alfamation
an inTEST Company
MEMBER of EPIC
OPTICA CORPORATE MEMBER

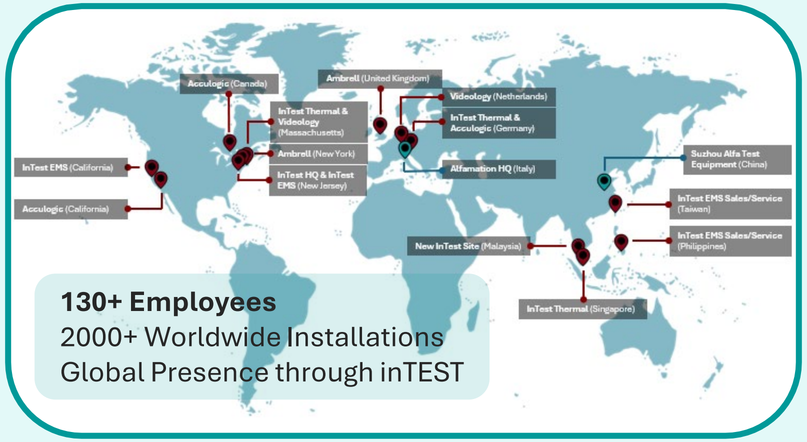
Functional Testing of Micro-Optics for Automotive™

Micro-optics
SUMMIT & EXPO
Amsterdam
2nd & 3rd December 2024

Simone Francavilla
Project Leader and Product Manager

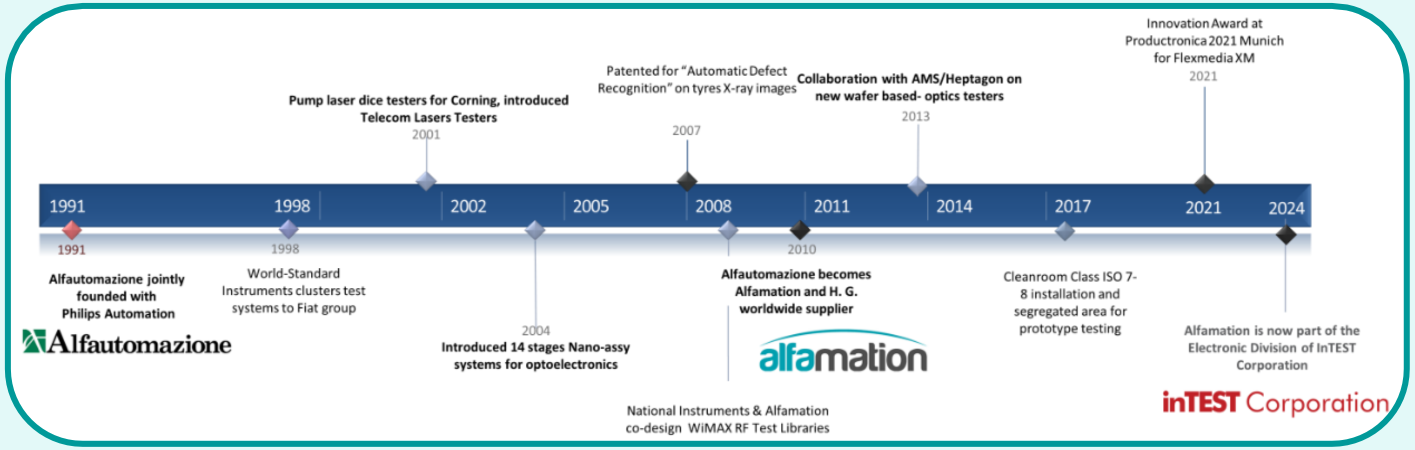
Alfamation - 33 years of expertise

Headquarters in Lissone (MB)
Italy
Part of inTEST Corp. (NJ USA)
NYSE: **INTT**



130+ Employees
2000+ Worldwide Installations
Global Presence through inTEST

- Strong R&D and Engineering
- Expertise in Optics
- Deep knowledge in Image Processing
- Experience in Optoelectronics and Photonics



1991
Alfautomazione jointly founded with Philips Automation

1998
World-Standard Instruments clusters test systems to Fiat group

Pump laser dice testers for Corning, introduced Telecom Lasers Testers
2001

2004
Introduced 14 stages Nano-assy systems for optoelectronics

Patented for "Automatic Defect Recognition" on tyres X-ray images
2007

National Instruments & Alfamation co-design WiMAX RF Test Libraries

2010
Alfautomazione becomes Alfamation and H. G. worldwide supplier

Collaboration with AMS/Heptagon on new wafer based- optics testers
2013

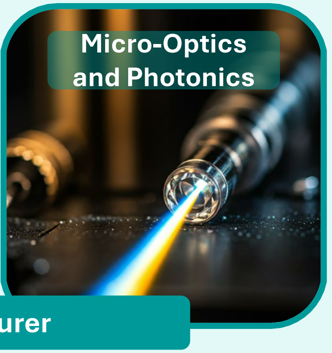
Cleanroom Class ISO 7-8 installation and segregated area for prototype testing

Innovation Award at Productronica 2021 Munich for Flexmedia XM
2021

Alfamation is now part of the Electronic Division of InTEST Corporation


Consumer Electronics


Automotive Infotainment


Micro-Optics and Photonics

Diversified Global Manufacturer

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- RF & Wireless
- Infotainment & Telematics
- 5G and V2X

- Consumer Electronics
- Displays
- PCBA Functional Test

- Audio Amplifier Test
- 32 Simultaneous Audio Channel Testing

Hyperion™ Common Test Platform

flexmedia XM

MULTIPLE INSTRUMENTS, ONE FAMILY

- Specialty Test Modules
- Audio-Video Generators/Analyzers
- Camera Simulators
- Ethernet-powered, OS-Agnostic

BATTERY MANAGEMENT PCBA TEST

Single-Site Drawer

Dual-Site Turntable

Dual-Site Drawer

Pixelshooter^{TM} Automated Display Tester

WALOT

WAfer-Level-Optics Tester

For High-Volume Manufacturing

What makes a good Automated Test Equipment?

