3D QUALITY CONTROL FOR HIGH PRECISION MANUFACTURING

Daniel Hofmann

photon focus

ABOUT PHOTONFOCUS

Photonfocus is part of ISRA VISION in Atlas Copco´s Machine Vision Solutions division

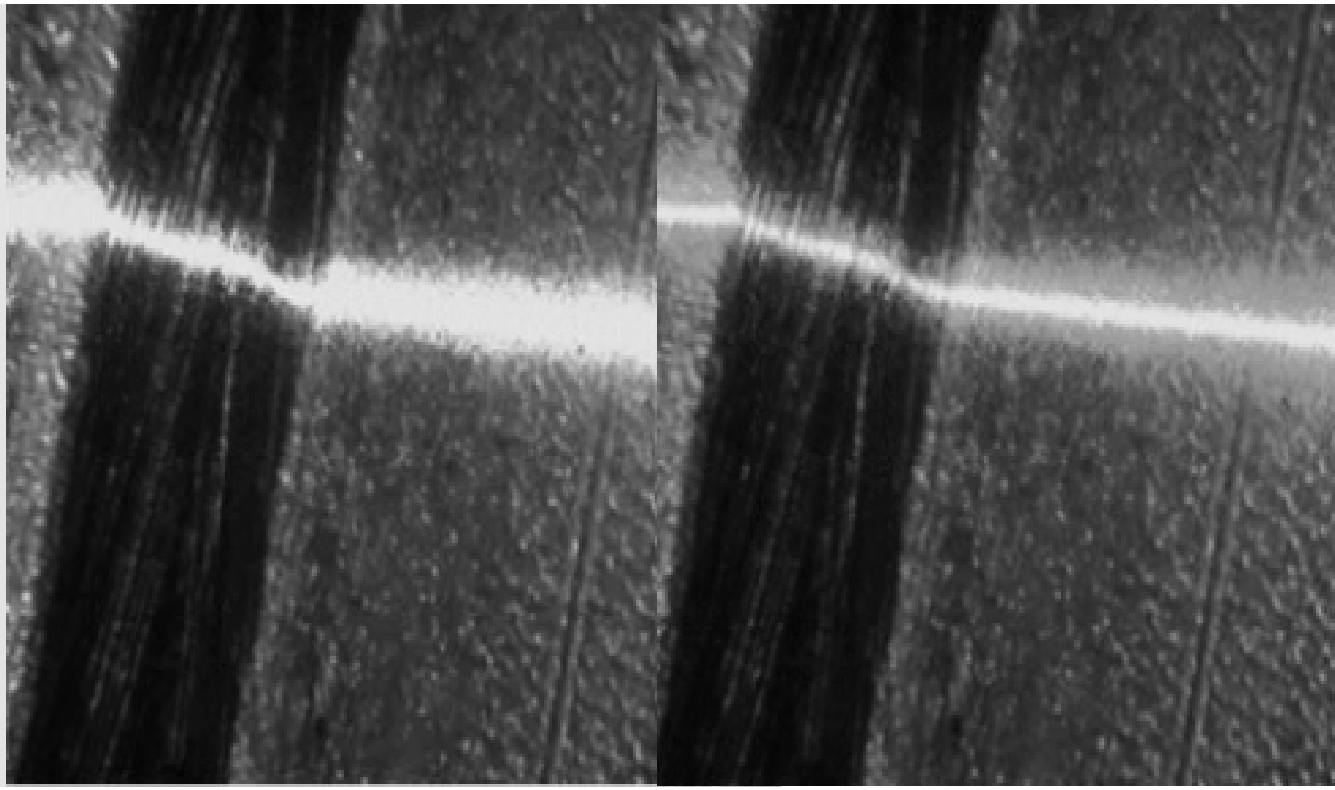
- 20+ years vision system competence
- Pioneer of high-performance imaging
- Award winning imaging specialist
- CMOS sensor manufacturer since 2001
- Extreme flexibility in camera design
- Swiss quality assurance

- 1200+ employees in MVS division
- More than 30 years experience in machine vision
- One of the world-leading machine vision innovators
- 10,000+ installations worldwide

- Swedish multinational industrial group
- Founded in 1873 (1920 stock-listed)
- 55,000+ employees (2024)
- Customer service centers in over 70 countries
- Customers in 180+ countries
- Revenues: 15* Billion EUR (2024)
- *Based on the average exchange rate in 2024

