

# Status and Future Plan of PLS-II

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on behalf of PLS-II Accelerator Division

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## Requirements of 2023 Operation

### ❖ User Service of 190 days

### ❖ Beam Availability > 97%

- Maintenance of linac and storage ring

### ❖ 3 GeV Top-Up Operation

- Stable operation of linac klystrons

### ❖ 250 ~ 400 mA Beam Current

- Stable operation of three cryo-modules

### ❖ Electron Beam Stability < 1 $\mu\text{m}$ rms

- Operation of slow orbit feedback

### ❖ Photon Beam Stability < 2 $\mu\text{m}$ rms

- Operation of photon position feedback by using PBPM

### ❖ Electron Beam Stability during ID gap change < 6 $\mu\text{m}$ rms

- Operation of fast orbit feedback

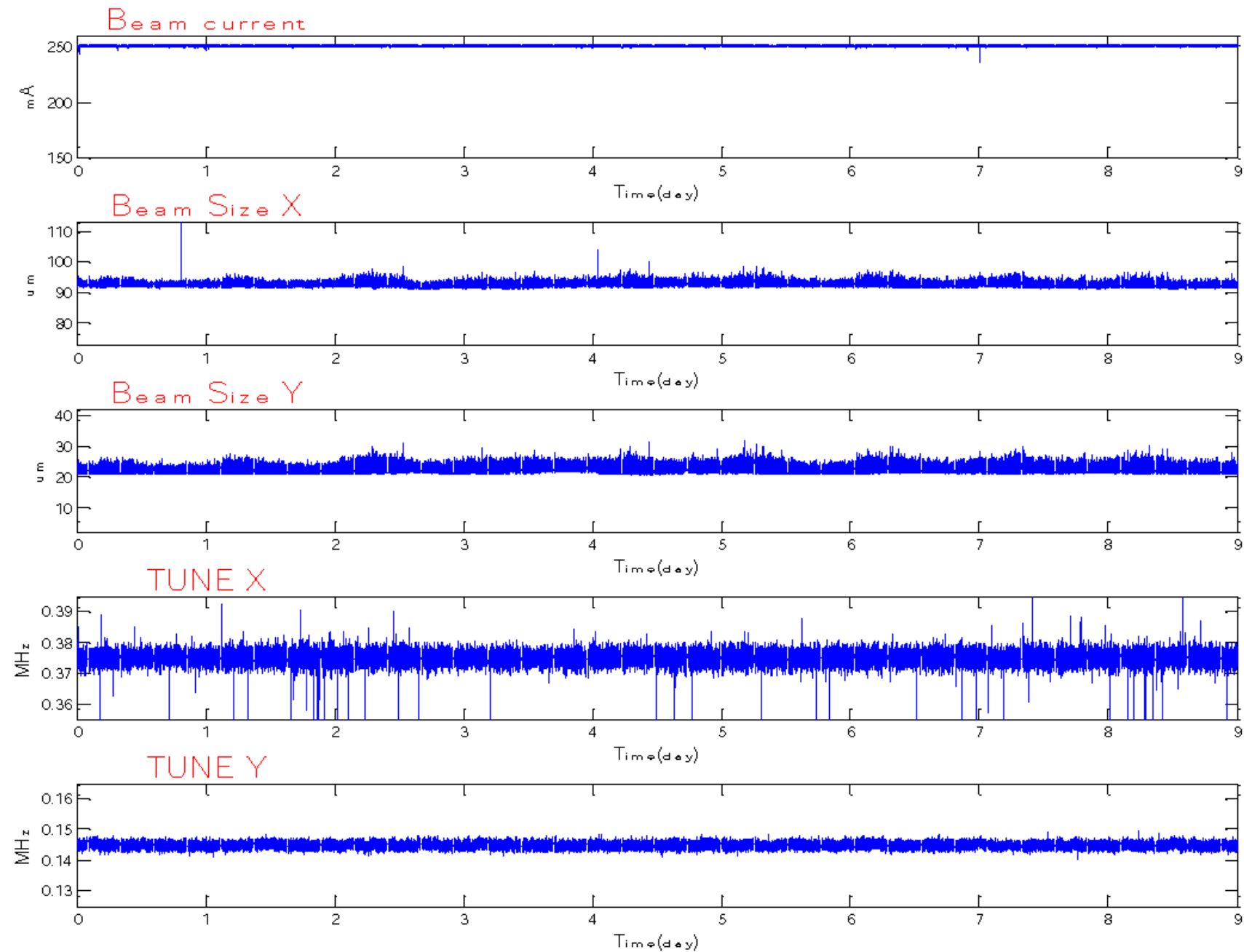
### ❖ Single Bunch Current in Hybrid Mode: 5 mA

