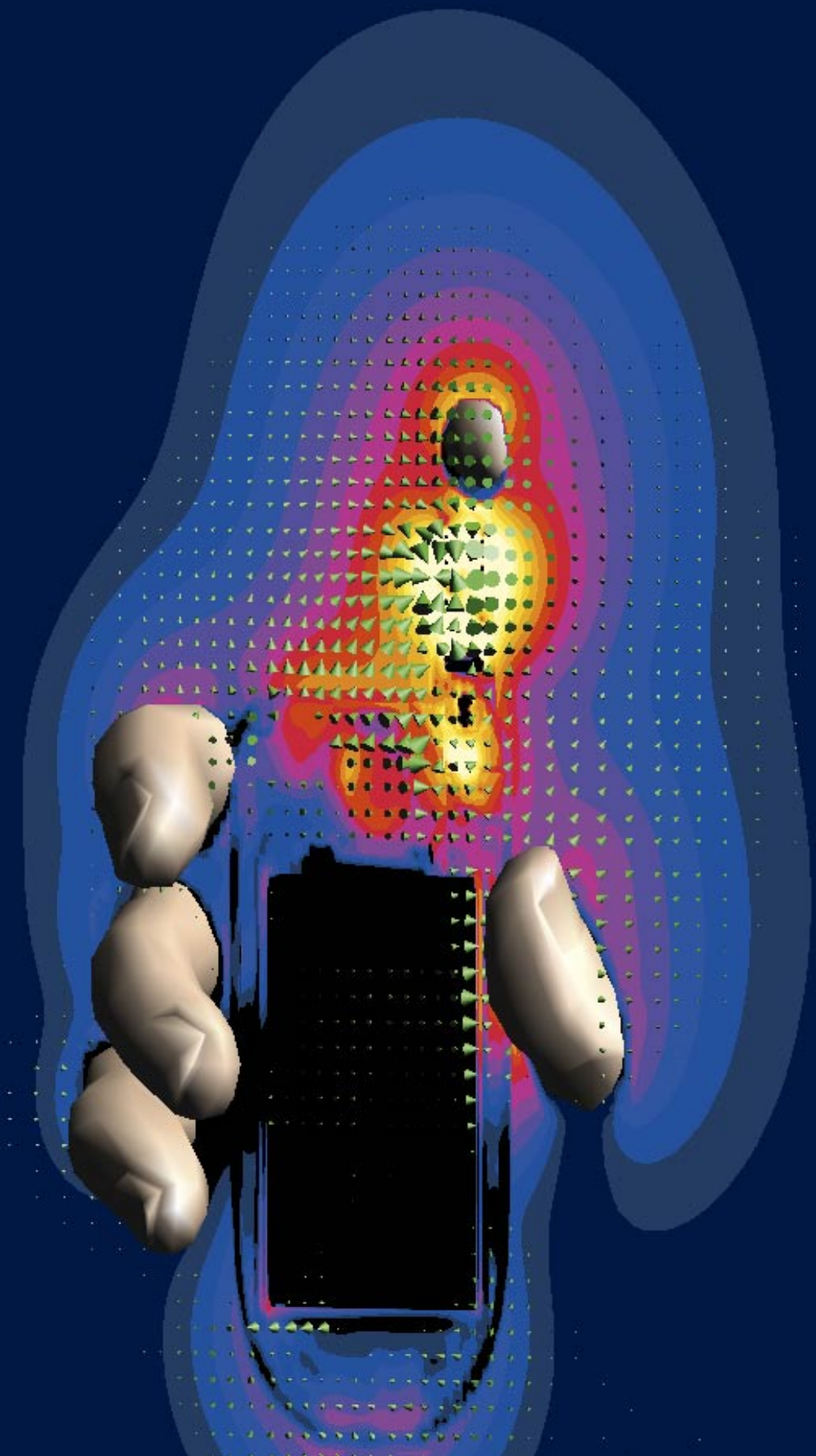
IT'IS FOUNDATION 2004



IT'IS FOUNDATION

In 2004 the IT'IS Foundation completed its fifth year since beginning with a bold five-year goal: Build a research institution recognized internationally for its distinguished core competency with a solid infrastructure and broad-based funding.

Today we are not quite there, but have come remarkably far in creating a research institution widely recognized for meeting the challenges that arise "wherever EMF meets tissue". The large variety of projects undertaken (page 11) and respectable publication record (page 8) are further signs of our success.

These accomplishments could not have been achieved without committed external advisors and the talent and dedication of all past and current project leaders, PhD students and scientific assistants. I am immensely grateful to them all (page 5). Special mention is due to the contributions of our great friend and advisor W. Ross Adey, who passed away in 2004 at age 82, far too early. His support and encouragement were joined to the ever-challenging stimulation from his broad knowledge and restless intellect. He has left us with the inspiration to continue the challenge to match his vision.

The Health Support Systems group, formed in 2003, developed well over the past year. In particular, the group initiated a hyperthermia treatment project (page 16), despite the previously mixed record of RF energy application in the treatment of cancerous tumors. We expect that the new and sophisticated clinical tools IT'IS is developing for use in hyperthermia planning and treatment – including new antennas, software and imaging algorithms – will prove instrumental in the revival and expansion of hyperthermia applications. We have already established a broad network of clinical collaborators and currently are seeking long-term funding. Additionally, the ULTRACOM project has expanded the knowledge and potential for on-body communications.

Body-mounted transmitters were the focus of our recent advances in exposure assessment. Breakthroughs were also achieved in our new time-domain sensor technology. In collaboration with the US Food and Drug Administration (FDA), the IT'IS Foundation conducted research that resolved the long-standing controversy generated by the proposition that children may absorb greater amounts of energy from mobile phones than adults (page 13).

Despite the slowing of industry funding for research needed to support health risk assessments, IT'IS remains committed to scientifically sound comprehensive risk assessment. In 2004 we used some of our own resources to support key *in vitro* experiments and human provocation studies. Our work on human volunteer studies is reviewed on pages 14 and 15. We hope that 2005 will see funding of the Swiss NFP NIS program and the NTP study by US NIEHS in order to close some of the most important research gaps.

We greatly appreciate the public institutions and private companies of the wireless industry listed on page 9 for their endorsement and initiative in supporting our current and past projects. We especially thank the Swiss Commission for Technology and Innovation for funding projects that advanced our research on a variety of difficult issues affecting modern wireless technology, and the Swiss Federal Office of Public Health for funding several specialized and highly useful research projects.

