LATEST INNOVATIONS

FOR SURFACE QUALITY CONTROL

Dominik Recker | 19.01.2023

ISRA VISION – AN ATLAS COPCO COMPANY

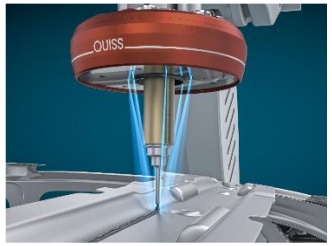
ATLAS COPCO GROUP

Business Area	Division
COMPRESSOR TECHNIQUE	
VACUUM TECHNIQUE	
INDUSTRIAL TECHNIQUE	Motor Vehicle Industry Tools and Assembly Systems General Industry Tools and Assembly Systems Industrial Assembly Solutions **Machine Vision Solutions** Industrial Technique Service Chicago Pneumatic Tools
POWER TECHNIQUE	

€10 Billion Revenue

43.000 Employees

2018 **QUISS** Industrial Vision Solution



2020 **ISRA VISION** Industrial Vision Solution

2020 **PERCEPTRON** Industrial Vision Solution

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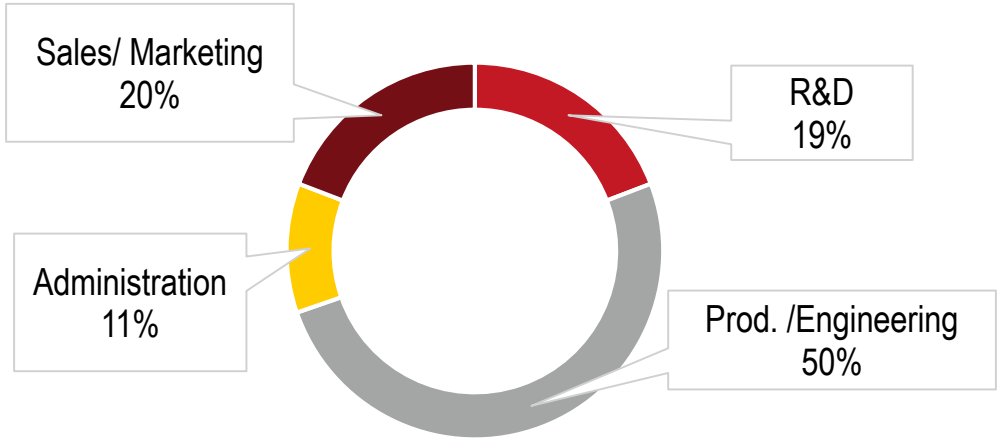
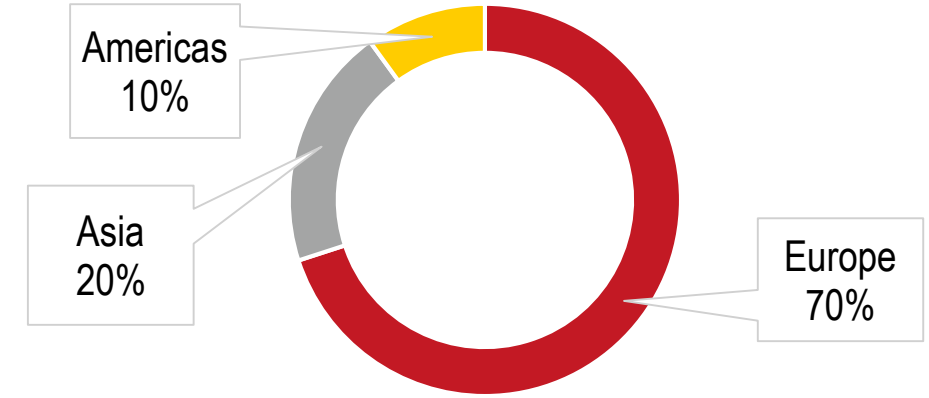
GLOBAL BUSINESS





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ISRA VISION – MORE THAN 30 YEARS EXPERIENCE IN SURFACE INSPECTION AND ROBOT VISION

Application Specific Standard Products

High-end products for complex applications in niche markets

Key Account Management

Leading-edge technology

Global players

Significant market share

In-depth process expertise

Outstanding ROI

Machine Vision

Algorithms & Software

Optics & Illumination

Industry 4.0

ISRA VISION

Production Analytics

Embedded Hardware

Modular Hardware Platform

Service-oriented Software

Leading-edge technology

Focus on 3D Machine Vision

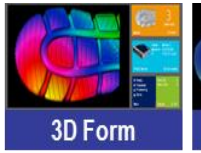
High-volume markets

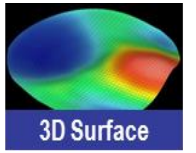
Multi-channel distribution

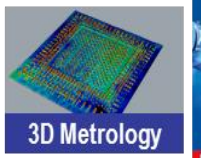
Outstanding ROI

Generic Standard Products

Standardized products for all markets







Distributors, Integrators, OEM

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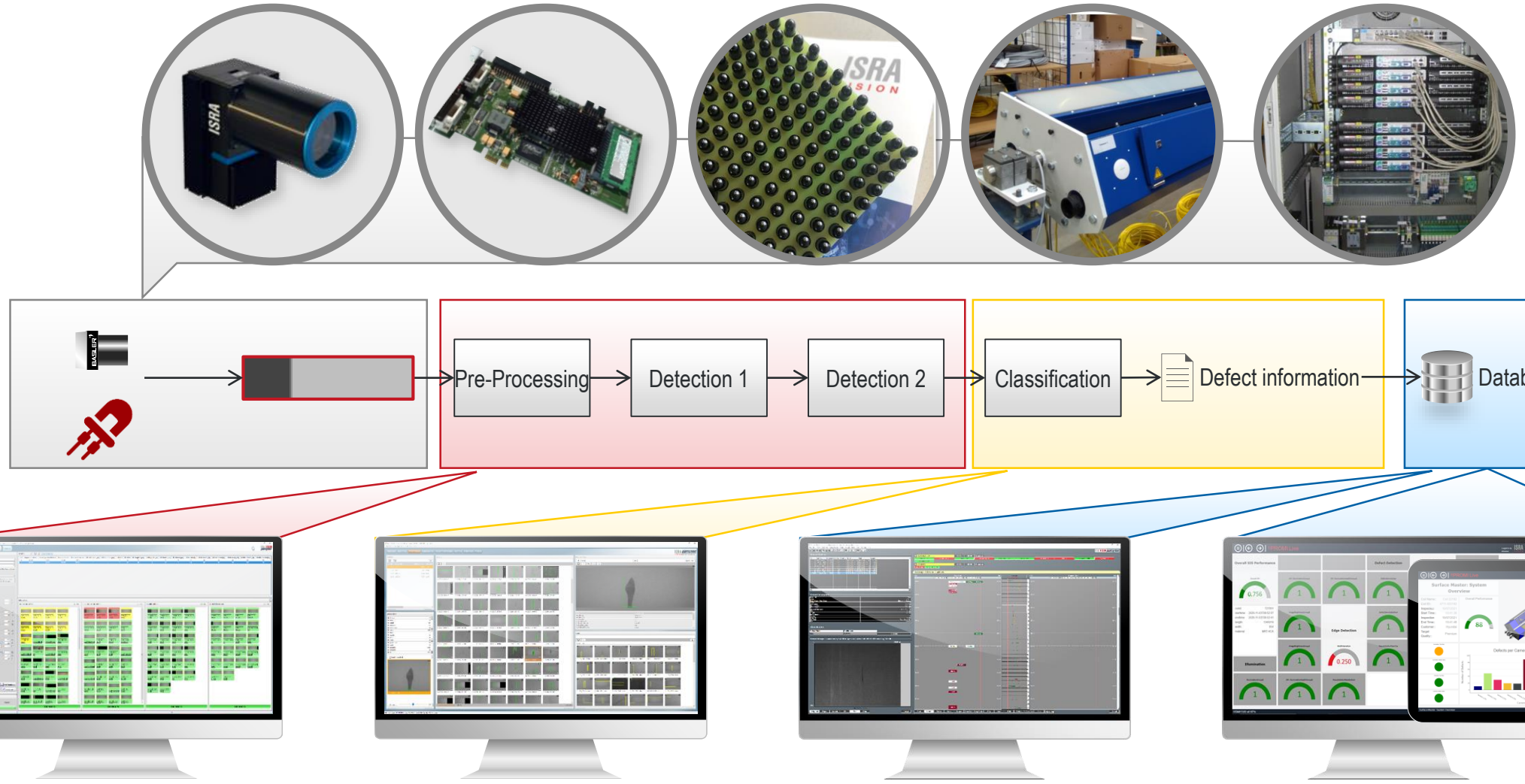
ISRA DELIVERS…

Dedicated SOFTWARE & HARDWARE



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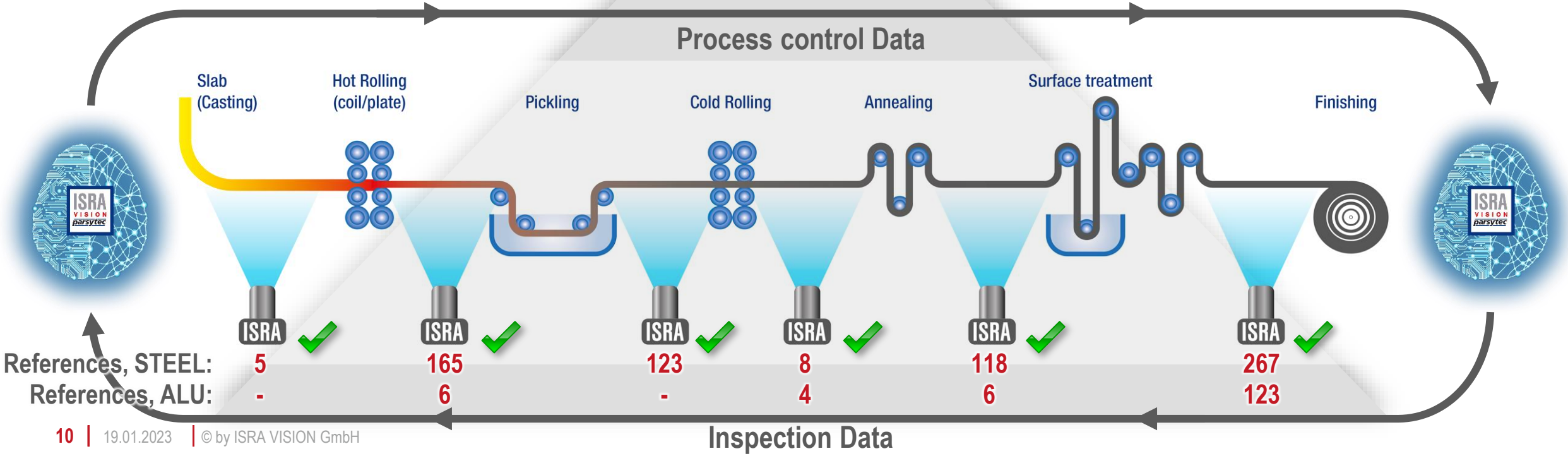
COVERING AND CONNECTING THE ENTIRE PROCESS CHAIN

GUI

PERFORMANCE/CONDITION MONITORING

QUALITY MANAGEMENT SOLUTIONS



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CHALLENGES & INNOVATIONS

1. Pixelsynchronized, multi-channel image recording
2. Waviness detection
3. Profile (Extrusion) inspection
4. Neuronal Network Classification
5. Condition Monitoring
6. Quality Management

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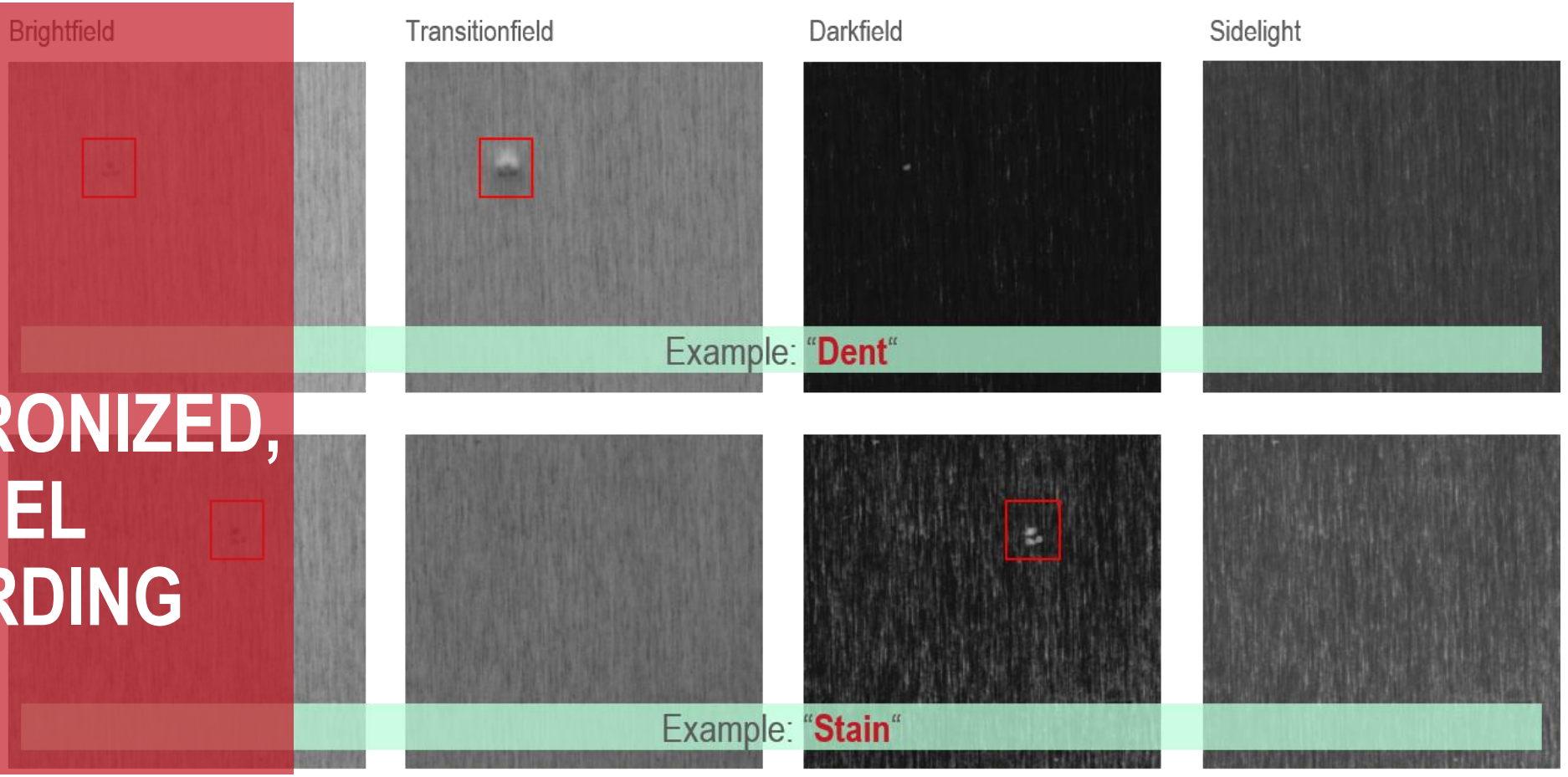
1

