IMS X-Ray Systems
X-Ray Detectors „XRLD“

X-RAY SYSTEMS

Innovative X-Ray Inspection Systems for a Wide Range of Applications

Making the Invisible Visible: Welcome to the World of IMS X-Ray Systems

The systems of IMS Röntgensysteme GmbH are based on Wilhelm Conrad Röntgen‘s discovery of X-rays in 1895, which were later named after him and also became known as Roentgen rays.
This discovery, which was honoured with a Nobel Prize, still has an impact today and continues to gain importance in the system developments at IMS Röntgensysteme GmbH due to its many different possible applications. Since our foundation in 2000, our team has been researching and developing for our customers on a project-by-project basis in order to meet the individual requirements of a wide range of sectors.

IMS Röntgensysteme GmbH specialises in the field of non-contact inspection of a wide variety of organic and non-organic materials, making it possible to optimise the quality of various products and processes.

There is a wide range of possible applications, for example in quality assurance in the industrial and food sectors, in order to ensure that work processes are carried out in a such a way as to spare resources while at the same time improving quality and saving time. Using our expertise, we develop new customised solutions together with our customers.
This close cooperation results in innovations that are decisive steps ahead of the times and our competitors.

All IMS products incorporate the latest know-how and state-of-the-art production methods. Sustainability has always enjoyed high priority at IMS. This also means checking whether systems can be developed further by integrating new components.

Kind regards,

Markus Fackert
Managing Director

Hendrik Schultes
Managing Director

IMS Röntgensysteme GmbH

Made-to-measure the invisible: X-ray components and systems of IMS Röntgensysteme GmbH

X-ray components and systems must be optimized for each area of application. The diverse requirements in the special technical niche areas demand flexibility. In some applications, high stability and long-term reliability play the main role, in other areas price-optimized solutions are desired. We put customer requirements in the foreground of our actions.

Only those who can permanently deliver flawless products will be competitive in the global markets in the long term. This is ensured by safe, powerful and robust tested components and systems that can be used in the ongoing production process and enable non-destructive material testing.

With these requirements, IMS Röntgensysteme GmbH has consistently grown in terms of quality in recent years. Since 2000 we have been developing and manufacturing X-ray components and complete systems according to the clear tasks of our clients.

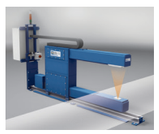
This includes X-ray systems for cold and hot strip thickness measurement in steel production as well as for use in microfocus technology for examining fully assembled circuit boards or smallest cast parts. Other measuring tasks are e.g. foreign object detection or check weighing in the sector of food industry.

History of the IMS Group

1980
January 15th, 1980; Foundation of IMS Isotope Messsysteme GmbH in Essen Kettwig

1986
Moving from Essen Kettwig to the present location Heiligenhaus Hetterscheid

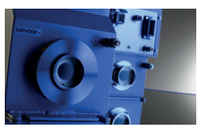
1988
IMS develops X-ray measuring systems for rolling goods



1996
IMS develops its own X-ray components

2000
Foundation of IMS Röntgensysteme GmbH

2006
IMS combines the control module and high voltage module to create an X-ray generator, and the XRG series becomes the standard.



2008
Like previous developments, the microfocus X-ray generators are also extremely compact and are modularly structured devices.

2017
IMS Röntgensysteme GmbH develops imaging and processing X-ray systems

today
IMS is constantly expanding and developing new product lines in Heiligenhaus

IMS Group – World Market Leader in Measuring Systems

Established in 1980, our company develops and produces isotope, X-ray and optical measuring systems for industrial use in the steel, aluminum and metal industries. Our head office is located in Heiligenhaus, Germany, and we currently have a workforce of approx. 500 employees on five continents.

IMS has a passion for precision and strong belief in quality. High-precision technology requires a maximum focus on quality. The technical competency we have accumulated as a result, paired with modern technology, enables us to implement high-end custom-built and needs-orientated solutions.

Over 5,000 IMS systems are in operation worldwide - each of them for a very special task. Our own development department and a clear structure in production enable us to react flexibly and quickly to special customer requests.

As a customer, you benefit from this - through continuous product quality, short downtimes on your production lines and the resulting sustainable cost savings. Use our experience and our know-how.

X-Ray Detectors: Technique and Operation Areas

Introduction to IMS XRLD detectors

The XRLD is an X-ray line detector for applications in industrial environments, especially in the field of non-destructive testing.

