

SRF activities at MHI-MS

2017.12.12

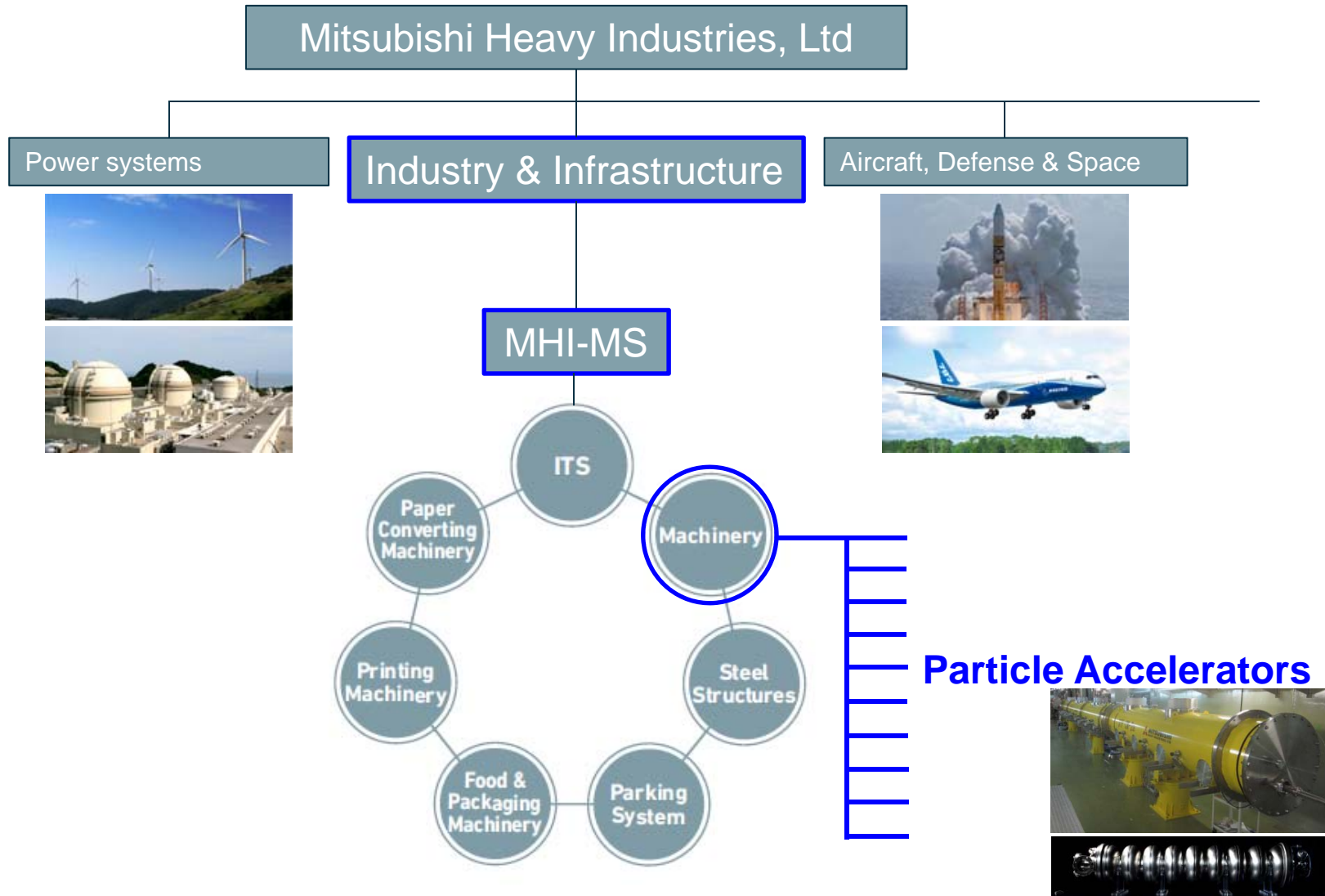
EUV-FEL WORKSHOP

Mitsubishi Heavy Industries Machinery Systems, LTD

- 1. Company organization**
- 2. History of SRF Products in MHI-MS**
- 3. Manufacturing Method of SRF cavity**
- 4. The High Pressure Gas Safety Law**
- 5. Conclusion**

