

UPGRADING AND ADAPTING TO CS-STUDIO PHOEBUS AT FACILITY FOR RARE ISOTOPE BEAMS

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Upgrading to CS-Studio Phoebus

- CS-Studio Phoebus is a significant upgrade to CS-Studio.
- Alarm System
 - FRIB deploys over 20 instances of alarm server along the beamline.
 - New Phoebus alarm server uses Apache Kafka vs. the old based on ActiveMQ and relational database.
 - Faster performance with the importing time of the alarm tree configuration.
 - Logs the history of alarm states and alarm configuration updates.
 - Includes a mode to disable email notifications for alarms temporarily.
 - Authorization mechanism extended for per-alarm-server instance basis.

| File Applications Window Hol | | | | | | | | (Area) | | | | | |
|---|---|----------------|------------------------------|--|-------------|---------------|----------------------------|--|-------|--------------------------|----------|---|----------------------|
| Real Process and and | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| Building, OPS Alarm Table X | | | | | | | | Autor, OPS Alarm Tree X | | ALARM, DPS. Armuniator > | | | |
| ACTIVE Martiel TB2 ALARM OPS | | | | | | | | | 1 E E | | | | Test. Clear Hossages |
| PY . | Description | | Alarea Status | Alarm Time | Alarm Value | PV Severity | Py Status | A DOWN | | Time Received + | Severity | Description Highly Mann-112 CDI 3 Crun - 26 Helium Reader Land | |
| | | | Dispressed | 2823-09-26 07.35.28.056 | | | STATE ALARM | * A - Atlanta | | | | Report Adams Line Coll & Crys All Person Reader Laws Report Alarms Line Coll & Crys MCHellum Reader Laws | |
| CISB PPSPUC NOSSLAUND RST. | | MINOR | STATE ALARM | 2823-09-25 15:38:45.290 | | 04 | NO ALARM | 1 6-87 (C) | | 2023-09-26 29 Sel 44.733 | | Americator stated | |
| | Artenis Vacuum - Intestion Ion Gauge Pressure | MAJOR. | HER, ALADA | 2823-89-25 17:07:54.229 | | | NO,ALARM | # <- 4050 # <- 4050 | | | | | |
| MUSELIN, DOMEAN, NO. | Arlemis Vacaure - Extraction Ion Gauge Pressare | MAJOR. | HER, MARK | 2823 09 25 16 44 49 329 | 3.82795428 | | NO,MARM | * # OLDET | | | | | |
| | Marries W - Horsenine Angliller Fallenbed Parent MP 808 - Wagnet Viceum Vessel CC-S Pressore | MINOR | HIGH, ALMINI | 2823-09-25 15:58.04.827 2823-09-26 41.09.08.427 | | OK . | ND ALARM NO ALARM | Fix L887 | | | | | |
| PL FIGL CCS DORD VF RD | HP BCR - Magnet VScaum Hease CED Pressure P5 F253 Variante - P53 Cold Cathoda Pressure | 14/9/20 | LINE HARM | 2823-09-25 12:30 18:005 | | ARRENT R | LINK ALARM | * (2) + 1.4.597 * (2) + 1.4.597 | | | | | |
| | P5 F253 Vacuum - Target Hagnet Chamber CC5 Pressure | | LINE ALMAN | 2823-86-22 09-35 12-310 | | ABAGIN. | LINK ALARM | | | | | | |
| | | | LINC, KLAPN | 2823-09-25 12-38-28.121 | | | LINK, ALARM | * @ erst | | | | | |
