the mixer power level is set to 10 dBm and the RF port power level rangecan be set from -26 dBm to 5 dBm to make sure the PLL loop works good. Mechanical Phase Shifter also used for PLL loop to adjust error signal to lock the cavity frequency. The power sensors which have high dynamic range in this system are used for measuring forward, reflect and pick-up power of the superconducting cavity. The environmental monitor contains cavity temperature sensors, LHe level sensors, He gas pressure sensor, cavity vacuum gauge and X-ray radiation detector. Each sensor is connected to its own equipment, which communicated with computer by GPIB or RS232.

The software system is based on Labview. The main code structure is mixed state machine and event structure. Cavity testing data acquisition and data analysis parts are separated and each subvi can be run fast and independently. Environment monitoring data acquisition part can be also run separated but slower running speed and synchronism. The main code screenshot and user interface are shown in Figs. 2 and 3.

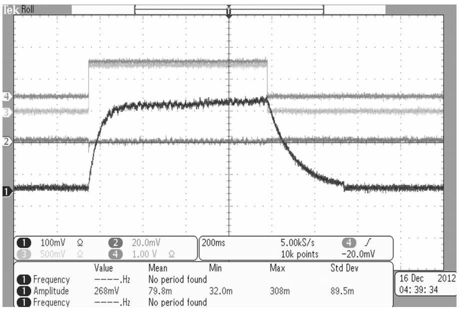

Fig. 4 Multipacting.

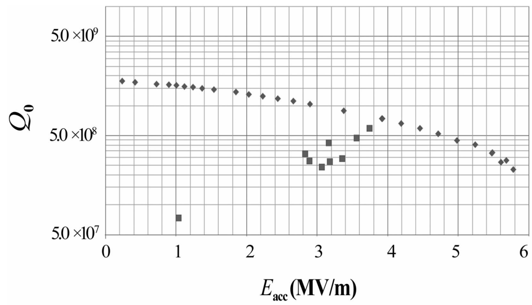

Fig. 5 IMP-HWR010-02 cavity test result.

IMP-HWR010-02 cavity has been test twice time on this system. At the first time, the HWR cavity hadn't do HPR processing, the cavity was showed very strong multipacting (Fig. 4) and a little X-ray dose. Ready for second test, the BCP and HPR processing had been done and low temperature vacuum bakingwas used for cavity cleaning surface during 3 d. After that, the cavity test result was good. No multipacting and no X-ray, the cavity performance was reached $Q_0 = 5.2 \times 10^8$ @ $E_{acc} = 4.7$ MV/m. The test result plot is shown in Fig. 5.

6 - 13 Development and Research of Machine Protection System with PLC Redundancy based on EPICS

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Machine protection system is mainly used for RFQ control in China ADS project. The flow and temperature monitoring for waterway are provided in this system, and if the temperature is above 22.5 ℃, the power source will be closed.

Fig. 1 Hardware of PLC controllers.

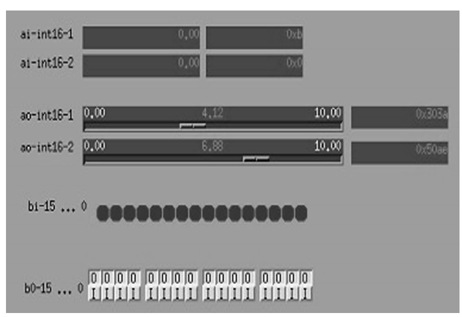

Fig. 2 Interface of communication for MPS.

With the PLC(Programmable Logic Controller)redundancy, it is important and necessary for the particle accelerator machine protection system to improve its stability and efficiency. The master PLC and slave PLC are connected by optical fiber, and the interval distance between the two PLC can be 80 km. If the master PLC goes wrong, the slave PLC will take over the work. The switch time can be very short, so the system will be worked uninterrupted and stably. Fig. 1 shows the hardware of both master and slave PLC controllers.

EPICS(Experimental Physics and Industrial Control System) is used in this control system. The EPICS IOC (Input/ Output Control) redundancy and the seamlessly switch between the master and slave PLC have been finished and achieved in machine protection system. If the IOC cannot receive data from the master PLC, the connection will be closed and a new connection with the slave PLC will be established. The redundant system can communicate with the EPICS IOC successfully and the parameters can be also easily monitored, modified and stored by this control system based on EPICS. Fig. 2 shows the testing interface of EPICS communicated with PLC. The IOC program and the interface will be modified and perfected in the further work.

References

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6 - 14 Automated Facility for SRF Cavity BCP Process

Guo Hao, Xiong Pingran, You Zhiming, He Yuan and Shi Zhixiong

Buffered chemistry polishing (BCP) has been widely used for surface treatment of SRF cavities, which uses mixed acid with hydrofluoric, nitric and orthophosphoric. There is a simple BCP facility for BCP processing of HWR cavities in IMP, currently. But there are several defects for BCP processing with this facility. For example, the operators have to mix acid manually, which increases the risk of operators hurt by acid; the process fumes have to be exhausted to the outdoor, which is harm to environment. In order to solve these defects, an automated BCP facility has been designed and processed.

Fig. 1 The photograph of automated BCP facility.

The automated BCP facility is shown in Fig. 1, which concludes 4 cells: 1 cell for BCP etching, 2 cells for acid mixing and 1 cell for acid transporting. The main concept of this facility design is to provide the safest environment for entire BCP processing. The most pipelines are installed in the cells which is made of polypropylene (pp), and the rest pipelines which are used for transporting acid in and out are placed in a PVC pipeline to prevent acid leaking. The control system is separated from pipeline, cavity and acids, which could protect operators from exposure to acids and fumes. The frames of facility are made of PP, and the pipelines used for acid transporting are made by PVDF which is one of the best anti-corrosion materials. The pipelines used for ultra pure water (UPW) transporting are made by C-PVC which could maintain the quality of UPW. There are two methods for reaction temperature controlling: acid cooling and cavity spray cooling. The ventilation system is designed to capture fumes at potential source, such as tanks