FRAUNHOFER AND FRAUNHOFER IIS EXAMPLES OF APPLIED RESEARCH

German-Turkish Days at Fraunhofer IIS and Fraunhofer IOF

Erlangen, Nov 11, 2014

Deutsch-Türkisches Jahr der
Forschung, Bildung und Innovation 2014
Türk-Alman Araştırma,
Eğitim ve İnovasyon Yılı 2014

Dr. Bernhard Grill
Fraunhofer Institute for Integrated Circuits IIS, Erlangen/Germany

Fraunhofer IIS

Joseph von Fraunhofer (17871826)

Researcher

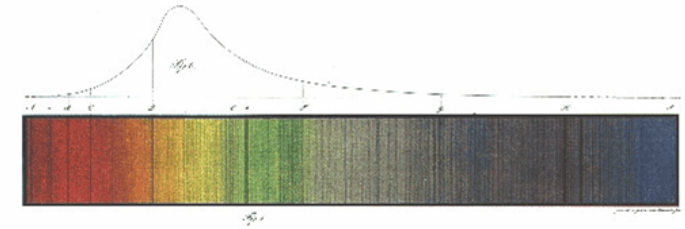
Discovery of the
“Fraunhofer lines”
in the solar spectrum

Inventor

New processing method
for lenses

Entrepreneur

Director and partner in a
glassworks

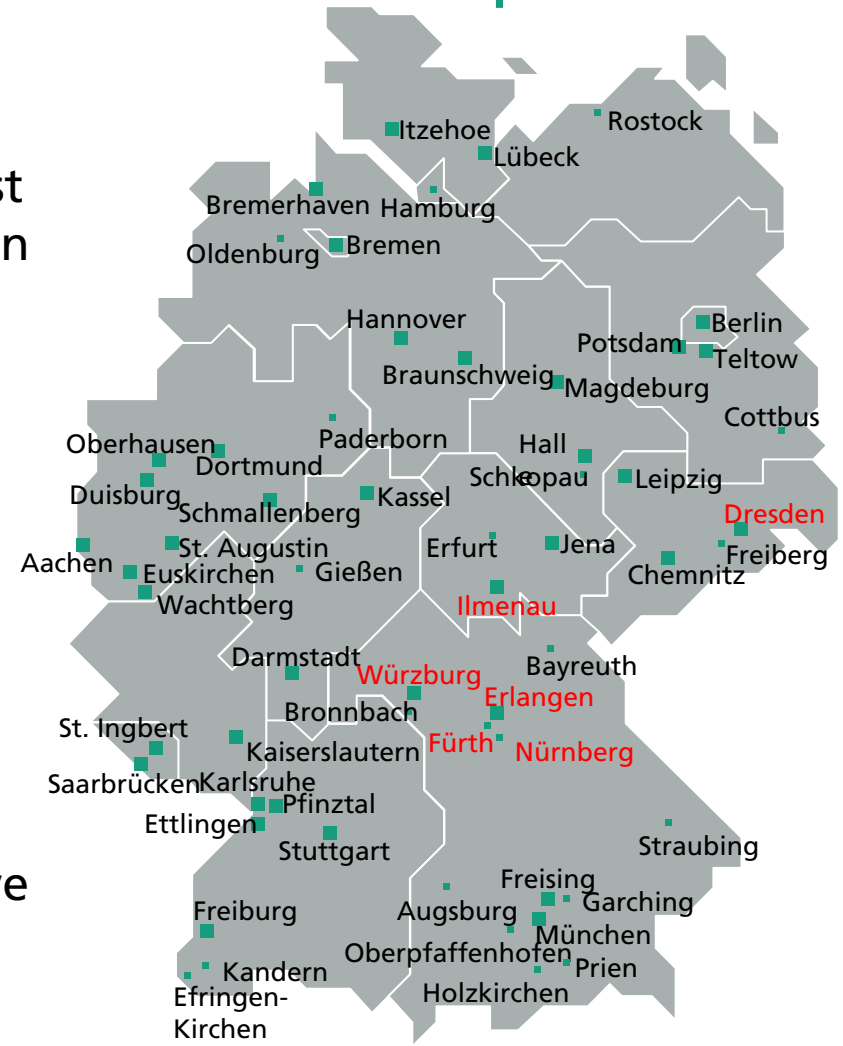


Fraunhofer IIS

The Fraunhofer-Gesellschaft

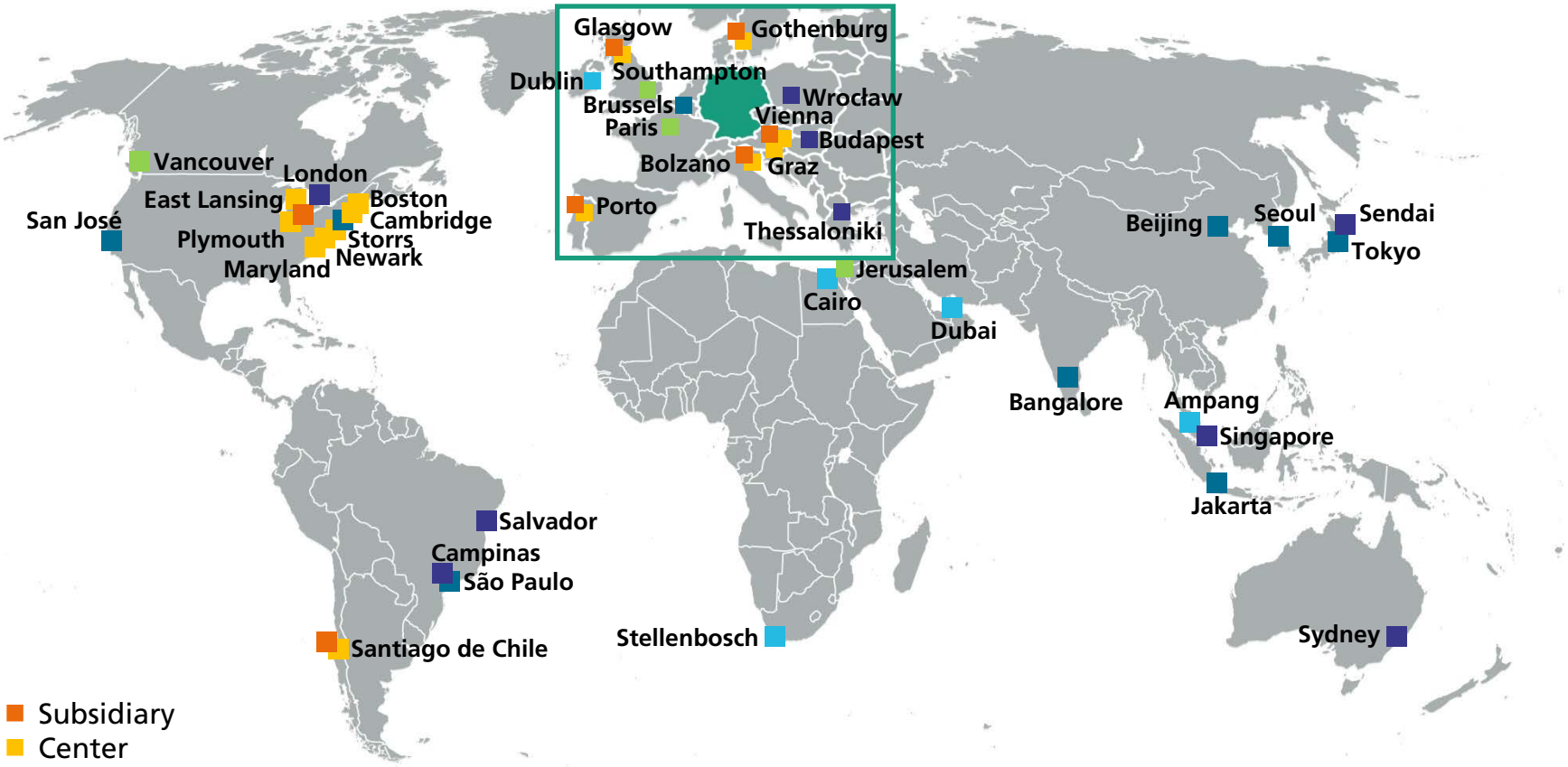
The Largest Organization for Applied Research in Europe

