IMS MESSSYSTEME GmbH
World Market Leader in Measuring Systems

IDS – Inclusion Detection System

Complete inspection for non-magnetic inclusions and impurities

Agenda

Facts and Figures

IMS Messsysteme GmbH

- Founded 14 January1980
- Headquarters in Heiligenhaus, North Rhine-Westphalia
- About 460 employees worldwide
- About 380 employees in Heiligenhaus
- 9 international subsidiaries

POWERED BY PEOPLE

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4500+
Measuring Systems in use

750+
Customers

60+
Countries

 | 10/18/2022

Agenda

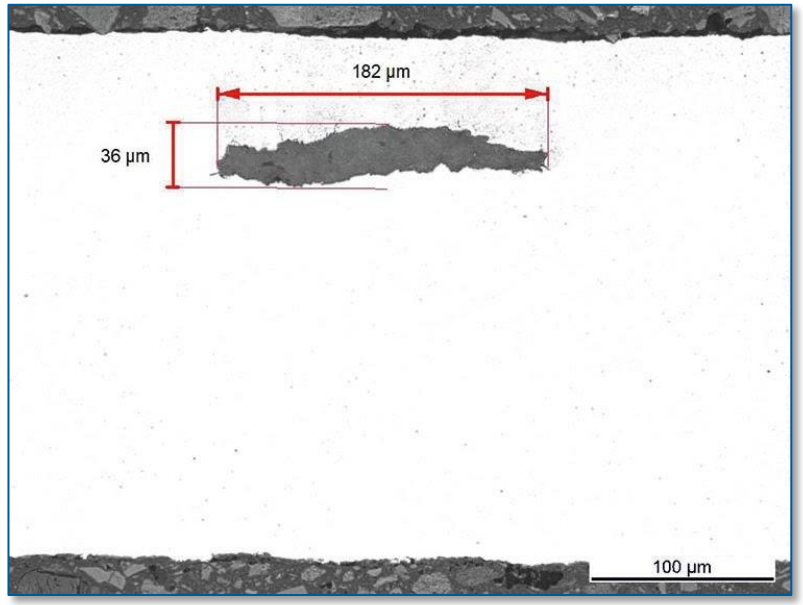
Non-Metallic Impurities (NMI)

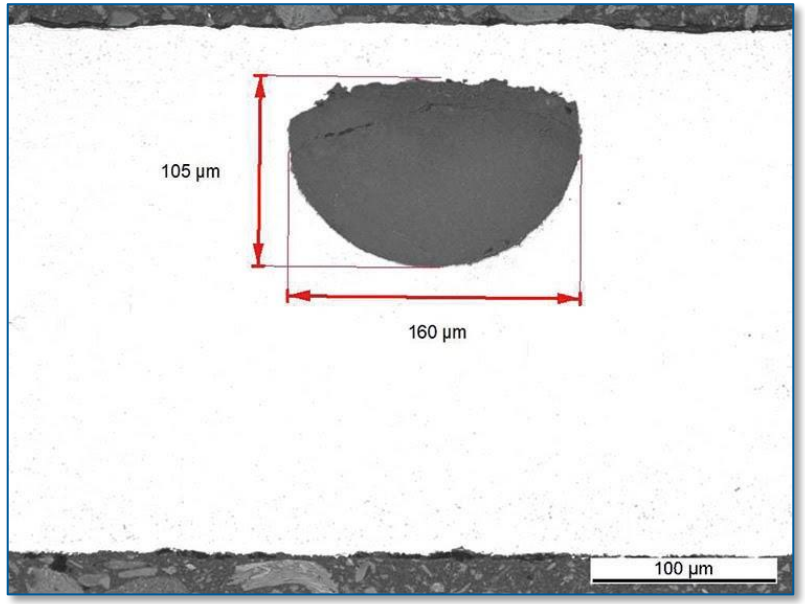
Challenge

- Tin plate can contain non-metallic impurities like inclusions and segregations
- NMIs can cause problems during the further processing, especially during deformation
- May lead to ruptures in applications involving high deformation rations, e.g., beverage cans

- Inclusions are sub-surface and cannot be detected by optical inspection

- Mostly oxides of metals like calcium or aluminum
- Deformation by rolling into elongated shapes
- Typical default defect: Inclusion with 1 mm length, 100 µm width and 10 µm length





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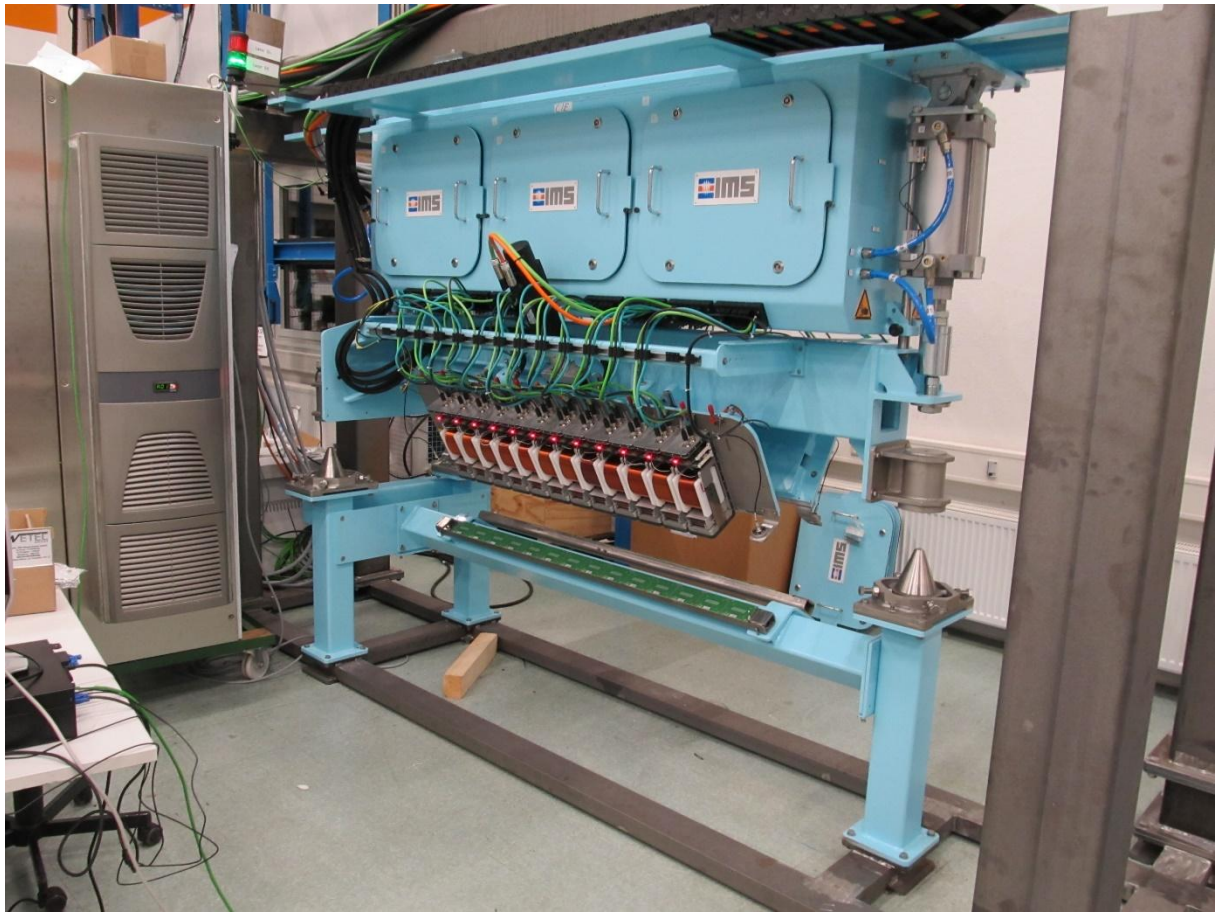
IDS – Inclusion Detection System

