PV Browser - A Web Based EPICS PV Information Query System

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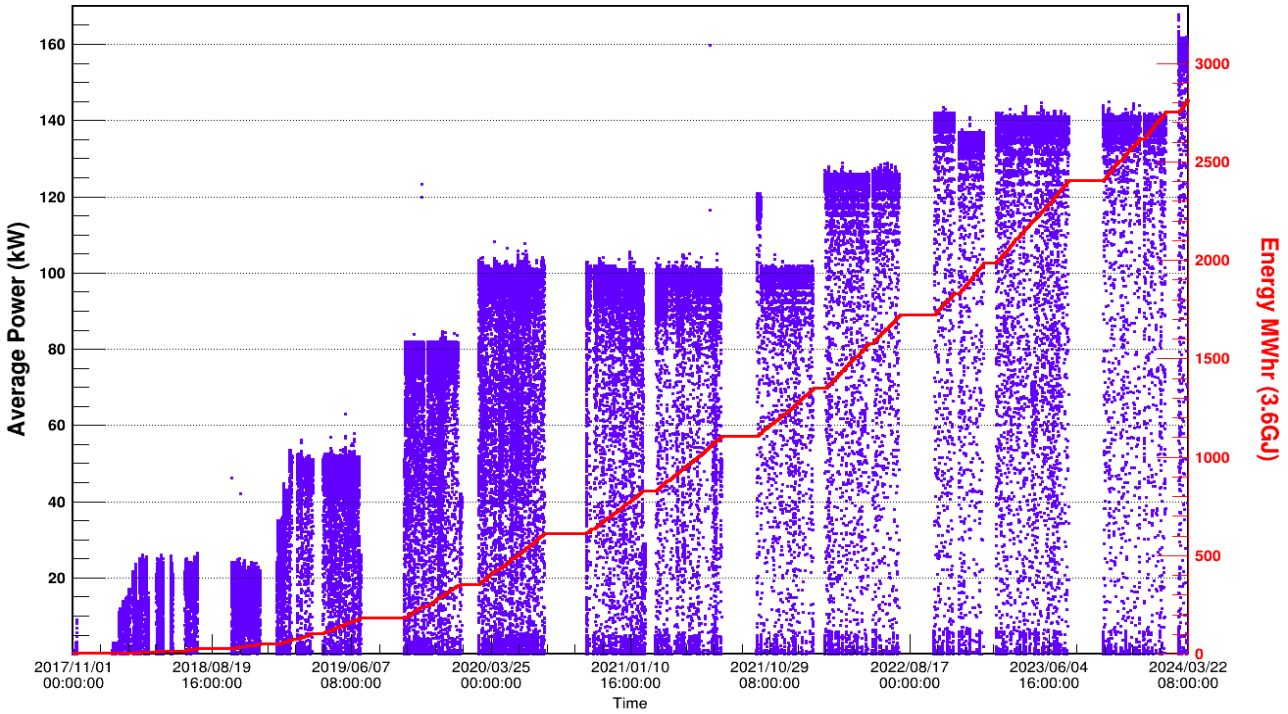
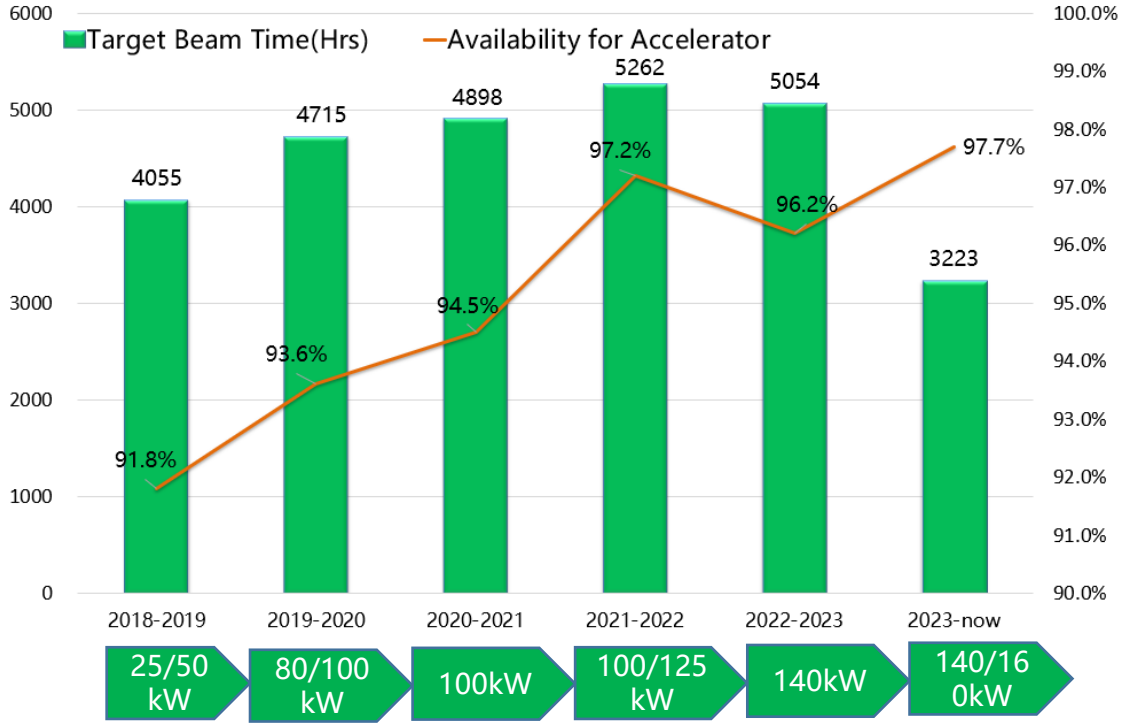
Brief Introduction of CSNS Operation and CSNS-II

