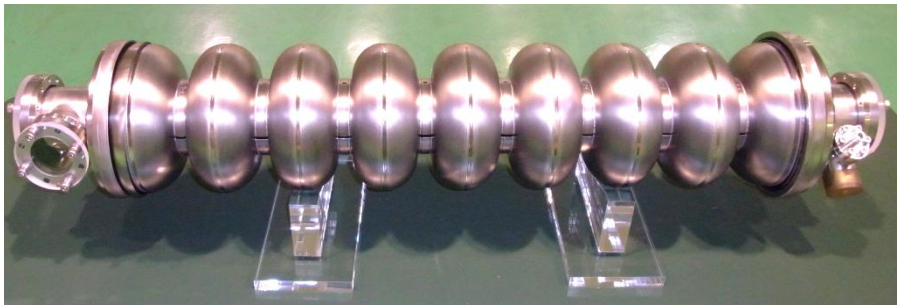
MHI-MS's view on cavity fabrication and engineering

TESLA TYPE cavity

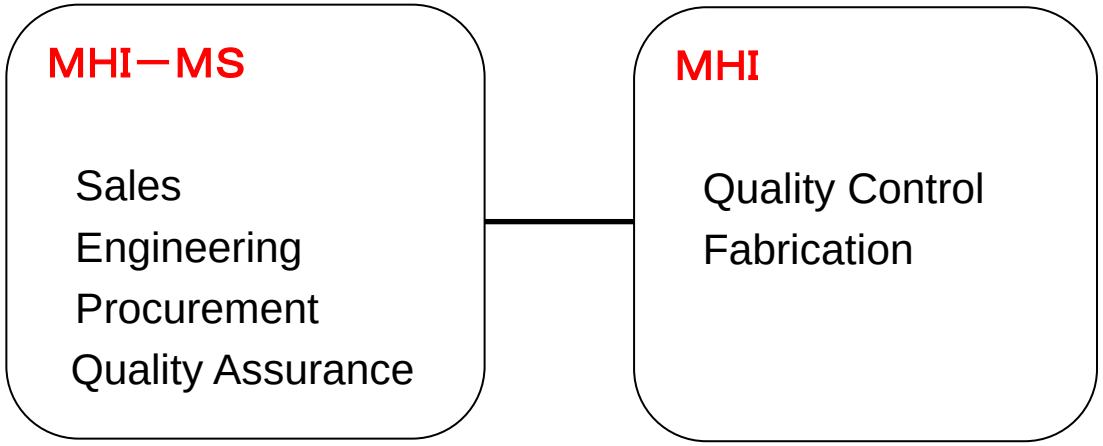


STF cavity

2 December 2015 TTC meeting@SLAC

MITSUBISHI HEAVY INDUSTRIES MECHATRONICS SYSTEMS, LTD.
Machinery Systems Business Department
K. Sennyu, A. Miyamoto, T. Yanagisawa, H. Hara

MHI-MS's view on cavity fabrication and engineering



2 December 2015 TTC meeting@SLAC

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MHIMS20151202

OUTLINE

1. Mass production for ILC
2. Engineering for cERL project at KEK
3. Engineering for QWR superconducting module at RIKEN
4. Summary

