

# mvIMPACT Configuration Studio: Smart Software for Smart Cameras

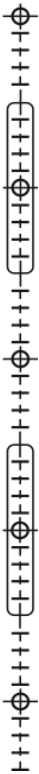


“Modern methods of recognition and processing of image information”  
5<sup>th</sup> annual workshop, Technical University of Liberec, 2017

Ingo Boesnach – MATRIX VISION GmbH – Germany

# MATRIX VISION

- manufacturer of industrial cameras, frame grabbers & imaging software
- located in Oppenweiler, 35 km northeast of Stuttgart
- approx. 90 employees
- approx. 40 developers (hardware & software)
- over 30 years in the computer vision industry



# Products



**GigE**  
VISION

**GEN i CAM**

**USB**  
VISION  
**GEN i CAM**





# mvBlueGEMINI

- 1/1.8" CMOS (grey/color) 1280x1024
- ARM dual-core CPU (800 MHz)
  - 1 GB DDR3 SDRAM
  - 4 FB FLASH memory
  - embedded Linux
- Altera FPGA
- MV I/O Board
  - power supply 12-24 V (< 5 W)
  - 6x I/O (trigger, flash, ...)
  - Gigabit Ethernet
  - Fieldbus (e.g. ProfiNET)
  - RS-232
- IP67 housing (lenses up to Ø38mm)
- size 99.5 x 65 x 39.6 mm



# Software Design



## *multi-platform*

- » run on smart camera, Windows/Linux PC
- » access via PC, tablet, smart phone



## *intuitive*

- » only a few steps to make an inspection



the Power of Machine Vision

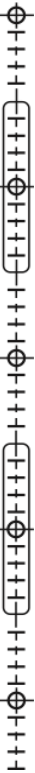
## *efficient*

- » high performance
- » high accuracy



## *extendable*

- » allows to include custom tools



# Configuration Mode

sequence  
of tools

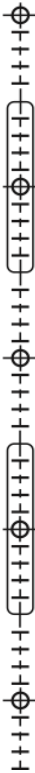
The screenshot shows the MATRIX VISION software interface in Configuration Mode. The top navigation bar includes buttons for 'Schleife' (Loop), 'Einzelauf' (Single Run), and 'Weiter' (Next). The left sidebar contains a sequence of tool buttons: 'Kamera einrichten', 'Bild aufnehmen', 'Code lesen', 'Objekt finden', 'Objekt prüfen', 'Tool einfügen ...', and 'Ergebnisse senden'. The central image view displays a camera module with a green bounding box around a component labeled 'BC-X102eG Rev.1.04'. The bottom results table shows the following data:

M	Name	Wert	Soll...	-Tol	+Tol
<input type="checkbox"/>	Ergebnis	OK			
<input type="checkbox"/>	Ergebnisnachricht				
<input type="checkbox"/>	Fehlerbit	falsch			
<input type="checkbox"/>	Größe des größten Defekts	0			
<input checked="" type="checkbox"/>	Bereiche mit kritischen Defekten				
<input checked="" type="checkbox"/>	Bereiche mit kleinen Defekten				

flow control

image view  
and  
configuration  
of selected  
tool

results of  
selected tool



# Find Multiple Objects

The screenshot displays the mvIMPACT-CS software interface. At the top, there is a navigation bar with a 'Configuration' dropdown menu and three control buttons: 'Loop' (with a circular arrow icon), 'Run Once' (with a play icon), and 'Step' (with a right-pointing arrow icon). Below this, the main workspace is divided into several sections. On the left, a 'Pick PCB boards' section contains three buttons: 'Set up camera', 'Get image', and 'Insert a new tool ...'. The 'Insert a new tool ...' button is currently active, showing a plus sign. The central workspace is empty, with a toolbar at the top containing icons for zooming and other functions. On the right side, a 'Manual' dropdown menu is visible, followed by a section titled 'Insert a new tool' which lists several options: 'Train tool parameters with wizard', 'Set tool parameters manually', 'Delete tool', 'Acquire image continuously', 'Acquire only one image', and 'Continue with the next tool'. At the bottom of the interface, a 'Results - Insert a new tool ...' section contains a table with the following columns: 'Name', 'Value', 'Nominal', '- Tol', and '+ Tol'. The table is currently empty.

# Measure

The screenshot displays the MATRIX VISION mvIMPACT-CS software interface. The main window shows a camera feed of a dark, textured object with a green bounding box and a small red circle indicating a measurement point. The interface includes a left sidebar with 'Objekt finden' and 'Tool einfügen...', a central image window with a green bounding box and a small red circle, and a right sidebar with 'Objekt finden' instructions and 'Ergebnisse'.

