OPTO ENGINEERING

OPTICAL IMAGING TECHNOLOGIES

OPTICS | LIGHTING | CAMERAS | SOFTWARE | ACCESSORIES | VISION SYSTEMS

Corporate Presentation

OPTO ENGINEERING

OPTICAL IMAGING TECHNOLOGIES

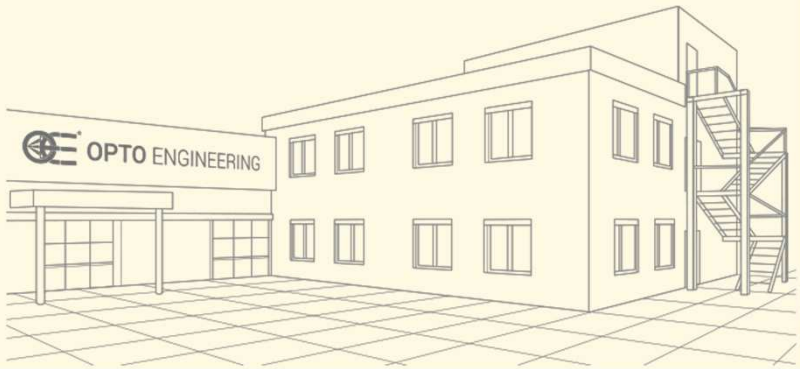
Who we are

OPTO ENGINEERING designs, manufactures and markets imaging components.
Our expertise in developing innovative optical systems has earned us worldwide recognition as a supplier of unmatched optical solutions.

OPTO ENGINEERING is the world leader in telecentric technology and the creator of many other optical products, which have enabled us to solve machine vision applications once considered impossible.

RETE LOMBARDIA ENWHP

ISO 9001 : 2015 International Organization for Standardization



OPTO ENGINEERING

OPTICAL IMAGING TECHNOLOGIES

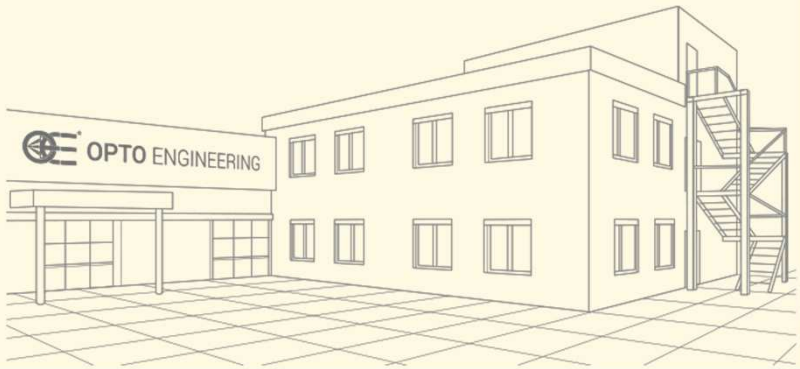
Who we are

Over the years, our expertise has expanded to other areas of technology. This, combined with a deep knowledge of the imaging market, has also made us a primary supplier of advanced **LED lighting solutions, revolutionary cameras, software, adaptive optics and artificial intelligence units**.

While we transform our competencies into products and profitable businesses, we do not lose our “Optics DNA”: our constant drive is to deliver increasingly more advanced **OPTICAL IMAGING TECHNOLOGIES**.

RETE LOMBARDIA ENWHP

ISO International Organization for Standardization 9001 : 2015



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Our driving principles

Excellence
We always start something to become the best at it.
To do that, we need excellent people on top of an excellent organization.

Commitment
Commitment is not just the basic requirement to achieve excellence: it is, in itself, a goal to achieve every day.

Cooperation
All the things we will do in the future, we will accomplish them with partners that share our values and desire to excel.

Change to Improve
Improvement is a never-ending process and a continuous path towards excellence with no fear of change.

Simplicity
Simple works better. Making complex things simple requires a huge creative effort and is an Italian art.

Speed
The geopolitical, social and economic scenarios keep changing rapidly. We can't be slower than the rest of the world: whatever we do, we'll do it fast.

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History & Trends: milestones

2016
Opto Engineering South East Asia Ltd. founded in Taipei
JV-based Technology scale-up program effective
Group management organization established
Proprietary, in-house developed, CRM and Logistics cloud software running

2015
New TCCORE patent pending technology released
ISO 9001 Certification Achieved
Re-positioning of Opto Engineering brand as Leader in «Optical Imaging Technologies»

2014
Product lineup spans 8 families, 60 series, 900+ models
New Opto Engineering facility opened in Mantova, Italy
OESUM srl, JV manufacturing high-power LED devices, founded

2013
German OE subsidiary, Opto Engineering Deutschland GmbH, founded in Munich

2012
Chinese OE subsidiary in Shanghai, Deep View Trading and Services Co. Ltd, established

2011
3D and Multi Mag optics added

2010
360° optics product family launched

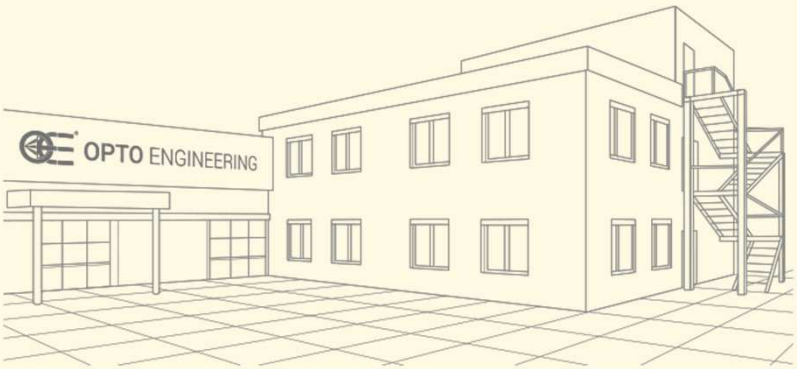
2009
New product and brand communication

2008
US OE subsidiary, Texas Industrial Optics Inc., established in Houston, TX

2006
Distribution network expands globally

2003
First telecentric lenses created and launched

2002
Opto Engineering founded



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Opto Engineering HQ
Mantova
ITALY

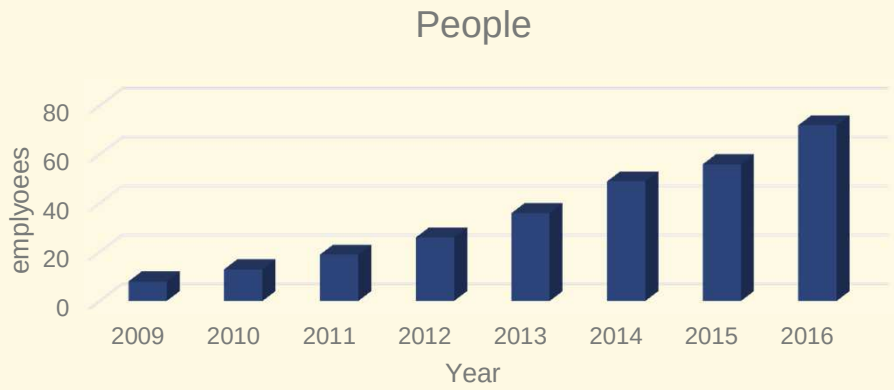
Opto Engineering GmbH
Munchen
GERMANY

Opto Engineering USA
Houston
USA

Opto Engineering CHINA
Shanghai
CHINA

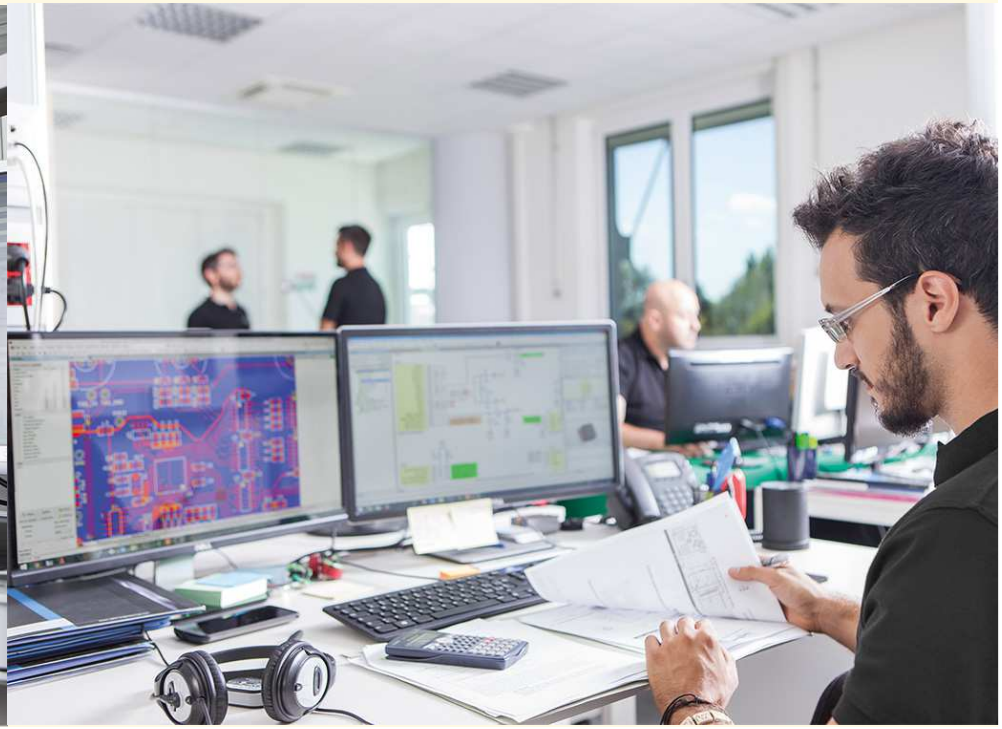
Opto Engineering South East Asia
Taipei
TAIWAN

Our figures: people & facilities



Operations

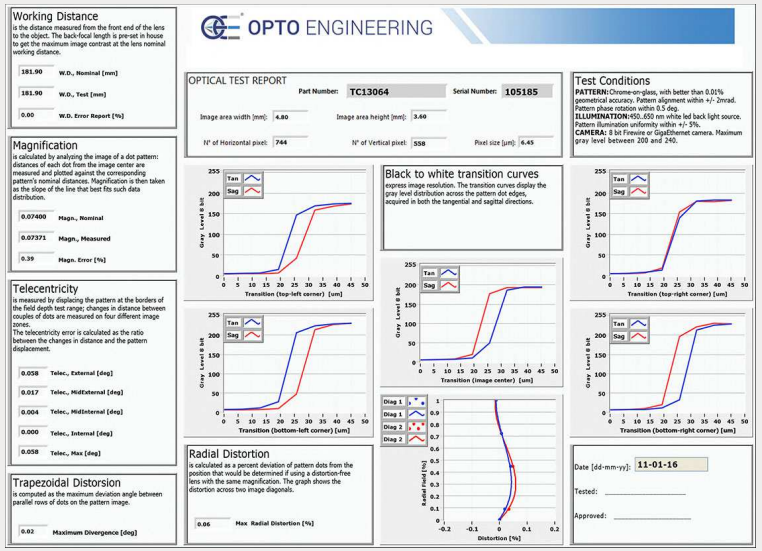
Our manufacturing units in Italy and the USA combine lean manufacturing with extensive use of information technology and visual programming to plan all the aspects of our operations.