Development

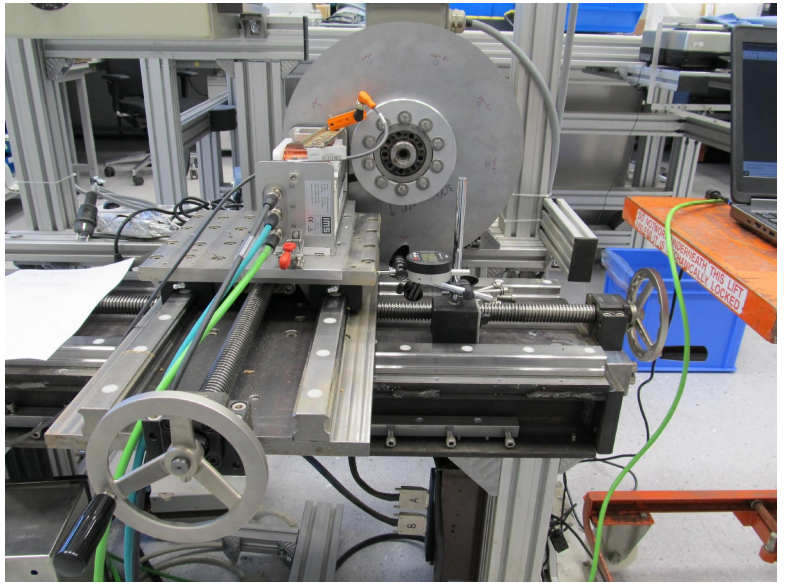
- IMS developed an online inspection system for NMIs based on magnetic flux leakage
- Sensors are incorporated into a compact device acting as a MFL line camera
- Can be combined in different configurations, enabling a gap-free coverage of inspected strip

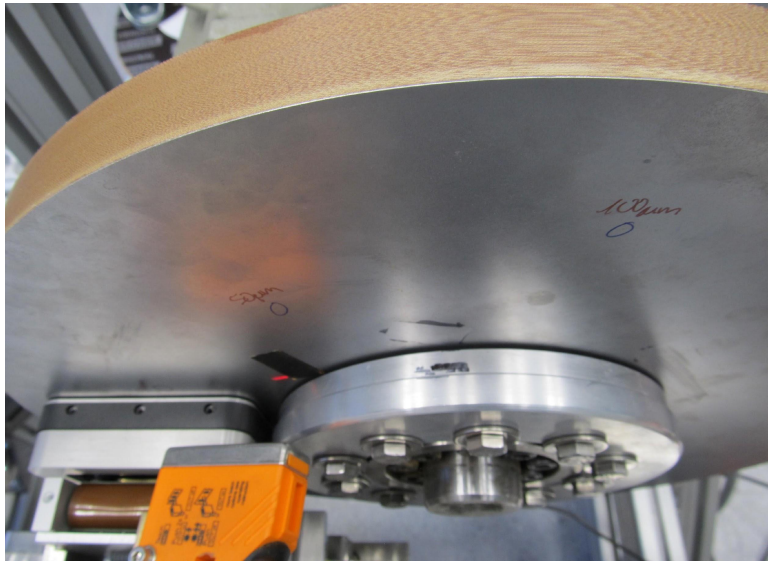


Development

Laboratory Setup

- Material speed simulation is implemented by fixing round plate samples to precisely faced discs
- The discs are rotated by a VFD-controlled motor
- A cross table is placed in front of the discs surface for precise sensor placement
- Customer samples with natural or artificial defects can be examined



