中国科学院高能物理研究所
Institute of High Energy Physics
Chinese Academy of Sciences

北京高能锐新科技有限责任公司
Beijing HE-Racing Technology Co., Ltd.

Accelerating Equipments Development at IHEP&HERT

OCT. 23th @Hangzhou,China

The 2024 international workshop on the high energy Circular Electron Positron Collider (CEPC)

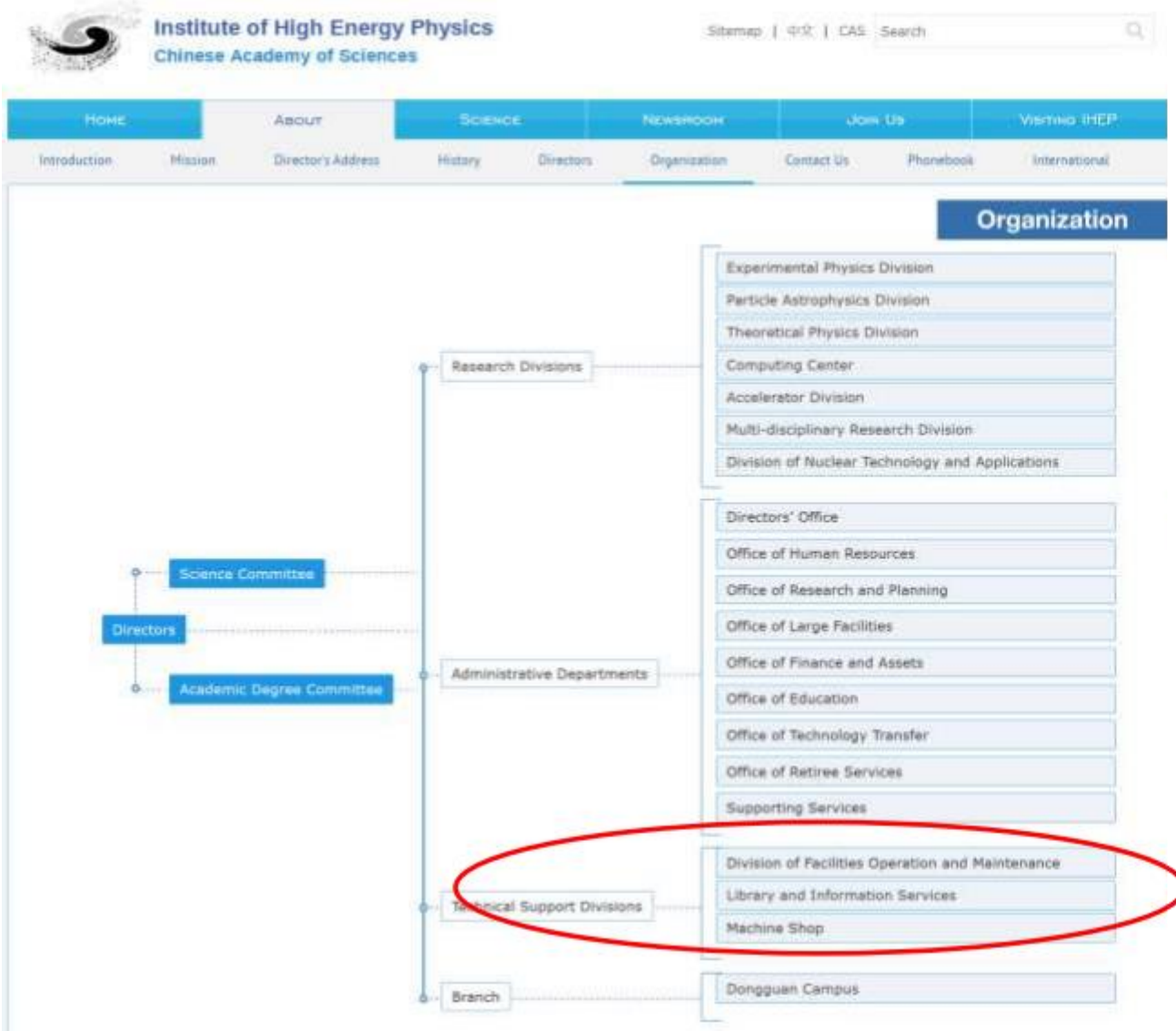
Outline

1. Brief Introduction
2. Magnets
3. Accelerating Structure and RT Cavities
4. SRF Cavities Couplers and Cryomodules
5. Facilities Serviced by HERT
6. Summary

1. Brief Introduction

高能锐新 HE-RACING TECHNOLOGY

- IHEP organization



- In year2013, the company(HERT) was established.
- The company is wholly owned by IHEP.
- Be responsible for the international development cooperation .

1. Brief Introduction

高能锐新 HE-RACING TECHNOLOGY

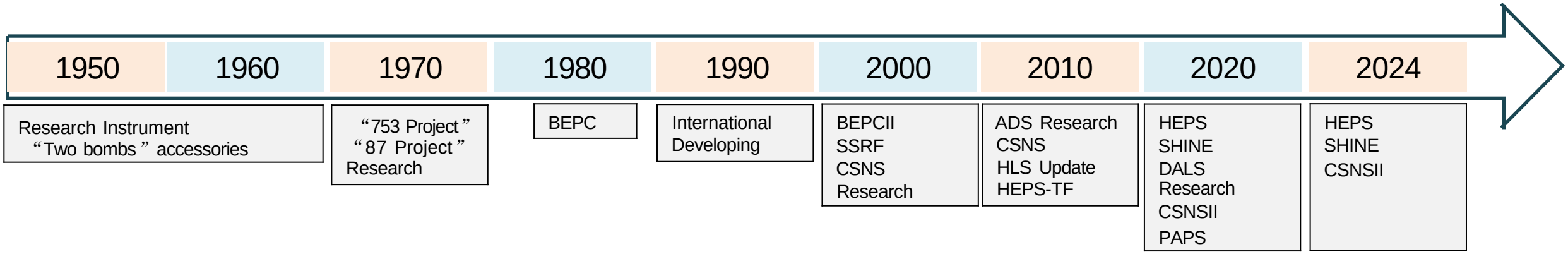
History

1950.5
Institute of Modern Physics·Technician Team
1953.10
Institute of Physics·Machine shop
1958.7
Institute of Atomic Energy·1st Workshop

1973.2
Institute of High Energy Physics,CAS·Machine shop

2013.4
Beijing HE-Racing Technology Co.,Ltd

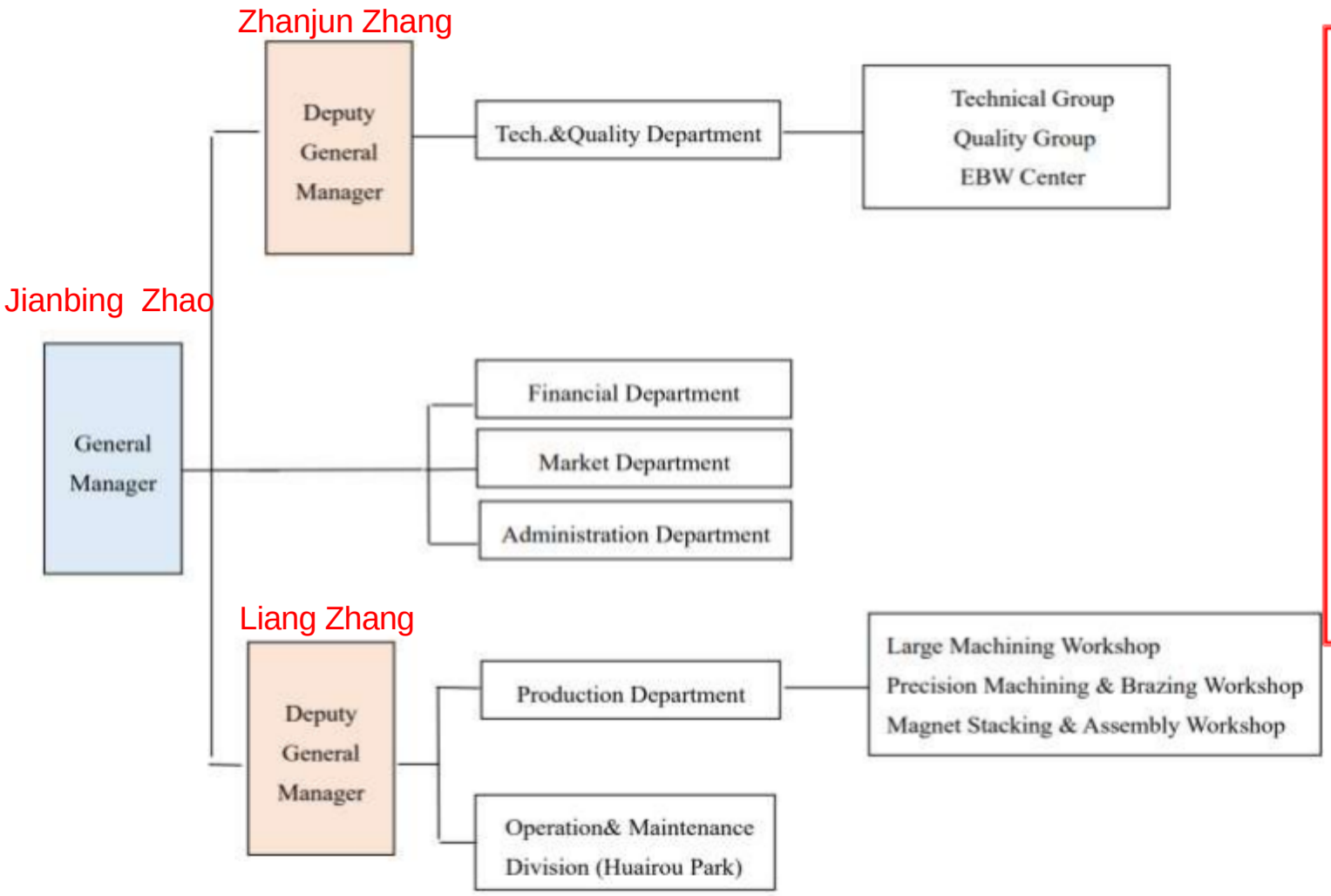
2024.6
Huairou Divsion of HERT



1. Brief Introduction

高能锐新 HE-RACING TECHNOLOGY

HERT Organization



- The company has 80 staff members in total. 20 of them are IHEP employees.
- Jianbing Zhao, Liang Zhang and Zhanjun Zhang are IHEP employees.

1. Brief Introduction

高能锐新 HE-RACING TECHNOLOGY

- **Main Products:**
  - Magnets
  - Accelerating Structure and RT Cavities
  - SRF Cavities, Couplers and cryomodules.
  - Insertion Devices
  - Microwave devices
  - RFQ and DTL
  - SLEDs

1. Brief Introduction

高能锐新 HE-RACING TECHNOLOGY

- **Project and Experience:**
  - BEPC/BEPCII, CSNS, SSRF, HEPS-TF, HLSII, THz, DCLS, SXFEL, CADS, SHINE,HEPS,DALS,HALF,CSNSII…
  - PLS/PLSII, PAL-FEL, PEFP, KEK-B, FIR/THz, RISP …
  - PEPII, SPEAR3, NSLSII, CLS, ILC-ATF2, LCLSII…
  - SPARK, LEG, E-XFEL, MAXIV, FERMI-Eletta, KIPT-ADS …

1. Brief Introduction

高能锐新 HE-RACING TECHNOLOGY

- **Machining Tools and Equipment:** (Total >500 sets)

编号	设备名称	品牌	型号	主要技术指标（行程（精度））mm	数量
1	加工中心	山崎马扎克	LGMazak	X/Y/Z:1050×510×560（0.008）	1
2	加工中心	哈斯	VF6	X/Y/Z:1626×813×762（0.01）	1
3	加工中心	沈阳机床	VMC 850E	X/Y/Z:850×510×540（0.02）	3
4	车铣中心	山崎马扎克	LGMazak QTN	直径Ø380×1033（0.01）	1
5	车削中心	山崎马扎克	LGMazak Nexus	直径Ø360×1063（0.01）	1
6	车削中心	山崎马扎克	LGMazak Nexus	直径Ø280×300（0.01）	2
7	线切割	沙迪克	AQ550Ls	X/Y/Z:550×350×320（0.003）	1
8	线切割	阿奇夏米尔	CA30	X/Y/Z:600×400×350（0.002）	1
9	氢气炉	北方华创	MHF5060	Φ500×600 （1100℃，±5℃）	1
10	氢气炉	北方华创	MHF3040	Φ300×400 （1100℃，±5℃）	1
11	三坐标	海克斯康	Classical	X/Y/Z:900×1200×800（0.0026）	1
12	检漏仪	INFICON	UL1000 Fab	最小检漏漏率：5×10-12mbar•L/s	1
13	真空炉	兰州真空	ZRT-3580-14W5	Φ1150×1650 （1300℃，±5℃）	1
14	电子束焊机	泰克米特	LARA52	X/Y/Z: 3300×1000×1300	1
15	电子束焊机	排达	THDW-9	X/Y/Z: 1050×500×700	1
16	四柱压力机	山东滕州	YQ32-200T	200T	1
17	网络分析仪	罗德施瓦茨	ZNB8	Max. 8.5GHz	1

1. Brief Introduction

高能锐新 HE-RACING TECHNOLOGY

■ EBW machines

EBW machine (3 sets)

Laser Welding machine

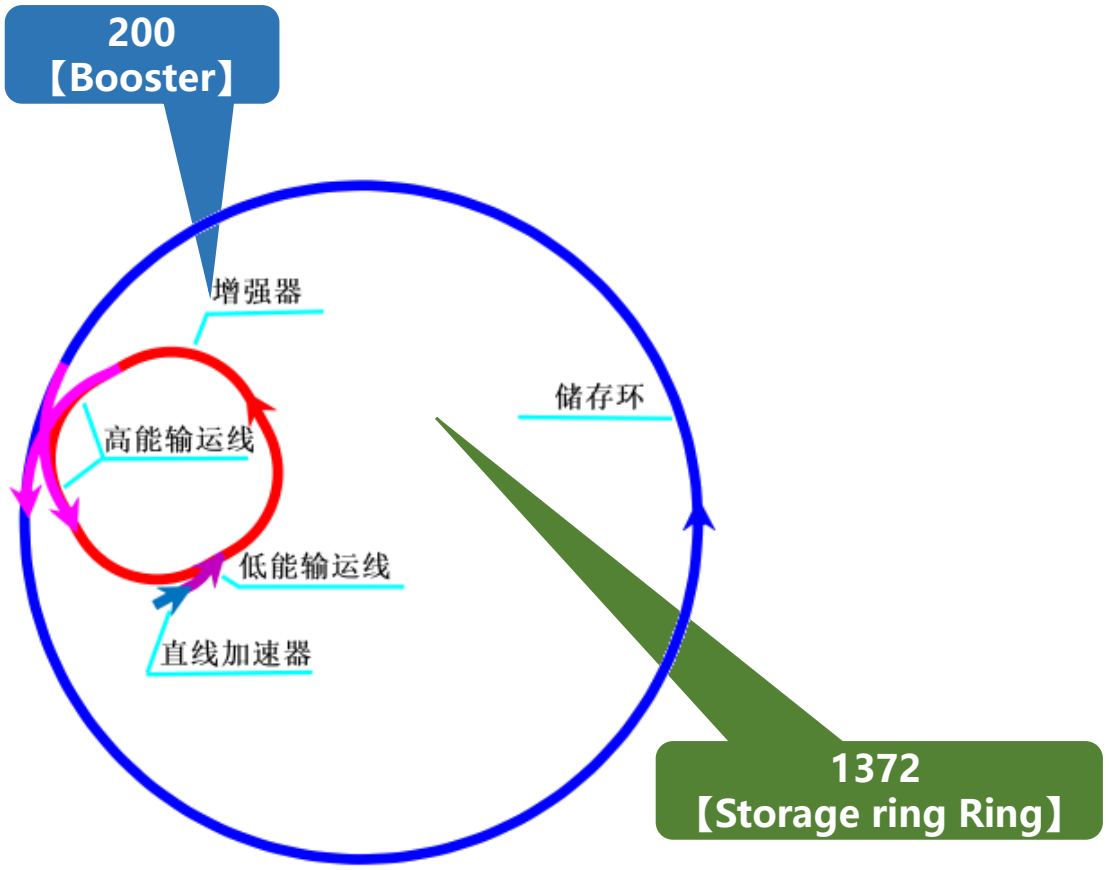
1. Brief Introduction

高能锐新 HE-RACING TECHNOLOGY

- **Qualifications and Honors:**

2. Magnets (HEPS)

2.1 Magnet List (1572 Sets in Total)



Booster Magnets		
Description	**Qty. (set)**	**Period**
Dipole	130	2019.12~2021.12
Sextupole	70	2019.12~2021.12

