Technical support for the Canadian SAP

F. Retiere with material provided by K.Graham (Carleton), D. Karlen (Uvic), C. Leroy (Montreal), T. Noble (Queens), J. Pinfold (Alberta), and N.Smith (SNOLAB)

Outline

- MRS resources
  - U. Alberta – Toronto MRS. Slide from J. Pinfold
    - Capabilities, Project, management
  - U. Montreal
  - Carleton
  - Queens
  - Uvic
- TRIUMF science technology department
- SNOLAB
- Discussion about future of MRS and opportunity to upgrade equipment through CFI

Capabilities OF THE CPP+ MRS FACILITY

- MRS Manpower:
  - M. Cadabaschi - Engineer (UofT – ret. to be replaced)
  - C. Ng - Engineer (UofA)
  - P. Davis - Electronics Engineer (UofA)
  - Dr R. Soluk – Detector Technologist (UofA)
- Dept Manpower (Available to CPP+ MRS @ $20/hr)
  - L. Wampler - Tech.(UofA)
  - J. Chaulk - Electronics Tech. (UofA)
  - Machinists: J. Cameron, A. Vinagreiro, D. Waege
- Specialized Facilities:
  - Large area fabrication + crane access & clean areas
  - Radon Free Clean room with machining facilities
  - Low background counting facilities + Betacage
  - HE X-ray facility
  - Access to glass blowing, machining and polishing shops
- Electronics Shop (digital and analog electronics):
  - CADENCE & AUTOCAD – circuit board design (to 32 layers), simulation, electronic CAD
  - ALTERA/ XILINX + MODELSIM - FPGA design & simulation
  - CMC - Access to IC design & fabrication capability
  - Equipment: *4 Ch. 4GHz scopes, 8.5 GHz Vector Network Analyzer, 10 GHz Arbitrary waveform generator, VGA Reball capability, Pick and place with reflow oven, etc.*
- Machining Mechanical Capability
  - Mechanical and Thermal (FE) CAD design
  - Uof A + UoF Dept. machine shop with 8 computer controlled lathes and mills – access to electro-erosion & waterjet cutting
  - Advanced Machining Facility – Large bed Toshiba mill with 2m 5 axis capability served by 15 ton crane

CPP+ MRS COMPLETED Projects in 2016-2017

- Paul Davis (Electronics Engineer)
  - **ATLAS Forward Protons (AFP) Detector -** Design of HPTDC + CFD FE readout + trigger (Δt ~ 14 ps achieved)
  - **CDMS (Cryogenic Dark Matter Search) -** Charge sensitive pre-amp.
  - **IceCube/PINGU -** PMT bases
  - **DEAP (Dark matter Experiment using Argon Pulse shape) 3600 -** Pulse simulation studies
  - **SNO+/DEAP/IceCube -** Beta-cage preamps
  - **SNO+/DEAP/IceCube -** Radonfree room DAQ
- Chris Ng (Engineer – with stamp)
  - **ATLAS- AFP -** Chief engineer
  - **SNO+ -** Mechanics of Tellurium purification system
- Chris Ng continued….
  - **DEAP 3600 -** Cool down studies using FEA
  - **MoEDAL-LHC Exp. -** Mechanical model of material budget
  - **JUNO (**Jiangmen Underground Neutrino Observatory) **& CHIPS** (Cherenkov detectors in mine PiTs) – Review Eng.
- Richard Soluk
  - **ATLAS-LUCID detector** – quartz-fibre calo. auxiliary detector and Bi207 calibration for LUCID PMT system
  - **ATLAS-AFP -** motorization of RP system
  - **MoEDAL-LHC Experiment -** Technical lead for detector systems and upgrades
  - **SNO+/DEAP/IceCube -** design of VETO system for Beta-Cage
  - **SNO+/DEAP/IceCube -** maintenance of Radon Free Lab.

Management scheme OF CPP+ MRS

- The Overall Operation of the CPP+ MRS resources is controlled by the CPP+ Operating Committee (OPCOM)
  - OPCOM Chair - The PI of the CPP+ MRS grant (JLP)
  - OPCOM Composition – PI + Applicants + Independent member(s) (M. Roney)
  - OPCOM members - ALBERTA [Hallin, Krauss, Pinfold], UBC [Tanaka], QUEEN'S [Chen, Noble], REGINA [Huber], TORONTO [Orr, Teuscher, Trischuk], YORK [Bhadra],VICTORIA[Roney]
- OPCOM Responsibilities – Accepting new projects, deciding project priorities if necessary, preparing grant applications, maintaining fair and efficient useage of the resources, long term planning

