

The New Way of Brain Mapping  
for the Operating Room  
and Neuro Monitoring Unit



# cortiQ Procedure



Invasive Electrode Grids are placed in the cortex, covering important areas to map



The patient performs preprogrammed tasks, allowing a better understanding of the functional regions of the brain



The Real-time High Gamma Mapping greatly reduces the need for Electric Current Stimulation



Surgeons can prepare and perform surgery much more quickly, with reduced costs and risk of error

## Benefits for Patients

With cortiQ, important “eloquent” brain areas can get identified to avoid damage during the surgery. The procedure minimizes the risk of accidental seizures during the surgery. The entire recovery process is then faster and easier for patients. The mapping procedure is much shorter than with other techniques.

## Benefits for Physicians

Unlike ECS, cortiQ does not produce artificial seizures and cannot produce pain. cortiQ measures high-gamma activity that is directly produced by neurons under each electrode, providing high spatial resolution without testing multiple combinations of electrode pairs, which is necessary during by bipolar ECS mapping.

cortiQ allows physicians to produce an individual real-time MAP (Mental Activity Profile) for each patient and to plan surgery better, with more detailed information and less preparatory work. cortiQ can be used at the patients’ bedside or in the operating room.

In some cases, ECS might be required, as it is the current gold standard mapping procedure. In these cases, cortiQ can identify neural areas that are “active” in a task decided by the surgeon, and thereby provide a fast pre-screening mechanism that may be used for optimized ECS mapping and surgical removal of affected tissue.

## Components

- Electrode interface box for 64-256 passive ECoG electrodes
- Computer running the mapping software
- Subdural strip or grid electrodes



# Brain Surgery

Epilepsy is a common neurological disorder that affects a large portion of the world population. Many of the affected people can control epileptic seizures with the use of medication, but for around 15–20% of this population, medication is not effective, and some of these patients choose surgery.

Brain cancer is another reason for surgery. There are various types of brain tumors, and the aim of surgery is to remove the tumor (or at least parts of it) while causing as little damage as possible to the healthy and eloquent brain tissue.

## Development of Brain Mapping

Functional brain mapping of the eloquent cortex is an essential step when planning resective brain surgeries. Mapping techniques like electrical cortical stimulation (ECS) and functional magnetic resonance imaging (fMRI) are well-established in clinical practice. However, these procedures have disadvantages, since ECS might be demanding for the patient and fMRI provides limited spatial and temporal resolution. ECS can also trigger accidental seizures.

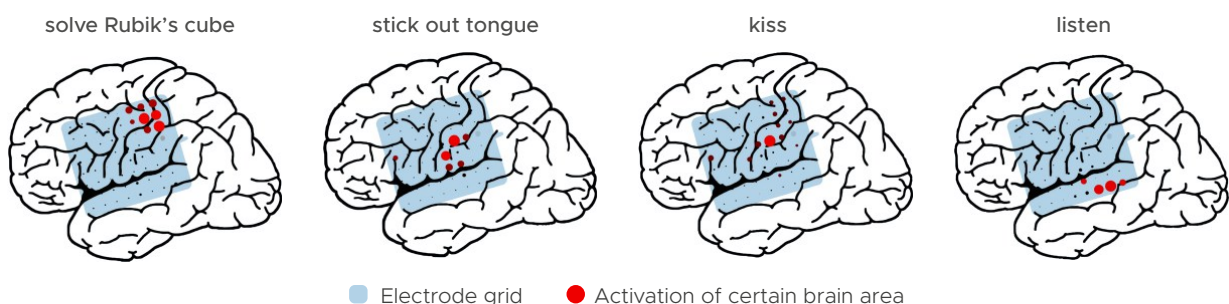
A passive mapping procedure based on electrocorticographic (ECoG) signals is a fast and precise mapping without the risk of causing pain or seizures. This mapping procedure has repeatedly demonstrated that it can accurately identify cortical regions related to receptive and expressive language functions, motor functions and the somatosensory system.

Therefore, cortiQ was created to optimize surgical procedures by minimizing the burden and risks for the patient and reducing the time required to prepare and perform the surgery.