PIXELSYNCHRONIZED, MULTI-CHANNEL IMAGE RECORDING



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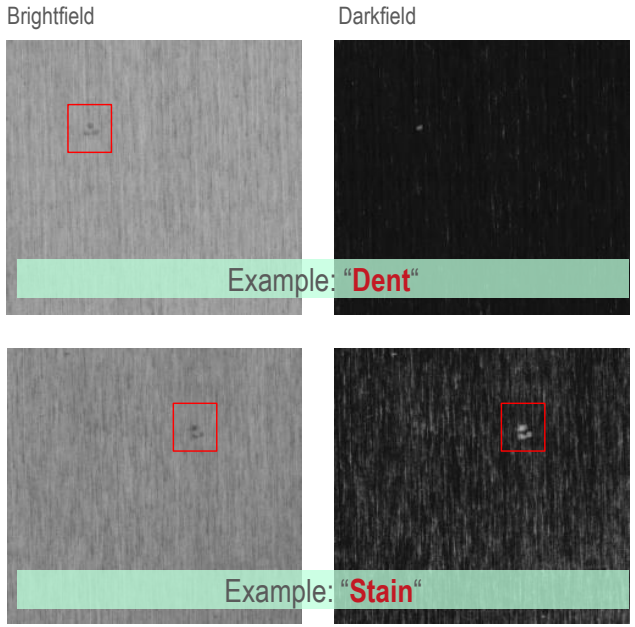
PIXELSYNCHRONIZED, MULTI-CHANNEL IMAGE RECORDING

CHALLENGE

- Multiple views required for better classification
- Multiple views require larger sensors
- Image recording split in regards to
  - Time
  - (Location)

SOLUTION

- Combined sensor
- Pixel-synchronized image recording



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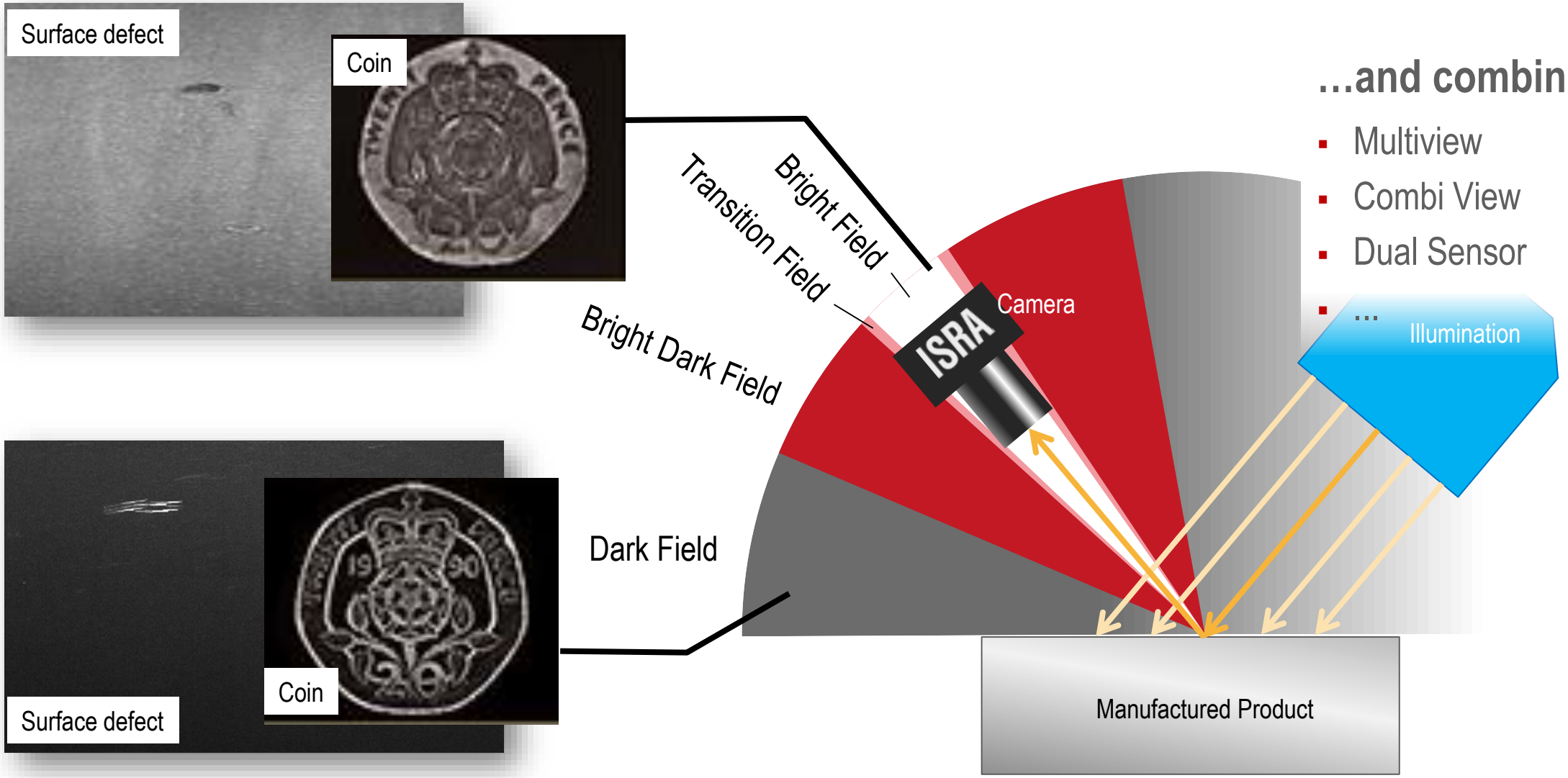
OPTICAL SETUP TECHNOLOGY



...and combinations

- Multiview
- Combi View
- Dual Sensor
- ...

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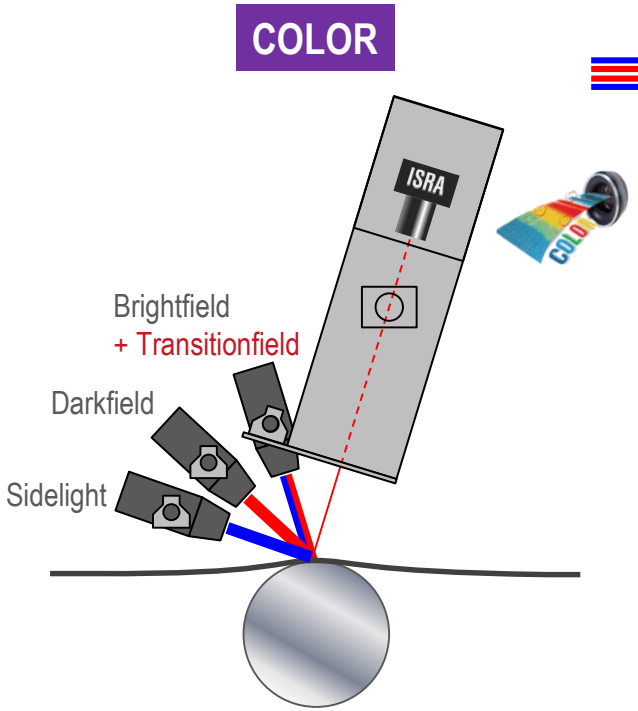
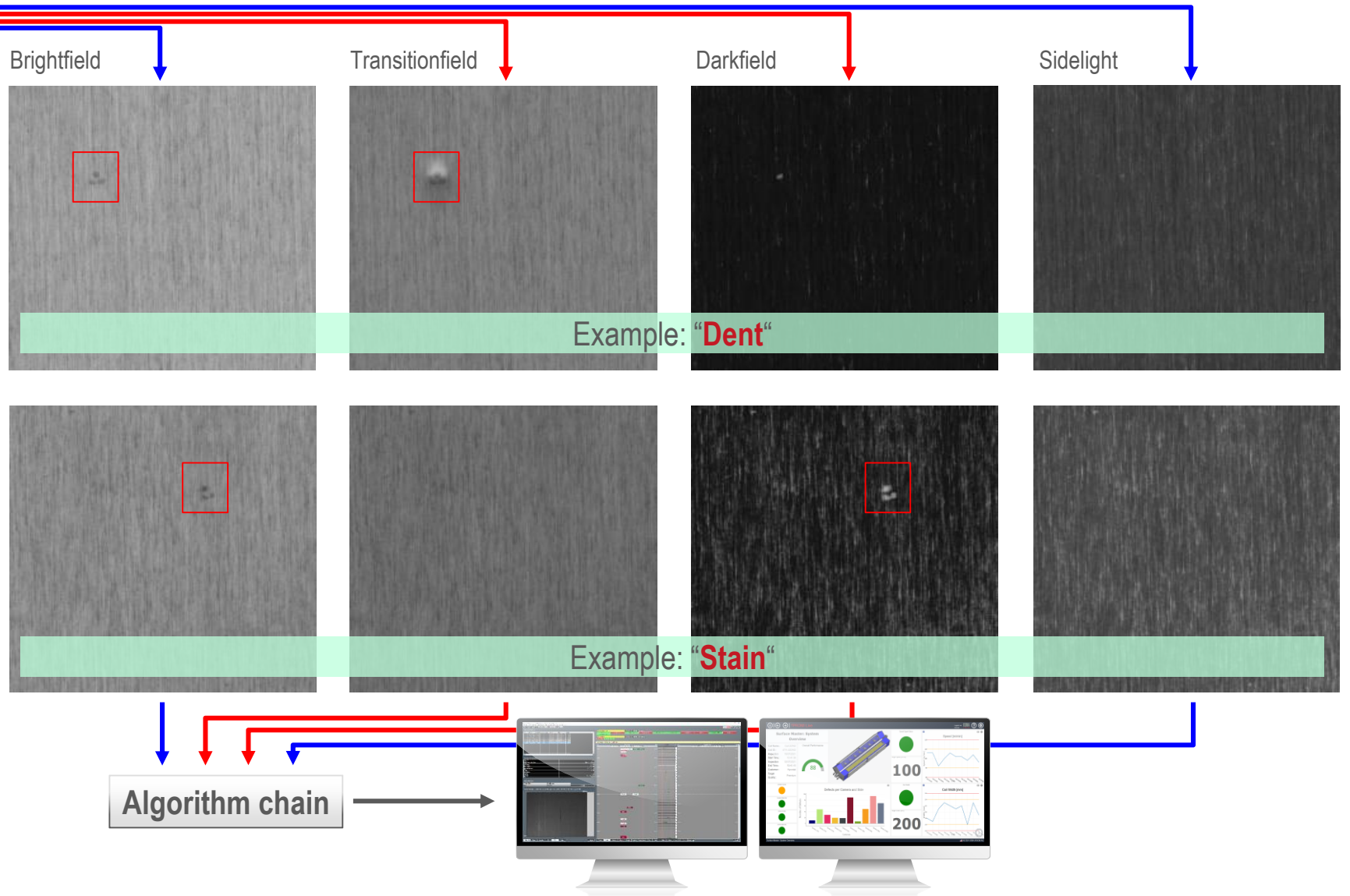
4 VIEWS IN 2 SHOTS – EXAMPLE 1





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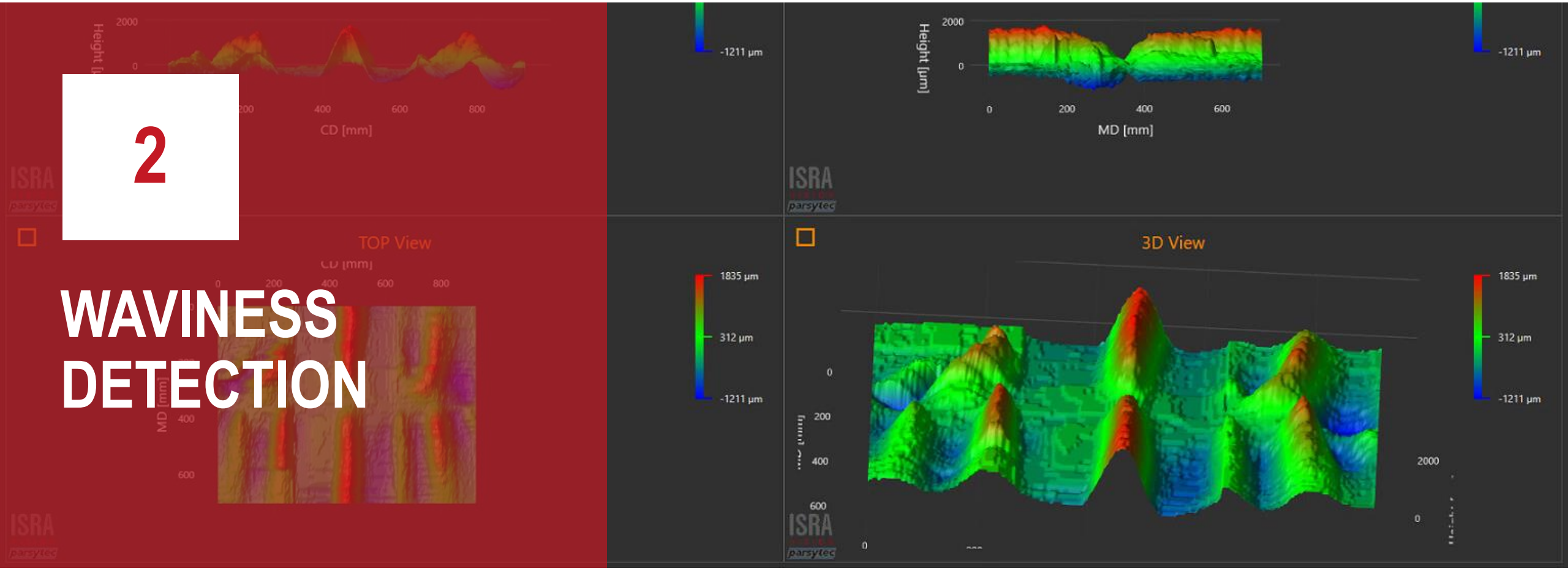
2