1. Mass production for ILC

Through the experience of
- STF cavity with jacket
- TESLA cavity without jacket

- **Dumbbell fabrication**

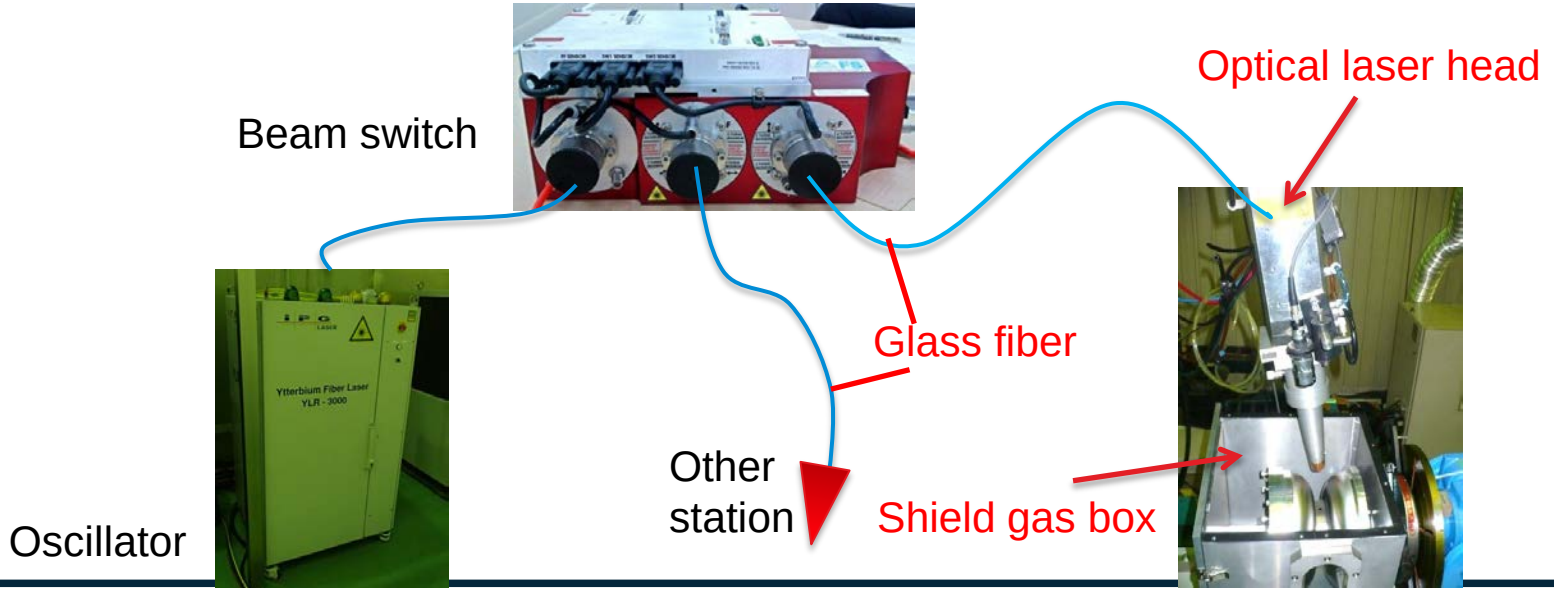
  >> Using LBW on stiffener is effective for mass production

  MOTIVATION

  ✓Cooling time after welding can be shortened

  ✓Laser can be divided by beam switch to multi station through the fiber

  ⇒ The Initial cost can be reduced



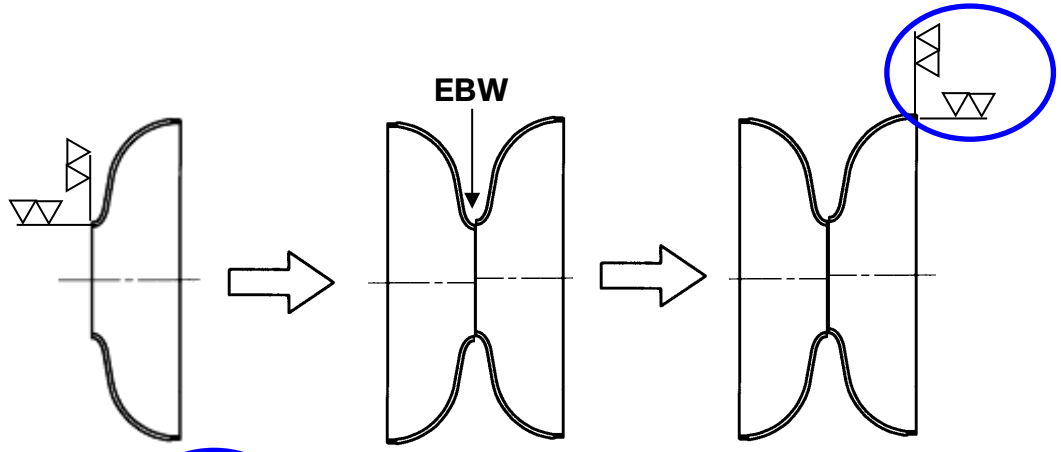
1. Mass production for ILC

- **Dumbbell fabrication**

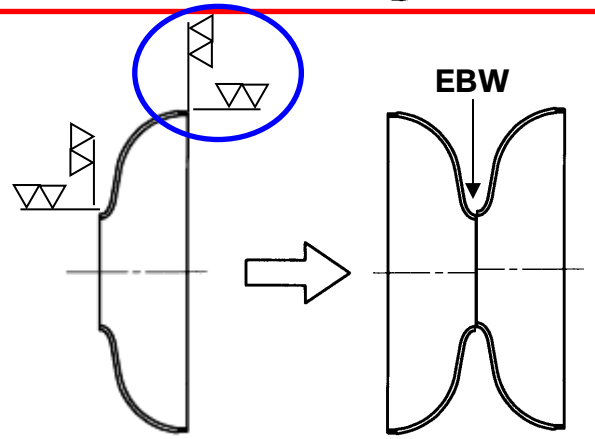
  >> Enough quality without machining after dumbbell welding

