Sustainability Projects Fund

OVER $5,000 APPLICATION FORM

COVER PAGE

PROJECT INFORMATION

Please complete the fields below with information regarding your project.

Project Title A helium recovery system for a unique human brain imaging core platform.

Brief Description Contribution to the renovation costs necessary to install a 100%-efficiency helium recycling system for McGill'smagnetoencephalography core facility at the McConnell Brain Imaging Center (The Neuro)

Total Estimated Project Budget $569,305 **Amount Requested from SPF** $80,000

Campus(es) Impacted ☒ Downtown ☐ Macdonald ☐ Gault Nature Reserve ☐ Other

CONTACT INFORMATION

Project Leader

This person must be a current McGill University student, administrative staff, or academic staff.

Name	Sylvain Baillet	Affiliation	Academic Staff
Email	sylvain.baillet@mcgill.ca	Campus	Downtown
Faculty/Unit/Organization	Faculty of Medicine, Montreal Neurological Institute (The Neuro)		

Project Team Members

The SPF encourages you to be inclusive, collaborative (especially between staff and students), diverse, and interdisciplinary when possible. To list more members, please complete a second cover page. You may email it to SPF Staff to include with your application.

Name	Marc Lalancette	Affiliation	Administrative Staff
Email	marc.lalancette2@mcgill.ca	Faculty/Unit/Organization	The Neuro
Name	Julien Doyon	Affiliation	Academic Staff
Email	julien.doyon@mcgill.ca	Faculty/Unit/Organization	The Neuro
Name	Franco Niro	Affiliation	Administrative Staff
Email	frank.niro@mcgill.ca	Faculty/Unit/Organization	The Neuro, Facilities
Name		Affiliation	Choose one.
Email		Faculty/Unit/Organization	
Name		Affiliation	Choose one.
Email		Faculty/Unit/Organization	

SUBMISSION INFORMATION

In line with the SPF Eligibility Criteria, our team certifies that this project takes place at McGill University, is sustainability focused, is requesting seed funding, and is action oriented. ☒ Yes ☐ No

Our team has read the SPF Terms & Conditions and agrees to respect them. ☒ Yes ☐ No

Our team understands that this application is not confidential and consents to have its contents shared with relevant stakeholders during the review process and, if approved, on the SPF website. ☒ Yes ☐ No

Our team agrees to have their contact information included in the complete and shared application and, if approved, on the SPF website. ☒ Yes ☐ No

Sustainability Projects Fund

OVER $5,000 APPLICATION FORM

PART 1: PROJECT OVERVIEW

Instructions: *Please answer the questions below as clearly and concisely as possible. You will be able to detail your project further in Part 2 of the Over $5,000 application process, the Project Plan, as well as submit relevant appendices. Once you have completed this Project Overview, save it and submit it online. SPF Staff will respond with feedback on your application within two weeks and send you Part 2. Once all sections are complete, the combined application will be provided to the SPF Governance Council for their review and decision. As a reminder, all SPF applications are assessed using the SPF Eligibility & Evaluation Criteria:*

ELIGIBILITY CRITERIA		EVALUATION CRITERIA		
AT MCGILL	**SUSTAINABILITY FOCUSED**	**ANALYSIS**	**IMPACT**	**FEASIBILITY**
SEED FUNDING	**ACTION ORIENTED**	**COLLABORATION**	**SUPPORT**	**CAPACITY BUILDING**

Before starting, you may find it helpful to consult the SPF Sustainability Brief and the Climate & Sustainability Strategy 2020-2025.

CONTEXT

Criteria assessed in this section: **SUSTAINABILITY FOCUSED, ANALYSIS**

1. **What specific sustainability-related need/issue have you identified at McGill and aim to address through your project? In your response, please describe clearly how the need/issue is related to sustainability.** *Note: Please wait to detail your project idea in response to Question 5. Limit ~100 words*

Helium in its liquid form is commonly used as an efficient cryogenic refrigerant in many advanced research systems and a range of strategic equipment. It is a non-renewable natural resource extracted from gas and oil fields. As such, it is subjected to wide and unpredictable variations in terms of supply availability and market price, which challenge the affordability and sustainability of operations in key areas of a research-intensive institution like McGill.
This well-documented and lingering scenario creates an unsustainable situation for specialized equipment for which there is no alternative in terms of cryogenic refrigeration such as the MEG Core at the Montreal Neurological Institute (The Neuro).

2. **How do you know this is a need/issue? What research have you done on this need/issue (e.g. consultation, observation, survey)?** *Limit ~100 words*

The general media have reported on current and future increasing challenges with helium availability and pricing at multiple occasions (e.g., New York Times, Sept 04, 2019). It exposes advanced research and other strategic areas of the Canadian portfolio to uncontrolled market fluctuations and subjects them to external, possibly adverse influences (new Russian production plant currently under construction, NYT Dec 08, 2020). The MEG Unit has had first-hand experience with supply shortages and steep price changes. We also discussed the issue with diverse stakeholders, incl. regional suppliers (Linde, Air Liquide), McGill Procurement and VPRI, other McGill Units exposed to similar conditions (MRI, NMR & Physics).

3. **What relevant information and/or best practices have you found that relate to this need/issue? In addition to information from external sources, detail any relevant related initiatives (past or current) that you are aware of at McGill.** *Limit ~100 words*

These conditions impose adopting alternative strategies. Fortunately, the technology and commercial solutions exist that enable the sustainable reuse of helium. The manufacturer of our equipment, CTF MEG, has partnered with Quantum Technologies, both being Canadian companies, to offer an automatic, closed-loop 100%-recovery system. Chemistry's NMR unit was recently supported by SPF (SP0242) to install a helium recovery system. However, its location precludes a direct connection to the MEG, requiring costly specialized transportation and handling and inducing substantial helium losses. Importantly, the recycling capacity of the NMR system (20 L/day) is insufficient to accommodate both units (MEG only: 12 L/day).

4. **What expertise or qualifications does your team have regarding this need/issue, if any?** *Limit ~100 words*

Our team includes faculty and highly-qualified research personnel that have cumulated 20 years of experience working with liquid helium systems. They have the experience and track-record purchasing and manipulating liquid helium to refill MEG systems twice weekly, ~52 weeks/year. They have identified the commercial recycling solution that would terminate the necessity to buy liquid helium while ensuring the good workings of the specialized equipment in service to a wide community of basic and clinical McGill neuroscientists. Importantly, they have worked with building specialists and FMAS to ensure feasibility of the installation, including detailed technical design and plans for the required renovations.

