

# Advanced Defect Detection



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Product Marketing Manager

# Agenda

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**Introduction to Vision Applications**

**Overview of Markets**

**Defect Detection Considerations**

**Cognex Tools**

- **InspectEdge**
- **Flexible Flaw Detect**
- **Surface Flaw Tool**

**Application Examples**

**Summary**

**QA**

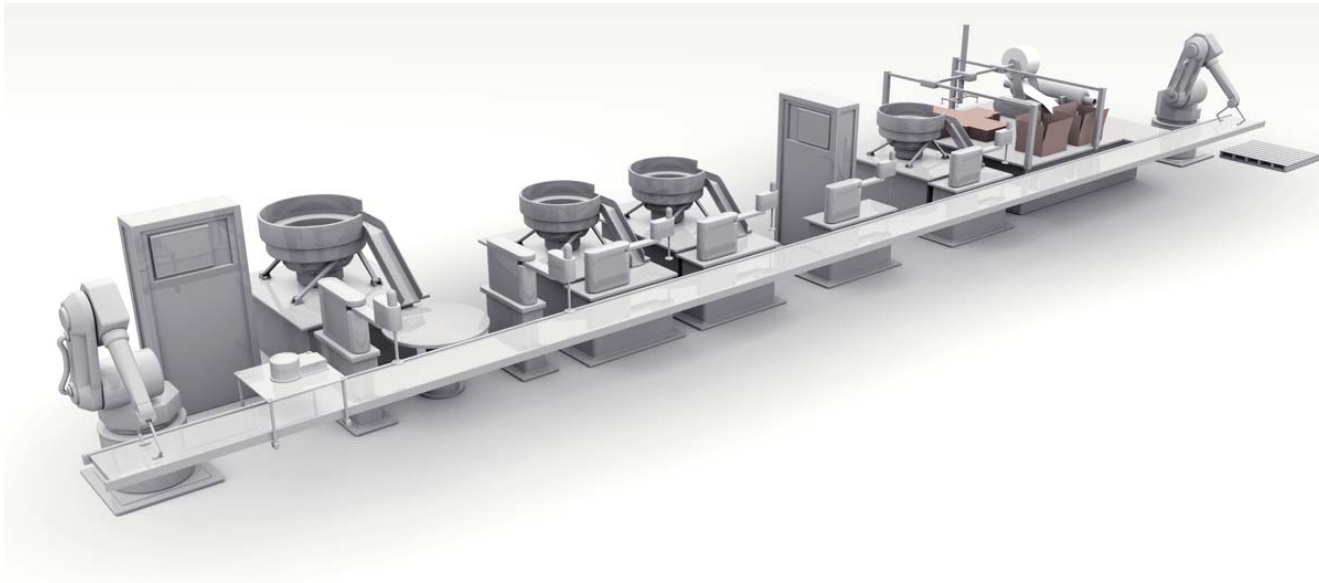
# High-Level Introduction

The Cognex logo is positioned at the bottom right of the slide. It features a horizontal bar with a yellow-to-white gradient on the left, followed by the word "COGNEX" in a bold, black, sans-serif font. Below the text, there is a faint, light gray reflection of the word "COGNEX" on a reflective surface.

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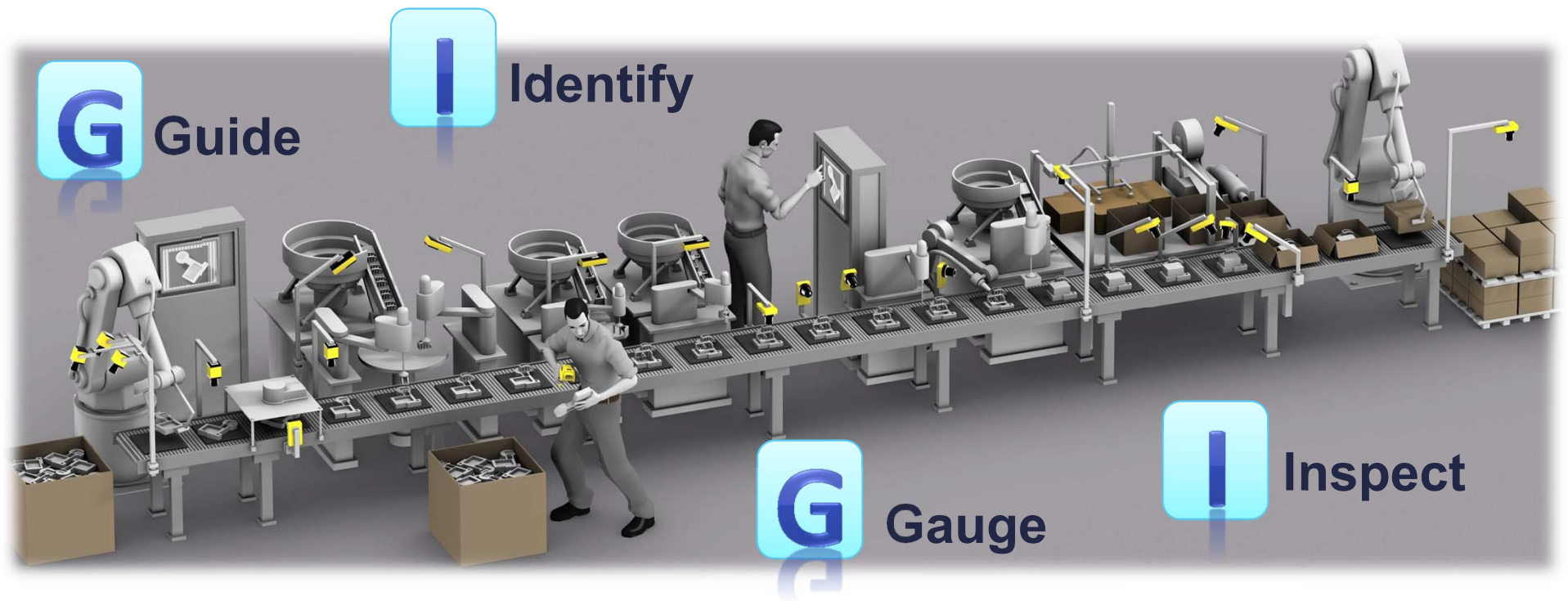
# What Does Machine Vision Do?

