



CEITEC
MAFIL



BULLETIN

VOL. 11

MAFIL Core Facility

INTRODUCTION

Dear readers, the year 2025 was a milestone year for us, as we celebrated 25 years since the beginning of functional brain mapping in Brno and 10 years since the launch of magnetic resonance imaging at CEITEC MU. In connection with this, we organized several events for both the public and professionals.

We managed to upgrade one MR scanner to the latest CIMA.X Fit model. And what awaits

us in 2026? New projects are being launched, and new technologies are being introduced. However, one of the things specific to 2026 concerns the funding of the laboratory. This is mainly provided by research funds from the state budget (mainly from the Czech-Biolmaging research infrastructure). However, the availability of these funds is linked to various evaluations that should show whether the supported activity is performing in line with expectations. And the year 2026 will be marked by a series of assessments. The second specific topic, which carries over from the previous year and will also have a significant impact on 2026, is data – that is, how we handle measured data and how we can make it available to the wider community.

On behalf of the entire CF MAFIL team, Michal Mikl



CEITEC

Central European Institute of Technology
BRNO | CZECH REPUBLIC

Information Bulletin of MAFIL

NEWS IN THE CZECH-BIOIMAGING AND EURO-BIOIMAGING INFRASTRUCTURES

The introduction mentioned the evaluation of infrastructure activities, which has a particular impact on funding from the state budget. This year, an ongoing evaluation of national research infrastructures is taking place – in our case, the Czech-BioImaging infrastructure. The result will affect the allocation of funds from 2027 onwards. The autumn of 2025 was devoted to preparing the documentation for this evaluation. At the same time, an internal evaluation of the functioning of individual laboratories within the infrastructure is also underway. This is being carried out by members of the international advisory committee, who visited the individual laboratories in November to inspect the workplaces and talk to some of the employees. In parallel with the national evaluation, we also prepared documentation for the evaluation of the Brno node of the European Euro-BioImaging infrastructure.

The year 2026 will therefore focus on completing these evaluations and subsequently on political decisions on the overall financial support for research infrastructures. The fact that 2026 is exceptional in this respect is also demonstrated by the internal evaluation carried out by the CEITEC MU institute, which we are also facing. So, what exactly does such an evaluation entail? For the laboratory, it mainly involves preparing documen-

tation on how well we are performing. This includes a series of figures showing the number of projects implemented, the number of users, the use of equipment, results in the form of publications, etc. But it also includes a series of descriptions and explanations about the composition of the laboratory team, employee training and development, the range of services we provide to users, data handling, quality control, and so on. These are often extensive documents and tables comparable to the supporting documents that must be submitted for scientific project applications or reports on the implementation of scientific projects – only here from the perspective of laboratories or infrastructure.



**CZECH
BIOIMAGING**

HOW „DEAD“ DATA LIVES ON

In recent years, the scientific community has placed increasing emphasis on the data obtained. This is due to practical aspects and the requirements presented by scientific journals (“provide the data on which you based your conclusions”) and grant agencies. Acquiring data can be challenging from both an economic and practical standpoint. Therefore, it is desirable that data should be made available to other researchers once their primary purpose has been fulfilled.

However, several issues need to be resolved before data can be published or shared. There must be storage space (technically called a repository) to ensure long-term storage of data and, at the same time, its availability to the wider scientific community. In order for other researchers to learn about the data, it is necessary for the data to be properly recorded in a catalogue so that it can be searched according to various parameters (e.g., whether it is MRI or EEG data, on which set of data it was measured, what task was used in functional brain mapping, etc.). The data must be appropriately described (annotated) and stored in a format that other researchers will be able to read and process. The data should also be of sufficient quality, i.e., it should be clear what data quality criteria it meets and whether it can therefore be used for the required purpose.

These aspects (data quality, data description, formats, standardized processing procedures, legal issues of sharing, etc.) in relation to neuroimaging data are addressed by the newly supported European COST action called INDoS (Improving Neuroimaging Data for Sharing). MAFIL laboratory is involved in this initiative through its experts.

The data also offer the possibility of creating a specialized publication describing an interesting dataset – information about one such publication is provided in the overview of interesting publications in this issue of the bulletin. The latest news related to data publication is the introduction of a new option for reporting scientific datasets as results in the RIV database. The categories Topen and Tost have been newly created for this purpose.



LOOKING BACK AT 2025

February 6, 2025, we celebrated the **10th anniversary of the installation of the MR** and the **launch of the CF MAFIL laboratory**

In the spring of 2025, the unique **SIEMENS CIMA.X FIT 3T magnetic resonance imaging system** was successfully put into operation

March 14, 2025, **Brain Awareness Week**, we participated with interesting lectures and an open house in our laboratories

March 27, 2025, the **spring neuroimaging workshop Dynamics in Brain Functions**

May 27-28, 2025, the **annual neuroscience conference** was held on the occasion of 25 years of functional magnetic resonance imaging in Brno

July 24, 2025, we participated in the **Mendel Festival**





In August, we were part of the **Summer School of Neural Engineering**

October 2, 2025, we participated in **Researchers' Night – Wealth in Your Head.**

November 2025 the traditional **Educational Neuroimaging Course**

Throughout the fall, we gave **lectures at the Brno Observatory and Planetarium** on a common theme: A Head Full of Questions (www.youtube.com/@HvezdarnaCzBrno playlist Lectures)

In the 2025/2026 academic year, a **new master's program in Neuroscience** was launched at the Faculty of Medicine of Masaryk University.

