University Currents

A Newsletter For and About the University Nuclear Engineering and Science Community

U. S. Department of Energy *Fall 2007*

2007 Nuclear Engineering Student Delegation

For the past 13 years, a group of students known as the Nuclear Engineering Student Delegation (NESD) has traveled to Washington D.C. over the summer to meet with policy makers and discuss important issues in nuclear engineering. This year's delegation convened in Washington D.C. from July 7-11 and had the privilege of meeting with NRC Chairman Dale Klein, NRC Commissioner Peter Lyons, Assistant Secretary for Nuclear Energy Dennis Spurgeon, Director of OCRWM Edward Sproat and congressional staffers. The primary discussion was the DOE University Programs, however, the policy statement included discussions on Yucca Mountain, GNEP/Gen IV, Non-Proliferation, Border/Port Security, Reliable Replacement Warhead Program and the Complex 2030 Program.

The majority of the meetings were spent discussing the importance of University Programs. After funding was eliminated for the second year and the House and Senate Appropriations committees reinstated only part of the funds, it became very critical that concern for this funding be well articulated during the meetings. The discussion was based on the fact that university nuclear engineering programs receive most of their funding from the government and that new metrics for evaluating the University Programs need to be created. The current metric of undergraduate enrollment does not properly reflect the needs of the industry and a new metric should combine such attributes as industry demand, graduation rate, size of a university's endowment and the ability of the university to self-sustain growth. We received a lot of support in our meetings for the University Programs and the need to reevaluate the metrics for the program.

This year the delegation gave a presentation about the importance of University Programs in a luncheon sponsored by the Foundation for Nuclear Studies. The luncheon was attended by, members of the DOE, congressional legislative aides and committee staffers on relevant committees. Presenting this need in front of a large and diverse audience helped to make our presence on Capital Hill meaningful.

2007 NESD Meeting with Assistant Secretary for Nuclear Energy Dennis Spurgeon in the "Atoms for Peace" room at the DOE. From Left Peter Glover, University of Massachusetts at Lowell; Tony Elliot, Oregon State University; Jacob DeWitte, University of Florida; Leah Spradley, Vanderbilt University; Assistant Secretary, Dennis Spurgeon; Jessica Mintz, University of California at Berkeley; Tyler Schweitzer, North Carolina State University; Erica Sherman, Rensselaer Polytechnic Institute; Gary Sanford, University of Florida; Tyler Ellis, Massachusetts Institute of Technology; and DOE Summer Interns (not pictured Lara Pierpoint, Massachusetts Institute of Technology).

University of Florida Promises Extradorinary Improvement in Scintillation Detection via Post-Processing Algorithm Called "ASEDRA"

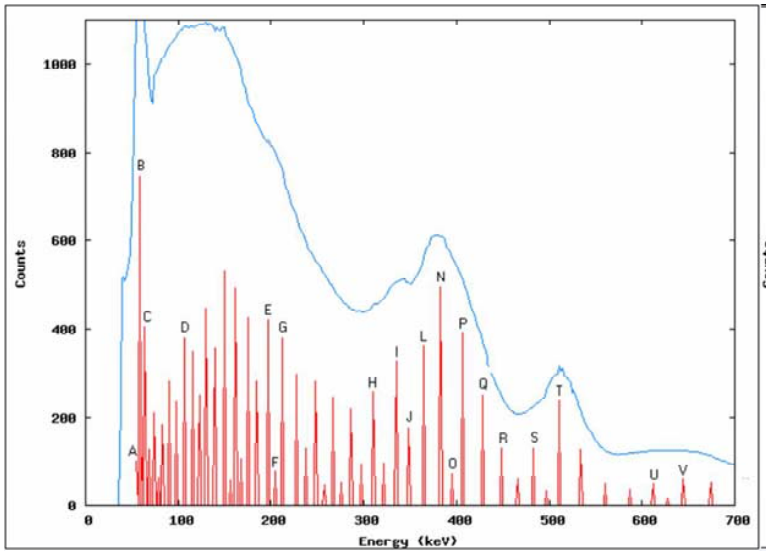
Researchers at the Florida Institute of Nuclear Detection and Security (FINDS) in the University of Florida's Nuclear and Radiological Engineering Department developed a solution to a 50-year-old problem when they worked up a unique algorithm that post-processes scintillator detector spectra to render photopeaks with high accuracy.

The post-processed spectrum output is directly comparable to resolved spectra from high resolution semiconductor detectors. For 50 years, there has been no way to get around the inherent poor resolution of sodium iodide, until the development of the new algorithm, according to Dr. Glen Sjoden, professor at UF's Nuclear & Radiological Engineering.

The algorithm, ASEDRA (Patent Pending), stands for "Advanced Synthetically Enhanced Detector Resolution Algorithm (ASEDRA)." ASEDRA is currently applied to sodium iodide (NaI(Tl)) detectors, which are highly robust, but inherently suffer from poor energy resolution. By rapidly post- processing a NaI(Tl) detector signal with ASEDRA over a few seconds on a standard laptop, and with no prior knowledge of sources or specific spectrum features, gamma ray lines are extracted on a level that is directly competitive with nitrogen cooled germanium detectors.

ASEDRA incorporates a novel denoising algorithm based on an adaptive Chi-square metric called ACHIP (also Patent Pending), to remove stochastic noise from low count spectra yet preserve fine detail, then employs a novel detector response algorithm to reveal specific gamma lines that composed the gamma ray spectrum.

A test of ASEDRA using a 10 minute count with shielded Weapons Grade Plutonium (WGPu) gammas (from an encapsulated PuBe source) was carried out with careful detector calibration, with results presented in Figure 1 for a 2"x2" NaI(Tl) detector. A very large number of WGPu peaks were extracted by ASEDRA, and were validated by a co-located, calibrated germanium detector (Figure 2). ASEDRA post-processing (with ACHIP denoising) required 28 s on a laptop to yield the photopeaks shown. Initial results clearly show that ASEDRA directly separated numerous plutonium gamma peaks (using no prior information)



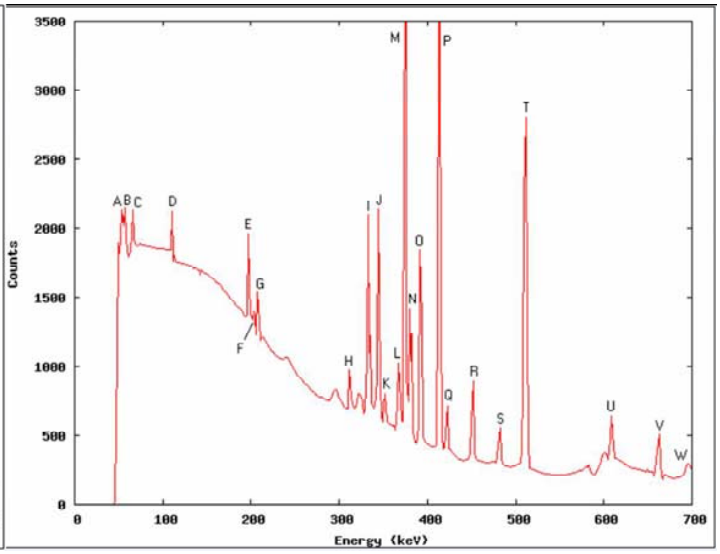


Figure 1 (Left). WGPu gamma spectrum from a 10 min count of a Pu-Be Source with peaks labeled alphabetically, post-processed in 28s using ASEDRA (denoised by ACHIP).
Figure 2 (Right): Germanium (denoised by ACHIP) detector spectrum from the same WGPu source; peaks that correlate between the two spectra are labeled alphabetically.

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Undergraduate Studies NE Public Policy

Is GNEP the answer to the high level waste issue? Idaho State University student Jason Andrus, a senior studying Nuclear Engineering, went to Washington, D.C. this summer to find out.

He was participating in the WISE program (Washington Internships for Students of Engineering), sponsored by the engineering professional societies. Andrus, who was sponsored by the American Nuclear Society and hosted by the Nuclear Energy Institute (NEI), spent nine weeks learning how government officials make public policies and how engineers can contribute to such decisions. In all, eleven outstanding students from across the country and from a variety of engineering disciplines participated.

Under the guidance of Dr. William Jackson, President of the HMJ Corporation, a small business specializing in advanced energy technology research, and Adjunct Professor of Engineering at George Washington University, the students met with public policy makers and others to learn how decisions about complex technical issues are made and how engineers and scientists can contribute to the process. The internship culminated in the research and writing of a paper on a public policy issue relevant to the student's particular engineering discipline.

Andrus chose for his topic: "Management of Used Nuclear Fuel and High Level Waste: Is GNEP the Answer?" "I addressed the possible alternatives to close the fuel cycle and tried to discuss … the benefits of each. Then I analyzed how well the GNEP program fit these," explains Andrus.

You can read Andrus' paper as well as the final presentations from all eleven WISE interns at www.wise-intern.org.

2007 WISE Fellows with Dr. William Jackson on the steps of the Jefferson Building of the Library of Congress. Jason Andrus is the third student from the left in the back row.

ASDERA
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which correlated extremely well to germanium results, as indicated using alphabetic labels aliasing gamma lines.

While final analysis of the WGPu data is under evaluation, so far it appears evident that ASEDRA also separated peaks in the low energy region that are difficult to resolve using germanium due to the inherent Compton scattering in similar regions of the germanium spectrum. Also, while applications have been limited to sodium iodide detectors to date, the ASEDRA (and ACHIP) algorithms could be adapted to any detector material that provides a radiation spectrum. For more information, write Dr. Glenn Sjoden at sjoden@ufl.edu.

References:

E. Lavigne, G. Sjoden, J. Baciak, and R. Detwiler, "*ASEDRA – Advanced Synthetically Enhanced Detector Resolution Algorithm, a code package for post processing enhancement of detector spectra,"* FINDS Institute, Nuclear & Radiological Engineering Dept., U. of Florida, 2007.