| | PS F252 V3ceum-P53 Cold Cathode Preciare | MINOR MINOR | UNCAUNT | 2823-09-25 12 38.21.122 2823-09-25 12 38.21.622 | | NOLDR. | LINK, ALARM LINK, ALARM | • (3.4.0) | | | | | |
| | PS FESE Vacuum - PS4 Cold Cathodie Pressure PS FESE Vacuum - PS5 Cold Cathodie Pressure | 10000 | LINC ALMM | 2823-09-25 12:39:21.672 | | ADDA. | LINK ALARM | · (\$155) | | | | | |
| | | 16925 | LINC ALMAN | 2822 09 12 20 11 33 368 | | NO.CR. | UNK ALARS | * @ + 405 | | | | | |
| | Ph F253, Vocaum - Torget Chantow Prarv Essige Process | | HER, NAME | 2823-09-25 05:44.58.754 | | NUCE | HER, ALAVIN | +@+n | | | | | |
| #5,9351,95,00363 v9,80 | PS FISE Vscsum - Wedge Magnet Chamber Prani Gauge | MAJOR. | HER_ALARM | 2823-09-22 09:30:14:522 | 0.85 | NAVOR | HER, ALADR | | | | | | |
| | PS F251 Vocaum - Wedge Chamber Feshi Geoge Pressure PS F251 Vocaum - Tartet Resolver Station Fault | | HER, ALARM | 2823-85-25-64-57-38-713 2823-89-26 01-32-35-980 | | NHJOR CK | HER, ALADH | | | | | | |
| | PS P212 Vacuum: Target Paughing Station Fault P3 P231 Vacuum: - Shedge Paughing Station Fault | LADEFINID | Discoveries had | 2023-00-20 27-32-31.002 | | ox in | NO, M. MIN | | | | | | |
| | Wedge Assembly - 011.63 Sitt Temperature | | Discorrected | 2822-09-26-07-22.31.962 | | 05 | NO ALARM | | | | | | |
| 2 PS FISLSCK DULKST AD 2 | Wedge Assembly - 011.63 Sit Temporature | UNDERING | Disconnected | 2823-05-26 47:22 31.950 | | 04 | NO,ALARM | | | | | | |
| | PS F151 Vacuum - PS1 TMP Current Grow | | LOLO, MARN | 2823-09-22 10 13 14 264 | | | LOLO, ALMIN | | | | | | |
| A PLANA THE DOMEST | PS P335 Viscourt - P53 194P Current Braw P5 P335 Viscourt - P53 194P Current Braw | MAJOR. | LOLD, ALARM | 2823-09-02 10-13-11-982 2823-09-02 20-13-13-370 | | NUCE | LOLO, ALARM | | | | | | |
| | PS FEST Macanet. PSA TAP Carment Innar | MARCH. | LOUD ALARM | 2823.05.22 10 14 58 323 | | No.CR | 1010 41400 | | | | | | |
| | PS FUEL Variant, PER TAP Carment Gran | 185,605 | LOLD MARK | 2823.05.22 10 12:54.490 | 0 | NUCE | LOLO ALATIN | | | | | | |
| PR. F181. THP. D1175.4 MD | Ph PERE View and PRE 1942 Canwood Draw | MAJOR. | LOLD, MARK | 2823-09-22 10-21-18-767 | | 10,08 | 1010,01414908 | | | | | | |
| | Verdge Asserbly - Wedge Temperature | UNDEFINID | Distanceched | 2823-09-26-07.32.31.960 | | CK . | NO,ALARM | | | | | | |
| | Wedge Assembly - Wedge Temperature Wedge Assembly - Wedge Meter Temperature | | Disconected Disconected | 2823-09-26-07-22-34.960 2823-09-26-07-22-34.962 | | CK CK | NO ALARM NO ALARM | | | | | | |
| PL7582-CE0_85387-VP_R0 | P5 F552 Variation - P53 CC0 Permane | MADE NO. | LOUD ALARM | 2823-09-25 12-22-56.992 | | No. CH | HOLD ALARM | | | | | | |
| | Ph F132 Viceum - P52 CCO Pressure | | | 2822-09-25 09-33-42.330 | | | LOLO ALMON | | | | | | |
| 1 P5 F152 P5 01315 VP PD | PS FEED VScoutt-PS2 Marci Sauge Process | MINOR | HERE ALARM | 2823-09-25 30.31.53.697 | | MINUR. | HIGH, NUMBER | | | | | | |