We are especially grateful to our industrial partners, Mobile Manufacturers Forum (MMF), MTTCO and SPEAG, for their commitment to long-term funding with "no strings attached" since 1999. This is essential for maintaining the IT'IS Foundation as the leading center of competence. We also thank TDC Sunrise for its support during our first five years.

We are also deeply grateful to our many colleagues at ETH Zurich, especially President Prof. Olaf Kübler, the entire IIS Laboratory of Prof. Wolfgang Fichtner, Prof. Albert Kündig, Prof. Manfred Morari, Prof. Heinz Jäckel and Prof. Gábor Székely.

Zurich, March 2005 *Prof. Niels Kuster*

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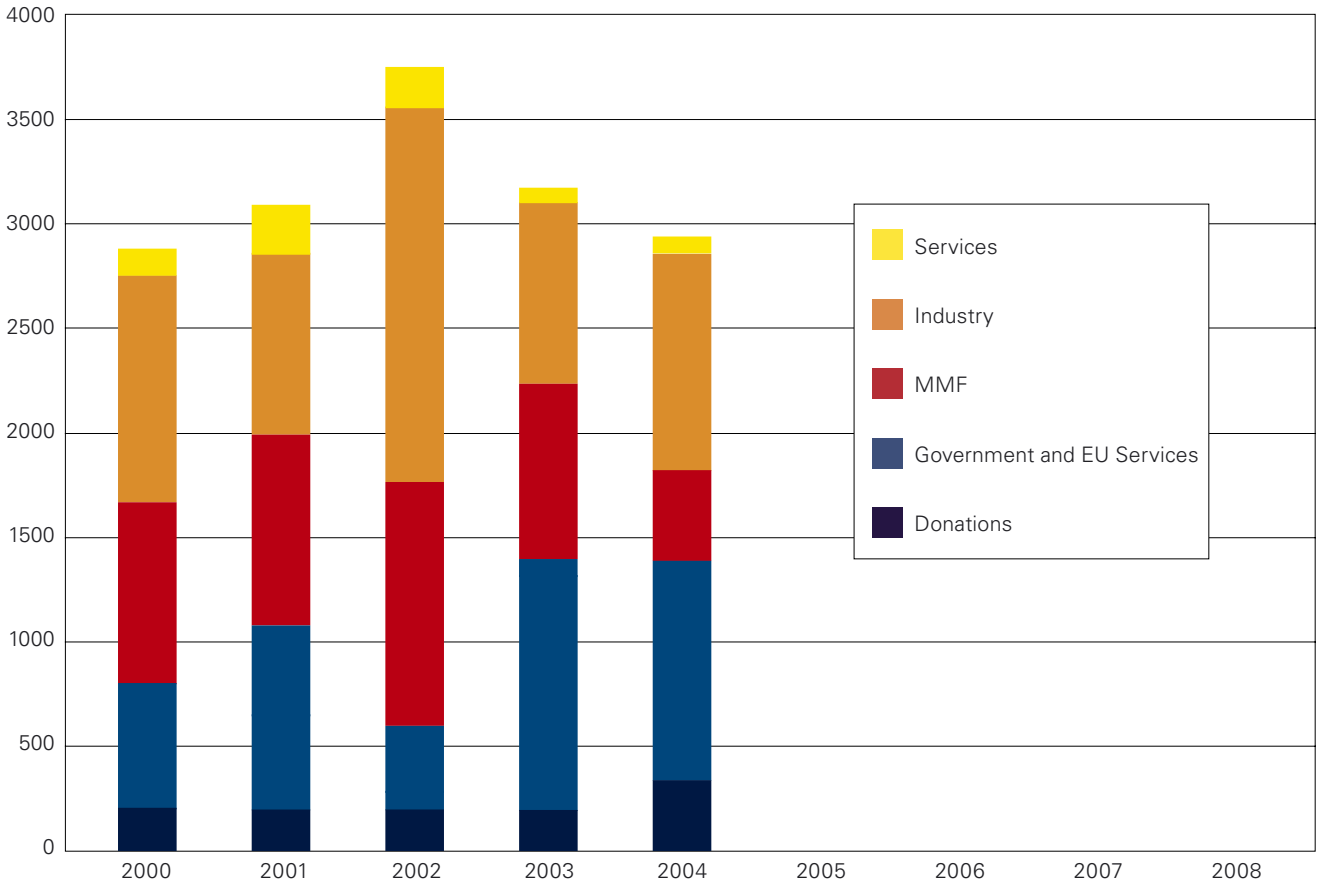
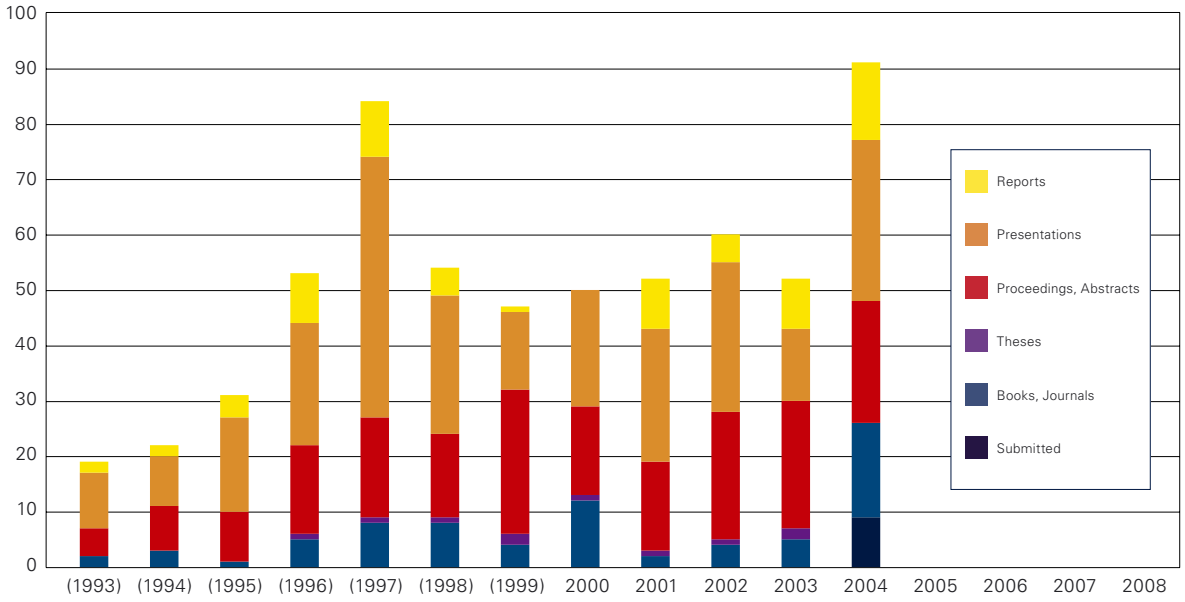
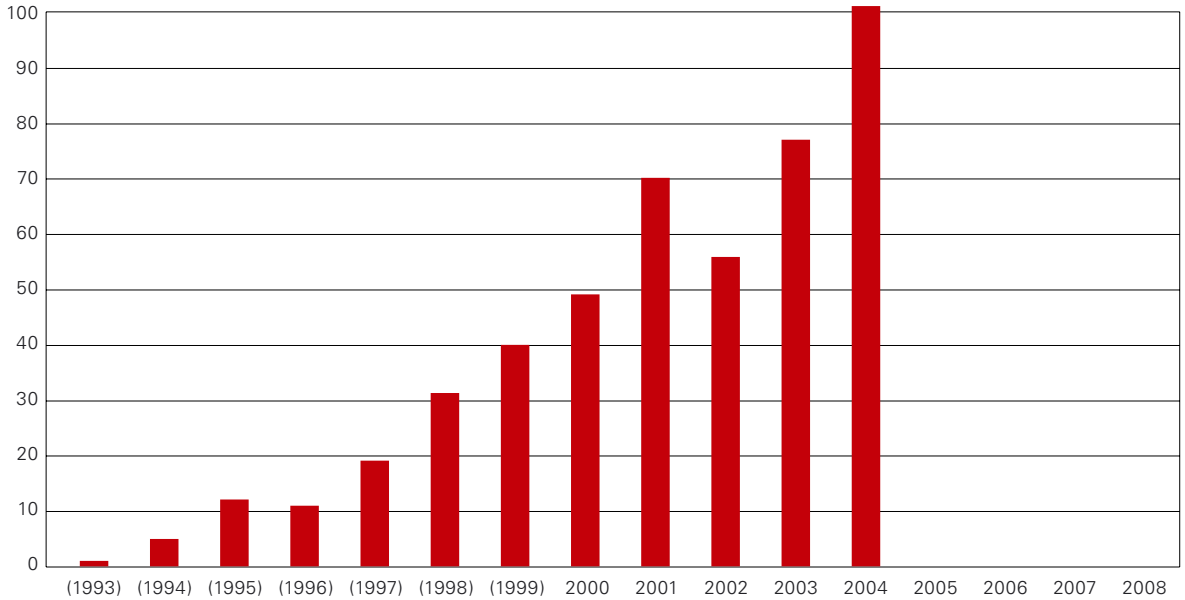