- Founded 1949 in Munich
- Fraunhofer-Gesellschaft, the largest organization for applied research in Europe
- Currently 67 Institutes in Germany with 24 000 employees
- € 2 billion annual research budget
  - € 1.7 billion is generated through contract research. € 0.3 billion is contributed by the German federal and Länder governments in the form of base funding
- Research centers and representative offices in Europe, USA, Asia and in the Middle East



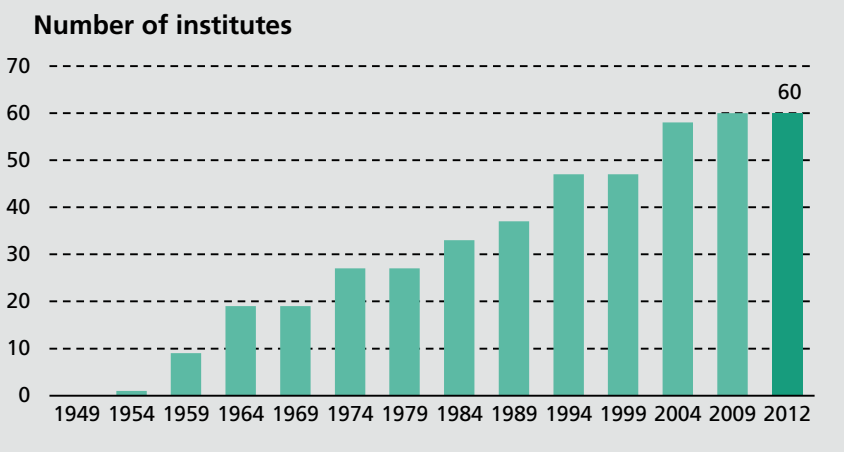
Fraunhofer IIS

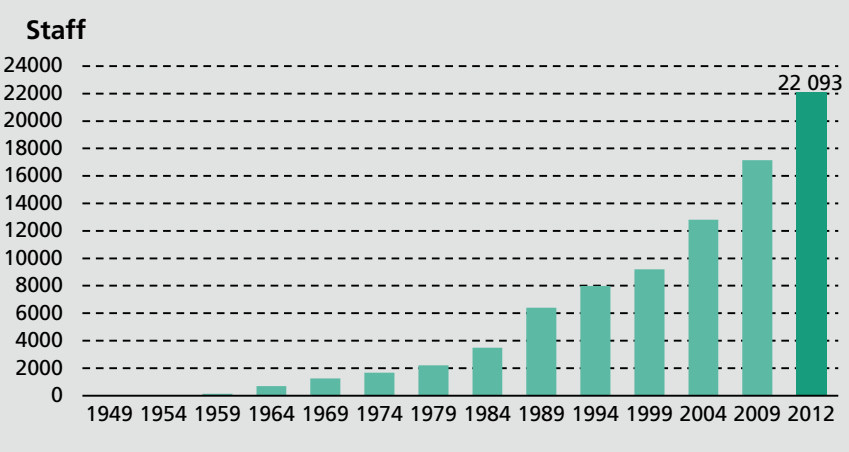
Fraunhofer worldwide

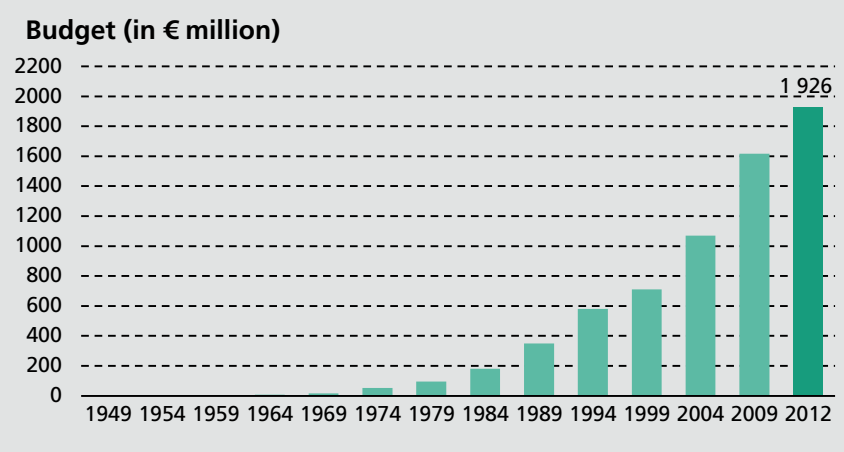


Fraunhofer IIS

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

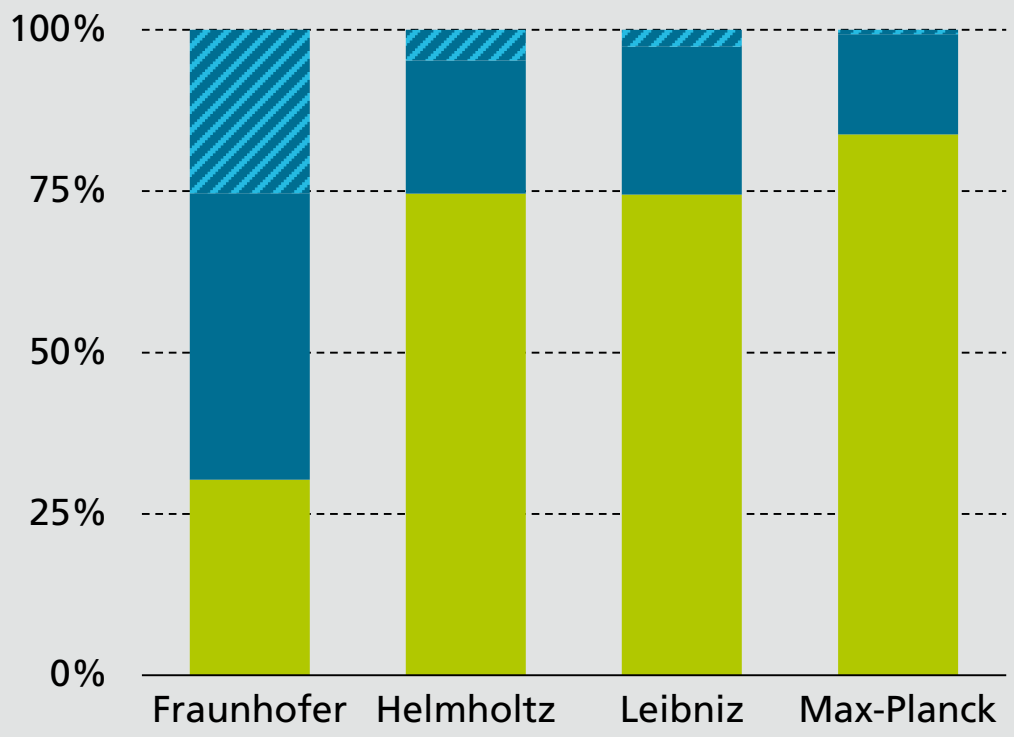






Fraunhofer IIS

German Research Landscape



- Contract financing from industry**
- Competitive public funding*
- Institutional core funding

Source: Paktbericht 2013, Data from 2012

* BMBF, Bundesländer, EU, ...

** Contract financing from industry without revenues from licensing intellectual property rights

Fraunhofer IIS

Fraunhofer Research and Business Models

Contract Research for clients from industry

- applied R&D, test & validation, consulting services for industry
- exclusively on request

Collaborative Research with partners

- forefront and applied research (demonstrators)
- e.g. funded by European Union and national funding bodies

Consulting Services

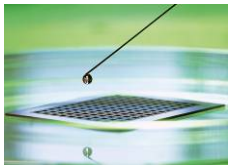
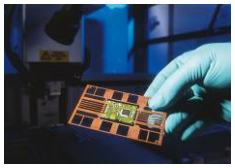
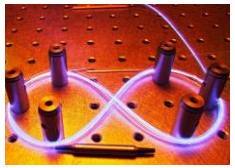
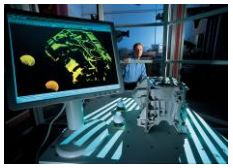
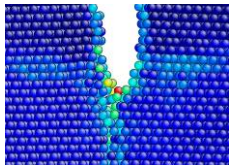
- Based on own research capabilities
- Support for decision makers

Patent / Technology / Product Licensing

- worldwide, preferably non-exclusive

Fraunhofer: Europe's Leader in Applied Research
Research Areas

- Information and Communication Technology
- Life Sciences
- Microelectronics
- Surface Technology and Photonics
- Production
- Materials and Components
- Defense and Security


Fraunhofer IIS

Fraunhofer IIS

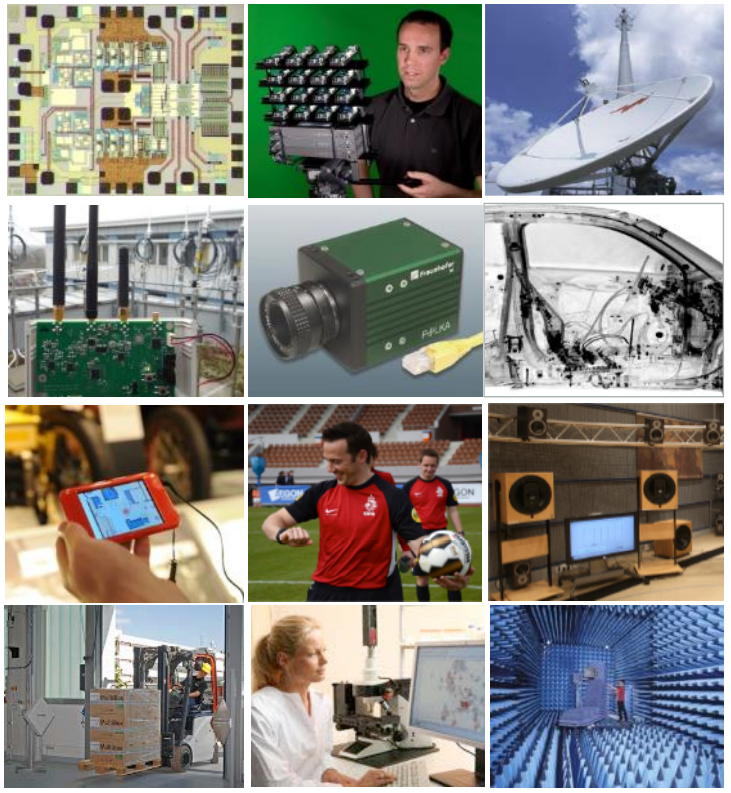
- Founded: 1985
- Locations: Erlangen, Fürth, Nuremberg, Dresden
