



Manufacturing process for RAON SSR Cavities

VITZRO NEXTECH Co., Ltd
Feb 28th ~ Mar 2nd 2023
Ungshik Choi

CONFIDENTIAL

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VITZRO NEXTECH Business Area

Accelerator

- Pohang accelerator system project
- Proton accelerator system project
- Heavy ion accelerator system project



Cryogenic Plant

- Cryo-Plant
- Test Center, Engineering



Aerospace

- Rocket Combustion Chamber
- Test equipment construction
- High-pressure oxidant piping

Plasma

- K-STAR Nuclear Fusion
- Plasma Application Processing
- Waste Resourcization

Company History

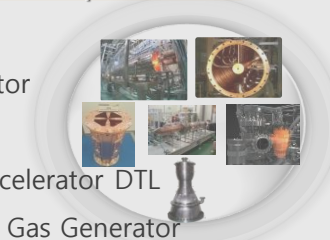
1955 - 2000 With the name of Kwangmyeong Electronics

- Vacuum Interrupter
- Insulation
- High Power Breaker
- Power Distribution
- RF Input Coupler (1997)



2001-2020 Listed on KOSDAQ(Korea Stock Market) Start Accelerator & Nuclear Fusion and Aerospace Business

- **Separated in 2016 "VITZRO NEXTECH Co., Ltd"**
- Manufacture of 350 MHz, 2.5 MV DTL Proton Accelerator
- Manufacture of High Power RF Klystron Component
- Manufacture of 350 MHz, 4 MV & 100 MeV Proton Accelerator DTL
- Rocket Combustion Chamber & 30 Ton Rocket Engine Gas Generator



2021s ~ Total Solution for Accelerator & Nuclear Fusion

PAL-XFEL Photon Accelerator

- Accelerating Structures, Waveguide & Beam Line Components

Heavy Ion Accelerator

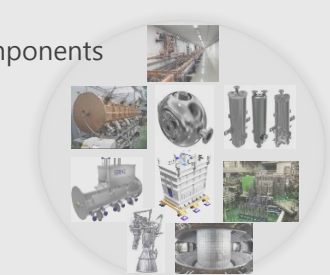
- SRF Cavity, QWR, HWR, SSR Cryomodule, SSR Cavity

Nuclear Fusion Device, Facility, Component

- NBI-I, NBI-II, PFC, Ion Source

Cryogenic

- Distribution System (DB Box, Transfer Line, Control)
- Rocket Engine Combustion Chamber (75ton)



I-2. Accelerator Business Experience

Domestic



ANSAN Factory

DAEJEON

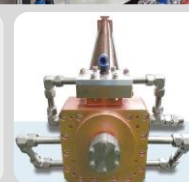
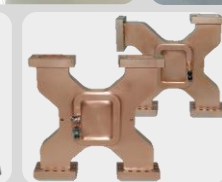
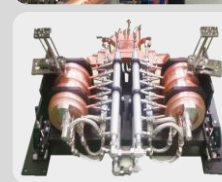
POHANG
GYEONGJU

ibs Institute for Basic Science

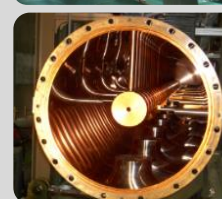
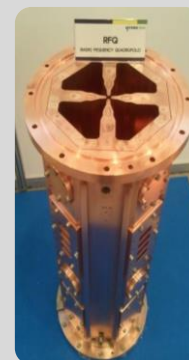


PAL

POHANG ACCELERATOR LABORATORY



KAERI 한국원자력연구원
Korea Atomic Energy Research Institute
양성자과학연구단
Korea Multi-purpose Accelerator Complex



