

# Annual Report 2022



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# Editorial

Dear Readers,

After two years of Corona, the past fiscal year 2022 proved to be one full of positive changes. With two additional institute directors, Dr. Karl-Peter Fritz in Stuttgart and Prof. Dr. Oliver Amft in Villingen-Schwenningen and Freiburg, we are strengthening the research fields of digital production and computer science.

Together with Prof. Dr. Andre Zimmermann, Dr. Karl-Peter Fritz is particularly committed to the product-oriented development and manufacture of components and systems using the technology portfolio of micro-assembly technology and is expanding the business area of "production as of batch size 1." The "German Innovation Award," an innovation prize established by the German Bundestag and sponsored by the German business sector, was a positive signal of this work: the Stuttgart Hahn-Schickard Institute received the prize for the "Digital Process Chain for Design and Production of Individualized Mechatronic Products."

Oliver Amft accepted the professorship of Intelligent Embedded Systems at the Freiburg Institute of Computer Science at the University of Freiburg. At the same time, he became the new director of the Hahn-Schickard Institute for Micro and Information Technology at the Freiburg and Villingen-Schwenningen sites.

Prof. Dr. Yiannos Manoli, longstanding director of the Hahn-Schickard Institute and holder of the Fritz Hüttinger Professorship for Microelectronics at the University of Freiburg, retired in June 2022. From 2005 to 2022, he played a major role in shaping the development of Hahn-Schickard. In particular, he shaped the area of hardware and software development, which brought a variety of solutions in the field of energy harvesters and self-sufficient sensor nodes to prototype maturity.

The green tech start-up ionysis set a strong example for climate neutrality: with the support of the University of Freiburg, it spun off from the research area „Electrochemical Energy Systems“ at Hahn-Schickard in order to develop more efficient membrane electrode units for fuel cells to market maturity with the help of strong partners. The two employees from Ulm, Dr. Mehmet Dinc and Benedikt Keitel, are still at the beginning on the path to spin-off with their business idea evoMIP.

Their business idea has already won over the start-2grow competition: they want to offer customized 3D filter materials with a memory function to make water treatment more reliable and efficient. We wish them every success and look forward to seeing what success stories the year 2023 will bring.

**Your Hahn-Schickard Institute Directors**

Dr. Nicole Hoffmeister-Kraut, Minister for Economic Affairs, Labour and Housing for the State of Baden-Württemberg, kicked off the construction project on Georges-Kohler-Allee together with Freiburg's Lord Mayor Martin Horn in June. The Hahn-Schickard Institute for Microanalysis Systems will have more space for developments at a common location. Around 2,700 square meters of office space and 3,500 square meters for laboratories, a clean room and workshops are planned.

# Hahn-Schickard: Three institutes, one mission

Hahn-Schickard-Gesellschaft für angewandte Forschung e.V.

Hahn-Schickard-Gesellschaft für angewandte Forschung e.V. has been conducting application-oriented research, development and manufacturing for intelligent products and technologies across all industries since 1955.

Around 300 employees are researching innovative solutions in the field of microsystem technology at four different locations in Baden-Württemberg. We strive to jointly shape a sustainable and livable future for the benefit of all!



Clemens Pecha  
Hahn-Schickard  
Managing Director



apl. Prof. Dr.  
Felix von Stetten  
Institute Director



Prof. Dr. techn.  
Boris Mizaikoff  
Institute Director



Prof. Dr.-Ing.  
Roland Zengerle  
Institute Director



Prof. Dr.  
Oliver Amft  
Institute Director



Prof. Dr.-Ing.  
Alfons Dehé  
Institute Director



Prof. Dr.-Ing.  
André Zimmermann  
Institute Director



Dr.-Ing.  
Karl-Peter Fritz  
Institute Director

## Hahn-Schickard Institute for Microanalysis Systems Freiburg + Ulm

- > Microfluidics
- > Point-of-care diagnostics
- > Bioanalytics
- > Electrochemical energy systems
- > Photonic diagnostics

## Hahn-Schickard Institute for Micro- and Information Technology Villingen-Schwenningen

- > MEMS Foundry
- > Microelectronics
- > Microsensors and microactuators
- > System Integration
- > Cyber-physical systems
- > Information and communication technology
- > Artificial intelligence

## Hahn-Schickard Institute for Micro Assembly Technology Stuttgart

- > Optical Microsystems
- > Rapid manufacturing
- > System-in-Foil
- > Spatial electronics
- > Microstructuring
- > Sensors

### Innovators

We develop intelligent products with microsystem technology for you: from the initial idea to production to the final product across all industries.

### Problem solvers

We tackle our customers' challenges while developing innovative solutions together with them.

### Shapers of the future

We are one step ahead: We perform pioneering research and prepare innovations for our customers.

### Partners

We have regional roots and are also globally in demand.

# Bodies + Committees

## Managing Director

**Clemens Pecha**  
Villingen-Schwenningen

## Institute Directors

**Prof. Dr. Oliver Amft**  
Villingen-Schwenningen + Freiburg

**Prof. Dr.-Ing. Alfons Dehé**  
Villingen-Schwenningen

**Prof. Dr.-Ing. Yiannos Manoli**  
Villingen-Schwenningen  
(left 05/2022)

**Prof. Dr. techn. Boris Mizaikoff**  
Ulm

**Apl. Prof. Dr. Felix von Stetten**  
Freiburg

**Prof. Dr.-Ing. Roland Zengerle**  
Freiburg

**Prof. Dr.-Ing. André Zimmermann**  
Stuttgart

**Dr.-Ing. Karl-Peter Fritz**  
Stuttgart

## Board

**Chairman of the Board:**  
**Prof. Dr. Volker Nestle**  
Festo SE & Co. KG

**Acting Chairman:**  
**Dr. Florian Krogmann**  
IST AG

**Dr. Franz Lärmer**  
Robert Bosch GmbH

**Dr. Wolfgang Spreitzer**  
Gruner AG

**Treasurer:**  
**Thomas Albiez**  
IHK Schwarzwald-Baar-Heuberg

## Board of Directors

**Chairman:**  
**Undersecretary**  
**Günther Leißnerkraus**  
Ministry for Economic Affairs,  
Labour and Housing for the State  
of Baden-Württemberg (resigned  
chairmanship in 09/2022)

**Dr. Kay Fürstenberg**  
Sick AG (as of 05/2022)

**Prof. Dr.-Ing. Bernd Gundelsweiler**  
Institute for Design and Manu-  
facturing in Precision Engineering  
(IKFF) University of Stuttgart