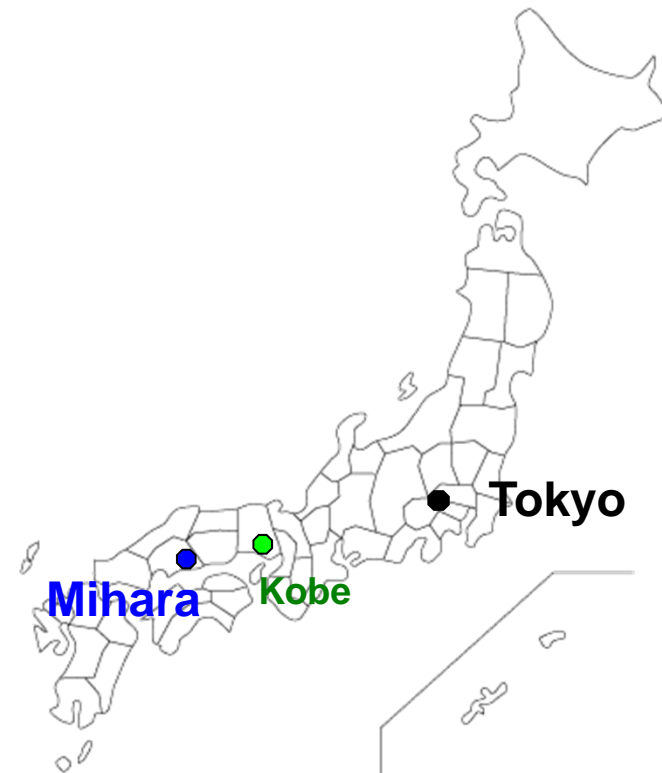
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1. Company organization



1. Company organization

- Main Products : Normal Conducting Accelerator
Superconducting Accelerator
RF Components (Waveguide, Coupler, Window etc.)
- Engineering and Sales site:
Kobe Headquarters (Hyogo Pref.)
- Production Site :
Mihara Office (Hiroshima Pref.)



1. Company organization
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2. History of SRF Products in MHI-MS

1989	KEK-TRISTAN (delivery)				
2005	KEK-STF (start)				
2007	KEK-CRAB (delivery)				
2012	KEK-cERL (delivery)		 <small>Photo courtesy of KEK</small>		 <small>Photo courtesy of KEK</small>
2013	NSRRC-TPS (delivery)				
2015	RIKEN-RIBF (start)				

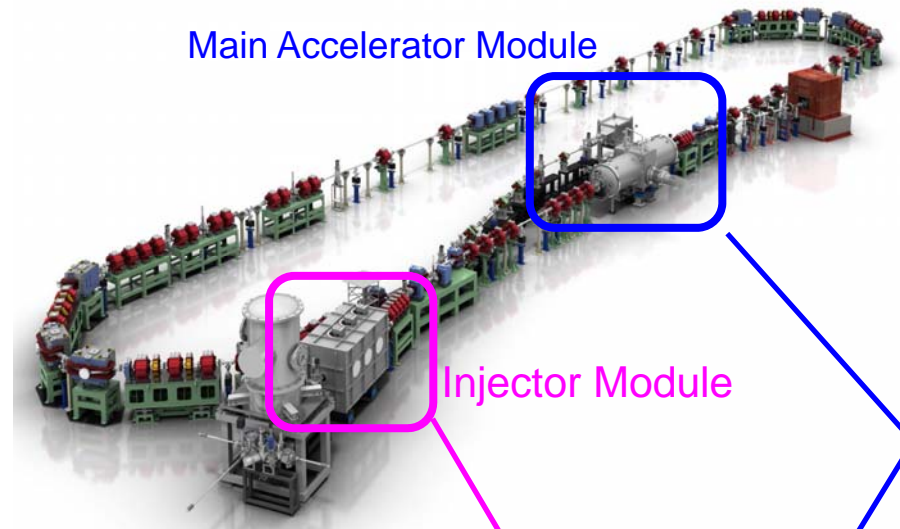
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3. Manufacturing Method of SRF cavity

