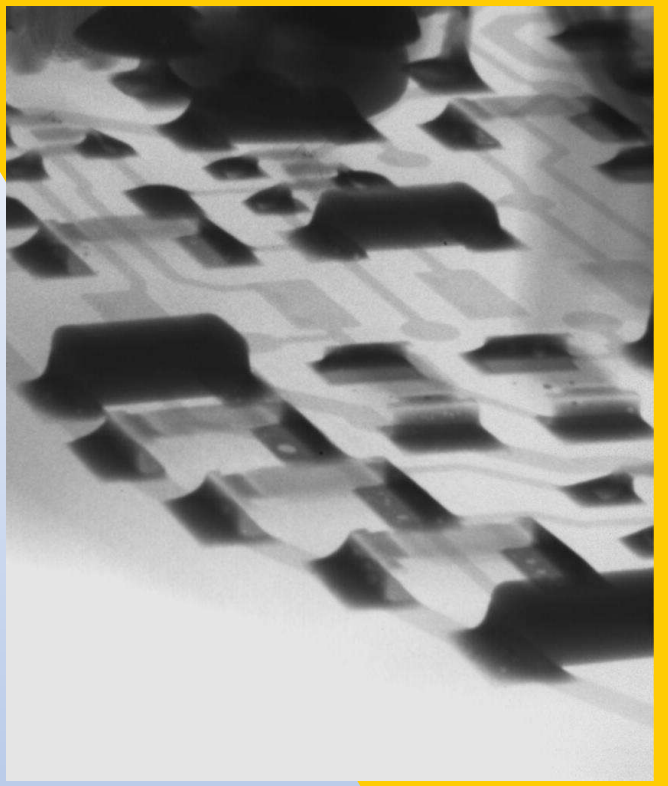
X-ray Inspection for Electronic Industry



XB02

Doc: Product Info Sheet. XB02 Print Rev02, 15 January 2025

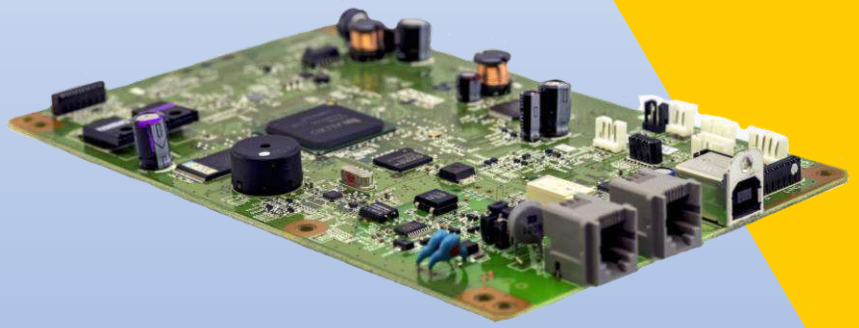
THE X-RAY SOLUTION
by Christoph Grohmann

X-ray Inspection for Electronic Industry

THE X-RAY SOLUTION company is a well-known manufacturer of high-end X-ray inspection systems for industrial applications in the field of inline high-speed inspection for various industries worldwide.

The range of X-ray inspection systems serves the automatic quality control of so-called safety parts for car- and aircraft-industries as well as electronic and battery industries.

As an automation specialist, THE X-RAY SOLUTION also provides numerous transport and handling equipment around the X-ray inspection.
Whatever is needed, we provide solutions from laboratory systems, semi-automatic systems all the way up to fully automated as inline processed.



The following presentation gives detailed information of the wide range of inspection performance and an overview of additional products in the field of electronic industry.

XB02
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THE X-RAY SOLUTION
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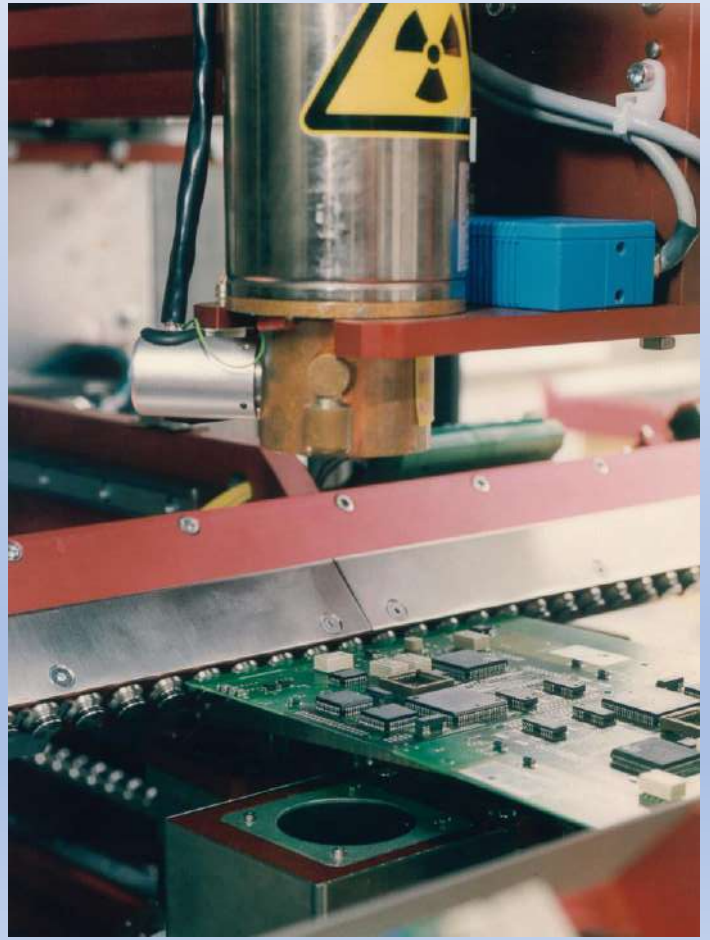
Method of X-ray Inspection

The method of inspection penetration is based on a fixed positioned PCB while the X-ray source and the detector are moving in x- and y-direction horizontally.
X-ray source is located above the PCB and X-ray detector is positioned underneath the PCB.



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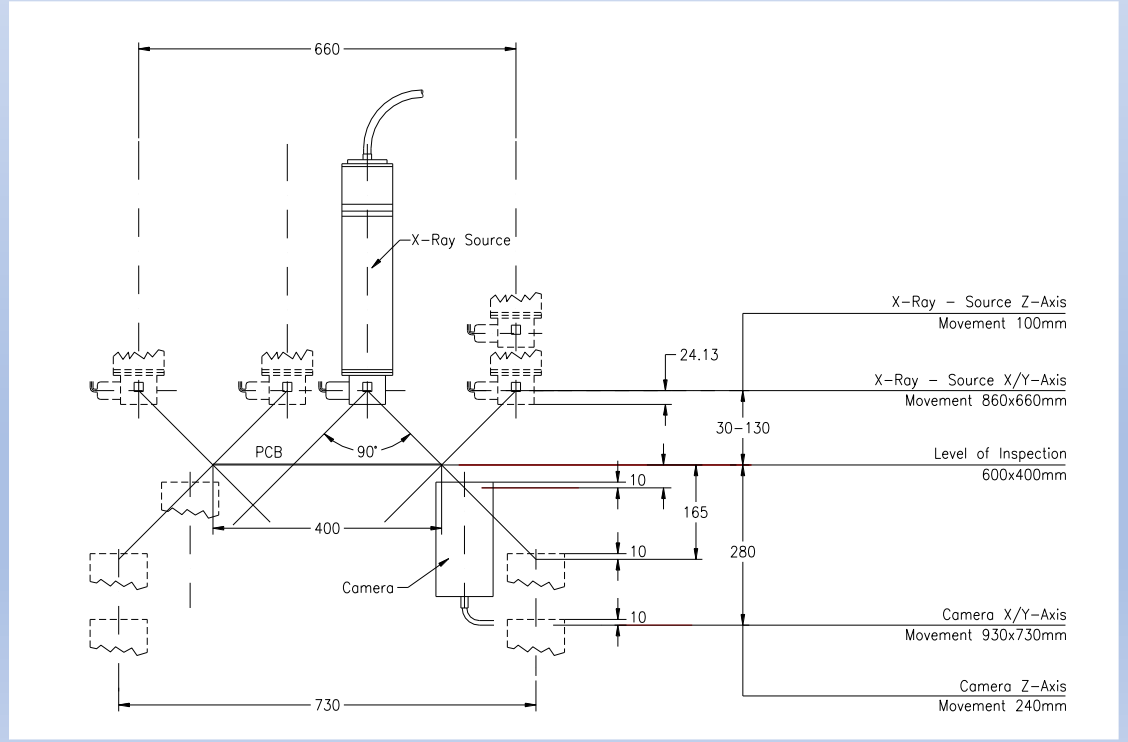
Geometry of X-ray Components

Both, X-ray source and X-ray detector are equipped with z-axis, what allows to move these X-ray components into the needed distance to the PCB for maximum physical magnification of 9 times and to keep distance to stand-out components.

X-ray source and X-ray detector are moving in x- and y-direction to reach any location of the PCB. For vertical penetration the X-ray source and detector move synchronically to generate a 2D image.
For the 2.5D inspection the source and the detector move out of center line into an angle of 90° to each other. At a specific position where 2.5D is required, the source and the detector then rotate around the region of interest. The angle as well as the number of pictures can be defined by teach-in mode.
With a penetration angle of 45°and 32 pictures the software generates already a proper 2.5D reconstruction of the region of interest. Sets of pictures 8, 16, 32 and 64 are available. This method is called laminographic 2.5D reconstruction.



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XB02

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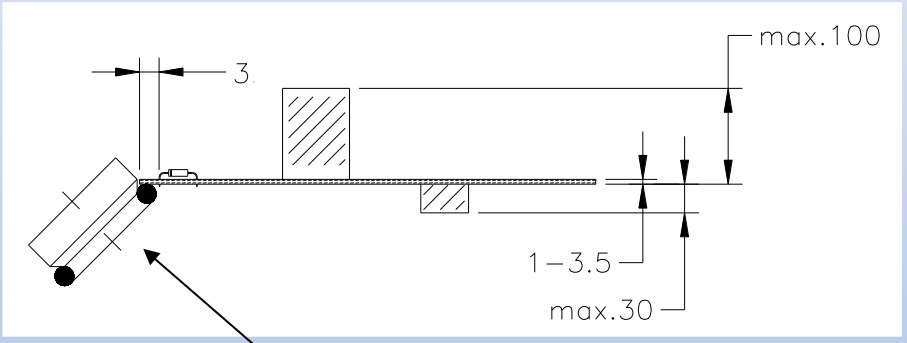
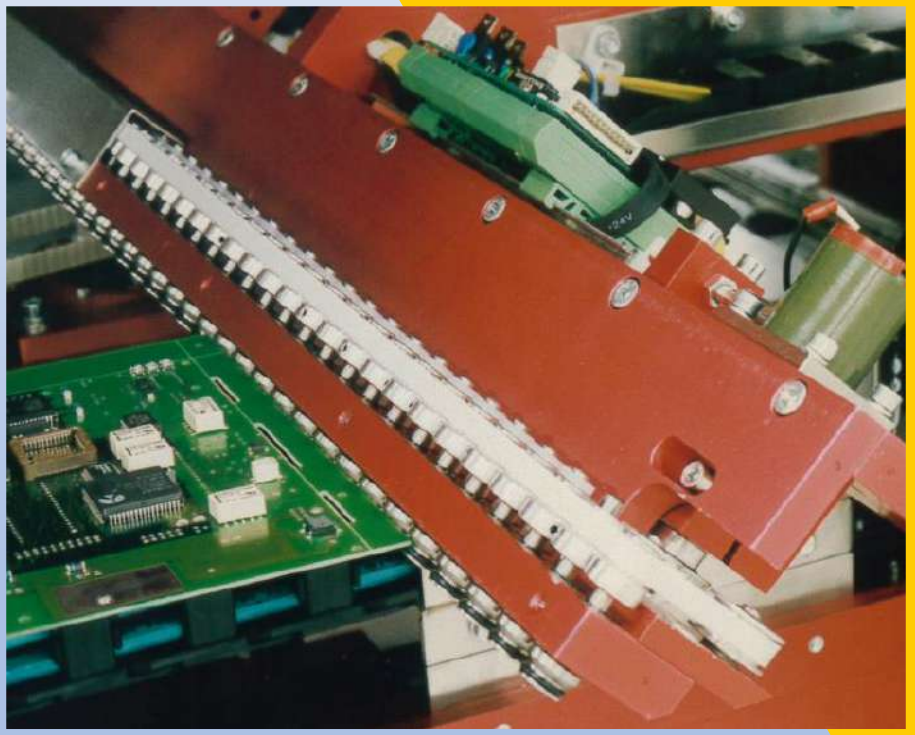
X-ray Inspection without any Dead-Zone

The XB02 system is equipped with a special roller conveyor with two features:

- Just 3mm at the edge of PCB is required as a restricted zone
- Thanks to the design of the rollers, positioned at an angle of 45°, X-ray penetration even by 45° at the edge of the PCB takes place without any dead-zone



Transport rollers under 45°
allow the 2.5D inspection even
at the edges of the PCB



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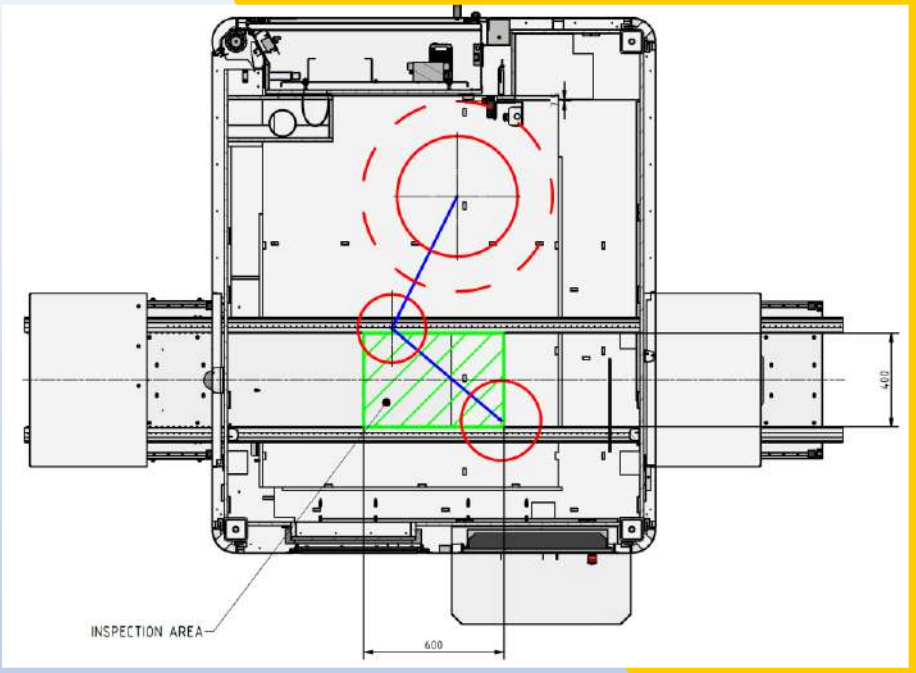
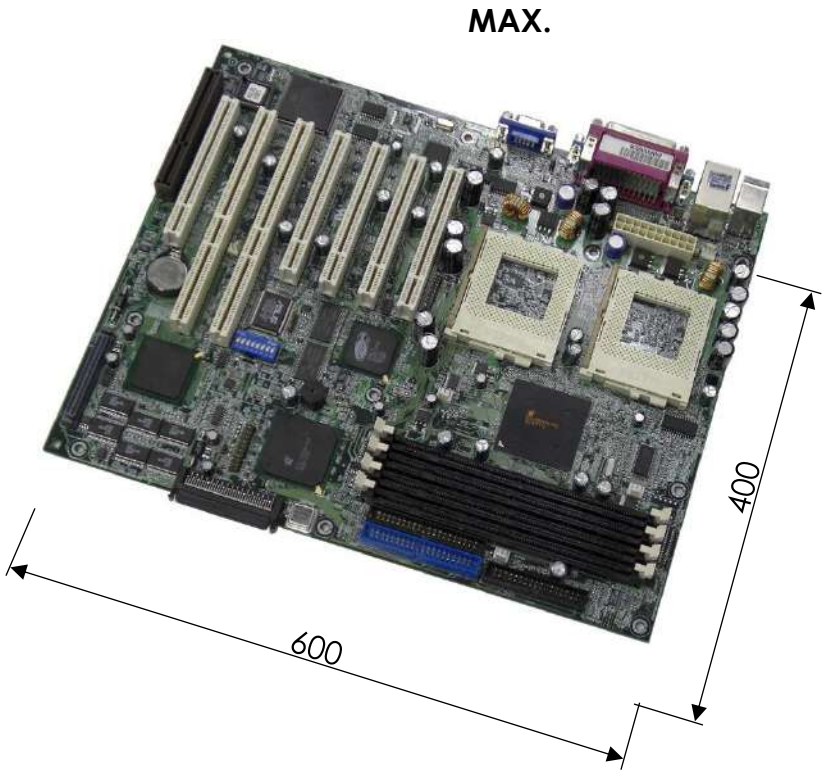
PCB Requirements

The overall design of the XB02 guarantees a wide range of PCBs for its inspection.

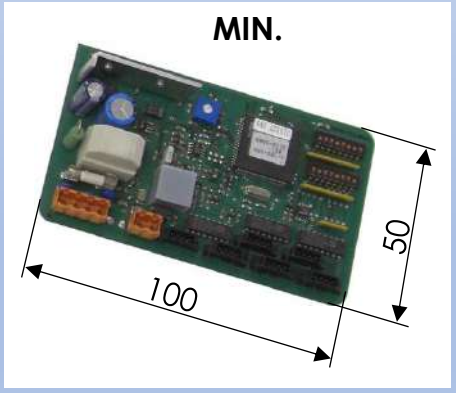
- max. component height at top: 100 mm
- max. component height at bottom: 30 mm
- max. weight of the Board: 1 kg
- max. size: 600 x 400 mm
- min. size: 100 x 50 mm



MAX.



MIN.



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Manipulator of X-ray Components

The following explains the dual-scara solution:

This scara solution is based on the concept of two scara arms (robots) are assembled at the same main-column inside the cabin.
One scara is located above the PCB conveyor system and the other scara is located below the PCB conveyor.
Each contains two high speed servo-drives, organised as a scara axes system, which moves the X-ray components in x- and y-direction as well as any angle across the surface of the PCB.

Thanks to its separation between X-ray source and X-ray detector, the system can do 2D inspection as well as 2.5D.
The regular inspection areas will be covered by 2D, then the two scara axes systems move exactly synchronously.

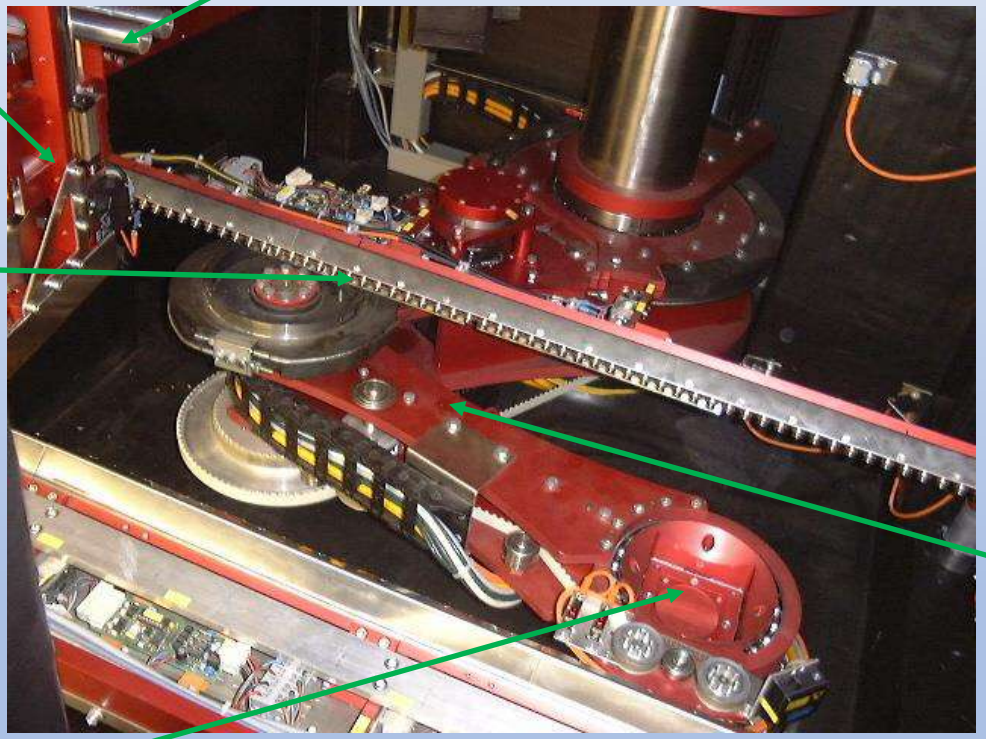
In case of specific areas require 2.5D, then the scara axes systems move into opposite coordinates.

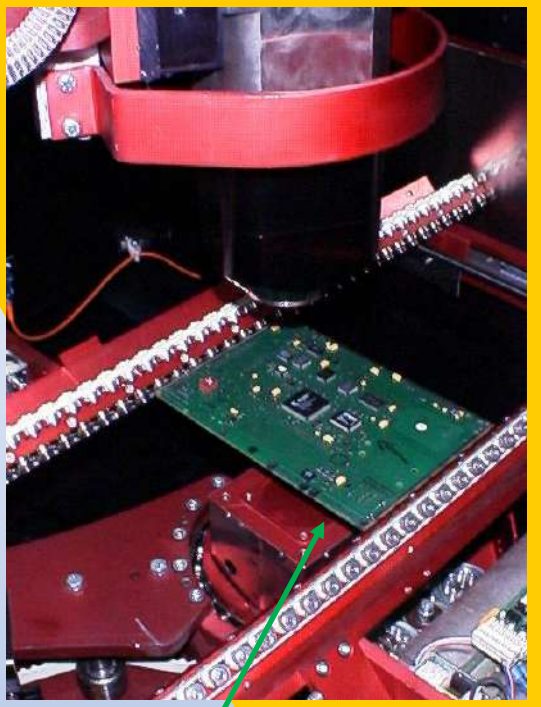
Additionally, to 2D and 2.5D, the method of separate axes systems for X-ray source and X-ray detector also allows to do inspections at any individual angle in order to verify the quality of very specific PCB components as well.

Equipped with the dual-scara system, the XB02 reaches a speed of down to 1.5 sec per 2D inspection position.

Manipulator of X-ray Components

Dual-scara solution:





XB02

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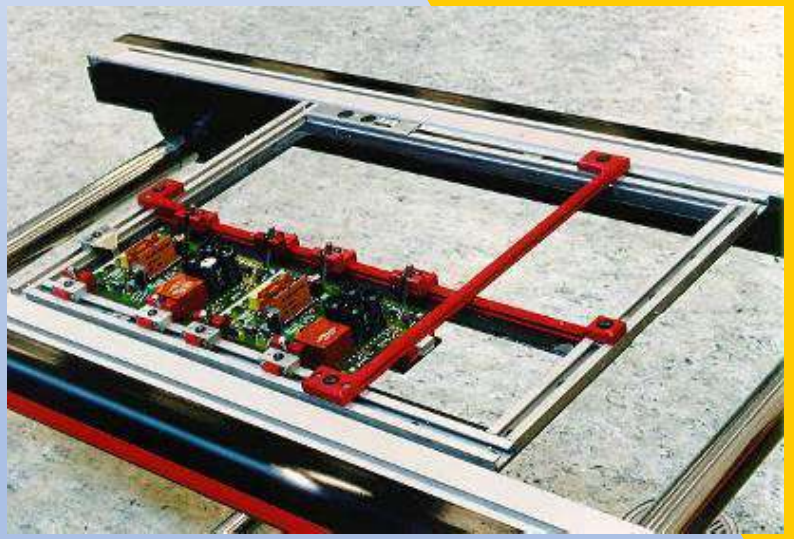
THE X-RAY SOLUTION

by Christoph Grohmann

PCB Transport Conveyor

XB02 is available with two different conveyor solutions.

One is a so-called carrier-less conveyor on which the PCBs are moved just using a side strip area of 2mm running on a belt. In this case, the transport conveyors are adjustable in its width in order to apply PCBs from 50 to 400mm width.
This width adjustment can be motor driven or adjustable by a hand-crank.

