ITIS FOUNDATION 2010

IT'IS FOUNDATION

The cornerstones laid during the first ten years continue to serve as a compelling framework for the governance and research activities of IT'IS. Our vision for the future is clear and strong, our priorities and strategies are well chosen, and our commitment to innovative implementations remains our vital force. This annual report and our new website illustrate how.

The Foundation's success in advancing our mission is evident in the steady progress on a variety of projects that work together to promote tangible advances in the quality of people's lives. As we grow, we build an integrated network of research capabilities inside and outside our own walls, creating partnerships and networks that bring together experts in disciplines with diverse perspectives. For example, we enlarge our cooperative research with major medical corporations around the world as we enhance our Computational Life Sciences activities. Notably, we secured funding for Sim4Life that allows further development of our multi-physics and tissue-model simulation platform and expanded our Virtual Population project (page 14) with new ambitious goals. This work will empower researchers around the globe to develop/optimize novel diagnostic and therapeutic modalities (page 16).

We also began three new collaborative research initiatives:

POSEIDON is a 2-year project for the development of a high-level simulation platform for the analysis, synthesis and optimization of millimeter-wave devices. This joint project will intensify our cooperation with academic researchers at EPFL and broaden our core strength in computational electrodynamics.

WEMS is a research initiative to develop the procedures and instrumentation for demonstrating in situ compliance with the new EU-Directive for workers (page 12).

SEAWIND, funded by EU FP7, is a 3-year collaborative aimed at broadening the scientific basis for assessing the potential adverse health risks of EMF exposures from network devices now ubiquitous in everyday life.

Successful completion of the 4-year Swiss Program NRP57 research initiative in 2010 had a beneficial impact on SEAWIND. The results confirmed the findings of the REFLEX studies that ELF may affect DNA integrity in human cells and reinforced evidence for effects of EMF exposure on sleep EEG. NRP57 also answered the open questions of cumulative exposure to the CNS, and fetus, marking it as one of the most productive national EMF projects.

Our commitment to investments in intellectual capital is a principal element of the Foundation's continuing scientific success. The energy, creativity, expertise and enthusiasm of our dedicated employees, students, and colleagues (page 5) demonstrate their exceptional commitment to our Foundation's goals and core values. We are proud of all we work with, their achievements, and the distinction they have given IT'IS over the past eleven years.

Breakthrough innovations come from those with a spirit of adventure and the boldness to see extraordinary possibilities. We deeply appreciate our many sponsors and donors (page 9) whose commitment and trust in our vision make it possible to pursue our goals year after year. The generosity of CTI, the Federal Office of Public Health, the Swiss National Science Foundation, EU Commission, NIEHS and the long-term commitment of SPEAG are the fuels that power us to imagine the 'unthinkable', taking IT'IS far beyond where it had gone before.

Collaboration is essential for sharing knowledge, creating high-impact agendas, and unleashing human capacity and productivity. We gratefully acknowledge and thank all our partners (page 10) for sharing knowledge and expertise drawn from their diverse disciplines. In particular, we thank Professors Wolfgang Fichtner, Klaas Prüssmann, Gábor Székely, and Juan Mosig who also share infrastructure and are advisors to our PhD/Postdocs.

As we begin this new chapter in our Foundation's history, we are every bit as excited and optimistic as we were when we began in 1999. We have always believed that success comes from addressing challenges, not avoiding them. We started a new decade with a stronger organization. The science has never been more promising, and the need for new knowledge never greater. We expect new growth and new innovations over the ten years to follow. Stay tuned.

