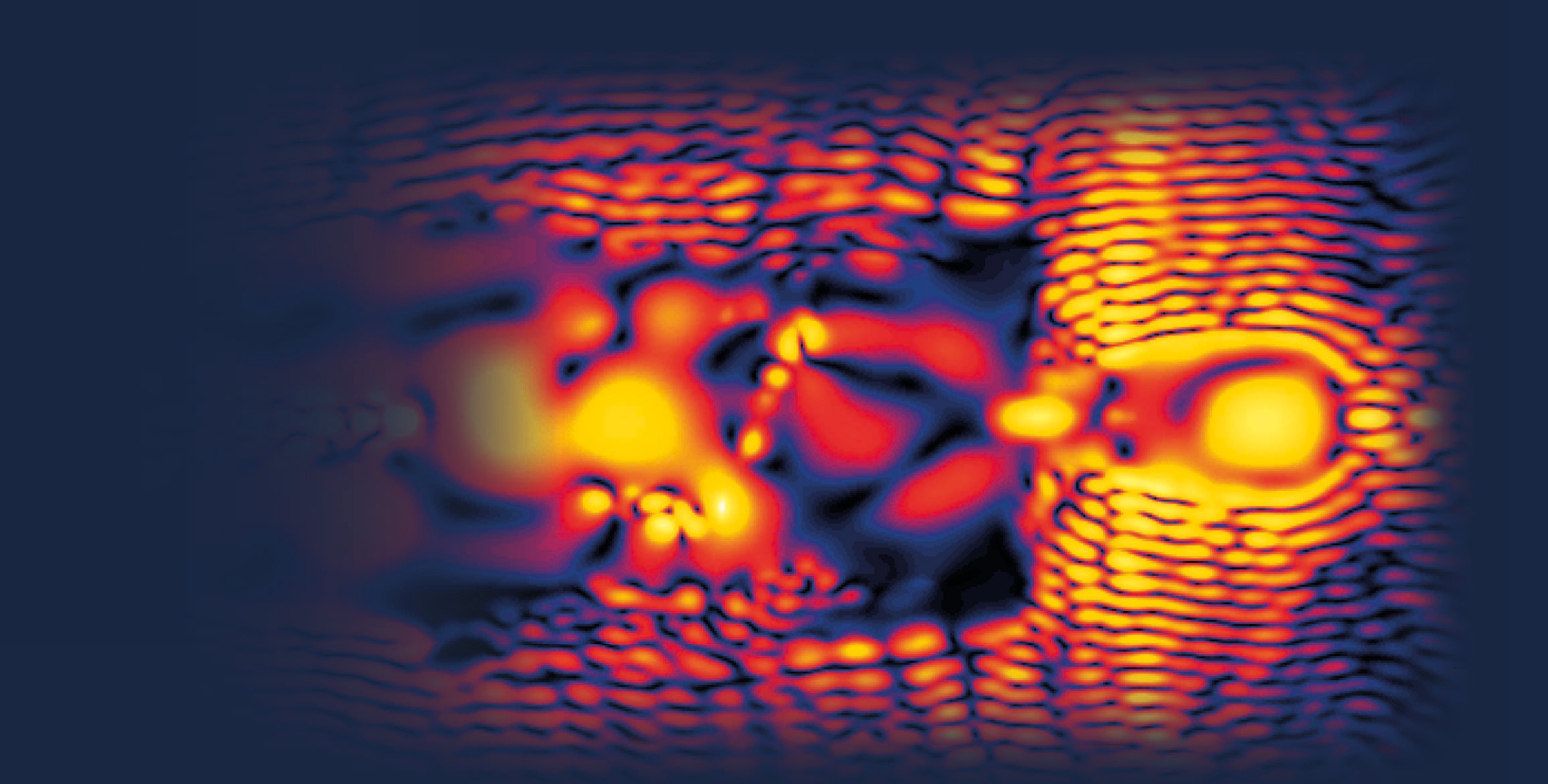

IT'IS FOUNDATION 2011

Title Page: Acoustic pressure field inside MRI gradient coil with pregnant female of the Virtual Population
Back Page: E-field inside MRI birdcage coil with the same model

IT'IS FOUNDATION

2011 marked a turning point for IT'IS. For the first time, the majority of newly acquired research projects and funding were related to medicine, reflecting our efforts to significantly expand our research scope beyond our traditional and primary focus on wireless industry needs. We successfully evolved our mission, strategy and overall approach to leverage our expertise in electromagnetics and explore new scientific frontiers at the interface of computation, biology, physics and engineering, specifically, the emerging field of personalized medicine based on computational life sciences. Our visionary goals for adapting our innovation engine to improve the quality of people's lives and adding healthy life years through personalized medicine are described in the *IT'IS for Health* Brochure.

Initial results of our ambitious research initiative to build Sim4Life, a multi-physics and multi-scale simulation platform, are summarized in this report. Several new toolsets were developed to optimize ultra-sound applications inside the human body (page 14) and to model interactions between EM fields and nerves (page 15). Sim4Life will contribute significantly to our long-term vision of being at the forefront of personalized medicine and will demonstrate our success and competences beyond electromagnetics.

We first introduced a feasibility prototype of the next generation of near-field probes in our 2005 Annual Report. Now the breakthrough technology has matured and the optically isolated, multi-axis, miniaturized active electric and magnetic field probes, developed with SPEAG, will become available for time-domain near-field evaluations, e.g., for on-chip and on-board EMI analysis (page 13).

Although our research activities have shifted to focus on *IT'IS for Health*, we still continue to address open scientific gaps in electromagnetic exposures and potential health hazards. Two projects are highlighted in this report: the development of a novel exposure system for observing cells during radiofrequency exposures (page 12) and the exposure assessments of emerging technologies (page 16). Furthermore, our successful bid for the EU FP7 call to investigate the biophysical mechanisms for a possible causal relationship between ELF MF exposure and cancer, especially childhood leukemia, resulted in the commencement of the 3-year multi-/interdisciplinary, collaborative project, ARIMMORA. The results may have an important impact reaching far beyond the project goals.

2011 was also challenging. The volatility of foreign currencies devalued our contracts, forcing us to compensate our losses with even greater commitment and tenacity. It has also been a year of unexpected transition as Prof. Wolfgang Fichtner opted for early retirement from ETH. As a founding member of IT'IS, he was crucial to the growth and development of the Foundation and for our relationship and daily interactions with ETH. In acknowledgment of his invaluable support and guidance, we are honored and grateful that he will continue to advise us as a Lifetime Honorary Board Member of the Foundation.

At the heart of our success is the commitment, creativity, expertise and enthusiasm of our dedicated employees, students and external advisors (page 5), and the guidance of all our Board Members (page 4). Their record of achievement is matched only by its potential. The smooth and effective collaborations with our partner institutes (page 10) also contributed to our innovative growth. In particular, we thank Professors Qiuting Huang, Klaas Prüssmann, Gábor Székely, and Juan Mosig for sharing infrastructure and advising our PhD students and PostDocs.

We are grateful to our many sponsors and donors (page 9) whose commitment and trust in our vision make it possible to pursue our goals year after year. Especially, the generosity of CTI, the Swiss Federal Office of Public Health, the Swiss National Research Foundation, the EU Commission, NIEHS, and the long-term commitment of SPEAG, help sustain our innovative growth.

In 2011, we demonstrated the success of our transformation. Next year, we will demonstrate its sustainability by strengthening and focusing our mission and building on our core values, while strategically addressing our new vision *IT'IS for Health*. Our research initiatives represent our commitment to advancing our mission of making a tangible difference in people's lives by enhancing the safety and quality of emerging electromagnetic technologies and improving the quality of life and adding healthy life years through personalized medicine.