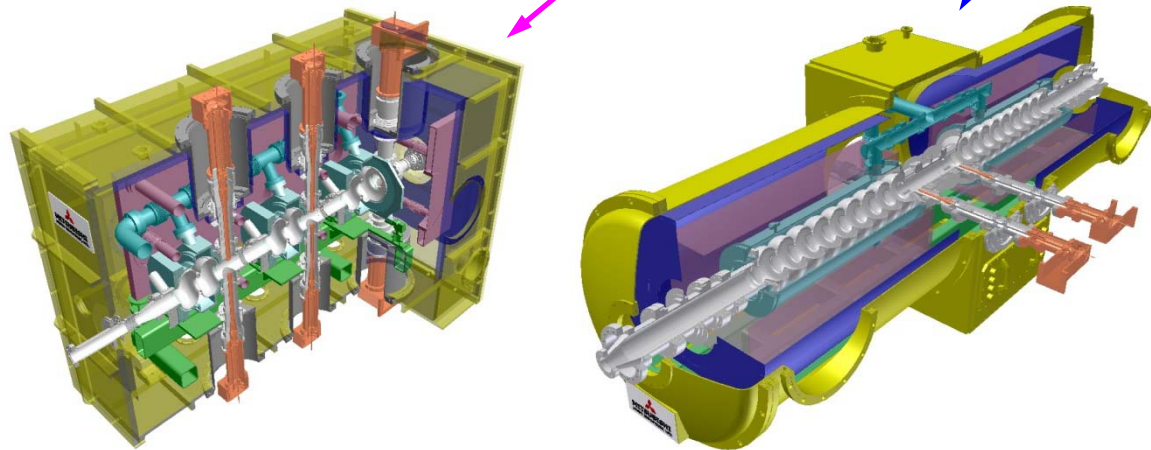
● Engineering

1. Basic Design of cavity from KEK
2. Mechanical design of cavity
3. Mechanical design of jacket and tuner
4. Fabrication of cavity
5. Design of assembling and alignment process of cold mass
6. Design of vacuum vessel
7. Fabrication and assembling of cryomodule

It took 3 years from design to fabrication of new 2 types of cryomodule.

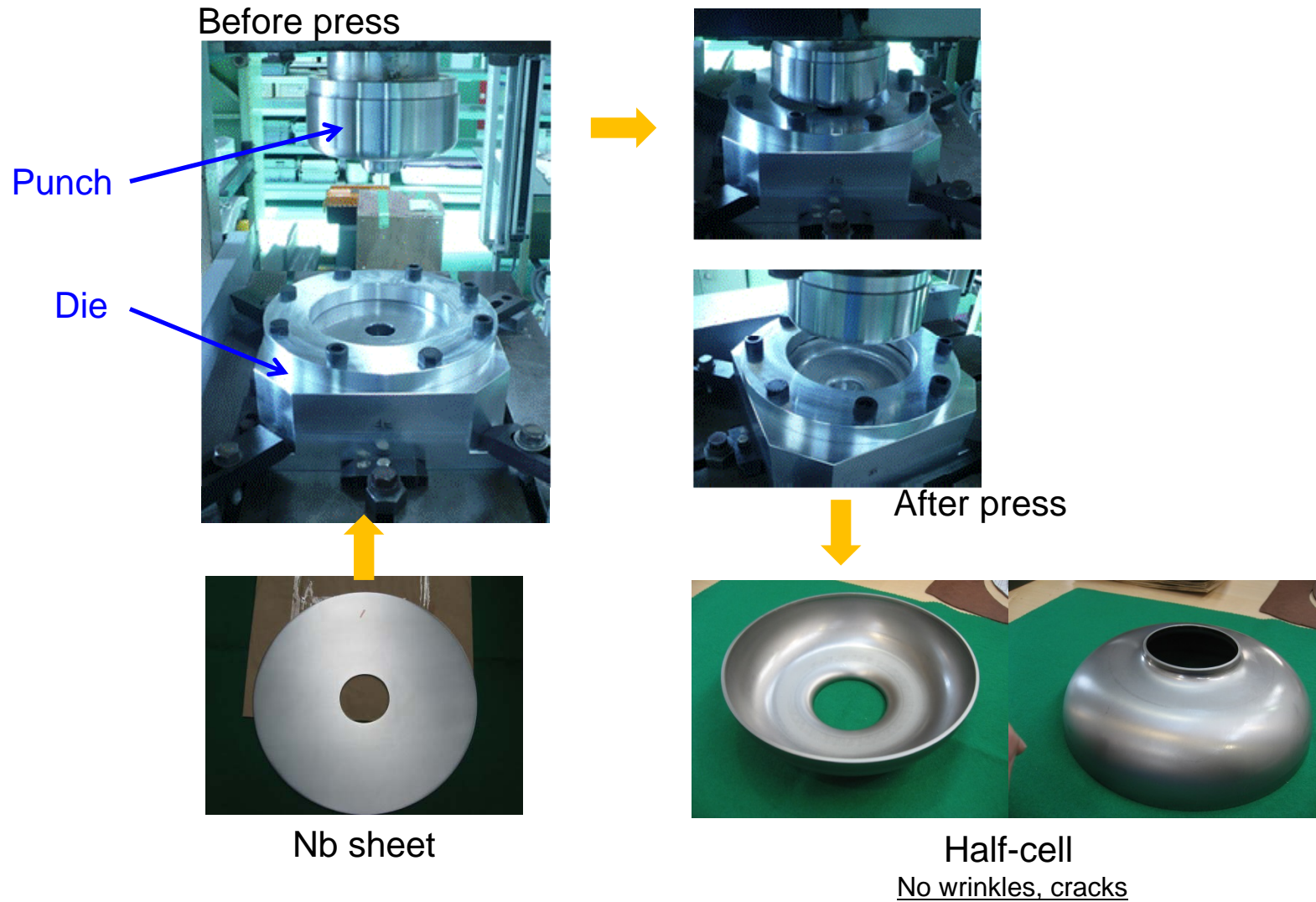


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3. Manufacturing Method of SRF cavity