- All applications should be made via the CPP+ MRS Website:
  - http://cpp-plus.physics.ualberta.ca/
- This website is can be accessed via the IPP page:
  - http://www.ipp.ca/sapmrs/index.shtml
- Or the website of the Canadian Institute of Nuclear Physics:
  - http://cinp.phys.uregina.ca/node/175

GRANT APPLICANTS: S. Bhadra (York), M. Chen (Queens), D. Grant (Alberta), A. Hallin (Alberta), G. Huber(Regina), C. Krauss (Alberta), R. Orr (Toronto), J. L. Pinfold (Alberta)*, H. Tanaka (Toronto), R. Teuscher (Toronto), W. Trischuk (Toronto)

Capabilities at Université de Montréal

- Instrumentation, conceptual design and R&D; electronics development (FPGA, firmware, low noise analogue circuits); computing (Monte-Carlo); mechanical
  - 1 physicist, 1 physicist part time
  - 1 engineer (physics)
  - 1 technician (electronics)
  - 2 technicians (machine shop)
  - (2.5 of these persons MRS funded)
- Electronics prototyping facility
  - FPGA rework
  - Reflow oven
- Machine shop
  - CNC mill, lathe, ,…
- Clean room (class 10,000, 1,000)
- Testing facility
  - Tandem accelerator (5.5 MV)

Université de Montréal

Projects in 2016-2017 at Université de Montréal

ELECTRONICS:

- Belle II (Electromagnetic Calorimeter end cap)
- ATLAS thin gap test bench (McGill)
- Gamma bursts simulator (Laurentian)
- Silicon PMT pre-amplifiers
- Test bench development (ATLAS ITK)
- GRIFFIN
- Blood counter (Laval)

- Detector development (PICASSO/PICO)
- ALPHAg machining

Université de Montréal

Capabilities at Carleton

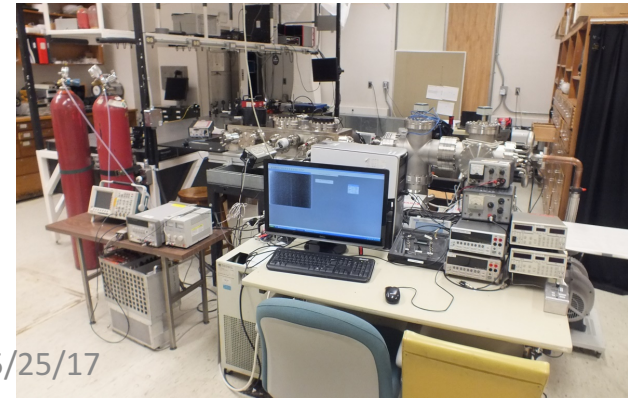
- Machinist/Technician (MRS)
  - precision small parts fabrication, welding, vacuum/gas system cleaning and assembly, leak-checking,
- Electronics Specialist (MRS)
  - analog and digital readout systems, power supplies, equipment certification, soldering, circuit design, cabling, system modeling and control
- Two Designers (MRS)
  - 3-D modeling, concept development, detailed design drawings for fabrication (e.g. CNC), as-built drawings, FEA calculations
- + TRIUMF and SNOLAB engineers based at Carleton

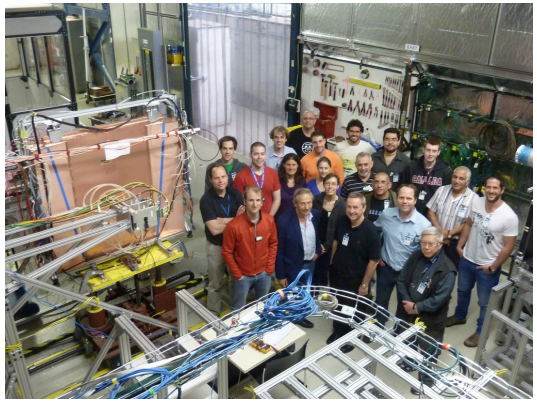
- Machine shop
- Electronics la
- Clean rooms
- Vacuum and gas handling equipment (Swagelok, VCR, Conflat, KF, custom)
- Electronics and DAQ (NIM, VME, LabView)
- Silicon pixel telescope

