

**Design of real-time alarm system for CAFe** 

N.Xie\*, Y.H.GUO, R.WANG, B.J.WANG, IMP, LAN Zhou 730000, P.R. China



## Introduction

CiADS plays an important role in the safety of spent fuel handling.CAFe as a prototype of CiADS.Its research purpose is to develop clean, efficient and safe nuclear fission energy, and to solve the future energy supply. Therefore, an alarm system is used to monitor the operating status of the equipment to improve the maintainability of the equipment.

# Methods





# Results

The interfaces of fault equipment and alarm data are displayed in the central control room and mobile terminal respectively.



| re.     | NI                   | 504                  | .voet                | EXT                           | 110 4.               | .00 E                 | LEBI                       | 21.09*        |
|---------|----------------------|----------------------|----------------------|-------------------------------|----------------------|-----------------------|----------------------------|---------------|
| 3       | .3E-7                | mba                  | r                    | 1.2E-7                        | mbar                 |                       | 1.26-                      | 7 mba         |
| P<br>Pv | 4.2<br>0.0           |                      | kPa<br>mbar          |                               | Pr<br>LHe            | 7.4                   | 472                        | w             |
| ć       | CL 1                 | 0                    | L 2                  | CL<br>37.                     | 3                    | CL 4                  |                            | 1.5<br>4.2    |
| M       | AGNE                 | •                    | (9<br>0.608          | 6)<br>1                       | Curren<br>83.87      | it (A)                | Rate                       | (A/s)         |
|         | INJ                  | 0                    | 0.601                |                               | 116.1                | 9                     | 0.00                       | 340           |
|         | EXT                  | 0                    | 0.531                |                               | 87.25                |                       | 0.07                       | 20            |
| F 0 0   | Puller<br>0.0<br>0.0 | kV<br>mA<br>m        |                      | Bias<br>218.0<br>1.38<br>10.0 | 2 V<br>mA<br>m       |                       | Sp<br>0.00<br>0.00<br>10.0 | kV<br>mA<br>m |
| 0.0     | ven 1                | vo                   | .0                   | A                             | Oven 2               | 2<br>v                | 0.0                        | A             |
| He<br>W | 9 G<br>P W<br>1 21.  | M(°)<br>T W<br>02 8. | 165.0<br>F-A V<br>18 | VF-B                          | 02<br>WF-C C<br>8.61 | GA(°<br>omp.\<br>3.72 | ) -0<br>WP Cor<br>24       | .0<br>mp.W    |

# Conclusions

- The alarm function of central control room and mobile terminal is realized
- The throughput of alarm information is improved
- Reduced troubleshooting time
- The maintainability of cafe is improved

## Introduction

China Initiative Accelerator Driven System (CiADS) plays an important role in the safety of spent fuel handling. This is a global challenge that has not yet been resolved by our country and the international nuclear energy community. Chinese ADS Front-end Demo Linac (CAFe) as a CiADS prototype. Figure 1 is the layout of the CAFe superconducting linear accelerator, which consists of nine parts. CAFe as a prototype of CiADS.Its research purpose is to develop clean, efficient and safe nuclear fission energy, and to solve the future energy supply. Therefore, the stable operation of the CAFe equipment is particularly important for the debugging and stable operation of the beam experiment. The alarm system can effectively improve the maintainability of CAFe.

①ECRIS: Electron Cyclotron Resonance LEBT: Low Energy Beam Line
②RFQ: Radio Frequency Quadrupole
③MEBT: Medium Energy Beam Line
④CM1
⑤CM2
⑥CM3
⑦CM4
⑧HEBT: High Energy Beam Line
⑨Beam Dump

Fig 1. Layout of CAFe superconducting linear accelerator





## IOC



It is used to obtain the data of the monitoring equipment and define the alarm threshold of the equipment.

#### Alarm service

It is the core of the alarm system. It can record alarm status, update alarm status and send alarm information.

#### Kafka

Realize two functions: ①Store the information of four alarm topics. ② Send alarm information.

## Phoebus

Display alarm interface: Alarm Tree , Alarm Area Panel, Alarm Log Table, Annunciator and Alarm Table.

Fig 2. The framework of the alarm system.



#### Fig 3. Deployment of remote interface

- In order to ensure data security, the server and enterprise WeChat account are deployed to the intranet and the extranet respectively.
- Intranet: The opi interface drawn by CS-Studio is deployed in the tomcat server on the intranet.
- Extranet: Deploy enterprise WeChat ac-count, and log in to the enterprise WeChat account through the administrator's authorization for staff in the office.
- The staff can view the real-time remote interface anytime and anywhere to understand the experimental situation.

