



SNOLAB Facility & Science Programme Update

Nigel J.T. Smith
Director, SNOLAB

- Performance over 2012-2017 MSI award
 - Initial science programme delivered world-leading results (COUPP, PICO)
 - Initial science projects well advanced in construction
 - Science programme has been expanded into new science areas
 - User community doubled in scale and visits
 - Robust operational processes in place (or almost in place)
 - SNOLAB operating at full capacity from staff and resources
 - Delivered on the mission of being an international partner and location of choice as within the Joint Venture objectives
- Mandate evolution
 - Need to develop from a site to a national laboratory operating within the international field
 - Additional capabilities required to support future programme
 - Additional hardware capability for risk mitigation; natural replacement cycle for facility systems
 - Staff to support science delivery and exploit planned capabilities

- Request fully funded:
 - CFI MSI Proposal funded for three years at \$28.6M (Request was five years)
 - \$28.8M co-funding secured from Province of Ontario, over five years to 2022
- MSI Requirements for 2020
 - SNO+ should have achieved publishable results from its water and LAB phases, and should be running stably and reliably with 0.5% Te loading.
 - DEAP-3600 should have published results on dark-matter limits (or discovery!) from its 2016-2018 running.
 - SuperCDMS should have progressed to a final decision on siting at SNOLAB, and be in its installation phase.
 - A major experiment should be identified for installation in the Cryopit, with conceptual and engineering studies completed, and the start of installation imminent.
 - Several smaller multi-disciplinary projects should have achieved publishable (or actionable, in the case of commercially-oriented projects) results.
 - SNOLAB should produce, in consultation with the research community, a vision, a strategic long term plan and a proposal for the facility beyond 2022.

- Following intent to broaden SNOLAB capability to support delivery of science, additional staff requested in:
 - Programme Operations: expert operators to provide base for plant operations within SNOLAB
 - Projects Office: additional project managers and co-ordinators to support extended programme delivery at SNOLAB
 - Scientific Research and Analytics: provide scientific connection to facility for all projects, improve assay capability (low background lab)
 - Programme Integration: additional surface cleaning staff
 - Strategic Risk: additional support person to each competency within group, will support additional requirements from incorporation
- Research group at SNOLAB has been increased to eight, to support project development and installation at SNOLAB, and science delivery from experiments

SNOLAB Organisation



SNOLAB Organisational Diagram SL-MCS-LED-10-001-P Rev 62 (May 2017)

Functional and line management organisational chart, job titles descriptive.

Additional Assignments

Laboratory Response Coordinators: liaise with Vale, primary emergency contact & response, knowledge and veto on underground activities

GLIMOS: experiment contact for health and safety, ensure personnel trained and competent, ensure P.I.P. in place

Surface Laboratory Manager: co-ordination and management of activity and space within the surface laboratories (**R. Ford**)

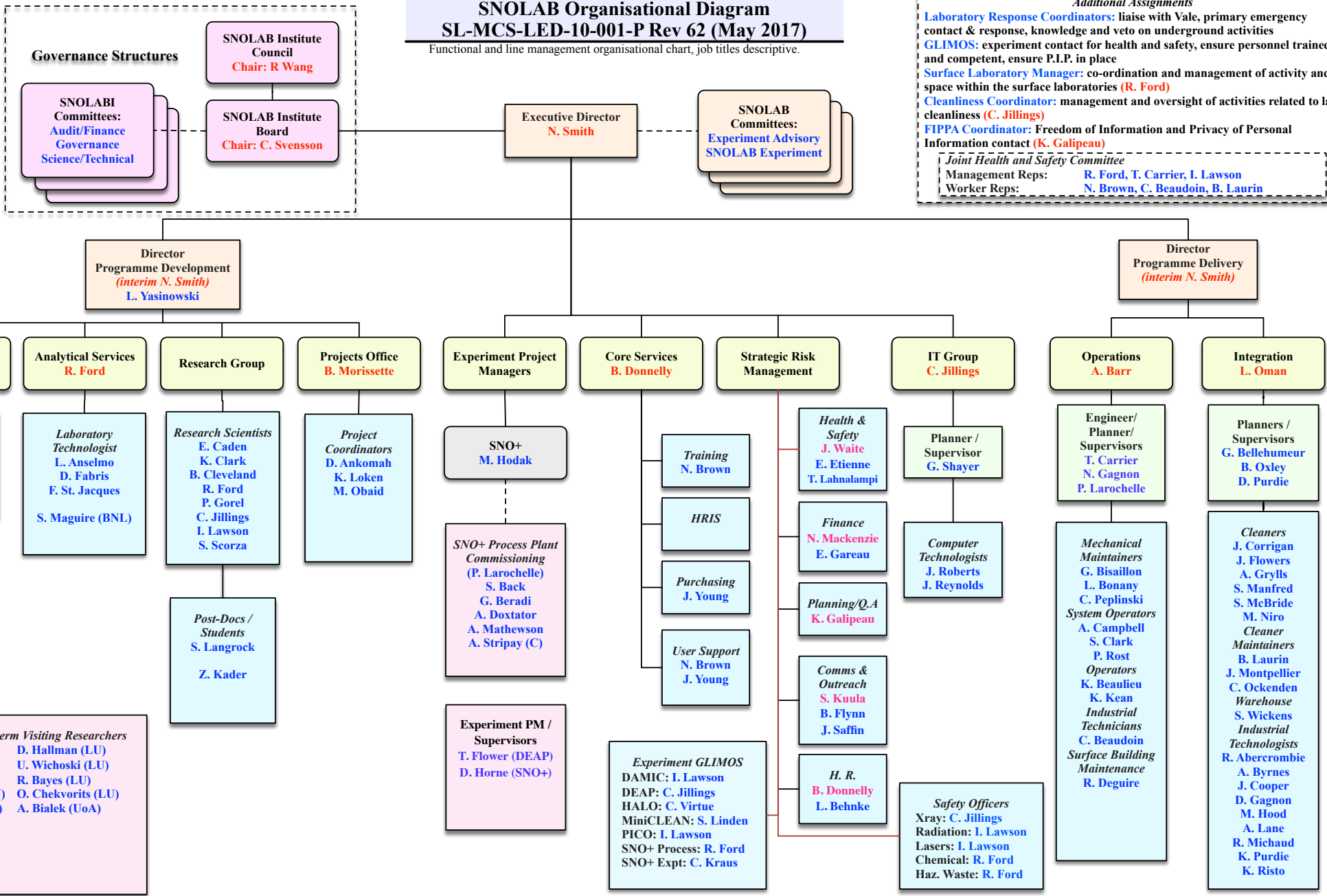
Cleanliness Coordinator: management and oversight of activities related to lab cleanliness (**C. Jillings**)

