

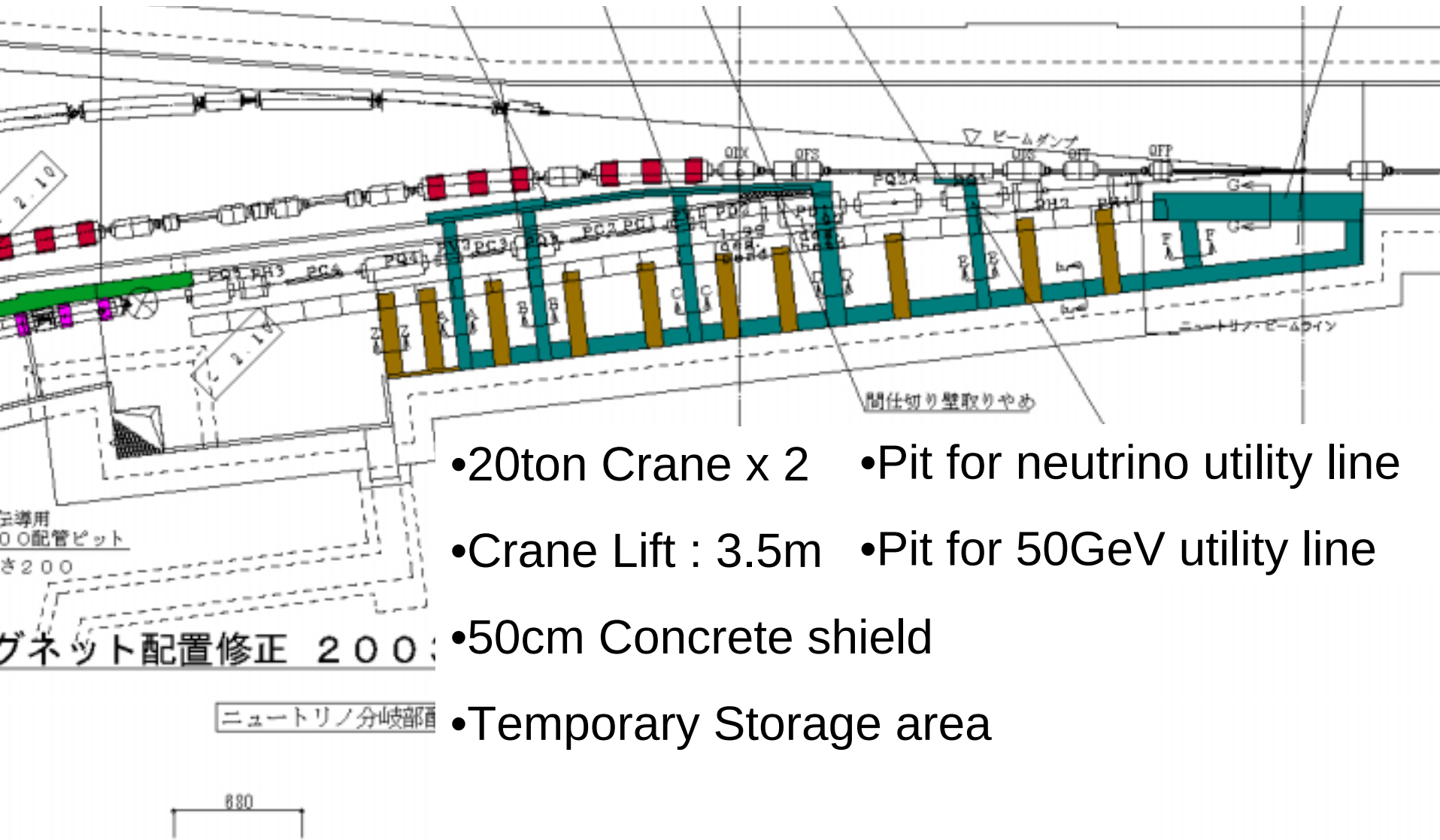
Warm magnets and the remote handling system in the J-PARC ν beam line

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Channel Group

Contents

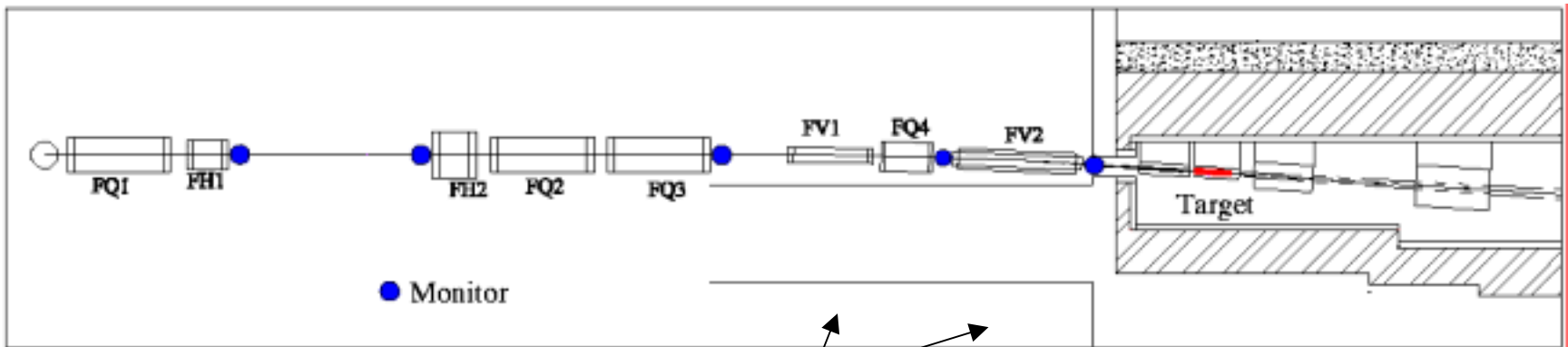
- Normal conducting magnet
 - floor plan for normal conducting magnet
 - Specification of magnets
 - Polyimide and MIC Magnets
- Quick disconnection and installation system
 - Remote hanging apparatus
 - Quick alignment and installation system
 - Cooling water connector

preparation section



Focusing Section

- We started to design the floor plan in detail.
- Design scheme is almost the same as that of preparation section.
- 20ton crane x 2, tunnel width : 2m+6m, pit for utility line, 50cm shield, etc...

