SANFORD UNDERGROUND RESEARCH FACILITY

Opportunities at the Sanford Underground Research Facility

Jaret Heise, Science Director
jaret@sanfordlab.org

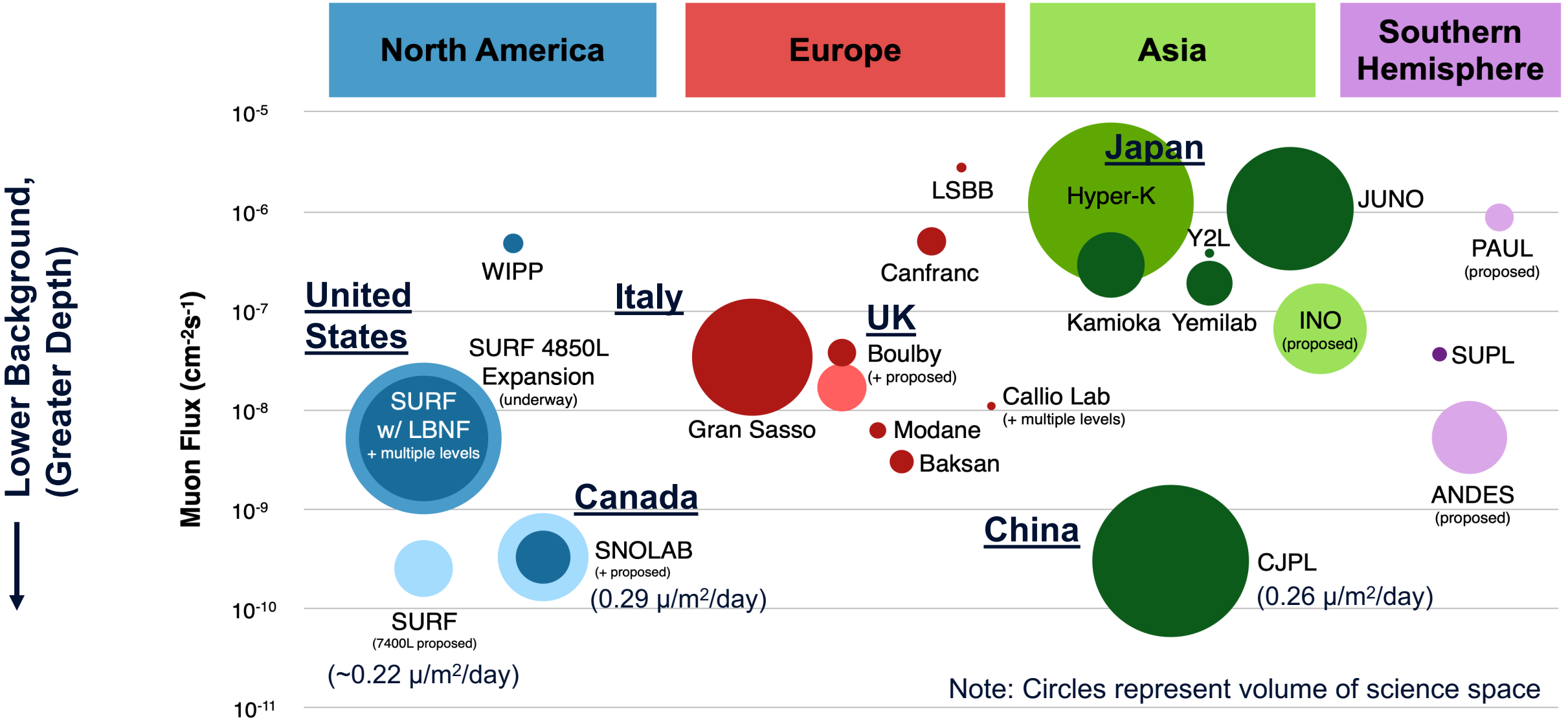
CETUP*
June 30, 2026

SURF in the Global Context

17 deep underground laboratories operating + 3 proposed

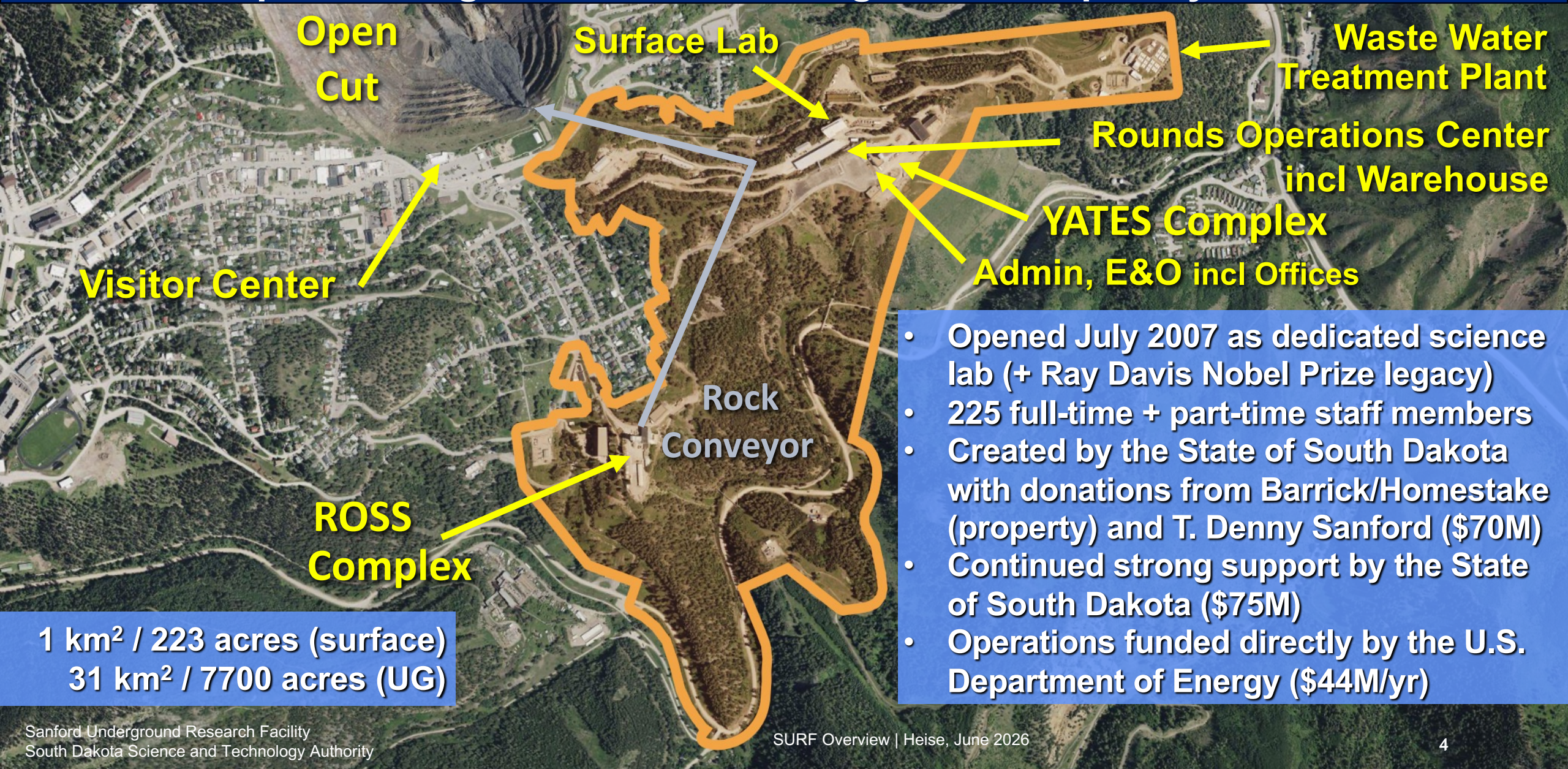
SURF in the Global Context

Deep site (4.5 μ/m²/day) with significant expansion potential, max depth 2450 m



Sanford Underground Research Facility

Nation's deepest underground lab, advancing multi-disciplinary research

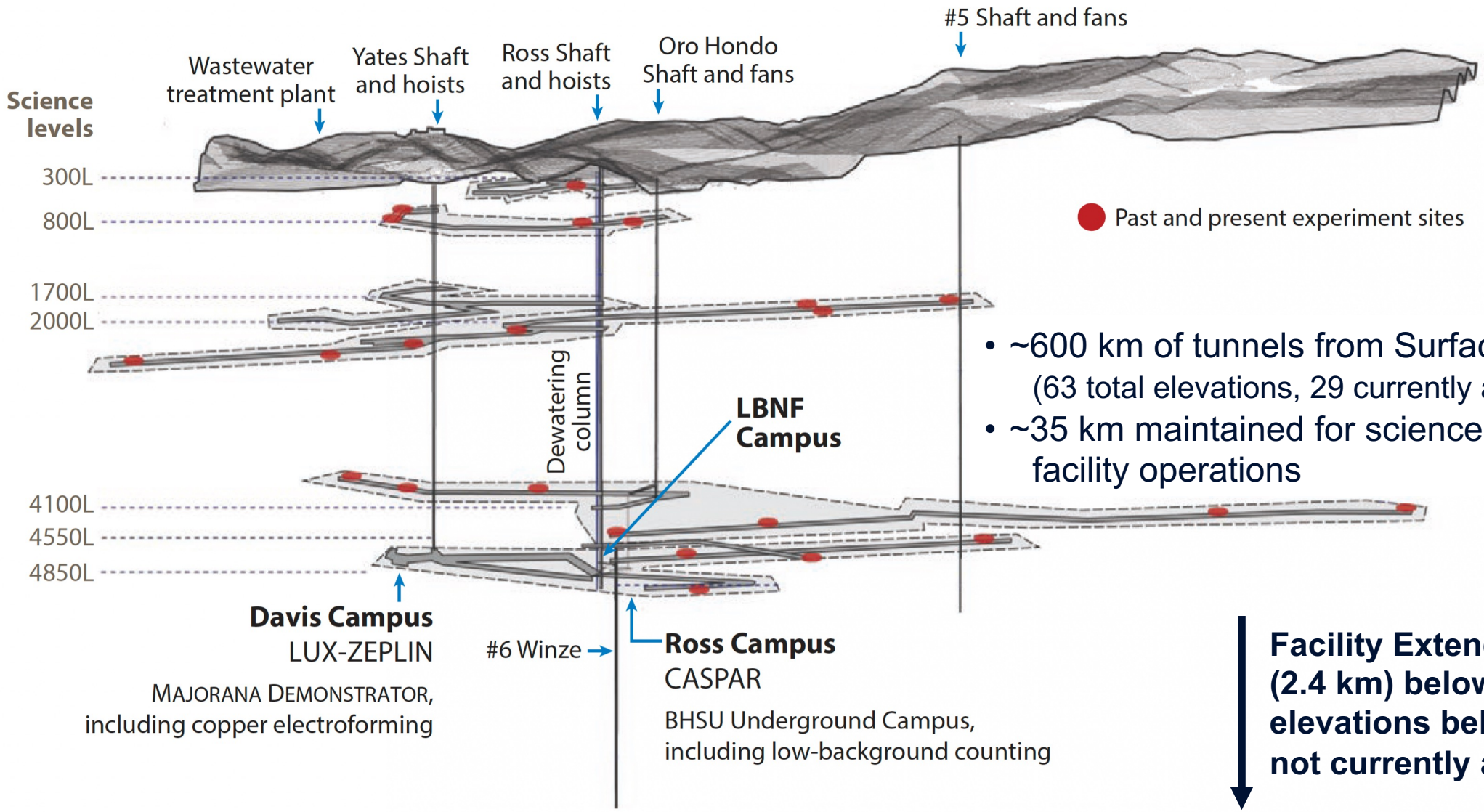


- Opened July 2007 as dedicated science lab (+ Ray Davis Nobel Prize legacy)
- 225 full-time + part-time staff members
- Created by the State of South Dakota with donations from Barrick/Homestake (property) and T. Denny Sanford ($70M)
- Continued strong support by the State of South Dakota ($75M)
- Operations funded directly by the U.S. Department of Energy ($44M/yr)

1 km² / 223 acres (surface)
31 km² / 7700 acres (UG)

SURF Underground Lab Geography

Largest footprint for science: access to rock mass of ~35 km^3, 35 km of tunnels

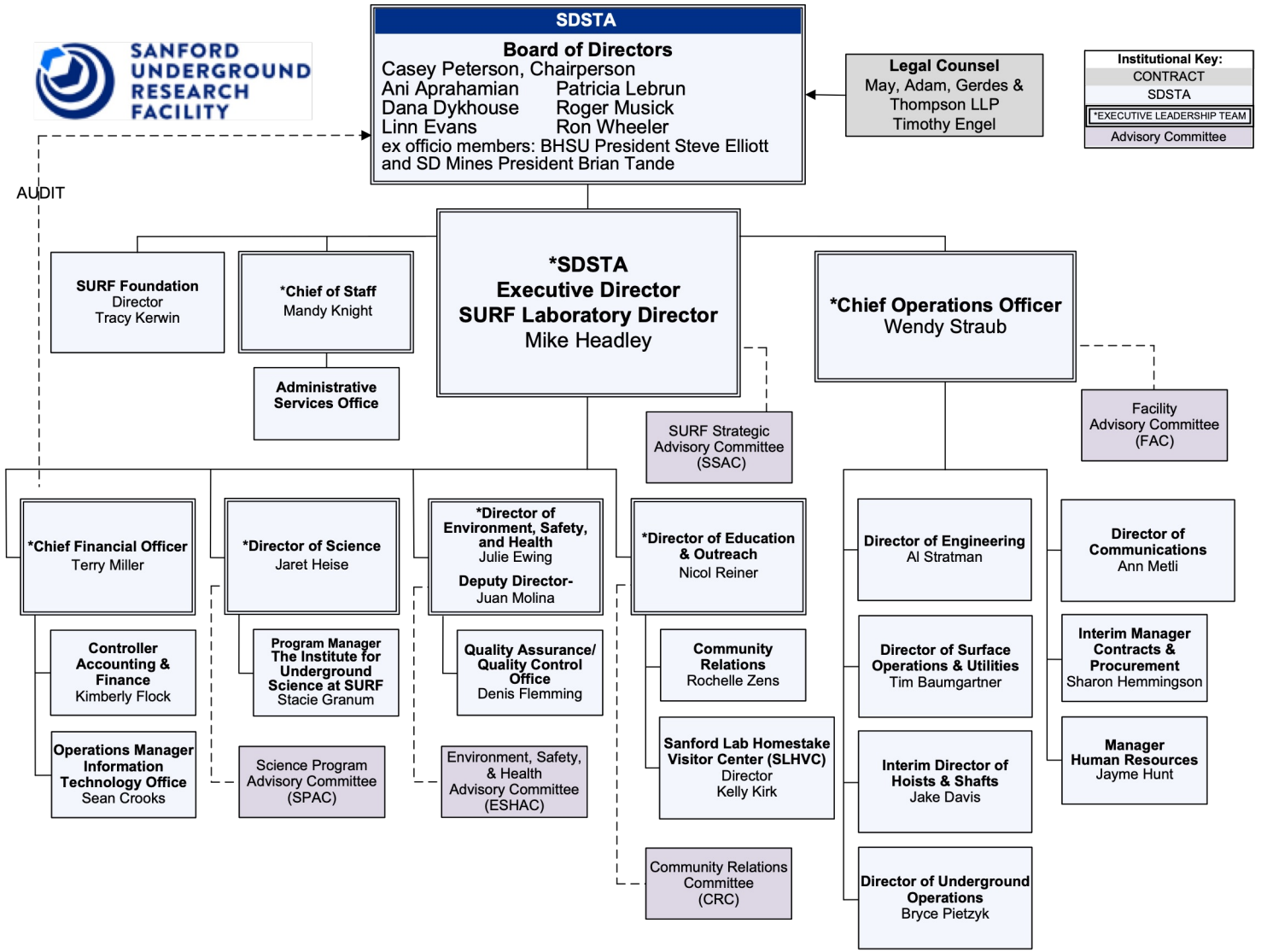


- ~600 km of tunnels from Surface to 2.4 km deep (63 total elevations, 29 currently accessible)
- ~35 km maintained for science and facility operations

Facility Extends to 8000L (2.4 km) below surface, elevations below 5000L not currently accessible

SDSTA Organization

Robust organization: 9 depts, 5 offices + Institute, Visitor Center and Foundation



Staffing Area	Current # ppl (%)	FY29 # ppl (%)
Admin / Mgmt	30 (13%)	30 (13%)
Engineering	13 (6%)	13 (6%)
ESH	21 (9%)	21 (9%)
Outreach	23 (10%)	23 (10%)
Scientific	5 (2%)	5 (2%)
Technical / Operations	133 (59%)	140 (60%)
TOTAL	**225**	**232 ***

* More LBNF/DUNE support likely

Current Science Direct Support = 19 ppl

Geology and Engineering

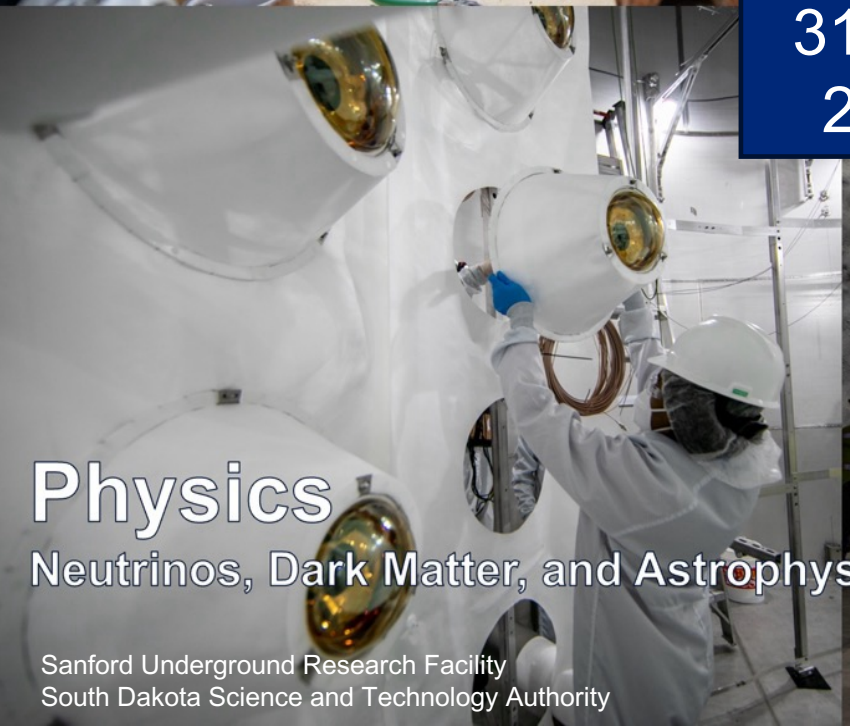
Enhanced Geothermal Systems
Mining Technology

