

2024/01/15

SNOLAB and QMUL Workshop on Quantum Technologies for Fundamental Physics

Welcome & Logistics

James Thomas

Queen Mary University of London

Jeter Hall

SNOLAB / Laurentian University



Queen Mary University of London

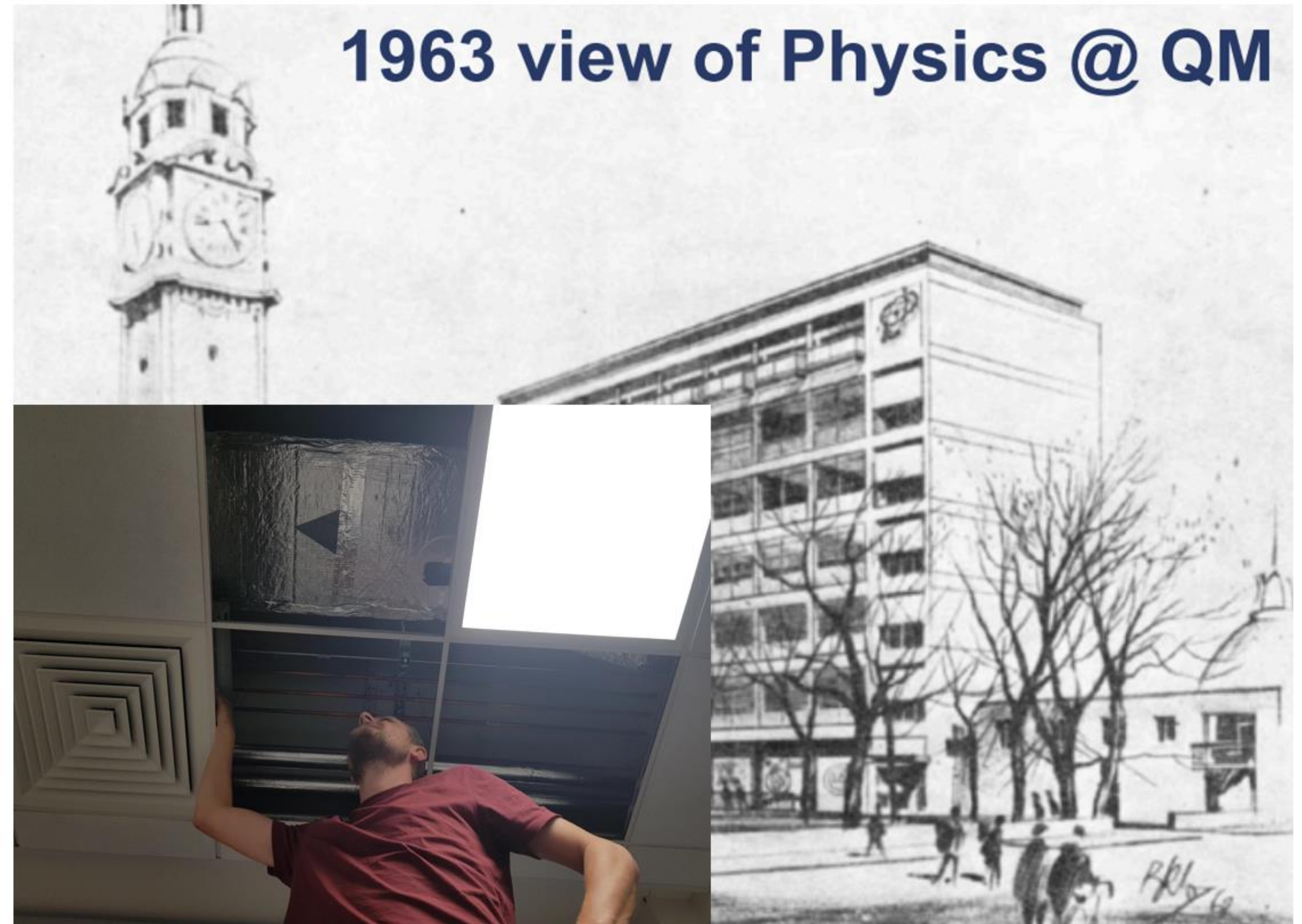


Mile End campus

- 5 Inner London campuses
- Russell Group university, over 33K students spread over five campuses
- Research intensive with a focus on social mobility
- 3 facilities: Science and Engineering, Medicine and Dentistry, Humanities and Social Sciences

Queen Mary University of London

- Long history back to 1123 with the founding of Barts hospital
- 1886 Mile End campus, and the Physics Department founded
- Long history of silicon detector development for ATLAS experiment
- New detector technologies (organic, single-electron devices) now being explored for medical, nuclear, space applications and fundamental science



