## Upgrade of CS-Studio Phoebus and Alarm System Core Support Programs

Peter Bonneau, Mary Ann Antonioli, Aaron Brown, Pablo Campero, Brian Eng, George Jacobs, Mindy Leffel,

Tyler Lemon, Marc McMullen, and Amrit Yegneswaran

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

April 19, 2023

The CS-Studio Phoebus alarm system development computer has been upgraded to the latest version of Phoebus and the alarm system core support programs. The updates have been successfully configured, installed, and tested.

The Linux computer system hosting the CS-Studio Phoebus alarm system being developed [1] has been upgraded to the latest production release of CS-Studio Phoebus 4.7.1, which incorporates the most recent features of all Phoebus applications and which supports the latest versions of the alarm system core support programs Apache Kafka and Apache Maven. A summary of the programs upgraded on the alarm system development computer is shown in Table I.

The software upgrades require writing configuration scripts, installing, and testing the 2.13-3.3.1 versions of Apache Kafka ZooKeeper and Kafka server. The Apache Kafka programs host the alarm system message streams that are used to communicate between all sections of the alarm code.

The Kafka configuration scripts execute once during the upgrade and generate the initial Phoebus alarm system interprocess communication infrastructure by implementing the specific Kafka message streams for the Phoebus 4.7.1 version of the alarm system. Kafka Zookeeper was checked by verifying whether the management of the server and generation of log files were correct. Kafka server was checked by verifying whether the generation of the three Phoebus alarm system message streams were correct.

As a prerequisite for the build from source code, Phoebus configuration files were written to define the alarm system operating parameters. In the *alarm\_preferences.properties* file, settings and options such as the name of the alarm server, communication port numbers, time-out limits for EPICS process variables (PVs), and customization of the alarm user interface menus, Fig. 1, were defined.

	T ( 11 1	TT 1 1	
Program	Installed	Upgraded	Program function
name	version	version	summary
Apache	3.8.6	3.9.0	project management
Maven			tool used to build
			Phoebus from source code
Kafka	2.13-3.2.0	2.13-3.3.1	manages Kafka clus-
Zookeeper			ter system
Kafka	2.13-3.2.0	2.13-3.3.1	hosts alarm system
server			message streams
Kafka	2.0	3.0	monitors Kafka sys-
message			tem health
monitoring			
Alarm	4.6.10	4.7.1	monitors EPICS PVs
server			for alarm conditions
			via channel access;
			stores alarm con-
			figuration settings for
			each PV
Alarm	2.0	3.0	monitors alarm
server			server health
monitoring			
Alarm	4.6.10	4.7.1	user alarm moni-
system user			toring and system
interface			configuration

TABLE I. Program upgrade summary.

	moth																	
A =   B +   S   C																		
Hall C-NPS Alarm Area Panel		Display × Alarm Log Ta	sie ×															
	Crystal Temps	Hall-C NPS softioc-test-2																
Cooling System		PV Name NPS-C2-TEM	PV HH HH HCH Readback set Readback set \$ MP-1 25.57 21.00 21.00 20.90		HIGH Readback 20.98	LOW LOW LOE sck set Readback se se 15.02 15.02 15	LOLO SHI	LOLO LOLO sel Readback	Alarm Status NO ALARM	Alarm Severity NO_ALARM	Scan Rate 1 second *	Range 10	Min temp °C	Max temp 'C 21.00				
		NPS-C2-TEM	P-2 20.26	21.00	21.00	20.98	20.98	15.02	25.02	15.00	15.00	NO_ALARM	NO_ALAR	J 1 second		15	21.00	
Hall C NPS Alarm Tree	NPS-CZ-CHILLER-TEN	P-1 16.09 P-2 16.92	21.00	21.00	0 20.96	20.98	15.02	15.02 15.02 15.02 15.02	2 15:00	15.00	NO_ALARM	NO_ALARM	V 1 second ·		15	21.00		
Hall-C-NP5 +	1 10																	
Country System     PV Sourcesc RPS-C2-CHU	The LEMM 7 - MORONANCH WARM	Mail-C-NPS Alarm Table X																
PV: bonneau:NPS-CZ-CHILLE	TEMP-2	Active Name: 3 Hali-C	MP5 +												2			
Control Territol     Pri: doctores/NPS-CZ-TURE-1 - Maxim/India_ALARM (DUDIO     Pr: doctores/NPS-CZ-TURE-2 - MAXIM/INDia_ALARM (DUDIO     Pr: doctores/NPS-CZ-TURE-2 - MAXIM/INDia_ALARM (DUDIO		PV borneau MPS-C2-TEMP borneau MPS-C2-TEMP	Description           P-1         Crystal Zone Temp 1           P-2         Crystal Zone Temp 1					Alarm Severity Alarm Status Alar Innch HIGH, ALARM 2022-10-11 1 Innch HIGH, ALARM 2022-10-11 1			Alarm 2022-10-11 11: 2022-10-11 11:	n Time Alarm V 1.53.26.368 20.99935912 1.53.02.368 20.96846417		94 OK	Severity	PV S NO, ALAI NO, ALAI	itatus UM	
	borneau/MPS-C2-CHU		About	CS-Studi	o (Phoebus	5			×	20.968189517051	957 OK		NO_ALA	OK.				
			Installation Information								0							
	C	Name						Value						_			_	
	Acknowledged Alarms: 0	wiedged Alarms: 0. User Settings Location					.home/bonneau/phoebus											
				PV Instaliation Location				.home/bonneau/Downloads/phoebuo-master/phoebuo						Alarm Value	. PV	Severity.	PV	itatus
													the second se					
			Current Use	7 Directo	ry .			home	/botteau/D	ownload	s/phoebus-	master/phoebuc						

FIG. 1. Customized Phoebus 4.7.1 Alarm Test System user interface.

