

The status of Insertion Devices magnetic field measurement at HEPS

W Chen, LL Gong, ZQ Li, HH Lu, SC Sun, YS Huang, YJ Sun, L Zhang, XY Li, YH Li, XZ Zhang, ST Zhao
Institute of High Energy Physics, CAS, P.O. Box 918, Beijing 100039, P.R. China
chenwan@ihep.ac.cn

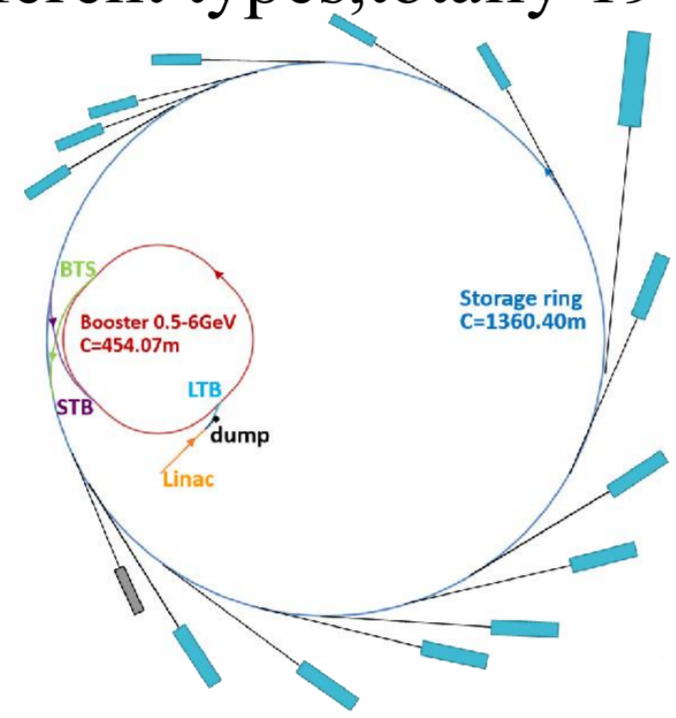
Abstract

HEPS is a new 6 GeV synchrotron radiation light source. Insertion devices play a significant role in achieving the high performance of the photons. There are 6 types of 19 insertion devices in total. Among the 19 insertion devices, there are IAU, Wiggler, CPMU, IVU, AK and Mango. The presentation describes the status of the magnetic field measurement for insertion devices. A new magnetic measurement laboratory is just setup for the measurements and fiducialization of insertion devices. The in-situ magnetic field measurement system for CPMU has been developed and has been used in HEPS CPMU measurement. The new in vacuum in-situ magnetic field measurement system for 4 meters long IVU is under development.

Introduction

- HEPS will be the first high-energy synchrotron radiation light source in China.
- HEPS is a high-performance and high-energy synchrotron radiation light source with a beam energy of 6GeV and an ultra-low emittance of better than 60pm.rad.
- The project will be completed by the end of 2025.
- 14 beamlines for HEPS in first phase, 6 different types, totally 19 insertion devices

type	quantity
CPMU	6
IVU	5
IAU	4
IAW	2
AK	1
Mango	1



Magnetic measurement laboratory for Insertion Devices

Totally 19 insertion devices, need to be completed in Apr.2024.

The existing lab is not big enough for accommodate the full HEPS insertion devices. Construct new labs and new measurement systems

new labs located in Magnet Technology Hall of PAPS(Platform of Advanced Photon Source Technology R&D)which is near HEPS.



