

CANADA FOUNDATION FOR INNOVATION

MSIF Workshop Panel 1

Diversifying and expanding facility user bases to optimize benefits for Canada / Diversifier et augmenter le nombre d'utilisateurs et utilisatrices des installations afin d'optimiser les retombées pour le Canada

**Moderator: Volker Gerdts, Director & CEO, VIDO
Monique Albert, Chief Operating Officer, CBG
Jodi Cooley, Executive Director, SNOLAB
Alexandre Forest, Executive Director & COO, Amundsen Science**

November 2, 2023



IMPROVE LIFE.



2023 MSIF Workshop
Monique Albert, COO

Introduction: Centre for Biodiversity Genomics



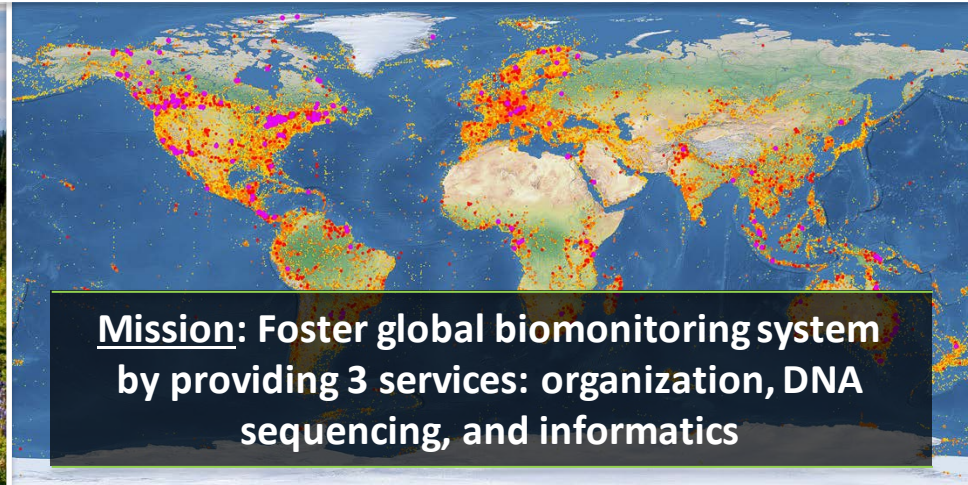
2005: Established as founding unit in the Biodiversity Institute of Ontario



2022: Transitioned to a separate University Research Centre



Vision: A world where we read the biosphere with DNA



Mission: Foster global biomonitoring system by providing 3 services: organization, DNA sequencing, and informatics

Introduction: The Motivation



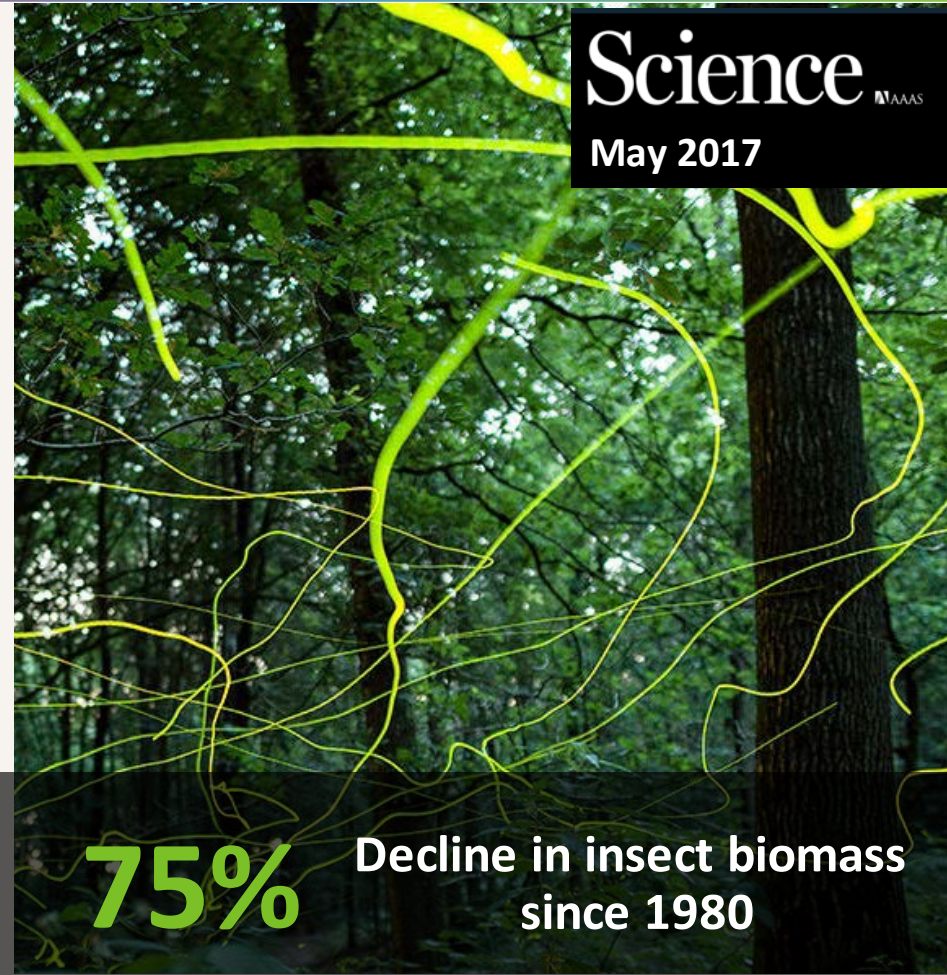
The image shows the cover of the WWF Living Planet Report 2018. It features a silhouette of a child jumping over another child sitting on the ground, set against a sunset background. The text on the cover includes the WWF logo, 'REPORT INT 2018', and 'ZSL LET'S WORK FOR WILDLIFE'. The main title 'Living Planet' is in large, semi-transparent letters, and the statistic '60% Decline in 3000 vertebrate species since 1970' is prominently displayed at the bottom.

WWF
REPORT
INT
2018

THIS REPORT HAS BEEN PRODUCED BY COLLABORATION WITH:
ZSL
LET'S WORK FOR WILDLIFE

Living Planet

60% Decline in 3000 vertebrate species since 1970

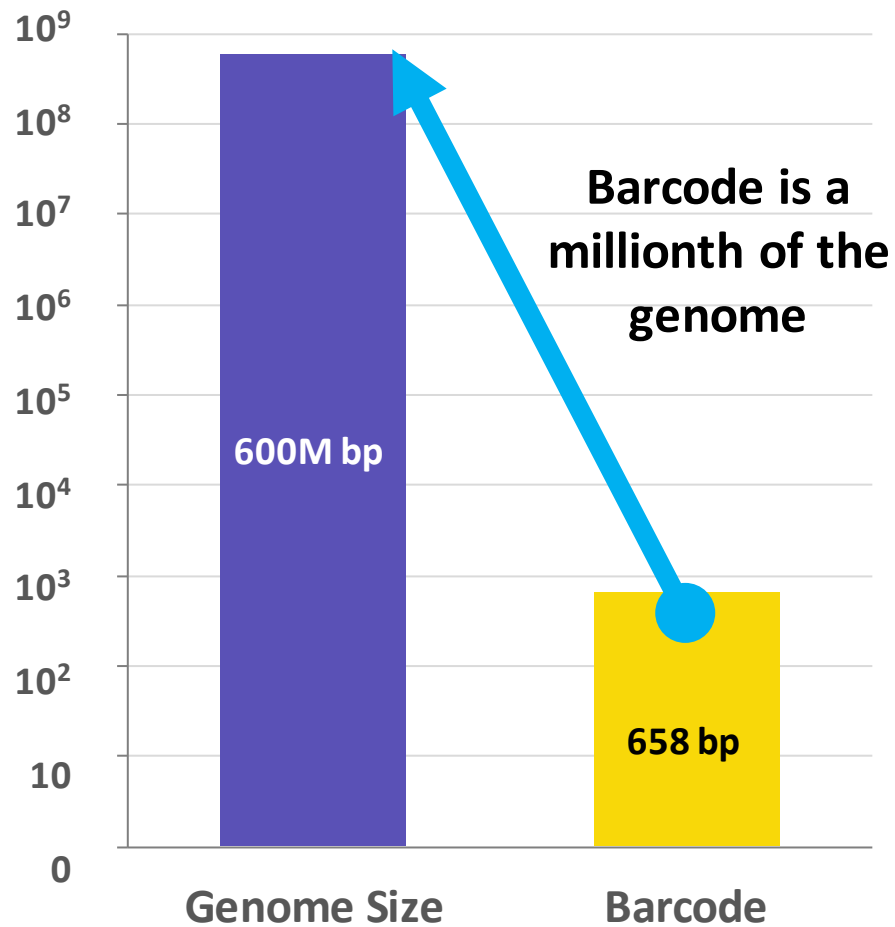
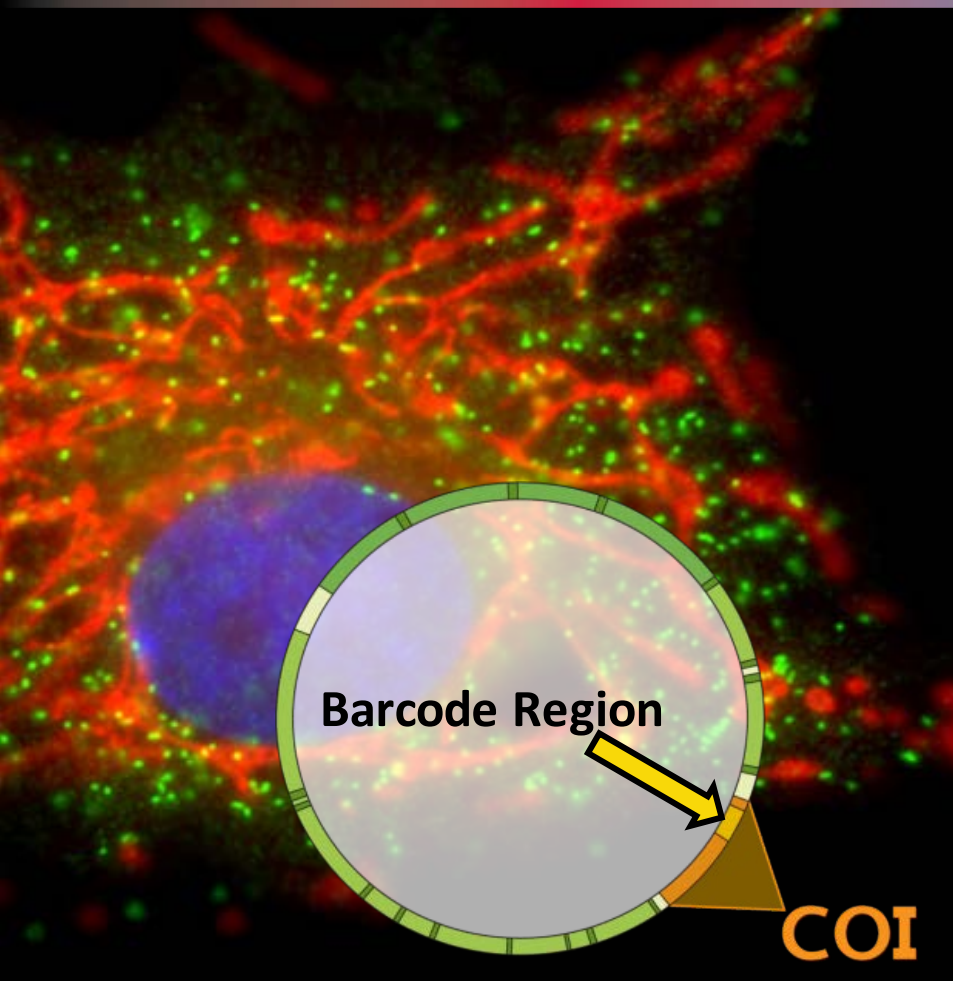


The image shows the cover of the May 2017 issue of Science magazine. It features a photograph of a forest with bright yellow-green glowing lines overlaid on the trees. The text on the cover includes the 'Science' logo with the AAAS symbol and the date 'May 2017'. The statistic '75% Decline in insect biomass since 1980' is prominently displayed at the bottom.