Storage Ring Magnets		
Description	**Qty. (set)**	**Period**
Sextupole	294	2020.05~2022.05
LG Dipole	98	2020.12~2023.06
Quadrupole	686	2020.12~2023.12
B&D magent	294	2020.12~2023.12

2. Magnets (HEPS)

高能锐新 HE-RACING TECHNOLOGY

2.2 Booster Magnets

2. Magnets (HEPS)

高能锐新 HE-RACING TECHNOLOGY

2.2.1 Booster Magnets (Dipole)

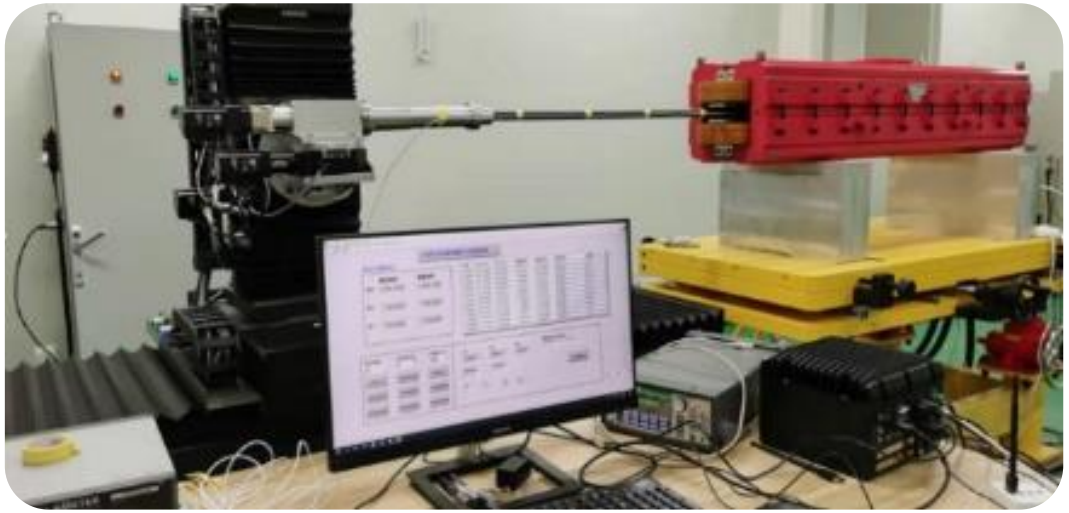
Core:

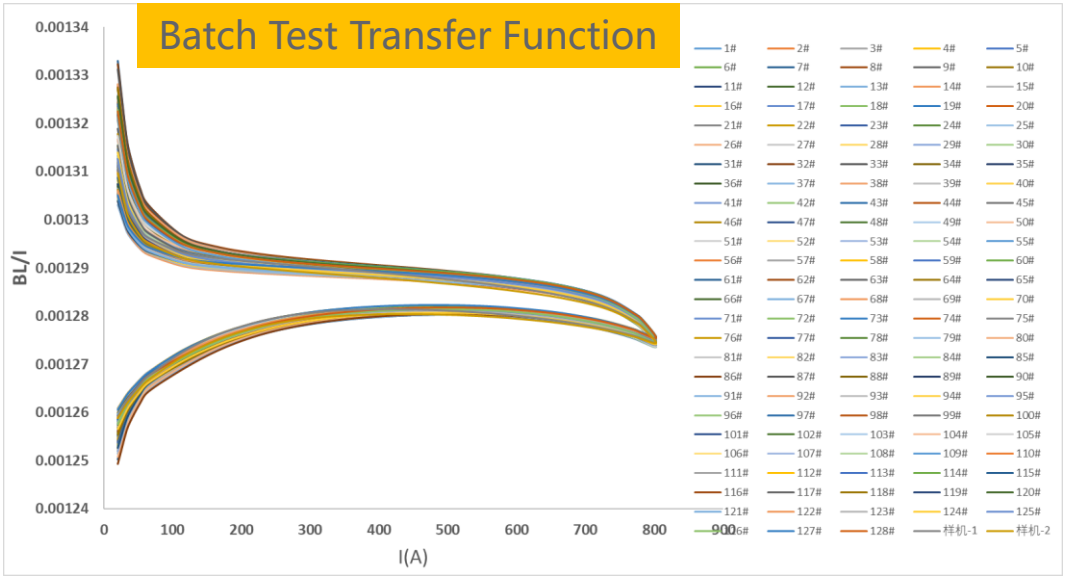
- Lamination type
- Glued and Welded

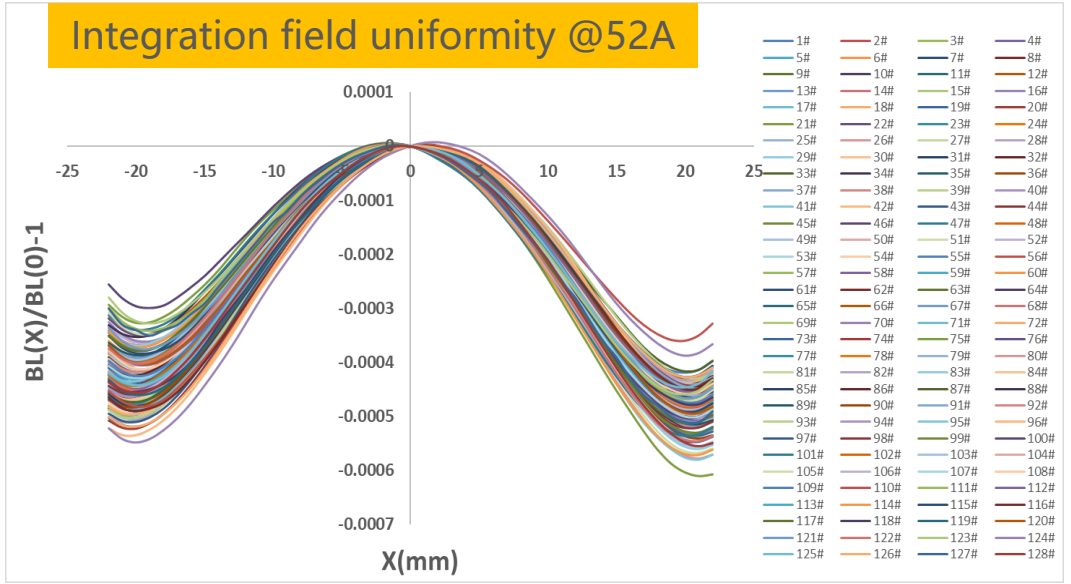
Parameters	Value	Unit
QTY.	130	set
Leff	1.450	m
Max. Field(@6GeV)	0.68	T
Min. Field(@500MeV)	0.05	T
Bending Radius	29.540	m
Gap	34.00	mm
Good Field Area (H×V)	30×20	mm
Uniformity(@0.5GeV, 6GeV)	1×10^{-3},5×10^{-4}	-
Integral Gradient Discretness	0.1%	-

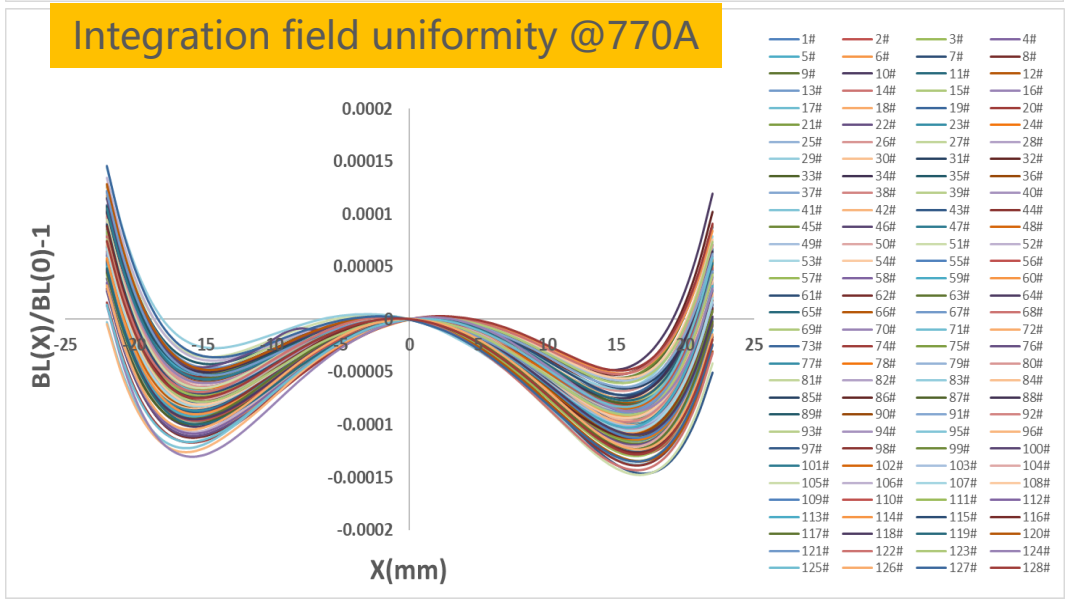
2. Magnets (HEPS)

2.2.1 Booster Magnets (Dipole)





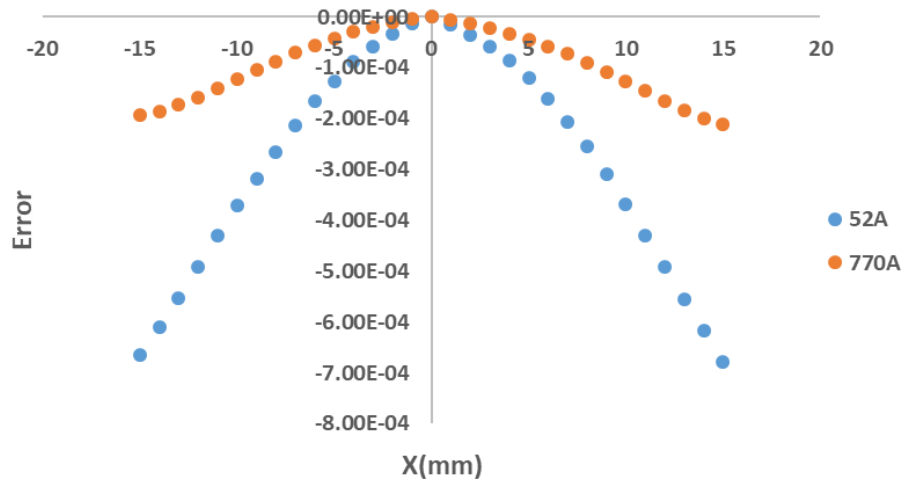




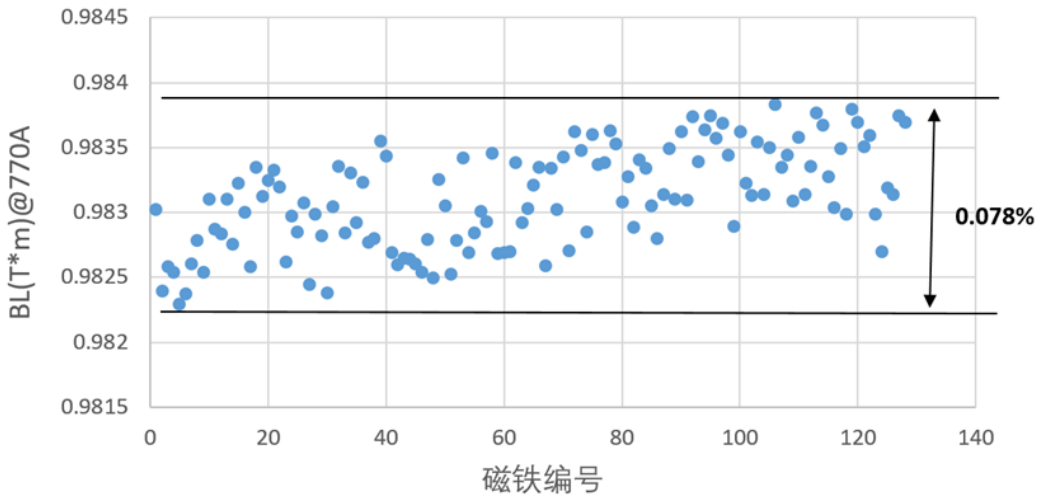
2. Magnets (HEPS)

2.2.1 Booster Magnets (Dipole)

Field Distribution Error

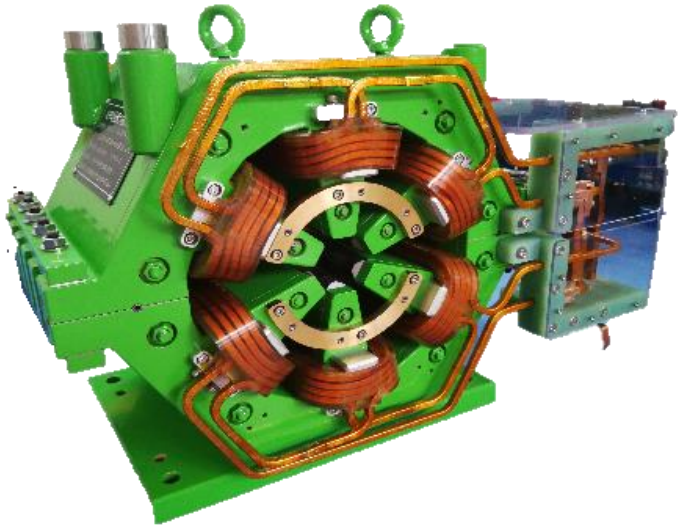


Batch Test Integral Field Discreteness



2. Magnets (HEPS)

2.2.2 Booster Magnets (Sextupole)



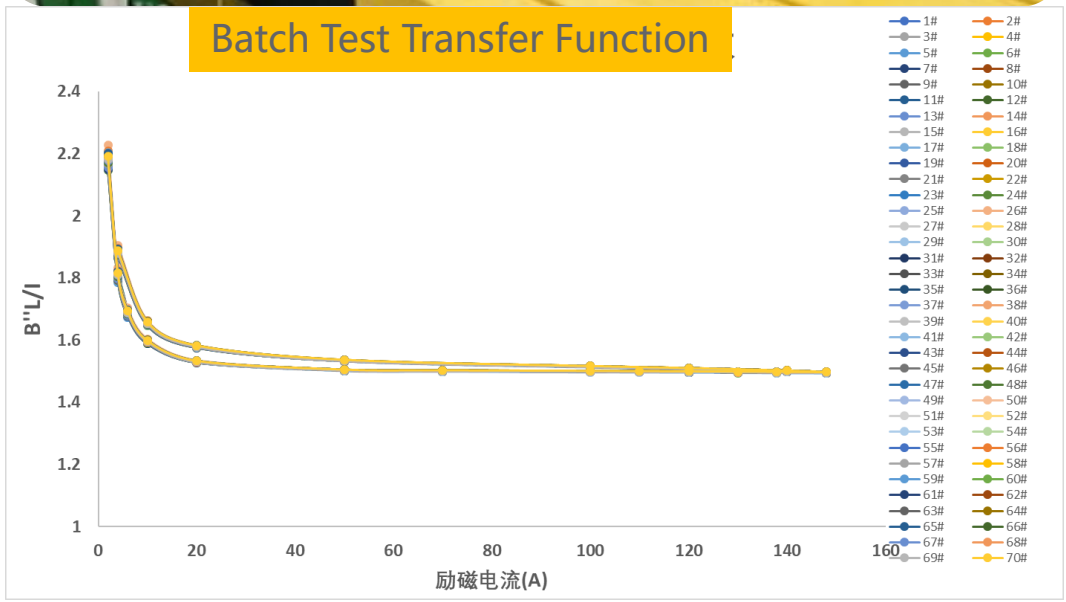
Core:

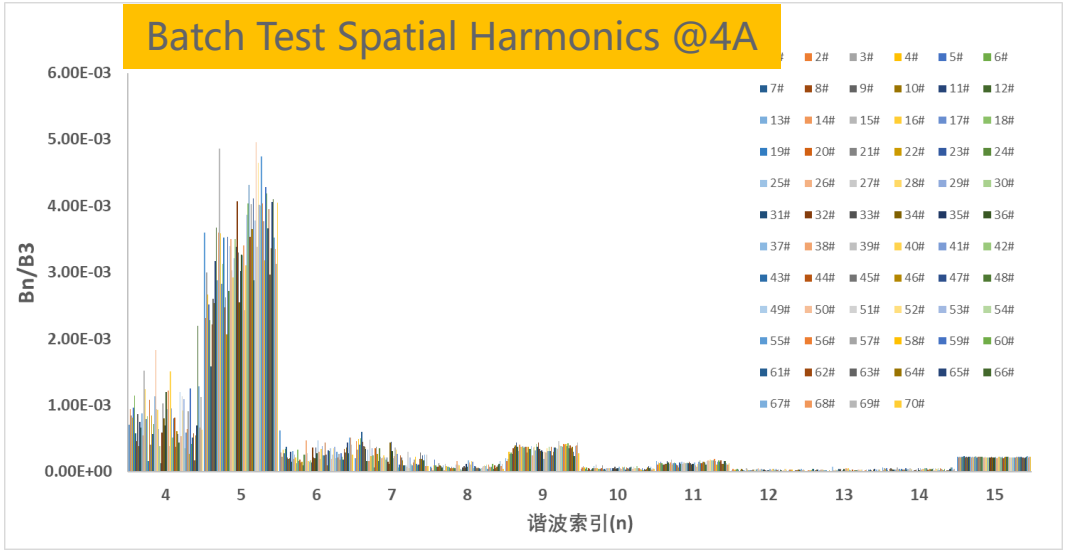
- Lamination type
- Glued

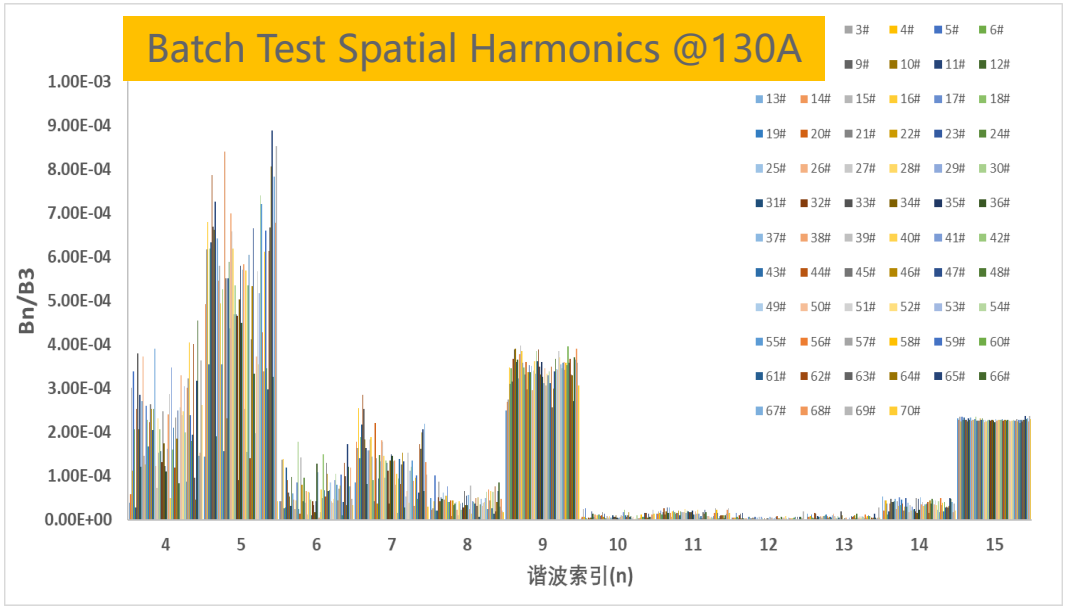
Parameters	Value	Unit
QTY.	70	set
Leff	0.2	m
Max. Field Gradient	1000	T/m^2
Min. Field Gradient	30	T/m^2
Good Field Radius	16	mm
Aperture	Φ40	mm
Harmonic Error(@0.5GeV, 6GeV)	5×10^{-3},1×10^{-3}	-
Integral Gradient Discretness	0.2%	-

2. Magnets (HEPS)

2.2.2 Booster Magnets (Sextupole)



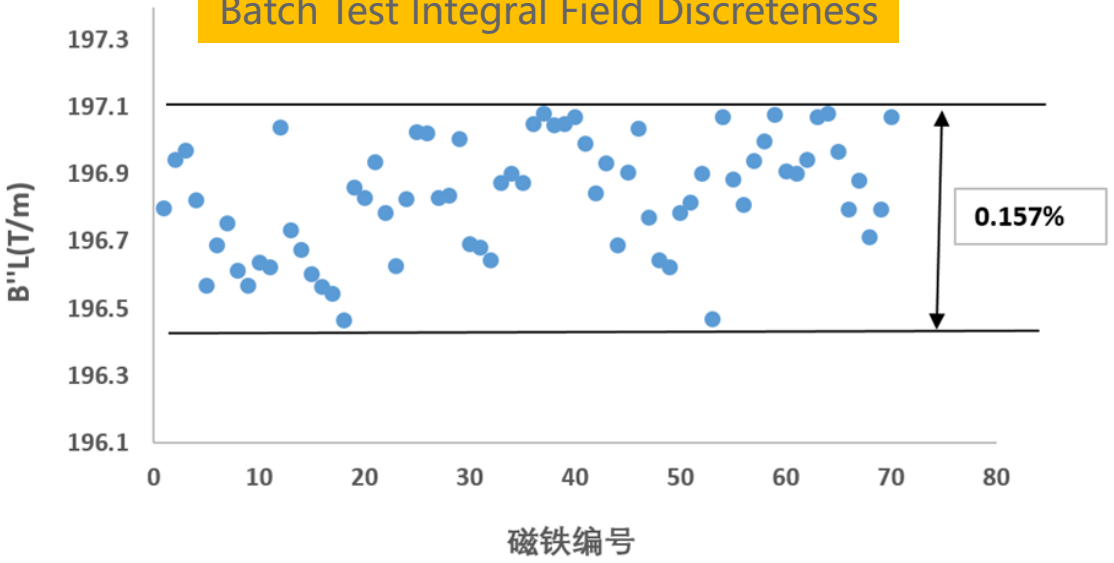




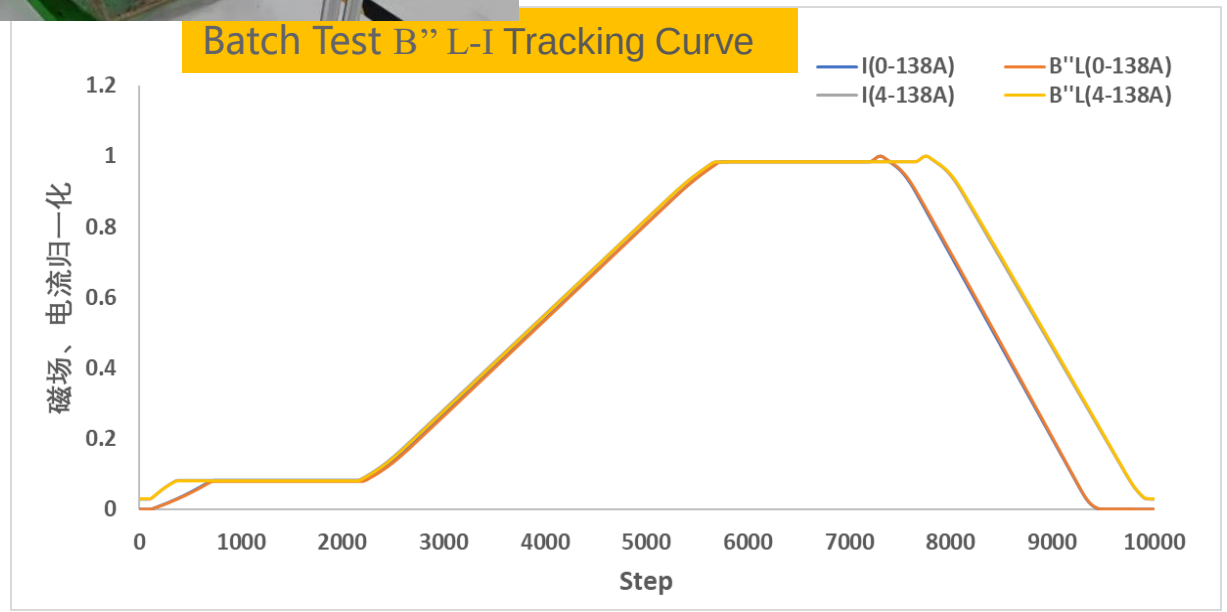
2. Magnets (HEPS)

2.2.2 Booster Magnets (Sextupole)

Batch Test Integral Field Discreteness



Batch Test B'' L-I Tracking Curve



2. Magnets (HEPS)

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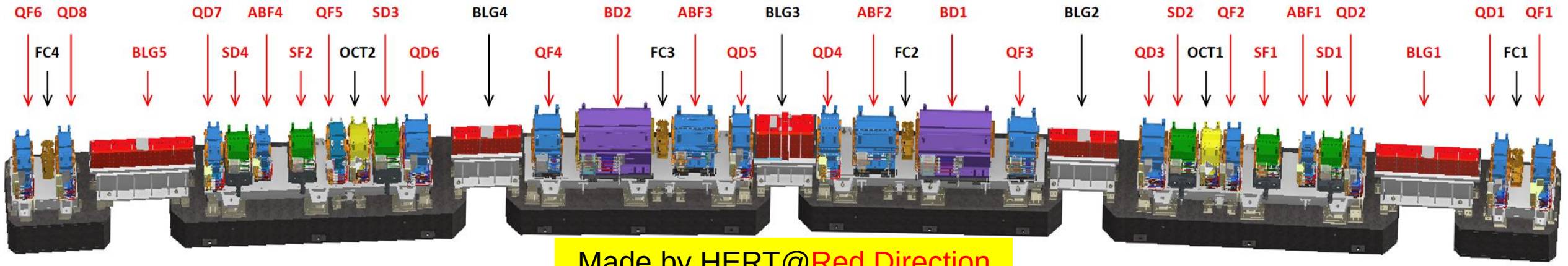
2.3 Storage Ring Magnets



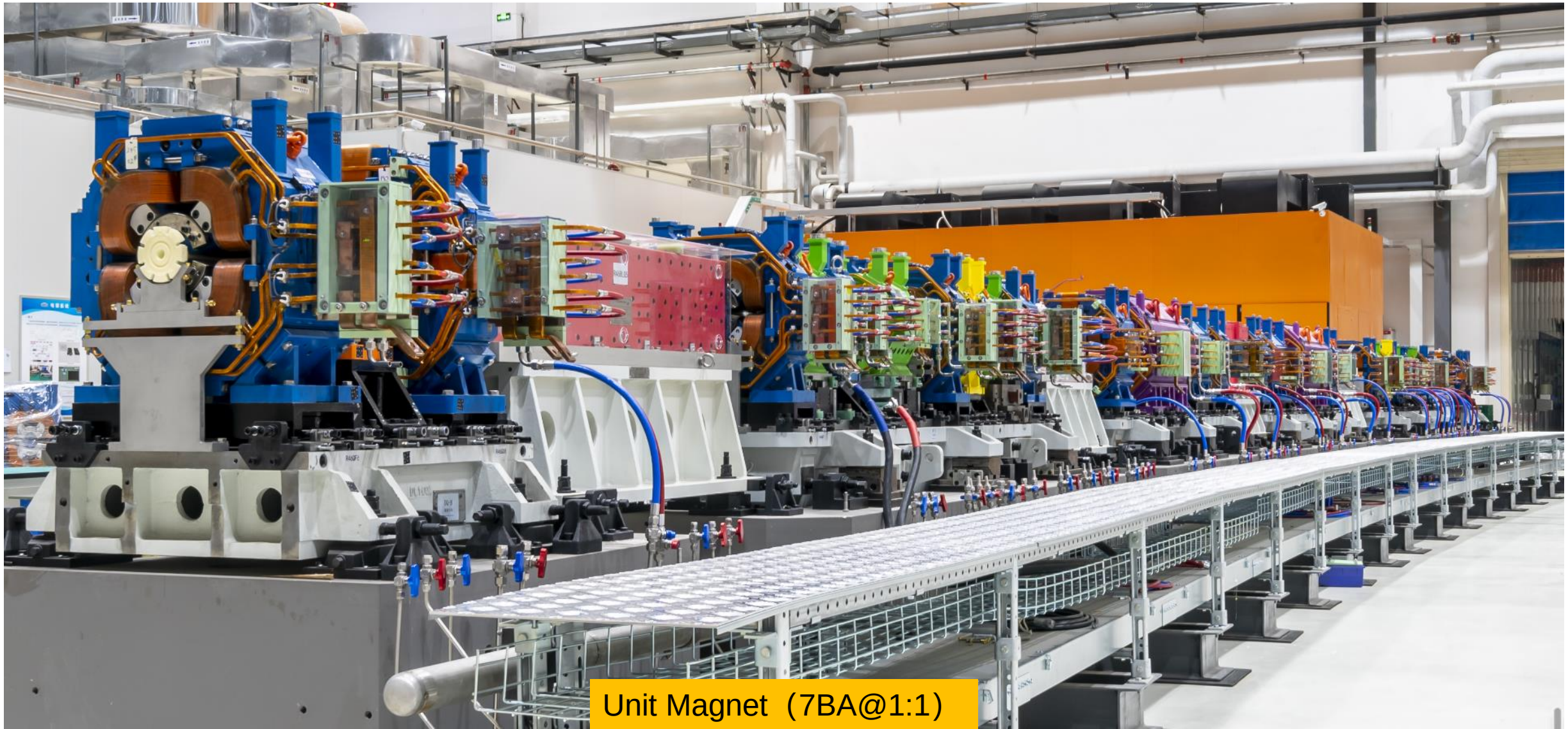
Made by HERT@Red Direction

Unit Magnet（7BA@Model and position indication）

2. Magnets (HEPS)

高能锐新 HE-RACING TECHNOLOGY

2.3 Storage Ring Magnets



Unit Magnet（7BA@1:1）

2. Magnets (HEPS)

2.3.1 Storage Ring Magnets (Dipoles)

TYPE	BLG1 (Type I)	BLG5 (Type II)
Qty (set)	48+1	48+1
Leff (m)	1.499	1.499
File (Gauss) (5 steps)	4838.4/3357.3/2863.6/ 2073.6/1283.7	1283.7/2073.6/2863.6/ 3357.3/4838.4
Integral Field (Gauss·m)	4322.0	4322.0
Integral Field Discreetness	1 × 10-4	1 × 10-4
Good Field Area (H×V) (mm)	[-11, 11] ×[-8, 8]	[-11, 11] ×[-8, 8]
Uniformity	4 × 10-4	4 × 10-4