Zurich, May 2011 *Prof. Niels Kuster*

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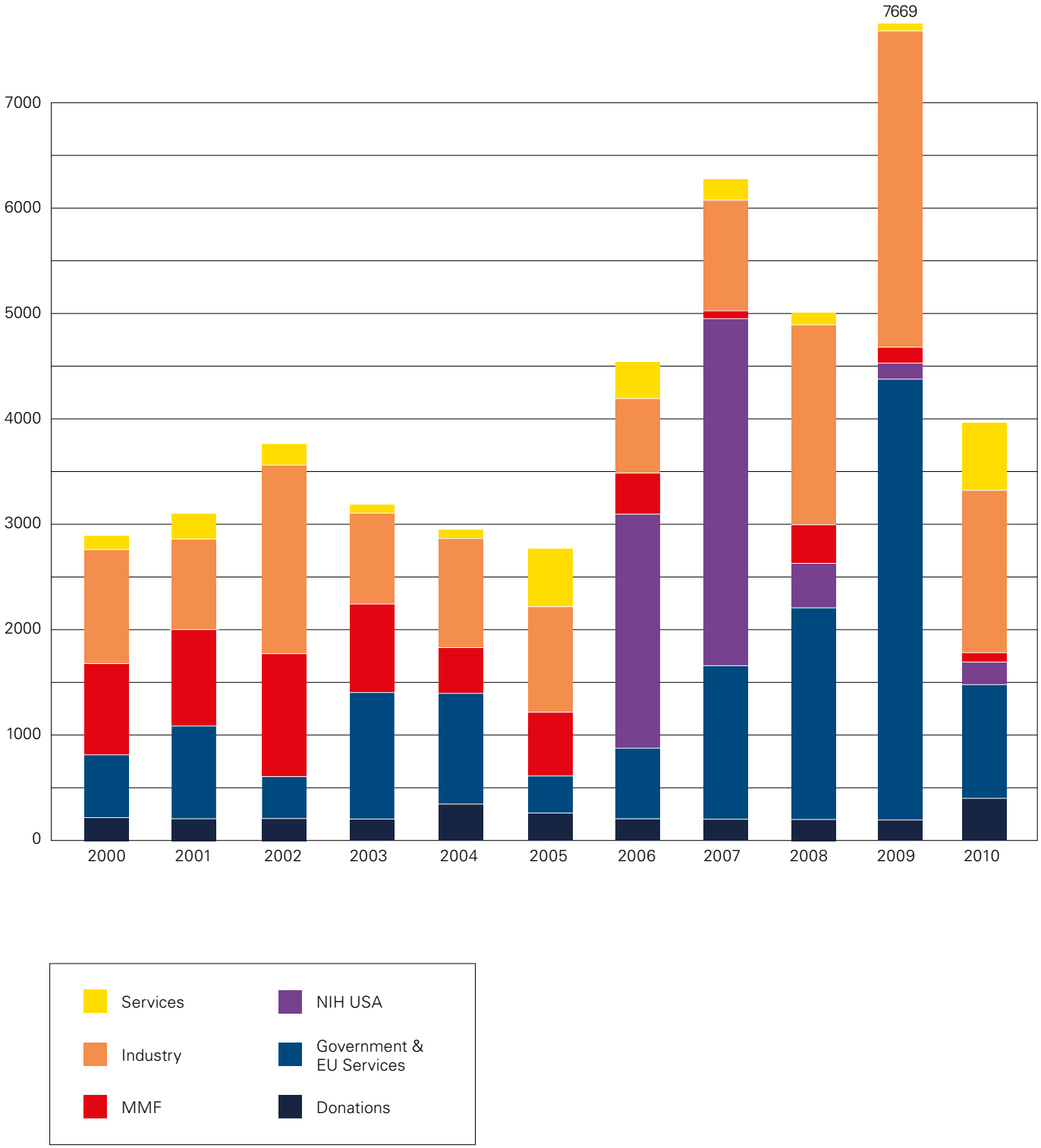
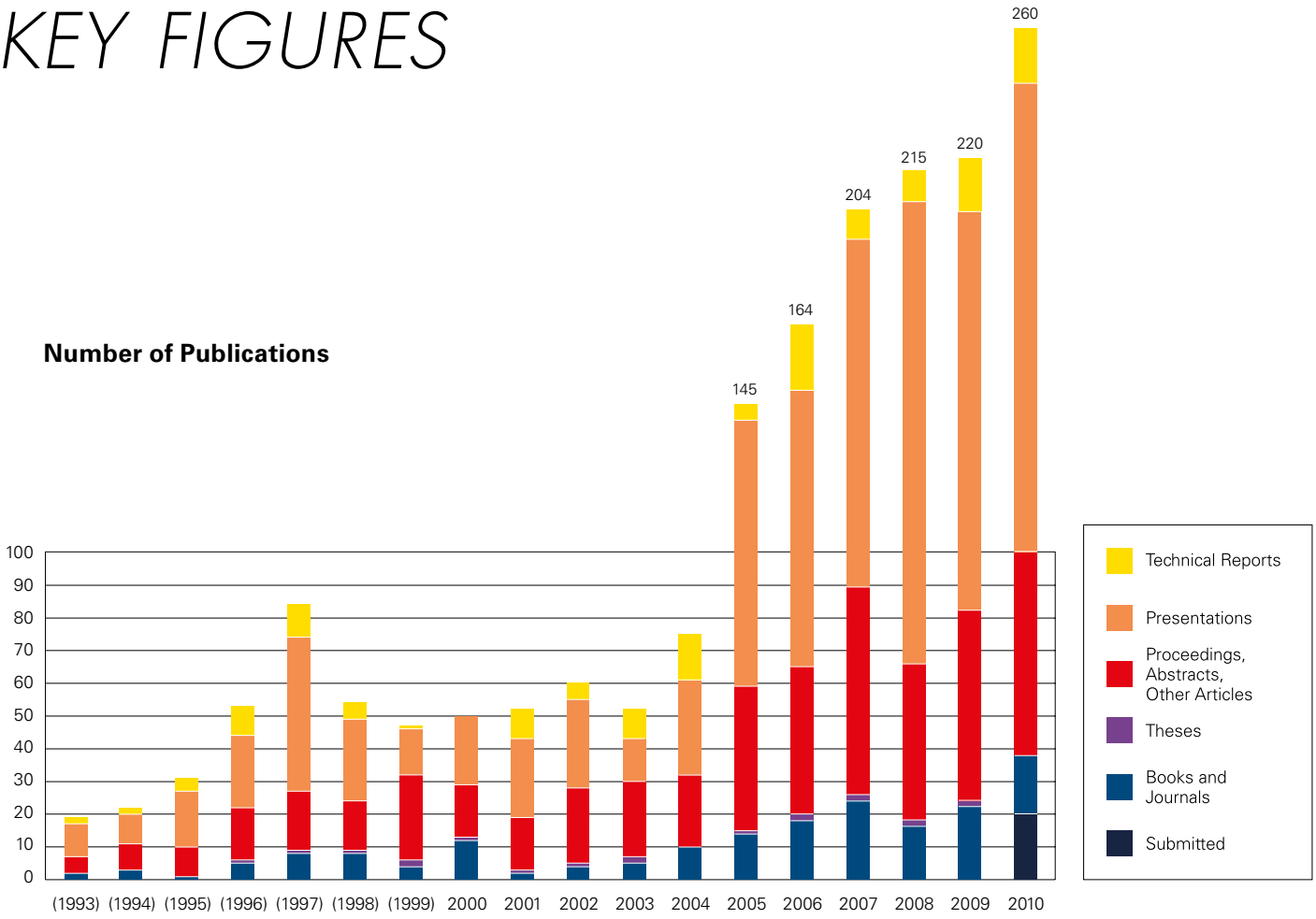
KEY FIGURES

Level of Funding (in 1000 CHF)