WAVINESS DETECTION



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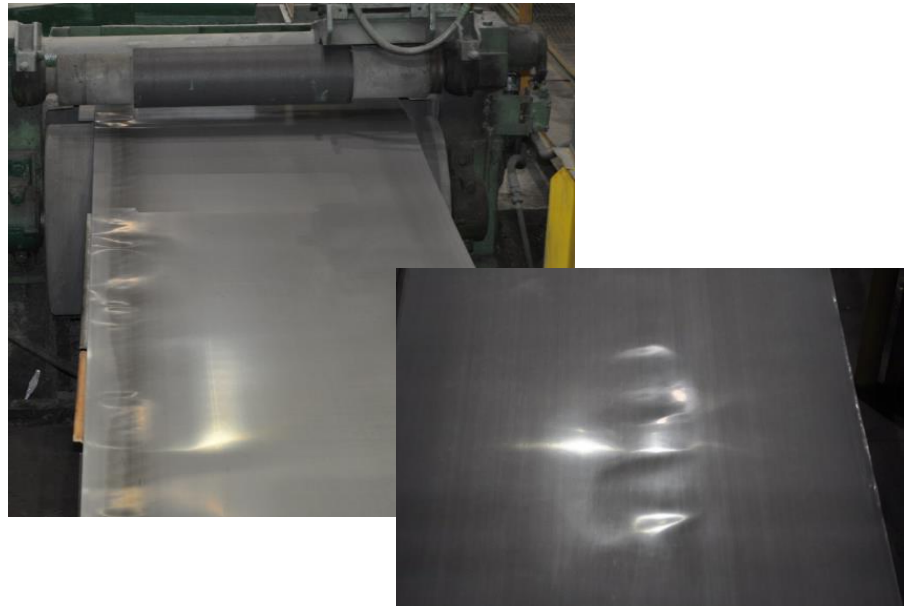
WAVINESS DETECTION

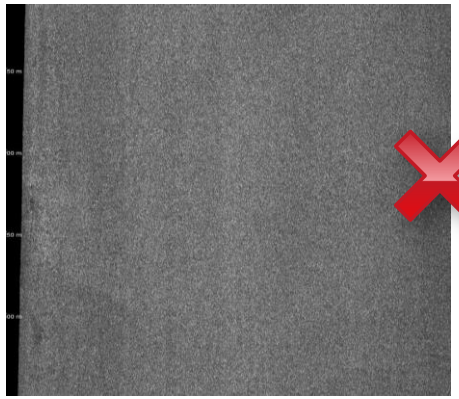
CHALLENGE

- Topography of metal strip (waves, buckles etc.) not always detectable with conventional technology

SOLUTION

- Laser triangulation to generate topographic (3D) surface scan of strip





Nothing visible in conventional image

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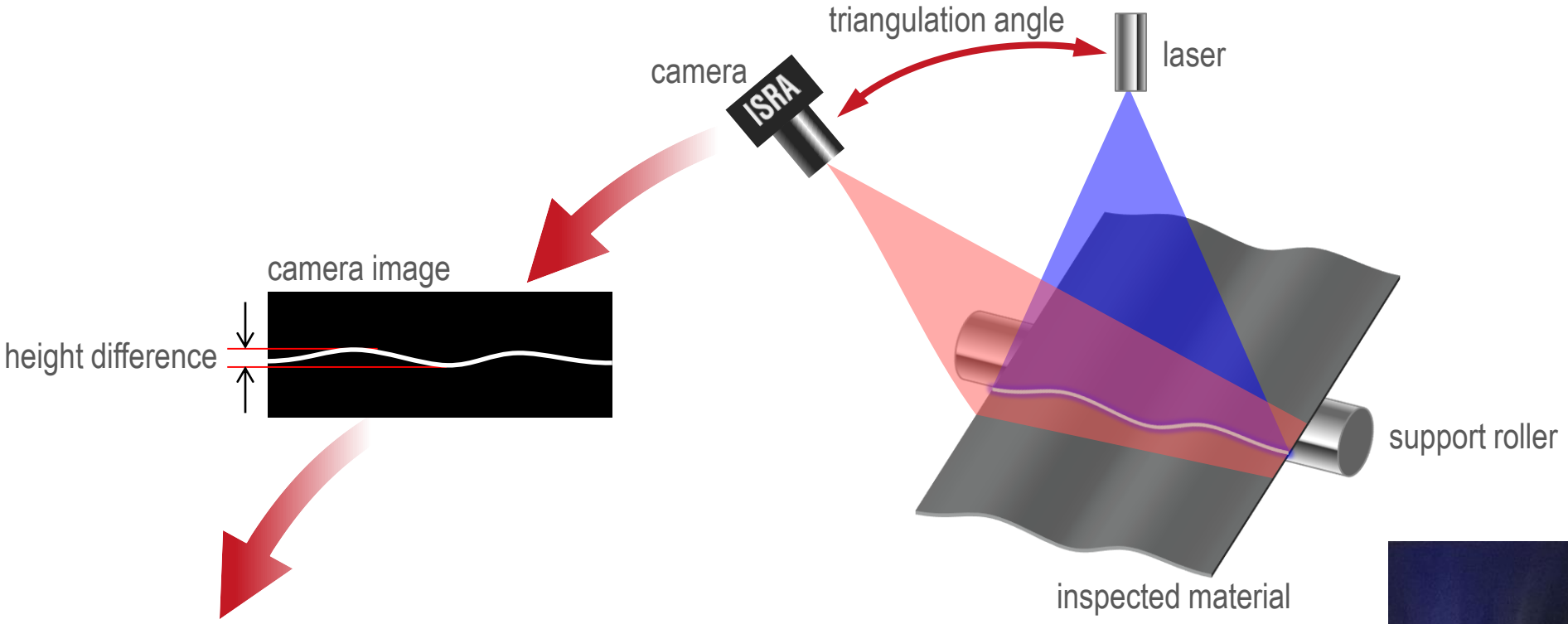
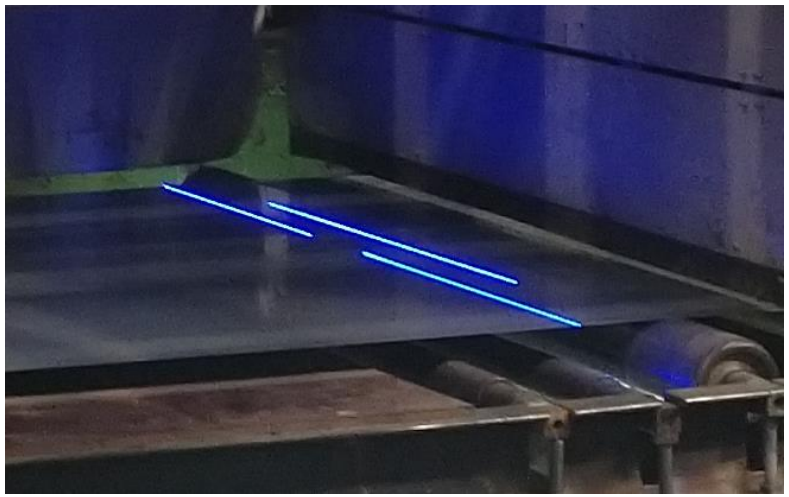
LASER TRIANGULATION



CALCULATION OF SURFACE TOPOLOGY/PROFILE USING

- image/camera resolution
- triangulation angle
- height difference in image pixels



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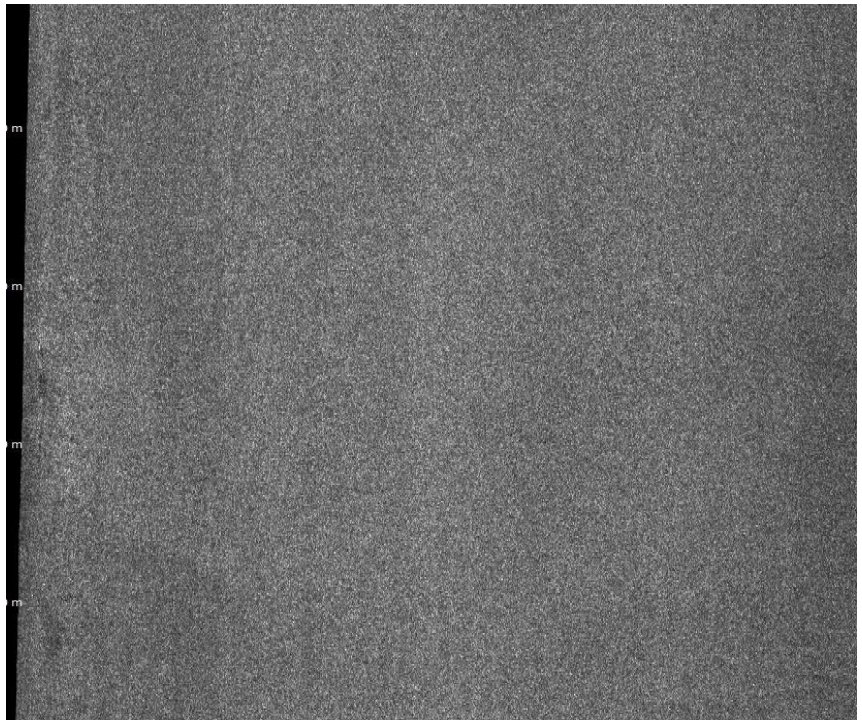
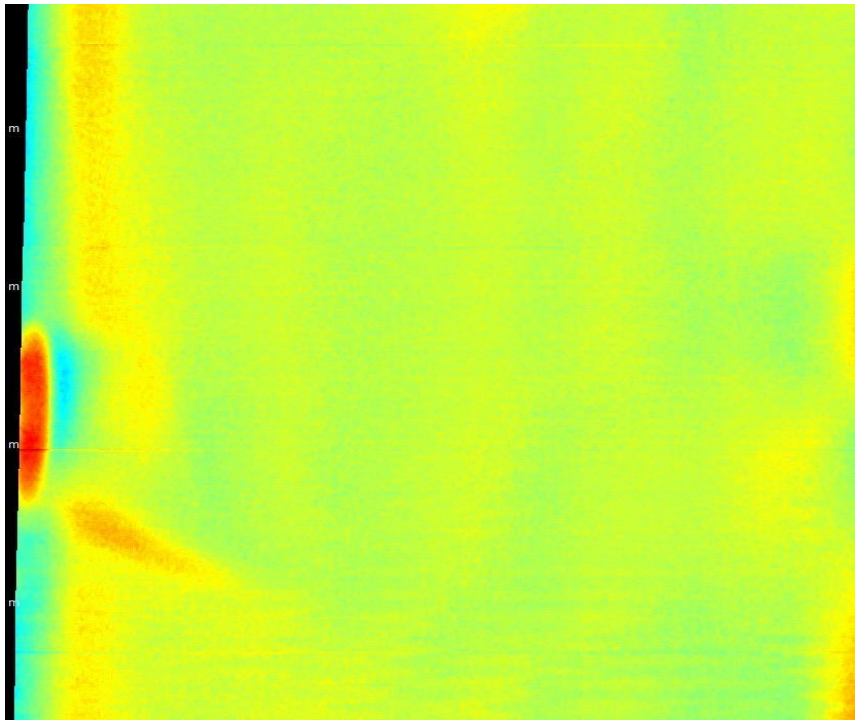
2D + 3D INSPECTION OF WAVES

2D Channel



Nothing visible in conventional image

3D Channel



Detectable

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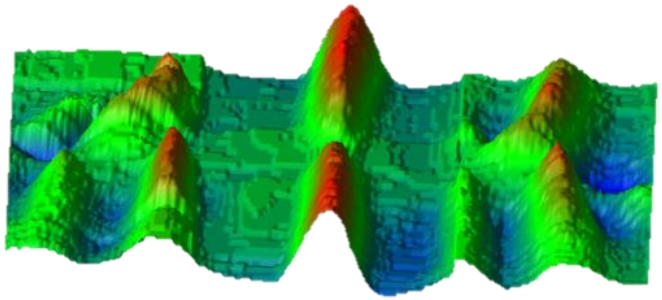
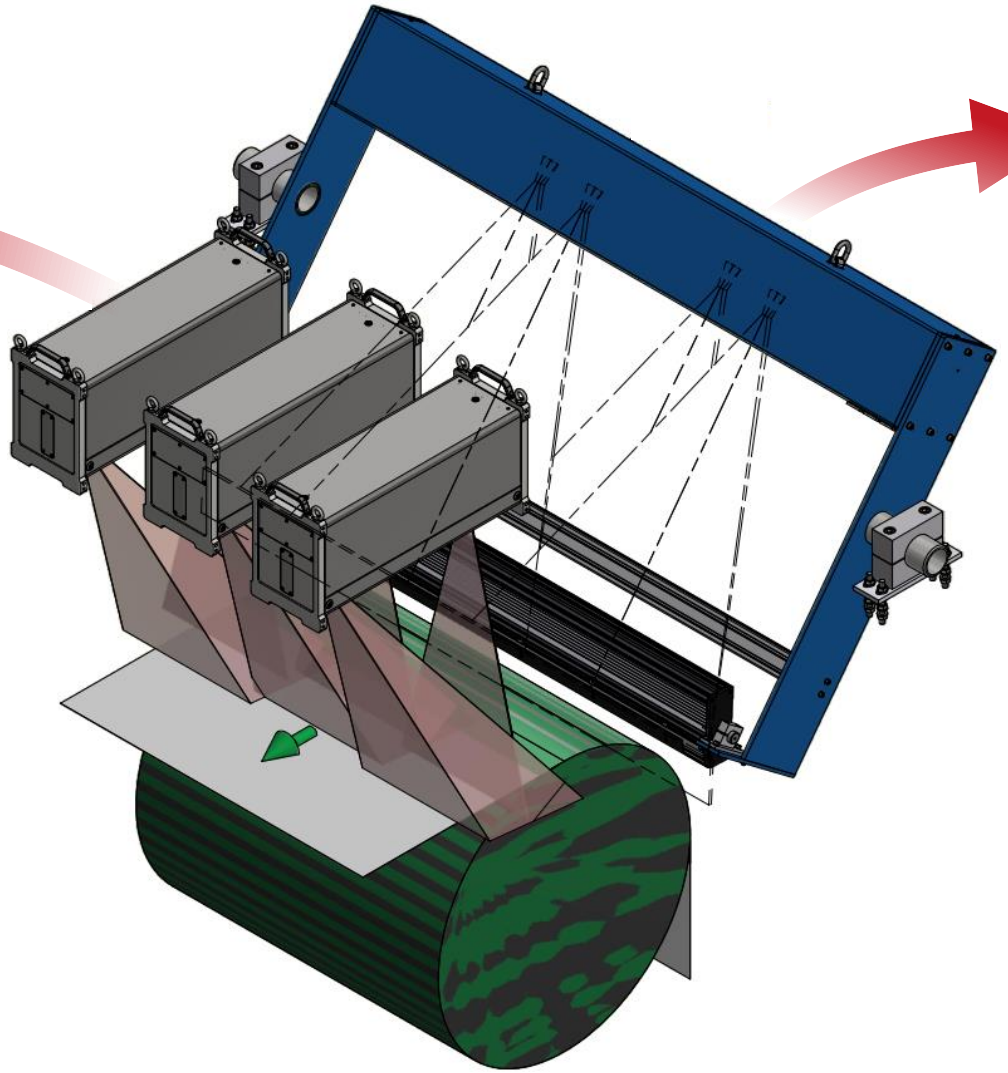
STRIP INSPECTION: 3D + CONVENTIONAL INSPECTION