PROJECT IDEA

Criteria assessed in this section: **ALL ELIGIBILITY & EVALUATION CRITERIA**

5. **What is your project idea? Please describe the idea thoroughly and concisely. Identify how SPF funding will be used, key contributions to sustainability at McGill, and, if your project is happening in different stages, core phases in the project.** *Note: You may also share how the project is new or how it complements, builds upon, or scales existing initiatives. Limit ~400 words*

McGill's MEG Unit hosts a magnetoencephalography instrument that measures the femtotesla magnetic fields generated by neural electrical activity to produce images of brain functions at the millisecond timescale. This capacity is unique amongst neuroimaging technologies. The fields are so tiny that specialized sensing technology is required, based on the principles of quantum physics. To operate, the sensors must be cooled down to super-conducting temperatures with liquid helium. No other refrigeration system can be considered, due to mechanical noise. The MEG system boils off 5,000 L of liquid helium every year and needs to be refilled twice a week. With recent helium prices, the unit's yearly supply costs have surged from $50K to $130K, which jeopardizes its operations and the access for about 50 McGill researchers and students to a unique scientific instrument (only 200 worldwide).

The only fully sustainable solution to the chronic issue of helium supply is to install a recovery and recycling system for this non-renewable resource. In close collaboration with the MEG system vendor, we have identified a recovery system with the advantage of recovering 100% of the helium in a closed-loop fashion. Overall, the solution would reduce helium costs and intervention of specialized personnel down to virtually zero. This solution would also reduce entirely the carbon emissions due to transportation of our weekly deliveries. By contributing to the reduction of global helium demand, this project would also strengthen McGill's continued leadership in neuroscience, Canada's strategic independence, and ensure more sustainable supply conditions for other critical uses of helium (e.g., in hospitals).

We were successful in obtaining the major portion of the funds to purchase and install the recovery system via a platform grant from Brain-Canada ($430,000), including $40,000 for the necessary renovations (after consultation with building specialists). Unfortunately, these costs have been revised dramatically after the recent completion of the full renovation planning phase with FMAS, which involved external professionals. Costs are now estimated at about $180,000, which jeopardizes the realization of the project and the goals of sustainable operations at McGill. The McConnell Brain Imaging Centre and The Neuro will be able to contribute about $30,000 additional funds, the

Faculty of Medicine & Health Sciences another $30,000. We therefore request support from SPF in the amount of $80,000 to secure the realization of the project.

Once the funding is secured, the project will be executed in the Fall of 2021, with full recycling of helium starting immediately.

6. **Is your project related to the University's Climate & Sustainability Strategy 2020-2025?** ☒ Yes ☐ No

7. **Is your project related to the University's Equity, Diversity & Inclusion Strategic Plan 2020-2025?** ☐ Yes ☒ No

8. **If you answered yes to Question 6 or 7, how does it relate? Please refer to the relevant strategy category, theme, goal, and/or action in your response.** *Limit ~200 words*

The extraction of helium is tightly integrated to the oil and natural gas economy. Helium gas is extracted from pockets in the soil and liquefied using techniques that are energy greedy. More fundamentally, and beyond the budgetary pressure imposed to research and other units like ours exposed to helium shortages and related price surges, it just makes no sense in 2021 to rely on a non-renewable natural resource when recycling alternatives are available off the shelf. We see investments in such technological solutions as a moral obligation for us researchers and specialists and our research-intensive institution, in a developed country that does not have capacity for helium production but rather, develops and markets the technology to recycle it efficiently. In short, helium on-campus consumption is intimately dependent on a carbon-heavy extraction, production industrial chain and therefore is a target for McGill's current Climate & Sustainability Strategy.

Another significant aspect concerns the termination of weekly helium deliveries, which will reduce carbon emissions considerably. We refer to the category of procurement for replacing a wasteful practice of "single-use" helium purchasing by a sustainable recovery and reuse system. This aim is also relevant to the research & education mission as we communicate on the benefits of helium savings, esp. via our recurrent training programs for neuroscience students.

TRANSFORMING CAMPUS

Criteria assessed in this section: **AT MCGILL, IMPACT**

9. **In the table below, describe your proposed project's 2-5 main impacts on the McGill community or its main goals to accomplish. Please check the stakeholders that will be impacted. Finally, list at least one key success indicator for each impact (e.g. # people will be engaged, % waste will be diverted, # buildings certified).** *Note: Indicate a realistic target for each success indicator (e.g., rather than "# people engaged," include a target such as "50 people engaged").*

		Main Impacts/Goals	McGill Stakeholders Impacted (check all that apply)	Key Success Indicator(s)
REQUIRED	1	Reduce risks of helium depletion in MEG system, avoiding shutdowns, research delays & restart costs.	☒ Undergraduate ☒ Academic Staff ☒ Postgraduate ☐ Admin. Staff ☐ Alumni	No shutdown, no emergency search for helium supply.
REQUIRED	2	Return to a sustainable operating budget	☒ Undergraduate ☒ Academic Staff ☒ Postgraduate ☒ Admin. Staff ☐ Alumni	Long-term self-sufficiency of MEG core facility serving a large McGill community.
OPTIONAL	3	Reduce carbon emissions (from extraction & transportation)	☒ Undergraduate ☒ Academic Staff ☒ Postgraduate ☒ Admin. Staff ☒ Alumni	~1-5 tons CO2 per year for transport only.
OPTIONAL	4	Reduce permanent loss of helium on Earth (when released in atmosphere, it dissipates in outerspace).	☒ Undergraduate ☒ Academic Staff ☒ Postgraduate ☒ Admin. Staff ☒ Alumni	Savings of >5,000 L of liquid helium per year.

	5		☐ Undergraduate ☐ Academic Staff ☐ Postgraduate ☐ Admin. Staff ☐ Alumni	

10. Have you considered implementing your project at more than one McGill campus? (e.g. If your project is downtown, could it be implemented at Macdonald Campus as well?)

☐ Yes ☒ No

11. Please describe your choice of campus(es) and why this choice is best for your project. *Limit ~150 words*

While the general solution of a recovery system can be applied to any facility that uses helium, the specialized solution we wish to install is designed specifically for our MEG system, which is the only one at McGill. We have already obtained the vast majority of the funds to purchase the recycler. Our present request is to respond to unanticipated increases in renovation costs. The planned system will be attach to the MEG instrument in a closed-loop fashion, which will increase recycling efficiency (no transportation = no depletion and no losses) decrease operating costs and augment the availability of the system and of highly-qualified personnel towards other tasks and services to students and researchers, instead of performing lengthy biweekly refills (about 5 hours per week).