The following properties of the XRLD x-ray line detectors, among others, are individually adapted to customer requirements in dependence on the measurement task:

- energy range (up to 160 keV)
- active sensor length (from 51.2 mm to 870.4 mm)
- pixel resolution (from 0.2 mm to 0.8 mm)

The detector is supplied with a .NET based API for implementation in the customer application.

Additionally, first tests can be carried out by using our program “Demo GUI XRD” (see the figure below).

Professional image processing software can be ordered separately.

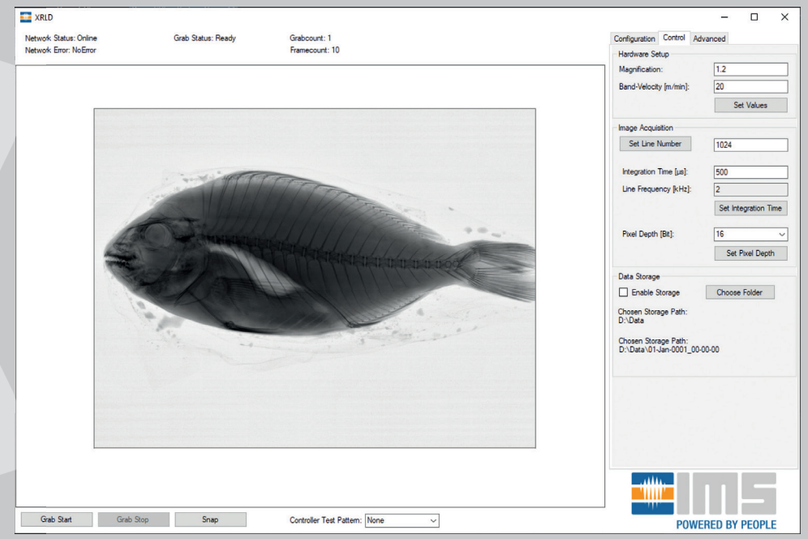
Typical detector application

Digital X-ray systems are used in the industrial sector for non-destructive testing (NDT) and non-contact inspection of a wide variety of materials. The test object to be inspected is transilluminated by X-rays and the attenuated X-rays are recorded by an X-ray detector. The beam parameters (such as high voltage, filter, etc.) depend strongly on the object and the measurement task.

A typical measuring system consists of the components outlined in the figure below on the right-hand side.

In a system with a line detector, the test object is usually moved relative to the beam plane by means of a conveyor belt. The X-ray source consists of an X-ray tube, which is operated with a corresponding X-ray generator and emits a fan-shaped beam directed at the sensitive surface of the X-ray line detector.

A computer – equipped with a GigE port – is used to control beam generation and image acquisition by the detector. The recorded data can then be processed with appropriate image processing algorithms. Optional devices, such as encoders, can be used to trigger the detector synchronously with the movement of the object or to start recording of an image.



Mode of operation

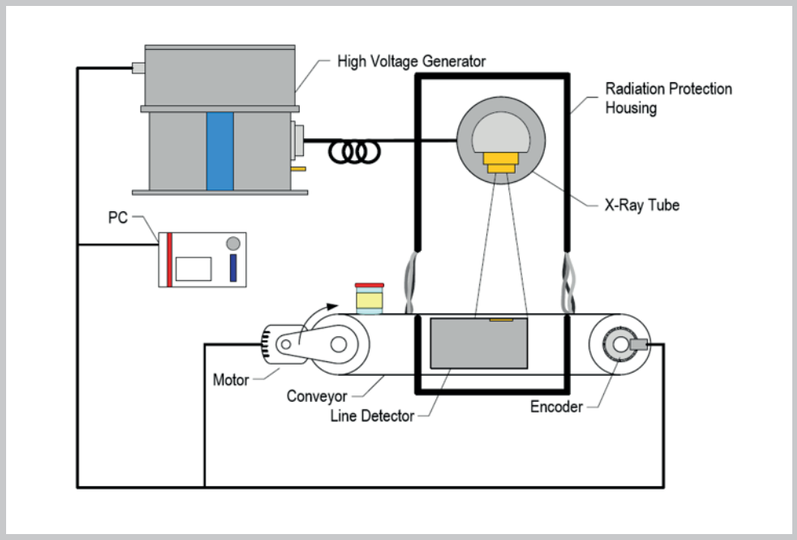
The detector uses a so-called indirect detection mechanism: the (high-energy) X-ray photons are converted into photons of the visible light spectrum by a scintillator.