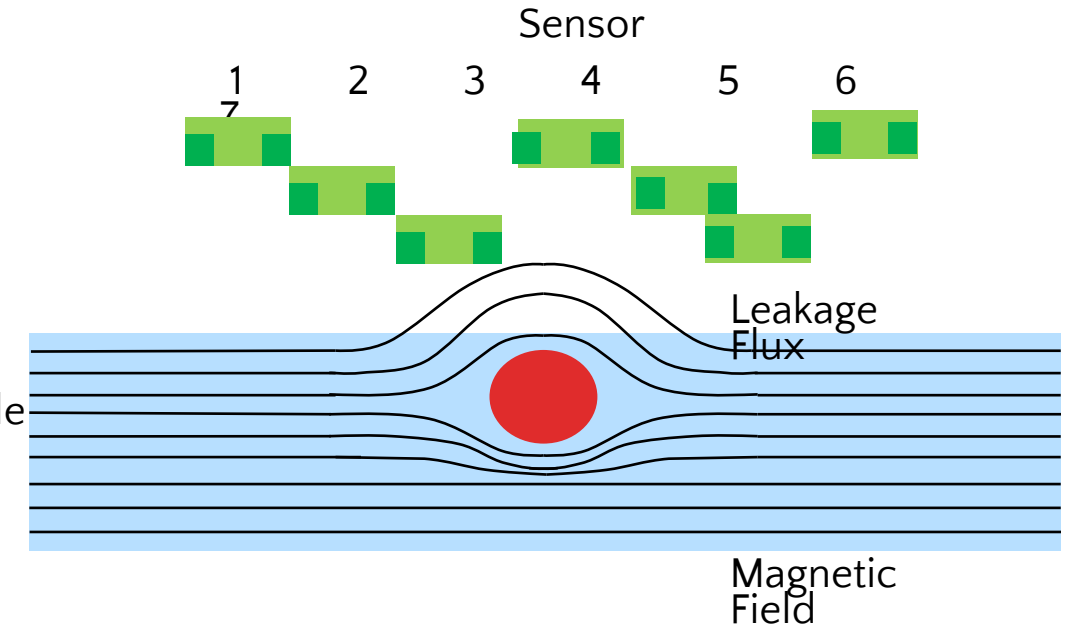


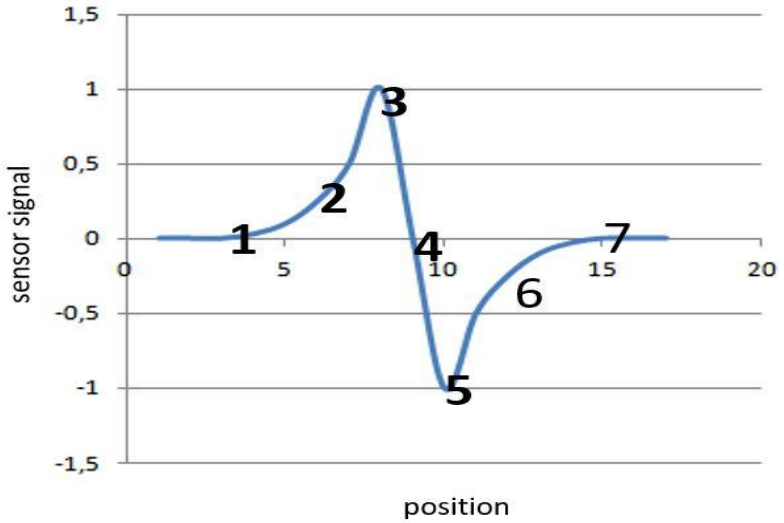
Principle of Measurement

Magnetic flux leakage

- Variation in the magnetic cross-section of a magnetically saturated material causes a flux variation on its surface
- Most defects are non-magnetic, making this approach suitable

- MFL is widely used in form of magnetic powder testing
- IMS Messsysteme developed a measuring system based on GMR-Sensors, enabling complete online MFL inspection
- Compared to similar systems, the liftoff to the inspected material is increased making the system less vulnerable, while sensitivity is improved





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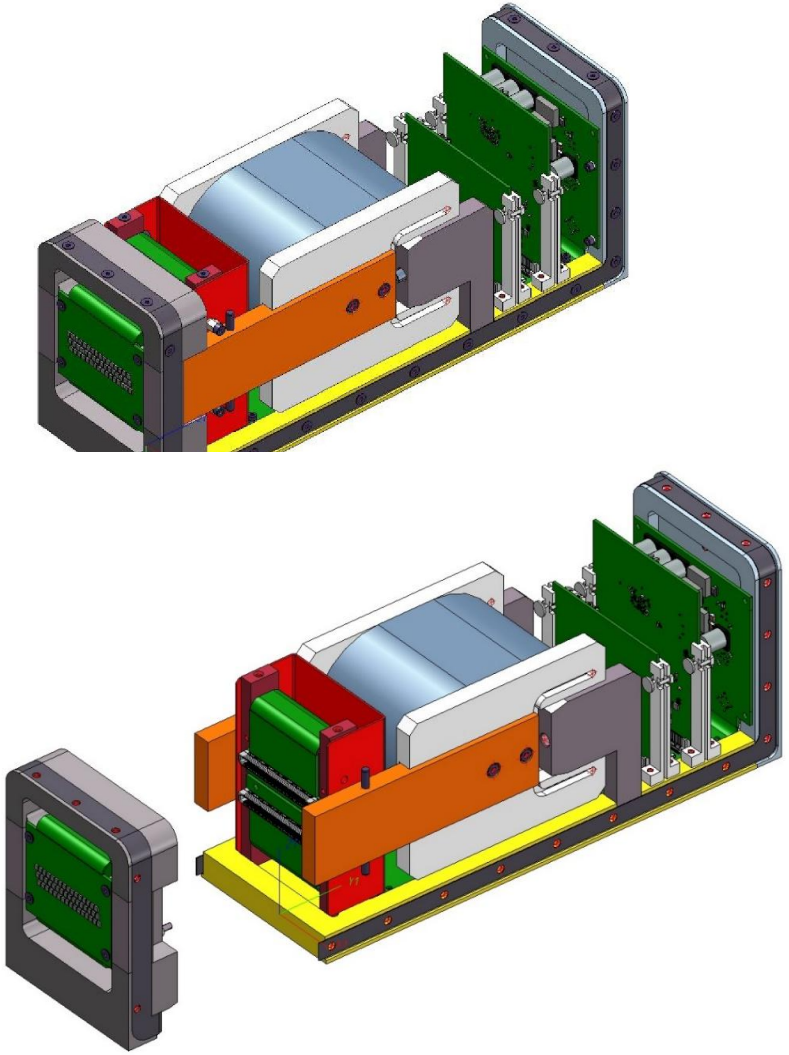
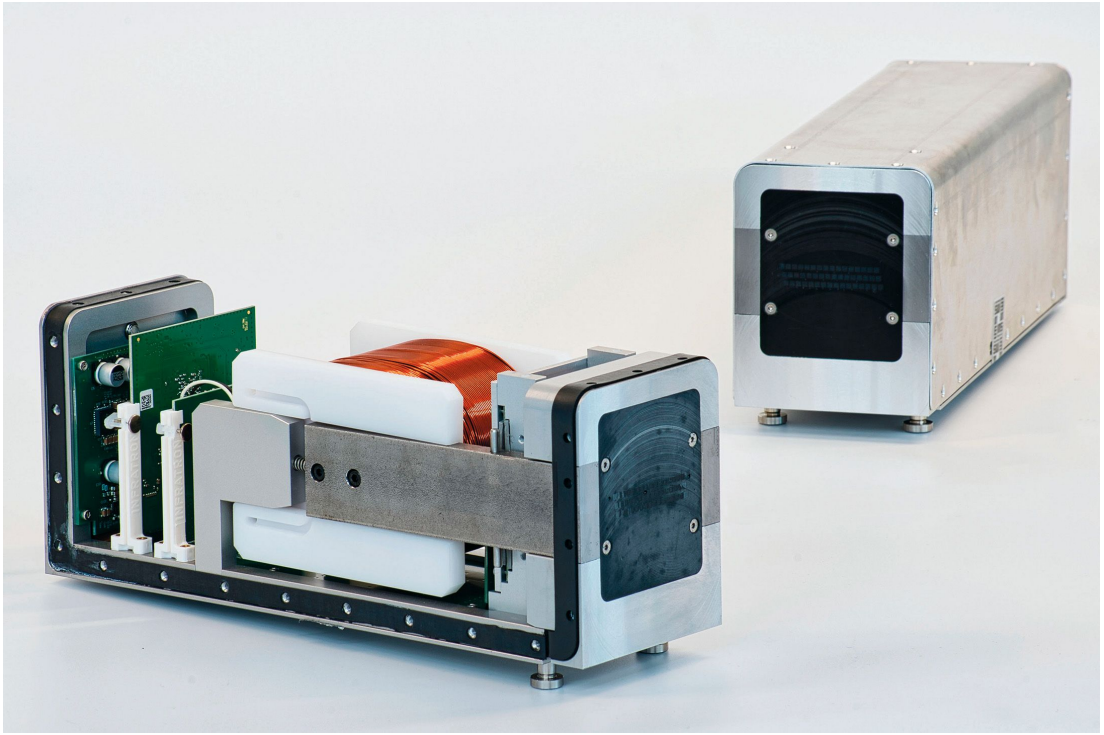
Sensor Modules

