# DESIGN AND DEVELOPMENT OF THE ECR ION SOURCE CONTROL SYSTEM

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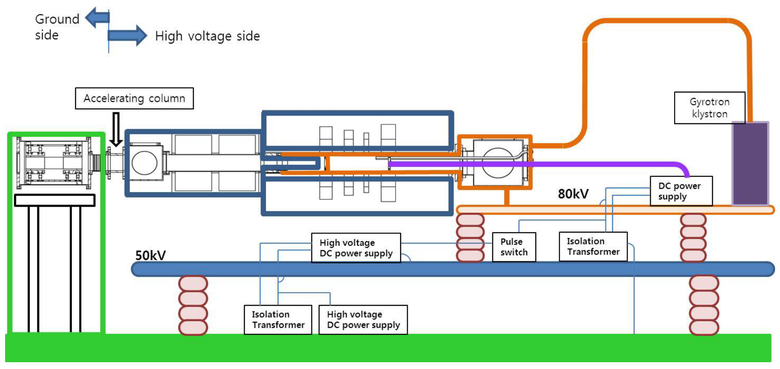
The Rare Isotope Science Project at the Institute for Basic Science construccts a heavy ion accelerator (RAON) facility in South Korea. The stable ion beam for the RAON accelerator could be generated by ECR ion source system. Therefore, it is necessary to build an ECR ion source control system that could be integrated into an accelerator control system easily. The vacuum control system is divided several parts because of one vacuum chamber among three different voltage stages (ground, 50 kV, and 80 kV). In this report, we will present the preliminary design and implementation of vacuum control system for the ECR ion source. We plan to use a Programmable Logic Controller (PLC) in order to control the vacuum system through interlock logic program. The PLC system has two major components: a digital I/O module that provides power to each component and standard RS-232 modules to connect the gauge and pump controllers. In addition, we will discuss its extension plan to integrate the vacuum control system into the RAON accelerator control system based on the EPICS framework.

## ECR ION SOURCE

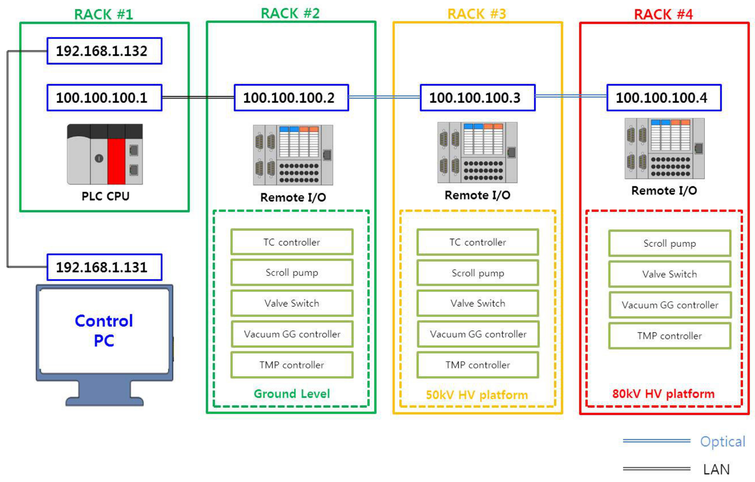



The driver linac injector of the RAON consists of a 28-GHz superconducting Electron Cyclotron Radiation (ECR) ion source, the LEBT (low energy beam transport), the 500-keV/u RFQ (radio-frequency quadrupole) and the MEBT (medium energy beam transport). For the ECR ion source, superconducting magnets and dual high power RF sources of 28 GHz and 18 GHz are used to improve its performance [1]. The high voltage ion sources could get from two different high voltage platforms (50kV and 80kV).

