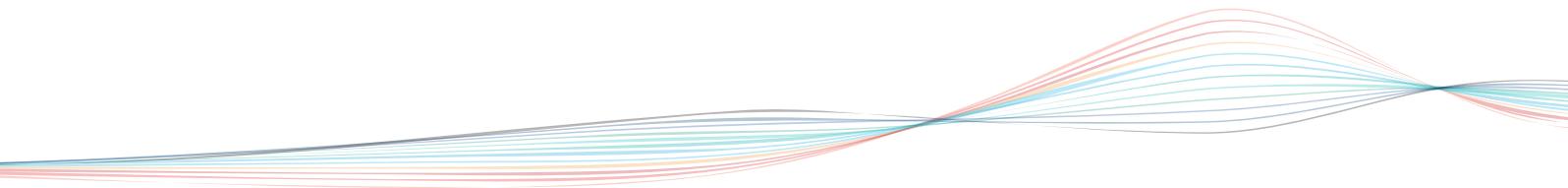




3-D Imaging in Medicine

Cutting-Edge Research in Germany's Medical Valley



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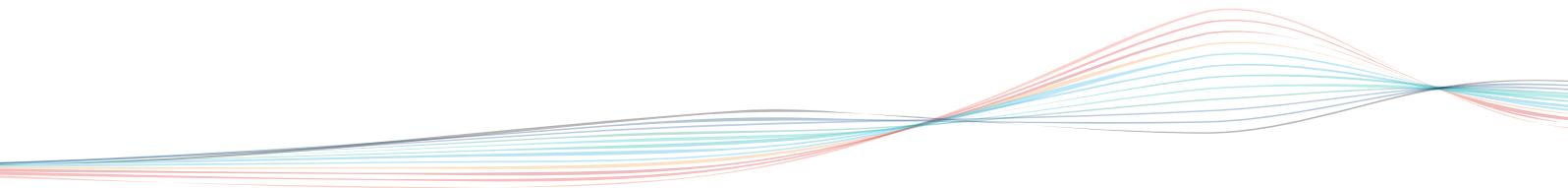
Germany – Partner for Medical Technology

Germany has an excellent position in the fields of science, research and development, both by European and by international standards. German companies play a leading role in the development of innovative products, and „Made in Germany“ is regarded as a seal of quality and of solid German workmanship throughout the world.

In our globalized world, scientific and technological progress is no longer achieved in isolation within individual countries, but depends on cooperation and the exchange of ideas with leading experts from across the world. That is

why, in its future efforts to improve its technological position, Germany plans to cooperate more closely with recognized centres of excellence and strengthen its role as a “gateway to Europe” for its international partners.

To this end, the German Federal Government, under the leadership of the Federal Ministry of Education and Research (BMBF), has launched an initiative to advertise Germany as an excellent research location. Under the motto “Germany – Land of Ideas”, the campaign will highlight the attractiveness of Germany and its research environment in important target countries and present German research organisations, including universities, institutes, and private companies that are active in the



field of research. The field of medical technology has been selected for the fourth thematic campaign. Medical technology is an emerging sector that is based on high knowledge intensity and possesses outstanding innovative strength. The campaign has the aim of initiating more mutually beneficial R&D collaborations between German and foreign research institutions and companies.

Numerous sectorspecific events organized by German research and technology establishments will give interested partners the opportunity to establish contacts with German research establishments and strong technological companies till the end of 2013. Currently, workshops, multiplier events, partnering

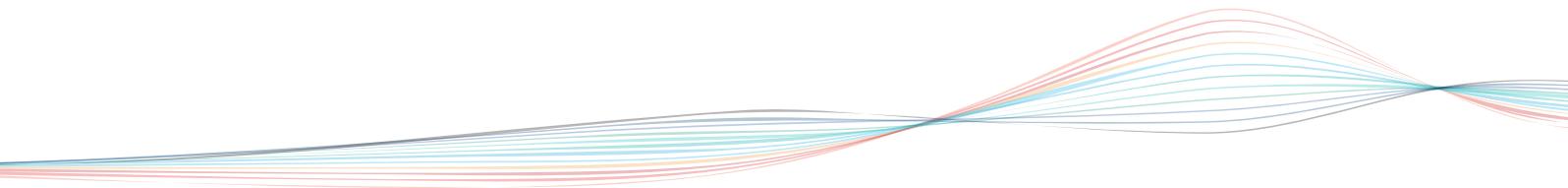
events, lectures, and presentations at conferences and meetings are being organized. They are aimed at scientists at universities and research institutions, scientists and decision-makers at R&D-oriented companies, junior scientists, multipliers, and investors.