Biology

Extremophiles, Biodiversity

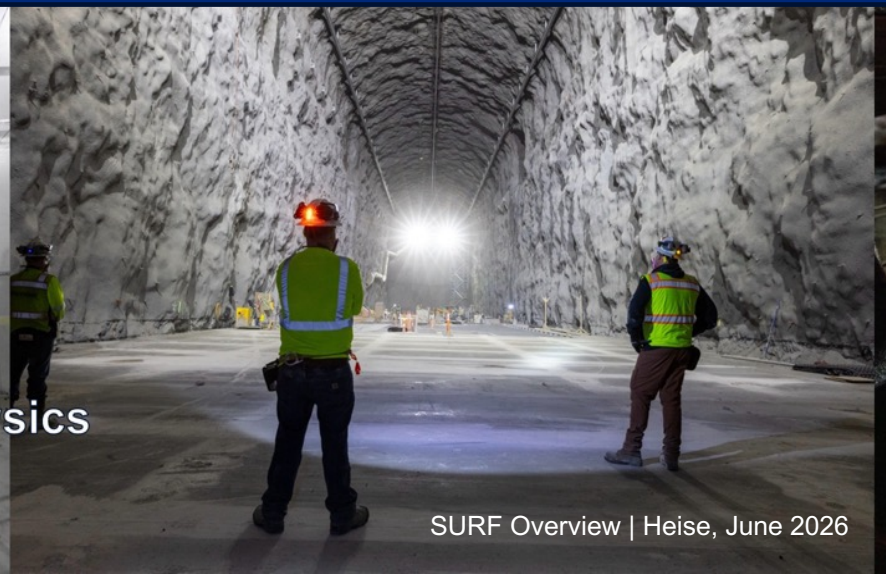
Science Program

31 Expts with 1,850 Collaborators,
280+ Institutions in 47 Countries



Physics

Neutrinos, Dark Matter, and Astrophysics



Partnerships

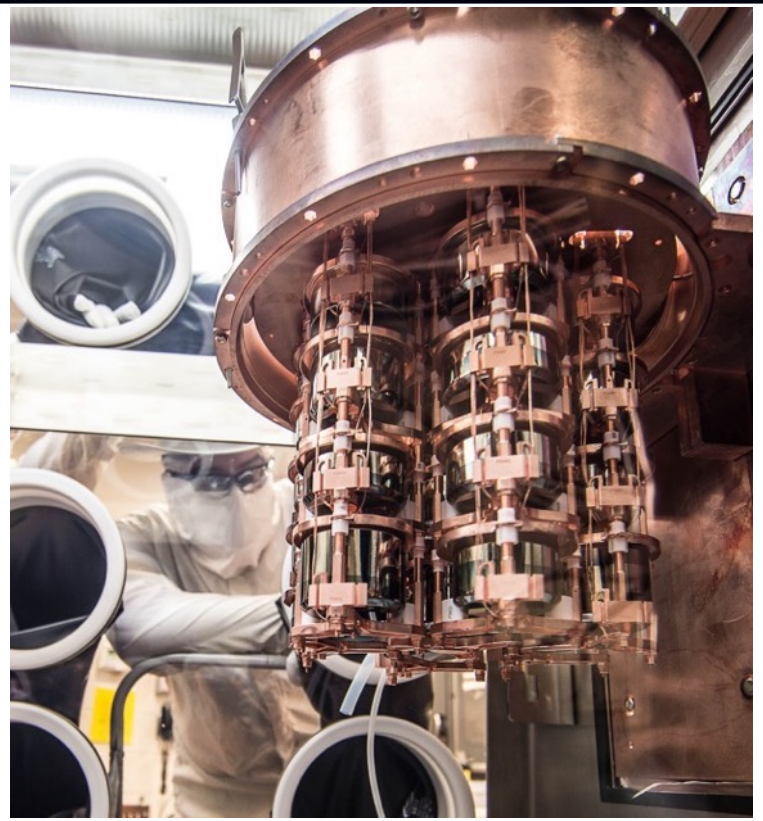
Commercial, Technology,
Industrial, Workforce development

SURF Science Program – Current Physics Highlights

Strong and diverse program with exciting future

LUX-ZEPLIN (LZ)

- Direct search for **dark matter** using 10 tonnes xenon
- World-leading WIMP-search results announced 2022, 2024 + 2025 (^{8}B ν)



MAJORANA DEMONSTRATOR (MJD)

- Investigate **neutrinoless double-beta decay** using 44 kg Ge
- Ge-76 DBD and Ta-180 decay searches complete, decom underway

CASPAR

- Stellar fusion reactions to study **nucleosynthesis** using accelerator
- Initial phase 2015-2021, next phase started in 2025, last for 3+ years

SURF Material Assay at BHUC

Low-background counting capabilities serving national & international community

SURF Material Assay at BHUC

Low-background counting capabilities serving national & international community

Detector	Crystal		[U] mBq/kg	[Th] mBq/kg	Status	Comments
	Type	Size				
Maeve (LBNL)	p-type (85%)	2.2 kg	**0.1** (10 ppt)	**0.1** (25 ppt)	Production assays	Relocated from Oroville. Old Pb (200-yr old) inner shielding.
Merlin (LBNL)	n-type (115%)	2.2 kg	**~0.2** (~20 ppt)	**~0.2** (~50 ppt)	Operating	Installed 2025.
Morgan (LBNL)	p-type (85%)	2.1 kg	**0.2** (20 ppt)	**0.2** (50 ppt)	Production assays	Low-bkgd upgrade 2015.
Mordred (USD/CUBED, LBNL)	n-type (60%)	1.3 kg	**0.7** (60 ppt)	**0.7** (175 ppt)	Production assays	Low-bkgd upgrade 2015-2016, shield access upgrade.
Twins (Dual HPGe) (LBNL, BHSU, UCSB)	p-type (2x120%)	2x 2.1 kg	**~0.01** (~1 ppt)	**~0.01** (~1 ppt)	Operating	Low-bkgd upgrades 2016-2017; flexible shield configuration.
RHYM+RESN (Dual HPGe) (LLNL)	p-type (2x65%)	2x 1.1 kg	**<0.1** (<10 ppt)	**<0.1** (<25 ppt)	Production assays	Cryocooler, low-E ^{210}Pb (<2 mBq/kg).
Ge-IV *(Alabama, Kentucky)*	*p-type (111%)*	*2 kg*	***0.04*** *(3 ppt)*	***0.03*** *(8 ppt)*	*Offline*	*Gantry + hoist for vertical design. Awaiting relocation to Ross Campus.*

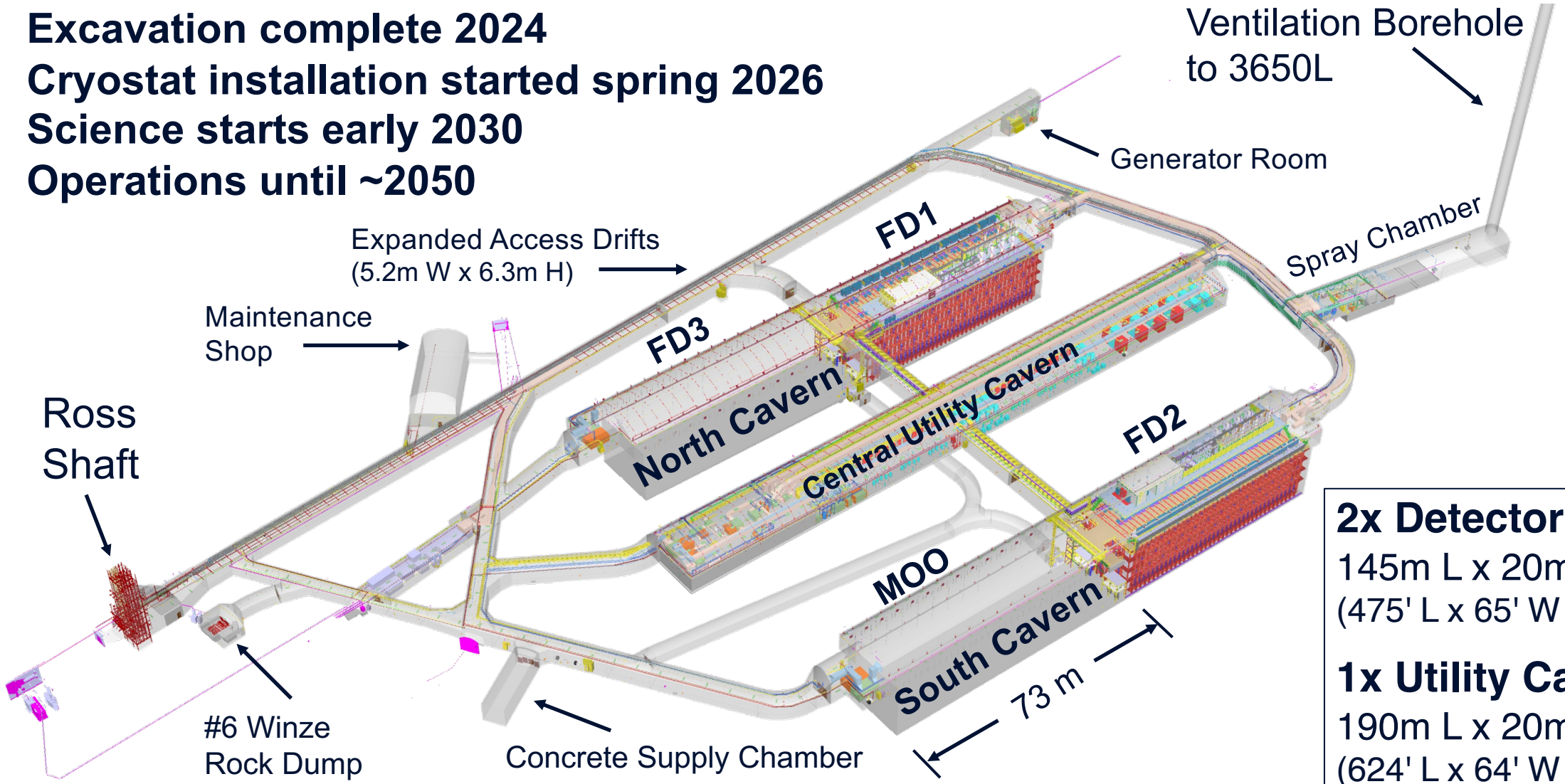
Also see: LZ Assay Paper https://arxiv.org/pdf/2006.02506

Local universities have some additional material screening capabilities: **HPGe** ([0.2-0.4 kg]/SD Mines), **ICP-MS** (BHSU), **Rn emanation** characterization (0.1 mBq/SD Mines), **Alpha** (1 mBq/m^2 ^{210}Po/SD Mines; XIA UltraLo-1800/LZ purchased)

Long-Baseline Neutrino Facility (LBNF)

LBNF will host the Deep Underground Neutrino Experiment (DUNE)

Excavation complete 2024
Cryostat installation started spring 2026
Science starts early 2030
Operations until ~2050



2x Detector Caverns:
145m L x 20m W x 28m H
(475' L x 65' W x 92' H)

1x Utility Cavern:
190m L x 20m W x 11m H
(624' L x 64' W x 37' H)

LBNF South Cavern

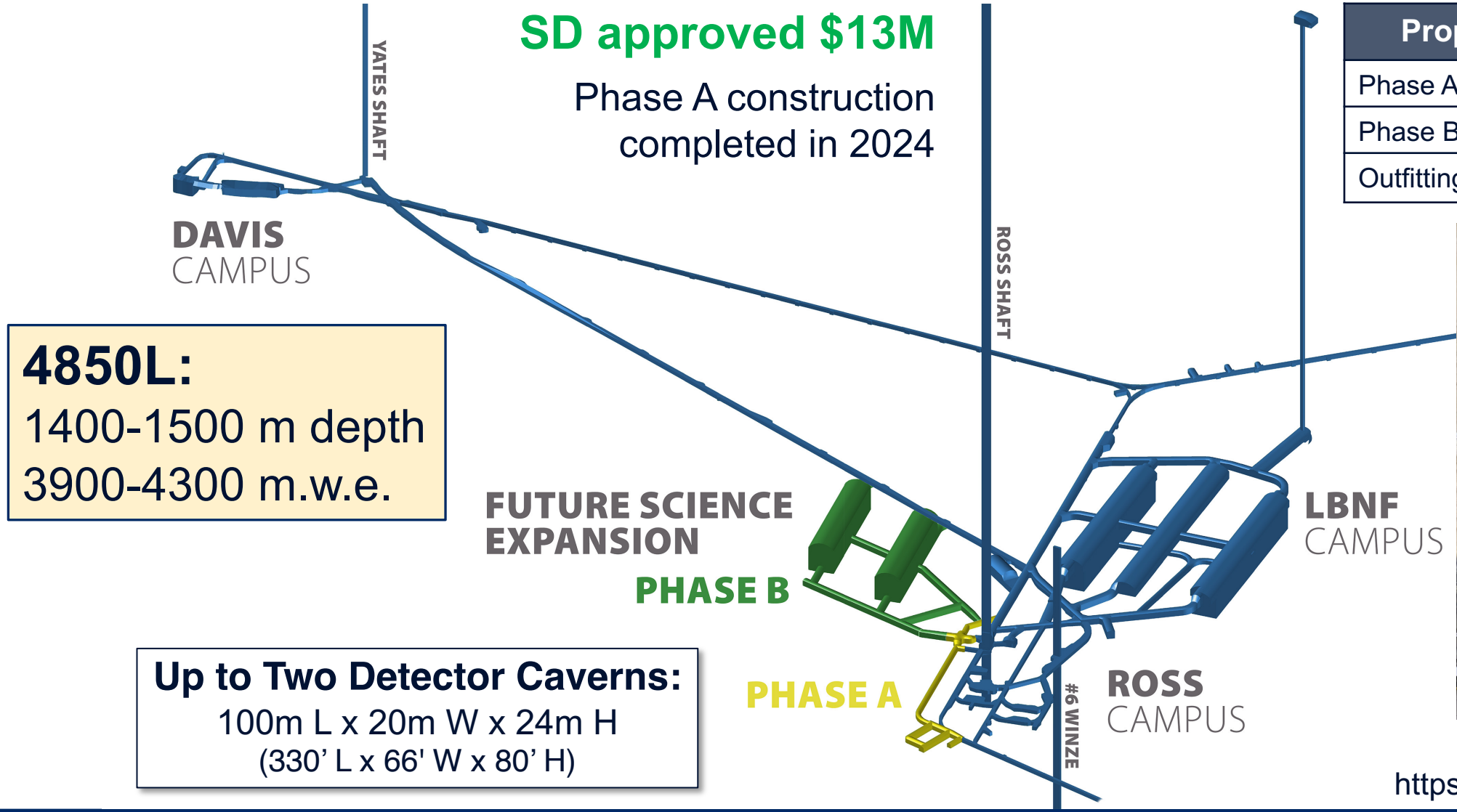
Deep Space Needed for Future Experiments

U.S. strategic plan endorsed SURF expansion for neutrino and dark matter expts

SD approved $13M

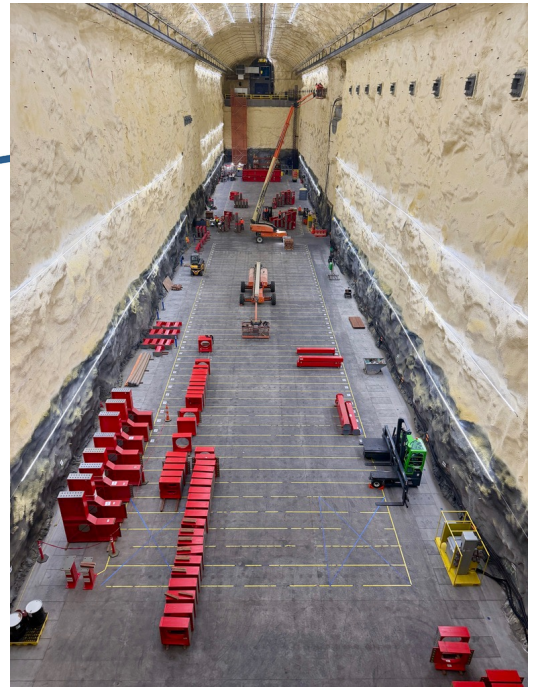
Phase A construction completed in 2024

Proposed Funding Model	
Phase A	$13M State of SD ✓
Phase B	$100M Private
Outfitting	$100M Federal/Private



4850L:
1400-1500 m depth
3900-4300 m.w.e.