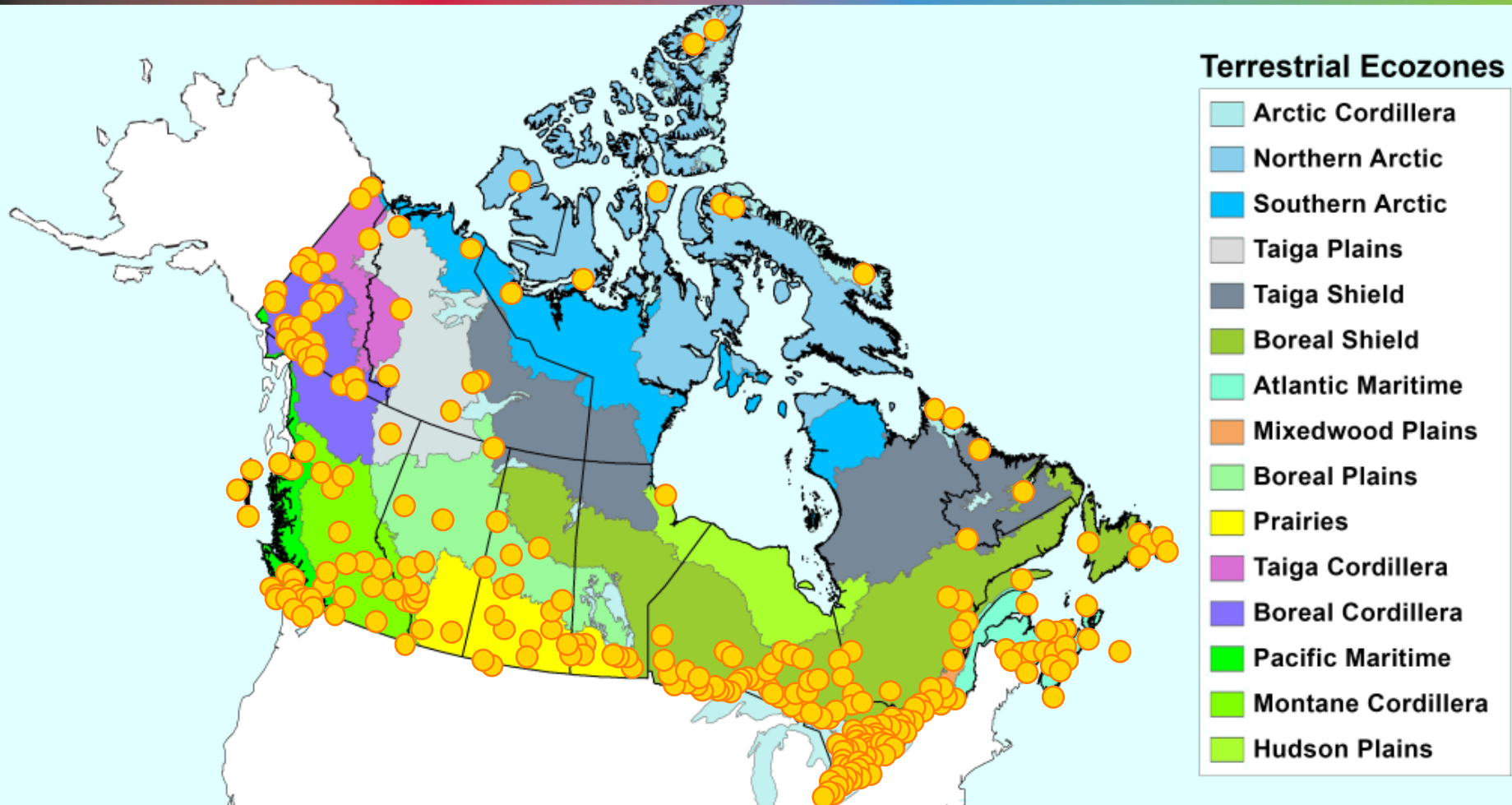
Science AAAS
May 2017

75% Decline in insect biomass since 1980

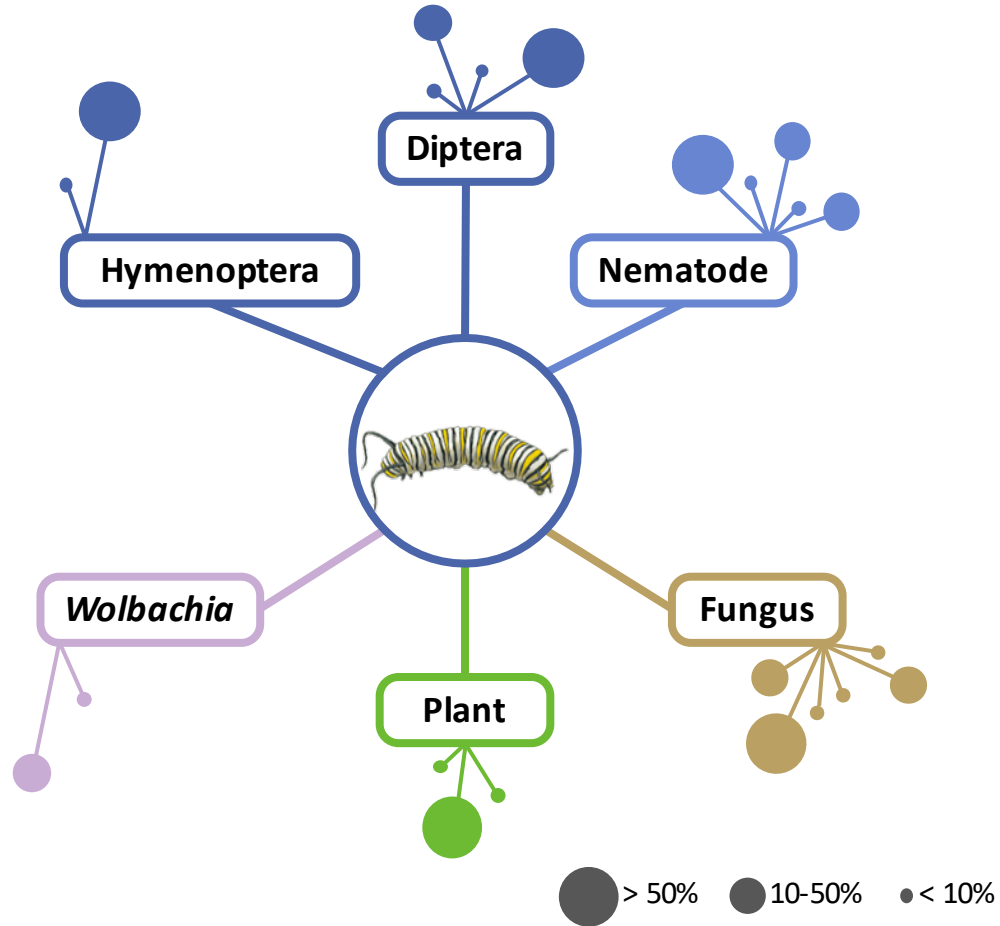
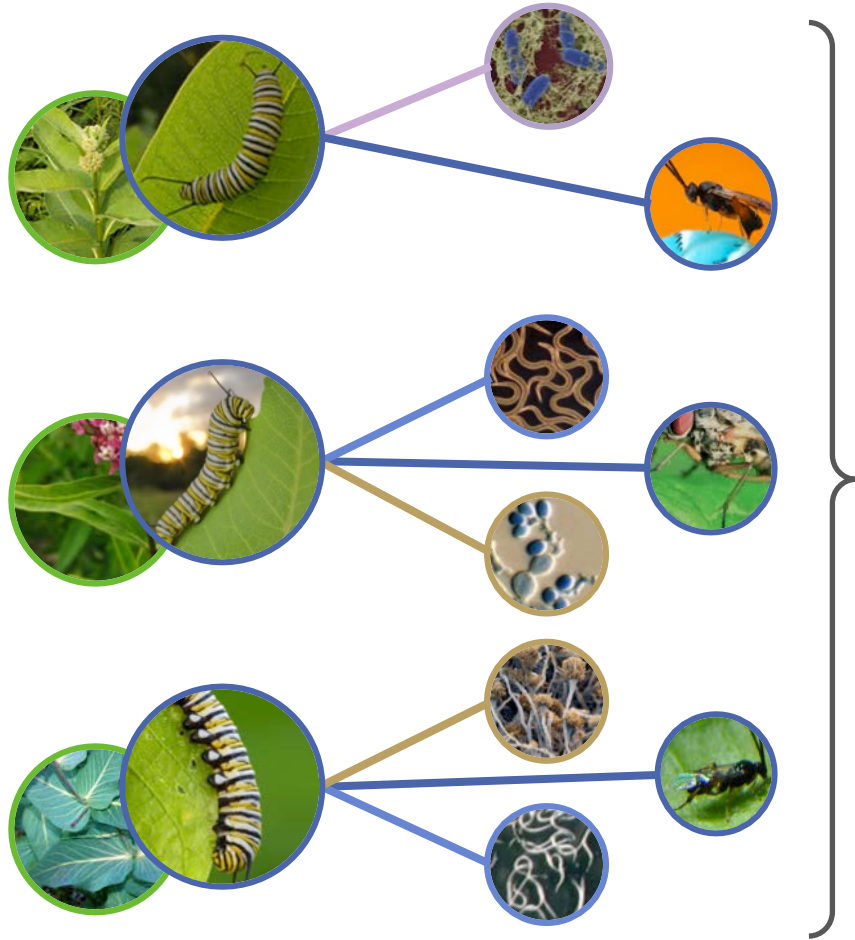
Introduction: Barcode Region for Animal Kingdom



Introduction: Species Discovery & Ecozone Validation



Introduction: Species Interactions



Introduction: Biodiversity Genomics Services



SPECIMENS: >10M



IMAGE LIBRARY: >8M

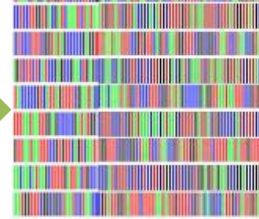


DNA EXTRACTS: >12M

Biorepositories



DNA BARCODING
CAPACITY: 3M SPECIMENS PER YEAR



METABARCODING
CAPACITY: 20K BULK SAMPLES PER YEAR

Sequencing



14M+ DNA BARCODES
1M+ SPECIES



Informatics

Introduction: Strong Usership in 2022-23

3M specimens + DNA
extracts added

8K specimens + DNA
extracts loaned



Biorepositories

2.1M individual specimens
sequenced

5K bulk samples sequenced

300 external users from 30
nations



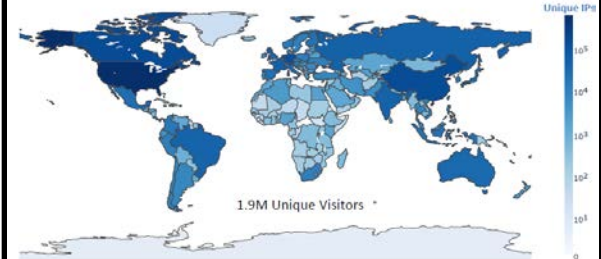
Sequencing

1.9M unique IP visits

7.2M ID requests fulfilled

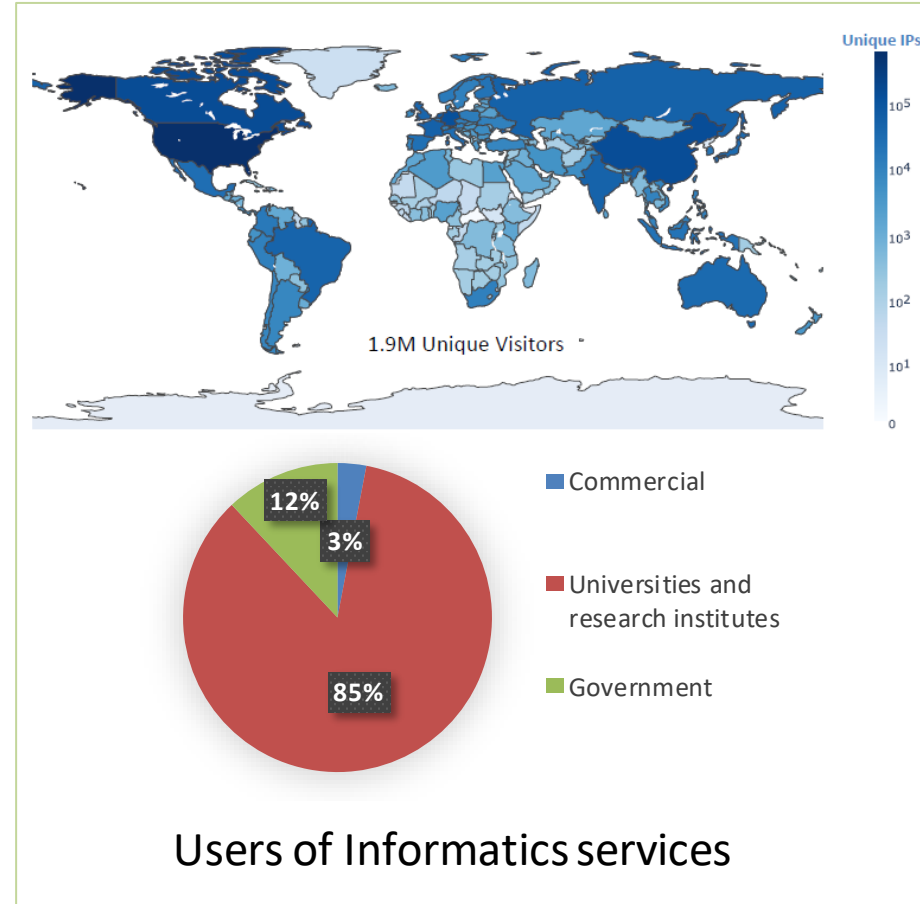
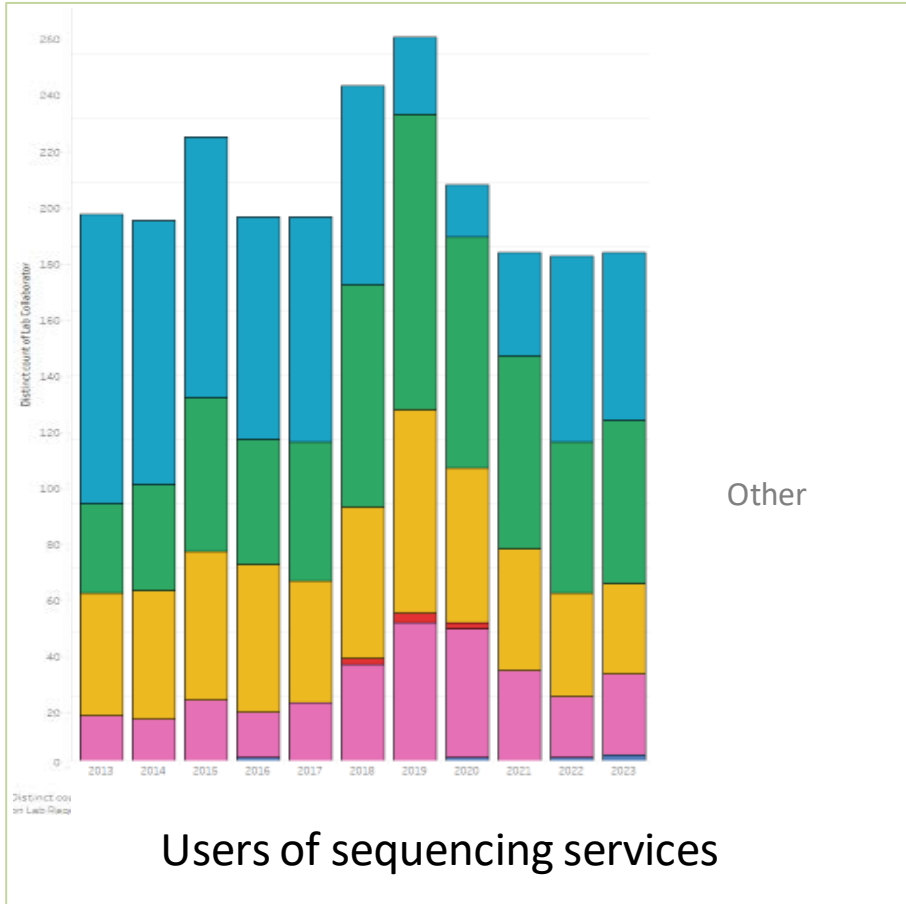
94M records analysed

