

HOMESTAKE DUSEL AND SANFORD LABORATORY NEWSLETTER

Dear Homestake Collaboration,



Herewith the January edition of our monthly newsletter for Homestake DUSEL and South Dakota's Sanford Laboratory. We always welcome your input on news, links to news articles, upcoming workshops, conference notices, scientific updates, information concerning the Collaboration, and other highlights relevant to our shared goal.

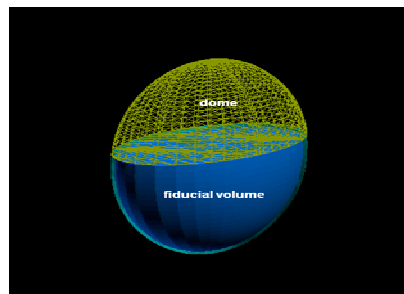
For the past few weeks, Homestake DUSEL has been focused on the first annual review scheduled for January 28-30, 2009. Special thanks to the external "Red Team" who reviewed the entire collection of review presentations 15-17 December. Members of the Red Team included Lowell Klaisner (SLAC-ALD), Albert Lazzarini (CalTech - LIGO-Deputy Director), Jess Albino (SLAC-Underground Construction), John Wilkerson (UNC-Majorana), and Bob Lanou (Brown-Neutrinos). Senior Berkeley Management participated in the review including James Krupnick (COO), Jim Siegrist (ALD-General Sciences & Physics), James Symons (Nuclear Science), and Kem Robinson (Engineering).

IMPORTANT DATE: January 28-30, 2009

**DUSEL Annual Review
Berkeley, California
Committee will be chaired by Ed Temple.**

EXPERIMENTAL FACILITY CONCEPTUAL DESIGN

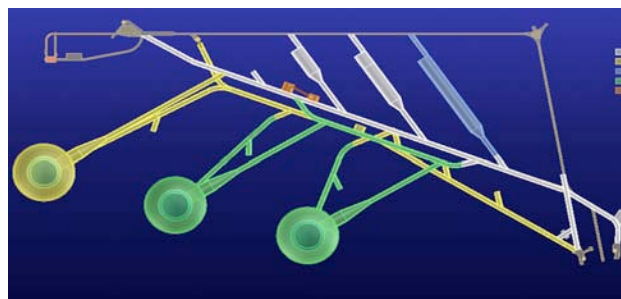
Ziggy Hladysz, Steve Marks, Dave Plate and Syd De Vries have continued to refine the conceptual design of the 4850L. This has resulted in a safer and more realistic approach to dimensioning and spacing of the new excavations, particularly the large cavities. New design alternatives include employing unique shapes such as an ellipsoidal cavity which offer improved stability and more cost-effective excavation methods.



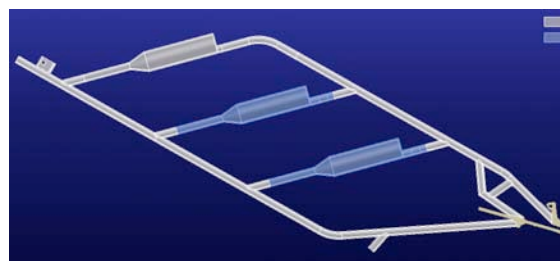
Example of an ellipsoidal cavity

4850L LAB DEVELOPMENT LAYOUTS

Dave Plate, in consultation with Ziggy Hladysz, Syd De Vries, and Steve Marks, has developed a new conceptual layout of the excavations at the mid-level and deep-level campuses. The figures below show likely phasing of excavations. The current base line for the mid-level campus includes two lab modules and a single large cavity for a water Cherenkov long base line neutrino detector, indicated by the silver and yellow colors, respectively. A third lab module, indicated by the light blue color, and the green colored large cavities indicate possible future development. The figure for the deep-level campus uses the same color scheme, and shows a single lab module included in the base line, with two future modules as possible future development.



Mid-level campus (4850L) layout



Deep-level (7400L) campus layout

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Large Cavities and Long Baseline Neutrino Programs

The main focus in December for the Long Baseline Neutrino Collaboration was on the completion of the Long Baseline Neutrino Program "Depth Document." This document folds in the facility-specific input with the physics driven shielding requirements to make a recommendation for the depth of the Large Cavities. The document concludes that the 4850 Level is the correct level for the physics programs associated with the large cavities. Previously the facility team had presented arguments for the 4850L from the facility perspective. The document is being submitted to the Physics Archive.