KEY FIGURES

Number of Publications



Group Citation Index



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PROJECTS

Measurement and Computational Techniques

TD SENSOR	development of a field sensor in the time and frequency domains
MT SENSOR	development of a novel micro-thermal sensor for temperature measurements with high spatial resolution in RF hostile environments
TRINITY	simulation tool for the robust design and integration of next generation information technology devices (see page 12)
CSCIENCE HANDHELD	research on the scientific basis to test compliance of handheld and body-mounted transmitters (see page 13)
CSCIENCE Protocol NIS	methodology for determining the measurement uncertainty of exposure assessment inside buildings
EX-T	research on the effects of torso exposure to wireless devices with respect to existing compliance testing standards
EXPA INDOOR – BAG	development of procedures for the assessment of human exposure to electromagnetic radiation from wireless devices in home and office environments
BASEXPO	development of procedures for assessing human exposure to EMF radiation from base stations
STANDARDIZATION	participation in regulatory activities (standards committees & governments)

Health Risk Assessment

PERFORM A / ZHEJIANG	*in vivo* research on possible health risks from mobile phones and base stations through carcinogenic studies in rodents
PERFORM B	*in vitro* and *in vivo* replication studies related to mobile phones and base stations
PERFORM C	human studies related to mobile phones and base stations (see page 15)
EMF & BRAIN – SLEEP	effects of EMF on sleep, sleep EEG and brain function (see page 14)
EMF & BRAIN – CBF/CBV	effects of EMF on cerebral blood flow, cerebral blood volume and neural activity (see page 15)
REPLICATIONS	replication studies of bio-experiments
REPLICATIONS TNO	replication studies of bio-experiments focusing on UMTS-like exposure conditions (see page 15)
sXc – 900 / 1800 / 1900	optimization of systems for the exposure of cells to GSM/DCS/UMTS
sXv – NTP / NIEHS	optimization of systems for exposure: dosimetry of the reverberation chamber setup for the NTP / NIEHS study by NIST
sXh – RF / ELF	optimization of systems for exposure of human volunteers: assessment of ELF exposure from GSM handsets and development of an optimized RF / ELF exposure setup
sX3P	dosimetric evaluation of third party exposure systems
EXPA EPI – CTIA	exposure assessment for epidemiological studies of mobile phone users

Health Support Systems

ULTRACOM	channel model of the human body for medical monitoring systems
HYPER-T	research and optimization of hyperthermia treatment quality (see page 16)

NOVEL CONFORMAL MESHES

The finite-difference time-domain (FDTD) method is recognized as the most powerful technique for solving complex EM problems. SEMCAD-X, jointly developed with SPEAG under the umbrella of the CTI project TRINITY, is recognized as the most advanced platform for antenna and medical device developers as well as for dosimetric studies.

One major drawback of the FDTD scheme is the inherent staircase meshing that can lead to inaccuracies in the geometrical discretization of complex models. To address this, TRINITY has incorporated a subproject for the development of conformal meshing, leading to improved representation of curved or non-conformally aligned structures.