● Forming



3. Manufacturing Method of SRF cavity

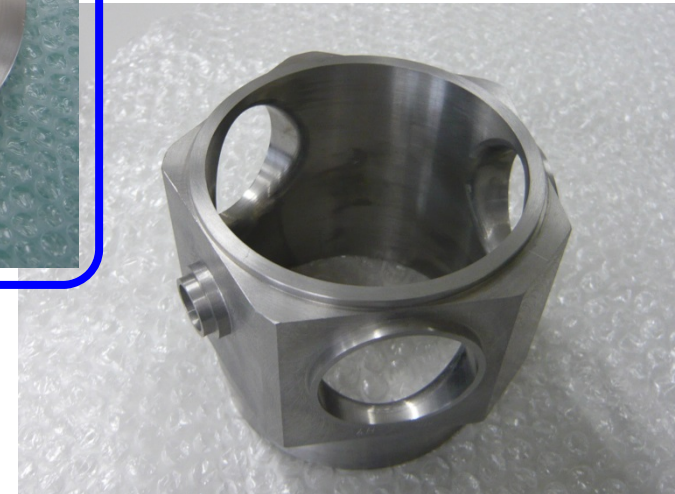
● Machining



Turning



Milling



3. Manufacturing Method of SRF cavity

●Welding

Electron Beam Welding (EBW)



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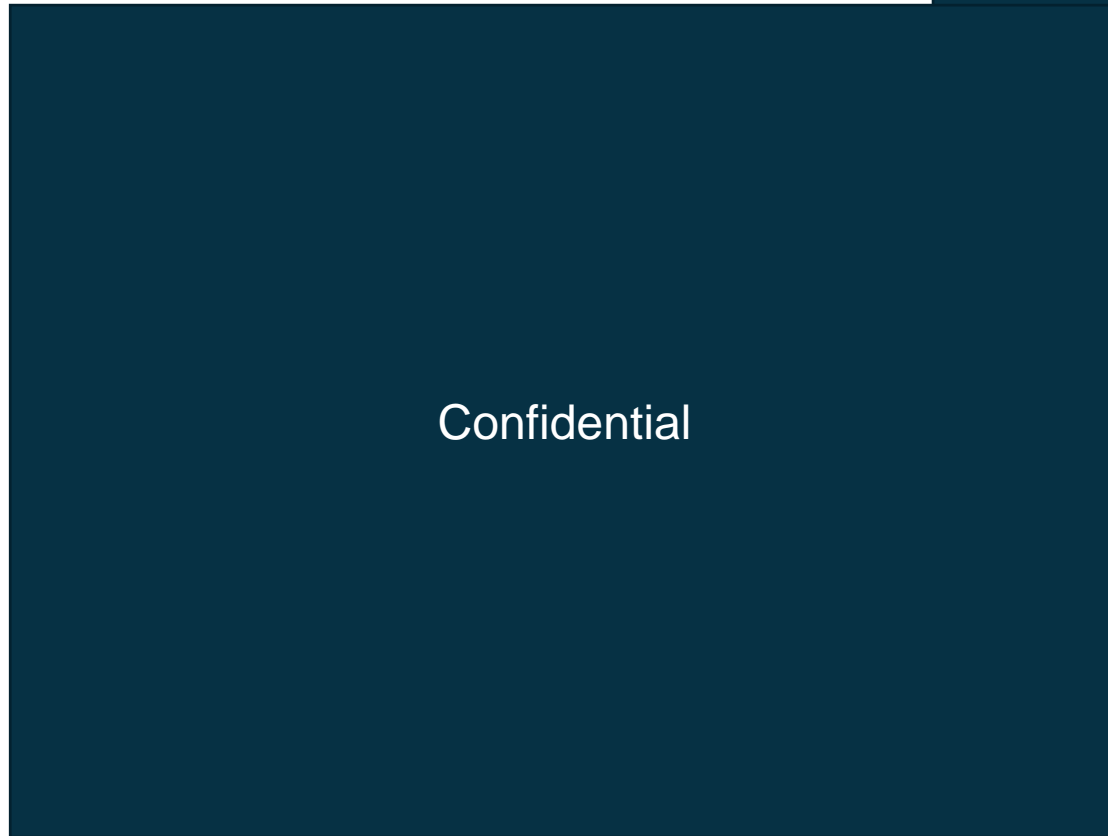
Specifications