Zurich, March 2012 *Prof. Niels Kuster*

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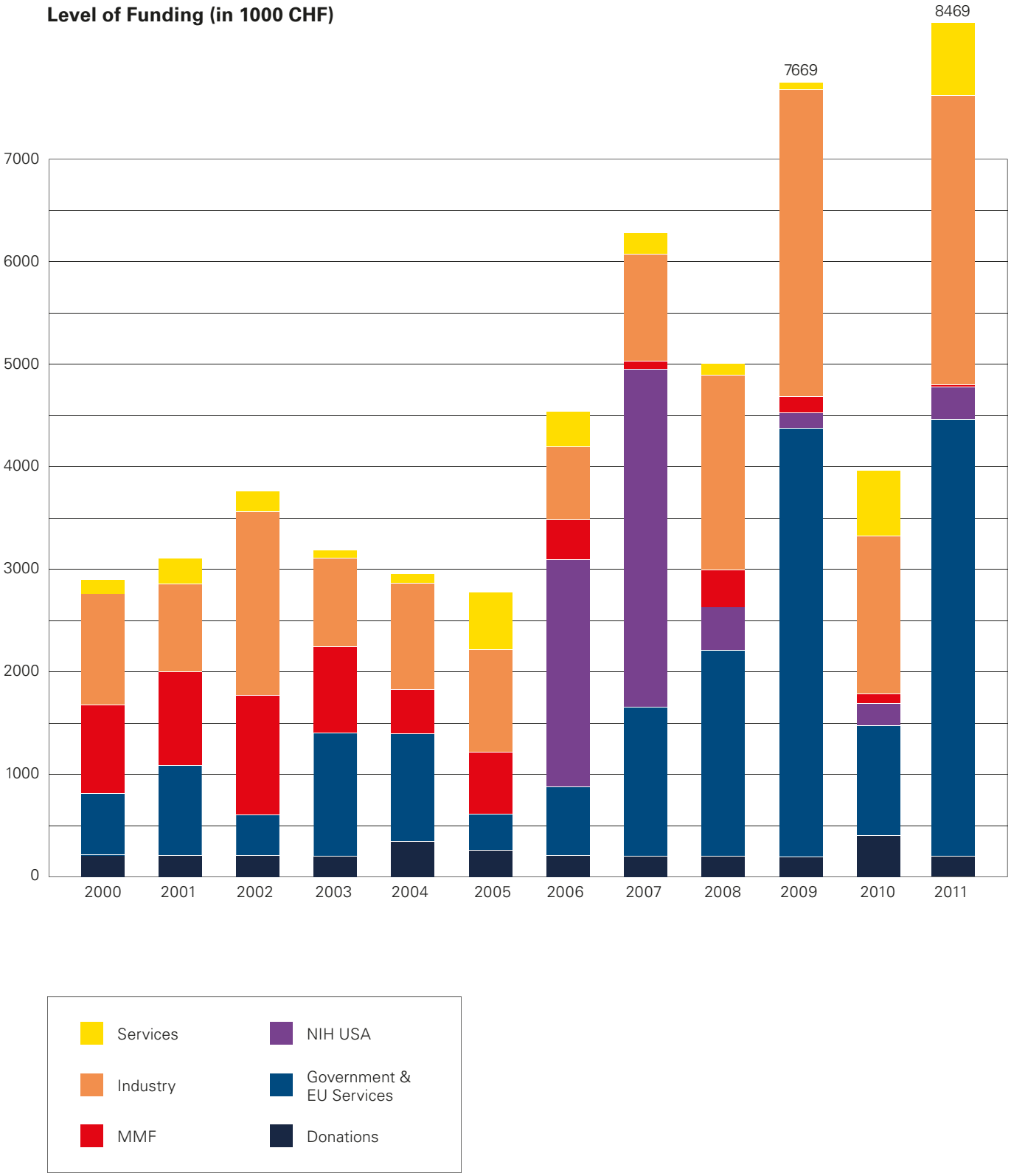
Level of Funding (in 1000 CHF)
8469
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4000
3000
2000
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2000
2001
2002
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2010
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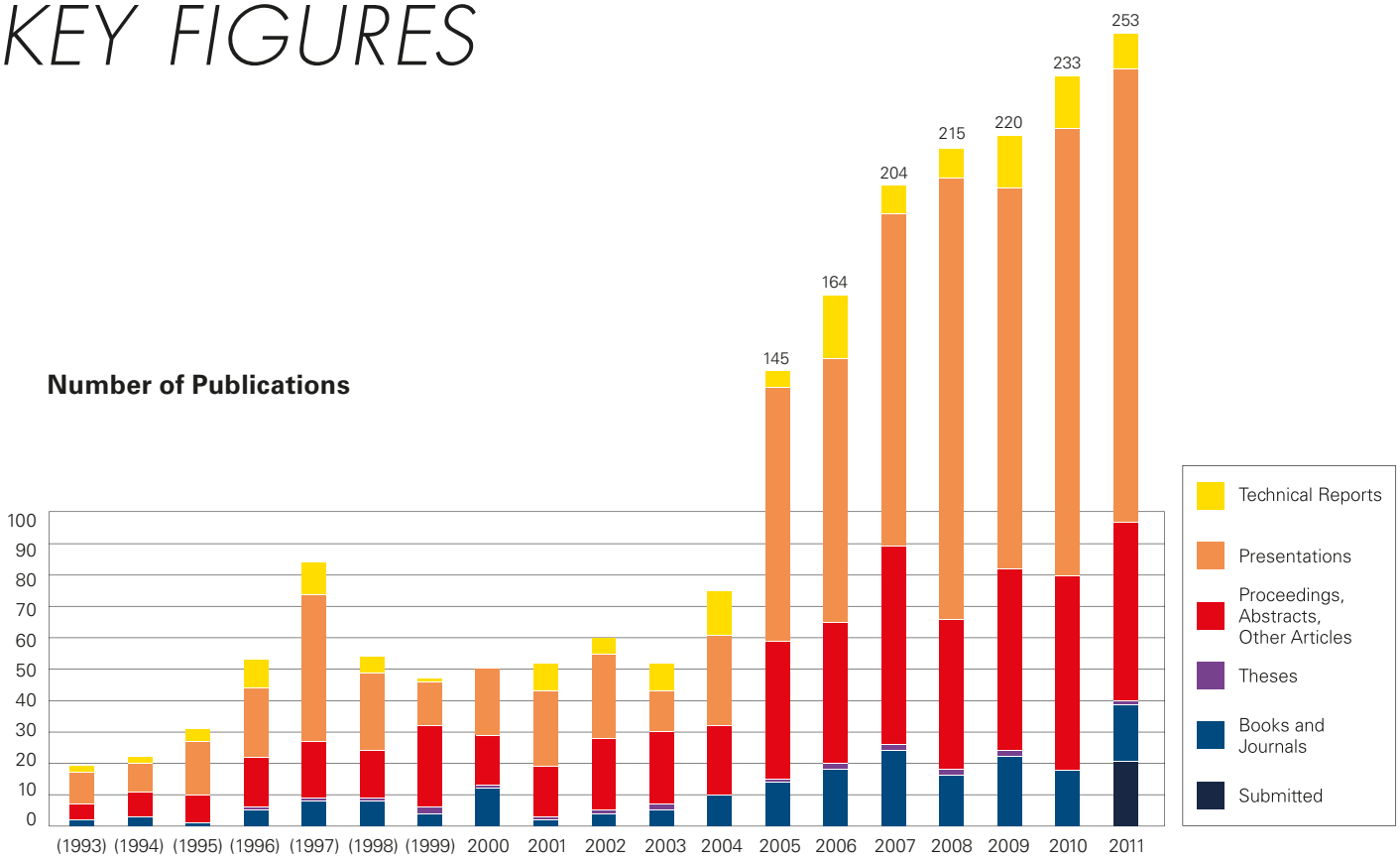