# **Results**



#### Alarm Area Panel



#### Alarm Table

| ctive Alarms: 66 | MPS *           |                |                 |                |              |                         |             |             |            |
|------------------|-----------------|----------------|-----------------|----------------|--------------|-------------------------|-------------|-------------|------------|
|                  | PV              |                | Description     | Alarm Severity | Alarm Status | Alarm Time              | Alarm Value | PV Severity | PV Statu   |
| MPS F03:PS HE    | 8T-T0_CH01:In5T | MPS F03.P5 HE  | BT-TD CH01:InST | MAJOR          | LOLO ALARM   | 2020-12-03 11:03:53.920 | 0           | MAJOR       | LOLO ALARM |
| MPS_F04:PS_CM    | 12-SOL2:InST    | MPS_F04.PS_CN  | 2-50L2:InST     | MAJOR          | LOLO_ALARM   | 2020-12-03 10:33:28.798 | 0           | OK          | NO_ALARM   |
| MPS F04:PS CM    | 2-SOL4:InST     | MPS FD4:PS CN  | 2-SOL4:InST     | MAJOR          | LOLO ALARM   | 2020-12-03 10:33:30.699 | 0           | OK          | NO ALARM   |
| MPS Soft:BD A    | CIS:STATUS      | MPS Soft BD A  | IS:STATUS       | UNDEFINED      | Disconnected | 2020-12-03 08-21:51.998 |             | OK          | NO ALARM   |
| MP5_Soft BD_A    | CIS1:STATUS     | MPS_Soft:BD_A  | IS1:STATUS      | UNDERINED      | Disconnected | 2020-12-03 08:21:51 999 |             | OK          | NO ALARM   |
| MPS Soft BD A    | US2.STATUS      | MPS Soft BD A  | IS2:STATUS      | UNDEFINED      | Disconnected | 2020-12-03 08-21:51.998 |             | OK          | NO ALARM   |
| MPS Soft BD A    | KIS3 STATUS     | MPS Soft BD A  | 053:STATUS      | UNDERINED      | Disconnected | 2020-12-03 08:21:51.998 |             | ок          | NO ALARM   |
| MPS Soft BD A    | 054.STATUS      | MPS_Soft:BD_A  | US4:STATUS      | UNDEFINED      | Disconnected | 2020-12-03 08:21:51 999 |             | OK          | NO_ALARM   |
| MPS Soft BD A    | CISS:STATUS     | MPS Soft BD A  | ISS-STATUS      | UNDEFINED      | Disconnected | 2020-12-03 08:21:51.999 |             | OK          | NO ALARM   |
| MPS Soft BD A    | CIS6:STATUS     | MPS_Soft:BD_A  | 156:STATUS      | UNDEFINED      | Disconnected | 2020-12-03 08:21:51.999 |             | OK          | NO ALARM   |
| MPS_Soft BD_A    | CIS7:STATUS     | MPS_Soft:IID_A | IS7:STATUS      | UNDERMED       | Disconnected | 2020-12-03 08:21:51.997 |             | OK          | NO ALARM   |
| MPS Soft BD A    | US8:STATUS      | MPS Soft BD AL | IS8:STATUS      | UNDEFINED      | Disconnected | 2020-12-03 08:21:51 998 |             | OK          | NO ALARM   |
| MP5_Soft:BD_A    | KIS9 STATUS     | MPS_Soft:BD_A  | US9:STATUS      | UNDEFINED      | Disconnected | 2020-12-03 08:21:51.997 |             | OK.         | NO ALARM   |
| MPS_Soft BD_A    | RIS10 STATUS    | MPS_Soft BD_A  | 0510-STATUS     | UNDEFINED      | Disconnected | 2020-12-03 08:21:51.997 |             | OK.         | NO_ALARM   |
| MPS_Soft:BD_A    | CIS11:STATUS    | MPS_Soft:IID_A | 0511:STATUS     | UNDEFINED      | Disconnected | 2020-12-03 08-21:51.997 |             | OK          | NO_ALARM   |
| MPS_Soft:BD_A    | CIS12:STATUS    | MPS_Soft:BD_A  | 0512:STATUS     | UNDEFINED      | Disconnected | 2020-12-03 08:21:51.998 |             | OK          | NO_ALARM   |
| MPS_Soft:BD_A    | OS13-STATUS     | MPS_Soft:BD_A  | 0513-STATUS     | UNDERINED      | Disconnected | 2020-12-03 08:21:51.999 |             | OK          | NO_ALARM   |
| MPS Soft BD A    | RIS14:STATUS    | MPS_Soft:BD_A  | 1514:STATUS     | UNDEFINED      | Disconnected | 2020-12-03 08:21:51.998 |             | OK          | NO_ALARM   |
| MPS_Soft BD_A    | CIS15:STATUS    | MP5_Soft:8D_A  | US15 STATUS     | UNDEFINED      | Disconnected | 2020-12-03 08:21:51 998 |             | OK          | NO_ALARM   |
| MPS_Soft BD_A    | CIS16:STATUS    | MPS_Soft:8D_A  | US16:STATUS     | UNDERINED      | Disconnected | 2020-12-03 08:21:51.998 |             | OK          | NO_ALARM   |
| MP5_Soft:BD_A    | CIS17:STATUS    | MPS_Soft:BD_A  | 0517:STATUS     | UNDEFINED      | Disconnected | 2020-12-03 08:21:51 998 |             | OK          | NO_ALARM   |
| MPS_Soft:BD_A    | 0518:STATUS     | MPS_Soft:BD_A  | IS18:STATUS     | UNDEFINED      | Disconnected | 2020-12-03 08:21:51.998 |             | OK          | NO_ALARM   |
| cknowledged Alar | ms: 3           |                |                 |                |              |                         |             |             |            |
|                  | PV              | *              | Description     | Alarm Severity | Alarm Status | Alarm Time              | Alarm Value | PV Severity | PV State   |
| E MPS_Core:PS_C  | M3_HEBT:InST    | MPS_Core:PS_C  | 43_HEBT:InST    | MAJOR_ACK      | LOLO_ALARM   | 2020-12-03 15:28:31 203 | 0           | MAJOR       | LOLO_ALARM |
| MPS_Core:PS_N    | IEBT:InST       | MP5_Core:P5_M  | EBT:InST        | MAJOR_ACK      | LOLO_ALARM   | 2020-12-03 14:36:00.104 | 0           | MAJOR       | LOLO_ALARM |
| E MPS F03:PS HI  | BT-T1 Q03:MST   | MPS F03-PS HE  | BT-T1 003-inST  | MAIOR ACK      | LOLO ALARM   | 2020-12-03 14:22 33 717 | 0           | MAJOR       | LOLO ALARM |

