1-5. LHD Project Research Collaboration

In order to realize the LHD project, both fusion technology and the plasma physics must be developed in a long-term program. Success with this program will require collaboration 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 three 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. Then, the committee of the LHD Project Research Collaboration in NIFS determines the collaboration subjects, together with their budgets. They finally require the approval of the Advisory Council for Research and Management of NIFS. An important point to choose a subject of collaboration is to know whether it was already carried out or will be done firstly in NIFS. A new attempt, which is useful for the LHD project and is not planned in NIFS, is, of course, always welcome to the collaboration program for LHD project. 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. Development of high beta plasma formation using ICRF high harmonic fast wave.
2. Study of the fueling pellet transportation in the guiding tube.
3. ECH and ECCD using new remote steering antenna.
4. Production mechanism of D^- ions and evaluation of D^- ion current extraction.
5. Dynamics of hydrogen atoms and molecule in the periphery plasma studied by mean of polarization separated spectra.
6. Spectroscopy and atomic modeling of EUV light from LHD plasma.
7. Development of wide band and compact X-ray spectrometer.
8. Optical diagnostics of non-contact divertor plasma.
9. Improvement of plasma performance by strong ECH with high power gyrotron.
10. Formation mechanism and transport of dust particles in the divertor plasmas.
11. Development of integrated simulation code for helical plasma experiments
12. Production mechanism and transport control of impurity hydrocarbon in LHD plasma.
13. Development of 2-dimensional Thomson scattering measurement.
14. Study of helical magnetic configuration and plasma energy measurement.
15. Neutral particle flow measurement using single mode laser diode.
16. EBW ECH and ECCD in high density plasma.

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

1. Study on effects of bending strain to critical current characteristics of Nb_3Al CIC conductors.
2. 14MeV-neutron beam induced change in characteristics of materials for superconducting magnets under 4.5 K.
3. Development of New High Field and High Current Density Superconductors for Fusion Devises.
4. Suitability of Boron-titanium as First Wall.
5. Measurement of the negative ion and control of recombination plasma in the LHD Divertor.
6. Kinetics of Hydrogen Isotopes at Surfaces and Bulks of Plasma Facing Materials Based on Group 5 Metals.
7. Heat Removal Enhancement of Plasma-Facing Components by Using Nano-Particle Porous Layer Method.
8. Investigation of tritium behavior and traceability in in-vessel systems of LHD during D-D burning.
9. Assessment study on biological effects of radiation in LHD.
10. Study on environmental behavior of tritium.
11. Experimental study on liquid lithium flow for IFMIF target.
12. Integrated Experimental Process Study for Removal of Tritium and Impurities from Liquid Lithium.
13. Optimized thermo-mechanical design of high intensity neutron source test cell for material irradiation.
14. Application of Advanced High Temperature Superconductors for Fusion Plasma Experimental Devices.
15. Effects of Simultaneous Helium Irradiation on Hydrogen Behavior in Plasma Facing Materials.
16. Development of Current Leads Combined with the Pulse-Tube Cryocooler
17. In situ measurement of surface modification of plasma-facing material during the long duration discharge
18. Evaluation of Advanced Tungsten Materials as Plasma Facing Materials

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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