To complete the application process, please submit this form on the SPF website. The SPF Staff will be in touch regarding your application within two weeks and will send you Part 2 for the Over $5,000 application process, the Project Plan.

OVER $5,000 APPLICATION FORM

PART 2: PROJECT PLAN

Instructions: *Please answer the questions below as clearly and concisely as possible. Once you have completed this Project Plan, save it and submit it online. SPF Staff will respond with feedback on your application within 2 weeks. Once all sections are complete, the combined application will be provided to the SPF Governance Council for their review and decision. As a reminder, all SPF applications are assessed using the SPF Eligibility & Evaluation Criteria:*

ELIGIBILITY CRITERIA		EVALUATION CRITERIA		
AT MCGILL	**SUSTAINABILITY FOCUSED**	**ANALYSIS**	**IMPACT**	**FEASIBILITY**
SEED FUNDING	**ACTION ORIENTED**	**COLLABORATION**	**SUPPORT**	**CAPACITY BUILDING**

IMPLEMENTATION

Criteria assessed in this section: **ACTION ORIENTED, FEASIBILITY, IMPACT**

1. **List the key activities for your project and indicate the timing for these on the right. Please be specific and realistic when formulating your activities, ensuring that they are achievable within the indicated timeframe.**

Key Project Activities	Start Date (DD-MM-YY)	End Date (DD-MM-YY)
Finalize fund raising for renovations	01-06-21	01-08-21
Final approval of renovation design & plans with FMAS and professionals	01-06-21	09-08-21
Call for tender for contractors	16-08-21	18-10-21
Construction work (electrical, ventilation and chilled water supply)	25-10-21	31-01-22
Recovery system delivery and installation, by CTF MEG	31-01-22	07-02-22
Operate helium recovery system, termination of weekly helium deliveries	14-02-22	
Update facility website to feature recovery system info and its positive impacts	01-03-22	01-09-22
Communicate with facility users and neuroscience community before and after installation	01-09-21	01-09-22
Include helium recovery topic in MEG training programs	14-02-22	

2. **Please describe what will happen to your project after the SPF funding ends. Additionally, please share if anything will be produced or installed (e.g. a workshop guide, equipment, a toolkit, a network, website, etc.) and indicate future maintenance plans.** *Limit ~200 words*

SPF funding will contribute to the renovation costs required for the installation of the purchased closed-loop 100%-recovery helium recycling system to be connected to the MEG instrument at McGill/The Neuro.
After funding ends, the installation will be complete and the recovery system will operate continuously over the foreseeable lifetime of the MEG instrument (at least 10 more years, but virtually indefinite).

Maintenance of the recycler will be provided by CTF MEG, with its cost folded into the MEG instrument's service contract. The MEG Unit's operating costs are covered by user fees paid to the McConnell Brain Imaging Centre (BIC). We emphasize that the MEG Unit's operating costs will decrease dramatically after the installation of the helium recycler, by about $130,000/year (@ current market price of liquid helium). Therefore, the installation of the helium recycler will improve both the environmental and financial sustainability of operations. The saved expenses will be directed towards new technological developments and innovations, training opportunities for students, an expanded service portfolio to all users, and to other BIC Units.

We will broadcast the meaningful implications of the project to our vast biomedical research community, via the Faculty of Medicine's research listserv, and to students via our training programs, social media and our facility's website.

3. Please list any potential risks associated with your project and the measures you will take to reduce their likelihood.

Main Risks	Preventative Measures
Unforeseen issues with vendor e.g., bankrupcy.	Limited cash released to vendor (33% paid before delivery). Alternative commercial solutions have been identified.
Delays in construction, equipment delivery, or COVID-related issues.	Regular project meetings with vendor, FMAS and all parties involved in the construction. All coordinated by McGill FMAS.
Equipment may not fit in planned space	Careful planning phase completed: Three alternative layouts have been identified and drafted.
Technical problems once equipment is in operation.	Warranty and maintenance contract signed with vendor, who will perform live remote monitoring of recycling operations.

STAKEHOLDER ENGAGEMENT

Criteria assessed in this section: **AT MCGILL, COLLABORATION, SUPPORT, CAPACITY BUILDING**

4. **Please list all the key stakeholders involved in your project, indicating their role and support. If the stakeholder has provided a support letter, please indicate so here and attach it as an appendix document.** *Note: Projects involving modifying a space on campus, making a permanent installation, hiring a full-time staff, or adding/modifying a garden, etc., must seek permission from the appropriate stakeholder(s) (e.g. building director, Campus Planning and Development Office, staff supervisor, etc.). SPF Staff can help you assess if any key stakeholders need to be added to your list.*

Stakeholder's Name(s)	Title	Role in the Project	Support/Permission	Support Letter
Julien Doyon	Director of McConnell Brain Imaging Centre	Support from host research centre, incl. funding.	Confirmed	No
Guy Rouleau	Director of The Neuro	Host intitution, provides funding.	Confirmed	Yes
Diana Patricia Montenegro	Associate Director Facilities, The Neuro	Coordination with FMAS & construction profesionals.	Confirmed	No
Caroline Turgeon	Project Manager, The Neuro	Project coordination with contractors and professionals	Confirmed	No
David Eidelman	Dean of the Faculty of Medicine	Host Faculty, provides funding.	Confirmed	Yes
Reza Farivar	Director, Integrated Program Neuroscience	Support to project emphasizes its significance for grad trainees.	Confirmed	Yes
Pascale Patenaude	Green Labs Initatives @ The Neuro	Support of sustainable research practices	Confirmed	Yes
Fu Gao	McGill Neuroscience Undergraduates	Support of sustainable research practices & MEG program	Confirmed	Yes
Graham Currie	Procurement Manager	Buyer	Confirmed	No
			Choose one.	Choose one.

5. **How will you communicate about your project and share its impacts with your stakeholders and the McGill community? Please describe your tactics (e.g. social media, workshops, tabling, newsletters, etc.) and any related timing (e.g. at the beginning, during, or after the project). Related activities can also be included in Question 1.** *Limit ~200 words*

We will broadcast the project's impacts and SPF's contribution to a diversity of researchers and trainees concerned by MEG operations and neuroscience research in general, once the recycling system is fully functional. The targeted channels include:
- Specific story by The Neuro and Faculty of Medicine & Health Sciences (FMHS) communication offices (>15,000 social media subscribers + websites)
- The MEG Unit & Dr. Baillet's online presence (website (~1,200 unique visits monthly) + >2,000 Facebook, ~3,000 Twitter, ~6,000 LinkedIn)
- The FMHS's research listserv (>3,000 recipients)
- The BIC's email list (~1,000 subscribers).

