SWISSOPTIC AG – AN INTRODUCTION

Welcome.

SWISSOPTIC
A member of the JENOPTIK Group

WHERE CAN YOU FIND US?

CLOSE TO OUR CUSTOMERS – IN EUROPE AND IN ASIA

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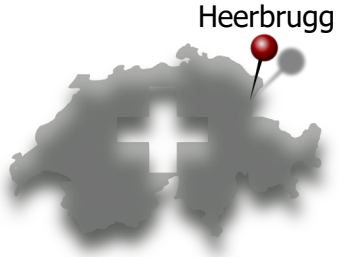
WILD HEERBRUGG HIGH PRECISION CAMPUS

AN INNOVATIVE PHOTONICS LOCATION SINCE 100 YEARS



WHAT DO WE OFFER?
APPLICATIONS WITH LIGHT

Many of our customers are …

- **Global players** within the different market segments

Their products are …

- technically advanced **light-using products**

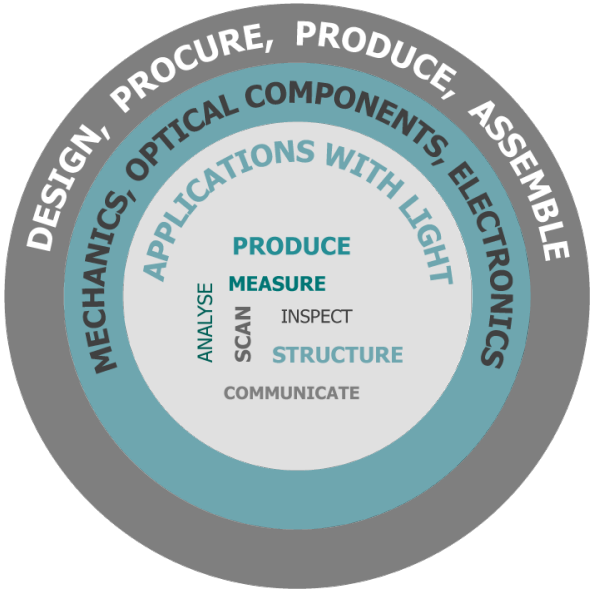
In cooperation with the customers we create …

- innovative (sub-) **system solutions using** optical, mechanical and electronic components (OEM)

Our services:

- **design and development**
- professional **worldwide procurement**
- reliable **production of key components, assembly and system integration**