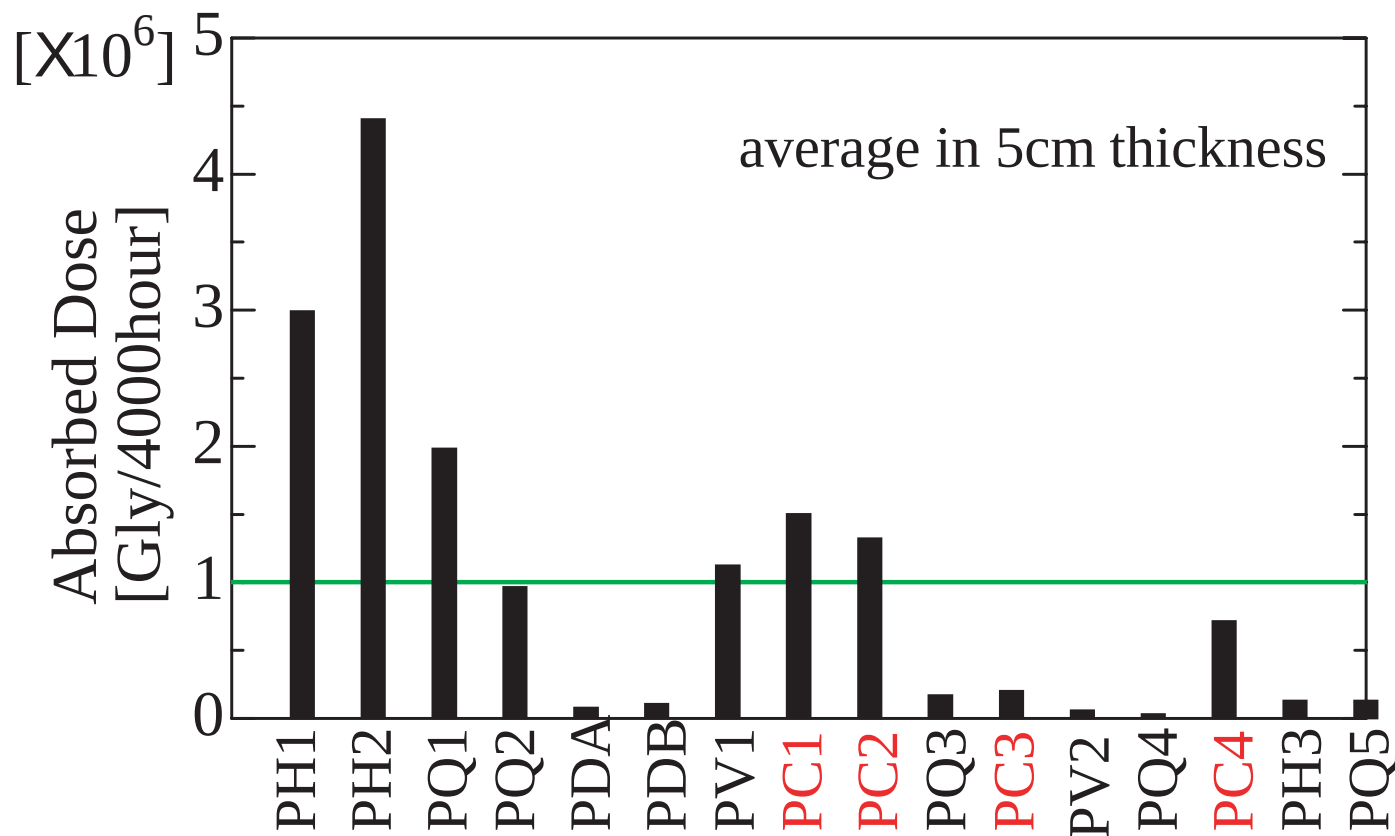


Vertical steering magnet
Change off-axis angle w/ this.