MU/MURR Alum

The University of Missouri-Columbia recognizes its distinct mission of providing all Missourians the benefits of a world-class research university, with tightly interlocked missions of teaching, research and service working together on behalf of all citizens.

The MURR Center's mission fully echoes that three-part assignment.

The MURR Center is not a degree-granting unit, but we support student endeavors in a very large way. It is difficult to capture the full extent of our involvement in students' successes, but each year we attempt to gather as much information as possible from our faculty and associates. For the year ending June 30, 2006, 11 students from MU and two other universities earned degrees based on research they conducted at MURR: seven doctoral, one master's and three bachelor's. In addition, there were at least 72 other degree candidates from 18 universities actively engaged in MURR-based research. On top of that 23 other full-time students had jobs at MURR during the year, and 39 full-time staff attended MU part-time. And then there are unnumbered students who come for tours of MURR, attend classes taught by our faculty and faculty associates…there is a whole lot of MURR-related education going on.

Most of the students move on and away, and it is easy to lose track of them.

Andy Casella

This month we look in on Andy Casella, Junior Scientist at Pacific Northwest National Laboratory (PNNL) in Richland, Washington. Andy's experiences at MURR played a large role in setting the tone of his graduate educational experience. After earning the BS in Chemical Engineering in December 2001, he worked concurrently as a laboratory assistant while pursuing the Masters in Nuclear Engineering program. Funded by a DOE Radiochemistry Education Award Program grant fellowship (for which Bill Miller was Principal Investigator), Andy started his graduate experience at MURR working closely with Vicki Spate, Dave Robertson, and Bill Miller on a study using Instrumental Neutron Activation Analysis (INAA) to analyze air filters for environmental radionuclides.

After successfully competing for a prestigious national DOE Nuclear Engineering Fellowship to support his doctorate here at MU, Andy's research shifted in January 2004 to investigating "Modeling of Molecular and Particulate Transport in Dry Spent Nuclear Fuel Canisters" for his doctoral research. His work with Curators' Professor Sudarshan Loyalka to model gas transport sought to advance knowledge of aerosol behavior as it relates to power reactor accidents and nuclear waste repositories. Experimental aspects of his research were done in residence at the Pacific Northwest National Laboratory, under guidance of Dr. Brady Hanson. Andy returned to MU to defend his dissertation in Nuclear Engineering in July 2007.

One of Andy's WNU field trips was to the Yucca Mountain Geological Waste Repository

Andy's background at MURR as a researcher in an operating, regulated nuclear facility contributed significantly to his successful pursuit of several national and international professional development opportunities that augmented his graduate education. In the summer of 2004, Andy did a summer internship as a nuclear criticality safety engineer at BWX Technologies, Inc, in Lynchburg, VA.

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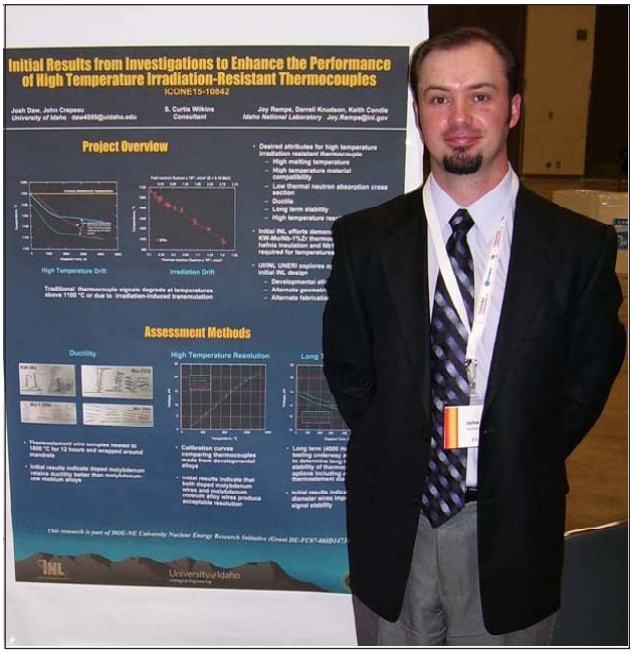
University Idaho/INL NERI Results Presented at ICONE15 in Japan

University of Idaho (UI) student, Josh Daw, traveled to Nagoya, Japan, to present a paper and poster, "Initial Results from Investigations to Enhance the Performance of High Temperature Irradiation-Resistant Thermocouples," at the ASME-sponsored 15th International Conference on Nuclear Engineering (ICONE15). These results were obtained as part of a University Nuclear Energy Research Initiative (UNERI) in which UI Professor John Crepeau and Idaho National Laboratory (INL) researcher Dr. Joy Rempe are mentoring students as they investigate options associated with fabrication techniques, geometry, and alloys, to further enhance the performance of these thermocouples at INL's High Temperature Test Laboratory (HTTL). Daw received funding from the ASME to attend the conference and was invited by conference organizers to publish his paper in an upcoming special edition devoted to outstanding ICONE15 papers.



University of Idaho student, Josh Daw, describes results from UNERI research on High Temperature Irradiation-Resistant Thermocouples at the ICONE15 poster session.

MU/MURR
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Andy's BWXT experience was followed in the summer of 2005 with practicum at Savannah River National Laboratory working with charged particle detection systems. He was also selected to participate in the first World Nuclear University Summer Institute. The applicant pool included 135 graduate students and young professionals from 46 different countries. The US Department of Energy co-sponsored the first Summer Institute, hosting it July 9-August 20 at Idaho National Laboratory (INL). The Summer Institute had been conceived in June 2004 during a meeting hosted by the IAEA of WNU stakeholders in Vienna as a means for providing unique educational experience aimed at building future global leadership in the fields of nuclear science and technology. Andy's background at MURR allowed him to contribute real world insights about operating nuclear facilities as he in turn learned from world renowned nuclear professionals, such as Hans Blix and other leaders in the nuclear industry.

WNU Summer Institute graduate Andy Casella flanked by John Ritch (left), Director General of the World Nuclear Association (WNA) and Hans Blix (right), Swedish diplomat and Head of the International Atomic Energy Agency (IAEA) from 1981-1997.

New Building Addition and Cyclotron Facility Open Doors at the Unviersity of Missouri Research Reactor (MURR)

The University of Missouri-Columbia has made significant commitments toward augmenting infrastructure at MURR to expand the research and educational opportunities for students and faculty across the country. Many of the facilities available at MURR provide a truly unique educational experience in the US and enable gaining deeper insights in a broad spectrum of disciplines. This leadership and commitment to creating new infrastructure recently culminated in the dedication of the new $6M, 25,000 square foot building addition at MURR to house new laboratories and provide much needed classroom and office space. The construction is a major accomplishment, providing facilities essential for expanding interactions with faculty and students in nuclear sciences and engineering in the years to come.

The addition provides much needed space for new offices to alleviate overcrowding and for three new classrooms to support of nuclear sciences and engineering coursework. The addition also houses for new laboratories, plans for which include the installation of a radiation detection laboratory, a new sample preparation facility for the Archeometry Center, and other research / teaching labs in other technical areas.

As part of the new building initiative, MU researchers and administrators and private industry collaborated to fund the acquisition and installation of a new General Electric 16 MeV cyclotron at MURR that will produce proton-rich isotopes to complement the array of neutron-produced isotopes from MURR's 10 MW reactor. MURR Director Ralph Butler explains, "Researchers have been seeking a cyclotron in Columbia for more than six years. Not only will this machine fill a vital gap in our area's medical diagnostic abilities, but the additional building and associated cyclotron facilities will allow the University to expand its research and teaching capabilities as we continue to investigate the latest technologies for medical and other uses."

The new cyclotron facility with external beam capability will provide engineering, physical and life sciences students and faculty with exceptional opportunities to conduct research in key fields such as materials science and biomedical engineering, as well as development of methodologies and other technological applications. Such studies and advancements serve to increase MU's standing as a leader in contributing to the success of the nuclear industrial, governmental and academic communities.

Ralph Butler (left) and MU Chancellor Brady Deaton (right) cut the ribbon to mark the official opening of the 25,000 sq ft office and lab addition and cyclotron facility held Wednesday, August 15, 2007.

Cyclotrons produce isotopes for positron emission tomography (PET), a diagnostic method with broad applications. Some of the very short-lived cyclotron-produced radioisotopes used in PET must be administered to the patient very soon after production.

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University of Florida, Dr. Glen Sjoden Receives First Endowed FPL Term Professorship Award

University of Florida's Associate Prof. Glenn E. Sjoden was honored to receive the first Endowed Florida Power and Light (FPL) Term Nuclear Engineering Professorship Award for the Three-Year period 2007 – 2010.

"I am thrilled and honored to receive this award," he said, "and I can't wait to see what good things we can accomplish with it."

The award was presented by Florida Power & Light Company's Senior Vice President for Nuclear Power, Mr. Art Stall, a Nuclear & Radiological Engineering (NRE) department alumnus, and NRE chairman Dr. Alireza Haghighat. Dr. Sjoden was selected by a special Awards Committee, based upon his excellence in teaching, research and public service of importance to the nuclear power industry.

"We are extremely proud of the accomplishments of Dr. Sjoden," said Department Chair and Professor Dr. Alireza Haghighat. "Glenn knows his industry extremely well and demonstrates his dedication daily to his students," he said.

Dr. Sjoden intends to use the award to further his research into areas that will help and improve the use of nuclear power to generate electricity.
Dr. Haghighat thanked FPL for its generous and continued support of NRE.

Dr. Sjoden came to the UF's N.E. department two years ago as an Associate Professor in nuclear engineering. His research interests include particle transport and numerical methods, nuclear systems analysis: medical, power generation, defense programs, NDT, and detection. Also he is a specialist in convective heat transfer, computational fluids, and high performance computing applications.

Dr. Glenn Sjoden (c) receives the first Endowed FPL Term Professorship Award from MR. Art Stall (r), FPL's Senior Vice President for Nuclear Power and Department Chair and Professor Dr. Alireza Haghighat.

