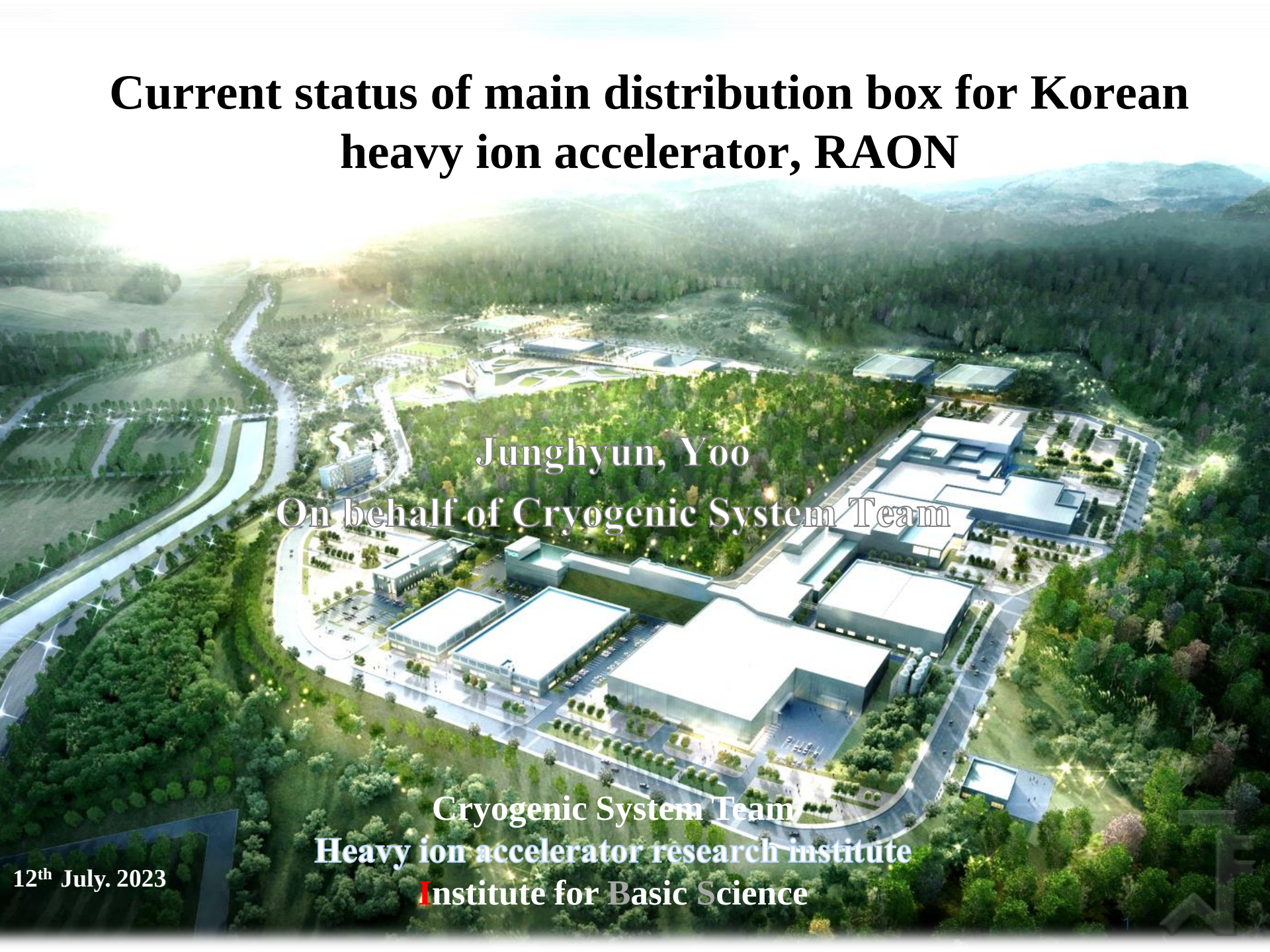
Current status of main distribution box for Korean heavy ion accelerator, RAON



Junghyun, Yoo
On behalf of Cryogenic System Team

Cryogenic System Team
Heavy ion accelerator research institute
Institute for Basic Science

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Heavy ion accelerator research institute