## cortiQ - Rapid Cortical Mapping

cortiQ was developed to help surgeons identify functional brain regions with high-gamma activity before the surgery. Neurosurgeons will be able to use and modify cortiQ paradigms based on individual surgical needs. The system will then give patients tasks related to the functional activities performed by the brain tissue near the epileptic focus or tumor. For example, if the pathological tissue is close to the motor area, the system will ask the patient to move arms, feet or even lips.

The brain activity patterns produced during these movements will be transmitted in real time to the system, notifying the neurosurgeon that these parts are important for a certain movement and therefore should remain untouched. This set up is much faster and safer than conventional technology, and reduces the risk of an accidental seizure during this mapping process or errors during surgery.



In this experiment, cortiQ was used to localize the sensory and language regions. The patient had to follow the instructions presented on a monitor to explore the motor and somatosensory area of the left hand, as well as the receptive language area (Wernicke's). The patient followed a paradigm that consisted of 4 tasks: solve a Rubik's cube, stick out the tongue, kiss and perform a speech comprehension task by listening to a story. The whole mapping only took about 5 minutes.

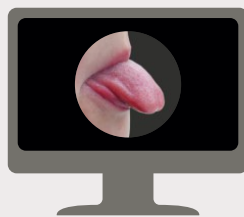


## Benefits of the cortiQ System

- Map cortical functions in the operating room during tumor resection
- Map cortical functions in neuro monitoring before the surgery
- Perform the cortiQ mapping first and then validate the results with ECS to reduce the total mapping time

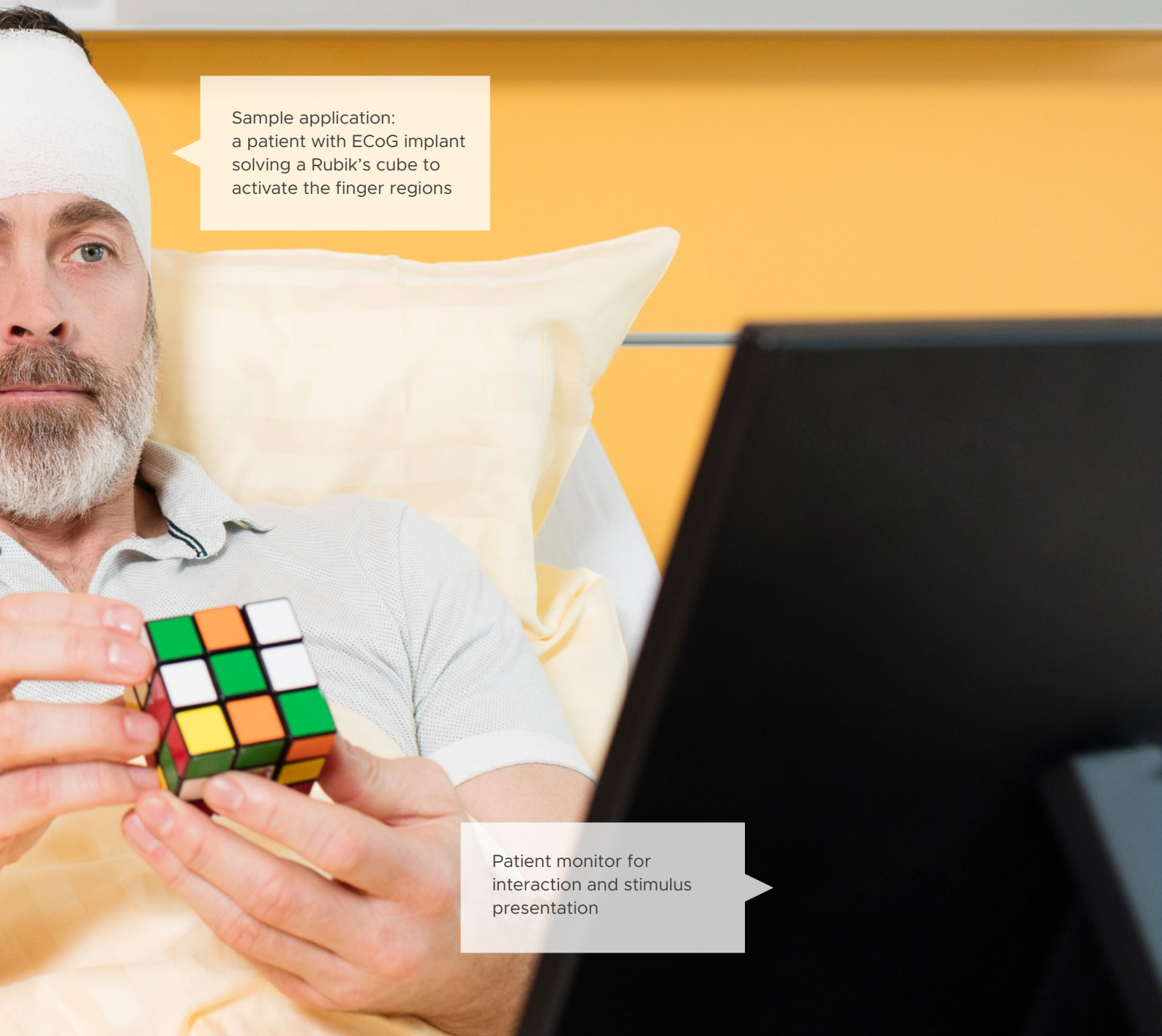
ECoG amplifier with ECoG electrodes connected