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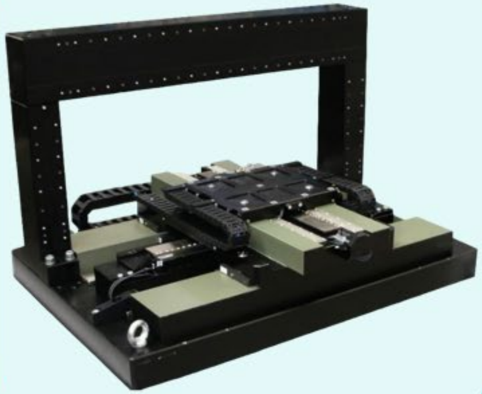
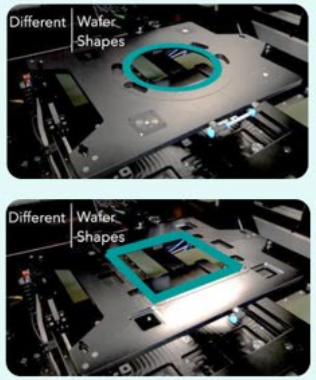
Cost Optimization

- No well-established standard to refer to
- Multiple variants of the “same” product
- Different devices, different shapes and sizes

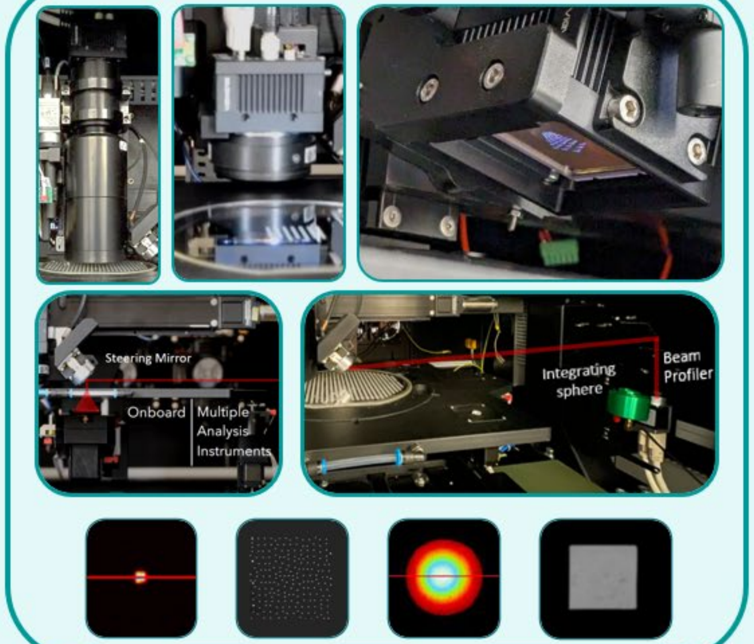
Modularity



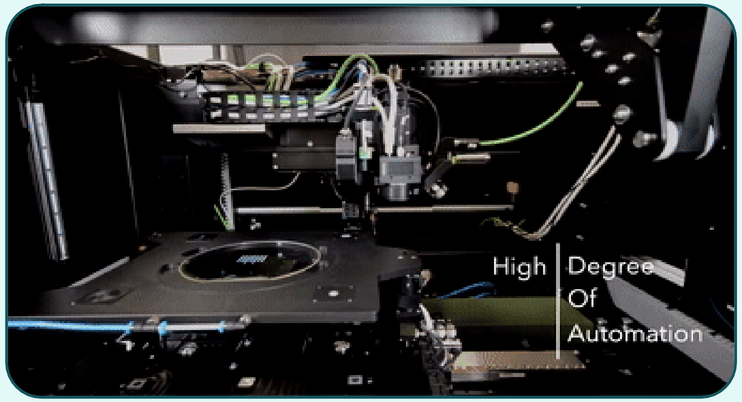
Base Platform - XY Wafer Handling System



Multiple Chuck Options



Multiple Instruments Configurations

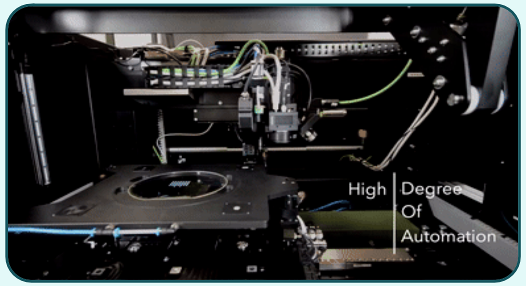


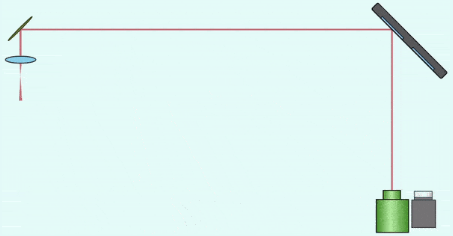
Fully Configured Setup!

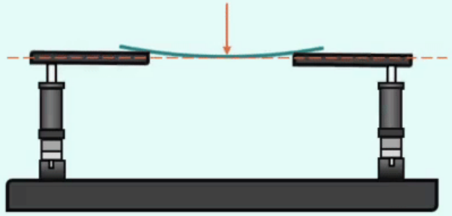
- Well-established common platform to concentrate efforts on application challenges
- Common-base of components and spare-parts
- Reduced maintenance and semi-automatic calibrations
- One platform, multiple applications

