Pan-Canadian Board for NSERC MRS Supported Technical Teams 2025 Report

James L. Pinfold, for the Board

Board Composition as of June 2025

- Jean-François Arguin - Université de Montréal - Montréal MRS manager
- Miriam Diamond - University of Toronto – at large
- Kevin Graham - Carleton University - Carleton MRS manager
- Garth Huber - University of Regina - CINP executive director
- Blair Jamieson - University of Winnipeg - Winnipeg MRS manager
- Rituparna Kanungo – Saint Mary's University – at large
- James Pinfold - University of Alberta - UofA MRS manager - *Board Chair*
- Fabrice Retiere - TRIUMF
- Carsten Krauss - University of Alberta - IPP director
- Brigitte Vachon – McGill University – McGill MRS manager

Rationale for the MRS Management Board

- *Why have MRS resources?*
  - *To enable the development of a pool of available technology experts across Canada that are free of change*
  - *Thus innovative ideas can start small, often without funding, can be leveraged by MRS resources to larger national and international project*
- *Why do we need coordination?*
  - *To dynamically match MRS resource to SAP community needs*
  - *To complement support from existing non MRS-funded resources (SNOLAB, TRIUMF, McDonald Institute) and project-specific professionals (e.g. CFI-funded)*
- *The PanCandian Board was created to provide the above. Its composition is:*
  - *Representatives from resource providers: MRS, TRIUMF,*
  - *Representative from users*
  - *Other members who provide additional needed expertise.*

Operation of the Board

- ***Just fill a form in on the IPP or CINP websites***
  - ***IPP*** - *https://particlephysics.ca/community/major-resources/*
  - ***CINP*** - *https://cinp.ca/subatomic-physics-major-resources-support-facilities*
- ***Request*** *goes out to the board:*
  - *Further details and clarifications may be sought*
  - *The Board votes to approve - so far none have been rejected*
- ***At last year's CAP*** *Miriam suggested implementing a ticket-based system within new dedicated website – we should beta test this approach.*
- ***Reporting – aiming to enhance transparency***
  - *Meet every 4 months – in between discuss by e-mail.*
  - *Standardized forms and meeting minutes on goggle drive*
  - *This material would move to a new dedicated website*
- ***Allocation:*** *try to choose the best technical match & perhaps refine request*

Strategizing Resource Usage and Expertise

- *MRS resources are free to the user, though with limitations*
  - *Concentrated commitment over a big chunk of time (~a month or two) is strongly discouraged due to the need for access of other users.*
- *Other resource areas potentially available at McDonald Institute, SNOLAB and TRIUMF*
  - *Getting access to TRIUMF resources can be problematic*
  - *McDonal Institute resources are, assumedly,available only for SNOLAB related projcets*
- *CFI provides project-based resources*
- *Another issue is the use of technical "hardware" resources owned by the MRS facilities.*
  - *The use of MRS funds to upgrade these technical resources is severely limited by MRS rules*
  - *There are no special grants for the hardware-type technical resources that are not related to a particular experiment and are generally available.*
- *Is there a longer-term solution? We need a national SAP discussion: A Canadian Advisory board for Subatomic physics Instrumentation?*

MRS Group Sites

UNIVERSITY OF ALBERTA

1. *Mech. Engineer (with stamp)**
2. *Electronics Eng.*
3. *Detector Tchnlgist*

Carleton UNIVERSITY

1. *Machinist/Tech.*
2. *Electronics Eng.*
3. *Electronics Tech.*
4. *Designer*

McGill

GRANDESCUNT AUCTA LABORE

1. *Firmware Eng.*

Université de Montréal

FIDE SPLENDET ET SCIENTIA

1. *Electronics Eng.*
2. *Electronics Eng.*
3. *Electronics Tech.*
4. *Software design.*
5. *Detector tchnlgst*