We will highlight the topic of helium recovery as an unconventional yet within-reach example of research and ecological sustainability in the several training events we organize around the MEG Unit at least twice yearly (2,500 attendees since 2011). We will also make the topic a specific section of the MEG-operator certification training we deliver (so far to >40 users). We will place signs in the lab to highlight the presence of the recovery system, acknowledging its funders and explain its beneficial impacts to visitors, including donors, students, patients and their families.

6. **If applicable, are there any training, volunteer opportunities, jobs, or complementary applied student research integrated in your project? Please describe.** *Limit ~100 words*

N/A

OVER $5,000 APPLICATION FORM

PROJECT BUDGET

Criteria assessed in this section: **FEASIBILITY**

Revenues

Indicate any funding you will receive or may receive to complete your project, including funds from McGill departments and units.

Funding Source(s)	Amount Requested	Request Status
Sustainability Projects Fund (SPF)	$80,000.00	Requested
Brain Canada Foundation Platform Support Grant	$429,305.00	Confirmed
Faculty of Medicine and Health Sciences	$30,000.00	Confirmed
Montreal Neurological Institute-Hospital	$30,000.00	Confirmed
REVENUES GRAND TOTAL *(must match Expenses Grand Total)*	**$569,305.00**	

Expenses

Indicate your project expenses below. Please remember to include tax and shipping costs, if any.

Item Description	Unit Cost	# of Units	Total Cost	Expense paid by SPF?
Electrical and HVAC renovations	$176,474.0	1	$176,474.00	Yes, partially
CTF certified 100% helium recovery system	$345,188.0	1	$345,188.00	No
Helium recovery system installation	$47,643.00	1	$47,643.00	No
1-year warranty (included)	$0.00	1	$ 0.00	No
Yearly maintenance (included with MEG system service contract)	$0.00		$ 0.00	No
	$0.00		$ 0.00	Choose one.
	$0.00		$ 0.00	Choose one.
	$0.00		$ 0.00	Choose one.
	$0.00		$ 0.00	Choose one.
	$0.00		$ 0.00	Choose one.
	$0.00		$ 0.00	Choose one.
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	$0.00		$ 0.00	Choose one.
	$0.00		$ 0.00	Choose one.
	$0.00		$ 0.00	Choose one.
	$0.00		$ 0.00	Choose one.
Expenses Subtotal			**$569,305.0**	

Salaries & Wages

If applicable, please indicate any paid positions needed for your project. Please note: if you complete this Salaries & Wages section, you must also complete the Staff Position Information Appendix.

Position Title	~# Hours per Week	~# Weeks	Hourly Wage	Subtotal	+ 20% Benefits	Total Cost	Funding Sources
			$0.00	$ 0.00	1.2	$ 0.00	
			$0.00	$ 0.00	1.2	$ 0.00	
			$0.00	$ 0.00	1.2	$ 0.00	
			$0.00	$ 0.00	1.2	$ 0.00	
Salaries & Wages Subtotal						**$ 0.00**	

EXPENSES GRAND TOTAL *(must match Revenues Grand Total)*	**$569,305.0**

APPENDIX

Relevant Support Documents

List any appendix documents in order in the table below.
Please keep the total number of pages as low as possible (recommended max 10). Please include any relevant support letters.

Doc #	Appendix Document Title	# of Pages
1	Support letter from Guy Rouleau, Director of the Montreal Neurological Institute-Hospital	1
2	Support letter from David Eidelman, Dean of the Faculty of Medicine and Health Sciences	1
3	Support letter from Neuroscience Undergraduates of McGill	1
4	Support letter from GreenLabs Initiatives @ The Neuro	1
5	Support letter from Reza Farivar, Integrated Program for Neuroscience	1
6	Recovery system description, from CTF MEG quote	4
7	Description of electromechanical interventions, from feasibility study	2
8		
9		
10	Staff Position Information Appendix, if applicable	

Institut-Hôpital neurologique de Montréal
Montreal Neurological Institute-Hospital

Guy Rouleau
OC, OQ, MD, PhD, FRCPC, FRSC

Directeur, Le Neuro
Directeur, Dép. de neurologie et neurochirurgie, Université McGill
Directeur, Dép. de neuroscience, CUSM

Director, The Neuro
Chair, Dept. of Neurology and Neurosurgery, McGill University
Director, Dept. of Neuroscience, MUHC

McGill
Centre universitaire de santé McGill
McGill University Health Centre

June 4, 2021

Sylvain Baillet, PhD
Scientific Director, MEG Core Unit
McConnell Brain Imaging Centre
Montreal Neurological Institute
Sylvain.baillet@mcgill.ca

RE: McGill's Sustainability Projects Fund

Dear Dr. Baillet,

I am writing in strong support of the installation of a liquid helium recycler that will guarantee the sustainability of MEG operations at the McConnell Brain Imaging Centre hosted at The Neuro.

The solution you and your team have elected will not only significantly reduce operating costs and the amount of intervention of highly-qualified personnel on the system; it will also ensure that the environmental impact of MEG activities is minimized, saving about 5,000L of liquid helium per year. I also emphasize that MEG research is one of the key operations at the Neuro that make our research assets quite unique and particularly competitive on the international scene.

I understand that you have obtained the vast majority of the funds towards the purchase of the helium recycler. I also understand the renovation costs are significantly more expensive than budgeted initially. For this reason, The Neuro will contribute an additional $30,000 towards the execution of the project.

This letter is also to encourage McGill's Sustainability Projects Fund to contribute towards a project that will significantly expand McGill's portfolio of sustainable research operations.

For all these reasons, I wish you great success with this exciting project and I am looking forward to its prompt execution.

Sincerely,

Dr. Guy Rouleau

McGill

Faculty of Medicine and Health Sciences

Faculté de médecine et des sciences de la santé

David Eidelman MDCM, FRCPC, FACP
Vice-Principal (Health Affairs)
Dean, Faculty of Medicine and Health Sciences

Vice-principal (Santé et affaires médicales)
Doyen de la Faculté de médecine et des sciences de la santé

June 2, 2021

Dr. Sylvain Baillet
Professor, Neurology and Neurosurgery
Director, McConnell Brain Imaging Centre
Montreal Neurological Institute

Dear Prof. Baillet,

I am pleased to express strong support of the Faculty of Medicine and Health Sciences (FMHS) towards your project of installing a 100% efficacy helium recycler attached to the MEG instrument based at the McConnell Brain Imaging Centre. I understand the technology would be a permanent solution to the lingering supply issue of liquid helium necessary to operate the refrigeration system of the instrument. In addition, this solution would significantly reduce operating costs and the amount of intervention of highly qualified personnel on the system. Importantly, the helium recycler would dramatically and permanently reduce the environmental impact of MEG operations, which are crucial to many McGill researchers, their trainees and the FMHS's strategic research portfolio.