Flexibility

Hardware

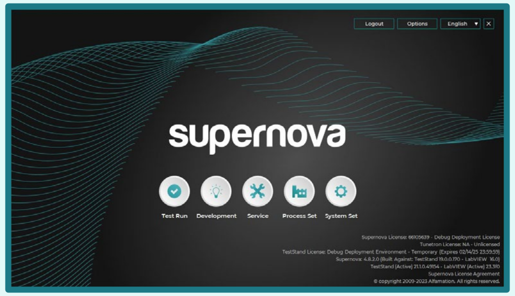


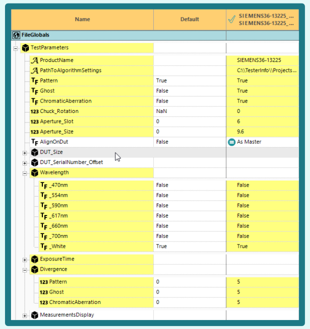


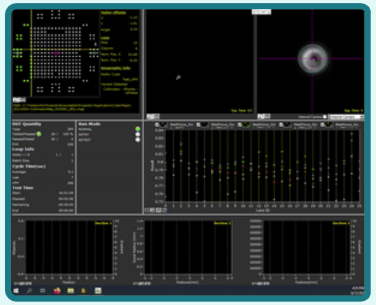


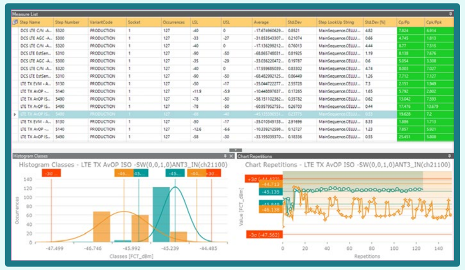
- Multiple Automated Degrees of Freedom

Software









- User-friendly and powerful GUI

- Multiple Degrees of freedom allowing to test different product variants without retooling and recalibrations
- A powerful and user-friendly software interface to adjust test parameters (Supernova™ : Alfamation proprietary test sequencer based on NI Teststand)

Efficiency

- Fast solution for an efficient process
- Robust and Stable solution to avoid false calls and insightful process characterization

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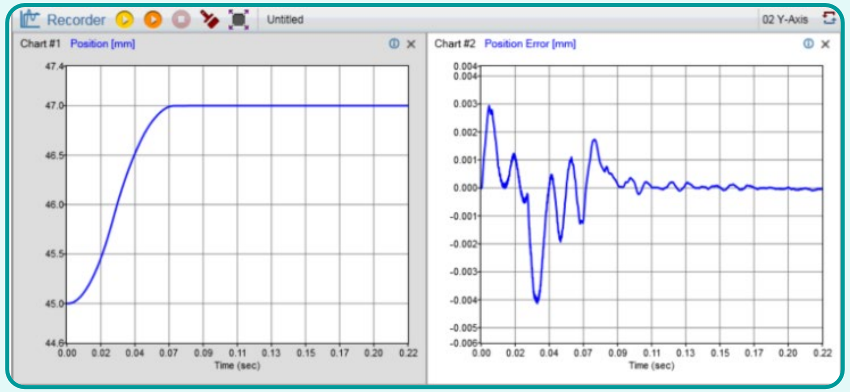
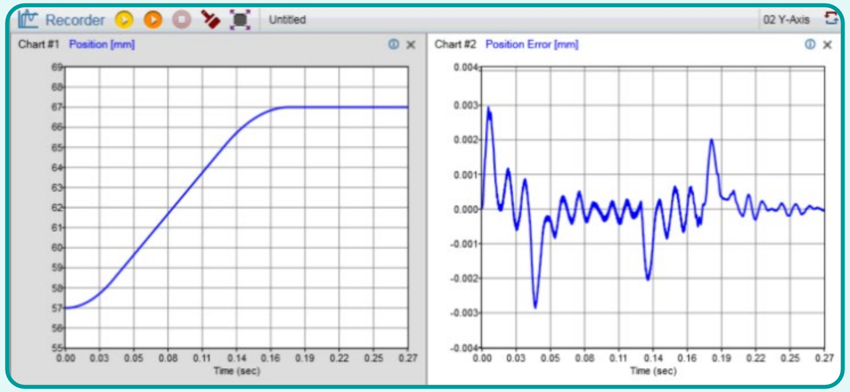
High Throughput



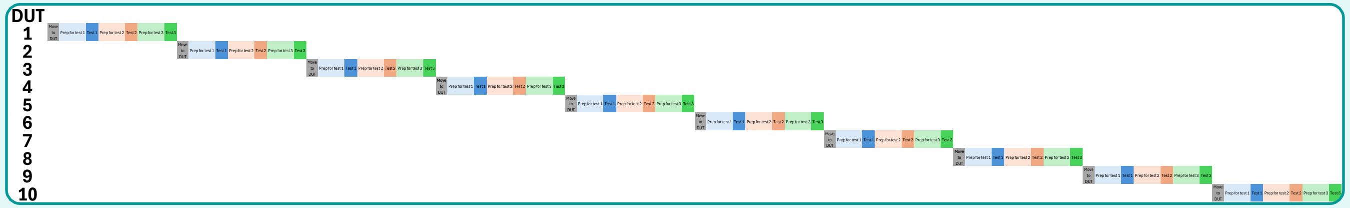


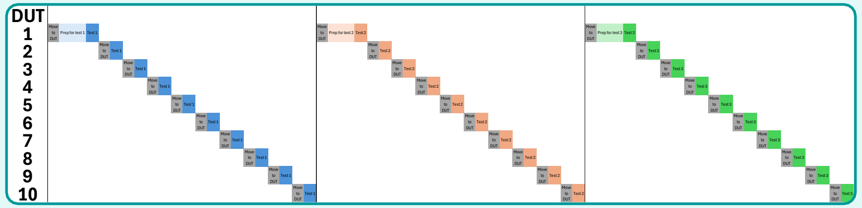
Step Size	Stepping Time (Settling within 300 nm)
2 mm	90 ms
10 mm	200 ms

Fast and Reliable Positioning

- Algorithms, Image Processing and results logging are all run in parallel to movements and positioning to remove or reduce the overhead

Parallel Threads





Reduced Test Time
Same Test Scope

Batch Logic

Reliability

- According to the Automotive Industry Action Group (AIAG) if your measurement system's variation is less than 10% of process's variation, then it is acceptable.