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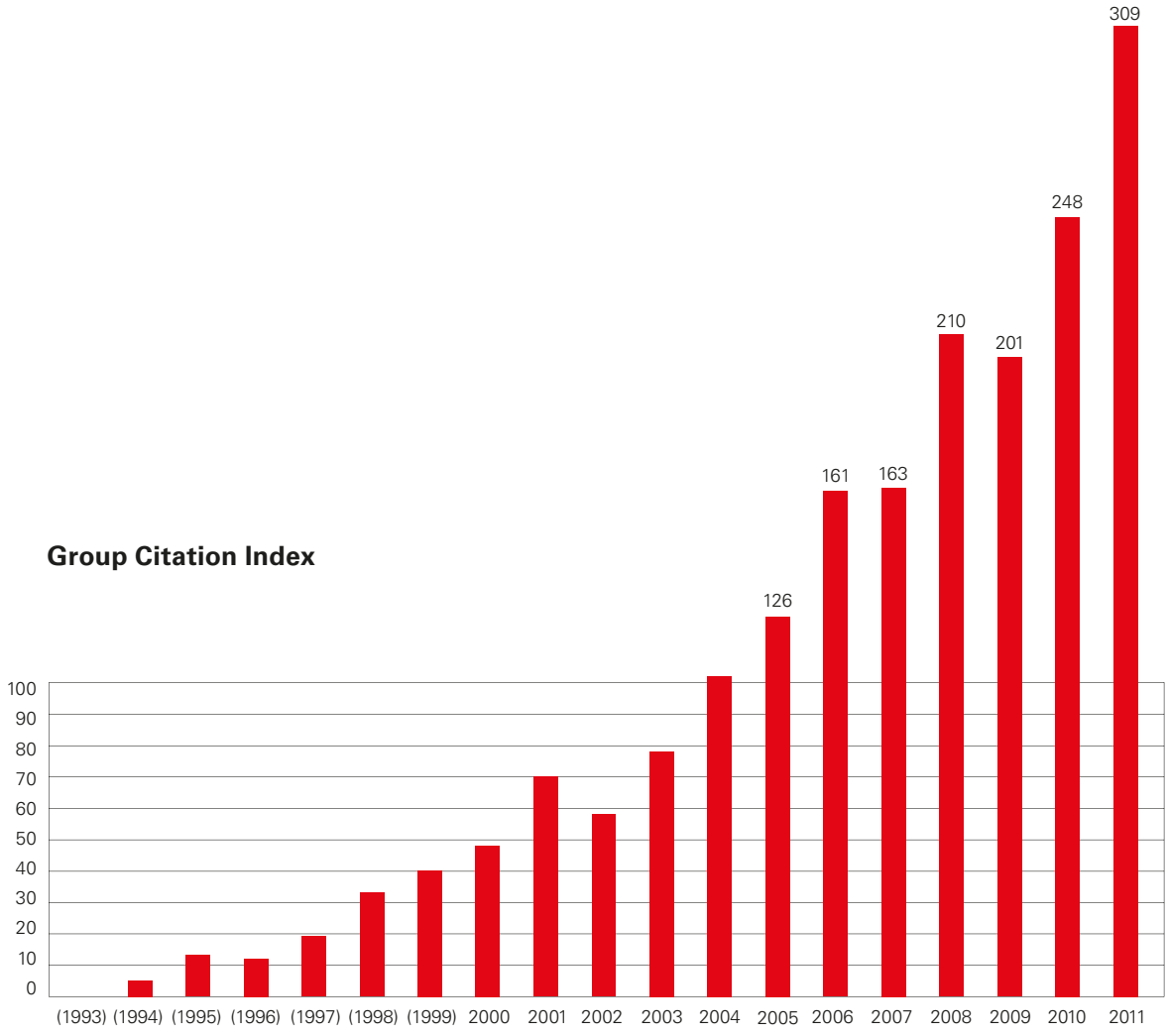

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PROJECTS

EM Technology

TD SENSOR	Development of a field sensor in the time and frequency domains
MT SENSOR	Development of a micro-thermal sensor
POSEIDON	Solvers for the next generation of waveguide and high-power devices
WEMS	Development of procedures and instrumentation for demonstration of worker's EM safety

EM Exposure & Risk Assessment

sXc, sXv, sXh	Development of optimized exposure systems for bioexperiments from static to GHz
sXv – NTP/NIEHS	Development, manufacturing, installation and detailed dosimetry of the reverberation chamber-based exposure system for the NIEHS in vivo studies
BRAIN-X	Assessment of the brain functional region-specific exposure to EMF for near-field and far-field sources
NRP-Sleep	Effect of RF electromagnetic radiation on human sleep EEG and cognitive tasks
REPLICATIONS	Replication & extension of biomedical studies with high potential for impact
ZonMw	Assessment of the exposure of children to electromagnetic fields from ELF to RF in uncontrolled environments
EX-MSELF	Assessment of ELF current distributions induced in the human head from UMTS and GSM mobile phones
EX-Mats	Exposure evaluation of therapeutic magnetic field mats
EXPA EPI–CTIA	Exposure assessment for epidemiological studies of mobile phone users
EX-Bulbs II	Assessment of the human exposure to EMF of long-fluorescent tubes
BAG EX-Chef II	Assessment of the current induced in workers when exposed to the magnetic fields of induction cookers
STANDARDIZATION	Participation in regulatory activities (standards committees & governments)
ARIMMORA	Identification of possible causal relationships between EMF-LF exposure and cancer, with a focus on childhood leukemia
SEAWIND	Assessment of exposure and health risks associated with wireless network devices

Medical & Health

Sim4Life	Multi-scale, multi-physics simulation platform for computational biomedicine and life sciences
CO-ME III	Investigation of focused ultrasound-induced reversible blood brain barrier opening
HYCUNEHT	Research and optimization of hyperthermia treatment quality
MRI+	Development of MRI exposure risk probability based on local temperature safety considerations

Virtual Population

Volumetric Meshes	Generation of enhanced volume meshes
Elderly Person Models	Generation of anatomical CAD models of elderly human models for dosimetric and medical applications
Morphing Technique	Development of a physically-based morphing tool

LIVE CELL IMAGING DURING ELECTROMAGNETIC EXPOSURE

Despite the ubiquity of extremely low frequency (ELF) magnetic fields (MF) and radio frequency (RF) electromagnetic fields (EMF), there is insufficient understanding of their interactions with biological tissues and their effects on living organisms. Live-cell imaging, in which living cells can be examined in real-time and both transient and persistent effects can be visualized and recorded under various exposure conditions, is a promising methodology to gain further insight.

Live-cell imaging is possible with the two programmable exposure systems developed by IT'IS for ELF-MF and RF-EMF exposures, respectively. These high-precision setups allow for blinded experiments and fully characterized exposures while simultaneously supporting live-cell imaging and other state-of-the-art applications, including confocal scanning fluorescence microscopy. In both cases, the exposure system is constructed around a live-imaging chamber in which a monolayered cell culture is inserted.

In the ELF system, two asymmetrical coils optimize the homogeneity of the B-field in the exposure plane (better than 1.2%) despite the limited space available on the side of the microscope objective. Because considerable power is dissipated in the field windings at high field strengths, temperature changes are minimized by placing those windings in good thermal contact to a jacket through which water circulates at predefined temperatures. The stainless steel objective lens has been shown to have no influence on the exposure. This computer-controlled setup generates signal waveforms that are composed either of the pure fundamental frequency or of the fundamental with several harmonics.

The system simultaneously monitors both the exposure, with B-fields of up to 4 mT root-mean-square amplitude, and the environmental conditions. The flexibility this setup offers in terms of exposure frequencies and waveforms makes it an ideal tool for the real-time investigation of so-called therapeutic frequencies, which are being evaluated for their effect on tumor progression for instance, or for challenging hypotheses on the carcinogenic effects of exposure to electrical power lines.

