HEPS CEPC CSNS BEPC

IBIC2024

Sept. 9-13, 2024 · Beijing, China

13th INTERNATIONAL BEAM INSTRUMENTATION CONFERENCE

Sept. 9 -13, 2024 · Beijing, China

CONFERENCE PROGRAM

中国科学院 CHINESE ACADEMY OF SCIENCES

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

The Institute of High Energy Physics (IHEP)

http://english.ihep.cas.cn/au/it/

The Institute of High Energy Physics (IHEP), a Chinese Academy of Sciences research institute, is China's biggest laboratory for the study of particle physics. We want to understand the universe better at the most fundamental level – from the smallest subatomic particles to the large-scale structure of the cosmos. We also want to use the knowledge and technology that comes from our research for the good of humanity. As well as theoretical and experimental research into particle and astroparticle physics, we have a broad range of research in related fields such as accelerator technologies and nuclear analysis techniques. The Institute also provides beam facilities for researchers in other fields of study.

Working at IHEP are over 1400 full-time staff, as well as over 500 postdocs and graduate students. Particle physics is a very collaborative and a very international field, and we have partnerships and experiment collaborations with dozens of universities and research institutions across China and worldwide.

IHEP's main campus is at Yuquan Road in the west part of Beijing. The Beijing campus hosts the Beijing Electron-Positron Collider, the BESIII experiment, the Beijing Synchrotron Radiation Facility, and most of IHEP's research and administrative staff.

The Dongguan campus, in Guangdong province in the south of China, is home to the China Spallation Neutron Source facility. In addition, IHEP runs experiment sites at Daya Bay and Jiangmen (both in Guangdong Province), Yangbajing (Tibet) and Daocheng (Sichuan).

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Contents

Welcome Message

Dear Colleagues,

On behalf of the organizing committee, we are pleased to welcome you to Beijing, China, for the 13th International Beam Instrumentation Conference (IBIC 2024) between September 9th and 13th 2024. IBIC Series bring together the world community of experts in instrumentation for particle accelerators, to explore the physics and engineering challenges of beam diagnostics and measurement techniques for charged particle beams. The 3.5 days conference includes tutorials on selected topics, invited and selected talks, as well as poster sessions. All properly presented contributions will be edited and published as JACoW Proceedings.

IBIC2024 is held by Institute of High Energy Physics (IHEP), which is China's biggest laboratory for the study of particle physics. BEPCII and CSNS, two large scale facilities are operating, HEPS, a fourth generation light source is under construction in IHEP. As part of the conference, a tour of the HEPS construction site or BEPCII tunnel is organized.

Beijing, the capital of the People's Republic of China (PRC), center of politics, culture, transport, tourism and international communication of China, is a fast-growing, dynamic metropolis, attracts foreign businesses and visitors, and maintains a firm grip on its rich cultural heritage.

Looking forward to meeting you in Beijing!

Jianshe Cao
IBIC 2024 Conference Chair

Junhui Yue
IBIC 2024 SPC Chair

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Junhui Yue, SPC Chair, IHEP, China

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Jun He, IHEP, Scientific Secretary, Oral and Poster Manager
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Xing Liu, IHEP, Registration and VISA Manager, Social Activity Manager
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Yanming Wang, IHEP, IT Manager (Network)
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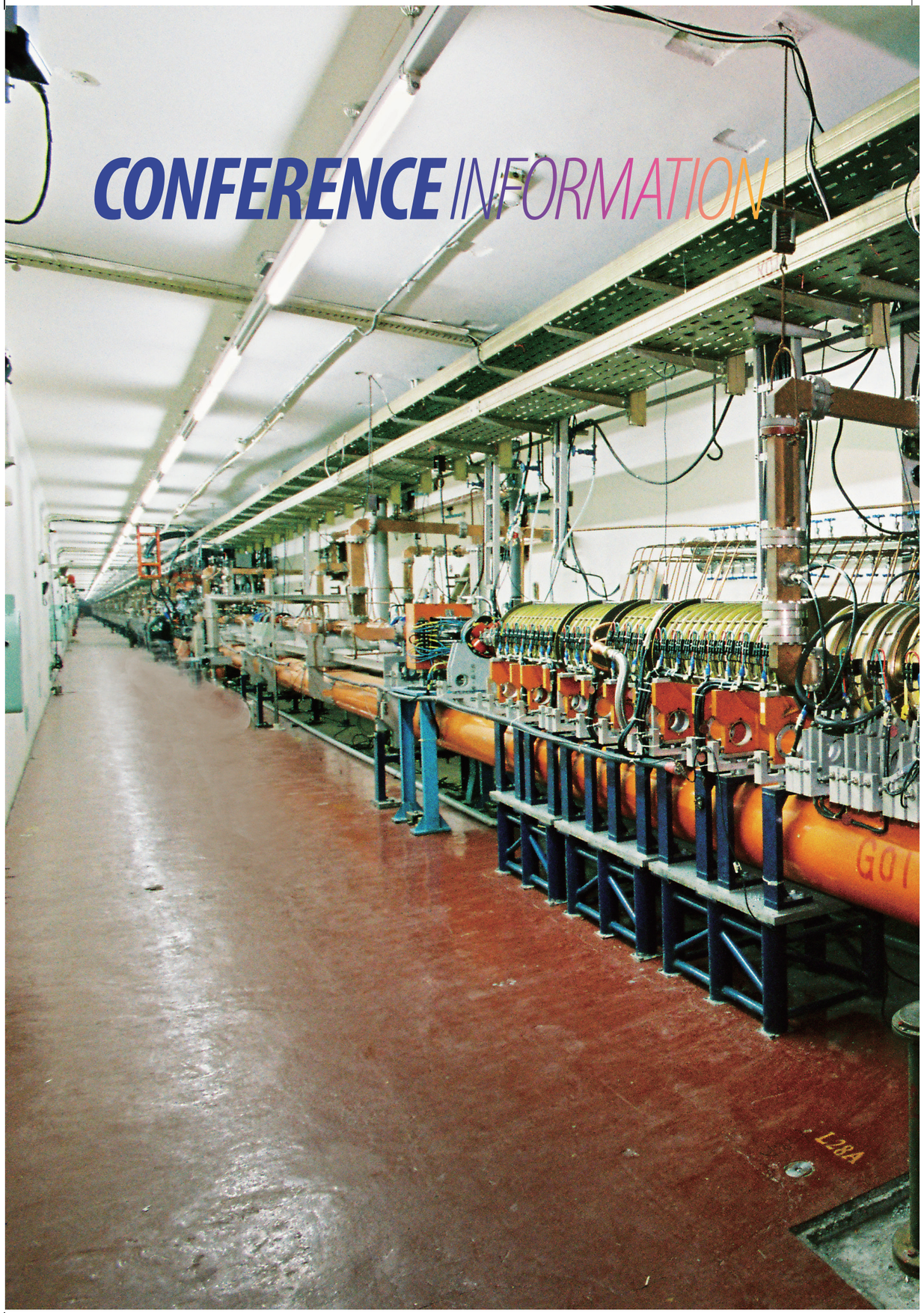
Volker RW Schaa, GSI (Ret.), Germany
Fancong Zeng, IHEP, China



Classifications

MC1: Beam Charge and Current Monitors
• Diagnostic systems measuring the average beam current, instantaneous total intensity or individual bunch intensity.

MC2: Beam Loss Monitors and Machine Protection
• Diagnostic systems measuring the average beam loss, instantaneous beam loss or individual bunch loss.
• Machine protection architectures based on inputs from beam instrumentation systems, as well as machine protection apparatus such as scrapers, collimators, radiation shields, etc.

MC3: Beam Position Monitors
• Diagnostic systems used for the measurement of beam position: orbit measurement techniques, trajectory measurement techniques, and bunch-by-bunch position measurement systems.
• This track includes the use of diagnostics associated with secondary beams, e.g. photon beamlines, to measure the position of the charged particle beam.

MC4: Transverse Profile and Emittance Monitors
• Diagnostic systems used for the measurement of transverse beam size, transverse beam profile, transverse emittance, and beam halos.
• This track includes both interceptive and non-interceptive diagnostics.

MC5: Longitudinal Diagnostics and Synchronization
• Diagnostic systems used for the measurement of longitudinal beam parameters such as bunch length, bunch profile, arrival time, energy spread, or longitudinal emittance.
• Systems used for beam synchronization and timing distribution.

MC6: Feedback Systems and Beam Stability
• Systems used to stabilize or control any beam or accelerator parameter either in a closed or open loop. This includes control of orbit, trajectory, longitudinal stability, bunch-by-bunch transverse stability, emittance, tune, chromaticity, etc.
• This can include descriptions of the detectors, actuators, any specialized acquisition electronics used to acquire the signal, as well as related data processing techniques. The feedback or feedforward aspects should, however, form a major part of the submission, otherwise, the diagnostic description would be better suited to the track dealing with the primary measurement under discussion.

MC7: Data Acquisition and Processing Platforms
• Data acquisition systems or architectures of relevance for beam diagnostic systems. This includes acquisition platforms, data processing techniques, electronic component validation or characterization.
• Computing platforms, control and acquisition software and operating systems of relevance for beam diagnostics.

MC8: Machine Parameter Measurements
• Systems used to measure machine parameters such as betatron tune, chromaticity, higher-order multipoles, space charge, impedance, beam-beam, etc.

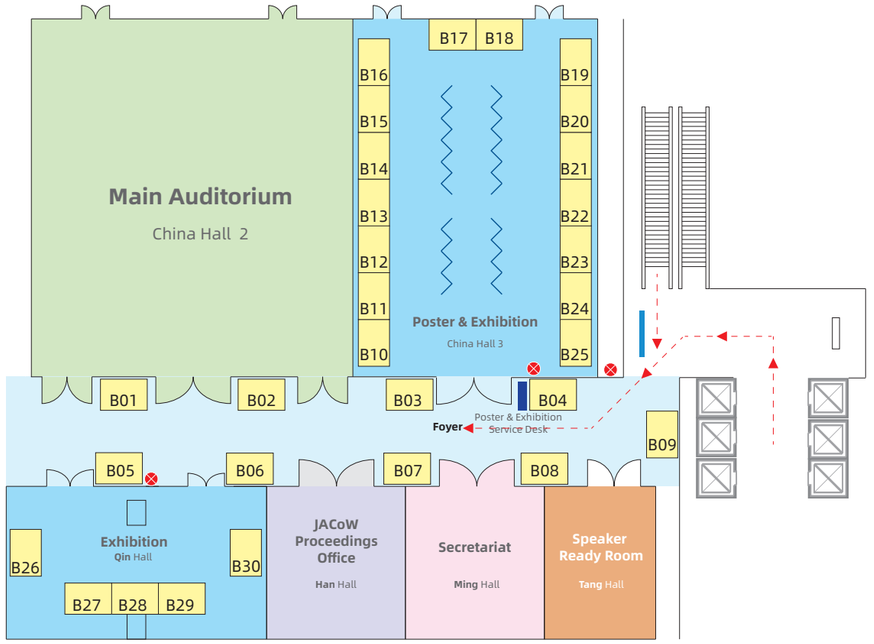
• Techniques and algorithms used for such measurements.
• Other diagnostic devices or techniques which do not clearly match any of the previous tracks.

MC9: Overview and Commissioning
• General description of beam instrumentation devices and systems at new facilities or machine upgrades.
• Commissioning results and lessons learned.
• Workshop reports related to beam diagnostics.

Venue

Hotel: Wanda Realm Beijing 北京万达嘉华酒店
Add: No. 18A Shijingshan Road, Shijingshan District, Beijing, P. R. China
地址： 北京市石景山区石景山路甲 18 号 1 号楼

5F FLOOR PLAN



5F of the hotel

Main Auditorium at China Hall 2
Poster & Exhibition at China Hall 3
Exhibition at Foyer of China Hall & Qin Hall
JACoW Proceedings Office at Han Hall
Speaker Ready Room at Tang Hall
Secretariat at Ming Hall

Smoking Policy

The venue is a non-smoking facility. Participants are requested to refrain from smoking in all areas.

Wi-Fi

Free Wi-Fi for participants.

5F Conference Area

Name: IBIC2024

Password: ihepibic2024

Hotel

Name: WandaHotels

1. Access code will be sent to you by SMS after you fill in your mobile phone number (for mainland China +86 numbers only).

2. WeChat Authorized Login

Please come to the hotel's front desk if you cannot receive the code. The staff there will help you.

Registration & Information Desk

Date	Opening Hours	Location
Monday, September 9, 2024	13:30-20:00	1F Lobby
Tuesday, September 10, 2024	08:00-17:30	
Wednesday, September 11, 2024	08:00-16:30	5F Secretariat at Ming Hall
Thursday, September 12, 2024	08:00-17:30	
Friday, September 13, 2024	08:00-13:00	

JACoW Proceedings Office, Speaker Ready Room & Secretariat

Date	Opening Hours	Location
Monday, September 9, 2024	13:30-20:00	5F **JACoW Proceedings Office** at Han Hall **Speaker Ready Room** at Tang Hall **Secretariat** at Ming Hall
Tuesday, September 10, 2024	08:00-17:30	
Wednesday, September 11, 2024	08:00-16:30	
Thursday, September 12, 2024	08:00-17:30	
Friday, September 13, 2024	08:00-13:00	

Poster & Exhibition Service Desk

The Poster & Exhibition Service Desk is on 5F, daily opens at 08:00 from September 10 -13, 2024.

The schedule for the poster session is as follows:

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Date	Time	Schedule
TUP: MC3: Beam Position Monitors MC4: Transverse Profile and Emittance Monitors MC9: Overview and Commissioning		
Tuesday, September 10, 2024	Before 10:00	Putting up your poster
	16:00-17:30	TUP: Tuesday Poster Session
	After 17:30	Remove your poster
WEP: MC4: Transverse Profile and Emittance Monitors MC5: Longitudinal Diagnostics and Synchronization MC6: Feedback Systems and Beam Stability MC7: Data Acquisition and Processing Platforms		
Wednesday, September 11, 2024	Before 10:00	Putting up your poster
	14:20-15:50	WEP: Wednesday Poster Session
	After 16:00	Remove your poster
THP: MC1: Beam Charge and Current Monitors MC2: Beam Loss Monitors and Machine Protection MC5: Longitudinal Diagnostics and Synchronization MC8: Machine Parameter Measurements		
Thursday, September 12, 2024	Before 10:00	Putting up your poster
	16:00-17:30	THP: Thursday Poster Session
	After 17:30	Remove your poster

Lunch, Welcome Reception, Conference Banquet, and Coffee Break

Registration fee includes daily lunch, welcome reception, conference banquet, and coffee breaks.

Lunch (Ticket Required)

Date and Time: Buffet Lunch 12:30-13:30, September 10-12, 2024
Lunch Box 12:20-13:00, September 13, 2024

Location: 2F Beijing Ballroom

Welcome Reception (Ticket Required)

Time: 17:30-21:00, Monday, September 9, 2024

Location: 1F Lobby Lounge

Conference Banquet (Ticket Required)

Departure Time: 18:00 Thursday, September 12, 2024

Pick-up Point: 1F Hotel Lobby

Dinner Time: 18:30-21:00, Thursday, September 12, 2024

Location: Grand Mansion Restaurant (Zheng Yuan Da Zhai Men) 正院大宅门（西翠路店）
No. 11 Xicui Road, Haidian District, Beijing 北京市海淀区西翠路 11 号

The restaurant is built as Siheyuan, an ancient Chinese-style courtyard house. Grey bricks, wooden carving ornaments on the wall, ancient Chinese furniture, and red palace lanterns. These, at once, bring you to a scenario of a rich traditional Chinese family.

The food is a fusion of Beijing, Hangzhou, Sichuan, and Cantonese styles.
During the dinner, enjoy the Chinese Traditional Performances of Peking Opera, Face Changing Show, Acrobatics, and Chinese traditional music instructions – Erhu.

Coffee Break
Coffee breaks are served at the exhibition area at China Hall 3 & Qin Hall.
Sponsored by

Facility Tour (BEPCII or HEPS)

Departure Time: 13:00, Friday, September 13, 2024
Pick-up Point: 1F Hotel Lobby

In Beijing district, there are two large accelerators runs by IHEP, one is BEPCII, and the other is HEPS. The conference has arranged two facility tour routes, to BEPCII or HEPS, the attendees can select one of them.

Option 1: BEPCII
(20 minutes drive from hotel, return to Wanda Realm from BEPCII by 15:00)

About BEPCII
The Upgrade Project of Beijing Electron Positron Collider (BEPCII) consists of the injector, the storage ring, the transportation line, the Beijing Spectrometer (BES), the Beijing Synchrotron Radiation Facility (BSRF). Below is the general layout of the BEPCII.

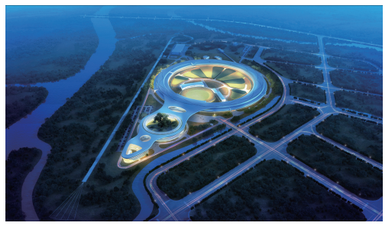
BEPC II is a two-ring e+e- collider running in the tau-charm energy region (Ecm = 2.0-4.2 GeV), which, with a design luminosity of 1×10^{33} $cm^{-2}s^{-1}$ at the beam energy of 1.89 GeV, is an improvement of a factor of 100 over its successful predecessor, BEPC. The upgrade will use the existing tunnel, some major infrastructure items, and some of the old magnets. The 202 m long linac of the new machine can accelerate electrons and positrons up to 1.89 GeV with a positron injection rate of 50 mA/min.

Its installation was completed in the summer of 2005 and it has reached most of the design specifications. The collider consists of two 237.5 m long storage rings, one for electrons and one for positrons. They collide at the interaction point with a horizontal crossing angle of 11 mrad and a bunch spacing of 8 ns. Each ring holds 93 bunches with a beam current of 910 mA. The machine will also provide a high flux of synchrotron radiation at a beam energy of 2.5 GeV.

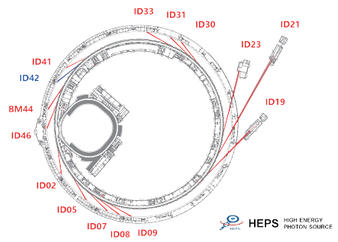
Option 2: HEPS
(1.5 hours drive from hotel, return to Wanda Realm from HEPS by 18:00)

About HEPS
The High Energy Photon Source (HEPS), under construction since 2019, is located in the northern core area of Huairou Science City (HSC) and is one of HSC's large scientific facilities. When it is commissioned, HEPS will not only be the first high-energy light source in China but also one of the brightest fourth-generation synchrotron radiation facilities in the world.

HEPS complex buildings resemble a magnifying glass, thus aptly symbolizing the role of HEPS as a powerful tool for characterizing microstructure of matters. And as one of the key projects listed in the 13th Five-year Plan for national major scientific and technological infrastructure construction, HEPS is an important platform for original and innovative research in the fields of basic science and engineering research. HEPS project, undertaken by Institute of High Energy Physics, Chinese Academy of Sciences, comprises of accelerators, beamlines and utility facilities. The estimated construction period is scheduled for six and a half years.



The storage ring of HEPS is 1360.4 m in circumference. Its electron energy is 6 GeV and the brightness is more than 1×10^{22} phs/s/mm^2/$mrad^2$/0.1%BW. By using a 7-Bending Achromatic (7BA) lattice, the horizontal emittance of the electron beam can surpass 60 pm•rad, which is the main feature of the fourth-generation diffraction limited light source.



HEPS could accommodate more than 90 high-performance beamlines and stations. Phase I involves construction of 14 user beamlines and stations for researchers in the fields of engineering materials, energy materials, environment research, health study and medicine development, and catalyst in petrochemistry industry, among others. HEPS will provide high-energy, high-brilliance, high-coherence synchrotron light with energies up to 300 keV and more, with the capability for nm spatial resolution, ps time resolution, and meV energy resolution. While providing conventional technical support for general users, HEPS will also operate as a platform for in-situ and operando investigation of real-time structure evolution of the engineering materials with multi-scale and multimodal X-ray probes, which will enable breakthrough in design and manipulation of such materials to meet the requirement from national development strategies and urgent core industrial needs.

Outing (Summer Palace)

Departure Time: 16:00, Wednesday, September 11, 2024
Pick-up Point: 1F Hotel Lobby (Ticket Required)
**** Please make sure you bring your ID card or Passport with you.***
* ***It will be quite some walk, please wear comfortable shoes.***

Schedule

16:00	Shuttle bus to the East Gate of Summer Palace
16:30-19:00	Free time in Summer Palace, on your own explore the royal garden
19:00	Shuttle bus from **West Gate** of Summer Palace
	Meeting Point: West Gate (西宫门) of Summer Palace **Staff Number: Frank Wang, +86 138 0117 9709**
	Return to Wanda Realm
	If you miss the time, please arrange your own transfer back.

Summer Palace is the largest and most well-preserved royal park in China, it greatly influences Chinese horticulture and landscape with its famous natural views and cultural interests, which also has long been recognized as 'The Museum of Royal Gardens'.

It was an imperial garden in Qing Dynasty. Mainly dominated by Longevity Hill and Kunming Lake, it covers an expanse of 2.9 square kilometres (1.1 sq mi), three-quarters of which is water.

In December 1998, UNESCO included the Summer Palace on its World Heritage List. It declared the Summer Palace "a masterpiece of Chinese landscape garden design. The natural landscape of hills and open water is combined with artificial features such as pavilions, halls, palaces, temples and bridges to form a harmonious ensemble of outstanding aesthetic value".

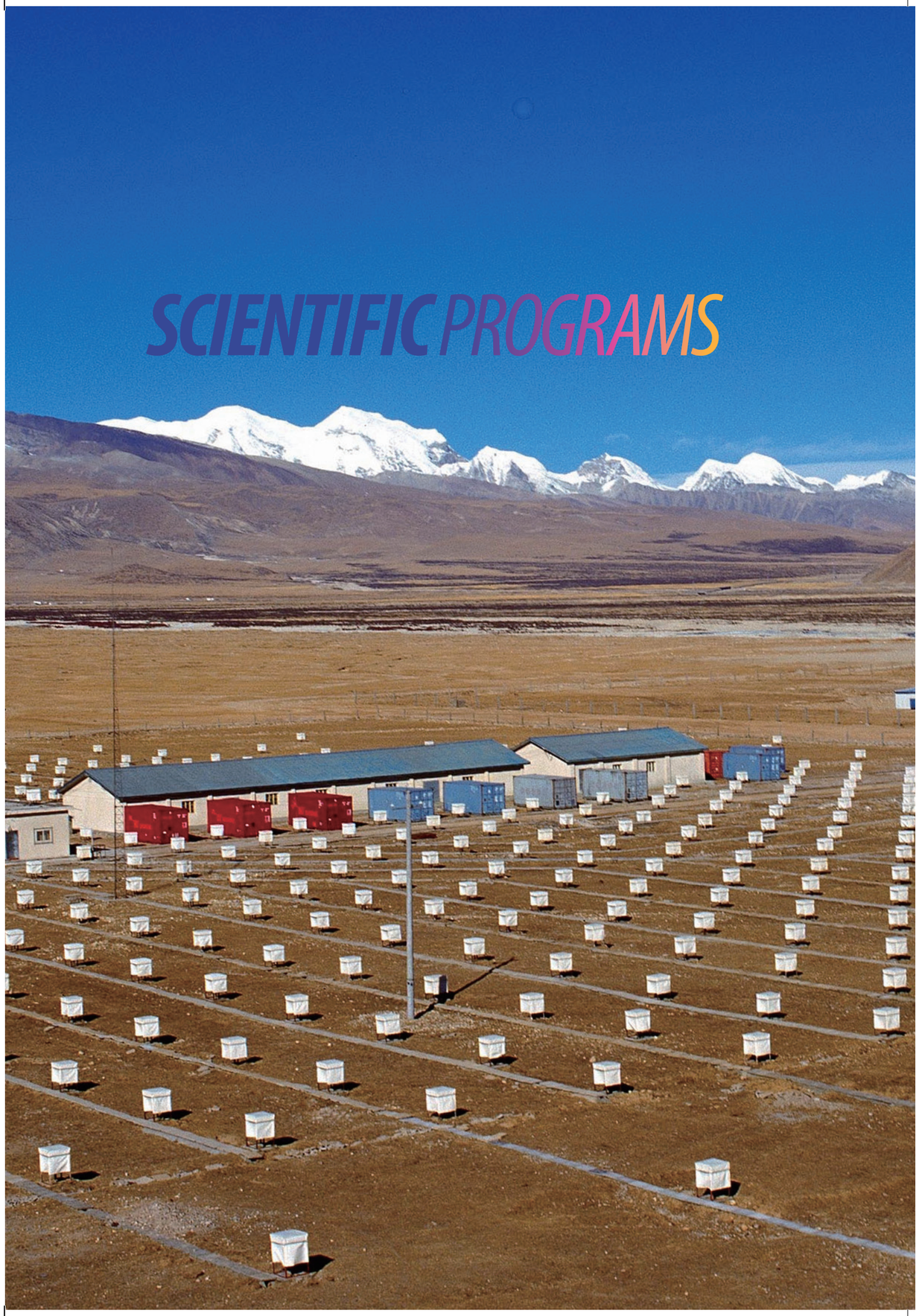


Emergency Numbers

Police (Calling)	110
Police (Text message)	12110
First-aid Ambulance	120
Fire	119
Traffic Accidents	122

110, 120, and 119 are free calls. 110 may be used for all emergencies. It is the first number to call. Whether 119 or 120 is called depends on the situation.