The visible light thus generated is detected by a silicon photodiode array; each element of the array represents an individual detector pixel and the distance between two neighbouring pixels is defined as the pixel resolution. The voltage, which corresponds to the measured charge per pixel, is converted by an A/D converter and processed by a data acquisition board. Digital line and image data are provided via a GigE interface. The detector is also parametrised via the GigE interface using UDP telegrams.

The choice of scintillator material depends on many factors but is crucial for the success of the underlying measurement task. The specific selection is made in coordination with the respective customer requirement.

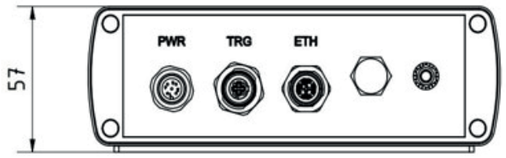
Hardware-based calibration

The IMS XRLD detector features hardware-based gain and offset calibration pixel by pixel.
As a conclusion, the detector can be used in the optimum gray-value range with the greatest possible dynamic range over the entire detector width, depending on your concrete measurement task.



Technical Specification of IMS XRLD Detectors

The following sections provide an overview of the possible equipment variants of the XRLD X-ray line detectors. In addition, the properties for a special example configuration of the detector with a 614.4 mm long sensor surface and a pixel resolution of 0.4 mm are given. If no value range is given, the specifications apply to all versions of the XRLD X-ray line detectors.



Technical data

Property	Value Range	Example Configuration
Energy range of the incident X-rays	Up to 160 keV	Up to 40 keV
Scintillator material	GOS	
Length of active sensor area	From 51.2 mm to 870.4 mm	614.4 mm
Number of pixels	From 128 to 4352	1536
Pixel resolution	From 0.2 mm to 0.8 mm	0.4 mm
Pixel height	From 0.3 mm to 0.8 mm	0.6 mm
Pixel width	From 0.15 mm to 0.72 mm	0.32 mm
Maximum line frequency	From 3.1 kHz to 5 kHz	5 kHz
Maximum scanning speed	From 62.5 cm/s to 400 cm/s	200 cm/s
Minimum integration time	From 200 µs to 320 µs	200 µs
Maximum integration time	128 ms	
A/D resolution	16 bit	
Saturation	~50,500 A/D values at 16 bit	
Date interfaces	1 x GigE 1 x trigger interface (RS485)	
Operating temperature range	0 to 50 degrees Celsius	
Operating humidity	< 85% at 30 degrees Celsius / non-condensing	
Storage temperature range	-10 to 60 degrees Celsius	
Storage humidity	< 95% at 40 degrees Celsius / non-condensing	

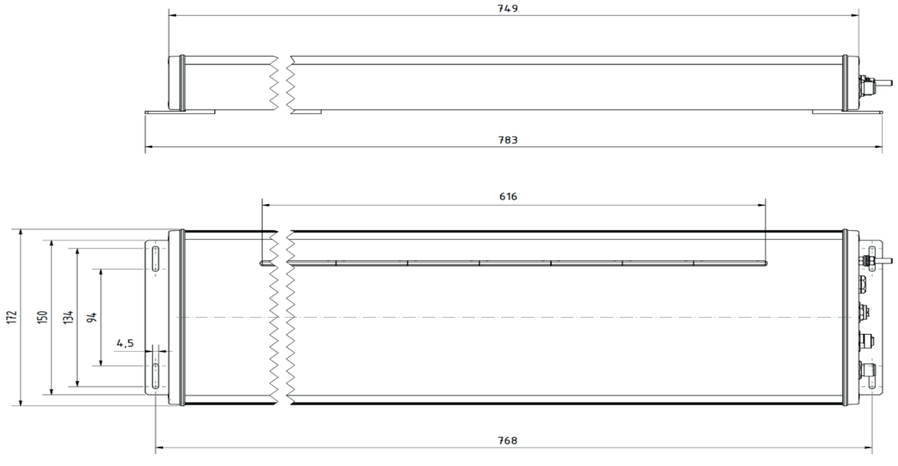
XRLD DETECTORS:
TECHNICAL SPECIFICATIONS

Electrical data

Property	Value Range
Supply voltage	12 - 24 V / DC (direct voltage)
Permissible residual ripple of the supply voltage	100 mV (peak to peak)
Power consumption	Max. 30 W
Interface data	1 x GigE 1 x Trigger interface (RS485)

