

STRUCTURE REFORM AND SPECIAL ECONOMIC ZONE IN LARGE HELIUM LIQUIFIER COMPLEX FOR THE 4TH GENERATION ERL LIGHT SOURCE

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Abstract

As the fourth generation energy recovering super-conducting linac (ERL) driven light source is planned to develop and to build as the most advanced national light source facility in Japan, this is a conceptual design work and key components developmental programs including a 200MeV prototype construction. Our existing 4K zero-boil off refrigerator cryogenic and a huge 2K liquefier facility will be combined to make a new hybrid one. Because all cryogenic devices in Japan have been seriously and unnecessarily controlled and affected their safety, maintenance, operation and construction over these several tens years, we will therefore have to cut back excess safety regulation in Japanese domestic high pressure vessel code using a structure reform and special economic zone policy.

1 INTRODUCTION

As the fourth generation energy recovering super-conducting linac (ERL) driven light source is planned to develop and to build as the most advanced national light source facility in Japan Atomic Energy Research Institute (JAERI), this is a conceptual design work and key components developmental programs including a 200MeV prototype construction. These cryostats were previously reported and designed to be installed in a single 500m long cryostat to minimize their heat invasion, and whole cryostat system cryogenically cold over 25 years /cold maintenance, non-stop and continuous operation of cryogenic refrigerator system like Fig.1.

In the text, we introduce you some details of our existing cryogenic facilities and developmental works, and explain our achievements and future plans. Because all cryogenic devices in Japan have been seriously and unnecessarily affected their safety, maintenance, operation and construction over these several tens years, we will therefore have to cut back overwhelming excess safety regulation in Japanese domestic high pressure vessel code adopting a structure reform and special economic zone policy in order to construct the cryostat sequentially over a few years.

2 LIQUEFIER AND ZERO-BOIL OFF

REFRIGERATOR

As we have successfully demonstrated our easy maintenance and non-stop operability of the JAERI zero-boil off cryostat over a few tens of years, then we hope to build very large cooling power 2k and 4K refrigerator systems for future JAERI ERLs like Figs. 2 and 3 using our cryogenic experiences and technologies[1]. Conventional large He liquefiers have intrinsically better wall-plug efficiency to cool the cavities down to very low temperature than the zero-boil off cryostat and integrated refrigerators system. We need another independent group of about 10 or 20 night watchmen to run the large liquefier for 3 terms per year of 3 months-long continuous operation and one month-long maintenance in 24 hours-basis under a severe safety regulation of Japanese domestic pressure vessel code. We plan to avoid these time-consuming domestic rules and to shorten the required and unnecessarily administrative procedures processing times introducing a so-called Japanese structure reform and free-trade zone policy in cooperating with Ibaraki Prefecture Office and METI (Japanese Ministry of Economy Trade and industry). Under the policy, we hope to combine these two different cryogenic systems into one hybrid system and to keep cool using the zero-boil off systems' small refrigerator during idling without any RF excitation, and using the large liquefier during high power beam operation. The hybrid system can minimize the electricity consumption and probability of vacuum leak failures in the hybrid cryogenics, and therefore we can economically run our cryogenic system continuously cool without stopping and warming up to the program end over 25 years or more.

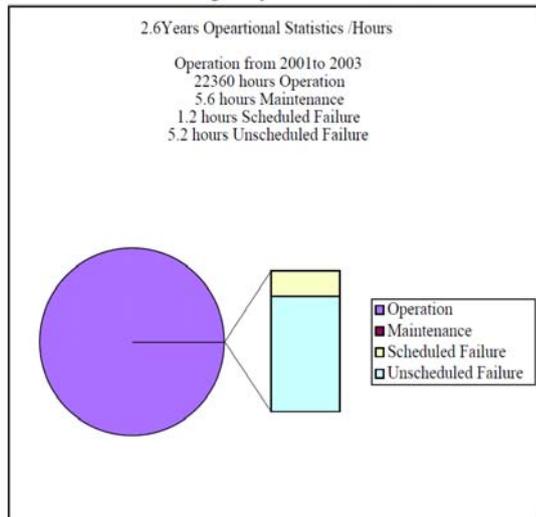
3 SUMMARY

Here, we discussed about both of the new 2K cooling hybrid system and structure reform and special economic zone. Both of them are thought to be mandatory in realizing the 4th generation super-conducting ERL driven light source in Japan.

REFERENCES

- [1] E.J.Minehara, Nucl.Instrum.andMeth.A483 (2002) 8-13.

Non-Stop and Continuous Operation of Cryogenic Refrigerator System Except for Unscheduled Emergency or Power Failure



Statistics of the cryogenic system operation in 2001-2003 Japanese fiscal year, after the cold maintenance was regularly performed.

Figure 1: Statistics of Non-stop operation.

Long-Life and Static Pulse Tube /GM Refrigerator System for Idling Operation

Stand-Alone, Zero-Boil Off Superconducting rf Linac FEL Driver

Large-Scale Liquefier Cases

JAERI Design

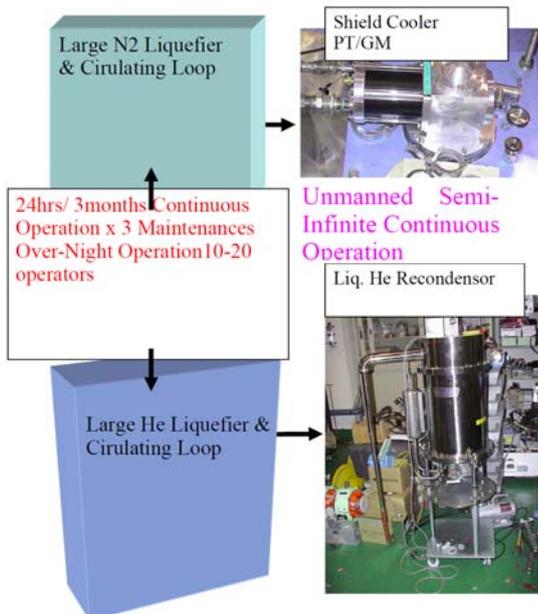


Figure 2 : Comparison between large-scale liquefier and Zero-boil off refrigerator

External Huge Refrigerator for Routine and High Power Operation

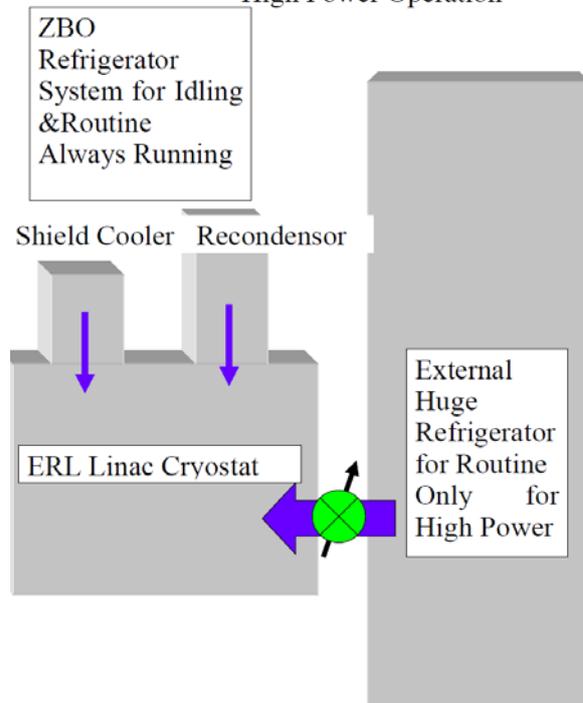


Figure 3: Combination between the large scale liquefier and zero-boil off refrigerator.