**Ergebnisse**

Name	Wert	Sollwert	- Tol	+ Tol
Toolverarbeitung	Erfolgreich			
Ergebnisnachricht	Zusatzinformationen und Hinweise zur Fehlerursache			
Ausführungszeit	Zeit der Toolausführung in Millisekunden			
Anzahl gefundener Objekte	1	1	0	
Verschiebung in Richtung X [px]	57,164			

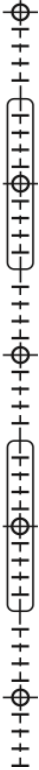


# Read Text & DataMatrix

original size



zoomed



# Read DataMatrix

The screenshot displays the MATRIX VISION software interface. The main window shows a live video feed of a Listerine Total Care Sensitive mouthwash bottle. The software has successfully read a DataMatrix code on the bottle. The interface includes a top navigation bar with 'Schleife', 'Einzellauf', and 'Weiter' buttons. On the left, there is a 'New program' section with options like 'Kamera einrichten', 'Bild aufnehmen', and 'Tool einfügen...'. On the right, a 'Handbuch' (manual) section provides instructions for 'Kamera einrichten' and 'Ergebnisse'. At the bottom, an 'Ergebnisse' (results) table shows the following data:

Name	Wert	Sollwert	- Tol	+ Tol
Toolverarbeitung	Erfolgreich			
Ergebnisnachricht				
Ausführungszeit [ms]	39,675			

# Read & Verify Text

The screenshot displays the MATRIX VISION software interface. The main window shows a camera feed of a Listerine bottle with a blue bounding box around the label. The label text is: "Milder im Geschmack", "Rundumschutz für schmerzempfindliche Zähne", and "LISTERINE TOTAL CARE SENSITIVE". The software interface includes a left sidebar with buttons for "Kamera einrichten", "Bild aufnehmen", "Code lesen", and "Tool eingefügt...". The top bar has "Schleife", "Einzelbild", and "Weiter" buttons. The right sidebar shows a "Konfiguration" panel with instructions and a "Seitenmenü" with options like "Kontinuierlich Bilder aufnehmen", "Ein einzelnes neues Bild aufnehmen", and "Zum nächsten Tool wechseln". The bottom panel shows a table of results.

Name	Wert	Sollwert	- Tol	+ Tol
Toolverarbeitung	Erfolgreich			
Ergebnisnachricht				
Ausführungszeit [ms]	535,909			
Anzahl gefundener Codes	1	1	0	
Ergebnisbereich	[ 900,242 , 609,345 , 38,4 , 42,803 , 327,335* ]			

# Monitor Mode

timeline  
of  
inspections

The screenshot displays the 'Monitor' window of the MATRIX VISION software. The top bar includes 'Start', 'Stop', and 'Neu' buttons, along with the MATRIX VISION logo. The main area is divided into three sections:

- Inspection Timeline (Left):** A list of inspection results from #1115 to #1125. Each entry shows a date (01.01.1970), a time (03:59:12 or 03:59:13), and a duration in milliseconds. The entry for #1121 is highlighted in green, indicating it is the selected inspection.
- Image View (Center):** A live image of a camera module. A red pen is pointing to a label that reads 'BC-X102eG Rev. 1.04 Made in Germany MATRIX VISION'. A scale bar at the top of the image shows '64.160156'.
- Results Table (Bottom Right):** A table titled 'Ergebnisse' showing the results for the selected inspection (#1121).

Tool	Name	Wert
Objekt prüfen	Ergebnis	
Objekt prüfen	Größe des größten Defekts	1526

results of  
selected  
inspection

# Monitor & Reports

**Systemeinstellungen**

System: FTP-Server: ftp://192.168.65.230  
Benutzer: test  
Passwort:   
OK Berichte exportieren:   
NOK Berichte exportieren:   
OK Bilder exportieren:   
NOK Bilder exportieren:   
Dateinamen-Präfix: report  
Verbindung: **Test**

Neu starten Schließen

**Berichte**

Auf dieser Seite kann konfiguriert werden, ob Berichte und Bilder exportiert werden sollen, sowie deren Speicherort.