New Building Addition
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"Having this tool here along with the research capabilities at MURR will allow us to not only offer this radiopharmaceutical to mid-Missouri healthcare facilities, but also help us develop new radiopharmaceuticals in our fight against cancer and heart and brain disease," said nuclear pharmacist, Marc Weichelt. The cyclotron is expected to be operational by Fall 2007.

For further information about the technical aspects of the cyclotron, contact Marc Weichelt at weicheltm@missouri.edu.

Some 100 guests joined MU/MURR administrators, faculty, staff and students for the opening ceremony activities.

Nuclear Engineering Students Spend Summer at Oak Ridge National Laboratory (ORNL)

A total of forty eight students and professors participated in the Nuclear Science and Technology Division's (NSTD) summer internship program at Oak Ridge National Laboratory (ORNL). The ORNL summer interns total about three hundred each year across the laboratory.

ORNL's Dr. Brad Rearden (second from right) with Aaron Fleckenstein (far left) and Adam Thompson (University of Tennessee) and Allison Miller (University of New Mexico).

Nineteen students came under the Nuclear Engineering Science Laboratory Synthesis (NESLS), a program specifically designed for students working in nuclear applications (http://www.ornl.gov/sci/nuclear_science_technology/nstip/index.html). About half of the NESLS students were funded by the Office of Nuclear Energy and the rest were supported by other DOE programs at ORNL. The NESLS students represented nuclear engineering programs at California at Berkeley, North Carolina State, Michigan, Tennessee, Penn State, Oregon State, Wisconsin, Purdue, Texas A&M, New Mexico, Prairie View A&M and Georgia. The students had several opportunities to attend a seminar series which included the following topics.

- Designing Future Combustion Systems for Renewable Fuels
- Reactor Production and Medical Applications of Radioisotopes
- A Coarse Mesh Response Expansion Method for Eigenvalue Transport Problems
- Radiation Physics Research at Georgia Tech
- Mesh Refinement Techniques Applied to Neutron Balance Equations, and then some
- Atomic-Scale Simulation of Radiation Damage in Structural Materials
- Neutron Source Development at the SNS
- A Nanodosimetry-Based Linear-Quadratic Model of Cell Survival in Support of 252Cf Neutron Brachytherapy
- Piecewise Linear Discontinuous Finite Element Discretizations of the Transport Equation in RZ and XYZ Geometry
- Error Estimates for Discrete Ordinates Methods Used in Solving the Neutron Transport Equation
- Neutron-Induced Reaction Cross Section Studies at GELINA

Dr. Sara Pozzi (ORNL) and Shaun Clarke (Ph.D. student at Purdue University)

- Hybrid Monte Carlo-Deterministic Methods for Simulating Particle Transport
- Advanced Transmutation Reactors

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Streamlined Flow Diagram Helps Visualize Image Registration

The University of Florida's Associate Professor Sanjiv Samant's research group is developing an ultra-fast image registration algorithm to allow doctors to study the effect of organ shifting and deformation in radiation therapy. A registration currently takes several minutes, which is too long for clinical use, but will only take a few seconds with this methodology. By including the effect of organ deformation, radiation beams can be delivered with greater accuracy to the tumor.

Graduate student Junyi Xia, who is working to earn his Ph. D. in medical Physics, presented his work on the new algorithm at the American association of Physicists in Medicine's Annual Meeting in Minneapolis, MN this past summer.

4D computed tomography is now available in radiation therapy, and allows one to acquire multiple 3D CT imaging volumes during a time interval, hence capturing important information on organ motion. Figure 1 depicts the deformation field between two CT data sets of lung imaging for a patient. The deformation is the result of breathing motion.

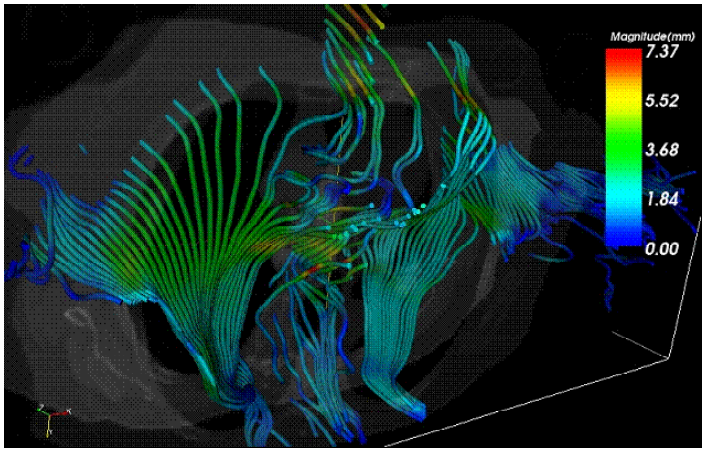

Figure 1. Deformation field between two CT data sets of lung imaging for a patient using an image registration algorithm.

ORNL
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- Photonuclear Physics Models, Simulations and Experiments for Nuclear Nonproliferation
- Monte Carlo Models of Neutron Detection with Organic Scintillators
- Penn State's Nuclear Engineering Program in the Nuclear Renaissance
- Spherical Harmonic Based Methods for Time-Dependent Radiation Transport
- Fuels Programs: Past, Present, Future

The students also participated in several tours at the High Flux Isotope Reactor (HFIR), the Spallation Neutron Source (SNS), the Oak Ridge Electron Linear Accelerator (ORELA), and the Radiochemical Engineering Development Center (REDC).

The university participants (students and professors) were treated to an event at the American Museum of Science and Energy (AMSE).

Dr. Jean Ragusa (Texas A&M professor) and Dr. Kevin Clarno (ORNL)

Massachusetts Institute of Technology DOE Nuclear Summer Institute 2007

This year's Nuclear Summer Institute was held at MIT from June 25-29. This one-week course, "Thermal Hydraulic Experiments for Nuclear Engineers", combines experiments with theories that cover a wide range of fluid dynamics and heat transfer topics that are relevant to nuclear reactor design and safety analysis. Four hands-on experiment segments on measurements of fluid thermal physical properties, single-phase heat transfer and viscous pressure loss, pool boiling and critical heat flux measurements, and flow boiling two-phase heat transfer measurements; four demonstrations on hydraulic loop, optical probe, flow instability, air-water two-phase flow dynamics; and seven lectures were given throughout the week. The experimental facilities and associated instrumentation available for the summer course were funded primarily through DOE's Innovations in Nuclear Infrastructure and Education (INIE) grant and are part of a Thermal Hydraulics Laboratory established jointly by MIT's Nuclear Science and Engineering Department and Nuclear Reactor Laboratory. This summer course provided the students with a unique and rewarding experience in applying what they learn in the classroom to real-world applications. The students also toured the 5-MW MIT Research Reactor and learned

Students from twelve universities participated in a productive week-long lab course at MIT's thermal-hydraulics lab

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Massachusetts Institute of Technology

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about various ongoing research programs in particular the in-core experiment program and advanced fuel and materials testing. Twenty-one students from Texas A&M, Kansas State, Ohio State, Oregon State, Florida, Wisconsin-Madison, Michigan, Missouri, North Carolina State Univ., MIT, UMass Lowell, and UC Berkeley participated in this course. The course co-directors are Dr. Lin-wen Hu of the Nuclear Reactor Lab, and Prof. Jacopo Buongiorno and Dr. Tom McKrell of the Nuclear Science and Engineering Department.

2nd Tokyo Tech-MIT Symposium - July 25-28, 2007

A group of five faculty and eight students from MIT participated in the 2nd Tokyo Tech-MIT Symposium on Innovative Nuclear Energy Systems, held July 25-28 in Kamakura, Japan. Dramatically, the group arrived in Japan the day following the major earthquake that damaged a nuclear power station and received international attention. "The event was discussed at our meeting and covered thoroughly in the Japanese media," said MIT graduate student David Carpenter. "But what really struck me was seeing a children's call-in show discussing the event, because it showed how their culture was able to communicate a complicated, sensitive, and timely issue to a very young audience.

The three-day symposium, co-sponsored by the Tokyo Tech's Center of Excellence Program and MIT's Center for Advanced Nuclear Energy Systems (CANES) within the Department of Nuclear Science and Education, follows up on the first Tokyo Tech-MIT symposium, held at MIT in November 2005. In addition to sessions on the fuel cycle, heat transfer, and innovative fast reactions, the conference brought student participants together in small groups to create "Games for Public Nuclear Education." "Definitely fun," said MIT graduate student Anna , "and useful not only educationally but also for the collaboration and interaction between the students. We made friends during this trip and were able to experience the Japanese culture from the inside."

Asked for her impressions of the trip, MIT graduate student Lara Pierpont offered a bit of haiku:

The trip was a blast. Breakfast fish with eyes and teeth — Scary! Sushi — yum.

MIT Department of Nuclear Science and Engineering students and faculty tour Kamakura during the Tokyo Tech-MIT Symposium

North Carolina State University Nuclear Engineering News

Hawari Wins Alcoa Foundation Engineering Research Award

Dr.Ayman Hawari

One of the Alcoa Foundation Engineering Research Awards for 2007 was presented at the spring faculty meeting for the College of Engineering at North Carolina State University to Dr. Ayman I. Hawari, associate professor of nuclear engineering and director of the Nuclear Reactor Program. Hawari was awarded the Alcoa Foundation Engineering Research Achievement Award, intended to recognize young faculty who have accomplished outstanding research achievements during the preceding three years.

Recognized as a leader in the areas of Generation IV nuclear power reactors and fundamental neutron physics, Hawari has succeeded in establishing the NC State PULSTAR reactor as one of the top university research reactors in the country. Among his most notable achievements are his introduction of innovative methods for calculating the neutron scattering law for materials of importance to Generation IV reactor design, research in the area of neutron slowing down and thermalization, development of accurate methods for simulating filter effects in the design of thermal neutron beam experiments, and development of the only high-intensity positron beam for nanoporosity at a U.S. reactor.

