

HOMESTAKE DUSEL AND SANFORD LABORATORY NEWSLETTER

Dear Homestake Collaboration,

Welcome to the September 2010 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

October 1-3: Workshop on major DUSEL physics topics – SDSM&T, Rapid City (See page 8 for more details)

October 18-20: Internal PDR (Preliminary Design Report) Review - Berkeley



Figure 1: The new DUSEL Logo

Davis Campus Mapping and Laser Scanning

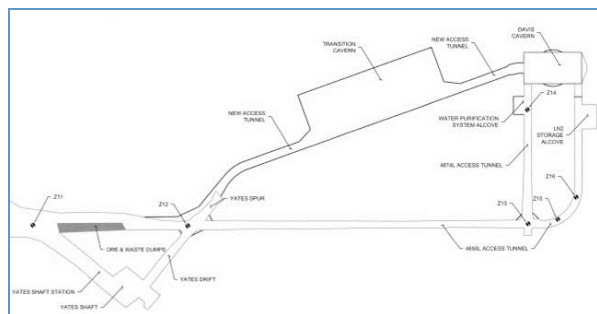


Figure 2: Davis Campus Mapping and Laser Scanning Area

The first phase of mapping and laser scanning of the Davis Campus has been completed. The work included laser (LIDAR) scanning of the Davis Chamber, Transition Cavern and connecting drifts (Figure 2). LIDAR scanning was performed by Maptek Inc. using a high resolution (Z+F Ltd) red light laser scanner. The associated survey involved placement of five new surveying benchmarks in the Davis Campus area, and survey support for the scanner by Four Front Design Inc. which utilized a total station.

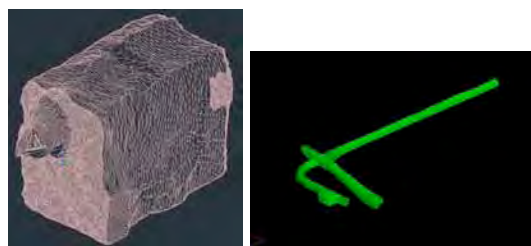


Figure 3: Davis Chamber Triangulation (preliminary, low resolution vector model)

Figure 4: Triangulation of the Davis Campus Connecting Drifts

Excavation mapping with a scanner is a two-step process. The laser creates a "vector map" which will be used to develop a detailed mathematical model of the excavation (Figures 3 and 4). The second step is to take a high-resolution photograph covering a 360° field of view of the scanner at exactly the same location. A single "circular photo" consists of 24 consecutive photographs, 12 Mpixels each for the total of 288 Mpixels. The high-resolution, 360° photograph is then digitally "draped" over the vector map to create an accurate, virtual model of the excavation (Figure 5).



Figure 5: Virtual Model of the Davis Chamber (preliminary, low-resolution model created to assess lights needed)

The laser scanning was accompanied by manual mapping of the geology and rock structure by Lachel Associates and Golder Associates. A standard, traditional manual mapping procedure is needed for digital model verification, and to collect data that cannot be deduced from the virtual model. On the other hand, manual mapping of the entire Davis Chamber without laser scanning would have been limited by its height (Figure 6). Both techniques are complementary.



Figure 6: Height Limitations for Manual Mapping in the Davis Chamber

An accurate model of the entire Davis Campus will be developed over the next several weeks. A new coordinate system was created for this purpose, with desired 1 mm resolution. This local coordinate system will then be used for successive scans of the rest of the 4850' Level Campus, and eventually will be united with the surface UTM and Lat/Long coordinate systems. The immediate use of the model will involve structural analysis and interpretation of the geology needed for large cavity designs. This new way of interpretation will be performed interactively off the computer screen. The second laser scanning campaign will be performed sometime in the near future after shotcrete is applied to the surfaces of the Davis Campus excavations. Direct comparison (subtraction) of the two models will be used to calculate shotcrete thickness and to assess the effectiveness of shotcrete application.

A good quality laser scan or equivalent photogrammetric model - as a 'technical blue print' - has a potential for multiple uses such as virtual geology mapping, geotechnical analysis and interpretation, excavation design, excavation convergence monitoring, blasting design and control (overbreak management and smooth blasting control), excavation performance to measure and document construction progress and conduct risk analysis, ground support and infrastructure inventory, spatial design of DUSEL scientific

experiments, facilities and instrumentation, and safety management and training tool.