Substantial contribution to the process chain of our customers



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HOW DO WE OPERATE?
ON A BROAD BASE. HIGHLY SPECIALIZED

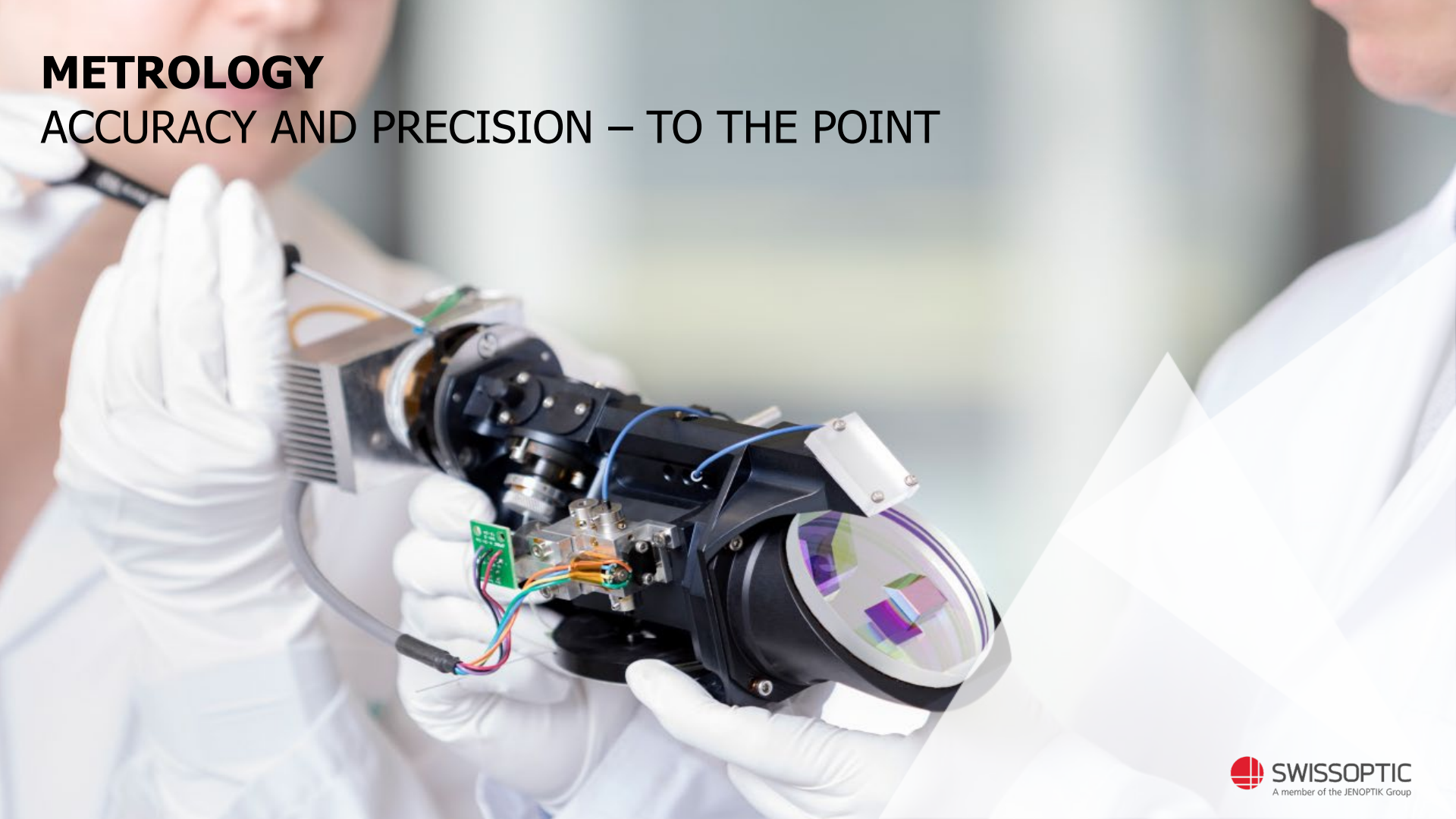
Semicon
- Lithography
- 3D Integration
- Inspection
- Metrology

Photonics Solutions
- Space
- Laser technology
- High-precision optical components

Metrology
- Geodesy
- Photogrammetry
- Industrial surveying
- Industrial metrology

Medical Applications
- Ophthalmology
- Life Sciences

METROLOGY
ACCURACY AND PRECISION – TO THE POINT



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METROLOGY

OPTO-MECHANICAL SYSTEMS FOR INNOVATIVE METROLOGY

Geodesy

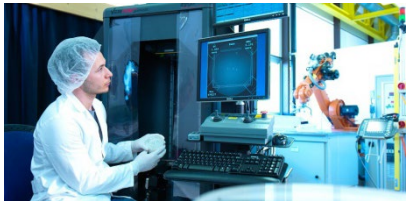
- Theodolites
- Total stations
- Laser scanners

Photogrammetry

- OEM lenses for aerial cameras
- Beam splitters

Industrial surveying

- Laser trackers
- White light scanners



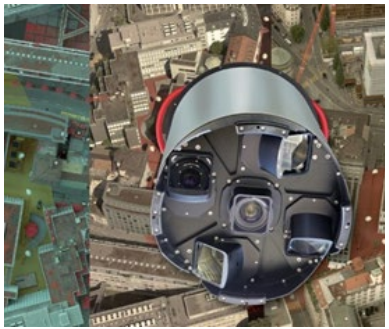
Industrial metrology

- Opto-electronic sensors
- Interferometer lenses

METROLOGY
OPTO-MECHANICAL SYSTEMS FOR INNOVATIVE METROLOGY

Market characteristics, trends

- High accuracy of portable devices
- Compact, lighter, faster, and at the same time less expensive
- Automation options
- Industry 4.0 requires smart sensor systems



The solution

- TPS total stations
- Aerial camera lenses for photogrammetric measurements
- Integration of superior aspherical lenses
- Opto-electronic sensor systems
- Application-specific systems engineering

Our strengths

- Competence in development
- Measurement technology perfectly aligned to the production technology
- Assembling competence incl. quality check of complete systems
- Global sourcing with qualified partners