The RF exposure system is constructed around a live-cell imaging chamber that is integrated into a circular cavity to provide a homogeneous and circularly polarized field. The area on the microscope slide of characterized uniformity is large enough to acquire a sufficient number of cells for the accurate estimation of exposure-induced effects. Yet, as both the lens and its position are likely to affect the results, the homogeneity and the SAR level of each objective lens utilized must be characterized a priori. The RF setup offers the possibility to select different signal modulations with up to very high peak-to-average ratios and to accurately monitor the exposure and environmental conditions. Possible artifacts resulting from sham isolation (>50 dB) and from temperature differences in the exposure and sham media (<0.1 °C) are minimized.

The wide range of modulation types and bandwidths are offered in a simple-to-use format and allow for detailed studies on numerous biological phenomena occurring at the cellular level. Examples of such phenomena include the disruption of mitotic spindles induced by amplitude-modulated carrier waves in tumor cells or electroporation-type effects triggered by pulsed microwave signals. The latter effects can be studied since the system can generate high instantaneous SAR levels and their dynamics can be visualized using appropriate UV dyes.

In the various setups that have been used in the past to investigate the biological effects of ELF-MF and RF signals, cells were exposed for defined time periods and analyses were performed post exposure. The IT'IS systems offer a competitive advantage by providing real-time monitoring of the effects and a wide range of real-world and worst-case exposure conditions. Although these systems are still in their infancy, they undoubtedly offer the flexibility and the necessary characteristics to examine complex cellular responses under various exposure conditions and to test novel hypotheses about possible interaction mechanisms between electromagnetic fields and biological tissues.

NOVEL TIME-DOMAIN ELECTRIC AND MAGNETIC FIELD PROBES

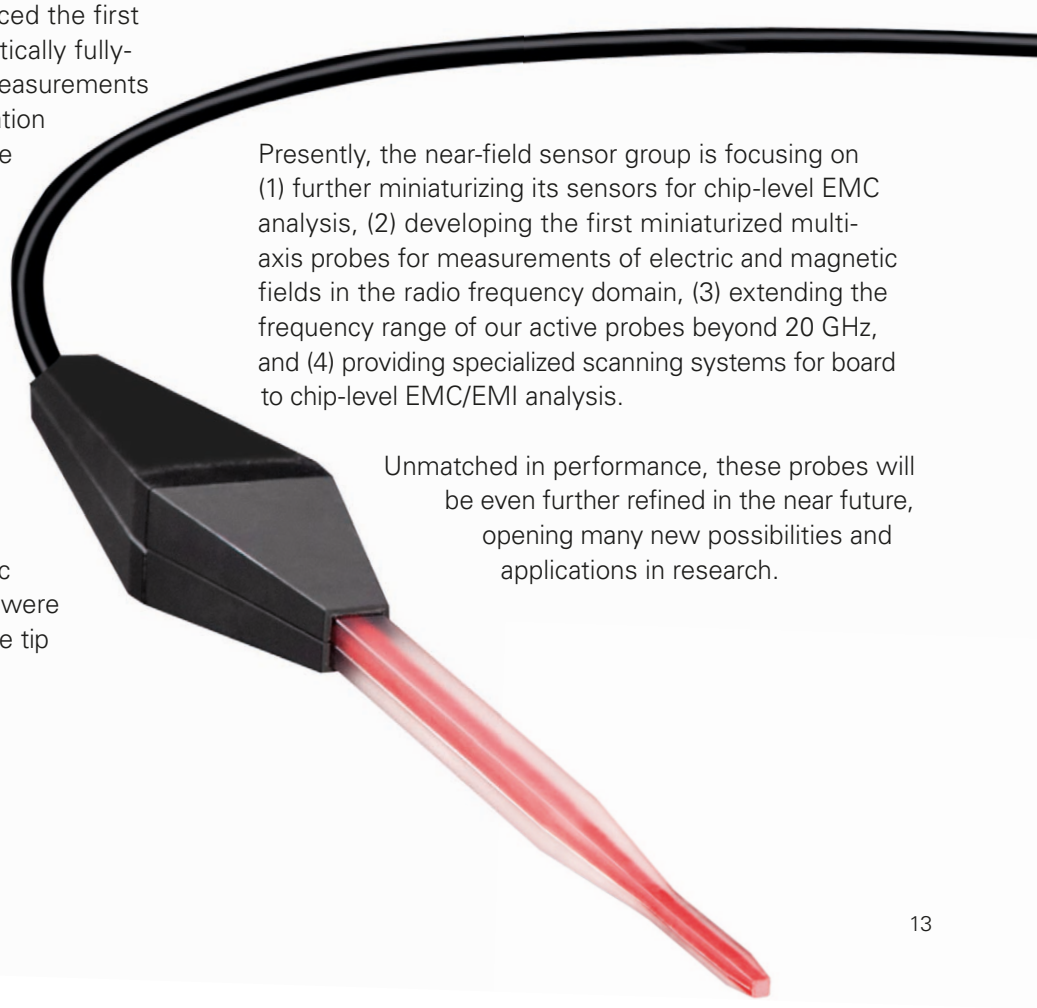
Electronic device manufacturers work under constant competitive pressure to miniaturize and streamline their products while simultaneously adding and enhancing functionality. The trend towards increased miniaturization requires that electronic components be placed more closely together, while the drive for increased functionality creates a push towards higher processing speeds. Both of these trends result in dramatic increases in electromagnetic interferences (EMI) and electromagnetic compatibility (EMC) issues among device components due to the growing noise from processors, clock signals, and communication systems. Mutual interferences between circuit components now represent one of the greatest challenges in designing new electronic devices, particularly those that include processes sensitive to electromagnetic interferences such as GPS. At the same time, the analysis of radio frequency transmitters becomes more complex, e.g., multiple-input multiple-output (MIMO) systems or multi-transmit magnetic resonance imaging (MRI) systems.

In our 2005 Annual Report, we introduced the first feasibility prototype of miniaturized, optically fully-isolated field probes for time-domain measurements in the radio frequency range. In cooperation with our commercial partner SPEAG, we have now developed the first zero series of single-axis sensor probes for electric and magnetic field measurements.

These sensors provide a spatial resolution of <2 mm, a sensitivity of <0.3 µA/m/√Hz or 0.15 mV/m/√Hz, and a dynamic range of >75 dB for a 1 MHz resolution bandwidth. To limit parasitic reception and achieve ideal receiving patterns of the canonic magnetic and electric dipoles, the sensor designs were implemented in a ruggedized silica probe tip and optimized by simulations.

In parallel, SPEAG developed a new remote unit acting as an optical power supply and an opto-electrical converter. The opto-electrically converted signals from our time-domain sensors can be processed by standard equipment such as spectrum-, signal-, and vector network analyzers. This unit was redesigned to make the sensor platform fully compliant with current LASER safety standards, to make it compatible for use with multi-axis probes, and to offer an extended frequency range up to 16 GHz. In addition, an advanced automatic self-calibration algorithm was integrated, decreasing the uncertainties induced by drift effects in the sensor head to <0.15 dB.

Some of our industrial and research partners are already using prototypes of our new sensors for large-scale chip level EMC qualifications and for the characterization of MRI birdcage multi-transmit coils. The sensors were also used for validation measurements of an MRI multi-channel transmit coil, the results of which were presented at the ISMRM and EBEA 2011 conferences.