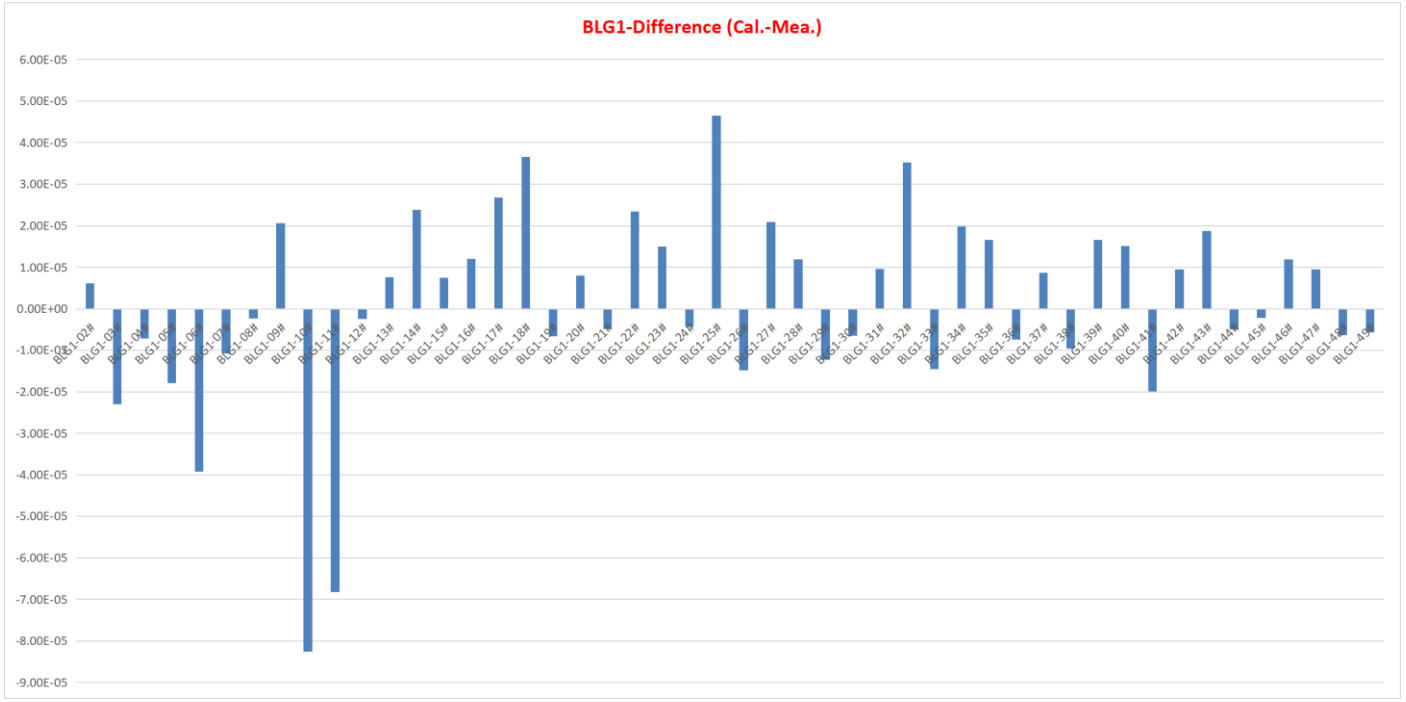
Permanent Magnet:

- Core (DT4 Steel)

2. Magnets (HEPS)

2.3.1 Storage Ring Magnets (Dipoles)

Measurement Results(BLG1,49sets)



2. Magnets (HEPS)

2.3.2 Storage Ring Magnets (Quadrupole type I, 340sets)

Core:

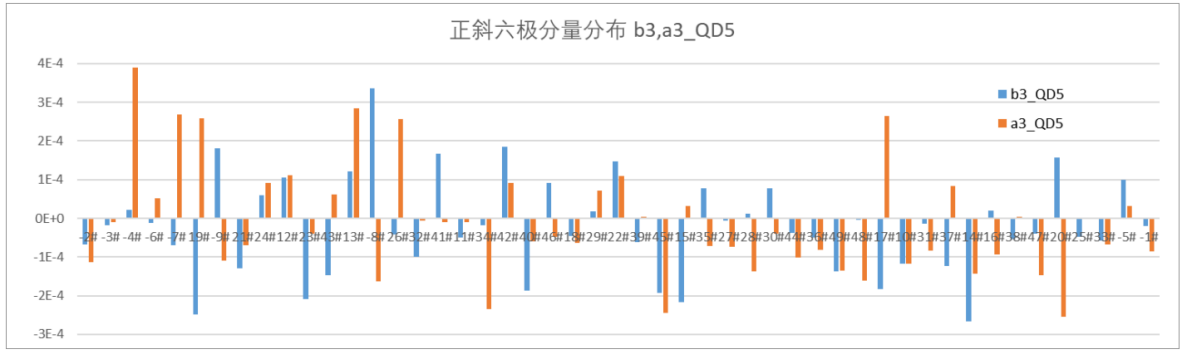
- Lamination type
- Welded

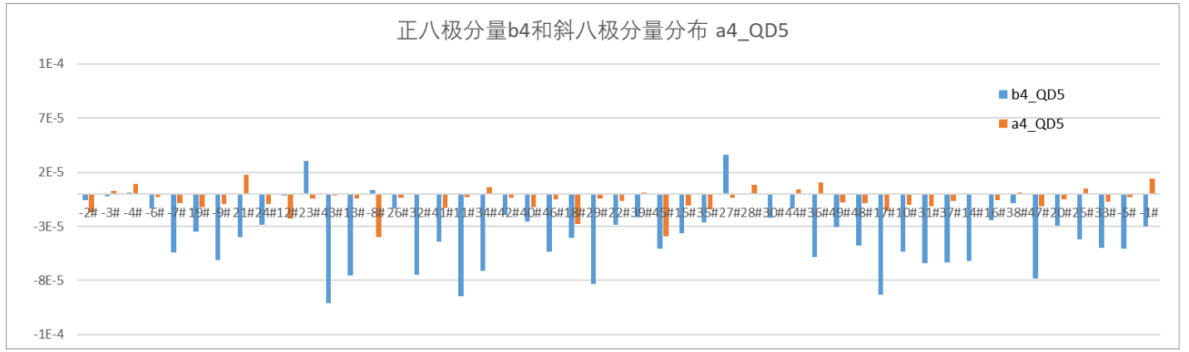
Description	QF1/6-245	QF1/6-201	QD2	QF2	QD3/6	QD5
QTY.(Set)	47+1	47+1	47+1	48+1	96+2	48+1
Core Length (mm)	245	201	180	201	327	260
Leff (mm)	255	211	190	211	337	270
Field Gradient (T/m)	78.2	77.5	73.7	77.2	78.7	74.2
Good Field Radius (mm)	5	5	5	5	5	5
Aperature (mm)	26	26	26	26	26	26
Harmonic Error	$B_3/B_2 \leq 4\times10^{-4}$, $B_4/B_2 \leq 4\times10^{-4}$, $B_5/B_2 \leq 2\times10^{-4}$, $B_n/B_2 \leq 1\times10^{-4}$ for n>5					
Integral Gradient Discreetness	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Bonding Coil	None	None	None	None	None	None

2. Magnets (HEPS)

2.3.2 Storage Ring Magnets (Quadrupole type I, 340sets)

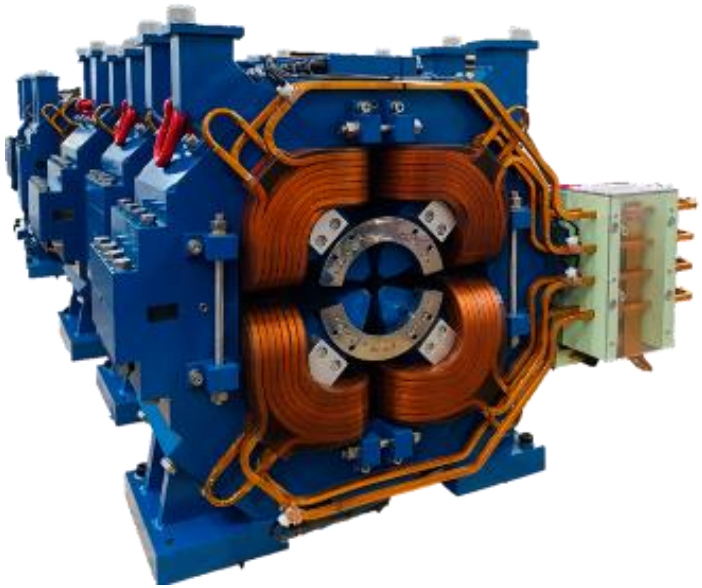
Measurement Results (QD5, 49 sets)





2. Magnets (HEPS)

2.3.3 Storage Ring Magnets (Quadrupole type II, 148sets)



Core:

- DT4 Steel

Description	QD4	QF5	QD7
QTY.(Set)	48+1	48+1	49+1
Core Length (mm)	260	201	180
Leff (mm)	270	211	190
Field Gradient (T/m)	74.2	77.2	73.7
Good Field Radius (mm)	5	5	5
Aperature (mm)	26	26	26
Harmonic Error	$B_3/B_2 \leq 4\times10^{-4}$, $B_4/B_2 \leq 4\times10^{-4}$, $B_5/B_2 \leq 2\times10^{-4}$, $B_n/B_2 \leq 1\times10^{-4}$ for n>5		
Integral Gradient Discretness	0.2%	0.2%	0.2%
Bonding Coil	None	None	None

2. Magnets (HEPS)

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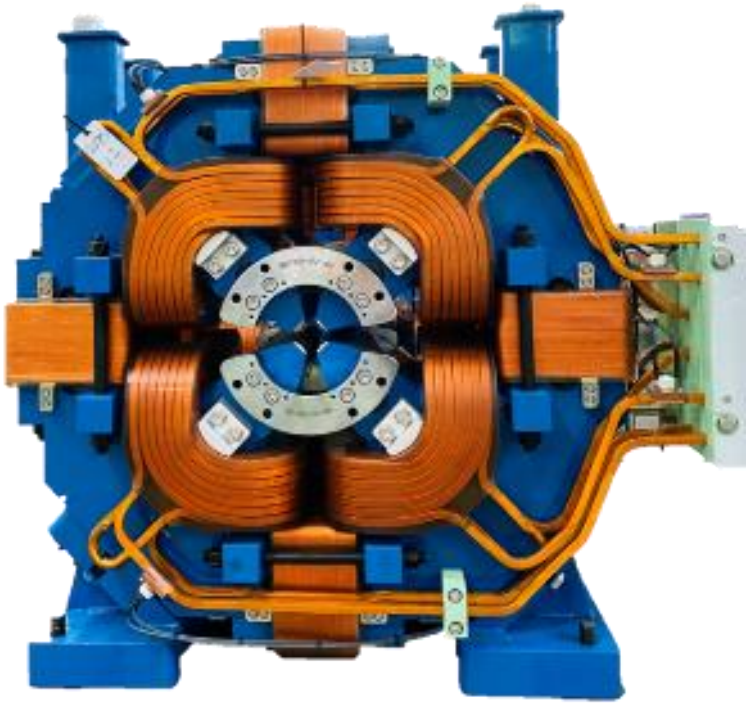
2.3.4 Storage Ring Magnets (Quadrupole ,with bonding coil, 194sets)



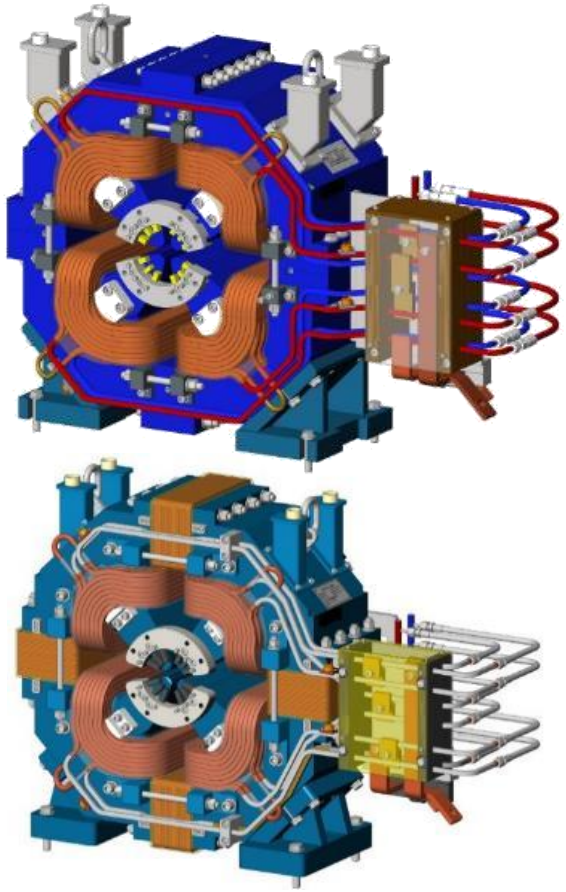
Description	QD1/8-192	QD1/8-180	QF3/4
QTY.(Set)	47+1	47+1	96+2
Core Length (mm)	192	180	374
Leff (mm)	202	190	384
Field Gradient (T/m)	77.4	68.7	79.6
Good Field Radius (mm)	5	5	5
Aperature (mm)	26	26	26
Harmonic Error	$B_3/B_2 \leq 4\times10^{-4}$, $B_4/B_2 \leq 4\times10^{-4}$, $B_5/B_2 \leq 2\times10^{-4}$, $B_n/B_2 \leq 1\times10^{-4}$ for n>5		
Integral Gradient Discretness	0.2%	0.2%	0.2%
Bonding Coil	Yes	Yes	Yes

Core:

- Lamination type
- Welded

2. Magnets (HEPS)

2.3.4 Storage Ring Magnets (Quadrupole ,Special, 4sets)



Core:

- DT4 Steel

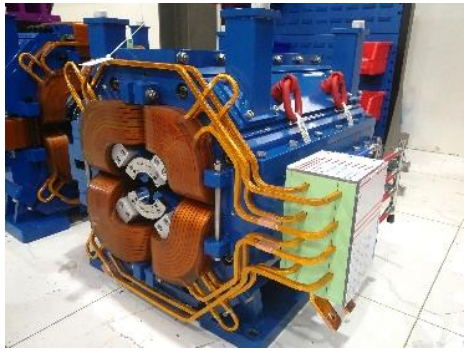
Description	R02QF6	R48QF1	R02QD8	R48QD1
QTY.(Set)	1	1	1	1
Core Length (mm)	245	201	192	180
Leff (mm)	255	211	202	190
Field Gradient (T/m)	78.2	77.5	77.4	68.7
Good Field Radius (mm)	5	5	5	5
Aperature (mm)	26	26	26	26
Harmonic Error	$B_3/B_2 \leq 4\times10^{-4}$, $B_4/B_2 \leq 4\times10^{-4}$, $B_5/B_2 \leq 2\times10^{-4}$, $B_n/B_2 \leq 1\times10^{-4}$ for n>5			
Integral Gradient Discretness	0.2%	0.2%	0.2%	0.2%
Bonding Coil	None	None	Yes	Yes

2. Magnets (HEPS)

2.3.6 Storage Ring Magnets (B&D, 294sets)

Core:
- Lamination type
- Welded

Core:
- DT4 Steel

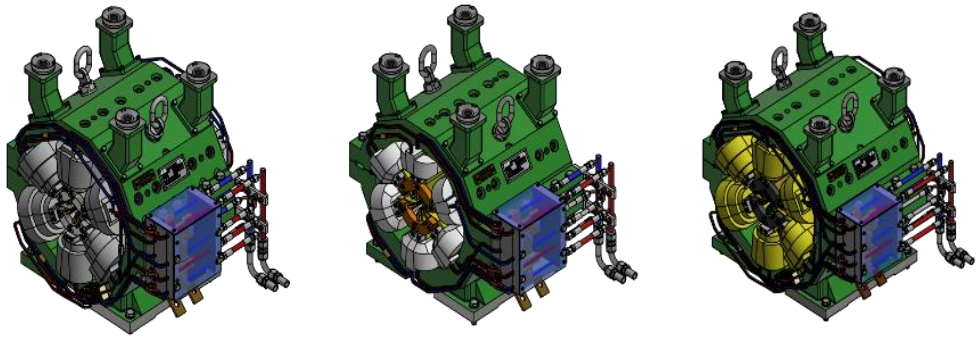


Core:
- Lamination type
- Welded

Description	BD12	ABF1/4	ABF2/3
QTY.(Set)	96+2	96+2	96+2
Core Length (mm)	1040	180	590
Leff (mm)	197.2	179.9	609.9
Field Gradient (T/m)	34.54	53.43	66.43
Good Field Radius (mm)	5	5	5
Aperature (mm)	45	30	30
Harmonic Error	$B_3/B_2 \leq 6\times10^{-4}$, $B_4/B_2 \leq 6\times10^{-4}$, $B_5/B_2 \leq 3\times10^{-4}$, $B_n/B_2 \leq 1.5\times10^{-4}$ for n>5		
Integral Gradient Discretness	0.2%	0.2%	0.2%
Bonding Coil	None	None	None

