

LBNF/DUNE Update Public Meeting

Sanford Lab Update

Mike Headley

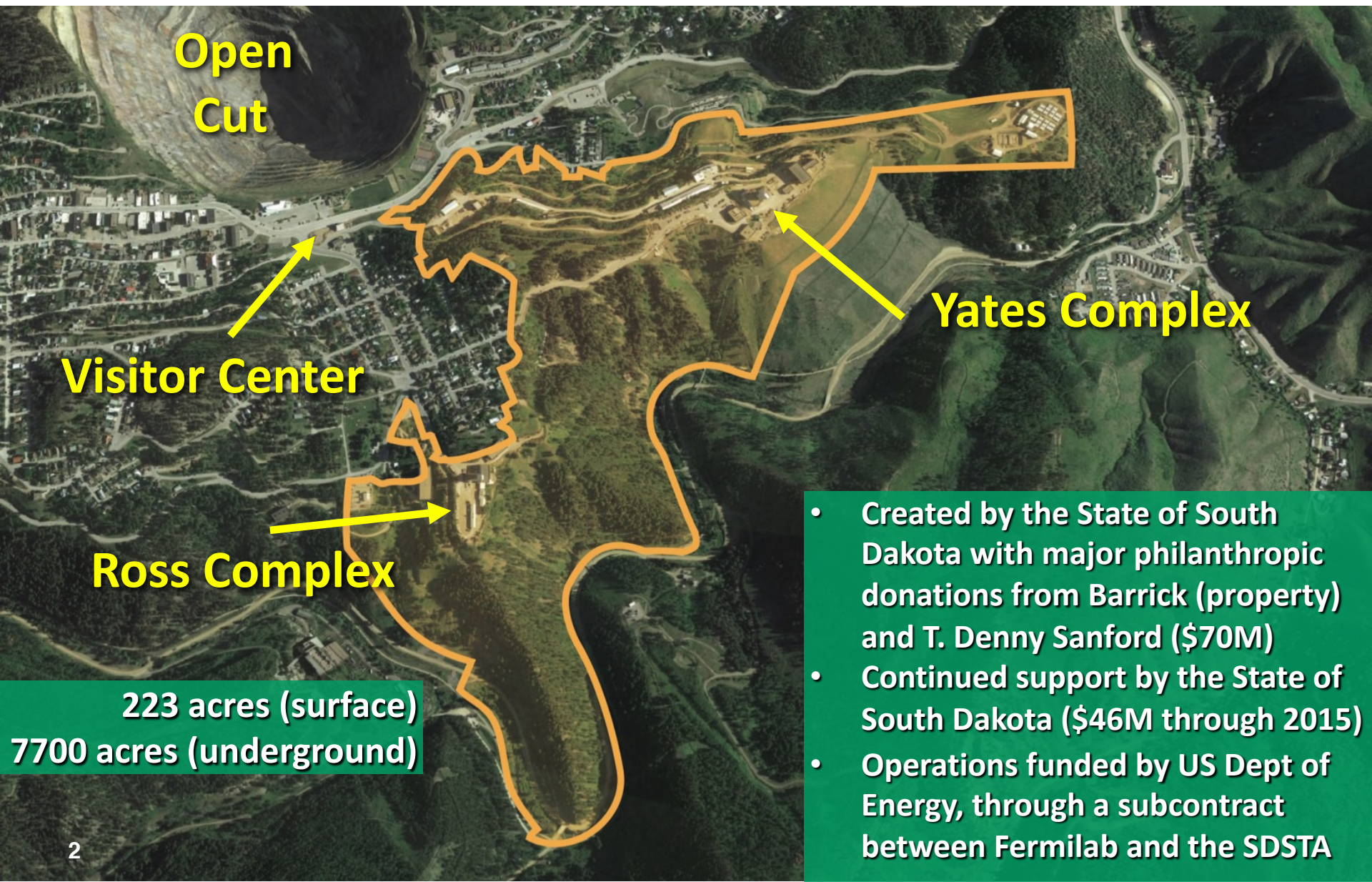
SDSTA Executive Director and Sanford Lab Director