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Turinsky Awarded the 2007 R.J. Reynolds Tobacco Company Award

Dr. Paul J. Turinsky, Professor of Nuclear Engineering at North Carolina State University received the 2007 R.J. Reynolds' Award for Excellence. Recognized as a leader in the area of core analysis and design, Turinsky continues to make progress on developing nuclear fuel management optimization capabilities.

Dr. Paul J. Turinsky

The Reynolds award was established within North Carolina State University's College of Engineering to honor a member of the Engineering faculty who demonstrates superiority in several areas of activity that relate to the University's missions of teaching, research, and extension. The annual award is supported by R. J. Reynolds Tobacco Company through the NC State Engineering Foundation to bring recognition to scientific and educational achievements in fields of engineering.

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NC State's Nuclear Engineering Students Wins ANS Mark Mills Award

Libai Xu, PhD graduate in nuclear engineering, was awarded the 2007 Mark Mills Award by the American Nuclear Society (ANS). The title of his thesis was "Prompt Gamma-ray Imaging for Small Animals". Currently, Xu is employed with Pathfinder, a nuclear oil logging company in Houston, TX.

Drs. Libai Xu and Robin Gardner

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North Carolina State University Nuclear Engineering News (continued from page 12)

Dr. Robin Gardner, professor in chemical and nuclear engineering at NC State University, was his adviser.

The Mark Mills Award is presented "to the graduate student author who submits the best original technical paper contributing to the advancement of science and engineering related to the atomic nucleus," according to the ANS. The award is to be presented to Dr. Xu at the Winter Meeting of the ANS in November. Over the years, several PhD graduates from the Nuclear Engineering Department have won the Mark Mills Award.

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Shen Zhang Receives A U.S. Department of Energy AFCI Fellowship

Mr. Shen Zhang

Shen Zhang, incoming graduate student at North Carolina State's nuclear engineering program, received the Advanced Fuel Cycle Initiative (AFCI) fellowship. A program within DOE's Office of Nuclear Energy, the award is aimed at increasing research into closing the nuclear fuel cycle and recycling components of used nuclear reactor fuel. Mr. Zhang was also a graduate of the nuclear engineering program at NC State University; graduating summa cum laude in May 2007.

AFCI fellowships are awarded annually to students who plan to pursue research in technical areas related to the separation of nuclear waste components, the fabrication of these components into recycled fuel, and the preparation of new waste forms with increased long-term stability. This research furthers the Global Nuclear Energy Partnerships (GNEP), announced last year by President Bush, which supports the expansion of nuclear power in the world while reducing the risks of weapons proliferation, and increasing the efficiency of waste recycling programs.

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Two Successful Science Teachers' Workshops in Nuclear Science and Technology

Annually, NC State's Nuclear Engineering Program hosts a Science Teachers' Workshop in Nuclear Engineering. This past summer, the department hosted two such workshops.

2007 Science Teachers' Workshop in Nuclear Science & Technology

The first two-day workshop was held in June; the first day was on-campus and the second day at Progress Energy's Shearon Harris Nuclear Power Plant. The workshop attracts chemistry and physics teachers who wish to learn more about nuclear engineering theory and practice. At NC State's Nuclear Engineering Department they were provided with lectures, labs and a tour of research facilities. At Shearon Harris they visited the simulation room, the environmental labs and received a bus tour of the facility. Ms. Marshall,

Teachers take tour during Harnessed Atom Program

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North Carolina State University Nuclear Engineering News (continued from page 13)

Director of Outreach Programs, stated "[t]hese workshops provide useable information and resources for the classroom; they also initiate class field trips to the department, and cultivate a long lasting relationship."

The second science teachers' workshop, held in August, was the Harnessed Atom Program. The U.S. Department of Energy, Office of Nuclear Energy, selected a handful of university sites to participate in the field test for this high school curriculum project. John Gutteridge from DOE's Office of Nuclear Energy, and Lisa Marshall from NC State's Department of Nuclear Engineering, partnered with representatives of General Electric-Hitachi – Nuclear Energy, to provide select teachers from across North Carolina with nuclear science curriculum funded by the DOE Office of Nuclear Energy in cooperation with SAIC (Pete Xiques). For two days, these teachers participated in lectures, labs and an industrial field trip to GE-Hitachi's Fuel Fabrication Facility in Wilmington, N.C. A success as well, teachers are already making arrangements to bring their classes to the nuclear engineering department, and requesting in-class presentations.

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High School Students Spend Three Weeks With NC State's Nuclear Engineering Program

High school students from across the nation spent three weeks in July with NC State's Nuclear Engineering Department. A combination of lectures, labs, small group projects, and industrial field trips provided rising juniors, rising seniors, and incoming freshman students with a more detailed look at what

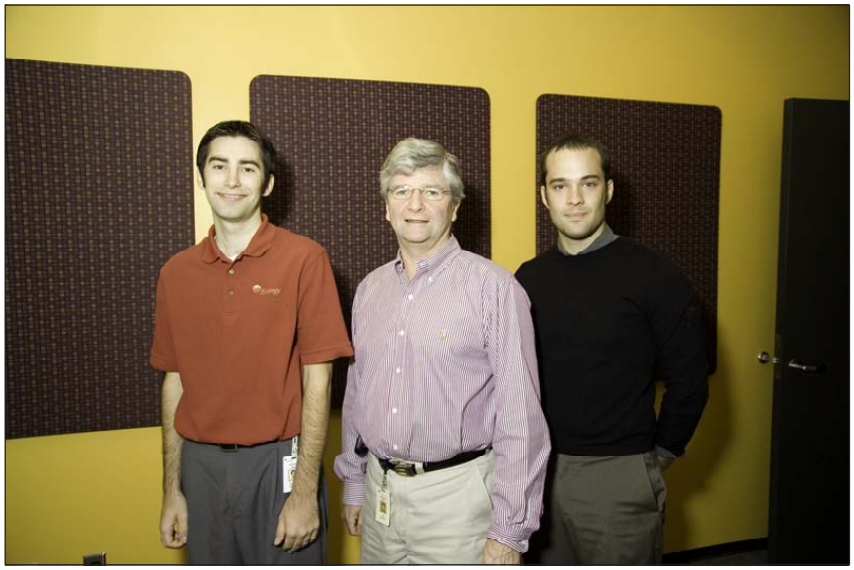
Young Investigators on tour at PetNet Solutions, a radio-pharmaceutical company in Durham, NC

nuclear engineering has to offer. It was also an opportunity for students to experience a university campus, receiving instruction in the admissions process, and library research as well. Feedback from parents attested to the need and success of longer outreach programs. Students and parents alike appreciated the variety of the program, comments included "I like that we were allowed to work in groups on projects and took trips to facilities where nuclear engineers work." When polled approximately 25 percent of the student participants stated that they hoped to enroll in NC State's undergraduate program.

Oregon State University Leadership Pipeline Program

Nuclear power is back and with it comes amazing opportunities for some OSU student leaders. With nearly 50% of the nuclear workforce retiring in the next 10-15 years, one of the biggest challenges facing the nuclear renaissance is filling the leadership gap. Here is where some OSU ingenuity may make a difference. Last year, the Department of Nuclear Engineering and Radiation Health Physics developed a Leadership Pipeline Program aimed at identifying students with leadership abilities for placement as apprentices under the day to day supervision of a Senior Executive in the nuclear industry. The objective was to give our OSU students a unique top-down view of what it takes to run a major nuclear power corporation. When approached, Dan Keuter, Vice President of Business Development for Entergy Nuclear, and graduate and long time supporter of OSU, immediately recognized the potential for the program and offered to mentor two OSU student leaders this past summer. A student leadership competition, which included applications, essays, and interviews by a panel of seasoned industry executives, was held last winter. The winners, Tony Elliot and Charles Keller, were announced at the national student conference of the American Nuclear Student held in Corvallis in March of this year in front of 300 students and 100 industry representatives from across the nation. Tony and Charles have now finished the apprenticeship of a lifetime.

Entergy pulled no punches. They have a billion dollar business to run and the responsibility of operating a fleet of 10 nuclear power plants around the country. Charles was given assignments that included working with company leaders, meeting with the CEO, and traveling to meetings in Atlanta, Chicago, Vernon, Russellville, Houston, and St. Francisville/Baton Rouge. He developed corporate governance documents for the Innovations Group with the goal of pitching the concept at a meeting with the President of Planning, Development and Oversight. He assisted with brainstorming, gathering, and reporting information to members of the Innovations group on on-going projects. The experience far exceeded his expectations. "This program is designed for people with self motivation and strong work ethics. They give us the freedom to work independently." Charles has accepted a position at Entergy and now has the vision of gaining the experience he needs to be an industry leader.



Dan Keuter (center) with his student apprentices, Tony Elliot and Charles Keller

Tony was given the daunting task of documenting and evaluating the Entergy Nuclear "fleet-wide" procedures with an eye towards improving the company from a top-down reassessment of standard operations and plant activities. This assignment also involved traveling cross country to gain knowledge on products, experiences and operations. "The meetings and trips that I attended, although somewhat beyond my scope of expertise, allowed me to personally interact with senior members of Entergy and other corporations. This was a vital experience that allowed me to view how Entergy, and other large companies, operate from a corporate standpoint. No other experience would have allowed me to interact with seasoned veterans of the nuclear industry." Tony is returning to OSU to complete his Masters degree.

Dan Keuter's and Entergy's view of the Leadership Pipeline experience? "Let's do this again next summer!"

Idaho National Laboratory Summer Interns Get

Summary

When environmental chemistry major Jessie Shipp attended school as an undergraduate at Saint Cloud State University, classes often consisted of theory-based work. But internships at Idaho National Laboratory offer the real world experience one can't get at school, according to the summer intern.

"You're actually seeing research and chemistry and what it's for," Shipp said.

She said she also gets to work with instrumentation not found at universities and sees the life of a project from its beginning to the final product.