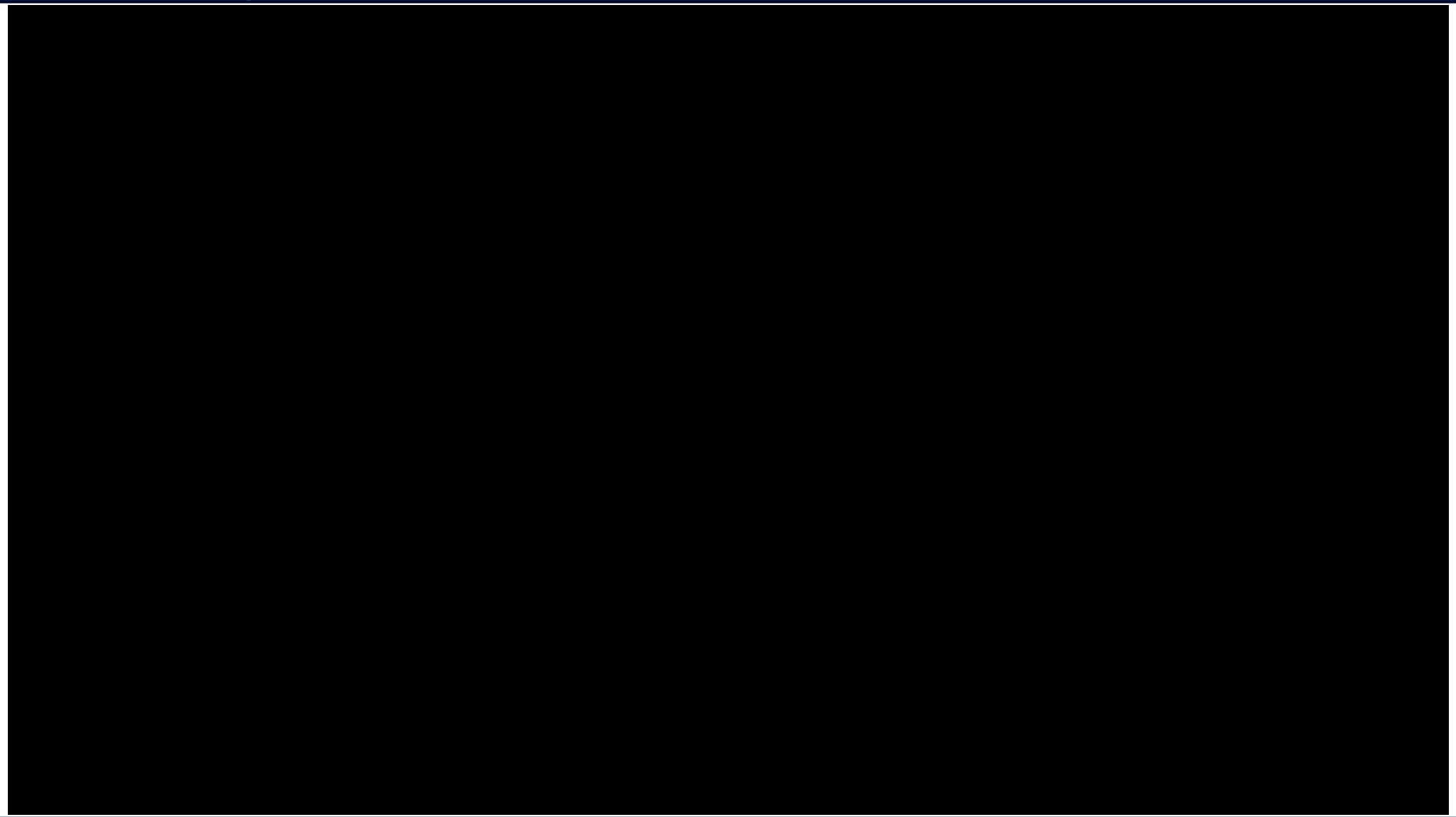
Up to Two Detector Caverns:
100m L x 20m W x 24m H
(330’ L x 66' W x 80’ H)



See also:
https://arxiv.org/abs/2603.06504

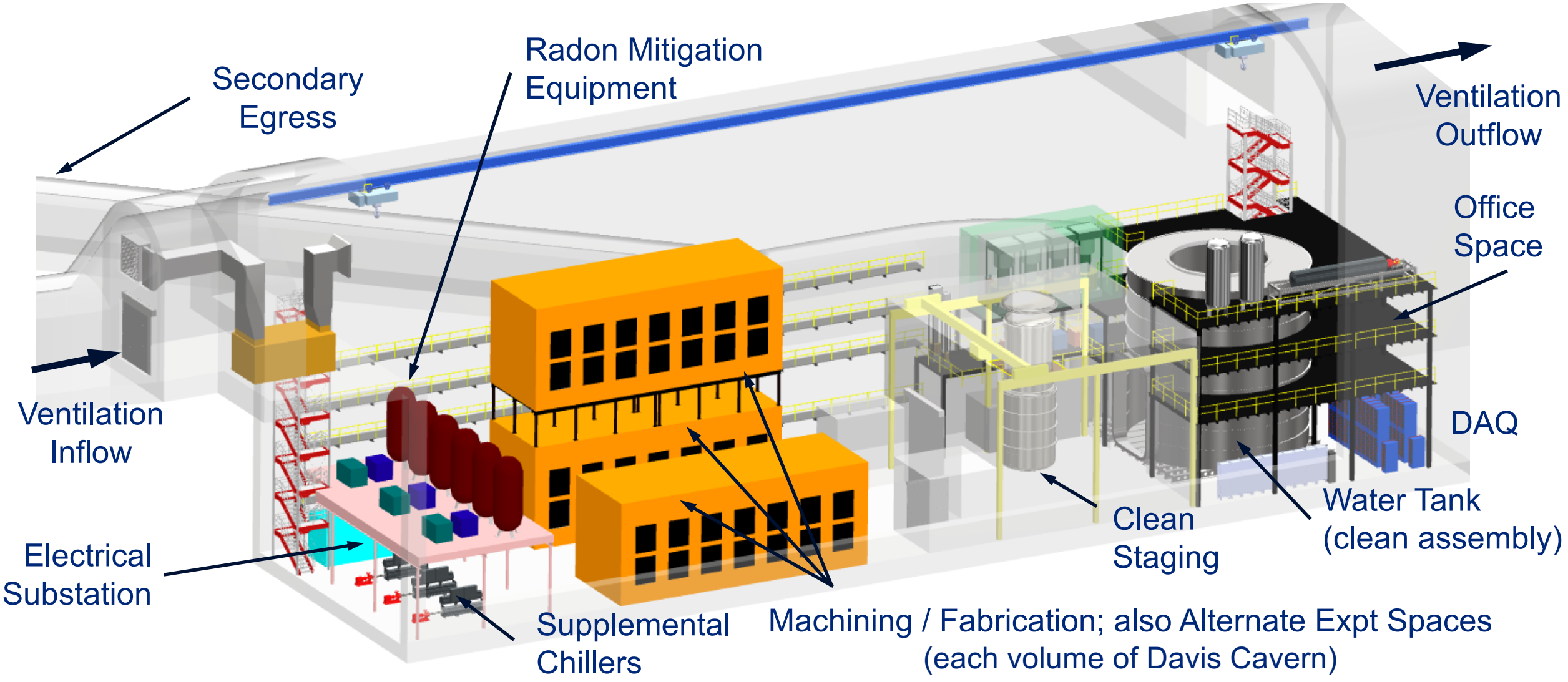
4850L Laboratory Expansion – Phase A

Expansion blasting video: https://vimeo.com/982238458



Next-Generation Science at SURF

Several deep options available



SURF User Association

https://sanfordlab.org/surf-user-association (incl registration)

Purpose

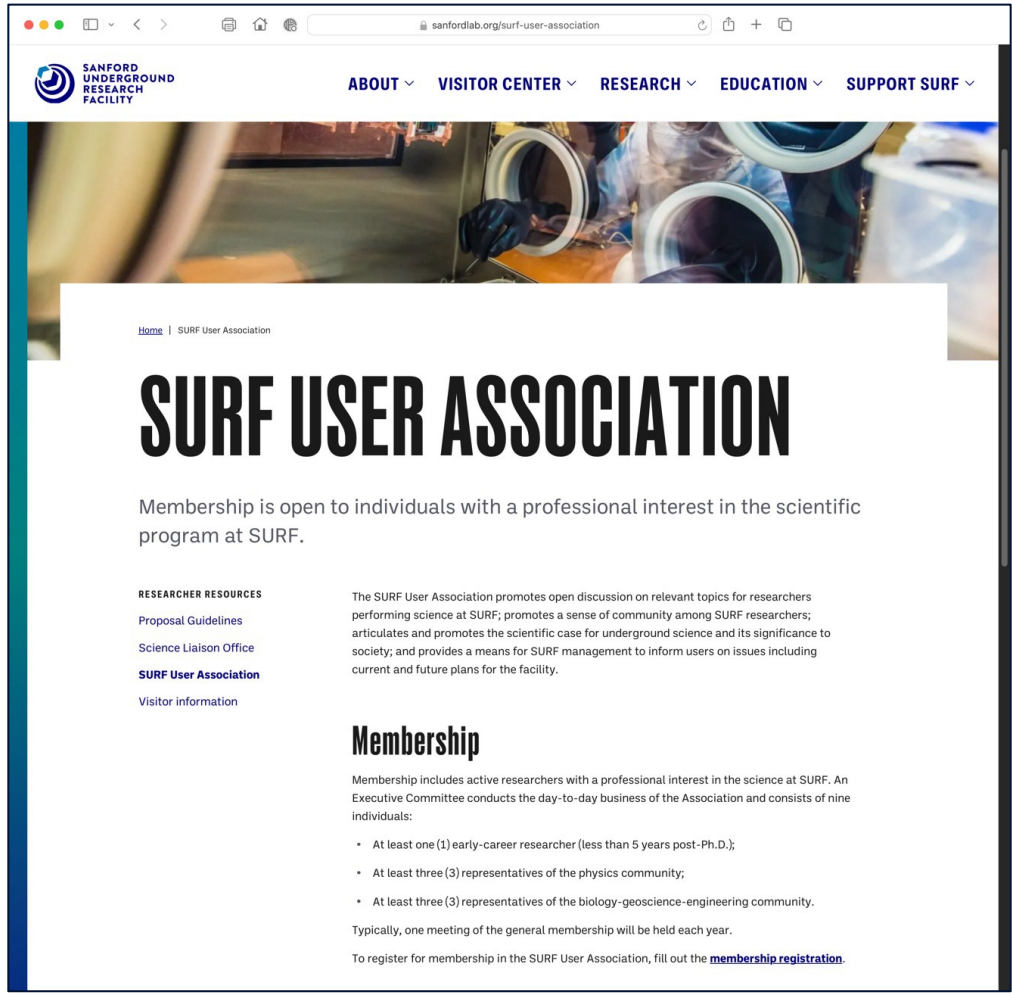
- **Two-way communication** on topics important to researchers
- Promotes a **sense of community** amongst SURF experiments and researchers
- Articulates and promotes **scientific case for UG science** and significance to society, provides channel for **advocacy**

Organization

- **Membership = 537** (open to all UG science community)
- **Executive Committee** consists of 9 individuals across scientific disciplines, incl early career. Quarterly meetings with SURF Management

Events

- **Engagement** initiatives in progress, stay tuned in 2026
- **General meetings** typically annually, last @ CoSSURF 2024
- **Topical workshops**, incl community planning (e.g., Vision2021)
- **Advocacy**, with participation in 2026 HEP DC Visit (interactions with 27 congressional offices + OSTP)



SURF Aspires to Become DOE User Facility

Important to have deep underground user facility in the U.S.

Benefits

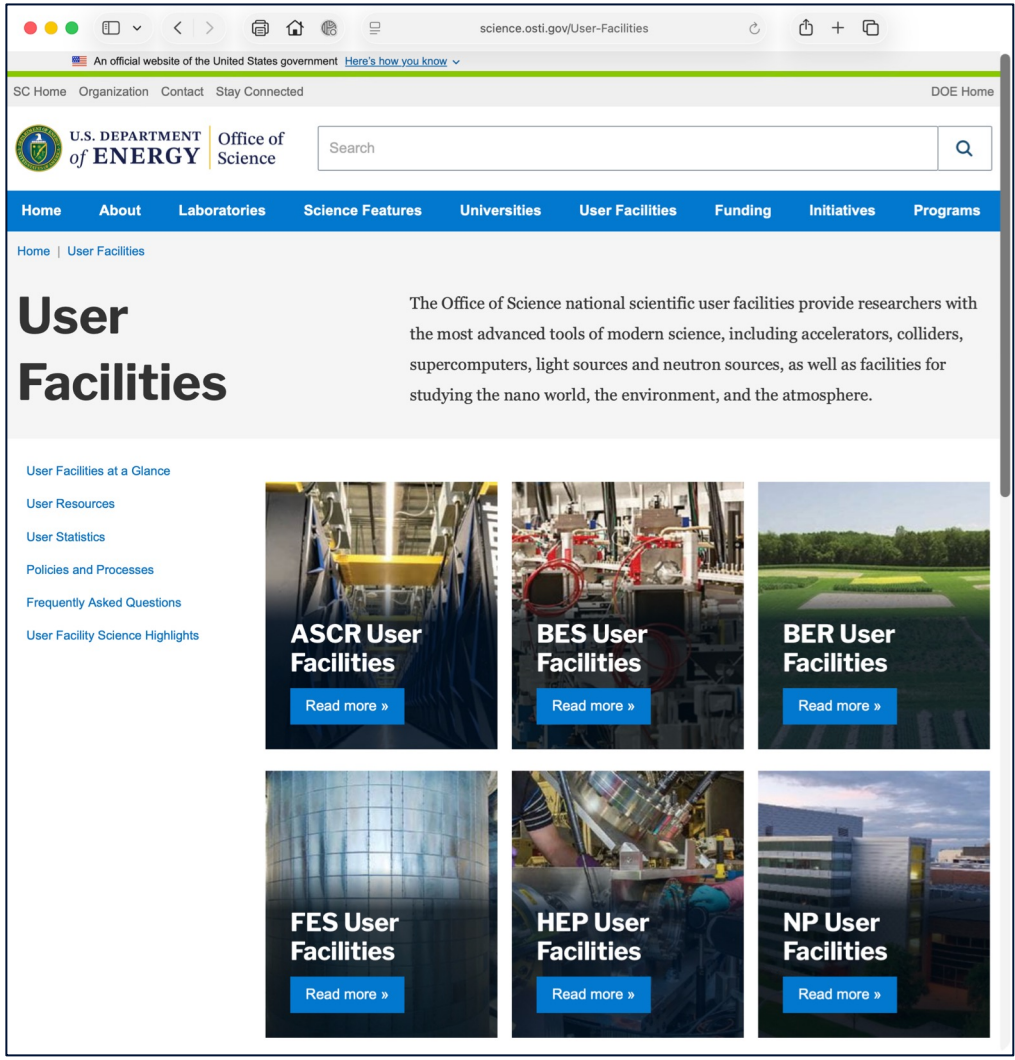
- Expands DOE User Facility portfolio to incl underground lab, raises SURF's stature within DOE community.
- Promotes underground science in U.S., increases SURF funding opportunities (FOAs encourage partnerships w/ User Facilities)
- Enhances SURF's role in global science community.
- Communicates SURF is open to a broad range of science and users, SURF processes for hosting science accepted by DOE.

Main Requirements

- Facility open to users regardless of nationality or institution. ✓
- Allocation of facility resources determined by merit review. ✓
- Facility resources for users to conduct work safely and efficiently. ✓
- The facility supports a formal user organization. ✓

Status

- User Association + Science Program Advisory Committee established.
- Significant maintenance for Yates Shaft completed March 2025.
- Application draft near final, awaiting DOE invitation to submit.



SURF Science Strategic Plan

Long-term vision to ensure SURF continues to serve scientific community

Goals

- **Program:** Attract world-leading scientists and experiments
- **Facilities:** Ensure SURF facilities support science program
- **Support:** Ensure organizational capabilities serve experiments
- **Engagement:** Establish strong SURF role in global UG science community

Physics (closely aligned with top U.S. national priorities)

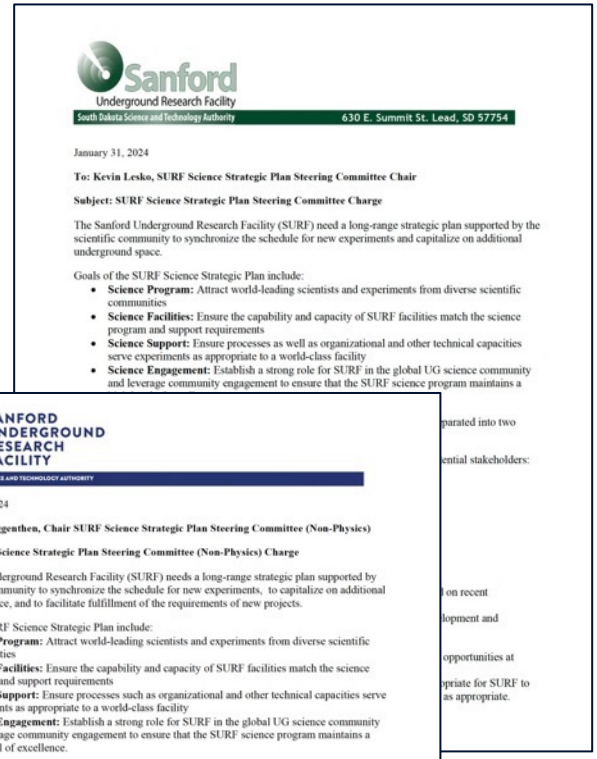
- DUNE support (Phase 1 and Phase 2)
- Generation 3 Dark Matter (XLZD and/or ARGO)
- 'Agile' Experiments / Low-Mass Dark Matter
- General R&D facility

} **Quantum User Facility w/ dilution refrigerator**

- Generation 2 Dark Matter upgrade (extend LZ ops + low-mass dark matter)

Non-Physics (based on community expert input)

- SURF is critical hub for innovation and discovery:
  - Geology and geomechanics (geothermal, real-time sensing, etc)
  - Biology and microbial systems (extremophiles, incl CO_2 sequestration)
  - Industrial and academic partnerships (e.g., CAT, NSF REU programs, etc)



Sanford Underground Research Facility
South Dakota Science and Technology Authority 630 E. Summit St. Lead, SD 57754

January 31, 2024

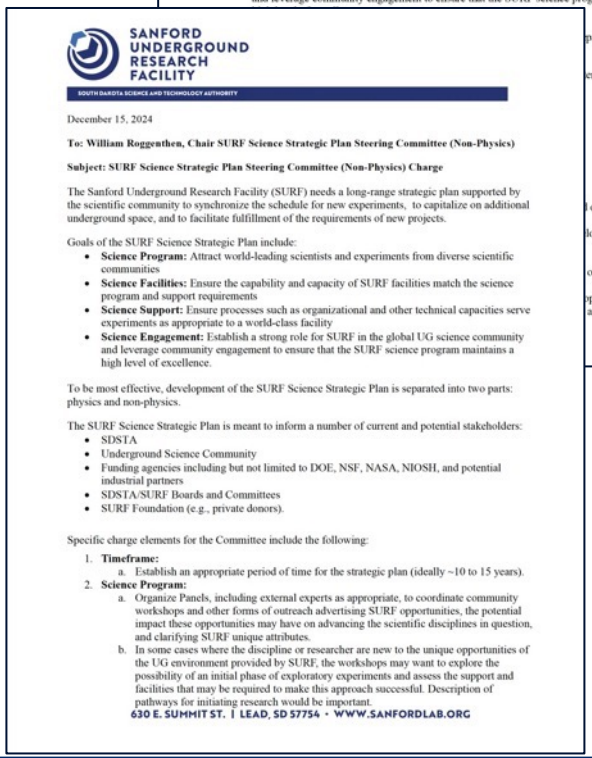
To: Kevin Lesko, SURF Science Strategic Plan Steering Committee Chair

Subject: SURF Science Strategic Plan Steering Committee Charge

The Sanford Underground Research Facility (SURF) need a long-range strategic plan supported by the scientific community to synchronize the schedule for new experiments and capitalize on additional underground space.