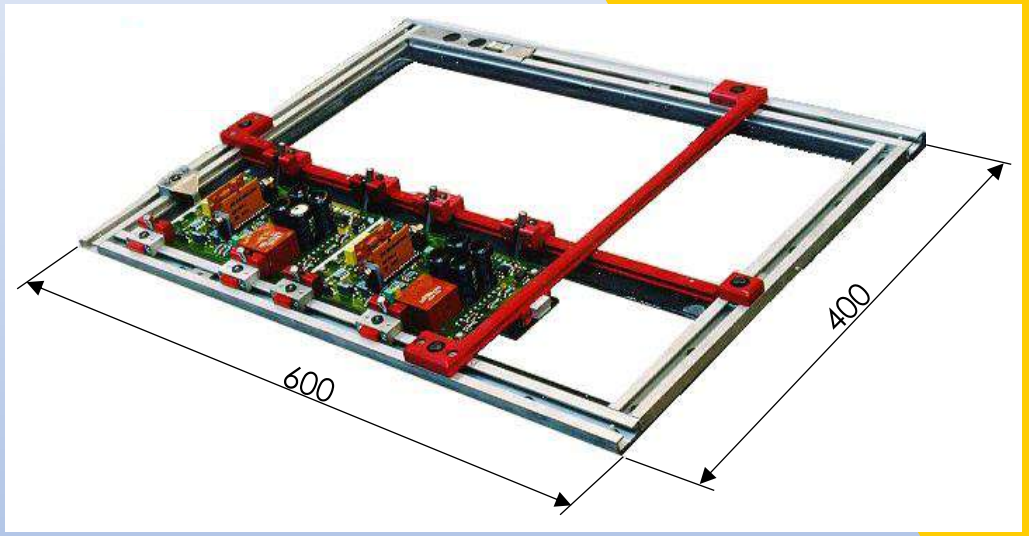


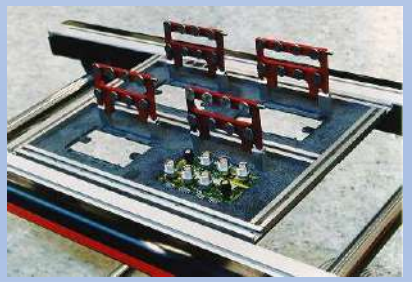
The other solution is based on a fixed width of the transport conveyor by using so-called PCB-carriers.
Our multi-flexible PCB-carriers can be adjusted to any size of PCB.

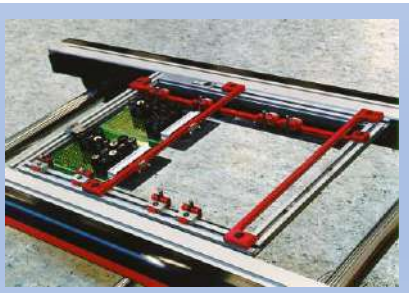
PCB Carrier System

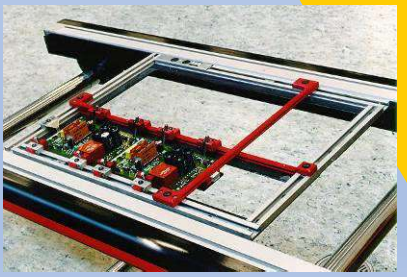
Using a fixed transport conveyor width, THE X-RAY SOLUTION provides a multi-flexible carrier system. Adjustable strips allow the handling of a wide range of PCB sizes for single and multiple loading.
Based on the same standard carrier also product specific nests and fixtures are applicable.

Thanks to its special design and materials,
these carriers can also run through soldering machines.









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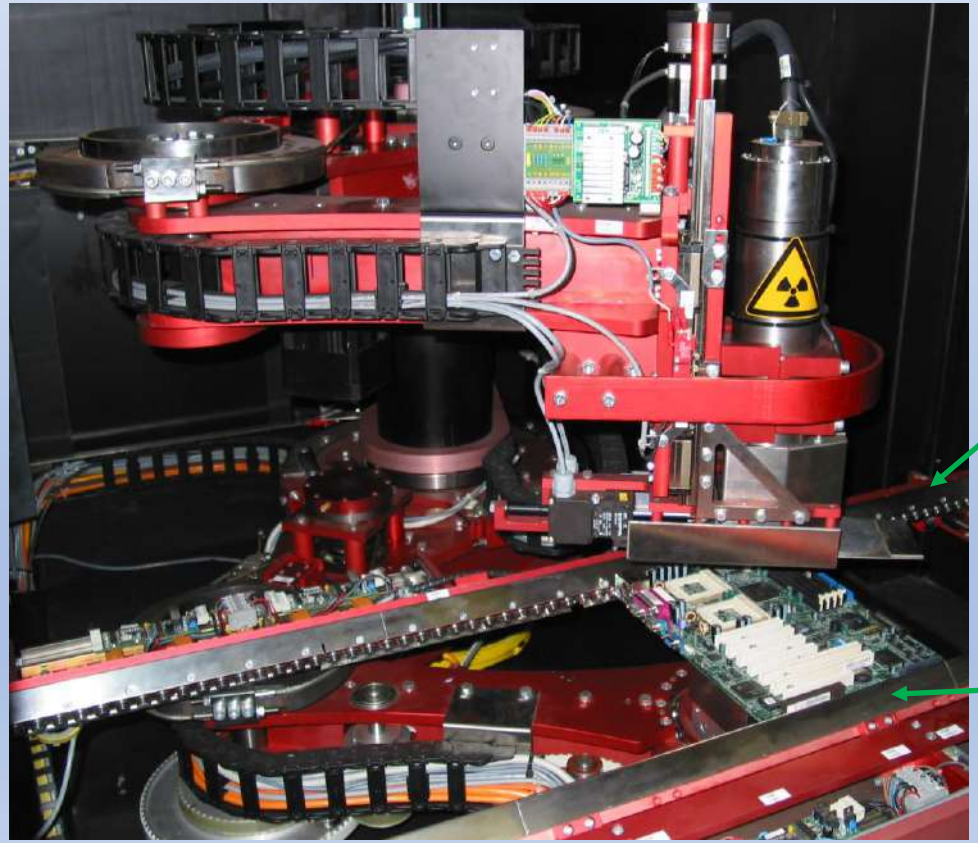
PCB Carrier-less Transport Conveyor

The inner conveyor system of XB02 can be equipped with a width adjustment, motor driven or by hand-crank, so that the width of the conveyor is fully adjustable to the current PCB size without using carriers.



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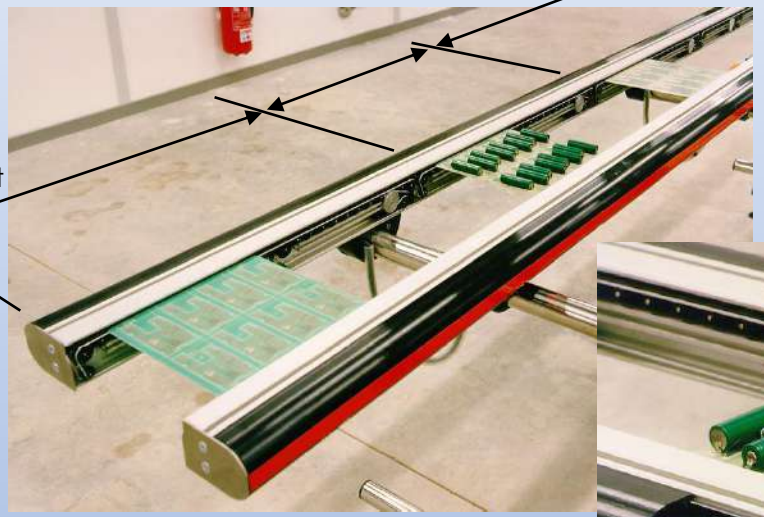
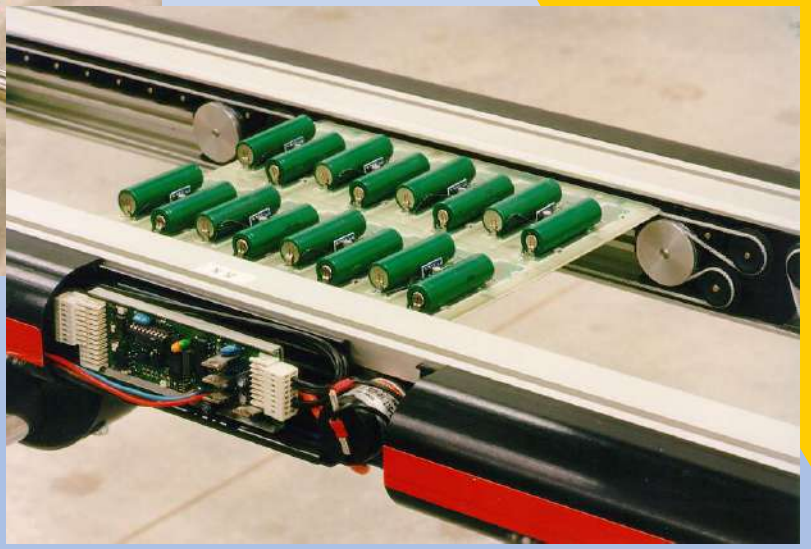
PCB Carrier-less Transport Conveyor

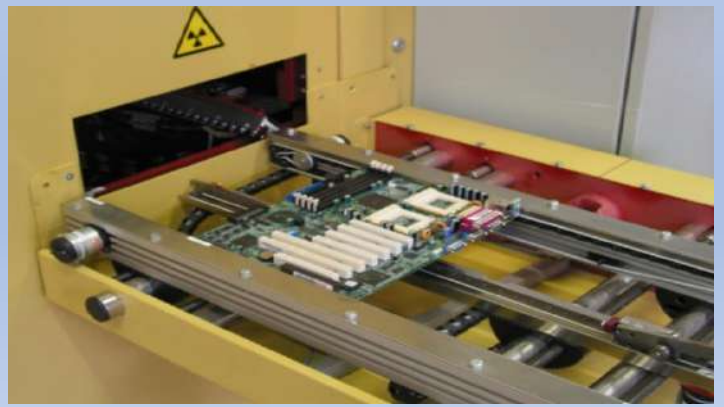
For infeed and outfeed of PCBs, THE X-RAY SOLUTION provides various PCB conveyor systems from segmented belt transport without stopping units to continuous belt systems with PCB separating units.

All versions are available with motor driven automatic width adjustment or adjustment by hand-crank.

Pitch of segmented belt transport can be customized







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X-ray Inspection made for Clean-room

The systems are made to meet the strict rules of clean/dry-room conditions as well as to guarantee easy access for trouble-shooting, maintenance and service.

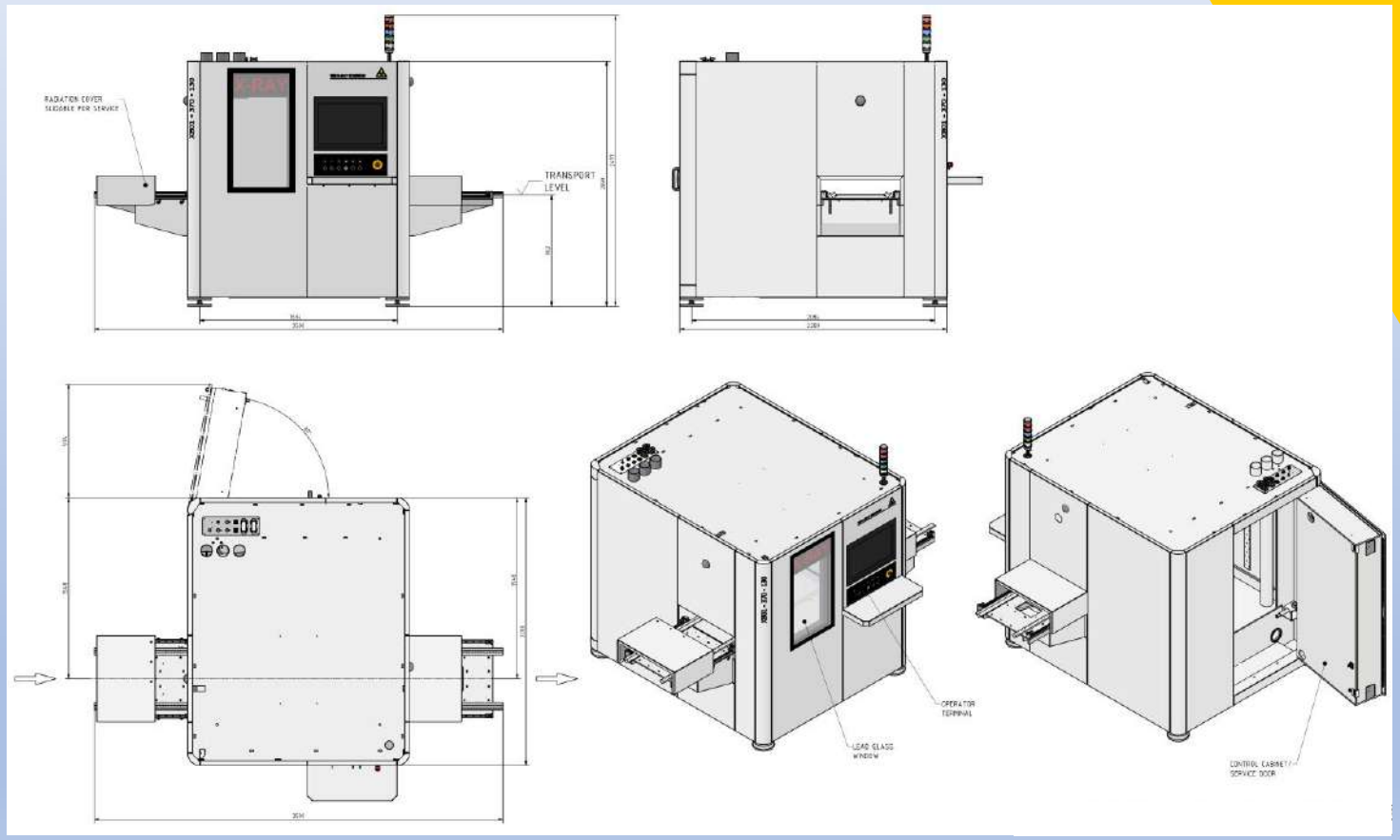
- **Clean/Dry-room features:**
  - Separated cooling environment for control cabinet
  - Separated exhaust of X-ray cabin
  - Easy to clean super-finish

- **Service and maintenance:**
  - Cabin-integrated control cabinet
  - Large service door for easy access
  - X-cams for process control and remote trouble-shooting

THE X-RAY SOLUTION
by Christoph Grohmann

Footprint of X-ray Inspection

The very compressed design of XB02 reaches a small foot-print by guaranteeing a wide range of PCB sizes from 50 x 100 mm to 400 x 600 mm without any limitation on 2D and 2.5D operation.



