

MR Magnets

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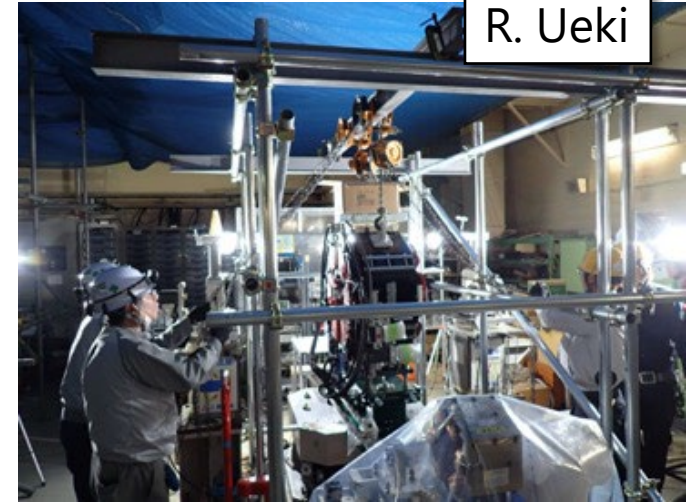
- Skew sextupole magnets for non-linear collimator
- New power supplies
- IR restoration
- Some failures in the power supply
- Summary

Skew sextupole magnets for non-linear collimator

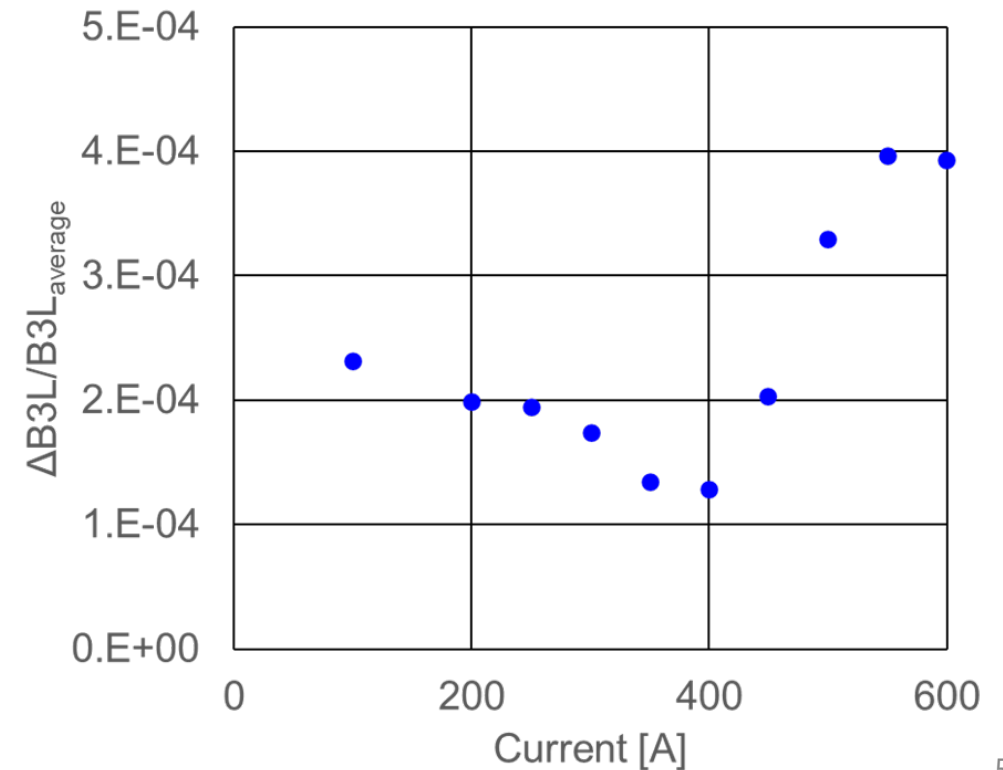
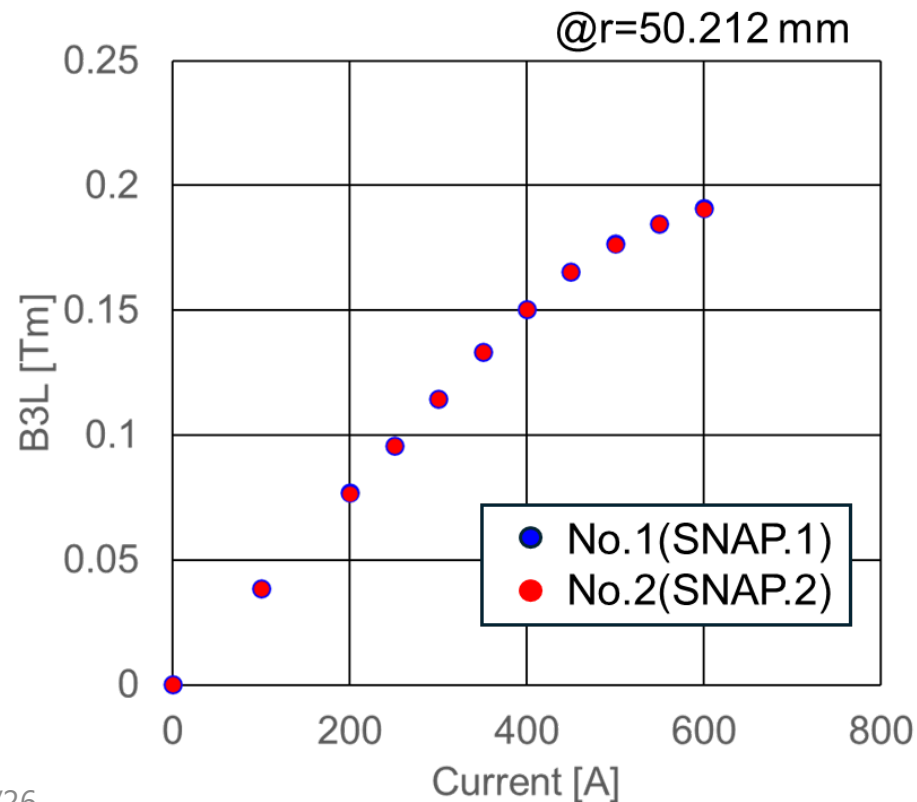
Magnetic field measurement of skew sextupole magnets