Goals of the SURF Science Strategic Plan include:

- **Science Program:** Attract world-leading scientists and experiments from diverse scientific communities
- **Science Facilities:** Ensure the capability and capacity of SURF facilities match the science program and support requirements
- **Science Support:** Ensure processes as well as organizational and other technical capacities serve experiments as appropriate to a world-class facility
- **Science Engagement:** Establish a strong role for SURF in the global UG science community and leverage community engagement to ensure that the SURF science program maintains a



SANFORD UNDERGROUND RESEARCH FACILITY
SOUTH DAKOTA SCIENCE AND TECHNOLOGY AUTHORITY

December 15, 2024

To: William Roggenthen, Chair SURF Science Strategic Plan Steering Committee (Non-Physics)

Subject: SURF Science Strategic Plan Steering Committee (Non-Physics) Charge

The Sanford Underground Research Facility (SURF) needs a long-range strategic plan supported by the scientific community to synchronize the schedule for new experiments, to capitalize on additional underground space, and to facilitate fulfillment of the requirements of new projects.

Goals of the SURF Science Strategic Plan include:

- **Science Program:** Attract world-leading scientists and experiments from diverse scientific communities
- **Science Facilities:** Ensure the capability and capacity of SURF facilities match the science program and support requirements
- **Science Support:** Ensure processes such as organizational and other technical capacities serve experiments as appropriate to a world-class facility
- **Science Engagement:** Establish a strong role for SURF in the global UG science community and leverage community engagement to ensure that the SURF science program maintains a high level of excellence.

To be most effective, development of the SURF Science Strategic Plan is separated into two parts: physics and non-physics.

The SURF Science Strategic Plan is meant to inform a number of current and potential stakeholders:

- SDSTA
- Underground Science Community
- Funding agencies including but not limited to DOE, NSF, NASA, NIOSH, and potential industrial partners
- SDSTA/SURF Boards and Committees
- SURF Foundation (e.g., private donors).

Specific charge elements for the Committee include the following:

1. **Timeframe:**
   a. Establish an appropriate period of time for the strategic plan (ideally ~10 to 15 years).
2. **Science Program:**
   a. Organize Panels, including external experts as appropriate, to coordinate community workshops and other forms of outreach advertising SURF opportunities, the potential impact these opportunities may have on advancing the scientific disciplines in question, and clarifying SURF unique attributes.
   b. In some cases where the discipline or researcher are new to the unique opportunities of the UG environment provided by SURF, the workshops may want to explore the possibility of an initial phase of exploratory experiments and assess the support and facilities that may be required to make this approach successful. Description of pathways for initiating research would be important.

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SURF Quantum User Facility

Multi-user, low-background, ultra-low temperature test facility

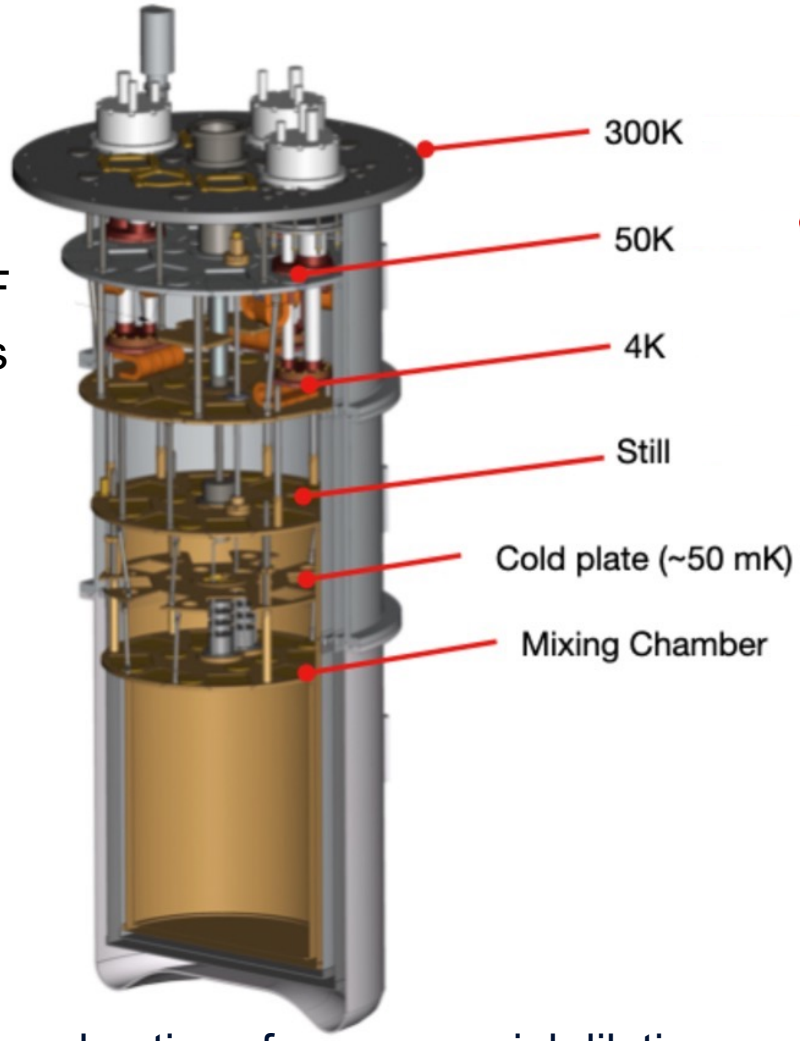
No deep underground cryogenic facility currently exists in the U.S.

Establish internationally-competitive research resources

- Detectors with extremely low energy thresholds and excellent energy resolution require isolation from ionizing radiation at deep facility like SURF
- Serve experiments using cryogenic calorimeters, quantum phonon sensors for applications in particle astrophysics, incl dark matter, 0νββ, CEvNS
- Attract industry leaders in quantum computing (Google, IBM, D-Wave)
- Bolster $3M investment in SD Center for Quantum Information Science & Technology

Planning underway

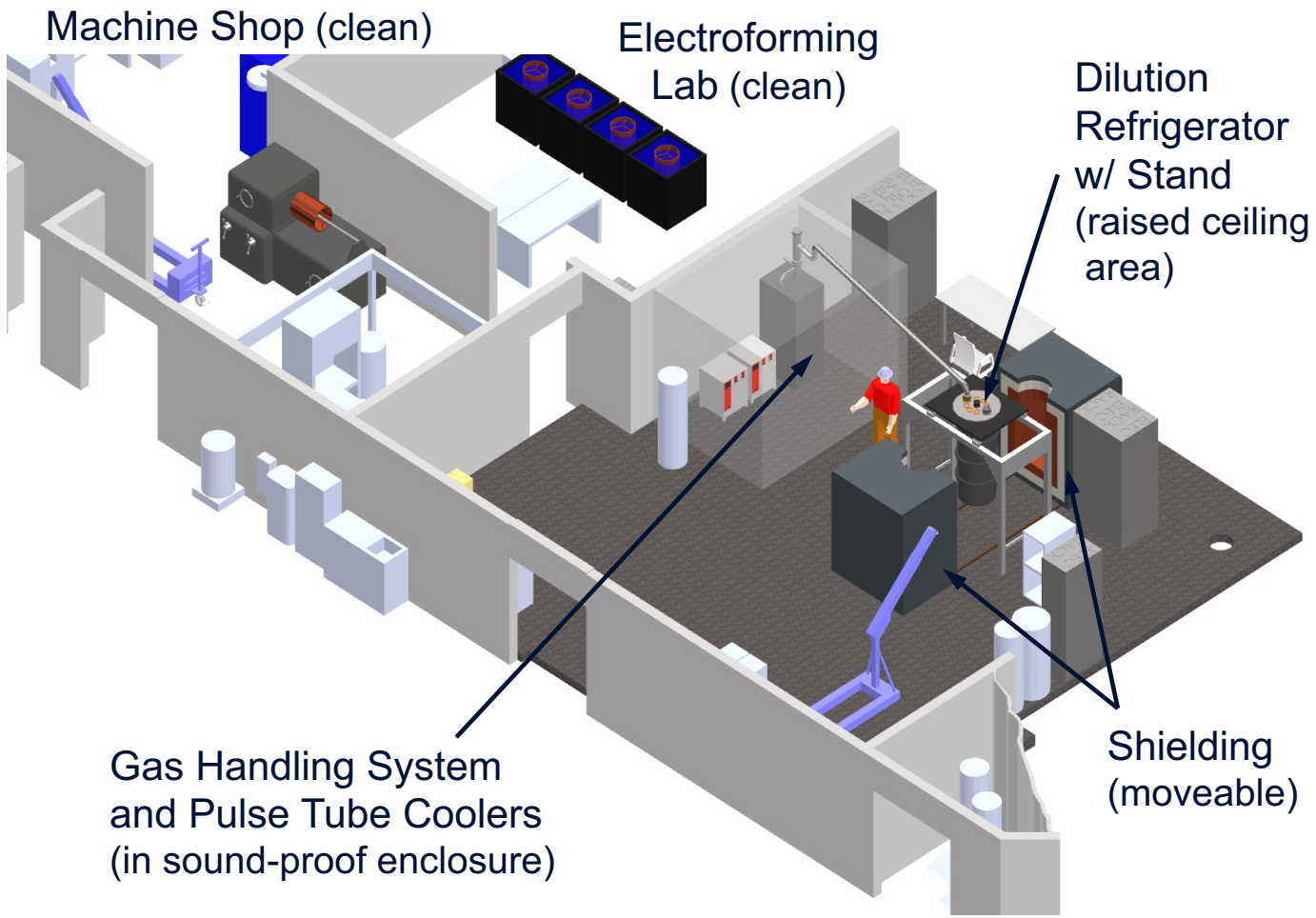
- Quantum Partnership Workshop (2026 event 3rd in series: https://indico.sanfordlab.org/e/Quantum2026) enhancing synergies with state QIS initiatives as well as broader interest in topics such as quantum communication networks
- Facility upgrades understood (mainly electrical, cooling)
- Cleanroom space available, also Pb shielding



Several options for commercial dilution refrigerator that would meet facility needs

SURF Quantum User Facility

Deep site at 4850L Davis Campus planned to support range of quantum science



Area (total = **140 m²**): 11 m × 9.8-12.8 m × 2.7 m (H)
Area (raised section): 5.9 m × 5.8 m × 3.2 m (H)

SURF Vertical Facility

Unique facility would serve broad range of science communities

Science

- Atom interferometry using quantum sensors (ultralight dark matter, gravitational waves)
- Quantum communication network; also atmospheric cloud chamber, microgravity studies, isotope separation, etc

Community Interest

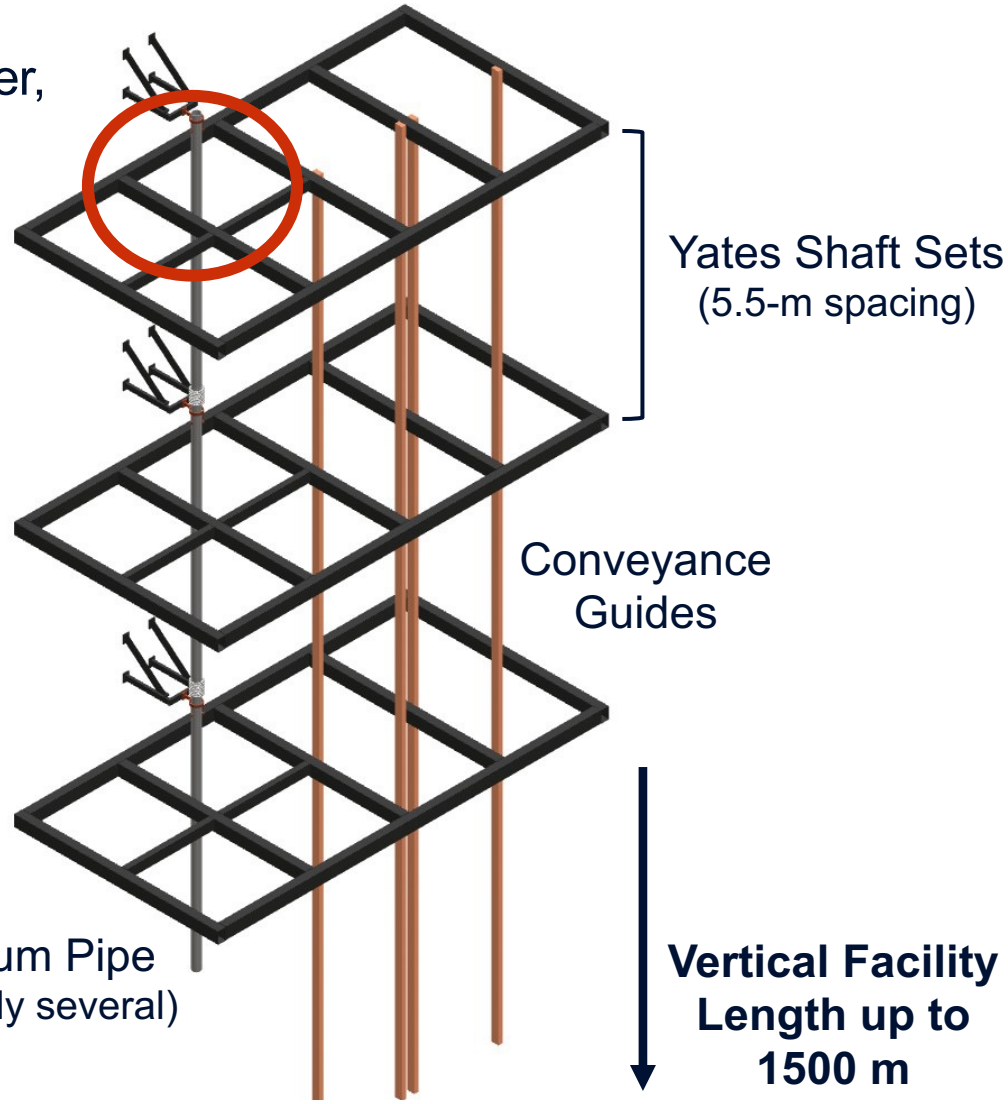
- Various workshops since 2008 to explore opportunities a SURF
- SURF joined TVLBAI collaboration in Oct 2025 (50+ institutions)

Expt Requirements (TVLBAI https://arxiv.org/pdf/2503.21366)

- **1.5-m diameter** shaft (minimum), **15-cm diameter** pipe for ultra-high vacuum
- Possibly separate pipes for separate applications

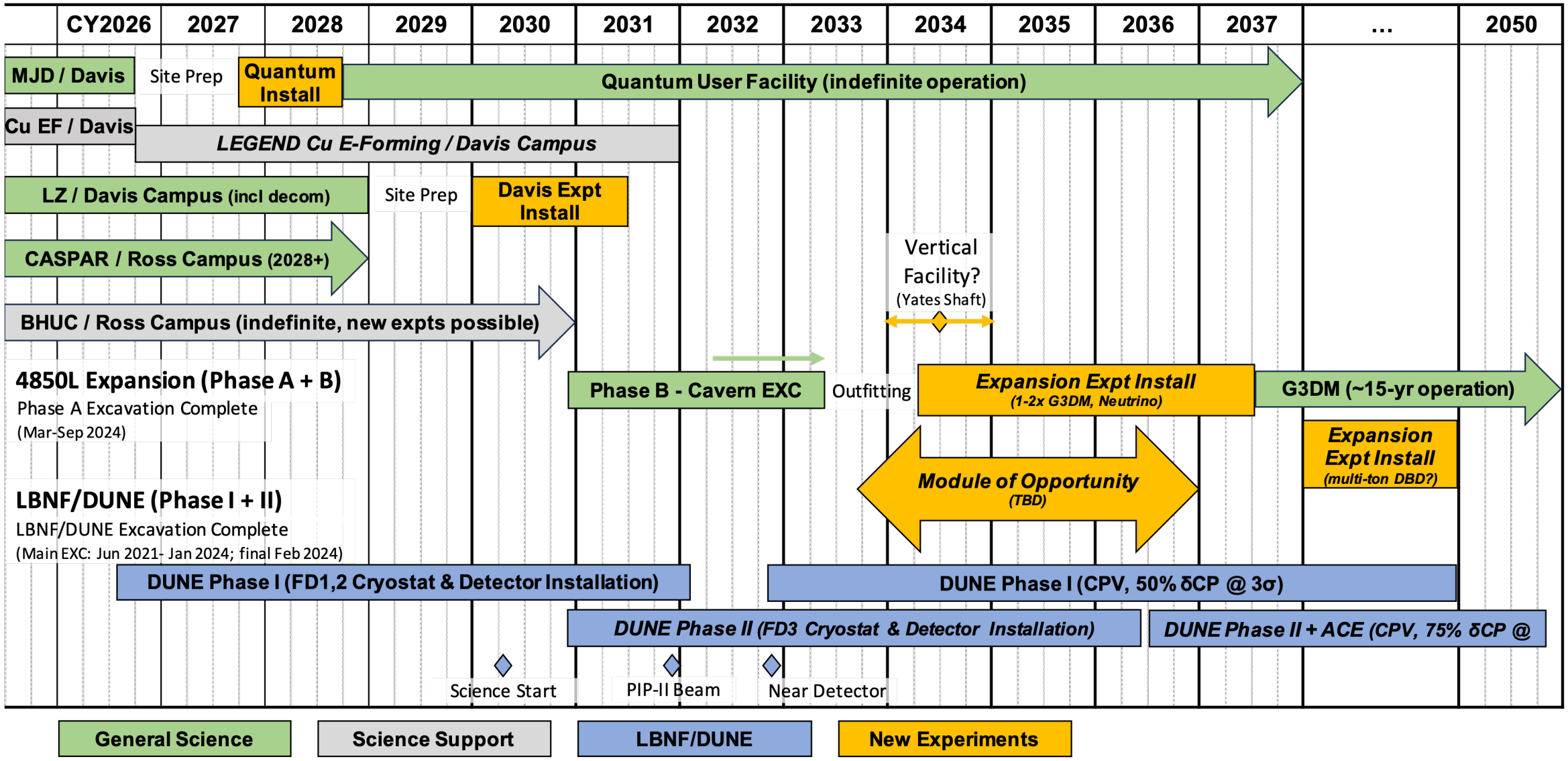
SURF Facility

- Initial shaft study completed March 2022
- **Yates Shaft refurbishment** in 2030s after related upgrades complete (electrical, incl hoists)
- Potential use of "Runabout" compartment **1.75m x 2.0m**



