

# Automotive



How Machine Vision is used to meet today's increased demands for information, quality, and manufacturing flexibility in the automotive industry



## Proven Applications in Automotive Plants



### Body Shop

- Sealant Inspection
- Robot Guide
- Panel ID
- Error-Proofing
  - Holes, Studs
  - Weld Nuts

### Paint Shop

- BIW Clamped
- Panel ID/Verify
- BIW Sequence
- AdPro Present
- Error-Proofing
  - BIW Options

### Tire Room

- Robot Guide
- Match Marker
- Tire/Wheel ID
- Error-Proofing
  - Tire to Wheel
  - Sequencing

### Door Line

- Door Sequence
- Error-Proofing
  - Side Mirrors
  - Door Handles
  - Door Panels
  - Verify Assy.

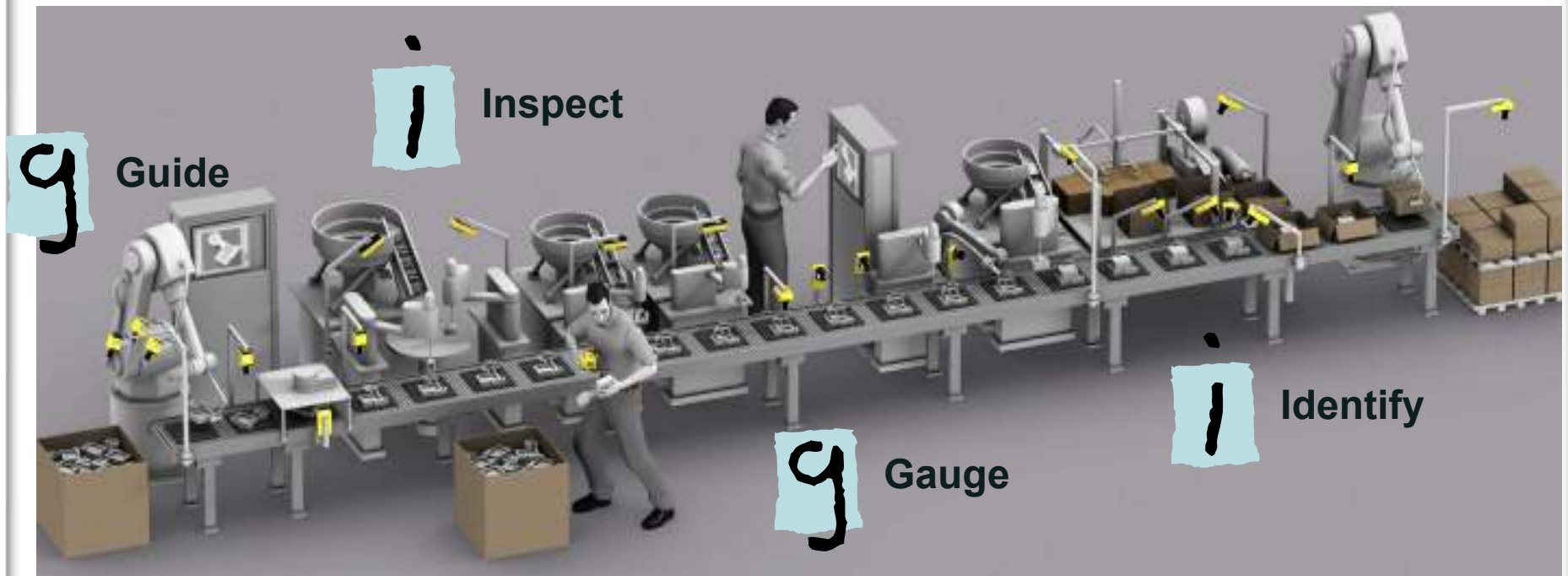
- Benefits of Machine Vision:
  - 100% Error Proofing
  - 100% Inspection

# Vision Applications



What does machine vision do?

g i g i



# Engine Applications



- Surface Inspection
  - Journal bearings
  - Cylinders
- Gauging
  - Spark plugs
  - Injectors
- Assembly Verification Inspection
  - Turbochargers
  - Piston/rod assemblies



Gauge

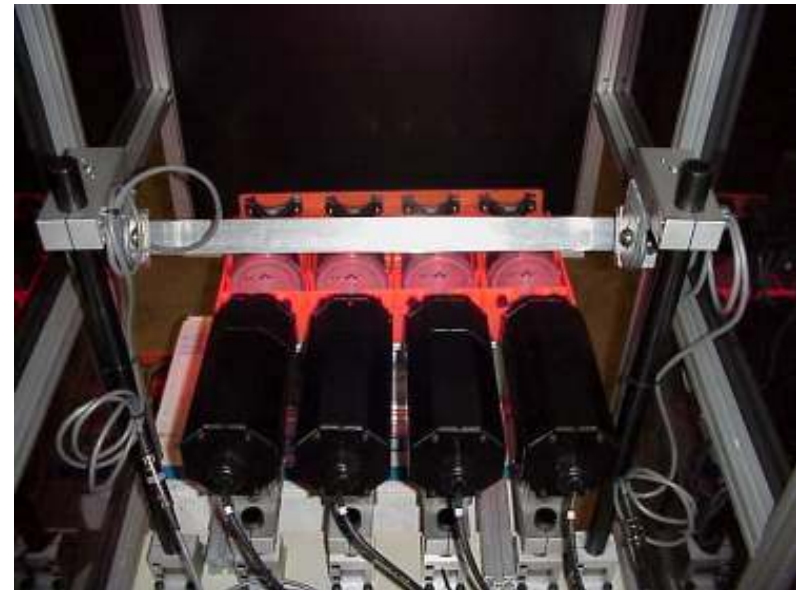


Inspect

# Piston Verification



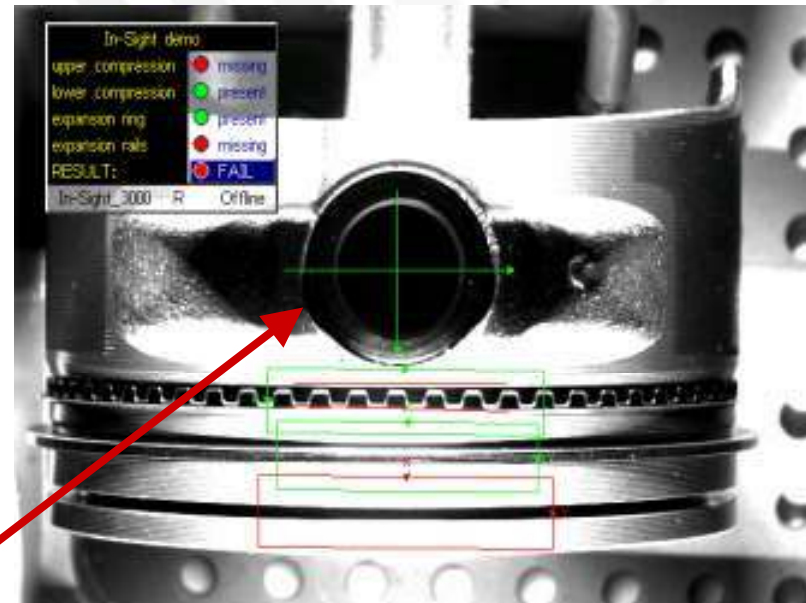
- Which piston is it?
  - In Ford Motor Company
  - Verify that the right pistons are assembled into the right engines
  - Pistons are distinguished by 1 of 3 alphanumeric codes
  - “Exceptional at verifying the codes, and is running at 99.998 efficiency.” ,  
Rod Sturgis  
Project Engineer, Industrial Automation



