2020-06-10

SNOLAB Update

IPP-CINP Joint Meeting

Nigel Smith
Executive Director

Same guy as last year....

SNOLAB Values

- SNOLAB re-confirms its commitment to creating a safe and respectful environment for all, including ensuring we hold people accountable to these values.
- Our commitment is encapsulated in our Code of Conduct and Core Values:
  - *SNOLAB values courtesy, honesty, diversity, tolerance, equity and dignity in the treatment of one another. Employees have the right to feel safe and respected in their work place.*
  - *SNOLAB is committed to ensuring that all employees, visitors, suppliers, business associates, volunteers, clients and the general public are treated with respect and dignity. Violent, harassing, discriminatory, offensive, intimidating, humiliating or otherwise disrespectful behaviour will not be tolerated.*
- Following the Strike for Black Lives, SNOLAB commits to support actions to address racism in the academy, and to develop a local action plan.
- Comments, suggestions and input is welcome. Please contact Samantha Kuula, our EDI Officer.

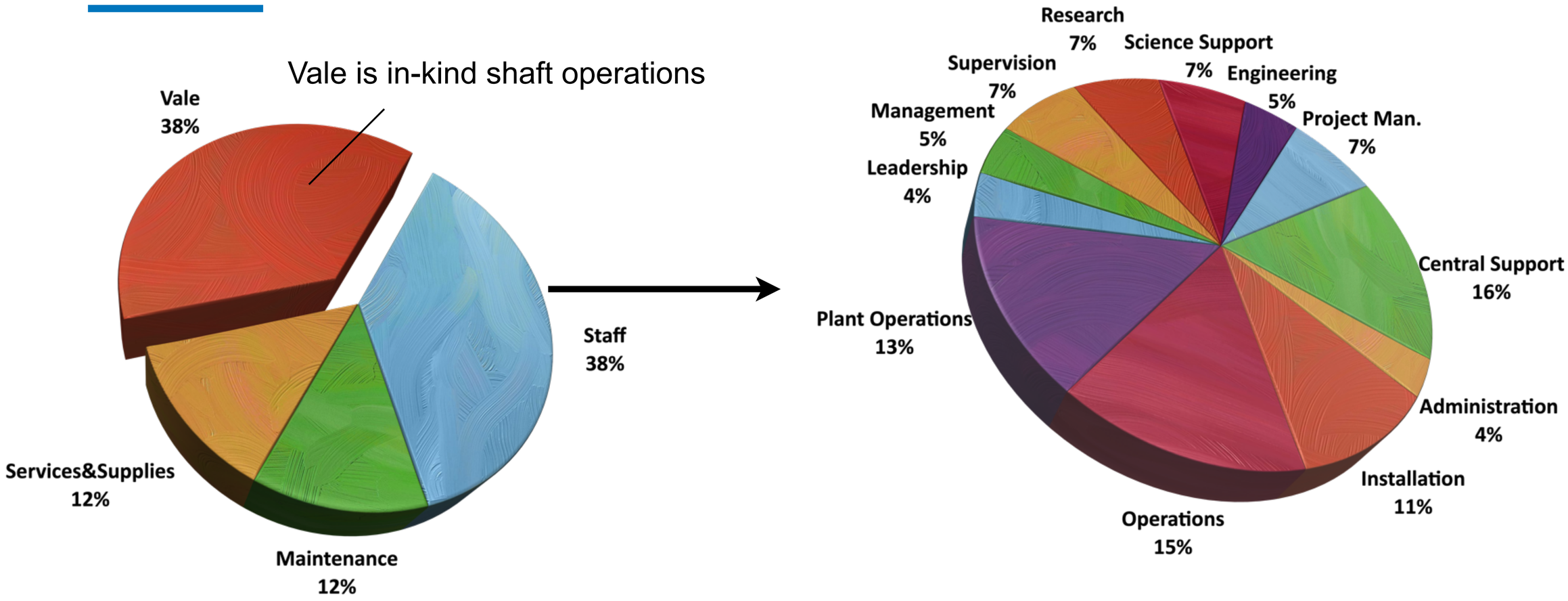
Core value
Teamwork

Core value
Accountability

Key Messages

- CFI M&O Funding secured through to April 2023 (April 2022 for Ontario co-funding)
  - Changes in eligibility to support infrastructure and science delivery (inc. students on eligible tasks)
  - Discussions progressing on governance model, role of national facilities in Canada
- Science programme developing strongly, results from multiple projects, user-base expanding
  - Publications from DEAP, SNO+, PICO, DAMIC, …
  - New science threads developing beyond APP
- Construction underway for next phase (SuperCDMS/CUTE, NEWS-G, PICO-40/500, …)
- Future large scale APP programme strategy based around dark matter and neutrino less double-beta
  - Strong engagement with DOE over US programme for double-beta (Cryopit allocated, site selection (and technology down-select?) expected this year)
- Connecting to strategic planning in Canada (ACP, LRP), US (Snowmass, P5, NSAC), EU (ApPEC)
  - Our (SNOLAB) next strategic planning process will begin early next year
- COVID-19 has impacted SNOLAB as at all facilities
  - Limited access, shift in project priorities; small increase in access now occurring

