# Plan for repairs and safety improvements

September 25, 2013

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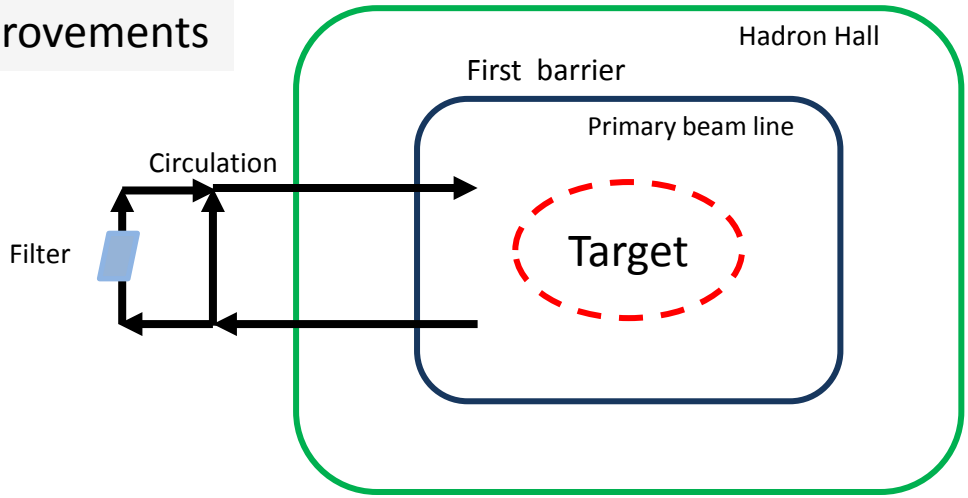
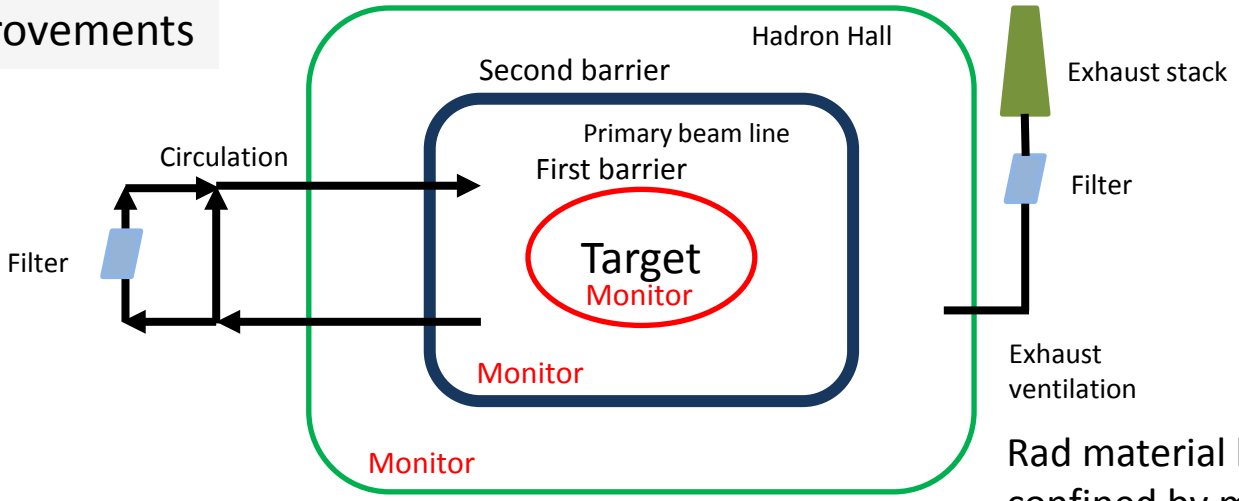
# Concept of the improvements

Before the improvements




After the improvements




Rad material has to be confined by multiple barriers.

# List of items of safety improvements

Endorsed by external committees (the External Expert Panel, NRA, a prefectural committee)

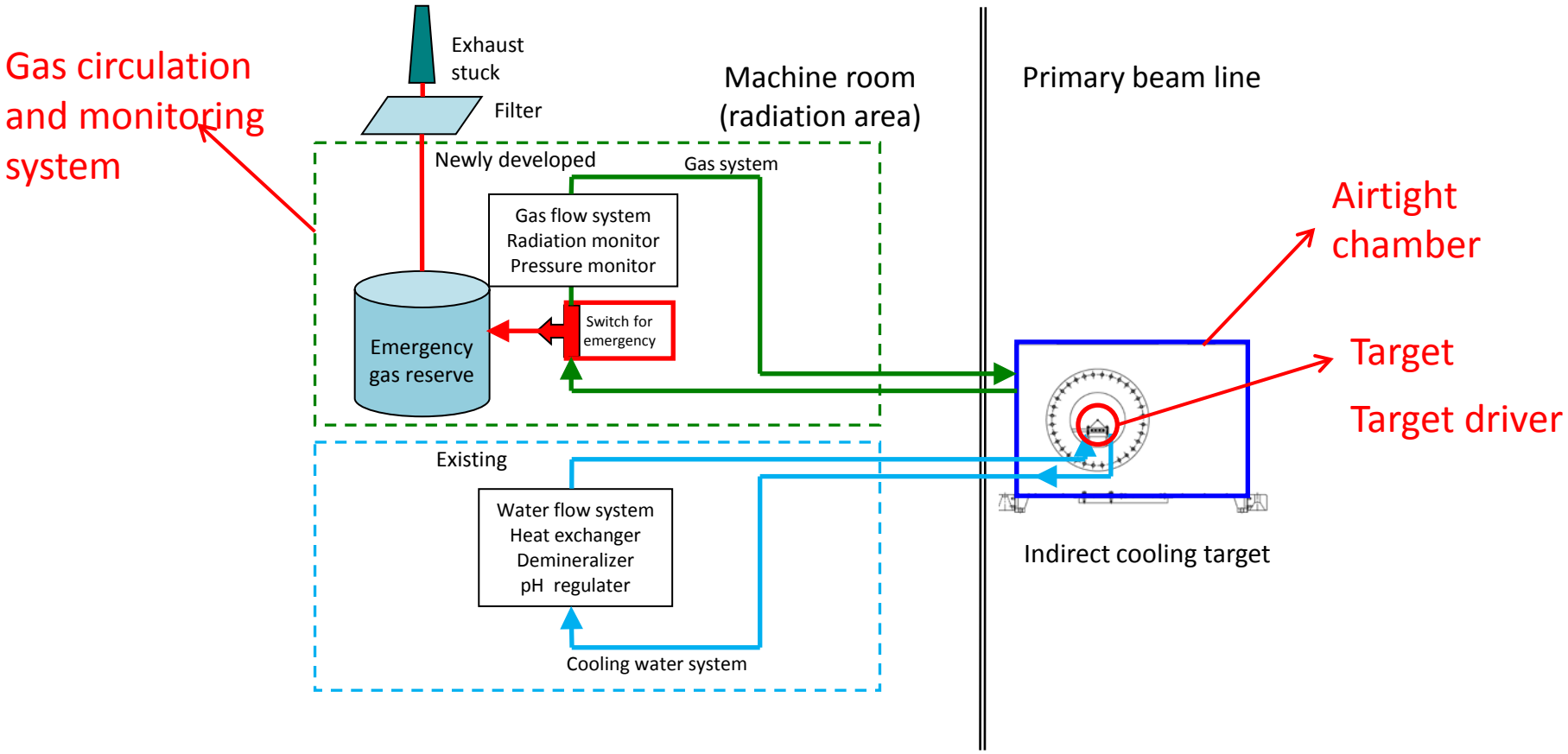
- Target system：
  - Building an airtight target chamber
  - Building a gas circulation system and its monitor system
  - Improving the target monitor system
  - Target displacement during accelerator commissioning（target driver）
- Primary beam line：
  - Improving airtightness of the upper shielding
  - Improving airtightness of the exits to secondary beam lines
  - Improving airtightness of the cable passthroughs
  - Building radiation monitoring
- Hadron Hall：
  - Constructing controlled exhaust system
  - Contamination check at the gateways
  - Improving radiation monitoring
- Common recognition of radiation-related information

  Improving the whole radiation monitoring and information sharing system

# Target System

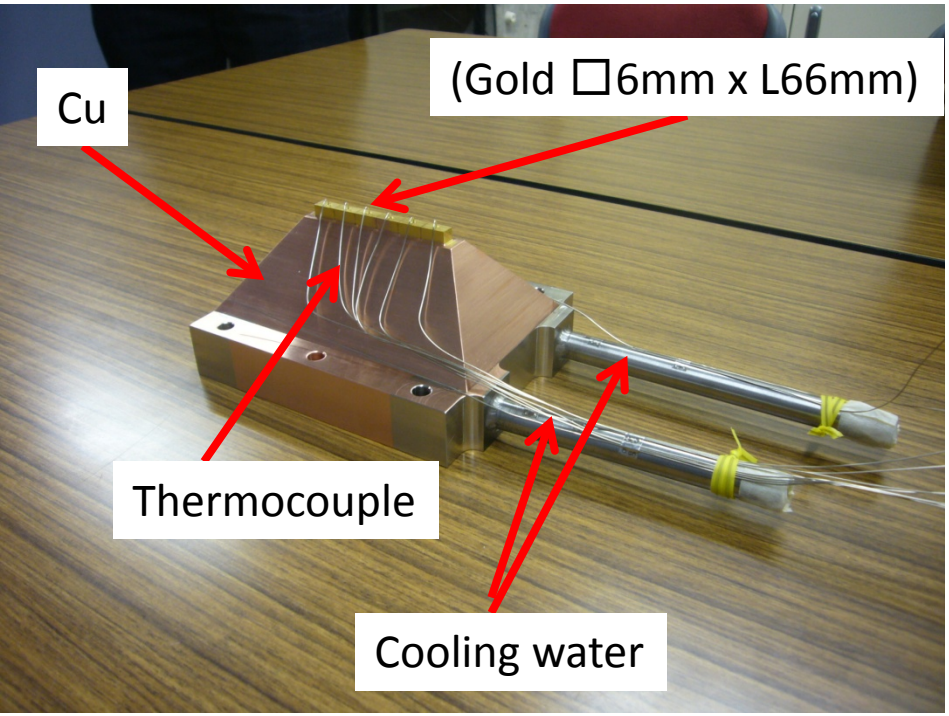
- Building an airtight target chamber
- Building a gas circulation system and its monitor system
- Improving the target monitor system
- Target displacement during accelerator commissioning（target driver）