  only with machining before dumbbell welding

TESLA Process



STF Process



Easy Process

Convergence of dumbbell frequency in mass production

1. Mass production for ILC

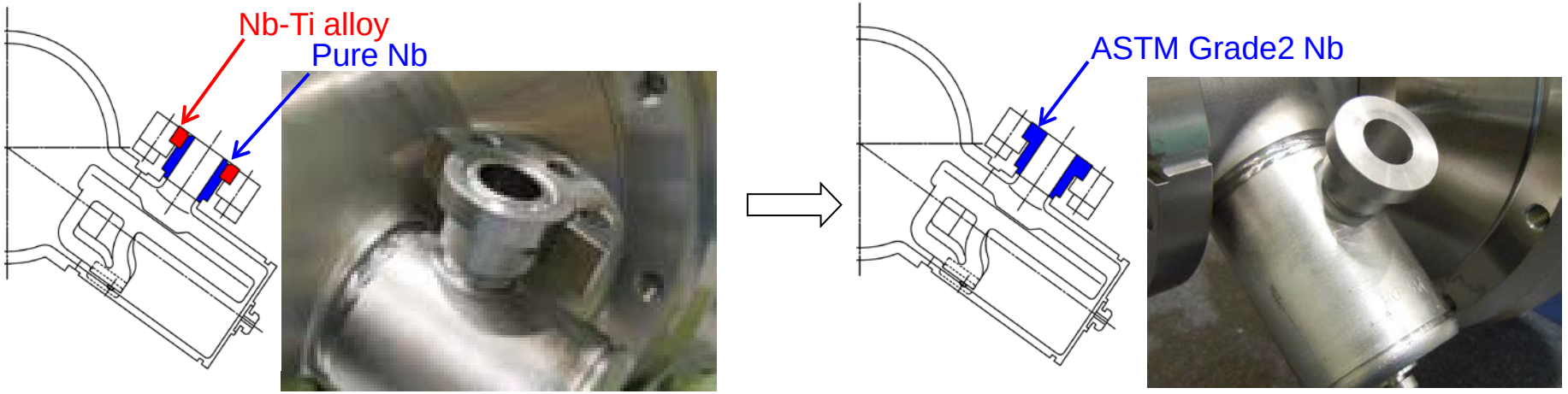
- **End group fabrication**

  >> Changing flange material to Grade2 Nb from NbTi

  MOTIVATION

  ✓Easy to seal for Electric Polishing

  ✓Reducing the number of parts



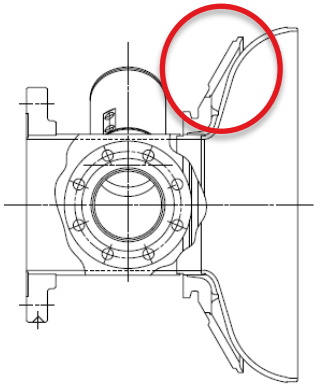
- **End group fabrication**

  >> Changing conical disk material to Ti from NbTi by changing heat treatment temp.