## Alarm Log Table

|                         |                                  |                        |                           | Ch-Madio ()             | Phoebus()               |                  |                 |             |        | *                |
|-------------------------|----------------------------------|------------------------|---------------------------|-------------------------|-------------------------|------------------|-----------------|-------------|--------|------------------|
| Alarm Log Table #       |                                  |                        |                           |                         |                         |                  |                 |             |        |                  |
| Query powthinner        | ty-"Sciencepen"&correct_soverty- | "Scurrent_message="6us | er = "Shoet = "Scammand + | dutart+7 deptéend+now   |                         |                  |                 |             |        | (bears)          |
| Config                  | PV                               | Severity               | Message                   | Time                    | Message Time            | Current Severity | Current Message | Command     | User   | Hast             |
| state-MMIS/Power-fee    | MPS_PD4-PS_CM2-EXCV0-INET        | OK                     | 040                       | 2023-03-06 35-33-34.628 | 2021-02-06 15 23-14 528 | 0.6              | NID, ALARA      |             |        |                  |
| Late MPL/Power-fea-     | MPS_FD4.PS_CH2-SDL3.InST         | OK                     | OK                        | 3021-01-06 15-88-14-528 | 2031-01-06 15 33-14 529 | OK.              | ND_ALARM        |             |        |                  |
| state./MPS/Power-Sol    | MP5_F04.P5_CH2-50L2.H/6T         | OK                     | OK.                       | 2021-01-06 15:23:14 528 | 2031-01-06 15:33:14.528 | 04               | ND_ALABA        |             |        |                  |
| shate (APS/Power-Sul-   | MPS F04 P5 CH1-DCH3-H5T          | OK                     | OK                        | 2021-01-06 15:33:14.528 | 2023-02-06 15:22:14:528 | 06               | NO ALABA        |             |        |                  |
| state MPLPower-So-      | MPS_PD4_PS_CH1-SOL2 INST         | OK                     | OK                        | 2021-01-06 15:33-14.528 | 2031-01-06 15:33:14:528 | OK               | NO ALARM        |             |        |                  |
| state /MPS/Power-Sol.   | MP5_P04 P5_CH1-SOLA InST         | OK                     | OR                        | 2021-01-06 15:33 14.528 | 2021-01-06 15:33:14 528 | OK               | ND_ALARM        |             |        |                  |
| state MPLPower So.      | MPS, FD4 PS, CM2-DCV2-In/RT      | OK                     | OK                        | 2021-01-06 15-33-14-528 | 3021-02-04 15-33-14 328 | DK.              | NO.ALARM        |             |        |                  |
| command (RPS/Pow        | Primer Baddly                    |                        |                           |                         | 3921-01-06 18:33 14 504 |                  |                 | acknowledge | insec. | <b>incathoot</b> |
| state (MPG/Power-So.    | NPS_Core-PS_CH4_DUMP-INST        | enapoin.               | LOLO_ALARM                | 2021-01-06 15-29-41-362 | 2021-01-06 15:22:02.517 | 0.6              | NO_ALARH        |             |        |                  |
| state /MPS/Prest-Su     | HIPS_FO3:PS_CM4-SOLA.HIST        | BAALOIR                | LOLD_ALARM                | 2021-01-06 15:29-41.367 | 2021-02-06 15:32:54.798 | OK               | NO_ALARH        |             |        |                  |
| state /HPS/Power-Su     | NPS_P02-PS_CH4-DCV+InST          | MALOR                  | LOLO_ALARM                | 2021-01-06 15:29 41 362 | 2021-01-08 15:31:57.392 | OK               | NO_ALARM        |             |        |                  |
| state APS/Press So.     | MPS P05-P5 CM4-DCH4-HST          | MALOR                  | LOLO ALABM                | 2021-01-06 15:29-41.362 | 2021-02-08 15-33-54-091 | OK               | NO ALARM        |             |        |                  |
| state MPS/Power-So      | MPS, Core PS, CH4, DUMP HIST     | MALOR                  | LOLID, ALARM              | 2021-01-06 15-29-41-382 | 2021-01-08 15-29-46 918 | MAQOIN           | LOLD ALARM      |             |        |                  |
| state MPh/Power-fee     | MPS, FOS-PS, CM4-DCH4-INST       | MAJOR                  | LOLO ALARM                | 2021-02-08 15-29-41-982 | 2021-02-08 35:29-46.898 | MADOR            | LOLD, ALARM     |             |        |                  |
| state./MPGPower-list.   | MPS_FDS-PS_CM4-SDL8-InteT        | MAJOR                  | LOLO ALARM                | 3021-02-06 15:29-41.963 | 2021-01-06 13:29:46.898 | MACOR.           | LOLD ALARM      |             |        |                  |
| state /MPS/Power-Su-    | MPS_F03-PS_CM4-DCV8-INET         | MAJOR                  | LOLO, ALARM               | 2021-01-06 15:29 41.342 | 2021-02-06 33:29:44.898 | MAJOR            | LOLD ALARM      |             |        |                  |
