13. International Collaboraiton

Many research activities in NIFS are strongly linked with international collaborations with institutes and universities around the world. These collaborations are carried out in various frameworks, as follows,

1) Multinational coordination in Fusion Power Coordinating Committee (FPCC) under International Energy Agency (IEA),
   - Stellarator-Heliotron Technology Cooperation Program (TCP)
   - Plasma-Wall Interactions TCP
   - Spherical Tori TCP

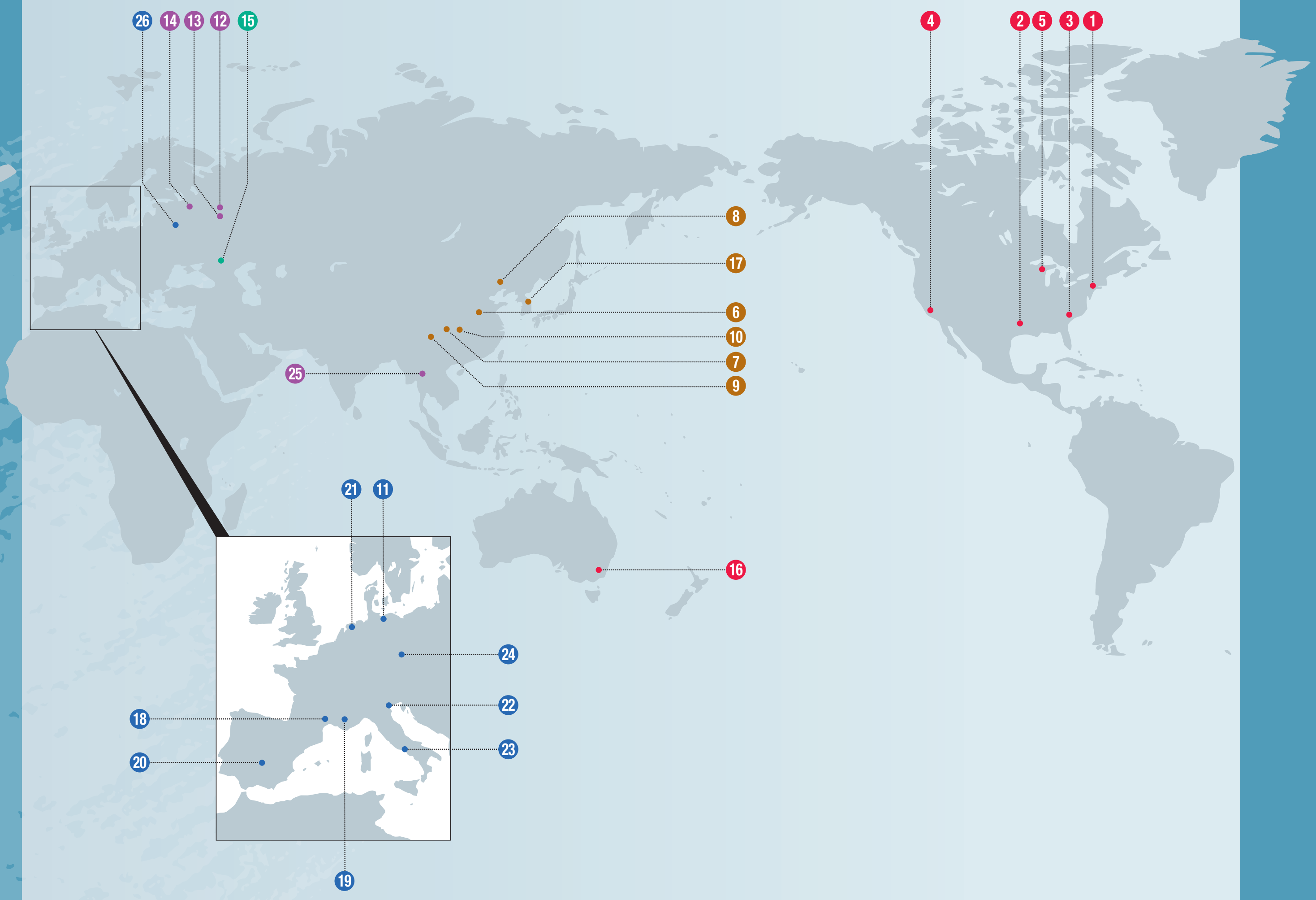
2) Binational coordination,
   - Japan-United States Collaborative Program
   - Japan-Korea Fusion Collaboration Programs
   - Japan-China Collaborative Program
   - Japan-EU Cooperation

3) Coordination with other institutions
   - 32 international academic exchange agreement

The geographical distribution of international collaborations and summary of each activity are shown in the following pages.
In FY2022, as the pandemic diminished, personal exchange with overseas organizations recovered gradually and the international collaborations became active, although it was still far from the situation before the pandemic.

