

## Test & Measurement Solutions: Vision systems 'what's the limit'



### Technical Solutions Towards Quality

25 October 2012 NI Days

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## Test & Measurement Solutions



- Solution provider specialized in tailor made solutions for measuring, testing, control a assembly.
- more than 15 years experience
- Offices in Hasselt (BE), Arnhem, Eindhoven (NL) and Wroclaw (PL)
- delivering services and turn-key solutions to a wide variety of industries.
- Concurrent Engineering partner joining you in all your project steps

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## Statement

### **Test & Measurement Solutions: 'The challenges of integrating vision in production environments'. Steven Dom**

When integrating vision systems for inspecting or measuring components in a production environment, a number of factors play a crucial role in making this a success. In this presentation I would like to show you a few practical examples in which the challenge, the possibilities and the solution are explained. Furthermore, flexibility, integration and maintainability are very important in order to use them effectively.

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## Integration Challenges

- **Vision expertise**
  - **Right platform at the right place**
    - PC based system
    - Smart Camera
  - **1D, 2D, 3D or specific sensor technology**
    - Line scan
    - Image arrays
    - Laser
    - Spectrum
  - **Combining external inputs with vision sensor**
    - Analogue measurements
    - Motion systems
    - PLC – ERP connections



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## Integration Challenges

- **Environmental dependencies**
  - Lighting(visible, invisible) – contrast – Shadow- Reflections
  - Speed– Vibrations
  - Color
  - Position– overlap – rotation
  - Varying product features (fruits...)
- **Level of possibilities to integrate in customer environment**
  - Knowledge of automation
  - Knowledge of mechatronics
  - Seamless integration in existing production processes



## Integration Challenges

- **Reliability & maintainability**
  - **Difference between measuring and inspection applications**
    - Selftest at startup & fail-diagnose
    - Optical Watchdog
    - Real time contrast & light level control
  - Fast system component replacement
  - Adjustment tools
  - Control algorithms
  - Statistics & history



## Integration Challenges

- **Calibration**
  - Gain
  - Color
  - Intensity
  - Position
  - Contrast – sharpness
- **Tools**
  - Golden parts
  - Calibration targets
  - Logging
  - Off line simulation on real captured images (replay)
- **Validation procedures**



## Integration Challenges

### Challenge:

**Integrating all previous mentioned elements into  
one reliable vision system  
to be kept operational by the operators**



## Some questions a buyer should ask

1. Does the vision system make it easy to set up applications, create custom operator interfaces and administer vision system networks?
2. What is the importance of part location tools, and how can I assess their performance?
3. Does the vision system have a complete set of image pre-processing tools?
4. What should I look for in character reading and verification capabilities?
5. How can I determine the repeatability of a vision system's gauging tools?
6. How do I evaluate industrial code reading tools and what are some specific features to look for?
7. What networking and communications features should I look for?
8. What should I know about vision system accessories?
9. Does the vision system vendor offer a wide range of hardware options? Are they rugged enough for my environment?
10. Does the vision system supplier provide the support and learning services I need?

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## Integration Challenges

- Vision Systems, 10 most important issues that come up.
  - Part Rotation
  - Scale Variations
  - Blur
  - Poor contrast
  - Inconsistent lighting
  - Shadows
  - Part overlapping
  - Reflections
  - Vibrations
  - Process variations



## Examples

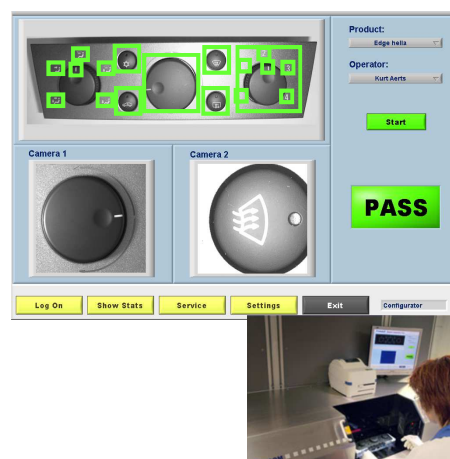


## Product inspection with Vision

### Automatic in-line inspection of dashboard sub-panels

Inspection includes:

- Correct lay-out (the right button in the right place)
- Intensity of of back-lighting, uniformity
- Torque measurement of knobs



## Production Monitoring



In-line monitoring of Dashboard production

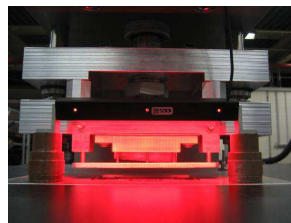
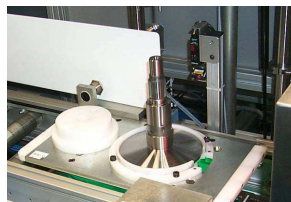
In-sequence verification of correct configuration of dashboards



