



PV Browser - A Web Based EPICS PV Information Query System

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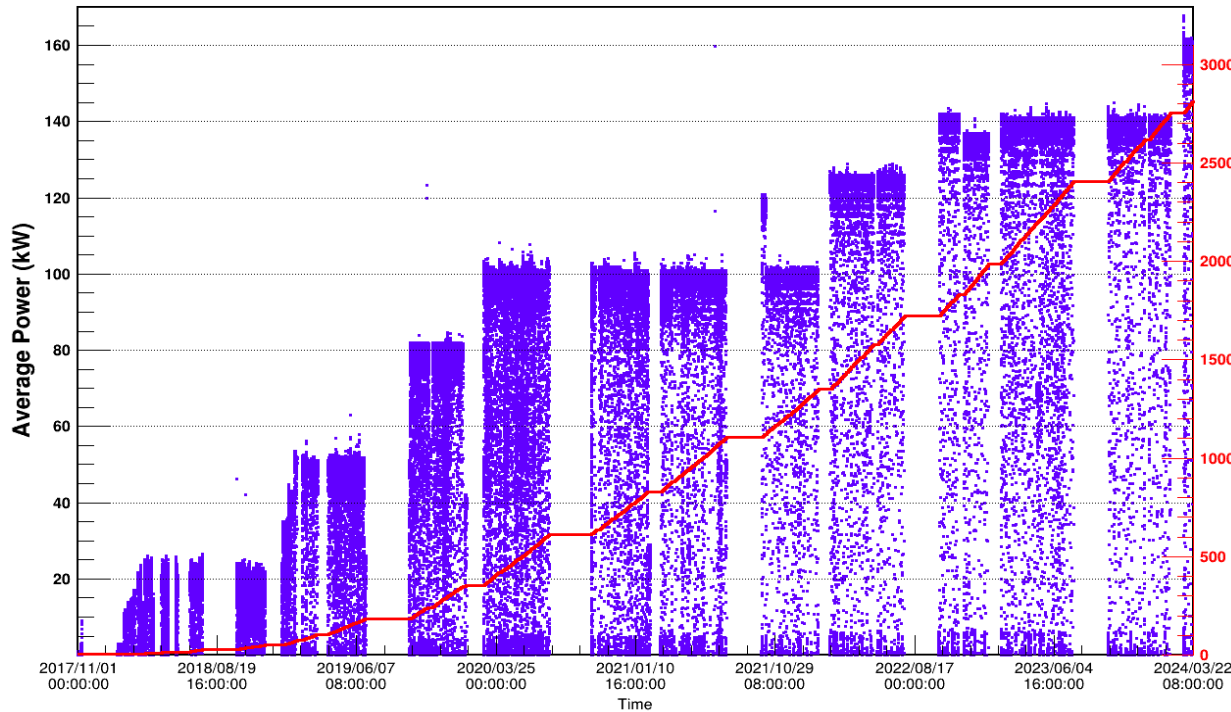
CSNS@IHEP

2024 Spring EPICS Collaboration Meeting, Pohang

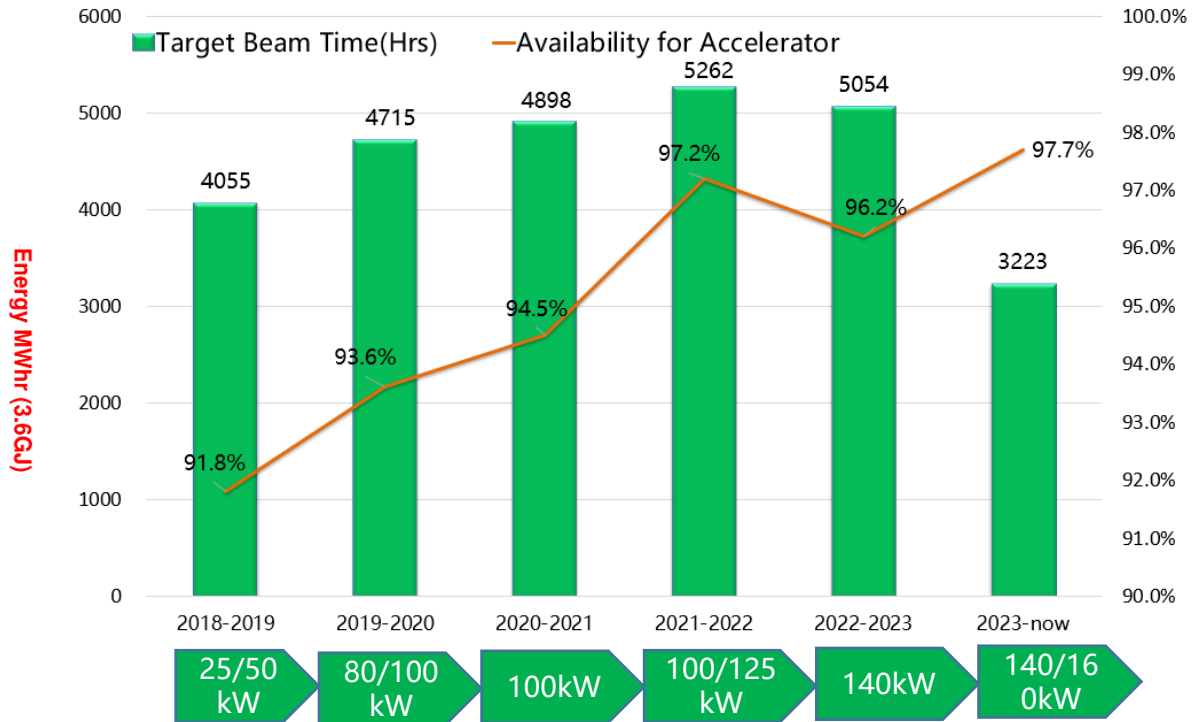
Brief Introduction of CSNS Operation and CSNS-II



- CSNS is operating at 160kW beam power since March 2024
- Total number of PVs accelerator only is about 100,000



