Fraunhofer
Heinrich Hertz Institute

Ready for the Future

2010 | 2011 | **2012**

In late 2010, **Prof. Dr. Dr. Holger Boche,** the second executive director of Fraunhofer HHI, left the Fraunhofer-Gesellschaft to take up an appointment at the Technical University of Munich.

A little Time-out…
It's a good tradition to take a break from time to time, to sit back and take a cool look at how your company's faring.

I cordially invite you to join me in a tour of selected highlights from the past few years, a tour which hopefully will be as entertaining as it is informative. We have made a small and by no means exhaustive selection from the vast range of themes and issues addressed by our departments and which we think are particularly illustrative of the work of our institute.

You will see how, after a phase of consolidation and settling in to the Fraunhofer-Gesellschaft, the Heinrich Hertz Institute has entered a new phase of life – with new departments, new markets, and exclusive platforms for our partners in industry and science.

We are now superbly well equipped to face the future.

Hans-Joachim Grallert
Executive Director
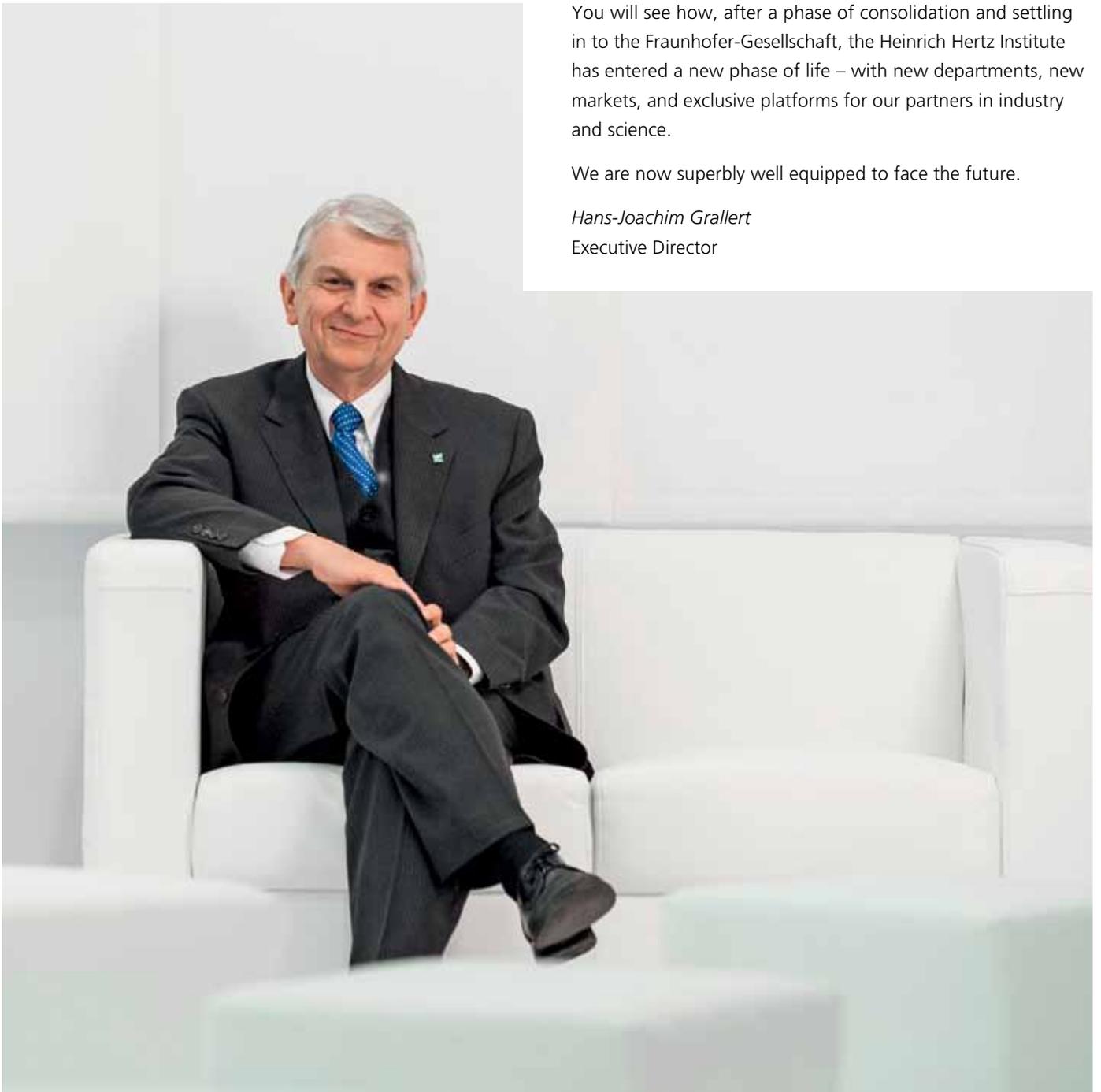
Platforms for Cooperation

An exclusive pre-competitive environment offers space for partners from industry and science to join forces and test products and services for tomorrow's markets.

Partner Platforms

In the past few years, alongside its technical laboratories, the Fraunhofer Heinrich Hertz Institute has created an excellent infrastructure for promoting collaboration between industry and research. Commercial enterprises join forces with research institutes in partnership programs that further the development of strategic themes and technologies.

TiME Lab – Tomorrow's immersive Media Experience Lab
Pioneering the future of content is the mission of the HHI TiME Lab – Tomorrow's immersive Media Experience Lab which commenced operations on 19 February 2010. A high end auditorium equipped with high resolution projection technology presents a 180' panoramic projection while an array of 140 loudspeakers offer superb soundstage playback and an astonishingly realistic multimedia environment. In 2012 this was further enriched by integration of 3D technology and control-by-gesture systems. The lab's partners include the Berlin Philharmonic Orchestra and the Konrad Wolf Academy for Film and Television.

**www.hhi.fraunhofer.de/timelab**
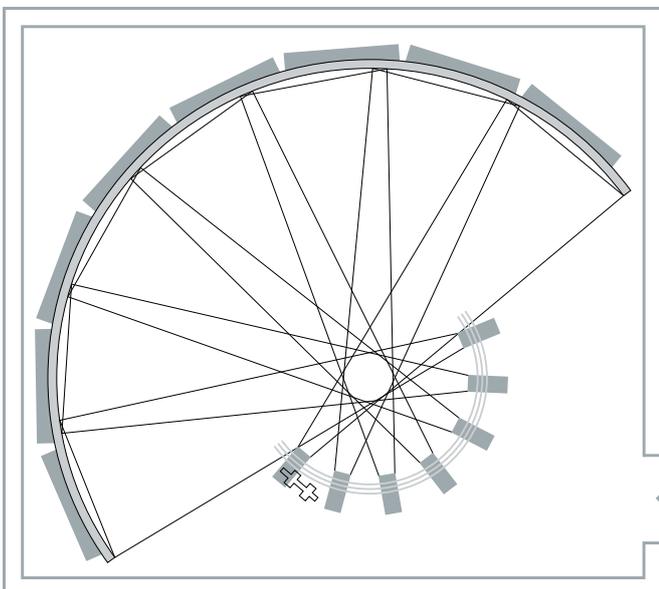
ENTRANCE

The Internet of Services

2010 marked the opening of the THESEUS Innovation Center for the Internet of Services. The Center was a showroom, R&D lab, communication platform and marketing tool at one and the same time, and its 500 m^2 of floor space supported the marketing of results from the THESEUS program, the German government's most ambitious IT program (2007 – 2012).