Local Contact Information:
Ms. Audrey Liu, +86 189 1172 3900
Ms. Qu Chen, +86 139 0108 5466



Program at a Glance

Program at a Glance

Time	Monday, September 9th	Tuesday, September 10th	Wednesday, September 11th		Thursday, September 12th	Friday, September 13th
(UTC+8)		**TUA: Overview and Commissioning Chair: Junhui Yue**	**WEA: Data Acquisition and Processing Platforms Chair: Yongbin Leng**		**THA: Longitudinal Diagnostics and Synchronization Chair: Hirokazu Maesaka**	**FRA: Transverse Profile and Emittance Monitors Chair: Kenichirou Satou**
9:00		TUAIO：Jianshe Cao (IHEP) Welcome & Opening Remarks	WEAI1：Michael Buechler (DESY) FWK - An Open-source FPGA Framework by DESY for Large Scientific Projects		THAT1：Sebastian Schulz (DESY) Latest Achievements in Femtosecond Synchronization of Large Scale Facilities	FRAT1：Mariusz Sapinski (PSI) Secondary, Thermionic and Delta Electrons Emission from Thin Targets
9:10		TUAI1：Yuhui Li (IHEP) Overview of Chinese Accelarator				
9:20						
9:30			WEAI2：Andreas Schlogelhofer (CERN) Remote Sensing of Fast Beam Signals Using Electro-optical Modulators			
9:40						
9:50		TUAC2: Stefano Mazzoni (CERN) Overview of the FCC-ee Beam Instrumentation R&D			THAI2：Christelle Hanoun (PhLam-U.Lille) Cost-effective Time-stretch Terahertz Electro-optic Recorders, by Using 1550 nm Laser Probes	FRAC2: Hao Zhang(Cockcroft Institute) BGC monitor: First year of operation at the LHC
10:00			WEAC3：Zhixue Li (IMP) Newly Developed Digital Signal Acquisition and Processing Platform for Beam Instruments at IMP			
10:10		Conference Photo (10:10-10:20)				Coffee Break (10:10-10:50)
10:20		Coffee Break (10:20-10:50)				
10:30		**TUB: Overview and Commissioning/Transverse Profile and Emittance Monitors Chair: Changbum Kim**	**WEB: Transverse Profile and Emittance Monitors Chair: Fernando Henrique Cardoso**		**THB: Machine Parameter Measurements Chair: Peter Forck**	**FRB: Beam Loss Monitors and Machine Protection/Beam Charge and Current Monitors Chair: Thibaut Lefevre**
10:40						
10:50		TUBI1：Kota Ueshima (NIQST) Commissioning of the Beam Diagnostic System for NanoTerasu: A New 3 GeV Light Source in Japan	WEBI1：Renjun Yang (IHEP) Achieve a Record Dynamic Range of Halo Diagnostics with a Novel Fluorescence Wire Scanner		THBI1：Sonja Jaster-Merz (DESY) High-dimensional and Ultra-sensitive Diagnostics for Electron Beams	FRBI1：Bruce Schumm (UCSC) Development of Ultra-fast Diamond-sensor Based Systems for Advanced Accelerator Diagnostics
11:00						
11:10						
11:20		TUBI2：Florian Benedetti (QST) Beam Instrumentation Performance during Commissioning of LIPAc	WEBI2：Ji-kwang Hwang (GWNU) Design and Experimental Validation of High-Resolution Single-Shot Emittance Diagnostics for Heavy-Ion Beams		THBI2：Shanshan Cao (SARI) Nondestructive Beam Energy Measurement Using RF Cavity Beam Arrival Time Monitor	FRBC2：Montague King (CERN) A Systematic Investigation of Beam Losses and Position Reconstruction Techniques Measured with a Novel oBLM at CLEAR
11:30						
11:40						FRBC3: Sara Benitez Berrocal (CERN) SPS Fast Spill Monitor Developments
11:50		TUBC3：Jun Peng (IHEP) Beam Diagnostics for CSNS- Ⅱ Linac Commission and Operation	WEBC3：Narender Kumar (Cockroft Institute) First Proof-of-concept Transverse Beam Profile Measurements with Gas Jet in-vivo Dose Profiler for Medical Accelerators		THBC3：Arnold Kruschinsk (HZB) Laser Modulator for SSMB Used as a Diagnostic Tool	
12:00						FRCL1：Carsten Welsch (UOL) IBIC2025 Report
12:10		TUBC4：Wan Zhang (IHEP) Beam Size Measurement With Gratings at BEPCII	WEBC4：Yu Du (IMP) Evaluating the Use of Common Statistical Divergences to Quantify the Differences between Beam Distributions in High-dimensional Phase Space		THBC4：Yuwen An (IHEP) Observation and Study of Space Charge Effect Frequency Shifts in High-intensity Accelerators	FRCL2：Junhui Yue (IHEP) Concluding Remarks and Closing
12:20						Simple Lunch Box (12:20-13:00)
12:30		Lunch Break (12:30-13:30)				
13:00						
		TUC: Beam Position Monitor Chair: Carsten Welsch	**WEC: Feedback Systems and Beam Stability Chair: Nicolas Hubert**		**THC: Longitudinal Diagnostics and Synchronization Chair: Marco Veronese**	Tour to BEPCII or HEPS, Start from 13:00 at the Wanda Realm Return to Wanda Realm from BEPCII by 15:00 Return to Wanda Realm from HEPS by 18:00
13:30	Registration Opens 13:30	TUCI1：Xing Yang (USTC) Bunch-resolved 3D Beam Position Measurement System and Its Application in FELiChEM	WECI1：Takeshi Nakamura (KEK) Bunch by Bunch Feedback Systems Review		THCI1：Marco Marongiu (HZB) Approaching an optimum time resolution for synchroscan streak-camera measurements with visible synchrotron light	
13:40						
13:50						
14:00		TUCC2：Victor Verzilov (TRIUMF) Low frequency beam position monitoring at the TRIUMF cyclotron injection line	WECC2：Lucas Pelike (LNLS) Modeling of the SIRIUS Fast Orbit Feedback Control Loop		THCC2：Yong Zhang (IMP) Direct Measurement of the Longitudinal Emittance for a Proton Beam at Exit of a Radio Frequency Quadrupole	
14:10						
14:20		TUCC3：Donghyun Song (PAL) Photon Beam Position Monitor for PLS-II Beamline	Coffee Break(14:20-14:50) & WEP: Wednesday Poster Session (14:20-15:50)		THCC3：Gian Luca Orlandi (PSI) Absolute Characterization of sub-fs Electron Bunch-Length in SwissFEL using a Bunch-Compressor Monitor	
14:30						
14:40		Coffee Break (14:40-15:10)			Coffee Break (14:40-15:10)	
14:50		**TUD: Beam Position Monitor Chair: Junxia Wu**			**THD: Longitudinal Diagnostics and Synchronization Chair: Gero Kube**	
15:00						
15:10		TUDI1：Hongming Xie (IMP) Overview of the BPM System for HIAF & CiADS Projects			THDI1：Feng Qiu (IMP) On-line Beam Synchronous Phase Calibration Using Beam-Induced RF Signals	
15:20						
15:30						
15:40		TUDC2：Collette Pakuza (JAI) The Study of High-frequency Pick-ups for Electron Beam Position Measurements in the AWAKE Common-beamline			THDC2：Donghyun Kwak (IBS) Capacitive Pick-Up Type Bunch Shape Monitors for Low-Energy Ion Beams at RAON	
15:50						
16:00		TUP: Tuesday Poster Session (16:00-17:30)	Shuttle Bus to East Gate of Summer Palace (16:00-16:30)		THP: Thursday Poster Session (16:00-17:30)	
16:10						
16:20						
16:30			Visiting Summer Palace (16:30-19:00)			
17:30	Welcome Reception 17:30-21:00 Wanda Realm					
18:00					Transportation to Conference Banquet (18:00-18:30)	
18:30					Conference Banquet: Grand Mansion Restaurant (18:30-21:00)	
19:00		SPC Meeting	Shuttle bus to Wanda Realm from West Gate of Summer Palace(19:00-19:40)			
19:40						
21:00						

Information for Oral Speakers

Please make sure that you finish your remarks within the time allocated for your presentation so that there is time for questions and discussion.

Talk Timing

- Tutorials: 40 mins + 10 mins (for Q&A)
- Invited: 25 mins + 5 mins (for Q&A)
- Contributed: 15 mins + 5 mins (for Q&A)

Slide Size, Format, and Display

The projector's aspect ratio will be **16:9,** but slides with a different aspect ratio such as 4:3 can be accommodated. Slides will be displayed via hardware running Microsoft Windows. There will be no provision for authors to use their personal computers under any circumstances.

Upload your Presentation before the Conference

The files of the presentations should be uploaded to Indico as early as possible, but **at the latest by 3:00 p.m. on the day before your presentation**. Accepted formats are Microsoft PowerPoint and Adobe PDF.

At the Conference

Speakers who have not uploaded their files in advance, please upload them as the Guidelines on IBIC2024 website or deliver them to the conference organizers at least one day in advance (Please note that we do not accept USB disc copies, you may try to download the file from your mailbox, etc.). At that time, please visit the presentation Quality Assurance desk (**Speaker Ready Room**) to ensure that your presentation has been properly loaded and can be displayed correctly. Slides that have been successfully submitted and presented will be published in the web version of the proceedings without further action on the part of the speaker. If you have any special needs, please visit the **Speaker Ready Room**.

The Speaker Ready Room is at Tang Hall. The day before presentations, all speakers are required to check that their slides are working correctly on the computers located in this room that are the same as those used in the auditorium.

Speaker Ready Room Hours

- Monday, Sep. 9 / 13:30 – 20:00
- Tuesday, Sep. 10 / 08:00 - 17:30
- Wednesday, Sep. 11 / 08:00-16:30
- Thursday, Sep. 12 / 08:00 - 17:30
- Friday, Sep. 13 / 08:00 – 13:00

During Your Presentation

The organizers will ensure that your slides are ready prior to your scheduled time slot. A pointer, slide controller, microphone, and timer will be provided.

The session chair assistant will help speakers with their presentations and any minor issues.

13th INTERNATIONAL BEAM INSTRUMENTATION CONFERENCE
Sept. 9 -13, 2024 · Beijing, China

Poster Sessions Guidelines

Posters **MUST be** in **PORTRAIT** orientation (**vertical**), not landscape. **The poster format is ANSI A0 (84.1 cm x 118.9 cm)**.

The necessary material for poster display will be provided by the Conference Organizers.

The SPC reserves the right to reject publication of papers which have not been properly presented or manned in the poster sessions. Manuscripts of contributions to the proceedings (or enlargements of them) are not considered as posters and papers presented in this way will not be accepted for publication.

There are **three poster sessions** from Tuesday (September 10) to Thursday (September 12) in the afternoon, please refer to the program.

Poster Session Time	Main Classifications
TUP: Tuesday-September 10 (from 16:00 to 17:30)	MC3: Beam Position Monitors MC4: Transverse Profile and Emittance Monitors MC9: Overview and Commissioning
WEP: Wednesday- September 11 (from 14:20 to 15:50)	MC4: Transverse Profile and Emittance Monitors MC5: Longitudinal Diagnostics and Synchronization MC6: Feedback Systems and Beam Stability MC7: Data Acquisition and Processing Platforms
THP: Thursday- September 12 (from 16:00 to 17:30)	MC1: Beam Charge and Current Monitors MC2: Beam Loss Monitors and Machine Protection MC5: Longitudinal Diagnostics and Synchronization MC8: Machine Parameter Measurements

Poster sessions are at **China Hall 3**. The table above shows the Poster Session Time and classifications. The time slot is the time when the poster presenter must be attending the contribution. **Each day is a different poster session**.

Each poster has an assigned location on a poster panel placed in the exhibition hall identified by the **program code.** A label on the panel is indicating the poster code.

The poster must be placed at the assigned location **early morning before the starting of the morning coffee break.** Poster Session Managers will be available with the necessary material for display. **The poster shall be removed after 17:30** of the corresponding session day.

Proceedings

The papers will be processed by the editorial team. Authors will be able to check the status of their paper(s) at the screen in front of the **JACoW Proceedings office**. Email notifications of the processing status will also be triggered to primary (submitting) authors as processing is completed. Please follow your email and return promptly.
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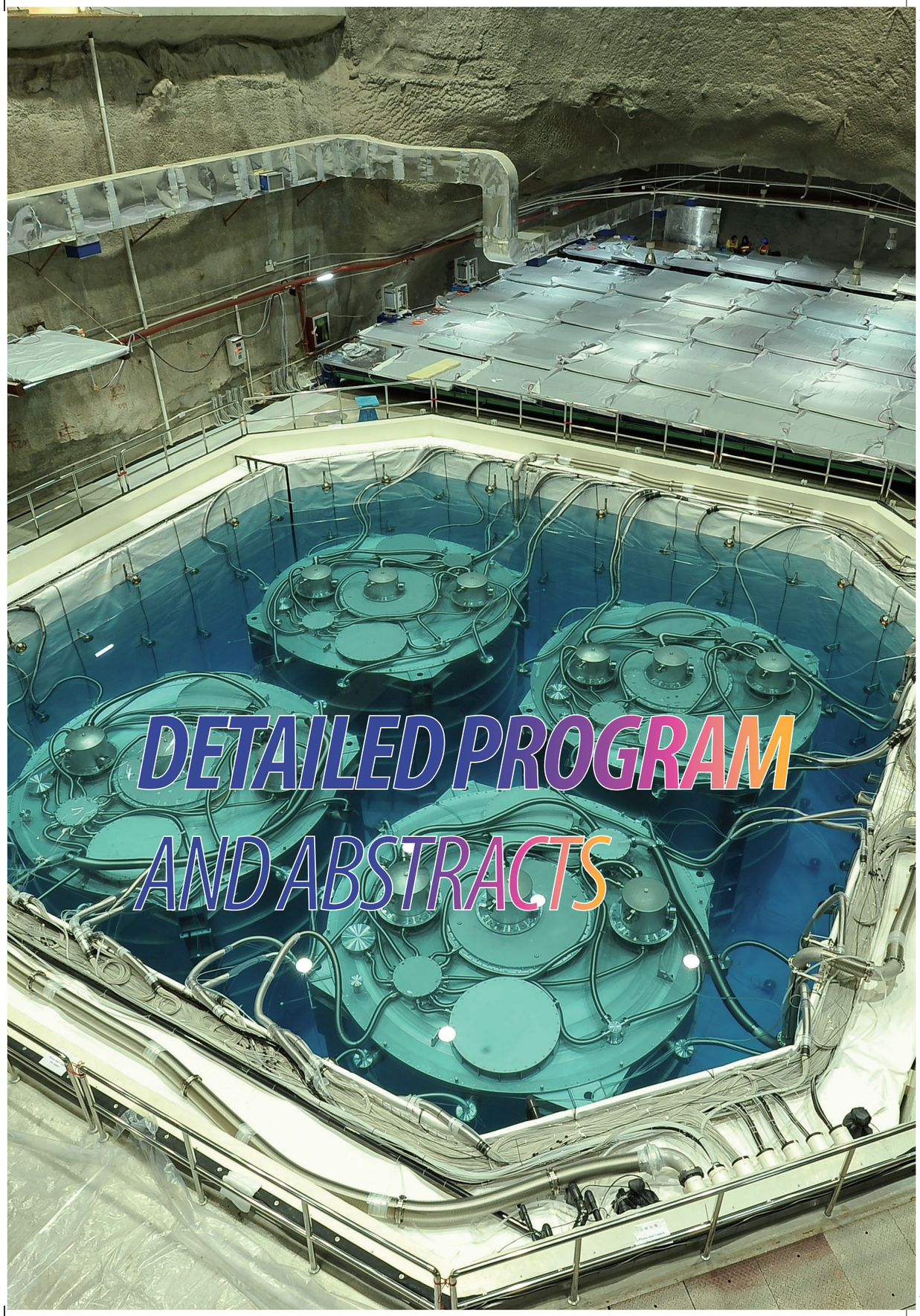

DETAILED PROGRAM AND ABSTRACTS

DETAILED PROGRAM AND ABSTRACTS

Contents

10-Sep-24 09:00 – 10:10 China Hall 2

TUA: Overview and Commissioning

Chair: Junhui Yue (Institute of High Energy Physics)

TUAIO 09:00 **Welcome & Opening Remarks**

Jianshe Cao (Institute of High Energy Physics)

TUAI1 09:10 **Overview of Chinese Accelerator**

Yuhui Li (Chinese Academy of Sciences)

There are different types accelerators have been operating, constructing and planning. This paper provides a review and the present status of the accelerators in China which includes collider, FEL, synchrotron light sources, spallation neutron sources, heavy ion accelerator and so on.

TUAC2 09:50 **Overview of the FCC-ee beam instrumentation R&D**

Stefano Mazzoni (European Organization for Nuclear Research)

The talk shall present an overview of the FCC beam instrumentation needs, the corresponding main challenges. This will review the different R&D activities being currently pursued, including Beam position and loss monitoring, Transverse and longitudinal monitoring systems as well as polarimetry and luminosity monitoring.

10-Sep-24 10:50 – 12:30 China Hall 2

TUB: Overview and Commissioning/Transverse Profile and Emittance Monitors

Chair: Changbum Kim (Pohang Accelerator Laboratory)

TUBI1 10:50 **Commissioning of the beam diagnostic system for NanoTerasu: a new 3 GeV light source in Japan**

Kota Ueshima (National Institutes for Quantum Science and Technology).

NanoTerasu is a 4th generation 3 GeV light source newly constructed in Sendai, Japan. The circumference is 349 m and the natural emittance is 1.1 nm rad, which is realized by a double-double-bend lattice. The commissioning of the storage ring started in June 2023 and the stored current reached 300 mA in November. The beam diagnostic system for NanoTerasu mainly consists of button BPMs to monitor both single-pass and COD beam orbit, a DCCT to monitor the stored current, an X-ray pinhole camera to measure the beam size. To suppress collective instabilities, a transverse bunch-by-bunch feedback (BBF) system is also in use. The BBF system can also measure the betatron tune. In this talk, an overview of the beam commissioning of NanoTerasu, the performance of each beam diagnostic component, and fine-tuning of the electron beam optics will be presented.

TUBI2 11:20 **Beam instrumentation performance during commissioning of LIPAc**

Florian Benedetti (IFMIF/EVEDA Project Team).

In summer 2024, LIPAc will end its commissioning of Phase B+ after several months of operations. The phase has been focused on the increase of the duty cycle in 5 MeV deuteron operation to validate the different components of the accelerator. The various beam instrumentation systems were tested in depth in order to confirm their performances and limits. The present contribution exposes the different results and feedback obtained with the beam instrumentation during the operations. These outcomes are already useful to prepare the next and challenging Phase C and will contribute to the designs of the onward accelerator-based neutron sources. A few remarks on the beam instrumentation performance during commissioning of LIPAc will be presented.

TUBC3 11:50 **Beam diagnostics for CSNS-II linac commission and operation**

Jun Peng (Institute of High Energy Physics).
Renjun Yang, Yanliang Han (Institute of High Energy Physics), Zhiping Li (Dongguan Neutron Science Center).

The China Spallation Neutron Source (CSNS) has launched a power upgrade project this year. The beam power delivering to the target will improve from 100kW to 500kW by five times the beam current while keeping the output energy 1.6GeV unchanged. As the beam current increases, the space charge effect will be enhanced during the RCS injection and initial acceleration process. To suppress this effect, the linac of lattices will be upgraded by adjusting the current lattice and adding a superconducting linac behind the DTL. An extensive suite of diagnostics has been developed for the CSNS-II linac, which we will present in this paper.

TUBC4 12:10 **Beam size measurement with gratings at BEPCII**

Wan Zhang (Institute of High Energy Physics).
Dechong Zhu, Jianshe Cao, Jun He, Junhui Yue, Yanfeng Sui (Institute of High Energy Physics).

The vertical beam size measurement was carried out at BEPCII using a phase grating and an absorption grating based on the Talbot effect. Due to the partial coherence of the source, coherence length can be calculated by measuring the visibility decay of interferograms recorded at different distances behind gratings. The vertical beam size of $68.19 \pm 2\ \mu m$ was obtained based on the relationship between coherence length and source size. A comparison of the vertical emittance derived from grating Talbot method and synchrotron radiation visible light interferometer method was presented to evaluate the method. The vertical emittances from two methods are 1.41 nmrad and 1.40 nmrad respectively. The 0.1% difference indicates the grating Talbot method for beam size measurement is reliable. This technique has great potential in small beam size measurement in the fourth-generation synchrotron radiation light source, considering its small diffraction limitation and simple experimental setups.

10 Sep–Tue

10-Sep-24 13:30 – 14:40 China Hall 2

TUC: Beam Position Monitor

Chair: Carsten Welsch (The University of Liverpool)

TUCI1 13:30 **Bunch-resolved 3D beam position measurement system and its application in FELiChEM**

Xing Yang (Shanghai Institute of Applied Physics).

A new infrared free-electron laser FEL facility named FELiChEM has been built at University of Science and Technology of China in Hefei. It is a user facility dedicated for energy chemistry research and can deliver the infrared laser in the spectral range of 2.5-200 μm to five research stations. FELiChEM consists of mid-infrared MIR and far-infrared FIR free-electron laser oscillators driven by a 60 MeV linac. The time structure of the electron beam can be easily tuned with the macrobunch width of less than 10 μs macrobunch repetition rate of 1--10 Hz and optional microbunch repetition rate within 238, 119, 59.5 and 29.75 MHz. A 3D bunch-by-bunch position measurement system was developed to monitor not just the average position of the macrobunch but also every individual bunch position in the train. With this toolkit, a significant beam loading effect can be easily observed downstream of the linear accelerator structure, and a strong dispersion effect is observable downstream of the optical oscillator. This diagnostic tool proves to be very useful for analyzing the status of the machine and implementing corresponding optimization measures. This paper will give a brief introduce of the machine, the hardware and software structure of the 3D position measurement system, and its application in machine commissioning and operation.

TUCC2 14:00 **Low frequency beam position monitoring at the TRIUMF cyclotron injection line**

Victor Verzilov (TRIUMF).

A new 1mA ion source and a new injection line are presently under construction at TRIUMF for the 500 MeV H- cyclotron. A 300keV ion beam is pulse modulated at the exit of the ion source with a duty cycle varying in the range 1% - 99%. The pulse repetition frequency is around 1kHz and this is the only time varying beam structure available for a substantial fraction of the injection line, till the beam is bunched with an RF-frequency of 23MHz, before being injected to the cyclotron. A set of new diagnostics was developed to support operation of the injection line including the beam position monitoring system operating in the kHz regime. The beam position measurements are based on capacitive pickups and high-impedance electronics to extend the sensitivity towards low frequencies. Details of the system and test measurements will be presented.

TUCC3 14:20 **Photon Beam Position Monitor for PLS-II Beamline**

Donghyun Song (Pohang Accelerator Laboratory).
Changbum Kim (Pohang Accelerator Laboratory).

Photon Beam Position Monitor (PBPM) is an effective monitor for the synchrotron radiation position in a beamline of PLS-II and has been used for the insertion device beamline as well as the bending beamline. In this study, we report the operational status of PBPMs for PLS-II. The PBPM feedback system combined with the orbital feedback system maintains the same position of synchrotron radiation in the beamline. In addition, the scanning results of the blade current show that the orbital distortion can be monitored inside the insertion device. This means that the fine alignment of the electron orbit is possible with this result.

10-Sep-24 15:10 – 16:00 China Hall 2

TUD: Beam Position Monitor

Chair: Junxia Wu (Institute of Modern Physics, CAS)

TUDI1 15:10 **Overview of the BPM system for HIAF & CiADS projects**

Hongming Xie (Institute of Modern Physics, Chinese Academy of Sciences).

Both large-scale facilities, CiADS and HIAF, have a SC linac with current range from tens μA to 20 mA demanding a big dynamic for BPM. The HIAF booster ring accelerates all ion beams from MeV/u to GeV/u, resulted an unprecedented challenge to BPM with induced voltage in range of 40 Uv-40 V. Four types of pickups are designed, with the capacitive pickups inside the quadrupoles, the titanium button BPMs inside the CMs with a compact geometry, a complex structure integrated with BPM, a water-cooled niobium ring and vacuum pumps within 300 mm between the CMs. The SiO2 cables under 2 K are developed by the joint R&D with a domestic company. For the synchrotron, a diagonal-cut BPM is designed with a good position linearity, low beam impedance, good vacuum performance up to 5.0E-12 mbar, as well as good mechanical properties with the electrode coaxiality less than 0.2 mm. To obtain precise and reliable position measurement, the dedicated electronics are developed for the position and phase measurement in linac, and the turn-by-turn trajectory and orbit measurement for synchrotrons. Moreover, the non-linearity calibration due to the approaching effect and fringe field is carried out and a high-order polynomial correction algorithm is implemented on FPGA to get the real-time accurate position for beam offsets. Furthermore, both newly developed BPM electronics have self-testing and self-calibration functions. Presently the BPM system is preparing for the installation.

