WG7 AFAD2018

# Present status of Cryomodule and Cryoplant for LIPAc

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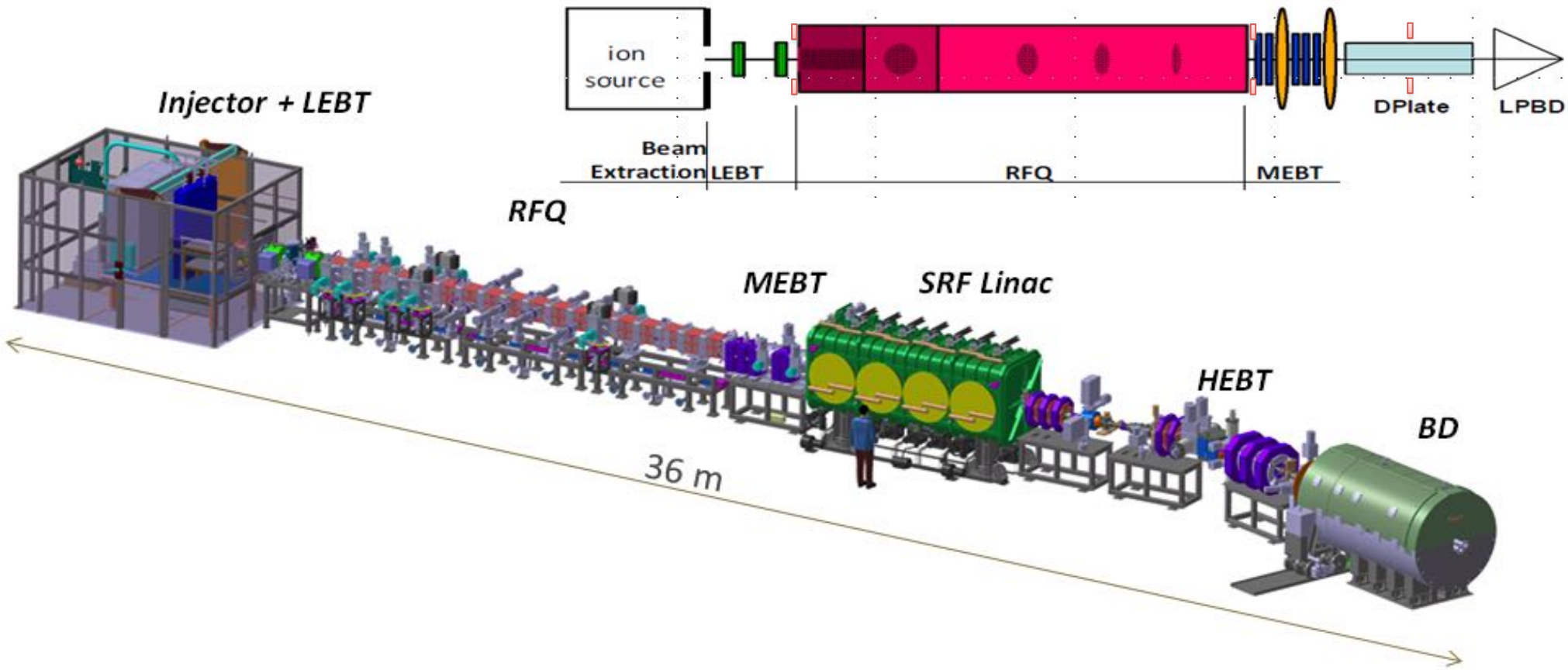
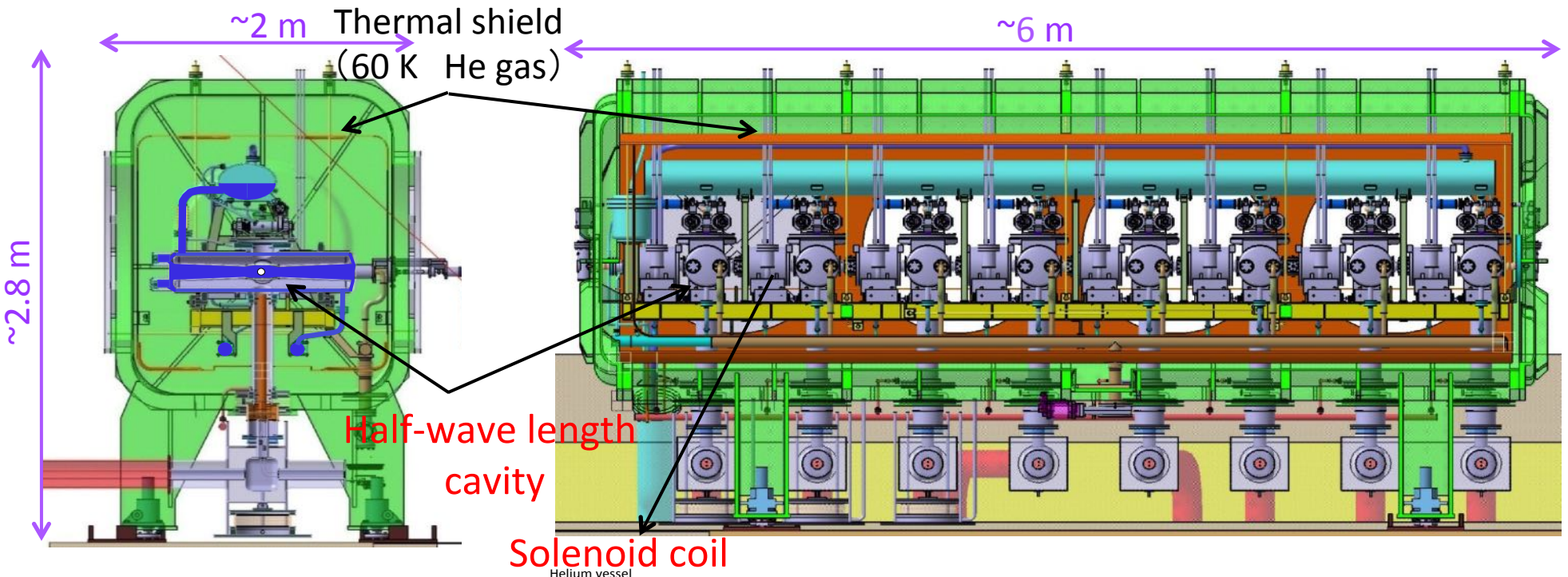
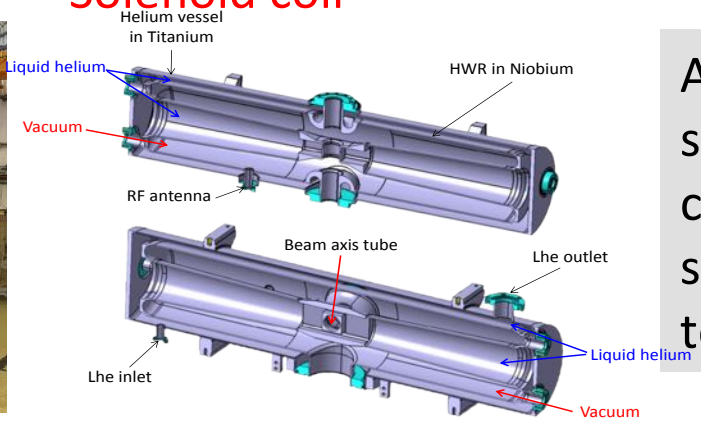
# LIPAc: Linear IFMIF prototype Accelerator