**Claus Mayer**  
Ministry for Economic Affairs,  
Labour and Housing for the State  
of Baden-Württemberg, Unit Head

**Dr. Rolf Merte**  
elexis AG (left in 05/2022)

**Undersecretary (LMR)**  
**Susanne Ahmed**  
Ministry of Science, Research  
and the Arts Baden-Württemberg

**Eckhard Kloth**  
Testo SE & Co. KGaA  
(left in 05/2022)

**Prof. Dr. Michael Kühl**  
Institute for Biochemistry and  
Molecular Biology, University of Ulm

**Prof. Dr. Ulrich Mescheder**  
Furtwangen University,  
Institute for Applied Research

**Prof. Dr.-Ing. Peter Post**  
Festo SE & Co. KG

**Prof. Dr. Michael Auer**  
Steinbeis-Stiftung

**Prof. Dr.-Ing. Gisela Lanza**  
Institute for Production Technology at  
the Karlsruhe Institute of Technology

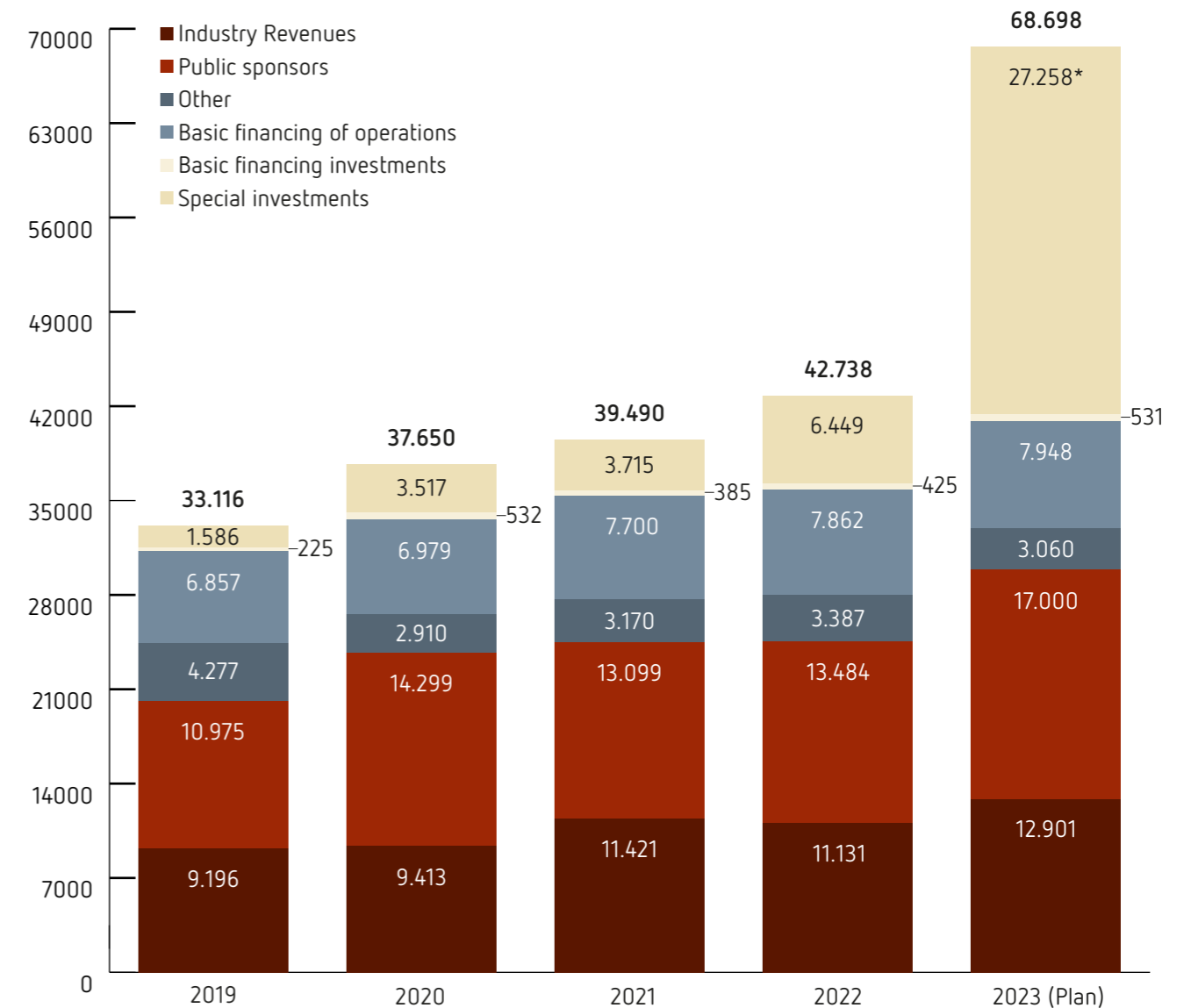
**Jürgen Roth**  
Lord Mayor, Major District Town of  
Villingen-Schwenningen

**Dr. Ludger Bodenbach**  
Roche Diagnostics GmbH  
(as of 05/2022)

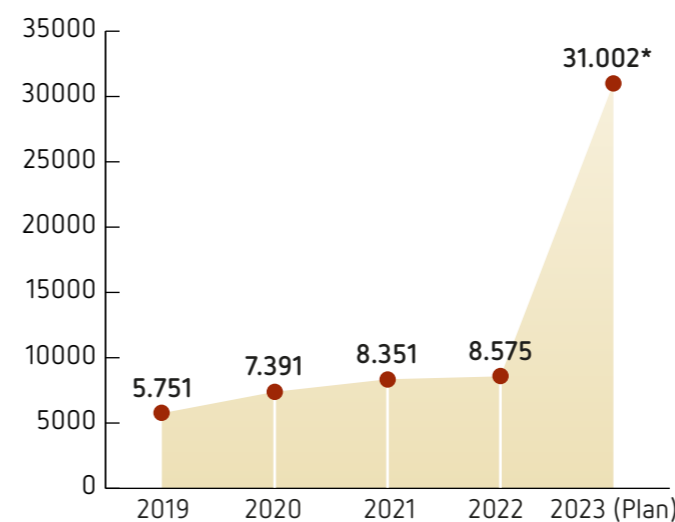
**Dr. Mirko Lehmann**  
Endress+Hauser Flowtec AG

**Prof. Dr.-Ing. Ulrike Wallrabe**  
Department of Microsystems  
Engineering, University of Freiburg

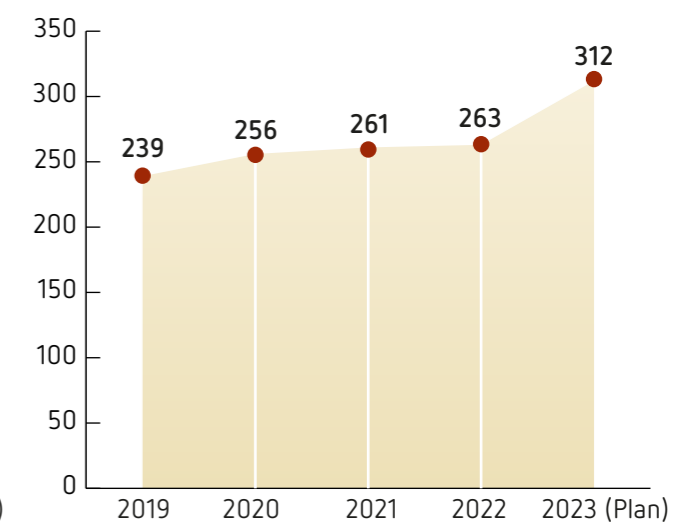
# Budget Figures (in T Euro)