2013 marked the beginning of a new phase of life when the THESEUS Innovation Center was rechristened CINIQ – The Center for Data and Information Intelligence. Partners from industry and science, both old and new, now cooperate on building the future of Cloud Computing, Big Data and the Internet of Services.

www.ciniq.de

CINIQ
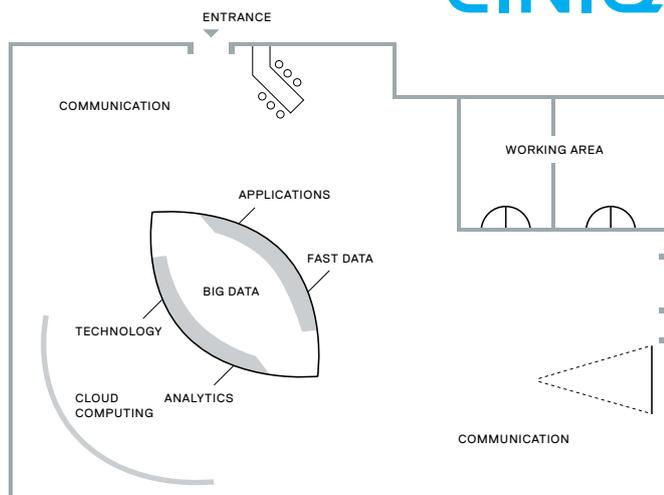
New in 2013. CINIQ – Center for Data and Information Intelligence

The 3D Innovation Center

Specialized in 3D production, 3D content and 3D distribution, the 3D Innovation Center at the Fraunhofer Heinrich Hertz Institute opened in August 2012 and offers its 50 partners from industry and science both, an experimental playground and a marketing environment.

Partners can participate in the Center's Steering Committee to help shape the future of the 3D Innovation Center while numerous working groups offer them the opportunity to discuss and debate forward-looking themes. The solid expertise of the Center's partners across the whole 3D systems chain generates new synergies in product development, marketing and distribution, and helps to give the Center a prominent position both on the market and in the public eye.

www.3Dinnovationcenter.de

3D INNOVATION CENTER
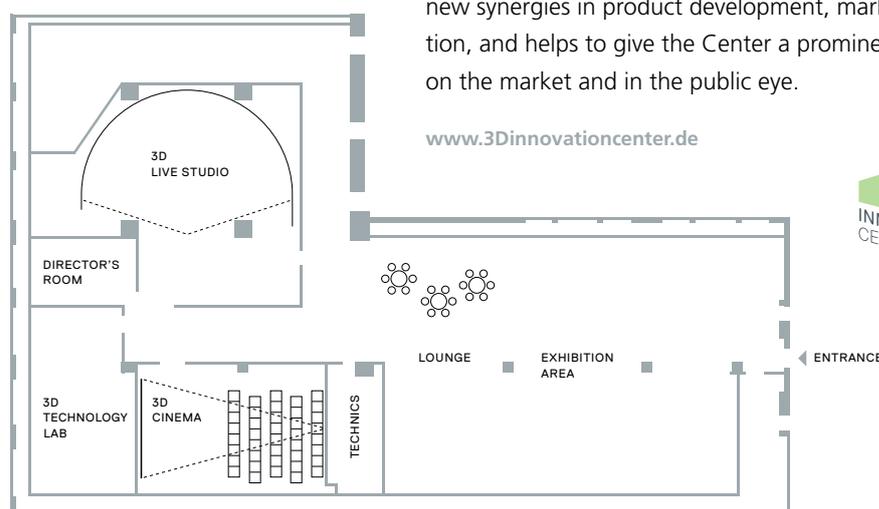
Inside / Outside Networking

An innovative blend of internal collaboration, regional networking and international outreach is creating new markets.

HHI Worldwide – Innovative Solutions for the International Market

On 5 May 2011 the Fraunhofer Heinrich Hertz Institute and Fraunhofer USA open an office on the eastern seaboard of the USA. The bureau in Cambridge, Massachusetts will now coordinate collaboration between companies and research institutes in North America in the fields of medical technology and security technology as well as projects involving 3D multimedia, control by gesture, optical wireless transmission and optical sensor technology.

On a global level HHI works together with representatives in Tokyo and on the west coast of the USA.

Raising the Berlin Profile – a New Annex and Stronger Networking

In 2012 the Heinrich Hertz Institute opened a new annex to its main building in the Berlin Tiergarten district. Now the 3,400 sqm of additional space house the 3D Innovation Center, CINIQ – The Center for Data and Information Intelligence, the Institute's Image Processing and High Speed Hardware Architectures departments.

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The Fraunhofer-Gesellschaft – Europe's Biggest Organization for Applied Research

- Over 80 research institutes
- Over 22,000 employees
- 1.9 billion Euro research budget

HHI is a Member of Fraunhofer Groups for

- Microelectronics
- Information and Communication Technology (guest)
- Defense and Security (guest)

HHI is a Member of the Fraunhofer Alliance for

- Embedded Systems
- Ambient Assisted Living AAL
- Digital Cinema

HHI is a Member of the Fraunhofer Cluster

- Life-Cycle-Engineering for Turbo-Machines
- Next Generation ID

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World Expo Shanghai 2010

Some four million visitors to the German Pavilion tried their hand at the control by gesture system developed by the Fraunhofer HHI.

Partners for Industry
Scientific excellence drives market success.
Solutions of true merit.

Photonic Networks and Systems
Optical communication networks. For more transmission capacity, safety and energy efficiency.

Our work is focused on the development of optical communication networks for applications in tomorrow's core, metro, access and in-house networks. The key issues addressed are enhancing transmission capacities and outreach, reducing energy consumption, and making communication networkers safer and more flexible. R&D work on new systems and network concepts adopts an analytical, numerical and experimental approach. The department is equipped with high performance simulation tools, beyond state of the art measuring technologies, superb system lab facilities and also offers the possibility of field testing.

Optical Satellite Networks
Optical Core and Submarine Networks
Optical Access and Metro Networks
Optical Indoor Networks

www.hhi.fraunhofer.de/pn

Beyond 100 G – New Solutions for Greater Data Capacity
Over the past ten years global demand for broadband in telecommunications networks has been steadily rising by 50–100 percent a year. The current challenge in core networking is to raise transmission capacity per wavelength channel in optical fiber and free-space transmission systems over the 100 Gbit/s mark – beyond 100 G. At the same time, the costs, energy consumption and footprint of each transmitted bit must also be reduced.

Optical Wireless Data Communication
Optical wireless data communication is an attractive solution for areas with a special need for safety and electromagnetic compatibility (EMC). The Fraunhofer Heinrich Hertz Institute has developed a technology that enables data transmission through off-the-shelf LED lights used for room lighting. Data rates of 1.25 Gbit/s have been reached in the first lab demonstrations.