EVENTS OF THE YEAR 2026

Practical training in our laboratories as part of the Master's program in Neuroscience

Seminar on building the MINDR (Multimodal Imaging & Data Repository), March 12, 2026, Brno

Brain Week 2026: Seven days full of discoveries and inspiration, March 9–15, 2026, Brno
(The program at CF MAFIL will be on Friday, March 13, 2026)

FAIR MAFIL workshop, May 11, 2026, Brno

Summer school NESS: Neural Engineering Summer School, August 24–28, 2026, Brno

Science Night <https://www.nocvedy.cz/en>, September 25, 2026, Brno

November 2026 Traditional autumn neuroimaging workshop

MR CIMA.X FIT

Success in the heart of Europe: The latest magnetic resonance has arrived at our laboratory.

The beginning of 2025 went down in the history of our laboratory in a big way. After years of intensive use of the Prisma system, it was time for a generational change that has once again put us at the forefront of the field. During a month-long planned shutdown, a logistically demanding operation took place, during which the old machine gave way to the new MAGNETOM Cima.X Fit system. The whole process was all the more prestigious as it was the first installation of this type in Europe.

The path to the new magnetic resonance was not easy. While the service team completely deconstructed the original technology during the first week, the laboratories were filled with components for the new system over the following fourteen days. The installation was so extensive that it temporarily paralyzed the entire workplace. Due to the adjacent space being filled with materials, the operation of our second magnetic resonance also had to be temporarily stopped. The demanding weeks culminated in a phase of careful testing, fine-tuning, and professional training of our staff.



The first scientific projects on the new Cima.X Fit machine were launched in the spring, and by the end of 2025, we had successfully completed 15 research projects on it. The transition to this technology has opened up completely new possibilities for us, thanks to both the extraordinary performance of the gradients in the hardware and the advanced software tools for data processing.

Although implementing such a unique technology naturally brings initial challenges related to optimization and solving new problems, our vision remains clear. We are proud to be the first in Europe to harness the potential offered by Cima.X Fit. We believe that thanks to this state-of-the-art equipment, we will be able to implement unique projects of international significance in the coming years.



INTRODUCING INTERESTING PROJECTS IN CF

Innovative combination of eye tracking, EEG, and magnetic resonance imaging in multiple sclerosis research

Preparations are currently underway for two studies to be conducted as part of the MASH StG/CoG project, led by MUDr. Pavel Hok, Ph.D. The first study focuses on cognitive difficulties experienced by patients with multiple sclerosis, while the second focuses on visual difficulties in the same patient group following optic nerve inflammation. As part of these studies, we are preparing settings at CF MAFIL for simultaneous EEG-fMRI measurements with LCD glasses, using their built-in eye tracker. With its help, we will not only monitor eye movements during the measurement but also use them for interactive control of visual stimulation. In addition to MRI measurements, participants will undergo cognitive and visual function tests. Thanks to its innovative nature, the project has been supported by the Czech-Biolmaging national research infrastructure.

From Amsterdam to Brno: Why did neuroscientists choose CF MAFIL for their visual perception research?

Monitoring human brain activity simultaneously using several independent imaging methods is a highly sought-after methodological approach in contemporary neuroscience. Thanks to its wide portfolio of modalities and advanced technical support, CF MAFIL is an ideal workplace for conducting such studies, offering its capacities and expertise not only to the scientific community in the Czech Republic, but also to research partners from abroad. In 2025, we were approached by a neuroscience group from the University of Amsterdam and invited to collaborate on a project studying how higher cognitive processes influence our visual perception of the world around us. The project requires the simultaneous collection of data from EEG, functional magnetic resonance imaging, and eye tracking. Thanks to advanced methodological support and the unique background of CF MAFIL, in conjunction with funding obtained from the Czech-Biolmaging infrastructure, our laboratory has become a partner in this international project. Data collection began in the fall of 2025, and we expect to complete the measurements in the spring of 2026.

