Development of sPHENIX INTT high voltage GUI

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The super pioneering high-energy nuclear interaction experiment is a new collider experiment in a relativistic heavy-ion collider. A silicon strip tracking detector called the intermediate silicon tracker (INTT) is a subdetector of the sPHENIX. Its silicon sensors must have an applied bias voltage of 100 V for full depletion. This voltage must be able to be ramped up, ramped down, shut off, and monitored remotely, and is referred to with the abbreviation HV (high voltage).

The INTT uses two WIENER MPOD crates, each containing eight ISEG HV modules.[a)] Each ISEG HV module uses 14 (of its 16) channels to apply a bias voltage to an individual sensor; therefore, all of the 224 sensors on the INTT receive a bias. This organization is consistent with the readout of the INTT, *i.e.*, 14 channels on the same ISEG module supply bias to all the sensors using the same read out card (ROC).

Most sPHENIX subsystem interfaces use Ignition, a monitoring framework; however, because the MPOD crates have no interface through this framework, a separate program was developed to monitor and control the crates. This Python program introduced in the INTT issues net-snmp commands to set or retrieve MPOD values, such as the voltage, current, and MPOD status code. The program uses PySimpleGUI to spawn and update an interactive window for users.

Owing to the numerous channels being monitored, an efficient visual organization scheme was required. The developed scheme follows the hardware and readout organization of the INTT in that channels are organized into tabs in similar to their organization in the ROC board or ISEG module. An example is shown in Fig. 1.

Because only the channels of one tab are viewed at any time, users need to be able to easily view what is occurring on another tab. Thus, each tab has two indicators above it. Considering "on" and "off" states as true and false, respectively, the upper indicator

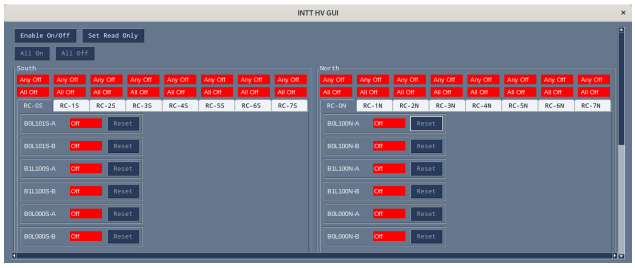

Fig. 1. INTT HV GUI in March 2024. Buttons that issue network commands can be disabled for comfort of user. Buttons exist to turn all HV channels and reset them individually. It has one tab per ROC, with two indicators above each tab.

serves as the logical conjunction ("and") of the channel states, whereas the lower indicator acts as a logical disjunction ("or"). The upper indicator answer the question, "are any channels off?" and displays either "Any Off" or "All On." Analogously, the lower indicator answer the question "are any channels on?" and displays either "Any On" or "All Off."

Therefore, a user can verify the detector is fully on if and only if the upper indicators ("and" of on/off states) displayed "All On." Conversely, a user can verify the detector is fully off if and only if the lower indicators ("or" of on/off states) display "All Off."

Importantly, any and all turned on commands ensure tripping functionality and current are set before ramping any channel. This is a failsafe to ensure that the currents never exceed certain thresholds, and the corresponding channel is ramped down to maintain the safety of the silicon sensors.

The INTT HV GUI is an important component of the detector monitoring framework, allowing users to easily turn the detector on and off and to verify the channel status to ensure data integrity and protect detector hardware.

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a) WIENER is a distributor of custom, multi channel high-voltage power supplies, and ISEG is a precision high-voltage power supply manufacturer that WIENER uses in the MPOD crates used by the sPHENIX.

DOI:10.34448/RIKEN.APR.57-089