Fraunhofer IOF
»Solutions with light«

Fraunhofer Institute for Applied Optics and Precision Engineering IOF

Director
Prof. Dr. Andreas Tünnermann

www.iof.fraunhofer.de
Fraunhofer-Gesellschaft, the largest organization for applied research in Europe

- 67 institutes and research units
- More than 23,000 staff
- €2 billion annual research budget totaling. Of this sum, more than 1.7 billion euros is generated through contract research.
  - Roughly two thirds of this sum is generated through contract research on behalf of industry and publicly funded research projects.
  - Roughly one third is contributed by the German federal and Länder governments in the form of base funding.
Mission Statement

- The Fraunhofer-Gesellschaft promotes and conducts applied research in an international context, to benefit private and public enterprise and is an asset to society as a whole.

- Fraunhofer Institutes help to reinforce the competitive strength of the economy in their region, throughout Germany and in Europe.

- As an employer, the Fraunhofer-Gesellschaft offers a platform that enables its staff to develop both professional and personal skills.
Joseph von Fraunhofer (1787 — 1826)

**Researcher**
- Discovery of the “Fraunhofer lines” in the solar spectrum

**Inventor**
- New methods for processing lenses

**Entrepreneur**
- Director and partner in a glassworks

“Fraunhofer lines”
Fraunhofer-Gesellschaft
Locations in Germany

Data 2013

- 67 institutes and independent research units
- 7 Fraunhofer Groups
- Worldwide locations

- institute or independent research unit
- other research unit
Pooling expertise
Fraunhofer Groups

- Institutes working in related subject areas cooperate in Fraunhofer Groups
  - foster a joint presence on the R&D market
  - help to define the Fraunhofer-Gesellschaft’s business policy

- ICT
- Life Sciences
- Light & Surfaces
- Microelectronics
- Production
- Materials and Components – MATERIALS
- Defense and Security VVS
Fraunhofer Group for Light & Surfaces

1. Applied Optics and Precision Engineering IOF
2. Electron Beam and Plasma Technology FEP
3. Laser Technology ILT
4. Physical Measurement Techniques IPM
5. Surface Engineering and Thin Films IST
6. Material and Beam Technology IWS

1. Aachen
2. Dresden
3. Braunschweig
4. Freiburg
5. Jena
Strategy planning at the Fraunhofer-Gesellschaft

Fraunhofer-Gesellschaft

1 Corporate Strategy

7 Group Strategies

Institute Strategies

Group 1
Institute

Group 2

Group ...

top-down

bottom-up
From a small association to the leading organization for applied research in Europe

Budget (in € million) ¹

² 2013: preliminary
From a small association to the leading organization for applied research in Europe

![Bar chart showing the increase in staff from 1949 to 2013, with a peak of 23,236 in 2013.](image-url)
Optics Region - Thuringia
Economic data in the field of optical technologies

<table>
<thead>
<tr>
<th>Enterprises</th>
<th>188</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turnover</td>
<td>€ 2800 Mio.</td>
</tr>
<tr>
<td>R&amp;D rate</td>
<td>10 %</td>
</tr>
<tr>
<td>Export rate</td>
<td>66 %</td>
</tr>
<tr>
<td>Employees</td>
<td>15,350</td>
</tr>
<tr>
<td>scientist in research institutes</td>
<td>1,200</td>
</tr>
<tr>
<td>Turnover development since 2010</td>
<td>+ 4 % p.a.</td>
</tr>
</tbody>
</table>

© OptoNet e.V. 2013
Jena – City of Light
Example for collaboration of industry and university

Friedrich-Schiller-University (1558)

Carl Zeiss
Ernst Abbe
Otto Schott
Jena – City of Light
Example for collaboration of industry and university
Jena – City of Light
Beutenberg Campus
Fraunhofer IOF
Markets
Fraunhofer IOF
Business Fields

Optical Components & Systems

Precision Engineering Components & Systems

Functional Optical Surface & Layers

Laser Technology

Photonic Sensors & Measuring Systems
The Fraunhofer IOF charts the entire process chain, from the system design to the manufacture of prototype systems.
Highlights

Aerospace

GAIA effective media grating

230mm
Articles

Measurement result, color-coded height

Solder paste volume, height, defects

Image and computation

= 30 Million 3D point/s (10 3D-image/s)

→ Worldwide leading data rate
Highlights

Coatings for EUV collectors

Challenges

- Reflection > 70%
- $\lambda = (13.5 \pm 0.03)$ nm
- 660 mm substrate size
Highlights
Coatings for EUV collectors

Challenges

- Reflection > 70%
- $\lambda = (13.5 \pm 0.03)$ nm
- 660 mm substrate size
Highlights
Micro processing with ultrashort laser pulses

“long” pulse (3.3 ns)

Ultrashort pulse (200 fs)

Drilling of injection nozzles in serial production

up until 20% less gas consumption

Photos: BOSCH
Fraunhofer IOF – Solutions with light