							CS	Studio												×
File Applications W	Jindow Help																			
😭 🐸 🖷 💌 🤘	5. 📑																			
Hall-C-NPS Alarm Area P	anel	Display × Display ×																		
	10													100 %	w 80					
	Hall-C NPS softloc-test-2																			
Cooling System	Crystal Temps	PV Name NPS-CZ-TEMP-1 NPS-CZ-TEMP-2	PV Readback 20.30 27.38	HIHI k set 21.00 21.00	HIHI Readback 21.00 21.00	HIGH 20.98 20.98	HIGH Readback 20.98 20.98	LOW set 15.02	LOW Readback 15.02	LOLO k set 15.00 15.00	LOLO Readbac 15.00	Alarm Status NO_ALARM	Alarm Severity NO_ALARM MAJOR	Sca Rate A 1 second 1 second	n F • •	Range °C 6 10	Min temp °C 15 21	Max temp °C 21.00 31.00		
Hall-C-NPS Alarm Tree	<u> </u>	NPS-CZ-CHILLER-TEMP-1 NPS-CZ-CHILLER-TEMP-2	17.13 17.54	21.00	21.00 21.00	20.98 20.98	20.98 20.98	15.02 15.02	15.02 15.02	15.00	15.00 15.00	NO_ALARM NO_ALARM	NO_ALARM	A 1 second A 1 second	v v	6	14 15	20.00 21.00		
Cooling System     PV: bonneau:NPS-     PV: bonneau:NPS-CZ     Crystal Temps	CZ-CHILLER-TEMP-1 - MA	Hall-C-NPS Alarm Table X Active Alarms: 2 Hall-C-NP PV	5 •		Descrip	ption		Alarm	Severity	Alarm	Status	Alarm	Time	Alarm Value	e PV	severity	! P	V Status		
PV: bonneau:NPS	-CZ-TEMP-1 - MINOR/LOW	bonneau:NPS-CZ-TEMP-1		Crystal Z	Crystal Zone Temp 1			MINOR		LOW_ALA	ARM	2023-03-30 11:36:42.813		15.0051270	ок		NO_ALARM			
# PV: bonneau:NPS-	CZ-TEMP-2 - MAJOR_ACK	bonneau:NPS-CZ-CHILLER-	TEMP-1	NPS-CZ-0	CHILLER-TER	мр-1		MAJOR		LOLO_AL	ARM	2023-03-30 11	:37:04.813	14.1697413	MAJOR	•	LOLO	ALARM		
		Acknowledged Alarms: 1																		
		PV		Description			Alarm Severity		Alarm Status		Alarm Time		Alarm Value PV Severit		Severity	y PV Status				
				Crystal 2	Ione Temp I	2		MAJOR_A	.CK	HIHI_ALA	IRM	2023-03-30 11	:32:41.813	21.0299076	MAJOR	1	HIHU	LARM		

FIG. 2. User interface for the Phoebus 4.7.1 Alarm Test System.

Apache Maven 3.9.0 is the project management tool used to build Phoebus from source code. Once the Maven upgrade was completed, it was used to build the Phoebus core program and applications. After building each section of the Phoebus source code (called a unit), Maven runs a test of the unit to verify the proper operation of code in that section. Upon completion, the 13K+ line build log file was reviewed. No errors were reported in the log file.

To verify the correct operation of the build, the Phoebus applications and alarm core support programs were tested, first the automated startup sequencing of the alarm system core support programs [2]. Next, using the Phoebus alarm test system softIOC [3], and the user interface for the alarm test system, Fig. 2, a series of tests [4] were run on the alarm system development computer. All tests passed.

In conclusion, the CS-Studio Phoebus alarm system development computer has been upgraded to version 4.7.1, as have the alarm system core support programs. The upgrades have been successfully configured, installed, and tested.

- [1] P. Bonneau, et al., *Proposal to Implement Alarm System* in Control System Studio Phoebus for the Hall C Neutral Particle Spectrometer, DSG Note 2021-37, 2021.
- [2] P. Bonneau, et al., Automated Startup and Sequencing of the CS-Studio Phoebus Alarm System Core Programs, DSG Note 2022-16, 2022.
- [3] P. Bonneau, et al., *Development of the EPICS Software* <u>Input/Output Controller for Testing the Phoebus Alarm</u> <u>System of the Hall C Neutral Particle Spectrometer</u>, DSG Note 2022-06, 2022.
- [4] P. Bonneau, et al., *Testing of the CS-Studio Phoebus Applications and Alarm System Core Programs*, DSG Note 2023-06, 2023.