- Staff: more than 830
- Budget: approx. 108 Mio Euro
- Revenue sources:
  ~55% income from industry
  ~20% public research contracts
  ~25% public basic funding

- www.iis.fraunhofer.de

Fraunhofer IIS

Fraunhofer Institute for Integrated Circuits IIS – Business Fields

- Audio and Multimedia
- IC-Design and Design Automation
- Sensor Systems
- Imaging Systems
- Positioning, Navigation, Localization
- Communications
- Energy Management
- Nondestructive Testing
- Medical Technology
- Supply Chains
- Safety and Security Technologies



Fraunhofer IIS

Fraunhofer Institute for Integrated Circuits IIS – Some Research Highlights

Fraunhofer IIS

Research Area Audio and Multimedia

More than 20 Years of Development – 5 Generations of Successful Audio Codecs

Approx.
7 billion devices
are using audio technology from Fraunhofer IIS

EVS/MPEG-H

xHE-AAC

MPEG Surround, AAC-ELD

HE-AAC, HE-AACv2

AAC, AAC Low Delay

mp3, mp3 Surround, mp3HD

1992 1997 2003 2007 2012

Fraunhofer IIS

Audio & Multimedia Research Highlights

A new sound dimension thanks to Fraunhofer Symphoria

- Natural sound: The Fraunhofer Symphoria 3D technology opens up the sound image and creates an impressive dimensionality and spaciousness
- The combination of intelligent signal processing software and height speakers creates a revolutionary sound experience in the car
- Cooperation of Audi, B&O and Fraunhofer IIS:
  - Based on its psycho-acoustic know-how in 3D audio, Fraunhofer IIS developed a signal processing software for 3D playback
  - B&O delivers speakers and amplifier
  - Audi integrates the system into the car

Fraunhofer IIS

Audi Q7 3D Sound Concept Car

- World premiere at **Consumer Electronics Show CES 2013 in Las Vegas**

Fraunhofer
IIS

Fraunhofer Cingo
For a Great Sound Experience on Small Devices

- With Fraunhofer Cingo tablets or smartphones become true surround sound theaters
- Cingo users can expect …
  - an excellent surround sound listening experience over stereo speakers or headphones.
  - a more natural and clear sound for stereo content.
  - loudness optimization for listening in noisy environments.

