MCNP® Site Support NEWSLETTER

FIRST QUARTER 2021

Welcome to the MCNP® Site Support Newsletter

We would like to welcome you to the first quarterly edition of the MCNP® Site Support Newsletter. The objective of the newsletter is to communicate relevant information on accomplishments, status and plans to our stakeholders. We look forward to your feedback and suggestions for subsequent issues.

The MCNP Site Support project was approved by the Laboratory Director's Office during the summer of 2020 and was formally initiated at the beginning of FY21. The project was approved in recognition that the MCNP Monte Carlo transport code is relied upon by a large number of organizations throughout Los Alamos, across DDW, DDSTE, and DDOPS, and spanning applications impacting national nuclear security, operations, and basic science. It is intended to provide ongoing funding for user support activities and for code maintenance and modernization.

This first edition of the newsletter highlights the formation of the MCNP Steering Committee, made up of representatives from line and program organizations across the Laboratory. We include a summary of our FY21 plans for code modernization. We also initiate a regular feature with brief focus articles on one organization's use of MCNP. We hope you find the newsletter to be useful and interesting.

Introducing the MCNP Steering Committee

The MCNP Steering Committee (MSC) was chartered in July 2020 by Senior Laboratory Leadership Sponsors **Carol Burns** (DDSTE) and **Mark Chadwick** (ALDX) to help bring recognition to the fact that the code is relied upon by a large number of organizations throughout Los Alamos, across DDW, DDSTE, and DDOPS.

The fundamental goal of the MSC is to create an enhanced level of communication among the entire MCNP community at Los Alamos that will enable the developer community and the user community to both benefit and collectively define directions into the future.

MSC membership is comprised of representatives from Los Alamos organizations, both line and program, that have direct connections to the code. Division leaders and program directors were provided with a copy of the charter and asked to nominate representatives from their organizations. Leadership response was prompt and enthusiastic. The initial MSC membership is comprised of 29 individuals representing 27 different organizations across 8 ALD's and 14 Divisions.

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MSC FY21 first quarter meetings

The first MSC meeting in FY21 was held on Oct. 7. Senior Laboratory leadership sponsors kicked off the virtual meeting with their welcome and expectations for the MSC. Individual MSC members then briefly described their relationship with MCNP, bringing to everyone's attention the wide variety of applications of the code across Los Alamos. **Jeremy Sweezy**, chair of the MSC, discussed objectives of the MSC and also the opportunities (and limitations) afforded by the new MCNP Site Support project. **Mike Rising**, MCNP technical lead, summarized code modernization accomplishments over the past three years as well as plans for FY21. There was also a brief summary of plans for FY21 MCNP user support.

The second FY21 meeting was held on Dec. 16. Prior to the meeting, a survey was sent to MSC members requesting their input on a variety of topics related to MCNP user support. 23 responses were received, providing much valuable information. The meeting provided a summary of the survey feedback and how the information received would feed into current and future plans for user support. The meeting also featured a presentation titled "LANL Isotope Program: MCNP User Perspective and Needs," by Eva Birnbaum, Ellen O'Brien, and Etienne Vermeulen. The unique requirements and use of the code by the Isotope Program were of broad interest across the MSC – we plan on similar presentations during future MSC meetings.

Peer Support for MCNP Site Support Funding

"Thank you for sharing this news. The institution support of MCNP is important especially as it is a major computational tool used worldwide. It is always gratifying to see that top management listens seriously to our suggestions."

William Barletta, adjunct professor of physics, Massachusetts Institute of Technology

MSC Membership

Casey Anderson	XTD-PRI
Jennifer Arthur	NCS
Jordan Douglas	RP-PROG
Leanne Duffy	AOT-AE
Jay Elson	NEN-5
Tim Goorley	XCP-7
Wim Haeck	XCP-5
Karen Kelley	W-13
Keegan Kelly	P-27
Charles Kelsey	LANSCE-FO
Marc Klasky	P-23
Kathleen McDonald	FCI-DO
Geordie McKenzie	NEN-2
Garrett McMath	NEN-1
Eric Nelson	XCP-8
Ellen O'Brien	C-IIAC
Jim Smith	T-5
Chris Stanek	MST-8
Ionel Stetcu	T-2
Elizabeth Sussex	GC-IP
John Tanski	A-2
Travis Trahan	XCP-3
Holly Trellue	NEN-5
Scott Turner	XTD-NTA
Marion Vance	ISR-2
Scott Vander Wiel	CCS-6
Trevor Wilcox	XTD-SS
Joe Zerr	CCS-2
Ning Zhang	NCS

MCNP USER PROFILE

Ellen O'Brien, Inorganic Isotope and Actinide Chemistry, C-IIAC

The mission of the Department of Energy's (DOE) Isotope Program is to support the production of, and the development of production techniques for, radioactive and stable isotopes that are in short supply for research and applications, and of strategic importance to the nation.

