SNOLAB Facility & Science Programme Update

Nigel J.T. Smith
Director, SNOLAB
- Brief update on the Science Programme
- The SNOLAB Community
- Update on SNOLAB Process
  - Facility Developments
  - Organisation
  - Project lifecycle
  - Funding status
  - Strategic planning
Continuing the legacy...

SOLAR MODEL

SNO USED HEAVY WATER TO MEASURE TWO SEPARATE THINGS

ELECTRON NEUTRINOS

ALL NEUTRINO TYPES

Excellent Agreement With the Solar Model Calculations

LESS THAN ONE CHANCE IN 10 MILLION FOR “NO CHANGE IN NEUTRINO TYPE”

A CLEAR DEMONSTRATION NEUTRINOS CHANGE THEIR TYPE: 2/3 OF THE ELECTRON NEUTRINOS HAVE CHANGED TO MU, TAU NEUTRINOS ON THE WAY FROM THE SOLAR CORE TO EARTH. THIS REQUIRES THAT THEY HAVE A FINITE MASS.
# Current Science Programme

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Progress on experiments

- SNO+: Uses existing SNO detector.
  - Heavy water replaced by scintillator loaded with $^{130}\text{Te}$. Modest resolution compensated by high statistical accuracy. ($^{130}\text{Te} \rightarrow ^{130}\text{Xe} + e^- + e^-$)
  - LAB process plant construction completed, commissioning underway. Cavity fill underway (leaks fixed, “float-the-boat” concluded), Te plant in development.

- DEAP-3600: Single phase Liquid Argon using PSD
  - target construction complete, cooling underway, expect argon fill in the next three weeks. All ancillary systems complete.

- MiniCLEAN: Single Phase Liquid Argon using PSD
  - target construction complete, cool-down underway. Ancillary systems complete.

- SuperCDMS-SNOLAB: Dark matter Si / Ge crystals with ionisation / phonon readout
  - Planning well advanced for deployment, new test facility (CUTE).

- PICO: Rapid expansion bubble chambers. Insensitive to MIPS at operating temperature, threshold devices; alpha discrimination proven;
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; planning 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.

- Genomics:
  - Low radiation environment impact on mutations, NSERC funded project in development with NOSM;
  - 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

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New Directions

MODCC: First occupant (Revolution) optimising mining operations

REPAIR: Low radiation genomics tests

Nigel J.T. Smith

Ottawa
12th June, 2016
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)
Underground visits

- Underground visits by category
  - SNOLAB Staff
  - Facility Users and Contractors
  - Visitors (inc. untrained users)

- Steady increase from 2011/12, almost to double number of shifts
  - All driven by increase in user (and visitor) shifts
    - Illustration of “enhanced capacity for innovation”

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SNOLAB Structure

- Internal reorganisation to better support projects through project phases implemented
- Includes development of Strategic Risk Group, reporting directly to the Director

[Diagram of SNOLAB Structure]

- Associate Director Science & Programme Development
  - Research Scientists
  - Project Coordination
  - Design Engineering
  - Analytical Services

- Associate Director Programme Integration & Operations
  - Operations
  - Integration

- Core Services
  - Procurement
  - User Support
  - Training
  - I.T.?
Space developments

- Cryopit
  - Experiment not yet defined (process underway)
- Bio/Chemlab under discussion with genomics teams from NOSM
- Low background lab reprioritised and broken into two phases
  - HPGe Systems
  - Additional capabilities which are under review and finding request
Progress on facility systems

- SNOLAB Infrastructure:
  - Facility projects given reduced priority to focus on experiments
    - Low background capabilities recently increased in priority due to community needs and review feedback
  - MODCC project provided funds to refurbish surface facility third floor to provide a new research deck
  - Capital infrastructure secured for surface generator plant emergency power, in final discussion with Vale

- 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
New Research Deck is open
Lab developments

Diamond drilling

Surface generator plant (3MW)

Extending semi-clean room

Creating office space
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

![Diagram]

- Conception
  - GW-0 Conceptual Approval
- Feasibility
  - GW-1 Space Approval
- Development
  - GW-2 Deployment Approval
- Implementation
  - GW-3 Operations Approval
- Operation
  - GW-4 Decommm. Approval
Alignment with Other Processes

- The SNOLAB Life cycle aligns with other institution and agency processes including the US Department of Energy, TRIUMF, CFI.