## Investments (in T Euro)



## Employees (Full-time equivalent)



\* Incl. special investments for the new institute building in Freiburg

## Other Figures

13,5  
Mio. €

R+D joint projects

11,1  
Mio. €

Industry Revenues

335

Jobs in the spinoffs

10

Dissertations

34

Master theses

17

Student research projects

9

Bachelor theses

15 External events + conferences  
(analog, digital and hybrid)

6 Individual events

## Courses



18 Lectures



4 Seminars



1 Colloquium



4 Internships

## Publications



42 Journals + Online Magazines



43 Conference Papers



9 Published final reports



All scientific publications from Hahn-Schickard

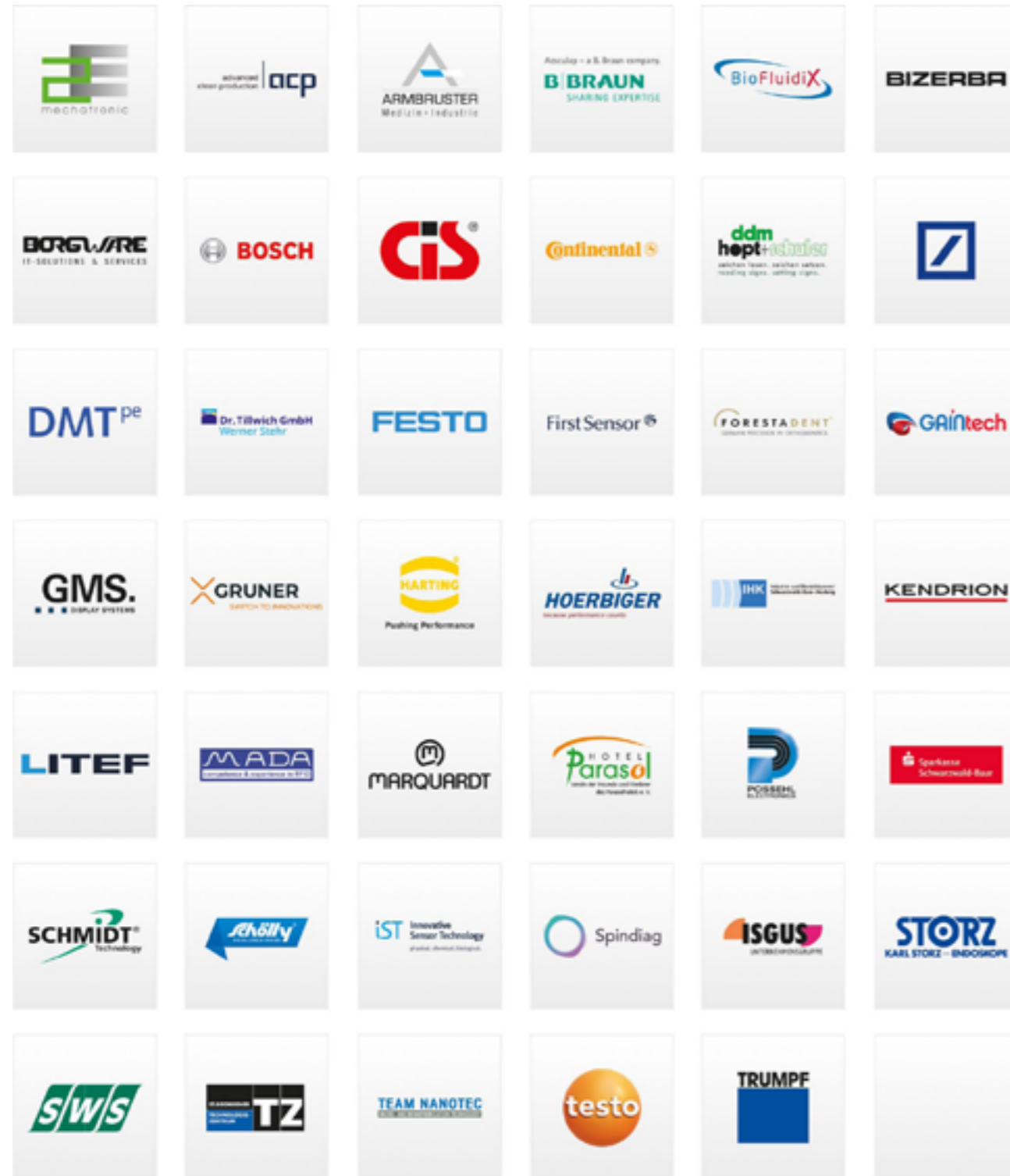


103 Granted patents

# Members

A membership at Hahn-Schickard is worthwhile. As a member of Hahn-Schickard, you influence our thematic orientation, the future topics we tackle, and always stay in the picture about the results of our preliminary research.

When it comes to funding projects or finding partners, we establish regional, national and international contacts for your business. Through our close connections to universities and other research institutions, you will always have your finger on the pulse with us.



Excerpt from our members

# Hahn-Schickard News

Our Hahn-Schickard-News informs you about highlights from research and development and at which trade fairs and events you can experience our developments. In addition, we continuously inform you about planned joint projects with your possible participation and about job offers at our four locations.

Don't miss any more news and subscribe to our newsletter!



Newsletter  
Simply subscribe now:  
[Hahn-Schickard.com/newsletter](https://www.hahn-schickard.com/newsletter)



## Social Media

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facebook



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# Regional Networks + Cooperations

Regional roots, global demand, outstanding networks. Information, communication and microsystem technologies are more closely connected in southwestern Germany than anywhere else in the country. We network to drive the transfer of our technologies and to quickly establish new partnerships targeted at the needs of our customers.

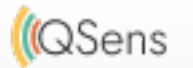


**innBW**  
Stuttgart




Hahn-Schickard is part of the Innovation Alliance Baden-Württemberg (innBW), an alliance of independent research institutes. These conduct results-oriented contract research in the future fields of sustainable mobility, environmental technology and resource efficiency, health and care, information and communication.

**Qsens**  
Stuttgart




Qsens is dedicated to the development of quantum sensors. In addition to research, the focus is on the establishment of a regional ecosystem for the future industrial production of quantum sensors for early-stage adoption in Germany.

**Photonics BW**  
Aalen



Photonics BW e.V. is the innovation network for the promotion of optical technologies in research, development and application, education and training as well as promotion of young talent and public relations in Baden-Württemberg.

**Arena 2036**  
Stuttgart



As a research campus of the future, ARENA2036 forms the innovation platform for cooperation between science and industry with a focus on mobility of the future. The aim is to facilitate cooperation between SMEs, start-ups, large companies and research.