SNOLAB by the numbers



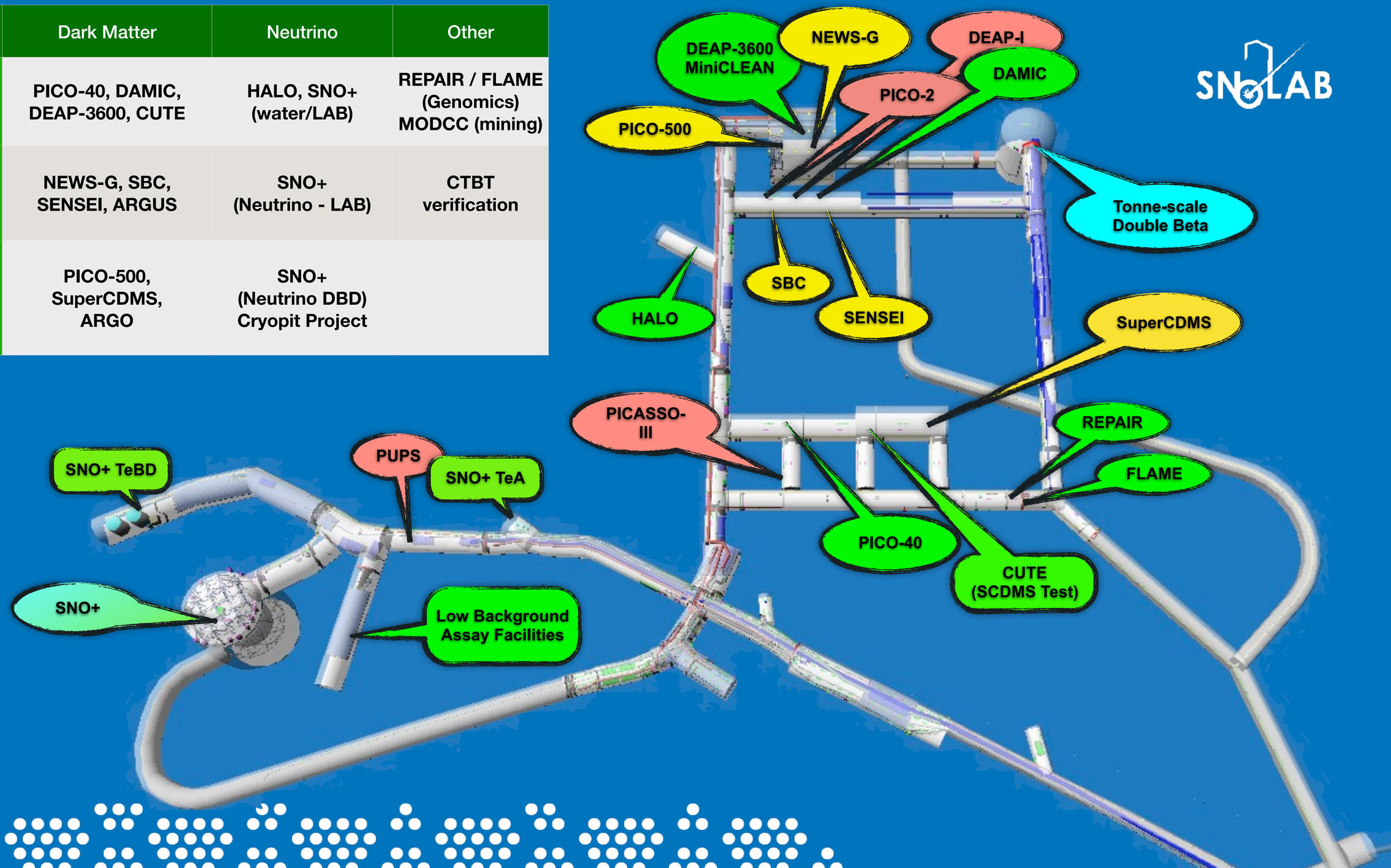
Maintaining capacity for research

- CFI Change in eligibility for some MSI to 60:40 ratio as proposed in the Naylor review, six year grant
- Expanded eligibility - R&D for ‘improving services’, strategic planning, incorporation
  - This provides some small scale ‘LDRD’ type support for infrastructure
  - Ineligible - direct research costs, real or leased property, science internships and exchanges, stipends
- Current staff level 123 FTE, ramping to 137
- Expanded eligibility - students/trainees on eligible MSI O&M activities
  - Funding secured up to 15 FTE students across all competencies (this summer had students in engineering, science, projects, comms, HR)
- New projects supported - PICO-500 infrastructure, Liquid nitrogen plant for facility development

Project Description	Total Project Estimate ($k)
PICO-500 infrastructure (safety, platform, etc.)	1,000
Liquid nitrogen plant to supply facility needs	1,500
TOTAL	2,500

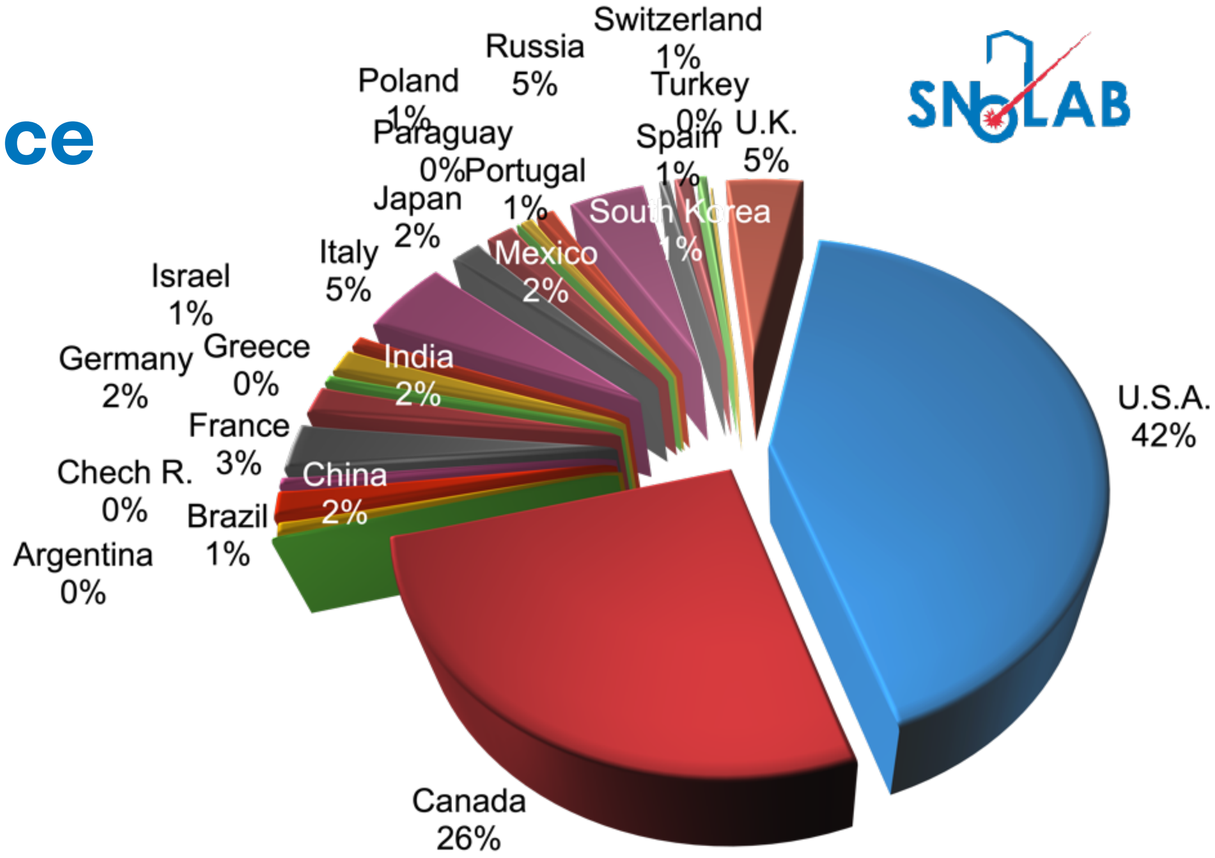
Table 2: Key facility refurbishment project costs, totalled across all years of the proposal