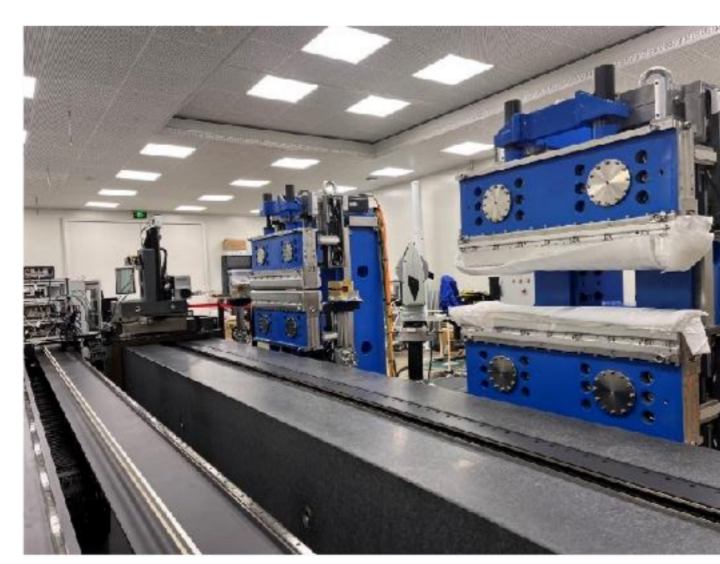
Magnetic measurement systems

	IAW	IAU	IVU	CPMU	AK	MANGO	system Status
1# Hall Probe bench		●		●			work
2#Hall probe bench	●	●	●	●	●		work
3m In-Situ Hall Probe measurement system				●			work
5m In vacuum Hall Probe measurement system			●				In commissioning
Lateral support Stretched Wire	●	●		●	●		work
Symmetrical support Stretched Wire			●	●			1 work 1Under development
Longitudinal probe Hall system						●	

Hall probe measurement benches for in air ID

2 Hall probe measurement benches, 6.5m motion strock, 3-D Hall sensor

X,Y,Z,A,C 5 motion axes. A and C axes are useful for fine angular positioning of the Hall sensor



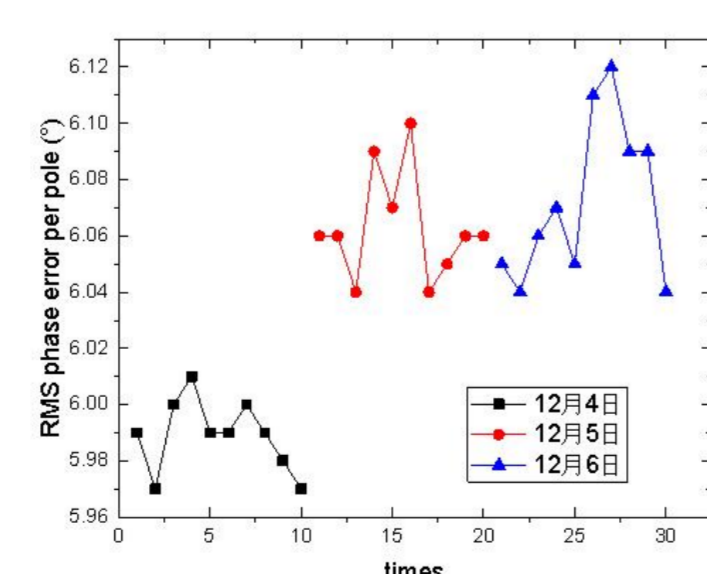
Z axis Flatness deviation $< \pm 10 \mu\text{m}$

Z axis Positioning accuracy: $< \pm 1.5 \mu\text{m}$

RMS phase error :

10 times RMS repeatability: $< 0.02^\circ$

3 days reproducibility: $< 0.16^\circ$



Lateral support Stretched Wire system for in air ID

	$\Delta I1(\text{Gscm})$	$\Delta I2(\text{Gscm}^2)$
short term	< 1	< 300
long term(5days)	< 4	< 500