A funding request was drafted to begin work on the large cavity design and geotechnical site investigations. We anticipate submitting this request in early in 2009 to fund the Large Cavity Advisory Board, the Geotechnical Advisory Board, and to establish site investigations of the 4850 Level including geological mapping, coring, and core-testing.

GEOTECHNICAL UPDATE

Geotechnical Advisory Committee (GAC)

After a successful eight months of GAC activities and a favorable review by the DUSEL Internal Review Committee, the GAC is ready to address new challenges: the implementation of the geotechnical contracts, overcoming the funding constraints, an appropriate adjustment of the scope to be implemented through a phased approach, the addition of very large cavities to the program, and the need for new GAC membership with significant hard-rock mining experience.

New additions to the GAC include: Mr. Douglas Tesarik (NIOSH), Dr. Rimas Pakalnis (University of British Columbia) and Syd De Vries (DUSEL—*ex officio*). Since some of the existing GAC members have retired or are doing other things, there is still a need for two or three more members.

Geotechnical Supplemental Proposal

Ziggy Hladysz has been working with S3 DUSEL team (Lesko, DiGennaro, Kadel, De Vries and Marks) on the geotechnical supplemental proposal outline and additional funding needed to address the

design very large cavities for Long Base Line Experiments.

Work continues with Kelly Cuthbertson to develop the WBS schedule for the geotechnical program and new excavation design.

Preliminary Architectural Program

We continued to refine the preliminary architectural program for the lab and its infrastructure needs through meetings with the various science teams. The Underground Site Infrastructure RFP process continued with receipt of proposals from three firms, meetings with the selection committee to review the proposals and shortlist, followed by interviews with two of the three firms. With the decision of the selection committee, we notified the selected firm and will begin work to refine scope and develop a contract. Our work on solving the insurance issue with SDSTA continued, so the agreement with RESPEC for the geotechnical work can conclude.

The week before the "Deep Science" tour (November 17-20), Dr. Kevin Lesko was a keynote speaker at the South Dakota Technology Summit in Sioux Falls, where he presented seminars to advanced-placement science students at two Sioux Falls high schools. Many of those students attended the "Deep Science" lectures the following week.

SANFORD UNDERGROUND LABORATORY AT HOMESTAKE

The South Dakota Science and Technology Authority improved its dewatering system, re-entered the Yates Shaft, increased staffing and continued early public outreach and planning for early science at the 4850 Level.

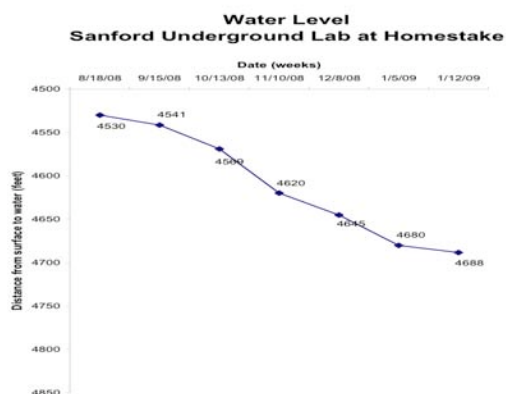
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Left: Tom Regan. 1100 photos show first exploration at 1100 level which is only accessible from Yates Shaft

Dewatering accelerating at Homestake

The water level at Homestake was within three feet of the 4700 Level by mid-January. That's down 170 feet from the high-water mark of 4,530 feet, which was reached in August.



Water level graph

Projections for reaching the 4850 Level, where the LUX Dark Matter Detector will be installed, range from late March to mid-July. A precise prediction is difficult because the South Dakota Science and Technology Authority continues to improve its capacities for pumping and treating mine water.



Sand filter piping

A new sand-filter system that was successfully tested in December will remove iron from the mine water faster, more efficiently, with less need for chemicals. The 32 new filters should be operating by Jan. 20. They will double the treatment capacity, from just over 1,000 gallons a minute.

Underground, the three new 700-horsepower pumps have been added to the existing pump chain. In addition a new submersible pump system for Six Winze has been designed. Two Grundfos submersibles, each capable of 840 gallons per minute, will pump from as deep as the 5150 Level.