# Piston Assembly Applications



- Ring Inspection
  - Verify presence/absence
  - Verify ring is seated
  - Verify correct location
- Wrist pin retaining ring
  - Verify presence/absence
  - Verify ring is seated
- Ring Gap Orientation
  - Verify ring gaps are not aligned to prevent blow by
  - Line scan used when piston can be rotated
  - Multiple cameras used when piston must be fixed



# Transmission Applications



- Component Inspection
  - Castings, bearings & gears
- Part Identification
  - Bearings, cases, clutches, etc.
- Assembly Verification and inspection
  - Clutches, torque converters, valve bodies, etc.



# Identify Camshaft



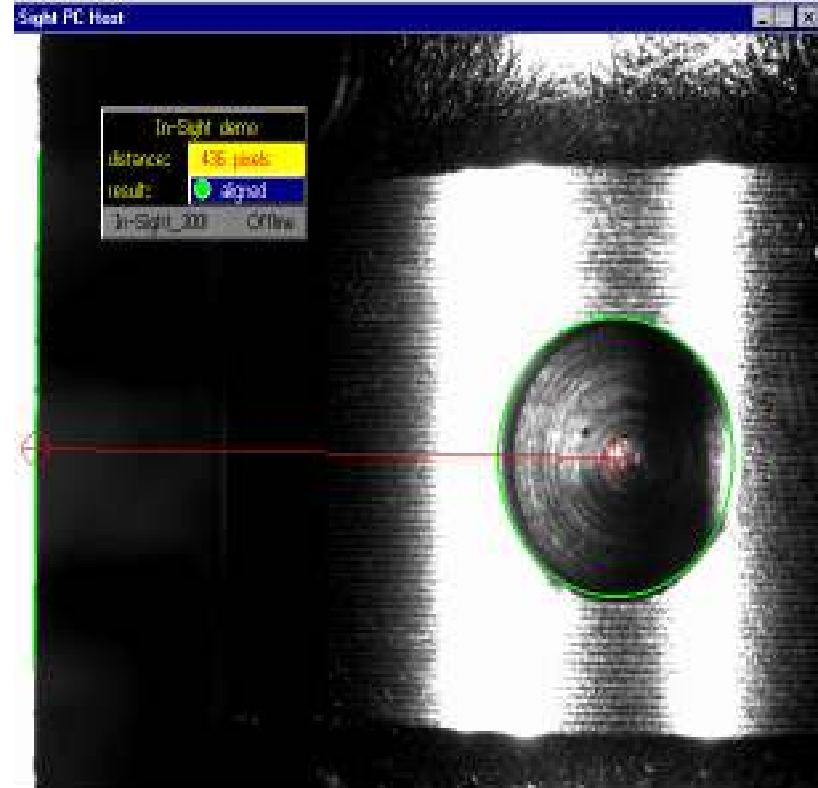
- Read 2D Matrix Code
  - Code located on the end of camshaft
  - Part is fixtured so vision sensor can zoom in on the mark.
  - Sensor and lighting must be slightly off-axis to allow tooling to lower down to the end of the part



# Hole Location



- Find location of milled hole on camshaft
  - On each of two camshafts, a milled hole needs to be located to a 0.1 mm accuracy
  - Once the hole's position is found, servos spin the camshaft so that two pins can be inserted into the holes



# Mark Verification



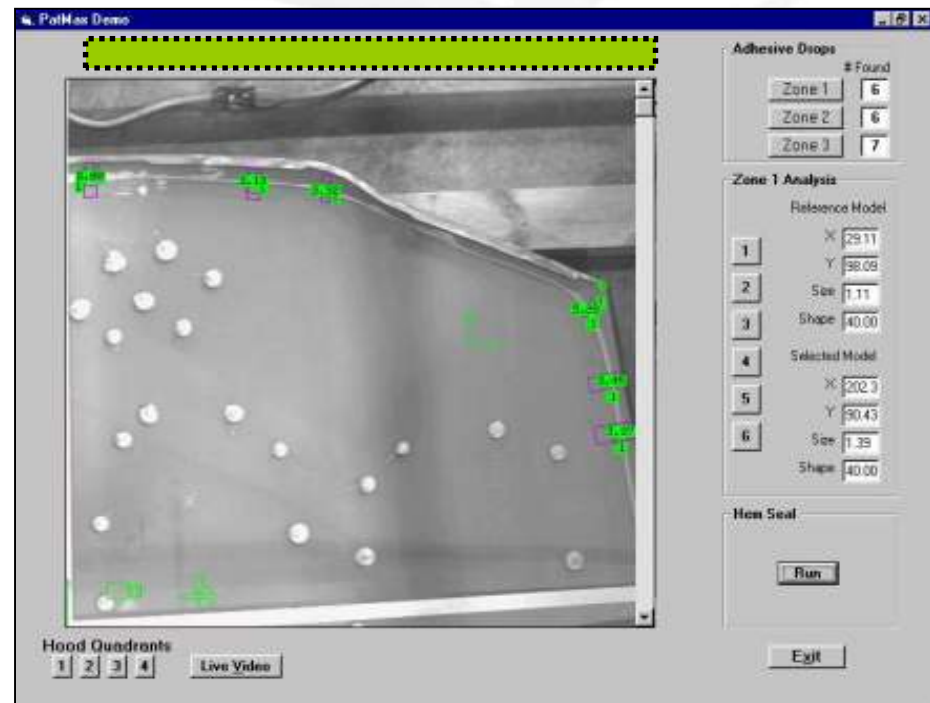
- Flywheel Balance Mark
  - Locate mark despite variation in location and appearance
  - Standard photo sensors cannot reliably find mark



