



Insight – into brain function





Mapping for functional insight and improved surgical outcomes

Elekta Neuromag® delivers real-time mapping of brain activity by non-invasively measuring the magnetic fields produced by the brain. Using magnetoencephalography (MEG), Elekta Neuromag® safely provides both clinicians and researchers with 3-D mapping of brain activity.



MEG is presently regarded as the most efficient method for tracking brain activity in real time for many reasons. Compared to EEG, MEG has unique sensitivity to epileptic activity.¹⁾

MEG also offers functional mapping information and measurement of brain activity in real time, unlike Computer Tomography (CT) and Magnetic Resonance Imaging (MRI and fMRI) which only provide structural, anatomical and metabolic information. With MEG the brain is seen “in action” rather than viewed as a still image. Last, and most important is MEG’s far-superior ability to resolve millisecond temporal activity associated with the processing of information – the main task of the brain.

¹⁾Journal of Clinical Neuroscience (2003) 10(2), 236-238, “Focal magnetoencephalographic spikes in the superior temporal plane undetected by scalp EEG”, by Masaki Iwasaki et. al.

MEG measures the magnetic field produced by the brain and localizes the brain activity with no need to invasively enter the body. The result is a functional image of brain impulse pathways which answers questions such as:

- What activity is the brain producing and where is it coming from?
- Which parts of the brain undertake various tasks?
- How does the brain function, both normally and in cases of illness?

MEG offers a unique combination of both fine-spatial and fine-temporal resolution with millimeter and sub-millisecond accuracy.

Elekta Neuromag® users can pinpoint brief spontaneous events as well as the sources of evoked responses from brain areas responsible for somatosensory, auditory, visual, and language processing.

The highest, lowest, longest and densest

Elekta Neuromag® represents a new standard for combined MEG/EEG devices offering the densest sensor array, highest amount of neuromagnetic information per sample, highest sampling rate, lowest system noise and longest cryogenic refill interval.

Elekta Neuromag® also performs

measurements differently from other MEG products. The unique sensor design combined with our advanced software makes it possible to gain data with unsurpassed details even from the deepest realms of the brain. The system also has the highest available immunity to magnetic interference, either patient related or external. The patient helmet array provides field distribution sampling at 510 distinct positions, with sensors configured into a total of 306 independent channels.

A pioneering tradition and global presence

Elekta leads the development of disease-specific treatments with unique competencies in neurosurgery, stereotaxy and precision radiation delivery. Our history of instrumentation and software development within MEG spans 20 years and five system generations – from early prototypes to today’s multi-channel systems covering the entire head. Perhaps the most convincing recommendation for the quality of our offering is the fact that more than 50% of all published articles relating to MEG cite the use of Elekta Neuromag® equipment. The breadth and strength of our offering is reflected in our global installed base: we provide turnkey installations with comprehensive service and education as well as helpful financing options.

Creating new procedures for clinicians and researchers

Around the world, specialists are developing clinical MEG routines. The list of new applications is growing daily and includes pre-surgical mapping for neurosurgery as well as MEG-MRI integration to enhance accuracy of surgical navigation and planning of radiation therapy.

For patients with drug-resistant focal epilepsy, surgery is an increasingly common alternative and MEG is proving useful in research programs for locating epileptogenic areas in relation to functionally important cortical regions.

On-going research and development in other areas include cerebrovascular disease and mild brain trauma; psychiatric disorders, such as schizophrenia and depression; learning disorders, such as dyslexia; as well as normal cognitive functions underlying memory and language.

Patient comfort

Elekta Neuromag® is the most viable patient-handling system available. The system is compact and easy to situate on the premises, and the versatile design makes the unit flexible and easy to use. The design also allows for both supine and sitting positions optimizing patient comfort and handling. A mobile patient bed with an adjustable upper level and a mobile patient chair are also included

with a pediatric chair available as an option.

The unit is provided with adult- and child-sized EEG caps with additional cap sizes available as options.



An examination flows like this

1. The actual scanning process can take as little as a few minutes or up to several hours depending on the procedure.

Three to five small coils are attached on the patient's head. These coils form a coordinate system that helps synthesize the combined MEG and MRI data.

2. Location of the coils with respect to anatomical landmarks on the head are determined with a 3-dimensional digitizer to allow alignment of the MEG coordinates with the anatomy provided by separate MRI images. During the measurement the marker coils are employed to continuously follow the head position.

3. The brain activity, spontaneous or evoked in response to various types of stimuli, is recorded with good on-line control on the quality of the recorded data.

