1-5. LHD Project Research Collaboration

The fusion technology and the plasma physics must be developed in a long-term program. Success with this program requires collaborations with scientists and researchers from universities and institutes in Japan and also from all over the world.

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 co-workers can devote themselves to R&D's more efficiently and enthusiastically by spending much more time.

From four years before, the LHD Project Research Collaboration started to invited 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. The Fusion Network has two committees related to this collaboration: one deals with the fields of fusion and plasma science and another with fusion engineering. 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.

From last year LHD team proposed three subjects for supporting research in universities to drive forward the future deuterium experiment in LHD effectively. Another important point is whether that program can contribute to stimulate university researches and LHD programs.

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

1. Improvement of plasma performance by strong ECH with high power gyrotron.
2. Formation mechanism and transport of dust particles in the divertor plasmas.
3. Development of integrated simulation code for helical plasma experiments
4. Production mechanism and transport control of impurity hydrocarbon in LHD plasma.
5. Development of 2-dimensional Thomson scattering measurement.
6. Study of helical magnetic configuration and plasma energy measurement.
7. Neutral particle flow measurement using single mode laser diode.
8. EBW ECH and ECCD in high density plasma.
9. Wave physics study in high beta plasma
10. Development of real time control system for MHD instability
11. Comprehensive study and experimental technique for plasma turbulence and transport
12. Development of magnetic island detection by magnetic measurement
13. Characteristic evaluation of RF ion source with Cesium seeding
14. Study of correlation between density fluctuation and ECCD using high harmonic electron Bernstain wave

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

1. 14-MeV Neutron Irradiation Effects on Super-conducting Magnet Materials under Cryogenic Temperature
2. Development of New High Field and High Current Density Superconductors for Fusion Devises
3. Measurement of the negative ion and control of recombination plasma in the LHD Divertor
4. Kinetics of Hydrogen Isotopes at Surfaces and Bulks of Plasma Facing Materials Based on Group 5 Metals
5. Heat Removal Enhancement of Plasma-Facing Components by Using Nano-Particle Porous Layer Method
6. Experimental study on liquid lithium flow for IFMIF target
7. Integrated Experimental Process Study for Removal of Tritium and Impurities from Liquid Lithium
8. Optimized Thermo-mechanical Design of High Intensity Neutron Source Test Cell for Material Irradiation
9. Application of advanced high-temperature superconductors for fusion plasma experimental devices
10. Effects of Simultaneous Helium Irradiation on Hydrogen Behavior in Plasma Facing Materials
11. Development of Current Leads Combined with the Pulse-Tube Cryocooler
12. In situ measurement of surface modification of plasma-facing material during the long duration discharge
13. Evaluation of Advanced Tungsten Materials as Plasma Facing Materials
14. Dynamic Behavior of Tritium Release from Stainless Steel for LHD
15. Compatibility and Mass Transfer Study for Liquid Breeder Blanket System
16. Change in properties of superconducting magnet materials by fission neutron irradiation
17. Feasibility Study of LiPb-He-SiC High Temperature Blanket Concept
18. Development of advanced superconducting conductors for fusion devices
19. Basic studies for reduction of tritium retention, and for recovering and recycling of H, D and T under LHD-DD operations
20. Hydrogen isotope retention behavior on the surface of metal-carbon mixture layer under carbon, hydrogen isotopes and helium simultaneous irradiation circumstance
21. Study on behavior of environmental tritium and assessment of influence on environment
22. Assessment study on biological effects of low-dose radiation

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

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