1963 view of Physics @ QM

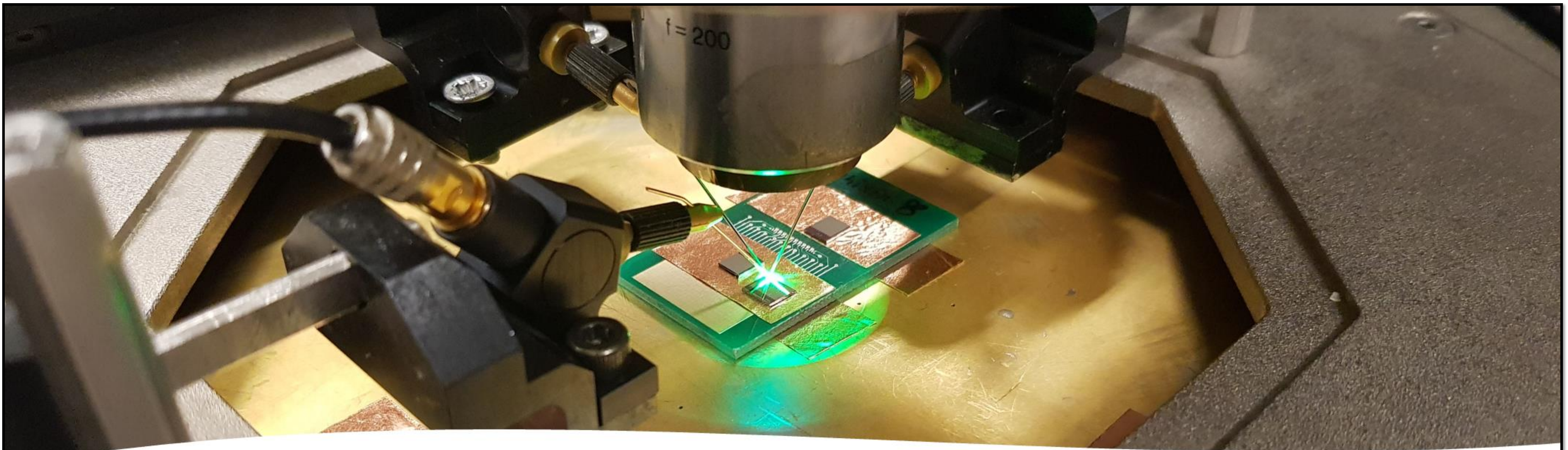
First dilution fridge installation Jan 2024

Workshop Origin and Funding - Quantum for Science

- A joint programme that is funded through the UKRI International Science Partnership Fund. Its aim is to support UK researchers to collaborate with international partners to:
 - develop quantum technologies for fundamental physics discoveries *or*
 - apply quantum technologies developed for fundamental physics into a range of sectors where appropriate
- The funding opportunity has three priority countries for exchanges, the US, Canada and Switzerland, with partner universities or national laboratories.



Map of workshop participant institutions.



Workshop Objectives

- Establish a new research network between the UK, Canada, USA, and Switzerland for fundamental physics based on quantum technologies
- Share expertise to explore quantum technologies for new sensors in particle detection
- Develop proto-collaborations and initiate grant submissions that harness funds from national research councils to promote long-term collaborations

Schedule – Key points

Monday 15/1	Tuesday 16/1	Wednesday 17/1	Thursday 18/1
	08:00 – Coach to SNOLAB	05:30 – Coach to SNOLAB for tour	08:00 – Coach to SNOLAB
	09:00 – 12:30 Invited talks	07:00 – 12:30 Underground tour	09:00 – 10:30 Invited talks
13:00 – 14:00 SNOLAB seminar	13:30 – 15:00 Funding landscape discussion	13:30 – 15:00 Proto-collaboration building activity	11:00 – 12:00 Proto-collaboration activity presentations, and next steps
14:00 – 14:45 Flash talks	15:30 – 17:15 Invited talks	15:30 – 17:00 Invited talks	12:30 - Lunch, then coach to airport
15:15 – 17:45 Invited talks			
	19:00 – 21:00 Dinner		

Proto-collaboration building activity

Wednesday 13:30 – 15:00

- Break out into four groups, with distributed expertise.
- Have 30 minutes to brainstorm scientific ideas for new experiments in particle detection, ideally where a quantum technology is an enabler
- Questions to think about: what are the major technical and fundamental challenges, where is the missing expertise, what is the smoking gun experiment? How could quantum technologies seen here fill those gaps. What would a new collaboration look like?
- Make a poster using flipchart paper, Post It notes to present this idea.
- Rotate groups
- From the resulting 8 posters, mark those the posters that are most viable, impactful, or exciting

Thursday 11:00-12:00

- Presentation of the four highest ranking posters (5 minutes each), followed by discussion
- Discussion of a new workshop

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Any Questions?

