

Dear SURF Readers,

Welcome to the July 2012 Sanford Underground Research Facility (SURF) monthly newsletter. In the coming months, this newsletter will be posted online, and a pdf copy will be available. You will also receive an email reminder every month providing the link to the newsletter and SURF news updates. We will still be glad to receive your input on news, links to news articles, upcoming workshops, conference notices, scientific updates, information concerning SURF, employment opportunities, and other highlights relevant to underground science.

Important Dates

August 2: Luncheon seminar, Lead, South Dakota (more details on page 5)

August 21-23: EHSOC meeting, Lead, South Dakota

DIANA: Neutron background measurements at the 4100 Level

Researchers from the University of Notre Dame (UND) are currently taking data on the 4100 Level at SURF to characterize the thermal and near-thermal neutron background there. This is an element of the campaign at various deep underground laboratories to determine a suitable site for the proposed DIANA (Dual Ion Accelerators for Nuclear Astrophysics) facility. The DIANA group is planning to take measurements on other levels at SURF and at WIPP (the Waste Isolation Pilot Plant in New Mexico). UND is the lead institute for the collaboration developing a next-generation underground accelerator facility for nuclear astrophysics. The other members of the collaboration are from the University of North Carolina, Western Michigan University, Colorado School of Mines, Michigan State University, and Lawrence Berkeley National Laboratory.

Some of the processes that will be studied with DIANA are the neutron-capture reactions in stellar nucleosynthesis, the synthesis process responsible for roughly half of the elements heavier than iron that we know today. These reactions occur at such low energies that a direct measurement of their cross sections presents a significant challenge that

can only be overcome by going underground. The neutron flux in deep underground environments is about three orders of magnitude lower than on the surface, leading to a much more favorable signal-to-background ratio in the measurement of key astrophysical reactions.

With the cosmic-ray induced neutron flux severely suppressed, the main background component is from radioisotopes present in the walls of the underground environment. Depending on the type of rock, this component can vary by up to a factor of 10 from place to place underground. To characterize the neutron background level and determine the optimal location for DIANA, the UND team is conducting measurements at various deep underground sites, each with very different environmental conditions. The experimental setup consists of four He-3 counters and two polyethylene moderators of different volumes. The equipment is brought to its underground location and set up to take data in a matter of a few hours to facilitate relatively quick location changes after a few months of measurement. During the week of June 11, collaboration members Andreas Best and Karl Smith set up the equipment at SURF as seen in Figures 1 and 2.



Figure 1: Sanford Lab Motor Operator Neil Engle transports crate to the airlock on the 4100 Level



Figure 2: Left: University of Notre Dame physicist Andreas Best (left) and graduate student Karl Smith set up a counter to detect neutrons on the 4100 Level Right: Andreas Best and Karl Smith inside the airlock

The UND team consists of Andreas Best, Joachim Goerres, Ed Stech, Michael Wiescher, and graduate students Alex Long and Karl Smith. Fred Jung, an undergraduate student, also participated in the project. So far, measurements have been made at the Kimballton Underground Research Facility near Virginia Tech and at the Soudan Underground Laboratory in Minnesota.

Jim Siegrist, DOE Associate Director, Office Of High Energy Physics, and former LBNL Physics Division Director, had a medical event while flying to the Bay Area on June 30. The doctors said that he had an amazing recovery. All best wishes for Jim's return to health, and a special thanks to Jim from the SURF Team for all he has done in support of underground science. In his position as LBNL Physics Division Director and also as an aide to UC Berkeley Vice Chancellor for Research Graham Fleming, Jim was involved with the DUSEL and SURF Project for several years. At the Office of High Energy Physics he has supported important science programs including LBNE, searches for Dark Matter, and Neutrinoless Double Beta Decay.