2. Magnets (HEPS)

2.3.7 Sextupole (3 types, 294 sets)



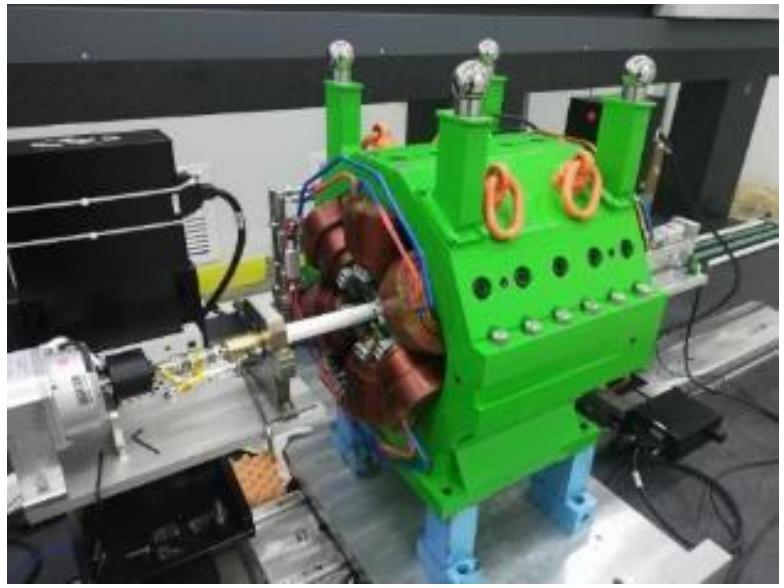
Core:

- Core (DT4 Steel)

Description	SD1&4	SD2&3	SF1&2
QTY.(Set)	96+2	96+2	96+2
Core Length (mm)	304	350	318
Leff (mm)	314	358	326
Field Gradient (T/m^2)	4588	7360	7494
Integral Gradient Discretness	6×10^{-3}		
Integral Gradient Discretness (Sorting)	3×10^{-3}		
Good Field Radius (mm)	5	5	5
Aperature (mm)	26	26	26
Harmonic Error	$B_4/B_3\leq5\times10^{-3}$, $B_5/B_3\leq2.5\times10^{-3}$, $B_n/B_3\leq1.25\times10^{-3}$ for n>5		
Bonding Coil	Yes	Yes	None

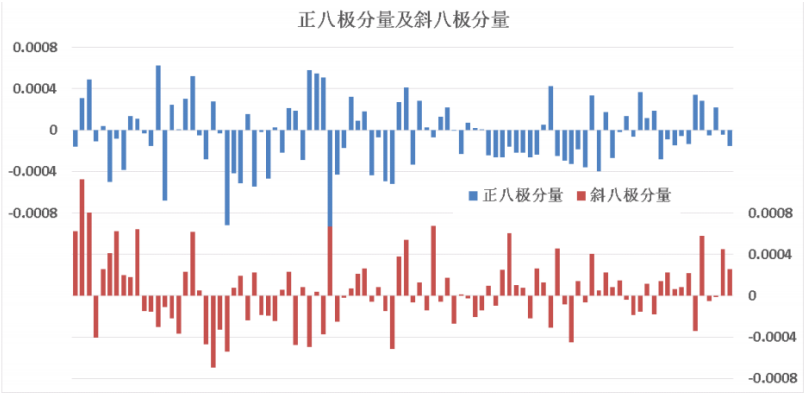
2. Magnets (HEPS)

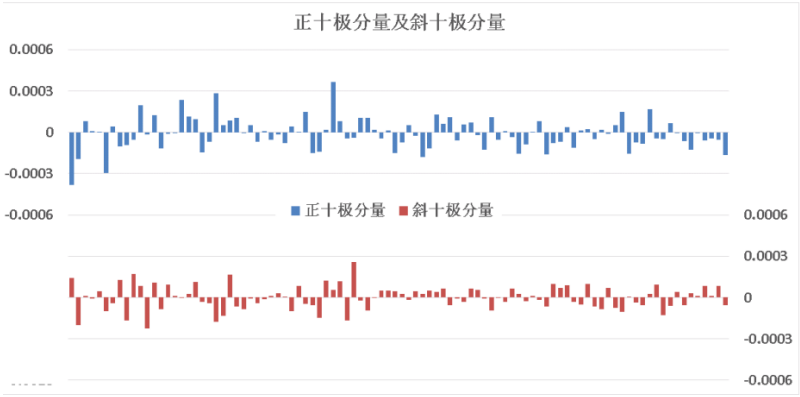
2.3.7 Sextupole (3 types, 294 sets)

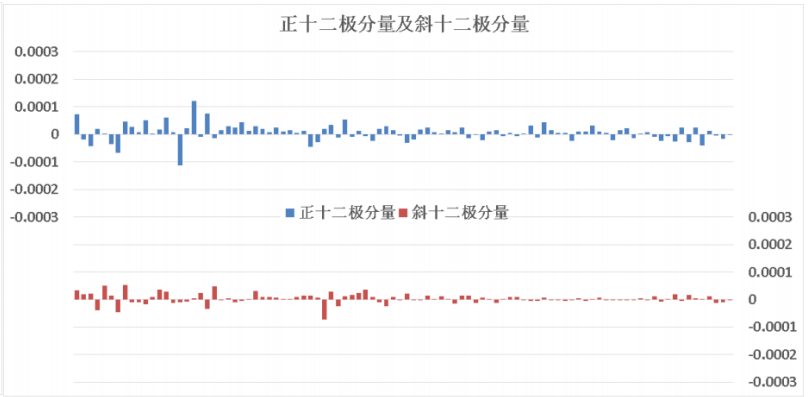


- 系统高阶场分量b9基本为常数(1.6E-04)。
- 由加工装配综合误差引起的八极、十极和十二极磁场如图 所示。

Measurement Results(SD23,98sets)







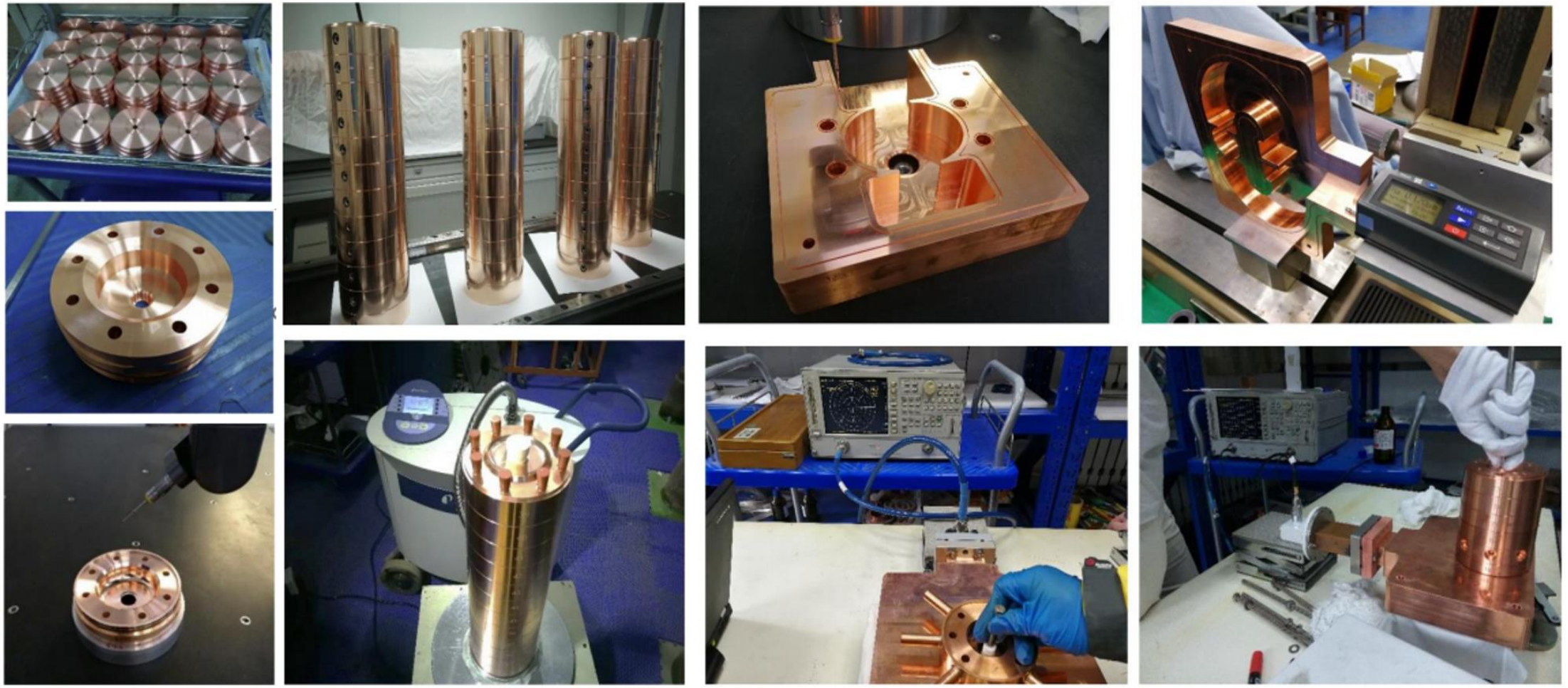
2. Magnets (HEPS)