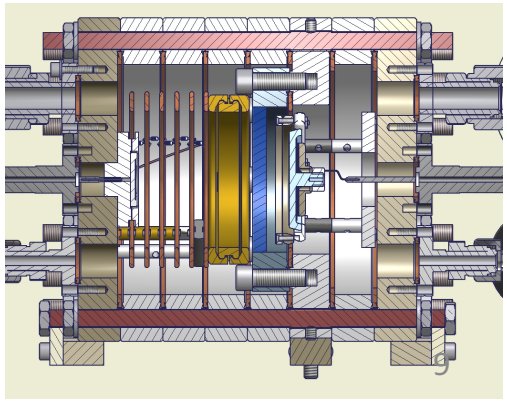
- Carleton Science and Technology Centre (STC) https://carleton.ca/stc/

Projects at Carleton on 2016-2017

- ARIEL
- ATLAS (FCAL, sTGC, ITK)
- CUTE/NEWS
- DEAP
- EXO-200 and nEXO
- SNO+







Queen's Resources: Personnel: 65% supported by MRS, 35% at Queen's

Koby Dering: P. Eng. (Mechanical Engineering). Member of PEO

Design and fabrication of detector components, ultrahigh purity/ultrahigh vacuum/large chambers, stress analysis, calibration and deployment systems, cryogenic components and systems

- Currently supporting NEWS (Engineer of Record), Cute, KDK, DEAP

Phil Harvey: B.Sc.E/M.Sc.E. (Engineering Physics).

Programming C++, Perl, HTML, JavaScript, hardware interfacing and graphics display. Data Acquisition

- Developed much of the SNO DAQ / Display interface plus DEAP re-surfacer and seismic calculations…
- Currently supporting SNO+, CUTE, DEAP and **Alpha-G (New)**

Robert Gagnon: Mechanical Engineering Technologist:

Mechanical design / fabrication, operation of low background counting facility

- Support for NEWS, CUTE, KDK, Clean room facilities, low back ground counting…

All very experienced with the needs of underground facilities and operations, but not limited to these areas only.

Queen's Resources: Facilities

Clean Rooms:

Two clean rooms with general lab space, fume hoods, tooling, laminar flow hoods, …

Low Background Counters

Radon emanation cambers for the pre-screening of materials for use underground.

PMT testing.

Dark boxes, electronics, magnetic field suppression…

Machine and Fabrication shops

CNC mill, conventional mills, lathes, saws, grinders, and usual machine tools

Please contact us to request use of the resources. See: http://owl.phy.queensu.ca/group/mrs.html or follow the links on the IPP and CINP websites: www.ipp.ca and www.cinp.ca

Capabilities and projects at UVic

- P. Poffenberger (MRS)
  - Highly versatile technologist providing a broad range of support
- (+ TRIUMF and internal technicians and engineers)

- ALPHAg TPC laser calibration system
- ATLAS LAr electronics upgrade (phase 1)
- ARIEL electron to gamma conversion target
- BELLE-II

Joint management at Carleton, Queens and UVic

- Joint prioritization board
  - T. Mattison (UBC) [chair], M. Boulay (Carleton), B. Jamieson (Winnipeg), F. Retiere (TRIUMF), M. Roney (IPP), Brigitte Vachon (McGill), K. Graham (Carleton), D. Karlen➡ R. Sobie (U Vic), T. Noble (Queens)

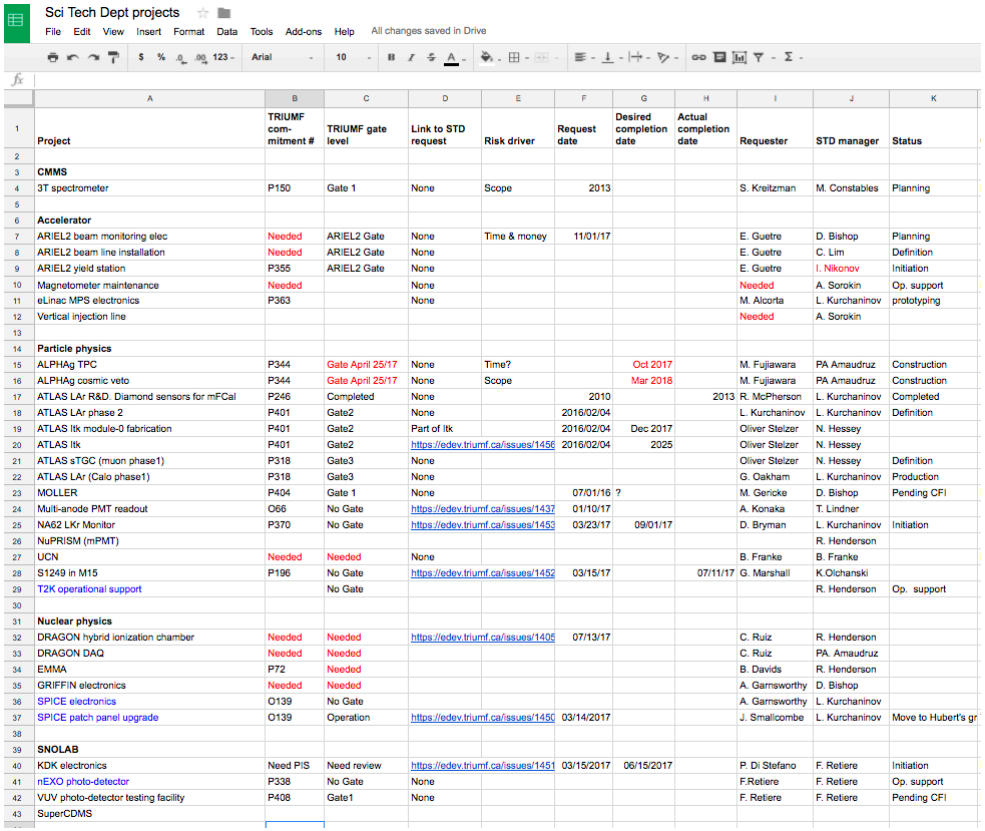
- Request through common form: http://owl.phy.queensu.ca/group/mrs_form.html