3D inspection

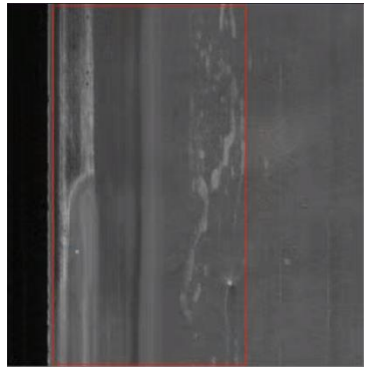
- waviness measurement
  - down-web direction
  - cross-web direction
- detection & classification of (large) topographical defects





2D inspection

- detection & classification of 2D defects & (small) topographical defects



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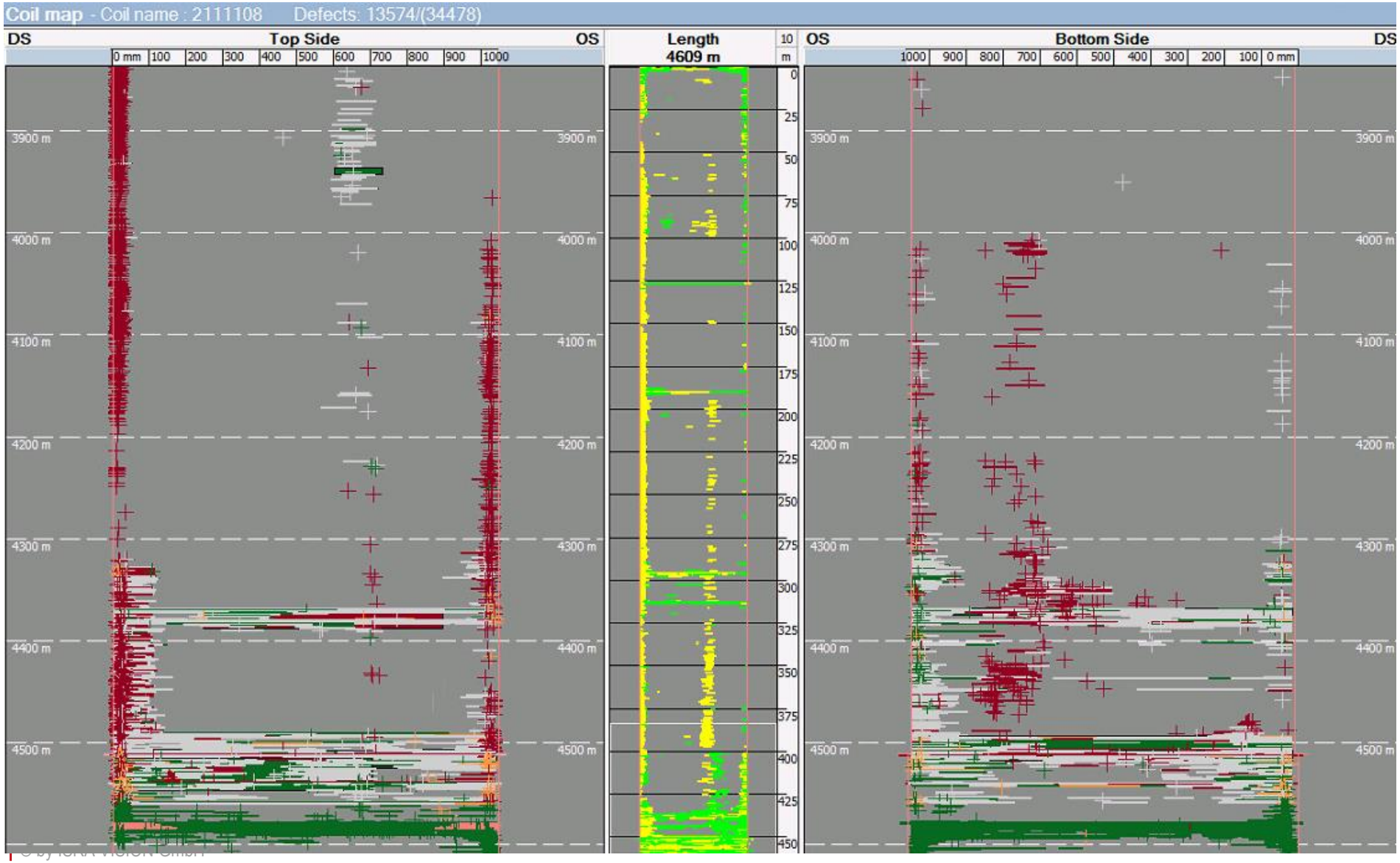
3D + CONVENTIONAL INSPECTION: DEFECT MAP



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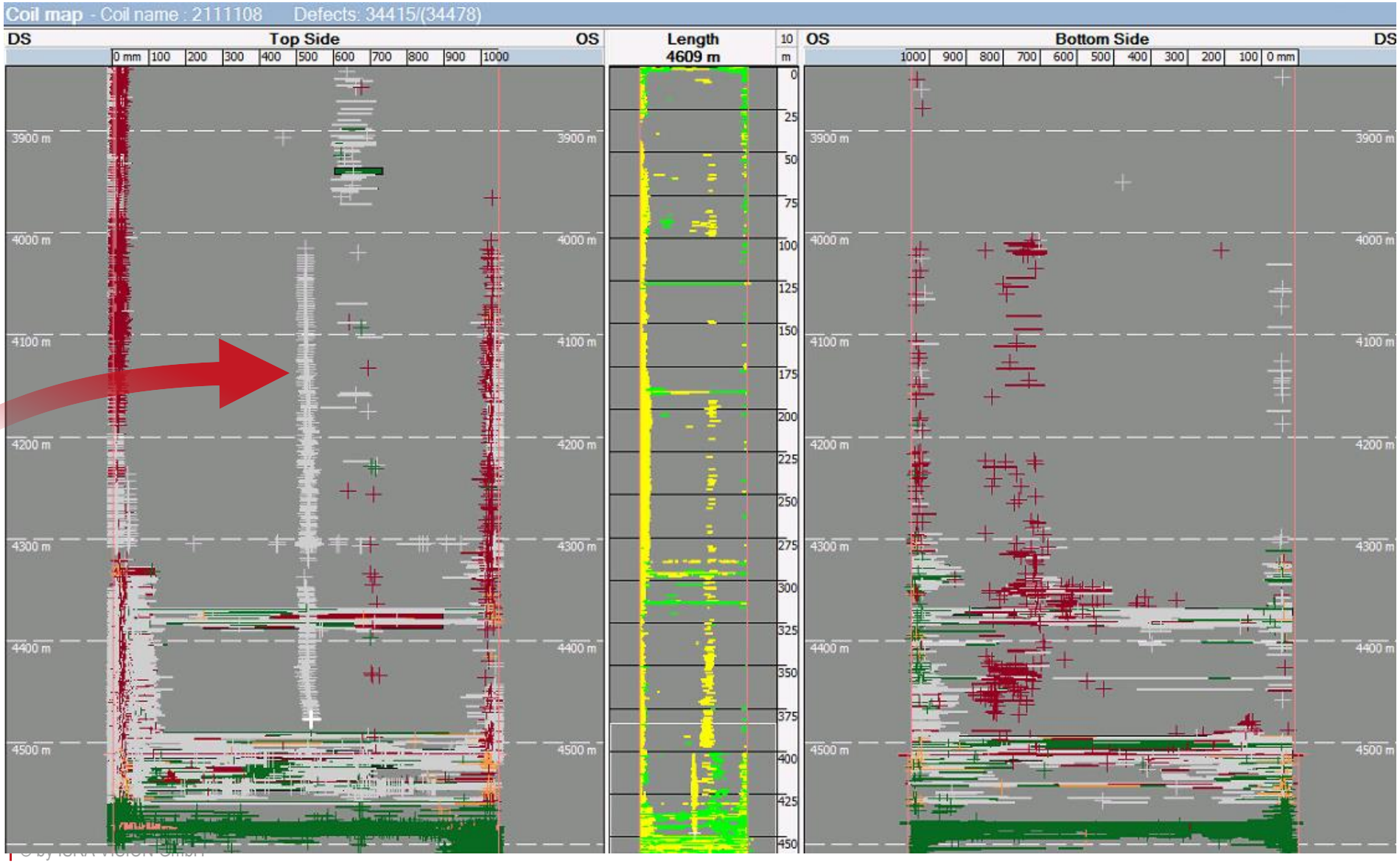
3D + CONVENTIONAL INSPECTION: DEFECT MAP

only detected in **3D**



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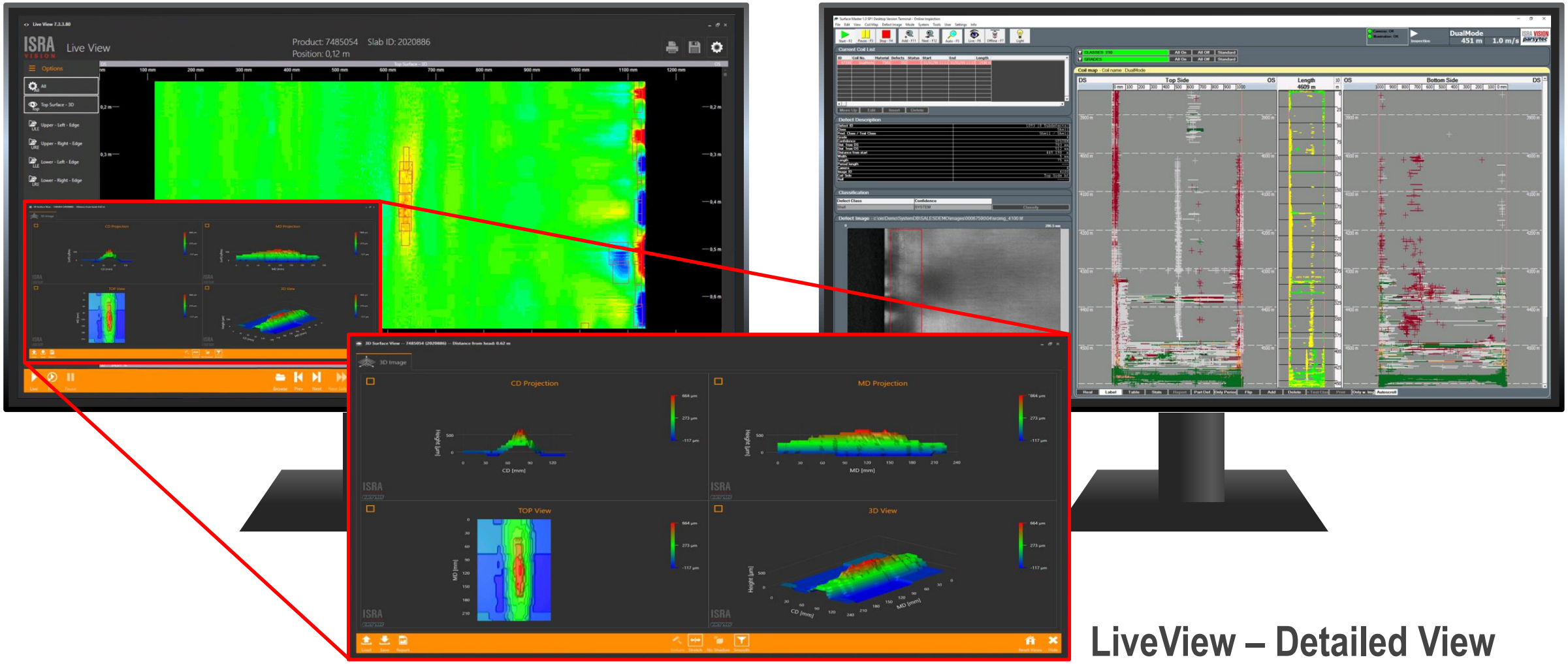
OPERATOR VIEW

LiveView

ODIS (= Operator Display)



LiveView – Detailed View

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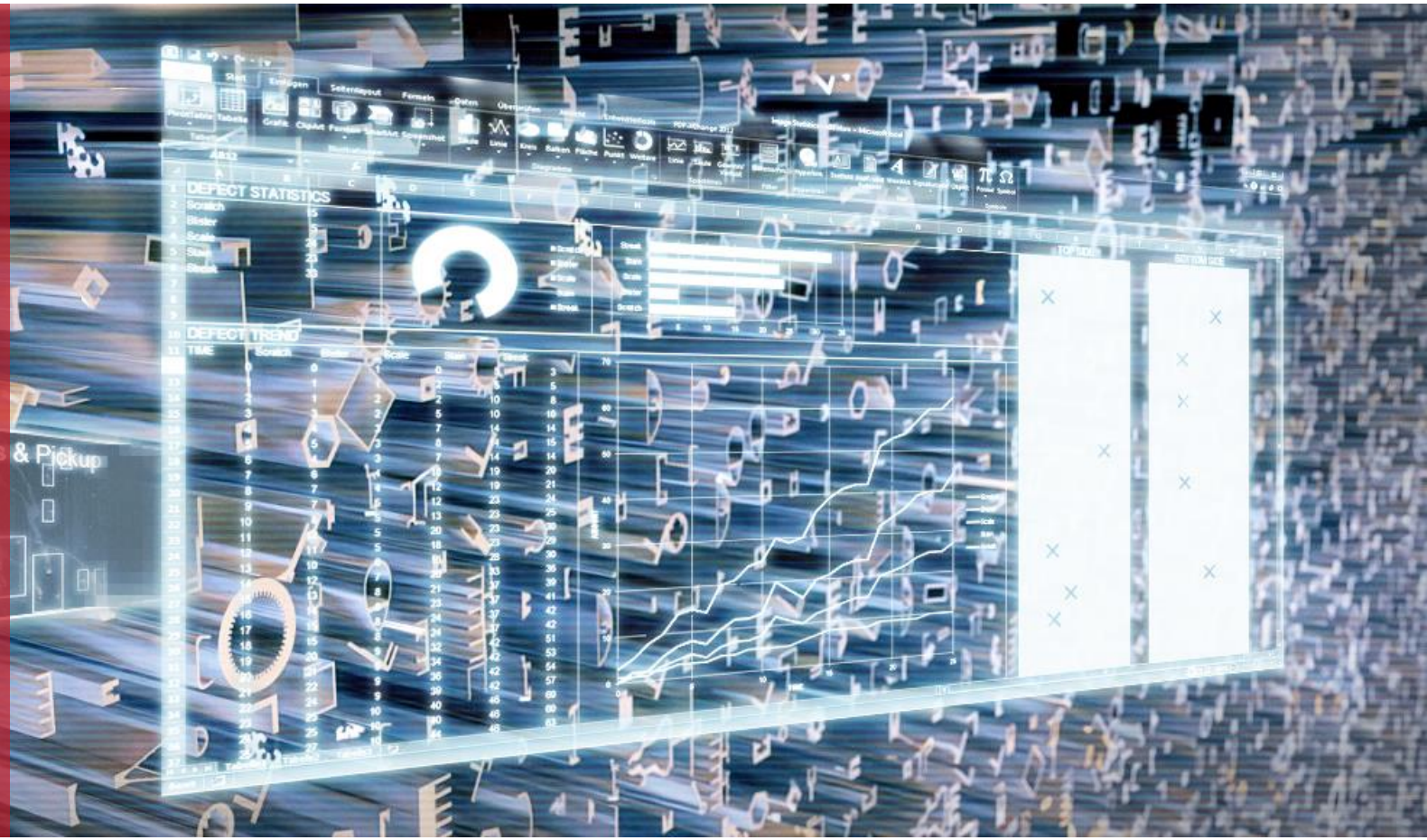
3

