HOMESTAKE DUSEL AND SANFORD LABORATORY NEWSLETTER

Dear Homestake Collaboration,

Welcome to the April 2011 monthly newsletter for Homestake DUSEL and South Dakota's Sanford Laboratory. We gladly receive your input on news, links to news articles, upcoming workshops, conference notices, scientific updates, information concerning the Collaboration, employment opportunities, and other highlights relevant to our shared goal.

Important Dates

May 2-5: Infrastructure Advisory Board meeting - Lead

May 2-5: EH&S Oversight Committee meeting – Lead

May 10-12: MAJORANA Collaboration - Chicago

DOE Committee Review Panel at SLAC

On April 13-15, a review committee appointed by the DOE Office of Science, led by Jay Marx of LIGO-Cal Tech and Mark Reichanadter of SLAC, met at SLAC to review underground experiments and options for implementing underground science experiments. Members of the DUSEL Project Team and other DUSEL associates joined the committee for the three-day meeting.

Presentations included a condensed summary from the 850-plus page DUSEL Preliminary Design Report. Other information presented covered the areas of management, project controls, facility design, and operations. The committee will present its findings and conclusions in a report to the DOE within approximately 6-8 weeks.

Physicists Gather in Berkeley for Cosmogenics Workshop

On April 13-15, over 70 physicists from around the world gathered in Berkeley, California for the DUSEL-sponsored *Cosmogenic Activity and Backgrounds Workshop*. The event was held at Lawrence Berkeley National Laboratory. The goal of the workshop was to explore the uncertainties from experimental measurements and theoretical models of cosmogenic activity and backgrounds, to discuss the challenges in interpreting the data, to compare models to experiments, and to lay out a roadmap for future efforts. The workshop attracted not only researchers engaged in underground experiments around the globe, who are striving to characterize this subject and understand its impact on nuclear and particle physics experiments, but also experts in a variety of fields. The scope of the workshop included topics in cosmic-ray-induced neutron spallation and subsequent interactions, isotope production, electromagnetic and hadronic showering, and muon-incident interactions and propagation, etc.

Figure 1: Over 70 physicists met in Berkeley for the Cosmogenics Workshop

The workshop opened with a series of presentations on measurements of cosmogenic activity. Attendees were treated to first views of a number of preliminary results. This included an update of the measurement of neutron yield by the Large-Volume Detector (LVD) at Gran Sasso, which is now in much better agreement with other measurements at similar depths. Other notable results included views of first data from several clever experimental setups focusing on neutron spallation, such as the Neutron Multiplicity Counter and the Fast Neutron Spectrometer, and beam measurements of isotope production and inelastic neutron scattering. A number of recent results, previews of analyses in the works, and cosmogenic measurements from many underground labs worldwide were also presented.

The second day focused on theoretical models and Monte Carlo simulations of cosmogenic activity. One highlight was a presentation on recent active

development efforts within the Geant4 Monte Carlo framework, in coordination with the AARM (Acquisition and Assay of Radiopure Materials) Collaboration and the low background underground physics community, to improve simulations of muon-nuclear and neutron-induced interactions. A representative from the FLUKA team presented the validation of that simulation package, and representatives from the nuclear data evaluation community described current efforts to generalize nuclear data formats and access. A report on the activities of the European group ILIAS was also given, providing a successful example of collaboration across the community, and giving a number of good lessons for similar collaborative opportunities such as that presented by AARM.

Figure 2: Bags of shotcrete await mixing in Transition Cavity. The Cosmogenics Workshop focused on issues to take place in Homestake DUSEL modules

On the third day, the workshop covered background estimates and projections in current and future experiments. The XENON100 collaboration presented their estimates of cosmogenic backgrounds, which did not pose a problem for their recent Dark Matter result. On the other hand, a GERDA representative described their discovery, upon turning on the detector, of a much larger than expected cosmogenic background from *in-situ* production of ^{42}K. Many of the DUSEL S4 grant recipients were present to describe their background estimates, shielding strategies, and depth requirements as well.

From the presentations and discussions, it is clear that scientific understanding of cosmogenic activity and backgrounds is still incomplete. While some puzzles have been solved, new ones are appearing in their place. However, a number of modern detectors are producing a wealth of observables and are being simulated in great detail. With the basic underlining physics process reasonably well understood, there is some optimism that much headway can be made in the coming years. In the meantime, experimentalists will continue to strive to deploy sufficient shielding to reduce these backgrounds, whether it be active, passive, intrinsic, or external such as kilometers of rock.

