

MEOPTA TECHNOLOGICAL  
AND PRODUCTION CAPABILITIES

# A BETTER VIEW OF THE WORLD

FROM THE INITIAL IDEA  
TO THE FINAL PRODUCT

EUROPEAN  
OPTICS  
since  
1933

**me opta**

# A BETTER VIEW OF THE WORLD

Meopta is an international company with a long, rich tradition of developing, manufacturing and assembling world-class optical, opto-mechanical and optoelectronic products. Meopta's state-of-the-art design, engineering, manufacturing and assembly capabilities enable it to provide the highest quality products and services to the industrial, military and consumer markets.

Boasting one of the best trained and most highly skilled work forces in the industry, Meopta develops and manufactures the most technologically advanced, high-performance products in the world.

From precision medical and scientific instruments to digital cinematic projectors, aerospace technologies, military weapon systems and consumer sports optics, Meopta's unparalleled experience allows it to design, engineer and manufacture a diverse array of high-quality products across a broad spectrum of markets and industries, making it a global leader in the optical field.



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# RESEARCH AND DEVELOPMENT

Meopta and its research development centre represent an ideal combination, in which a manufacturing company has its own development base to stimulate innovation, implementation and introduction to serial production.

## FROM THE INITIAL IDEA TO THE FINAL PRODUCT

Meopta delivers a sophisticated all-in-one service, that is flexible and cost effective.



### COOPERATION WITH COMPANIES

#### RAY TRACING METHODS & PHYSICAL OPTICS

- Zemax OpticsStudio
- Code V
- VirtualLab

#### CAD & PLM

- PTC Creo
- Siemens Teamcenter

#### NUMERICAL SIMULATIONS

- Dassault Systems Abaqus
- Mathematica
- MatLab

#### SW CONSTRUCTION

- .NET (C#)



### COOPERATION WITH UNIVERSITIES

This collaboration allows us to stay on top of current developments in the field of optics and precision mechanics and participate in various research and development projects.

**Academy of Sciences of the Czech Republic**

**Palacky University in Olomouc**  
Faculty of Science, Department of Optics

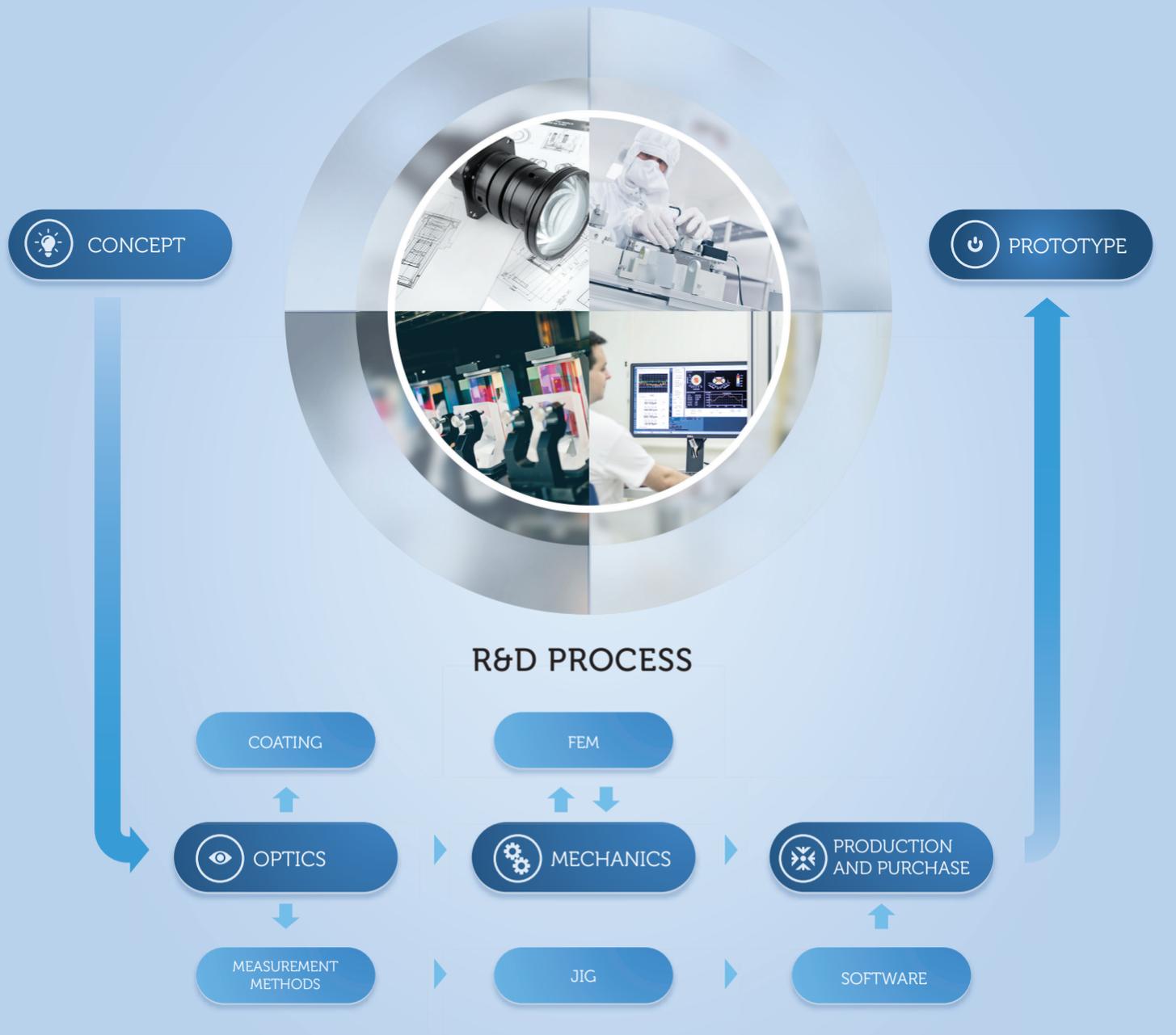
**Czech Technical University in Prague**

