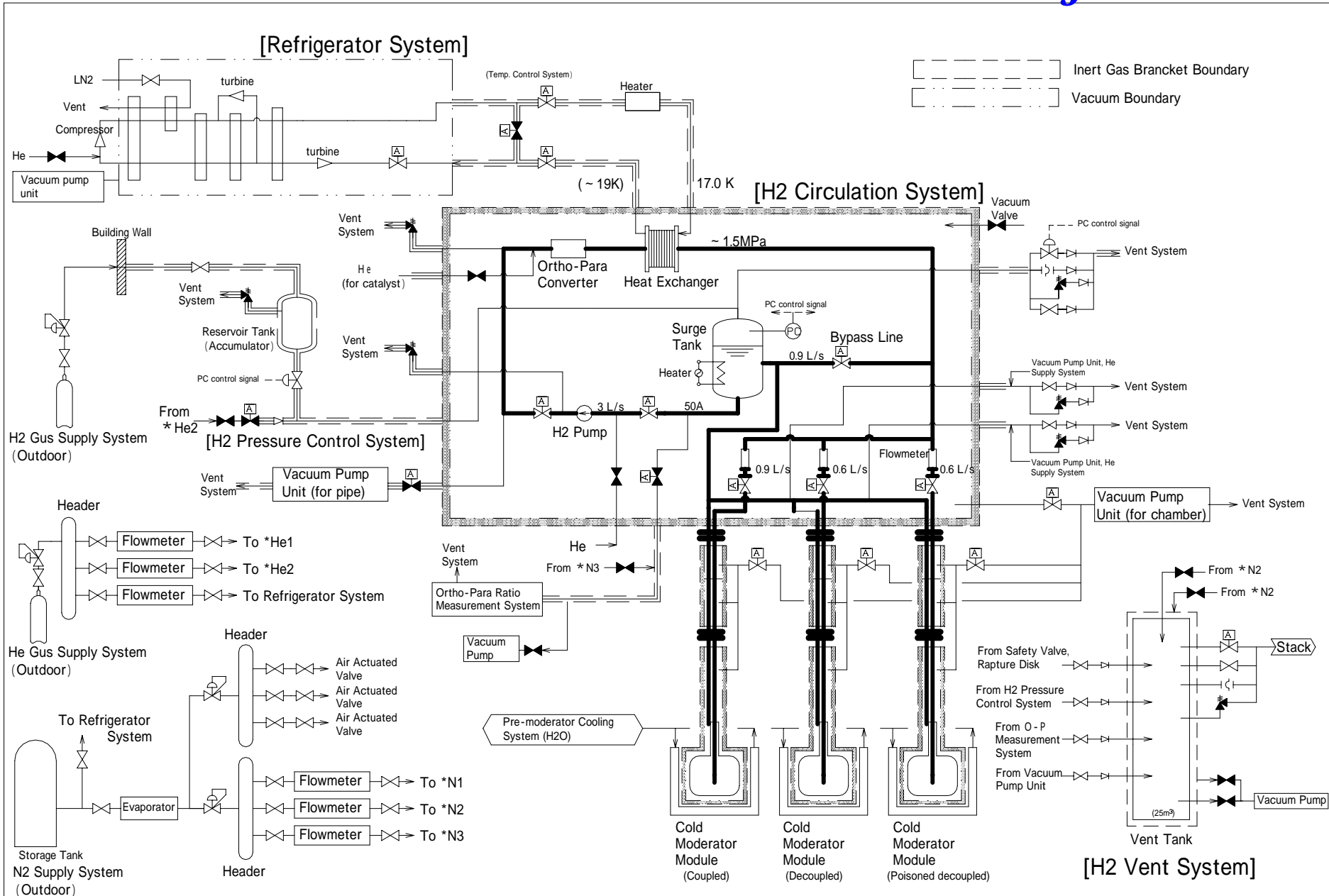


Overview of Cryogenic Loop

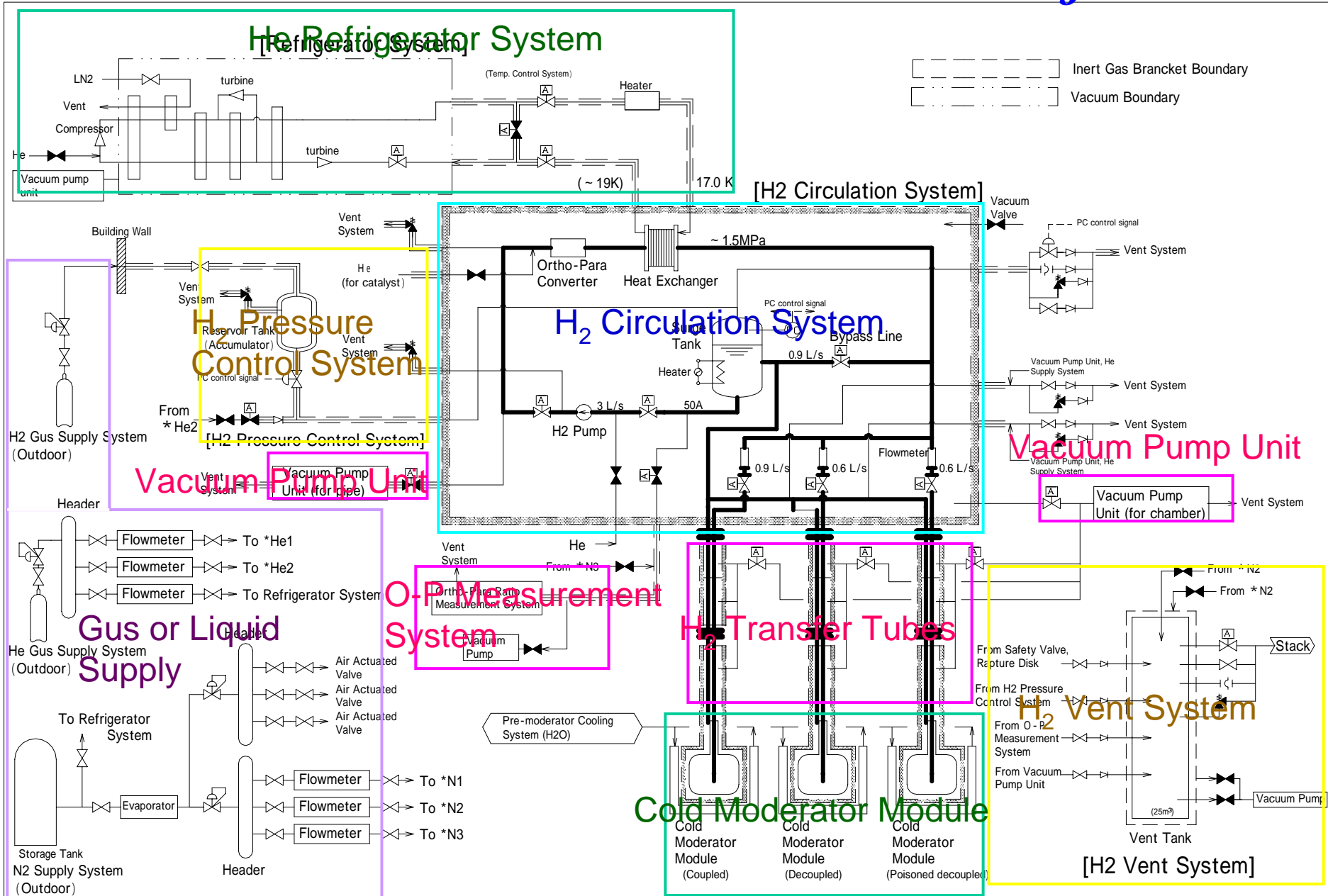
Japan Atomic Energy Research Institute (JAERI)

**Tomokazu ASO, Takashi KATO, Toshio TAKAHASHI,
Isamu USHIJIMA, Masanori KAMINAGA,
Hidetaka KINOSHITA, Yoshikatsu TORII, Ryutaro HINO**