Slides from all presentations are posted on the meeting website:

https://docs.sanfordlab.org/docushare/dsweb/View/Wiki-141/HomePage

DuRA Survey and DuRA Charter

The DUSEL Research Association Executive Committee (DuREC) is conducting a survey among members of DUSEL.org to see if they wish to become voting members of the DUSEL Research Association (DuRA). (You may have already received your request.) Membership in DuRA is open by request; all are welcome. Given the research-specific focus of DuRA, emails regarding DuRA business may not be of interest to all and this underlies the upcoming membership request from DuRA. The request will come in the form of a brief survey. Responding to the survey will automatically establish membership. For more info on the DuRA survey: https://spreadsheets.google.com/viewform?formkey=dEZyUWhNQTJEb2RDMFFTdU15YTBoUHc6MQ

DuRA Charter: http://www.dusel.org/PDFs/dura-docs/DuRA_charter_20101202.pdf

DUSEL IN THE NEWS

Read DUSEL news items:

nature.com: *Fukushima reactor products could skew experiment detectors* (March 26) – Includes comments from Michael Miller of the MAJORANA experiment

Rapid City Journal: *Sanford lab moves forward, despite DUSEL staff cuts (April 9); Science lab*

construction interrupted by elevator problem (March 22)

Black Hills Pioneer: *Budget cuts could have negative impact on DUSEL* (Wendy Pitlick, March 25) – Includes comments from PI Kevin Lesko and South Dakota Senator John Thune

DUSELwatch.com: DUSEL design complete; *Lab hoist running again after it jams; Sanford Lab scientists register Japan quake from 2,000 feet underground* (Wendy Pitlick)

Watch a Video:

Longer version of Deep Science video now on YouTube: http://t.co/Viprz8O

www.sanfordlab.org - Check out "Twitter updates" in lower left hand column

SANFORD UNDERGROUND LABORATORY AT HOMESTAKE

Ross Shaft

After a three-week shutdown, the Ross Shaft was back up and running on March 19. Use of the shaft was restricted after the work deck on top of the conveyance came in contact with set steel in the shaft, stopping the cage near the 3200 Level.

The Ross Shaft steel damaged in the incident has been replaced. Non-destructive testing (ultrasonic and magnetic) has been completed on the Ross service cage welds, bolts, steel, and on the Ross Shaft rope. Shaft guides have been adjusted, and the work deck was replaced with a new, simpler design.

When the cage became stuck, crew members worked as a team to follow procedure, and, fortunately, there were no injuries. An inspection crew used the south skip to retrieve the two infrastructure technicians who were in the conveyance. An emergency door was used to transfer the techs, so that they arrived to the surface within 40 minutes.

Figure 3: Infrastructure techs Neil Engle and Mike Oates rock bolt a drift at the Ross Campus

On April 14, infrastructure technicians removed the last piece of old pipe from the Ross Shaft, marking a milestone toward converting the old Homestake mine into a first-class underground laboratory. For the past year, about 20 infrastructure techs have been removing more than 8 miles of pipe from a shaft approximately 5000 feet deep.

Figure 4 outlines the architecture of the Ross Shaft, which is divided into vertical compartments. The industrial elevator car or cage runs up and down the shaft in one such compartment as illustrated in the graphic. Some sections of the compartment had as many as 10 parallel pipes, ranging from 2-inch water lines to 14-inch pipes used to dewater Homestake during its mining era.

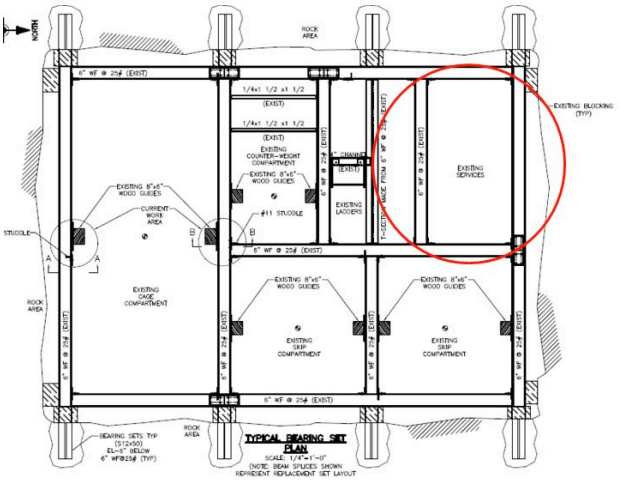

Figure 4: Schematic of the Ross Shaft. Cage compartment shown at left. Pipe compartment circled in red.