The project team received great help and support from the Sanford Laboratory management and personnel. The following are involved in the Project:

- Zbigniew J. Hladysz – project manager and DUSEL geotechnical lead
- Scott Schiele – Maptek/laser scanning
- Carrie Randolph-Loar – Lachel/geology mapping
- Steven Otto – Golder/geology mapping
- Tom Trancynger – Sanford/geology mapping
- Randy Deibert – FourFront/surveying
- Bob Deibert – FourFront/surveying
- Kevin Hechmeister – Golder/safety and logistics

Crystal Growth and Detector Development for DUSEL Experiments

Dr. Dongming Mei and collaborators in the CUBED (Center for Ultra-Low Background Experiments at DUSEL) collaboration are working on the development of techniques to manufacture crystals with unprecedented purity levels that may be used by experiments proposed for DUSEL. The CUBED research center which was created in 2009 as part of the state of South Dakota's research initiative to promote economic development within the state, recently received an additional \$3M in funding support from the DOE EPSCoR Office. This timely investment in research and development may establish DUSEL as the only site in the world where low activity, high-purity germanium crystals are manufactured. Ultra-low background experimenters studying neutrinoless double-beta decay and dark matter are very interested in employing germanium detectors fabricated using high-purity germanium.

The crystal-growing program was started last year with guidance from Dr. Gene Haller (LBNL). Dr. Yuen-Dat Chan and the Si/Ge Detector Engineering Group at LBNL continue to work closely with the CUBED team. In addition, a small workshop with several scientists from the GeoDM (Germanium Observatory for Dark Matter at DUSEL) Collaboration was held on September 16-17, 2010 at the University of South Dakota (USD) to discuss germanium crystal growth, characterization, and detector fabrication.

It has been demonstrated (D.-M. Mei, Z.-B. Yin, and S. R. Elliott, *Astroparticle Physics* 31 (2009) 417-

420, and arXiv:1002.4703V2, CoGeNT Collaboration) that cosmogenically-produced isotopes in germanium crystals create backgrounds for neutrinoless double-beta decay and dark matter experiments. The best way to minimize the cosmogenic backgrounds is to purify, grow, and fabricate germanium detectors underground, which is why Dr. Mei and his collaborators are pursuing an underground facility at the Sanford Underground Laboratory at Homestake.



Figures 7-8: Crystal Growth Lab at University of South Dakota

Within CUBED, the crystal-growing project has state-wide participation by USD, South Dakota School Mines and Technology (SDSMT), and South Dakota State University (SDSU) with USD serving as the lead institution. Crystal pulling equipment was purchased earlier in 2010 to outfit two surface laboratories at USD and SDSMT. A crystal growth lab at USD is beginning operation under the guidance of physicists Drs. Mei, Sun, and Xiang who are working on the crystal growth and chemist Dr. Jiang who is leading a group to work on the crystal characterization at USD. Dr. Keller is working with USD administration to identify a surface facility for full operation of the project on the surface for two years. At SDSMT, Dr. Howard is leading a group working on the poly zone crystal refining and Dr. Hong is working on the crystal growth. Dr. McTaggart at SDSU is working on the mono-zone crystal refining with Dr. Mei at USD. Dr. Baroughi at SDSU will be working on the crystal characterization with Jiang. Dr. Guiseppe (USD) is working with

Sanford Lab Science Liaison Director Dr. Heise to design and accommodate the underground labs.

The research and development of this project, including the science of the subprojects will involve dozens of undergraduate students, graduate students, and postdoctoral fellows. In addition, the advanced technologies inherent in the project will provide students with many multidisciplinary opportunities in physics, chemistry, mathematics, material science, engineering, and computation, as well as chemical analysis, material characterization and purification, low background counting, and neutron activation.

In addition, CUBED supports the following research activities: 1) Dr. Medlin at SDSMT works with the Majorana Demonstrator for electroforming copper at the Sanford Lab; 2) Dr. Keeter et al at Black Hills State University (BHSU) and Dr. Alton at Augustina college collaborate with MAX for dark matter experiment; 3) Dr. Bai at SDSMT and Dr. Mei at USD participate in the LUX experiment at Sanford Lab; and 4) Dr. Szczerbinka at Dakota State University (DSU) works on the various neutrino cross section calculations.