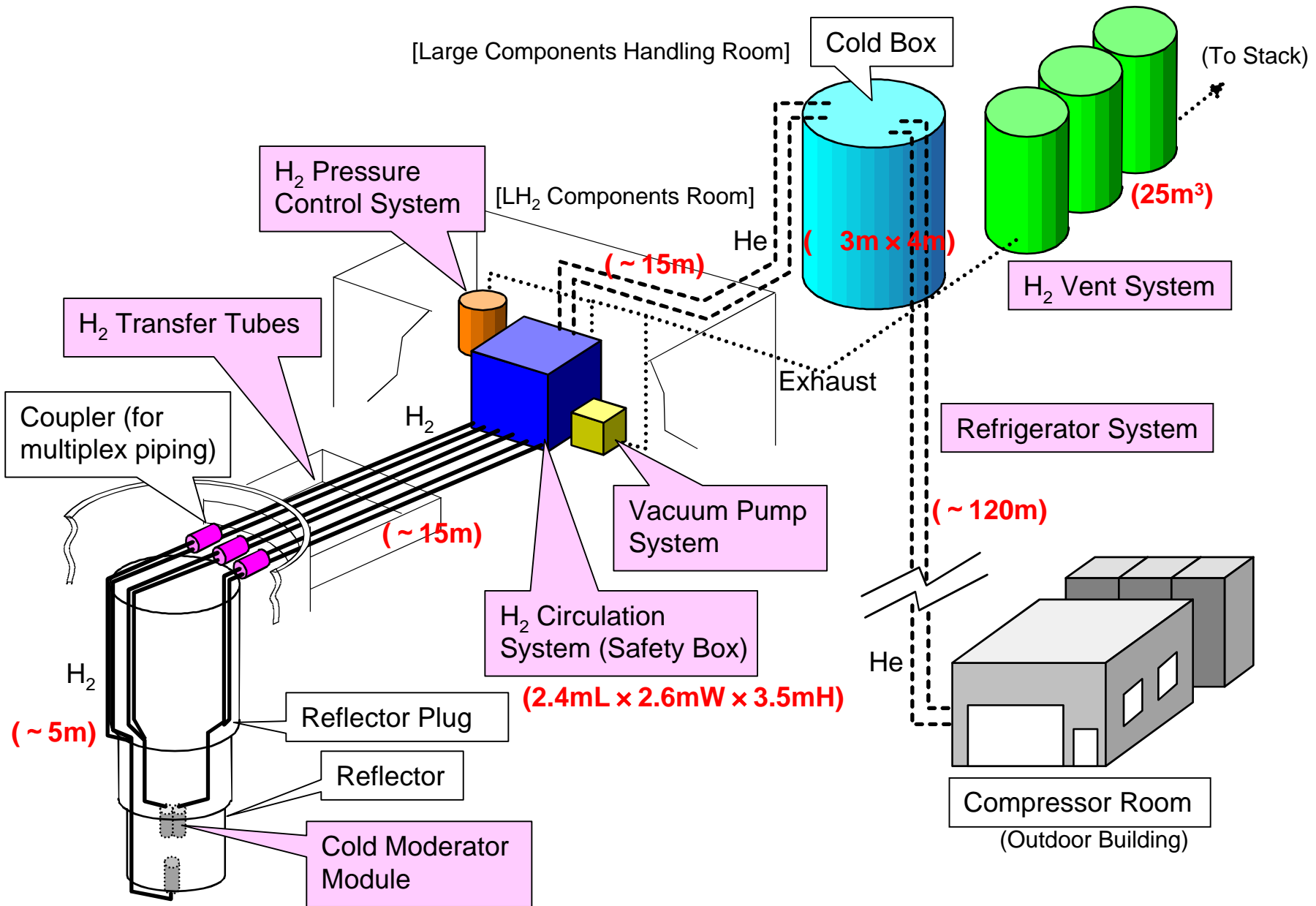
Flow Diagram of Cryogenic System



Flow Diagram of Cryogenic System

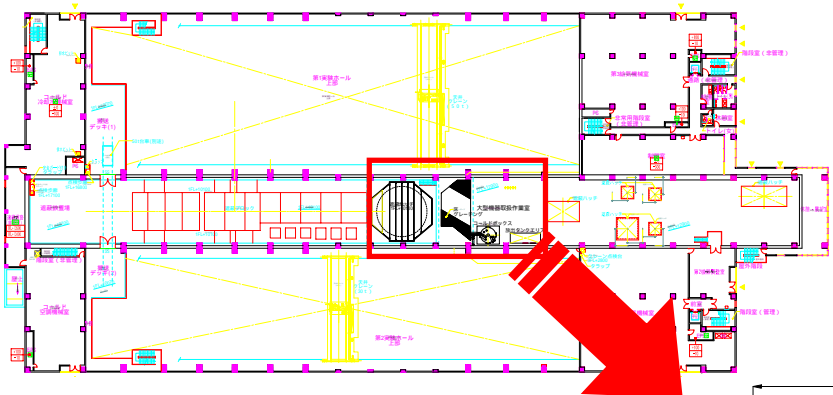


Outline of Cryogenic System

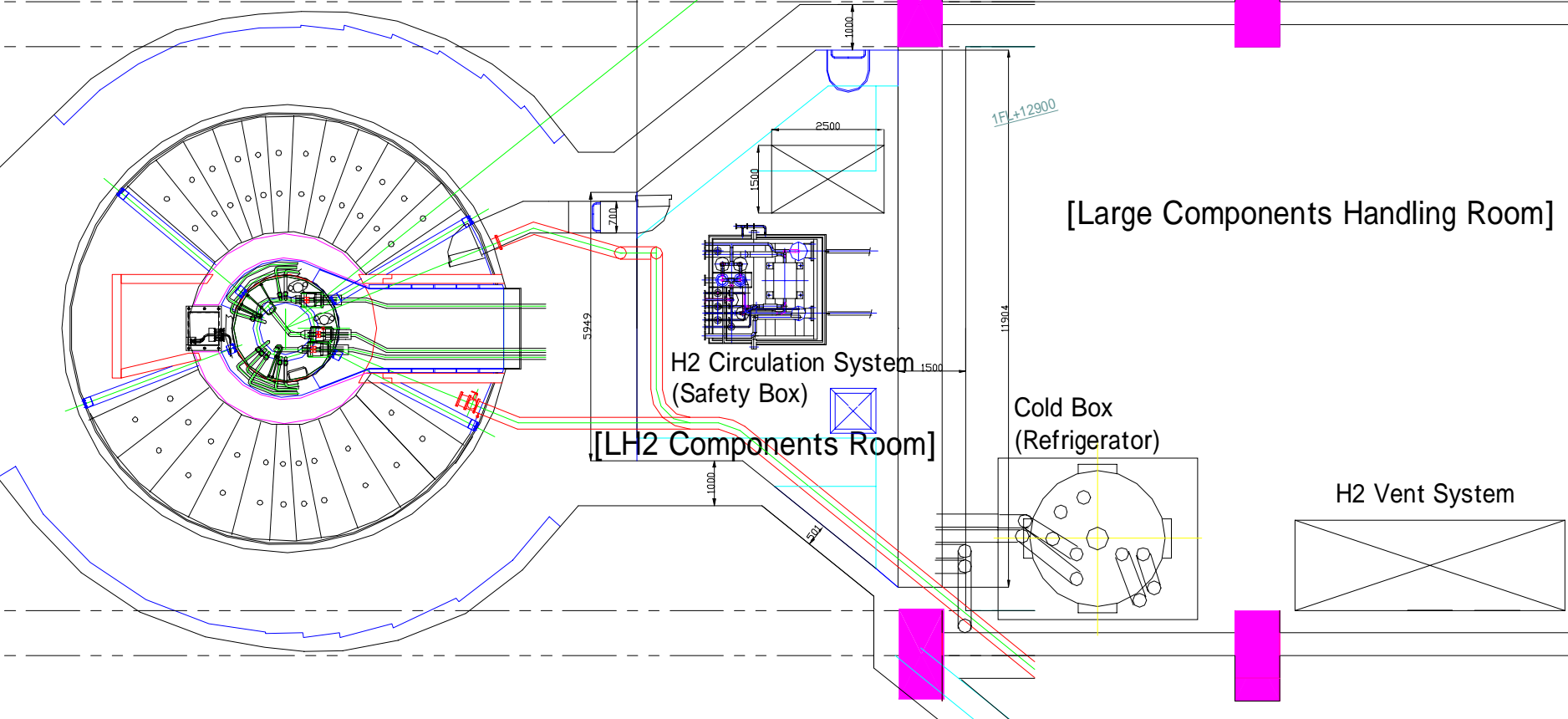


- Cryogenic system consists of a H₂ circulation system, a refrigerator system, H₂ transfer tubes, three cold moderator modules, a H₂ pressure control system, vacuum pump units and a H₂ vent system.