TUDC2 15:40 **The study of high-frequency pick-ups for electron beam position measurements in the AWAKE common-beamline**

Collette Pakuza (European Organization for Nuclear Research).
Bethany Spear, Philip Burrows, Weida Zhang (John Adams Institute), Eirini Poimenidou, Manfred Wendt, Michal Krupa, Stefano Mazzoni, Thibaut Lefevre (European Organization for Nuclear Research), Eugenio Senes, Shengli Liu (Fermi National Accelerator Laboratory), Victor Verzilov (TRIUMF).

The common beamline of the AWAKE experiment at CERN involves the co-propagation of two particle beams: protons with 48 nC bunch charge and 250 ps bunch length, and electrons with up to 600 pC bunch charge and approximately 4 ps bunch length. The existing operational beam position monitors at AWAKE cannot measure the electron bunches whilst the more-intense proton bunches are present, due to their low operating frequency. In order to try and address this challenge, two high-frequency pick-ups were studied. These included the conical shape button pick-up and the Cherenkov diffraction radiation-based pick-up designed to operate at 30 GHz. Both devices were installed at AWAKE and were connected to two identical read-out systems designed by TRIUMF. This contribution presents and discusses the results obtained from beam-based measurements during the current experimental year.

10-Sep-24 16:00 – 17:30 China Hall 3

TUP: Tuesday Poster Session

TUP02 **Innovative transverse position measurement method based on precise signal phase detection and its experimental validation**

Xing Yang (Shanghai Institute of Applied Physics).

The accurate measurement of the transverse position of a beam is crucial in particle accelerators, as it plays a key role in determining the beam parameters. Existing methods for beam position measurement rely on the detection of image currents induced on electrodes or the narrow-band wake field excited by the beam passing through a cavity-type structure. These methods have some limitations. Indirectly measuring the multiple parameters is computationally complex and requires external calibration to determine the system parameters in advance, and the utilization of the beam signal information is incomplete. In this work, a novel method that measures the absolute electron beam transverse positions proposed. By utilizing the geometric relationship between the center position of the measured electron beam and multiple detection electrodes, as well as analyzing the differences in the arrival times of the beam signals detected by these electrodes, the absolute transverse position of the electron beam crossing the electrode plane can be calculated. This method has features such as absolute position measurement, position sensitivity coefficient independent of the vacuum chamber aperture, and no requirement for symmetrical detector electrode layout. The feasibility of this method is validated through numerical simulation and beam experiments.

TUP04 **Development and performance evaluation of the cavity BPM system for SHINE**

Jian Chen (Shanghai Synchrotron Radiation Facility).
Fangzhou Chen (Shanghai Synchrotron Radiation Facility), Longwei Lai, Shanshan Cao (Shanghai Advanced Research Institute), Renxian Yuan (SSRF).

The Shanghai high repetition rate XFEL and extreme light facility (SHINE) under construction is designed as one of the most advanced FEL facilities in the world, which will produce coherent x-rays with wavelengths from 0.05 to 3 nm and maximum repetition rate of 1MHz. To achieve precise beam trajectory measurement and stable alignment of the electron and photo beams in the undulator, the cavity beam position monitors (CBPM) including beam diameters of 35mm in LINAC and Bunch distribution section and 8mm in undulator have been designed and developed for the SHINE. The requirement of the transverse position resolution is better than 1 μm and 200 nm for a single bunch of 100 pC, respectively. In this paper, we present the design of the cavity BPM system and the processing of the key equipment. The beam test bench has been established at the Shanghai Soft X-ray FEL facility (SXFEL), and preliminary beam experiments indicate that, with the bunch charge about 100pC, the position resolution of CBPM-35mm and CBPM-8mm is better than 330 nm and 70 nm, respectively.

TUP05 **Development of multi-channel time-division multiplexing RF signal conditioning front-end for CAFe2 Beam Position Monitor system**

Pengfei Deng (Institute of Modern Physics, Chinese Academy of Sciences).
Feng Qiu, Guirong Huang, Jin Ma, Yuan He, Zhen Ma, Zheng Gao, Zhenglong Zhu (Institute of Modern Physics, Chinese Academy of Sciences).

The construction of China Accelerator Facility for Superheavy Elements (CAFe2) is advancing based on Chinese ADS Front-end Demo Linac (CAFe). However, the original Beam Position Monitor (BPM) read-out electronics of CAFe could not meet the requirements of the CAFe2 BPM probes in terms of quantity and the measurement demands of low-intensity heavy ion beams. In response to this challenge, a high-speed RF switch array supporting multi-channel multiplexing, adjustable gain and filtering was developed. This array served as the RF signal conditioning front-end, together with the RF front-end and digital signal processing platform, to constitute a complete BPM read-out electronics. Laboratory testing validated the feasibility of the high-speed RF switch array and the entire read-out electronics. Compared with traditional read-out electronics, the read-out electronics equipped with the high-speed RF switch array enables the measurement of 32 signals from 8 BPM probes. This approach significantly improves the system's integration and reusability,

while offers an efficient solution for implementing multi-channel time-division multiplexing measurement under different beam intensities and operating frequencies. Additionally, by simultaneously accessing signals from multiple BPM probes, this system better supports differential measurement. Overall, the high-speed RF switch array not only meets the requirements of CAFe2 but is also applicable for other accelerators with multiple BPM probes.

TUP06 **New Bunch-by-Bunch acquisition system on the ESRF Storage Ring and the Booster**

Kees Scheidt (European Synchrotron Radiation Facility).

Four units of a new Bunch-by-Bunch RF acquisition system are installed on BPM buttons & strip-lines of both the ESRF Storage Ring and the Booster. Each system has 4 independent channels and specific internal data processing that offers a high resolution measurement of both the beam position and charge, and this of each individual electron bunch. The applied systems will be described in their functionality and obtained results will be shown.

TUP07 **Stripline design for tune measurement in the ILSF Storage Ring**

Samira Mohammadi Alamouti (Iranian Light Source Facility).
Amir Danaeifard, Nafiseh Khosravi, Zahra Rezaei (Iranian Light Source Facility).

The Iranian Light Source Facility Storage Ring is under design with a 528 m circumference and will store the electron bunches with 3 GeV energy to produce high-flux radiation that ranges from infrared to hard X-rays. Two Striplines are planned to be installed in the ILSF storage ring for beam tune measurement. The first one will be used for exciting the beam and the other for horizontal and vertical beam position measurements. In this paper, the design of the striplines for the ILSF storage ring is investigated. Each stripline is matched with 50Ω and has 4 strips (electrodes) that are placed at 45 degrees to the beam axis, the best geometry is achieved and optimized by CST Microwave Studio simulation.

TUP08 **Design of button beam position monitor for the ILSF booster**

Samira Mohammadi Alamouti (Iranian Light Source Facility).
Nafiseh Khosravi, Zahra Rezaei (Iranian Light Source Facility).

The Iranian Light Source Facility Booster is under design with a 504 m circumference and will accelerate the electron bunches from 150 MeV to 3 GeV. the 50 button-type beam position monitors (BPMs) are considered the non-destructive tools to measure the beam position in the ILSF booster. In this paper, the design of the BPM for the ILSF booster is studied. The BPM blocks have 4 buttons (electrodes) that are placed at 45 degrees to the beam axis. to choose the best geometry, The BPMs with different button diameters and gaps are simulated by the CST Microwave Studio and BpmLab.

TUP09 **Prototype of BPM electronics for FEL-HMF**

Wei Peng (Anhui University). *Shichuan Ding.*

This paper presents a prototype of BPM electronics for experimental installation of free electron laser and high magnetic field (FEL-HMF). FEL-HMF integrates mid-long Infrared free electron laser, high magnetic field and cryogenic, which is a critical apparatus for new advanced materials especially for low-power electronic materials. The BPM electronics consists of two ADC chips and one FPGA SoC. The ADC has two channels, and sampling rate is 240Msps. The FPGA SoC implements high speed digital signal and data process. The logic part of FPGA SoC is running signal process. The processor part of FPGA SoC runs Linux operating system and EPICS-based user application program. This BPM electrons has been tested and analyzed in lab. Its X and Y position is ~1.4um (RMS).

TUP10 **A high-precision low-latency DBPM processor for HALF**

Jiajun Qin (University of Science and Technology of China).
Kexi Hou, Lei Zhao, Yi Tang (University of Science and Technology of China).

Hefei Advanced Light Facility (HALF) is a fourth-generation vacuum ultraviolet and X-ray diffraction limit synchrotron radiation (DLSR) light source under construction. It is expected to have an ultra-low emittance and an extremely small beam size, which requires high-precision orbit detection and fast feedback control. The processor is the key component of the digital beam position monitor (DBPM) and control system, which is required to provide a submicrometer resolution in beam position measurement with a processing latency of lower than 90 μs. This paper presents the design and testing of a high-precision low-latency

DBPM processor. In order to reduce the latency and ensure the high position resolution, a specific higher sampling frequency is chosen to reduce the quantization noise platform of the analog to digital convertor and an optimized low-order filter is adopted. Specialized efforts are devoted to the low jitter sampling clock generation and low noise analog circuit design. Furthermore, a dual-pilot tone structure was employed to compensate the gain variations across the four channels of the beam monitor sensor. The laboratory test results show that the DBPM has a position resolution of better than 400 nm for turn-by-turn acquisition, better than 90 nm for fast acquisition at 20 kHz rate, and better than 20 nm for slow acquisition at 10 Hz rate, with a total latency of less than 80 μs.

TUP11 **Beam position monitors for HEPS**

Jun He (Institute of High Energy Physics).

At the High Energy Photon Source (HEPS), a high orbital stability of typically 10 % of the beam size and angular divergence must be achieved, which implies that the beam orbit must be stabilized to the sub-micrometer level. A button and stripline beam position monitor (BPM) were designed based on the analytical formulas and CST simulations results. The results of electromagnetic field simulations revealed how various mechanical errors, such as button size and location accuracy, as well as the related button capacitance, exert different influences on the beam position measurement. The performance of an actual BPM pickup was measured, along with an assessment of the error on the beam position measurement. Additionally, a wakefield analysis, including an investigation of trapped resonant modes and related thermal deformation, was conducted. The characteristic impedances of the stripline were designed to be 50 Ω and confirmed by measurements. The position sensitivity, position resolution, capacitance and the electro-mechanical offsets were measured using the Lambertson method, and the calibration coefficients were measured using a stretched wire. Various problems that arise during the processing and installation process will also be introduced.

TUP12 **Optimization of the kicker/BPM design with tapered striplines**

Shalva Bilanishvili (Istituto Nazionale di Fisica Nucleare).
Mikhail Zobov (Istituto Nazionale di Fisica Nucleare).

The injection kicker design exploiting strip-lines and linear taper connections of the strip-lines to the feedthroughs was proposed and has been successfully used in the DAFNE electron-positron collider. Such a design has helped to reduce the device beam coupling impedance, to improve the uniformity of the deflecting electromagnetic fields and to provide better matching with the feedthroughs. In this paper we propose using nonlinear taper connections in order to decrease further the beam coupling impedance. We have performed numerical simulations and analytical studies of several nonlinear tapers demonstrating that the coupling impedance can be substantially reduced while keeping or even improving the transfer (signal) impedance of the strip-line kickers (or BPM). The effect of the nonlinear tapering is particularly important for short strip-line devices when the taper length is limited due to lack of available space and/or when the strip-lines are moved closer to the beam in order to increase the device shunt (signal) impedance.

TUP13 **The design of Beam Position Monitor of Wu Han Photon Source**

Haoyu Dong (Huazhong University of Science and Technology).
Geng Wei, HaoHu Li (Wuhan University), Zhengqiu Luo, Zhengzheng Liu (Huazhong University of Science and Technology).

As a 4th generation synchrotron radiation source, Wuhan Photon Source has stringent requiments on BPM resolution and longitudinal coupling impedance. An optimized button BPM design for its 1.5 GeV diffraction-limit storage ring is presented. Systematic effects caused by material and structure variations in BPM on longitudinal coupling impedance are also studied, which will benefit the future design of similar type BPMs.

TUP14 **High-sensitivity RF direct sampling processor redefines the beam diagnostic system**

Longwei Lai (Shanghai Advanced Research Institute).
Yimei Zhou (Shanghai Advanced Research Institute).

RF direct sampling and processing of beam signals has always been the goal pursued in beam diagnostic systems. Now it's time to make it happen. For the first time, a high-sensitivity RF direct sampling processor has been developed for C-band cavity pickups in

SHINE/SXFEL. It redefines the beam diagnostic system. There is no longer a need for complex analog down-conversion modules in traditional cavity BPM/BAM systems. In addition, the processor can simultaneously meet the signal processing needs of different cavities with a center frequency below 6 GHz. Obviously, the RF direct sampling processor greatly reduces the complexity and costs of the system, shows great versatility. Meanwhile, compared to the down-conversion electronics, this processor demonstrates much higher sensitivity (twice) due to a significant reduction in analog components. The processor also has a huge advantage in other beam diagnostics because of its wide bandwidth and high sampling rate, such as bunch-by-bunch measurement and feedback system on synchrotron radiation facility. Now it's time to massively apply the RF direct sampling processor to promote the development of beam diagnostic technology.

TUP15 **Neural network technique for improving accuracy, reliability and robustness of beam position monitor system**

Fangqi Huang (Institute of High Energy Physics).
Jun He, Taoguang Xu, Yanfeng Sui (Institute of High Energy Physics).

The beam position monitor (BPM) is a crucial instrumentation system for the commissioning and operation of the accelerator. The accuracy and robustness of the beam position monitor system are essential for ensuring the stability of the accelerator. Currently, the four voltage signals obtained by the BPM electrodes are used to calculate the beam position by fitting of a polynomial in BEPC-II and HEPS. The system also provides a formula that expresses the relationship between the three voltage signals and the beam current position to improve the system's robustness. The existing polynomial fitting formula using four voltage signals has an optimal accuracy of only 10 μm, but the accuracy of the three voltage signals calculation is not high. To address this issue, we propose using neural networks for beam position calculation. This approach will not only guarantee the accuracy of the beam position measurement, but also improve the system's robustness, even in the case of one or two electrodes being wrong. In our experiments, the trained neural network has shown promising results, with an accuracy of less than 5 μm when using four voltage signals, less than 10 μm when using three voltage signals, and less than 15 μm when using two voltage signals. Therefore, our method can significantly improve the accuracy and the robustness of the system.

TUP16 **Development status of the BPM system for the SPring-8-II storage ring**

Hirokazu Maesaka (RIKEN SPring-8 Center).
Hideki Dewa, Mitsuhiro Masaki, Shiro Takano, Takahiro Fujita (Japan Synchrotron Radiation Research Institute), Shinji Suzuki (Japan Synchrotron Radiation Research Institute (JASRI)).

We are developing a BPM system for the 6 GeV fourth-generation light source, SPring-8-II, which is a renewal of the third-generation light source, SPring-8. The new storage ring will be equipped with 340 button-type BPMs. BPM heads with molybdenum button electrodes have been designed to achieve the position sensitivity coefficients required for SPring-8-II as well as minimal beam impedance and heat dissipation. The BPM heads for the vacuum chambers of the prototype cell are currently being fabricated to validate the mechanical design. As for radiation-resistant signal cables, PEEK-insulated semi-rigid cables will be used for connection to the BPM head, and polyethylene-insulated corrugated cables relay from the girder side to the readout electronics. High-precision and stable readout electronics consist of RF front-end boards and high-speed digitizer boards based on the MTCA.4 standard. The initial batch of electronics has already been installed to replace the obsolete single-pass BPM system of the current SPring-8, and the performance evaluation is in progress. In this presentation, we will report the overview and the development status of the SPring-8-II BPM system.

TUP17 **Pulse Injection source for use with Cavity Beam Position Monitors**

Mark McCallum (John Adams Institute).
Alexander Aryshev, Nobuhiro Terunuma (High Energy Accelerator Research Organization), Alexey Lyapin (John Adams Institute), Konstantin Popov (High Energy Accelerator Research Organization (KEK)), Max Bosman (Royal Holloway, University of London).

The Cavity Beam Position Monitor (CBPM) system at Accelerator Test Facility 2 (ATF2, KEK, Japan) operates with attenuation at a reduced 200 nm (vs measured 20-30 nm) resolution to cope with CBPM to magnet misalignment. In addition, CBPMs need regular calibrations

to maintain their performance. To address these limitations, a pulse injection system is under development. This system aims to compensate for static offsets by injecting an anti-phase replica of the average beam signal directly into the sensor cavities. The same signal can provide a calibration tone for the whole processing chain and eliminate lengthy beam-based calibrations. Proof of principle tests for such a system have been conducted in December 2023. In this paper, we report on the results of the first beam test, discuss the technical challenges and provide a preliminary hardware specification for future experiments.

TUP18 **Stripline BPM for CSNS-II injection upgrade**

Biao Zhang (Institute of High Energy Physics).
Muhammad Abdul Rehman, Renjun Yang (Institute of High Energy Physics).

The CSNS accelerator complex is upgrading the injection area to improve the beam-loss control during beam injection and acceleration in the Rapid Cycling Synchrotron. At CSNS, the linac beam energy will be increased from 80MeV to 300MeV employing a new superconducting accelerating section, and the beam power at the spallation target will be 500kW. To accomplish these requirements, a stripline-type BPM has been designed with a large aperture and 50 Ω stripline electrodes. This BPM has an inner diameter of 52 mm and is used to detect the beam with a current of 10-30 mA and a pulse width of 100-500us. Several geometrical and electrical parameters have been optimized with numerical simulation. This paper will describe the design and optimization of the stripline-type BPM in detail, and some simulation results are also shown and discussed.

TUP19 **High-quality feedthrough developments for beam detectors**

Sun An (Nanjing Institute of Proton Source Technology).

Feedthroughs have been used for different accelerator detectors, such as BPM, BAM, CBPM, ACCT, and the RF cavities etc. that are used to test the beam properties and RF cavity signals. For this purpose, large bandwidth with low transfer loss is required. The long-life and high-stability are also needed. The SMA-type and N-type feedthroughs are developed. The bandwidth of the SMA-type is up to 20 GHz, and that of the N-type up to 13 GHz with low transfer loss. Those feedthroughs have used in the strip-BPM, button-BPM, and CBPM etc.

TUP20 **Developing a new beam position monitor electronics for HIPA, The PSI High Intensity Proton Accelerator**

Boris Keil (Paul Scherrer Institut).
Pascal Huber (Paul Scherrer Institute).

The High Intensity Proton Accelerator (HIPA) at PSI presently has an RF beam position monitor (BPM) system based on 20-year-old Xilinx Virtex-2 Pro Systems-on-Chip (SoC), using application-specific integrated circuits (ASICS) for direct digital downconverters. For the planned upgrade of the electronics as well as for new HIPA projects, we started the development of a new HIPA BPM electronics, using a generic electronics platform called "DBPM3" that is already being used for SwissFEL and SLS 2.0 electron BPM systems. In this contribution, first test results of a DBPM3-based HIPA BPM electronics prototype are presented, including a comparison with the present electronics.

TUP21 **Electron bunch position determination using a high frequency button beam position monitor in the AWAKE facility**

Bethany Spear (John Adams Institute).
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The AWAKE facility uses novel proton beam-driven plasma wakefields to accelerate electron bunches over 10m of Rubidium plasma. Precise monitoring of 2 diverse beam types necessitates an electron beam position monitor (BPM) working in a frequency regime of tens of GHz. A high frequency conical button-style BPM with a working regime of up to 40 GHz has been investigated as a way to discriminate the electromagnetic fields of 19 MeV, 4 ps electron bunches propagating spatially and temporally together with a 400 GeV, 170 ps proton bunch in the AWAKE common beamline. The sensitivity of the HF BPM to the electron beam position is determined under various beam conditions, with both electrons and protons, and integration with a TRIUMF front-end is discussed.

TUP22 **On-line beam synchronous phase measurement using deep learning models**

Lijuan Yang (Institute of Modern Physics, Chinese Academy of Sciences).
Chengye Xu, Feng Qiu, Yuan He (Institute of Modern Physics, Chinese Academy of Sciences), Muyuan Wang, Rihua Zeng (European Spallation Source ERIC).

The on-line calibration of beam synchronous phase (SP) is crucial for enhancing the operational efficiency of accelerators. Recently, we developed an artificial intelligence (AI)-based beam information measure model that uses transient beam loading information as input while simultaneously predicting beam current and SP. This method employs Long Short-Term Memory (LSTM) to extract multi-dimensional radio frequency (RF) time-series features and incorporates an attention mechanism to evaluate the weights of RF waveforms at different times. The method can work in complex operating conditions such as open-loop, closed-loop, and with or without cavity detuning, and has higher precision and stronger generalization capabilities compared to other online calibration method of SP (such as those based on cavity differential equations or RF beam vector). We validated the consistency of the algorithm results with BPM and BCM measurements on the Buncher of European Spallation Source. Our method achieves an mean absolute error of 0.28° for predicting SP and 0.47 mA for predicting beam current, showing very promising results.

TUP23 **Development of an automatic calibration system for BPM**

Li Li (Institute of Modern Physics, Chinese Academy of Sciences).
Hongming Xie, Jia Yin, Peilin He, Ruixia Tian, Yong Zhang, Ze Du (Institute of Modern Physics, Chinese Academy of Sciences).

Beam position monitor(BPM) is used to measure the horizontal and vertical positions of the beam in the vacuum pip. Before online installation, it usually needs to be calibration. High Intensity Heavy-ion Accelerator Facility(HIAF) and China initiative Accelerator Driven System (CiADS) will need a large number of BPM, so it is a great challenge for BPM calibration work. In order to complete this work efficiently and accurately, this research designs and develops an automatic BPM calibration system. The hardware of this BPM calibration system consists of 4 major sections, they are calibration platform equipment, precise motion control device, signal processing electronics and industrial computer. The control software was programmed by C to realize automatic calibration functions based on EPICS. A high-order fitting algorithm programmed by python used to solve the problem of smaller linear range of the capacitive BPM. It significantly improves the accuracy of position measurement after calibration.

TUP24 **Development of digital beam position monitor for HEPS**

Yaoyao Du (Institute of High Energy Physics).
Jianshe Cao, Jun He, Junhui Yue, Qiang Ye, Yanfeng Sui (Institute of High Energy Physics), Shu-Jun Wei (Chinese Academy of Sciences).

High Energy Photon Source (HEPS) is a proposed new generation light source with a beam energy of 6 GeV, high brightness, and ultra-low beam emittance. An RF BPM has been designed at IHEP as part of an R&D program to meet the requirements of both the injection system and storage ring. The RF BPM architecture consists of an Analog Front-End (AFE) board and a Digital Front-End board (DFE) based on a custom platform. In this paper, we present the overall architecture of the RF BPM electronics system and the performance evaluation of the BPM processor, including beam current, filling pattern, and position measurement resolution as a function of the beam current.

TUP25 **Development of stripline-type beam position monitor system for CSNS-II**

Muhammad Abdul Rehman (Institute of High Energy Physics).
Biao Zhang, Fang Li, Renjun Yang, Weiling Huang, Zhihong Xu (Institute of High Energy Physics).

As part of the CSNS-II upgrade, the H- LINAC beam energy will be increased from 80 MeV to 300 MeV using superconducting cavities. To accurately measure beam position, phase, and energy, stripline-type Beam Position Monitors (BPM) are essential. The shorted-type stripline BPM was chosen for this upgrade due to its excellent S/N ratio and rigid structure. As space is limited in the LINAC's SC section, the BPMs must be embedded in the quadrupole magnet. Two prototypes, with inner diameters of 50 mm and 96 mm, were designed using numerical simulation codes and manufactured for beam testing. This paper will detail the

simulation, design, and beam test results of the prototype BPMs for CSNS-II.

TUP26 **Design and experiment of BPM electronics for the CSNS RTBT line**

Ruiyang Qiu (Institute of High Energy Physics).
Fang Li, Lei Zeng, Renjun Yang, Tao Yang, Weiling Huang, Weiwen Chen, Zhihong Xu (Institute of High Energy Physics).

The primary objective of the first phase of the China Spallation Neutron Source (CSNS) project is to accelerate negative hydrogen ions to 80 MeV using a linear accelerator. Subsequently, these negative hydrogen ions are stripped to become protons, which are then injected into a rapid cycling proton synchrotron. The proton beam is accelerated to an energy of 1.6 GeV and directed through a beam transport line to a tungsten target, where spallation reactions occur to produce neutrons. The Ring to Target Beam Transport (RTBT) line handles two 90 ns beam pulses extracted from the ring. This article mainly focuses on the validation design of the beam position measurement electronics in the RTBT section. It considers the impact of increased power on the signal after the second phase upgrade of the spallation source, involving front-end analog design, FPGA-based position algorithms, and related testing.

TUP27 **The development of new BPM signal processor at SSRF**

Mingjie Zhang.
Longwei Lai, Yimei Zhou (Shanghai Advanced Research Institute), Yingbing Yan ((Shanghai Advanced Research Institute)).

A BPM signal processor has been developed for SSRF since 2009. It composed of Virtex5 FPGA, ARM board, and 4 125MSPS sampling rate ADCs. Since then, electronic technology has made significant progress. Such as Zynq UltraScale+ MPSoC FPGA contains both hard-core ARM and high-performance FPGA, and ADCs with a sampling rate of 1GSPS have been applied in mass production. A new BPM processor with Zynq UltraScale+ MPSoC FPGA and 1GSPS ADCs is under development at SSRF. Due to the application of new technologies, the processor performance will be significantly improved. The new processor can also meet the needs of ultra-low emittance measurement for the new generation of light sources. This paper will introduce the design of the processor and the relative tests.