  MOTIVATION

  ✓Reducing the material cost

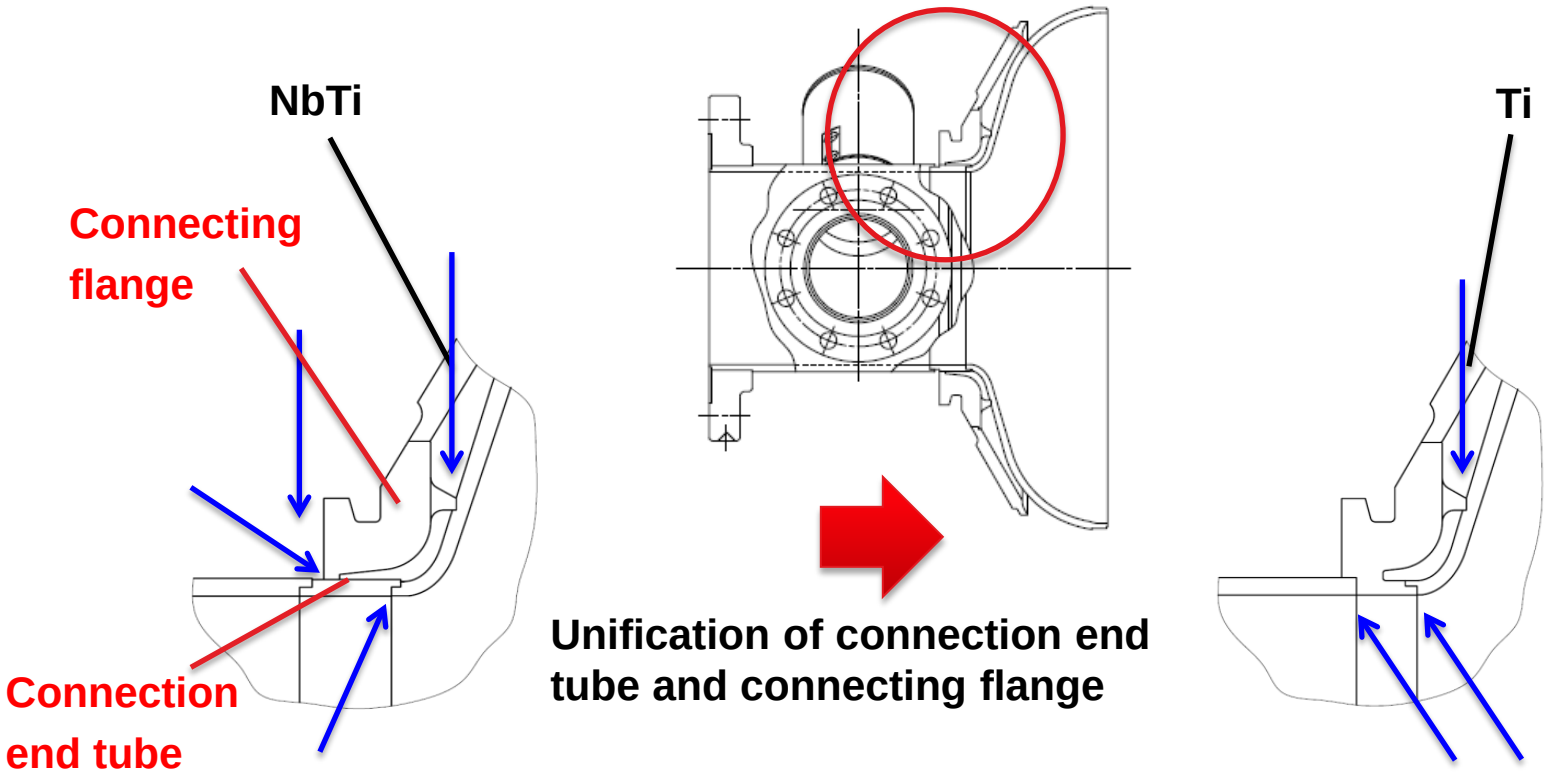
  ✓Easy to joint with jacket without EBW



NbTi ⇒ Ti

1. Mass production for ILC

- **End group fabrication**
  - **>> Connection end tube**
    - **MOTIVATION**
      - ✓Reducing the number of parts