When it comes to the hard sciences, "nuclear engineering seems to be the hot topic," said Shipp.

And for students with internships in the Nuclear Programs department of INL, this summer proved to be a challenging learning experience in a field that has gained international attention and growing importance.

One-hundred and one students from 19 different states and Korea were awarded internships in Idaho National Laboratory's Nuclear Programs this summer. The students represented 31 different universities and high schools.

Chemistry and physics major Megan Longo received a Department of Energy Office of Science Undergraduate Laboratory Internship (SULI) with INL this summer.

"It's amazing to be on the cutting edge of technology," she said. A senior at Albertson College of Idaho, Longo used an Inductively Coupled Plasma-Atomic Emission Spectrometer (ICP-AES) to analyze actinides, the radioactive components of spent nuclear fuel.

Longo enjoyed the access to scientists and equipment. She said the spectrometer she worked with this summer is one not often found in university science departments, if at all. Longo said the opportunity to speak with experts was also helpful.

"If there's anything you want to learn about, they'll get the technician to tell you about it," she said.

"That is what our programs are all about," said Una Tyng, University Programs lead in the Educational Programs department.

Tyng said internships at INL help students discover the exciting aspects of their field and give them the experience they need to make future career decisions.

Like Longo, Shipp mentioned the hands-on experience as an advantage to her graduate INL Nuclear Programs internship. She also said their mentor, Jeff Giglio, ensured they were getting the most from their time at INL by giving them access to scientists with related expertise. Giglio is a chemist in the analytical lab at the Materials and Fuels Complex.

National Laboratory summer intern Jessie Shipp works in a radiological hood at the Materials and Fuels Complex. Shipp is a recent graduate of Saint Cloud State University and received a graduate internship from INL's Nuclear Programs department this summer.

Real World Experience, Hands-on Opportunities

At the end of their terms, Longo and Shipp will continue their individual pursuits. Longo said her dream job would be in a position with NASA.

"But I would definitely come back to INL," she said.

INL Fuels Development mechanical engineer Jared Wight did come back to INL—twice. Wight received a SULI internship in summer 2004. He conducted modeling of gas cooled fast reactor fuels as part of the Next Generation Nuclear Plant project at Argonne National Laboratory-West (ANL-W) under Mitchell Meyer. Wight secured part-time work with the Reduced Enrichment for Research Test Reactors program at ANL-W while attending school as a senior mechanical engineering major. He continued work in the program as an intern the summer following graduation from Brigham Young University-Idaho.

Senior Albertson College of Idaho student Megan Longo pipettes standards in a lab at INL's Materials and Fuels Complex under the supervision of chemistry lab technician Marcos Jimenez. Longo used spectrometry to determine the higher wavelengths of actinides for easier detection of the elements in research environments.

This summer marked the third year Wight has worked with INL, and the second year he has mentored an intern. His mentor, Meyer, has now become his manager.

"I think it teaches you a lot about how to apply what you're learning in school or how engineers and scientists actually apply what they did in school," said Wight of his internship experience. "That to me was very valuable."

Wight also said working at INL prepared him for his career.

"It's hard for someone going into an engineering or scientific field to have any type of prior work experience when they graduate from a university unless they've done something like this," he said. "I think also it helps you to know whether or not what you're doing in school is what you really want to do."

Though many students obtain internships to study other scientists' research, PhD student Kurt Terrani found INL the only laboratory where he could conduct his own. A student at University of California, Berkeley, Terrani wanted to study thorium containing hydride fuel. Terrani contacted entities in the United States, Europe and Asia in search of a thorium source, but none were available or willing to supply the metal. After discovering INL held a source, Terrani secured an internship with Nuclear Programs.

"It's nice to be exposed to the way these guys do their job," he said.

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I N L Summer Interns Get Real World Experience, Hands-on Opportunities (continued from page 17)

Terrani said the internship also broadened his background in nuclear and materials subjects and gave him experience in a national laboratory rather than a business setting. Terrani also experienced the technical approvals that come with working with radioactive materials and hazards issues.

"Every step of the game takes a long time," said Terrani. "But when you get there, it's nice."

In addition to those with internships in Nuclear Programs, five individuals received internships on faculty sabbatical or were conducting research from various universities.

INL Activities

Mentors and interns enjoyed a day in the sun June 7th for the INL Education Programs Summer Picnic in Freeman Park. Students met other individuals with internships in the program and enjoyed a barbecue dinner with their mentors.

Nuclear Programs interns participated in an all-day tour of the INL Site July 10, 18 and 26. While there, they stood atop the historical EBR-I reactor—the first nuclear reactor in the world to produce usable amounts of electricity. Students also learned about INL's Advanced Test Reactor (ATR) while touring the Reactor Technology Complex. The ATR exhibits the unique capability of producing in a few weeks or months the neutron flux radiation commercial nuclear reactors might produce in a matter of years. At the Materials and Fuels Complex, interns followed the path of spent fuel from Experimental Breeder Reactor-II. Interns got to examine the hot cells, where spent fuel is collected from fuel rods, placed in electrorefiners, subjected to heat from induction coil furnaces, and eventually cast into a less enriched waste form.

Nuclear Programs students, many of them funded through the University Program within DOE's Office of Nuclear Energy, shared their knowledge with INL employees at the INL's Poster Session August 6th. Students made scientific posters of their summer research and got the opportunity to discuss their work and answer questions from those in attendance.

Recent Saint Cloud State University graduate Jessie Shipp works in a glove box as chemistry lab technician Jana Northam watches. Shipp participated in method development to "fingerprint" strontium samples in order to trace where they may have originated.

Oregon State University Hosts 2007 National American Nuclear Society Student Conference

Oregon State University was the site of this year's American Nuclear Society (ANS) Student conference, "Nuclear Technology around the World: Solving Tomorrow's Problems, Today." The national conference, held March 29-31, attracted 325 participants from 18 universities and numerous companies throughout the US. The theme was particularly timely as many nations around the world actively seek new sources of clean and reliable energy.

The tremendous success of the conference can be attributed to the remarkable organizational efforts of the local ANS student chapter in the Department of Nuclear Engineering and Radiation Health Physics. The conference committee raised $130,000 from 40 corporate sponsors and DOE's Office of Nuclear Energy. They brought in 7 keynote speakers including NRC Commissioner Peter Lyons; ANS President Harold McFarlane; Tom Christopher, President and CEO of AREVA; Dan Keuter, Vice President of Planning and Innovation at Entergy; John Gutteridge, Director of University Programs at DOE/NE; and Andrew Klein of the Idaho National Laboratory. They also recruited 21 Career Fair Exhibitors and organized sessions for 102 technical papers and posters. Students also provided tours of the Radiation Center 1 MW TRIGA reactor and the state-of-the-art APEX test facilities used for Westinghouse AP600 and AP1000 certification.

The conference gained national publicity when National Public Radio reporters interviewed students at the conference to gain their insights into the prospects for future employment in nuclear power. The interviews were featured as part of NPR's Marketplace program broadcast.

In addition to outstanding speakers, employment opportunities, tours, and technical sessions, students from all over the country came together to network, have fun, and share common goals. This student conference highlighted the innovative spirit of a new generation of nuclear engineer. They are bright, able to organize, and ready to impact the energy future of our nation.

Details of the conference can be found at: http://groups.engr.oregonstate.edu/ans/conference.htm

For more information on Nuclear Engineering and Radiation Health Physics at Oregon State University, visit the website at: http://ne.oregonstate.edu/

Radiation Imaging and Detection at the University of Michigan

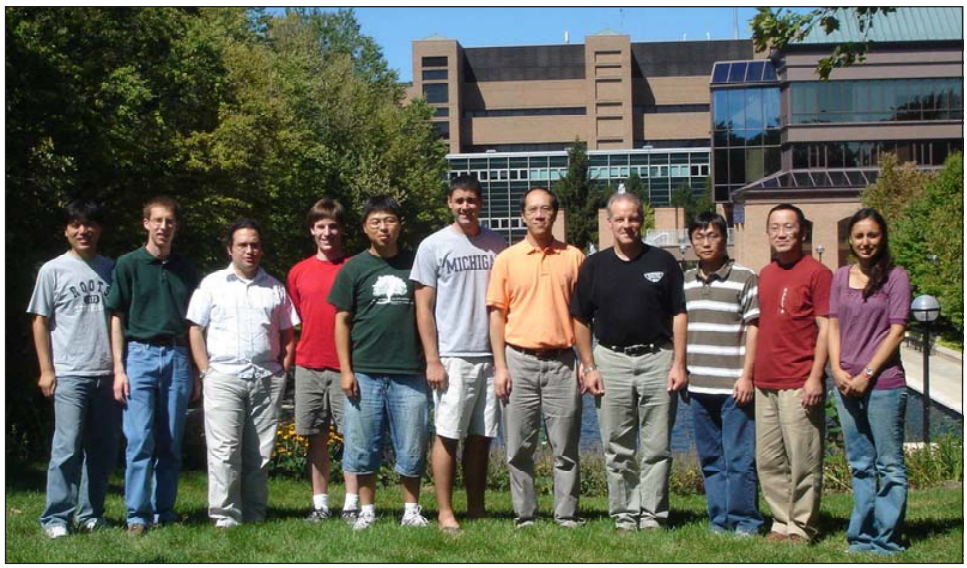
On a computer screen in Ann Arbor, Michigan recently, a dark red arrow swiveled for a few seconds before coming to rest pointing toward a corner of the screen. "The source is to the upper left of the detector," Willy Kaye, a graduate student, noted. Kaye is a member of Professor Zhong He's research group in the Department of Nuclear Engineering and Radiological Sciences at the University of Michigan. The group is busy working on gamma-ray imaging and nuclear-isotope detection using 3D-position-sensitive semiconductor detectors, which are capable of high energy resolution and room-temperature operation.