FIPPA Coordinator: Freedom of Information and Privacy of Personal Information contact (**K. Galipeau**)

Joint Health and Safety Committee

Management Reps: **R. Ford, T. Carrier, I. Lawson**

Worker Reps: **N. Brown, C. Beaudoin, B. Laurin**



Funded staff levels



- Requested staff funded
- Plant operators / system operators increases from 6 to 12
 - Provides base-line support to projects for plant ops.
 - Currently planning around core support to DEAP and SNO+
 - Does not support physics operations or interpretation

Competency / Group	Current Staff level	2015 Funded Staff level	Revised Budget Level
Directorate	2	3	4
PA/Admin Support	1	3	3
Core Services	3	3	4
Strategic Risk	8	7	11
I.T.	3	3	3
Engineering Office	4	5	7
Analytical services	3	3	4
Projects Office	10	3	7
Scientific Research	8	7	8
Programme Integration	23	23	28
Programme Operations	15	14	23
TOTAL	80	74	102

Infrastructure Costs



- Data pipeline is getting maxed out
- As initial SNOLAB infrastructure ages, several components require replacement or upgrading to sustain anticipated programme
- Major (unfunded) request to continue improvements to the power reliability and distribution at SNOLAB
 - viewed as one of the high technical risks we face

Project Description	CFI 5yr Request (\$k)	Revised Project Estimate (\$k)
Dedicated 13.8kV feeder from surface to SNOLAB facility	4,400	-
Process plant replacements and critical spares	700	700
South drift air handler unit replacements	300	300
Mine power centre refurbishment	250	250
Fire water refurbishment and plant relocation	600	600
Upgrade of 1Gbit offsite line to 10Gbit	600	400
Low background laboratory and assay outfitting	1,250	750
Seismic monitoring replacement	300	300
Additional insurance costs upon incorporation	750	450
Additional power costs when experiment plants operational	900	600
Contingency – drift and building fabric	1,750	1,050
TOTAL	11,800	5,400

Current Science Programme



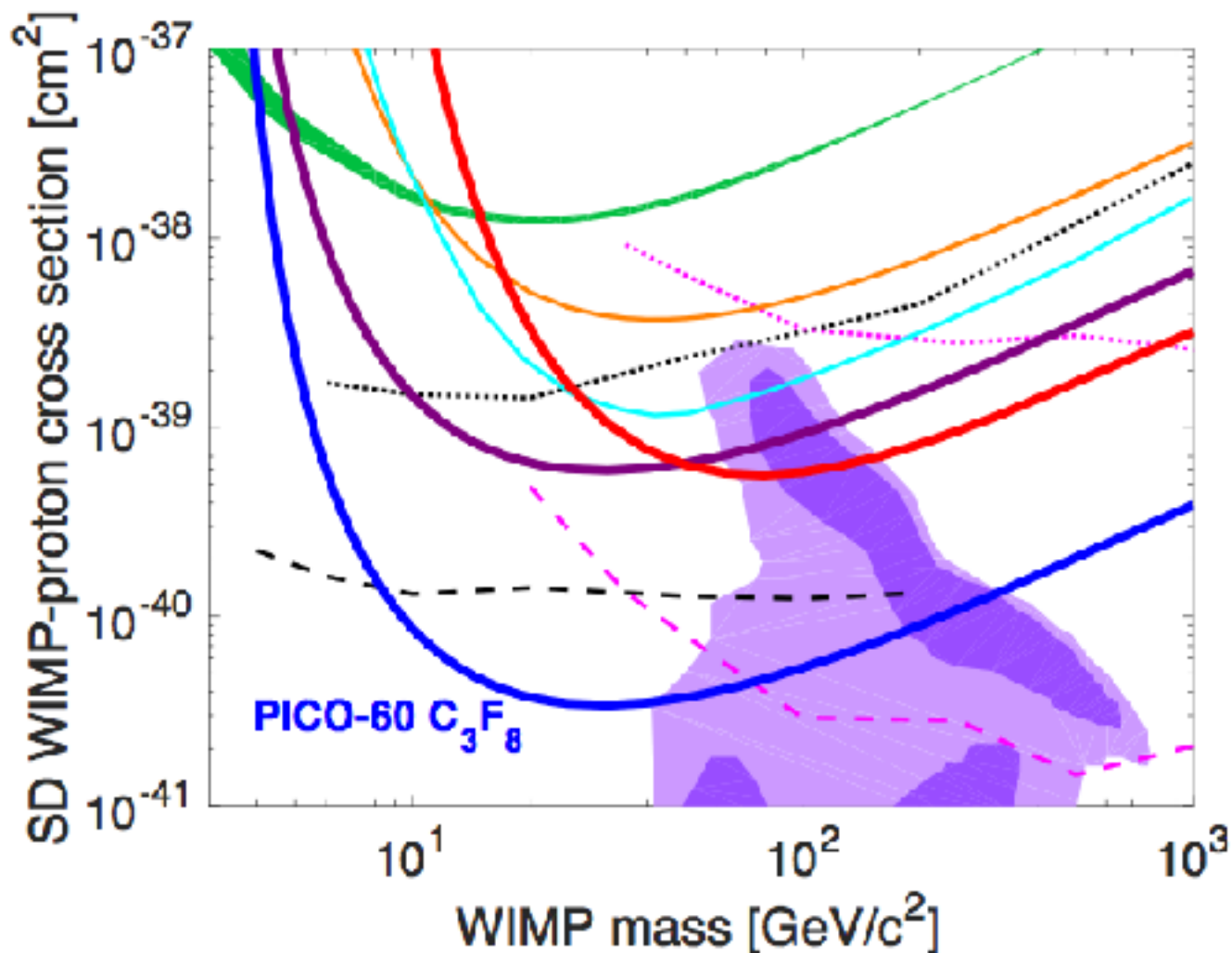
Experiment	Neutrino	Dark Matter	Other	Space allocated	Status
COUPP-4		√		"J"-Drift	Completed
CUTE		√	Test Facility	Ladder Labs	In Preparation
DAMIC		√		"J"-Drift	Operational
DEAP-1		√		"J"-Drift	Completed
DEAP-3600		√		Cube Hall	Operational
DEAP-50T/CLEAN		√		Cube Hall	Letter of Intent
DMTPC		√		Ladder Labs	Concept Phase
DUST			Test Facility	Ladder Labs	Letter of Intent
FLAME			Genomics	External Drifts	Operational
LEGEND (GaIT)	√			Cryopit	Letter of Intent
nEXO	√			Cryopit	Concept Phase
HALO	√			Halo Stub	Operational
MiniCLEAN		√		Cube Hall	Commissioning
MODCC			Mining Data Centre	Surface Facility	Operational
NEWS		√		Cube Hall	In Preparation
PICASSO-III		√		Ladders Labs	Completed
PICC-2L		√		"J"-Drift	Completed
PICC-60		√		Ladder Labs	Operational
PICC-500		√		Ladder Labs	Letter of Intent
PUPS			Seismicity	Various	Completed
REPAIR			Genomics	Chem Labs	Operational
SuperCDMS		√		Ladder Labs	In Preparation
SNO+	√			SNO Cavern	Commissioning