1. Mass production for ILC

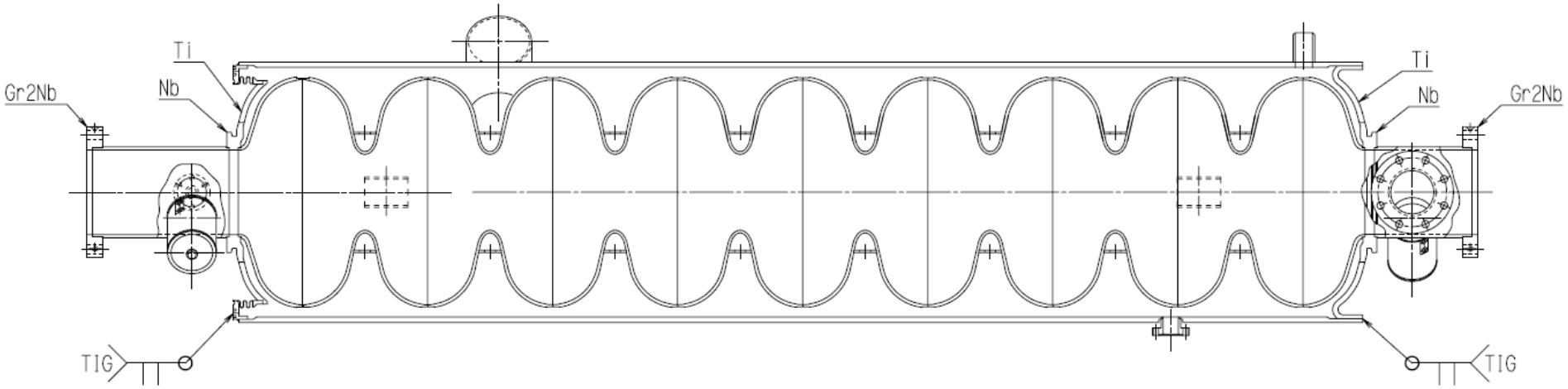
- **Cavity assembly**

  >> Ready for mass production!

4 cavities = 36 equators welding
by 1 vacuum vent

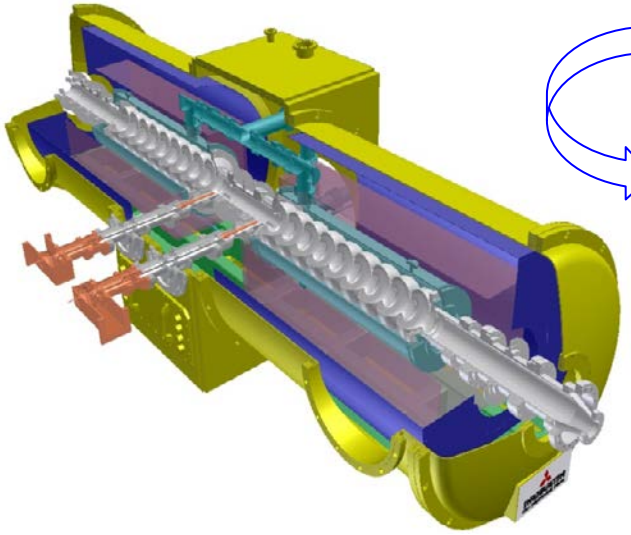
1. Mass production for ILC

- **Jacket assembly**
  - **>> Simplifying the tank structure**
    - **But Jacket structure depend on the tuner system**
      - ✓Reducing the number of parts
      - ✓All welding to TIG