SURF Science Strategic Planning

Timeline



SURF Summary

- SURF has strong relationship with DOE that benefits UG science community:
  - SURF has mandate to **support experiments** and ensure **safe and reliable access for decades**.
- SURF offers world-class service to the underground science community:
  - SURF attributes attract **world-leading** experiments and scientists from **diverse scientific communities**.
  - SURF has **proven track record** of enabling high-impact science by leveraging strong **institutional partnerships**.
- SURF is playing a strong role in the UG science community:
  - **User Association** serving as catalyst for community discussions: https://sanfordlab.org/surf-user-association.
  - **Institute** has had significant impact with initial programming and building intellectual community.
- SURF wants to host future world-leading experiments:
  - LBNF excavation done, outfitting started in 2024. **DOE** "**Module of Opportunity**" expanded physics program.
  - Construction underway to **increase underground laboratory space**, plans advancing for new large caverns on 4850L on timeframe of **next-generation neutrino and dark matter experiments (~2030s)**.
  - Call for **Letters of Interest (LOIs)** re-affirmed prospective experiments and identified **new avenues**. New facilities in planning (Quantum User Facility) and consideration (Vertical Facility).
  - SURF is **deep laboratory** site and offers **largest footprint** in the world for scientific pursuits. **Many options to host future initiatives – big or small!**

Sanford Underground Research Facility

Thank You!

Agency Acknowledgement:
The Sanford Underground Research Facility (SURF) is a federally sponsored research facility under DOE-SC HEP Award Number DE-SC0020216 (cooperative agreement)

Sanford Underground Research Facility

SURF Mission:

We advance world-class science and inspire learning across generations.

SURF Vision:

The world's preferred location for underground science and education.

SURF serves the entire underground science community

SURF welcomes and encourages research from all disciplines that are able to take advantage of the unique attributes of our laboratory

Sanford Underground Research Facility
General summary

Site: Deepest underground lab in U.S., largest footprint for scientific pursuits (former Homestake Gold Mine). Operations funded directly by U.S. Department of Energy ($44M/yr). Robust org, total staff = 225 ppl.

Science Program:

- **Past:** Davis Solar Neutrino Experiment, LUX, MAJORANA DEMONSTRATOR ($0\nu\beta\beta$, ^{180m}Ta), others (incl Deep Underground Gravity Lab, affiliated w/ LIGO collaboration; Industry/engineering w/ Caterpillar)
- **Current:** LZ, CASPAR, Low-bkgd counting (BHUC), Geoengineering (esp. geothermal, seismic), Geomicrobiology, Engineering
- **Future** (no funding/site decisions yet):
  - Dark Matter: Low-mass (SPLENDOR, HydroX), next-generation WIMP (XLZD, Argo), other (CrystaLiZe)
  - Neutrino: Liquid scintillator (Theia), multi-ton-scale $0\nu\beta\beta$ (LEGEND 6000), XLZD, etc
  - QIS, atom interferometry – gravitational waves, ultra-light dark matter: km-scale vertical or horizontal

Facility:

- **4850L Existing:** Davis Campus and Ross Campus operating well
- **4850L Quantum User Facility:** Dilution fridge for QIS at Davis Campus (exploring funding avenues)
- **4850L LBNF/DUNE:** Excavation complete, “Module of Opportunity” for expanded science program (DOE)
- **4850L Expansion:** Up to 2x caverns (100m L × 20m W × 24m H), complete in early 2030s (private/DOE?)
- **Vertical Facility:** Accommodate during Yates Shaft refurbishment, schedule TBD / ~2030s (DOE/other?)

Sanford Underground Research Facility
Physical characteristics

- **Property:** 1 km^2 (surface) with ~1600 m^2 storage (incl drill core) and 355 m^2 staging/assembly space; 31 km^2 (total underground) with ~600 km of tunnels extending to over 2450 m below ground.
- **Access:** Vertical; personnel and materials via one of two main shafts (Yates Shaft extensive maintenance campaign completed, DOE funding discussions for full refurbishment). Facility dedicated to science.
  - Yates Shaft: 1.39 × 3.77 × 2.58 m, 4.8 tonnes (lengths up to 7.3 m possible at reduced payload mass)
  - Ross Shaft: 1.40 × 3.70 × 3.62 m, 6.1 tonnes (lengths up to 8.2 m possible at reduced payload mass; new cage soon)
- **Depth:** Main UG level = 4850L (1480 m, 4300 mwe), muon flux = $(5.18 \pm 0.27)\times10^{-5}$ $\mu/m^2/s$ (4.5 $\mu/m^2/d$). Several other UG elevations for science: 300L, 800L, 1700L, 2000L, 4100L, 4550L.
- **Space:**
  - Surface (science space, as low as class 10-100): 210 m^2 (cleanrooms = 92 m^2 / 914 m^3)
  - 4850L (science space, as low as class 100): Davis Campus (1018 m^2 / 4633 m^3), Ross Campus (920 m^2 /3144 m^3)
  - Radon-reduction: Surface = 2200x reduction @ 300 m^3/h (Ateko), Davis = 700x reduction @ 150 m^3/h (SD Mines)
- **Bkgds** (4850L): Radon* = 210-330 Bq/m^3, gamma = 1.9 $\gamma/cm^2/s$, neutron (thermal) = 1.7×10^{-2} $n/m^2/s$.

* Studies conducted Summer 2024, expect to reduce Rn concentration

- **Utilities:**
  - Power = 24,000 kW capacity (20,000 kW available now, 15,000 kW in FY27); Standby = 3 diesel generators (390 kW)
  - Chilled water (2x 246 kW), purified water (37.8 lpm), compressed air (up to 1100 scfm, 140 scfm at Davis Campus)
  - Network = 20 Gbps internally, 10 Gbps externally (100 Gbps planned), WiFi available surface + underground

Sanford Underground Research Facility
Capabilities

- **Unique environments for multi-disciplinary research:** SURF has attracted world-leading experiments and scientists from diverse scientific communities.
  - **Overburden protection from cosmic-ray muons:** SURF is the deepest underground lab in U.S., one of deepest laboratories in the world (1500 m, 4300 mwe). SURF is expanding to meet the needs of next-generation experiments
- **Local radiation shielding:** Water tank and corresponding water purification system, steel shielding; also selection of low-activity facility construction materials/finishes (e.g., concrete, shotcrete)
- **Assay capabilities:** Low-bkgd counting serving national & international community (~10 μBq/kg U/Th)
- **Material production/purification:** One of only a few labs where UG Cu electroforming is performed (average U, Th decay chain ≤ 0.1 μBq/kg)
- **Environmental control:** Experience w/ HEPA filtration cleanrooms, dehumidifier, Rn-reduction systems
- **Implementation and operations support:** Robust organization with support for planning, execution and coordination of science program activities both planned and ongoing at facility. SURF has proven track record of delivering successful science.
- **Community catalyst:** User Association, incl Vision Workshop 2021. Science Program Advisory Cmttee. Both groups support upcoming SURF application to become **DOE Office of Science User Facility**

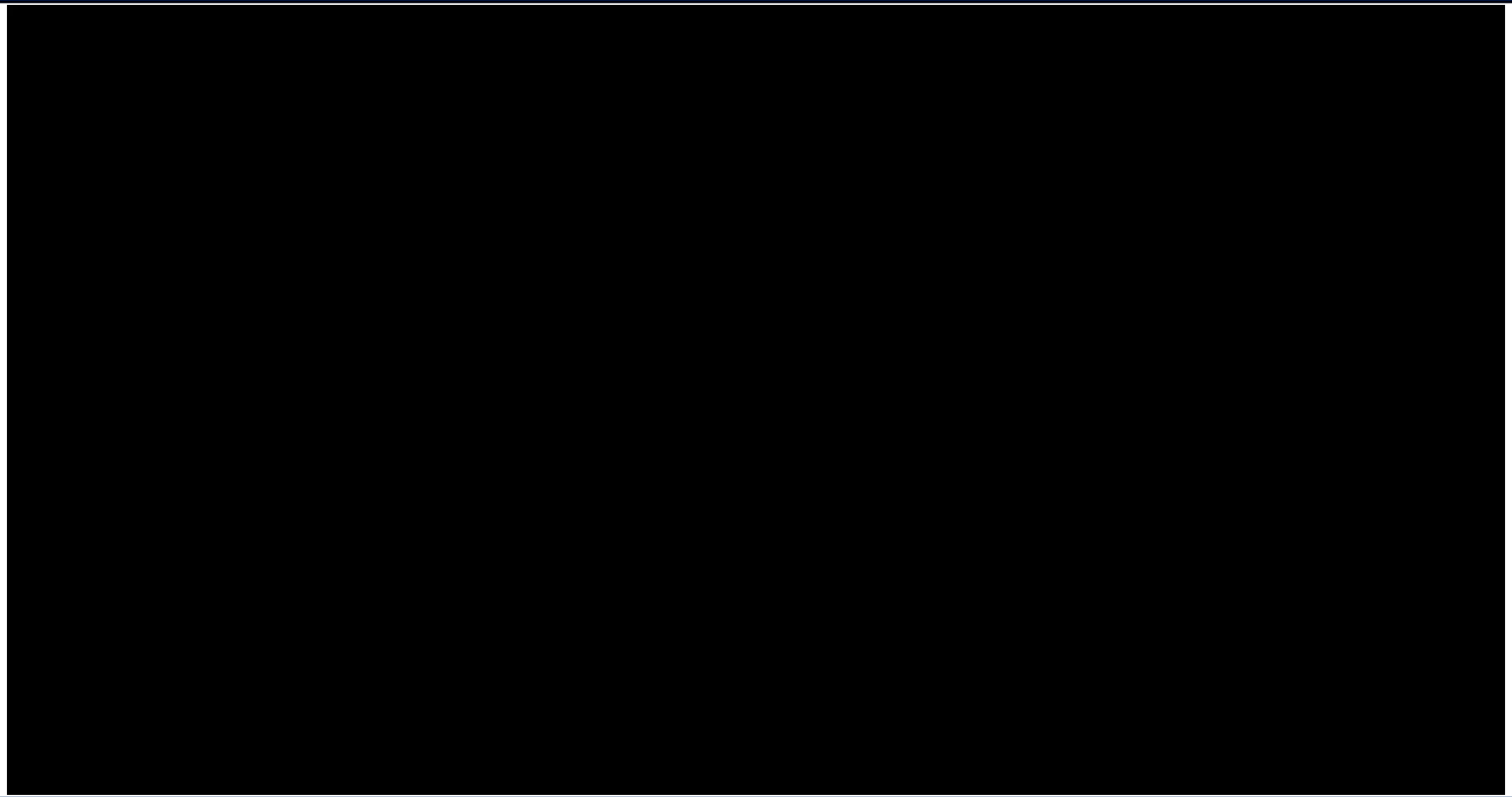
Sanford Underground Research Facility

Lead, South Dakota, USA

LBNF North Cavern

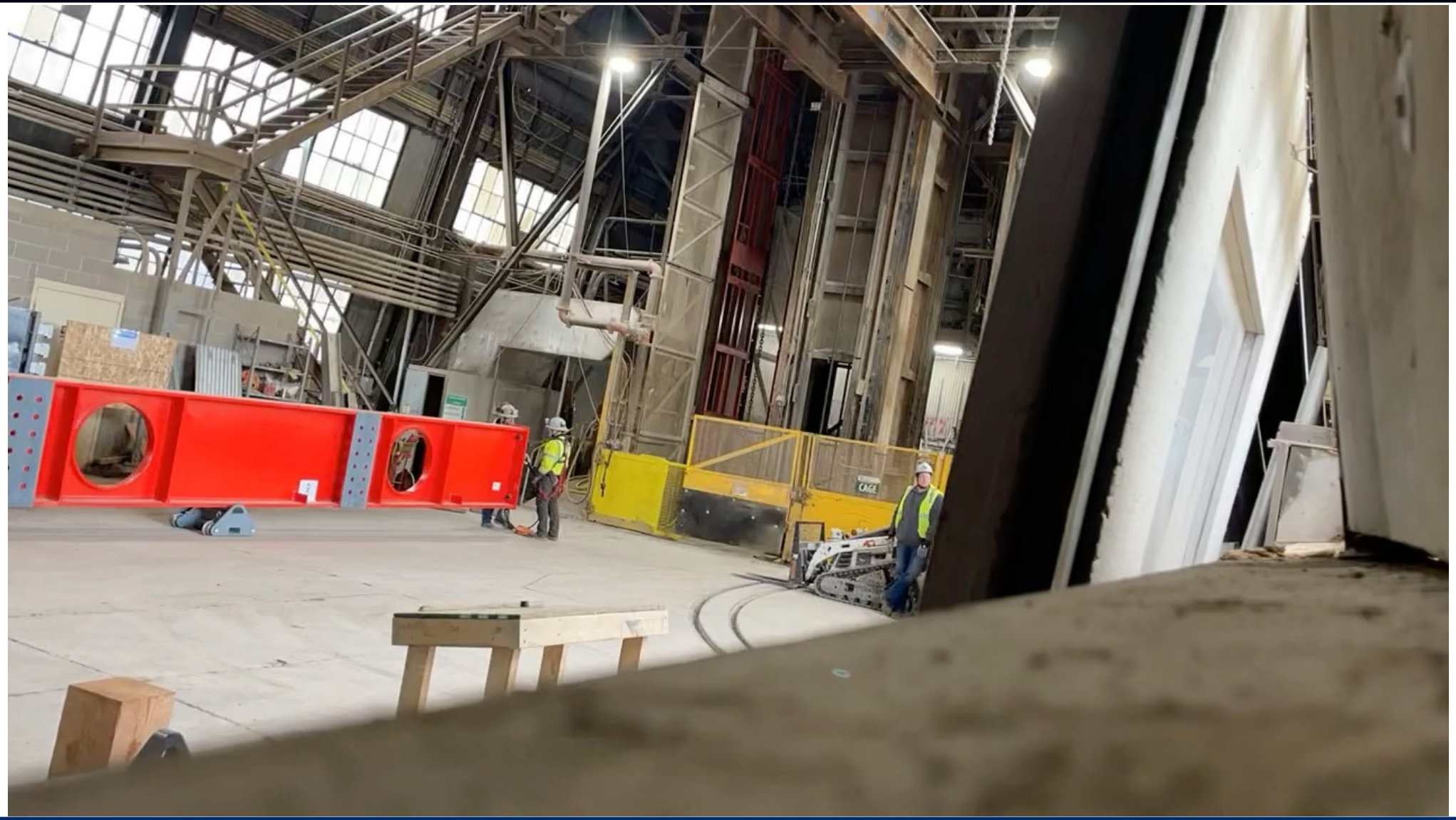
LBNF/DUNE Cryostat Installation Underway

