

Accelerating the future



EPIC Meeting on Micro Optics Manufacturing

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Wednesday, 22 April, 2020

A hand is shown holding a small, square wafer in a complex testing machine. The machine is illuminated with bright green laser light, which is focused on the wafer. The machine has various components, including lenses, mirrors, and a circuit board with a green PCB. The background is a light blue gradient.

NTS Optel

Customized High Volume Testing solution for Wafer Level Optics

Content:

- Introduction NTS Optel
- Capabilities and Focus area 's
- (Co)development and manufacturing of optical modules and systems
- Typical DOE, ROE, MLA, Wafer level optics test parameters
- Customized (high volume) tester solutions for optical wafers and optical modules (Wafer level Optics, DOE, MLA)
- Technical challenges and solution directions.
- Q&A

About NTS Optel



NTS Optel is a High tech engineering and manufacturing company, specialized in applied optics, opto-mechatronics, imaging and laser technology.

❑ Consultancy, Design, Co-development

Starting with optics: When standard available products cannot solve the question, Our Optel engineers are capable to investigate and design a dedicated solution for you. We use techniques such as Laser, Custom Optics, Spectroscopy, Vision and LED.

❑ Product design, prototyping and series production

We focus on providing the best suitable solution by design and can assemble your prototype and series at NTS Optel. In addition we make use of our Group enabling ultra precise machining, granite and sheetmetal manufacturing. Our vertically integrated global footprint enables assembly and manufacturing on all continents.



New high tech facility April 2020
Nijmegen the Netherlands

Part of NTS-Group

Eindhoven

Headquartered in Eindhoven, the Netherlands

€ 270+

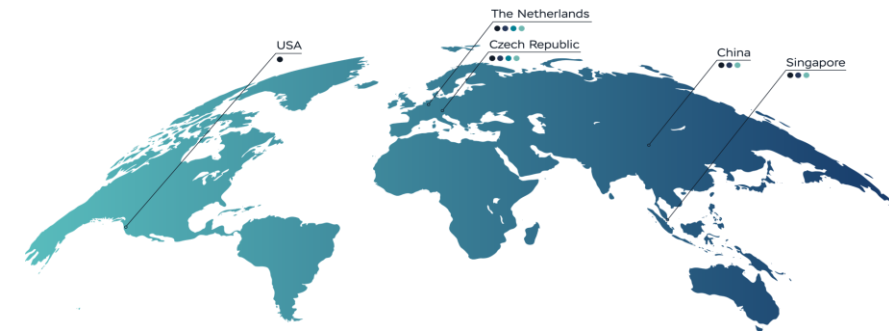
Million turnover

1700+

Employees worldwide

70+

Years of experience in manufacturing industry



NTS Optel capabilities

We use ray tracing for our optical designs

And apply all imaginable optical techniques:

- Vision techniques
- Laser triangulation, distance and 3D-measurement
- Laser and white light interferometry
- Laser diffraction
- Spectroscopy

from EUV, UV, visible, NIR to IR.

