TUP 105

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Preparation of the cryomodule assembly for the LIPAc in Rokkasho

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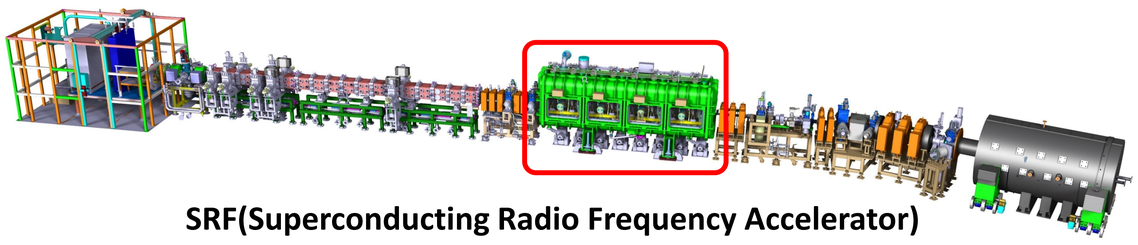
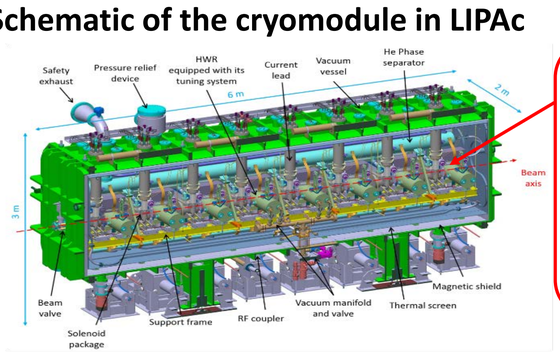
Schematic of the Linear IFMIF Prototype Accelerator (LIPAc)



SRF(Superconducting Radio Frequency Accelerator)

Schematic of the cryomodule in LIPAc



String assembly in clean room

Introduction

The staged installation and commissioning of LIPAc is ongoing at Rokkasho Fusion Institute of QST, Japan for validating the low energy section of the IFMIF deuteron accelerator up to 9 MeV. The LIPAc Superconducting Radio Frequency accelerator (SRF) cryomodule is assembled under the responsibility of EU Home Team, and the assembly work recently starting at Rokkasho in March 2019. To fulfil the cleanliness requirements for the assembly process, QST took the responsibility to prepare the infrastructure of a cleanroom and associated devices. In this present paper, the details of the preparation work for the cryomodule assembly made by QST will be presented.

Layout of the clean room and clean equipment

Specification of the clean room for LIPAc SRF assembly

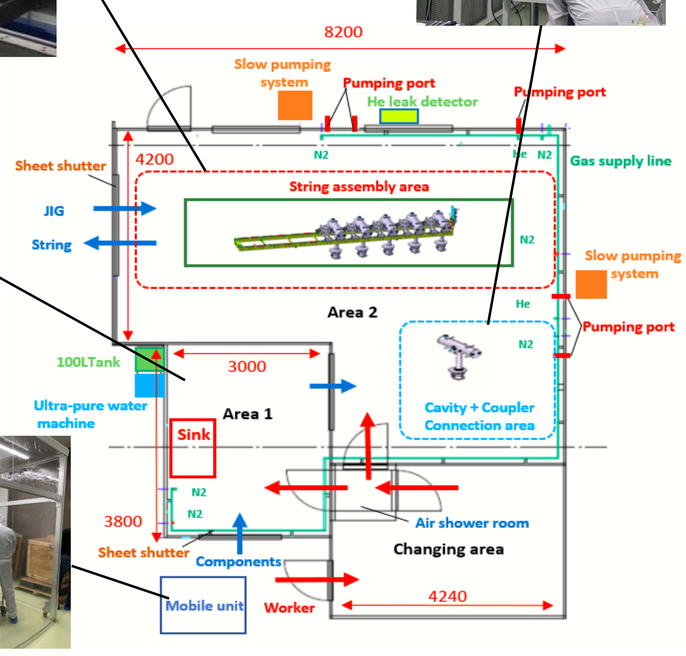
Cleanliness	ISO 14644-1 class 5
Unit size (mm)	8200 x 8000 x 3000
Laminar flow limit	1m (from floor)

String assembly in area2.