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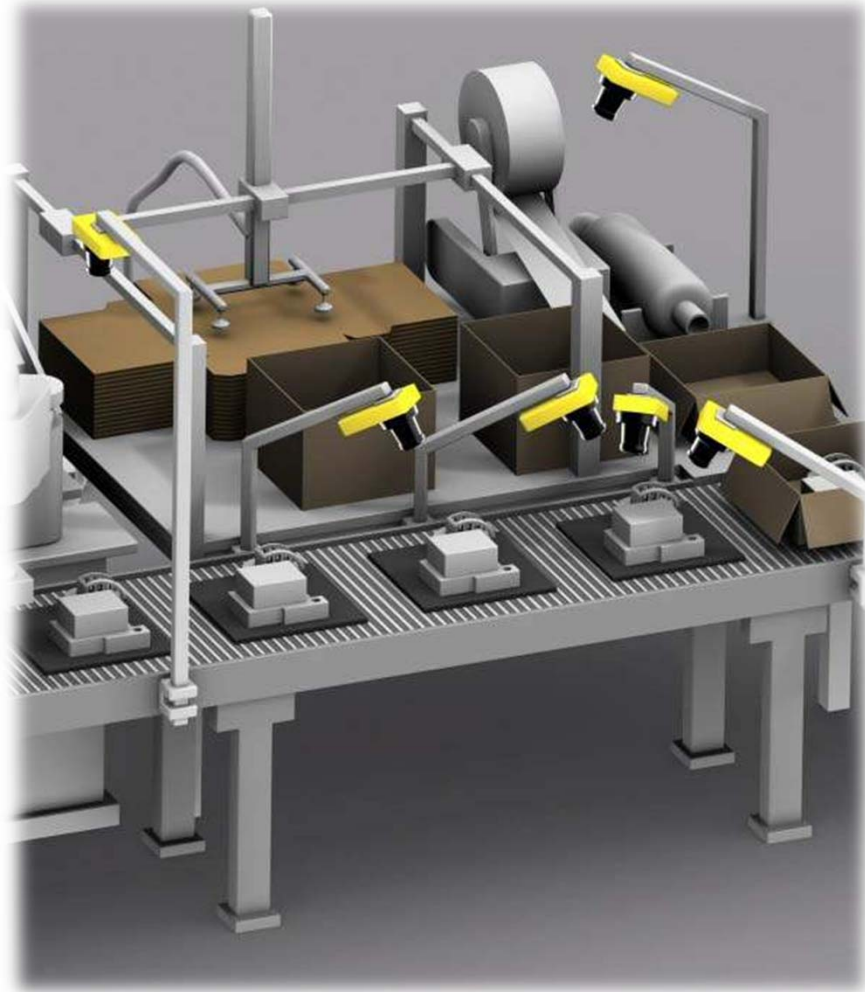
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# Think: GIGI



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# Inspection



## Completeness

- Fill Level
- Feature Presence
- Assembly Verification

## Correct Location

- Orientation
- Skew

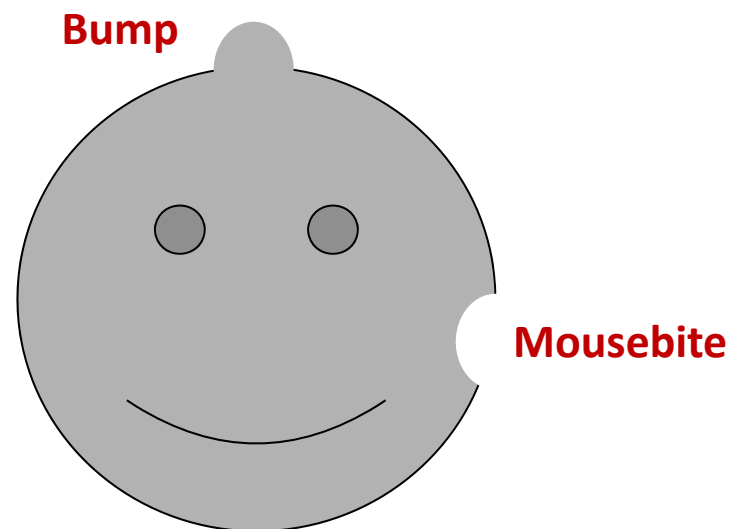
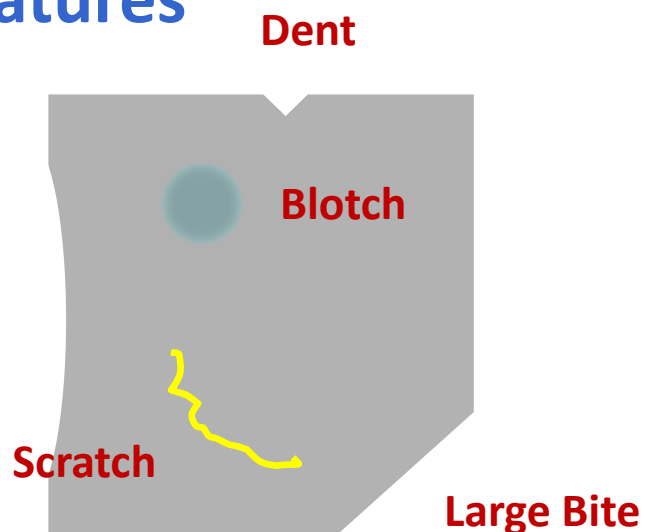
## Quality

- Part Defects
- Surface Inspection
- Contaminants

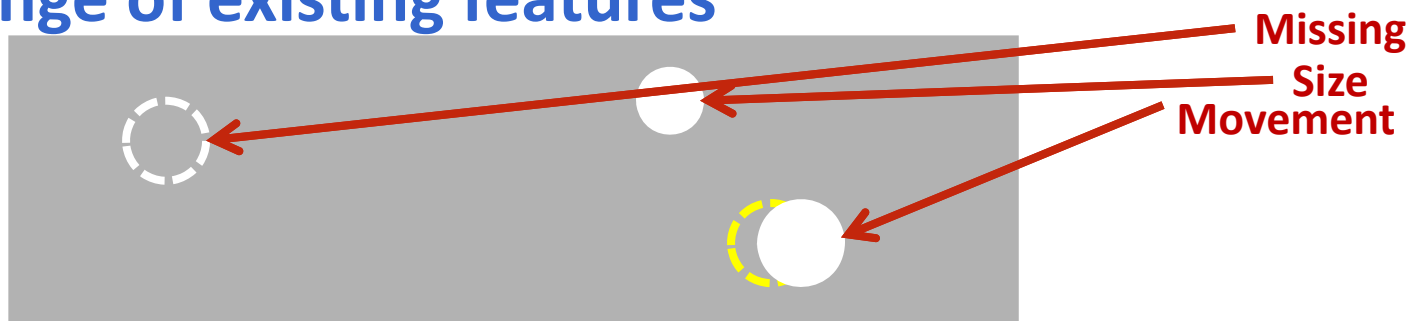
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# Defect Detection Applications

## Features



## Change of existing features

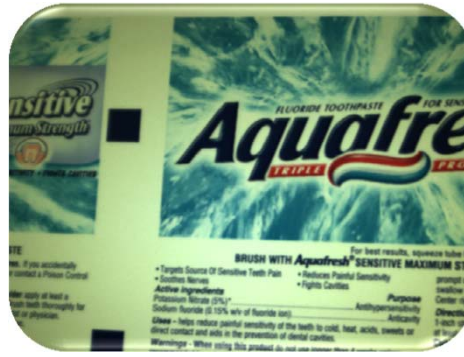


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# Who Needs Defect Detection?