Percentage of Process Variation (%R&R)	Acceptability
Less than 10%	The measurement system is acceptable
Between 10% and 30 %	The measurement system is acceptable depending on the application, the cost of the measurement device, cost of repair, or other factors.
Greater than 30%	The measurement system is not acceptable and should be improved

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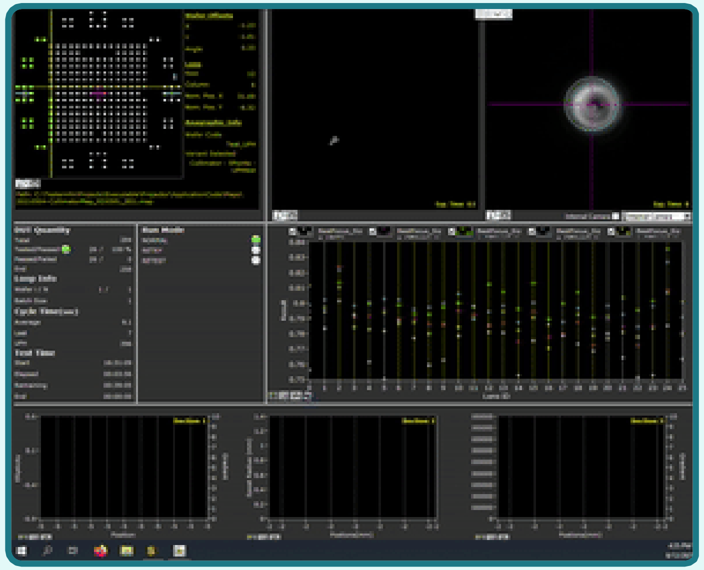
Production Plant Challenges

- Compatibility with Mass-Production environment

Production and Clean Room Compatibility



Operator-Friendly User Interface

- Network Integration
- MES Interface

Plant Interface

- Automatic Serial Number reading and Alignment procedure
- Robotized Automatic Wafer loading compatibility

Reduced Operator Workload

- Ventilation and Filters Unit for Clean Room integration

Clean Room Compatibility

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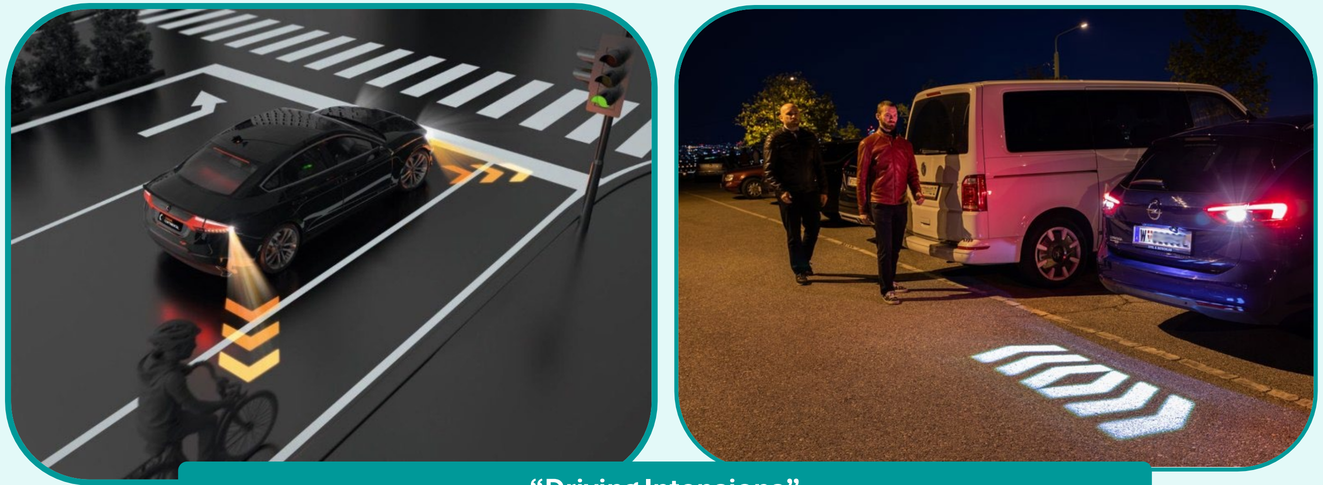
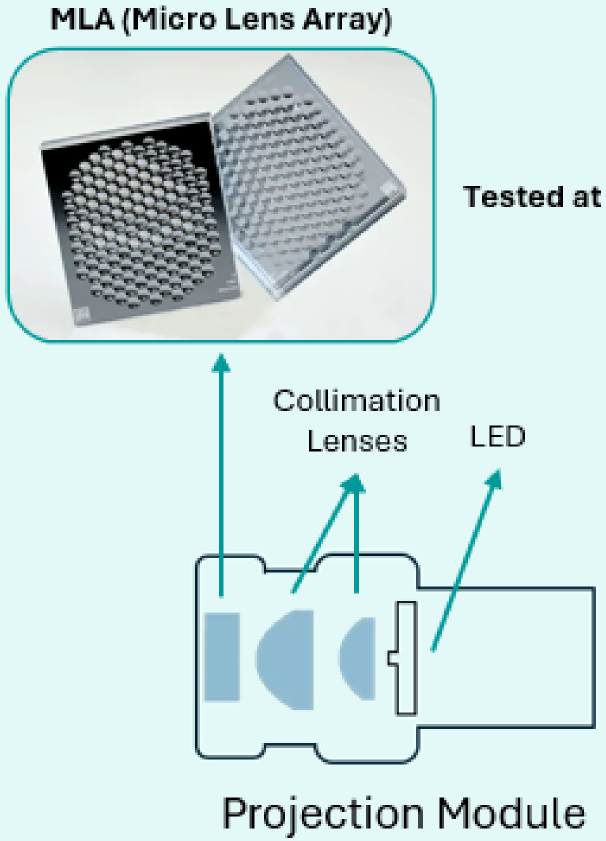
MLA Decorative Lighting
Welcome Carpet and “Driving Intensions”

Welcome Carpet



“Driving Intensions”