- Board recommends allocation of all resources with balance across community.
- Board prioritizes on basis of need and equitable use of resources

Capabilities at TRIUMF (Sci. Tech. Dept)

- Instrumentation physics group (conceptual design and R&D)
  - 3 physicists (2 grant eligible)
  - CPARC funded technician/engineer being hired
- Detector facility group (detector design and construction)
  - 4 engineers/physicists & 2 technicians
  - Scintillator shop: 1 engineer & 2 machinists
- Detector electronics group (focus on analog electronics)
  - 2 engineers & 1 technician + 1 CFI funded technician (ALPHAg)
- Electronics development group (focus on digital electronics)
  - 3 engineers + 1 temp. engineer and 1 temp. tech
- Data acquisition group (also helping with project management)
  - 5 engineer/physicists + 1 CFI funded physicist (ALPHAg)
- Scintillator shop
  - Machine shop with focus on non-metallic machining (G10, acrylic,…)
  - CNC mill, lathe, large CNC router,…
- Clean rooms
  - Large clean room
  - Upgraded clean room for silicon detector assembly (ATLAS Itk)
- Testing facility
  - Designed for handling flammable gas
  - Partial renovation planned for photo-detector testing
  - PMT testing facility (funded by H. Tanaka CFI)
  - Beam line for detector test (M11)