THE UNIVERSITY OF WINNIPEG

LUX ET VERITAS FLOREANT

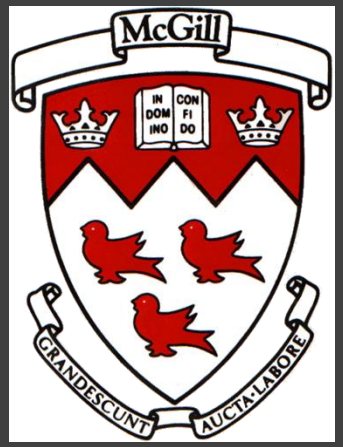
1. *Electrical Eng.*

NB Note that Mitchel Baker is the only registered engineer in the MRS resource

Recent MRS Group Activity

1. ATLAS –LUCID
2. ATLAS- AFP
3. DARKSIDE
4. DEAP
5. EIC CAL.
6. HYPER-K
7. MoEDAL-MAPP
8. MATHUSLA (new)
9. nEXO
10. PICO
11. P-ONE
12. SNO+

1. ARIEL
2. ATLAS-ITK
3. ATLAS-sTGC
4. EXO
5. DEAP
6. Hyper-K
7. MOLLER
8. PICO



1. JUST HIRING.

1. ATLAS
2. BELLE II.
3. DUNE.
4. nEXO.
5. PICO
6. SBC

1. DEAP.
2. HAICU
3. TUCAN
4. MOLLE
5. nEXO

MRS Group Abilities

UNIVERSITY OF ALBERTA

1. Registered engineer (CAD, FEI, Thermal)
2. Cryogenic design
3. Fast Analog & digital electronics design
4. Multi-layer PCB des.
5. DAQ software
6. ASIC design
7. FPGA programming
8. CNC machining
9. Radon Free const.
10. Detector design
11. Glass blowing

Carleton UNIVERSITY

1. Fast Analog & digital electronics design
2. Multi-layer PCB des.
3. DAQ software
4. FPGA programming
5. CAD design (FEA)
6. CNC machining
7. DAQ software

McGill

1. FPGA firmware.

Université de Montréal

1. Fast Analog & digital electronics design
2. Multi-layer PCB des.
3. DAQ software
4. FPGA programming
5. Pellatron Tandem beams
6. Precision machining

THE UNIVERSITY OF WINNIPEG

1. Fast electronic design
2. Precision Current sources
3. Analog & Digital electronic design
4. Multi-layer PCB des.
5. HV monitoring
6. DAQ Software

Recent MRS Awards

- *Three NSERC SAP Awards were up for renewal for the period 2025 - 2030*
  - *Alberta (CPP+), Montreal , Winnipeg*
- *We were required to apply for a 5-year grant; previously, a 3-year grant was required.*
- *RESULTS of the NSERC requests*
  - *Alberta MRS was awarded a 5-year grant cut by 29%*
  - *Montreal MRS was awarded a 5-year grant cut by 16%*
  - *The Winnipeg MRS award was cancelled (they will reapply in 2025)*
- *The NSERC report on the Alberta and Montreal resources was glowing. The cuts were blamed on the shortage of funds.*
- *Conclusions & summary:*
  - *The cuts will result in the effective loss of at least 2 MRS personnel and their collective knowledge and experience, although they will try to be retained using other funding*
  - *No special commitment by NSERC to "protect" community wide MRS resources*
  - *The relatively recent increase in NSERC funding do not seem to be making a difference*

REPORTS FROM MRS FACILITIES

Alberta MRS Resource

- **Based at the University of Alberta, the CPP+ MRS Centre is available to support SAP-NSERC funded projects. The Current grant & MRS personnel:**

GRANT SUMMARY

Applicant:	James Pinfold
Application Number:	SAPMR-2022-00004
Title:	CPP+, the MRS Application for the Centre for Particle Physics
Administering Organization:	University of Alberta
Amount of Award:	1/3 2022/2023 $230,000 2/3 2023/2024 $350,000 3/3 2024/2025 $350,000
Co-Applicant(s):	Gingrich, Douglas Hallin, Aksel Huber, Garth Krauss, Carsten Moore, Roger Piro, Marie-Cécile Yáñez Garza, Juan Pablo
Award Start Date:	April 1, 2022 **Award End Date:** March 31, 2025