I am pleased that you have obtained the great majority of the funds towards the purchase of the system. I understand the detailed renovation costs have been revised and are now significantly more expensive than initially planned. The FMHS will contribute additional funds towards the successful execution of this key project.

For all these reasons, I reiterate our Faculty's support towards your project that will enable sustainable research operations, and I personally encourage your initiative of seeking further support from McGill's Sustainability Projects Fund, which will enable the prompt execution of the project.

Sincerely,

David Eidelman, MDCM

McGill University
3605 de la Montagne Street
Montreal, Quebec, Canada H3G 2M1

Université McGill
3605, rue de la Montagne
Montréal (Québec) Canada H3G 2M1

T: 514 398-3524
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david.h.eidelman@mcgill.ca

McGill | Integrated Program in Neuroscience

Montreal Neurological Institute, Room 141
3801 University Street
Montreal, Quebec, Canada H3A 2B4

Tel: 514-398-1905
514-398-1229
514-398-6243
Fax: 514-398-4621

ipn.admissions@mcgill.ca
ipn@mcgill.ca

To: Dr. Sylvain Baillet, Scientific Director, MEG Core Unit, McConnell Brain Imaging Centre, Montreal Neurological Institute.

RE: McGill's Sustainability Projects Fund, MEG Helium recycler project

Dear Dr. Baillet,

I am pleased to write in strong support of your project to install a liquid helium recycler to guarantee the sustainability of MEG operations at the McConnell Brain Imaging Centre (The Neuro).

MEG is a unique asset of McGill's brain imaging research portfolio. Dozens of researchers and graduate trainees in our program, myself included, are using MEG for their research projects. It has provided them a distinctive, competitive edge in terms of research technology and training opportunities. For instance, about 20 of our students have registered to the MEG Unit's week-long training session your team will deliver in the context of the IPN's Summer School this year.

For these reasons, I sincerely hope that your application to McGill's Sustainability Projects Fund will be successful. It will guarantee the execution of a project that is both scientifically significant and environmentally meaningful.

Thank you for spearheading this important initiative.

Sincerely,

Reza Farivar
Director, Integrated Program in Neuroscience
Canada Research Chair in Integrative Neuroscience
Associate Professor, Ophthalmology & Visual Sciences

04/06/2021

Dear McGill Sustainability Projects Fund,

On behalf of The Green Labs Initiative at the Neuro (GLI@Neuro), we would like to express our full support of Dr. Baillet's project entailing the installation of a liquid helium recycler attached to the MEG device at the Neuro.

GLI@Neuro is a student-led initiative dedicated to reducing the environmental impact of scientific research at the Neuro and beyond. The support we have received from trainees, researchers and the McGill Office of Sustainability, particularly through the Sustainability Projects Fund, has allowed us to implement several programs within our labs to address research-related plastic, energy and water waste. However, larger-scale changes need to be made, and we're thrilled to see researchers at the Neuro taking the lead.

The brain imaging unit at the Neuro is currently responsible for the annual burn-off of 5,000L of liquid helium. Helium is a rare, non-renewable and expensive resource that is now becoming endangered. Given the shortage of helium in the world, we should not be wasting this precious resource, even for top priority research activities. We therefore strongly endorse Dr. Baillet's initiative to install new technology in the neuroimaging unit of the Neuro that would allow for the recycling of helium.

Dr. Baillet has secured the funding to purchase the specialized equipment for the MEG device, but further funds are required to cover the increased costs of installing the helium recycler. We hope that the Sustainability Projects Fund can provide the financial support necessary to implement this technology. If Dr. Baillet's application is successful, his initiative will not only reduce unnecessary waste at the Neuro but will set a strong example of McGill's commitment to sustainable research.

Sincerely,

The GLI@Neuro team

To: Dr. Sylvain Baillet, Scientific Director, MEG Core Unit, McConnell Brain Imaging Centre, Montreal Neurological Institute.

RE: McGill's Sustainability Projects Fund, MEG Helium recycler project

Dear Dr. Baillet,

On behalf of Neuroscience Undergraduates of McGill (NUM), we wish to express our strongest support to initiatives like yours that aim to steer research activities on campus towards a more sustainable future.

Our association represents more than two hundred and fifty undergraduate students involved in neuroscience training across McGill.

Many of us are involved in neuroimaging undergraduate research projects and we recognize MEG as a unique modality for brain imaging that contributes to McGill's distinctive portfolio.

We fully endorse your current efforts to bring in a 100% liquid helium recycler that will capture and closed-loop refill the MEG Unit at The Neuro, bringing helium supply costs and environmental impact down to the bare minimum. As training undergraduates, we also appreciate the impact that this project will have on freeing time for specialized personnel currently in charge of refills to offer user and student support.

For all these reasons, our group strongly supports your application to McGill's Sustainability Projects Fund. We hope your efforts will be successful in preserving McGill's research and training's leading edge in a manner that is fully sustainable.

Signed,

Fu Gao (*President*)
Roselyn Lu (*CEO*)
Tasha Miller (*Graduate Representative*)
Hunter Murdoch (*VP External*)
Fahima Khan (*VP Fundraising*)
Janik Felcarek-Hope (*VP Secretary*)
Justin Galouzi (*U2 Representative*)

APPENDIX A

CTF MEG INTERNATIONAL SERVICE LP

CTF Certified 100% Helium Recovery System

CTF Certified 100% Helium Recovery

Why do I need helium recovery?

The state of helium supply has been a major issue in the medical and gas supply field. With both supply and production issues it has made national news. The healthcare industry is still the largest end user of helium (Source: Statista). Due to the small atomic mass of helium when it is released it simply rises into space, as the earths gravitational pull is to weak to keep it in the atmosphere. As such helium is a finite resource, and most models predict ongoing price increases.

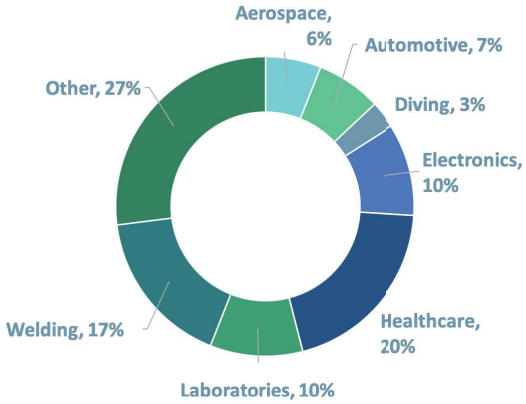
In 2008 90% of helium supply came from the US, but in recent years this has changed. The largest reserves is that held by the US Department of Land Management, and this will be phased out by 2021. One of the alternative supplies comes from Qatar, but trade embargoes in recent years has halted this supply.