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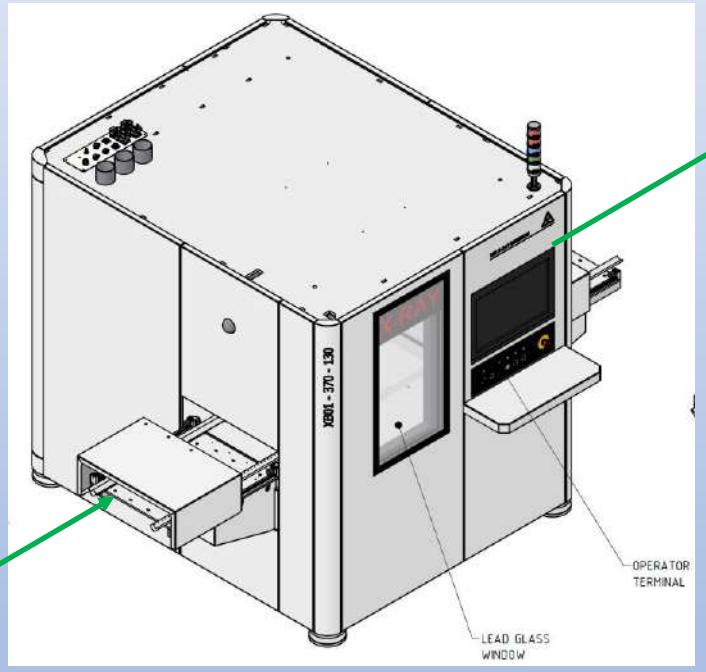
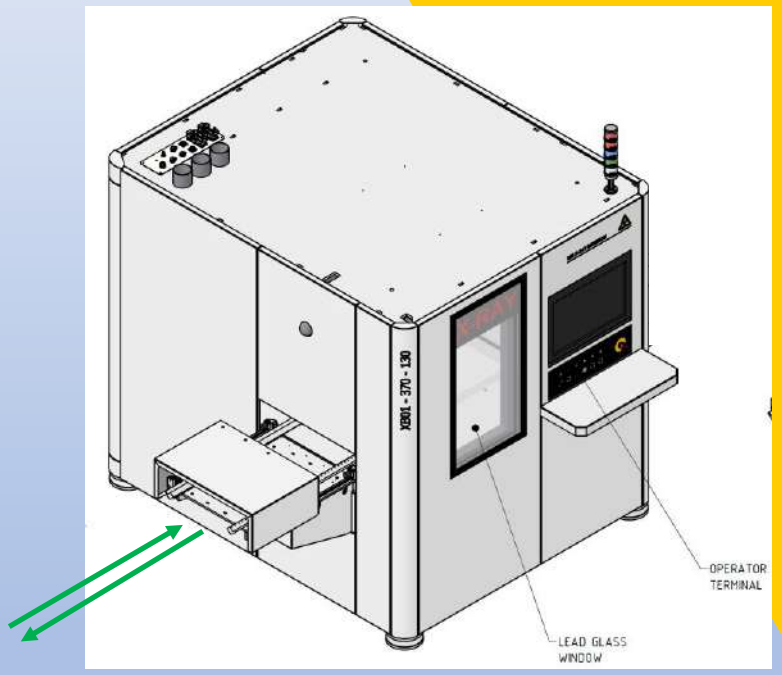
X-ray Inspection from Automatic Inline to Stand-alone

The standardized machine main cabin allows inline process-flow from left to right or from right to left.
The same basis machine can also be used as a stand-alone unit with loading and unloading at the same side (SSIO).
Depending on the integration at customer, this SSIO can be done from right or from left side of the machine.



Inline processed, left to right or
right to left



Stand-alone version with same side
in/out, on right or left side of cabin

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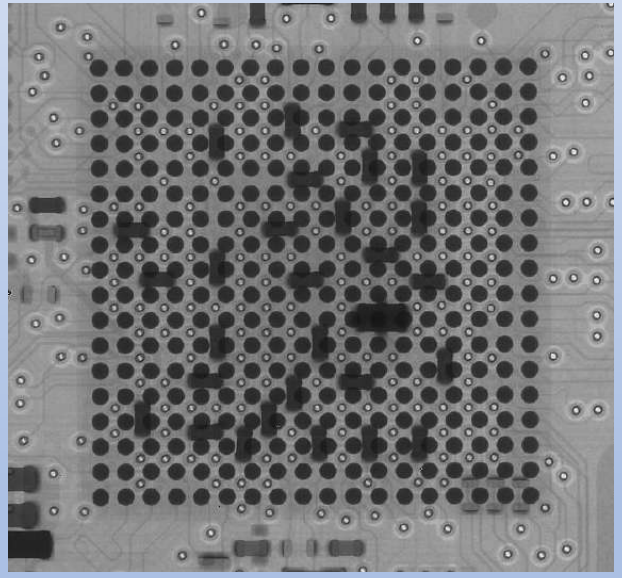
by Christoph Grohmann

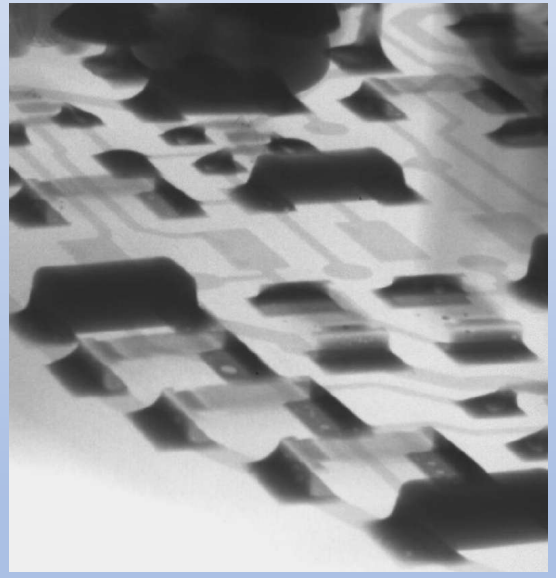
X-ray Inspection Features

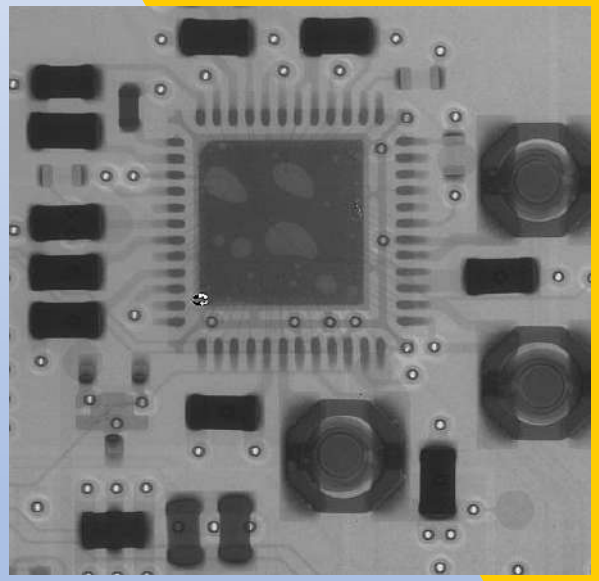
The XB02 PCB inspection system is made for 2D inspection while even 2.5D is optionally available without and difference on mechanical side. Therefore, even a customer starts with the 2D version, at any later time the system can be upgraded to 2.5D.

Thanks to the state-of-the-art digital flat panel with a pixel size of 6µm, the system reaches an extreme fine object resolution and a brilliant image quality.

The following pages gives a detailed overview of inspection features.



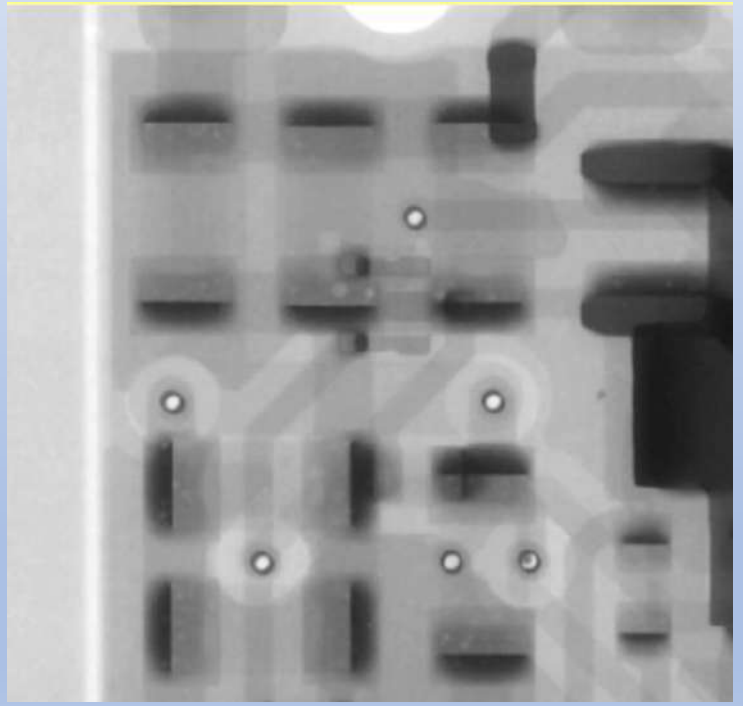


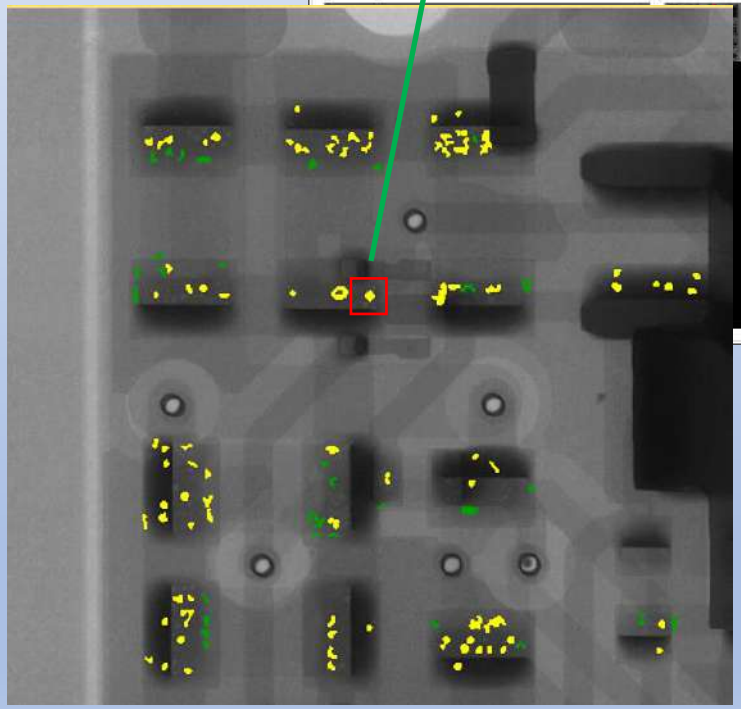


X-ray Inspection Features

At all solder-points the software is detecting gas holes inside the solder-joints as well as between SMD component and PCB.

Limits are definable.