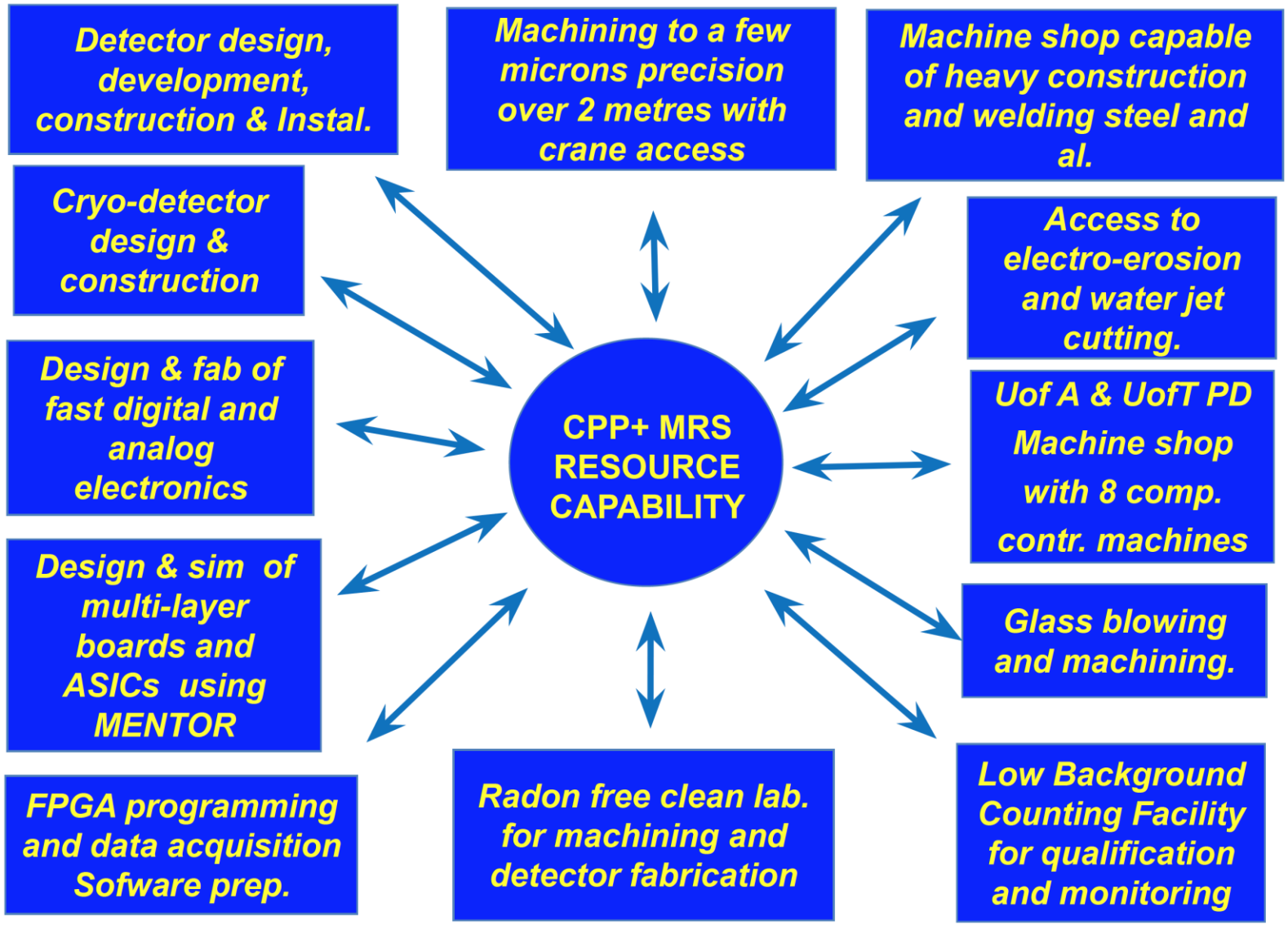
- **Over the past several years the CPP+ MRS Resource made important contributions to 80% of the SAP experiments "taking data"**

Dr Richard Soluk
MRS Detector Technologist

Mitchel Baker
MRS Engineer (with Stamp!)

