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## **Simplifying cryogenic process control at ESS LINAC through automation: development and integration of an automatic control sequence**

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This paper presents the Automatic Control Sequence (ACS) developed and implemented to simplify the control of cryogenic processes in the linear accelerator (LINAC) at the European Spallation Source (ESS), which includes 27 cryomodules and 43 valveboxes. The main objectives of the project were to reduce the risk of human error and minimize manual operations —while maintaining full decision-making authority in the hands of the operator. The sequence is designed through interdisciplinary collaboration, with Excel serving as a central platform for information exchange. A custom Python script is then used to generate PLC code in SCL programming language based on the defined logic. The final sequence is deployed on a master PLC and 43 dedicated PLCs, fully integrated with the EPICS control system and interconnected via Profinet for optimized system synchronization. A user-friendly operational interface was developed using CS-Studio, serving as both a monitoring and control layer. It provides visibility across all levels of the control system —from individual devices, through local PLC sequences, up to inter-system synchronization. This paper provides an overview of the development of the Automatic Control Sequence and discusses key lessons learned and future improvements in cryogenic control at ESS.

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### **Footnotes**

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