DuRA News

First Annual DuRA Meeting and PDR Rollout

A preliminary view of the design of the facility was aired at the First Annual DuRA Meeting and PDR Rollout, held at Fermilab on September 2-3, 2010. The meeting summarized the current state of the design, and took comments from the scientific community. The proceedings were streamed live and are archived, together with the full suite of science talks at:

<http://www.dusel.org/workshops/fallworkshop10/index.htm>
<http://www-visualmedia.fnal.gov/search/100902DURA.htm>

During and after the FNAL DuRA annual meeting, the executive committee collected feedback from the community and provided a summary to the Project Office. This gives the Project Office an important source of feedback from the potential users. The Joint Oversight Group (JOG) has requested information motivating the depth requirements for

HOMESTAKE DUSEL AND SANFORD LABORATORY NEWSLETTER

several experiments expressing interest in the 7400' Level. Those experimental groups are responding. In addition, a document is being coordinated by Bernard Sadoulet and Steve Elliott that will summarize the depth requirements of the various physics experiments. Please contact: elliotts@lanl.gov or Sadoulet@berkeley.edu if you have questions or wish to contribute input.

The BGE (Biology, Geology and Engineering) group is compiling scientific rationale and cost summaries from both extended and localized experiments to locate at the 7400' Level, including enhanced chance of success in the optimal deep and long borehole drilling/coring/sampling and better control with higher stress levels in coupled process experiments. This documentation is being collected by Tullis Onstott, Derek Elsworth, Herb Wang, and DuRA BGE members. Please contact tullis@Princeton.EDU if you have questions or wish to contribute input.

DuRA Executive Committee

At the DuRA Meeting, the DuRA Executive Committee members were introduced. Steve Elliott is the Chair and Rick Gaitskell is the Vice-Chair. The other DuRA exec members are Priscilla Cushman, Duane Moser, Manoël Couder, Andrew Hime, Ken Lande, and Joe Wang. DEDC's Chair Derek Elsworth and Co-Chair Hank Sobel, Daniela Leitner, Larry Murdoch, and T.C. Onstott are also members of DuRAexec to ensure a smooth transition from the DEDC, and generate lively discussion.

Over the next few months, DuRA members are welcome to provide comments and observations as input to DUSEL's PDR after its draft is released. Please contact any of the DuRA Executive Committee members to provide your input (cc: jswang@lbl.gov who will compile the information).



DUSEL IN THE NEWS

To read about DUSEL stories:

Symmetrybreaking: *DUSEL planning on track* – September 13 - www.symmetrymagazine.org/cms/

Article on Warren Matthews, new DUSEL Cyber Infrastructure Chief Engineer: *Lab family looking forward to making Black Hills their home* by Wendy Pitlick, August 26 - Duselwatch.com

Other Duselwatch.com Articles by Wendy Pitlick: *75 miles of Rock History*; *Deep pumping*; *Looking for deep life*; *Davis Cavern excavation*; *SD students directly benefit from lab research*

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

SANFORD UNDERGROUND LABORATORY AT HOMESTAKE

Core-sample Archives

This summer, Kelli McCormick of the South Dakota Geological Survey and Chase Hamer, a geology graduate student from the South Dakota School of Mines & Technology updated the Homestake core-sample archive. This process included opening hundreds of boxes, checking information, and updating the database. Scientists and engineers can now search for core samples by categories of geologic formation, rock characteristics, depth or other parameters. On-line SDGS resources can be found at: <http://www.sdgs.usd.edu/>



Figure 9:
Kelli McCormick and Chase Hamer behind the pallets containing core samples

Pipeline Bridge at Kirk Gulch

On September 15, Donovan Construction of Spearfish and other contractors began building a new pipeline that will carry water nearly two miles from Homestake Mining Company's Grizzly Gulch tailings reservoir to the water treatment plant at Sanford Lab. Due to a long-term agreement with Homestake Mining, water from Grizzly Gulch is

HOMESTAKE DUSEL AND SANFORD LABORATORY NEWSLETTER

blended with water from underground before sending it to the lab's water treatment plant. Grizzly Gulch water cools the Sanford Lab's warmer underground water and lowers the concentration of dissolved solids. The Sanford Lab's treatment plant removes ammonia from Grizzly Gulch water and lowers the suspended solids.



Figure 10: Aerial view – the tunnel is the Oro Hondo adit

Kirk Road was closed as Cretex Concrete Products delivered the 99-foot pre-cast concrete bridge and D&W Crane Rigging of Rapid City lowered the bridge on to piers. Upon completion, the bridge will carry the double-walled pipeline over Kirk Road and Whitewood Creek. From there, the pipeline will enter the Oro Hondo tunnel at the 300' Level. RCS Construction of Rapid City will install the pipeline through the 300' Level to the Ross Shaft. Sanford Lab technicians will take over from the Ross shaft to another tunnel near the surface. RCS will continue the construction from the tramway to Homestake's former Mill Reservoir, a large concrete basin that feeds the water treatment plant. The treatment plant discharges clean water into Gold Run Creek. The new set up will make it easier to treat both sources of water before release.