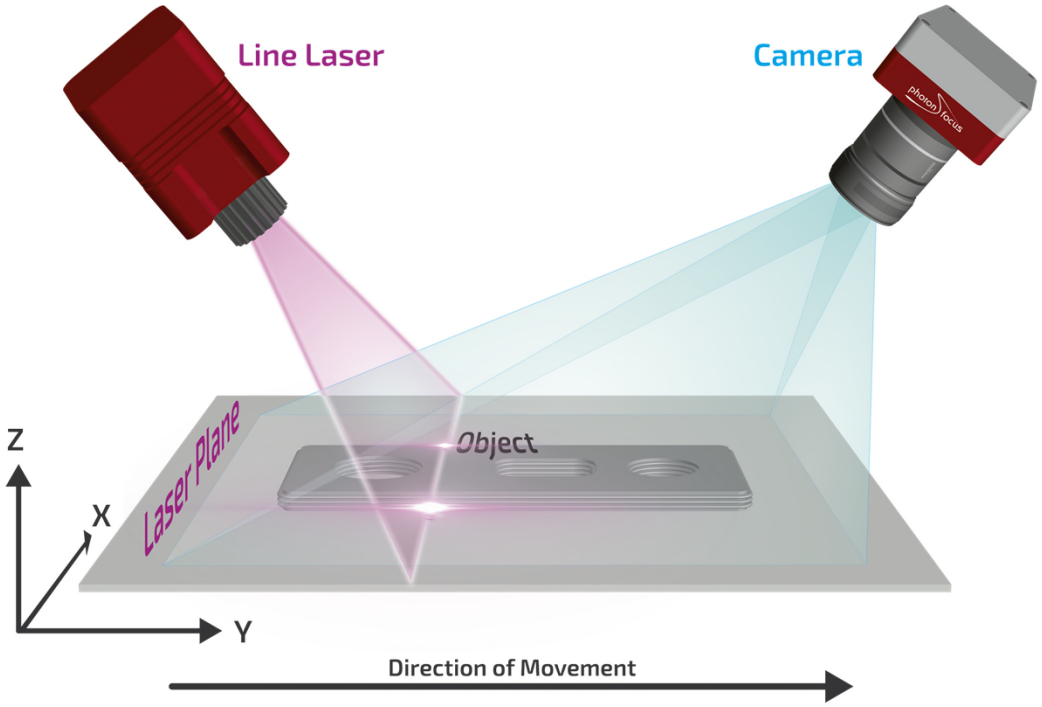
No. 1

HOW DOES 3D LASER PROFILING WORK?



HOW DOES 3D LASER PROFILING WORK?

The Basics!

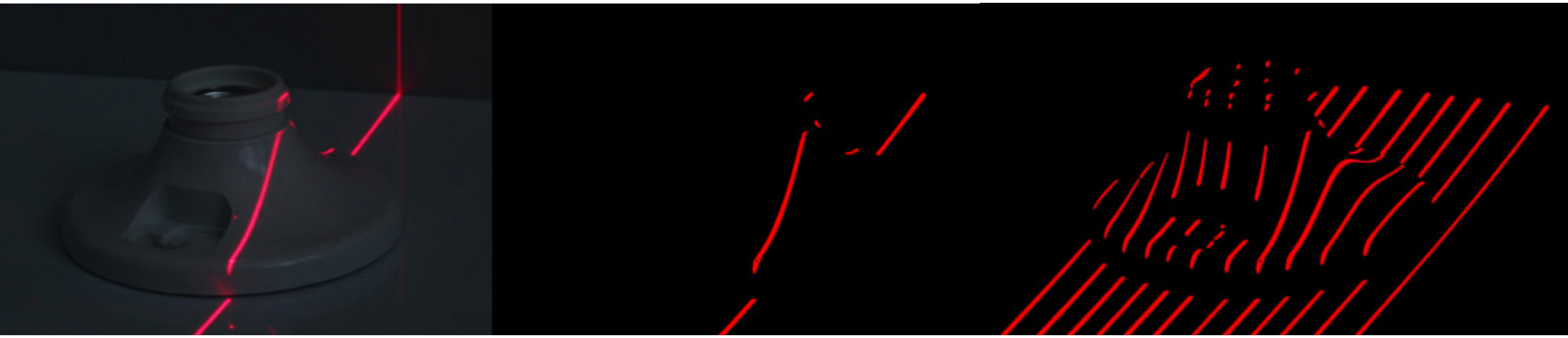


- **Also known as Laser Triangulation.**
- Laser plane is parallel to X.
- Movement direction, and laser, are synchronized to Y.
- This provides orthogonal coordinates.
- Assuming the geometry of the projection is stable **and known**, a camera can image the laser line and calculate the 3D shape using 2D data.

