

# Computer Generated Holograms

INTERFEROMETRIC  
ASPHERE TESTING

PRECISION ALIGNMENT  
OF OPTICAL SYSTEMS

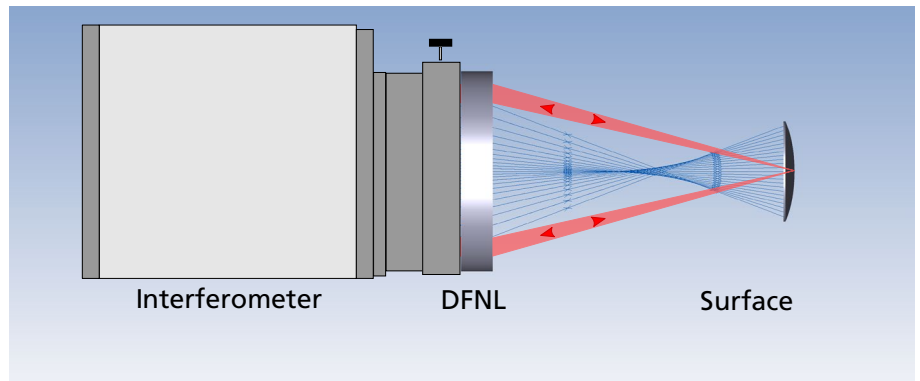
LASER BEAM SHAPING

# Interferometric Asphere Testing

## Customer testimonial

„Besides the remarkable performance we reach adopting Dioptic DFNL-type CGHs, very few companies can be so collaborative in the design phase and accurate on delivery dates“

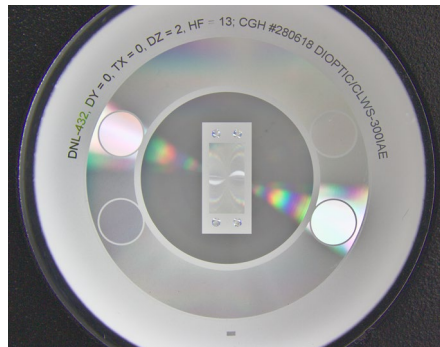
**Massimiliano Rossi**  
(Media Lario S.r.l.)



Surface Testing with a DFNL



DFNL with adjustment hologram



CGH for free form testing



5-axis CGH Alignment System

## DFNL: ASPHERIC TRANSMISSION SPHERE

- Our patented DFNLs (Diffractive Fizeau Null Lenses) are used in the same manner as standard transmission spheres. DFNLs allow the testing of a wide range of non-spherical surface forms
- The Fizeau principle guarantees that the set-up is free of any disturbances resulting from the hologram substrate
- Easy adjustment of the lens under test by means of the integrated adjustment hologram

## YOUR ADVANTAGES

- Testing of:
  - large convex surfaces
  - surfaces with large radius
  - (Off-axis) aspheres
  - Cylinders
  - Free form surfaces
- Compatible with all common interferometers
- Fast-track manufacturing within 3 weeks possible

## CGH: INTERFEROMETRIC TESTING OF STRONGLY CURVED SURFACES

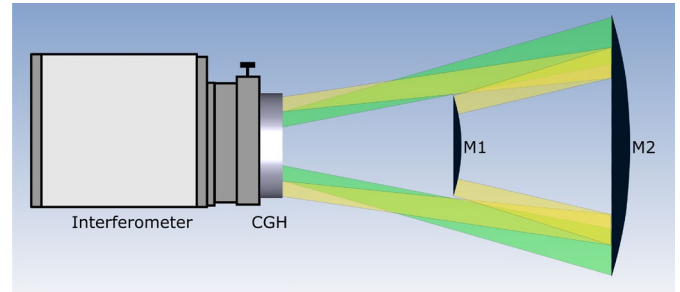
- For strongly curved surfaces computer generated holograms (CGHs) are combined with a spherical transmission sphere
- Various alignment aid holograms for alignment of the CGH and the test element are integrated on the CGH substrate
- 5-axis CGH alignment system available

Parameter	Value
Surface type	Convex & Concave
Maximum test diameter	220 mm (Convex) 8 m (Concave)
f/#	$\pm 1.0 - \infty$ (DFNL) $\pm 0.7 - \infty$ (CGH)
Measurement accuracy	$\lambda/20$ ( $\lambda/40$ with calibration)

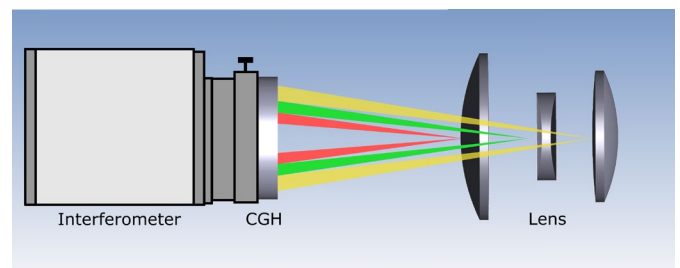
# Precision Alignment of Optical Systems



8 zone CGH for the alignment of the Euclid space telescope



Alignment principle of a mirror telescope



Alignment principle of a lens system

## LENS ALIGNMENT

- Ultra precise alignment of several lenses with a relative accuracy down to  $1\mu\text{m}$
- Simultaneous alignment of the lens position and tilt possible

## ALIGNMENT OF MIRROR TELESCOPES

- Alignment of mirrors in a telescope with micrometer precision
- The relative position and tilt of the mirrors can be tested using several sub-holograms on a single substrate