KEY FIGURES

Number of Publications



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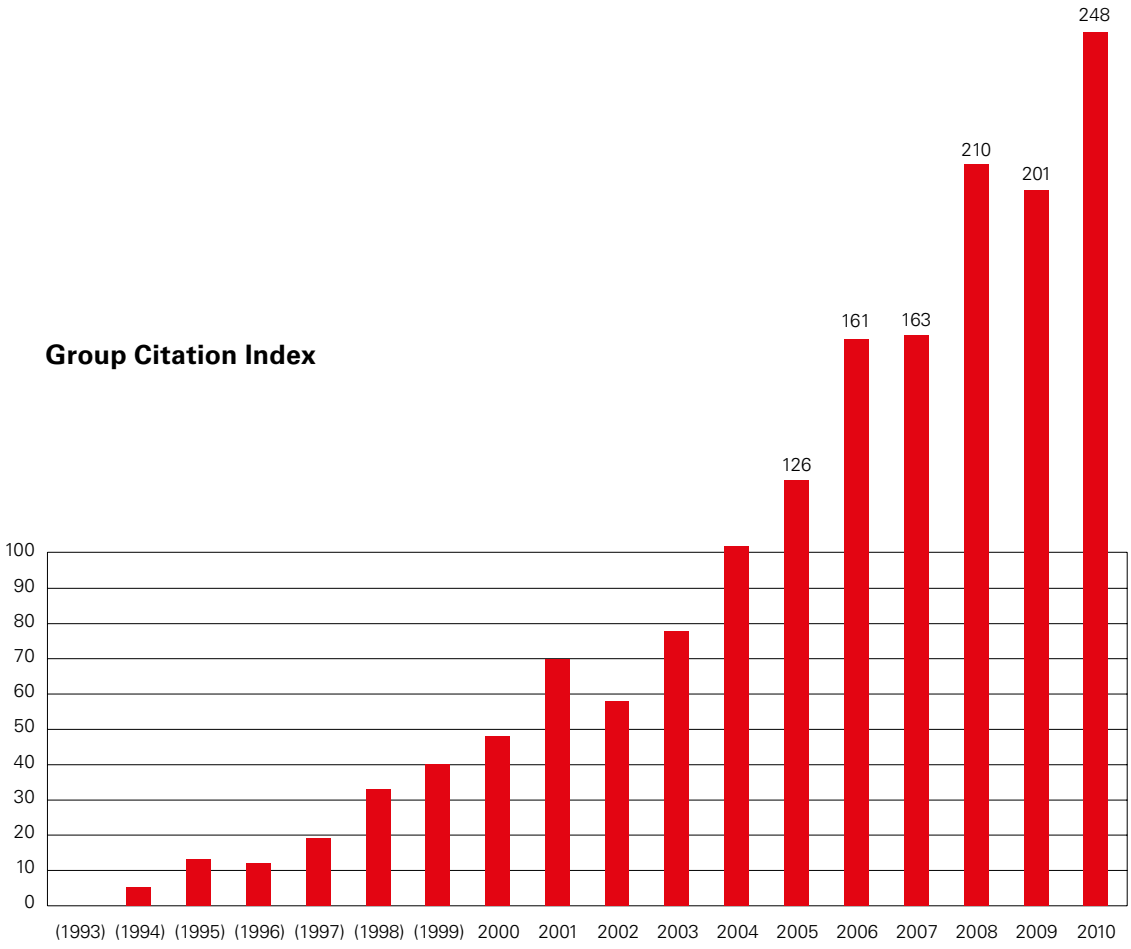

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PROJECTS

EM Technology

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

EM Exposure & Health

sXc	development of optimized exposure systems for in vitro studies from static to GHz
sXv – NTP / NIEHS	development, manufacturing, installation and detailed dosimetry of the reverberation chamber based exposure system for the in vivo studies by the NIEHS
sXh	development of an optimized exposure system for human provocation studies from static to GHz
sXc – Live	development of a miniature ELF exposure system for use in live cell imaging during EMF exposure
SEAWIND	assessment of exposure and health risks due to wireless network devices
REPLICATIONS	replication studies of bio-experiments
NRP Genotox	genotoxic effects of electromagnetic fields (RF and ELF) on cells
NRP Worms	effects of c.elegans worms exposure to electromagnetic fields
NRP Sleep	effects of RF electromagnetic radiation on human sleep EEG and cognitive tasks
EXPA EPI – CTIA	exposure assessment for epidemiological studies of mobile phone users
EX-AGE	characterization of mobile system exposures considering age dependent anatomical and physiological changes
EX-KIDS	evaluation of the whole body exposure of children with respect to present EMF exposure standards
BRAIN-X	assessment of the brain functional region specific exposure to EMF for near- and far-field sources
FETEX	assessment of the exposure of the fetus to electromagnetic fields from ELF to RF in uncontrolled environments
ZonMw	assessment of the exposure of children to electromagnetic fields from ELF to RF in uncontrolled environments
BAG Chef	assessment of the currents induced in workers when exposed to the magnetic field of induction cookers
EX-Bulbs	assessment of the human exposure to EMF of energy saving bulbs
STANDARDIZATION	participation in regulatory activities (standards committees & governments)

Medical

Sim4Life	multiphysics multiscale simulation platform for computational biomedicine and life sciences
CO-ME III	investigation of focused ultrasound (FUS) induced reversible blood brain barrier (BBB) opening
MHD phase II	development of a magneto-hydrodynamic solver for anatomical models
HYCUNEHT	research and optimization of hyperthermia treatment quality
COLHA	characterization and optimization of the RF link of hearing aids
MRI+	development of MRI exposure risk probability based on local temperature safety considerations
INHY	development and characterization of a magnetic field applicator for heating magnetic nanoparticles for cancer therapy