Underground Ops Foreman Jack Stratton supervised the project. Some Homestake veterans working for Sanford Lab helped in the planning stage. Infrastructure Tech and crew lead Bill Heisinger recommended the use of chains in order

to secure all the old pipe in the shaft and prevent sections of pipe from being jarred loose. Other crew leads included Doug Sneesby, Dick Goetz, Kyle Ehnes, and Rod Hansen.

Figure 5: Infrastructure techs Brent Larsen, Kyle Ehnes and Rowdy Roberts with pipe from Ross Shaft

While working in the Ross Shaft, techs wore fall-protection harnesses at all times. They worked in teams of two or three, using hammers, crowbars and an acetylene torch to cut pipes into 12-foot sections. Safety measures were always in place, including a spark barrier for the torch. Infrastructure Tech Sneesby devised a system of buckets and hoses to funnel the shaft's natural runoff water into a fire suppression system. Technicians working below communicated by radio with winch operators on the surface. Some of the pipes were severely rusted and thin. Those pipes were secured with nylon straps instead of chains. Thorough inspections of the work area were conducted at the beginning of each shift. Over the course of the year, there were no injuries or incidents.

"For safety and for design—both near term and long term," said Acting DUSEL Project Director Mike Headley. "A safe, accessible Ross Shaft is a key element of the project."

Figure 6: Contractor wets down the Davis Cavity walls in preparation for applying shotcrete

Davis Cavity

Crews have been busy in the past weeks applying shotcrete in the Davis Cavity. Once crews are finished in Davis, they will move their equipment to the Transition cavity and commence work there.

Sanford Lab Project Engineer Bryce Pietzyk, Engineering Technician Kip Johnson, and Infrastructure Technician Sion Hanson worked on the project with the crew from CAI Construction, led by Jim Norris.

Johnson and Doug Bretz of CAI alternated operating the remote-controlled robotic arm that applies the shotcrete, dispensed from 2000-pound bags. The crew might apply up to 50 bags per day.

Figure 7: View of Davis Cavity from Transition Cavity as crew member prepares to apply layer of shotcrete

The SDSTA Board of Directors awarded a contract to Ainsworth-Benning Construction of Spearfish, South Dakota, to outfit the Davis Campus. The contract includes the construction of concrete floors, lab modules, cleanrooms, showers and infrastructure for air handling, electricity, fiber-optic data cables and plumbing.

EDUCATION AND OUTREACH

Planning for the Sanford Center for Science Education (SCSE)

On April 16, a virtual DUSEL (vDUSEL) planning meeting was held at Sanford Laboratory. Participants began to formulate a strategy for an initial vDUSEL module on cosmic rays. The module will serve as a prototype for future vDUSEL modules on other underground science topics. Virtual DUSEL is a collaborative effort led by Dakota State University.

Early Programming

Undergraduate Education: The Science Club from Northern State University in Aberdeen, South Dakota visited Sanford Lab on March 25. Jaret Heise conducted a talk and led a tour of the LUX Surface Laboratory. The students also visited Black Hills State University, and learned about Deep Life from Cynthia Anderson. Their visit included a tour of BHSU's genomics laboratory.

Sanford Lab/DUSEL was a sponsor of the regional meeting of American Indians in Science and Engineering Society (AISES) held in Rapid City on April 15-17. Connie Giroux was a member of the organizing committee, while Julie Dahl and Peggy Norris staffed an information table about the Sanford Underground Laboratory.

K-12 Education: Sanford Lab hosted teachers and students from the BHSU/Sanford Lab Quarknet Center on March 16 and 18 representing five South Dakota high schools. The students participated in Quarknet-sponsored *International Hands-on Particle Physics Masterclasses,* a program created by Technische Universitat Dresden, Germany. Students analyzed tracks that might give evidence for the J/Ψ meson, then joined an online videoconference with high school classes from around the country. After the Quarknet activities, students toured the LUX Surface Lab and Yates Hoist Room. Professor Kara Keeter of BHSU, and Sanford Lab Science Liaison Jaret Heise organized the events. More than 8,000 students worldwide participated in masterclasses in March, working with scientists from 100 universities and laboratories in 23 countries. For more information: www.physicsmasterclasses.org

Figure 8: Screen shot from Dr. Kara Keeter's laptop taken during the multi-site conference. Upper left window shows control room at Fermilab. Upper right window shows students at Yates Education Building and LUX Surface Lab.

