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Implementation of Web-based Operational Log System at RIBF

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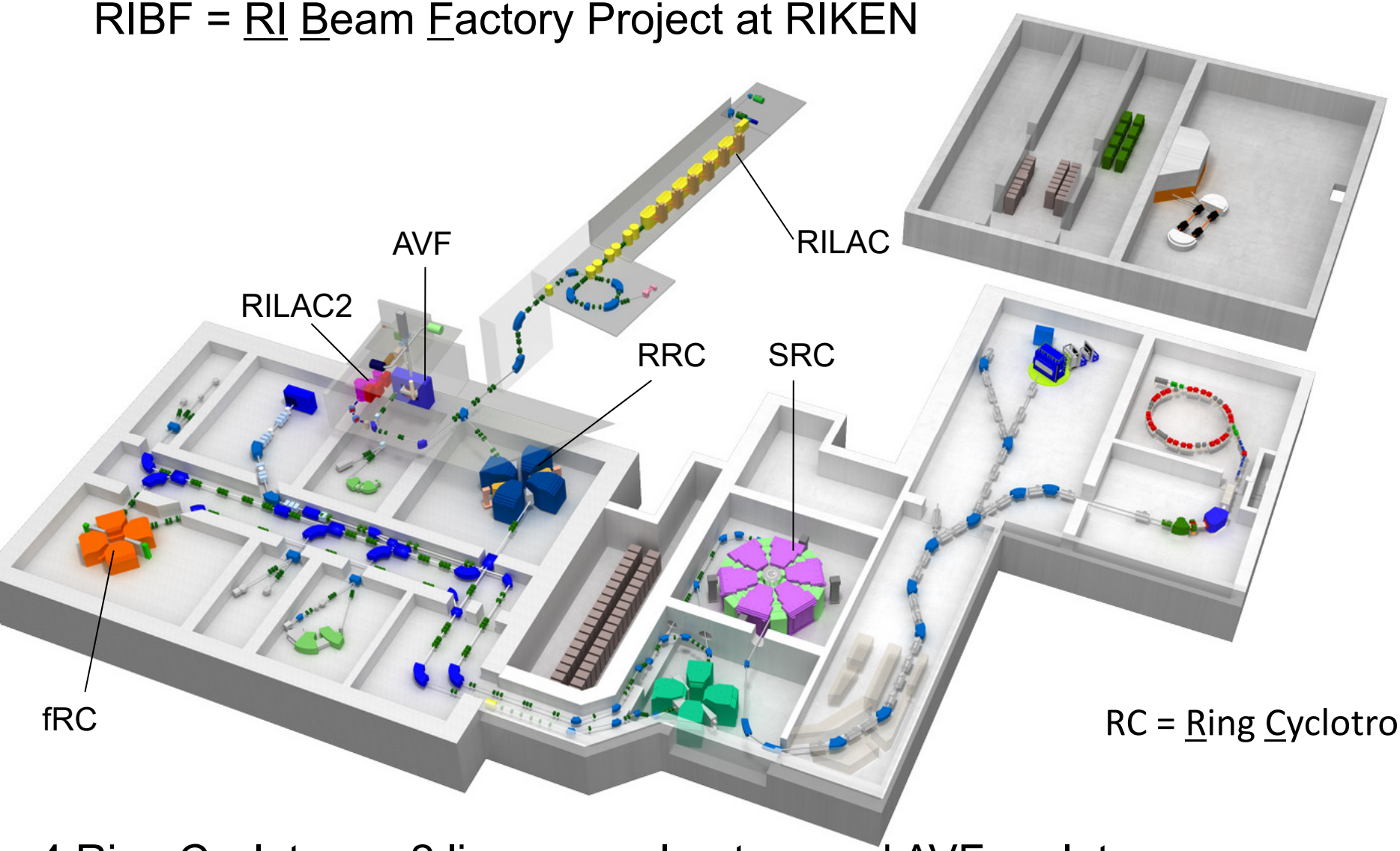
Outline

- Overview of RIBF
- Control system for RIBF
- Operational Log System
  - Zlog
  - RIBF Operational Log
  - Beam Status History
- Summary

Overview of RIBF

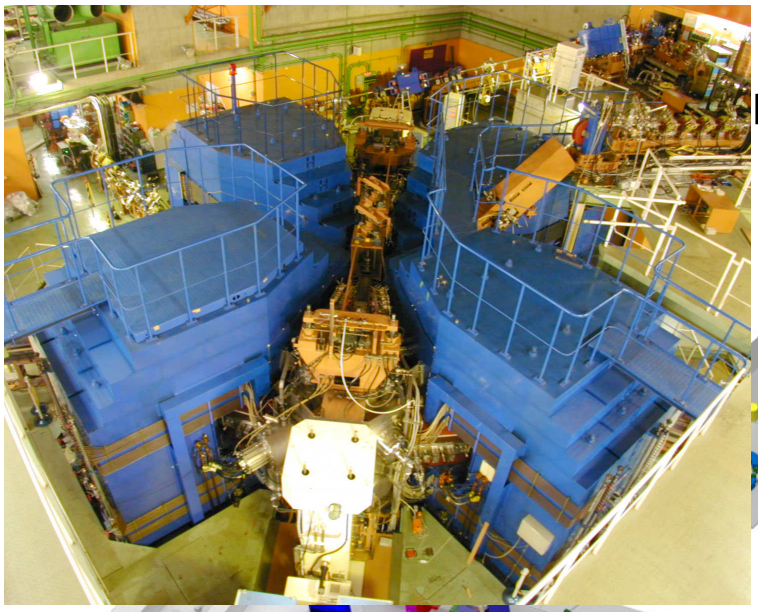
RIBF = RI Beam Factory Project at RIKEN



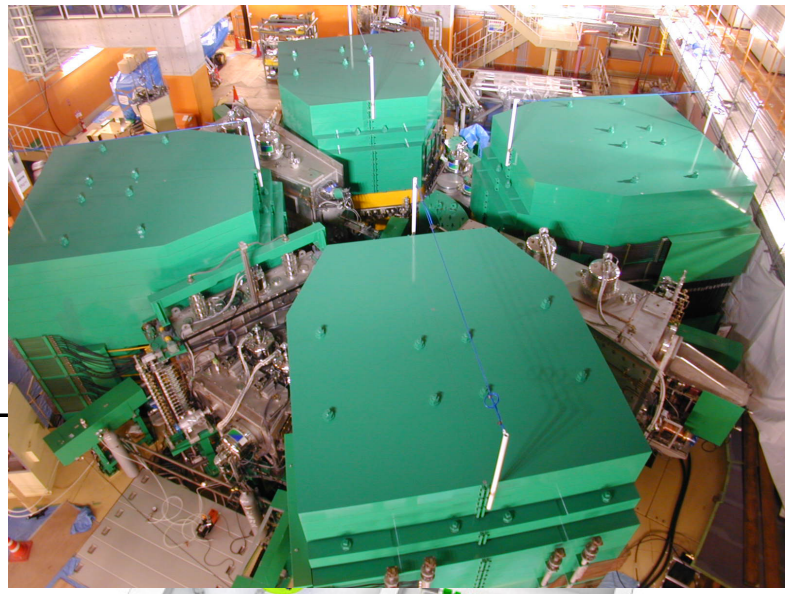
RC = Ring Cyclotron

4 Ring Cyclotrons, 2 linear accelerators and AVF cyclotron.

Overview of RIBF

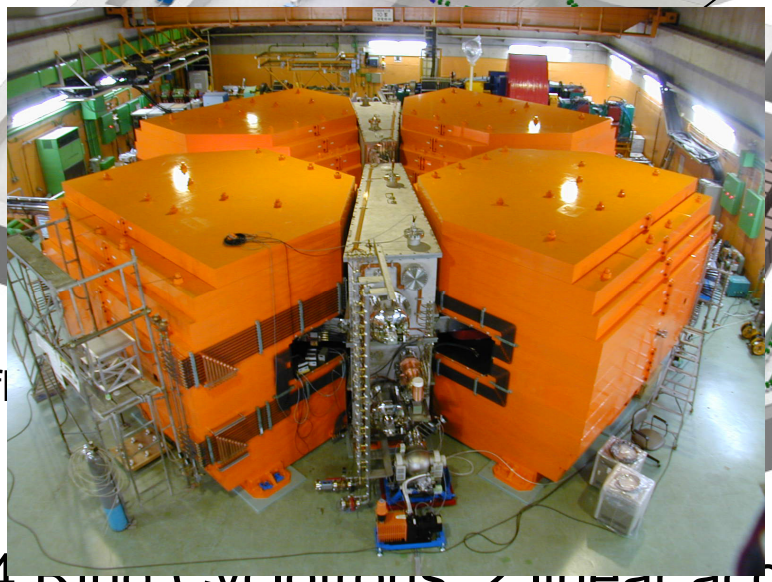


roject



RIL

RRC SRC



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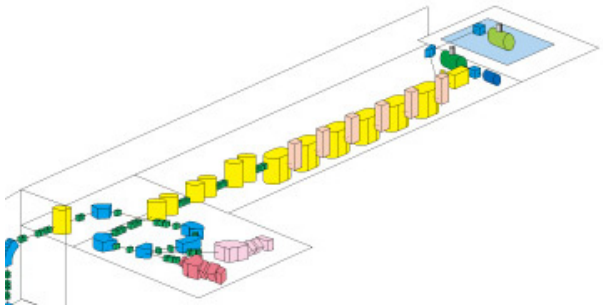
4 Ring Cyclotrons, 2 linear accelerators and AVF cyclotron.

Overview of RIBF

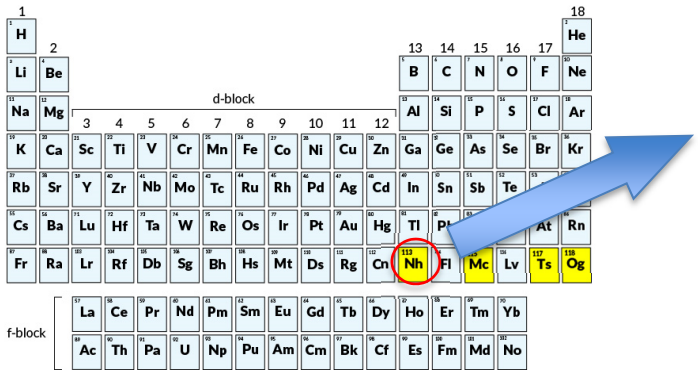
- Variable heavy ion beams have been provided for experiments.
- RIBF mode (RILAC2 + RRC + fRC + IRC + SRC) have been provided
  * 238U, 124Xe, 48Ca, 70Zn beam = 345MeV/u.

- RILAC stand-alone mode have been provided
  * 50Ti, 51V, 48Ca, 27Al, 40Ar, 70Zn, 24Mg, and 22Ne beam < 6.6 MeV/u.

New chemical element Nihonium with symbol **Nh** and atomic number **113**, were discovered in RILAC of RIBF project.



RIKEN Linear Accelerator (RILAC)



Original picture, ScienceNews, “Four newest elements on periodic table get names”

Reference, O. Kamigaito, et al. Proc. of IPAC2016, Busan, Korea, P. 1281

Control System for RIBF

RIBF control system is based on EPICS.