TRIUMF Sci Tech dept projects in 2016-2017



Sci Tech Dept projects

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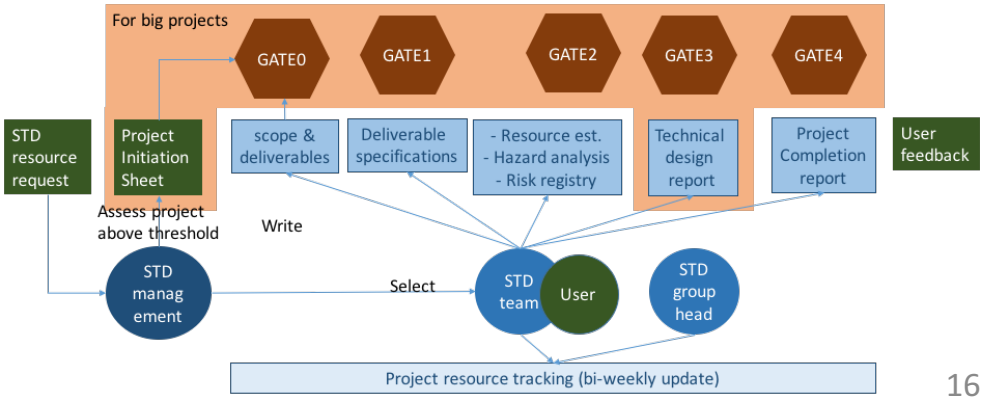
	Project	TRIUMF com-mitment #	TRIUMF gate level	Link to STD request	Risk driver	Request date	Desired completion date	Actual completion date	Requester	STD manager	Status
3	**CMMS**										
4	3T spectrometer	P150	Gate 1	None	Scope	2013			S. Kreitzman	M. Constables	Planning
5											
6	**Accelerator**										
7	ARIEL2 beam monitoring elec	Needed	ARIEL2 Gate	None	Time & money	11/01/17			E. Guetre	D. Bishop	Planning
8	ARIEL2 beam line installation	Needed	ARIEL2 Gate	None					E. Guetre	C. Lim	Definition
9	ARIEL2 yield station	P355	ARIEL2 Gate	None					E. Guetre	I. Nikonov	Initiation
10	Magnetometer maintenance	Needed		None					Needed	A. Sorokin	Op. support
11	eLinac MPS electronics	P363		None					M. Alcorta	L. Kurchaninov	prototyping
12	Vertical injection line								Needed	A. Sorokin	
13											
14	**Particle physics**										
15	ALPHAg TPC	P344	Gate April 25/17	None	Time?		Oct 2017		M. Fujiawara	PA Amaudruz	Construction
16	ALPHAg cosmic veto	P344	Gate April 25/17	None	Scope		Mar 2018		M. Fujiawara	PA Amaudruz	Construction
17	ATLAS LAr R&D. Diamond sensors for mFCal	P246	Completed	None		2010		2013	R. McPherson	L. Kurchaninov	Completed
18	ATLAS LAr phase 2	P401	Gate2	None		2016/02/04			L. Kurchaninov	L. Kurchaninov	Definition
19	ATLAS Itk module-0 fabrication	P401	Gate2	Part of Itk		2016/02/04	Dec 2017		Oliver Stelzer	N. Hessey	
20	ATLAS Itk	P401	Gate2	https://edev.triumf.ca/issues/1456		2016/02/04	2025		Oliver Stelzer	N. Hessey	
21	ATLAS sTGC (muon phase1)	P318	Gate3	None					Oliver Stelzer	N. Hessey	Definition
22	ATLAS LAr (Calo phase1)	P318	Gate3	None					G. Oakham	L. Kurchaninov	Production
23	MOLLER	P404	Gate 1	None		07/01/16	?		M. Gericke	D. Bishop	Pending CFI
24	Multi-anode PMT readout	O66	No Gate	https://edev.triumf.ca/issues/1437		01/10/17			A. Konaka	T. Lindner	
25	NA62 LKr Monitor	P370	No Gate	https://edev.triumf.ca/issues/1453		03/23/17	09/01/17		D. Bryman	L. Kurchaninov	Initiation
26	NuPRISM (mPMT)									R. Henderson	
27	UCN	Needed	Needed	None					B. Franke	B. Franke	
28	S1249 in M15	P196	No Gate	https://edev.triumf.ca/issues/1452		03/15/17		07/11/17	G. Marshall	K.Olchanski	
29	T2K operational support		No Gate							R. Henderson	Op. support
30											
31	**Nuclear physics**										
32	DRAGON hybrid ionization chamber	Needed	Needed	https://edev.triumf.ca/issues/1405		07/13/17			C. Ruiz	R. Henderson	
33	DRAGON DAQ	Needed	Needed						C. Ruiz	PA. Amaudruz	
34	EMMA	P72	Needed						B. Davids	R. Henderson	
35	GRIFFIN electronics	Needed	Needed						A. Garnsworthy	D. Bishop	
36	SPICE electronics	O139	No Gate						A. Garnsworthy	L. Kurchaninov	
37	SPICE patch panel upgrade	O139	Operation	https://edev.triumf.ca/issues/1450		03/14/2017			J. Smallcombe	L. Kurchaninov	Move to Hubert's gr
38											
39	**SNOLAB**										
40	KDK electronics	Need PIS	Need review	https://edev.triumf.ca/issues/1451		03/15/2017	06/15/2017		P. Di Stefano	F. Retiere	Initiation
41	nEXO photo-detector	P338	No Gate	None					F.Retiere	F. Retiere	Op. support
42	VUV photo-detector testing facility	P408	Gate1	None					F. Retiere	F. Retiere	Pending CFI
43	SuperCDMS										

- Main projects
  - ALPHAg (CFI funded)
  - ATLAS LAr and Itk
- Many projects. 30 in total
  - Particle physics
  - Nuclear physics
  - Accelerator
  - And a bit of applied and condensed matter