Paul Davis
MRS Electronics Engineer

Alberta MRS Resource



Alberta MRS Resource - Current & Recent Users

ATLAS AFP

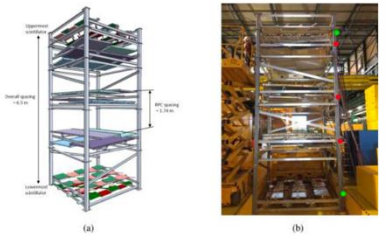
ATLAS LUCID

MoEDAL-MAPP

DARKSIDE

DEAP

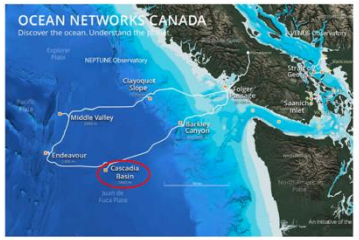
IceCube



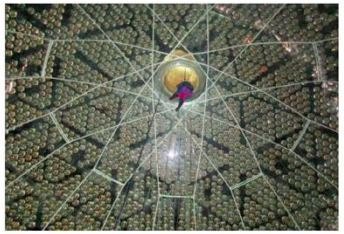
MATHUSLA (starting)

NEWS-G

PICO-500



P-ONE (planned, requested by external user)



SNO+

SBC

Carleton Technical Team (MRS Supported)

PanCanadian MRS Report 2025

- Personnel
  - Electrical Engineer and Electronics Technician
    - simulation, circuit design, testing, FGPA programming
    - analog and digital readout systems, power supplies, equipment certification
    - soldering, cabling, system modeling, and control
  - Machinist/Technician
    - precision small parts fabrication, welding, vacuum/gas system cleaning and assembly, leak-checking
    - C&C milling/programming
  - Designer
    - 3-D modeling, concept development, detailed design drawings for fabrication (e.g., CNC), as-built drawings, FEA calculations

  ⇨ have worked closely with TRIUMF, McDonald Institute, and SNOLAB engineers

- Facilities, Equipment, and Expertise
  - machine shop, electronics lab, clean rooms (CNC mill, lathe, water jet, 3D printing, etc.)
  - Carleton Science and Technology Centre (STC)
  - cryogenic, vacuum, and gas handling equipment (Swagelok, VCR, Conflat, KF, custom)
  - electronics and DAQ (NIM, VME, LabView, FGPA)
  - EUDET silicon pixel telescope
  - Department of Electronics CUMFF/FANSSI facility

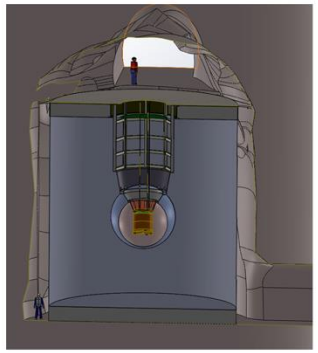
Carleton University

Success

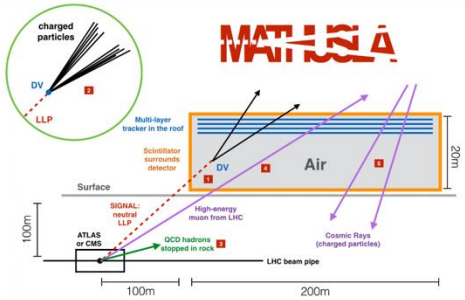
Select Contributions from the Carleton Technical Team

