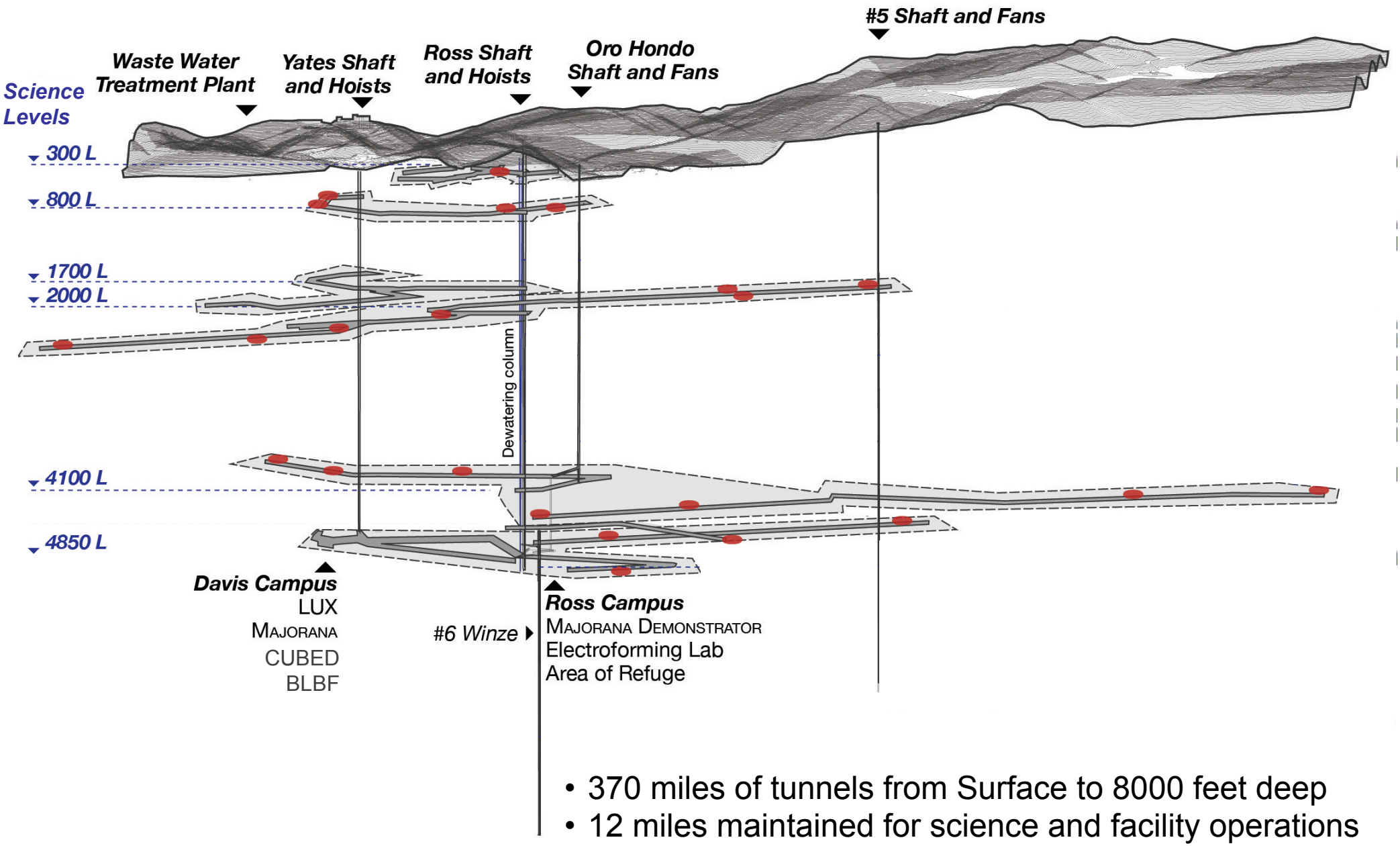
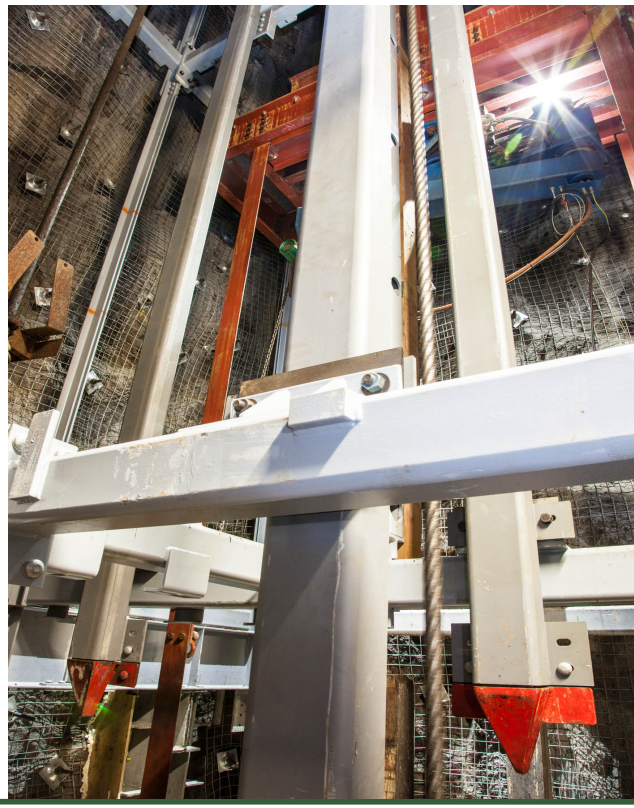
1. Underground Lab Geography