**University of Technology in Brno**

**Masaryk University**

**Institute of Physics**

**Joint Laboratory of Optics**



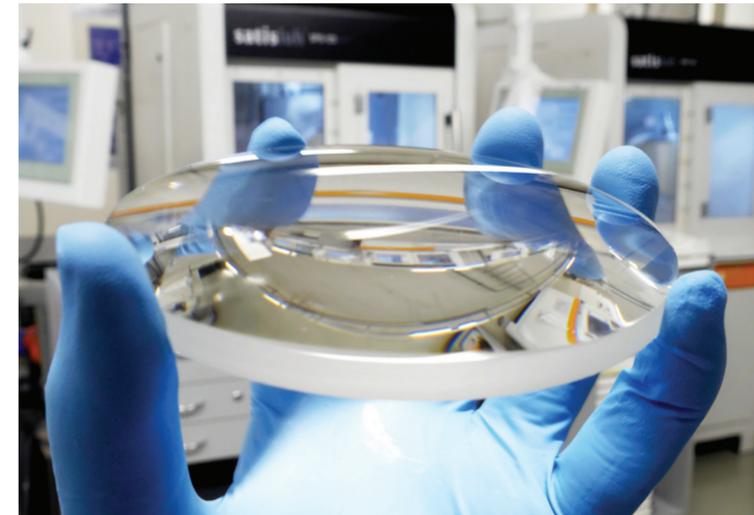
# OPTICAL PRODUCTION

We manufacture all convex and concave spherical lenses from various optical glasses and  $\text{CaF}_2$ .

We also have aspherical lenses in our portfolio.

## QED TECHNOLOGIES

help to overcome the limitations of traditional polishing and metrology methods.



## SPHERICAL OPTICS

We develop and manufacture optical components for the wavelength from DUV to NIR.



## POLISHING TECHNOLOGY

- We polish optical components on synthetic pads while using high-speed technology or using conventional methods involving natural pitch. With both processes we can achieve surface micro-roughness down to  $2 \text{ \AA}$ , surface quality, scratch-dig 20-10 and irregularity up to  $\lambda/20$ .
- For the strictest shape parameter Meopta uses MRF correction.
- We can produce spherical lenses from diameters of 5 mm up to 250 mm.
- We work with top consumable suppliers, so our polishing process is constantly evolving.



QED is the ultimate in flexible polishing technology.

QED's MRF computer-controlled polishing systems produce better, faster and cheaper high-precision optics.

High-performance MR fluids help polish superior optical surfaces or achieve ultra-low roughness.

QED's ASI(Q) created by the company that revolutionized stitching, brings you an even greater ability to make and measure complex optics.

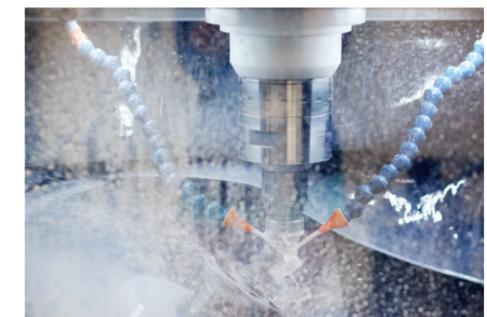
The ASI is powered by QED's powerful Subaperture Stitching Interferometry.



