Contribution ID: **537** Contribution code: **WEPD098** Type: **Poster Presentation**

Fermilab's control system development with digital twin

Wednesday, 24 September 2025 16:30 (1h 30m)

Control Systems development is often the last thing considered when designing and building new equipment, e.g. a new detector or superconducting RF LINAC; however when the new equipment is installed, it is the first thing desired to be operational for testing. Due to frequent delays in building new equipment and project deadlines, control system development and testing is often curtailed. A way to alleviate this problem is to simulate the control system, though this will be challenging for complex systems.

The Fermilab PIP-II (proton improvement plan - II) project is being constructed at Fermilab to deliver 800 MeV protons of > 1 MW beam power to replace the present LINAC for the remainder of the existing accelerator complex. The new LINAC consists of a warm front end (WFE), 23 superconducting RF cryomodules (of 5 types), and a beam transfer line (BTL) to the existing complex.

The accelerator physics group has a parallel project to create a digital twin (DT) of the PIP-II accelerator. We have coupled the EPICS controls to this DT and are developing both the DT and EPICS software in parallel. This will allow us to develop the EPICS software framework, the HMIs, sequences, high level physics applications, and other services for use in a fully functional control system.

This presentation will detail the work that we have performed to date and show demonstrations of controlling and monitoring the status of the accelerator, as well as future plans for this work.

Funding Agency

This manuscript has been authored by FermiForward Discovery Group, LLC under Contract No. 89243024CSC000002 with the U.S. Department of Energy, Office of Science, Office of High Energy Physics.

Footnotes

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Session Classification: WEPD Posters

Track Classification: MC14: Digital Twins & Simulation