Beam Power	Max. 10kW
Accelerating Voltage	80kV

3. Manufacturing Method of SRF cavity

●Welding

Iris

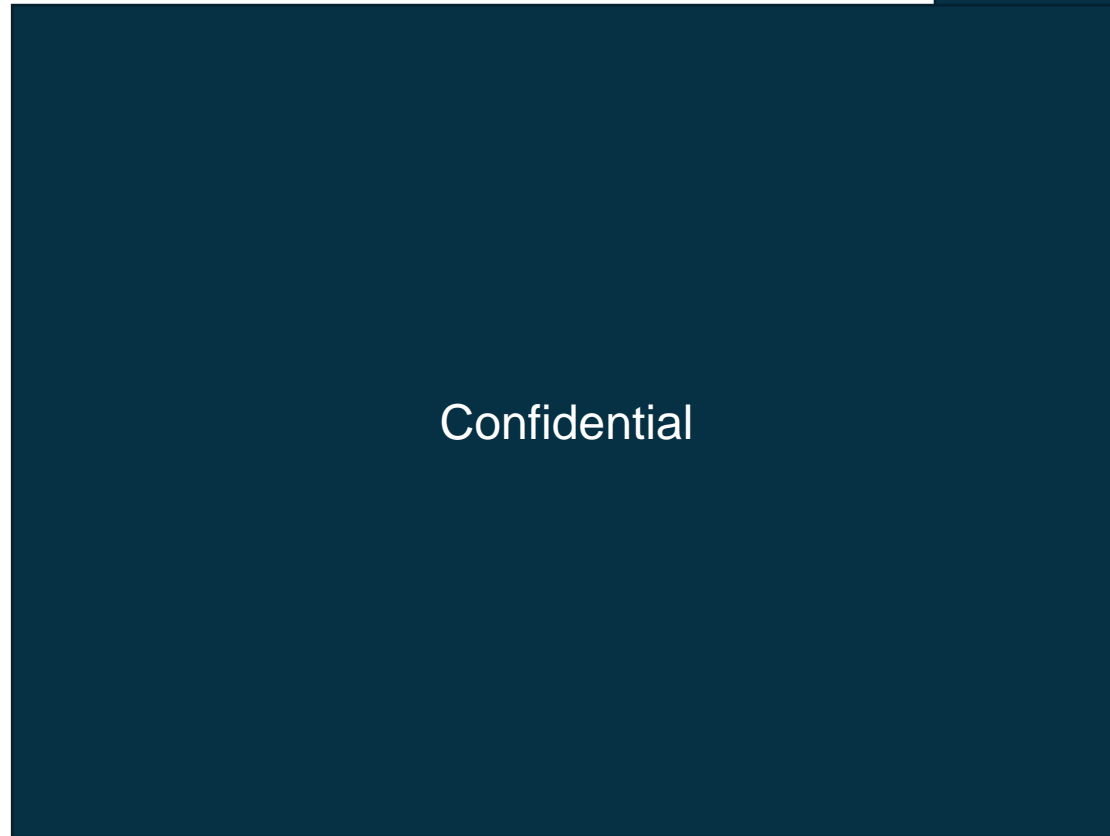


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3. Manufacturing Method of SRF cavity

●Welding

Equator (cut model)

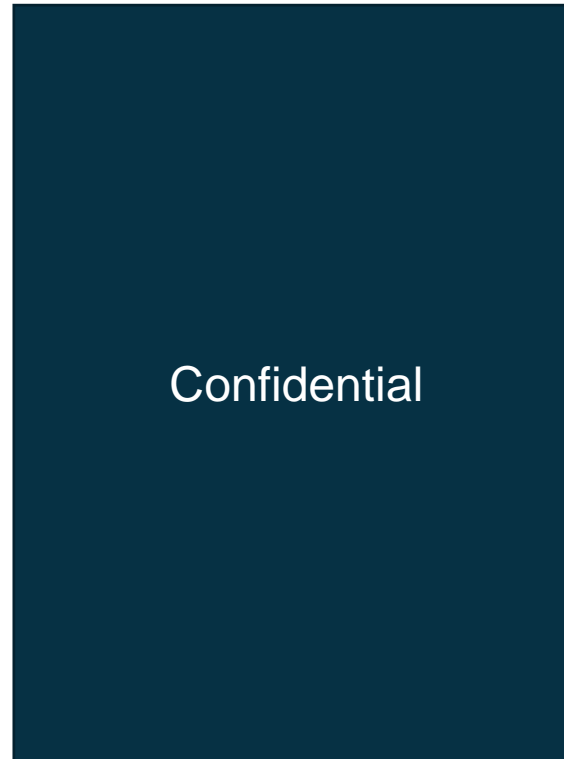


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3. Manufacturing Method of SRF cavity