The Technology in Education (TIE) conference-the largest education conference in the state-was held in Rapid City on April 3-5. Sanford Lab/Education Department staff presented a workshop and a technical session. In addition, a pre-workshop on cosmic rays called 'Cosmic Connection' was held at Sanford Laboratory on April 1. Twenty-seven science teachers from across the state at all grade levels attended. In the morning, participants learned about the nature of cosmic rays with online and hands-on activities. In the afternoon, they toured the Waste Water Treatment Plant, the Hoist Room, and the LUX Surface Laboratory.

On April 7, Peggy Norris spoke about the status of Sanford Lab to a group of educators from K-12 and technical colleges in the area as part of a conference of the South Dakota Association for Career and Technical Education. The visit also combined a tour of the Homestake Mining Museum.

On April 14, Peggy Norris spoke via videoconference to educators and technical coordinators at several schools in the mid-Atlantic region in an Internet2 web conference on STEM education. The event was organized by the Mid-Atlantic Gigapop in Philadelphia for Internet2 (MAGPI), a regional hub for facilitating the use of high speed internet for education and research.

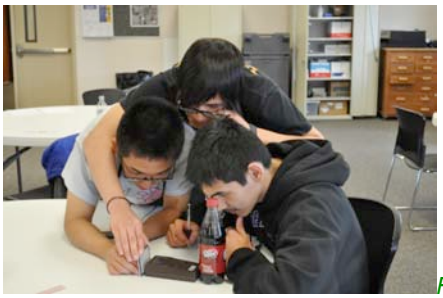

Figure 9: High school students from Red Cloud explore the properties of radiation

On April 19, the Sanford Lab Communications and Education Departments hosted a group of science and English students, and teachers from Red Cloud Indian School in Pine Ridge. The five English students learned about science journalism from Bill Harlan and Matt Kapust. The seven high school and five middle school science students explored the topic of radiation in the environment with Peggy Norris. Connie Giroux spoke to the students during lunch, and afterward, all students toured the LUX Surface Laboratory, where post-doc Peter Sorenson

(LLNL) and graduate student Carlos Hernandez Faham (Brown University) explained their activities in building the LUX detector. Once the LUX scientists had finished explaining that they had just spent several weeks constructing and leak testing flanges, one middle school student raised her hand and asked the crucial question, '*Did you buy a dark matter detector kit and follow the instructions?*'

General Public: Peggy Norris spoke to the Black Hill Astronomical Society on April 18. Her topic was on Supernovae.

On April 30, as part of the ICECube collaboration meeting in Madison, Wisconsin, and in celebration of completion of the string deployment, there will be a simulcast public talk and planetarium dome show by Principal Investigator Francis Hazen. The Journey Museum in Rapid City will be used as a remote viewing site for this event, and Bai Xinhua from SDSMT, a longtime member of the ICECube collaboration (as well as LUX and LBNE) will provide local expertise to answer questions from the audience.

ENVIRONMENT, HEALTH & SAFETY

Garden Safety

Spring garden: enjoy the outdoors, get a bit of exercise, beautify your neighborhood, or grow your own vegetables.

Wear garden gloves, sturdy shoes or rubber boots, wide-brimmed hats, and long pants, especially when using sharp tools or machinery. Keep sharp tools and harmful chemicals out of the reach of children.

Watch out for poisonous plants or stinging nettles. If you have pets, make sure that what you plant is not toxic for them.

Safety pages on Sanford Lab website: www.sanfordlab.org - Use the left hand menu to open individual pages

STAFF NEWS

Figure 10: Wendy Zawada (left) with Procurement Specialist Pam Millard in Davis Cavern after excavation

Wendy Zawada, Project Engineer for Underground Construction and Excavation, will be joining the DUSEL science team. She will be ramping up on a number of science projects, probably starting with LUX on scheduling, as well as other activities.

Wendy said, "I am excited about my move to the 'dark matter' side of the project and I look forward to the new challenges on the horizon. Currently my focus is to understand the underground needs of the LUX and CUBED experiments and incorporate the installation of these groups within the ongoing Sanford Lab operations. Early Science is key to successful future science here at the Sanford Lab, and I hope I can help make this possible!"

