

§3. Consideration on History of Compact Helical System Based on Historical Documents

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Through compiling chronology and writing the draft we have been making an effort to write a booklet of the history of Compact Helical System (CHS). Up to the fiscal year 2015 the history from its beginning to FY1988 had been summarized. In FY2015 the history of 1989 was searched and the result is described in the first-half of this report. In the history of Institute of Plasma Physics (IPP), Nagoya University CHS was not necessarily proposed as a natural consequence of IPP's policy. In the latter half of this report the comment on the history of IPP at the middle period is described because the basic guideline of IPP thereafter was formed, which helps to understand the situation of CHS proposal.

I. The year of 1989 was the brilliant year for helical system research in the world. Up to 1988 three new machines, ATF, CHS and W7-AS, started their operation and initial experimental results were reported. As is shown in the table below the members of Committee on Education of the House of Councilors guides by Mrs. Akiko Santo visited CHS in February. One of the authors (K.M.) explained the purpose of CHS and initial results to them. The world community had an interest in CHS. Dr. L. Peranich came from GA to do the experiment on the effect of perturbation field on the confinement of helical plasma. From ATF the project leader, Dr. J. Lyon and the core member Dr. J. Harris visited CHS and joined the experiment. From IOFAN Dr. L. Kovriznykh visited CHS.

The inward shift of magnetic axis was applied for the first time to improve the confinement that is based on the σ -optimization. The initial result on confinement scaling

was reported on Asahi newspaper as "Low aspect ratio is favorable for confinement." The international workshops on helical system and the first International Toki Conference were held and CHS results were presented.

II. In 1961 IPP was established on the basis of the so-called A-plan as an Inter University Research Institute. The policy of the A-plan was that the fusion research should be constructed from basic theory and experiment. Regarding the basic plasma experiment in IPP, researchers and collaborators won Nishina Memorial Prize three times in 1960s. Up to now total number of the Prize which was given to researchers in the field of plasma and fusion is not many, but six. In that sense basic plasma researches at that time was noteworthy. Other three were given to electron acceleration with laser, H-mode theory, and spontaneously generated electromagnetic field through CHS and JFT-2M experiments, respectively. The idea of the A-plan seemed to survive throughout the lifetime of IPP (1961-1989) and at the middle period of IPP, i.e., 1970s, it is thought that the policy giving importance to new ideas was determined. Although JIPP-1 stellarator and JIPP T-II stellarator/tokamak were constructed many researchers at IPP believed that conducting these experiments has no new idea, because tokamak and stellarator are not original machines in Japan. Many machines based on new ideas were built, however, unfortunately those have not survived at all because high-performance plasma could not be produced. In summary, IPP did not concentrate on the confinement of toroidal plasmas, such as tokamak and stellarator. In 1985 the large helical device project was determined as the future plan of universities and CHS was quickly proposed although quite a lot of researchers in IPP were unfavorable. The research result at the middle period of IPP was presented at the 71th Annual Meeting of The Physical Society of Japan at Tohoku Gakuin University in March, 2016. (NIFS15KVXV003)

Initial Chronology of CHS				
Year	Relation with Large Helical Project	IPP	Relation with Heliotron	International Relation
1989	May 29 Establishment of NIFS	February 1 the House of Councilors Committee on Education (Akiko Santo, Columbia•Top) visited CHS April 18~May 10 L. Peranich May 9~27 J. Harris June 27~28 L.Kovriznykh November 8 Asahi Shinbun (Evening Newspaper) December 4~7 Int. Toki Conf. (presented on 6) December 11~12 J. Lyon December 13 ~ 16 M.Murakami	January 24 Workshop (at Heliotron) October16 -17 Japan-US WS (at Heliotron)	April 10-14 Stellarator WS (at ORNL) December 7-9 Japan-US/IEA WS (presented on December 8)