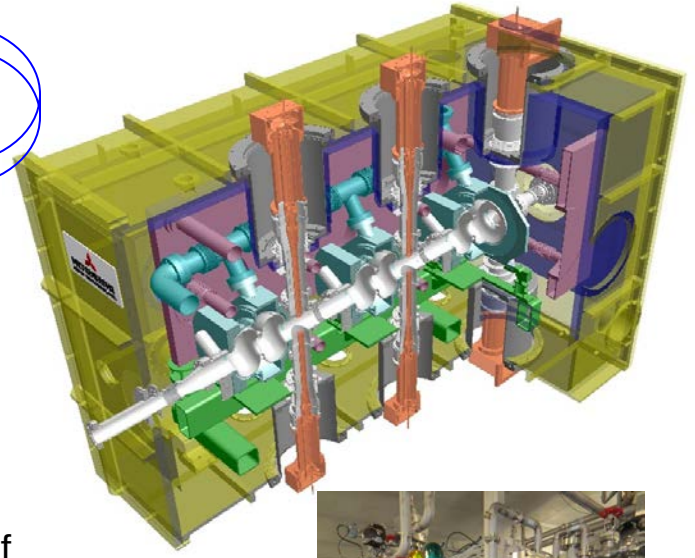


Plan of jacket structure

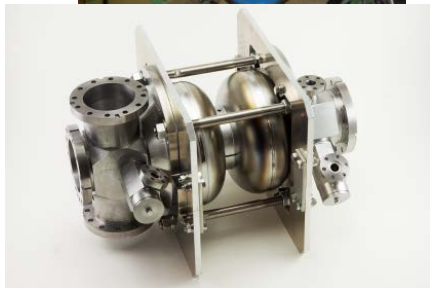
2. Engineering for cERL project at KEK

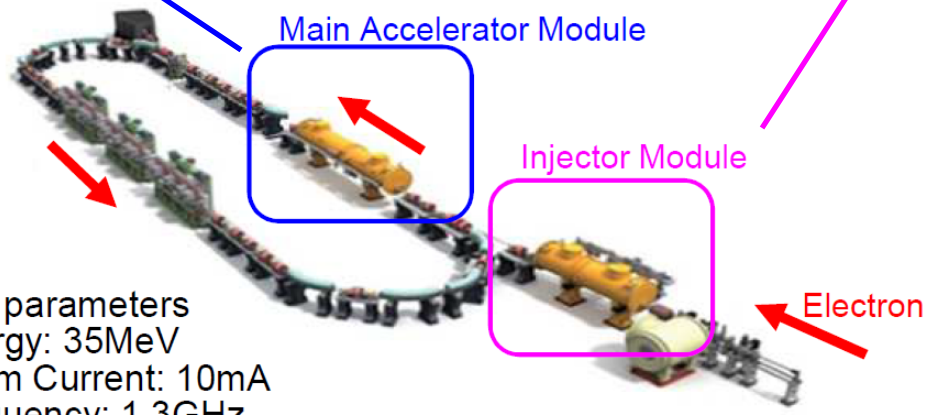


1. Basic Design of cavity from KEK
2. Mechanical design of cavity
3. Mecanical design of jacket and tuner
4. Fabrication of cavity
5. Design of assembling and alignment process of cold mass
6. Design of vacuum vessel
7. Fabrication and assembling of cryomodule



It took 3 years from design to fabrication of 2 types of cryomodule with governing high pressure gas safety law.

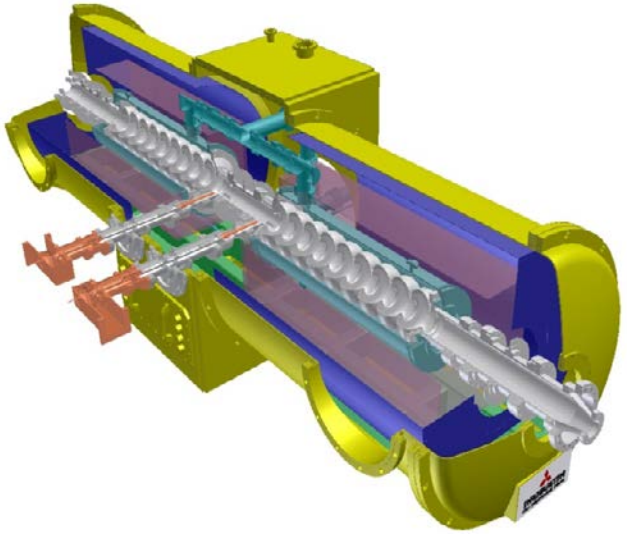




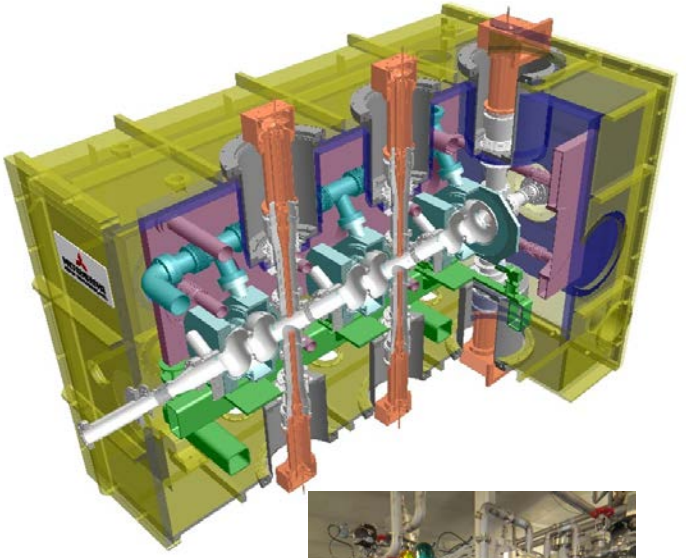
cERL parameters
- Energy: 35MeV
- Beam Current: 10mA
- Frequency: 1.3GHz