**MDR- & IVDR Competence Center**  
Reutlingen + Freiburg




The competence center supports companies throughout the entire life cycle of a medical product, spanning from the initial idea to development, the approval process, clinical use and the end of the product's life.

**microTEC Südwest**  
Freiburg



The cross-industry technology cluster is headquartered in Freiburg. In the field of microsystem technology, microTEC Südwest with its 360 cluster partners, is one of the largest technology networks in Europe.

**BioLAGO**  
Konstanz



BioLAGO is the network for the regional healthcare industry and brings together experts from the high-tech sectors of medical technology, diagnostics, bioinformatics and pharmaceuticals, including personalized medicine.

**TechnologyMountains**  
Villingen-Schwenningen



TechnologyMountains sees itself as a link between business and science and initiates development and cooperation projects with its members in order to create synergies, systematically promote competencies and drive innovation.

**MedicalMountains**  
Tuttlingen



MedicalMountains represents the medical technology industry on a regional, national and European level. The network has set itself the goal of bringing small and medium-sized companies together, promoting their growth and further expanding their competitive advantage.

# Nationwide Networks + Cooperations

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## Zuse-Gemeinschaft

The German Industry Research Foundation Konrad Zuse e.V. (Zuse-Gemeinschaft) represents the interests of independent, non-profit, industry-oriented research institutes. The association, which is open to technology and industry, has 77 members nationwide. As practice-oriented and creative idea providers, they translate the findings of science into applicable technologies for companies, thus preparing the ground for successful innovations. The Hahn-Schickard-Institutes as well as other innBW institutes are among the members.



## Diagnostics Network Berlin-Brandenburg

The DiagnosticsNet|BB brings together the interests of highly innovative medium-sized companies and internationally renowned research institutes from all areas of in vitro diagnostics, not only in the Berlin-Brandenburg region. Founded in 2007, the network represents a total of over 6,000 employees and annual sales of more than 300 million euros.



## AiF – Research Network for SMEs

To make it easier for small and medium-sized companies to realize projects in the field of microsystem technology are easier to realize, we are working intensively with funding organizations such as the German Federation of Industrial Research Associations (AiF), through whose network we have already successfully implemented many commercial projects.



## ECPE European Center for Power Electronics

ECPE European Center for Power Electronics e.V. was founded in 2003 on the initiative of leading power electronics companies as an industry-driven research network to promote education, innovation, science, research and technology transfer. The network comprises more than 200 members. Its main objectives are pre-competitive research, education and training, and public relations for power electronics in Europe.



## Organic and Printed Electronics Association (OE-A)

The OE-A is the leading international industry association for organic and printed electronics and represents the entire value chain of this industry. For more than 200 companies from Europe, Asia, North America and Africa work together in the OE-A to further promote the development of a competitive infrastructure for the production of organic electronics. The OE-A bridges the gap between science, technology and application and was founded in 2004 as a working group within the VDMA.



## 3-D MID

The Research Association Spatial Electronic Assemblies (Forschungsvereinigung Räumliche Elektronische Baugruppen 3-D MID e.V.) is the world's largest network for MID technology, with around 100 members from manufacturers, users and research institutions in the fields of engineering, materials, injection molding, structuring/metallization, assembly, soldering and testing.





# Successful Technology Transfer: Our High-Tech Spin-Offs

Knowledge-based spin-offs from research institutes are considered to be a particularly sustainable form of technology transfer, not only because they enable cutting-edge technology from research to find its way into the market, but above all because these spin-offs create high-tech jobs directly at the respective Hahn-Schickard Institute location.

## BioFluidix GmbH

2005

Automation solutions for liquid handling in miniaturized ultra-low volume range (pico, nano and microliter)



## Verapido Medical GmbH

2013

The spin-off specializes in the development of innovative, safe and convenient devices for injection and infusion into or under the skin.



## CYTENA GmbH

2014

Laboratory equipment that isolates, sorts, and dispenses individual human cells or bacteria encapsulated in picoliter droplets.



## Spindiag GmbH

2016

The company offers diagnostic solutions for infectious diseases such as a laboratory-grade rapid PCR test for SARS-CoV-2.



## Actome GmbH

2017

With the patented PICO technology, a large number of different proteins and their interactions can be detected simultaneously.



## Detagto GmbH

2022

With IRIS technology, components and products can be traced with a simple recording of the surfaces and thus completely without marking.



## CYTENA Bioprocess GmbH

2018

CYTENA Bioprocess Solutions is a subsidiary of the listed company Cellink AB, now BICO, and provides bioprocess solutions to the pharmaceutical industry and top research institutes.



## Dermagnostix GmbH

2021

Molecular diagnostic solutions for skin diseases that predict individual therapy responses and disease progression within a short time based on PCR.



## Hahn-Schickard International GmbH

2020

As a transfer company, Hahn-Schickard International markets its products and services on an international level.



## Endress+Hauser BioSense GmbH

2021

Microfluidic automation solutions for molecular biological analysis in the fields of food, water and wastewater: simple - fast - on site



## ionysis GmbH

2022

The GreenTech start-up ionysis develops highly efficient, emission-free and sustainable core components for fuel cells, the energy converters of the future.



# ionysis GmbH

## The spin-off ionysis develops sustainable core components for the hydrogen economy

A team from the "Electrochemical Energy Systems" division at Hahn-Schickard in Freiburg founded "ionysis GmbH" with the support of the University of Freiburg. The aim is to develop more efficient membrane electrode units for fuel cells with the help of strong strategic partners and to bring them to market maturity.

In order to achieve climate targets, sustainable mobility must also become a reality for heavy-duty vehicles. ionysis GmbH develops highly efficient, emission-free and sustainable harvesting components for fuel cells. This includes ensuring that the so-called "membrane electrode units" have a significantly reduced content of perfluorinated substances, a problematic component that is increasingly being banned worldwide due to its environmental impact. "Together with international partners, we have succeeded in developing new types of fuel cells for the first time that are state of the art,

but have a lower environmental impact," explains Dr. Matthias Breitwieser, Chief Technology Officer at ionysis GmbH. "This makes them particularly suitable for applications such as heavy-duty commercial vehicles."

ionysis started operations with a team of 8 on September 1, 2022, which has already grown to 15 employees within the first six months. Along with Dr. Matthias Breitwieser (Chief Technology Officer), Dr. Florian Lombeck (Chief Scientist) and Dr. Severin Vierrath (Scientific Advisor), who are active or former employees of Hahn-Schickard and the University of Freiburg, Dr. Andreas Büchler (Chief Operation Officer) and Lisa Langer (Chief Financial Officer) round out the technical founding team.