**Automotive**



**Food & Beverage**



**Consumer Electronics**



**Plastics**



**Printing**

# Common Defect Detection Challenges

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1. Looking for 'Anything Anywhere'

2. Accounting for complex features

3. Process variation



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# Managing The Challenges

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## Manage the Application

- Define defects & constrain problem
- What is 'Anything' and 'Anywhere'?
- Understand the process variation

## Choose the Right System

- Optimize lighting and optics
- Flexible platform
  - Resolution and color
  - Processing speeds
- Robust, flexible and fast algorithms

# Cognex Defect Detection Tools

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# Cognex Tools

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## InspectEdge

- Min/max & gaps along a line path

## SurfaceFlaw Detection

- Surface imperfections with intensity variation

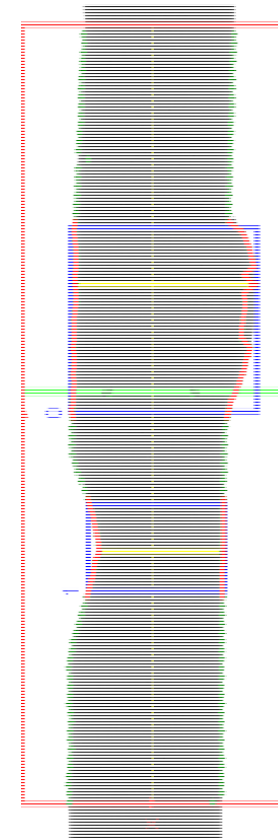
## Flexible Flaw Detect (FFD)

- Edge & area based inspection of shapes

# InspectEdge

## Advanced edge analysis to find features or defects

- Find Edges
- Reference “found” edges and inspect for:
  - Defects
  - Edge width
  - Position
- Train bead path to:
  - Account for variable positioning

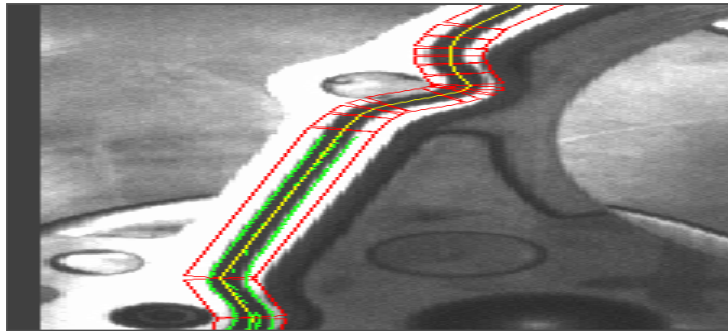


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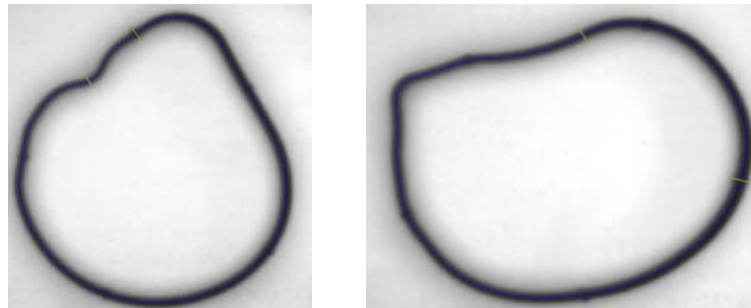
# InspectEdge

## InspectEdge accounts for:

- Complex shapes



- Process variation



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# Surface Flaw Tool

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**Advanced inspection which finds defects on surfaces with intensity variation**

- Select area and choose defect types
- Ignore unwanted features (as desired) with mask

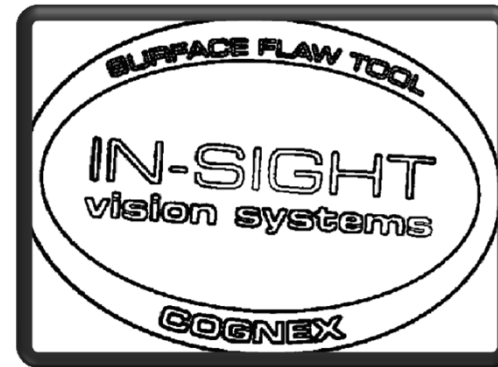


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# Surface Flaw Tool

## Surface Flaw Detection accounts for:

- Complex features



- Process intensity variation



No Variation



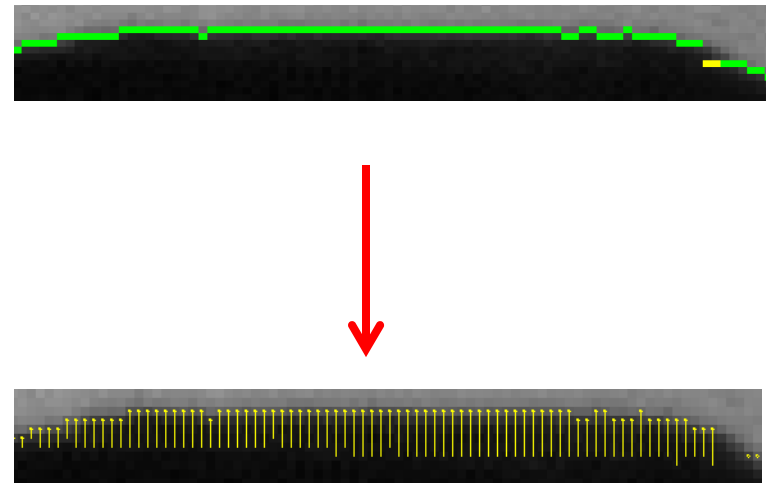
Intensity Variation

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# Flexible Flaw Detection (FFD)

## Advanced inspection tool to inspect shapes and patterns

- Train “Golden Image”
- Apply ‘Flex’ to edges
- Detect flaws, appropriate flaws
- Ignore features with mask