Cavity + Coupler connection at small space in area2.

Clean up small components and tooling in area1.

Pre-clean up components in mobile unit before the installation to the cleanroom.

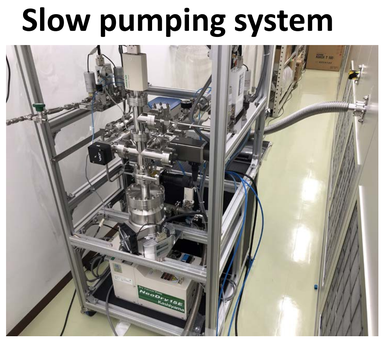


The compact clean room was designed just for the string assembly. There are no the high pressure washing system and other large equipment. All areas are kept cleanliness by the FFUs (Fan Filter Unit) vertical down flow system with ULPA (Ultra Low Penetration Air) filters. In the acceptance test, particle measurement was performed at 1 m height no particles were observed in the entire area. It was confirmed that the installed clean room was suitable for the cryomodule assembly.

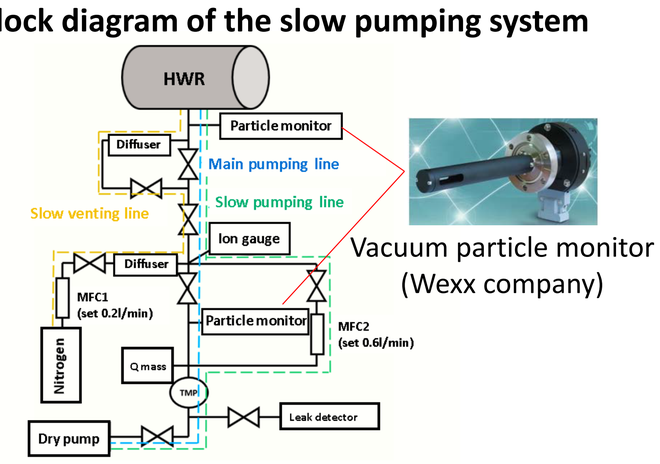
Slow pumping system

Slow pumping system is prepared for SRF assembly to avoid particle diffusion during vacuum operation. This pumping system was designed by Prof. Dr. Sakai of KEK and assembled in a class 3 super clean room.

Slow pumping system

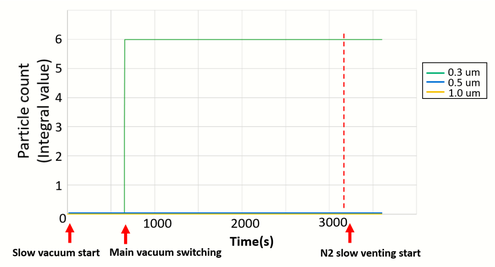


Block diagram of the slow pumping system



Vacuum particle monitor (Wexx company)

Particle measurement in vacuum

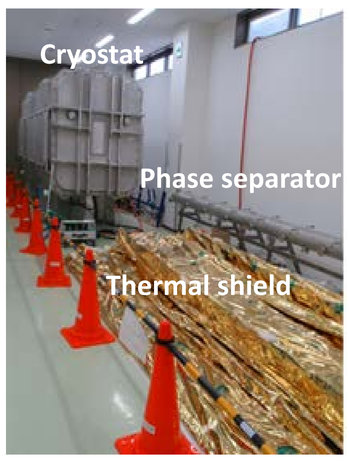


Result: 0.3 µm particles were detected when switching slow to main vacuum mode... No particle detection during the pumping and N2 venting!

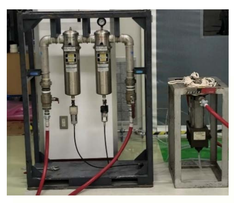
Transport of the components

In LIPAc cryomodule assembly and transportation, air caster load is adopted.