Overseas

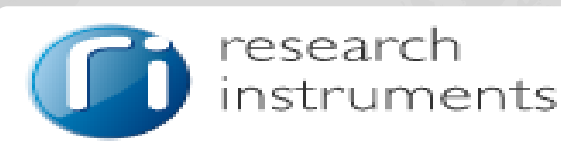
North America



Canadian
Light
Source

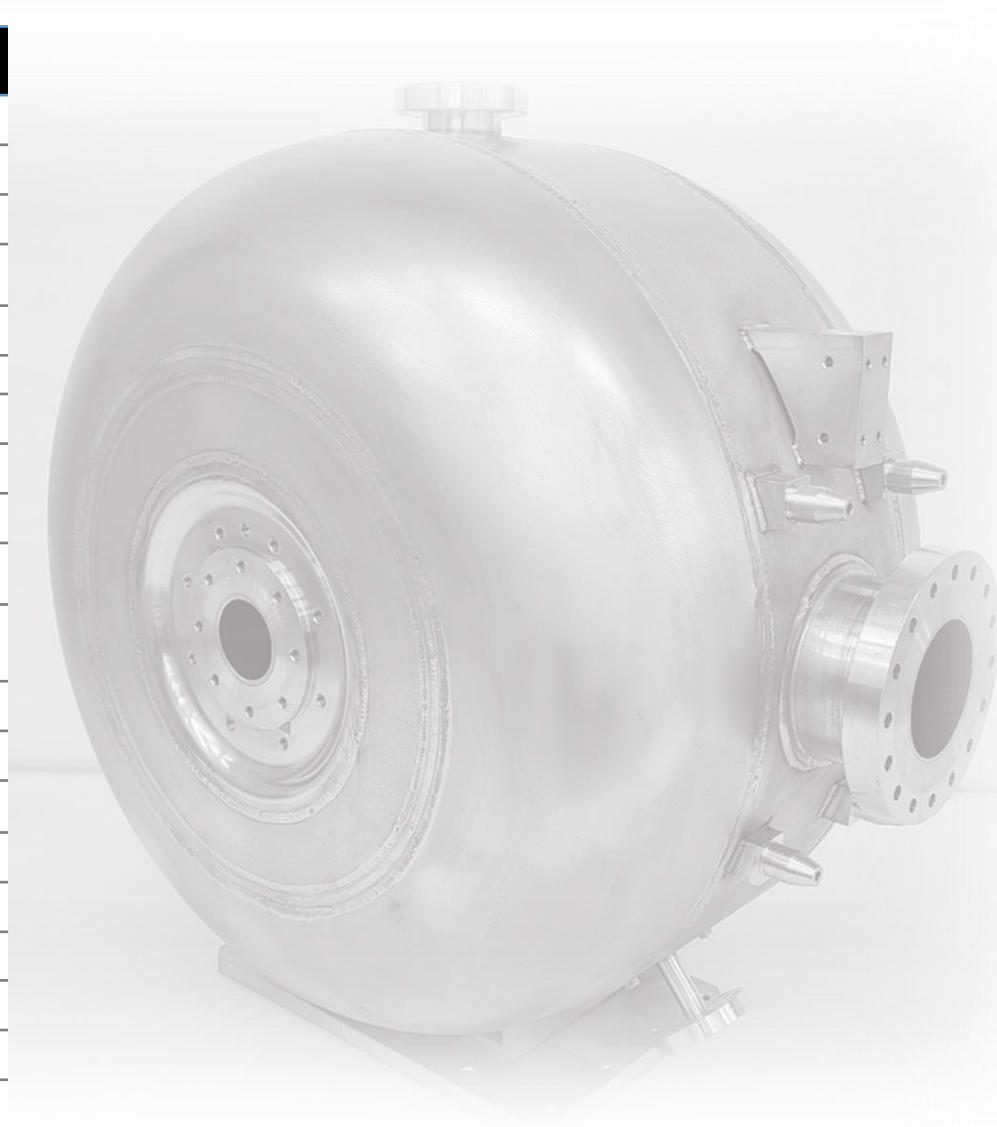


Europe



Core Facilities

Category	Group	Facility Name
Facilities	Manufacturing Facilities	Electron Beam Welding Machine
		Electron Beam Welding Machine
		Vacuum Oven
		Cleanroom (10class)
	BCP Facility	Pumping Station (Cleanroom)
		Pumping Station
		Helium Leak Detector
		BCP Facility
		BCP Facility
		HPR Facility (Vertical, Horizontal, Tilted)
Metrology Facilities	Network Analyzer	
	CMM by ZEISS	
	Portable 3D Measuring Scanner	
	Laser Tracker	
S/W	Ansys	Thermal / Structure analysis
		Flow analysis
	CST	High Frequency Electromagnetic Analysis
		Analysis of Particle behavior
		Thermal / Structural Analysis
		Electronic Multiplication Analysis



Certifications

Certificate of Approval

This is to certify that the Management System of:
VITZRO NEXTECH Co., Ltd.
 327, Byeolmang-ro, Danwon-gu, Ansan-si, Gyeonggi, 15503, South Korea
 has been approved by Lloyd's Register to the following standards:
 AS 9100 (technically equivalent to EN 9100:2018 and JISO 9100:2018)
 ISO 9001:2015

This certification has been performed in accordance with the requirements of EN 9104-001:2013
 Lloyd's Register Quality Assurance is accredited under the IAQG ICGP scheme

Certification Structure - Single

Il-Hyung Lee - Korea Operations Manager
 Issued by: Lloyd's Register Quality Assurance Limited

Issue date: 4 June 2020 Original approval: AS 9100 - 4 June 2014
 Expiry date: 3 June 2023 AS 9100 - 4 June 2014
 Certificate identity number: 10262301 ISO 9001 - 4 June 2014

Approval number(s): AS 9100 - 0069254 / ISO 9001 - 00015004

The scope of this approval is service to:
 Design, development, manufacture, assembly and servicing of products
 for space, nuclear power plants, accelerators and plasma plants, vacuum systems.

ISO9001

Certificate of Registration

This is to certify that:
VITZRONEXTECH Co., Ltd.
 327, Byeolmang-ro, Danwon-gu, Ansan-si, Gyeonggi-do, Republic of Korea

Has been assessed by International Certification Registrar Ltd., in respect of their
 Occupational Health and Safety Management Systems and found to comply with
ISO 45001:2018

Approval is hereby granted for registration providing the rules and conditions
 relating to certification are observed at all times.

Certification Scope
 Design, Manufacture of Precision Machining/Accelerator, Plasma Application Facilities,
 Combustion Device for Industrial

Certificate Issue Date: 27th December 2019 Initial Issued Date: 27th December 2019
 Expiration Date: 26th December 2022 Certificate No.: OHS044019

The Seal of ICR Limited was here: to affixed

David E. Tuttle
 President

ISO 45001

CERTIFICATE OF AUTHORIZATION

The named company is authorized by The American Society of Mechanical Engineers (ASME) for the scope of activity shown below in accordance with the applicable rules of the ASME Boiler and Pressure Vessel Code. The use of the ASME Single Certification Mark and the authority granted by this Certificate of Authorization are subject to the provisions of the agreement set forth in the application. Any construction stamped with the ASME Single Certification Mark shall have been built strictly in accordance with the provisions of the ASME Boiler and Pressure Vessel Code.

COMPANY:
VITZROTECH CO., LTD.
 327, Byeolmang-ro, Danwon-gu
 Ansan-si, Gyeonggi-do 15603
 Republic of Korea

SCOPE:
Manufacture of Class 1 and Class 2 pressure vessels at the above location only

AUTHORIZED: **November 17, 2020**
 EXPIRES: **November 17, 2023**
 CERTIFICATE NUMBER: **59074**

David E. Tuttle
 Board Chair, Conformity Assessment

Paul Chang
 Managing Director, Conformity Assessment

ASME-U2

Certificate of Registration

This is to certify that:
VITZRONEXTECH Co., Ltd.
 327, Byeolmang-ro, Danwon-gu, Ansan-si, Gyeonggi-do, Republic of Korea

Has been assessed by International Certification Registrar Ltd., in respect of their
 Environmental Management Systems and found to comply with
KS I ISO 14001:2015 / ISO 14001:2015

Approval is hereby granted for registration providing the rules and conditions
 relating to certification are observed at all times.

