

gral capacitor C is discharged, the time of discharge is about  $10 \mu\text{s}$ , and then a single process cycle ends.

The test to the front-end readout circuit has been implemented. The test result of one channel is described as bellow. The integral duration time is set to  $10 \mu\text{s}$ , a constant weak current is fed into the under-test channel, and a  $10 \text{ pF}$  integration capacitor is chosen. The range of input equivalent charge is from  $0.5$  to  $48 \text{ pC}$ , the range of output voltage is from  $0$  to  $+5 \text{ V}$ , the linearity error is less than  $0.7\%$ , which is shown in Fig. 3.

## Reference

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# 5 - 5 Setup of Remote Monitor and Control System for LECR3 and LAPECR1 Ion Sources

Zhou Detai, Wang Yanyu, Zhou Wenxiong, Luo Jinfu, Lin Fuyuan, Yin Jia Yu Yanjuan, Feng Yucheng and Li Jinyu

LECR3 and LAPECR1 ion source are the fountainhead of the accelerator system which includes a quite complex and complete structure owing lots of different equipments. In order to improve the operating efficiency of the ion sources, the LECR3 and LAPECR1 ion sources control system has been successfully established as a set of system in August 2012. Two sets of equipment, totally 70 parameters need to be monitored and controlled involve the magnetic field power supplies, high-voltage power supply, HV platform



Fig. 1 Picture of controllers modules.

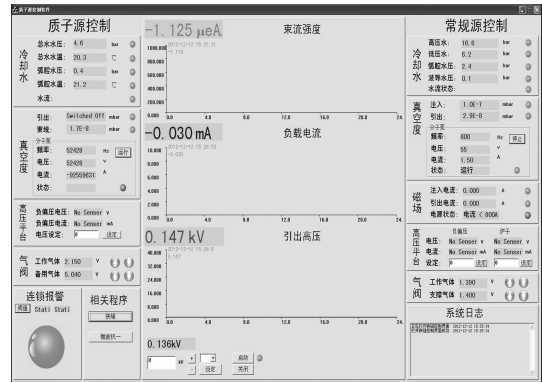


Fig. 2 Software interface of the overall control system.

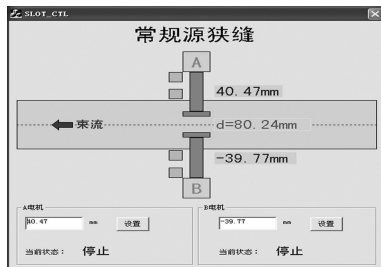


Fig. 3 Beam diagnostic slit movement control.

power supplies, beam diagnostic slit movement, vacuum valve, microwave machine, interlock protection and alarm systems, etc. Due to the characteristics of the special nature of the ion source and the dispersed distribution of the equipment, self-designed controller and serial port server have been used to build the hardware platform and the whole control structure is established base on field bus and Ethernet technology. The photo of controllers modules used in this system is shown in Fig. 1. Since this remote control system is used, all equipment has worked smoothly. In aids of this control system, the data real-time monitor, equipment control and interlock protection of the ion sources has been realized and it shows good security and stability since Aug. 2012.

Integrated control software based on VC has been developed to control all the equipment. Software interface of the overall control system is shown as follows in Fig. 2. The beam diagnostic slit control is com-

pleted based on the servo motor, human-machine interface of which is shown in Fig. 3. Through this software, operators can remotely monitor and control whole equipment which is essential for LECR3 and LA-PECR1 ion sources easily. During the period of the control system running, if any equipment goes wrong, it will automatically alarm and do the interlock protection. Alarm state will appear in the software interface with alarm information and flashing light. In the meantime, real audible and visual alarm will be triggered. It was proved in practice that the control system can monitor all the parameters and control most of them. Now, the control system is running well. With its assistance, heavy ion beams with various energy has been delivered successfully by LECR3 for HIRFL for hundreds of hours.

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## 5 - 6 Development of HIRFL-CSR Environment T/H Monitoring System

Li Yunjie, Wang Yanyu, Yin Jia, Pei Chengquan and Luo Jinfu

The accurate monitoring of the temperature and humidity of the accelerator environment is the prerequisite to guarantee the normal operation for HIRFL-CSR. So the environment temperature and humidity monitoring system of the HIRFL-CSR was developed and realized by the slow control group in IMP on 2012 to reach this target.

The T/H detect module based on MSP430F149 was designed for the hardware platform<sup>[1]</sup>. This module contains up to 8 temperature sensors and 1 humidity sensors. The resolution of temperature detection is low than 0.1°C and the humidity is low than 5%. Over 25 T/H detect modules have been installed in corridor power room, SSC shimming power room, power room in 2<sup>#</sup> Building, CSRm, east and west platform of CSRm. It is shown in Fig. 1.



Fig. 1 T/H module installation places.

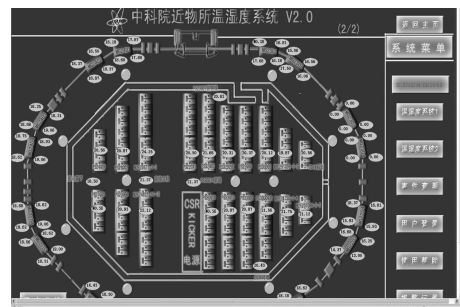


Fig. 2 The software interface for real time data and location.

The software interface based on Force Control configuration software of SUNWAY Corporation<sup>[2]</sup> has been running all the time in the central control room which can provide the real time data of T/H with the location information since the summer of 2012. And the history data curve of T/H is also been provided. It shown in Figs. 2, 3 and 4.

Once the temperature or humidity is abnormal, an audible and visual alarm information will be generated in the software interface. Also, the location where the abnormal temperature and humidity take place will be shown on this interface.