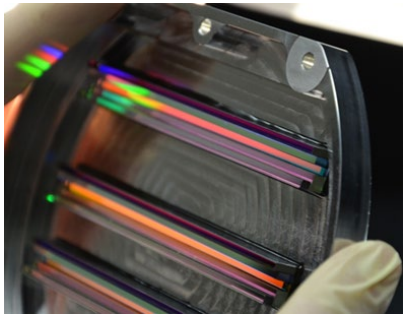
Your benefits

- System responsibility – from concept to prototype to volume production
- Excellent knowledge of the processes and of product requirements
- Inhouse assembly & testing of the whole device
- Possibility to relocate the volume production to our subsidiary in China

METROLOGY
MULTISPECTRAL BEAM SPLITTING FOR AIRBORNE CAMERA

Market characteristics, trends

- Aerial photography
- Generating of maps, soil analysis and environmental simulations
- Separation of colors and angles
- Use of line sensor with >20,000 pixels

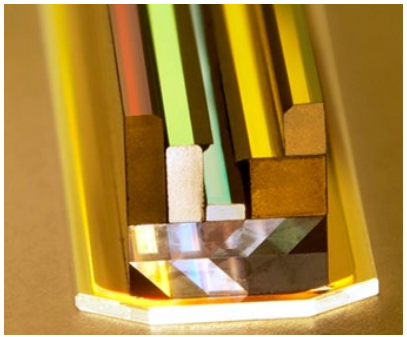


The solution

- Multispectral beamsplitter for line sensor
- Dimensions of the beam splitter: 11.5 mm x 11.0 mm x 105.0 mm
- Consisting of 14 single parts with 19 different coatings
- Process accuracy during production +/-3µm

Our strengths

- Competence in development
- Measurement technology perfectly aligned to the production technology
- Assembling competence incl. quality check of complete systems
- Global sourcing with qualified partners



Customer benefit

- Cost reduction
  - Single objective lens, separation in colors and angles after lens
  - 5 channels integrated, no additional filter
  - increased scanning line length → reduced numbers of flights
- Greatly improved resolution

SEMICON
RIGHT TO THE LIMITS OF THE POSSIBLE

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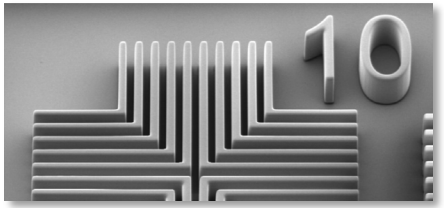
SEMICON
SOLUTIONS FOR THE SEMICONDUCTOR INDUSTRY



Lithography (alignment)

- Opto-mechanical systems
- High-end optical components
- Polarisation optics
- Silizium based high-precision mechanical parts

Optical Mask Inspection

- Opto-mechanical assemblies
- Opto-electronic systems
- High-end lenses

Optical Wafer Inspection

- Opto-mechanical assemblies
- DUV-Lenses

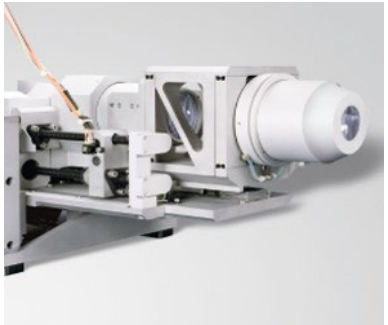
SEMICON: MANUFACTURING EQUIPMENT
OPTO-MECHANICAL AND OPTO-ELECTRONIC SYSTEMS

Market characteristics, trends

- The features on semiconductor chips are becoming smaller and smaller
- A higher accuracy and better resolutions for optical metrology and inspection equipment are required
- Cost of ownership needs to be reduced, by e. g. higher throughput, continuous yield improvement and reduction of development time and efforts

Our strengths

- Well-established product development process
- Assembly and metrology in high quality clean rooms (ISO 5 and VOC controlled)
- Manufacturing of key components
- Customer-specific metrology
- Extensive supply chain base



The solution

- Design, prototype manufacturing and volume production from one source
- High quality optical assemblies and key components

Your benefits

- Reduction of complexity in the supply chain
- Fully qualified products (CoC)
- Competent partner for all aspects of optical design, manufacturing and assembly

PHOTONICS SOLUTIONS

CONVINCING SOLUTIONS FOR YOUR IDEAS

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PHOTONICS SOLUTIONS
WE MAKE LIGHT WORK

Avionics & Space

- Modules for satellite communication and earth observation, e.g. for environmental monitoring
- Multispectral enhanced vision systems for commercial aviation

Defense & Security

- Surveillance system optics (Night/Day)
- Optical IR system components

Industrial & Machine Vision

- Camera Objectives for high speed imaging systems
- Assemblies for high accuracy laser drilling

High Precision Optical Components

Optical key components made of various material for highly demanding applications, e.g.