*Engineering validation tests up to 9MeV is planned by LIPAc at Rokkasyo site, Aomori, Japan. The LIPAc consists of Injector, IFMIF prototype RFQ linac and Superconducting RF linac. Now, RF aging of RFQ is ongoing with MEBT, D-plate & LPBD from October, 2017 .*



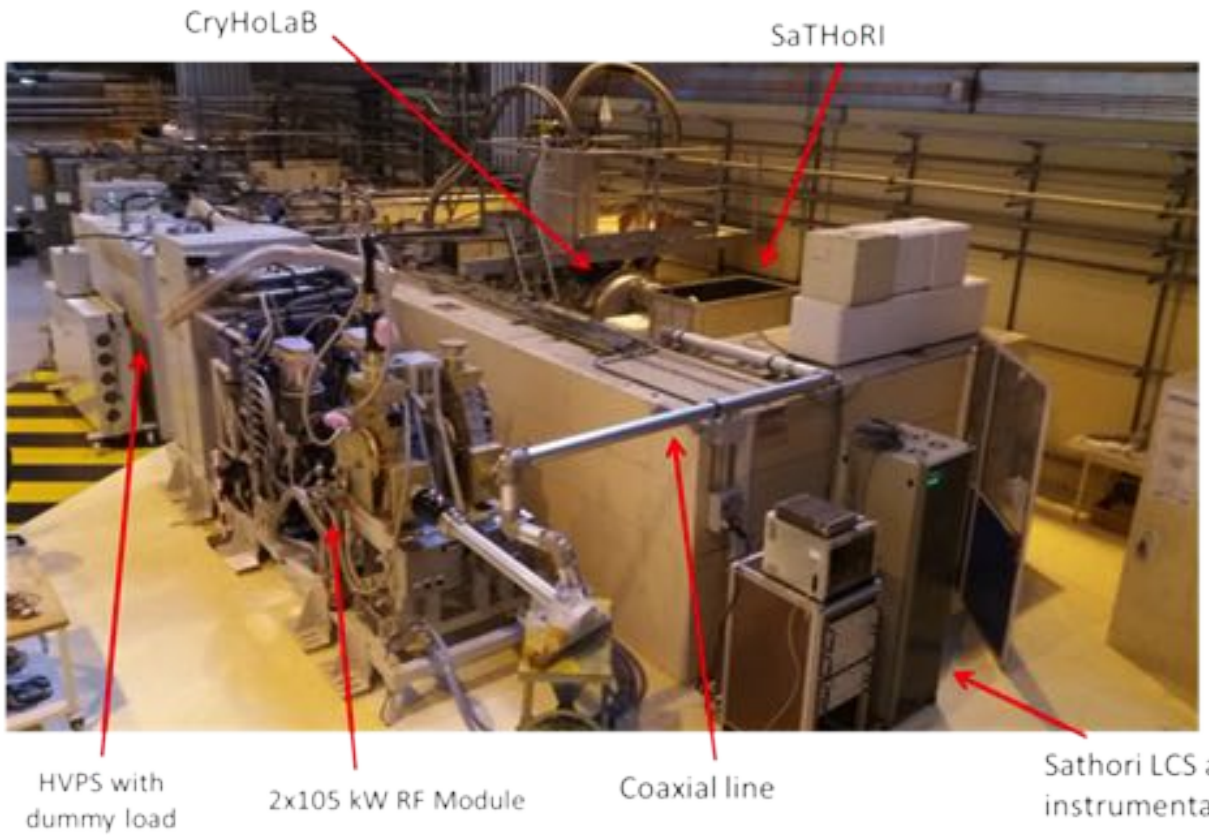
# SRF linac

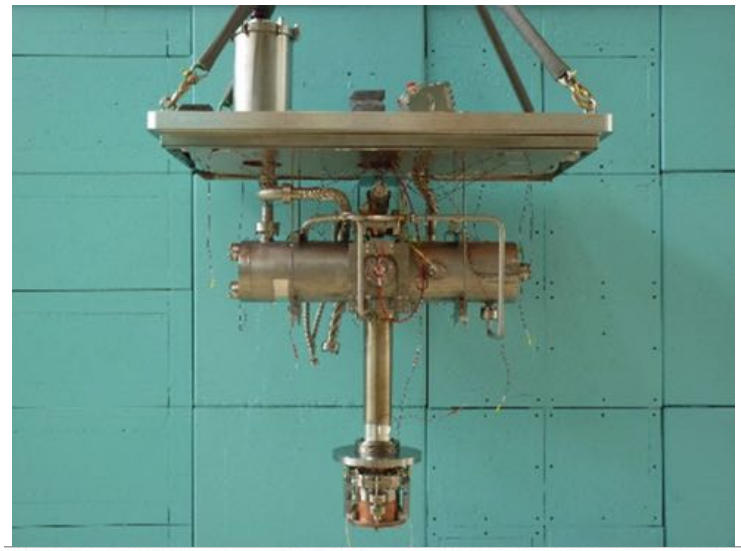


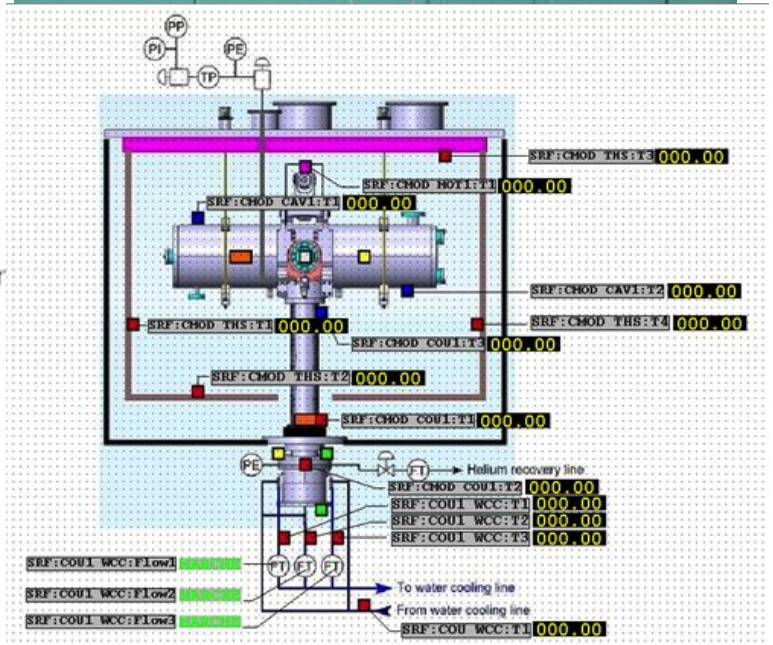




Assembling with 8 cavities and solenoid coils is planned using a clean room (Class 5) at Rokkasho site on 2018 late. Acceleration tests are started in 2019.