24 October 2017



Sanford Underground Research Facility

Recently added Ellison and Tramway Tracts to Surface Footprint

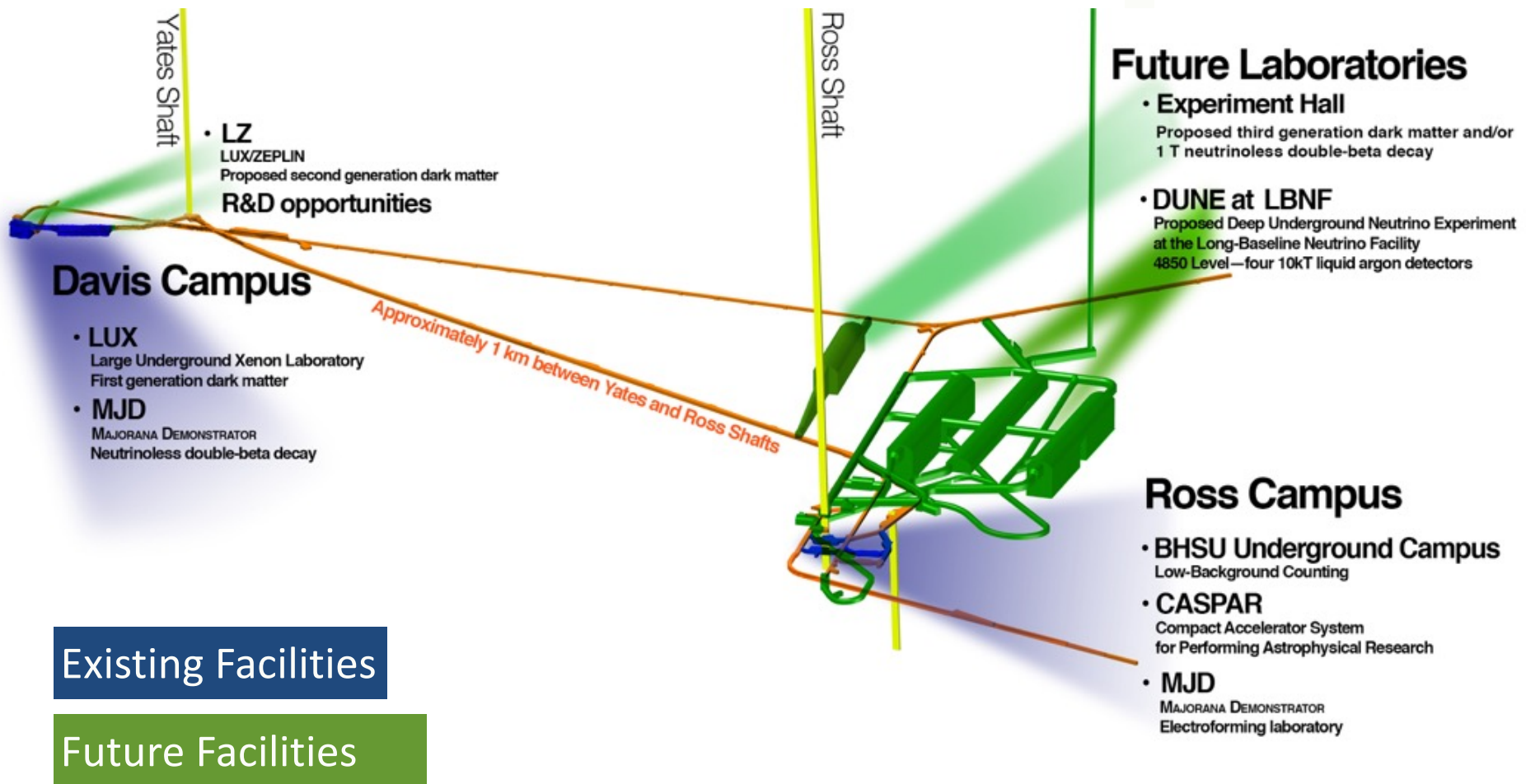


223 acres (surface)

7700 acres (underground)

- Created by the State of South Dakota with major philanthropic donations from Barrick (property) and T. Denny Sanford (\$70M)
- Continued support by the State of South Dakota (\$46M through 2015)
- Operations funded by US Dept of Energy, through a subcontract between Fermilab and the SDSTA

4850L Science Facilities



Current Underground Science Program Physics (4850L Davis Campus)

MAJORANA DEMONSTRATOR:

- Studying the neutrino's mass and the matter/antimatter imbalance in the universe. Proving techniques for tonne-scale experiment.
- **Status:** 2 cryostats with 44 detectors (40kg Ge) assembled. Physics data collection is underway.



Large Underground Xenon (LUX):

- Direct detection of dark matter.
- **Status:** Data taking completed May 2016. Decommissioning completed. Detector on display at Visitor Center. Remains one of the most sensitive DM experiments in world.

