§7. Consideration on History of Nuclear Fusion Research Based on Historical Documents

Matsuoka, K.,
Iguchi, H.

Accomplishing the document of CHS (Compact Helical System) history is the target of the collaboration. In this fiscal year the collaboration was focused on clarifying the history of the initial phase of CHS project at the Institute of Plasma Physics (IPP), Nagoya University.

As mentioned in the annual report of the last year it can be said that CHS was officially free from the LHS (at present LHD) project, and the steering committee (SC) and expert committee (EC) of IPP had little relation with CHS. CHS project was managed by the CHS group and was under the guidance of the New Planning Office[*1)] (NPO) that was actually the head-quarter of IPP. In 1987 CHS was constructed and the experiment started in 1988. At ORNL Advanced Toroidal Facility (ATF) of which aspect ratio was 7 was near completion, CHS group had a close contact with ORNL group during these periods, because CHS and ATF had the common feature of the low aspect ratio. In the followings notable events will be mentioned with some comments. The superscript number corresponds to the event in the table.

CHS group discussed the response to the inquiries from NPO[*1)] regarding the CHS mission and contribution to fusion research development[*2, *3)]. What was discussed are responsibility of the leader, the purpose of the experiment that it should not compete plasma parameters but conduct physics experiment, and so on. The experimental plan[*4, *5, *6)] of 1988 was discussed by taking account of the possible budget. The optimization of plasma cross-section was discussed from the viewpoint of 28GHz gyrotron power injection and RF would be used for plasma production independent of magnetic field strength. Effort was made for profile measurement across the plasma cross-section. The shape of ports was confirmed. Regarding the torus hall and utilities the details of CHS basement, and routes of hard-wiring for coils and signal cables, and pipe-works for cooling water and compressed air were arranged. Three types of coil current waveforms are discussed: 1) magnetic axis shift keeping the flux and quadrupole component constant during the shift, that is, no OH current drive and no change in the ellipticity, 2) swing of quadrupole component keeping the flux and dipole component constant, that is no axis shift, 3) the flux swing to drive plasma current keeping the dipole and quadrupole components constant. In determining the coil current the fringing magnetic field was optimized to vanish near the diagnostics and heating area by minimizing the total coil current dipoles. The inward shift of magnetic axis has led to the improvement of confinement in CHS and LHD. At the meetings[*7, *8, *9)] global strategy of IPP related to LHS was discussed. The first experimental result was reported as a post-deadline paper at the IAEA being supported by the fusion community. The number of the collaborative research is NIFS11KVXP010.

Chronology of Early Phase of CHS

Year	Large Helical Device	Steering Committee (SC) and Expert Committee (EC) of IPP, Nagoya Univ.	IPP, Nagoya University	International Relations
1987	2.3 Design Team (at Heliotron) 7.28 Design Task Force (DTF) 9.3 DTF 9.4 LHS Machine Sub Group (M Sub G) 9.18 DTF (Sub G) 10.15 DTF 11.4 M Sub G 11.18 LHS Plan Sub Group (P Sub G) 11.25 DTF (at Heliotron) 12.17 P Sub G (at Heliotron)	1.8 Helical System Meeting (at IPP) 3.4 HS Meeting (at IPP) 3.14 LHS Meeting (at Heliotron) 6.17 HS Sub Committee 6.18 (156th SC) *7) 10.17 HS Sub Committee	1.14 CHS Machine Meeting 1.26 Specification fixed 2.13 New Planning Office *1) 2.20～2.21 CHS Group Meeting (GM)*2) 2.23 CHS GM (16th) *3) 3.3 CHS GM (17th) *4) 3.9 CHS GM (18th) *5) 3.16 CHS GM (19th) *6) 4.11 IPP News Letter 5.20 Technical Evaluation Standards of CHS 5.22 Bid for CHS 6.15 Bid opening 7.30 ～ 7.31 Symposium on Future Plan 10 Yellow Book 「CHS Experiment Project」 10.21 ～ 10.22 Meeting with HITACHI	3.11 Presentation at US - Japan WS (divertor) 11.8 ～ 11.15 US - Japan WS (ORNL)
1988	1.7 M Sub G 1.8 DTF 2.19 DTF (at Heliotron) 2.23 M Sub G (at Heliotron) 3.12 DTF	1.7 (158th SC) *8) 1.21 (94th EC) *9)	2.11 Meeting with HITACHI 4.12 Installation of CHS 5.31～6.4 Account Audit 7.22 Lyon Visit 7.29 Grieger, Wobig Visit 8.1 Carreras, Anderson, Rome, Oktay Visit 9.6 and 9.13 Meeting of Supporting Experiment 10.10～10.21 IAEA (10.19 CHS PDL Presentation)	3.23 US - Japan WS (Heliotron) 7.25 ～ 7.28 Stellarator WS (in Kyoto)