PROFILE (EXTRUSION) INSPECTION



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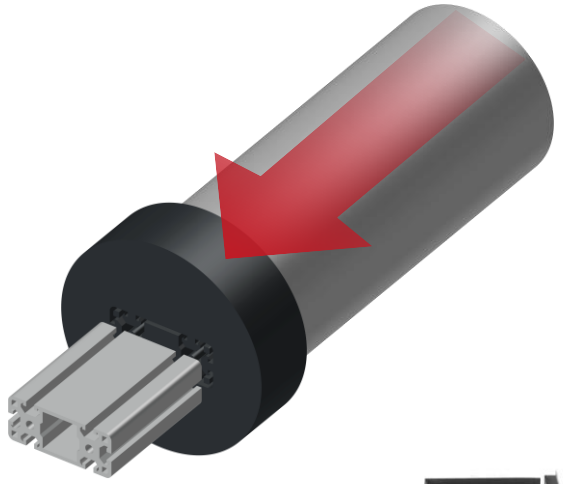
PROFILE (EXTRUSION) INSPECTION

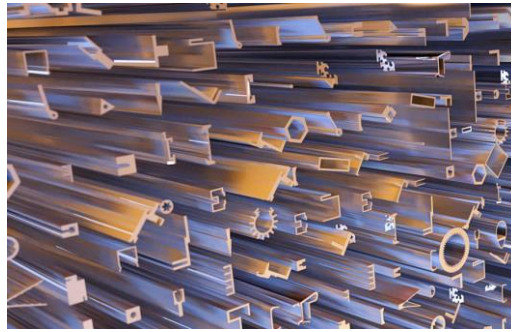
CHALLENGE

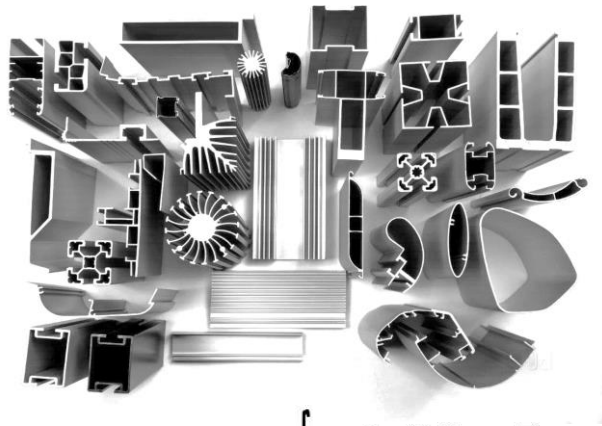
- So far no automatic surface inspection system for the aluminium profile (extrusion) industry

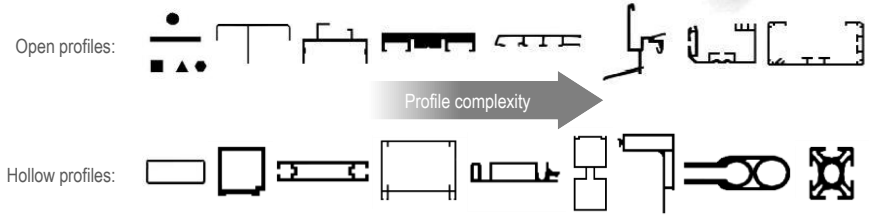
SOLUTION

- Transfer experience of 25 year strip inspection to the extrusion industry









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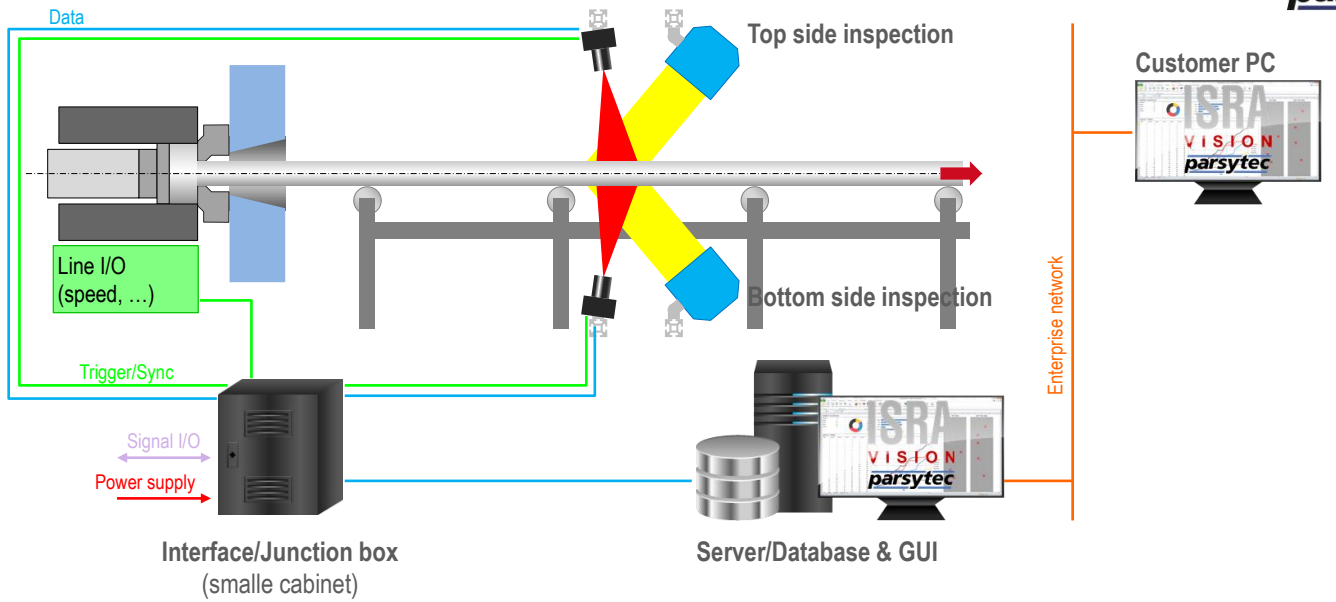
EXTRUSION INSPECTION

- Transferring the experience of 25 years flat surface inspection to
  EXTRUSION



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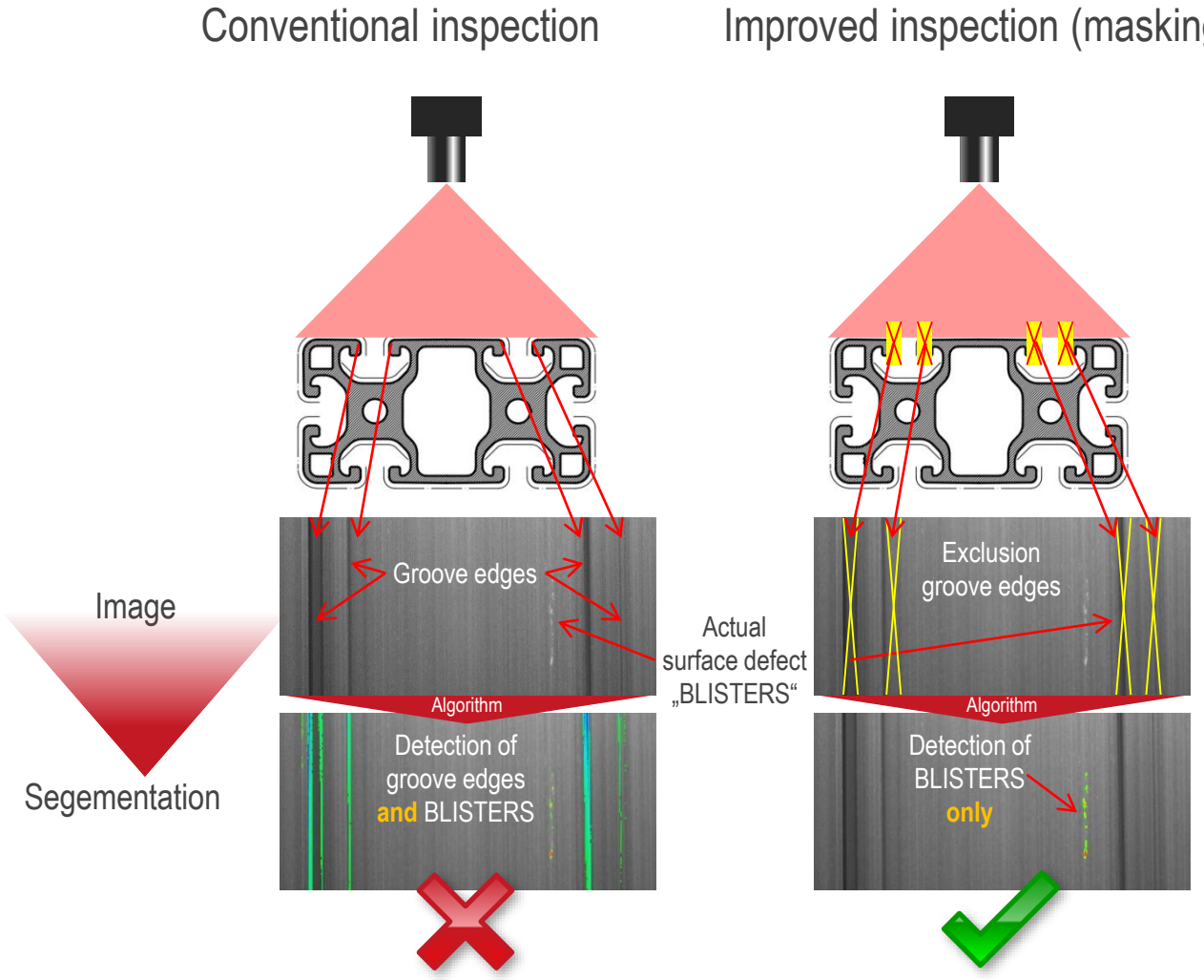
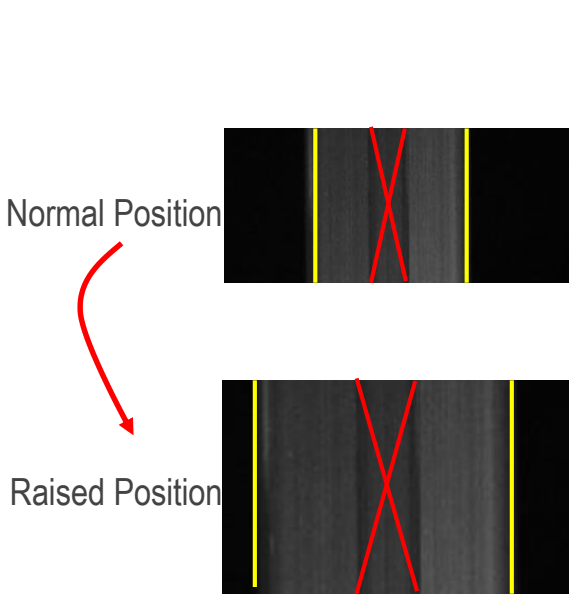
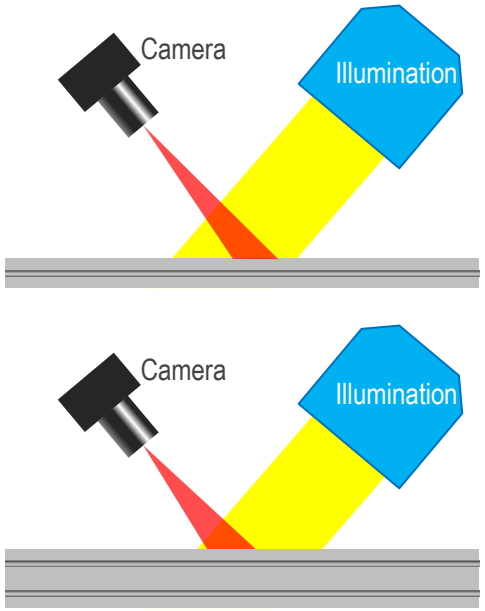
CHALLENGES TO OVERCOME