Beam power ramp history

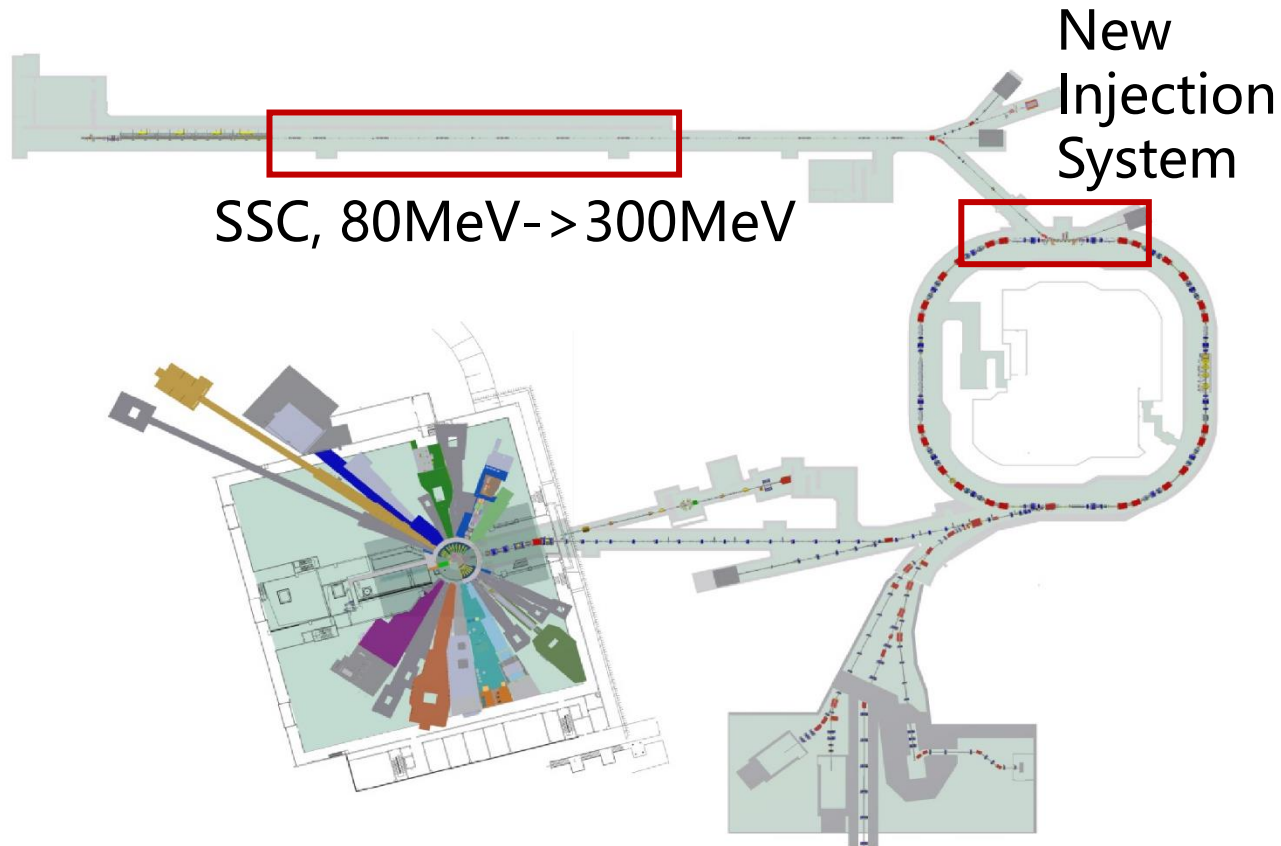


Beam time and availability

Brief Introduction of CSNS Operation and CSNS-II



- Beam power will be upgraded from 160kW to 500kW
- Total number of PVs accelerator only will be 200,000+



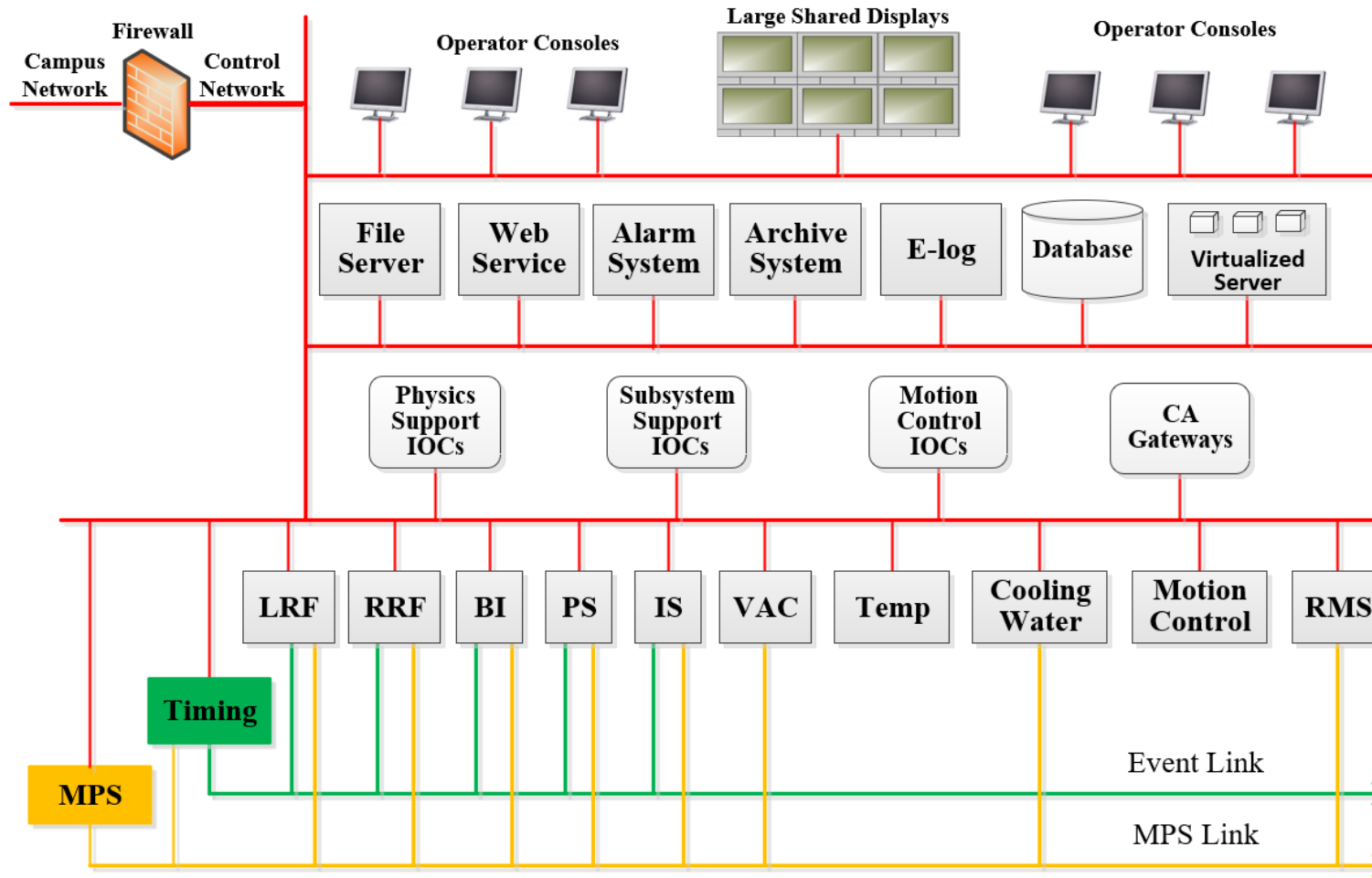
| Parameters | CSNS | CSNS-II |
|-----------------------------------|-------------|----------------|
| Beam Power (KW) | 100 | 500 |
| Rep-Rate (Hz) | 25 | 25 |
| Beam Energy (GeV) | 1.6 | 1.6 |
| Avg Current (μA) | 62.5 | 312 |
| Linac Energy(MeV) | 80 | 300 |
| Linac Pk Current (mA) | 15 | 40 |
| Linac RF Frequency (MHz) | 324 | 324/648 |
| Linac Beam Width(μS) | 400 | 600 |