- 370 miles of tunnels from Surface to 8000 feet deep
- 12 miles maintained for science and facility operations

2. Overall Status

- Facility
  - Ross Shaft Rehab
    - Strip and re-equip underway, new steel installed to 1615’
    - Expect completion Summer 2017 to meet LBNE schedule
  - Yates Shaft
    - Provides main access, ongoing maintenance
  - Dewatering
    - Current level is ~5750 feet below surface
    - Strategy is to hold water level ~1000’ below 4850L (cost, safety)
  - Laboratories
    - Multiple groups active at Surface Lab, Ross and Davis Campuses
    - Expansion plans for the Ross Campus
- Science
  - LUX and MAJORANA: LUX initial results, preparing for ~300 live-day run; MJD prototype commissioned, main Cu+Pb shield complete
  - CUBED and Berkeley Low-background Counters: Crystals, shielding installed, eventually move to Ross Campus to accommodate LZ
  - CASPAR: 60% Ross Campus design received, safety review Feb 2014
  - LZ: Submitted for funding for Davis Campus, down-select process
  - LBNE: NEPA EA advanced, 4850L geotech drilling completed Apr 2014



3. Current Science Program

Physics

LUX – *Dark matter using Xe*

MAJORANA DEMONSTRATOR – *Neutrino-less double-beta decay using Ge, also copper electroforming*

CUBED – *Low-bkgd counting, isotope separation, bkgd characterization (possibly future Crystal Growth)*

Berkeley LBF – *Low-bkgd counting*

CASPAR – *Neutron bkgds, lab design*

LBNE – *Cleanliness tests on surface and underground, lab design*

DUGL – *Seismic characterization for future gravity-wave detector*

Plus interest from others (eg., R&D)