- 48 GMR-Sensors in one sensor module
- Spatial resolution is 1 mm
- Total width of a module is 95 mm
- 2 lines of modules are sufficient for full coverage
- Variable sampling rate of up to 200 kSa/s, sufficient for 1000 m/min strip speed
- Protected sensor block, easily exchangeable in case of damage



Sensor Modules

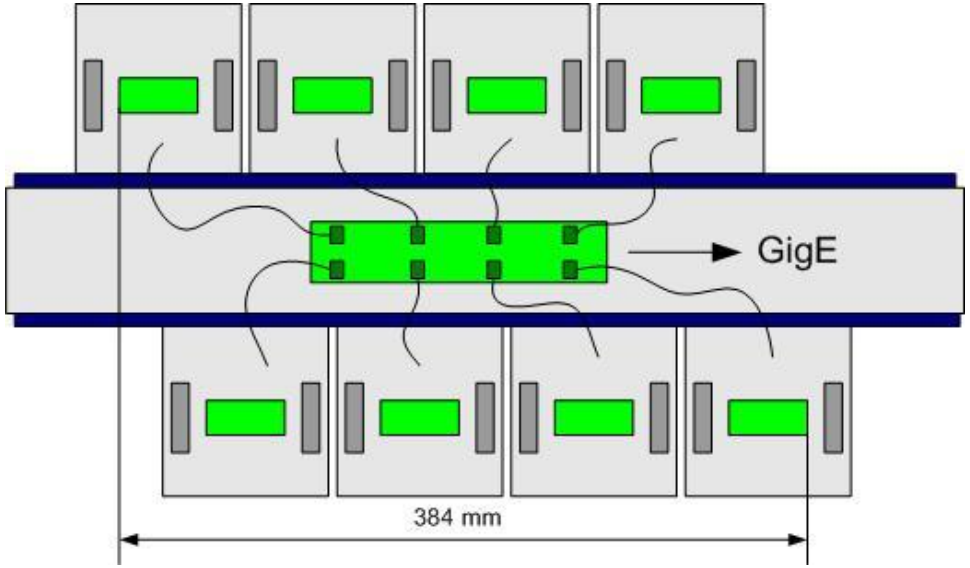
- Protected sensor block, easily exchangeable
- No mechanical adjustment needed after change
- Magnet can be turned off for cleaning and safe maintenance
- Dust- and spray-water-proof

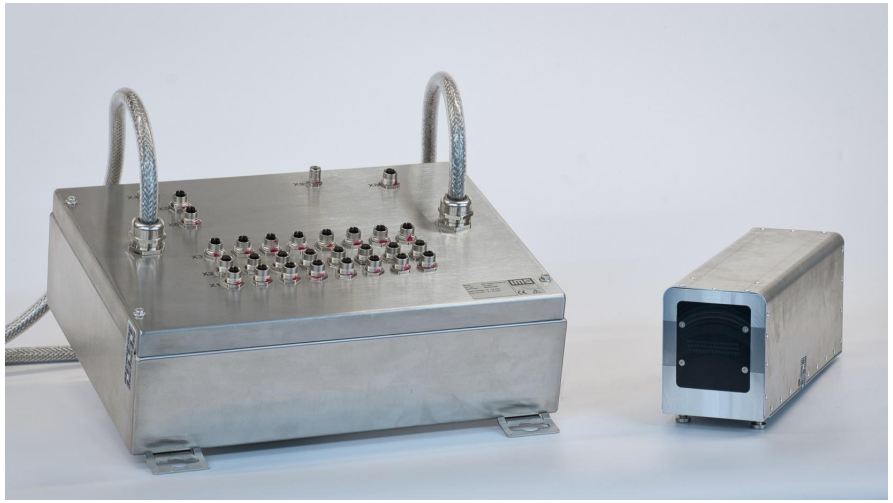


Module Configuration

Aggregator Hub

- Sensor modules arranged in two rows
- Max. 8 modules are combined to one group
- Each group covers a width of 384 mm
- Each group represents a MFL Line Scan Camera with GigE connection
- Min. 20 mm/max. 65 mm. at both strip edges are not covered by sensors