TUP28 **Design of beam position monitoring interlocking protection system**

Ruixia Tian (Institute of Modern Physics, Chinese Academy of Sciences).
Fafu Ni, Hong Xie, Jianjun Su, Junxia Wu, Kewei Gu, Li Li, Yong Zhang, Yuan Wei, ZhiXue Li (Institute of Modern Physics, Chinese Academy of Sciences).

The machine protection system guarantees the safe operation of the HIAF (High Intensity heavy-ion Accelerator Facility) in different operating modes and also prevents damage to the online equipment in the event of a failure. Beam current data such as beam current position and phase is an important basis for analyzing and diagnosing accelerator faults. In this paper, the authors designed the beam position and phase interlock monitoring system. The system is based on circular buffer and AXI4 protocol to realize the interaction of interlock data and locking of interlock status. At the same time, the system uses memory mapping to save the interlock beam data. Laboratory tests show that the system could save the beam position, beam phase, SUM signals and amplitude of sensed signal per probe path during interlocking before and after 8ms and latch the interlock status of 25 channels. The system was deployed at the CAFe-LINAC gas pedal in March 2024 to complete online measurements.

TUP29 **Measurement and calibration of a striping BPM for the HALF injector**

Dongyu Wang (University of Science and Technology of China).

The striping beam position monitor (BPM) for the Hefei Advanced Light Facility (HALF) injector was subjected to measurement and calibration. The process included S-parameter measurements to evaluate signal isolation and the stretched wire method for BPM mapping, yielding measurement sensitivity and mapping data for the BPM. These measurements reduced the intrinsic nonlinearity of the BPM, corrected installation errors of its components, and provided reference data for online error elimination. The results demonstrate that the striping-type BPM meets the beam position measurement requirements of the HALF injector.

TUP30 **Development of high-precision beam position monitor for the Korean 4GSR project**

10 Sep–Tue

Si-Won Jang (Pohang Accelerator Laboratory).
Bokkyun Shin, DongCheol Shin, Dotae kim, Seohyeon An (Pohang Accelerator Laboratory).

The Korean 4GSR project is currently under construction in Ochang, South Korea, with the aim of achieving first beam commissioning in 2027. Designed to achieve an emittance approximately 100 times smaller than that of third-generation synchrotron radiation storage rings, the project requires the development of several high-precision beam diagnostic devices. In particular, the beam position monitor (BPM) is aimed at reducing longitudinal wake impedance to suppress heating and beam instability. For this purpose, two types of 4GSR BPM pick-up antennas have been developed. The first utilizes a SiO2 glass insulator, while the second is designed in a cone shape using Al2O3. The differences and advantages of the two designs are explained, and the performance obtained through actual beam tests will be described. This presentation will provide an overview of the current development status of the beam position monitor developed for the 4GSR project, including details on the approximate configuration of the 4GSR BPM system.

TUP31 **First experiences with the new Pilot-Tone-based eBPM system in Elettra Storage Ring**

Gabriele Brajnik (Elettra-Sincrotrone Trieste S.C.p.A.).
Giulio Gaio, Raffaele De Monte, Silvano Bassanese (Elettra-Sincrotrone Trieste S.C.p.A.).

This paper presents the first experiences acquired with the new eBPM system based on pilot tone compensation, developed for Elettra 2.0. After the successful delivery of seven complete systems, belonging to a pre-series production within the signed partnership with Instrumentation Technologies, we started their integration in the current machine, in order to gain experience and develop all the functionalities required for the future commissioning of the new accelerator, scheduled for 2026. To do so, an entire section of Elettra storage ring has been equipped with the new systems: eight Libera Electron units have been replaced by eight Pilot Tone Front End (PTFE) and four digital platforms (DAQ10SX). Tests were carried out during dedicated machine shifts, focusing on integration with the new global orbit feedback at different data rates (10 kHz, 100 kHz and turn-by-turn), with and without pilot tone compensation. Nevertheless, triggered acquisitions were made in order to test first turn capability of the system. Another unit has been attached to a pair of spare pick-ups (low-gap BPMs), in order to continue the development of new features and to provide different types of data (raw ADC data, turn-by-turn calculated positions, etc.) for machine physics studies, even during user-dedicated shifts.

TUP33 **Cherenkov Diffraction Radiation Beam Position studies at Diamond Light Source**

Alec Clapp (Royal Holloway, University of London).
Lorraine Bobb (Diamond Light Source Ltd), Pavel Karataev (John Adams Institute).

This paper will show beam position studies performed using a Cherenkov Diffraction Radiation (ChDR) based Beam Position Monitor (BPM) at Diamond Light Source (DLS). Displaying the characterization of the BPM using the 3 GeV electron beam at DLS and comparing the effectiveness of this prototype to an existing Inductive Beam Position Monitor (IBPM) in use in the DLS Booster To Storage (BTS) transfer line. The functionality of the BPM is explored, utilizing both wideband and narrowband ChDR emission with the application of filters to the ChDR detection system.

TUP34 **Intermediate stage amplifier electronics for HIAF ring beam diagnostic system**

Shangshang LU (Institute of Modern physics, Chinese Academy of Science).
Fafu Ni, Junxia Wu, Yuan Wei, ZhiXue Li (Institute of Modern Physics, Chinese Academy of Sciences).

This article introduces the intermediate stage amplifier electronics for the HIAF Ring beam diagnostic system, it has intermediate stage amplifier, high-impedance preamplifier gain switching control, self-check, fiber communication, and enthernet communication functions. The intermediate stage amplifier has 4 channels, each channel has three gain states: 20dB, 0dB, -20dB, combining with preamplifier which has 2 gain states (30dB and 0 dB), 6 gain states can be got to make the signal magnitude input to BPM electronics falls in optimal range for ADC sampling as possible. According to simulation result, the maximum voltage of BPM induction signal could exceed 40V with 50Ω impedance, so a low reflection low-pass filter is placed before amplifier to avoid the devices damage and signal reflection, the filter bandwidth is 10MHz and it can attenuate the peak voltage by half at shortest beam signal while S11＜-25dB. Electronics integrates two 8-pole LEMO connectors as control outputs to control the preamplifier gain state. The self-check signal is generated by an active

crystal oscillator, and injected into 4 channels by 4 drivers. Optoelectronic converter, electro-optic converter and ethernet module are integrated to achieve remote communication. All control logic and communication is realized by an Actel FPGA chip.

TUP35 **Current status of the manufacturing and testing of the BPM electronics for ELETTRA 2.0**

Uroš Dragonja (Instrumentation Technologies).
Andrej Gabrščček, Manuel Cargnelutti (Instrumentation Technologies), Gabriele Brajnik, Raffaele De Monte (Elettra-Sincrotrone Trieste S.C.p.A.).

In this paper we are presenting the status of the partnership between Instrumentation Technologies and Elettra Sincrotrone Trieste for the realization of 200 BPM electronics for ELETTRA 2.0. Last year, 200 Pilot Tone Front-End (PTFE) units were successfully developed and produced. During the present year, 100 Digital Acquisition platforms, each one used to digitize and process the signals from two BPM pickups, are in production after the successful pre-series tests. Elettra Sincrotrone Trieste was more involved in concept design, prototype development, and firmware programming, while Instrumentation Technologies was focused on design for manufacturing, implemented rigorous testing procedures, and handled the production. During the project, it was also necessary to overcome a period of material shortages, particularly for the chips used in the digital part. Testing during the pre-series and series production phases ensured that each unit met the desired performance criteria necessary for stabilizing long-term measurement drifts in BPM systems. Additional units were produced to account for potential failures and performance variations, ensuring that all units delivered performed to specification.

TUP37 **Eletronic test bench for the validation of BPM and Time of Flight acquisition systems**

Sidi Mohammed Ben Abdillah (Université Paris-Saclay, CNRS/IN2P3, IJCLab).

MYRRHA (Multi-Purpose Hybrid Research Reactor for High-Tech Applications) aims to demonstrate the feasibility of high-level nuclear waste transmutation at industrial scale. MYRRHA Facility aims to accelerate 4 mA proton beam up to 600 MeV. Beam Position monitors are key elements in many accelerators. for instance, once BPMs are installed along a linear accelerator or a storage ring, they remain inaccessible for any validation of updated or rejuvenated electronics. this paper addresses this issue with the realization of an electronic test bench simulating the outputs signals of BPM electrodes for a given beam energy, phase and position. the bench is realized for MYRRHA BPMs and it offers simulated beams with a position precision down to 50µm and phase precision down to 0.5° on a wide range.

TUP38 **Beam position monitor for MYRRHA high energy beam transport line**

Sidi Mohammed Ben Abdillah (Université Paris-Saclay, CNRS/IN2P3, IJCLab).

MYRRHA (Multi-Purpose Hybrid Research Reactor for High-Tech Applications) aims to demonstrate the feasibility of high-level nuclear waste transmutation at industrial scale. MYRRHA Facility aims to accelerate 4 mA proton beam up to 600 MeV. The accurate tuning of LINAC is essential for the operation of MYRRHA and requires measurement of the beam transverse position and shape, the phase of the beam with respect to the radiofrequency voltage with the help of Beam Position Monitor (BPM) system. MYRRHA is divided in two phases, the first phase, called MINERVA, includes several sections allowing beam acceleration up to 100 MeV. the second phase includes a High Energy Beam Transport (HEBT) line up to 600MeV. A BPM prototype was realized for the HEBT line. This paper addresses the design, realization, and calibration of this BPMs and its associated electronics. The characterization of the beam shape is performed by means of a test bench allowing a position mapping with a resolution of 0.02 mm.

TUP39 **Measurements and performance analysis of Cavity Beam Position Monitors for EUPRAXIA @SPARC_LAB**

Giovanni Franzini (Istituto Nazionale di Fisica Nucleare).
Alessandro Cianchi (Università di Roma II Tor Vergata), Angelo Stella, ***Danilo Quartullo****, Giampiero Di Pirro, Mario Del Franco, Massimo Ferrario, Riccardo Pompili (Istituto Nazionale di Fisica Nucleare), Fabio Marcellini (Paul Scherrer Institut).*

EuPRAXIA@SPARC_LAB is a new accelerator complex to be built at INFN-LNF. It will be a Free Electron Laser, based on an X-band LINAC and a plasma wakefield acceleration stage, in order to reach a total energy of 1 GeV. Along with other types of beam diagnostics, Cavity

Beam Position Monitors (cBPM) are foreseen to be installed before and after the plasma acceleration module and between the undulator sections, where the required precision for beam position measurements is 1 µm. In order to find the best solution for the cBPM design and its related readout electronics, we performed beam measurements by using a specifically designed test bench installed at SPARC_LAB LINAC, where three cBPMs were mounted. As a first measurement campaign, we used the “PSI BPM16” model and the readout electronics “LIBERA CavityBPM” by Instrumentation Technologies, which were already available to us. We present here the results of the tests conducted, mainly focused on evaluating the precision of the beam position measurements obtained with these devices and the related electronics.

TUP40 **Optimization design of a helix-based test bench for low-β BPM**

Minwen Wang (Tsinghua University in Beijing).
Di Wang, Xin Zhuo, Zhongming Wang (Northwest Institute of Nuclear Technology).

Beam Position Monitors (BPMs) are crucial in particle accelerators for accurately measuring beam trajectories. Given the inaccuracies in their manufacturing and assembly, stringent offline calibration procedures are imperative to ensure the accuracy of beam position measurements. The prevalent calibration method, notably the wire test method, is designed for relativistic beams and is unsuitable for low-β beams. This paper presents a novel approach using a helical slow-wave structure to simulate the electromagnetic fields of low-energy beams, thereby enabling the calibration of BPMs for low-β applications. Utilizing a helix-based calibration platform, we calibrated the nonlinear response of BPMs at the Xi’an Proton Application Facility to a 7 MeV proton beam, thereby expanding the BPM's measurement range from about 20% to 50% of its aperture through polynomial fitting. This enhancement broadens the precision and scope of beam position measurements, significantly benefiting the operation and optimization of particle accelerators.

TUP41 **Test of BPM cables vs and temperature humidity**

Chongyang Liang (Chinese Academy of Sciences).

Measuring the absolute position of the beam in the intensifier and storage ring of a high energy photon source (HEPS) requires measuring the offset between the electrical and mechanical centers of the beam position monitor (BPM). In the HEPS project, a four-electrode BPM is used, and the signals from each of the four electrodes of the BPM probe are led out by a cable. During the operation of the intensifier and storage ring, the influence of ambient temperature and humidity on the BPM cable and the difference between the four channels will directly lead to changes in the BPM measurement results. In this paper, vector network analyzer (VNA) is used to test the data of signal amplitude change of four BPM cables within ten hours when temperature and humidity change. The conclusion is that the influence of temperature on the signal is about 0.01 dB/℃, the influence of humidity on the signal is about 0.05 dB/10%, and the relative change between channels is about 5%.

TUP42 **Results of HESR BPM testing**

Christian Boehme (Forschungszentrum Jülich GmbH).
Arthur Halama, Guenther Koch, Vsevolod Kamerdzhiev (GSI Helmholtzzentrum für Schwerionenforschung GmbH).

For the HESR diagonally cut BPMs were designed, with 64 manufactured and tested with a purpose-built BPM test-stand. This test-stand had to host BPMs of various lengths, the overall length of the complete vacuum system varies from 450 mm to 1585 mm. For all BPMs several properties, e.g. the geometric factors or the electrical center in relation to the geometric center, were measured utilizing the test stand. The results of these measurements will be presented together with the challenges resulting from the design choices made for the layout of the test stand.

TUP43 **Bunch-by-bunch beam position measurements at PETRA III**

Carolina Alvarez de Santiago (LPC Caen).
Danilo Bisiach (Instrumentation Technologies), Gero Kube, Hans Thomas Duhme, Joerg Neugebauer, Tobias Marwedel (Deutsches Elektronen-Synchrotron).

The PETRA IV project is set to enhance the current PETRA III synchrotron into an ultra-low-emittance source. The reduced emittance will impose stringent requirements on machine stability and operation. In order to cope with these requirements, bunch-by-bunch

information is required from most of the monitor systems. For precise monitoring of beam position and charge, the Libera Digit 500 instrument was tested as a readout electronics for BPMs at the existing machine PETRA III. This system features four channels with a 500 MHz sampling rate, synchronized with the accelerator's RF, enabling observation of beam properties with a bunch-by-bunch resolution, thus facilitating a more comprehensive understanding of beam behavior. This contribution provides an overview of the latest beam measurements at the single bunch level, allowing observation of beam oscillations and injection dynamics.

TUP44 **SOLEIL II beam position monitors: design, simulations and button prototyping.**

Moussa El Ajjouri (Synchrotron Soleil).
Alexis Gamelin, Filipe Alves, Nicolas Hubert, Zhengxuan Fan (Synchrotron Soleil).

SOLEIL II is the low emittance upgrade project for Synchrotron SOLEIL, targeting an emittance of ~80 pmrad. The new lattice includes 180 Beam Position Monitors (BPM). Due to the different constraints on the magnet yokes, beam stay clear and synchrotron radiation, 3 different types of BPM will be installed on the storage ring with inner diameter distributed between 16 and 24 mm. Electromagnetic and thermal simulations have been conducted to validate the designs. Manufacturing the feedthroughs is a challenge due to the conical shape of the button and the small (200 µm) thickness of the gap with the BPM body. Prototypes of the button have been made by two different manufacturers, and possibilities for improvement identified. These prototypes will test in the current machine to validate the simulation results. This paper presents the designs, summarizes the results of the simulations, and describes the metrology process and results of the two batches of feedthroughs.

TUP45 **The design and accurate calibration of HIAF-Ring BPM**

Peilin He (Institute of Modern Physics, Chinese Academy of Sciences).
Hongming Xie, Junxia Wu, Li Li, Ruixia Tian, Yong Zhang, Ze Du, xiaodong Zhang (Institute of Modern Physics, Chinese Academy of Sciences), Jia Yin ((Institute of Modern Physics, Chinese Academy of Sciences)).

Beam Position Monitors (BPM) are the non-destructive monitors used most frequently at nearly all linacs, cyclotrons, and synchrotrons. The most basic function of BPM is to provide the accurate position of the centre of mass of the beam for closed orbit feedback and other demands. However, due to the error of actual processing, the k value and the actual electric center will be different with the ideal k value and electric center of BPM, which requires us to accurately measure the k value and offset value of each set of BPM offline. There are 72 sets of BPMs in HIAF BRing & SRing, with 10 specifications and plate radius ranging from 180mm to 330mm, but the shape and size of the front and back pipes connected to BPMs are variety during actual installation. Based on theoretical analysis, the k value and offset value of the BPM which electrode plates are too close to the flange are greatly affected by the pipes connected to bpm at both ends, and the measurement error can even reach 9mm. Therefore, this paper takes HIAF BRing and SRing BPM calibration as examples to explain how to accurately calibrate BPM.

TUP46 **Design and deployment of an in-vacuum Electro-Optic BPM at the CERN SPS**

Max Bosman (Royal Holloway, University of London).
Stephen Gibson (Royal Holloway, University of London), Thibaut Lefevre, Thomas Levens (European Organization for Nuclear Research).

Accurate monitoring and control of charged particle beams at the HL-LHC demands the development of new beam diagnostics tools. This poster provides an overview of the electro-optic beam position monitor (EO-BPM), currently taking measurements at CERN's SPS. This device uses the Pockels effect to monitor the transverse position and instabilities in the particle beam. Comprising of a laser source, electro-optic crystal, optical system, and a fast photodetector, the EO-BPM operates by generating a modulated optical signal directly linked to the propagating electric field of the beam. The EO-BPM is designed as a self containing button with fibre-coupled laser connected to the crystal inside and a fibre coupled Mach-Zehnder interferometer yielding sum and difference signals on the outside. A segment of the SPS beam pipe is fitted with a mount to connect the button, allowing the electric field induced by the particle beam to be captured and transferred to the electro-optic crystal. The goal is to gain insight into the transverse position along the bunch and the identification of intra-bunch instabilities, contributing to precision in beam monitoring and control.

TUP47 **Research on X-ray beam position front-end electronics based on diamond detectors**

Kai Wang (Institute of High Energy Physics, Chinese Academy of Sciences).
Hongbin Liu, Jian Zhuang, Qinglei Xiu (Institute of High Energy Physics, Chinese Academy of Sciences).

This project aims to collect high-frequency high-precision data from the weak current signals generated by the quadrant-type diamond detector used for high-precision beam position monitoring. The main approach is to design a current conversion amplification circuit based on the theory of high-resistance I-V weak current to achieve fast conversion and collection of the four-channel weak current with large dynamic range and multiple ranges at high frequency, with the highest precision reaching the pA level. The circuit uses the ADA4530-1 amplifier with extremely low input bias current budget to complete the front-end circuit setup. The circuit's bandwidth is simulated and analyzed, with the bandwidth limited to 159 Hz. The design uses a protection ring design, a three-axis BNC connection, and a custom shielded box to enhance the shielding performance of the measurement system. The output signal is converted to a 24-bit high-precision analog-to-digital signal by the AD7172-2, and further connected to the core control board for signal closed-loop control to achieve overall isolation of the analog and digital circuits. The final experimental test shows that the detection sensitivity of the circuit for pA-level weak currents is 9.7936 mV/pA, and the error of the circuit is 1.3% when the weak current is greater than 10 pA, which can meet the demand for beam position measurement in the stable beam system.

TUP48 **Study and FPGA implementation of BPM algorithm for synchronized light source**

Zhenan Liu, Min Li (Institute of Modern Physics, Chinese Academy of Sciences).
Jiaxu Hou, Ruishi Mao, Yuqiao Zhang (Institute of Modern Physics, Chinese Academy of Sciences), Xiaojuan Wei (Northwest Minzu University).

Beam Position Monitor (BPM) system is an important part of the beam measurement system, which plays a vital role in the stable operation of the accelerator. In this paper, based on the requirement of high resolution of the BPM system, the DBPM algorithm is implemented on Matlab and FPGA, firstly, the overall design of the DBPM algorithm is introduced; secondly, the implementation method of each module is elaborated in detail; and again, the existing simulation data and the beam current data are simulated in the Matlab and Modelsim environments respectively, using the quadrature demodulation and Moving Average Filter; finally,do offline testing based on this DBPM algorithm Experimental. Results show that the quadrature demodulation algorithm incorporating a sliding average filter has higher positional resolution.

TUP49 **BPM-based electron beam trajectory optimization at PITZ**

Dmytro Dmytriiev (Deutsches Elektronen-Synchrotron DESY at Zeuthen).
Andreas Hoffmann, Anne Oppelt, Christopher Richard, Daniel Villani, Felix Riemer, Frank Stephan, Frieder Mueller, Matthias Gross, Mikhail Krasilnikov, Namra Aftab, ***Xiangkun Li****, Zohrab Amirkhanyan (Deutsches Elektronen-Synchrotron DESY at Zeuthen), Grygorii Vashchenko (Deutsches Elektronen-Synchrotron).*

The Photo Injector Test Facility at DESY in Zeuthen (PITZ) has been developing high brightness electron sources for the XUV and soft X-ray free-electron facility (FLASH) and the European X-Ray Free Electron Laser facility (EuXFEL) at Hamburg. Its research fields have expanded into applications in recent years like THz FELs, and radiation biology for cancer treatment. Since the applications require varying beam parameters (bunch charge from <10 pC up to 4 nC, momentum from 6 MeV/c up to 22 MeV/c), a robust and reliable beam trajectory recovery and correction algorithm has been developed, which allows to fast establish and/or recover a quasi-optimal performance for different experiments. One of the key functions is to make certain quadrupoles steering-free, which is critical for THz FELs and radiation experiments. It also provides a detailed beam trajectory overview by fitting the beam positions measured at beam position monitors (BPMs) using the response matrices and with the earth magnetic fields (EMF) considered, providing a deeper understanding of the intermediate beam trajectory and enabling efficient corrections. In this poster, the analytical model, the robustness test and the experimental performance of this tool will be presented.

TUP51 **Maximum entropy tomography of 4D transverse phase space distributions using 2D measurement results**

Liwen Liu (Institute of Modern Physics, Chinese Academy of Sciences).
Chun Yan Jonathan Wong, Yu Du, Zhijun Wang (Institute of Modern Physics, Chinese Academy of Sciences).

Obtaining the complete distribution of a beam in high-dimensional phase space is crucial for predicting and controlling beam evolution. Based on the theory of maximum entropy tomography, we developed an algorithm for reconstructing the four-dimensional (4D) transverse phase space distribution. Our algorithm can take any number of 2D linear projections as constraints, and iteratively converges to the unique numerical solution which is the maximum-entropy distribution satisfying the constraints. Having verified the algorithm with simulation experiments, we plan to use it to conduct 4D phase space tomography in the MEBT and HEBT of the heavy ion linac CAFe II.

TUP52 **Wire scanner based beam diagnostics during energy-recovery operation at the S-DALINAC**

Felix Schliessmann (Technische Universitaet Darmstadt).
Adrian Brauch, Dominic Schneider, Jan Hanten, Katharina Elisabeth Ide, Lars Juergensen, Lennart Stobbe, Manuel Dutine, Manuel Steinhorst, Marco Fischer, Michaela Arnold, Norbert Pietralla, Ruben Grewe, Simon Weih, Uwe Bonnes (Technische Universitaet Darmstadt).

The electron accelerator S-DALINAC can be operated in conventional acceleration (CA) and energy recovery (ER) modes. In an ER mode, electrons pass the main linear accelerator (LINAC) twice as often compared to the corresponding CA mode: following the acceleration, the electrons are decelerated to return kinetic energy to the electromagnetic fields inside the cavities of the main LINAC. The recovered energy is recycled during the acceleration of subsequent electrons. However, as a result of the deceleration, the electromagnetic fields are impacted. Thus, the fields and consequently the beam properties after acceleration in ER mode differ from those in CA mode. To compare the beam properties after acceleration present in both modes, a non-destructive diagnostic system is necessary since otherwise the ER mode would be interrupted. For this reason, wire scanners were build and used to measure beam properties in the two-turn CA and the two-turn ER mode. Details on the wire scanners and the measurements are presented.

TUP53 **Designed and implemented 128-channel readout electronics based on the CFC**

Xiaoxuan Qiu (Institute of Modern Physics, Chinese Academy of Sciences).
Junxia Wu, Kewei Gu, Tong Liu, ZhiXue Li (Institute of Modern Physics, Chinese Academy of Sciences).

To convert weak current signals into voltage pulse signals proportionally, a 128-channel readout electronics system is developed. The front-end analogue circuits of this readout electronics system are designed based on the Charge to Frequency Converter (CFC) circuit structure, and the back-end digital board processes the voltage pulse signals. After the performance test in the laboratory and the beam test in PREF, This system can proportionally convert currents from 1 pA to 1 μA into voltage pulse signals with an input dynamic range of 120 dB. The maximum nonlinear error does not exceed ±10%, and the system's resolution is less than 100 fA. The isolation between the adjacent channels is lower than -114 dB. The system is used not only for beam profile monitoring, but also for the flatness, symmetries and scanning uniformity measurements of slow-extraction beams. The system is of great value in the field of weak beam profile measurements.

