Control and monitoring system of gas strippers

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We report on the control and monitoring system of a gas stripper, a new RIBF charge stripper using a gas target. A gas stripper has been developed as an alternative to a traditional carbon-foil stripper for increasing the intensity in very heavy ion beams such as uranium or xenon beams at the RIBF. A recirculating helium gas stripper[1] and an air stripper[2] are installed at the A02 site after the RRC and at the M04 site after the fRC (GS-A02 and GS-M04), respectively.

The schematic block diagram of their control and monitoring system is shown in Fig. 1.

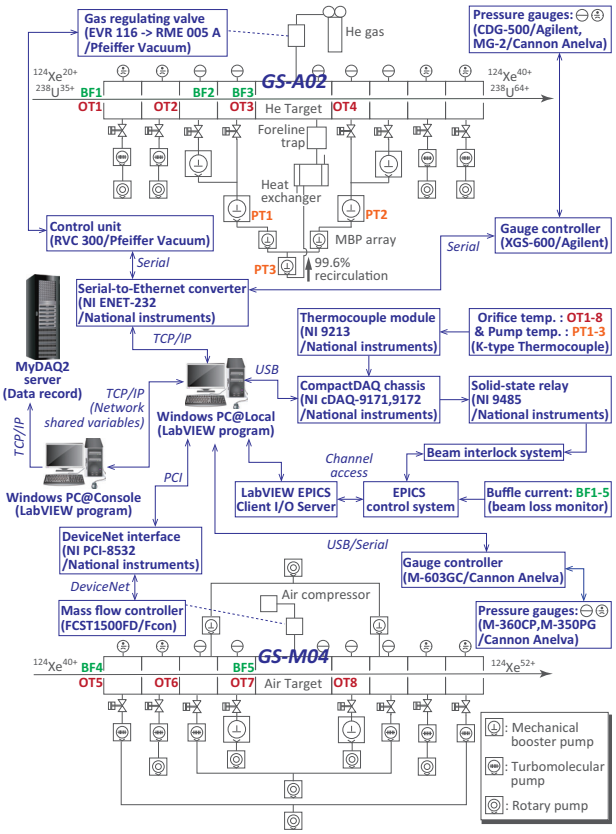

Fig. 1. Schematic block diagram of control and monitoring system for gas strippers.

We developed a user-friendly GUI program using the LabVIEW for the system, which includes the following:

- Remote control of the pressure and/or flow rate of the target gas
- Monitoring of the pressure of each differentially pumped section
- Monitoring of buffle current BF1–BF5 (beam loss monitor) via the EPICS control system[3,4]
- Monitoring of the temperature of orifices OT1–OT8 and mechanical booster pumps PT1–PT3
- Signal output to the beam interlock system in response to the monitoring value via the NI CompactDAQ
- Data recording to the MyDAQ2 system[3]

The developed system allows us to remotely optimize the target pressure of gas strippers with the assistance of the online beam monitoring system[5]. Figure 2 shows the correlation among the target pressure of GS-A02, beam timing, and beam intensity nondestructively observed by a phase probe (PP).

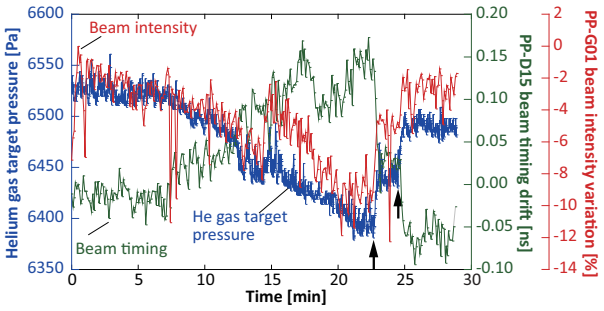

Fig. 2. Correlation among target pressure of GS-A02, beam timing, and beam intensity observed by the phase probe.

In this case, the beam timing at PP-D15 (31 m downstream of the GS-A02) gradually varied owing to the energy loss reduction in the GS-A02 as its target pressure decreased[6], resulting in a ∼10% decrease in beam intensity at PP-G01 (5 m downstream of the SRC). The beam intensity was recovered by twice fine controlling the target pressure by observing the beam monitoring system, as indicated by the arrows in Fig. 2. The pressure should be regulated with ±1% accuracy by the control unit, however, it got out-of-control at the end of the machine time, so we speculate that its accuracy was reduced owing to irradiation damage to the regulating valve EVR 116 near the GS-A02 in the RRC vault. EVR 116 has been replaced with radiation-proof RME 005 A.

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