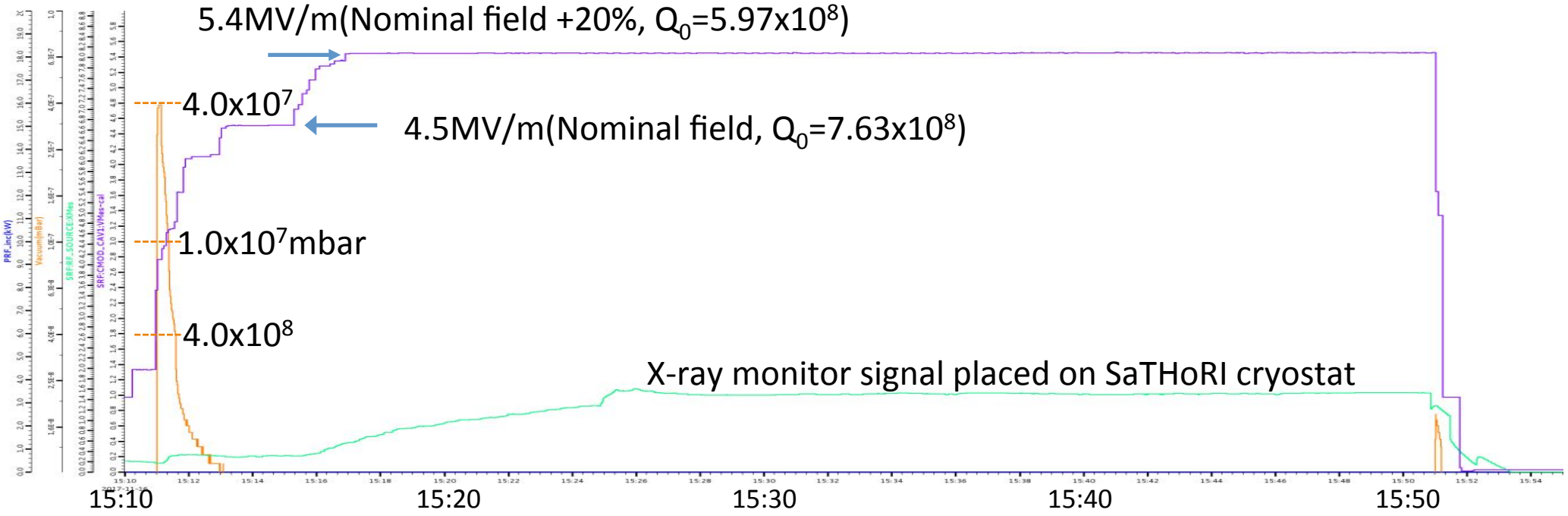
# Teststand of SaTHoRI cryostat (CEA-Saclay)