# Flexible Flaw Detection (FFD)

## Flexible Flaw Detection accounts for:

- Complex features



- Process variation

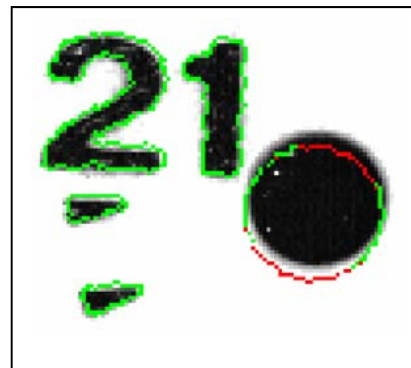


Figure 1 – Before Flex



Figure 2 – After Flex

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# Application Examples

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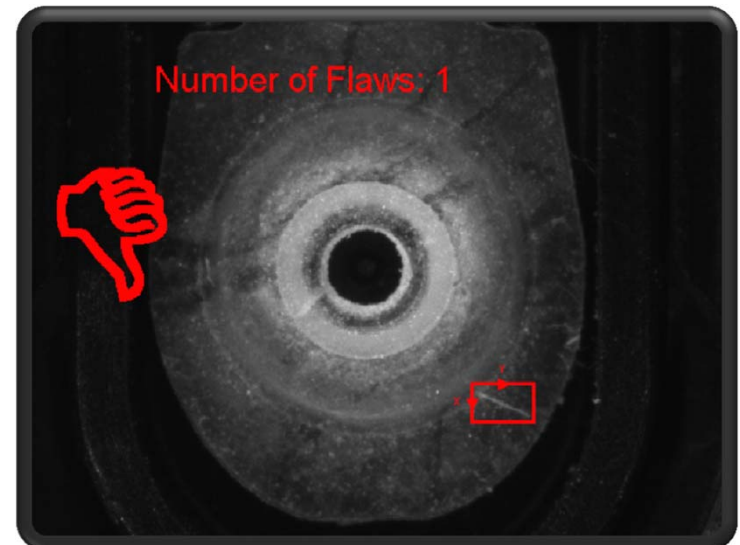
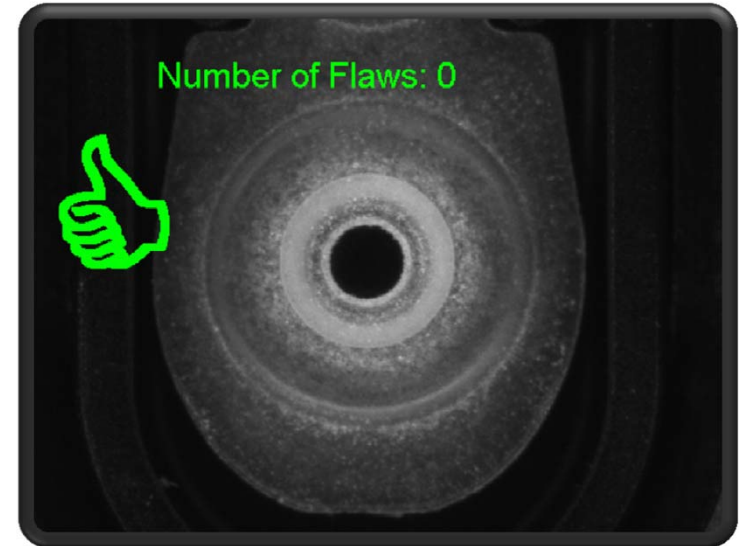
# Medical Device Application

## Application

- Part: Rubber Valve
- Detect Tears
- Detect Holes

## Challenge

- Noisy features
- Complex Edge-based features



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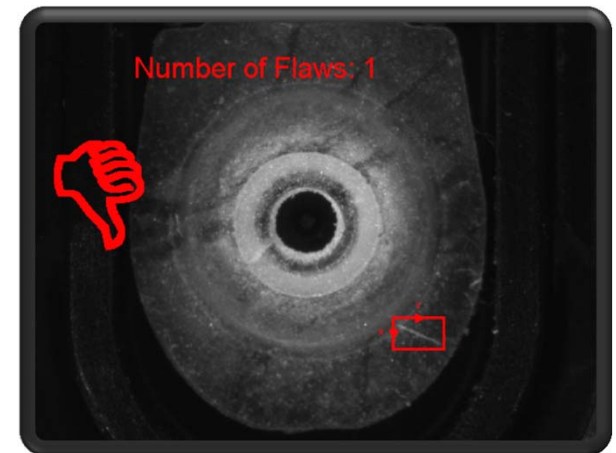
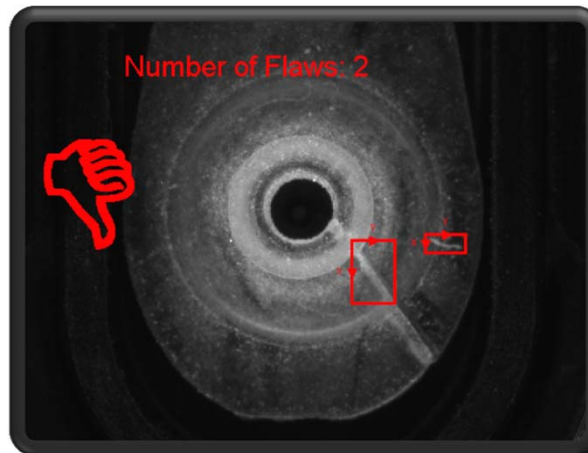
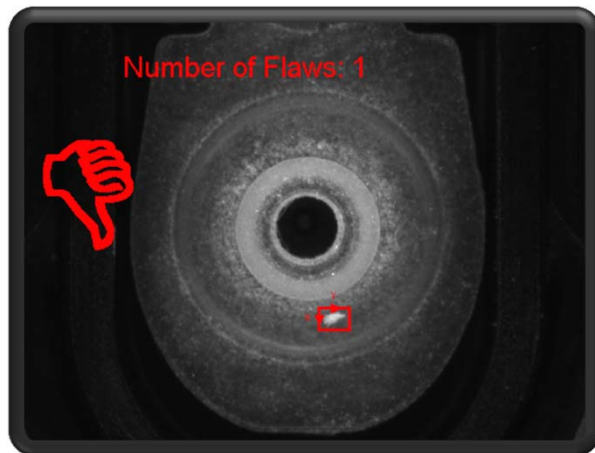
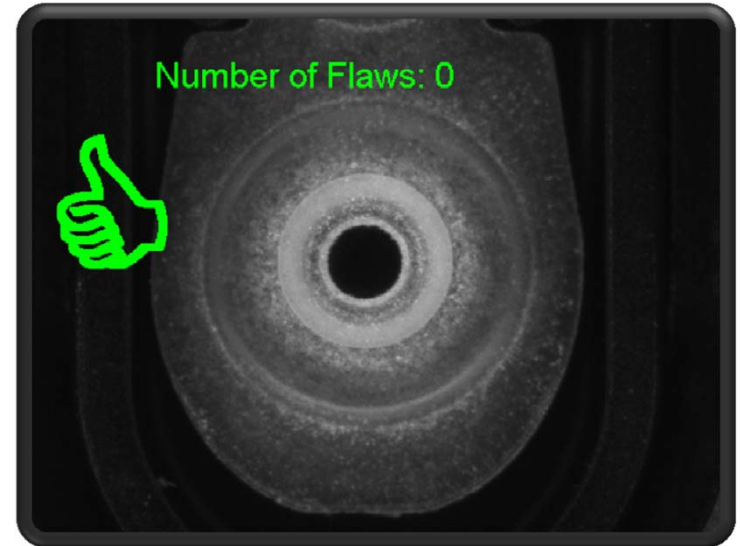
# Medical Device Application