Operations

We developed in-house many operation management tools to optimize production resources in order to meet the real needs of our customers.

Quality Assurance is paramount to us: **all our products are tested with specifically developed instrumentation and most of them are delivered together with an individual test report**.



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Communication

TRADESHOWS

Opto Engineering attends at least 8 different international tradeshows related to Imaging Technologies in Germany, the USA, China, Taiwan, Italy, Korea and Japan.

Our Marketing Team manages these events in full to effectively deliver the Company's message *"glocally"* and facilitate the interplay between customers and sales people.

Communication

CATALOG

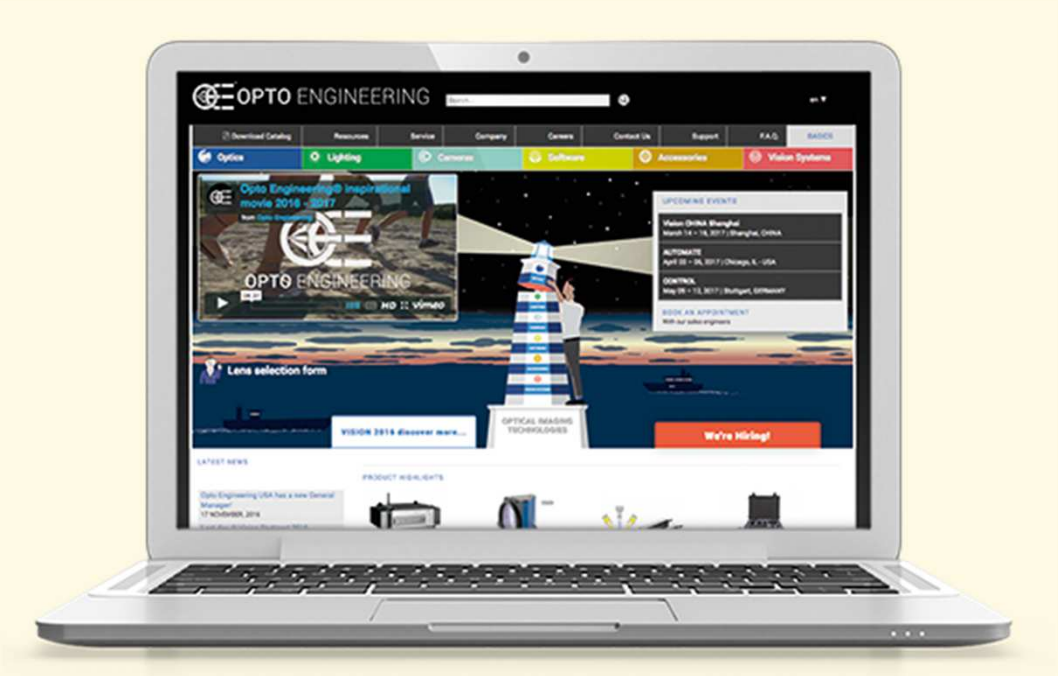
Every year, Opto Engineering delivers its catalog worldwide with many brand new products and a wealth of information on imaging solutions and innovative technologies.

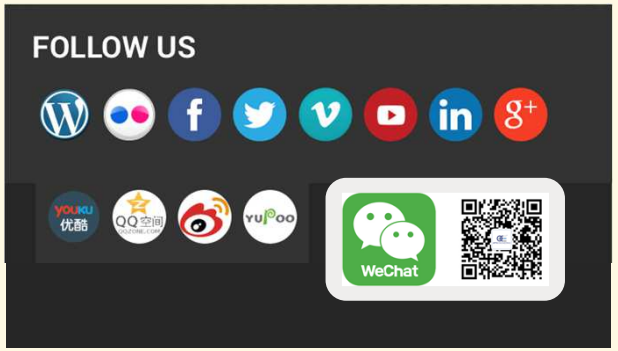
Communication

WEBSITE

Our website ww.opto-engineering.com is one of the best information platforms in the machine vision industry.

The website is available in 9 languages and offers several media contents like product videos, application notes and tutorials. **We value your time: less time spent searching for data means more productivity.**





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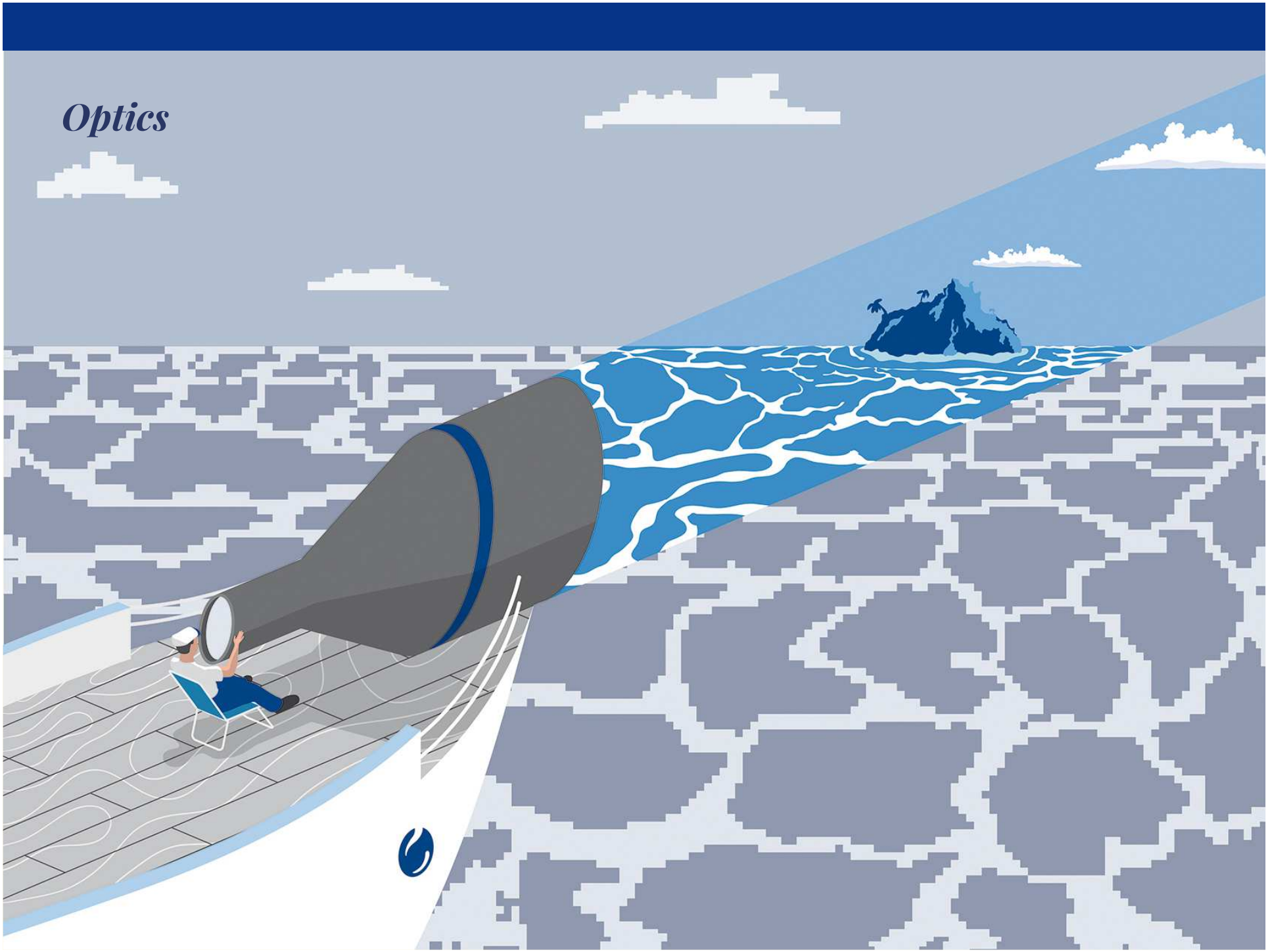
Products & Technologies

Optics



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OPTICS

Opto Engineering provides the best price-performance ratio optics for imaging and machine vision, tailored for the widest range of industries and applications.

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Products & Technologies

OPTICS

CORE series

Ultra compact telecentric lenses and illuminators

CORE series telecentric lenses and illuminators are up to 70% smaller than other solutions on the market due to their unique space-saving design, which is patent pending internationally. They deliver excellent optical performance in extremely reduced space, allowing you to build compact measurement systems while reducing production, transportation and storage costs.

inVISION TOP INNOVATION 2016

Vision Systems DESIGN 2016 Innovators Awards GOLD

INTERNATIONAL PATENT PENDING

OPTO ENGINEERING

OPTICAL IMAGING TECHNOLOGIES

Products & Technologies

OPTICS

NEW

MZMT12X series

12X continuous macro zoom lenses with motorized control

This series of high resolution motorized macro zoom lenses delivers superb optical performance in a compact and robust design. The Opto Engineering® design integrates two bipolar stepper motors that respectively control zoom and focus with fine increments, ensuring extremely accurate and repeatable results throughout the entire 12x zoom range. MZMT12X macro zoom lenses are designed for 2/3“ and are available with or without coaxial illumination.