Geology

GEOX™ – *Optical fiber applications, tiltmeters, env monitoring*

Hydro Gravity – *Local gravity for water tables, densities*

PODS – *Petrology, ore deposits, structure (mainly core)*

Transparent Earth – *Seismic arrays*

Plus interest from others

Biology

Biodiversity – *BHSU, SDSMT*

Biofuels – *SDSMT*

Bioprocessing R&D – *SDSMT*

Syngas/Biofuels – *SDSMT*

NASA Astrobiology Institute – *USC/DRI*

Plus interest from others

Engineering

None currently, but interest from geothermal, Xilinx

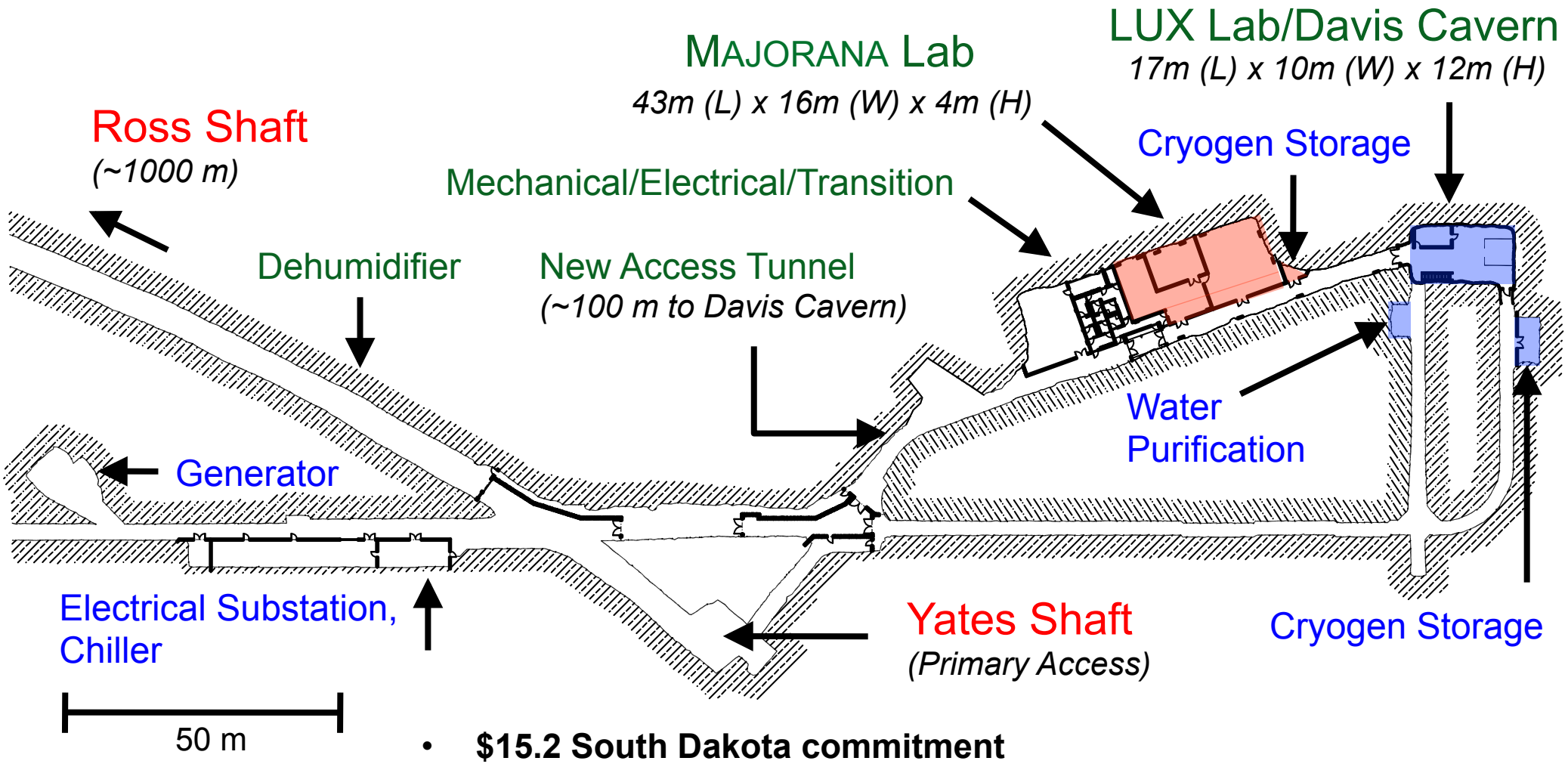
Previous include:

- *Signal Propagation*
- *Submersible*

Total Active = ~16 groups
(Plus Others)

