# camea

Visual Inspection Systems

Uniscan

CAMEA Uniscan is a complex industrial system platform for visual quality inspection and control. The systems are designed according to the customer's needs using state-of-the-art technologies such as computer vision and artificial intelligence, high resolution cameras and visualization, data archiving and securing.

All key technologies used for creating the most innovative products are continuously being developed by CAMEA. These products include: video detection and image processing software, intelligent (smart) cameras, real-time data processing units, illumination units, application software etc. While OEM components are available for integration into current systems (3rd party systems), fully-featured systems are also being provided. CAMEA closely cooperates with technological and business partners in engineering, installation, maintenance, staff training etc.
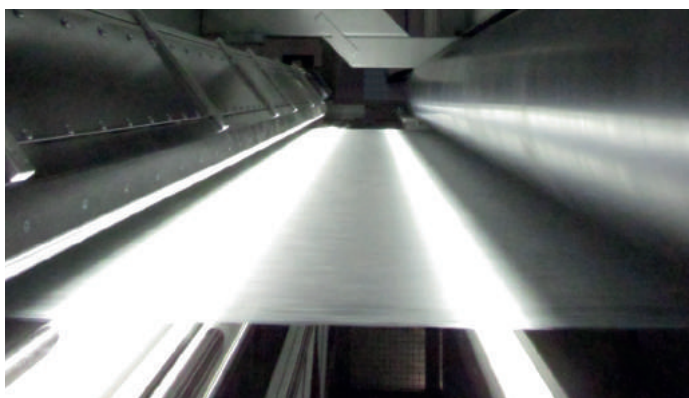
Projects
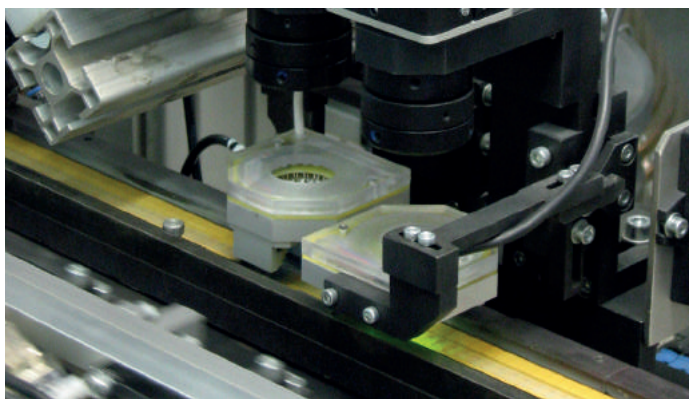
Component Inspection

Component visual quality control of tantalum capacitors.

» AVX Czech Republic, s. r. o.

Continuous Strip Inspection

A set of line scan cameras inspects infinite strips of various materials (non-woven textiles, foils, paper, metal etc.).

» PEGAS NONVOWENS, s. r. o.

Bottle Inspection

Visual bottle inspection for quality control and consistency of bottle walls, bases and necks, prior to filling.
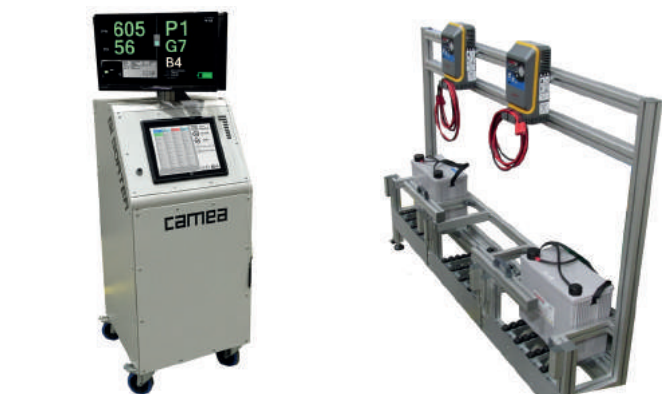
» NATE Chotěboř, a.s.

Label Inspection

The visual inspection system measures the width and product orientation; the width of colour strip and its labels are compared to a reference label.
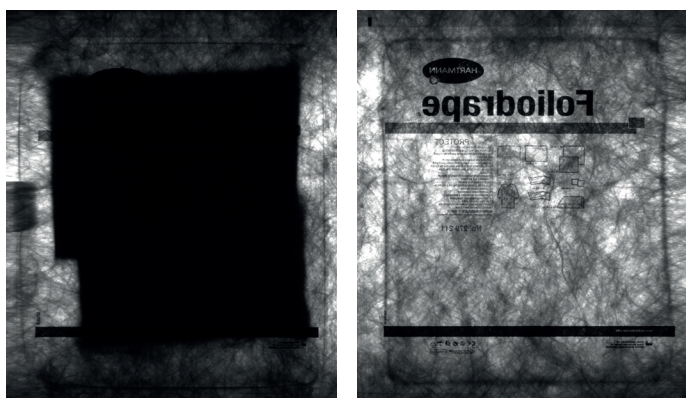
» KOH-I-NOOR HARDTMUTH, a.s.

Machine Package Reading

The system is equipped with a camera and illumination for automatic reading of packages in a central/local warehouse. The application shows the user where to place the package. Implemented methods: capital letter OCR, barcodes, QR matice.
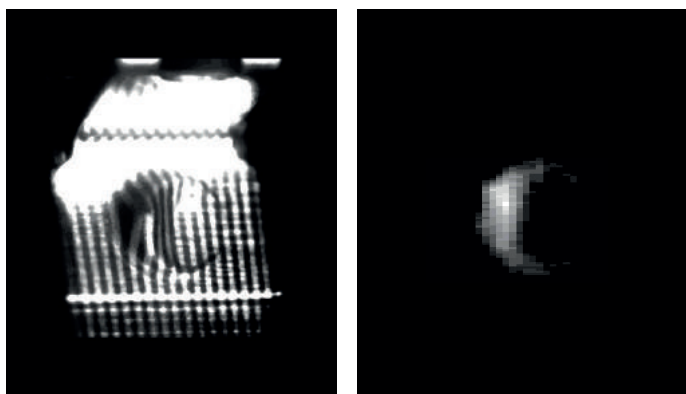
» DHL SK

Packaging Quality Inspection

The system ensurescorrect product placement, shipping packaging integrity, blisters and joint weld quality. System also inspects barcodes and searches for missing components.

