Studsvik

Studsvik Scandpower

December 2024 Newsletter

Opening Remarks

Reflecting on the last year, Studsvik Scandpower has been busy developing new software, improving our existing software and tools, and meeting with all of our global customers. Today, we have reasons to be optimistic around the world that the existing plants will

operate as long as possible and that the rapid electrification of the economy will require nuclear energy to fill a significant portion of the growing energy demand. Today is a good day to be in the nuclear industry.

For those of us who like interesting and different problems, we have plenty of those. Resource availability and cost for outages have pushed some utilities to extend cycles to 24 months, and the jury is out whether fuel-efficiency outweighs operational efficiency. To offset this, the design space is opening up to HALEU fuel between 5 and 10 percent, which sounds simple from the onset until one gets into the details where we find our joy. If the CMS users are anything like I was in my core design engineer days, there was nothing more satisfying than creating a core design with low peaking factors, high discharge burnup, and 4 fewer feeds than required to meet the cycle EFPD requirements. Now as engineers, we adapt to the new operational paradigms and lead our organizations to the best designs with the best operational analytical tools available.

The operational nuclear design space is just beginning for advanced non-LWRs, and with the launch of the first-ever NQA-1 3-D Monte Carlo Transport code Peacock this year, the simulation capability will be far more precise than the biases and uncertainties of new fuel matrices, new chemistries, and dynamic stochastic locations of special nuclear materials ("SNM") where fuel moves during operations. Our system of software development provides assurance for the regulatory scrutiny that your calculations will require so that your team can concentrate on building, fueling, and operating your reactors rather than creating new codes and debugging and maintaining them all separately. Operational experience ("OE") will be our friend, and our team is excited to help new operators improve margins and increase efficiency as soon as they start producing the OE we (operators, regulators, suppliers, advisors) all need.

December brings a season of multiple holidays and all of the simultaneous joy and stress that it produces. From the Studsvik Scandpower team to yours, I wish you happy holidays and a happy new year (whether that be a Gregorian calendar or a Lunar calendar moving into the Year of the Snake January 29, 2025). From the Rossi Wharton family where we celebrate Christmas in Boston, we sincerely hope that you have a moment to enjoy loved ones and reflect upon successes, failures, and lessons to take to extend a successful 2024 into 2025. It's a good time to be a nuclear energy professional, and I look forward to continuing this journey with all of you in 2025.

Sincerely,
Art Wharton, SSP President and CEO

Code Updates

Studsvik Scandpower continues to release updates for its CMS5 software suite.

Highlights of new features and capabilities, as well as minor software corrections available in these new versions, can be found in the Changes and Release Notes documents in the "Software Updates" section of the Studsvik Support Site (login required) - https://support.studsvikscandpower.com/

CMS5 software has been qualified under the Studsvik, Inc. NQA1 1994, 10 CFR 50 Appendix B, 10 CFR 21 Quality Assurance Program and HELIOS2 under ISO-9001.

Current code versions for other Studsvik software include: CASMO5_VVER v3.09.00, SIMULATE5_VVER v2.07.00, SIMULATE5-K_VVER v2.07.02, SIMULATE-3 v6.25.00, SIMULATE-3K v2.12.00, S5POST v1.00.00, CMSView5 v1.0.6, NORDIC v3.03.00

If you would like to receive an update to your software under your current software maintenance agreement, please contact your Studsvik representative.

CASMO5 v3.09.00

August 2024

2D lattice physics transport code for PWR and BWR

(VVER capability available in a separate version)

HELIOS2 v2.04.01

September 2023

2D general geometry lattice physics transport code

- Improvements and corrections for the cross-section uncertainty feature.
- Improved resonance shielded self-scatter data for tungsten.
- Improved isotopic weighting factors for fission neutron emission.
- Optional reduced burnup chains.

- Multithreaded computation.
- Linear source Method of Characterization (MoC) solution.
- Optional 8-family delayed neutron data.