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



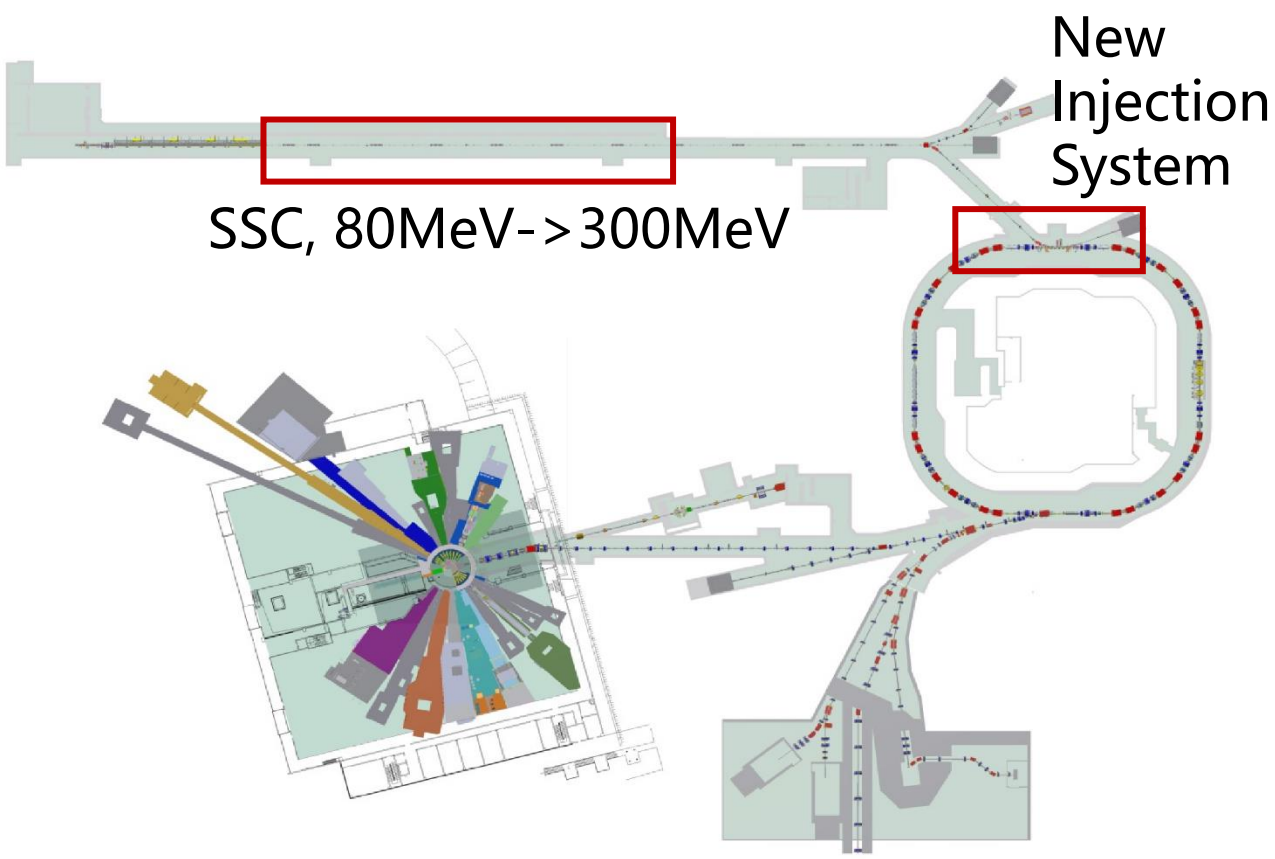
Beam power ramp history



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+

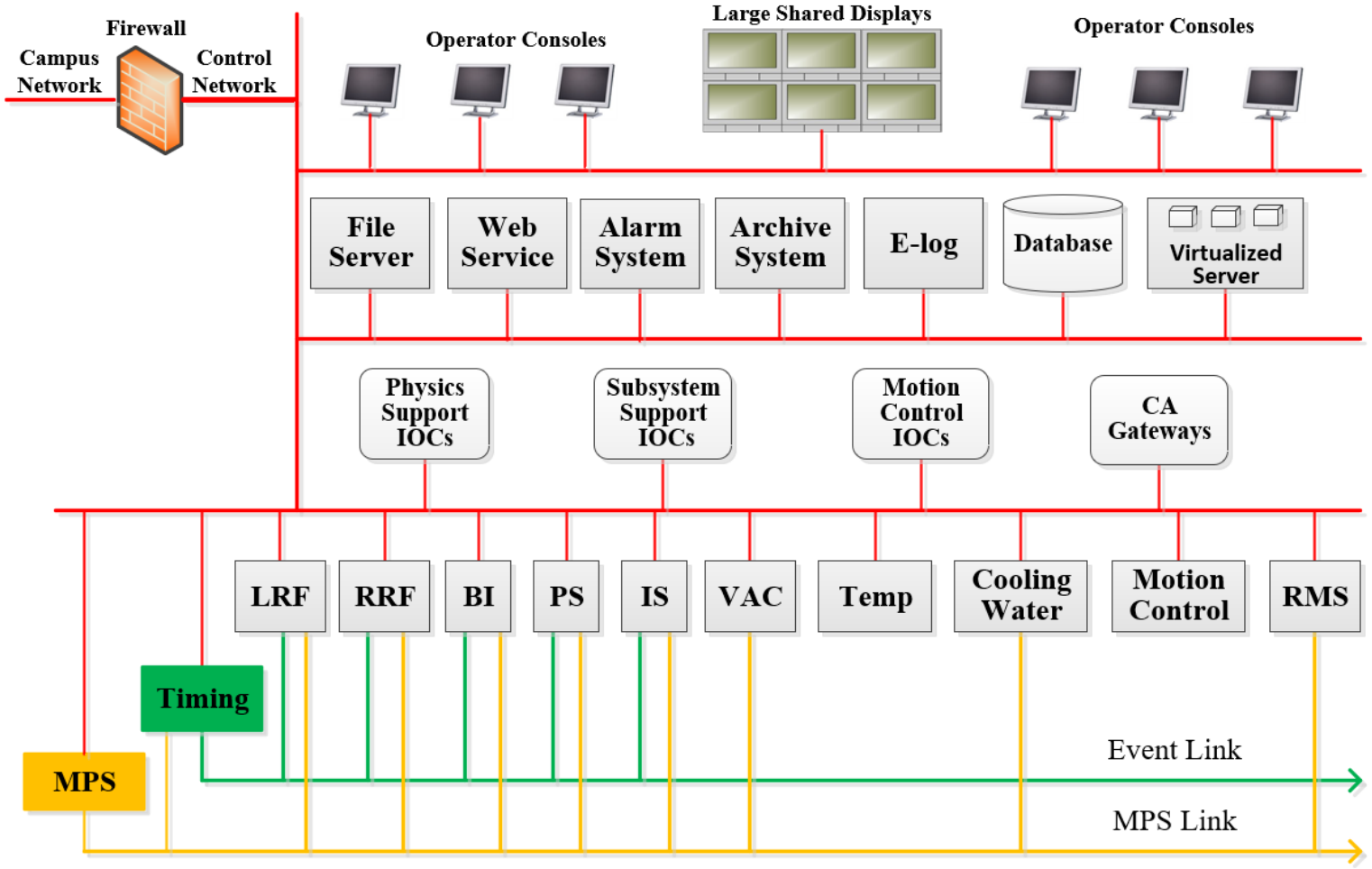


NEW: 9 neutron beam line, 1 muon and 1 proton line