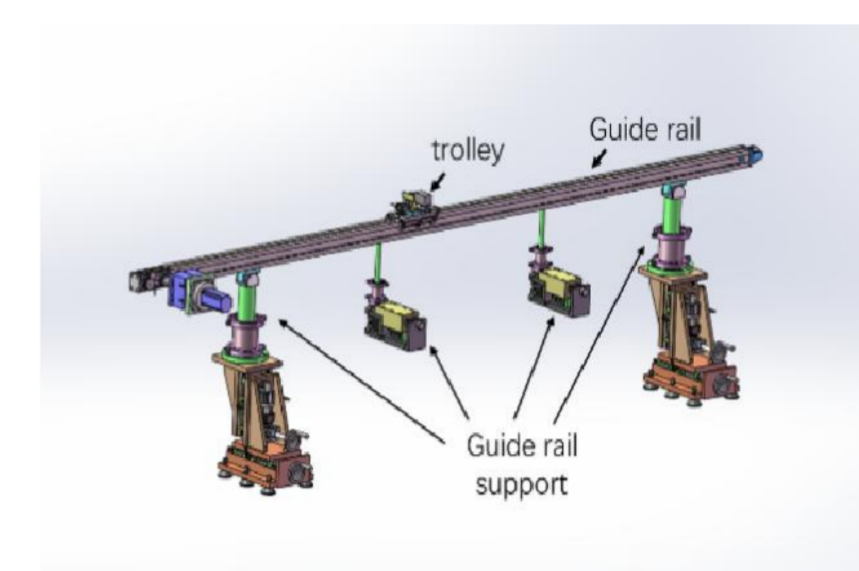
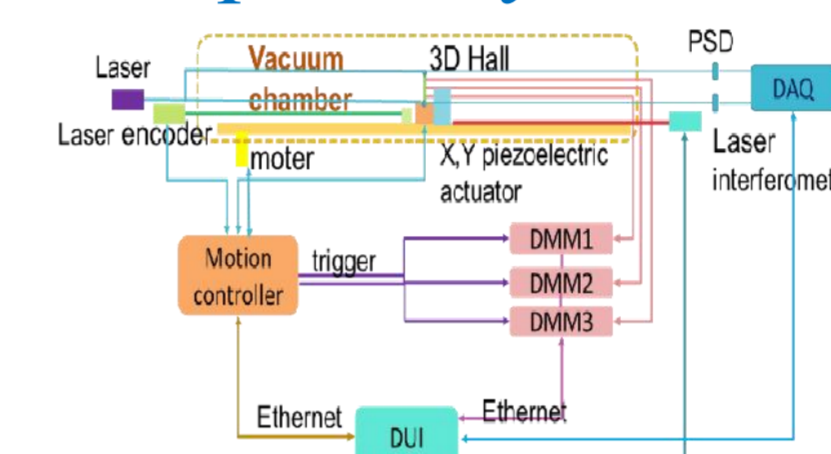


CPMU measurement system

- 3m In-Situ Hall probe system
- Symmetrical support SW



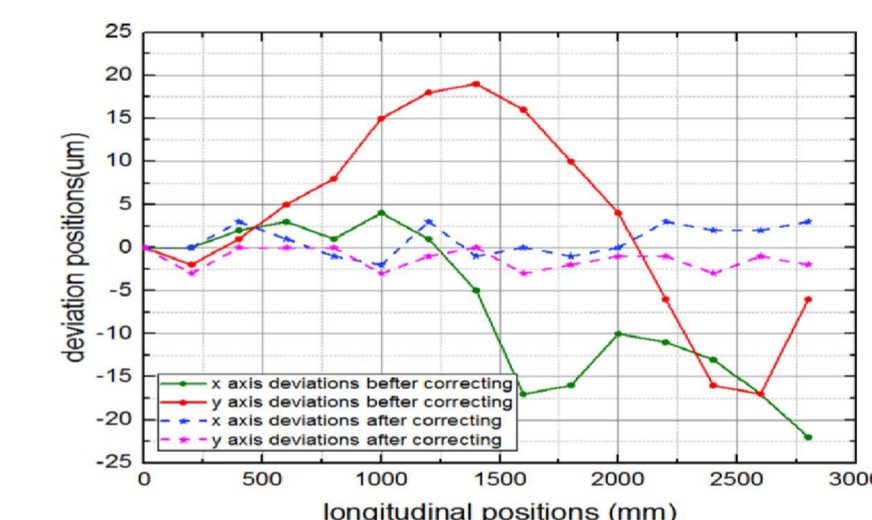
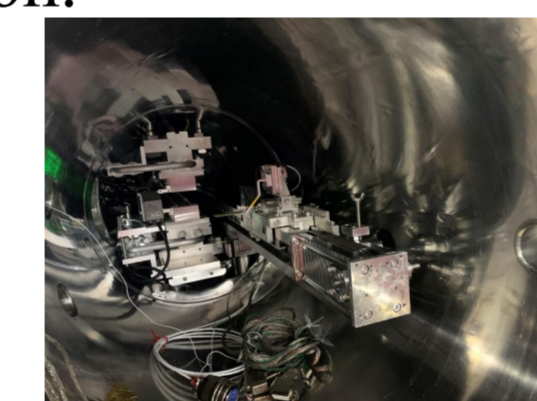
3m In-Situ Hall probe system