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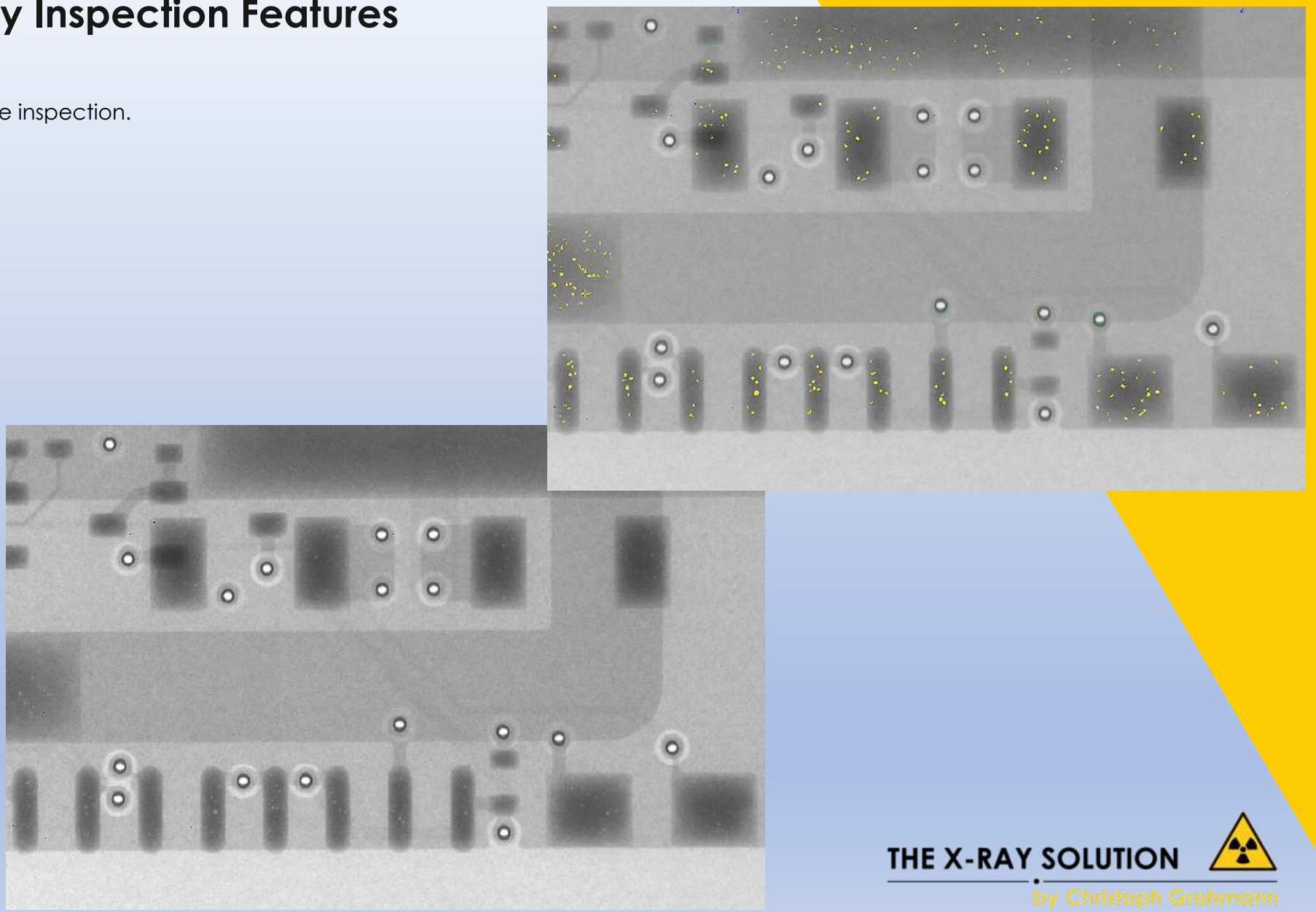
X-ray Inspection Features

Gas hole inspection.



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THE X-RAY SOLUTION

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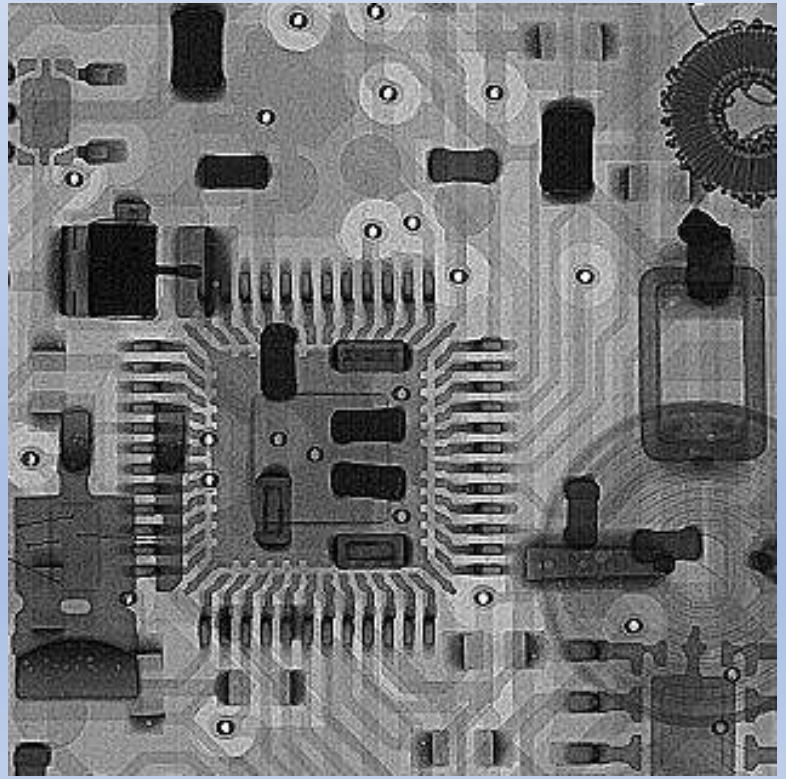
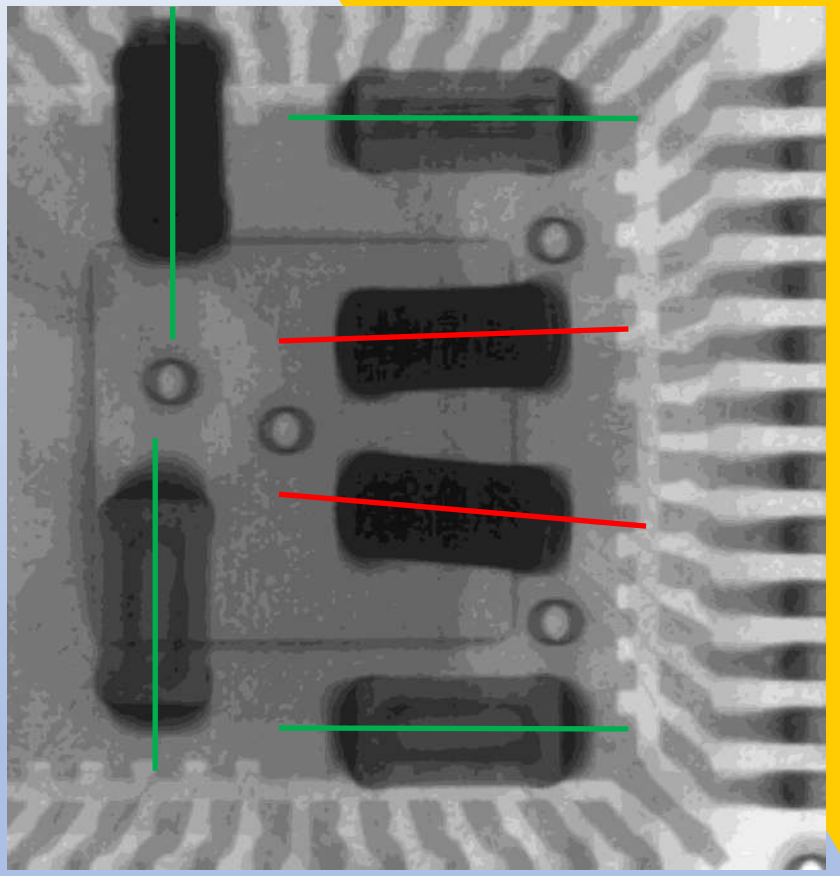
X-ray Inspection Features

Another feature of the inspection software checks the positioning deviation in x- and y-direction as well as the rotation condition of each single SMD component according to PCB layout and Gerber data.

Limits are definable.





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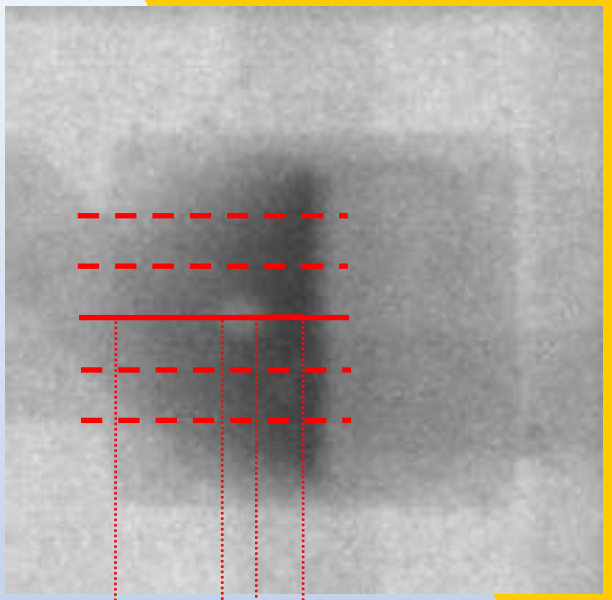
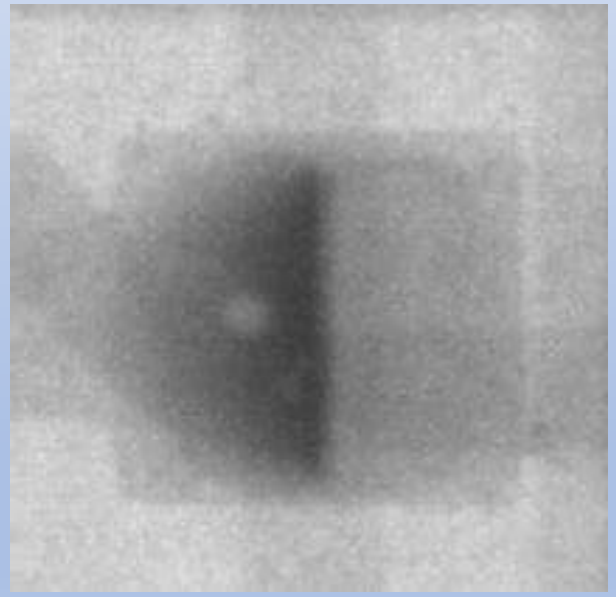
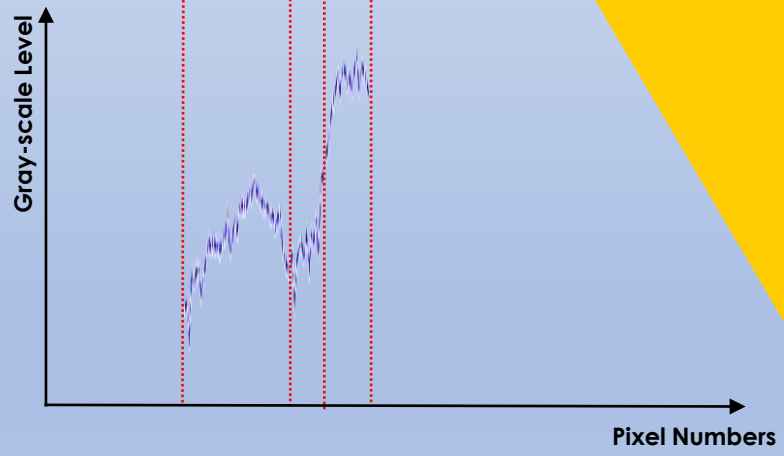
X-ray Inspection Features

The analysis of solder-joint on each component works on the measurement of gray-levels along the defined line. Depending on specification this can be just one line or multiple lines.







