

2 INTRODUCTION

MEG (magnetoencephalography) is a non-invasive functional brain imaging technology, very much akin to EEG. MEG has greater sensitivity though as it measures the very small magnetic fields produced by neuronal activity, these latter are less prone to distortion due to the skull bone than EEG. Its spatial resolution is overall similar to fMRI's, with much greater temporal resolution, on the order of the millisecond scale.

The MEG instrument and environment are considered as safe because the measurement principles are passive: magnetic sensors are inserted in a helmet, and measure the femto-tesla magnetic fields generated by neural activity. No energy or radio-active compound is impressed, injected or used. MEG requires minimal subject's preparation: standard EOG and ECG electrodes are positioned for basic monitoring of heart beats and eye movement, which cause artifact in MEG recordings and therefore can be better controlled and attenuated offline; additional head-positioning coils can be attached to the skin to monitor head movements. All equipment and miscellaneous supplies for a generic MEG session have received adequate certification to ensure the subject's safety.

The participant seats or lays supine on a specially-designed chair/bed, and his/her head is brought inside the MEG helmet, which covers essentially the lateral, superior and posterior aspects of the cranium. The MEG instrument and participant remain inside a passive magnetically-shielded room (MSR), which is a room of about 80 sq ft consisting of 3 layers of metal alloys to attenuate magnetic interference from the environment. At all times, the participant can communicate via video and audio intercom with the operators outside the room. He/she can also walk out of the room by operating the knob from the inside of the MSR. There is no known medical restriction to MEG. The only risks known to us is for participants prone to claustrophobia, although the MEG environment is that of a room, not a tunnel. There is no loud noise generated during acquisition, hence MEG environment is generally considered as relatively comfortable to participants, including for most patients and young children. A care giver can stay in the MSR seating next to the participant, if necessary. Another possible risk from MEG is the spontaneous boil-off of the liquid helium used for refrigeration of the superconducting sensing system. Although very unlikely, boil-off can occur with minimal risk to participants: the MEG instrument has safety valves to prevent pressure from building inside the helium reservoir and if helium is released, the air ventilation inside the MSR has been designed to rapidly exhaust the extremely volatile helium gas out of the MSR. Although helium is inert, there is a risk of oxygen depletion inside the MSR, in case of massive helium boil-off. Alarms have been set-up inside the MSR to detect low levels of oxygen. It would take only seconds to the attending personnel to open the MSR door, which would immediately resolve the situation. Overall, the risk of and potential harm from spontaneous helium boil-off in the MEG is minimal and much lower than that MRI quenching for instance.

A typical MEG session is very much akin to an EEG or fMRI session for cognitive and clinical neuroscience studies. Investigators may be interested in mechanisms involved in memory, attention, language, etc. or brain disorders and MEG can be an appropriate tool for brain mapping and studying functional connectivity between brain regions. Participants can be involved in tasks whereby they are presented with stimulating events (visual, auditory, somatosensory, etc.) to which they might need to respond to (using keypads, voice, etc.). Specific apparatus and experimental conditions will be submitted for review and approval: all MEG studies will be first

reviewed the MEG Research Committee (see members below) for scientific appropriateness, to conform the MEG scanning policies before they are submitted for approval to the REB. The procedure is similar to the one in place for MRI and PET research scanning.

3 REQUESTING ACCESS FOR A NEW STUDY

New MEG studies require technical development time to identify potential issues in the implementation of the paradigm (acquisition parameters, event triggering, testing of experimental equipment, etc.) and the acquisition of pilot data. To encourage access to the MEG by new investigators, the following specific procedure applies.