Modular Terabit Solutions for Testing Flexible Optical Network Designs
The Photonic Networks and Systems department offers a multi-terabit test solution developed in partnership with ID Photonics. This platform enables the evolution and testing of forward-looking ultra-rapid broadband network architectures for data rates of up to 54 Tbit/s per fiber.

System Labs
- High-speed WDM / OFDM / OTDM test environments
- High-speed recirculating fiber-loop test environments
- On-chip testing and measuring capabilities
- High-speed protocol test environment

Broadband as a Hard Locational Factor – FTTX-PLAN for Optimized Cost Planning
Ever heavier data traffic calls for continuous improvement in transmission channels – a powerful data transmission infrastructure is now a hard locational factor for many cities and towns. Yet the construction of optical fiber based broadband networks is a venture that comes with high investment costs and risks. FTTX-PLAN has been specially developed to support the strategic decision-making of city network operators and new local providers in the construction and extension of optical fiber broadband networks.

Records in Data Transmission

2011 World record in serial data transmission via optical fiber (10.2 Tbit/s)

**2012** LED-based, optical wireless data communication – throughput of 1.25 Gbit/s

Dr. Ronald Freund has been head of the Photonic Networks and Systems department since 2010, leading a team which now consists of 50 scientists, engineers, technicians and assistants.

Photonic Components
Nearly every second bit now carried on the internet is based on an optical component developed by HHI.
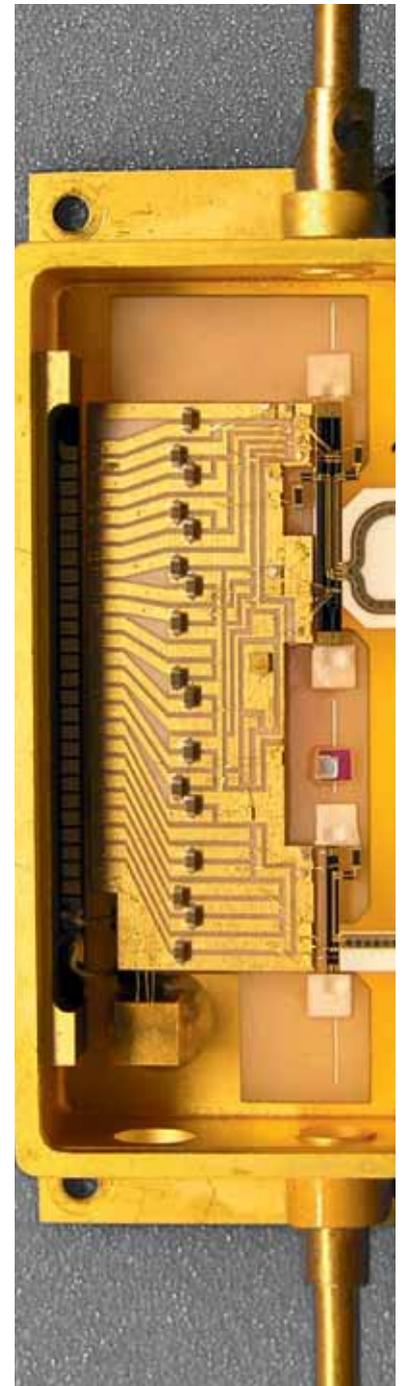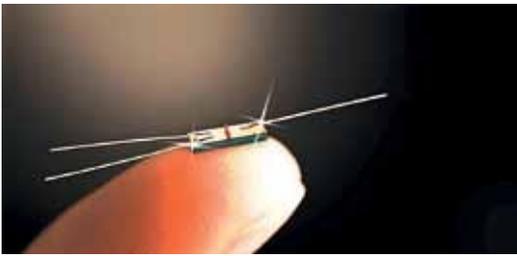
Martin Schell Appointed as Professor
In fall 2012 the head of the Photonic Components department, Martin Schell, took up his appointment as Professor of Optic and Optoelectronic Integration at the Technical University of Berlin.

Detectors and Photoreceivers
InP based Mach-Zehnder Modulators
Polymer OEIC
Terahertz Generation and Detection
Diffractive Optical Elements
Technology: III / V Epitaxy
Technology: Processing

www.hhi.fraunhofer.de/pc

Over the past ten years the data traffic volume on the internet has been steadily growing at an annual rate of 40 to 60 percent with no signs of this trend leveling out. Powerful optical components can help avoid the high costs associated with the laying of new fiber optic cables and the duplication of equipment, while also allowing for more energy-efficient data transmission. The Photonic Components department is specialized in optoelectronic semiconductor components for data transmission at rates of up to 100 Gbit/s and beyond. The department also researches and develops applications in sensorics, terahertz spectroscopy, and high end semiconductor lasers for industrial usage.

European Champions – EU drives forward photonics R&D in Berlin

Statistics from the European Union show that from 2007 – 2011 just under 10 percent of EU funding for photonics research went to the Fraunhofer Heinrich Hertz Institute in Berlin, making HHI the leader among 60 German companies and research institutes. Nearly every second bit now carried on the internet is based on a photonic component developed by HHI. EU funding is helping HHI and three other Berlin companies to consolidate and extend their lead position in photonic data transmission.

Platform Technology for Application-Oriented PICS – PARADIGM
The PARADIGM project targets at a fundamental transformation in the way indium phosphide (InP) based photonic integrated circuits (PICs) are developed and manufactured in Europe. The decisive step in the project is the development of a generic platform technology for application specific PICs. The new approach pioneered by PARADIGM will also give non-experts access to PICs and stands for sustainable production with the potential for significant future growth – not only in the field of data transmission. PARADIGM addresses the whole product development cycle from conception and design to fabrication and usage.

Components for Terabit Networks – MIRTHE
The MIRTHE project researches monolithic integrated TX and RX photonic integrated circuits with an aggregated speed of 100 – 400 Gbit/s on a single wavelength, whilst also cutting the costs and energy consumption. These component technologies will engage with the next generation of terabit networks and represent a major step forward to realization of Green IT.

Terahertz-2.0 – A Modular Highly Sensitive THz Technology
Electromagnetic waves in the terahertz range are able to penetrate most non-metallic materials and detect the presence of complex chemicals like drugs and explosives. At the same time, THz based sensor systems open up new possibilities in non-destructive screening of cutting-edge special materials. The Terahertz 2.0 project is developing a new generation of THz technologies. This first generation of compact, low-priced and robust systems will enable the broad array of benefits of THz radiation to be applied in any kind of work environment without the need for specialized personnel.

IPRM Conference
HHI was the organizer and host of the 2011 Compound Semiconductor Week, a joint event of the 38th International Symposium on Compound Semiconductors and the 23rd International Conference on Indium Phosphide and Related Materials.

Fiber Optical Sensors Systems
A new generation of photonic sensors makes for added efficiency.

Integrated Optics with Femtosecond Lasers
Fiber Optical Micro Sensors
Nanostructured Materials for Energy Transformation

www.hhi.fraunhofer.de/fs

A new generation of photonic sensors is surfacing in measurement and control systems in such application areas as early detection of danger, energy management and medical technology. These new sensors are distinguished by their exceptionally high miniaturization, communication capability and energy efficiency. To manufacture such sensors, research on nanostructured materials is now being undertaken together with development of processing methods for integrated optical components with ultra-short light pulses.