30 TB data accessed



Informatics

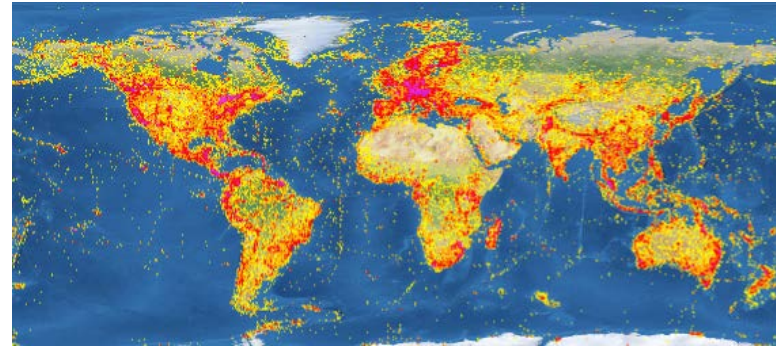
User Diversity: Demographics



User Diversity: Categories



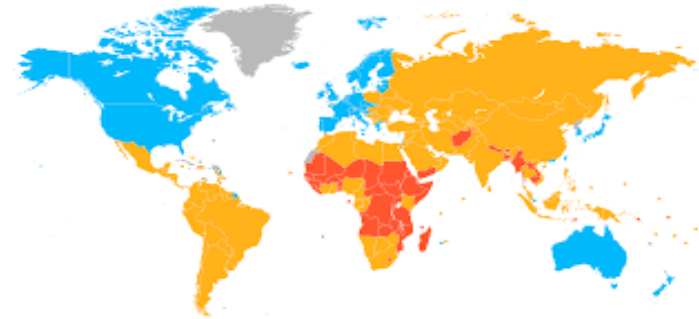
SECTOR



LOCATION



CITIZENS and COMMUNITIES



DEVELOPING NATION STATUS

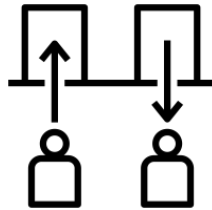
User Diversity: Categories



RELATIONSHIP

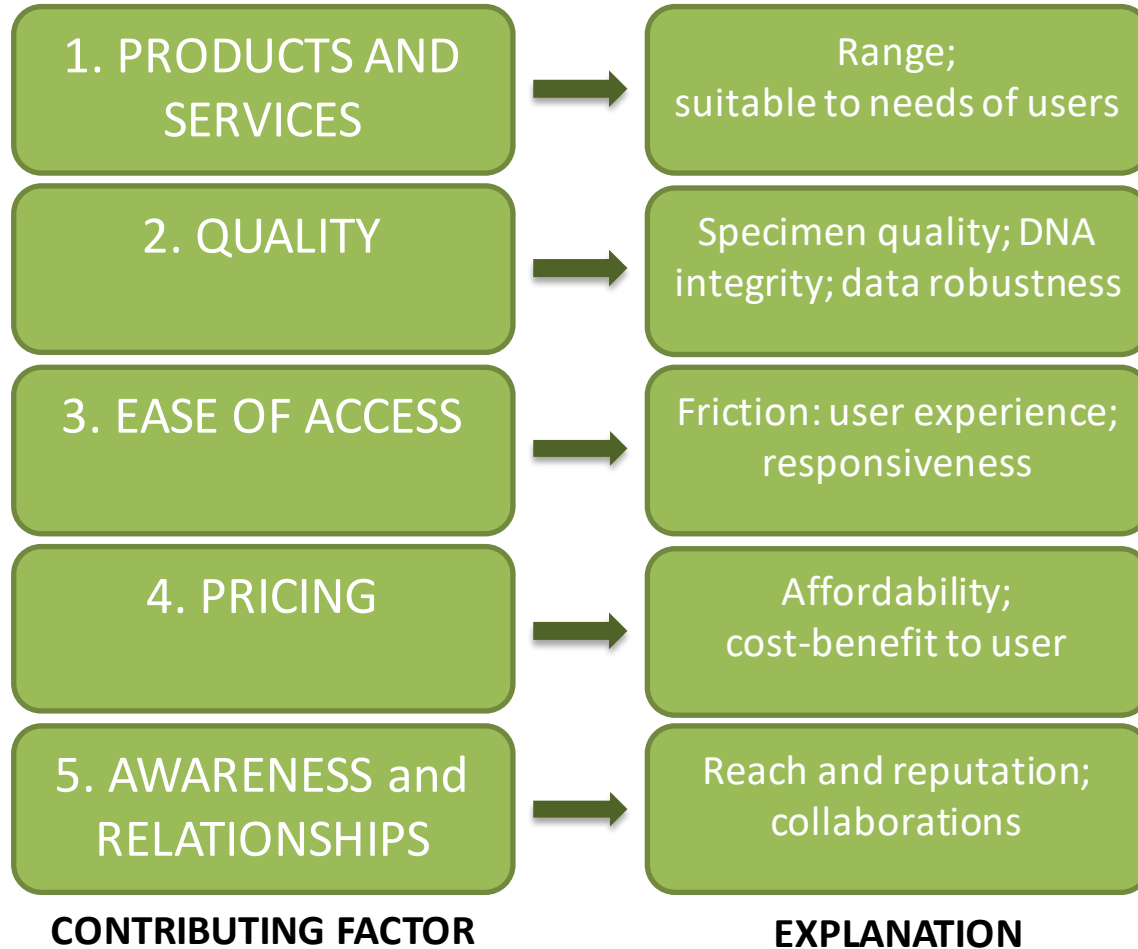


TYPE OF REQUEST

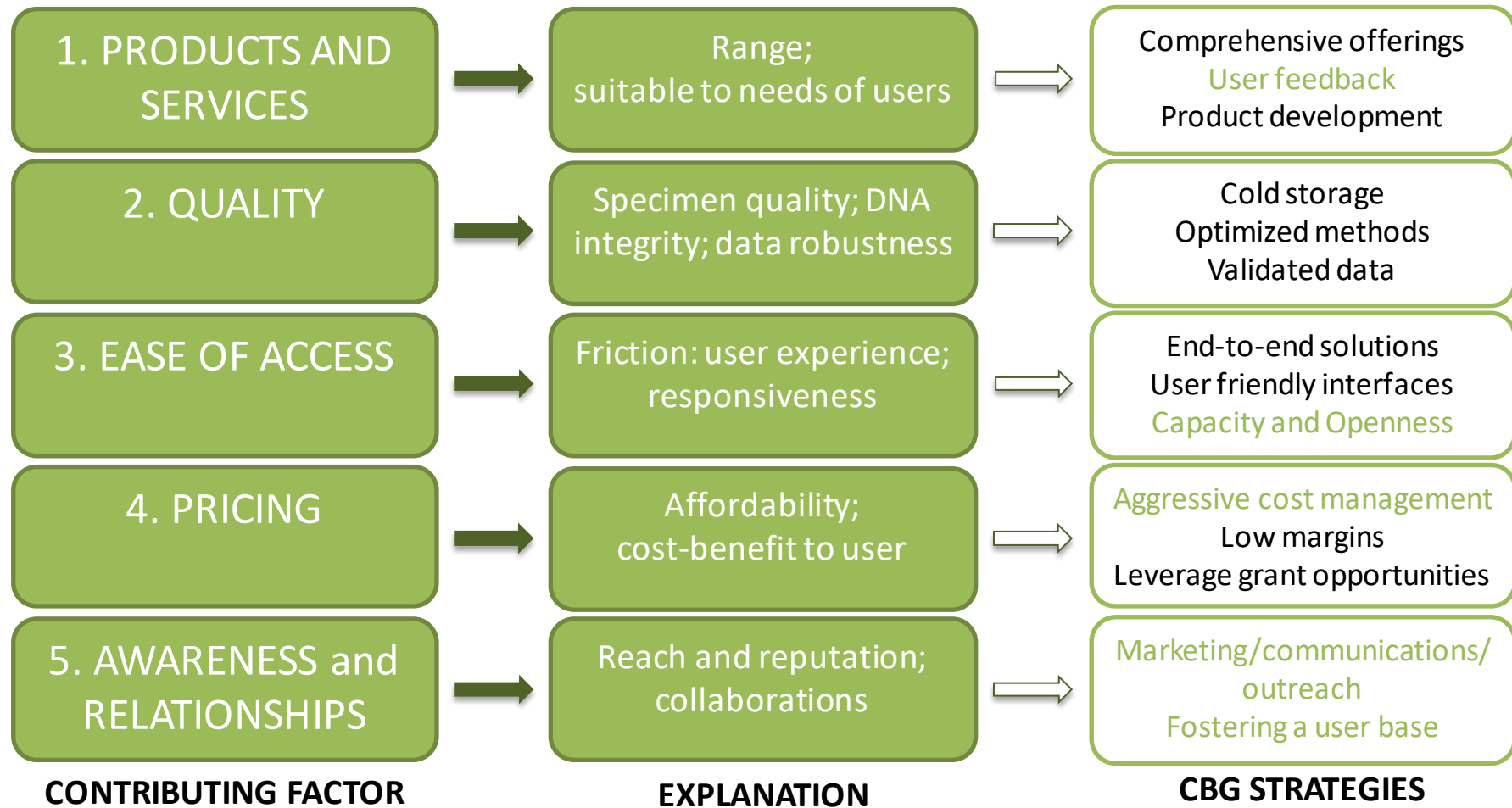


IMPACT

Expanding User Base: Influencing Factors



Expanding User Base: Influencing Factors



Expanding User Base: User and Expert Feedback

Track trends in service requests

Partnerships committee

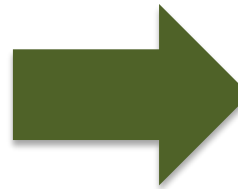
- “voice-of-customer”
- usefulness/performance

User surveys

- Satisfaction
- Future needs

Science Committee

- Advice on:
- technology
 - methodology



- 1. Address gaps to match user needs/demand**
- 2. Develop technologies to advance capabilities**

Expanding User Base: Aid Access



BOLDSYSTEMS

Barcode of Life Data Systems Handbook

A web-based bioinformatics platform supporting the DNA barcoding of animal, plant, and fungal species.

Centre for Biodiversity Genomics Biological Material Transfer Agreement (BMTA)

Accession Number

| | |
|-----------------------|----------------------|
| Provider Name: | Registered By: |
| Provider Institution: | Registration Date: |
| Provider Address: | CBO Contact: |
| | Origin of Specimens: |

Please confirm that Provider name and address are correct, specify via email if Provider is different.

Voucher Quantities: Specimens Lots

Voucher Materials: leaflet specimen in ethanol
 herbarium
 Tissue Form: SAMF (Sampling on Public Specimens)
 Sequencing: Remote Library Contribution
 Pricing: Remote Library Contribution
 Analysis Requested: 2027_SEQVEX_96_SFPD_DNA_Extraction
 Loan Conditions: permanent loan

Special Conditions: (requested by provider or permit issuing authority) Other, please specify: _____

Yes Data may be shared with other collaborators and institute
 Yes Data may be made public on BOLD
 Yes Voucher taxonomy may be updated
 Yes Voucher specimens may be loaned

This BMTA provides a record of the mutually agreed Terms negotiated between the Provider and the Centre for Biodiversity Genomics. It is intended to be used in conjunction with the Standard Operating Procedures (SOPs) for Biodiversity Genomics and the Biological Material Transfer Agreement (BMTA) and the data release policy attached hereto. Understood that the cost recovery fee as negotiated with the Biodiversity Institute of Ontario for collection, processing, molecular analysis, and any applicable special conditions will be charged to the organisation representing:

On behalf of the Provider of Biological Materials: _____ Signature: _____ Date signed: _____

This BMTA becomes effective when signed by the Provider. Please return signed copy via email to: biol@centforbio.org

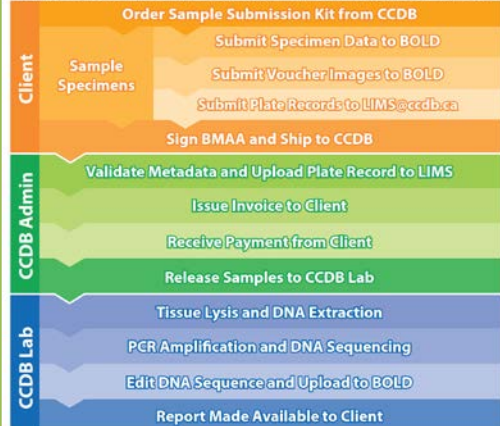
Centre for Biodiversity Genomics Malaise Trap Sampling STANDARD OPERATING PROCEDURES - 500ML BOTTLES

- SAMPLING KIT**
- Package Contents:
- Paperwork (digital documents also attached in the CCDB equipment email from shipping@ccdb.ca)
 - Standard Operating Procedure (SOP)
 - Bulk Sample Shipment Checklist, Biological Material Transfer Policies, and Customs Declaration Form (PDF)
 - Sample Log Sheets (Excel)
- Equipment:
- 1x Malaise trap kit
 - 1x Decanting kit (i.e. spare sampling ring)
 - 1x Netting kit
 - Shipping stickers
 - 52x pre-labelled 500ml sample collection bottles
- Optional Item Package:
- 500ml Ethanol
 - Ethanol waste container
 - Ethanol quart bottle
 - Standard household freezer (-20°C), preferred, or refrigerator for sample storage
 - Return shipping materials
 - 2x 40L pails (optional)



CCDB Canadian Centre for DNA Barcoding Understanding Sample Submission and Processing at the Canadian Centre for DNA Barcoding

This workflow and the following documents are designed to assist in the preparation of materials before they are sent to the Canadian Centre for DNA Barcoding. To ensure that your submission is not delayed please follow all instructions and complete the checklist before shipping.