R. Ueki

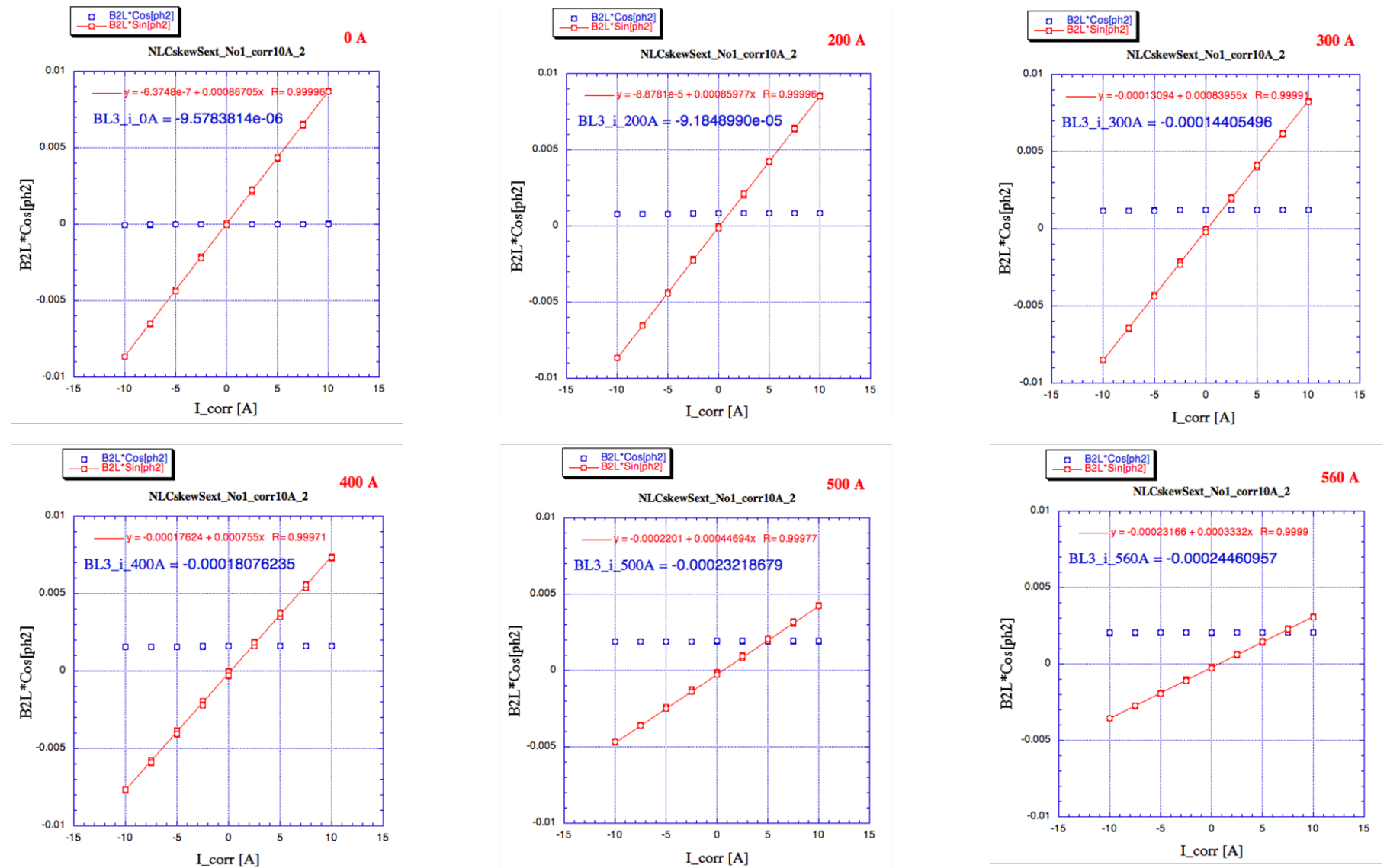
- The operation current is 227 A.
- The difference between each magnet's value and the average value in B_3L is about 2×10^{-4} .



The pair of skew sextupole magnets are driven by the same power supply, so the difference in B_3L appears as it is. However, the difference is acceptable.



- Each skew sextupole magnet has trim coils, and the trim coils were connected to generate a skew quadrupole field.
- B_2L sensitivity depends on the main sextupole coil current due to the saturation of the iron yoke.