Black Silicon – Energy from Infrared Light

Conventional silicon solar cells use the visible part of sunlight to generate energy. The latest black silicon cells, however, can generate energy from the invisible infrared band of sunlight. The raw silicon material is treated with a special laser technique which significantly increases its power of light absorption and thus the efficiency of the black silicon solar cells themselves. What's more, these new black silicon solar cells are also much cheaper to produce than conventional solar cells as they only require half of the manufacturing stages needed for standard cells.

Optimal Trimming – Smart Sails for Setting New Records

New fiber optical sensors enable boats to sail safely at the outer limits of endurance. These sensors compute real-time measurements of the forces the sails, masts and hull are exposed to. They are based on fiber Bragg grating (FBG) sensors or sensors inscribed in optical fibers. These sensors are integrated in an optical fiber cable attached to the boat's sails, hull or mast.

Novel Gas Diffusion Electrodes for Zinc-Oxygen Batteries

Zinc-oxygen accumulators can store four times more energy than standard lithium-ion batteries. However, the downside of the zinc-oxygen battery – which is now widely used in hearing aids – is that it is non-rechargeable, due to degradation of the material used for the electrodes which is unable to meet all the essential requirements for electrodes – excellent catalyst properties, high conductivity and high corrosion resistance against electrolytes. One way out of this impasse is to use nanostructured metal surfaces. The electrode surface can be successfully structured using ultra-short laser pulses and the new electrodes thus produced are non-degradable and easily fulfill the whole list of requirements.

Miniaturized Sensor Chips in Glass for Photoacoustics

Photoacoustics can be used to measure trace gases in concentrations ranging from several percent to just a few ppm. A newly developed technique in a miniaturized design enables a photoacoustic sensor to be realized in a glass substrate. The central component in this special kind of photoacoustic sensing is a tuning fork in a quartz glass plate which serves as a selective frequency detector. Reading of the mechanical oscillations of the tuning fork is purely optical using a miniaturized interferometer that itself forms part of the glass substrate, and is made possible by a direct writing technique using femtosecond lasers. This technique enables the introduction of complex waveguide structures in transparent materials. The new compact sensor chips are particularly suitable for the fiber optical monitoring of gas concentrations at multiple points of measurement.

High Speed Hardware Architectures
High speeds and minimal latency for high-performance computing.
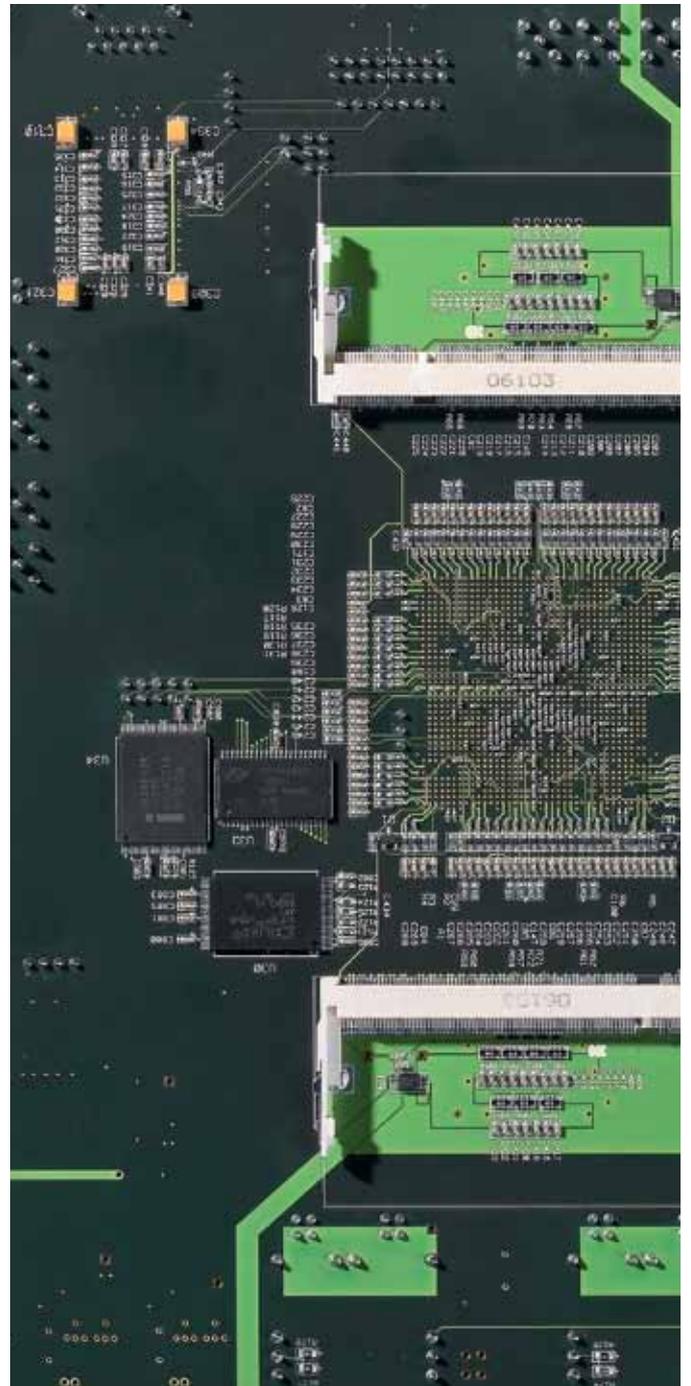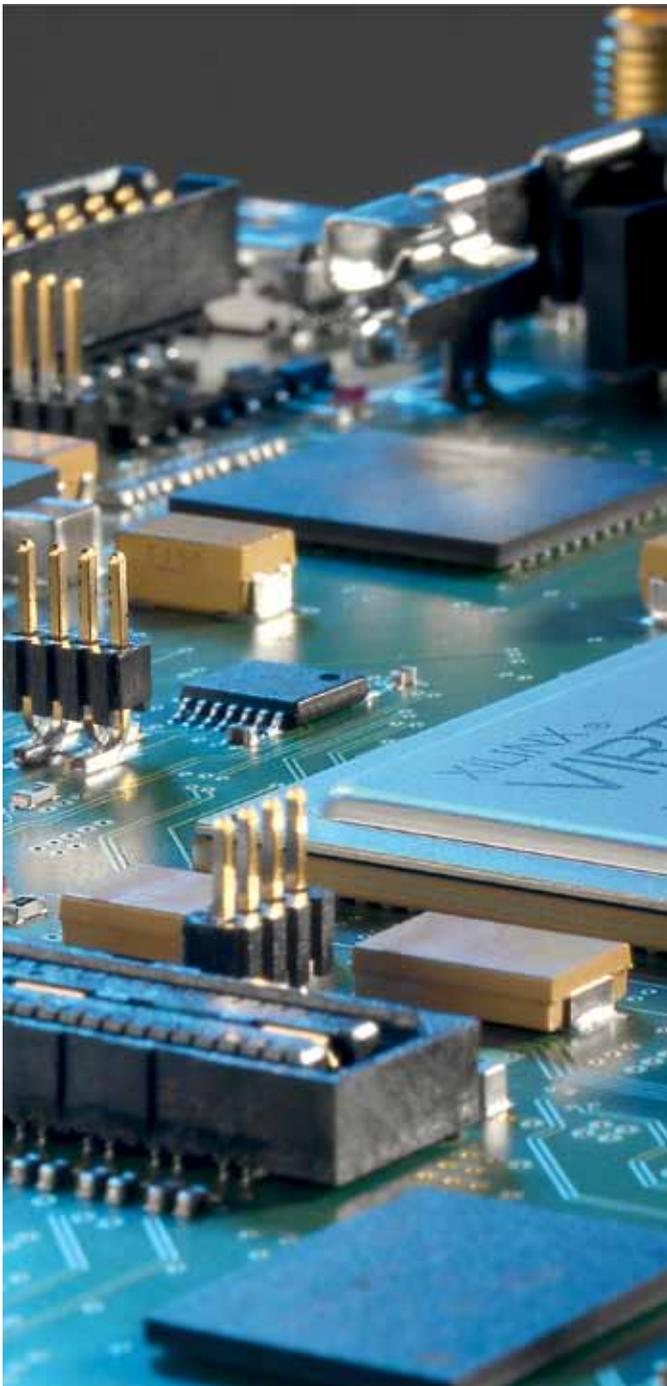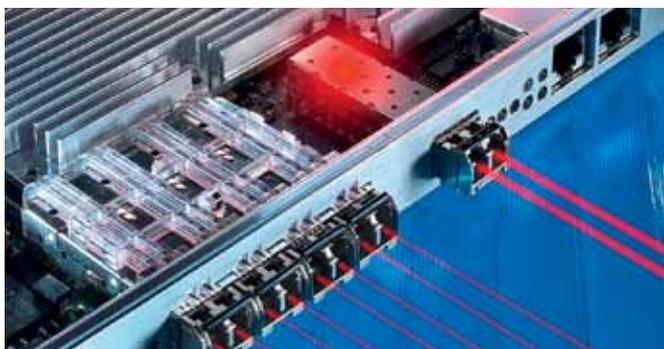
System Engineering
Embedded Systems
FPGA and Microcontroller Design
IC Design
Integrated Optical Systems
Distributed Sensor Systems