Land Acknowledgment

SNOLAB is located on the traditional territory of the Robinson-Huron Treaty of 1850, shared by the Indigenous people of the surrounding Atikameksheng Anishnawbek First Nation as part of the larger Anishinabek Nation.

We acknowledge those who came before us and honour those who are the caretakers of the land and the waters.



We ask all attendees to abide by SNOLAB's Code of Conduct

Privacy	EDI	Academic Integrity
<ul style="list-style-type: none">• Do not record events or take screenshots of virtual events without permission• Keep personal information shared with attendees private• Always ask permission before sharing others' contact information	<ul style="list-style-type: none">• Respect differences• Welcome and include all participants• Value all contributions, regardless of who they are coming from• Consider adding your pronouns to your display name	<ul style="list-style-type: none">• Display intellectual honesty and accountability• Exercise authority responsibly• Avoid conflict of interest• Provide professional feedback in a constructive and respectful manner• Create and maintain a professional environment characterized by tolerance and respect

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?

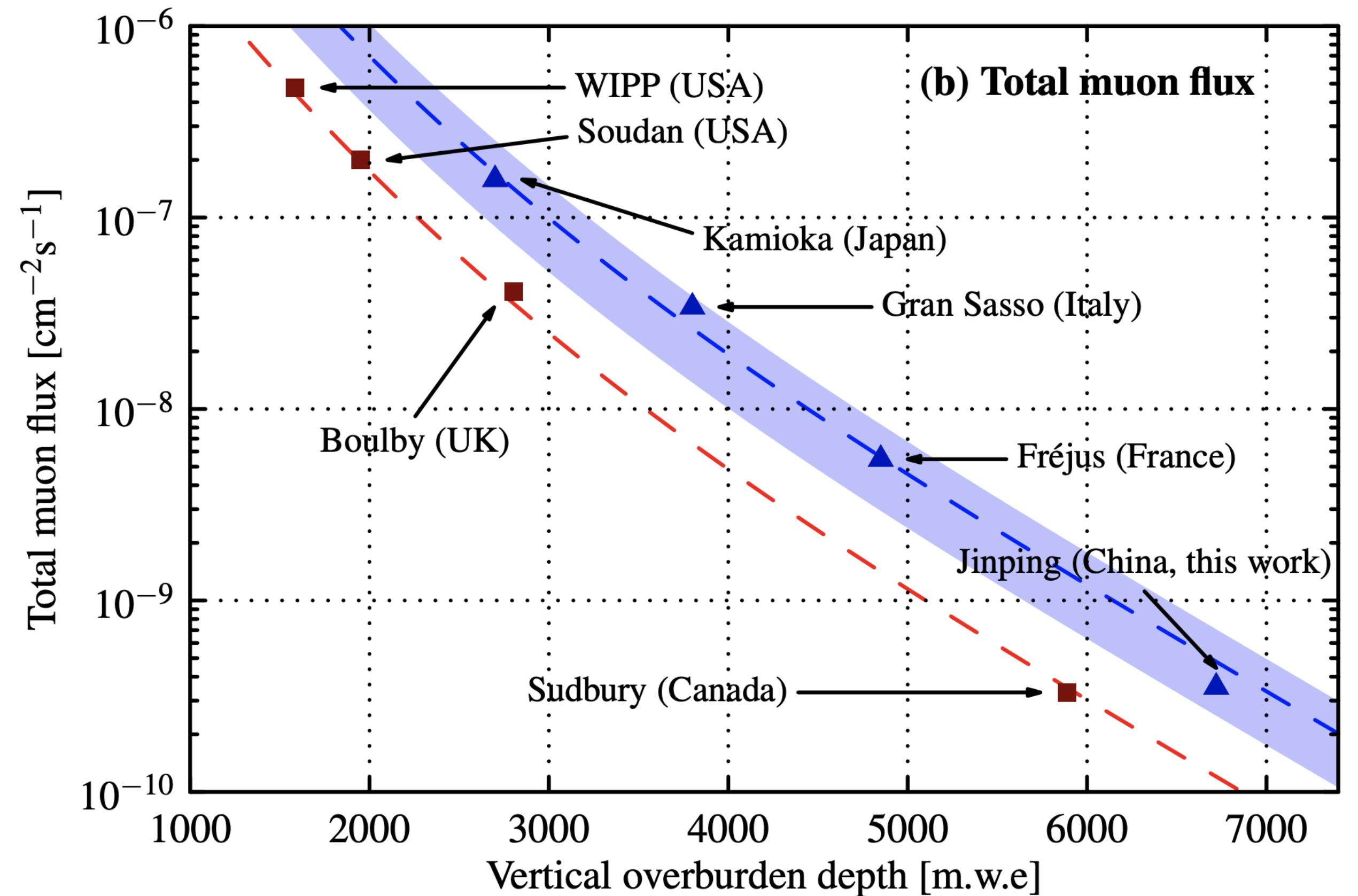
A growing community of users *needs* environments that are both shielded from radiation and clean to achieve sensitivity for rare event searches.