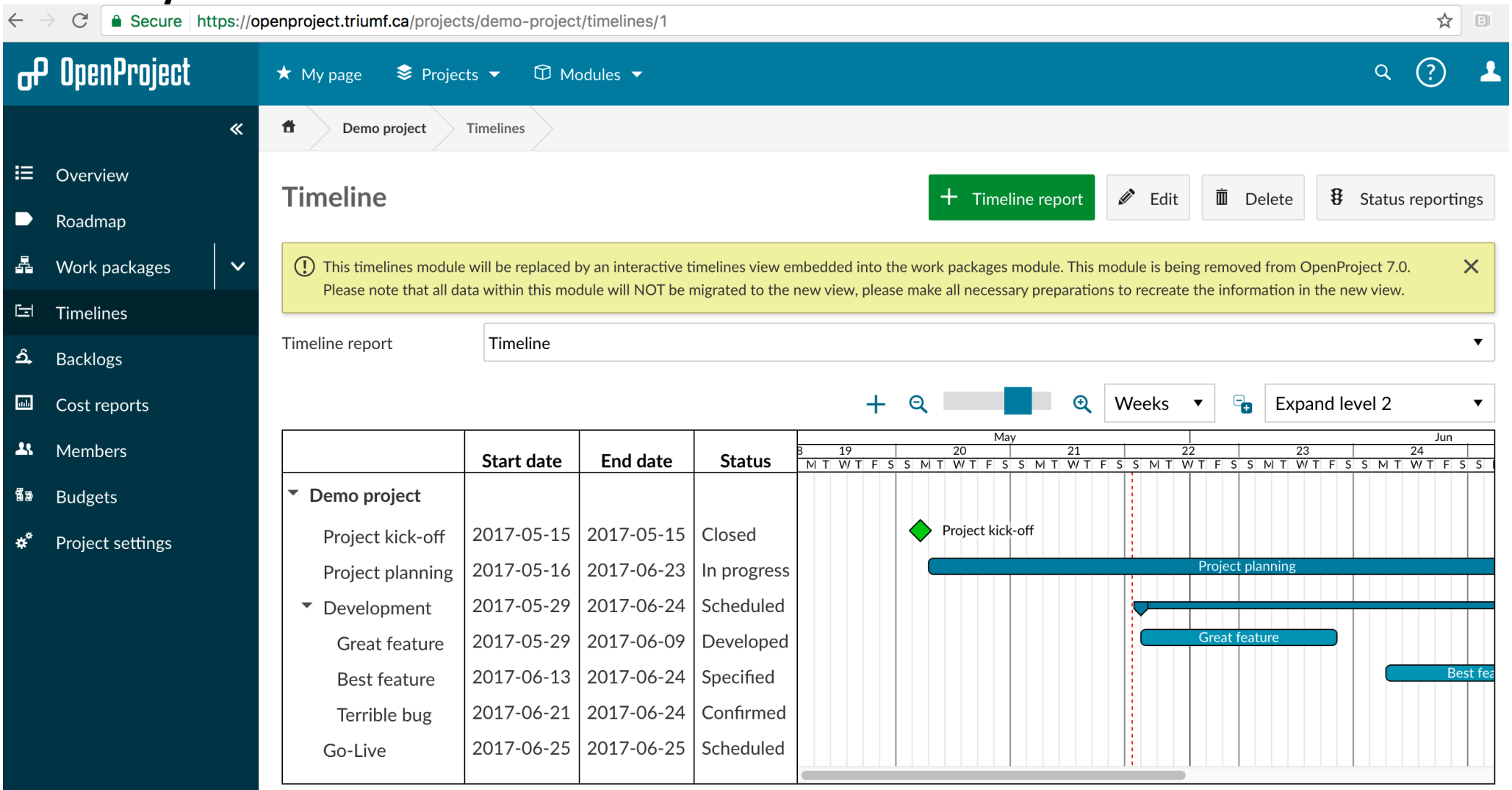
Resource management within TRIUMF Sci Tech dept

- Efficient project management for ALPHAg
  - Large projects are ”easy” because the project management overhead is acceptable
- 30+ project on the go!
  - Most small but they nevertheless require resources
  - Hard to manage with limited management manpower

- Investigating project workflow solutions
  - Requirements: task management, resource management (time sheet), document management user access
  - Solutions: evaluating ~~Wrike~~, Workzone, Openproject, ~~Clarizen~~



Online project management system



If interested in trying. Create an account here: https://openproject.triumf.ca/
Though email me as well as I am not sure how new users are managed

