METAL OPTICS
ULTRA PRECISION PARTS

LT ULTRA
OUR PROFESSION IS PRECISION

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OUR MISSION

We are proud to be involved in some of the major scientific developments of the new millennium.

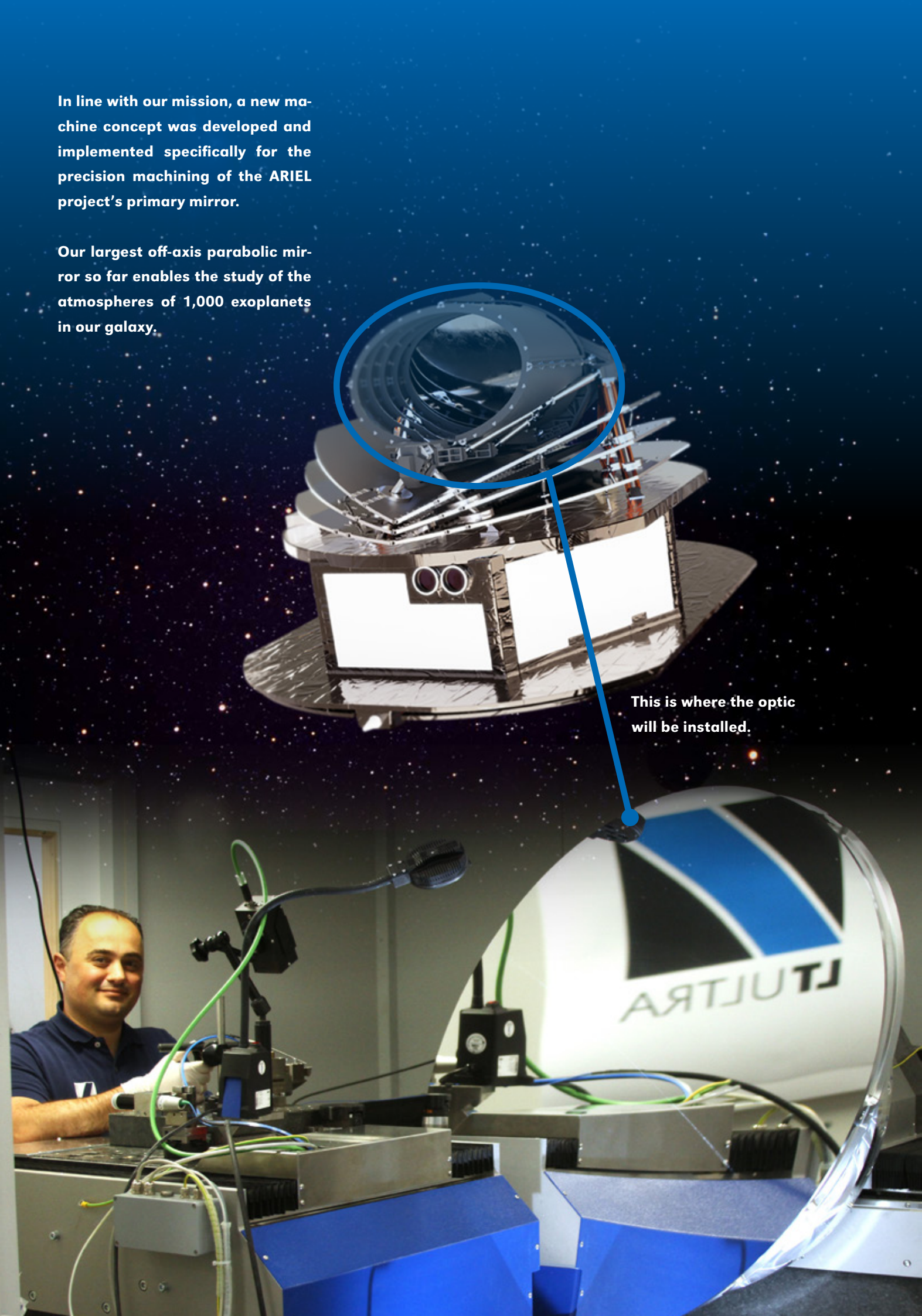
For example, we develop components for experiments
with diameters of 26,659 meters,
at energies of 50 TeV,
at distances of 14 billion light-years
... or just a few nanometers.