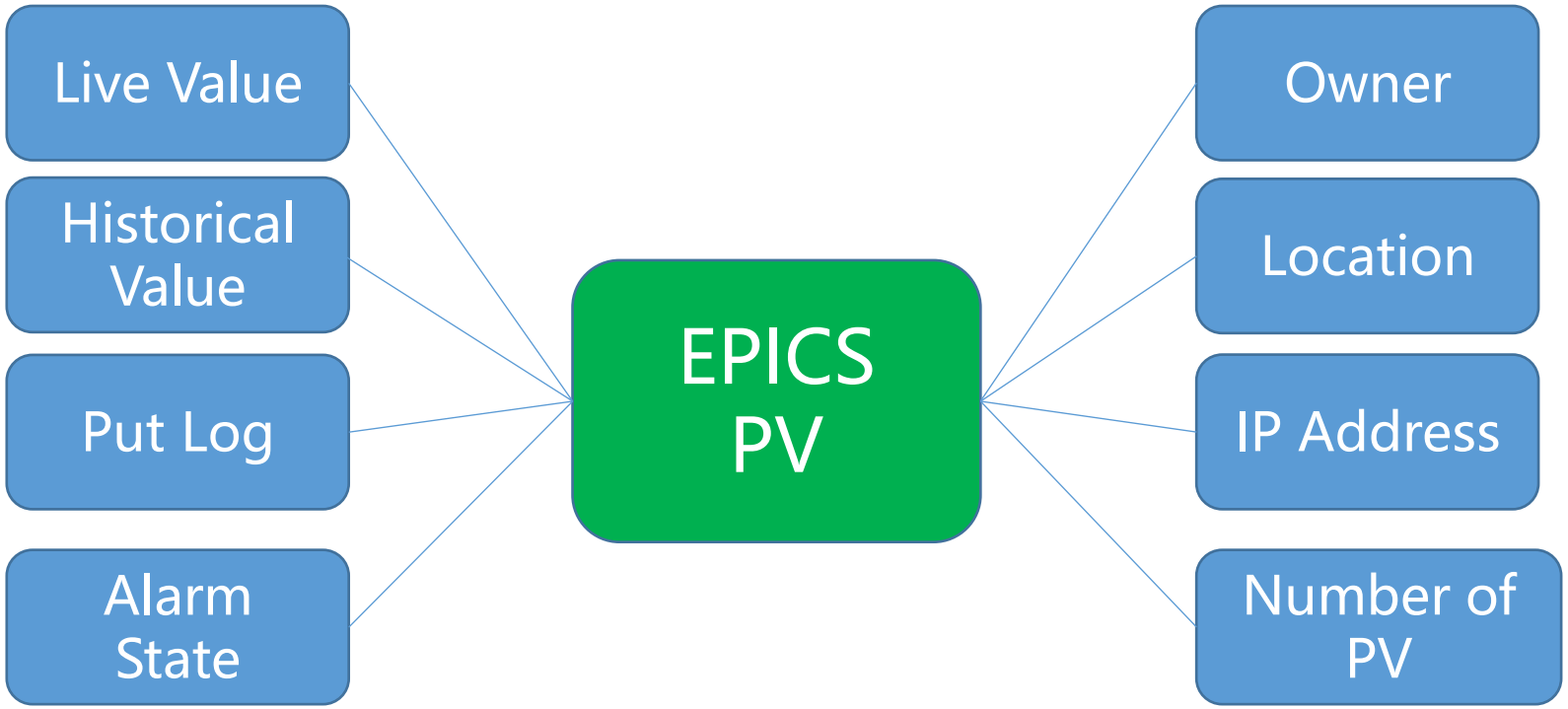
Parameters	CSNS	CSNS-II
Beam Power (KW)	100	500
Rep-Rate (Hz)	25	25
Beam Energy (GeV)	1.6	1.6
Avg Current (μA)	62.5	312
Linac Energy(MeV)	80	300
Linac Pk Current (mA)	15	40
Linac RF Frequency (MHz)	324	324/648
Linac Beam Width(μS)	400	600