TUP54 **Estimation of beam transverse parameters through a multimode fiber using deep learning**

Qiyuan Xu (Cockcroft Institute).
Alexander Hill, Carsten Welsch (The University of Liverpool), Federico Roncarolo, Georges Trad (European Organization for Nuclear Research), Hao Zhang (Cockcroft Institute).

In response to CERN's need for alternative imaging solutions of scintillating screens due to the discontinuation of radiation-hardened VIDICON tubes, the single large-core multimode fiber (MMF) has been identified as a potential medium to transmit image signals to a CMOS camera situated away from radiation-prone areas. However, significant challenges in image distortion at the fiber's output end complicate the reconstruction of the original beam distribution. To address this, a novel machine learning-based approach was introduced that utilizes a deep convolutional encoder-regressor network. It first compresses the fiber image into a latent space. Subsequently, a fully connected regression network directly estimates the beam parameters, such as centroids and widths, from the encoder output without the need to reconstruct the detailed image. This contribution will showcase an end-to-end system capable of estimating transverse beam parameters from the MMF output speckle patterns. Offering a safe, camera-preserving solution for beam imaging in high-radiation environments.

TUP55 **Design of the BPM button for ALBA II**

Laura Torino (ALBA-CELLS Synchrotron).
Oriol Traver Ramos, Ubaldo Iriso (ALBA-CELLS Synchrotron).

As many other light sources, ALBA is also going through an upgrade phase leading to ALBA II. In this context, new Beam Position Monitors (BPMs) have to be designed to fit the reduced vacuum chamber. The buttons and the block were designed to be as compact as possible minimizing the impedance to avoid overheat and maintaining a good signal level. Different shapes and materials were simulated and the best were selected to be produced as prototype. In this proceeding, we present the design process and the simulations that lead to the ALBA II BPM button design.

TUP56 **New interferometric aperture masking technique for full transverse beam characterization**

Ubaldo Iriso (ALBA-CELLS Synchrotron).
Bojan Nikolic (University of Cambridge), Christopher Carilli (National Radio Astronomy Observatory), Laura Torino (ALBA-CELLS Synchrotron).

The classical double-aperture interferometry using the visible part of the synchrotron radiation has been used in accelerators for beamsize measurements since the late 90s. However, this technique provides the beam size projection only in the direction given by the two aperture centers (i.e. only the horizontal or vertical direction). To fully characterize the transverse electron beam ellipse, given by the two semi-axis of the ellipse and its tilt angle, the double-aperture system could be rotated in a process that can take few minutes. Instead, using radio-astronomy techniques, this paper shows a new interferometric method with several apertures by which a full 2d transverse beam characterization is done in real-time.

TUP57 **Heterodyne Near-Field Speckle simulations using SRW at the ALBA FE21**

Ubaldo Iriso (ALBA-CELLS Synchrotron).
Andriy Nosych, Jose Alvarez, Laura Torino (ALBA-CELLS Synchrotron), Bruno Paroli (Universita' degli Studi di Milano e INFN), Daniele Butti, Georges Trad, Stefano Mazzoni (European Organization for Nuclear Research), Marco Potenza (Universita' degli Studi di Milano & INFN), Mirko Siano (Università degli Studi di Milano).

Several experiments were done to measure the transverse beam size at the NCD ALBA beamline using the Heterodyne Near Field Speckles (HNFS) technique. Inside the FCC collaboration, it was decided to move these experiments to the ALBA Front End 21, where currently an x-ray pinhole camera is working since 2021. The goal is that the two measurement techniques can work alternatively and measure the electron beamsize of the same source point, so that a direct comparison between both techniques can be done. This paper reports the SRW simulations performed in order to investigate the feasibility of the HNFS experiments at this new location. In particular, it focuses on the effect of the dipole radiation and the design of the high energy and high bandwidth monochromator requirements.

TUP58 **Study of X-ray Fresnel diffractometry for small beam sizes at Diamond Light Source**

Niki Vitoratou (Diamond Light Source Ltd).
Lorraine Bobb (Diamond Light Source Ltd).

The feasibility of X-ray Fresnel diffractometry to measure small beam sizes beyond the resolution of X-ray pinhole cameras is studied for the case of Diamond Light Source. After the Diamond-II upgrade, beam sizes as small as 4 μm are anticipated and are not resolvable by the X-ray pinhole cameras, which are the workhorse for beam size, emittance, and energy spread measurements. X-ray Fresnel diffractometry employs a single slit with an optimised width, producing a double lobe diffraction pattern. The visibility of this double lobe intensity distribution relates to the beam size and promises micron-scale beam size measurement. Numerical studies and simulations have been conducted to assess the feasibility of diffractometry for Diamond Light Source. The parameters for the experimental setup have been determined and preliminary experimental results are presented. Challenges and improvements for achieving this measurement for Diamond-II are discussed.

TUP59 **Design of X-ray ionization beam profile monitor for Korea-4GSR**

Woojin Song (Pohang University of Science and Technology).

Garam Hahn, HyoJung Hyun, Jae-Hong Lim, Jehan Kim, Min-Ho Seo, Seonghan Kim, Seungcheol Lee, Sunmin Hwang, Yong Sung Park (Pohang Accelerator Laboratory), Moses Chung (Pohang University of Science and Technology).

The Insertion Device (ID) photon beam of a synchrotron can be contaminated with radiation from upstream and downstream bending magnets, causing position measurement errors in blade-type monitors. Beamlines of the low emittance storage ring are particularly sensitive to photon beam position variations, requiring more accurate measurements. To address this, we designed an ionization profile monitor to non-destructively measure the profile and position of the white undulator beam at Korea-4GSR without contamination. Leveraging the relatively large active area of readout devices suitable for small emittance beams we have designed a 1:1 mapping field to defocus photo-ions. Given that the defocusing field can induce errors due to vertical position, we propose a calibration method and validate it using particle tracking simulation.

TUP60 **Design of HEPS beam diagnostics**

Yanfeng Sui (Institute of High Energy Physics).
Dechong Zhu, Fang Liu, Jianshe Cao, Jun He, Junhui Yue, Lingda Yu, Qiang Ye, Taoguang Xu, Xiaoyu Liu, Yan Lu, Yaoyao Du, Ying Zhao, Zhi Liu (Institute of High Energy Physics), Huizhou Ma, Lin Wang, Shu-Jun Wei, Wan Zhang (Chinese Academy of Sciences).

HEPS is a fourth generation light source which has horizontal emittance around 34pm.rad to gain the high brilliance photon beam, this ultra-low emittance brings many engineering challenges for beam instrumentation. The resolution of the beam position measurement and the beam size measurement is need to reach sub-micro meter. The large current and multi-bunches need bunch by bunch feedback system to cure beam instabilities. This paper will present an overview of beam instrumentation.

TUP62 **Commissioning of the slow extraction beam instrumentation at PREF**

Tong Liu (Institute of Modern Physics, Chinese Academy of Sciences).
Geng Wang, Hang Ren, Hong Xie, Jiajian Ding, Jiancheng Yang, Jianjun Su, Junxia Wu, Kewei Gu, Li Li, Lingxiao Hou, Liping Yao, Long Jing, Ning Li, Peilin He, Shuang Ruan, Tian Wang, Yongliang Yang, Youjin Yuan, ZhiXue Li (Institute of Modern Physics, Chinese Academy of Sciences).

The Proton Radiation Effects Facility (PREF) aiming for the displacement damage effect research was proposed by XTIPC (Xinjiang Technical Institute of Physics and Chemistry, Chinese Academy of Sciences) in 2018. The facility was designed and constructed by IMP (Institute of Modern Physics, Chinese Academy of Sciences). The beam commissioning of PREF had been started since August to September of 2023. Four types of instruments, scintillation screen, Faraday cup, scintillator and ionization chamber are implemented for the proton beam profile, intensity, position, efficiency, spill structure. With the beam instruments, the machine reached nearly 95% slow extraction efficiency for all energies from 10 to 60 MeV, 5× 10^{10} particle per second (ppp), 2×2 cm² up to 20×20 cm² scanning area.

TUP63 **A project for a Compton photon source at the SKIF synchrotron facility**

Viacheslav Kaminskiy (Russian Academy of Sciences).
Oleg Meshkov (Budker Institute of Nuclear Physics).

SKIF is a synchrotron radiation facility under construction in Novosibirsk. Electron beam energy 3 GeV, beam current up to 0.4 A and extremely low horizontal beam emittance 75 pm·rad are convenient to make a high-energy photon source at the main storage ring. Gamma-photons are obtained using Compton backscattering (inverse Compton scattering) of IR, UV and visible laser radiation. Using modern high-power lasers, Compton photons in hundreds-MeV energy range and rates up to 300 MHz can be achieved. Also, higher Compton photon energies (up to 2.6 GeV) can be generated using synchrotron radiation reflected towards the electron beam. A preferable option for photon monochromatisation is tagging photons by recoil electrons with resolution of 0.6%...0.8% (or ~2 MeV), which is an advantage of ultra-low electron emittance. The discussed Compton source is mainly usable for photonuclear and photohadron processes such as photofission and production of π, η, Δ at nuclei. Also nonlinear QED, EM detectors calibration and other applications are in interest.

TUP64 **Design and construction status of the diagnostic system for the Compact LAser Plasma Accelerator-II**

Kai Wang (Peking University).
G. H Wei (Beijing Laser Acceleration Innovation Center), K. D Wang (Peking University).

Over the past two decades, laser-driven proton radiotherapy devices have garnered significant attention among novel accelerator technologies, due to their high acceleration gradient. Peking University is engaged in the construction and development of CLAPA-II (the Compact LAser Plasma Accelerator II), a proton therapy facility which utilizes a laser-plasma acceleration scheme. This facility comprises two horizontal and vertical beam transmission lines, operating at a repetition rate of 1Hz, capable of delivering 10^8-10^10 protons per second. We have implemented both interceptor and non-interceptor detectors for precise measurements of proton beam. Notably, this is the first instance where an ionization chamber and cavity BPM have been integrated into a laser proton therapy accelerator. To validate the performance of our beam diagnostic system, we have established an offline test platform that simulates the laser proton beam. The results indicate that the offline test resolution of the cavity BPM has achieved 0.2μm in the range of ±3mm. Furthermore, we explored the absolute collection efficiency and particle recombination factor of ionization chamber with ultra-high dose rate proton beams, leveraging the laser-driven ultrashort electron beam generated by Peking University's CLAPA-I facility. This paper provides an overview of the beam diagnosis system's overall layout, accompanied by a detailed description of the detector design and corresponding measurement results.

TUP65 **First beam commissioning and beam quality optimization of the CiADS front end**

Duanyang Jia (Institute of Modern Physics, Chinese Academy of Sciences).
Weilong Chen, Yuan He, Zhijun Wang (Institute of Modern Physics, Chinese Academy of Sciences).

The China Initiative Accelerator Driven System (CiADS), a multi-purpose facility driven by a 500 MeV superconducting RF linac, is currently under construction in Huizhou, Guangdong. In order to ensure the stable operation of the superconducting linac, we conducted optimization research on the beam quality in the front-end section of CiADS. By using the point scraping method, part of the beam halo particles are removed in advance at the entrance of the LEBT, avoiding the generation of beam halo particles. On the other hand, since the beam extracted from the ECRIS contains a portion of H^{2+} and H^{3+} particles, impurity particles may lead to a decrease in the transmission efficiency of downstream accelerators. By separating the mixed beam, it is possible to measure the proportion and phase space distribution of the mixed beam at the exit of the ion source, thereby achieving accurate measurement of the proton beam. This paper mainly outlines the first beam commissioning of CiADS Front end. Additionally, the effectiveness of the point scraping method has been verified through transverse emittance measurement, and the proportion and phase space distribution of the mixed beam was measured. Furthermore, the stability of the ion source was tested, and the centroid shift of the ion source extracted beam was measured.

TUP66 **Certification testing of prototype superconducting quarter-wave and half-wave resonators for HIAF**

Mengxin Xu
Zehua Liang (Institute of Modern Physics, Chinese Academy of Sciences).

The 81.25MHz quarter-wave resonator (QWR) and 162.5MHz half-wave resonator (HWR) are selected as the main accelerating cavities for the superconducting ion Linac (iLinac) of the High Intensity heavy-ion Accelerator Facility (HIAF) at Institute of Modern Physics (IMP). Six QWR007 (βopt=0.07) cavities and eight HWR015 (βopt=0.15) cavities have been fabricated before the mass production to verify the design and production quality control. Two cavities of the both types have been random chosen to surface processing and vertical testing for performance validating before welding helium vessel. In this paper, the development of SRF cavity for HIAF will be addressed, which including the fabrication, surface processing and vertical testing results. The achieved gradients for both cavities have exceeded 60%~100% of requiring operation gradients. The Q0 of both types' cavities have meet the 2 K operation requirement too. These results inspired to push the cavity production for the HIAF project forward to the mass production stage.

TUP67 **First results of INR RAS linac timing system upgrade**

Alexander Titov (Institute for Nuclear Research of the Russian Academy of Sciences, Moscow, Russia).

Denis Donets, Ilya Shirikov, Ilya Zhabin, Izabel Spiridonova, Letkin Dmitry (LLC DIALTEK), Sergei Gavrilov (Institute for Nuclear Research of the Russian Academy of Sciences, Moscow, Russia).

INR RAS linac was developed in late 1970s and build during 1980s. Its timing system is based on the fifty years old technologies and requires full upgrade due to system stability decrease, lack of spare parts, progressing hardware degradation and increase in RF jamming. Moreover, the timing system upgrade should be done without additional accelerator complex shutdowns. In this paper a project of a new timing system that fulfills all requirements is presented. Various features and production peculiarities of the new timing system hardware and software are described. Results of the implementation of new system first parts and its commissioning and plans for future upgrade are discussed.

TUP68 **Diagnostic beamline for the superconducting RF photoinjector test stand at DESY**

Sonja Jaster-Merz (Deutsches Elektronen-Synchrotron).
Dirk Lipka, Dmitry Bazyl, Elmar Vogel, Klaus Floettmann, Silke Mogk, Winfried Decking (Deutsches Elektronen-Synchrotron), Mikhail Krasilnikov (Deutsches Elektronen-Synchrotron DESY at Zeuthen).

For future continuous wave (CW) and High-Duty-Cycle operation of the European XFEL, research and development of the DESY L-band CW photo injector is ongoing. Presently, the implementation of a superconducting radio frequency (SRF) gun operated at 1.3 GHz with a copper photocathode is the baseline solution. The electron beam quality, in particular the slice emittance, produced by this injector is key for the successful operation of the free-electron laser. In order to study the achievable beam quality and stability of operation, a dedicated test stand and diagnostic beamline is being developed at DESY. Here, we present an overview of the foreseen diagnostic components and methods at the SRF CW photoinjector test stand.

TUP69 **Beam diagnostics systems for the LINAC of LUTF**

Ming Meng (Chongqing University).
Bocheng Jiang, DongHui Zhu, Junqiang Zhang, Lei Yang, Tao Lei, Xi Wu, XiaoDong Yang, Yao Yang, Yao Zhang, ZhongQuan Li (Chongqing University).

"Laboratory for Ultrafast Transient Facility" is organically composed of two major categories of core parts: one is a Ultrafast Transient electron microscope cluster; the other is a Ultrafast Transient synchrotron radiation device that provides ultraviolet to X-rays. The first stage of synchrotron radiation device includes a 0.5 GeV linear accelerator as full energy injector, a high-current storage ring, and a beam line. For the construction of the linear accelerator beam diagnostics system, the main focus is on the reliability and maintainability of the system. The system mainly includes beam position measurement system, bunch charge measurement system and beam profile measurement system; the article will mainly introduce the composition and design of these systems.

TUP70 **The design of beam instrumentation system of SILF**

Tao Yu (Institute of Advanced Science Facilities).

Shenzhen Innovation Light-source Facility (SILF) is designed to be the so-called forth generation synchrotron radiation light source operating at 3.0 GeV, 300 mA, and with the emittance less than 100 pm·rad. With the increase in luminosity of the light, higher stability of the electron beam is required, which may also result in increased measurement diversity and accuracy. Here, an overview of the SILF beam instrumentation system is provided, along with detailed descriptions of its key technology, including the Beam Position Monitor (BPM) and electronics, transverse feedback kicker and electronics, and beam transverse size measurement. Additionally, the future development of the beam instrumentation system is discussed.

TUP71 **The beam diagnostics of 300MeV proton and heavy ion synchrotron for SESRI project**

Tiecheng Zhao (Institute of Modern Physics, Chinese Academy of Sciences).
Ruishi Mao, Xincai Kang (Institute of Modern Physics, Chinese Academy of Sciences), kai tang, kai zhou, min li, weilong li, yongchun feng, yucong chen, zhiguo xu (Institute of Modern physics, Chinese Academy of Science).

The SESRI (Space Environment Simulation and Research Infrastructure) is a large-scale space science and technology experimental research accelerator clusters, the 300MeV proton and heavy ion accelerator is the key part. It consists of an ECRIS (Electron Cyclotron Resonance Ion Source), a linac cascade injector, a compact synchrotron, and three

irradiation terminals. The proton and HI with 2MeV and 5.6MeV/U can be injected, and slowy extracted from the ring with the RF-KO and Ese. The operation cycle is about 3-10s. The Scintillation Screens are used to monitor the beam profile. They are driven by motors for the different orbits. The wire scanners are used to measure the beam profile during the acceleration process, in order to obtain the beam emittance; In order to meet the requirements of large current range, the BPM system adopts a Libra adjustable gain amplifier, and uses Libra Hadron to achieve BBB and 1kHz closed orbit measurement. RF-KO provides a transverse extraction electric field. Amplitude and frequency modulation are used for the extraction signals. At the same time, a feedback system based on excitation and fast quadrupole is adopted. Through the above methods, the uniformity of beam extraction is greatly improved.

TUP72 **Beam diagnostics and preliminary commissioning results of HUST-PTF**

Shaokun Zhou (Huazhong University of Science and Technology).
Aote Chen, Bin Qin, Chengyong Liu, Qushan Chen, Yu Chen (Huazhong University of Science and Technology).

Huazhong University of Science and Technology is building a cyclotron-based Proton Therapy Facility (HUST-PTF). The facility mainly consists of a 240MeV superconducting cyclotron, a beam transport line, a fixed treatment room and two rotational treatment rooms. HUST-PTF uses three kinds of detectors, Fluorescent screen, Faraday cup and ionization chamber, for the beam parameter measurements. The proton beam was extracted from the cyclotron and injected into the transport line for the first time in April 2024. This paper will give an overview of the beam diagnostic system of the transport line and present the preliminary beam parameters, such as beam intensity, energy spread and emittance, after a first stage commissioning progress.

TUP73 **Features of non-destructive beam instrumentation at the INR RAS high-intensity hydrogen ions linac**

Sergei Gavrilov (Russian Academy of Sciences).
Alexander Titov, Ivan Polonik (Russian Academy of Sciences).

The linac of INR RAS is a high-intensity accelerator of protons and H-minus ions, which is used for a complex of neutron sources, isotope production, proton irradiation and investigations in proton flash therapy. A non-destructive beam instrumentation plays a key role in the linac tuning. The general peculiarity of this multi-component system is that all detectors are home-made devices with a wide operation range and can be used at different ion linacs with a minimum adaptation to beam parameters. Beam current transformers for standard and in-air measurements, resonance and capacitive position and phase monitors, BIF-monitor for 1D and beam cross-section monitor for 2D non-destructive profile diagnostics. Different operation features and manufacturing peculiarities are presented in this paper. Results of implementation, operation and continuous upgrade are described. Also easily scalable typical designs of some detectors are discussed.

TUP74 **Neutron detection system of the NDPS at RAON**

Cheolmin Ham (Institute for Basic Science).
Chang Wook Son, Charles Akers, CheongSoo LEE, Dong Geon Kim, En Hee Kim, Geonhee Oh, Jae Cheon Kim, Jaesung Kim, Kwang Bok Lee, Kyoungho Tshoo, Mijung Kim, Minsik Kwag, Sangjin Lee, Seong Jae Pyeun, Taeksu Shin (Institute for Basic Science), Donghyun Kwak (Ulsan National Institute of Science and Technology), Young-Ouk Lee (Korea Atomic Energy Research Institute).

The Nuclear Data Production System (NDPS) was constructed at Rare Isotope Accelerator complex for ON-line experiments (RAON) to produce nuclear data for neutron-induced reactions at a few tens of MeV. For the neutron time-of-flight measurement, various neutron detectors, such as gas-filled Parallel Plate Avalanche Counter (PPAC), MICRO-MEsh-GASeous (MICROMEGAS), and EJ-301 liquid scintillation detectors, were installed in the NDPS neutron beamline. The NDPS recently performed its first beam commissioning with 16 MeV/nucleon 40Ar ion beams. For the measurement of the neutron beam, EJ-301 liquid scintillation detectors and activation foils (natAl, natFe, natZr, natAu, natBi, etc) were used to measure the neutrons from the graphite target. In this presentation, we report a detailed description of the NDPS neutron detection system with its current status.

11-Sep-24 09:00 – 10:20 China Hall 2

WEA: Data Acquisition and Processing Platforms

Chair: Yongbin Leng (University of Science and Technology of China)

WEAI1 09:00 **FWK - an open-source FPGA framework by DESY for large scientific projects**

Michael Büchler (Deutsches Elektronen-Synchrotron).

In recent years, DESY has dedicated significant effort to the development of an open-source FPGA framework named FWK. This initiative is geared towards expediting FPGA development within the scientific community, with a particular focus on experimental physics applications. The framework functions as an abstraction layer, streamlining the utilization of diverse FPGA vendor tools, facilitating IP integration, simplifying register and documentation creation, and offering a host of additional advantages. In conjunction with FWK, DESY is committed to providing numerous IPs as open-source resources that seamlessly integrate with the framework. This presentation is intended to provide a comprehensive overview of the framework, accompanied by concrete examples drawn from real-world applications.

WEAI2 09:30 **Remote sensing of fast beam signals using electro-optical modulators**

Andreas Schloegelhofer (European Organization for Nuclear Research).
Stefano Mazzoni, Thibaut Lefevre, Thomas Levens (European Organization for Nuclear Research).

Electrical measurements of fast signals, as generated in particle accelerators, encounter severe limitations due to the high-frequency losses in RF transmission lines. This study describes measurements conducted with electro-optical modulators employing various radio-over-fibre techniques. Experimental data consist of different beam-generated signals, which underline the versatility of such a system. Signals from electromagnetic devices such as wall current monitors, as well as those captured from coherent transition radiation screens and coherent Cherenkov diffraction radiators, are presented. The potential deployment of such a remote sensing acquisition system in large-scale facilities is discussed.

WEAC3 10:00 **Newly developed digital signal acquisition and processing platform for beam instruments at IMP**

ZhiXue Li (Institute of Modern Physics, Chinese Academy of Sciences).

A new digital signal acquisition and processing platform for beam instruments at IMP is designed and realized based on Zynq MPSoC FPGA. Two FMC mezzanine slots are featured for analogue front-end electronics and analogue-to-digital converting, as well as for the WR timing. The real-time data communication between different platforms is realized through multi-gigabit links. To facilitate the real-time data transmission from PL to PS, an universal technology for high-speed, multi-channel data transmission is developed, where two channels can achieve a transmission rate of up to 2 GB/s in a 64-bit data stream with a maximum clock of 250 MHz per channel, and the other two can achieve a data-throughput of 1.28 GB/s in a 512-bit width with a maximum clock of 20 MHz individually. This technology has been verified by the synchrotron BPMs for simultaneous transmission of the raw data with a sampling rate of 250 Msps from each electrode, the turn-by-turn trajectory data, as well as the orbit data without any conflict. Additionally, the trajectory data are processed on an Arm Cortex-R5F real-time processor integrated on the MPSoC to get a real-time tune measurement. Till now the platform is implemented and operated at IMP machines for all beam instruments such as beam current, BPMs, beam loss measurement and so on. From on-line operation, the platform has an excellent performance and good long-term stability. Also the platform is utilized for the HIAF machine protection system.

11-Sep-24 10:50 – 12:30 China Hall 2

WEB: Transverse Profile and Emittance Monitors

Chair: Fernando Cardoso (Brazilian Synchrotron Light Laboratory)

WEBI1 10:50 **Achieve a record dynamic range of halo diagnostics with a novel fluorescence wire scanner**

Renjun Yang (Institute of High Energy Physics).

Achieving sustainable beam operation in high-power accelerators requires careful control and minimization of halo-particle-induced beam loss. To accomplish this, it is important to have a clear understanding of the halo-particle distribution. While state-of-the-art instruments can achieve a dynamic range of ~10^6 with counting readout schemes, a novel fluorescence wire scanner combined with a conventional metal wire has recently been proposed and demonstrated at CSNS. This new approach has achieved a sensitivity at the single-particle level and a dynamic range of over 10^8. A 100x1x0.15 mm^3 Chromox fluorescence wire has been prepared at CSNS, which has demonstrated excellent light yield and radiation hardness. By capturing fluorescence images with a CMOS camera in a dark environment, a new record dynamic range of about 6x10^8 has been achieved. Continue efforts on optimizing the fluorescence wire, observation system, and sensor hold promise for further improvements in dynamic range and sensitivity.

WEBI2 11:20 **Design and experimental validation of high-resolution single-shot emittance diagnostics for heavy-ion beams**

Ji-Gwang Hwang (Gangneung-Wonju National University)
Garam Hahn (Pohang Accelerator Laboratory).