UPCOMING EVENTS AND ANNOUNCEMENTS

Workshops

Fourth IUPAP International Conference on Women in Physics, Stellenbosch, South Africa, April 5-8, 2011. Conference goals: provide an opportunity to view and analyze current status of, and progress in promoting women in physics in each country and internationally; provide an arena for women in physics to share their scientific accomplishments and create international scientific collaborations; and build capacity in each participating country to design and implement changes to improve the participation and advancement of women in physics.
For more info: http://www.uswip.org/

12th International Conference on Topics in Astroparticle and Underground Physics, **Münchner** Künstlerhaus (Munich House of Artists), Munich, Germany, September 5-9, 2011. Topics

covered by the conference: Cosmology and particle physics, Dark matter and its detection, Neutrino physics and astrophysics, Gravitational waves, High-energy astrophysics and cosmic rays.
For more info: http://taup2011.mpp.mpg.de/

Third International Workshop on Baryon and Lepton Number Violation (BLV-2011), Gatlinburg (Edgewater Hotel), Great Smoky Mountains, Tennessee, September 22-24, 2011. The Workshop purpose is to discuss state of the art of B,L, and B-L violation search, stimulate experimental and theoretical developments in this area, and attract new and young researchers to this field. Other topics will include: proton decay, n-nbar transformations, MAJORANA neutrinos and their role in physics beyond the standard model and in Cosmology.
For more info: http://www.phys.utk.edu/blv2011/

DuRA Events

Presentations that may be of interest to DuRA members are scheduled in the following meetings:

2011 APS April Meeting, Anaheim, California, April 30-May 3, 2011.
http://www.aps.org/meetings/april/index.cfm

45th U.S. Rock Mechanics/Geomechanics Symposium with sessions on Geology and Geophysics, Mining Engineering, DUSEL Rock Mechanics, Civil Engineering, and underground construction, San Francisco, CA, June 26-29, 2011. http://www.armasymposium.org/

2011 XXV International Union of Geodesy and Geophysics (IUGG) General Assembly, workshops and business meetings, Melbourne, Australia, June 28-July 8, 2011. http://www.iugg2011.com/

Meeting of the Division of Particles and Fields of the APS, Brown University, Providence, RI, August 9-13, 2011. http://www.hep.brown.edu/~DPF2011/

12th International Congress on Rock Mechanics, with workshop WS-5 on Networks of underground research laboratories for international disciplinary innovations, Beijing, China, Oct. 17-21, 2011. http://www.isrm2011.com/page.asp?id=100

Please send information regarding upcoming meetings of interest or presentations from DuRA members, as well as other related events to Steve Elliott (elliotts@lanl.gov) or Duane Moser (Duane.Moser@dri.edu).

JOBS

Postdoctoral Position in neutrino physics, LHEP, University of Bern. EXO experiment searching for the neutrinoless double beta decay in the 136-Xe isotope. Send letter, CV, publications list, and two reference letters to: Dr. Razvan Gornea, Laboratorium für Hochenergiephysik, Universität Bern, Sidlerstrasse 5, 3012 Bern (Switzerland). For more info: gornea@lhep.unibe.ch

Visiting Assistant Professor, Dept. of Physics, Univ. of South Dakota. Candidate will participate in 2010 DUSEL Research Center (CUBED) activities and in the planned DUSEL experiments. Apply at: https://yourfuture.sdbor.edu or submit materials to Chair of Physics Search Committee, Dept. of Earth Science & Physics, University of South Dakota, 414 East Clark, Vermillion, SD 57069 or to physics@usd.edu.

Senior Tenured Faculty, Physics Dept., Temple University, in all areas of Astrophysics particularly experimental/observational. Applicants must have his/her own high-quality research program with substantial research funding, and teaching experience. To apply, send CV, pubs list, research plan, current grant support, statement of teaching philosophy and 5 references, or for more info: http://www.temple.edu/physics/news/positions.html or Search Committee, Dept. of Physics, Temple University, 1900 N 13th Street, Philadelphia, PA 19122-6082.

Postdoctoral Fellow with PhD in Microbiology or Geology to work on NSF PIRE-funded project with focus on microbial community structure and diversity, biogeography, genomics and related research in China, Tengchong Geothermal Field, Yunnan Province. To apply send CV and research statement, or for more info: Dr Hailiang Dong, Dept of Geology, Miami University, Oxford, OH 45056, or dongh@muohio.edu.

Postdoctoral Position, UC Santa Barbara, Particle Detector Development, Dept. of Physics. Lead detector R&D program, building ultra-high-resolution particle detectors for future neutrino and dark matter detectors. Assist KATRIN neutrino experiment and at UCSB Nanofabrication Facility. Contact: bmonreal@physics.ucsb.edu, Professor Ben Monreal or http://hep.ucsb.edu/

Newsletter Editor: Melissa Barclay
Contributors: Kevin Lesko, Bill Harlan (Sanford Lab); Jason Detwiler, Yuen-Dat Chan, M. Gilchriese (Cosmogenic Activity and Backgrounds Workshop); Steve Elliott, Derek Elsworth, Joe Wang (DuRA News); Peggy Norris, Ben Sayler (Education and Outreach).

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