SIMULATE5 v2.07.00

October 2024

3D steady state nodal simulator code for PWRs and BWRs

SIMULATE5-K v2.07.02

December 2024

Advanced, multi-group nodal code for transient analysis of LWRs using SIMULATE5 methodology.

- A new capability for modeling the medical Co-60 production from Co-59 is implemented.
- A new module is implemented for automated BWR Reactivity Insertion Accident Analysis.
- Various new summary file edits.

- Updates to intra-pellet power profiles used with fuel temperature evaluations.
- Capability to perform Pressurized-Water Reactor Control Rod Ejection and Boiling Water-Reactors Control Rod Accidents following NRC Regulatory Guide 1.236.
- The implementation of the transient critical power ratio (CPR) methodology based on the Thermal Limit (TLM) library has been completed.
- The interface between CMS5 and the subchannel code VIPRE has been implemented in SIMULATE5-K.
- Implementation of reactivity calculation model based on the exact perturbation theory.

CMS LWR

SNF

CMSLink5 v1.23.00

August 2024

Linking code between CASMO5 and SIMULATE5/3, SIMULATE5-K/3-K

SNF v1.08.02

February 2024

3D spent nuclear fuel isotopics and decay heat tracking

- New calculational capability to enable the tracking of Co-60 inserted into PWR guide tubes.
- Irradiation history modifiers to address missing or incomplete history.
- Upgraded and extended set of isotopic uncertainties based on CASMO5.
- Improvement in processing of asymmetric assemblies.

CMSBuilder v2.00.00

July 2023

A graphical fuel management and loading pattern design suite that provides core design engineers with a sophisticated interface to simplify assembly design, fuel shuffling and loading pattern evaluation.

SIMULATE-3K v2.12.00

November 2024

An advanced, two-group nodal code for transient analysis of LWRs using SIMULATE-3 methodology.

- Implementation of BWR Core Design Projects.
- Core Average Axial Plots.
- Plots View - Core parameters versus cycle exposure.

- Mark Minimum and Maximum Core Values from the Main UI.
- Display the Average Value of the Primary Core Parameter.
- Display Batch Labels in Inventory View Core Parameter.
- Display Batch Labels in Inventory View.
- Correction in the evaluation of the fuel thermal conductivity using the external material tables.
- Correction in the evaluation of the energy per fission in the decay heat model.
- Improvements for Sandwich Type Shielding assembly.
- Updates to the intra-pellet power profiles used with the fuel temperature calculations. Consistent with the profiles used by SIMULATE5 version 2.07 .
- Implemented the MATPRO heat capacity correlation for Zircaloy.

Studsvik Annual Customer Feedback Survey

Studsvik Scandpower is working to more actively engage with our customers and understand their preferences and needs as it relates to the products and services provided by Studsvik Scandpower. Please provide your feedback to us using the link below.

Link to the 2024 survey: 2024 Studsvik Annual Customer Feedback Survey

We look forward to reviewing your responses and working to adjust our priorities to best fulfill the brand promise of state-of-the-art nuclear fuel lifecycle software and support for the global nuclear energy fleet.