Progress on experiments



- SNO+: Uses existing SNO detector. Heavy water replaced by scintillator loaded with ^{130}Te . ($^{130}\text{Te} \rightarrow ^{130}\text{Xe} + e^- + e^-$)
 - Detector submerged, DAQ exercised, water physics data taking started.
 - LAB process plant construction completed, commissioning underway, LAB is on site. Te plant in construction, diol process development continues.
- DEAP-3600: Single phase Liquid Argon using PSD
 - Detector is collecting dark matter data from Nov 2016.
 - Analysis expected to be completed by TAUP meeting
- MiniCLEAN: Single Phase Liquid Argon using PSD
 - Cool-down complete; reviews completed, argon fill underway.
- SuperCDMS-SNOLAB: Dark matter Si / Ge crystals with ionisation / phonon readout
 - Planning well advanced for deployment, especially CUTE test facility.
- PICO: Rapid expansion bubble chambers. Insensitive to MIPS at operating temperature, threshold devices; alpha discrimination proven;
 - PICO-60: New run completed, analysis finalised, paper arXiv:1702.07666.
 - PICO-40 under construction (right-side up chamber)

WIMP - Proton Exclusion



The 90% C.L. limit on the SD WIMP-proton cross section from PICO-60 C_3F_8 (blue), along with limits from PICO-60 CF_3I (red), PICO-2L (purple), PICASSO (green), SIMPLE (orange), PandaX-II (cyan), IceCube (dashed and dotted pink), and SuperK (dashed and dotted black)