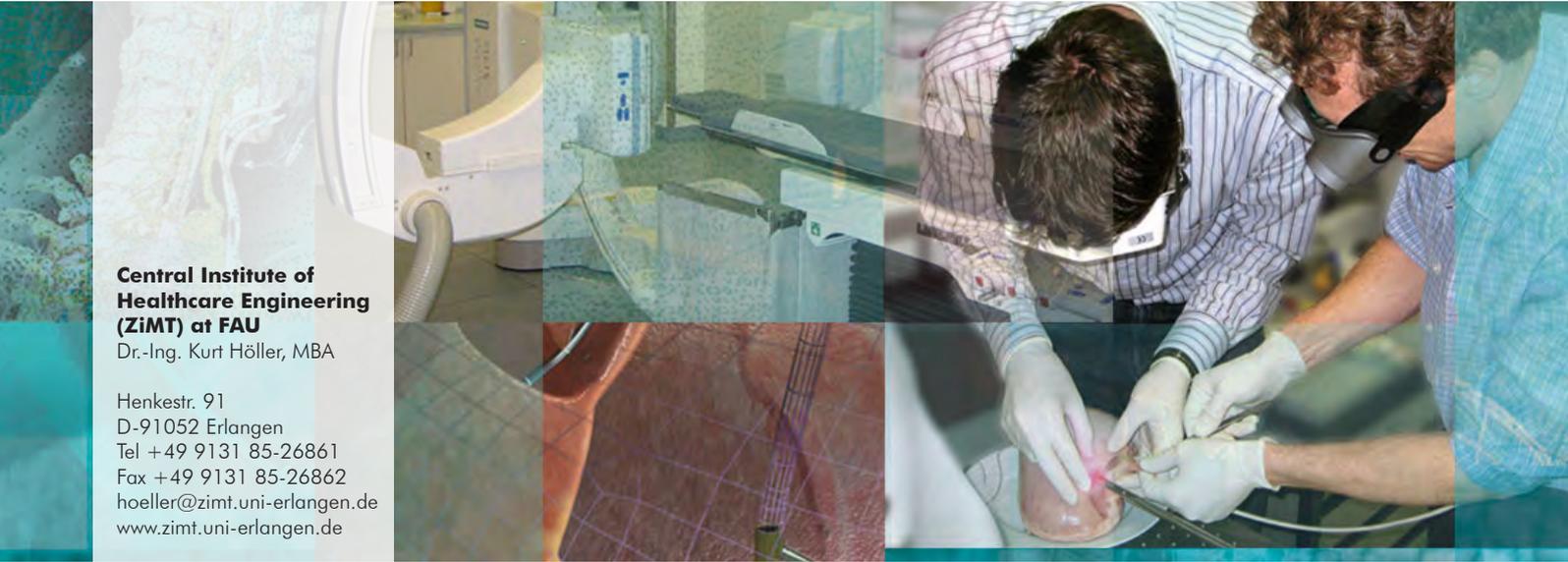
BMBF has selected 8 participants that highlight its ideals and goals for initial support. So health technology is one of the main research and teaching topics of the Friedrich-Alexander-Universität (FAU) and its numerous spin-offs. FAU scientists have made substantial contributions to medical imaging, telemedicine, biomaterials, and therapeutic systems. Strong links to Siemens Healthcare, Fraunhofer IIS and about 50 companies in



the Metropolitan Region contribute to the excellent FAU research environment. The campaign aims at scientific exchange as well as integration of international competence in medical engineering into Erlangen's research, development, and education.

To this end, under the auspices of the FAU's Central Institute of Healthcare Engineering (Zentralinstitut für Medizintechnik ZiMT), the partners conduct workshops abroad with the aim of establishing international graduate schools and cooperation. Erlangen as a highly innovative location offers unique opportunities and prospects for young scientists and experts especially in the field of medical 3-D imaging.



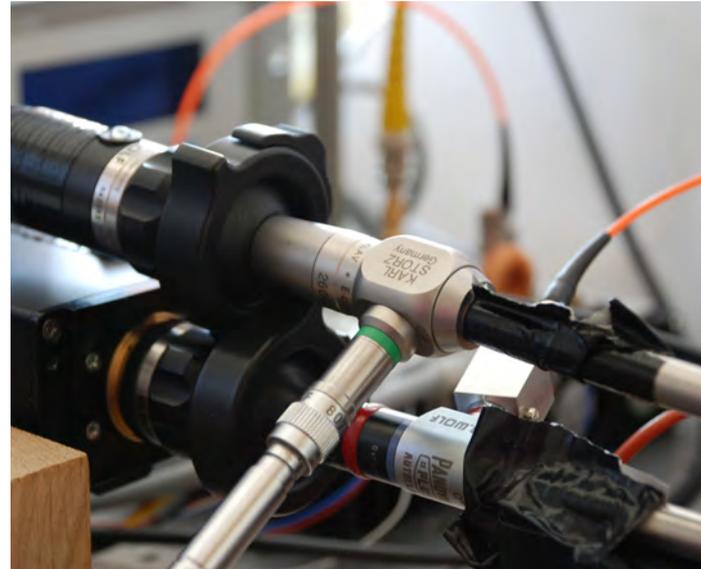


**Central Institute of
Healthcare Engineering
(ZiMT) at FAU**

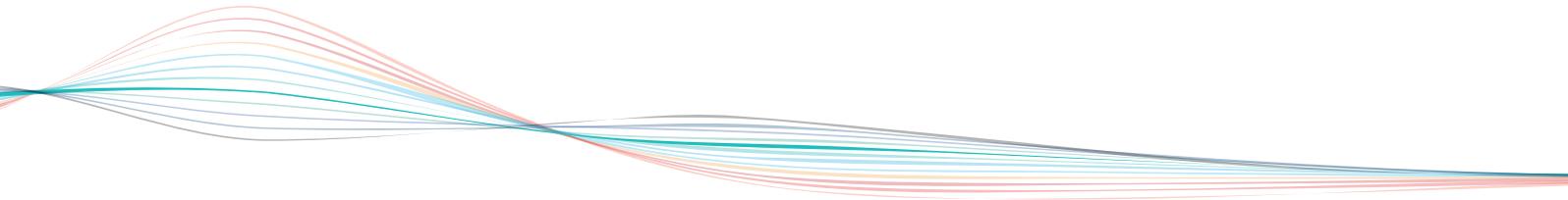
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The **Central Institute of Healthcare Engineering (ZiMT)** plays a prominent role concerning the science at the Friedrich-Alexander-Universität (FAU) Erlangen-Nürnberg. The scientific focus of “healthcare engineering” is of the greatest social relevance considering the demographic development. This focus is perfectly embedded here at FAU in an excellent research environment. Our goal is to prolong life expectancy, to improve the quality of life and to reduce healthcare costs. Scientists at FAU have contributed fundamentally to progress in the areas of medical imaging, telemedicine, biomaterials and therapeutical systems.