Current status of main distribution box for Korean heavy ion accelerator, RAON

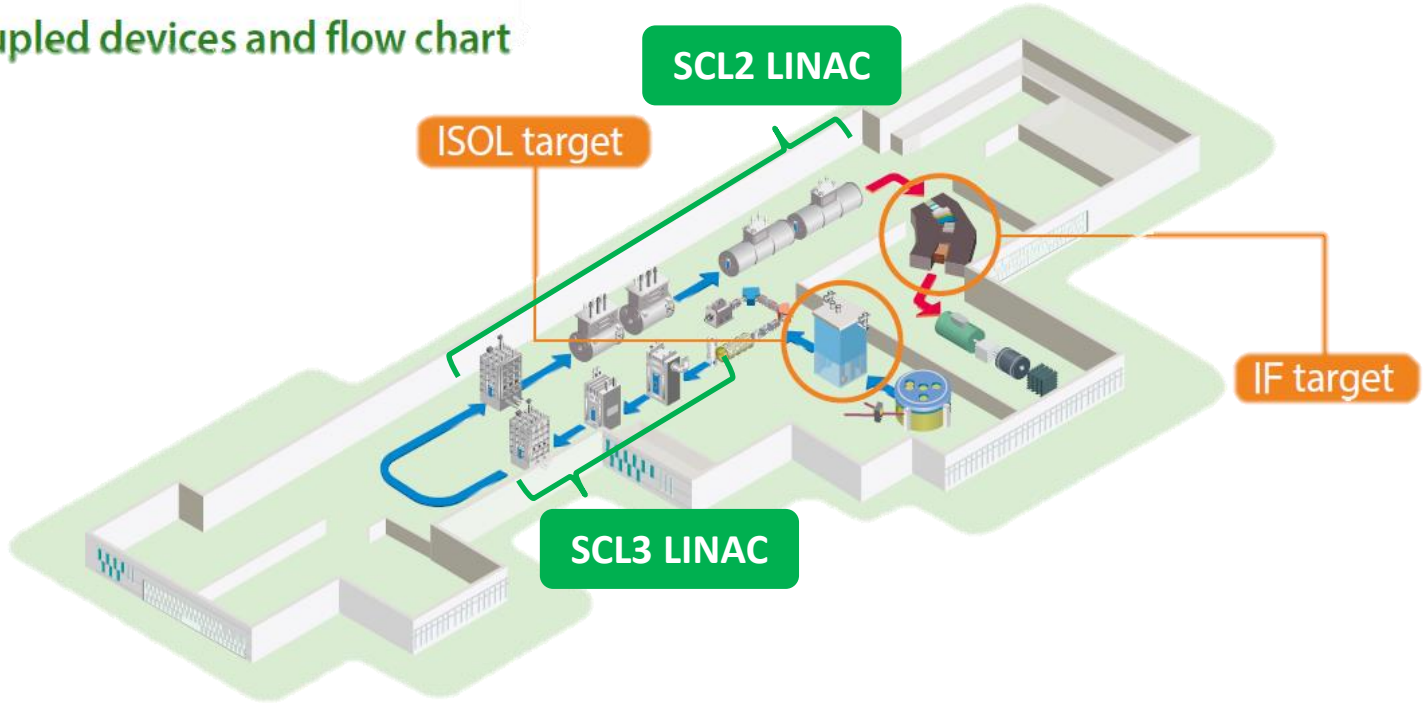
Contents

1.1 Korean heavy ion accelerator (RAON)

- ISOL or IF or combined (ISOL + IF)
- Two superconducting linear accelerators (SCL3 & SCL2 LINAC)

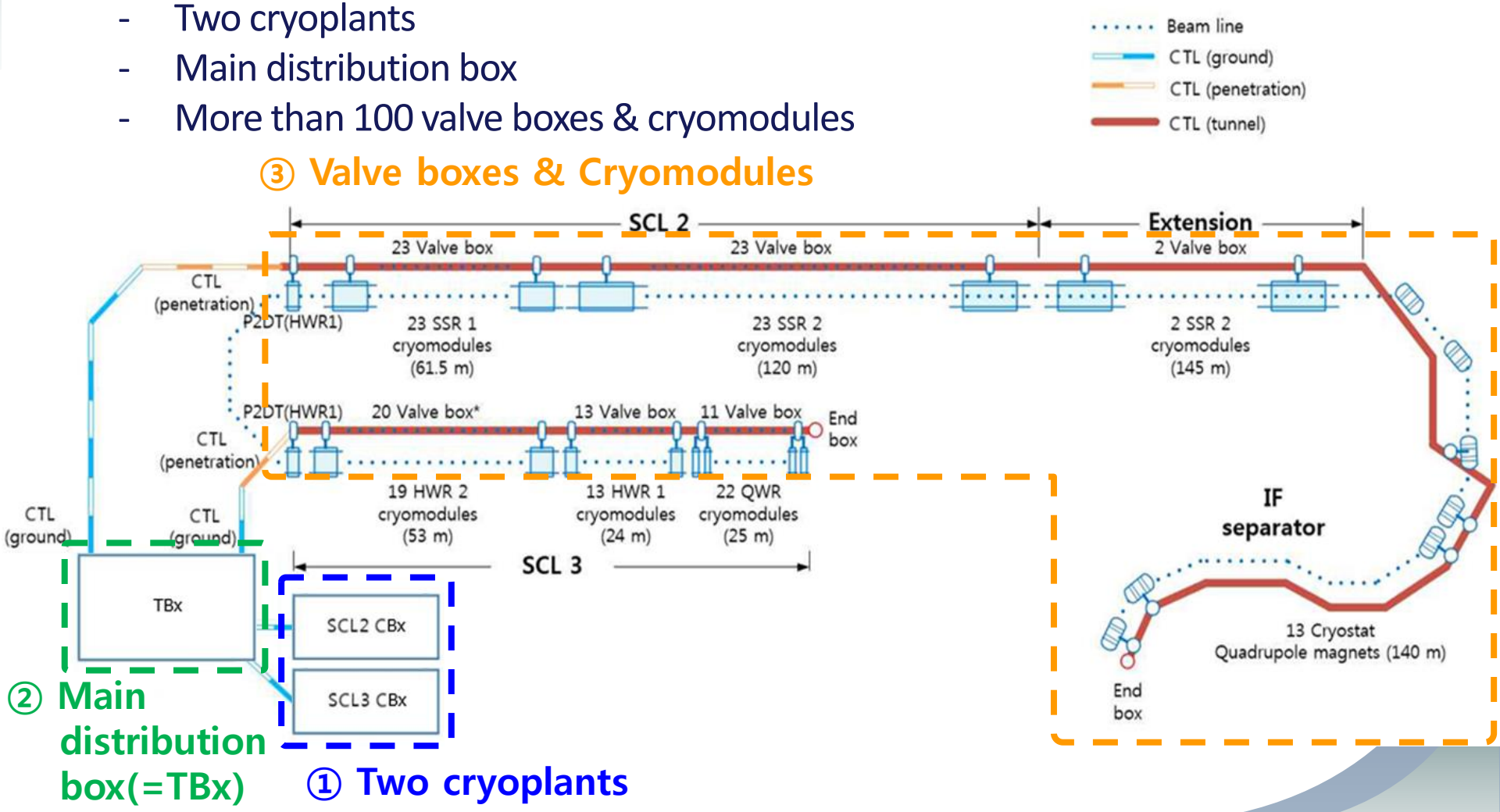
→ Need cryogenic system with helium (2.05 K)