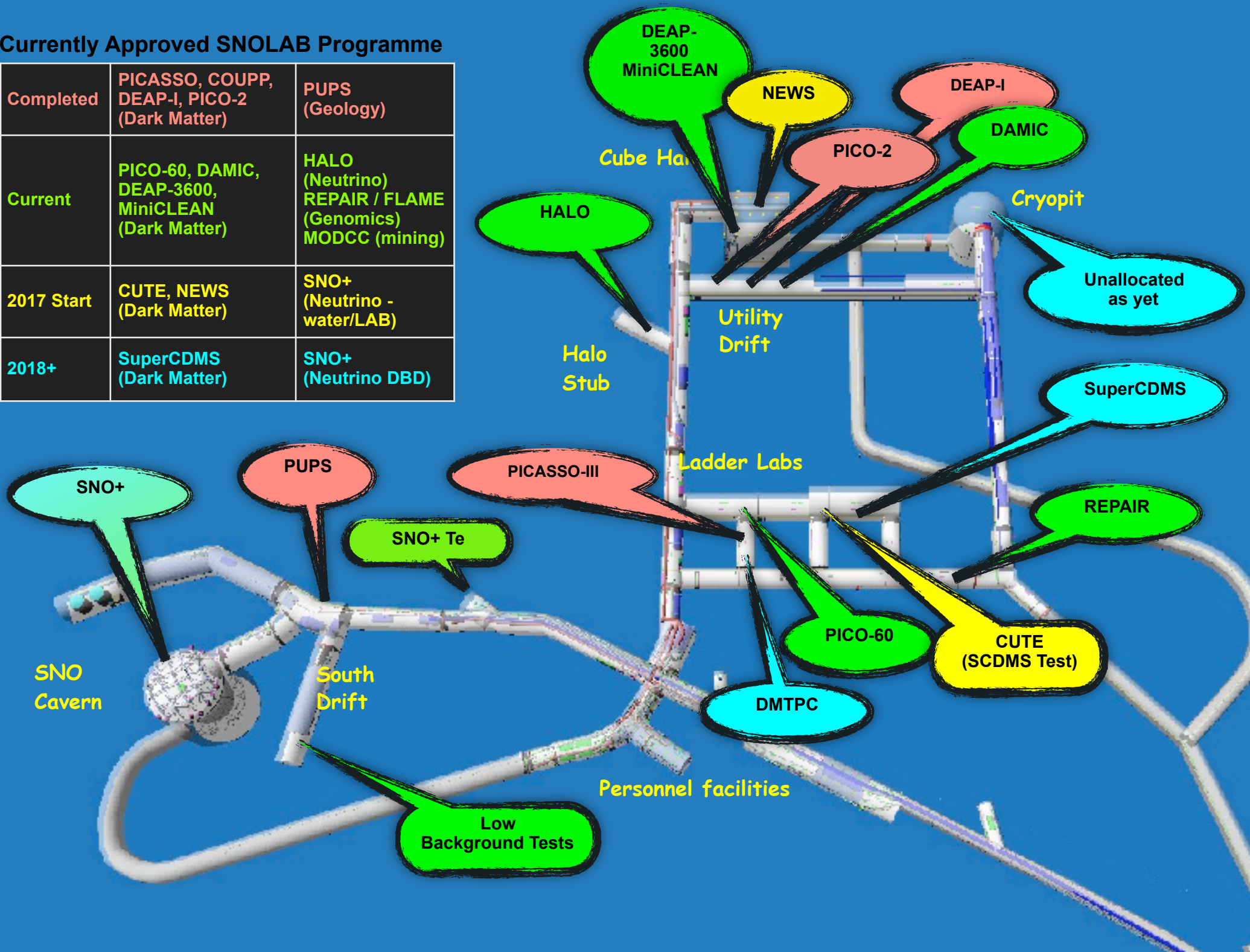
Progress on experiments



- DAMIC CCD based dark matter detector
 - Initial science run complete (arXiv:1510.02126), first 100g prototypes installed, upgrade underway.
- NEWS DM detector: high pressure spherical chamber; development underway
- DMTPC DM directional detector: planning underway
- HALO Supernova neutrino detector
 - SNEWS connection made October 2015. Live to SN.
- MODCC Mining mining data
 - construction completed August 2015. Space is fully operational (3 SME)
- Genomics:
 - REPAIR low radiation environment impact on mutations underway;
 - Fruit fly metabolism tests complete with Laurentian. New tests planned.
- nEXO Double beta detector
 - engineering support to evaluate deployment at SNOLAB.

Currently Approved SNOLAB Programme

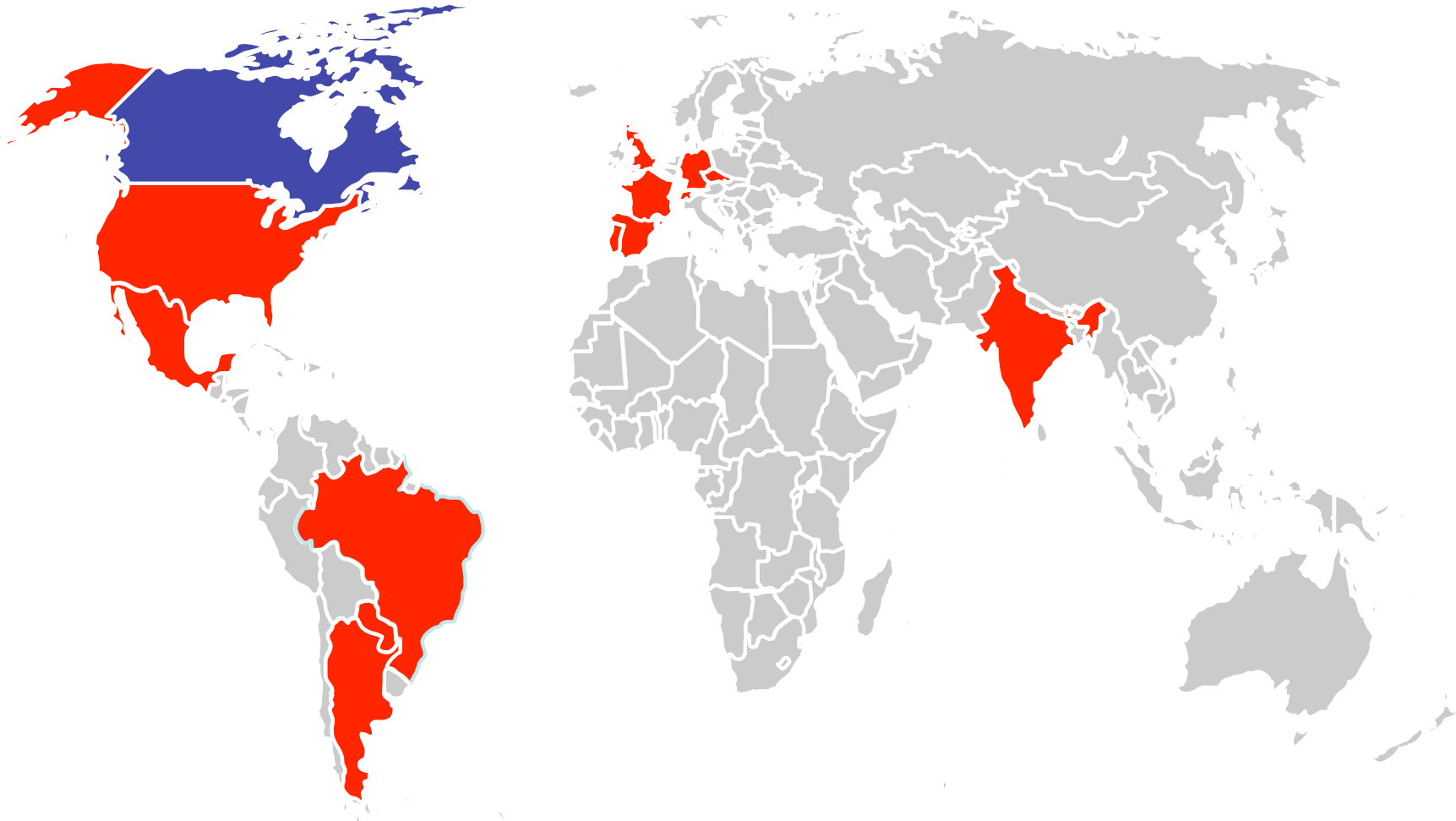
Completed	PICASSO, COUPP, DEAP-I, PICO-2 (Dark Matter)	PUPS (Geology)
Current	PICO-60, DAMIC, DEAP-3600, MiniCLEAN (Dark Matter)	HALO (Neutrino) REPAIR / FLAME (Genomics) MODCC (mining)
2017 Start	CUTE, NEWS (Dark Matter)	SNO+ (Neutrino - water/LAB)
2018+	SuperCDMS (Dark Matter)	SNO+ (Neutrino DBD)