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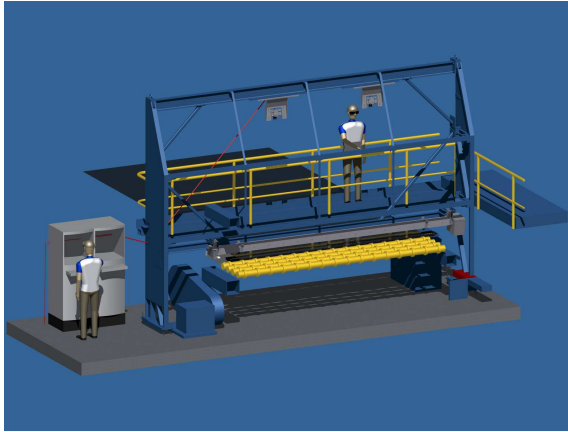
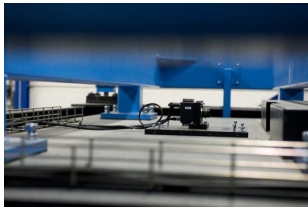
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## Off-line versus In-line inspection



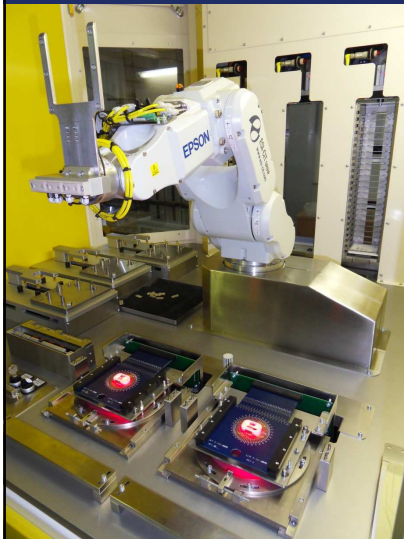
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## Coupled Systems



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## Resonance Testing



Full-automatic testing of properties of peizo-electric elements (MEMS)

- Robot handling all Device Under Test
- Machine Vision guiding Robot hand with micro-meter precision
- Extremely fast measurements

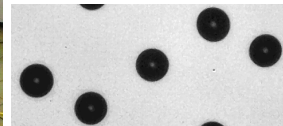
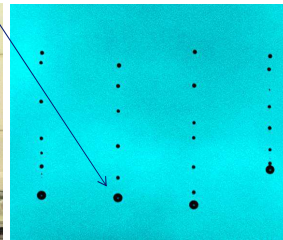
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## Print Head Drop Characterization

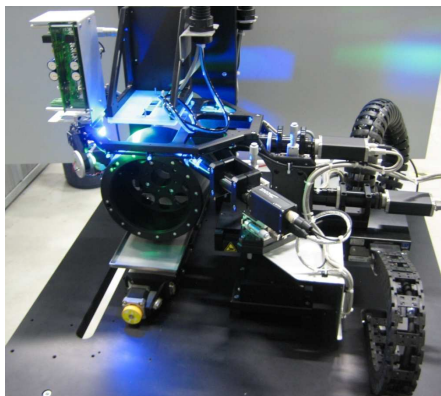
Inkjet calibration using in-flight pictures of the drops



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## Picoliter drops in-flight



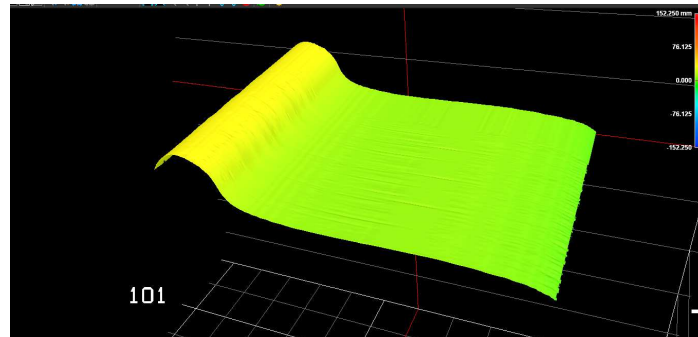
Measure the volume very small drops ( $<10\text{pl}$ )  
picoliter drops in-flight

- Dual cameras + complex volume model
- 100ns, 100A flashlight using simple LED

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## Rail road wheel

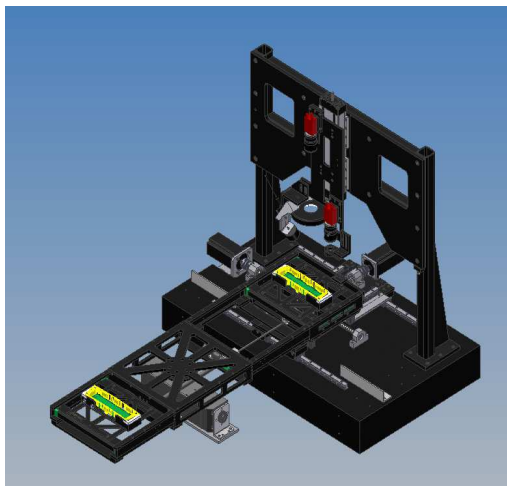


Laser scanning for measuring rail wheel profiles combining laser scanner with precise rotational movement

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## Complete integration



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## Statement

**Quality is a  
requirement  
not an option**



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