Mechanical data

Property		Value Range	Example Configuration
Dimensions Housing	Length (excl. mounting attachment)	From 276 mm to 1021 mm	749 mm
	Width	172 mm	
	Height	57 mm	
Dimensions X-ray entrance window	Length	From 55 mm to 874 mm	618 mm
	Width	5 mm	
Distance top edge of detector housing to top edge of scintillator (determined by design)		From 13.2 to 15.4 mm	15.4 mm
Weight		From 2.5 to 9.5 kg	7 kg



Inspection of Plastic Tubes

100% control – 24/7

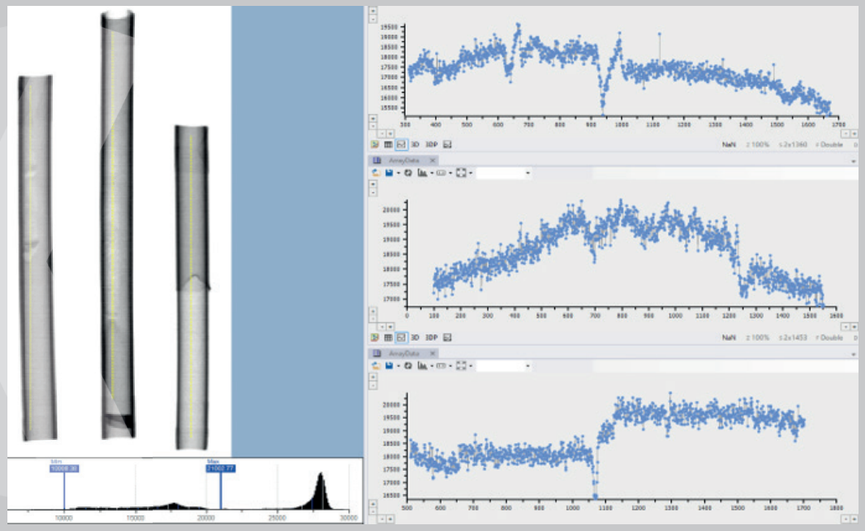
Plastic tubes for use in underfloor heating are manufactured in endless production systems by extrusion. For optimal thermal insulation, these tubes consist of several layers that are applied in successive process steps.

During these several process steps, various production defects in the tubes can occur, such as:

- Inclusions of foreign objects
- Cracks or material breakouts
- Deformation
- Damage / tear off of a layer

Such defects are of course intolerable for tubes in heating systems and must therefore reliably detected. Therefore, the most important requirement to the detection in this measurement task is a small pixel size in connection with a high scanning speed in order to be able to detect even the smallest defect.

The picture below shows X-ray images of three different tubes. Various anomalies can already be recognized visually due to the high dynamic range of the detectors that have been used.