4. To complete the examination, the MEG data is analyzed by software and the resulting knowledge of the spatial distribution of brain activity is combined with the MRI image.



- Densest sensor array: 306 MEG channels
- Lowest system noise
- Highest yield of information per sample

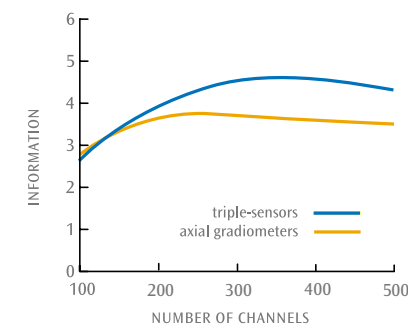
- Highest sampling rate: up to 10 kHz
- Longest liquid helium refill interval: one week
- Both gradiometers and magnetometers



A mobile patient bed with an adjustable upper level and a mobile patient chair are also included with a pediatric chair available as an option.

The ultimate in sensitivity

The Eleka Neuromag® sensor array provides optimal performance in neuromagnetic studies. This is due to the ingenious geometry of the triple-sensor element. The design, comprising two planar gradiometers orthogonal to each other and a magnetometer, enables a very dense spatial sampling of the magnetic flux. Three partially overlapping pick-up coils, provide three orthogonal, independent channels of information. This allows you to increase the total number of channels to 300 without sacrificing the noise performance of the individual channels.



This graph compares the amount of neuromagnetic information sampled vs. the number of channels in two types of sensor arrays. The triple sensor array collects about 20 % more information with a optimal array of 300 to 400 channels. This is due to the orthogonality of the channels and the large pick-up area. In other MEG systems using only axial sensor arrays, the amount of information sampled does not grow after about 200 channels. With this type of design the increasing of the channel count leads

to decreased sensor size and decreased sensitivity of the individual sensors.

Sensor elements consist of two orthogonal planar gradiometers and one magnetometer coupled to a multi-SQUID (Superconducting QUANTUM Interference Device) to provide three independent measurements of the magnetic fields. During measurement, the SQUIDs amplify the extremely weak magnetic fields of the brain and transform them into signals. The encapsulated sensors are immersed in liquid helium and positioned about three to four cm from the cortex and feature the lowest inherent noise in the industry.

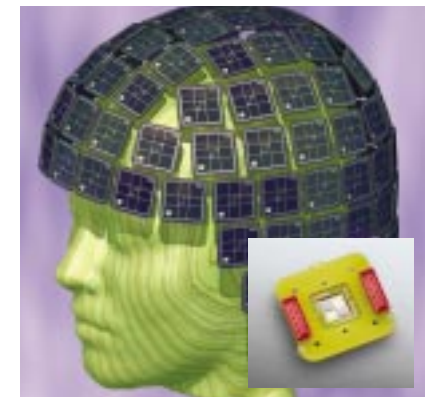
Eleka Neuromag® optimally combines the focal sensitivity of the planar gradiometers and the more widespread sensitivity of the magnetometers, making the system ideal for studies of both local and spontaneous activity and of the deepest brain structures, without compromise.

Minimal noise for maximal comfort

Our low-noise gradiometers and magnetometers – with outstanding interference compensation by on-line Signal Space Projection (SSP) and Signal Space Separation (SSS) – shorten measurement times and improve both patient comfort and diagnostic output.

Affordable, convenient and safe cryogenics

Consumption of liquid helium for cryogenic cooling is minimized in both measurement positions to reduce operating costs. Low boil-off rate provides a long refill interval of seven days. A safety exhaust line ensures patient protection.

