VISOR2™

TMS Navigation System

Transcranial magnetic stimulation allows performing painless focused stimulation of various brain regions. Specialist performing TMS can consider what brain region is stimulated only having sufficient knowledge of brain anatomy and the shape of magnetic field induced by a coil. Nevertheless, the stimulation remains "blind". Visor2™ TMS navigation system provides the opportunity to **see** the stimulated brain region.

Neurosoft
Medical diagnostic equipment

System Components

Set of IR Cameras

Infrared cameras connected to PC track positions of special fiducial markers with up to 0.25 mm accuracy.

Coil Tracker

Tracker is attached to the coil and allows camera to define the coil position and orientation at any moment.

Head Bandage with Special Tracker

The tracker lets the system to know current position and orientation of patient's head.

EMG Amplifier

EMG amplifier allows system to acquire muscle evoked response to magnetic stimulus.

Specialized Software

The software performs all necessary calculations and displays on the screen the real-time composite image of 3D brain map combined with depth, location, and shape of the magnetic field in relation to the subject's brain.

Personal Computer

Neuro-MS/D magnetic stimulator

Visor2 navigation system works with **Neuro-MS/D** magnetic stimulator. Stimulator is connected to the system through trigger input, so it can "inform" the system when a user send stimulus to coil. At that moment the system starts EMG acquisition (if EMG system is connected) and marks the stimulated point on 3D brain map on the screen.

## Stands and Trolleys for System Positioning in Laboratory

* EEG system, electrode system and patient chair are not the elements of **Visor2** navigation system and are supplied separately

Patient preparation*

Stimulation with simultaneous EEG acquisition*

Operating Principles

The system works the following way:

1. Input of patient's MRI to the system. MRI makes the navigation more precise. If you have no patient's MRI, the system performs calculations basing on simplified models.

2. Construction of 3D brain map. The 3D brain map is also constructed basing on patient's MRI and is displayed on the screen. Software interface allows turning the map around any axis, zooming it in and out etc.

3. Patient preparation. The head bandage with tracker is placed on the patient's head. Then the researcher using the special pointer and following the software recommendations touches certain points on patient's head: earlobes, nasal bridge, mastoid bones etc. Cameras at each pointer touch "see" where its tip is located in relation to head sensor positioned earlier. This procedure helps to "tie" 3D brain model and the system. When the "tying" procedure is finished, the system will always know about head position and orientation including coordinates of each cerebral gyri. This process is similar to orientation by geographic map. In the beginning of the process you are not tied to map. Then you start to search for references: street names, numbers of houses, bridges. Finally you find yourself on the map and know how to turn the map for further orientation.

4. Coil is "tied" to the system the same way.

5. At this step system "knows" where the patient's head and coil are, and what their orientation in relation to each other is. At that the system displays not only 3D brain map, but also coil image and vector showing the direction of its magnetic field. So, you can **see** the stimulated brain area and can change it moving the coil. The picture is changing in a real-time mode.

6. Several minutes are spent to learn how to move coil, watching on the screen, and position it directing magnetic field properly.

7. Finally you can "see" the stimulated brain area. Press "Stimulus" button located on the coil. At that you are completely sure that you stimulate the preselected point. This is neuronavigated TMS! If you perform the previous steps carefully, the accuracy can reach 0.25 mm.

8. If the EMG amplifier is connected to the system and electrodes are positioned on the patient, the system will be also informed if the stimulation of certain brain area evokes tension of muscle monitored by electrodes. Using this technique you can find brain areas responsible for certain muscles. This procedure is known as "mapping".
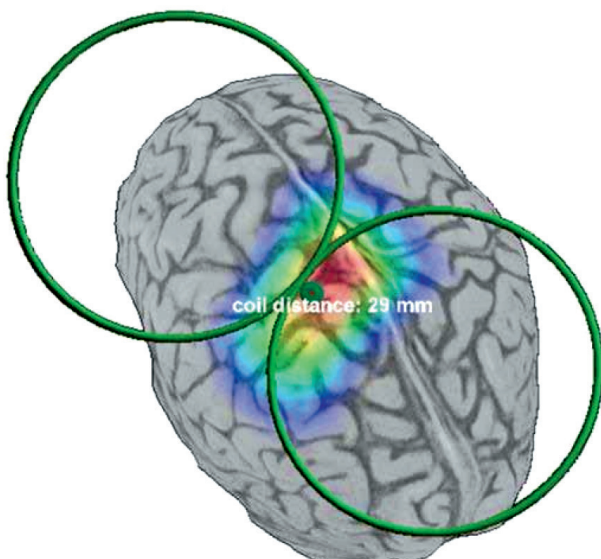
Combined image of brain map and coil model
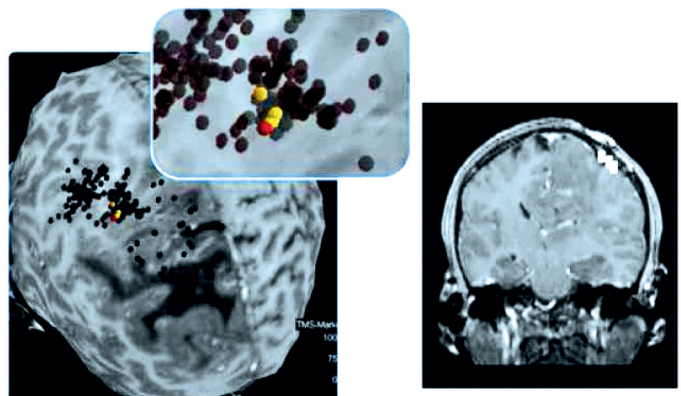
Example of screen image at mapping: search of brain area responsible for the work of certain muscle. Grey points of stimulated area did not produce response to stimulus; color points – produced response to stimulus

Practical Application of TMS Navigation System

For researches:
- in studies of magnetic stimulation influence on various brain areas;
- in studies of brain's plasticity.

In practical medicine:
- for the performing of rTMS treatment with high accuracy localization of stimulation area;
- for the mapping of motor brain areas at tumors (tumor can displace the motor area by a distance of up to several centimeters; TMS with navigation allows to define the location of new motor area);
- for the research of brain plasticity after strokes.

Neuro-MS/D

series of transcranial magnetic stimulators for diagnostic, therapeutic and research purposes

- Peak magnetic field — up to 4 Tesla
- Number of pulses generated during one session — up to 10 000
- Several delivery set variants
- Cooling unit and expansion unit can be included in the delivery set optionally
- Pulse waveform: monophasic, biphasic, theta-burst (TBS), paired stimulation
- 2-channel digital EMG system for motor response threshold acquisition
- Neuro-MS.NET software for magnetic stimulator control
- Set of different coils (non-cooled, cooled, placebo)
- «Delayed charging» mode
- Multistage system of device protection
- Connection to computer via USB port

Visor2 is a trade mark registered by «ANT Neuro bv» Enschede, The Netherlands
Visor2 is the system manufactured and supplied by «ANT Neuro bv» Enschede, The Netherlands

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