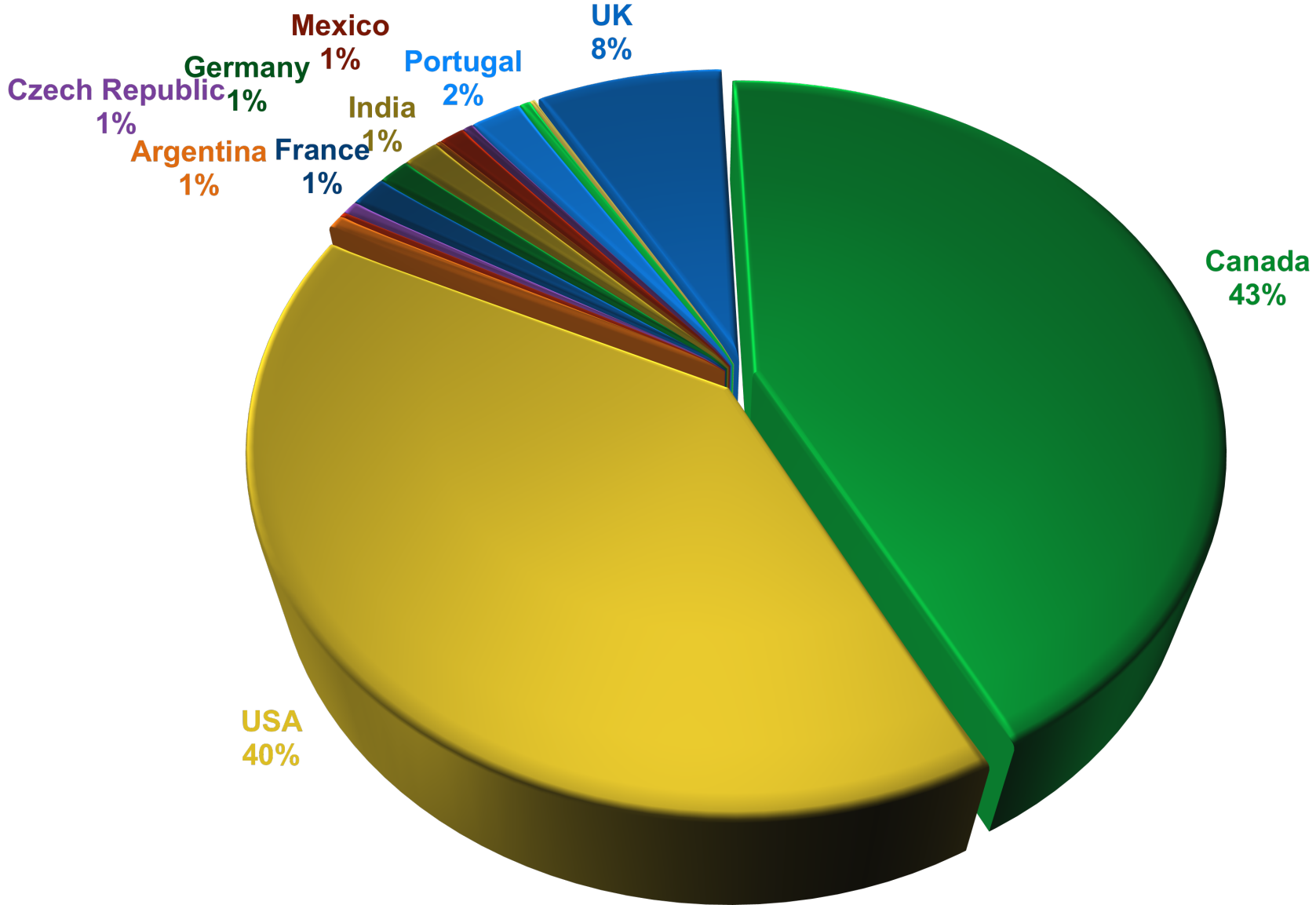
Community supported



- 164 faculty researchers from 78 institutions over 15 countries
 - ~25% of faculty are Canadian
- >500 faculty, highly qualified personnel and technical support
- ~11,000 underground person-shifts per year (~50/dayshift)