Lighting

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OPTICAL IMAGING TECHNOLOGIES

LIGHTING

Opto Engineering provides machine vision lighting products designed to satisfy industrial automation applications such as LED illuminators and pattern projectors.

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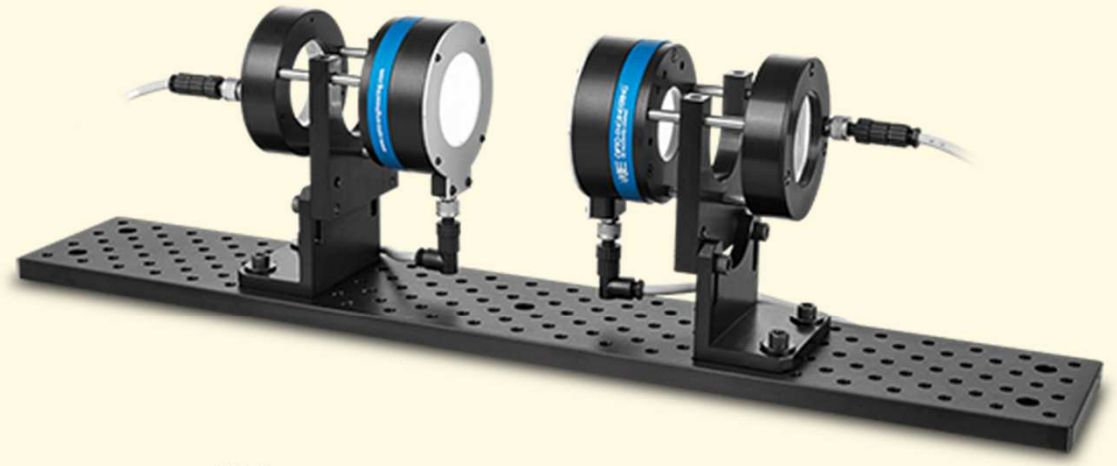
Products & Technologies

LIGHTING

View-through system

Space-saving illumination system for double side object inspection



Vision Systems DESIGN 2015 Innovators Awards SILVER

View-through system is a compact space-saving unique illumination solution designed to illuminate two sides of an object. It consists of two symmetrical modules, each one made of two illumination units:

- A diffusive strobed dome illuminator (white color)
- A special active “view-through” backlight unit (white color)

View-through system is designed to create very compact inline inspection solutions that illuminate and image both sides of fast-moving objects.

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Products & Technologies

LIGHTING

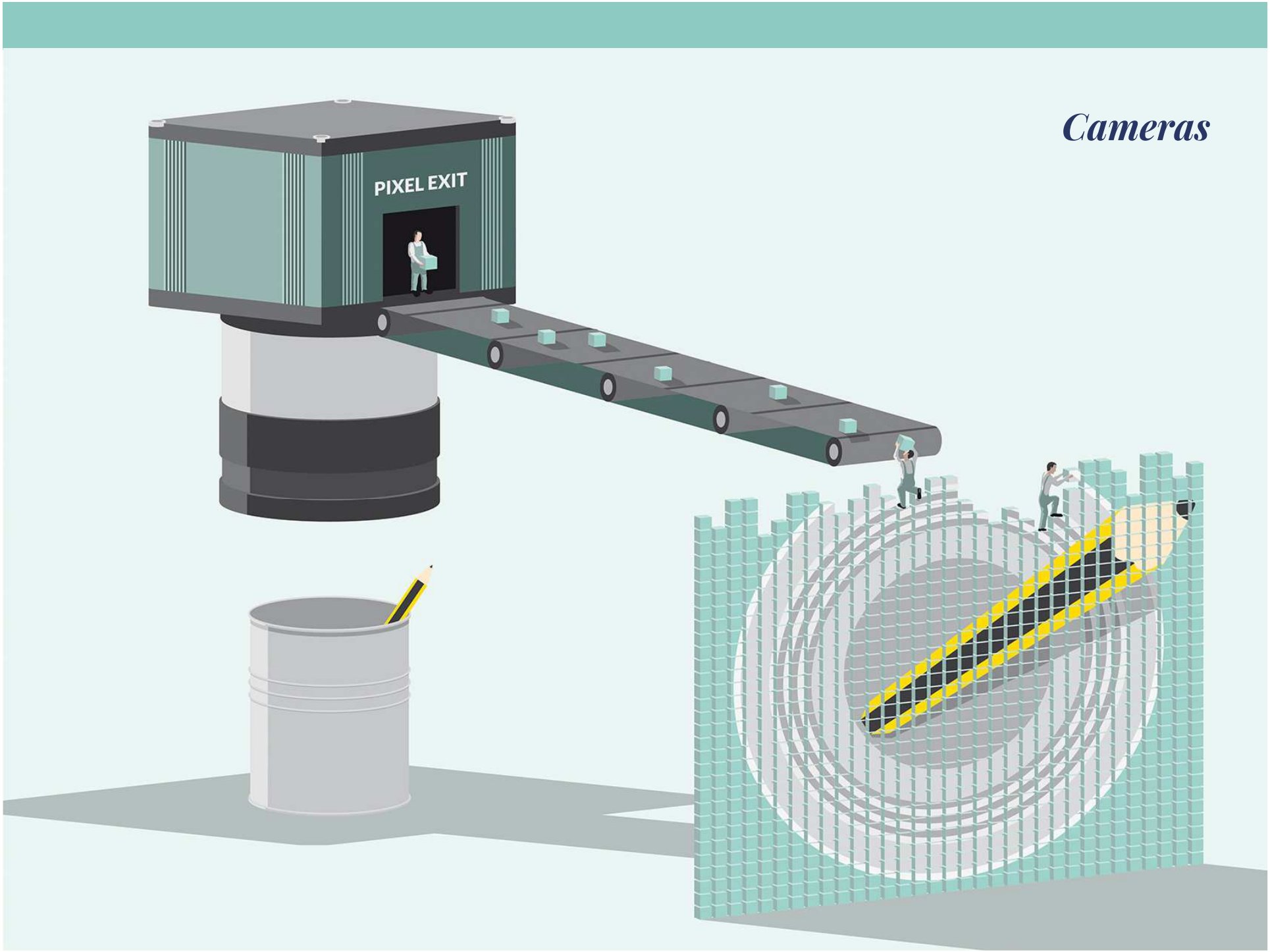
NEW

LTLNC series

Continuous LED line lights

LTLNC series are ultra-high power LED line illuminators designed for line scan applications. Their special design provides a powerful and homogeneous beam of light that is sharply focused onto the inspected object by means of a condenser lens.

Cameras



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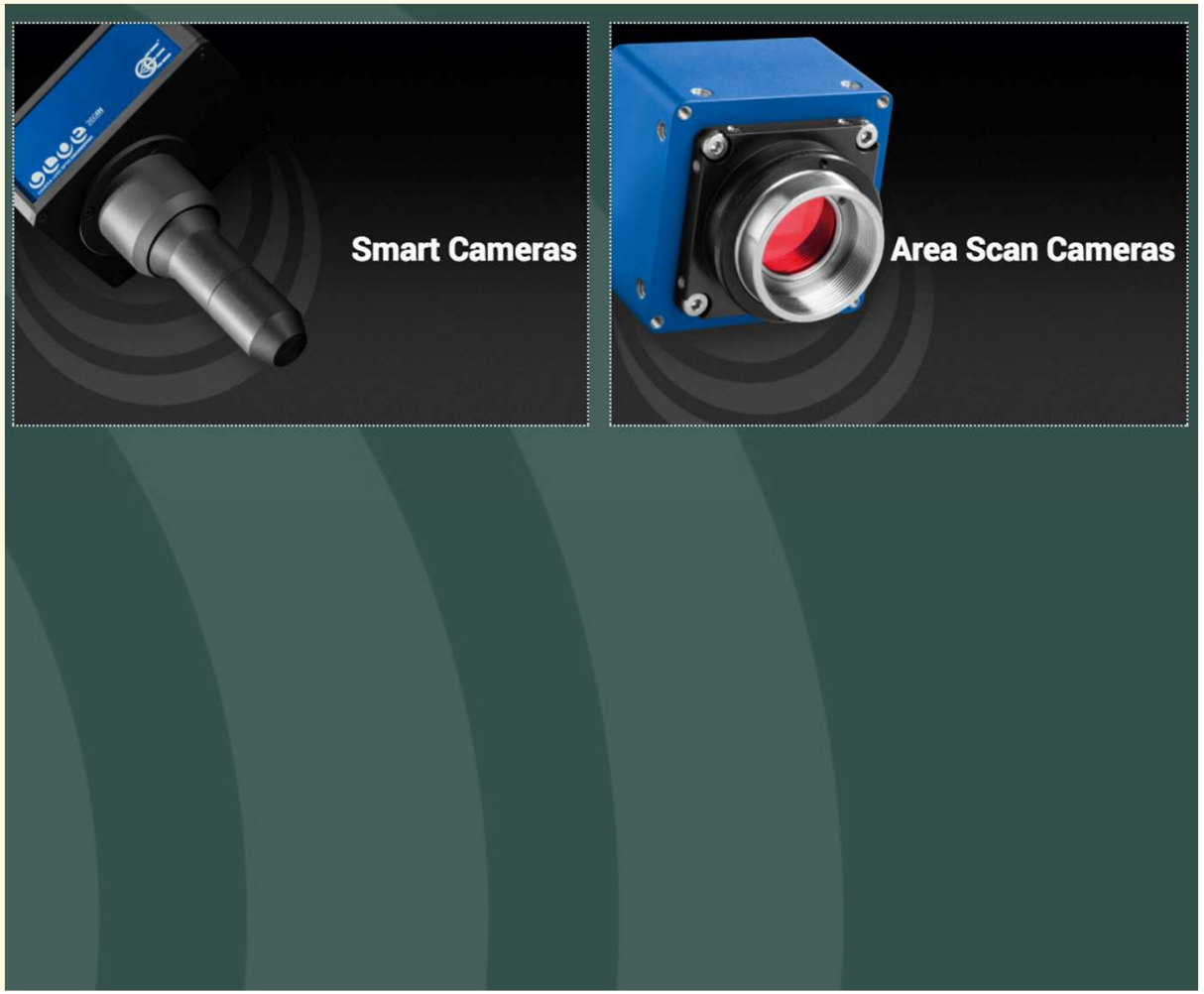
OPTICAL IMAGING TECHNOLOGIES

CAMERAS

Opto Engineering provides machine vision lighting products designed to satisfy industrial automation applications such as LED illuminators and pattern projectors.