Figure 11: Dan Moller (RCS) and Kip Johnson (Engineering Technician) push supplies onto the Oro Hondo adit at the 300' Level

The new line replaces Homestake's "decant line." Homestake Mining Co. is replacing the line on the company's property at Grizzly Gulch. Sanford Lab is

installing the double-walled polyethylene line on lab property. Project Manager Mike Johnson says that water should be flowing through the new pipe by October.

New Sanford Lab Parking Lot

The new Sanford Lab parking lot was finished just in time for the September 23 meeting of the SDSTA Board, and a September 24 visit by members of the National Science Board. The new lot has 110 regular parking spaces and four handicapped spaces as well as islands and arrows to direct the flow of traffic. Project Engineer Bob Kaufman managed the job, Dale Russell wrote the specifications, and Construction Manager John Matthesen along with Engineering Technician Kip Johnson and Drafter Bill Feterl created the design. J&J Asphalt of Rapid City was the contractor.



Figure 12: New Sanford Lab parking lot

EDUCATION AND OUTREACH

Planning for the Sanford Center for Science Education (SCSE)

The research firm of David Heil and Associates (DHA) has conducted over 1200 interviews of tourists in and around the Black Hills this summer in order to understand factors that would draw visitors to a science education center at DUSEL. An initial report will be ready in time to inform the DUSEL's Preliminary Design and also for South Dakota's upcoming legislative session. The work is funded in part by the South Dakota Department of Tourism.

Beginning this fall and into the spring, DHA will be interviewing other potential audience sectors and facility users-K-12 educators, college faculty, area residents and scientists-to understand what potential exhibits and programs of the SCSE would be most appealing and beneficial. This work will inform a

comprehensive business planning process to take place in 2011.

An update on SCSE planning and early education activities was presented at the DuRA meeting at Fermilab in September by Peggy Norris. The talk can be found at:

http://www.dusel.org/workshops/fallworkshop10/n_norris.pdf.

Early Education Activities

During the weekend of October 2-3, the DUSEL E&O Team will have an exhibit table at the Annual Meeting of the Society for the Advancement of Chicanos and American Indians in Science (SACNAS) featuring Sanford Lab/DUSEL. The meeting will take place at the Anaheim Convention Center in southern California. If your department has an REU or other internship program that includes DUSEL-related research, send flyers to distribute at our table. Please send to: Dr. Peggy Norris, Sanford Underground Lab, 630 E. Summit St, Lead, SD 57732.

On October 23-24, DUSEL E&O will have a tent at the USA Science Festival on the Mall in Washington, D.C. (<http://www.usasciencefestival.org/>) featuring hands-on activities in physics and geoscience. E&O is still looking for DUSEL science groups in the northeast to send students/postdocs to work at this event, which is expected to draw close to 100,000 people.

Please contact Peggy (pnorris@sanfordlab.org) for more information.

Russell joins DUSEL as Cultural Liaison



Daryl "KC" Russell will start on October 12 as DUSEL's new Cultural and Diversity Liaison and Coordinator. He is currently Director of the Indian Health Care Initiative for South Dakota Governor Michael Rounds. He is also a member of

the DUSEL-Sanford Lab Cultural Advisory Committee. In his current position, Russell works directly with tribal, federal and state agencies and with the private sector on health issues. Before joining the Governor's staff in April 2008, Russell had retired after 36 years with the South Dakota National Guard and the Indian Health Service. He lives in Aberdeen, SD with his wife, Diane. They have three grown children and five grandchildren. Russell is an enrolled member of the Lower Brule Sioux Tribe.

ENVIRONMENT, HEALTH & SAFETY

EHSOC Comes to Homestake



Figure 13: EHSOC - Jim Krebs, Jim Tarpinian, Craig Ferguson, Mike Andrews, and Tony Iannacchione

The Environment, Health and Safety Oversight Committee (EHSOC), commissioned by Graham Fleming, UC Berkeley Vice Chancellor for Research, came to the Homestake site and conducted its first assessment of the integrated and unified DUSEL/Sanford Environment, Health and Safety program. The EHSOC, chaired by Craig Ferguson, Director of EHS at SLAC National Accelerator Laboratory, found considerable progress and many noteworthy practices including the technical strength of the project staff (related to EHS), the quality of the EHS staff and leadership, the eagerness and willingness for continuous improvement and seeking out of best practices, and the effective operations work planning meetings.