- Masking relative to detected edges
- No problems with height variations





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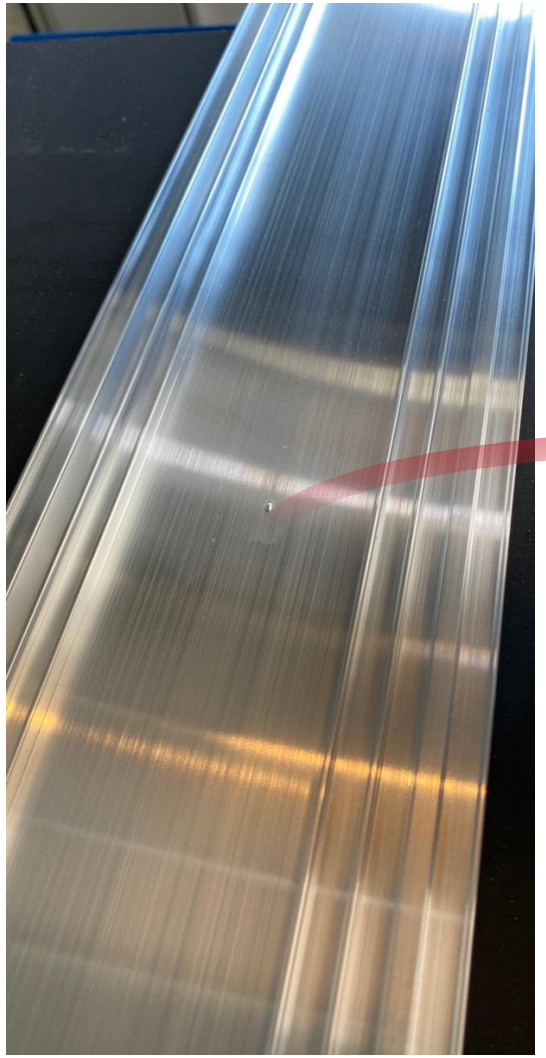
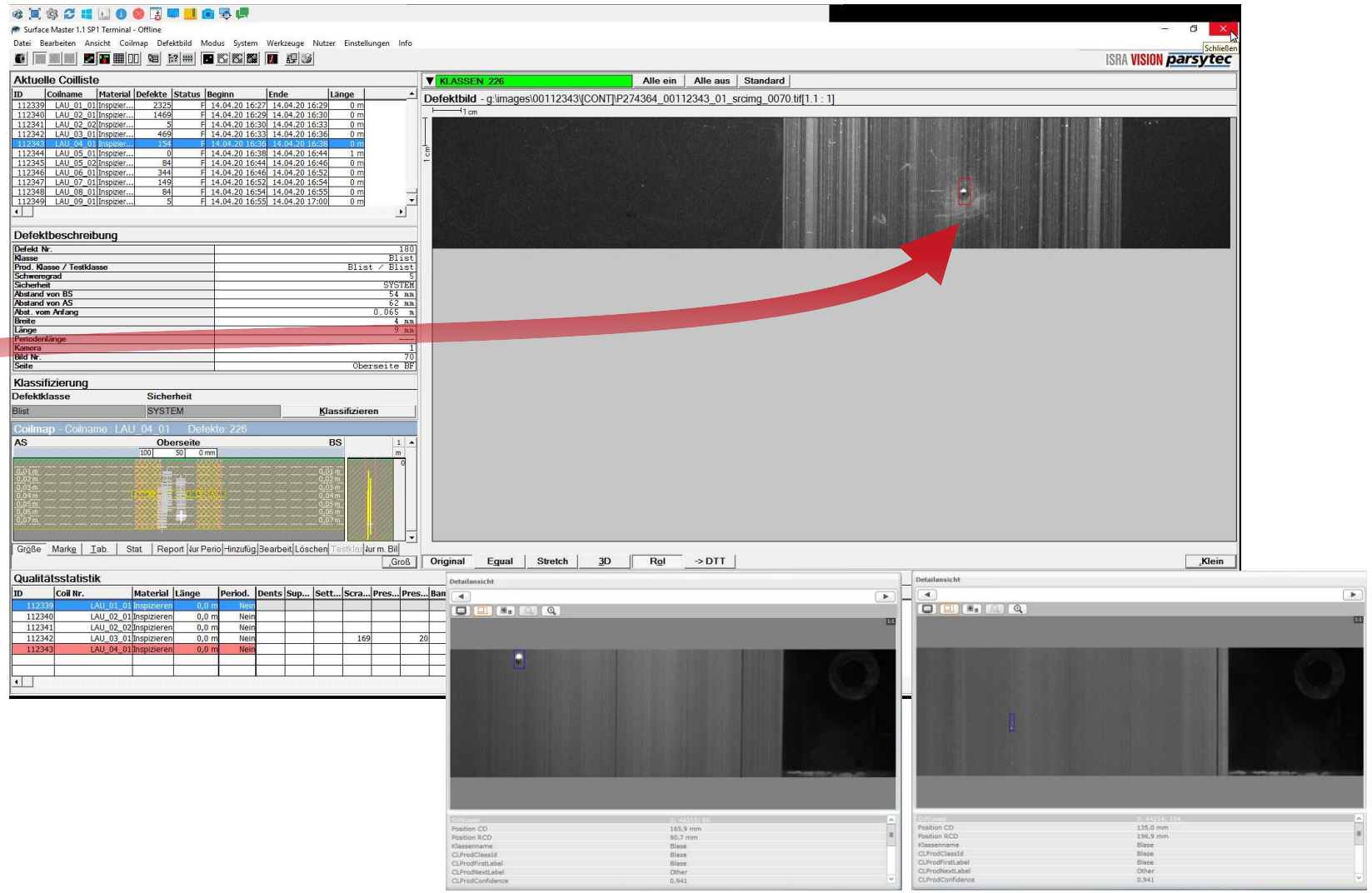
EXTRUSION – DEFECT DETECTION EXAMPLES

Blister





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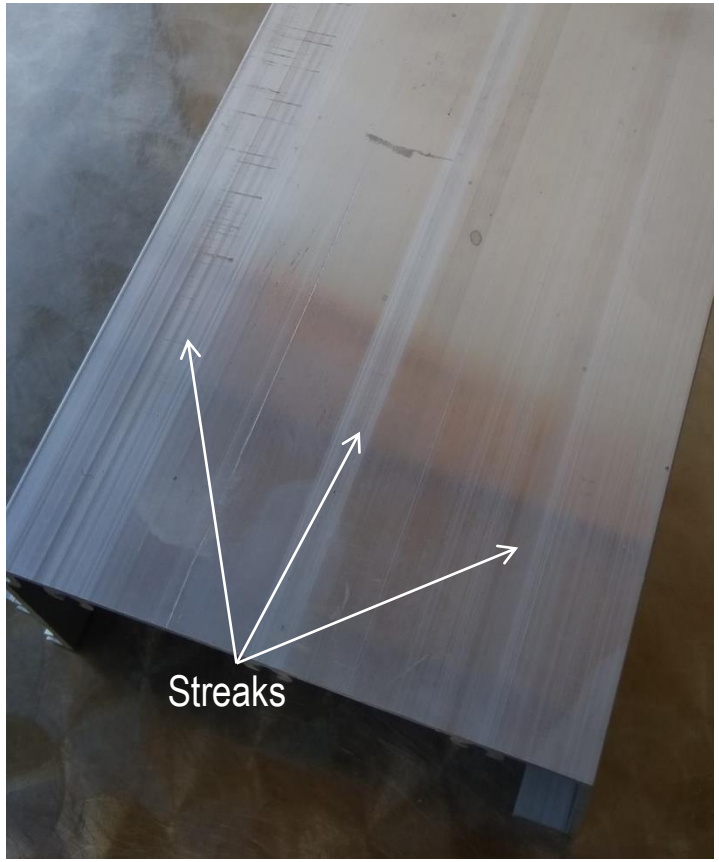
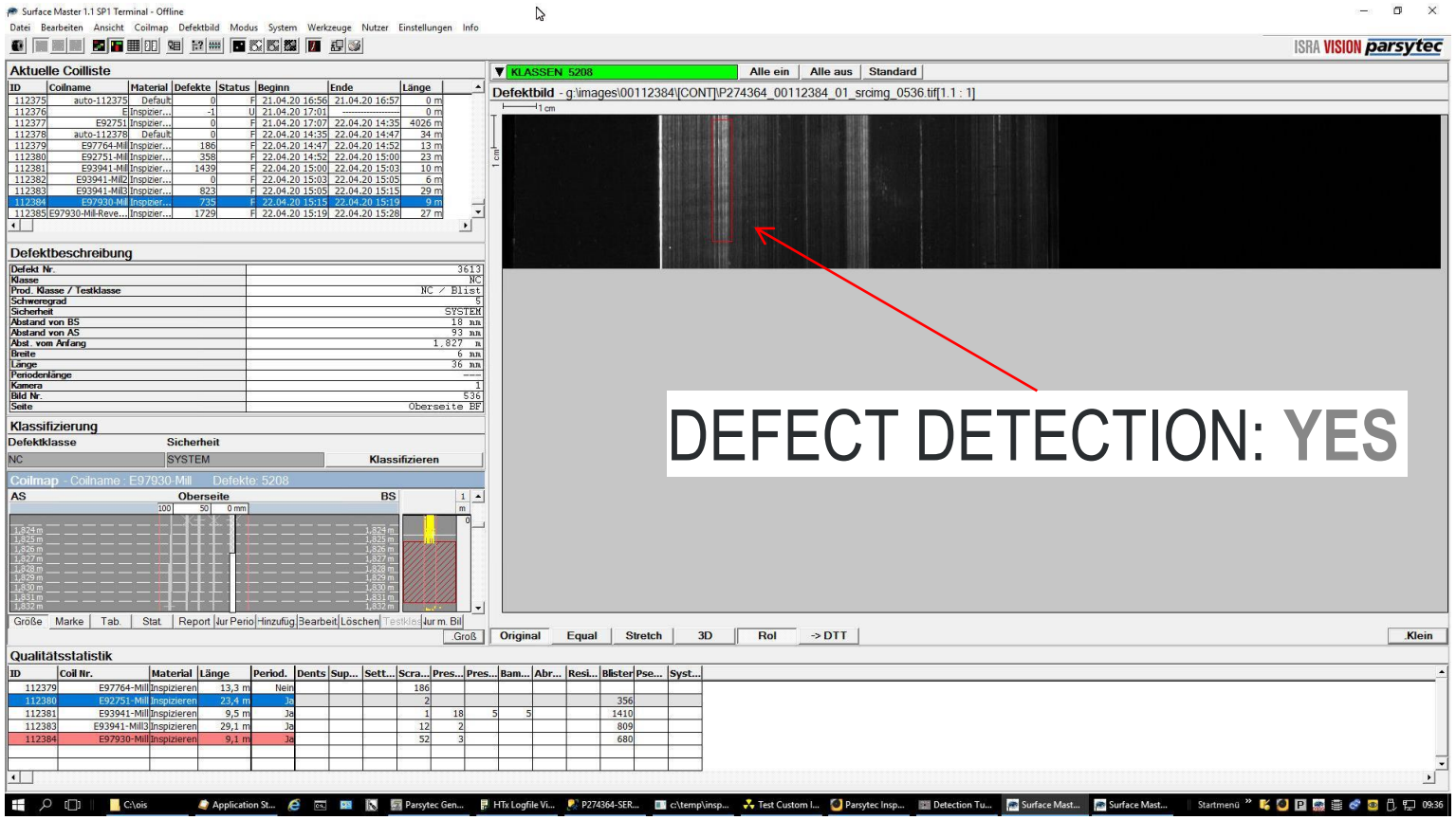
EXTRUSION – DEFECT DETECTION EXAMPLES

DIE STREAKS





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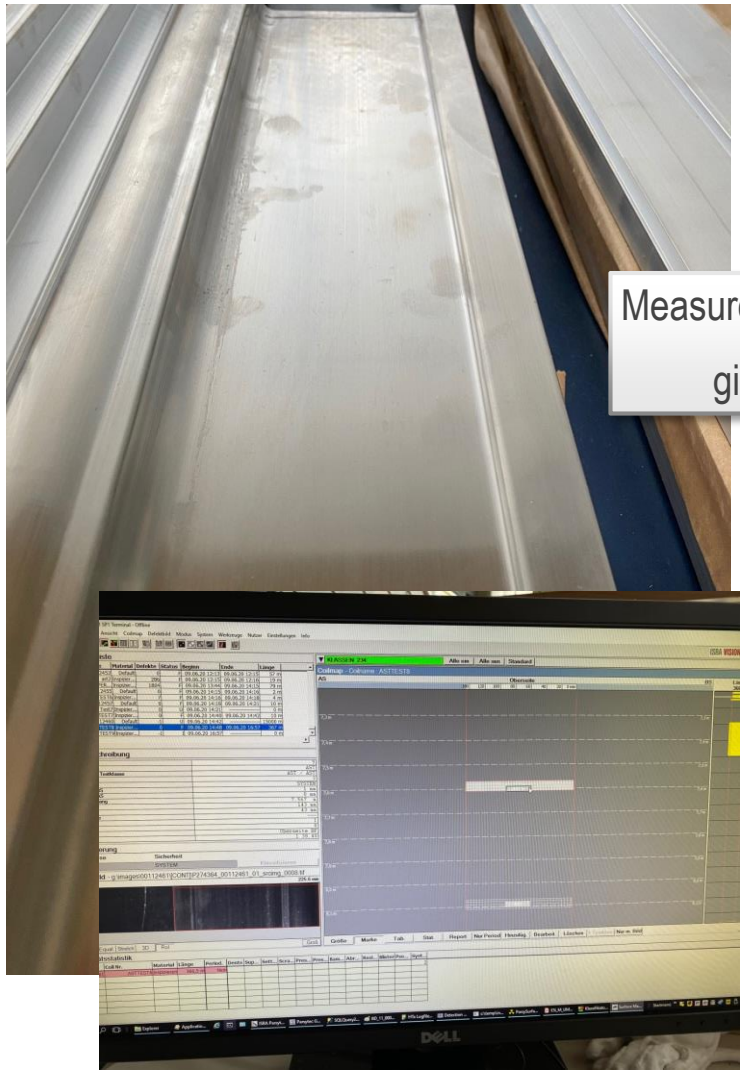
EXTRUSION – DEFECT DETECTION EXAMPLES

DIE STREAKS



Measured **SURFACE STRUCTURE (AST)**

gives indication about die wear

Visual Alarm

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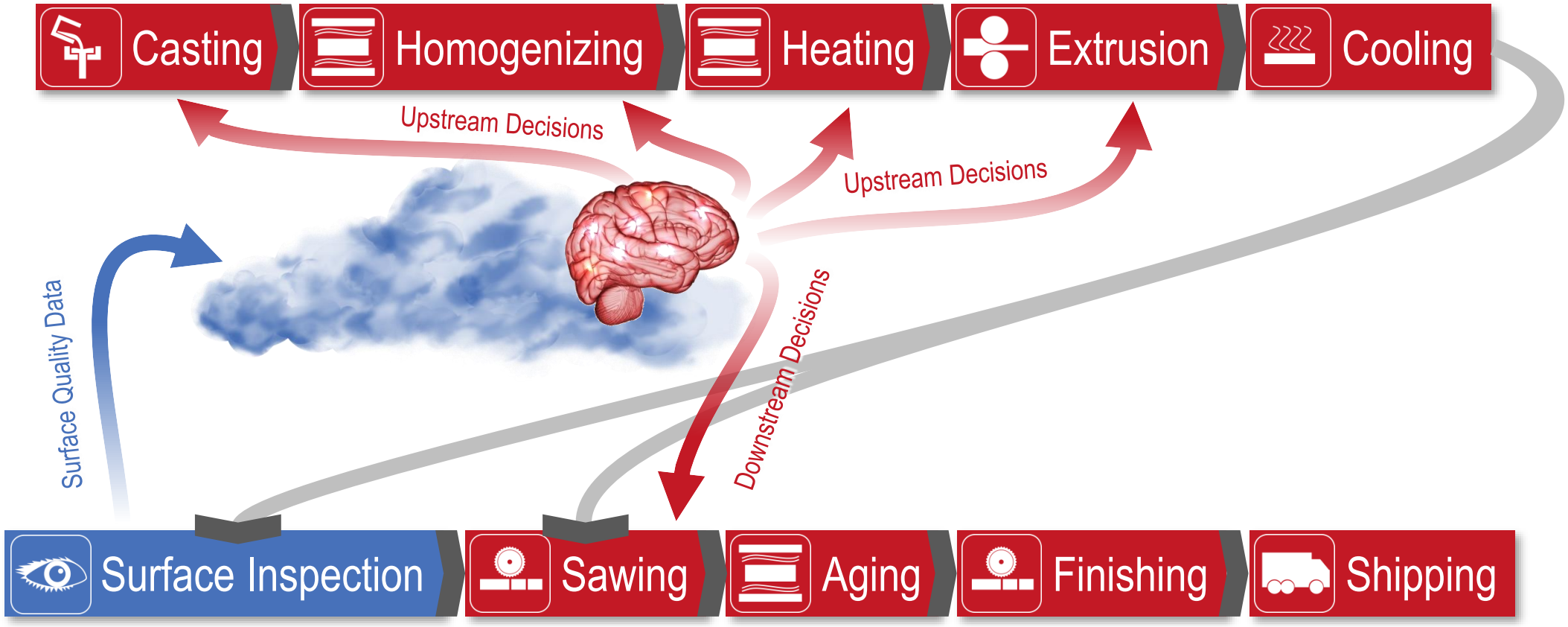
THE FUTURE EXTRUSION PLANT