Certification Scope
 Design, Manufacture of Precision Machining/Accelerator, Plasma application facilities,
 Combustion device for Industrial

Certificate Issue Date: 03rd March 2020 Initial Issued Date: 31st March 2017
 Expiration Date: 30th March 2023 Certificate No.: EK005717

The Seal of ICR Limited was here: to affixed

David E. Tuttle
 President

ISO 14001

CERTIFICATE OF AUTHORIZATION

The named company is authorized by The American Society of Mechanical Engineers (ASME) for the scope of activity shown below in accordance with the applicable rules of the ASME Boiler and Pressure Vessel Code. The use of the ASME Single Certification Mark and the authority granted by this Certificate of Authorization are subject to the provisions of the agreement set forth in the application. Any construction stamped with the ASME Single Certification Mark shall have been built strictly in accordance with the provisions of the ASME Boiler and Pressure Vessel Code.

COMPANY:
VITZROTECH CO., LTD.
 327, Byeolmang-ro, Danwon-gu
 Ansan-si, Gyeonggi-do 15603
 Republic of Korea

SCOPE:
Manufacture of pressure vessels at the above location only

AUTHORIZED: **November 17, 2020**
 EXPIRES: **November 17, 2023**
 CERTIFICATE NUMBER: **48827**

David E. Tuttle
 Board Chair, Conformity Assessment

Paul Chang
 Managing Director, Conformity Assessment

ASME U STAMP

CERTIFICATE OF AUTHORIZATION

The named company is authorized by The American Society of Mechanical Engineers (ASME) for the scope of activity shown below in accordance with the applicable rules of the ASME Boiler and Pressure Vessel Code. The use of the ASME Single Certification Mark and the authority granted by this Certificate of Authorization are subject to the provisions of the agreement set forth in the application. Any construction stamped with the ASME Single Certification Mark shall have been built strictly in accordance with the provisions of the ASME Boiler and Pressure Vessel Code.

COMPANY:
VITZROTECH CO., LTD.
 327, Byeolmang-ro, Danwon-gu
 Ansan-si, Gyeonggi-do 15603
 Republic of Korea

SCOPE:
Fabrication and assembly of pressure piping at the above location only

AUTHORIZED: **November 17, 2020**
 EXPIRES: **November 17, 2023**
 CERTIFICATE NUMBER: **59090**

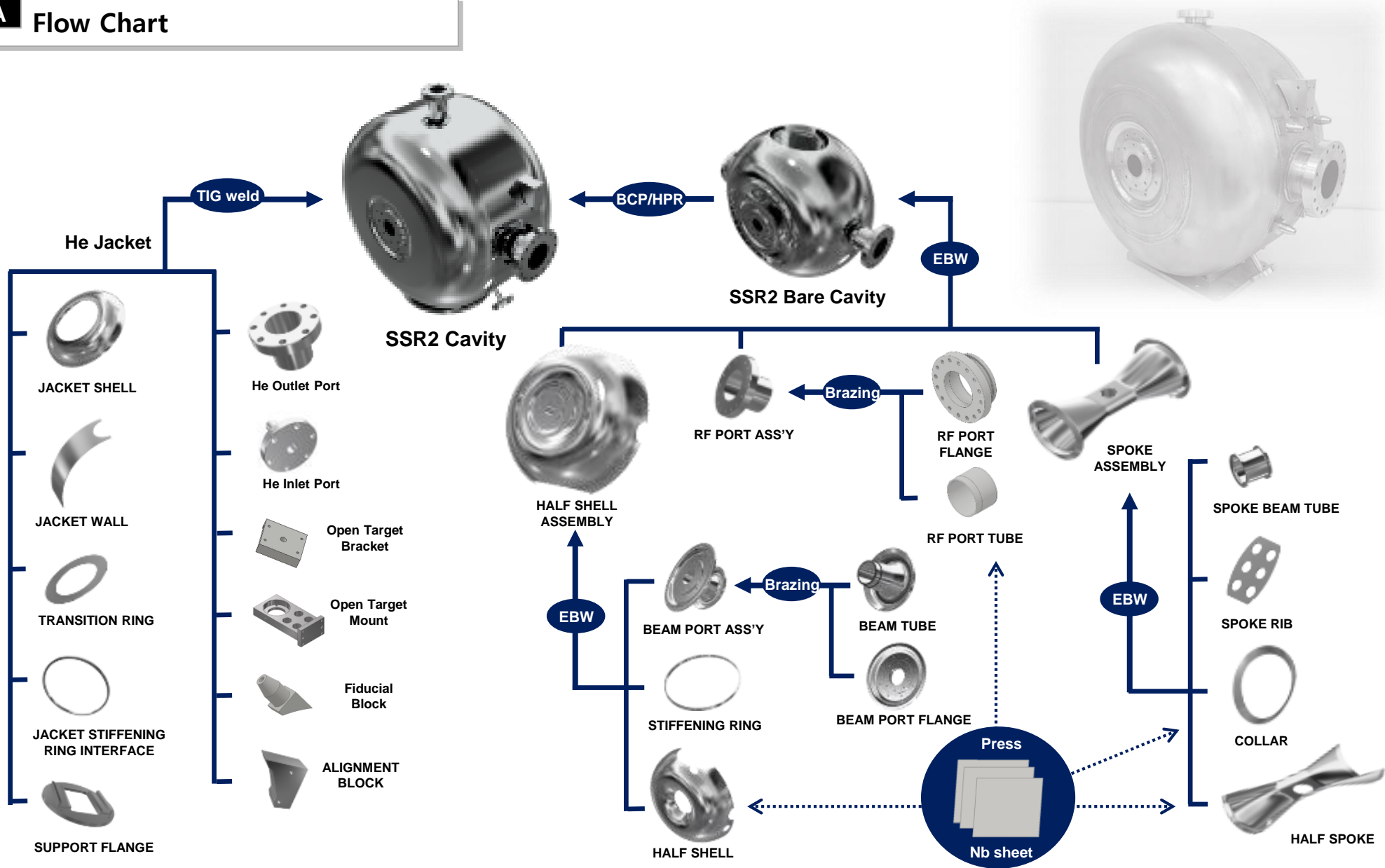
David E. Tuttle
 Board Chair, Conformity Assessment