Projects and products for our customers in industry and science benefit from our experience.

OUR PROFESSION IS PRECISION

In line with our mission, a new machine concept was developed and implemented specifically for the precision machining of the ARIEL project's primary mirror.

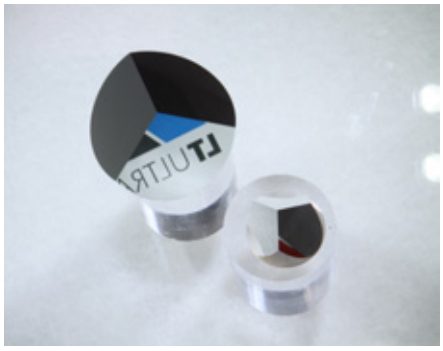
Our largest off-axis parabolic mirror so far enables the study of the atmospheres of 1,000 exoplanets in our galaxy.



MILLING/ FLY-CUTTING

With our fly-cutters/milling machines, we can machine not only flat surfaces and plane mirrors but also other shapes. Depending on the material and geometry, **flatness in the sub-micrometer range and roughness values as low as 2 nm Ra are possible.**

Detailed information available upon request.

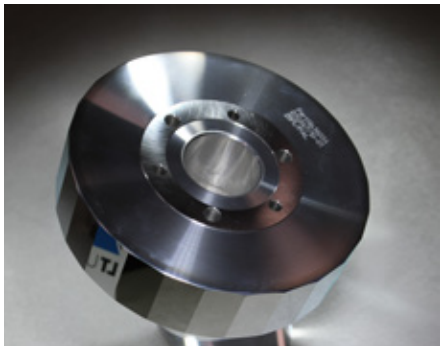


Plane mirrors:

- Machining up to 500 mm × 500 mm (or Ø800 mm) possible.

Roof mirrors:

- Machining of various angles and any number of surfaces possible.

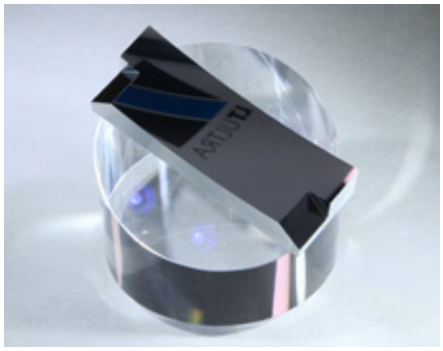


Polygon mirrors:

- Machining up to key width dimensions of 750 mm possible.
- Manufacturing of any pyramidal angles; manufacturing with different pyramidal angles on one polygon is also possible.

Typical accuracies:

- Dividing error approx. 5 arcsec*
- Pyramidal error approx. 5 arcsec*

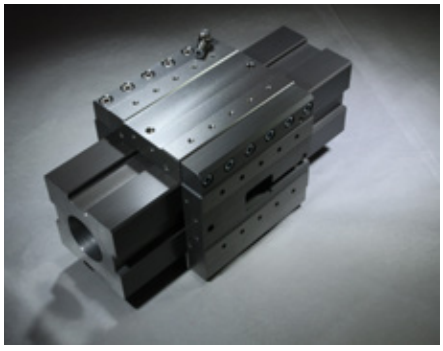


Spheres:

- Machining up to 500 mm × 500 mm (or Ø800 mm) possible.

