Dear Homestake Collaboration,

Welcome to the April monthly newsletter for Homestake DUSEL and South Dakota's Sanford Laboratory. We would like to receive 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.

Important Dates

July 10, 2009: EHS meeting at Sanford Lab

NEWS UPDATE FROM ITALY

Following the devastating Abruzzo earthquake that hit the region near L'Aquila and the Gran Sasso laboratory on April 6, many were anxious about the safety of the people and the laboratory facility. Steve Marks and others have heard from contacts at Gran Sasso, including Eugenio Coccia and Roberto Tartaglia. Members of the Lab are safe and the laboratory surface and underground facilities have apparently survived intact. Please refer to the LNGS website for more information:

http://www.lngs.infn.it/lngs_infn/scripts/news/earthquake.html

EXPERIMENTAL FACILITY EXPERIMENTAL DESIGN

DUSEL Preliminary Design

The DUSEL Engineering group is evaluating several configuration options for the Yates Shaft hoists and conveyances. The evaluation is a cost, benefit analysis considing the support for access and transportation of scientific equipment and the estimated cost of the various options. Construction plans for a set of model experiments are being used to determine the support each option provides for the installation of the Integrated Suite of Experiments.

The first option, as shown in Figure 1, is based upon the J. S. Redpath Corporation study completed in September of 1997. This option maintains the current dual cage configuration but replaces the timber structure with steel and inserts a concrete liner, and adds an automated personnel lift.

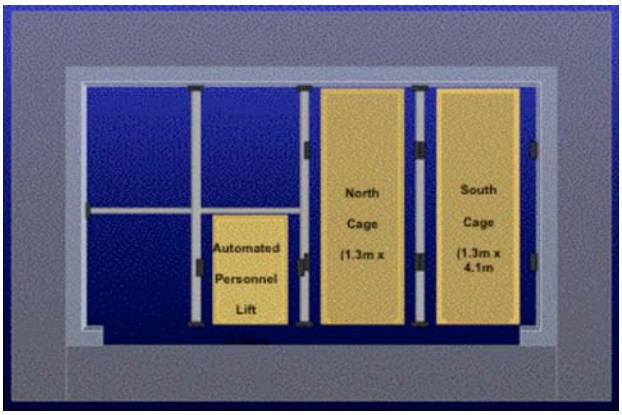

Figure 1. Plan View of existing Yates Shaft replacing one skip hoist with an automated personnel lift.

Option 2, as shown in Figure 2, consists of a single super cage replacing the current dual cage configuration. The middle structural member in the shaft compartment is removed to accommodate the single larger cage. An automated personnel lift, like that for Option 1, is also included. The figure shows a typical cryostat, representative of those proposed for dark matter search and double beta decay detectors, as it would fit in the supercage. Note that while the increased cage size will accommodate larger objects, additional hoist and headframe modifications will be necessary to accommodate the increased payload weights .

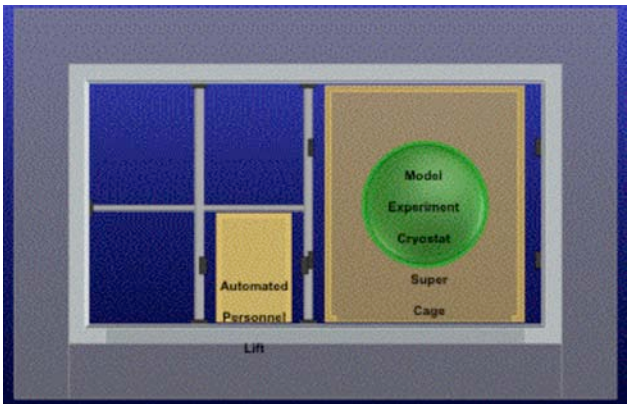

Figure 2. Plan View of existing Yates Shaft replacing one skip hoist with an automated personnel lift and North and South cages with one Super Cage.

Option 3, shown in Figure 3, includes a cage that will accommodate a standard shipping container. Access for a personnel lift would be from the back side in this option. Note that the minimum dimension for this option is smaller than that for Option 2. This option will also require an upgrade to the hoist and headframe. The evaluation of these concepts is in progress and will rely on previous studies and the current infrastructure assessment as a basis for cost estimates.

