

SAP technical (MRS + TRIUMF) support

F. Retière [TRIUMF] representing (a fraction of) the technical support community

Or in other words,
Technology excellence for physics
discoveries

Technology excellence

1. Outstanding people/expertise

- Yes, physicists can do anything... but not always very well and nor quickly
 - Scotch tape is great... up to a point.
 - Do physics graduate students really need to build electronics boards for example?
- Outstanding engineers and technicians make world of difference
 - Recruiting them on a per-project basis is risky and inefficient
 - NSERC MRS, TRIUMF and SNOLAB enable retaining outstanding technical people
 - Team dynamic also makes a huge difference, however resources somewhat fragmented

2. Outstanding capabilities

- For example specialized machining, radioassay,...
- Balance in-house capabilities with commercial capabilities

3. Management

- Ensuring that projects are completed on time and budget is hugely tricky
- “Smart” management is key

Overall technical SAP support sources

- **Alberta MRS**
- **Carleton Uvic Winnipeg MRS**
- **Université de Montreal MRS**
- McDonald Institute
 - Phasing out by 2023
- TRIUMF
 - **Science Technology department**
 - P&S in Physical Science Division
 - Engineering division
- SNOLAB

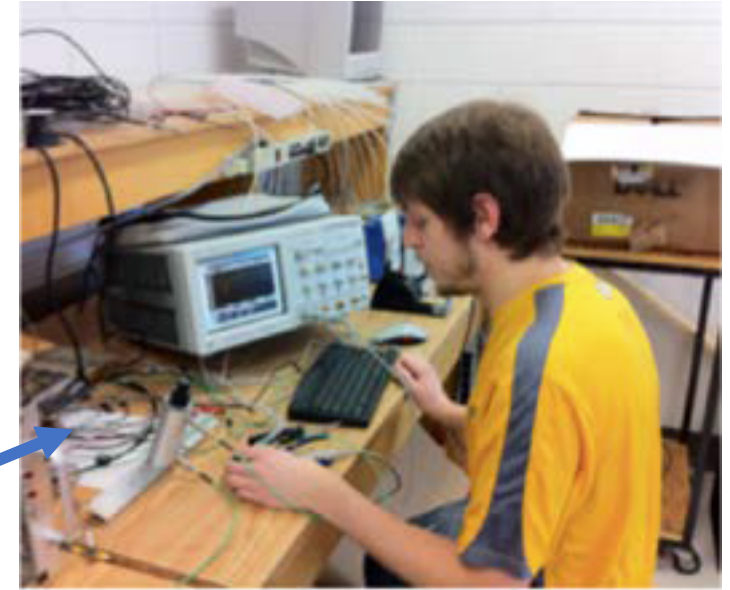
Continuity and critical mass considerations

- CFI provide funds to hire technical manpower but no continuity at the project/experiment scale
- As a community, we are continuously developing and building new experiment. So continuity exists at the community level
- Continuity may be achieved at the scale of TRIUMF or SNOLAB but they do not encompass the whole community
- NSERC MRS program provide technical manpower at universities but how much can a single person do? Is site critical mass important?