Quality Control Tobacco

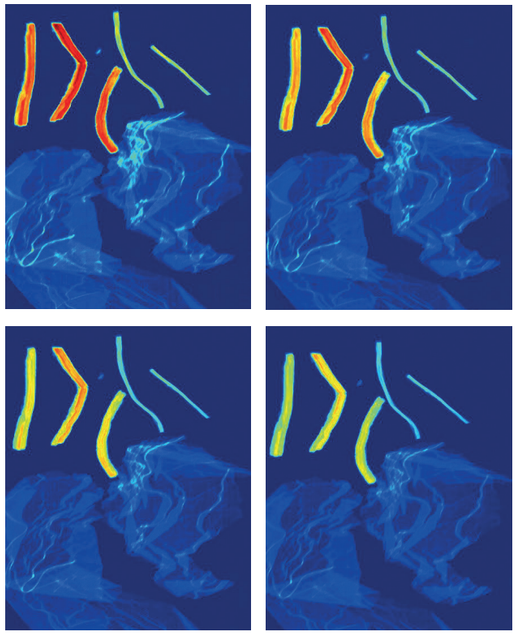
Tobacco leaf grading

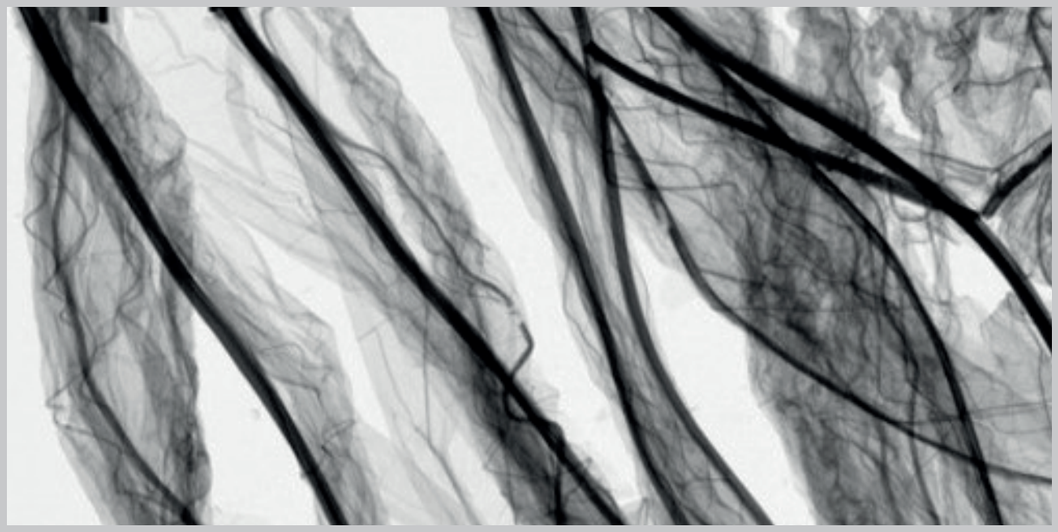
An important quality feature for processing tobacco is the ratio of stem to leaf material.

A major challenge of this measurement task is, to generate constant gray-scale images of the examined tobacco over the large width of a production facility in order to reliably differentiate stem from leaf material.

In order to accomplish this task without using complex technical X-ray absorbers, we use the possibility of pixel-precise offset and gain calibration of our detectors.

The pictures on the right show X-ray images of tobacco leaves at different energies. Due to the false color display, the stem and leaf can be separated easily manually or automatically via image processing.





Interested? Just get in Touch!

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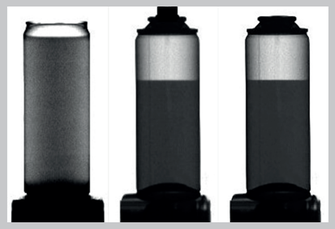
Further Application Examples

Preventative Maintenance

Identify damaged production equipment before it fails and causes more extensive damage.

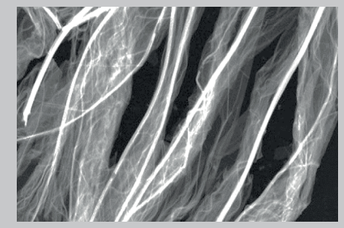


Fill Level Measurements

Identify the precise fill level in your non-transparent containers, for example, in canisters or cans, and optimise your filling processes.

Incoming Goods Inspection

Be confident about the raw materials that you receive; there‘s a lot that cannot be detected with the naked eye, but with IMS solutions it becomes visible.



Completeness Check

Customers expect products which are both faultless and complete; automated monitoring from IMS secures your market position.

Foreign Object Detection

For all parties involved, complaints are an aggravation, so use IMS solutions to prevent complaints and further consequences, such as recalls.

IMSocial

„Responsibility means to blame yourself for the lack of sustainability.“

(Ronny Boch, geologist, free author)

Conservation of resources through precision out of passion and quality out of conviction

We at IMS, as the world market leader for measuring systems, are aware of our social responsibility of sustainable management!

To give our customers, suppliers and stakeholders a transparent insight into concrete measures we have implemented in the IMS Group, we launched the project IMSocial in close adherence to the principles of Corporate Social Responsibility (CSR).

But for us at IMS, IMSocial is more than just a project! IMSocial is a belief and stands for the values of our corporate philosophy.

We not only want to achieve sustainability in our products and customer relations, but also place the same demands on our social, ecological and economic responsibility.

The first thought that comes to mind in connection with the non-contact measuring systems from IMS for the steel, non-ferrous metal and aluminium industries is certainly not one of active conservation of resources.

However, our isotope, x-ray and optical measuring systems do exactly that: they save and preserve resources!

The IMS product portfolio comprises numerous measuring systems and processes for various types of measurement. Our systems deliver and document exceptionally precise measurement results under the toughest conditions in hot and cold rolling mills as well as service centres. In this way it is possible to detect material defects, surface irregularities, tolerance and dimensional deviations and many other factors that, in the worst case, would lead later to material rejects at an early stage during the manufacturing process.

After all, the sooner even minor defects – which in steel products can already render them useless – are detected, the faster machining processes can be corrected. And precisely this contributes significantly to active climate protection as it is no longer necessary to produce new products to substitute defective ones, thereby saving energy and water, and also reducing reject rates significantly.

Learn more about IMSocial and visit us at **www.imsocial.info**!

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