## ASPHERICAL OPTICS

The worldwide trend in increasing the performance, accuracy and resolution of optical systems has introduced elements with aspherical surfaces into the design.

Meopta has bought the latest machines and metrology instruments for aspherical lens production. We can produce aspherical lenses from diameters of 10 mm up to diameter 250 mm. If necessary, Meopta uses MRF technology for the finest correction of the polished surface.



# OPTICAL PRODUCTION

We produce all standard types of prisms (Right Angle, Penta, Roof, Schmidt, Corner Cube), light pipe homogenizing rods, polygons, wedges, filters, reticles, and more.

## CEMENTING

Optical assemblies consisting of two or more spherical and/or planar optical elements are bonded with advanced synthetic cements. We use an advanced automatic cementing machine for large-volume manufacturing of bonded assemblies.



## FLAT OPTICS

### ULTRASONIC CLEANING

Meopta has a total of six environmentally friendly ultrasound multi-tank washing lines to clean the optical components and jigs.

The universal 17-tank washing line uses organic solvents and is the most commonly used line. It can clean to optical varnish, wax, pitch and polishing powders from the pre-production stage. For ready-to-coat components we have a dedicated ultrasonic system.

### POLISHING TECHNOLOGY

We use CPM machines either equipped with natural pitch prepared by our proprietary formula or synthetic pads.

The achievable surface quality of the polished flat optics is up to scratch-dig 20-10 and micro-roughness down to 2Å. In the manufacturing process we can achieve angular accuracy up to 1 arc per second thanks to optical contact fixation. Surface flatness and irregularity can go up to  $\lambda/20$  (based on material and dimensions).

As in the case of spherical optics, we use non-contacting interference measurement for the in-process surface quality and shape inspection.



## OUR CAPABILITIES

- **Materials:** HFO<sub>2</sub>, SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, Ta<sub>2</sub>O<sub>5</sub>, Y<sub>2</sub>O<sub>3</sub>, MgF<sub>2</sub>, Al, Ag, Au, Inconel
- **Hot and cold coating process**
- **Wavelengths** 193 nm – 1,600 nm (213 nm, 248 nm, 266 nm)
- **Working environment**  
Class 1,000, Class 10,000
- **Over 40 vacuum coating chambers**  
(evaporation with IAD technologies)
- **Reactive magnetron sputtering**

## THIN FILM COATING PRODUCTION

- DIELECTRIC FILTERS**
  - UV filters, dichroic filters, IR filters, notch filters
- MIRRORS**
  - Dielectric (VIS, cold mirrors, hot mirrors, laser mirrors)
  - Metal (Ag, Al, Au, Cu, Cr)
- GREY (DENSITY) FILTERS**
  - Dielectric
  - Metal
- ANTI-REFLECTIVE COATING**
  - Single layer
  - Multilayer
- BEAM SPLITTERS**

## VACUUM COATING

Meopta is known worldwide as a reliable supplier of optical parts for the most demanding thin layers conforming to the requirements of antireflection, high reflection, beam-splitting, polarization and spectral filtration.



## PHOTOLITHOGRAPHY

The manufacture of reticles is based on the technology of positive photolithography by working with chromium layers on glass substrates. This method is used to make both positive and negative reticles and numeric markings as well as fine patterns on glass substrates. We make reticles with the thickness tolerance of the chromium lines starting from 0.003 mm.

# MECHANICAL MANUFACTURING

We offer our customers CNC and conventional technology processing (including EDM process) and various kinds of surface and heat treatments.

## SURFACE TREATMENT

Within our manufacturing process, we can provide various types of finishes required for the final design of the product.



## MACHINING

WE HAVE LONG EXPERIENCE WITH THE FOLLOWING MACHINING PROCESSES

- Turning technology including driven tools
- Milling technology including 5-axis machining
- More than 120 CNC machines altogether
- Grinding technology
- Sheet metal parts – high precision and quality, small-batch production
- Electrical discharge machining



SOME OF WHAT WE OFFER:

- Blasting of structured surfaces with glass beads, steel beads or corundum to achieve a satin structure
- Anodic oxidation-standard, hard and inorganic process
- Other finishing operations, such as nickel and cadmium plating, copper and bronze blackening; alkaline oxidation of stainless steel, stainless alloys and steel, electrolytic polishing of aluminium and stainless steel, painting, etc.

## HEAT TREATMENT

Vacuum quenching or work in a controlled nitrogen atmosphere.

Multi-purpose line with a controlled atmosphere of a mixture of gases.