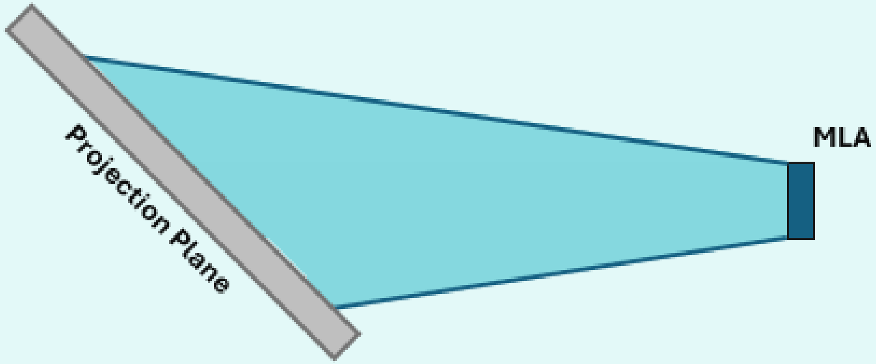
MLA (Micro Lens Array)

Projection Module

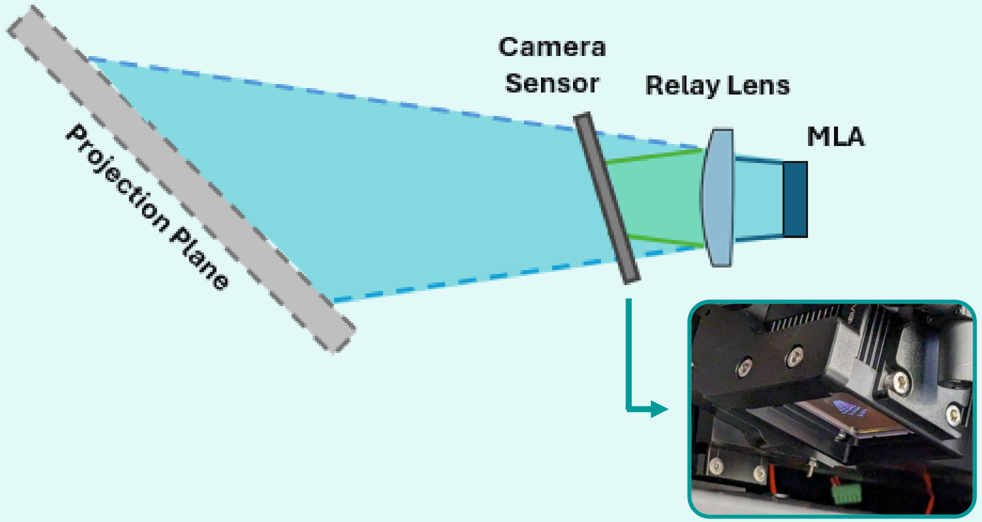
Tested at Wafer-Level!

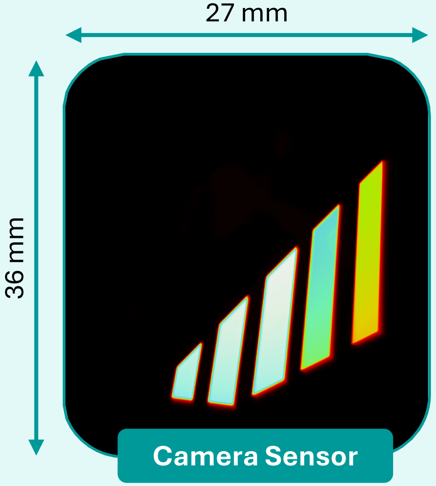
MLA Decorative Lighting
Setup – Projection on Target Plane (i.e. Street)

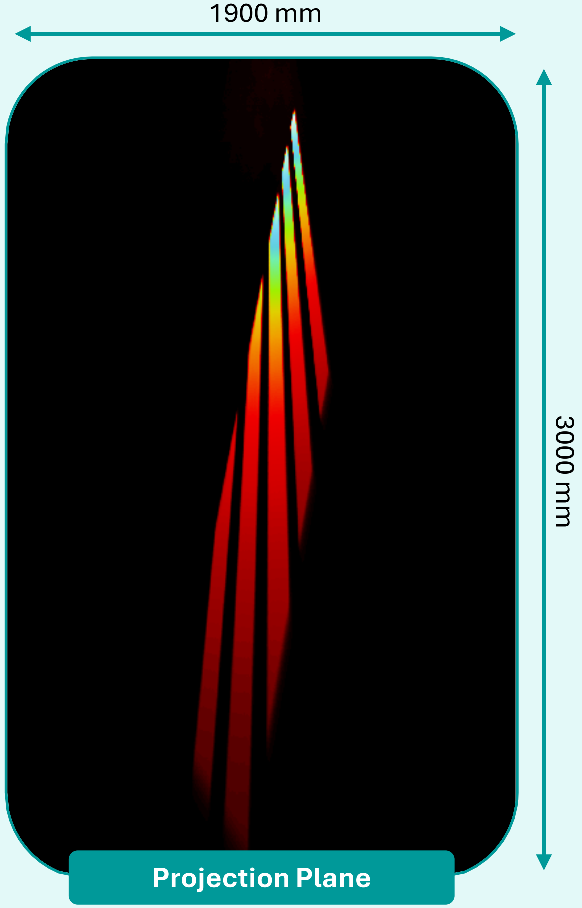
Use-case Setup



Testing Setup







- **Relay Lens System** to keep the test setup compact
- **High-Resolution Camera Sensor**
- **Multiple Degrees of Freedom:** to test products with different projection setups without retooling
- **Alfamation proprietary Algorithm** to “project” the image obtained on the senor to the target plane

