About Studsvik Scandpower

Studsvik

Studsvik Scandpower (SSP) is the leading global provider of vendor-independent, state-of-the-art nuclear fuel management software and world-class engineering services. SSP offers a full suite of software product offerings, training, and engineering services, to support operating utilities, fuel vendors, safety authorities, and research organizations around the world.

HISTORY

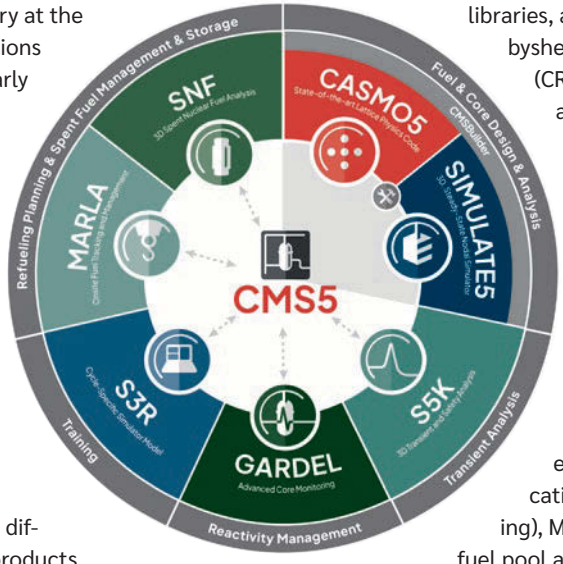
Studsvik Scandpower began as Studsvik of America in the early 1980s in Boston, MA with Malte Edenius and Kord Smith joining forces to develop a fast running and highly accurate physics analysis code system flexible enough to model both BWRs and PWRs. The idea was that a two-step approach involving a lattice transport theory-based code (CASMO-3 at the time) for group constant and discontinuity factor generation coupled with a two-group, steady-state nodal diffusion theory code with pin power reconstruction (SIMULATE-3) could be just as accurate as time-consuming, fine-mesh PDQ calculations that were in use by industry at the time. Enabled by engineering workstations and PCs arriving on the scene in the early 1990's, the CASMO-SIMULATE combination went on to be very successful as it provided the means for utilities to easily perform their own core reload calculations and to provide independent oversight and confirmation of nuclear fuel vendor calculations. Also, by developing CASMO/SIMULATE under a 10 CFR 50 Appendix B / 10 CFR 21 / NQA-1 Quality Assurance Program, the software could be readily adopted by industry in safety related applications. Quality Assurance and Support is a big differentiator between commercial SSP products and software developed at national laboratories, research institutes, and universities.

In 1998, Studsvik of America merged with the Norwegian company Scandpower AS to form Studsvik-Scandpower Inc (SSP) which had a similar suite of software. The successful Helios-2 generalized geometry lattice physics code is a legacy of this merger. The combined expertise of the two companies proved to be a powerful combination.

CASMO-3 was soon followed by CASMO-4 where the transmission probabilities transport solver was replaced by a modern Method of Characteristics (MoC) solver. By listening closely to our customers, SIMULATE-3 continued to evolve with many engineering features designed to reduce the engineering workload by automating many procedures. Eventually CASMO-4/SIMULATE-3 was replaced by CASMO-5/SIMULATE-5, which set the stage for CMS5, which now fully supports VVERs as well as PWRs, BWRs, and SMRs. In 2017, marking a major milestone, CMS5 was generically licensed by the USNRC for PWRs.

OUR PRODUCTS

Today, the core of CMS5 consists of CASMO5 and SIMULATE5. CASMO5 features the E7R1 and E8R1 nuclear data libraries, a linear source MoC, and the Chebyshev Rational Approximation Method (CRAM) for depletion. SIMULATE5 is a multigroup, fully analytic nodal diffusion theory code with axial homogenization and a detailed radial sub-mesh model. In addition to steady-state SIMULATE5, SSP has developed a transient version (SIMULATE5-K) for analysis of a wide variety of BWR, PWR, and VVER transients.



Studsvik CMS5 Software

The CMS5 code suite provides the foundation, or rather the neutronics engine, upon which engineering applications such as GARDEL (core monitoring), MARLA (outage fuel shuffling and spent fuel pool and dry cask storage management), and SNF (for calculating backend isotopics, source term, and decay heat for LWRs) are built.

The adoption of SIMULATE5 for online core monitoring in GARDEL further underscores the high computational efficiency achieved with SIMULATE5, while simultaneously retaining unsurpassed accuracy. Therefore, the same SIMULATE5 used for core design, is also used in online core monitoring in the control room with direct line of sight to the core.

Studsvik also offers the very successful and globally adopted S3R core model for real-time training simulators, and the CMS-Builder GUI for LWR loading pattern design optimization.