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



Information we care about PV



Information we care about PV

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

epics-modules/
caPutLog

Channel Access Put Logger, from DESY/BESSY

slacmshankar.github.io
http://slacmshankar.github.io/epics

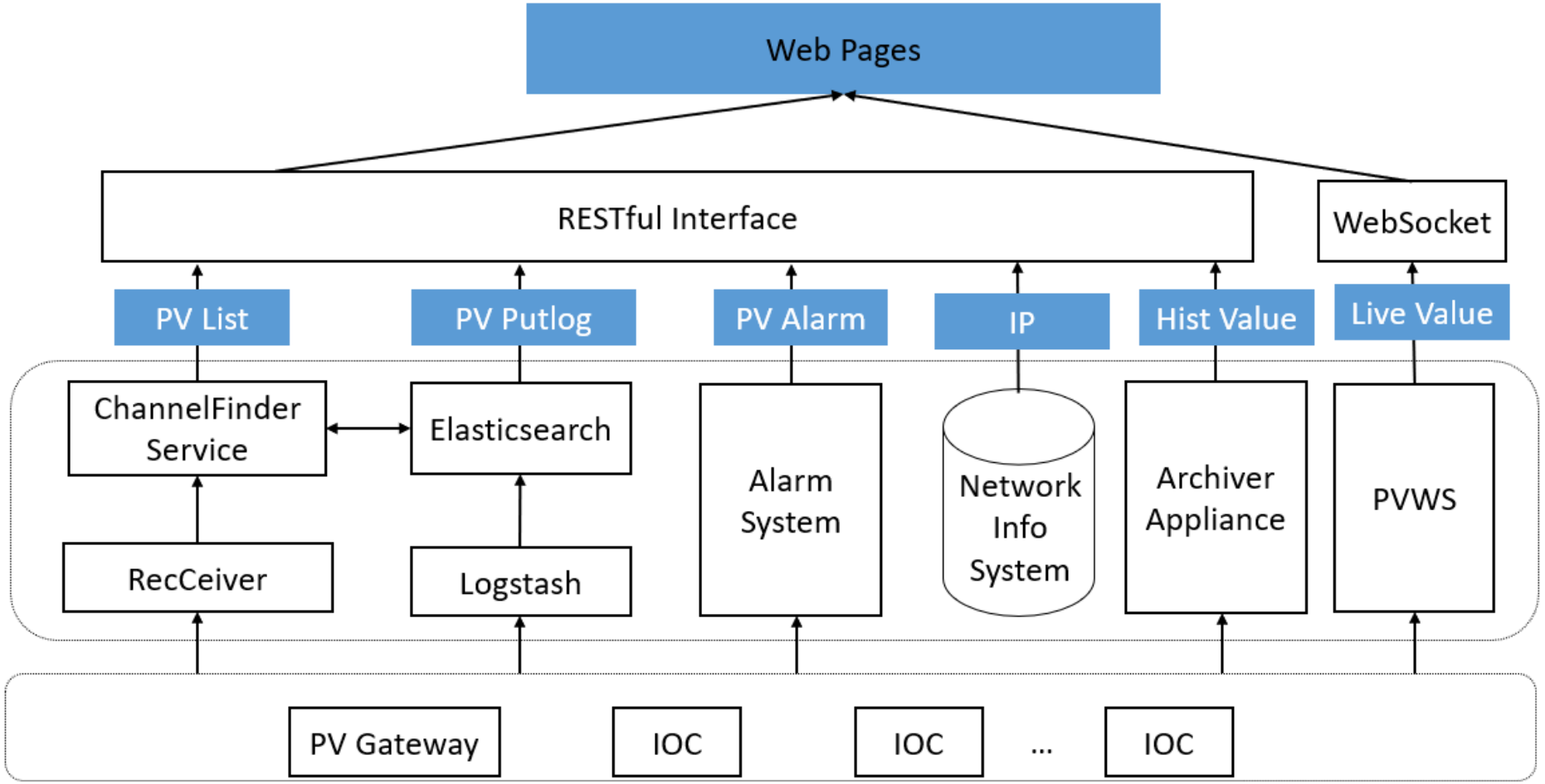
EPICS Archiver Appliance

ChannelFinder/
recsync

EPICS Record Synchronizor

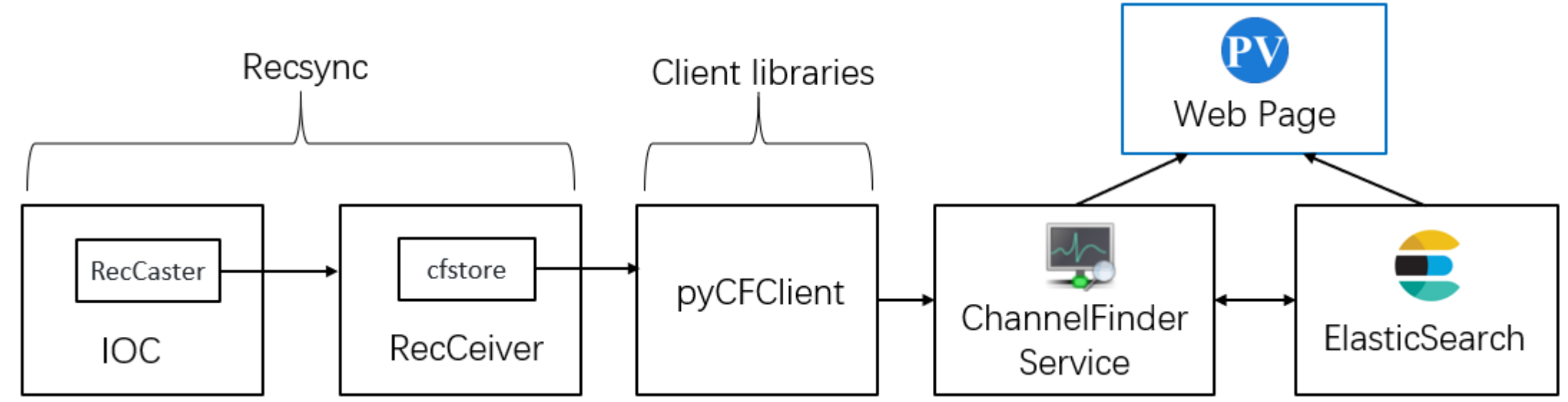
Design of PV Browser

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



PV List

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



PV list module

PV List

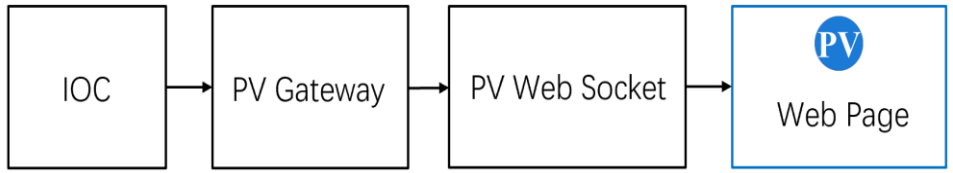
- PV name list, IOC name list, IOC IP list and PV detailed information can be showed in the main page