BIN DETAILS BOLD:AA88479

| BIN URL | BOLD ID | Average Distance | 5.47% (n=16) |
|---------------------|------------------------------|------------------------------|--------------|
| DOI | BOLD:AA88479 | Maximum Distance | 1.97% (n=6) |
| Number of Sequences | 10 (25% PAID) | Distance to Nearest Neighbor | 0.20% (n=6) |

NEAREST NEIGHBOR (NN) DETAILS

| Nearest BIN | BOLD ID | Average Distance | 0.20% (n=6) |
|----------------|------------|---------------------------------------|-------------|
| Member Number | 7 | Maximum Distance | 0.17% (n=6) |
| Nearest Member | UTMAYZ0214 | Average Distance <td>0.03% (n=6)</td> | 0.03% (n=6) |

Nearest Member: [UTMAYZ0214](#) [BOLD:AA88479](#)

SPECIMEN IMAGES:

BE COMPLIANT WITH BOLD'S REQUIREMENTS

COLLECTION SITE:

DISTANCE DISTRIBUTION:

ATTRIBUTION:

Specimens Representative

BOLD OPENS LICENSING FOR MORE THAN 2.5 MILLION IMAGES

800-2711 BOLD:0247-01

BOLD:0247-02 BOLD:0247-03

BOLD:0247-04 BOLD:0247-05

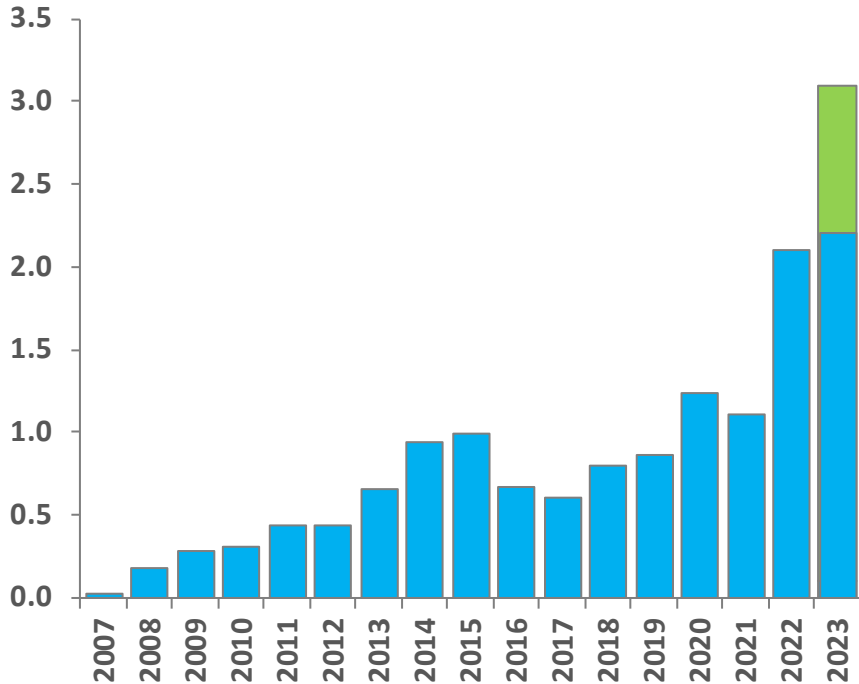
The Barcode of Life Data Systems (BOLD), the world's largest repository of DNA barcode data located at the University of Guelph's Centre for Biodiversity Genomics, has opened licensing on 85% of its specimen image database.

NEWS RELEASE

PREPARED

Harmon James

Expanding User Base: Raise Capacity



3 fold increase in capacity over 3 years
(from 1M to 3M)

Specimen Processing and DNA Barcoding

BOLD SYSTEMS DATABASES IDENTIFICATION TAXONOMY WORKBENCH RESOURCES LOGIN

BARCODE OF LIFE DATA SYSTEMS v4

beta

Advancing biodiversity science through DNA-based species identification.

[EXPLORE THE DATA](#)

DESIGNED TO SUPPORT THE GENERATION & APPLICATION OF DNA BARCODE DATA

BOLD is a cloud-based data storage and analysis platform developed at the Centre for Biodiversity Genomics in Canada. It consists of four main modules: a data portal, an educational portal, a registry of BINs (putative species) and a data collection and analysis workbench.

Please note that this version of BOLD is in beta and will contain bugs. Users can help address these bugs by testing the system and reporting issues to support@boldsystems.org. This version is very different from the prior one but has access to all the same data.

- DATA PORTAL
- EDUCATION PORTAL
- BIN DATABASE
- WORKBENCH

BOLD 4 (2015): supports up to **10M** records

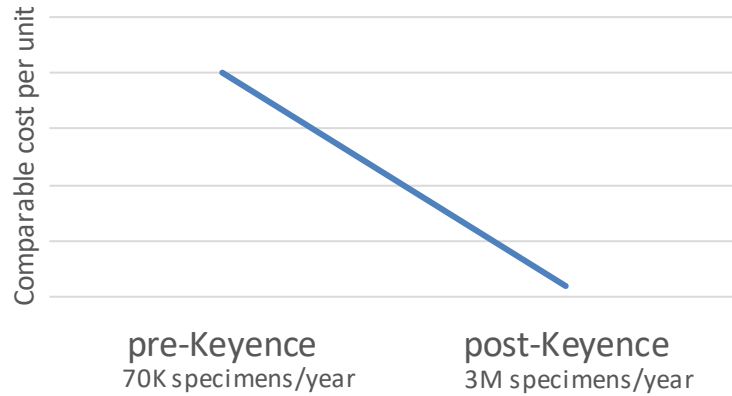
BOLD 5 (2024): support up to **100M** records

10 fold increase in capacity

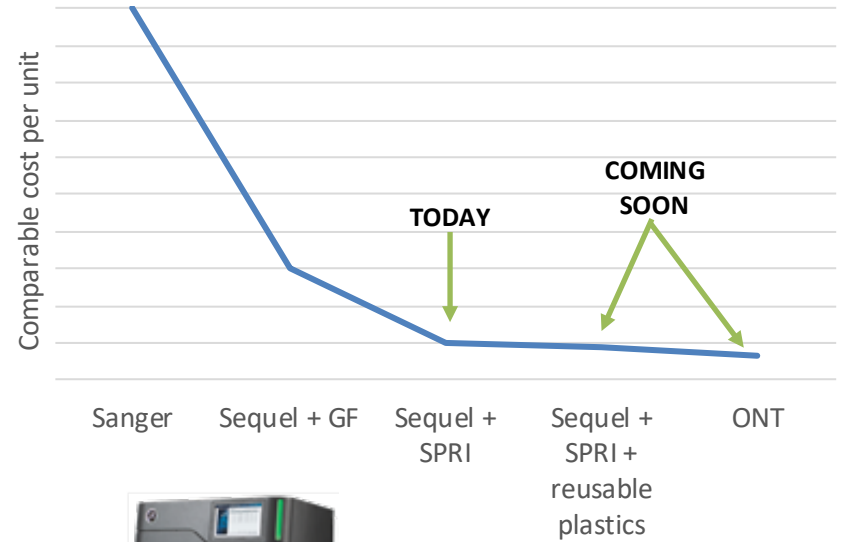
Data Systems

Expanding User Base: Reduce Costs

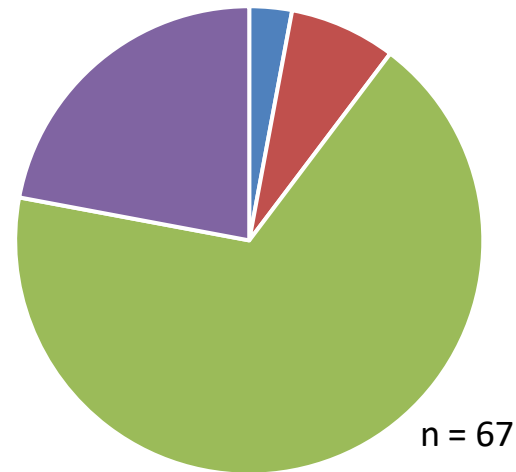
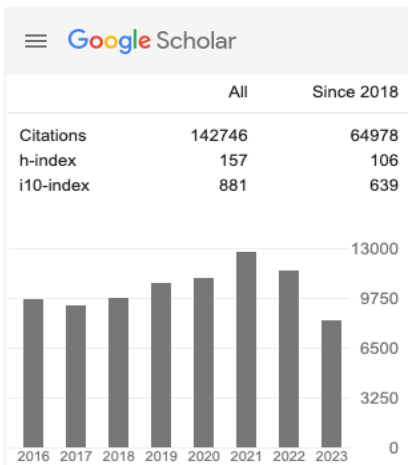
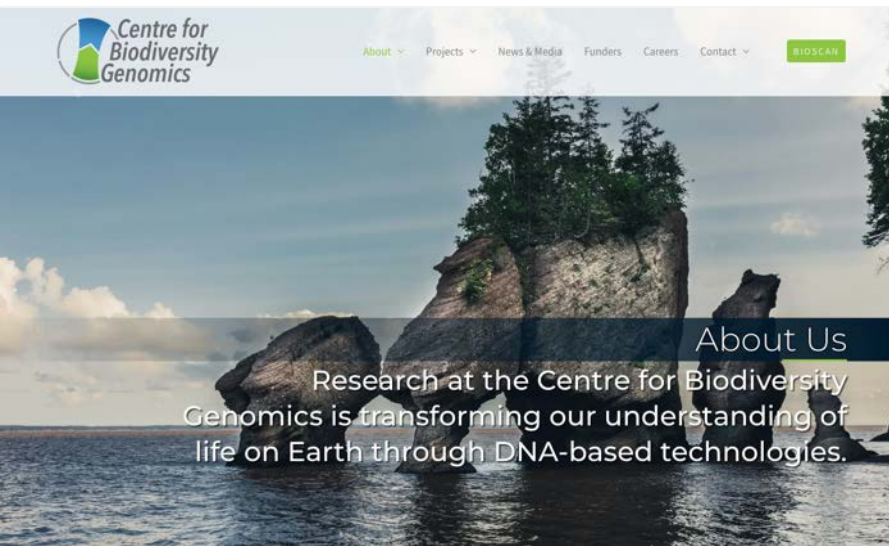
Digital imaging costs per specimen



Extraction and sequencing costs



Expanding User Base: Marketing and Outreach



- Courses, workshops, training sessions
- Public events (hosted): symposia, conferences, open houses, group tours
- Media relations: interviews, press releases, broadcasts, podcasts
- Stakeholder events: presentations, booths at trade shows, conferences