## Application

- Part: Rubber Valve
- Detect Tears
- Detect Holes

## Solution

- Surface Flaw Detect



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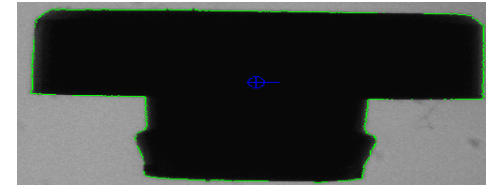
# Automotive Application

## Application

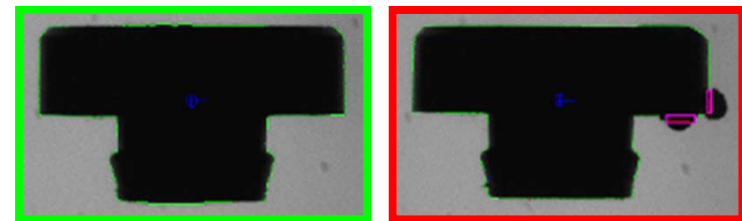
- Part: Gas Cap
- Detect Flash
- Detect Short-Shot

## Challenge

- Account for molding process variation



Gas Cap



Flash on Gas Cap

# Automotive Application

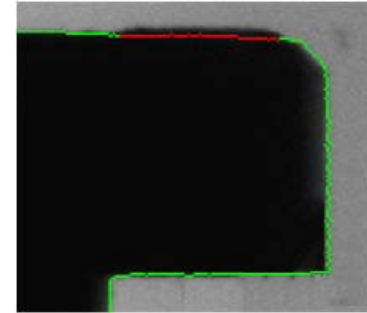
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## Application

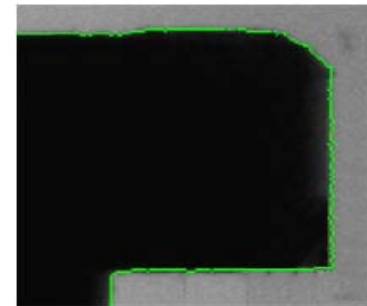
- Part: Gas Cap
- Detect Flash
- Detect Short-Shot

## Solution

- Flexible Flaw Detect



Normal process variation causes  
false reject without Flex



With Flex Applied

# Consumer Product Application

## Application

- Part: Pad Printed Label
- Detect Gross Printing Defects

## Challenge

- Print Positional Variation



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# Consumer Product Application

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## Application

- Part: Pad Printed Label
- Detect Gross Printing Defects

## Solution

- Flexible Flaw Detect



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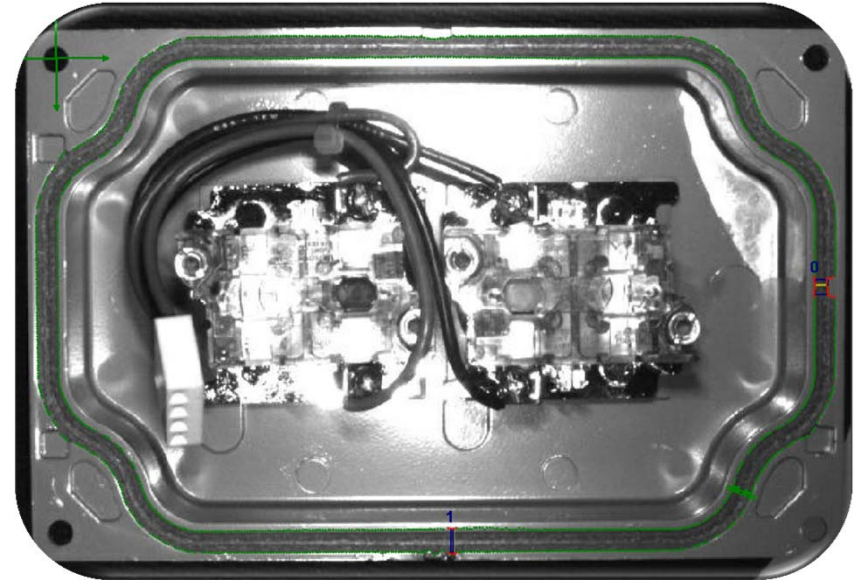
# Automotive Application

