NSERC MRS Supported Technical Teams Management Board

Board composition in June 2023

Jean-François Arguin - Université de Montréal - Montréal MRS manager
Miriam Diamond - University of Toronto
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 - Started July 2022
James Pinfold - University of Alberta - UofA MRS manager
Randall Sobie - University of Victoria, MRS manager
Fabrice Retiere - TRIUMF
Mike Roney - University of Victoria - IPP director
Brigitte Vachon – McGill University – McGill MRS manager - Started April 2023

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, SNOLAB, TRIUMF,…
  - Representative from users
  - Advise resource providers

Establishing Operational Processes

- **Requesting Resources**
  - Form for requesting support online
  - Issue with tracking request and response time need fixing
    - Looking at a ticket-based system within new dedicated website
- **Reporting on Progress to the Committee**
  - Meeting every 4 months at the very least
  - Standardized forms currently in Google drive
  - 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 upgrade: interlock safety system, electrical tests of front-end chips**
    - **LAr calorimeter upgrade: design of calibration boards**
  - **PICO:**
    - **Design of acoustic amplifier boards**
  - **nEXO:**
    - **Electronics for muon veto system**
  - **Belle-II:**
    - **LYSO scintillator beam monitoring system**

Montreal MRS Resource: Machine Shop and Beam

- **Machine shop**
  - **Team: 3 machinists with combined 50 years of experience working on subatomic physics experiments**
  - **State-of-the-art equipment**
  - **Recently built custom-made equipment for:**
    - **nEXO, Barium tagging, Hyper-K, SBC, PICO, ATLAS, etc**
- **Tandem beam:**
  - **Pelletron Tandem that can produce e.g. proton beam up-to 11 MeV with 15 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:** Ongoing HR approval to post job ad shortly

Carleton Technical Team (MRS Supported)

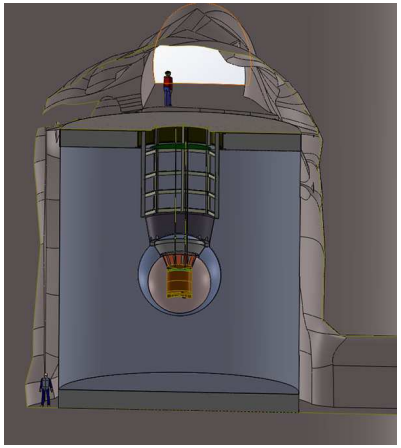
- **Personnel**
  - **Electrical Engineer and Electronics Technician**
    - simulation, circuit design, testing, FGPA programming
    - analog and digital readout systems, power supplies, equipment certification
    - soldering, cabling, system modeling, and control
  - **Machinist/Technician**
    - 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
- We have worked closely with TRIUMF, McDonald Institute, and SNOLAB engineers

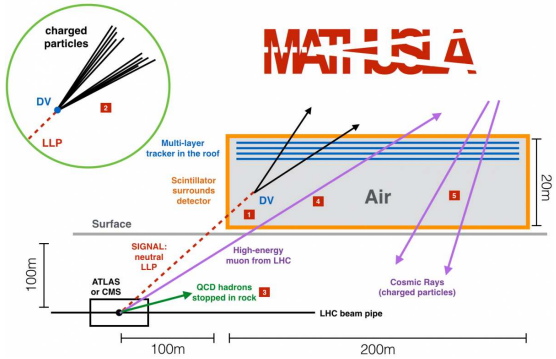
- **Facilities, Equipment, and Expertise**
  - Machine shop, electronics lab, clean rooms (CNC mill, lathe, water jet, 3D printing, etc.)
  - Carleton Science and Technology Centre (STC)
  - Cryogenic, vacuum, and gas handling equipment (Swagelok, VCR, Conflat, KF, custom)
  - Electronics and DAQ (NIM,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