- 1. Contact the Director of MEG Research (sylvain.baillet@mcgill.ca)** to schedule the presentation of the project by the investigator at the weekly MEG staff meeting (Thursdays at 2pm). The researcher will present his/her project for about 20 minutes and benefit from interacting with the MEG staff and the local MEG community in elaborating the MEG implementation of his/her study.
- 2. Contact the MEG system manager (marc.lalancette2@mcgill.ca)** to schedule time in the MEG suite to setup experimental parameters and equipment.
- 3. Schedule up to 3 pilot sessions.** These sessions are used to test the experimental setup and timing, and adjust the protocol as needed. Special billing applies. Contact the MEG system manager to book these sessions before you obtain REB approval.
- 4. Obtain review from the MEG Research Committee (MEGRC).** Instructions and policies can be found on the MNI website ([MEG Research Committee](#)).
Note that projects with standard anatomical MR scans of participants can be accommodated without requiring to obtain approval from the MRI Research Committee.
Following the meeting of the MEGRC, the Principal Investigator will receive a letter with the Committee's decision and recommendations, should changes be required.
- 5. Seek approval from the appropriate Research Ethics Board (REB).** Instructions and policies can be found on the MNI website ([REB](#)). The letter from the MEG Research Committee must be included in this submission.
- 6. Contact the BIC Accounting Clerk (bic-finance.mni@mcgill.ca)** for instructions on setting up your account and study in the BIC booking system. Each new study must be added to the system and require an REB file number and billing information (FOAPAL or PO for external researchers).

For all McGill Downtown campus researchers: A FOAPAL must be provided for all scanning services. Please use 010243 (MEG Scanning) for the Activity code. At the end of each month, payments are

processed through McGill Banner feeds using the given FOAPAL. An invoice will be sent to the investigator each month to approve the charges.

For all other researchers (including other McGill network researchers, including from the Douglas or RI-MUHC): Researchers must provide the BIC with a standing Purchase Order issued by the hospital or company who is paying for the services. The total amount of the standing PO must be large enough to cover all scan requests until the end of the fiscal year (approximation). Invoices will be sent from McGill Central Accounting and not the BIC. Purchase Order is to be made out to:

McGill University
Accounts Receivable
3465 Durocher St., Suite #323
Montreal, Quebec, H2X 0A8
Contact: Maria Anania – maria.anania@mcgill.ca
Telephone: 514-398-2311
Fax: 514-398-1327

4 INSTRUMENT AND STAFF AVAILABILITY

The MEG instrument is available 7 days a week / 24 hours a day to investigators with MEG-operator certification (see Obtaining MEG-Operator Certification).

The MEG staff is available to assist investigators for MEG measurements or obtaining certification: Monday to Friday, 08:00 -17:00.

System maintenance imposes interruptions of MEG measurements for one hour once or twice a week, usually at the end of the day Wednesdays and Fridays. The MEG staff will accommodate booking on these days to the best of their ability.

Booking requests are placed online by investigators through the McGill Faculty of Medicine core services schedule: <https://medoas.medicine.mcgill.ca/pls/htmlldb/f?p=298> (see Booking Procedure).

Definition of an MEG Session

When booking online, investigators need to specify the amount of time needed for each session and will be billed accordingly. An MEG session is defined as the time necessary for MEG data acquisition in the instrument and the duration for subject preparation, by a single investigator. The time necessary for subject preparation varies from a minimum of 15 minutes for a MEG-only acquisition to 45 to 60 minutes when EEG needs to be acquired simultaneously with MEG. The recording time depends on the protocol and will vary by study. There is no restriction in the number of subjects within a session. If additional time is used, it will be billed (see Billing).

5 BOOKING PROCEDURE

All requests for measurement times need to be submitted to the reservation system:

<https://medoas.medicine.mcgill.ca/pls/htmlldb/f?p=298>

Each new study and user must first be set up in the system. See Requesting access for a new study, step 6.

1. Review the calendar to find an appropriate free time

2. Request a reservation

Participant ID: Please fill in the subject code for all MEG bookings, as proof that there is a confirmed participant. Reserving time slots without a confirmed participant is not allowed.

Time requested: You must book the entire time required for your study (setup + recording). This is typically 3 hours for a pilot study or when using the EEG cap, and 2 hours for most standard subject recordings. The duration of the session billed to the researcher includes the subject preparation time and measurement time. Billing starts with the time block that was booked.

3. Confirm your reservation

Reserved time will be approved within 24 hours of the request. It is the responsibility of the researcher to verify that his/her session block has been correctly granted.