(T. Morisaki)

Academic Exchange Agreements



U.S.A. 1 Princeton Plasma Physics Labolatory (PPPL)
2 Institute for Studies, The University of Texas at Austin (IFS)
3 Oak Ridge National Laboratory (ORNL)
4 Center for Energy Science and Technology Advanced Research, University of California, Los Angelse (UCLA)
5 College of Engineering, University of Wisconsin, Madison

China 6 Institute of Plasma Physics, Chinese Academy of Sciences (ASIPP)
7 Southwestern Institute of Physics (SWIP)
8 Peking University
9 Southwest Jiaotong University (SWJTU)
10 Huazhong University of Science and Technology

Germany 11 Max Planck Institute for Plasma Physics (IPP)

Russia 12 Russian Research Center, Kurchatov Institute (KI)
13 A. M. Prokhorov General Physics Institute, Russian Academy of Sciences (GPI)
14 Peter the Great St. Petersburg Polytechnic University

Ukraine 15 National Science Center of the Ukraine Khar'kov Institute of Physics and Technology Institute of Plasma Physics (KIPT)

Australia 16 Australian National University (ANU)

South Korea 17 National Fusion Research Institute (NFRI)

France 18 Aix-Marseille University (AMU)
19 Commissariat à l'énergie atomique et aux énergies alternatives (CEA)

Spain 20 National Research Center for Energy, Environment and Technology (CIEMAT)

Netherlands 21 Dutch Institute for Fundamental Energy Reseearch (FOM)

Italy 22 CONSORZIO RFX
23 Institute of Lonized Gas (IGI)

Czech 24 HiLASE Center, Institute of Physics CAS (FZU)

Tailand 25 Chiang Mai University

Poland 26 Institute of Plasma Physics and Laser Microfusion (IPPLM)

The ITER International Fusion Energy Organization (ITER)

US – Japan (Universities) Fusion Cooperation Program

US-Japan Joint Activity has continual from 1977. The 43rd CCFE (Coordinating Committee for Fusion Energy) meeting was held on April 21, 2023 via a video conference system. Representatives from the MEXT, the DOE, Universities and research Institutes from both Japan and the US participated. At the meeting, the current research status of both countries was reported together with bilateral technical highlights of the collaborations. FY 2022 cooperative activities were reviewed, and FY 2023 proposals were approved. As the pandemic diminished personal exchanges with overseas organizations recovered gradually. On the other hand, some collaborative activities still continued by remote participation and web meetings.

(1) Fusion Technology Planning Committee (FTPC)

In this category of US-Japan collaboration, there are six research fields: superconducting magnets, low-activation structural materials, plasma heating-related technology, blanket engineering, in-vessel/high heat flux materials and components, and power plant studies and related technologies. In fiscal year 2022, despite the continuation of the COVID-19 pandemic, two-thirds of proposed collaborations were accomplished, including three Japan to US personal exchanges and one US to Japan one. All the exchanges were in the research field of in-vessel/high heat flux materials and components, and the plasma-surface interactions research facility PISCES at UCLA was used for all of them. Fruitful experimental results were obtained in all these collaborations, and for the one US to Japan personal exchange with the title "Characterization of deuterium super-saturated surface layer in tungsten", it was found, when using Transmission Electron Microscopy (TEM) at NIFS, that the deuterium plasma exposure of tungsten may cause formation of a Deuterium Supersaturated Surface Layer (DSSL), even at a low incident energy of ~75 eV. It has also been confirmed that this observation is consistent with a previous measurement using laser-induced breakdown spectroscopy (LIBS).

Although one Japan to US (in the research field of superconducting magnet) and one US to Japan (plasma heating-related technology) personal exchange were canceled, sufficient discussions have been held among the corresponding members via e-mails and/or video conferences to make agreements about the resumption of these programs in the coming fiscal year FY2023.

(2) Fusion Physics Planning Committee (FPPC)

In the area of fusion physics, two committee meetings, five workshops and 19 personnel exchanges were held. Notably, four of the workshops and 14 of the personnel exchanges were conducted on-site, as shown in Figs. 1 and 2.

Fig. 1 Magnetic Reconnection Workshop in Monterey.

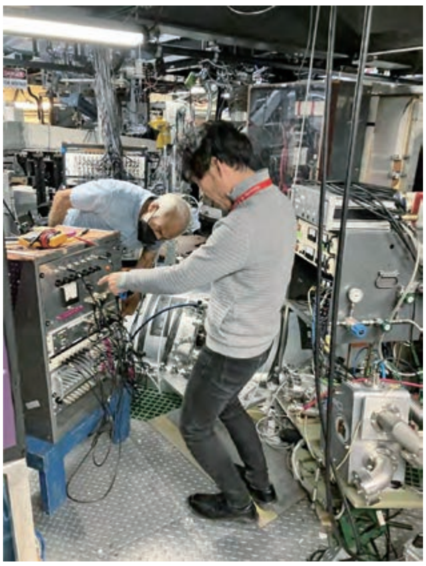


Fig. 2 Experiment in Univ. Wisconsin, Madison.

(3) Joint Institute for Fusion Theory (JIFT)

A workshop “Theory and simulation on high field and high energy density physics” was held at Spokane in October 2022. In the category of personal exchange, one US to Japan exchange visit for “Kinetic-MHD hybrid simulations of energetic-particle driven instabilities” and one Japan to US exchange visit for “Collaboration on Tokamak boundary plasma turbulence simulations for divertor heat flux width” were successfully completed. The latter exchange visit resulted in publication in Computer Physics Communications (Figure 1). Three Japan to US and three US to Japan personnel exchange programs were carried out as remote collaborations. A JIFT discussion meeting was held online on September 30, 2022 in the Plasma Simulator Symposium. The status of JIFT activities for 2022–2023 was reviewed and recommendation plans for 2023-2024 were discussed by email among members of the JIFT Steering Committee in December 2022.