## Application

- Part: Assembled Gasket
- Confirm Gasket path
- Find defects

## Challenge

- Complex shape
- Reflective background



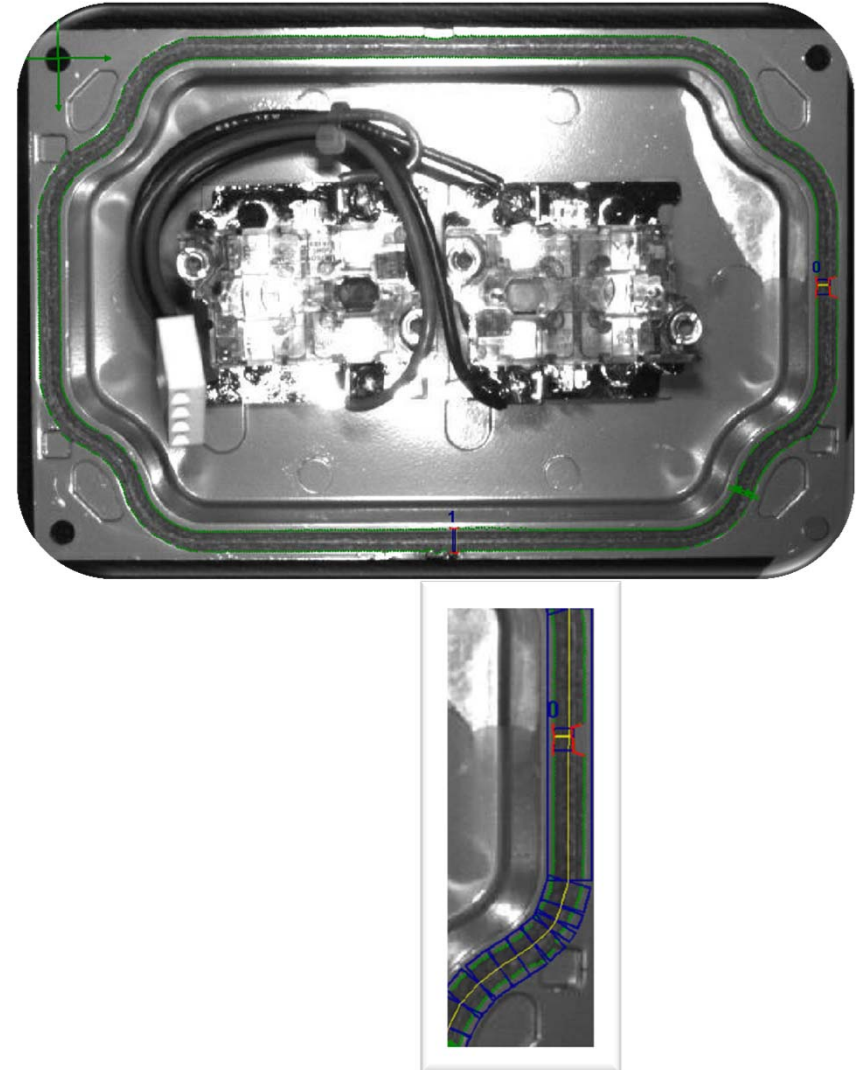
# Automotive Application

## Application

- Part: Assembled Gasket
- Find defects
- Confirm Gasket path

## Solution

- InspectEdgeWidth



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# Consumer Product Application

## Application

- Part: Blow molded plastic container
- Detect burn marks and other discoloration

## Challenge

- Ignore surface noise
- Discoloration Faint
- Varied color backgrounds



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# Consumer Product Application

## Application

- Part: Blow molded plastic container
- Detect burn marks and other discoloration

## Solution

- Color In-Sight
- Surface Flaw



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# Consumer Packaging Application

## Application

- Part: Label
- Detect defects and discoloration

## Challenge

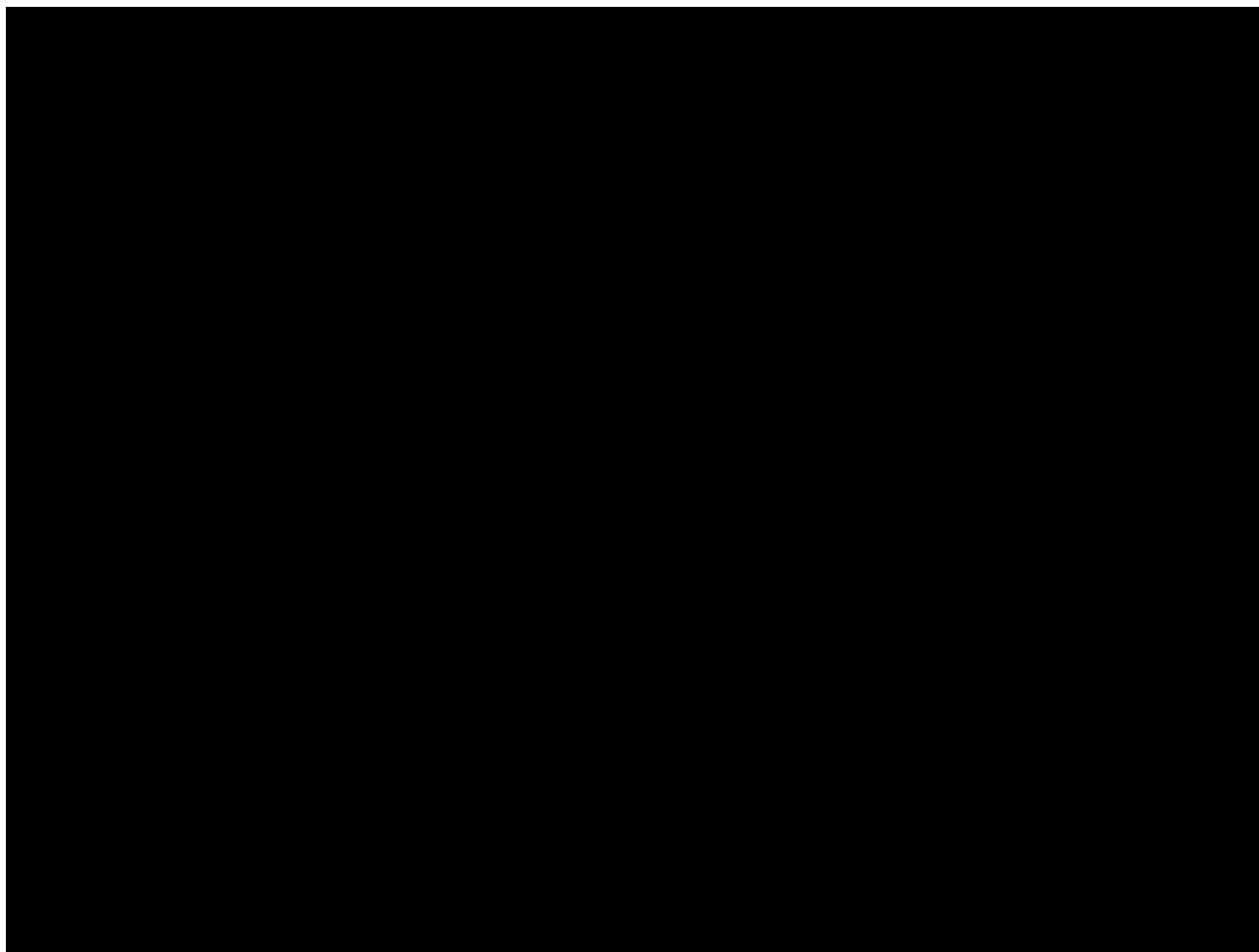
- Non-linear light intensity
- Color intensity variation slight
- Different defect colors
- Different background colors



