THE CONTROL SYSTEM BASED ON EPICS FOR THE EXPERIMENTAL TARGET PROTOTYPE

Qiang Zhao, Cong Liu, Jian-rong Sun, et al.

Institute of Modern Physics, Chinese Academy of Sciences, [730000] Lanzhou, China

Introduction

China initiative Accelerator Driven System (CiADS) has been approved as a strategic plan to build an ADS demonstration facility in the next few years. An experimental target prototype has been constructed and tested for some important issues at Institute of Modern Physics, Chinese Academy of Sciences, China. The control system which was built based on the real-time distributed control software of experimental physics and industrial control system (EPICS) was attempted for the experimental target prototype. The layout of the prototype is shown as Fig.1.

Three loops: Loop 1, Loop2 and Loop 3, as shown in Fig.1, were designed for different functions and experiments. The Loop 1 was designed mainly for testing several challenging and key technologies of the spallation target. At the same time, the feasibility of the mass flow-meters and sieve sorter was also tested. The Loop 2 was designed for testing the feasibility of the heat-exchanger. A proton beam was not considered at the first stage of the target design, so, a middle frequency heating device was used in the Loop 2 to heat the grains before they flow into the heat-exchanger. The Loop 3 acts only as a recovery system. A four-way valve was fixed at the entries of the three loops to control which loop to be used for experiment.

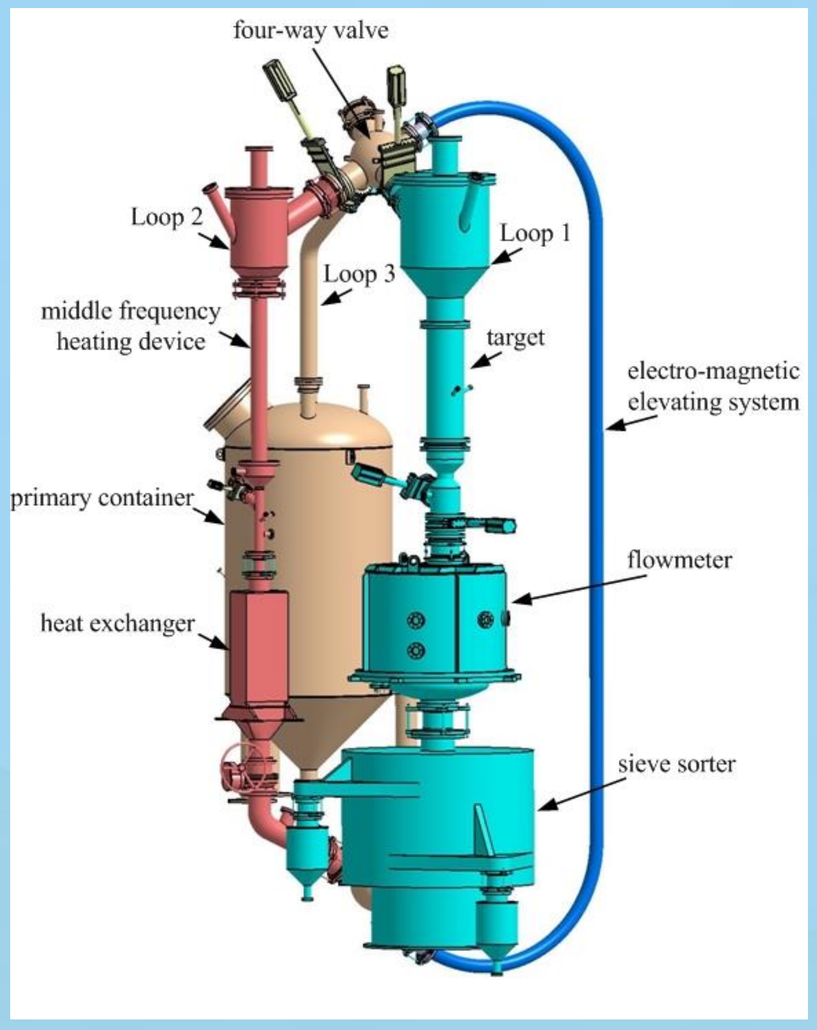

Figure 1: Layout of the prototype.

Figure 3: Photos of the prototype.

Main text

The architecture of the target control system is shown as Fig.2. It consists of several sub-systems with their own control system. So, each of them was considered as an IOC when integrated with EPICS. The OPI was developed by Labview and all the data was recorded in an oracle database. In addition, a timing system was also designed and constructed for each sub-system, assuring that the data would be sampled by each controller at the same time and be better analysed in the future.

Siemens PLCs were used as the controllers of the sub-systems of Elevating system, Sieving system and Helium-loop system. The “SLS s7 driver” developed by National Synchrotron Radiation Research Center was used as the driver for the corresponding IOCs after some minor revisions for our own requirements. The revisions involve the driver support, device support, record support and the script files under the principles of EPICS. An Ethernet-Serial Server was used because the Siemens PLCs only configured a serial (RS485) module rather than an Ethernet communication module.