Summary of the J-PARC v beam line warm magnets

No.	Name	Magnet Type	Optical Gap[mm]		Magnetic Field[Tesla]		Length [mm]	Magnet Gap[mm]		Outward form[mm]			Maximam ratiang			Normal Operation			Weight [ton]
			V	H	operate	max rating		V	H	W	H	L	Current [A]	Voltage [V]	Power [kW]	Current [A]	Voltage [V]	Power [kW]	
1	PH1	6C220MIC	41	116	1.000	2.000	1,000	100	300	1,400	1,200	1,400	2,000	101	202	1,000	50	50	13
2	PH2	6C220MIC	54	152	1.000	2.000	1,000	100	300	1,400	1,200	1,400	2,000	101	202	1,000	50	50	13
3	PQ1	Q460MIC	200		0.910	1.000	3,000	200		1,280	1,280	3,500	2,300	283	651	2,093	258	539	39
4	PQ2	Q360MIC	150		1.130	1.000	3,000	150		1,280	1,280	3,500	2,500	206	514	2,825	232	657	39
5	PD1	8D360	115	134	1.898	2.000	3,000	150	400	1,500	800	3,500	2,500	153	383	2,372	145	344	29
6	PD2	8D260	81	142	1.898	2.000	3,000	100	400	1,400	700	3,500	2,500	100	250	2,372	95	225	24
7	PV1	6D320MIC	52	109	1.000	2.000	1,000	150	300	1,100	600	1,400	2,500	130	325	1,250	65	81	5
8	PQ3	Q460	200		0.620	1.000	3,000	200		1,280	1,280	3,350	2,400	160	384	1,488	99	148	39
9	PV2	6D320	98	83	1.000	2.000	1,000	150	300	1,100	600	1,500	2,000	150	300	1,000	75	75	5
10	PQ4	Q360	150		1.150	1.000	3,000	150		1,280	1,280	3,500	2,500	102	255	2,875	117	337	39
11	PH3	6D220	48	73	1.000	2.000	1,000	150	300	1,200	600	1,400	2,000	100	200	1,000	50	50	6
12	PQ5	Q360	150		1.060	1.000	3,000	150		1,280	1,280	3,500	2,500	102	255	2,650	108	287	39
PP Total															3,920.6			2,844	292
13	FQ1	Q260MIC	70		0.862	1.000	3,000	100		1,200	1,200	3,000	2,000	152	304	1,724	131	226	35
14	FH1	4D220	69	49	1.000	2.000	1,000	100	200	1,000	440	1,400	2,000	90	180	1,000	45	45	4
15	FH2	6D220	81	124	1.000	2.000	1,000	160	400	1,200	600	1,400	2,000	90	180	1,000	45	45	6
16	FQ2	Q360MIC	150		0.970	1.000	3,000	150		1,280	1,280	2,500	2,500	206	515	2,425	200	485	39
17	FQ3	Q360MIC	150		0.900	1.000	3,000	150		1,280	1,280	2,500	2,500	206	515	2,250	185	417	39
18	FV1	6D250	86	125	1.896	2.000	2,500	150	300	600	1,200	2,900	2,500	90	225	2,370	85	202	14
19	FQ4	Q330	98		0.930	1.000	1,500	150		1,200	1,200	3,000	2,000	117	234	1,860	109	202	17
20	FV2	6D280	86	87	1.890	2.000	4,000	150	300	600	1,200	4,400	2,500	120	300	2,363	113	268	23
FF Total															2452.8			1,889.9	177
Total															6,373.4			4,733.5	469

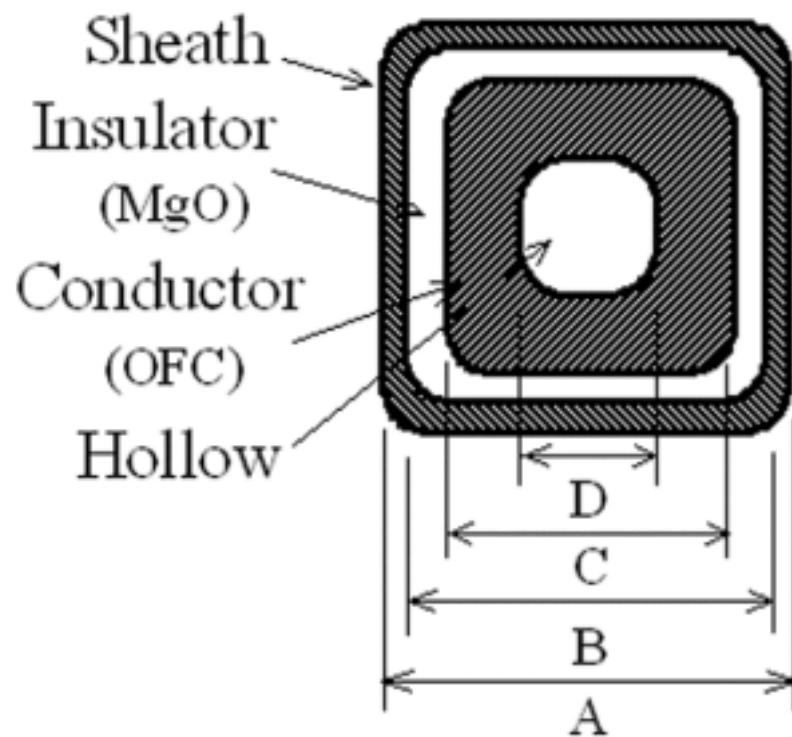
Radiation dose at the magnets in Preparation Section (Tanabe-kun)



