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Incorporating new subsystem into an existing cryogenic controls system

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Brookhaven National Laboratory (BNL) has been operating the Relativistic Heavy Ion Collider (RHIC) for over 20 years. Superconducting magnet operations on RHIC rely on the stable operations of the Cryogenic Control System (CCS) to process and circulate 48,000 gallons of 4K helium supporting RHIC's superconducting magnets. Over the years of RHIC operations, several subsystems requiring cryogenic cooling have been added to RHIC's CCS. The latest addition is the sPHENIX detector that has a 1.5T superconducting solenoid at its core. A new cryo-distribution and cryo-controls system was developed and deployed to operate the sPHENIX magnet in 2022 and 2023. The new CCS architecture and infrastructure installed for sPHENIX is based on the future EIC CCS design. This was an opportunity to modernize the CCS for the local sector of RHIC around sPHENIX, as well as a demonstration of the complete future EIC CCS. This paper will review the hardware and software architecture implemented for the sPHENIX CCS, lessons learned from initial operations, and how to extend and improve this design for EIC.

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