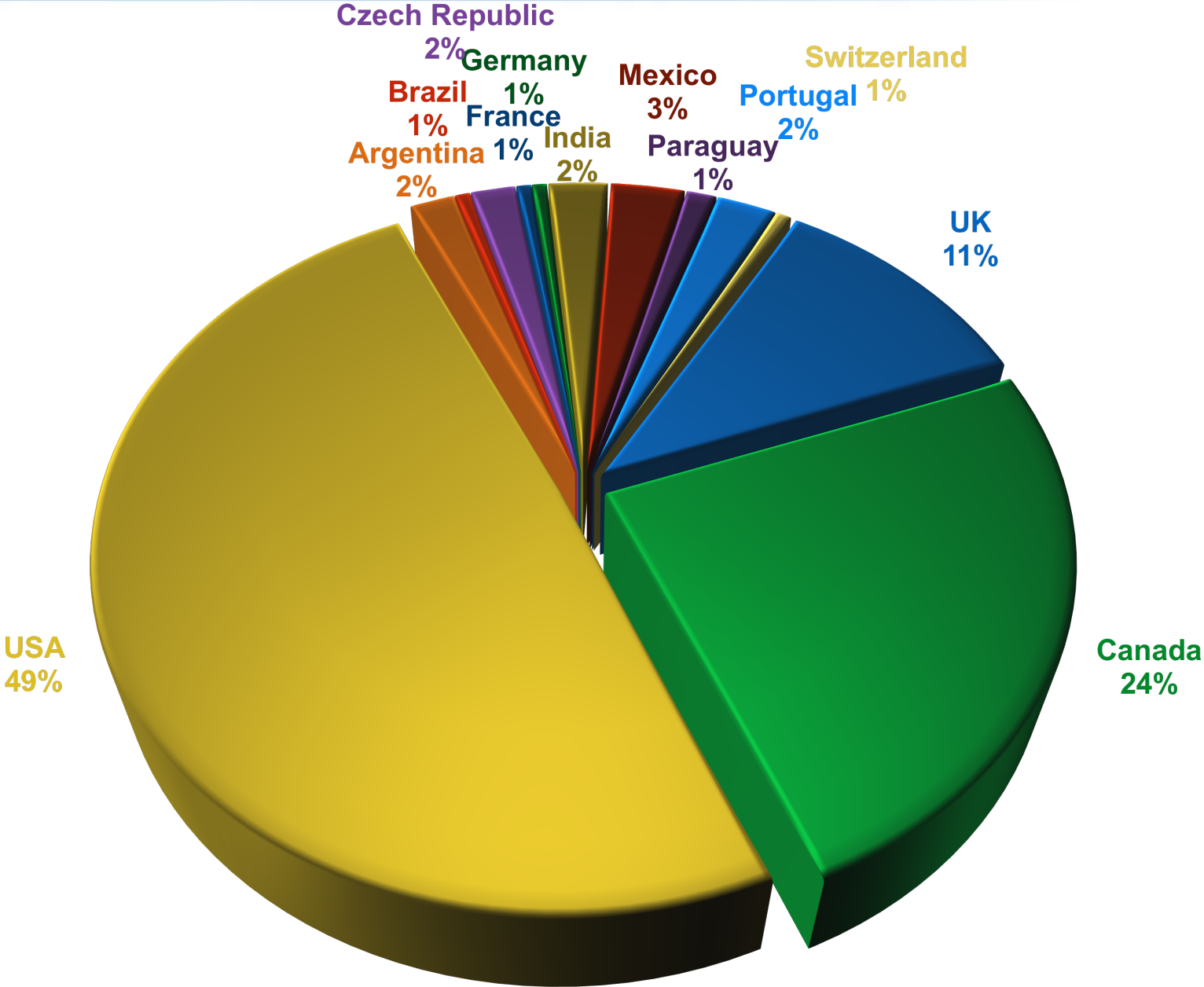


User-base by Country



Total Number of Users - 488

Faculty by Country



Total Number of Academics - 164

Progress on facility systems

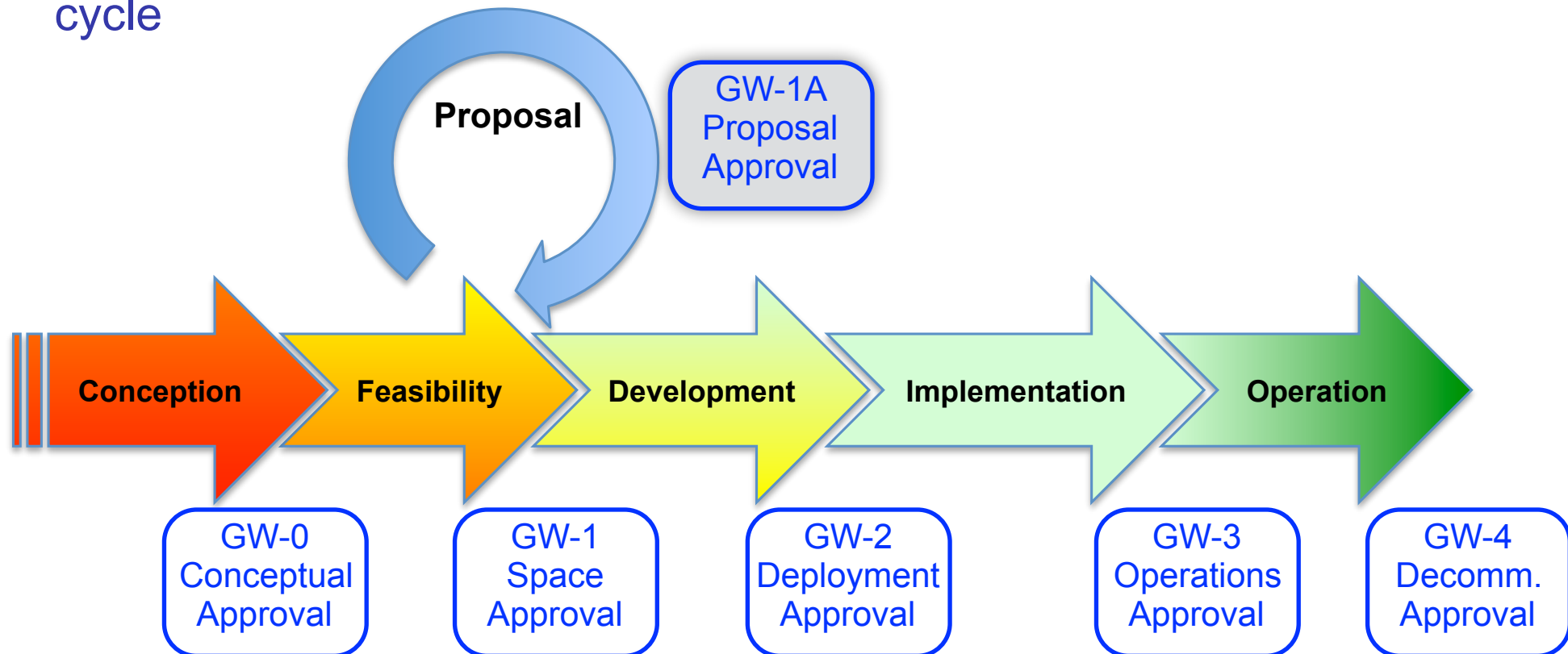


- SNOLAB Infrastructure:
 - Low background capabilities increased in priority due to community needs and review feedback
 - New HPGe detectors from Vue des Alpes and Soudan installed
 - Development of refuge to provide additional size and underground office space underway
 - MODCC project completed refurbishment of surface facility third floor
 - Capital infrastructure secured for surface generator plant emergency power