PanCanadian MRS Report 2025

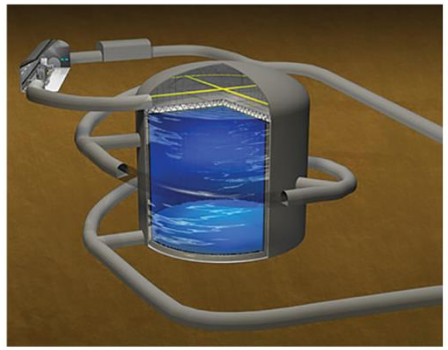
EXO



MATHUSLA



Hyper-Kamiokande

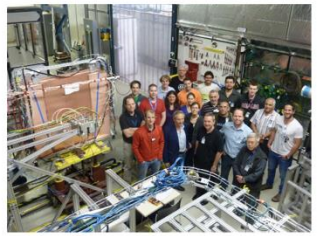


TRIUMF ARIEL
ADVANCED RARE ISOTOPE LABORATORY

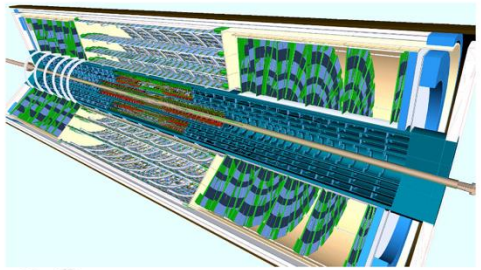
DEAP

For more than 20 years, the Carleton Technical Team has been contributing to subatomic physics via R&D, Testing, Large-Scale Assembly and Delivery, and Maintenance of particle detector systems for a variety of projects in Canada and around the world.

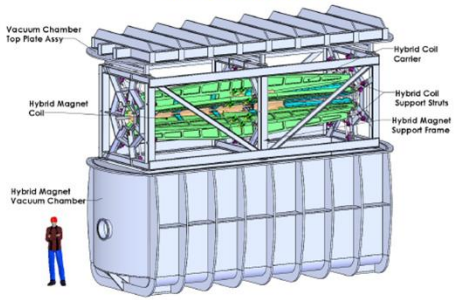
ATLAS-sTGC



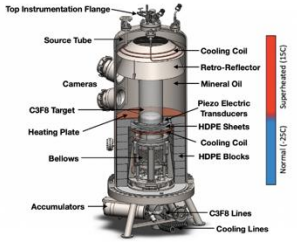
ATLAS-ITK



MOLLER



PICO



McGill MRS Resource

- **Funded resource: *Specialized firmware engineer***
- **Examples of types of support envisioned:**
  - Consultancy in high-level design of complex firmware projects.
  - Hardware-specific firmware optimization.
  - Expertise in firmware implementation of interfaces to generalized readout components developed for subatomic physics research.
  - Firmware design and implementation in highly integrated readouts of state-of-the-art sensors.
  - Firmware implementation of machine learning algorithms in large-scale FPGA-based embedded systems.
- **Status:**
  - Hiring delays due to recruitment challenges.
  - Preferred candidate now identified, and currently going through immigration process to finalize contract.
  - Timescale of start of contract depends on immigration delays.

Montreal MRS Resource: Machine Shop and Beam

- **Machine shop**
  - Team: currently two machinists with extensive experience working on subatomic physics experiments
  - State-of-the-art equipment
  - Recently built custom-made equipment for:
    - TUCAN, Darkside-20k, SBC, PICO, ATLAS, nEXO, etc
- **Tandem beam:**
  - Pelletron Tandem that can produce e.g. proton beam up-to 11 MeV with 15 μA current
  - Can produce a mono-energetic neutron beam for calibrating dark matter detectors
- **More information about the Montreal Resource can be found at: https://wiki.umontreal.ca/display/LTA/Home**

Montreal MRS Resource: Electronics Lab

- **Wide-ranging expertise in electronics design, DAQ, FPGA firmware, trigger, slow control, detector mechanics, etc**
- **Team: 3 PhD physicists, 1 electronics engineer, 1 tech**
- **Recent projects:**
  - **DUNE:**
    - Data-filter system (software), timing system (firmware)
  - **ATLAS:**
    - ITk tracker: interlock system design, tests of front-end chips
  - **PICO:**
    - Design of acoustic amplifier boards
  - **SBC**
    - Design of LED light ring
  - **nEXO:**
    - Electronics for muon veto system
  - **Belle-II:**
    - LYSO scintillator beam monitoring system