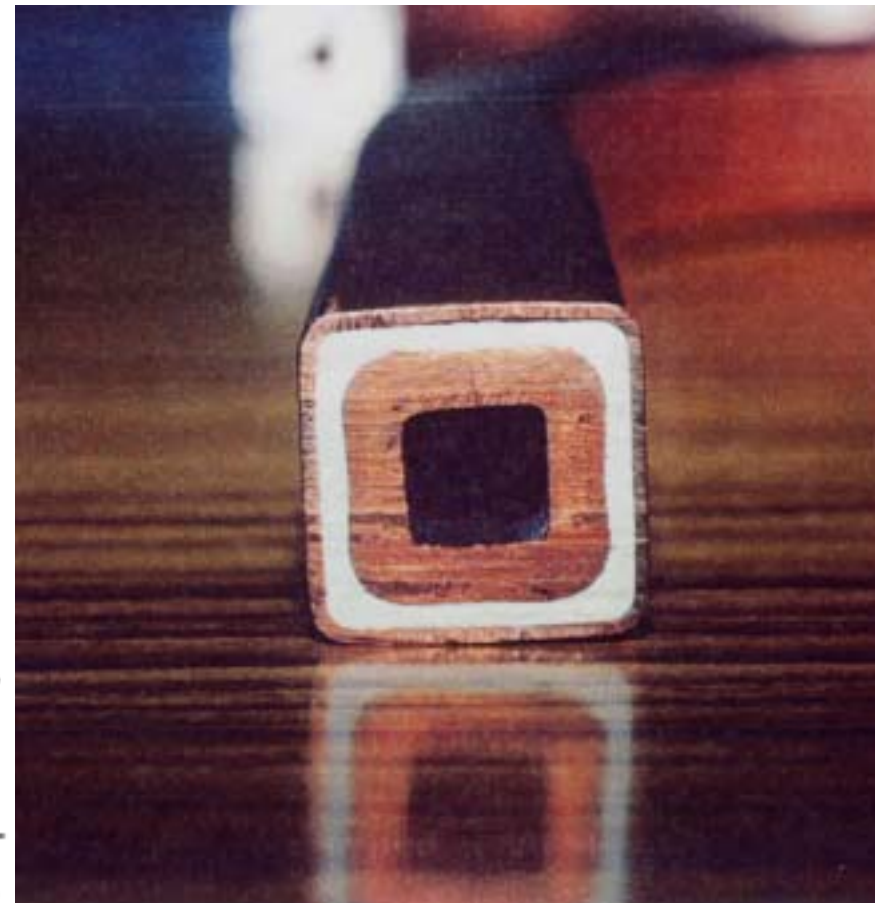


- Typical magnets for JPARC-nu beam line
- Q460
 - Insulator : Polyimide ~ $10^{**}8\text{Gy}$
 - Bore diameter : 20cm
 - Length : 3m
 - Current : 2500A
 - Voltage : ~ 160V
 - Weight : 32ton
- Q440MIC
 - Insulator : MgO ~ $10^{**}11\text{Gy}$





Status of Mineral Insulation Cable

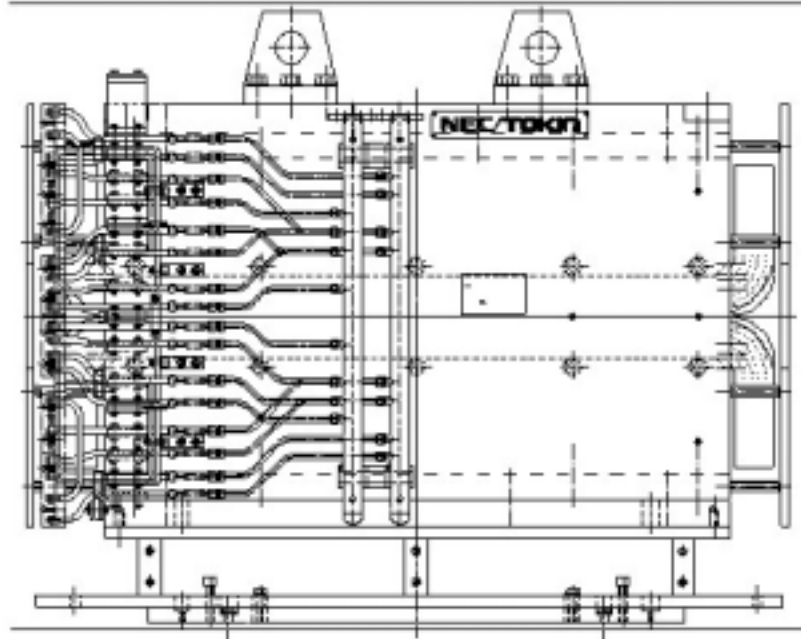
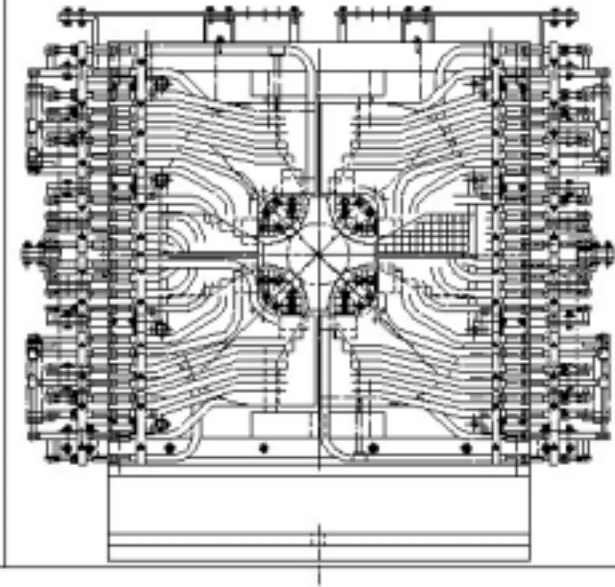


Nominal Current (A)	2000	2500	3000	1000*	2000*
Dimensions (mm)					
A: Outward Size	20.0	23.8	28.0	18.0	14.0
B: Insulator Size	18.0	21.6	25.0	16.6	12.6
C: Conductor Size	14.6	18.0	20.0	13.2	9.2
D: Hollow Size	7.4	10.0	10.0	--	--
Cross Section (mm ²)					
Conductor	150.9	211.7	293.1	168.4	78.8
Insulator	117.7	153.2	227.4	106.6	79.4
Seath	73.4	95.3	150.6	47.8	36.6
* indicates Solid Conductor MICs. No hollow is in Cu conductor.					

