

## CCJ operations in 2023

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The RIKEN Computing Center in Japan (CCJ)<sup>1)</sup> commenced operations in June 2000 as the largest off-site computing center for the PHENIX<sup>2)</sup> experiment being conducted at RHIC. Since then, CCJ has been providing numerous services as a regional computing center in Asia. We have transferred several hundred terabytes of raw data files and nDST<sup>a)</sup> files from the USA.

Many analysis and simulation projects are being conducted at CCJ, which are listed on the web page <http://ccjsun.riken.jp/ccj/proposals/>. As of December 2023, CCJ has contributed to 49 published papers and 45 doctoral theses.

The network configuration and computing hardware (nodes) and software (OS, batch queuing systems, database engine, *etc.*) are nearly the same as described in the old APR,<sup>3)</sup> and the number of servers are summarized in the Table 1. The main server serves users' home directory and services such as NIS, DNS, and NTP. Interactive servers are used for the compilation and test runs for the jobs before the submission to the computing nodes. Two login servers serve ssh-login from the internet. A replacement of a login server with new OS is planned.

Table 1. Number of servers, disk size and model number, as of 2023 Dec.

	num ber	disk size (TB/node)	model number
Main server	1	6(built-in) + 15.5(RAID)	DL360G10
Login server	2	-	DL20G9/DL20G10
Interactive server	4	-	-/DL320G6/ DL160G9/DL360G10
calculation node 1	17	10	DL180G6
calculation node 2	9	20	DL180G6
Work disk server	2	26 / 39	DL180G9/DL385G10
DB server	1	1	DL145G3
library(AFS) server	1	9	DL180G6
Transfer server	2	12 / 39	DL180G9/DL380G10
Docker test server	1	-	DL20G9

In addition, we operate one dedicated server for the RHICf group<sup>4)</sup> and two servers for the J-PARC E16 group<sup>5)</sup> in order to maintain their dedicated compilation and library environments along with some data.

We operate 26 computing nodes, and 352 (= 8 × 17 nodes + 24 × 9 nodes) jobs can be processed simultaneously via these computing nodes using a batch queuing system, LSF 9.1.3.<sup>6)</sup> Table 2 lists the number of malfunctioning SATA or SAS disks in the HP servers, namely, computing nodes and NFS/AFS servers.

Three 10-KVA UPSs are operated as power supplies

Table 2. Number of malfunctioning HDDs in HP servers during 2011–2023.

Type (TB)	total held	11	12	13	14	15	16	17	18	19	20	21	22	23
SATA(1.0)	192	9	20	16	11	14	8	18	16	8	9	10	5	4
SATA(2.0)	120	4	5	2	0	10	2	10	2	10	5	9	7	5
SATA(4.0)	26	-	-	-	-	-	-	-	0	0	0	2	0	2
SATA(6.0)	20	-	-	-	-	-	-	-	0	0	0	0	0	0
SAS(0.15)	38	1	1	0	2	3	5	1	3	6	3	5	2	1
SAS(0.3)	26	1	0	0	1	1	0	1	0	2	1	2	1	0

for these nodes. Five air conditioners are operated in the machine room. Two had malfunctioned and were repaired in 2023.

The main network switch was replaced in December 2023, from Catalyst 4900M to Catalyst 9300 24UX, to support 24-port 10GBASE-T for servers. One 10GBASE-LR is used for the uplink to RIKEN-LAN and two 10GBASE-SR are used for the downlink to edge switches for the calculation nodes, as before.

CCJ and the RIKEN IT division have been jointly operated since July 2009. In April 2015, “HOKUSAI Greatwave” system was launched and the joint operation with CCJ continued, with the inclusion of a hierarchical archive system wherein approximately 1093 TB of CCJ data were stored as of December 2023. A breakdown of the data is presented in Table 3. We participated the test operation of “Hokusai Gratewave 2(HGW2)” started in December 2023.<sup>7)</sup>

Table 3. Tape usage in Hokusai as of December 2023.

user	total	PHENIX official	KEK/ J-PARC	RHICf	user-level archive
size (TB)	1093	749	179	8	156

A new tape archive system in the RIKEN IT division, which is decoupled from HOKUSAI, will be commenced in 2024. The current archive system will be shutdown by the end of JFY 2024 and the data will be copied to new system. The access to current system from CCJ is maintained via HGW2.

### References

- 1) <http://ccjsun.riken.jp/ccj/>.
- 2) <http://www.phenix.bnl.gov/>.
- 3) S. Yokkaichi *et al.*, RIKEN Accel. Prog. Rep. **56**, 122 (2023).
- 4) Y. Itow *et al.*, arXiv:1409.4860 (Proposal).
- 5) S. Yokkaichi, in this report.
- 6) <https://www.ibm.com/docs/en/spectrum-lsf/>.
- 7) <https://i.riken.jp/supercom/>.

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<sup>a)</sup> A term for a type of summary data files in PHENIX