- **Deformation of laser line provides shape outline to extract!**

CONTINUOUSLY MOVE PRODUCT IN FRONT OF LASER

Or conversely move the laser in front of the product!



Visible to human eyes

Visible to camera
(with laser wavelength bandpass filter)

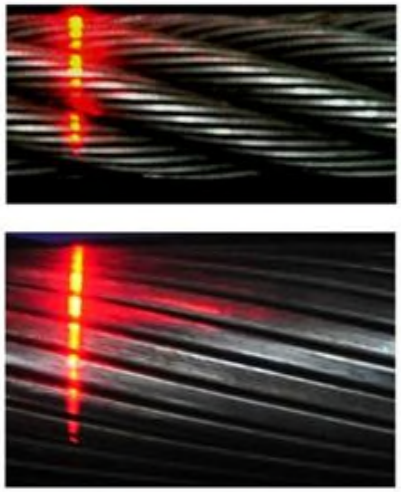
Accumulated 3D Data

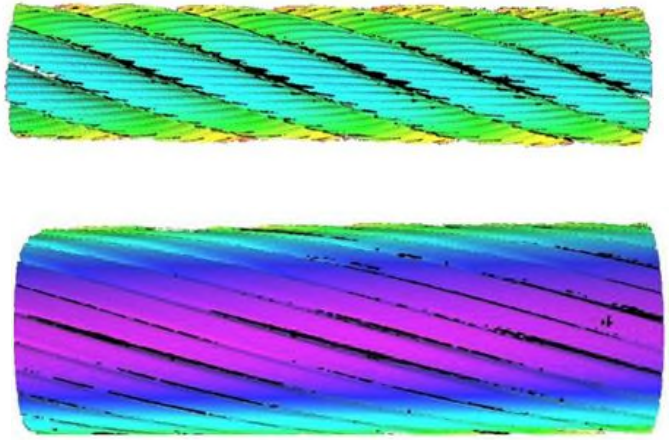
No. 2

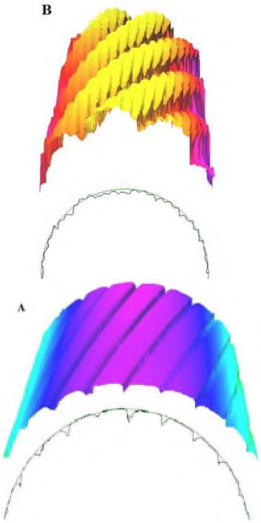
APPLICATION EXAMPLES

APPLICATION EXAMPLES

Twisted steel cable surface depth inspection – Partially reflective







Twisted steel cable inspection – in movement!

- Curvature inspection
- Depth between brading inspection

APPLICATION EXAMPLES

Food inspection

Cookie (or Chocolate!) Inspection

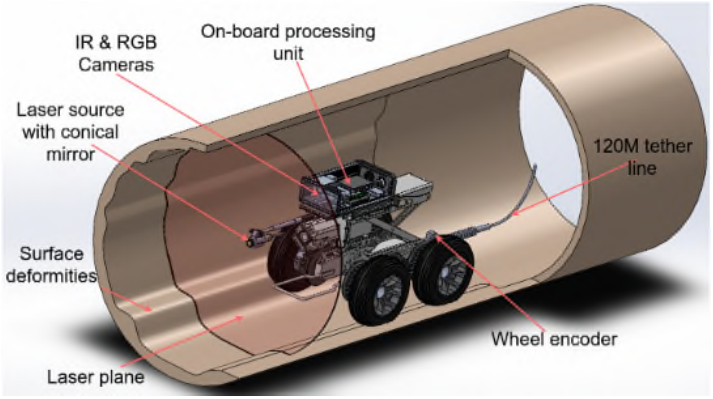
Inspection of:

- Circularity
- Dimension
- Thickness (height)
- Missing or Partial „piece“

Image Source: www.osela.com

APPLICATION EXAMPLES

Drainpipe inspection



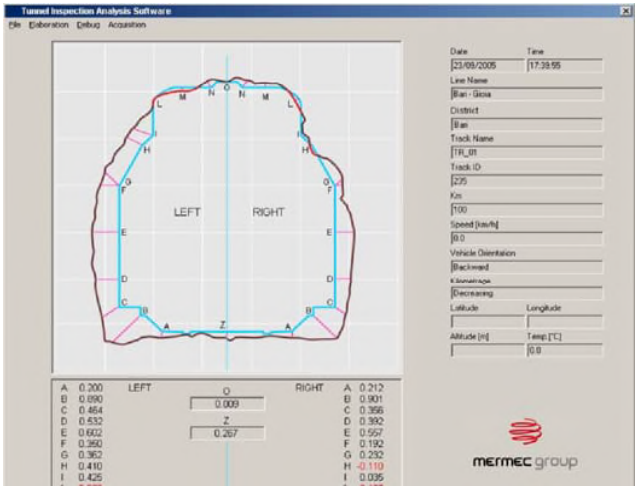
Inspection of:

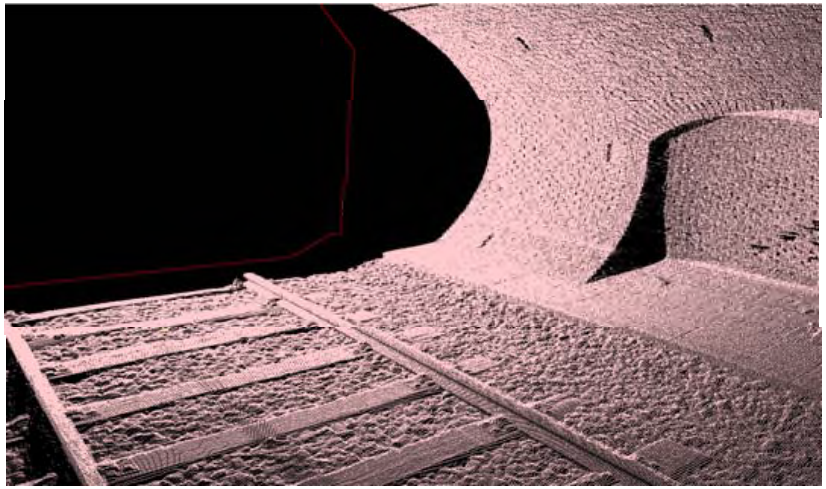
- Welding seam breaks
- cracks in pipe
- breaks in pipe
- disruption
- sedimentation

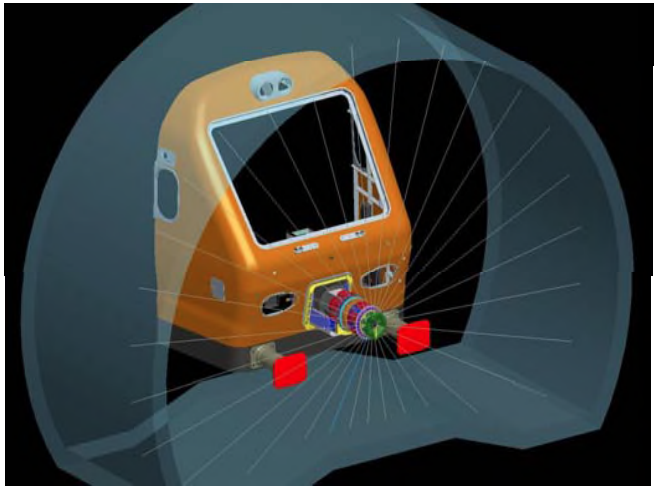
Image Source:
https://arxiv.org/pdf/1907.12172.pdf