Cylindrical mirrors:

- Machining of cylindrical mirror strips with lengths up to 800 mm possible



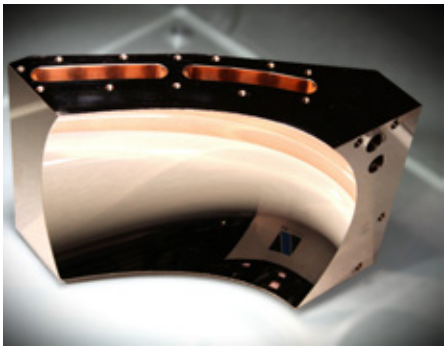
UP alignment surfaces:

- Up to 300 mm × 400 mm
- Machining of multiple surfaces tilted in space relative to one another possible.
- Accuracies in a single-digit micrometer range. Detailed information available upon request.

* Depending on geometry

TURNING

Using 3-axis and 4-axis turning technology, almost any conceivable geometry can be manufactured. Depending on material and design, **form accuracies in the sub-micrometer range and surface roughness as low as 2 nm Ra are possible.**
Detailed information available upon request.

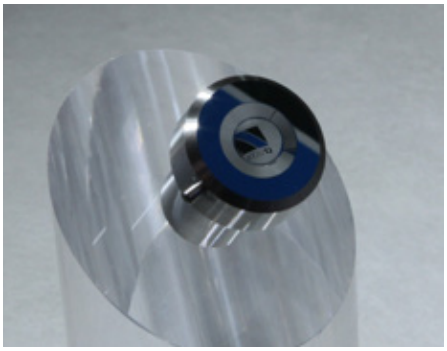


Spheres / Aspheres:

- Radii from approx. 5 mm to infinity (concave and convex)
- Mirror dimensions up to Ø1300 mm possible

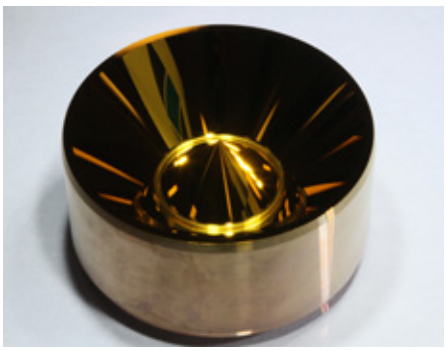
Freeform surfaces:

- In combination with dynamic axis technology, any non-rotationally symmetric geometries can also be realized.
- OAPs with long focal lengths are also feasible.



Optical surfaces in steel:

- With ultrasonic-assisted diamond machining, optics made of low-carbon steels can also be manufactured without polishing.
- Typically up to 53 HRC hardness



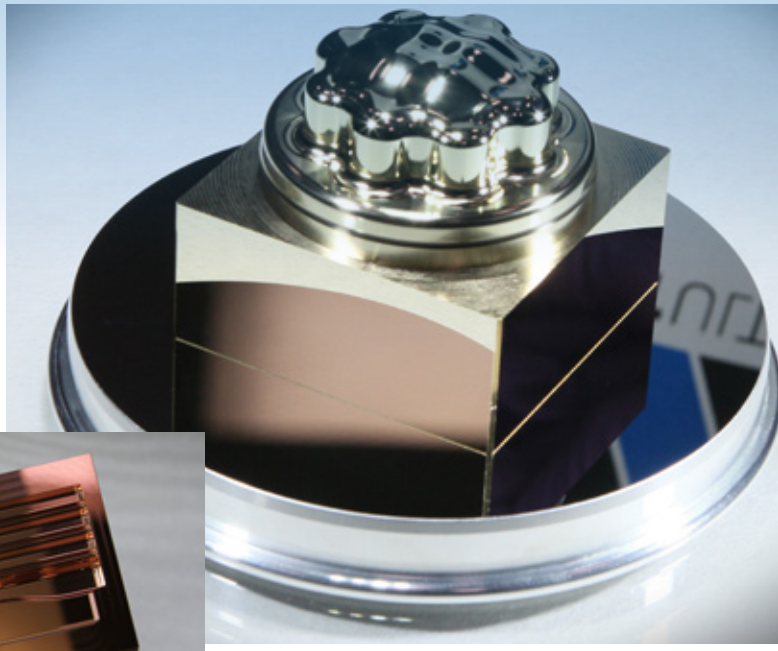
Other common optics:

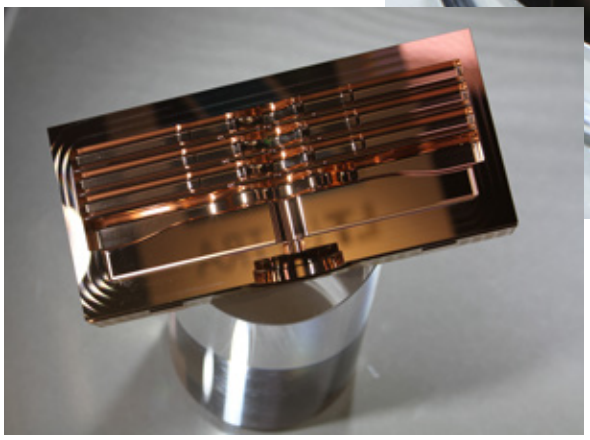
- Conical mirrors
- Bifocal parabolic mirrors
- Waxicon / axicon
- Step mirrors
- Integrator mirrors

UP MILLED PARTS AND MICRO MILLING

With our ultra-precision milling machine, multi-axis ultra-precise milling in a single setup is also possible. The maximum axis travel ranges are X 900 mm, Y 350 mm, and Z 200 mm.

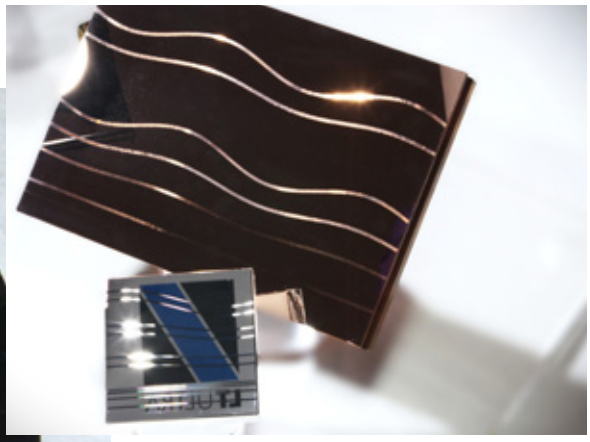
Achievable accuracies and roughness values depend on the respective geometry.