- Three cold moderator modules are fixed on the reflector plug which is vertically inserted in a helium vessel.
- H₂ circulation system covered by a safety box, H₂ pressure control system, and vacuum pump units are installed in the H₂ component room near the top of the reflector plug.
H₂ transfer tubes connect between the cold moderator modules and the H₂ circulation system.
- The cold box and the H₂ vent system are installed in the large components handling room where is used to exchange the reflector plug. Other components of the refrigerator system are placed out of the MLF building.

Layout of Cryogenic System

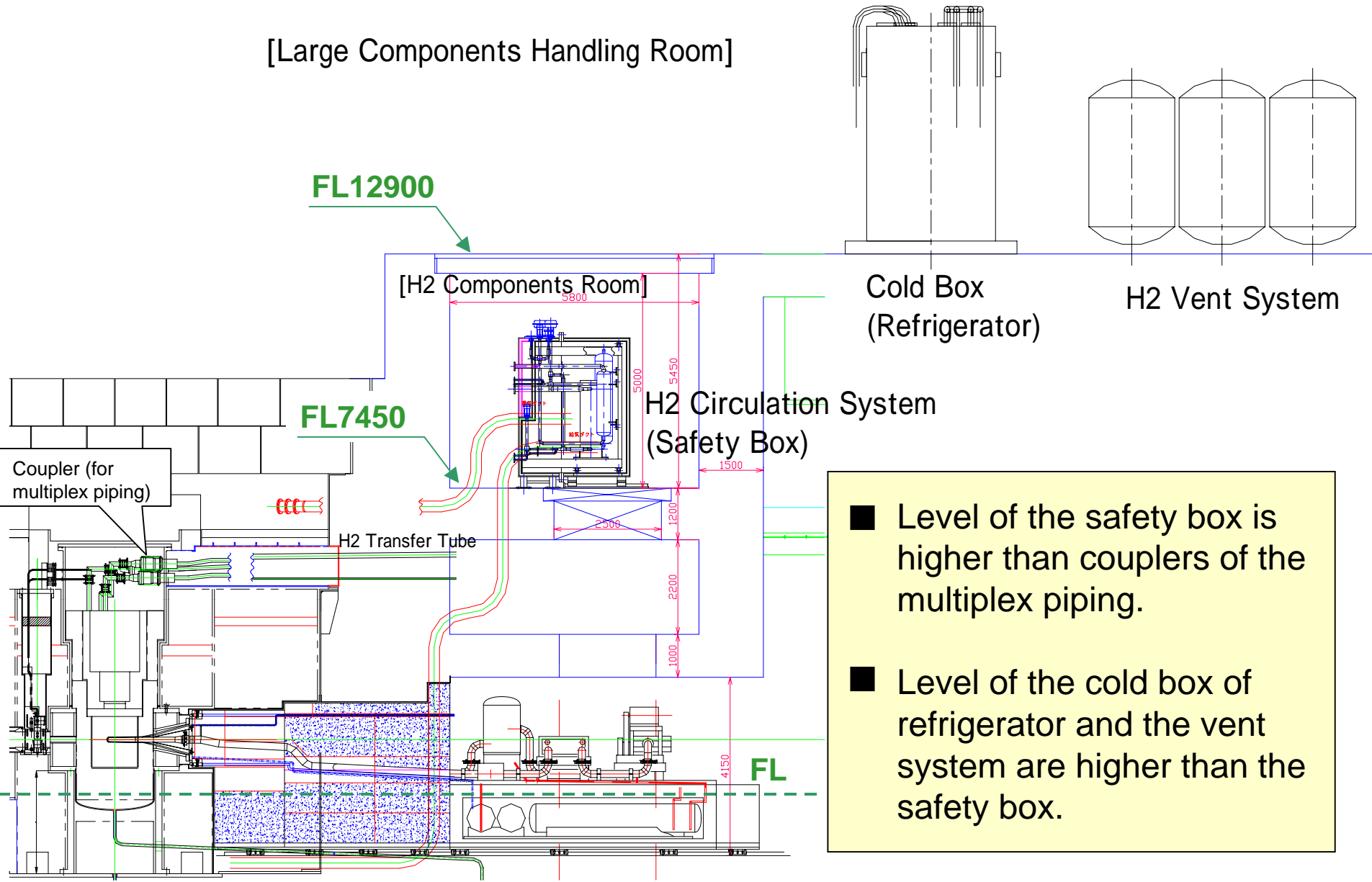


- The safety box is located in the LH₂ components room.
- The cold box and the vent system are located in the large components handling room.