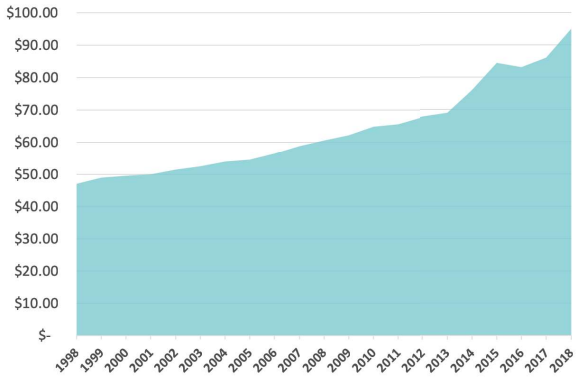
The SQUID devices responsible for the sensitivity of the CTF MEG system must be maintained at an ultra-low temperature by immersion in liquid Helium (LHe). The CTF 100% Helium recovery system can recycle 100% of the LHe required to do this. Helium is a scarce non-renewable resource and the supply is subject to interruptions and increasing cost. The CTF MEG system uses about 7000 liters per year. The Helium required by an CTF MEG is Grade A helium which is 99.995% pure.

Apart from the scarcity of helium there is the additional logistics required when having to fill the system. There is a need to have staff available for several hours twice a week to do the transfers of LHe into the MEG system. This operation requires training to perform and carries risks at several stages to both operators and equipment. And if supply is not available then after 4 days the MEG warms up which causes a necessary costly thermal cycle, and could put the system out of action for multiple weeks.

The CTF 100% Helium recovery system is a closed-loop solution with automated transfers that will eliminate the need to purchase LHe and perform manual LHe transfers. This Helium recovery system can be used by existing CTF MEG sites as well as with new CTF MEG installations.

No Manual Refills, Future Proof, Secure





BLM Prices (In-Kind) Since 1998

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Specifications Subject to Change Please Enquire

System Description and Schedules

System Description

The CTF MEG 100% Helium recovery system utilizes a two cold-head liquefier with a capacity to liquefy 40 liters of LHe per day. The liquefier includes a 250 litre LHe storage dewar. The other system components include a warm Helium gas compressor, Helium gas storage tanks, a custom LHe transfer line and a touch-screen system controller.

The warm Helium gas compressor and Helium gas storage tanks captures the exhaust gas from the system during LHe transfers into the MEG dewar when that exhaust is more than the liquefier can handle at the time. In addition, this storage system can store the normal Helium boil-off from the MEG allowing the liquefier to be shut down during the day reducing audible noise. During the night, the liquefier has enough capacity to liquefy the contents of the storage tanks in addition to the regular MEG system boil-off.

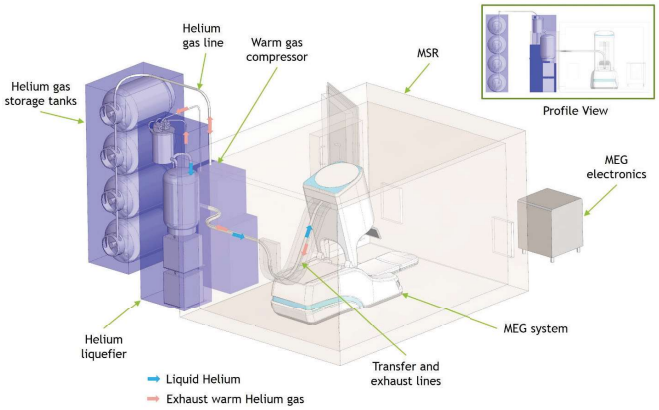
Shutting the liquefier down during the day is not a requirement for undisturbed MEG operation as the liquefier and the MEG system are separated by a long transfer line and MEG dewar pressure is precisely controlled. Normal MEG data collection can be performed while the liquefier is running without issues.

The transfer line has a non-magnetic leg that is always installed into the MEG dewar. The other leg of the transfer line is always installed into the storage dewar of the Helium liquefier. The control system monitors the status of both the recovery system and the MEG dewar, carrying out unattended automated LHe transfers at scheduled times and monitoring the combined systems for any sign of abnormal behavior.

An advantage of the two cold-head liquefier is that it provides a level of redundancy as operation can continue with just one cold-head operating provided the liquefier is left running during the daytime. Additionally, the time between required liquefier servicing can be extended as the hours of operation of the two cold-heads can be balanced by the system controller.

The system controller maintains control over all aspects of the Helium recovery process. It is a very robust system with numerous sensor inputs, capable of monitoring many parameters and smart enough to recognize when something is wrong and how to safely and appropriately handle all situations. Scheduling transfers and other functions can be done via the touch screen interface.

No Manual Refills, Auto-Scheduled



The CTF 100% Helium Recovery System

Cooling Water Requirements (combined system):

Inlet temperature 5°C to 25°C (41°F to 77°F)

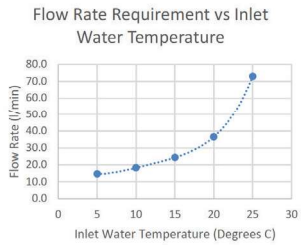
Target outlet temperature 30°C

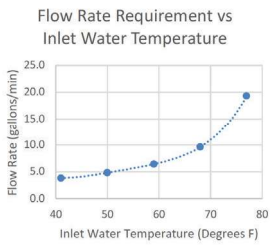
Pressure < 8bar (116 psi)

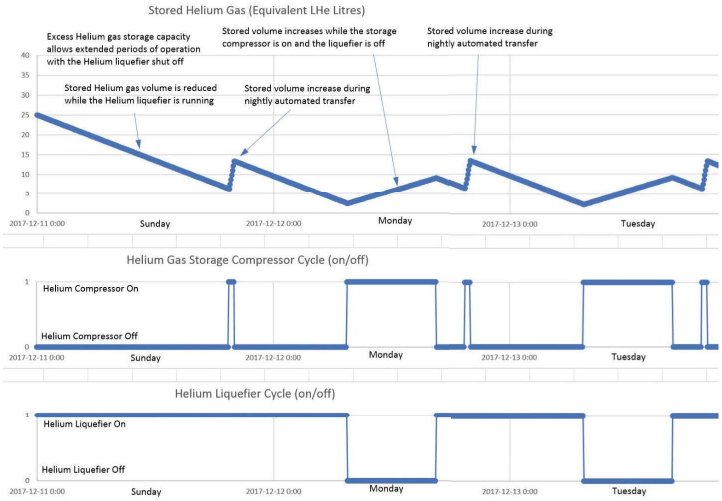
Pure water or water/glycol mix (flow required increases by about 15% with a 50% glycol mix)

Required cooling water flow rate depends on inlet temperature and varies from a minimum of ~14 l/min at 5°C to ~69 l/min at 25°C (~4 to ~19 gallons per minute, 41°F to 77°F).