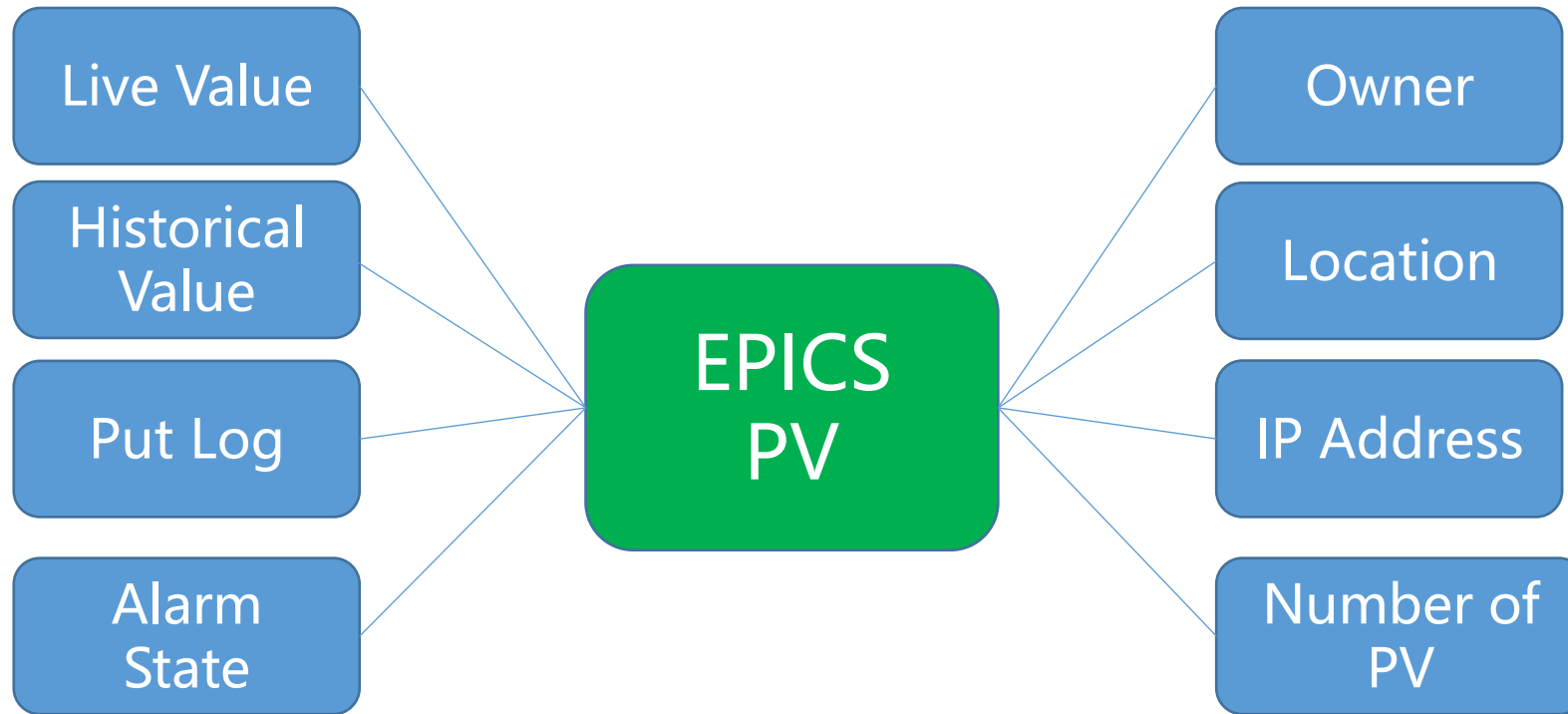
NEW: 9 neutron beam line, 1 muon and 1 proton line

Accelerator Control System Upgrade Towards CSNS-II



- EPICS V3 and V7 mixed control system
- Total number of V3 and V7 IOCs will be more than 200





- There are many tools to collect these information in EPICS community
- Browsing these PV related information via web pages is more convenient



slacmshankar.github.io
<http://slacmshankar.github.io/epics:>
[EPICS Archiver Appliance](http://slacmshankar.github.io/epics:)

epics-modules/
caPutLog

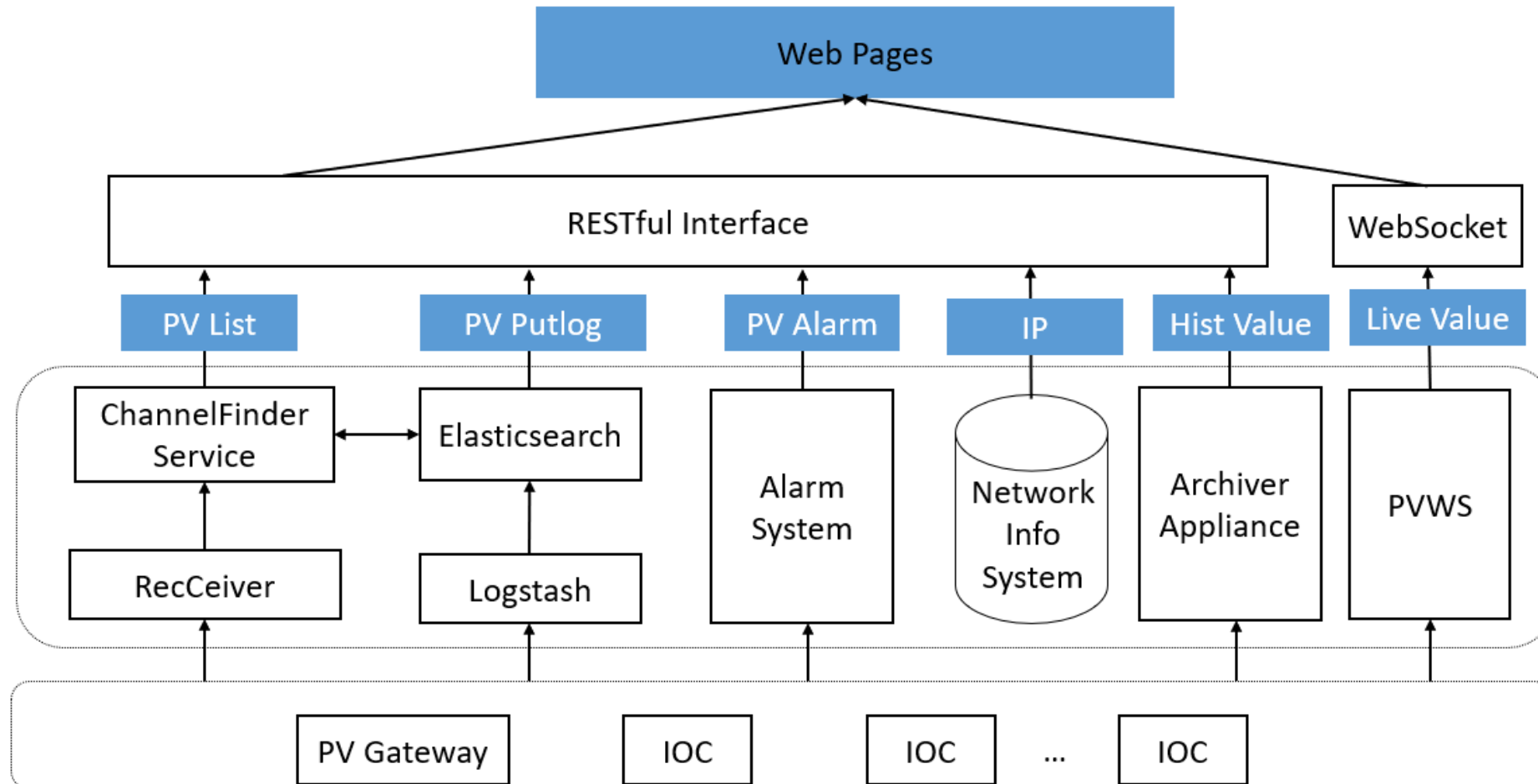
Channel Access Put Logger, from DESY/BESSY