A pepper-pot diagnostic device was developed to accurately and robustly retrieve particle distribution in horizontal and vertical phase spaces by single-shot emittance measurements. Two masks that differ in both composition and manufacturing method were fabricated: one made of phosphor bronze by an optical lithography process and another made of stainless steel (SUS) by laser cutting. Scanning electron microscope (SEM) measurements of the two masks revealed that the former is superior in terms of regularity and shape of the mask holes and is therefore more suitable to use. A new image-processing algorithm, cluster noise removal method, was developed which improves the resolution of the phase-space distribution measurements over traditional methods. The results show that the diagnostics can robustly and reliably retrieve the four-dimensional (4-D) phase-space distribution of ion beams with a single-shot measurement.

WEBC3 11:50 **First proof-of-concept transverse beam profile measurements with gas jet in-vivo dose profiler for medical accelerators**

Narender Kumar (Cockcroft Institute).
Carsten Welsch, Farhana Thesni Mada Parambil, Milaan Patel (The University of Liverpool), William Butcher (Cockcroft Institute).

To ensure patient safety, treatment efficacy, and facility efficiency, a full online characterisation of the charged particle beam is required for every ion beam therapy facility. Current dosimetry methods offer limited information or are invasive to the beam, asking for the development of in-vivo dosimetry solutions.

The QUASAR Group, based at Cockcroft Institute in the UK, has been developing non-invasive beam monitor for medical accelerators since 2015. Detailed transverse beam profile monitoring is the first step towards in-vivo dosimetry. The current monitor applies a supersonic beam gas curtain, interacting with a charged particle beam to then exploit the resulting impact ionization to record the transverse beam profile. A prototype monitor was tested at Dalton Cumbrian Facility's pelletron accelerator for proof-of-concept beam measurements in summer 2023. The measurements were carried out for different beam energies, sizes and intensities and with both, proton and carbon ion beams. This contribution presents the monitor design and functioning principle, results from the experimental campaign, and planned upgrades to achieve real-time, non-invasive dosimetry.

WEBC4 12:10 **Evaluating the use of common statistical divergences to quantify the differences between beam distributions in high-dimensional phase space**

Yu Du (Institute of Modern Physics, Chinese Academy of Sciences).
Chun Yan Jonathan Wong, Liwen Liu, Zhijun Wang (Institute of Modern Physics, Chinese Academy of Sciences).

Quantifying the difference between two beam distributions in high-dimensional phase space is crucial for interpreting experimental or simulation results. This study aims to analyze and compare several common statistical divergences that quantify the differences in high-dimensional distributions, and to determine which of them are suitable for beam physics applications. We tested these divergences with common kinds of initial distributions by computing how the difference values vary when the mismatch factor and emittance change, between the same and different kinds of distributions. These results, along with similar comparisons after extended beam transport, provided guidance on the use and choice of statistical divergences for beam phase space distributions.

11-Sep-24 13:30 – 14:20 China Hall 2

WEC: Feedback Systems and Beam Stability

Chair: Nicolas Hubert (Synchrotron Soleil)

WECI1 13:30 **Bunch by bunch feedback systems review**

Takeshi Nakamura (High Energy Accelerator Research Organization).

Bunch-by-bunch feedback systems have become essential components of high-energy particle accelerators, particularly for ultra-low emittance rings. These systems have been widely used in accelerator facilities to ensure beam quality and to apply them to extensions such as beam diagnostics or manipulation. Bunch-by-bunch feedback systems include various hardware components and related technologies, ranging from fast digital signal processing to high power radiofrequency devices. This talk would be an overview of the bunch by bunch feedback systems and present the outcome and conclusions of the iFAST Workshop hosted by KIT in March 2024.

WECC2 14:00 **Modeling of the SIRIUS fast orbit feedback control loop**

Lucas Antonio Pelike (Brazilian Synchrotron Light Laboratory).
Ana Clara de Souza Oliveira, Augusto Fraga Giachero, Daniel Tavares, Fernando Cardoso, Fernando de S á, Gabriel Silvano Ramirez, Guilherme Ricioli Cruz (Brazilian Synchrotron Light Laboratory), Érico Nogueira Rolim (Brazilian Nanotechnology National Laboratory).

The SIRIUS Fast Orbit Feedback system was put into routine operation for users in 2022. Recently, efforts have been made to study the coupling between the horizontal and longitudinal plane dynamics of the FOFB and LLRF feedback loops, an issue increasingly important in 4th generation synchrotron light sources operating with low synchrotron frequencies. New system identification experiments were conducted to develop an accurate black box MIMO model of the feedback loop. The high frequency response discrepancies among several fast corrector magnets are captured in this model and allow prediction of closed loop behavior, which is especially important for designing high gain controllers. This paper describes the obtained model, its validity and enabled improvements on the feedback loop performance and robustness.

WEP02 **Bunch-by-bunch profile measurement during beam available time**

Ruizhe Wu (University of Science and Technology of China).
Bao-gen Sun, Jigang Wang, Leilei Tang (University of Science and Technology of China), Xiaochao Ma (Budker Institute of Nuclear Physics).

One bunch-by-bunch Profile Measurement System has been built in the Hefei Light Source HLS-II to measure the profile positions and profile sizes of each bunch in the storage ring during beam available time. Corresponding configuration of the system and the analysis of the measurement error are described in detail in this paper.

WEP03 **Two-dimensional reconstruction by the multi-strip ionization chamber at PREF**

Tong Liu (Institute of Modern Physics, Chinese Academy of Sciences).
Hang Ren, Jiajian Ding, Junxia Wu, Kewei Gu, Li Li, Lingxiao Hou, Liping Yao, Long Jing, Ning Li, Tian Wang, Xiaoxuan Qiu, Yongliang Yang, ZhiXue Li (Institute of Modern Physics, Chinese Academy of Sciences).

The 60 MeV Proton Radiation Effects Facility (PREF) spent nearly 1 month at the commissioning phase, during which the multi-strip ionization chamber (MIC) at the experimental terminal offered the core parameters, beam spot, scanning area, scanning uniformity, beam flux. However, the projectile distribution provided by the MIC loses some information, such as the flux in a selected area less than the scanning area. This paper proposes a method of two-dimensional reconstruction and experimentally demonstrates that the MIC has the ability to provide a 2D scanning distribution at a sample rate of 10 kHz.

WEP04 **An X-ray pinhole camera for SESAME storage ring**

Hussein Al-Mohammad (Synchrotron-light for Experimental Science and Applications in the Middle East).
Abdelrahman Hasoneh, Maher Al Shehab (Synchrotron-light for Experimental Science and Applications in the Middle East), Omar Kailani (SESAME).

An X-ray pinhole camera beamline has been installed recently at SESAME storage ring as a very beneficial non-destructive tool, used to characterize the electron beam size and behavior. The design of the beamline is kept as simple as possible with a modification on the Copper absorber to provide a sufficient flux of X-ray proper for imaging. The beamline is under operation now and used for the measurement of beam size, emittance, coupling in the ring, and detection of beam instabilities. This paper describes the design details, simulations and measurement results obtained during the beamline commissioning.

WEP05 **Diagnostics visible beamline at SESAME storage ring**

Hussein Al-Mohammad (Synchrotron-light for Experimental Science and Applications in the Middle East).
Abdelrahman Hasoneh (Synchrotron-light for Experimental Science and Applications in the Middle East).

Visible light range of synchrotron radiation is a versatile diagnostics tool for accelerator studies and measurements. SESAME's storage ring has a dedicated diagnostics visible light beamline from 6.5-degree beam port of bending magnet source point. The beamline will host in future a time-correlated single photon counting unit to measure the bunch filling pattern, fast gated camera and a streak camera for longitudinal diagnostics. Recently, the beamline has been extended to be operational from outside the tunnel (dedicated hutch) to allow more flexible studies with direct source imaging and a double-slit interferometry for vertical beam size measurement and study transverse instabilities. In this paper we give an overview of the design of the beamline, modifications and present first results.

WEP06 **Design and test of an ionization profile monitor at the 80 MeV linac in CSNS**

Mengyu Liu (Chinese Academy of Sciences).
Anxin Wang, Muhammad Abdul Rehman, Renjun Yang, Tao Yang, Weiling Huang, Xiaojun Nie, Zhihong Xu (Institute of High Energy Physics).

The beam transverse profile is very essential in the beam diagnostics of a high intensity proton accelerator. A Residual Gas Ionization Profile Monitor (IPM) has been developed and implemented as a non-destructive diagnostic tool at the LRBT of CSNS. The design specifics of the IPM and presents initial measurements conducted in ion collecting mode are discussed in this paper. Big challenges arose during the initial experimental period, especially the honey comb. A series of planned experiments are outlined to address these challenges in future IPM developments.

WEP07 **An online 2D spatial-resolved proton spectrometer based on a scintillation-fiber-cube**

Tan Song (Peking University).
Jiarui Zhao, Wenjun Ma, Ying Gao, Yujia Zhang (Peking University).

The applications of proton beams require precise diagnosis of their properties including spectrum and spatial distribution. Distinct from the case of traditional accelerators, limited online detectors are available for laser-driven proton beams with high transient fluence, somewhat impeding the progress in this field. This paper presents an online proton spectrometer, named Scintillation Fiber Cube Proton Spectrometer (SFCPS), which can diagnose proton beams with sub-millimeter (~500 um) spatial resolution and wide fluence range. The SFCPS offers an energy range of approximately 6~93 MeV with an energy resolution of 0.5% at 80 MeV, as calibrated. We demonstrated the SFCPS's ability to reconstruct the 2D energy spectrum of parallel proton beams with uneven spatial distributions. Further discussion and analysis reveal that the SFCPS's lower detection threshold for proton beams is approximately 1×10^5 p/cm2.

WEP08 **The project of Kirkpatrick – Baez focusing system for beam diagnostics on the SKIF**

Oleg Meshkov (Budker Institute of Nuclear Physics).
Egor Glushkov, Ilya Malyshev (Institute of Applied Physics), Victor Dorokhov (Budker Institute of Nuclear Physics).

The Siberian Ring Radiation Source (SKIF) is an upcoming 4th-generation SR source under construction in Novosibirsk, Russia. The designed beam emittance for SKIF is 75 pm-rad, which corresponds to a beam size of 6 micrometers at the observation point within the dipole magnet. The transverse beam dimensions are essential parameters for tuning and reliable operation of the facility. The SKIF diagnostic suite includes a double-slit interferometer operating in the ultraviolet region of the spectrum. This device's spatial resolution should be sufficient to measure the radial size of the beam to an accuracy of 10 percent. These diagnostics will be used during the commissioning of SKIF and afterwards. Although an additional source of information on beam dimensions and dynamics would be desirable for assurance, taking into account the record designed value of beam emittance. The application of X-ray optics and the Kirkpatrick-Baez focusing system seem to be the most suitable options. The article discusses the project of this system, which will acquire X-rays from a SKIF dipole magnet. Simulations of the heat load on the mirrors, means of compensation of thermo-induced surface distortion (thermo-bump) and the spatial resolution of the KB system are described. The choice of scintillator screens, expected temporal resolution, and sensitivity of the diagnostics are discussed as well.

WEP09 **Superconducting solenoid optimization and fields measurement at ELBE**

Shuai Ma (China Academy of Engineering Physics, Institute of Applied electronics).
Andre Arnold, Anton Ryzhov, Jana Schaber, Jochen Teichert, Pavel Evtushenko, Peter Michel, Petr Murcek, Reinhard Steinbrück, Rong Xiang (Helmholtz-Zentrum Dresden-Rossendorf).

In order to reduce the projected transverse beam emittance, a solenoid is usually used at normal conducting as well as superconducting radio frequency (SRF) photoinjectors. At the ELBE SRF Gun-II, a superconducting solenoid is located inside the gun´s cryomodule about 0.1 m far from the end of the gun cavity. The solenoid has a longitudinal magnetic field on the axis with a Gaussian-like shape and an effective length of 0.042 m. To determine the beam aberration due to the anomalous, weak quadrupole fields of the solenoid, we measured and analyzed the multipole fields of the solenoid. In this paper, two different multipole magnetic field analysis methods are presented. We also calculated the effect of these fields on the beam emittance. Based on these studies, a group of quadrupole correctors has been installed downstream in the beamline. A comparison of the experimental findings for quadrupole field correction and simulation will be given. For beams with relatively large diameters, the spherical aberrations of the solenoid can increase the emittance significantly. For that reason, an improved solenoid design meets the mechanical and cryogenic demands.

WEP10 **Optimized design of an emittancemeter for a C-band photocathode RF gun**

Weiwen Chen (Institute of High Energy Physics).

Renhong Liu, Renjun Yang, Shimin Jiang, Tao Yang, Xiao Li (Institute of High Energy Physics).

To enhance the performance of the next generation of X-ray free electron lasers (XFEL), it is essential to produce a high quality electron beam with a low emittance, for instance, below 0.2 mm mrad for a 100 pC bunch charge. In order to demonstrate the fundamental techniques required for future FEL facilities, a C-band photoinjector test facility has been constructed based on Southern Advanced Photon Source(SAPS) pre-research project . A emittance meter based on the consecutive double-slit-scan method has been developed for the purpose of determining the emittance of such small beams. It has been demonstrated that this emittance meter could achieve a satisfactory accuracy when compared to an emittance meter developed using the single-slit-scan method. The primary parameters of the emittance meter have been optimized by numerical simulations with respect to the measured step motor motion accuracy and the expected resolution of the optical observation system.

WEP11 **The upgrade of the target multiwire profile monitor for the CSNS-II project**

Tao Yang (Institute of High Energy Physics).
Fang Li, Lei Zeng, Renhong Liu, Renjun Yang, Ruiyang Qiu, Taoguang Xu, Weiling Huang, Xiaojun Nie, Zhihong Xu (Institute of High Energy Physics), Mengyu Liu (Chinese Academy of Sciences), Anxing Wang (University of Science and Technology of China), Ming Meng (Chongqing University), Quanru Liu (University of Chinese Academy of Sciences).

The beam power is lifted up to 500 kW for the phase II of the China Spallation Neutron Source (CSNS-II) project, which is five times the power of CSNS-I. At the CSNS, the neutron beams are generated by the spallation reaction of 1.6-GeV protons striking on a tungsten target. The multiwire profile monitor (MWPM) in front of the proton beam window is the only instrument for long-term monitoring of proton beam distribution when the protons are delivered to the spallation target. The wire interval of the target MWPM of CSNS-I is 7 mm, which is slightly sparse for beam profile measurements during the beam operation in recent years. To ensure the precisely monitoring and provide accurate signal for the Machine Protection System (MPS) when the beam is abnormal, an upgraded design was proposed and implemented. The design mainly employs the Printed Circuit Board (PCB) technique to route the signal originated from the tungsten wires. Four bias planes comprised of tungsten wires are added to mitigate the crosstalk effect brought about by stray electrons and enhance the secondary emission effect. The minimal wire interval of present design is 2 mm and the whole equipment is more compact compared with the previous one due to the PCB scheme. This paper will detail the design and manufacturing of the CSNS target MWPM.

WEP12 **Developments of wide dynamic-range halo monitor for 8 GeV proton beams at FNAL**

Yoshinori Hashimoto (High Energy Accelerator Research Organization).
Chihiro Ohmori (Japan Proton Accelerator Research Complex (J-PARC)), Hiroshi Sakai (Kanto Information Service (KIS), Accelerator Group), Masahiko Uota, Masaki Tejima (KEK), Robert Ainsworth (Fermi National Accelerator Laboratory), Takeshi Toyama, Tomoi Sasaki, Toshiyuki Mitsuhashi (High Energy Accelerator Research Organization), Yoichi Sato (Japan Proton Accelerator Research Complex).

The FNAL accelerator complex has been upgrading in increasing beam intensity and beam quality. A new beam halo diagnostic device is required in the beam transport line between booster and Recycler. For this purpose, it was decided to introduce the wide dynamic range monitor technique that was developed in 2012 and has been in operation at the J-PARC beam transport line. The device is a two-dimensional beam profile monitor, and it has a dynamic range of approximately six digits of magnitude by using of Optical Transition Radiation and fluorescence screens. Eliminating harmful beam halos is the most important technique for high-intensity proton accelerators. Therefore, beam halo diagnosis is indispensable and becomes more and more important. New FNAL device has been manufactured in a collaboration between J-PARC and FNAL as a part of U.S.-Japan Science and Technology Cooperation Program in High Energy Physics. The equipment will be manufactured at J-PARC and will be shipped to FNAL in 2025. We designed the device to satisfy FNAL specifications: the beam energy, intensity, and size. Currently, most of the equipments are under construction. The large-aperture optical system has been completed and its optical characteristics are being evaluated at J-PARC. We have been also investigating measurement methods corresponding to FNAL bunch trains. This paper reports on the current status of these developments.

WEP13 **Application of the Nanogate-38 camera for beam diagnostics in the VEPP-2000 collider**

Maksim Timoshenko (Budker Institute of Nuclear Physics).
Ivan Koop (Budker Institute of Nuclear Physics & Novosibirsk State University & Novosibirsk State Technical University), Oleg Meshkov, Sergey Sherstyuk, Veronika Boyarkina (Budker Institute of Nuclear Physics & Novosibirsk State University), Victor Dorokhov (Budker Institute of Nuclear Physics).

The Nanogate-38 gated camera with a temporal resolution of 60 nanoseconds was used to measure the transverse beam dimensions in the BEP booster and the VEPP-2000 electron-positron collider. The camera was used in combination with a double-slit interferometer to measure the vertical beam size and with projection optics to construct a transverse beam profile in single-turn mode. Some beam characteristics were measured, such as decoherence time, radiation damping time and fast attenuation time. The purpose of these experiments was to investigate the possibility of using this camera to measure the transverse dimensions of the beam and its emittance, as well as to conduct experiments on accelerator physics at the SKIF synchrotron radiation source.

WEP14 **Bunch resolved transverse beam diagnostics at BESSY II**

Irma Shmidt (Helmholtz-Zentrum Berlin fuer Materialien und Energie GmbH).
Gregor Schiwietz, Günther Rehm (Helmholtz-Zentrum Berlin für Materialien und Energie).

For diagnostics of the different bunch types at the BESSY II electron-storage ring, a streak camera and a fast-gated ICCD camera have been installed at two neighbouring beamlines, both of which are powered by visible light from the same dipole magnet. This contribution is focused on the ICCD camera and its first applications. After an improvement regarding the ICCD repetition rate, the maximum illumination rate exceeds now the BESSY II revolution frequency of 1.25 MHz. Furthermore, we have improved the optical light-transfer system and characterized the optical magnification, the spatial resolution and time resolution of the system. Initial measurements have been restricted to direct bunch-resolved imaging of the 2-dimensional transverse shapes of different types of bunches. Specifically, the Pulse Picking by Resonant Excitation (PPRE) bunch is investigated in more detail. This bunch is horizontally broadened by a quasi-resonant incoherent perturbation and leads to pseudo single-bunch radiation within the complex multi-bunch fill-pattern at the BESSY II storage ring.

WEP15 **Non-destructive beam profile measurements with an Ionisation Profile Monitor (IPM) based on Timepix3&4 Hybrid Pixel Detectors (HPDs)**

Mark McLean (CERN).
Chiara Pasquino, Clara Fleisig, Gabriela Cabrera, Gunn Khatri, James Storey, Juri Joul, Maria Teresa Ramos, William Andrezza (CERN).

Beam Gas Ionization monitors have been in operational use in the CERN PS for two years now, and they were installed in the SPS this year. An overview of the operating principal of the instruments is presented, followed by an update on their development. The mechanical design has been simplified and the Timepix3 devices are now mounted individually for easier assembly and maintenance. Reliability and availability have been improved with a new radiation-hard readout, using the GBTx and bPOL12 devices. Performance has been improved with a SoC Back-End making good use of both the FPGA and the Processing System. We have worked to improve the calibration of the instruments, equalization can now be performed in-situ and we have a procedure to calibrate the response between the four detectors. This paper also presents some example results from the instruments and describes our plans for future developments.

WEP16 **Upgrade of the phase space multiscreen of FERMI Linac**

Marco Veronese (Elettra-Sincrotrone Trieste S.C.p.A.).
Giulio Gaio, Giuseppe Penco, Maurizio Bossi (Elettra-Sincrotrone Trieste S.C.p.A.).

The measurement of the longitudinal phase space at the end of FERMI linac is one of the most important characterization of the electron beam properties prior to delivery to the FEL lines. It is performed using an RF-deflecting cavity in conjunction with a dipole to spread the beam in time and energy. The beam transverse distribution is then measure with a multiscreen. The original multiscreen installed in 2009 had a large FOV with a 45deg YAG orientation and 1.5MPx camera. An upgrade has been devised to improve resolution, frame rate and robustness to COTR contamination. The upgrade design is based on a COTR suppressing geometry, a dispersion minimizing incidence angle, a double mirror vacuum optical layout and a Scheimpflug camera geometry. The optical distortion has been

characterized by using a precision checkerboard target and automatic Matlab nodes detection. This leads to a transformation matrix that is applied at the image server level to the raw image to remove the trapezoidal distortion. The detector is 8 Mpx 10 Gbit/s CMOS camera fiber coupled to the image sever and capable of full frame 50Hz acquisition.

WEP17 **Physical design of an online beam monitor for heavy-ion single event effects tests**

Di Wang (Northwest Institute of Nuclear Technology).
Baichuan Wang, Minwen Wang, Wei Chen, Yihua Yan, Zhongming Wang (Northwest Institute of Nuclear Technology).

Accurate measurement of flux rate is essential in heavy-ion single event effects tests, but it presents significant challenges for monitoring low energy (5~10MeV/u) and low intensity (less than 1E6/s) heavy-ion beams. In this paper, we propose a novel detector that enables real-time monitoring of flux rate by simultaneously measuring the beam intensity and profile using secondary electrons on both the front and back surfaces of thin films. The confinement of secondary electrons through electric and magnetic fields is achieved, with CST simulation conducted to validate the method. This approach offers several advantages over conventional methods, including high spatial and temporal resolution, reduced mass thickness, and multi-parameter measurement capability. Our research expands the application potential of such detectors while providing technical support for radiation measurement in single event effects tests.

WEP18 **Troubleshooting the Ionization Profile Monitor (IPM) for CSNS's 1.6 GeV RCS**

Muhammad Abdul Rehman (Institute of High Energy Physics).
Jilie Sun (Paul Scherrer Institute), Lei Zeng, Renjun Yang, Weiling Huang, Zhihong Xu (Institute of High Energy Physics), Peter Forck (GSI Helmholtzzentrum für Schwerionenforschung GmbH).

Non-invasive and turn-by-turn beam transverse profile monitoring is essential for the tunning and operating CSNS 1.6 GeV Rapid Cyclic Synchrotron. A residual gas Ionization Profile Monitor (IPM) was designed and installed in RCS for horizontal beam profile measurement. However, several challenges related to electromagnetic interference (EMI), vacuum, and MCP operation in the IPM were identified. The EMI is induced by the beam itself and further accelerator components. An improved Faraday cage was implemented to counteract the EMI issues. In order to achieve the desired MCP gain, a suitable pull-down resistor was incorporated into the MCP power supply circuit. After these improvements, the IPM was commissioned successfully. This paper will describe the challenges of IPM and early beam commissioning results.

WEP19 **Fast wire scanner design for Shenzhen Superconducting Soft X-Ray FEL**

Peng Li (Institute of Advanced Science Facilities).
Jiahang Shao, Wei Wei, Weiqing Zhang (Institute of Advanced Science Facilities).

In the Shenzhen Superconducting Soft X-Ray FEL project (S3FEL), it is planned to use a fast wire scanner for online measurement of beam transverse dimensions. The repetition frequency of the beam pulse is 1 MHz, the charge of a single bundle is about 100 pC. According to the different installation positions of the fast wire scanner, the bundle length will vary between 5 ps and 50 fs. The scanning wire adopts tungsten filament with a diameter less than 30 μm, and the motor adopts a linear motor with a designed motion speed of 1 m/s. The position feedback would use two grating rulers, one of which is an absolute grating ruler connected to a PLC controller for motion controlment, and the other incremental grating ruler can directly output TTL signals to trigger the signal acquisition electronics. The grating ruler has a resolution of 50 ns and an overall structural accuracy better than 10 μm. Using the wire position of the incremental grating ruler as the x-axis and the plastic scintillator combined with a photomultiplier tube to detect the beam loss signal as the y-axis, the transverse distribution of the beam is reconstructed.

WEP20 **The project of optical diagnostics of the beam dimensions of the storage ring with ultra-low emittance SKIF**

Victor Dorokhov (Russian Academy of Sciences).
Oleg Meshkov (Budker Institute of Nuclear Physics), Veronika Boyarkina (Budker Institute of Nuclear Physics SB RAS & Novosibirsk State University).

The SKIF, a fourth-generation synchrotron radiation source is being constructed in Russia. This installation has an ultra-low emittance, allowing for high beam intensity in various scientific and technological fields. A crucial aspect of SKIF is its availability of diagnostic instruments that measure the beam transverse dimensions. This will allow for minimizing the emittance during operation and comparing it with a calculated value. This comparison is critical for determining whether the physical setup meets the design specifications. In addition to measuring the transverse dimensions of the beam, it is also important to observe the behavior of the longitudinal profile and measure its parameters with good accuracy. Since the calculated emittance of 75 mrad corresponds to the beam sizes of less than 8 microns at the radiation output sites, a diagnostic complex was developed as part of the working project, including a beam size monitor based on a double-slit interferometer. Observation and measurement of the longitudinal distribution of the beam will be carried out using mutually complementary devices, such as a streak camera and electron-optical dissector.