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

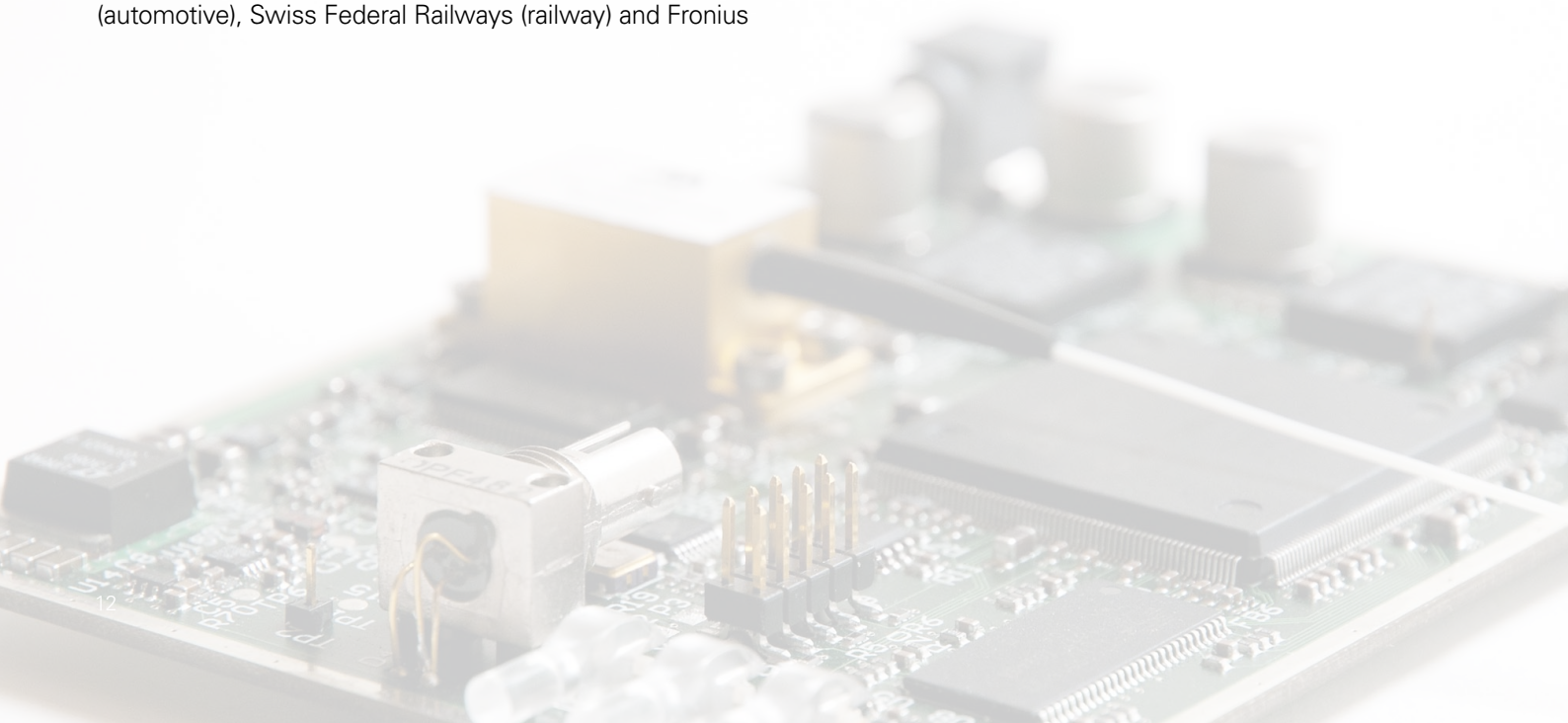
NOVEL EM INSTRUMENTATION

In 2012 the European Union is scheduled to begin enforcement of Directive 2004/40/EC that requires employer evaluation of workplace exposure to electromagnetic fields (EMF) from static to GHz frequencies. Implementation of these requirements poses a significant challenge for employers, many of whom lack the resources and expertise required to demonstrate compliance with EMF regulatory limits. For some employers, where workers must be close to high-voltage and high-current equipment, the reference levels used to indicate safety may be exceeded in many circumstances, triggering the need for more sophisticated evaluations. The resulting process may require either source modifications or proof that health and safety are assured by satisfying the basic restrictions on exposure. Unlike reference levels that can usually be demonstrated with a handheld meter, the basic restrictions refer to EMF within the body ("in situ"). Obviously, in situ EMF cannot be determined by instruments placed in a worker's body, but are determined indirectly by methods that are technically difficult, time-consuming, and expensive. In order to avoid a burden for the European economy, it is imperative that employers be able to fulfill their responsibilities under the directive using reliable and cost-effective techniques.

The aim of the WEMS project is to develop the procedures needed to demonstrate compliance, particularly for the automotive, railway, and metal fabrication industries. To do this, we have formed a consortium with eleven partners from five European countries. This consortium includes industrial partners from the three target industries: Volvo (automotive), Swiss Federal Railways (railway) and Fronius (metal fabrication). Leading academic researchers in the field of electromagnetic exposure evaluation are key members of the consortium.

One of the main tasks of WEMS is to develop novel instrumentation needed to demonstrate compliance with basic restrictions in close proximity to the source. WEMS builds on new equipment developed in the recently completed IT'IS project on assessment of human exposure in proximity to compact fluorescent light bulbs, but with an extended frequency range of 0–10 MHz and for various sources. The transformation coefficients of the measured induced currents to the currents induced in the human models will be determined using the Virtual Population and a variety of other sources. Measurement uncertainty of the equipment will be assessed in spatially and temporally non-uniform fields.

The procedures, the novel instrumentation, and a software-based tool for demonstrating compliance with the EU directive, will be ready for use when the new EU directive comes into effect and will significantly contribute to legal certainty for the required workplace evaluations. Both industry and regulatory agencies will benefit. The results also promise to yield data of value in refining standards based on correlations between environmental field strengths and induced field strengths.