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X-ray Inspection Features

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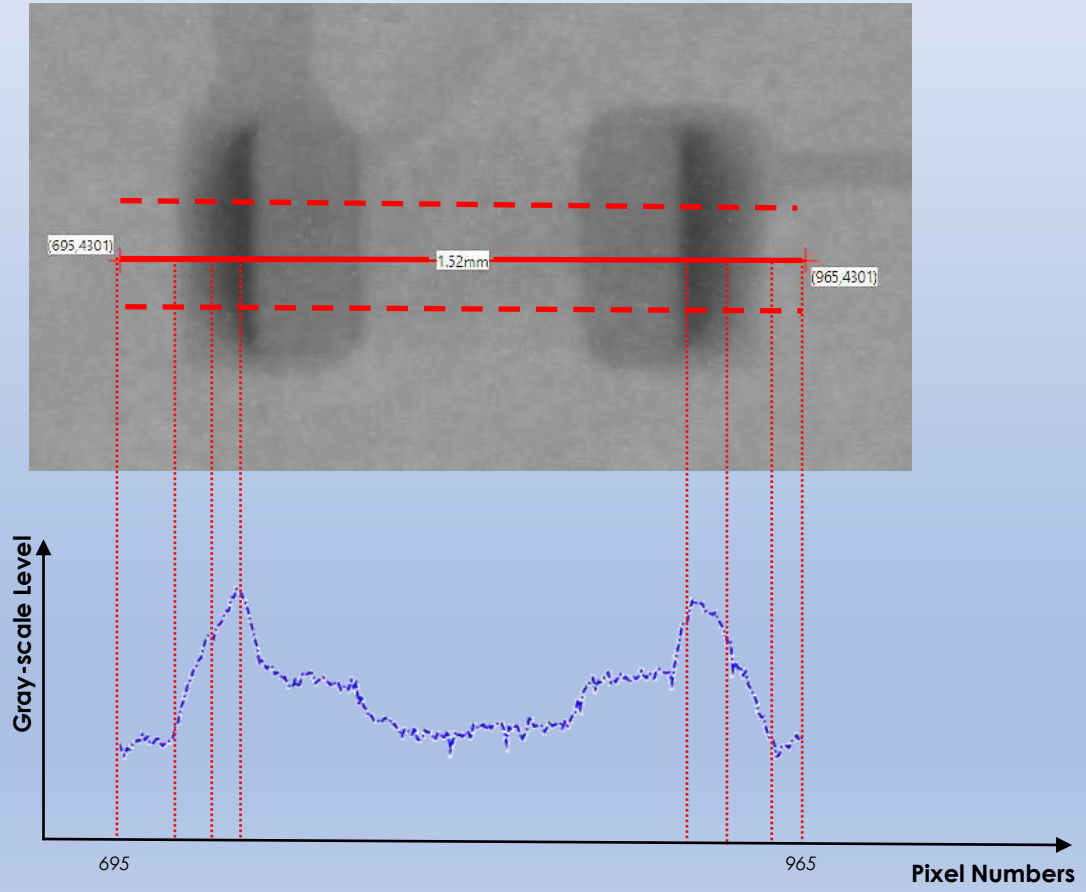

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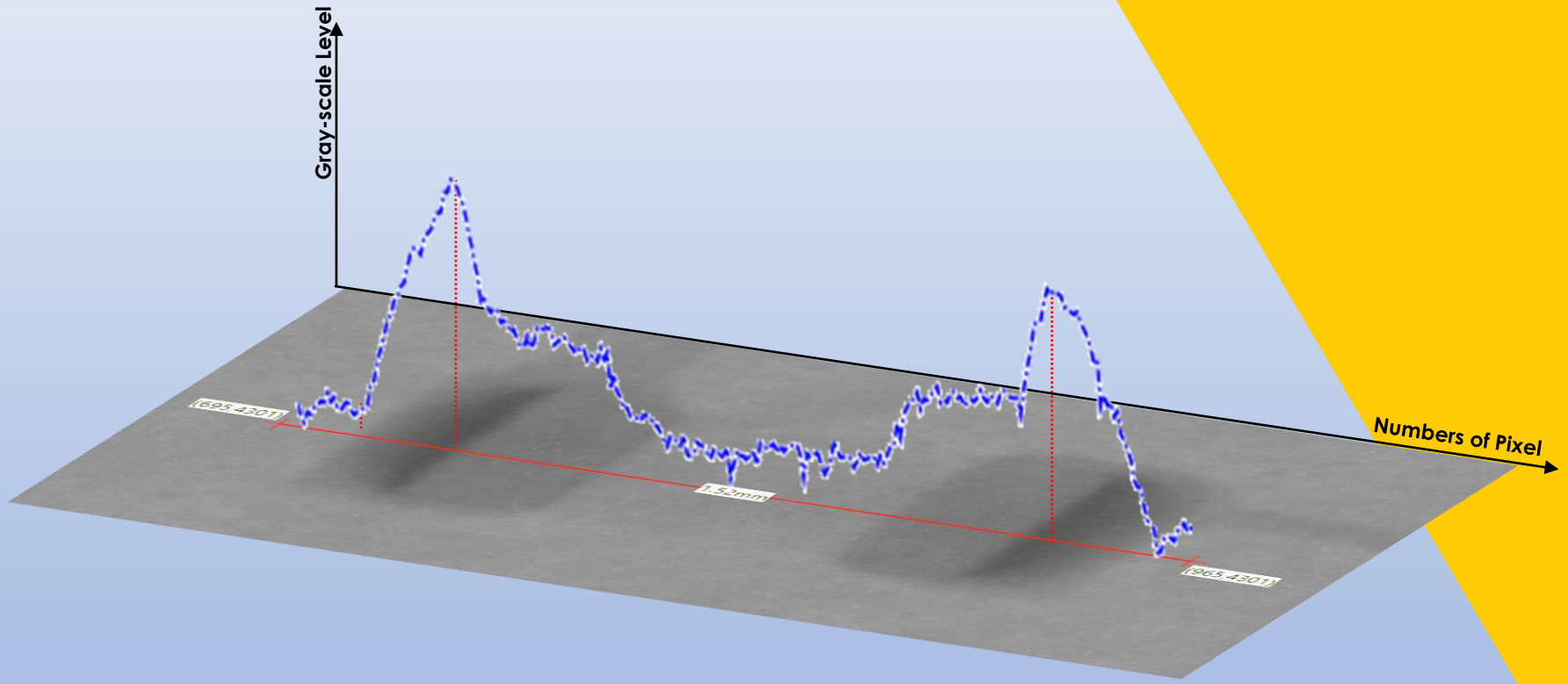
X-ray Inspection Features



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THE X-RAY SOLUTION

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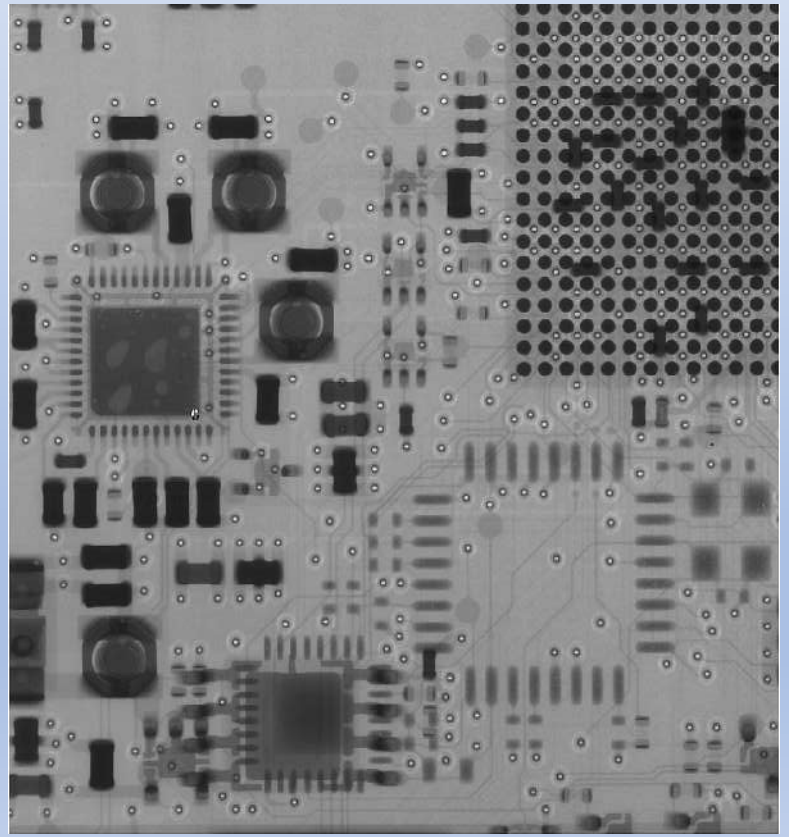
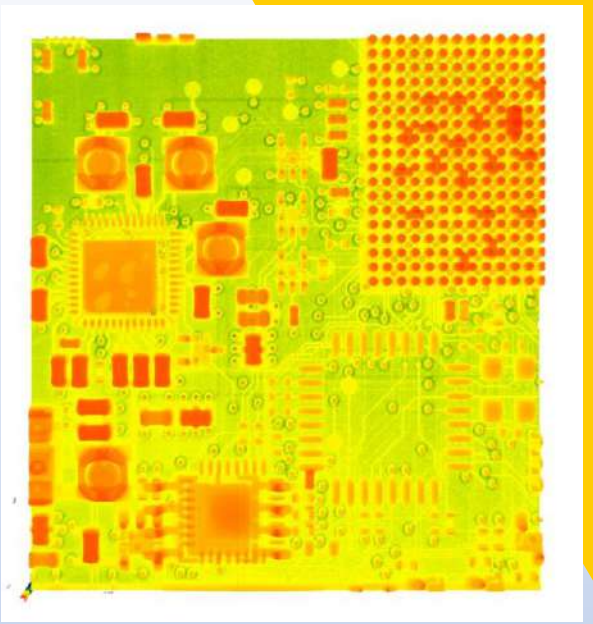
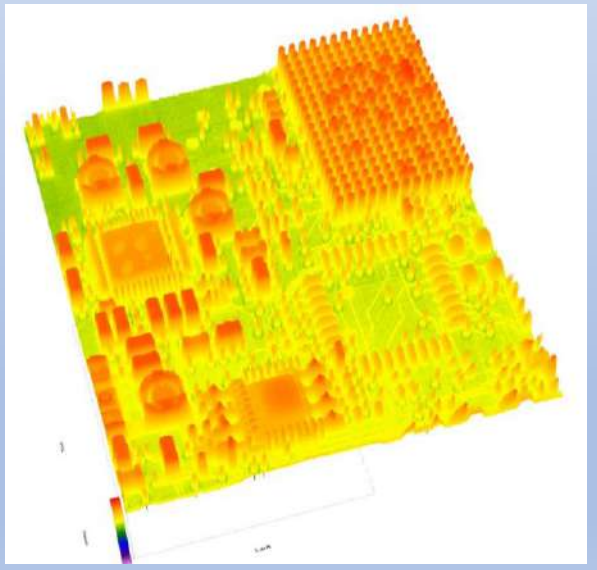
X-ray Inspection Features

For additional visualization, the 3D plot function is available.





Gray-scale Level shown by 3D Plot – Top-view

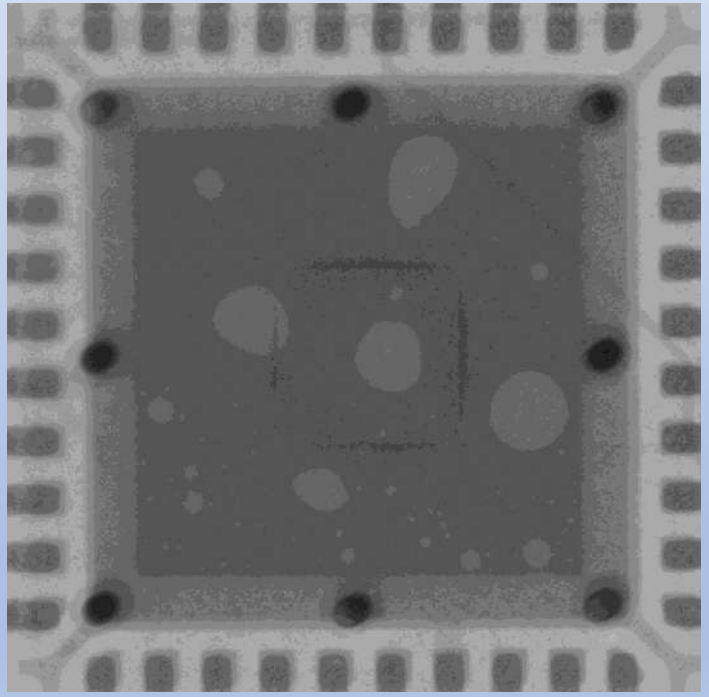


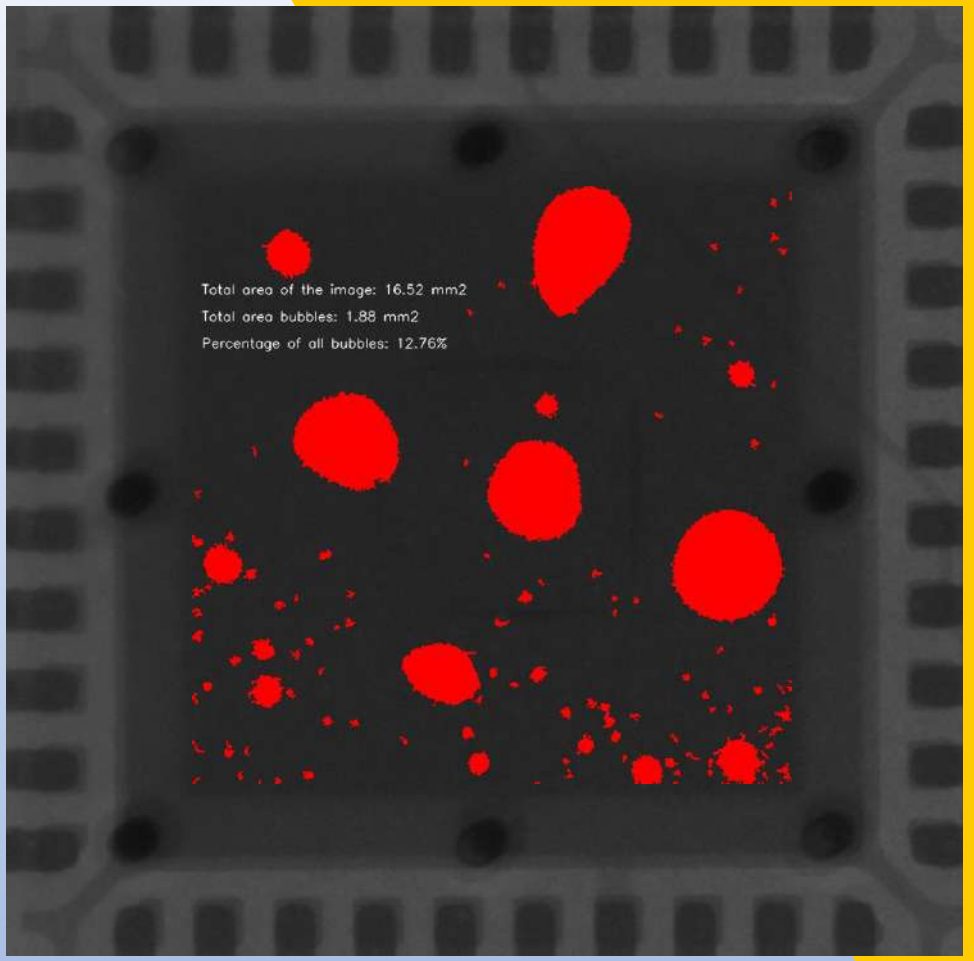
Gray-scale Level shown by 3D Plot – Angle-view

X-ray Inspection Features

A specific ROI allows to detect and to calculate the percentage of contacted surface.