APPLICATION EXAMPLES

Tunnel inspection





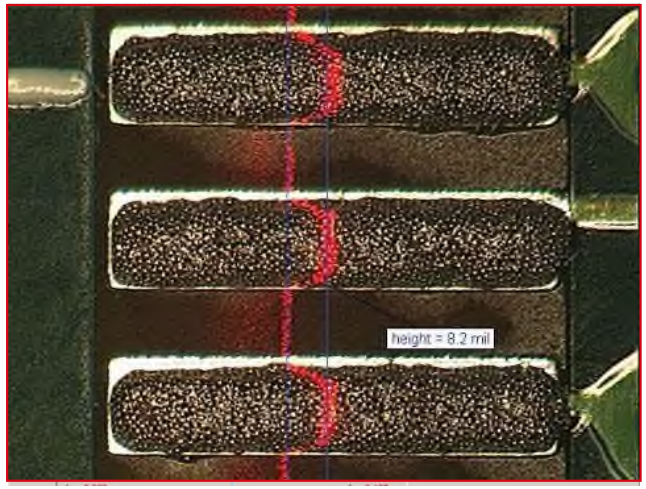


- Red line = Tunnel Shape
- Blue line = Train Shape

Image Source: Mermec

APPLICATION EXAMPLES

Solder paste inspection

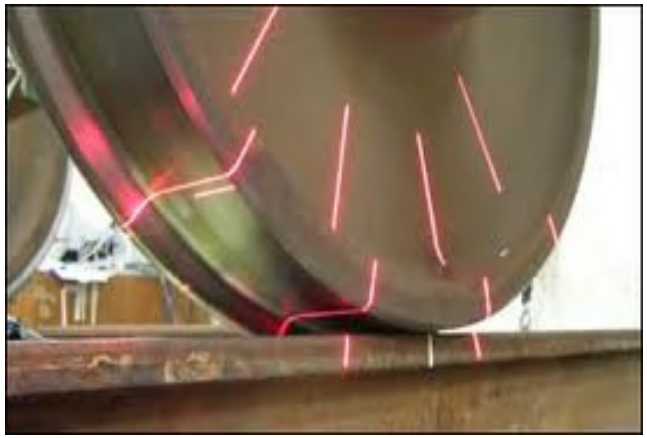


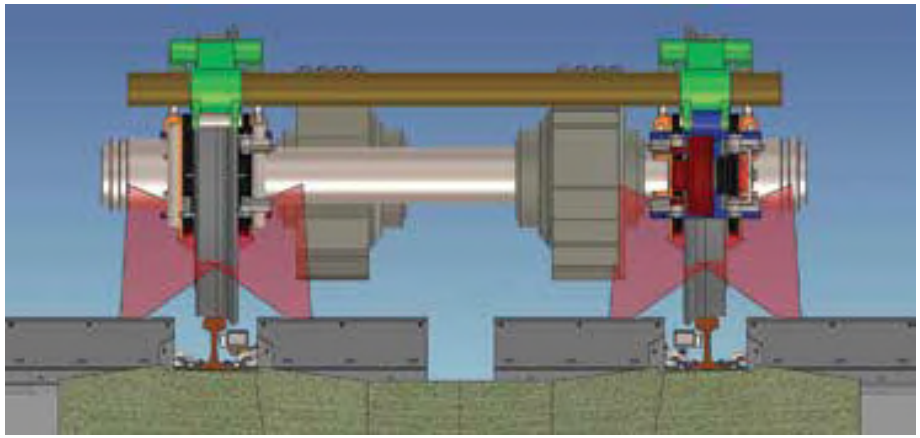
- Very thin laser line required
- Height = 8.2 mil / 0.21mm

Image Source: Unknown

APPLICATION EXAMPLES

Train wheel inspection





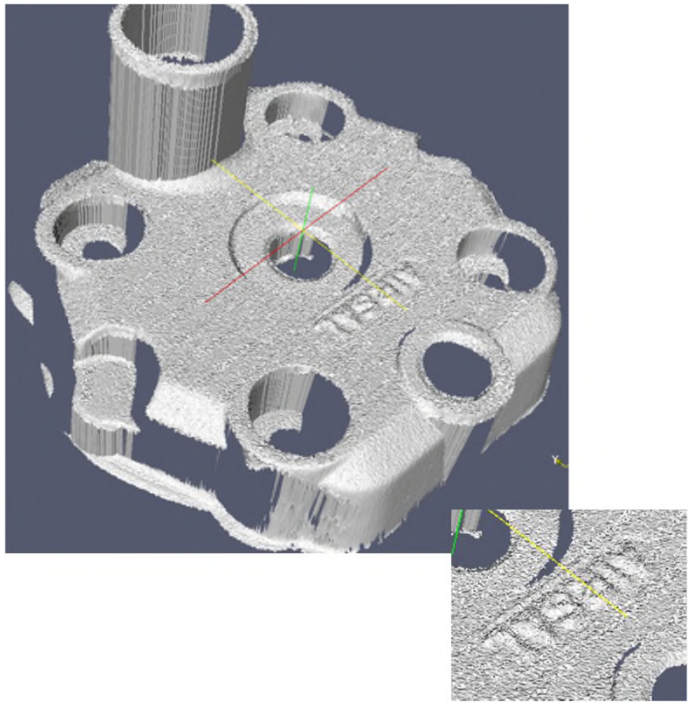
- Quality and wear inspection
- Wheel thickness measurement
- Lasers fitted underneath track at train service station !