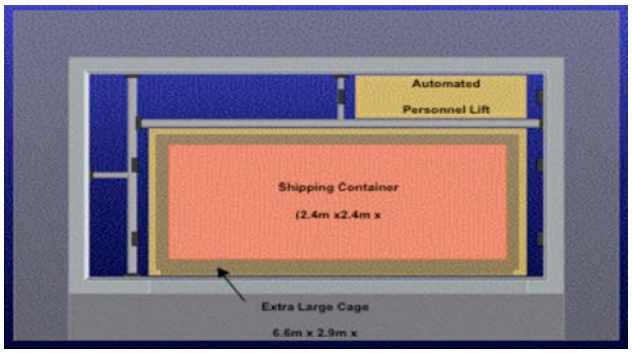

Figure 3. Plan View of existing Yates Shaft with everything relocated to allow for one extra large cage to allow the transfer of a small shipping container.

Figure 4. A few days after Spring Equinox, this winter scene greeted attendees at the March 25-27 Directors Visit at Homestake meeting. Operations crews cleared more than 80 inches of snow from the property in March. Connie Giroux (left), Susan Von Stein, Tom Trancynger and Deb Meyer

MARCH 25-27 MEETING, SOUTH DAKOTA

DUSEL Digs Deeper to Welcome DOE

(Paul Preuss, March 30, 2009, LBNL News Center)

The Deep Underground Science and Engineering Laboratory (DUSEL) planned for the Homestake Mine in Lead, South Dakota, is a National Science Foundation-sponsored proposal, but on Wednesday, March 26, a visit by Department of Energy representatives, including Dan Lehman of DOE's Office of Project Assessment, Fermilab director Pier Oddone, Brookhaven director Sam Aronson, and Berkeley Lab's Nuclear Science Division director James Symons and Engineering Division director Kem Robinson, signaled intense DOE interest in working with NSF and the state government to create what will be the biggest, deepest underground science facility in the world.

The highlight of the trip was a descent from swirling snow at the surface (Figure 4) to 72-degree warmth 4,550 feet down in the rock, the deepest yet that visitors have been able to delve into the retired gold mine – not quite as far down as the research "campus" DUSEL plans at the mine's 4,850-foot Level, however. There DUSEL – led by Kevin Lesko of Berkeley Lab and UC Berkeley with co-PI Bill Roggenthen of the South Dakota School of Mines and Technology – will excavate one or more "large cavities," enormous caverns each big enough to swallow Mount Rushmore whole. Filled with ultrapure water and instrumented by researchers from Brookhaven, these huge detectors will measure neutrinos from a beam created in a Fermilab accelerator hundreds of kilometers away. Until now, however, the future home of this Long Baseline Neutrino Experiment has been not just underground but underwater, flooded after the mine was closed. The South Dakota Science and Technology Authority's Sanford Lab has been purifying and pumping the water out at a rate of 1,500 gallons a minute.

The government and ordinary citizens of South Dakota – who have filled auditoriums all over the state for the Sanford Lab's "deep science" lectures – have made an enormous commitment to the success of the mine, including $120 million in state funds and private contributions from philanthropist T. Denny Sanford that have kept the operation going until now. When that money runs out, the federal government will have to step in. At a reception at the South Dakota School of Mines and Technology to welcome guests from DOE, NSF, DUSEL, and others, South Dakota's gung-ho DUSEL supporter and governor, Mike Rounds, urged all parties to work together, noting that the "future of NSF's and DOE's high-energy physics programs rest here," and describing the unique partnership as an alloy whose strength is greater than that of any of its components. Rounds suggested that great things

await those who work underground, including more Nobel Prizes like the one that came late to Ray Davis, who uncovered the "missing solar neutrino" puzzle (which Lesko helped solve) during an experiment at Homestake in the 1960s. Rounds also noted that the last DOE lab director who visited DUSEL, Steven Chu by name, soon went on to become Secretary of Energy.◆

UPDATES

Surface Infrastructure Alterations and Upgrades

Having issued the first two contracts for (1) Geotechnical Site Investigations and (2) Site Assessment of Infrastructure to support underground construction and operations, the next Request for Proposals to perform a Site Assessment of Surface Buildings and Infrastructure is currently open, with proposals due on April 15. Job site tours scheduled for March 21-22 and 27-28 were delayed due to weather and rescheduled for April.