The NI DAQs were used as the controllers of the Heat exchanging system and Main-loop system. It is easy for integrating Labview with EPICS for the most important work has been finished by the NI engineers. In this work, the variables which were related to the other sub-systems were communicated by building a CA Client and CA Server.

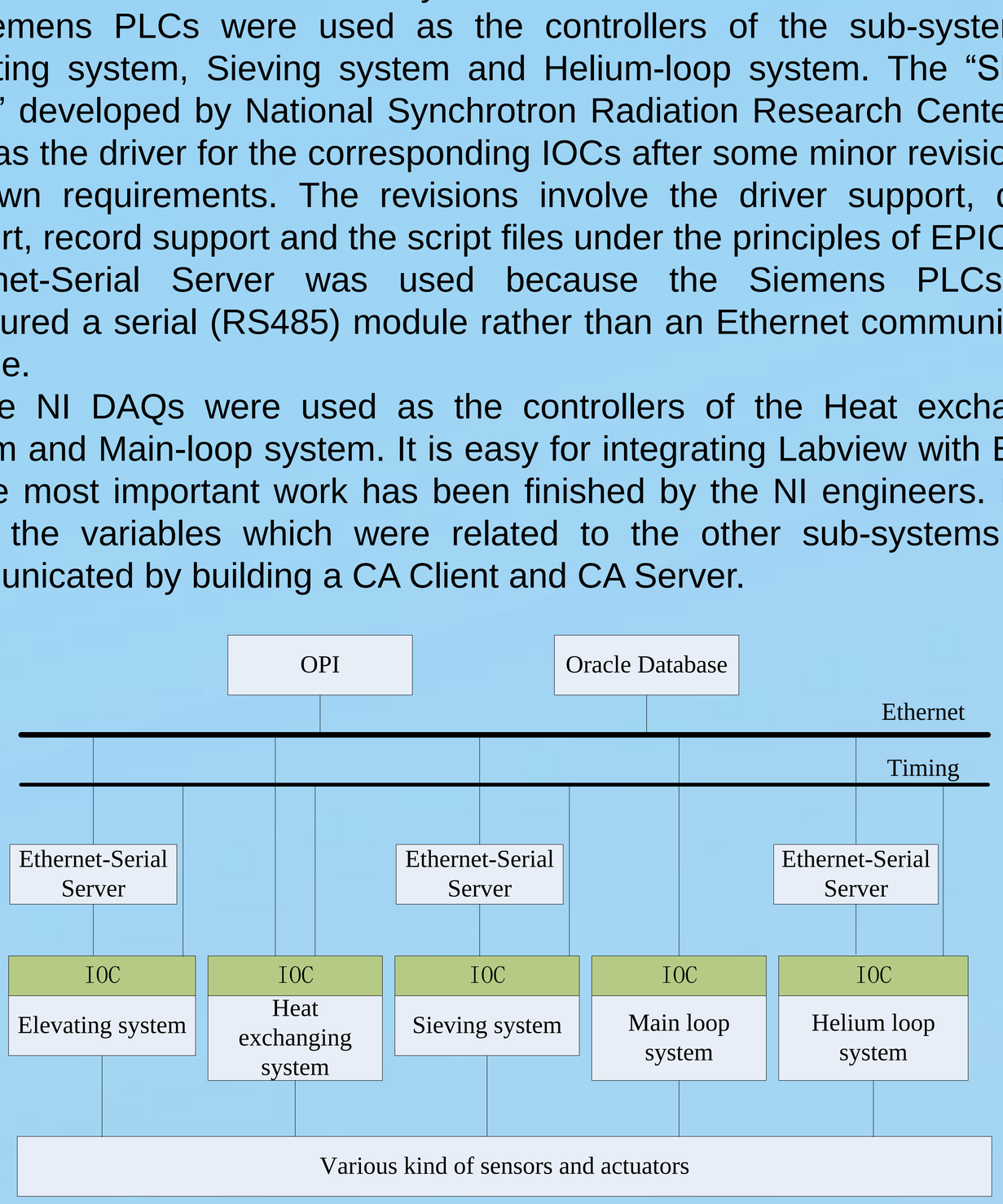

Figure 2: Architecture of the control system.

Conclusion

Some tests have been performed for the performance of the control system, including the stability of the communication between the sub-systems and other characteristics. The control system was finally proved stable and could basically meet the elementary requirements of the spallation target system.

References

[1] Q. Zhao, et al., Monitoring method for neutron flux for a spallation target in an accelerator driven sub-critical system, Chin. Phys. C 40 (2016)

[2] YU Chun-lei, et al., Design of Control System for High Intensity Proton RFQ Based on Redundancy Technology, Atomic Energy Science and Technology. 2014, 48(4), 740-745.

[3] GUO Yu-hui, ZHENG Ya-wei, et al., Design of Vacuum Control System for Injector II in ADS, Atomic Energy Science and Technology. 2012, 46, 539-543.