●Welding

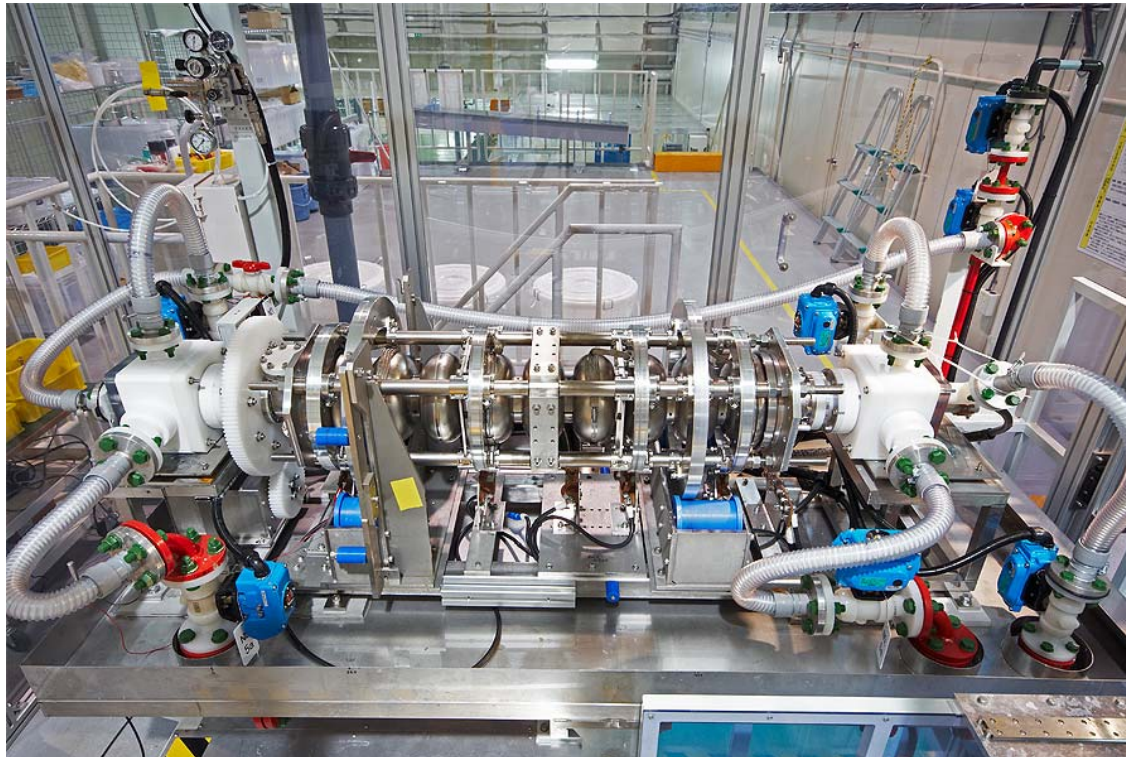
Jacket



3. Manufacturing Method of SRF cavity

● Surface treatment

EP@KEK



HPR@KEK



Photo courtesy of KEK

3. Manufacturing Method of SRF cavity

● Surface treatment (Otherwise)

BCP@MHI-MS



HPR@MHI-MS



3. Manufacturing Method of SRF cavity

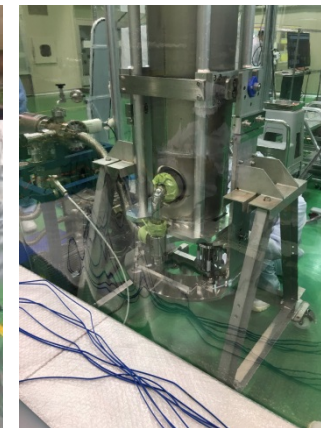
● Assembly (Class 10)