| | P5 SC31 - Magnet Temperature High | LADEFINED | Disconected | 2823-09-26-07-22-31-962 | | CK. | NO, ALARM NO. ALARM | | | | | | |
| | PS 5033 - Hagest Tomperature High PS 5031 - Hagest Tomperature (see High | | Discovershed Discovershed | 2823-09-26-07-32-31-960 2823-09-26-07-32-31-960 | | CK CK | NO.ALMIN NO.ALMIN | | | | | | |
| | P5 Sc31 - Magnet Temperature High | INDEFINIT | Discover had | 2022 00 00 01 12 10 000 | | 14 | NO. M. ARM | | | | | | |
| 2 PS.5034/9C.98795/T.Rd | P5 5031 - Magnet Tomperature High | | Otermnexted | 2823-09-26-67-22-36-962 | | 04 | NO,ALARM | | | | | | |
| | P5 5032 - Magnet Temperature High | | Disconnected | 2823-05-26 47-22-31.999 | | 66 | NO,ALMIN | availab (05 alarm area bara) n | | | | | |
| 🧏 PE NEDO/YO NEITEJ /T P.D. | PS 3022 - Hagnet Temperal are High | UNDEFINID | Disconnected | 2823-09-26 01.32-31.869 | | OK . | NO ALMEN | | | | | | |
| Acknowledged Alerne: 306 | | | | | | | | | | | | | |
| | Description | | | Alarm Time | | | | | | | | | |
| | 805-885 - OCCT 05578 Communication Last MERT 875 Vacuum - Beamline Pressure Interteck | INVALID_ACK | | 2023-89-39 15:05 33.258 2023-89-39-39-08-23 #3.184 | | | COMP ALARM STATE ALARM | | | | | | |
| | Adore 115 Vacuum - Reprint Pressure Interests | maning and | | 2021-09-25-08-27-03-188 | | | STATE ALLER | Editabil | | | | 2.450,9887 | |
| & PL DECLINA DOUTLAN KITS | | | | 2022-09-20 10:24 14:462 | | | STATE ALARS | | | | | | |
| TE SECLINA DESIGNAL RES | | | UNIC ADARD | 2023-09-25 15:24 54.402 | | PINCO | UNCALAIM | | | | | | |
| # PE_SECLPT_D00007_FD_1 | | | 1010,8,48.9 | 2023-89-21.18-02-93-830 | | | LOLO, ALARM | | | | | | |
| # PE, SPELTER, DOBLINE, NUT, NUT, & PL SPELTER, DOBLINE, POWERD | | INNON, ACK | STATE ALARM | 2023 09 25 12 54 96 852 | | MAGE. | STATE, ALARM | | | | | | |
| THE SECOND DESIGN REPS | | TOPLE ACK | UNK ALAIM | 2023-01-01.06.52.56.370 | | PRALO | UNK RUNN | | | | | | |
| (E) FE, ISBC2-HW D0577 8.K, 8575 | #P ECR P5 - LODEV VW P5 Interfacts | WWLD.ACK | UNKALAM | 2023-89-81 08:52 58:378 | Interleck | MALO . | UNCRAFT | | | | | | |
| | RP ECR - Reform Pressure | | UDUD, MARM | 2023-89-25 15 27-83 946 | | | LOLD, ALARM | | | | | | |
| | HP 820 HF - Microsove Art piller Inter Inch | | STATE, MARK | 2023-09-25 15 22 28 347 | | MAGER. | STATE_ALABA | 101 | | | | | |
| E FL_SPC2.TMP_00053.PLT_REPS | RP ECR Vacuum - Injection TRP Fault RP ECR Vacuum - Extra fact TRP Fault | HANDR ACK | STATE MAAN | 2023-09-25 15:22 28.347 2023-09-25 15:22 28.347 | | MALER. | STATE ALARM STATE ALARM | | | | | | |
| THE LEAST AND DESIGNATION OF | | | UST ALARM | 2023 89-25 15 22 28 307 | | Rode O | LOT ALLOW | | | | | | |
| THE LEAST ANCE, DOMENTIAL LITTLE. | | WWLD, KOK | UDF, MAAN | 2023-09-06 12-37-00-681 | ADK | PRALID | UCP_ALKER | | | | | | |
