

### 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 and future helical type reactor. Many 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. Especially recent achievement of high ion temperature, high beta and very high density plasmas and steady state operation show the possibility of innovative helical reactor design. The extensive study of 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 heliotron 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 February and approximately 20 researchers from universities and 60 from NIFS attended. On the first session, following reports are presented by NIFS members in charge and discussed.

- Recent progresses of high beta and high ion temperature experiments and their future prospects using deuterium plasma in LHD
- Research issues of theory and simulation of turbulent transport and Alfvén eigenmode induced transport
- Management of activated products at JT-60U and the status of JT-60SA project
- Handling of neutron and tritium in JET device in Culham.

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

- Operational experience of NBI heating device using deuterium
- Gyrotron development for LHD steady state experiment
- Physics research from nuclear reaction
- Neutron measurement from the experience of JT-60U
- Hydrogen retention on plasma facing component

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

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