Carleton University

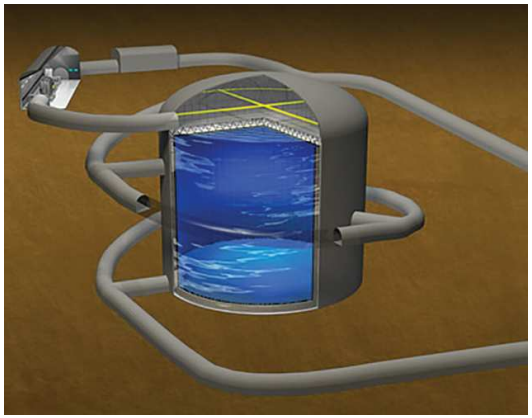
Select Contributions from Carleton MRS Team

nEXO





Hyper-Kamiokande

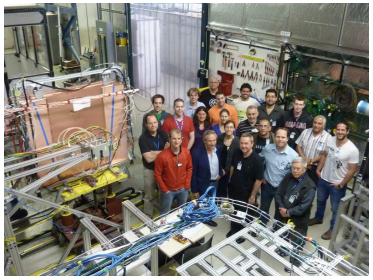


TRIUMF ARIEL
ADVANCED RARE ISOTOPE LABORATORY

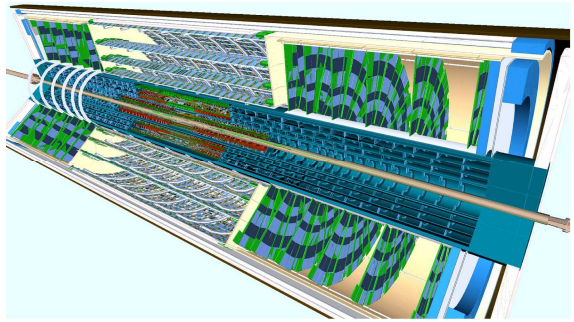
DEAP

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.

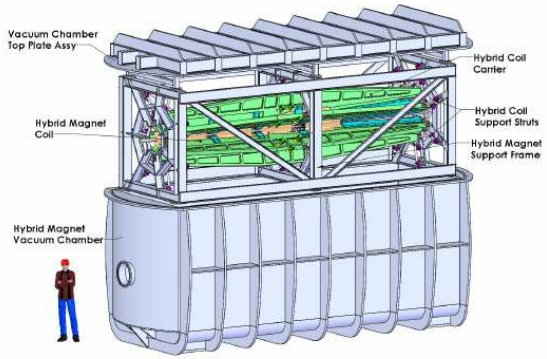
ATLAS-sTGC



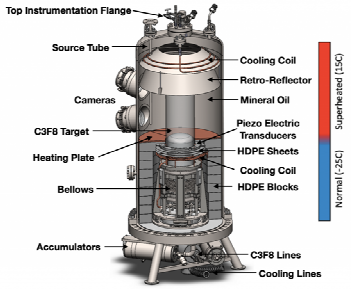
ATLAS-ITK



MOLLER



PICO



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 2.5/4 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

- Photogrammetry camera electronics for HyperK
  - USB, HDMI, and Power over 100 m underwater
- Degaussing current relay box and current readouts for TUCAN
- Multi-channel high precision current source for TUCAN B0 coil
- Multi-channel current source for shim coils for TUCAN
- Learning higher speed electronics for HVMAPS project (Carelton resource as lead) for Moller
- Goal: We are hoping for applications to use our resource, from PI's outside Manitoba

Alberta CPP+ Major Resources Support Centre

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

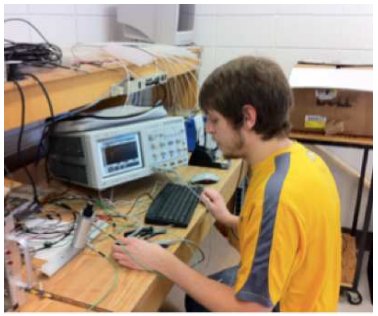
GRANT SUMMARY

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"*
- ***Contacting the CPP+ MRS Resource** from the IPP or CINP site:*
- *https://cinp.ca/subatomic-physics-major-resources-support-facilities*

Dr Richard Soluk
MRS Detector Technologist

Mitchel Baker
MRS Engineer (with Stamp!)



