

# Pan-Canadian Board for NSERC MRS Supported Technical Teams

## Board composition as of May 2024

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 - CIMP 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

Fabrice Retiere - TRIUMF

Mike Roney - University of Victoria - IPP director

Brigitte Vachon – McGill University – McGill MRS manager

# Need for the MRS Management Board

- **The case for MRS resources**
  - To ensure specialized expertise remains in a state of readiness for researchers across Canada to use
  - To enable initial work that can be used as a stepping stone for Canadians to lead larger scale contributions to national and international projects (e.g. eventually supported by CFI-funded dedicated technical personnel)
  - To enable the development of technology experts across Canada
- **The case for enhanced coordination**
  - To match MRS resource to SAP community needs
  - To complement support from existing MRS-funded resources (SNOLAB, TRIUMF, McDonald Institute) and project-specific professionals (e.g. CFI-funded)
- **How?**
  - Representative from resource providers: MRS, TRIUMF, ...
  - Representative from users
  - Advise resource providers

# Establishing Operational Processes

- **Requesting Resources**
  - **Form for requesting support:**  
**<https://particlephysics.ca/community/major-resources/>**
  - **Request-tracking and response time issues need fixing**
    - **Looking to implement a ticket-based system within new dedicated website**
- **Reporting on Progress to the Committee**
  - **Meeting every 4 months at the very least**
  - **Standardized forms and meeting minutes currently in Google drive**
  - **Aiming to setup a dedicated website in the next 6 months**
    - **Goal is to enhance transparency**
- **Resource Allocation**
  - **Currently based on best technical match and best effort**

# Next Steps:

## Strategizing resource usage and expertise

- **MRS resources are free to the user, though with limitations**
  - **Commitment is limited to 4 months (renewable) in order to be available for other projects**
- **Other resources available at McDonald Institute (hopefully continuing), SNOLAB and TRIUMF**
  - **Process to access resources not broadly known/understood**
- **CFI provides project-based resources**
- **Very limited coordination between resource “provider”**
- **Longer Term: A Canadian Advisory board for Subatomic physics Instrumentation?**

# 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 safety system, 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

# Montreal MRS Resource - Machine Shop and Beam

## ■ Machine shop

- **Team: currently one machinist with extensive experience working on subatomic physics experiments**
  - Currently in the process of hiring 2 more people
- **State-of-the-art equipment**
- **Recently built custom-made equipment for:**
  - nEXO, Barium tagging, SBC, PICO, ATLAS, TUCAN, etc

## ■ Tandem beam:

- **Pelletron Tandem that can produce e.g. proton beam up-to 11 MeV with 15  $\mu$ A 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>**

# McGill MRS Resource

- **Newly funded :** *Specialized firmware engineer*
- **Background:** Innovations in microelectronics, high speed communication and FPGA technologies bring tremendous opportunities to the field, that however come at the cost of increased firmware development complexity requiring a high level of specialized expertise.
- **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: job ad will be posted shortly**

# Carleton MRS Resource

## ■ Personnel

### ■ Electrical Engineer and Electronics Technician

- simulation, circuit design, testing, FPGA 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

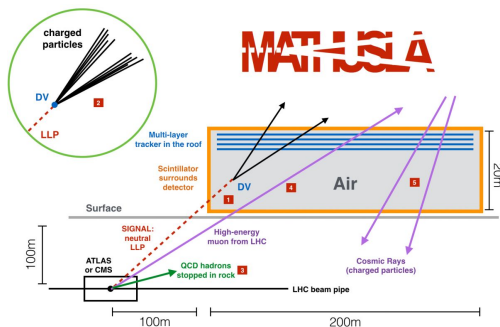
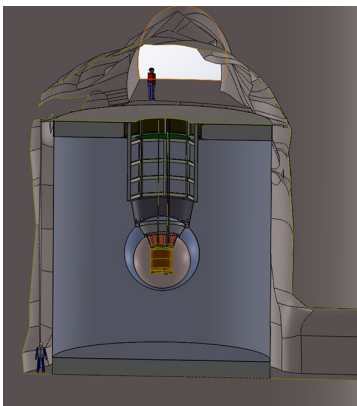
## ■ Facilities, Equipment, and Expertise

- 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, FPGA)
- EUDET silicon pixel telescope
- Department of Electronics CUMFF/FANSSI facility