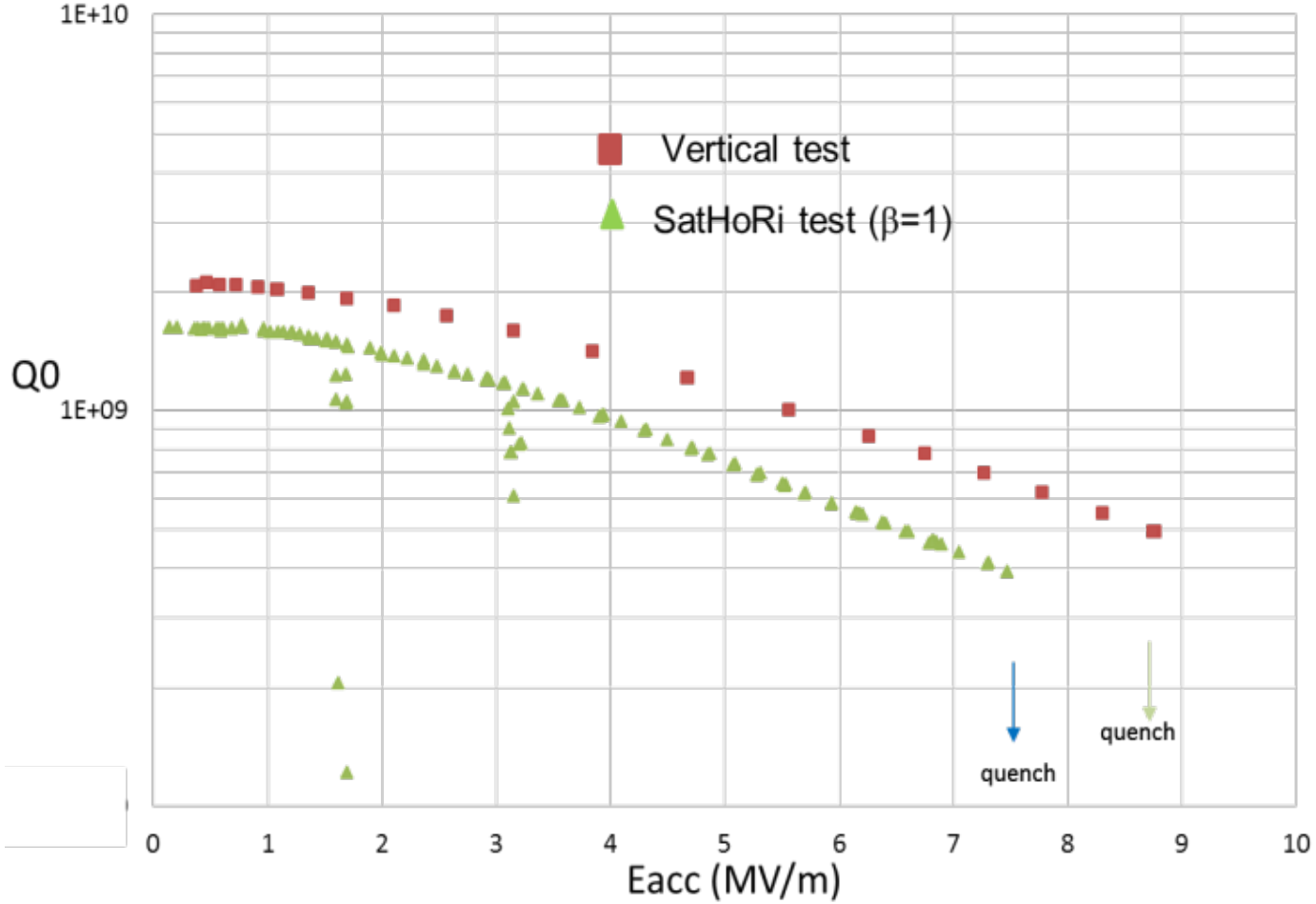
# RF power ramp-up




@ Nominal accelerating field of 4.5MV/m have been achieved (around 14kW of injected RF power)

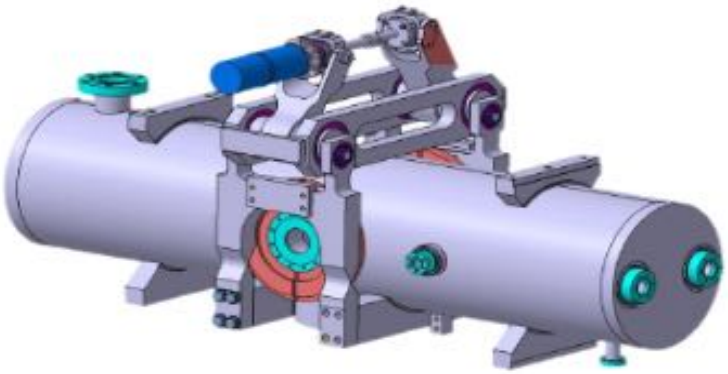
@ Field up to 5.4MV/m(Eacc_nom +20%) stable during 30minutes.