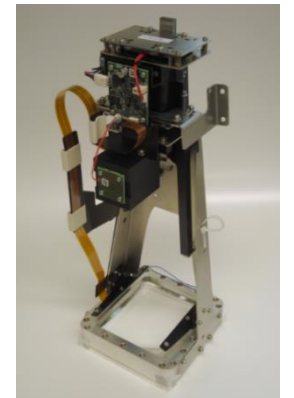
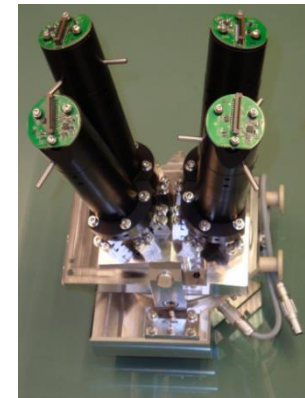
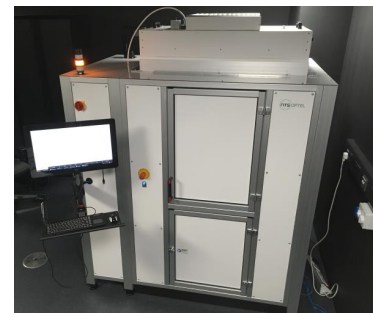
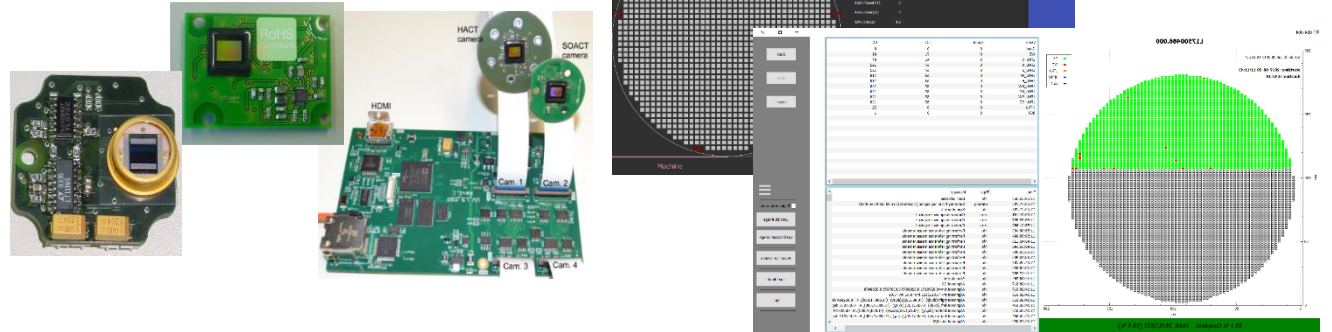
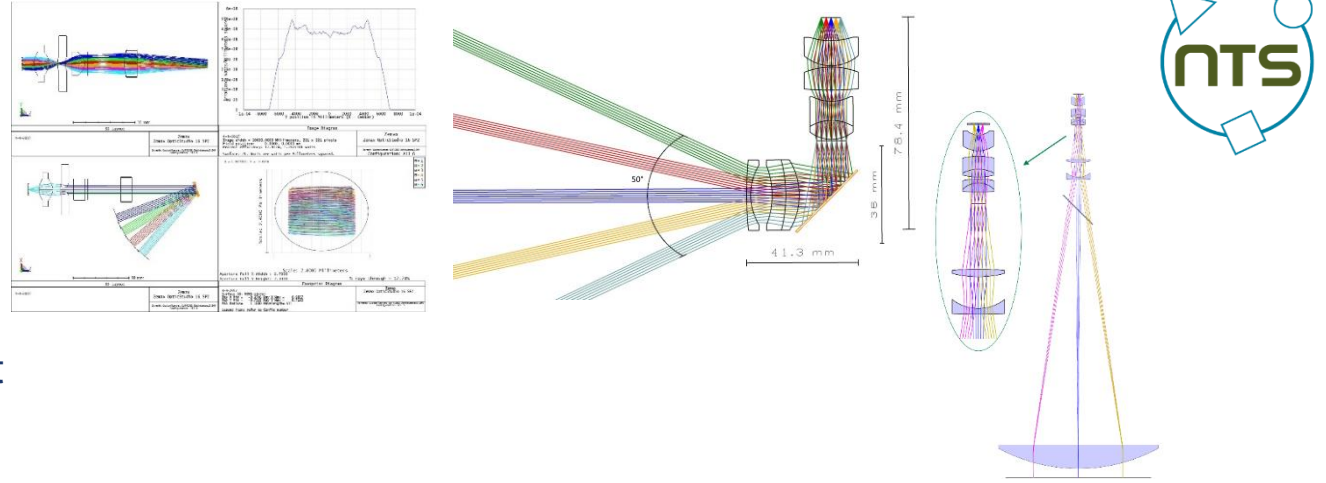
Add the electronics:

- Analog and digital electronics design
- Embedded software

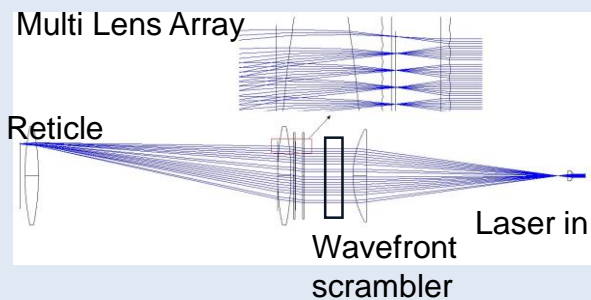
We design and build the mechanics

And implement software for processing, control and GUI

We are capable of providing complete solutions!

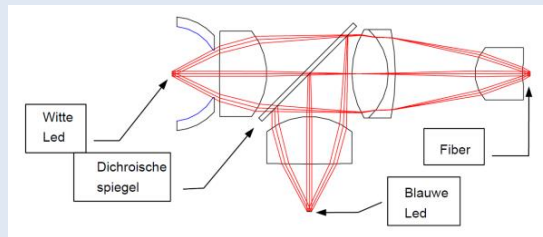


What we do: Development and manufacturing of optical modules and systems



UV beam homogenizer
(Semicon application)

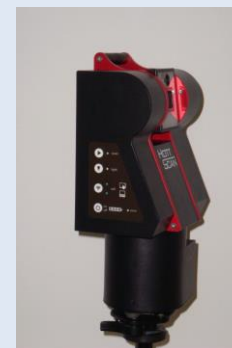
NTS Optel role:
Development and production



Endo-illuminator
Eye surgery application

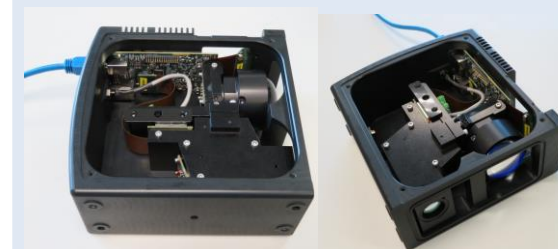
NTS Optel role:
Development and production

Multiple product examples for
medical, Analytical applications



NTS Optel role:
Development and production

Lidar systems:
Design and small series production



MEMS based Lidar systems

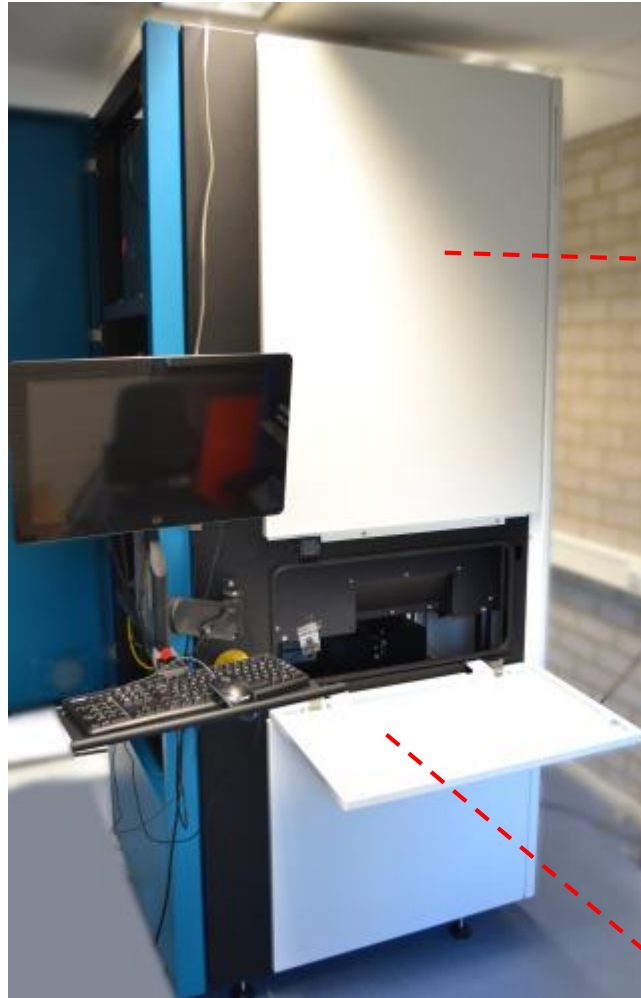
NTS Optel role:
Development and production