Fraunhofer Cingo brings an unrivaled surround sound experience to Google Nexus devices.

Google play

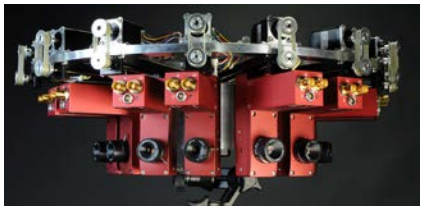
SK broadband

Fraunhofer IIS

Research Area Professional cameras technologies –

for industry, medicine, movie, TV and broadcast, automotive, security, research and science

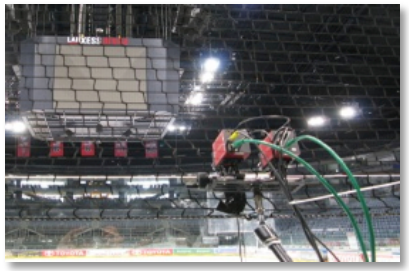
- 3D-, Panorama- and Multi-view-camera-system
- High-speed cameras for industrial, medical and sportive applications
- Cognitive Camera-systems: Sophisticated High-speed Object Recognition Engine SHORE™ for face recognition, face analysis, object detection, gestural recognition and scene analysis

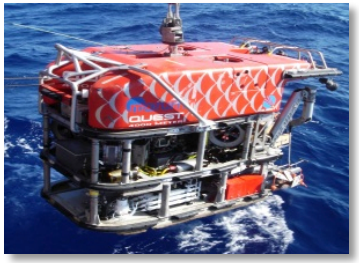


Fraunhofer IIS

Smart Point-of-View Cameras –
INCA camera platform

- Design of an intelligent HDTV camera platform INCA for Point-of-view applications
  - Extremely compact und robust
  - Modular, intelligent, cooperative, autonomous
  - Integrated metadata acquisition (e.g. acceleration)





Fraunhofer IIS

Smart Point-of-View Cameras –
The Holgerson Eagle Cam

- Full-custom design based on INCA camera platform
- Camera-internal recording of very special views in HD-quality from the back of an eagle
- Production of a movie „Cry of the eagle“ sponsored by Red Bull & Terra Mater

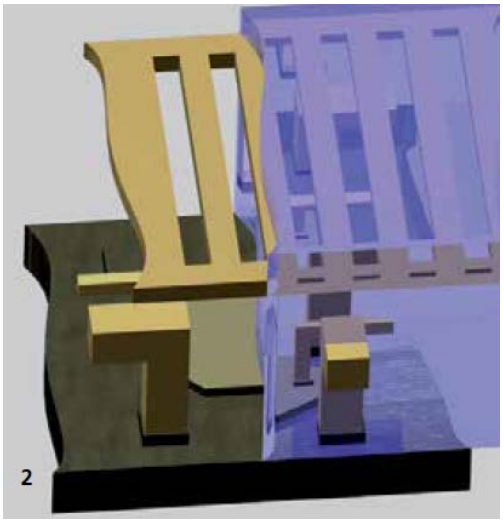
Red Bull MEDIA HOUSE

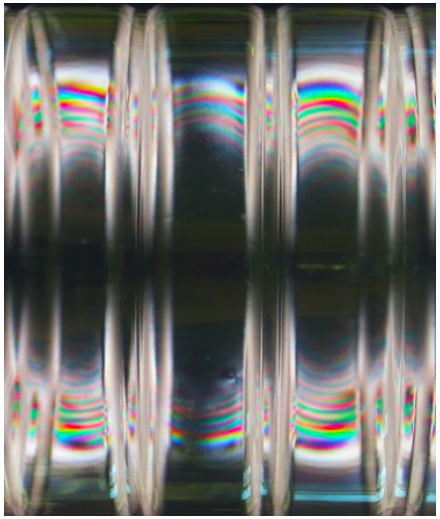
TERRA MATER
Factual Studios

Fraunhofer IIS

POLKA Polarization Camera –
Uncover the Invisible

- Pixelwise detection and measurement of the polarization state of light
- Custom made CMOS-sensor with on-chip polarizers
- One-shot image acquisition for moving objects (no motion artefacts)
- Real-time measurement of polarization information
- High-speed with frame rates up to 300 fps