# $Q_0$ vs. $E_{acc}$ curve

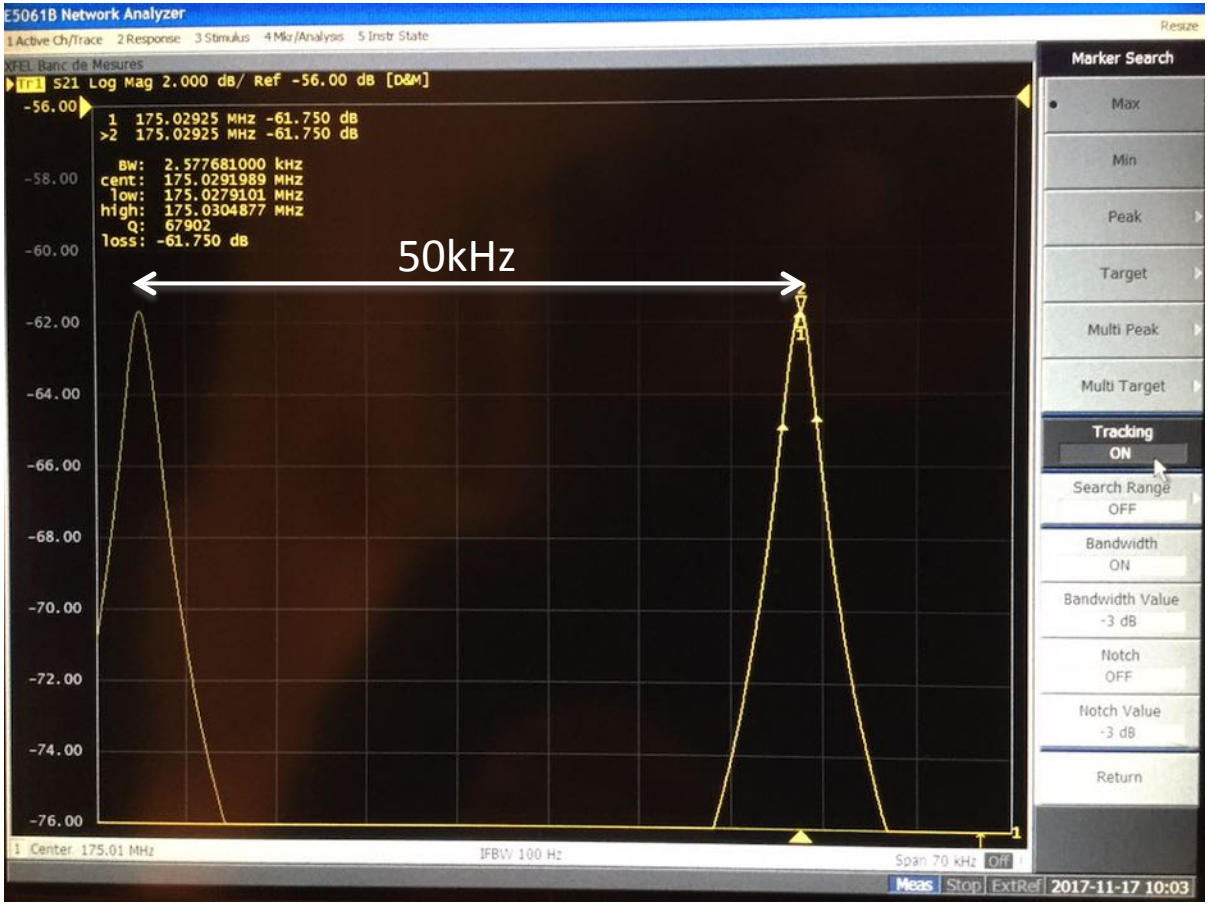



@The maximum accelerating field in horizontal test is 7.5 MV/m.
@The measured $Q_0$ at nominal field (4.5 MV/m) is $8x10^8$
which is above the specifications ($5x10^8$).

# Detuning procedure



175MHz ± 25kHz




@ Time to disengage the tuning system (full range from 174.975 to 175.025MHz): 28 minutes and 20 seconds.
→ Meets the UPS specifications(45 min)