- SNOLAB Processes:
 - Overhaul of SNOLAB operational policies/procedures continues
 - Experiment lifecycle management now implemented including gateways, with required reviews at each stage to ensure clear understanding of resource requirements

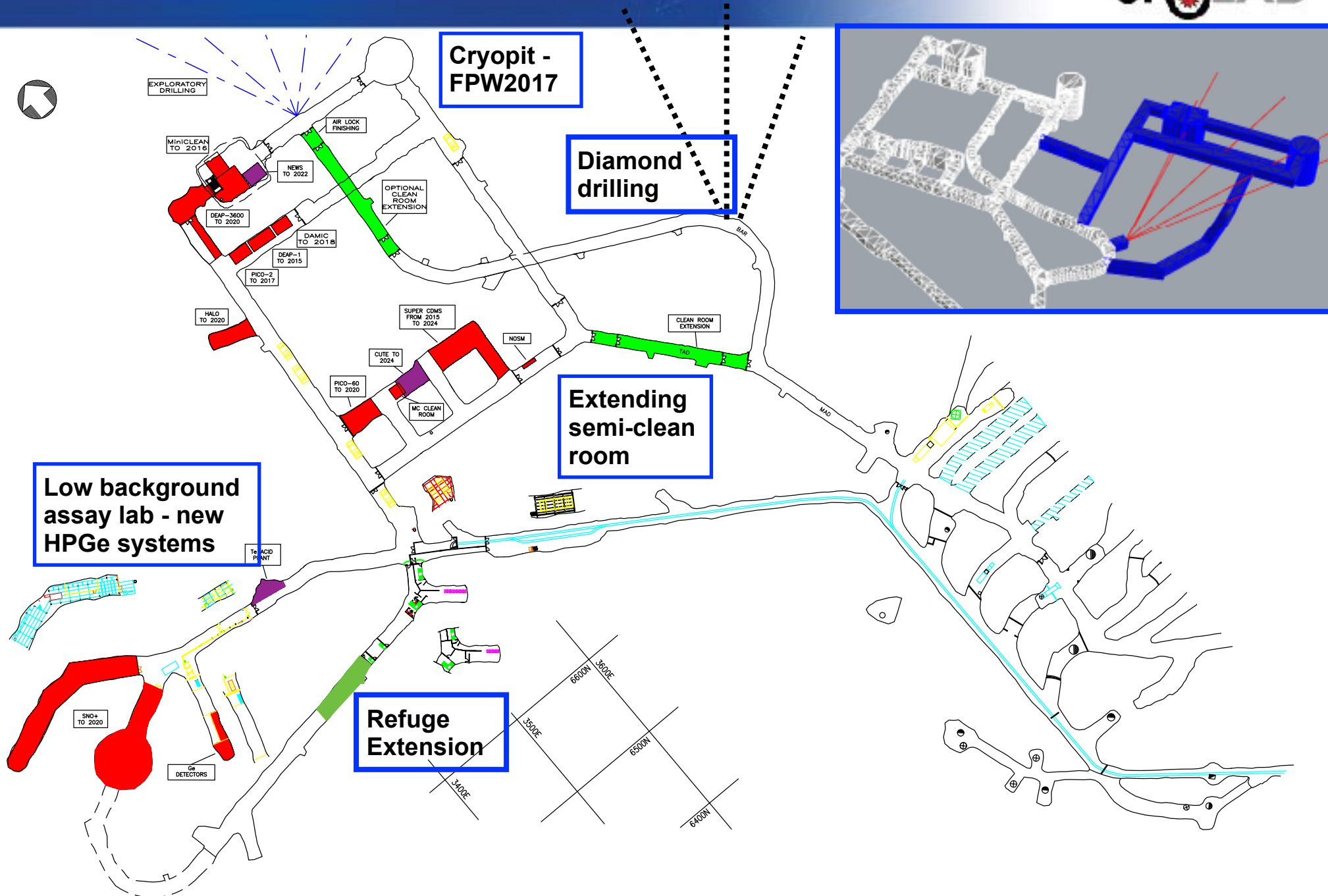
Life Cycle Phases



- Process implemented Fall 2015; aligns with DOE and TRIUMF
- Each phase leads to a GateWay, prior to passing to next phase
- SNOLAB Projects Office supports projects through the process; all projects have a project coordinator assigned
- Expressions of Interest accepted at any time, natural EAC biannual cycle