# Adhesive on Body Panel



- Measure the Part
  - Accurately measure body panel in order to apply adhesive





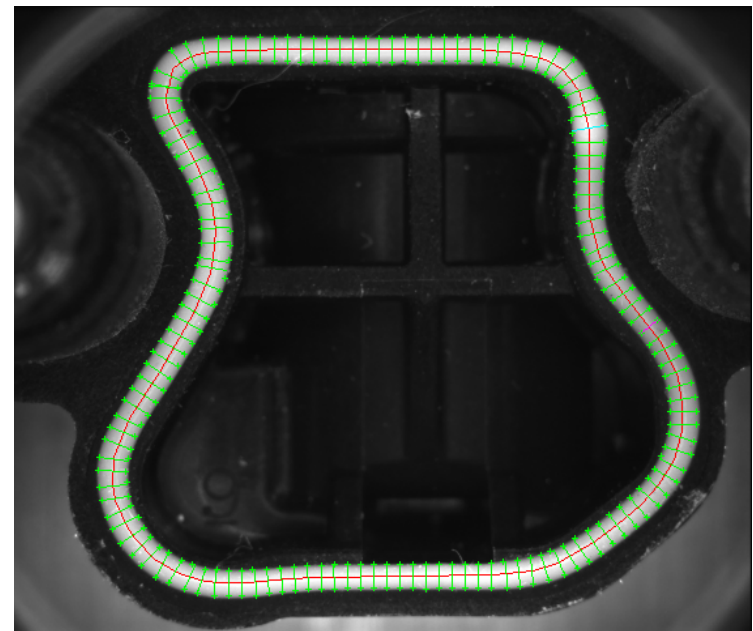
Aplatec

# Bead Tracking Application

- Confirm dispensing of greases, glues and adhesives
  - Application specific software tool speeds set-up
- Calculates the following data items:
  - Fail percentage = 0%
  - Min Bead Width = 15.620 Pixels
  - Max Bead Width = 25.449 pixels
  - Max Offset from Nominal Path = 478.000 pixels
  - Max Gap Size = 0 pixels
  - Accumulated Gap Size = 0 pixels



Inspect





APLIATEC

## Verify Presence of Proper A/C Unit

- In-Sight vision sensor mounted 15 feet above inspection point to verify assembly
  - 2½" x 2½" labels are viewed through side window to identify the A/C unit
  - PatFind capability used to overcome label offset and skew
  - When defects are detected the line stops and vans are quickly repaired



Identify

# Fuse Box Inspection



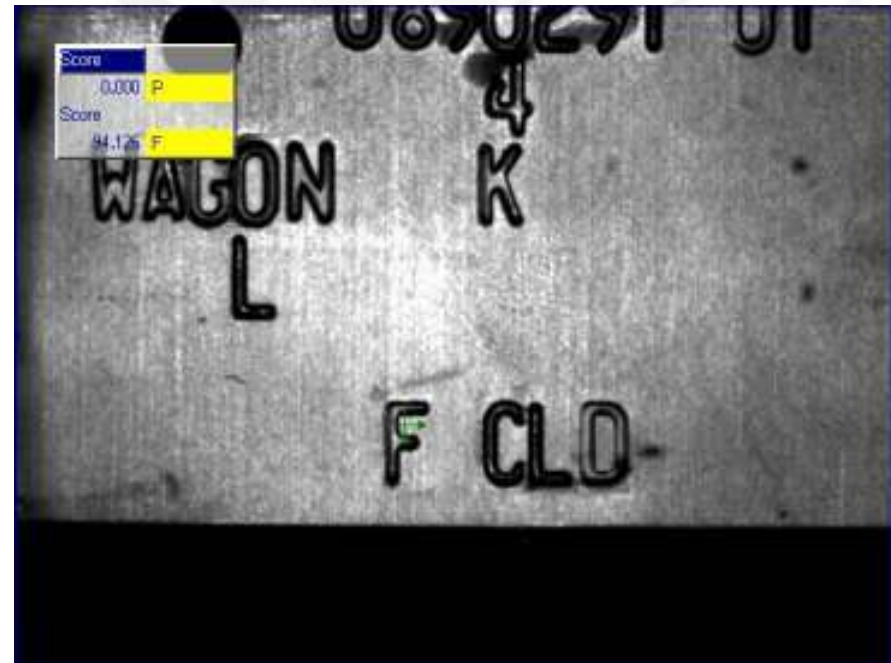
- Configuration & Combination of Fuses verified
  - Check for presence of correct fuse
  - 6 different types identified by color
- Communicate to external GUI
  - Configuration of fuses sent via Ethernet to external operator interface device



# Identify Car Model



- ID Tag Reading
  - Read character code (OCR) on ID Tag in order to identify car model and options needed
- “**Cognex** Vision has been exceptional at identifying the codes providing 100% automated inspection.”



# Robotic Guidance



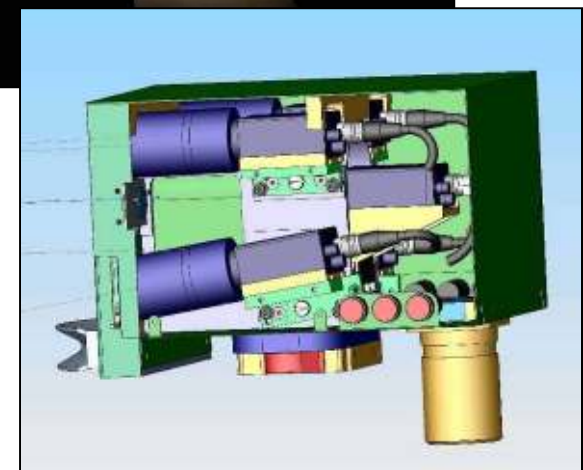
- Application:
  - Integration of vision with robots for assembly line applications
- Benefit:
  - PatMax proved to be the most reliable and accurate solution



# Quality Control



- Application:
  - The quality control for head-up displays (HUD)
- Benefit:
  - Improves company's image and reputation

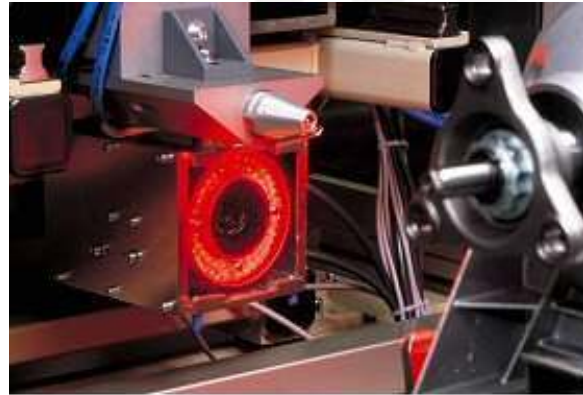


**g** Gauge

# Character Reading



- Application:
  - OCV on cast lettering on side of transmission housings
- Benefit:
  - Part tracking and cast quality inspection