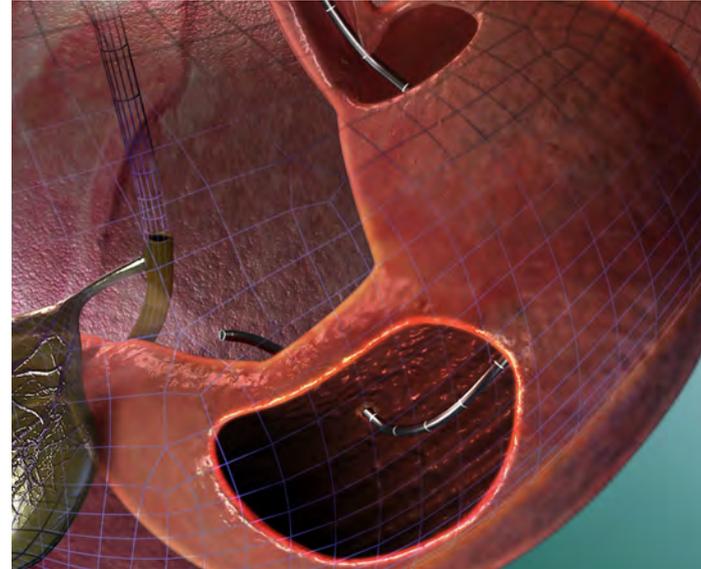


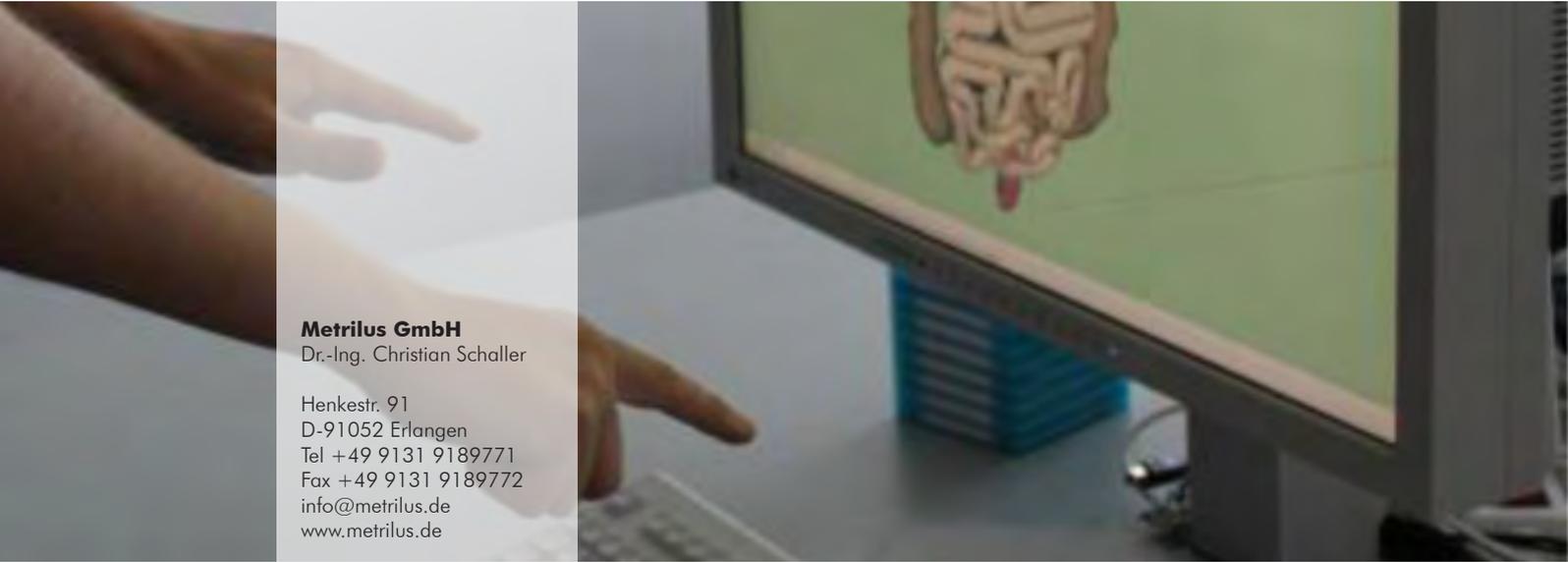
Medical technology is one of the main focuses of FAU. About 50 professors and university lecturers are working in this sector. Since the foundation of ZiMT in December 2009, they are associated at an institutional level. All activities in this research field meet at ZiMT with the mission of expanding the research network in the focus area of healthcare engineering, within and around the university. Additionally, it supports a transparent public image of the highly dynamic area of healthcare engineering at FAU.



ZiMT forms a link between industry and science. Therefore, amongst its main responsibilities are the coordination of the expertise of the numerous affiliated facilities as well as the supervision of the bachelor and master program in medical engineering.

In this regard the biggest university of northern Bavaria has established a new organizational unit, which sharpens its biomedical engineering profile and improves the general conditions for the interdisciplinary collaboration in diversified research areas in medical technology. ZiMT will act as a catalyst for joint research and education.



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Metrilus GmbH offers software for all kinds of real-time 3-D applications. The software and tailored solutions support all kinds of Time-of-Flight sensors, Kinect and light section. In the beginning of 2010, Metrilus was founded as one of the first companies worldwide to provide a profound and complete solution for real-time 3-D imaging.

We offer our customers tailored software for all kinds of applications within this domain. This includes the support of a variety of 3-D acquisition modalities, including Time-of-Flight, structured light, light section and the combination of all these modalities for multi-sensor set-ups. Whether you are se-

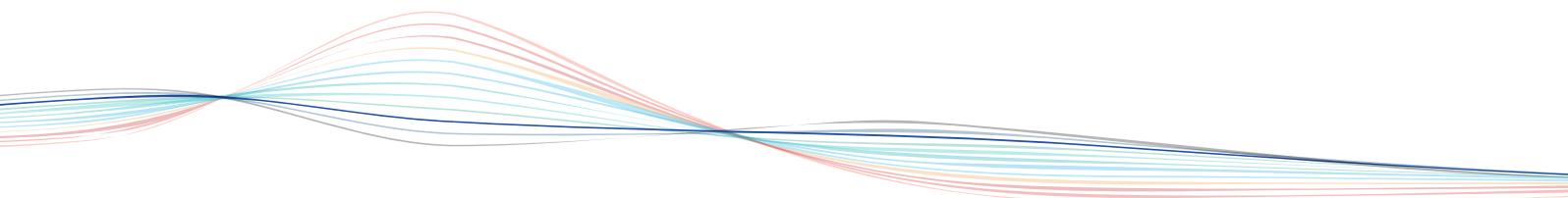




arching for standard software components to help you speeding up your own range-imaging application development or you are searching for someone to provide you a fully integrated software solution you are at the right place. Metrilus developments are based on our powerful and proven core technology, called metri[base]. Several customers in various business fields already rely on metri[base].

