Development of a low voltage system and GUI for sPHENIX-INTT

M. Shimomura,[*1,*2] Y. Akiba,[*2] J. Bertaux,[*3] D. Cacace,[*4] R. G. Cecato,[*5] A. Enokizono,[*2] K. Fujiki,[*2,*6] M. Fujiwara,[*1] T. Hachiya,[*1,*2] S. Hasegawa,[*2,*7] M. Hata,[*1] B. Hong,[*8] J. Hwang,[*8] M. Ikemoto,[*1] R. Kan,[*1] M. Kano,[*1] T. Kato,[*2,*6] T. Kikuchi,[*2,*6] T. Kondo,[*9] C. M. Kuo,[*10] R. S. Lu,[*11] N. Morimoto,[*1] I. Nakagawa,[*2] R. Nouicer,[*4] G. Nukazuka,[*2] R. Pisani,[*4] C. W. Shih,[*10] R. Shishikura,[*2,*6] M. Stojanovic,[*3] Y. Sugiyama,[*1] W. C. Tang,[*10] Y. Terasaka,[*1] H. Tsujibata,[*1] M. Watanabe,[*1] and X. Wei[*3]

In the high-energy nuclear collision experiment initiated at relativistic heavy ion collider (RHIC) in 2000, the results of azimuthal anisotropy and yield suppression of the produced particles revealed the production of quark-gluon plasmas (QGPs), "high-temperature QCD matter" in which quarks and gluons are not confined to nucleons, and the properties of these strongly coupled QGPs were not expected before the experiment.[1] To investigate the properties of QGPs in detail, the sPHENIX experiment was initiated in 2023 as an upgrade to the PHENIX experiment. This upgraded experiment included specialized detectors for measuring jets and upsilons. In this experiment, we developed and introduced a silicon track detector (INTT) with high position and time resolution for detecting charged particles. This study introduces a low-voltage (LV) supply system that powers the INTT read-out card (ROC), read-out chips (FPHX chips[2]), and other components and a graphical user interface (GUI) shown in Fig. 1 built with Ignition Designer for controlling the system. Ignition Designer is part of the Ignition industrial software platform developed by Inductive Automation.[3] It offers an intuitive and user-friendly graphical user interface, enabling users to build projects easily. The interface enables interaction with live data, allowing users to monitor real-time values when operating the LV system. Moreover, it facilitates users with a drag-and-drop functionality for easy visual development. All operations are performed by local computers using a client launcher, as shown in the right side of Fig. 1.

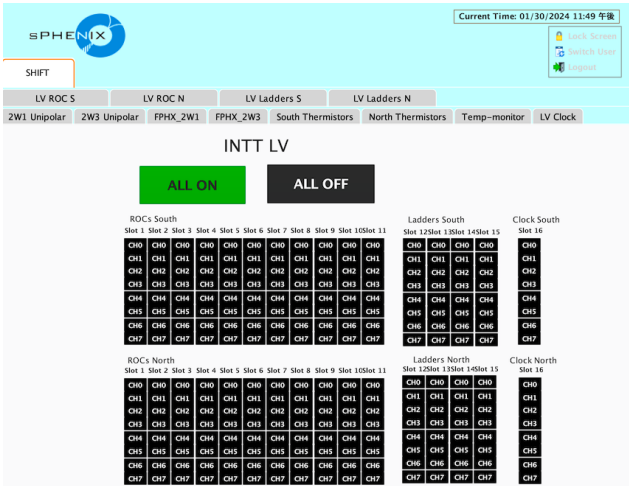

Fig. 1. Ignition Designer for development.

The INTT LV system uses distribution boards, filter boards, FPHX chips, and beam clock distribution boards (clocks). The distribution board supplies the power to the ROC, filter board, and clock. The filter board powers the individual FPHX chips. A crate contains 16 distribution boards. As shown in Fig. 2, 11 slots are used for 8 ROCs, 4 slots (CH12-CH15) are used for 8 filter boards, and 1 slot (16) is used for 8 clocks. The INTT needs 16 ROCs, which are housed in 2 crates located at the north and south positions.

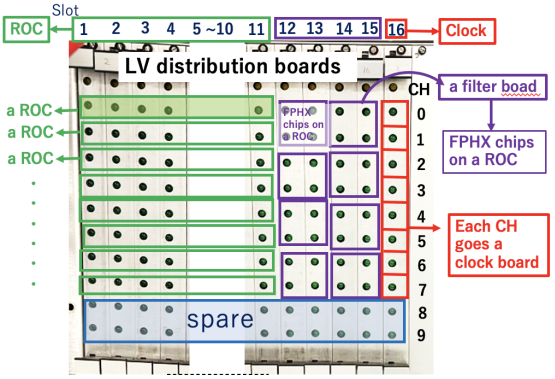

Fig. 2. INTT LV distribution boards and their connected components.

During the operation, multiple voltages for a ROC must be applied simultaneously. The sequence clock, ROC, and FPHX must be followed when powering down. User-friendly switches adhere to the sequence, and real-time monitoring triggers an alarm for deviations exceeding 15% from the expected current values. This comprehensive development resulted in the trouble-free operation of the LV system in 2023, enabling successful data collection by the INTT.

*1 Department of Mathematical and Physical Sciences, Nara Women's University
*2 RIKEN Nishina Center
*3 Department of Physics and Astronomy, Purdue University
*4 Physics Department, Brookhaven National Laboratory
*5 Instrumentation Division, Brookhaven National Laboratory
*6 Department of Physics, Rikkyo University
*7 Japan Atomic Energy Agency
*8 Department of Physics, Korea University
*9 Tokyo Metropolitan Industrial Technology Research Institute
*10 Department of Physics, National Central University
*11 Department of Physics, National Taiwan University

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