Capabilities at SNOLAB

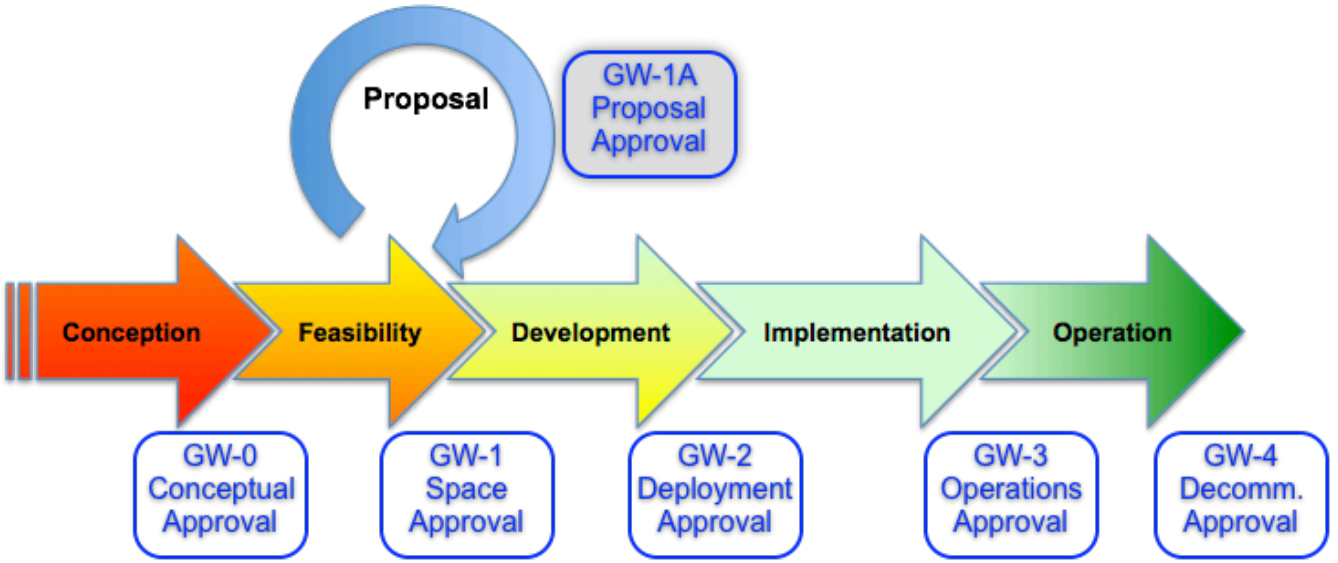
- Manpower (ex. Supervision)
  - Research Scientists (8)
  - Chemical Technologists (3)
  - Engineering (4)
  - IT Support (3)
  - Installation Support (9)
  - Project coordination and project management (4)
  - Project Operations (6+7)
  - Facility support
    - Cleaners/Maintainers (9)
    - Logistics (4)
- Equipment and Services
  - Underground cleanroom facilities
  - Surface cleanrooms facilities
  - Chemistry
    - Chemical assay
    - Chemical management/disposal
  - Low background assay
    - HPGe detectors
    - Alpha/Beta & Radon detectors
    - Ashing capability
    - AES
    - Low background database management
    - ICP-MS through external connections
    - Connections to PNNL resources
  - Machine shops (surface & underground)
  - Project coordination and management

Projects in 2016-2017 at SNOLAB

Experiment	Neutrino	Dark Matter	Status	Collaboration Demographics
CUTE		√	In Preparation	Canada, US, UK, France, India, Spain
DAMIC		√	Operational	Canada, US, Argentina, Brazil, Mexico, Paraguay, Switzerland
DEAP-3600		√	Operational	Canada, US, UK
DEAP-50T/CLEAN		√	Letter of Intent	Canada, US, UK
DMTPC		√	Concept Phase	US, UK,
DUST			Letter of Intent	Canada
FLAME			Operational	Canada
Ge-1T	√		Letter of Intent	Canada, US
nEXO	√		Concept Phase	Canada, US
HALO	√		Operational	Canada, US, UK, France, Germany, Japan
MiniCLEAN		√	Commissioning	Canada, US
MODCC			Operational	Canada
NEWS		√	In Preparation	Canada, US, France
PICO-60		√	Operational	Canada, US, Czech Republic, India, Mexico
PICO-500		√	Letter of Intent	Canada, US, Czech Republic, India, Mexico
REPAIR			Operational	Canada
SuperCDMS		√	In Preparation	Canada, US, UK, France, India, Spain
SNO+	√		Commissioning	Canada, US, UK, Germany, Mexico, Portugal