» Hartmann - Rico, a. s.


3D Reconstruction

Object 3D surface reconstruction, volume measurement and surface area properties checking.

» AVX Czech Republic, s. r. o.

Continuous Strip Inspection
UniscanDETECTOR

UniscanDETECTOR is a visual inspection system designed for defect detection on non-woven textiles, plastic foils, paper, metal plates, etc. The system can detect defects as small as 0,1 mm^2 at speeds up to 2000 m/min. Maximum product width is 5 m. The system is fully configurable according to the customer's requirements and can be used in various phases of theproduction process.
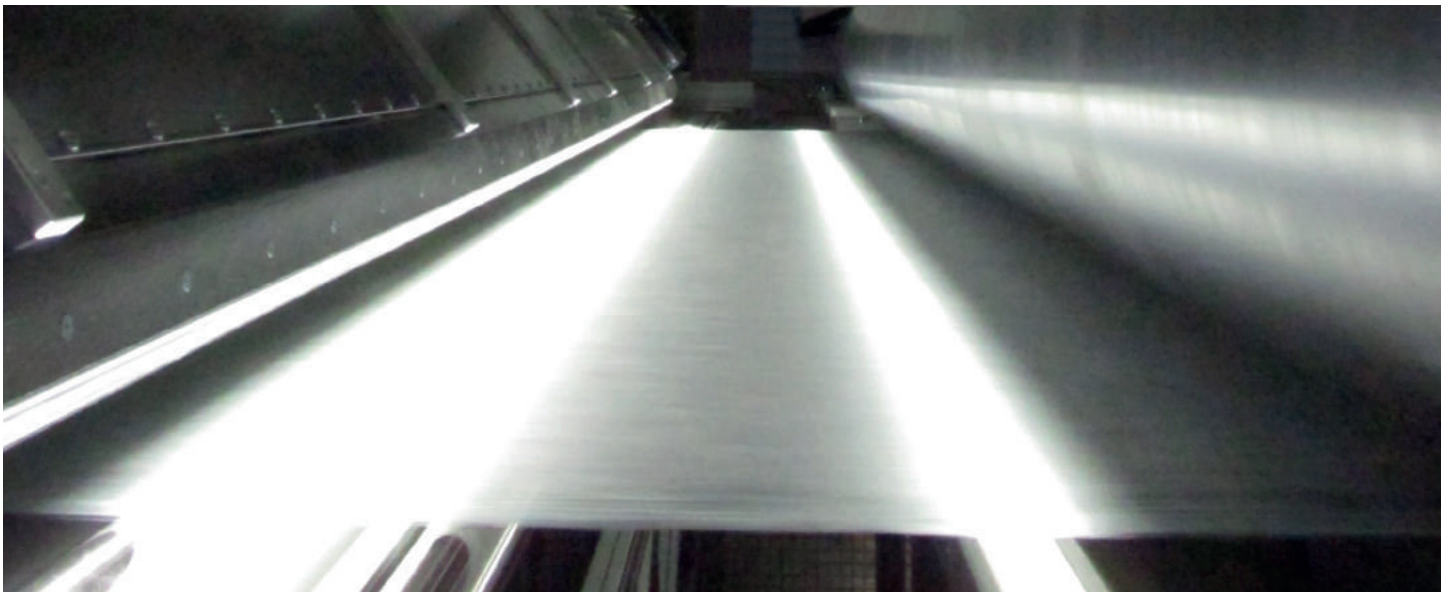
Features