Astrophysical systems emit high energy radiation which create muons in Earth's atmosphere

SNOLAB has the lowest muon flux 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.

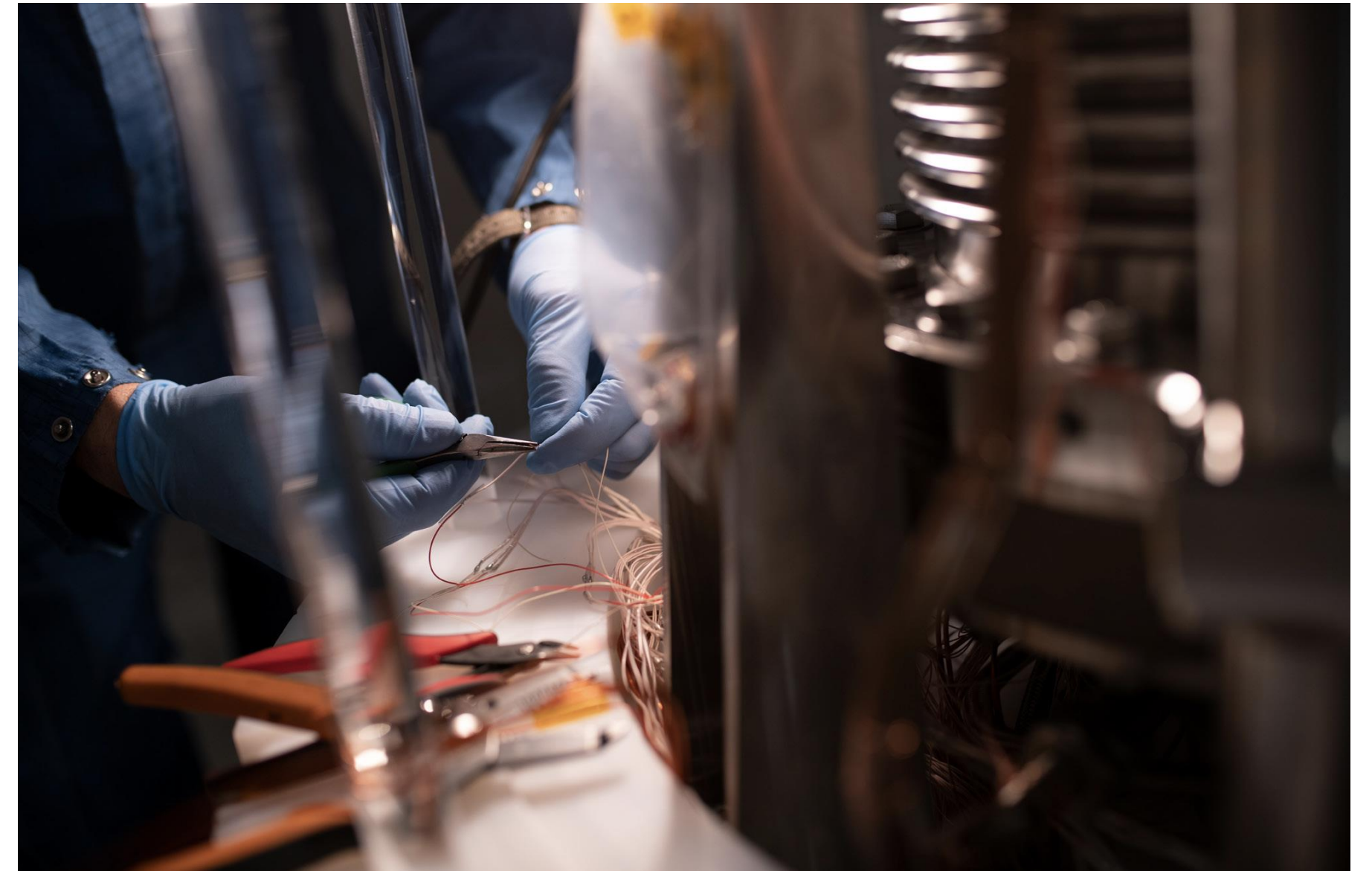
- What is the nature of dark matter?
- What is the nature of the neutrino?