	Dark Matter	Neutrino	Other
Current	PICO-40, DAMIC, DEAP-3600, CUTE	HALO, SNO+ (water/LAB)	REPAIR / FLAME (Genomics) MODCC (mining)
2020 Start	NEWS-G, SBC, SENSEI, ARGUS	SNO+ (Neutrino - LAB)	CTBT verification
2020+	PICO-500, SuperCDMS, ARGO	SNO+ (Neutrino DBD) Cryopit Project	

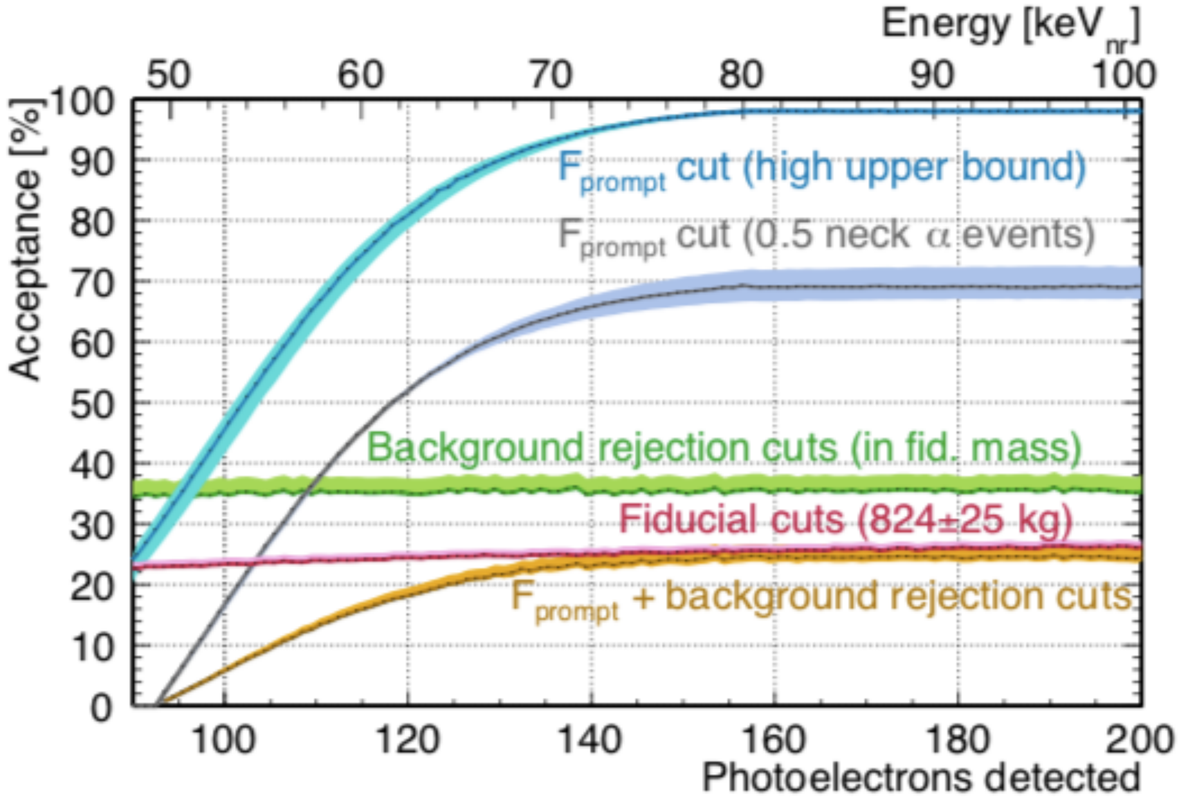


Overview of science performance

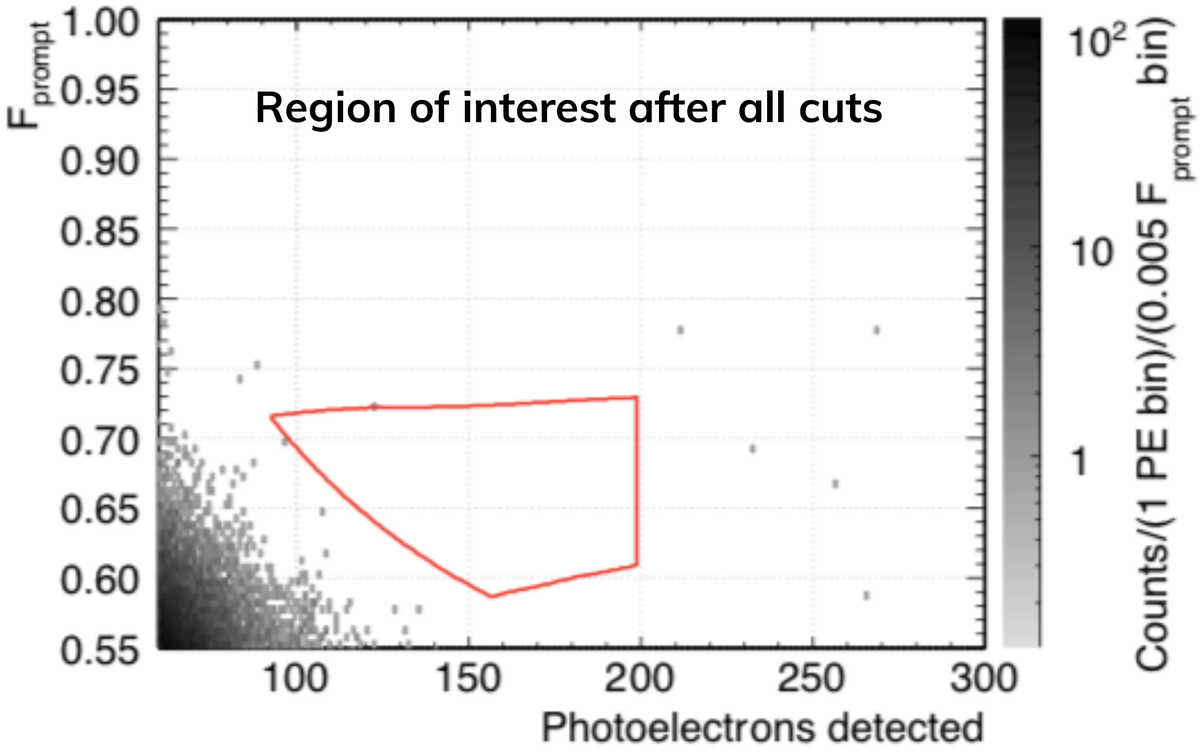
- Publications during review period from all major projects: DEAP, SNO+, PICO, SENSEI, DAMIC, …
  - https://www.snolab.ca/science/publications
- Construction well advanced for additional projects: CUTE, SuperCDMS, PICO 40/500