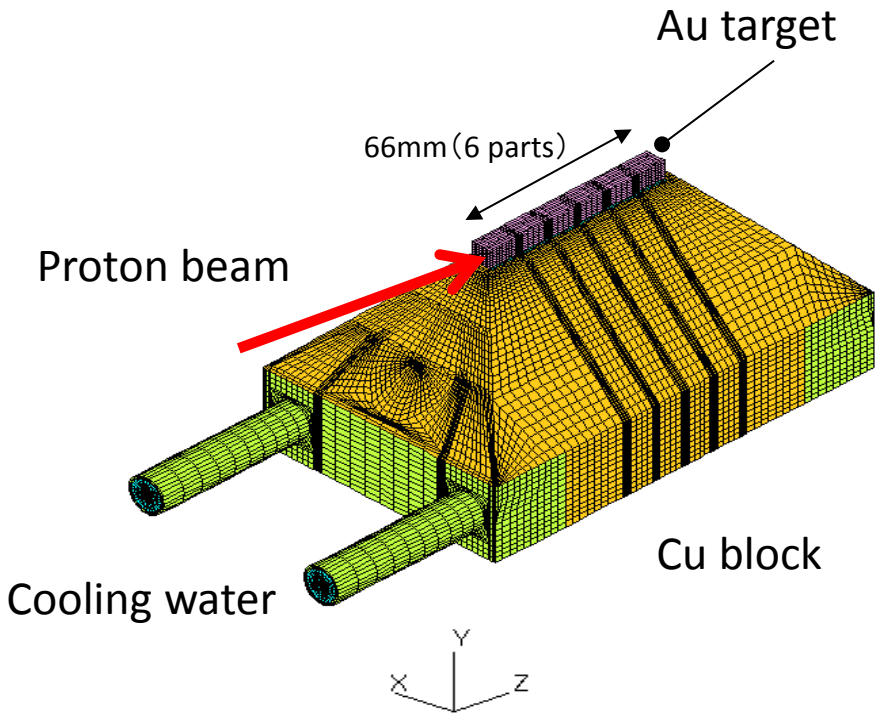
# Scheme


Gas circulation and monitoring system
Exhaust stuck
Filter
Machine room (radiation area)
Primary beam line
Newly developed
Gas system
Gas flow system
Radiation monitor
Pressure monitor
Switch for emergency
Emergency gas reserve
Airtight chamber
Target
Target driver
Existing
Water flow system
Heat exchanger
Demineralizer
pH regulater
Cooling water system
Indirect cooling target

# Target

Present gold target




Issues to be studied：

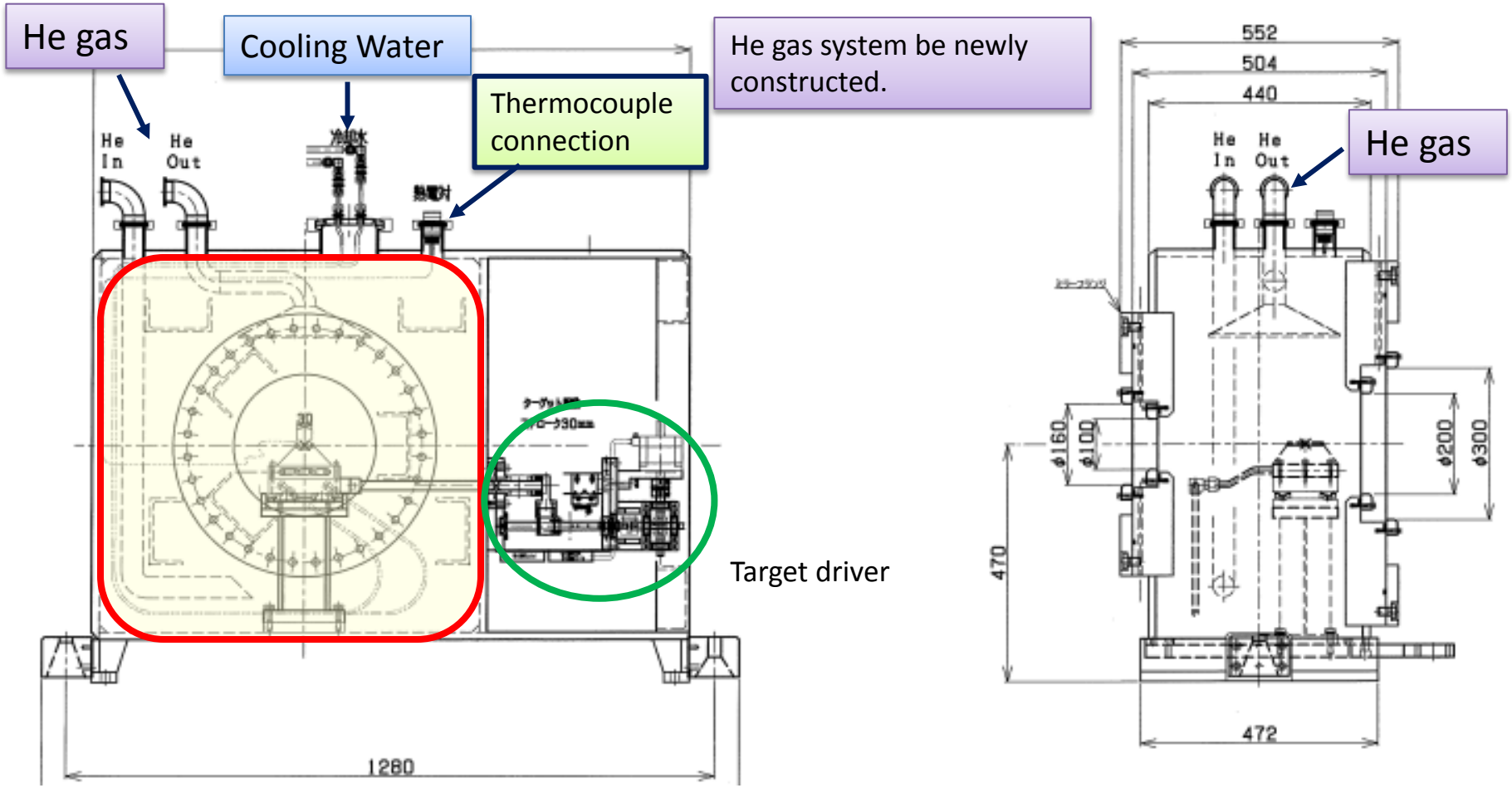
1. Material (Au, Pt, W, …)
2. Shape and position of the cooling water pipes

→ Appropriate beam power should be determined according to calculation of thermal stress