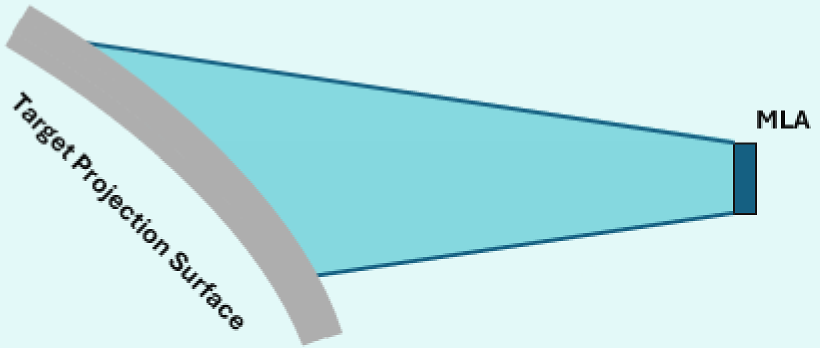
Test Metrics: Relative Brightness, Contrast\Gradient, Cross Talk\Ghost, Chromatic Aberration
Speed: Up to **2800 UPH** (Units per hour)
Stability: Gage R&R < 10%

Performance

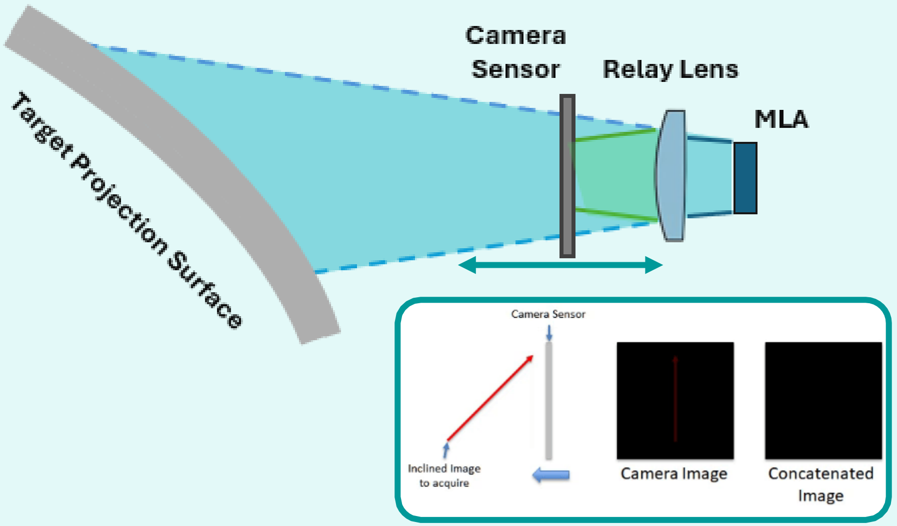
MLA Decorative Lighting

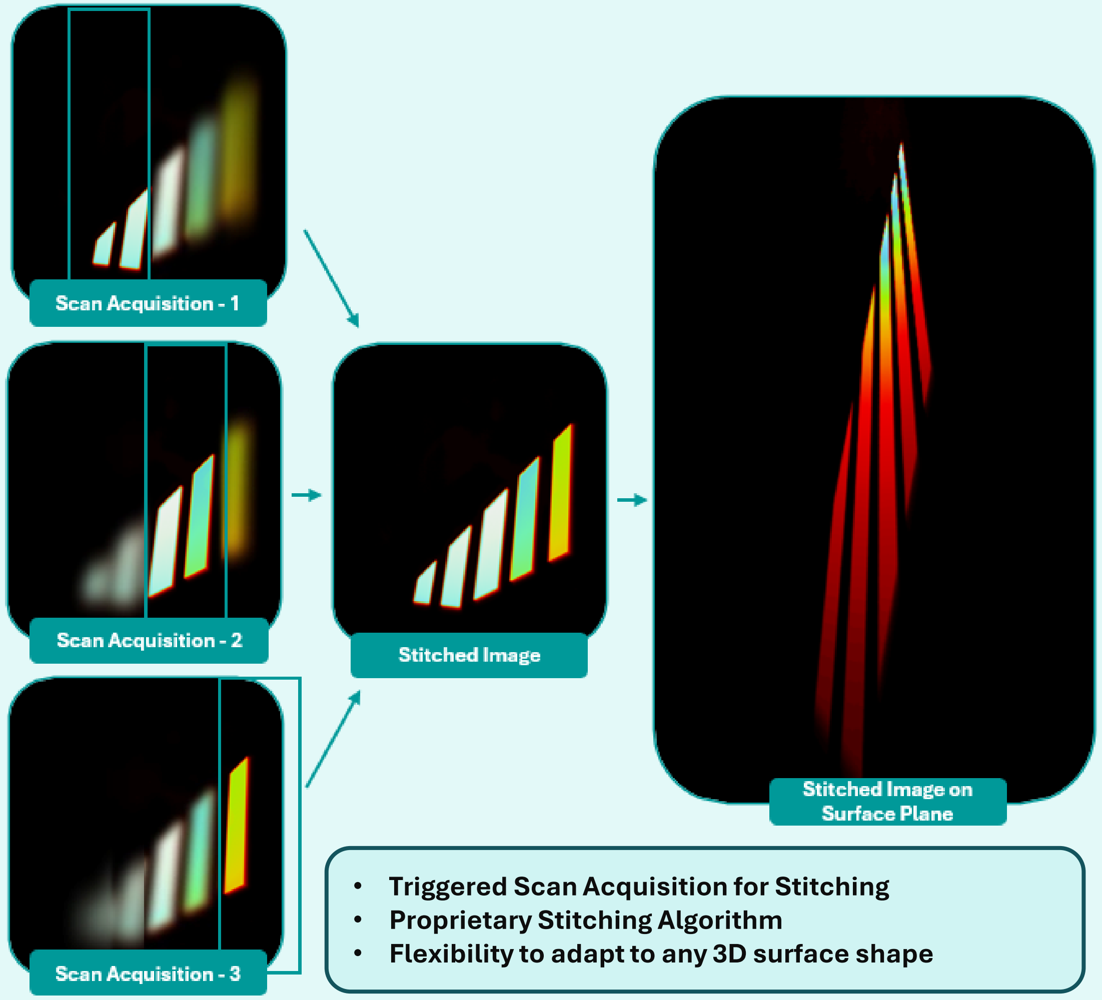
Setup – Projection on Arbitrary Surface (i.e. Dashboard)