Correction coil excitation curve

Works in Oho straight section during LS1



Processing baseplate



Production and alignment new baseplate



Processing Q-mag stand



Installation beam chamber



Alignment of Q-mag



Installation of SNAP



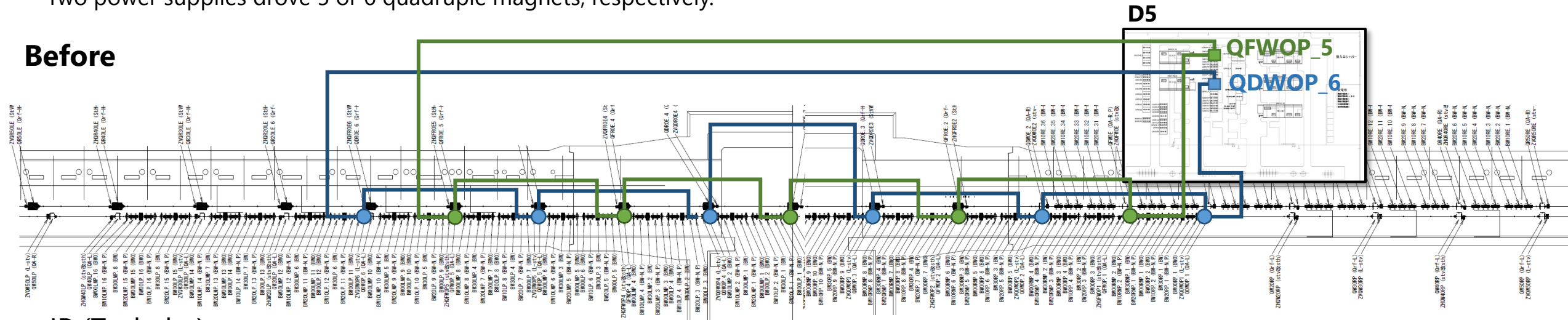
Alignment and survey

New Power supplies

Magnets and power supplies configuration

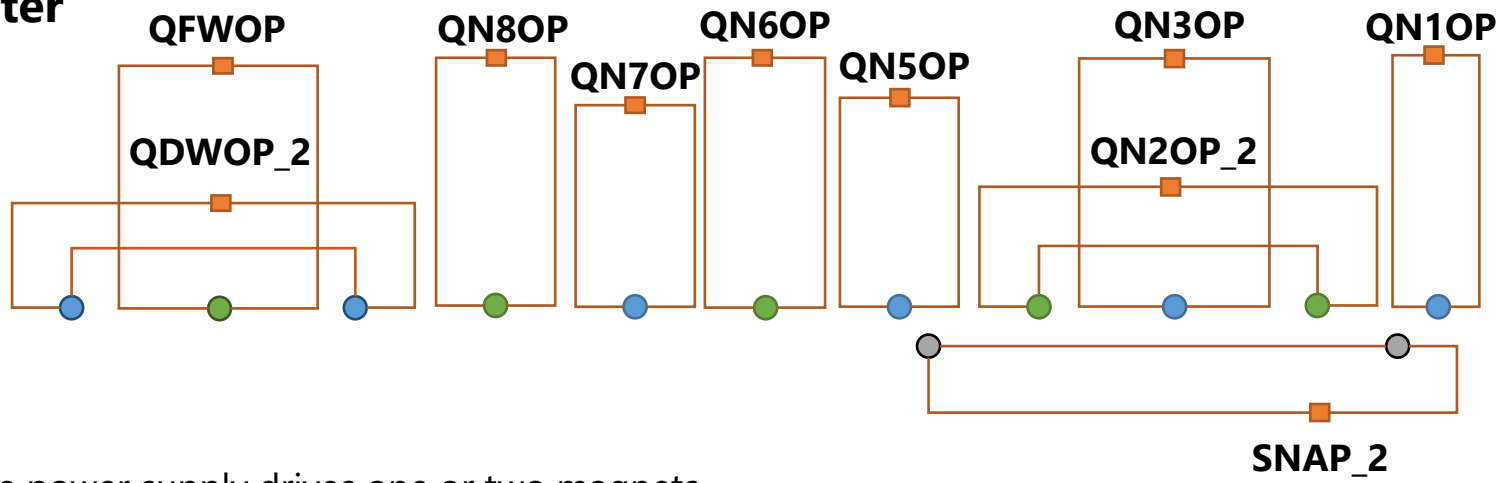
Two power supplies drove 5 or 6 quadruple magnets, respectively.

Before



← IP (Tsukuba)

After



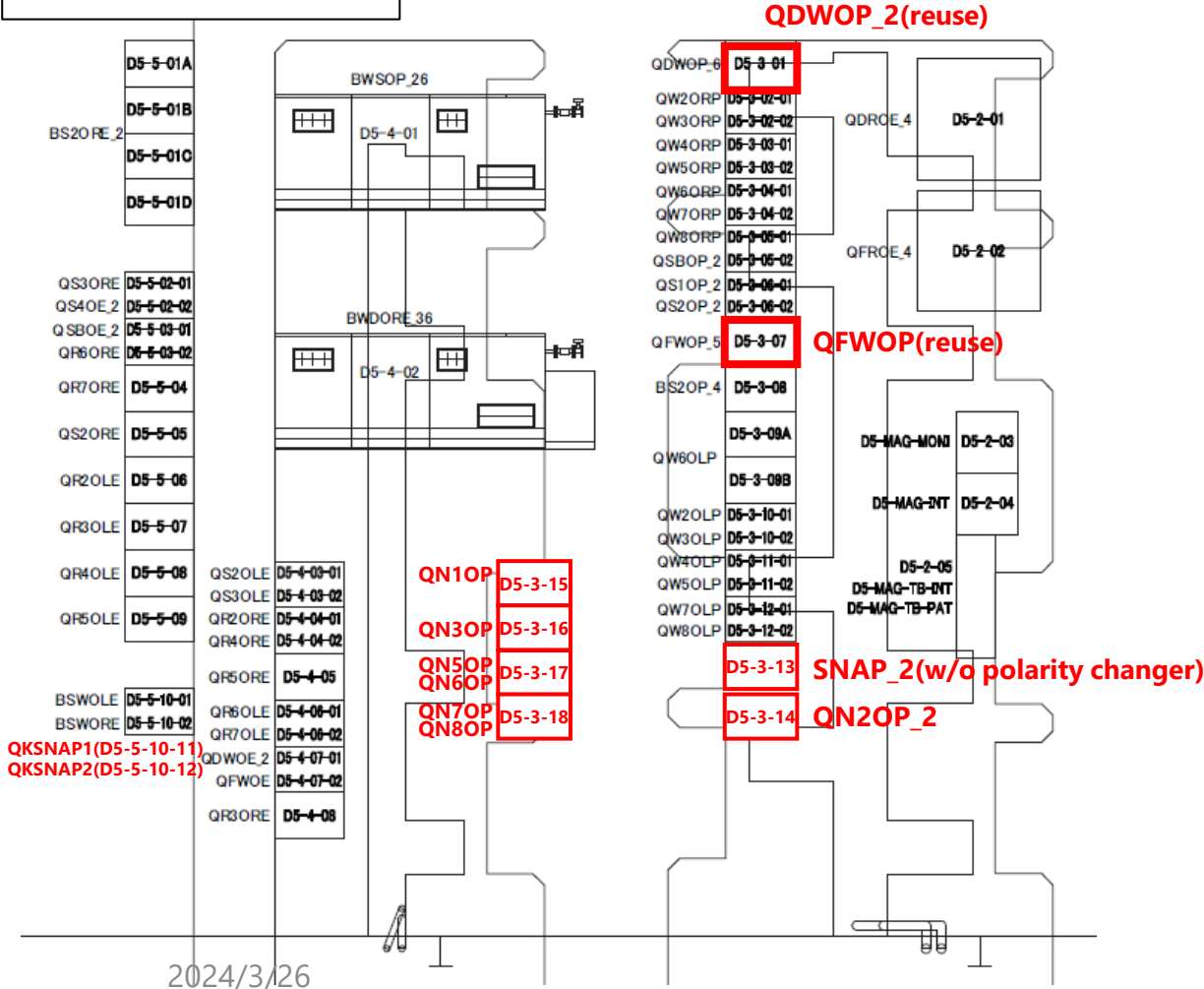
One power supply drives one or two magnets.