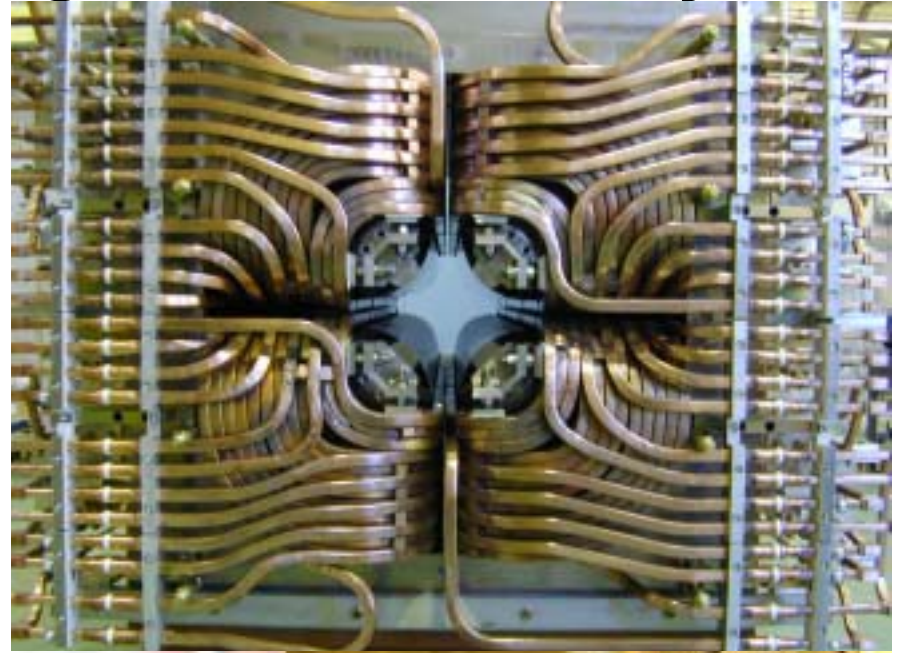
Construction of actual magnet

Q440MIC

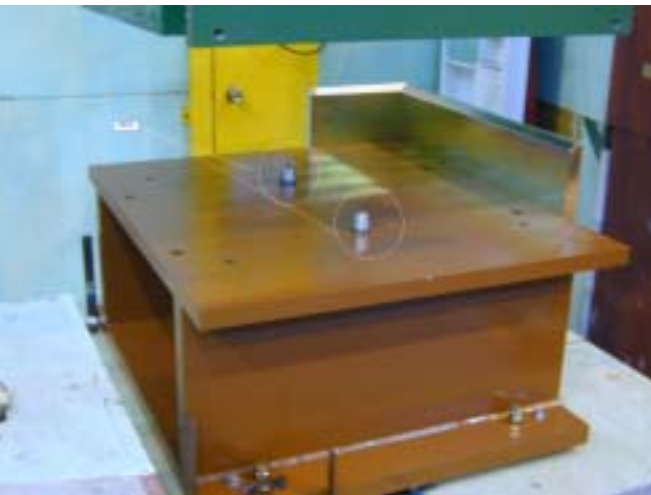
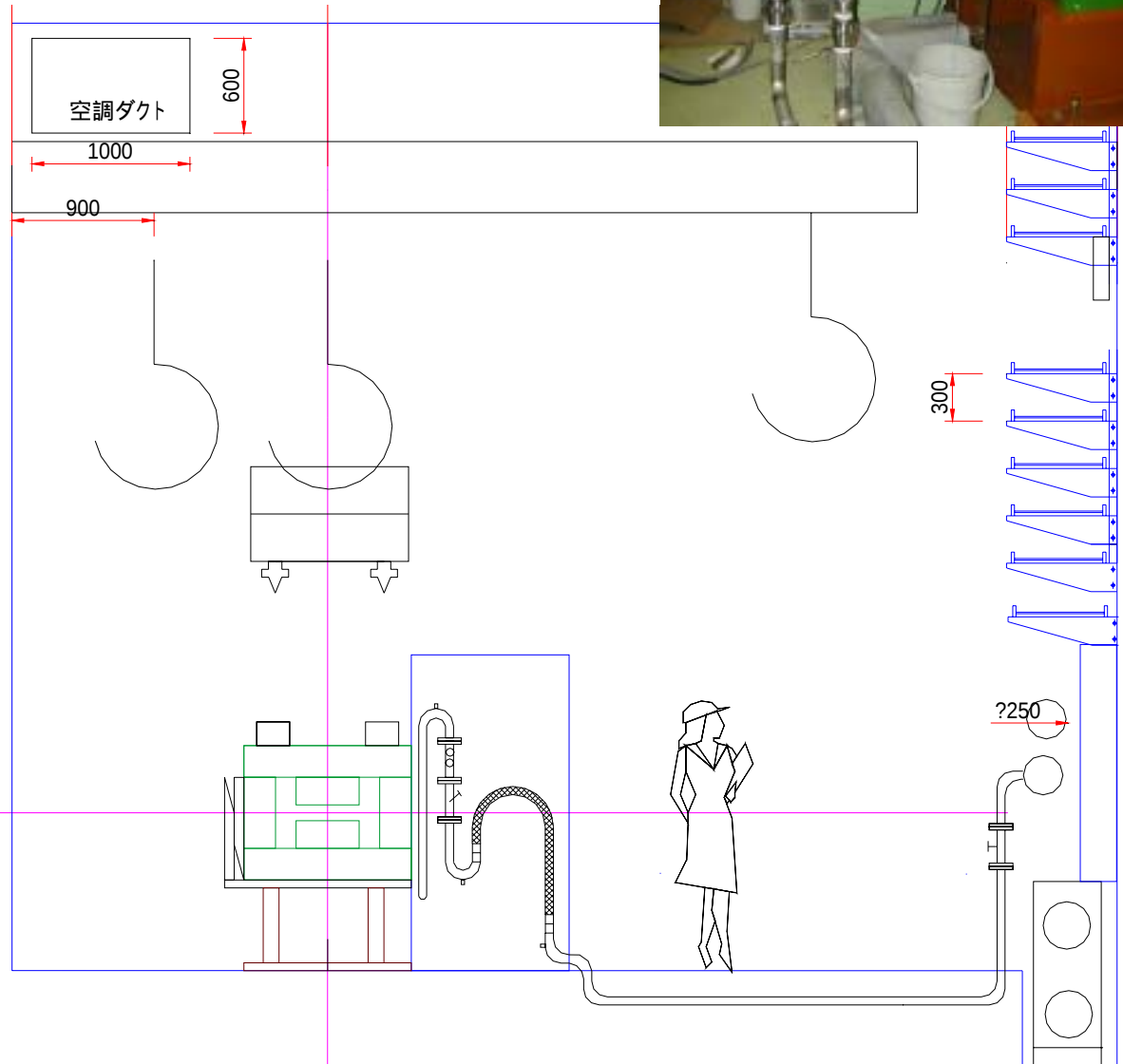
- 20cm bore diam., 200cm pole length
- 43T/pole, 1.3T@pole
- Nominal current/voltage=2200 A/200V
- Cooling water=290 L/min.@1MPa
- Cooling water Temp. rise=30
- Approximate Weight=33ton