Cavity string by KEK



Photo courtesy of KEK

CR in MHI-MS



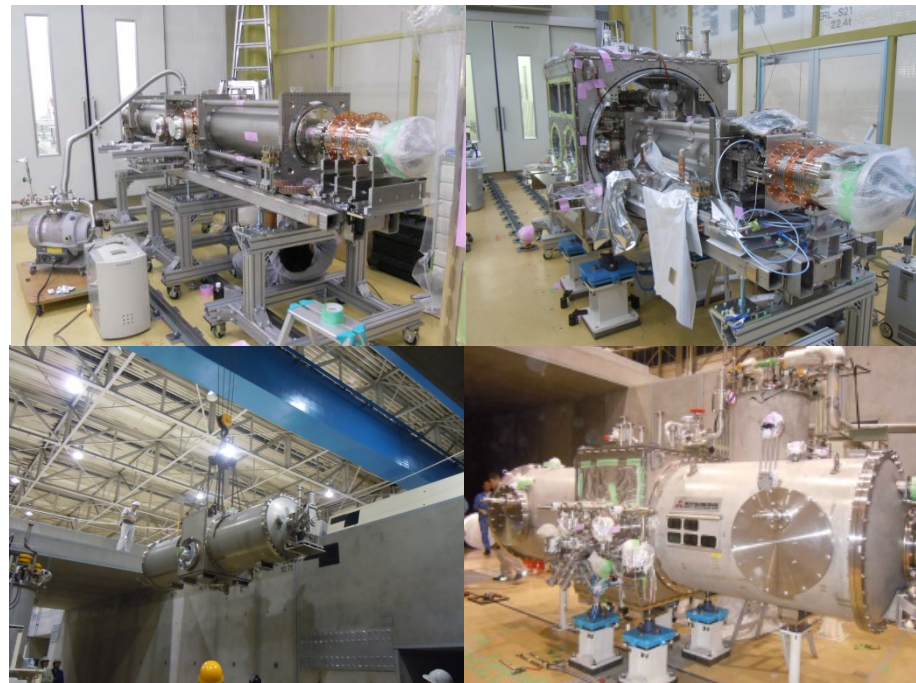
3. Manufacturing Method of SRF cavity

● Assembly (Cryomodule)



Injector Module

Main Accelerator Module



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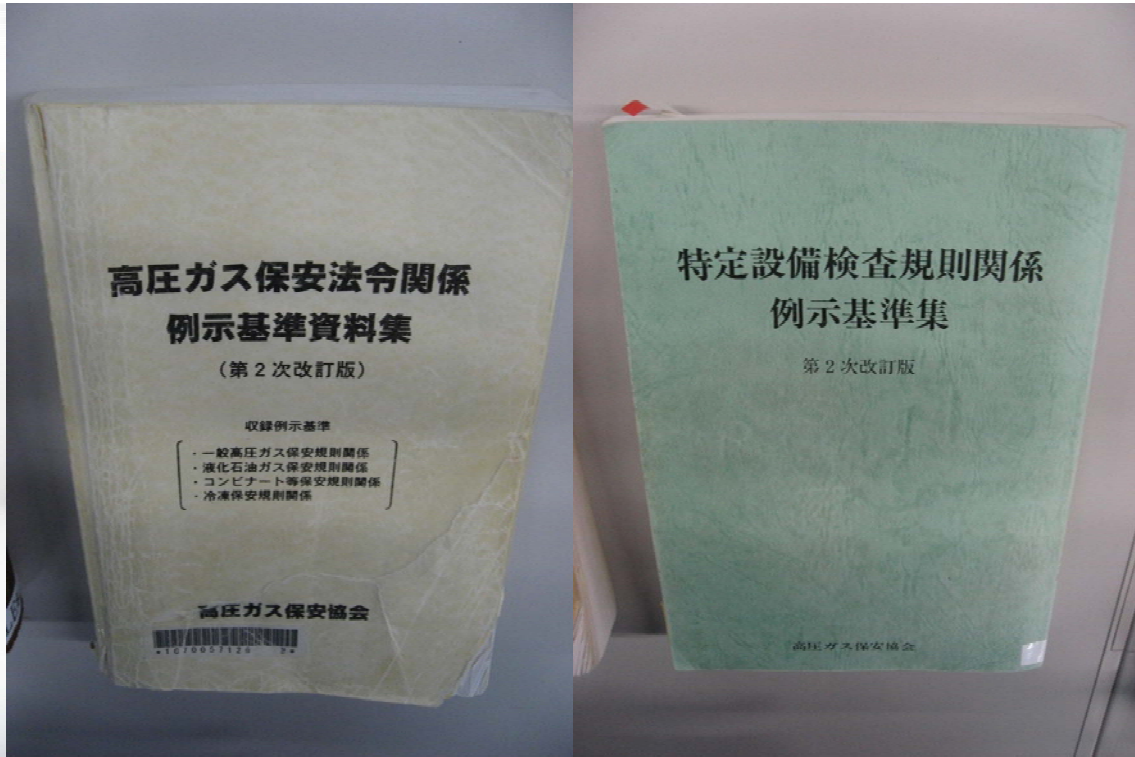
4. The High Pressure Gas Safety Law

● Standard

The statute book



The handbook of inspection



- High-pressure gas equipment
- Refrigeration equipment (etc.)