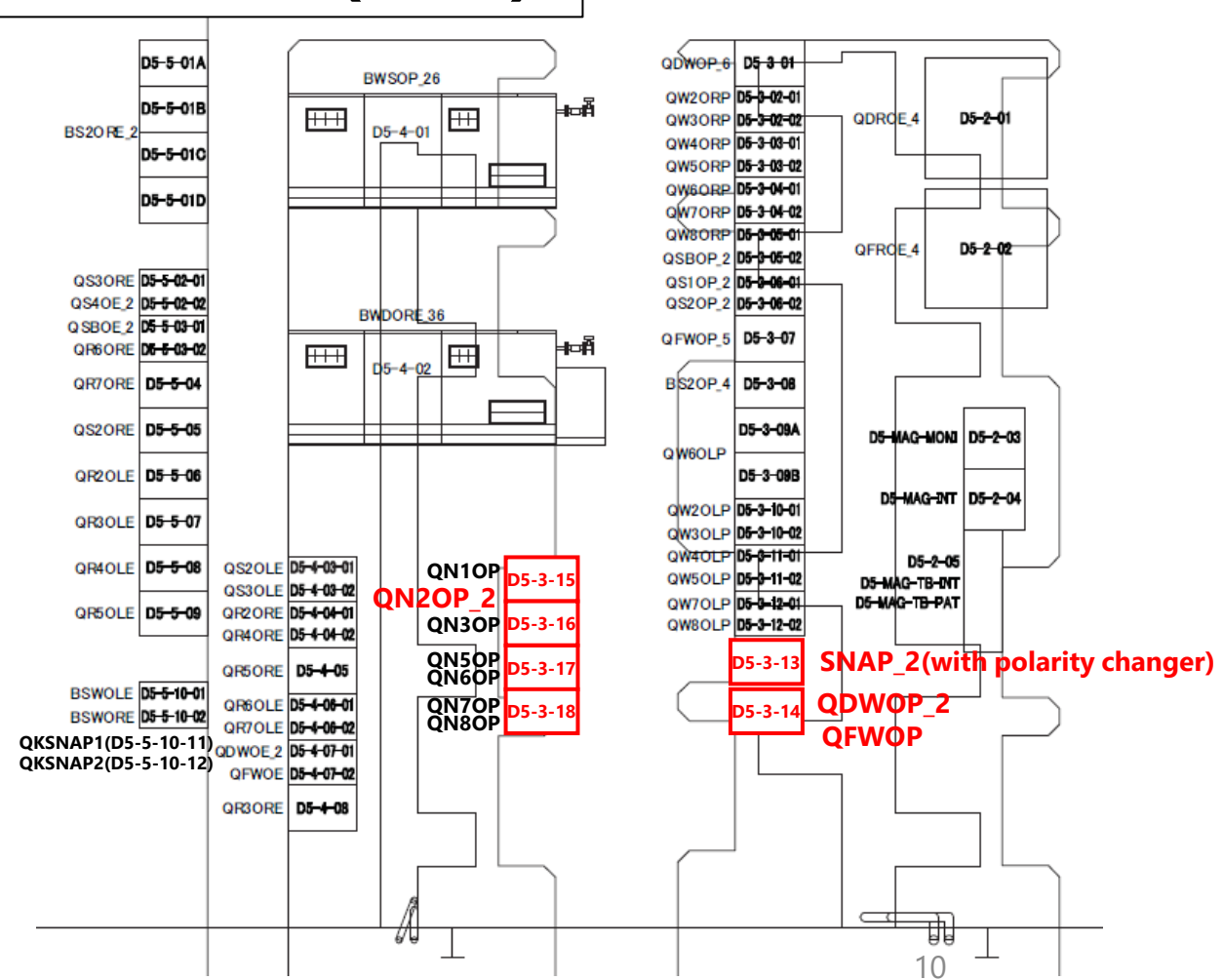
Power supplies arrangement

Ten power supplies for Q and skew sextupole magnet are needed.
Two small PSs for the trim coil are needed.