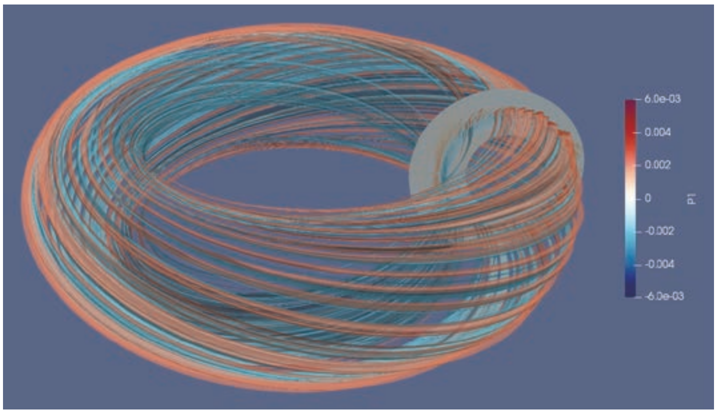
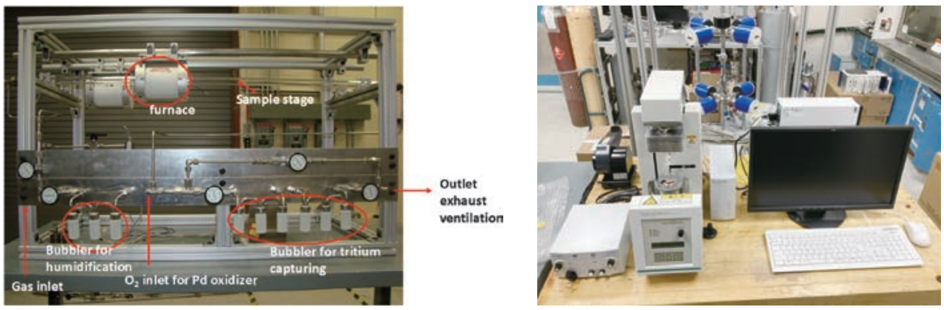


Fig. 1 Three-dimensional structure of perturbed pressure during pedestal collapse in full annular torus ELM crash simulation [H. Seto *et al.*, Comput. Phys. Commun. **283**, 108568 (2023)]

(4) US-Japan Joint Project: FRONTIER

The FRONTIER collaboration started in April 2019 to provide the scientific foundations for reaction dynamics in interfaces of plasma facing components for DEMO reactors. This project consists of four tasks: Irradiation Effects on Reaction Dynamics at Plasma-Facing Material/Structural Material Interfaces (Task 1), Tritium Transport through Interface and Reaction Dynamics in Accidental Conditions (Task 2), Corrosion Dynamics on Liquid-Solid Interface under Neutron Irradiation for Liquid Divertor Concepts (Task 3) and Engineering Modeling (Task 4). To examine liquid metal-structural material compatibility under neutron irradiation, five Sn capsules were exposed to neutrons for 10.5 days in a High Flux Isotope Reactor at Oak Ridge National Laboratory (ORNL) in cycle 500, after an extensive approval process for this unique experiment. The irradiated capsules were transported to the hot cells in March 2023 for starting post-irradiation examinations. In the Safety and Tritium Applied Research (STAR) Facility at Idaho National Laboratory (INL), a mobilization device and a thermogravimeter were installed to examine high temperature oxidation of neutron-irradiated tungsten and consequent emissions of radioisotopes under accidental conditions.



Mobilization device (left) and thermogravimeter (right) installed in INL to examine high temperature oxidation of neutron-irradiated tungsten and consequent emissions of radioisotopes under accidental conditions.