ChannelFinder/
recsync

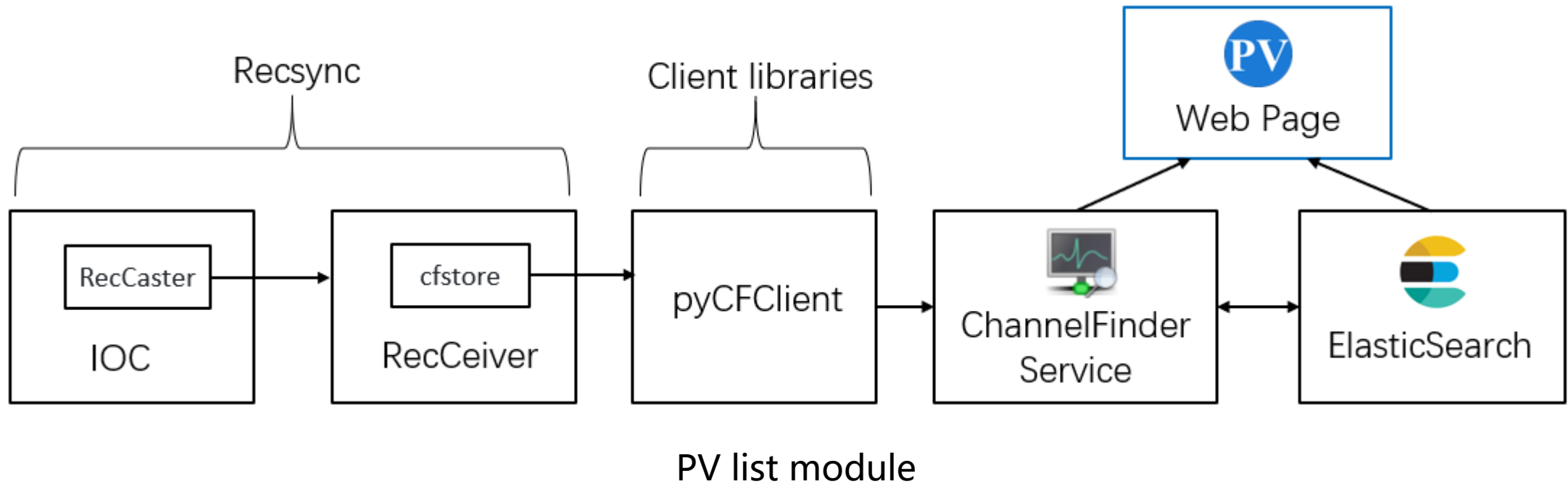
EPICS Record Synchronizer

Design of PV Browser

- Front end: Vue.js framework + PrimeVue component library
- Backend: Node.js and community existing tools



- Directory service tool ChannelFinder and EPICS record synchronizer tool RecSync
- Web pages get PV record data from ChannelFinder service and ElasticSearch directly



- PV name list, IOC name list, IOC IP list and PV detailed information can be showed in the main page

CSNS加速器PV信息平台

PV信息 | IOC状态 | PV操作日志 | 报警信息

PV信息

IOC: 111个, PV: 74282个。

| PV名称 | IOC名 | IP地址 | 系统 | 子系统 | 更新时间 | 操作 |
|----------------------------------|------|--------------|----|-----|---------------------|---------|
| ACC_ANI_RS:DOSE:GAMMA:ID101:HW | Dose | 10.1.200.113 | CO | PPS | 2023-09-20 10:47:37 | 👁️ 📄 🗑️ |
| ACC_ANI_RS:DOSE:GAMMA:ID101:LW | Dose | 10.1.200.113 | CO | PPS | 2023-09-20 10:47:37 | 👁️ 📄 🗑️ |
| ACC_ANI_RS:DOSE:GAMMA:ID101:calc | Dose | 10.1.200.113 | CO | PPS | 2023-09-20 10:47:37 | 👁️ 📄 🗑️ |
| ACC_ANI_RS:DOSE:GAMMA:ID103:HW | Dose | 10.1.200.113 | CO | PPS | 2023-09-20 10:47:37 | 👁️ 📄 🗑️ |
| ACC_ANI_RS:DOSE:GAMMA:ID103:LW | Dose | 10.1.200.113 | CO | PPS | 2023-09-20 10:47:37 | 👁️ 📄 🗑️ |
| ACC_ANI_RS:DOSE:GAMMA:ID103:calc | Dose | 10.1.200.113 | CO | PPS | 2023-09-20 10:47:37 | 👁️ 📄 🗑️ |
| ACC_ANI_RS:DOSE:GAMMA:ID105:HW | Dose | 10.1.200.113 | CO | PPS | 2023-09-20 10:47:37 | 👁️ 📄 🗑️ |
| ACC_ANI_RS:DOSE:GAMMA:ID105:LW | Dose | 10.1.200.113 | CO | PPS | 2023-09-20 10:47:37 | 👁️ 📄 🗑️ |
| ACC_ANI_RS:DOSE:GAMMA:ID105:calc | Dose | 10.1.200.113 | CO | PPS | 2023-09-20 10:47:37 | 👁️ 📄 🗑️ |

List Data
Hist Data
Putlog
Network

列表

| 名称 | PV数量 | ⚙️ |
|----------------|------|----|
| RTBT QPS PSC | 1914 | 🔍 |
| DTL trim 2 PSC | 1597 | 🔍 |
| LRBT main PSC | 1581 | 🔍 |
| DTL main 2 PSC | 1572 | 🔍 |
| DTL trim 1 PSC | 1541 | 🔍 |
| LRBT trim PSC | 1541 | 🔍 |
| fpsLinac | 1541 | 🔍 |
| DTL main 1 PSC | 1518 | 🔍 |
| RCS COPS | 1434 | 🔍 |
| MEBT PSC | 1433 | 🔍 |

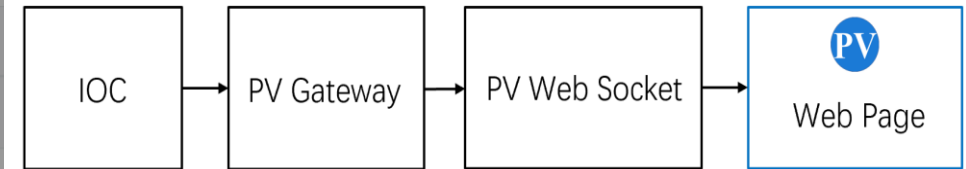
IOC List

PV List main page

- PV Web Socket tool PVWS was adopted as the backend
- Web page subscribes the PV live data and alarm state