What we do in micro optics: Typical test parameters (on DOE/MLA/Micro Optics)

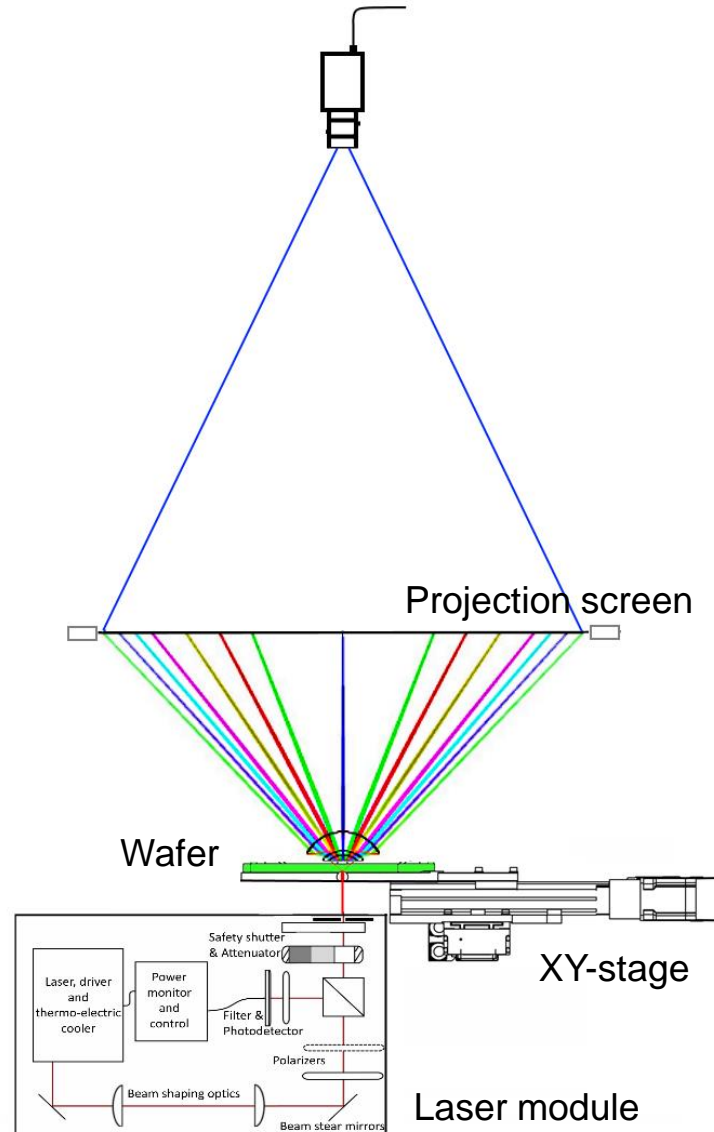


- Relative zero order power
- Occurrences of hot-spots
- Total diffraction efficiency
- Horizontal and vertical diffraction or refraction angles (FOV)
- Relative spot or line powers
- Pattern contrast
- Spot and line quality in terms of FWHM
- Homogeneity over spot profile or diffusor profile
- Low and high frequency inhomogeneity of diffusor
- Any other parameters our customers would like to test....