4. 4850L Davis Campus

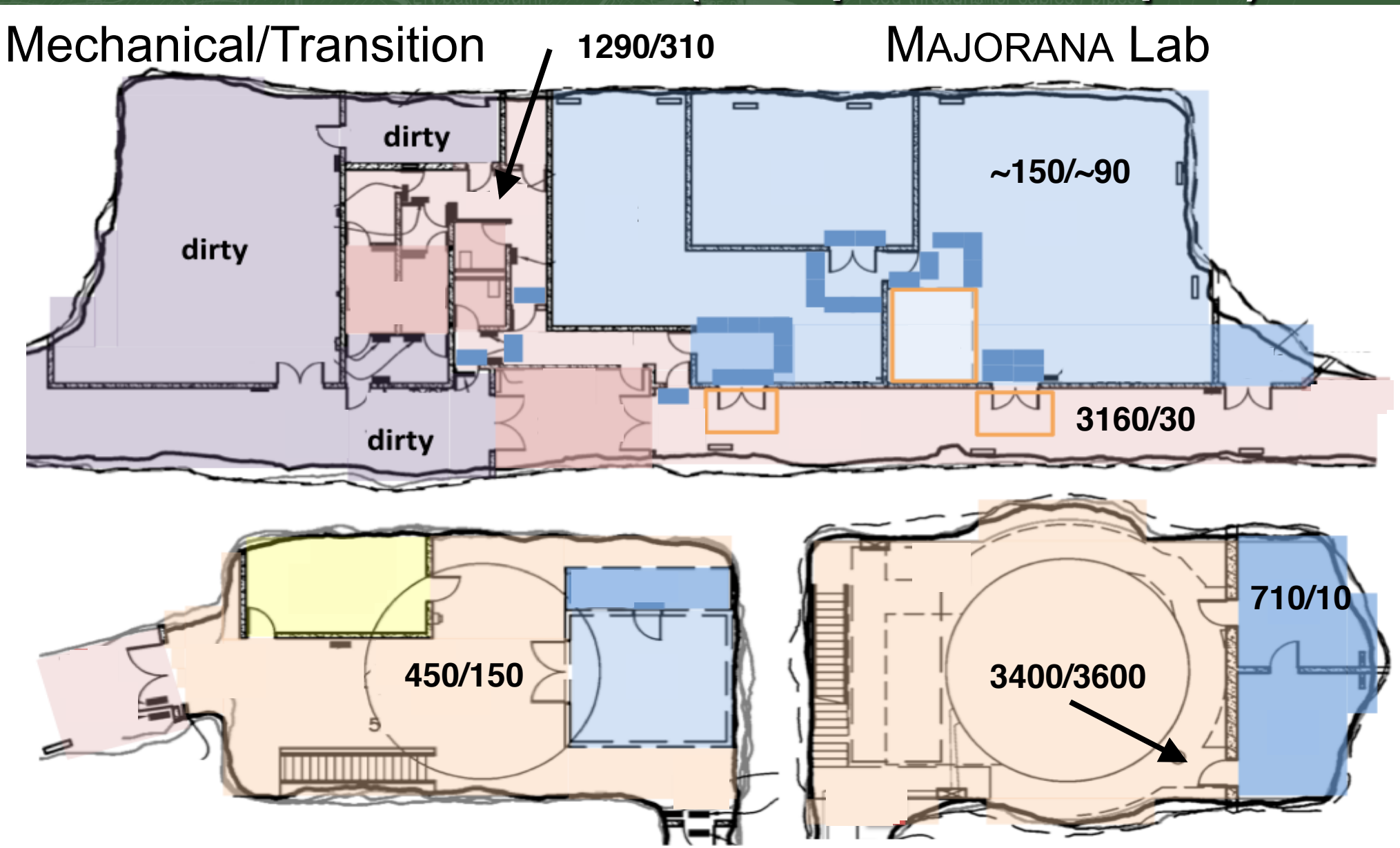
2,732 m² (Total) / 927 m² (Science)



- **$15.2 South Dakota commitment**
- Sep 2009 – Jan 2011: Excavation performed in-house (16,632 tonnes)
- Jan 2011 – Jun 2011: Low-activity shotcrete (1,264 – 2,000 lb bags)
- Jun 2011: Outfitting contractor mobilized
- May 2012: Substantial completion (Dedication May 30)
- *Zero lost-time injuries*

5. Davis Campus Cleanliness

Recent Particle Count Data (Occupied/Unoccupied)



6. Low-Background Counting

CUBED and Berkeley (Oroville) Installed at 4850L Davis Campus

CUBED HPGe counter:

- ORTEC 1.2 kg crystal, n-type coaxial, 60% relative efficiency
- Shield established in early April 2014 (incl Cu, Pb and Rn purge)
- Currently gathering baseline background and calibration data
- Predicted sensitivities: ~200 uBq/kg U/Th

Berkeley HPGe counter:

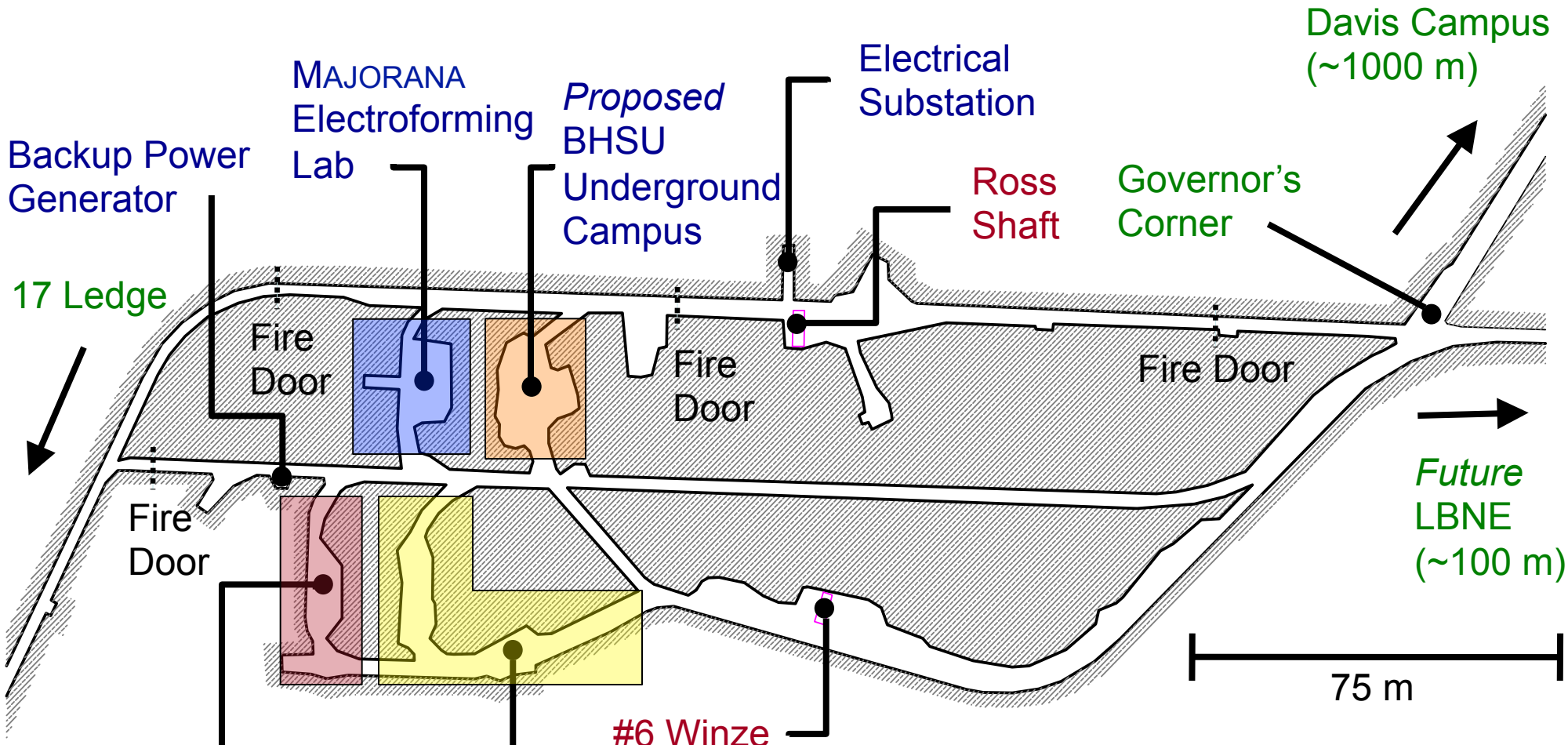
- ORTEC 2.1 kg crystal, p-type coaxial, 85% relative efficiency
- Shield established May 2014 (incl Cu, Pb and Rn purge)
- Currently commissioning
- Sensitivities (~1 week): 600 uBq/kg (U), 800 uBq/kg (Th)

CUBED LBC

Berkeley LBC (Oroville)

7. 4850L Ross Campus

Existing Excavations Offer ~740 m²



- Mar 2011: Eforming Lab occupancy
- Sep 2012: Refuge Chamber installed
- *Dec 2014: CASPAR initial occupancy*
- *Spring 2015: BHSU Underground Campus (also low-bkgd counters) occupancy*