- Supported community has grown to >850 users from 130 institutes across 23 countries (Poland added last Fall, with Governor General witnessing MoU signature)
- SNOLAB space is now very tight, success of programme and continued demand from community (and lack of expansion capability in current envelopes)
  - Already recycling space as programme evolves
- Future developments in DM/0νββ in planning phases (ARGO, cryopit)



Recent DEAP Result: Phys. Rev. D 100, 022004 (2019)



Cut efficiencies



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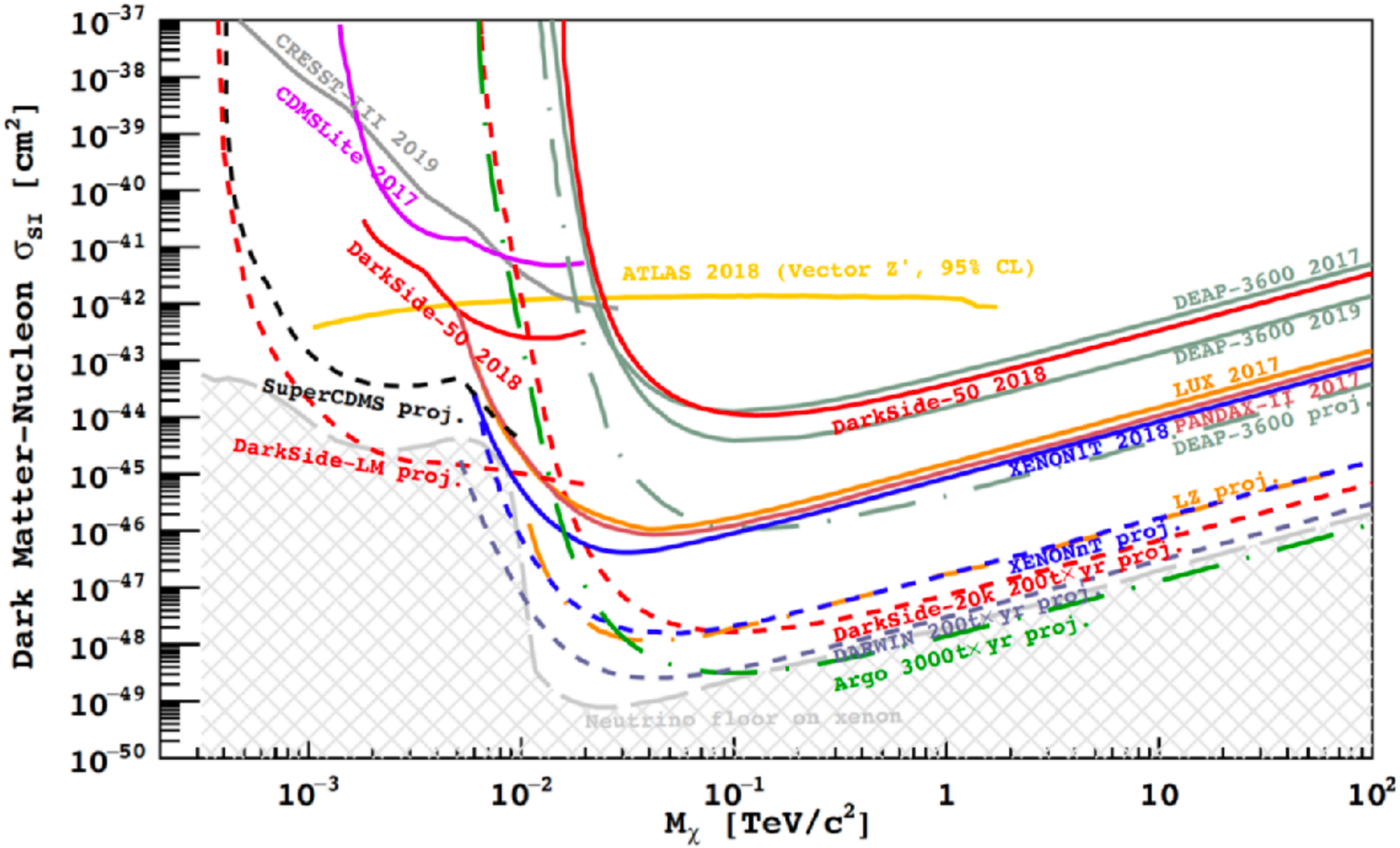
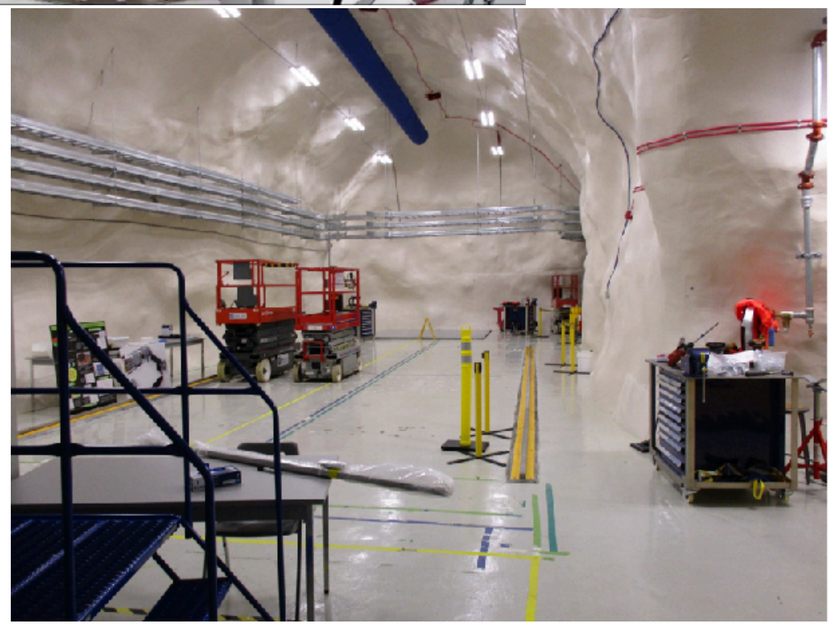