Image Source: Z-Laser GmbH

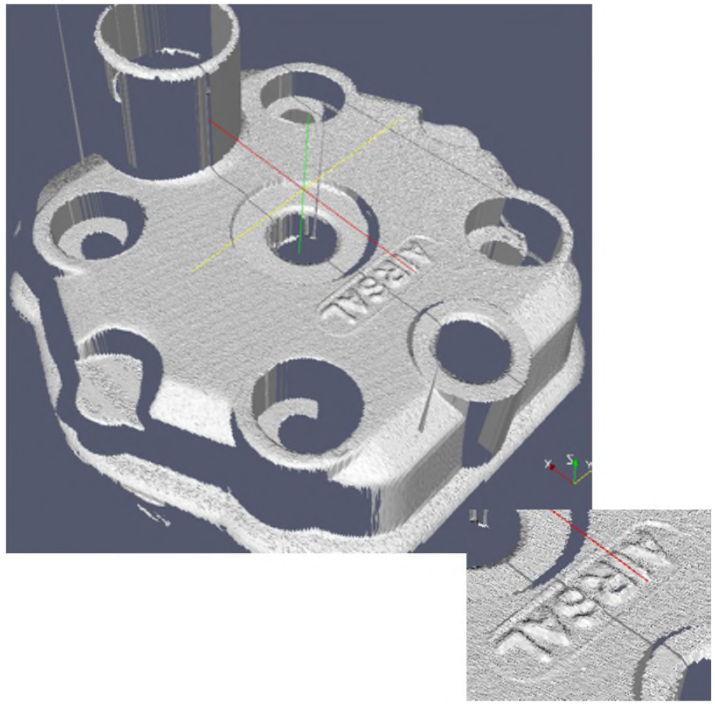
PHOTONFOCUS' LINE FINDER ALGORITHM

Provides 8x to 10x better detection accuracy

CENTER OF GRAVITY „COG“



LINE FINDER



HIGHLY REFLECTIVE SURFACE SCENARIOS

Which is the correct laser line to choose for application?

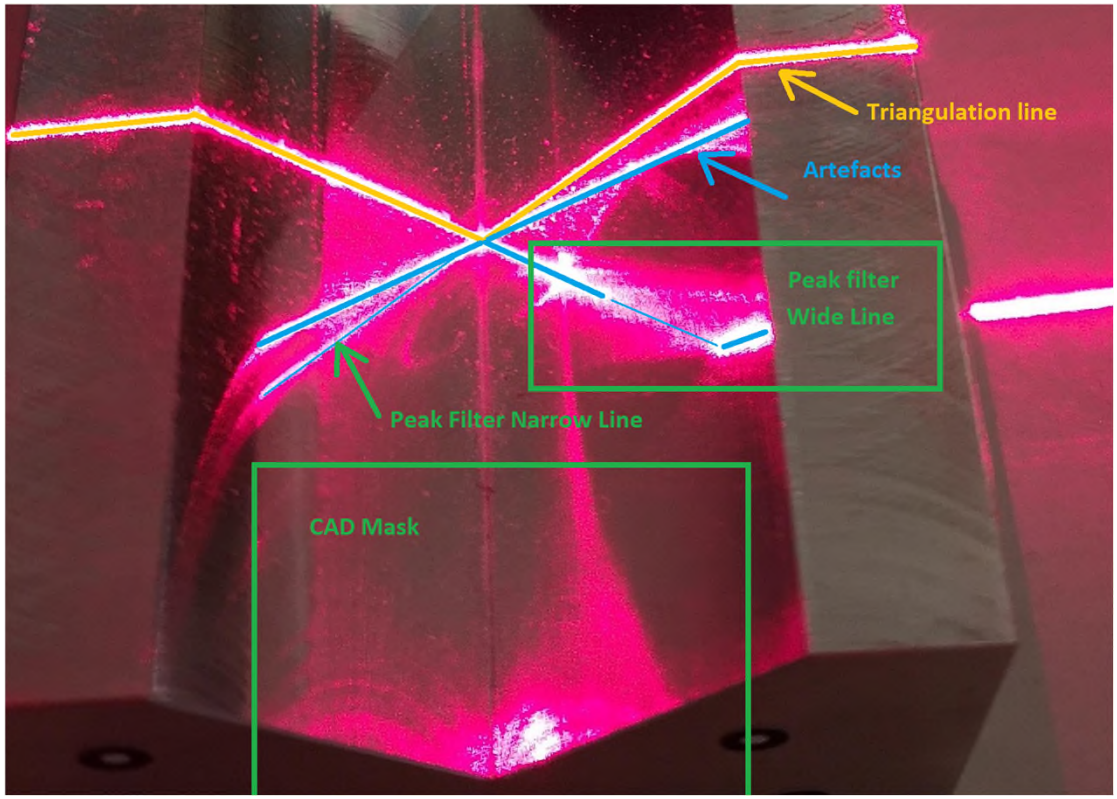


Image Source: : Photonfocus GmbH

HIGHLY REFLECTIVE SURFACE SOLUTION - 3D07 !

Multipeak Linefinder algorithm is the best choice!