MetriCam is the first common and unified real-time 2-D / 3-D camera SDK for .NET. It supports all major Time-of-Flight cameras from Fotonic, Mesa Imaging, SoftKinetic, TriDiCam, PMD Technologies and ifm electronics as well as 2-D (color) cameras and Kinect / XtionPro.

The first common and unified real-time 3-D camera SDK for C#/.NET



With MetriCam it is possible to integrate all major 2-D and 3-D cameras into your own .NET applications. You can speed up your own development and concentrate on the problems you wanted to solve using Time-of-Flight cameras or PrimeSense sensors.

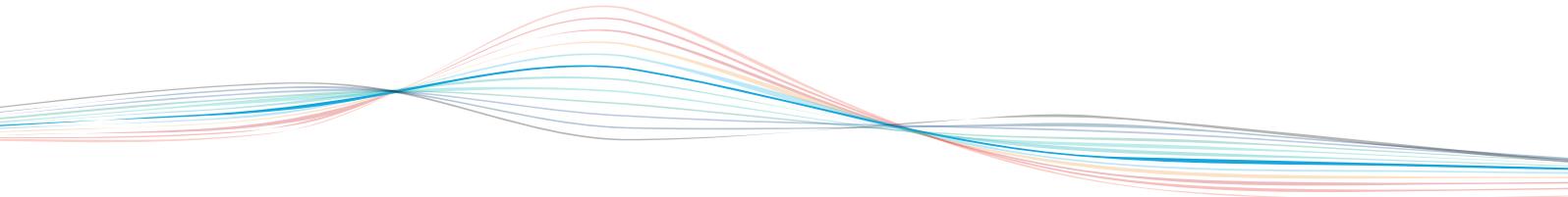
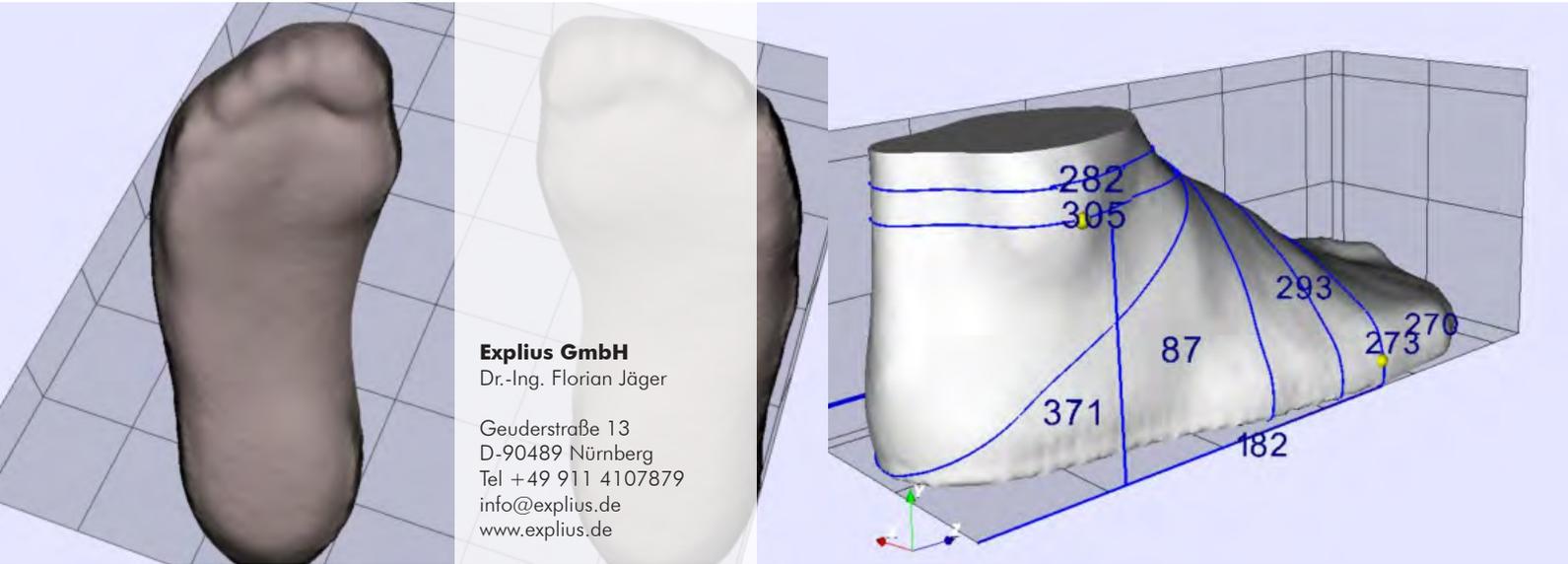
Intrinsic and extrinsic camera calibration, comfortable and accurate

MetriCal



We support:

- unified interface for all cameras
- simultaneous multi-camera management
- featuring all fundamental camera features
- thread-safety
- events for camera connects and disconnects
- object oriented programming interface
- extendable with other sensors



Explus GmbH was founded 2012 as a Spin-Off of the Pattern Recognition Lab at the Friedrich-Alexander-Universität. It develops medical software products in the field of orthopedics, rehab-technology, custom shoe design, as well as the planning of reconstructive surgeries. All products base on an innovative software library that was developed by Explus GmbH. It allows combining multiple 3-D acquisitions, scanned using low-cost sensors to form a high quality model of the scanned object.

The 3-D data can be processed using modern image processing and computer vision techniques. By using Explus' software library, it is possible to use light-weighted, portable, low-cost 3-D sensors in many new fields of application.