U. Alberta – Toronto CPP+ MRS team

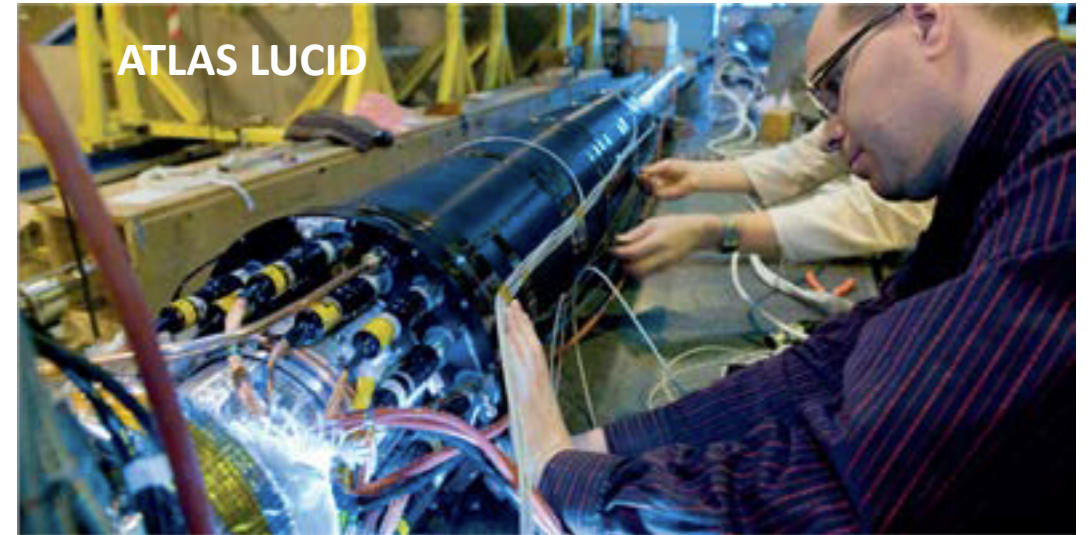


- Richard Soluk (detector technologist)
- Paul Davis (electronics engineer)
- Mircea Cadbaschi (engineer)
- Mitchel Baker (engineer)
- And wide ranging capabilities at UofA
 - <http://cpp-plus.physics.ualberta.ca/>



U. Alberta – Toronto CPP+ recent projects

- ATLAS Forward proton
- ATLAS-LUCID
- MOEDAL-MAPP (complete detector)
- DEAP-3600 and
- DarkSide-20k
- PICO-40, PICO-500 and Scintillating bubble chambers
- SNO+
- P-ONE



Carleton Technical Team (MRS Supported)

- Personnel

- **James Botte and Olay Chen:**

- **Electronics Specialist and Electronics Technician**
 - analog and digital readout systems, power supplies, equipment certification
 - soldering, circuit design, cabling, system modeling and control

- **Philippe Gravelle**

- **Machinist/Technician** - precision small parts fabrication, welding, vacuum/gas system cleaning and assembly, leak-checking

- **Rodney Schnarr**

- **Designer** - 3-D modeling, concept development, detailed design drawings for fabrication (e.g. CNC), as-built drawings, FEA calculations
 - ⇒ working closely with McDonald Institute and SNOLAB engineers based at Carleton

- Facilities and Equipment

- machine shop, electronics lab, clean rooms, vacuum and gas handling equipment (Swagelok, VCR, Conflat, KF, custom), electronics and DAQ
 - (NIM, VME, LabView), silicon pixel telescope

- **Carleton Science and Technology Centre (STC)** <https://carleton.ca/stc/>



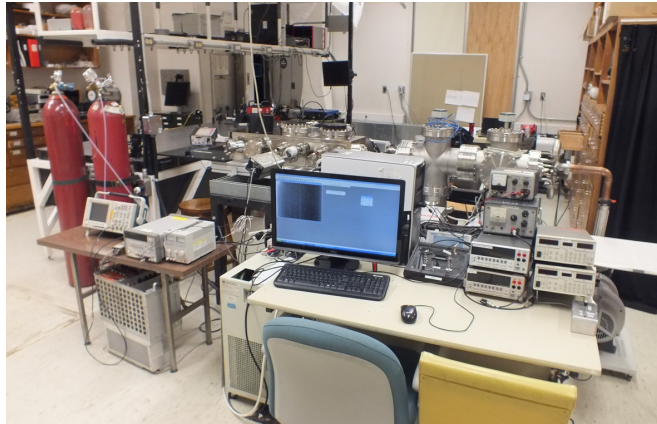
Carleton
UNIVERSITY

Carleton Technical Team

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.