For the past several years, as crystal-manufacturing techniques have improved to allow thicker crystals, Zhong He and his group have been working on these pixilated semiconductor detectors, mostly focusing on CdZnTe, but more recently branching out to include the denser HgI_2 and TlBr. By using the ratio of the cathode signal to the anode signal or using timing information from these several-cubic-centimeter detector blocks, all three spatial dimensions of the gamma-ray interaction locations can be determined to within about one millimeter.

This allows the detectors to operate as Compton cameras for all directions simultaneously, making it possible to reconstruct images showing the distribution of photon-emitting isotopes around the detector and even to reconstruct the true energy spectrum of photons coming from any specific direction using probabilistic methods. By recording multiple interaction locations in the detector and the corresponding energy depositions from an incident gamma ray, the angle of Compton scattering can be estimated, determining the true incident direction to within a cone.

As a proof of their methods, the group was able to map the intensities of natural background radiation in a room of the lab and ended up learning that the person on the other side of the wall was using a weak Cs-137 source. More recently, the group designed and constructed the first detector-array systems and associated electronics to improve detection efficiency and angular resolution of the system.

A major thrust of the research is in homeland security applications to find and identify possibly threatening sources in the field. The high energy resolution, high density, and room-temperature operation make these detectors well suited for work away from the lab. The imaging information available from these detectors can greatly improve sensitivity, allowing better detection of weaker sources compared to a simple spectroscopic detector.



The radiation measurement group at the University of Michigan. From left to right: Jae Cheon Kim, Christopher Wahl, Burcin Donmez, Willy Kaye, Weiyi Wang, Stephen Anderson, Professor Zhong He, James Berry, Yuefeng Zhu, Feng Zhang, and Sonal Joshi.

Neutron Science Laboratory Established at the University of Michigan

The University of Michigan has recently established the Neutron Science Laboratory (NSL) to provide a verstaile neutron source for teaching and research purposes within the Department of Nuclear Engineering and Radiological Sciences (NERS) and elsewhere within the University community. The NSL is built around a D711 neutron generator, comprising a

D711 comprises (D-T) head with 8-Ci tritium target, high voltage supply (blue tank), two chillers, and control units.

(D-T) head, capable of producing up to $2x10^{10}$ neutrons/s, and associated instrumentation and counting systems. The D711 delivered to the University of Michigan is one of the first two units built by Thermo Electron Corporation with new digital control circuitry, which provides more flexible and robust operation of the neutron generator.

Operation of the D711 as a Class AA facility with a State of Michigan permit requires that the radiation dose rate outside the test cell be less than 2 mrem/hr (20 μSv/hr). A number of shielding designs for the D711 were studied as part of design projects for *NERS 554, Radiation Shielding*, and Matt Studenski's M.S. project provided the final design built around a prefabricated cave structure. The cave shield has a small footprint and does not require any reinforcement of the foundation and floor for the laboratory space, thereby minimizing the laboratory construction expenditure.

The (D-T) head mounted on the shield door provides ample space for a number of experiments for one of the Departmental laboratory courses, *NERS 425, Applications of Radiation*. In addition to practical neutron activation analyses, efforts are underway to develop experiments that could characterize neutrons undergoing slowing down and diffusion in moderating assemblies. In addition, the D711 will be used in the development of radiation detectors for homeland security applications. Initial dose measurements of the D711 facility were made at 10% of rated capacity and Assistant Professor Michael Hartman, who recently joined the NERS department, will take the lead in performing the full qualification testing of the facility. The purchase of the D711 neutron generator, construction of the shielding facilities, and acquisition of the detection and counting equipment has been made possible through INIE grants and substantial University cost sharing.

Test cell occupying a 13 m x 11 m area includes a cave shield with a borated polyethylene shield (blue plate, far left) and guard structure (yellow) for the shield door, surrounded by labyrinth of stacked concrete blocks, 0.6m thick and 2.44 m tall.

Cave shield and the 3-ton door with the (D-T) head mounted and placed on four air bearings and floor guarding.

Plasma Pulse-Generator Arrives at University of Michigan from Russia

The University of Michigan has recently taken delivery of the first 1-MA Linear Transformer Driver (LTD) in the USA. This unique, compact, 0.1- TW, 100 ns plasma generator will be used to implode wire-array z-pinches in the Plasma, Pulsed Power and Microwave Laboratory in the Nuclear Engineering and Radiological Sciences (NERS) Department. Lab Director Ron Gilgenbach describes the LTD as a 3-meter diameter-ring filled with 80 high voltage (100 kV) capacitors and 40 switches. The current of the capacitors is inductively added by a magnetic core, hence the transformer designation. This z-pinch research project is part of an inertial confinement fusion (ICF) collaboration between UM and Sandia National Laboratories. Sandia ICF experiments transmit up to 20 MA current through imploding arrays of wire-plasmas to generate the world's most powerful x-ray pulse for heating and compression of DT fusion fuel. The UM team involves NERS Professors Ron Gilgenbach and Y.Y Lau along with their graduate students, while the Sandia collaborators include Mike Mazarakis, Tom Mehlhorn, and Mike Cuneo. In August 2006, Gilgenbach and Mazarakis traveled to the Institute for High Current Electronics in Tomsk, Siberia to join Russian LTD developer Alexander Kim for testing of the Michigan LTD. When the UM LTD module was stacked in an array with four such Sandia LTD modules the experiment successfully generated pulses of -0.5-MV and 1-MA, demonstrating inductive voltage adding. Sandia scientists are considering LTD technology for the next generation PW z-pinch driver

(see: http://www.sandia.gov/news/resources/releases/2007/rapid-fire-pulse.html). The advantages of the revolutionary LTD circuit are its repetitive-pulsing capability, high current, fast-risetime, greatly improved reliability and approximately double energy efficiency compared to conventional Marx/water line technology, compactness and inductive voltage addition. The UM team is working intensively to develop a new experimental facility: MAIZE (Michigan Accelerator for Inductive Z-pinch Experiments). This UM facility will be utilized to investigate the plasma physics and engineering issues involved in generating intense x-ray pulses for ICF by LTD-driven, imploding, wire-array z-pinches. This work is supported by the U. S. Department of Energy through a Sandia National Laboratories contract; cost-sharing has also been provided by the University of Michigan.

Ron Gilgenbach with UM students and the 1-MA LTD machine, MAIZE, on its arrival at the University of Michigan. From left to right: Ed Cruz, Tim Rabin, Brad Hoff, David French, Jacob Zier, Ron Gilgenbach, Matt Gomez, Tyler Fowler-Guzzardo, and Nick Jordan.

Summer Interns Flock to MURR

Once again, MURR is collaborating with the MU Undergraduate Research Opportunity Program to host undergraduate researchers from across the country. These talented young researchers are conducting Summer Semester studies with various scientists and engineering at MURR. Dr. Joe Kyger is for the second consecutive year facilitating the summer program at MURR, working with the research students and their respective project mentors to ensure a productive, interesting and rewarding summer experience for everyone.

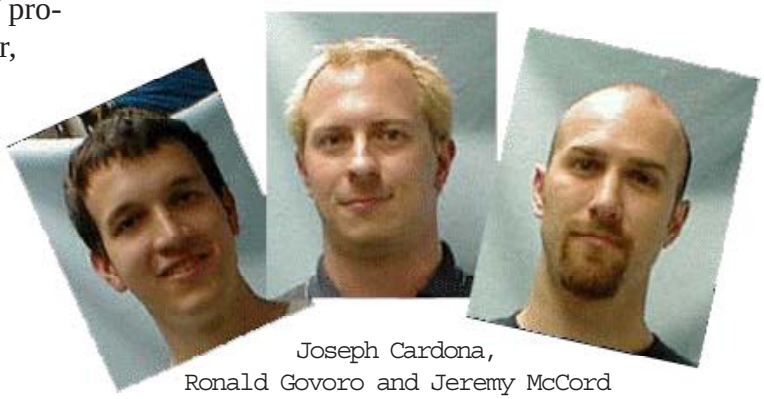
Alejandro Barilari, Julio Figueroa and Jose Perez

These summer research experiences are being made possible at MURR with financial support from various sources:

- MU's US Department of Energy (DOE) Innovations in Nuclear Infrastructure and Education (INIE) grant—Wynn Volkert, PI
- National Science Foundation (NSF)/National Institutes of Health (NIH) Research Experiences for Undergraduates (REU) in Radiochemistry grant—Susan Lever, PI
- NASA's Missouri and Puerto Rico Space Grant Consortium (PRSGC) programs—John Miles and A. Gonzalez, PIs, respectively
- MU Chemistry Department's Chapin Stevens Research Fellowship program—Sheryl Tucker, Coordinator
- MU's US Army grant—Shubhra Gangopadhyay, PI
- MU's DOE University Partnership grant—William Miller, PI

The following gives some background information on the students as well as their funding programs. The MURR Center is continuing a long tradition of providing unique educational opportunities to tomorrow's researchers and engineers, and in the past few years there has been a renewed and burgeoning support of the MU mission to provide the benefits of a world-class research university. Truly, MURR research provides an excellent opportunity for the summer undergraduate researchers to gain innovative professional and educational experiences not found at any other university.

Alejandro Barilari, Julio Figueroa and Jose Perez, all juniors in engineering at the Polytechnic University of Puerto Rico, are working with Wale Oladiran, Doug Charlton and others on MURR's initiative to design and develop a prototype for a proposed new NAA pneumatic tube system. An automated system has potential to increase throughput, provide a wider range of analytic options, and decrease personnel dose. Alejandro is working on a new sample sealing mechanism, while Jose and Julio are developing controller software and a graphical user interface for the system. Scholarships for Alejandro and Jose are funded by the PUPR subcontract with MU under a DOE University Partnership grant, and Julio is supported through MU's NASA Space Grant Consortium program, led by Professor John Miles in the MU Mechanical Engineering Department.