# Plan

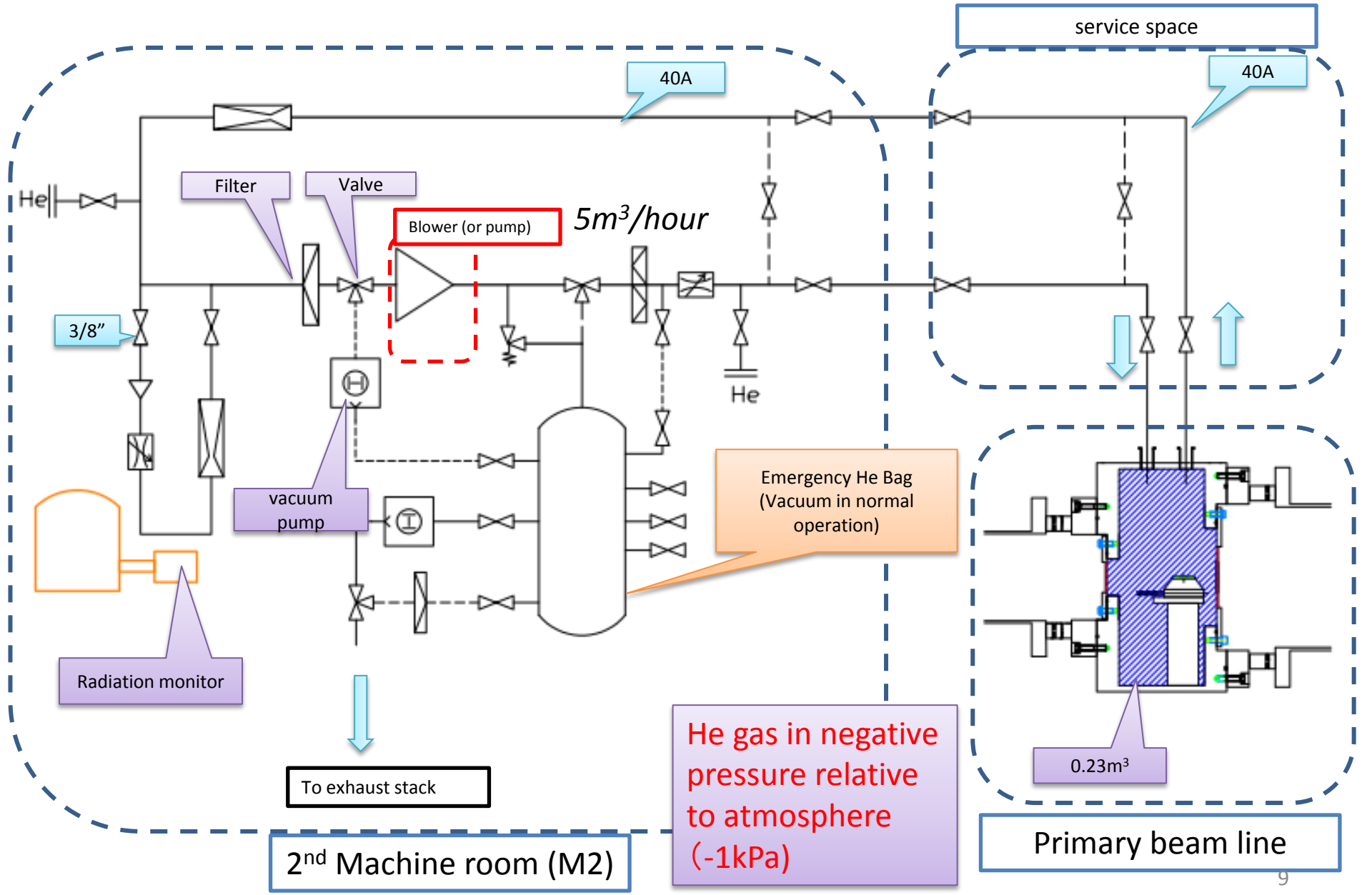
- Details of the new target will be fixed in the near future.
  - Target material
  - Detailed shape
  - Upper limit of the beam power
- Future
  - Present type of the target (indirect water cooling) will be replaced by a more robust target (direct water cooling assumed).
  - R&D is necessary for a more robust target and we expect it will be available around 2016.

# Target chamber (under developing)

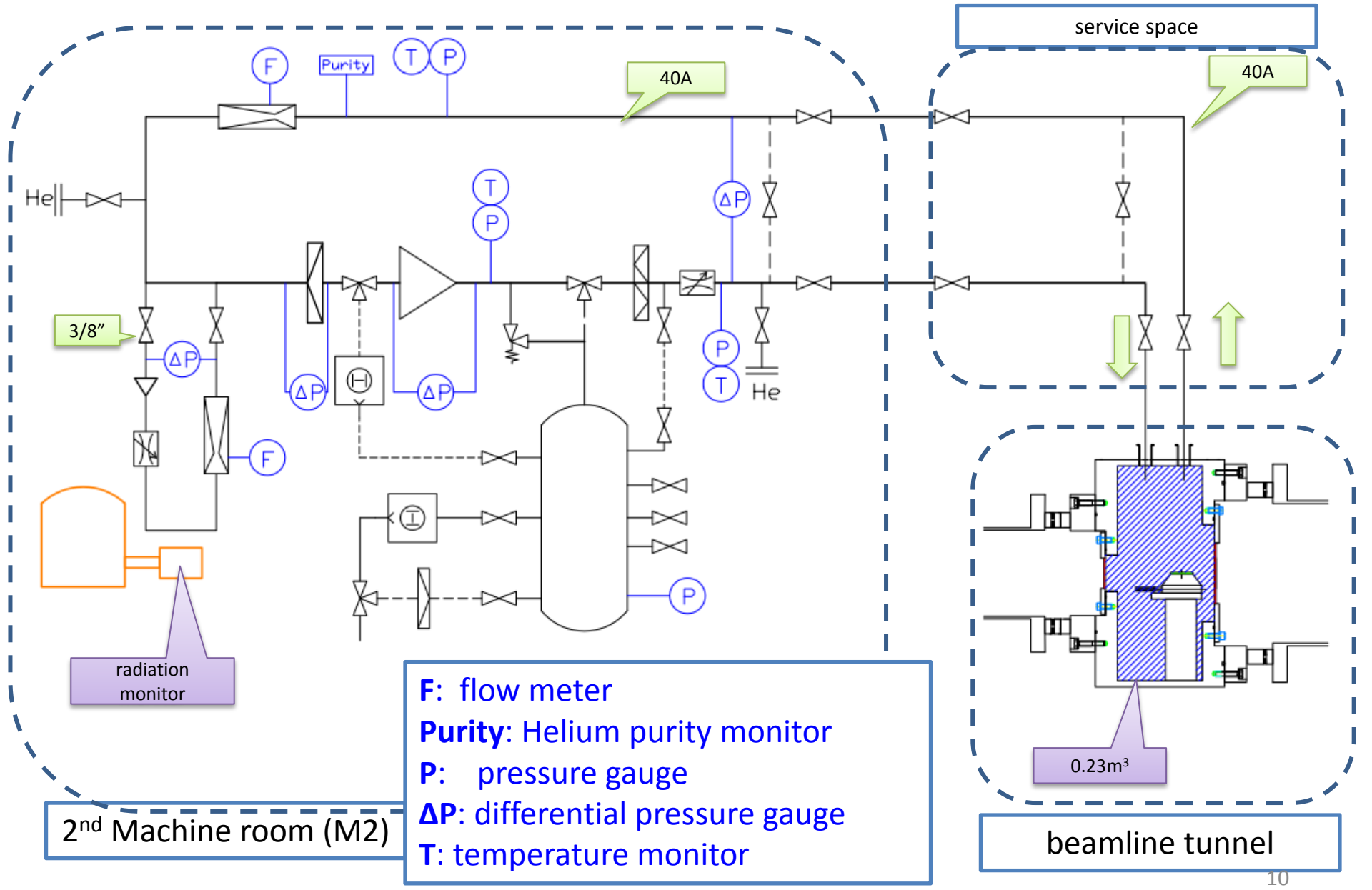



Airtightness of the chamber body is ensured by seal welding.
Airtightness of connection points for piping is secured by a metal gasket.
He leakage rate at each point is estimated as ＜1.3E-10 Pa･$m^3$/sec

# Helium circulation system



# Gas monitors




**F**: flow meter
**Purity**: Helium purity monitor
**P**: pressure gauge
**ΔP**: differential pressure gauge
**T**: temperature monitor

2nd Machine room (M2)

beamline tunnel

# Primary beam line

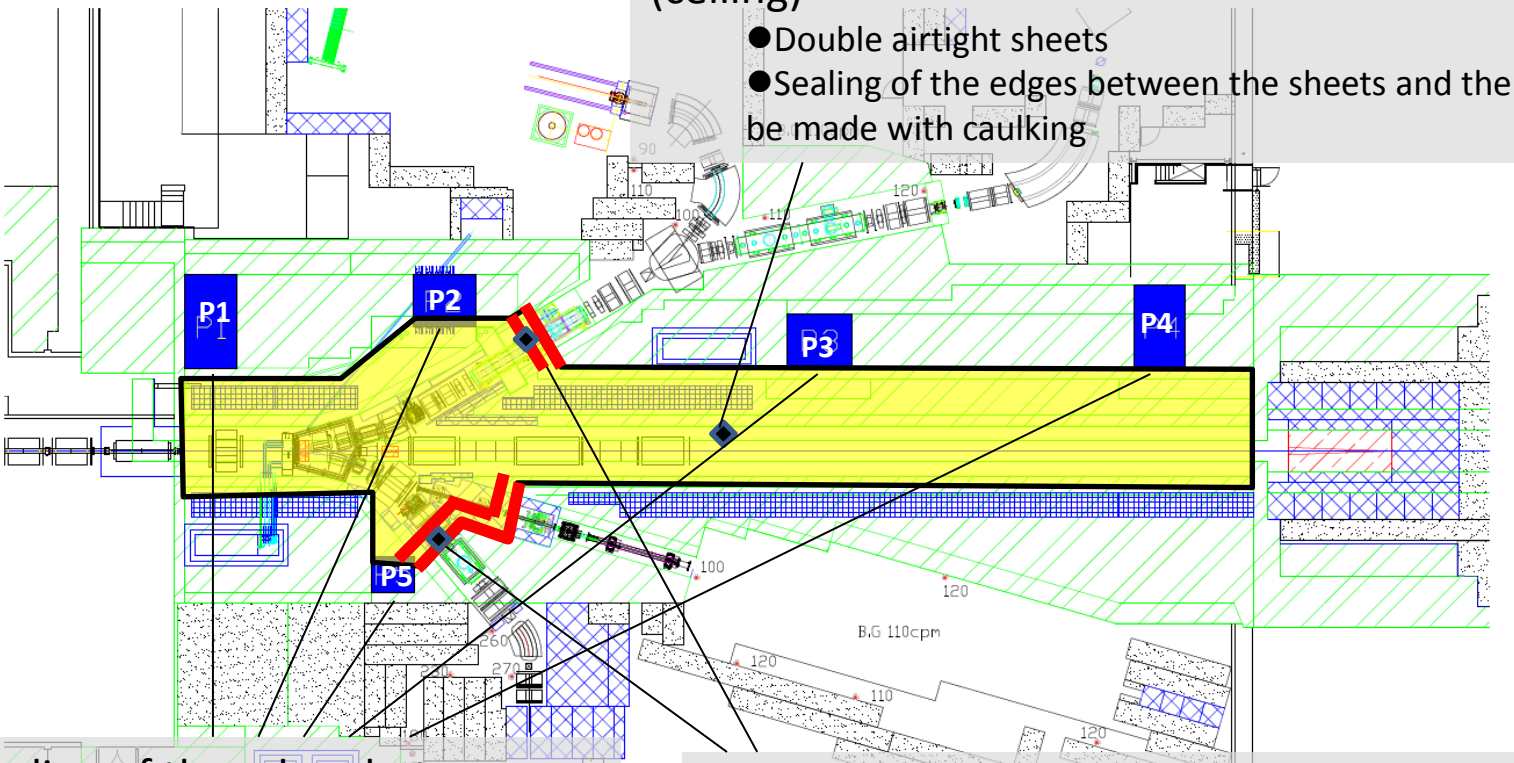
- Improving airtightness of the upper shielding
- Improving airtightness of the exits to secondary beam lines
- Improving airtightness of the cable passthroughs
- Building radiation monitoring