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OPTICAL IMAGING TECHNOLOGIES

Products & Technologies

CAMERAS

NEW

CLOE series

Optical cameras for precision measurement and 360° view inspection

CLOE optical cameras offer a new approach to machine vision applications. Camera, optics and image pre-processing hardware are packaged in a pre-assembled and pre-calibrated unit to deliver the best possible digital image right out of the box. The embedded image pre-processing functions greatly simplify software programming for image analysis, thus making CLOE cameras ready for use even with vision software and systems that have limited image correction tools.

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OPTICAL IMAGING TECHNOLOGIES

CLOE-CORE series offers a new approach to metrology applications.

This optical camera contains pre-aligned imaging components and a pre-processing unit that deliver “the best possible digital image”, where distortion has already been corrected and the object’s edges have been pre-processed to facilitate accurate edge detection.

CLOE-CORE cameras ready for use with vision systems that have few software calibration tools.

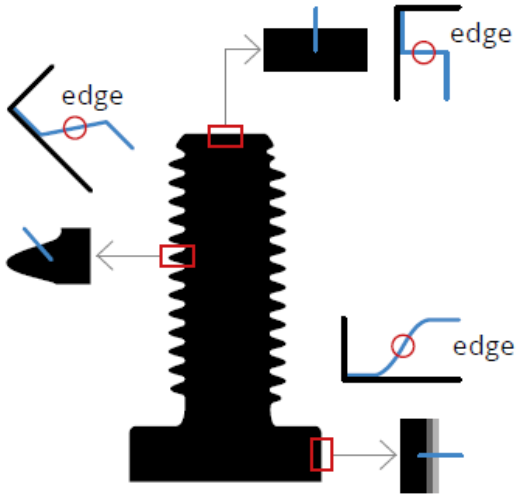
Perfect for precision measurement applications
Camera, optics and image pre-processing hardware packaged in a pre-assembled and pre-calibrated unit.

Onboard distortion correction
CLOE-CORE cameras are corrected for distortion at production level, ensuring minimal distortion right out of the box.

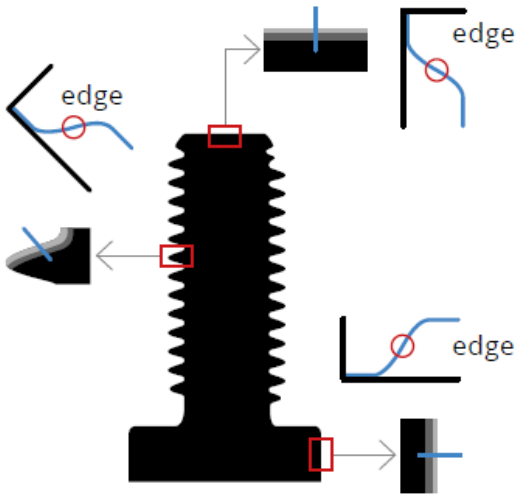
Constant magnification and FOV for every model
Every optical camera model provides the same FOV, magnification and working distance.

Edge recognition and pre-processing
Object's edges are analyzed and pre-processed onboard according to standard calibration models.

Different types of edges are pre-processed by CLOE-CORE cameras according to a standard sigmoidal edge transition profile. An improved image is generated for further processing by an external measurement software. All edges can be correctly analyzed using standard algorithms, ensuring consistent measurement results.

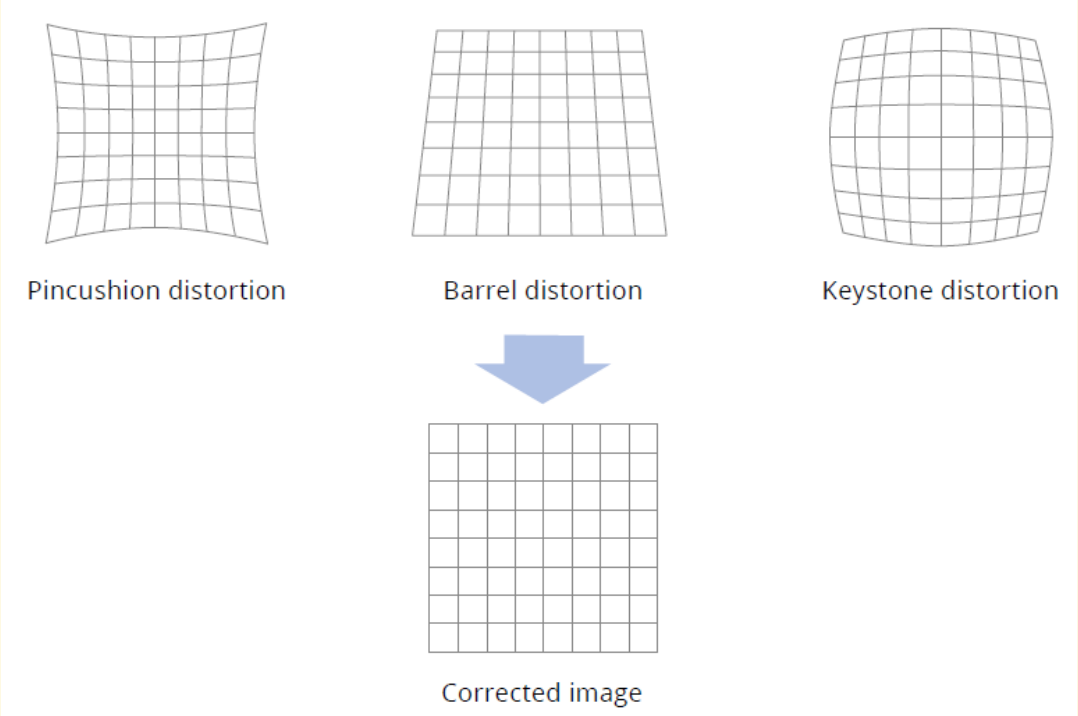


Raw image: objects with complex geometry contain different types of edge profiles.

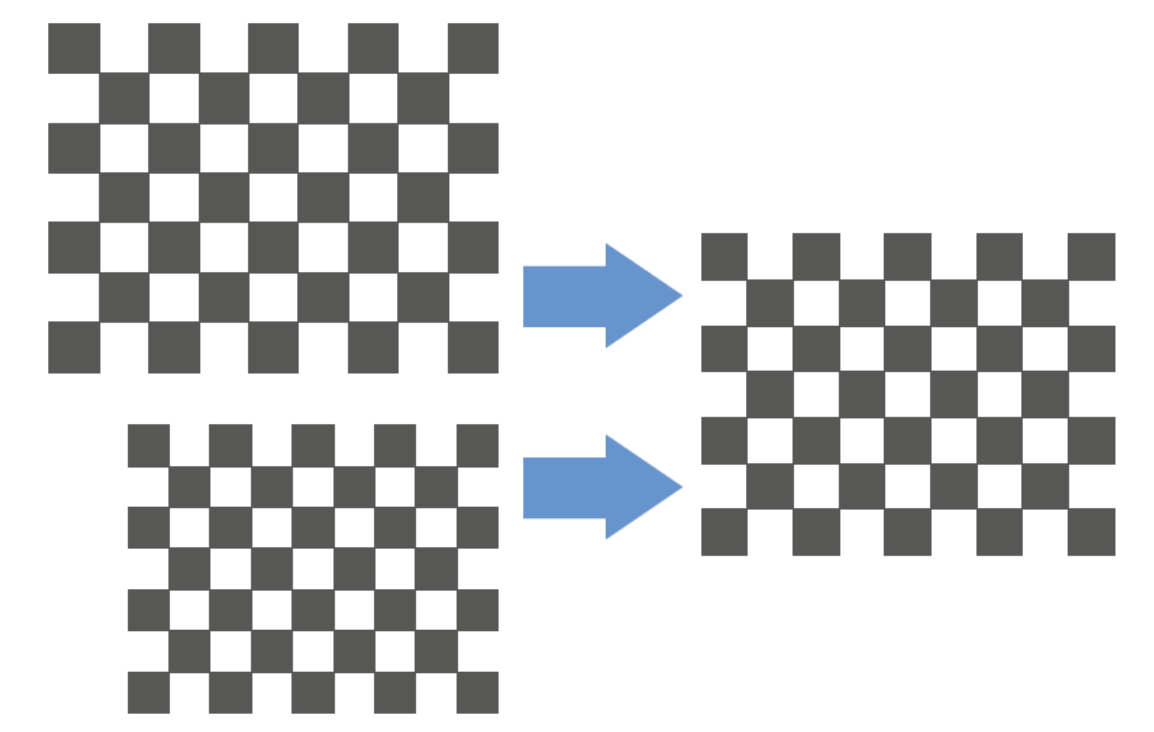


Pre-processed image: different types of edges are processed according to a standard sigmoidal edge transition profile.

The residual distortion of a bi-telecentric lens in CLOE-CORE metrology cameras is calibrated on-board coherently with the factory calibration data. CLOE-CORE systems are corrected for distortion at production level, ensuring minimal distortion right out of the box (when imaging a certified calibrated pattern illuminated with a green diffuse backlight).



Magnification, FOV and working distance of each particular unit are always the same, ensuring a hassle-free integration of multiple camera systems and consistent batch-to-batch measurement machines.