EXPOSURE OF FETUS

The goal of this project funded by the Swiss National Research Program 57, ZonMw and SECO was to answer one of the open questions in exposure assessments, namely, to analyze the exposure of the fetus with respect to the field conditions for different types of electromagnetic field exposure. For the systematic characterization of the exposure of the fetus to electromagnetic fields, three anatomical computer models of a pregnant woman in different gestational phases were developed (3rd, 7th and 9th month of pregnancy). The fetuses are based on different image sources (MR and CT scans). Three dimensional CAD models were developed using the segmentation software iSEG. They consist of up to 17 different tissue types and were integrated into the adult female model Ella of the Virtual Family.

The exposure of the fetus was evaluated numerically using the finite-difference time domain method (FDTD) for the radio frequency (RF) range (70 MHz–2.45 GHz) and the finite element method (FEM) for the low frequency (LF) range (magnetic field exposure from 16 Hz–200 kHz). Different exposure scenarios were modeled using a matrix of generic sources surrounding the womb at different distances and in different polarizations. Special attention was paid to uniform exposure (LF and RF), electronic article surveillance systems, induction cooker hobs, and RF sources of mobile devices operating in the immmediate environment of the abdomen.

The exposure of the fetus was compared to the basic restrictions on current density (LF) and SAR (RF) as proposed by ICNIRP, 1998 for the respective reference levels for the incident field considering the limits for the general public (uncontrolled environments) and for occupational exposure. Both basic restrictions and reference levels for occupational exposure are generally higher in comparison to those of the general public by a factor of 5, which corresponds to 7 dB (SAR) or 14 dB (current density). In working environments, occupational exposure levels apply to the mother, which also increase the exposure of the fetus by the same amount.

In summary, the most important findings were:

- If the incident fields are compliant with the reference levels for the general public at the location of the fetus, the basic restrictions are met in all investigated cases if not considering Additional investigations are necessary to assess the envelope of the uncertainty due to the anatomical variations of shape and position of the fetus in the womb.

- If the mother is exposed to occupational exposure limits, the exposure of the fetus may be above the basic restrictions for the general public.

- Some product standards must be revised since they are in contradiction with the basic restrictions.

- We found that the coupling of external EMF sources with fetuses is sufficiently different that product standards should consider them as special cases. The methodologies developed within this project have proven to be sufficient to conclusively characterize the exposures for any sources.

DYNAMICALLY MORPHING ANATOMICAL MODELS

The extended Virtual Family and Virtual Classroom have proven valuable for research at IT'IS and for more than two hundred other research groups. This wide adoption is attributable to their faithful anatomical representations that were derived from high-resolution MR images of healthy volunteers. The initial images were segmented into an extensive number of tissues (>80) using techniques that allow reconstruction of fine structures and thin layers. However, the growth in applications of modeling techniques for certification of medical equipment and optimization of diagnostic and therapeutic methods require a much larger set of anatomical models in order to closely represent the large variations in anatomy and body posture found in the human population.

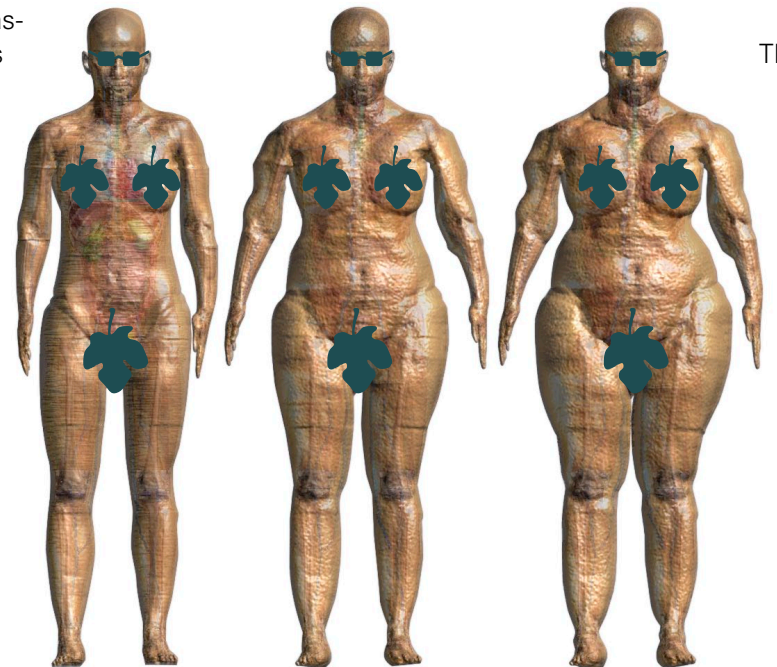
IT'IS is currently developing two technologies to add morphing functionality to our human and animal models. The first aims at increasing and decreasing the body mass index (BMI) by a finite-element-method (FEM) based procedure that increases or reduces the volume of the fat layers with a good anatomical approximation. The second allows geometric warping of the model using a series of interactive manipulators. The two approaches can also be combined such that realistic changes can be obtained interactively within constraints based on precomputed deformation fields.

The morphing procedure is not based on geometric deformation but on physics using existing models to expand or collapse selected fat tissues (at a rate which can vary between regions). Subsequent computations yield the deformation field of the whole model by assuming that the other tissues deform passively using realistic mechanical properties (e.g., incompressibility) and treating the bones as rigid (non-deformable) bodies. This procedure can be performed repeatedly, thereby generating a series of related models of different BMI. Thus far, two models, Ella and Fats, have been subjected to this procedure yielding a large increse in the coverage of human body types compared to the original segmented models.