# Configuration diagram of Cryoplant

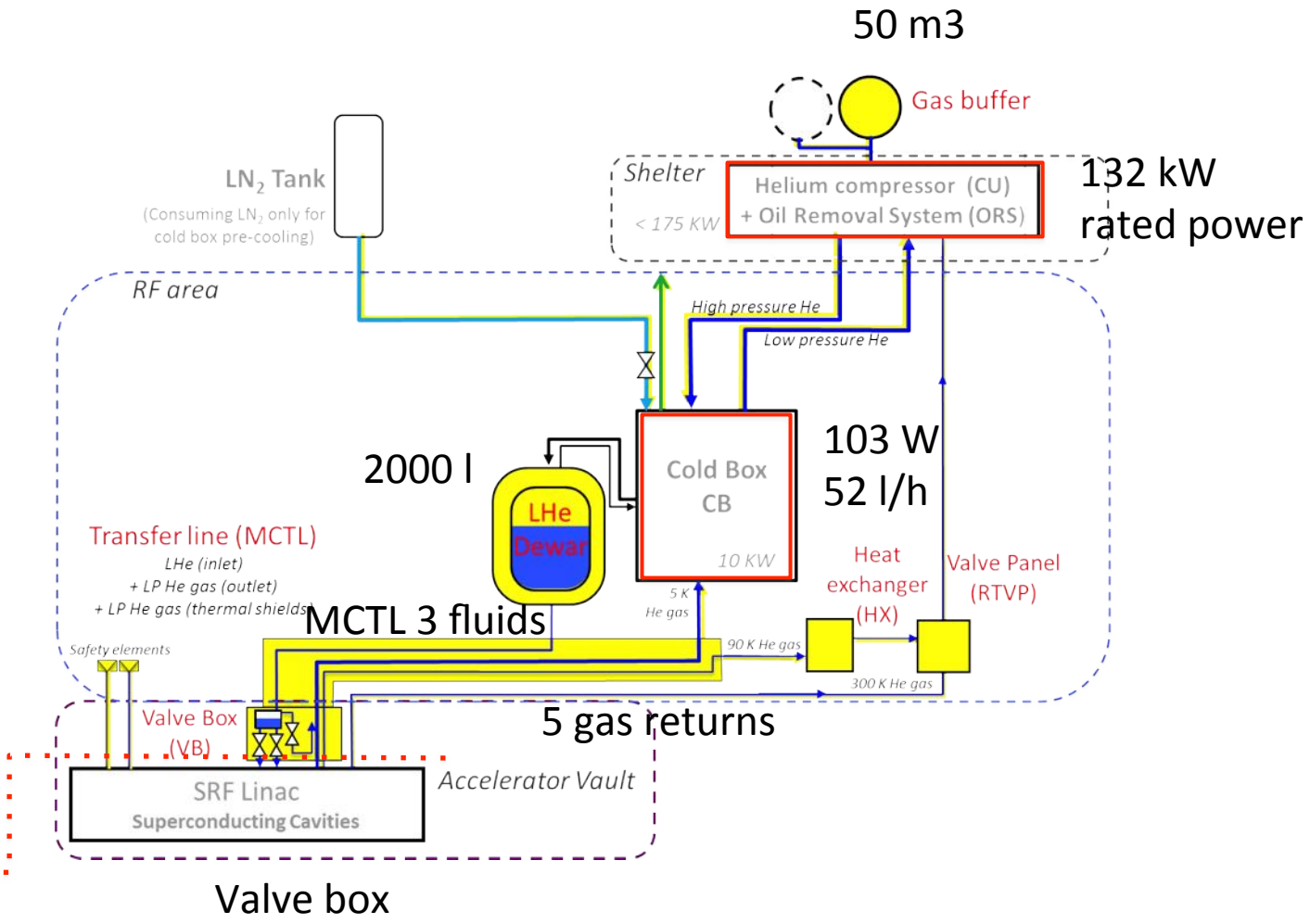
**Cryogenic production**

He liquefaction in a closed loop

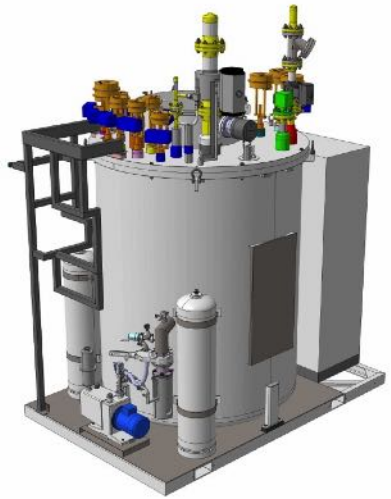
**Cryogenic distribution**

Transfer and storage of fluids (cryogenic or not)

