(1) Study of Deuterium Experiment Program in LHD

To achieve higher performance plasmas and to confirm technical advantage of a Heliotron-type configuration in designing a future economical steady state fusion reactor, the National Institute for Fusion Science (NIFS) planned an experiment program using deuterium plasmas. On March 28th in 2013, the NIFS signed the Agreement for Environmental Conservation with local governments which include Toki-city, Tajimi-city, Mizunami-city and Gifu-prefecture. They also signed the agreement of operation of deuterium experiments on LHD.

These agreements are the achievement from the long and enormous efforts of mutual understanding with local governments and public activities to build a trustworthy relationship. In 2007, the Safety Assessment Committee of NIFS Deuterium Experiment consisting of outside members issued a report indicating that the measures for Safety of LHD Deuterium Experiment was considered reasonable and proper. After the nuclear accident at the Fukushima No.1 nuclear power plant, which was triggered by the tsunami caused by the Great East Japan Earth quake, the measures were reexamined. The Safety Assessment Committee reevaluated the measures and reported that the reexamined measures were reasonable and proper in Feb. 2012.

After the agreement for the Environmental Conservation was made with local governments in 2013, the preparation for the LHD deuterium experiment was started. On April 25th in 2014, a workshop was held at NIFS in order to share the basic idea of LHD deuterium experiments with the NIFS collaborators and to discuss its experiment plan. Approximately, 24 researchers from universities and 23 researchers from NIFS attended this workshop. In the first session of the workshop, the basic plan and brief schedule for LHD deuterium experiment were explained. The policy for the radiation safety control was also explained in the session. In addition to them, following talks were presented in the workshop to show the plans for the upgrades of LHD hardware and to discuss the effective use of the deuterium experiments for the deep understanding of plasma physics and fusion reactor design.

- "The operational scenario for starting the deuterium experiments ",
- "Exploration in toroidal plasma transport physics for comprehensive understanding of isotope effect"
- "A new research phase in plasma heating, energetic particle and MHD physics in LHD deuterium experiment"
- "Confinement study and new plasma diagnostics for LHD deuterium experiments
- "Turbulence and long-range correlation"

To accelerate the participation of collaborators in universities to the LHD deuterium experiments, a symposium was also held in the plasma conference in 2014. The isotope effect of plasmas confinement was chosen as a main topic for the symposium since it is one of the key topics to explore at the LHD deuterium experiment and it is also necessary to extend the plasma parameter region to design a helical fusion reactor with high degree of accuracy. Followings were the title of talks presented in the symposium;

- "Isotope effect on H-mode plasmas in JT-60U"
- "Isotope effect on the internal transport barrier plasmas"
- "Theoretical prediction for isotope effect on turbulence transport"
- "New diagnostics to explore the isotope effect and the mass ratio effect on plasma confinement"

In addition to the isotope effects, the other physics and engineering topics also be considered such as, high energy particle confinement physics and hydrogen isotope retention studies, as the main topics for the deuterium experiment. The investigation of necessary hardware for these topics was also started from 2013 under the collaboration frame work with researchers in universities.

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