Jan. 2024

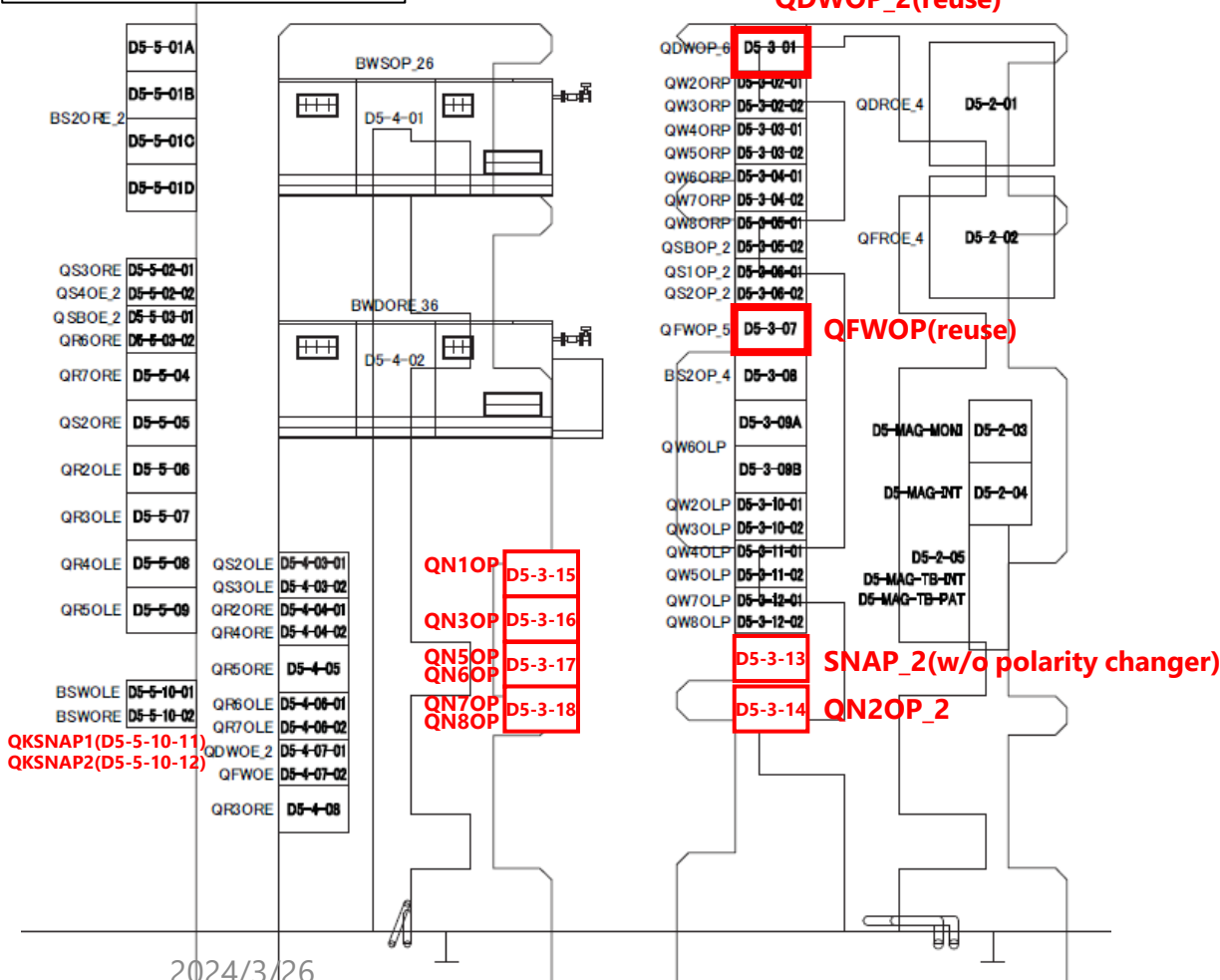


Oct. 2024(Plan)



Power supplies arrangement(cont.)

Jan. 2024



Production of 10 (+ spare) new power supplies has started.
 Contract signed in April 2022.
 Delivery was scheduled for March 2023.

However, due to COVID-19 and other factors, delivery within LS1 (by summer 2023) was impossible.
 As a result, the newly manufactured power supplies were delivered in March 2024.

The required number of power supplies was secured by reusing PSs, borrowing spare PS in DR, and restarting power supplies that had been stored for parts removal. (Thereby ensuring the required number of units plus one.)

However, in October 2023, a PF's power supply failed, and a power supply with a compatible rated output was lent. Thus, we are currently operating without a spare PS.

Power supplies arrangement(cont.)

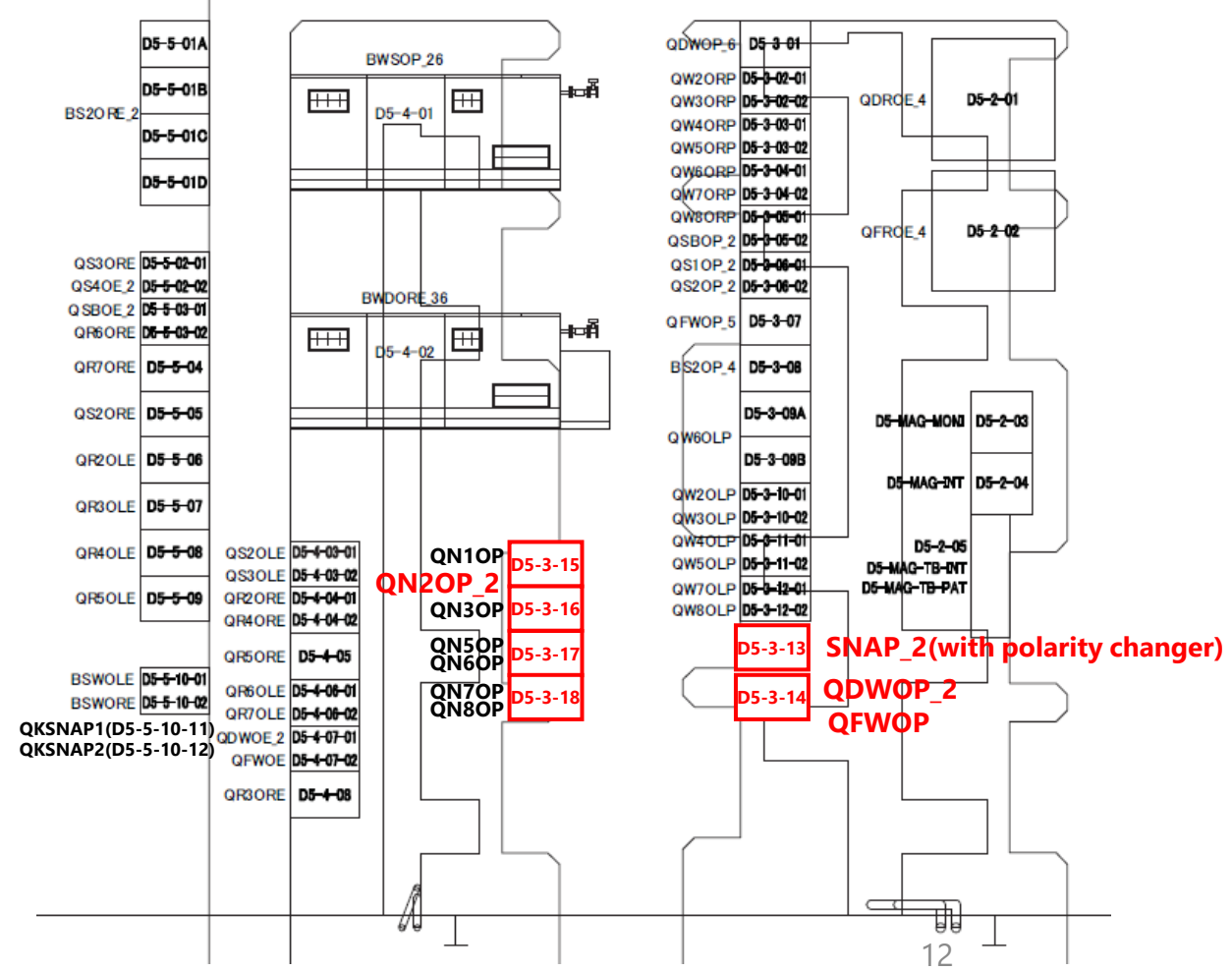
Skew sextupole magnets need to change the polarity. A power supply with a polarity changer has to be used. However, the alternative power supply does not have the polarity changer, so an extension cable is used.



2024/3/26

The installation of the newly manufactured power supplies will be held during the shutdown in the summer of 2024. Ready for the power supply arrangement change, the power cables were wired at an extra length.