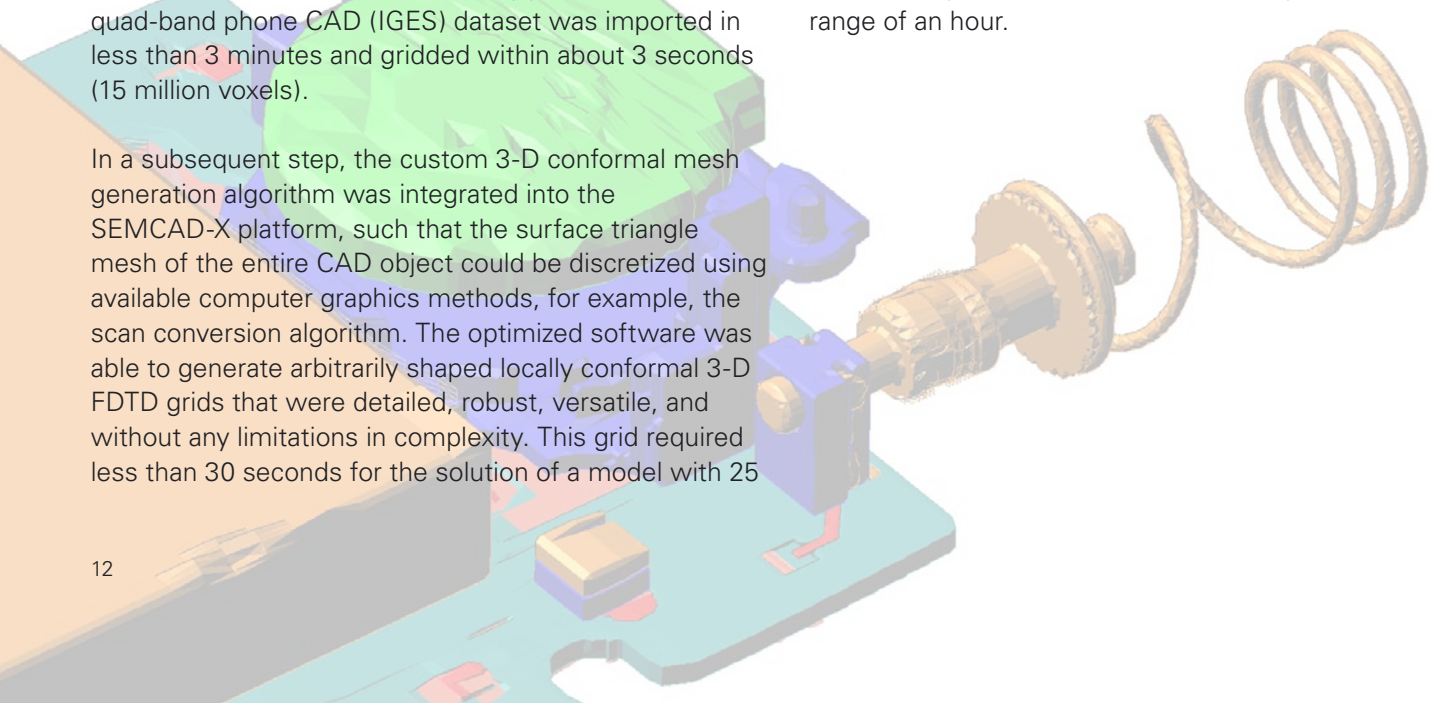
Our implementation of a conformal mesh generator uses semi-automated gridding created with a novel algorithm which also supports graded meshes. The new scheme is very fast, allowing grid generation for very complex objects within seconds. For example, a mesh of about 100 million cells was applied to a CAD model consisting of more than 200 parts within less than 5 seconds using an Intel P4 3.6 GHz processor.

Combined with the latest version of the ACIS modeling toolkit and a fast 3-D OpenGL rendering engine developed in-house, arbitrarily complex CAD based configurations can be processed. A recent study performed with one of the major mobile handset manufacturers has demonstrated the tool's outstanding performance: A quad-band phone CAD (IGES) dataset was imported in less than 3 minutes and gridded within about 3 seconds (15 million voxels).

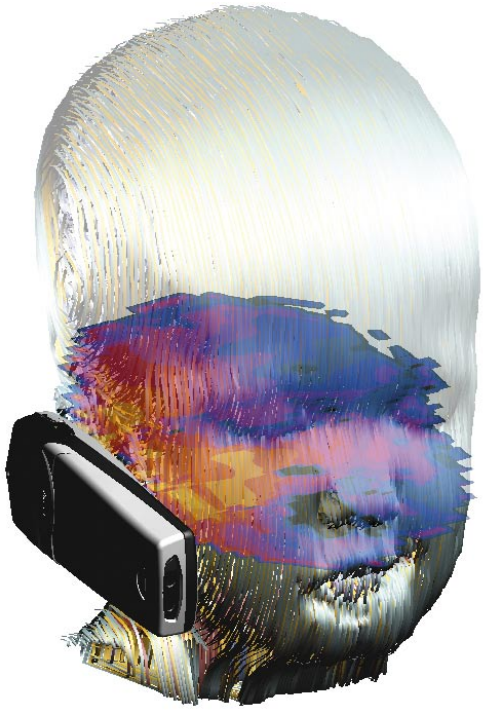
In a subsequent step, the custom 3-D conformal mesh generation algorithm was integrated into the SEMCAD-X platform, such that the surface triangle mesh of the entire CAD object could be discretized using available computer graphics methods, for example, the scan conversion algorithm. The optimized software was able to generate arbitrarily shaped locally conformal 3-D FDTD grids that were detailed, robust, versatile, and without any limitations in complexity. This grid required less than 30 seconds for the solution of a model with 25 million voxels to define a VHP-based full body anatomical model with more than 100 organs and tissues in the proximity of a mobile phone model that was developed from a CAD structure with more than 500 parts. In addition, this scheme has been extended to permit the discretization of thin surfaces, for example, the use of CAD or rendering data based on the 3D studio format for input of the device.

Furthermore, a set of conformal Yee schemes have been developed for dielectrics (averaging: arithmetic, harmonic; weights: line, area, volume) and PEC (contour path based) structures. These schemes have been combined with the mesh generation algorithm. The ability to use a conformal mesh with coarser spatial resolution that nonetheless produces the same accuracy as a fine staircasing mesh results in remarkable savings in memory requirements (fewer cells) and simulation time (larger time step). Investigations performed on curved PEC structures, which are very sensitive to spatial resolution, have demonstrated speed enhancements by a factor of 10 while maintaining or even improving the level of accuracy observed in the near- and far-field.