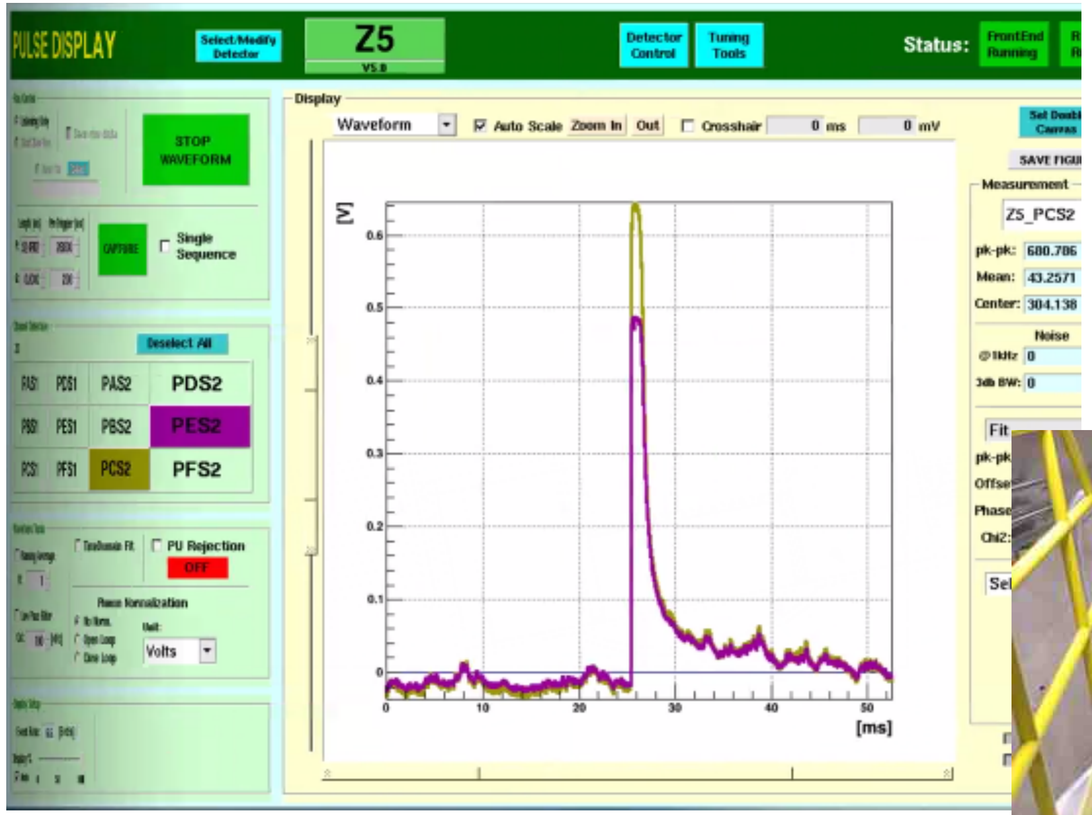
SuperCDMS@SNOLAB

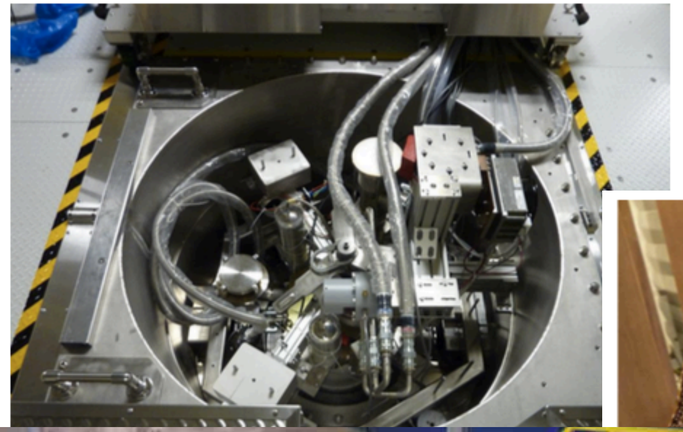
- Construction of SuperCDMS infrastructure is underway at SNOLAB
- Tower construction in US well advanced
- Shield fit test completed at Lemer Pax
- Cryogenic ‘fridge operation successfully achieved

