

Nearly 30 years of magnetic resonance tomography at Siemens Medical Solutions

From red bell pepper to a look inside the human brain

The first experiments in magnetic resonance tomography were started 28 years ago at Siemens. Much has happened since the first acquisitions of a red bell pepper and the introduction of the first T-class systems. Images are generated from the inside of the human body through a magnetic field alone – without ionizing radiation. Innovations by Siemens continuously improved patient-friendliness and efficiency. Today, neurologists, psychologists, and neurosurgeons can use functional magnetic resonance imaging (fMRI) to see exactly what is going on in the brain and where. The virtual flight through the human intestines is as feasible as targeted cancer diagnosis. Using Tim technology, Magnetom Avanto enables high-resolution single-session whole body acquisitions of patients as tall as 205 centimeters. The new T-class MR generation also enables acquisitions with continuous table move.

At the end of 1978, the first magnet was installed in a wooden hut on a tract of land belonging to the Siemens research lab in Erlangen, Germany. The absence of iron was (and still is) very important, because magnetic field interferences caused by ferromagnetic parts in the environment have to be strictly avoided in MRT technology. But there were additional challenges to be mastered by the researchers. The inhomogeneities of the magnetic field had to be compensated

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for plus occasional power outages delayed the first image acquisition. Also at night, signals from an Australian radio station or interfering signals from other radio services were received in place of MR signals because the frequencies of MR systems lie within radio wave frequencies.

After the system was ready for operation in 1979, a red pepper provided the first MR images. "A red pepper is of decent size with lots of structures in it and does not move during longer measurement times," says Siemens physicist, Arnulf Oppelt, explaining this decision. The first head exam requiring an acquisition time of 8 minutes followed in March 1980.

The first clinical MRT by Siemens was installed in Germany in 1983 at the Medizinische Hochschule Hannover (Medical College of Hannover). Professor Heinz Hundeshagen and his colleague examined more than 800 patients with the oil-cooled 0.2 Tesla magnet. At that time, a complete examination took up to one and a half hours. In the same year, the first installation of a superconducting magnet took place at the Mallinckrodt Institute in St. Louis, USA.

The development of superconducting magnets increased the speed of image acquisitions as well as simplified installation and considerably improved image quality. But there was the matter of weight. The first superconducting magnets weighed up to 8 tons and were 2.55 m long. Plus they were accompanied by twelve cabinets full of electronics to control the system and to reconstruct the data into images. Approximately 80 square meters were required for installing a complete system. Today, the 1.5 Tesla Magnetom Avanto system by Siemens requires less than 30 square meters together with its two processor cabinets.

In 1993 Siemens was the first manufacturer who marketed a magnetic resonance system open along the side, the Magnetom Open, especially suitable for

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claustrophobic patients. In 2003, the company introduced Tim technology (Total imaging matrix). Tim enables for the first time whole-body imaging including excellent image quality in a single session. The previously required time-consuming changing of body coils and repositioning of patients are now a thing of the past.

Today neurologists, psychologists and neurosurgeons gain new insights into the functional and metabolic events of the brain with the help of functional magnetic resonance tomography (fMRT). The so-called BOLD effect (Blood Oxygen Level Dependent) is used to gain information about the functions of various brain areas. This may lead to new rehabilitation therapies for stroke patients: MR images are able to show to what degree healthy brain areas take over the functions of dead areas. In the ultra-high field arena, Siemens markets the 3 Tesla Magnetom Trio system for examinations from head to toe.

The system providing the most space for patients is the Magnetom Espree, the first 1.5 Tesla open-bore MR system that measures not more than 125 cm in length. And in cardiology, MRT is breaking new ground as well. Using the so-called self-gated CMR technology (Cardiovascular Magnetic Resonance, CMR), a periodic signal is extracted from the image data. It is used in place of the conventional electrocardiogram (ECG) to synchronize the image data with cardiac motion. The patient does not need cables or electrodes.

In 2006, new MRs of the T-class with syngo TimCT (Continuous Table move) revolutionized the MR world by replacing step-by-step measurements. The T-class makes it possible to move the patient continuously through the magnet. A single acquisition provides a seamless patient image. For example, a pelvis/leg angiography previously performed step-by-step is now reduced to half the number of work steps by using TimCT. This not only saves time, it also reduces costs while it improves diagnostic certainty. At the same time, TimCT improves

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image quality as well, because the body region to be examined is located in the magnet isocenter where measurement results reach the highest of quality.

The continuous development of MRT opens additional new applications: a virtual flight through the human intestines will, for example, show even small polyps. If these are removed in a timely manner, the onset of colon cancer can be prevented with a high level of probability.

Today, 28 years after the first beginnings of magnetic resonance tomography, physicians and researchers possess a tool that helps them to quickly and thoroughly examine bodily functions in a patient-sparing manner.

Images for this press release are available under

<http://www.siemens.com/med-pictures/25JahreMR>

<http://www.siemens.com/med-pictures/Tim-Avanto>

<http://www.siemens.com/med-pictures/Tim-Trio>

<http://www.siemens.com/med-pictures/espreo>

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