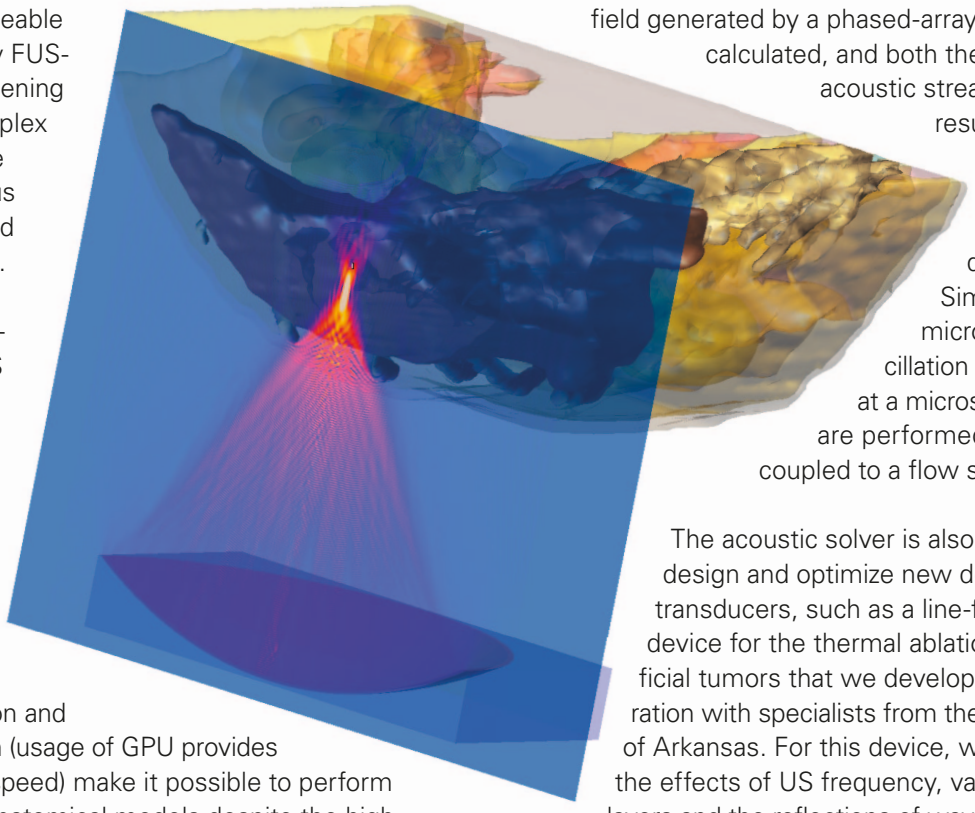


Presently, the near-field sensor group is focusing on (1) further miniaturizing its sensors for chip-level EMC analysis, (2) developing the first miniaturized multi-axis probes for measurements of electric and magnetic fields in the radio frequency domain, (3) extending the frequency range of our active probes beyond 20 GHz, and (4) providing specialized scanning systems for board to chip-level EMC/EMI analysis.

Unmatched in performance, these probes will be even further refined in the near future, opening many new possibilities and applications in research.

MODELING OF FOCUSED ULTRA-SOUND INSIDE THE HUMAN BODY

Ultrasound (US) is a widely accepted and long-established diagnostic imaging modality in medicine. Its use in ultrasound ablation therapy is recent and relies on new advances in magnetic resonance (MR)-guided focused ultrasound (FUS) and high-intensity focused ultrasound (HIFU). FUS and HIFU are non-invasive and accurate, reduce the risk of bleeding or infection, avoid collateral damage, and involve no ionizing radiation. FUS and HIFU applications include targeted non-invasive neurosurgical interventions and the treatment of Alzheimer's patients with targeted delivery of blood brain barrier (BBB)-impermeable therapeutic agents by FUS-induced reversible opening of the BBB. The complex US propagation in the highly inhomogeneous human body is studied using simulation tools. We developed an acoustic solver to perform 3D full-wave US simulations inside complex anatomical models while considering tissue inhomogeneity and nonlinearity, attenuation, reflections, and interference effects. Effective parallelization and hardware acceleration (usage of GPU provides a 36-fold increase in speed) make it possible to perform simulations in large anatomical models despite the high resolution needed due to small wavelengths. As part of our Sim4Life platform, the solver integrates seamlessly into the modeling and discretization framework and can make full use of the Virtual Population anatomical models and our previously developed medical image segmentation tool.



This solver was already used for applications such as the modeling of brain tissue ablation (thalamotomy) in patients treated for neuropathic pain and FUS ablation of renal and hepatic tumors. In all cases, we estimated the energy deposition resulting from the applied FUS, the induced tissue heating, and the resulting lesion shape. Tissue heating was determined by coupling the acoustic simulation to an in-house thermal solver optimized for in vivo simulation that models perfusion, thermal tissue damage, etc.

In collaboration with the Laboratory of Thermodynamics in Emerging Technologies at ETH Zurich, we are developing a promising multi-scale model of reversible BBB opening. For this particular application, the macroscopic pressure field generated by a phased-array applicator is calculated, and both the microscopic acoustic streaming and the resulting stress and strain in the vessel walls are determined. Simulations of micro-bubble oscillation (cavitation) at a microscopic scale are performed and then coupled to a flow solver.

The acoustic solver is also useful to design and optimize new devices and transducers, such as a line-focused US device for the thermal ablation of superficial tumors that we developed in collaboration with specialists from the University of Arkansas. For this device, we quantified the effects of US frequency, various tissue layers and the reflections of waves on bones, and validated those estimations using watertank measurements.

Ultrasound-based therapeutic applications have great clinical potential. The tools we have developed, and which we have already tested on a variety of applications, open novel possibilities in research and in personalized applications of ultrasound-based therapies. Those tools are also a cornerstone of IT'IS activities in computational life sciences in and around the human body.

MODELING EM-NEURON INTERACTIONS FOR NEUROPROSTHETICS AND SAFETY ASSESSMENT

Electromagnetic (EM) fields interact with nerves intentionally or unintentionally. Unintentional interactions include neural stimulation or inhibition through exposure to strong low-frequency fields (e.g., from an MRI gradient coil) and represent a safety concern, whereas intentional interactions require for instance neuroprosthetic devices to positively interfere with neural systems. Intended nerve stimulations artificially compensate for lost capacities (blindness, paralysis, hearing deficiencies, balance loss, etc.) by replacing missing sensing or signal transmission functionalities. Examples of therapeutic interventions include retina and cochlear implants and treatment by deep brain stimulation (DBS). In the latter case, the modulation of neuronal activity by electrodes implanted in specific brain areas is an efficient treatment for patients suffering from chronic pain, Parkinson's disease, tremor or dystonia.

