipping, but not deeper indented areas, such as the cavities on the top side. It's not just impossible to inspect these areas directly, but laser line data can also inadvertently lead to pseudo pixels, due to especially thin ridges or reflections off ridges and curves, thus producing unreliable results.

Help is at hand with our innovative 3D profile scan process with integrated reflex optics. With this technology, even cavities can be inspected at a high frequency to ensure that the entire mould is free from chipping and foreign bodies.



Two mould sub-images and overall image (right) without shadowing

3D Profile Scanner with Reflex Optics

With the reflex process, the optical path crosses a semi-permeable mirror that splits the path into two separate paths. In the camera sight, the paths overlap together again on the inspected object. Given that the second optical path has an auxiliary mirror and gives onto the laser line from the opposite side, alignment, angle, scale and length are identical for both views. The camera sees the laser line from two different directions at once. If the view is obstructed by a ridge or other protruding object, the laser line becomes darker.

Advantages of the reflex system

On condition that the cavities are at least twice as wide as they are deep, the advantage compared with former inspection methods is that shadows only appear when there is an anomaly. Cavities can now be inspected completely.

- Insensitive to overexposure
  > no missing or pseudo pixels for highly reflective surfaces with dark soiling
- More flexibility for adjusting the exposure time to the color of respective moulds
- Less noise due to uniform brightness because of different viewing directions
  > Data determination possible
- Only one camera required for a bi-directional view
  > no extra software needed and scanning rate maintained
- 3D matching to reference moulds
  > new moulds are much easier to pre-capture as there is no need to think about the specifics such as the positioning, number, or shape of the cavities

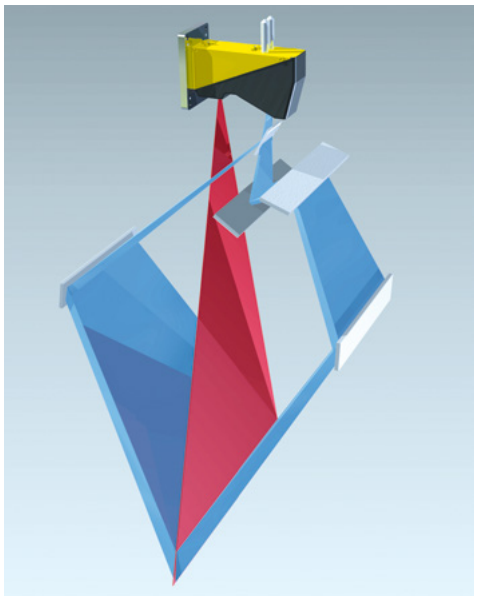
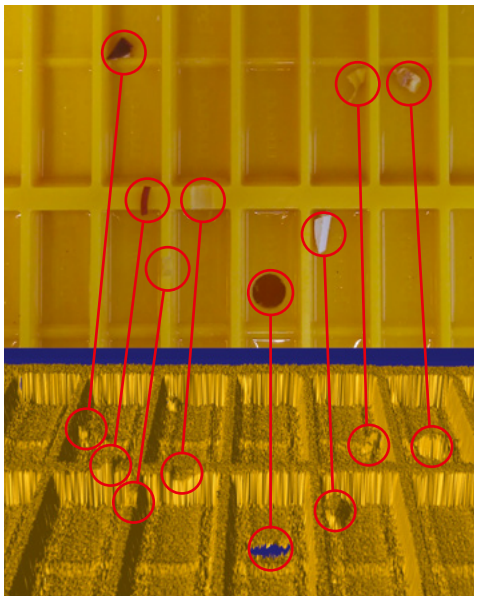


Illustration of the different light paths (red – laser, blue – camera)



Various contaminations in a mould; top – 2D color image, bottom – 3D image

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