» 100% inspection 24/7

» Detection of periodic defects

» Automatic detection of edges and material width

» Slitting quality control

» Possible integration of alarms and marking systems

» Material color inspection

» Real-time visualization of defects on several distributed stations

» Export of statistics, print of output protocol

» Easy integration due to modular design

» Suitable for in-line systems and rewinders

» Online support 24/7

Purpose

» Production efficiency improvement

» Decreased number of complaints from customers

» Long-term overview of production quality due to simple export of statistics
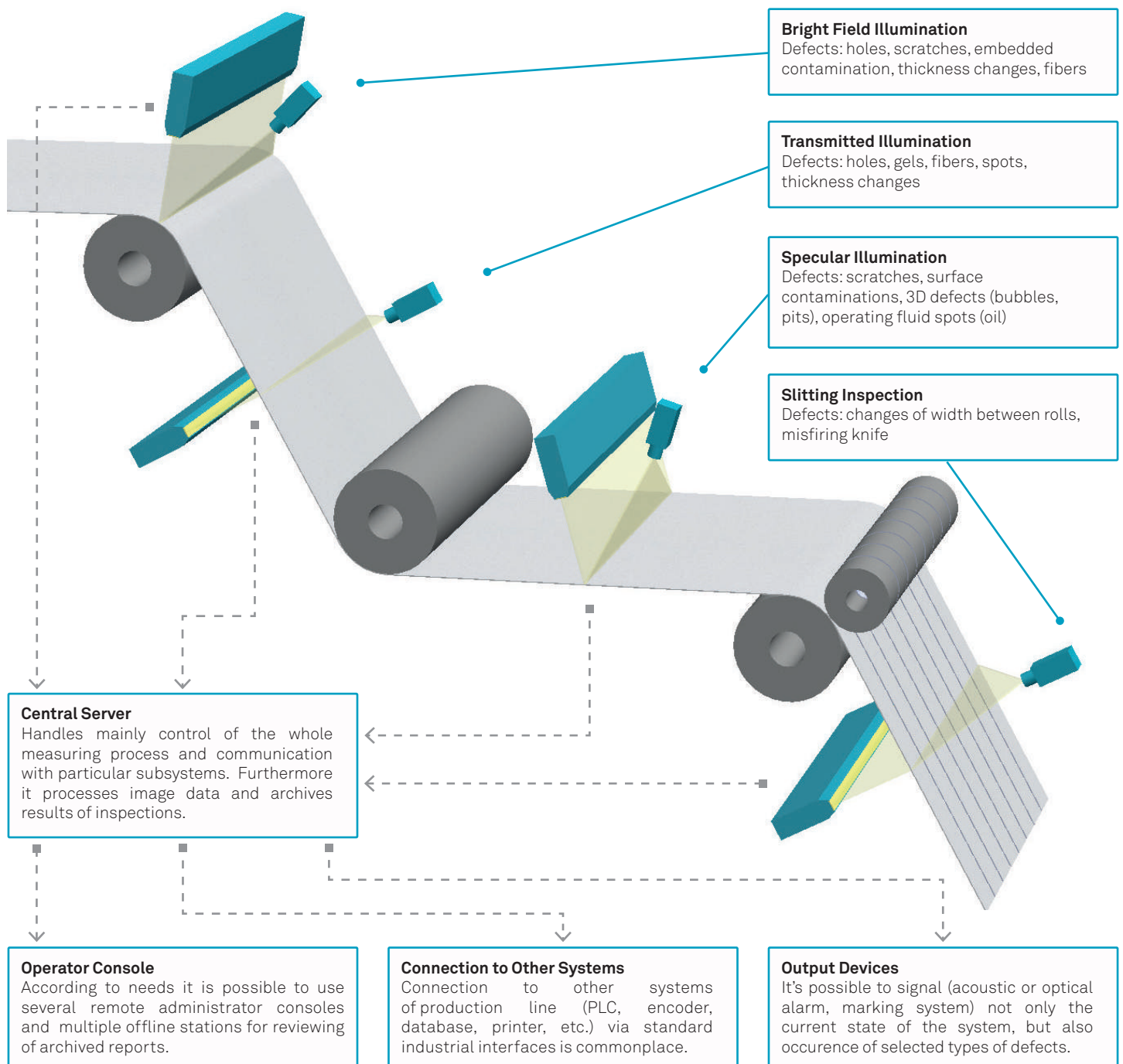
Applications

» Non-woven fabric inspection

» Metal plate inspection

» Paper inspection

» Foil inspection

» Polycarbonate plate inspection

» Wooden plank and beam inspection

» Inspection of products on conveyor belts

System Overview

The system can detect many different kinds of defects, e.g. holes, spots, foreign objects, changes of pattern, homogeneity of material etc. These defects are then automatically classified using neural network algorithms into categories according to training samples in a database.

To achieve best detection results the system uses adjustable high-power LED illumination, high-speed line scan cameras and sophisticated lens control. It is applicable to a wide range of thickness, colors and patterns of produced material.

Every part is designed as modular as possible, so it can be adapted to individual customer's requirements and limitations of a given production line. The system can be installed in different stages of production, i.e. from primary material to the final product for the end customer.

Bright Field Illumination
Defects: holes, scratches, embedded contamination, thickness changes, fibers

Transmitted Illumination
Defects: holes, gels, fibers, spots, thickness changes

Specular Illumination
Defects: scratches, surface contaminations, 3D defects (bubbles, pits), operating fluid spots (oil)

Slitting Inspection
Defects: changes of width between rolls, misfiring knife

Central Server
Handles mainly control of the whole measuring process and communication with particular subsystems. Furthermore it processes image data and archives results of inspections.

Operator Console
According to needs it is possible to use several remote administrator consoles and multiple offline stations for reviewing of archived reports.

Connection to Other Systems
Connection to other systems of production line (PLC, encoder, database, printer, etc.) via standard industrial interfaces is commonplace.

Output Devices
It's possible to signal (acoustic or optical alarm, marking system) not only the current state of the system, but also occurence of selected types of defects.

Components

Camera Unit

UniscanDETECTOR uses state-of-the-art line scan cameras with high resolution sensors (up to 16 kpx), outstanding signal/noise ratio and line frequency of up to 200 kHz. The lens is mounted to the camera using a specially developed adapter, which allows remote management of the lens aperture and focus.

Illumination Unit

To achieve best detection results, the system uses adjustable high-power LED illumination. To highlight particular types of defects there are also versions with different wavelengths of light, eventually with special angle illumination.

Rack Unit

The core of the system is a rack unit containing computational units for data processing. It also provides a power supply for all subsystems. Using standard industrial interfaces (Ethernet, RS232/485, etc.), it can communicate with other systems. In case of operation under more demanding conditions, it can be equipped with air-conditioning or a ventilation unit.
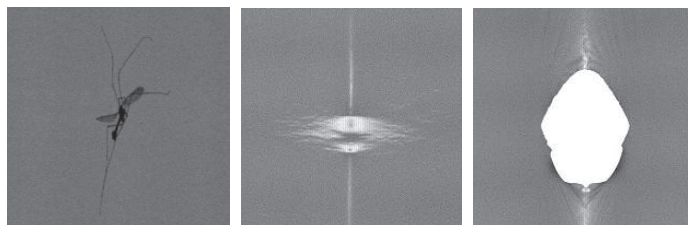
I/O Module

The expansion I/O module PULSIO allows connection of output signals to other systems (signalling, marking, etc.) and also custom input signals (start/stop, material break, etc.). Programmable logic inside can also act as a state machine of the production line and share this information with the central server which controls the whole inspection accordingly.