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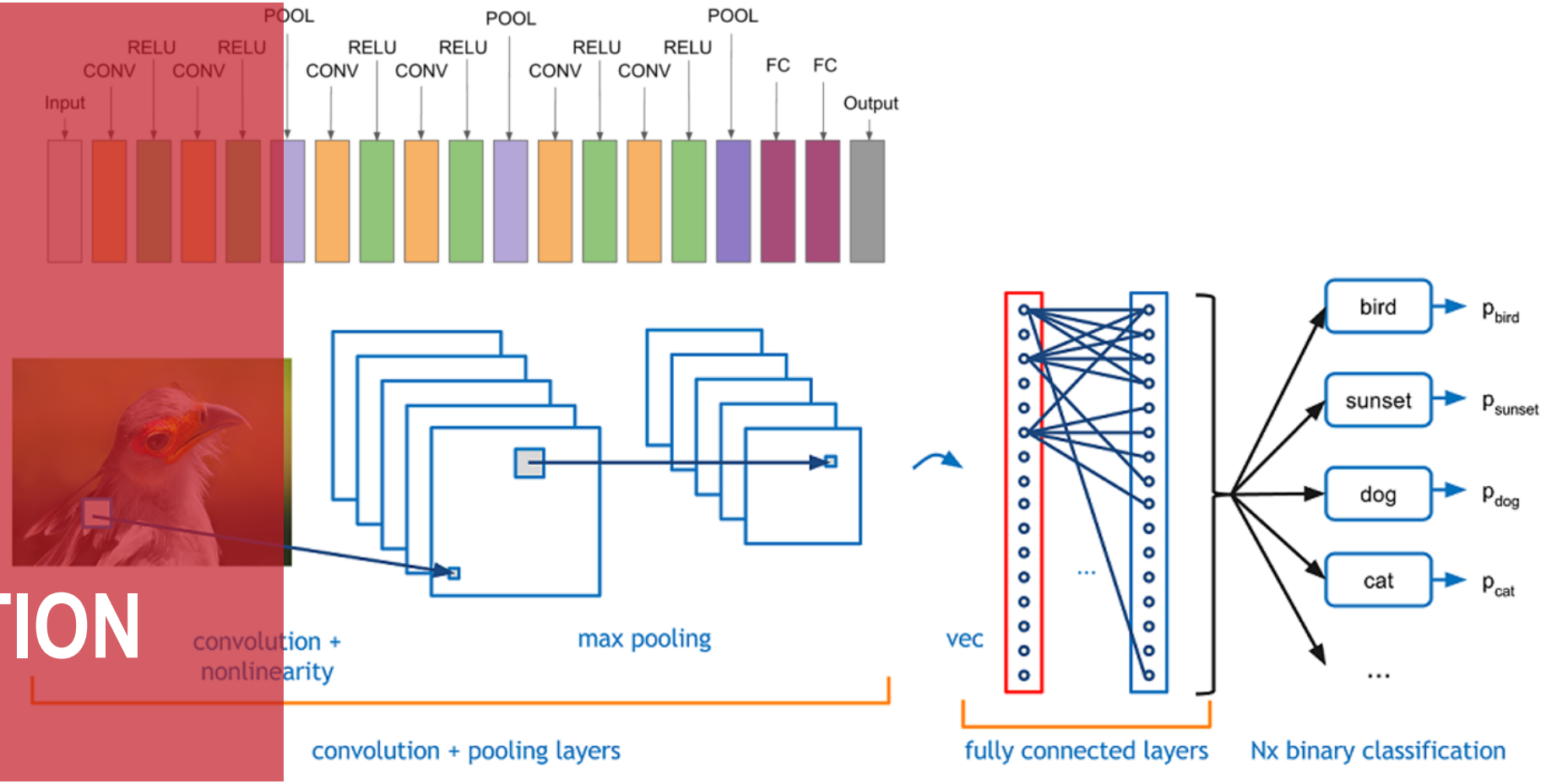
4

NEURONAL NETWORK CLASSIFICATION



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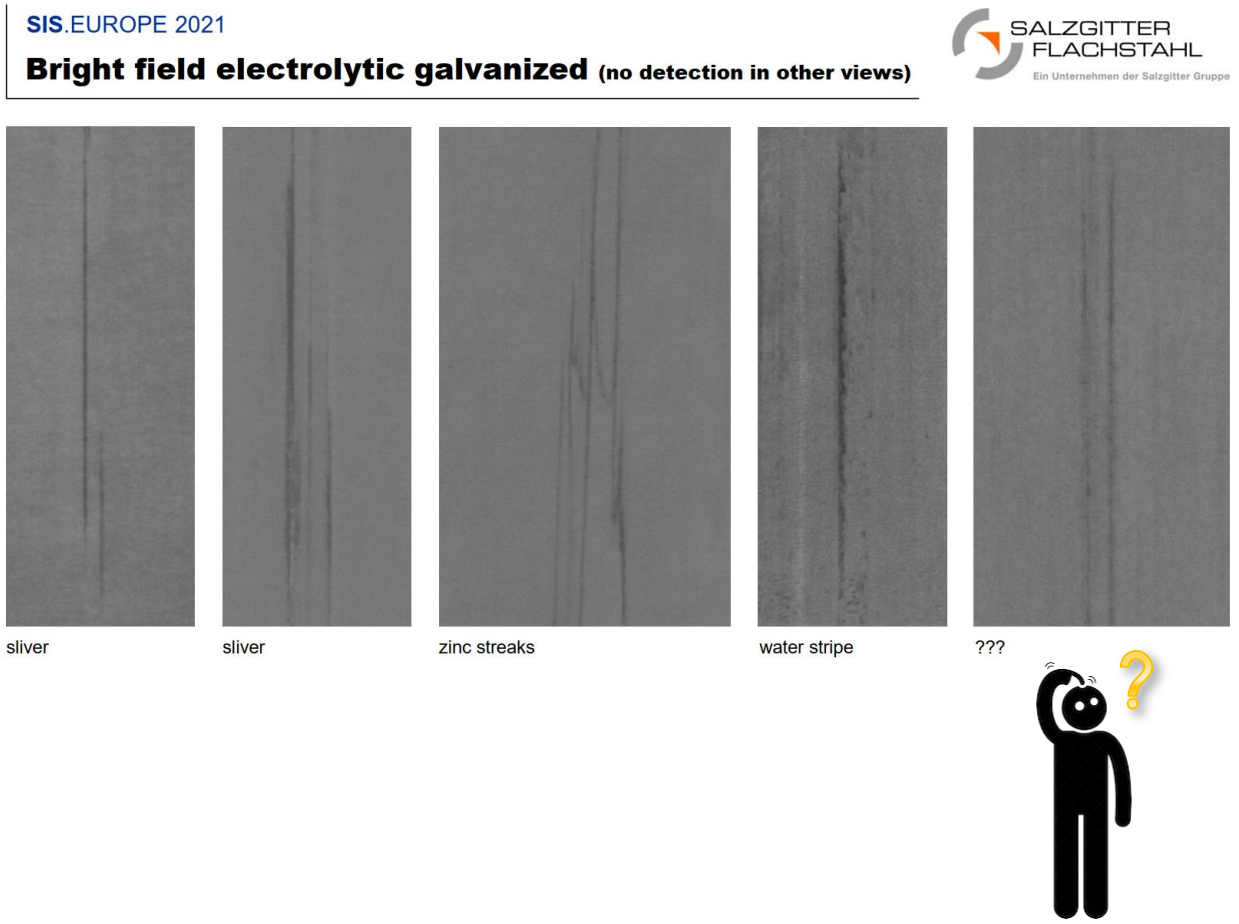
NEURONAL NETWORK CLASSIFICATION

CHALLENGE

- „Conventional“ Classification sometimes struggles with challenging defects

SOLUTION

- Apply neuronal network classification to inspection system, to improve classification



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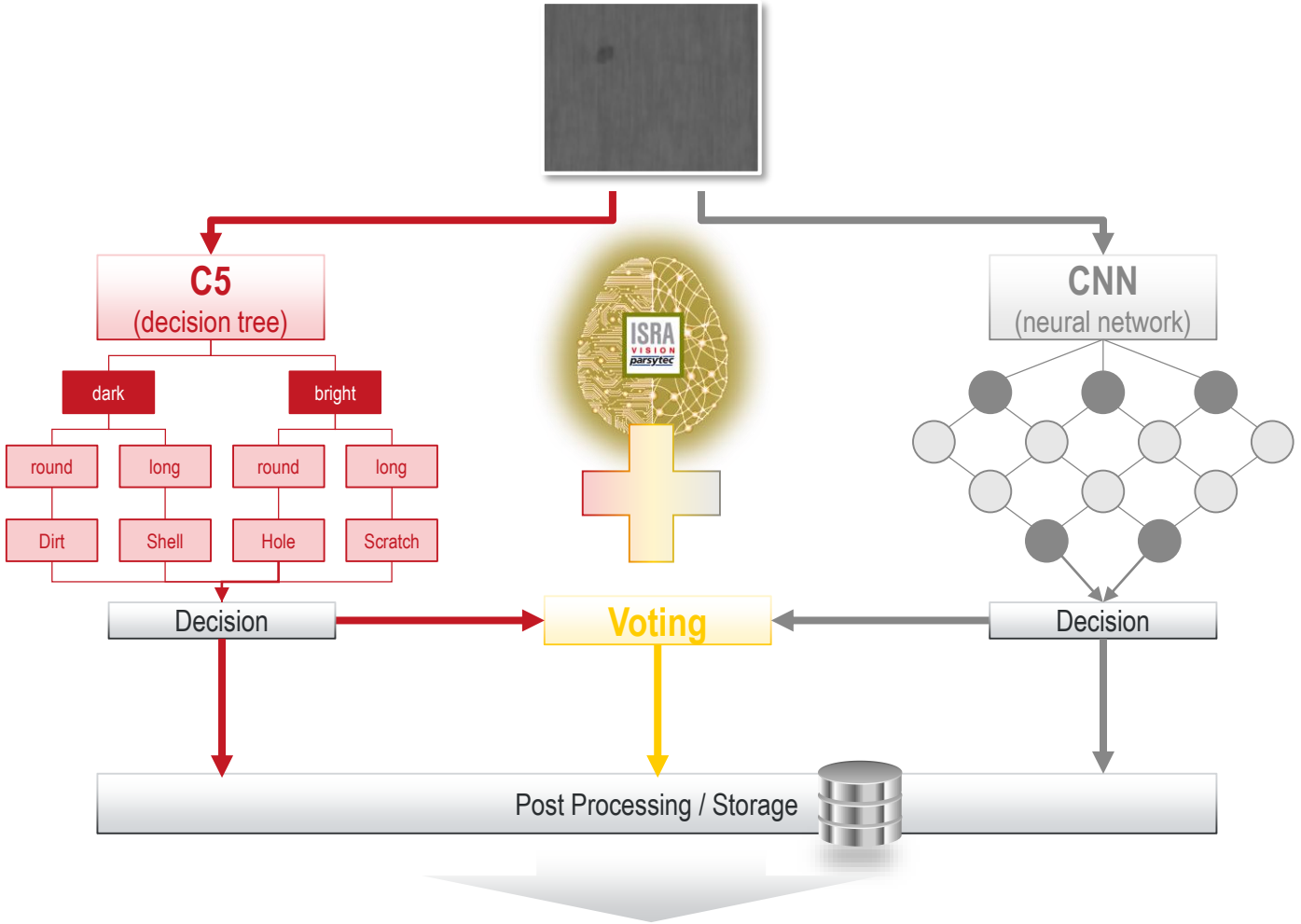
IMPROVING THE CONVENTIONAL CLASSIFICATION

C5 CLASSIFIER

- Strict (understandable) rules
- Sophisticated training



CNN CLASSIFIER

- Neural network (“black box”)
- Simple/fast training

CNN benefit (up to) 25 %

(depending on application and pre-condition)

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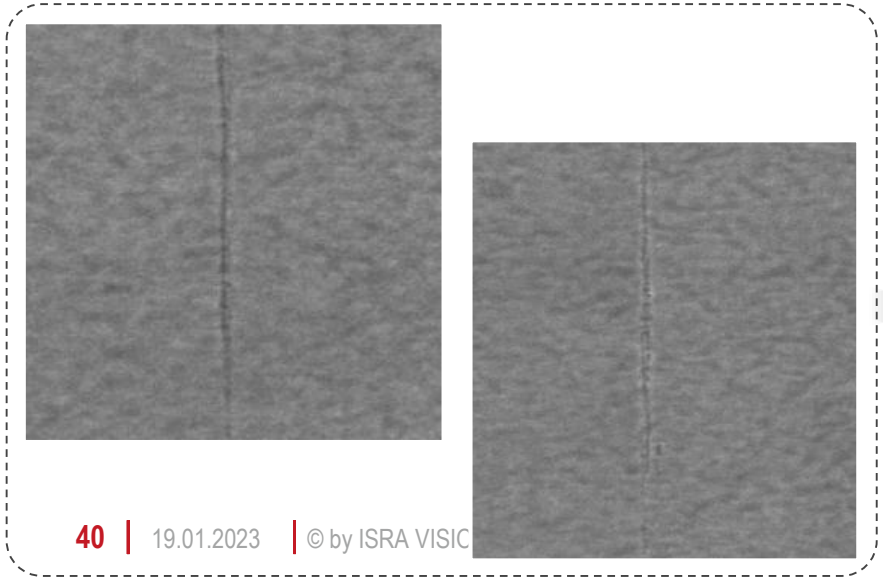
EXAMPLE – CLASSIFYING CHALLENGING DEFECTS