Percentage is definable.

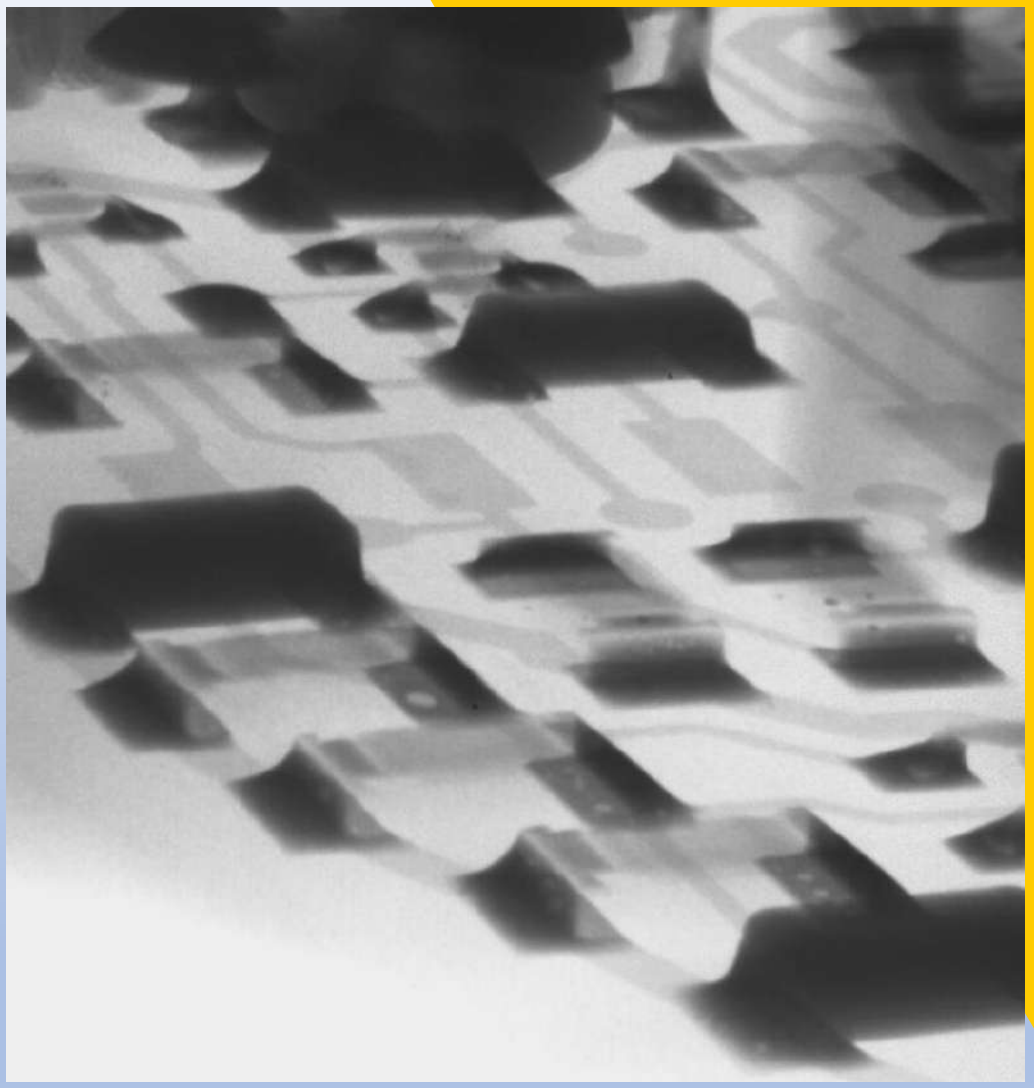




THE X-RAY SOLUTION
by Christoph Grohmann

X-ray Inspection Features

Due to separate manipulation of X-ray source and detector it is also possible to inspect any location of the PCB at individual angle of penetration.

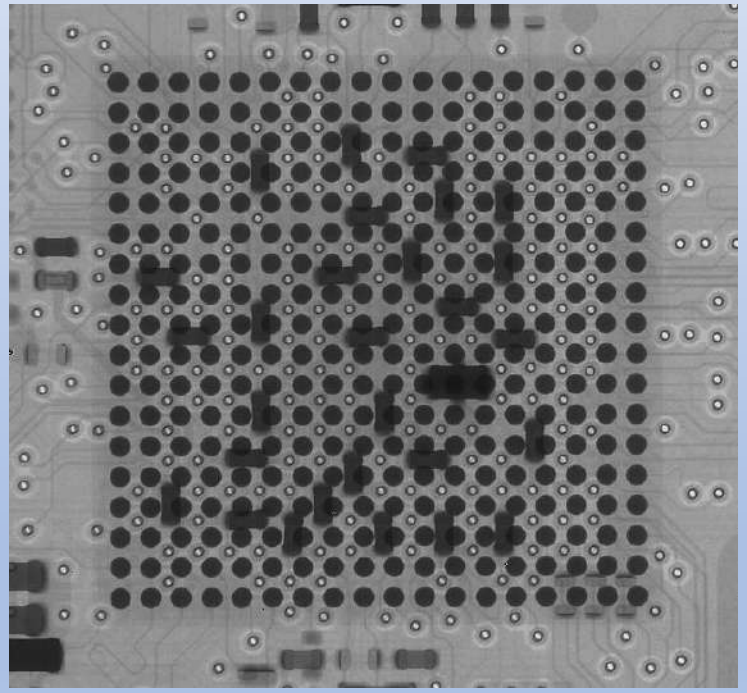


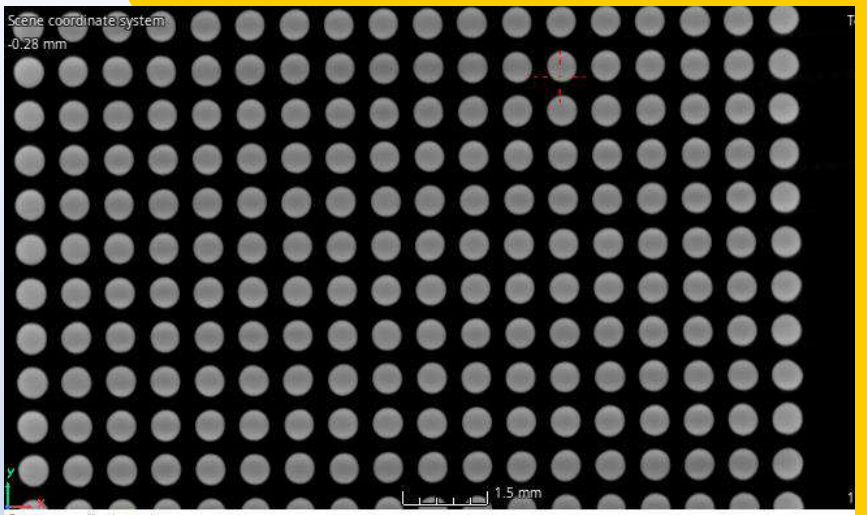
THE X-RAY SOLUTION
by Christoph Grohmann

X-ray Inspection Features

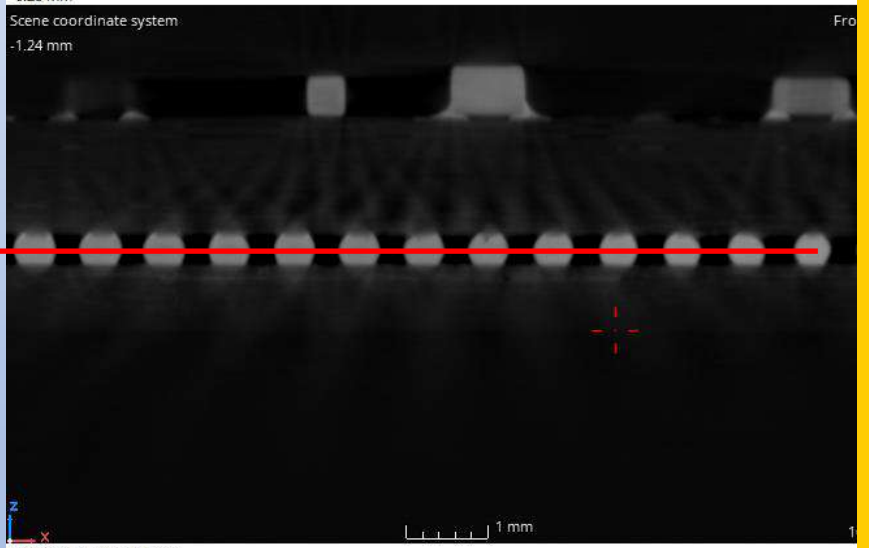
For inspection of BGA and other relevant components, the system is equipped with a planar Laminographic function that creates a 2.5D image.

The red line indicates the centre of the balls.