LUX Detector at Visitor Center



Current Underground Science Program Physics (4850L Ross Campus)

Compact Accelerator System for Performing Astrophysical Research (CASPAR):

- Studying nuclear reactions in stars resulting in the generation of elements heavier than Fe.
- **Status:** Notre Dame and SDSM&T faculty and students leading assembly and commissioning process. “First beam” achieved in July 2017.

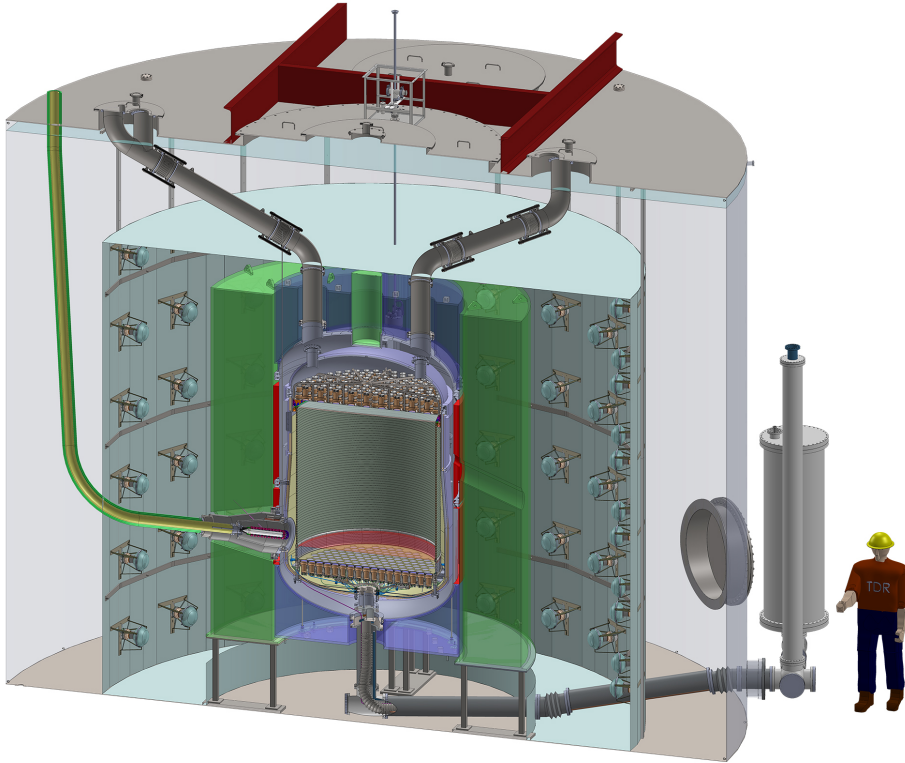


Black Hills State University (BHSU) Underground Campus:

- Low background counting to characterize radiopurity of detector components.
- **Status:** Installed 4 counters and counting underway for LZ photo multiplier tubes. Providing opportunities for undergraduates in physics and other science disciplines.