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



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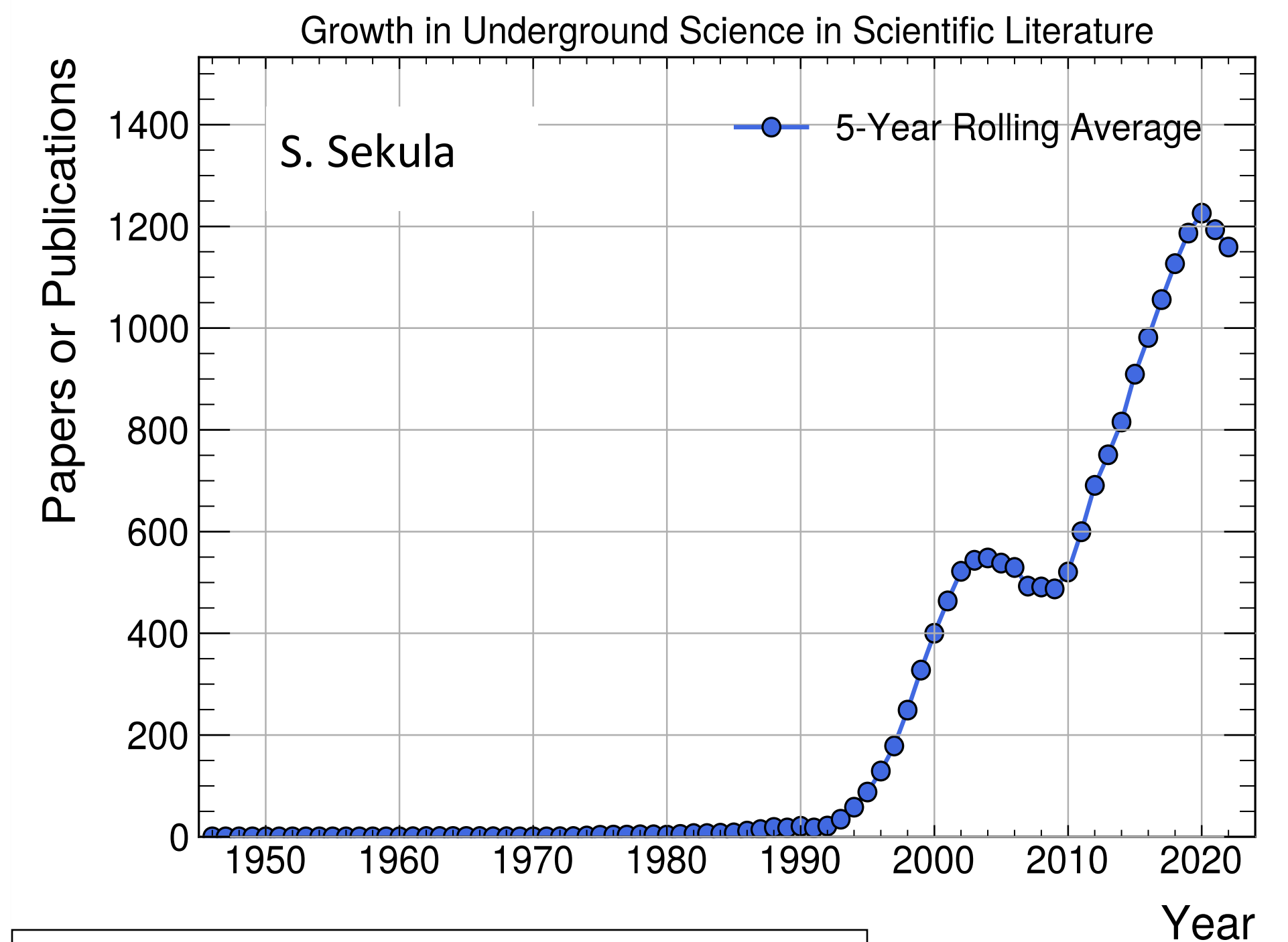
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- Effects of radiation on quantum technologies



Publications in underground science.
Includes all underground labs.

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.