- Designated equipment

4. The High Pressure Gas Safety Law

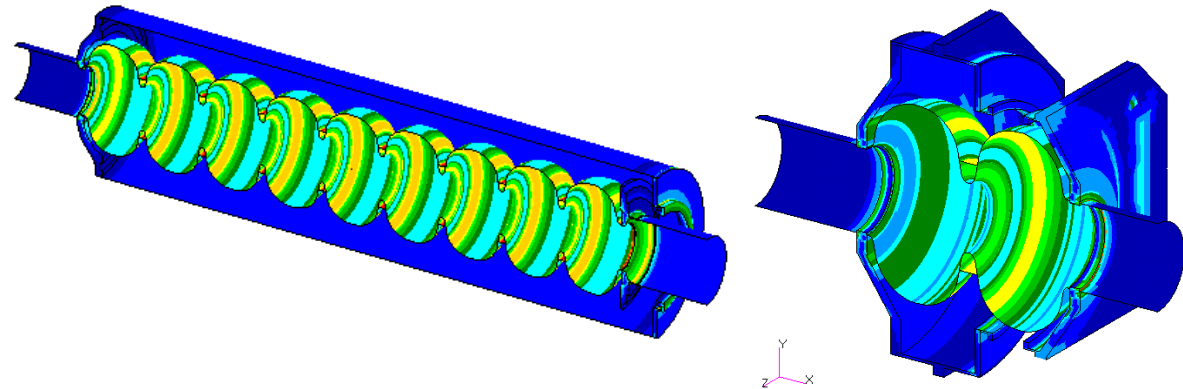
● Inspection

Design

-Calculation

-Analysis

-High pressure test



4. The High Pressure Gas Safety Law

● Inspection

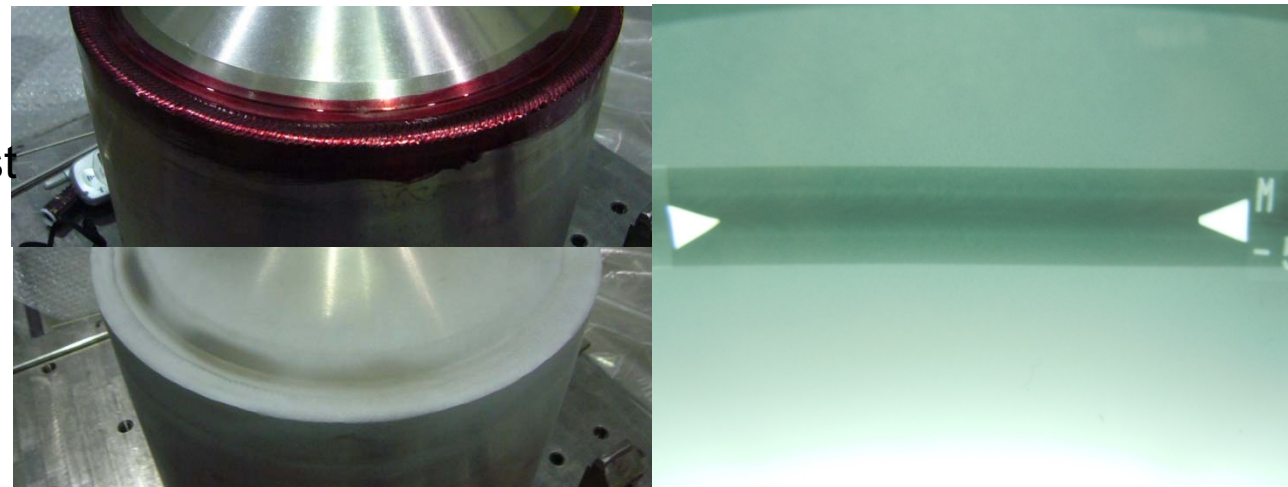
Material



Welding

-Penetrant test

-Radiographic test



4. The High Pressure Gas Safety Law

● Inspection

Mechanical test

- Tensile test
- Bend test



Structure

- Pressure test
- Gas leakage test



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5. Conclusion

- **The production procedure described here is just one of the cases.**
- **MHI-MS tries to progress step by step to offer a high quality product.**
- **MHI-MS continues to support the dreams of researchers in their quest for scientific technology that will benefit mankind and society.**

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