ISOL+IF coupled devices and flow chart



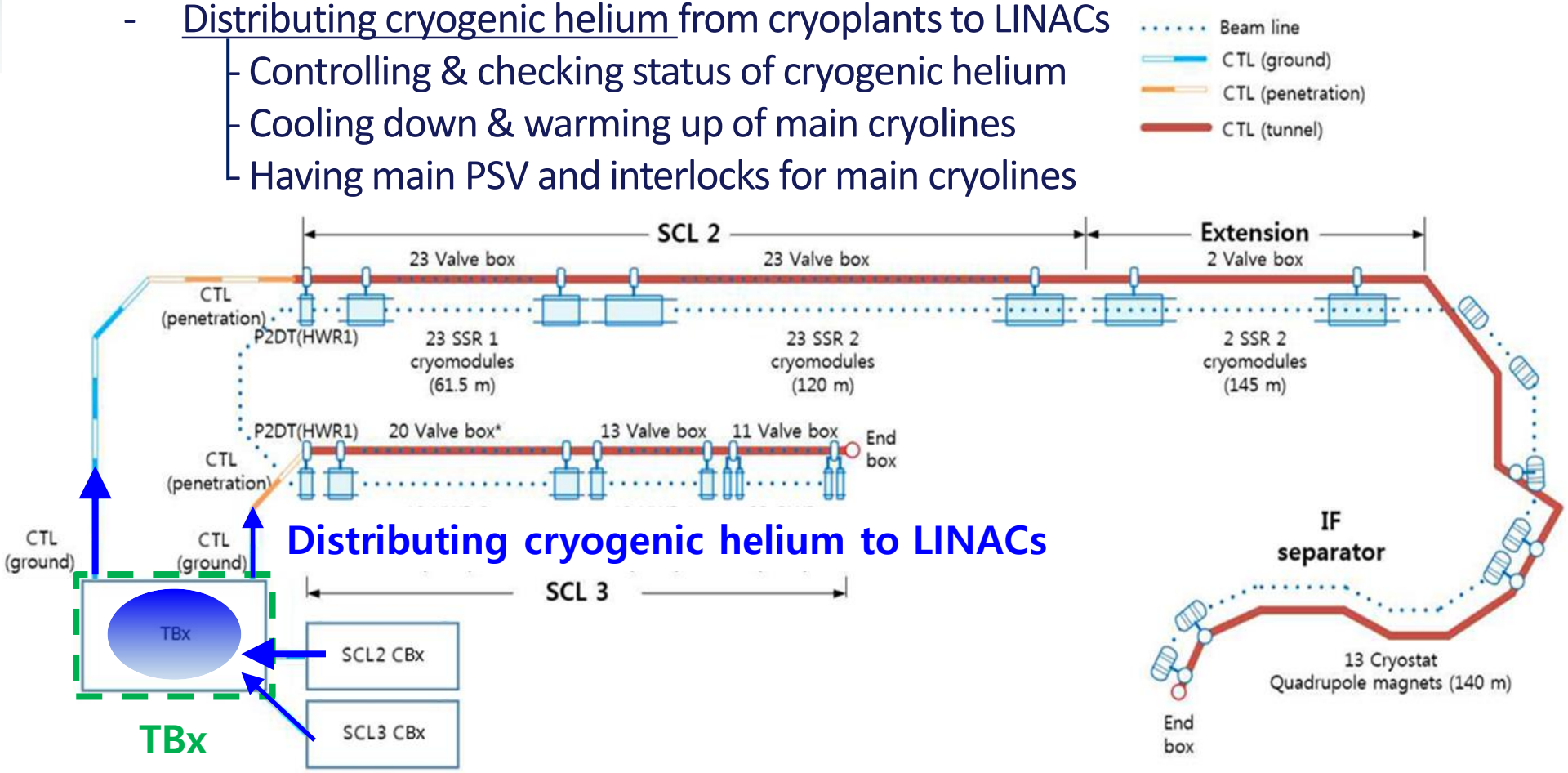
1.2 Cryogenic system in RAON

- Two cryoplants
- Main distribution box
- More than 100 valve boxes & cryomodules