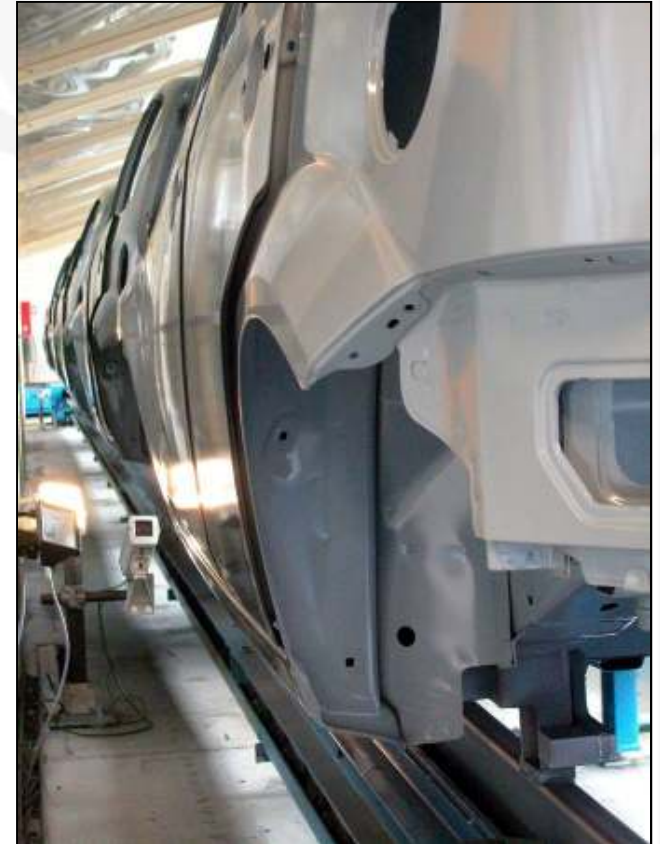


Identify

# Product Traceability



- Application:
  - Read the vehicle ID-plates at the production lines
- Benefit:
  - Absolutely safe identification for a smooth production process and for a high faultless quality of the vehicles



# Inventory Control



- Application:
  - System for identifying all components
- Benefit:
  - Performance analysis, full traceability



# Part Traceability



- Application:
  - Reading of character on the car body to implement the right components
- Benefit:
  - Traceability, operational improvements, minimise product recalls



## Benefits of Machine Vision:



- Increase Productivity
- Trace Parts
- Boost Yields
- Enhance Product Quality
- Lower Capital Costs
- Reduce Scrap & Rework
- Increase Customer Satisfaction
- Improve Brand Image

# Automotive Suppliers



How Machine Vision is used to meet today's increased demands for information, quality, and manufacturing flexibility in the Tier One automotive supplier industry



## Proven Applications for Automotive Suppliers



### Guidance

- Orient airbag initiators for assembly
- Load/unload engine blocks, body panels, alternator brackets, wheels and more
- Assemble axle, brake & steering parts to automate assembly

### Inspection

- Print quality of dashboard graphics
- Surface inspection of journal bearing for dents/scratches
- Weld inspection on steel wheels
- Flash & short shots on tail lamps
- Rivets seated & fully formed
- Catalytic converter cell inspect

### Gauging

- Sealant width
- Lock cylinders
- Brake fittings
- Sending units
- Airbag initiator

### Error-Proofing

- Verify clutch assembly
- Airbag inflator assembly
- Radio face plate
- Roller bearings
- Ignition cylinders

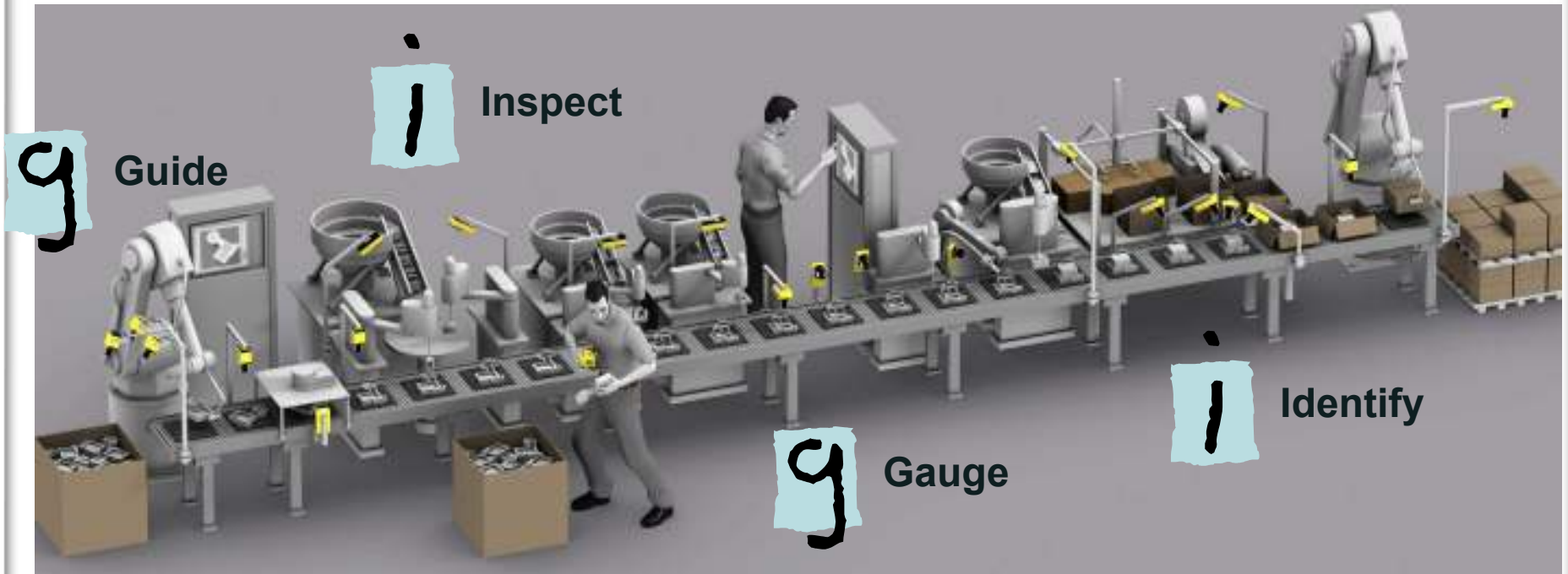
- Benefits of Machine Vision:
  - 100% Inspection
  - Part Traceability

# Vision Applications



What does machine vision do?