Additional Features

» Customization of SW according to customers' needs
» Detection sensitivity management
» Setting of minimum defect's size
» Self-learning classifier
» Automatic compensation of illumination intensity
» Classification of defects to categories
» Communication with systems on the production line
» Possible integration of other sensors
» Automatic system diagnostics
» User rights management
» Low operating costs

Examples of Defects

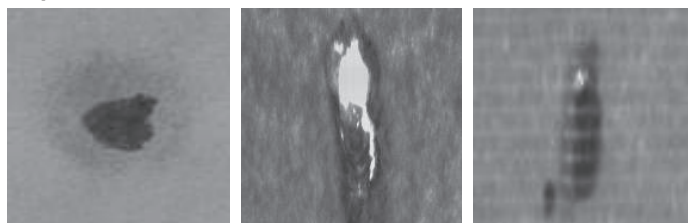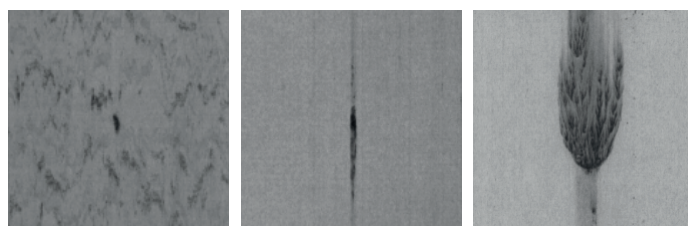**Foil**

Non-woven Fabric

Paper

Metal

System Outputs

Graphical distribution of defects in a reel

Production overview

Detail of slitting defect

Diagnostical output of system (report of windings, cuts, speeds, temperatures, sensitivities, etc.)

Basic Specifications

Power Supply	230 V AC
Temperature	5 - 60 °C
Production Speed (max)	2000 m/min
Material width (max)	5 m
Defect Size (min)	0,1 mm²
Image Resolution (typical)	0,1 mm/px

References

Fatra, a. s.
PEGAS NONWOVENS s. r. o.
JIP – Papírny Větřní, a. s.
Balsac papermill s. r. o.
OP papírna, s. r. o. (delfortgroup AG)
SILON s. r. o.
TRIBOMETAL (now MAHLE s. r. o., SK)

System Examples

Inspection system implemented on a production line

High-power linear LED illumination

Bottle Inspection
UniscanBOTTLE

UniscanBOTTLE is a visual inspection system for high-speed checking of bottles and glasses prior to their filling. Typically it is applied in food industry (breweries, distilleries, spirits industry, drink production lines, etc.) as part of health and safety checks. The system verifies the bottle necks, bases, walls and at the same time scans each object from up to four angles to achieve maximum performance and quality control.
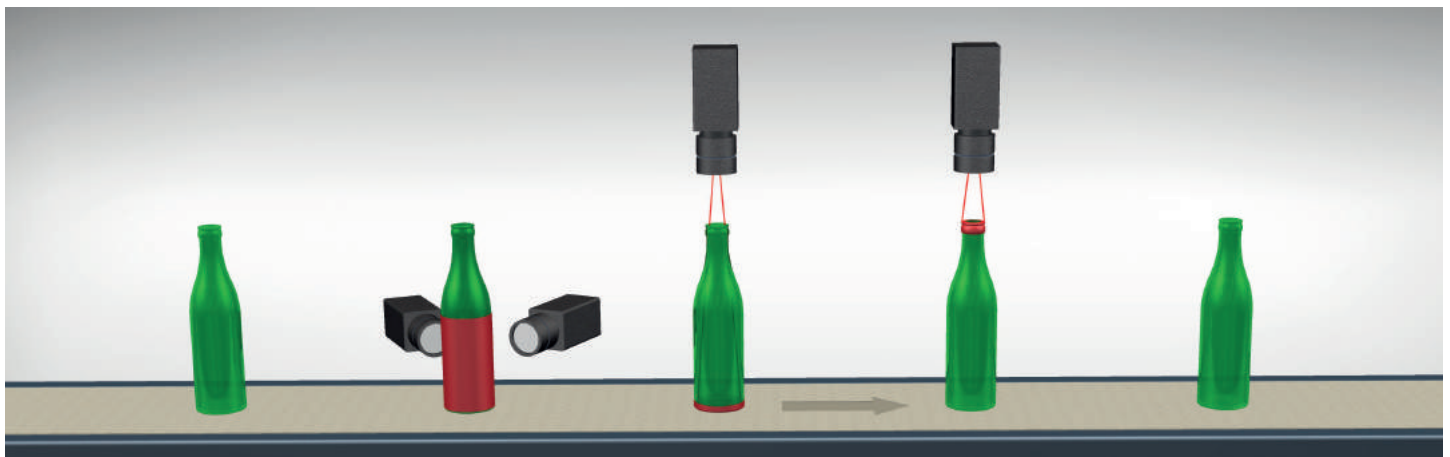
Operation principle of a bottling line – a) bottle wall inspection, b) bottle base checking, c) bottle neck checking

Features

» Detection of defects from 1mm^2
» Suitable for lines with speeds up to 72,000 bottles/hour
» Powerful flash illumination synchronized with the presence of a bottle and the camera
» Sensitivity configuration for each inspection
» Configuration of minimum size of detected defects
» Configuration of different bottle typ detection
» Flexibility due to the modularity of the system
» Integration with higher levels of the production line
» Inspection result statistics export
» Result image data backup
» User and user rights management
» Remote service and management
» Application localization

