IMP INSTITUTE OF MODERN PHYSICS

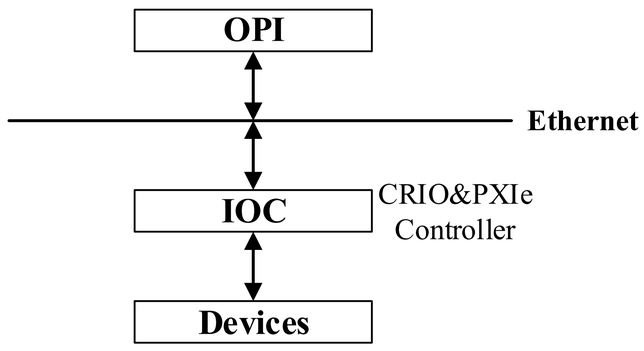
VACUUM CONTROL SYSTEM OF SSC-LINAC

Xiaojun Liu, Wei Zhang, Shi An, Jianjun Chang, Yun Chen, Junqi Wu, IMP, Lanzhou, China

Introduction

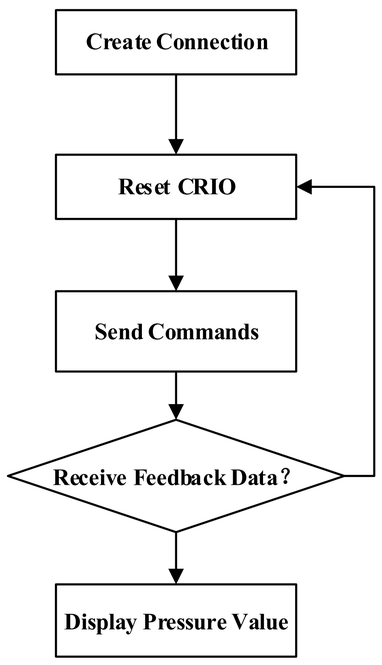
SSC-Linac is a linear accelerator injector of SSC in HIRFL. The vacuum control system is based on EPICS which is a real-time distributed control software. The Labview real-time VIs and EPICS VIs were used to design Input/Output Controller(IOC). The different kinds of cRIO modules were adopt in device layer, which can monitor the serial port data from vacuum gauges and contol vacuum valves. The whole control system can acquire vacuum data, control vacuum devices remotely, make the pressure value of the vacuum gauge and vacuum valve interlocked. It also keep the equipment work stable and the beam has a high quality.

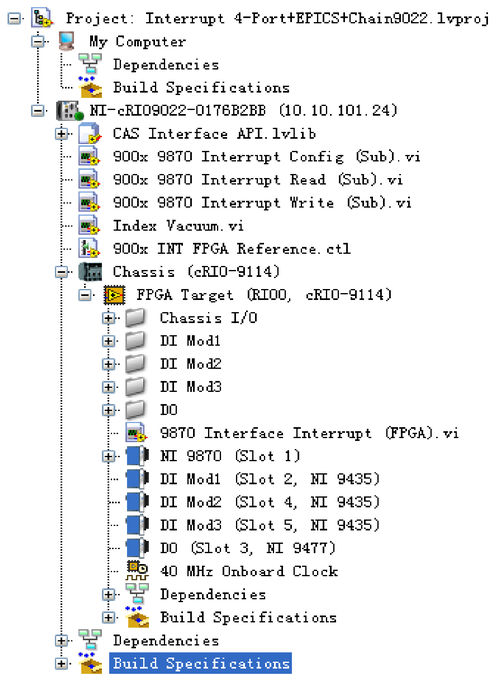
The Control System Structure

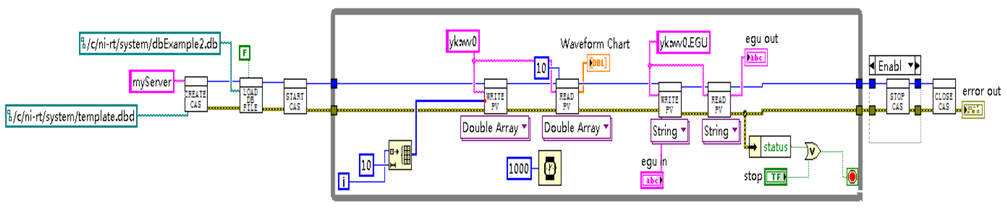


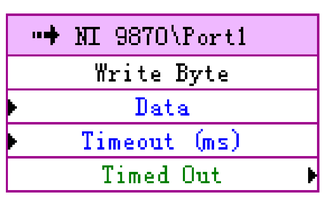
The control System structure is based on EPICS.

