



## Four years of fruitful HPC collaboration between RIKEN and the CEA

The CEA and RIKEN HPC experts met in October 2020, for their bi-annual Plenary Workshop. The event, organized online over 3 days, was the opportunity of a waypoint regarding joint R&D efforts on the different topics of the CEA-RIKEN collaboration. Since the previous workshop in March, an Activity Report summarising 3 years of fruitful collaboration – 2017-2019 - was issued, and the momentum and liveliness of joint efforts remained intact.

[The Activity Report Executive Summary](#) is available online. It underlines that the first initial work plan was fulfilled, augmented by new topics, and emphasises the main outcomes of the collaboration and related publications. The October 2020 workshop was then the opportunity, now coming close to 4 years of collaboration, to report and exchange on the progress of all the technical and non-technical topics:

- programming environments and languages, runtime environments, and energy-aware job schedulers are technical topics explored jointly since 2017;
- applications in quantum chemistry and condensed matter physics, and the seismic resistance of nuclear facilities are also early but sustained topics of joint development;
- efforts are continued as well on human resources, training and skill generation, e.g. via staff exchange and Summer Schools;
- performance and impact assessment are also permanent concerns, with a mix of a technical (performance and energy efficiency) and non-technical (cost efficiency, more general industrial outcomes) aspects;
- AI and Big Data applications, as well as the evaluation of ARM-based architectures, are new topics actively developed since 2019.

This year RIKEN successfully deployed the supercomputer Fugaku, Number 1 machine worldwide in the latest Top500 ranking. It was in particular useful for COVID-19-related studies and research. On its side, CEA contributed to similar efforts, operating Joliot-Curie supercomputer with dedicated fast track resources for the researchers. This is a strong extra evidence of the societal importance of HPC technologies and methodologies, applied to scientific applications and discoveries.

The CEA-RIKEN High Performance Computing and Computational Science agreement was signed in Tokyo on January 11, 2017, within the more general framework of a collaboration agreement between the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT) and the French Ministry of Higher Education, Research and Innovation (MESRI). Since then, CEA and RIKEN have been focussing jointly on developing and optimising scientific applications in different areas (such as health, or material sciences, risk and hazard management...) and improving their supercomputing technologies.

The collaboration will run until the end of 2021 and the two partners are already actively considering topics for a continuation from 2022 onwards, with the perspectives of both exascale consolidation and post-exascale era.

It enables France and Japan to join forces in the worldwide race on HPC, computational sciences and data sciences and the scientific applications they can enable. The French and Japanese approaches show a number of similarities, not only in their technological choices but also in the priority given to the construction of user ecosystems around these new supercomputers. HPC and Artificial Intelligence are strategic areas for France and Japan in terms of national sovereignty, as well as enablers in scientific, societal and economic terms. This collaboration leverages knowledge for applications in numerical simulation, processing of large volumes of data, and artificial intelligence. Currently, about 40 researchers are involved in this collaboration.



*Figure 1 : CEA-RIKEN collaborators in annual workshop on October 2019, Tokyo*

## HPC at RIKEN

RIKEN is Japan's largest and most comprehensive research organization, with a staff of 3500 persons and a budget of 775 million euros. For over a century since its foundation in 1917, RIKEN has fostered pioneering, innovative research in fields spanning the entire range of the natural sciences, from developmental biology and neuroscience to quantum physics and computer science. Today, RIKEN encompasses a network of world-class research centers across Japan, offering state-of-the-art facilities that rank among the best in the world.

The RIKEN Center for Computational Science is home of the supercomputer Fugaku, the world's most powerful supercomputer. Fugaku is being developed under a national plan to design Japan's next generation flagship supercomputer and to carry out a wide range of applications that will address high-priority social and scientific issues. It will be put to use in applications aimed at achieving the Society 5.0 plan, by running applications in areas such as drug discovery; personalized and preventive medicine; simulations of natural disasters; weather and climate forecasting; energy creation, storage, and use; development of clean energy; new material development; new design and production processes; and—as a purely scientific endeavor—elucidation of the fundamental laws and evolution of the universe. The new supercomputer is scheduled to begin full operation in Japanese fiscal year 2021 (which starts in April 2021).

<https://www.riken.jp/en/>  
<https://www.r-ccs.riken.jp/en/>

### HPC at CEA

CEA is a French multidisciplinary research institution, with a workforce of more than 15,000 persons and a budget of 4.1 billion euros. Its activity focuses on four areas: fundamental research (physical sciences and life sciences), technological research for industry, nuclear energy (fission and fusion), defense and security.

CEA is a major player all along the advanced computing and HPC value chain, from technologies to usages. Different CEA divisions are active in the development of large scientific applications, in order to tackle our next challenges in terms of climate modelling, fusion energy, low-carbon energy, material sciences, global security, astrophysics, health. CEA is also a key player in the development of silicon technology, architecture of processors, artificial intelligence hardware and software; as well as in supercomputer co-design, the development of HPC software environments, programming tools and algorithms.



GENCI's Joliot-Curie supercomputer hosted and operated by CEA at TGCC  
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CEA operates world-class computing resources and delivers related services, in particular for research (TGCC) and industry (CCRT). TGCC is a leading European supercomputing facility, whose operation and user support are ensured by teams of the CEA centre in Bruyères-le-Châtel (91, France).

<http://www.cea.fr/english-portal>  
<http://www-hpc.cea.fr/index-en.htm>