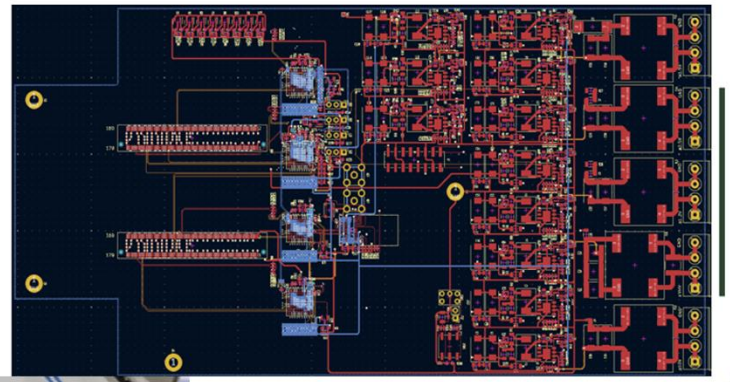
Uwinnipeg MRS Resource – Shomi Ahmed

- BSc Electrical Engineering (Electronics engineering)
- MSc Physics (University of Manitoba), supervisor Jeff Martin
- Working towards P.Eng designation
  - Accepted as Engineering Intern (EIT) in Nov. 2021
  - P.Eng Mentoring at 4/4 years required work experience
  - After work experience prof. practice exam
- Examples of past and ongoing projects
  - Ultrastable precision current sources (<1ppm)
  - HV leakage current monitoring (+-250kV,<100pA)
  - 64-ch shim coil current source using DACs and MUX
  - Underwater photogrammetry camera systems
  - Degaussing system relay boxes (CSA compliant, 60A contactors)

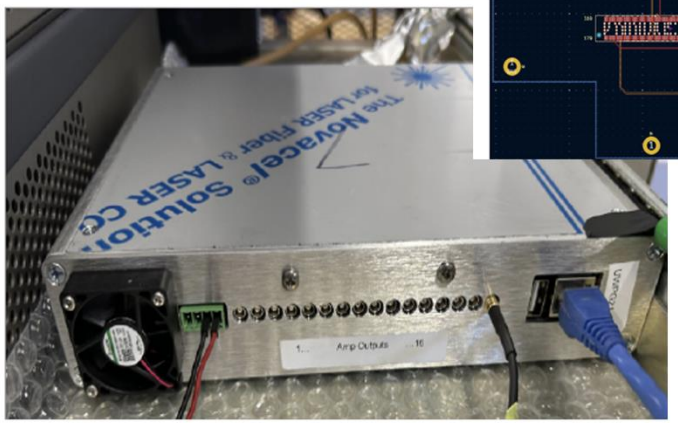
Success

Uwinnipeg MRS Resource – Projects

- Lolx SiPM bias and amplifier boards for DEAP, HAICU, TUCAN and nEXO
  - Ensured QA and verification before installation
- HVMAPS readout systems using lpGBT for MOLLER (with Carleton MRS)
  - Breakout cable flex board design, high-speed readout routingS

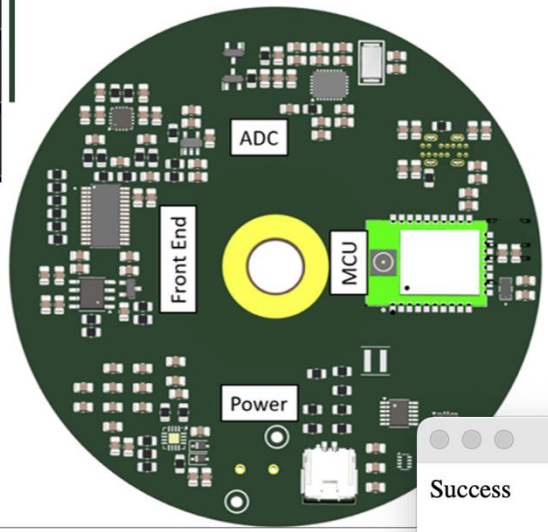


HVMAPS board



Lolx board

HV leakage
Current monitor



Success