The Isotope Production Facility (IPF), located at the LANSCE linear accelerator, utilizes a 100 MeV pulsed proton beam on multiple stacked targets to help fulfill the mission of the DOE Isotope Program by making radioisotopes for a broad range of application spaces. Accelerator-produced isotopes are clinically important for diagnostic imaging procedures, and a number of therapeutic isotopes are also under development within the LANL Isotope Program. One important therapeutic isotope currently produced at IPF is actinium-225, which is an alpha-emitting radioisotope used for cancer treatments via targeted alpha therapy (TAT).

MCNP is used to track proton interactions and heat deposition within the target materials used at IPF, as well as the production of secondary particles – in particular, the high-energy secondary neutron flux. MCNP is used in combination with CINDER to track the production and decay of radioactive isotopes during target bombardment to aid in estimating production yields and to ensure an active radionuclide inventory for the facility is maintained. Maintaining inventory limits at IPF is a critical safety basis control, so this system must be robust and defensible.

Ellen O'Brien has been a staff member with the LANL Isotope Program since 2019, and has been modeling IPF target geometries with MCNP since she began collaborating with the team in 2016 as a graduate student. She has a background in nuclear engineering and finds the unique combination of engineering and physics present at IPF to be an exciting challenge.

Some of O'Brien's main areas of interest include probing the complex physics present in the IPF target irradiation chamber and cooling system, working to improve targetry for high current irradiations such as for actinium-225, and collaborating with other national laboratories to collect nuclear data populating unexplored interaction regions of interest for isotope production.

TRAINING

MCNP training moves online swiftly, seamlessly during COVID-19 to meet LANL, NNSA, DOE, and external user community needs

Training has always been an important part of supporting MCNP's user community.

Past in-person training reached 200+ users in 10-15 courses per year across various U.S. government laboratories and organizations, educational institutions, and industry. An in-person introductory class had been completed on March 6, 2020, shortly before COVID-19 forced a shutdown in travel.

The MCNP Team recognized that training must continue despite the challenges presented by the pandemic. Because training is integral to supporting the MCNP user community, coursework was moved online near the onset of COVID-19 in order to provide fast, efficient access to critical knowledge.

Through the end of CY 2020, a total of six on-line courses were offered, attracting 195 attendees. The rapid pivot from in-person to online training was recognized by NA-114 in their November 2020 Quarterly Highlights: "In a post-COVID-19 world, these online training opportunities will continue to deliver efficient user education and training for many important MCNP applications across the U.S. nuclear complex."

Upcoming on-line MCNP classes are listed on the following page.

CODE MODERNIZATION

MCNP taking shape: 'Modernization via Modularization'

For the past couple of years, progress in MCNP code modernization has begun to slowly take shape. Our approach is, "Modernization via Modularization." By separating the MCNP code base into more modular components, the long-term sustainability, maintainability and flexibility of the code will allow current and future developments to continue for the foreseeable future.

Ultimately, progress toward code modernization is required so that the MCNP code can continue to meet the current needs of a wide range of Los Alamos mission spaces, as well as be more readily adaptable to emerging needs throughout the community.

How it all began

Efforts to modernize the code began with a concerted effort to modernize many of the code development practices and tools in place prior to the start of this endeavor. In order for follow-on code modernization efforts to be successful, many general code development processes were upgraded.

Moving away from "home-grown" tools toward more modern, industry-standard software development tools allows many on the development team to spend time more efficiently, focusing on the quality of the ongoing and future code improvements.

One of these significant code improvements came as the industry standard HDF5 library was adopted to replace many of the peripheral files that the MCNP code needs or generates. Other code modernization efforts have also focused on modularization of the source code into components (sources, particle track outputs, tallies, etc.), and active work continues on either cleaning up these components or replacing them with modern alternatives.

While the roots of the MCNP code go back many decades, there are many changes taking place now looking toward the long-term sustainable future of the MCNP code.

—**Mike Rising**, MCNP technical lead

MCNP COMING ATTRACTIONS

Upcoming MCNP classes

- **Apr 5-9, 2021: Intermediate MCNP6 (online)**

Mon 9:00 - Fri 12:00
Non-US citizens must register by 2021-01-25

- **May 24-28, 2021: Introduction to MCNP6 (online)**

Mon 9:00 - Fri 12:00
Non-US citizens must register by 2021-03-22

- **June 7-9, 2021: Criticality Calculations with MCNP6 (online)**

Mon 9:00 - Wed 4:30
Non-US citizens must register by 2021-04-05

Note that the MCNP Site Support project provides free training to all LANL students.

For more details, visit:
https://laws.lanl.gov/vhosts/mcnp.lanl.gov/classes/classinformation.shtml

Save the Date

MCNP 2021 User Symposium

We are planning to hold the MCNP 2021 User Symposium during the week of July 12. The symposium, which will be held virtually this year, will include presentations by the development team on the latest and planned capabilities. It will also feature presentations from MCNP users inside and external to the Laboratory. Details to come.

Release of MCNP6.3

Release of MCNP6.3 will occur in FY21, stay tuned for updates and alpha-testing requests.