Consortium for Advanced Simulation of LWRs

U.S. DEPARTMENT OF ENERGY
Nuclear Energy

CASL Test Stands . . . Enabling the CASL mission

In a nuclear reactor core there are many phenomena in motion at both the microscopic and macroscopic levels that ultimately affect the performance, reliability and lifetime of critical components. A comprehensive, science-based understanding of these complex challenges requires high fidelity modeling & simulation (modsim) technology. CASL brings together a diversified team of specialists from DOE National Labs, academia, and industry to develop the modsim technology and test its accuracy and precision in the prediction of commercial light water reactors (LWRs). CASL Test Stands are the pivotal transition point for moving CASL's new modsim technology, or the Virtual Environment for Reactor Applications (VERA), into the field of practice.

CASL Test Stands represent an early deployment of VERA into an actual engineering/design environment for the purpose of rapid and enhanced feedback and testing, use, and ultimate adoption of VERA in supporting real-world LWR applications. The Test Stand project can cooperate with a wide range of experimental and commercial facilities operated by government, industrial and academic organizations that are engaged in LWR designand operation to test the technology and to enable integration of the technology by the Test Stand host organization.

CASL Core Partners

CASL is focused on enhancing the performance of LWRs with predictive, science-based modsim technology. The CASL Test Stand's principle objective is to critically exercise CASL's Virtual Environment for Reactor Analysis (VERA) capabilities in addressing issues important to the nuclear industry on computing platforms that are accessible to end users. The deployment of Test Stands also provides a valuable mechanism for obtaining constructive feedback and continuously improving CASL products.

Each Test Stand utilizes a functional prototype VERA installation at a remote site on the end-user's computing platform. Alternatively, the Test Stand host may elect to utilize the National Lab's world-class computational resources (known as leadership-class platforms). The features of a Test Stand can include:

- location at a CASL industry partner, council member, or collaborator site
- use of ORNL-based computing assets or local site computing assets
- independent use of functional VERA prototypes for familiarization and evaluation
- support for modeling and simulation of the user's issue of interest using VERA to develop a solution process, and share results with CASL for mutual benefit
- opportunity to explore previously modeled CASL simulations

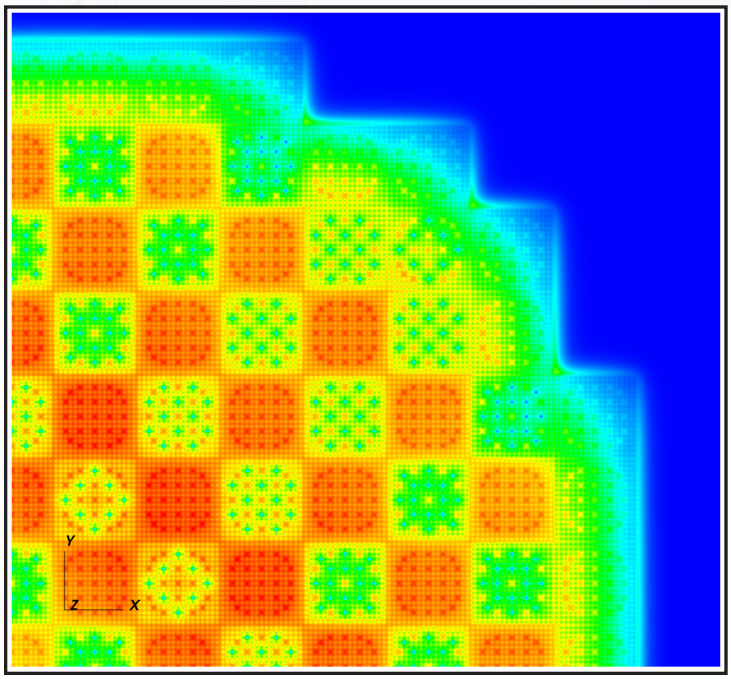
CASL Test Stands can be located at user facilities to allow for evaluation of system effectiveness and to provide opportunities for feedback on areas of improvement.

Making the Transition from Research to Industry Implementation

Industrial leaders maintain their competitive edge through judicious selection of emerging technologies that keep their enterprise cost-effective, efficient, and in the forefront of industry best practice. These "early adopters" enjoy the benefits of access to trial technologies at reduced expense and at a time when they can influence the evolving technology to best suit their practical needs. CASL's Test Stands are deployed with those needs in mind, while benefiting the CASL development work. The benefits to end-users include:

- access to functional prototypes of VERA for unique problem solving
- capabilities to test, validate, and qualify VERA's ability to meet end-user requirements and to provide feedback for improving usability
- comparison of VERA technologies to existing methods on performance margins, efficiency of operations, and economic factors for nuclear power plants
- evaluation of the usability of VERA technologies relative to existing computational capabilities
- assessment of VERA impact on current work flow

Test Stands provide a direct benefit to the CASL VERA development team, through critical feedback on: VERA's ability to meet nuclear science and engineering requirements; identification of key features either missing or underrepresented; usability of the technology to the problem of interest; broaden and deepen the level of verification, validation, and qualification testing available to VERA; ability to VERA to insert itself into (or augment) current industry workflows, etc.



The Test Stand environment allows evaluation of the suitability of VERA tools for predicting reactor core performance under both normal operating conditions and hypothetical accident scenarios.

CASL Test Stands are being launched in 2013 and criteria have already been established for selection of organizations that will receive the first available functional VERA prototypes. These early adopters will cooperatively work with CASL to identify a simulation problem of importance to their nuclear facilities, and will receive ongoing assistance for VERA training, testing and operational assessment.

Westinghouse

Westinghouse Nuclear in Pittsburgh, PA has received a "beta" version of the first functional CASL Test Stand.

CASL and the Electric Power Research Institute (EPRI) are discussing the deployment of a CASLTest Stand in 2013.

Tennessee Valley Authority (TVA) plans to implement a CASL Test Stand in 2014

CASL's Test Stands will allow early industry implementation of the coupled multiphysics technology provided within the VERA, and will allow the industrial users to provide the crucial feedback necessary to achieving a technology that can be effective in applying the higher-fidelity solutions to operating commercial power plants. Test Stand users will supply feedback on simulation capabilities, compatibility with user computing platforms, usability of the VERA, applicability to simulations of interest to the user, and performance relative to existing industrial methods.

To find out more about VERA Test Stands and to follows the research and development activity related to modeling and simulation of nuclear reactor cores, please visit www.casl.gov • casl-info@casl.gov

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