# Scheme

- Hadron Hall

◆Improving airtightness of the upper shielding (ceiling)

- ●Double airtight sheets
- ●Sealing of the edges between the sheets and the walls be made with caulking




◆Sealing of the edges between the sheets and the walls be made with caulking

- ●Strengthening seals of gaps and cable exits

◆Improving airtightness of the exits to secondary beam lines

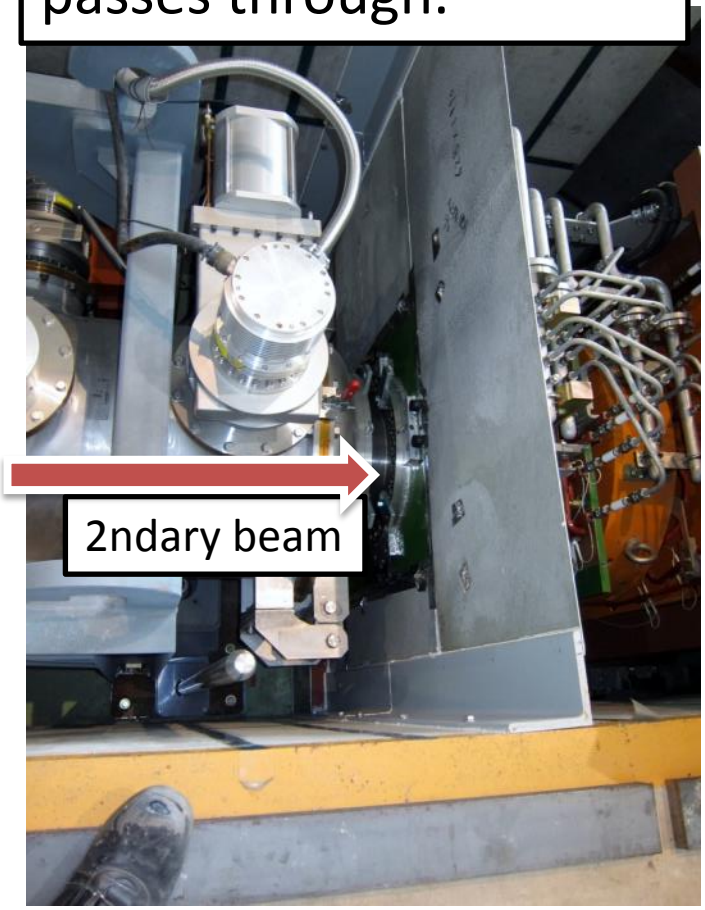
- ●Double air-partitions
- ●Sealing of the edges with caulking

# (mostly single-layered) Air sealing as of today.

The ceiling of the primary beam line as of today

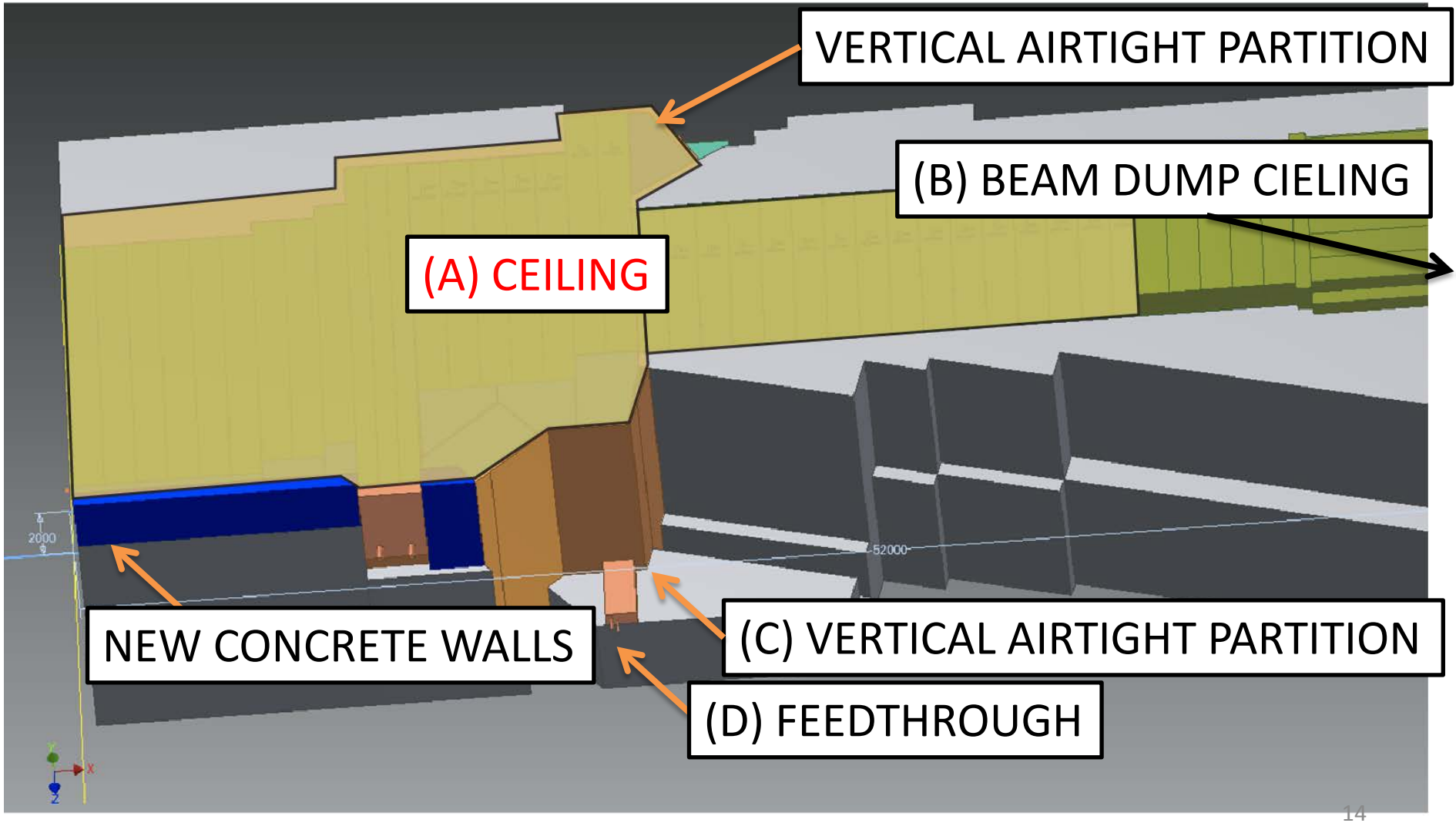
Primary proton beam

Single-layered airtight partition where 2ndary beam line passes through.



2ndary beam

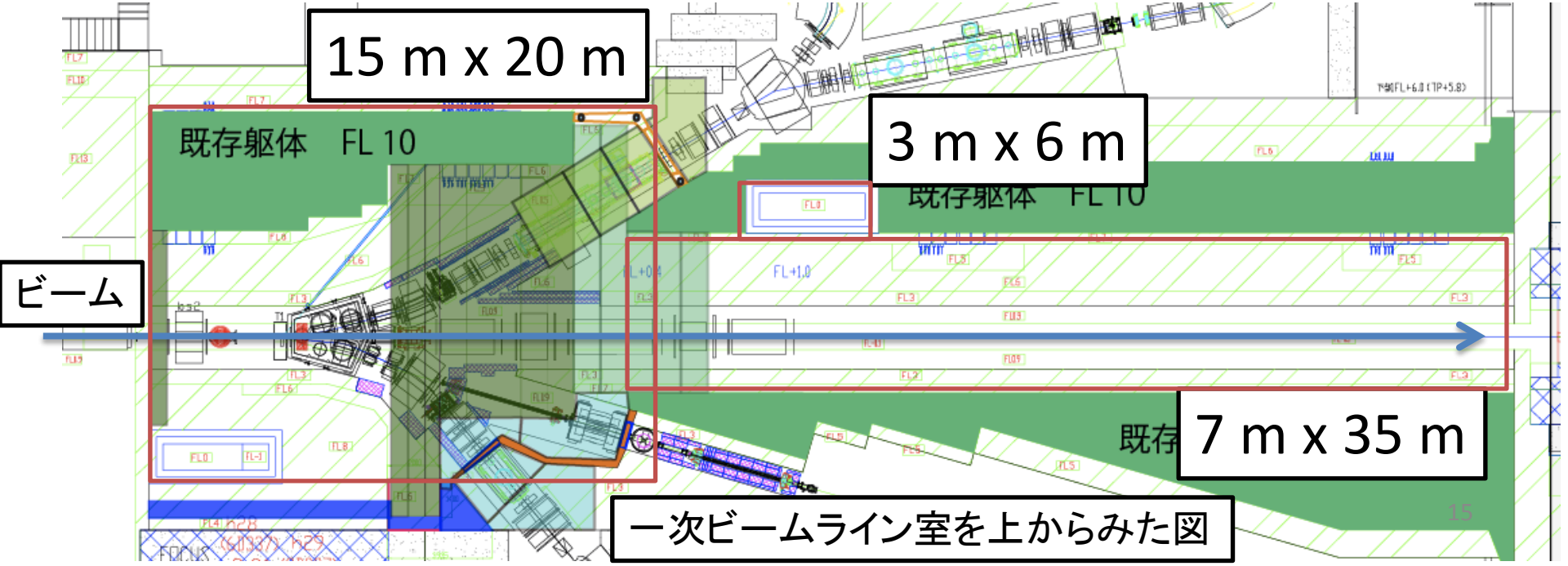
We double the airtight layers
to improve the air sealing of the primary beam line area.