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OPTICAL IMAGING TECHNOLOGIES

Common measurement system integration

TO DO LIST

- Make sure the sensor or lens do not limit the system resolution
- Check and adjust back flange distance
- Calibrate image distortion
- Write and/or apply image processing algorithms to optimally analyze the object's edges

REPEAT X TIMES FOR EVERY SYSTEM

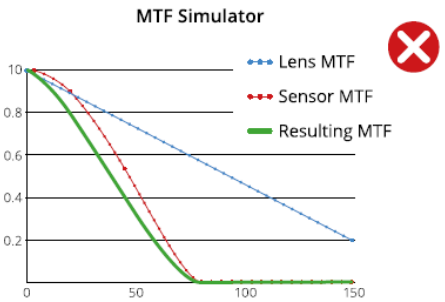
CLOE-CORE integration

TO DO LIST

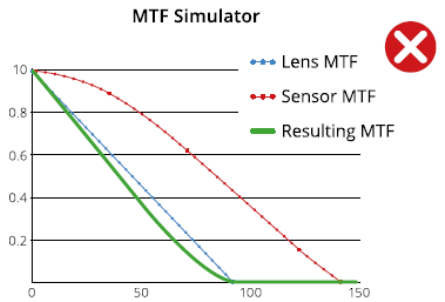
Ready to use!

TASK: Make sure sensor or lens do not limit the system resolution

Resolution limited by detector or lens



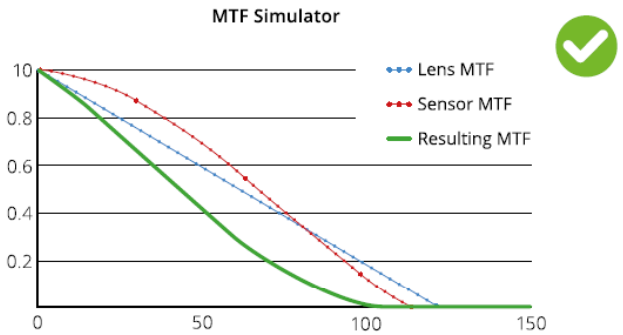
Example of a resolution limited by detector.



Example of a resolution limited by lens.

Choosing suitable components for a precision measurement system requires a study aimed at matching camera and lens resolutions. Pixels that are too small or too large will not only influence the overall resolution of the system, but also the overall depth of field. The lens aperture and CTF should also be optimized for the camera sensor resolution, in order to avoid degraded image quality and poor system efficiency.

Perfectly matched lens to sensor resolution



Example of a balanced resolution.

CLOE-CORE cameras maximize optical performance thanks to the latest CMOS sensor technology and CORE bi-telecentric lenses, whose resolution is perfectly matched to the sensor pixel size.

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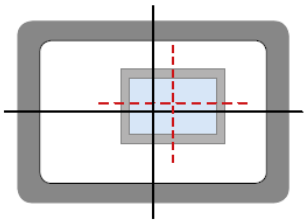
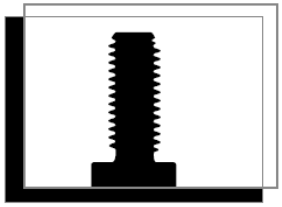
OPTICAL IMAGING TECHNOLOGIES

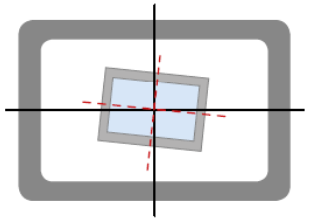
TASK: Make sure the camera sensor is correctly aligned

Sensor is decentered or rotated





Resolution limited by detector.



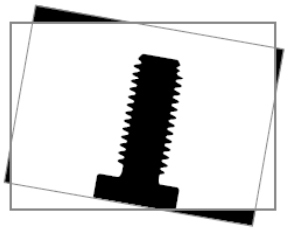
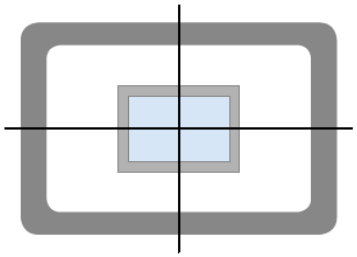


Image sensor is rotated.

The accuracy in mounting a sensor impacts image quality. If the sensor is decentered or rotated, a part of the image may not be usable. However the user will notice it only after mounting the lens and taking an image.
Moreover, the sensor position may vary from camera to camera, which would require extra work to verify that all cameras produce the same result.

Correct sensor alignment



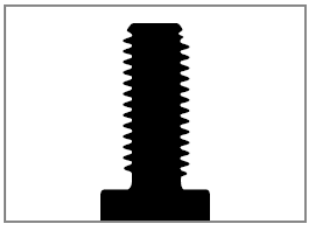
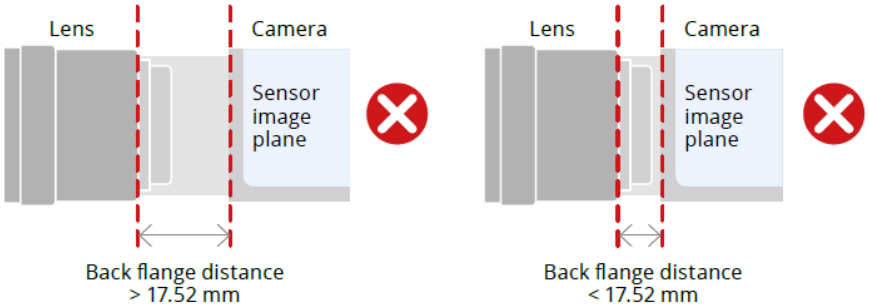


Image sensor correctly aligned.

CLOE-CORE optical cameras integrate an extremely precise mechanism developed to correctly mount the sensor inside the camera assembly, thus preventing sensor rotation or decentering. This ensures that the image quality of the optical system is optimal and not affected by the last link in the chain – the sensor.

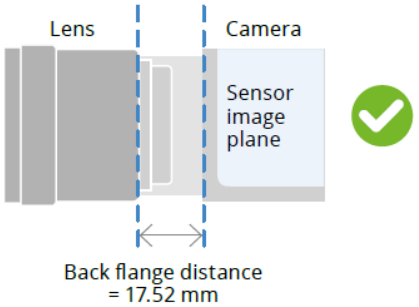
TASK: Check and adjust back flange distance

Back flange distance is not respected

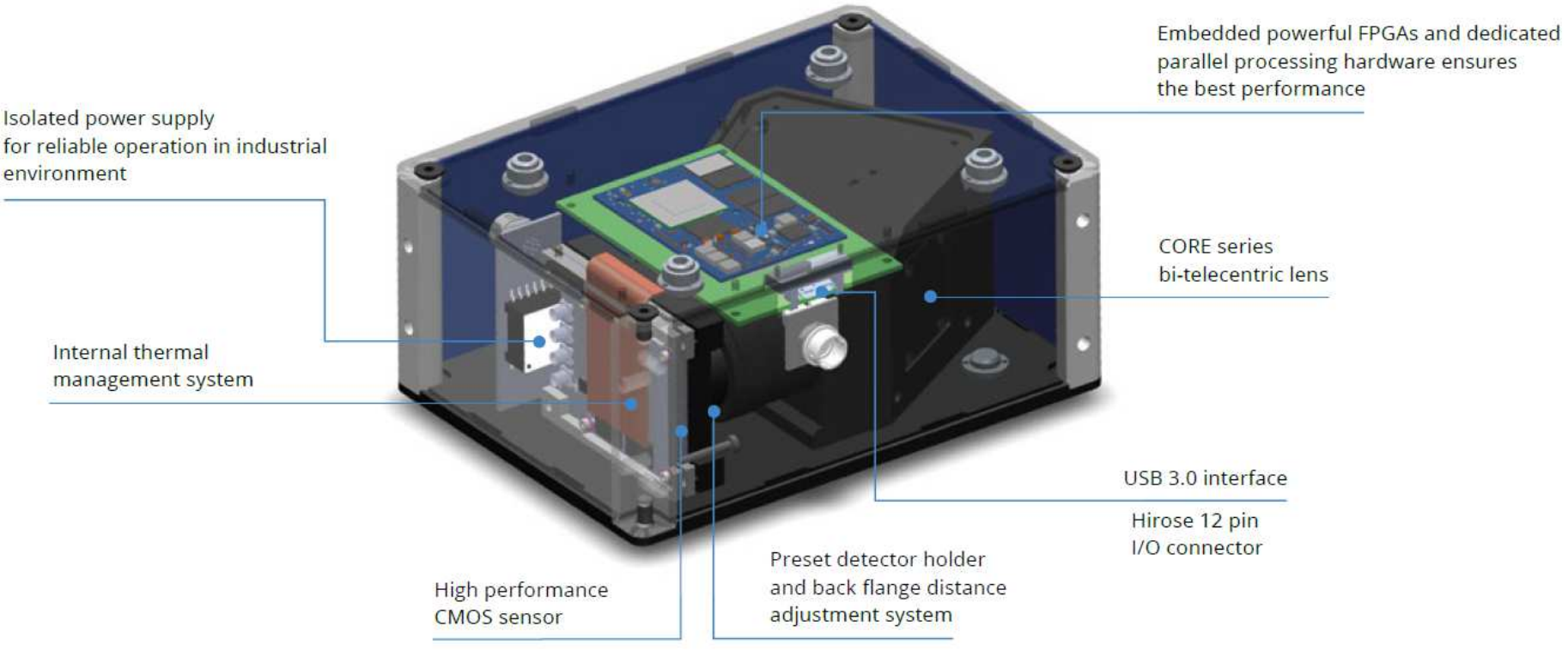


While C-mount lenses are designed with a flange-focal length of 17.52 mm, many cameras do not accurately meet this industrial standard. When the back focal distance is not correct, the best focus plane of the lens will be shifted from the nominal working distance value. The bigger the difference, the more the optical performance will be affected. In order to reach the best possible lens performance, it is necessary to calculate and manually adjust the back focal distance.

Correct back flange distance



CLOE-CORE optical camera components are precisely aligned in production, ensuring that the back focal distance is correctly set. As a result, you can simply mount the CLOE-CORE camera in your system and put the sample at the nominal working distance to get optimal results.
No further verification or adjustments is needed, making the integration of CLOE-CORE cameras extremely fast.