- Complex aspheres / spheres /plano-optics
- Aspherical mirror systems
- Cylinder lenses

PHOTONICS SOLUTIONS
AVIONICS & SPACE

Market and Trends
- Improving safety by enhancing vision of pilots with multispectral systems
- Space Data Highway – trend towards optical communication in space (LEO to GEO and back)
- Earth observation, especially for environmental monitoring, gains importance

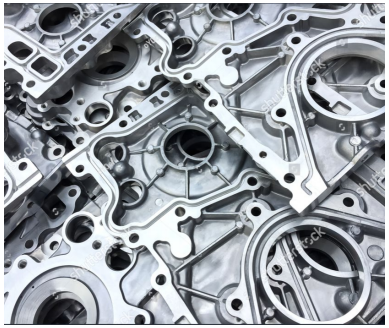
Our strength
- Successful participation in space projects
- Experienced team of engineers
- Comprehensive production competence
- AIT clean rooms with ISO 5
- PM and QM systems according to ECSS standard

The solution
- Optical systems and components with diffraction limited performance under conditions in space
- Lightweight mirrors made of ceramics and Zerodur®
- Realization of the highest requirements for a long-term error-free operation (more than ten years)

Your benefits
- Aerospace qualified and certified technologies (space heritage)
- All services from one source (design, development, production)
- Commitment and quick decision-making
- Manufacturing sites in Germany and Switzerland

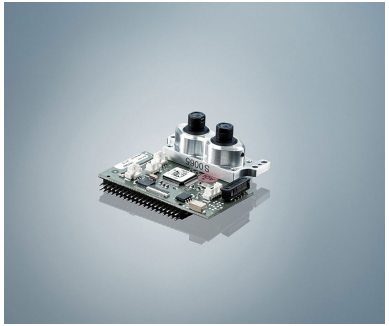
PHOTONICS SOLUTIONS
INDUSTRIAL & MACHINE VISION

Market and Trends
- Increasing demand for image based analysis of production steps
- Vision systems often determine process speed
- Faster and higher resolving camera sensors with specific spectral coverage demand for higher performance optical „front end"



The solution
- Optical systems and components with diffraction limited performance @ competitive price points
- Telecentric systems for highest measurement performance
- Small, lightweight and cost effective opto-mechatronical systems

Our strength
- Leading in designing optics for metrology, meeting application and customer needs
- Highly skilled team of engineers addressing the various challenges in opto-mechatronic setups
- Comprehensive production competence including multispectral beamsplitter and filter systems



Your benefits
- All services from one source (design, development, production)
- Effective global sourcing network for subcomponents, mechanics and electronic components
- Commitment and quick decision-making
- Manufacturing sites in Germany and Switzerland

MEDICAL APPLICATIONS

HEALTH IN A NEW LIGHT

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MEDICAL APPLICATIONS
CONTRIBUTION TO INNOVATIONS IN MEDICAL TECHNOLOGY

Ophthalmology

Optical components and systems for

- Ophthalmic lasers (LASIK)
- Eye diagnostics (fundus imaging systems, OCT etc.)

Dentistry

- Dental measuring cameras
- Dental video cameras
- Intraoral cameras
- Caries detection systems
- Lab scanners

Endoscopy

- 3-chip cameras, autoclavable
- 2-chip cameras, VIS-NIR
- Endoscopes
- Autoclavable lenses
- Chip-on-tip

Life Sciences

- Lens systems
- Broadband lenses
- Microscope lenses
- Laser modules
- Spectrometers

MEDICAL APPLICATIONS
OPHTHALMOLOGY

Market characteristics, trends

- The market is characterized by a high demand for laser eye surgery as well as corresponding diagnostics
- The demographic change leads to an increasing demand for cataract surgery

The solution

- Optical solutions that optimally comply with the specifications of the complete system of our customers
- Light systems with high output illumination

Our strengths

- Many years of market experience: We know the physiological requirements of eye treatments and surgeries
- Development and production from one source
- Reliable qualification and documentation of our systems guarantee high product and patient safety