www.hhi.fraunhofer.de/hs

Established on 1 January 2010, the High Speed Hardware Architectures department develops a broad range of hardware systems – from integrated circuitry and board solutions to complete system design – and makes them ready for market. Use of optimized, reconfigurable, microelectronic implementations and hardware platforms means that even huge volumes of data can be processed and transported at high speeds of up to 10 Gbit/s, 40 Gbit/s and beyond with minimal latency. This is of great benefit to areas of application such as uncompressed video transmission, medical technology and network systems for broadband low latency products.

New Impetus for Machine-to-Machine Communication
Machine-to-machine communication deals with the automated exchange of information between technical systems like machines, robots and road vehicles. Development of highly optimized network stacks and PCI express connectivity is a major driving force for innovation on the machine-to-machine market. Application of FPGA-based hardware solutions (Xilinx Altera FPGAs) can drastically reduce key performance parameters like latency while also significantly raising net bandwidth. Special boards support ultra-rapid communication at forthcoming speeds of 40 – 100 Gbit/s.

Lab-Free Diagnostics and Detection
Optical sensors can analyze a huge variety of substances and gases with detection limits down in the low pbb range. The integrated optical sensor chips react in real-time to the refraction of light from the medium on the chip's surface as optical characteristics are changed by certain molecules on the chip. The differences thus recorded to the start-out situation offer information on the molecular composition of liquid and gaseous substances. Use of Complementary Metal Oxide Semiconductor (CMOS) technology enables low cost production of these sensor chips which are used in the fields of medical technology, foodstuff technology and security systems.

The Ultra-Rapid Data Generator for Maskless Lithography
In maskless lithography a single electron beam is shot through a programmable photoresist which deflects and controls it for inscription of specific patterns on the wafer. For control of the programmable photoresist in a production tool data must be transmitted with a throughput of multiple Tbit/s. To realize this, the HS department is developing highly optimized data path components and IP cores like a 10 Gb TCP/IP stack for network connectivity.

The 3D BioMedia Data Center
In 2011 HHI began to address the development of diagnostic systems. HHI's proven expertise in the integration of embedded systems enables us to cope efficiently with the multitude of incoming signals and the high computing power and bandwidth they require, and to present 3D computer tomography data in real-time. This technology facilitates the work of physicians both in the operating theater and in point-of-care diagnostics.

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Appointments
In April 2011 Prof. Dr. Gregorius was appointed as head of Microsystems Technology at the department of Microelectronics of the University of Applied Sciences (HTW) Berlin, and Prof. Dr. Voß was appointed as head of Digital Technology and Computer Architecture at the Beuth University of Applied Sciences Berlin.

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Wireless Communication and Networks

Wireless systems solutions for tomorrow's information networks – from theory to roll-out.
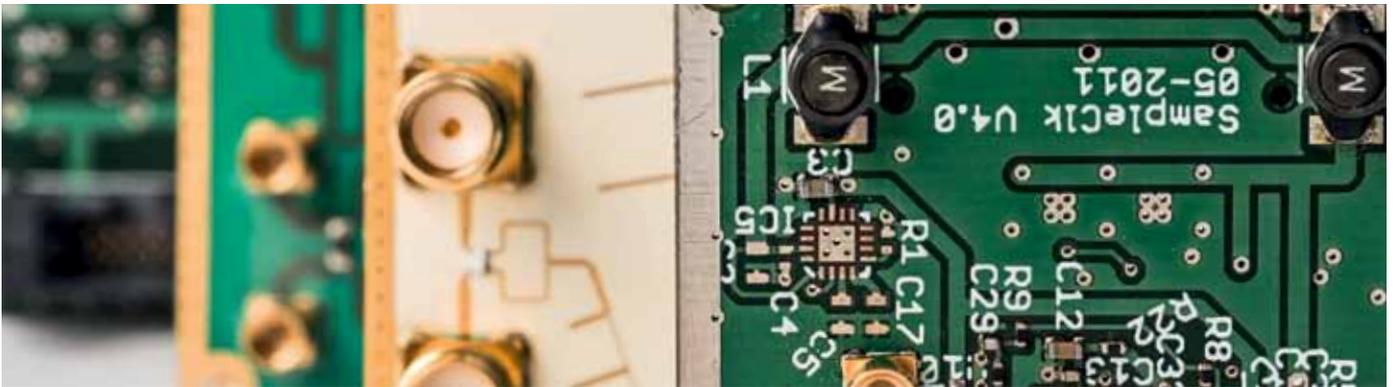
Wireless information transmission is just one of the topics addressed by Fraunhofer HHI. Key areas of research interest include multi-antenna systems, multicell simulations, reconfigurable radio, heterogeneous networks, network information theory, self-organization, and 60 GHz communication, while services for its customers and partners include studies and measurement, hardware prototype development, and system level simulation.