The following technologies must effectively interact to obtain high quality models: a highly efficient mechanical finite element solver, a powerful meshing tool capable of creating high quality unstructured meshes based on complex and noisy voxels, and a robust voxeler. Our newly developed technologies could also be employed for other changes, for example, shape changes of muscles and tissues when changing the postures of the models.

The second approach, interactive warping, presents the user with a series of tailored interactive manipulators to anisotropically scale, stretch, bend, twist and warp the entire model or its sub-regions while inspecting the modifications in real time. Our implementation uses modern visualization and multiresolution rendering that is based on our customization of VTK software. Different warping filters can be combined into a pipeline. By maintaining a filter history, previous filters can be adapted and the entire pipeline re-executed.

In addition, deformation fields computed from a previous FEM simulation can be used by the interactive warping tool to interactively deform the underlying anatomical model within a limited range merely by varying deformation and scaling factors. Additional deformation fields could be obtained by using 4-D medical image data acquisition and registration to track, for example, deformations due to breathing or heart activity.



These morphing-based extensions of our model set illustrate just one of the many research activities in our Virtual Population initiative aiming to offer the research community continuously improved human models.

ANALYZING THE MAGNETO-HEMODYNAMIC EFFECT

The computational life sciences group at IT'IS currently focuses on the ambitious effort to build the Sim4Life platform for advanced multi-physics multi-scale simulations that can be applied to complex anatomical models. This platform is needed for phenomena that involve multiple types of physics described by sets of coupled equations. It is expected that such a platform will have numerous applications in clinical medicine and medical research.

As one of the first applications, IT'IS performed a study together with the US Food and Drug Administration (FDA) to evaluate the diagnostic potential of the magneto-hemodynamic effect (MHD). MHD describes the interaction between a strong static magnetic field and a flowing electrically conducting medium such as blood. This interaction generates changes in the electric potential that can be measured on the human skin as a blood-flow dependent perturbation of the electrocardiogram (ECG) signal. If these changes can be reproducibly measured with standard ECG devices, they could be employed for non-invasive diagnostics of cardiac blood-flow characteristics such as stroke volume and cardiac output. We also anticipate further heart diagnostic applications.

In a first step, measurements were performed with the same person who volunteered to take the whole-body MRI scans for the generation of Duke of the Virtual Population. Measurements were taken inside and outside an MRI magnet using advanced MR sequences to measure the blood-flow, and standard ECG equipment to measure the potential changes. The signal was extracted using lab-designed signal analysis software. We found that the MHD signal is strongly location dependent, and can be measured reproducibly.

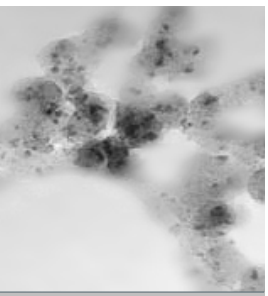
In the second step, the Duke model was refined with an accurate model of the aorta and vena cava (see picture) based on the new MR images taken during an experiment applying the in-house image segmentation software iSEG. Flow simulations were performed for the aorta and vena cava using the recently developed and efficiently parallelized Galerkin finite element solver and as input the measured flow at the entries of the vessels. Due to the high Reynolds number, the calculations were performed using anisotropic diffusion stabilization. It is noteworthy that detailed features of the flow pattern in the complex aortic arch region were correctly predicted.

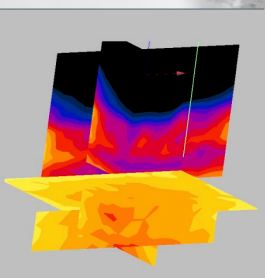
The resulting time-varying potential changes at the body surface have been computed using a specialized low-frequency solver. We found that the simulations reliably reproduced major features of the measured MHD signal with the exception of the immediate vicinity of the heart where agreement was poor because blood-flow within the beating heart was not considered.

These newly developed MHD simulations can now be employed to optimize the measurement points on patients at which reliable spatially- and temporally-resolved blood-flow information can be obtained noninvasively. The application also demonstrates the power of the Sim4Life platform in development with respect to solver efficiency and flexibility as well as the quality of the pre- and post-processors.

MAGNETIC NANOPARTICLE HYPERTHERMIA APPLICATOR FOR CANCER THERAPY

Nanoparticles derived from iron oxide exhibit magnetic properties depending on the frequency of an applied magnetic field and the nanoparticle size. An applied alternating magnetic field causes power loss within the nanoparticles thereby producing heat. This specific power loss (SPL) is a function of magnetic field strength, frequency, and nanoparticle size. Therefore heating can be maximized at a given frequency by optimizing nanoparticle size.





Hyperthermia therapy is a type of cancer treatment in which tumors are exposed to high temperatures to kill or damage cancer cells. Two ranges of target temperatures are used in such treatment. High temperatures (>60°C) are used in thermal ablation and RF surgery, for example, to kill targeted tissue directly. Lower temperatures (40–45°C) activate apoptotic, immunologic and other responses. A new experimental cancer treatment technique involves heating the tumor using magnetic nanoparticles excited by an externally applied magnetic field. Patients with solid tumors can be treated with a nanoparticle composite injected into pre-existing tissue spaces and heated by exposure to an external magnetic field after injection. In the case of tumors within bones, the polymer injection allows in situ casting of the lesion core. In contrast, implant magnetic field exposure allows moderate secondary heating of the implant and of adjacent tissues, inducing cell death in heat-sensitive tissue adjacent to the implant. The combination of in situ casting and implant heating provides a means to destroy tissue, particularly tumors, in a controllable and localized fashion.

A magnetic field applicator is used to heat nanoparticles inside the patient. The ideal applicator would consist of light materials that provide a homogeneous field distribution. Several published experimental designs are in use in clinical trials. However, these applicators are either large, heavy constructions with magnetic material cores and homogeneous fields, or small and light with highly inhomogeneous fields only suitable for heating nanoparticles in the immediate vicinity.