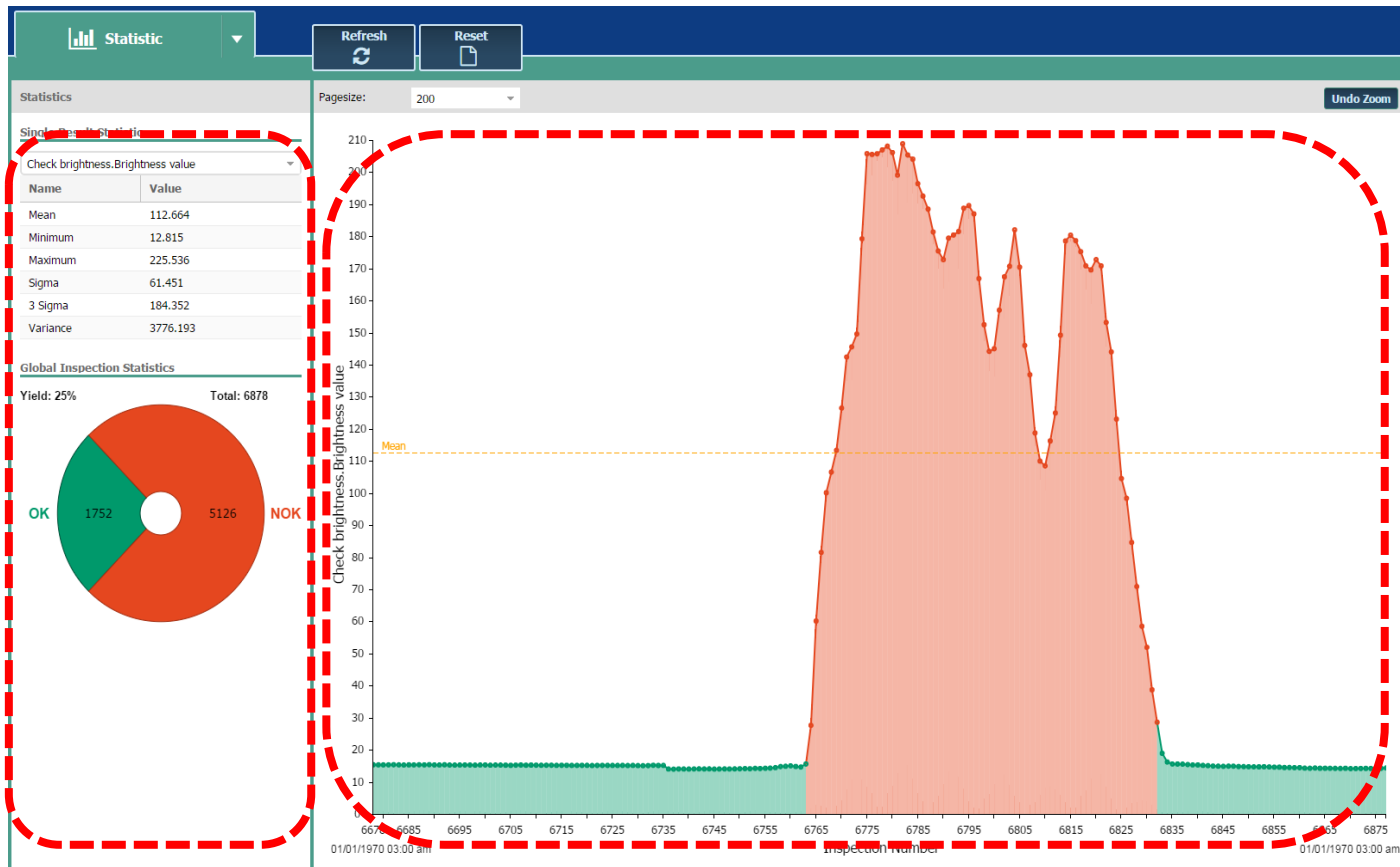
Name	Description
FTP-Server	Die IP-Adresse oder die URL (beides beginnend mit ftp://) des Servers auf dem die Berichte abgelegt werden.
Benutzer	Der Name des FTP-Benutzers.
Passwort	Das Passwort des eingestellten FTP-Benutzers.
OK/NOK-Berichte/Bilder exportieren	Legt fest, ob Berichte und/oder Bilder im Falle von erfolgreichem und/oder fehlgeschlagenem Zugriffsergebnis gespeichert werden sollen.
Dateinamen-Präfix	Wenn Datenamen über Berichte- bzw. Bilddaten wird der hier festgelegte Präfix verwendet.
Verbindung	Startet einen Verbindungstest zum eingestellten FTP-Server mit den eingestellten Logindaten.

**Ergebnisse**

Tool	Name	Wert	Sollwert	-Tol	+Tol
Code lesen	Enthalbener Text	632060			
Text lesen	Ausgabebet	632060			



# Statistics Mode



statistics of all inspections

history of the last 1000 inspections

# Monitor & Statistics

The screenshot displays the Matrix Vision software interface. On the left, a 'Monitoring' panel shows a list of inspection results with columns for ID, date/time, and duration. The current result is #7419. The central area shows a live image of a mechanical part with green measurement lines and a magnification of 61.07%. The bottom right features a 'Results' table with columns for Tool, Name, Value, Nominal, - Tol, and + Tol.