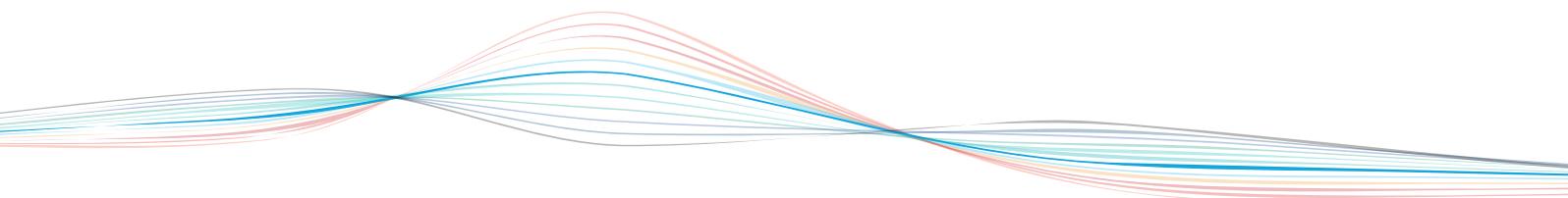


At the moment, Explus mainly develops solutions utilizing consumer cameras, like ASUS Xtion Pro and Microsoft Kinect.

Customers of Explus GmbH are primarily companies that are already firmly established in the target market and who want to extend their range of products by high-tech applications. These applications are individually and exclusively developed for a customer. Furthermore, they can be licensed and sold as a white label OEM product using the company's own name.

Many companies in the medical area, like technical orthopedics, don't have the required knowledge to develop such projects themselves. Explus offers companies the opportunity to license an integral, well-engineered product with marginal development costs and hence little financial risk.

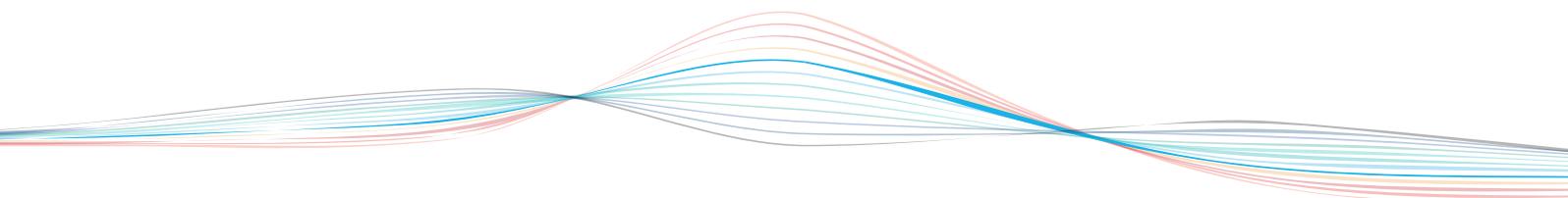
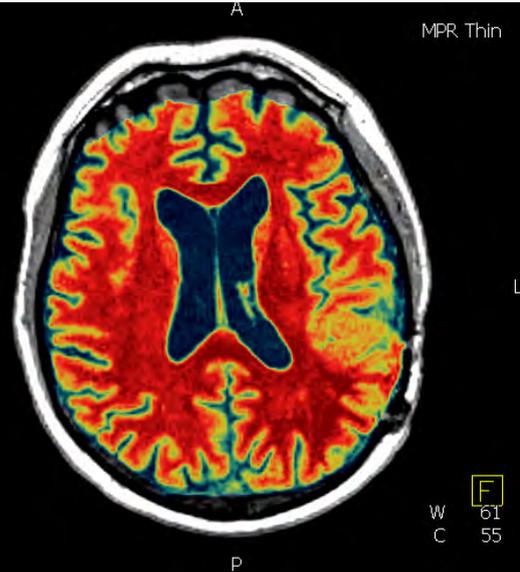
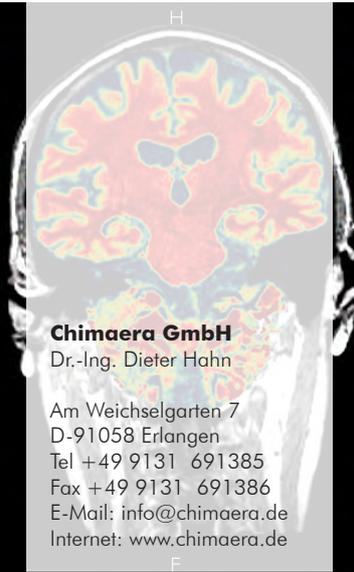
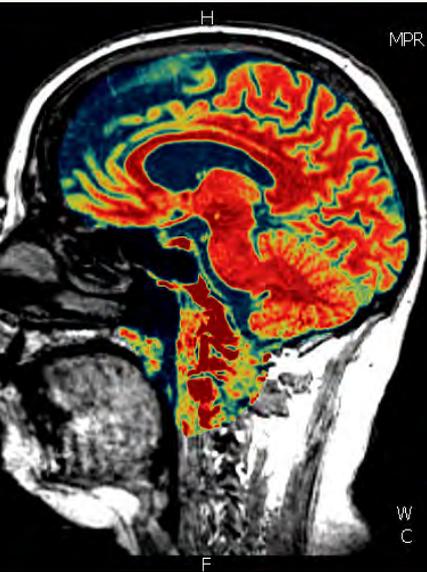
An example for a white label product developed by Explus is the 3-D foot scanner "iScan 3Dp". It is successfully distributed by the company "IETEC Biomechanical solutions" (www.biomechanical-solutions.de) and commercially available since September 2011.





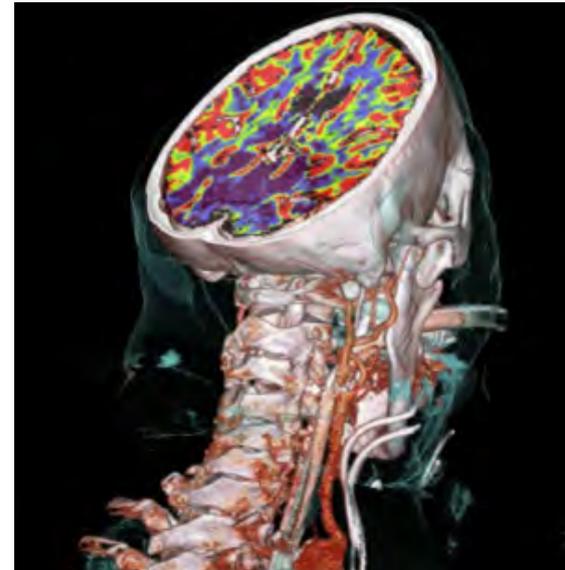
The system uses Microsoft's "Kinect for Windows" as 3-D camera sensor. Thus, "iScan 3Dp" enables a fast, precise, and portable acquisition and measurement of individual three-dimensional foot models. Time-consuming, labor-intensive casting and form construction of foot positives during the development of custom made shoes is unnecessary.