*Interface with Cryomodule*



# Cryoplant

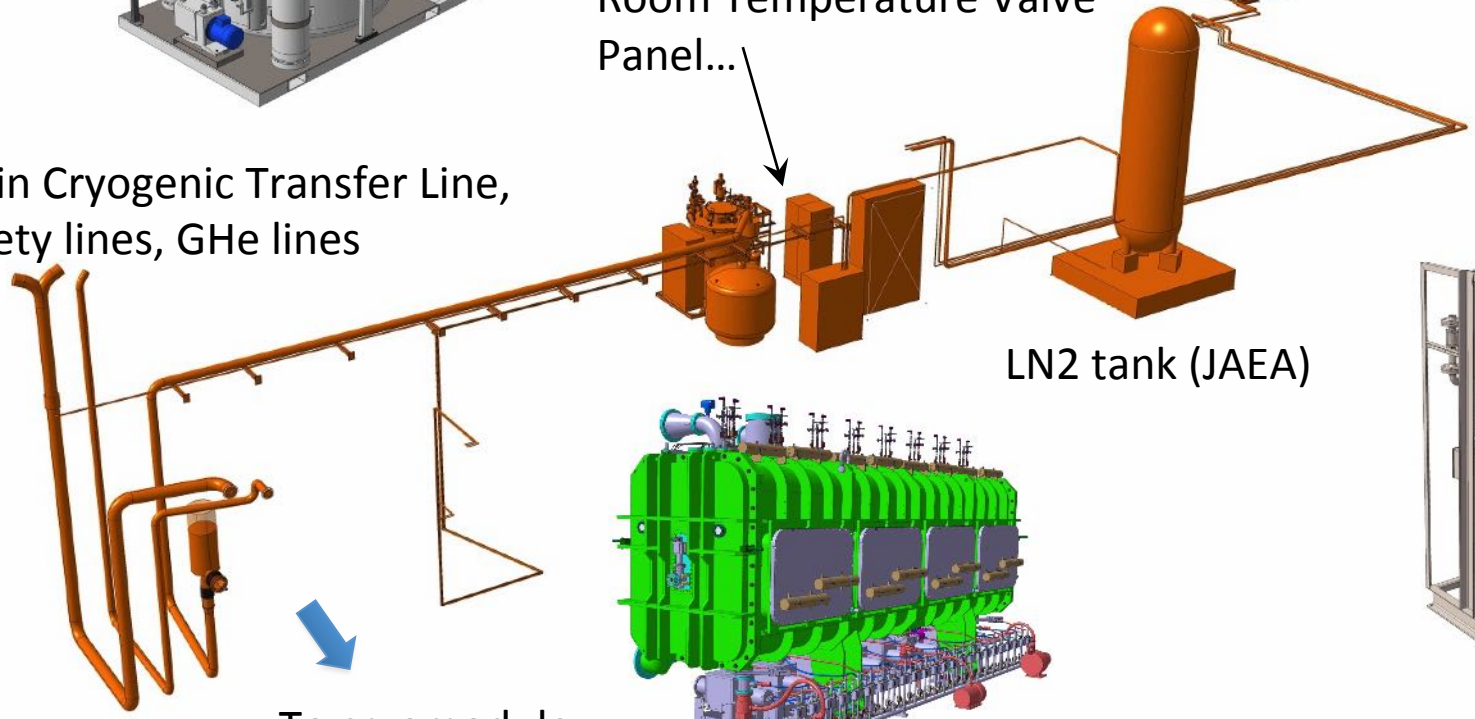


He Gas buffer Tank

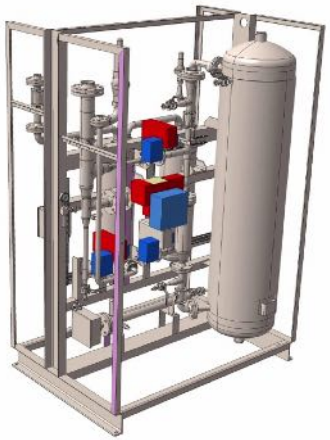
Compressor Unit +
Oil Removal System

Cold Box, Dewar,
Room Temperature Valve
Panel…

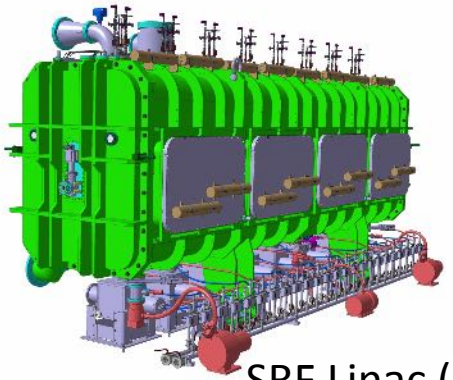
Main Cryogenic Transfer Line,
Safety lines, GHe lines



LN2 tank (JAEA)



To cryomodule



SRF Linac ( cryomodule)

# Installation of Cryoplant at Rokkasho site

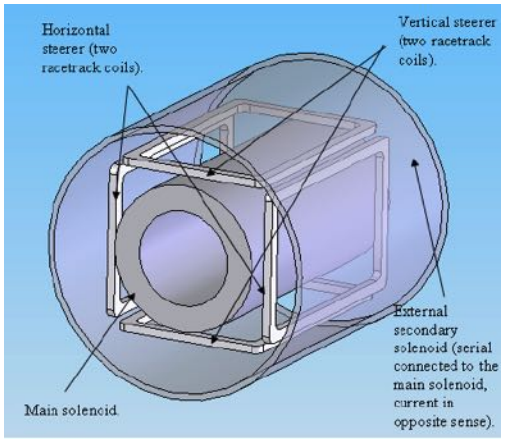
He Compressor & Oil Removal System


Cold box(103W, 52 l/h) &
He Dewar (2000 l)


He GAS Buffer Tank; 50m$^3$


Valve box

# Design parameter of Solenoid & Steerer




## Solenoid coils

| | | |
|---|---|---|
| Inner radii of inner/outer coil | 30/83 | mm |
| Outer radii of inner/outer coil | 44.4/86.35 | mm |
| Length of inner/outer coil | 187/190 | mm |
| Number of turns of inner coil | 249x22 | |
| Number of turns of outer coil | 253x5 | |
| Coil peak field | 5.85 | T |
| Nominal current | 210 | A |
| Integrated field | 1.10 | T·m |
| Stored energy | 11.957 | kJ |
| Self-inductance | 0.54 | H |
| Stray field at upper/lower cavity | 22/21 | mT |
| Bare/insulated wire diameter | 0.7/0.75 | mm |