## Requirements

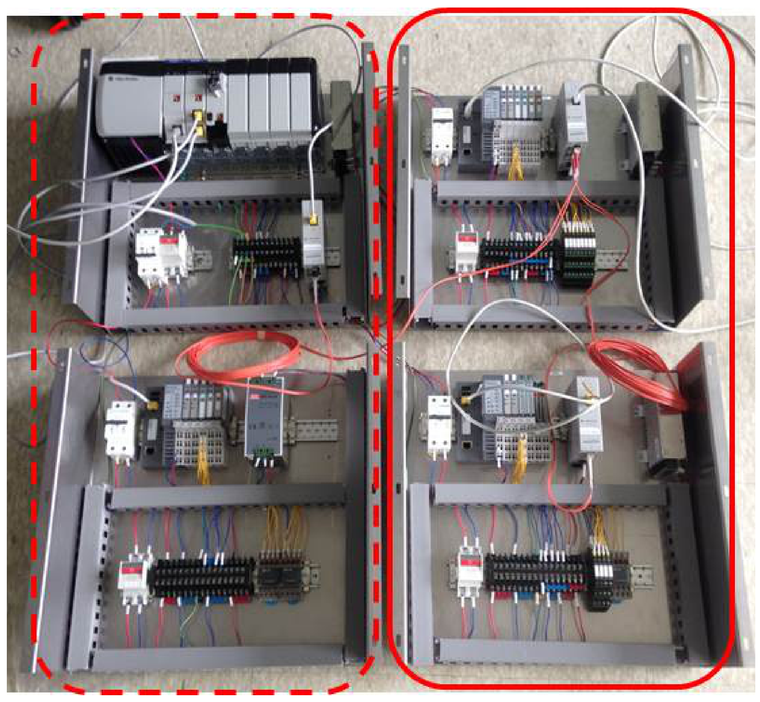
- Connecting related equipment (Gauge Controller & TMP controller etc.)
- Development of AB PLC Ladder Program (Vacuum control & Interlock)
- Make Human-Machine Interface (HMI) program
- Development the EPICS IOC
- Serial communication for Gauge Controller & TMP controller

## PLC control



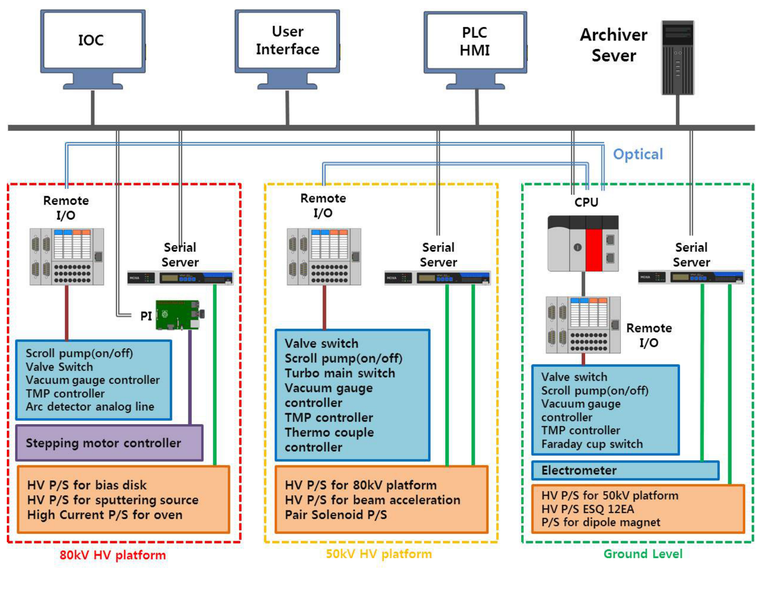

- Vacuum system of the ECR ion source is controlled by AB PLC
- Interlock system performed with ladder logic program
- There are used LAN & optical cable to configure the network system

