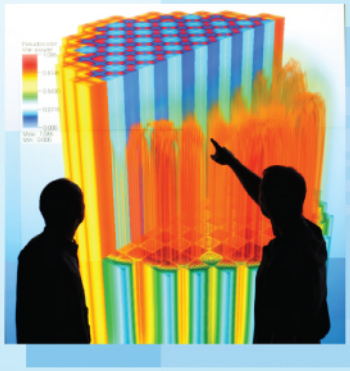
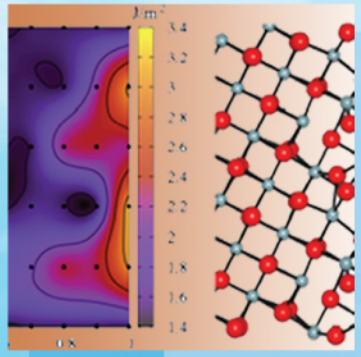
CASL-U-2014-0166-000

Power uprates
and plant life extension



Engineering design
and analysis

Science-enabling
high performance
computing



Fundamental science

Plant operational data

Consortium for Advanced Simulation of LWRs

L3:EC.P9.05

CASL Summer Workshop Report 2014

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Virginia Polytechnic Institute and State University

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U.S. DEPARTMENT OF ENERGY | Nuclear Energy

CASL-U-2014-0166-000

CASL Education Council Summer Student Workshop 2014
June 11-13, 2014
Oak Ridge National Laboratory

CASL (The Consortium for Advanced Simulation of Light Water Reactors) - A DOE Energy Innovation Hub for Modeling & Simulation of Nuclear Reactors Education Program hosted their fourth annual Summer Student Workshop in the summer of 2014. The workshop was held in Oak Ridge, Tennessee mainly at the Oak Ridge National Laboratory JICS Auditorium. The purpose of the workshop was to orient and introduce graduate to VERA modules providing a hands-on experience with three software platforms: BISON, CTF, & MPACT, highlight graduate student work in the programs, as well as provide opportunities for the students to interact with each other and CASL Leadership and staff. In total there were 23 students attending from seven schools. The workshop agenda included project overviews from the CASL Leadership team, presentations and hands-on demonstrations of VERA, and tours of the Spallation Neutron Source (SNS), the original graphite reactor, and High Flux Isotope Reactor (HFIR). The workshop was a valuable research and development resource for the students as well as the module developers. It provided the opportunity to investigate challenges in the hands-on application of the modules and exam ways to improve the sessions; thus providing new information and giving perspective and in depth knowledge on the entire module development project. Despite the challenges, overall the feedback was positive from all involved: students, staff, and faculty.

Workshop Description:

Formal activities began Wednesday evening with an informal dinner and interactive session at the Hampton Inn and Suites in West Knoxville. The dinner program “Introduction to CASL and the 2014 Workshop Goals” was led by Dr. Mike Doster and included introductions to the CASL Education Program, its mission, and the goals of the workshop. Dr. Doster, Director of the CASL Education Program, provided a general overview of the CASL project as well as a description of the important roles of the students. Dr. Doster also introduced CASL leadership staff, Dr. Doug Kothe, Dr. paul Turinsky, Dr. John Turner, and Mrs. Linda Weltman. Dr. John Turner gave a brief overview about the goals of VERA. He discussed VERA informing the students that it was a suite of tools for scalable simulation of nuclear reactor core behavior. VERA includes both “core simulator” components and components for specific challenge problems. Dr. Leigh Winfrey and Ms. Sherry Bailey of the Education Program staff led the remaining interactive portions of the program designed to facilitate an open environment between the students.

In the activity, the students were assigned a person whom they were required to introduce to the group. Each student had to “interview” their assigned peer. The assignment not only involved asking their name but also determining something they shared with the other individual as well as a unique fact to share with the group. They were also to uncover their undergraduate and graduate experience, why they were interested in nuclear energy as well as their understanding of their roles in CASL. Through this exercise, each student met two people: the person they were “interviewing” and the person that was “interviewing” them. Once the “interviews” were complete, each student introduced their assigned participant to the entire group. The activity was successful; the students met more than the intended two other people, received experience speaking in front of the group, and learned useful information about all of their peers. The activity permitted the students to not only learn the various skill set of the group but also disseminate where they might fit into the CASL landscape.

The entire second day and most of the third day were devoted to technical talks about the three software platforms: BISON, CTF, & MPACT and then hands-on working sessions using the software platforms. Additionally the students were given tours of three ORNL facilities. Students also gave presentations on their CASL project work both in oral and poster formats. The list of specific talks and tours is listed in the attached workshop agenda. Once the technical portion of the program was concluded, the students were again led through interactive sessions to help them and the workshop facilitators process and assimilate what all had gained through the workshop.