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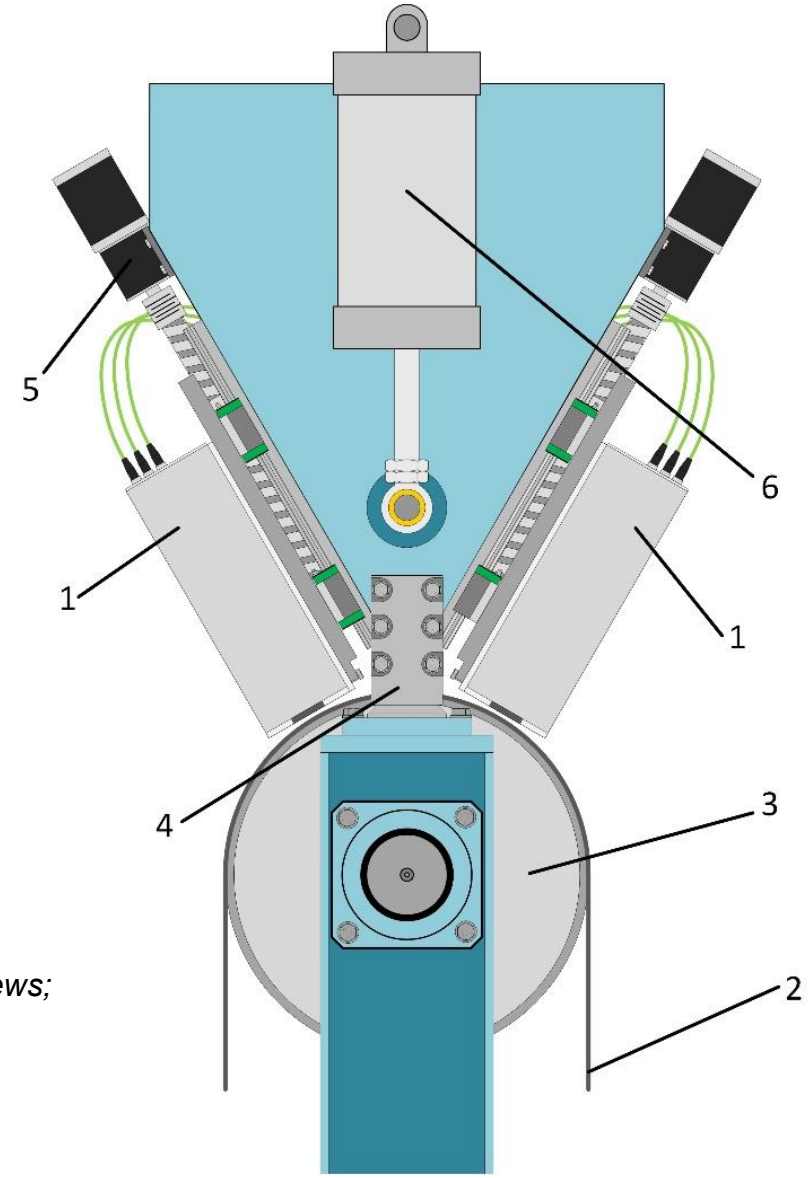
Contact-Less Inclusion Detection

- Installation on roll – close to the surface but without contact
- Precise liftoff adjustment by ball screws and servo drives
- Adapts to variable material thickness
- Liftoff is controlled by capacitive sensors
- Fast pneumatic retraction to prevent collisions



1: sensor modules; 2: measured strip;
3: support roll; 4: pilot pin;
5: fine adjustment with servo drives and ball screws;
6: fast retraction by pneumatic cylinders

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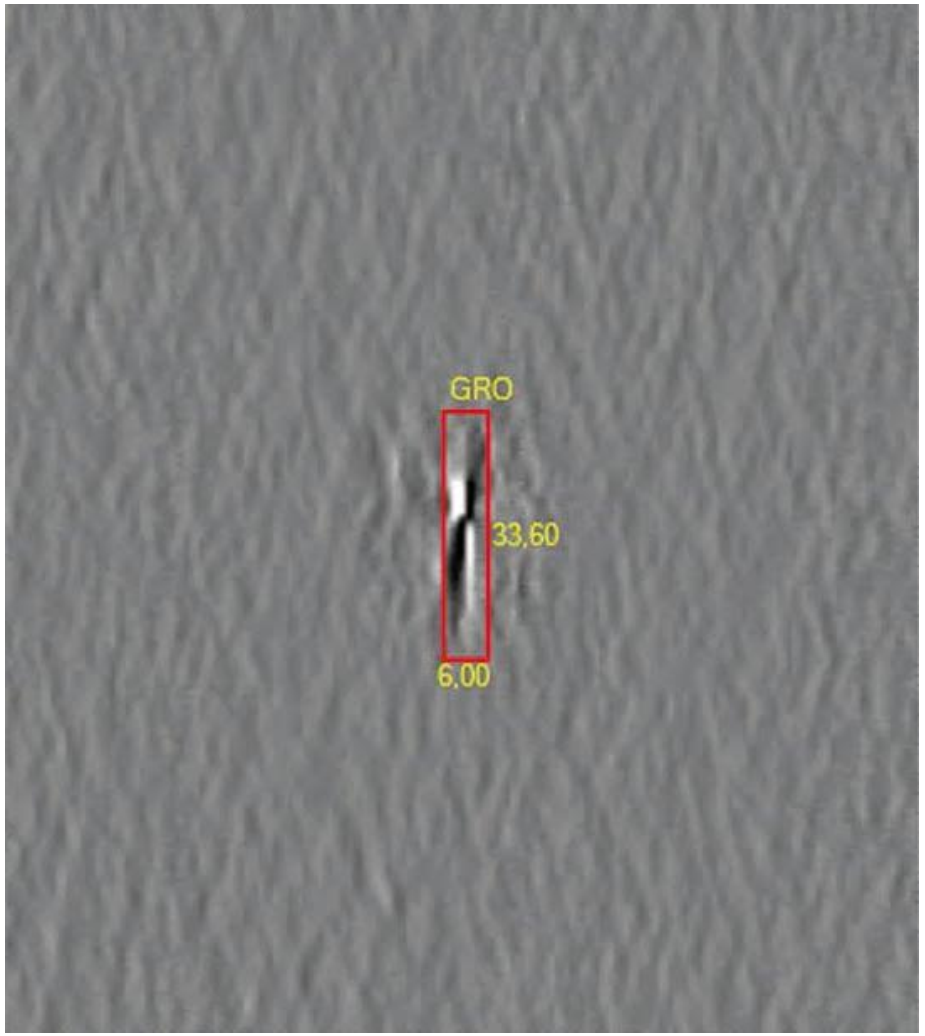
IDS – Inclusion Detection System