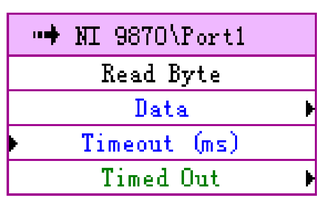
The Flow Diagram of the Control System











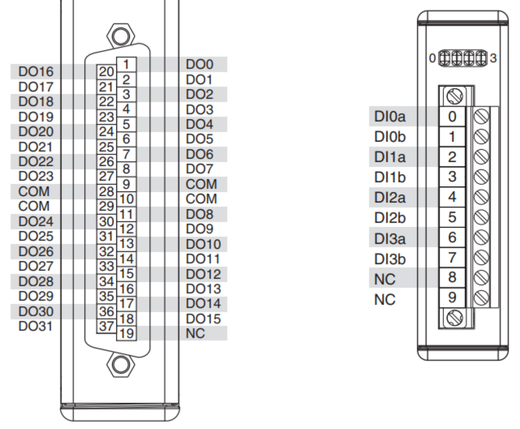
The design includes three sections, which are to receive pressure data from vacuum gauge, to control vacuum valves to be in or to be out, to get the status of vacuum valves. We use FPGA mode to design the program with Labview, because FPGA mode is more stable and faster than SCAN mode. We need an external power supply which has 5V voltage to control vacuum valves. NI provides EPICS modules to write and read data with PVs, The modules support five kinds of data, such as ai, ao, bi, bo and waveform, if you want to define a new type of record, it is forbidden.

The Hardware of Vacuum Control System

The interface of vacuum gauge is RS232, DB9, so we use NI-9870 serial module to receive pressure data from vacuum gauges. We use NI-9477 which is a digital output module to control vacuum valves and use NI- 9435 which is a digital input module to get valve status.

	RJ-50 Pin	Signal Name*
RJ50 Jack: 1 NC, 2 RI, 3 CTS, 4 RTS, 5 DSR, 6 COM, 7 DTR, 8 TXD, 9 RXD, 10 DCD	1	No Connect
	2	RI
	3	CTS
	4	RTS
	5	DSR
	6	GND
	7	DTR
	8	TXD
	9	RXD
	10	DCD

*These signals are shared by all four RJ-50 connectors on the NI 9870.

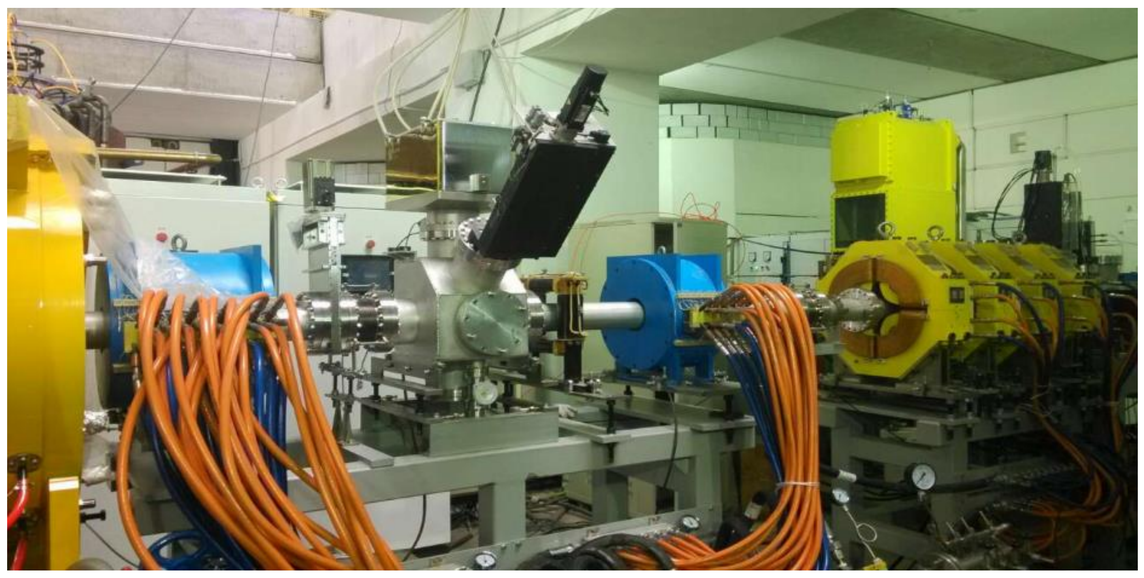


The NI 9870 has four full-featured, independent RS232 DTE ports that are isolated from the other modules in the system. Each port is fully compatible with the ANSI/EIA/TIA-232 standard.

The NI 9477 is a digital output module for CompactDAQ and CompactRIO systems. Each channel is compatible with 0 V to 60 V signals and features 1,000 Vrms withstand isolation from channel to earth ground. The module can sink up to 625 mA per channel continuous current on all channels and is capable of sinking up to 20 A of current per module (1 A per channel maximum).

The NI 9435 has a 10-terminal, detachable screw-terminal connector that provides connections for four digital input channels. Each channel has two terminals, DIa and DIb, to which you can connect voltage signals. The DIa and DIb terminals are interchangeable. The NI 9435 measures whether the difference between the DIa and DIb terminals is greater than or less than the digital logic levels and limits the current flow as needed.

Conclusion



The program has been used for some years in SSC-Linac. It works stable in case of EPICS control structure and NI hardware. The hardware was designed for redundant way in case of adding other digital devices.

NI labview supports only 5 kinds of record, if you want to read or write other PVs which is defined by users own, Labview will fail to do that.