The System schematic layout of Hall probe measurement system

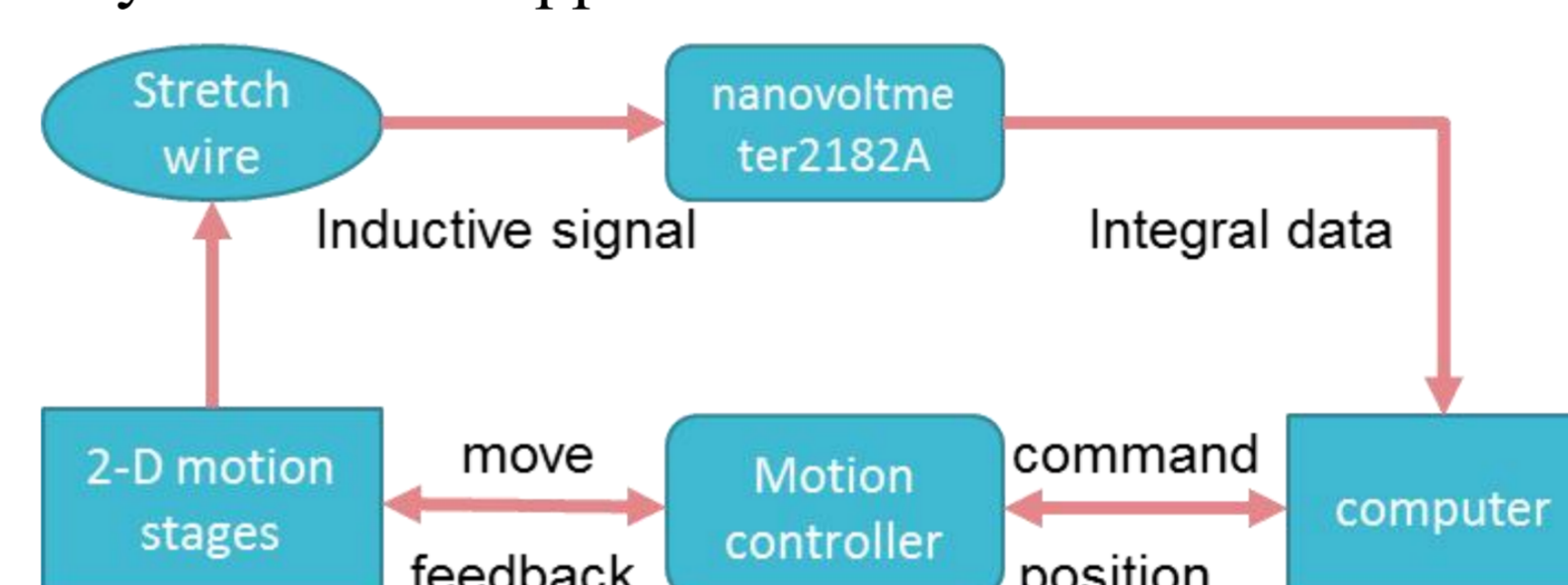
The three-dimensional diagram of four-point support guide rail structure

- Two dimensional piezoelectric stages, Hall probe, optical mirror, pinhole, etc. are placed on the trolley
- The strokes of piezoelectric stages in X and Y directions are 26mm and 12mm respectively, which are used for CPMU magnetic center scanning and guide rail straightness error dynamic compensation.



symmetrical support SW measurement system

symmetrical support structure Counteracts the effects of vacuum suction.