SURF: Supplement Articles

The second in a series of SURF Newsletter Supplement articles, "The MAJORANA DEMONSTRATOR Project at the 4850 Level Davis Campus" is now available at:

<http://www.dusel.org/html/early-science-progress.html>



SURF IN THE NEWS

ScienceDaily.com: [Physicists Close in On a Rare Particle-Decay Process: Underground Experiment May Unlock Mysteries of the Neutrino](#) (June 4)

Black Hills Pioneer: [Lead celebrates Neutrino Day](#) (Dennis Knuckles, July 16)

[Neutrino Experiment planned for Kirk Canyon](#) (Wendy Pitlick, July 9)

[Don't Bump the Detector!](#) (Wendy Pitlick, June 26)

Rapid City Journal: [Dark-matter detector has new home in South Dakota](#) (July 13)

[Neutrino day set for July 14](#) (Aaron Orlowski, July 10)

[Underground science lab gives annual free festival](#) (July 6)

Science.com: [Betting Big on Science](#) (Adrian Cho, July 13)

DUSELwatch.com (Wendy Pitlick, July 3): *Sanford Lab education impact spans multiple ages, levels*
Sanford Lab economic impact slow but significant
Timeline

For twitter updates see: www.sanfordlab.org

Reports Available

Prepublication version of the report of the decadal study by the Committee on the Assessment and Outlook for Nuclear Physics (NP2010 Committee):
http://sites.nationalacademies.org/BPA/BPA_069589

The National Research Council report – "An Assessment of the Deep Underground Science and Engineering Laboratory":

http://www.nap.edu/catalog.php?record_id=13204

Marx-Reichanadter Committee report to DOE:

http://science.energy.gov/~media/np/pdf/Review_of_Underground_Science_Report_Final.pdf

SANFORD UNDERGROUND LABORATORY NEWS

LUX detector arrives at underground lab

On Thursday, July 12, the LUX dark-matter detector arrived at the 4850 Level of SURF. The detector was built over the course of three years. Its core is encased in a double-walled titanium cryostat that is 6.5 feet high and 3 feet in diameter. The tank holds 700 pounds of liquid xenon chilled to minus 160°F. Another piece of the detector, the breakout cart, consists of a complicated assortment of pipes, conduits, and valves.

On Wednesday, the LUX detector was first taken carefully by forklift from SURF's surface lab to the top of the Yates Shaft, a distance of about 800 feet (shown in Figure 3). By Thursday, the detector was ready for its slow descent by underground cage. Due to all the precautions, a trip that normally lasts

about 10 minutes took about two hours. The equipment was heavily protected by bubble-wrap, protective foam, and plastic film, while accelerometers attached to the LUX equipment measured bumps and vibrations.



Figure 3: The LUX detector is moved by forklift into Yates Shaft Headframe on July 11



Figure 4: Researchers, engineers, and technicians maneuver the LUX dark-matter detector at Sanford Lab's 4850 Level

Once on the 4850 Level, the equipment was moved 500 feet to the Davis Campus on air bearings, which lift heavy equipment on a thin cushion of compressed air (see Figure 4).

LUX scientists and the Sanford Lab team had already practiced the move with steel and Styrofoam before the actual operation. *Donovan Construction* of Spearfish, SD moved the detector on the surface. *Feuillerat's Welding and Machinery Moving* of Rapid City provided the air bearings. Woody Burns of *CVD Construction* also assisted with the detector move. Key Sanford Lab staff include LUX Operations Manager David Taylor, Project Engineer Wendy Zawada, and Facilities Technician Gary Larson.

LUX researchers and Sanford Lab personnel spoke live from the 4850 Level on Friday, July 13 on the South Dakota Public Radio program "Innovation". In the next phase, the LUX detector will be unwrapped, hooked up, and tested before it is

lowered into a 71,600-gallon water tank that further protects it from background radiation.

Construction Updates

During the week of June 25, LUX researchers installed 16 photomultiplier tubes (PMTs) in the LUX detector's water tank located in the Davis Cavern (shown in Figure 5). The PMTs will detect the Cherenkov-effect light pulse produced in the water by penetrating cosmic-ray muons to veto or ignore, potential background-causing events.



Figure 5: LUX collaboration members John Bower (left) of Lawrence Livermore National Lab and Sergey Uvarov of UC Davis work on a string of four photomultipliers in the LUX tank

In the nearby Transition Cavern, MAJORANA collaboration members and Sanford Lab staff installed the over floor base that will support the MAJORANA DEMONSTRATOR detector and its heavy lead shielding (shown in Figure 6). Plastic scintillators will be inserted between the beams of the over floor to provide a veto signal similar to the veto signals from the PMTs in the LUX tank.