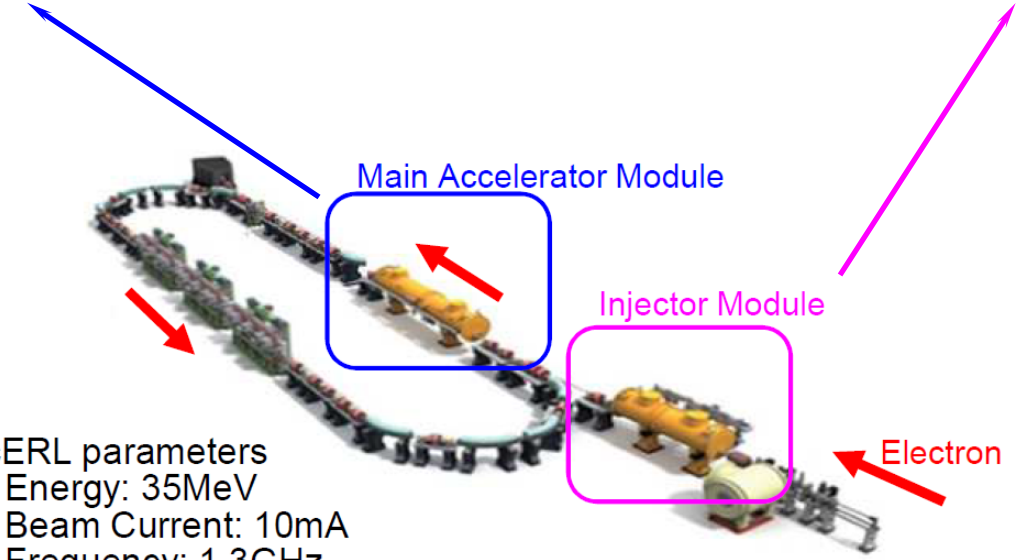
Courtesy of KEK

2. Engineering for cERL project at KEK



By discussing about total design for new type of cryomodule with researcher from planning phase, the project can achieve good result in a short term





cERL parameters
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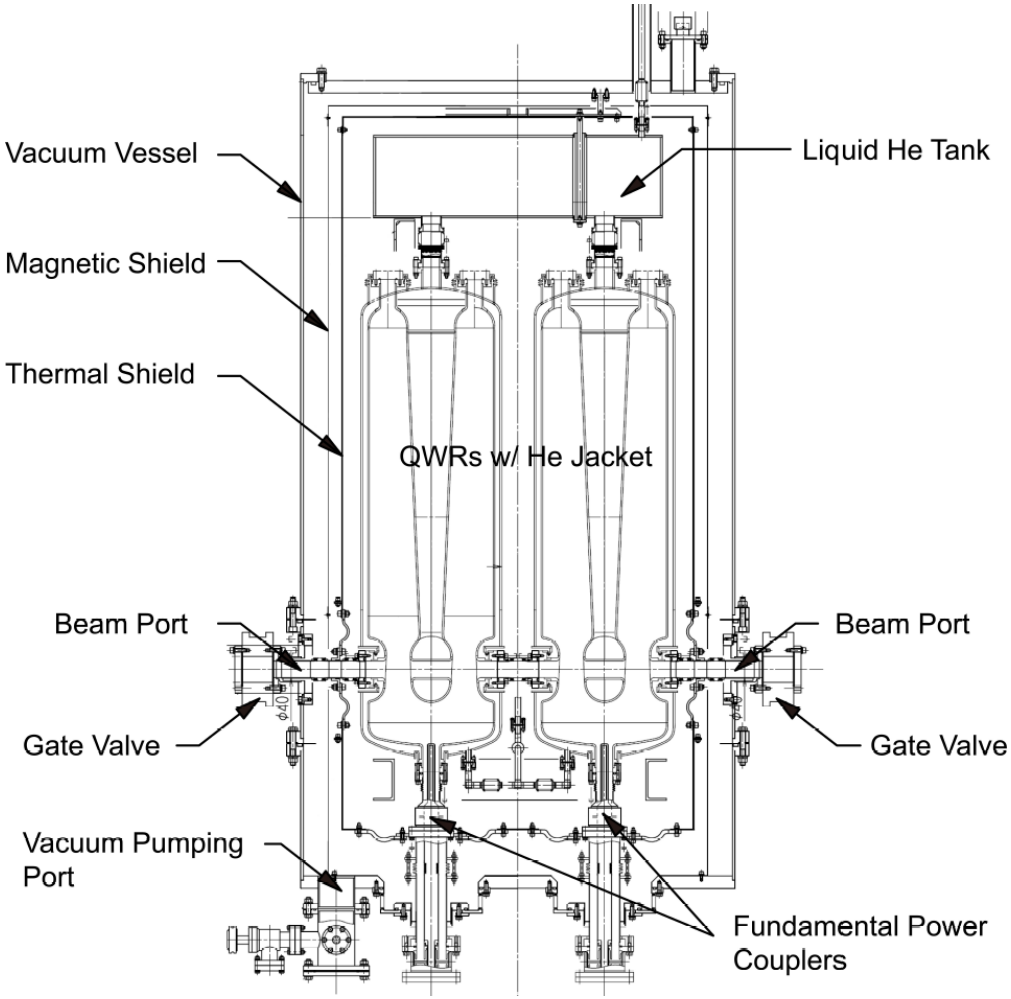
Courtesy of KEK

3. Engineering for QWR superconducting module at RIKEN

1.RF Design of cavity and coupler from RIKEN
2.Mechanical design of cavity and coupler
3.Mecanical design of jacket and tuner
4.Design of pre-tuning procedure of cavity
5.Fabrication of cavity
6.Design of assembling and alignment procedure of cold mass
7.Design of vacuum vessel
8.Fabrication and assembling of cryomodule

It takes 22 months from design to fabrication of QWR cryomodule without high pressure gas safety law from this June.