Optical Wafer Tester: Modular re-usable direct imaging (conoscope) and rear projection imaging

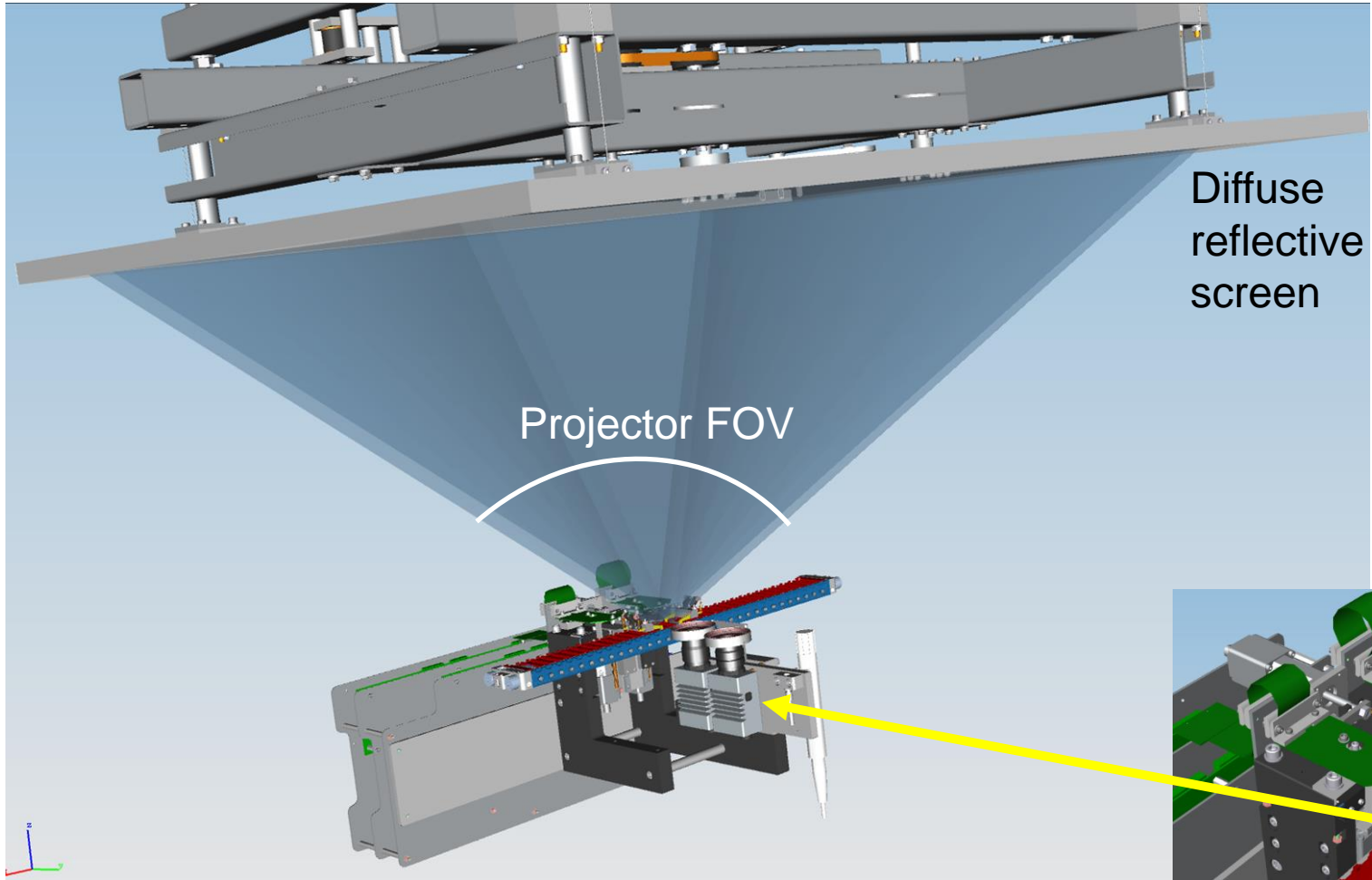


Manual loaded OWT

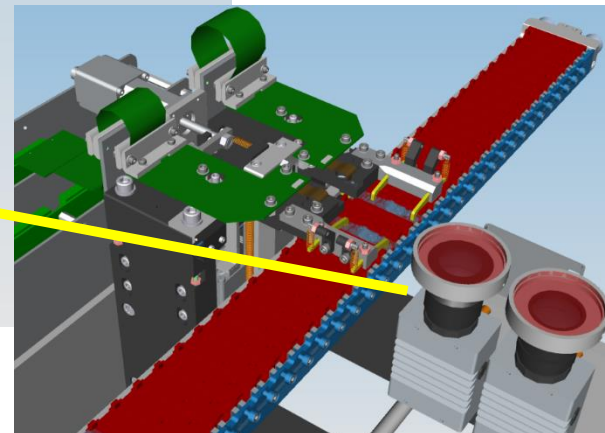


Automated EFEM loaded OWT

Optical Module Tester: front projection imaging (qualification of integrated WLO and module)



Narrow and wide field
IR-camera's





Technical challenges we have seen and solved

Pattern imaging optics:

Cover a large FOV (up to 150°) with sufficient resolution

- Solution: Custom designed aspherical objective

Low sensitivity drop-off and distortion over the FOV

- Solution: Custom designed aspherical f-theta objective with low distortion + built in distortion calibration target and angular sensitivity
- Optics without vignetting.

Tolerance in wafer surface location

- Custom Optics designed with large entrance pupil => less sensitive to misalignment.

Sufficient working distance

- Custom Optics designed with minimum workable distance

Noise reduction

- Speckle reduction by moving projection screen

Laser module:

Accurate center wavelength

- Lasers are wavelength preselected and temperature controlled

Stable operation

- Temperature control + optical feedback + RF modulation.

Spot size fitting the active area

- Custom aperture which is relayed to the active area. (Relay optics)

High beam quality

- Built in spatial filter to clean up beam profile.

Many more challenges we solved:



Wafer handling, gripping and clamping

- manually/EFEM,
- Use of vacuum or mechanical solutions

Bow/warp of wafer (up to 1-2 millimeters!):

- Requiring bow/warp mapping
- Tip-tilt and height corrections with 6Dof stage

Pitch variations over wafer:

- Alignment on multiple fiducials
- Use actual elements.

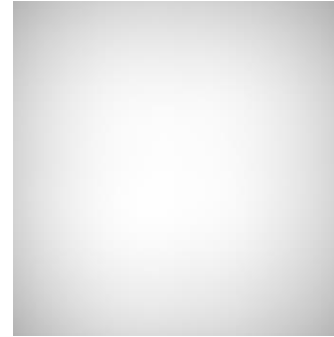
Sensitivity drift of pattern imaging camera: $\sim 0.5\%/degr.$ @ 940nm.

- Thermal control
- Regular reference measurements with calibration optics

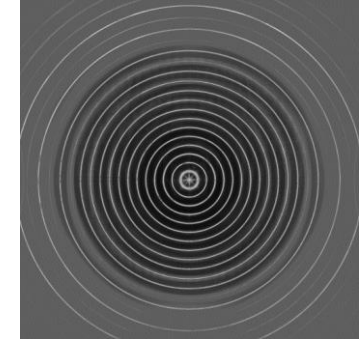
Calibration:

- Distortion based on reference grating
- Sensitivity over VOF with calibration LED
- Laser power level (100% level)