Applications

» Inspection of different bottle types, sizes and materials (glass, PET)
» Detection of defects, impurities and foreign objects on washing line outputs and filling line inputs
» Inspection of bottle quality during production

Detected Defects

» Impurities (e.g. funghi, scratches) on walls or the bottom
» Foreign objects (straws, shards, foils, bottle caps etc.)
» Missing pieces (broken or cracked bottles)
» Chipped, non-compact, dirty bottle neck
» Bottle shape and color
» Label or cap presence

Detected defects on a bottle neck (left) and inside a bottle (right)

Basic Specifications

Power Supply	230 V AC
Temperature	5 - 60 °C
Speed (max)	72 000 bottles/hour
Defect Size (min)	1 mm²
Image Resolution (typical)	0,4 mm/px

System Outputs

System user interface CS

System user interface DE

The UniscanBOTTLE visual inspection system is a part of EXAN, a complex solution for bottling line inspection of bottle quality, manufactured by NATE Chotěboř, a. s.

Detailed information can be found at www.nate.cz.

References

Litovel Brewery
PepsiCo CZ
Rychtář Brewery
Protivín Brewery
Korunní
Toma Teplice nad Metují
Samson Brewery
Trutnov Brewery
Jihlava Brewery
Steiger - Vyhne (SK)
Urpiner - Bánská Bystrica (SK)
Kirov (RU)
Liepaja (LT)
Jurajska (PL)
Tervete (LT)
Morshansk (RU)
Piwniczanka (PL)
APO Fruchsäfte (AT)
Ritterbräu Neumarkt (AT)
and others...

System Examples

**UniscanBOTTLE inspection system**

Filling line with UniscanBOTTLE installed

Component Inspection
UniscanCVS

The UniscanCVS series visual systems are designed for visual product quality control during manufacturing of a broad range of components. The components can be scanned a set of cameras from different views as required. The system is adaptable in terms of verifying incomplete polarity markings, cracks and chippings etc. Special illumination is used to highlight 3D defects, simultaneously suppress characters and enhance production defects, e.g. microscopic holes, contamination. The system can accurately detect defects from sizes of microns at a rate of dozens of components per second. Further quality control consists of comparing contact's shapes and rejecting defective components.
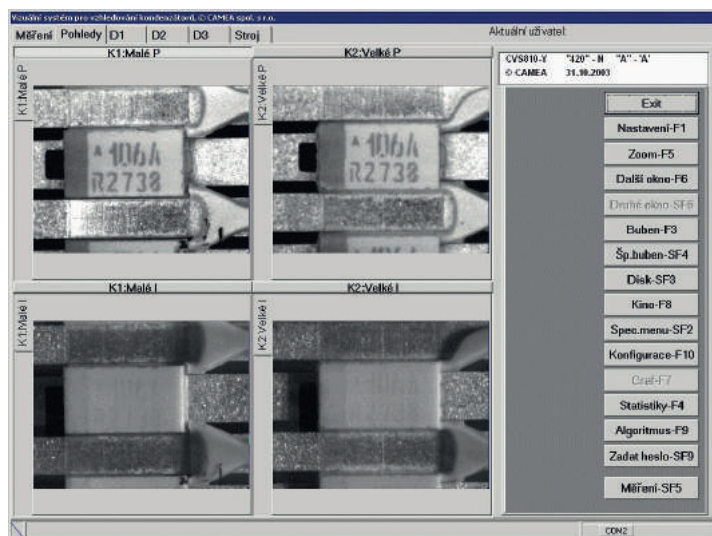
User interface for quality inspection of 3D defects

Features

» sensitivity configuration for each inspection
» configuration of detected defects parameters
» possible defect set extension
» statistics export
» automatic system diagnostics
» user and user rights management
» remote service and management

Detected Defects

The system can detect defects the size of units of microns on tens of components per second with high precision.

» Cracks
» Fragments
» 3D surface defects
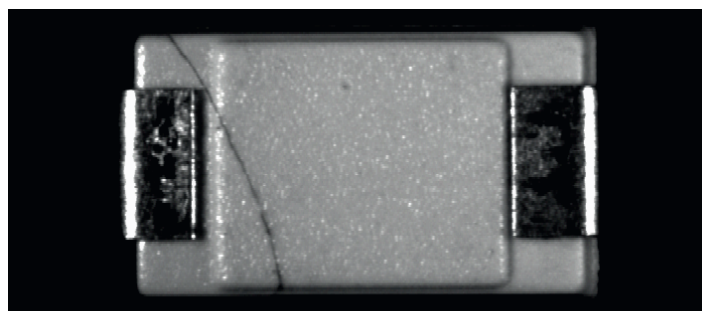» Contamination (dirt, ash)
» Gauging component sizes

Applications

» SMD component inspection
» Different component shape inspection
» Item orientation and positioning inspection
» Color and structure inspection
» Welding quality inspection
» Contact inspection etc.

Detected crack on a component casing

References

AVX Czech Republic, s. r. o.