- A key difference is that many other processes end at the beginning of operation of the Project while the SNOLAB process continues through decommissioning.
Current Status

- All projects need to be included in life cycle process (CFI requirement as well as good practice)
- CFI IF proposals need to complete GW-1A prior to submission

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CFI MSI Programme

- SNOLAB Proposal to CFI MSI programme is in review
  - Five year funding proposal April 2017 - March 2022
  - Proposal submitted April 21st, face to face review last Tuesday
  - Result to be know third week September
  - Similar timescale as (hoped for) Queen’s CFREF proposal
  - Matching funds: Ontario Province Ministry Research & Innovation, Vale

- Additional funding requests made
  - Staff: additional project coordination and management
  - Staff: additional research scientists capability
  - Staff: additional expert plant operations and supervision
  - Staff: additional experiment and analytics support
  - Non-staff: low background assay capability
  - Non-staff: additional redundancy on power distribution systems (to augment generator plant)
  - Support for anticipated change in governance model (incorporation)
Community Feedback

- SNOLAB is looking for community input
- Low background capability
  - Richard Ford co-ordinating (richard.ford@snolab.ca)
  - Planning new low background lab and detectors
  - What does the community need?
- Strategic Plan 2017 - 2022
  - Next strategic plan is in development
  - Will define objectives for SNOLAB to 2022
  - Aim to conclude by end September
  - Community engagement through a steering group
    - Chaired by Hiro Tanaka, U of Toronto
    - Web based survey concluded
    - Town Meeting, April 1st
  - Please let us have your thoughts!
## Community Input Steering Group

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<td>Hiro Tanaka (Chair)</td>
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<td>Isabelle Blain</td>
<td>Formally NSERC VP</td>
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<td>Doug Boreham</td>
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<td>Christine Kraus</td>
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The SNOLAB Strategic Plan Steering Committee is asked to:

- engage, and solicit input to the Strategic Plan from, the SNOLAB scientific community;
- distil the community input into a coherent view, presented to the SNOLAB Director as a ‘community input report’;
- inform the construction of the Strategic Plan to ensure the community view is fulfilled.
Our current Strategic Goals

- Enable and spearhead world-class underground science
  To ensure SNOLAB supports, maintains and executes a world-class research programme, and plays its own significant role in the shaping and delivery of the science.

- Develop and maintain world-class facilities and infrastructure
  To ensure SNOLAB remains at the forefront of infrastructure provision for underground science.

- Educate, inspire and innovate
  To develop broad economic impact to Canada and our surrounding region by educating and inspiring through both public and professional outreach, developing highly qualified personnel and delivering innovative solutions through the use of small and medium scale enterprises.

- Develop delivery systems of internationally recognised standard
  To develop SNOLAB internal quality management and delivery processes, and the connections to the experiments, through internationally recognised practices and processes to ensure efficient and effective management of resources and exemplary safety standards.
Wall Art

Our Strategic Goals are to:

- Enable and spearhead world-class science
- Develop infrastructure for world-class science
- Promote world-class science and inspire the next generation
- Develop world-class processes
Programme and Future Perspectives

- SNOLAB science programme developing well:
  - New results from PICO and DAMIC in the last year
  - DEAP-3600 about to fill
  - MiniCLEAN cooling
  - SNO+ water fill in progress, rope systems tested
  - LAB plant for SNO+ completed, final commissioning
  - SNO+ TeA systems in final design
  - New projects in genomics, mining engineering

- SNOLAB infrastructure and processes under continued development
  - New surface research deck
  - New project management process implemented

- Quinquennial funding proposal under review
  - Results this Fall
  - (Also awaiting next stages of CFREF process)