WEP21 **Transverse emittance measurement using a wire scanner in injector of RAON**

Eunhoon Lim (Institute for Basic Science).
Gi dong Kim, Hyung joo Woo, Jangwon Kwon (Institute for Basic Science).

The Rare Isotope Accelerator Complex for ON-line Experiments (RAON) is a facility designed to produce rare isotope beams using the ISOL and IF methods. RAON has a variety of diagnostic devices to measure beam characteristics. Among them, emittance is an important parameter in determining beam characteristics. RAON was applied the Multi-wire scan and Quadrupole scan methods to measure emittance using a wire scanner. These methods of measurement was confirmed through beam generation and transmission simulation at Python. Afterwards, in the beam commissioning, the beam size were measured by 3 wire scanners installed in the MEBT section and the emittance were calculated from the Multi-wire scan and Quadrupole scan methods. In this poster, we present simulation results and Argon beam emittance measurement results.

WEP23 **Halo monitor for high-intensity hadron beams based on supersonic gas curtain**

Hao Zhang (Cockcroft Institute).
Carsten Welsch, Milaan Patel (The University of Liverpool), Farhana Thesni Mada Parambil (University of Liverpool), Narender Kumar, Oliver Stringer, William Butcher (Cockcroft Institute).

Although there is no clear definition of beam halo in particle accelerators, it is generally regarded as particles outside of the beam core with an intensity level of less than 10-5 or 10-6 of the peaks. In high-intensity, high-power hadron accelerators, the presence of halo particles may cause emittance growth and beam loss, difficulties in beam control and collimation, increase the noise of detectors, and cause activation or even damage to accelerator components. To understand the halo dynamics, experimental studies are essential, but the required detection techniques are often too limited and do not meet the required high dynamic range. In this contribution, a supersonic gas curtain-based profile monitor is considered for beam halo measurement in high-intensity, high-power hadron accelerators. This monitor is based on the beam gas curtain (BGC) monitor, successfully used in the Large Hadron Collider. Instead of a broad curtain with uniform density, a new concept with two shorter curtain segments which can be adapted to the shape of the beam core and aim at the halo particles only is applied. The monitor design and operating principle will be presented, and the anticipated integration time, signal intensity and dynamic range will be discussed, as well as opportunities for increasing the sensitivity by incorporating micro-channel plates or the Timepix detector.

WEP24 **New wire scanner at SXFEL**

Fangzhou Chen (Shanghai Synchrotron Radiation Facility).
Jian Chen, Jian Dong (Shanghai Synchrotron Radiation Facility), Jie Chen (Shanghai Advanced Research Institute), Yongbin Leng (University of Science and Technology of China).

In the past year, the wire scanner at SXFEL is upgraded to a new firmware. Unlike the previous version, where a target frame is equipped with tungsten wires in three directions, the new system uses horizontal and vertical independent scanning methods. The beam loss detector adopts plastic scintillator fiber, and the PMT module is also designed with a Raspberry PI for dynamic signal conditioning. The detailed design is described in this paper.

WEP25 **Accurate beam spot fitting for transverse beam size measurement in the HALF injector**

Dongyu Wang (University of Science and Technology of China).

Bao-gen Sun, MingDong Ma (University of Science and Technology of China).

For the fourth-generation synchrotron radiation (SR) light source, obtaining high-quality light heavily relies on the performance of the injector, which requires the accurate measurement of the transverse beam size. Therefore, an improved beam spot fitting method has been proposed to enhance measurement accuracy. Since beam spots do not always follow a standard Gaussian distribution, traditional Gaussian fitting methods struggle to achieve the required precision. This paper conducts a preliminary analysis of beam spot data to select the most suitable fitting model, including the superposition of two Gaussian distributions, the generalized Gaussian distribution, and the skewed Gaussian distribution. By choosing the most appropriate model, the transverse beam size can be measured more accurately, thereby meeting the high-performance requirements of injectors for synchrotron radiation sources. Experimental measurements were conducted on the electron gun of the injector of the Hefei Advanced Light Facility (HALF), verifying the feasibility of the proposed method.

WEP26 **The design and ideas of non-destructive ionization profile monitors for HIAF synchrotrons and future applications**

Hong Xie (Institute of Modern Physics, Chinese Academy of Sciences).

More than 4 Ionization Profile Monitors (IPM) have been mounted in HIRFL, which play an important role in the beam optics optimization, electron cooling research, and ion-electron recombination study so on since 2016. To meet the profile needs of HIAF project with multiple beam species and high dynamic challenges, mainly two kinds of IPM structure have been chosen. At first, 5 IPMs equipped with the Micro Channel Plates (MCPs) 、Phosphor screen (P46) and camera acquisition have been deployed in Booster Ring (Num. 3) and Spectrometer Ring (Num. 2), which use discrete electrodes for precisely high voltage supplying and can achieve a good spatial resolution around 50 μm. There is also another IPM designed without a P46 and camera for the electron-photon conversion and capture, but a ceramic anode and the fast multi-channel electronics instead. The purpose is to measure a fast turn by turn profile with a least 64 MHz sampling rate for machine studies. Some new features and experiments have also been performed at IMP, like using an IPM for transverse emittance measurements. A compact IPM with one cage measuring horizontal and vertical profiles has also been built and tested, which shows good results under a constraint magnet filed. And a new prototype based on the ionization products captured by a microstrip line or coaxial 50 Ω anode is proposed to measure bunch shapes. It's for sure that the ionization mechanism or yields can be explored more values in the beam instrumentation.

WEP28 **Experience with PSI's Main Ring Cyclotron Long Radial Probe**

Mariusz Sapinski (Paul Scherrer Institut).
Martin Rohrer, Rémi Martinie, Simon Lindner (Paul Scherrer Institut).

A Long Radial Probe is a device that measures the transverse beam profile in a cyclotron along its radius. The current iteration of the probe was installed in the PSI Main Ring Cyclotron in 2022. After a successful start, the probe suffered from a strong coupling to RF-fields leaking from the cavities and breaking the carbon fibres. A series of measures were attempted and produced ambivalent outcomes. This paper describes the challenges and presents the experiments and thermal calculations which led to solving the RF-heating issue.

WEP29 **The Large Hadron Collider's beam wire scanner consolidation**

Jonathan Emery (European Organization for Nuclear Research).
Ana Guerrero, Chiara Pasquino, David Belohrad, Federico Roncarolo, Morad Hamani, Nabil El-Kassem, Raymond Veness, William Andreazza (European Organization for Nuclear Research), Aurelie Goldblatt, Maria Teresa Ramos (CERN).

To serve the needs of the High Luminosity (HL) LHC, a consolidation of the beam wire scanner has been initiated. The instrument is a crucial tool for measuring the transverse beam profile by moving a thin carbon wire across the beam. It can only withstand a fraction of the LHC's nominal beam intensity but provides a reference to calibrate other instruments that operate non-invasively at higher beam intensities. Since the start of the LHC, the scanners have provided hundreds of thousands of measurements, but the design has technical limitations that need to be addressed to provide the required reliability and performance for the HL runs. The initial consolidation phase involved testing the injector's acquisition and control electronics in the LHC to assess its suitability for the specific beam conditions. As part of this process, we updated the mechatronic and motion controller. Beam test campaign has revealed higher performance w.r.t the existing system and a higher adaptability to varying beam conditions. Simultaneously, we are developing a novel actuator that uses a permanent magnets-based coupling replacing the standard bellows and long arm that limits the performance and induces vibrations. Before testing this new concept with beam, we have developed a calibration bench to evaluate the mechanism's precision and accuracy of the wire position determination. This contribution presents the 2023 beam and laboratory tests as well as the electromechanical developments.

WEP30 **Detailed bench investigations and comparison of four low-light cameras**

Peter Forck (GSI Helmholtzzentrum für Schwerionenforschung GmbH).
Leonie Bauer, Serban Udrea (GSI Helmholtzzentrum für Schwerionenforschung GmbH).

Sensitive cameras are frequently operated to record low-light processes such as Beam Induced Fluorescence or optical transition radiation for transverse profile determination. We compared four cameras based on different principles: Firstly, we investigated an Image Intensifier equipped with a double MCP (producer ProxiVision); secondly, an electron-multiplied CCD (emCCD Teledyne Princeton Instruments ProEm+:512B); and, thirdly, sCMOS cameras (producer PCO.edge4.2bi and Teledyne Kinetix 22). LEDs generate light pulses within a wavelength range of 385 to 500 nm and a duration of 0.03 to 8 ms to vary the photon flux. Moreover, the spatial resolution is compared. The image intensifier is the most sensitive camera type and provides very low noise; however, the method provides only a limited spatial resolution. The investigated emCCD camera has a comparable sensitivity but provides a better spatial resolution. The sCMOS cameras provide a factor of about 5 to 10 lower sensitivity depending on wavelength. A quantitative comparison of signal-to-noise ratios and statical fluctuations for several wavelengths will be presented.

WEP31 **Beam profile monitor design at HEPS storage ring**

Dechong Zhu (Institute of High Energy Physics).

High Energy Photon Source (HEPS) is a 6 GeV ultralow-emittance light source, the transverse beam sizes of the storage ring will be less than 10 μm. In order to measure such small beam sizes in both directions, a beam diagnostic beamline with two crossed cylindrical Kirkpatrick–Baez (KB) mirrors was designed. Before that, a test KB imaging system was installed at SSRF to test the performance of KB mirrors. By varying the beam sizes with different skew quadrupole settings, different beam images were observed, the horizontal beam sizes were coincidence with the theoretical values. In this paper, the performance of the test KB system will be introduced, the HEPS diagnostic beamline design will be also introduced.

WEP32 **Long-term performance of the extended pulsed optical timing system**

Fabio Rossi (Elettra-Sincrotrone Trieste S.C.p.A.).
Mauro Predonzani (Elettra-Sincrotrone Trieste S.C.p.A.).

The optical timing system of the FERMI facility recently underwent a significant upgrade to accommodate requests for additional pulsed links for remote lasers or diagnostic stations. Following the successful completion of compliance tests, the long-term performance of the extended system was evaluated through out-of-loop measurements. In the setup each of the two pulsed subsystems, synchronized to the common optical master oscillator, feeds a stabilized fiber optic link. The relative stability between the outputs has been monitored at a remote location. The results achieved and the challenges encountered during the measurements will be discussed.

WEP33 **Synchronization of Peking University THz FEL**

Xiang Zhang (Peking University).

Peking University plans to conduct experimental research on a THz FEL (Terahertz Free Electron Laser) amplifier using a DC-SRF (Superconducting Radio Frequency) electron gun. The DC-SRF electron gun, which is capable of generating high-quality electron beams with high repetition rates and low emittance, is suitable for use in large scientific facilities such as FELs and ERLs. The experimental setup of the THz FEL amplifier mainly includes a

1.3GHz DC-SRF electron gun, a 2.856GHz RF (Radio Frequency) deflection cavity, a 2.4 GHz cavity-based Beam Arrival Monitor (BAM), a 1.3 GHz 2×9 Cell superconducting accelerator module, as well as photocathode drive laser systems and THz seed light systems. The two laser systems have repetition rates of 81.25 MHz and 100 MHz, respectively. Since the operating frequencies of the components on the THz FEL amplifier device are not identical and some frequencies do not have a multiple relationship, clock generation schemes based on PLL (Phase-Locked Loop) or mixers cannot fully meet the experimental requirements. Therefore, we have employed DDS (Direct Digital Synthesis) to generate the key frequencies. Additionally, to ensure the normal operation of the BAM, signal detection and processing of the BAM signals have been implemented based on the KC705 and FMC150 platforms.

WEP34 **Design of an S-band parallel-coupled transverse deflecting cavity with variable polarization for multi-dimensional phase space diagnostics in photoinjectors**

Jiahang Shao (Institute of Advanced Science Facilities).
Weiqing Zhang, Zongbin Li (Institute of Advanced Science Facilities).

Beam quality from photoinjectors is critical for lasing in Free Electron Laser (FEL) facilities. While phase space measurement are usually limited to 2D with conventional methods, the recently-developed transverse deflecting cavities (TDCs) with variable polarization provide the capability to measure multi-dimensional phase space information. Such information could reveal coupling between 2D phase spaces and guide the improvement of beamline setup for optimal lasing performance. In this manuscript, we present the design of an S-band parallel-coupled TDC, in which two chains that deflect beam horizontally and vertically are independently fed by waveguide networks and variable polarization can be obtained by adjusting the relative amplitude and phase between the networks. This structure has several advantages, such as compactness, tunability, high shunt impedance, single-frequency operation, etc. In this manuscript, physical and mechanical design of this TDC as well as preliminary simulation study of multi-dimensional phase space diagnostics in FEL photoinjectors will be presented in detail.

WEP35 **THz resonator based electron beam manipulation**

Xiaoyu Liu (Institute of High Energy Physics).

In recent years, with the development of powerful THz source technologies, THz structures are widely utilized for electron beam manipulation, such as acceleration, deflection, compaction and diagnostics. Taking the bunch length measurement as an example, combining with high field strength and high resonant frequency, the THz structure based deflector could reach femtosecond or even sub-femtosecond resolution. In this paper, a 0.1THz Fabry-Perot resonator based structure will be introduced, which could provide time-dependent deflection for short electron beam to resolve the bunch length with high resolution. By adjusting the relative orientation of the beam direction and the E-field direction of the incident THz source, this structure is also potential for beam acceleration.

WEP36 **Transverse feedback to damp collective beam instabilities, past, present and future**

Takeshi Toyama (High Energy Accelerator Research Organization).

Starting with my first experience of the transverse feedback damper in the KEK 12 GeV PS in 2006, where we tested with analog system and in addition digital controller from SPring-8 team. Since then, digital systems have come to cover almost all the machines. In J-PARC MR bunch-by-bunch transverse feedback system had been introduced with a collaboration at the proton beam power around 150 kW in 2010. The weaknesses of this system quickly became apparent. It can damp only the center of mass motions of the whole bunches. It could not suppress intra-bunch betatron motion with different betatron phase in a different longitudinal bunch position. This happens in the case of a non-zero chromaticity. Then the intra-bunch feedback system was introduced in 2014 with a proton beam power of approximately 250 kW and has been operating successfully to date. But already this system cannot suppress collective beam instabilities in certain chromaticities over proton beam intensity of 2 - 3E+14 protons per pulse. The higher the sampling rate, the higher the damping efficiency. This system is currently under development. The above is for long bunches of 100-200 ns. Trials in case of much shorter bunches will be also reviewed.

WEP37 **Preliminary design consideration for CEPC fast luminosity feedback system**

Meng Li (Chinese Academy of Sciences).
Dou Wang, Haoyu Shi, Jie Gao (Chinese Academy of Sciences), Philip Bambade (Université Paris-Saclay, CNRS/IN2P3, IJCLab), Sha Bai (IHEP).

Future large high-luminosity electron-positron collid- ers such as Circular Electron Position Collider (CEPC), and Future Circular Collider (FCC-ee) require nanometre-sized beams at the interaction point (IP). The luminosity is very sensitive to the beam orbit drifts at the IP. It is essential to have a fast luminosity feedback system at the IP to maintain optimum beam collision conditions and prevent a luminosity degradation due to orbit drifts in the presence of mechanical vibrations and dynamical imperfections. We considered two possible methods for this purpose for CEPC: one based on measurements of the luminosity and the other based on measurements of the beam orbits around the IP. In this paper, we present the preliminary design consideration for a fast luminosity feedback system at the IP of CEPC.

WEP38 **Orbit feedback system in SOLARIS synchrotron, final step implementation and first measurements**

Roman Panas (National Synchrotron Radiation Centre).
Maciej Mleczko, Michal Piekarski, Michal Zurek (National Synchrotron Radiation Centre).

SOLARIS, a third-generation synchrotron radiation source in Kraków, Poland, is dedicated to providing high-brilliance X-ray beams for various scientific disciplines. The successful operation of a synchrotron radiation facility heavily relies on precise control of the electron beam orbit within the storage ring. Orbit deviations, even on a small scale, can adversely affect beam quality, leading to decreased performance and efficiency of experimental setups. To mitigate these effects, an Orbit Feedback System is essential, providing correction of orbit deviations. In this study, we present the implementation of an enhanced Orbit Feedback System consisting of fast and slow orbit correction systems as well as RF drift compensation. System consists of feedback algorithms calculating corrective actions of the actuators (fast and slow correction magnets) based on beam position measurements. We also present first measurements and tests for the system showing its capabilities.

WEP39 **The development of bunch-by-bunch transverse feedback system at SSRF based on RF direct sampling**

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Longwei Lai, Yimei Zhou (Shanghai Advanced Research Institute).

The commonly used bunch-by-bunch transverse feedback system is based on the scheme of analog down-conversion, which down converts the $3f_{RF}$ beam signal to the baseband with a phase adjusted local oscillator. The system contains a large number of analog devices, which make the system complex and vulnerable to environment changes. Today, sampling the high frequency signal directly with high performance ADC is available. A new bunch-by-bunch feedback system based on RF direct sampling is under development at SSRF. The new system structure is much simpler compared to the traditional one and much powerful. The direct sampling processor has 4 input channels, which can simultaneously process horizontal, vertical, large bunch vertical feedback, and bunch charge measurement. The RF processor has 4 ADC channels (maximum sampling rate is 2.6GHz, bandwidth is 9GHz), 4 DAC channels (maximum frequency is 500MHz). The processor uses Xilinx system-on-chip UltraScale+ MPSoC FPGA. Paper will introduce the system structure, the processor design and performance, FIR filter designing and preliminary tests.

WEP40 **The design of SILF fast orbit feedback system**

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The Shenzhen Innovation Light Source Facility (SILF), as a 4th light source, is an accelerator-based multidiscipline user facility planned to be constructed in Shenzhen, Guangdong, China. The accelerator complex is composed of a 200 MeV linac, a booster with ramping energy from 0.2 GeV to 3.0 GeV, and a 3.0 GeV storage ring, and two e-beam transport lines for injection and extraction among accelerators. The circumference of the storage ring is 696 m, which includes 28 hybrid seven-bend achromat (H7BA) lattice periodic units to achieve the emittance below 100 pm·rad. SILF needs to control the beam orbit change within 10% of the cluster size within a certain frequency. In order to meet the beam orbit stability requirements, it is necessary to establish a fast orbit feedback (FOFB) system with field programmable gate arrays (FPGA) to reduce feedback latency and increase

bandwidth. The FOFB system adopt 28 sub-stations with the same hardware and software function to obtain bias-data from the beam position monitors (BPMs) data using 2.38Gbps in the SFPs and send correct-data to the fast corrector power supplies using a serial point-to-point link around the storage ring, and each substation share BPMs data with daisy-chained using of 10Gbps in the SFPs. This paper introduces the FOFB system design outline and progress. Some technical plans and schedules are also discussed.

WEP41 **Overview of SLS 2.0 beam based feedbacks and BPM system**

Boris Keil (Paul Scherrer Institut).
Fabio Marcellini, Goran Marinkovic, Markus Roggli, Pedro Baeta Neves Diniz Santos (Paul Scherrer Institut).

For the ongoing upgrade of the Swiss Light Source (SLS) storage ring, the previous ageing beam-based feedbacks and beam position monitor (BPM) systems are replaced by newly developed versions, where beam commissioning is planned to start in January 2025. Feedbacks include the fast orbit feedback (FOFB), transverse and longitudinal multibunch feedback (MBFB), and filling pattern feedback (FPFB). In this contribution, we give an overview of the architectures and development/production status of these feedbacks and of the BPM system, including latest pre-beam test results.

WEP42 **Directly driving GHz-range power amplifiers with RF systems-on-chip for the SLS 2.0 longitudinal multibunch feedback**

Boris Keil (Paul Scherrer Institut).
Goran Marinkovic, Pedro Baeta Neves Diniz Santos (Paul Scherrer Institut).

In the past, the longitudinal multibunch feedback (MBFB) at the Swiss Light Source (SLS) storage ring had used an analog upconverter to translate the output signal of a 500 MSample/s DAC to the 1.25-1.5 GHz operation frequency range of the longitudinal MBFB kicker magnet and its power amplifier. For SLS 2.0, we have investigated the possibility to drive the power amplifier of a newly designed kicker (operating at 1.75-2 GHz) directly with the multi-GHz / multi-GSample/s DACs of an RF System-on-Chip (RFSoC). First lab test results with the new SLS 2.0 kicker magnet and its power amplifier are presented. Related methods for RFSoC-based bunch-to-bunch crosstalk compensation in the presence of transient beam loading and 200ps range arrival time variations along the bunch train are also presented. Moreover, the latest status and plans for our MBFB firmware/software implementation on an RFSoC will be given.

WEP44 **Transverse feedback system commissioning for hybird operation mode in SSRF**

Ning Zhang (Shanghai Advanced Research Institute).
Longwei Lai, Renxian Yuan (Shanghai Advanced Research Institute).

In SSRF phase II upgrade project, , a specified hybrid bunch was designed to be injected up to 20mA in Hybrid Filling Pattern. Although it is currently unclear to what extent the transverse instability would affect the accumulation of the hybrid bunch current , the beam-line station still hopes to obtain higher luminous flux. For this purpose, an independent feedback loop has been added to the transverse feedback system to suppress the transverse oscillation caused by the hybrid bunch. This paper would describe the system commissioning and related experiment.

WEP45 **New fast orbit feedback system using MicroTCA Based BPM electronics for the PF-ring**

Ryota Takai (High Energy Accelerator Research Organization).
Hidenori Sagehashi, Mami Shiozawa, Mikito Tadano, Takashi Obina (High Energy Accelerator Research Organization).

The upgrade of the fast orbit feedback (FOFB) system is currently underway at the PF-ring. The new FOFB system consists of MicroTCA-based BPM electronics and a feedback control (FBC) unit. The BPM electronics are prepared with the same number as BPMs and synchronously transmit 10-kHz rate beam position data to the FBC unit via an optical data link. The FBC unit immediately calculates the closed orbit distortion from the received position data and performs an inverse matrix operation to correct it. The results are converted to analog signals by fast D/A converters and set to power supplies of the fast steering magnets. The primary goal of the new FOFB system is to archive a closed-loop bandwidth of 100 Hz, which is about 100 times the current system performance. Details on the new BPM electronics and the new FOFB system using them will be presented as well as some initial results obtained during beam tests.

WEP46 **Application of reinforcement learning for efficient beam tuning in CiADS room temperature front-end prototype accelerator**

Chunguang Su (Institute of Modern Physics, Chinese Academy of Sciences).
Yu Du, Zhijun Wang (Institute of Modern Physics, Chinese Academy of Sciences).

In proton accelerators, nonlinear effects, such as space charge effects and fringe field effects, significantly contribute to the nonlinear characteristics of beam dynamics and control strategies. These nonlinear characteristics increase the degree of coupling between accelerator control elements, complicating the beam commissioning process and extending beam tuning time. Reinforcement Learning (RL) is adept at swiftly formulating decisions contingent upon the prevailing system state and control demands, thereby offering an efficacious control strategy for accelerator systems. We have conducted a study on beam tuning based on reinforcement learning for application in the beam tuning process of the current CiADS room temperature front-end prototype accelerator. The goal of this research is to enhance the efficiency of the tuning process. To achieve this, we trained RL agents in a simulated environment. Subsequently, the successfully trained agents will be tested in the real accelerator environment to validate their effectiveness.

WEP47 **Deep learning framework for fault detection in accelerators**

Michal Piekarski (National Synchrotron Radiation Centre).

The main goal of NSRC SOLARIS is to provide the scientific community with high-quality synchrotron light. To achieve this, it is necessary to constantly monitor many subsystems responsible for beam stability and to analyze data about the beam itself from various diagnostic beamlines. This work presents an in-depth analysis of multi-modal, deep learning-based frameworks for fault detection within big research infrastructures, with a specific focus on accelerator facilities. The study explores diverse approaches and architectures for identifying anomalies indicating potential faults in operation. At the present stage, a binary classification is performed: stable beam operation or unstable beam operation / no beam with the accuracy of 90%. The models and the results obtained so far are discussed, along with plans for future development.

WEP50 **Research on visualization and indexing of PV data based on the ELK stack**

Yukun Li (Institute of High Energy Physics).
Jianshe Cao, Qiang Ye, Yaoyao Du (Institute of High Energy Physics).

This paper presents a comprehensive solution for the real-time collection and analysis of BPM telemetry data using Kafka and the ELK stack. It includes the transmission of PV variables from BPM electronic devices to the Kafka message queue, thus realizing a powerful and scalable data streaming process. By retrieving JSON formatted data from Kafka using the ELK stack, efficient data indexing and visualization in Kibana are achieved. The paper details the architectural design, implementation details, and the advantages of using Kafka as a BPM data dissemination center. This integration not only enhances the performance and reliability of the data processing pipeline but also provides physicists and engineers with powerful tools for the real-time visualization and monitoring of BPM data. Our approach has shown significant improvements in data accessibility, searchability, and real-time analytics, offering profound implications for future research and development in the instrumentation and diagnostics of particle accelerators.