PV List main page

PV Live Data

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

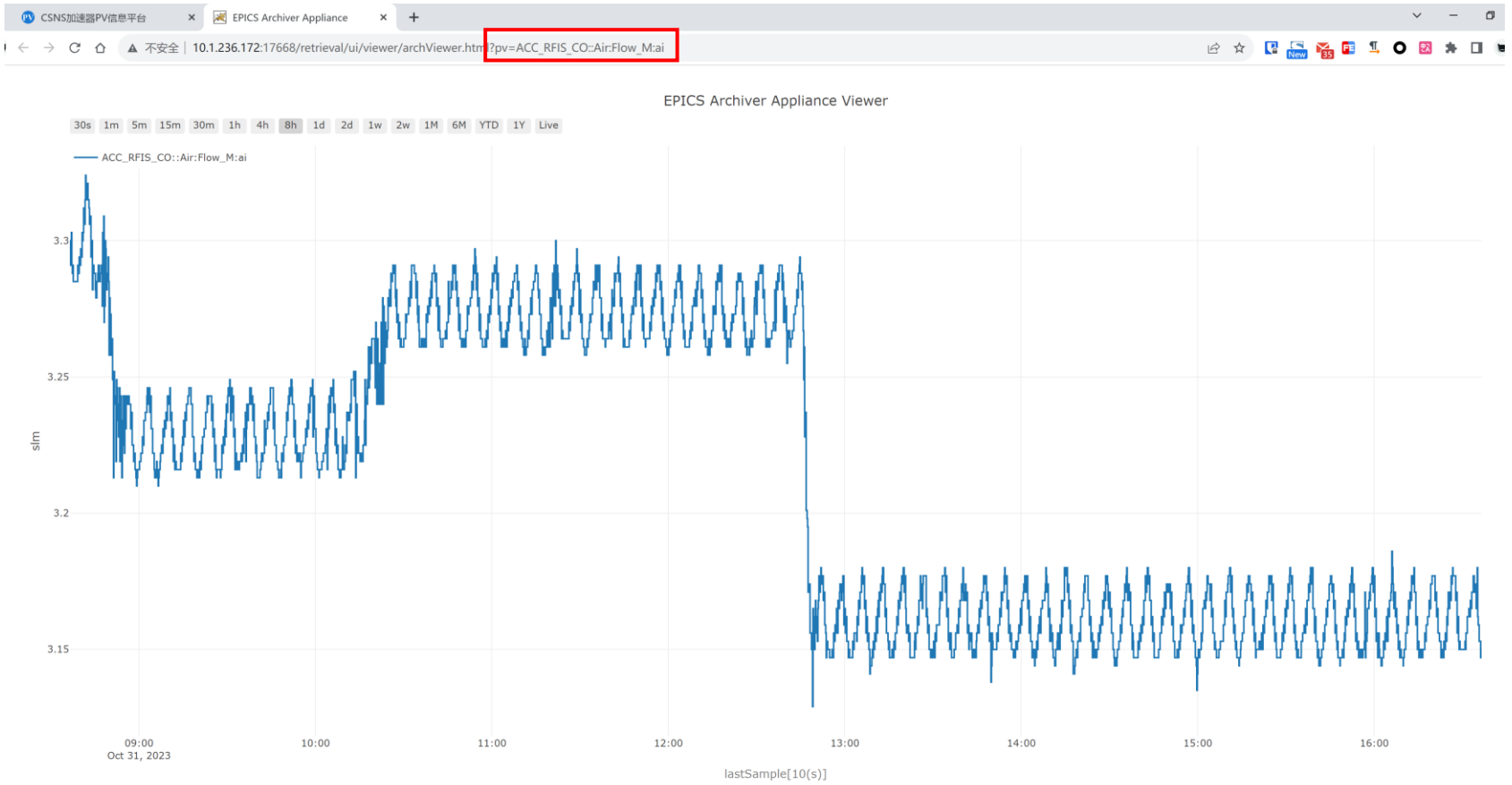
PV Live data



PV live data module

PV Historical Data

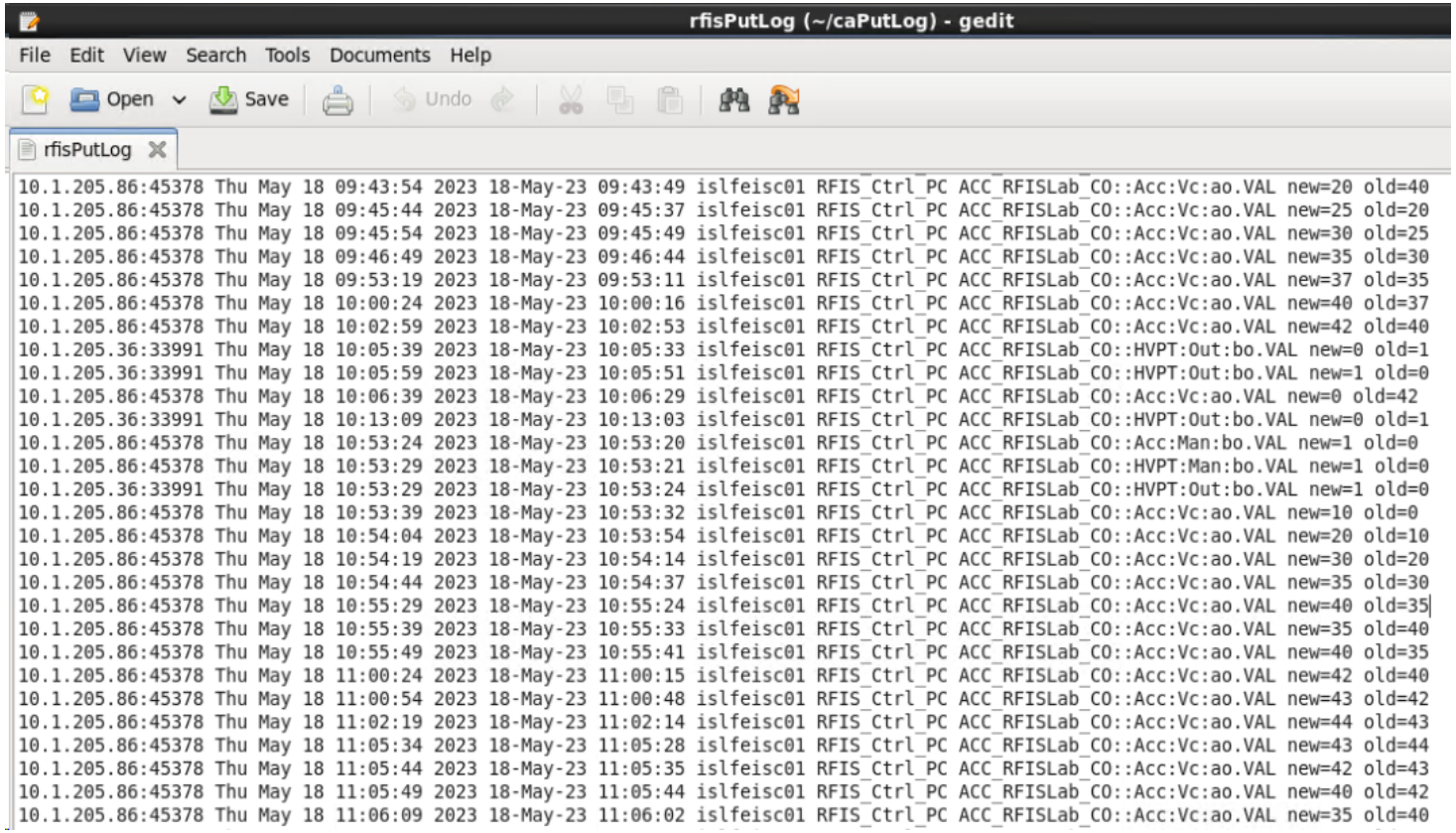
- The EPICS Archiver Appliance supports data retrieval in multiple formats/MIME types. PV browser calls the in-built web service to show the historical data