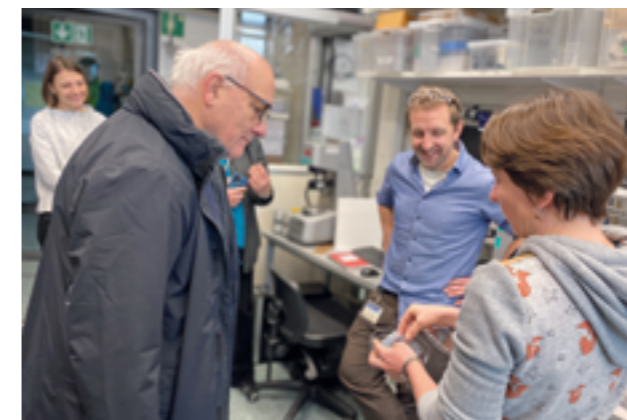
The goal is to further develop novel, more environmentally friendly membrane electrode units and also to



ionysis develops fluorine-free core components for fuel cells



Novel membrane electrode units based on research at Hahn-Schickard and the University of Freiburg



Green Party member of the state parliament Alexander Schoch visits ionysis laboratory in Freiburg

demonstrate their technical feasibility on a large scale. As another start-up in the field of hydrogen and decarbonization technologies, ionysis GmbH complements the strong GreenTech start-up scene in Freiburg.

The foundation for the spin-off was laid in the context of several publicly funded research projects: Both the state of Baden-Württemberg ("DirectMEA") and the Federal Ministry for Economic Affairs and Climate Action ("DirectStack," FKZ: 03ETB024D) provided financial support for the work. In addition, the German Federal Ministry of Education and Research provided funding within the framework of the projects "FlexCoat" (FKZ: 01DM19008A) and "FC-CAT" (FKZ: 03SF0579B) provided funding tailored to the German-Canadian exchange. This enabled in particular an intensive technical cooperation with the "Hydrogen Hub" Vancouver. For the spin-off, two strong investors could be gained, who not only contribute the financial means: "Through our investors, we not only have substantial financing in the mid single-digit million range, but also valuable access to industry know-how and support in business development," says Lisa Langer.

ionysis is another spin-off resulting from Prof. Dr. Roland Zengerle's team. These spin-offs have now created around 335 high-tech jobs in Freiburg. With Dr. Matthias Breitwieser's move to the management of ionysis, Dr. Carolin Klose is taking over the management of the "Electrochemical Energy Systems" division at Hahn-Schickard together with Dr. Severin Vierrath: "I am very much looking forward to my new task and the further development of the group. ionysis is a great motivation for our work and offers an excellent perspective for further synergies and cooperations in the future," says Dr. Carolin Klose.



"With ionysis, we are now spinning off our eighth company at the Freiburg site, demonstrating that we are not only innovative in the field of life sciences, but also in the area of energy and sustainability issues."

**Prof. Dr. Roland Zengerle**

Director at the Hahn-Schickard Institute and Head of Laboratory for MEMS Applications at the Faculty of Engineering at the University of Freiburg



The founding team from left to right: Lisa Langer (Founder, CFO), Dr. Florian Lombeck (Founder, Chief Scientist), Dr. Andreas Büchler (Founder, COO), Dilara Sultanova (Junior Process Engineer), Claudia Schwarz (Development Engineer), Farmal Khan (Junior Process Engineer), Dr. Matthias Breitwieser (Founder, CTO), Dr. Severin Vierrath (Founder, Scientific Advisor). Source: ionysis GmbH

## Computer Science and Digital Production

2022 saw a number of changes in the management of the Hahn-Schickard Institute. Dr.-Ing. Karl-Peter Fritz and Prof. Dr. Oliver Amft became the new institute directors.

After Professor Yiannos Manoli took his well-deserved retirement in the summer of 2022, Professor Amft took up his new position in August. He followed the call of the University of Freiburg to the professorship of Intelligent Embedded Systems Lab at the Department of Computer Science and thus also became the new institute director at the Hahn-Schickard Institute of Micro- and Information Technology at the Freiburg and Villingen-Schwenningen sites.

Amft, who was born in Dresden, has the best prerequisites for this position due to his diverse, application-oriented research and development activities. Amft is moving to the Institute of Medical Informatics, Biometry and Epidemiology at the University of Erlangen-Nuremberg after most recently working for five years as head of the Chair of Digital Health.

After studying electrical engineering and information technology at the Chemnitz University of Technology,

Amft worked for several years as an engineer and project manager at ABB Switzerland before earning his doctorate in information technology on medical wearables at the ETH Zurich, where he subsequently conducted research for several more years. His path later took him to the Netherlands, where he spent five years at the Eindhoven University of Technology as an assistant professor of signal processing before accepting a professorship at the University of Passau in 2014, where he established a chair in sensor technology.

"I am very much looking forward to working with the Hahn-Schickard team. Together, also including the University of Freiburg, this gives me an excellent starting position to set new impulses and focal points in the fields of data science, embedded medical technology and wearable systems, for the state of Baden-Württemberg as well as internationally," says Amft, who now leads the VS site together with Prof. Dr. Alfons Dehé.

In Stuttgart, at the Institute of Micro Assembly Technology, there have also been changes at the management level. Since May 2022, Dr. Karl-Peter Fritz is the new director of the institute and now leads the location together with Prof. Dr. André Zimmermann. Hahn-Schickard

Stuttgart researches new technologies and methods for highly integrated, hybrid microsystems. In order to continue the growth of recent years and to expand research and development services as well as manufacturing for industrial customers, an expansion of the institute's management became necessary.

Dr. Fritz received his doctorate in 2012 from the University of Stuttgart on miniaturized valve implants and most recently held the position of division manager for components + systems at Hahn-Schickard. With the expansion of the institute's management, Stuttgart is pursuing two main goals:

- > Product-oriented development as well as manufacturing of components and systems using the technology portfolio of micro assembly technology. Associated with this is the expansion of the business field of manufacturing from batch size 1.
- > Development and production of individualized micro systems based on digital process chains. Here, the focus is on developing use cases for the topic area of "rapid manufacturing" using additive manufacturing processes.

"I look forward to continuing the excellent cooperation with our customers and all employees," says Dr. Fritz. "In the new function, I would like to specifically transfer our broad technology expertise into product developments for industry."

Target applications include patient sensor technology, retrofit sensor technology for the Industrial Internet of Things, sensor technology for the New Space, and customer-specific radio frequency packages.

Professor Zimmermann will continue to hold dual positions at Hahn-Schickard Stuttgart and at the Institute of Microintegration (IFM) at the University of Stuttgart. "The expansion of the institute's management is an important course setting to be able to serve the interests of our customers even better in the future. According to the motto 'Visions to Products,' Hahn-Schickard accompanies its customers from the product idea to its successful implementation on the market. Strengthening product-oriented development and development and manufacturing competence creates the conditions for this," says Prof. André Zimmermann and looks forward to the cooperation.