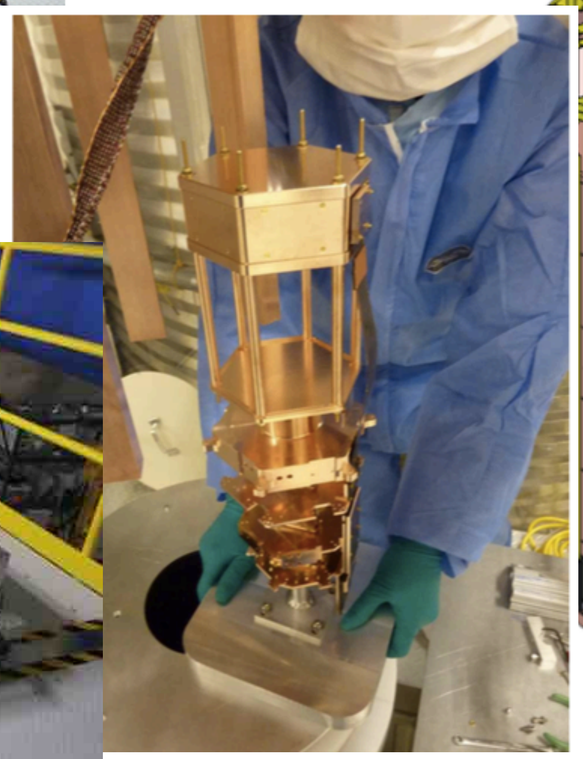


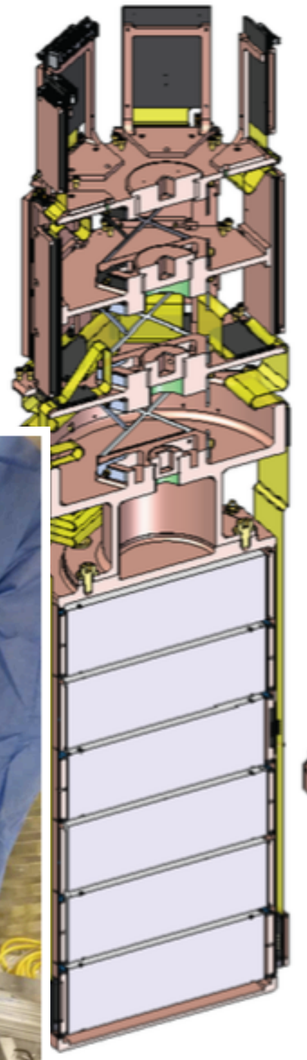
CUTE@SNOLAB

- CUTE test facility operational - first SuperCDMS pathfinder pulses last August









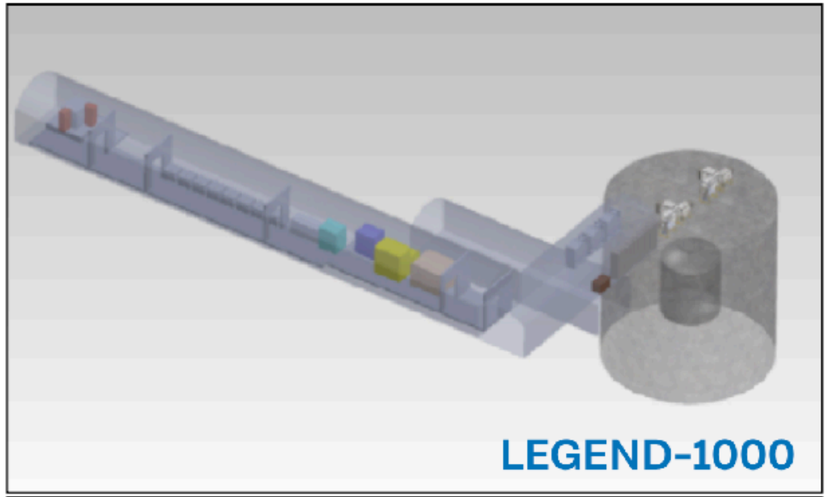
Future strategy overview

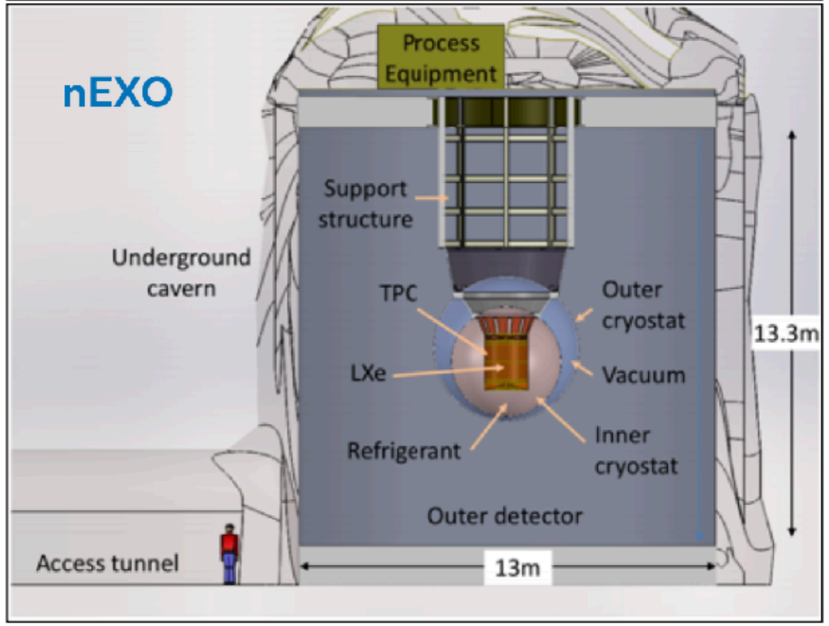
- Focus on maximising science return from investment made in SNOLAB and community, following community strategy discussions (ACP, LRP, P5/NSAC, SNOLAB)
- Support and deliver existing programme (following appropriate strategy)
- Combination of major projects ($400M), smaller scale facilities (PICO-500/SuperCDMS), capabilities
- Medium term focus is double-beta decay with second generation project in Cryopit
  - Discussions with DOE/NSF as well as Canadian stakeholders
- Longer term focus is G3 dark matter project (eg ARGO liquid argon 300 tonne)
  - ARGO collaboration has specified SNOLAB as target location
- Maintain opportunity for smaller scale development and diversification of science

- Maintain capabilities, especially where overlap/connectivity
  - Cryogenics and liquid noble management (eg Xe and UAr management for $100M payloads)
  - Low background production, construction, assay, cleaning, etc.