It covers

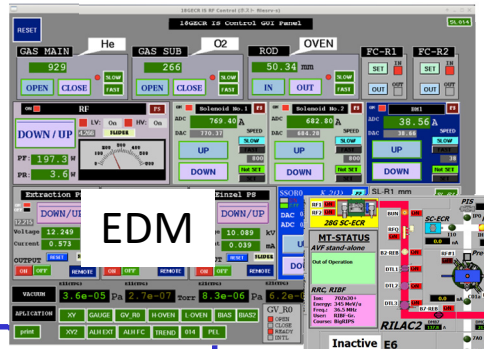
* Magnet Control
* Beam Diagnostics
* ECR Ion Source Control
* Vacuum Control
* Beam Interlock System

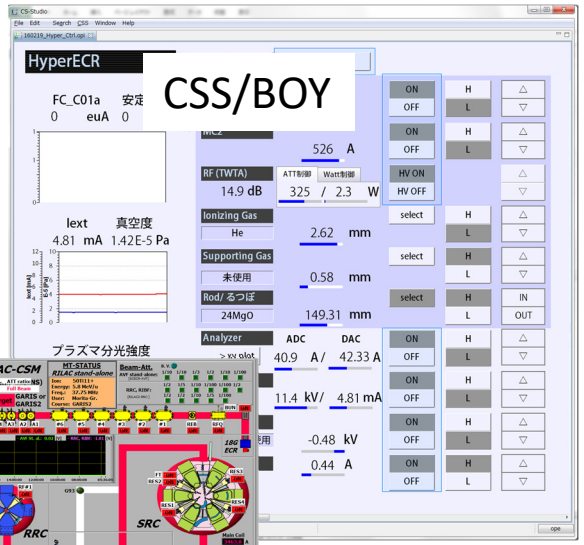
Komiyama-san reported in No. TUPHA028.

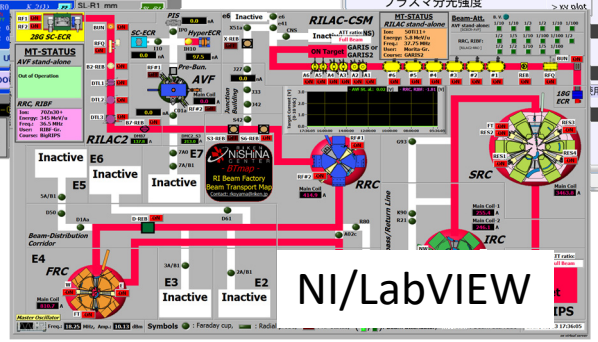
Other services

* Operational Log system
* Data archive system (PostgreSQL)
* Management system (like IRMIS)
* Alarm system (CSS/Beast)

Operator Interface



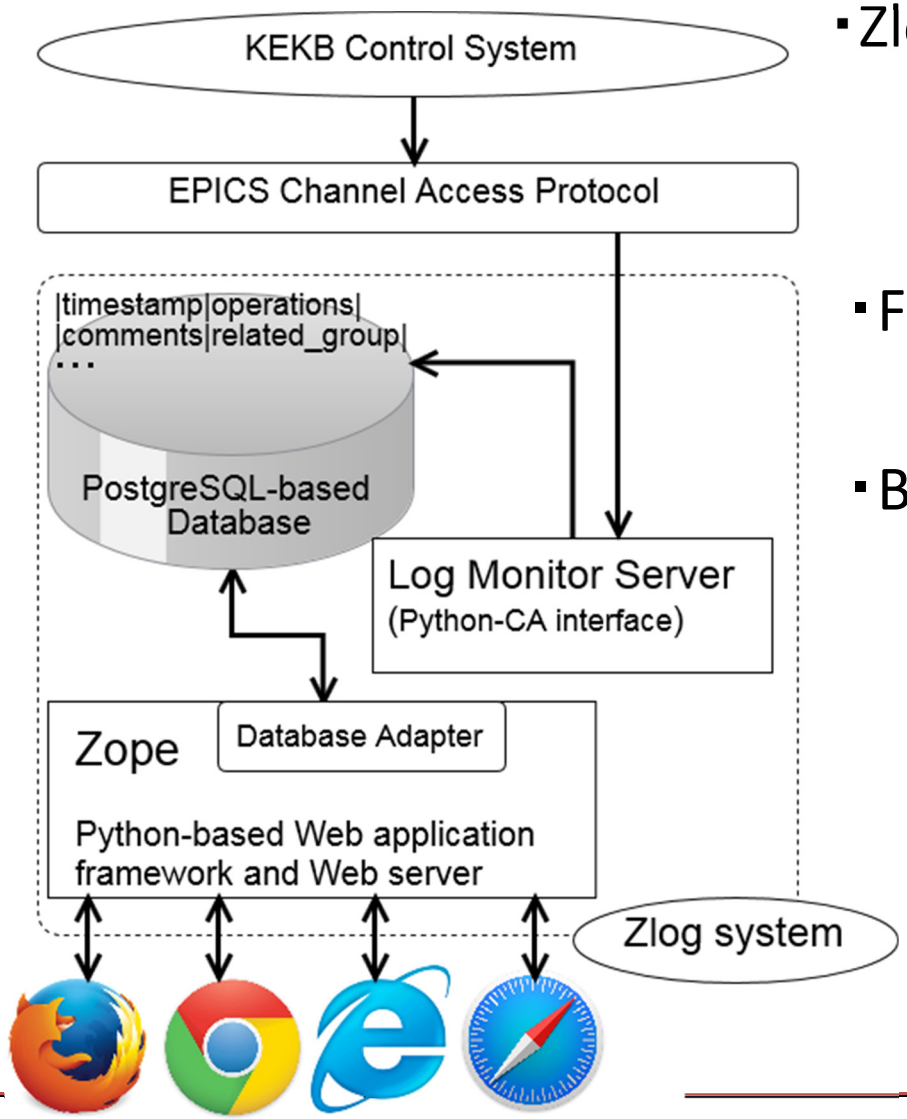




Stand Alone Control System

- RF Control (Only monitor via EPICS)
- Radiation Management System

Operational Log System (Zlog)

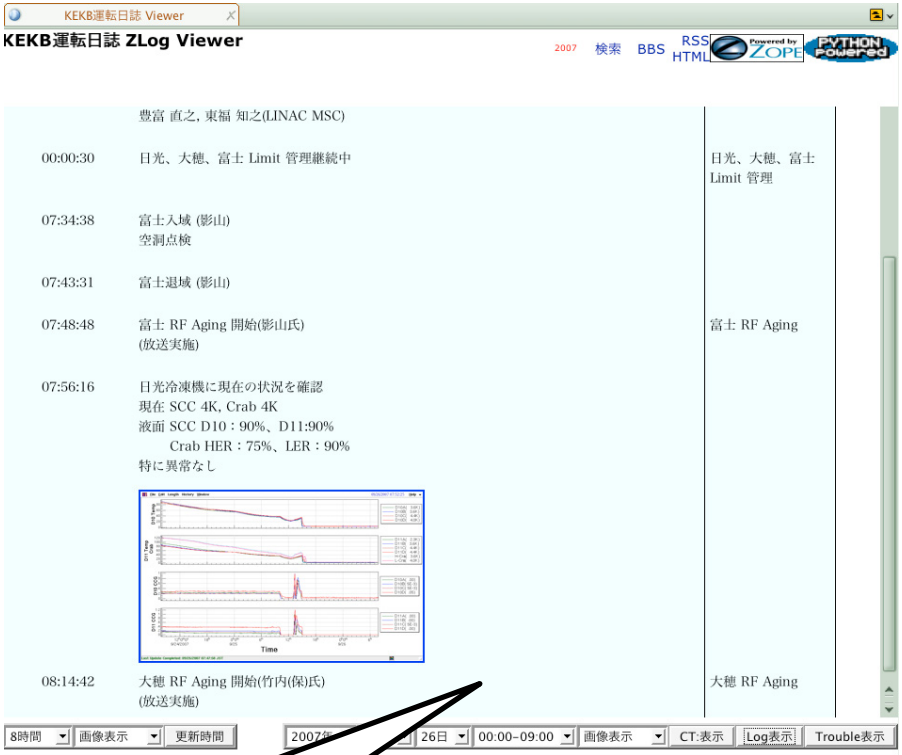


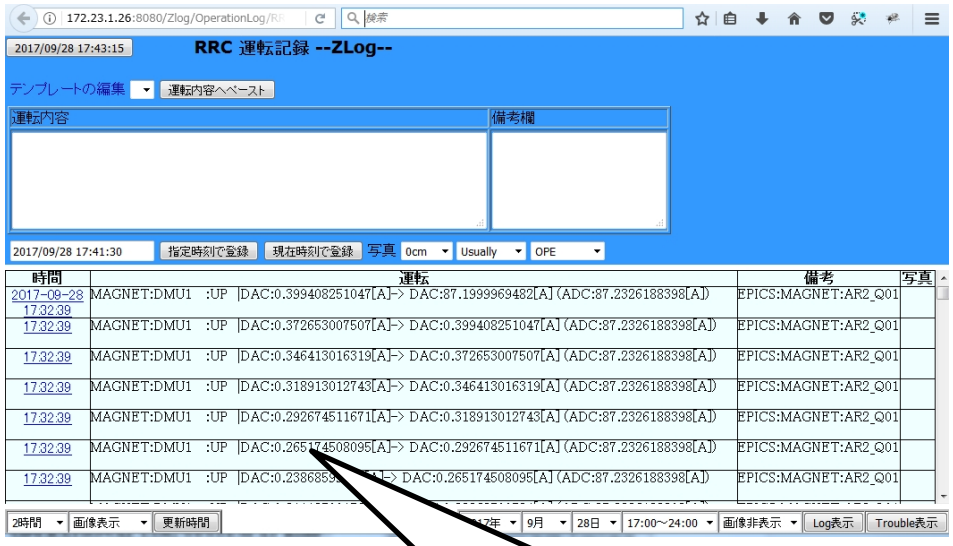
- Zlog has been introduced in RIBF.
  - Zlog = **Z**ope-based operational **log** system.
  - Zlog has been developed by KEK control group.
- Frontend
  - Web applications provided by Zope.
- Backend
  - PostgreSQL-based database.
  - Log Monitor Server coded in Python

Automatically operational log Inserted by using caMonitor.

Operational Log System (Zlog)

Zlog user interface





Log viewer for KEKB

Zlog Index page for RIBF

Reference, K. Yoshii et al., in Proc. ICALEPCS2007, Knoxville, Tennessee, USA, 2007, p. 299.

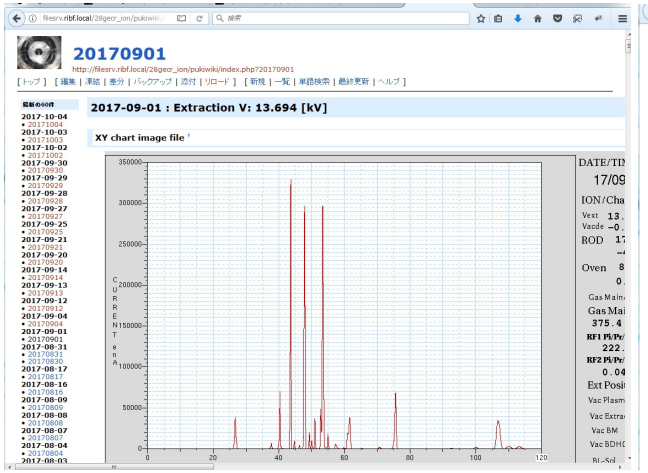
Operational Log System (Zlog)

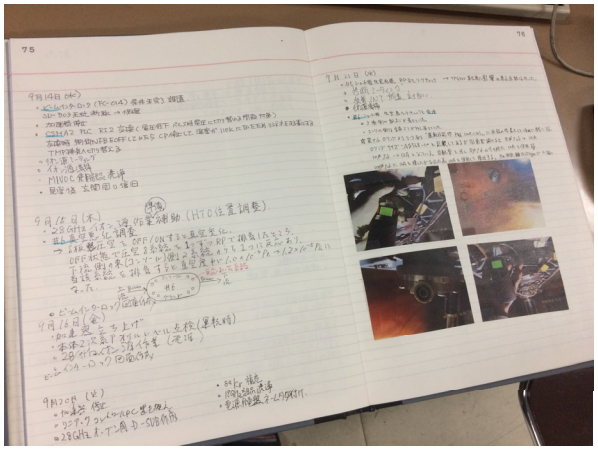
In use of Zlog for RIBF,

- Automatically inserted operational logs are often required.
- On the other hand, writing by hand is a little.