Tool	Name	Value	Nominal	- Tol	+ Tol
Measure object	Distance[line line] [mm]	63.306	62.991	1.73	1.73
Measure object	angle [°]	-112.843	-112.853	10	10
Measure object	Distance[line line] 2 [mm]	23.594	23.57	1.73	1.73

# Tools & Applications

- setup of camera
- find
- check
  - variation
  - brightness
  - focus
  - color
- measure
- read
  - code
  - text
- digital I/O
- data input
- result output



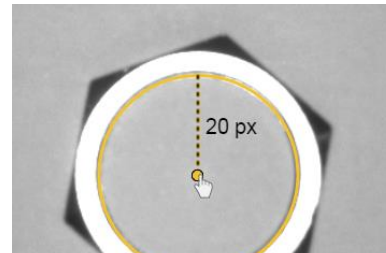
Quality assurance



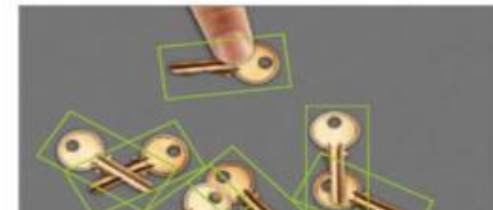
Identification



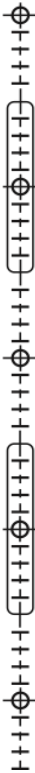
Pick & Place



Measuring

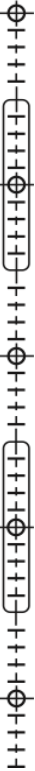


Sorting & Counting



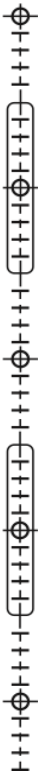
# Communication

- HTTP / TCP
  - network discovery via Avahi / Bonjour
  - configuration via web browser (multi-client)
- I/Os
  - e.g. trigger, flash and real-time control of actors
- Fieldbus, UDP & RS-232
  - send/receive results of an inspection (customizable)
- FTP reports
  - send results as XML + images (customizable)
  - human readable and printable (e.g. PDF)
- Upload
  - new firmware
  - custom tools



# Simplicity

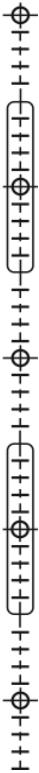
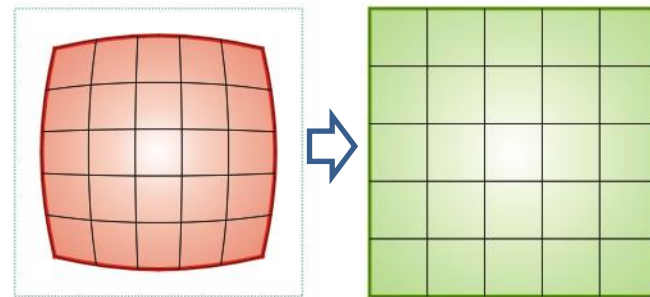
- Easy and intuitive access
  - web browser only, no installation required
  - runs on PCs and mobile devices
- Easy to use and understand configuration
  - high-level tools (e.g. find, measure, read, check, count ...)
  - simple UI, only a couple of parameters
  - complex algorithms automatically find best parameters





# Efficient Hardware

- CPU with NEON® Advanced SIMD extension
- FPGA with
  - debayering (color sensor)
  - lens calibration (rectification)
  - automatic white balance
  - JPEG compression (web browser)
  - realtime I/Os
- SoC with fast internal data transfer



# Efficient Software

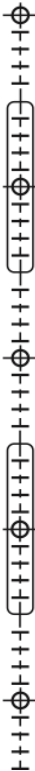
*HALCON* imaging library by MVTec

- comprehensive, fast and stable algorithms
- optimized for mvBlueGEMINI  
i.e. multi-core and SIMD

Algorithms by Matrix Vision

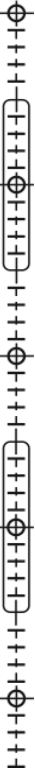
- implement wizards
- automatically decide on suitable parameters
- perform smart imaging based on *Halcon* library

*powered by*  
**HALCON**



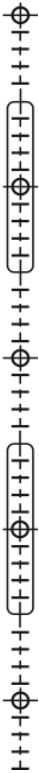
# Expandability

- Use arithmetic & logic operations to combine results from different tools as a new input
- Create custom tools to add features
  - imaging algorithms
  - new communication
- Connect custom tools to existing tools
  - create new results
  - use results from previous tools
  - write results to build-in statistics and/or to FTP server
- Integrate with third-party systems
  - add your own C/C++ libraries
  - support new communication protocols



# Expandability

- Use the mvIMPACT-CS framework for custom tools
  - data structures
  - server-client communication
  - user interface
  - ...
- Use the included *HALCON* library for custom tools
  - image preprocessing
  - Matching
  - blob analysis
  - 3D vision
  - ...



# Thank you – Questions?

## Further information

<http://www.matrix-vision.com>

<http://www.smart-vision-software.com>

## Contact information



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