| Copper to superconductor ratio for inner/outer solenoid wire | 1.3 / 3.2 | |
| Critical current at 6/7 T, 4.2 K | 349/260 | A |
| RRR | 70 | |
| Filament diameter | <12 | μm |
| Working point on the load line | 86.2 | % |

## Steerer coils

| | | |
|---|---|---|
| Cross section of the coil | 5.95 x 6 | mm |
| Number of turns | 9 x 8 | |
| Winding mandrel dimensions | 130 x 82 | mm |
| Distance between coils | 100 | mm |
| Nominal current | 50 | A |
| Integrated field | 3.51 | mT·m |
| b3 | -1150 | units ($10^{-4}$) |
| b5 | -33.77 | units ($10^{-4}$) |
| Reference radius | 20 | mm |

@The 1st Solenoid coil & Steerer will be tested at CIEMAT, the first result will be reported on Video Conference on Feb. 2018.

# Summary

@ For the cavity, the nominal field of 4.5MV/m and the $E_{ACC}$ +20% field were successfully carried out on SaTHoRI cryostat, the measured $Q_0$ at nominal field (4.5 MV/m) is $8x10^8$. It is above the specifications ($5x10^8$)

@ For tuning system, the time to disengage in 28 minutes and 20 seconds can be performed.

@ For solenoid coil and steerer, the 1st test result will be done in Feb. 2018.

@ Assembling works will start around 2nd semester 2018 at Rokkasho site without delays in production and transport.