Select projects that have been supported:

EXO



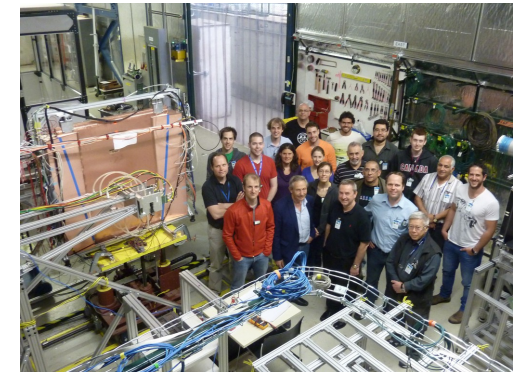
DEAP



FCAL



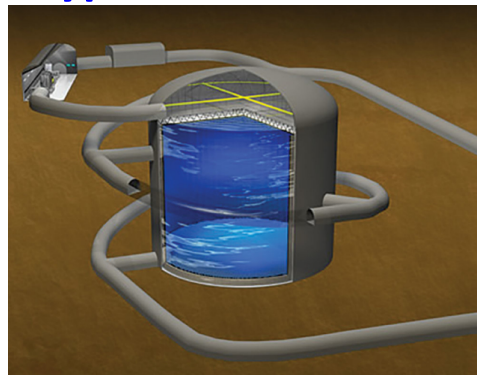
ATLAS



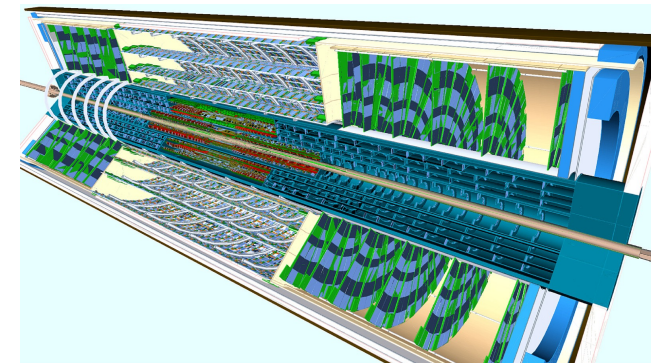
sTGC

ARIEL

Hyper-Kamiokande



ITK



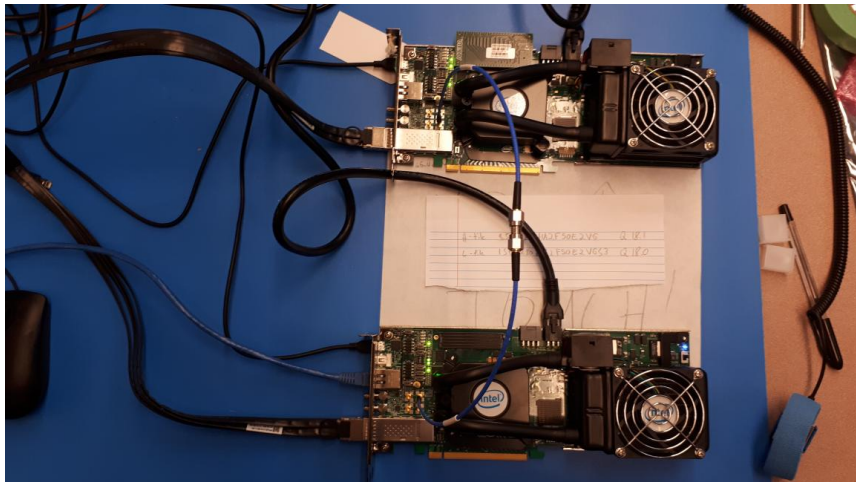


Detector physicist: Sam de Jong (2017-present)

PhD research: designed, assembled, and commissioned thermal neutron detector system using tubes of helium-3 for the Belle II experiment

Current work: FPGA program development for ATLAS LAr Calorimeter and Belle II

Expertise: GEANT4 detector simulation, DAQ software, digital electronics



Resources at the University of Victoria:

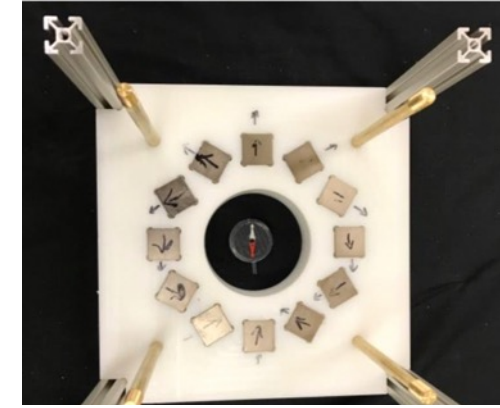
Clean room, vacuum test equipment, local machine shop, electronics shop and general laboratory space

<https://www.uvic.ca/science/physics/vispa/research/resources/index.php>

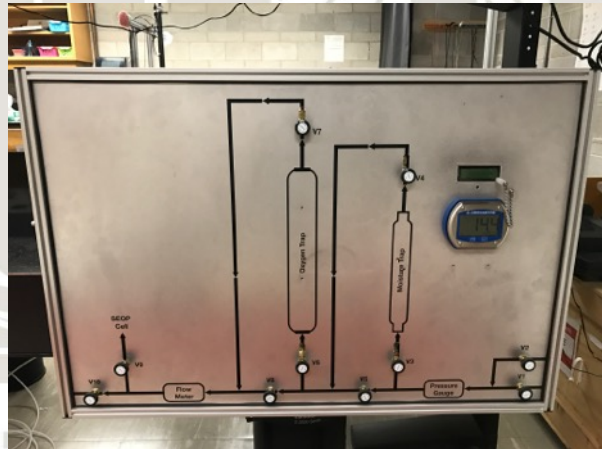
Winnipeg NSERC SAP MRS Resource

For examples of past projects supported by David Ostapchuk see:
www.uwinnipeg.ca/physics/research/nserc-funded-sap-mrs-technician.html

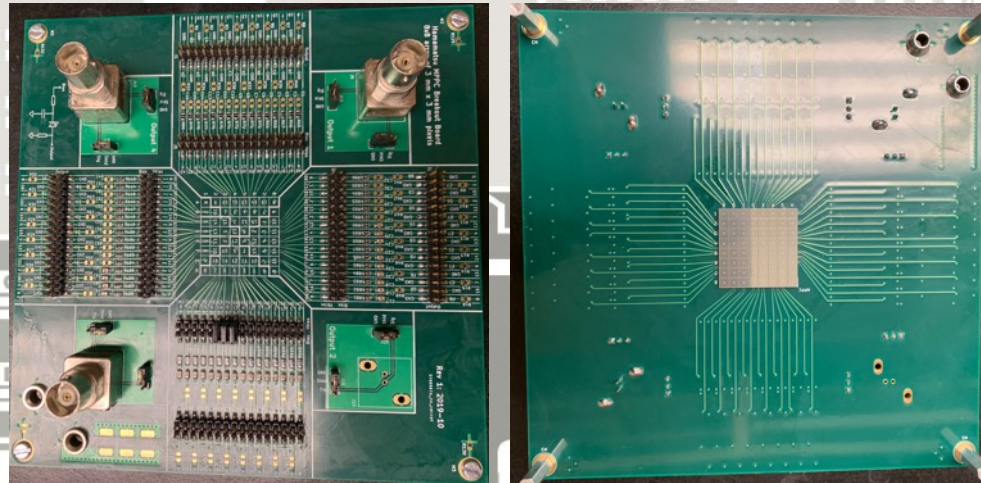
- Technician: David Ostapchuk (MSc Physics)
- General detector fabrication support
 - Electronics PCB, simple machine work, 3D printing, laser cutting
 - Access to North Forge Fabrication Lab (www.northforge.ca)
 - Larger machined parts contracted out to local machine shops
- Resource allocated by UVic/Carleton/UWinnipeg allocation board