Paul Chang
 Managing Director, Conformity Assessment

ASME PP

II-1. Flow Chart of SSR Cavity

A Flow Chart



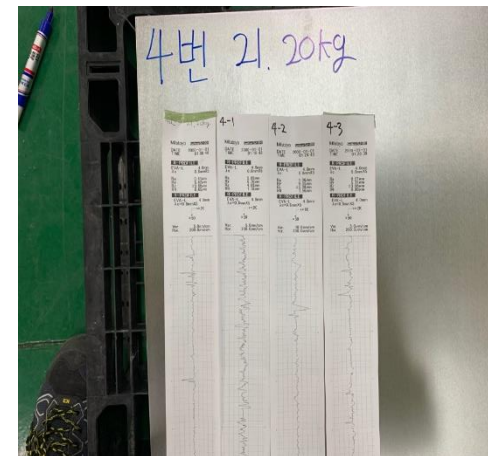
A Check Materials (Nb)



Visual Inspection



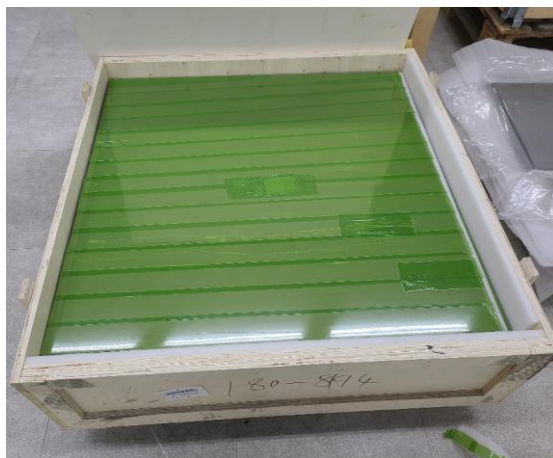
Measuring XRF



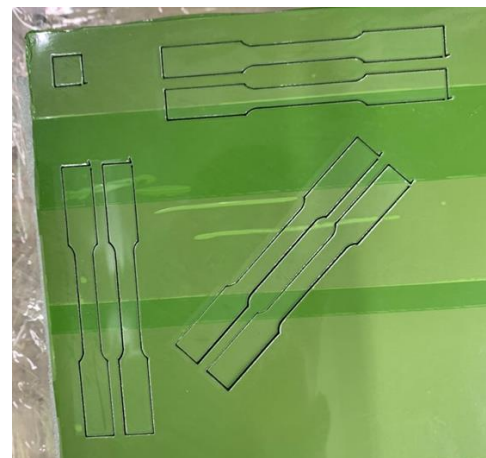
Record each sheet



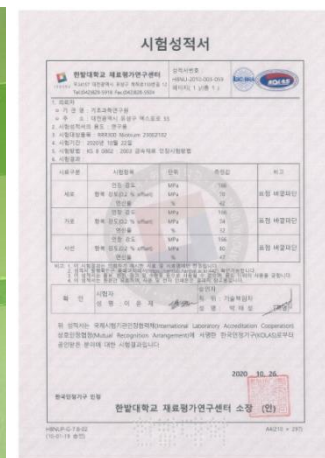
Soaking test



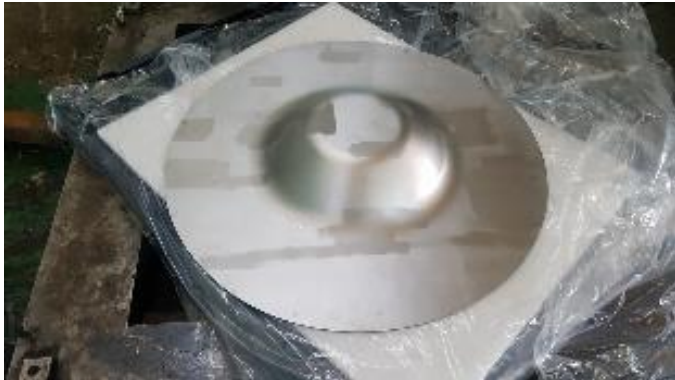
Masking & Surface protection



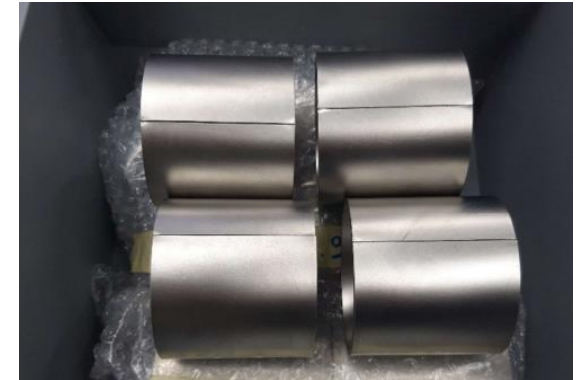
Tensile test & Certification



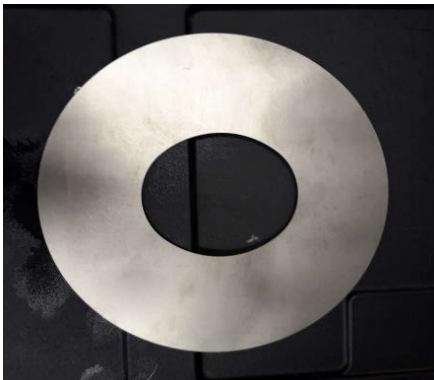
B Press Process



Half Shell : Press



RF Port Tube : Press



Collar : Press



Half Spoke : Press



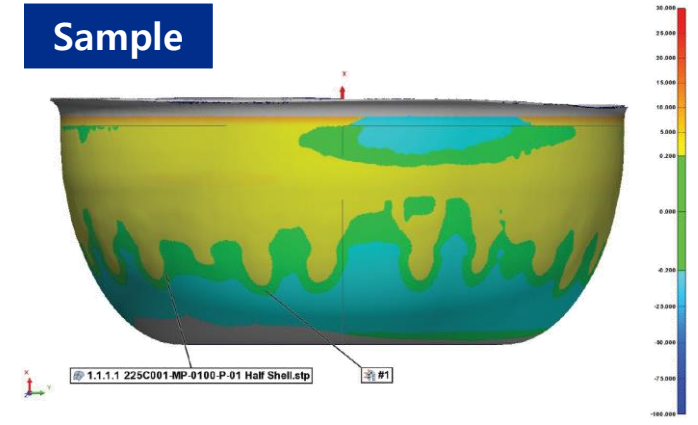