Paul Davis
MRS Electronics Engineer

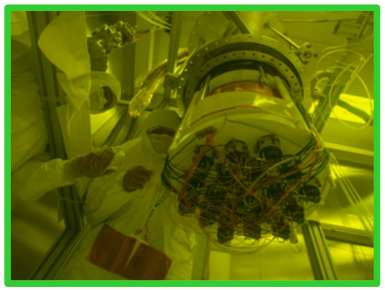

Detector design, development, construction & Instal.
Machining to a few microns precision over 2 metres with crane access
Machine shop capable of heavy construction and welding steel and al.
Cryo-detector design & construction
Access to electro-erosion and water jet cutting.
Design and fabrication of fast digital and analog electronics
CPP+ MRS RESOURCE CAPABILITY
Uof A & UofT PD Machine shop with 8 comp. contr. machines
Design & simulation of multi-layer boards and ASICs using MENTOR
Glass blowing and machining.
FPGA programming and data acquisition Sofware prep.
Radon free clean lab. for machining and detector fabrication
Low Background Counting Facility for qualification and monitoring

CPP+ MRS: Current/Recent Users

ATLAS AFP

ATLAS LUCID

MoEDAL-MAPP

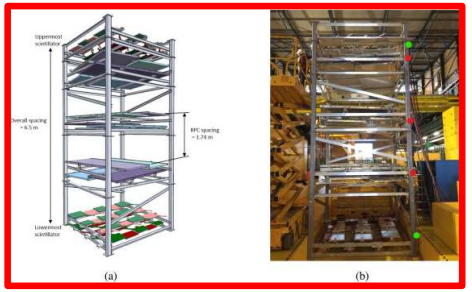


DARKSIDE

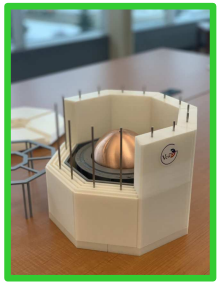
DEAP

Hyper-Kamiokande

IceCube

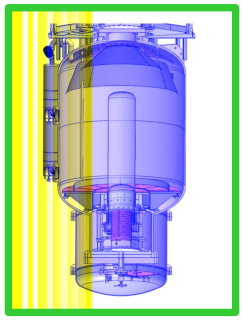


MATHUSLA (planned)

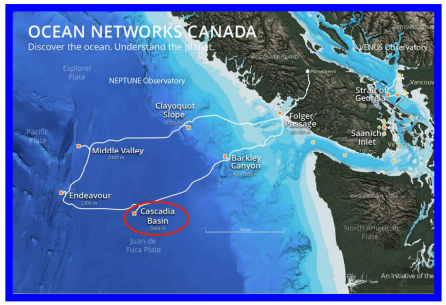


NEWS-G

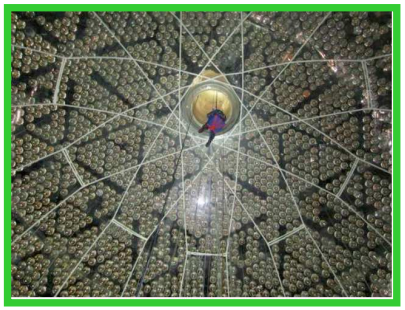
nEXO



PICO-500



P-ONE (planned)



SNO+

SBC

PanCanadian MRS Report 2023

Alberta Involvement

Alberta involvement but requested by external user

NO Alberta involvement requested by external user

To Request Resources

- Resource requests can be submitted via the fillable pdf form available at:

  https://cinp.ca/subatomic-physics-major-resources-support-facilities
- Users should email the request to: pancanadianmrsboard@triumfoffice365.onmicrosoft.com
- The resource request will be reviewed by the Pan-Canadian MRS Technical Coordination Board