| (THIS HERE AND A COMPANY LODAL) | | | UDI, MARK | 2023-09-06 12:37-00-681 | | PRALD | UDF, ALARM | | | | | | |
| TE NEWTON: DIGIGAN, LTDI, A. TE NEWTON: DIGIGAN, R75, T. | MEDT M - First Buncher Interfects | WWLD, KX | UDF_NAAM UDF_NAAM | 2023-89-86 12 37-96-889 2023-89-86 12 57-96-889 | | MALO . | UCF_ALARM | | | | | | |
| S PENERT INC. DUDINAL, PORT. 1. | | | 100, 4, 400 | 2023-09-06 12 37 96 869 | | | LOF, ALARM | | | | | | |
| | MIT II - Second Burcher Terry Taul | | UNI MARK | NUTL PROFE TO DO AN ART | | PROFESSION IN | LET ALTER | | | | | | |
| | BFD Hiscaum - Caualiar Pressure Interfects | | STATE MAAN | 2023-09-06 12 37-06 557 | | MALER. | STATE ALABR | 640 | | | | | |
| # PENONCOUSING, KNO | | INNOR, ADX | STATE, MAAN | 2023-89-86 12:37-96.557 | | MADE. | STATE, ALABR | 1112 | | | | | |
| E HUNOMEDING CONSIGNATION AND | RECORF - Interlacts RECORDENCE - Foreign Pressure Tarles Th | INNON, ACK | STATE ALARM | 2023-09-06 10-55 36.145 | | MALOR. | STATE ALSO | | | | | | |
| E RE NO RE MORE WITH | BPD Social - Fondine Pressure Tarbo TS BPD Statute - Fondine Pressure Tarbo TS | INNOR, ADX | HIR MARK | 2023-09-05 15 28 26 205 | | MALER. | HER, ALARM | | | | | | |
| | REPAILANT FORMER FEMALE FORMER | manife with | STATE & ARM | 2023 85-86 12 32 66 558 | | MAGE | STATE ALARM | | | | | | |
| | MPD-Amplifier - Screen GOW Provider | INNON, ACK | LOLD, M.MM | 2023-09-06 12:37-96:587 | | | LOLO, ALARM | | | | _ | | |
| # PERFORMANCE F.FD | 872-long-blar - Anada LOV Fire Lew | INNON, ACK | UDUD, N.M.M. | 2023-09-06 12-17-00.107 | | | UR-0,ALMIN | | | | | | |
| E HUNGATENBELFED | RFD-King Miler - 2006/W LD, Filler LDer | HANDR, ACK | LOLD, M. M.M. | 2023-09-06 12:37-06:557 2023-09-06 12:37-06:557 | | | LOLO, ALARM | | | | | | |
| | MD-Ampiller - SHN Match L.D. Row Low SCS3 Vacuum - Respire Pressare | | UDUD_NLARM HTML ILLARM | 2023-89-86 12:37.06.557 2023.89.25 15:28-96.273 | | | LOLO ALARM 1994 ALARM | | | | | | |
| # PE_SCS1 #PG_DED01VP_R0 # PE_SCS1 #PG_DED01VP_R0 | SCS1 Varaum - Reighting Pressare SCS1 Varaum - Reighting Pressare | HANDA, ACK | 100,0,000 | 2023-09-25 15 28-96 273 2023-09-25 15-58-45 092 | | MALE R. | THE ALLER | 105 | | | | | |
| E HE SCALAPE DETSJ VP RD | SC62 VIscault - Reughing Pressare | INNON, ACK | HIN, NAME | 2023-09-25 12:58 46.000 | 1.08-0 | MALER. | HER ALKER | | | | | | |
| T #5_F25L006_0899239P_R0 | FS FESE Vacuum - Target Chamber COS Pressare | | UNICALAIM | 2023-09-25 12:38 14:121 | 0.0 | MINOR | UNCAUNT | | | | | | |
| | 15 F252 Vacuum - Beam Dang-Dramber CCE Pressure | | UNK, ALADA | 2023-89-34 12-42-52 188 | | MINOR | UNC ALASS | | | | | | |
| C. M. FILL COL. (11143 VP.)40 | PEPER Values - Wedge Hagnet Chamber COS Pressure | INNER, ACK | 100,0100 | 2023-09-29 12-38 13-767 | | Minute. | URC, RAPIN | | | | | | |