1.3 Main distribution box (= main Terminal Box, TBx)

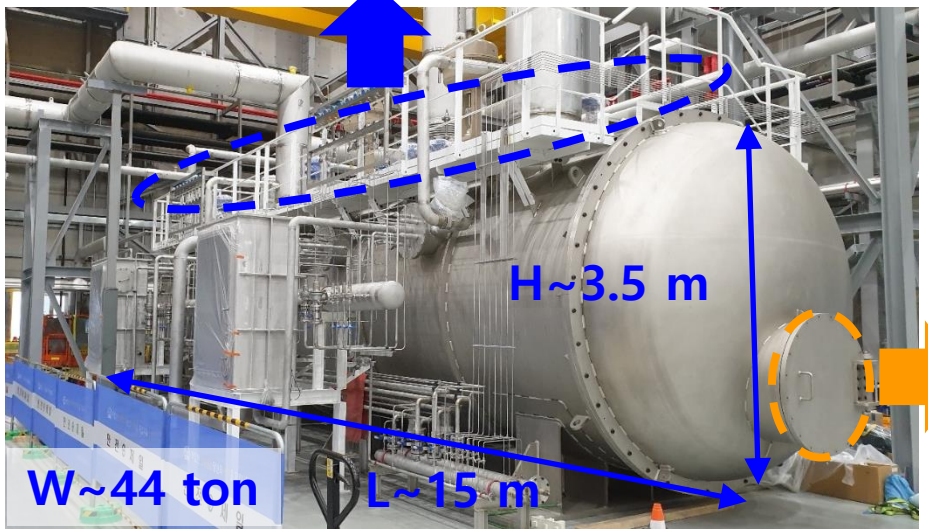
- Distributing cryogenic helium from cryoplants to LINACs
  - Controlling & checking status of cryogenic helium
  - Cooling down & warming up of main cryolines
  - Having main PSV and interlocks for main cryolines

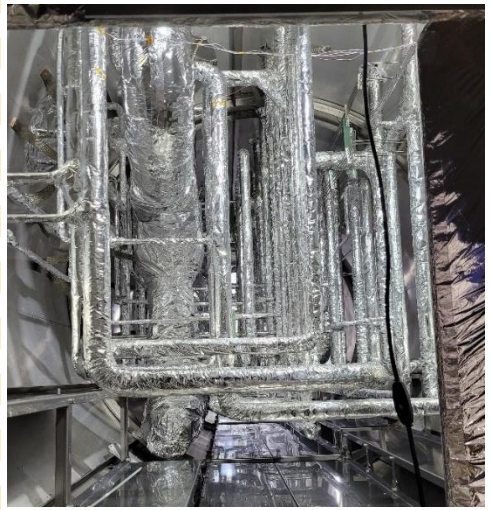


2. Current status of main distribution box

2.1 Completion of construction; Hardware

- **Cryogenic valves**
  - 44 ea.
  - DN10 ~ 250
- **Etc**
  - TT (Cernox, PT)
  - PT (Static, dynamic)
  - Vacuum pumping station
  - PSV, Cryo-check valve
  - FT (PDT w/ venturi)
  - Helium guard for 2 K
  - Separated TS





