



Contribution ID: 39 Contribution code: TUPD012

Type: **Poster Presentation**

A new PLC based control system to orchestrate the PS main power converters

Tuesday 23 September 2025 16:00 (1h 30m)

The Power for the PS (POPS) system supplies the Proton Synchrotron (PS) magnets by exchanging energy between capacitor banks and magnet loads, minimizing direct power draw from the electrical network. The POPS+ upgrade improves availability through redundancy by integrating additional power converters, introducing a new PLC-based control system to manage increased complexity and to retrofit legacy turnkey controls infrastructure. This distributed architecture features a central PLC orchestrating all power converters and their FGC4-based controllers. The PLC enables the custom integration of the FGC4 platform, originally designed for generic converters, into POPS+. A key challenge is the implementation of a real-time Ethernet communication protocol (FGC4PN) on a Multi-Functional Platform (MFP) attached to the PLC. The PLC also manages the state machine, including startup, charging and stopping sequences, as well as interlocks and safe start conditions, leveraging CERN's UNICOS framework for standardized control and SCADA supervision. This paper presents the design and implementation of the control system, detailing the distributed architecture and the communication strategies. It also highlights the use of the Hardware-in-the-Loop (HIL) simulation platform for the system integration, development and virtual commissioning.

Footnotes

Funding Agency

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Session Classification: TUPD Posters

Track Classification: MC02: Control System Upgrades in Existing Facilities