## YOUR ADVANTAGES

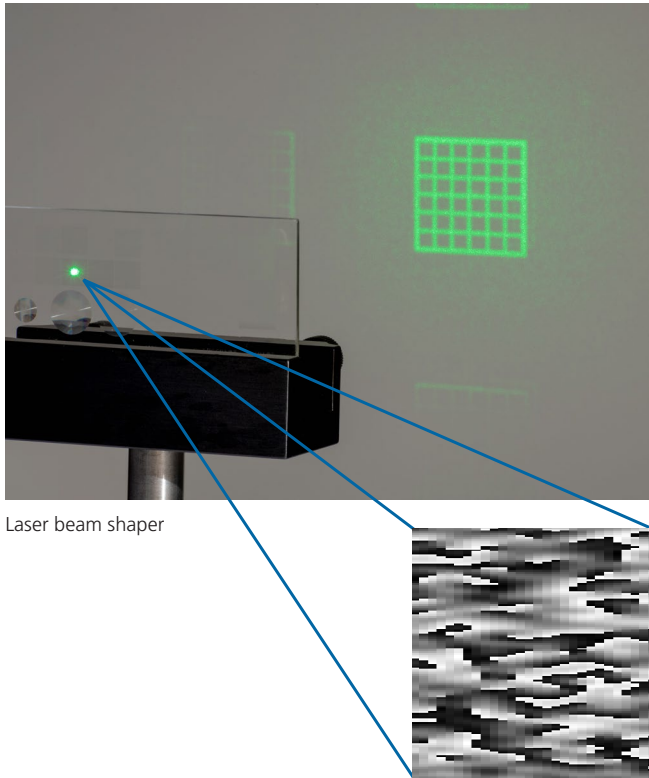
- Alignment of systems with extremely small alignment tolerances
- Alignment of systems with a detection spectrum far from the visible range (e.g. mirror telescopes)
- Alignment of systems operating in conditions that cannot be reproduced during the manufacturing process (e.g. temperature for space telescopes)

### Customer testimonial

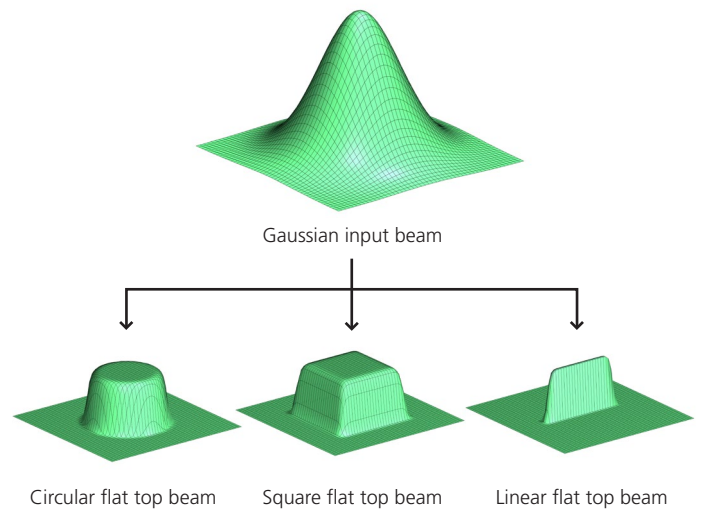
„Up to 8 lenses plus a reference beam literally „happening“ on one single glass surface ... that's optics designers dream world.“

**Dr. Frank Grupp (Observatory  
Max-Planck-Institute for  
extraterrestrial Physics)**

# Laser Beam Shaping



Laser beam shaper



## COMPUTER GENERATED HOLOGRAMS FOR LASER BEAM SHAPING

- Generation of various intensity distributions from a laser beam:
  - Laser beam homogenization
  - Structured illumination
  - Beam splitter
  - Diffusers
  - Pattern projection
- Application in medical technology, automotive sector, 3D measurement, product marking, counterfeiting protection and consumer products

## YOUR ADVANTAGES

- Customer specific design, manufacturing and testing from a single source
- Production of individual pieces and series production possible
- Low energy loss: Up to 95% diffraction efficiency

### Customer testimonial

„Our longtime partner DIOPTIC supports us reliably and with high-quality holograms for the beam path of the SCHWIND AMARIS excimer laser family. These ensure a very reproducible beam profile and a trouble-free optical beam path. The result is a Super Gaussian beam profile, which contributes to the particularly smooth and tissue-saving removal by AMARIS in laser eye surgeries.“

**Thomas Hollerbach, Project manager R&D  
(SCHWIND eye-tech-solutions GmbH)**

## Industry experience

- Compliance of industry standards
- Extensive network
- Fast project launch time

## Quality management

- DIN ISO 9001:2015 certified
- Complete documentation
- Transparent results

**Better  
together**

**Advantages with DIOPTIC**

## Flexibility

- Quick reaction time
- Personal support

## Know-how of our expert team

- Solutions on a high scientific level
- Patentable results
- Efficient and professional project handling

Head Office:  
DIOPTIC GmbH  
Bergstraße 92A  
69469 Weinheim  
Germany  
Tel. +49 6201 65040-00  
CGH@diopic.de  
www.diopic.de

**China:**  
Beijing OPTURN Company LTD  
Room 607, Yingzhi Building  
No. 49-3, Suzhoujie Street  
Beijing 100080  
China  
Tel. +86 10 62527843  
sales@opturn.com  
www.opturn.com

**UK:**  
Lambda Photometrics Ltd.  
Batford Mill  
Harpenden, Hertfordshire, AL5 5BZ  
United Kingdom  
Tel. +44 1582 764334  
Ken.Middleton@Lambdaphoto.co.uk

**Israel:**  
Lahat Technologies Ltd.  
Atir Yeda St. 17  
4464313 Kfar Saba  
Israel  
Tel. +97209 7646 200  
sales@lahat.com