Prof. Dr. Oliver Amft



Dr.-Ing. Karl-Peter Fritz

## Product Highlights

# ermagnostix completes seed-plus funding round with €4.6 million

Dermagnostix, one of eight spin-offs from Hahn-Schickard in Freiburg and the University of Freiburg, has raised €4.6 million in new capital in its seed-plus financing round. This will be used to prepare the market launch of the first products and to develop further diagnostic tests. The new capital will be used for the German and European rollout of a microfluidic system for the diagnosis of skin diseases, consisting of the „PsorX-LabDisk“ and the „LabDisk-Analyzer“. In addition, the portfolio is to be expanded for further rapid tests in the field of skin cancer and chronic inflammatory skin diseases.

With PsorX, the world's first test that distinguishes psoriasis from eczema at the molecular level, Dermagnostix closes a major diagnostic gap between highly

efficient therapeutics on the one hand and inadequate, antiquated diagnostic procedures on the other. This is achieved through molecular diagnostics based on proprietary IP. The company relies LabDisk technology from Hahn-Schickard, a fully automated, microfluidic analysis system for point-of-care diagnostics. PsorX-LabDisk is the world's first molecular test to distinguish psoriasis from eczema, a condition affecting nearly 10% of the population. The innovative products are expected to expand the toolkit of pathology laboratories and hospitals.

Further funding raised, such as a €2.5 million grant from the European Innovation Council (EIC), will strengthen the young company's successful trajectory.



# Small and energy-efficient MEMS micro loudspeakers for innovative user applications

**Pioneering work for the "Internet of Voice" has emerged. Hahn-Schickard and Bosch Sensortec enter into a development cooperation in the field of acoustic microsystems.**

Tomorrow's Internet will be mobile and audio-based. To support the shift in communication away from typing and reading to speaking and listening, new technologies are needed that enable innovative audio- and voice-based user applications. This is the goal Hahn-Schickard and Bosch Sensortec have set for their "next generation" microelectromechanical (MEMS) speaker development collaboration.

Smaller than conventional loudspeakers, more powerful with lower energy consumption, the innovative MEMS micro loudspeakers meet the market requirements of the "Internet of Voice," the voice-activated Internet, and enable innovative user applications.

Bosch Sensortec and Hahn-Schickard have already been working together on various projects for several years. With the current cooperation, Hahn-Schickard will play a key role in the development of acoustic microsystems

that usefully complement Bosch Sensortec's MEMS sensor portfolio for consumer electronics.

The complementary expertise of the two development partners shows how well they complement each other: Bosch Sensortec is a leading supplier of MEMS sensors for consumer electronics and has extensive experience in the development and industrialization of high-volume MEMS products. The Baden-Württemberg application-oriented research institute Hahn-Schickard, on the other hand, draws on many years of experience in the development of MEMS innovations and their small-scale production with its own state-of-the-art clean room in Villingen-Schwenningen.

"We are thrilled to be working with a global player like Bosch Sensortec to advance one of the biggest MEMS topics of the future. This cooperation illustrates once again how much trust the industry has in Hahn-Schickard's competence and expertise," says Alfons Dehé, Institute Director of Hahn-Schickard in Villingen-Schwenningen and Chairholder of the Georg H. Endress Professorship for Smart Systems Integration at the University of Freiburg.

# Diversity

## For more equality and inclusion

A diversity of perspectives, skills, talents and experiences fosters community, creativity and innovation and thus strengthens the performance of the organization as a whole. Living diversity at Hahn-Schickard means preventing possible social discrimination, increasing equal opportunities and building networks with others.



**Anke Bruha**  
Equal Opportunities Officer Stuttgart

"I am pleased that diversity is gaining more visibility because it opens up many new opportunities and perspectives that need to be put to good use."



**Clemens Pecha**  
Chief Financial Officer at Hahn-Schickard

"I am pleased that diversity is gaining more visibility, because at Hahn-Schickard we attach importance to ensuring that all employees enjoy working for us and can fully exploit their potential. To this end, it is important that everyone is treated and promoted equally."



**Konstantinos Mitsakakis**  
International Business Development

"I'm glad to see that diversity is gaining more visibility, because it gives the opportunity to any kind of minority groups to express themselves equally."



**Elias Brohammer**  
Employee, Software Solutions/KI

"I'm glad to see diversity gaining more visibility because every person deserves the same opportunities and good pay shouldn't depend on gender."



**Dr. Karl-Peter Fritz**  
Executive Board Member

"I'm glad to see diversity gaining more visibility because it's one of the keys to success: valuing individual strengths and motivating our colleagues as a result."



**Melanie Bühler**  
Chairwoman of the Works Council Freiburg

"I'm glad to see diversity is gaining more visibility because it will make our workplace even more creative, colorful and attractive."



**Dr. Kerstin Gläser**  
Division Manager

"I'm glad to see diversity gaining more visibility because it gives new perspectives on different issues."



### International Dinner

Diversity was also on the menu at the International Dinner. Everyone was able to contribute to expanding people's tastes with dishes from their own culture.

### Everyone benefits from diversity!

- ↑ 29% Teamwork
- ↑ 70 % Individual feelings of inclusion
- ↑ 43% Probability of profit
- ↑ 20% Revenue from innovation

Simplified representation based on various studies by Deloitte, McKinsey, Diversity Charter provided by Diversity Yes!

### Diversity promotes innovation

We are committed to creating a tolerant and open working atmosphere for employees of different gender, age, skin color, faith and sexual orientation, as well as people with and without disabilities.

# Additional Highlights



08.03.2022

## Enabling Technologies for Scalable Diamond Quantum Sensors (QSCALE)

The project deals with enabling technologies for NV center-based technologies. These technologies play a central role in the transfer of quantum sensor technology to the industrial market as well as in the scalability of this sensor type. In the area of miniaturization and integration, the project lays decisive building blocks for the successful commercial use of quantum sensor technology.



02.06.2022

## Groundbreaking ceremony for research building on the Faculty of Engineering campus

Dr. Nicole Hoffmeister-Kraut, Minister of Economics, Labor and Housing for the State of Baden-Württemberg, together with Freiburg's Lord Mayor Martin Horn, kicked off the construction project on Georges-Köhler-Allee with a groundbreaking ceremony. The two-story building will provide around 2,700 square meters of office space and 3,500 square meters of space for laboratories, a clean room and workshops.



11.04.2022

## Technology transfer award for test device for infection diagnostics

The in vitro diagnostics company Spindiag, a spin-off of Hahn-Schickard and the University of Freiburg, and Hahn-Schickard are awarded the Technology Transfer Prize 2020 of the German Physical Society (DPG) for the research-based development of the PCR-based rapid test system Rhonda.