MFL – Line Scan Camera

- Sensor output is recorded along the length of the strip
- Result can be interpreted as line scan image

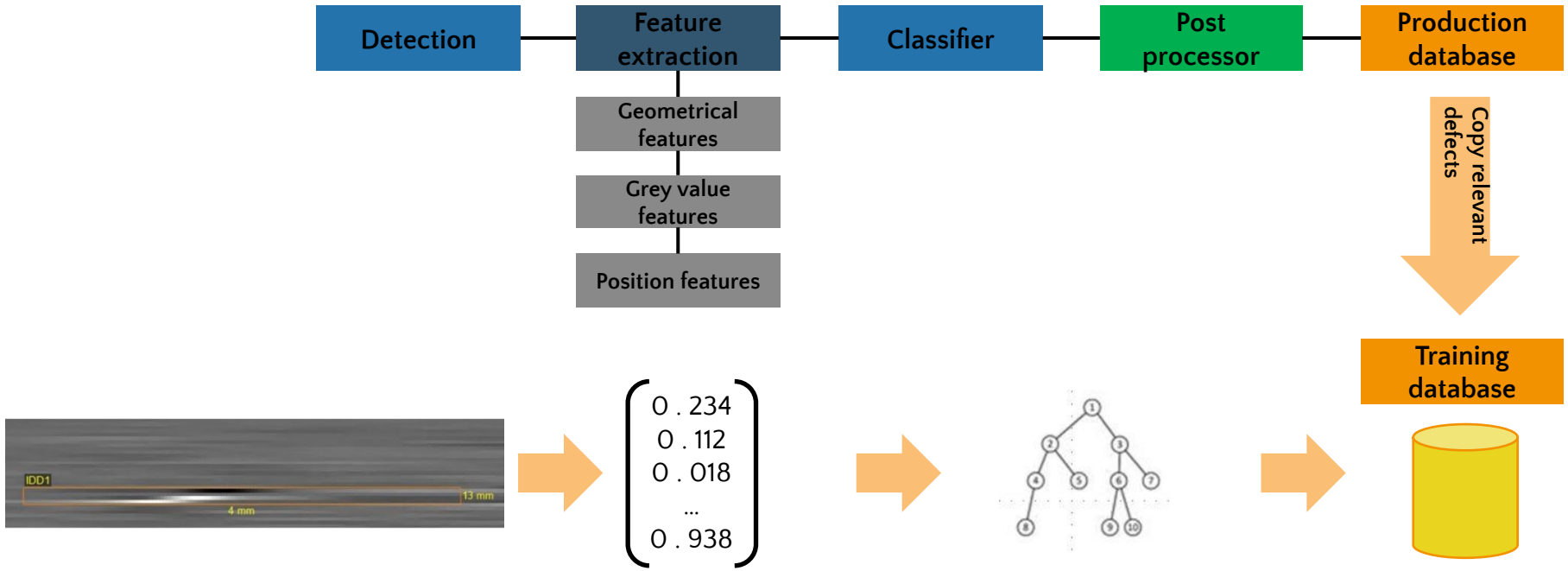
- Exemplary image of a detected defect



Combining Experience: IDS + IMS Inspection Technology

MFL – Line Scan Camera

- Images are evaluated by the IMS surface inspection software
- IDS uses all the features of IMS inspection technology – developed for surface inspection systems



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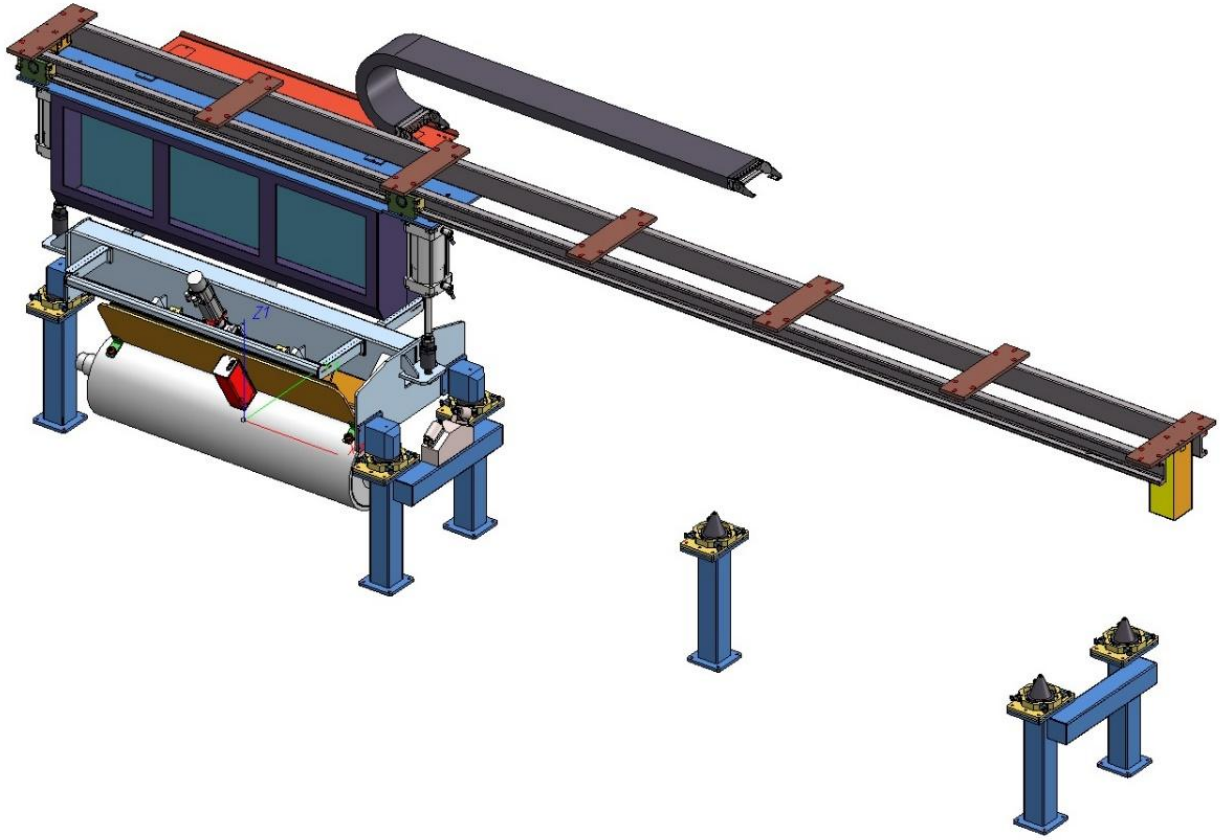
IDS – Inclusion Detection System