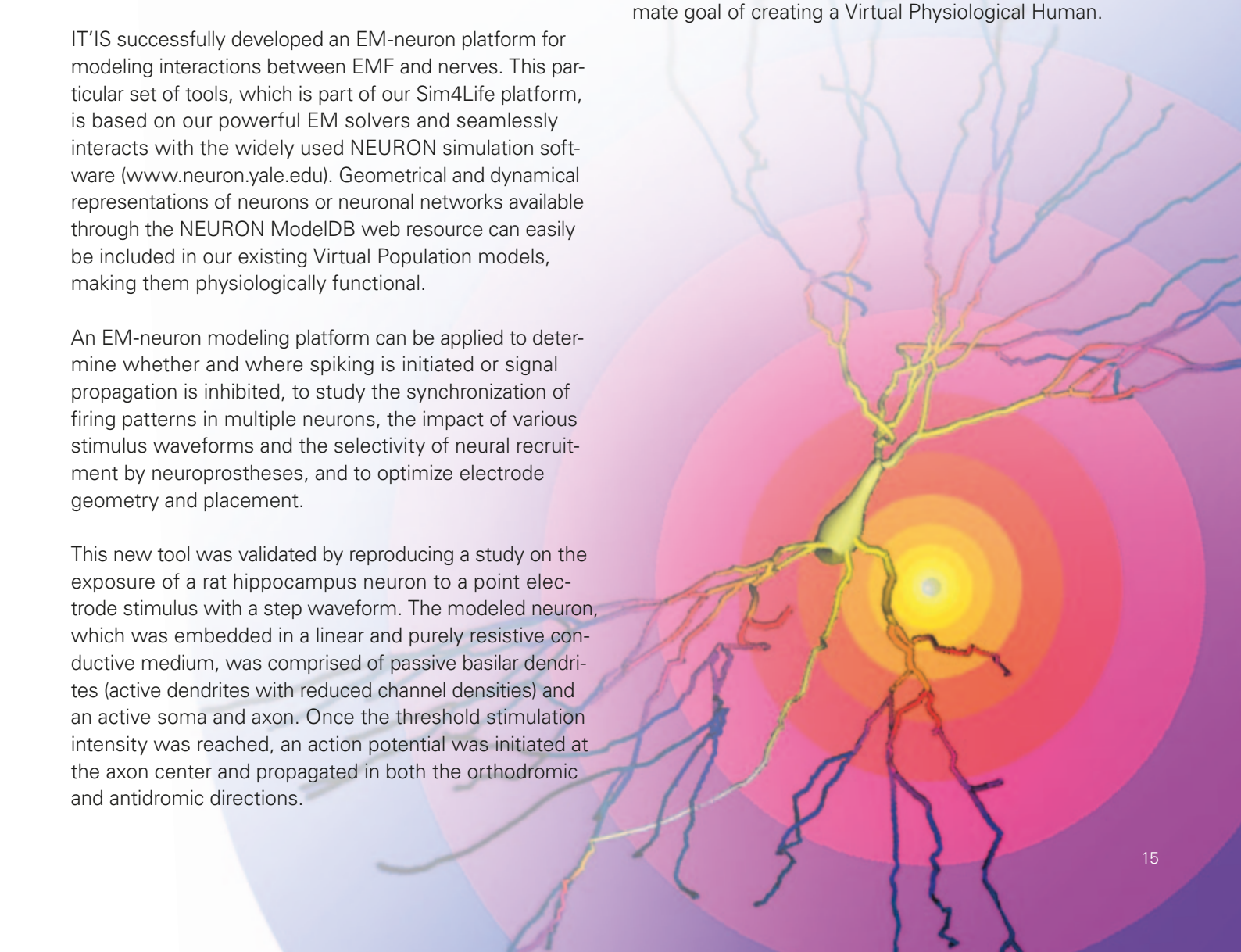
IT'IS successfully developed an EM-neuron platform for modeling interactions between EMF and nerves. This particular set of tools, which is part of our Sim4Life platform, is based on our powerful EM solvers and seamlessly interacts with the widely used NEURON simulation software (www.neuron.yale.edu). Geometrical and dynamical representations of neurons or neuronal networks available through the NEURON ModelDB web resource can easily be included in our existing Virtual Population models, making them physiologically functional.

An EM-neuron modeling platform can be applied to determine whether and where spiking is initiated or signal propagation is inhibited, to study the synchronization of firing patterns in multiple neurons, the impact of various stimulus waveforms and the selectivity of neural recruitment by neuroprostheses, and to optimize electrode geometry and placement.

This new tool was validated by reproducing a study on the exposure of a rat hippocampus neuron to a point electrode stimulus with a step waveform. The modeled neuron, which was embedded in a linear and purely resistive conductive medium, was comprised of passive basilar dendrites (active dendrites with reduced channel densities) and an active soma and axon. Once the threshold stimulation intensity was reached, an action potential was initiated at the axon center and propagated in both the orthodromic and antidromic directions.

Future extensions include the integration into existing anatomical models of high-resolution sub-regions (cochlear and vestibular systems, eyes, selected brain regions) where EM-neuron interactions are particularly relevant. This platform, which combines the powerful EM-solvers developed at IT'IS with the flexible NEURON software, and our next course of action represent a major contribution to the field of EM-neuron interactions and provide a key tool to assess safety, develop novel treatments and neuroprosthetic devices, and improve the efficacy of existing ones.

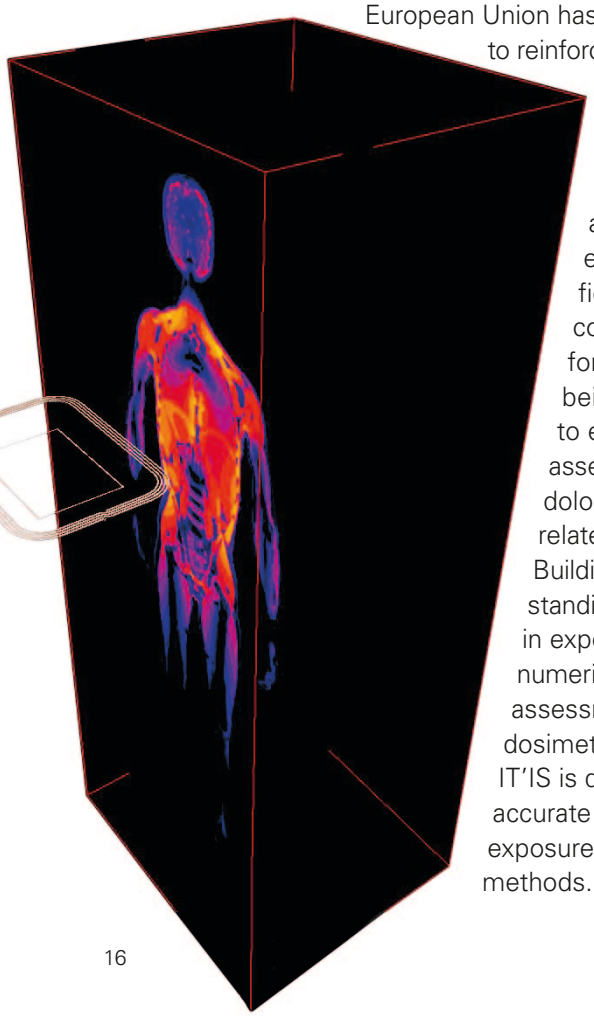
EM-neuron interaction is only one of the multiple areas in which we are adding functional layers to the Virtual Population models under the umbrella of the *IT'IS for Health* Initiative. All of this work contributes to the ultimate goal of creating a Virtual Physiological Human.



EXPOSURE EVALUATIONS OF EMERGING TECHNOLOGIES

Individual exposure to electromagnetic fields is increasing as new technologies become available and more advanced. The prevalence of these technologies at workplaces and at home emphasizes the need for better exposure assessment methodologies. At work, sources of exposure include the manufacturing of electric and hybrid vehicles, the clinical and scientific application of magnetic resonance imaging, the industrial induction heating of metals, and the construction and maintenance of power grids. At home, exposure sources include energy-saving light bulbs, wireless power systems for charging electronic devices, cooking appliances using magnetic induction or multi-gigabit-per-second wireless communication systems.

While certain technologies (e.g., mobile phones) already benefit from well-established safety standards and from mature methods for characterizing and quantifying electromagnetic exposure, assessment methods and standards for other exposure sources are not yet fully established and reliable exposure estimates are still missing. As the European Union has committed to reinforcing Directive 2004/40/EC on the exposure of workers to the risks associated with electro-magnetic fields in 2012, considerable effort is currently being dedicated to establishing the assessment methodologies for work-related exposure. Building on its long-standing experience in experimental and numerical exposure assessment, the dosimetry group at IT'IS is developing accurate whole-body exposure estimation methods.



Among our most recent studies, induction cookers were found to induce fields exceeding established public safety limits, particularly when the user is within 30 cm of the appliance. These results called for a revision of the current product standards. The same study revealed that the exposure levels of a fetus's central nervous system exceeded established public safety limits when the pregnant mother was exposed to electromagnetic fields at occupational levels. Another study on energy saving light bulbs triggered the development of novel measurement equipment for induced fields.

To ensure that exposure from emerging technologies is within the safety limits, numerous open issues remain to be addressed. The most urgent issues are:

- To develop computationally-efficient numerical methods to rapidly assess exposure at low frequencies (below 10 MHz) in realistic environments;
- To increase the resolution of existing tissue models and to refine available models of the nervous system;
- To extend the IT'IS Virtual Population to include at-risk population segments;
- To develop morphological tools to assess the effects of induced fields during electromagnetic exposures on the anatomy;
- To improve experimental techniques for exposure assessments at low frequencies (below 10 MHz) and high frequencies (above 6 GHz);
- To establish international safety standards that adequately address exposure in the ever-increasing number of individuals wearing medical implants;
- To use techniques that consider actual human exposure and cover a majority of the population (e.g., at least 95%) as a basis for international measurement standards.