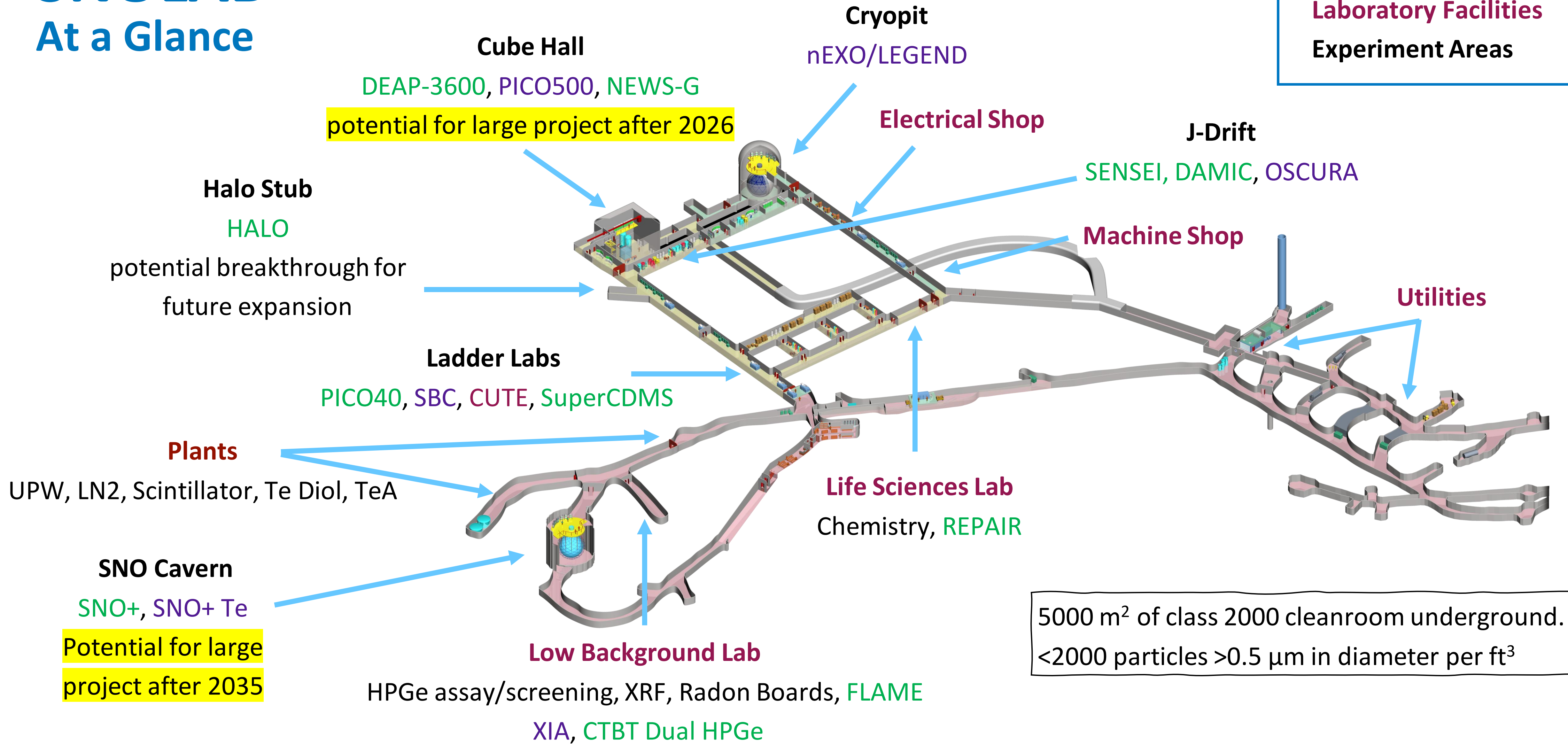
Expected outcomes:

- 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



SNOLAB – At a Glance

Current Experiments
Future Experiments
Laboratory Facilities
Experiment Areas



Infrastructure: Surface Spaces & Support

Offices, Clean Labs, Shipping/Receiving on Surface

- Dedicated office space for users.
- Clean room laboratories for surface work and final checks before shipping underground.
- Multiple meeting rooms (10-20 people) and auditorium seating 150.

Create Welcoming Environment - SNOLAB Underground Science Institute

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.
- Goal of increasing the interactions between scientific collaborations while accomplishing the experimental goals.





Washrooms are available on every floor.



All-gender, accessible washroom on the first floor.



Drinking water is available in the spigot near the kitchenette faucets, watercoolers. Please **do not** drink the tap water.