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# Color Surface Flaw Demo

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# Automotive Application

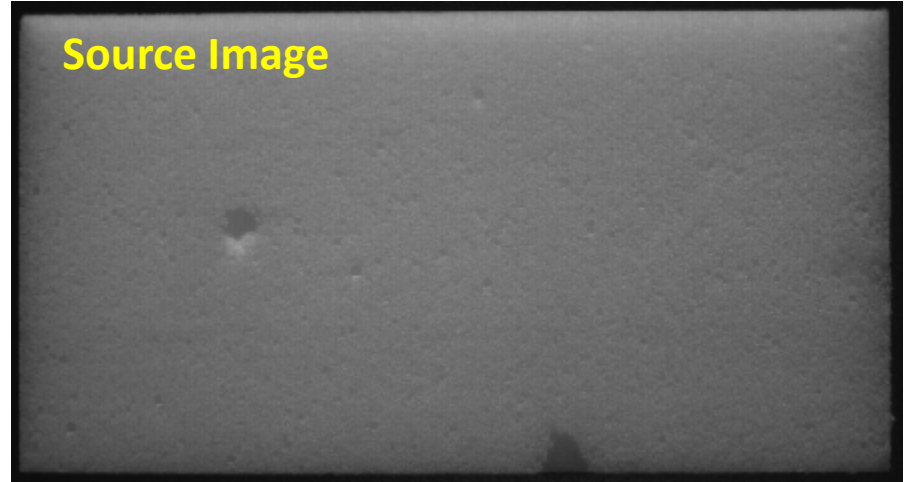
## Application

- Part: Engine Filter
- Find tears and damage

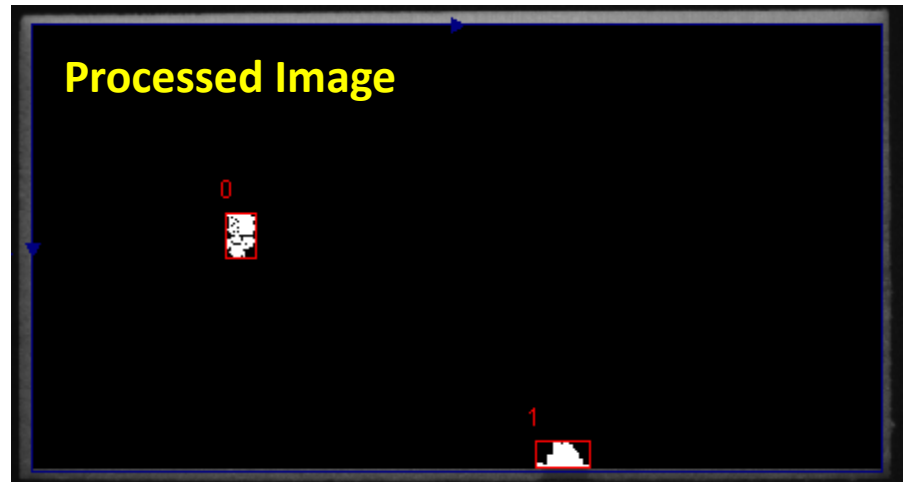
## Solution

- Flexible Flaw Detect

Source Image



Processed Image



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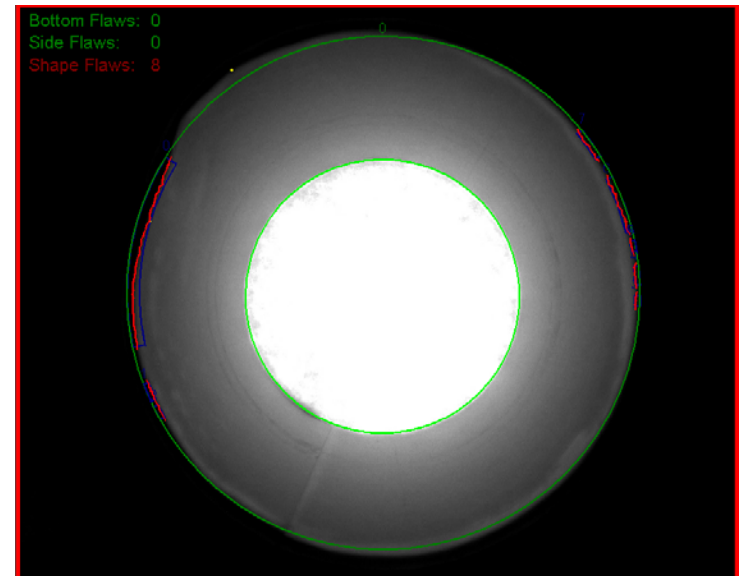
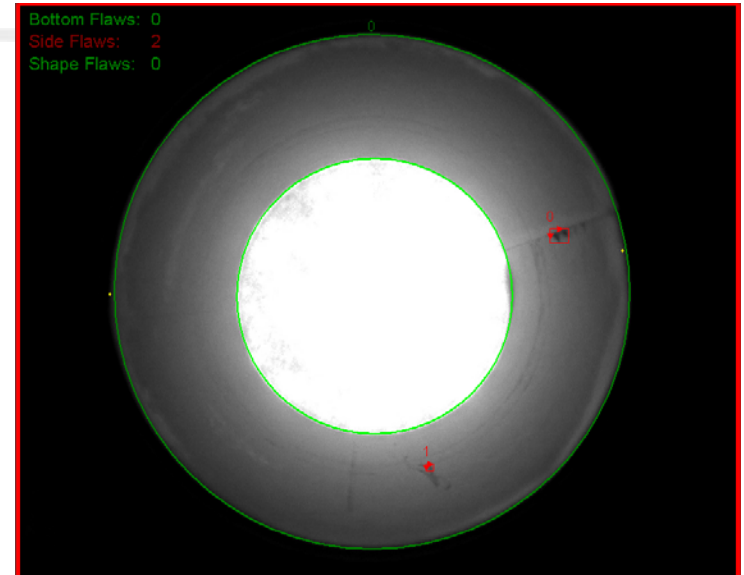
# Consumer Product Application

## Application

- Part: Paper Cup
- Inspect defects along the wall and bottom
- Confirm lip of cup correctly formed