| Aste MPLICR/MPL         | MPS Concept LLRF31.mSY           | OK                     | OK                        | 2021-01-06 15:27:07-841 | 2021-01-08 15:27:07.441 | OK               | NO_ALABA        |             |        |                  |
| state /MPS/LLRP/MPS     | MPS_Conc.RF_LLRF-821057          | OK                     | OK                        | 2021-01-08 15:27:07-841 | 2031-01-06 15:27:07-841 | OK               | NO_ALARM        |             |        |                  |
| state /MPS/LLR/MPS      | MPS. Core:RF_LLRFIL.IHST         | OK                     | OK                        | 2023-01-00 15:27:07.441 | 2023-03-06 15:27:07-843 | OR               | NO ALARM        |             |        |                  |
| shale /MPS/LLRP/MPS     | MPS. Core-RP_LLRF12-biST         | OK                     | OK                        | 2021-01-06 15-27-07-841 | 2021-02-06 15-27-07-841 | OK.              | ND ALARM        |             |        |                  |
| shade JMPS/LLRP/MPS.    | MPS_COVE-RP_LLRF22.015T          | CH.                    | OR                        | 2023-02-06 15-27-07.441 | 2023-03-06 35:27:07.441 | 04               | NO, ALARM       |             |        |                  |
| state (MPG/LLR/MPG      | MPS_Core-RP_LLRF-ELmoST          | OK                     | OK                        | 2021-01-06 15:27:07.441 | 2021-02-04 15:27:07.441 | 08               | NO_ALARM        |             |        |                  |
| date /MPS/LLR//MPS      | MPS_Conu.RF_LLRd-RFQ.anST        | OK                     | OK                        | 2021-01-06 15:27:07.441 | 2031-01-06 15:27:07.441 | .08              | NO_ALARM        |             |        |                  |
| state (MPSALLRPMPS      | MPS Core RF LLRF-82 mST          | OK                     | OK                        | 2021-01-06 15-27-07.440 | 2021-02-08 15:27:07.441 | OK               | NO ALABA        |             |        |                  |
| state /MPS/CLRP/MPS     | MPS Cone/RP LLRF42/HST           | OK                     | OK                        | 2022-01-06 15:27:07.441 | 2021-01-08 15-27-07-841 | OK               | NO ALABA        |             |        |                  |
| shate:/MPSALMP/MPS      | MPS_Core:RP_LLRP21.inST          | OK                     | OK                        | 2021-01-06 35:27:07.441 | 2021-03-08 15:27-07-843 | OK               | NO_ALABA        |             |        |                  |
| shate /MPS/LLRP/MPS     | MPS. Cone-RP_LLRP32.mvST         | OK                     | OK                        | 2021-01-06 15-27-07-641 | 2021-01-06 15:27:07-841 | OK               | NO_ALAAM        |             |        |                  |
| command (MPS/LLRF       | LLRF                             |                        |                           |                         | 2021-01-06 15:27:07.417 |                  |                 | acknowledge | tinec  | tocalheat.       |
| Late /MPL/Soft MPL/     | MPS SHEED ARISE STATUS           | OK                     | OK                        | 2021-01-06 15:27-01.544 | 3031-01-06 15:27:01.544 | 04               | NO_ALABA        |             |        |                  |
| state, MPS/Soft_MPS/    | MPS SOR BD AXIS6 STATUS          | OK.                    | OK.                       | 2021-01-06 15:27-01.544 | 2031-01-06 15:27:01 544 | OK.              | NO_ALABM        |             |        |                  |
| state:/MPS/Solt_MPS/    | MPS_Soft ED_AXIS16 STATUS        | MAJOR_ACK              | LOLO_ALARM                | 2021-01-05 15:41:20.906 | 2021-01-06 15:27:01.544 | MAJOR            | LOLD_ALABM      |             |        |                  |
| state /6875/5olt \$475/ | MPS. Self-BD AXIS/STATUS         | OK                     | OK                        | 2021-01-06 15:27-01.544 | 2021-02-06 15:27:01 544 | OK.              | NO ALARM        |             |        |                  |
| state, MPS/Lon, MPS/    | MPS, Soft BD, Y3 STATUS          | OK                     | OR                        | 2021-01-06 15-27-01-548 | 2021-01-06 15:27-01-544 | OK               | NO ALARM        |             |        |                  |
| state (MPS/Solt MPS/    | MPS_Soft ED_T2-SYATUS            | OK                     | OK                        | 2021-01-06 15-27-01 544 | 2021-01-06 15-27-01-544 | OK               | NO_ALARM        |             |        |                  |
| state (MPSrint MPS).    | MPS_SAN TOTAL STATUS             | OK                     | OK                        | 2021-02-06 15:27:01.568 | 2021-01-06 15 27:01.544 | OK               | NO_ALARM        |             |        |                  |
| state, MPS/Solt, MPS/   | NPS_SOR VALVE STATUS             | OK                     | OK                        | 2021-02-06 15:27:03.544 | 2021-02-06 15:27:01 544 | OK               | ND_ALABM        |             |        |                  |
| state MPS/Soft MPS/     | MPS SAT BO ARIST STATUS          | OK                     | OK                        | 2021-01-06 15:27-01.543 | 2021-02-06 15:27:01.544 | OR               | NO_ALARM        |             |        |                  |
| shate MPS/Sole MPS/     | MPS Soft BD AXISB STATUS         | OK                     | OK                        | 2021-01-06 15:27:01.544 | 2021-01-06 15:27:01 544 | 05               | NO ALABM        |             |        |                  |