These new methods and implementations constitute a significant benefit and performance increase for applications in mobile communication and medicine. With them, CAD datasets from industrial environments can be imported and meshed in SEMCAD-X within a few minutes. At the same time, computation times for real-world configurations have been markedly reduced to the range of an hour.



MOBILE PHONE EXPOSURE OF CHILDREN VS ADULTS



Since the early 90s, our group has been working to establish the scientific and technical basis for the health risk assessment and compliance testing of cellular communications. Currently, every new mobile phone model must be tested before introduction to the market. Our research and tools have significantly contributed to the international guidelines for testing compliance with EMF safety regulations for transmitters operating in the vicinity of the body.

Measurement techniques based on a standarized homogenous phantom derived from a 90th percentile male head are well established for compliance testing and research. However, prominent authorities have questioned whether these techniques yield trustworthy results for RF energy absorption in children. For example, the International Expert Group on Mobile Phones in the UK predicted higher absorption in children due to higher tissue conductivity at young ages. Other studies claimed significantly higher exposures for children than adults as a result of a child's smaller head size. These findings were inconsistent with the results of our own research and appeared to be at odds with the generally accepted absorption mechanism in the near-field of antennas. In pursuit of a scientific resolution to the controversy, the IT'IS Foundation, in cooperation with the Center for Devices and Radiological Health of the US Food and Drug Administration (FDA) in Washington, DC, has revisited this issue within the CSCIENCE project. Four publications have resulted from these activities.

The first study was an extension of our previous research [Health Physics (1998) 74(2): 160–168]. Instead of examining dipoles held at fixed positions and distances from adult and child heads as in the earlier work, the new work evaluated exposures from three generic phone-like devices and a commercial mobile phone handset. The data gave no evidence for higher absorption in children [*Bioelectromagnetics* (2005) 26(2): 125-137].

In the second study, the FDA coordinated an international inter-laboratory comparison among fourteen laboratories, including those whose research showed enhanced absorption in adult heads scaled to represent child heads. The new approach, which was similar to the Schönborn [1998] study, compared the spatial peak SAR exposure of 14 different anatomical head models of adults and children to a common standard provided by the SAM phantom [Brian Beard et al., "Result of the protocol for the computational comparison of the SAM phantom to anatomically correct models of the human head", to be submitted]. In addition to the use of many different head phantoms, several handsets were tested [Wolfgang Kainz et al. "The specific anthropomorphic mannequin (SAM) compared to 14 anatomical head models using a novel definition for the mobile phone positioning", *Physics in Medicine and Biology*, submitted]. This study concluded that the SAM phantom yields a conservative exposure estimate for all heads considered, and particularly that there was no trend for higher RF absorption in the smaller phantom heads. The observed variations within the different anatomical models were clearly related to individual anatomical characteristics of the head, such as tissue distribution or pinna thickness, but not head size.

WHO requested a review of all aspects of the study, including discussions related to changes in tissue electrical properties during childhood [Andreas Christ and Niels Kuster, "Modelling of RF exposure in the heads of adults and children: Differences in energy absorption", *Bioelectromagnetics*, submitted]. Consistent with the two projects described above, this review concluded that the mechanism of RF energy absorption is applicable independent of head size for children and adults. However, there are remaining uncertainties about important parameters such as the distance between the head and phone, which is affected by the thickness and elasticity of the pinna (outer ear) and the dielectric parameters of tissue, which are subject to change during maturation from childhood to adulthood. Additional research efforts are needed to address both issues.

HUMAN STUDIES FOR RISK ASSESSMENT

Human studies provide important, relevant and reliable information for risk assessment without introducing the questions that can arise from interpretations of *in vitro* and *in vivo* studies. The following is a summary of the status of several key human studies based on expertise provided by the IT'IS Foundation.

Project SLEEP & EMF
Partner: Institute of Pharmacology and Toxicology, University of Zurich, Switzerland

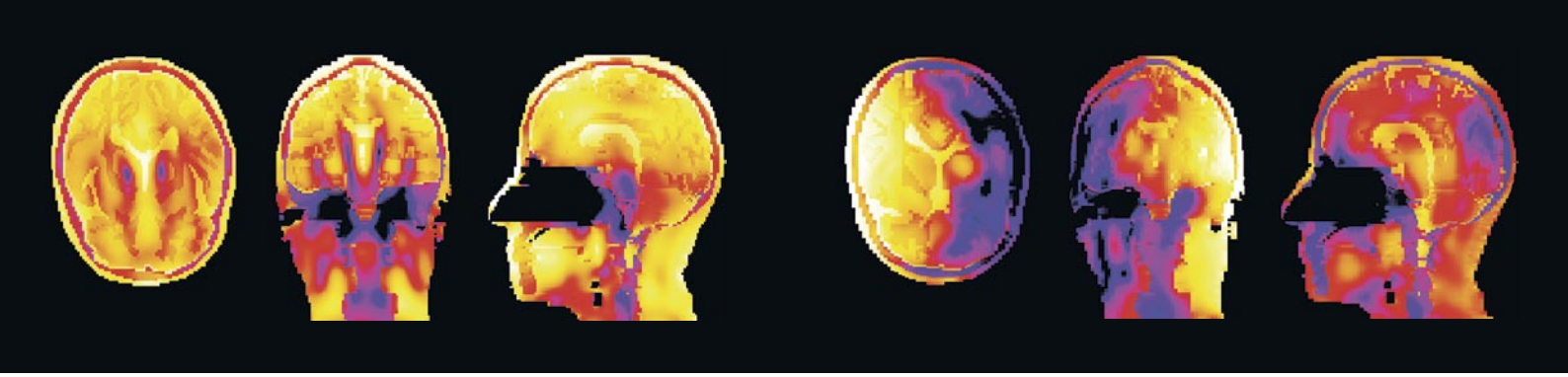
The first of five studies on the possible effects of modulated electromagnetic fields (EMF) was stimulated by previous reports of changes in brain rhythms recorded on electroencephalograms (EEG) made during sleep. The heads of 24 healthy, young subjects were exposed bilaterally on a schedule during which EMF were alternately turned on or off every 15 minutes throughout an entire nighttime sleep period. The EMF frequency and pulsed modulation pattern resembled a generic base-station GSM signal at 900 MHz. EMF amplitude was set to achieve a calculated peak spatial SAR (SAR_{ps}) of 1 W/kg in the subject's head. The principal finding was that EEG spectral power increased during non-rapid eye movement (non-REM) sleep, with maximum changes in the 10-11 Hz and 13.5-14 Hz bands. The changes, which appeared during the initial phase of sleep and then subsided, were small but comparable to those of benzodiazepines, other sedatives or experimental manipulations of sleep. The results demonstrate that EMF with pulse characteristics similar to those of mobile phones may promote sleep and modify sleep EEG [*Neurosci. Lett.* (1999) 275[3]: 207-210].