Your benefits

- A system that is adapted to the application in an optimal way
- No compromises compared to standard „catalog optics"
- From the optical design to volume production – all services from one source

MEDICAL APPLICATIONS
LIFE SCIENCES

Market characteristics, trends

- The trend towards personalized medicine/point of care requires small and mobile medical equipment
- Analysis of the smallest samples, high throughput and detection of extremely weak signals are key factors for competitiveness
- Cost pressure is the driver for automation

Our strengths

- Provider of OEM/PLM system solutions
- > 10 years of experiences in:
  - Optical design
  - Product design
  - Competence in assembling
  - After sales service
  - Global supply chain management
- Clean rooms: levels ISO 5-8

The solution

- Opto-electronic components
- E. g. multi-chip prism components used in fluorescence detection
- Broadband lenses with a broad spectrum: 200 – 1,000 nm
- Microscope lenses
- Spectrometers

Your benefits

- Optics – Electronics – Mechanics: We are your one-stop source
  - Development
  - Manufacturing
  - Sourcing
  - After sales service
- Cost-optimized high-volume solutions

CORE COMPETENCE IN OPTICS AND ASSEMBLY

PRECISION AND PERFORMANCE SERVING YOUR NEEDS

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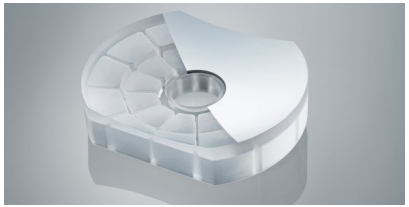
CORE COMPETENCIES IN MANUFACTURING
COMPONENTS AND OPTO-MECHANICAL SYSTEMS

Spherical & Aspherical Optics

- ∅ from 10 to 350 mm
- Form and surface quality according to requirements
- Innovative & lean production processes and high end metrology equipment

Plano Optics

- Dimensions 2 to 350 mm
- Capable of producing small series w/ high accuracy OR several 1'000 pieces/month with relaxed tolerancing
- Large variety of substrates



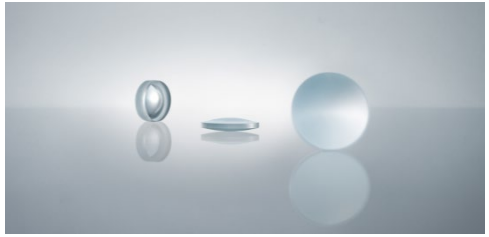
Coating & Microstructures

- Realization of customized coating designs according to application requirements
- Mirrors, AR and HR coatings with excellent performance on various substrates
- Reference structures, reticles and masks created by lithography and direct laser writing

Assembly

- Highly skilled assembly teams
- Integration of optics, mechanics and mechatronics/electronics
- Optronics assembly with iterative metrology

CORE COMPETENCE PRODUCTION
SPHERICAL & ASPHERICAL OPTICS



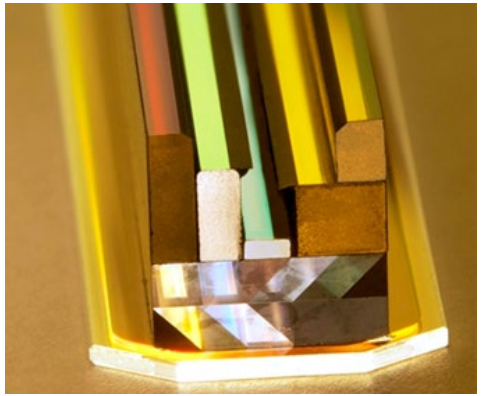
▶ Capabilities	Spherical and aspherical optics LASER optics (high energy, femto seconds, UV, ...)
▶ Dimensions	∅ 10 – ∅ 300 mm (350 mm under certain conditions)
▶ Radii	5 mm – ∞
▶ Centricity	10" according ISO 10110
▶ Form Error	up to 1/100 PV @ 546 nm
▶ Surface Roughness	0.2 nm RMS (2 Å)
▶ Center Thickness	+/- 3 µm
▶ Diameter Tolerance	+/- 3 µm
▶ Scratch & Dig	up to 5/1 x 0.016 according ISO 10110
▶ Metrology & Quality Control	

- Interferometry for spheres and aspheres
- Contactless metrology of Ø, roundness and center thickness
- Surface roughness with white-light interferometer
- Tactile instruments for metrology of aspherical & freeform surfaces