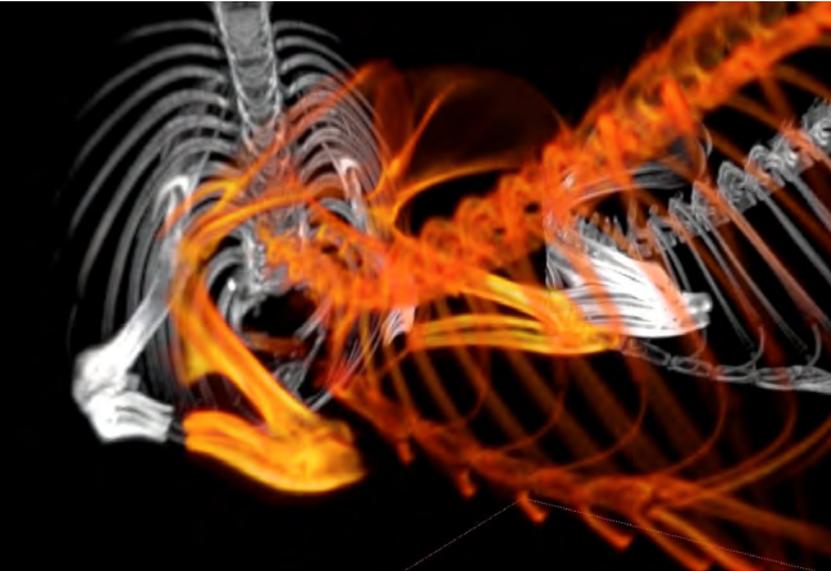




Chimaera GmbH is a spin-off of the Pattern Recognition Lab at the Friedrich-Alexander-Universität. It develops algorithms for reconstruction, segmentation, classification, and registration of medical images. Before its foundation in 2007, the company had already established itself by integrating various specialized applications of the newest medical imaging devices of big manufacturers like Siemens Healthcare.

The company is divided into three key competencies: image processing, software services, and consulting. Innovative products are based on a profound and developed background in the field of medical image processing, as well as pattern recognition. Chimaera specializes on the development of high-tech software solutions.





CT Imaging GmbH
Dipl. Kfm. Georg Ruile

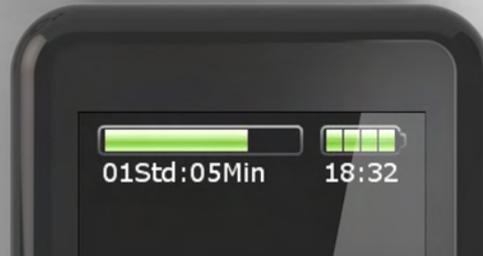
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CT Imaging GmbH was founded in 2008 originating from the Institute of Medical Physics of the Erlangen-Nuremberg University. As a specialist in the field of computed tomography (CT), CT Imaging develops new techniques and applications for medical imaging and image processing. The range of products includes complete CT systems as well as CT equipment and CT software for all stages of the digital imaging process.

Dedicated high-resolution CT-systems are the main focus of our system development efforts. Examples include in vivo small animal imaging in research and development as well as dedicated breast imaging. Our

innovative capacity is not only marked by numerous publications and patents, it is furthermore clearly visible in the development of the world's first dual-source micro-CT system and a brand-new detector chip for CT imaging applications. Using our modular software platform, we cover both individual steps and the entire imaging process chain, such as reconstruction and artifact correction, visualization, or dose simulation and calculation.

As a private enterprise CT Imaging networks with both medical facilities for clinical trials and industrial partners for technical development.

**cerbomed GmbH**

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Cerbomed GmbH is an innovative medical device company located in Erlangen that aims for market leadership in the field of non-invasive therapies using vagus nerve stimulation (VNS). The company was founded in 2005 as a spin-off of the FAU. It focuses on its company owned technology, transcutaneous Vagus Nerve Stimulation (t-VNS®), as well as developing and providing devices for its therapeutical applications.

Cerbomed has great experience in planning, financing, documentation, and realization of clinical studies and also knows the special requirements for medical devices. Additionally, cerbomed's *NEMOS®* products are the first non-invasive VNS devices that enable selective, transcutaneous stimulation of the vagus nerve. In March 2011, cerbomed received the European clearance (CE mark) for *NEMOS®*. Since its foundation, cerbomed has won various awards for innovation and spin-offs.



ZiMT
ZENTRALINSTITUT FÜR MEDIZINTECHNIK

METRILUS

EXPLIUS

CHIMAERA

CT Imaging

cerbomed
smart | neuro | therapy

CiNNAMED
COMMUNICATION | CONSULTING | COMMERCE



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CiNNAMED GmbH is the latest University Spin-Off at the Medical Valley. It was founded in 2013 by the responsible campaign coordinators of the Erlangen consortium at the Central Institute of Healthcare Engineering (ZiMT) to continue the worldwide activities after the end of the campaign in the year 2014.

For that matter, not just the large number of contacts and links to the USA and Brazil will be intensified and profitably used for the partners of the Medical Valley. Even current projects in China will be developed and supported.

In our globalized world, scientific, economic and technological progress is no longer achieved in isolation within individual countries. It depends on cooperation in markets and the exchange of ideas with leading experts from across the world.

CiNNAMED helps you to build a bridge between hot spots in Europe, China, Brazil, Russia and USA. The consequent mission is Communication, Consulting and Commerce with products and services in the field of Medical Technology, Healthcare and Biomedical Engineering. Worldwide.

Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU) is one of the largest universities in Germany. With its five faculties, FAU offers an almost unique scope of subjects ranging from the Humanities to Law and Economics as well as Sciences, Medicine and Engineering. The close collaboration between the single disciplines is reflected by the University's Mission Statement „Advance through Networks“.

FAU thus offers perfect conditions for interdisciplinary research and learning to students and scientists alike. Moreover, over the last decades, the University has established its reputation as a top-ranking insti-

tution in cutting-edge research. It is firmly anchored in a close network of interdisciplinary co-operations. These include partners from industry, specialised non-university research centre and a number of leading international universities. Within the Metropolitan Region Nuremberg, FAU likewise plays an important role as employer, generator of innovations and centre for education.





Research in
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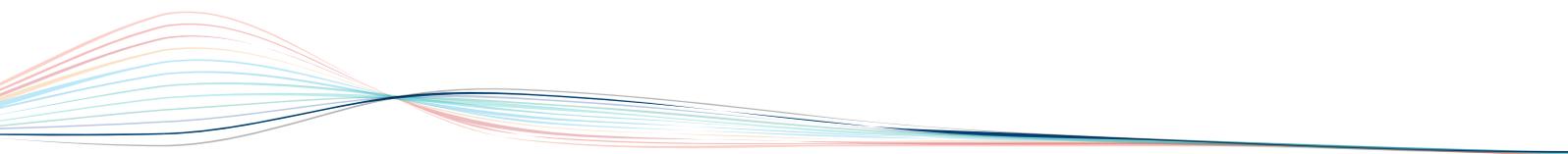
Land of Ideas

Official Partner

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Founded in 1824, the university hospital **Universitätsklinikum Erlangen** offers leading edge medical care of highest quality. With more than 1.300 beds, within 43 departments, it covers every field of modern medicine, using the world's state-of-the-art operating theaters and up-to-date equipment for science-based diagnostic and therapeutic procedures. Teaching, research and medical care are of the highest standard. Research results from Erlangen are setting standards for prevention, diagnostics and therapy. Close multidisciplinary collaboration guarantees optimal care. More than 7.300 employees are working to achieve their common purpose: to promote health and to cure disease.

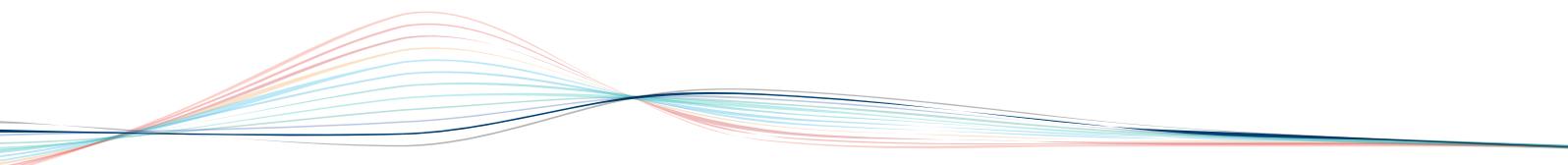
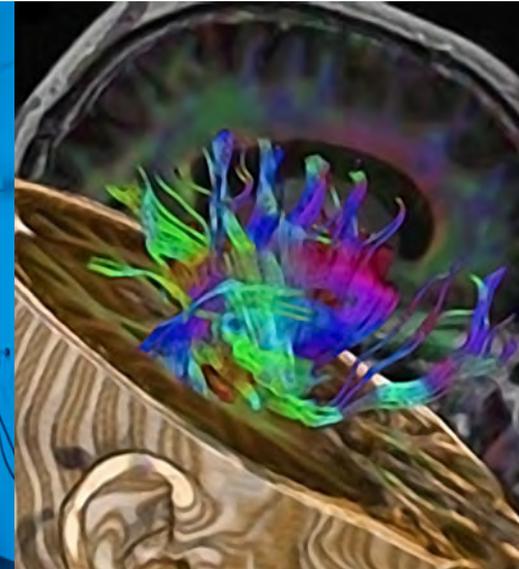
The Departments of Radiology and Neuro-radiology, for instance, concentrate on multimodal CT and MR imaging. Equipped with state-of-the-art imaging technology, i.e. high-field MRI, PET-CT/MRI and modern flat-panel imaging interventional suites embedded in hybrid surgical areas, other focuses are oncology, cardiovascular diseases, neuroscience, immunology and medical technology. Close partnerships with Siemens Healthcare, the FAU Institute of Medical Physics and the Department of Computer Science / Pattern Recognition Lab guarantee optimal care and high scientific output.



Universitätsklinikum Erlangen

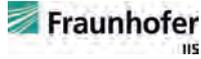
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Prof. Dr. med. Arnd Dörfler

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In close cooperation with the Hospital and the University of Erlangen, the **Fraunhofer Institute for Integrated Circuits IIS** focuses mainly on the field of medical engineering. The “medical image processing” group researches and develops image analysis procedures intended to support doctors’ diagnoses, computer-assisted detection of pre-cancerous lesions and computer-assisted interventions. Main use cases are procedures and systems for the analysis and interpretation of endoscopically and microscopically obtained imaging data for diagnostics, laboratorial medicine (e.g. hematology) as well as life science.

The Fraunhofer IIS operates the Medical Technology Test and Demonstration Center METEAN. METEAN’s goal and main focus is to connect synergistically with local partners from the industry, sponsors, and the university hospital to combine medical research competences and clinically ambulant practical expertise, thereby joining research ideas with medical and clinical necessities and opening new perspectives for innovative and market-driven products.