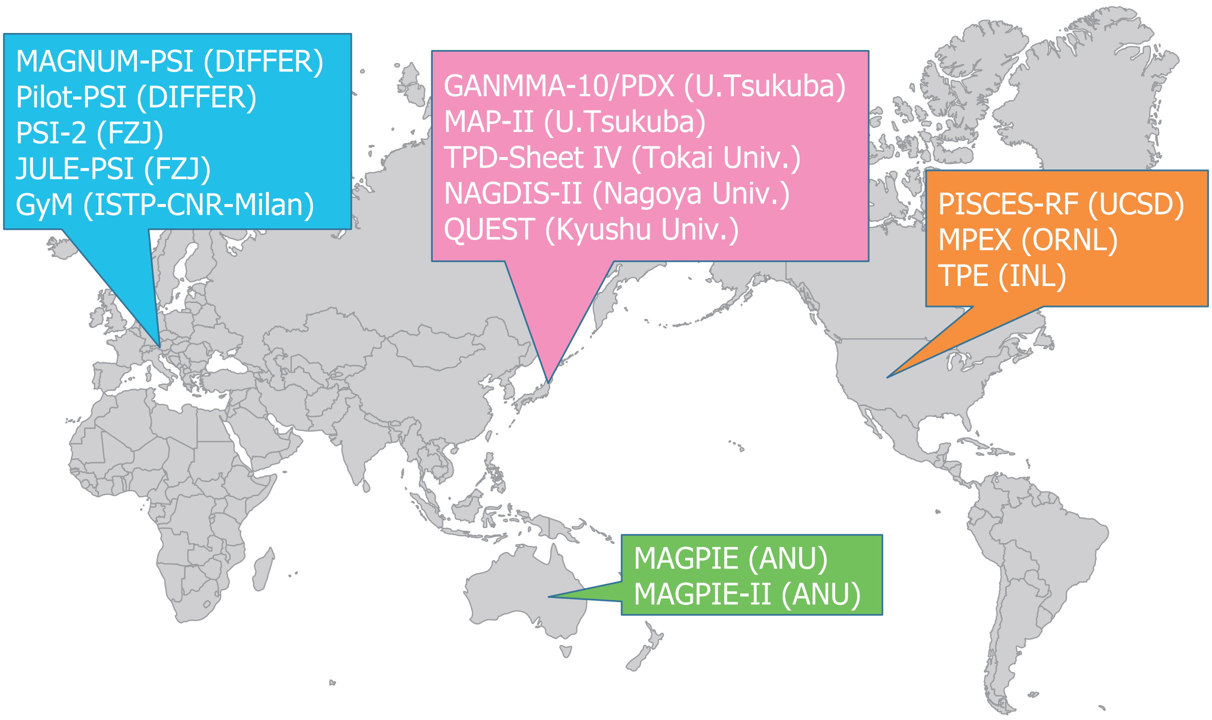
(T. Morisaki, S. Masuzaki, N. Yanagi, H. Sugama and Y. Hatano)

Plasma Wall Interaction (PWI) Collaboration

This collaboration is based on the IEA Technical Collaboration Programme (TCP) of the “Development and Research on Plasma Wall Interaction Facilities for Fusion Reactors” (PWI TCP) which involves Japan, Europe, the United States, and Australia. The objective of this program is to advance the physics and technologies of plasma-wall interaction research by strengthening cooperation among plasma-wall interaction facilities (in particular, by using dedicated linear plasma devices), to enhance the research and development effort related to a fusion reactor’s first wall materials and components, shown in the figure below.

NIFS collects proposals for international collaborative studies based on the PWI TCP, from domestic universities every year. The proposals are reviewed by the PWI technical committee whose members are domestic senior researchers in universities, QST, and NIFS, and some of the proposals are approved. Proponents of the approved collaborative research go to foreign institutes with support from NIFS and conduct the studies.

In this fiscal year, a collaboration on PWI experimentation was conducted.



Main Plasma-Wall Interaction facilities in member countries

Observation of Spontaneous Arcing on Tungsten Surface Structure by High-Density Plasma Irradiation with Impurity Gas

D. Hwangbo (University of Tsukuba)

Impurity gases used for cooling in the divertor region have recently been found to mix with helium (He) plasma to form nano-structure bundles (NTBs) on a tungsten (W) surface, i.e., protruding structures with a length of more than 100 m. Isolated protrusions of NTBs are a source of field electron emission in high-density plasmas. In particular, under the sheath electric field that soars in high-density plasma, there is a very high possibility of generating spontaneous arcing, even in the absence of an external heat load supply. In this study, we conducted experiments at DIFFER in the Netherlands from February to March 2023 to clarify the relationship between the frequency of arcing and the surface topography of a sample by adjusting the electric potential of the sample placed in a high-density plasma.

(S. Masuzaki)

IEA (International Energy Agency) Technology Collaboration Programme for Cooperation in Development of the Stellarator-Heliotron (SH) Concept ("IEA SH-TCP")

Highlight

The restrictions put in place by Covid-19 have been relaxed, and direct international collaboration has been reinstated

The objective of the Stellarator-Heliotron Technology Collaboration Programme (TCP) is to improve the physical basis of the Stellarator-Heliotron concept and to increase the effectiveness and productivity of research and development efforts related to that concept by strengthening cooperation among IEA Member Countries. The cooperation program will consist of the following activities: exchange of information; dispatch of experts to facilities or research groups of the Parties; joint planning and coordination of experimental programs in specific fields; workshops, seminars, and symposia; joint theoretical design and systems studies; exchange of computer codes; joint experiments.

The various activity restriction measures taken to prevent the spread of Covid-19 beginning in 2020 were hampering not only the execution of direct international collaborative research, which is the main activity of the IEA SH-TCP but also the research activities of each country. However, with the start of 2022, the restrictions on Covid-19 in each country were significantly relaxed. For example, the easing of the limit on the number of people in the control room has made it easier to conduct and participate in face-to-face experiments. As a result, active international exchange is returning, and it is expected that the SH TCP will once again become more active in the future.

Major achievements in 2022–2023

Significant events in the IEA SH-TCP from 2022 to 2023 include: (1) the completion of the Large Helical Device (LHD) project, which has been carried out since FY2012 as part of the Ministry of Education, Culture, Sports, Science and Technology (MEXT) Large-Scale Academic Frontier Promotion Project. In conjunction with this, the last deuterium experiment was performed at the LHD, and the experiment was safely completed; (2) experiments were resumed and completed at W7-X in Germany, where numerous improvements were made, including the installation of forced cooling divertors for high-heat fluxes. It is also worth mentioning that, as highlighted above, the relaxation of various regulations by Covid-19 that started in 2020 in multiple countries has made it possible to conduct and participate in experiments face-to-face, and active international exchanges are returning.