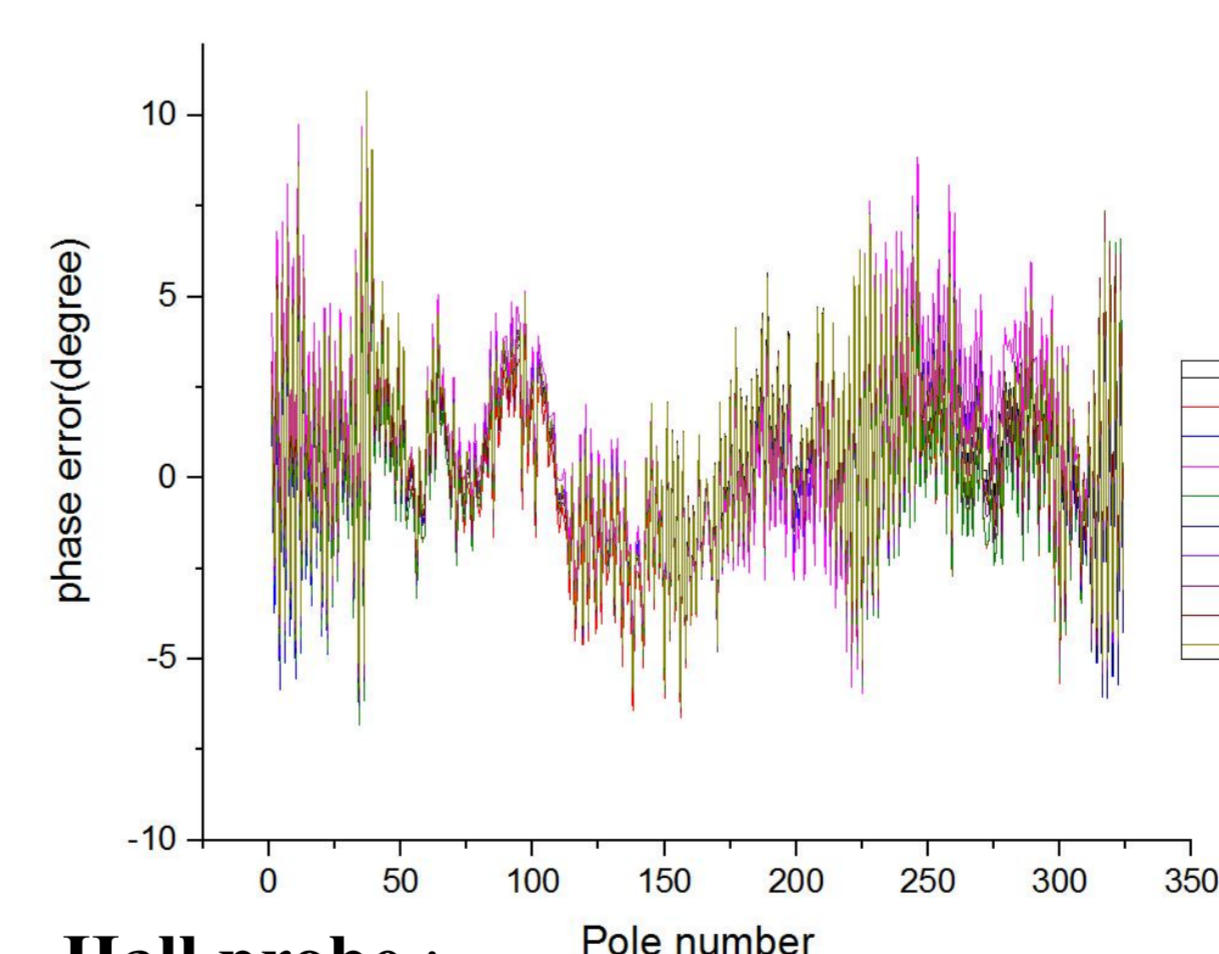
SW system diagram



Support structure of one side

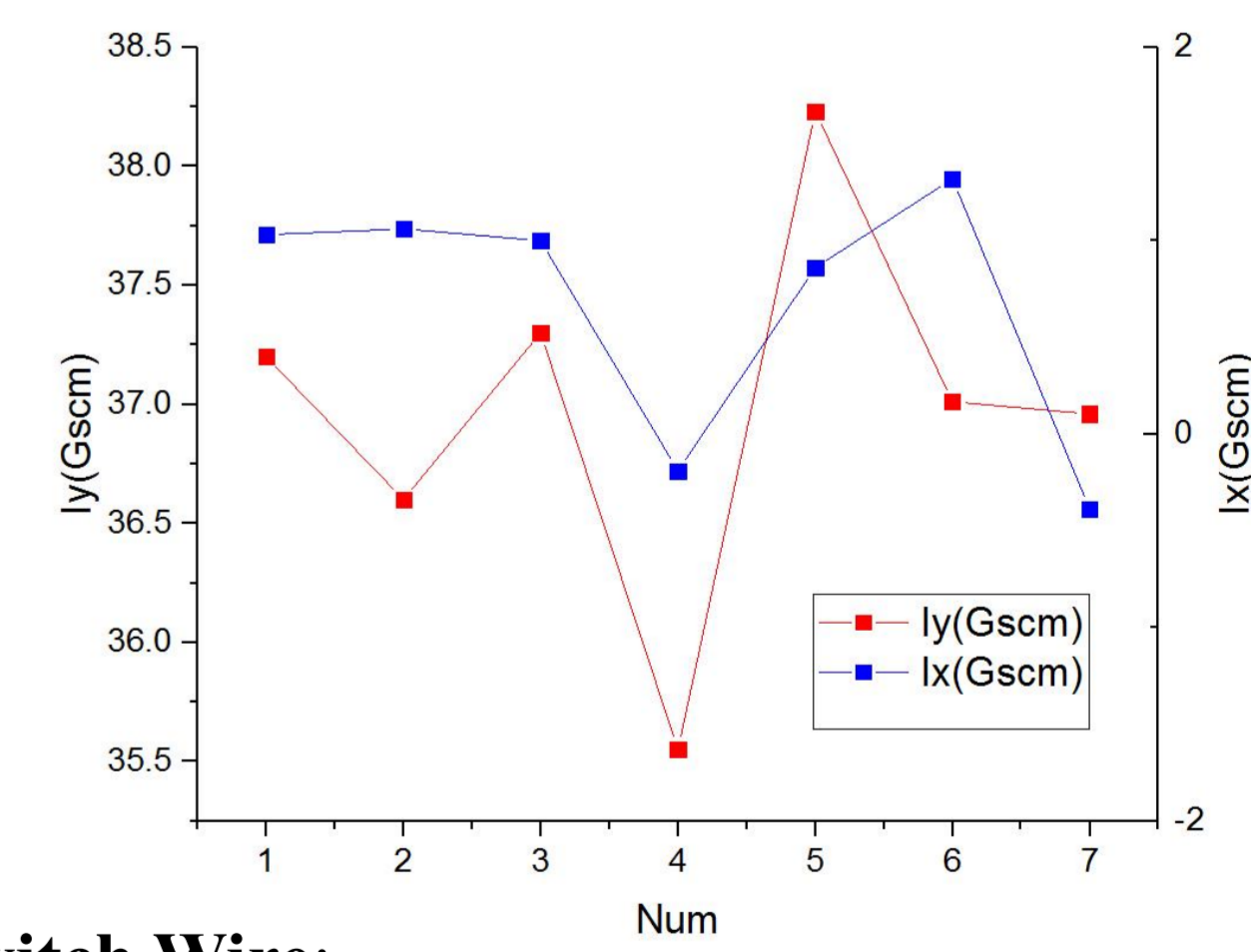
System performance

- repeatability (CPMU 12 works in cryogenic condition @ Gap 5.2mm)



Hall probe :