VERTICAL AIRTIGHT PARTITION
(B) BEAM DUMP CIELING
(A) CEILING
NEW CONCRETE WALLS
(C) VERTICAL AIRTIGHT PARTITION
(D) FEEDTHROUGH
2000
52000

# Gas Barrier Sheets


EVAL (a kuraray product)

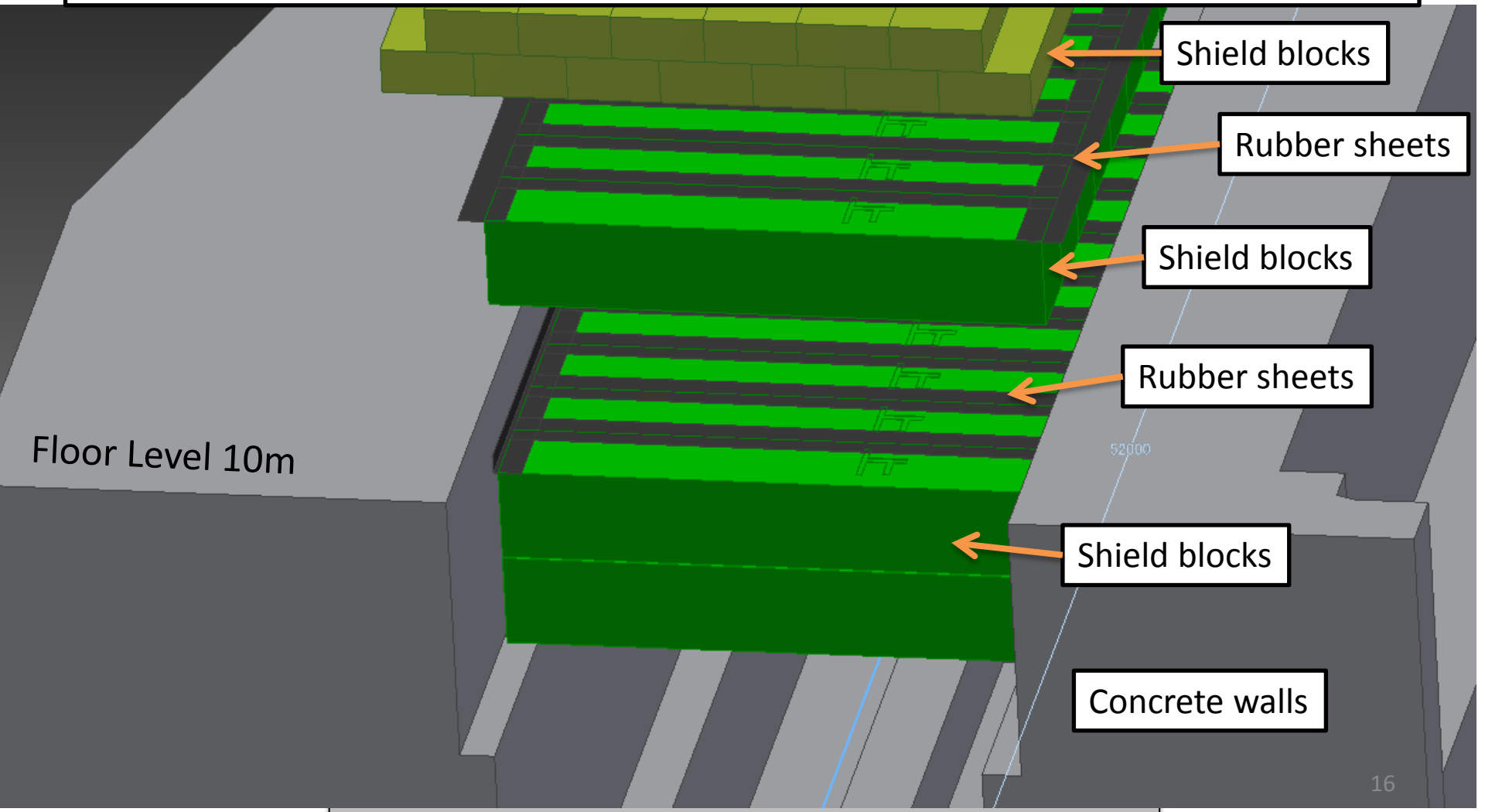
- Superior Gas barrier property
- Can produce quite large sheets.
- We can minimize the number of joints which are the primary causes of air leak.




一次ビームライン室を上からみた図

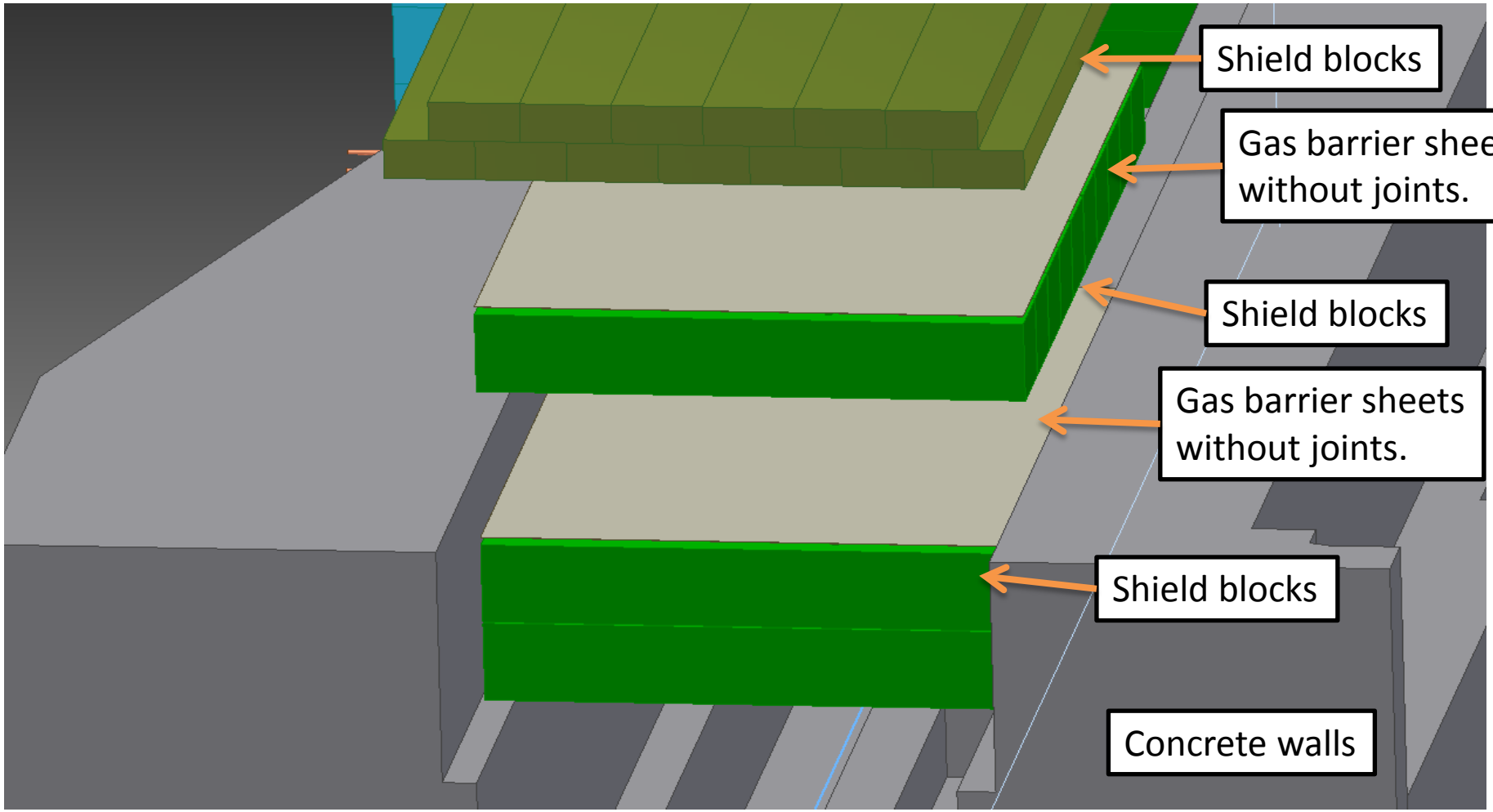
# CIELING (as of today)