* Wiki-based system and paper-based logbook are also usually utilized for comment-writing still now.

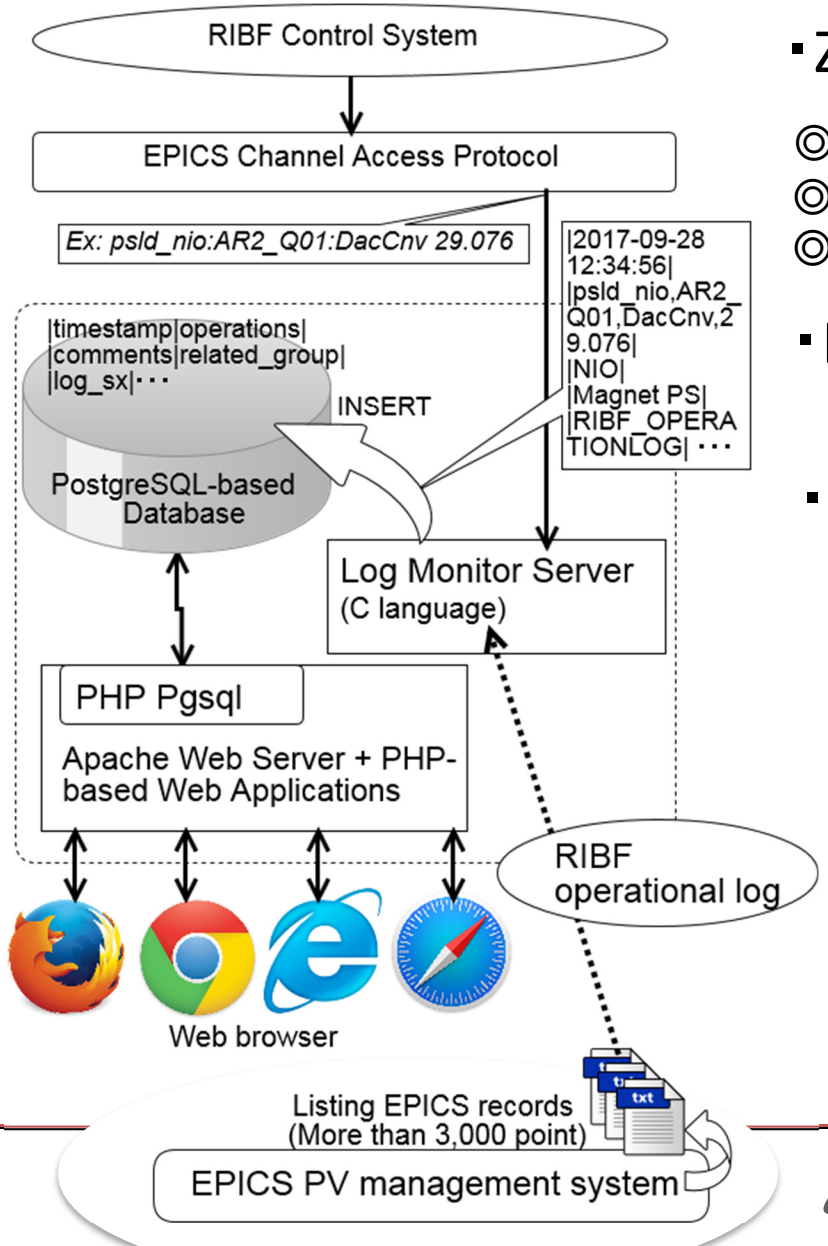
* Various kind of user interface is required for operational log system.





Development of new RIBF operational log system

RIBF Operational Log System (Architecture)



- Zlog compatible system.

◎ Web application + Log monitor server + database
◎ Same table structure with Zlog database.
◎ Zlog user interface is available with RIBF operational log.

- Frontend

Web applications developed with PHP and jQuery.

- Backend

PostgreSQL-based database.
Log Monitor Server coded in C language
Listing more than 3,000 EPICS records using PV management system

Automatically inserted operational log is a comma-separated character string.

ex : psld_nio,AR2_Q01,DacCnv,29.076,

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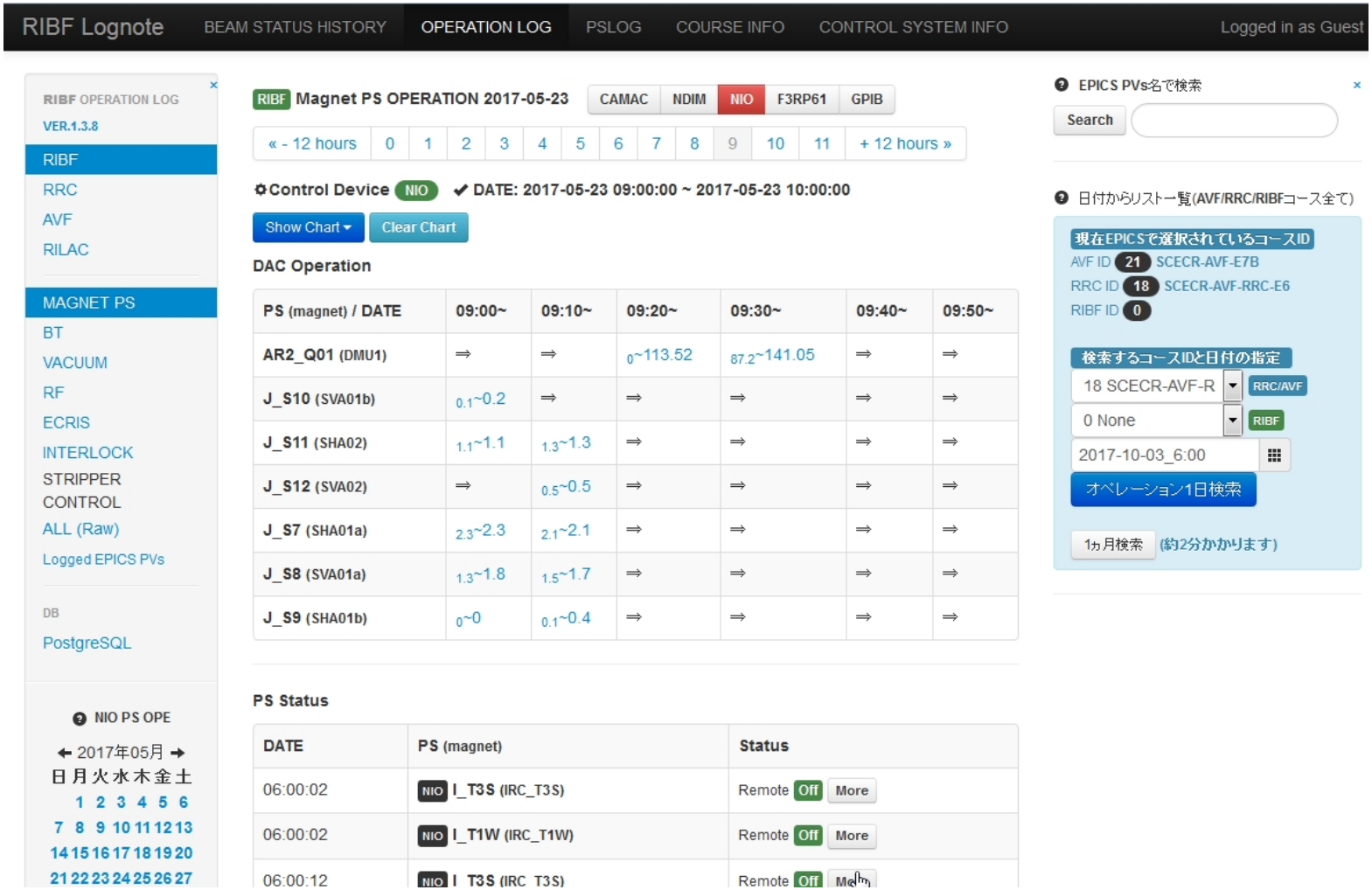
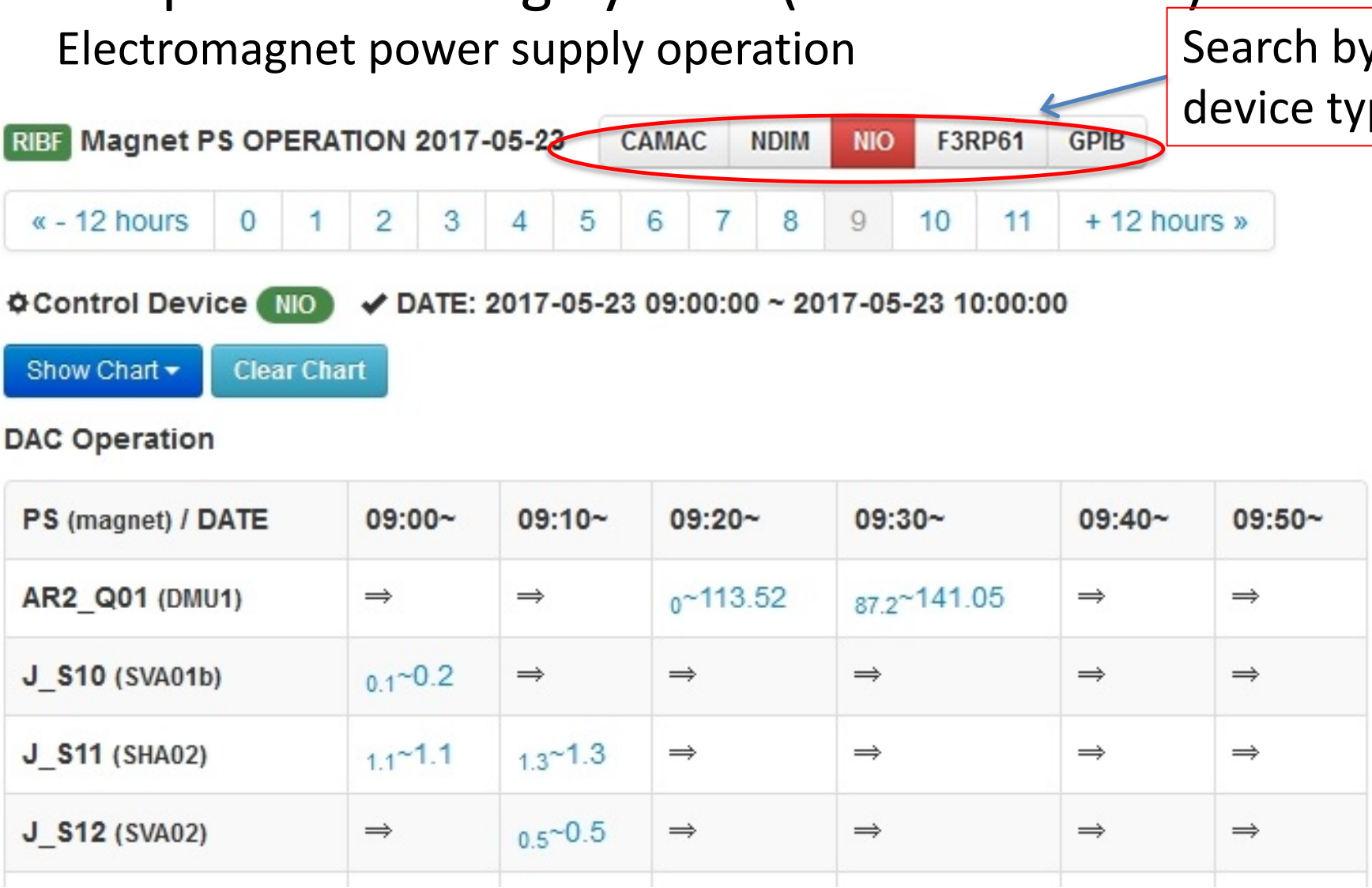
RIBF Operational Log System (User Interface)