LUX-ZEPLIN (LZ) Dark Matter Experiment

LZ will be located in the Davis Cavern on the 4850 foot level



LZ Detector and Shielding

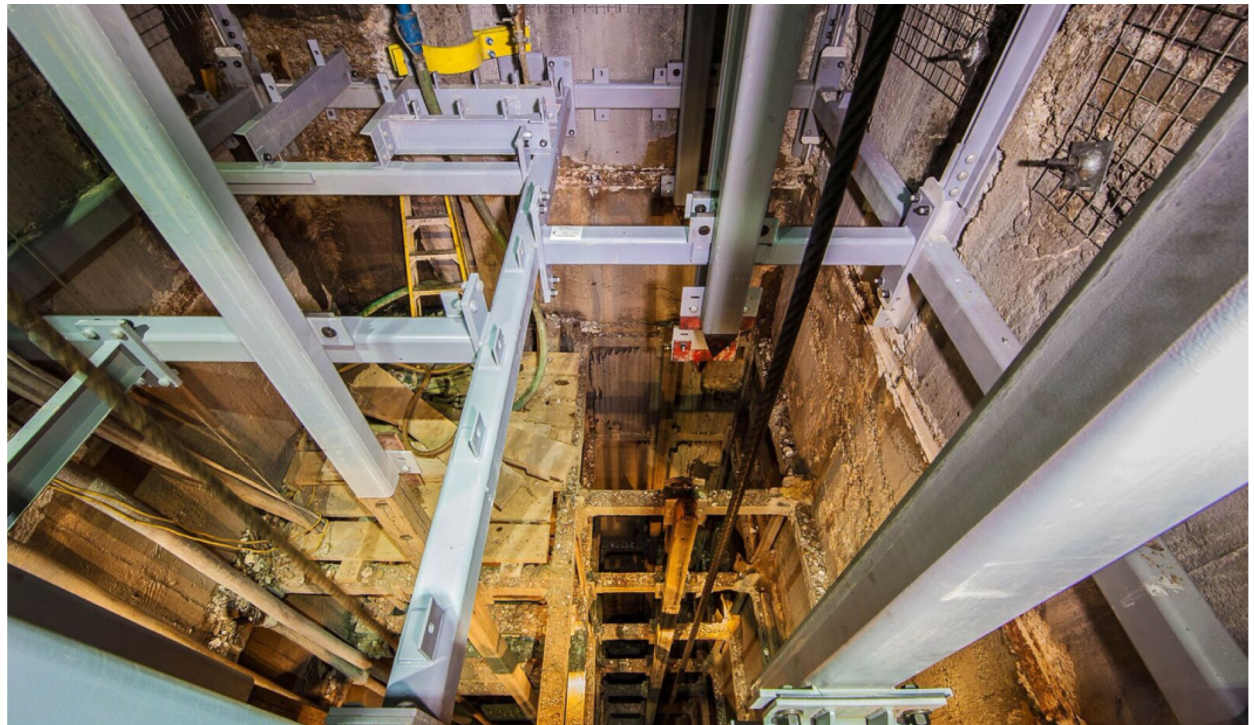
- LZ collaboration includes ~220 members at 36 institutions.
- 10,000 kg Xe (3,500 gallons). 30x larger, 100x more sensitive than LUX.
- Using existing Surface Laboratory and 4850L Davis Campus facilities.
- Project has been “baselined” by DOE.
- Surface facility upgrades completed.
- Underground work to start Dec 2017.
- Experiment installation in 2018-19.
- Operate for 5 years starting ~2020.

Ross Shaft Refurbishment Update

4,980 feet down from surface (96% complete overall)

Surface		Schedule
Tramway	Completed	
300 L		
800 L		
1250 L		Q1 CY2014
1400 L		
1550 L		
1700 L		
1850 L		
2000 L		
2150 L		
2300 L		Q1 CY2015
2450 L		
2600 L		
2750 L		
2900 L		
3050 L		
3200 L		
3350 L		Q1 CY2016
3500 L		
3650 L		
3800 L		
3950 L		
4100 L		
4250 L		
4400 L		Q1 CY2017
4550 L		
4700 L		
4850 L		
5000 L		Q2 CY2018

- Ross Shaft constructed in 1930s. Rehabilitation initiated in August 2012 to modernize the shaft for LBNF construction.
- SDSTA self-performing the project. Includes removal of old shaft steel and installation of ~6M pounds of new steel.
- Reached the 4850L with steel installation on Oct 12th. Shaft steel installation is set to complete in May 2018.



Sanford Lab Educational Opportunities for K-12 Students

School Presentations

Elementary

- A Day in the Life...
- Particle Accelerators

Middle School

- Career Opportunities
- Dark Matter

High School

- Neutrinos

Curriculum Units

Elementary

- Exploring Unseen
- Force Be With You

Middle School

- Seismic Science
- Search Dark Matter

High School

- Perplexing Puddles
- Star-Stuff

In Development

- There & Back Again
- Waterworks

Field Trips

Opportunities to visit the lab are limited. School visits available:

- Fall
- Spring

E&O Student Impact - Numbers in Review

- 2016-2017 School Year
 - Students at field trips - 602
 - Students at classroom talks - 8513
 - Students using curriculum units - 3408
- Summer 2017
 - Teachers at summer workshops - 54
- Over the last two years
 - Students at field trips - 1,265
 - Students at classroom talks - 17,091
 - Students using curriculum units - 4,326
 - Teachers at summer workshops - 112



Economic Impacts in South Dakota

Through September 2017 (end of U.S. Federal FY2017)

Spending in South Dakota to date	\$185 million
FY18 total budget (all sources & activities)	\$22.9 million
FY18 SURF Operations budget (DOE funds)	\$14.6 million
Annual payroll budget in SD (FY18)	\$13.3 million
Annual non-payroll budget in SD (FY18)	\$6.7 million
Jobs in South Dakota	158
Active research groups	23
Research groups with SD members	18



Total Spending in South Dakota through Sept 30, 2017

Grouped by 3-digit zip code region.