Joseph Cardona, Ronald Govoro and Jeremy McCord

Three MU Mechanical and Aerospace Engineering (MAE) undergraduates, Joseph Cardona, Ronald Govoro and Jeremy McCord, have been chosen

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Summer Interns Flock to MURR

(continued from page 23)

to assist with an ongoing collaboration by Charlie Allen, Mike Flagg and others at MURR with Drs. Sherif El-Gizawy and Greg Solbrekken of the MU MAE department. The students will help evaluate LEU as a target material for producing fission product molybdenum-99 with scholarships funded by MU's DOE INIE program.

Anthony DeGraffenreid

Anthony DeGraffenreid is visiting MURR from Truman State University with funding made possible by MU's NSF REU in Radiochemistry program. Anthony's project deals with the use of instrumental neutron activation analysis (INAA) to determine the concentrations of fluorine and gadolinium in a biological tissue matrix, specifically rabbit aortas, at the ppm level.

Erika Frye is also receiving scholarship support from the NSF REU in Radiochemistry program. She is studying Environmental Science at the University of Rochester in New York. Erika's summer project is to research the production of bismuth-213, an alpha emitting radioimmunotherapeutic agent used in the treatment of cancer.

Karl Holland is a senior archeology student at California State University, who is transitioning to graduate work at Texas A&M University. His undergraduate advisor at CSU is Hector Neff, formerly from MURR. As part of the Archaeometry Lab's ongoing activities, Karl is working this summer with Mike Glascock on NAA of pottery and other archeological materials. His research involves sourcing post-classic Maya and colonial New Spain pottery excavated from Soconusco, Mexico. This is being done to examine the trade networks concerning the region, attempting to discern if the pottery from either of the two periods was being produced locally or was imported, also whether the production centers can be identified via NAA.

Karl Holland

Mark McLaughlin is a Chemistry student at Notre Dame University. With financial support from MU's NSF REU in Radiochemistry program, Mark is working with Cathy Cutler's group to evaluate new chelates for binding gallium-68 to deliver radiopharmaceutical doses.

Joscelyn Ocasio-Escobales

Joscelyn Ocasio-Escobales is finishing her BS Chemical Engineering degree at the Polytechnic University of Puerto Rico. This summer she will be working with Ron Dobey, Bill Miller and others to collect and analyze environmental samples in and around MURR to assess public doses from normal facility operations. Her summer scholarship is funded by the PUPR's subcontract with MU under a US DOE University Partnership grant.

Nebiat Sisay, a Chemistry student from the Southern University of New Orleans,

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Summer Interns Flock to MURR

(continued from page 24)

was a Summer 2006 researcher at MU in the Chemistry Department. This will be his first experience at MURR, as he joins Cathy Cutler's group this summer to investigate ligands for separating lanthanides. Nebiat's scholarship is funded through the MU Chemistry Department.

MU Chemical Engineering undergraduate Bradley Spatola is also working with Cathy Cutler's research team in their investigation of the possibility of radiolabeling DOTA-Y3-TATE with high specific radiolanthanides to yield a higher tumor/normal tissue ratio than with low specific activity Lu-177. If proven, this could potentially result in an improved treatment of metastatic cancer.

While not physically on site at MURR, several other students are working in collaboration with MURR this summer on two projects in MU's Electrical Engineering Department that are designed to lead to increased utilization of MURR's materials analysis capabilities. Dr. Maruf Hossain in the MU Electrical Engineering is hosting two PUPR students, Jose Rodriguez and Jose Sanchez, to conduct investigations of silicon carbide based betavoltaic devices for technologies needing small amounts of electrical power, such as onboard electrical needs for deep space missions and remote environmental sensors. This work is funded jointly through the Missouri and Puerto Rico NASA Space Grant Consortium and the DOE INIE grant. Miguel Lopez and Vidal Candelaria, also from PUPR, are another team of student investigators who are working with Dr. Scott Kovaleski to evaluate ferroelectric cathodes for use in applications electric propulsion.

MURR hosted 18 students during the Summer 2007 session. Thirteen gathered for this group shot. Eight of the students are from the Polytechnic University of Puerto Rico, a partner Hispanic-Serving Institution (HSI) in the Midwest Nuclear Science and Engineering Consortium.

American Nuclear Society Activities Update

The American Nuclear Society (ANS) continues to take a proactive role in supporting nuclear engineering education. ANS Student Sections – 33 across the country – play a vital role by conducting events that foster public understanding of nuclear science and technology and student interest in nuclear careers.

Oregon State University ANS Student Section, Corvallis, Oregon, hosted the 2007 ANS Student Conference. Approximately 300 students and 75 professionals attended the conference where they made technical presentations, networked with other students and professionals, and participated in a career fair where 25 companies were represented. The 2008 ANS Student Conference will be hosted by the Texas A&M University ANS Student Section, College Station, Texas, February 28 through March 1, 2008.

The number of ANS Alpha Nu Sigma Honor Society chapters is growing. Since January 1, there were four chapters re-activated and one new chapter inducted for a total of 21.

A Nuclear Careers mini DVD was released in March '07 and is available from ANS Outreach. The DVD was produced by Simpson-Scarborough LLC with funding provided from DOE's Office of Nuclear Energy's University Program.

ANS conducts and supports outreach activities with teachers and students at the secondary level. This effort helps assure that more educators have accurate information about nuclear science and technology and the many career opportunities in the field. In late February, 28 teachers attended an ANS organized full-day teacher workshop in Tucson, Arizona, in conjunction with the Waste Management meeting (WM07). In June, ANS organized and conducted a full-day Teacher Workshop at MIT, Cambridge, MA, for 33 teachers, in conjunction with the ANS Annual meeting in Boston.

From July 29 to August 1, ANS provided an exhibit at ChemEd07, at the University of North Texas, Denton, Texas. This event drew more than 650 chemistry teachers from around the nation. Approximately 70 teachers attended two 60-minute workshops where ANS offered hands-on teaching tools for including nuclear content in the chemistry classroom.

ANS has continued to support Student Sections, university nuclear engineering departments, and ANS Local Sections with materials for outreach programs targeting secondary teachers and students, even though its DOE/NE funded grant ended on April 2, 2007.

Career fair at 2007 ANS Student Conference

Space, Reactors, and NE Summer Internships

Idaho State University senior Caleb Robison spent the summer working on two separate projects at the Idaho National Laboratory (INL). Robison, who is double-majoring in nuclear engineering and mechanical engineering, divided his time between the Advanced Test Reactor (ATR) and the Center for Space Nuclear Research (CSNR).

Robison has worked for more than two years at the ATR focused on the ATR Life Extension Project, a program to identify and implement the actions needed to continue the safe operation of the reactor to the year 2040.

Robison reports, "This summer I worked entirely on what we call deficiency resolution, which is resolving concerns about problems that various people have found over the course of time. Some of these discrepancies are as simple as quoting a pressure as psia instead of psig and can be as complicated as significant differences between drawings and the actual plant configuration."

Advanced Test Reactor at the Idaho National Laboratory

Caleb Robison working at the TRA-608 demineralizer building that provides high purity water to the Advanced Test Reactor at the Idaho National Laboratory.

In his other summer intern role at the INL, Robison was employed by the CNSR, which was established in 2005 to engage university researchers in the development of advanced space systems powered by nuclear energy, including nuclear electric and thermal propulsion systems and radioisotope power generators for future missions. Robison analyzed candidate isotopes to replace Pu-238 as fuel for space applications. He researched production techniques, costs, availability, shielding, power densities, decay chains, and daughter products of each isotope and compared them using a weighted average. He also worked on schemes of transferring heat from the general purpose heat source to the hot head of a heat engine.

Robison sees great value in such internships. "Working at the INL has been a fantastic opportunity to not only see the application of the principles learned in the classroom, but also to be presented with real life engineering problems and be allowed to figure out the best solution and see those changes implemented."

ISU Adds BS in NE and Hires Four New Faculty

The first class of six students graduated from Idaho State University this past May of 2007 with the newly-established Bachelor of Science in Nuclear Engineering degree. Two took jobs in the nuclear power industry, and two now work for the Idaho National Laboratory. Another student received a NANT and entered the Master's degree program in NE at ISU. The sixth received a promotion at his current engineering job.

As a further contribution to the nuclear renaissance, the NE program added four new faculty members. The new Chair and Professor is George R. Imel who has worked at the Argonne National Laboratory (ANL) for over twenty years, the past nine of which he has been detached to CEA/Cadarache in France developing new forms of data acquisition and analysis for fast critical and subcritical systems as well as mentoring graduate students.

Patricia Paviet-Hartmann, Associate Research Professor, most recently worked for AREVA NP's MOX fuel project. She received her Ph.D. from the University of Paris-IX in Radiochemistry. Her particular field of interest is Actinide and Radionuclide Chemistry. She has a joint appointment with the Idaho National Laboratory (INL).

