10. Platform Management Office

As an inter-university research institute, the National Institute for Fusion Science (NIFS) provides research equipment, including large research facilities such as the Large Helical Device (LHD) and Plasma Simulator "Raijin," for joint usage and conducts collaborative research with domestic and foreign universities and research institutes. The Platform Management Office, which comprises three sections: the Large Helical Device (LHD) Section, the Computer Section, and Engineering Facilities Section, was established in FY2023 to manage and operate the research facilities at NIFS.

In FY2023, we started a paid platform-sharing system to make NIFSs' facilities available for purposes other than collaborative research. First, we started the platform-sharing with academic researchers, but we are also considering expanding the system to private companies to fulfill a role appropriate to the needs of the times (https://www8.cao.go.jp/cstp/fusion/index.html).

Large Helical Device Section

The Large Helical Device (LHD) Section is composed of the Experiment Planning Task Group (TG) and the Device Planning TG. It is responsible for managing and operating the LHD and provides the support necessary for carrying out LHD experimental research. The Experiment Planning TG plans experiments in response to experimental proposals from collaborators, manages machine times and schedules, and plans the personnel required to carry out the experiments. The Device Planning TG plans the maintenance and operation of the device required to carry out LHD experiments.

The LHD has been conducting experimental research as the world's largest superconducting plasma confinement device for a quarter century since it made its first plasma in March 1998 and has achieved many results. Although the LHD project was completed in FY2022, in order to utilize the legacy of the LHD project so far, such as high-precision diagnostics and various heating devices, the LHD will operate for three years as an academic research platform from FY2023. In the Academic Research Platform LHD, which can stably generate high-temperature plasma, we will conduct international collaborative research to address the principles of various complex phenomena common not only to fusion plasma but also to space and astronomical plasmas, by investigating the internal structure of plasma using a variety of high-precision diagnostics in the LHD.

The first experiment campaign of the Academic Research Platform LHD was held from 13 May 2024 to 20 June 2024. Prior to the experimental campaign, 165 experiment proposals were received, including 118 from domestic collaborators and 47 from overseas. In December 2023, the LHD Research Forum was held online to introduce the experimental proposals. Each of the 165 experimental proposals plans experiments under various conditions, and allocating all the proposals to the limited experimental period is a challenging problem. The Experiment Planning TG have arranged an experimental schedule that allows more researchers to produce fruitful results. During the plasma experiment campaign, 6,335 shots of plasma experiments were performed over 55 operational days, and 140 research themes were carried out. In addition, the deuterium plasma experiments performed in the LHD from 2017 to 2022 have ended, and the Academic Research Platform LHD now performs experiments without deuterium. Therefore, there is no further generation of neutrons or tritium during the plasma experiment campaign.

The LHD promotes open science. It is the only fusion research facility in the world that publishes experimental data in real-time (https://www-lhd.nifs.ac.jp/pub/Repository_jp.html). It also uses an online meeting system to facilitate communication with collaborators in distant places, and it is possible to participate in LHD experiments via the Internet without visiting NIFS. The results of each day's experiments are reported promptly in an online meeting the morning after the experiment and published on a web page (https://www-lhd.nifs.ac.jp/rails/dspp_plan/).

(R. Sakamoto)

Computer Section

The Computer Section is composed of the Plasma Simulator Task Group (TG), Database TG, and Data Analysis Equipment TG.

The Plasma Simulator "Raijin" is a massive parallel supercomputer system utilized to promote academic-simulation research on nuclear fusion science and to support research and development that can contribute to progress in simulation science. The Plasma Simulator "Raijin" consists of 540 computers, each of which is equipped with one scalar processor for controlling the system and eight "Vector Engine" accelerators for high-speed computing. The 540 computers are connected with each other by a high-speed interconnect network. The computational performance of the system with Vector Engines is 10.5 petaflops. The capacities of the main memory and the external storage system are 202 terabytes and 32.1 petabytes, respectively. The supercomputer system is capable of large-scale simulation of fusion and other complex plasma phenomena. The Plasma Simulator was operated for 351 days and supplied 27 million VE hours of computational time on 82 subjects to 271 users in FY2023. The Plasma Simulator TG supports usage of the Plasma Simulator through operation scheduling and maintenance of the network, support of users' simulation code development, running the code, and other matters.

The Database TG provides the NIFS Atomic and Molecular Numerical Database at http://dbshino.nifs.ac.jp/ for researchers all over the world, which contains numerical data, such as cross-sections, for collision processes between electrons, atoms, and molecules in plasmas. The amount of stored data, which is 1,765,059 pieces in total as of Apr. 4, 2024, increased from 1,629,876 (Apr. 3, 2023), is the largest among the databases of collision cross-sections provided anywhere in the world. Many researchers access our database for their research. We are also making databases, e.g. the Atomic Data and Analysis Structure (ADAS), available for domestic collaborators, which are provided under international collaborations.

Data analysis equipment includes the experimental data acquisition and analysis system, the SNET research collaboration network, and the CompleXcope immersive virtual reality system. The experiment-data system accumulates over three petabytes of diagnostic and analyzed data from NIFS LHD and other universities' devices via SNET. The amount of plasma diagnostic data acquired by LHD experiments still continues growing even after 25 years of operation, exceeding 70 GB per short-pulse plasma discharge of less than ten seconds duration. The LHD project makes the entire research resources, including hundreds of analysis programs, available to the public at the same level as local and remote collaborative researchers. This is a research project to develop and build a "Plasma and Fusion Cloud." The world's largest nuclear fusion database is expected to be used for fusion energy developments and for "data science" and other fields, to promote the "Open Science" of the nuclear fusion research. CompleXcope enables observers to enter 3-D data space and observe plasma from various directions, thereby facilitating the study of plasmas with complex structures.

(Y. Todo, H. Miura, I. Murakami and H. Nakanishi)

Engineering Facilities Section

The Engineering Facilities section manages and operates experimental facilities in the Superconducting Magnet System Laboratory, the Fusion Engineering Research Laboratory, the Radiation Controlled Area in the LHD building, the Development Laboratory, and the Diagnostics Laboratory. A task group is assigned to each experimental building to coordinate the dates and systems of experiments. In FY2023, we established and implemented rules for collecting equipment usage fees and electricity usage fees. As a result, annual electricity usage was reduced to less than half of what it was before, and it was concluded that this was largely due to the reduction of usage of air conditioning systems.

(S. Imagawa)