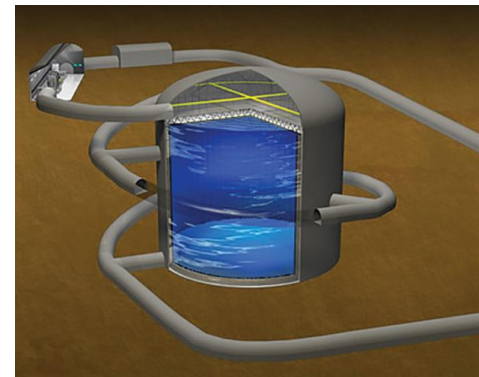


# Carleton MRS Resource - Selected Contributions

nEXO



Hyper-Kamiokande



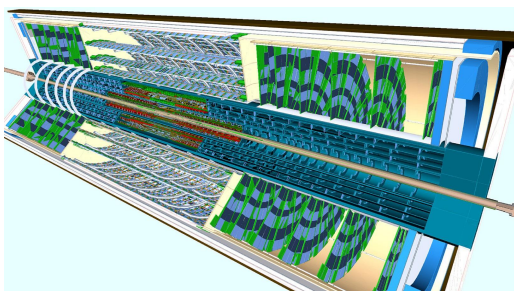
DEAP



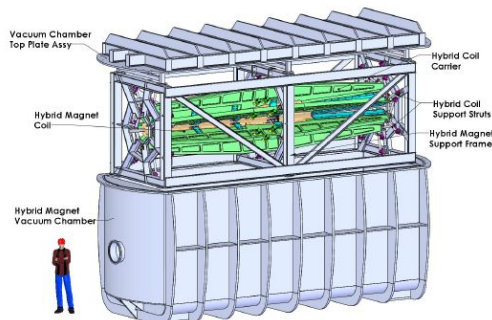
For more than 20 years, the Carleton Technical Team has been contributing to subatomic physics via R&D, Testing, Large-Scale Assembly and Delivery, and Maintenance of particle detector systems for a variety of projects in Canada and around the world.



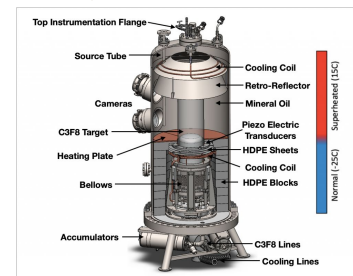
ATLAS-ITK



MOLLER



PICO



# 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 3/4 years required work experience
  - After work experience prof. practice exam
- **Winnipeg MRS ready to accept requests for electronics engineering support**
  - Consulting and selection of commercially available electronics
  - Schematic layout and circuit simulation
  - PCB procuring and board stuffing
  - Circuit Testing

# UWinnipeg MRS Resource – Current Projects

- **HyperK: photogrammetry camera electronics**
  - USB, HDMI, and Power over 100 m underwater
- **TUCAN: ultra-stable current supply, degaussing current relays, shim coil current supply**
- **Moller HVMAPS: connector boards, high-speed circuits (Carleton resource as lead)**
- **SiPM readout:**
  - Producing LoLX boards for researchers at Carleton and TRIUMF
  - Adapting LoLX boards for TUCAN use
- **UCN: leakage current circuit for UNBC researchers**
- **Goal: We are hoping for applications to use our resource, from PI's outside Manitoba**