高能锐新
HE-RACING TECHNOLOGY

3. Accelerating Structure and RT Cavities

高能锐新 HE-RACING TECHNOLOGY

3.1 S Band Accelerating Structures (9 sets)

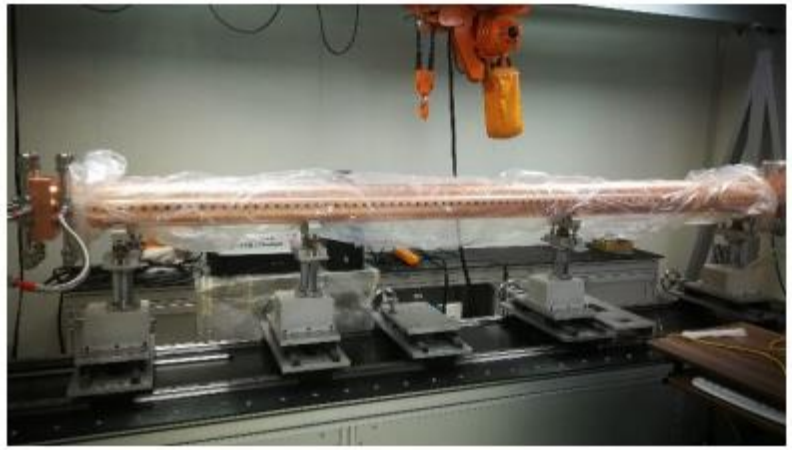


3. Accelerating Structure and RT Cavities

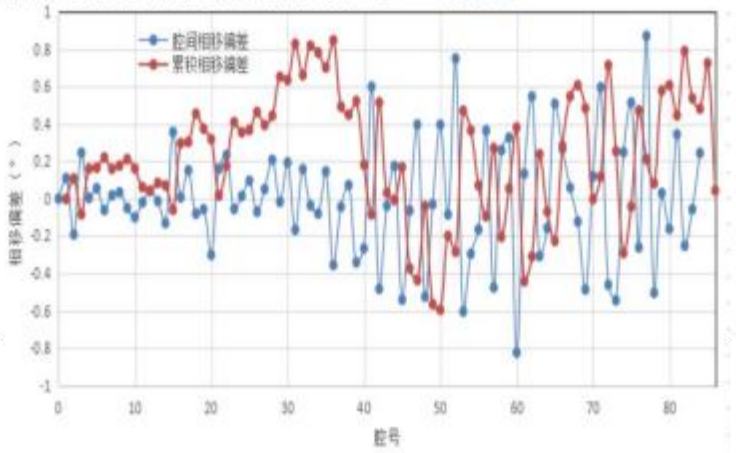
高能锐新 HE-RACING TECHNOLOGY

3.1 S Band Accelerating Structures (9 sets)

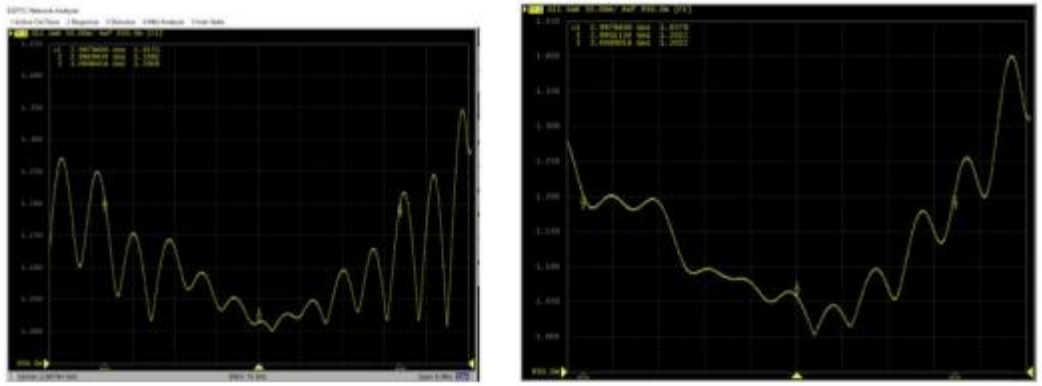
- 将根据采购方的要求，协助进行加速管的测试与调谐



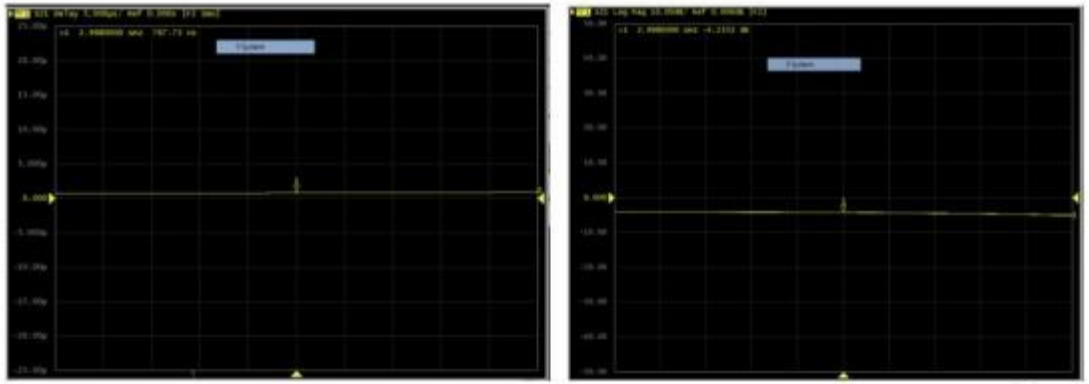
- 调整腔间相移和累积相移误差±2°以内



- 完成输入/输出耦合器驻波比测试（≤1.1）



- 填充时间与衰减测试

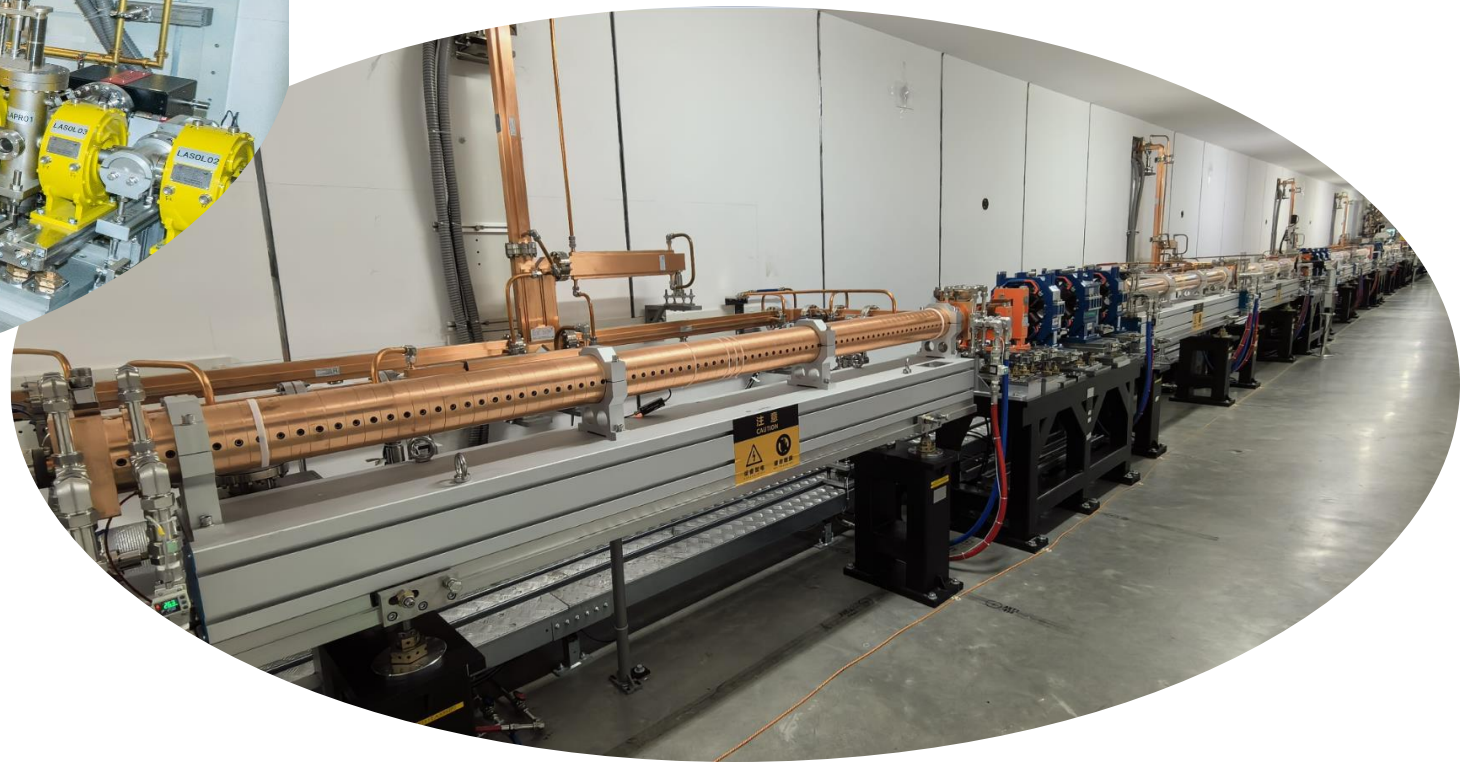


3. Accelerating Structure and RT Cavities

高能锐新 HE-RACING TECHNOLOGY

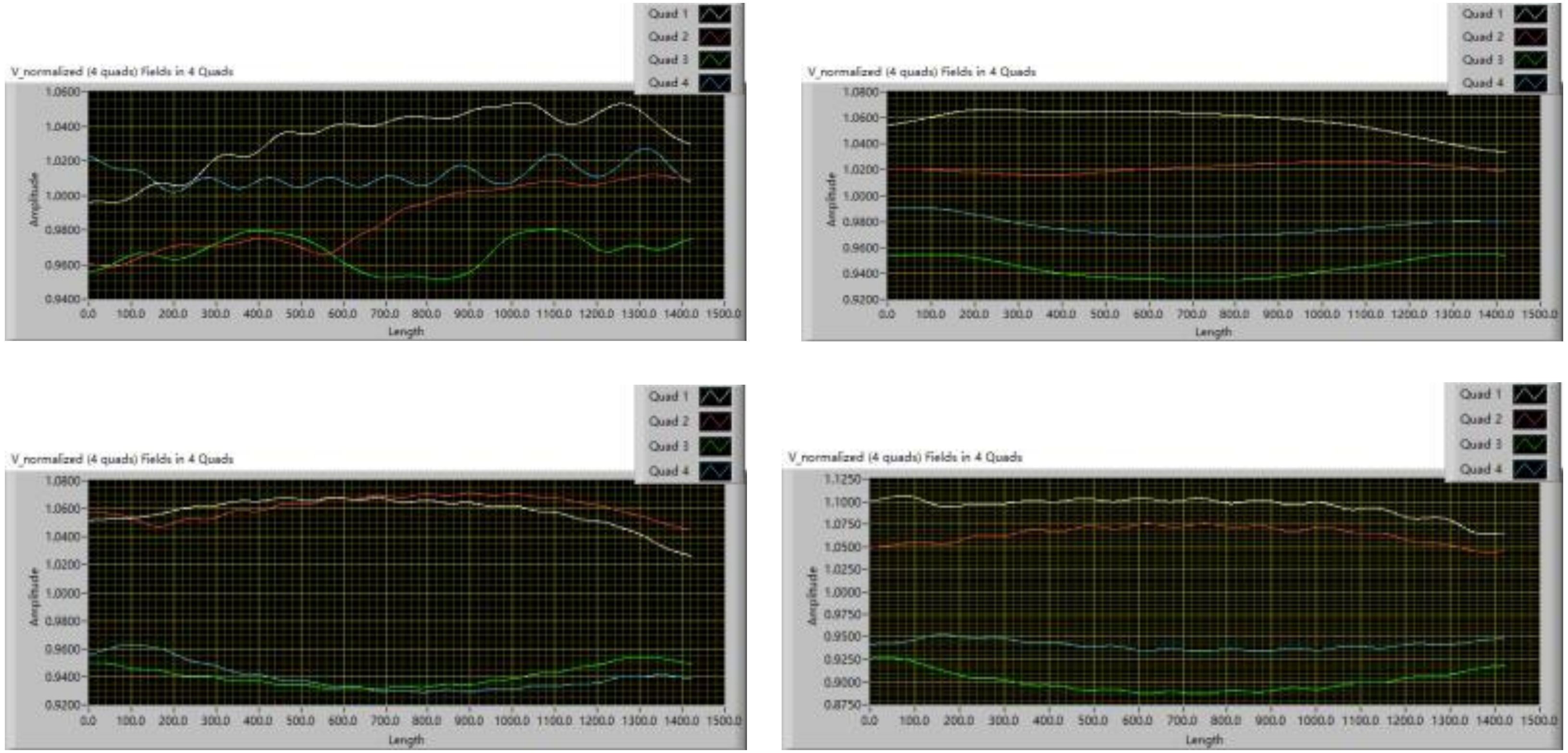
3.1 S Band Accelerating Structures (9 sets)

HEPS Linac



3. Accelerating Structure and RT Cavities

3.2 RT Cavities (RFQ)



3. Accelerating Structure and RT Cavities

高能锐新 HE-RACING TECHNOLOGY

3.3 RT Cavities (DTL)

	1	2	3	4	5	6	7	8	9	10	11	Triplet	12	13	14	15	16	17	18	19	20	21	22	23	24
IN	0.14	0.02	0.01	-0.10	0.11	-0.01	0.06	0.07	0.06	-0.01	-0.08	-0.05	0.00	-0.03	-0.03	0.11	0.03	0.05	0.15	0.02	0.01	-0.04	0.10	0.01	0.06
OUT	-0.04	0.07	0.04	-0.09	0.03	0.05	0.02	0.01	-0.06	0.00	0.04	-0.06	0.03	-0.11	0.00	0.05	-0.01	0.08	-0.11	-0.04	0.04	0.05	0.04	0.09	0.13

图 5 漂移管 Z 向绝对值偏差

	1	2	3	4	5	6	7	8	9	10	11	Triplet	12	13	14	15	16	17	18	19	20	21	22	23	24
OUT	0.067	0.058	0.025	0.026	0.015	0.087	-0.01	0.074	0.02	0.021	-0.04	-0.03	0.102	-0	0.037	-0.01	0.013	-0.02	0.053	0.031	0.011	-0	0.008	-0.02	-0.04
IN	0.067	0.058	0.009	0.022	0.014	0.06	-0	0.083	0.016	-0.04	-0.04	-0.11	-0	-0	0.043	-0.02	0.009	-0.06	0.061	-0.02	0.028	-0.06	0.009	-0.04	-0.02

图 3 漂移管 X 向同轴偏差

	1	2	3	4	5	6	7	8	9	10	11	Triplet	12	13	14	15	16	17	18	19	20	21	22	23	24
OUT	0.019	-0.05	0.037	-0.04	0.087	-0.04	0.105	0.067	0.064	-0.03	-0.04	0.087	0.04	0.058	-0	0.024	0.008	0.042	-0.03	0.03	0.024	0.065	0.042	0.011	-0.04
IN	0.019	-0.05	0.045	0.02	0.042	0.034	0.077	0.018	0.017	0.022	0.051	-0.08	-0.02	-0.04	-0.02	-0.03	-0.03	-0.03	0.035	-0.05	-0.06	-0.02	-0.02	-0.01	0.009

图 4 漂移管 Y 向同轴偏差

4. SRF Cavities Couplers and Cryomodules

高能锐新 HE-RACING TECHNOLOGY

2.1 Cavities-Parameters List (130 Pieces)

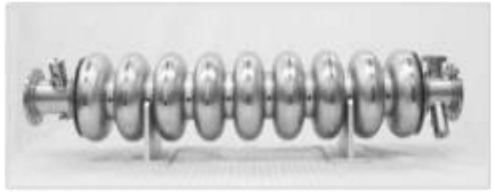
Item	Facility	Type	Frequency (MHz)	Qty. (Piece)	Eacc (MV/m)	Remark
1	HEPS-TF	QWR	166.7	2	19	VT
2	HEPS	QWR	166.7	2	14	Online
3	CiADS	Spoke, β=0.12	325	4	11.5	Online
4	CiADS	Spoke, β=0.21	325	5	12	Online
5	CiADS	Spoke, β=0.24	325	1	11.2	VT
6	CiADS	Double Spoke, β=0.51	325	1	16	VT
7	CSNSII	Doubl Spoke, β=0.51	325	4	13	VT
8	RISP	Spoke, β=0.51	325	7	12	VT
9	HEPS	Single CELL elliptical	500	4	16	Online
10	BIIU	Single CELL elliptical	500	2	16	HT (4K)
11	HALS	Single CELL elliptical	500	2	16	VT (4K)
12	CSNSII	Single CELL elliptical	648	1	24	HT
13	CEPC	2CELL elliptical	650	1	24	VT
14	CEPC	5CELL elliptical	650	3	12	VT (4K)
15	PAPS	2CELL elliptical	650	3	36	VT
16	CiADS	6CELL elliptical	650	1	24	VT
17	PAPS&SHINE	Single CELL elliptical	1300	28	43	VT
18	ILC R&D	9CELL elliptical	1300	1	24	VT
19	PAPS	9CELL elliptical	1300	2	25	VT
20	SHINE	9CELL elliptical	1300	8	25	HT
21	SHINE	9CELL elliptical	1300	8	25	VT
22	SHINE	9CELL elliptical	1300	20	25	VT
23	ZJ Lab	9CELL elliptical	1300	8	25	VT
24	DALS	9CELL elliptical	1300	8	23	HT

4. SRF Cavities Couplers and Cryomodules

高能锐新 HE-RACING TECHNOLOGY

4.2 Cavities-Pictures

Spoke 024
第一支超导腔
(325MHz)



9 Cell 超导腔
第一支椭球腔
(1.3GHz)

2 Cell 超导腔
5 Cell 超导腔
(650MHz)

双Spoke腔
(325MHz)

Spoke 051
SSR2超导腔
(325MHz)

QWR Cavity
HEPS超导腔
(166.7MHz)

2014 → 2015 → 2016 → 2017 → 2018 → 2019 → 2020 → 2021

Spoke 012
ADS 注入器超导腔
小批量生产

Spoke 021
ADS 主加速器超导腔
小批量生产

HEPS-TF超导腔
第一支QWR超导腔
(166.7MHz)

高Q值1.3GHz 9 Cell
高Q值1.3GHz 单 Cell

Cavity
HLS 超导腔
(500MHz)

SRF Cavities

4. SRF Cavities Couplers and Cryomodules

4.2 Cavities-Pictures

PAPS
2Cell 椭球腔
(650MHz)

CSNSII
双Spoke 051
(325MHz)

HEPS
单Cell 椭球腔
(500MHz)

DALS
9Cell 高Q椭球腔 (1300MHz)

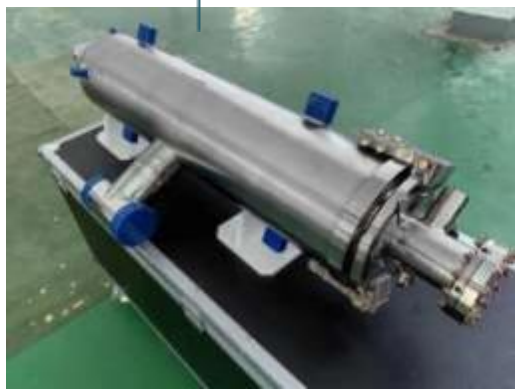
2021 2022 2023

SHINE
9Cell 高Q椭球腔
(1300MHz)

HALF
单Cell 椭球腔
(500MHz)

HEPS
QWR腔
(166MHz)

SHINE
(1300MHz)



4. SRF Cavities Couplers and Cryomodules

高能锐新 HE-RACING TECHNOLOGY

4.3 Couplers-Parameters List (80 Pieces)

Item	Facility	Cavity Type	Frequency (MHz)	Window Type	Qty.	Remark	Power
1	SERI	DTL(NC)	80	Coaix, Plate	2	Online	
2	IBS	HWR (SCC)	162.5	Coaix, Plate	2	Test	
3	CiADS	HWR (SCC)	162.5	Coaix, Plate	2	Online	CW 15kW
4	HEPS-TF	QWR (SCC)	166.7	Coaix, Plate	2	Test	
5	HEPS	QWR (SCC)	166.7	Coaix, Plate	10	Online	TW250kW,SW100kW
6	CSNS	Spoke (SCC)	324	Coaix, Plate	2	Test	TW300kW， 5%
7	CiADS	RFQ (NC)	325	Coaix, Plate	8	Online	
8	CiADS	Spoke (SCC)	325	Coaix, Plate	7	Online	CW,10kW
9	CiADS	Buncher (NC)	325	Coaix, Plate	3	Online	CW,7kW
10	CSNS	RFQ (NC)	325	Coaix, Plate	5	Online	
11	BNCT	RFQ (NC)	325	Coaix, Plate	5	Online	95kW, 80%
12	BEPCII	1 cell (SCC)	500	Coaix, Plate	4	Online	TW,250kW,SW,100kW
13	HEPS	5Cell (NC)	500	Coaix, Plate	2	Test	TW 250kW,SW 波100kW
14	PAPS	2Ccell (SCC)	650	Cylinder	2	Test	
15	ILC R&D	9cell (SCC)	1300	Cylinder	2	Test	
16	SHINE	9cell (SCC)	1300	Cylinder	8	Test	CW14kW;SW7kW
17	DALS	9cell (SCC)	1300	Cylinder	8	HT	CW14kW;SW7kW
18	SHINE	9cell (SCC)	1300	Cylinder	4	Test	CW14kW;SW7kW