### Annunciator

| CS-Studio (Phoebus) ×   |          |   |  |  |  |  |  |  |
|-------------------------|----------|---|--|--|--|--|--|--|
| MPS Annunciator ×       |          |   |  |  |  |  |  |  |
| MPS 🔻                   |          | Sector Clear Messages                       |  |  |  |  |  |  |
| Time Received           | Severity | Description                                 |  |  |  |  |  |  |
| 2021-01-06 15:21:19.750 | ОК       | Annunciator started                         |  |  |  |  |  |  |
| 2021-01-06 15:21:33.333 | A MAJOR  | MAJOR Alarm: MPS_Core:RF_LLRF21:InST        |  |  |  |  |  |  |
| 2021-01-06 15:23:47.341 | 💧 MAJOR  | MAJOR Alarm: MPS_Soft:CM2_BPM01_TEMP:STATUS |  |  |  |  |  |  |
| 2021-01-06 15:23:48.140 | 💧 MAJOR  | MAJOR Alarm: MPS_Soft:BPM_TEMP:STATUS       |  |  |  |  |  |  |
| 2021-01-06 15:23:48.240 | 💧 MAJOR  | MAJOR Alarm: MPS_Soft:TOTAL:STAUTUS         |  |  |  |  |  |  |
| 2021-01-06 15:29:46.919 | A MAJOR  | MAJOR Alarm: MPS_F05:PS_CM4-DCH4:InST       |  |  |  |  |  |  |
| 2021-01-06 15:29:46.919 | 💧 MAJOR  | MAJOR Alarm: MPS_F05:PS_CM4-DCV4:InST       |  |  |  |  |  |  |
| 2021-01-06 15:29:46.919 | 💧 MAJOR  | MAJOR Alarm: MPS_F05:PS_CM4-SOL4:InST       |  |  |  |  |  |  |
| 2021-01-06 15:29:46.938 | 💧 MAJOR  | MAJOR Alarm: MPS_Core:PS_CM4_DUMP:InST      |  |  |  |  |  |  |