Lab developments underground



2017 Future Projects Workshop

August 16th and 17th, 2017 at SNOLAB, Sudbury, Canada

As part of its medium term planning process, SNOLAB is undertaking a scoping review of potential future small- and medium-scale experiments seeking to locate in the underground campus at 2070m in the Creighton mine. This Future Projects Planning workshop is part of this horizon scanning exercise, and experimental collaborations that have an interest in using any space underground, including any of the large-scale experimental areas within SNOLAB. over the next five to ten years are invited to present their capabilities, status, plans, and infrastructure requirements.

Registration

If you are interested in attending or presenting at FPW 2015, please register [HERE](#).

Schedule

Schedule and talks will be available on [Global Indico - SNOLAB](#)

More Information

For more information, please contact:
Ken Clark
SNOLAB Research Scientist
[Ken.Clark\[at\]snolab.ca](mailto:Ken.Clark[at]snolab.ca)
(705) 692 7000 x 2244

Lab Developments - surface



- Project experienced delay due to strong harmonics seen on new power feed down shaft
 - eventually traced to skip hoist operations, required retuning of hoist
 - harmonics now manageable, SNOLAB looking at local active filtering
- Project approved fully by Vale following regulatory assessments
- Anticipate generator purchase this FY, installation through 2018 to ensure on-line for SuperCDMS (main requirement)



Promoting Canada internationally



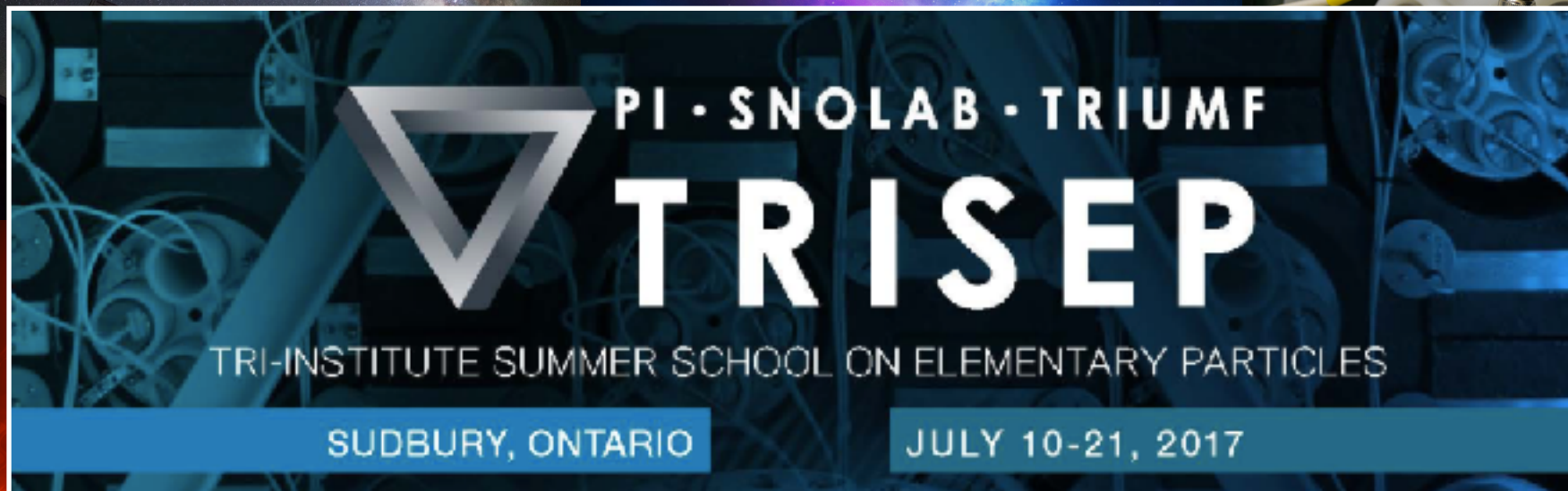
TAUP & TRISEP 2017 in Sudbury



XV International Conference on
Topics in
**Astroparticle and
Underground Physics**



24 - 28 July 2017
Sudbury, ON, Canada



PI · SNOLAB · TRIUMF
TRISEP
TRI-INSTITUTE SUMMER SCHOOL ON ELEMENTARY PARTICLES
SUDBURY, ONTARIO JULY 10-21, 2017

The central graphic features a large, stylized, grey, three-dimensional inverted triangle on the left. To its right, the text "PI · SNOLAB · TRIUMF" is written in a white, sans-serif font. Below this, the word "TRISEP" is written in a very large, bold, white, sans-serif font. Underneath "TRISEP", the text "TRI-INSTITUTE SUMMER SCHOOL ON ELEMENTARY PARTICLES" is written in a smaller, white, sans-serif font. At the bottom, there are two blue rectangular boxes: the left one contains "SUDBURY, ONTARIO" and the right one contains "JULY 10-21, 2017". The background of this graphic is a dark blue with faint, glowing particle tracks and detector components.