At the LHD, the 24th cycle experiment was initially scheduled to be conducted from the end of September 2022 to the beginning of February 2023. However, due to the rising cost of electricity, the duration of the experiment had to be shortened, and the experiment was terminated at the end of 2022. Although the period of the experiment was shortened, experiments to clarify isotope effects in helical plasmas were steadily conducted in both hydrogen and deuterium plasmas. The analysis results are expected to be presented at important international conferences scheduled in the future, for example, IAEA FEC2023. At Heliotron J at Kyoto University in Japan, plasma experiments were conducted as usual, focusing on control of structure formation and improvement of transport based on the detailed control of magnetic configuration, and various international joint experiments were carried out. In W7-X, after about three years of extensive modifications, experiments resumed, and the plasma experiment phase OP2.1 was conducted. W7-X succeeded in producing plasma with an average heating power of 2.7 MW and a plasma duration of 480 s, i.e., 1.3 GJ of injection energy. This is 17 times higher than the previous record by W7-X. These results will also be presented at important international conferences, such as IAEA FEC2023, scheduled shortly.

Summary of 51st S-H TCP executive committee meeting

The 51st Executive Committee (ExCo) meeting of the S-H TCP was held on June 21, 2022, in Warsaw, Poland, during the following 23rd International Stellarator-Heliotron Workshop (ISHW), with hybrid face-to-face and remote participation. The meeting discussed the status of SH TCP legal document amendments, reports from the Fusion Power Coordinated Committee (FPCC), additional TCP members such as Costa Rica and sponsoring members, and the timing and location of the 24th ISHW.

23rd International Stellarator-Heliotron Workshop (ISHW)

The 23rd International Stellarator-Heliotron Workshop (ISHW), postponed due to Covid-19, was held in Warsaw, Poland, from June 20 to 24, 2022, hosted by the Institute of Plasma Physics and Laser Microfusion (IPPLM). Due to the easing of Covid-19 travel restrictions in Europe, the workshop was held in person. Still, for those unable to come to Warsaw, Poland, there was an opportunity to participate remotely for various reasons. The topics of this workshop were: 3D effects on transport and confinement; impurity sources and transport; plasma edge physics and plasma wall interaction; energetic particles, MHD, and plasma stability; theory and simulation; energy, particle, and momentum transport; stellarator and heliotron reactor design studies, and 3D effects in tokamaks and reversed field pinches. The total number of participants in the workshop was just over 130, mainly from Europe, with seven from Japan. The number of participants from Japan was minimal compared to previous workshops. This may have been because the easing of Covid-19 travel restrictions in Europe was recently concluded, and Poland is a neighbor of Ukraine, a country at war with Russia.

There were 29 invited talks, 16 oral talks, and 67 poster presentations at the workshop, including six invited talks from Japan (five from NIFS and one from Kyoto University). Four invited talks reported the latest experimental results from the LHD, including the initial results of the He beam injection experiments in LHD by N. Tamura (NIFS). Also, five invited talks reported on stellarator optimization, including one from H. Yamaguchi (NIFS). In this workshop, a student poster award was given to three young researchers. The next ISHW will be held in Hiroshima, Japan, in 2024.

22nd Coordinated Working Group Meeting (CWGM)

The 22nd Coordinated Working Group Meeting (CWGM) was held on June 24, 2022, in Warsaw, Poland, following the 23rd ISHW. The CWGM, like the ISHW, was a hybrid of face-to-face and remote participation, and because it was held right after the ISHW, it was shorter than the regular CWGM. The meeting was also held as an international seminar of the Japan Society for the Promotion of Science (JSPS) Core-to-Core Program “Advanced Core-to-Core Network for High-Temperature Plasma Dynamics and Structure Formation Based on Magnetic Field Diversity (PLADyS)”, in which the Institute of Energy Science and Engineering, Kyoto University, serves as the Japanese base institution. A. Dinklage (IPP) introduced the status of the CWGM, which had been temporarily suspended due to Covid-19, as well as expected future joint experiments. Next, Y. Suzuki (Hiroshima Univ.) and S. Inagaki (Kyoto Univ.) remotely introduced the concept of the META-stellarator and experiments for it. Finally, the plans for each country’s experiment device (LHD, W7-X, TJ-II, Heliotron J and HSX) for FY2022 were introduced, and the possibility of international joint experiments was discussed. The next CWGM will be held in Kyoto, and a concrete action plan for the CWGM will be discussed remotely before the next meeting.

(N. Tamura, K. Ida and K. Nagasaki (Kyoto Univ.))

Japan-China Collaboration for Fusion Research (Post-CUP Collaboration)

I. Post-CUP collaboration

The post-Core University Program (Post-CUP) collaboration is motivated by cooperation on fusion research with institutes and universities in China including the Institute of Plasma Physics Chinese Academy of Science (ASIPP), Southwestern Institute of Physics (SWIP), Peking University, the Southwestern Jiaotong University (SWJTU), Huazhong University of Science and Technology (HUST) and other universities both in Japan and China. The Post-CUP collaboration is carried out for both studies on plasma physics and fusion engineering. Based on the following implementation system, the Post-CUP collaboration in FY 2022 was executed.