Oct. 2024(Plan)

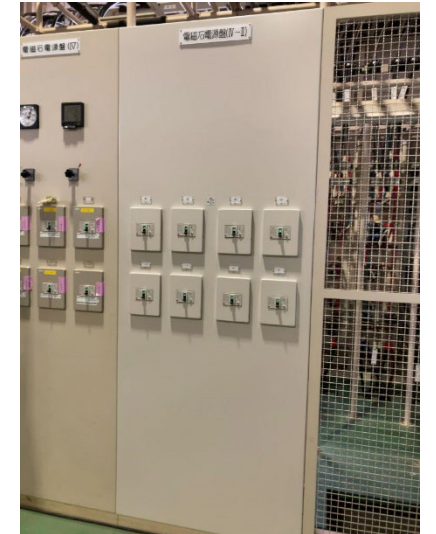
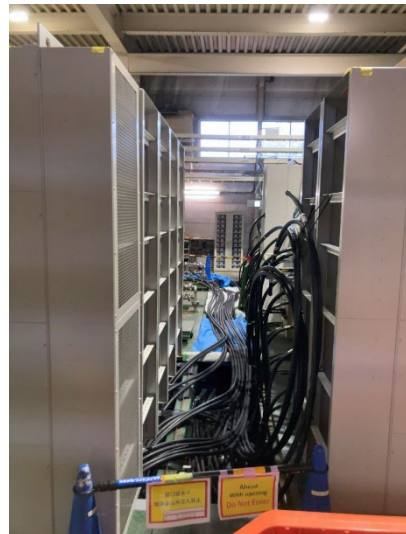


Works in D5 power supply building



Delivery and storage the power supplies.

Reinforcement with steel to install the racks over the cable pits.



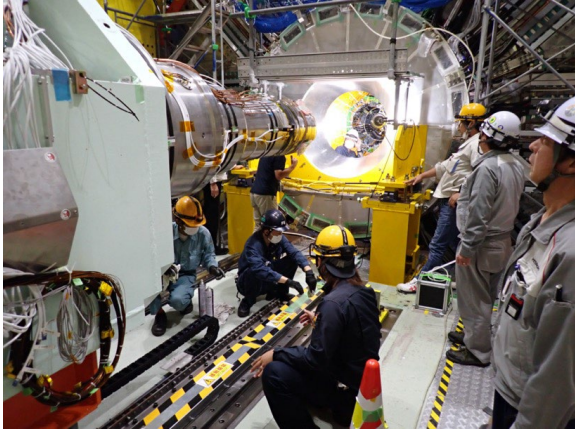
2024/3/26

Power cable connection.

Additional breakers were added to the distribution board.

IR restoration

Works in Tsukuba straight section during LS1



QCSL moving forward



QCSR moving forward



Magnets restoration



Alignment of magnets



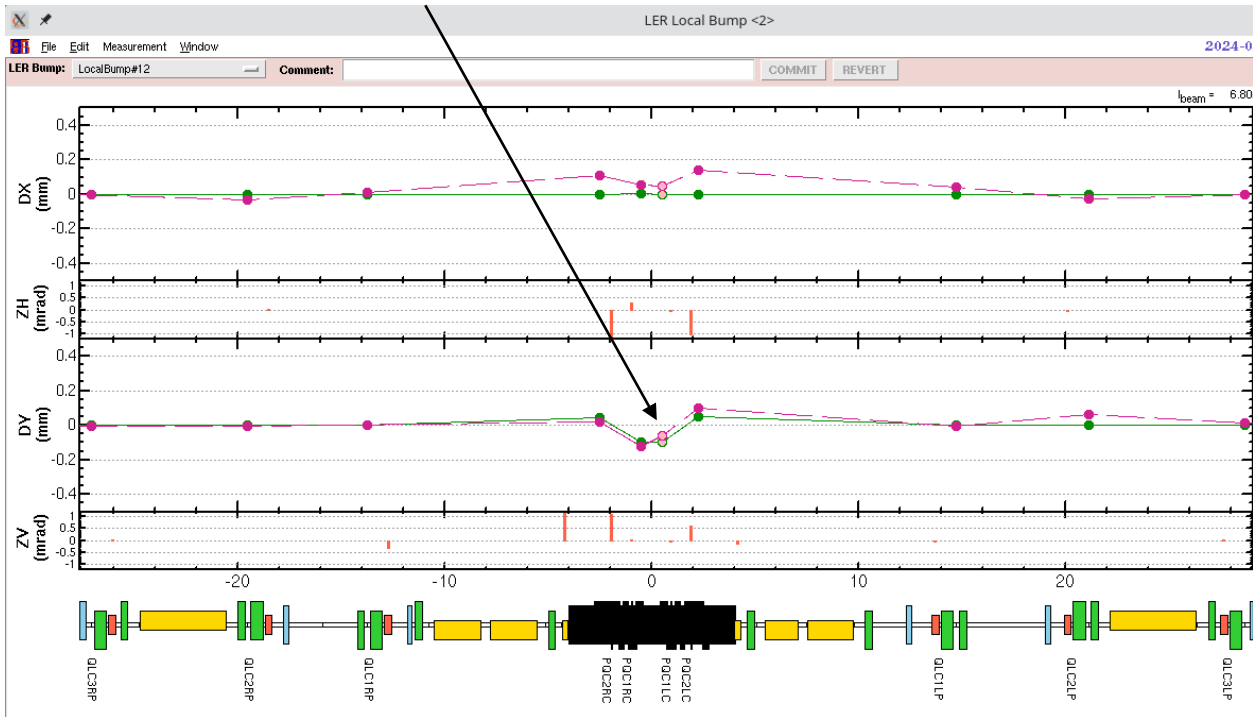
Survey of magnets at L and R side



First collision tuning (Feb. 19)