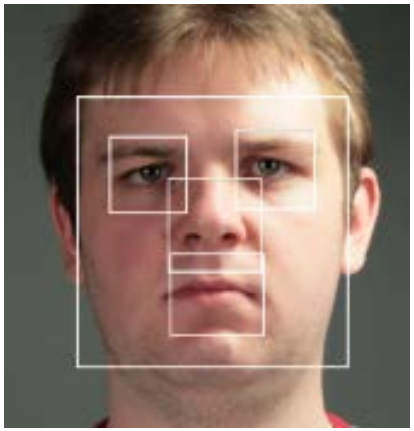


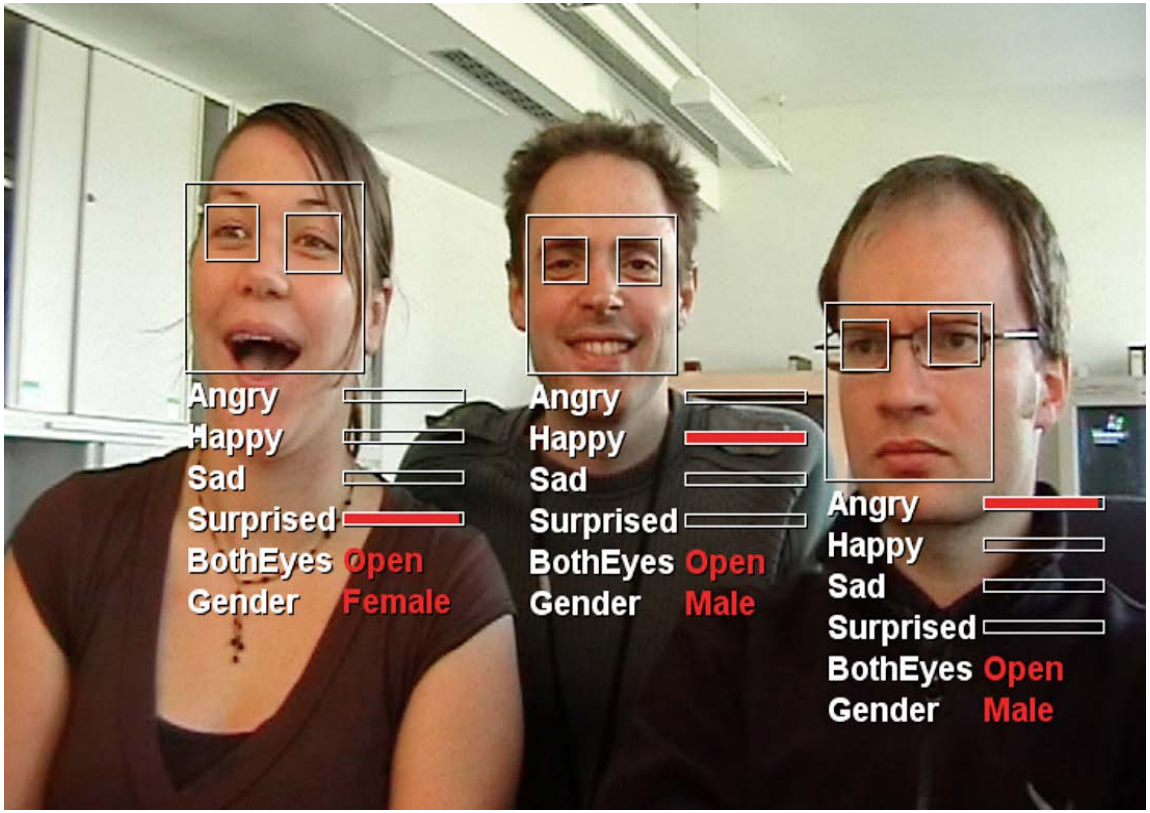


Fraunhofer IIS

Cognitive Camera Systems

- Sophisticated High-speed Object Recognition Engine SHORE™ for face recognition, face analysis, object detection, gestural recognition and scene analysis