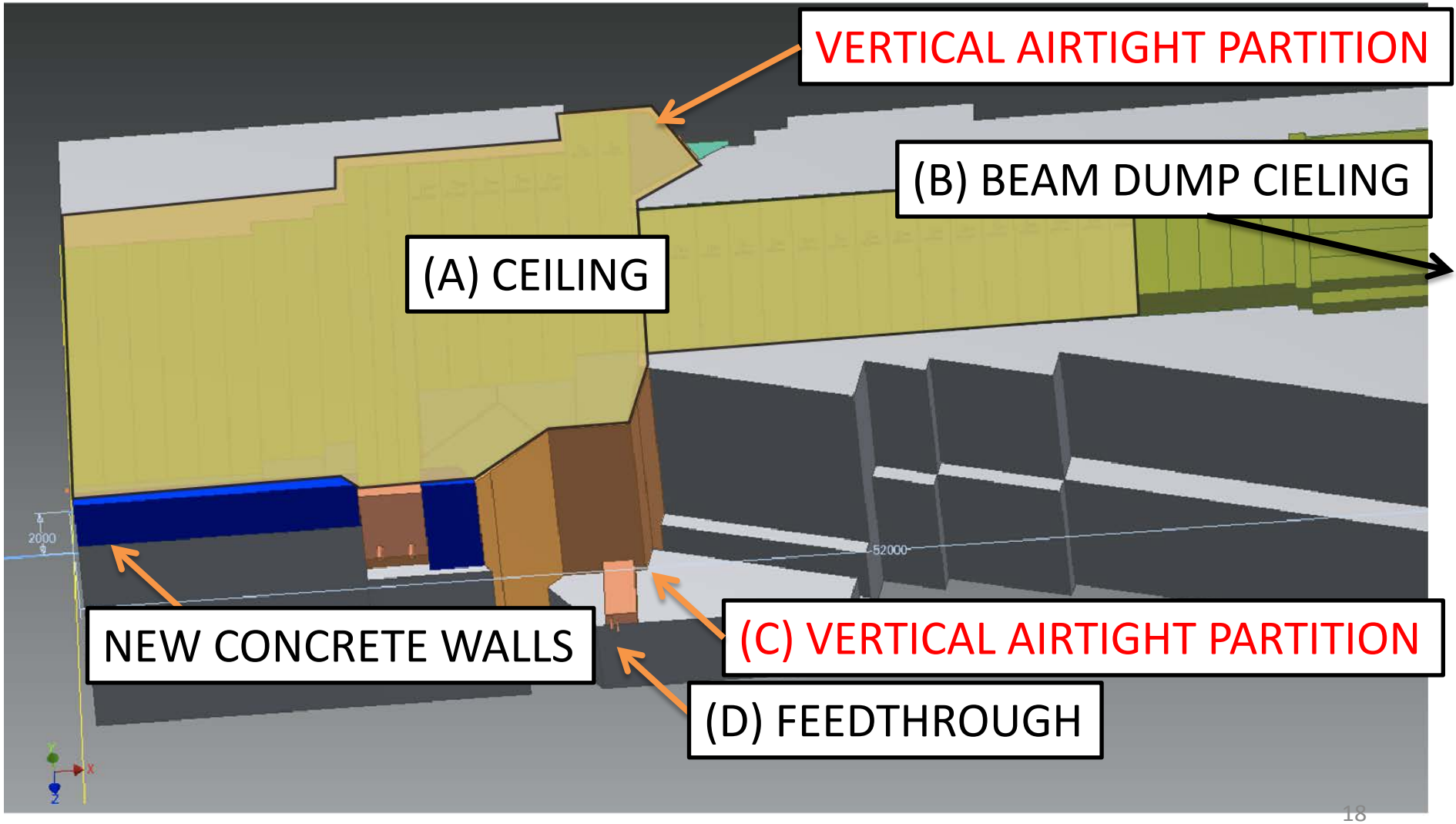
Place rubber sheets along with the edges of the shield blocks.
→ Too many joints.



# CEILING after safety improvements

Cover it with a large sheet → the number of joints is minimum

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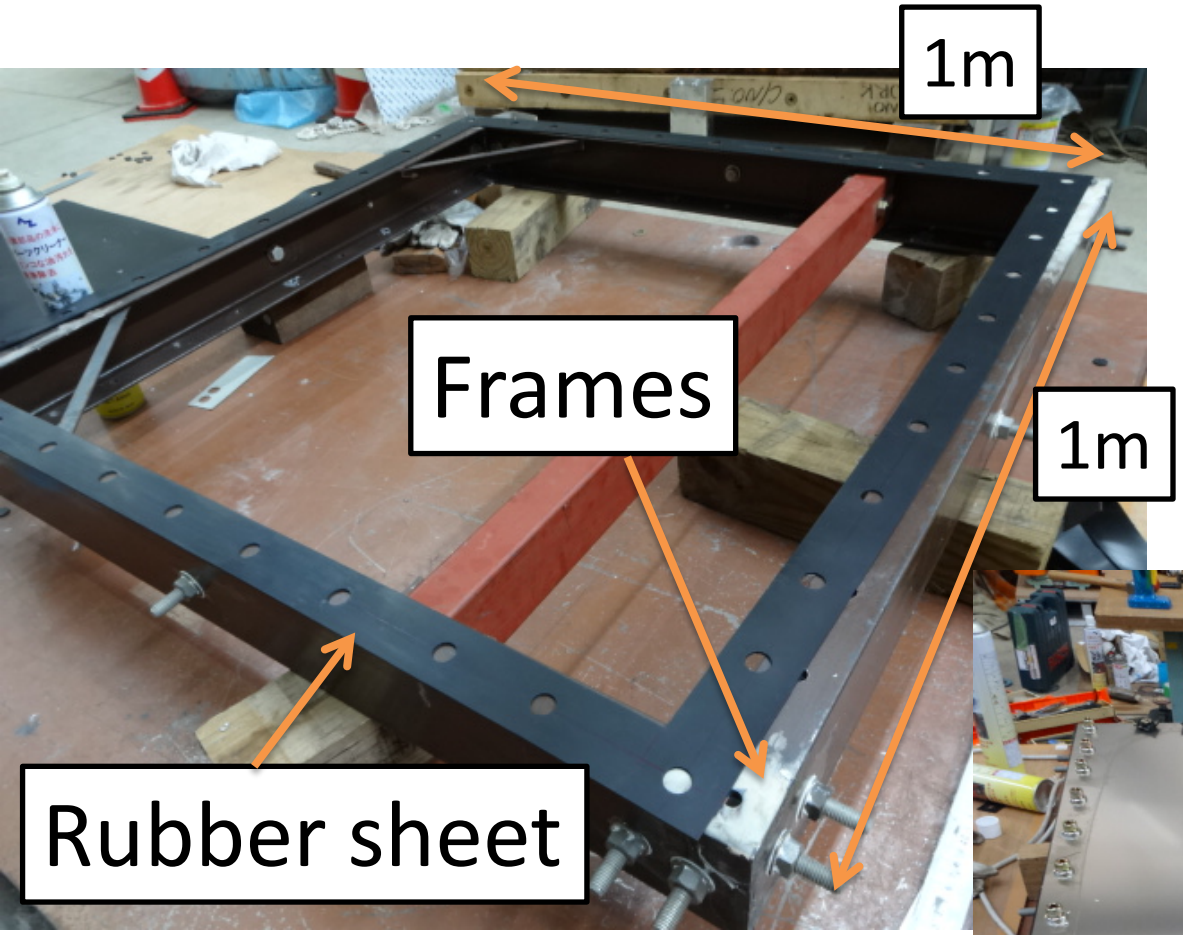
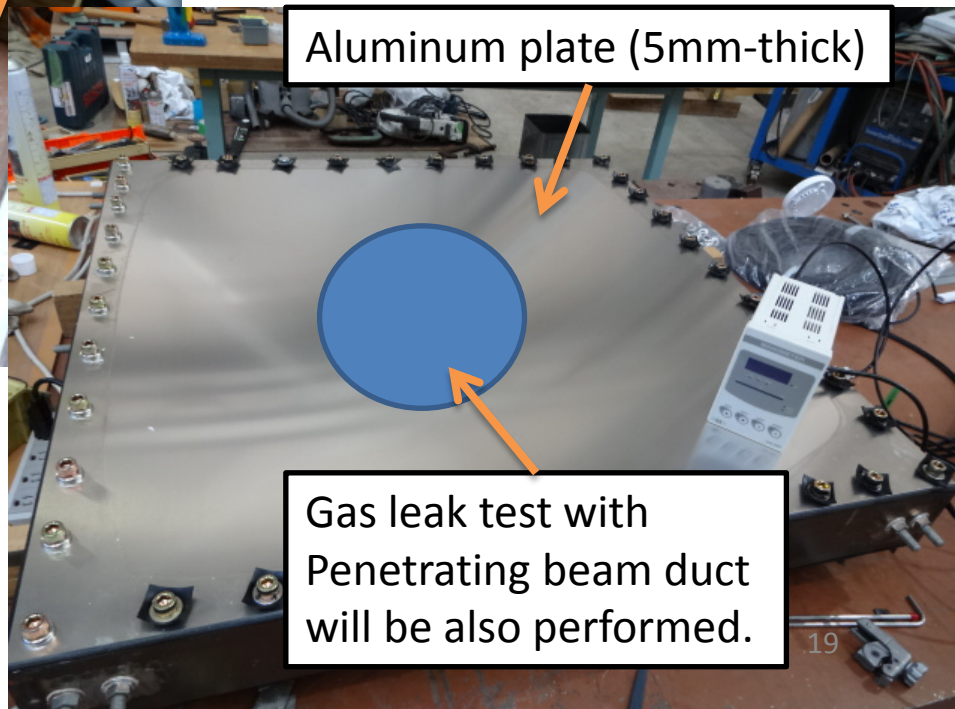
# Prototype of airtight partition