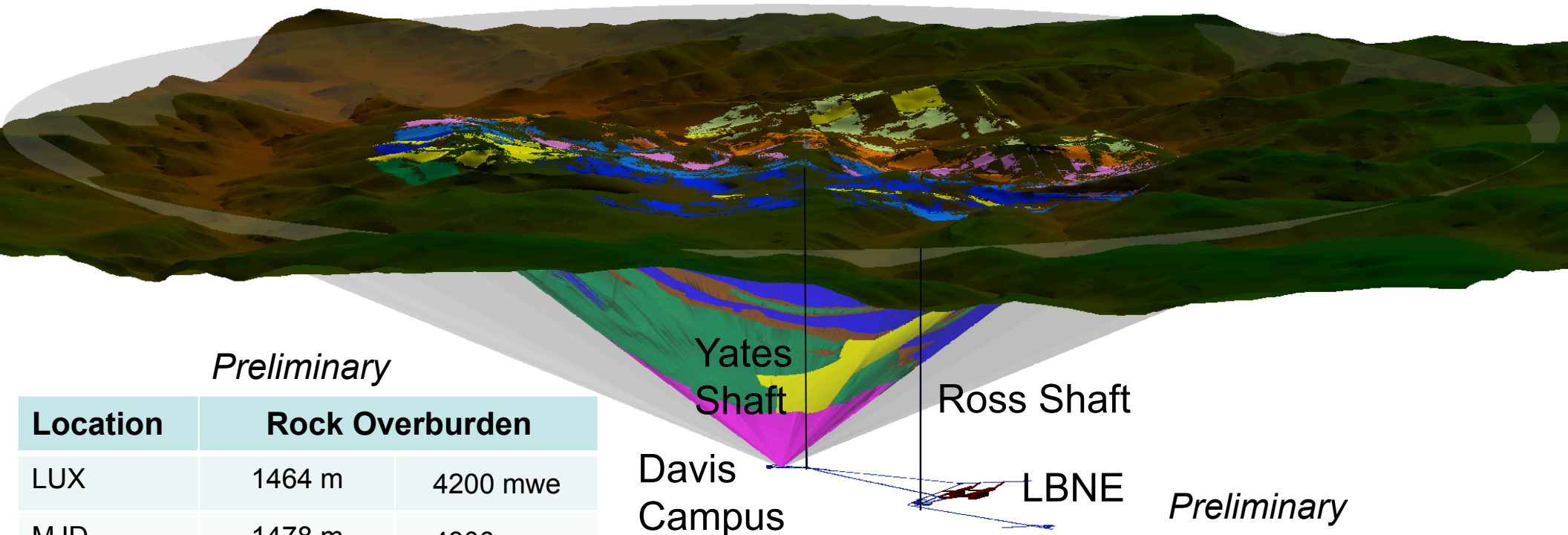
8. Science Opportunities – Space

- Surface Laboratory:
  - *190 m² lab space (lower 3 levels not fully developed)*
  - *Cleanroom (incl anteroom, 9' ceiling), water shield tank (~3-m diameter)*
- Davis Campus and Vicinity:
  - *Inside Davis Campus clean space, Lower Davis room: ~17 m² (14' ceiling height)*
  - *Two cutouts outside clean space: ~33-50 m² (with 12' avg ceiling height)*

9. Science Support – Liquid Nitrogen

10. Science Support – Geology Model

- 3D model of seven main rock formations, detailed surface topology
- Compiling rock geo-chemistry and density data from variety of sources, paper expected mid-2014



Preliminary

Location	Rock Overburden	
LUX	1464 m	4200 mwe
MJD	1478 m	4300 mwe
R&D Space	1561 m	4400 mwe

