§4. Directory on Recent Information about Operational Experiences on Large Superconducting and Cryogenic System in Fusion and Particle Accelerator

Satoh, S., Satow, T.,
Shintomi, T. (Nihon Univ.),
Haruyama, T. (High Energy Research Organization, KEK),
Mito, T.

1. PURPOSE of the STUDY

Large superconducting and cryogenic technologies become dominantly applied in the area of high energy particle accelerators and magnetic fusion experimental devices such as LHC and ITER. Since 1998 NIFS has been operating the largest Heliotron fusion experimental device called LHD which is claimed as having the first fully superconducting magnet combination in the world The operation of such systems could by no means be maintained before the public interest without sufficient and fine precaution to the public safety and the environmental preservation. The purpose of the study is to accumulate and construct extensive and beneficial archives about the experiences in such various devices through mutual correspondence. This mutual information exchange will be eventually published and provide a comprehensive directory for the relating researchers and engineers just like attending an International Conference.

2. PROCEDURE

A first step of three stages is to collect the relevant reports for the topics out of proceedings of international engineering conferences held during 1990 and 2011, to write a brief summary of the facility/device and to list the reference reports contributing the outline. The second step is to open the above materials to public and suggest any interested organization to exchange their recent activity, specially, in view of safe and stable operation. The third step will mostly be dedicated to maintain and up-to-date the directory.

3. PROGRESS in FY2011

The inclusion of particle accelerator into the original work scope of the magnetic fusion is due to its technological relativity in terms of large superconductivity and cryogenics, and in order to secure preciseness of the information especially about accelerator, it was desired to obtain the participations by the expertise from the field of particle acceleration, and professor Shintomi of Nihon U. and professor Haruyama of KEK participated the research discussion from September 2011.

Names of international conference proceedings of every back number between 1990 and 2011 are already reported in the 2010 annual report.-

Collected total number of the refrigerator papers are about 650 from past 21 years and of the superconducting magnet papers are 130 between 2006 and 2010.

General standards for selecting the facilities/devices are also described in the previous annual report.

The first step of the work has been conducted predominantly by S. SATOH and T. SATOW during FY2011 and the number in each category are shown as follows (Name of the facility/organization are reported previously),

(A) MAGNETIC FUSION—15
(B) PARTICLE ACCELERATOR—28
(C) MISCELLANEOUS—5

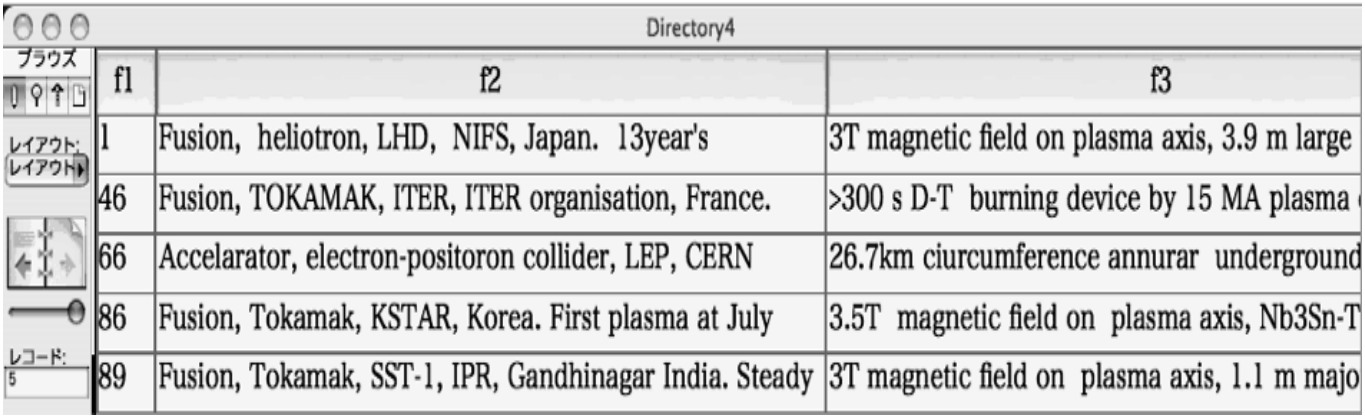
It is provable that several facilities might be out of the scope from the selecting standard here and are still remained unselected. The search for their new information must be kept-on collecting for future years.

During this second year's research, several new jobs were conducted. A query tool is developed using user friendly PC soft ware FileMaker Pro. That are firstly to gather and arrange each facility data card above into an Microsoft Excel table, secondly to convert it to a FileMaker Pro. table to facilitate key word query job. Figure shows a sample result with a keyword "kW" to row 3 (f3) in the table. Five facilities such as LHD(Jap), ITER(Fra), LEP(Sw), KSTAR(Kor), SST-1(Ind) are listed. They are currently one of the facilities using the world largest class helium refrigerator because a capacity beyond "1,000 Watt" is simply called a "kW" class refrigerator.

One more sample query was also conducted. The key word was "effective collision energy" and it was applied to row3 (f2). The term is extensively used in accelerator because the extent of the energy represents the capability of a given particle accelerator. The query result shows 6 world largest particle accelerators which have the effective collision energy over 100PeV, LHC(Sw), TEVATRON(US), LEP-II(Sw), ILC(US) and Two existing electron-positron collision device over 100TeV, KEK-B(Jap), PEP-II(US).

These query examples as well as the explanation on the data base were presented at the ***21st International Toki Conference on "Integration of Fusion Science and Technology for Steady State Fusion Generation"*** held at Toki Gifu Japan on 28 Nov.−1 Dec. 2011.

Figure List of world largest fusion and accelerator using kW class helium refrigerator.
A sample query result by FileMaker Pro with a keyword "kW" to row f3


Directory4

f1	f2	f3
1	Fusion, heliotron, LHD, NIFS, Japan. 13year's	3T magnetic field on plasma axis, 3.9 m large
46	Fusion, TOKAMAK, ITER, ITER organisation, France.	>300 s D-T burning device by 15 MA plasma
66	Accelarator, electron-positoron collider, LEP, CERN	26.7km ciurcumference annurar underground
86	Fusion, Tokamak, KSTAR, Korea. First plasma at July	3.5T magnetic field on plasma axis, Nb3Sn-T
89	Fusion, Tokamak, SST-1, IPR, Gandhinagar India. Steady	3T magnetic field on plasma axis, 1.1 m majo