Table 1 Implementation system of Japan-China collaboration for fusion research

Category	① Plasma experiment				② Theory and simulation	③ Fusion engineering research
Subcategory	①-1	①-2	①-3	①-4	—	—
Operator	A. Shimizu	Y. Yoshimura/ H. Takahashi	M. Isobe	T. Oishi/ M. Goto	G. Kawamura	T. Tanaka

①-1: Configuration optimization, transport, and magnetohydrodynamics, ①-2: Plasma heating and steady-state physics, ①-3: Energetic particles and plasma diagnostics, ①-4: Edge plasma and divertor physics, and atomic process

II. Primary research activities of collaboration in FY 2022

The fifth Steering Committee meeting for the NIFS-SWJTU joint project for the CFQS quasi-axisymmetric stellarator, was held on Dec. 9, 2022 online, as shown in Fig. 1. The progress of engineering design, current status of the construction of modular coils (MCs), and the vacuum vessel (VV) were reviewed [1]. At this time, in a total of 16 MCs, the first vacuum pressure impregnation (VPI) process of 15 MCs, and the second VPI of four MCs

Fig. 1 The fifth Steering Committee meeting of the NIFS-SWJTU joint project for CFQS held on Dec. 9, 2022 online. Top left, top right, and bottom pictures show participants from NIFS, Hefei Keye, and SWJTU, respectively.

have been finished. For the VV, the manufacturing of the first quarter toroidal section was finished and its vacuum leak test was in progress. The first plasma will be produced in 2024 in a condition of 0.1 T operation.

In research on energetic particles, the results of joint experiments in the Large Helical Device (LHD) were summarized as an invited talk in the Asia-Pacific Conference on Plasma Physics 2022 [2]. NIFS and ASIPP performed experiments to study the classical confinement of beam ions in EAST by means of short pulse neutral beam injection (NBI) in July 2022. Also, NIFS and ASIPP have been discussing implementation of collaborative research to measure lost energetic ions for EAST and BEST. Development of a gamma ray spectrometer with Compton suppression on the HL-2A tokamak was published as a joint outcome between NIFS and SWIP [3]. NIFS and SWIP have been discussing the design of neutral particle analyzers in HL-2M for phase space resolved measurement of energetic particles.

In research on plasma heating, the property of second harmonic ECCD with 54.5 GHz and 400 kW was investigated for the CFQS physics experiments. According to TRAVIS calculations with proper profiles of T_e and n_e, more than 30 kA of EC-driven currents, which is larger than the expected neoclassical bootstrap current (BSC) of 26 kA, was obtained in a standard QAS configuration and even in an extreme one with ±20% magnetic field ripples [4]. Thus, it is confirmed that at least in absolute value, sufficient EC-driven current will be available to compensate for the possible BSC. As for collaboration on NBI, NIFS accepted two internship students from the University of Science and Technology of China. One of them has been working on the COMSOL simulation relevant to the production and spatial distribution of n_e and T_e in a RF ion source, and the other student has been analyzing the beamlet profiles from experimental data. The NIFS NBI group also had a meeting with the SWIP NBI one to discuss and plan next year's DC-RF hybrid ion sources constructed at SWIP and NIFS.

In research on edge and divertor plasmas, collaborative work on extreme ultraviolet (EUV) and vacuum ultraviolet (VUV) spectroscopy has progressed. The emission line spectra of intrinsic impurities in the wavelength range of 5-2400 Å were identified in detail at the LHD. The EUV spectrometers developed at the LHD have been installed and are still in operation at EAST and HL-2A, and discussions have been initiated for comparison studies with the intrinsic and externally injected impurity spectra measured at those devices.

In research on theory and simulation, two collaborative papers were published. A multiscale particle simulation model was developed based on the Particle-in-Cell (PIC) simulation codes PICS1 and PICS2, and the transient heat load during an ELM pulse was investigated [5]. Heat flux deposition around the leading edge of castellated divertor blocks in KSTAR was investigated with the PIC simulation code PICS2 [6].

[1] CFQS TEAM, "*NIFS-SWJTU JOINT PROJECT FOR CFQS – PHYSICS AND ENGINEERING DESIGN – VER. 5.0*." December, 2022.

[2] K. Ogawa, H. Nuga, R. Seki, J. Jo, G.Q. Zhong, Y.P. Zhang, S. Sangaroon *et al.*, "*Progress in energetic particle confinement research in the Large Helical Device deuterium experiments using integrated neutron diagnostics*", 6th Asia-Pacific Conference on Plasma Physics on-line e-conference, Oct 9–14, 2022 (AAPPS-DPP2022), MF1-I27.

[3] Y.P. Zhang, J. Zhang, S.K. Cheng, J.J. Zhu, M. Isobe, P.F. Zhang, G.L. Yuan *et al.*, "*A gamma ray spectrometer with Compton suppression on the HL-2A tokamak*", Review of Scientific Instruments **93**, 123509 (2022).

[4] Y. Yoshimura, M. Kanda, R. Yanai, A. Shimizu, S. Kinoshita, M. Isobe, S. Okamura, K. Ogawa, H. Takahashi, T. Murase, S. Nakagawa, H. Tanoue, H.F. Liu, and Y. Xu, "*Investigation of Capability of Current Control by Electron Cyclotron Waves in the Quasiaxisymmetric Stellarator CFQS*", Plasma and Fusion Research **17**, 2402039 (2022).

