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C2Po1E-05: Commissioning and Initial Operations of the ESS Linac Cryomodules Cryogenic Controls: Achievements and Future Prospect

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The Cryomodules are critical components in the European Spallation Source (ESS) accelerator, playing a crucial role in connecting spoke cavities to high-beta elliptical cavities in the SRF Linac. These Cryomodules provide the necessary environment for operating, Spoke (Spk) cavities, Medium-Beta (MBL) and High-Beta (HBL) elliptical cavities, which are responsible for accelerating protons from 90 MeV to 2.0 GeV. The Cryomodule houses two double-spoke cavities per Spoke cryomodule and four elliptical cavity packages for MBL and HBL cryomodule, which need to be cooled to 2K to become superconductive and accelerate the beam. There are 13 SPK, 9 MBL and 21 HBL cryomodules to be installed and commissioned on the ESS accelerator.
An automation control system was developed to control and operate the cryogenic circuits, consisting of temperature, pressure, level, and flow sensors, heaters, and automatic valves connected to a control system based on a Programmable Logic Controller (PLC) integrated into EPICS through the Controls Network.
After the individual commissioning of the cryogenic control system for each cryomodule, a coordination of the entire system was needed using a Master PLC with overall safety functions and an Automatic Control Sequencer (ACS). The cryomodule controls were therefore integrated with the CMDS master control system, overseeing the simultaneous operation of all cryomodules and the distribution system.
The Control System was successfully commissioned leading to initial operations in December 2024, where the ESS Linac was cooled down to 2K.
This paper describes the last steps of the commissioning activities involving the coordination activities by the Master PLC, and the challenges and achievements when integrating the cryomodules controls into the CMDS. Furthermore, it describes the first operations of the control system during the cooldown until the Linac reached stable conditions at 2K, while preparing the next steps in the Accelerator Cryogenic Controls.

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