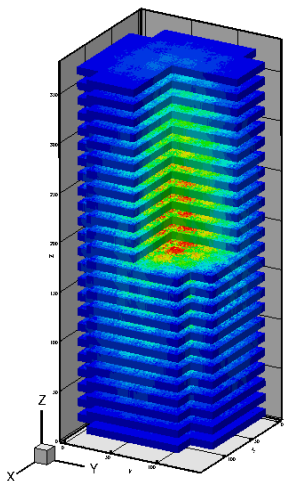


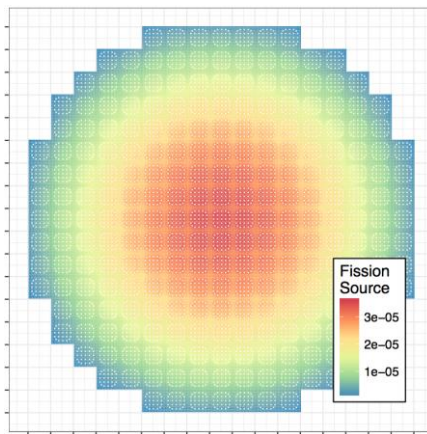
Rapid

Real-time Analysis for Particle Transport and In-situ Detection

The RAPID code system* is developed based on the Multi-stage Response-function particle Transport (MRT) methodology for performing real-time simulation of complex nuclear systems. Thus far, it has been applied and benchmarked for the simulation of spent fuel pools and storage casks, and reactor cores. RAPID can calculate system eigenvalue, subcritical multiplication, 3-D pin-wise fission neutron, gamma, and/or antineutrino distributions detector responses or surface radiation dose. When used in conjunction with measurements, e.g., for safeguards application, RAPID can identify potential fuel diversion or misplacement.

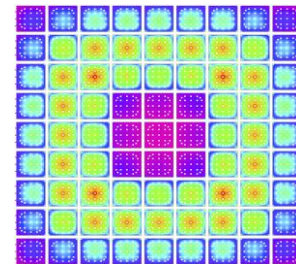


(1) GBC-32, 3D Fission Density



(2) Reactor Core, Pin-wise Fission Density

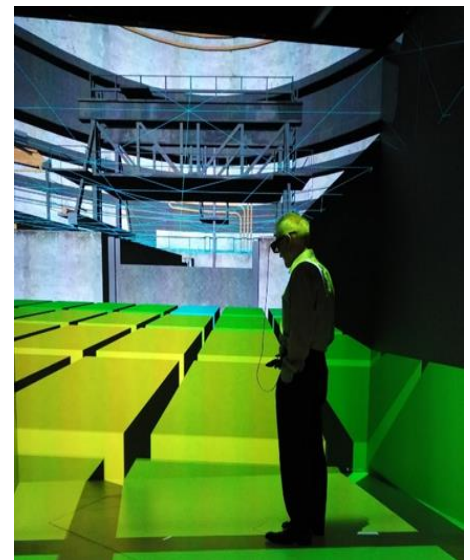
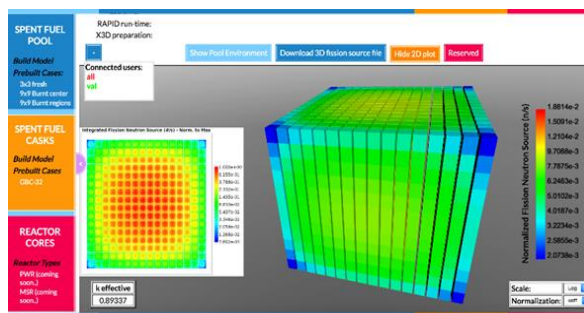
RAPID has been successfully benchmarked for reactor cores (Fig. 2), spent fuel pools (Fig. 3), and storage casks (Fig. 1) against traditional Monte Carlo predictions. Additionally, RAPID has been experimentally benchmarked on a subcritical facility. RAPID enables accurate and detailed neutronics calculations in real time (seconds/minutes) on a single computer core.



(3) 9x9 SFP, Pin-wise Fission Density

RAPID is incorporated into a Web application, that is referred to as the Virtual Reality System (VRS) for RAPID. VRS-RAPID* (Fig. 4) provides a collaborative Virtual Reality environment for a user to build models, perform simulation, and view 3-D diagrams in an interactive mode. These simulation results can be projected into a virtual system environment (e.g., a pool) for further analysis and training purposes. Additionally, VRS-RAPID outputs can be coupled with an immersive facility such as the VT's HyperCube System, as shown in the Fig. 5.

(4) VRS-RAPID



(5) VRS-RAPID in VT's HyperCube

*Patent pending, Oct 2017

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