- Operation of transverse feedback system

## 2023 Operation Result

### ❖ Beam Parameter

- Beam current: 250 mA
- Injection mode: Top-up mode
- Fill pattern: 300 + 1 hybrid mode
- Fractional tune: 0.375 (Horizontal) / 0.145 (Vertical)
- Beam size: 90  $\mu\text{m}$  (Horizontal) / 25  $\mu\text{m}$  (Vertical)



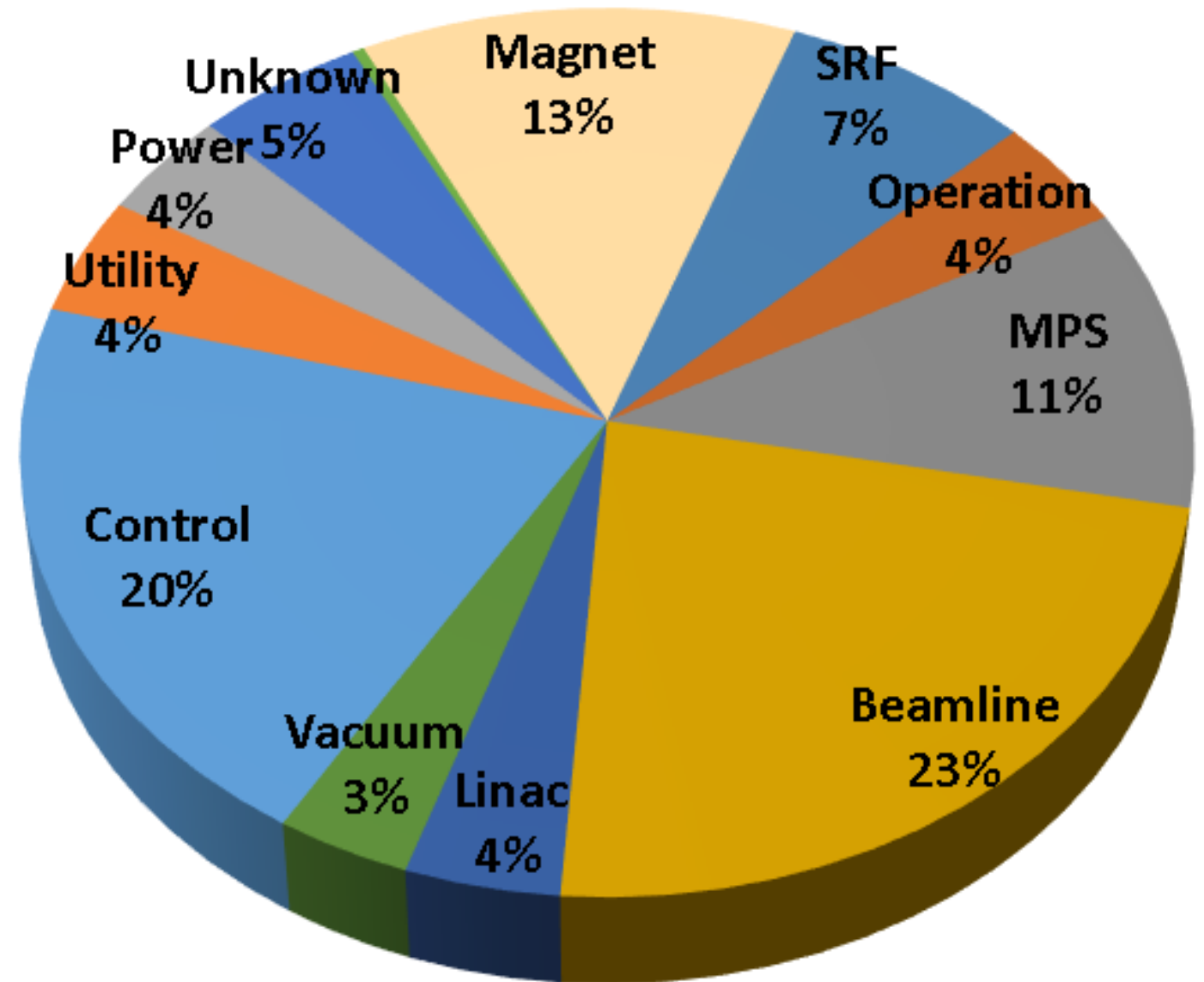
10 days operation result (2023. 4. 26 ~ 2023. 5. 4)