The second experiment investigated whether the effect differs between the right and left brain hemispheres and whether persistent changes could be found in post exposure EEG. 16 healthy, young right-handed men were exposed to the same signal and SAR_{ps} as in the first experiment, except that the exposures were unilateral and occurred only during the 30 minute awake period that preceded a three hour morning sleep episode. Right hemispheric, left hemispheric and sham exposures were made in three sessions of 30 minutes. Compared to sham exposure, which served as the control condition, EEG spectral power during non-REM sleep initially increased, with maximum effects in the 9.75-11.25 Hz and 12.5-13.25 Hz bands. Effects in each hemisphere were similar, demonstrating that there was no lateralization. Perhaps the most striking feature of this experiment was that exposures made while the subjects were awake modified EEG during subsequent sleep, for example, EMF-induced changes of brain rhythms persisted after the exposure period [*Neurosci. Lett.* (1999) 275[3]: 207-210]. These results strengthened the findings of the first study and added substantial new information on the nature of the phenomena.

The third experiment evaluated the modulation dependence of the sleep EEG effects in 16 healthy, young right-handed male volunteers. Each unilateral (left side only) 30 minute exposure was made prior to a nighttime sleep episode using one of three signals: a GSM "handset like" modulated signal at 900 MHz (SAR_{ps} of 1 W/kg); a CW signal at 900 MHz (SAR_{ps} of 1 W/kg); and sham. The modulated signal enhanced EEG power in the alpha frequency range prior to sleep onset and in the spindle frequency range during stage two sleep, whereas the non-modulated condition did not enhance power in the waking or sleep EEG. The results showed for the first time that pulse modulation is necessary to induce changes in waking and sleep EEG [J. Sleep Res. (2000) 11[4]:289–295].

The fourth experiment investigated EMF effects on the regional cerebral blood flow (rCBF) in a group of 12 healthy young men exposed to a "base station like" signal as applied in the first and second studies, a "handset like" signal as applied in the third study and sham. Positron emission tomography scans were taken after a 30 minute unilateral (left side) head exposure. An increase in relative rCBF in the dorsolateral prefrontal cortex on the side of exposure was observed only for the "handset like" exposure, whereas the "base station like" signal revealed no differences [J. Sleep Res. (2002) 11, 289–295; *European Journal of Neuroscience*, in press, 2005].

In the fifth study, we investigated the effect of the modulation on cognitive performance and waking EEG. 24



healthy male subjects were unilaterally exposed for 30 minutes to a pulse modulated, a continuous wave EMF or sham exposure, using a double-blind crossover design at a SAR_{ps} of 1 W/kg. During exposure, subjects performed three computerized cognitive tasks, each presented twice in a defined order. In addition to a baseline EEG, the waking EEG was recorded immediately after, and again 30 and 60 minutes following exposure. Analysis is in progress. Results are expected by the end of 2005.

The preceding five experiments were all conducted at the same time-averaged SAR_{ps} of 1 W/kg. In a sixth experiment, additional levels of 5 W/kg, 0.2 W/kg and sham were added to investigate dose dependence in a group of 16 healthy subjects exposed unilaterally (left side) to the "handset-like" signal used in the 3rd and 4th studies. Analysis is in progress. Results are expected before the end of 2005.

The startling outcome of this series of experiments is the consistency of effects on sleep EEG, even though the modulation, side of exposure, time sequence of exposure and EEG recording were varied. The observed EEG changes indicate a non-thermal effect similar in magnitude to chemically induced changes. In view of this, a detailed dosimetric analysis was conducted to provide exposure estimates for functional regions of the brain. The SAR distributions are shown above. The SAR in the left and right thalami were similar in all experiments [*Bioelectromagnetics* (2003) 24[4]:262-76].

Project PERFORM C

Partner: National Institute of Psychosocial Health, Karolinska Institute, Stockholm, Sweden

The objective of this project is to establish whether exposure to radiofrequency fields (RF) from mobile phone use during the day has an acute effect on: self-reported symptoms of headache, vertigo, skin irritation and sensations of heat; the cardiovascular system as reflected by blood pressure, heart rate and heart rate variability; sleepiness and performance; and subsequent night's sleep. Eighty subjects will be exposed for three hours prior to sleep to a GSM signal simulating a conversation at a time averaged SAR_{ps} of 1.4 W/kg. The skin temperature of the ear lobe will be artificially increased by approximately 2°C over each of the exposure sessions. EEG and heart rate will be monitored continuously throughout the night. At one hour after the start of exposure, and again at the end of exposure, subjects will be asked to report symptoms, have their blood pressure measured and blood samples drawn. Blood analyses will include serum levels of, for example, prolactin, thyroxine, growth hormone, and DHEAS. Cognitive tests of vigilance, simple reaction time, and spatial memory will be performed before and during exposure. Initial results are expected in 2006.

Project EMF & BRAIN - CBF/CBV

Partner: Biomedical Optics Research Laboratory, Clinic for Neonatology, University Hospital Zurich, Switzerland

This study was triggered by the results of experiment 4 of the project SLEEP & EMF on cerebral blood flow. Changes in cerebral blood flow (CBF) as well as cerebral blood volume (CBV) during EMF exposure will be studied with the relatively new technique of Near-InfraRed Spectrophotometry (NIRS). Unlike PET, NIRS has the advantage of showing real-time information with a resolution of 0.25s for CBF and CBV. The proposed experiments will explore the immediate effects of GSM-modulated versus CW signals on CBF/CBV at different exposure levels. Initial results of this study are expected in the second half of 2005.