## Solution

- InspectEdge
- Surface Flaw



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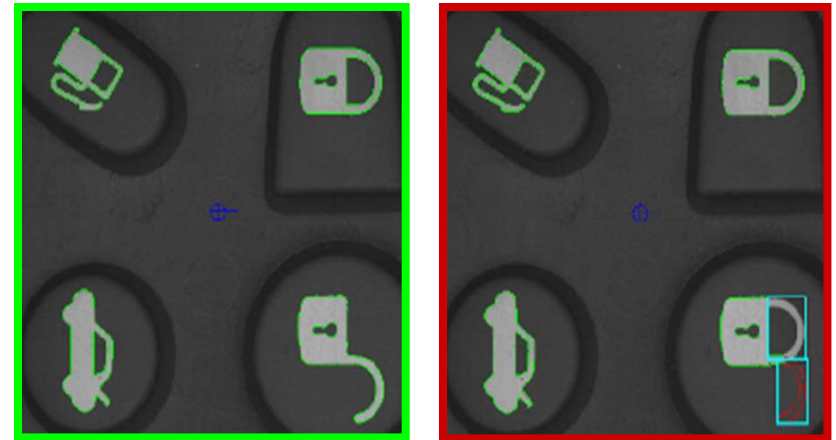
# Automotive Application

## Application

- Part: Automotive keypad
- Confirm placement of buttons

## Solution

- Flexible Flaw Detect



Auto Keypad Inspection

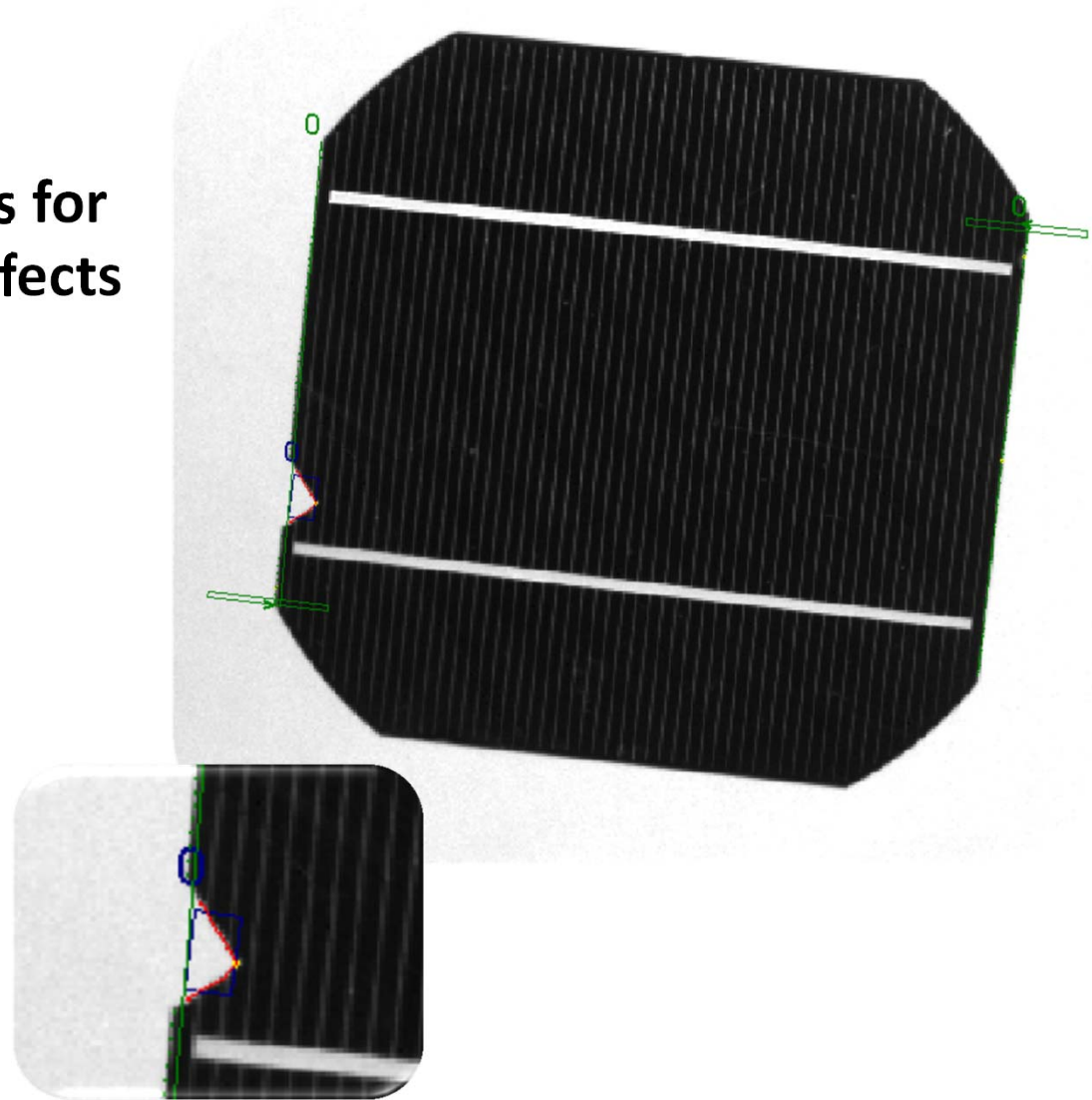
# Solar Application

## Application

- Inspect solar wafers for cracks, gaps and defects

## Solution

- InspectEdge



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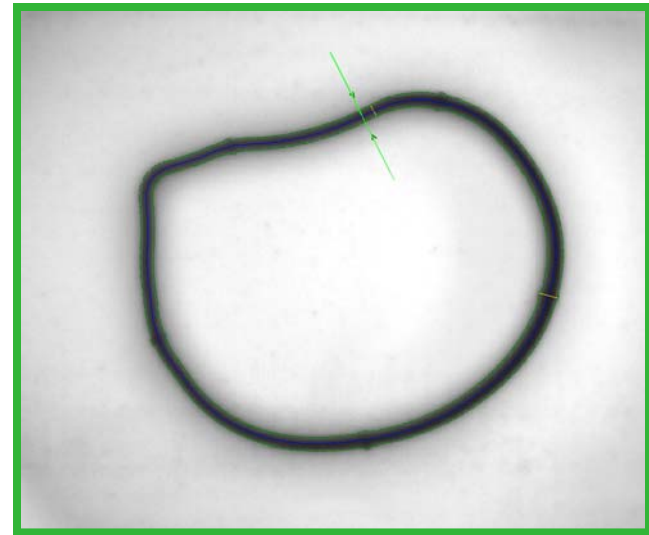
# Automotive Application

## Application

- Part: Flexible Rubber Gasket
- Find defects
- Allow for variable path

## Solution

- InspectEdgeTrainBeadPath
- InspectEdgeWidth



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# Summary

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## Defect Detection Considerations

- **Manage the Application**
  - Understand ‘anything’ and ‘anywhere’
  - Account for process variation
- **Choose the right system**
  - Optimized lighting and optics
  - Pixel resolution, color or grayscale
  - Powerful processing
  - Powerful, flexible and fast algorithms

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**Questions?**  
**Thank You!**