Cryostat beam arrival video: https://vimeo.com/1191695040/12915f8532



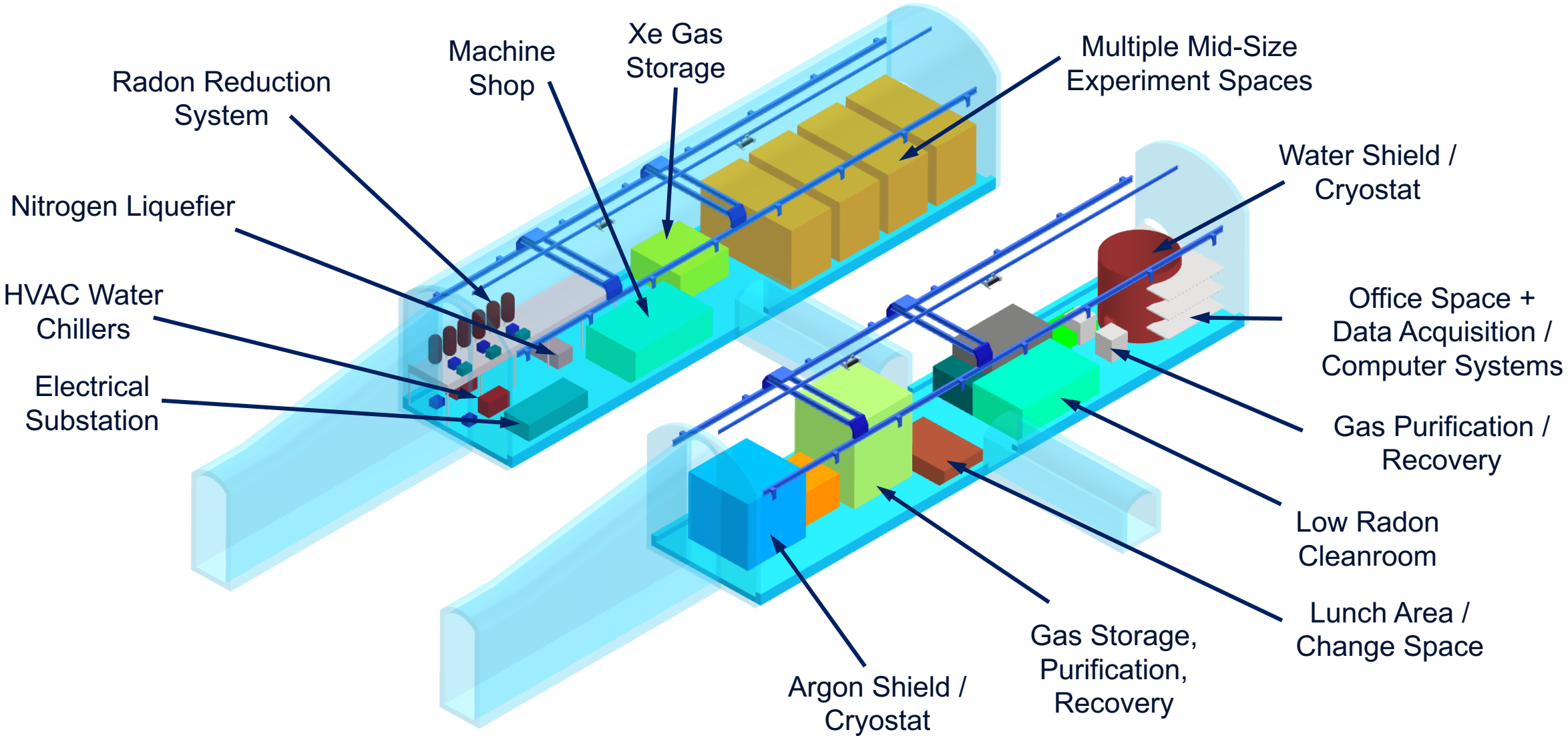
LBNF/DUNE Cryostat Installation Underway

Cryostat beam loading video: https://vimeo.com/1205831226/70989b0ee0



Next-Generation Science at SURF

Conceptual layout (2x 100m caverns), informed by DUSEL PDR, ARGO/XLZD, LZ

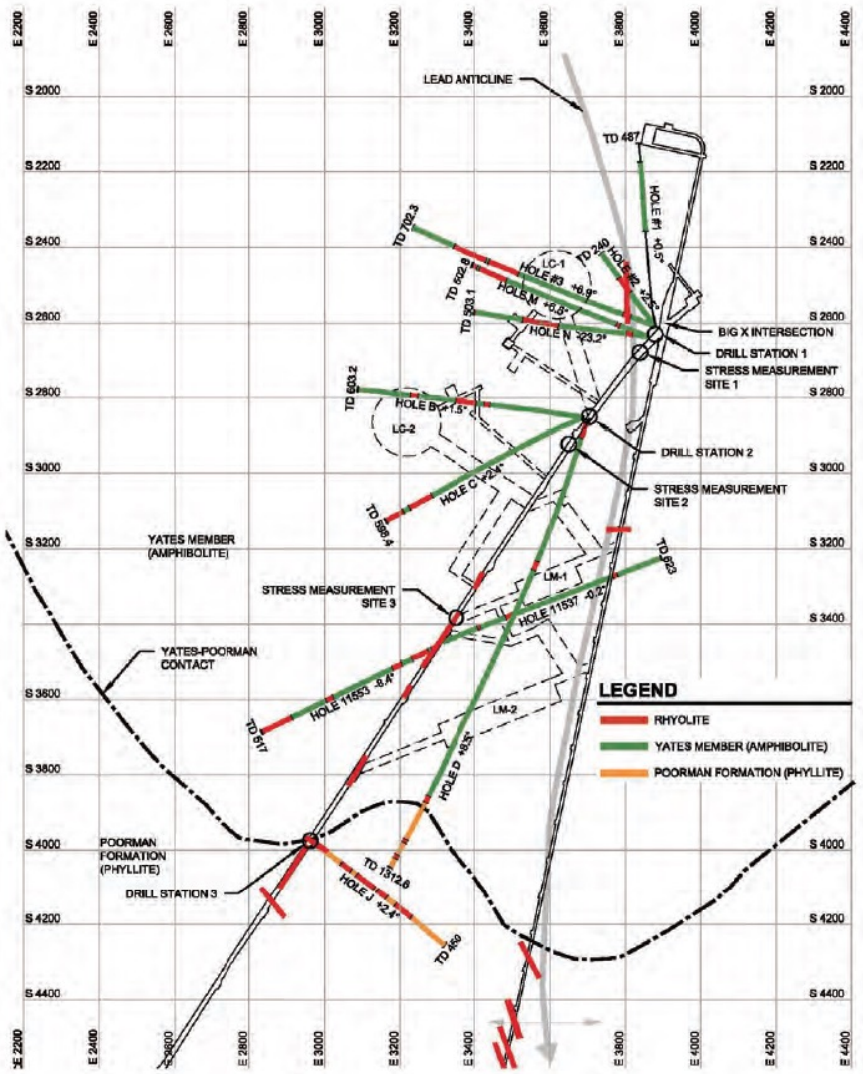


Next-Generation Science at SURF

Several deep options available, alternate geometries possible

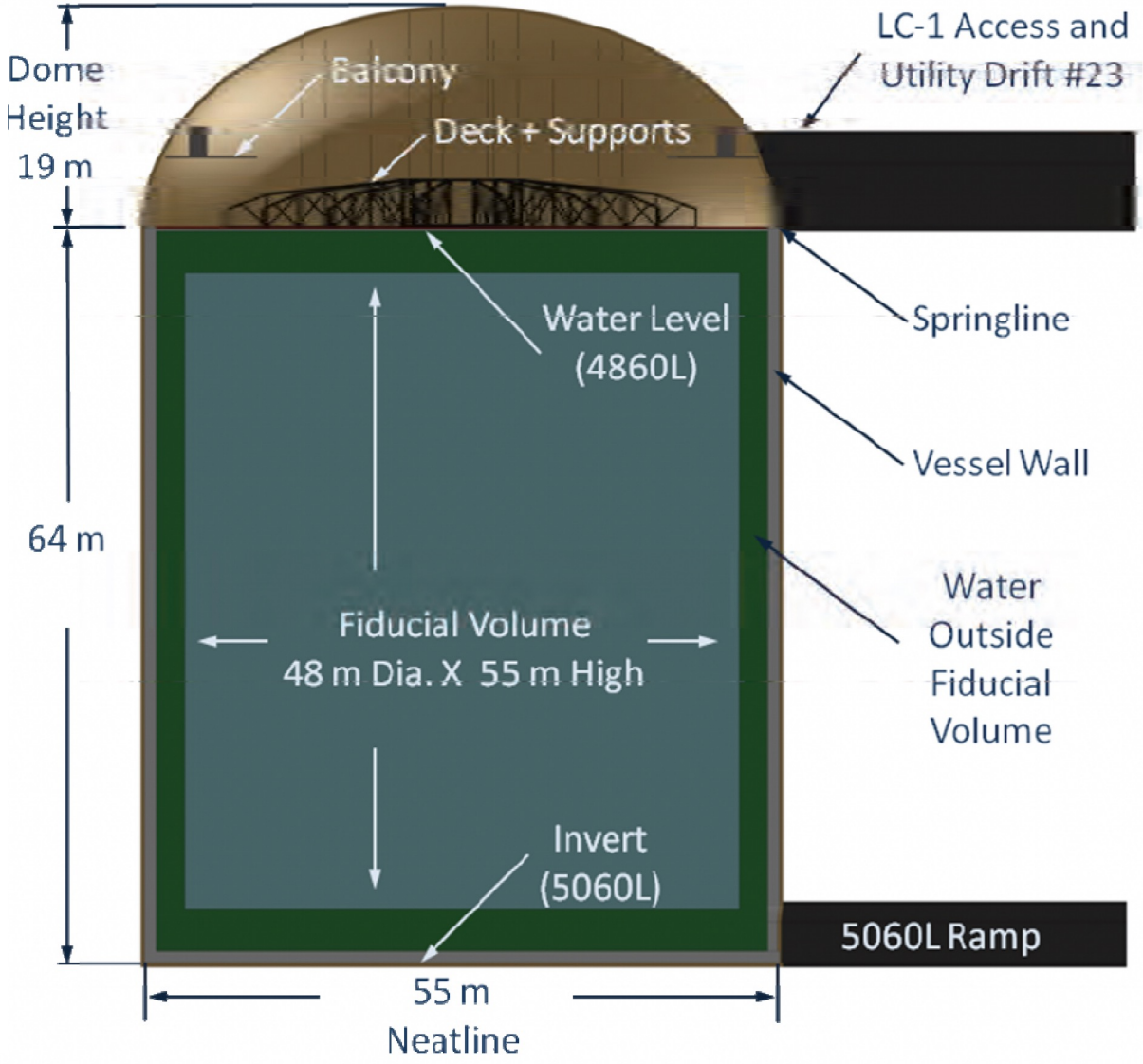
4850L Right Cylinder Studied

LBNE 100 kT Water Cherenkov (see DUSEL PDR: arxiv:1108.0959)



Ventilation

- **Exhaust:** 170,000 m^3/h (via raise to 4700L)
- **Fresh Air:** 30,600 m^3/h via Yates Shaft (1 exchange/hr)



SURF Experiment Implementation & Support

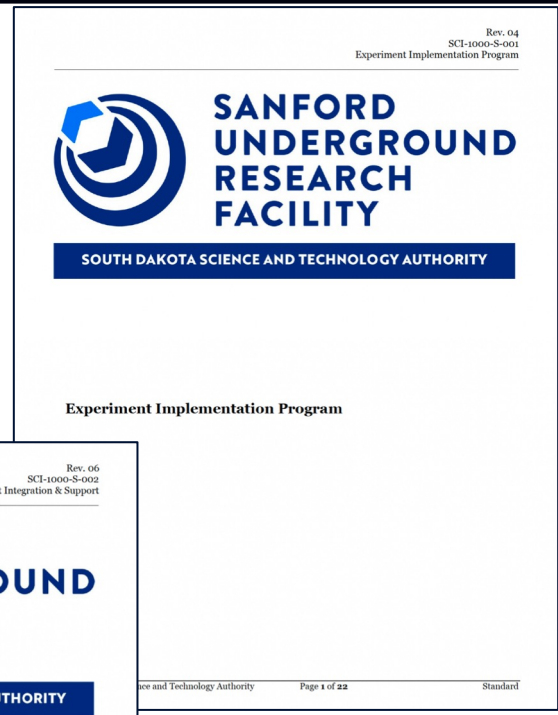
Framework for establishing relationships and expecations with experiments

Experiment Implementation Program

- Integral to the SDSTA institutional mission is advancement of **compelling underground research**, implemented in **effective** and **efficient manner**
- Groups requesting **significant resources** or **significant changes** to facility capacities and/or capabilities may be subject to external review and evaluation
- Several key elements:
  - Experiment Planning Statement
  - User Agreement [space commitment] (references Publications)
  - Access (Request form, risk waiver, insurance)
  - Experiment Decommissioning Statement

Experiment Integration & Support

- In partnership with experiment, SDSTA aims to maintain a robust **organization** with **resources** to promote **safe and successful experiment** operations at SURF (consistent w/ CA baseline support)
- Several key elements:
  - Several specific ESH Standards (incl Work Planning)
  - SURF Applications/Databases (TAP, SARF, etc)
  - Table of responsibilities (SDSTA and Experiment)
  - Perception Survey, Information for Researchers, etc



SURF Experiment Implementation & Support

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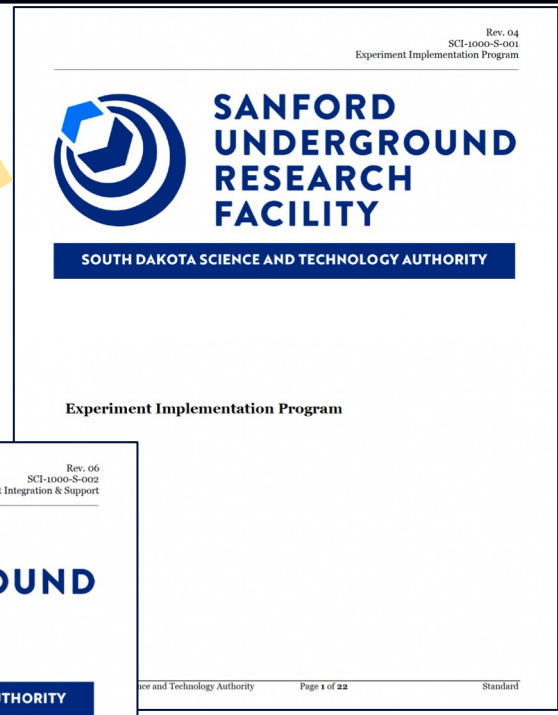
For more details, see CoSSURF 2024, User Association Session: https://indico.sanfordlab.org/event/68/sessions/160/#20240516