See graphs below







Stored Helium gas timeline with liquefier turned off during the daytime

System Specifications Space Requirements and Technical Specifications

Upgrading to the new takes 5 days of on-site installation and a minimum of 2 weeks post installation monitoring. Training of the utilisation of the equipment will be performed on site, and post installation preventative maintenance will require ongoing services.

Space Requirements:

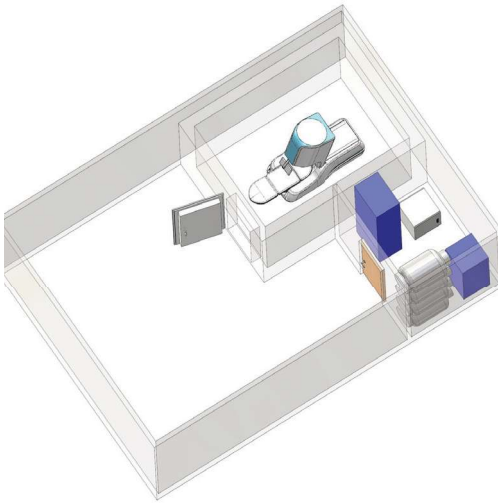
Each component has a minimum footprint but most need additional space around them for use/service access. A comfortable minimum room size for all the equipment would be about 8 feet by 10 feet. If that size space is not available in a single location, it is possible to have some of the components in separate areas. The liquefier itself needs to be close to the back of the MEG shielded room to minimize efficiency losses over the length of the transfer line between the liquefier and the MEG dewar. The warm Helium gas compressor can be located further away if necessary and the Helium gas storage tanks can be further separated from that compressor. The space above the MSR may be a potential storage space for Helium gas storage tanks.

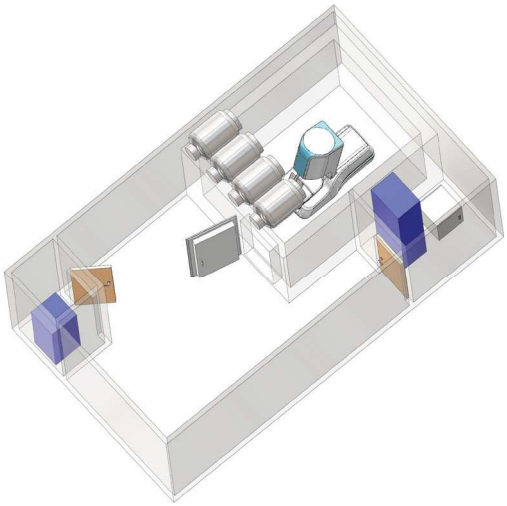
The layout for a facility is best done in collaboration with CTF. Once the facility's site dimensions are provided to CTF, several draft layouts will be generated such that the site users may select the optimal layout for their use. Once a final layout has been selected, detailed site drawings will be provided.

Some example layouts are shown on below.

Technical Specifications

Helium Liquefier	**Liquefaction capacity:** 40 liters/day **LHe storage capacity:** 150 liters **Electrical requirements:** Compressors: 480 VAC, 3 Phase, 60 Hz, 16 kW (maximum, not continuous) Control unit: 110 VAC to 240 VAC, Single phase, 50/60 Hz, <1 kW power consumption **Cooling water requirements:** Supply temperature: 5°C to 25°C (41°F to 77°F) Flow rate: ~13 to 63 l/min (~3.4 gal/min to 16.8 gal/min) depending on supply temperature (~32l/min at 20°C or ~8.4 gal/min at 68°F) Pressure <8bar (116 psi) pure water or water/glycol mix
Helium Gas Compressor	**Capacity:** 500 liters/min at 210 psi (equivalent to 3 per minute) **Electrical requirements:** 480 VAC, 3 phase, 60 Hz, 4kW (maximum, not continuous) **Cooling water requirements:** Supply temperature: 5°C to 25°C (41°F to 77°F) Flow rate: ~3.2 to 15.7 l/min (~0.8 gal/min to 4.2 gal/min) depending on supply temperature (~7.9l/min at 20°C or ~2.1 gal/min at 68°F) Pressure <8bar (116 psi) pure water or water/glycol mix
Helium Gas Storage Tanks	**Tank capacity:** ~8 liters (gas equivalent to ~8 liters of LHe) per tank **Tank pressure:** 210 psi **Number of tanks:** 4 (additional tanks available as an option), storing gas equivalent to ~32 liters of LHe **Tank dimensions:** 30" diameter by 52" tall (can be installed on side and/or stacked) A single larger outdoor tank is also available, storing gas equivalent to ~70 liters of LHe