CVS visual systems benefit from using custom designed optics
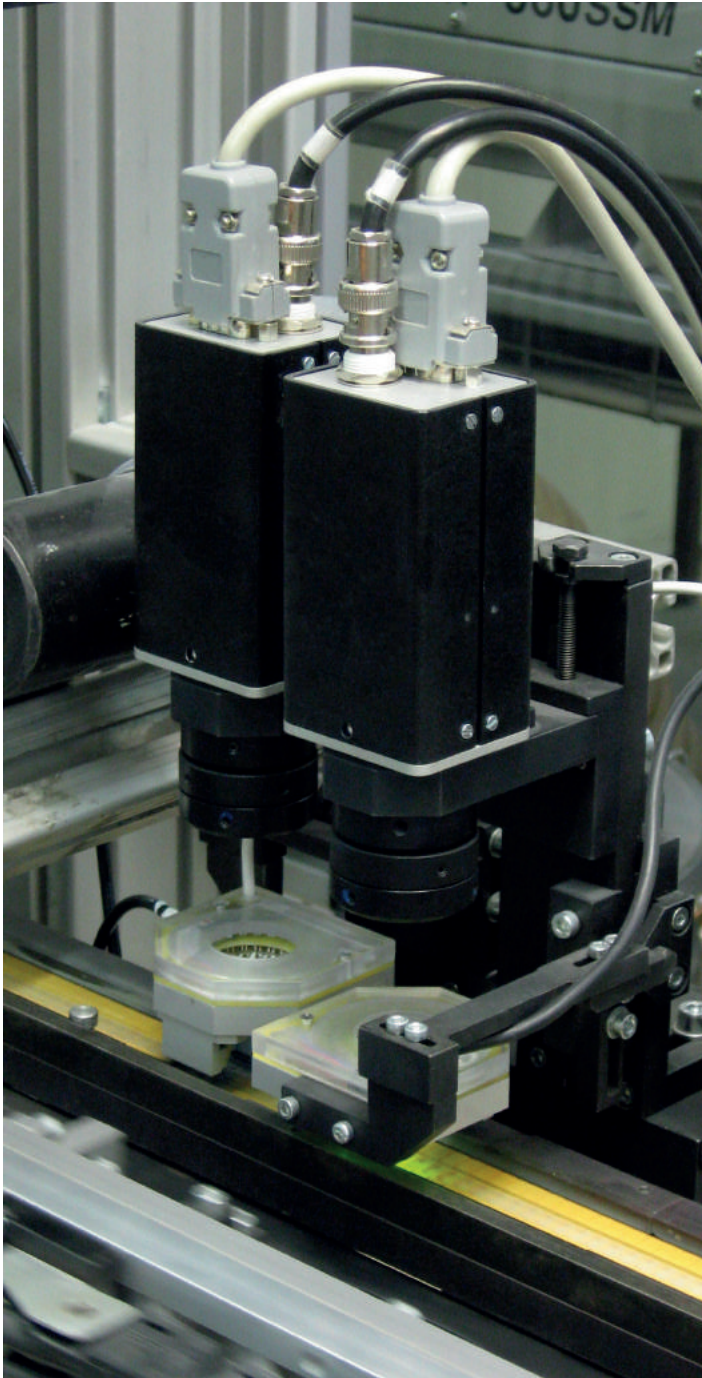
Visual surface defects inspection on a production line
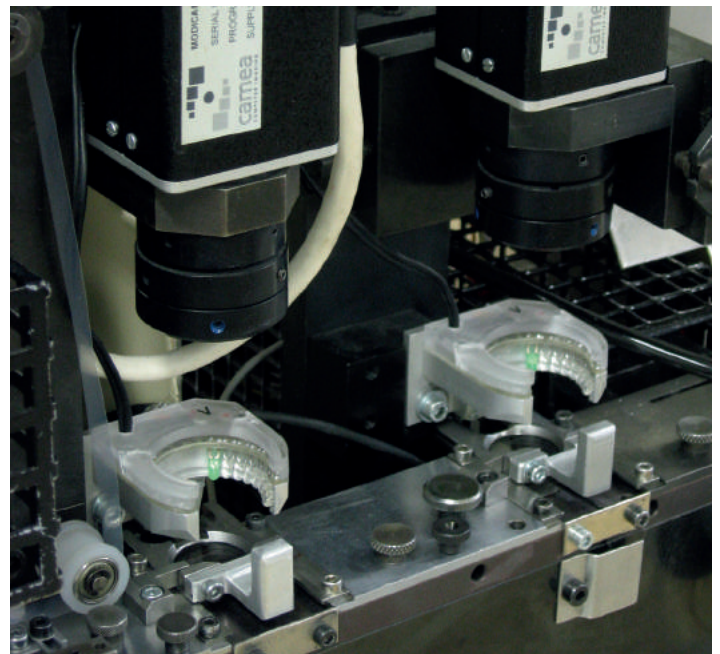
System illumination units

The UniscanCVS series visual systems are used during production as well as quality control of one of the world's biggest tantalum and niobium capacitor manufacturer. Millions of components on three continents are inspected daily.

Laser Beam Deflector
UniscanLASER

The UniscanLASER optical systems intended for precise and fast laser beam deflection. The deflector is designed for applications requiring accuracy within microns, such as miniature contact welding, cutting and carving. Due to the system's small size it is possible to insert it between the output of a laser beam and the manufactured component.

The UniscanLASER system can be enhanced with an intelligent camera system for image processing together with an adjusted illumination unit. This solution consists of advanced algorithms for automatic object targeting, system calibration and other features. Applications benefit from correction of errors caused by manufacturing tolerances, product mounting during on the fly contact welding, etc.
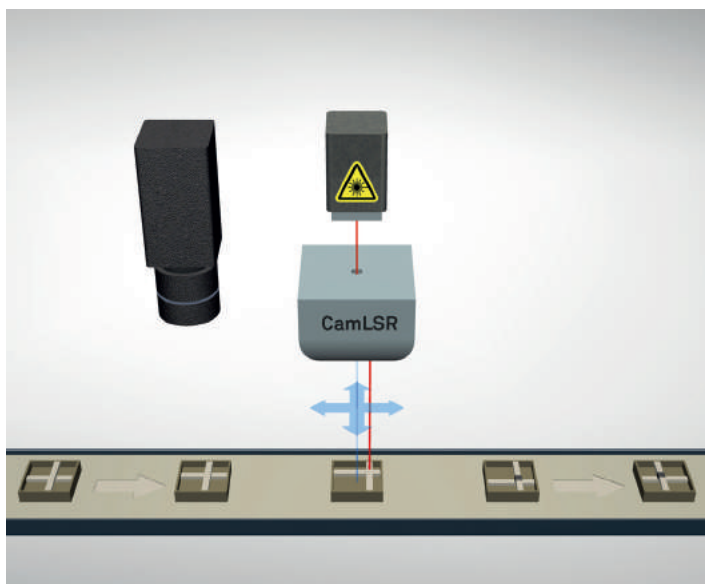
Operation principle of laser beam deflection