Embedded powerful FPGAs and dedicated parallel processing hardware ensures the best performance
Isolated power supply for reliable operation in industrial environment
CORE series bi-telecentric lens
Internal thermal management system
USB 3.0 interface
Hirose 12 pin I/O connector
Preset detector holder and back flange distance adjustment system
High performance CMOS sensor

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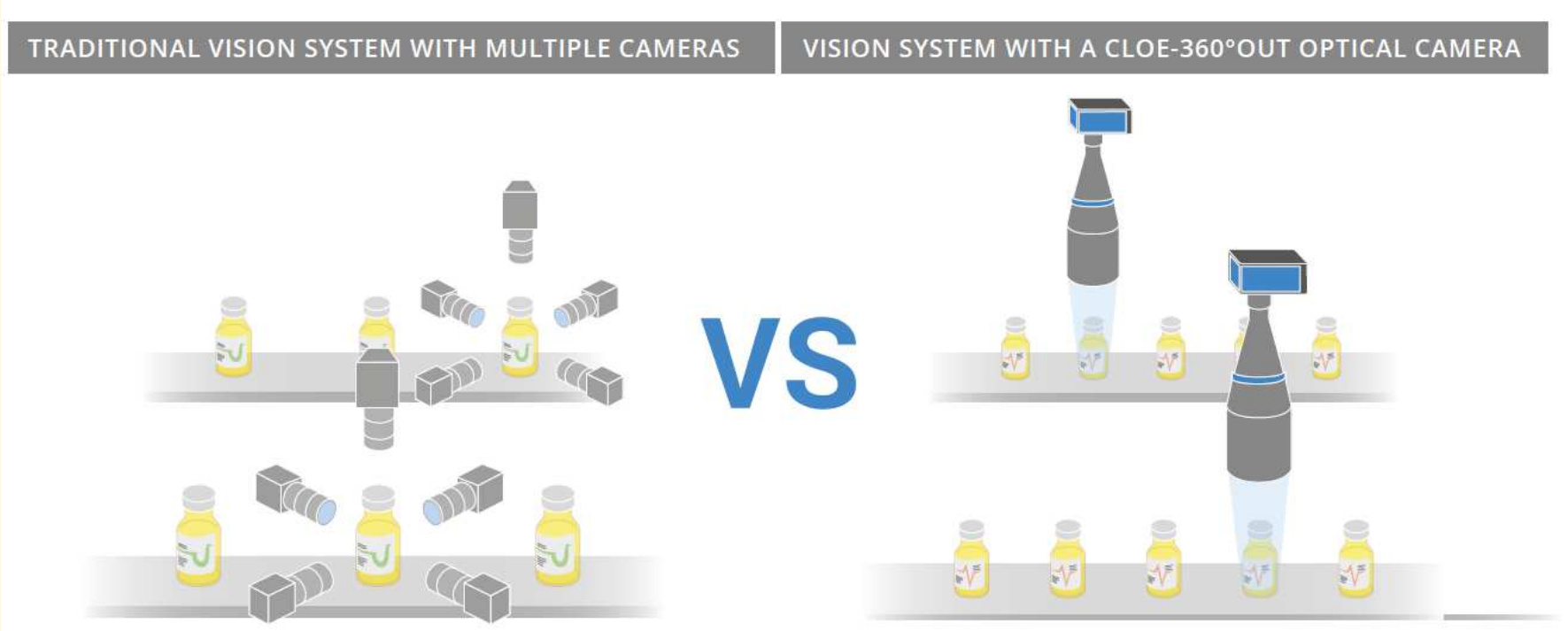
OPTICAL IMAGING TECHNOLOGIES

CLOE-360°OUT is a family of optical cameras designed for 360° outer surface inspection. The image of the object produced by the optical camera is an “unwrapped” representation of the top and side walls of the object. Image unwrapping is instantly performed by the camera’s preprocessing firmware on the basis of factory calibration data, which determines the most suitable type of image transformation. The embedded image pre-processing functions greatly simplify software programming for image analysis, thus making CLOE-CORE cameras ready for use even with vision softwares and systems that have limited image correction tools


TRADITIONAL VISION SYSTEM WITH MULTIPLE CAMERAS
VISION SYSTEM WITH A CLOE-360°OUT OPTICAL CAMERA
VS

OPTO ENGINEERING

OPTICAL IMAGING TECHNOLOGIES

The perfect device for pericentric imaging

Camera, optics and image pre-processing hardware bundled in a single pre-assembled and pre-calibrated unit.

360° top and side inspection with just one camera

No need for multiple cameras around and over the object.

Automatic image unwrapping

Embedded software instantly performs automatic image unwrapping.

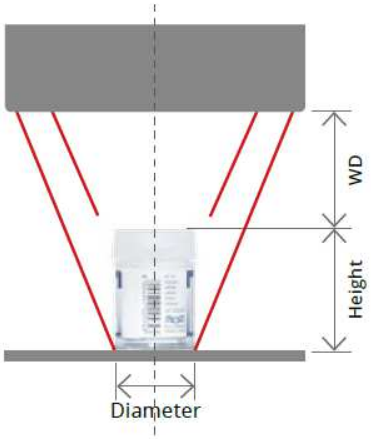
Off-axis distortion correction

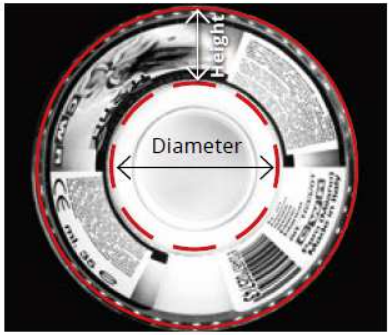
CLOE-360°OUT corrects distortion also when samples are slightly off-centered.

Constant FOV for every model

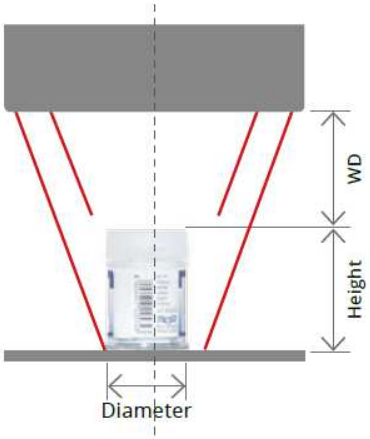
Every camera model can image objects within a specific range of diameters and heights, with excellent consistency between units. This makes them easy to swap out or to integrate in multiple production lines.

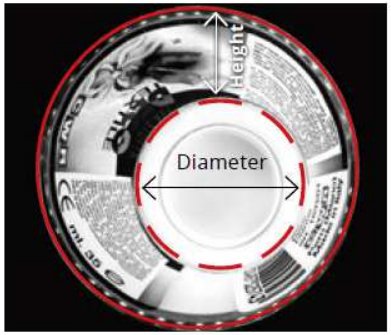
Raw image: object is well centered under the lens





Raw image: object is slightly decentered under the lens





Unwrapped image: a single continuous image of the top and lateral surfaces of the object is automatically generated

The optical camera's firmware automatically corrects **distortion and unwraps the image even when the object** is slightly off-centered. The lateral and top surfaces of the objects are captured within the same image.

OPTO ENGINEERING

OPTICAL IMAGING TECHNOLOGIES

CLOE-360°IN is a family of optical cameras designed for 360° inner inspection of concave objects. The optical camera automatically produces an “unwrapped” and perfectly focused image of the inside of an object with a single image.
Although the object’s position on the conveyer belt may not always be accurate, CLOE-360°IN cameras are programmed to successfully pre-process the image of an object even when it is slightly offcentered. The pre-processed image can be further analyzed with any type of vision software, making CLOE-360°IN cameras ready for use even with vision softwares and systems that have limited image correction tools.


TRADITIONAL VISION SYSTEM WITH MULTIPLE CAMERAS
VS
VISION SYSTEM WITH CLOE-360°IN OPTICAL CAMERA

OPTO ENGINEERING

OPTICAL IMAGING TECHNOLOGIES

The perfect device for inner surface inspection

Camera, optics and image pre-processing hardware bundled in a single pre-assembled and pre-calibrated unit.

Inner surfaces imaged in perfect focus in a single image

No need to rotate the part or to use multi-camera systems to perform your inspection.

Embedded firmware delivers automatic image unwrapping

The undistorted image makes additional software processing easy.

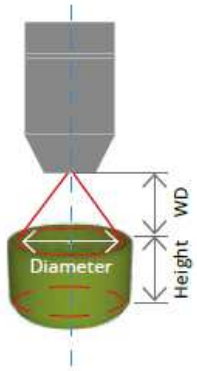
Distortion correction of slightly off-centered images

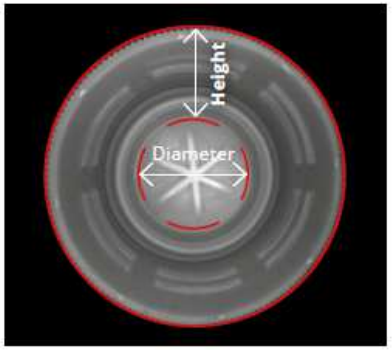
Slight variations in the object's position are compensated by CLOE-360°IN pre-processing algorithms.

Constant FOV for every model

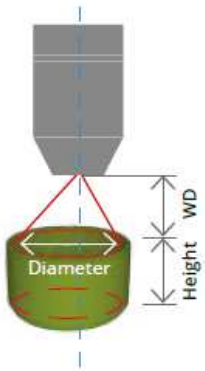
Every camera model is pre-set for a specific range of diameters and heights, allowing for quick and easy integration with consistent results.