20.06.2022

## Verabschiedung von Institutsleiter Yiannos Manoli

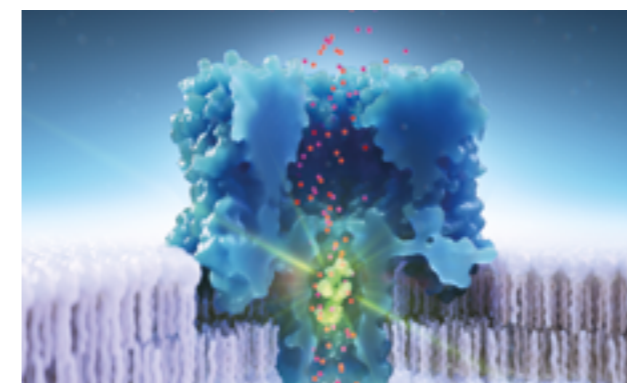
Prof. Dr.-Ing. Yiannos Manoli, long-time Hahn-Schickard institute director, retired in June 2022. Hahn-Schickard's impressive development is due in great part to Yiannos Manoli's leadership. He greatly shaped the field of hardware and software development, which brought diverse solutions in the field of energy harvesters and autonomous sensor nodes to prototype maturity.



25.05.2022

## Innovation Award "German Innovation Award"

In the category "Excellence in Business to Business, Machines & Engineering," Hahn-Schickard received the award for "the digital process chain for the design and production of individualized mechatronic products." Based on 3D printing of tool inserts and subsequent functionalization, it enables the rapid development and production of individualized mechatronic products.



19.07.2022

## 45 million euros for research on nanopores for personalized medicine

The nanodiag BW future cluster coordinated by Hahn-Schickard is one of seven winners of the Clusters4Future initiative nationwide. Research results in nanopore technology from the University of Freiburg are to be transferred into innovative products and services for personalized medicine within the next nine years.

# Additional Highlights



21.09.2022

## Industry Meeting MID Summit & MID Workshop 2022

The joint event of Hahn-Schickard and the 3-D MID e.V. research association took place on September 21 and 22. The nearly 100 participants experienced two intensive days around the topic of MID (Molded Interconnect Devices) with 13 expert presentations from the business and research sectors on MID applications, new materials and technologies as well as additive manufacturing processes, poster sessions, trade exhibition and workshops.



27.10.2022

## Automotive Cluster for the Black Forest-Baar-Heuberg Region

In order to successfully shape the transformation of the automotive industry in the Black Forest-Baar-Heuberg region, the German Federal Ministry of Economics is funding a consortium. Over the next two and a half years, around three million euros will flow into the region. This will set in motion a structural development process supported by various institutions in which automotive suppliers in the region can participate.



26.09.2022

## SME Digital Center Climate. Neutral. Digital

The Mittelstand-Digital Zentrum Klima. Neutral. Digital aims to enable small and medium-sized enterprises and craft businesses to take concrete steps toward climate neutrality. The center's focus areas include energy-efficient infrastructure, resource-saving production processes and services, IT security & AI and targeted support through climate coaches.



10.11.2022

## AI for sensor-related usage

Edge AI can simplify the operation of complex plants and systems by detecting and assessing changes in condition directly on site. These lean, decentralized AI solutions eliminate the need for raw data to be sent from a large number of sensors to a central entity such that significantly less data needs to be transmitted and assessed. A system can therefore become more resistant to malfunctions.



28.09.2022

## Innovative 3D filters emerge as new business idea

Hahn-Schickard employees Dr. Mehmet Dinc and Benedikt Keitel from Ulm prevailed against strong teams in the nationwide start2grow start-up competition organized by the Dortmund Economic Development Corporation and took fourth place. Customized 3D filter materials with memory function are to make water treatment more reliable and efficient.



22.11.2022

## Best Paper Award from BSN'22

Lena Uhlenberg, research associate at Hahn-Schickard, and Prof. Oliver Amft, institute director at Hahn-Schickard, were awarded the Best Paper Award for their paper „Comparison of Surface Models and Skeletal Models for Inertial Sensor Data Synthesis“ at BSN'22, beating out 35 other competitors.

# Committee Participation

Name	Type of participation	Name of the body or organization
<b>O. Amft</b>	Co-editor	IEEE Pervasive Computing (Magazin der IEEE CS Society)
	Co-editor	IEEE Journal of Biomedical and Health Informatics (J-BHI)
	Co-editor	Frontiers in Computer Science
	Co-editor	Frontiers in Bioengineering and Biotechnology
	Co-editor	IEEE Open Journal of Engineering in Medicine and Biology (OJEBM)
	Member of the Advisory Board	SNSF Sinergia Evaluation Commission for Interdisciplinary Research
	Member	EMBC Program Committee, Biomedical Sensors & Wearable Systems track
	Program Committee	IEEE Wearable and Implantable Body Sensor Networks (BSN) Conference
	Program Committee	International Workshop on Multimedia Assisted Dietary Management (MADiMa2022)
	Program Committee	ACM International Symposium on Wearable Computing (ISWC)
	Member	DGBMT Expert Committee Model-based Personalized Medical Technology (MPM)
	Member	DGBMT Technical Committee Mobile Diagnosis and Therapy Systems - mHealth
	Member	IEEE EMBS Wearable Biomedical Sensors and System (WBSS)
	Member	Institute of Electrical and Electronics Engineers (IEEE), IEEE Computer Society, IEEE Engineering in Medicine and Biology Society (EBMS)
	Member	German Society for Biomedical Engineering (VDE DGBMT)
Member	German Society for Medical Informatics, Biometry and Epidemiology (GMDS) e.V.	
Assessor	funding program Distr@I for the state of Hesse	
<b>A. Bittner</b>	Member	VDE
	Member	Society Microelectronics, Microsystems and Precision Engineering (GMM)
	Member	IMAPS
<b>C. Blattert</b>	Member	Expert Group Surfaces, microTEC Südwest e.V.
<b>N. Borst</b>	Expert Group Spokesperson	In-vitro-Diagnostics microTEC Südwest e.V.
	Member	smart analytics BioRegio STERN
<b>A. Dehé</b>	Program committee	Smart Systems Integration Conference
	Member	AMA Science Council
	Business Advisory Council	Sparkasse Schwarzwald-Baar
	Member	IHG-SBH Working Group Production 2030
	Advisory Board	Innovation and Research Centre (IFC) of Furtwangen University
	Member	Steinbeis Board of Trustees
	Member of the Board	CoHMed
	Spokesperson + Chairman of the Board	Innovationsallianz Baden-Württemberg e.V. (innBW)
	Member of the Board	TechnologyMountains e.V.
	Shareholder	MedicalMountains e.V.
	Advisory Board Science, Research and the Arts	Baden-Württemberg International (bw-i)
	Member	D E G A e.V. German Acoustical Society
	Member	Allianz Industrie 4.0 Baden-Württemberg
	Member of the Expert Group	AiF, German Federation of Industrial Research Associations "Otto von Guericke" e.V.
	Program Committee	Micromechanics and Microsystems Europe (MME) Workshops
Program Committee	Microsystem Technology Congress	
Program Committee	EuroSensors	
<b>W. Eberhardt</b>	Member	VDE/VDI Society Microelectronics, Microsystems and Precision Engineering (GMM), Expert Committee 5.5 Packaging and interconnection technology
	Member	VDE/VDI Society Microelectronics, Microsystems and Precision Engineering (GMM), Expert Committee 5.6 Mechanically Integrated Assemblies
<b>N. Elkmann</b>	Member	Organizational Committee Smart Day 2022
<b>B. Folkmer</b>	Member	NAFEMS - The International Association for the Engineering Analysis Community
	Member	ANSYS User Club e.V.( AUC)
	Member	Virtual Dimension Center w.V. - Zentrum für Digitale Produktentwicklung (VDC TZ St. Georgen)
	Member	Expert Group Smart Systems, mircoTEC Südwest e.V
	Member	Fraunhofer-Alumni e.V.
<b>K.-P. Fritz</b>	Member	GMM VDE/VDI Committee Expert Area 4.1: Fundamental issues in microsystems technology and nanotechnology
	Head	GMM VDE/VDI Expert Area 4 Microsystem technology and nanotechnology
	Member	Steering Committee Microsystem technology Congress
	Reviewer	Federal Ministry for Economic Affairs and Climate Protection
<b>K. Gläser</b>	Member	Printing Technology Group, microTEC Südwest e.V.
<b>T. Grözinger</b>	Member	VDE/VDI Society for Microelectronics, Microsystems and Precision Engineering (GMM), Technical Committee 5.6 Mechanically Integrated Assemblies
<b>R. Günzler</b>	Executive Committee Member, Chair Working Group Healthy Living, Chair Task Force EDIHs	European Technology Platform on Smart Systems Integration (EPoSS)
	Member Core Group, Chair Track „Food, Biomedical, Health“	“Smart Systems Integration“ Conference
	Advisory member of the German Committee	Interreg Northwest Europe
<b>S. Herrlich</b>	Member	Steuerkreis TechnologyMountains e.V.
	Member of the Board	VDC St. Georgen w.V.
	Deputy Board Member	Connected Health in Medical Mountains (CoHMed)