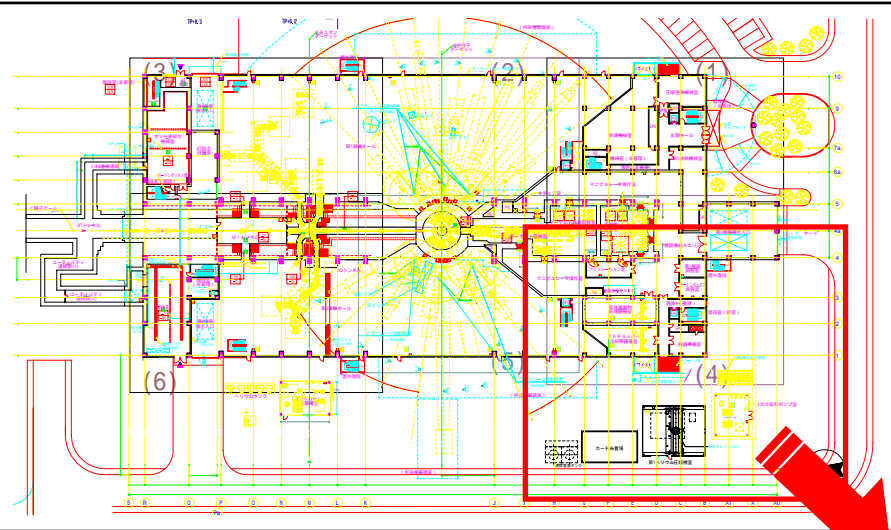
Layout of Cryogenic System

[Large Components Handling Room]



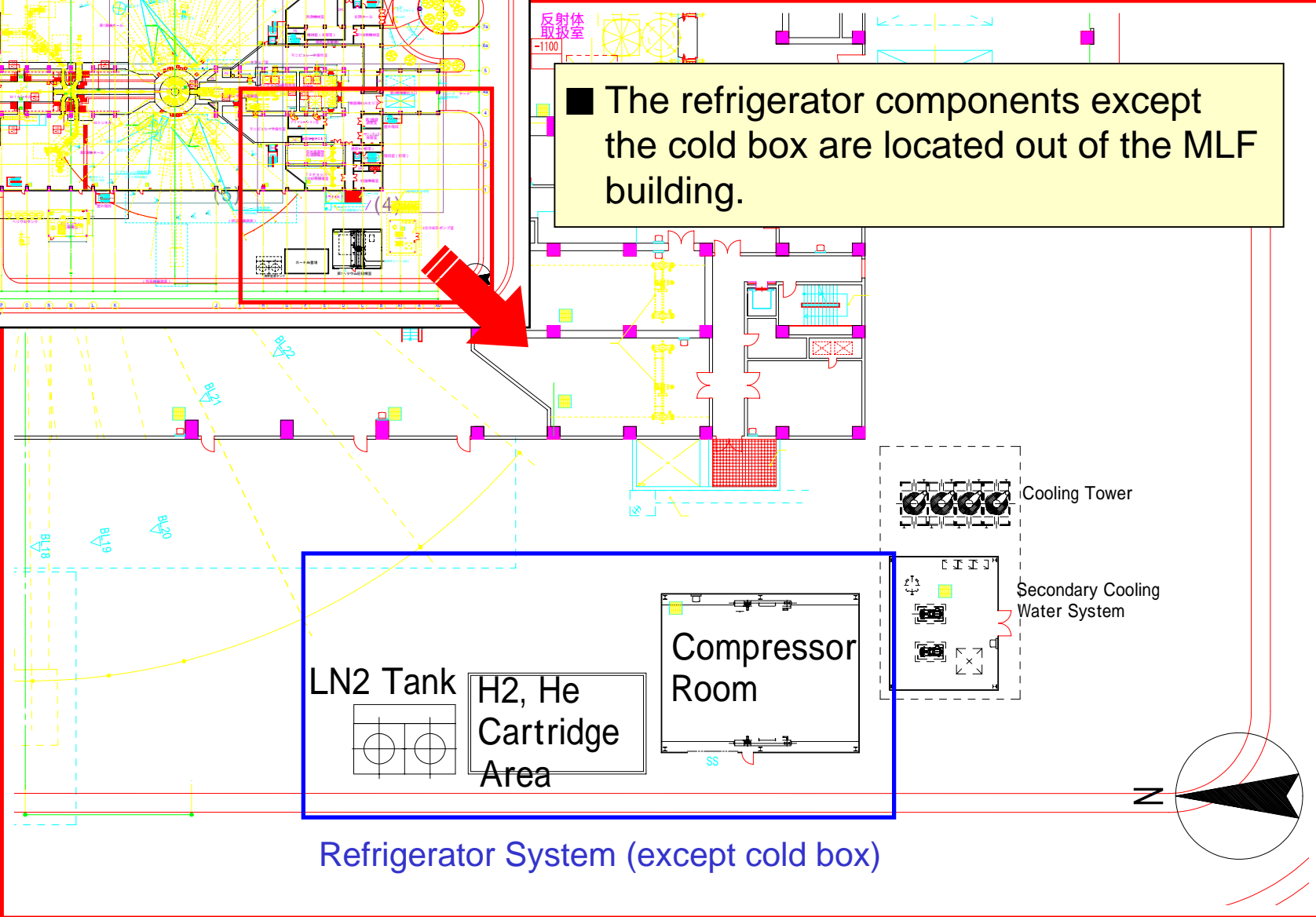
- Level of the safety box is higher than couplers of the multiplex piping.
- Level of the cold box of refrigerator and the vent system are higher than the safety box.