Technical Sessions:

Many returning students attended the CASL student workshop this year. Specific talks about key software applications (BISON, CTF, & MPACT) were highlighted with an emphasis on the Virtual Environment for Reactor Applications (VERA). Dr. John Turner of Oak Ridge National Laboratory assisted in organizing the bulk of the technical program. Hence, VERA was covered in detail. To begin the technical sessions, Dr. Doug Kothe, Director of CASL, and Professor J. Michael Doster, Director of the CASL Education Program, gave an overview of the CASL project and all Focus Area research. The specific technical challenge problems to be addressed by the project were put into the industry context. Dr. Koroush Shirvan, Visiting Scientist from MIT, gave the first presentation on BISON. He discussed BISON and gave examples of its application. Dr. G. Ivan Maldonado, Associate Professor at University of Tennessee, Knoxville and his PhD student**,** Cole Gentry, led the second presentation on the uses of CTF. Dr. Ben Collins, R&D Associate at Oak Ridge National Laboratory presented the information concerning the MPACT code. The same speakers would each lead the hour and half hand-on experiences in each code during the workshop.

To present a different use of computational science, a discussion about Understanding Earth's Climate was given by Dr. Katherine J. Evans during lunch on the first day. The dinner speaker on day one was Dr. John Levesque, Director Cray's Supercomputing Center of Excellence at ORNL. He examined the history of supercomputers and their use in exascale systems.

The technical talks discussed above are available in power point format from Ms. Sherry Bailey at NCSU or on the CASL SharePoint site at ORNL.

Three technical tours were provided to workshop participants this year. The first tour was of the High Flux Isotope Reactor (HFIR) at ORNL. Day two tours included the Spallation Neutron Source (SNS) and the original graphite reactor.

Student Interactive Sessions:

On the 2nd day seven students submitted entries for the lunch poster session. During lunch the four judges (Mike Doster, Bill Martin, John Turner, and Leigh Winfrey) as well as CASL staff and fellow workshop participants examined all the entries and questioned the students about their work. The judges determined three winners among the entries or their outstanding work: Lulu Li, MIT (1st), Jun Fang, NCSU (2nd), & Andrea Jokisaari, UM (3rd).

Poster Submissions CASL Summer Student Workshop 2014

Name	University	Title
Cameron Brown	North Carolina State University	Advanced turbulence models for two-phase flows
Jun Fang (2nd Place)	North Carolina State University	Two-phase simulations
Jinyong Feng	North Carolina State University	Two-phase flow simulation
Andrew Gerlach	University of Michigan	Modeling the SPERT-III Reactor Experiments with MPACT
Miaomiao Jin	MIT	CRUD simulation
Andrea Jokisaari (3rd place)	University of Michigan	Phase field modeling of Zr/Zr hydride system
Kelly Kenner	University of Tennessee	SMR Modeling with VERA
Lulu Li (1st Place)	MIT	Reactor physics, Methods of Characteristics, acceleration schemes

List of Faculty, Staff and Education Program members attending CASL Speakers and Staff Summer Student Workshop 2014

Name	Email
Sherry Bailey	sbbailey@ncsu.edu
Benjamin Collins	bscollin@umich.edu
J. Michael Doster	doster@ncsu.edu
Doug Kothe	kothe@ornl.gov
G. Ivan Maldonado	Ivan.Maldonado@utk.edu
William Martin	wrm@ umich.edu
Koroush Shivran	kshirvan@mit.edu
Paul Turinsky	turinsky@ncsu.edu
John Turner	turnerja@ornl.gov
Linda Weltman	weltman@ornl.gov
Leigh Winfrey	leigh.winfrey@vt.edu

Highlights from Student Group Comments and Feedback:

As part of the last session of the 2nd date, J. Michael Doster and Sherry Bailey divided the students into four subgroups and asked them to discuss five questions.

- What were the positive points of the workshop?
- What needed improvements?
- Did you get out of the workshop what you thought you would?
- Did you gain a better perspective of CASL and its mission?
- What else would you add to the workshop?

Students then presented a summary of their discussion to the group. Doug Burns was on hand to address the students and respond to the discussion.

Student responses included:

- Enjoyed the tours and speakers, would like more information about the physics behind the code, how the code was developed, and more information on how to use it.
- Students thought the presenters assumed they knew more than they did, would like more background. Students also want more examples as well as explanations on how it used. Students thought more directions beforehand would be useful.
- ~~Students wanted to see more of Knoxville. They would like a social component implemented.~~
- Too many kinks in the Wi-Fi, more testing before the workshop would have assisted.
- Students suggested a primer and/or manual for the code beforehand. Or access to the files beforehand.
- Students enjoyed both the lunch and dinner speaker.
- Students were grateful to receive information/skills they might actually use in the future studies.
- ~~Cobra presentation = Not Good,~~ Bison & MPACT ~~better~~ presentations were in particular very good
- Students thought that since all their backgrounds were different, they did need more introductory material. A broader umbrella and then move to the specific problem. Perhaps even a different tract for a new student versus a returning student.
- Workshop is a tight schedule – either less tours or more days to complete workshop.
- A better description of the topics before the meeting may be useful.
- Students ask who is your target audience for this workshop?
- Students do like interacting with each other and also getting the chance to hear about other students' research.
- Students felt the presentation quality was high. Perhaps slides could be delivered ahead of time.
- Maybe complex cases should be run in groups.
- Students requested some kind of user guide to VERA.