[5] G. Niu, G. Kawamura, S. Dai, Q. Xu, T. He, F. Nian *et al.*, "*Multiscale particle simulation of the temporal evolution of heat flux into poloidal gaps of castellated divertor with edge-localized modes*" Nuclear Fusion, **63**, 066036 (2023).

[6] Q. Xu, G. Kawamura, E. Bang, Z. Yang, G. Niu, F. Ding, S. Hong, and G. Luo, "*Heat load inside the gaps of castellated tungsten blocks with different shapes in KSTAR*", Nuclear Materials and Energy **34**, 101390 (2023).

(M. Isobe, A. Shimizu, K. Tsumori, H. Takahashi, K. Ogawa, T. Oishi, M. Goto and G. Kawamura)

Japan-Korea Fusion Collaboration Programs
FY 2022 Japan-Korea Diagnostics Collaboration

Japan and Korea have been collaborating on the development of plasma diagnostics since 2004. The topics have included Thomson scattering, ECE, CXS, bolometer, energetic ion and neutron diagnostics, ECEI and RF diagnostics, SXCCD and VUV cameras and automated integrated data analysis. On January 26th – 27th, 2023, Prof. Peterson visited NFRI in Korea and we held a hybrid meeting to discuss the collaboration (See Figure 1). There were approximately 10 participants from each country.

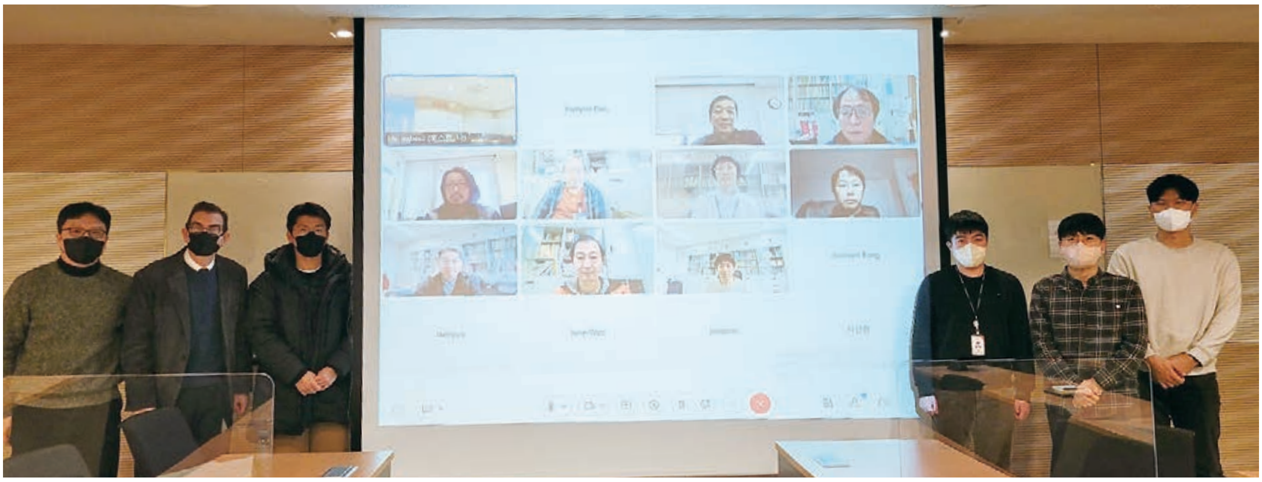


Fig. 1 Image from hybrid meeting regarding the Japan-Korea diagnostics collaboration.

Time-resolved triton burnup study in KSTAR

Further analysis was carried out of triton burnup experiments performed in FY2020 and 2021 in the relatively high I_p condition using a Sci-Fi detector developed under the Japan-Korea collaboration. A higher triton burnup ratio was obtained in the off-axis ECRH case (shot # 30287) compared to the on-axis ECRH case (shot # 30285) as seen in Figure 2. The amplitude of the MHD instabilities was suppressed in the off-axis ECRH case, indicating that triton transport due to MHD instabilities is reduced.

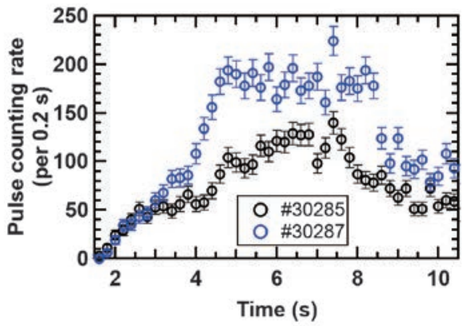


Fig. 2 Time evolution of D-T neutron counts by the Sci-Fi detector.

Real-time Thomson scattering diagnostics on KSTAR and LHD

The real-time Thomson scattering system on KSTAR provides the electron temperature data to the PCS (plasma control system). The fast digitizers produced by CAEN are used. The GPU system is used for the signal processing with Fourier transformation in the signal fitting and the neural network calculation of the electron temperature. Real-time measurement on LHD with digitizers from TechnoAP started on November 2022. Real-time display of electron density and temperature profiles was made possible. The data were transferred to the ASTI (Data Assimilation system), which is developed by S. Murakami and Y. Morishita (Kyoto University). The following problems remained and discussion with the KFE group was useful for resolving them: (1) Data transfer time between the digitizers and the analysis PC: The multi-thread processing for each digitizer will be tried in the next LHD experiment. (2) Excluding noise components mainly due to the digitizer: Detailed discussions were made about the errors and the fitting methods.