6 MEG DATA COLLECTION AND RETRIEVAL

Raw data is collected and stored on the acquisition workstation. The raw data is then transferred overnight to the MEG data disk (/meg/meg1/data/) and made available to their respective investigator on the BIC network for at least a month following the session date. DATA IS AUTOMATICALLY DELETED each month. It is therefore the sole responsibility of the investigator to retrieve his/her data in a timely manner.

Access to BIC data storage

For investigators who have access to the BIC data storage, raw MEG data can be loaded directly to that storage space. Arrangements must be made directly with the MEG system manager (marc.lalancette2@mcgill.ca) to setup this service. For information regarding access and billing rates for BIC data storage, see <https://mcgill.ca/bic/core-facilities/computing-data-storage>.

7 SESSION CANCELLATION

In the event that a booked session needs to be cancelled, this can be done directly on the schedule by the investigator up to 5 working days before a session. For late cancellations (under 5 working days before the session), the session will be billed at the normal rate.

For the MEG-infinity plan (see Billing), after 3 late cancellations, an additional penalty fee of \$250 will be charged for all further late cancellations.

Commitment to the Schedule

Every effort will be made to avoid changes in the MEG schedule but occasional staffing shortages, equipment failure or other unforeseen issue may require that a confirmed session be rescheduled. The researcher will be notified as soon as possible and every effort will be made to reschedule the session shortly thereafter, with no penalty charge.

8 BILLING

MEG-Infinity Subscription Plan

A new billing option for MEG research is being tested until December 2019: MEG-infinity. This program enables high-powered neuroscience research, encourages the adoption of open-science practices, and maximizes the impact of research funds. MEG-infinity offers unlimited access to MEG recording time against the payment of a flat subscription fee, valid over a 6-month period. See <https://www.mcgill.ca/bic/core-facilities/meg>.

Billing Policy

A usage-based billing option is still available. Researchers will be invoiced for the maximum of the length of time they have reserved on the MEG instrument, or the effective block of time used if a session exceeds the scheduled duration.

Billing Rates – Data Acquisition

Different rates apply depending on the level of service provided by the MEG staff, the certification of the investigator as MEG operator (see Obtaining MEG-Operator Certification) and whether the session is a pilot or a regular research session.

Current rates can be found on our website. <http://www.mcgill.ca/bic/core-facilities/access>

Billing Rates – Data pre-processing and analysis

Data pre-processing & analysis is available upon request. Investigators need to contact the Director of MEG Research for billing quotes and scheduling of service.

9 OBTAINING MEG OPERATOR CERTIFICATION

Investigators are encouraged to obtain certification to become an operator of the MEG instrument to benefit from 24/7 access to the MEG instrument, i.e. access outside regular opening hours and a discount on rates.

To obtain certification, the investigator needs to follow the following procedure:

Train with the MEG System Manager (marc.lalancette2@mcgill.ca) to cover aspects of subject safety, preservation of system integrity and general procedure for data acquisition during pilot sessions.

Attend 3 recording sessions of his/her own study, supervised and assisted by the MEG System Manager. The 3 training sessions are billed at the regular data acquisition rate. There is no additional cost to obtaining this certification.

The MEG System Manager and the Director of MEG Research may require that additional training sessions are necessary for the investigator before obtaining certification.

The investigator is then notified by a letter from the Director of MEG Research that he/she has obtained certification to operate the MEG system independently. The certification is valid for all current and future studies run by this investigator. The MEG Program will maintain a list of certified MEG operators so that other PI's are encouraged to use their services.

10 MEG TRAINING SESSIONS

Investigators that collect MEG data can use the workstations in the MEG suite to learn how to pre-process and analyze their data with the assistance of the MEG team. This access is typically granted for a period of time, pending availability of workstations, long enough to analyze 1-2 subjects and develop an analysis workflow.

For investigators looking for MEG training or that are interested in learning more about Brainstorm, there are several training courses offered throughout the year. The schedule can be found on the BIC website under Training and Events ([MEG training](#)).