Articles & Blogs

Biodiversity in a bird's nest: DNA as a tool for bird conservation

September 6, 2023

Articles & Blogs

CBG hosts 10th iBOL Science Committee meeting

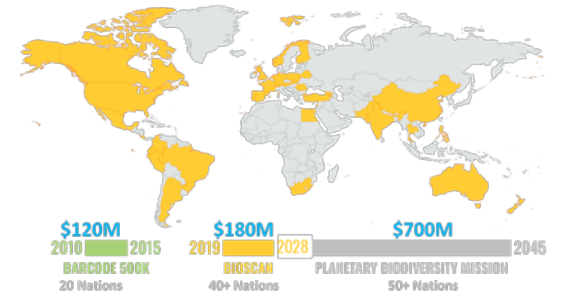
August 12, 2023

Articles & Blogs, The Newsroom

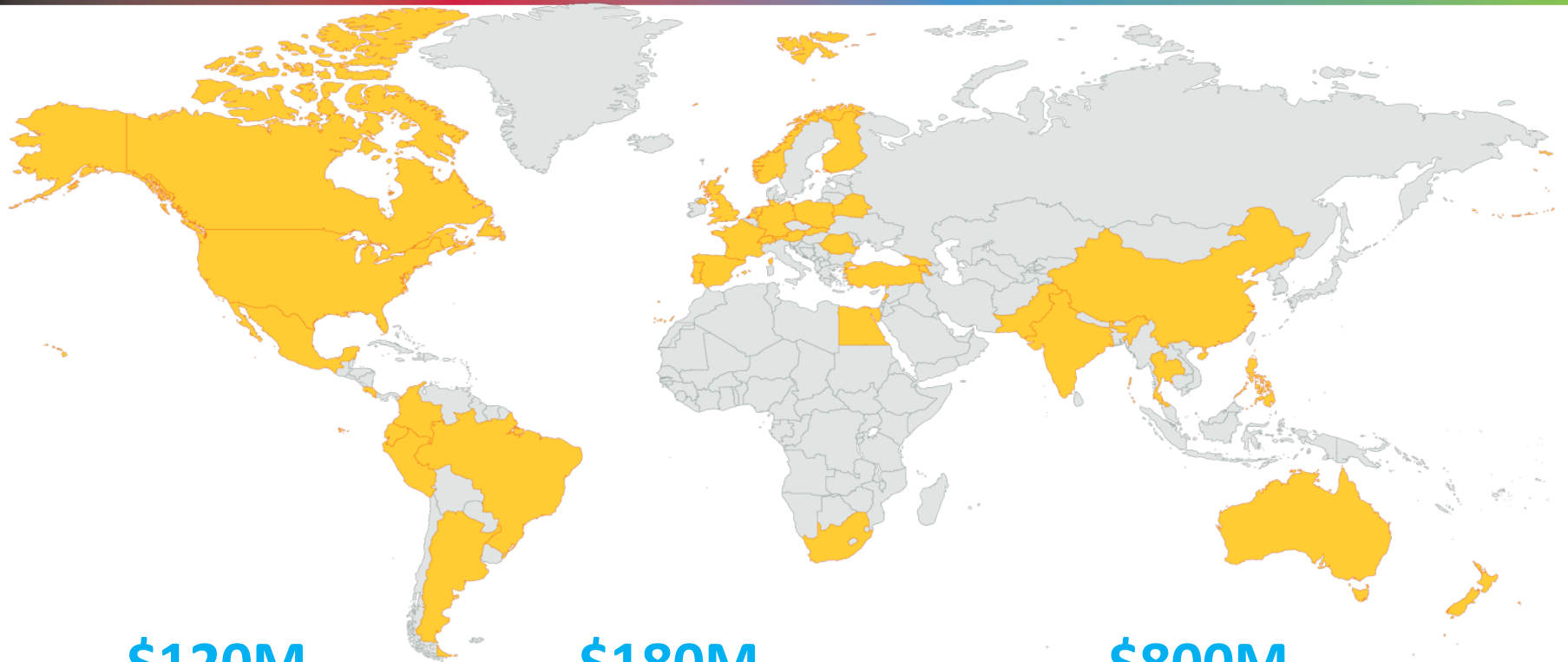
Prof recognized for innovation leadership in Canada's marine sector


June 6, 2023


Expanding User Base: Expand iBOL Consortium



Expanding User Base: Lead Global Research Programs

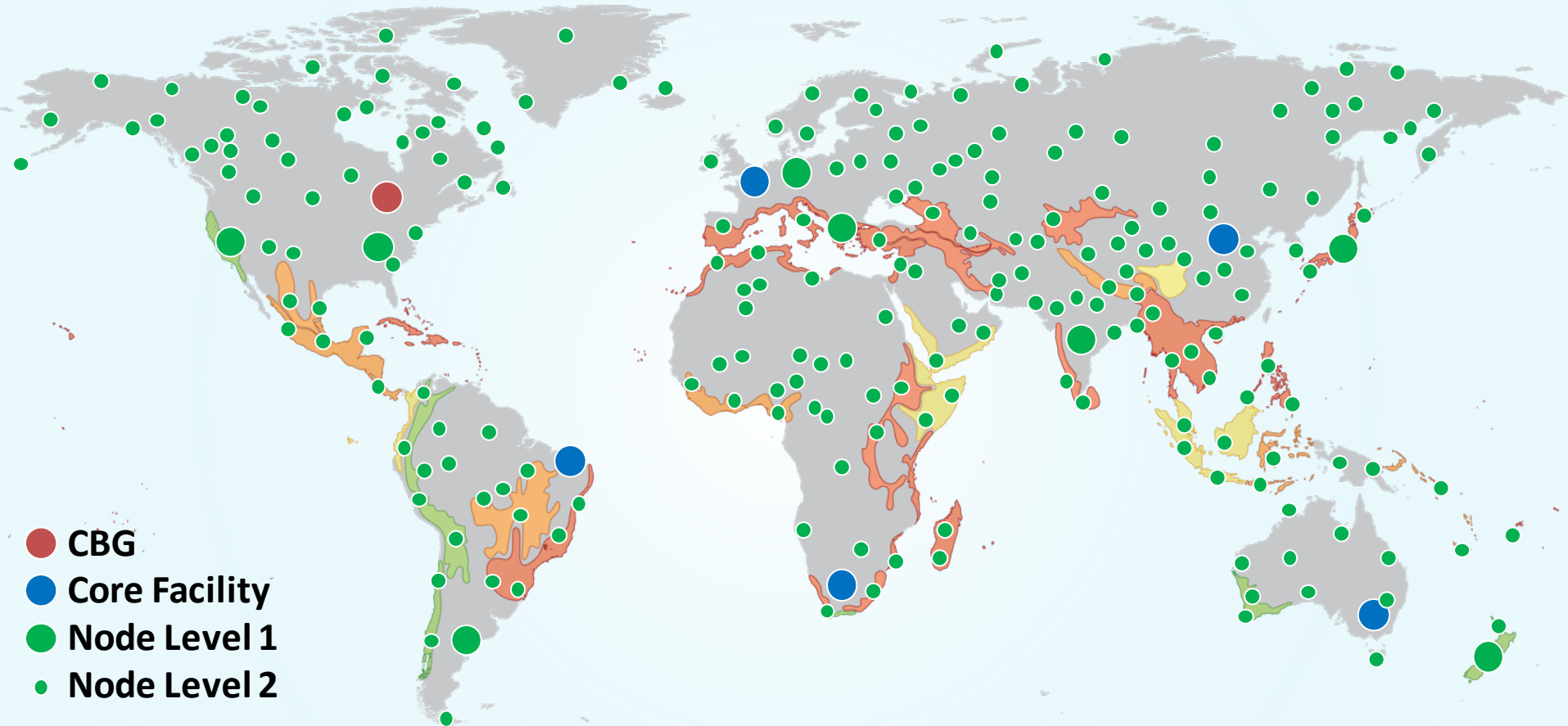


\$120M
2010  2015
BARCODE 500K
20 Nations

\$180M
2019  ~~2015~~
BIOSCAN
40+ Nations

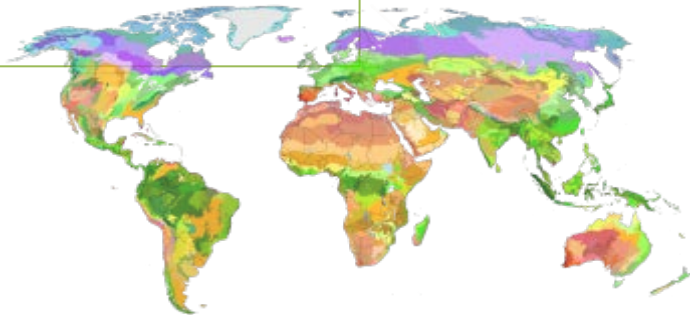
\$800M
 2045
PLANETARY BIODIVERSITY MISSION
50+ Nations

Expanding User Base: Support Distributed Facilities



Challenges: Broaden the User Base

Generate data for half of the world's 867 ecoregions



Seek synergy with users



Knowledge to manage biodiversity for:

- Policymakers
- Government
- Communities
- Conservation agencies
- Environmental assessment consultants

Adjust proportion of data users from high-impact sectors



Thank you



**CANADA
FIRST**

RESEARCH
EXCELLENCE
FUND

INNOVATION.CA

CANADA FOUNDATION FOR INNOVATION | FONDATION CANADIENNE POUR L'INNOVATION



GenomeCanada




Ontario Genomics

**WALDER
FOUNDATION**



New Frontiers in Research Fund
Fonds Nouvelles frontières en recherche

Ontario 

Ministry of Colleges
and Universities



Philanthropy



**NSERC
CRSNG**



Polar Knowledge
Canada

GORDON AND BETTY
MOORE
FOUNDATION

**UNIVERSITY
of GUELPH**

*Diversifying and
expanding the facility
user base to optimize
benefits for Canada*

*Alexandre Forest, Amundsen
Science*

*MSIF Workshop 2023
Saskatoon, 2 November 2023*



2,600+

research days at sea since 2003

300,000+

nautical miles travelled since 2003

3,000+

scientists from 25+ countries

2,100+

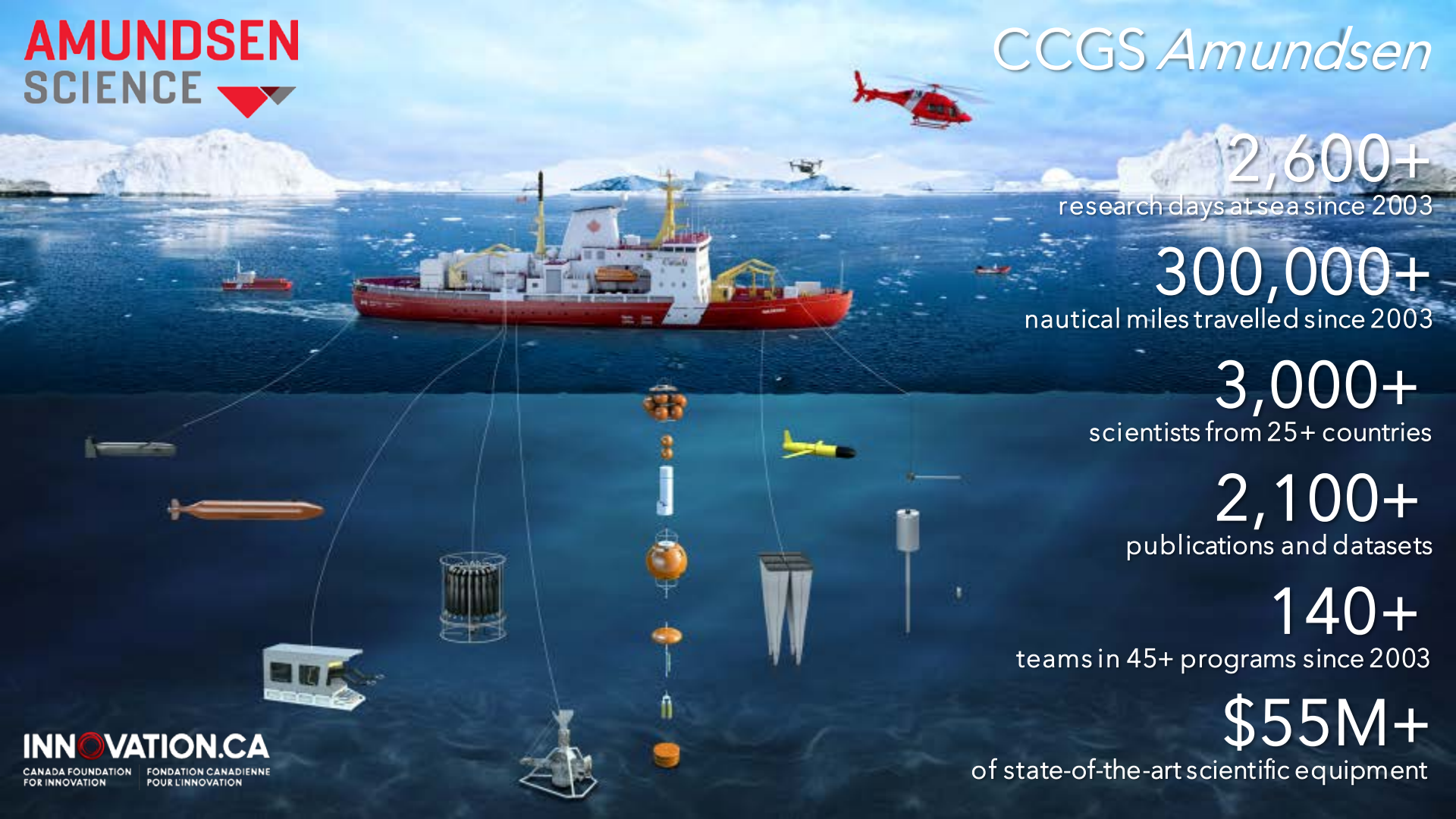
publications and datasets

140+

teams in 45+ programs since 2003

\$55M+

of state-of-the-art scientific equipment



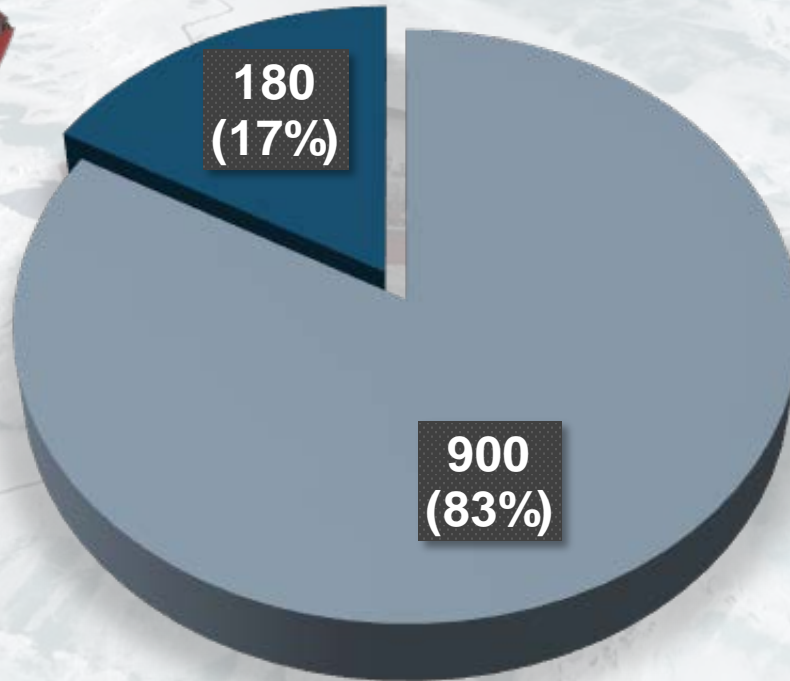
CCGS Amundsen user base \approx 1100 / year