C Measuring of Shape & Soaking test



Soaking Test (after press)



3D Scanning & Measuring



Brazing (Beam & RF Port)



Thermal Shock Test



He Leak Test

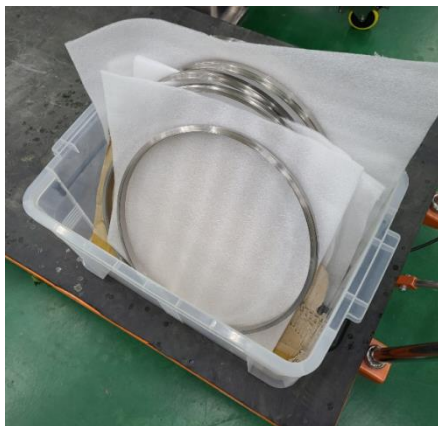
D EB welding & TIG welding



Half shell



Half shell + Beam Port + stiffening ring : EBW



Stiffening Ring (Nb / Cu / STS) : TIG & EB welding

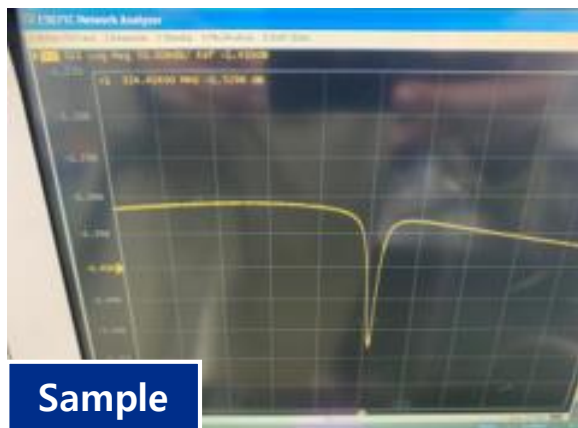
D EB welding & Clamp up test



Half shell : Machining



Spoke : EBW, Machining



Sample

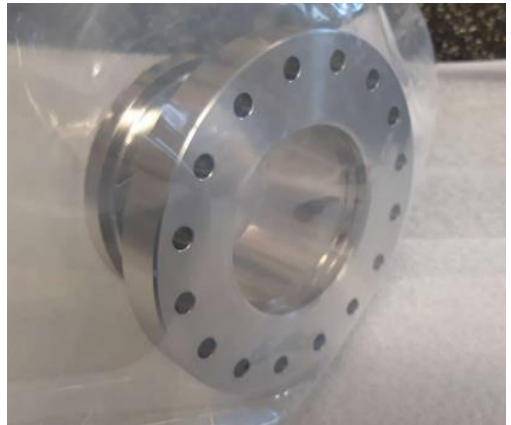
Clamp up Test : Network Analyzer



Half Shell + Half shell : EBW, Machining



D EB welding & Brazing

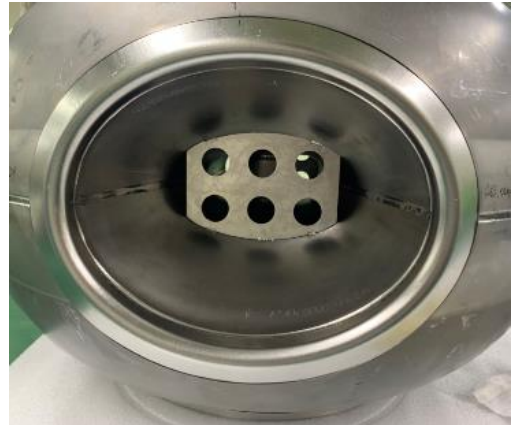
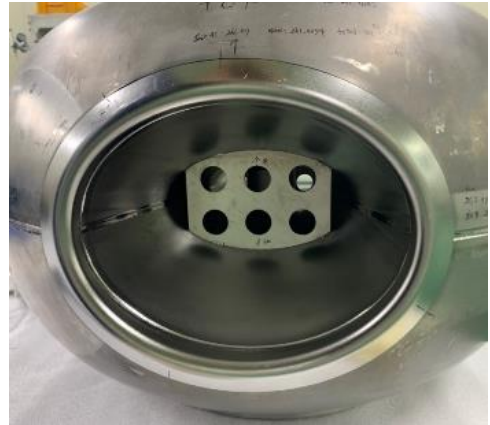