Transported components

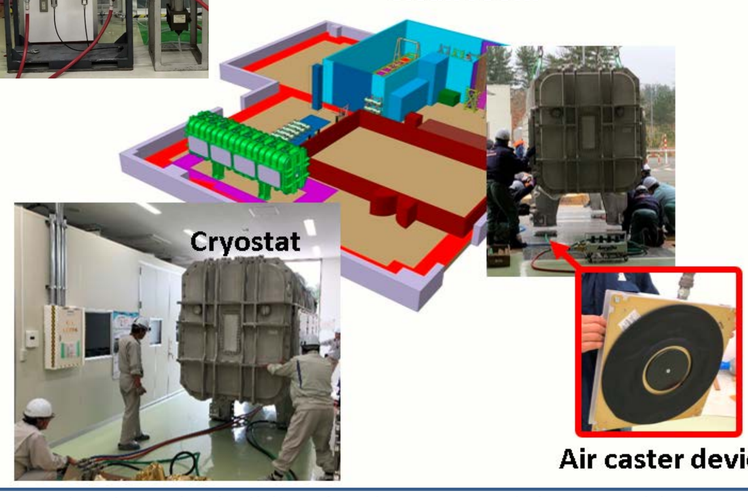


Arrangement of the transportation apparatus



Satisfying ISO8573-1:2010 class 1 clean compressed air to prevent contamination.

Clean room

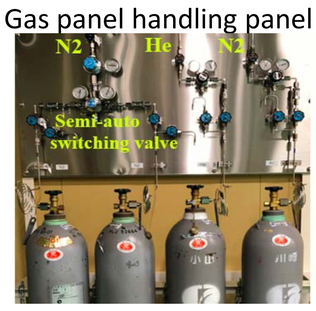


In March 2019, cryostat transportation into the building for the cryomodule assembly was successfully done using the air caster system, which will be also used for the installation of the cryomodule in future.

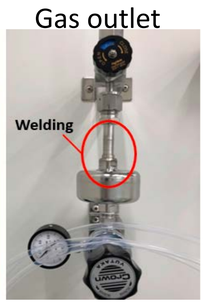
Pure gas and ultrapure water generator

Pure gas supply line

Gas panel handling panel



Gas outlet



Pipe was electropolished and welding.

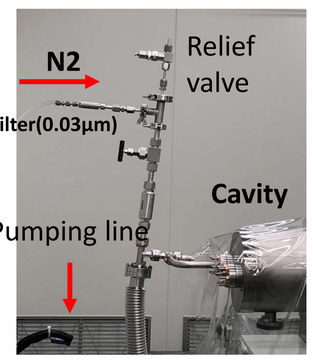
Ultrapure water generator

Milli-Q Integral MT 15XL

Resistivity：~18 MΩ･cm
Produce rate: 15 L/ hour
Storage: 100 L

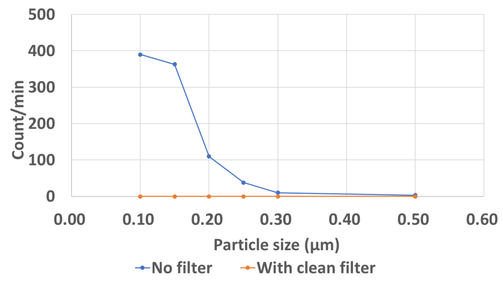
Sufficient for the washing of the small tooling.

N2 purge unit



Clean up vacuum components and construct the "purging unit" to prevent cavity contamination.

Particle measurement at N2 purge line



There is no fear of the particle contamination.

Summary

- Clean room of class 5 and cleaning equipment for the assembly of SRF was prepared under the responsibility of the QST in Rokkasho site.
- Slow pumping system was constructed and its cleanliness was proved by particle measurement in vacuum operation.
- Air caster load module system was introduced for transportation and successfully applied for transporting the cryostat in March 2019.
- The string assembly in clean room was started in March 2019 under the responsibility of F4E, and the cryomodule assembly will be completed by March 2020.

This work was undertaken under the Broader Approach Agreement between the European Atomic Energy Community and the Government of Japan. The views and opinions expressed herein do not necessarily state or reflect those of the Parties to this Agreement.