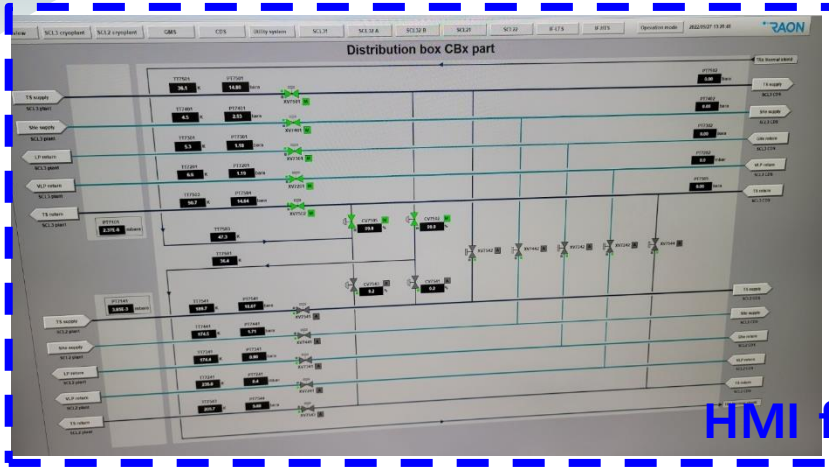
- **Cryolines**
  - 5 type

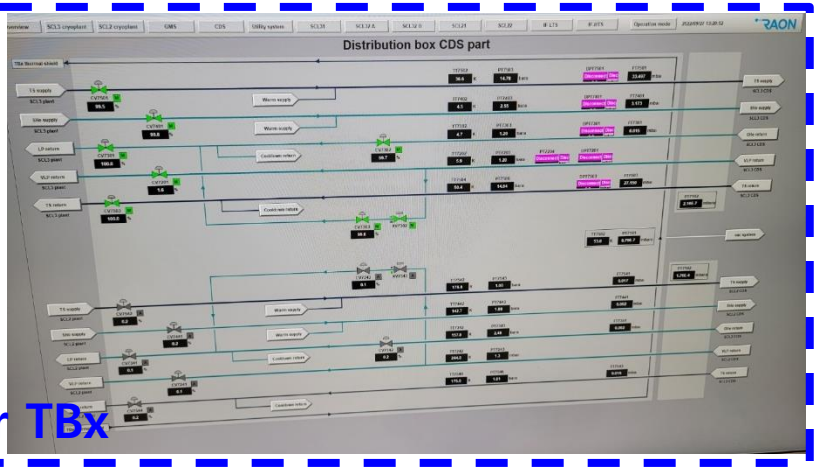
i) TSS (35 K, 15~22 bar)
ii) TSR (45 K, 15~22 bar)
iii) SHe (4.5 K, 3 bar)
iv) GHe (4.5 K, 1.3 bar)
v) VLP (2.05 K, 32 mbar)

  - STS316L
  - MLI + vacuum

2. Current status of main distribution box

2.2 Completion of construction; Control system

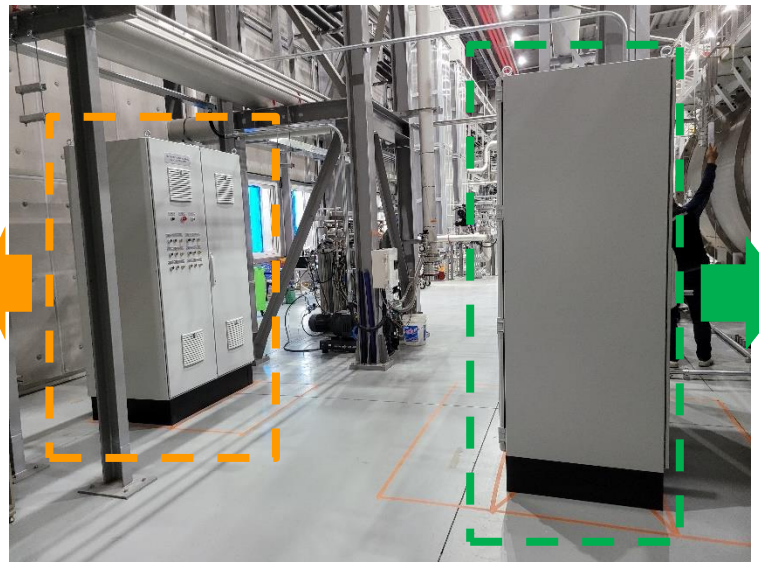




HMI for TBx

EPICS network

Vacuum pumping system panel (Electricity panel)

