

## New gas handling system for parallel plate avalanche counter

H. Sato,<sup>\*1</sup> Y. Shimizu,<sup>\*1</sup> N. Fukuda,<sup>\*1</sup> T. Sumikama,<sup>\*1</sup> H. Baba,<sup>\*1</sup> K. Kusaka,<sup>\*1</sup> S. Michimasa,<sup>\*1</sup> M. Ohtake,<sup>\*1</sup>  
H. Suzuki,<sup>\*1</sup> H. Takeda,<sup>\*1</sup> Y. Togano,<sup>\*1</sup> Y. Yanagisawa,<sup>\*1</sup> and M. Yoshimoto<sup>\*1</sup>

In the BigRIPS fragment separator, parallel plate avalanche counters (PPACs) are used for the position detection of radio isotope beams at each focal plane.<sup>1)</sup> Sometimes there was a trouble in destroying thin window foils of the PPAC by misoperation, and therefore, there was a need to introduce an automatic (programmed) gas handling system. In addition, PPAC manipulation via the network without interrupting experiments is useful for the efficient operation of the BigRIPS. Thus, we started to introduce the new gas handling system that is automatic and remotely operable. This mission is part of the BigRIPS automation scheme in the TRIP project in RIBF.<sup>2,3)</sup>

In the new gas handling system, pneumatically actuated bellows valves must be controlled by a programmable logic controller (PLC) in a programmed sequence based on the interlock function. The PLC (Mitsubishi FX3S-30MR/ES) is selected on the condition that it is compatible with experimental physics and industrial control system (EPICS) because it should be connected to the LAN for remote control and logging via EPICS. As shown in Fig. 1, remote operation can be performed on a web-based graphical user interface of the BYACO ecosystem.<sup>4)</sup>

The photograph of the new gas handling system is shown in Fig. 2. A normally open bellows valve (Fujikin FP-91-6.35) is adopted for a bypass valve and normally closed valves (Fujikin FPR-91-6.35) are adopted for others. The amount of gas flow is regulated by a manual needle valve (Fujikin FUBFN-91M-6.35). The solenoid valves (SMC V110-D5-CU-C4) for pneumatics and a manifold (VV100-10F-AD2-05U1-C6F1) are selected because of their small size. An auto pressure controller (Fujikin UPC-4J2C-C13L, 0–100 Torr) and its power source (Fujikin SP-833A/WX) controls the pressure. The new gas handling system can be operated locally as well as remotely only by pushing “GAS ON” and “GAS OFF” buttons on the panel.

Replacement with the new gas handlers from F3 to F12 was completed. The remaining F1 and F2 gas handlers can be replaced after the radiation resistance test of the PLC.

### References

- 1) H. Kumagai *et al.*, Nucl. Instrum. Methods Phys. Res. B **317**, 717 (2013).
- 2) H. Baba *et al.*, RIKEN Accel. Prog. Rep. **57**, 27 (2024).
- 3) Y. Shimizu *et al.*, RIKEN Accel. Prog. Rep. **57**, 97 (2024).
- 4) T. Sumikama *et al.*, RIKEN Accel. Prog. Rep. **54**, 82 (2021).

<sup>\*1</sup> RIKEN Nishina Center

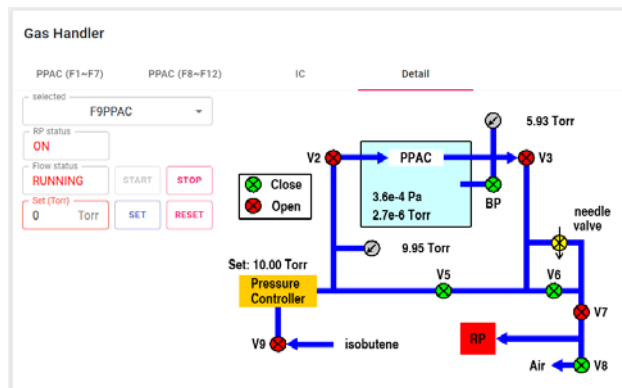


Fig. 1. Screenshot of the web-based GUI of the gas handling system for the PPAC. The page displays the status of valves, and the pressure both in the PPAC and the focal plane chamber.

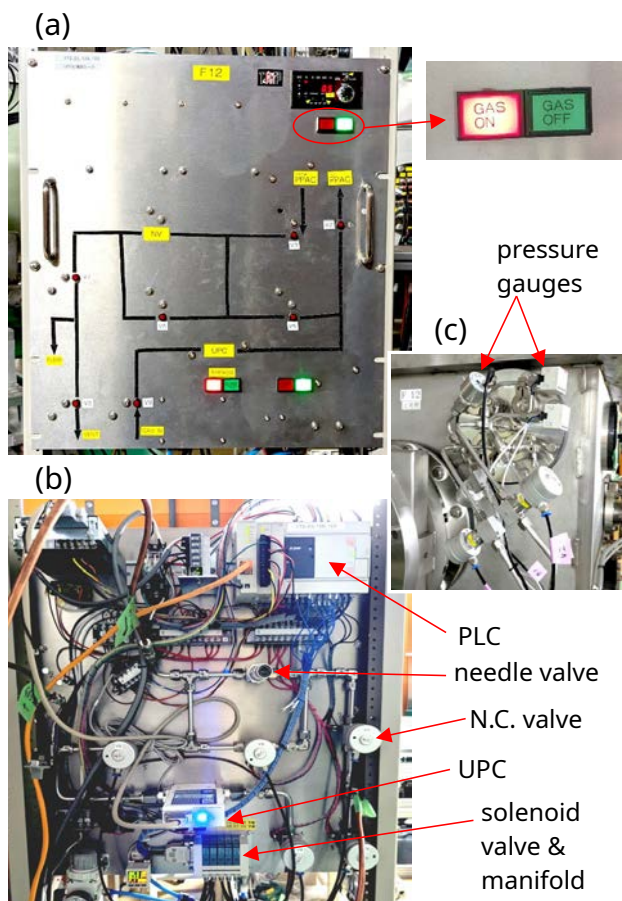


Fig. 2. New gas handling system for the PPAC. (a) front of the panel, (b) back of the panel, (c) in/out/bypass valves and pressure gauges (Nidec PA-850-102A-NR2, SMC ZSE20A-R-01-J).