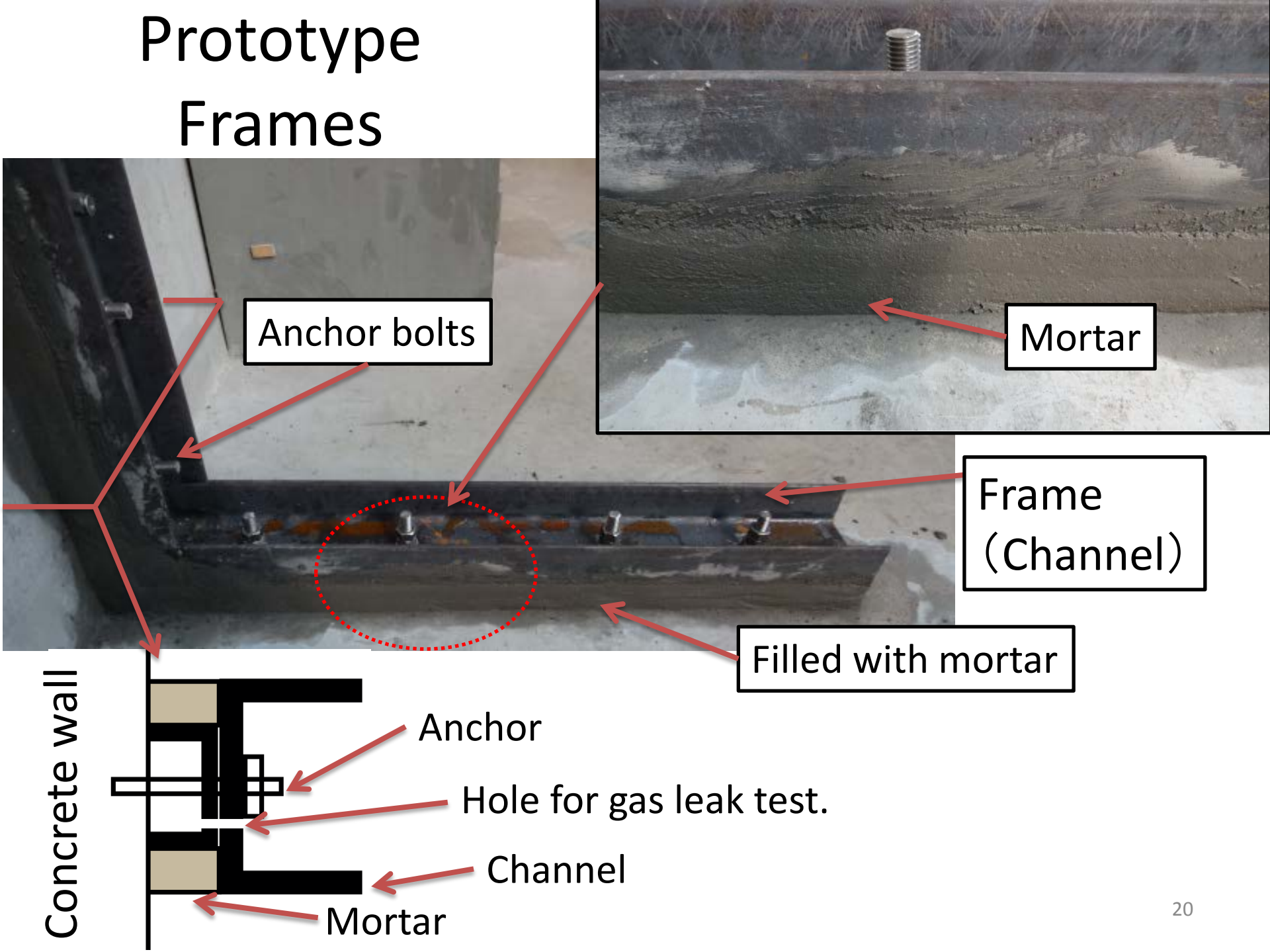


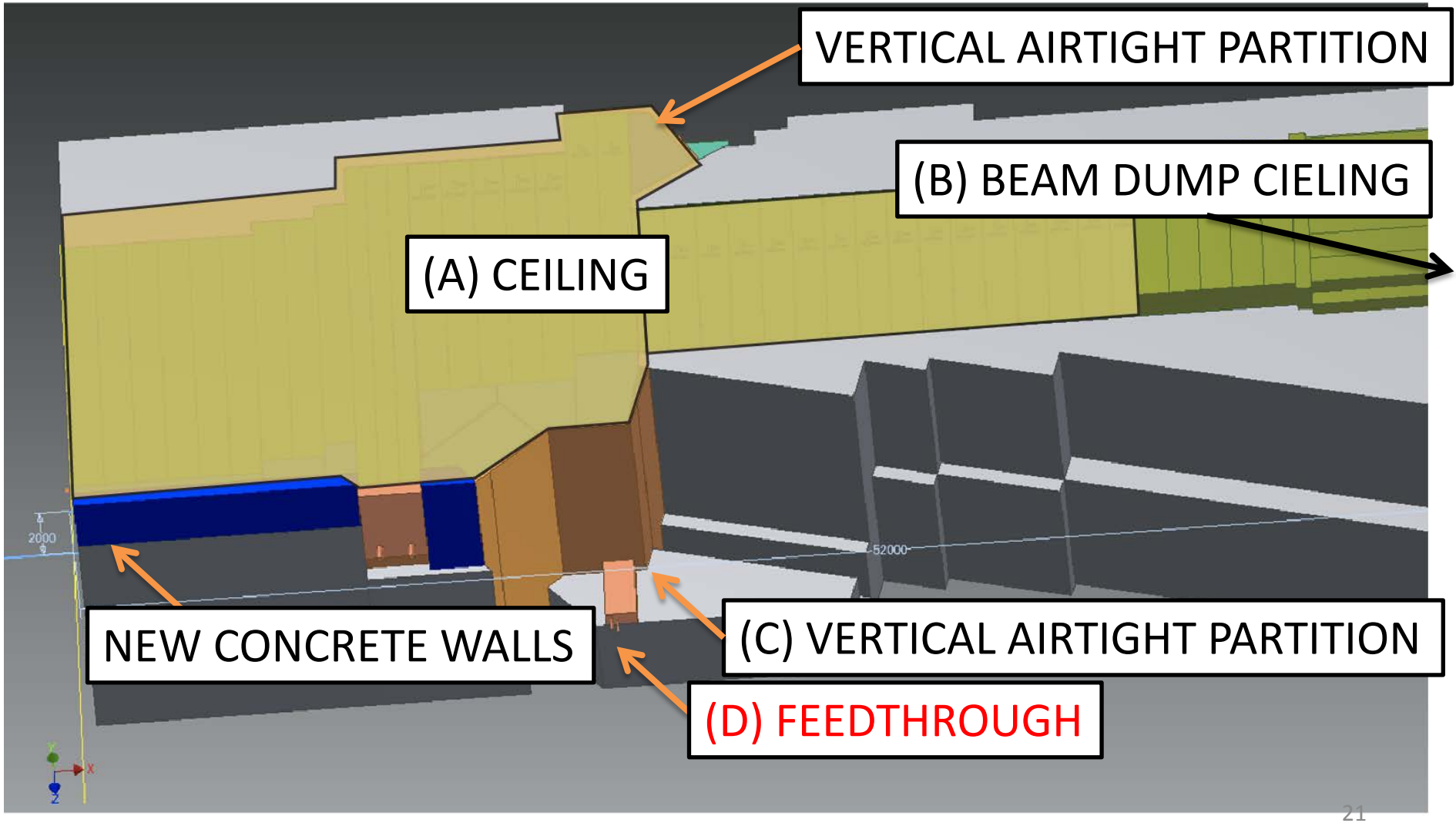

Gas leak test being performed independently from the joints between the frames and the walls.

- Quantitative Gas leak test being performed.



# Prototype Frames

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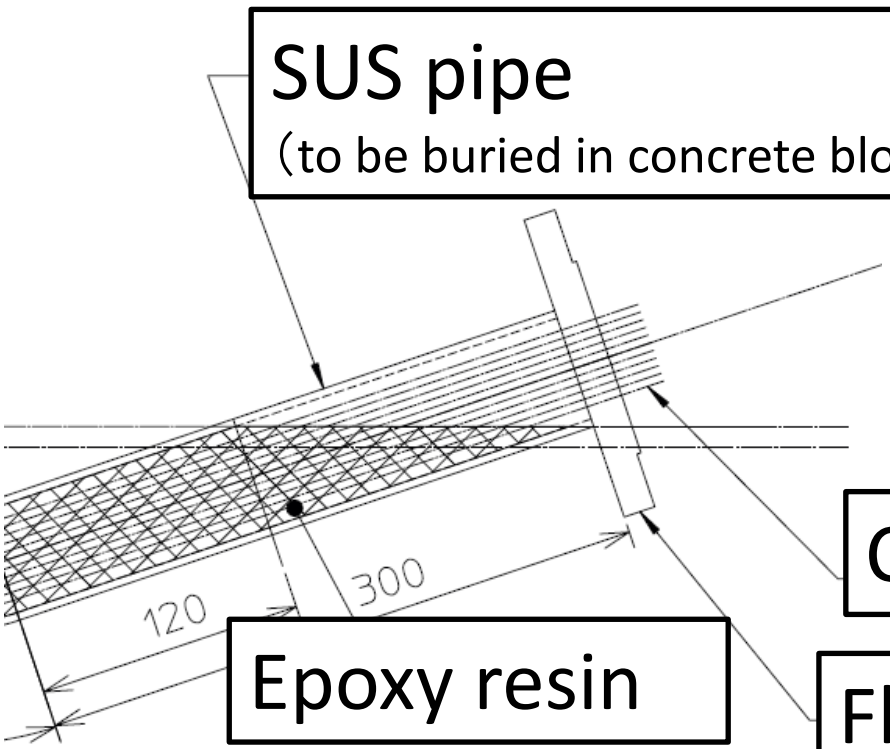
2000
52000

# Safety improvements of FEEDTHROUGH

- Safety improvements of FEEDTHROUGH
  - SUS pipe buried in concrete block.
  - Cables pass through the SUS pipe.
    - Filled with epoxy resin.
  - Patch panel.