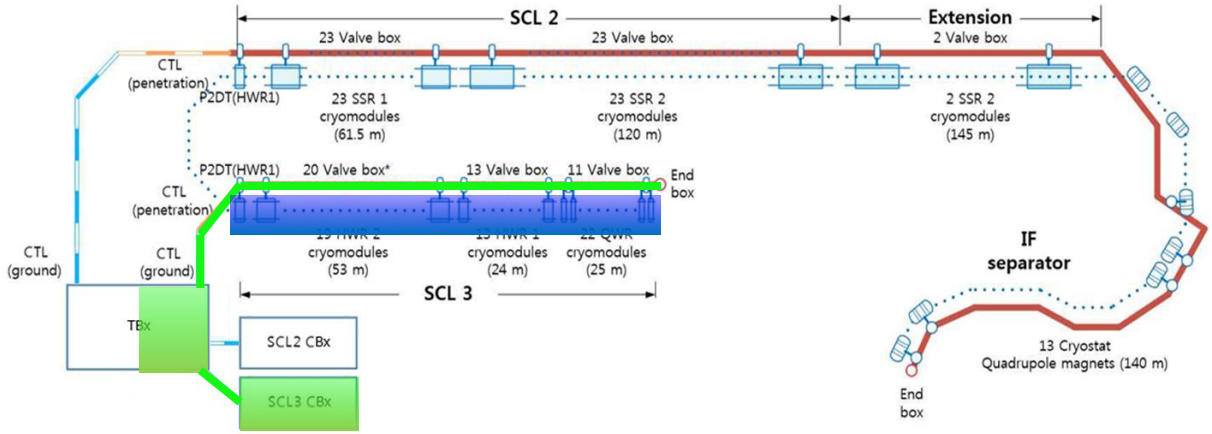


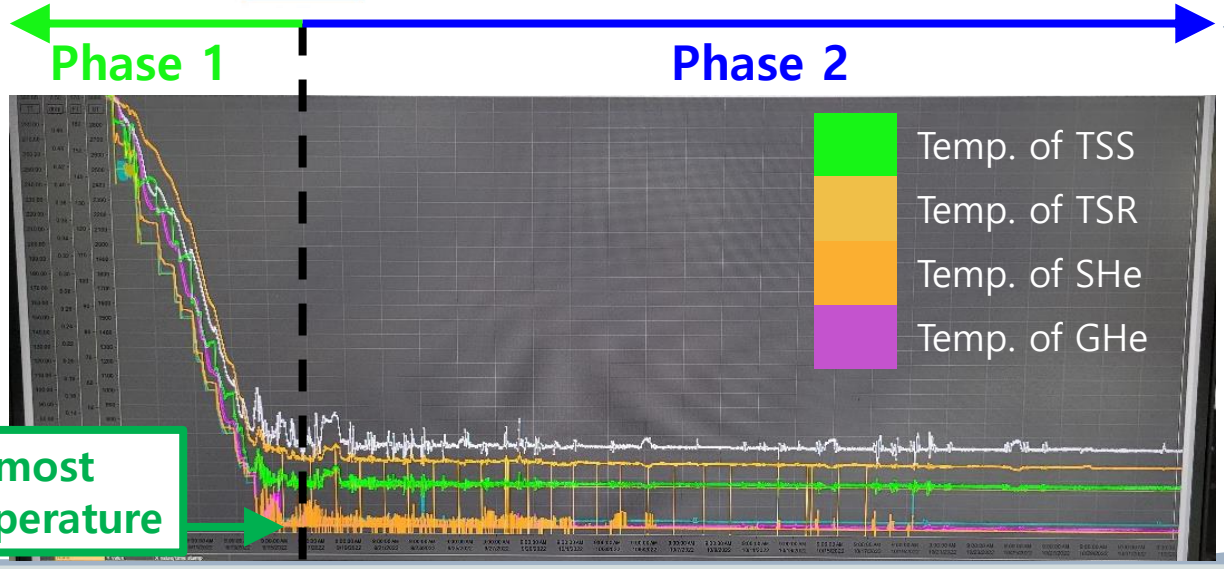
TBx control panel (PLC panel)

2. Current status of main distribution box

2.3 Completion of SCL3 commissioning – 300 to 4.5 K

- **Phase 1**: Cooldown of SCL3 coldbox – TBx – SCL3 main cryoline – TS of cryomodules
- **Phase 2**: Cooldown of SCL3 cryomodules (one by one)