CORE COMPETENCE PRODUCTION
PLANO OPTICS

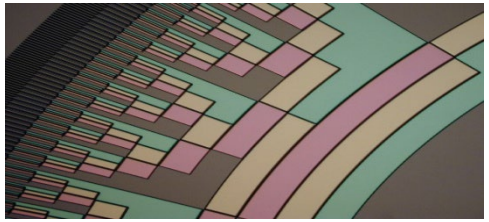
- Capabilities: Prisms and plano-parallel optics
Multifunctional and monolithic optics
High precision prism systems
Complex 3D glass & ceramic components
- Dimensions: 2 – 250 mm (350 mm under certain conditions)
- Flatness: 1/100 PV @ 543 nm
- Angle Error: 0.5"
- Parallelism: 0.2"
- Surface Roughness: 0.15 nm RMS
- Scratch & Dig: up to 5/1 x 0.004 according ISO 10110
- Metrology & Quality Control
  - Temperature controlled environment
  - Interferometry
  - Goniometer (angle and beam deflection)
  - White-light interferometry (surface roughness)
  - 2½/3D-metrology

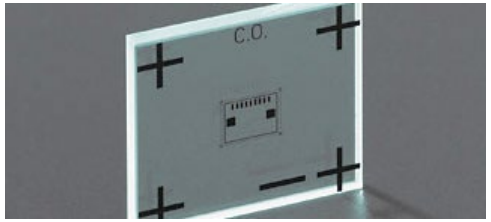
CORE COMPETENCE PRODUCTION
COATING

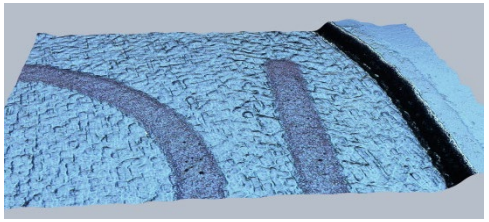


- Capabilities in customer specific coating design:
  - Anti reflex (V-coat, broad band, …)
  - Narrow band filters (transmission & reflexion)
  - Band pass & laser protective filters
  - Laser coatings with high damage threshold
  - High reflecting metallic and dielectric mirrors
  - Electric conductive coatings (ITO)
  - Chrome- and Black Chrome coatings
- Spectral Range: 190 nm – 6,000 nm
- Substrates: Optical glass, filter glass, quartz, sapphire, semiconductor
- Metrology & Quality Control:
  - Spectrophotometers and diode arrays
  - Environment according ISO and MIL (temperature, humidity, autoclave)
  - Abrasion and adhesion testing
  - Surface analytics (Tensiometer, …)
  - Chemical robustness testing
  - 4-point resistance measurement

CORE COMPETENCE PRODUCTION
MICROSTRUCTURES





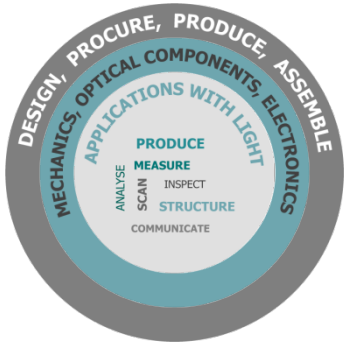


- Capabilities
  - Masks, apertures, gradient filter
  - Reticles and cross hairs
  - Beam splitter with hole raster
  - Encoder disks & linear gratings
  - Fluorescent structures on lenses
  - Reference masks for testing and calibration of optical instruments
  - Direct femtosecond laser surface structuring
- Diameter: 2 mm – 200 mm
- Line Width: ≥1 µm
- Accuracy: 0.5 µm
- Metrology & Quality Control
  - Stereo microscopes & macroscopes (80 x)
  - Wafer microscope (1’000 x)
  - White Light Interferometer for roughness, step height & layer thickness measurements

CORE COMPETENCE PRODUCTION
ASSEMBLY

- **Integration**
  - Combination of optical, mechanical and electronic components (cementing & gluing)
  - Stress free assembly of optical components & cleaning
- **Centering**
  - High-precision centering of optical components
- **System Qualification**
  - Testing and documentation of assemblies
- **Infrastructure:**
  - Clean rooms ISO 5-7
  - Assembly under flow boxes
  - Assembly of UV optics in AMC controlled environment