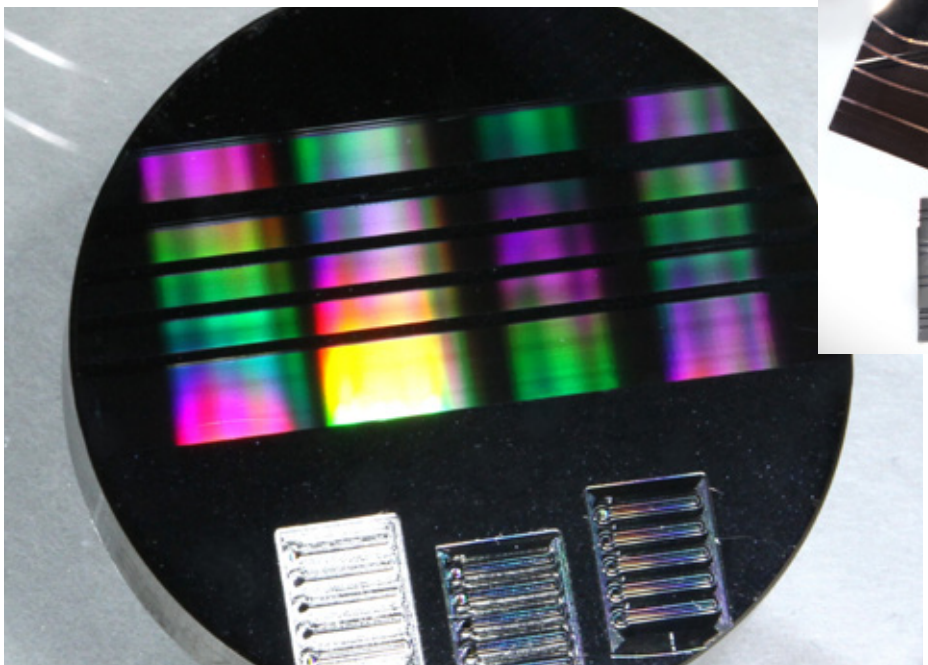




STRUCTURED OPTICS

Structured optics such as microlenses, gratings, and Fresnel lenses can also be manufactured. Structural depths in the sub-micrometer range can also be achieved.





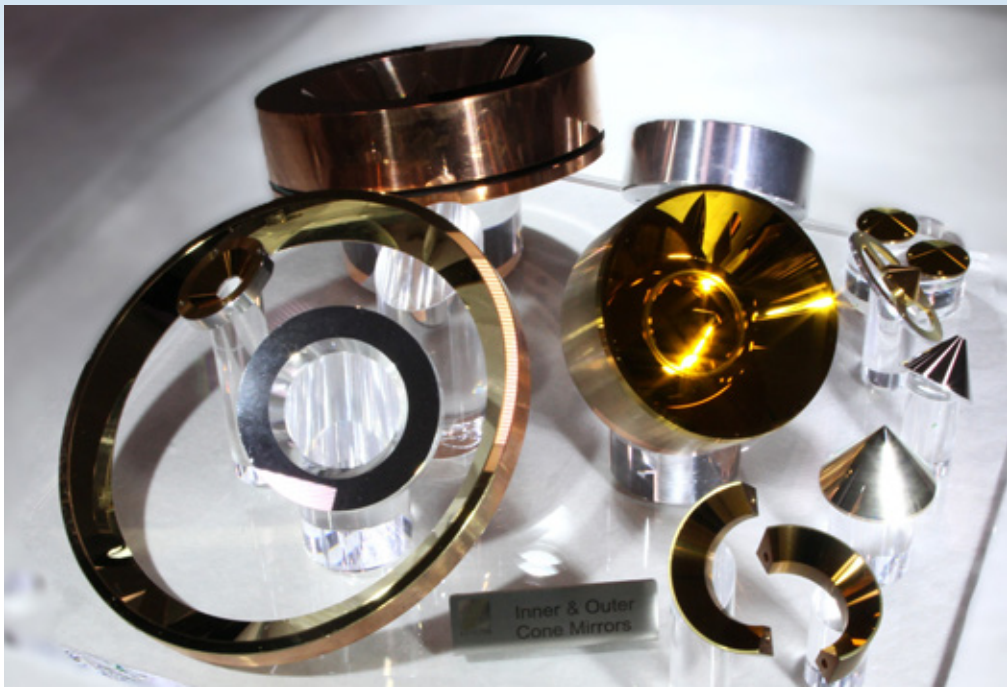
MATERIALS AND COATINGS

Common materials:

- Oxygen-free copper (CU-OFE)
- Aluminum
- Aluminum alloys (preferably 6082 and 6061)
- Brass
- Plastics (mostly PMMA)
- Crystals
- All non-ferrous metals

Special materials:

- Various low-carbon steel alloys (ultrasonic-assisted turning for optical surfaces)



Coatings:

- Aluminum with / without protective layer
- Silver with / without protective layer
- Gold with / without protective layer
- Enhanced coatings (gold, silver, aluminum)*
- Super enhanced coatings
- Phase-shift coating
- Hard gold
- Molybdenum
- SiO2 protective coating
- MgF2 protective coating
- Yttrium oxide protective coating

Further information:

Cooling

Almost all optics can be manufactured with or without (water) cooling.

Quantities

Thanks to our extensive and flexible machining capabilities, both single and series production are possible.

* Coatings can be optimized for specific wavelength ranges.

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