PV Live data

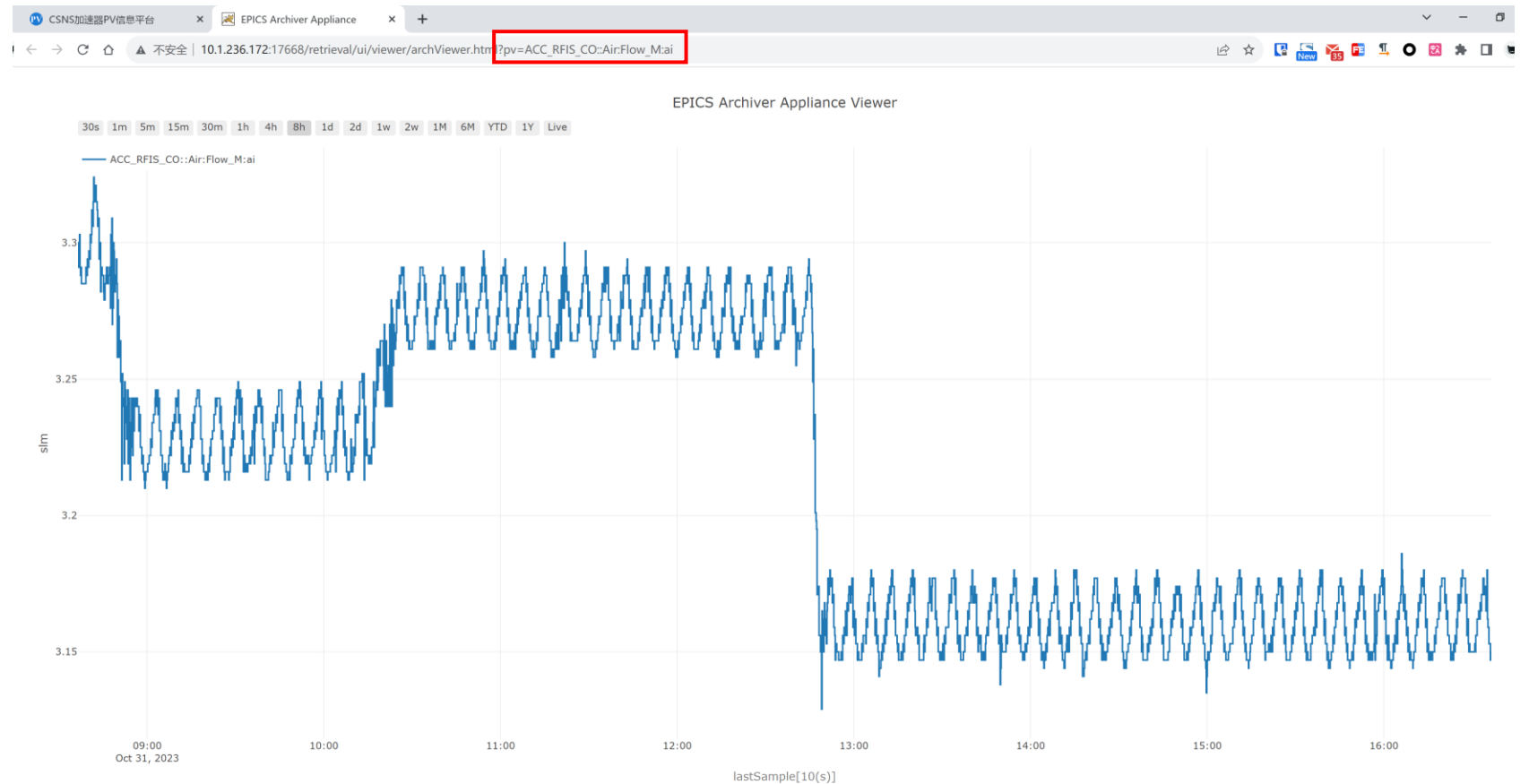


PV live data module

PV Historical Data

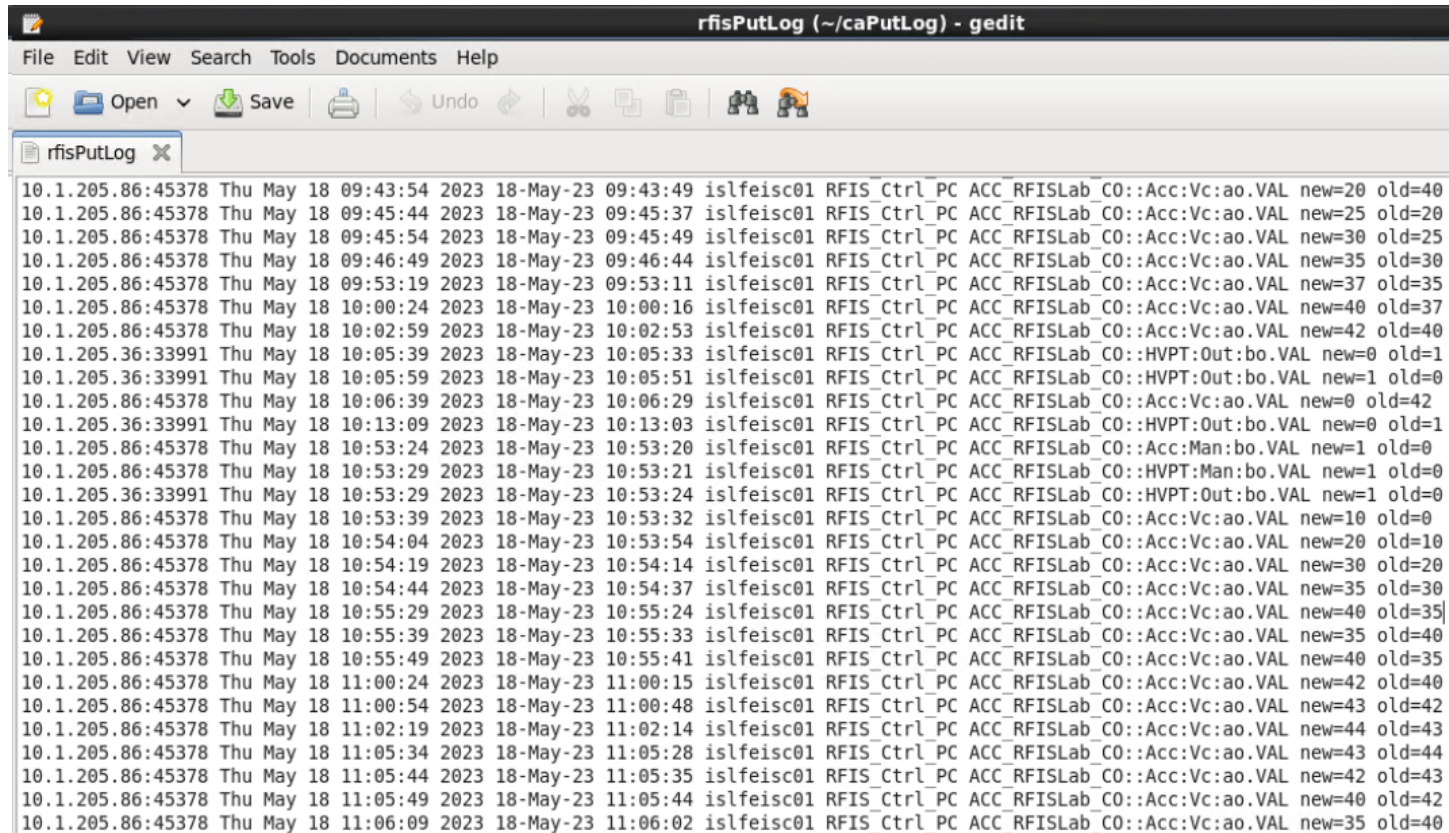


- The EPICS Archiver Appliance supports data retrieval in multiple formats/MIME types. PV browser calls the in-built web service to show the historical data