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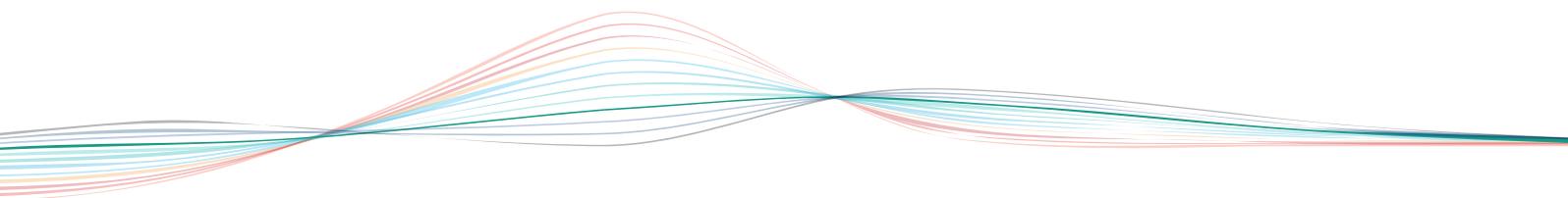
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MEDICAL VALLEY
Energie | Geräte | Metrologie | Diagnostik | Nürnberg

SIEMENS

Stadt Erlangen

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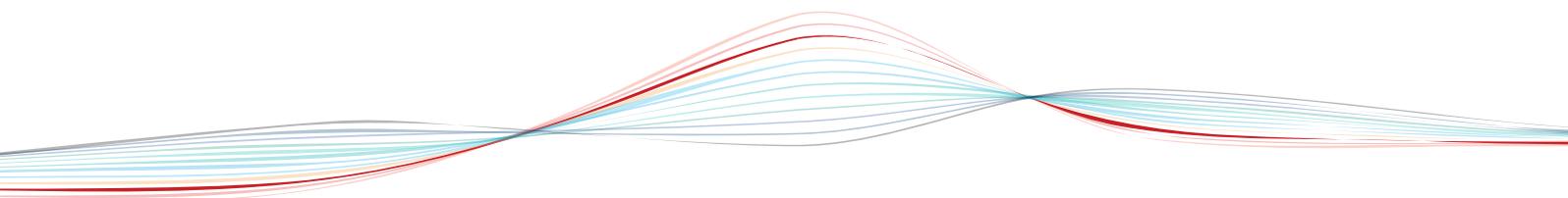


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The **Siemens AG Healthcare Sector** has highly distinguished locations in the world that can be used for establishing, strengthening, and supporting new cooperation. The headquarters of the healthcare sector being in Erlangen, intensifies the positive impulse of this location for bidirectional cooperation. Especially for the recruitment of international scientists and experts, as it is of great importance to be recognized and associated with attractive and well-respected brands.

In 2012, Siemens Healthcare generated a turnover of 13.6 Billion Euros and a profit of 1.8 Billion Euros. Siemens Healthcare is

market leader in the field of imaging diagnostics.

In cooperation with FAU, a joint doctoral program for healthcare engineering will be established. The aim is to qualify excellent engineers for work in a transcultural industrial context. This eight semesters lasting program includes international industrial research stays in cooperation with Siemens AG. It addresses excellent graduates at selected partner universities in Germany, USA and China.

FAU
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IIS

MEDICAL VALLEY
Europäische Metropolregion Nürnberg

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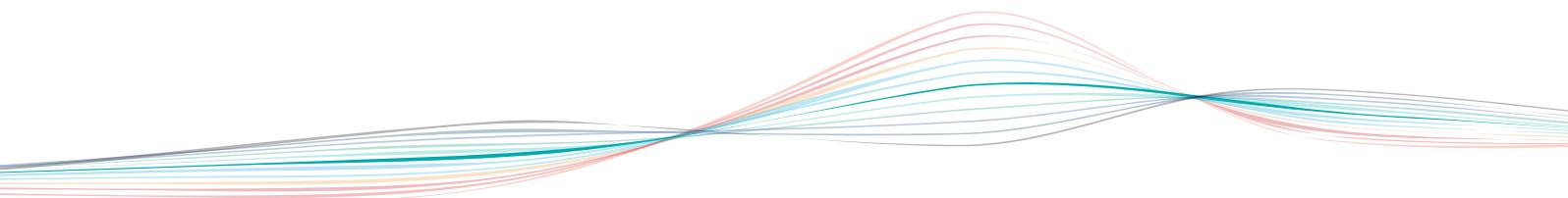
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Medical engineering has a long tradition in **Erlangen**. Today it is also a main pillar which is considered to be the foundation for a successful future. Erlangen is well known in Germany as a leading medical innovator, having created ether anesthesia, the X-ray machine, and the surgery simulator.

For optimal support of product innovations, the city still plays a decisive role as a moderator by expanding the close cooperation between industry and science via the establishment of new contacts and forums. Erlangen AG was founded in 2005 by the main shareholders, Siemens AG, Friedrich-Alexander-Universität, Erlangen-Nürnberg, and the city of Erlangen who initiated a

stock company to effectively and sustainably position the location of science and economics Erlangen. The pre-existing networking activities also include entrepreneurs who come to take advantage of the excellent settings that were also established by the in 2003 founded Innovation Centre for Medical Technology and Pharmaceuticals (IZMP).

Aside from the university, the board of trade and industry, and Siemens Health-care, the city of Erlangen is also a founding member of the group "Medical Valley EMN". Its goal is the promotion of metropolitan area as Germany's leading center in the field of healthcare engineering.



Stadt Erlangen



Research in
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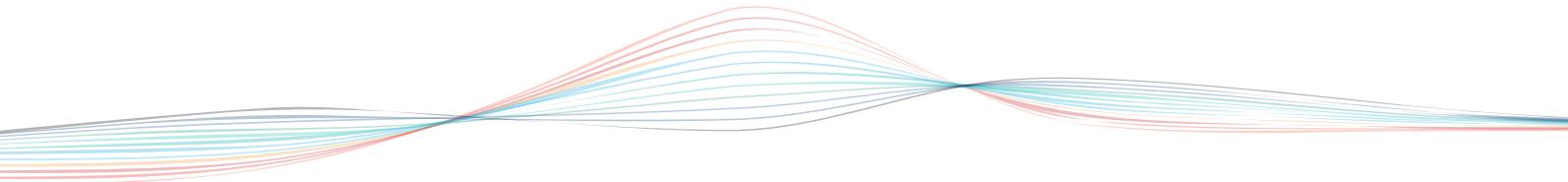
Illustrations

Cerbomed GmbH, Chimaera GmbH, CiNNAMEd GmbH,
CT Imaging GmbH, Explus GmbH, FAU, Fraunhofer IIS,
Medical Valley EMN e.V., Metrilus GmbH, Stadt Erlangen,
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