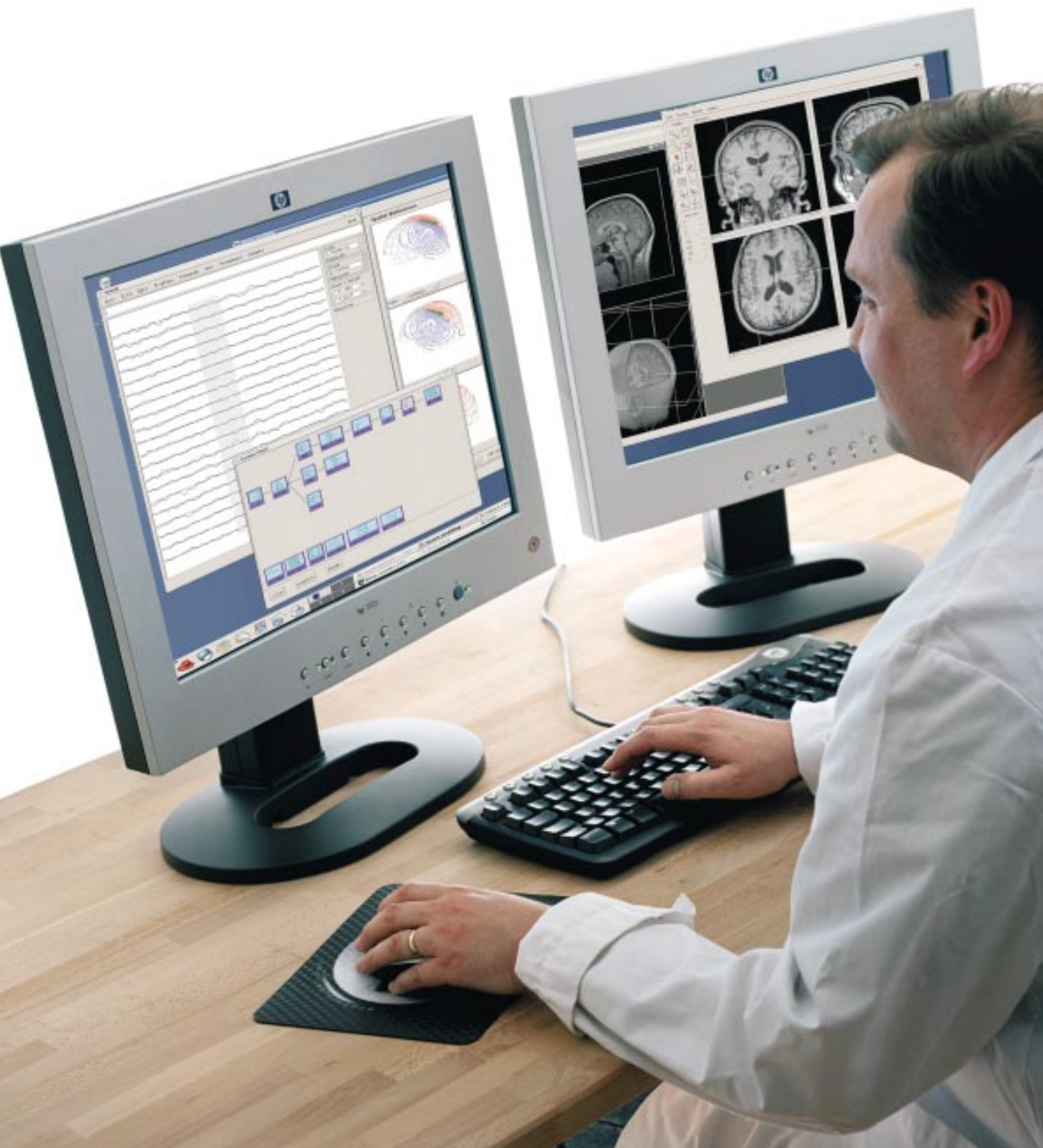


The detector array of the Eleka Neuromag® system comprises triple-sensor elements that are evenly distributed over the entire head. The size and extent of the detector array ensure that activities from even the most peripheral areas, such as frontal and temporal lobes and the cerebellum can be acquired with high precision.



EEG caps:

- 64 channels. 124-channel cap available as an option
- Non-magnetic
- Easy and fast to attach
- Standard sizes: S, L
- XL and multiple small sizes available as options



Unique software – from clinical routines to the most demanding brain research

The combined advantages of Elekta Neuromag® software are redefining MEG and the clinical potential it represents. The software provides extensive capabilities for data acquisition and processing, source modeling and anatomic visualization as well as DICOM 3.0-based image transfer and retrieval for full compatibility with other systems.

Optimize your crucial data acquisition

All channels are sampled simultaneously. The acquisition system features a high dynamic range and versatile on-line averaging and monitoring capabilities.

Optimize the data presentation

The powerful “data plotting” display tool for one or more evoked MEG/EEG data sets includes statistical analysis and mathematical operations.

Acquired data preserving the spatial arrangement of the sensors is configured to locate the prominent source areas at a glance, and to analyze the temporal characteristics of the respective signal waveforms. User-defined layouts are available for EEG data and multiple data sets can be overlaid to compare the responses of the various conditions used in an experiment.

Analyze continuous data

The customizable software can supply you with spontaneous MEG/EEG data in “strip-chart-recorder” displays. A

large library of user-selectable signal processing functions is available that can be configured either through a graphical user interface or via a built-in programming language.

