§82. Promotion of All-Japan ST Research Program

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Based on the recommendation of the Fusion Research Working Group and the conclusions of the "Kyushu University Plasma Boundary Dynamics Experimental Device Review Committee", spherical tokamak (ST) research in Japan was reorganized in 2005 as All-Japan ST Research Program (AJSTRP) supported by NIFS Bi-Directional Collaboration, and a new ST device QUEST was constructed at Kyushu University to fulfill one of the two main missions of this program, steady state operation. The formal establishment of the NIFS Bi-Drectional Collaboration Research Promotion Expert Subcommittee for ST Research (ST Subcommittee) in November 2006 marked a great progress. The ST Subcommittee makes plans for activities in the entire field of ST research, coordinates collaborative efforts among different research groups, discusses any issues related to ST research, and reports to NIFS Bi-Directional Collaboration Committee as necessary. Since then, this Subcommittee has been working to establish the research plan of AJSTRP and to coordinate its activities. The activities of the ST Subcommittee are published on the AJSTRP website at NIFS, http://www.nifs.ac.jp/kenkyo/icr/st.html.

AJSTRP promotes creative and innovative research at universities and other institutions. Examples include non-inductive plasma start-up and ultra-high beta ST formation by plasma merging. In order to maintain international competitiveness and to make significant contributions internationally, it is crucial to integrate all resources, including experimental research using existing ST devices as well as theoretical and computational research. The purpose of this collaborative research is to plan and promote the activities of AJSTRP, making maximum utilization of the NIFS Bi-Directional Collaboration framework, actively involving various ST research groups.

The Tenth and the Eleventh meetings of the ST Subcommittee were held during FY2011. The Tenth Meeting was held at NIFS on September 27, 2011. The Eleventh Meeting was held at NIFS on February 22, 2012. Prof. Yamazaki of Nagoya University attended the Tenth meeting as an observer, and joined as an official member representing the Nagoya University group from the Eleventh meeting. Dr. Peng (Oak Ridge National Laboratory, U.S.A., member of ST Subcommittee) attended both meetings, and brought international perspective. He pointed out that both NSTX and MAST will be shut down over the next few years for substantial upgrades, so this is a great opportunity for the Japanese ST program to make major contributions in ST research.

In order to accomplish the goals of AJSTRP, it is crucially important to make collaborations among different ST groups much more active. To alleviate the serious shortage of research budget and manpower, each group should share expertise (such as Thomson scattering from Univ. Tokyo, data acquisition and analysis from NIFS, gyrotron from Univ. Tsukuba) and miximize utilization of limited resources. Research on QUEST is supported by the Kyushu University part of NIFS Bi-Directional Collaboration, but up to now it has not been easy to support collaborations among other universities (such as between Univ. Tokyo and Kyoto Univ.). A new category called "Network-Type" Collaboration, which allows direct collaboration between "non-Center" universities, started last year. We are working with NIFS to utilize this system to enhance the activities of AJSTRP.

The ST Subcommittee has the function of coordinating contributions to the IEA Implementing Agreement (IA) from Japan. The Executive Committee for the IA on ST met during the International ST Workshop (ISTW) at NIFS in September 2011. Participants from Japan were A. Komori and Y. Takase (Chair). Since the IA will expire in June 2012, application for extension was prepared and submitted to IEA. The request for extension was discussed at the Fusion Power Co-ordinating Committee (FPCC) meeting at the OECD Headquarters in January 2012, and the FPCC recommended to the Committee on Energy Research and Technology (CERT) to approve the extension of the IA until June 2017. Under this IA, experiments on plasma start-up by the electron Bernstein wave are being carried out on MAST using a high-power (200 kW) long-pulse (0.3 s) 28 GHz gyrotron transferred from ORNL. Japan leads the world in this research, and Japanese contribution is very important. The results of these experiments have a large impact on the design of burning ST devices such as a volumetric neutron source and a commercial fusion reactor. Two more collaboration topics were discussed, steady-state operation and future applications of ST.

An important activity of the IEA IA is to organize the ISTW, which is held every other year (on years in which IAEA FEC is not held). A very successful ISTW, organized jointly with IAEA Technical Meeting and US-Japan ST Workshop, was held at NIFS during the period September 27-30, 2011. The number of participants was 67, representing 21 institutions from 9 countries (including 26 graduate students). High-level discussions on a broad range of issues, from recent results and near-future plans of ST research to long-range research strategy and commercial fusion reactor design were conducted.

Collaborations with the US are performed under the framework of the Japan-US Cooperation Program, whereas collaborations with MAST are supported by the NINS Project "Study of turbulence, magnetic islands, and magnetic field lines in magnetically confined plasmas". We are working to strengthen collaborative activities under these programs.