

§5. Study of Deuterium Experiment Program in LHD

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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) has 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 trustworthy relationships. 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 were considered to be reasonable and proper. After the nuclear accident at the Fukushima No.1 nuclear power plant in 2011, the measures were reexamined. The Safety Assessment Committee re-evaluated the measures and reported that the re-examined 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 December 10, 2015, the domestic meeting was held at NIFS in order to facilitate discussions on experiment planning for the coming LHD deuterium experiments. More than 90 researchers attended. After the reports on basic plans, safety management, and diagnostics capabilities in the deuterium experiment, presentations on physics topics (major targets of

deuterium experiment) such as isotope effect, energetic particles confinement, plasma-wall interaction/steady state operation, and the neutron applications were made from collaborators in universities and NIFS researchers.

Based on this domestic meeting, the international workshop on LHD deuterium experiment was held on February 9 and 10, 2016 at NIFS, to share the past progress/present status and then to discuss future directions with international collaborators.

Along with the long-history of the unresolved isotope effect, expectations for increased understandings/clarifications of the topics based on the cutting-edge diagnostics, theory and simulation were mentioned. The differences of properties on the H mode transition depending on the ion species, suggestions for comprehensive research including atomic and molecular dynamics, deuterium experiment plans in the experimental facilities in Asian region and its collaboration possibilities with LHD were also reported.

The research on the dynamic response, for which, LHD has played a leading role internationally, was also explained as a candidate of experimental technique to detect the isotope effect in plasmas.. An experiment proposal based on this innovative view was made to possibly clarify the long-standing mystery: the isotope effect.

In the summary session, it was agreed by participants that further continuous discussions should be promoted to maximize the outcome of the LHD deuterium experiment. From the LHD experiment board, the establishment of “the international program committee (IPC) for the LHD deuterium experiment” was suggested, and it was also fully agreed.