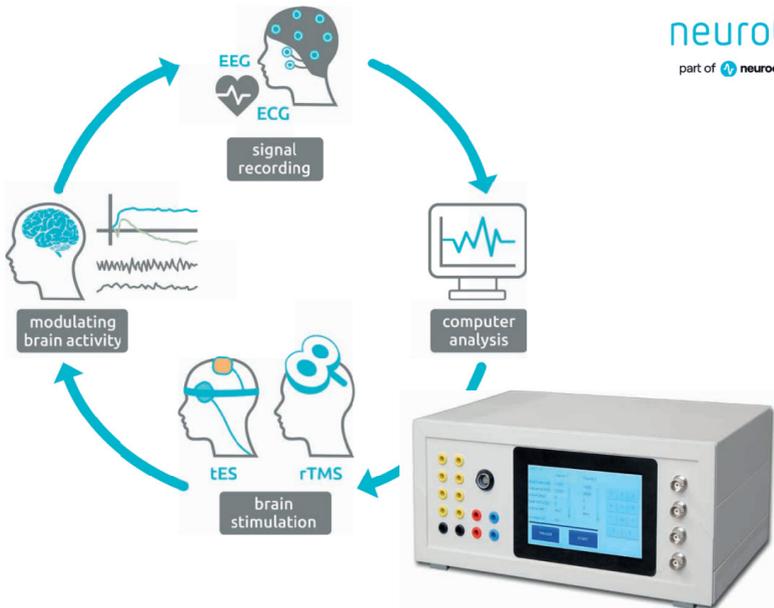
INTERESTING TECHNICAL SOLUTIONS

neuroConn LOOP-IT

All-in-one solution for non-invasive transcranial electrical stimulation

Non-invasive transcranial electrical stimulation (tES) allows modulation of brain activity in both healthy individuals and patients with neurological or psychiatric disorders. The simultaneous use of tES and electrophysiological recording significantly advances our understanding of local and network effects in the brain induced by stimulation, as well as the functional role of brain oscillations. Changes in individual parameters such as intensity, frequency, and phase significantly affect the results of stimulation. The LOOP-IT system helps researchers precisely control these parameters and influence brain activity with high temporal and spectral accuracy.

The device is specially designed for modern stimulation approaches such as temporal interference stimulation, state-dependent and closed-loop experiments – all simultaneously and synchronously using a single device. More information is available on the manufacturer's website: <https://www.neurocaregroup.com/en/technology/loop-it>.



neuroConn
part of neurocare group AG

SELECTED PUBLICATIONS

Mikl, M., Ingrová, K., Gajdoš, M. et al. **Complex multi-echo fMRI dataset: New strategies in processing of multi-echo data.** *Sci Data* (2026). <https://doi.org/10.1038/s41597-026-06694-6>

This is an example of an article describing a relatively unique dataset that was created in our laboratory as part of a GAČR grant project - New strategies in processing of multi-echo fMRI data. The data itself is available in the OpenNeuro repository (<https://openneuro.org/datasets/ds006926/versions/1.0.0>) and can also be found using a unique DOI identifier <https://doi.org/10.18112/openneuro.ds006926.v1.0.0>. The article describes the creation and purpose of the dataset, technical parameters, data quality control, conversion to the standardized BIDS format, and related technical validation.

Mareckova, K., Trbusek, F., Marecek, R., Chladek, J., Koscova, Z., Plesinger, F., Andrysková, L., Brazdil, M., & Nikolova, Y. S. (2025). **Maternal depression during the perinatal period and its relationship with emotion regulation in young adulthood: An fMRI study in a prenatal birth cohort.** *Psychological Medicine*, 55, e39. <https://doi.org/10.1017/S0033291725000042>

This publication reveals that maternal depression after birth programs brain function, skin conductance, and heart rate of the offspring during an emotion regulation task, and that these effects are long-term and detectable in young adulthood. The altered brain function and physiology during the emotion regulation fMRI task manifested also in the behavior. Women exposed to maternal depression after birth used more emotion suppression, a maladaptive emotion regulation strategy, when regulating negative emotions in young adulthood, and brain response in the superior frontal gyrus and anterior orbitofrontal cortex mediated these relationships. These findings have been published in *Psychological Medicine* (D1 in Psychiatry as well as Psychology) in 2025.

Latta, P., Jiřík, R., Vitouš, J., Macíček, O., Vojtíšek, L., Rektor, I., Standara, M., Křístek, J., & Starčuk, Z. (2025). **Two-parametric prescan calibration of gradient-induced sampling errors for rosette MRI.** *Magnetic Resonance in Medicine*, 93(3), 1285–1297. <https://doi.org/10.1002/mrm.30355>

This is an example of technical development based on collaboration between CEITEC MU, the Institute of Scientific Instruments of the Czech Academy of Sciences, and the Department of Radiology, Masaryk Memorial Cancer Institute. Within a grant project funded by the Czech Science Foundation (GA22-10953S), a novel rosette pulse sequence with trajectory autocalibration features was developed and successfully tested in volunteers as part of the PROSTAPILOT study.

LET'S END WITH A RIDDLE

1				8				9
	5		6		1		2	
			5		3			
	9	6	1		4	8	3	
3				6				5
	1	5	9		8	4	6	
			7		5			
	8		3		9		7	
5				1				3



BULLETIN

VOL.11

MAFIL Core Facility

This issue of CF MAFIL Bulletin was prepared by:

Martin Gajdoš, Petr Kudlička, Martin Lamoš, Peter Latta, Klára Marečková, Radek Mareček, Michal Mikl, Kristína Ruzsová, Marie Schejbalová, Lucie Šimková, Michaela Vaňharová, Luboš Vojtíšek

mafil.ceitec.cz/en/



www.ceitec.eu