The EHSOC focused on six areas during their assessment: EHS Organization and Programs, Initial Science and EHS Integration, Work Planning and Control, Hoisting and Rigging, Training, Emergency Response, and Underground Construction. In addition to the review, Tony Iannacchione (University of Pittsburgh) gave a presentation on

HOMESTAKE DUSEL AND SANFORD LABORATORY NEWSLETTER

EHS related risk management to further assist us in our efforts to identify and mitigate risks within the Laboratory.



Figure 14:

EHSOC in the newly painted Majorana electro-forming cavern

The EHSOC had a number of recommendations in its final report, pointing out ways to improve our commitment and execution of integrated safety management. The report concluded with the following statement: "There has been significant improvement, and the project is on a fast trajectory to be able to support initial science and beyond." We are rapidly making progress towards "One Project – One Laboratory and demonstrating that *Mining is our past. Science is our Future. Safety is our foundation.*"

Protecting Water Quality and the Environment

During the first week of September, Environmental Manager John Scheetz worked with GEI Consultants on Sanford Lab's annual bio-monitoring program. Sanford Lab discharges water into Gold Run Creek which flows into Whitewood Creek. Fish populations live and propagate in these waters. Human resident populations could also be affected as this is a hiking, camping, and fishing area.



Figure 15: GEI

Consultants Don Conklin (left), Shai Kamin, and Erin Smith electro-fishing in Whitewood Creek

Between 1870 and 1977, tailings generated during the operation of Homestake mine were released directly into Gold Run Creek. The hazardous

substances included arsenic, copper, zinc, selenium and mercury. GEI measures fish populations upstream and downstream at the intersection of Gold Run and Whitewood creeks, using electro-fishing techniques which allow them to catch and release the fish. Sanford Lab staff collects the water samples and sends them to an independent lab for analysis. The good news, according to John Scheetz, is that fish populations are comparable upstream and downstream. Sanford Lab is doing its part to protect water quality and the environment.



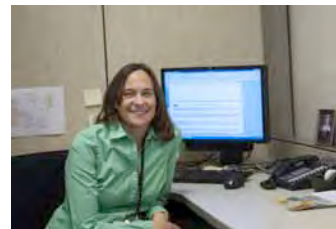
Back to School Safety:

- Slow down while driving in school zones
- Wait for school buses – Passing a stopped school bus with flashing lights could also result in a hefty fine
- Watch carefully at school crosswalks

Safety pages on Sanford Lab website:

www.sanfordlab.org - Use the left hand menu to open individual pages

NEW STAFF



Pam Hamilton is the new DUSEL Systems Engineering Support Specialist. She is located at the Sanford Lab in Lead. In this new role, Pam will be leading the management of DUSEL facilities requirements in the DOORS requirements management system along with leading the administration of DUSEL configuration management (CM) systems and CM activities. Pam has worked in private industry and brings to DUSEL a very strong background in requirements development and management along with configuration management and system testing. She lives in Spearfish and is a welcome addition to the collective SDSTA / DUSEL team.



Chuck Lichtenwalner has joined the Sanford Underground Laboratory at Homestake to serve as the Experimental Health & Safety Manager. He is currently renting a house in Lead, overlooking the Yates shaft. Chuck spent 32 years working at Bell Laboratories as a researcher, first in low energy nuclear physics, then in optical networking, and also as an industrial hygienist and safety engineer. Following that, he worked in the Science Programs group of the EH&S department at Harvard University. Most recently, he managed the Occupational Health & Safety department of the contractor operating the US Air Force base at Morón de la Frontera, Spain. He shares that he enjoyed an extended vacation in southern Spain, with weekly interludes on the base. He will be using his laboratory experience supporting the researcher's health and safety efforts.

Chuck is looking forward to working with (and learning from) the experimenters, and enjoying cooler weather than southern Spain.

UPCOMING EVENTS AND ANNOUNCEMENTS

Upcoming DuRA Events

Presentations will take place in the following upcoming meetings with DuRA members. Some of the highlights will be presented by speakers in future monthly reports:

International Conference on Greenhouse Gas Technologies, September 19-23, 2010, Amsterdam
<http://www.ghgt.info/>

EMSEV, October 3-6, 2010, Orange, CA
<http://sites.google.com/site/emsev2010/scientific-program-1>

Neutrino Geoscience 2010, October 6-8, 2010, Gran Sasso
<http://geoscience.lngs.infn.it/>

ISRM International Symposium 2010 and 6th Asian

Rock Mechanics Symposium October 23-27, 2010, New Delhi
<http://www.arms2010.org/>

2010 AGU Fall Meeting, December 13-17, 2010, San Francisco - Sessions H52, NH13
<http://www.agu.org/meetings/fm10/>

Please send information to Steve Elliott (elliotts@lanl.gov) regarding upcoming meetings with known presentations from DuRA members, as well as any other related events or ideas.