Easy Maintenance

- System can be completely driven out of line for maintenance
- Features automatic cleaning
- In park position, all sensors are automatically equalized
- Easy module mounting and dismounting

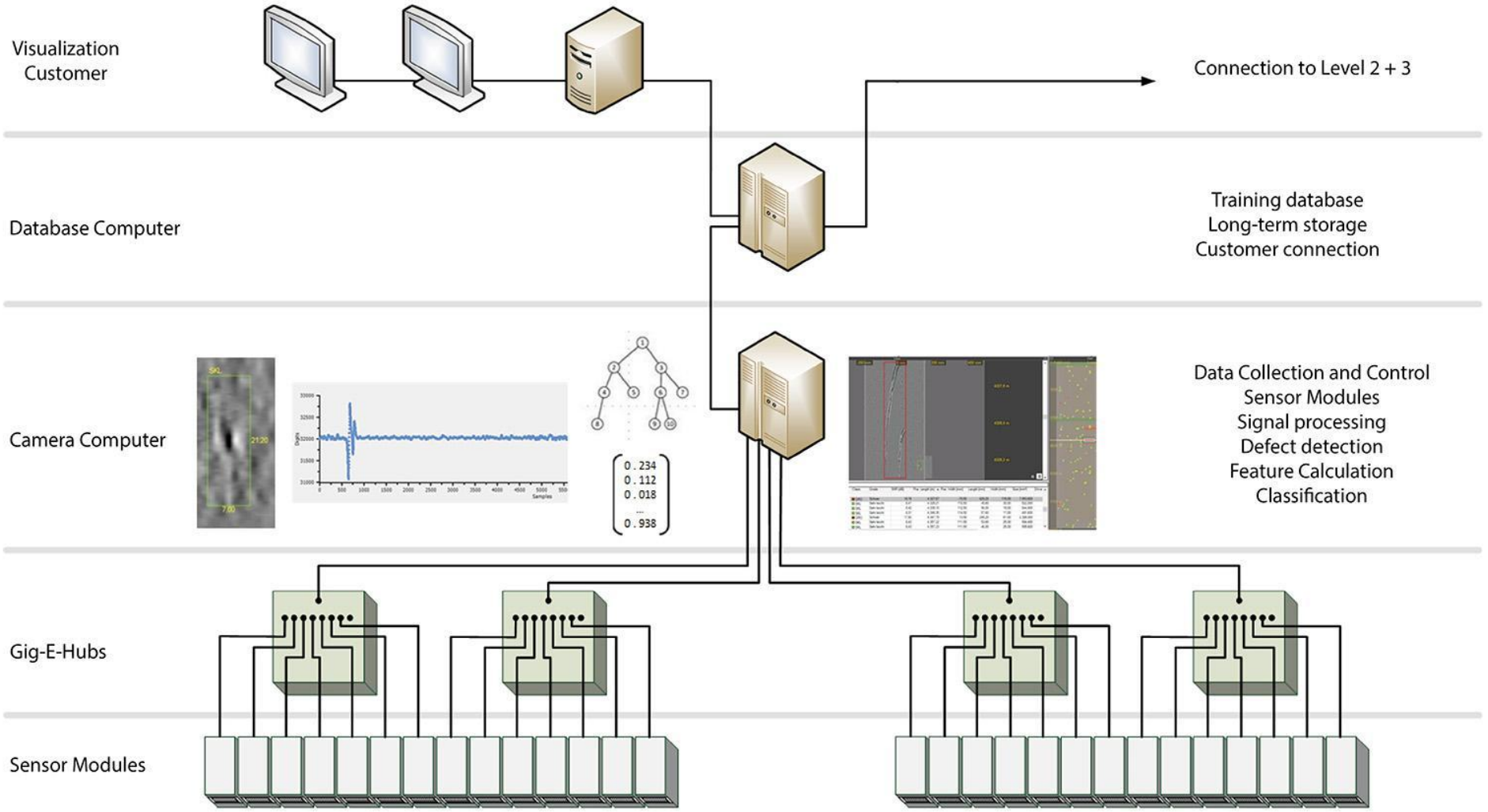


Measuring System

Requirements

Material	Cold Rolled Ferromagnetic Steel
Thickness	0,12 – 0,35 mm (Tin Plate)
	0,3 – 1 mm (Colled Rolled Steel)
Speed	10 m/s
Defect Size (LxWxH)	1 mm x 100 µm x 10 µm
Liftoff	app. 0,5 mm
NIMI Material	Air
	SiO2
	AL2O3
	AL2O3 CaO
Roughness	Ra < 1,5 µm