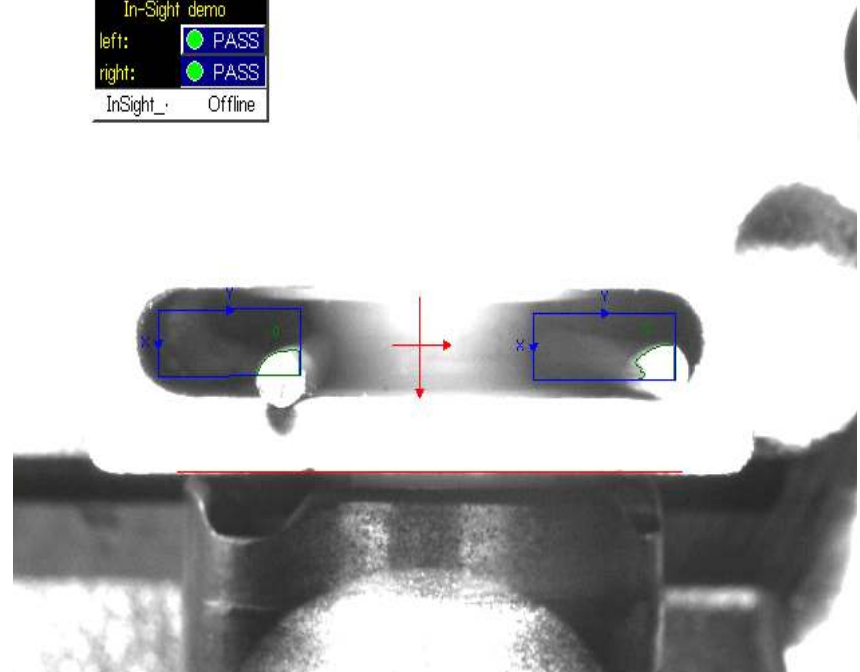
g i g i



# Valve Body Assembly



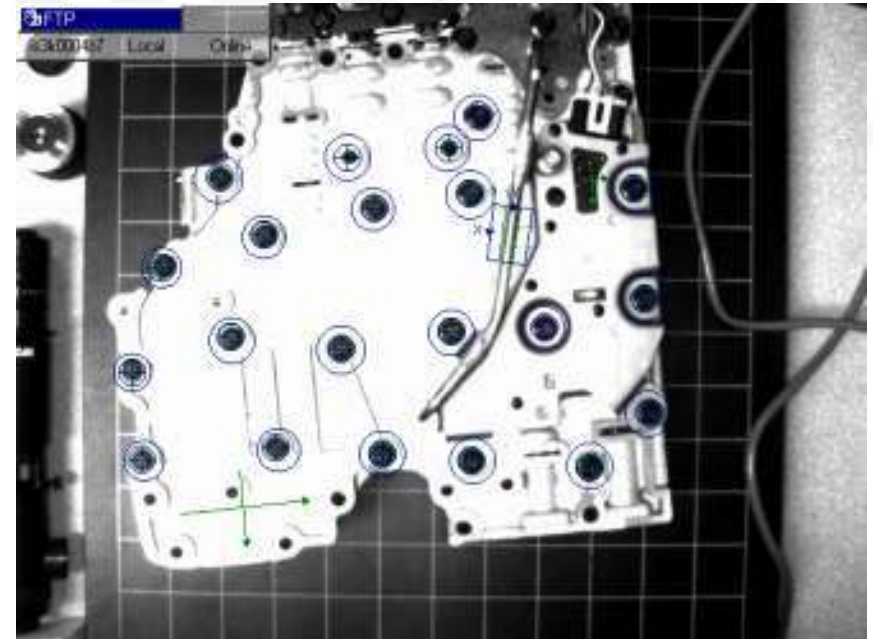
- Verify Assembly of Valve Body
  - Check that an electrical cable connector is properly seated
  - Check that a metal clip is present in a specific region of the valve body



# Valve Body Gauging & Verify



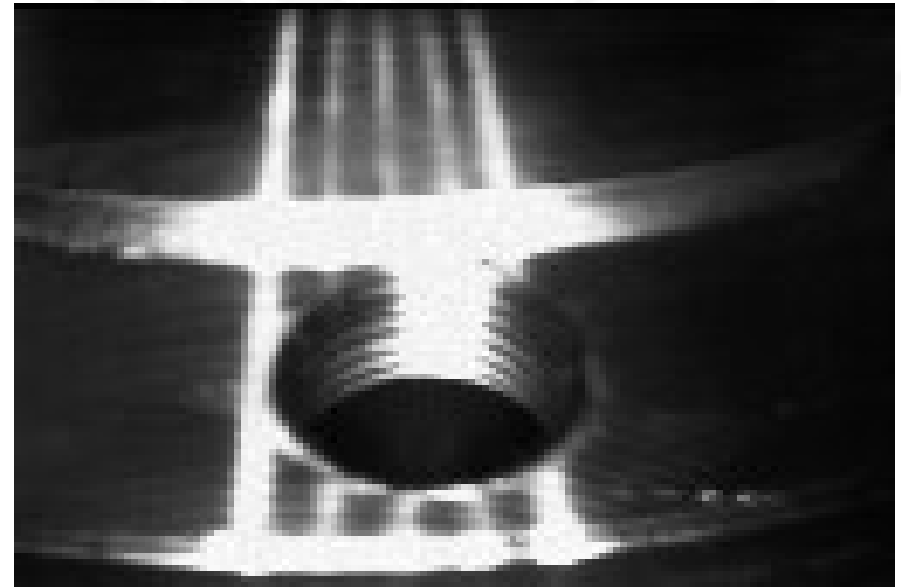
- Gauging spacer plate hole position
  - Verifying presence and location of 169 holes
- Assembly Verification
  - Springs & balls present
  - Bolts & bore retainer clips
  - Spacer plate & harness body
  - Solenoid clips & reverse tube
  - Control module body



# Thread Detection



- Detect presence of threads
  - Locate hole and verify presence of threads
  - 100% inspection required by automotive manufacturer
  - Replaces expensive eddy current probe method



# Bushing Application



- Inspect & Gauge Bushings
- “When there is a recurring failure mode, the Vision System enables me to determine its cause for rapid action and correction.”