G2 0νββ programme

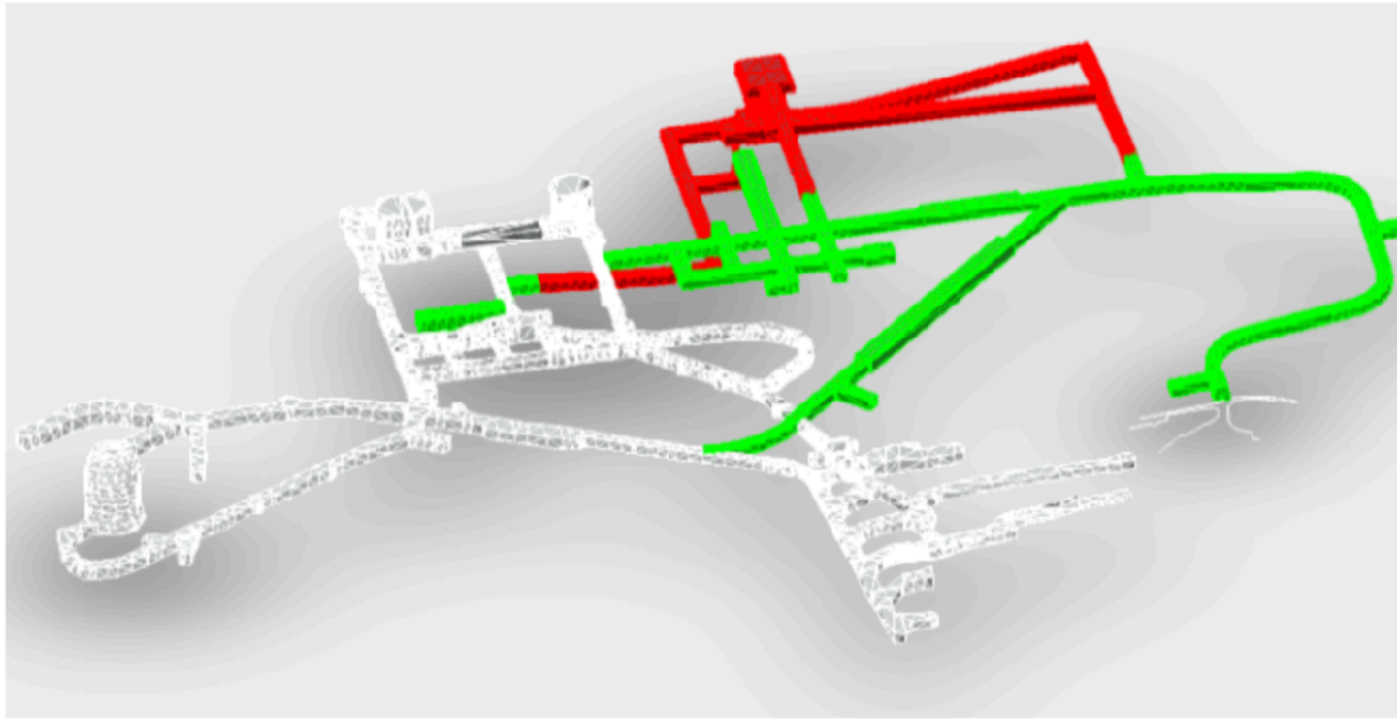
- US Second generation 0νββ programme has CD-0 from December 2108
- DOE have been focussed on the EIC decision, including location: this is concluded; Now switching to 0νββ programme
- This will be a two-step process, site selection, then technology selection — potential timescale impacted by COVID-19
  - Site selection expected this year
  - Subsequent down-select on technology (eg nEXO/LEGEND)
- We are working with DOE on requirements and information for site selection.
- The G2 0νββ project is becoming very real, even as timescale remains somewhat unknown. SNOLAB is stepping up planning and capabilities to support the selected project.
- **This will become our highest priority science project at that point, given near-term world-leading potential**





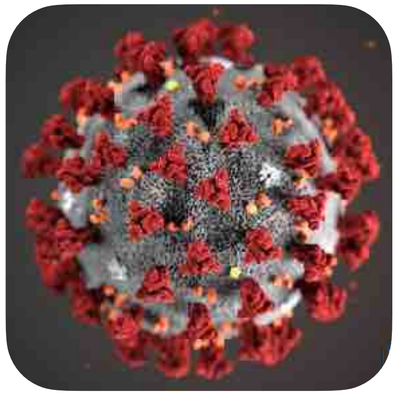
Potential future expansion

- Evaluation of expansion possibilities completed
- Included current (ambitious) plans as communicated by community
- Cost prohibitive O($120M) without appropriate funding programme
- Such development would require substantial ROI (eg LEGEND-1000 at cost $400M) and substantial support from community
- Space will be fixed at SNOLAB for the foreseeable future
- This may impact ability to host development projects (and clearly limits large-scale projects)



COVID and Future Operations

- SNOLAB is currently operating under its Emergency Response Plan
- Being managed as a Major (Tier 3) emergency
  - On-site Incident Command team; Daily calls between the senior leadership team
  - Three independent teams to provide redundancy in operations
- General philosophy is to prioritising life safety, facility and experiment integrity, current experiment operations and *future proofing experiment and facility operations.*
- Beginning to increase shifts and starting work that can be done with minimal increase in numbers on site
- New protocols already in place, including Vale protocols for access
  - Temperature scanning, screening questionnaire, physical distancing, increased cleaning/hygiene



COVID and Future Operations

- What factors affect this planning?
  - Where are we in the restart locally and provincially? (matching our restart to best practice)
  - What access capability do we have for people and logistics?
    - currently limited to ~10-15 person-shifts / week; just switched to five day operations
  - What type of work can we do in each stage? What projects can we work on?
    - Risk based analysis using Task Hazard Analysis, including COVID awareness
- Prioritisation of projects takes into account the current situation, what we think we can do, and when, during the next phases.
- Construction projects will be deferred until much better logistical access, which will impact some of our experiments
  - This is reflected in the resource conflict prioritisation list, where the facility projects are more prominent.