Electromagnet power supply operation



RIBF Operational Log System (User Interface)

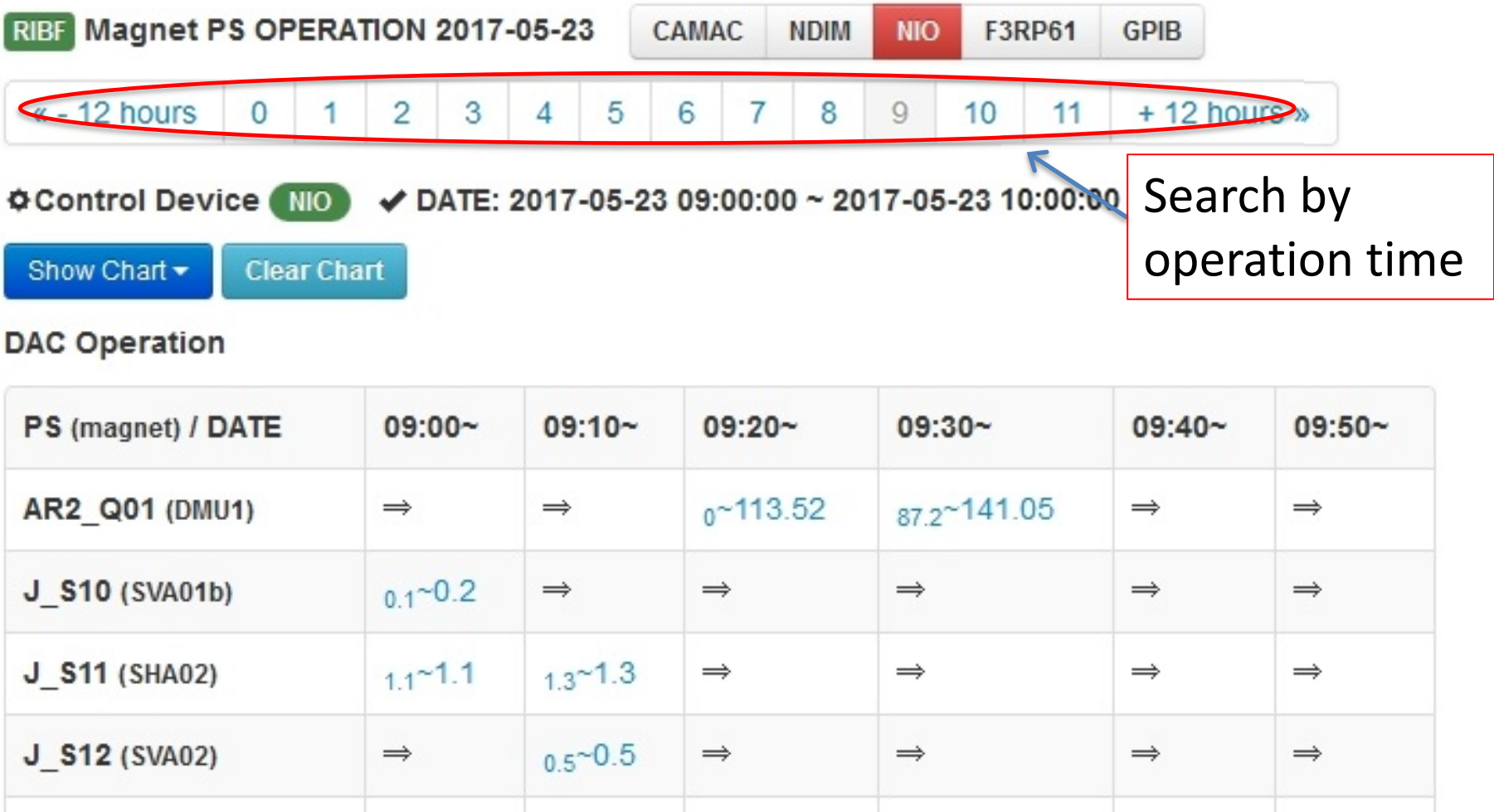
Electromagnet power supply operation



PS (magnet) / DATE	09:00~	09:10~	09:20~	09:30~	09:40~	09:50~
AR2_Q01 (DMU1)	⇒	⇒	$_{0}$~113.52	$_{87.2}$~141.05	⇒	⇒
J_S10 (SVA01b)	$_{0.1}$~0.2	⇒	⇒	⇒	⇒	⇒
J_S11 (SHA02)	$_{1.1}$~1.1	$_{1.3}$~1.3	⇒	⇒	⇒	⇒
J_S12 (SVA02)	⇒	$_{0.5}$~0.5	⇒	⇒	⇒	⇒

RIBF Operational Log System (User Interface)

Electromagnet power supply operation



RIBF Operational Log System (User Interface)

Electromagnet power supply operation

RIBF **Magnet PS OPERATION 2017-05-23** | CAMAC | NDIM | NIO | F3RP61 | GPIB

« - 12 hours | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | + 12 hours »

Control Device NIO ✔ **DATE: 2017-05-23 09:00:00 ~ 2017-05-23 10:00:00**

Show Chart ▾ | Clear Chart

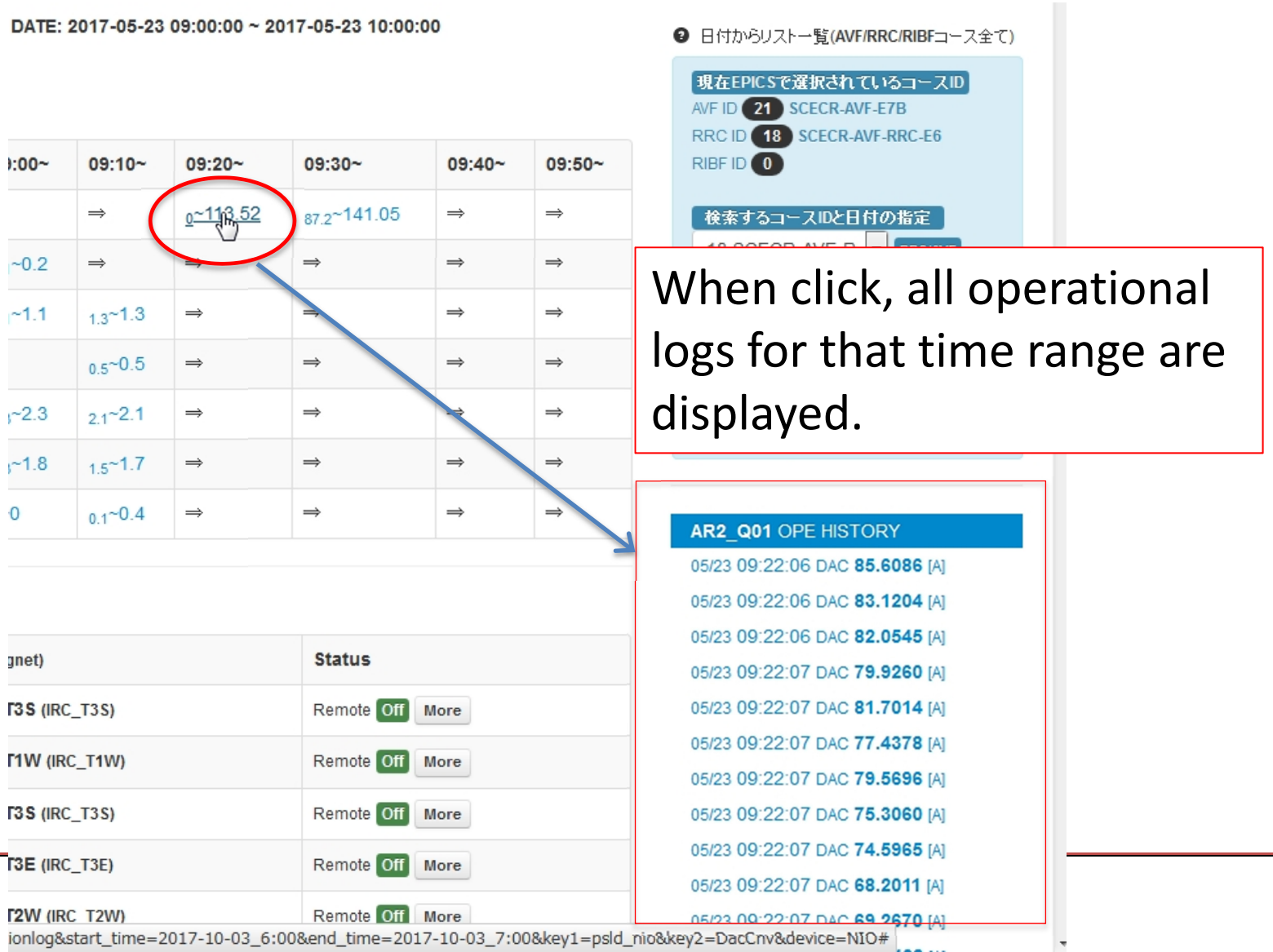
DAC operation for 10min

DAC Operation

PS (magnet) / DATE	09:00~	09:10~	09:20~	09:30~	09:40~	09:50~
AR2_Q01 (DMU1)	⇒	⇒	$_{0}$~113.52	$_{87.2}$~141.05	⇒	⇒
J_S10 (SVA01b)	$_{0.1}$~0.2	⇒	⇒	⇒	⇒	⇒
J_S11 (SHA02)	$_{1.1}$~1.1	$_{1.3}$~1.3	⇒	⇒	⇒	⇒
J_S12 (SVA02)	⇒	$_{0.5}$~0.5	⇒	⇒	⇒	⇒