10th Korea-Japan Seminar on Advanced Diagnostics for Steady-State Fusion Plasmas

On the 15th and 16th of September, 2022 Seoul National University hosted the 10th Korea-Japan Seminar on Advanced Diagnostics for Steady-State Fusion Plasmas online. There were 9 lectures from Korean Scientists, 8 lectures from Japanese experts and one lecture from a scientist in the United States of America. The number of students attending the seminar were 20 from Japan and 19 from South Korea, some of whom can be seen in Figure 3.

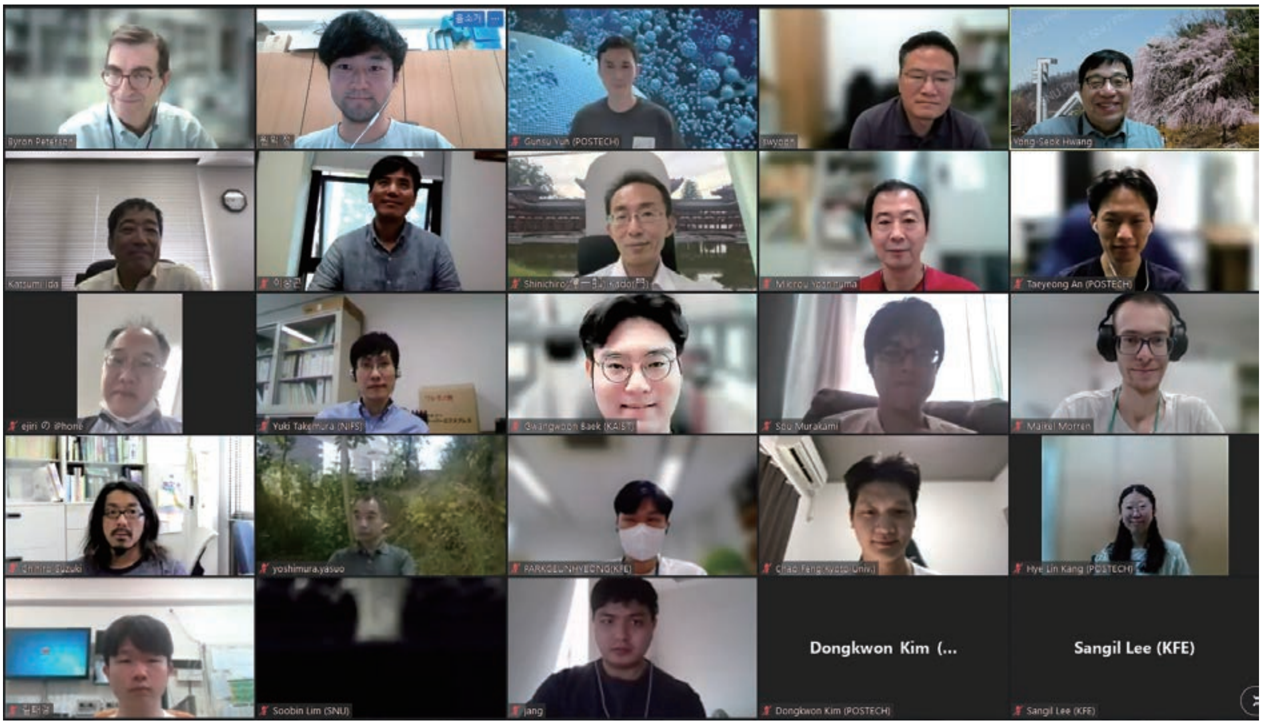


Fig. 3 Screen image of 10th Korea-Japan Seminar on Advanced Diagnostics for Steady-State Fusion Plasmas held online September 15th – 16th, 2022 and hosted by Seoul National University.

[1] Yamada, H. Funaba, J. H. Lee, Y. Huang, and C. Liu, “Neural Network Data Analysis in the Large Helical Device Thomson Scattering System”, Plasma and Fusion Research **17**, pp. 2402061-1–2402061-4 (2022).

[2] H. Funaba, I. Yamada, R. Yasuhara, H. Uehara, H. Tojo, E. Yatsuka, J.H. Lee, and Y. Huang, “Fast Signal Modeling for Thomson Scattering Diagnostics and Effects on Electron Temperature Evaluation”, Plasma and Fusion Research **17**, pp. 2402032-1–2402032-4 (2022).

[3] K. Ogawa, M. Isobe, S. Kamio, H. Nuga, R. Seki, S. Sangaroon, H. Yamaguchi, Y. Fujiwara, E. Takada, S. Murakami, J. Jo, Y. Takemura, H. Sakai, K. Tanaka, T. Tokuzawa, R. Yasuhara, and M. Osakabe, “Studies of energetic particle transport induced by multiple Alfvén eigenmodes using neutron and escaping energetic particle diagnostics in Large Helical Device deuterium plasmas”, Nuclear Fusion **62**, 112001 (2022).

(B. Peterson, I. Yamada and K. Ogawa)