Please complete the survey by **January 15, 2025.**

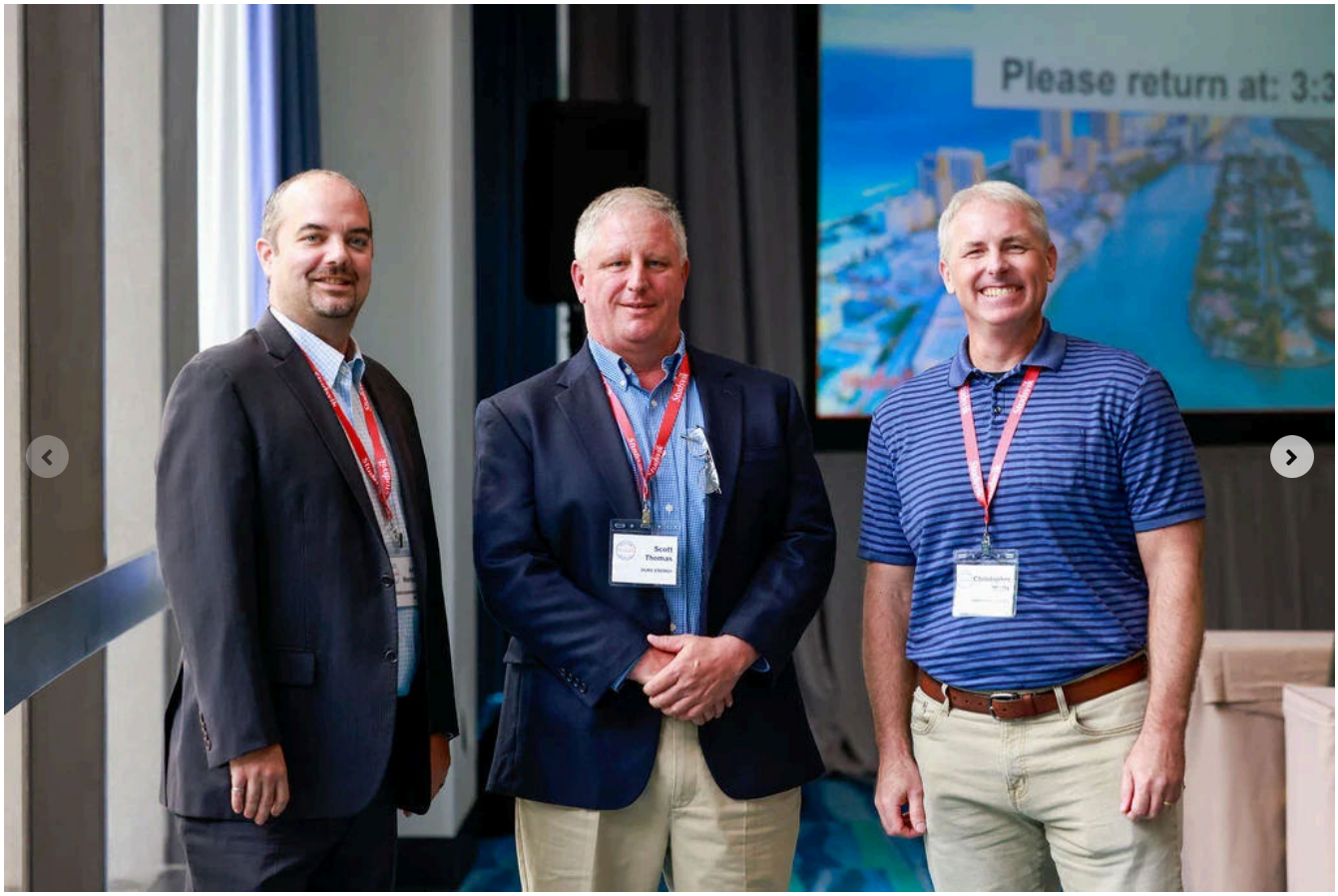
Thank you!

UGM 2024 Highlights

The annual Studsvik Scandpower User Group Meeting (UGM) was held in Miami, Florida in July. The meeting brought together over 68 people from 8 countries and 21 utilities/customers.

Attendees learned about recent improvements in the CMS5 software suite as well as new developments including Peacock, the new continuous energy Monte Carlo analysis tool.

Below are a few pictures from the event.



Save-the-date UGM 2025

Studsvik Scandpower's next annual user's group meeting will be held in Prague, Czech Republic during October 19–22, 2025.

More information will be shared in 2025.

CMSBuilder

Past CMSBuilder Webinar

Did you miss the CMSBuilder webinar? No problem, you can watch the video and learn more about the recent updates to the software code.

The webinar covered how **CMSBuilder** enables core designers to efficiently evaluate multiple loading patterns and receive immediate graphical feedback on essential design modifications. Features such as interactive core maps and the ability to easily adjust fuel assemblies were highlighted. The webinar also demonstrated how **CMSBuilder** enhances the design process while ensuring the accuracy necessary for reload licensing.

The presentation and video can be found on our support site using the link below.