PV Historical Data

- Usually, CaPutLog module and iocLogServer were used to collect the PV put log , the Put log was stored in separated local files, it is hard to read



```
rfisPutLog (~/.caPutLog) - gedit
File Edit View Search Tools Documents Help
Open Save Undo
rfisPutLog x
10.1.205.86:45378 Thu May 18 09:43:54 2023 18-May-23 09:43:49 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::Acc:Vc:ao.VAL new=20 old=40
10.1.205.86:45378 Thu May 18 09:45:44 2023 18-May-23 09:45:37 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::Acc:Vc:ao.VAL new=25 old=20
10.1.205.86:45378 Thu May 18 09:45:54 2023 18-May-23 09:45:49 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::Acc:Vc:ao.VAL new=30 old=25
10.1.205.86:45378 Thu May 18 09:46:49 2023 18-May-23 09:46:44 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::Acc:Vc:ao.VAL new=35 old=30
10.1.205.86:45378 Thu May 18 09:53:19 2023 18-May-23 09:53:11 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::Acc:Vc:ao.VAL new=37 old=35
10.1.205.86:45378 Thu May 18 10:00:24 2023 18-May-23 10:00:16 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::Acc:Vc:ao.VAL new=40 old=37
10.1.205.86:45378 Thu May 18 10:02:59 2023 18-May-23 10:02:53 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::Acc:Vc:ao.VAL new=42 old=40
10.1.205.36:33991 Thu May 18 10:05:39 2023 18-May-23 10:05:33 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::HVPT:Out:bo.VAL new=0 old=1
10.1.205.36:33991 Thu May 18 10:05:59 2023 18-May-23 10:05:51 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::HVPT:Out:bo.VAL new=1 old=0
10.1.205.86:45378 Thu May 18 10:06:39 2023 18-May-23 10:06:29 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::Acc:Vc:ao.VAL new=0 old=42
10.1.205.36:33991 Thu May 18 10:13:09 2023 18-May-23 10:13:03 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::HVPT:Out:bo.VAL new=0 old=1
10.1.205.86:45378 Thu May 18 10:53:24 2023 18-May-23 10:53:20 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::Acc:Man:bo.VAL new=1 old=0
10.1.205.86:45378 Thu May 18 10:53:29 2023 18-May-23 10:53:21 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::HVPT:Man:bo.VAL new=1 old=0
10.1.205.36:33991 Thu May 18 10:53:29 2023 18-May-23 10:53:24 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::HVPT:Out:bo.VAL new=1 old=0
10.1.205.86:45378 Thu May 18 10:53:39 2023 18-May-23 10:53:32 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::Acc:Vc:ao.VAL new=10 old=0
10.1.205.86:45378 Thu May 18 10:54:04 2023 18-May-23 10:53:54 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::Acc:Vc:ao.VAL new=20 old=10
10.1.205.86:45378 Thu May 18 10:54:19 2023 18-May-23 10:54:14 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::Acc:Vc:ao.VAL new=30 old=20
10.1.205.86:45378 Thu May 18 10:54:44 2023 18-May-23 10:54:37 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::Acc:Vc:ao.VAL new=35 old=30
10.1.205.86:45378 Thu May 18 10:55:29 2023 18-May-23 10:55:24 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::Acc:Vc:ao.VAL new=40 old=35
10.1.205.86:45378 Thu May 18 10:55:39 2023 18-May-23 10:55:33 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::Acc:Vc:ao.VAL new=35 old=40
10.1.205.86:45378 Thu May 18 10:55:49 2023 18-May-23 10:55:41 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::Acc:Vc:ao.VAL new=40 old=35
10.1.205.86:45378 Thu May 18 11:00:24 2023 18-May-23 11:00:15 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::Acc:Vc:ao.VAL new=42 old=40
10.1.205.86:45378 Thu May 18 11:00:54 2023 18-May-23 11:00:48 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::Acc:Vc:ao.VAL new=43 old=42
10.1.205.86:45378 Thu May 18 11:02:19 2023 18-May-23 11:02:14 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::Acc:Vc:ao.VAL new=44 old=43
10.1.205.86:45378 Thu May 18 11:05:34 2023 18-May-23 11:05:28 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::Acc:Vc:ao.VAL new=43 old=44
10.1.205.86:45378 Thu May 18 11:05:44 2023 18-May-23 11:05:35 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::Acc:Vc:ao.VAL new=42 old=43
10.1.205.86:45378 Thu May 18 11:05:49 2023 18-May-23 11:05:44 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::Acc:Vc:ao.VAL new=40 old=42
10.1.205.86:45378 Thu May 18 11:06:09 2023 18-May-23 11:06:02 islfeisc01 RFIS_Ctrl_PC ACC_RFISLab_C0::Acc:Vc:ao.VAL new=35 old=40
```

The content of iocLogServer log file

- CaPutLog module and Logstash were adopted, the put log was saved into ElasticSearch
- Web page gets PV put log from ElasticSearch

CSNS加速器PV信息平台

PV信息

IOC状态

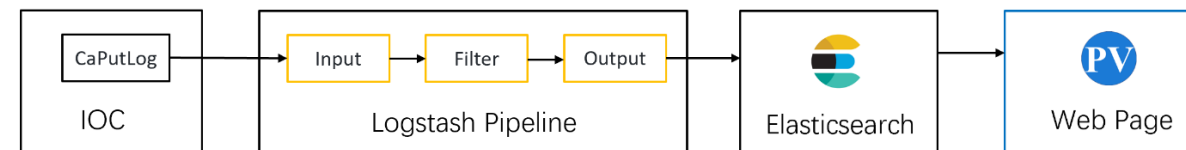
PV操作日志

报警信息

PV操作日志

| PV名称 | 操作客户端 | IOC IP地址 | 旧值 | 新值 | 修改时间 |
|-------------------------------------|------------|-------------|----|----|--------------------|
| ACC_RFISLab_CO::RFPS2:Fault:bo.VAL | islfeisc01 | 10.1.205.36 | 1 | 1 | 31-Oct-23 15:37:08 |
| ACC_RFISLab_CO::RFPS:Man:bo.VAL | islfeisc01 | 10.1.205.86 | 0 | 1 | 31-Oct-23 15:36:04 |
| ACC_RFISLab_CO::Extr1:V_15kV:ao.VAL | islfeisc01 | 10.1.205.36 | 3 | 8 | 31-Oct-23 15:09:35 |
| ACC_RFISLab_CO::Acc:Vc:ao.VAL | islfeisc01 | 10.1.205.86 | 0 | 50 | 31-Oct-23 15:09:26 |
| ACC_RFISLab_CO::RFPS2:En:bo.VAL | islfeisc01 | 10.1.205.36 | 0 | 1 | 31-Oct-23 15:03:56 |

PV put log page



PV Put log module

PV Alarm State



- Pheobus kafka based alarm system was used
- Web page get the active alarms directly from kafka