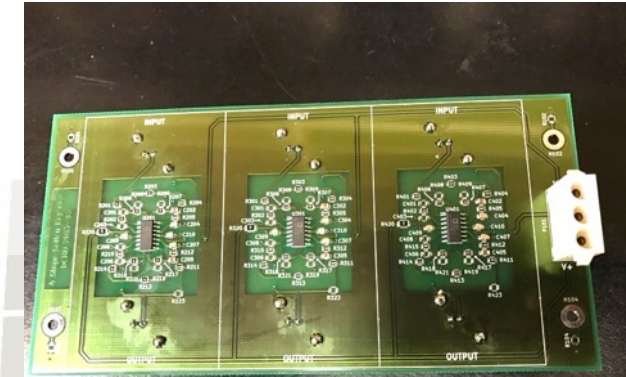
Halbach array for polarized Xe (TUCAN comagnetometer)



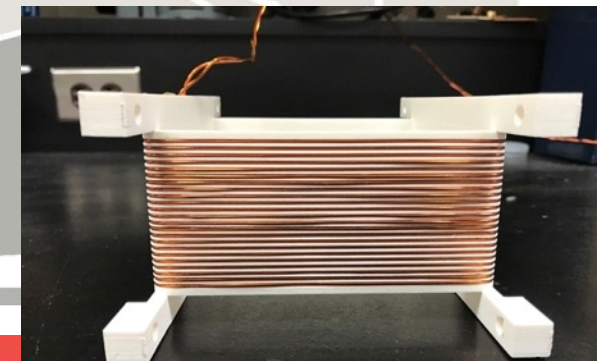
Gas panel for Xe project



MPPC Breakout board for EMPHATIC



Butterworth filters for TUCAN



Spin-flipper coil for TUCAN

Université de Montreal

- MRS personel

- Jean Soucy - Head of machine shop
- Chen-Chao Wen- Software and system expert
- Hongfei Cao - Electronics technician
- Nikolai Starinsky (50% MRS) – Engineering physics
- Tomy Arial (50% MRS) – Mechanical workshop
- Louis Godbout (20% MRS) – Ion beam facility

- Facilities

- Machine shop
- Instrumentation design and prototyping
- Ion beams for testing, calibration and radiation damage

TRIUMF Science Technology department

- Physics Instrumentation group
 - L. Kurchaninov (front end elec.)
 - A. Sher (MC and FEA simulations)
 - A. Sorokin (Elec. R&D tech)
 - Detector facility
 - J. Blanco (Mech. tech.)
 - P. Lu (Det. Phys./eng.)
 - R. Henderson (Det. Phys./eng. - head)
 - R. Maharaj (Mech. Tech.)
 - N. Massacret (Det. Phys./eng.)
 - I. Nikonov (Mech. Eng.)
 - Detector facility shop
 - C. Chan (fabrication tech.)
 - C. Lim ()
 - Y. Zielinski (machinist)
 - Electronics Development
 - D. Bishop (Elec. hardware – head)
 - M. Constables (Elec./Mech. integration)
 - Y. Lin (FPGA)
 - *P. Margetak (Elec. Hardware – MI)*
 - C. Pearson (FPGA)
 - B. Shaw (FPGA)
 - Data Acquisition
 - P-A. Amaudruz (System eng. - head)
 - T. Lindner (DAQ system)
 - K. Olchanski (computing infrastructure)
 - B. Smith (User interface)
- And research scientists, B. Franke,
N. Hessey (Phys. Inst. Group head and deputy),
F. Retiere (department head)