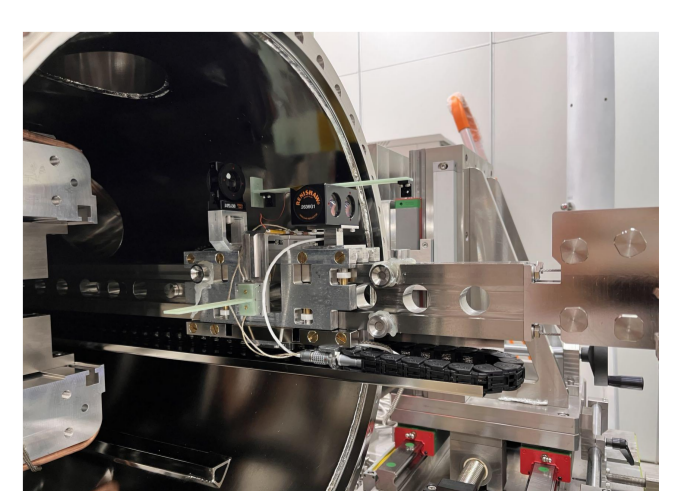
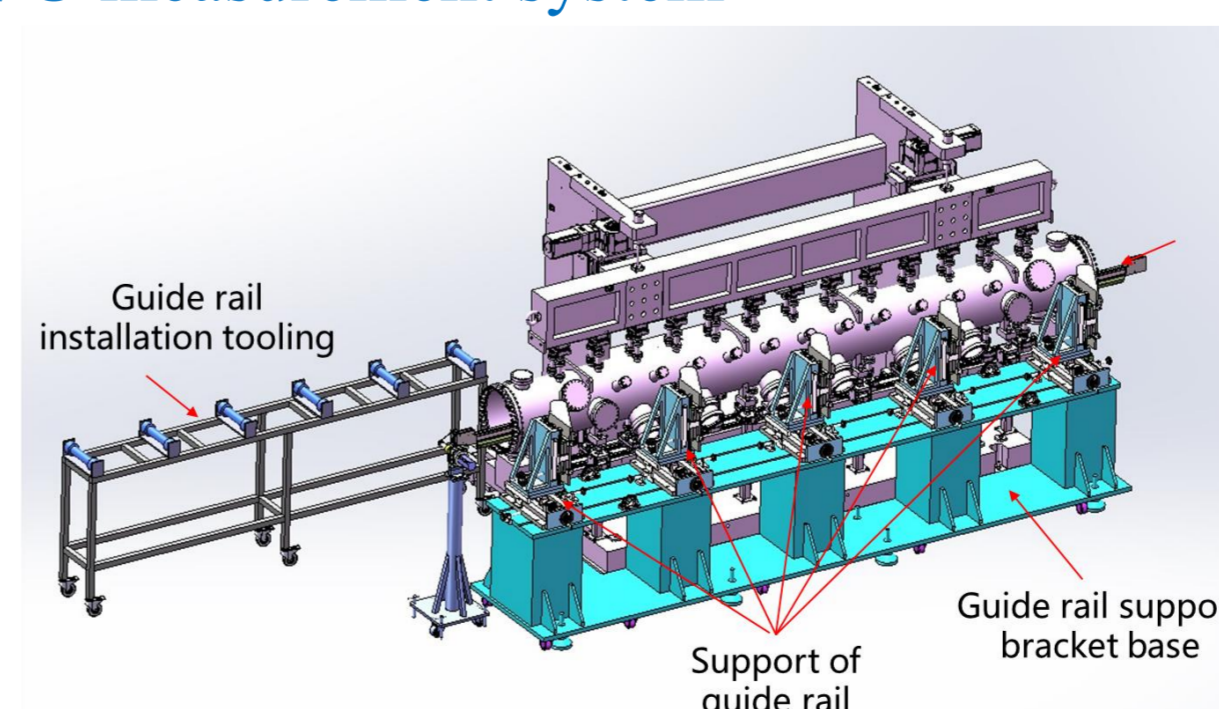
RMS phase error reproducibility is 0.034° by 10 continuous measurements



Switch Wire:

max error of By and Bx first field integral are 2.0 and 1.71Gscm by 7 continuous measurements

IVU measurement system



Summary

- 2 new magnet measurement laboratories are built to handle the insertion devices magnetic measurements.
- All measurements of IDs must be completed in April 2024.
- Many challenges of magnetic field measurement for IVU, CPMU and AK