Layout of Cryogenic System



反射体
取扱室
-1100

■ The refrigerator components except the cold box are located out of the MLF building.

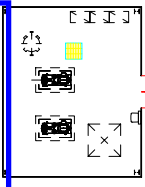


LN2 Tank
H₂, He
Cartridge
Area

Compressor
Room

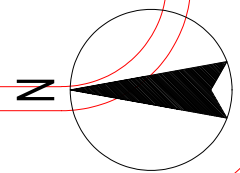


Cooling Tower

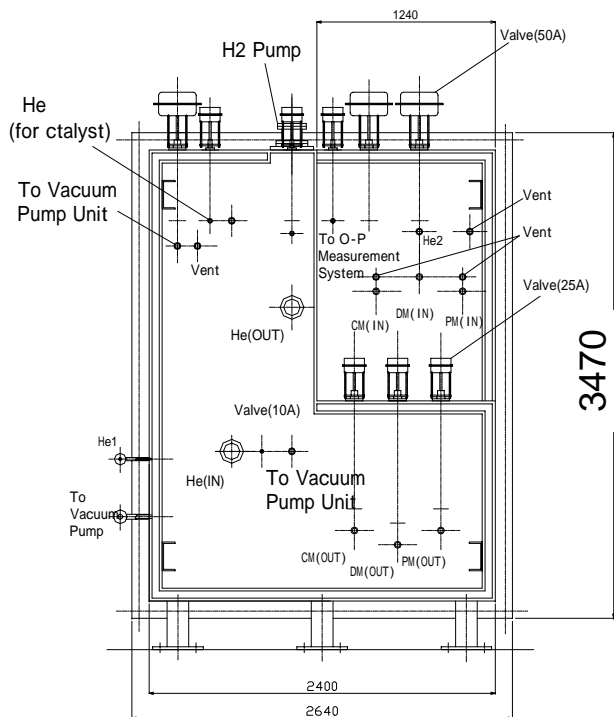
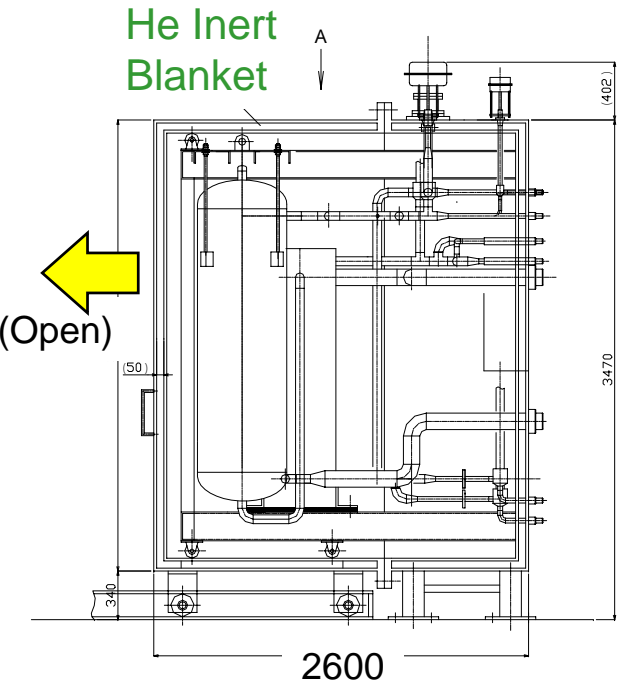
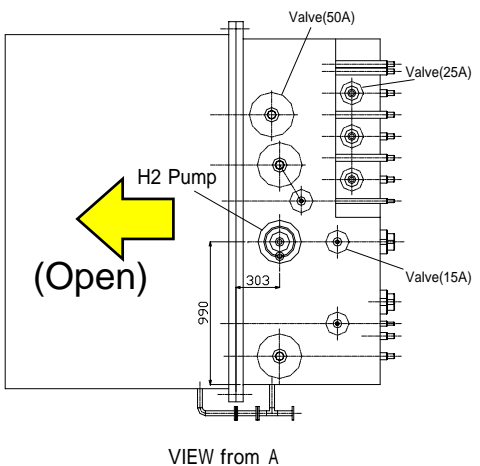
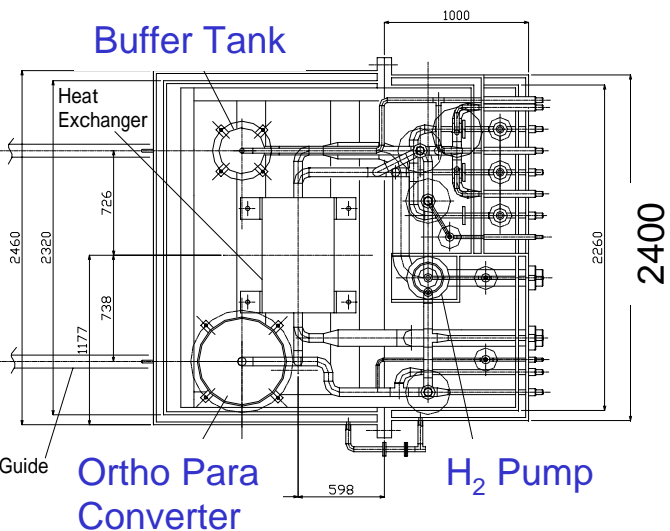