RF port + Shell assy : EBW, CMM

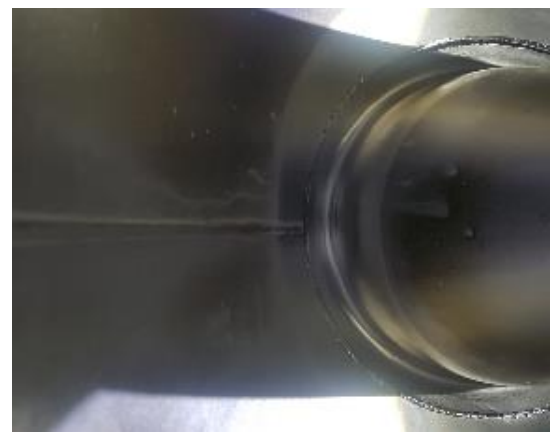


Collar + Spoke : EBW, Machining, CMM

D Final EB welding

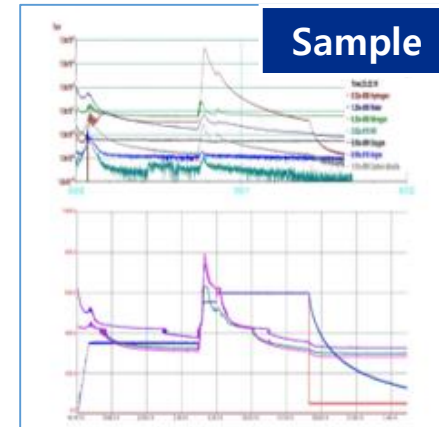
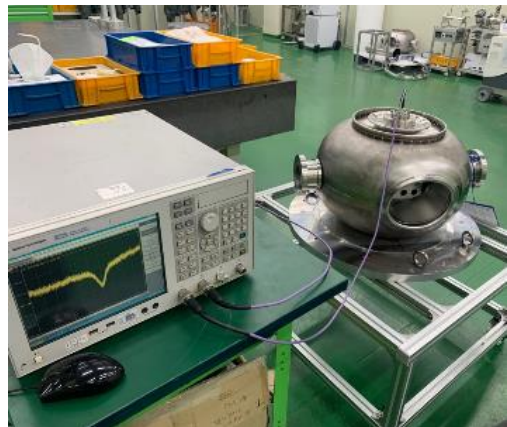


Shell assy + Spoke assy : Check the outside of shape



Bare Cavity : EBW (Check Welding Bead _ inside / outside)

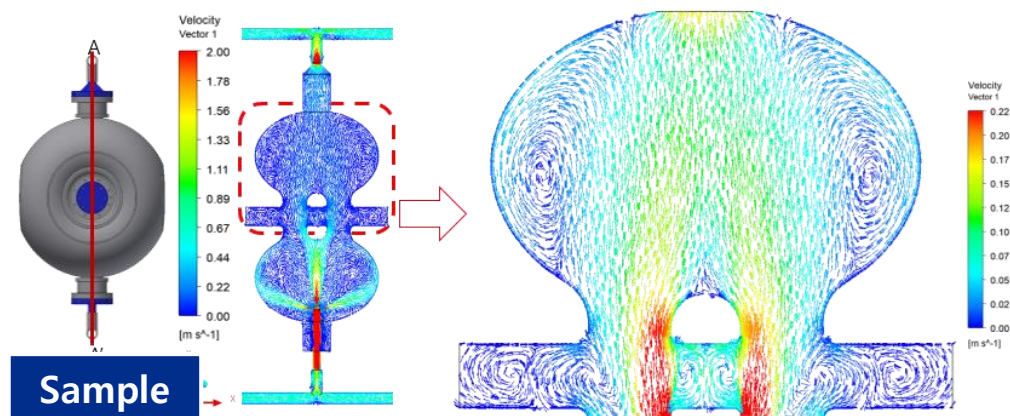
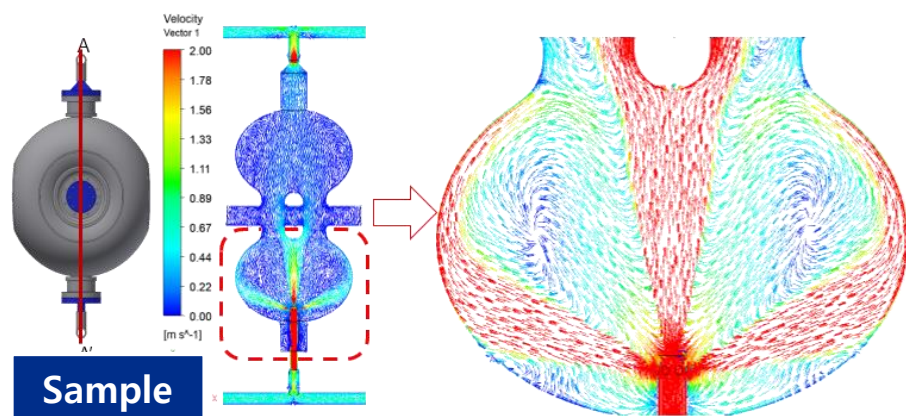
E Surface Treatment (BCP)