Infrastructure for Underground Operations and Research Space

The Site Infrastructure Assessment work to Support Underground Construction and Operations commenced with the first site visit 8-12 March. Preliminary investigations were conducted on the Yates and Ross shafts and hoists, Facility Hydrology, Electrical infrastructure, EH&S systems, Lab Footprint Geotechnical, and IT and Data Communication. The contractor prepared a preliminary report that includes findings, conclusions, recommendations and a plan for continued work. Details of the 6-9 April site visit will be covered in future reports.

Syd De Vries prepared a Scope of Work for the Power Washing program, which is required for the 4850 L Geotechnical Site Investigations and assisted in the development of the near term Geotechnical Site Investigation Schedule.

The existing contract with RESPEC is in the readiness phase with safety training scheduled for 7 – 10 April, and site mapping at the 300 L scheduled for the second half of April. RESPEC reported project management activities (for January and February). In addition to two monthly reports, they submitted documents: Project Management and Implementation for Geotechnical Services, and their Safety Plan.

Research Instrumentation and Equipment and Experimental Requirements

On February 26-28, Steve Marks, David Plate and Kevin Lesko attended the Long Baseline Detector workshop at UC Davis. At the meeting, Marks extended discussions with the LAr TPC group. Their proposal is to incorporate 5kT of LAr into an initial detector module, and to eventually incorporate as much as 100 kT in several detector modules. The transportation of this large quantity of LAr underground, as well as a plant for re-liquefaction requires considerable infrastructure support. Marks and Plate continue to participate via regular teleconferences.

Assessment of the experimental requirements for the Yates shaft continues. DUSEL members met with members of the DIANA nuclear astrophysics accelerator collaboration to get a better understanding of all components of their proposed facility and how it might be transported to and assembled underground. The goal is to assess cost and schedule impact of various configurations of the Yates shaft on the construction of this and other proposed experiments.

Steve Marks participated in a safety review of the LUX early implementation experiment. This was a follow up from the December LUX readiness review. A schedule for safety reviews to achieve approval for implementation was established.

Large Cavity Detector

Syd De Vries and Ziggy Hladysz visited Devil's Slide Tunnel project in Pacifica, CA to investigate Laser Mapping techniques.

The development of the 3D Geo-Structural Model, required to be completed by the Large Cavity Advisory Board's upcoming visit to Homestake in July, will be accomplished through two separate contracts: one with the SDSM&T geologists, and the second by requesting additional services within the existing contract with RESPEC. The scope for both contracts has been issued following review by the Geotechnical Advisory Committee.

The preliminary 3D structural model of the geology and rock structure is being developed by Drs. A. Lisenbee and M. Terry (SDSM&T). They are amassing the available information, performing structural interpretation and developing the structural/geology model of the rock mass in the area of the initial large cavity siting (See Figure 5). A

new contract has been signed and executed. This work will be completed by May 15, 2009.

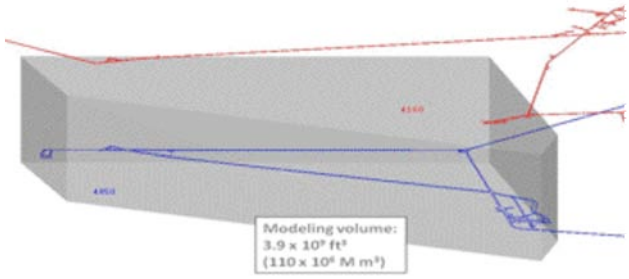

Figure 5. Modeling for the levels initially selected for large cavity siting.

A proposal was submitted to RESPEC requesting an estimate for additional services. This extension of the existing RESPEC contract includes: a) the conversion of the preliminary 3D Geo-Structural Model from the raster format into Vulcan 3D-vector format and b) a preliminary engineering geology assessment of the rock volume relevant to the large cavity siting.

Environmental Impact Statement

The first meeting to initiate the EIS process was held on March 11-12 at LBNL. Participants included Margaret MacDonell and John Peterson (ANL), Steve Meador (NSF), Richard DiGennaro, Kevin Lesko, Steve Marks, and Bill Roggenthen (DUSEL). Discussion topics included schedules, strategies, and priorities for implementation of the EIS, conceptual alternatives for DUSEL plans, and preparation for a site visit in May 2009, aiming to prepare for a Public Scoping meeting in August or September 2009.