### OUR CAPABILITIES

Production of highly accurate components:

- 850 square meters for highest precision
- Temperature  $22^{\circ}\text{C} \pm 2^{\circ}\text{C}$  for machining ( $22^{\circ}\text{C} \pm 1^{\circ}\text{C}$  for inspection)
- Accuracy up to 1 micron
- CNC milling, hard turning, grinding
- CMM measuring
- Contour/roughness measurement
- Roundness/cylindricity measurement
- Controlled humidity

### CMM measuring



### CNC milling



# ASSEMBLY

Assembly of the most complex opto-mechanical and electro-optical groups and systems.

Standard assembly line and specialised assembly.

## SPECIAL ASSEMBLY METHODS



### MEOPTA HAS THE FOLLOWING TECHNOLOGICAL CAPABILITIES TO SUPPORT AND COMPLEMENT THE ASSEMBLY PROCESS

- Precise centring of optical components in mechanical bodies (precision of up to  $\pm 0.001$  mm)
- Assembly with a predefined axial distance between the individual optical components (precision of up to  $\pm 0.001$  mm)
- Technologies to eliminate the contamination of the internal optical surfaces by dust or humidity
- CNC feeding equipment for the precise application of adhesives and cements; pneumatic dosing devices for adhesives and cements (we are also the manufacturer of these dosing devices)
- Laser printing technology (CO<sub>2</sub>, Nd: YAG laser, fibre laser)
- Degassing chamber
- Nitrogen charging
- Ultrasound cleaning of mechanical components
- UV adhesive and cement curing ovens (we are also the manufacturer of these ovens)
- Plasma activation of component surfaces before bonding
- Electro assembly



## CLEANROOM DETAILS

- Vacuum chamber for outgassing
- GMP washing machine for cleaning the parts
- CNC plasma cleaning machine
- Optic centration machine
- Interferometer
- Nitrogen boxes with relative humidity control



### TECHNICAL DATA

Cleanroom class According to ČSN EN ISO 14644	ISO 4/ISO 5/ISO 6 plus AMC (Airborne Molecular Contamination)
Area	2,500 m <sup>2</sup>
Filtration system	Hepa filters, Ulpa filters, chemical filters
Central particle monitoring system	From 0.1 $\mu$ m to 0.5 $\mu$ m
Nitrogen charging	5.0 purity with chemical filtration
Voltage	110 V, 220 V
Working wavelengths	1550 nm, 1030 nm, 635 nm, 633 nm, 532 nm, 405 nm, 365 nm, 266 nm, 193 nm

# QUALITY CONTROL

## OPTICAL MEASUREMENTS

### MEASURING OF THE FOLLOWING PARAMETERS

- Interferometric measurement
- Spectral measurement
- Measurement of shapes, sizes and angles
- Measurement of surface roughness
- Laser measurement
- MTF
- Measurement on optical bench

## MECHANICAL MEASUREMENTS

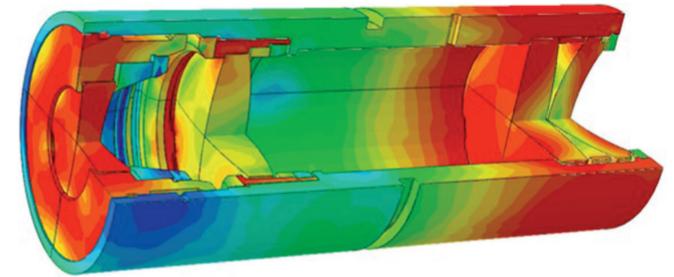
During each stage of mechanical component manufacturing, all required measurements are performed to ensure that specified technical parameters are met.



Because of our professionalism, we can offer customers professional measurement and testing services, as well as development of measurement methods and devices.

We think these services will precisely meet your needs, and that Meopta's testing laboratory will become your reliable partner in measuring, testing and developing your own measurement methods.

## PARAMETER VERIFICATION & TESTING



### ACHIEVABLE INSPECTION RANGES

- Wavelength range from 190 nm up to 3.3 microns (up to 15 microns for special conditions)
  - In any angle of incidence and polarization
  - Reflection, transmission, absorption, optical density
- Dimensional precision going down to 0.5 micron and 1 arc. sec.
- Radius and surface precision up to fragments of fringes (<0.1 micron)
- Mechanics opto-mechanical assemblies and optics (including rotary symmetrical aspheres)



## ENVIRONMENTAL TESTING

### MECHANICAL RESISTANCE

- Mechanical shocks up to 1,000 g
- Sine and random vibrations

### COMBINED TESTING

- Vibrations and shocks at low and high temperatures

### CLIMATIC INFLUENCES

- Low and high temperatures for both operation and storage
- Slow and fast temperature changes
- Temperature shocks
- Humidity
- Salt mist
- Dust
- UV
- Temperature tests at reduced pressure
- Tests by immersion in up to 30 m



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