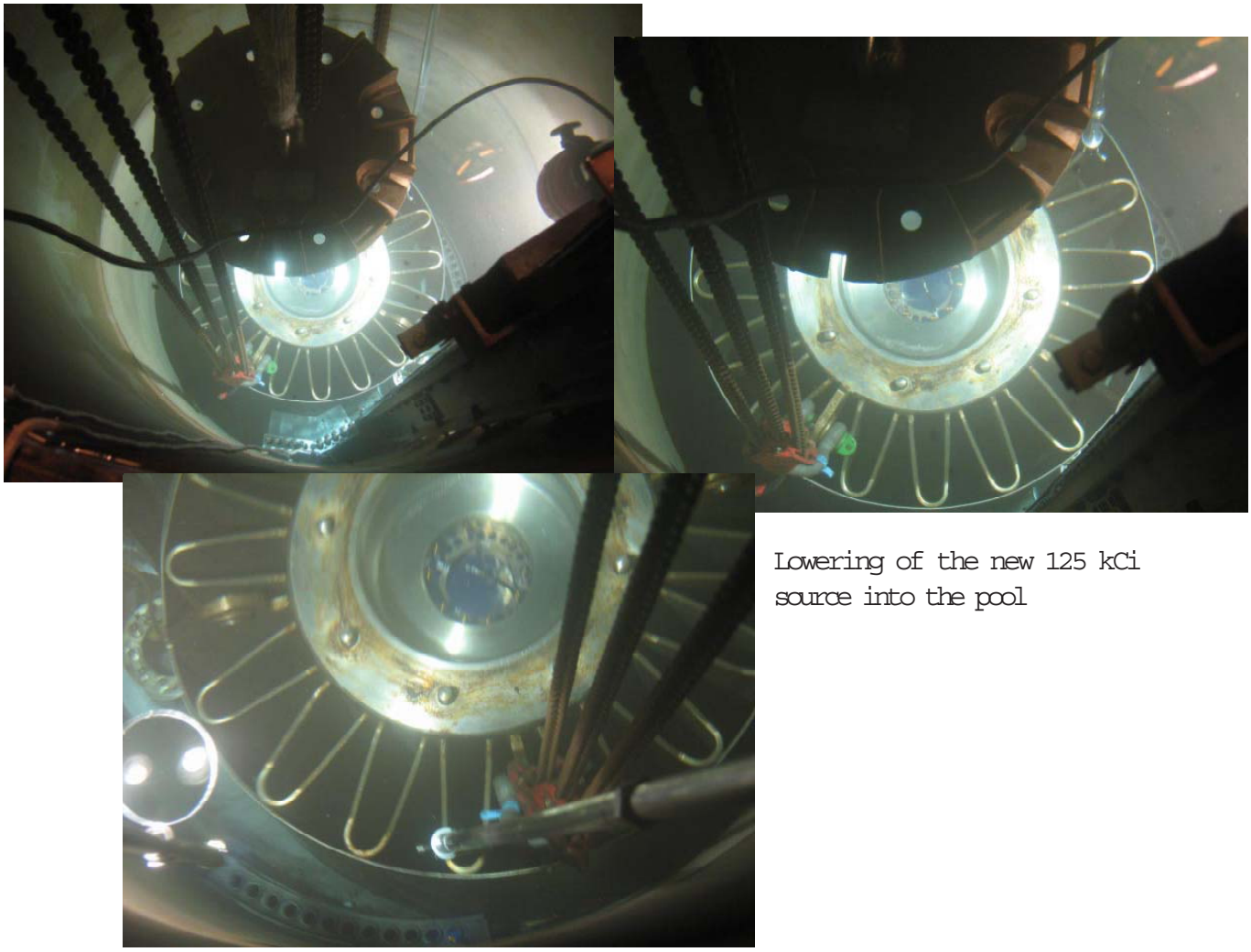
Jianwei Chen, Assistant Professor of Nuclear Engineering, engaged in Post-Doc work at the Idaho Accelerator Center after he completed his Ph.D. in Nuclear Engineering at the University of Cincinnati. Dr. Chen is working with the INL on reactor physics of gas-cooled reactors, Monte Carlo simulation in nuclear engineering and radiation science, and nondestructive assay of spent fast reactor fuel.

Thomas Hartmann, Associate Research Professor, moved to ISU from the University of Nevada-Las Vegas where he was directing the Structure and Solid Phase Analysis group in the Science and Technology Program. He received his Ph.D. from the University of Heidelberg in Mineralogy. His specialty is materials research, especially solid phase analysis and X-ray diffraction. He, too, holds a joint appointment with the INL.

New ISU faculty from left: Jianwei Chen, George Imel, and Thomas Hartmann

University of Maryland Cobalt Arrives

The Radiation Facilities at the University of Maryland (UMD) has recently upgraded to a 125 kCi (4.625×10^{15} Bq) ^{60}Co gamma source, the largest source available at any research institute in the world. The new source, consisting of ten 18 in. (0.46 m) pencils doubly encapsulated in stainless steel, was purchased from Reviss and installed on September 24th of this year. Currently, UMD is working with the National Institute of Standards and Technology (NIST) to establish dose rate certification, with expected values of approximately 12 Mrad/hr. In addition to the new source, modifications have been made to the source housing that will allow both planar and annular irradiation configurations. Graduate students from a diverse range of departments at UMD and collaborating institutions will utilize the source for many state-of-the-art projects, including: investigation of the kinetics of radiation induced polymerization of acrylates, low-LET radiotherapy of *in vitro* cell systems, radiation induced crosslinking of UHMWPE for clinical use in joint replacement, formation and behavior of stable nitroxide radicals, and radiation induced repair within biological systems. In addition to these, industrial applications of the new source include radiation qualifying of various components for nuclear power plants and high dose simulation of space environments. Funding for this project was provided by the DOE and private industry.



Lowering of the new 125 kCi source into the pool

Conversions of University Research Reactors

As a part of its nonproliferation mission, DOE-NNSA converts research reactors in the U.S. and around the world from operating within highly enriched uranium (HEU) to low enriched uranium (LEU) fuel. LEU is not suitable for use in a nuclear weapon and is not sought by civilian terrorists or criminals. The conversion is part of the Administration's efforts to minimize the use of highly enriched uranium applications around the world.

Since fiscal year (FY) 2006, university research reactors at Texas A&M University and the University of Florida have been converted. Conversion of the Purdue University occurred during FY 2007.

Other university reactors scheduled for conversion are Oregon State University (FY 2008), Washington State University (FY 2008), and the University of Wisconsin (FY 2009).

HEU was primarily used in research reactors to produce isotopes for medical applications, and early rector technology used HEU fuel because it was more difficult to achieve comparable power levels using LEU. However, modern reactor designs that use newer high-density LEU fuels while maintaining comparable power levels make conversion an attractive option for limiting the availability of HEU nuclear material.

The Global Threat Reduction Initiative's (GTRI) mission includes returning and securing nuclear fuel and radiological sources, protecting radiological and nuclear material and converting research reactors around the world. Currently, GTRI is working to convert 59 more reactors around the world from HEU to LEU by 2014.

Two additional university research reactors are planned for conversion after 2010. These are the reactors at the University of Missouri-Colombia and the Massachusetts Institute of Technology.

Homeland Security Research at RPI

The research group lead by Dr. Danon is working on two projects that are funded by the Domestic Nuclear Detection Office at the Department of Homeland Security. Both projects are related to the use of radiation to detect explosives and special nuclear materials. One project involves development of a new novel neutron source based on pyroelectric crystals acceleration. This project is based on results obtained from a NEER funded research grant that showed for the first time that pyroelectric crystals can produce fusion neutrons by simple heating of the crystals. The objective of the project is to improve the neutron yield and develop a portable, battery-operated neutron source. Two nuclear engineering graduate students Donald Gillich and Andrew Kovanen, and two undergraduate students, Brian McDermott and Becky Marus, are working on this project.

Another new project is focused on development of a new high efficiency solid state detector based on cheap solar cell technology. This detector will be an improvement on current detection technologies because of the high efficiency, the small size, faster response time and the fact that no bias voltage is required for operation.

Neutrons and Nuclear Engineering

Oak Ridge National Laboratory hosted two workshops in April 2007 relevant to nuclear engineering education.

In the *Neutron Stress, Texture, and Phase Transformation for Industry* workshop [http://neutrons.ornl.gov/workshops/nst2/], several invited speakers gave examples of neutron stress mapping for nuclear engineering applications. These included John Root of National Research Council of Canada, Mike Fitzpatrick of the UK's Open University, and Yan Gao of GE Global Research on their experiences with industrial and academic uses of neutron diffraction. Xun-Li Wang and Camden Hubbard described the new instruments at ORNL that can be used for such studies.

This was preceded by the *Neutrons for Materials Science and Engineering* educational symposium [http://neutrons.ornl.gov/workshops/edsym2007]. It was directed to the broad materials science and engineering community based in universities, industry and laboratories who wish to learn what the neutron sources in the US can provide for enhancing the understanding of materials behavior, processing and joining. Of particular interest was the presentation of Donald Brown of Los Alamos about using "Neutron diffraction measurements of strain and texture to study mechanical behavior of structural materials."

At both workshops, the ORNL neutron scattering instruments relevant to nuclear engineering studies were described. The Neutron Residual Stress Mapping Facility (NRSF2) is currently in operation at the High Flux Isotope Reactor; the VULCAN Engineering Materials Diffractometer will begin commissioning in 2008 at the Spallation Neutron Source. For characteristics of these instruments, as well as details of other workshops, meetings, capabilities, and research proposal submissions, please visit http://neutrons.ornl.gov. To submit user proposals for time on NRSF2 contact Hubbard at hubbardcr@ornl.gov.

Over 100 members of the academic, industry, and government research communities attended the Neutrons for Materials Science and Engineering educational symposium held at Oak Ridge National Laboratory.

First Advanced Test Reactor (ATR) National Scientific User Facility (NSUF) Workshop

In April 2007, the Department of Energy designated the ATR as a National Scientific User Facility to enhance U.S. leadership in nuclear science and technology. By making ATR more easily accessible to users - including universities, laboratories and industry - the Department is expanding its support of basic and applied nuclear research and development to advance the nation's energy security needs.

The Idaho National Laboratory hosted the first Annual User Workshop for the Advanced Test Reactor National Scientific User Facility (ATR NSUF) September 13 -14, 2007, in Idaho Falls. The workshop was an excellent opportunity for universities, industry, and other federal agencies to learn about the new role that the Department of Energy has identified for the ATR, one of the world's most versatile reactors, and ways that your research programs may benefit from using the ATR research capabilities.

For more information please visit the ATR NSUF website at https://secure.inl.gov/atruserfacilityws07/Default.aspx

Important Dates to Remember

2007-2008

- ✓ American Nuclear Society Meeting, Washington, D.C. November 11-15, 2007
- ✓ American Nuclear Society Student Conference, Texas A&M University, College Station, Texas. February 28 - March 1, 2008

For Additional Information Please Contact

John Gutteridge
NE-3/Germantown Building
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585-1290
john.gutteridge@nuclear.energy.gov