Figure 6: Science Laboratory Custodian Robyn Varland cleans the MAJORANA assembly area near the just-installed over floor

Also during the week of July 11, machinist Randy Hughes put copper on a lathe (shown in Figure 7) and started fashioning parts for the MAJORANA DEMONSTRATOR (MJD) experiment, which will look for neutrinoless double-beta decay. This may be the

world's only machine shop in a deep-underground clean room. More details on this activity will be featured in the August newsletter.

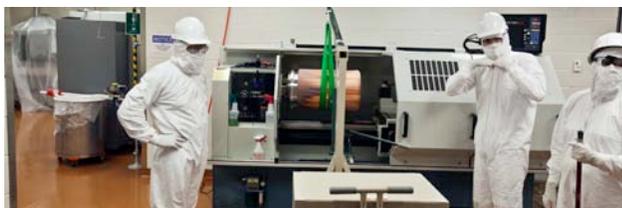


Figure 7: Machinist Randy Hughes of Adams ISC, MAJORANA Integration Coordinator Reyco Henning of University of North Carolina, and Laboratory Custodian Robyn Varland of Sanford Lab inside the clean-room machine shop at the 4850 level - Note copper on the lathe in center

Safety at Sanford Lab

On June 13, an underground evacuation drill took place at Sanford Lab to provide practice for the Emergency Response Team (ERT) and Sanford Lab management (shown in Figure 8).

Environmental Manager John Scheetz, a member of the ERT, initiated the emergency scenario at 9:30 a.m. at the Davis Campus on the 4850 Level. In this simulated emergency, Underground Laboratory Supervisor Tom Trancynger "discovered a victim" played by Infrastructure Tech Dan James, who had been overcome by simulated hydrogen sulfide gas. Trancynger moved the victim to safety and reported the incident. The underground lab was evacuated and an Emergency Operations Center (EOC) assembled at the Yates Admin building. Two other ERT teams were also assembled and deployed.



Figure 8: Emergency Response Team members respond in an underground emergency drill

Oddly coincident, one of the contractors underground reported difficulties during the drill. As a precaution, he was evacuated and taken to a hospital, and later reported to be doing fine.

The purpose of the drill was to improve emergency communications, update the risk management register for underground hazards, and provide a more efficient EOC.

New Emergency Response Guides are available at Sanford Lab and will be posted throughout the Lab, underground and on the surface. Each guide comes with four homework assignments so that employees will become familiar with emergency procedures.

Like Sanford Lab on Facebook (and also see Sanford Lab's Photo of the Day): <http://www.facebook.com/SURFatHomestake>

EDUCATION AND OUTREACH

Recent Activities

Twenty-two high school students traveled more than five hours each way to visit Sanford Lab as part of the Sitting Bull Summer Science Academy at Sitting Bull College in Fort Yates, North Dakota. The College serves the Standing Rock Indian Reservation. The summer academy, an educational outreach program sponsored by North Dakota EPSCoR, is designed to build new, and strengthen existing, pathways for American Indian students to pursue careers in STEM fields. Instructors from Sitting Bull College also took part, along with the head of the North Dakota statewide summer academy program, Dr. Robert Pieri, a Mechanical Engineering Professor at North Dakota State University.

The GEAR-UP program held its annual Summer Honors program at SDSMT again this year. Connie Giroux of the Sanford Lab Science Department gave mini-lectures to three different groups of GEAR-UP students this summer, including senior girls. In addition, Cultural and Diversity Coordinator KC Russell, Lisa Rebenitsch, intern and graduate student in computer science at Michigan State University, and Sanford Lab's Director of Education and Outreach Ben Saylor represented Sanford Lab at the GEAR-UP Career Day event at SDSMT on June 25, speaking with approximately 70 students.

Northern Illinois University brought 16 teachers from the Chicago area to the Black Hills for an afternoon

as part of a weeklong geology field camp. The group looked at land use in the Black Hills and ways to make earth science relevant to their students, who are predominantly Hispanic. The teachers performed a water filtering design activity (shown in Figure 9) and toured Sanford Lab's Waste Water Treatment Plant.



Figure 9: Intern Lisa Rebenitsch looks on while teachers from Illinois take part in the water filter engineering design challenge

Intern Lisa Rebenitsch has been working with Sanford Lab's Education and Outreach Department this summer to prepare a prototype interface to bring Sanford Lab data to students and teachers, using some of the tiltmeter data collected by Fermilab Physicist Jim Volk and his collaborators. The application, which will be available on the Sanford Lab website in the near future, features selected files that contain data collected at Sanford Lab from earthquakes around the world.