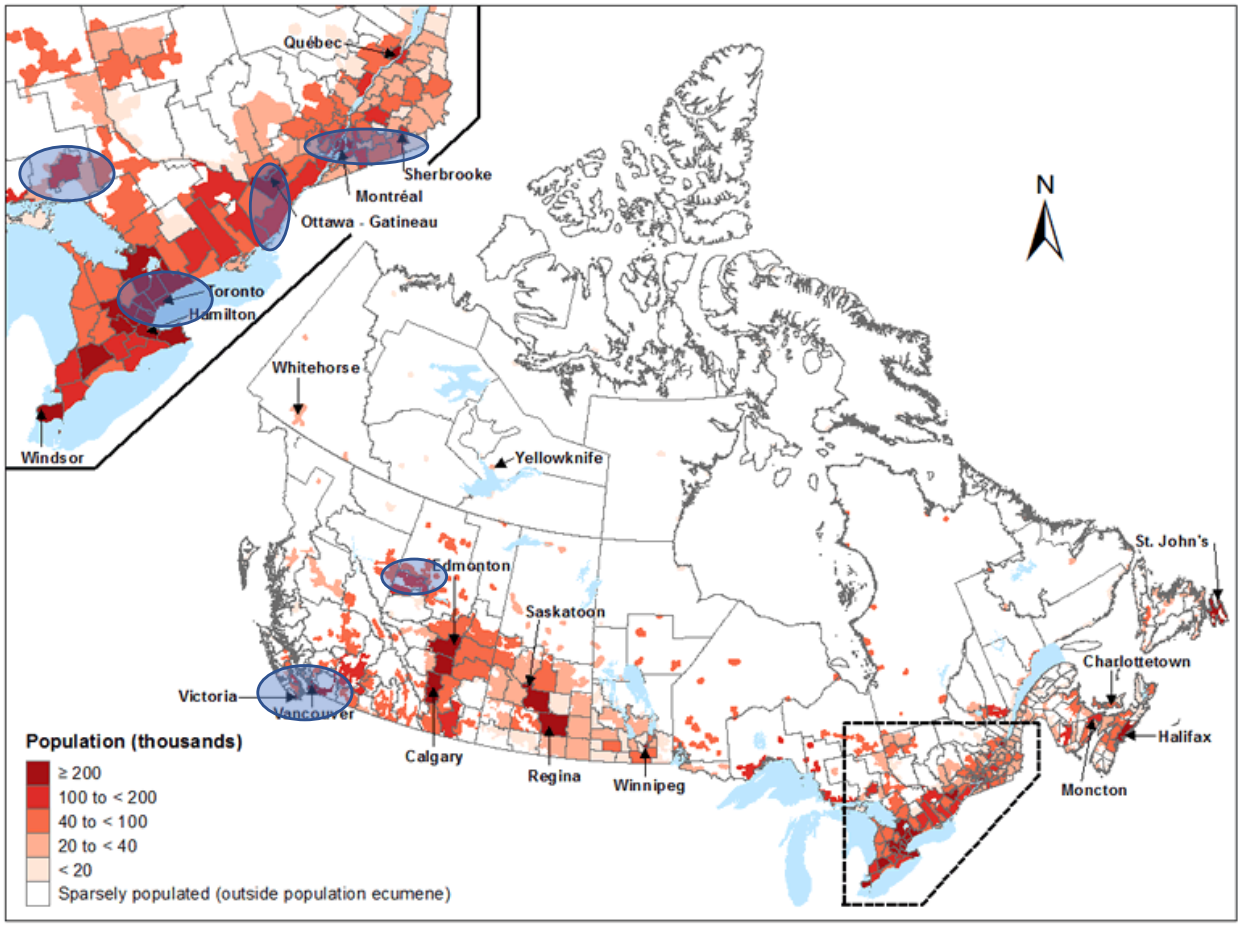
Management scheme at SNOLAB

- Projects
  - Access to resources primarily through GateWay process (lifecycle approach)
  - Once project accepted at GW-0 then SNOLAB resources available
  - Assay capabilities available by direct request
  - SNOLAB resources are to support deployment of experiments, rather than direct costs of resources
  - Implication of Naylor not yet clear



Summary

- Wide range of technical resources and capabilities available to SAP through MRS and in labs
- Wide range of projects being tackled
- Transparent management scheme in place
  - Resulting in enhanced access by community



Source: Statistics Canada, Demography Division

Outlook - Discussion

- Further concentration? Canada wide management
  - Move towards a single MRS for the whole IPP (or SAP) community?
  - Coordinate with TRIUMF and SNOLAB?
  - Pros: better use of available resources
  - Cons: increase management burden
- Increase specialization? “Excellence center”
  - Pros: enhance technical capabilities. May be important for cutting edge development
  - Cons: limits what a single institute can do by itself
- Infrastructure/equipment upgrade
  - Common CFI IF (2019) application for upgrading our technical infrastructure (e.g. machine shop, electronics,…)?
    - If yes, make a wish list this year and identify a PI
  - Coordinate with TRIUMF 5 year plan