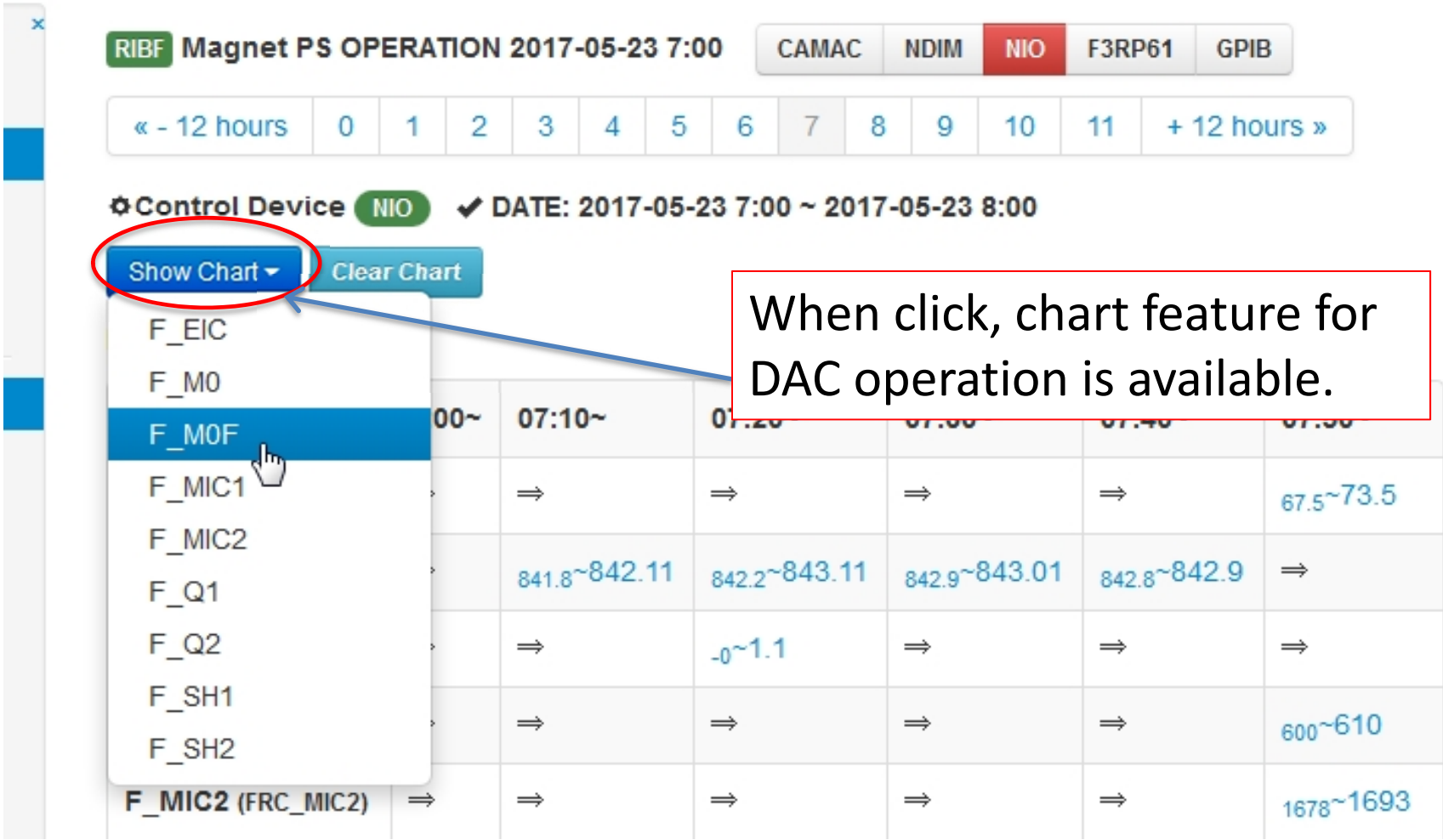
RIBF Operational Log System (User Interface)

Electromagnet power supply operation



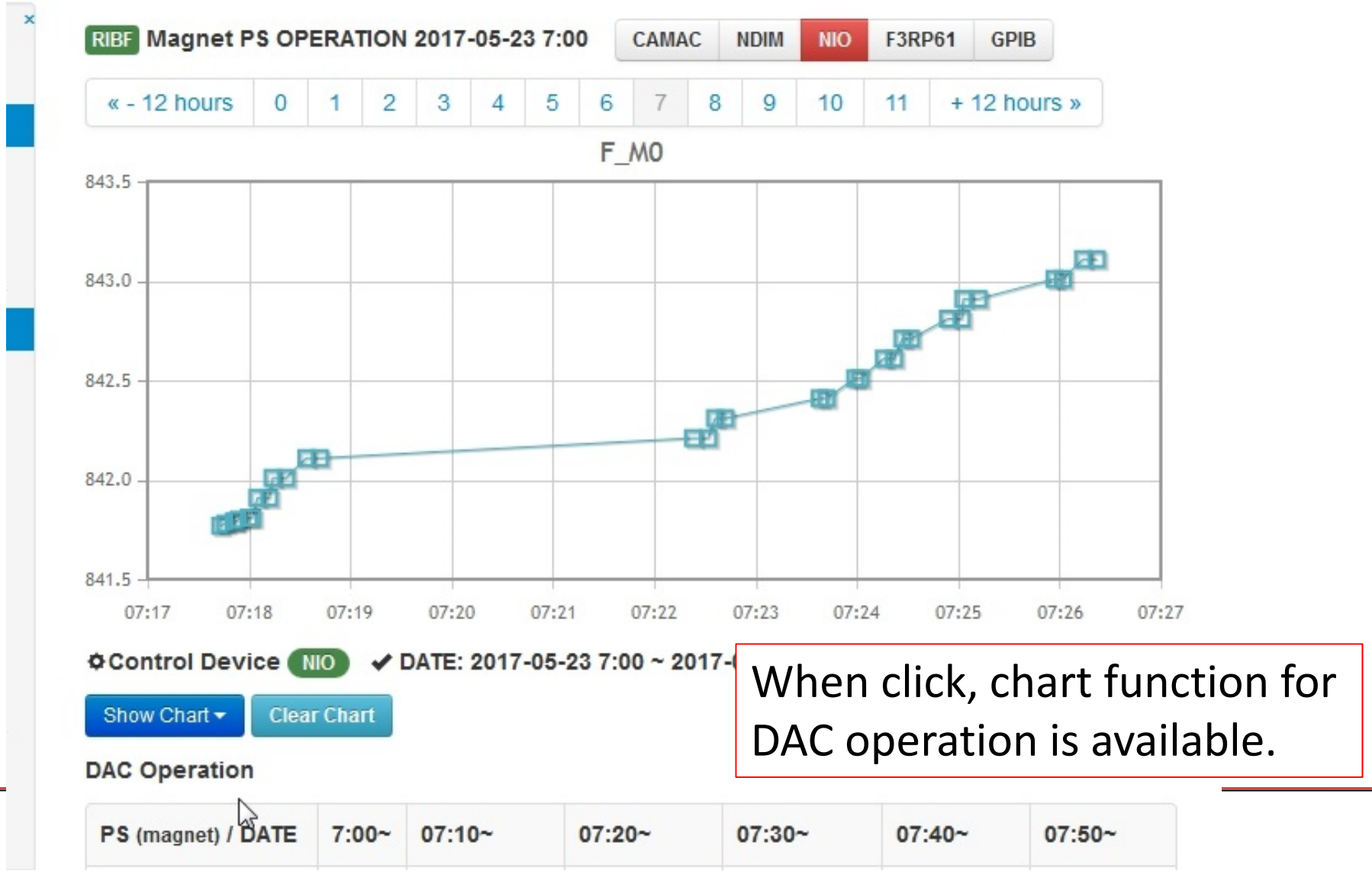
RIBF Operational Log System (User Interface)

Electromagnet power supply operation



RIBF Operational Log System (User Interface)

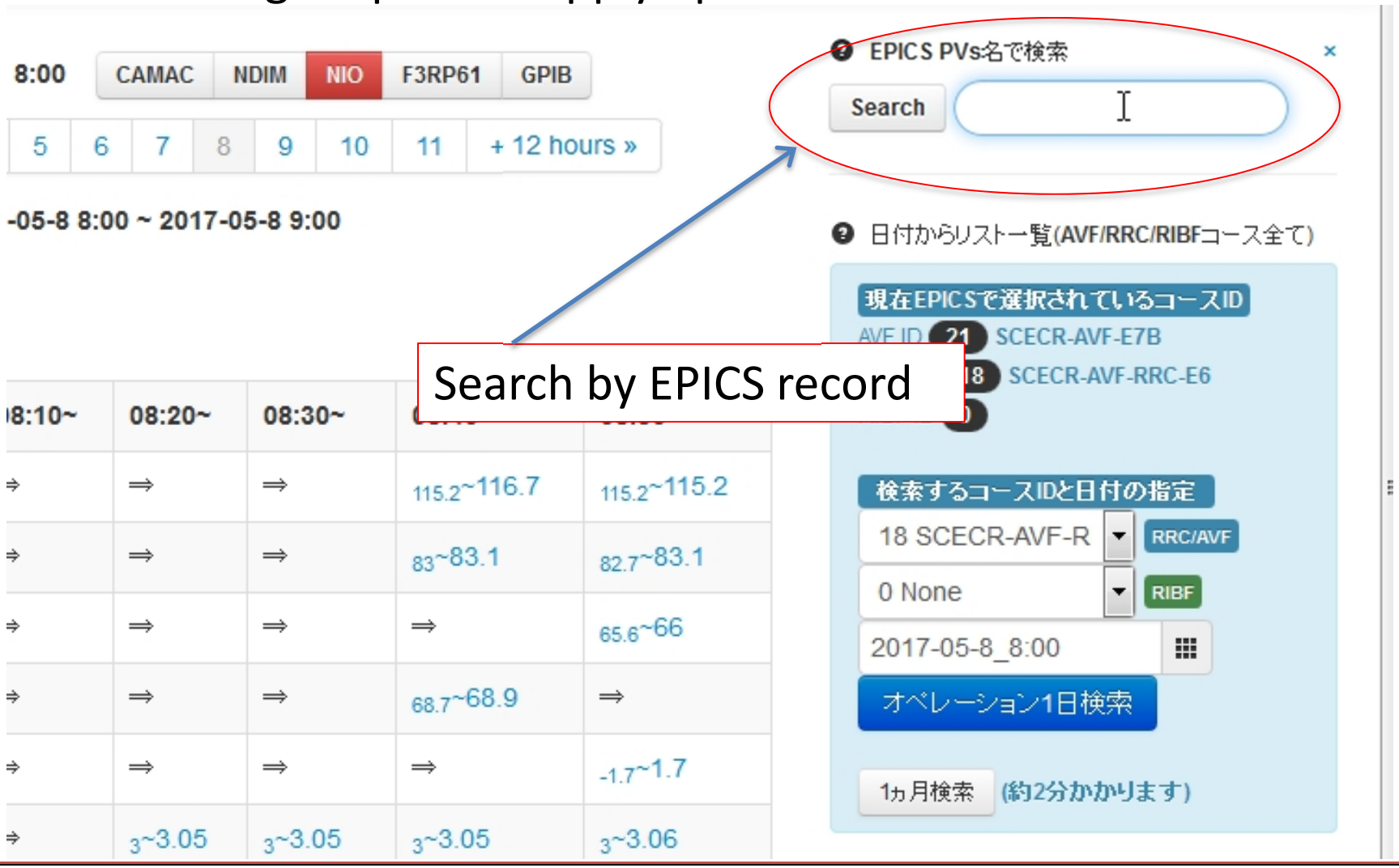
Electromagnet power supply operation



When click, chart function for DAC operation is available.