Use the Kamada and Ritaccio paradigms to quickly perform



### **RITACCIO PARADIGM**

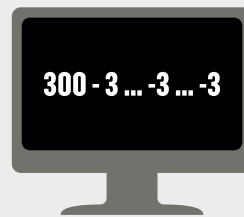
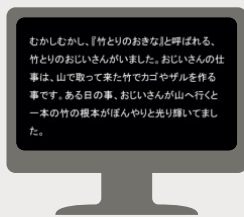
solve Rubik's cube, stick out the tongue, kiss and listen



Sample application:  
a patient with ECoG implant  
solving a Rubik's cube to  
activate the finger regions

Patient monitor for  
interaction and stimulus  
presentation

form the mapping or create your own mapping paradigm.



### KAMADA PARADIGM

solve Rubik's cube, read a story, listen to a story, perform calculations



cortiQ is a product of g.tec medical engineering GmbH in Austria.

g.tec develops and produces brain-computer interfaces for many different applications.

g.tec's products and research activities have been widely presented in peer-reviewed research publications, demonstrating the quality of g.tec's tools and methods.



## Experts' experiences with cortiQ

“Real-time cortiQ mapping eliminated the risk of seizure caused by electrocortical stimulation, and helped us to understand functional dynamics of each brain function.”

Kyoussuke Kamada, M.D., Ph.D., Asahikawa Medical University, Japan



“There are numerous advantages of cortiQ when compared to ECS, such as flexible stimulus presentation, time- and effort- effectiveness, and the possibility to work with patients that are unable actively engage in the task.”

Milena Korostenskaja, Ph.D., University of Florida, Florida, USA



“cortiQ can be used to map motor, expressive or receptive language, and other functions, and has been shown to have good concordance to results from other imaging techniques.”

Gerwin Schalk, Ph.D., Wadsworth Center, NY, USA

## SCIENTIFIC REFERENCES

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Kapeller C, Korostenskaja M, Prueckl R, Chen PC, Lee KH, Westerveld M, Salinas CM, Cook JC, Baumgartner JE, Guger C, CortiQ-based Real-Time Functional Mapping for Epilepsy Surgery, Journal of Clinical Neurophysiology 2015, vol. 32(3), pp e12-e22. doi: 10.1097/WNP.0000000000000131

## Mobile Intraoperative Monitoring Service (mIOM)

The mobile IOM Service offers cortiQ functional brain mapping at your hospital. g.tec will send an experienced expert to perform the mapping together with your team, so that the mapping results are immediately available before or during the surgery. Please contact:

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