PV Historical Data

PV Putlog

- 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

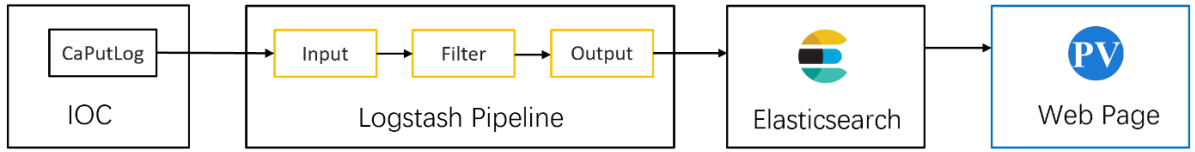


The content of iocLogServer log file

PV Putlog

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

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

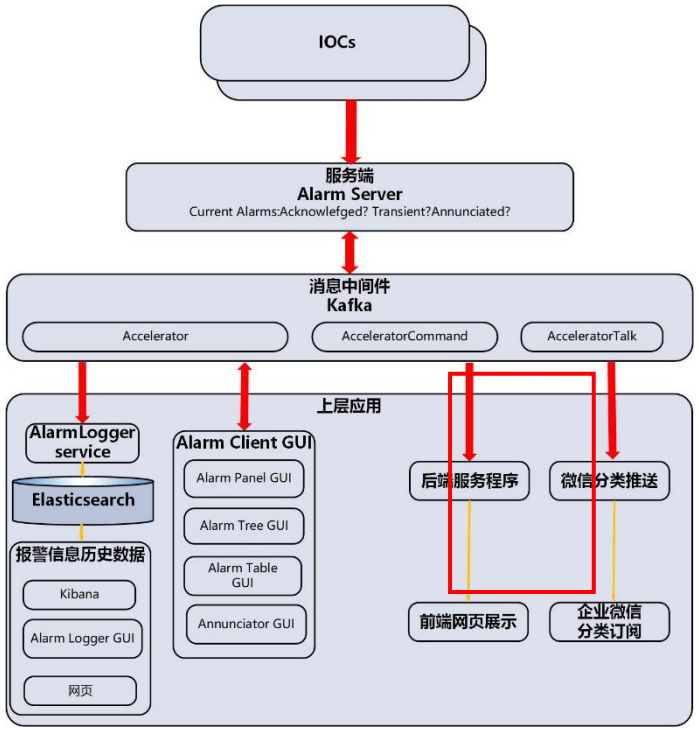
PV	Description	Alarm Severity	Alarm Status	Alarm Time	Alarm Value	PV Serverity	PV Status

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:In	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