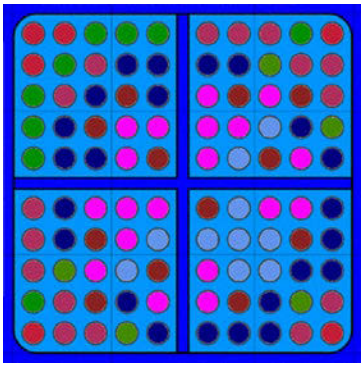
JOSHUA HYKES

Hykes

Studsvik Scandpower's employees are the backbone of the company. As a leader in the reactor physics community, Studsvik hires the most talented recent graduates, experienced professionals and researchers from the world's leading nuclear engineering educational programs.

Highlighting one of our many talented employees, Joshua Hykes, was hired fresh off his PhD from North Carolina State University (NCSU) in 2012. While at NCSU, Joshua had many awards and scholarships: Robert A. Dannels Memorial Scholarship (ANS), Allan F. Henry/Paul A. Greebler Scholarship (ANS), and was a DOE Computational Graduate Fellow. Joshua spent summers interning at Constellation, INL, LANL, and ORNL, where he gained additional practical experience. After joining the SSP CASMO5 development team, and receiving his PE certification, Joshua won the Studsvik Scandpower Employee of Excellence award and is now the lead developer for CASMO5 under Methods Group Manager, Rodolfo Ferrer, (winner of the ANS RPD Early Career Reactor Physicist Award in 2023). This is indeed a very talented methods development team.

As an influential young leader in the nuclear industry, Joshua continues to contribute to the reactor physics community by his work in depletion methods, transport methods, resonance theory methods, nuclear data, and most recently in Uncertainty Quantification (UQ) methods. Joshua recently played a key role in the addition of UQ capabilities based on nuclear data covariance into CASMO5. By using a multi-group library based on the ENDF/B-VIII.0 covariance data, stochastic sampling has been automated in CASMO5 which enables the perturbation of all output parameters based on perturbed (input) nuclear data. This is a significant development which lays the foundation for future work involving UQ and reactor analysis.



Example of CASMO5 Lattice

FUTURE

These are exciting times in the nuclear industry with renewed interest in nuclear power globally. Looking to grow into the future, Studsvik Scandpower is ready to answer the call as the industry evolves. Currently under development to help the nascent and emerging Advanced Reactor community, SSP is developing Peacock, a continuous energy, generalized geometry Monte Carlo code for group constant generation on consumer grade hardware. Peacock is intended to fill the gap in the nuclear industry for a user-friendly Monte Carlo code developed under NQA-1 and backed by SSP's unparalleled support. As an example, Peacock can be used to investigate TRi-structural ISOtropic (TRISO) fuel forms such as in Figures 1 and 2, and can be used to capture three dimensional effects in designs where tradi-tional two-step methods may introduce significant approximations.

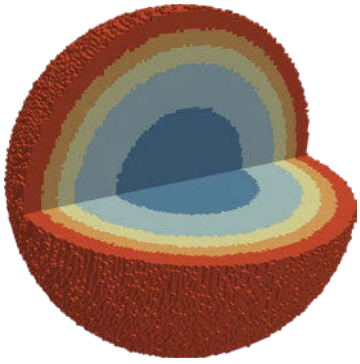


Figure 1. TRISO modeling in Peacock [Example of a TRISO kernel]

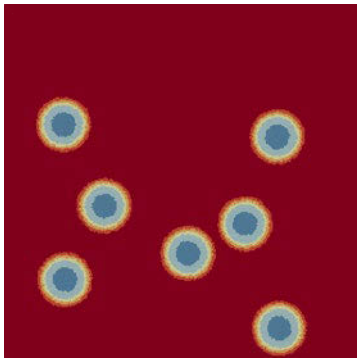


Figure 2. TRISO modeling in Peacock [Example of TRISO substrate]

Today, Studsvik's CMS5 is the most advanced and feature-complete LWR reactor analysis code system with unified methods in the world. Recent developments and ongoing work in CMS5 include extending the current USNRC PWR generic licensing to fuel higher enrichments (> 5 wt%) and higher burnups, advanced nuclear data libraries such as E8R1 and JENDL-5, improved computational performance via parallel processing, support of target irradiation for isotope production, and advanced transient analysis capabilities in support of new regulatory requirements, such as RG 1.236.

The tradition of practical reactor physics modeling continues today in Studsvik Scandpower software, training, and consulting. Studsvik Scandpower was built on the idea of making core neutronics calculations easier to perform for engineers without sacrificing accuracy.

What started decades ago as a close collaboration between nuclear engineers, physicists, software specialists and on-site engineers has now gained a global following. The SSP suite of software products is utilized globally for reactor fuel and core design, as well as analysis and operational support. Today, our state-of-the-art simulation software is the trusted choice in nearly half of the world's light-water reactors (LWRs).

Ensuring a safe, sustainable, and reliable road to a new chapter in clean energy production is our contribution to society now and in the future.

Find out more about Studsvik Scandpower at www.studsvik.com/ssp.

Studsvik