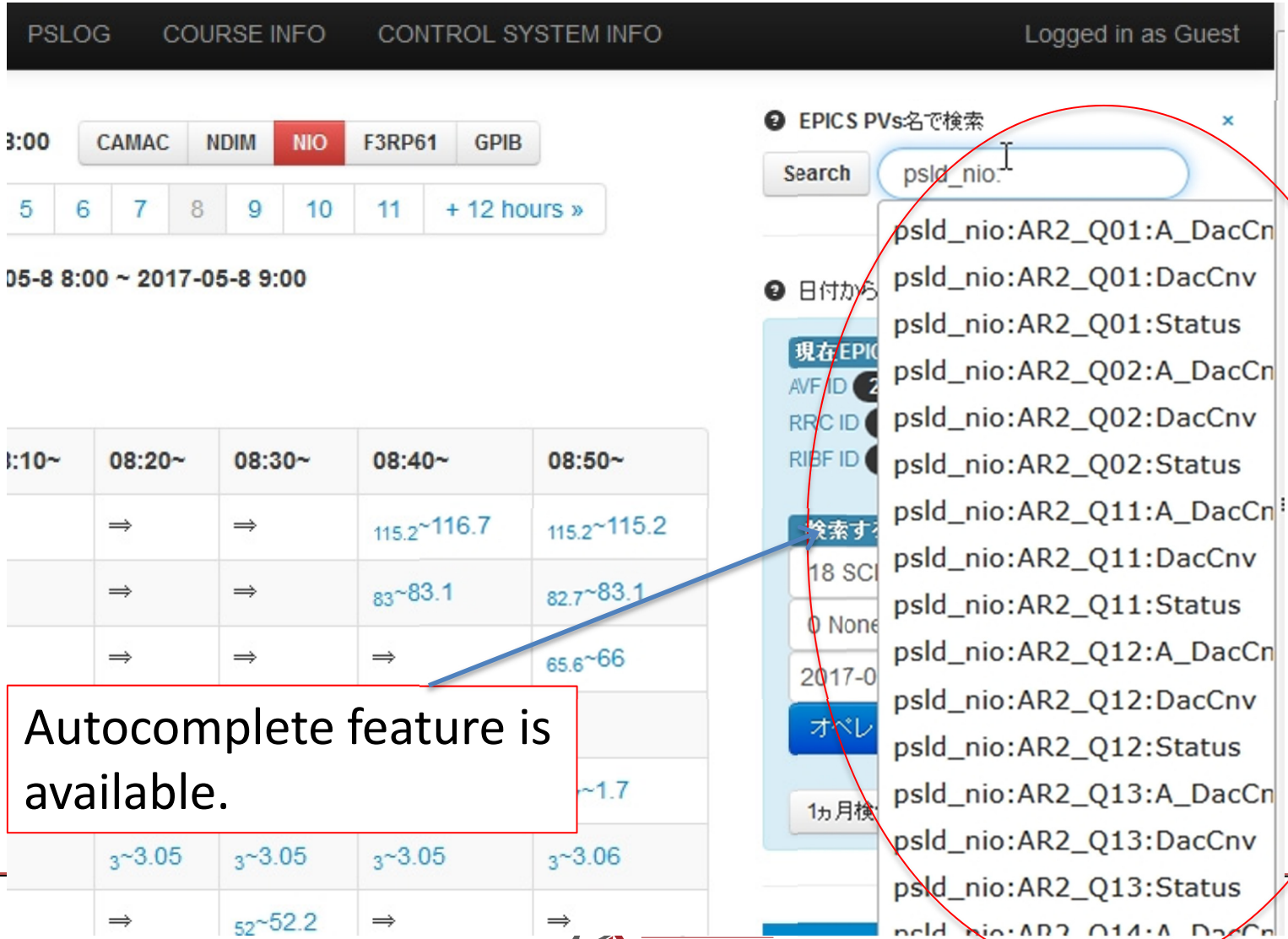
RIBF Operational Log System (User Interface)

Electromagnet power supply operation



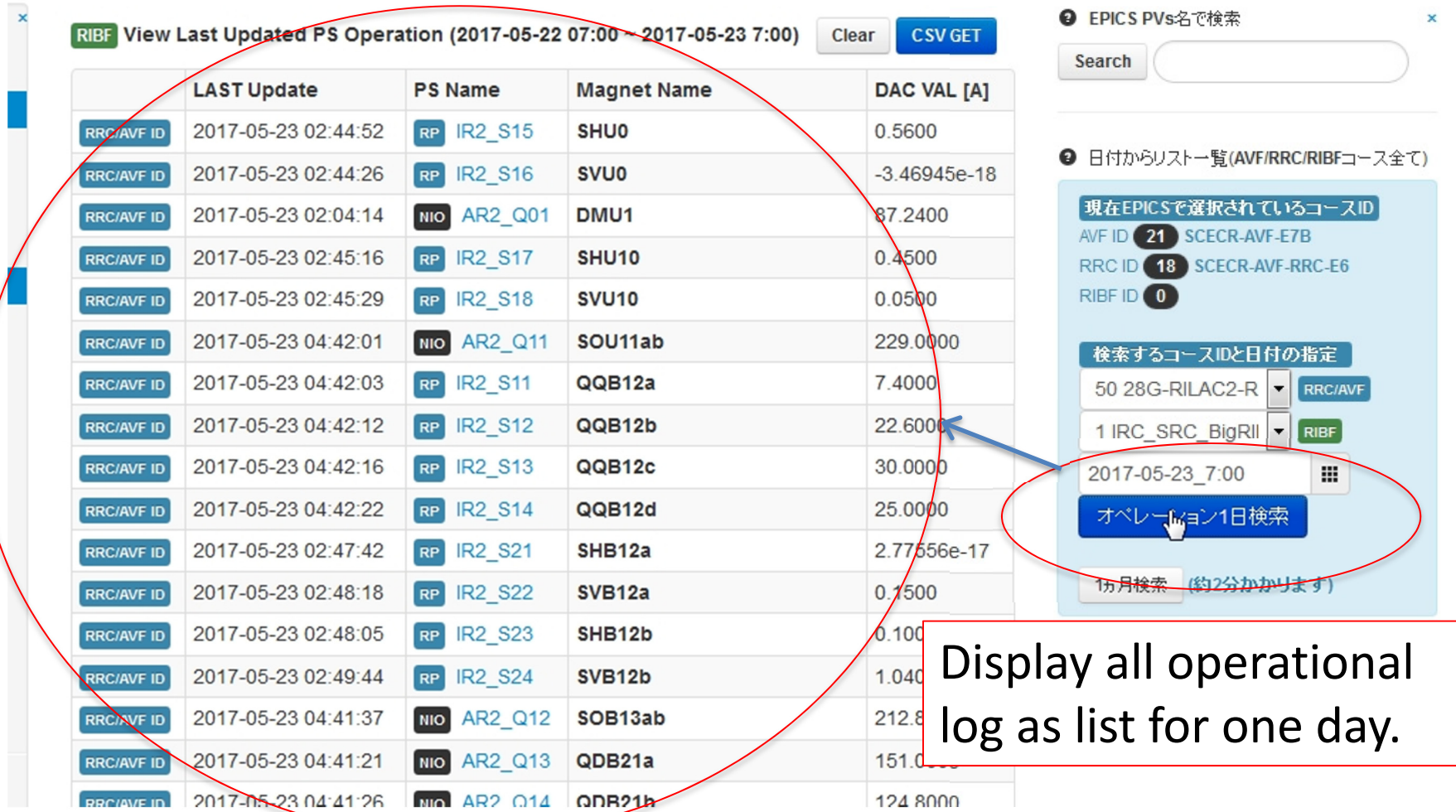
RIBF Operational Log System (User Interface)

Electromagnet power supply operation



RIBF Operational Log System (User Interface)

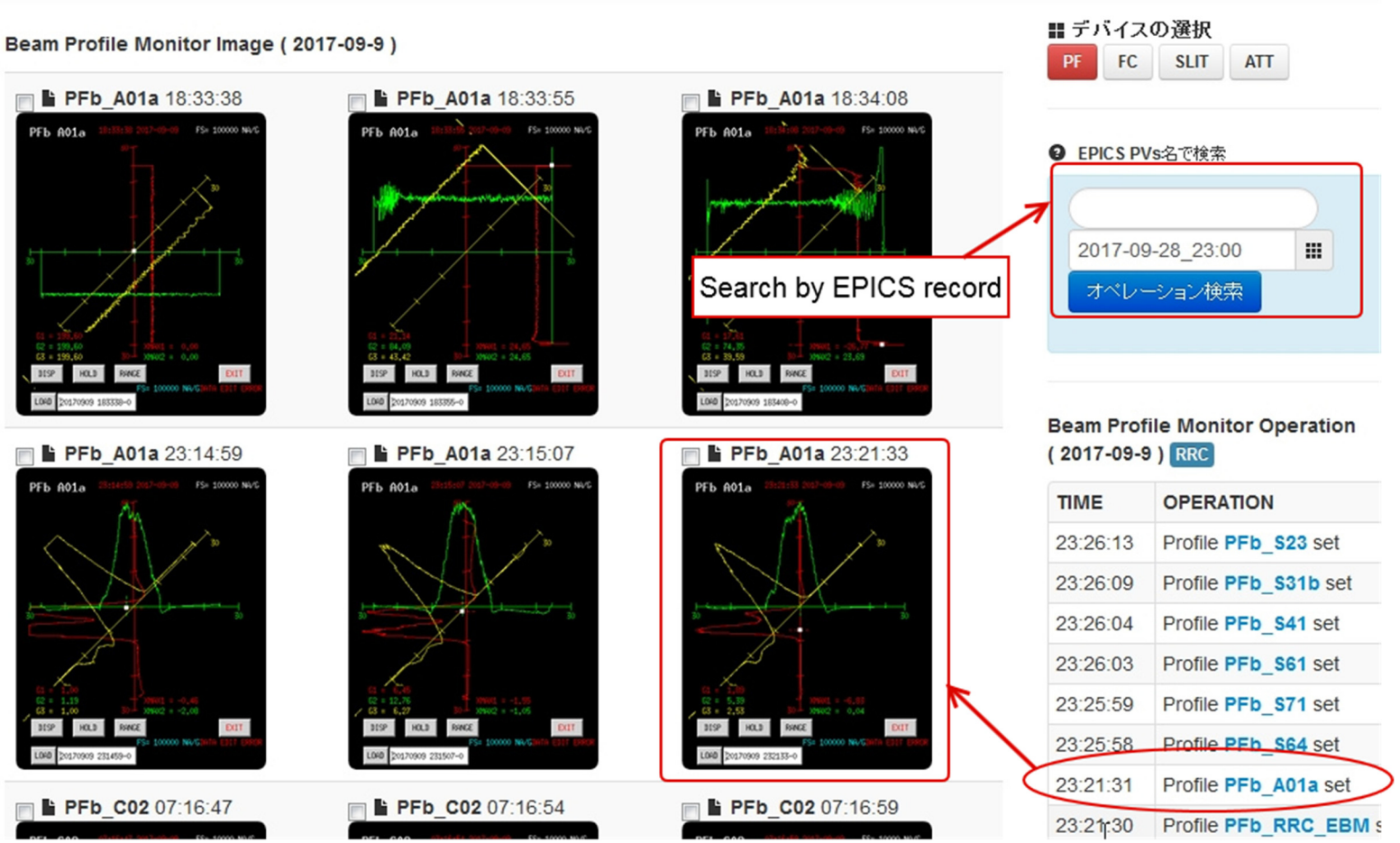
Electromagnet power supply operation



Display all operational log as list for one day.