Secondary Cooling
Water System

Refrigerator System (except cold box)

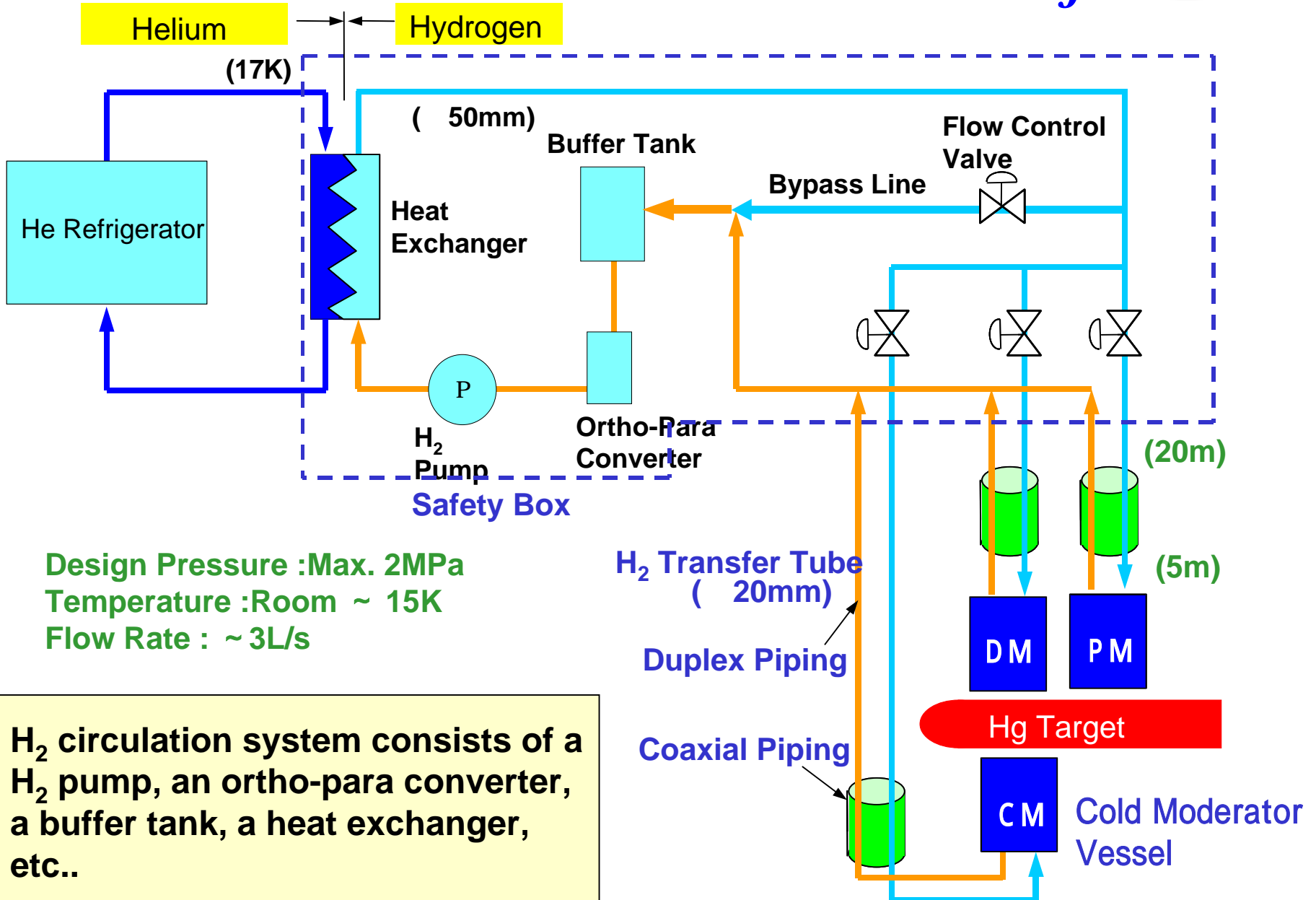


H₂ Circulation System



- The components of H₂ circulation system are installed in a safety box which is a vacuum vessel covered by inert blanket of He.
- The safety box can be opened horizontally for maintenance and inspection on the Japanese high-pressure gas regulation including liquefied gas.

H₂ Circulation System



Design Pressure :Max. 2MPa
Temperature :Room ~ 15K
Flow Rate : ~ 3L/s

H₂ circulation system consists of a H₂ pump, an ortho-para converter, a buffer tank, a heat exchanger, etc..