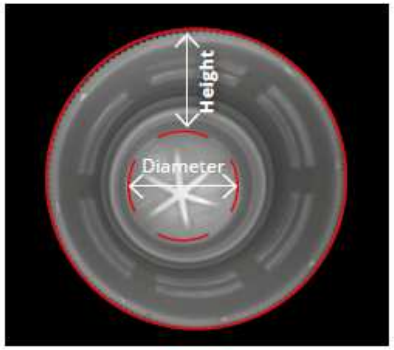
Raw image: bottle cap is well centered under the lens



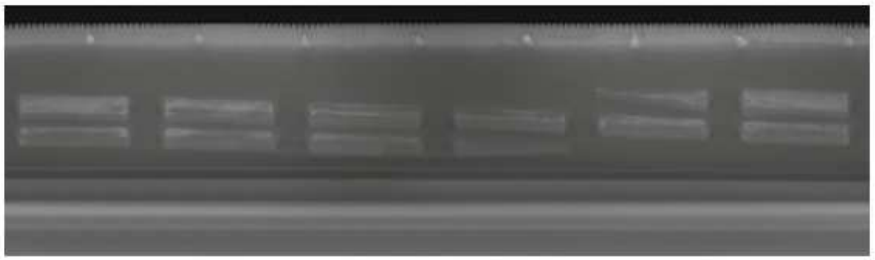


Raw image: bottle cap is slightly decentered under the lens



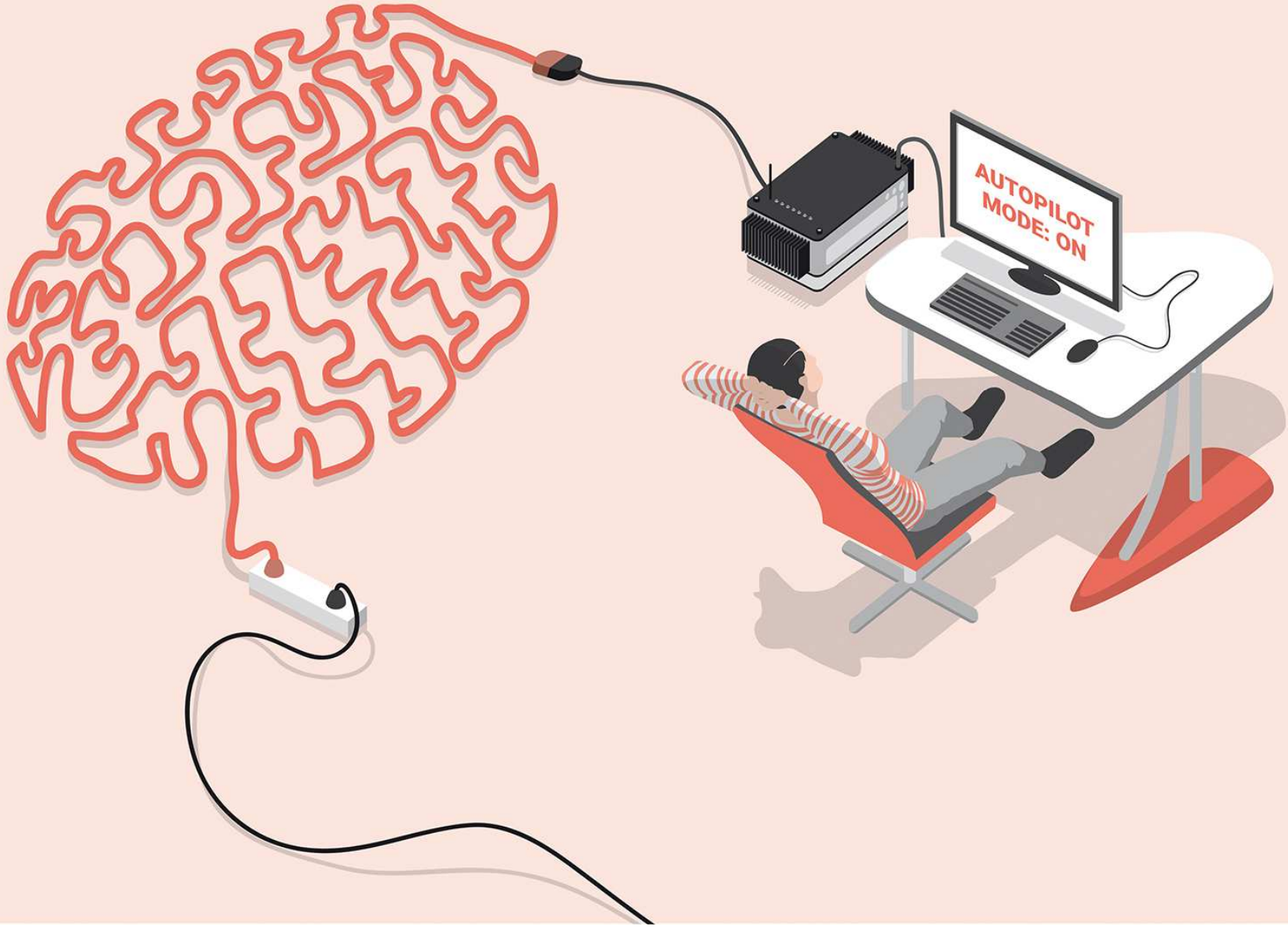


Unwrapped image: a single continuous image of the side walls and bottom of the object is automatically generated



CLOE-360°IN camera is programmed to pre-process and generate unwrapped images of both centered and slightly decentered objects.
The inner and bottom surfaces of the part are imaged in focus within the same image.

Vision Systems



OPTO ENGINEERING

OPTICAL IMAGING TECHNOLOGIES

VISION SYSTEMS

Opto Engineering has identified specific needs concerning machine vision systems, providing unconventional solutions that are both smart and easy to use.

OPTO ENGINEERING

OPTICAL IMAGING TECHNOLOGIES

Products & Technologies

VISION SYSTEMS

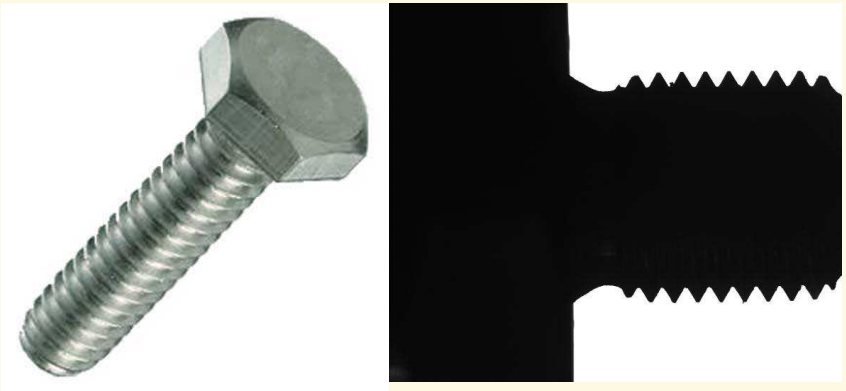
NEW

ALBERT

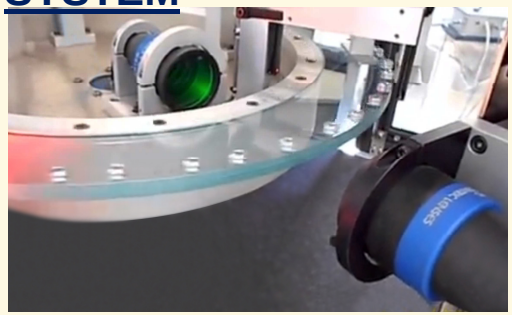
Self-learning vision system for food inspection

ALBERT is an innovative and easy to use vision system that learns from examples as humans do, thanks to its core technology based on neural networks: ALBERT is the perfect solution for the inspection of baked goods such as cookies or chocolate pastries. Unlike traditional systems, it can be quickly re-trained to sort a new product or adapted to a new batch of ingredients.

TRADITIONAL VISION SYSTEMS



SCREW MEASUREMENT SYSTEM



Operate with **well defined single-variable pass-fail criteria**

The goal of the system is to
- check the dimensions on a screw
- **reject** the component **if one of the dimensions is out of tolerance**

FOOD INSPECTION

CHALLENGES

- The acceptance criterion is often a **complex combination** of many parameters
- The **severity** of the defect is a **subjective** combination of multiple variables
- Products feature a **high degree of variability in shape and/or color**
- One single line is used for **multiple products**
- There is need to simply and rapidly modify the acceptance criteria in order to
    - **inspect new products**
    - follow **changes in production requirements**

OPTO ENGINEERING

OPTICAL IMAGING TECHNOLOGIES

ALBERT

ALBERT is a vision system for SHAPE and COLOR inspection, based on artificial intelligence techniques.

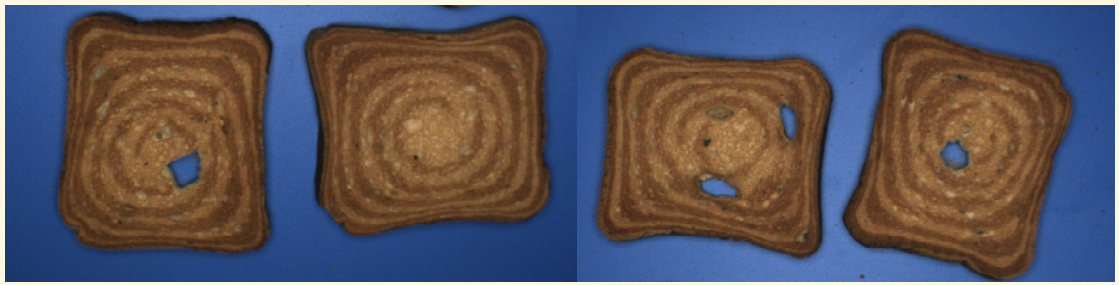
Learns from examples as humans do.

OPTO ENGINEERING

OPTICAL IMAGING TECHNOLOGIES

ALBERT

Inspects complex products with high variability as **simply** as a human operator would.



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OPTICAL IMAGING TECHNOLOGIES

ALBERT

Self-learning

Learns the features of your products **directly from the production line** without complicated settings.
NO NEED to present the good parts only.

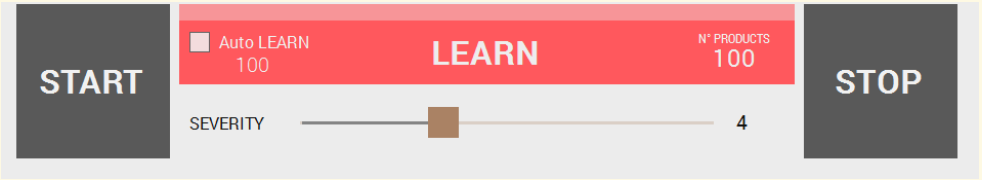
ALBERT

Self-learning

Learns the features of your products **directly from the production line** without complicated settings.
NO NEED to present the good parts only.