Greg Hay

Dana Glacier



Inspect

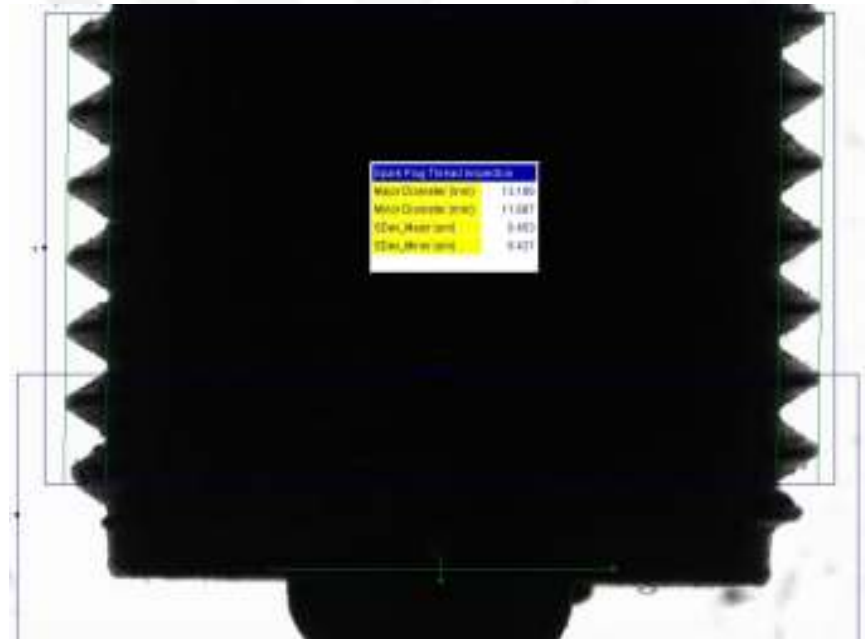


Gauge

# Spark Plug Application



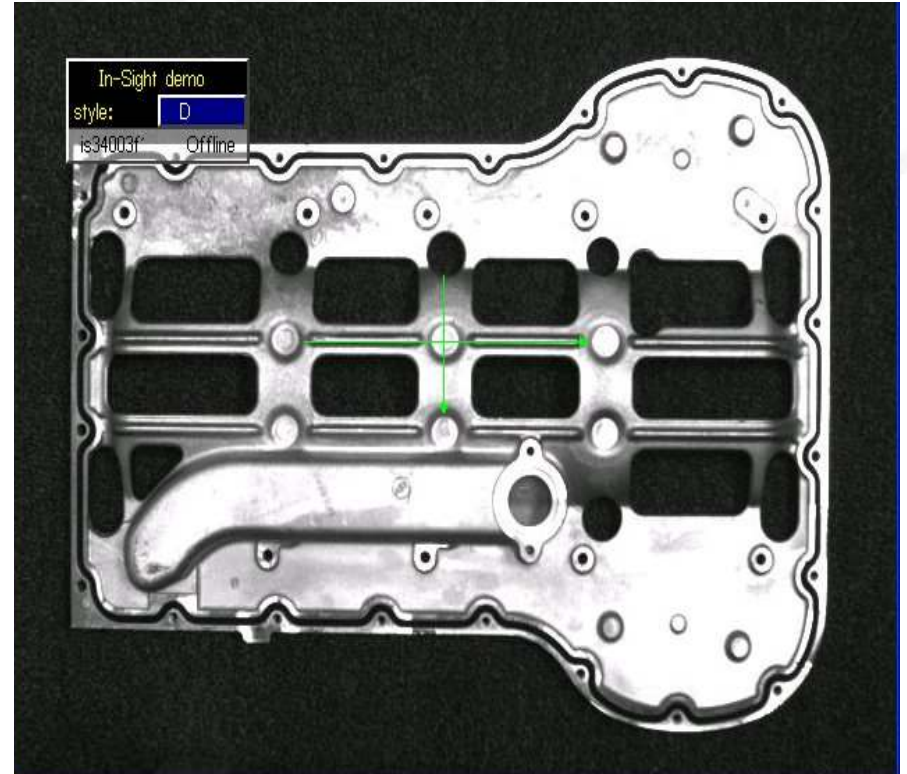
- Gauge Spark Plug Dimensions
  - Measure the major and minor diameters of spark plug threads
  - Accuracy must be 0.0535 mm or better
  - Dimensions must be read within 1 second



# Oil Pan Application



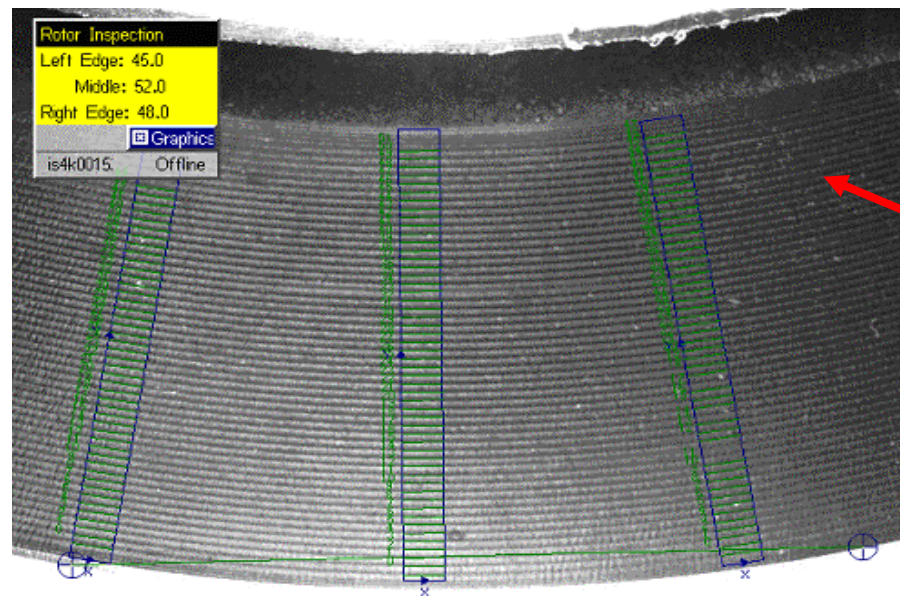
- Identify 4 different oil pan models
  - Parts will be presented to the vision sensor with  $\pm 1/4$ " positional uncertainty and  $\pm 3$  degree rotational uncertainty
  - Cycle time is 1 second



# Brake Rotor Inspection



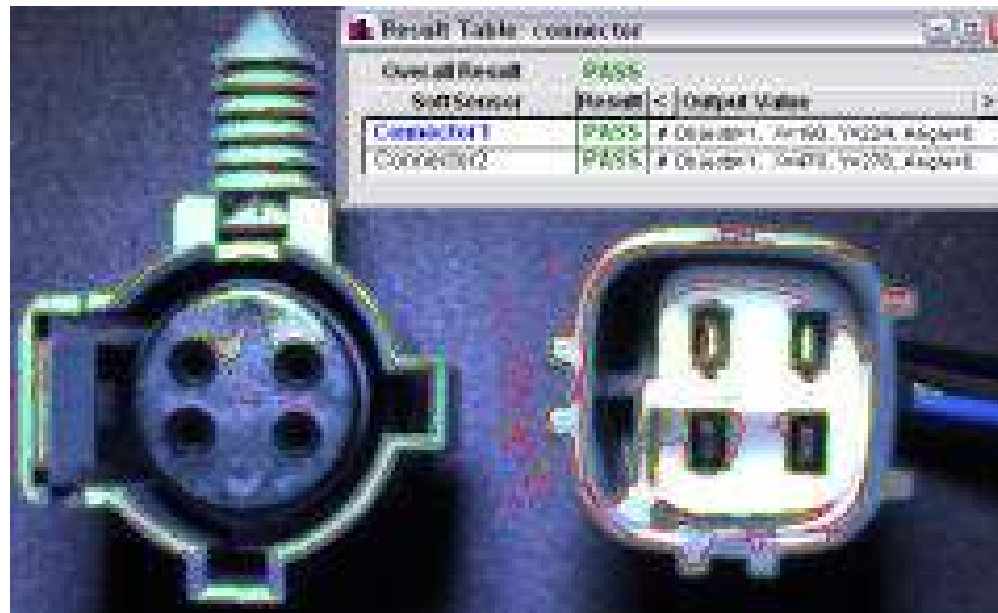
- Brake Rotor Grooves
  - Inspection of brake rotors for machined surface
  - The vision system must quantify the correct amount of grooves