Scene coordinate system
Top 1 [x-y plane]
-0.28 mm

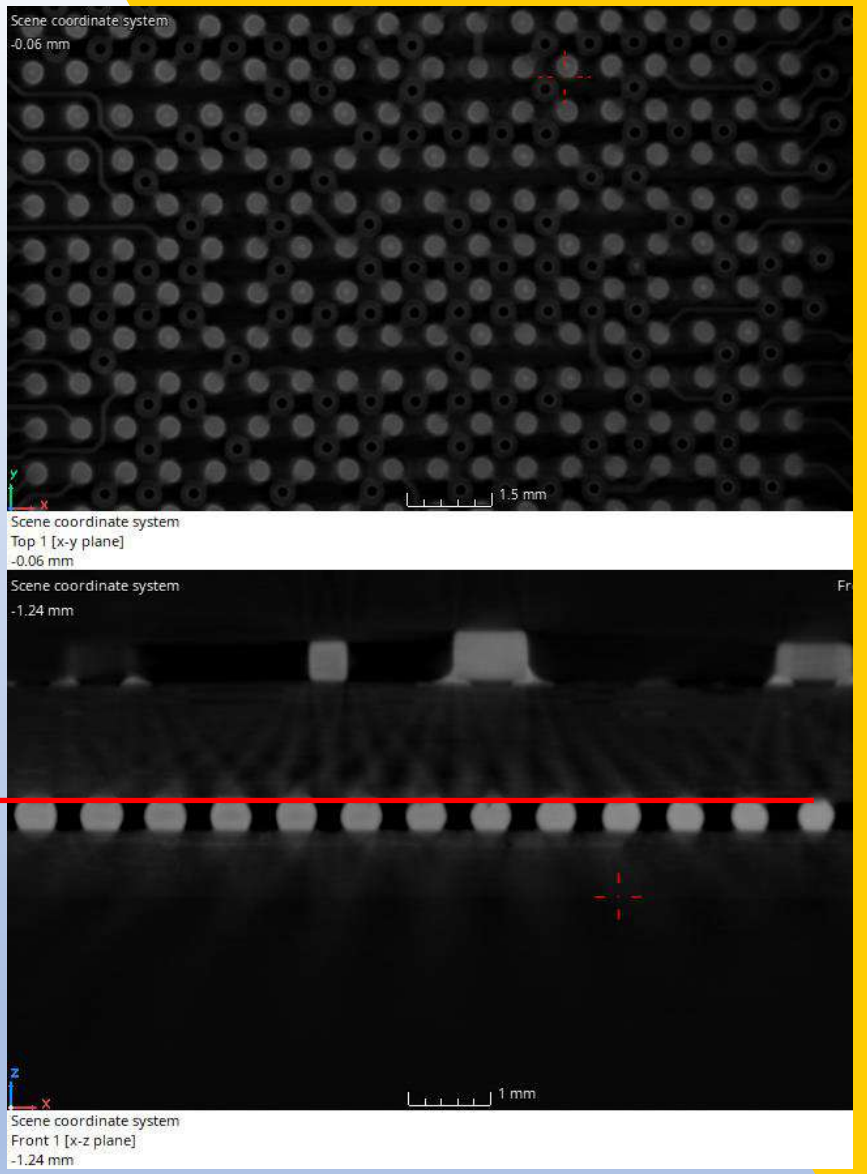


Scene coordinate system
Front 1 [x-z plane]
-1.24 mm

THE X-RAY SOLUTION
by Christoph Grohmann

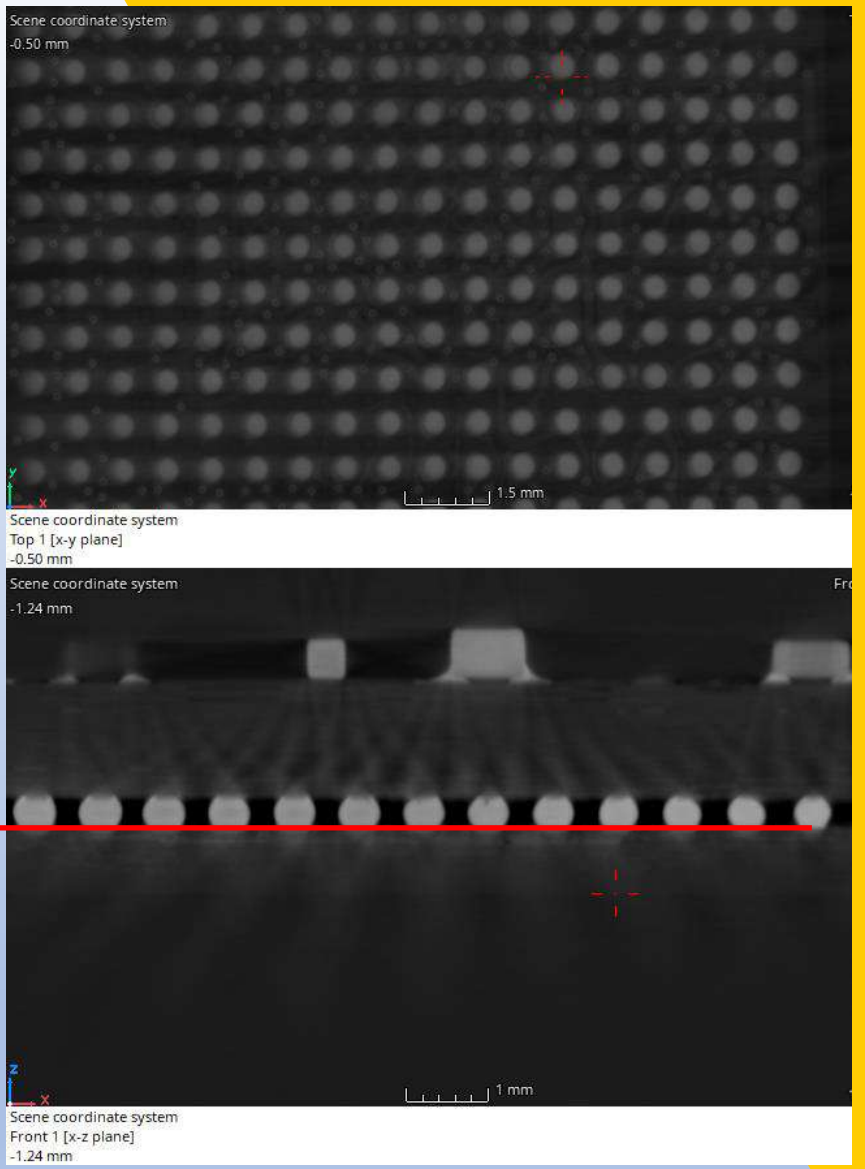
X-ray Inspection Features

The red line indicates the connection of the balls to the PCB.



X-ray Inspection Features

The red line indicates the connection of the balls to the BGA component.



THE X-RAY SOLUTION
by Christoph Grohmann

Technical Data of X-ray Source

The X-ray source has a micro-focus and is an extremely robust unit made for industrial use.

- Micro focus X-Ray source with on-board generator
- Shutter system with safety switches
- Interlock for safety

Technical Data:

- Closed System
- 130 kV, 0.5 mA
- Focal spot size 6 µm
- Power output max. 65 W

XB02

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THE X-RAY SOLUTION

by Christoph Grohmann

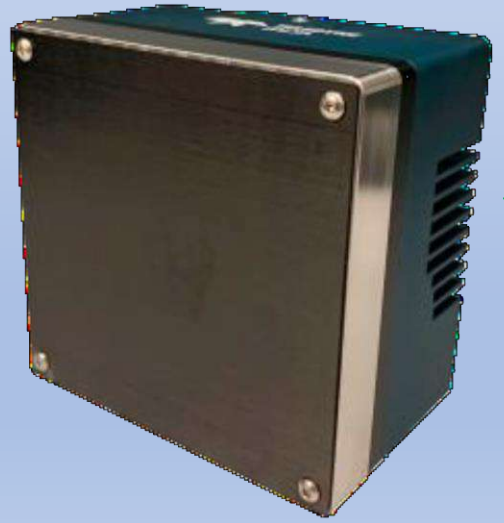
Technical Data of Detector from Teledyne Dalsa

The other available detector is a digital X-ray flat panel form Teledyne Dalsa.
Its very small pixel size of 6µm guarantees the highest possible object resolution.

TELEDYNE DALSA
Everywhereyoulook™

Technical data:

- 6 µm pixel size
- 10720 x 8064 pixels
- Input Field 64.3 x 48.4 mm
- Framerate 16 fps



XB02

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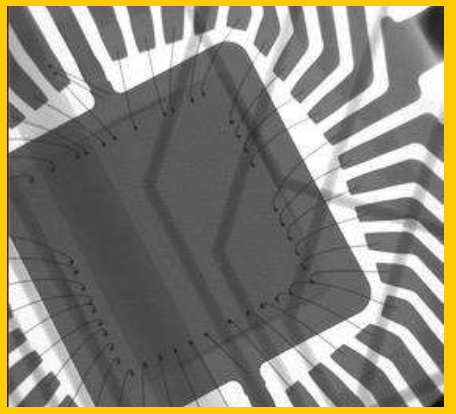
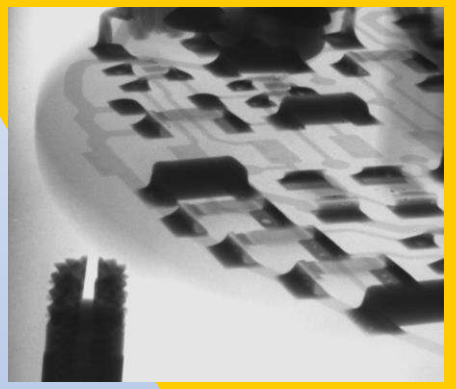
THE X-RAY SOLUTION
by Christoph Grohmann

X-ray Inspection for Laboratory

For laboratory uses the X-ray inspection system can be equipped with different X-ray sources from mini- and micro- to nano-focus. On the detector side, pixels sizes from 95µm down to 6µm are available.

The system´s easy to handle sliding draw allows the placement of a very wide range of products to be inspected as electronics, micro-mechanics and organic materials.





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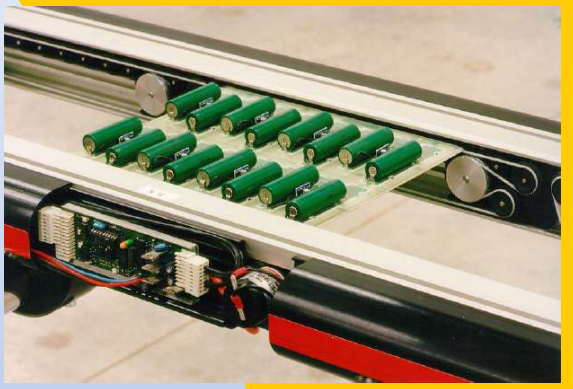
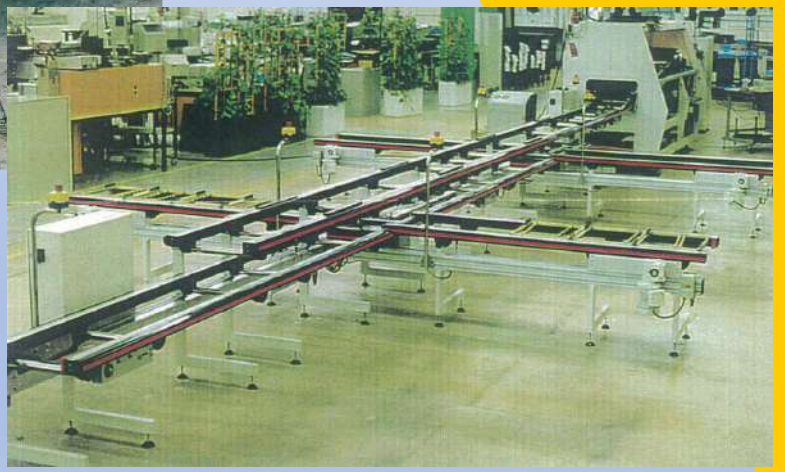
Transport and Assembly Lines for Electronic Industry

Various transport and assembly lines





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THE X-RAY SOLUTION

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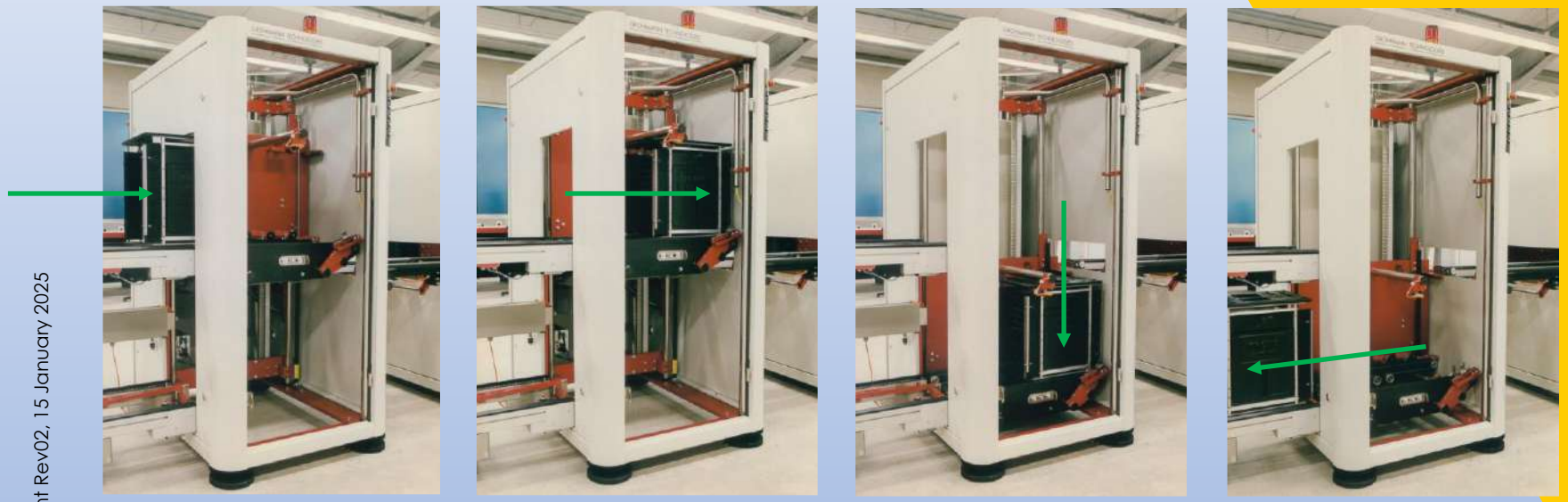
PCB Container Loading and Unloading Systems

Automatic container loading and unloading systems are available for batch-production.
Single PCB handling guarantees loading and unloading X-ray process as well as other production processes like assembly, soldering and ICCT and FT.



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In-circuit and Functional Test Systems

For in-circuit and functional tests, THE X-RAY SOLUTION provides customized solutions.

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X-ray Inspection for Electronic Industry

GET YOUR SUSTAINABLE SOLUTION

Our Commitment

- ✓ Highest Level of German Machine Design and Quality
- ✓ World-class Components like Siemens PLC / Spectra IPC
- ✓ Plug & Play System Concept
- ✓ Industry 4.0
- ✓ TUV Approval Certificate
- ✓ 2-Year Guaranty
- ✓ Service Contract with 24/7 Support
- ✓ Sustainability

ASK FOR DETAILED PERFORMANCE LIST
XB02 AND QUOTE

FOR MORE INFORMATION, PLEASE CONTACT
contact@thexraysolution.de

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