4. SRF Cavities Couplers and Cryomodules

高能锐新 HE-RACING TECHNOLOGY

4.3 Couplers-Pictures

325MHz-ADS

324MHz-CSNS

162.5MHz-CADS

325MHz-ADS

500MHz-BEPCII

2012 2013 2014 2015 2016

4. SRF Cavities Couplers and Cryomodules

高能锐新 HE-RACING TECHNOLOGY

4.3 Couplers-Pictures

1.3GHz | 352MHz-BNCT | 650MHz/1.3GHz-CEPC | 1.3GHz-SHINE | 166.6MHz-HEPS TF

2017 | 2018 | 2019

4. SRF Cavities Couplers and Cryomodules

高能锐新 HE-RACING TECHNOLOGY

4.3 Couplers-Pictures

325MHz-R ISP

500MHz

324MHz

166MHz-HEPS

1300MHz-DALS/SHINE

2020

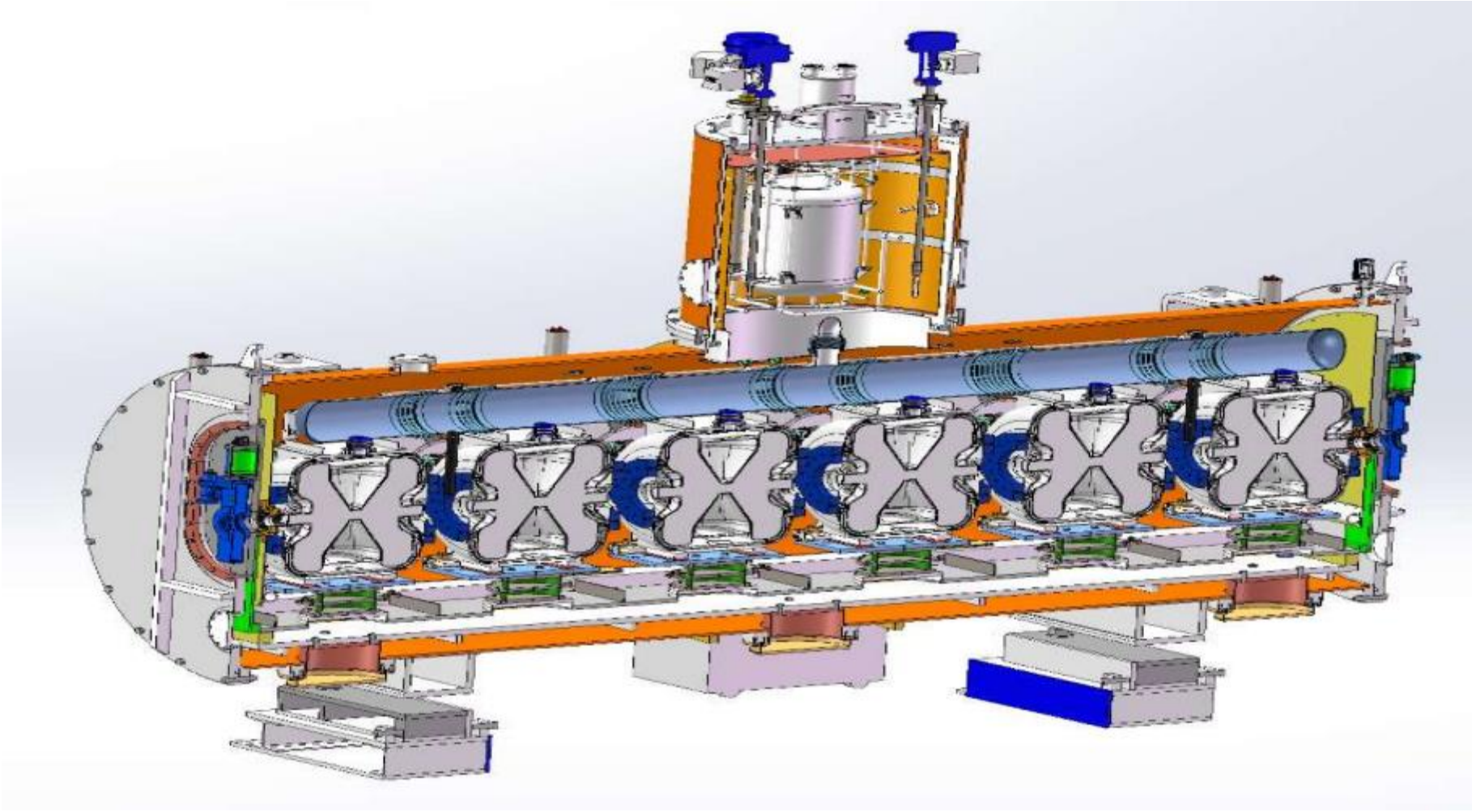
2021

2022-2023

4. SRF Cavities Couplers and Cryomodules

高能锐新 HE-RACING TECHNOLOGY

4.4 SSR2 Spoke 325MHz Cavity cryomodule-3D model



4. SRF Cavities Couplers and Cryomodules

高能锐新 HE-RACING TECHNOLOGY

4.4 SSR2 Spoke 325MHz Cavity cryomodule-Assembly at RISP

Cavity string alignment

Cryomoduel complete

4. SRF Cavities Couplers and Cryomodules

高能锐新 HE-RACING TECHNOLOGY

4.5 Double Spoke 325MHz Cavity cryomodule-Cavities VT

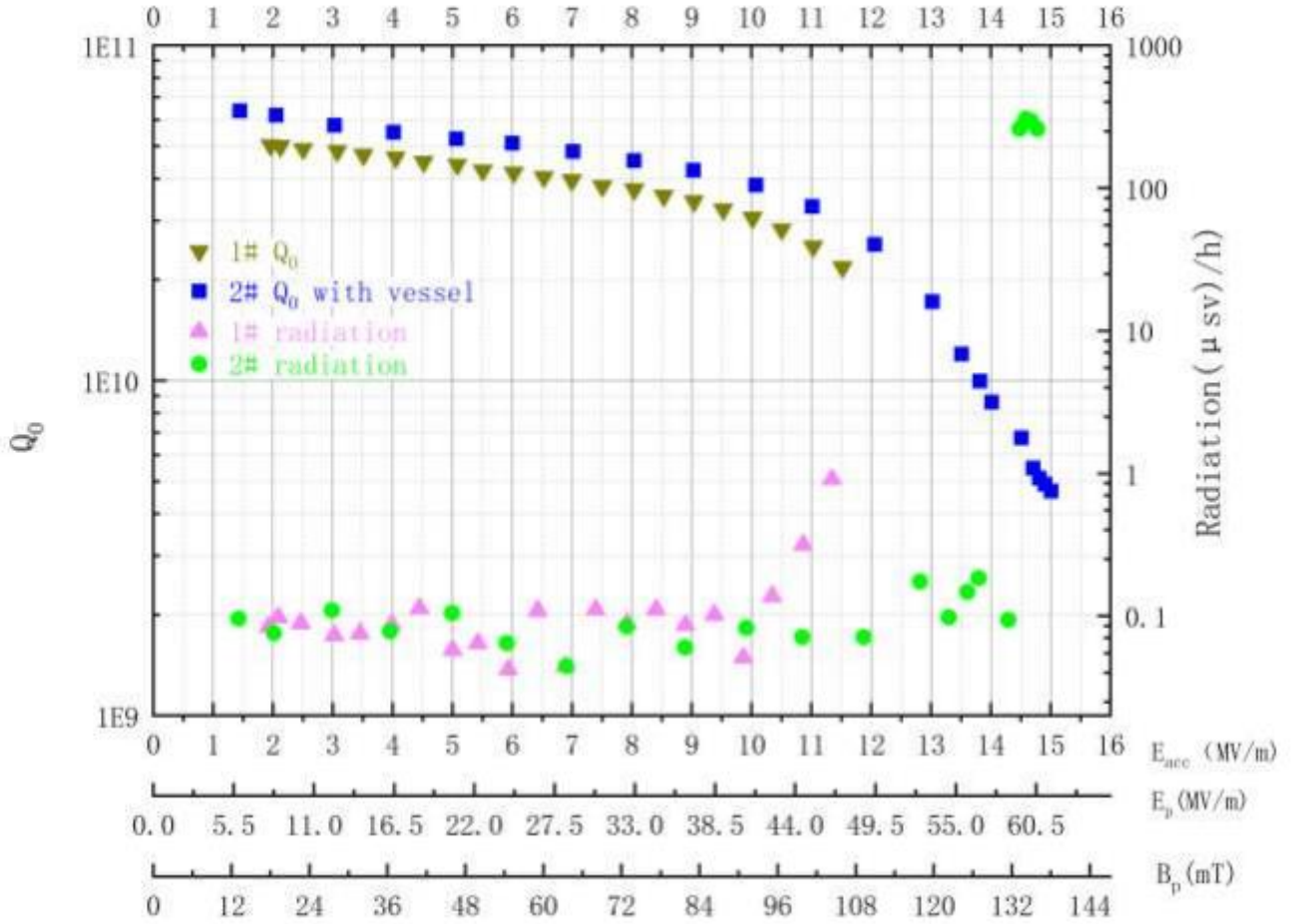
CSNS-II SRF Cavities

	324 MHz Double Spoke Resonator	648 MHz 060 5-cell Elliptical Cavity	Units
Frequency	324	648	MHz
β_g or β_{opt}	0.5 (β_{opt})	0.6 (β_g)	
Beam aperture	50	96/130	mm
E_p/Eacc	3.72	2.76	
B_p/Eacc	7.83	5.14	mT/(MV/m)
R/Q	451	274.8	Ω
E_{acc}(Max.)	9	16	MV/m
V_{acc}(Max.)	6.25	11.152	MV

20 Spoke Cavities for CSNS-II

4.5 Double Spoke 325MHz Cavity cryomodule-Cavities VT

Cavity HPR



VT Results

高能锐新 HE-RACING TECHNOLOGY

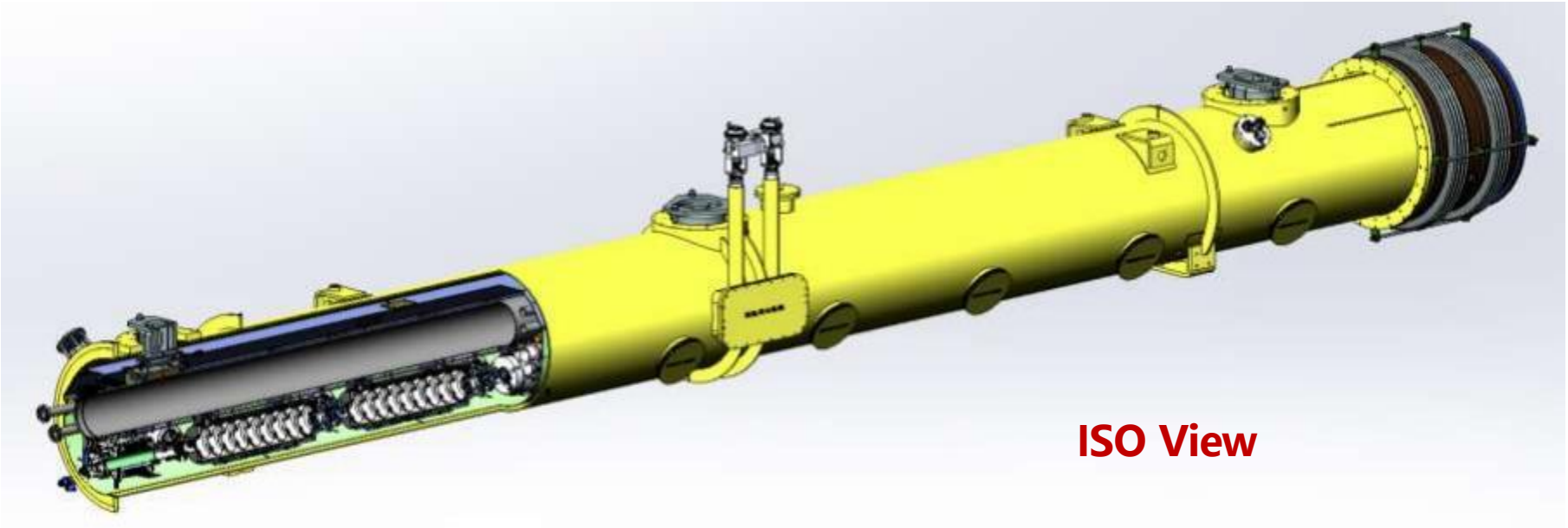
4.5 Double Spoke 325MHz Cavity cryomodule- Cryomodule

General Assembly

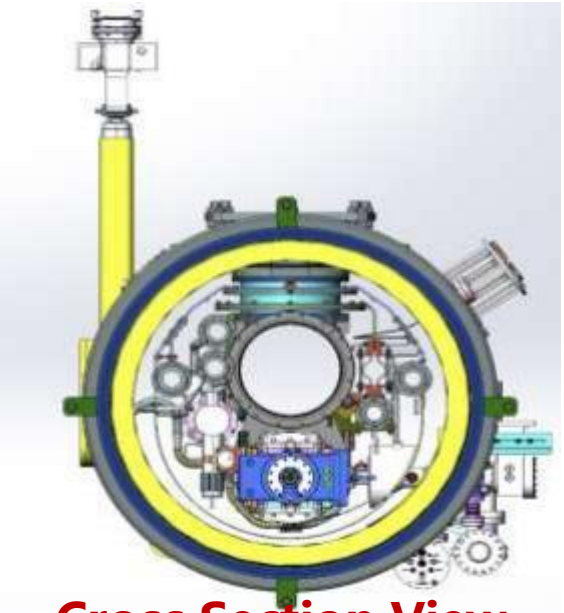
4. SRF Cavities Couplers and Cryomodules

高能锐新 HE-RACING TECHNOLOGY

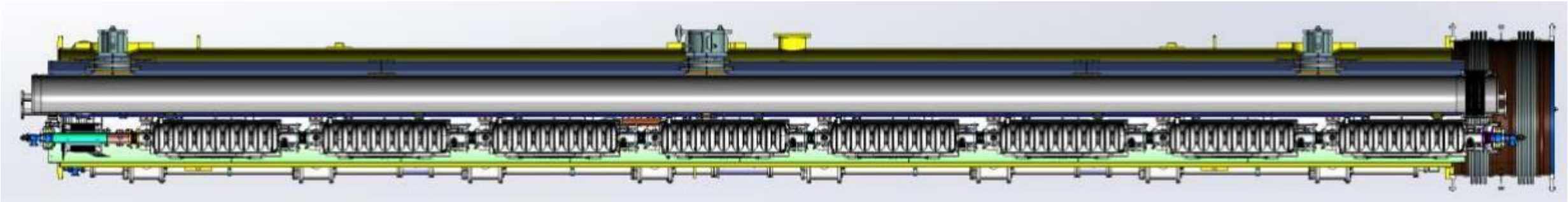
4.6 1.3GHz cryomodule-3D model



ISO View



Cross Section View



LongitudinalSection View

4. SRF Cavities Couplers and Cryomodules

高能锐新 HE-RACING TECHNOLOGY

4.6 1.3GHz cryomodule-General assembly

Cryomodule assembly and HT test was finished.

Q0 3.8E10@16MV/m; 3.6E10@21MV/m;
Average Max. Eacc 23.1MV/m

Key process:

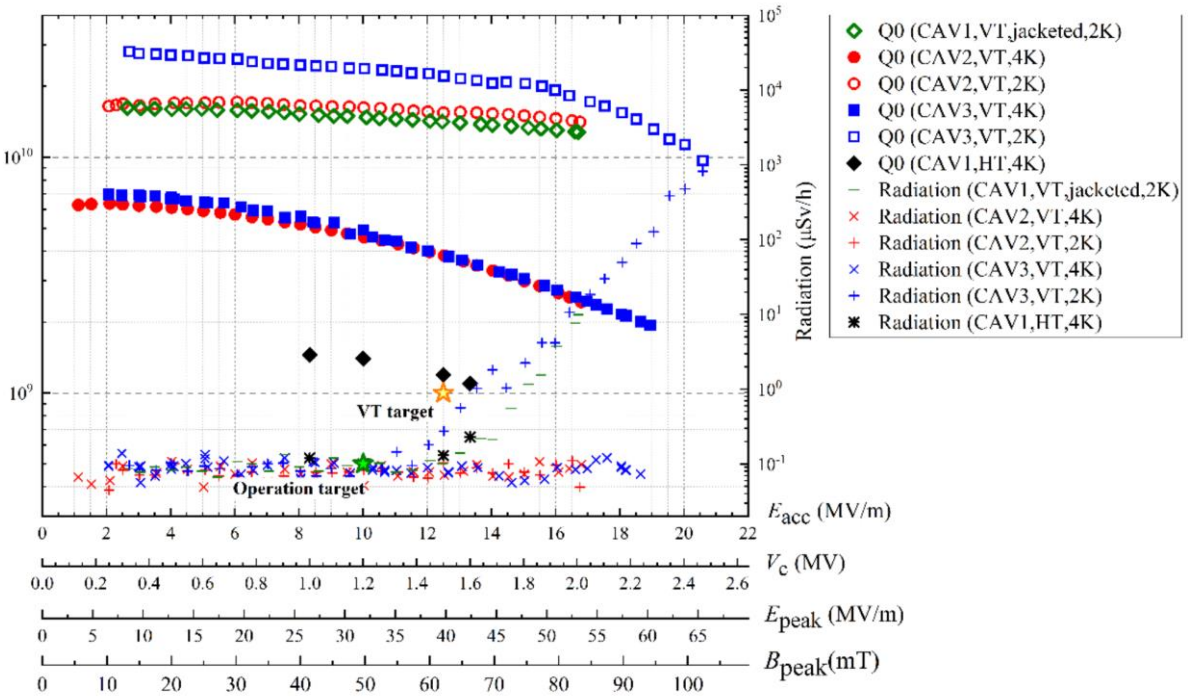
(1) HPR cavity before assembly;

(2) Do RT coupler conditioning before cooling down;

(3) Optimize anchor connection;