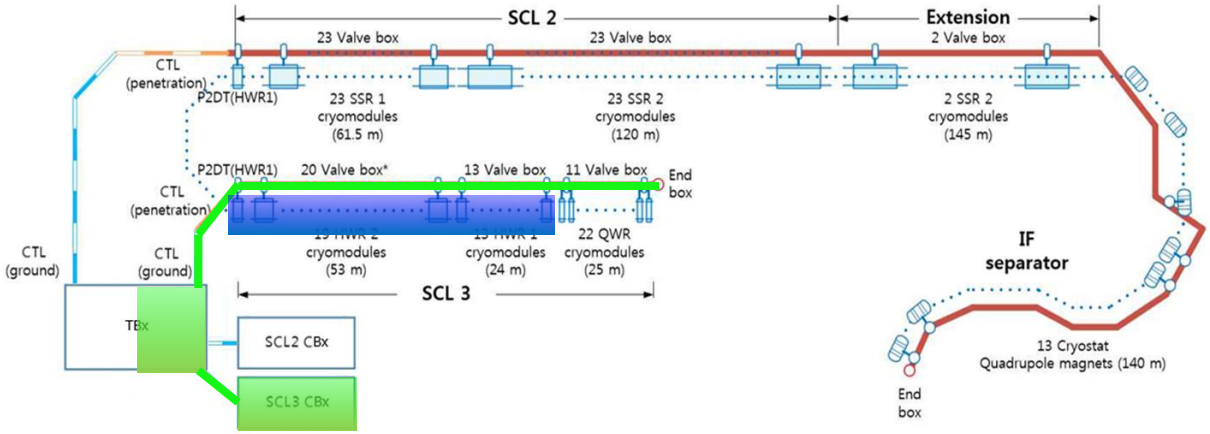
~ 2 months

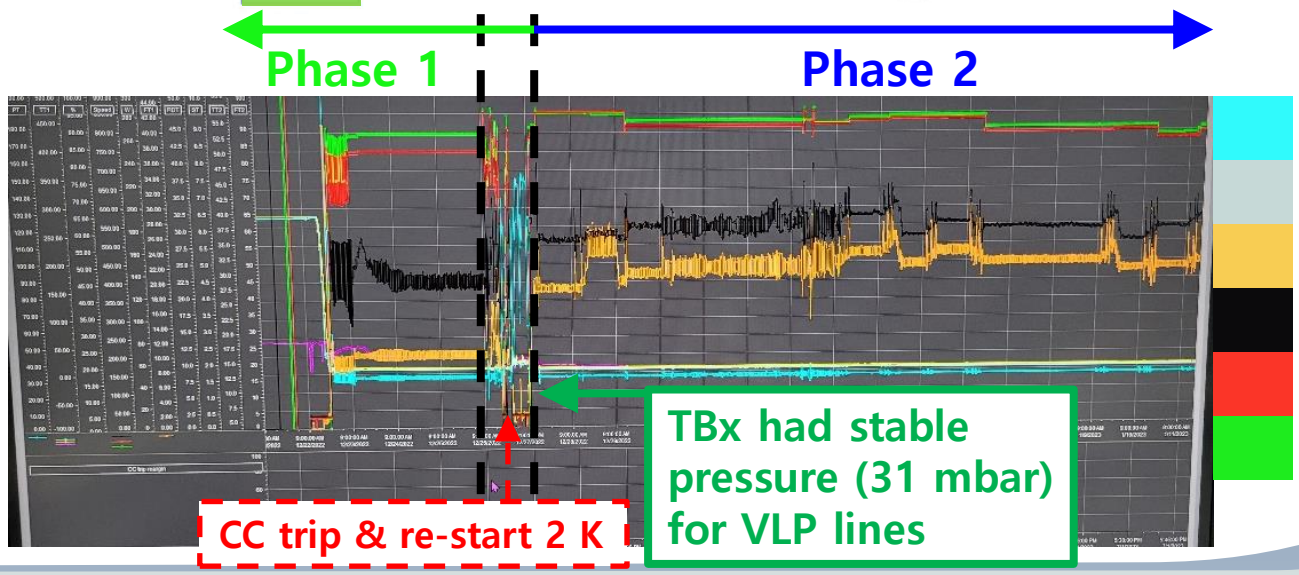
TBx had almost stable temperature

2. Current status of main distribution box

2.3 Completion of SCL3 commissioning – 4.5 to 2 K

- **Phase 1**: 2 K pumping of SCL3 coldbox – TBx – SCL3 main cryoline
- **Phase 2**: 2 K pumping of SCL3 cryomodules (HWR only, one by one)