Simple and Intelligent

Inspects in a more strict or tolerant way by simply moving a slider according to different production requirements.



Booth 1F44 Hall 1

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OPTICAL IMAGING TECHNOLOGIES

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Suitable to identify complex defects

Understands the quality of products even with complex features and high variability.

OPTO ENGINEERING

OPTICAL IMAGING TECHNOLOGIES

ALBERT

Self-learning

Learns the features of your products **directly from the production line** without complicated settings.
NO NEED to present the good parts only.

Simple and Intelligent

Inspects in a more strict or tolerant way by simply moving a slider according to different production requirements.

Suitable to identify complex defects

Understands the quality of products even with complex features and high variability.

IP65 Rated

Ideal for the food industry.

OPTO ENGINEERING

OPTICAL IMAGING TECHNOLOGIES

ALBERT

Increase / decrease
SEVERITY LEVEL

POWER

STOP CHECK

START CHECK

Press together
LEARN PHASE

LED diffuse strobe illuminator, white

8 mm f1.4 f16 lens

LED status BAR
LEARN PHASE = **YELLOW**
CHECK PHASE = **GREEN** (OK PART) **RED** (NOK PART)
SET SEVERITY LEVEL = **BLUE**

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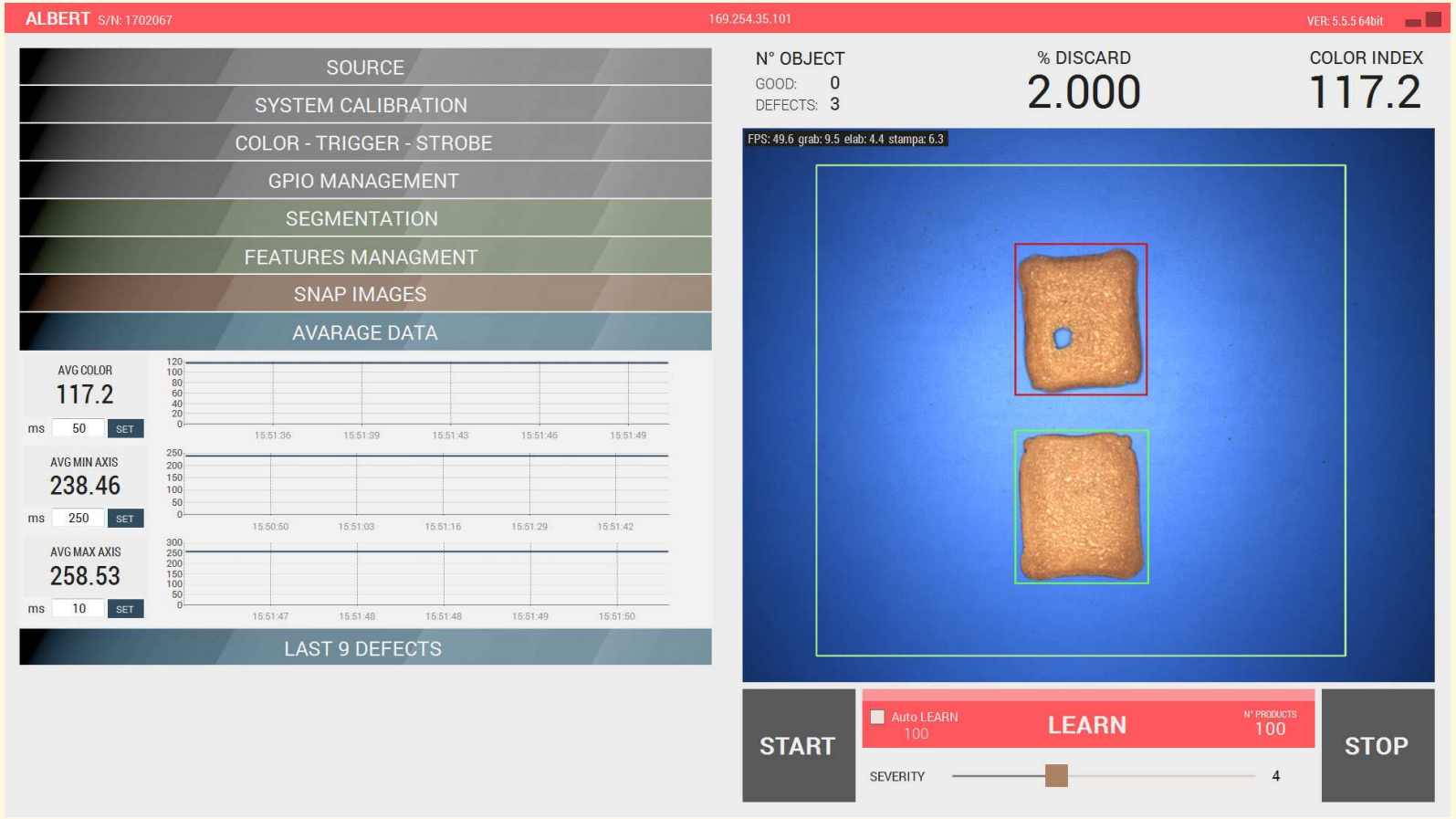
OPTICAL IMAGING TECHNOLOGIES

ALBERT



APPLICATIONS

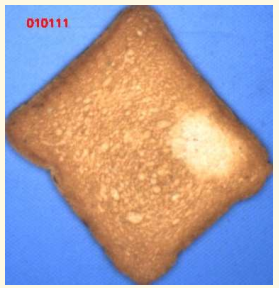
- → **PRODUCTS FEATURING NATURAL VARIATIONS IN THEIR INGREDIENTS**
- → **PRODUCTS FEATURING A HIGH DEGREE OF VARIABILITY IN SHAPE AND/OR COLOR WHERE TRADITIONAL VISION SYSTEMS SUFFER (e.g. → FOOD)**
- → **PRODUCTS THAT ARE NOW INSPECTED BY HUMAN OPERATORS (OBSERVATION)**
- → **ONE SINGLE LINE FOR MULTIPLE PRODUCTS**
- → **NOT OVERLAPPED PRODUCTS**

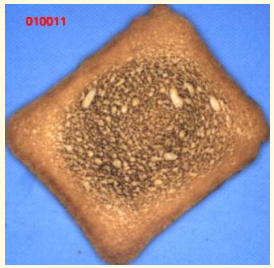
APPLICATIONS EXAMPLES

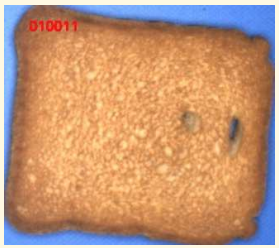
TOASTED BREAD

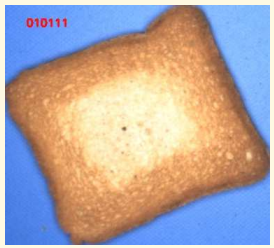
OK

TYPE OF DEFECTS





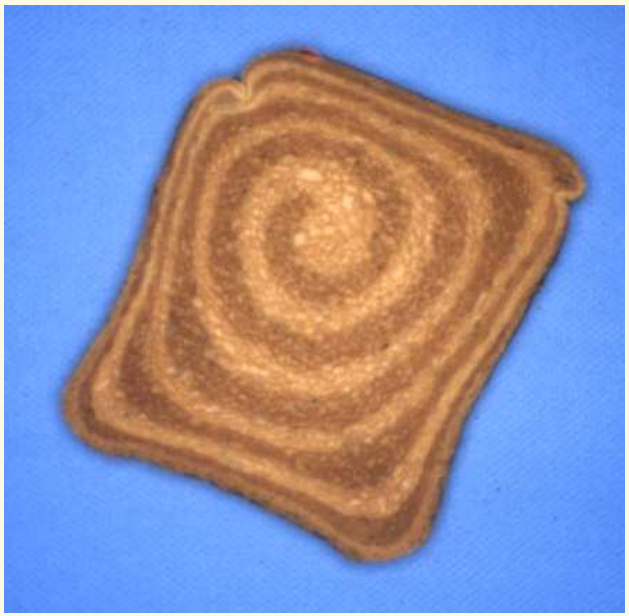




APPLICATIONS EXAMPLES

TOASTED BREAD

OK



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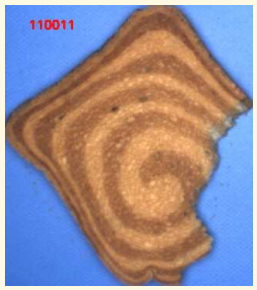
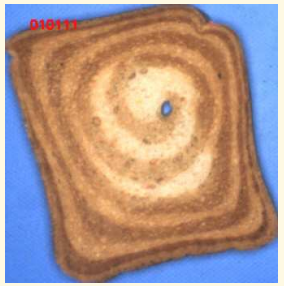
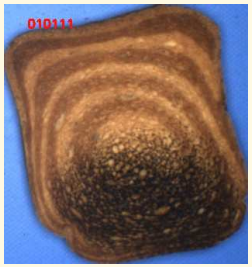
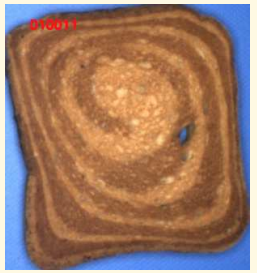






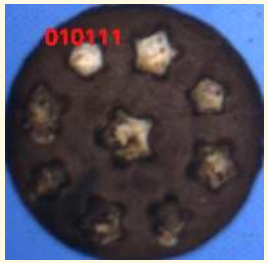


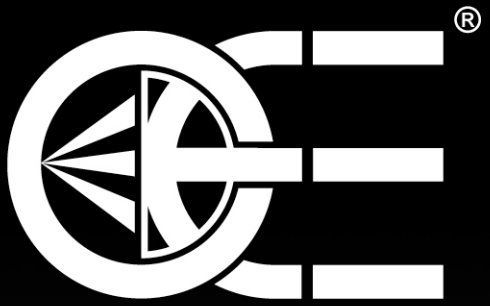
APPLICATIONS EXAMPLES

COOKIES

OK

TYPE OF DEFECTS





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Thank you ☺