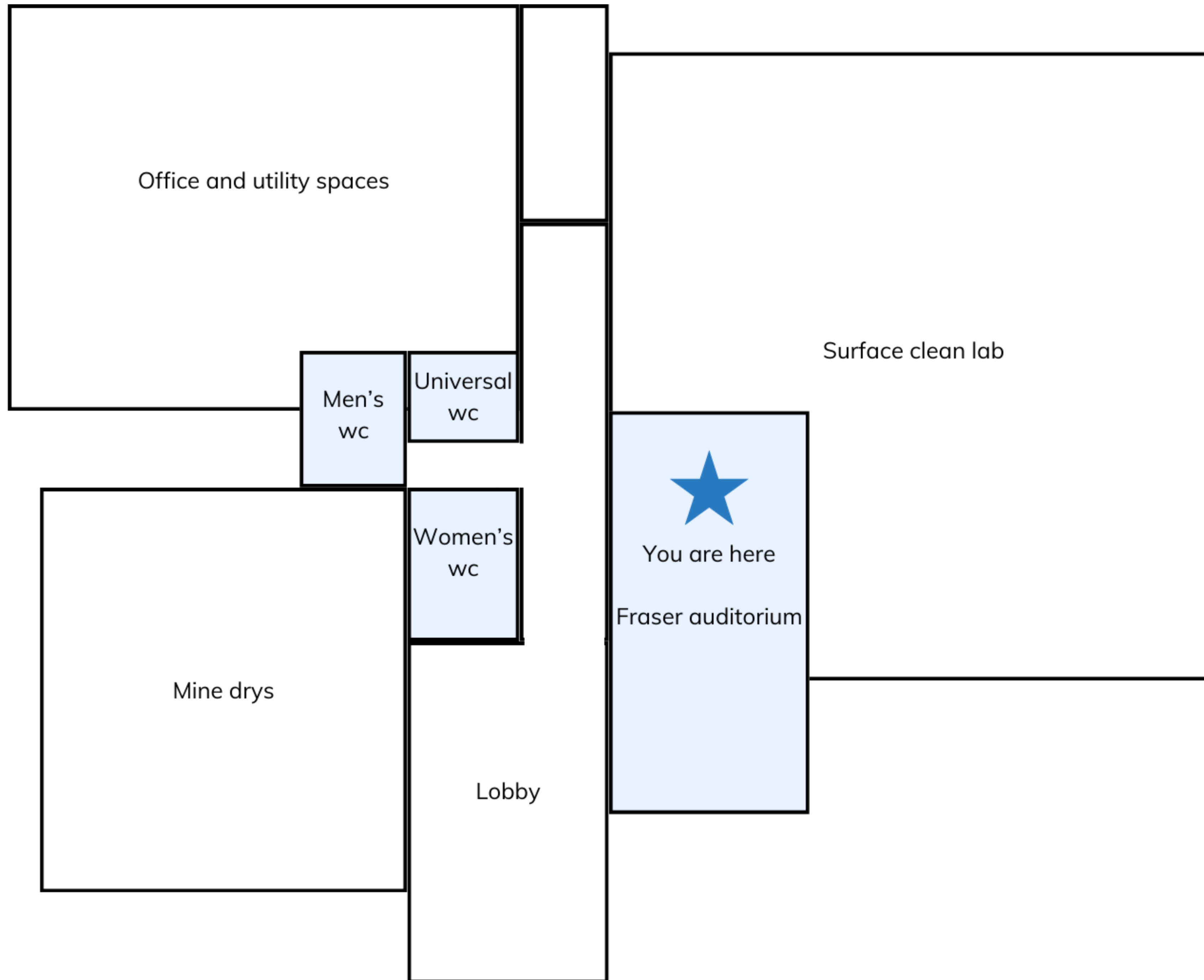


Coffee/tea is available in the kitchenettes on the 1st, 2nd, and 3rd floors.



Wi-Fi is SNOLAB-Guest (no password).

Entrance doors will be locked each day ~30 min after the conference concludes.