Q440MIC Magnet Assembly

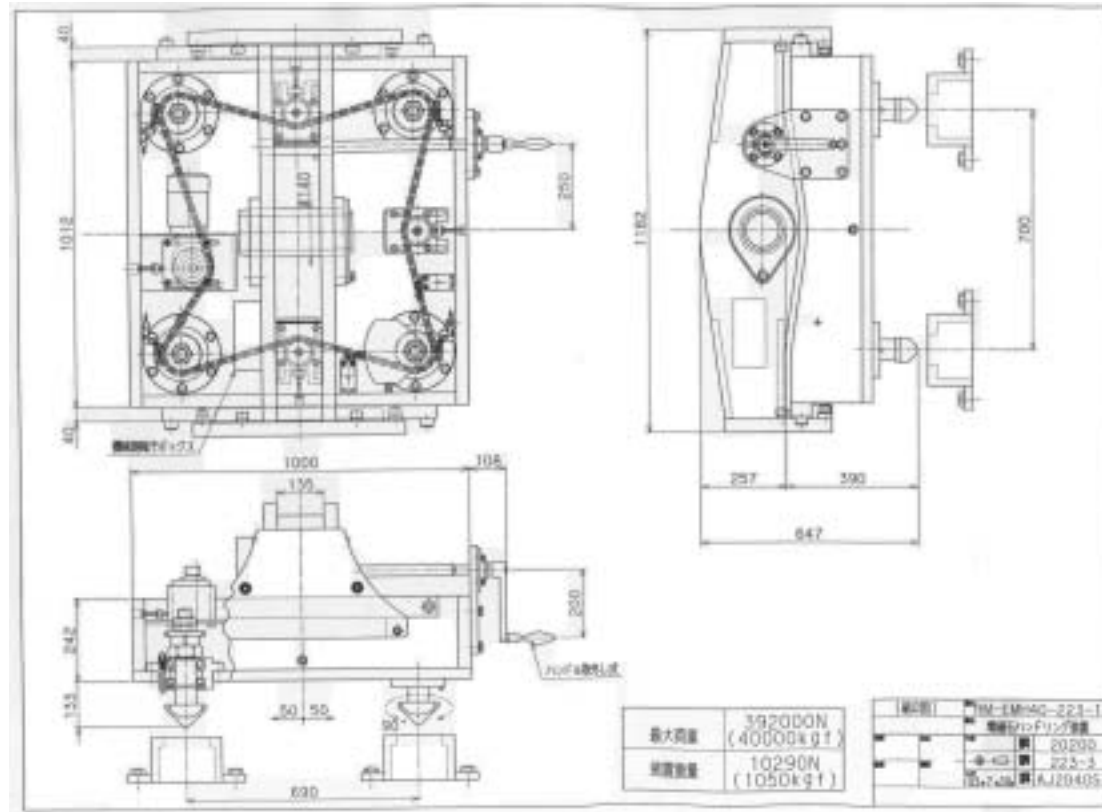


Cross section of the normal conduction magnet tunnel



The development of “Twist-lock” (an automatic sling apparatus)

- Specification
 - Slinging remotely
 - Maximum load : 40 ton
 - Four point connection (the fewer, the better)
 - The distance of each point : ~ 700mm
 - Height of the apparatus : within 1m
 - Electrical power operation
 - Interlock system
 - Balancing mechanism