Newly installed 700 hp pump at the 2450 joins another one on that level

Also in Six Winze -- a shaft that connects the 4550 Level to the 8000 Level -- a Sea-Bird deep-water sampler was deployed for the first time on Jan. 14. The sampler will provide data on water temperature, conductivity and pH in the deep pool. The SDSTA and the DUSEL Collaboration are sharing the cost of the sampler.

Underground infrastructure improvements

The biggest news in December was the re-entry of the Yates Shaft by contractor RCS Construction of Rapid City, S.D. By late December crews had reached the 1100 Level, where they inspected drifts and rock conditions. Homestake Mining Co. used the 1100 Level to divert water from the deep mine, and the South Dakota Science and Technology Authority is considering a similar proposal.



Above: RCS Crew in Yates Shaft

SDSTA engineers are designing a ventilation plan for the 4850 Level, using mine-ventilation software. Currently a single large fan in the Kirk Drift ventilates the mine, pulling air down the Yates and Ross

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shafts. Another fan in the Oro Hondo shaft will increase airflow to lower levels.

Ventilation underground is controlled by "air doors" that can be opened or closed to change flow. Plans for air-door rehabilitation, water-control bulkhead construction, rock bolting for ground control and removal of old utilities are 90% complete. The projects will be advertised in January.

The underground risk assessment project was 85 percent complete by the end of December. The risk assessments are detailed, documented assessments of Homestake level by level.

Support for early science

Work continues on engineering designs for infrastructure to support the LUX Dark Matter Experiment, which will be installed in the Davis Cavern at the 4850 Level.

CNA Consulting Engineers are evaluating locations for the Majorana Experiment Counting Laboratory. One option would allow Majorana to share mechanical and electrical systems with LUX.

Thirteen members of the LUX Collaboration attended the LUX/Sanford Lab readiness review, which was on the Yates campus Dec. 3-5. The collaboration presented material to an external review committee whose members were:

- * Dr. Fraser Duncan, SNOLAB (Chair);
- Dr. Michael Andrews, Fermilab;
- Dr. Norbert Rempe, WIPP;
- Dr. Steve Marks, LBNL/DUSEL.



LUX reviewers visit in December

Meanwhile, other early science projects continued to work underground:

- Researchers with the Low Gravitational Background Project (associated with LIGO) installed new commercial seismometers and custom-built instruments manufactured by collaborators from Salerno, Italy.

- Hydrometry studies by Dr. Larry Stetler of the South Dakota School of Mines and Technology continued. Tiltmeter arrays and climate stations are operating underground.

- Dr. Dongming Mei of the University of South Dakota, Dr. Fred Gray of Regis University and their colleagues continued to collect background radiation data, which will be important for large physics experiments such as LUX and Majorana.

UPDATE FROM THE DUSEL EXPERIMENT DEVELOPMENT COMMITTEE (DEDC)

Since the last newsletter in December, we suspect that many in the scientific community have been immersed in the task of compiling science plans for the S4 solicitation. This frenzied activity relented on Friday January 9th, with the passing of the submission deadline. From the community driven proposals which the DEDC has been tracking, we know of 14 submitted in physics and 10 in biology-geoscience-engineering. Of course there may be others of which we are unaware, and we encourage those proponents to contact us with the details they wish to share.

Close on the heels of the S4 submission deadline, NSF will hold its first annual review of the DUSEL project and facility. The DEDC will of course participate in this review and are tasked with representing the community science plan. We are currently assembling the material to present the science plan to the review committee – and many proponents have been contacted to supply updates to our presentations which will best represent the current status of their experiments. Thanks to all of you who have obliged.

If you are a submitter of an S4 proposal which you suspect is unknown within the community and to the DEDC we encourage you to contact us. This will allow us to wrap your project into the growing science plan and to represent you in important interactions with the facility, other experimenters and in review bodies. Please contact any member of the DEDC to do this.

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EDUCATION AND OUTREACH

The SDSTA has instituted a new program of regular monthly briefings for three local governments -- the cities of Lead and Deadwood and Lawrence. The Sanford Lab Public Information Department also continued the "Deep Science for Everyone" lecture series, with a presentation at Riggs High School in Pierre, the state capital. Students, government officials and legislators attended. (About 200 people turned out for Dr. Jose Alonso's talk, despite temperatures falling to 20 degrees below zero.) About 2,300 people have attended the "Deep Science" lecture series.