Office and utility spaces

Men's
wc

Universal
wc

Women's
wc

Mine drys

Lobby

Fraser auditorium

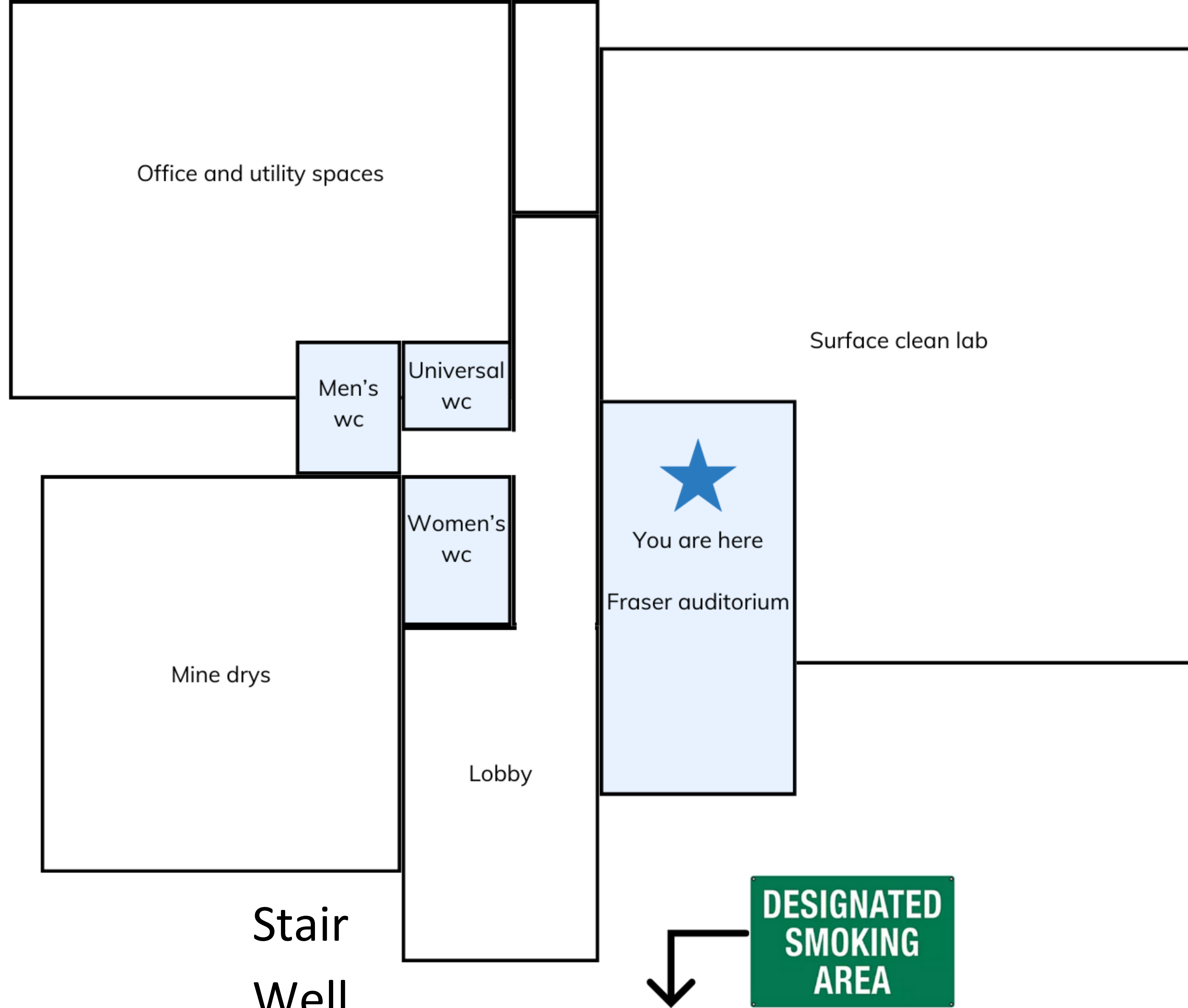
You are here

Surface clean lab

Emergency Evacuation

- Do not use the elevator in an evacuation.
- Use the nearest stairwell to exit the building.
- Report to the SNOLAB Assembly Area.
- The SNOLAB Assembly Area is in the front parking lot, straight ahead from the front doors of the building.







First aid kits: 1st floor lobby, 2nd and 3rd floor kitchenettes.



Defibrillator: 2nd floor kitchenette.



EpiPens: 2nd floor kitchenette.



For a **medical emergency**, call the Vale Plant Protection Office at **705-692-2292**.



To dial out using a landline phone, dial 8 before dialing the number.



Breakfast and lunch will be provided during the conference hours.

See the Indico Page for the timetable breakdown:
<https://indico.cern.ch/event/1345184/timetable/>

It is also shared on the television screens in the front lobby.
Please send copies of presentations in working order to Erica Brunelle.

Conference Organizer Erica Brunelle will be stationed at the front desk for any other questions / concerns you may have. Feel free to ask any of the planning committee below as well:

James Thomas, Queen Mary University of London
Jan Mol, Queen Mary University of London
Adrian Bevan, Queen Mary University of London
Jeter Hall, SNOLAB
Stephen Sekula, SNOLAB

Any Questions?