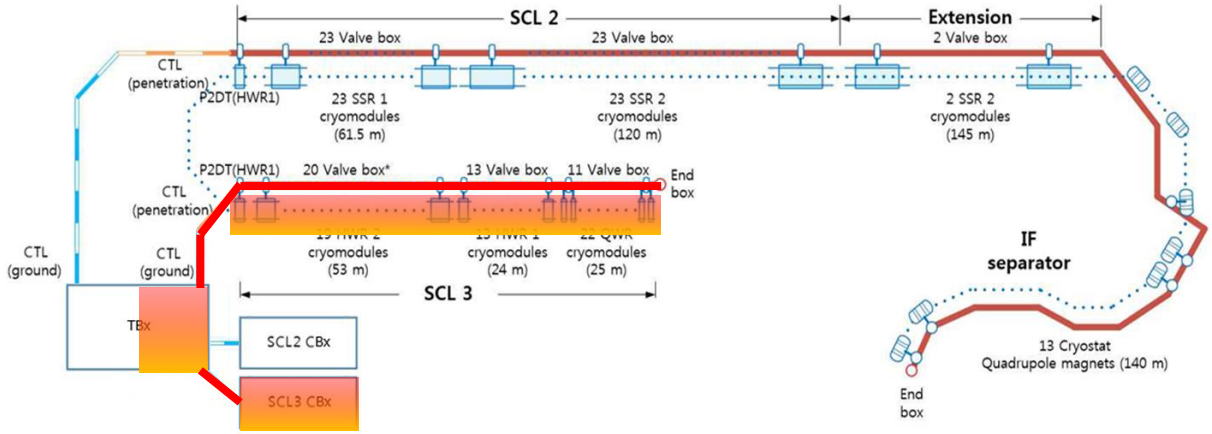


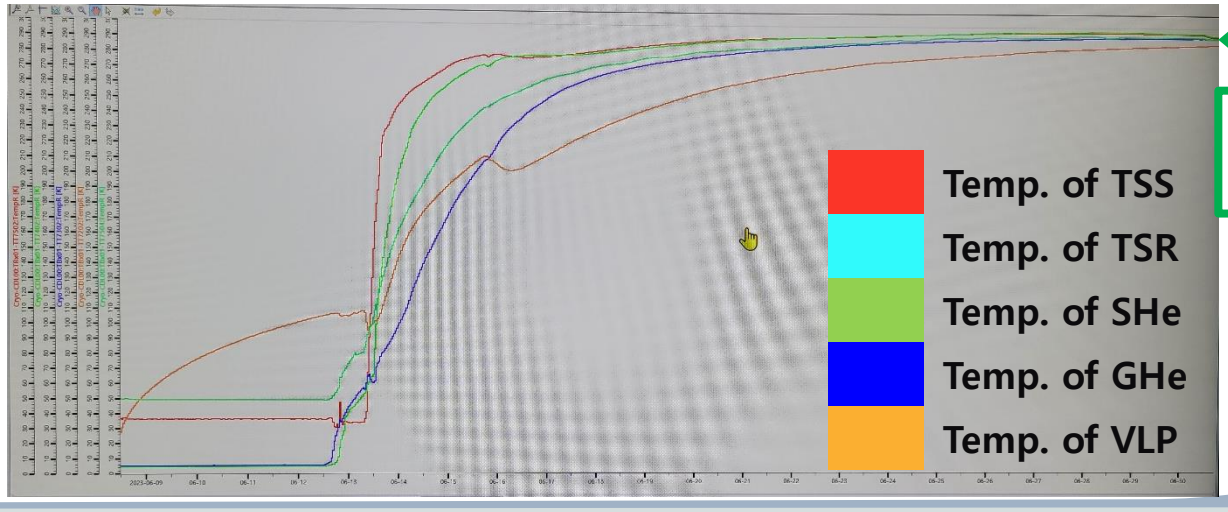
2. Current status of main distribution box

2.4 Completion of warm-up

i) Stopping 2 K system (PVPS + cold compressors)

ii) Warming-up whole SCL3 together



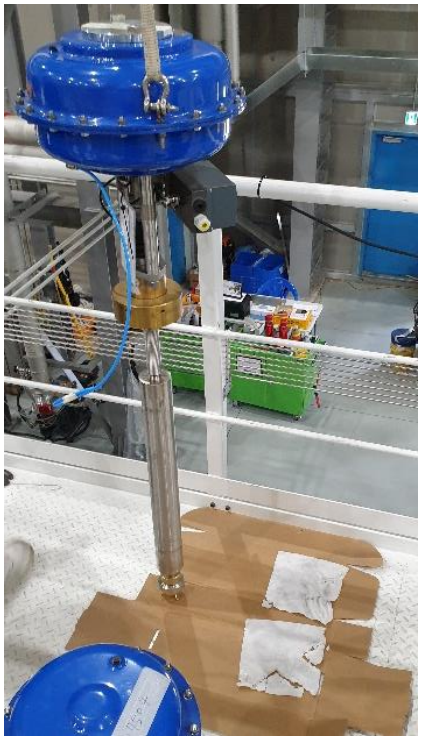


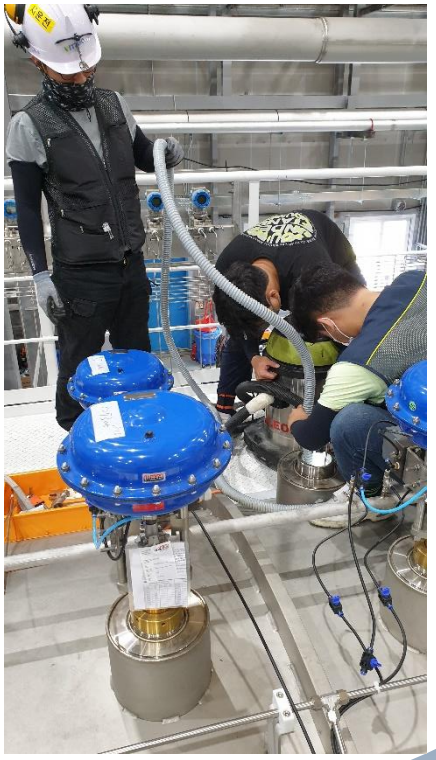
Warm-up of TBx was finished

3. Lesson learned

3.1 Cloths at the plug of the cryogenic valves (1)

- **Period**: Operation test for cryogenic valves @ pre-commissioning phase
- **Symptom**: Malfunction of one cryogenic valve
- **Inspection:** Raising the cryogenic valve and inspecting inside
- **Action**: Inspecting & cleaning the cryogenic valve
  Conducting seat leak test for whole installed valves





3.2 Preparation for regular blackout

- **Period**: 1st July, 2023 – Regular inspection for electrical facility
- **Preparation**:
  - i) Depressurizing whole cryolines below 2 barA
  - ii) Protecting vacuum level of the vacuum chamber
  - iii) Controlling every instrumentation as failure position
  - iv) Disconnecting main instrument air
  - v) Conducting PLC ON/OFF test
  - vi) PLC OFF

Future plan of TBx for 2023

Plan for 2023	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Short maintenance						
Preparation for cooldown (Leak test, conditioning…)						
2nd cooldown of SCL3						
1st cooldown of SCL2-IF * All section of TBx will be cooled down						

5. Summary

- TBx is a facility to distribute cryogenic helium from cryoplants to LINACs.
- Construction of TBx was finished.
- SCL3 section in TBx was successfully cooled down and warmed up.
- SCL3 section in TBx was operated well at cryogenic condition.
- We will cool down again our cryogenic system at the end of this year.

Thank you!

Please feel free to give your comments and contact to us.
(e-mail: trikara@ibs.re.kr)