As novel technologies emerge, we are committed to providing rapid and accurate solutions for determining electromagnetic field exposure, establishing reliable and sound safety standards, and identifying risk factors.

SERVICES

The IT'IS Foundation offers a wide range of R&D services to develop solutions and applications ranging from multi-scale and multi-physics simulations to near-field measurements in the fields of physics, engineering and medicine. These technology platforms harness the expertise and skills of our researchers and employees as well as our state-of-the-art laboratory. Services include, but are not limited to:

RF Safety and Compliance Evaluation of Transmitters
The IT'IS Foundation is regarded as the preeminent, truly independent institute for dosimetric evaluation. We are committed to developing the most accurate, flexible and suitable testing procedures in conjunction with regulators, national standards laboratories and industry (see page 10). Our close cooperation with leading system manufacturers allows us to provide the best possible services using the most recent and cutting-edge testing technologies.

MR Safety and Compliance Evaluation of Implants
The IT'IS Foundation offers reliable and efficient solutions to address the safety of MRI and the compliance of active and passive implants in MR according to the latest ISO/IEC recommendations. Our comprehensive solutions include test planning development, numerical and experimental evaluations, and documentation preparation for FDA submissions.

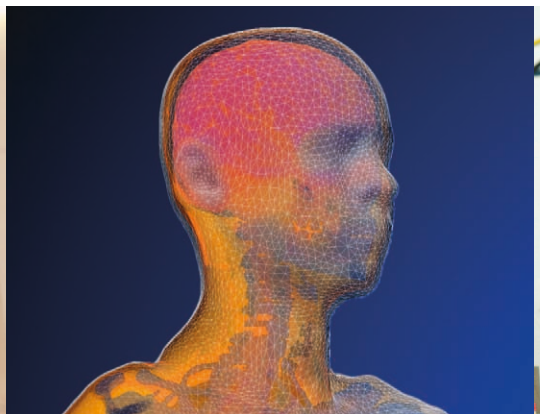
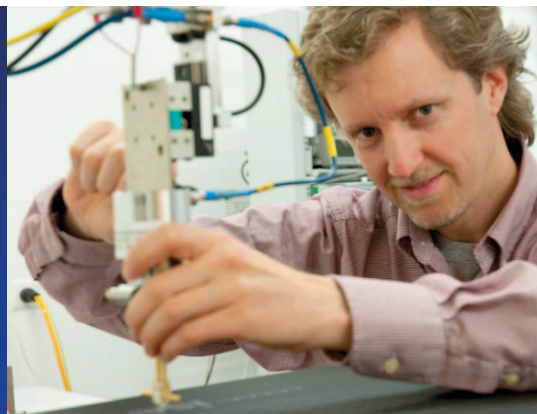
Communication Link System Design
The IT'IS Foundation provides expert consultations on standards and homologation rules, including the revision of technical requirements, the assessment of regulation procedures, and the evaluation of impending standards. We also offer full development and design services for customer-specific antennas with optimized link budgets when operated in complex environments, e.g., on-body or inside the body.

Computational Life Science Evaluations and Analyses
The IT'IS Foundation provides expert, customized analyses and evaluations of specific medical, diagnostic and therapeutic applications using our cutting-edge multi-scale, multi-physics platform. In parallel, new models and features are continuously developed for our Virtual Population. Our comprehensive database of the physical parameters of biological tissues is also updated and refined continuously (www.itis.ethz.ch/database).

Exposure Systems
The IT'IS Foundation designs and develops various exposure systems for in vitro, in vivo, and human studies on EM interactions. These systems can be customized to meet specific needs and are optimized for efficiency and flexibility while providing maximum homogeneity, a wide dynamic range, and a variety of amplitude modulation schemes. Additional features include the monitoring of environmental parameters and double-blind experiments.

Safety White Papers
The IT'IS Foundation provides a full range of safety white papers, resulting from its extensive research activities in health risk assessment and its active participation in commissions developing EMF and MRI safety guidelines. Numerous international organizations, industries and government agencies have entrusted the Foundation to draft white papers for existing and future technologies as well as for specific devices.

EMF Workshops
The IT'IS Foundation organizes customized workshops on EMF-related issues in collaboration with our national and international partners. On-site and specialized workshops and seminars can also be arranged upon request.

INFRASTRUCTURE

Dosimetric, Near-Field and EMC/EMI Facilities

Semi-Anechoic Chamber
This shielded, rectangular chamber has the dimensions 7 x 5 x 2.9 m (L x W x H). It is equipped with a reflecting ground plane floor, and half of its walls are covered with electromagnetic absorbers. The chamber contains an integrated DASY52NEO system and can be utilized for all research activities involving dosimetric, near-field and far-field evaluations, the optimization and synthesis of handheld devices, body-mounted transmitters, implants, desktop applications, micro-base and pico-base station antennas, exposure setups, calibration procedures, EMI tests, MRI safety tests, compliance testing of implants, etc.

Two Reverberation Chambers
The Blue and NIEHS reverberation chambers have the dimensions 4 x 3 x 2.9 m and 3.7 x 2.2 x 2.7 m (L x W x H), respectively. Both chambers are equipped with two mechanical stirrers and provide controlled and consistent environments for EM emissions and immunity testing, as well as shielding effectiveness and susceptibility testing of electromagnetic equipment.

Facility for Dosimetric Compliance Testing
IT'IS shares a facility with Schmid & Partner Engineering AG, which meets the requirements for dosimetric evaluations. Class C accreditation is expected in summer 2012 through METAS for all types of dosimetric evaluations.

Technical Equipment and Instrumentation

Spectrum and Network Analyzers
1 Rohde & Schwarz ZVA24 Vector Network Analyzer, 10 MHz–24 GHz
1 Rohde & Schwarz FSP Spectrum Analyzer, 9 kHz–30 GHz
1 HP 8753E Network Analyzer, 30 kHz–6 GHz
1 HP APC 85033B Calibration Kit
1 Rohde & Schwarz ZV-Z52 Calibration Kit

Signal Generators and Testers
1 Agilent E8251A Signal Generator, 250 KHz–20 GHz
1 Rohde & Schwarz SMU200A, Signal Generator
1 Rohde & Schwarz SMT06, Signal Generator
1 Rohde & Schwarz SMIQ02B, Signal Generator
1 Rohde & Schwarz SML03, Signal Generator
2 Rohde & Schwarz SML02, Signal Generators
1 Rohde & Schwarz SMY02, Signal Generator
1 HP 8647A, Signal Generator 250 KHz–1000 MHz
1 Agilent 33250A, Waveform Generator
3 Agilent 33120A, Waveform Generators
1 Rohde & Schwarz CTS55, Digital Radio Tester
1 Rohde & Schwarz CMU200
3 Anritsu 3700A