Stability & Machine Faults (January 1, 2023~ August 1, 2023)

❖ **Stability**

- Beam availability: 99.4% (3245.2 hr / 3264 hr)
- Mean time between faults: 120 hr
- Mean time trouble repair: 0.74 hr

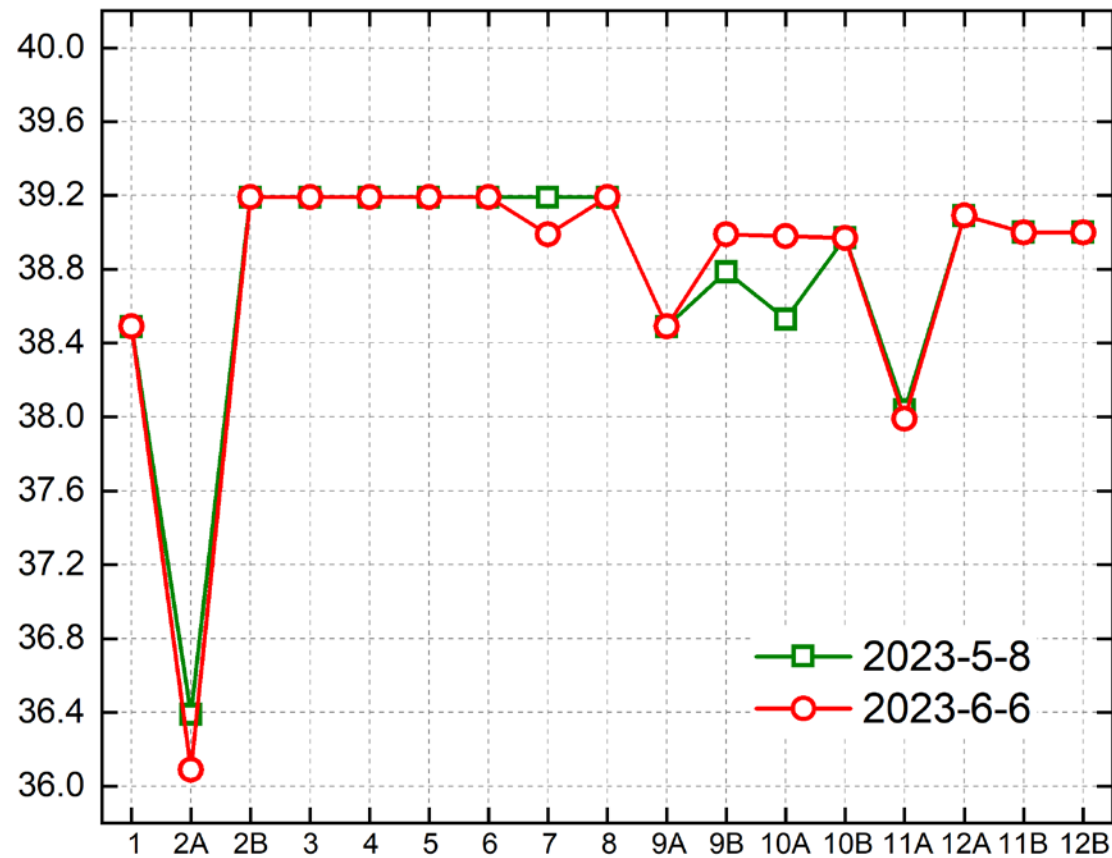
**2023 Fault Time: 19.07 hr**



## 2023 Summer Maintenance

### ❖ Linac

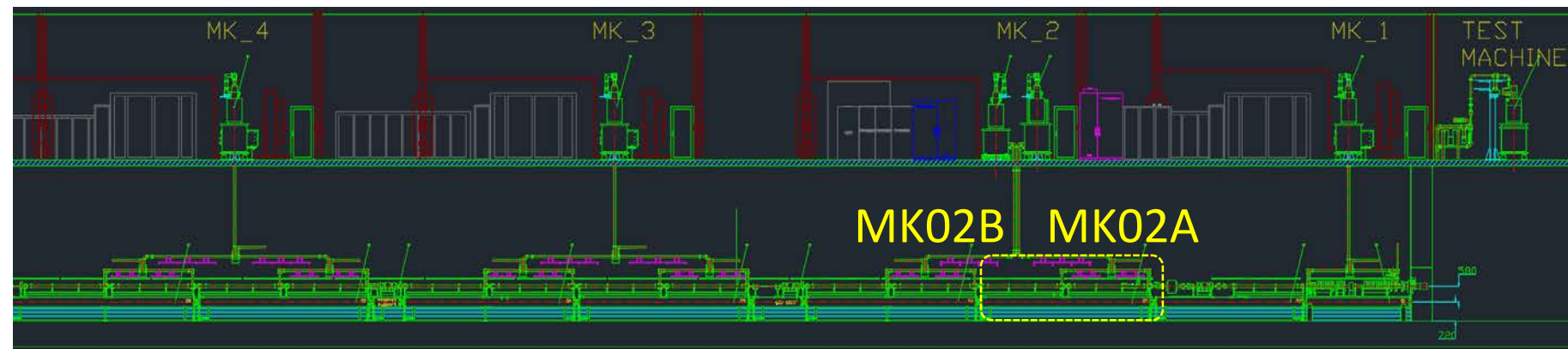
- 2A accelerating columns were exchanged
- 10B klystron exchange with a new one
- 2 Thyratrons were exchanged with a new type



