# **Digital Twins for Cost and Schedule Reduction in Nuclear Construction** Exploration using a commercial PLM platform with laboratory demonstrations

## Motivation

nuclear facility construction Recent projects—both in the U.S. and abroad—have faced severe cost and schedule overruns, leading to delays, abandoned projects, and expenses surpassing double the original estimates. Many of these challenges stem from issues related to constructability and quality control, which could be mitigated with better anticipation, identification, and response strategies.

## Enhancing QA/QC with a Single Source of Truth



Digital Twins integrate automated quality assurance and quality control (QA/QC) processes by digitizing inspection workflows, documentation tracking, and issue resolution . This approach minimizes human error, reduces delays, and ensures regulatory compliance through real-time data validation and reporting .

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# **Digital Twin Platform**

engineering, inspection, and project management, Digital By centralizing **digitization**, Twins enhance efficiency, reduce costs, and improve quality throughout nuclear construction. While industries like aerospace and advanced manufacturing have successfully harnessed this technology, nuclear construction is just beginning to explore its full potential.

Our research explores how Digital Twins can revolutionize large-scale construction by:

Enhancing real -time performance monitoring

Improving coordination across complex regulatory environments

Streamlining construction through Building Information Modeling (BIM) and Finite Element (FE) models

Bringing near -real -time as -built data into an integrated software platform

# FEA – Tracking Structural Changes and **Predicting Performance**



Digital Twins integrated with Finite Element Analysis (FEA) allow for real time assessment of structural integrity during nuclear construction. By transitioning from an as-designed to an as-built and as-is model, engineers can detect variations in material properties, stiffness, and geometric changes that impact performance.

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Digital Twins integrated with **Building Information Modeling (BIM)** enable proactive management of fit -up tolerances, ensuring components align as expected before installation. By comparing asdesigned vs. as-built data in real-time, teams can detect misalignments early, adjust tolerances, and prevent costly rework . This approach enhances construction accuracy, reduces delays, and optimizes material usage, leading to smoother project execution .





# BIM – Managing Fit - Up Tolerances to **Reduce Rework**