Sensitivity calibration



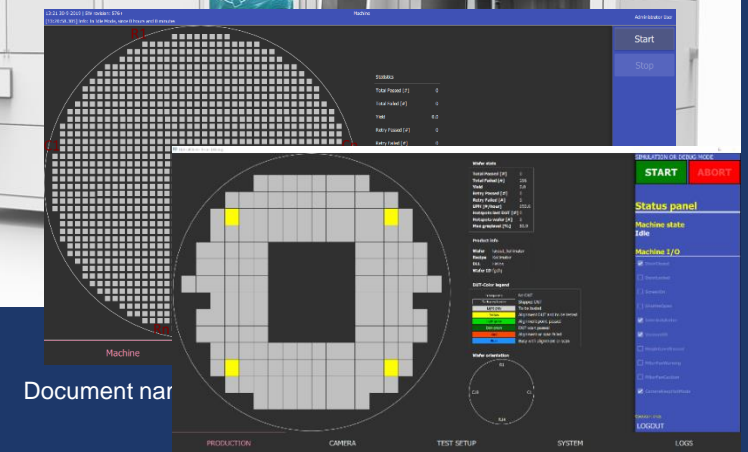
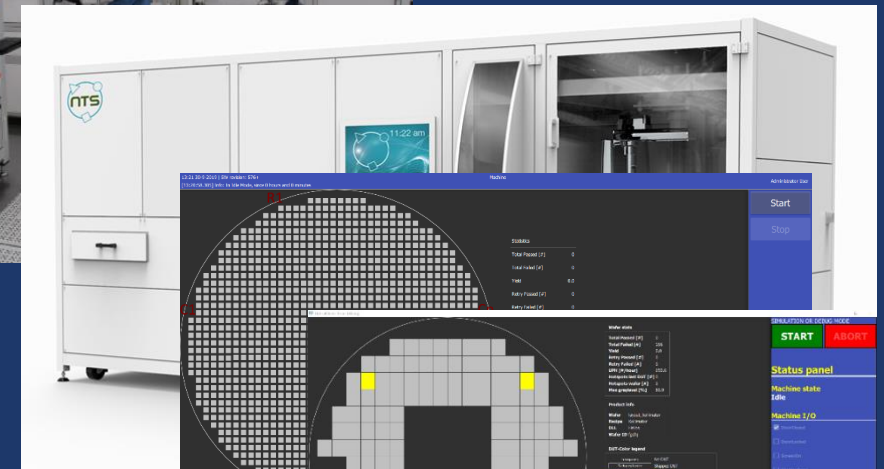
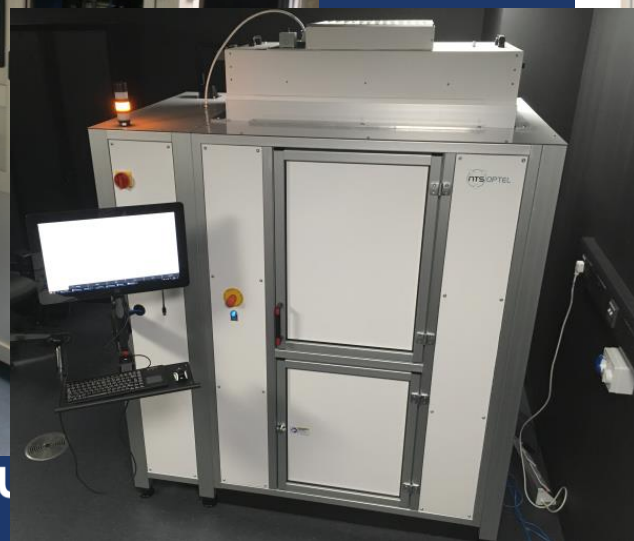
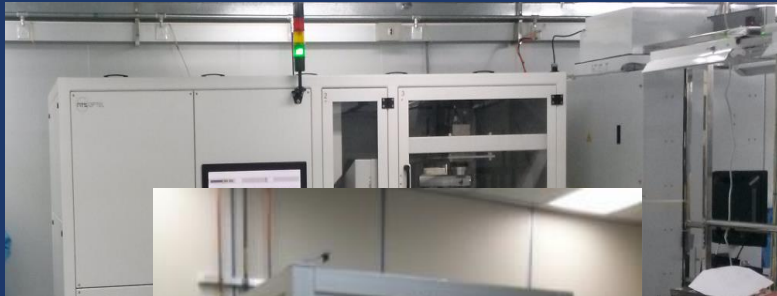
Distortion calibration



We invite you to contact us? Ruud.van.Oers@nts-group.nl



Questions?



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