Features

» Very fast and accurate deflection
» Suitable for a wide range of laser products
» Open Camera System (optional)
» Variety of different types of products supported
» Turn-key solution
» Statistics export
» Automatic system diagnostics
» User and user rights management
» Remote service and management

Applications

» Accurate laser deflection
» Laser welding
» Laser carving
» Laser cutting

## Operation Principle

The system consists of two parts: the measurement section and the laser section. The measurement part (in this case the camera system) performs exact positioning measurement (e.g. for welding) on each component. This acquired data is transferred to the laser section, where the UniscanLASER controls the laser beam deflection based on the supplied positioning data.

Basic Specifications

|	
Dimensions (W×H×D)	110 × 45 × 110 mm
Laser Beam Deflection (max)	± 0.1 to ± 0.3 mm (fixed) in both axes
Resolution	0,1 % of max. range
Thermal Stability	better than 0,005 %/°C of range
Thermal Stability of Zero	better than 0,007 %/°C of range
Time for Adjustment	better than 20 ms for transition between position extremes
Wavelength	400 – 1300 nm, based on laser
Interface	RS232, I/O interface, custom

References

AVX Czech Republic, s. r. o.

The production of tantalum capacitors uses the visual system during the leadframe capacitor connector anode welding stage.
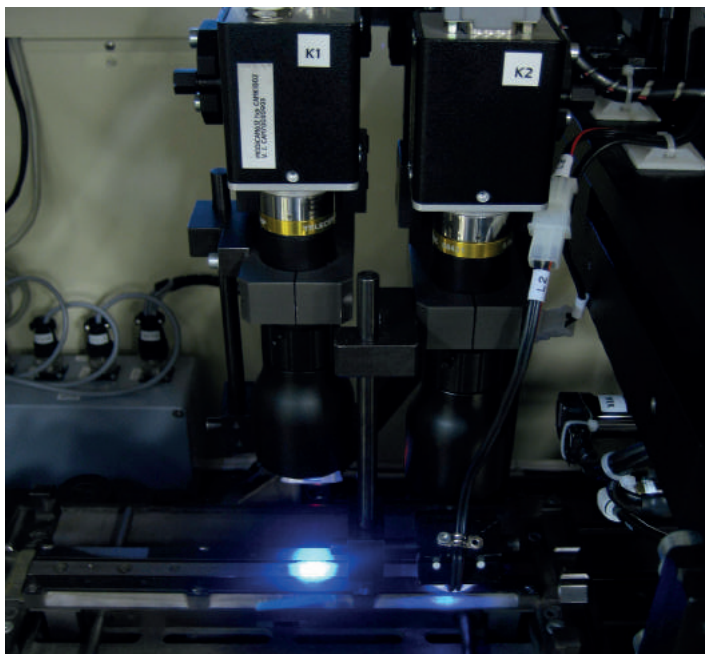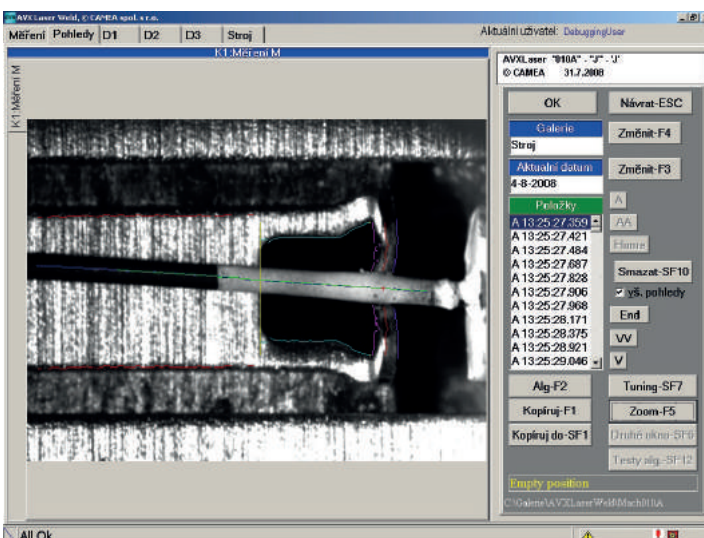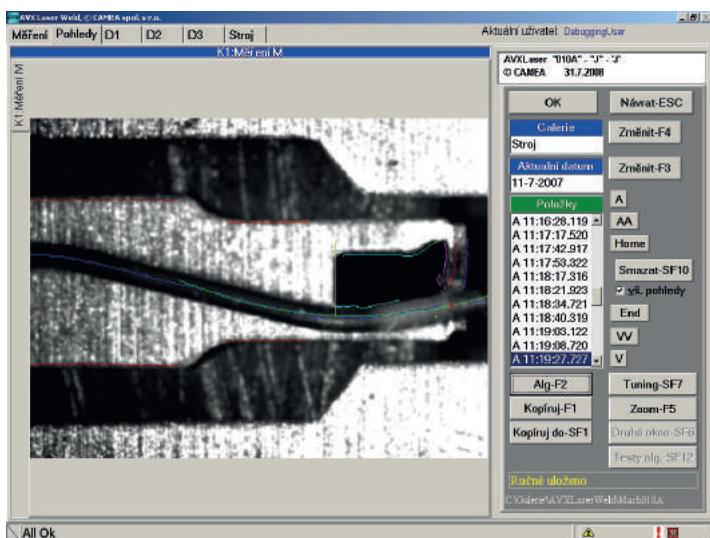