Through discussing about total design for new type of cryomodule with RIKEN from planning phase, the project will be proceeded smoothly.



N. Sakamoto et. al., WEBA06, SRF2015

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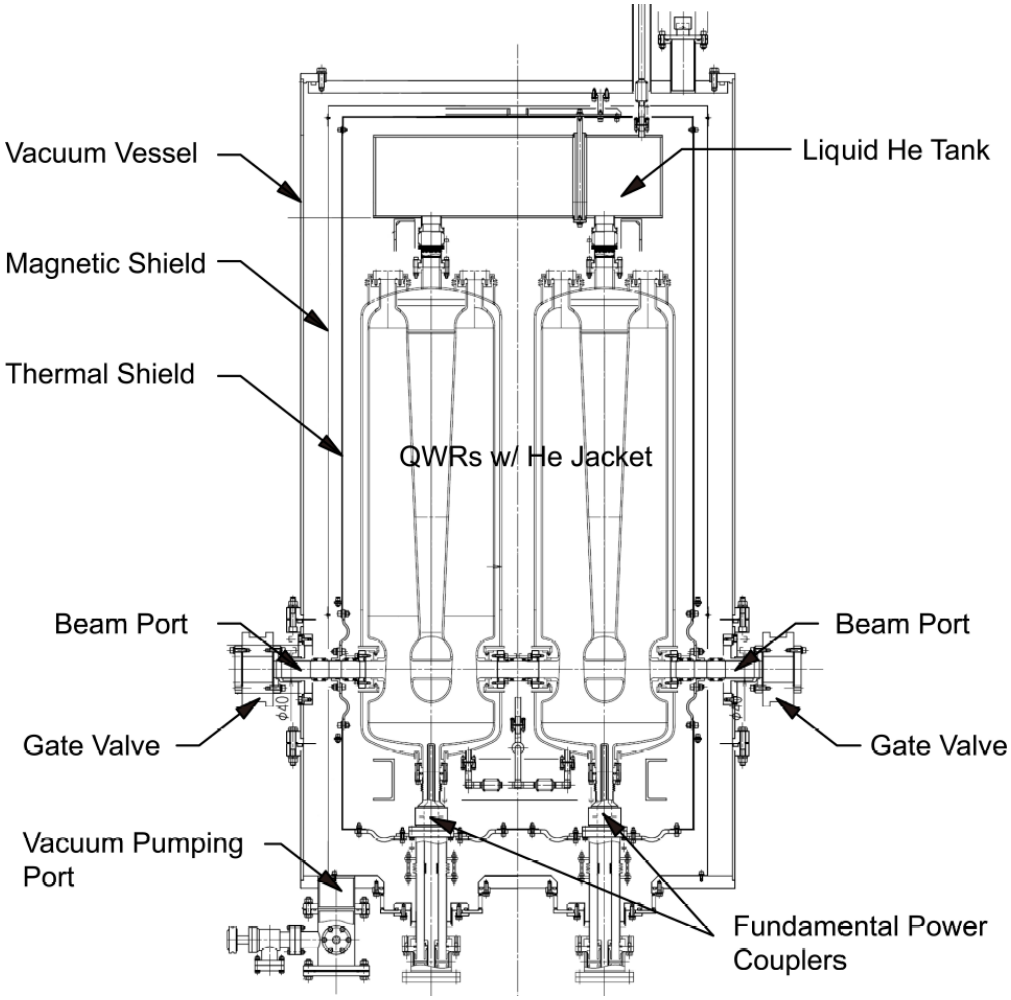
Move to cavity fabrication and design of jacket and tuner.



N. Sakamoto et. al., WEBA06, SRF2015

4. Summary

✓Through the experience of cavity fabrication for TESLA type and STF, we found the better structure and procedure for mass production.

✓ Most important thing to succeed the project in a short term is to discuss about total design with industries and researcher from planning phase.

Thank you for your attention!

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