PV信息 IOC状态 PV操作日志 报警信息

报警信息 > 当前报警

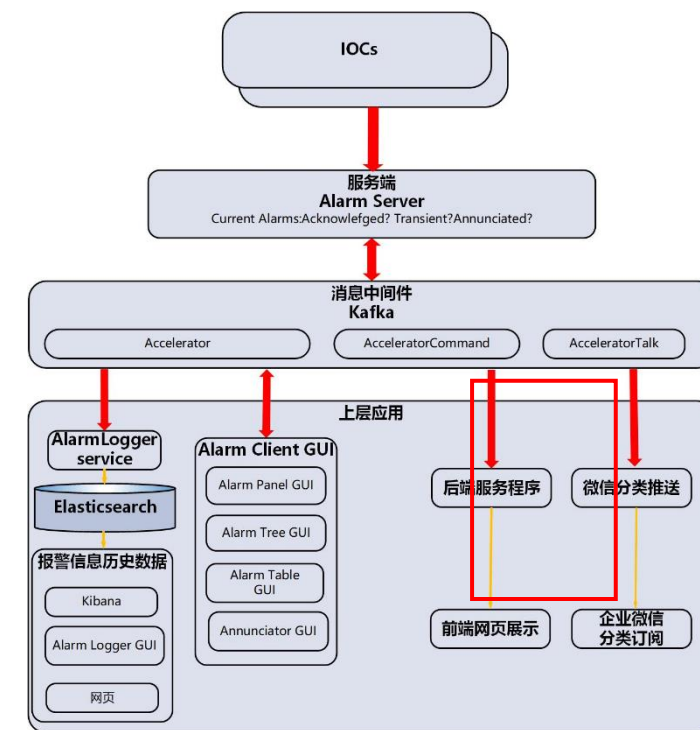
Active Alarms

| PV | Description | Alarm Severity | Alarm Status | Alarm Time | Alarm Value | PV Serverity | PV Status |
|----------------------------------|-------------|----------------|--------------|------------|-------------|--------------|-----------|
| Showing 0 to 0 of 0 << < > >> 20 | | | | | | | |

Acknowledged Alarms

| PV | Description | Alarm Severity | Alarm Status | Alarm Time | Alarm Value | PV Serverity | PV Status |
|---------------------------|-------------|----------------|--------------|---------------------|-----------------|--------------|-------------|
| ACC_RCS_MPS::RF06:Lock:bi | 05环高频6号腔联锁 | MAJOR_ACK | STATE_ALARM | 2023-10-31 12:22:36 | ALARM | MAJOR | STATE_ALARM |
| ACC_RCS_MPS::RF07:Lock:bi | 05环高频7号腔联锁 | MAJOR_ACK | STATE_ALARM | 2023-10-31 12:22:34 | ALARM | MAJOR | STATE_ALARM |
| ACC_RFQ_FPS::IntLk:ln | 12RFQ高频联锁 | MAJOR_ACK | STATE_ALARM | 2023-10-31 12:34:58 | Permanent Alarm | MAJOR | STATE_ALARM |
| ACC_RCS_MPS::RF03:Lock:bi | 05环高频3号腔联锁 | MAJOR_ACK | STATE_ALARM | 2023-10-31 12:22:36 | ALARM | MAJOR | STATE_ALARM |

Active alarm page



The Phoebus kafka alarm system deployed at CSNS

- Web page gets alarm history from the Phoebus alarm system in-built RESTful API

PV信息 IOC状态 PV操作日志 报警信息 ▾

报警信息 > 报警记录

开始时间: 结束时间:

| PV | Serverity | Message | Time | Message time | Current Severity | Current Message |
|----------------------------------|-----------|---------|---------------------|---------------------|------------------|-----------------|
| ACC_RFQ_CO:Wall1_2Wtr:FS12:NC:bi | OK | OK | 2023-10-31 04:52:05 | 2023-10-31 04:52:05 | OK | NO_ALARM |
| ACC_RFQ_CO:Wall1_2Wtr:FS12:NC:bi | OK | OK | 2023-10-31 04:49:21 | 2023-10-31 04:52:04 | MAJOR | STATE_ALARM |
| ACC_RFQ_CO:Wall1_2Wtr:FS12:NC:bi | OK | OK | 2023-10-31 04:49:21 | 2023-10-31 04:49:21 | OK | NO_ALARM |
| ACC_RFQ_CO:Wall1_2Wtr:FS12:NC:bi | OK | OK | 2023-10-31 04:49:13 | 2023-10-31 04:49:20 | MAJOR | STATE_ALARM |
| ACC_RFQ_CO:Wall1_2Wtr:FS12:NC:bi | OK | OK | 2023-10-31 04:49:13 | 2023-10-31 04:49:13 | OK | NO_ALARM |

Alarm history page

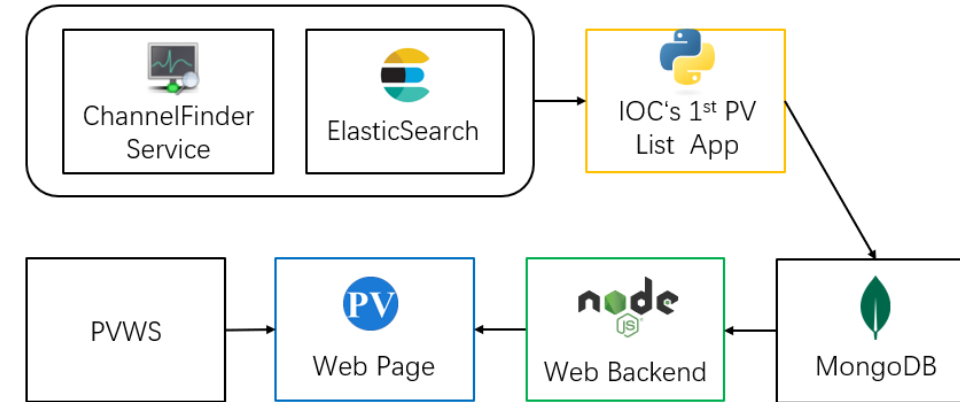
- A python application periodically get the 1st PV of each IOC from ElasticSearch, and save to MongoDB
- Get the value of these PVs via PVWS, if these PVs are all alive, then the IOCs are all alive

CSNS加速器PV信息平台

正常IOC: 85个, 异常IOC: 18个。

| | | | |
|---|---|---|--|
| RCS QS PSC 10.1.203.45 PRPSC05 更多信息 | fpsLRBT 10.1.200.180 vxTarget 更多信息 | I2BConvert 10.1.203.99 CRCOVM5 更多信息 | RCS trim V PSC 10.1.203.44 PRPSC04 更多信息 |
| WNS PS 10.1.206.126 RTCOWNS126 更多信息 | RCS trim H PSC 10.1.203.43 PRPSC03 更多信息 | PS alive 10.1.203.98 CRCOVM13 更多信息 | RCSBPMTransformation 10.1.204.61 CRCOVM14 更多信息 |
| RTBT QPS PSC 10.1.203.51 RTPSC01 更多信息 | RCSPSTransformation 10.1.204.53 CRCOVM41 更多信息 | DTL trim 2 PSC 10.1.203.25 L2PSC02 更多信息 | fpsLinac 10.1.200.176 LNCoFPS01 更多信息 |

IOC Status page



IOC status module

- From this page, more detailed PV information can be acquired
- This page is useful after the long shutdown of the accelerator