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

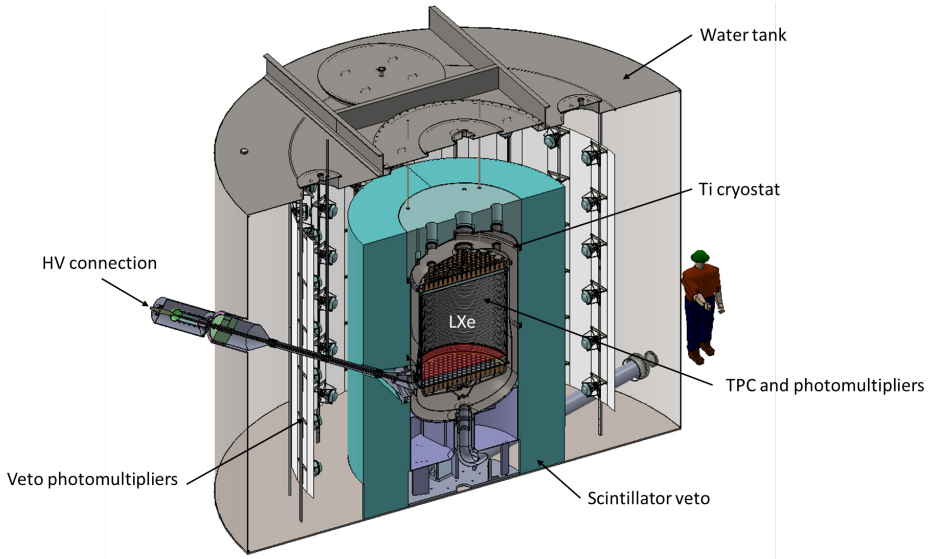
Preliminary

Location	Rock Overburden	
MJD Eform	1503 m	4300 mwe
LBNE 10 kt	1391 m	3900 mwe
LBNE 24 kt	1374 m	3800 mwe

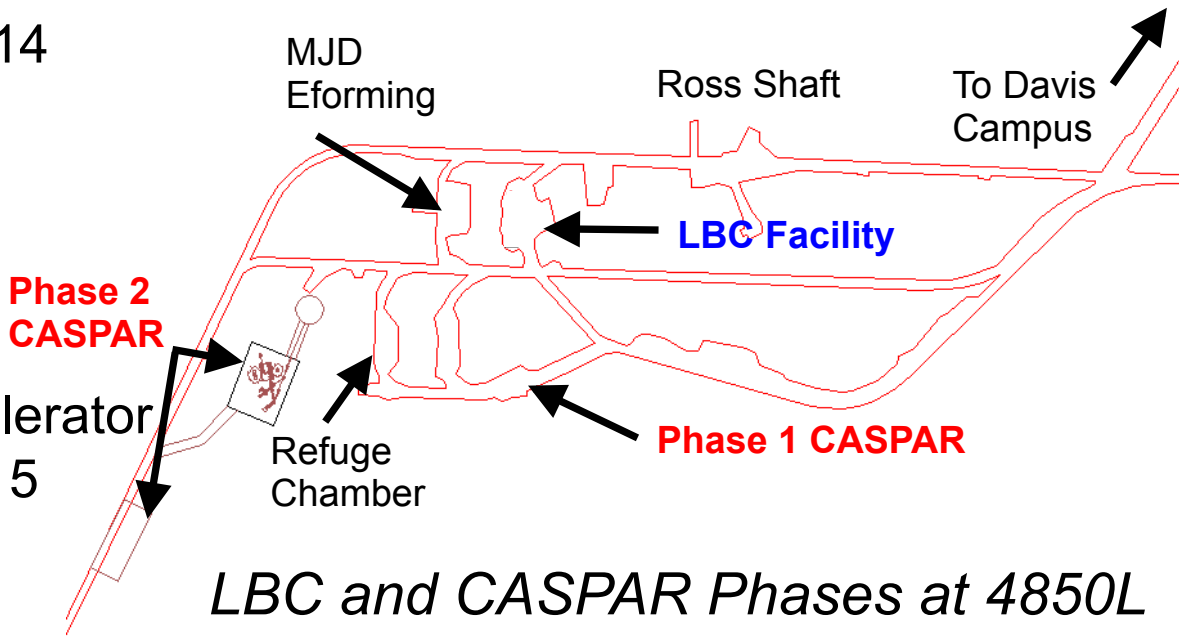
11. Future Physics Expts at the 4850L

Implementation Through the End of the Decade

- **Dark Matter:** G2 LUX-ZEPLIN (LZ)
  - LXe (~10T total / 7T active / 6T fiducial)
  - Using existing infrastructure (Davis Cavern, water tank), improved veto (liquid scintillator)
  - Start commissioning/operation ~2017
- **0νββ:** MJD
  - Current generation through 2018/2019
- **Low-Background Counting:**
  - CUBED, Oroville operational in 2014
  - Exploring additional capabilities
- **R&D Space:** Options available
- **CASPAR:**
  - Phase 1:Relocate small UND accelerator into existing UG space in 2014/2015
  - Phase 2:Full scope (low/high E) in new excavation