Check Frequency and He leak test

Cavity : BCP room & BCP Facilities

Heat treatment & RGA data



Flow analysis for BCP process

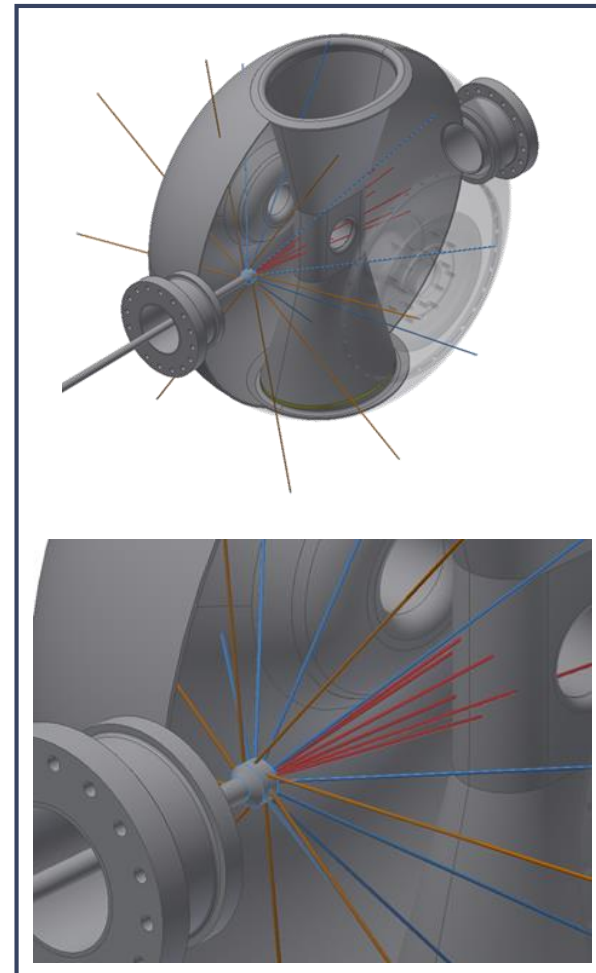
E Surface treatment



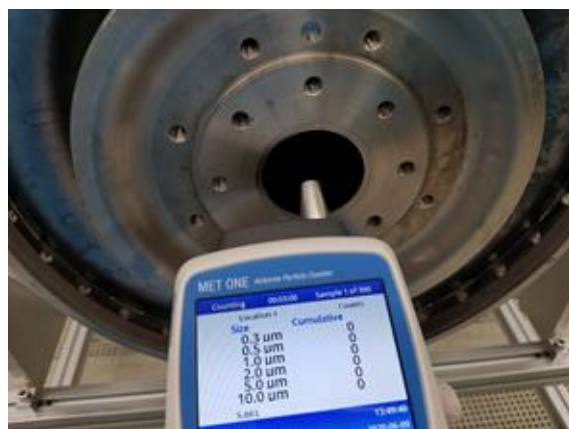
Bare Cavity : USC



Cavity : HPR (Vertical, Horizontal, Tilted)



Pressure direction review

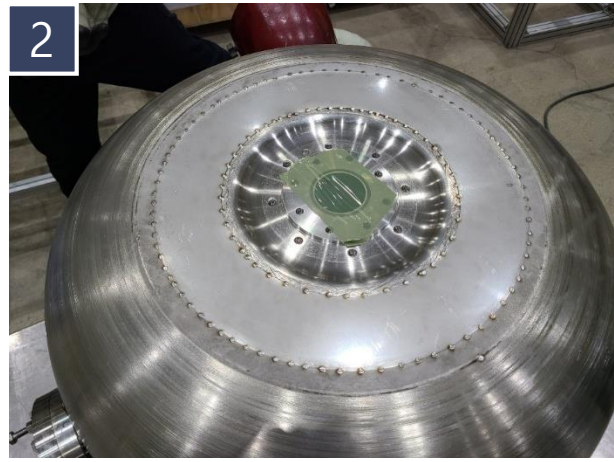


Check particles

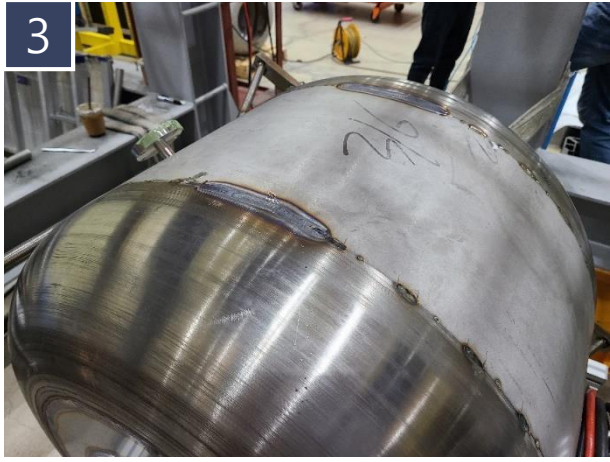
F He Jacket (TIG welding & Tuning)