CSNS加速器PV信息平台

PV信息 | **IOC状态** | PV操作日志 | 报警信息

IOC状态

正常IOC: 85个, 异常IOC: 18个。

| | | | |
|---|---|---|--|
| RCS QS PSC 10.1.203.45 PRPSC05 更多信息 | fpsLRBT 10.1.200.180 vxTarget 更多信息 | I2BConvert 10.1.203.99 CRCOVM5 更多信息 | RCS trim V PSC 10.1.203.44 PRPSC04 更多信息 |
| WNS PS 10.1.206.126 RTCOWNS126 更多信息 | RCS trim H PSC 10.1.203.43 PRPSC03 更多信息 | PS alive 10.1.203.98 CRCOVM13 更多信息 | RCSBPMTransformation 10.1.204.61 CRCOVM14 更多信息 |
| RTBT QPS PSC 10.1.203.51 RTPSC01 更多信息 | RCSBSTransformation 10.1.204.53 CRCOVM41 更多信息 | DTL trim 2 PSC 10.1.203.25 L2PSC02 更多信息 | fpsLinac 10.1.200.176 LNCofPS01 更多信息 |

IOC Status page

RCS trim V PSC
10.1.203.44
PRPSC04
更多信息

查看PV信息

查看PV操作记录

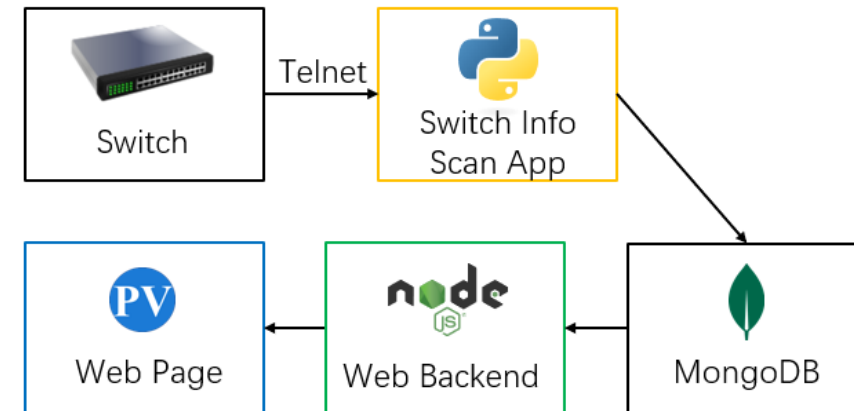
查看网络信息

IOC Network Information

- The IOC detailed network information can also be queried
- Operators can quickly get the related switch information



The detailed IOC network information

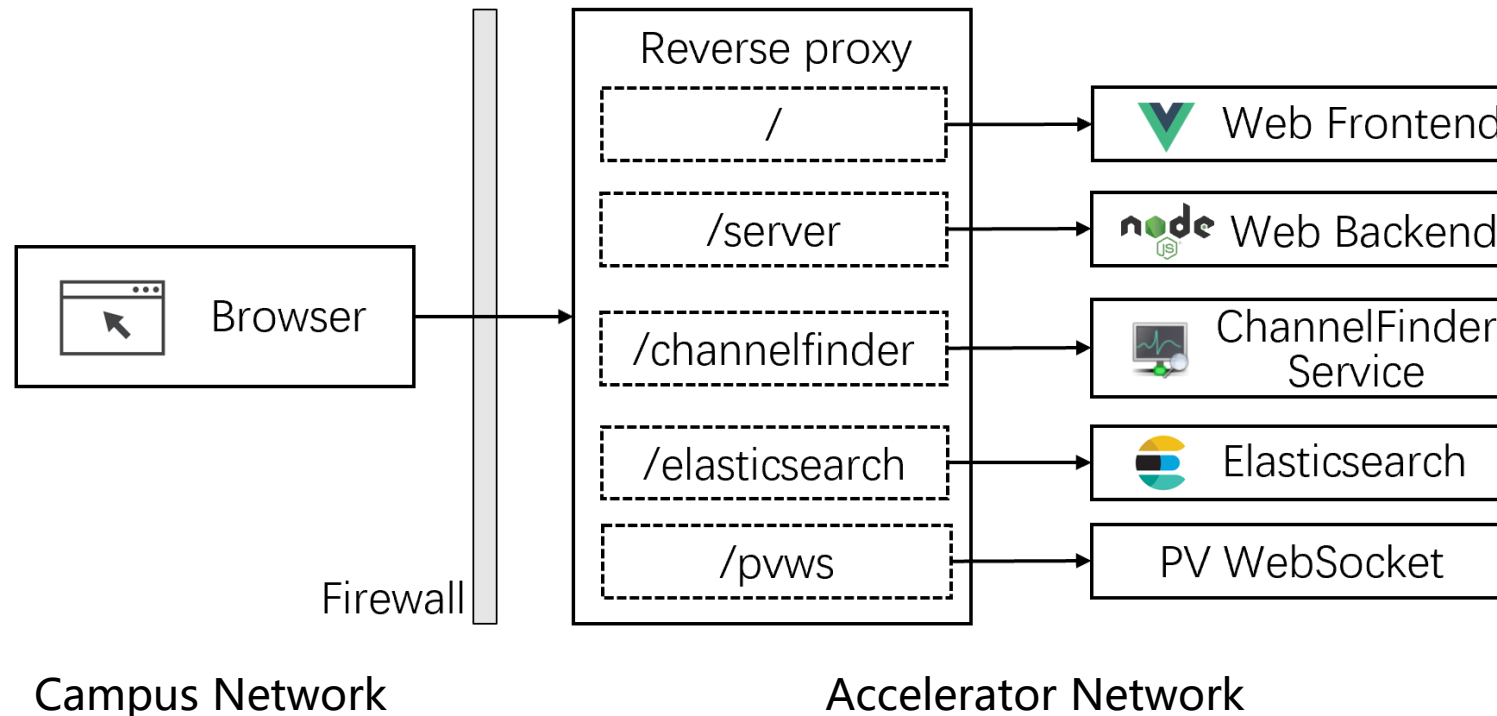


- List all the IP addresses used for EPICS IOCs, then we can go to the each of the IOC for the detailed information

| IP | MAC | 核心交换机端口 | CCR2952-1 | 接入交换机端口 |
|--------------|----------------|-----------------|-----------|----------------------|
| 10.1.200.13 | 5869.6c35.d03c | AggregatePort 1 | CCR2952-1 | |
| 10.1.200.58 | 0000.6486.b21d | AggregatePort 1 | CCR2952-1 | GigabitEthernet 0/6 |
| 10.1.200.59 | 0000.6486.b21e | AggregatePort 1 | CCR2952-1 | GigabitEthernet 0/3 |
| 10.1.200.60 | 0000.648d.4141 | AggregatePort 1 | CCR2952-1 | GigabitEthernet 0/5 |
| 10.1.200.61 | 0000.648d.0f30 | AggregatePort 1 | CCR2952-1 | GigabitEthernet 0/4 |
| 10.1.200.74 | 00e0.4b51.f439 | AggregatePort 1 | CCR2952-1 | GigabitEthernet 0/1 |
| 10.1.204.110 | ecb1.d759.30f1 | AggregatePort 1 | CCR2952-1 | GigabitEthernet 0/11 |
| 10.1.204.111 | ecb1.d761.22b5 | AggregatePort 1 | CCR2952-1 | GigabitEthernet 0/10 |
| 10.1.204.112 | ecb1.d761.22cb | AggregatePort 1 | CCR2952-1 | GigabitEthernet 0/9 |
| 10.1.204.113 | ecb1.d759.314b | AggregatePort 1 | CCR2952-1 | GigabitEthernet 0/13 |

Deployment of PV Browser at CSNS

- Proxy server Nginx was adopted to deploy the PV Browser
- The system was deployed at CSNS accelerator in 2022. Now, it is frequently used by the operator



Thank you for your attention!