Rev. 04
SCI-1000-S-001
Experiment Implementation Program

SANFORD UNDERGROUND RESEARCH FACILITY

SOUTH DAKOTA SCIENCE AND TECHNOLOGY AUTHORITY

Experiment Implementation Program


Rev. 06
SCI-1000-S-002
Experiment Integration & Support

SANFORD UNDERGROUND RESEARCH FACILITY

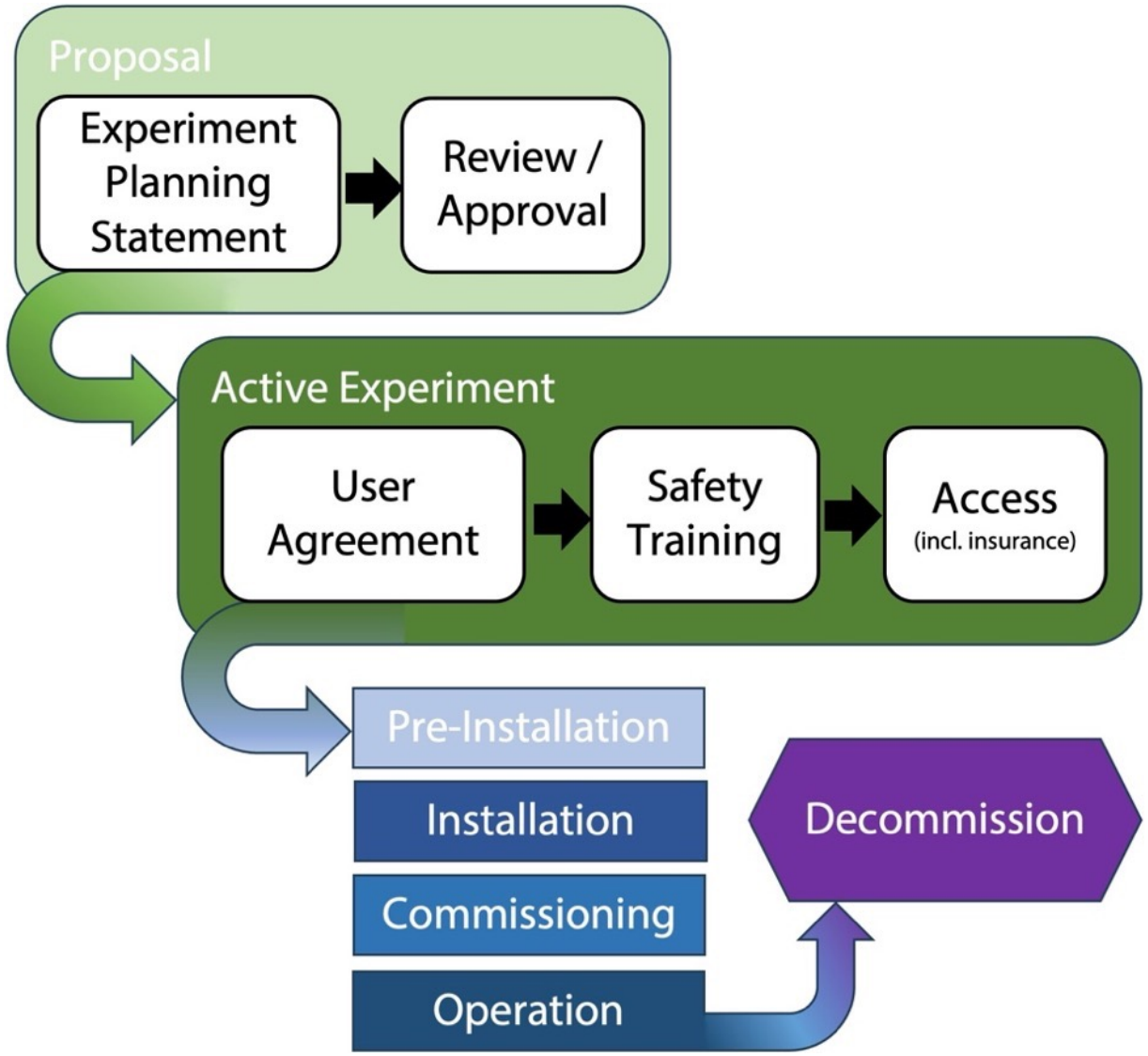
SOUTH DAKOTA SCIENCE AND TECHNOLOGY AUTHORITY

Experiment Integration & Support

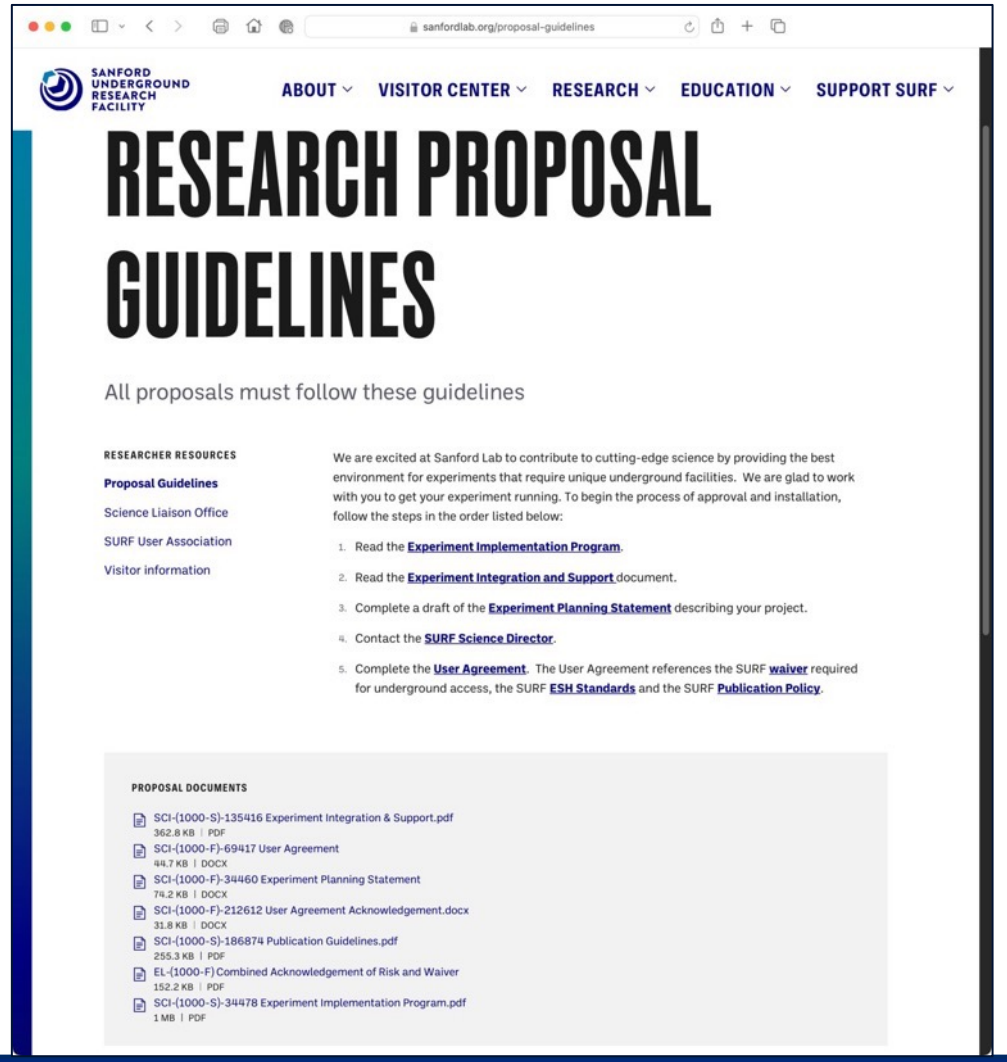
South Dakota Science and Technology Authority Page 1 of 9 Standard

SURF Experiment Implementation Program

Identify interfaces and hazards within approval framework



https://sanfordlab.org/proposal-guidelines



SURF Call for Letters of Interest

Ensuring SURF used to its fullest scientific potential

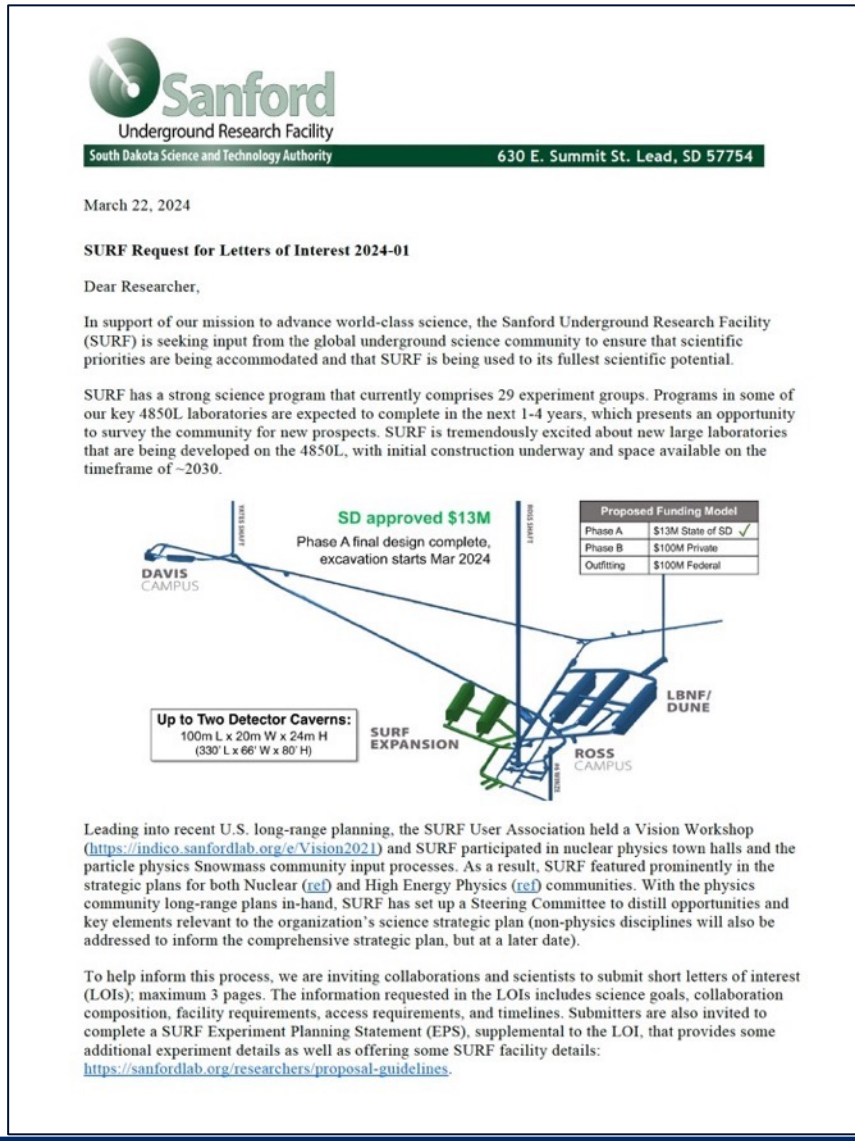
Significance of 2024 LOI Call:

- SURF's first formal call to UG science community since 2005!
- Initial calls selected strong physics anchors for Davis Campus: MJD and LUX (which led to current LZ)
- 2024 call is opportunity for SURF to advance scientific strategic plan goals, ensure strong science program continues

Overview of 2024 LOI Call:

- Open to all disciplines: Physics, Geology, Biology, Engineering
- Identifies specific existing space on 4850L and 4100L, other undeveloped areas may be available now
- 4850L Expansion started Mar 17, 2024, space available ~2030 (nominally two detector caverns: 100 m L x 20 m W x 24 m H, LOIs and subsequent discussions will inform final design)
- LOIs reviewed by SURF Science Program Advisory Committee
- Nominal deadline May 17, 2024, **LOIs still being accepted**

15 responses received, initial SPAC review complete



Sanford
Underground Research Facility
South Dakota Science and Technology Authority 630 E. Summit St. Lead, SD 57754

March 22, 2024

SURF Request for Letters of Interest 2024-01

Dear Researcher,

In support of our mission to advance world-class science, the Sanford Underground Research Facility (SURF) is seeking input from the global underground science community to ensure that scientific priorities are being accommodated and that SURF is being used to its fullest scientific potential.

SURF has a strong science program that currently comprises 29 experiment groups. Programs in some of our key 4850L laboratories are expected to complete in the next 1-4 years, which presents an opportunity to survey the community for new prospects. SURF is tremendously excited about new large laboratories that are being developed on the 4850L, with initial construction underway and space available on the timeframe of ~2030.

Leading into recent U.S. long-range planning, the SURF User Association held a Vision Workshop (https://indico.sanfordlab.org/e/Vision2021) and SURF participated in nuclear physics town halls and the particle physics Snowmass community input processes. As a result, SURF featured prominently in the strategic plans for both Nuclear (ref) and High Energy Physics (ref) communities. With the physics community long-range plans in-hand, SURF has set up a Steering Committee to distill opportunities and key elements relevant to the organization's science strategic plan (non-physics disciplines will also be addressed to inform the comprehensive strategic plan, but at a later date).

To help inform this process, we are inviting collaborations and scientists to submit short letters of interest (LOIs); maximum 3 pages. The information requested in the LOIs includes science goals, collaboration composition, facility requirements, access requirements, and timelines. Submitters are also invited to complete a SURF Experiment Planning Statement (EPS), supplemental to the LOI, that provides some additional experiment details as well as offering some SURF facility details: https://sanfordlab.org/researchers/proposal-guidelines.

SURF Experiment Implementation & Support

Framework for establishing relationships and expecations with experiments

Science Program Advisory Committee (SPAC)

https://sanfordlab.org/science-program-advisory-committee

- SPAC consists of up to **14 members** across scientific disciplines, incl senior + strong mid-career individuals, 3-year terms (extendable)

Purpose

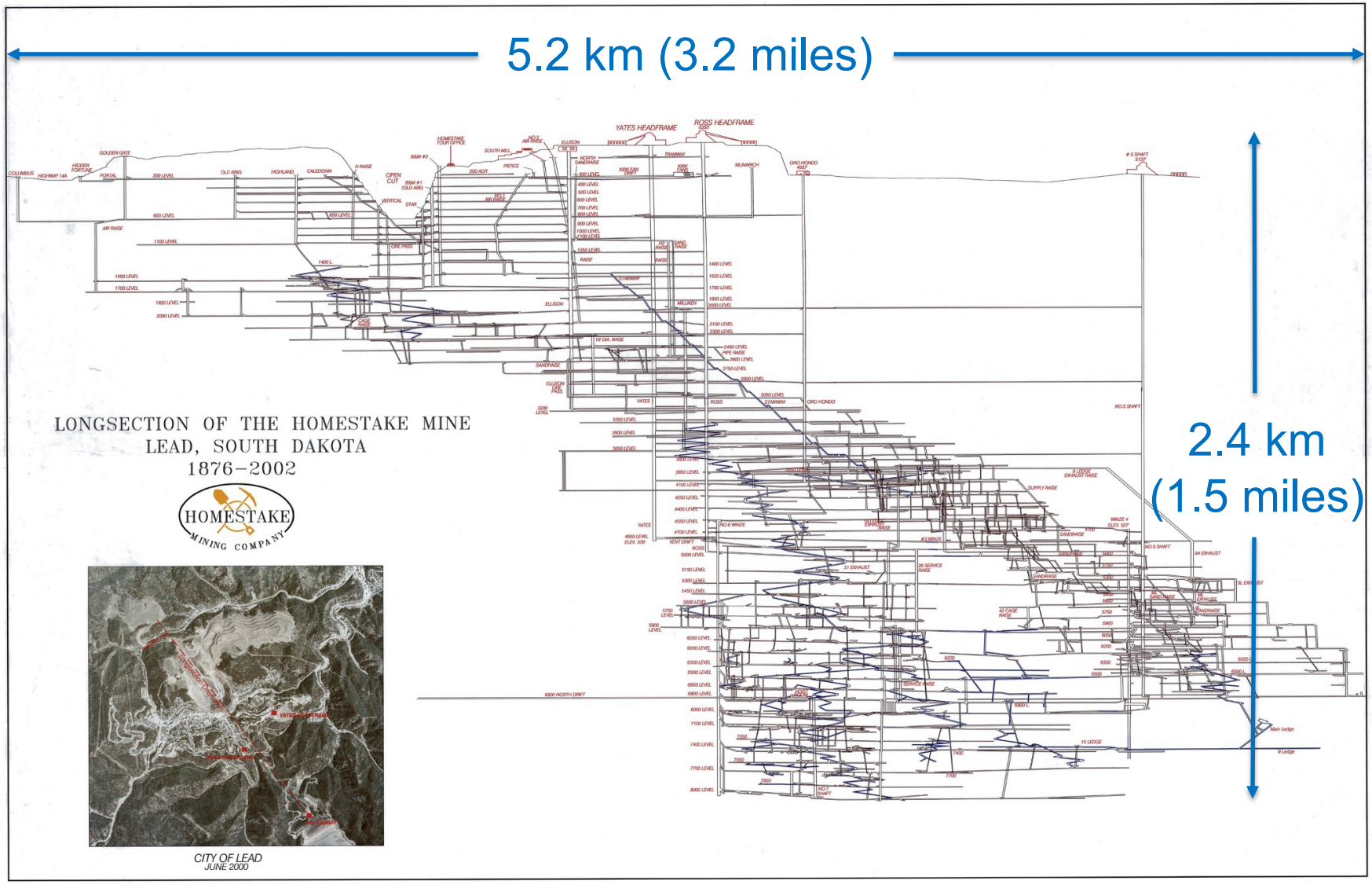
- **Science Program:** Provide guidance on overall SURF scientific program (incl current/proposed expts); peer review per DOE User Facility (future)
- **Science Support:** Advise on SURF experiment implementation program and organizational capacity to support experiments
- **Science Facilities:** Advise on capability and capacity of the SURF facility necessary to support the SURF scientific program

Experiment Review

- Expt proposal presentations, review of SURF 2024 Letters of Interest
- SPAC input on competing proposals for limited space at SURF using SDSTA-developed criteria:
  - Scientific merit and/or application impact; compatibility with SURF science program
  - Need for unique environment and characteristics offered at SURF
  - Technical, organizational, and funding readiness; environmental, safety, and operational risks

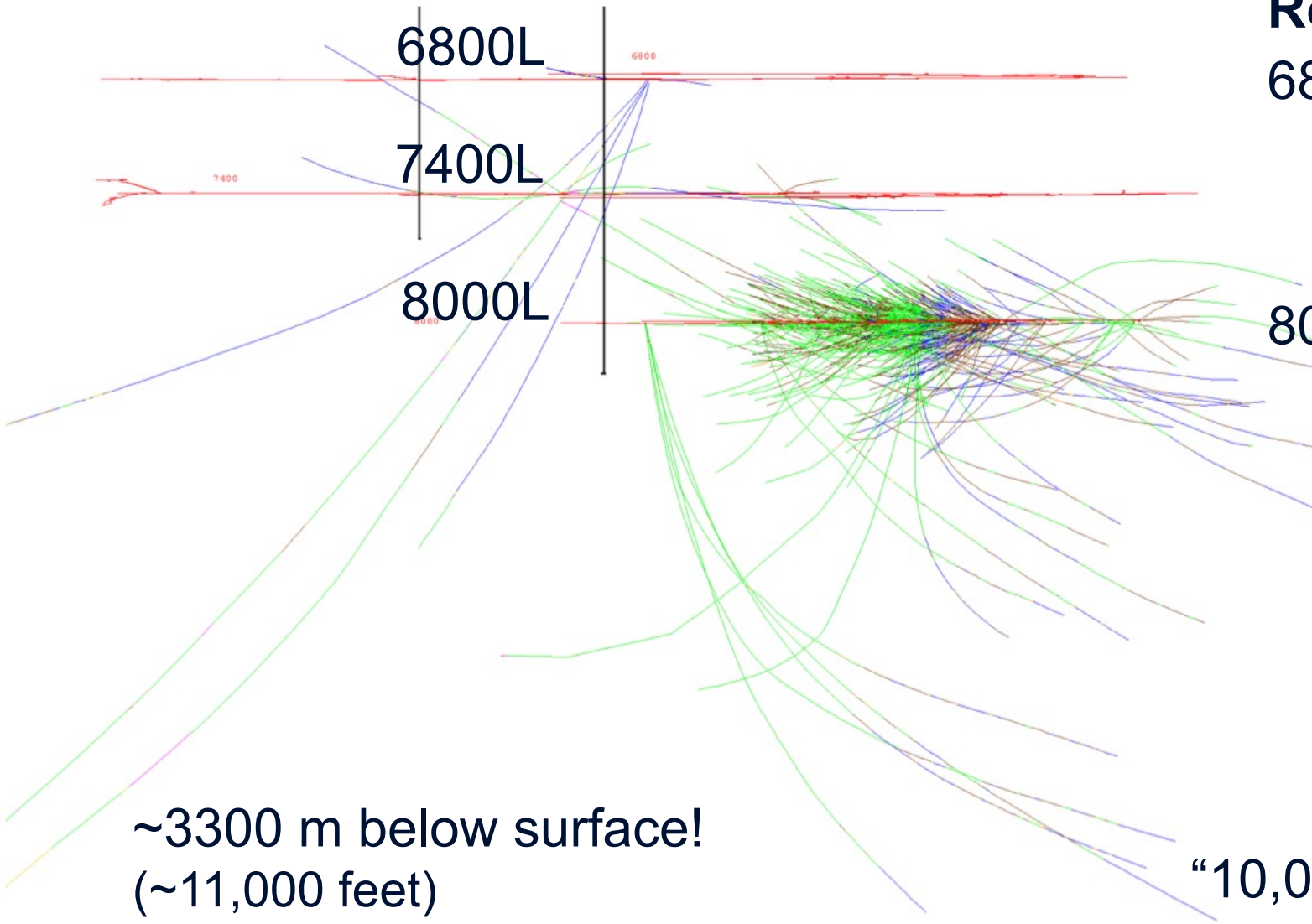
SURF Underground Lab Geography

Significant underground footprint for science



SURF Underground Lab Geography

Future possibilities to access existing deep holes?