Use-case Setup



Testing Setup





- Triggered Scan Acquisition for Stitching
- Proprietary Stitching Algorithm
- Flexibility to adapt to any 3D surface shape

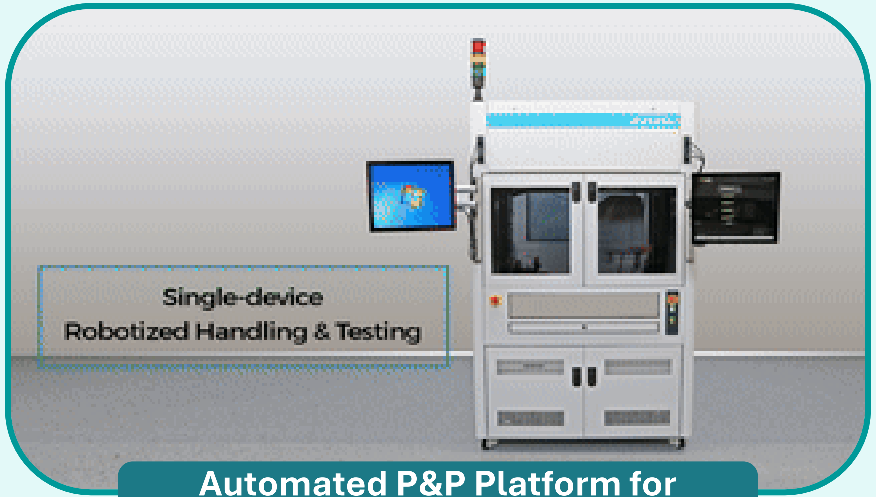
Collaborations
Testing Micro-Optics and Assembled Modules

- This is just a portion of **Alfamation** portfolio and capabilities!
- **Alfamation** is looking for:

- **instruments and test methods** to integrate in out test platforms
- new **micro-optics and photonics test challenges**

- **Alfamation**, by leveraging its strong engineering capabilities can:

- supply **innovative automated test solutions**
- develop **new test methods**
- **not only at wafer level**!



Automated P&P Platform for Assembled Module Testing

Manual Loading Test Platform for Assembled Module Testing

VISIT US AT OUR BOOTH!

CONTACTS

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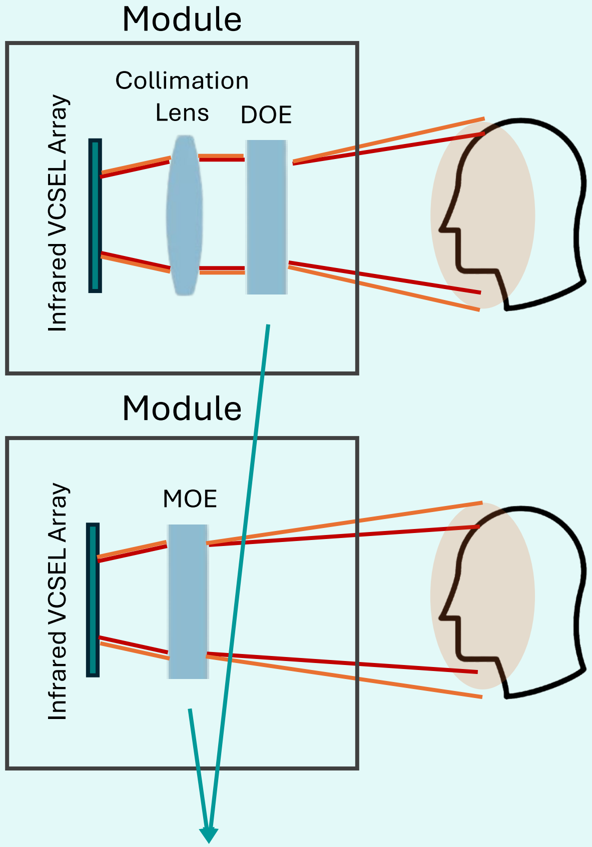
Conoscopy Mode: DOEs and MOEs testing

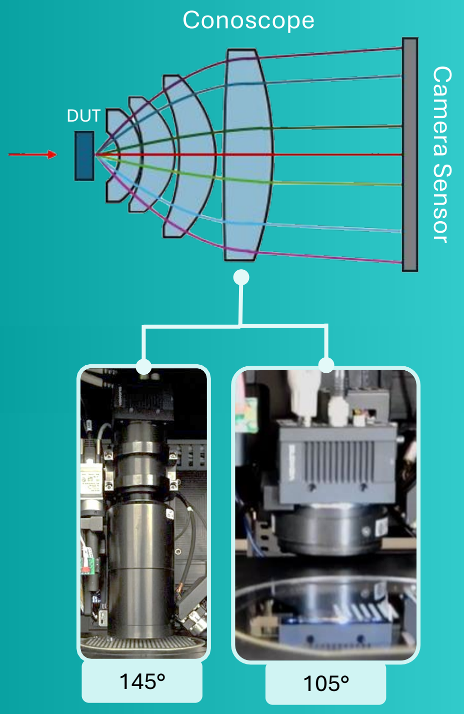


Tested at Wafer-Level!

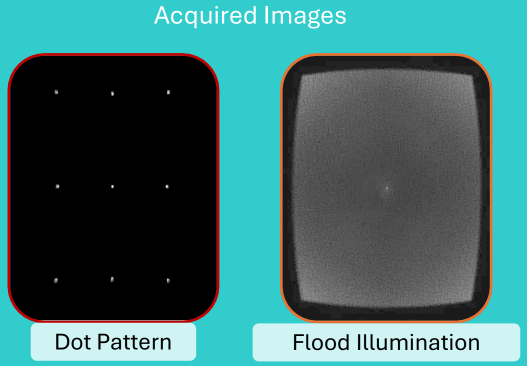
DOEs and MOEs are used for both **Dot Pattern Projection** (**red**) and **Flood Illumination** (**orange**) in the face id and gesture recognition procedure.

Conoscopy Mode: Test Principle and Configuration

- **High-resolution camera + Conoscope**
- **High acceptance angle**
- **Angular Map**



Different conoscopes design for different needs!