TRIUMF Sci Tech recent projects

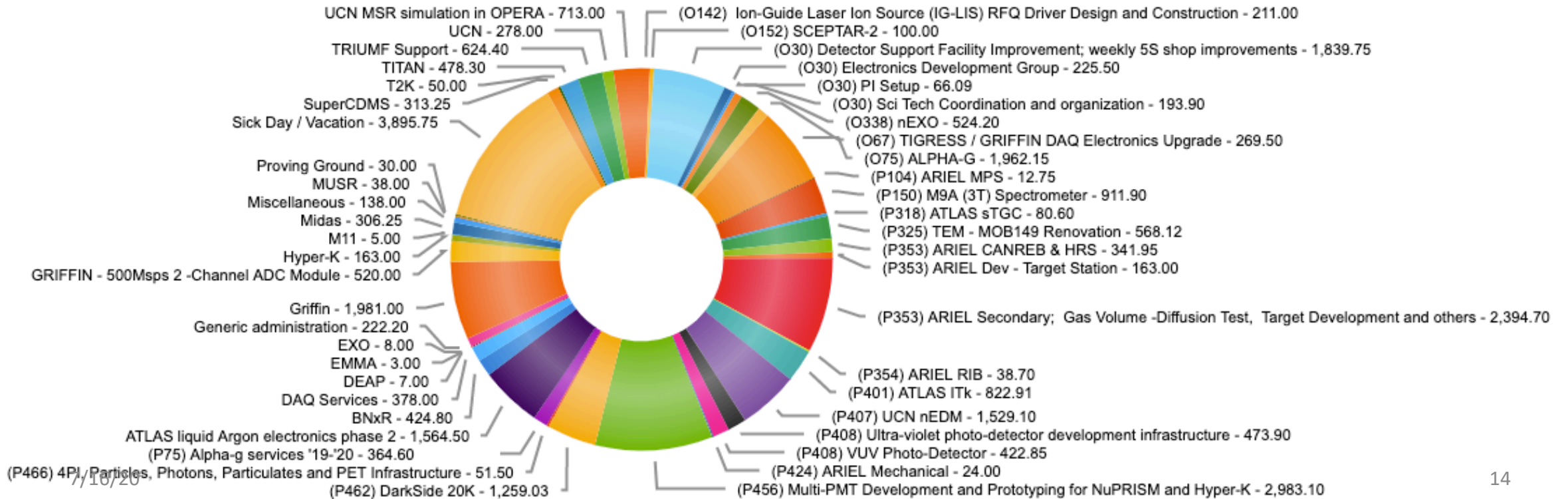
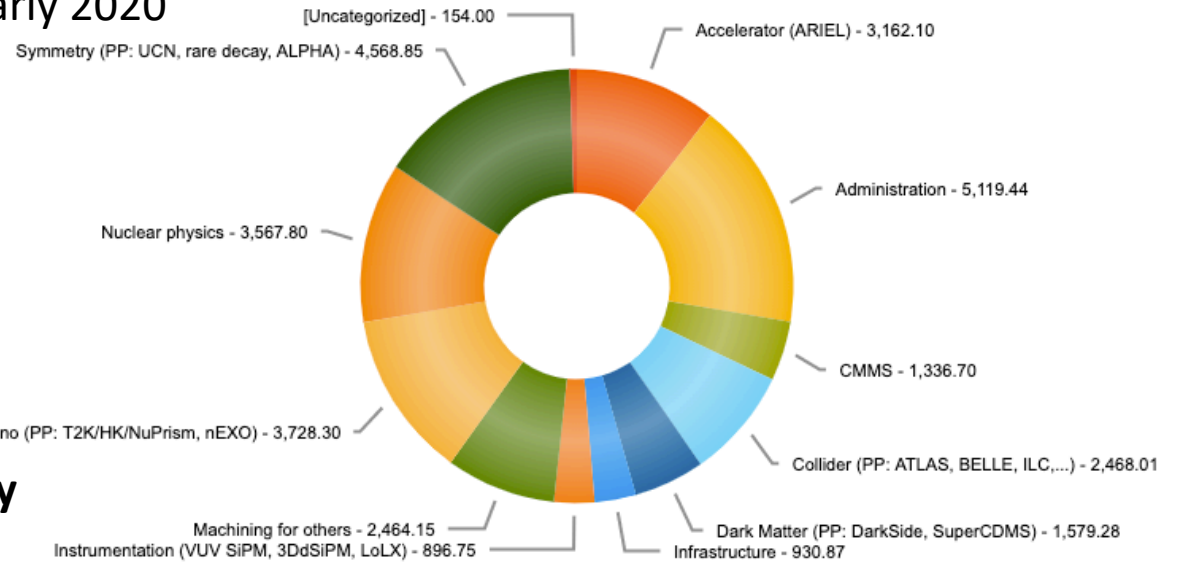
Project list since early 2020