1 out of 6 users board the ship



Primary on-board users

- 85% Canadians
- 60% universities
- 80% HQPs
- 35% students (PhD, MSc, post-docs)
- 50-50% men/women
- 50% below 30 years



No data users without primary users

Second-level users (data users)

- 65% Canadians
- 75% universities
- 65% HQPs
- 30% students (PhD, MSc, post-docs)

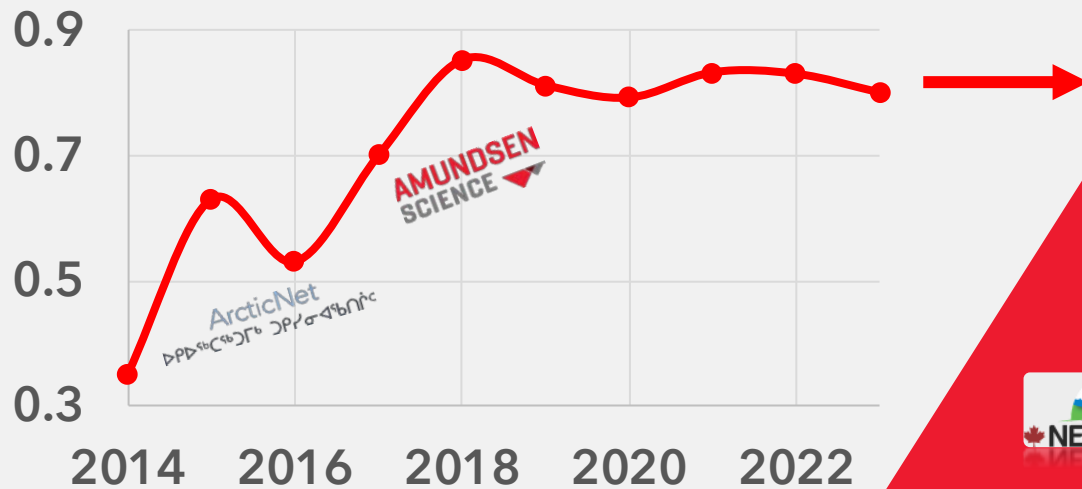


On-board users: both a scientific and human experience

Often "life-transformative"...



What diversity mean: Diversity at the program level



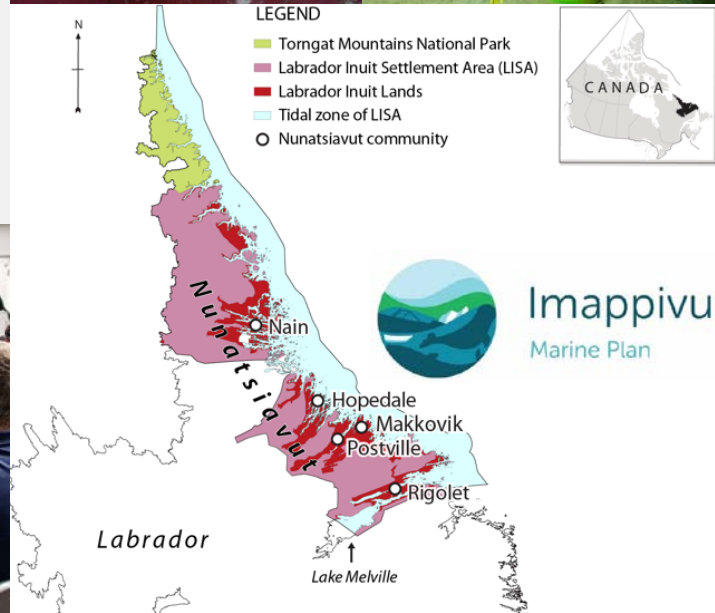
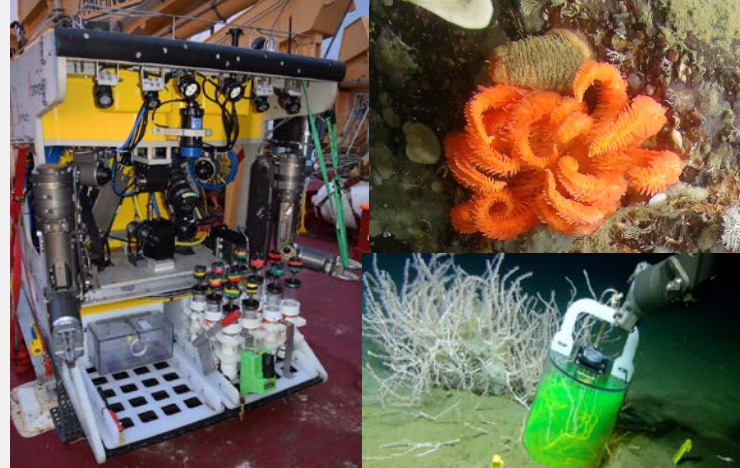
Simpson's Diversity Index increased since the creation of Amundsen Science, but reaches a plateau



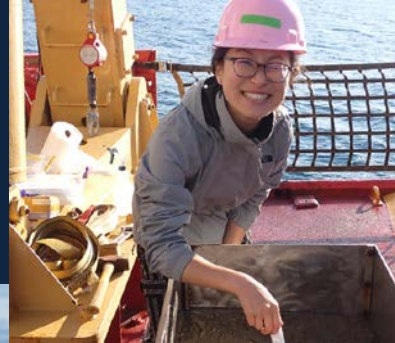
Example: Imappivut 2023

First primary program led by an Inuit organization

- Nunatsiavut leading in collaboration with key academic and federal partners
 - MUN / Marine Institute, U of C, NRCan & DFO, AS
- Holistic view of research, onboard training
- First Inuit Chief Scientist
- Research & cultural exchange day in Nain



Diversity at the individual level



Our commitment to Equity, Diversity and Inclusion

Amundsen Science is committed to develop and adopt comprehensive EDI practices. Some actions taken recently to broaden the scope of our user's community and help people feel safe on board:

- Form a committee to identify strategies to improve EDI practices;
- Adopt an Equity, Diversity and Inclusion Action Plan;
- Create a Code of Conduct for Expedition Participants.
- Identify safe contact persons onboard and onshore.
- Facilitating Inuit participation and supporting Indigenous-led research



Strengthening user engagement and diversifying our user community will contribute to the sustainability and growth of the facility.

Strategies for diversifying and expanding the user base

Reach out, reach out, reach out!

In-person & virtual visits
to universities,
departments, and
communities

Organization of
workshops and
participation to relevant
conferences

Increase public
awareness: newsletter,
website, social media,
outreach, etc.



Key communication and outreach activities

Social media



Website

<https://amundsscience.com/>

Upcoming conferences



ArcticNet Science Meeting, Iqaluit, December 2023

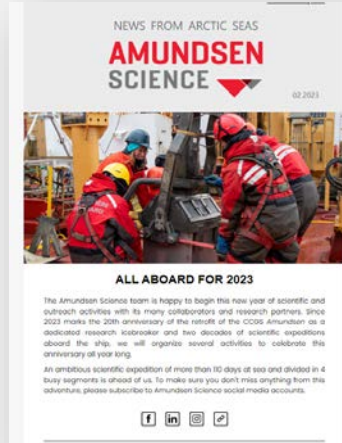


Arctic Science Summit Week, Scotland, March 2024

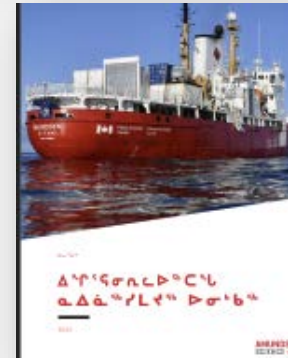


Canadian Polar Data Workshop V, Halifax, May 2024

Newsletter



Annual Amundsen Science Planning Workshop



Expedition summaries & reports

Users become ambassadors since our most important success criterion is their satisfaction and the achievement of their scientific objectives

1- Drive the science program of the *Amundsen*

2- Drive the development of the central equipment pool



4- Their funding is leveraged by AS for the operation of the ship and new equipment

3- Are consulted regularly through the Annual Planning Workshop and other venues

Challenges to diversifying and expanding the user base and mitigation approaches

Challenge

1

- Increasingly high ship-time costs that prevent access to users who may have no or limited access to ship-time funding

Challenge

2

- Costly and complex logistics associated with the mobilization and access to the ship that new users may find discouraging

Challenge

3

- Lack of awareness from users who may still believe that the *Amundsen* is always fully booked only used by a few large programs



Challenges to diversifying and expanding the user base and mitigation approaches

Mitigation approach 1

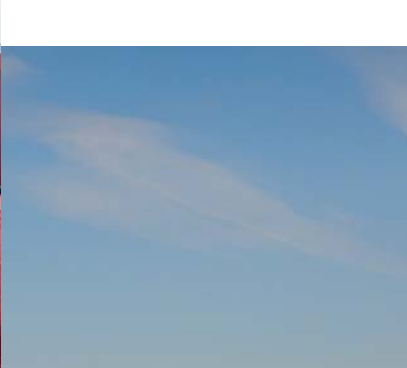
- Use of a larger share of the MSI funding to support innovative projects from atypical new users

Mitigation approach 2

- Increased support from Amundsen Science to aid in the mobilization and implementation of under-represented projects

Mitigation approach 3

- Continuously reaching out to the national and international community and to Inuit Nunangat organizations



Thank you!

Join us!



2023/11/02

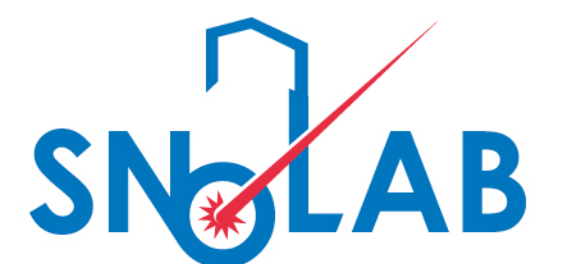
SNOLAB Overview

Jodi Cooley

Executive Director | SNOLAB

Professor of Physics | Queen's University

Adjunct Research Professor | SMU



Introducing SNOLAB



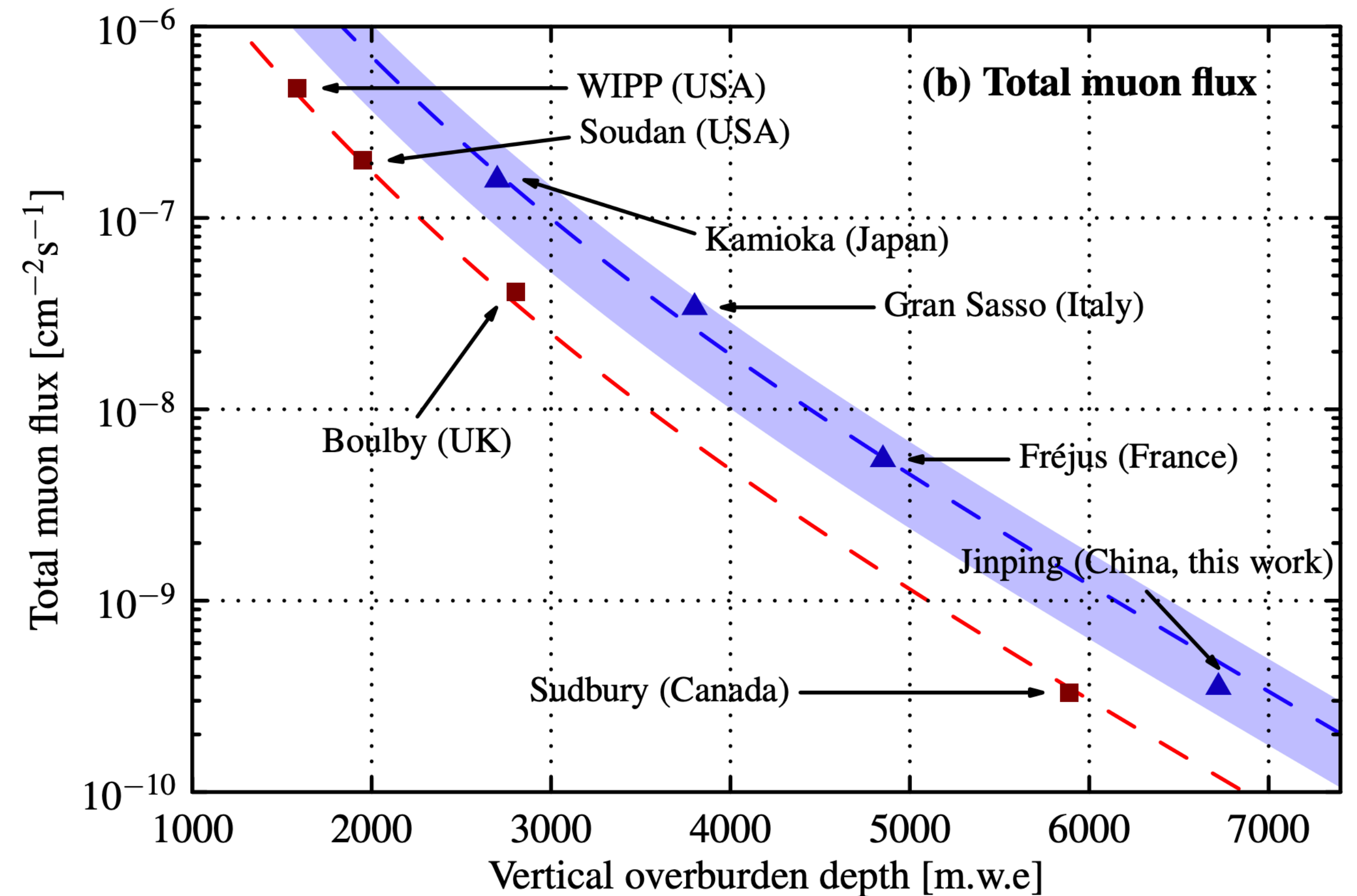
- SNOLAB hosts rare event searches and measurements. It's located 2 km underground in the active Vale Creighton nickel mine near Sudbury, Ontario, Canada.
- SNOLAB is operated jointly by University of Alberta, Carleton University, Laurentian University, University of Montreal, and Queen's University.
- SNOLAB operations are funded by the Province of Ontario, and the Canada Foundation for Innovation.