Students and staff interaction at opening session at hotel

Students listen to the tour guide at HFIR

Students get a behind the scenes tour of SNS.

Students stop for a group photo during their tour of SNS.

Consortium for Advanced Simulation of Light-Water Reactors (CASL)
Education Council Summer Student Workshop 2014 Agenda

Wednesday, June 11, 2014	
3:00 - 4:00pm	ORNL Bus Pickup at Airport/Destination: Hampton Inn and Suites Knoxville – Turkey Creek/Farragut, Knoxville, TN
5:00 – 6:00pm	Registration in Lobby of Hampton Inn and Suites Knoxville – Turkey Creek/Farragut
6:00 – 9:00pm	Interactive Kickoff Session with Dinner at the Hampton Inn and Suites "Introduction to CASL and 2014 Workshop Goals" (Michael Doster, NCSU, Sherry Bailey, NCSU, and Leigh Winfrey, Virginia Tech) "Virtual Environment for Reactor Applications (VERA) Overview" (John Turner, ORNL)
Thursday, June 12, 2014 Oak Ridge National Laboratory, JICS Auditorium, Bldg 5100, Room128	
7:00am	Breakfast provided by the Hampton Inn and Suites
7:30am	Bus Departs from Hotel **Badging will occur at Oak Ridge National Laboratory**
8:30am	Welcome, Mike Doster and CASL Leadership Doug Kothe
8:45am	Speaker Presentations (BISON) Koroush Shirvan, MIT
9:45am	Speaker Presentations (CTF) Ivan Maldonado and Cole Gentry, UT-Knoxville
10:45am	Break
11:00am	Speaker Presentations (MPACT) Bill Martin, UM, and Ben Collins, ORNL
12:00pm	Lunch and Speaker – Katherine J. Evans, Scientist, Computational Earth Sciences "Using Computational Science to Understand Earth's Climate"
12:30pm	Tour of HFIR
2:00pm	Working Sessions (BISON) Koroush Shirvan, MIT
3:30pm	Working Sessions (CTF) Ivan Maldonado and Cole Gentry, UT-Knoxville
5:30 – 7:00pm	Dinner and Speaker – John Levesque, Director Cray's Supercomputing Center of Excellence, ORNL "Examining Past Supercomputers To Understand How To Use Proposed Exascale Systems" Location: Bldg 5200, Room 202A
Friday, June 13, 2014 Oak Ridge National Laboratory, JICS Auditorium, Bldg 5100, Room128	
7:00am	Breakfast provided by the Hampton Inn and Suites
7:30am	Bus Departs from Hotel
8:00am	Pick up ORNL Summer Participants at Visitor Center
8:10am	Tour of SNS
9:05am	Tour of Graphite Reactor
10:00am	Break
10:15pm	Working Sessions (MPACT) Bill Martin, UM, and Ben Collins, ORNL
11:45am	Multi-Physics Coupling/Sensitivity Uncertainty Analysis (Mike Doster, NCSU and John Turner, ORNL)
12:30pm	Lunch – Student Poster Presentations sponsored by Westinghouse (conducted by Leigh Winfrey, Virginia Tech) Location: Bldg 5200, Room 202A
2:15pm	Feedback and discussion with workshop participants

3:15pm	Conclude, Summary and Action Items, Students, and CASL Leadership/Staff

Summer 2014 CASL Summer Workshop Student Participants

First Name	Last Name	Email Address	Current Institution
Taylor	Blyth	tsblyth@gmail.com	Penn State University
Cameron	Brown	csbrown3@ncsu.edu	North Carolina State University
Robert (Trip)	Dacus	rwdacus@gmail.com	North Carolina State University
Jun	Fang	jfang3@ncsu.edu	North Carolina State University
Jinyong	Feng	fengjinyong2008@gmail.com	North Carolina State University
Konor	Frick	klfrick2@ncsu.edu	North Carolina State University
Cole	Gentry	cgentry7@gmail.com	University of Tennessee - Knoxville
Andrew	Gerlach	agerlach@umich.edu	University of Michigan
Aaron	Graham	aarograh@umich.edu	University of Michigan
William	Gurecky	william.gurecky@utexas.edu	The University of Texas at Austin
Jason	Hite	jmhite@ncsu.edu	North Carolina State University
Ana	Jambrina Gomez	azj128@psu.edu	Penn State University
Miaomiao	Jin	mmjin@mit.edu	Massachusetts Institute of Technology
Andrea	Jokisaari	anmida@umich.edu	University of Michigan
Kelly	Kenner	kkenner@utk.edu	University of Tennessee - Knoxville
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Fatih Sinan	Sarikurt	fatihsinan@tamu.edu	Texas A&M University
Shane	Stimpson	sgstim@umich.edu	University of Michigan
Alex	Toth	artoth@ncsu.edu	North Carolina State University
Erik	Walker	ewalk@utk.edu	University of Tennessee - Knoxville