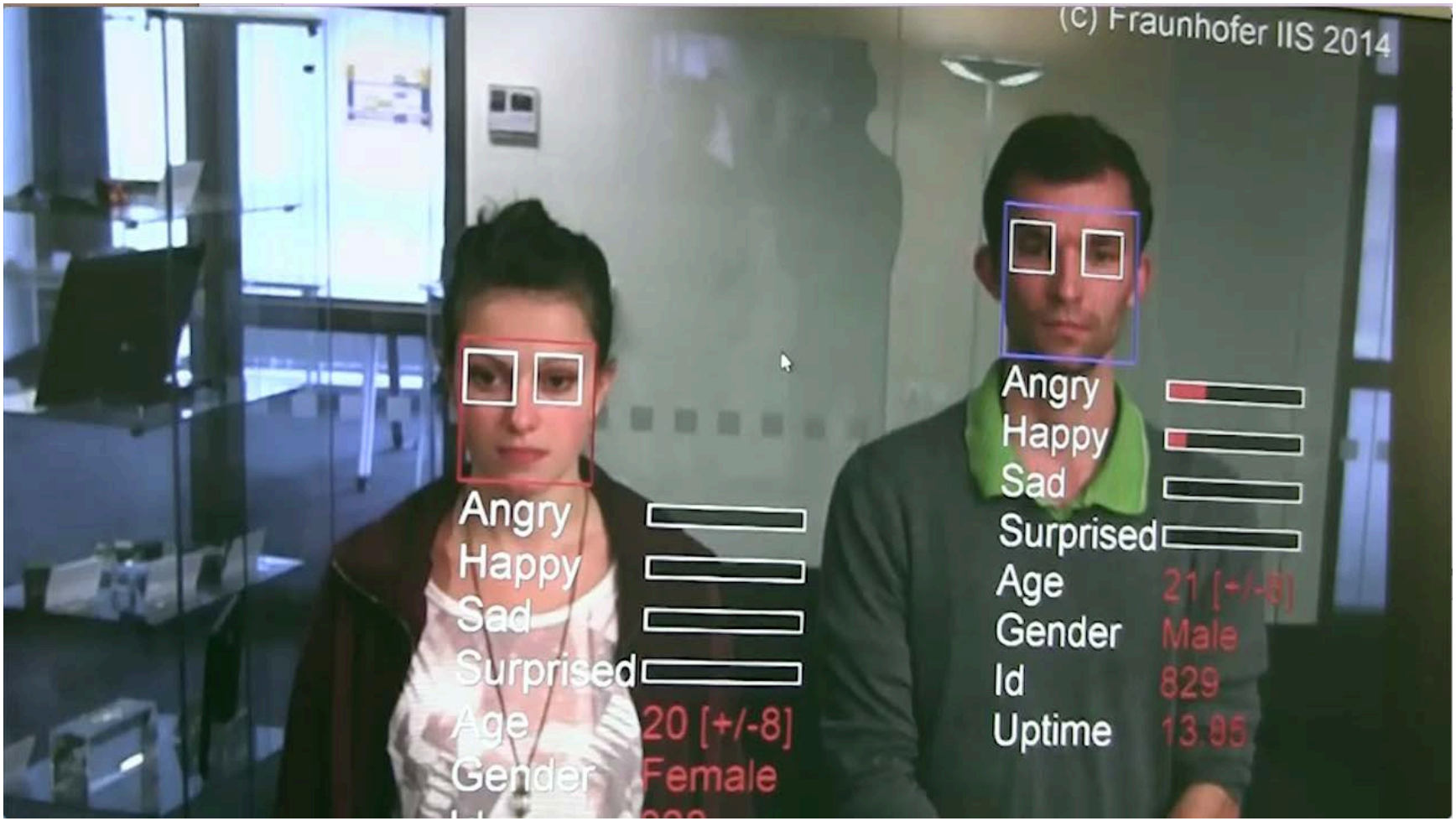




Fraunhofer IIS

SHORE™

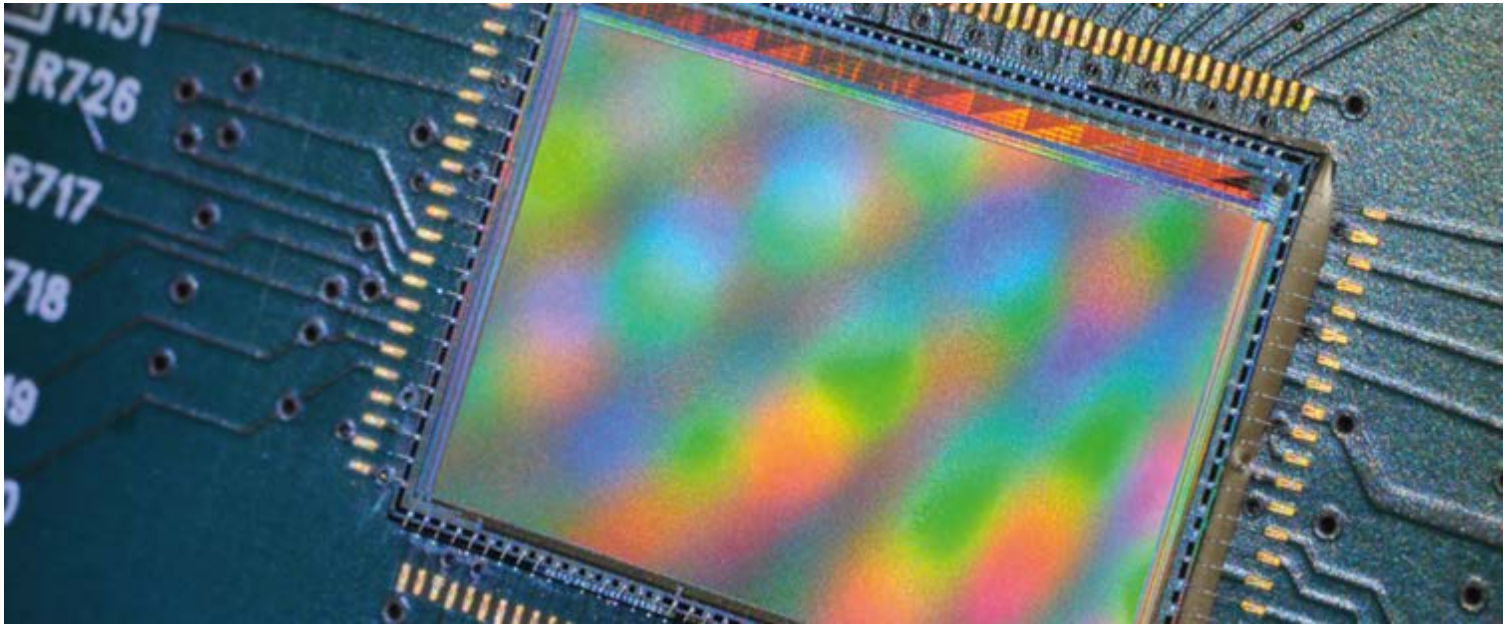
Detect the Information Behind



Fraunhofer IIS

Research Area Integrated Circuits and Systems

- Since 27 years independent interface to international semiconductor manufacturers
- Several hundred successfully completed ASIC designs in standard semiconductor technology
- Team of about 70 designers jointly work out solutions with the customer

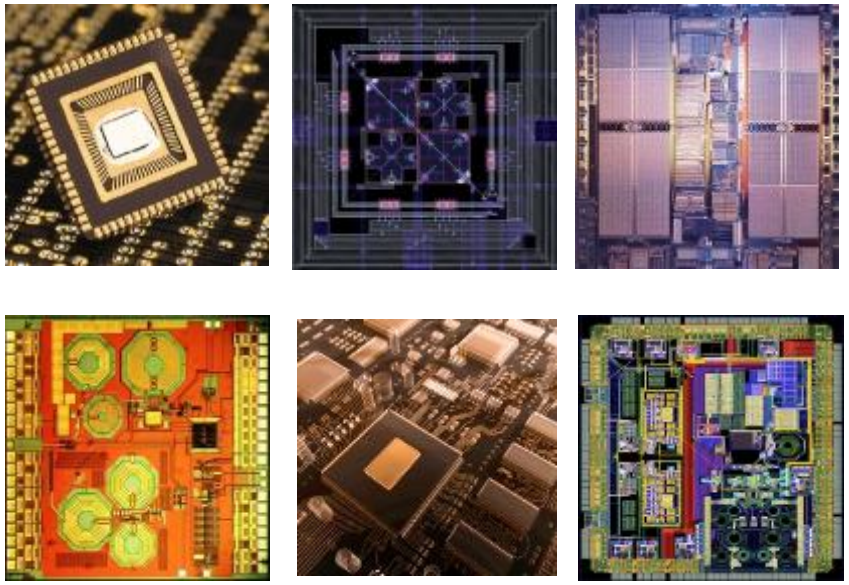


Fraunhofer IIS

Fraunhofer IIS –
Design of Application Specific Integrated Circuits

Solutions and competencies throughout the complete design process with focus on:

- Design of complex digital circuits
- Analog IPs and RF ICs
- Mixed signal ICs
- Analog-to-digital converters
- Integrated Sensor Systems

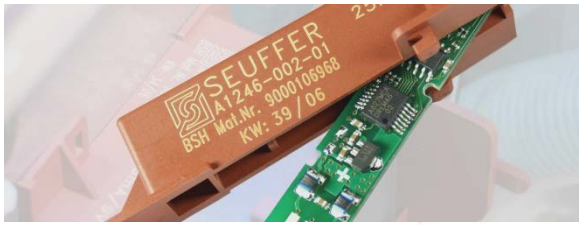


- IC design support
- Solutions and services for small and medium-sized companies
- Qualified IP Cores for ASICs and FPGA solutions

Fraunhofer IIS

Innovation in Magnetic Sensing
3D Hall Sensor Technology »HallinOne«

- HallinOne: patented technology to integrate also vertical Hall-Sensors (measuring B_x and B_y) on standard CMOS process
- Layout as “pixel cell”, measuring complete magnetic flux vector in nearly one point
- Field gradients can be measured by multiple pixel cells on one chip
- Integrated self test, self monitoring and sensitivity calibration
- On-chip temperature and offset calibration
- Applications (amongst others): distance, angle measurement, current measurement



Fraunhofer IIS

Support Activity »Virtual Foundry«

EUROPRACTICE MPW service

GLOBALFOUNDRIES

Channel Partner offering MPW-access down to 28 nm

EUROPRACTICE Software Service

CAD for European Academics

Managed and operated
Rutherford Appleton Laboratory (RAL), UK.

- 530 universities, 100 research labs
- 30,000 licenses
- »European«
- »non-commercial«

EUROPRACTICE IC SERVICE

IC prototypes and small quantities world-wide

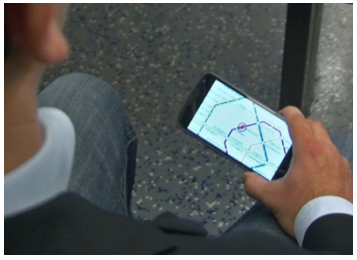
Consortium: IMEC, Fraunhofer IIS

- about 650 universities, research centers and about 300 companies
- »world-wide«
- »only export restricted«

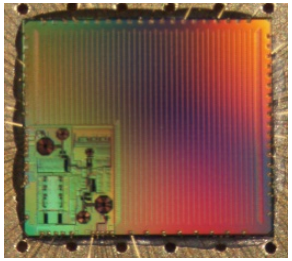
Fraunhofer IIS

Positioning, Communication and Identification Technologies

- Development of precise and performance-optimized GNSS receivers (GPS/EGNOS/Galileo/ GLONASS) including ASIC development
- Customized communication systems with high ranges, telemetry systems with a high number of participants (>1000), miniaturized transmitters, antenna design
- Development of RFID writing- and reading stations, TAGs including antennas, Near Field communication; RFID integrated in metal, fiber reinfored materials (glass/carbon)
- awiloc® – 3D positioning for buildings and urban areas: no inter-connected infrastructure, no server, no data communication