Figure 1: Alarm System View in Phoebus showing alarm table (left), alarm tree (top center), annunciator (top right) and area panel (bottom right).



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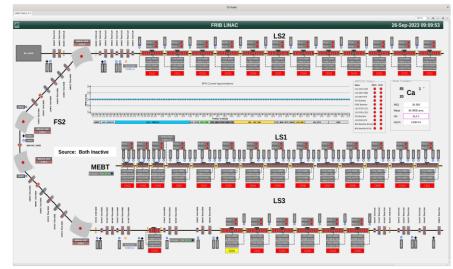
| | | <u>~ ! ! [</u> |
|-------------------------|-------------|----------------|
| Alarm Time | Alarm Value | PV Severity |
| 2023-09-06 12:37:29.289 | | UNDEFINED |

Figure 2: Mode to disable/re-enable email notifications.

Upgrading to CS-Studio Phoebus

Operator Interface Displays

- Utilized the auto-conversion tool provided with Phoebus to convert displays.
- Auto-conversion tool's advantages :
 - » Converted most widgets without needing any modifications
 - » Reported through warnings about missing widget, property, or script API.
 - » Corrected widget types when used in a wrong context in the old BOY display.
- FRIB users utilized script for bulk-fixing the common issues in converted files.
- User effort required in re-creating the old CS-Studio's perspectives with Phoebus equivalent "Layouts".
- Manual effort is restricted to fixing scripts with new APIs and plot widget type.





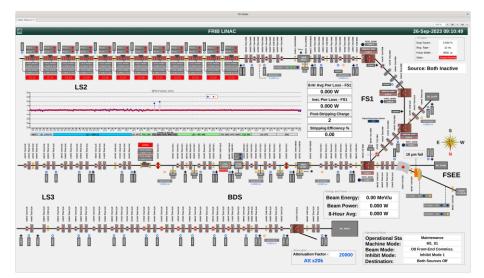


Figure 4: FRIB LINAC East in Phoebus Display Runtime



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Upgrading to CS-Studio Phoebus

Save and Restore

- Tool to take snapshots of PVs at a specific time and write values of a snapshot back to PVs at a later time.
- Backend for Phoebus Save-and-Restore is designed with Elastic Search for the storage for savesets and snapshots.
- Git migration tool with the Phoebus Save-and-Restore service to migrate hundreds of savesets and snapshots.
- Other Tools
 - Improved for user experience and system maintainability.
 - The Probe tool extended to display PV values in various formats.
 - A new tool "3D Viewer" has been added to allow users to configure 3 dimensional structures using spheres, cylinders and boxes which can be rotated, zoomed and moved when rendered on screen.

Summary

- FRIB is in the process of transitioning to the upgraded CS-Studio Phoebus.
- Utilizing a combination of auto-conversion tool, user scripts and manual testing to migrate our large number of displays to Phoebus Display Builder.
- Deployed multiple instances of the Phoebus alarm server across the FRIB beamline that has been robustly providing the alarm monitoring to the FRIB Operations and various engineering groups.
- In coming months, plan to transition all our displays to Phoebus for all FRIB beamlines and decommission the old CS-Studio and its services entirely.



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| ave And Restore × |
|--|
| Filter |
| Proot folder (http://phoebus-sar.ftc:8080) |
| Migration 2023-09-14 10:28:42 |
| 🔻 🗁 rf |
| FE |
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| ▶ 🗁 FS2 |
| ▶ 🗁 gts-clock |
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| Segments |
| SingleCavity |
| Amplifier |
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| ▶ <u>■</u> D0987_F3 |
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| Figure 5: Migrated Save-and-Restore |

Tanvi Ashwarya, 10 October 2023, Slide 4