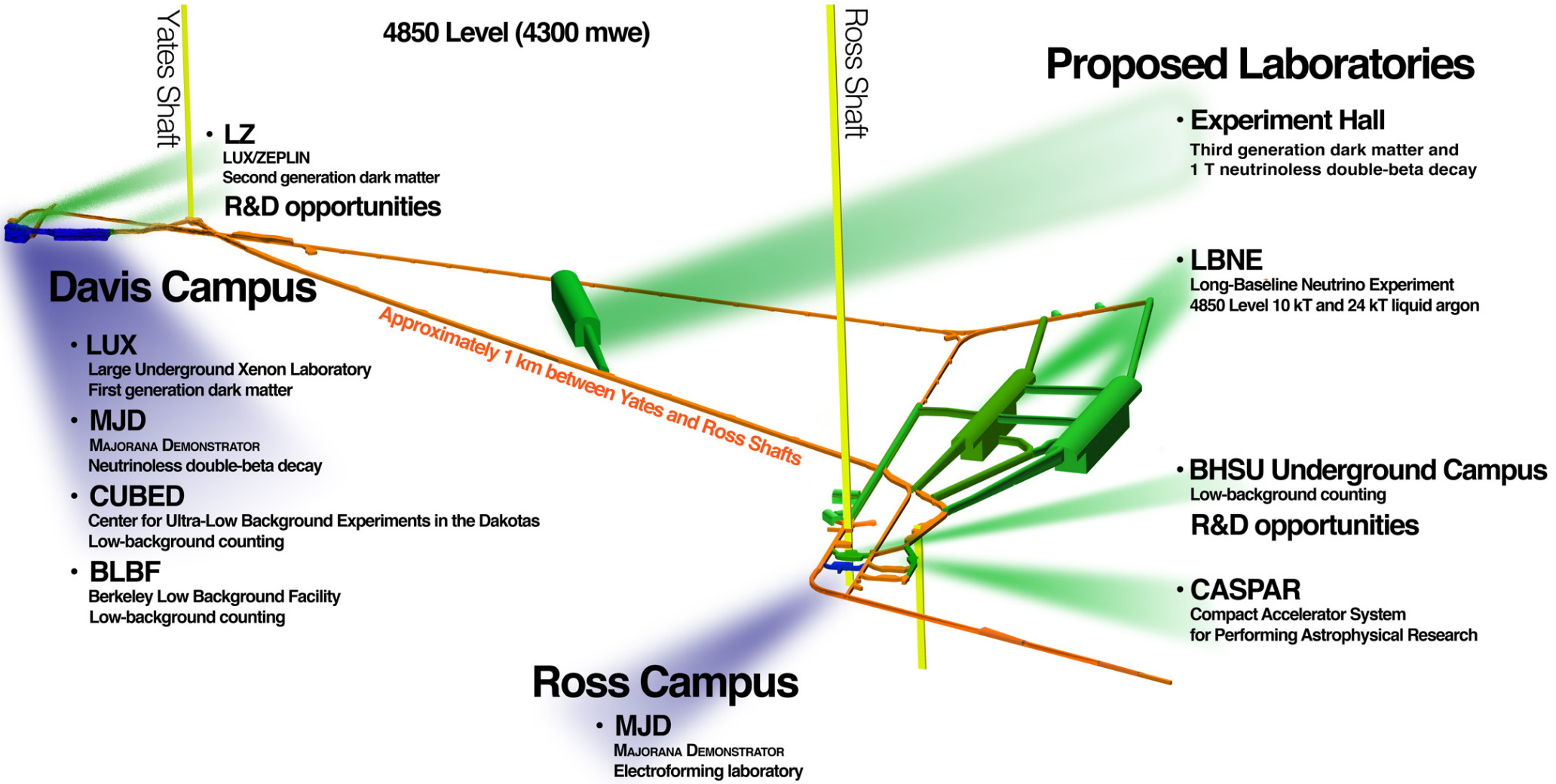


LZ at 4850L: ~10 tonnes LXe



LBC and CASPAR Phases at 4850L

12. Current & Future Science Program



Heise, arXiv:1401.0861v1 (2014)
Lesko, Euro Phys J Plus **127**, 107 (2012)