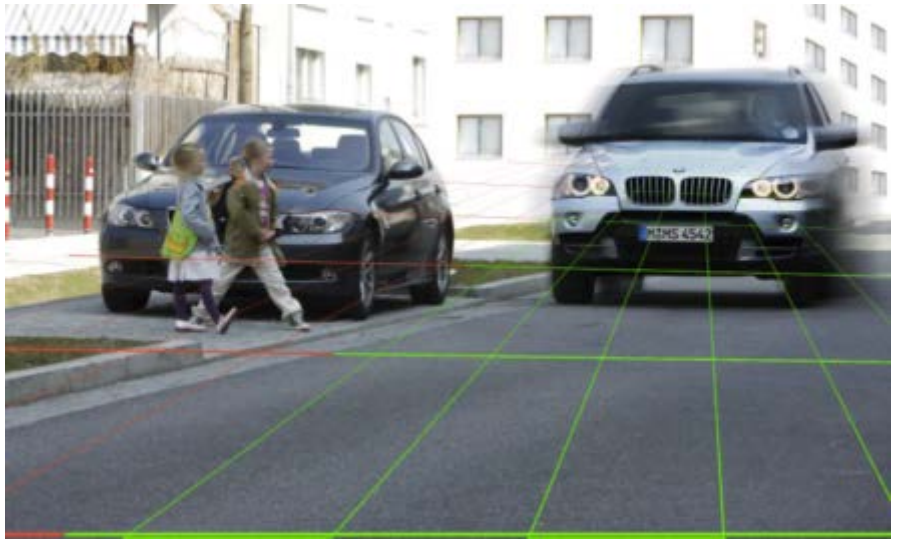


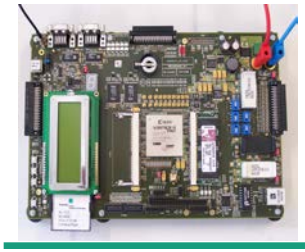


Fraunhofer IIS

Localization and Navigation Technologies

- SatNav receiver technologies for GPS, GLONASS, GALILEO
- Localization in WiFi and sensor networks
- Real-time high resolution radio based locating system in special areas of interest
- Inertial sensors
- Fusion of locating technologies and sensors

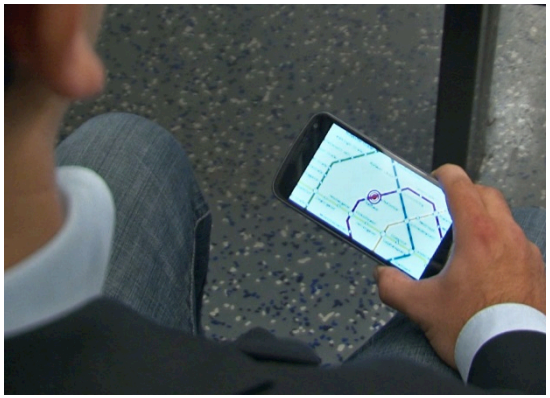




Fraunhofer IIS

3D positioning for buildings and urban areas with awiloc®

- awiloc® is a purely software-based, privacy-preserving seamless positioning solution for mobile devices
- awiloc® requires no inter-connected infrastructure, no server, no data communication, all that is needed is to plug-in Wi-Fi transmitter or BLE beacons
- awiloc® provides a high accuracy up to one meter on the mobile device
- awiloc® is worldwide well-established in museums
- awiloc® is also ideally suited for shopping centres, exhibition sides, public services …

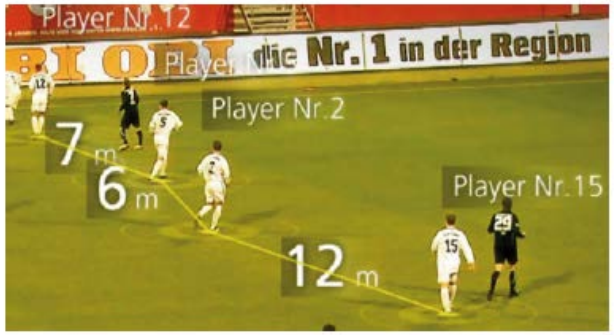


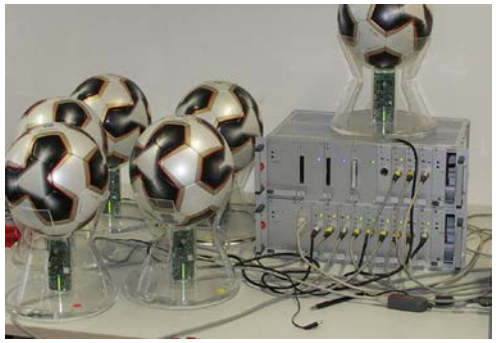
www.awiloc.com © Fraunhofer IIS, mobile devices with awiloc®

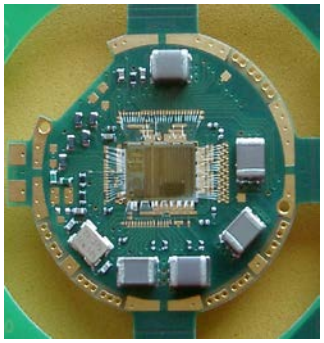
Fraunhofer IIS

Sport Technologies –
RedFIR – the leading tracking technology

- Analyzing football games with modern location technology (»Chip in the ball«)
- RFID Technology (not GPS)
- Accuracy of few cm
- Tracking rate: 200 Hz (Players) and 2000 Hz (Balls)
- Added-value through 3D-Visualization of the ball and new data within real-time
- New marketing opportunities for sponsors and media companies







Fraunhofer IIS

Fraunhofer IIS wireless link at the FIFA World Cup 2014 in Brasil

- Wireless link with the referee watch in the goal line technology (modified TI Chronos ez 430) at the World Cup in Brasil
- Secure and reliable data transmission to the referees
- Covers one stadium with only one 868 MHz transmitter
- Very long operating time: >12 h, >1000 goal messages incl. vibration

FIFA WORLD CUP Brasil

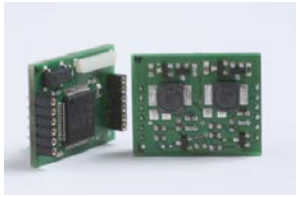
- In general Fraunhofer IIS integrates customer-specific telemetry solutions:
  e.g. Telegram Splitting System in a wide range distributed sensor net (with 8 dBm transmit power and a receiver sensitivity of -140 dBm, range >10 km)

Fraunhofer IIS

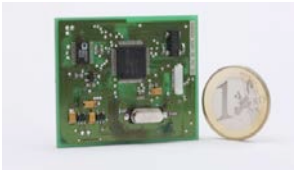
Medical technologies–
Intelligent Assistive Devices

- Various miniaturized sensor measuring systems, radio modules and RFID tags to collect physical values
- Wireless communication technology for data transmission (GSM, Bluetooth, ZigBee) and Telemonitoring
- Intelligent sensor textiles measures respiration effort and frequency, ECG, analyze movements and detect falls

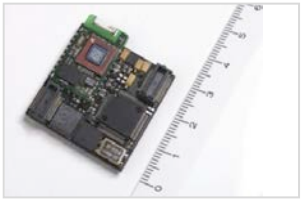
Respiration



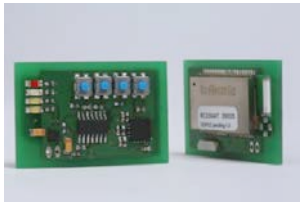
Oxygen saturation SpO_2



Electro-cardiogram ECG



Motion detection



Fraunhofer IIS

Fraunhofer IIS – Looking at the Whole Value Chain
Center for Smart Objects (Internet of Things)