Link: CMSBuilder Webinar

If you want to learn how CMSBuilder can help streamline your core design process and reduce overall design time, please reach out to your Studsvik commercial representative.

Did You Know?

Did You Know...that CASMO5 results will help form the basis of the soon to be updated ANS Standard 19.3.4, "The Determination of Thermal Energy Deposition Rates in Nuclear Reactors"?

Dr. Charles Wemple named to Executive Committee

Dr. Charles Wemple has recently been named a representative to the Cross Section Evaluation Working Group (CSEWG) Executive Committee. Dr. Wemple is an expert in nuclear data, NJOY processing, reactor analysis methods developments, and benchmarking to experimental data. He brings over thirty years of experience in nuclear science and technology in addition to his expertise of leveraging Studsvik's industry-standard reactor analysis tools.

Input from industry to the nuclear data evaluation process is crucial to the proper development and improvement of nuclear data evaluations since the safe and economic operation of existing Light Water Reactor (LWR) units relies on the quality of processed data libraries.

Congratulations, Dr. Wemple!

Publications

Learn more about recent publications from the Studsvik Scandpower team!

Studsvik Scandpower was featured in the **Annals of Nuclear Energy**, Volume 208, December 2024, Issue 110752 for the publication of "Nuclear data uncertainty quantification analysis at Studsvik Scandpower", authored by J. Hykes [a], T. Simeonov [a], R. Ferrer [a], C. Jönsson [b], C. Wemple [a], V.-P. Eronen [e], T. Ranta [c], A. Ranta-aho [d], V. Hynönen [d], J. Kumpula [d], J. Huttunen [e]

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Studsvik Scandpower has recently added nuclear data uncertainty quantification to several of its tools, with the hope to provide user-friendly access to these methods to existing users of HELIOS2, CASMO5, and SNF. The lattice physics codes HELIOS2 and CASMO5 have been extended to perform the propagation of nuclear data cross section uncertainty using statistical sampling. HELIOS2 utilizes existing uncertainty data based on the SCALE/XSUSA 44-group covariance library. In contrast, for CASMO5, Studsvik generated a custom covariance library based primarily on ENDF/B-VIII using the cross-section processing code NJOY/ERRORR.

This paper presents the methods for constructing and applying these perturbations. The perturbations applied to the cross sections have been verified by comparing HELIOS2 and CASMO5 uncertainties using identical perturbation vectors.

Read more here: Annals of Nuclear Energy Link

Studsvik Scandpower had two papers accepted and presented at the recent **TopFuel 2024** conference held in Grenoble, France in October 2024.

"Evaluation of control rod worth measurements using SIMULATE5-K", authored by U. M. Svensson [a], J. Borkowski [b], G. Grandi [b], T Bahadir [b]

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The paper describes a method to evaluate the control rod worth from rod drop measurements, using the point kinetics equations and Studsvik Scandpower's state-of-the-art 3D kinetics code, SIMULATE5-K. The results demonstrated excellent agreement between measurement and calculations utilizing CMS5.

"PWR Water Chemistry Capabilities in SIMULATE5" authored by U. M. Svensson [a], G. Grandi [b], T Bahadir [b], K. Lundgren [c]

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This paper describes the efforts currently being made by Studsvik Scandpower towards developing tools to predict CIPS. The calculational modules include a pH-module, a radiolysis and chemical reaction module, a crud deposition and formation module and a boron uptake module. These modules are being incorporated into Studsvik Scandpower's state-of-the-art 3D nodal code

SIMULATE5. The implementation of these modules in the depletion geometry of SIMULATE5 facilitates primary water chemistry calculations in a previously unmatched level of detail and spatial resolution.

Read more about the **TopFuel 2024** conference proceedings here: Conference Proceedings

Teodosi Simeonov contributed to the joint paper, "An Introduction to Spent Nuclear Fuel decay heat for Light Water Reactors; a review from the NEA WPNCS", EPJ Nuclear Science Technology 10,9 (2024), **WPNCS annual meeting**, OECD-NEA, Paris, September 2024.

