

NEW CONTROL SYSTEM FOR LAPECR2

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INTRODUCTION

Lanzhou All Permanent magnet ECR ion source No.2 (LAPECR2) is the ion source for 320 kV multidiscipline research platform for highly charged ions. Its old control system has been used for nearly 12 years and some problems have been gradually exposed and affected its daily operation. A set of PLC from Beckhoff company is in charge of the control of magnet power supplies, diagnostics and motion control. EPICS and Control System Studio (CSS) as well other packages are used in this facility as the control software toolkit. Based on these state-of-the-art technologies on both hardware and software, this paper designed and implemented a new control system for LAPECR2. After about half a year of running, the new control reflects its validity and stability in this facility.

NEW CONTROL SYSTEM ARCHITECTURE

There are two high potentials on the high voltage platform on which the LAPECR2 located. Electrical potential difference is needed and we used wireless communication to integrate all controlled devices together.

In design and implementation of the new control system, we adopted PLC from Beckhoff company to finish the control of passive devices and motion control. As for software, we choosed EPICS as the integrated development framework.

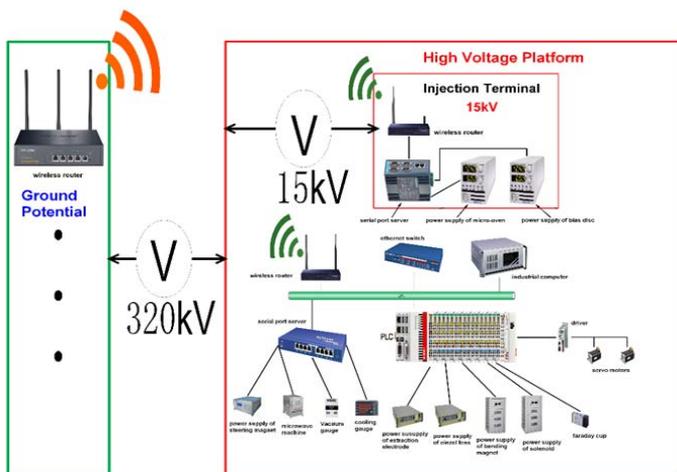


Diagram of control system architecture

HARDWARE CONFIGURATION

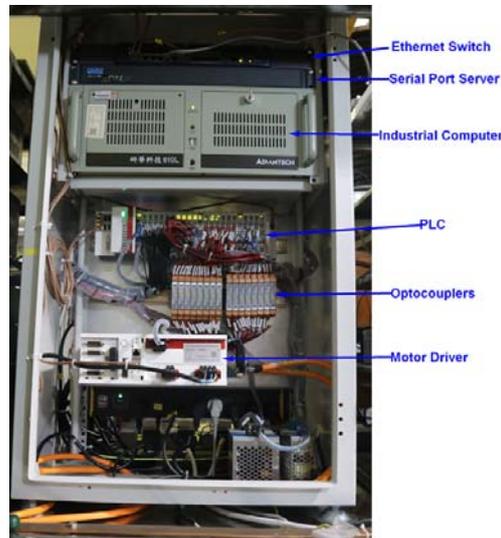
A powerful industry computer from Advantech company running CentOS 6.6 is used as EPICS IOC.

A high performance PLC from Beckhoff manages all analog devices, digital I/O devices, motion controls and interlocks. Communication between IOC and PLC is based on TCP socket.

Serial port servers were used to convert serial protocols to TCP socket for data exchange through the control network. Thus, all devices were integrated together into the control system network in a seamless way.

Two servo motors with absolute positioning functionality even when they are powered off are used to adjust two gas valves. The motor driver is also managed by the PLC through EtherCAT field bus.

This functionality provides the operators with precise control and quantitative reference. The servo motors need self-calibration zero spot only once after installation.



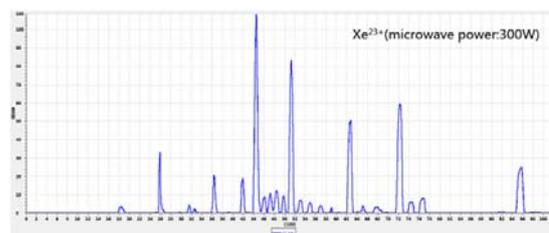
Hardware configuration

OPERATOR INTERFACE

Control System Studio (CSS) is used for rapid development. OPI has a main panel and three sub panels. Operation and monitoring is done in the "Adjust Beam" sub panel. The "Spectrum" sub panel is used to plot spectrogram and select the needed ion beam.



The "Adjust Beam" panel



The "Spectrum" panel

HARDWARE CONFIGURATION

Based on EPICS and PLC, the new control system for LAPECR2 was designed and implemented. Hardware and software resources were integrated to be a whole in the new control system which may provide some substantial reference for future work.

Since its completion in September 2016, the new control system has enabled successful operation of LAPECR2 and reflects its validity. The successful application of EPICS reflects its power and validity in LAPECR2.

In the future, we will implement new control system for the beamline and 6 experimental terminals. Based on EPICS and PLC, this will be favorable and smooth.