# Automotive Connector



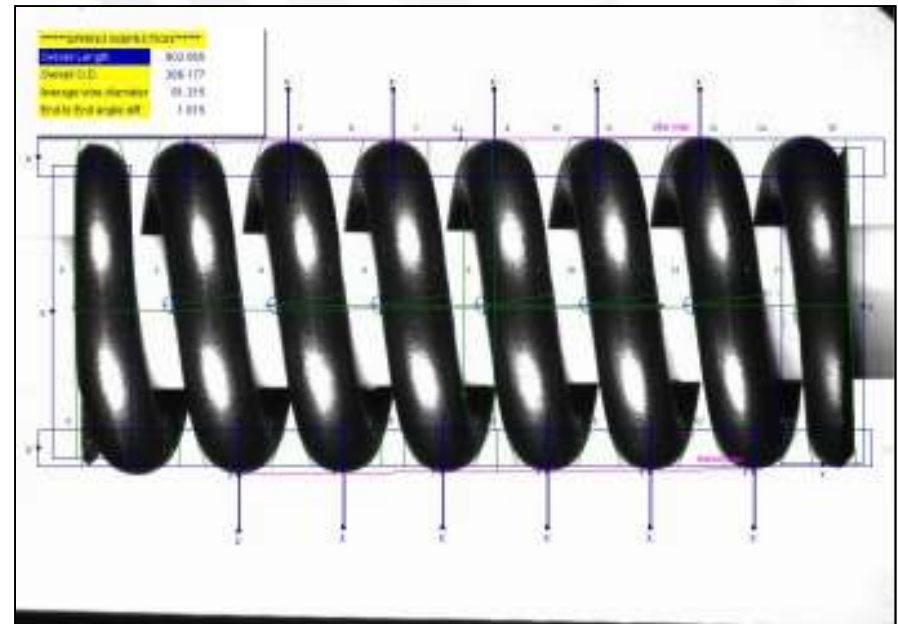
- Automotive Connector Feature Inspection
  - Verify correct insert in connector
  - 100% Inspection required



# Spring Gauging Application



- Three Fine Measurements Required
  - Measure the overall length, outside diameter, and wire diameter of springs
  - Tolerance for the measurements is 0.2 mm for length and diameter, and 0.5 mm for the wire diameter
  - A second camera looks at the end of the spring to measure characteristics of the chamfer and ground surface area.
  - Measure squareness of spring

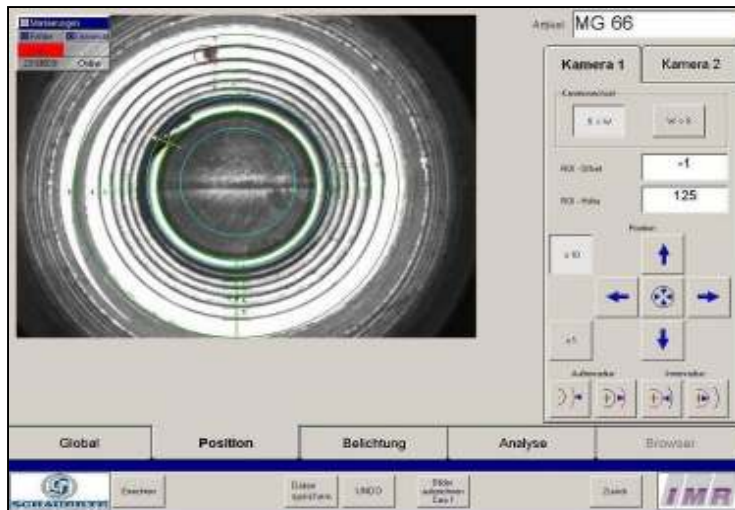
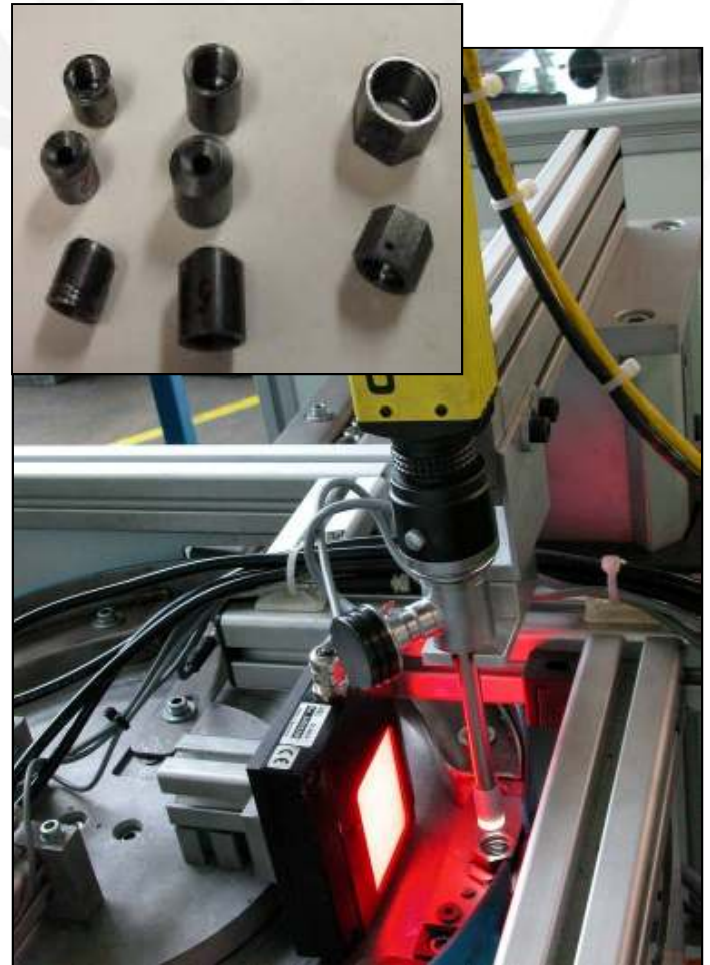


# Thread & Dimension Quality



- Application:
  - Quality Management in the manufacture of small components
- Benefit:
  - Improves companies image and reputation

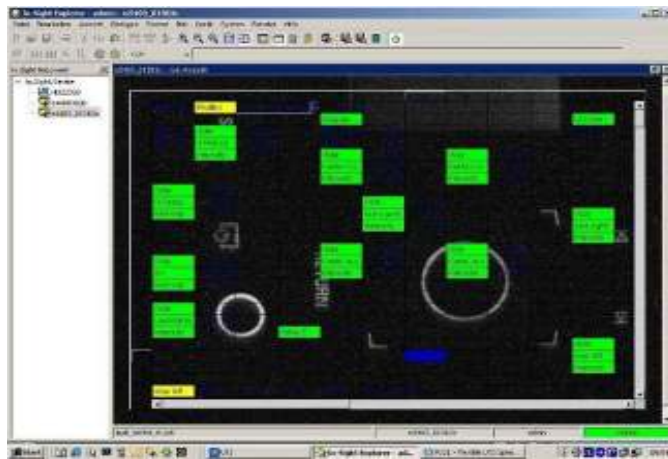
**g** Gauge



# Display Quality



- Application:
  - Control the quality of the displays and the buttons on navigation systems
- Benefit:
  - Provide a 100% product control
  - Increase manufacturing profit