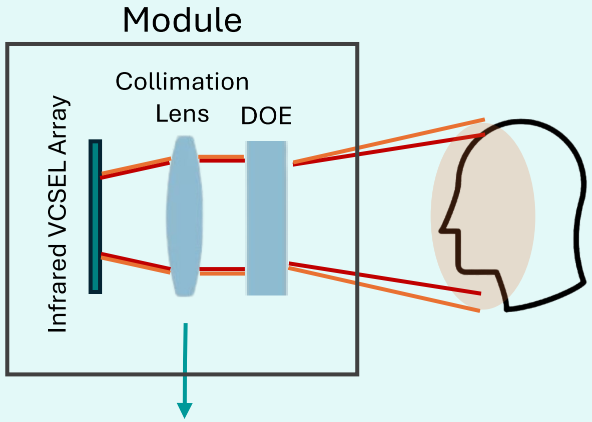


Test Metrics: Angular Distribution, Transmission Efficiency, Diffraction Efficiency, Uniformity
Speed: Up to **3000 UPH** (Units per hour)
Stability: Gage R&R < 10%

Performance

Collimated Beam Profiling Mode: Collimation Lenses testing

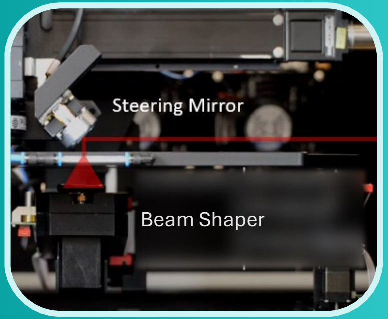
Collimation Lenses are components used in a very wide range of applications. In consumer electronics, they are often paired with DOEs for **face ID and gesture recognition**.

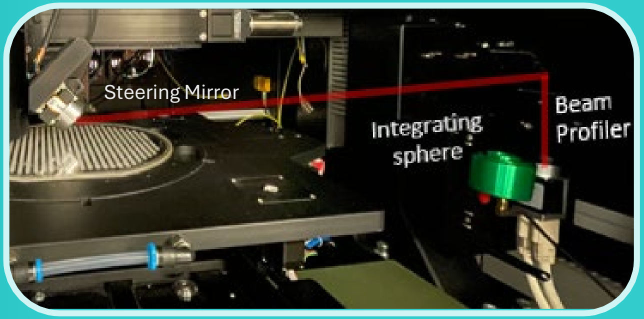


Tested at Wafer-Level!

Collimated Beam Profiling Mode: Test Principle and Configuration

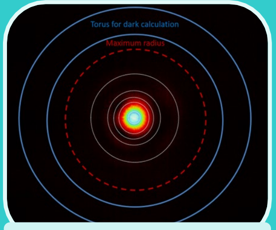
- **Distance sensor** for wafer warpage
- **Focus scan** for best focus and FFL measurement
- **Steering mirror, camera sensor** and **integrating sphere**





Test Metrics: **Spot Size, Transmitted Power, Flange Focal Length, Effective Focal Length**
Speed: Up to **1500 UPH** (Units per hour)
Stability: **Gage R&R < 10%**

Performance



Spot on Beam Profiler

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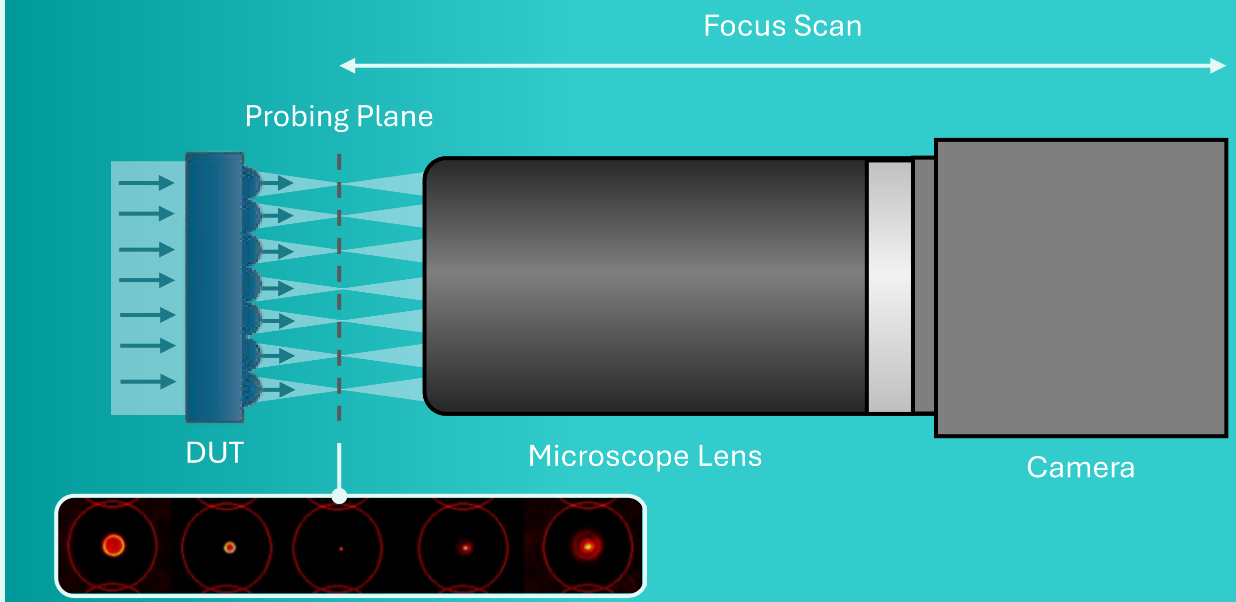
Coupling Micro-Optics Mode: Telecom and Imaging optics testing

Coupling optics are often used in telecommunication industry and for imaging purposes.

Coupling Micro-Optics Mode: Test Principle and Configuration



Test Metrics: **Efficiency, Flange Focal Length, Uniformity**
Speed: Up to **1500 UPH** (Units per hour)
Stability: **Gage R&R < 10%**

Performance

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