This paper summarized the efforts performed to understand decay heat estimation from existing spent nuclear fuel (SNF), under the auspices of the Working Party on Nuclear Criticality Safety (WPNCS) of the OECD Nuclear Energy Agency.

Link to the paper: Paper

Emiliya Georgieva presented at the **International PWR Prague conference** held in Prague, Czech Republic during October 2024. The presentation was focused on Studsvik's "Core Management System" (CMS5) for VVER Reactors and covered a methodology overview for the CASMO5, SIMULATE5, S5K and S3R software as well as associated benchmarks and comparisons to start-up tests and core follow results for VVER-1000 and VVER-440 units in Eastern Europe. Additional information was presented on the advanced on-line core monitoring system GARDEL, which also supports VVER type reactors.

The Studsvik Scandpower code package for VVER is commercially available and supports VVER-440, VVER-1000 and VVER-1200 reactors.

At the **ANS Winter Conference** and Expo in Orlando, Florida, Studsvik's **William Dawn** presented, "Peacock: Development of a New Continuous Energy Monte Carlo Transport Code", with authors, William C. Dawn, Charles Wemple, Joshua Hykes, Rodolfo M. Ferrer, and Joel Rhodes III (Studsvik Scandpower, Inc. 1070 Riverwalk Dr., Suite 150).

The paper describes the new continuous energy Monte Carlo Code developed by Studsvik Scandpower, intended for reactor physics modeling, shielding calculations, and criticality analysis. The paper further describes the particle tracking methods chosen for Peacock, the method for treating continuous energy data, and results from solving the C5G7 multigroup benchmark to verify the neutron transport solver and preliminary critical benchmarks from the ICSBEP presented to demonstrate the validation of the continuous energy neutron physics modeling.

Link to the conference paper: Paper

PEACOCK

Updates to Peacock

Peacock is a new continuous energy Monte Carlo code being developed by Studsvik Scandpower within our NQA-1 program. Peacock is designed to augment the capabilities currently offered by Studsvik Scandpower and provide new modeling options for advanced reactor designs.

Peacock was introduced to the community at the User Group Meeting (UGM) where the initial development was described, and validation and verification problems were presented. Peacock was introduced to the wider nuclear community at the Winter ANS meeting in Orlando, Florida.

Since the UGM, Peacock has also been enhanced to allow efficient parallel calculation and depletion calculations. Peacock is intended for uses such as: generating multigroup cross sections, shielding calculations, investigating advanced reactor designs, and more.

Please contact your Studsvik representative if you would like to receive more information about Peacock.

Studsvik Computing Platform Survey

Studsvik Scandpower is soliciting input from our customers on computing platforms. We are interested in hearing from those that receive the software shipments. This will help us make better informed decisions about future investments and where our customer needs are.

Please share this survey with your IT and/or software shipment teams.

Link to the survey: Computing Platform Survey

Thank you for your time and please complete the survey by **January 15, 2025.**

Upcoming Conferences and Events

Studsvik Scandpower staff are planning to attend a variety of industry events in 2025. We hope to see you some of these industry events in early 2025!

- **PowerPlantSim,** January 22–23, 2025 (Jacksonville, FL)
- **22nd Annual USA Member and Supplier-Partner Winter Conference**, January 28–30, 2025 (Tucson, AZ)
- **U.S. NIC Advanced Reactor Summit**, February 17–20, 2025 (Salt Lake City, UT)
- **U.S. NRC RIC**, March 11–13,2025 (Rockville, MD)
- **ANS Student Conference**, April 3–5, 2025 (Albuquerque, NM)
- **Canadian Nuclear Association 2025**, April 15–17,2025 (Ottawa, Canada)
- **ANS M&C 2025**, April 27–30,2025 (Denver, CO)
- **Advances in Nuclear Fuel Management (ANFM)**, July 20–23,2025 (Clearwater Beach, FL)

Happy Holidays

On behalf of the Studsvik Scandpower team (and the Idaho Falls office team member, Annie), we want to express our gratitude to our customers. We hope that you all have a relaxing holiday season with your friends and families. We look forward to working with you all in 2025!


Christmas

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