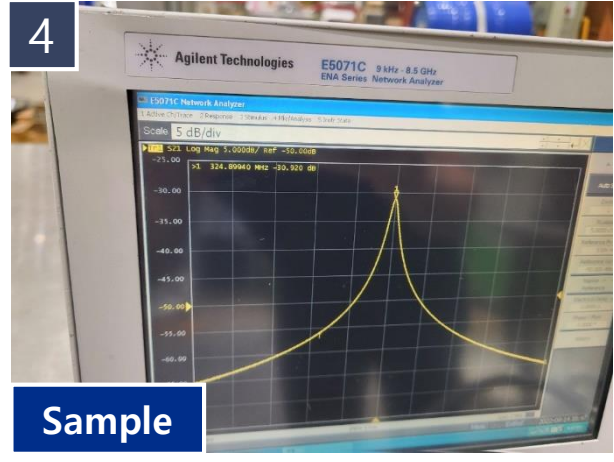
1 Assemble He Jacket part



2 Tack Welding



3 TIG Welding



4 Sample Tuning the frequency

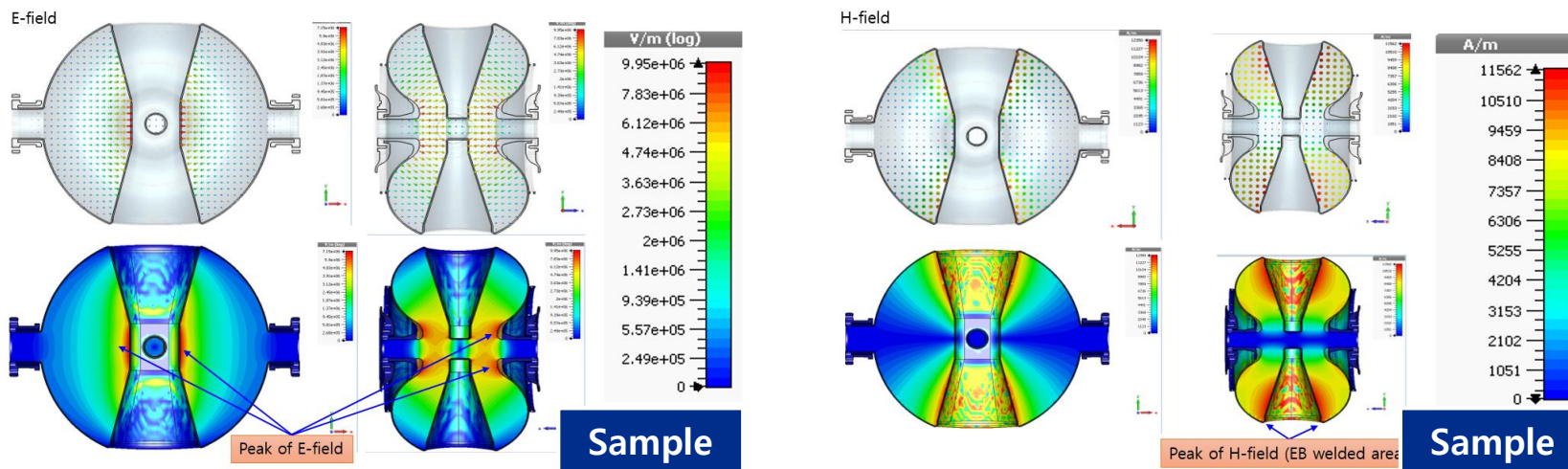


5 TIG Welding Accessory (Blocks, etc.)

F Thermal shock test

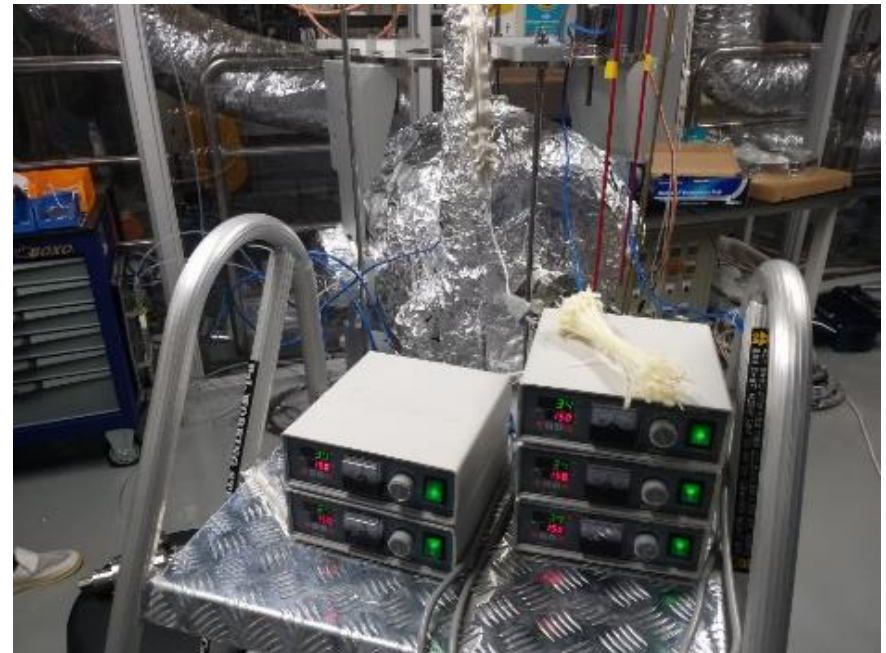


Simple Thermal Shock Test to check leakage



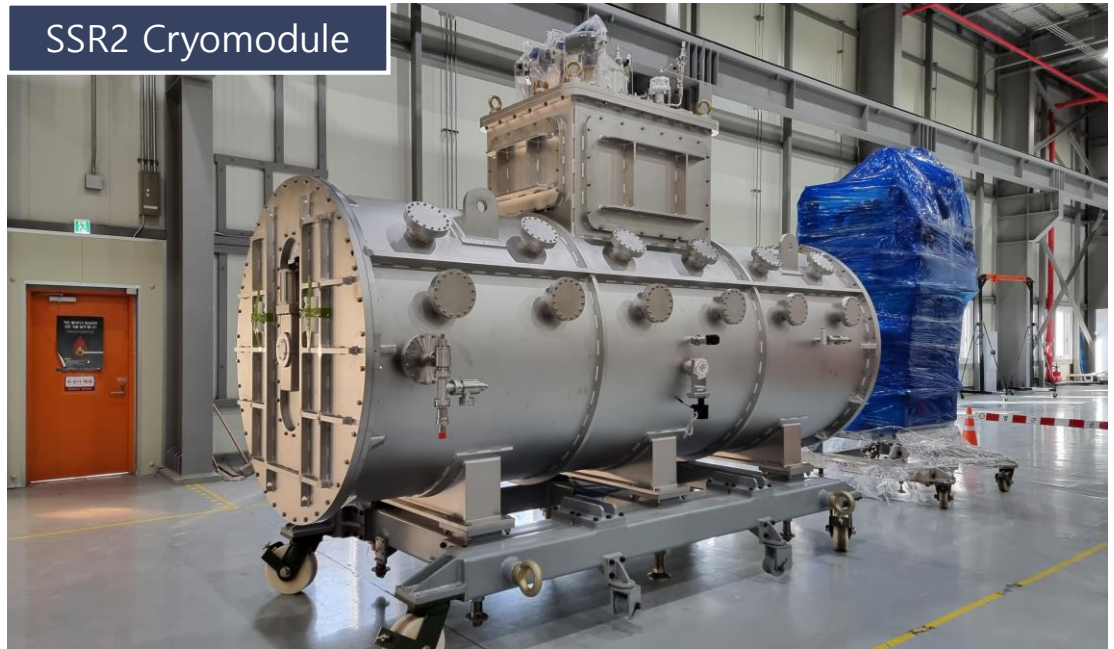
Analysis of E-Field, H-Field

G Vertical Test (IBS Site)



VT : Assemble & Baking (IBS site)

G Horizontal Test



Inside of SSR1 module

Inside of SSR2 module

Q & A

VITZRO

Thank you!