Applicator design is a multivariate problem encompassing field coil design, operating frequency, magnetic nanoparticle size, field strength, and power requirements. In choosing the operating frequency of the system there are various trade-offs to be considered. Specific loss power (SLP) (W/g) increases as a function of frequency (and also magnetic field strength squared), but the power absorbed in the patient (SAR) in locations other than that of the magnetic nanoparticles is also a function of the product of frequency multiplied by magnetic field strength. Consequently, there is a trade-off between SLP and unwanted SAR in healthy tissue.

The design of the field coils is dominated by field homogeneity requirements and the maximum patient size, whereas the number of turns in the field coils is a complex trade-off between field strength per ampere of current flowing and the proximity effect of the turns. The latter dramatically alters the effective loss resistance and the skin effect in both the field windings and the electrostatic shields. All the preceding factors affect the power requirement of the field windings in order to achieve the necessary magnetic field strength. Human dosimetry was carried out for each potential field coil arrangement to assess the degree of unwanted heating due to specific absorption in the patient versus the desired nanoparticle heating. A figure of merit was devised to assess the target operating frequencies. Additionally, the extent of the homogeneous field volume was determined. Larger volumes give greater benefit whether placing the patient in the applicator or placing the applicator over the patient, depending on the clinically preferable configuration. The final basic configuration is the basis of a prototype design in which winding spacing and layout were chosen to optimize the inductance/proximity effect resistance ratio.

The project explored and determined the limits on field strength that could be generated using an air core applicator (that is, one with no magnetic core materials) and went on to produce a prototype applicator. Furthermore, the design established safety limits for the applied field such that SAR in healthy tissue posed no harm to the patient.

SERVICES

Although the primary activities of the IT'IS Foundation are dedicated to advanced research, we also offer a range of unique services. Our strength is based on combining leading research activities and superior technologies in electromagnetic simulations and measurements from DC to the high GHz range. The services provided by our state-of-the-art laboratory include, but are not limited to:

RF Safety and Compliance Evaluations of Transmitters
The IT'IS Foundation is regarded as the preeminent, truly independent institute for dosimetric evaluations. We are committed to being at the forefront of developing the most accurate and suitable testing procedures in conjunction with regulators, national standards laboratories and industry (see page 10). As we closely cooperate with the leading test system manufacturers (e.g. SPEAG, ZMT, etc.), we provide services with cutting edge technologies for testing.

MR Safety and Compliance Evaluations of Implants
The IT'IS Foundation has expanded its activities in the development of safety procedures and evaluations of active and passive implants during MR scanning. We offer complete evaluation solutions according to the latest ISO/IEC drafts and beyond from test planning development, numerical and experimental evaluations, to documentation for FDA submissions.

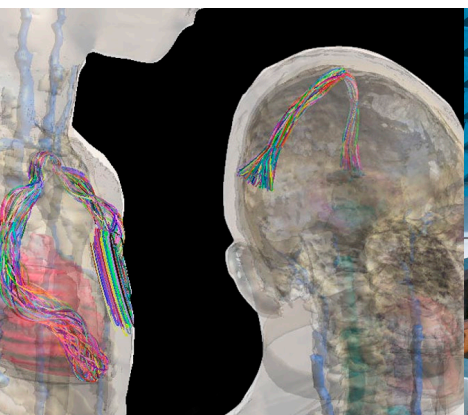
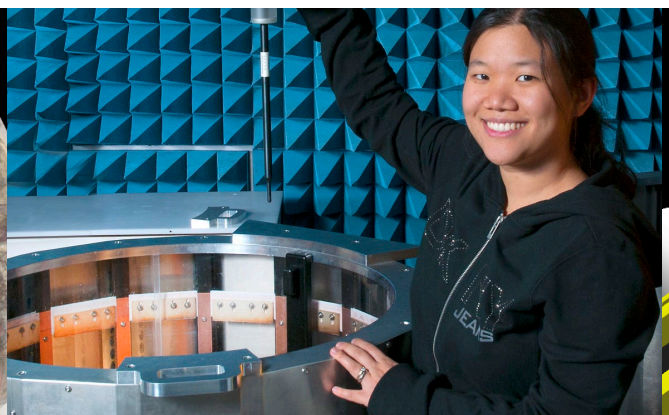
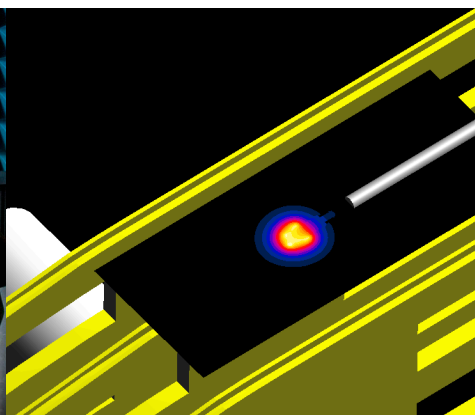
Communication Link System Design
We provide expert consultations regarding standards and homologation rules, including the revision of technical requirements, the assessment of regulation procedures, and the evaluation of impending standards. We offer full development and design services for custom-specific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

Virtual Population
The IT'IS Foundation is committed to expanding and continuously improving the Virtual Population. In cooperation with FDA, this project will develop the best quality human models representing the anatomical variations of the human population with respect to physical agents. These models are provided for free to the scientific community.

Exposure Systems
The IT'IS Foundation develops and designs a wide range of exposure systems for in vitro, in vivo and human studies on EM interactions for the biomedical community. We also design customized systems that are optimized for efficiency and flexibility while providing maximum homogeneity, a wide dynamic range and a variety of amplitude modulation schemes. Additionally, environmental parameters can be monitored and the setups allow double-blind protocols.