H₂ Circulation System

JAERI / KEK
Joint Project

■ H₂ Pump

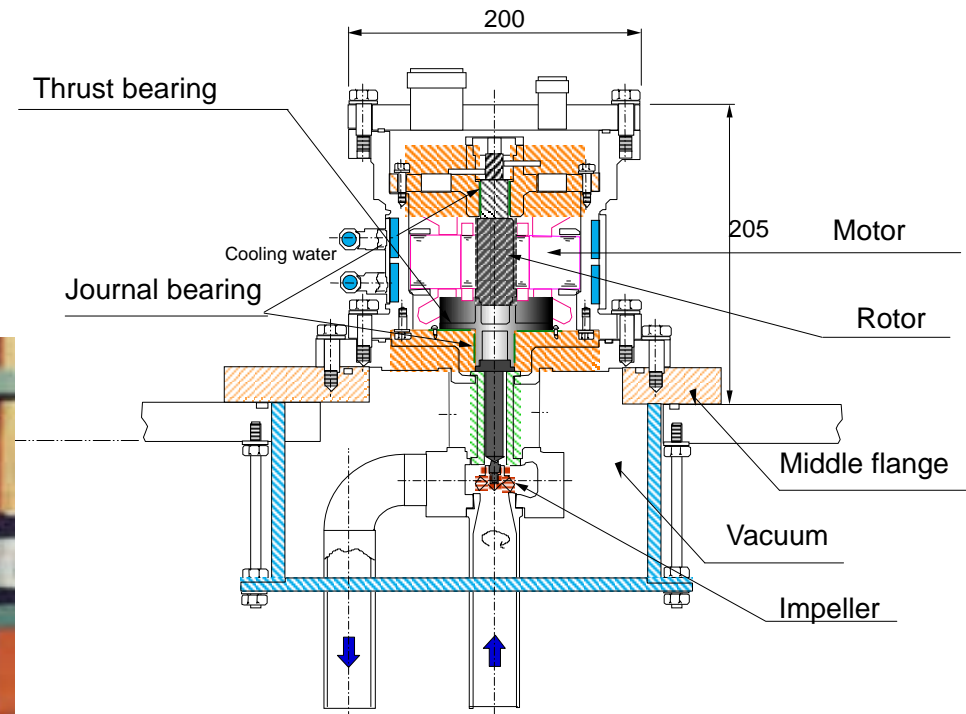
Flow rate : ~ 3L/s

Inlet press. : ~ 1.4MPa

Inlet temp. : ~ 17.5K

Outlet press. : ~ 1.5MPa

Head : ~ 0.1MPa



- A supercritical helium pump that was used for ITER superconducting coil R&D.
- Operation experience: more than 8,000h

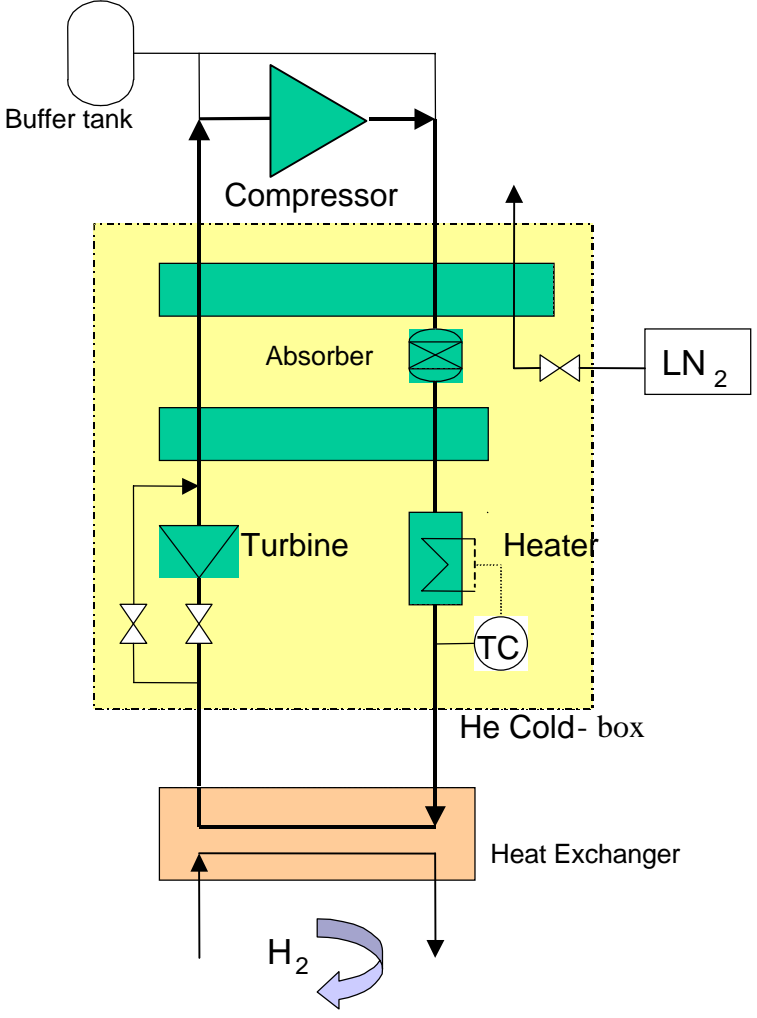
Refrigerator System

■ Refrigerator

Type : Brayton cycle
Refrigerator power : ~ 6kW (at 17K)

Design Heat Loads

Nuclear heating in hydrogen	1855W
Nuclear heating in moderator vessels including a poison	1896W
Heat inleake to hydrogen	218W
Heat inleake to transfer-lines	1012W
Heat input of the hydrogen pump	540W
Total	5521W



Flow Diagram of Refrigerator

- Design of the cryogenic system consisting of the H₂ circulation system and the refrigerator system makes in progress, referring the HFIR and the SNS facilities.
- Overall layout plan of the cryogenic system was determined.
- Based on this study, call for tender will be executed next April.