| Accelerator Atami Tree X Probe Probe File Browser MPSER®<br>Accelerator ■<br>Pr: ADSRADGAMCM, 01A<br>Pr: ADSRADGAMCM, 01B<br>Pr: ADSRADGAMCM, 01C - MAJQRHIGH, 4LARM (OK/NO, 4LARM)<br>Pr: ADSRADGAMCM, 01D<br>Pr: ADSRADGAMCM, 01E - MAJQRHIGH, 4LARM (OK/NO, 4LARM)<br>Pr: ADSRADGAMCM, 02B<br>Pr: ADSRADGAMCM, 02C<br>Pr: ADSRADGA           |
|---|
| Accelerator         ■           PH         IDE           PY: ADS SAD GGMCCM, DIA         PY: ADS SAD GGMCCM, DIA           PY: ADS SAD GGMCCM, DIA         PY: ADS SAD GGMCCM, DIA           PY: ADS SAD GGMCCM, DIA         PY: ADS SAD GGMCCM, DIA           PY: ADS SAD GGMCCM, DIA         PY: ADS SAD GGMCCM, DIA           PY: ADS SAD GGMCCM, DIA         PY: ADS SAD GGMCCM, DIA           PY: ADS SAD GGMCCM, DIA         PY: ADS SAD GGMCCM, DIA           PY: ADS SAD GGMCCM, DIA GMCHIGH, LAARN (OK/NO, ALARN)         PY: ADS SAD GGMCCM, DIA           PY: ADS SAD GGMCCM, DIA CAND, DIA CAND, ADG AND, DIA SAD GGMCCM, DIA         PY: ADS SAD GGMCCM, DIA           PY: ADS SAD GGMCCM, DIA         PY: ADS SAD GGMCCM, DIA           PY: ADS SAD GGMCCM, DIA         PY: ADS SAD GGMCCM, DIA           PY: ADS SAD GGMCCM, DIA         PY: ADS SAD GGMCCM, DIA           PY: ADS SAD GGMCCM, DIA         PY: ADS SAD GGMCCM, DIA           PY: ADS SAD GGMCCM, DIA         PY: ADS SAD GGMCCM, DIA           PY: ADS SAD GGMCCM, DIA         PY: ADS SAD GGMCCM, DIA           PY: ADS SAD GGMCCM, DIA         PY: ADS SAD GGMCCM, DIA           PY: ADS SAD GGMCCM, DIA         PY: ADS SAD GGMCCM, DIA           PY: ADS SAD GGMCCM, DIA         PY: ADS SAD GGMCCM, DIA           PY: ADS SAD GGMCCM, DIA         PY: ADS SAD GGMCCM, DIA           PY  |
|   |
| PV: ADS RADIGAMEM (D1A<br>PV: ADS RADIGAMEM (D1A<br>PV: ADS RADIGAMEM (D1A)<br>PV: ADS RADIGAMEM (D1C - MAJORHIGH (ALAMI (OKINO, ALAMI)<br>PV: ADS RADIGAMEM (D1C)<br>PV: ADS RADIGAMEM (D1C)<br>PV: ADS RADIGAMEM (D2)<br>PV: ADS RADIGAME                     |
| PV. ADS RAD GAMCM, 018<br>▶ PV. ADS RAD GAMCM, 018<br>▶ PV. ADS RAD GAMCM, 010<br>▶ PV. ADS RAD GAMCM, 021<br>▶ PV. ADS RAD GAMCM, 022<br>▶ PV. ADS RAD GAMCM, 028<br>▶ PV. ADS RAD GAMCM                               |
|   |
| PV. ADSRADGAMECM (01D<br>PV. ADSRADGAMECM (01D<br>PV. ADSRADGAMECM (01D<br>PV. ADSRADGAMECM (01D<br>PV. ADSRADGAMECM (02D<br>PV. ADSRADGAMECM (02D)<br>PV. ADSRADGAMECM (0               |
|   |
| <ul> <li> <b>№</b> PP. ADS:ADCGAM.CM. Q21 - MAQRHIGH, ALARM (OKINO, ALARM)<br/><b>№</b> PP. ADS:ADCGAM.CM. Q22 - MAQRHIGH, ALARM (OKINO, ALARM)               <b>№</b> PP. ADS:ADCGAM.CM. Q28<br/><b>№</b> PP. ADS:ADCGAM.CM. Q28<br/><b>№</b> PP. ADS:ADCGAM.CM. Q27<br/><b>№</b> PP. ADS:ADCGAM.CM. Q28<br/><b>№</b> PP. ADS:ADCGAM.CM. Q28<br/><b>№</b> PP. ADS:ADCGAM.CM. Q27<br/><b>№</b> ADS:ADCGAM.CM. Q28<br/><b>№</b> ADS:ADCGAM.CM. Q28<br/><b>№</b> ADS:ADCGAM.CM. Q38<br/><b>№</b> PP. ADS:ADCGAM.CM. Q30<br/><b>№</b> PP. ADS:ADCGAM.CM. Q30<br/><b>№</b> PP. ADS:ADCGAM.CM. Q30<br/><b>№</b> PP. ADS:ADCGAM.CM. Q32<br/><b>№</b> PP. ADS:ADCGAM.CM. Q42<br/><b>№</b> PP. ADS:ADCGAM.CM. Q44             <b>№</b> ADGRHIGH, LALARM (DK/NO, LALARM)<br/><b>№</b> PP. ADS:ADCGAM.CM. Q44<br/><b>№</b> PP. ADS:ADCGAM.CM. Q44</li></ul>   |
|   |
| PV: ADS ADJ, GAM.CM, Q28     #PV: ADS AND, GAM.CM, Q28     PV: ADS AND, GAM.CM, Q27     PV: ADS AND, GAM.CM, Q27     PV: ADS AND, GAM.CM, Q27     PV: ADS AND, GAM.CM, Q28     PV: ADS AND, GAM.CM, Q38     PV: ADS AND, GAM.CM, Q38     PV: ADS AND, GAM.CM, Q38     PV: ADS AND, GAM.CM, Q36     PV: ADS AND, GAM.CM, Q36     PV: ADS AND, GAM.CM, Q37     PV: ADS AND, GAM.CM, Q38     PV: ADS AND, GAM.CM, Q38     PV: ADS AND, GAM.CM, Q37     PV: ADS AND, GAM.CM, Q37     PV: ADS AND, GAM.CM, Q38     PV: ADS AND, GAM.CM, Q37     PV: ADS AND, GAM.CM, Q48     PV: ADS AND, M, M   |