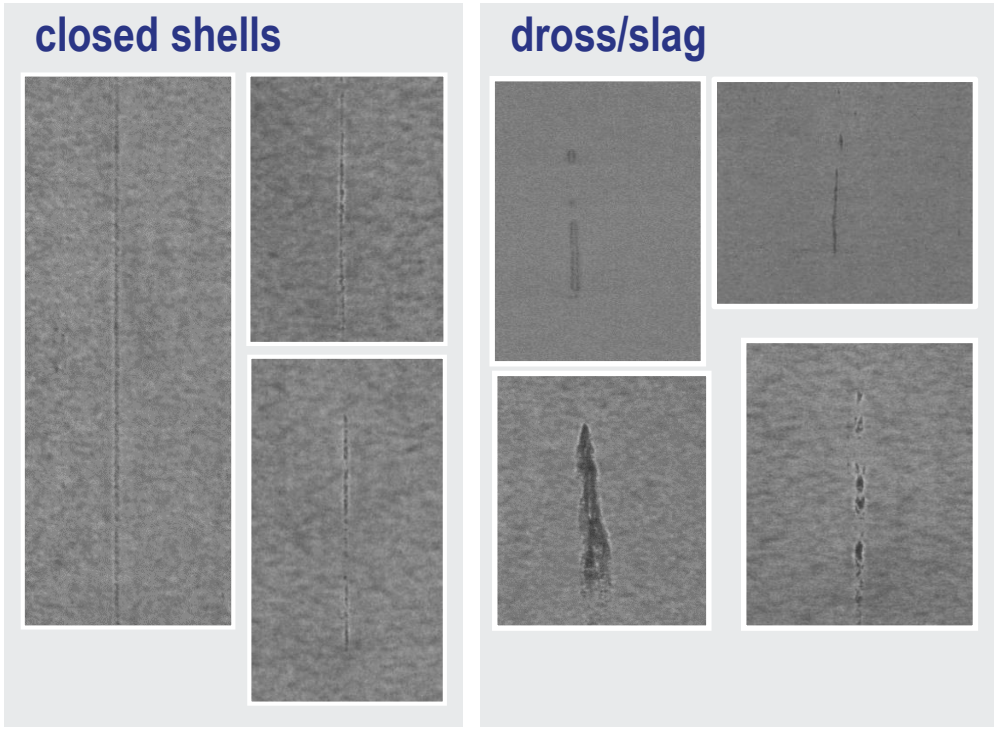
C5 (STANDARD-CLASSIFIER)

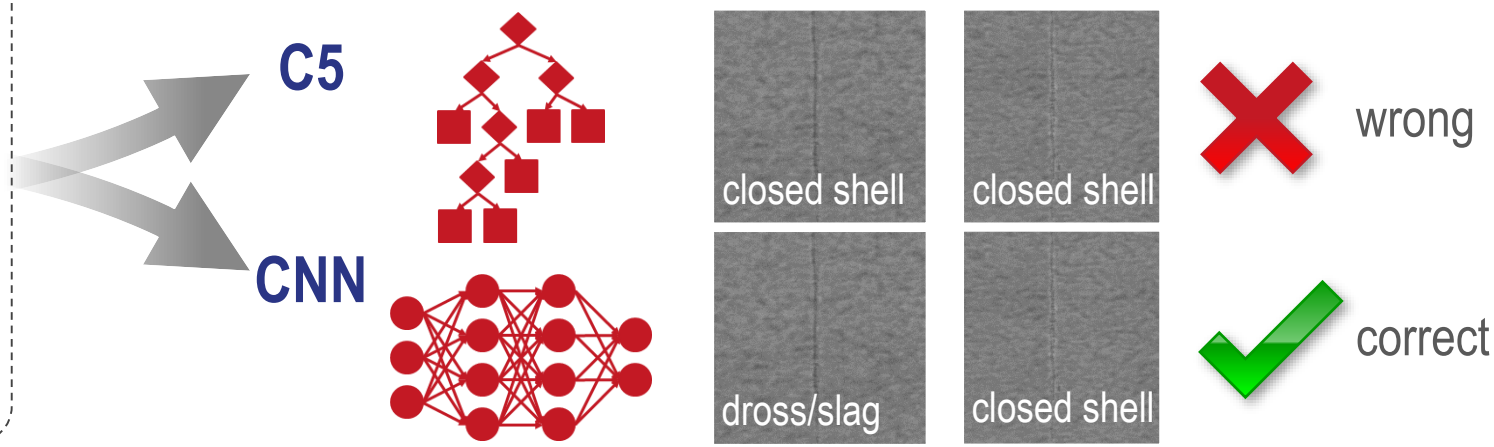
- in case of very similar appearances, the standard classifier has difficulties to distinguish the defects
- possible solution: post-processing (context classifier)

CNN

- the neural network is able to find features that can “easily” distinguish between both defect classes







5

CONDITION MONITORING

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EPROMI LIVE

Condition Monitoring enables you to permanently monitor the current state of

- Your Inspection System Health
  - Hardware
  - Image Acquisition (Illumination, Cameras)
  - Detection
  - Classification
- Your Produced Quality
  - Defect Class Statistics
  - Quality Decisions
- Mill-wide System State
  - All Production Lines on one Screen
- Access with any web-capable Device (PC, Smart Phone, Tablet, …)

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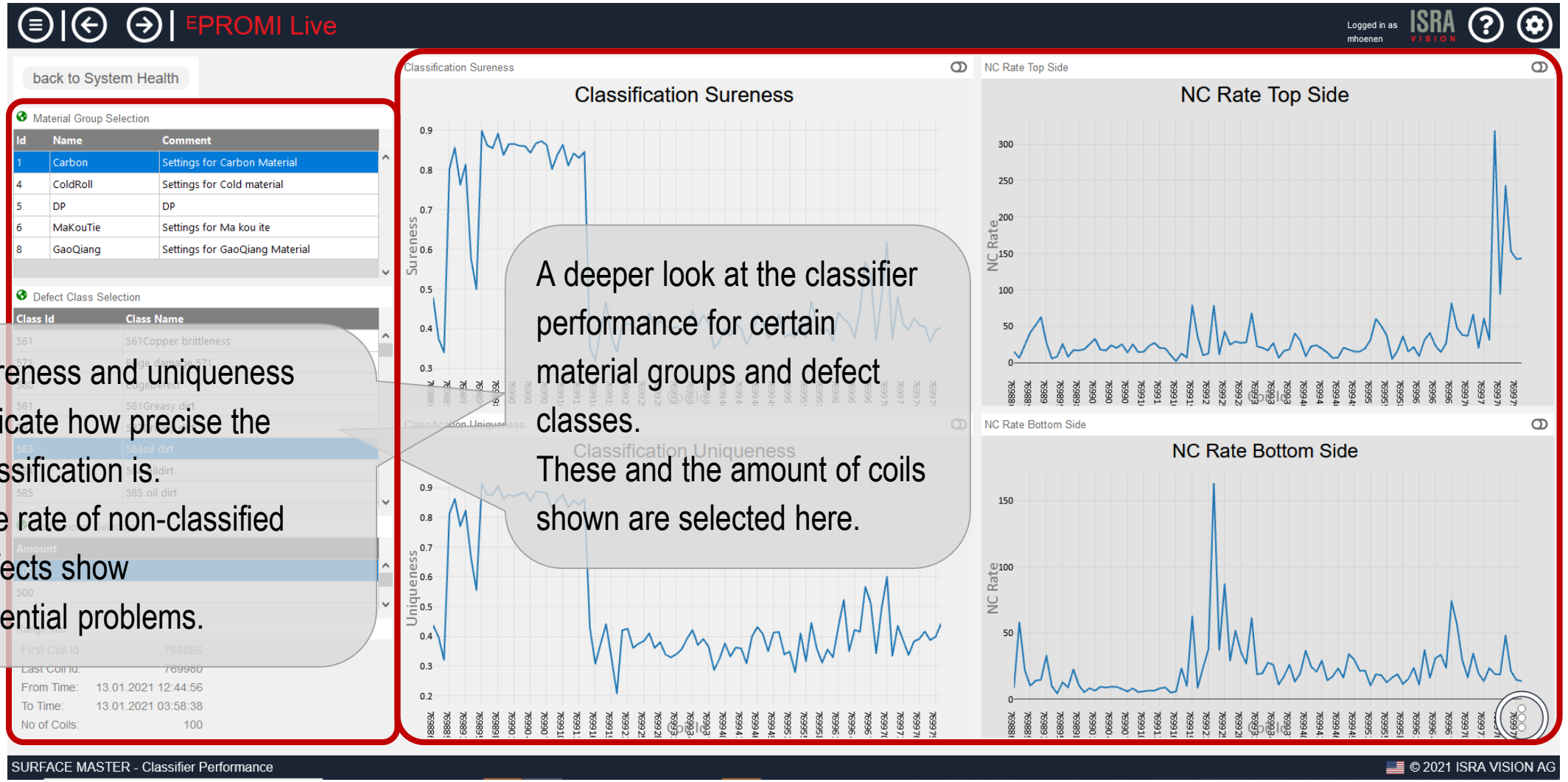
SURFACE MASTER Classifier Performance



Sureness and uniqueness indicate how precise the classification is.
The rate of non-classified defects show potential problems.

A deeper look at the classifier performance for certain material groups and defect classes.
These and the amount of coils shown are selected here.

Implementation according VDI/VDE/VDMA 2632 Blatt 4.2 possible

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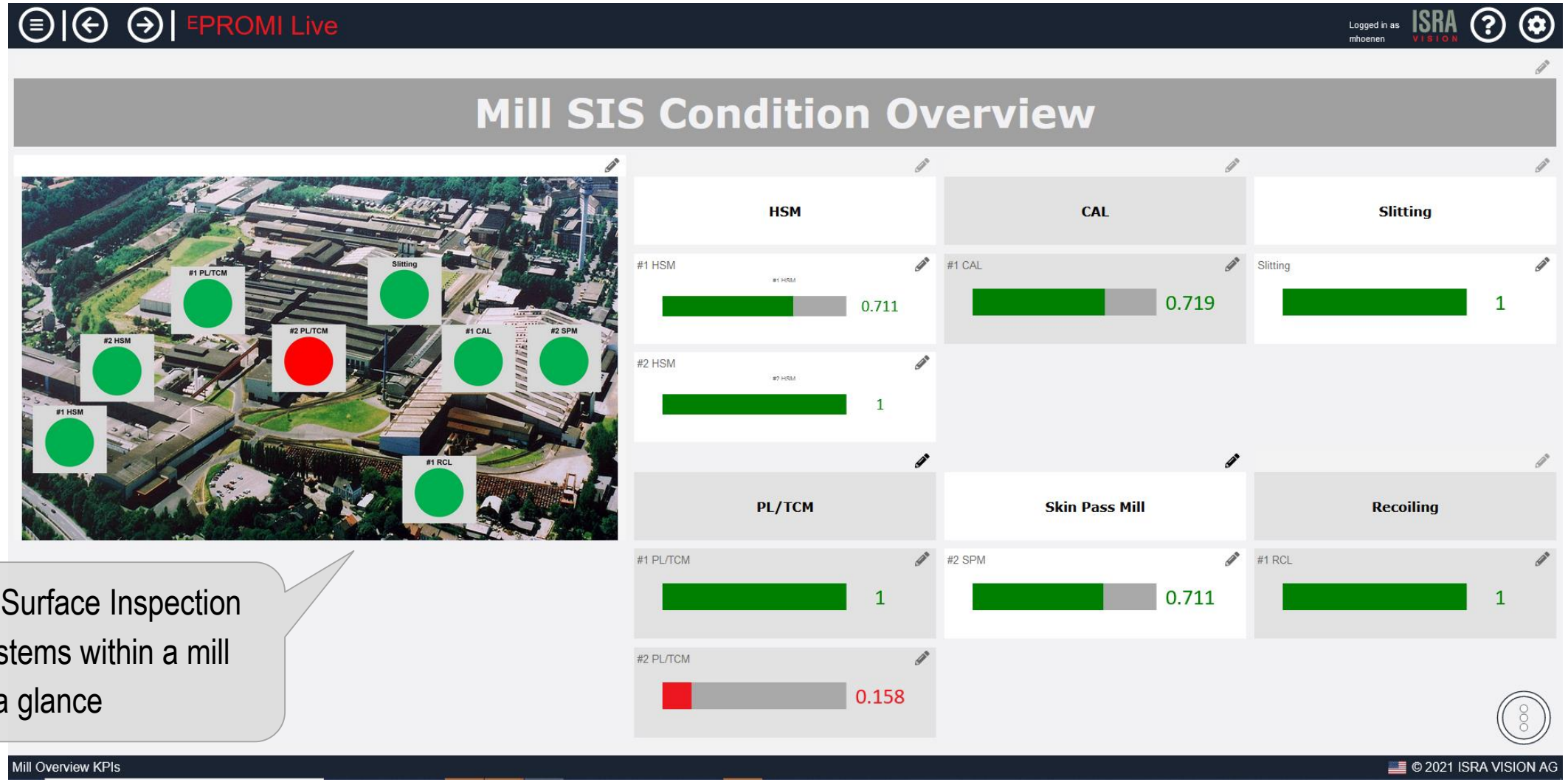
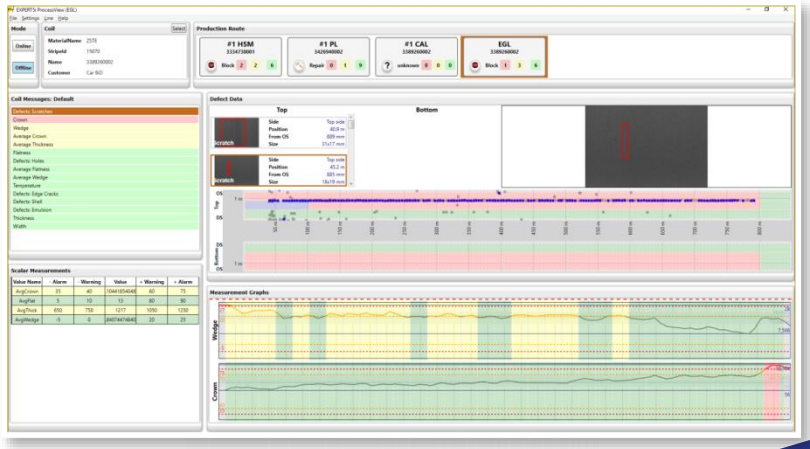
Mill Overview



All Surface Inspection Systems within a mill at a glance

READY FOR SMART FACTORY

Process view



Mill monitor

Central Monitor

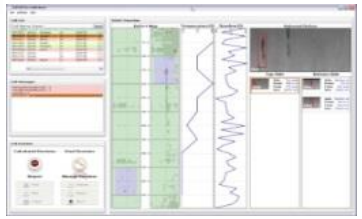
EXPERT5i | EXPERT5i | EXPERT5i

SIS | Gauges | SIS | Gauges | SIS | Gauges

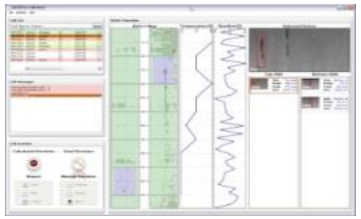
Casting → Hot Mill → Cold Mill → Annealing → Strip Processing

Upstream decisions

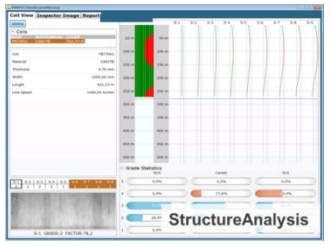
Downstream decisions



Coil release



Coil release



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THANK YOU

Fastest Cameras

- Color & Monochrome
- Matrix Scan
- Line Scan
- Up to 16k

Brightest Illumination

- Infrared, White, Blue, …
- Line Illumination
- Matrix Illumination
- Smart

Reliable Computing

- Specialized FPGAs
- Robust Detection
- Accurate Classification
- Deep Learning

Sophisticated Software

- Smart GUIs
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- For tough applications
- Easy to integrate
- Simple setup