Why Underground?

- A growing community of users *needs* environments that are both shielded from radiation and clean to achieve sensitivity for rare event searches.
- Astrophysical systems emit high energy radiation which create muons in Earth's atmosphere
- SNOLAB has the lowest muon fluxes available
- Clean room throughout the underground facility

Guo et al., [arXiv:2007.15925v2](https://arxiv.org/abs/2007.15925v2)



Science Strategy



The science at SNOLAB is focused on increasing our understanding of the particles and forces that have shaped the universe.

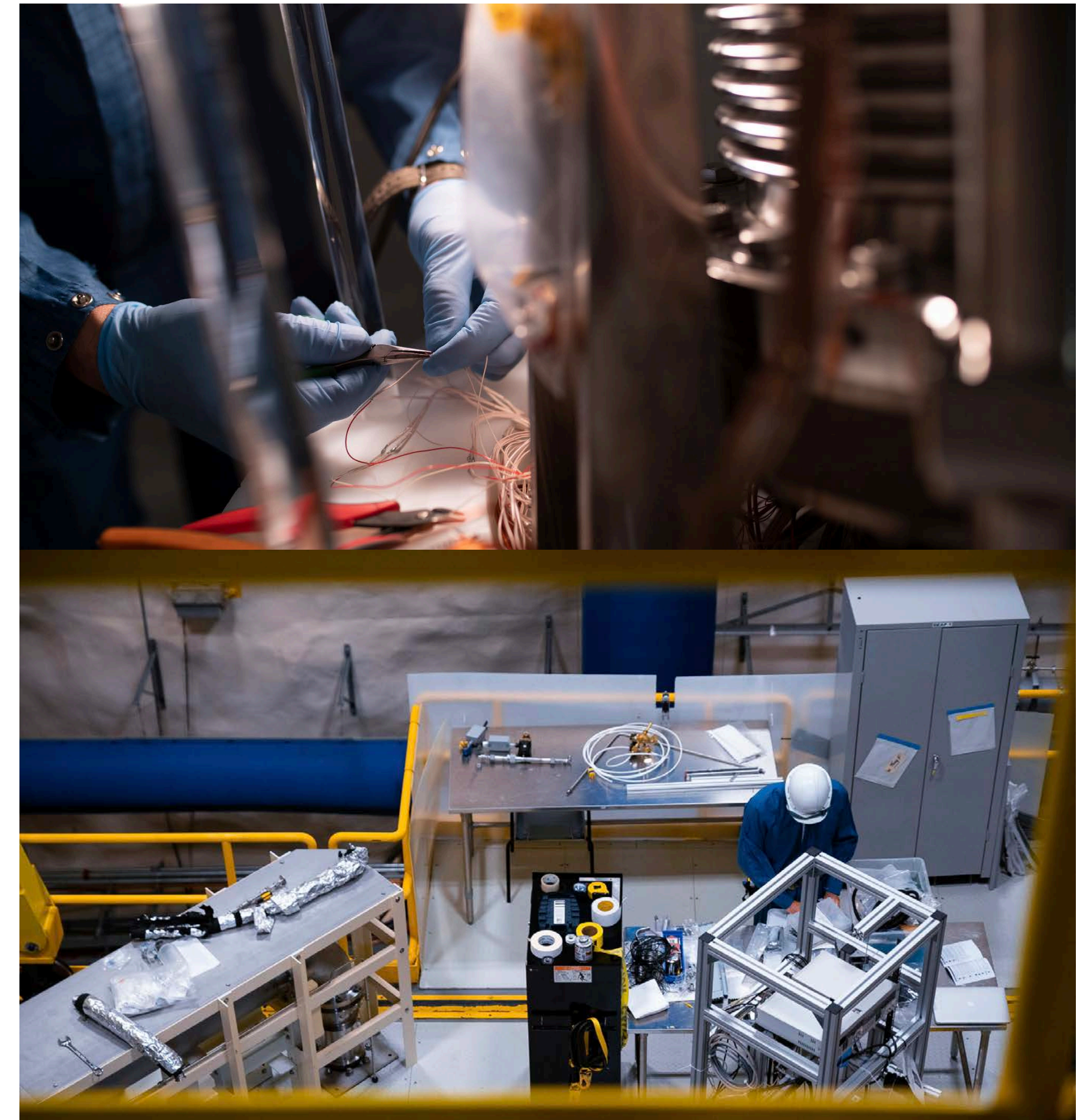
- What is the nature of dark matter?
- What is the nature of the neutrino?

SNOLAB collaborates with scientific research requiring deep underground facilities.

- Neutrino observatories (solar, supernovae, geo, reactor, etc.)
- Effects of radiation on biological systems
- Environmental monitoring (nuclear non-proliferation, aquifers, etc.)

SNOLAB is interested in pursuing new collaborations and opportunities in emerging areas of underground science

- Effects of radiation on quantum technologies



SNOLAB by Numbers



1000+ 

annual academic
users/collaborators

25% 

of those users/
collaborators are
Canadian researchers

24 

Our international
collaborators come
from 24 countries

164 

Our international
collaborators come
from 164 institutions

 - Participating Countries



What Does Diversity Mean to SNOLAB?



- World class science and research excellence requires contributions from diverse perspectives.
- People are the heart of SNOLAB's success:
 - Strive to achieve and maintain diversity in our staff, researchers, technicians, engineers, operations, corporate professionals and collaborators
- SNOLAB is committed to a diverse research portfolio.
 - Host experiments that represent diverse and multidisciplinary research topics.
 - Balance large-scale, mid-scale and small-scale programs.
 - Balance staging of experiments: conceptual design, technical design, installation, commissioning, operating and decommissioning.



1

Excellent science

Drive breakthrough discoveries at the frontiers of underground science.

Expected outcomes:

- Cementing of Canada's leadership in deep underground science
- A stronger, more competitive Canada in scientific discovery
- More Canadian researchers positioned as global leaders

2

Cutting-edge infrastructure

Continuously improve our research infrastructure to remain state of the art.

Expected outcomes:

- Attraction of the most advanced international experiments to Canada
- Greater global impact and enhanced reputation of Canada's underground science infrastructure

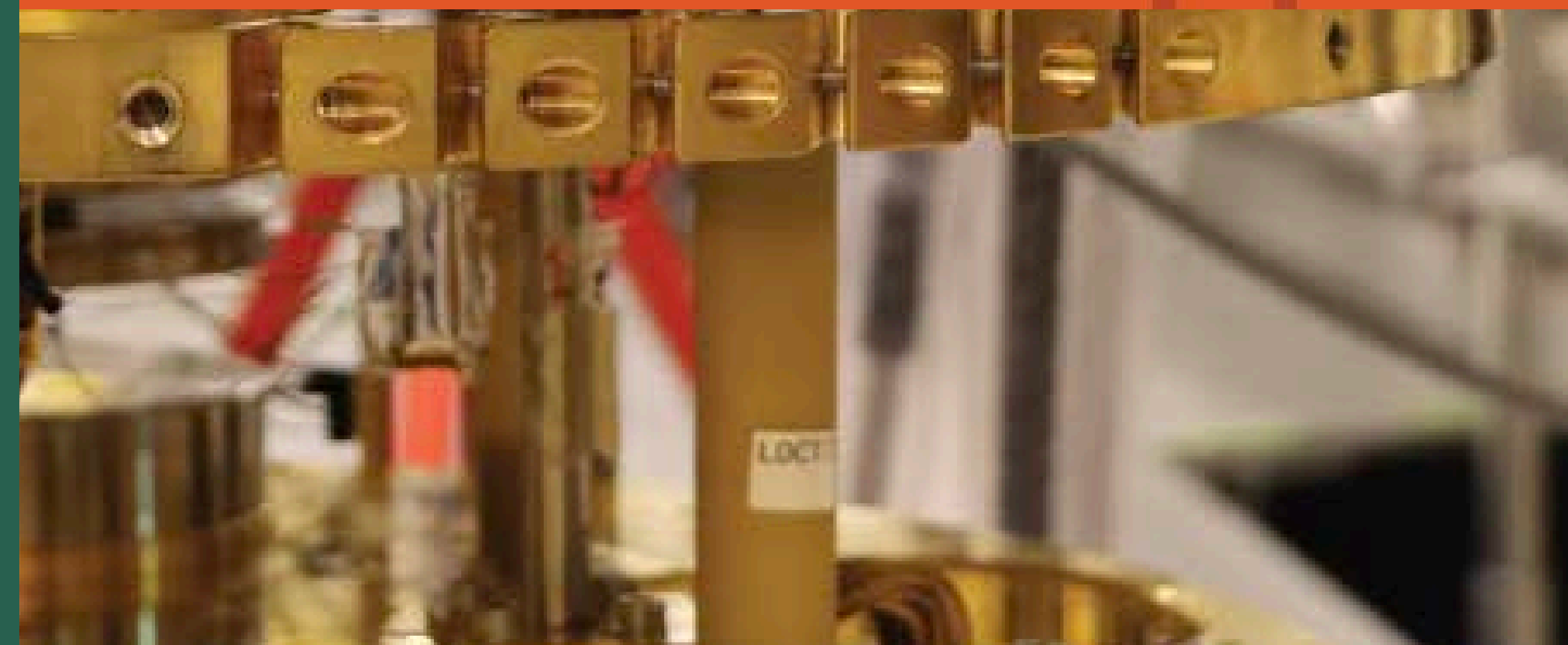
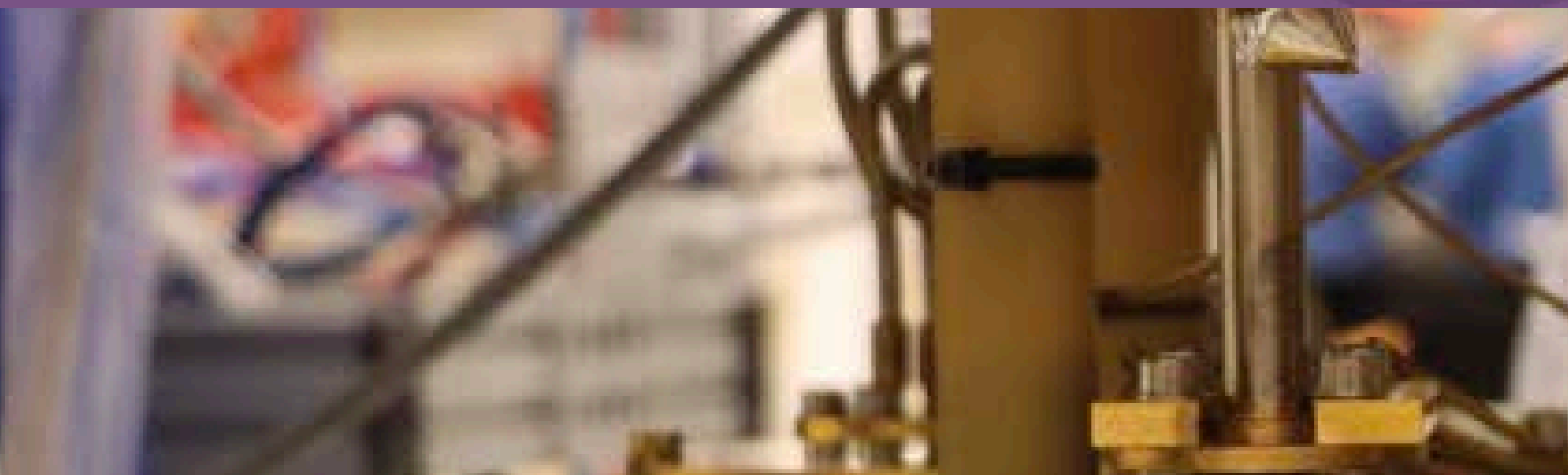
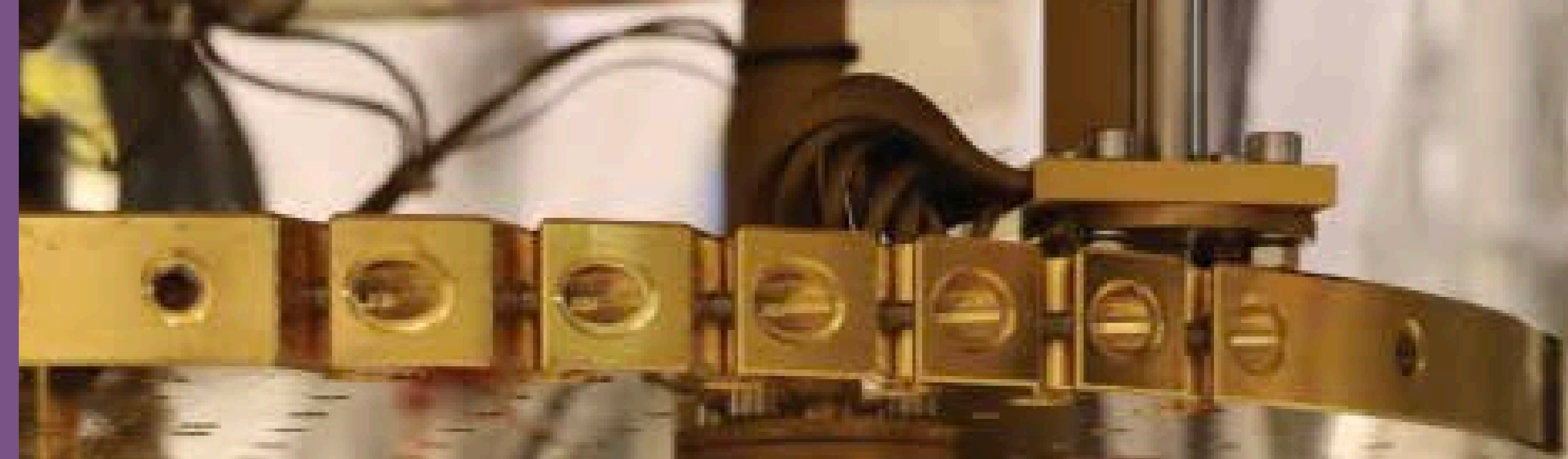
3

Skilled people

Foster and develop diverse talent in an inclusive environment.

