

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. The Safety Assessment Committee of NIFS Deuterium Experiment consisting of outside members only issued a final report in November 2007. The report evaluated the measures for safety is considered reasonable and proper.

We have been reconstructing the framework, especially based on the results of the experiment in LHD which has made much progress recently. The extensive study for the experiment program was 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 experiments such as the high ion temperature mode plasma and the 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 on 10th January and approximately 20 researchers from universities and 60 from NIFS attended. On the first session, following reports are presented by NIFS persons in charge and discussed.

- Summary of the deuterium experiment physics programs (planning) in LHD
- Plans for equipment development of LHD, magnet, diverter, NBI heating, RF heating, diagnosis, safety facilities and building maintenance
- Physics design of closed divertor in LHD
- Technology development of tritium removal

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

- Operational experience of JT-60 deuterium experiment
- Isotope effect of H-mode plasma in JT-60
- Tritium inventory and replacement by isotope atoms in vacuum chamber
- Absorption and desorption of tritium on stainless steel of LHD
- Isotope separation technology of deuterium and tritium
- Compact accelerator using helicon wave ion source and its application for DD neutron source
- Expectation to deuterium experiment from the standpoint of helical reactor design

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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