Name	Type of participation	Name of the body or organization	
<b>T. Hutzenlaub</b>	Member	Proteomics4Future Network	
	Member	European Liquid Biopsy Society	
	Member	Network BioLAGO e.V.	
<b>B. Inthasane</b>	Member	Organizing Committee Smart Day 2022	
	Head	Smart-Home & Living Baden-Württemberg e.V.	
<b>B. Johannsen</b>	Head	Medical Technology Network, VDI, Black Forest District Association	
<b>S. Karmann</b>	Member	EPoSS Scientific Council	
	Member	EPoSS Trademark Committee	
	Member	EPoSS Task Force Green ECS	
	Member	Smart Systems Expert Group, microTEC Südwest e.V.	
<b>M. Nagler</b>	Member	Accounting/Controlling Working Group of the Zuse-Gemeinschaft	
<b>C. Pecha</b>	Member	Executive Committee of the AiF Research Associations South	
	Member	Business Advisory Board Sparkasse Schwarzwald-Baar	
<b>C. Rathfelder</b>	Spokesperson	Working Group Smart-Day, Smart-Home & Living Baden-Württemberg e.V.	
	Member	Smart Systems Expert Group microTEC Südwest e.V.	
	Vice Chairman	Smart-Home & Living Baden-Württemberg e.V.	
	Member	Organizing Committee Smart Day 2022	
	Member	German Informatics Society, Software Technology Group	
	Member	Gaia-X Working Group Smart Living	
	Reviewer	Federal Ministry of Education and Research	
Member	Program Committee Embedded World Conference 2022		
<b>M. Rüb</b>	Member	Zuse Cluster Digitalization and AI	
	Member	EPoSS Working Group Edge AI	
	Member	Innovations Network SBH KI	
<b>A. Schumacher</b>	Guest Member	FA 10 Research Association on Welding and Allied Processes of the DVS	
<b>J. Seybold</b>	Member	Photonics BW e.V., Optical Technologies Innovation Network	
<b>A. Sikora</b>	Deputy Speaker Research Area "Technologies for intelligent systems"	Network of Research Baden-Württemberg Center of Applied Research (BW-CAR)	
	Spokesperson Expert group "Smart Systems"	microTEC Südwest e.V.	
	Chairman	Embedded World Conference	
	Chairman	Embedded World Exhibition Board	
	Scientific Advisory Board	Wireless Congress - Systems and Applications	
	Scientific Advisory Board	IoT Conference - Vom Sensor bis zur Cloud	
	Member Executive Board	OMS-Group e. V.	
	Member Supervisory Board	MIOTY Alliance e.V.	
	Member Supervisory Board	cedalo AG	
	<b>S. Spieth</b>	Member	Expert Committee Implantable Assistance Systems of the DGBMT
		Member	Micromedical Technology Group, microTEC Südwest e.V.
Member		Working Group Quantum Technologies, Photonics BW e.V.	
<b>F. von Setten</b>	Chairman	AiF Research Alliance Medical Technology (AiF-FAM)	
	Member	Committee for Economy and Science, City of Freiburg	
<b>R. Zengerle</b>	Spokesman	IVD Expert Group, microTEC Südwest e.V.	
	Member	National Academy of Sciences, Leopoldina	
<b>A. Zimmermann</b>	Member	Advisory Board des Journals Lab on a Chip	
	Chairman of the Board	VDE/VDI Society for Microelectronics, Microsystems and Precision Engineering (GMM)	
	Member	GMM VDE/VDI Committee FB 4.1: Grundsatzfragen der Mikrosystemtechnik und Nanotechnologie	
	Member	Steering Committee Microsystem technology Congress	
	Member	Steering Committee Allianz Industrie 4.0 Baden-Württemberg	
	Member	Competence Network Functional Nanostructures	
	Member Advisory Board	Association of Friends of the University of Freiburg im Breisgau e.V.	
	Member	Forum Health Care Location Baden-Württemberg	
	Assessor	Junge Innovatoren	
	Member	VDE Governing Board	
	Dean	Faculty of Engineering at the University of Freiburg	
<b>A. Zimmermann</b>	Member	Deutsche Gesellschaft für Materialkunde (DGM)	
	Member	International Microelectronics and Advanced Packaging Society (imaps)	
	Member	Organic and Printed Electronics Association (oe-a)	
	Reviewer	German Research Foundation (DFG)	
	Member	Multi Materials Micro Manufacturing (4M)	
	Member	Conference Committee FLEX Europe	
	Chairman	Research Advisory Board of the Research Association Mechatronic Integrated Devices 3-D MID e.V.	
	Assessor	Assessor group 6: Federation of Industrial Research Associations Otto von Guericke e.V. (AiF)	
	Member Scientific Committee	International Congress Molded Interconnect Devices	
	Member Scientific Committee	World Congress on Micro and Nano Manufacturing	
Member Steering Committee	Microsystem technology Congress		



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