

## EPICS Alarm System in Phoebus

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 February 16, 2024

The first Phoebus alarm application at Jefferson Lab is to be tested using a real-time data source—the EIC DIRC laser interlock PCB within the interlock enclosure [1]. This note presents an overview of the test software and hardware.

To facilitate the development, testing, and debugging of the Phoebus alarm system software packages, access to EPICS process variables (PVs) is required. The required PVs are provided by the laser interlock signal simulator developed with National Instruments cRIO hardware and software.

The test setup, Fig. 1, consists of a cRIO, an EPICS softIO, and Phoebus alarm system software packages [2].

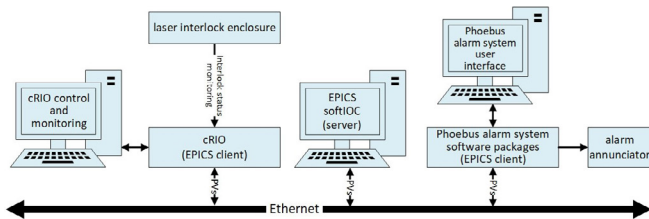


FIG. 1. Phoebus alarm system test setup for EIC DIRC.

The developed applications and startup procedure aid hardware and software testing and debugging of interlocks.

Table I summarizes the three-part startup procedure for the Phoebus alarm system test, which uses the test setup, Phoebus alarm system software packages, laser interlock signal simulator, and the developed laser interlock electronics inside the laser lab.

Startup procedure	Components and software tested	Layout loaded
Part 1	Phoebus alarm software independently tested with laser signal simulator	EIC-DIRC-ALARM-SIMULATOR
Part 2	cRIO hardware and software, EPICS softIO, and EIC DIRC laser interlock system	EIC-DIRC-cRIO-TEST
Part 3	Complete system test with cRIO hardware and software, EPICS softIO, and EIC DIRC laser interlock system with Phoebus alarm system	EIC-DIRC-TEST-V1

TABLE I. Summary of startup procedure.

First, the simulator is used to verify the proper operation of the Phoebus alarm system software packages and the user interface.

After starting the signal simulator [3], the Phoebus alarm system software packages [4] are started manually using four Linux terminal windows in the Phoebus alarm user interface.

Upon the start of the packages, the Linux terminal windows for Apache Kafka Zookeeper, Apache Kafka server, Phoebus alarm server, and the Kafka message stream monitor are checked for error-free program execution.

For each part of the startup procedure, a specific test application is executed via the Phoebus Load Layout command in the Phoebus Window menu, Fig. 2.

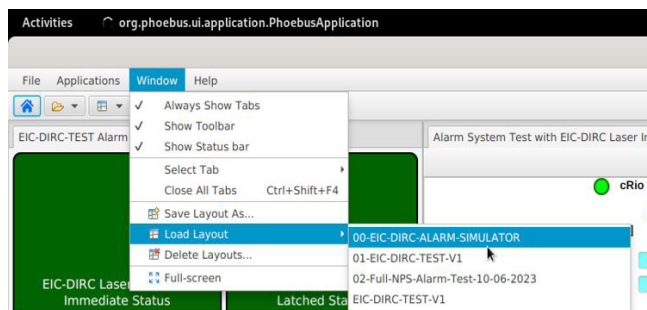


FIG. 2. GUI shows the Windows dropdown menu choices. Via the Load Layout tab (highlighted) the EIC-DIRC-ALARM-SIMULATOR, EIC-DIRC-cRIO-TEST, or EIC-DIRC-TEST files are loaded and executed.

For the first part of the start-up procedure, the Phoebus alarm system software is tested using the EIC-DIRC-ALARM-SIMULATOR, which determines the placement and size of the Phoebus programs on the display screen, Fig. 3.

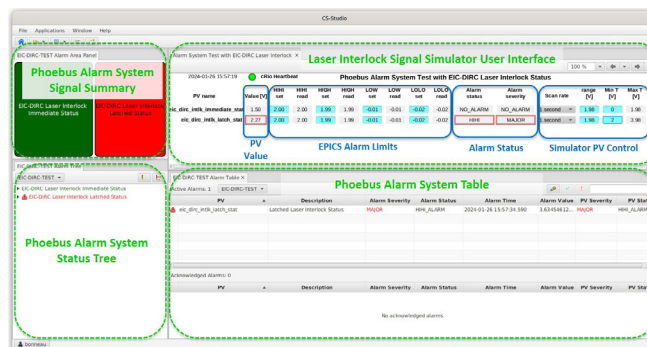


FIG. 3. Phoebus programs sized and displayed by EIC-DIRC-ALARM-SIMULATOR.

Phoebus then automatically starts the programs for the Phoebus Alarm System Signal Summary, Laser Interlock Sig-

nal Simulator User Interface, Phoebus Alarm System Status Tree, and the Phoebus Alarm System Table. The Phoebus alarm system is also checked for proper operation [5].

For Part 2 of the startup procedure, the load layout file EIC-DIRC-cRIO-TEST is executed. When EIC-DIRC-cRIO-TEST loads the user interface display for the softIOC, the execution of all Phoebus alarm programs and the simulator are terminated. EIC-DIRC-cRIO-TEST checks the cRIO and the EPICS softIOC, which must be working correctly before starting any of the Phoebus alarm programs.

Upon power up of the cRIO, the LabVIEW program on the cRIO is automatically started and begins digitizing the status signals from the laser interlock enclosure via an ADC in the cRIO chassis. The EPICS softIOC server is then started via a Linux terminal window.

The cRIO EPICS client sends status signals—PVs—via EPICS Channel Access (CA). The softIOC contains the user-controlled alarm limits for the PVs, compares the PV values with the alarm limits, and sets the alarm status and severity field of the PV if a limit is exceeded. The system is working correctly if the user interface display for the softIOC shows the expected status voltages and the alarms generated by the EPICS softIOC respond correctly to the user-controllable alarm limits.

In the last part of the startup procedure, the Phoebus alarm system programs are tested using the real-time laser interlock status signal PVs from the developed laser interlock electronics inside the laser lab, transmitted by the cRIO and softIOC. The EIC-DIRC-TEST-V1 layout is executed, which automatically starts the Phoebus alarm programs. The alarm system is then checked for proper operation.

Currently, the developed Phoebus alarm handler software for the EIC DIRC laser interlock system is being tested.

- [1] [T. Lemon, et al., \*Design and Features of the EIC-DIRC Laser Lab's Laser Interlock System\*, DSG Note 2023-01, 2023.](#)
- [2] [P. Bonneau, et al. \*Development of the CS-Studio Phoebus Alarm System for the EIC-DIRC Laser Interlocks\*, DSG Note 2023-43, 2023.](#)
- [3] [P. Bonneau, et al. \*Signal Simulator for Developing and Testing Phoebus Alarm System Software Packages for the Interlocks of the EIC DIRC Quartz Bar Laser Testing Lab\*, DSG Note 2023-56, 2023.](#)
- [4] [P. Bonneau, et al. \*Development and Implementation of the Phoebus Alarm System Software Packages for the Laser Interlock System\*, DSG Note 2023-49, 2023.](#)
- [5] [P. Bonneau, et al. \*Testing of the CS-Studio Phoebus Applications and Alarm System Core Programs\*, DSG Note 2023-06, 2023.](#)