# 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-Applcant(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**

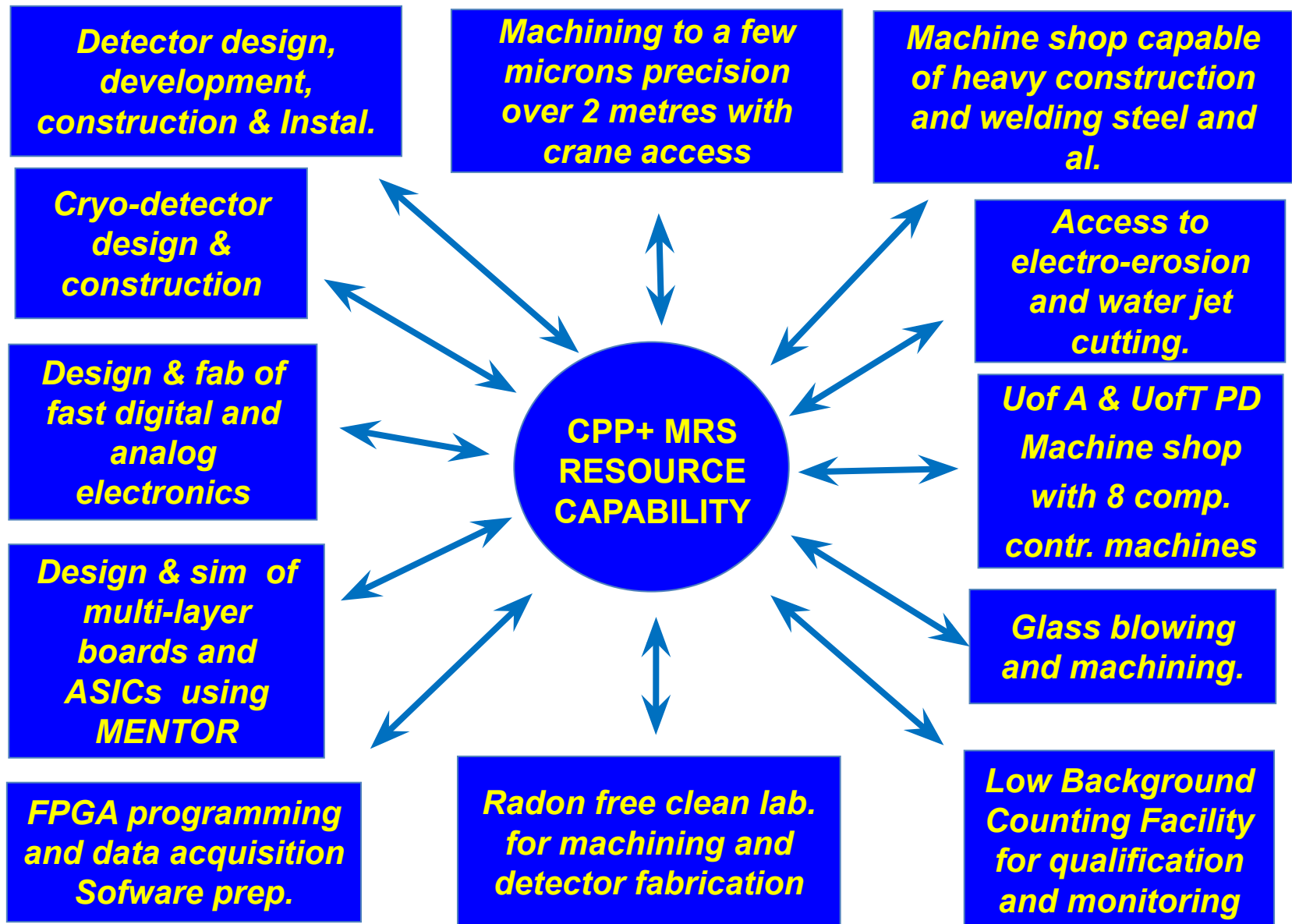


**Mitchel Baker**  
**MRS Engineer (with Stamp!)**



**Paul Davis**  
**MRS Electronics Engineer**

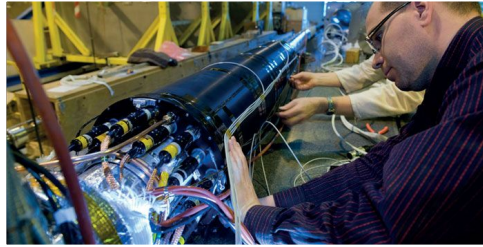
# Alberta MRS Resource



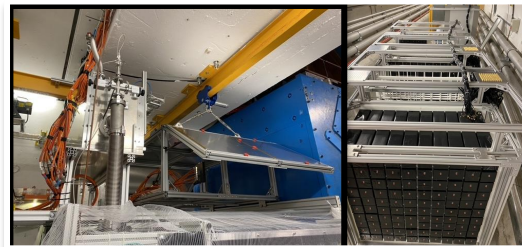
# Alberta MRS Resource - Current & Recent Users



*ATLAS AFP*



*ATLAS LUCID*



*MoEDAL-MAPP*



*DARKSIDE*



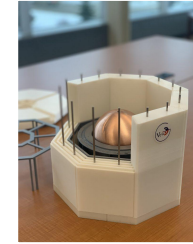
*DEAP*



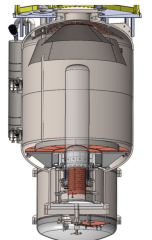
*IceCube*



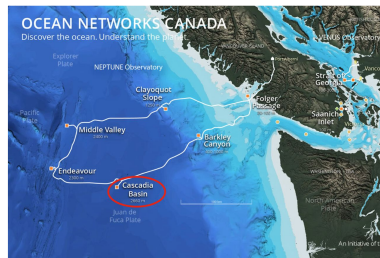
*MATHUSLA  
(starting)*



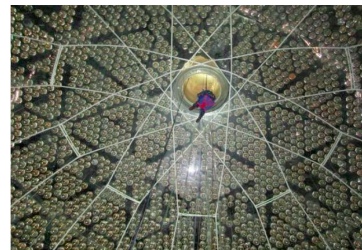
*NEWS-G*



*PICO-500*



*P-ONE (planned,  
requested by  
external user)*



*SNO+*



*SBC*