DASY, iSAR, EASY4MRI, MITS
2 SPEAG DASY52NEOs
2 SPEAG iSAR2 (1 Flat & 1 Head)
1 ZMT MITS1.5 w/Phantoms
1 ZMT MITS 3.0 w/Phantoms
1 ZMT MITS Gradient
1 INDY (3 year child head) Phantom
1 ISABELLA (6 year child head) Phantom
1 SPEAG SAM V6.0 Phantom
2 SPEAG ELI4 Phantoms
3 SPEAG ASTM Phantoms
1 SPEAG HAC RF Extension
1 SPEAG HAC T-Coil Extension
2 SPEAG EASY4MRI
4 SPEAG DAEasy4MRI, Data Acquisition Electronics
2 SPEAG DAE4, Data Acquisition Electronics
1 SPEAG TSIL, Temperature Probe
8 SPEAG T1V3LA, Temperature Probes
2 SPEAG H3DV6, H-Field Probes
2 SPEAG H3DV7, H-Field Probes
1 SPEAG EX3DV3, Dosimetric Probe
2 SPEAG EE3DV1, E-Field Probes
2 SPEAG ER3DV6, E-Field Probes
1 SPEAG EF3DV6, E-Field Probe
3 SPEAG ET3DV6, Dosimetric Probes
1 SPEAG ET1DV1, Dosimetric Probe
2 SPEAG ET1DV2, Dosimetric Probes
1 SPEAG EU2DV2, Probe
1 SPEAG HU2DV2, Probe
1 SPEAG AMIDV2, Audio Magnetic Field Probe
1 SPEAG AMIDV3, Audio Magnetic Field Probe
1 SPEAG H1TDS7zV1, H-field Time Domain Sensor
1 SPEAG, H1TDSxV1, H-field Time Domain Sensor
1 METROLAB, THM 1176, Magnetic Field Sensor

Meters
1 Rohde & Schwarz NRP, 2 NRP Z-91 Power Meter
2 Agilent E4419B, 4 HP 8482A, Power Meters
3 HP 436A, 3 HP 8481A, Power Meters
3 Agilent 34970A Data Acquisition Units
1 Handyscope HS3 Data Acquisition Unit
1 Handyscope HS4 Data Acquisition Unit
1 Magnet Physik FH49–7030, Gauss/Teslameter

Amplifiers
1 LS Elektronik 2450 Amplifier, 400 W / 900 MHz
3 LS Elektronik 2449 Amplifiers, 200 W / 900 MHz
2 LS Elektronik 2448 Amplifiers, 60 W / 900 MHz
3 LS Elektronik 2452 Amplifiers, 200 W / 1800 MHz
1 LS Elektronik 2451 Amplifier, 60 W / 1800 MHz
1 LS Elektronik 2447 Amplifier, 5 W / 1800 MHz
2 LS Elektronik 2780 Amplifiers, 40 W / 2140 MHz
1 Amplifier Research 10S1G4A, Amplifier, 800 MHz–4.2 GHz
1 Kalmus 717FC RF Power Controller, 200–1000 MHz
1 Nucletudes ALP336 Amplifier, 1.5–2.5 GHz
8 Mini-Circuits, Amplifiers, ZHL42, 700–4200 MHz

Other Equipment
1 Narda ELT-400 Magnetic Field Probe, 1 Hz–400 KHz
1 Narda EHP-50 EM Field Probe Analyzer, 5 Hz–100 KHz
8 Maury 1878B, 3-Step Tuners
1 Siemens, Universale Messleitung, (0.5) 1–13 GHz
6 Validation Dipoles D835, D900, D1640, D1800, D2450, D5GHz
2 SPEAG Dipoles SCC34 Benchmark
3 SPEAG, SHO V2 RB, RC &RP, OTA Hand Phantoms

Computers
(32) Laptop Computers
(22) Intel Core2Duo based: Apple MacBooks, MacBook Airs, MacBook Pros, Lenovo ThinkPads, Dell XPS, (3) Intel Core i5 based: Lenovo ThinkPads, (7) Intel Core i7 based: Apple MacBook Pros
(44) Workstation Computers
(14) AMD Opteron based, single and dual socket: HP, Acceleware, Dalco, and custom built; 8-64GB RAM, (1) AMD Phenom based, dual socket: custom built, 32GB RAM, (7) Intel Pentium4 based: Dell, 1-4GB RAM, (12) Intel Core i7 based, single and dual socket: Dalco and Custom Built, 8-32GB RAM
(5) Intel Xeon based, single and dual socket: Dalco, 24-144GB RAM
(3) Cluster and Specialized Computational Systems, (2) Intel Xeon based, dual socket: Dalco 144-192GB RAM each with multiple NVIDIA Tesla GPU units, (1) Linux based compute cluster: Custom Built 24/16 physical CPU/GPU socket, 192/64GB CPU/GPU RAM, Intel/AMD CPUS and NVIDIA GPUs
(4) Servers
(2) Intel Atom based: (2) Synology NAS w/ 30TB+ network file storage each, (1) Intel Core2Duo based: Apple Mac Mini
(1) IBM PowerPC G5 based: Apple Mac Pro

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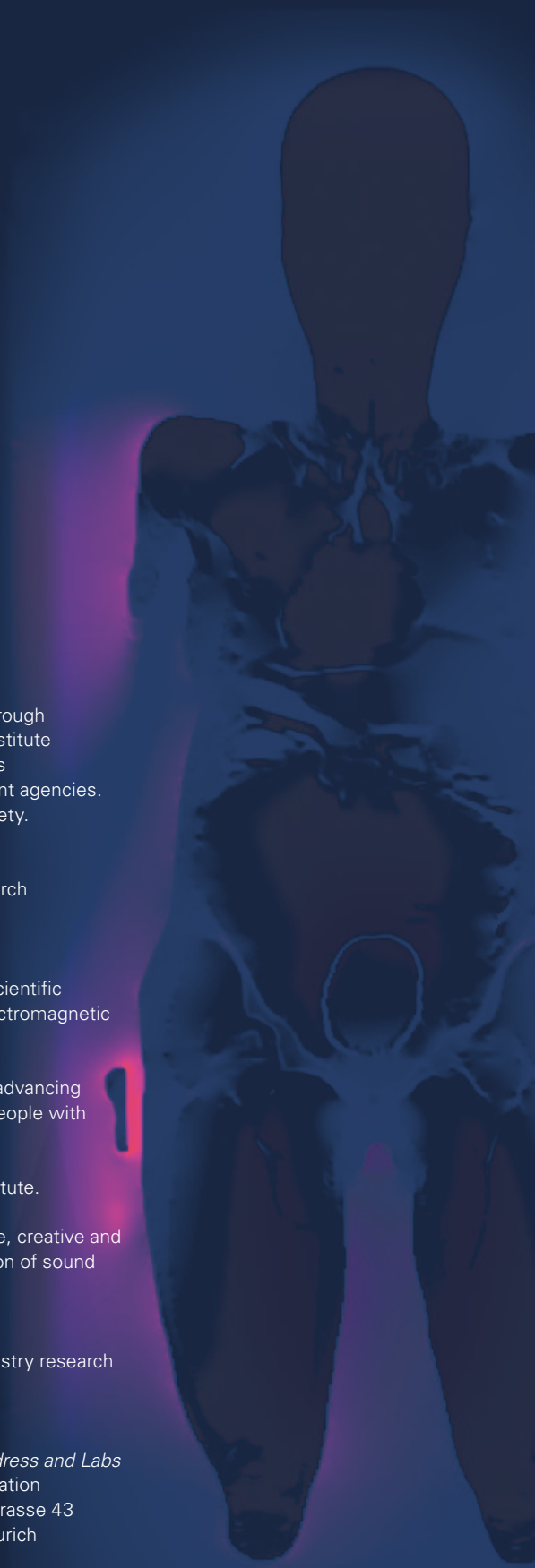
IT'IS FOUNDATION



History
The IT'IS Foundation was established in 1999 through the initiative and support of the Swiss Federal Institute of Technology in Zurich (ETH), the global wireless communications industry, and several government agencies. IT'IS stands for Information Technologies in Society.

Legal status
IT'IS Foundation is a non-profit tax-exempt research foundation.

Vision
IT'IS Foundation is dedicated to expanding the scientific basis of the safe and beneficial application of electromagnetic energy in health and information technologies.

IT'IS Foundation is committed to improving and advancing personalized medicine and the quality of life of people with disabilities through innovative research.

IT'IS Foundation is an independent research institute.

IT'IS Foundation endeavors to provide a proactive, creative and innovative research environment for the cultivation of sound science & research and education.

Funding
Private and industry sponsorship, public and industry research projects and services.

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