Rapid response on source estimates

Elekta Neuromag® software supports single- and multiple-dipole source location, including noise estimates, confidence limit calculations, principal component analysis (PCA), and signal space projection methods (SSP).

Spherically symmetric and boundary element conductor models are also supported. This module is designed for direct interaction with fast response times so that new estimates

are computed without delay when modeling parameters are changed. Thus, several alternative source configurations can be quickly investigated.

Proprietary SSS method: a revolution in MEG signal analysis

The Signal Space Separation™ (SSS) method enables resolution of the diagnostically valuable biomagnetic signal from magnetic interference. Even the most intricate cases, such as sources of magnetic interference on the subject’s head, can be handled.

To properly function, the method requires accurately calibrated, high-precision thin-film sensors. The SSS method is not available from other vendors.

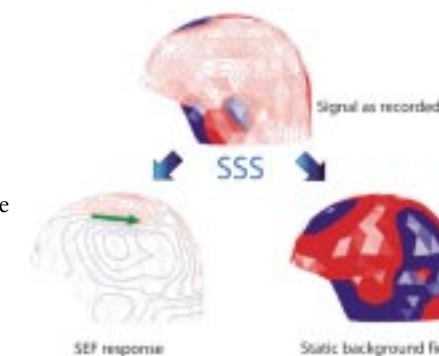
Additional software benefits:

MRI Integration – Simultaneously displays three orthogonal cross-sections. Source locations can be overlaid on the slices.

Segmentation of MRI Images – 2D and 3D image processing operations help extract various anatomical structures. Results can be stored as voxel volumes or triangular meshes enclosing the segmented objects.

3D Surface rendering – Visualizes segmented volumes. Source locations can be displayed on the 3D rendered images.

Report Composer – Output from other graphic modules can be easily dragged and dropped into new reports.



The SSS method separates all forms of magnetic interference and compensates for head movements.

Dual screens allow simultaneous display of e.g. raw data and on-line averaged data during data acquisition.

A lifetime commitment to continuous improvement

Elekta Lifecycle Services is more than just an after-sales service and support program. It is a commitment to optimizing the entire continuum of care, from improving clinical effectiveness, through ensuring staff competence and smoothing patient flow.

To ensure confidence in the use of your new equipment Elekta offers educational training programs worldwide. These training programs are designed to be adapted to specialized customer needs, from basic research to advanced clinical applications.

Training programs are divided into two parts, the first of which takes place at an Elekta Neuromag® training center. The second session is arranged at the customer site after the final installation and acceptance of equipment. Both sessions consist of lectures as well as practical hands-on experience.

Designing your site

To guarantee clinical utility and diagnostic quality, Elekta Neuromag® is installed in a magnetically shielded room

which sufficiently decouples the system from external magnetic interference.

Elekta can help with the planning and construction efforts by providing referenced contacts to several companies around the world that specialize in constructing spaces for MEG and similar equipment. Optionally, a turn-key delivery is available.

Personal contact meets tech-skills: Top marks in Service & Support

Elekta's service and support organization is available around the world. That means you can always call the local Elekta representative for help.

Our package of Service & Support programs offer various levels of customized support and maintenance to minimize costs and maximize the safety and availability of the Elekta Neuromag® unit. Service packages include everything from basic maintenance and supply of spare parts, to planned maintenance, upgrades, support and clinical information.



Elekta Lifecycle Services provides comprehensive service and education as well as financing options.

Fighting serious disease

www.elekta.com

Stereotactic Neurosurgery • Gamma Knife® surgery • Functional Mapping • Precision Radiation Therapy • Image Guided Radiation Therapy • Stereotactic Radiation Therapy

Corporate Head Office
Stockholm, Sweden
Tel +46 8 587 254 00
Fax +46 8 587 255 00
info@elekta.com

Worldwide Product
Support Center
Tel +358 9 756 2400
Fax +358 9 756 24011
neuromag@elekta.com

North America
Atlanta, USA
Tel +1 770 300 9725
Fax +1 770 448 6338
info.america@elekta.com

Europe, South America,
Africa & the Middle East
Tel +44 1293 654068
Fax +44 1293 654655
info.europe@elekta.com

Japan
Kobe, Japan
Tel +81 78 241 7100
Fax +81 78 271 7823
info.japan@elekta.com

Asia
Hong Kong, China
Tel +852 2891 2208
Fax +852 2575 7133
info.asia@elekta.com