

Reliable connection methods for gas piping and signal cabling of PPAC in focal-plane vacuum chambers at BigRIPS

H. Sato,^{*1} D. S. Ahn,^{*1} N. Fukuda,^{*1} T. Komatsubara,^{*1} Y. Shimizu,^{*1} H. Suzuki,^{*1} H. Takeda,^{*1} and K. Yoshida^{*1}

Two sets of parallel-plate avalanche counters (PPACs) are installed in each focal-plane vacuum chamber at the BigRIPS and ZeroDegree separators.¹⁾ For replacing the PPACs in a short time without any trouble, we introduced reliable connection methods for gas piping and signal cabling inside the chamber: a quick coupling and a multipole connector, respectively.

The PPAC is filled with 10 Torr of gaseous isobutane when in operation. The gas introduced from outside of the chamber is transferred to the PPAC through two Teflon tubes (for the inlet and outlet), and each tube is inserted into a Wilson seal connector on the PPAC. Because of the bad working environment due to the narrow space of the chamber, a defect in the fitting of the Wilson seal may occur, causing gas leakage. To avoid this, Full Flow Quick-Connects (Swagelok SS-QF4-B-6M0 and SS-QF4-S-6M0) were adopted for easy coupling (Fig. 1). The stems and bodies of the Quick-Connects are attached to the PPAC and Teflon tubes, respectively. A leakage test of the PPAC with the Quick-Connects was performed by filling 10 Torr of isobutane, and we observed no leakage in a vacuum of 5.5×10^{-5} Pa. In addition, no degradation of the vacuum occurred during the up-and-down motion of the

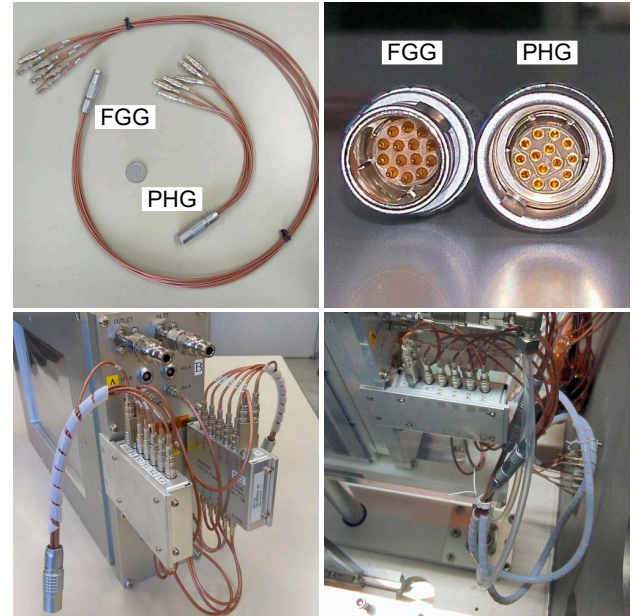


Fig. 2. Images of signal cables with multipole connectors. The shorter (200 mm) cables are connected to the PPAC, and the longer (800 mm) cables are connected to the chamber.

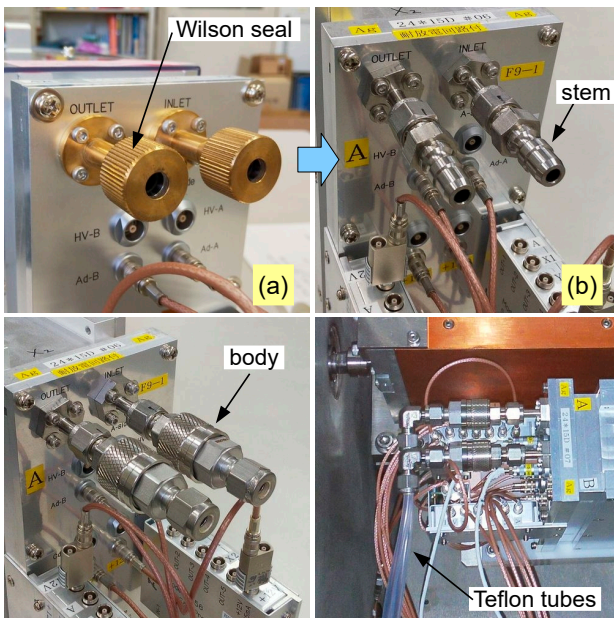


Fig. 1. Images of the Quick-Connects. (a) Ordinary gas ports with Wilson seals. (b) New gas ports with the stems of Quick-Connects.

PPAC. We applied the Quick-Connects to the PPACs in the F2, F3, F5, F7, F8, F9, F10, F11, and F12 chambers during the autumn beam time in 2019.

For signal readouts, five coaxial cables (for anode, x1, x2, y1, and y2) are independently connected to the output ports of the preamplifier of the PPAC. In addition, another cable for supplying a DC 12 V to the preamplifier is connected. For easy and error-free connection, 14-pin multipole connectors (LEMO FGG.1B.314.CLAD76 and PHG.1B.314.CLAD76) were adopted (Fig. 2). Six coaxial cables (RG178B/U) are soldered to one multipole connector. We performed the noise-level testing of the signal from the PPAC with the multipole connectors by using an alpha source ^{241}Am . As a result, the noise level of the signal was the same as that obtained with ordinary cabling. We applied the multipole connectors to the PPACs in the F3, F5, F7, and F8 chambers during the spring beam time in 2019.

We will finish the introduction of these two improvements to all the PPACs in 2020.

Reference

- 1) N. Fukuda *et al.*, Nucl. Instrum. Methods Phys. Res. B **317**, 323 (2013).

^{*1} RIKEN Nishina Center