RIBF Operational Log System (User Interface)

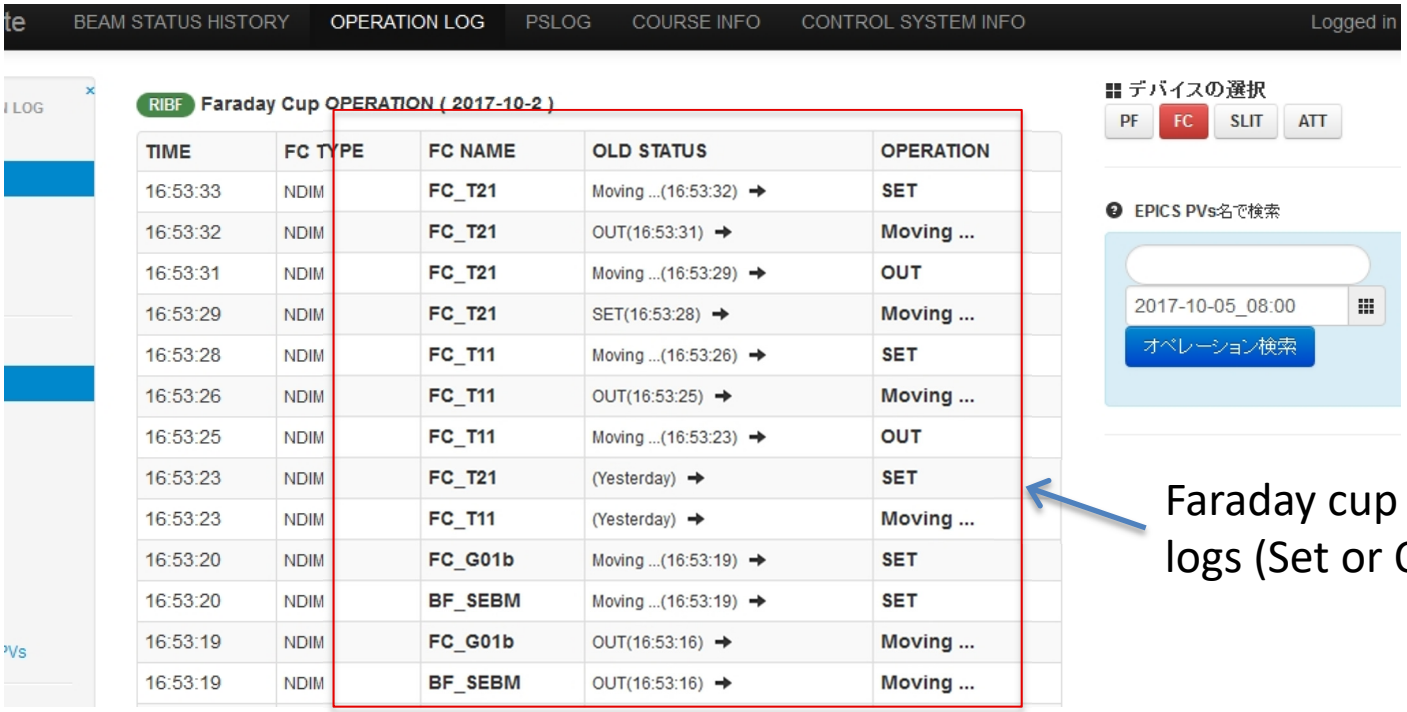
Beam diagnostics device operation



Not only the operational logs but also measured data is displayed.

RIBF Operational Log System (User Interface)

Beam diagnostics device operation



TIME	FC TYPE	FC NAME	OLD STATUS	OPERATION
16:53:33	NDIM	FC_T21	Moving ...(16:53:32) →	SET
16:53:32	NDIM	FC_T21	OUT(16:53:31) →	Moving ...
16:53:31	NDIM	FC_T21	Moving ...(16:53:29) →	OUT
16:53:29	NDIM	FC_T21	SET(16:53:28) →	Moving ...
16:53:28	NDIM	FC_T11	Moving ...(16:53:26) →	SET
16:53:26	NDIM	FC_T11	OUT(16:53:25) →	Moving ...
16:53:25	NDIM	FC_T11	Moving ...(16:53:23) →	OUT
16:53:23	NDIM	FC_T21	(Yesterday) →	SET
16:53:23	NDIM	FC_T11	(Yesterday) →	Moving ...
16:53:20	NDIM	FC_G01b	Moving ...(16:53:19) →	SET
16:53:20	NDIM	BF_SEBM	Moving ...(16:53:19) →	SET
16:53:19	NDIM	FC_G01b	OUT(16:53:16) →	Moving ...
16:53:19	NDIM	BF_SEBM	OUT(16:53:16) →	Moving ...

Faraday cup operational logs (Set or Out or Moving)

Faraday cup operation monitoring is closely related to measurement of the beam service time; therefore, we also implement another dedicated system.

Beam Status History

◎ Visualization system for beam service time by using Faraday cup operational logs.

- Faraday cup is a destructive beam monitor, is utilized for beam current measurement in RIBF.

◎ Beam availability is an essential factor for performance of accelerator.

◎ Beam service time is measured automatically by Beam Status History System.

- When beam service interruption occurs because of hardware troubles of the accelerators, etc., the top priority is fixing the problem and resuming the beam service again as soon as possible.
- Previously, hand-written log note book was used.

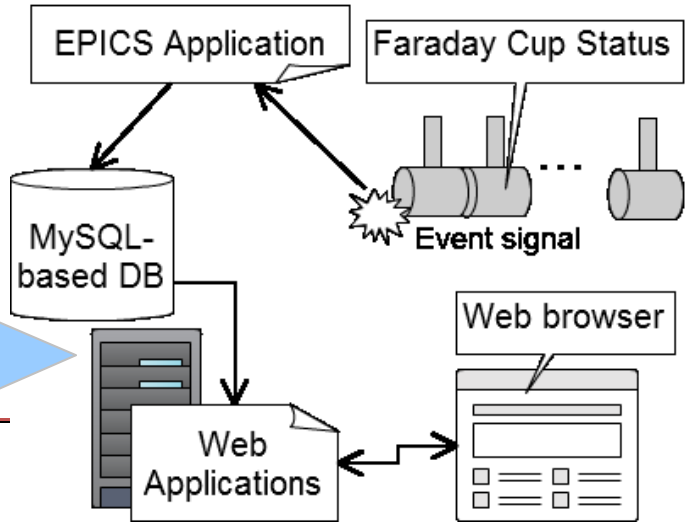
◎ As event signal, Faraday cup status (Set or Out) is used.

◎ The events are stored into MySQL-based database.

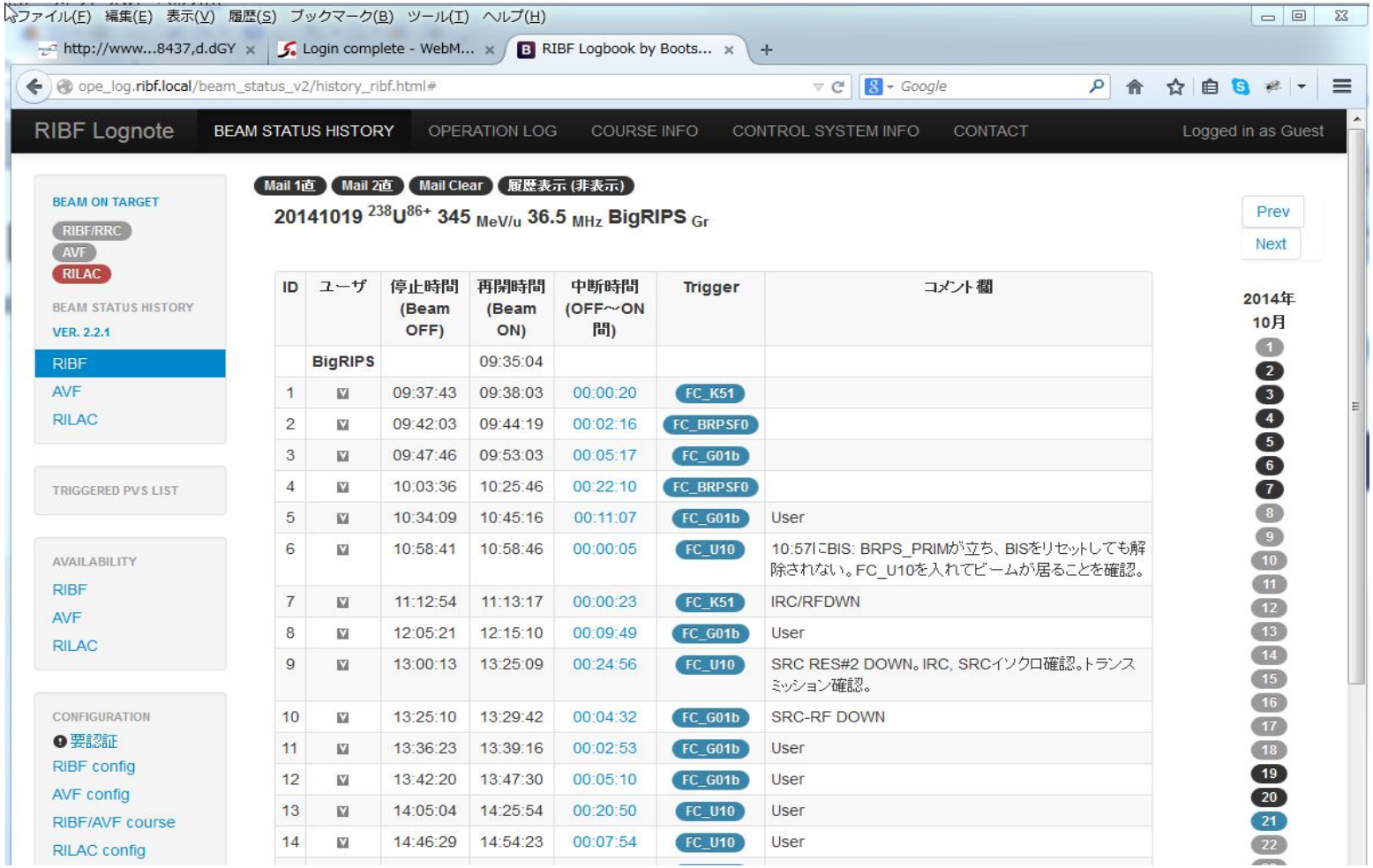
◎ The Web applications are developed with JavaScript chart library and JQuery.