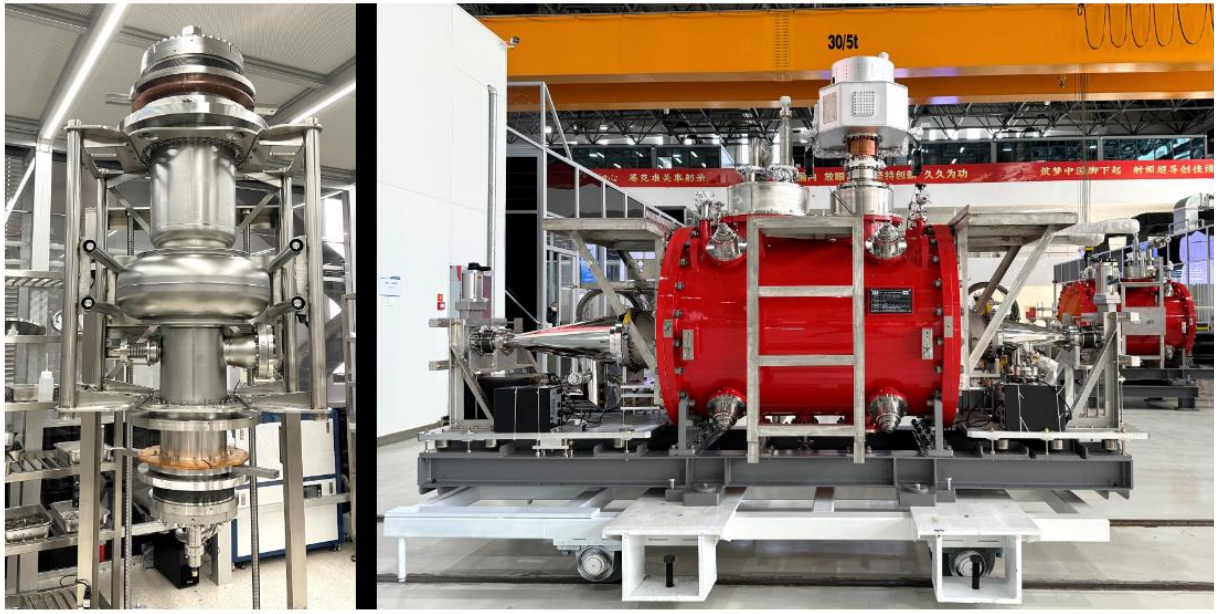
4. SRF Cavities Couplers and Cryomodules

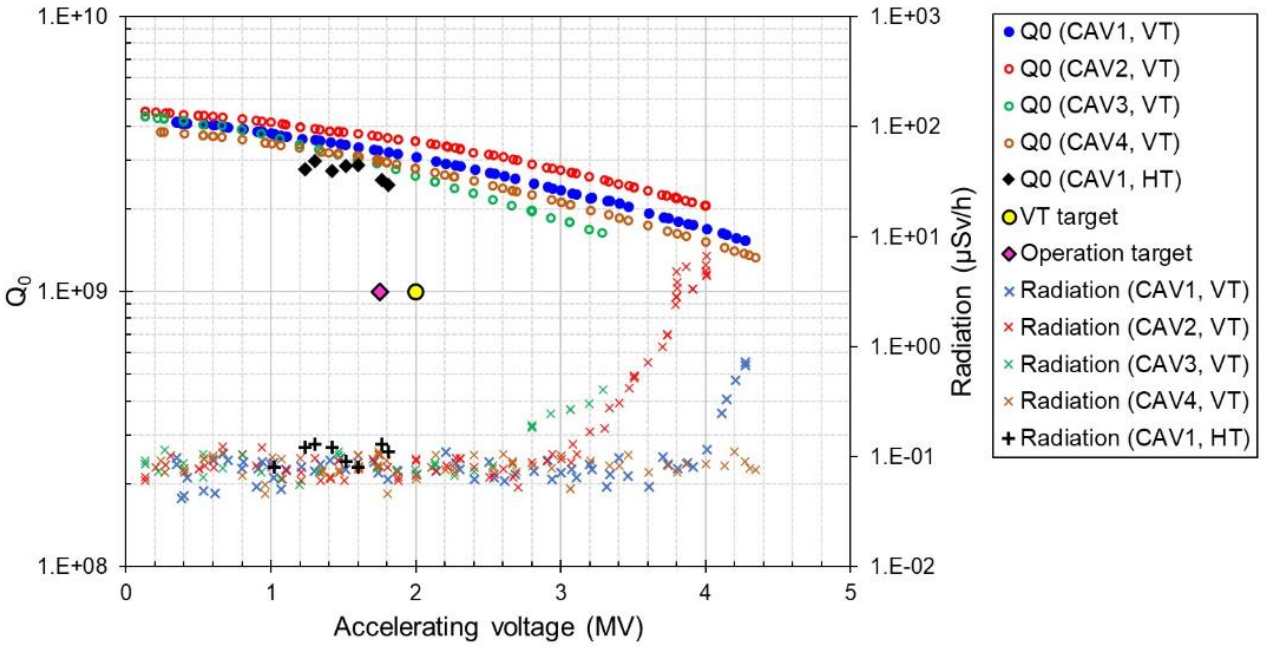
4.7 166MHz cryomodule (HEPS)



4. SRF Cavities Couplers and Cryomodules

4.8 500MHz cryomodule (HEPS)





5. Facilities Serviced by HERT

高能锐新 HE-RACING TECHNOLOGY

- CSNSII (Dongguan, Guangdong province)-Cavities and Couplers

5. Facilities Serviced by HERT

高能锐新 HE-RACING TECHNOLOGY

- HEPS (Beijing)-Cavities and Couplers

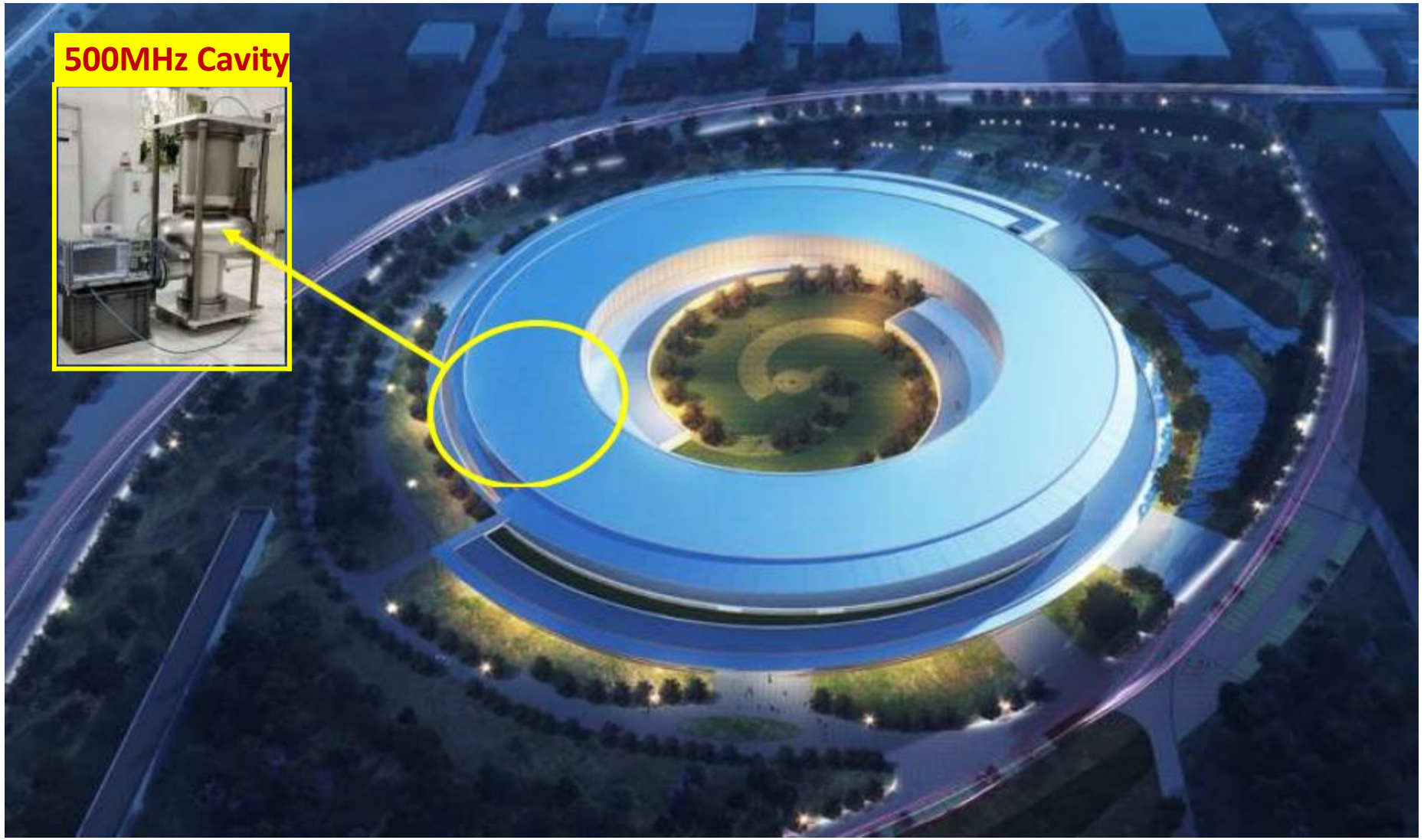
166MHz QWR cryomodule

500MHz single cell cryomodule

5. Facilities Serviced by HERT

高能锐新 HE-RACING TECHNOLOGY

- HALF (Hefei, Anhui province)-Magnets and Cavities



5. Facilities Serviced by HERT

高能锐新 HE-RACING TECHNOLOGY

- SHINE (Shanghai)-Cavities and Couplers

5. Facilities Serviced by HERT

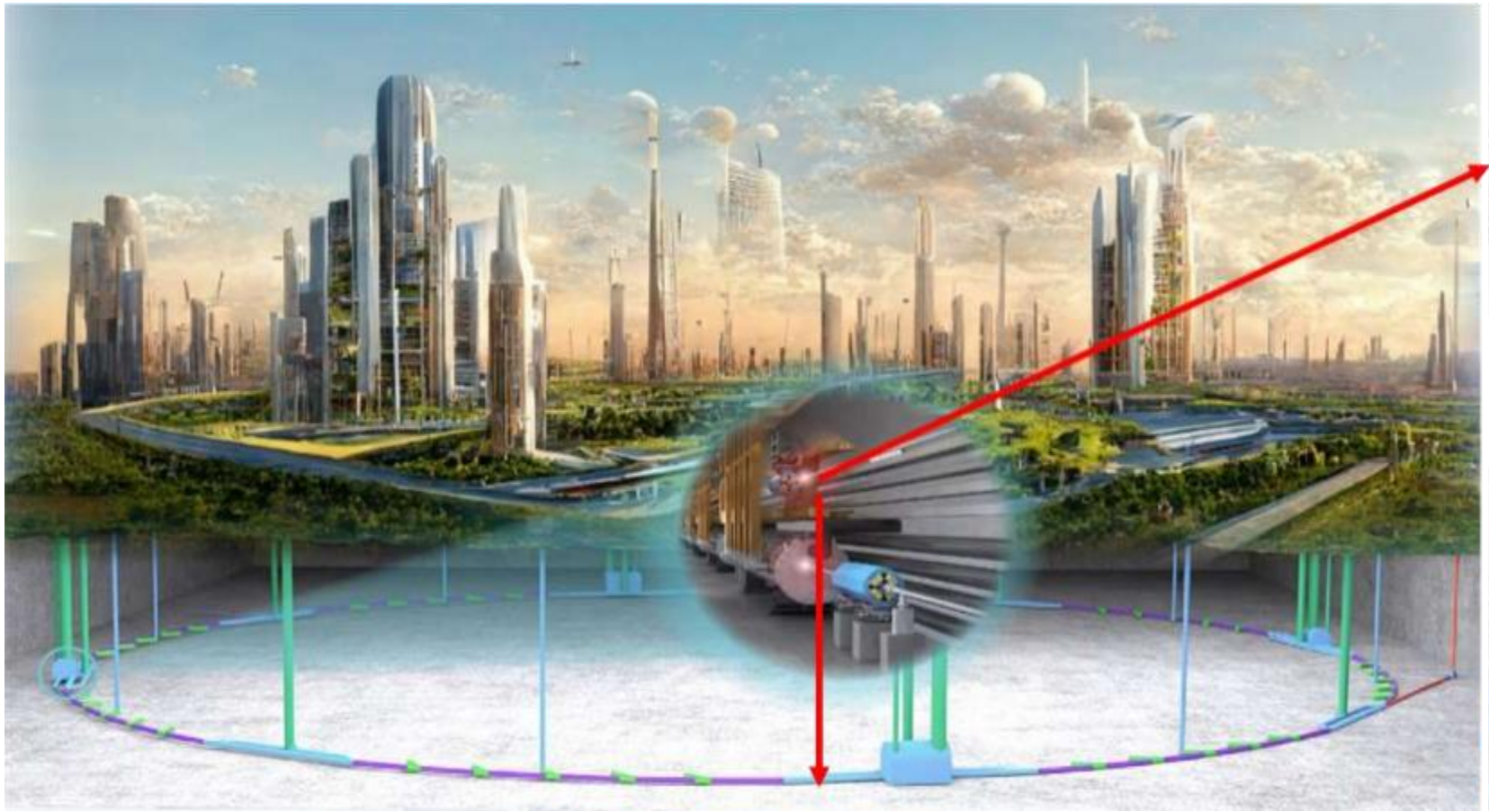
高能锐新 HE-RACING TECHNOLOGY

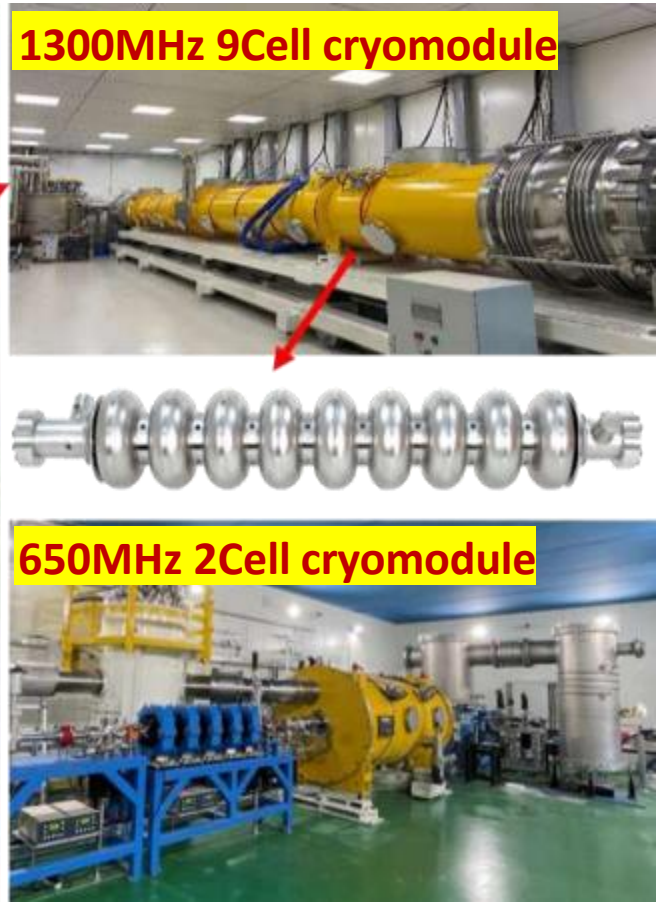
- S3FEL (Shenzhen,Guangdong province)-Cryomodules

5. Facilities Serviced by HERT

高能锐新 HE-RACING TECHNOLOGY

- CEPC research –Cavities and Couplers





5. Facilities Serviced by HERT

高能锐新 HE-RACING TECHNOLOGY

- **PAPS operation (20 staff of HERT)**

5. Facilities Serviced by HERT

高能锐新 HE-RACING TECHNOLOGY

- **PAPS operation (20 staff of HERT)**






5. Facilities Serviced by HERT

高能锐新 HE-RACING TECHNOLOGY

- **PAPS operation (20 staff of HERT)**

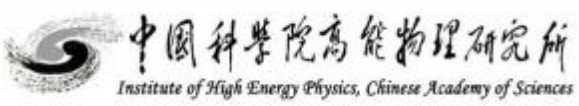
6. Summary

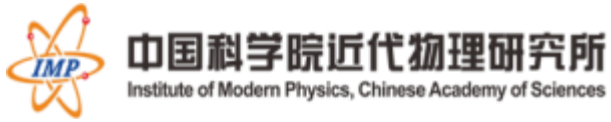
高能锐新 HE-RACING TECHNOLOGY

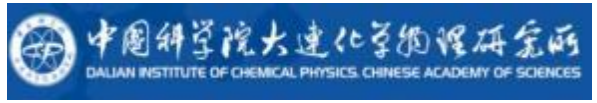
- HERT full with the experience for accelerator key technology and components R&D and manufacture.
- HERT has Successfully developed the magnets, accelerating structure, SRF cavities ,couplers and cryomodule for HEPS.
- HERT is willing to undertake more R&D work for all institutes, universities and labs.

6. Summary

高能锐新 HE-RACING TECHNOLOGY







Thanks for your attention!