CORE COMPETENCY SOURCING WUHAN
WITH A BROAD SUPPLIER BASE IN CHINA



Wuhan, China „Optics Valley"

- Founded 2006
- Production area 2,200 m2
- Employees >120
- ISO 9001:2015
- Capabilities:
  - Sourcing in China
  - Incoming quality control
  - Polishing
  - Coating
  - Centering / Cementing
  - Assembly
  - Outgoing inspection
  - Export worldwide

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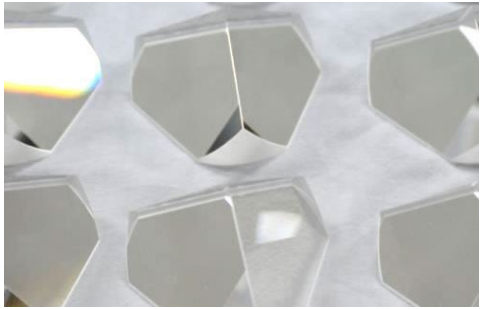
CORE COMPETENCE PRODUCTION WUHAN
CORNER CUBE POLISHING WITH HIGHEST ACCURACY



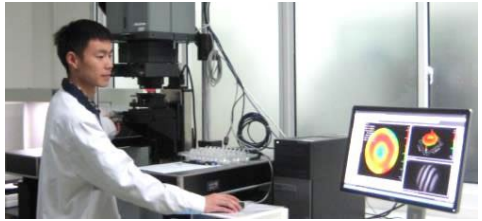
The solution

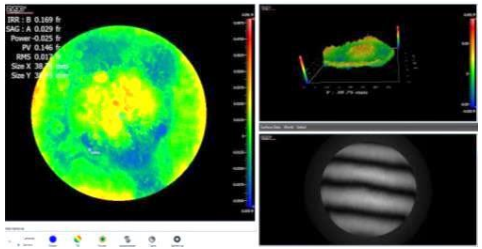
- Mass production of corner cube reflectors
  - 2” and 6” beam deviation
- Polishing with same machines and state of the art technology similar as in Heerbrugg
- In-process measurement of beam deviation

Equipment

- Annular polishing machines
- Eccentric lever grinding machine
- Manual chamfering bench

CORE COMPETENCE PRODUCTION WUHAN
LENS POLISHING FOR LOW VOLUME AND HIGH QUALITY





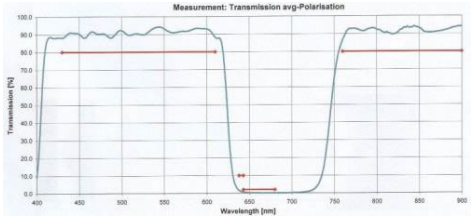
The solution

- Mass production of lenses diameter 5 to 50 mm
- Surface form (PV) λ/10
- Radius of curvature 5 mm to infinity
- Similar technologies & polishing machine as in Heerbrugg

Equipment

- Speed polishing machines (numerical controlled)
- Centering machine
- Zygo 4” interferometer
  - including absolute radius of curvature measurement

CORE COMPETENCE PRODUCTION WUHAN
COATING FOR ENHANCING OPTICAL PROPERTIES



The solution

- Antireflective broad band coatings, Filter coatings up to 50 Layers, Metal mirror coatings
- US-cleaning line semi-automatic
- Clean room ISO Class 7
- In compliance with ISO 9211

Equipment

- Bühler Leybold ARES1100
  - Plasma source APSpro, two e-beam HPE12 & OMS5100
- Hanil HVC-1100DA (two machines)
  - Physical vapor deposition (PVD with e-beam and ion source)
  - One machine with additional optical monitoring system
- Shimazdu UV-3600, Filmetrics F40

CORE COMPETENCE PRODUCTION WUHAN
ASSEMBLY WITH EXPERTISE AND PRECISION

The solution

- Opto-mechanical sub-assemblies
  - Objectives, Zooms, Eyepieces
  - Prism system, etc.
- Opto-mechatronic assemblies
- Cleaning, adjustment, gluing, fine cleaning
- Cementing of doublets and prisms
- Ball-centering

Equipment

- Laminar flow benches ISO Class 6
- Gluing and cleaning devices, adhesive mixing equipment
- Product specific alignment / inspection jigs
- Plasma cleaning system

WE HELP OUR CUSTOMERS TO GET TO THE TOP
AND TO REMAIN THERE

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