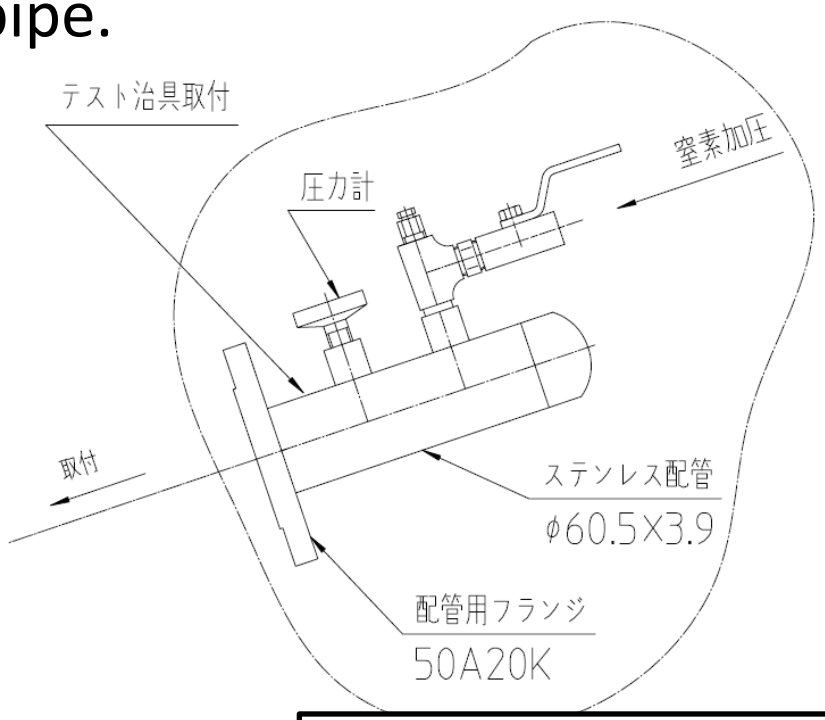



SUS pipe
(to be buried in concrete block)

Epoxy resin

Cables

Flange




Jig for
gas leak test.

# Gas leak test

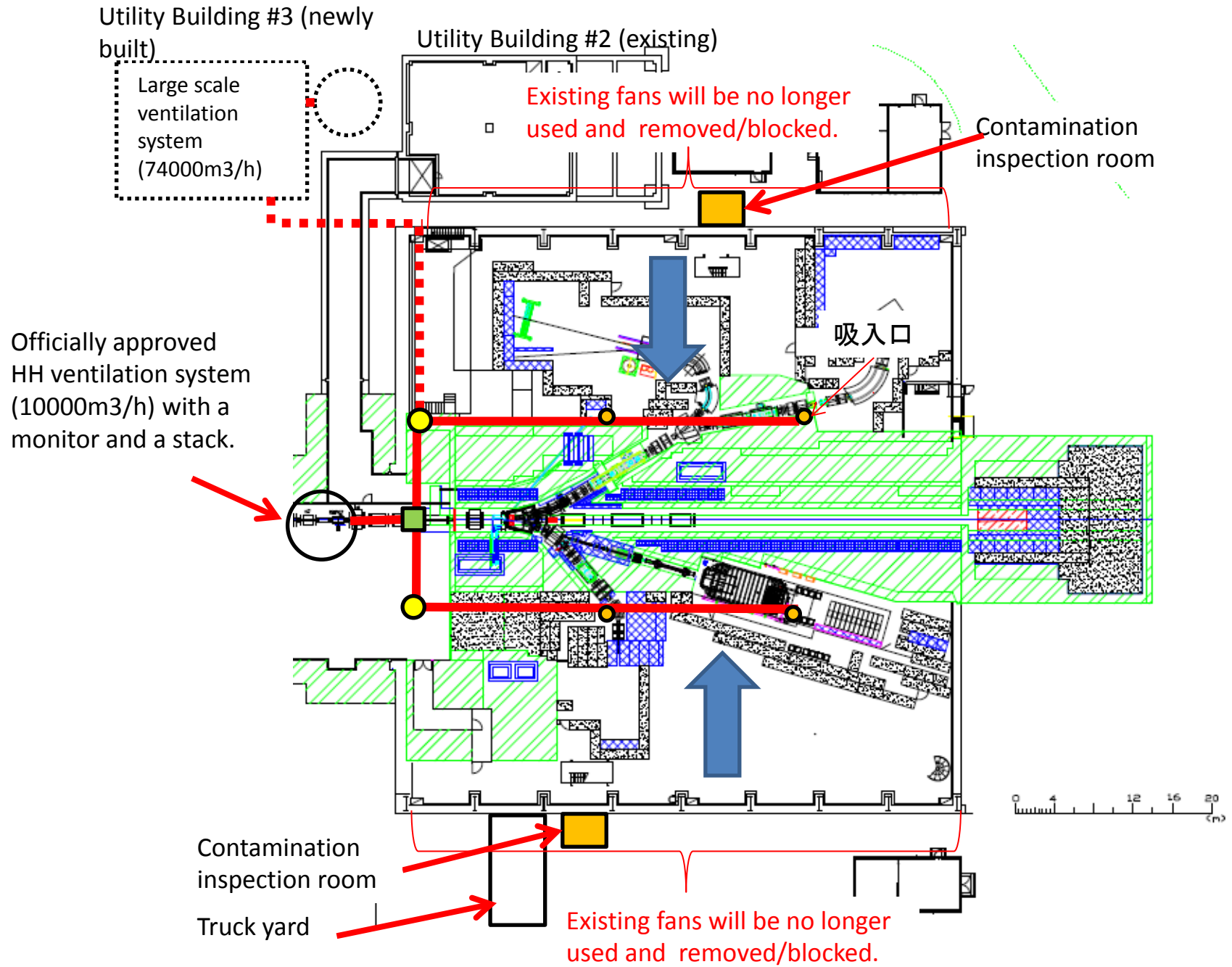
- Gas leak test
  - Pressurize or depressurize a test component, close its valve, and observe the pressure change.
  - Depressurize the test component, blow smoke from outside, and search for  places where smoke is inhaled.

- Gas leak test policy
  - Component test
    - Components are confirmed to be airtight before installation as far as possible.
  - Test after install.
    - After installation, the primary beam line area is depressurized and confirmed to be airtight using smoke.

# Hadron Hall

- Constructing controlled exhaust system
- Contamination check at the gateways
- Improving radiation monitoring

# Hadron Hall


Utility Building #3 (newly built)
Large scale ventilation system (74000m3/h)
Utility Building #2 (existing)
Existing fans will be no longer used and removed/blocked.
Contamination inspection room
吸入口
Officially approved HH ventilation system (10000m3/h) with a monitor and a stack.
Contamination inspection room
Truck yard
Existing fans will be no longer used and removed/blocked.

# Improvements of Monitor and Control System

| 大項目 | 中項目 | 小項目 |
|---|---|---|
| Monitor and Control | Target temp. monitor | Faster read-out system of target temperature |
| | | Temperature measurement synchronized with beams |
| | Spill monitor | Collection of signal shape from an air ion chamber |
| | | MPS with spill monitor |
| | He gas system | Measurement and recording of temp, pressure, humidity etc. |
| | | Remote control of He circulation system |
| | Interlock with 2ndary particles | MPS with no. of 2ndary particles produced |
| | Vacuum system | MPS with vacuum information |
| | | Remote control of valves |
| | Warning and alarm system | Use of EPICS alarm handler |

# Milestones

| Date | | Item | Comment |
|---|---|---|---|
| 2013 | Beginning of Oct. | Bidding procedure starts | |
| | Beginning of Oct. | Review committee | Intnat'l review |
| | Beginning of Nov. | Documents to Ibaraki Pref. | (socalled Shinzousetsu) |
| | End of Nov. | Application of building design approval | To Ibaraki Pref. |
| | By Dec. | Start construction/manifactureing | |
| 2014 | Jan. | Application for rad. license | HH ventilation system |
| | ~Mar. | HH ventilation system ready | 10000m3/h |
| | ~Apr. | Start installation of new target | |
| | ~Aug. | Improvements completed | |
| | | Target installation completed | |
| | | | |

# Review committee for Hadron renovation especially on the target and related system

- Purpose
  - Review the plan of improvements of the target, the target chamber, and related equipments of the Hadron Hall and make appropriate advise to the Director of the J-PARC Center
- Date
  - **October 8 - 9**
- Place
  - Tokai
- Reviewer
  - Philip Pile （BNL)
  - John Haines （ESS）
  - Yoshiaki Kiyanagi (Hokkaido)
  - Toshiyuki Kubo (RIKEN)
  - Masatoshi Futakawa (J-PARC MLF）
  - Yukihiro Miyamoto (J-PARC Radiation Group, observer)