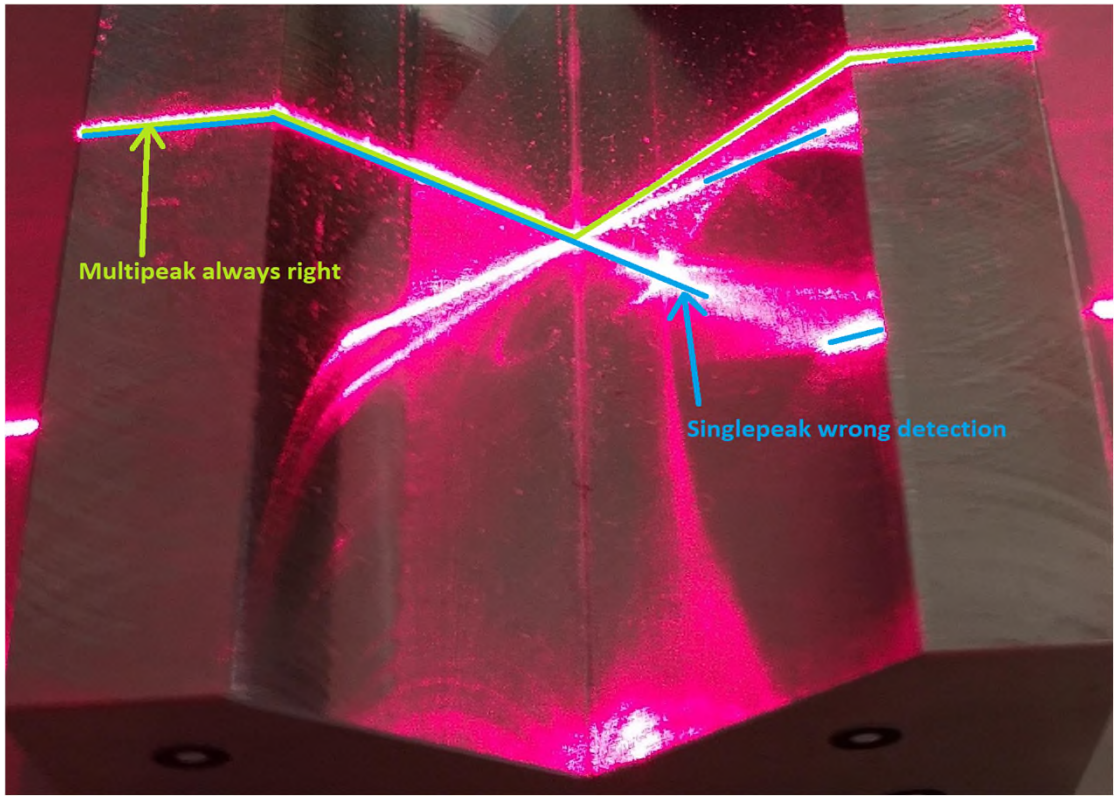
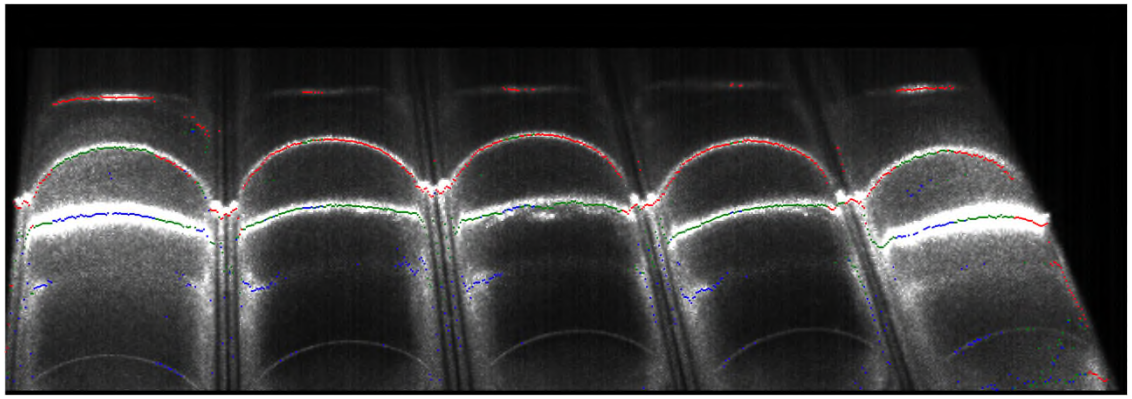


Image Source: : Photonfocus GmbH

APPLICATION EXAMPLE: REFLECTANCE ON GLASS

Pharmaceutical ampoules inspection



- One laser line projected on row of ampoules creates multiple reflection lines **per** ampoule!
- Different colors belong to different detected laser lines. Only red pixels of the upper row are correct