|   |
| PV. ADSIADCGAMICM, Q2D<br>PV. ADSIADCGAMICM, Q2E<br>PV. ADSIADCGAMICM, Q3E<br>PV. ADSIADCGAMICM, Q3A<br>PV. ADSIADCGAMICM, Q3A<br>PV. ADSIADCGAMICM, Q3C<br>PV. ADSIADCGAMICM, Q4E<br>PV. A                 |
| PV: ADS:RAD:GAM:CM_02E PV: ADS:RAD:GAM:CM_02E PV: ADS:RAD:GAM:CM_03A PV: ADS:RAD:GAM:CM_03B PV: ADS:RAD:GAM:CM_03B PV: ADS:RAD:GAM:CM_03D PV: ADS:RAD:GAM:CM_03D PV: ADS:RAD:GAM:CM_03D PV: ADS:RAD:GAM:CM_03D PV: ADS:RAD:GAM:CM_04E PV: ADS:RAD:GAM:CM_0  |
| PV. ADSRADGAMEM, 02F<br>PV. ADSRADGAMEM, 03A<br>PV. ADSRADGAMEM, 03A<br>PV. ADSRADGAMEM, 03C<br>PV. ADSRADGAMEM, 03C<br>PV. ADSRADGAMEM, 03C<br>PV. ADSRADGAMEM, 03C<br>PV. ADSRADGAMEM, 03C<br>PV. ADSRADGAMEM, 04E<br>PV. ADSRADCAMEM, 04E<br>PV. ADSRADCAMEM, 04E<br>PV. ADSRADCAMEM, 04E    |
| PV. ADSRADGAMECM, Q3A<br>PV. ADSRADGAMECM, Q3B<br>PV. ADSRADGAMECM, Q3C<br>■ PV. ADSRADGAMECM, Q3C<br>■ PV. ADSRADGAMECM, Q3C<br>■ PV. ADSRADGAMECM, Q3C = MAJORHIGH, ALARM (OKINO, ALARM)<br>■ PV. ADSRADGAMECM, Q3C = MAJORHIGH, ALARM (OKINO, ALARM)<br>■ PV. ADSRADGAMECM, Q4C<br>PV. ADSRADGAMECM, Q4C<br>PV. ADSRADGAMECM, Q4C<br>PV. ADSRADGAMECM, Q4E<br>PV. ADSRADGAMECM, Q4E<br>PV. ADSRADGAMECM, Q4E<br>PV. ADSRADGAMECM, Q4E  |
| PV: ADS:RAD:GAM:CM_038  PV: ADS:RAD:GAM:CM_038  PV: ADS:RAD:GAM:CM_020  PV: ADS:RAD:GAM:CM_020  PV: ADS:RAD:GAM:CM_020  PV: ADS:RAD:GAM:CM_020  PV: ADS:RAD:GAM:CM_020  PV: ADS:RAD:GAM:CM_040  PV: ADS:RAD:GAM:CM_040   |
| PV. ADSRADGAMEM, QSC<br>AVADSRADGAMEM, QSC<br>AVADSRADGAMEM, QSC<br>AVADSRADGAMEM, QSC<br>PV. ADSRADGAMEM, QSC<br>AVADSRADGAMEM, QSC<br>AVADSRADGAMEM, QSC<br>AVADSRADGAMEM, QSC<br>AVADSRADGAMEM, QSC<br>PV. ADSRADGAMEM, QSC<br>PV. ADSRADCAMEM, QSC<br>PV. ADSRADGAMEM, QSC<br>PV. ADSRADCAMEM, QSC<br>PV. ADSRADCAM |
| ● PY: ADS:ADD.GAM.CM, 040 - MAJORHIGH, LAAM OKINO, LAAMI<br>PY: ADS:ADD.GAM.CM, 031 - MAJORHIGH, ALAMI OKINO, ALAMI<br>● PY: ADS:ADD.GAM.CM, 037 - MAJORHIGH, ALAMI OKINO, ALAMI<br>● PY: ADS:ADD.GAM.CM, 043 - MAJORHIGH, ALAMI OKINO, ALAMI<br>● PY: ADS:ADD.GAM.CM, 044 - MAJORHIGH, ALAMI OKINO, ALAMI<br>PY: ADS:ADD.GAM.CM, 046<br>PY: ADS:ADD.GAM.CM, 046<br>PY: ADS:ADD.MLM   |
| ■ PV. ADS AND GANC M, Q SEE - MADRHIGH, LAAM (OKNO, QLARH)  |
| ■ VP. ADS:ADUCARCEQUE - MADRINELT_LANKI (DKND, JLANKI)<br>■ VP. ADS:ADUCARCEQUE - MADRINELT_LANKI (DKND, JLANKI)<br>■ VP. ADS:ADUCARCEQUE - MADRINELT_LANKI (DKND, JLANKI)<br>PV. ADS:ADUCARCEQUE - MADRINELT_LANKI (DKND, JLANKI (DKND, JLANKI)<br>PV. ADS:ADUCARCEQUE - MADRINELT_LANKI (DKND, JLANKI (DKND,  |
| ■ PY: ADSKADIGANCKI, QAL- XAQOHINGH_ALARM (OKNO, ALARM)<br>■ PY: ADSKADIGANCKI, QAL- MAJOHINGH, ALARM (OKNO, ALARM)<br>PY: ADSKADIGANCKI, QAL<br>PY: ADSKADIGANCKI, QAL<br>PY: ADSKADIGANI, ALM   |
| PVF. ADSTARDEGARCE, Q148 - PARAMETERIA ALARM (UKINO, ALARM)<br>PVF. ADSTARD-GAMACM, Q4C<br>PVF. ADSTARD-GAMACM, Q4D<br>PVF. ADSTARD-GAMACM, Q4E<br>PVF. ADSTARD-IN, ALM   |
| PY: ADS:RAD:GAR:CM_04D<br>PV: ADS:RAD:GAR:CM_04D<br>PV: ADS:RAD:GAR:CM_04E<br>PV: ADS:RAD:IN_ALM  |
| PV: ADS:RAD:GAM:CM_04E<br>PV: ADS:RAD:GAM:CM_04E<br>PV: ADS:RAD:IN_ALM  |
| PV: ADS:RAD:GAM:CM_04E<br>PV: ADS:RAD:IN_ALM  |
| FV. ADSTRADTIV ADV  |
| BV: ADS-BAD-OUT ALM   |
| <ul> <li>✓ Å ±8</li> </ul>  |
| > HEBT  |
| ► Æ MEBT  |
| · [ 13  |
| PV: ADS:BMPS:HEBT:BD:BUMP03_FRONT_DOWN.TEMP - MINOR/HIGH_ALARM  |
| ▶ 『温度貼片   |
| • (2) A H   |
| ▶ 空压机   |