Project TNO Verification and Follow-Up

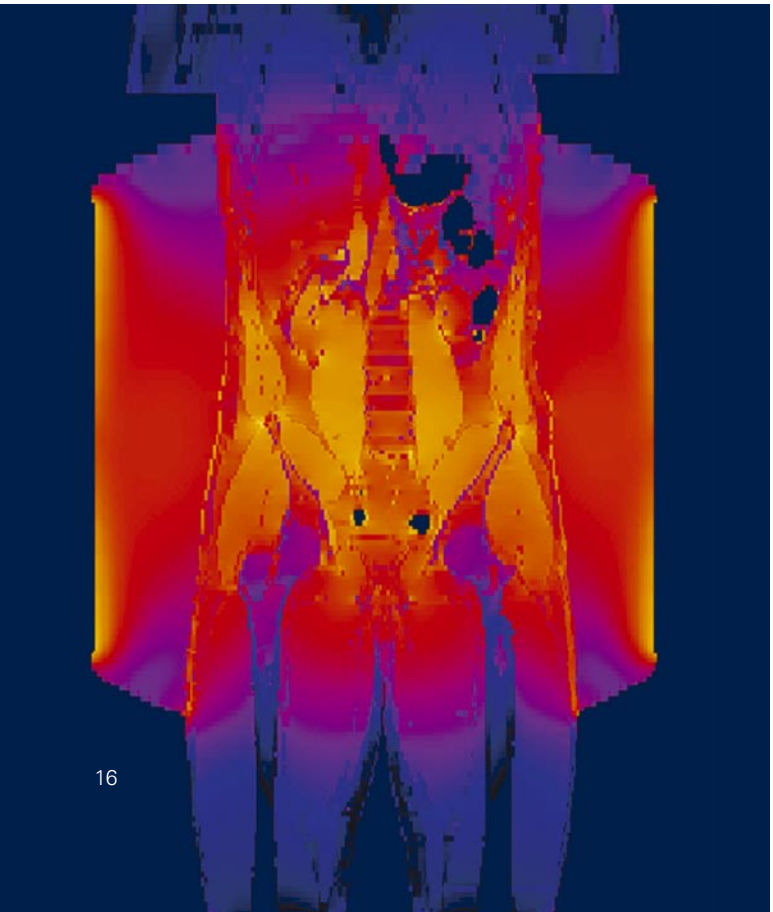
Partners: Institute of Pharmacology and Toxicology, University of Zurich, Switzerland; Department of Social and Preventive Medicine, University of Bern, Switzerland

This study will be conducted to verify results reported from a study recently completed in the Netherlands [Zwamborn APN, et al. (2003) TNO- report: FEL-03-C148, September]. The study will replicate the UMTS field condition of the TNO study (1 V/m) and add a third condition of 10 V/m. Results will be available by the end of 2005.

HYPERTHERMIA

With increased tissue temperature above 40°C, cancer cells are killed more readily by standard therapies using radioactivity and cytotoxic drugs, especially under conditions of reduced oxygen (hypoxia) and low pH. RF energy provides an effective way to produce tissue hyperthermia as a complement to standard therapies. Clinical studies have shown that the combination of hyperthermia and radiotherapy sharply increases survival rates for patients with a variety of cancer types. Deep regional hyperthermia created with electromagnetic (EM) radiation can be used to treat pelvic tumors by heating them with an antenna array surrounding the patient's torso. In the case of cervical cancer, the three-year overall survival rate can be almost doubled. Despite these impressive clinical statistics, hyperthermia has not yet gained widespread popularity among oncologists. The main reason is the difficulty of producing precisely controlled tissue hyperthermia under clinical conditions.

Today's systems are costly yet very rudimentary, and they require highly experienced, skilled personnel. The absence of reliable clinical methods for accurate prediction of the temperature distribution forces a trial-and-error approach designed to avoid temperatures too low to be effective or above the pain threshold. Therefore, the full range of potential patient benefits from hyperthermia in everyday clinical practice requires a patient based treatment tool combined with appropriate RF applicators.



Phase I of the new IT'IS Hyperthermia project will see the development of the software that will be the basis for effective treatment planning. The first of the four main software tasks is the transformation of patient-specific medical imaging data into a format suitable for numerical EM and thermal models based on the patient's anatomy and tumor location. The second is simulation of the EM field distribution generated by the custom antenna array that serves as the EM applicator. Third is the prediction of the resulting temperature increase in the various tissues. The final task is the optimization of applicator arrangement and excitation to achieve maximum effectiveness.

A number of issues will be critically important for the hyperthermia tool to prove practical in clinical settings and gain wide acceptance. Of these, perhaps most important is the extent of user involvement required for tissue/organ segmentation. Despite the power of modern computers, significant constraints are imposed by limits to computational resources and by the complexity of defining parameters for indiviual tissues as well as for the whole simulation model. The task is made more difficult by the necessary inclusion of thermoregulatory mechanisms and heat exchange models at the tissue level. Furthermore, calculation times need to be kept reasonable while achieving medically acceptable accuracy and precision.

The Hyperthermia project research is carried out with the close cooperation of oncology groups at the Canton Hospital La-Chaux-de-Fonds and the Erasmus Medical Center in Rotterdam. Our goal for 2005 includes enlarging the network of collaborating scientists involved in the project. IT'IS is currently working toward achieving the flexibility and ease of use that will make the final tool not only a major advancement over existing technology, but also the means to introduce innovative hyperthermia applicators for tumor location and treatment.

SERVICES

Antenna Design
The IT'IS Foundation provides a complete range of services ranging from antenna designs created by our team of experienced designers to detailed evaluations of RF safety compliance and immunity to EMI. We also consult on standards and homologation rules including revising technical requirements, assessing regulation procedures and evaluating impending standards.
We maintain an RF measurement laboratory and the latest tools for analysis and simulation: DASY4 and SEMCAD-X. Our core areas of competence are on-body and in-body wireless communications.

Compliance Testing
The IT'IS Foundation conducts compliance testing for RF applications to satisfy all national and international EMF safety guidelines. IT'IS is regarded worldwide as the leading, truly independent institute for dosimetric evaluations. We are a pacesetter for near-field analysis tools and at the forefront in developing the most accurate and suitable testing procedures. In 2005 the Foundation expects to obtain Class C accreditation for testing compliance with safety limits, which will enable us to develop new methodologies beyond the current test protocols specified in standards for evaluation of devices employing RF energy.

Safety White Paper
The IT'IS Foundation plays a leading role in worldwide research supporting health risk assessment and participates in commissions developing EMF safety guidelines. In recognition of these prominent contributions, IT'IS responds to requests from international organizations, industry and governments to draft safety white papers for existing and future technologies, as well as the devices needed for their implementation. For example, the IT'IS Foundation's support for risk evaluations may include EMF risk analysis, as well as predictions of worst-case exposure and worst-case temperature increase.