- Interdisciplinary team of engineers works on business models, assessment of technologies, technology development
- Creativity workshops as well as in-depth interviews as methods for problem identification
- Platform approach for development:
  - Technology platform for smart objects
  - Design platform for solutions
  - Test and evaluation center L.I.N.K.
  - Business Ecosystem for implementation
- Typical results: Solution blueprints, feasibility studies, technical prototypes, fully developed solutions and business cases

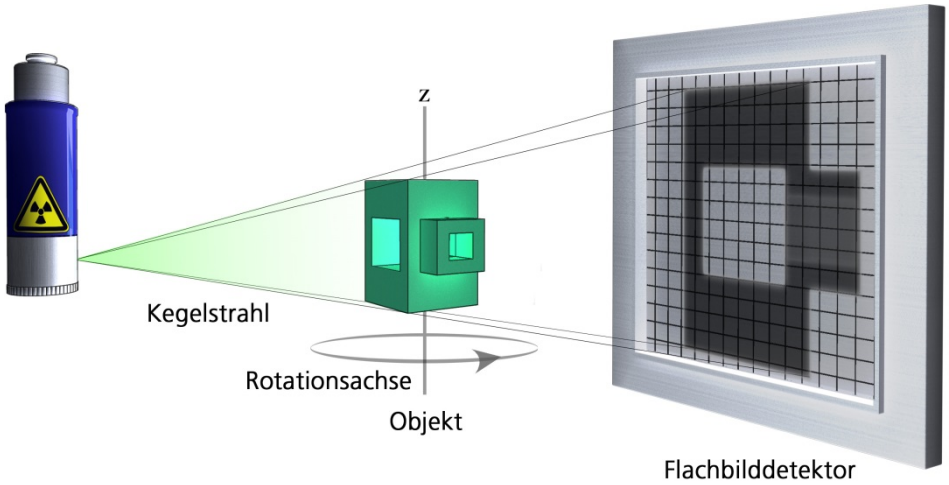
Fraunhofer IIS

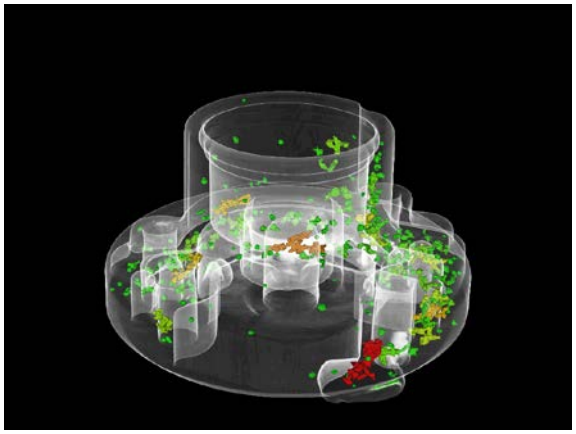
Research Area

Non-destructive Inspection and Testing

- 3D X-ray Computed Tomography (CT) for non-destructive inspection of materials and components

Beam Generation | Object Interaction | Image Acquisition | Image Reconstruction | Image Processing | Data Evaluation





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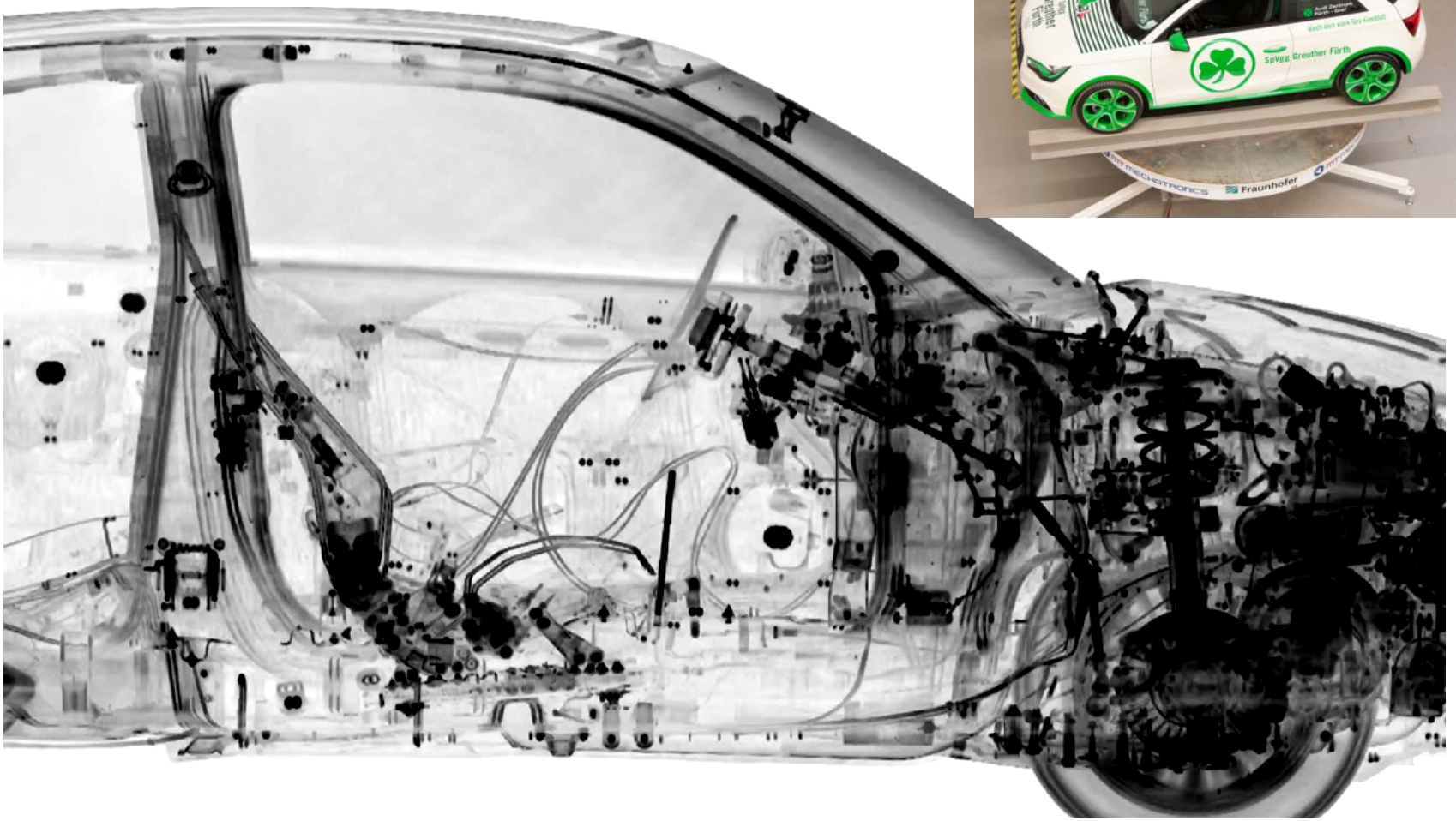
High Resolution X-Ray Volume Imaging of Large Objects

Car Audi A1 in 0.4 mm Voxel Size



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Thank you for your attention

Image taken at our DVB-SH transmitter site in Erlangen

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