◎ Same concept with Zlog

- Log monitor server + Web application + RDB

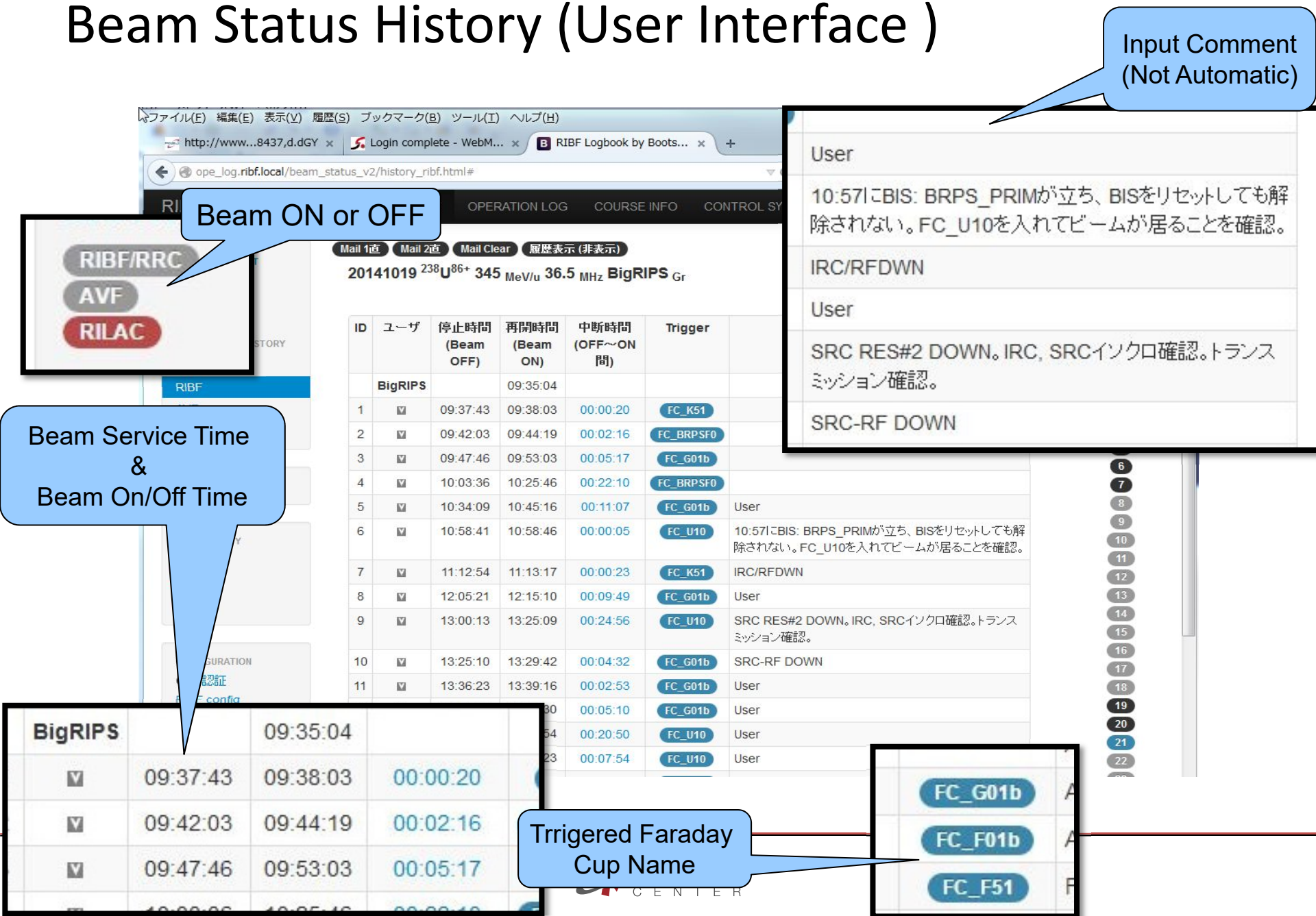


Beam Status History (User Interface)

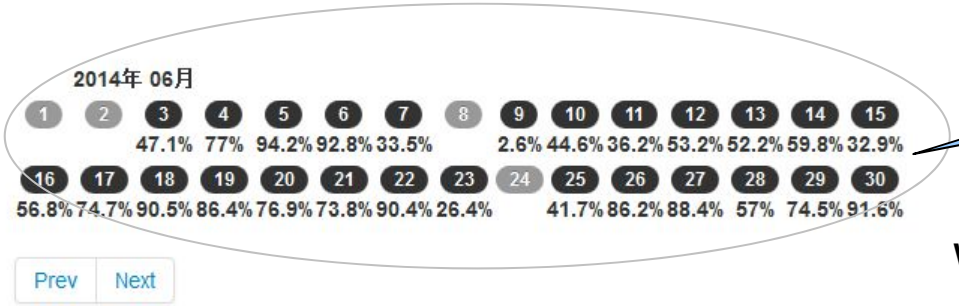


ID	ユーザ	停止時間 (Beam OFF)	再開時間 (Beam ON)	中断時間 (OFF〜ON 間)	Trigger	コメント欄
	BigRIPS		09:35:04			
1	M	09:37:43	09:38:03	00:00:20	FC_K51	
2	M	09:42:03	09:44:19	00:02:16	FC_BRPSF0	
3	M	09:47:46	09:53:03	00:05:17	FC_G01b	
4	M	10:03:36	10:25:46	00:22:10	FC_BRPSF0	
5	M	10:34:09	10:45:16	00:11:07	FC_G01b	User
6	M	10:58:41	10:58:46	00:00:05	FC_U10	10:57にBIS: BRPS_PRIMが立ち、BISをリセットしても解除されない。FC_U10を入れてビームが居ることを確認。
7	M	11:12:54	11:13:17	00:00:23	FC_K51	IRC/RFDWN
8	M	12:05:21	12:15:10	00:09:49	FC_G01b	User
9	M	13:00:13	13:25:09	00:24:56	FC_U10	SRC RES#2 DOWN。IRC, SRCインクロ確認。トランスミッション確認。
10	M	13:25:10	13:29:42	00:04:32	FC_G01b	SRC-RF DOWN
11	M	13:36:23	13:39:16	00:02:53	FC_G01b	User
12	M	13:42:20	13:47:30	00:05:10	FC_G01b	User
13	M	14:05:04	14:25:54	00:20:50	FC_U10	User
14	M	14:46:29	14:54:23	00:07:54	FC_U10	User

Beam Status History (User Interface)

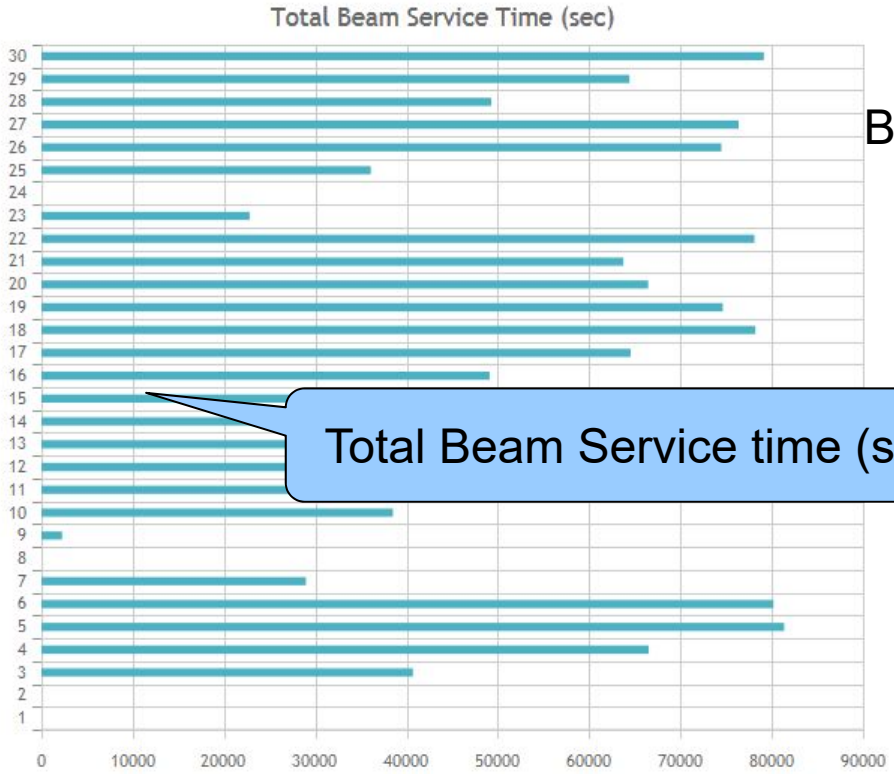


Beam Status History (User Interface)



Beam-On-Time Ratio

We can check the Beam Availability more easily than before.



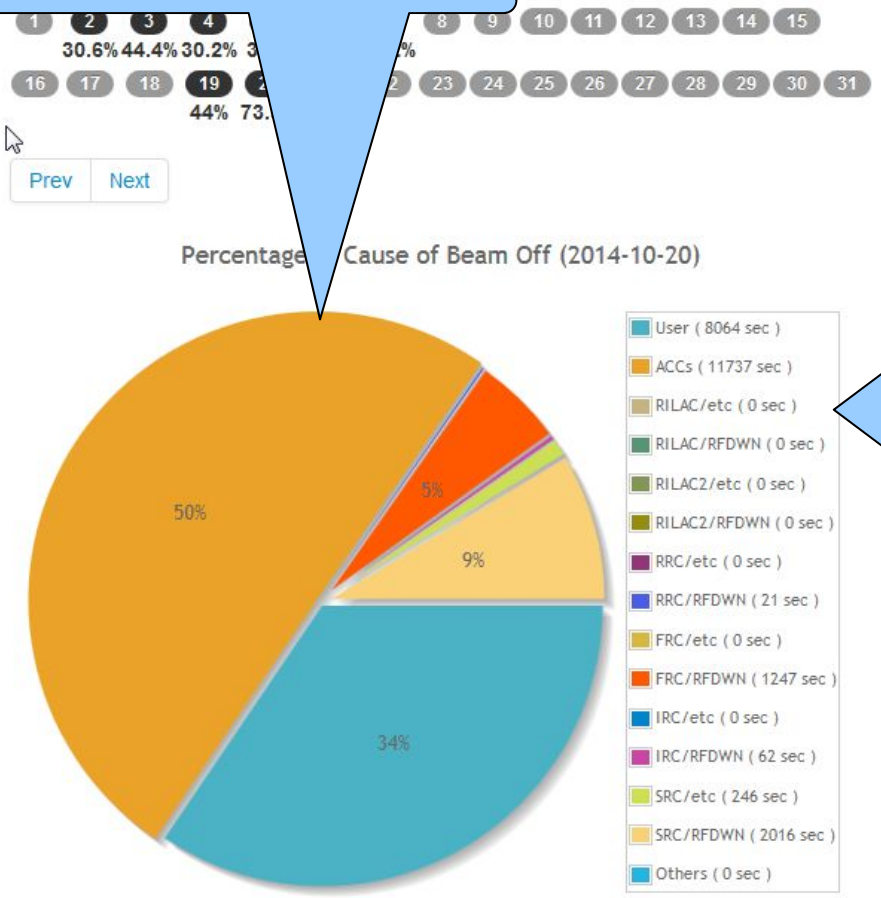
$$\text{Beam Availability} = \frac{\text{Beam Service Time}}{\text{Beam Request Time}}$$

Total Beam Service time (second) in 1 day are shown by bar chart.

Beam Status History (User Interface)

We can check the accelerator's conditions more easily than before.

Ratio in cause of beam-off



Beam-off time are calculated by input comments.

時間 ON間)	Trigger	コメント欄
		Auto generated: Keep beam-on-target.
		ACCs
		ACCs
:28	FC_F51	FRC/RFDWN
:23	FC_G50	SRC/etc
:45	FC_G01b	ACCs
:34	FC_G01b	SRC/RFDWN
:15	FC_F51	FRC/RFDWN
:20	FC_S71	RRC/RFDWN
:27	FC_G01b	ACCs
:11	FC_G01b	User
	FC_G01b	User

Results of Implementation

- To restore the previous parameters during the beam tuning, the accelerator operators utilize the RIBF operational log.

- It allows easy comparison of all past parameters, such as the electromagnet power supplies, with the current parameters.

- When some trouble, the operator can restore the accelerator condition as soon as possible.

- More than 3,000 EPICS record are monitored without problem.

Summary

- We have developed a new Web-based RIBF operational log system, which is compatible with Zlog, based on requests from the RIBF accelerator operators.

- It has provide various user interface for the operational log.

- In the case of problems during beam tuning in particular, it is useful for analyzing and restoring.

Thank you