Sanford Underground Lab staff also accompanied 20 geology students from South Dakota School of Mines and Technology to the 300 Level for a mapping exercise, which was lead by SDSMT professors.



December 4: Group of SDSMT Geo students at 300

Dr. Riccardo DeSalvo of CalTech, who has given a couple of "Deep Science" lectures on gravity waves, presented a two-hour lecture to physics students, who were bussed to Lead from Rapid City Central High School. The students also got a surface tour, including a trip to the Ross Shaft hoist room.



Above: High School students pose for photo in the hoist room

In early January, SDSTA staff took South Dakota Public Broadcasting, the Associated Press and a reporter from the Black Hills Pioneer (a local paper) to the 4550 and 2450 levels. Public television provided pool video to commercial stations in South Dakota, and the AP story was published throughout the region. In addition, South Dakota Public Television planned a one-hour edition of the program "South Dakota Focus" on progress at the lab.



South Dakota public television crew, AP reporter and photographer in 4550 Hoist room. Note reddish hue from iron. Red line on wall due to air bubble formation. This level is totally submerged.

SDSTA Staff additions and other stats

At the beginning of 2008, the South Dakota Science and Technology Authority had just over a dozen employees. By early January 2009 there were 66 employees on staff, plus about 20 temporary staff. Add contractors and on any given day about 150 people report to work at the Sanford Underground Laboratory at Homestake.

In 2008, the SDSTA paid 314 vendors and used the services of 49 contractors.

Homestake Hydrostatic Water Level System Installed and Running

The first two arrays of the Homestake Hydrostatic water Level System (Homestake HLS) were installed on the 2000-ft level during the week of January 5, 2009. The project is an active collaboration, led by Dr. Larry Stetler, a geological engineer from South Dakota School of Mines, and Dr. James Volk, a high energy physicist from Fermilab. The two met at the ISE Workshop that was held in Lead, SD in April

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2008. The Homestake HLS will ultimately consist of four series of six Tevatron-style sensors connected by water-filled tubing over 1000 feet of drift and around a corner. Comparison of water levels with other sensors in the array provide tilt and a direction of motion. The first two arrays, totaling 12 sensors, are being used to establish a baseline and to monitor ground response to dewatering as well as tidal effects. It is anticipated that dewatering from water-filled stopes and renewed excavations at lower levels will induce ground motion on scales different than dewatering from the drifts and shafts. These data will provide insight to the hydrologic character and properties of the Precambrian rock at

the site. Understanding ground motion at the site will be useful for future particle beam experiments in DUSEL.



Larry Stetler (left) and Jim Volk (right) making final connections to the termination of HLS Array A on the 2000-ft level

The current installation involved 12 HLS sensors in two independent arrays on the 2000-ft level. One near the Ross shaft and one approximately 2000 ft away. Two additional sensor arrays will be installed on the 4550 and the 4850-ft levels after access is available later in 2009. The data will be fed out of the mine using the new fiber optic backbone installed by the SDSTA.

The January installation was successful due to the assistance of SDSMT graduate student Jason Van Beek and SDSTA personnel who excavated holes and poured concrete bases. Special thanks to Tom Trancynger (SDSTA) for assistance in locating the sites and installation of the sensors.



In the red drift. Red is due to iron content. Sanford Lab geologist Tom Trancynger and three SDSMT researchers: Dr Larry Stetler (in black OSHA-approved cowboy hardhat!), Dr. Bill Roggenthen and graduate student Jason Van Beek

FOCUS ON SAFETY

If you are traveling to South Dakota be sure to dress warmly. Wear layers and bring a wool scarf or something to protect your face from the wind. Also be sure to pick up some water and snacks at the airport in case your car gets stalled or is blocked by snow during a snow storm. It could be some time before tow trucks or snow plows arrive. If you are trapped, do not turn on your engine for heating. Carbon monoxide poisonings have been associated with snow-obstructed vehicle exhaust systems.

JOBS IN PHYSICS

Postdoctoral position in the McKinsey Group at Yale University Department of Physics. Research possibilities include development of LXe, LAr, and LNe as materials for particle detection, as well as their use in the LUX and MiniCLEAN dark matter experiments. For more on this position: <http://mckinseygroup.physics.yale.edu/> Send CV, statement of research interests and publications list to: Daphne Klemme, Dept of Physics, Yale University, PO Box 208120, New Haven, CT 06520-8120 or to daphne.klemme@yale.edu.

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