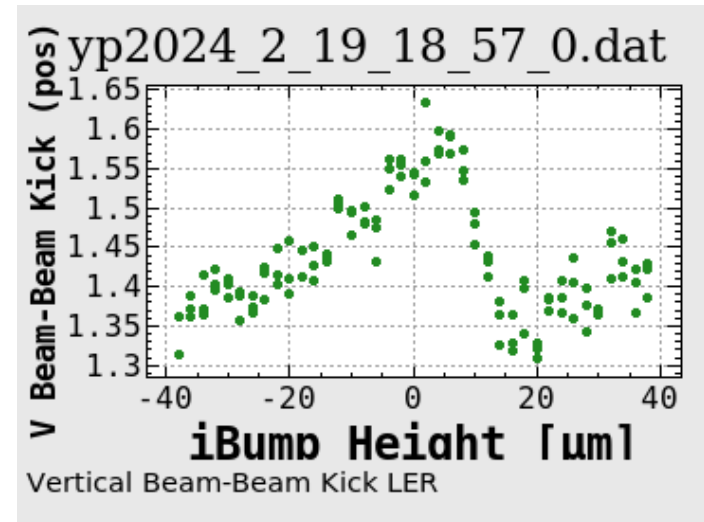
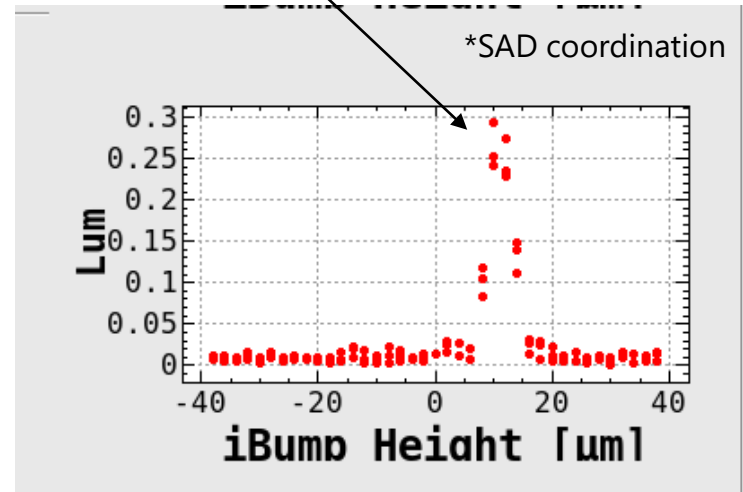
The difference between both beam was 85 μm .