BERKELEY: EH&S MEETING

On April 3, 2009, the Sanford Lab DUSEL EH&S Advisory Committee convened at Berkeley - LBNL. Members of the committee who could not meet at LBNL participated by phone. Members of the Committee include:

- SDSTA EH&S Director, Chair - Susan Von Stein
- LBNL EH&S Director - Howard Hatayama
- UC Berkeley EH&S Director - Mark Freiberg
- DUSEL Experimental Instrumentation Engineer - Steve Marks
- DENR representative - Mike Cepak
- DUSEL EH&S Director, Secretary - George W Campbell
- DUSEL Mining Engineer - Syd De Vries
- DUSEL User Group representative – Physics community and Earth Science Community - Bob Lanou
- Sanford Lab Scientific Liaison – Jaret Heise
- Local and regional environmental and cultural representative - Keith Moore
- LNGS INFN - Roberto Tartaglia
- FERMILAB – Mike Andrews

The group reviewed the progress on findings from the July internal review and the January NSF review. Jose Alonso gave an update on early experimental work, Roberto Tartaglia presented the Gran Sasso safety program, and Jaret Heise described the Sanford Lab radiation protection program.

Susan Von Stein presented a detailed review of the Sanford Lab EH&S program with an emphasis on the safety policy, mission, integrated safety management work plan, document management, and facility and level risk.

HOW REGIS UNIVERSITY STUDENTS SPENT THEIR SPRING BREAK

A physics group from Regis University is working together with Dongming Mei's group at the University of South Dakota to perform background characterization measurements in the Homestake mine. While the USD group is measuring radon concentrations and gamma ray energy spectra at many locations within the mine, the Regis group is focusing on a longer-term counting experiment that will determine the fluxes of fast neutrons and cosmic-ray muons at a few locations. It is expected that fast neutrons will be among the most significant backgrounds for future dark matter and neutrinoless double beta decay experiments to be located at Homestake, and a significant fraction of them are expected to be produced by spallation interactions between cosmic ray muons and nearby rock.

The experiment includes four BC-408 plastic scintillation counters, each 30.5 cm on a side, to measure the muon flux (Figure 6). Simultaneous hits in at least three of the counters are required for an

event to be registered as a muon; this is required in order to minimize the false coincidence rate from gamma rays produced near the detector. A 1.2 L liquid cell is located in the center of the detector; it is filled with Eljen Technologies EJ-309 scintillator, which offers excellent pulse shape discrimination between gamma and neutron events. Its flammability and toxicity are substantially reduced compared with liquid scintillators traditionally used for neutron detection.

Figure 6. Regis University students Chris Ruybal and Jon Totushek align the detectors in the background experiment, while SDSTA geologist and scientific liaison Tom Trancynger installs safety warning signage around the area.

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Operationally, the long-term counting experiment has offered some insights that will be useful as more sophisticated experiments are deployed. Currently deployed at a transformer pad site on the 2000 ft. Level, it is able to take advantage of the network infrastructure to continuously transfer data over the Internet to Regis. The experiment has also served as a test case for several of the Sanford Laboratory's safety and work planning procedures. It is expected that the apparatus will be re-deployed to the 800-foot Level and eventually to the 4850-foot Level (Figure 7).

The Regis group is led by Dr. Fred Gray; two undergraduate students, Christopher Ruybal and Jonathan Totushek, have done most of the real work of assembling the detector. A first set of results from the background counting measurements will be announced at the American Physical Society's April meeting, which will be held May 2-5 in Denver.

Figure 7. LUX scientist observes a Regis University experiment at the 4550 Level.

SANFORD UNDERGROUND LABORATORY AT HOMESTAKE

Dewatering in blizzards? No problem

The water level at the Sanford Laboratory at Homestake dropped 60 feet in March, despite more than 80 inches of snowfall in Lead, S.D. Sanford Lab operations crews plowed snow 24 hours a day during two big spring blizzards, and the pumping never stopped.

It is difficult to predict exactly when the important 4,850-foot Level will be reached, but the "sill" or floor of the level likely will be dry in April. Technicians could start rehabilitating the level in May.

