1-4. LHD Project Research Collaboration

The LHD Project Research Collaboration program has been contributed to develop basic research activities of the fusion technology and the plasma physics in Japanese universities in a long-term schedule.

The aim of the LHD Project Research Collaboration, being reported here, is to research and develop both technology and the scientific foundations that are useful for both the LHD group and the universities, and then, to apply these results to LHD experiments for the improvement of LHD. The characteristic of this collaboration program is that some R&D's are performed in each domestic university or institute, instead of in NIFS as conventional research collaborations. The advantage of this type collaboration over conventional one is that research collaborators can devote themselves to R&D's more efficiently and enthusiastically by spending much more time.

From ten years before, the LHD Project Research Collaboration started to invite public participation from universities and institutes in Japan. Three committees and one advisory council participate in selection process of collaboration subjects. At the beginning, the committees of the Fusion Network in Japan select and recommend some proposed plans to the committee of the LHD Project Research Collaboration in NIFS. NIFS has partnerships with Fusion Network linking three major research fields in Japan: fusion engineering, fusion science and plasma science. Although these fields have been developed independently, intimate collaboration between them is essential for further progress of fusion research. NIFS, as a Center of Excellence (COE) should develop a network of fusion research activities of universities and government institutions, including information exchange, planning, collaboration with foreign institutions and education of graduate course students. An important point to choose a subject of collaboration is a new attempt, which is useful for the LHD project and is not planned in NIFS.

As the fusion-plasma science program, following subjects were approved last year and reported in this book.

1. Static and Dynamical Spectroscopy on Neutral Hydrogen Transport in a Fusion Plasma
2. Energy Resolved X-ray Video Camera system in LHD
3. Development of Neutron Diagnostic Systems Leading to Extended Physics of Energetic Particle Confinement
4. Measurements of Charge Exchange Cross Sections for highly charged tungsten ions with hydrogen atoms
5. Development of the multi-pass Thomson scattering system in the GAMMA 10 tandem mirror
6. EEDF Measurement in the Freq. Domain with Differentiator Circuit on MAP-II Divertor Simulator
7. Positional stabilization of torus plasma with simple helical coils
8. Study of high power sub terahertz pulse gyrotron for application to collective Thomson scattering
9. Study of Atomic Excitation by Optical Vortex and Its Application to a Novel Laser Spectroscopy
10. Electron Bernstein wave heating in extremely over-dense plasmas
11. Development of a microwave frequency comb reflectometer for multi-scale turbulence measurement
12. Wavenumber measurement of electron gyro-scale density fluctuation using microwave scattering at UHR
13. Study on tokamak-helical hybrid configurations with a low aspect ratio
14. Determination of the response function for a particle recycling system and its application to SSO
15. Study of shielding effect of resonant magnetic perturbation and the interaction with MHD instabilities
16. Development of a large negative ion source and a photo-neutralizer for the continuous operation
17. New reconstruction method for eddy current distribution in toroid: verification from experiments
18. Study of RF Generated Fast Electrons and Their Behavior in the Low Collisionality Regime

As the fusion-engineering program, following subjects were also approved last year and reported here.

1. Development of Compact Divertor Plasma Simulator for Hot Laboratory
2. A proposal of in-situ diagnostics methods for PFMs under multiple irradiation
3. Study of selective exhaust of particles on LHD closed divertor
4. Production and development of tungsten materials for high heat flux components corresponding to neutron irradiation environment of fusion reactor
5. Plasma wall interactions under inert gas puffing for reduction of heat flux
6. Retention dynamics in damaged tungsten
7. In-situ LIBS Measurements of Hydrogen Isotope Retention and Material Mixing
8. Development of Plasma-Spray Technique and Evaluation of Coating Properties for LHD
9. R&D of Advanced Cooling Unit of Diverter and Its Non-destructive Inspection
10. Fundamental Study of Energy Conversion Divertor for Helical Reactors
11. Control of heat and hydrogen transfer by improvement of interface structure in heat exchanger of fusion blanket
12. Development of a helical winding using advanced superconductors for high magnetic fields
13. A New Approach for Estimation of the Biological Effects of Low Level Tritium Radiation
14. Study on development of environmental tritium behavior model incorporating organically bound tritium in plant
15. Development of Hydrogen Isotope Separation Technologies for DEMO Fuel Cycle
16. Tritium accumulation and its decontamination of deposition layer

These subjects are planned basically as the three years program. Therefore, the reports presented here represent one portion of the total subjects.

(Mutoh, T., Sagara, A.)