HIRATE – Small Cells for Great Reception

Ever larger numbers of users are driving traditional mobile radio cells to their limits. Yet with 60 GHz radio technology, small, very powerful and cheap to produce radio cells can be added to give extra capacity. The High Performance Digital Radio Testbed – HIRATE – offers universal flexible hardware for the realization and testing of tomorrow's mobile radio technologies. The platform is suitable for a broad array of applications including real-time channel sounding and 60 GHz overlay for mobile radio networks.

BUSData for Making the Best Use of Geothermal Energy

In geothermal exploration data for evaluation of the drilling environment are transmitted to the surface. The BUSData project realizes an acoustic data transmission technique over a 1.5 km drilling pipe using methods of wireless transmission technology. The high throughput rates achieved here promise efficient control of the drilling facility and significant reduction in costs.

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System Labs

- SDR LAB
- C2C, C2x Lab
- Wireless Sensor Lab

Software Defined Radio – The Flexible Test Environment for Mobile Radio Standards

A universal CPRI-enabled radio hardware for software defined radio (SDR) enables direct connectivity over optical fiber and CPRI – a specific optical interface between radio and control hardware – with other base station units. A flexible test environment is thus given for a broad array of standards like LTE and UMTS or cognitive applications in areas like the digital dividend and TV whitespaces.

Communicate Green – Optimized Mobile Radio Stations

The Communicate Green project investigates optimization of energy efficiency in mobile communication networks with the aim of tailoring radio transmission capacity to actual demand. This would mean savings of up to two million tons of CO_2 a year in Germany alone.

QUADRIGA – Hetnet and Scenario Models

The Quasi Deterministic Radio Channel Generator – or QUADRIGA for short – offers a geometry based stochastic channel model for multi-link tracking of receiver/user movements. It can be used both for the simulation of channels inside buildings and for the modeling of satellite links.

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Records

2011 ITG Best Paper Award for _Traffic-Aware Optimization of Heterogeneous Access Management._

2012 Best Student Paper at SPAWC: _Communicate Green. Radio Network Optimization._

2012 Best Demonstration Stand Award at the SAPHYRE Future Network & Mobile Summit: _Making Better Use of the Spectrum Resources Available for Wireless Communication._

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Image Processing
International leaders in video coding
and 3D video processing.
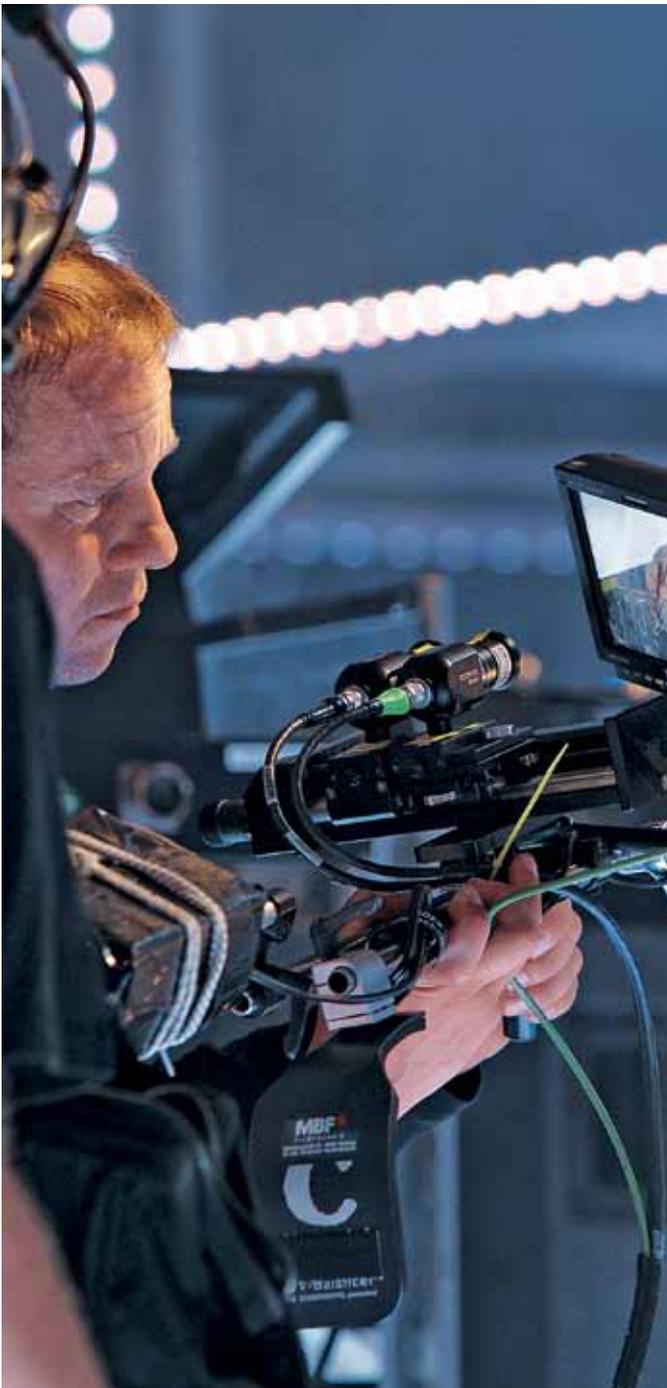
Award winning – brilliant video through efficient coding with international standards

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Scientists Thomas Wiegand, Heiko Schwarz, and Detlev Marpe have received numerous awards for the major pioneering role they played in the evolution of the H.264/MPEG4-AVC international standard.

2011 The Karl Heinz Beckurts Award
2012 The IEEE Masaru Ibuka Technical Field Award
2012 Nomination for the *Deutscher Zukunftspreis*

3D Coding
Multimedia Communication
Image and Video Coding
Content-aware Image Signal Processing
Computer Vision & Graphics
Immersive Media & 3D Video
Embedded Systems

www.hhi.fraunhofer.de/ip

Video data makes up by far the largest part of today's data traffic. The Image Processing department and its Multimedia Communication, Image and Video Processing, Immersive Media and Embedded Systems divisions are ideally positioned to play a leading role in this field. Video coding, 3D image and video processing and Ultra High Resolution video systems are the fields of strategic importance, and solutions evolved range for algorithms to complete hardware and software realizations.

Outstanding Contributions to Video Coding Standards
Over one billion devices worldwide now feature the H.264/MPEG4-AVC video transmission standard in whose development the Image Processing department has played a major pioneering role. The department is also a leading player in the co-development of the forthcoming even more efficient High Efficiency Video Coding (HEVC) standard together with MPEG and the ITU-T Video Coding Experts Group. A combination of various extensions to the standard will achieve further reductions of the bit rate by up to 50 percent with no impairment of visual quality.

From Stereo to Multiview 3D – Real-Time Conversion
Most of the 3D content now available is not compatible with autostereoscopic glasses-free playback devices. Real-time conversion of stereo to multiview enables playback of stereoscopic 3D content like the 3D Blu-ray disc format on nearly all standard autostereoscopic displays which means that time-consuming offline conversion is no longer needed and users can now select their preferred 3D settings on the fly.

Perfect Stereo 3D with the Stereoscopic Analyzer STAN
The stereoscopic analyzer STAN enables production of perfect 3D stereo. The system consists of hardware and software which analyses the stereo images while they are being shot, adapts camera settings in real-time and electronically corrects any subsequent distortions. STAN can be equally used for recording stereo content and for the real-time broadcasting of live events. It also generates metadata for subsequent 3D postproduction.