Snowmelt and spring rains will increase water running into the mine, but another set of three big 700 horsepower pumps was commissioned in March. The pumping capacity has increased to 2,200 gallons per minute. The surface plant has been enlarged with additional sand-filters to purify the water (Figures 8 and 9).

Two new high-volume submersible pumps in Six Winze -- a shaft from the 4,550-foot Level to the 8,000-foot Level -- will be activated in April.

Figure 8. Sand filters were enclosed in a building after a successful pilot test. They remove iron from Homestake's water faster, cheaper and with fewer chemicals than the clarifiers they replaced.

Figure 9. Close-up of sand filters.

DUSEL/Sanford Lab science support

The fiber network has been extended from the Yates Administration Building (the headquarters of Sanford Lab) to a large Homestake warehouse being rehabilitated for the LUX experiments.

Figure 10. LUX collaboration poses at Yates Shaft headframe at Homestake during their collaboration meeting held at site.

EDUCATION AND OUTREACH

Dr. Jose Alonso continued the Sanford Lab's "Deep Science for Everyone" public lecture series with a standing-room-only event in Rapid City. The crowd of 280 braved bitter cold and snow to hear Dr. Alonso talk about "Neutrinos and Black Holes in the Black Hills."

About 15 geology graduate students spent half a day at the 800-foot Level of the Sanford Lab mapping, surveying and preparing Homestake-related research proposals (See Figure 11 below.) Their professors from the South Dakota School of Mines & Technology had already scouted the location in February.

Figure 11. Geology grad students from South Dakota School of Mines and Technology confer at the 800-foot Level at Homestake.

Dr. Peggy Norris, Deputy Outreach Director for the Sanford Lab, worked with colleagues from the South Dakota Department of Education and the Governor's Office to choose 10 finalists for the new Davis-Bahcall Scholarship program. The students will spend a week studying at Sanford Lab and the South Dakota School of Mines, a week at Gran Sasso Laboratory in Italy and three weeks at Princeton University.

The pool of applicants was so impressive that the scholarship committee is working on ways to include about 20 more students in onsite study at Sanford Lab and at two national laboratories.

The Sanford Lab's Twitter micro-blogging site grew to 92 followers -- including Lawrence Berkeley National Laboratory.

Cultural Outreach

On March 12, the Cultural Committee held a regular scheduled meeting at the School of Mines. Meeting attendees presented and discussed the survey of American Indian perceptions of DUSEL, conducted by Black Hills State University. The development of Memoranda of Understanding with the regional tribal colleges was initiated.

Interactions with under-represented minorities continued in meetings with leadership from the GEAR-UP program Stacy Phelps and Jay Roman; Carter Kirk at the School of Mines to explore potential associations with the American Indian Science and Engineering Society, Al Schwalm from the Oglala Lakota College to continue developing relationships with OLC, and Dave Emery, CEO of Black Hills Corp to explore associations with BHC's internship programs for American Indians.

On March 27, two of Dr Larry Stetler's undergraduate students in Geological Engineering, Evan Keffeler and Katrina Knodel, presented a poster called "Installing the Homestake HLS for Ground Motion Studies." The venue was the Rocky Mt Section of the Association of Engineering and Environmental Geologists. Evan presented and was awarded first prize for the section.

NEW STAFF

Mr. Mike Headley has accepted the position of Deputy Project Manager for Facility Development. Working with Bill Roggenthen at SDSM&T, he will lead DUSEL project activities at the South Dakota site office. Also at SDSM&T, a job posting for the DUSEL EH&S Director was issued on April 2, 2009.

Two candidates for the DUSEL Project Mine Engineer Position were interviewed in March.

JOBS

DUSEL seeks EH&S Director. More details on the position can be found at the SDSMT website: https://yourfuture.sdbor.edu/applicants/jsp/shared/frameset/Frameset.jsp?time=1239296509126

At U.C. Berkeley, new job postings anticipated to be issued soon for two new positions of Deputy Director for Construction and Systems Engineer.

Newsletter Editor: Melissa Barclay
Contributors: Kevin Lesko, Bill Harlan, Paul Preuss, Steve Marks, Dave Plate, Syd De Vries, Ben Sayler, Peggy Norris, Frederick Gray, George Campbell, & Larry Stetler.
Special thanks to Bill Harlan for Figures 4, 7-11 photos. Figure 6 photo, courtesy of Fred Gray.

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