Exploitation of facility capabilities

- COVID has impacted prioritisation of projects away from experiment construction towards facility projects that can be done from home (primarily)
- Aim is to develop capabilities aligned with community need: low background assays, material production and machining where relevant, low radon systems
- Development of cryogenics and noble liquid potential at SNOLAB underway

RESOURCE CONFLICT MATRIX of PRIORITIES

PRIORITY #	STRAT PLAN OBJ	POG PROJECT #		GATEWAY
00-SP4			Imminent Safety Issues and Facility Emergency Repairs	
01-SP4			Facility Operations	
02-SP4			Executive Requirements	
03-SP1			Experiment Operations (DEAP-3600, HALO, CUTE, DAMIC, FLAME, REPAIR, PICO-40, SNO+)	GW-3
04-SP4			Executive Requirements - MVM	
05-SP4	2020-01		ProSapien IIR/NCR Management Software	
06-SP4			Internal Process Continuous Improvements: Sharepoint; Dynamics	
07-SP2	2018-19		Facility Expansion (Conceptual Design Phase)	
08-SP2	2019-12		Second Phase LN2 Plant GW2 Deliverables	
09-SP2	2018-02		Surface Generator Plant	
10-SP2	2018-17		Underground Combustibles Storage	
11-SP2	2019-04		Surface Facility Refurbishment	
12-SP2	2019-18		Swipe Access Cards	
13-SP2	2019-11		Primary RO Replacement	
14-SP1	2019-14		050 Xe-Still	GW-2
15-SP1	2018-06		001 SuperCDMS	GW-2
16-SP1	2019-02		032 nEXO	GW-0
16-SP1	2019-03		037 LEGEND-1000	GW-0
18-SP2	2020-02		Underground Facility Refurbishment	
19-SP2	2019-05		Mobile Fleet Upgrade	
20-SP2	2019-06		Cosmic Ray Demonstrator Units	
21-SP2	2020-03		Surface Workshop refurbishment	
22-SP1	2018-04		013 SNO+ LAB	GW-3
23-SP1	2018-14		047 SENSEI	GW-2
24-SP1	2018-03		038 NEWS-G	GW-2
25-SP2	2019-10		Upgrade LBL LN2 Plant	
26-SP1	2019-16		023 MiniCLEAN	GW-4
27-SP1			045 PICO-500	GW-0
28-SP2	2019-15		SNOLAB-LU Campus	
29-SP1			049 SBC	GW-1
30-SP1			013B SNO+TBD	GW-1
31-SP1			013A SNO+TeA	GW-2
32-SP2	2019-08		Scientific Computing Capability Upgrade	
33-SP2	2019-19		Low Radon Air Supply	
34-SP2	2019-17		SNOLAB VR	
35-SP1	2019-13		051 ARGUS GW1A Deliverables	GW-0
36-SP2	2018-10		BAR/TAD Concrete and Air Lock	
37-SP1			048 NEWSdm	GW-0

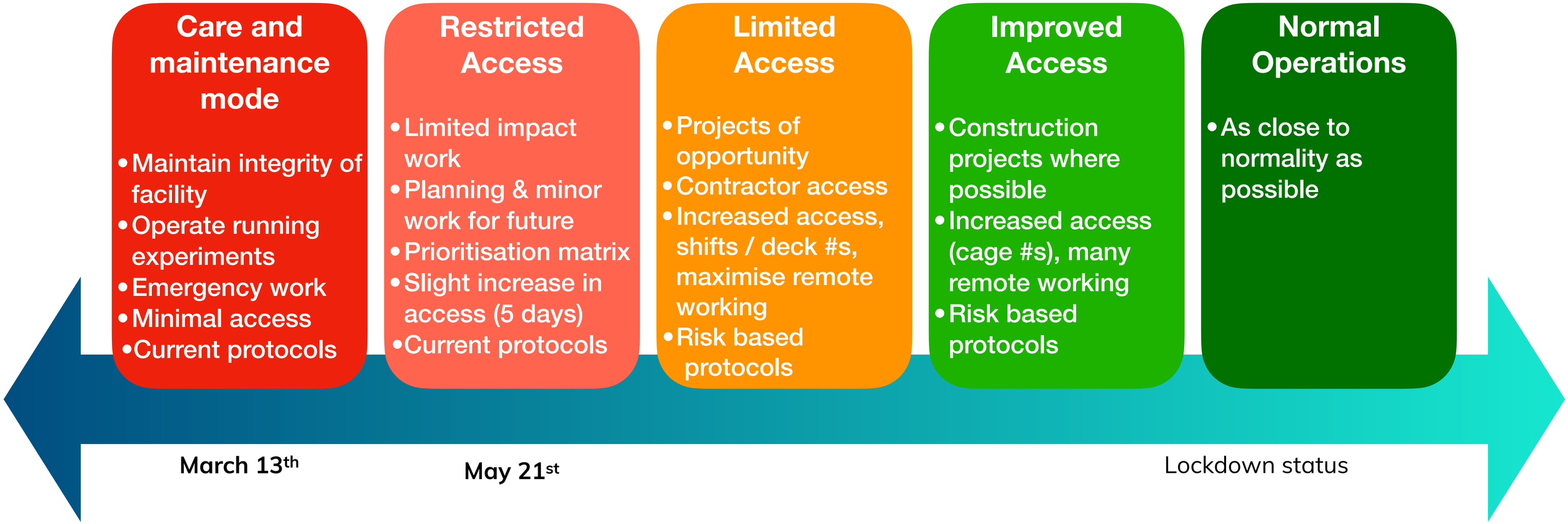
Responsive Requirements
Facility Developments
Science Programme

Revised: 2020-04-26

Note: 00 (Priority #) - SP4 (Stategic Plan Objective #)

NOTE: This list is used by management and supervision to guide priorities of their teams when there are competing demands on their resources.
It is NOT a ranked list based on science value but assesses many aspects.

Restart Philosophy



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