H.264 and HEVC Test-Suites
In the fiercely competitive and rapidly growing market for H.264/MPEG4-AVC decoders, development of robust and accurate implementations of this complex technology is a make-or-break factor. Such sophisticated high quality products require extensive testing across all features of the video coding standard. Numerous test suites for bit streams are offered for the testing of H.264/MPEG4-AVC decoder chips or set-top-boxes. In 2013 a test suite will be available for the new H.265/HEVC standard.

The Enhanced Low Latency Video Codec
The special ELLVC hardware implementation of the H.264 video codec is distinguished by its remarkably low latency, and its modest requirements in terms of hardware resources and power consumption. The standards-compliant ELLVC video codec is also easy to integrate in video-conferencing or video surveillance systems.

Interactive Media – Human Factors
Redefining the human-machine interface:
intuitive, intelligent, immersive.

Tracking Technologies
Autostereoscopic 3D Displays
Touch-Free Interaction
Image and Video Analysis
e-government
Alarm Systems

www.hhi.fraunhofer.de/im

At the human-machine interface the research focus is on solutions that need rapid robust algorithms for image recognition like control by gesture systems, eye-tracking and similarity-based image retrieval. Expertise is applied in a broad range of areas from sterile equipment operation in medicine to dedicated data input in the automotive industry and detection of counterfeit images. We also improve the resolution of 3D displays through eye tracking and real-time adaption of 3D image content. All our innovations place human beings with their cognitive and mental skills and abilities at the center of our solution design.

3D Laparoscopy – A Report
Does stereoscopic rendering of the inside of the stomach with laparoscopy have any advantages over monoscopic rendering with an endoscope? This was the issue investigated with 2D and 3D images and with and without the use of glasses. 48 surgeons were asked to execute and evaluate a pre-defined task, and the report's findings showed that while stereovision does indeed bring surgeons tangible benefits, the glasses-based system is still the most efficient solution.

The Interactive Shop Window
When it comes to shopping after closing time, a gesture recognition system enables late shoppers to select goods from a screen on the shop window, call up information about them and even pay for them! A software toolkit for gesture recognition makes these transactions quick and easy.

Detecting Counterfeit Images
Counterfeit images are a headache for image banks and press agencies but a new system now enables detection of counterfeits either in whole or part through their visual attributes. Unlike watermark-based searches, this system can easily cope with differences in scaling, bleeding and reformatting as well as changes in brightness and contrast.

Stand Where You Want – Adapting Distance for 3D Multiview Displays
Freedom of movement in front of 3D screens? Fixed beam splitters can change the viewing distance to autostereoscopic multiview displays. A new technique enables seamless adaption of the viewing distance in the range of one half to twice the original viewing distance – without any loss of depth and picture quality!

Interactive 3D for Magnificent Manuscripts
Developed in collaboration with the Bavarian State Library, the interactive 3D-Book-Explorer enables three dimensional viewing and "reading" of priceless books and manuscripts. Tracking of the viewers' eyes by cameras supplies the data required for the computation and collation of the part images for 3D viewing with no need for glasses. Control-by-gesture enables users to browse through the artifacts and view them from all sides.

Medical Technology and Security
Business units as the key to customized solutions.

The Medical Technology and Security business units have been consistently extended and consolidated since their establishment in 2008 and have raised their profile in a broad array of projects realized in association with industry partners.

Medical Technology

Now more than ever innovative technical solutions in the medical field must pay attention to increasing life expectancy in the population, demands for higher quality in healthcare and the pressure to lower costs in the healthcare sector. The Fraunhofer Heinrich Hertz Institute harmonizes excellence in technical expertise with the requirements of prospective users.

Expertise
- Image processing, modeling and coding
- HD rendering, storage, and evaluation
- Wired and wireless communication networks
- Innovative interfaces – usability, human-machine control, highend 3D
- Photonic components, diffractive optical elements
- User-centric design and ergonomics / usability

Selected Applications
- 3D visualization for diagnostics, treatment and training
- Video retrieval and analysis
- Wireless endoscopy
- Touch-free control of surgical instruments
- Radio sensor networks
- Optical sensors for detection of pathogens

Security

The advent of asymmetric threat scenarios and the watershed of 9/11 have promoted worldwide recognition of security as a research domain in its own right. IC technology plays a leading part in protection of intellectual property and assets. HHI brings its broad range of cross-departmental expertise to bear in its Security division.

Expertise
- Active terahertz systems
- Video structure analysis and image retrieval
- Photonic semiconductor technologies
- Communication networks
- Video coding
- Usability studies
- Embedded systems
- 3D image processing

Selected Applications
- Non-destructive materials testing based on terahertz radiation, Optical fiber sensors for earthquake security in buildings
- Evanescent field sensors for real-time detection of explosives, viruses and hazardous substances
- Visible Light Communication for new low cost solutions enabling indoor navigation
- Wireless data connectivity in the 60 GHz band for tamper and tap-proof communication in-the-field
- Depth maps and 3D rendering for innovative solutions for crime scene forensics and next generation ID documents
- Tailored video codecs for robust zero-latency video transmission

Transparent and Informative
We go where our customers and partners are.

Trade Fairs and Exhibitions

Trade fairs and exhibitions are Fraunhofer HHI's key platform for meeting customers and potential partners, identifying their needs and requirements and discussing possible solutions. Fraunhofer HHI exhibits at over 30 international trade shows each year – in Germany, North America and Asia.

www.hhi.fraunhofer.de/events

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https://twitter.com/HHI_Berlin

www.hhi.fraunhofer.de/news

University Chairs

TU Berlin
- Telecommunications – Prof. Dr. Hans-Joachim Grallert
- Image Communication – Prof. Dr. Thomas Wiegand
- Optics and Optoelectronic Integration –
  Prof. Dr. Martin Schell

HU Berlin
- Visual Computing – Prof. Dr. Peter Eisert

TU Clausthal
- Applied Photonics – Prof. Dr. Wolfgang Schade

HTW Berlin
- Microelectronics – Prof. Dr. Peter Gregorius

Beuth University of Applied Sciences Berlin
- Digital Technology and Computer Architecture –
  Prof. Dr. Sven Hendrik Voß

University of Potsdam
- Adaptive Video Processing – pending

Partnering with the Media

Traditional media are still our key partner for public relations work even though social media are growing in importance. The work of Fraunhofer HHI has global resonance:

2010 outreach to 142.34 million people
2011 outreach to 197.17 million people
2012 outreach to 166.42 million people

www.hhi.fraunhofer.de/press

Certified: Quality Management at HHI

In 2008 HHI developed and introduced a Quality Management System as per DIN EN ISO 9001 for all enterprise functions for research, development and production in the fields of photonics and electronics. Quality audits ensure compliance with the norms of the standard at all times.

Cooperation with Universities
- Johns Hopkins Hospital, Baltimore MD USA
- UC Berkeley, CA USA
- Boston University, MA USA
- MassCEC / DoE NREL – Wind Technology Testing Center (WTTC), MA USA

Behind the Scenes
HHI people are creative minds, keen sportspeople and great team players.