Sci Tech primary mandate is to support the SAP community

Focus on development and not operation

Project list since early 2020

Sorted by type



TRIUMF support, a dual-model

- Cost recovery

- Charge salary of technical personnel with minimum overhead
 - 100 for eng. And for tech
- Examples of such a model
 - Ongoing: ALPHAg, ATLAS phase 1
 - Future: nEXO, DarkSide-20k, MOLLER, mPMT (Hyper-Kamiokande)

- Complete support

- Personnel and facilities provided in-kind
- Example of such a model
 - On-site: UCN, GRIFFIN, photo-detector R&D infrastructure
 - Strategic investment:
 - accelerator technology for next generation colliders
 - Infrastructure for silicon detector assembly (ATLAS ITK)

Management structures

- Carleton-UVic-Winnipeg a prioritization board
 - Reorganized early 2020 to make it more manageable (fewer members)
 - Kevin Graham (Carleton manager), Randie Sobie (Uvic manager), Blair Jamieson (Winnipeg manager), Garth Huber (CINP), Mike Roney (IPP), Miriam Diamond (Toronto) and Fabrice Retiere (TRIUMD, chair)
- CPP+ (Alberta, Toronto) operating committee
 - Alberta [Hallin, Krauss, Pinfold (Chair)], Carleton [Boulay], Queen's [Chen, Noble], Regina [Huber], Toronto [Orr, Trischuk]
- TRIUMF Science Technology department
 - Project selection/prioritization by TRIUMF management
 - Sci Tech management responsibility on implementation of selected projects
 - In practice fair bit of flexibility for small projects

Moving towards pan-Canadian coordination

- Pros:
 - Cross-institution is a requirement for NSERC MRS
 - Maximize utilization of the resources
 - the right person for the right job – i.e. foster specialization
- Cons:
 - less institutional control
- Steps forward for 2020
 - Cross membership of boards and management structures
 - Setting up technical level communication channel
 - Share expertise
 - Share knowledge of who can do what
 - Group setup at TRIUMF to support this effort – virtual meeting soon
- Eventually... Single board?

Concluding personal remarks

- Start by creating an advisory SAP technical board
 - Membership include stakeholder (MRS + TRIUMF + SNOLAB) and few member at large (or IPP/CINP council rep.)
 - Receive project requests and recommend resource allocation
 - Forecast technology needs for the community and advise on personnel specialization (when hiring and through career evolution)
- Start addressing the issue of the resource currently supported by MI now
- Define a strategy for efficient project management
 - Aim is to maximize chances of project delivery on budget and on schedule while minimizing bureaucratic burden
 - Risk management and system engineering are key assets
 - Implement this strategy for all projects – **Every successful SAP project is an asset for the community as a whole**

Thank you.

And if you need help now:

Alberta CPP+, contact Jim Pinfeld, [pinfoldster@gmail.com](mailto:pinfeldster@gmail.com)

Université de Montreal, contact Jean-Pierre Martin jpmartin@lps.umontreal.ca

Carleton Uvic Winnipeg, submit <https://particlephysics.ca/wp/wp-content/uploads/Major-Resources-Support-request-form.pdf> to Kevin Graham
dr.kevin.graham@gmail.com

TRIUMF Science Technology dept <https://www.triumf.ca/science-technology/support-request>