# Tire Inspection



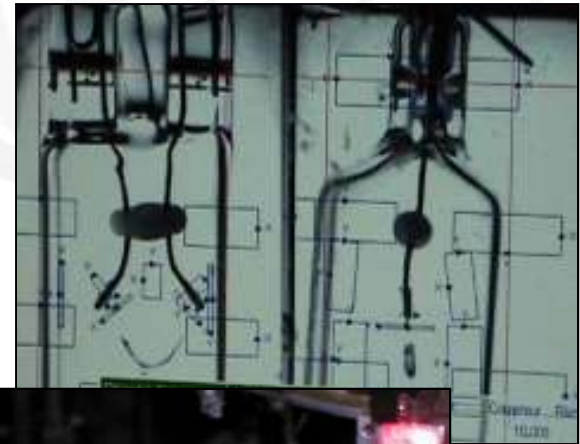
- Application:
  - Inspect the tires on the manufacturing line and measure any distortion with complete reliability
- Benefit:
  - Intercept the faulty tires and do this reliably



# Lighting System Quality



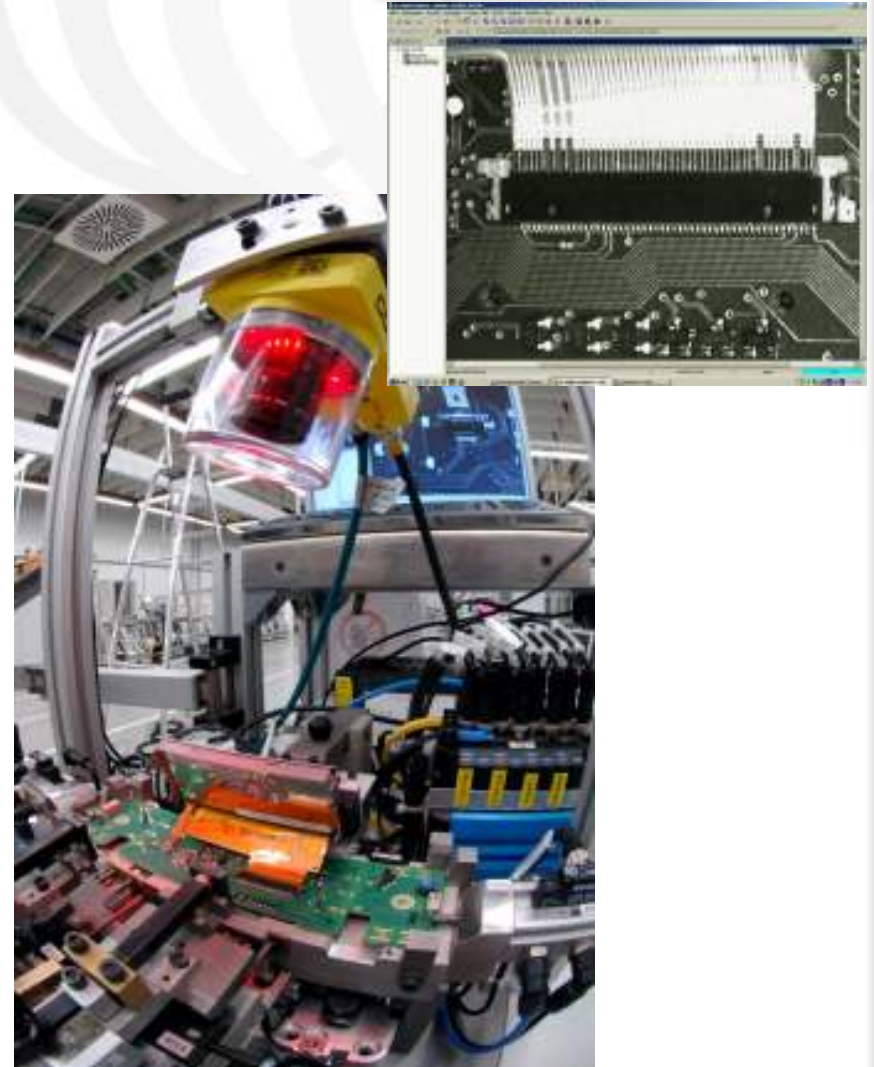
- Application:
  - Automotive lighting systems inspection
  - Production line must stay competitive
- Benefits:
  - High quality
  - Cost reduction
  - No need to be a vision expert
  - 100% quality control



# Circuit Board Connectors



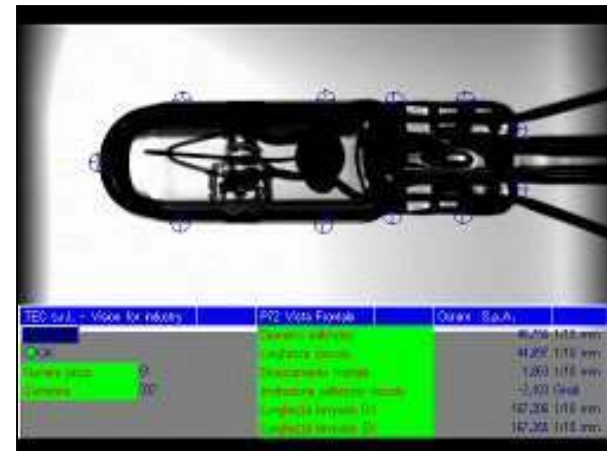
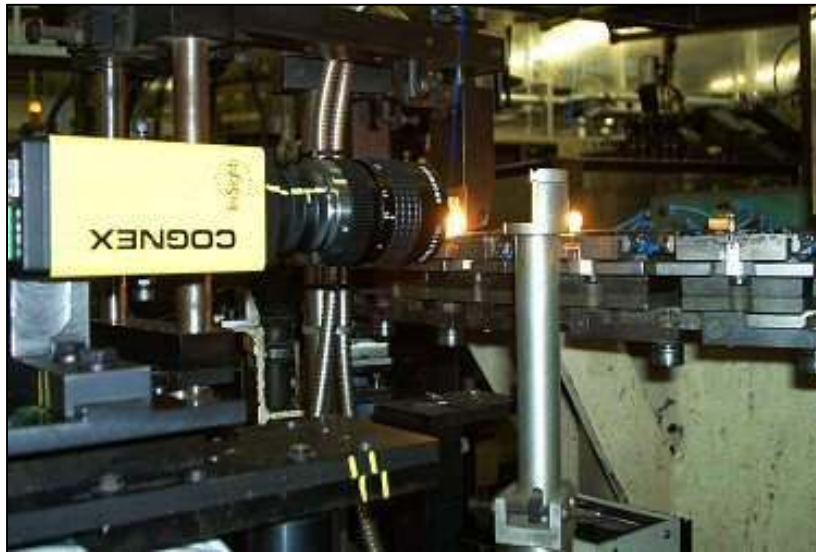
- Application:
  - Inspection of connectors on PCB's for navigation systems
- Benefit:
  - Robust and reliable solution to improve the product quality and reduce the production costs



# Precision Lamp Manufacturing



- Application:
  - System for inspecting lamp dimensions
- Benefit:
  - Process control, allows assembly automation



## Benefits of Machine Vision:



- Increase Productivity
- Trace Parts
- Boost Yields
- Enhance Product Quality
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