Fast Runnin' Scientists

HHI shows its team spirit at RUN BERLIN –
The Berlin Company Run Championships.
Every year some 100 HHI colleagues take part
in the Championship and aren't just the largest
group from any Fraunhofer institute in Berlin,
but frequently the fastest runners as well!

Heinrich – the interactive intranet

NEW IN 2012 Get Informed – Work – Join In

Award Winners – Special Award of the Association of Friends of the Heinrich Hertz Institute

Every year the association of former members of the Heinrich Hertz
Institute distinguishes patents of particular merit.

**2010 An Efficiency-Enhanced Optical Fiber Terahertz System
with Optimized Wavelength Correlations**
B. Sartorius, H. Roehle, D. Stanze, R. Dietz

**2011 Advanced Resource Management for Chunk-based
Streaming over LTE**
T. Schierl, T. Wirth, T. Haustein, Y. S. de la Fuente

**2012 Methods for Enhancing Bandwidth in Wandering
Wave Modulators**
D. Hoffmann

Girls' Day

Every year school girls from the age of 12 upwards visit the institute to
explore career opportunities within the MINT disciplines (mathematics,
information and natural sciences, technology). At HHI they can see
what it's like to work in a forwardlooking discipline – it's career guidance
with a decidedly practical edge!

Art at HHI

Are artists scientists? Or scientists artists? HHI has created a symbiosis of the two in its *Kunst im Haus* initiative where colleagues who are also active as artists exhibit their sculptures, paintings, photographs and video in the institute and discuss them.

Schrödinger's Cat
Carl M. Weinert

No Pane, just Proscuitto
Ludwig Mörl

Internal *Tower Day*

The HHI tower from top to bottom – only by the staircase not the elevator – every year at Tower Day all departments on the 14 floors of the institute open their doors with special exhibitions of their latest exciting projects. It's a perfect opportunity to become even better acquainted with colleagues and their special research interests.

Further Training Programs at HHI

From presentation techniques and budget planning to team building, HHI offers a broad array of further training opportunities. The programs are designed to cover various key areas of activity and are targeted at different career levels. Their overall aim is to ensure that each person working at HHI has the opportunity to enhance and develop his or her professional skills.

D4	Legal Aspects of Safety and Health at Work	Head of Department
D3	Budget Planning and Budget Controlling	
D2	Market Research and Roadmap Development	
D1	Present Your Department the Professional Way	
C4	Skills Training for Project Management	Group Manager
C3	Leading Appraisal Interviews	
C2	Practical Health and Safety at Work	
C1	Managerial Training	
B4	Project Acquisition	Project Manager
B3	Basics of Project Management	
B2	Communication and Moderating	
B1	Presentations and Language Skills	
A3	Financing and Cost Calculation	Research Fellow
A2	Inventions and Patents Research	
A1	Time Management and Techniques for Work	

The Direct Way
We set great store by dialog with our customers
and partners.

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At a Glance 2010 | 2011 | 2012
The Fraunhofer Heinrich Hertz Institute.
Selected indices give an outline of development over the past three years.

Budget (excluding Investment)

- Basic Funding
- National Projects
- Industry Contracts
- EU Projects
- Other Contracts

2010

13   14
32   41

In Percent

86 %
Third Party Funding

30 Mio. Euro
Total Budget

2011

9   16
11
40   24

84 %
Third Party Funding

34 Mio. Euro
Total Budget

2012

7   23
12
36   22

75 %
Third Party Funding

38 Mio. Euro
Total Budget
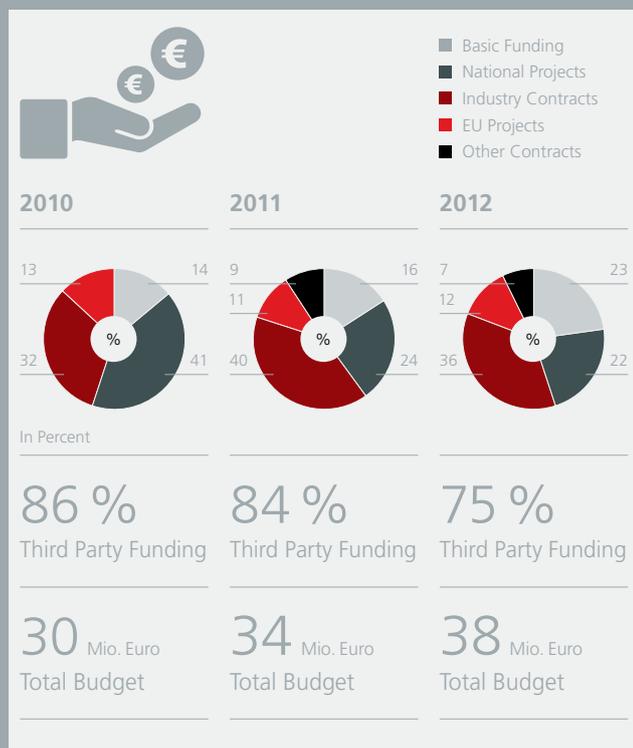
Disclosure of Inventions

2010	2011	2012
41	47	42

Employees
Full-time Equivalent

| 2010	2011	2012
280 Employees	280 Employees	303 Employees
100 Students	120 Students	221 Students
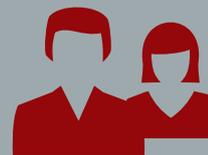
Patents, Trademarks and Utility Models

2010	2011	2012
820	923	1013

Review of 2005

241 Employees

50 % Third Party Funding

9   2
16
18   55

92 Students

22 Mio. Euro Total Budget
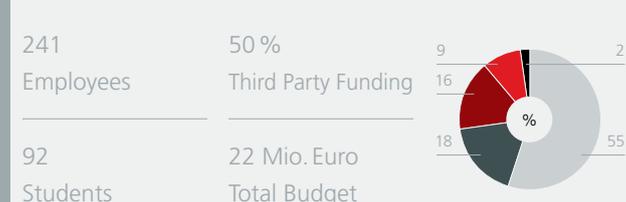
Doctorates

2010	2011	2012
4	2	4

Lectures and Seminars

Quantity

2010	2011	2012
27	34	34

Membership in Associations and Alliances

With Contribution

2010	2011	2012
50	50	50

Media Resonance

2010	2011	2012
1.263 Articles	1.422 Articles	1.408 Articles
142 Mio. Contacts	197 Mio. Contacts	166 Mio. Contacts
4,98 Mio. Euro Advertising Value Equivalence	6,81 Mio. Euro Advertising Value Equivalence	5,01 Mio. Euro Advertising Value Equivalence

Publications

2010	2011	2012
38 Publications in Scientific Journals	87 Publications in Scientific Journals	51 Publications in Scientific Journals
162 Publications for Conferences	147 Publications for Conferences	150 Publications for Conferences
4 Book Publications	8 Book Publications	12 Book Publications

University Chairs
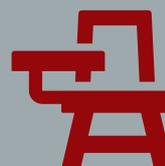
2010	2011	2012
6	6	7

Participation in Conferences

2010	2011	2012
106	97	137

Participation in Trade Fairs

2010	2011	2012
30	32	33

Impressions 2010 | 2011 | 2012
Welcome guests – Leading figures in government,
industry and the arts.