§10. Studies on History of Nuclear Fusion Research at the Dawn Stage

Amemiya, T., Uematsu, E. (CST, Nihon Univ.),
Matsuoka, K., Iguchi, H., Namba, C., Kimura, K.

This report summarized the results of our research on history of nuclear fusion research carried out by the joint research program of CST Nihon Univ. and NIFS FSA.

1. History of nuclear fusion research at the dawn stage in JAERI, ETL and RIKEN

Members of Japan Atomic Energy Research Institute (JAERI) were interested in research of nuclear fusion reactor in 1958. Shigeru Mori, the leader of nuclear fusion research group in JAERI, was going to start the experimental research on plasma heating by using the PIG plasma in 1960. However, in order not to conflict with the research project of the Institute of Plasma Physics (Nagoya Univ.), Mori shelved the project temporarily. Therefore, he restarted the plasma gun project in 1961, based on the experience of inspection of laboratories in USA. In 1968, JAERI started the preliminary experiment with the low beta hexapole toroidal device JFT-1. The purpose of JFT-1 was to learn how to proceed with the project toward a future big machine. In this period, JAERI's nuclear fusion research was greatly influenced by the B-plan philosophy of Goro Miyamoto (Univ. of Tokyo). In the so-called A-B dispute (1959), in order to study and improve the device engineering technology, Miyamoto emphasized the importance of the B-plan which aimed at constructing a medium-sized experimental device. Mori would understand Miyamoto's philosophy clearly, because he was a graduate of Miyamoto's laboratory. The experience of JFT-1 experiments is fully used for the next step device JFT-2 (the tokamak-type medium beta torus).

Electro Technical Laboratory (ETL) started the nuclear fusion research in 1957. This was based on the research of electric discharge and lighting rod by Shiro Hohki et al. In 1958, Tasaburo Yamada (the Faculty of Electric Power) carried out the theta pinch experiment. The result of this experiment was chosen as a unique paper at the First International Conference on Plasma Physics and Controlled Nuclear Fusion Research (IAEA Conference) in 1961 in Japanese presenters. However, the presentation was canceled just before the conference because Yamada did not attend the conference. Taro Kihara (Univ. of Tokyo) mentioned, in relation to Yamada's absence, in the conference report as follows: "It would be necessary to take general measures for one year to contribute to the next conference." During 1966 to 1968, ETL's fusion research was concentrated on the measurement of plasma parameters on the existing devices. Since 1969 the experiments of the 100kJ theta pinch and screw pinch devices have been carried out as "the research on the high beta plasma production".

The Institute of Physical and Chemical Research (RIKEN) established the laboratory of nuclear fusion research in 1958. In 1963, high-energy arc experiment was carried out by Kousuke Okamoto's group. The purpose of this experiment was to study basic characteristics of plasma. In addition, plasma diagnostics by microwave method was the main subject of RIKEN's study. A joint research project with JAERI started in 1966 and a measurement of plasma gun by microwave method was carried out. Based on studies in this period, RIKEN had taken charge of developing the relevant technology in the first stage of the Special Comprehensive Research Project since 1968. RIKEN's plasma diagnostics technology was the unsung hero behind nuclear fusion research in JAERI and ETL.

2. History of the nuclear fusion community's movement for invitation of international conference to Japan in 1970s

In 1969, the nuclear fusion committee discussed on invitation of an international conference. It was stimulated when M.S.Rabinovich (USSR) wrote to Kodi Husimi if Japan was able to hold an international conference on torus device before long or not. After the discussion by the committee, Japan Atomic Energy Research Institute (JAERI) decided to hold international conference. As a result, "Panel on low Beta Toroidal Systems" was held in Feburary 1971. After the conference, Husimi reported "Panel on low Beta Toroidal Systems" was successful, in spite of USSR member's absence, because many papers on torus device were presented.

On the other hand, the discussion on the invitation of IAEA conference was taken up in 1970. Husimi and Kenzo Yamamoto wrote to the pioneers asking for cooperation on the 5th IAEA Conference. In the 1st International Fusion Research Council (IFRC) meeting (1971), Federal Republic of Germany and Japan expressed interest in hosting the 5th IAEA conference. As a result of Japanese effort, IFRC members approved the proposal of Japan. Finally, the 5th IAEA Conference was held at the Tokyo Takanawa Prince Hotel, from November 11 to 15, 1974. Masaji Yoshikawa reported on this conference as follow: the 5th IAEA Conference hasn't produced any particular highlight. It means that nuclear fusion research was in the stage of a steady progress.

This work was conducted under NIFS Collaborative Research Program (NIFS11KVXP009).