# CCJ operations in 2019

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## Overview

The RIKEN Computing Center in Japan (CCJ)[1] commenced operations in June 2000 as the largest offsite computing center for the PHENIX[2] 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 TBs of raw data files and nDST [a] files from the RHIC Computing Facility (RCF)[3] to CCJ.

Many analysis and simulation projects are being conducted at CCJ, which are listed on the web page `http://ccjsun.riken.go.jp/ccj/proposals/`. As of December 2019, CCJ has contributed to 43 published papers and 44 doctoral theses.

## Computing hardware and software

The network configuration and the computing hardware (nodes) and software (OS, batch queuing systems, database engine, etc.) are almost the same as described in the previous APR.[1] We have two login servers, one main server (users' home directory, NIS, DNS, and NTP), and two disk servers the disk sizes of which are 13 and 26 TB. The main server has an external SAS RAID (21 TB) for the home and work regions of users as well as system usage. Moreover, the server has a RAID with built-in disks (13 TB) that can be used temporarily by users and the system.

We operate 26 computing nodes, of which 16 nodes were purchased in Mar. 2009 and 10 nodes were purchased in Mar. 2011. Thus, in total, 368 ($= 8 \times 16$ nodes $+ 24 \times 10$ nodes ) jobs can be processed simultaneously by these computing nodes using a batch queuing system, LSF 9.1.3.[4] The LSF license contract in CCJ is for 358 in total in JFY 2019, after the transfer of 80 licenses from the RIBF cluster. Table 1 lists the number of malfunctioning SATA or SAS disks in the HP servers, namely, computing nodes and NFS/AFS servers.

One database (postgreSQL[5]) server and one AFS[6] server are operated in order to share the PHENIX computing environment. It should be noted that only the SL5[7] environment is shared by the computing nodes, which have approximately 0.9 TB of library files. We started two new data-transfer servers, which have a 10 G Ethernet I/F and 12 TB SATA RAID with built-in disks. Data transfer of the order of 100 TB from J-PARC will start in 2020 and also from BNL in the future. In addition, we operate two dedicated servers for the RHICf group[8] and two servers for the J-PARC E16 group,[9] in order to keep their dedicated compilation and library environments along with some data. Three 10-KVA UPSs are operated as power supply for these CCJ nodes, should be replaced in 2020.

Table 1. Number of malfunctioning HDDs in HP servers during 2011–2019.

| Type(Size) | total | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| SATA (1 TB) | 192 | 8 | 16 | 18 | 8 | 14 | 11 | 16 | 20 | 9 |
| SATA (2 TB) | 120 | 10 | 2 | 10 | 2 | 10 | 0 | 2 | 5 | 4 |
| SATA (4 TB) | 10 | 0 | 0 | - | - | - | - | - | - | - |
| SAS (146 GB) | 38 | 6 | 3 | 1 | 5 | 3 | 2 | 0 | 1 | 1 |
| SAS (300 GB) | 26 | 2 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 |

## Joint operation with ACCC/HOKUSAI

CCJ and the RIKEN Integrated Cluster of Clusters (RICC) have been jointly operated since July 2009. In April 2015, a new system named "HOKUSAI Greatwave" was launched by RIKEN ACCC,[10] and the joint operation with CCJ continued, with the inclusion of a new hierarchical archive system in which approximately 900 TB of CCJ data are stored. As of Nov. 2019, 886 TB is used, with the inclusion of 749 TB of PHENIX official data, 25 TB of KEK/J-PARC data, 3 TB of RHICf data, and 109 TB of user-level archive data. Subsequently, the "HOKUSAI BigWaterFall" IA cluster, which has 840 nodes/33600 CPU cores, was launched in 2017 by ACCC. CCJ has not started to use the cluster, because it lacks support for NFS to share the computing environment of PHENIX, unlike RICC. In autumn in 2020, ACCC will start a charging system to users for thier usage of CPU-time and storage capacity. Thus we are discussing the optimal ratio of purchasing new machines to paying to ACCC.

References
1) S. Yokkaichi *et al.*, RIKEN Accel. Prog. Rep. **51**, 188 (2018).
2) `http://www.phenix.bnl.gov/`.
3) `https://www.racf.bnl.gov/`.
4) `https://www.ibm.com/support/knowledgecenter/en/SSETD4_9.1.3/lsf_welcome.html`.
5) `http://www.postgresql.org/`.
6) `http://www.openafs.org/`.
7) `http://www.scientificlinux.org/`.
8) Y. Itow *et al.*, arXiv:1409.4860 (Proposal).
9) S. Yokkaichi, in this report.
10) `http://accc.riken.jp/`.

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[a] term for a type of summary data files in PHENIX