### Interface Tree

| Alarm     | SECRA<br>Status | L-I    |        | baking |       | -      |
|-----------|-----------------|--------|--------|--------|-------|--------|
| Fe14+     | 504.96 e        | μA     | HV 4.  | 00 en  | nA    | 21.094 |
| INJ       |                 | EXT    |        | 1      | LEBT  |        |
| 3.3E-7 I  | nbar            | 1.2E-7 | 7 mbar | 1      | .2E-7 | mba    |
| P 4.2     | kPa             |        | Pr     | 7.4    |       | w      |
| Pv 0.0    | mba             | r      | LHe    | 111.47 | 2     | cm     |
| CL 1      | CL 2            | CL     | 3      | CL 4   | С     | L 5    |
| 32.2      | 33.0            | 37.    | 1      | 31.6   | 3     | 4.2    |
| MAGNET    | - (*            | %)     | Curren | t (A)  | Rate  | (A/s)  |
| SEXT      | 0.60            | 8      | 83.87  |        | 0.04  | 20     |
| INJ       | 0.60            | 1      | 116.19 | 9      | 0.08  | 40     |
| MID       | 0.44            | 0      | 11.07  |        | 0.00  | 98     |
| EXT       | 0.53            | 1      | 87.25  |        | 0.07  | 20     |
| Puller    |                 | Bias   | 5      |        | Spu   | ıt     |
| 0.0       | kV              | 218.0  | 02 V   | 0      | .00   | kV     |
| 0.0       | mA              | 1.38   | mA     | 0      | .00   | mA     |
| 60.0      | m               | 10.0   | m      | 1      | 0.0   | m      |
|           | m l             |        | m      |        |       | m      |
| Oven 1    | 107             |        | Oven 2 | 2      |       |        |
| 0.0       | V 0.0           | A      | 0.0    | VC     | 0.0   | A      |
| He GM     | 1(°) 165.0      | č      | 02     | GA(°)  | -0.   | 0      |
| WP WT     | WF-A            | WF-B   | WF-CC  | omp.W  | PCor  | np.WT  |
| 3.71 21.0 | 2 8.18          | 7.94   | 8.61   | 3.72   | 24    | .65    |



The above figure shows that using Kafka can effectively improve data throughput and ensure realtime alarms.

CAFe alarm system was built based on Kafka streaming media platform. Phoebus provides some alarm interfaces for monitoring PV.

- ✓ Remote real-time interface to achieve cross-regional alarm function.
- $\checkmark$  Phoebus's interface is simple to operate and easy to maintain.
- $\checkmark\,$  The alarm system saves troubleshooting time and improves the maintainability of CAFe.
- ✓ The entire control system has been deployed and put into operation in the central control room and is working well.