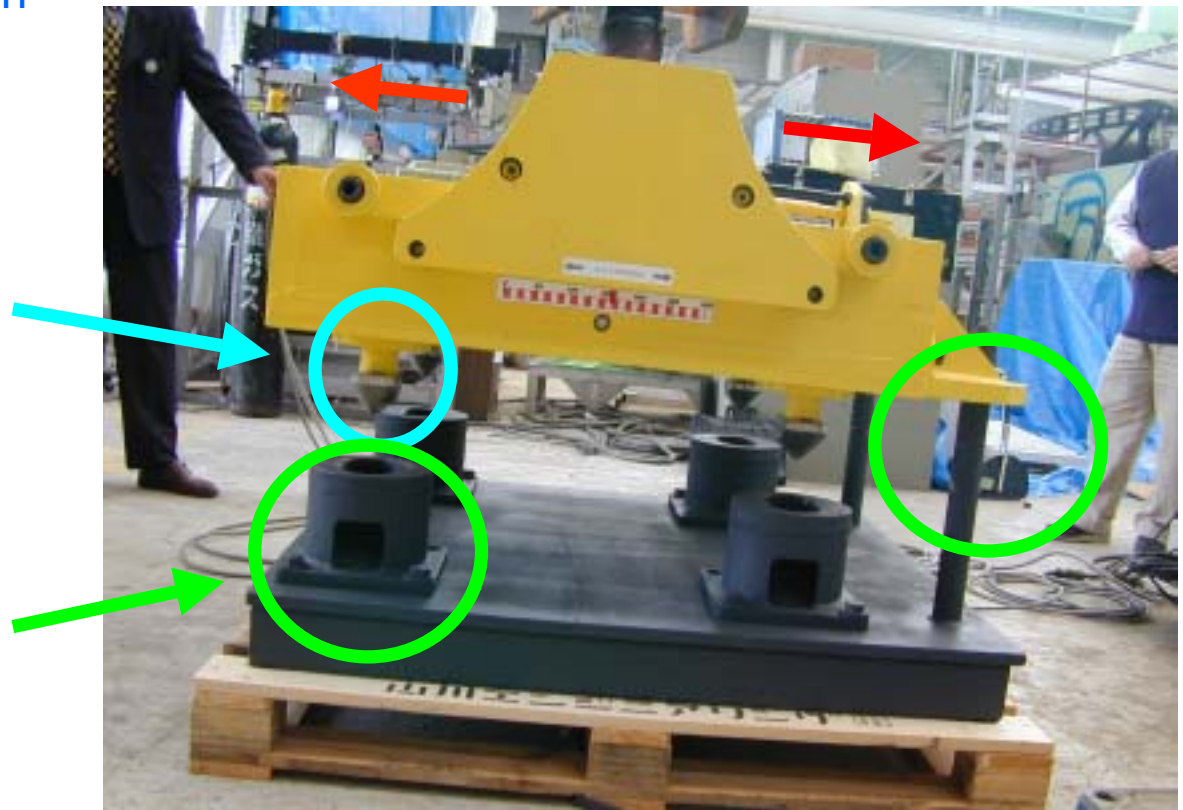
Interlock switch

Twist lock



Corner fitting

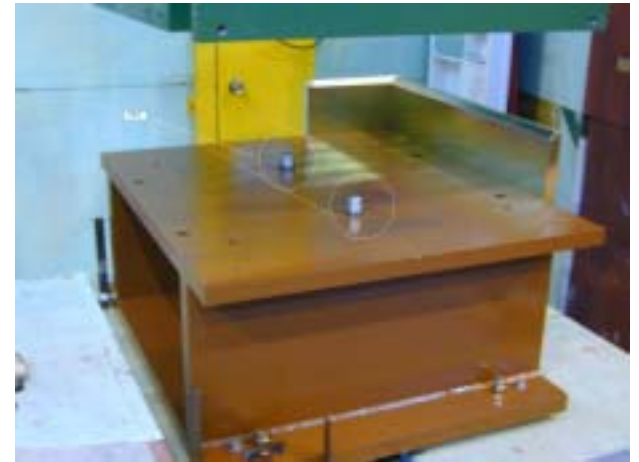
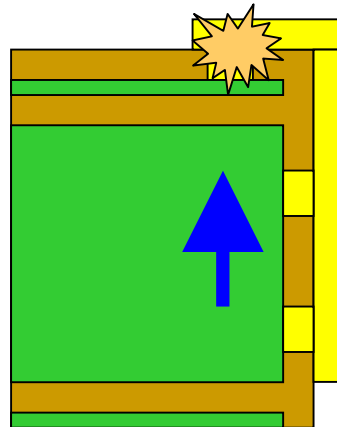
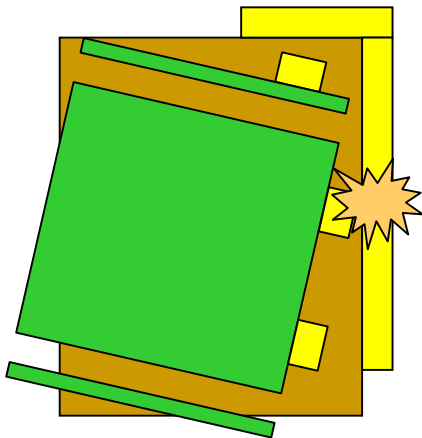
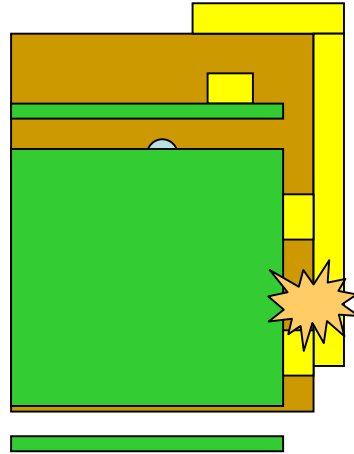
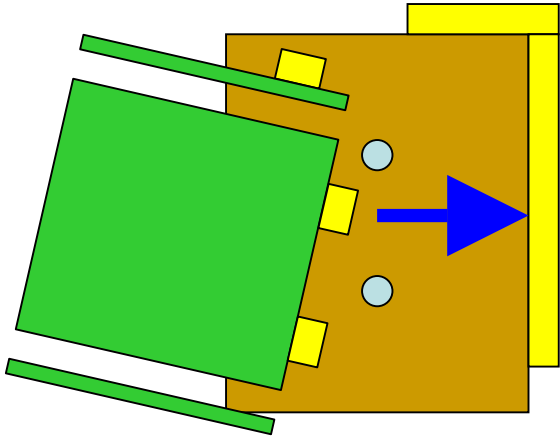
4 twist locks turned by the chain driven electric motor, simultaneously.