Applied high voltages in modulators



Newly installed accelerating column



Position of exchanged accelerating columns

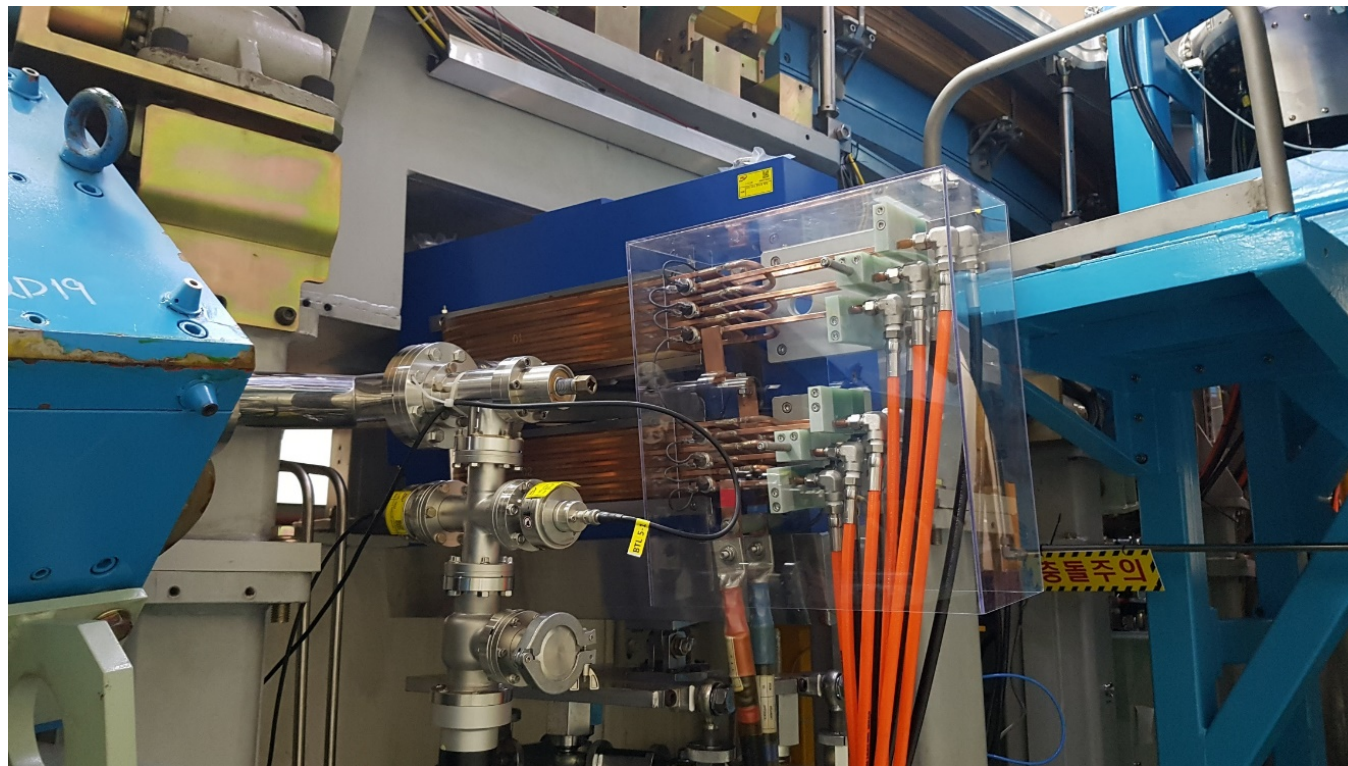
## 2023 Summer Maintenance

### ❖ Beam Transport Line

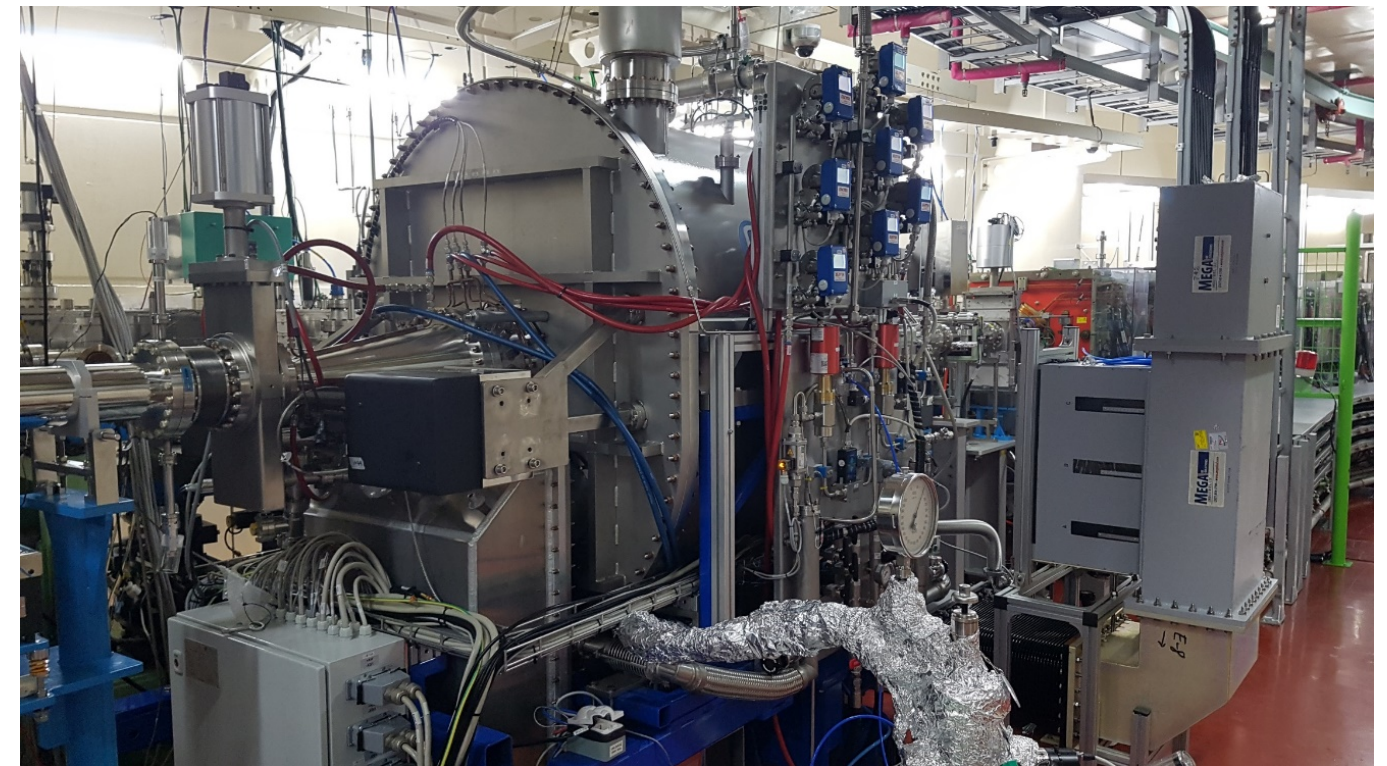
- HB03 magnet was exchanged with a new one

### ❖ Storage Ring

- CM #4 Installation was successfully finished for 400 mA beam current operation
- Installation of uninterruptible power supply for the compressor was finished



Exchanged HB03 magnet



Installed cyro-module #4

PLS-II Issues #1 (Linac Energy)