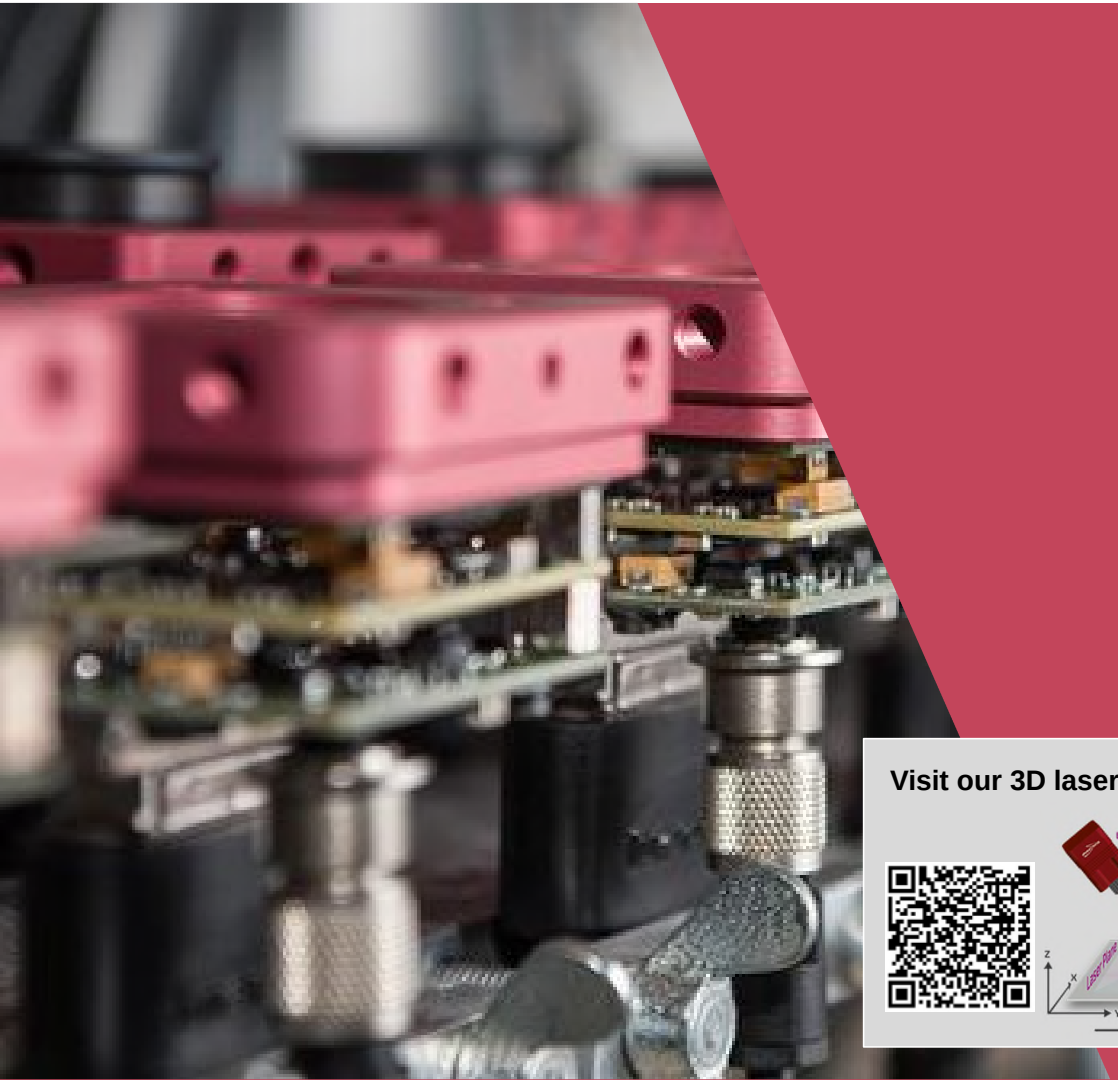
Image Source: : Photonfocus GmbH

QUESTIONS & ANSWERS

Feel free to ask questions about:

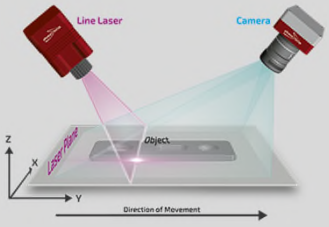
- 3D laser profiling
- Photonfocus 3D cameras
- Industry applications
- Customizations
- Integration possibilities
- …

I will be glad to provide answers and support



THANK YOU FOR YOUR ATTENTION!

Visit our 3D laser profiling page



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