Expected outcomes:

- Canadian leadership in advancing EDI in research facilities
- A new generation of HQPs prepared to discover and innovate in a global economy
- Greater access to STEM skills and opportunities in Northern Ontario



Strategies and Barriers to Expanding and Diversity SNOLAB User Base



- Pursue a diverse science portfolio anchored by our world leading dark matter and neutrino programs, and open to new science opportunities in emerging areas of underground science.
- Host experiments at a different stages of development
- Provide state-of-the-art infrastructure
- Encourage and foster a welcoming, collaborative environment for collaborations who use the facility.

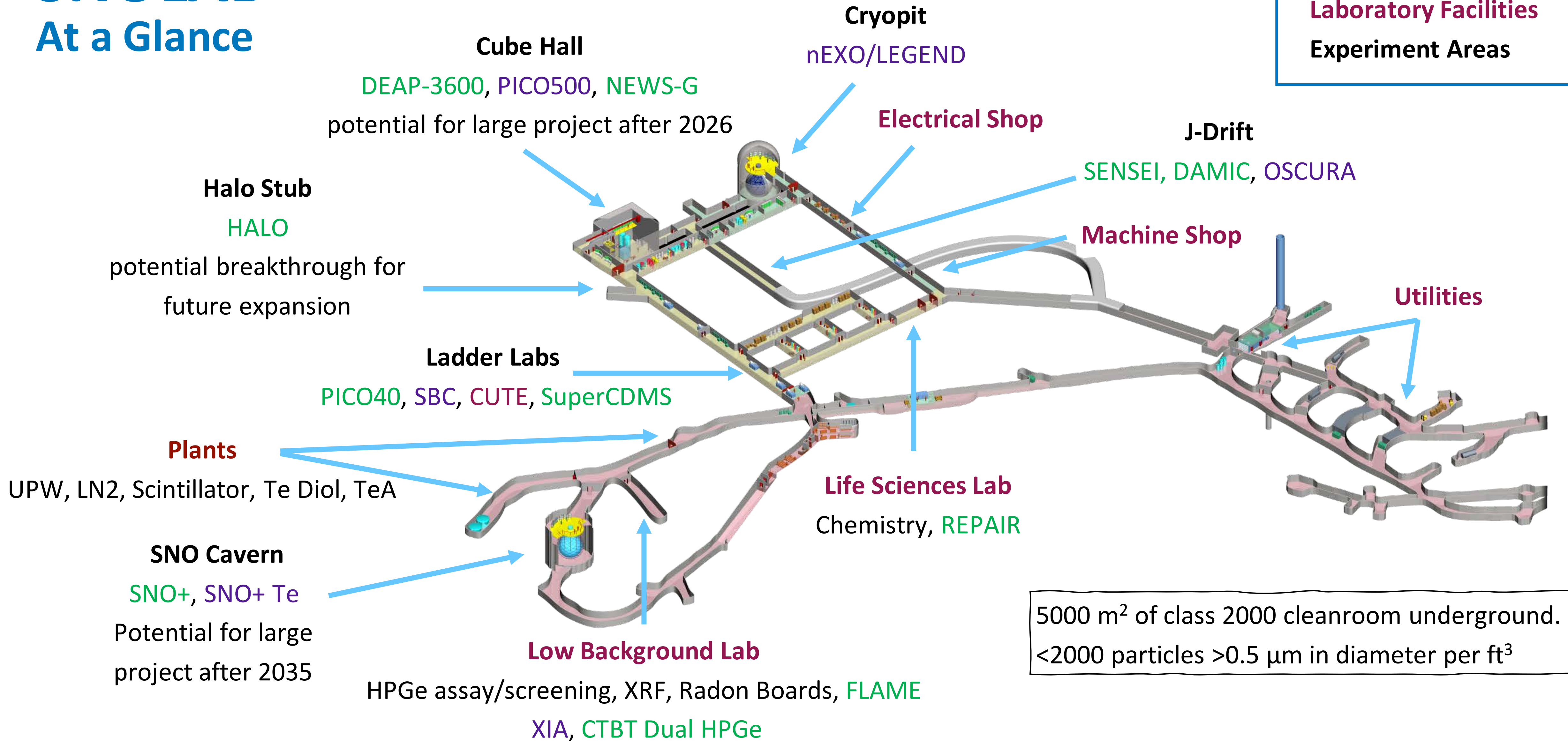
SNOLAB – At a Glance

Current Experiments

Future Experiments

Laboratory Facilities

Experiment Areas



Infrastructure: Surface Spaces & Support



Become an intellectual hub that fosters collaboration and connection.

- Assign dedicated staff to assist domestic and international users in the navigation of logistical and cultural aspects of their long-term stay;
- Create a formal user support system that users can rely on;
- Provide dedicated physical space to encourage collaboration and connection;
- Promote equity, diversity, and inclusivity.

Create Welcoming Environment - SNOLAB Summer of Science

- SNOLAB will host a series of meetings and workshops in Summer 2024
- Invited senior scientists in-residence will give/lead topical and relevant lectures and discussions in weeks between.
- Challenge: Need to find funding to offset housing and travel costs for student participants.



Infrastructure: Underground Spaces

Improvements to the underground environment.

- “Drys” are in need of renovations with particular attention paid to equity for those who need more privacy.
- Plans to create wellness spaces underground.

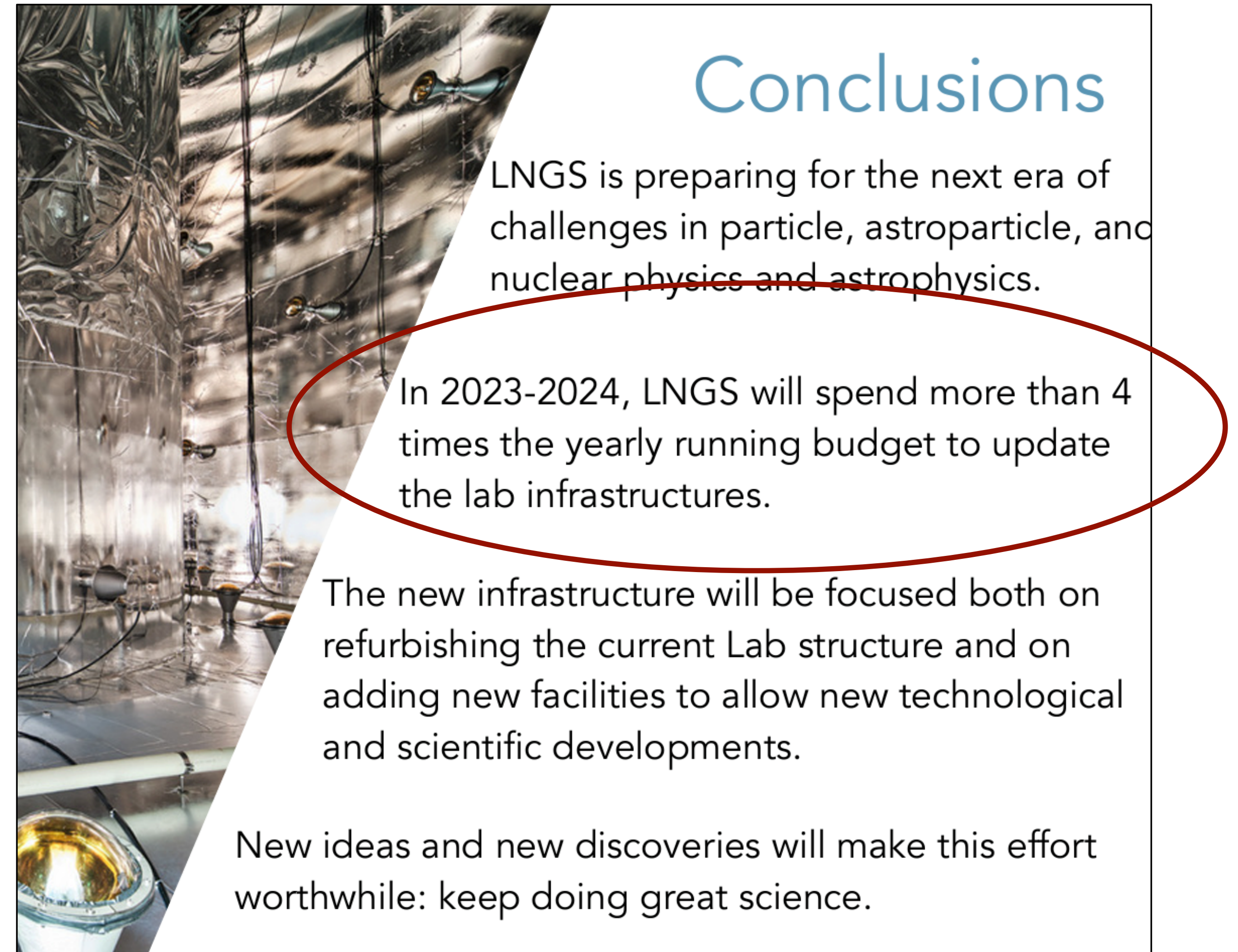
Two-fold challenge:

- Balancing the various demands on a strained budget.
- Execution needs to be staged in order to keep laboratory requirements for cleanliness.



Infrastructure Challenge: Competition

- Underground laboratories around the world are making significant investments in their infrastructure.
- Boulby Underground Facility (UK) is planning upgrade which includes doubling their staff and expanding their underground facility to include a large 25 m³ cavern to attract a next generation dark matter experiment.
- LGNS (Italy) will spend more than 4 times their yearly operating budget to update lab infrastructures.
- Homestake Underground Laboratory is also expanding their underground space.



Conclusions

LNGS is preparing for the next era of challenges in particle, astroparticle, and nuclear physics and astrophysics.

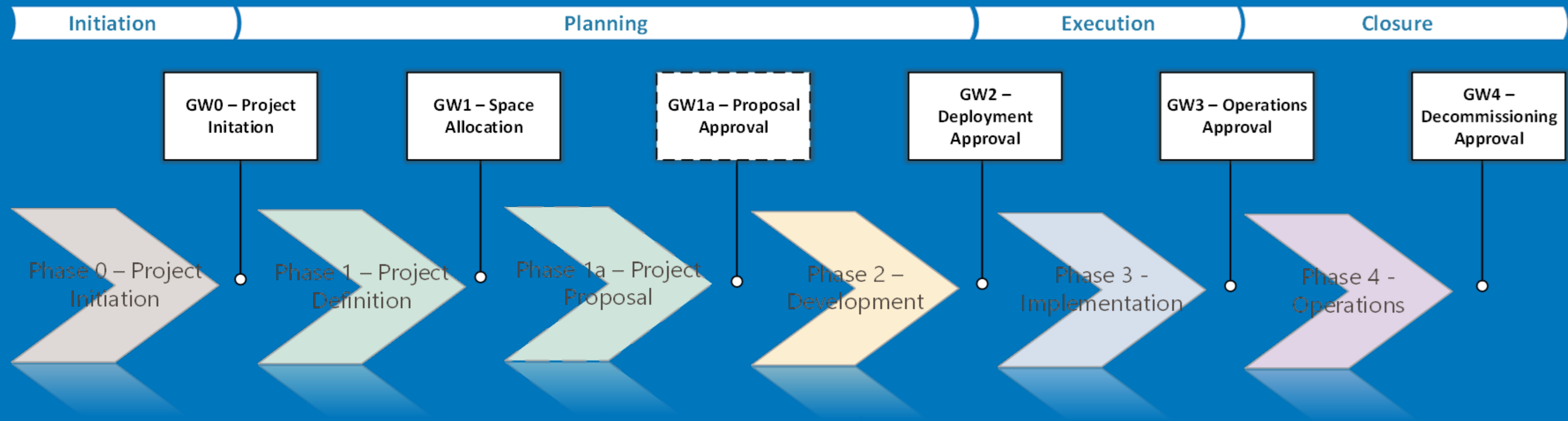
In 2023-2024, LNGS will spend more than 4 times the yearly running budget to update the lab infrastructures.

The new infrastructure will be focused both on refurbishing the current Lab structure and on adding new facilities to allow new technological and scientific developments.

New ideas and new discoveries will make this effort worthwhile: keep doing great science.

Accountability of Collaborations

SNOLAB PROJECT LIFECYCLE



- SNOLAB life cycle process whereby SNOLAB supports experiments through their life cycle at the lab.
- All collaborations who seek space allocations are required to have both an EDI plan and a code of conduct which is reviewed as part of the life cycle process for an experiment.

Conclusions



- SNOLAB is a clean, underground laboratory hosting a variety of experiments.
- To retain its global leadership, SNOLAB recognizes it is essential to weave diversity into the culture of the lab.
- Diversity is woven through the three pillars of our 2023-2029 Strategic plan: Excellent Science, Cutting-edge infrastructure, and Skilled people.
- I am very excited about the opportunities that SNOLAB provides the scientific community. I believe SNOLAB well positioned to attract world-class experiments and support major discoveries in the next decade.