

Design of a Chassis to House the Hardware Interlock System Components of Hall B's Second Ring Imaging Cherenkov Detector

Tyler Lemon, Mary Ann Antonioli, Peter Bonneau, Aaron Brown, Pablo Campero, Brian Eng, George Jacobs, Mindy Leffel, Marc McMullen, and Amrit Yegneswaran

Physics Division, Thomas Jefferson National Accelerator Facility, Newport News, VA 23606

December 16, 2021

The Detector Support Group is designing the hardware interlock system for Hall B's second ring imaging Cherenkov detector (RICH II). Part of this system is a chassis that houses the sbRIO-9629 controller and cRIO-9147 expansion chassis, which read SHT35 sensor PCBs [1] and gas system flow and pressure transducers. This note presents the design of the three-dimensional model generated in NX12.

Components for the RICH II hardware interlock system (one sbRIO-9629, one cRIO-9147 expansion chassis, power distribution terminals, and 3.3 V power supply) will be housed in a 4-U tall, 15-inch deep, 17-inch wide, rack-mount chassis. To optimize the layout of chassis components and to create fabrication drawings, a model of the proposed chassis was created in NX12.

A chassis was first created in NX12 using the dimensions from the chassis vendor's website [2]. Next the sbRIO, its heat spreader, and the RMC models were placed in the chassis. Once the custom reconfigurable input/output mezzanine card (RMC) [3, 4] and custom backplane PCB [5] were designed, their CAD models were imported into NX12, Figs. 1, 2, and 3.

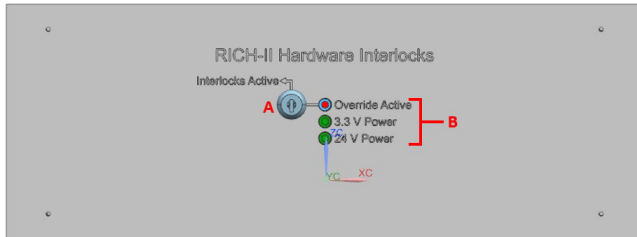


FIG. 1. Front view of chassis. Details of labeled items are in Table I.

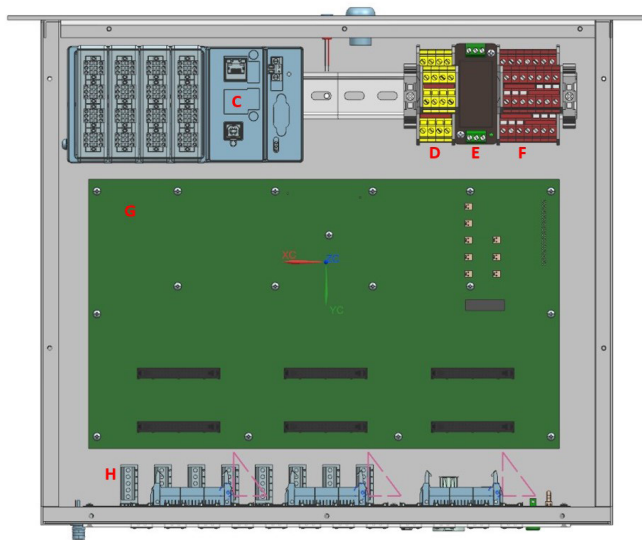


FIG. 2. Top view of chassis. Details of labeled items are in Table I.

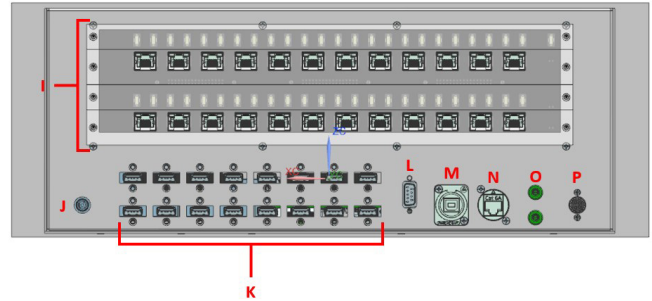


FIG. 3. Back view of chassis. Details of labeled items are in Table I.

Label	Description
A	keyed override switch for interlock system
B	front panel LED indicators for override status (red), external 3.3 V power supply status (green), and external 24 V power status (green)
C	cRIO-9147 expansion chassis on a DIN rail
D	3.3 V power distribution terminals
E	24 V-DC to 3.3 V-DC power supply; provides external 3.3 V power to chassis
F	24 V power distribution terminals
G	RMC; sbRIO and its heatspreader are under RMC in chassis top view
H	items mounted to back panel of chassis
I	backplane PCB with RJ-45 ports for I ² C communication connection to sensors and fuses for each sensor; fuses are covered by an acrylic panel
J	BNC port for connection to CAEN power supply interlock port
K	feedthroughs for sensors connected to cRIO-9147 expansion chassis
L	feedthrough for additional digital input/output connection to sbRIO
M	USB feedthrough for local connection for cRIO-9147 expansion chassis configuration
N	RJ45 feedthrough for sbRIO's network connection
O	banana plugs for configuring backplane PCB's connection to external ground
P	24-VDC power feedthrough for chassis

Table I. Details of labeled items in Figures 1, 2, and 3.

Peripheral components of the system, such as the cRIO-9147, the power supplies and distribution, sensor feedthroughs, and network connection feedthroughs, were placed in the NX12 model and rearranged, ensuring adequate room for wiring and routing of all internal cabling.

Once all components were satisfactorily placed in the chassis, NX12's drafting application was used to create fabrication diagrams, automatically converting three-dimensional views of the model into two-dimensional diagrams that were annotated to note fabrication details.

In conclusion, for the Hall B RICH-II detector, a new hardware interlock system is under development. For the chassis design and layout, a three-dimensional model was created in NX12 to ensure all components fit in the chassis and allow adequate room for interior cable routing. The model was then converted into diagrams for fabrication.

- [1] [Marc McMullen, et al., *Sensirion SHT-35 Sensor Board Design for Hall B's RICH II Detector*, DSG Note 2021-14, 2021.](#)
- [2] [Par-Metal Products Inc., *Aluminum Chassis – 12 Series*.](#)
- [3] [Marc McMullen, et al., *Design of the Reconfigurable Input/Output Mezzanine Card for the Hardware Interlock System of Hall B's Second Ring Imaging Cherenkov Detector*, DSG Note 2021-22, 2021.](#)
- [4] [Tyler Lemon, et al., *Selection of Parts for the Reconfigurable Input/Output Mezzanine Card of the Hardware Interlock System for Hall B's Second Ring Imaging Cherenkov Detector*, DSG Note 2021-24, 2021.](#)
- [5] [Marc McMullen, et al., *The Backplane Board of the Hardware Interlock System for the Second Ring Imaging Cherenkov Detector*, DSG Note 2021-29, 2021.](#)