❖ **Switch from Top-up to Decay Mode**

- 3 GeV Linac energy can only be obtained by using 17 klystrons and modulators
- If there is a problem with Klystron or Modulator, the injection mode must be switched to decay mode

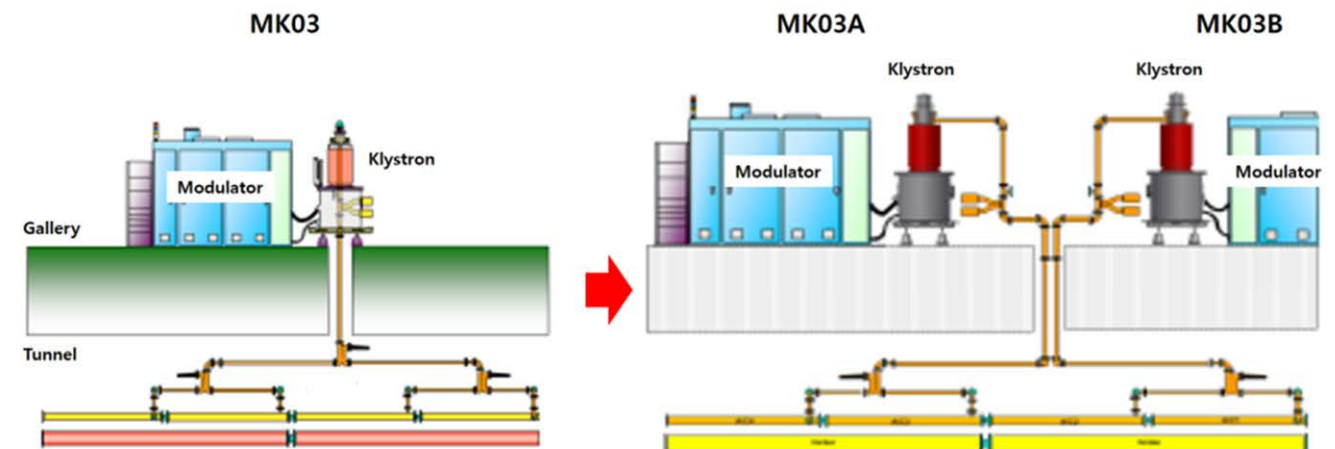
❖ **Optimization of Klystrons and Modulators**

- 3 LLRF systems and 14 IPAs are being used in PLS-II linac
- More SSA and LLRF are needed for the optimization of Linac klystrons and modulators

❖ **Addition of Klystron and Modulator**

- MK03 ~ MK08 klystrons run four accelerating columns
- More klystron and modulator can be added to make one klystron run two accelerating columns

Klystron	Acc. Column	Energy Gain (MeV)
1	4	250
2	4	300



## PLS-II Issues #2 (Injection)

### ❖ Injection section upgrade

- The injection section was upgraded to remove the injection transient effect in PLS-II
- Injection chambers and kickers were exchanged and are being used for PLS-II operation
- 4 kicker modulators were installed and their commissioning will be started in 2024

### ❖ Non-Linear Kicker

- 4GSR will use a conventional off-axis injection system by using kickers and septum magnet
- In addition, non-linear kicker can be considered and is understudying for 4GSR
- Non-linear kicker study is performed by PLS-II members (Jaeyu Lee, Jaehyun Kim, Gyeongsu Jang)
- After finishing the study, the result can be applied to PLS-II immediately



## PLS-II Issues #3 (Single Bunch Current)

### ❖ Single Bunch Current in Hybrid Mode

- 300 + 1 fill pattern is being used for hybrid mode operation
- 12 mA single bunch current was achieved with all ID gaps open in a machine study
- 5 mA single bunch current was delivered for user service in 2021
- 3 mA single bunch current was served for user service from 2022

### ❖ New Transverse Feedback System

- A new transverse feedback system is under development by a PLS-II member (Sinwon Jang)
- After development, its performance will be tested in PLS-II

### ❖ Third Harmonic Cavity

- Other facilities reported that they achieved a high single-bunch current with third harmonic cavities
- A prototype of a normal conducting cavity is under fabrication for 4GSR
- After fabrication of the prototype cavity, other cavities will be fabricated for the use of 4GSR
- It can be considered to use the prototype cavity to increase the single bunch current in PLS-II

Thanks to:

Thank you for your attention and PLS-II accelerator division