Fully Integrated Online System



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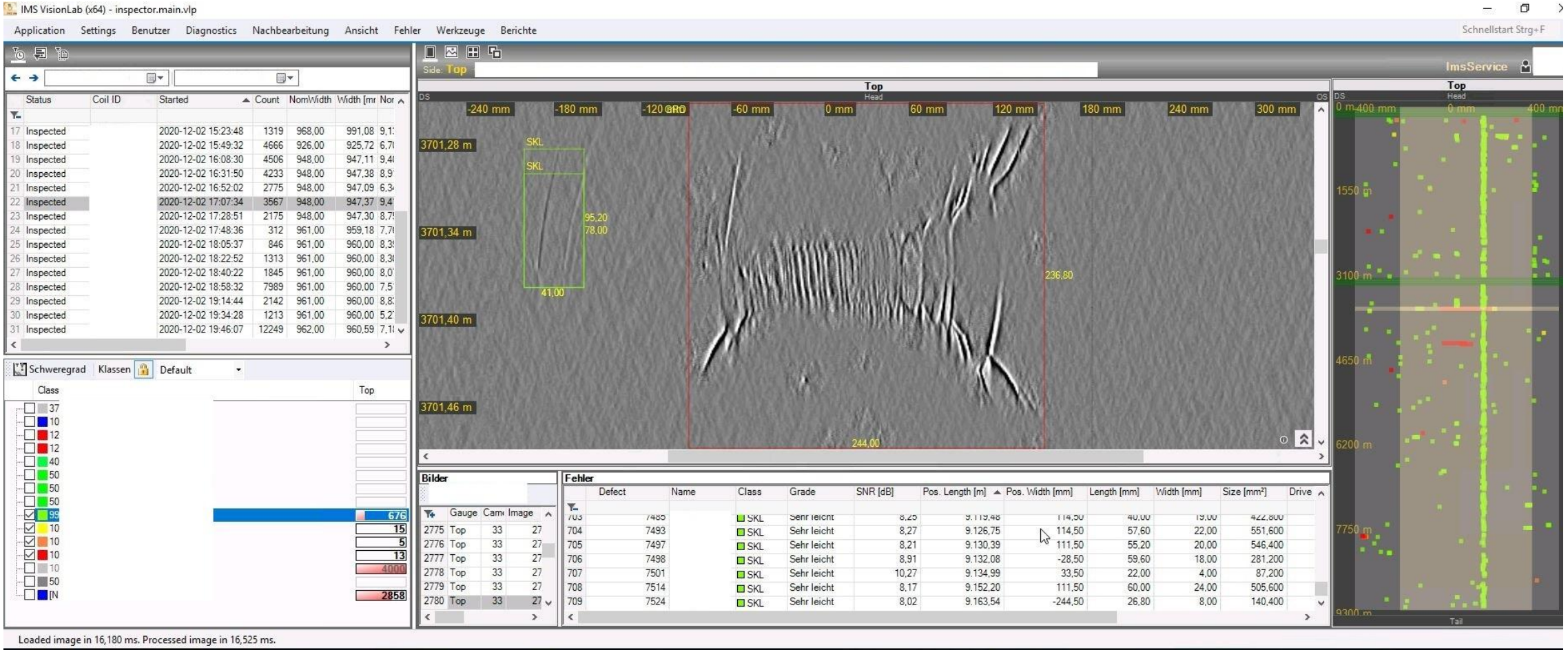
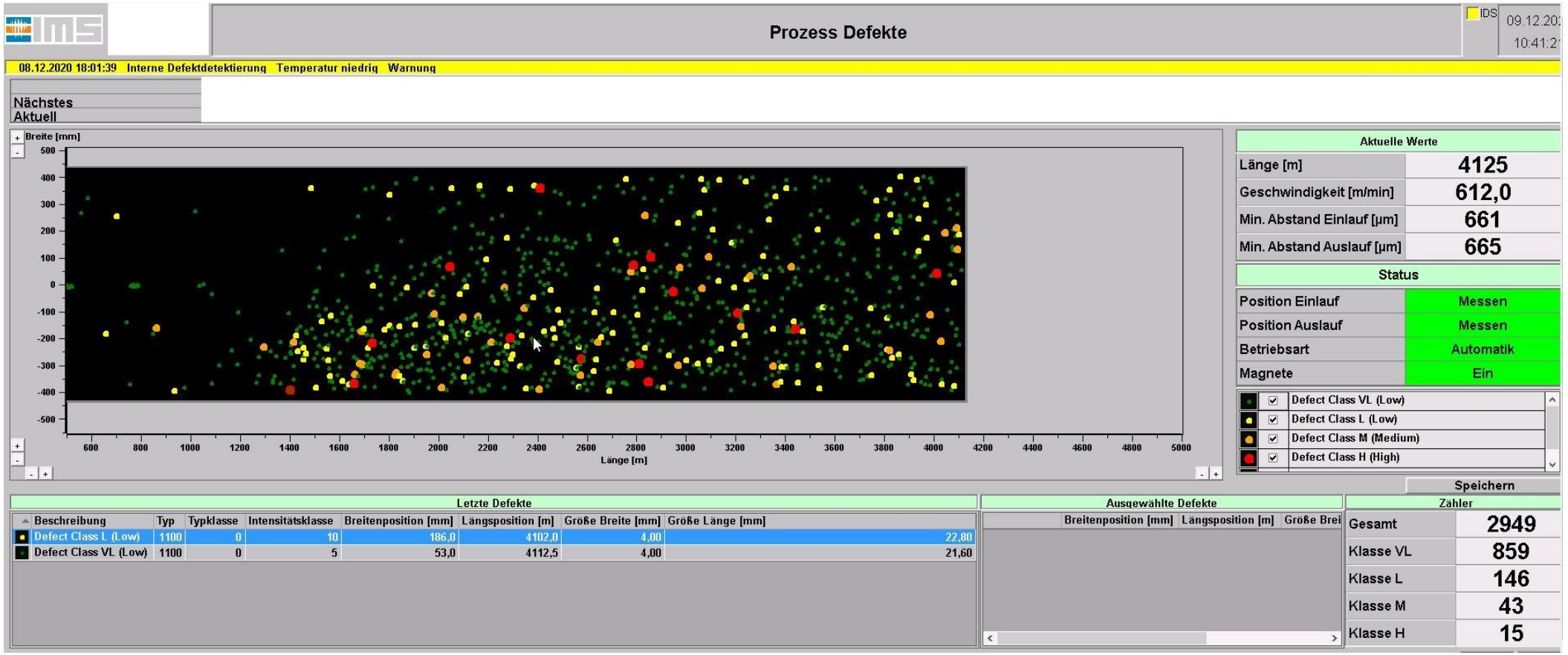
Sample: Large Scale Defect



Sample: Small defect, increasing defect density

Online Result



Agenda

IDS Installations

- First system was be installed in 2019
- Contains 28 sensor modules

- Follow up system with 34 sensor modules was installed in 2021

- Next installation will be test in CGL in 2023

Conclusions

- The new inspection system enables reliable material grading
- Customers can be supplied with tested material of guaranteed purity
- Defects can be tracked back to individual slabs.
- Enables new possibilities for the optimization of the manufacturing process

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