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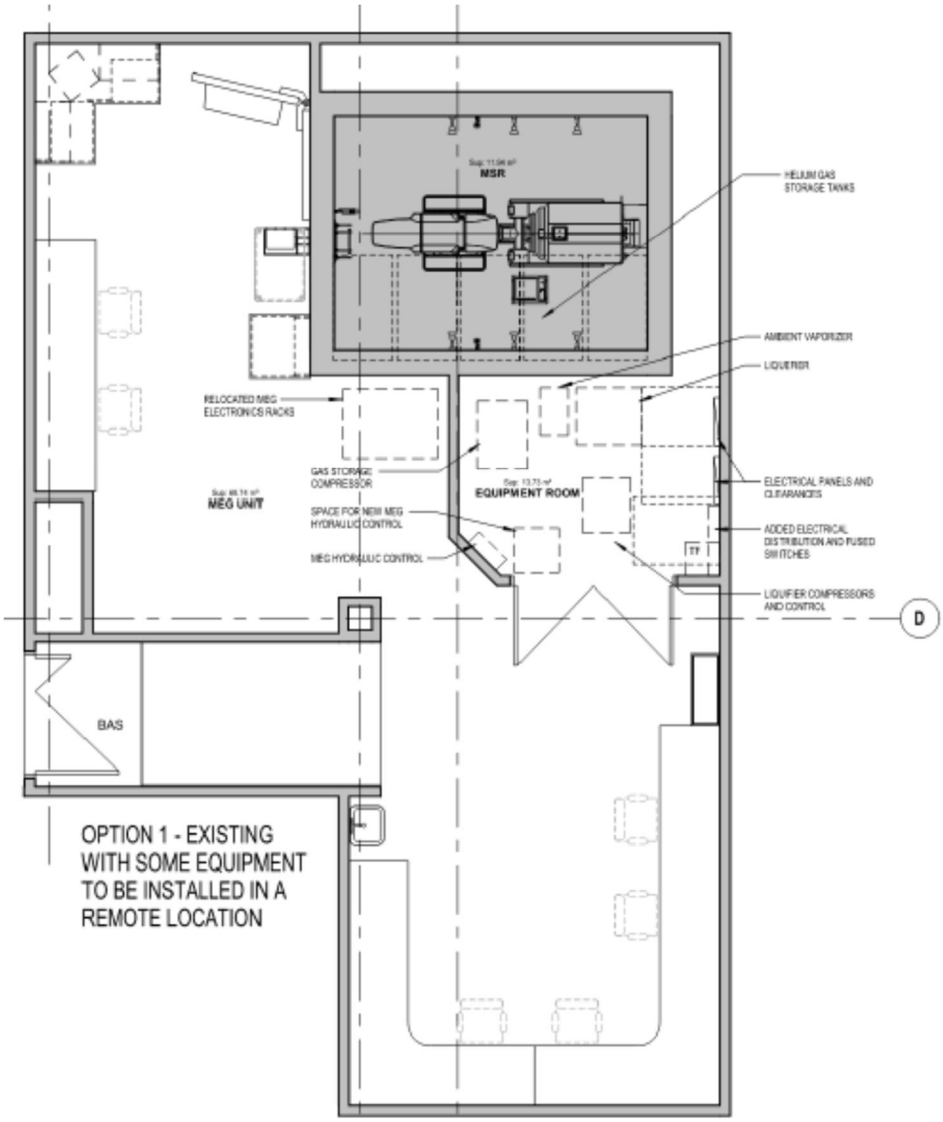
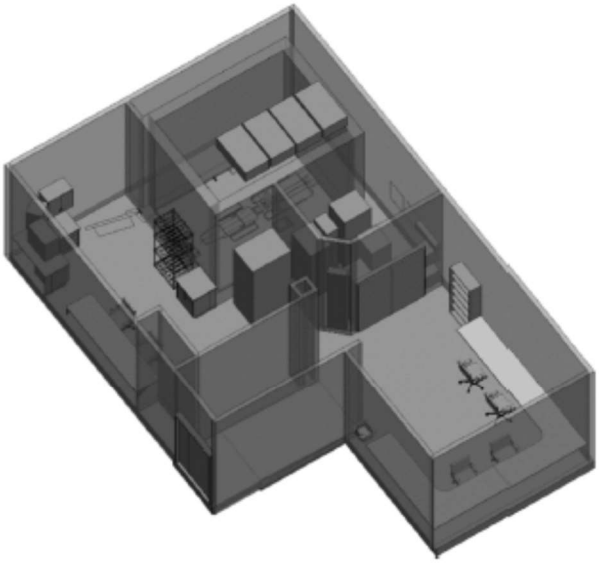
Specifications Subject to Change Please Enquire

Option 1:

No change to the rooms. All equipment, if possible, fits into the actual room and only the mechanical and electrical work are required. Architecture will be limited to the reparation required following the mechanical and electrical interventions.
The main risk with this option is that all the equipment might not fit. To be confirmed in the next phase of this project. The solution for this option remains in the possibility to install some of the required equipment in a remote location.
Due to the minimal impact on existing layout and construction cost, this option is preferred by the user.





Description of Electromechanical Interventions
The Neuro Building
Room NWB216

- Mechanical

Demolishing the 3/4-inch existing chilled water piping the serves the actual fan coil unit (FCU) until the 2-inch diameter main pipe and installing a new 2-inch pipe to comply with the cooling needs;
Demolishing the existing FCU named B2-VC-002 and installing a new FCU that has a cooling capacity of 24000 btu/h;
Adding two connections for chilled water with two isolation valves and one balancing valve. The connection to the equipment will be done by the equipment supplier at start-up;
Demolishing the existing exhaust duct (6-inch per 6-inch) coming from the NWB216A equipment room and installing a new duct that has an exhaust capacity of 1200 CFM.
Installing a new VAV terminal box and actuator on the new exhaust duct to control the airflow in case of Helium leakage.
Linking the existing low level oxygen sensor for the *Helium recovery system* to the new VAV terminal actuator and the existing actuator of the VAV terminal named B2-UTE-019;
Installing two (2) acoustic transfer ducts between the equipment room and the adjacent room
Balancing the chilled water network;
Balancing air supply and exhaust of the equipment room.

- Electrical

Installing a new 600 V, 40 A, 3 pole breaker in the panel 159G-PDU-B2(NWB258) supplying the whole helium recovery system;
Installing a new 30 kVA 600/480 V Y - Delta three phase transformer for the helium recovery system in the NWB258 electrical room;
Installing a new 42 cts Panelboard for power supply of the Helium Recovery System in the MEG room;
Installing 2 new 480 V, 30 A, 3 pole Circuit Breakers for the 2 liquefiers, a 3 pole 20 A Circuit Breaker for the recovery compressor;

Installing a 15 A Circuit Breaker for the Recovery Compressor in the existing MEG room panelboard;
Installing new conduits of 21 mm, 27 mm and 35 mm for the wires to connect all the new equipment to be installed;
Installing new #12 AWG cables for the wiring of the compressor and the control cabinet;
Installing new #10 AWG for the two liquefiers;
Installing new #8 AWG and #6 AWG for the primary and the secondary of the transformers;
Relocating existing outlets due to the extension of the MEG room;

- Architectural

Minor modifications to gypsum wall (without fire resistance)
- Minor expansion of the existing mechanical room
- Modification of the ceiling

Modification of the actual entrance to the mechanical room. If possible, the existing door should be move and reuse to reduce the timeline. If not, the door, frame and hardware will be replaced with similar.
Demolition and reconstruction of all architectural systems needed for mechanical and electrical interventions. Which includes:
- Modifications to suspended ceiling tiles
- Modifications to gypsum walls

The total architectural and electromechanical Class D budgetary estimate for the three options is available in the Appendix 2 of the present document.