Safety White Papers
As a leading player in the global effort on health risk assessment research and as an active participant in commissions developing EMF and MRI safety guidelines, the IT'IS Foundation provides a full range of safety white papers. Numerous international organizations, industries and government agencies have entrusted the Foundation to draft safety white papers for existing and future technologies as well as for the 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 2011 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
2 Anritsu 3700A

DASY, iSAR, EASY4MRI, MITS
1 SPEAG DASY52NEO
2 SPEAG iSAR^2 (1 Flat & 1 Head)
1 MITS1.5 w/Phantoms
1 MITS 3.0 w/Phantoms
1 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 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 H1TDS7zV1, H-field Time Domain Sensor
1 SPEAG, H1TDSxV1, H-field Time Domain Sensor
1 METROLAB, THM 1176, Magnetic Field Sensor
Tissue Simulating Liquids 27 MHz–6 GHz

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
1 EG&G Princeton Applied Research Lock-In Amplifier
8 Mini-Circuits, Amplifiers, ZHL42, 700–4200 MHz

Other Equipment
1 Narda H2304/101 Exposure Level Tester, 1 Hz–400 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
1 SPEAG, SHO V2 RB, OTA Hand Phantom
1 SPEAG, SHO V2 RC, OTA Hand Phantom
1 SPEAG, SHO V2 RP, OTA Hand Phantom
various

Computers
28 MacOS X: 1 PowerMac G5, 1 Mac Mini, 19 MacBook Pro, 4 MacBook, 3 MacBook Air
53 MS Windows: MS Windows: 8 Dalco AMD Opteron w8164/a Dualcore 2.2 GHz - 3.2 GHz, 2 Dalco AMD Xeon Quadcore 2.4 GHz, 2 Dalco AMD w8264i3 Workstation Hexacore 3.3GHz, 3 Dell Dimension 8300 P4 2.6-3 GHz, 3 Dell Dimension 8250 P4 1-3.4 GHz, 4 Dell Dimension 8200 P4 1-3 GHz, 1 Dell Dimension 5000 P4 3.2 GHz, 3 Dell OptiPlex GX110, 1 Compaq EVO, 1 IBM T61 Dualcore 2.5 GHz, 1 IBM T60 Dualcore 2.16 GHz, 1 IBM T43p PM 1.86 GHz, 1IBM T40 Centrino 1.5 GHz, 2 Lenovo TP T500 Dualcore 2.4 GHz, 1 Dell XPS T9500 2.6 GHz, 14 no-name custom built in-house PC's i7 Quad/Hexacore 2.2 GHz–3.3 GHz
4 LINUX: 3 AMD Dual Opteron aXware ClusterInABox (3 Dual-boot Windows XP 64 Professional), 1 Silverstone MiniCIB AMD Athlon 64 X2 Dual 2.41 GHz (Dual-boot Windows XP 64 Professional)

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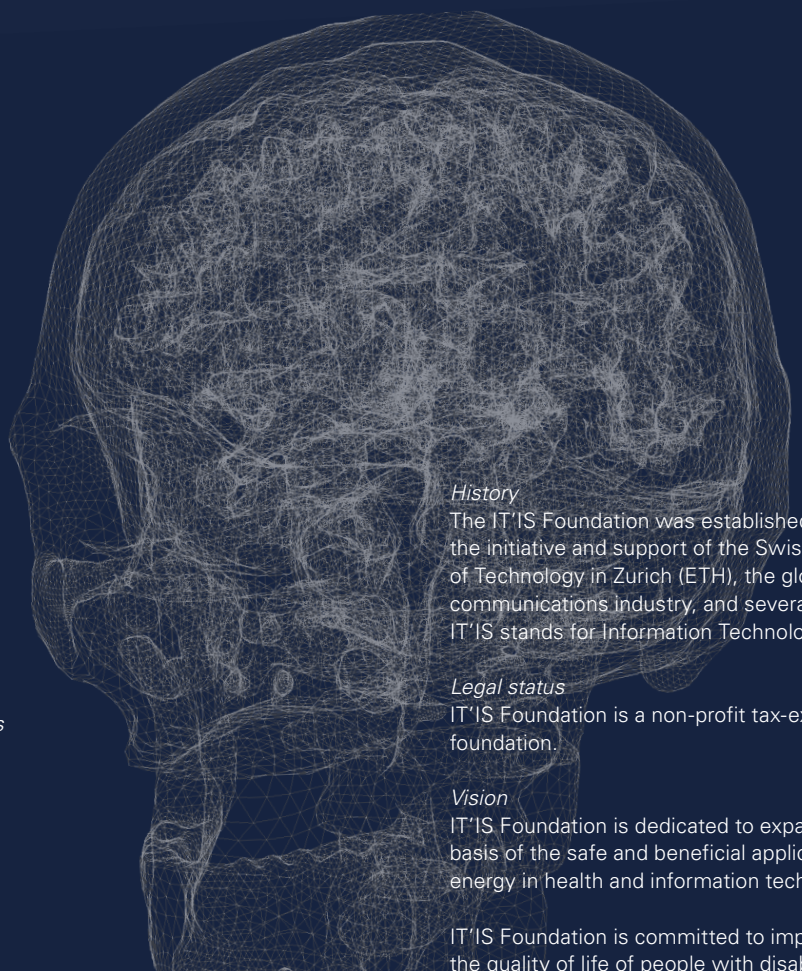

History
The IT'IS Foundation was established in 1999 through the initiative and support of the Swiss Federal Institute of Technology in Zurich (ETH), the global wireless communications industry, and several government agencies. IT'IS stands for Information Technologies in Society.

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 the quality of life of people with disabilities through innovative research and application of emerging technologies.

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 information services.

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