LER local bump -100 μm



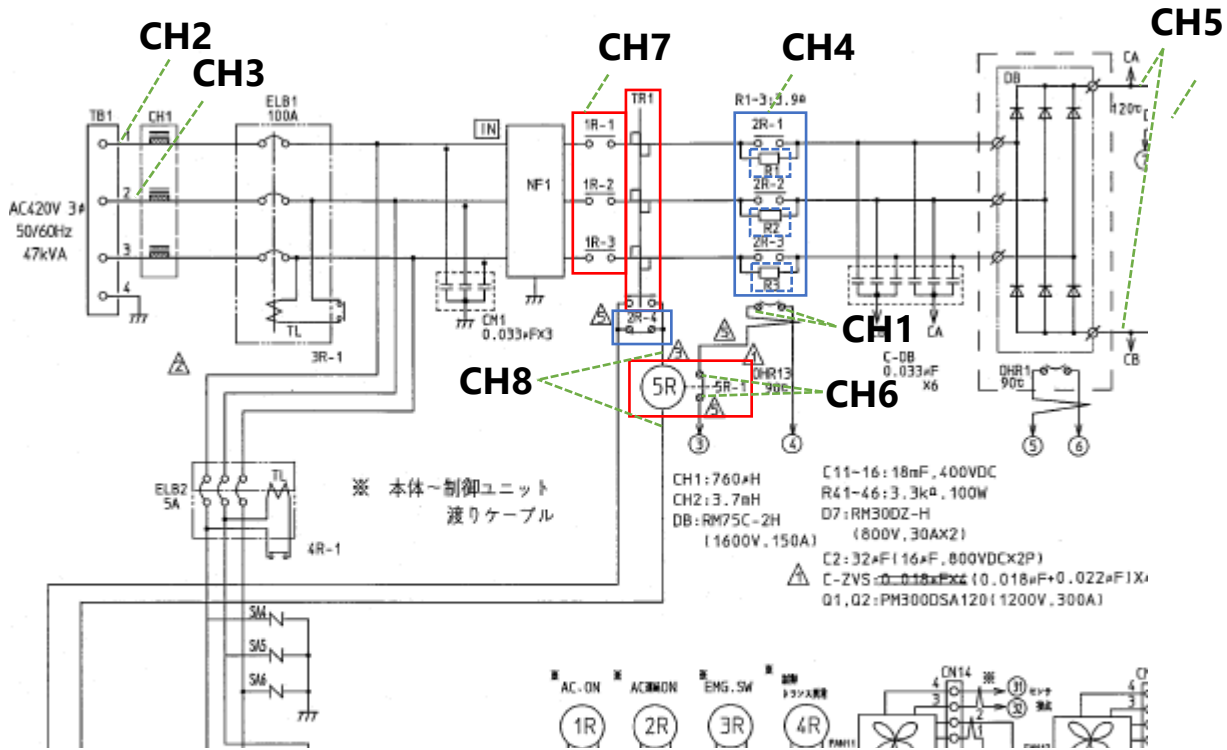
2024/3/26

iBump vertical offset (HER) 15 μm



Some failures in the power supply

Unintended interlock triggering

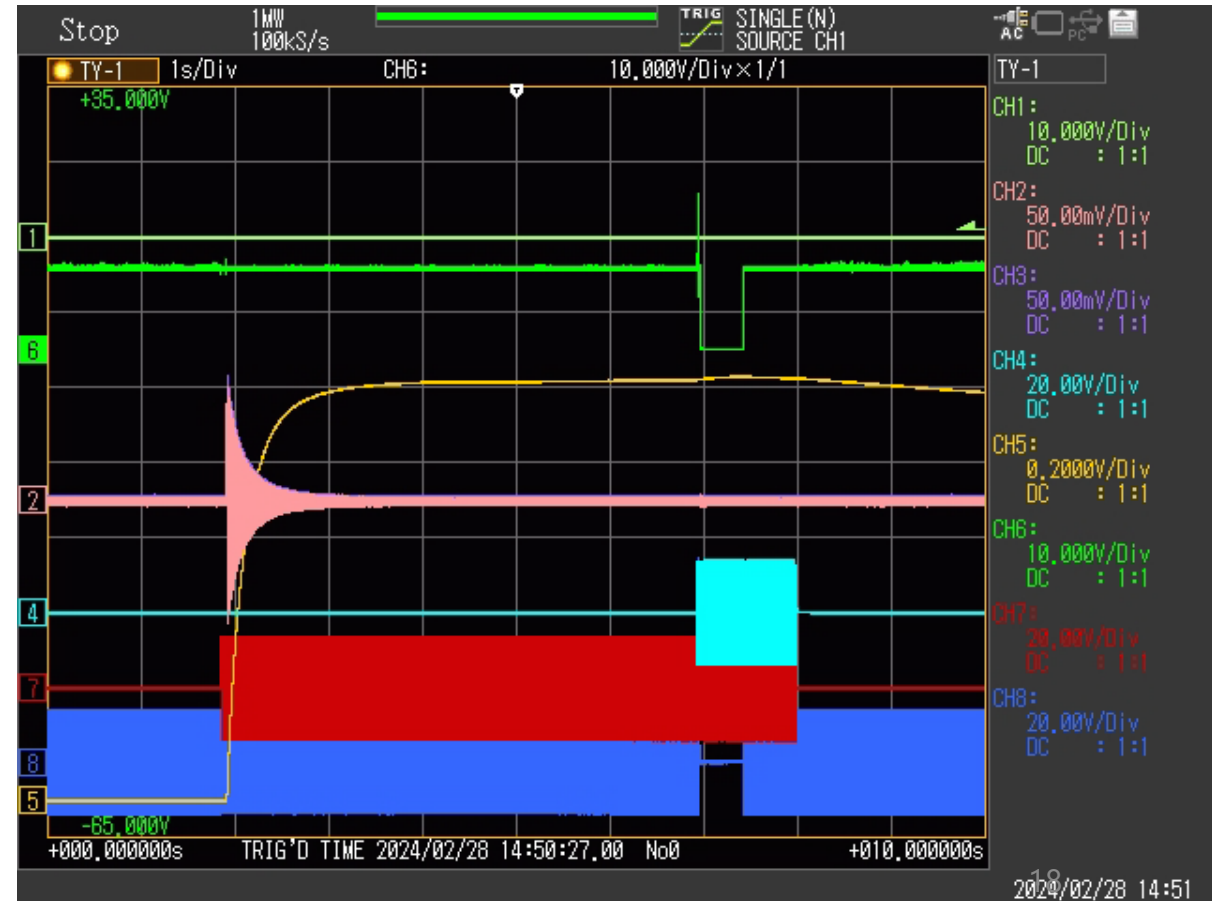


- CH1 : Thermoswitch (Open at high temp.)
- CH2,3 : AC current (1A/1mV)
- CH4 : Drive voltage of Contactor#2(2R) (10V/1V, AC100V)
- CH5 : DC voltage (500V/1V)
- CH6 : Relay(5R) (Close when voltage is applied.)
- Ch7 : Drive voltage of Contactor#1(1R) (10V/1V, AC100V)
- CH8 : Drive voltage of the relay(5R) (10V/1V, AC100V)

2024/3/26

The power supply(SD3ORE_2) frequently mis-detected interlocks(AC Over Current) and stopped. The beam operation was also stopped several times.

After these parts were replaced, this phenomenon no longer occurs.



2024/02/28 14:51

Unintended current reduction

The power supply(QFROE_4) sometimes unintentionally reduces the output current.
 The only interlock the power supply displays is "Tracking", but the output current is zero A.
 A malfunction due to noise in the control circuit is suspected.
 The control power supply was replaced, but the problem recurred.
 Other measures are under consideration.

KEKB Magnet PS / MGHPs:QFROE_4
 2024 02/24 07:30:19 IDX / 500.0A

SHREG
 SW: ON OFF
 Power: ON OFF

CURRENT SETTING
 SET: 251.7205 [A]
 READ: 0.0766 [A]
 Diff: -503287 [ppm]
 I(IN): 251.7205 SET

CONNECTION
 packet # -12524
 Preg 2
 N/A: I/F START

INTERLOCK
 FRI ALL
 Tracking

MGHPs:QFROE_4 I/L STATUS

IPREG/I2REG		IP2REG/I2REG		IP3REG/I3REG	
FRI ALL	Interlock	FRI ALL	Interlock	FRI ALL	Interlock
<input type="checkbox"/>	OC	<input type="checkbox"/>	## bit 17	<input type="checkbox"/>	## bit 33
<input type="checkbox"/>	OV	<input type="checkbox"/>	## bit 18	<input type="checkbox"/>	## bit 34
<input type="checkbox"/>	Thyristor Fus	<input type="checkbox"/>	## bit 19	<input type="checkbox"/>	## bit 35
<input type="checkbox"/>	Case Temp.	<input type="checkbox"/>	## bit 20	<input type="checkbox"/>	## bit 36
<input type="checkbox"/>	Trans. Temp.	<input type="checkbox"/>	## bit 21	<input type="checkbox"/>	## bit 37
<input type="checkbox"/>	Semicon.	<input type="checkbox"/>	## bit 22	<input type="checkbox"/>	## bit 38
<input type="checkbox"/>	GND Fault	<input type="checkbox"/>	## bit 23	<input type="checkbox"/>	## bit 39
<input type="checkbox"/>	Emergency	<input type="checkbox"/>	## bit 24	<input type="checkbox"/>	## bit 40
<input type="checkbox"/>	Ext.	<input type="checkbox"/>	## bit 25	<input type="checkbox"/>	## bit 41
<input type="checkbox"/>	DCCT	<input type="checkbox"/>	## bit 26	<input type="checkbox"/>	## bit 42
<input type="checkbox"/>	Water Flow	<input type="checkbox"/>	## bit 27	<input type="checkbox"/>	## bit 43
<input type="checkbox"/>	## bit 12	<input type="checkbox"/>	## bit 28	<input type="checkbox"/>	## bit 44
<input type="checkbox"/>	## bit 13	<input type="checkbox"/>	## bit 29	<input type="checkbox"/>	## bit 45
<input type="checkbox"/>	Thermostat	<input type="checkbox"/>	## bit 30	<input type="checkbox"/>	## bit 46
<input checked="" type="checkbox"/>	Tracking	<input type="checkbox"/>	## bit 31	<input type="checkbox"/>	## bit 47
<input type="checkbox"/>	Fan	<input type="checkbox"/>	## bit 32	<input type="checkbox"/>	## bit 48

2024/3/26

Tracking(Trig)

Control PS

U202-1

U201-1

Output Voltage

Output Current



19

Summary

- Skew sextupole magnets fabricated with new yokes and old coils performed properly and were installed in the beamline.
- New power supplies were not available in time due to COVID-19 and other factors, so a spare power supply and old power supplies were reconditioned to cover the cost.
- New power supplies were delivered this March and will be installed next summer.
- IR restoration is good.
- Some power supplies have problems.