

#### §4. Archives on Early Researches for Superconducting Magnet and Cryogenics Technology at NIFS

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##### INTRODUCTION

The study has begun from FY.2010 for the purpose of collecting and re-organizing notes, letters and unpublished research works written by the Late Professor Junya Yamamoto of National Institute for Fusion Science who had gone in 1996. However, this initial aim has to be changed due to the unexpected accident happened at the Institute, and the scope of the subject was sifted to “Archives on recent information about operational experiences on Large Superconducting Magnet and Cryogenics Facilities collected from the international engineering research societies among Fusion and Particle Accelerator. .

##### i) PURPOSE

During the past two decades the late professor J. Yamamoto chaired two International Conference (1993) / symposium (1996) held at NIFS Toki, Japan, both of which are titled similarly as above. Since then NIFS build and has operated the largest Heliotron fusion experimental device LHD which is claimed as having the first fully superconducting magnet combination in the world. On the other hand, large superconducting and cryogenic technologies become dominantly applied in the area of high energy particle accelerators and pre-demo scale fusion experimental devices such as LHC and ITER. The operation of such systems could by no means be maintained before the public interest without sufficient and exact precaution for the public safety and the environmental preservation. The purpose of the study is to accumulate and construct an extensive and beneficial archives about the experiences in such various devices through mutual e-mail correspondence. This mutual information exchange will be eventually published and that will provide a comprehensive directory for the relating researchers and engineers just like attending an International Conference.

##### ii) PROCEDURE

The 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 2010 , to write a brief outline of the facility/ device and to list the reference reports for the outline. The second step is to send the above materials to the organization and to inquire the recent status of their activity on the matter especially in view of safe and stable operation. Most of the information exchange will favorably be conducted through internets or e-mail correspondence with a consent base of eventual publication. The third step will mostly be dedicated to the editorial and publication works.

##### iii) PROGRESS in FY2010

The inclusion of particle accelerator into the original work scope of the magnetic fusion is due to it's technological relativity in terms of large superconductivity and cryogenics and such research subjects may be often reported and discussed within the same session of many conferences and symposiums.

Proceedings of every back number between 1990 and 2010 from which the relevant materials extensively sought are-

(1) Proceedings of International Cryogenic Engineering Conference.

(2) Advances in Cryogenic Engineering.

(3) IEEE Transaction on Applied Superconductivity.

Other important papers such as in “Fusion Engineering and Design”, “Proc. Particle Accelerator Conference” etc. are inferred according to necessity. Collected total of the papers are about 600 from (1) and (2) during past 20 years and 130 from (3) between 2006 and 2010.

General standards for selecting the facilities / devices are quoted as follows,-

(a) Equipped with helium refrigerator more than ~1 kW @ 4.5K equivalent capacity.

(b) System in continuous service , active and/or scheduled.

(c) Facilities / devices representing it's scientific activity of the organization.

It should be noted that the purpose of inquiring is to explore his / her accumulated experiences on the safety operation and is not intended to collect every aspect of it's research activity. Hence, for instance, an affiliation of the author need not to be the organization in which the facility / device is located.

The first step to write a brief outline and to list the reference has been conducted predominantly by S. SATOH and T. SAOW during FY2010 and they coverd the following facilities ( here, Name of the facility / organization with Country in parenthesis ),-

##### (A) MAGNETIC FUSION-15.

JET(GB), ITER(F), TORE-SUPRA(F), W7-X(Ger), EU-LCT(Ger), NBI-test/Padova(It), TF-CICC/Roma(It), JT60-SA(Jap), TRIAM(Jap), LHD(Jap), KSTAR(SK), T-15(Russ), HT-7U+EAST/Hefei(Chin), HL-1M/SWIP(Chin), SST-T(Id)

##### (B) PARTICLE ACCELERATOR-28.

4GSL/Duresbury(GB), MICE+ALICE/Rutherford(GB), ELBE/Dresden(Ger), FAIR+SRS/Darmstadt(Ger), HERA+TESLA/DASY(Ger), LHC+ATLAS+LEP/CERN(Swiss), SLA/PaulScherrer(Swiss), SERSE/Catania(It), JPARK(Jap), SPRING-8/JAERO(Jan), TRISTAN+BEL/KEK(Jap), CEBAF/Jefferson(US), TEVATRON+VLHC/Fermi(US), SNS/Oakridge(US), RHIC+g-2/Brookheven(US), AHF/Argonne(US), BABAR/Stanford(US), N-factory/Berkeley(US), NSCL/MichiganS.U(US), ISAC/TRIUMF(Canad), Nuclotron/JINR,Dubna(Russ), BEPC/CAS,Beijin(Chin), PKU-SKAF/Peking(chin), SSRF/Shanghai(Chin), TLS/NSRRC(Taiwan), Linac-booster/NSC,NewDelhi(Id), K-500/VECC,Kolkata(Id) .

##### (C) MISCELLANEOUS-5.

Cryocooler-CEL/MassachusettsI.T.(US), HighMagnetic Field/NHMFL,Tallahassee(US), SMES-POPE/U.Wisconsin-Madison(US), SpaceChamber/NASAJohnsonSpaceCenter, Houston(US) Super-GM(Jap).

As seen, several facilities might be out of the scope from the selecting standard through. The listing work for their papers are still on the half way and there might be some facilities still remained unselected, therefore inquiring works will be initiated after the Christmas Holiday of 2011.

In order to enhance the preciseness of the information such as the profile of the system and the category classification, it is desired to obtain the participations by the expertise from the field of particle acceleration, and this is expected to realize from September 2011.