Contribution ID: **24**   Type: **Talk**

Towards Scalable Digital Engineering Experiences for LIBRTI through NVIDIA Omniverse

Tuesday 3 February 2026 15:55 (30 minutes)

In this talk, we present the ongoing work on creating a high-fidelity digital twin of the LIBRTI facility using NVIDIA Omniverse and illustrate how design processes, real-time simulation, robotics, and visual analytics integrate to enable future operational workflows. The prototype interactive experience illustrates an example end-to-end irradiation sequence within the facility, including payload transport on an omnidirectional scissor lift, robotic service connection, neutron source activation with volumetric radiation visualisation, and shielded payload retrieval. The digital twin also integrates dose-rate modelling to support operational planning. By combining radiation simulations with Omniverse data processing and visualisation pipelines, users can visualise dose distributions, evaluate shielding strategies, and assess workflow timings to help optimise safe and efficient operations. Additional autonomous inspection concepts, such as the integration of Spot robots, demonstrate how digital twins can be leveraged to explore future operational envelopes. The scene is constructed from optimised CAD geometry of facility layouts, simulation data incorporated through Omniverse pipelines and visualised using Index volumetric rendering combined with RTX surface rendering to provide a realistic operational environment. Altogether, the elements will demonstrate a technology development pipeline of how digital twins can further improve the design understanding, safety assessment, and stakeholder communication of the overall LIBRTI program. To complement the demonstration, we describe the emerging Omniverse ecosystem at UKAEA and its deployment on the OVX cluster to enable scalable, multi-GPU real-time rendering and simulation. We present the architectural choices behind the platform, the necessary workflows and pipelines to support CAD and simulation assets, and the roadmap for integrating AI-driven capabilities such as robotic training and scenario generation via Isaac Sim. The resultant framework forms the basis for a wider operational digital twin strategy supporting immersive design review, operational workflow rehearsal, and decision support for LIBRTI and wider fusion programs.

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Session Classification: Session 1-4

Track Classification: LIBRTI Conference