Cameras with stroboscopic illumination at the measuring position
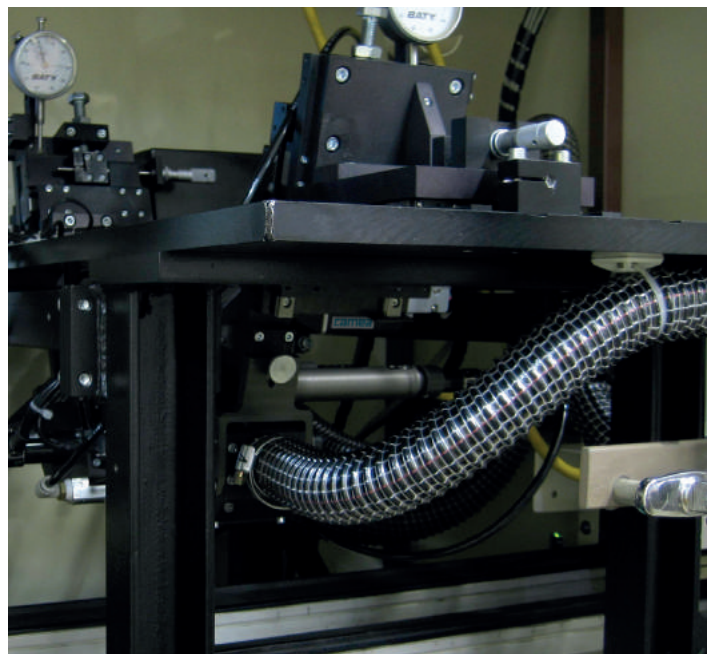
UniscanLASER integrated into a welding machine

The production of tantalum capacitors uses the visual system during the leadframe capacitor connector anode welding stage.

Images from visual inspection system – localization of connection leads enables accurate laser beam aiming

Machine Package Reading
UniscanCODEREADER

UniscanCODEREADER is a mobile device for optical reading of an identification code of a package and for subsequent automatic sorting to the corresponding pallet. Typical use would be in warehouses during loading or unloading goods to or from trucks etc. Warehouse operators therefore have information about incoming and outgoing goods available. Unloaded / loaded packages are equipped with tags with numeric identification codes. These codes also provide information about corresponding pallets. The device is suitable for packages tagged with numeric, bar or QR codes.

UniscanCODEREADER

Basic Specifications

Power Supply	12 V DC (batt.)
Battery Life (min)	8 hours
Temperature range	5 - 50 °C
Speed (max)	3600 packages/hour
Package Size (max)	600 x 600 x 600 mm
Letter Size (min)	3 mm
Image Resolution (typical)	0,15 mm/px

Package Information

» Tag image
» Read code for warehouse
» Corresponding pallet information
» No. of packages with different codes
» Incoming and outgoing package statisctics
» More information based on customer's needs

Features

» Camera with high resolution of up to 15 Mpx used for tag detection
» Three 24" Full HD monitors with wide viewing angles
» Storing of information about particular unloadings of incoming goods
» Automatic package sorting and pallet capacity check
» Battery powered
» Equipped with an illumination unit
» Wi-Fi network connectivity
» Export of data for further processing
» SW customization based on customer's needs

Applications

» Numeric, bar and QR code reading
» Increase in package sorting effeciency to corresponding pallets when unloading / loading goods

References

DHL SK

CAMEA

The company was founded in 1995 by a group of technical university researchers. With more than 20 years of experience in image processing (algorithms, illumination units, camera design), signal processing (algorithms, sensors, signal conditioning), real-time processing, embedded computing and HW/SW development for various traffic and industry applications, CAMEA is creating state-of-the-art and field-proven platforms for industrial and multifunctional intelligent transportation solutions with hundreds of applications around the world.

All key technologies used for designing the most innovative products are continuously being developed. While OEM components are available for integration into current systems, fully-featured systems are also being provided. CAMEA is a strongly customer-focused company, which creates individual and project oriented customizations of its technology portfolio, performs R&D of unique systems according to the customer's needs and closely cooperates with technological and business partners in engineering, installation, maintenance, staff training etc.

CAMEA has been certified with a quality management system according to ISO 9001:2001.
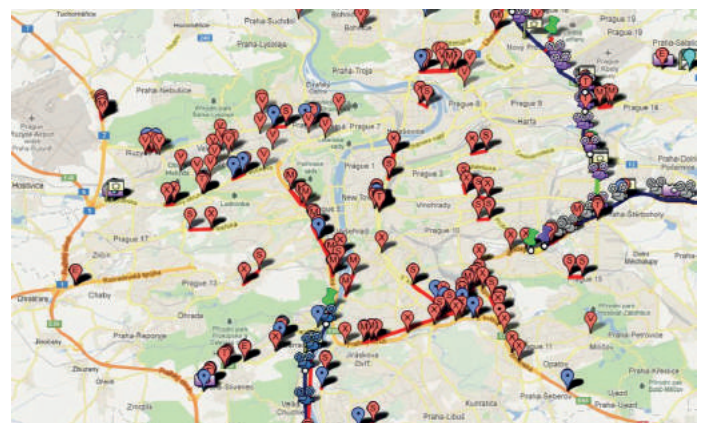
The enforcement ITS systems have been type approved and hold the appropriate certificates.

Unicam ITS systems are installed in many countries around the world.

For example in the city of Prague there are tens of systems integrated in a complex centrally operated ITS solution.

CAMEA, spol. s r. o.

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