EMF Workshops
We organize customized workshops on EMF-related issues of current interest in cooperation with national and international partners. The workshops give stakeholders from branches of research, industry and government valuable opportunities for the exchange of information among a selected group of peers.

INFRASTRUCTURE

Dosimetric, Near-Field and EMC/EMI Facilities

Semi-Anechoic Chamber
This shielded, rectangular chamber has the dimensions 7m x 5m x 2.9m (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 DASY4professional 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, etc.

Reverberation Chamber
This is a shielded, rectangular chamber with the dimensions 4m x 3m x 2.9m (L x W x H) equipped with mechanical stirrers. The chamber provides a controlled and consistent environment 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 2005 through METAS for all types of dosimetric evaluations.

Technical Equipment and Instrumentation

Spectrum and Network Analyzers
1 Rhode & Schwarz FSP, Spectrum Analyzer 9kHz – 30GHz
1 HP 8753E, Network Analyzer 30kHz – 6GHz
1 HP APC 85033B, Calibration Kit

Signal Generators and Testers
1 Agilent E4433B, Signal Generator, 4 GHz
2 Agilent E8251A, Signal Generator, 250KHz – 20GHz
1 Rhode & Schwarz SMT06, Signal Generator
6 Rhode & Schwarz SMIQ02B, Signal Generator
1 Rhode & Schwarz SML03, Signal Generator
3 Rhode & Schwarz SML02, Signal Generator
1 Rhode & Schwarz SMY02, Signal Generator
1 HP 8647A, Signal Generator 250kHz – 1000MHz
1 Agilent 33250A, Waveform Generator
8 Agilent 33120A, Waveform Generator
1 Rhode & Schwarz CTS55, Digital Radio Tester

DASY and EASY4
1 SPEAG DASY4professional
2 SPEAG DASY3mini
4 SPEAG EASY4
2 SPEAG DAE3, Data Acquisition Electronics
1 SPEAG DAE3mini, Data Acquisition Electronics
2 SPEAG TGLA, Temperature Probe
1 SPEAG TSIL, Temperature Probe
5 SPEAG T1V3LA, Temperature Probe
2 SPEAG H3DV5, H-Field Probe
1 SPEAG H3DV6, H-Field Probe
1 SPEAG HV2D, H-Field Probe
1 SPEAG EX3DV3, E-Field Probe
2 SPEAG EE3DV1, E-Field Probes
1 SPEAG ER3DV4, E-Field Probe
1 SPEAG ER3DV6, E-Field Probe
1 SPEAG EF3DP6, E-Field Probe
1 SPEAG ES3DV2, E-Field Probe
1 SPEAG ET3DV4, E-Field Probe
1 SPEAG ET3DV4R, E-Field Probe
1 SPEAG ET3DV5R, E-Field Probe
1 SPEAG ET3DV6R, E-Field Probe
2 SPEAG ET3DV6, E-Field Probe
1 SPEAG ET1DV1, E-Field Probe
2 SPEAG ET1DV2, E-Field Probe

Meters
1 Agilent E4419B, 3 HP 8482A, Power Meter
3 HP 436A, 3 HP 8481A, Power Meter
7 Agilent 34970A, Data Acquisition Unit
1 Magnet Physik FH49-7030, Gauss/Teslameter

Amplifiers
3 LS Elektronik 2450, Amplifier, 400W/900MHz
5 LS Elektronik 2449, Amplifier, 200W/900MHz
2 LS Elektronik 2448, Amplifier, 60W/900MHz
1 LS Elektronik 2453, Amplifier, 400W/1800MHz
3 LS Elektronik 2452, Amplifier, 200W/1800MHz
1 LS Elektronik 2451, Amplifier, 60W/1800MHz
1 LS Elektronik 2447, Amplifier, 5W/1800MHz
1 Amplifier Research 10S1G4A, Amplifier 800MHz – 4.2GHz
2 Kalmus 717FC, RF Power Controller 200MHz – 1000MHz
1 Nucletudes ALP336, Amplifier 1.5GHz – 2.5GHz

Other Equipment
1 System Validation Dipole D5GhzV2
1 System Validation Dipole D2450V2
1 Narda H2304/101 Exposure Level Tester 1Hz – 400KHz
8 Maury 1878B, 3-Step Tuner
1 Siemens, Universale Messleitung (0.5) 1GHz – 13GHz
2 SPEAG Dipole SCC34 Benchmark
1 SPEAG D900V2, Dipole 900MHz
1 SPEAG D1800V2, Dipole 1800MHz
8 Various Antennas
1 Tektronik 2235, Oscilloscope
1 Heraeus BB6620, Incubator

Computers
4 UNIX Solaris 5.6/5.8: 1 Sun Blade 100, 1 Dual 450MHz/4GB, 2 Sun Ultra Sparc2
16 MacOS X: 2 PowerMac G5, 2 PowerMac G4, 1 eMac G4, 2 iMac G4, 7 PowerBook G4, 1 iBook, 1 PowerMac G3
24 WinNT/Win2k/WinXP: 2 Dell OptiPlex GX110, 2 Dell OptiPlex GX100, 1 Compaq EVO, 1 Dell Dimension 4300 P4 1.5GHz 1GB, 6 Dell Dimension 8200 P4 1-3GHz 1-4GB, 3 Dell Dimension 8250 P4 1-3.4GHz 1-4GB, 4 Dell Dimension 8300 P4 2.6-3GHz 1-2GB, 1 Dell Dimension 8400 P4 3.2GHz 1GB, 1 Dell Inspirion P4 2.5GHz 500MB, 1 IBM Notebook PM 240MHz 500MB, 2 HP Vectra vl420MT P4 1.5GHz
1 LINUX: Dual P4 4GB

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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 is a non-profit tax-exempt research foundation.

Mission
Evaluation of the safety and risks related to current and emerging information technologies. Exploration of information technologies for medical, diagnostic and health support systems.
Improvement of the accessibility of information technologies for all members of society including disabled persons.

Commitment
We are committed to the advancement of science for the benefit of society at large while maintaining strict independence from any particular interest groups. We strive for open dissemination of research results and the education and professional growth of young scientists.

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

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