1-3. Study of Deuterium Experiment Program in LHD

NIFS has been making preparation for an experiment program using deuterium in order to offer technical advantages of LHD. Requisite studies have been conducted since a framework for the preparation was set up in 2005, as well as carrying out various activities aimed for the Agreement for Environmental Conservation with local government bodies.

We are reconstructing the framework, especially based on the results of the experiment in LHD which has made much progress recently. The plan for experiment is expected to be extremely precise since it forms a basis on the guideline of safety program. In this fiscal year, extensive study for the experiment program is conducted by incorporating a wide range of views from the university researchers through workshops and coordination research.

The application research such as the usage of the generated neutrons in the medical field as well as conducting experiments of plasma is also discussed.

A major issue of the deuterium experiment is to build up a reliable model which foresees future reactor design using the helical configuration. In the design data base, the definition of mass-dependency (isotope effect) with high accuracy is the most important physics issues. As a result of recent progress of high performance in plasma experiment such as a super dense core plasma with internal density barrier, deliberating future experiment program is greatly significant.

For the deuterium experiment, following issues have been taken up and examined:

1. Plasma confinement characteristics of deuterium plasma.
2. Upgrade of LHD magnetic confinement device and diverter performance.
3. Enhancements of plasma heating devices and diagnostic devices
4. Estimation of shielding effect for neutrons
5. Required electric power supply and controlling devices

Including above issues, a workshop was held aimed to have a discussion to enhance the validity and feasibility of the deuterium experiments in LHD.

The workshop was held in January and approximately 25 researchers from universities and 80 from NIFS attended. On the first session, following reports are presented by NIFS persons in charge and discussed.

- Summary of the Deuterium experiment programs (planning) in LHD
- Examination of Deuterium Plasma Confinement Physics in LHD
- Issues about the theory for deuterium experiment
- Plans for equipment development of LHD, diverter, NBI heating, RF heating, diagnosis, safety facilities and building maintenance

Valuable comments for many items by outside researchers of universities and institute are presented.

- Diagnosis of deuterium reaction and application of neutron sources in the inertial-electrostatic fusion device.
- Evaluation of deuterium reaction by using GNET/FIT code and potentiality of the research for the confinement of high-energy particles.
- Comments on the LHD deuterium experiment, which is based on the experience of Large tokamak.
- Collaboration to explain to fusion community and public society.
- Safety of tritium handling in deuterium experiment

Invaluable statements and comments were made for each issue, which made a significant workshop. As a common recognition, open debate with full-scale about the deuterium experiments in LHD should be held continuously in the future.

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