Forty-one elementary-grade students from Spearfish Kids Club summer camp visited Sanford Lab on July 5 to take part in an engineering design activity and tour of the hoist room. Participants included the two sons of Sanford Lab Science Director Jaret Heise, the two sons of Systems Engineer Pam Hamilton, and the daughter of Cultural Advisory Committee Member Urla Marcus.

Neutrino Day

On Saturday, July 14, annual Neutrino Day took place at Sanford Lab with a record 960 people attending. Over 70 volunteers from Sanford Lab, Lead Chamber of Commerce, the LUX and MAJORANA collaborations, the Davis-Bahcall scholars program, South Dakota Public Broadcasting, and others assisted. The City of Lead loaned a giant event tent. Black Hills Power, a new Neutrino Day partner, provided a generous grant for the science festival.

A variety of activities took place, including scientific presentations, hoist-room tours, hands-on science activities for kids, and live high-def talks with LUX scientists who were working underground. Shuttles operated frequently between the Homestake Visitor Center and Sanford Lab.

Half-hour talks were given by USAF retired Major Bob Von Liebman (now at South Dakota Air and Space Museum) on early cosmic-ray research from the Stratobowl, South Dakota School of Mines physicist Xinhua Bai and visiting physicist Jiali Liu on current cosmic-ray research in the US and China, University of South Dakota physicist Vincente Giuseppe on neutrinos, and by South Dakota School of Mines chemist Cabot-Ann Christofferson (shown in Figure 10) on copper-forming underground at Sanford Lab.



Figure 10: Cabot-Ann Christofferson speaks to standing-room only crowd about making the world's purest copper at Sanford Lab

The next Sanford Lab Lunch Seminar will take place Thursday, August 2, at 11:30 a.m. Ann Hast, Summer 2012 Teacher in Residence, will speak on "Incorporating Engineering into Science Education". Lunch will be catered by Cheyenne Crossing.

ENVIRONMENT, HEALTH & SAFETY



Summer Water Safety

- Maintain constant supervision of children in swimming pools and swimming areas. Swim in designated areas supervised by lifeguards.
- Don't drink and swim, and don't swim alone.

- If you are doing water sports, keep hydrated, especially in the heat. Wear lightweight and light-colored clothing. Surfboards and bodyboards should be used only with a leash. If you are boating, wear a life jacket.
- Use waterproof sunscreen, at least 15 SPF. Apply 30 minutes before exposure and reapply every two hours.

Safety pages on Sanford Lab website:

www.sanfordlab.org - Use the left hand menu

UPCOMING CONFERENCES AND WORKSHOPS

Underground Science Experiments & Research Seminars (USERS) continue bi-weekly on Thursdays, 1:30-2:30 PM. Alternate sessions will be held at LBNL and UC Berkeley, 325 Old LeConte Hall. If you are interested in attending these seminars please subscribe to this email list for future announcements:

<http://dusel.org/mailman/listinfo/ugsseminars>

NNN12: Next Generation Nucleon Decay and Neutrino Detectors - October 4-6, 2012, Fermilab, Batavia, IL.

<http://conferences.fnal.gov/nnn12/>

IWAA12: International Workshop on Accelerator Alignment - September 10-14, 2012, Fermilab, Batavia, IL.

<https://indico.fnal.gov/confLogin.py?returnURL=https%3A%2F%2Findico.fnal.gov%2FconferenceDisplay.py%3FconfId%3D4712&confId=4712>

DURA Events: Please send information regarding upcoming meetings of interest to DURA members to Richard_Gaitskell@brown.edu or jswang@lbl.gov.



JOBS

Postdoctoral Researcher position – Center for Neutrino Physics, Virginia Tech. Study of neutrino oscillations, working primarily on the Daya Bay Reactor Neutrino Experiment in China. Prof. Jonathan Link, jmlink@vt.edu, Virginia Tech Physics Dept., 317 Robeson Hall, M/C 0435, Blacksburg, VA 24061. Job #0121584. <http://www.jobs.vt.edu>

Process Development Engineer – Fluke Corporation. Knowledge of Physics, Electronics, and Material Science will be relevant. Position is at corporate headquarters in Seattle.

<https://danaher.taleo.net/careersection/external/jobetail.ftl?lang=en&job=FLU000738>

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