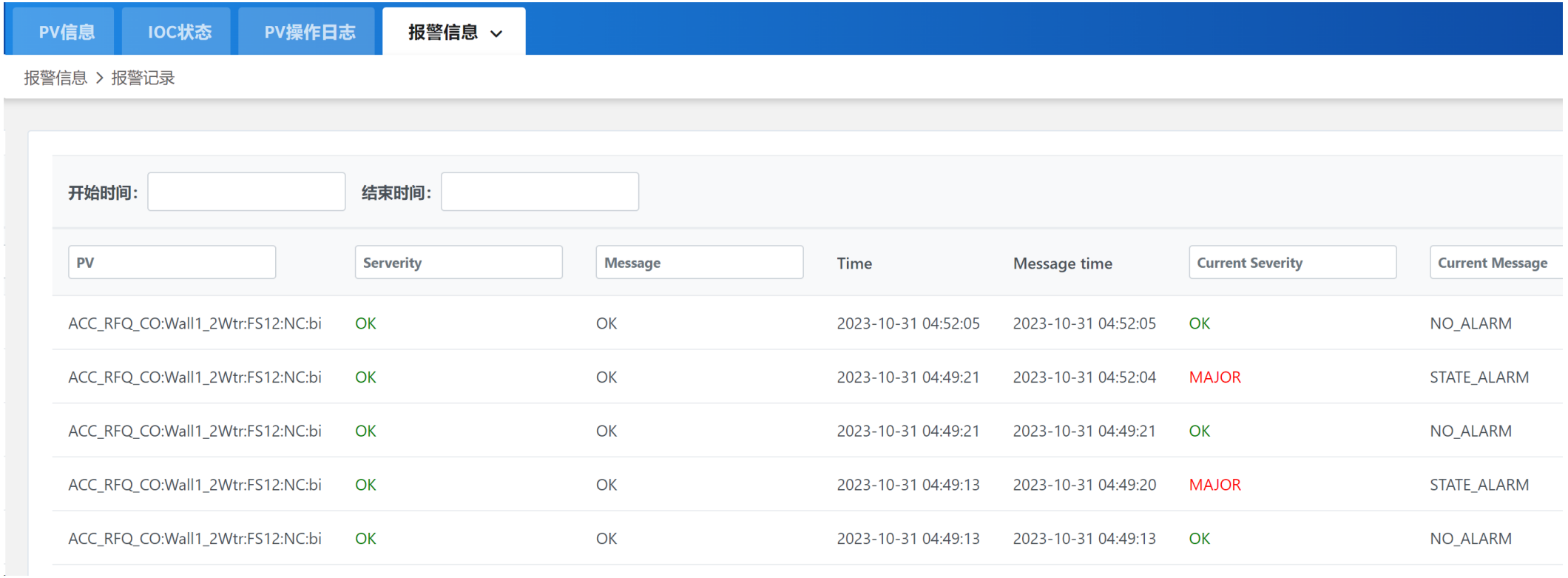
Active alarm page



The Phoebus kafka alarm system deployed at CSNS

PV Alarm State

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

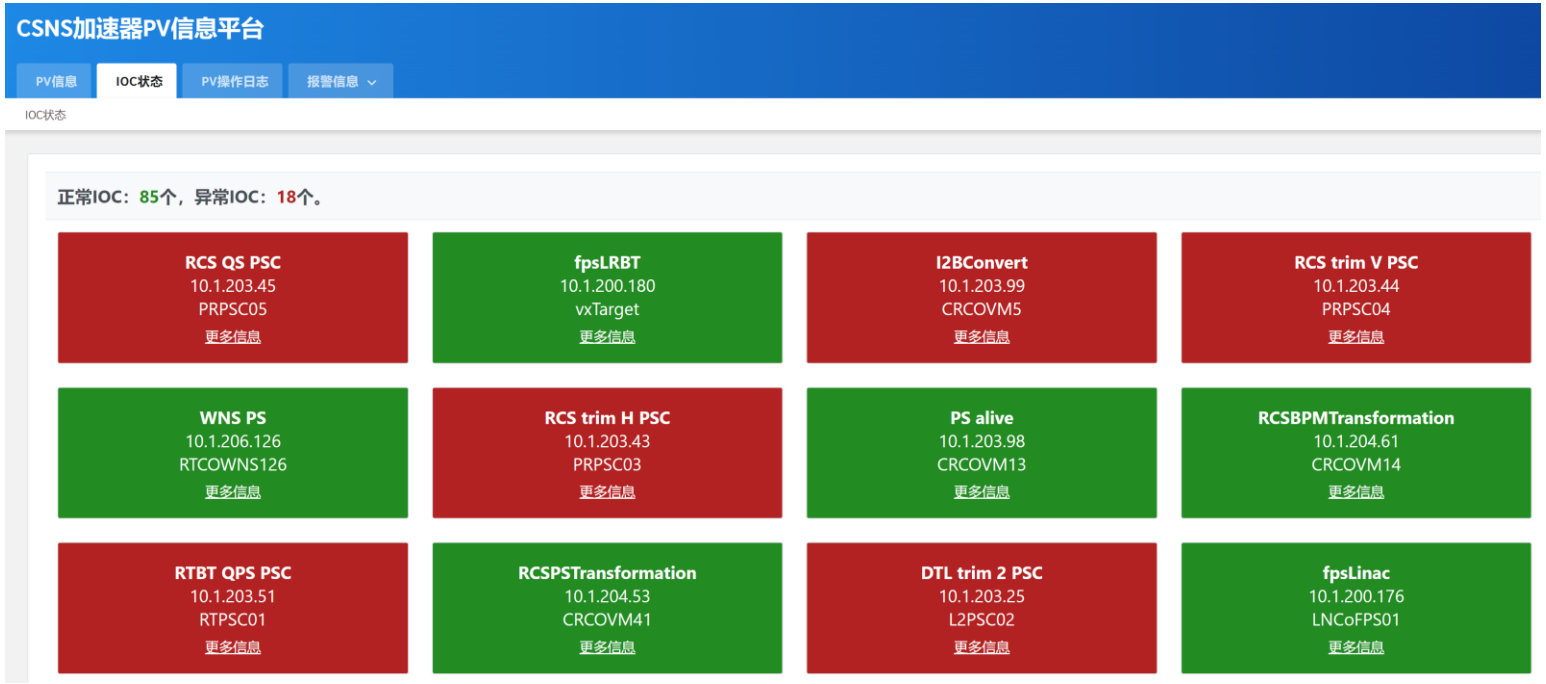


PV	Serverity	Message	Time	Message time	Current Severity	Current Message
ACC_RFQ_CO:Wall1_2Wtr:FS12:NC:bi	OK	OK	2023-10-31 04:52:05	2023-10-31 04:52:05	OK	NO_ALARM
ACC_RFQ_CO:Wall1_2Wtr:FS12:NC:bi	OK	OK	2023-10-31 04:49:21	2023-10-31 04:52:04	MAJOR	STATE_ALARM
ACC_RFQ_CO:Wall1_2Wtr:FS12:NC:bi	OK	OK	2023-10-31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