Workshop on major DUSEL physics topics will take place on October 1-3, 2010 at South Dakota School of Mines & Technology, Rapid City. Refer to the workshop website at:
<http://odessa.phy.sdsmt.edu/~bai/dusel.php>

The workshop will bring together theoreticians and experimentalists and also provide local scientists and students an opportunity to initiate dialogues with scientists from different projects.

The next Assay and Acquisition of Radiopure Material (AARM) collaboration meeting will be held at Sanford Lab on Friday-Saturday: November 12-13. Homestake Tours and informal meetings will take place on Thursday afternoon before the meeting.

Over the last year the AARM has been designing a common use low background counting facility (FAARM) for DUSEL. Such a facility will not be up and running until 2018. The focus of this collaboration meeting is to plan early implementation of screening, assay, material stockpiling, etc. for the period leading up to DUSEL and how to make a smooth transition. The group is asking current and potential experimenters and all ISE collaborations to send an official representative to the meeting. This will provide an opportunity to form a unified plan for early screening and seek resources to make it happen. This will involve multiple sites and existing assay installations as well as building up strength in this field. The facility plans themselves will also be reviewed and critical comments will be welcome.

Fourth Pontecorvo School - The IVth International Pontecorvo Neutrino Physics School, organized by JINR (Dubna) will be held September 26-October 6,

HOMESTAKE DUSEL AND SANFORD LABORATORY NEWSLETTER

2010 in Alushta (Crimea, Ukraine). For more info:
<http://pontecorvosch.jinr.ru/>



JOBS

Postdoctoral positions in the McKinsey group at Yale, Dept. 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. Especially experienced candidates may be considered for a research scientist position. Send CV, statement of research interests, and list of publications to: Daphne Klemme, Dept. of Physics, Yale University, PO Box 208120, New Haven, CT 06520-8120 or daphne.klemme@yale.edu.

Postdoctoral Position In Particle Detector Development, Dept. of Physics, UC Santa Barbara. Lead detector R&D program aimed at building ultra-high-resolution particle detectors for future neutrino and dark matter detectors, assist in hardware and analysis work on KATRIN neutrino experiment. Project may involve work in UCSB Nanofabrication Facility (<http://www.nanotech.ucsb.edu/>). Available Nov. 1, 2010 (neg). Include current CV, statement of research interests; arrange three letters of reference. For more info contact: Professor Ben Monreal, bmonreal@physics.ucsb.edu.

Newsletter Editor: Melissa Barclay

Contributors: Kevin Lesko, Willi Chinowsky, Bill Harlan (Sanford Lab), Zbigniew Hladysz (Davis Campus Mapping and Laser Scanning), Dongming Mei (Crystal Growth and Detector Development for DUSEL Experiments), Peggy Norris and Ben Sayler (Education and Outreach), Kem Robinson (EHSOC Comes to Homestake), Steve Elliott, Derek Elsworth, and Joe Wang (DuRA).

Photo Credits: Fig. 2: Sanford Lab and Zbigniew Hladysz; Figs. 3-5: Scott Schiele (Maptek); Fig. 6: Matt Kapust and Zbigniew Hladysz; Figs. 7-8: Keenan Thomas; Figs. 9-15: Matt Kapust.

BERKELEY OFFICE

UC Berkeley
DUSEL Project Office
2440 Bancroft Way, Suite 303
MC 1295
Berkeley, CA 94720-1295
Fax: 510-642-2258

HOMESTAKE DUSEL CONTACT INFORMATION

University of California at Berkeley

Kevin T. Lesko: 510-642-0147

KTLesko@berkeley.edu

Melissa Barclay: 510-642-2244

mbarclay@berkeley.edu

<http://www.dusel.org/>

South Dakota Science and Technology Authority

Ron Wheeler, Executive Director

Mandy Knight, 605-722-8650, x222

MKnight@sanfordlab.org

<http://www.sanfordlab.org/>

South Dakota School of Mines and Technology

William Roggenthen: 605-394-2460

William.Roggenthen@sdsmt.edu