Rock temperature

6800L: ~48 C / 119 F

8000L: ~56 C / 133 F

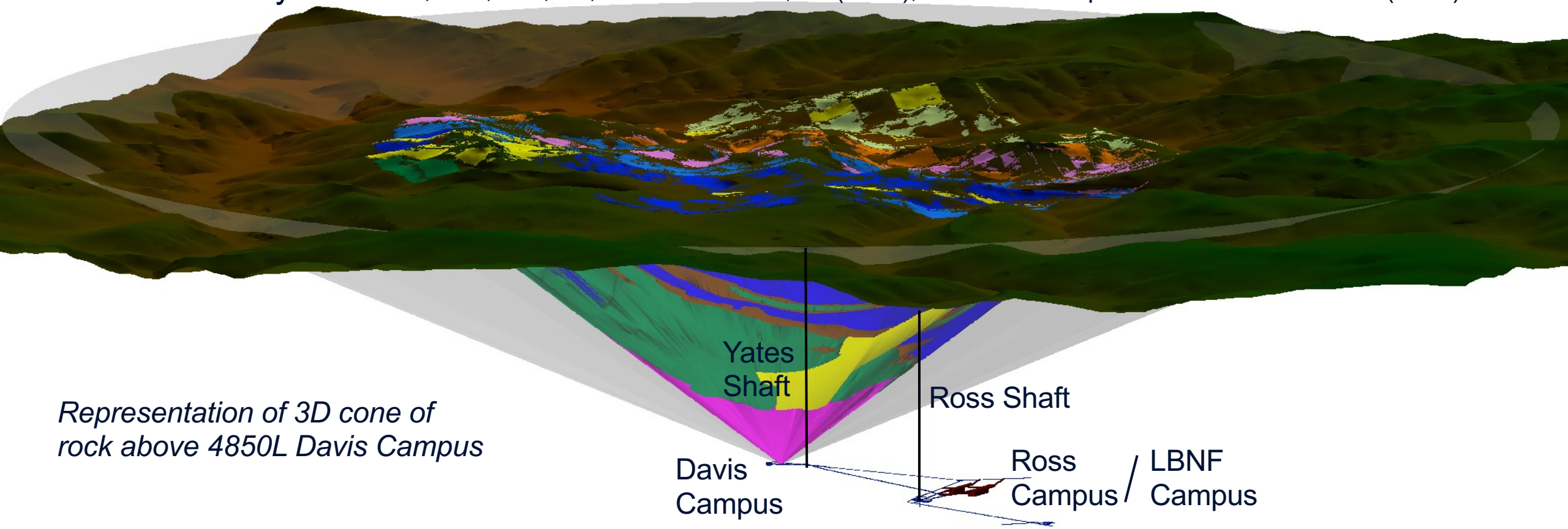
~3300 m below surface!
(~11,000 feet)

“10,000L”: ~74 C / 165 F

SURF Science Support – Geology Model

Site well understood, including drill core & logs

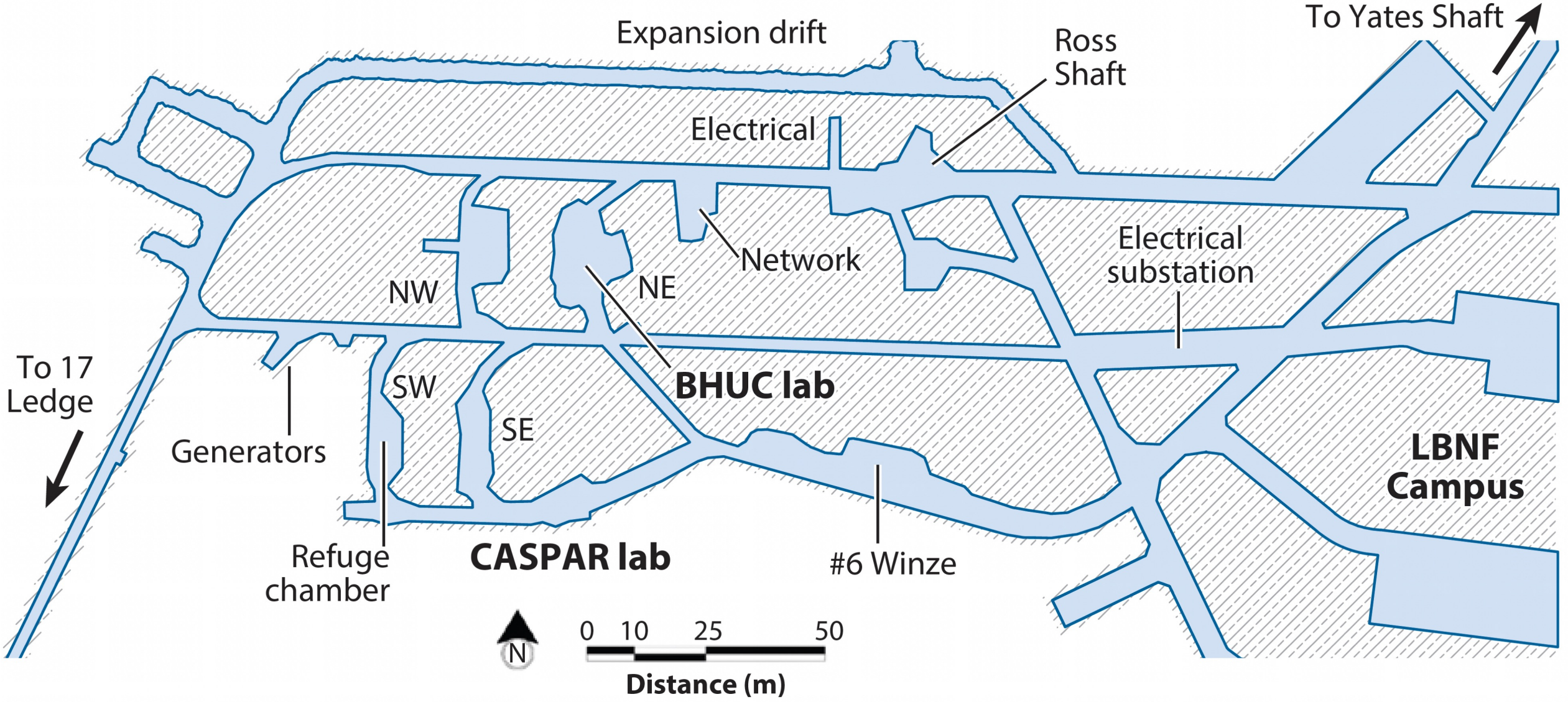
- 3D model of 12 rock formations (including rhyolite/phonolite intrusives)
- Detailed surface topology: Aerial survey for site performed 2011 (1' contours)
- Global coordinates: Survey performed summer 2016 (incl world's longest plumb bob)
- Rock density data: KH, TCT, WR, JH, *SD Acad Sci* **93**, 33 (2014); JH *ARNPS* in press - arXiv:2603.06504 (2026)



Representation of 3D cone of rock above 4850L Davis Campus

SURF 4850L Ross Campus

2,653 m² (Total) / 920 m² (Science)



SURF 4850L Ross Campus

Examples of laboratory space

2010-2017

Copper Electroforming

2015-2020, resumed 2025

Former MJD Electroforming:
Area = 228 m^2
(Cleanroom removed,
current construction office)

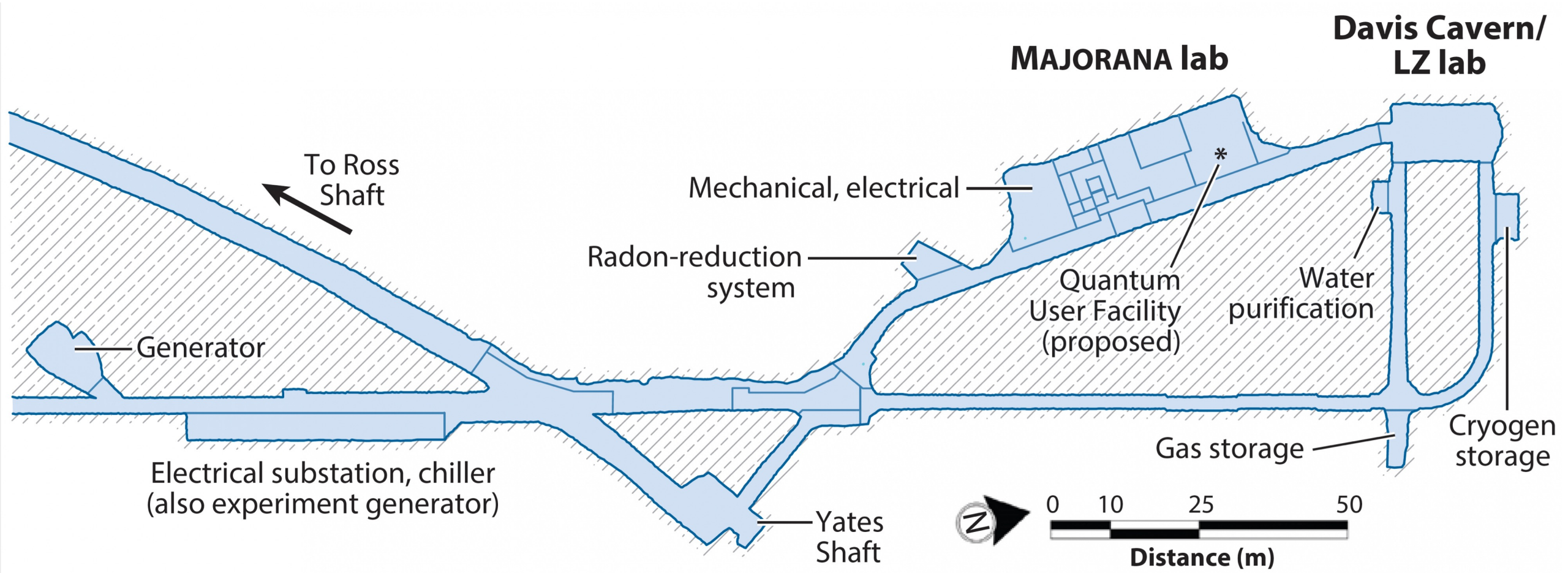
2015-2021, resumed 2025

BHUC Cleanroom:
Cavern Area = 268 m^2,
Cleanroom = 12.1 m × 6.1 m ×
2.4 m (H)

CASPAR Hall:
Area = 236 m^2,
30 m × 3 m (min) × 2.8 m (H)

SURF 4850L Davis Campus

3,017 m² (Total) / 1,018 m² (Science)



SURF 4850L Davis Campus

Examples of laboratory space

Detector Room (MJD):

Area =140 m^2, 11 m × 9.8-12.8 m × 2.7 m (H)

(raised section: 5.9 m × 5.8 m × 3.2 m (H))

Davis Cavern, Lower (LZ):

Area =142 m^2, 13.7 m × 9.1 m × 6.4 m (H)

(incl tank: 7.6 m dia. × 6.4 m H). Total Cavern H = 10.8 m

SURF Designated APS Historical Site

Announcement Sep 2020, Dedication May 2022

www.interactions.org/press-release/aps-designates-sanford-lab-morgan

INTERACTIONS.ORG
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A communication resource from the **world's particle physics laboratories.**

APS designates Sanford Lab, Morgan State University as historic physics sites

14 September 2020 - Sanford Underground Research Facility

The pioneering neutrino research done by Ray Davis over nearly three decades forever changed our understanding of the Standard Model of Physics

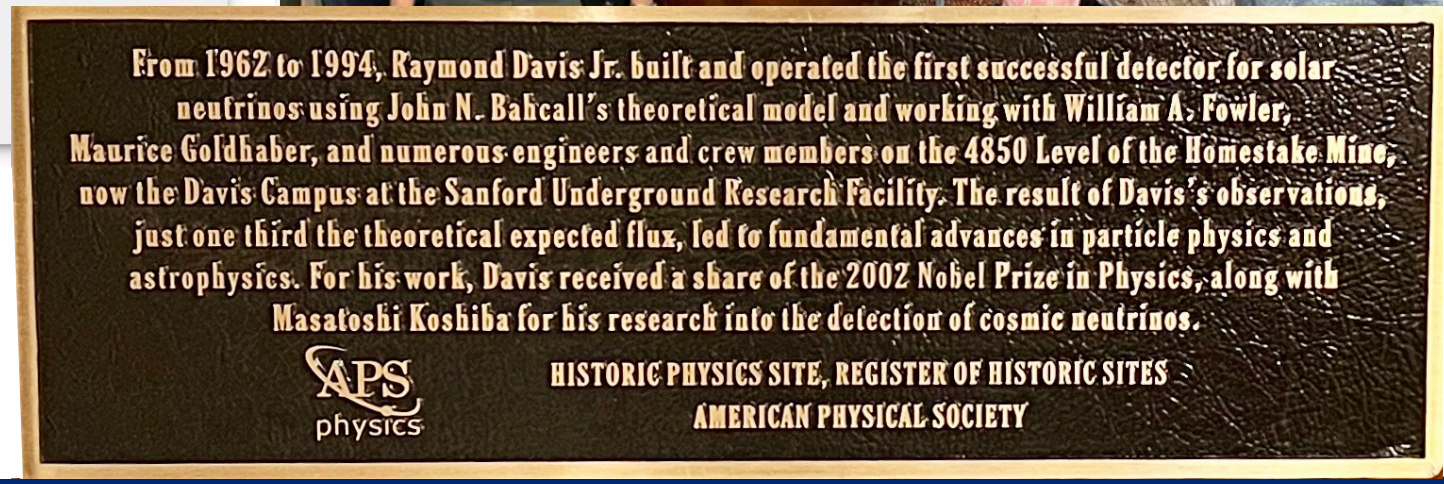
The American Physical Society (APS) today announced it has designated SURF one of two Historic Sites in physics. The other, Morgan State University in Baltimore, Maryland, is recognized as the birthplace of the National Society of Black Physicists (NSBP).

DATE ISSUED:
September 14th, 2020

SOURCE:
Sanford Underground Research Facility

CONTENT:
Press Release

CONTACT:
Constance Walter
Communications Director
cwalter@sanfordlab.org



Sanford Lab Homestake Visitor Center

Acquired January 2022. Greatly expands public outreach opportunities.

Čhaŋgléška Wakȟáŋ, the Ethnobotanical Garden at SURF

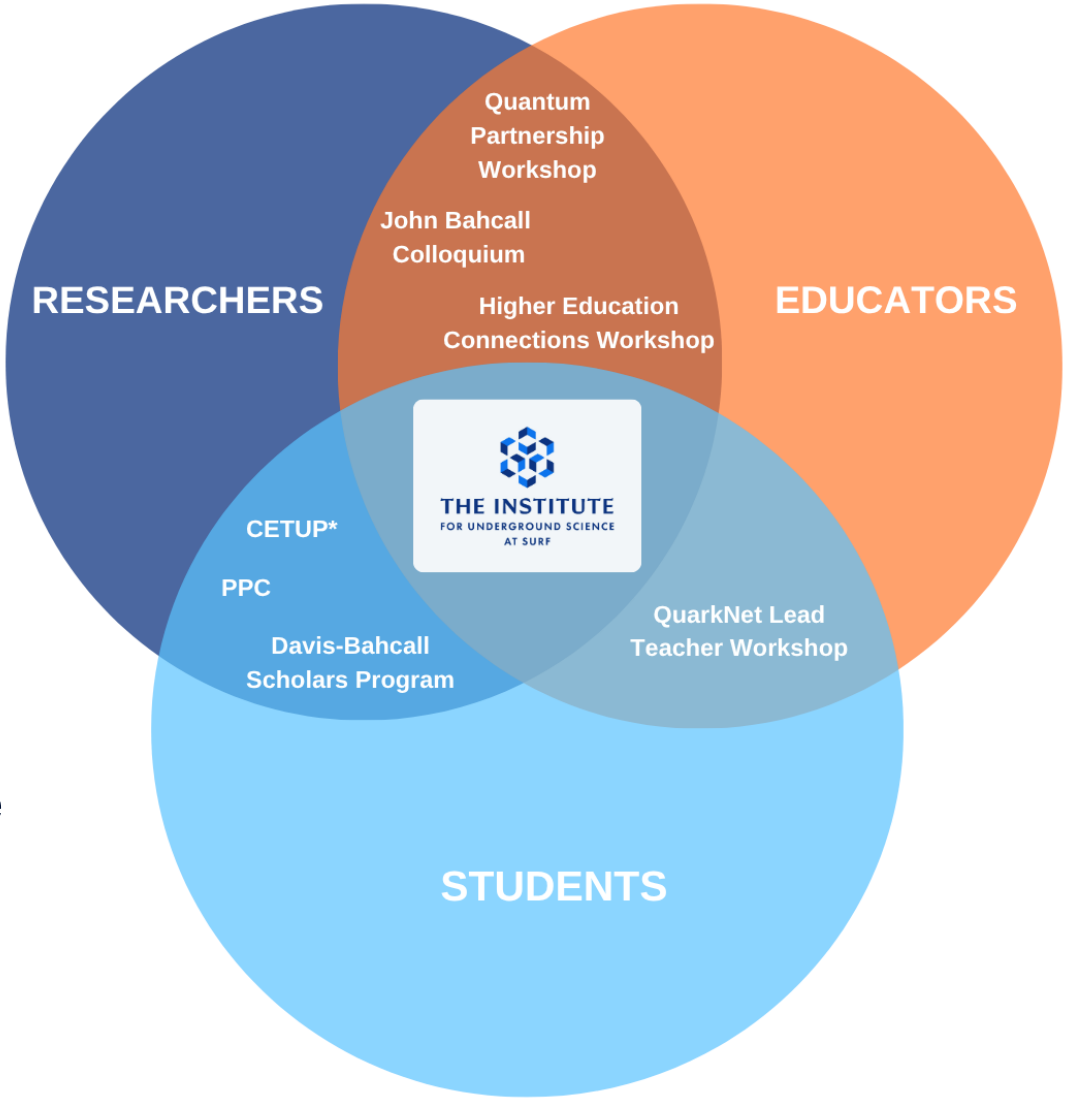
Public tours started summer 2024

Institute for Underground Science at SURF

Advancing program vision using existing resources to build constituency

Vision

Create a dynamic intersection of KNOWLEDGE, PEOPLE, and PLACE, dedicated to building an unparalleled intellectual community and serving as a world-leading center for underground science and technology



Priorities

- Build Intellectual Community
- Expand Educational Opportunities
- Foster Interdisciplinary Collaboration
- Establish Passionate Partnerships
- Construct a Path for Future Generations

The Institute for Underground Science at SURF

Goal: The Institute for Underground Science at SURF constructed by Sep 2035

World-leading center for

- **Underground science collaboration and intellectual community**
- **K-12 and public education & outreach programs**

THE INSTITUTE
FOR UNDERGROUND SCIENCE
AT SURF