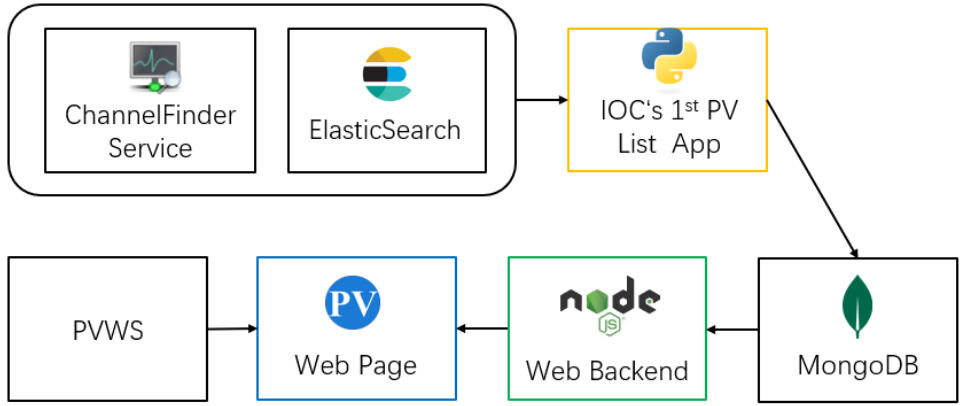
Alarm history page

IOC Status

- 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



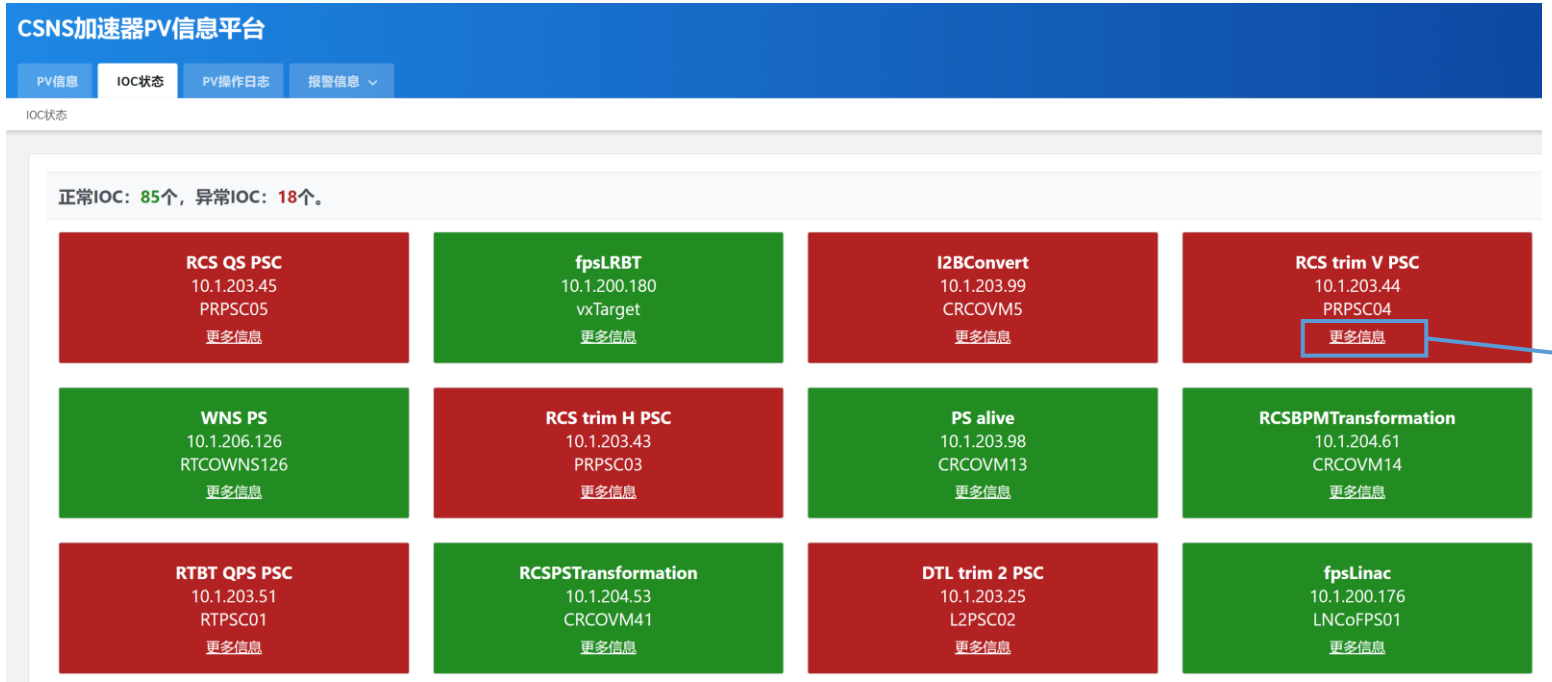
IOC Status page



IOC status module

IOC Status

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

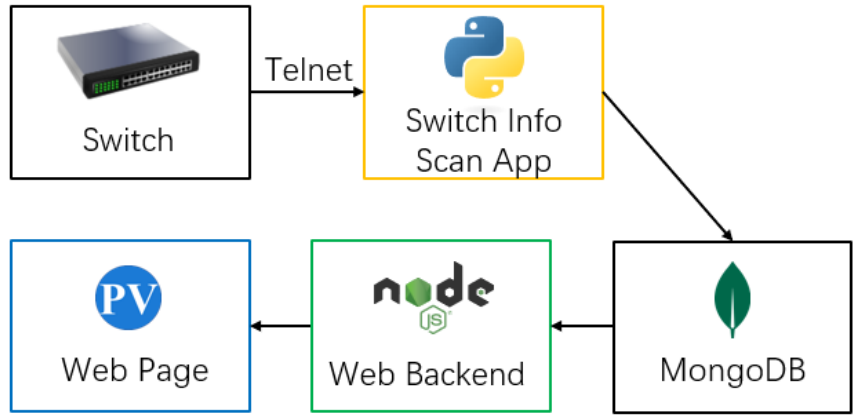


IOC Status page

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



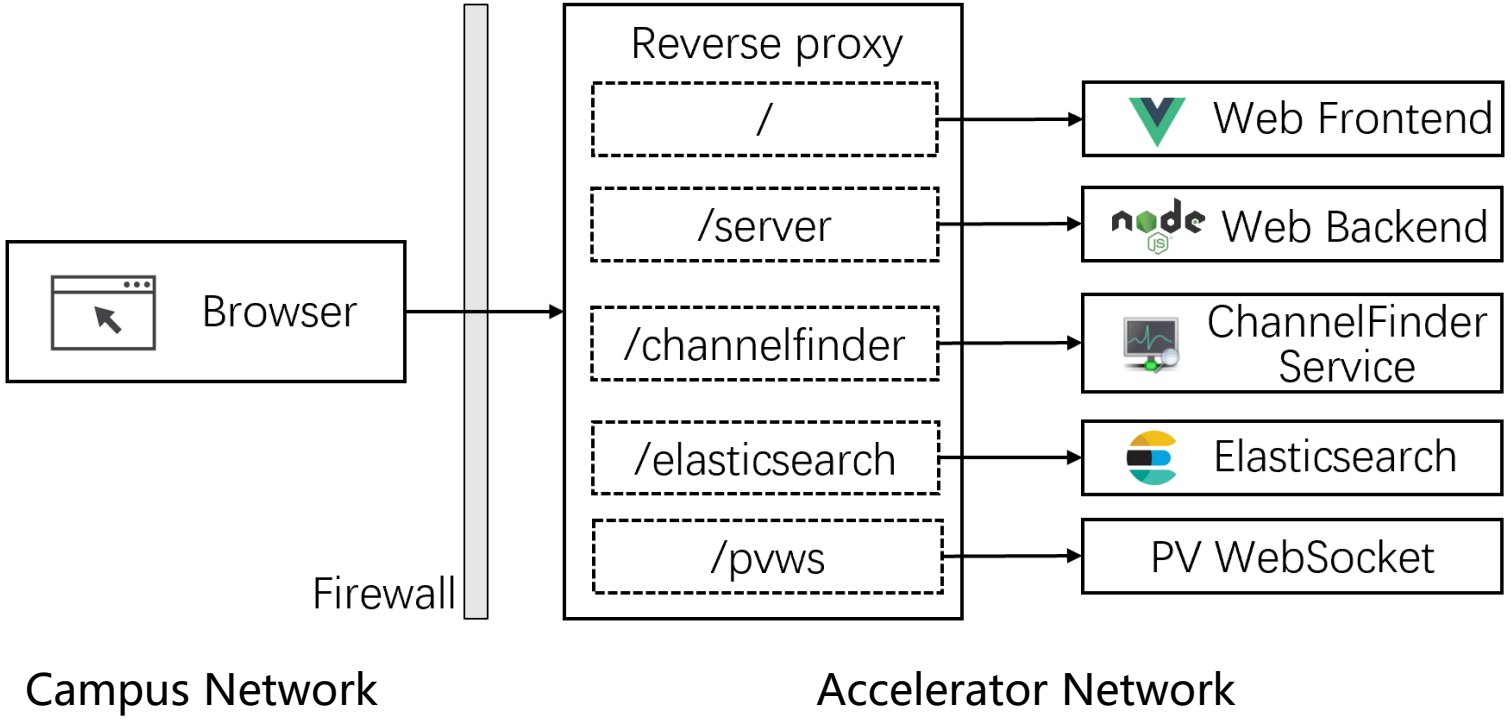
IOC Network Information

- 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!