## Prelimiary test for Networking & Installation



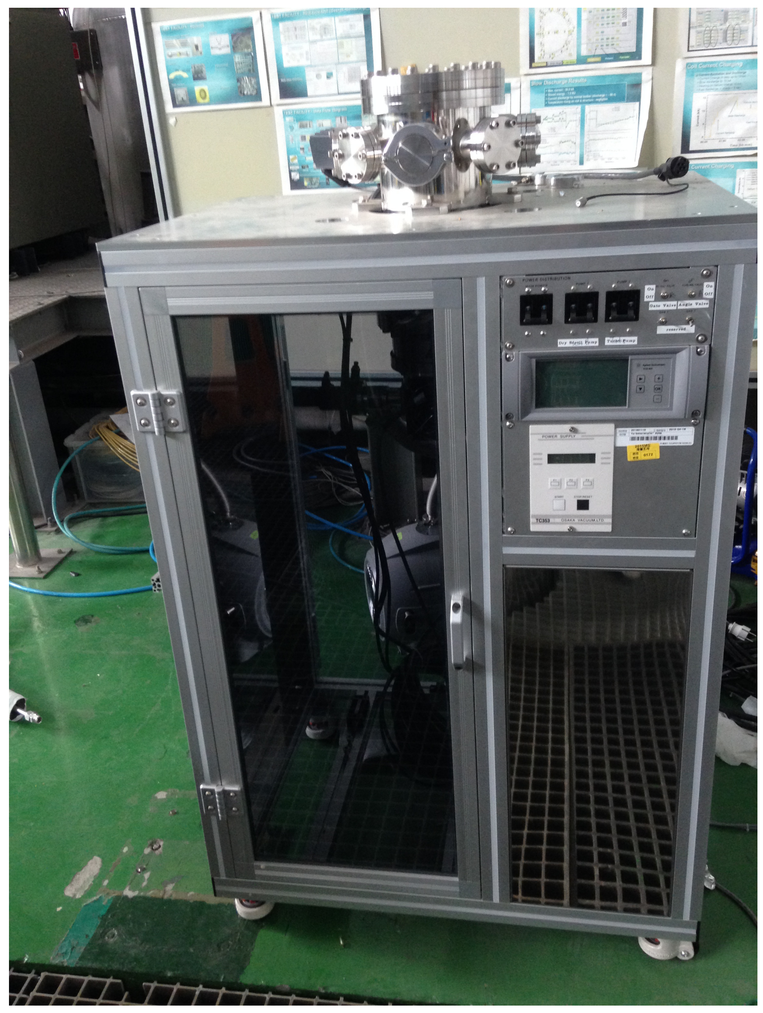
- Preliminary test set up for confirming teh network and I/O wiring.

- PLC chassis installed at the each rack.
- OSAKA turbo pump controller (TD353) & Vacuum gauge controller (XGS600) are connected with ASCII modules of AB PLC.
- Optical communication module (1734-ETAP2F) is installed to configure network system between ground platform and high voltage platform.




- The entire configuration of the ECR ion source vacuum system

## Demo vacuum control system



- We configured demo vacuum control system like the vacuum system of the ECR ion source to test serial communication for turbo pump controller and vacuum gauge controller.
- The vacuum system controlled by PLC will be integrated with EPICS framework.

## Summary

The system will be integrated with EPICS framework through Modbus TCP/IP module or Ether-IP module of the AB PLC. We are developing the EPICS IOC to control the vacuum system in real-time using EPICS drivers. The User Interface (UI) for monitoring and operating the system will be developed by the Control System Studio (CSS) software to provide easy control environment for users. The vacuum control system of the ECR ion source is finally designed by the ladder logic program to perform the interlock checks continuously without data from the EPICS IOC so that the PLC can perform its protection functions even when the IOC is shut down [2].

## Acknowledgement

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## References

[1] D. JEON et al., ”Design of the RAON Accelerator System”, Journal of the Korean Physical Society, Vol. 65, No. 7, October 2014, pp. 1010 ∼1019.

[2] M. E. Bannister?, F.W. Meyer, and J. Sinclair, ORNL, Oak Ridge, TN 37831-6372, USA