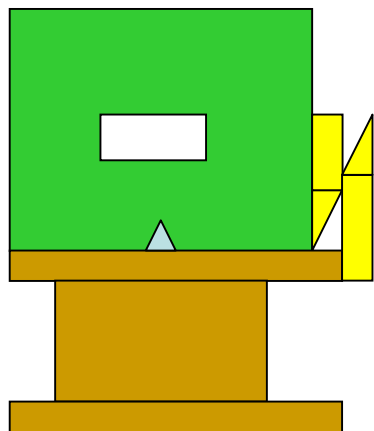
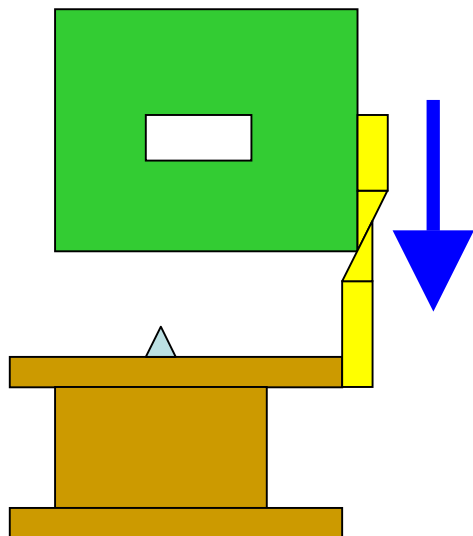


Remote Controller



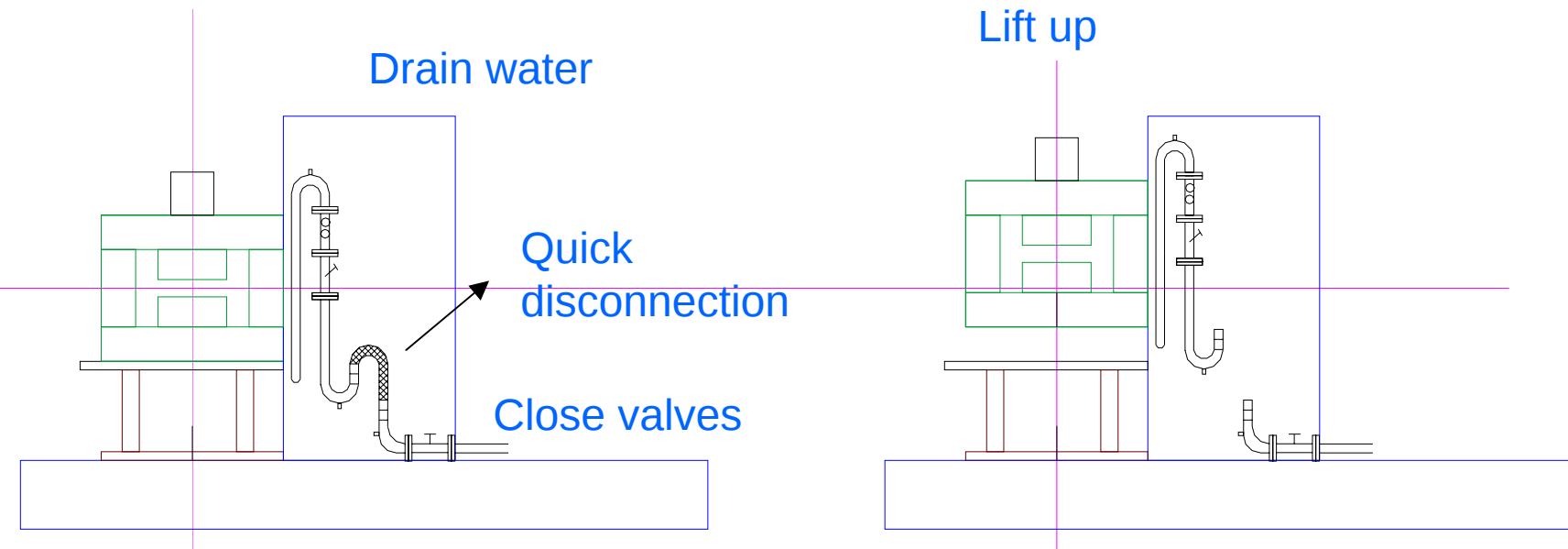
Quick alignment guide





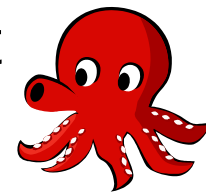
Connector of the cooling water

- Normal operation with 20 atm (2.0 MPa)
- Normal operation temperature : 15 ~ 80
- Pure water
- Two inch. Diameter
- Metal gasket
- The amount of leakage in case disconnection : 100ml/once
- The amount of time necessary for connection/disconnection by hand : 30sec/one circuit



Metal sealed lever coupler

- Using metal seal instead of rubber one
 - With 4 levers
 - Long lever
 - Fine tuning system for alignment



	H [mm]	T [mm]	material	Leakage test of Nitrogen with 3MPa	Leakage test of Water with 3MPa
Metal hollow O-ring	2.4	0.25	SUS321 with silver coating	No leak	No leak
Metal C-ring	2.4		Inconel X75 with silver coating	Small leak	No leak
Metal E-ring	2.6		Inconel718 with silver coating	Small leak	No leak

“Drain trap” type

“Elephant nose” type

Mock up test will be done soon.

Water lock

Ball valves used for steam
or viscous fluid piping
on the market

Gasket material : metal,
graphite, asbestos

KITZ Ball valve



Summary

- In the preparation section the floor plan design fixed.
- The technology of radiation resistant magnets is established.
- Each tools for quick disconnection and quick installation will be establish soon.
- Total test will be done at the mock up.



Schedule

	2005	2006	2007	2008
Preparation Section (12Magnets)	Design	Production	Installation Piping Total test	
Final Focus section (8 Magnets)		Design	Production	Installation Piping Total test

Electric power connector

- 3000 A