WEP51 **New graphical application for high-level synchrotron control with particular emphasis on the correction module**

Maciej Mleczko (National Synchrotron Radiation Centre).
Edyta Beyer, Piotr Andryszczak, Wiktoria Wiatrowska (National Synchrotron Radiation Centre).

SOLARIS, as a big-science facility, is obliged to provide the best possible conditions for conducting research. Due to the complex nature of synchrotron subsystems, we have met our needs and created the most convenient control system possible. The result of our work is a new graphical application for operators offering high level control over the most crucial subsystems of the synchrotron during beam injection and ramping. Moreover operator has now possibility to manage newly implemented mechanism for beam correction at one place. Application was developed in Python based on Tango Controls framework and PyQt library.

WEP52 **Data acquisition and processing platform design for SHINE wire scanners**

Jian Dong (Shanghai Synchrotron Radiation Facility).

Fangzhou Chen, Luyang Yu, Renxian Yuan (Shanghai Synchrotron Radiation Facility), Jie Chen, Shanshan Cao (Shanghai Advanced Research Institute).

Shanghai High repetition rate XFEL and Extreme light facility (SHINE) accelerates electrons to 8GeV with a high repetition rate of up to 1MHz. Wire Scanner stations are used to measure beam profile and emittance at SHINE. The data acquisition and processing platform for Wire Scanners are required to acquire time-stamped readings for each individual bunch. The platform consists of three parts: BLM (Beam Loss Monitor) data acquisition, BPM (Beam Position Monitor) data acquisition, and measurement software. The BLM data acquisition is used for collecting BLM head signal, parsing grating-ruler signal, and receiving White-Rabbit timestamp. The BPM data acquisition is used for collecting SBPM head signal, computing the beam position, and receiving White-Rabbit timestamp. The both acquisition parts have some common parts, so a generic FPGA carrier is designed which provides FPGA-based pre-processing and EPICS IOC by using MPSOC. While the BLM head signal and BPM head signal have different spectrums, so different mezzanine boards are designed for high-speed sampling. The measurement software running on a server is implemented by Python. The software can control the scanning mode, collect the BLM and BPM data, and calculate the beam profile and emittance. Finally, the prototype of data acquisition and processing platform is installed in Shanghai soft X-ray Free Electron Laser (SXFEL). The experimental results show that the platform can be used for SHINE.

WEP53 **High performance generic beam diagnostic signal processor for SHINE**

Yuxin Han (Shanghai Institute of Applied Physics).
Longwei Lai, Yimei Zhou (Shanghai Advanced Research Institute).

A generic signal processor has been developed for beam diagnostic system in SHINE. The stand-alone processor is used for the signal processing of stripline BPM, cavity BPM, cold button BPM, beam arrival measurement, bunch length measurement and other diagnostic systems. The main core is an SoC FPGA, which contains both quad-core ARM and FPGA on a chip. The ARM runs LINUX OS and EPICS IOC, and FPGA performs peripheral interfaces and high-speed real-time signal processing. An FMC carrier ADC board is mounted, which can sample 4 channels input signal with a maximum sampling rate of 1GSPS. The processor is equipped with a White Rabbit timing card, which can realize 1MHz high repetition rate synchronous measurement. Lab test results and on-line beam tests prove that the processor has high performance. This paper will introduce the processor development and applications on SHINE.

WEP54 **Application of open source hardware in the beam loss monitor system**

Ying Zhao (Institute of High Energy Physics).

The Beam Loss Monitoring system (BLM) for the HEPS booster ring consists of 27 plastic scintillators and 4 optical fibers. An open source hardware is used in the data acquisition of the Scintillator BLM system, to monitor the beam loss during the injection and energy ramping process. Design details and application is described in this paper and the commissioning results of is also present.

WEP55 **High-speed ADC and high-speed DAC MicroTCA.4 AMC-RTM pair for a multiple of diagnostics and feedback implementations**

Szymon Jablonski (Deutsches Elektronen-Synchrotron).
Behzad Boghrati (Deutsches Elektronen Synchrotron), Cagil Guemues (DESY), Holger Schlarb, Johannes Zink, Michael Fenner, Sven Pfeiffer, Uros Mavric (Deutsches Elektronen-Synchrotron).

We present the MicroTCA.4 electronics, an AMC-RTM pair, for direct sampling of wideband signals with high-speed ADCs, versatile digital signal processing with a SoC FPGA and driving of wideband signals with high-speed DACs. Its core component is the Zynq UltraScale+ RFSoC Gen 3. The RFSoC IC was mainly designed for the telecommunication and RADAR systems, however, it is also planned for manifold scientific experiments, which are shortly introduced in this paper. Not only a multiple of diagnostics can be implemented, but also wideband feedbacks due to driving capabilities of DACs. A hardware architecture is presented, which provides in-formation how the modules can be set up and configured for a particular application. The performance and functionalities are discussed with special focus on system noise, which is a great importance for high-precision scientific research.

WEP56 **Design of beam collimator control system for HEPS**

Shutao Zhao (Institute of High Energy Physics).
Chunhua Li, Haijing Wang, Jia Liu, Jianshe Cao (Institute of High Energy Physics), Dapeng Jin, Siyu Chen (Chinese Academy of Sciences), Nian Xie.

The primary function of the HEPS (High Energy Photon Source) collimator is to intercept lost particles induced by the Touschek effect, thus localizing beam loss and reducing it outside the collimator region. It also acts as a dump in emergency situations to meet equipment protection requirements. The collimator control system utilizes EtherCAT bus technology for precise motion control of the scraper. It interfaces with the EPICS system through modbusTCP, enabling remote operation from the HEPS control room. Due to its location in a high-radiation zone, the control system's drive components were selected for their special radiation resistance. On-site testing confirmed stable, precise movement of scraper meeting design requirements, and smooth operation of the remote control system.

WEP57 **Design and development of embedded EPICS system for beam measurement electronics**

Jianjun Su (Institute of Modern Physics, Chinese Academy of Sciences).
Junxia Wu, Kewei Gu, Long Jing, Ruixia Tian, Yuan Wei, ZhiXue Li (Institute of Modern Physics, Chinese Academy of Sciences).

The embedded EPICS control system for beam measurement is implemented based on the Zynq 7z020 SoC, which enables efficient and reliable real-time data acquisition, transmission, processing, and PV publishing of embedded IOCs. The data acquisition module uses a 24-bit ADC with a sampling frequency of 10Msps, which enables continuous sampling and data processing of detector signals, and interlocking signals can be output within 10μs. Data transmission and communication from the PL to the PS is achieved through the AXI bus, and the real-time data of different BRAMs and registers is accessed by manipulating memory base addresses and offsets. The ADC raw data with a continuous data rate of 200K/s can be stored without losing points. Through long-term online testing, the beam measurement electronics system can accurately monitor beam signals, output interlocking signals in a timely manner, and the software and hardware systems work stably and reliably for a long time. It can be widely used for signal measurement of beam loss, CT, Faraday cup, integral coil, power ripple, ionization chamber, wire scanner, etc.

WEP58 **Beam diagnostics control system upgrade of IPM LINAC**

Pedram Navidpour (Iranian Light Source Facility).
Samira Mohammadi Alamouti, Zahra Rezaei (Iranian Light Source Facility).

A series of upgrades has now begun to industrialize the applications of the experimental IPM electron LINAC. This includes upgrading the control system of the diagnostics tools and adding new tools and equipment to the system as well. We are aiming to build an integrated control system to collect and manage all diagnostics signals. This will allow us to continuously monitor and archive all of the beam parameters for LINAC performance analysis and improvement. It is hence decided that we migrate from LabVIEW to an EPICS-based control system which has many advantages in this regard. In the meantime, it is also required to employ more modern equipment with better control interfaces and add some extra diagnostics tools to the system as well. So during this upgrade, most of the job would be developing new control interfaces and high-level applications accordingly. In this paper, after a brief summary of the current diagnostics tools and our motivation for this upgrade, the scheme of the new control system and how different parts are integrated to the EPICS framework will be described.

WEP59 **Beam profile monitoring using incoherent Cherenkov Diffraction Radiation and scintillating screens at ILSF**

Zahra Rezaei (Iranian Light Source Facility).
Mohsen Akbari, Narges Khodabakhshi, Pedram Navidpour, Samira Mohammadi Alamouti, Sasan Ahmadiannamin (Iranian Light Source Facility), Zahra Pouyanrad (Amirkabir University of Technology).

The Iranian Light Source Facility (ILSF) plays a crucial role in advancing accelerator science and applications. In this study, we explore innovative techniques for precise beam profile monitoring, focusing on two complementary methods: Incoherent Cherenkov Diffraction Radiation (ChDR) and scintillating screens. Incoherent ChDR occurs when a charged particle passes through a dielectric medium with a velocity exceeding the phase velocity of light in

that medium. This phenomenon leads to the emission of electromagnetic radiation in the form of a cone. Our investigation focuses on incoherent ChDR as a powerful tool for beam position diagnostics. By analyzing the angular distribution of ChDR photons, we extract valuable information about the transverse position of the electron bunch. Our simulations demonstrate the feasibility of ChDR-based diagnostics at ILSF. We discuss optimal radiator materials, geometries, and detection strategies. In addition, we also present our findings on scintillating screen calibration, spatial resolution, and dynamic range. We believe that our research significantly contributes to the development of robust and efficient beam diagnostics at the storage ring of ILSF. By investigating Cherenkov Diffraction Radiation (ChDR) and utilizing radiation from scintillating screens, we enhance accelerator performance and facilitate future experiments.

WEP60 **Integrating InfluxDB and Grafana in a Dockerized CA EPICS Monitoring System**

Ziyang Qi (Harbin Institute of Technology (HIT)).
Jianli Liu, Zhiqiang Shen (Harbin Institute of Technology (HIT)), Liangchao Zhao, Qiming Chen.

A data monitoring system based on CA and EPICS designed for particle accelerators is proposed, which leverages Docker containers for deployment and integrates InfluxDB for data storage and Grafana for data visualization. The Data Collection Engine built with Python gathers data through EPICS Channel Access, caches it temporarily, and stores it permanently in InfluxDB. A two-level cache design is used to optimize data access. The monitoring system also offers a web application for configuration management and a web application for online data access and visualization in real-time, which provides a powerful and user-friendly solution for data collection, storage, visualization, and management in particle accelerator experiments.

WEP61 **Profile measurement of beam for 230MeV proton therapy cyclotron using scanning wires**

Tianyi Jiang (China Institute of Atomic Energy).
Qiqi Song, Tianjue Zhang, Yongjun Ma, yang Wang (China Institute of Atomic Energy), Zhiguo Yin (North China University of Technology).

For the 230MeV proton therapy cyclotron, the beam profile is crucial for the adaptation of the proton therapy planning system and an important basis for the commissioning of the beam line. At present, most of the proton therapy facilities use ionization chambers to measure beam profile, which has limited resolution, difficult manufacturing and high cost. China Institute of Atomic Energy (CIAE) designed the scanning wires diagnostic device for the proton therapy facility, which can realize high-resolution profile measurement. A readout electronic unit with fA resolution has been included to adapt to the low secondary electron emission rate of high-energy protons. The data acquisition part uses ZYNQ-7035 together with the 24-bit ADCs and transmits measurement results via MODBUS TCP protocol. The diagnostic electronics are placed close to the profile monitors to reduce the analog signal transmission distance. To adapt to the mode of the macro-pulse in the beam commissioning stage, a signal processing algorithm including a pulse detection method is designed, which can distinguish the frequency of macro-pulse. Besides that, A Butterworth filter and a Smooth filter have been used to filter measurement noise. The design of this wire scanning measurement system will be reviewed in this paper, together with several measurement results.

WEP62 **Design of AMC board according to MicroTCA.4 for BPM and LLRF application**

Haoyan Yang (Tsinghua University).
Bo Liang, Jianmin Li, Lin Jiang, Qiutong Pan, Yinong Liu (Tsinghua University), Liangjun Wei, Tao Xue (Tsinghua University in Beijing).

Beam position monitors are critical to ensuring that particle beams pass correctly through the various components of an accelerator, especially in high-precision experimental facilities such as colliders and synchrotron radiation sources. In recent years, in order to improve the performance and reliability of BPM systems, electronic systems based on MicroTCA have been widely developed and applied. MicroTCA is an advanced modular electronic platform that supports multiple AMC boards to operate on the same backplane and achieves a high degree of data integration and processing capabilities through high-speed backplane interconnection. In addition, the advanced management functions provided by the MicroTCA platform, such as power management, cooling control and module monitoring, further enhance system reliability and stability. The AMC board core chip developed in this study is

based on Xilinx KU060 FPGA and has powerful data processing capabilities; the AMC connector supports Ethernet and 4-lane PCIe Gen3 links; it adopts the Zone3 adapter+dual FMC architecture, which can receive RTM transmission through Zone3 In addition to the signals. It can also directly use the FMC card to receive signals through the AMC front panel, supporting up to 16 channels of 125MHz ADC. In addition to core functions, this AMC board also has a data pre-processing function, which can perform preliminary processing and compression of data before sending it to the MCH.

WEP63 **Design and performance test of 8 channel 125 MS/s digitizer with 16-bit resolution for BPM and LLRF application**

Qiutong Pan (Tsinghua University).
Bo Liang, Haoyan Yang, Lin Jiang (Tsinghua University), Liangjun Wei, Jianmin Li, Tao Xue (Tsinghua University in Beijing).

In an accelerator, the Beam Position Monitor (BPM), which typically consists of beam position probe and electronics, plays a role of providing information on the position of the beam in the vacuum chamber at the monitor location. The low-level RF (LLRF) control system is mainly used to control the high-frequency field and resonant frequency of the accelerating cavity to ensure the stable operation of the accelerator and output high-quality particle beams. In order for particle gas pedals to deliver higher quality particle beam streams, high performance electronics are needed to match them. This paper introduces the development and testing of an 8-channel 16bit 12MSPS FMC card for BPM/LLRF applications. Test results show that this design is characterized by low noise and meets the requirements of BPM/LLRF applications.

WEP64 **High-resolution quad-channel picoammeter: characterization and commissioning**

Lucas Tanio (Brazilian Synchrotron Light Laboratory).
Fernando Cardoso, Mauricio Donatti (Brazilian Synchrotron Light Laboratory).

To address the high demand for precise low current measurements at the Sirius accelerator and its beamlines, a quad-channel high-resolution Ethernet picoammeter has been designed*. The instrument can measure currents ranging from picoampere to milliampere across eight selectable ranges, featuring integrated ADCs enabling sample rates of up to 2 ksps and synchronization capabilities. This work aims to describe the design, characterization, and calibration results of the instrument. Special attention will be given to evaluating trigger latency, synchronization outcomes, as well as the device's installation and commissioning at beamlines, particularly for critical applications like on-the-fly scanning experiments. Furthermore, we will explore the interplay between trigger period, digital filter bandwidth, and front-end analog bandwidth to optimize signal-to-noise ratio in specific applications.

WEP65 **Design of data transmission scheme based on RDMA**

Yuqiao Zhang, Min Li (Institute of Modern Physics, Chinese Academy of Sciences).
Jiaxu Hou, Kai Zhou, Ruishi Mao, Zhenan Liu (Institute of Modern Physics, Chinese Academy of Sciences).

With the development of precise radiotherapy, high-throughput data transmission has become a critical component of beam diagnostics, i.e. for closed orbit feedback in the synchrotron, beam profile images captured with view screens, and medical images generated at the therapy terminal. As the volume of generated measurement data rapidly increase, the data transmission mode that utilizes traditional Ethernet protocol can not meet the transmission performance requirements. To break the bottleneck, this paper designs a prototype data transmission system based on RDMA technology. By directly transferring memory data between hosts, the system bypasses the operating system kernel and CPU intervention, thereby minimizing transmission latency and enhancing data throughput. The system utilizes the RoCE v2 network protocol and is implemented through the libibverbs dynamic link library to establish stable RDMA sessions and develop corresponding network programs. It uses TCP sockets to exchange control information, ensuring that both parties reach a consistent state before data transmission. Performance evaluations indicate that the network transmission scheme proposed in this paper offers lower latency, higher throughput, and reduced CPU usage compared to schemes using the TCP protocol. Additionally, the optimization of resource management strategies such as the use of Multithreaded Development and Shared Receive Queue ensures the efficient and dynamic management of system resources.

WEP66 **Slow control system of CEE-TPC**

Min Li (Institute of Modern Physics, Chinese Academy of Sciences).
Jinmei Dong, Kai Zhou, Peng Li, Ruishi Mao, Weilong Li, Xianglun Wei, Yuqiao Zhang (Institute of Modern Physics, Chinese Academy of Sciences), Herun Yang, Limin Duan, Yuhong Yu ((Institute of Modern Physics, Chinese Academy of Sciences), Youjin Yuan (University of Chinese Academy of Sciences).

The Time Project Chamber (TPC) serves as the core detector of the CEE spectrometer, which accurately measures dE/dx, momentum information, and charged particle tracks in the final state of large angularly separated reaction products of nuclear reactions at the Cooling Storage Ring External-target Experiment (CEE) at the Heavy Ion Research Facility in Lanzhou (HIRFL). It is used to investigate scientific questions related to the phase structure of low-temperature, high-density nuclear matter and the asymmetric equation of state of high-density, low temperature nuclear matter. A slow control system (SCS) was designed and implemented using the Experimental Physics and Industrial Control System (EPICS) software toolkit to monitor and control the TPC's operation, front-end electronics and environmental conditions in real time in order to achieve precise position and time measurements with this detector. Approximately 6000 control and monitoring information exchanges have been implemented through the process variables (PVs) in this architecture. In this paper, we describe the design of the SCS, its hardware and software components, commissioning and operation, as well as its performance.

WEP67 **Design and implementation of a high-precision time to digital converter based on ZYNQ 7000**

Jiaxu Hou, Ruishi Mao (Institute of Modern Physics, Chinese Academy of Sciences).
Lifan Liu, Min Li, Yuqiao Zhang, Zhenan Liu (Institute of Modern Physics, Chinese Academy of Sciences).

Time measurement technology is widely used in modern nuclear physics and particle physics experiments, aerospace and laser ranging etc. As its core technology, time to digital converter (TDC) is increasingly important. This paper presents a high-resolution TDC implemented in Xilinx ZYNQ 7000 device with a new encoder. This design introduces a novel pipeline-multiplexer encoder that realizes 'bubble_proof' by using a coarse-fine counter method based on the FPGA carry chain. In comparison to the conventional Wallace tree encoder, the proposed design exhibits reduce hardware and area requirements, as well as a shorter critical path. Additionally, the propagation delay time per delay cell (bin width) is dependent on the temperature and power supply voltage of the hardware circuit, automatic calibration of the ARM is necessary to ensure optical performance. The resolution of differential nonlinearity (DNL) and integral nonlinearity (INL) is approximately 11ps.Gaussian fitting indicates that the precision of this system is within 50ps, which is in accordance with the desired design specification.

WEP68 **Research on neutron instrument streaming data processing at CSNS**

Peixun Shen (Institute of High Energy Physics).
Jian Zhuang (Institute of High Energy Physics, Chinese Academy of Sciences), haiyun teng (Chinese Academy of Sciences).

In this study, we first conducted in-depth research on the reading and processing methods for streaming data applicable to neutron spectrometer experiments, based on the experimental methods and data processing requirements of neutron spectrometers and the data flow characteristics of distributed streaming data transmission platforms. We designed and implemented a general neutron spectrometer data stream reading and processing framework (NSDRP) to solve various problems encountered by the streaming data transmission platform in the application of neutron spectrometer experiments.100K messages of each Kafka topic are tested with NISDRP, the data reading and processing speed of NISDRP can reach 1000+Hz, which far exceeds the most Spallation Neutron Source. The NISDRP supports multiple types of data sources and can perform real-time processing and conversion of data streams. Additionally, we implemented a web-based user interface to facilitate experiment data processing and analysis, improving the efficiency and convenience of data processing. Finally, we used the framework to process and analyze experimental data, and compared and evaluated it with traditional file-based data processing methods. The results show that the framework significantly improves the processing efficiency and reliability of neutron spectrometer experimental data. This research outcome has important implications for data processing and application in neutron spectrometer experiments and related fields.

WEP69 **Design and implementation of mass spectrometer database**

Lifan Liu, Ruishi Mao (Institute of Modern Physics, Chinese Academy of Sciences).
Jiaxu Hou, Min Li, Yuqiao Zhang, Zhenan Liu (Institute of Modern Physics, Chinese Academy of Sciences).

Mass spectrometer, as a type of beam instrument, is capable of measuring and analyzing the mass and charge of different molecules and ions in a sample, thus identifying the type of particles. Mass spectrometer database software is an important part of mass spectrometer, which can realize the function of storing, managing, sharing and analyzing mass spectrometer data. Therefore, the establishment and improvement of specialized mass spectrometry databases and library retrieval techniques can facilitate the rapid identification and confirmation of compounds, providing a more efficient and accurate solution for substance detection. In this paper, a comprehensive mass spectrometry database management system is designed and implemented to simplify the user operation process from the collection, storage and management of mass spectrometry data to the querying, matching and analyzing of the data, providing a fast and accurate solution to meet the needs of scientific research on mass spectrometry data. The software uses Python for the implementation of core algorithms, builds a database based on MySQL and collects mass spectrometry data to fill in the database, and finally uses PyQt to design and implement a friendly and beautiful graphical user interface. With this software, unknown compounds in the samples can be identified and their possible structures and properties can be recognized, which provides a strong support for their application fields.

WEP70 **A generic distributed stream-processing framework for neutron spectrometer data process based on the asynchronous aggregation network**

Haiyun Teng (Chinese Academy of Sciences).
Jiajie Li (Chinese Academy of Sciences), Jian Zhuang (Institute of High Energy Physics, Chinese Academy of Sciences).

In the recent project of China Spallation Neutron Source (CSNS), a new designed distributed stream-processing framework is applied as the fundamental schema of data process system on user cooperative instruments. It is constructed with the open-source Apache Kafka software, which aims to aggregate the big data for manipulate sharing, and also with an synchronous trigger & tagging system, which provide synchronous mark for various data sources. Correlation could be identified among different measurements and subsystems to perform asynchronous manipulation，while quasi real-time characteristics is another profit from the stream-processing framework. Efficiency and adaptability of this technical framework has been verified during the operation of constructed user cooperative instruments in CSNS. An increasing number of data-processing functions and experiment methods have got benefit from it.

WEP71 **Design of beam energy adjustment system for heavy ions testing of space electronics**

Alexander Bakerenkov (Branch of JSC URSC - ISDE).
Georgiy Starodubtsov, Igor Skorkin, Pavel Chubunov (Branch of JSC URSC - ISDE).

Electronic components in spacecrafts and satellites are subjected to impact of high energy particles and heavy ions. Radiation damage of semiconductor electronic devices depends on linear energy transfer (LET) of the particle in semiconductor material which the device is fabricated of. During radiation testing of electronic components for space applications in particle accelerators we have limited set of ions with fixed energies and LET values due to complexity of adjustment of accelerator systems. According to standard test methods it is necessary to perform tests for several LET values in range from 1 to 100 (MeV*cm^2)/mg. It is possible to enhance available LET range using special screens with different thickness (degraders) to decrease initial energy of particles and adjust LET value without reset of the accelerator for another ion type or energy. It can significantly reduce complexity and duration of test processing. In this work by numerical calculations we have designed a set of degraders, which enable us to obtain almost any LET value from 1 to 100 (MeV*cm^2)/mg in silicon devices using only four ion types with fixed energies that is acceptable for all test procedures.

WEP72 **Compact semiconductor sensor for monitoring of energy distribution in heavy ion beams**

Alexander Bakerenkov (Branch of JSC URSC - ISDE).
Georgiy Starodubtsov, Igor Skorkin, Pavel Chubunov (Branch of JSC URSC - ISDE).

During experiments in particle accelerators online monitoring of energy distribution in particle beam is useful for correction of the accelerator setting and parameters. Time of flight (ToF) technique for energy monitoring is well known and approved method, which is used widely. Nevertheless, ToF technique requires long flight bases especially for high energy particles and can't be used to estimate spatial heterogeneity of the particle beam. Semiconductor energy sensors are compact and can be successfully used for these applications. Diodes with p-i-n structure are used for energy monitoring of particles with rages less than thinness of sensitive volume. High energy particles have long ranges in semiconductor materials. For online monitoring of high energy beams in this work we propose and experimentally verified a technique based on determination of linear energy transfer (LET) values of particles using diode structures with p-n junctions. Experimentally obtained LET value enables us to calculate energy if the particle type and diode semiconductor material are known. Proposed technique was successfully experimentally verified.

12-Sep-24 09:00 – 10:20 China Hall 2

THA: Longitudinal Diagnostics and Synchronization

Chair: Hirokazu Maesaka (RIKEN SPring-8 Center)

THAT1 09:00 **Latest achievements in femtosecond synchronization of large scale facilities**

Sebastian Schulz (Deutsches Elektronen-Synchrotron).

This tutorial addresses the realm of electrical, hybrid and specifically optical schemes for achieving a facility-wide synchronisation on the femtosecond level at free-electron lasers (FELs). After a brief introduction to the fundamental principles behind FEL operation and the significance of synchronisation for fully utilising their capabilities. Subsequently, it discusses various methods employed to achieve femtosecond-precision synchronisation, including low-noise timing references, different active stabilisation techniques, and advanced feedback algorithms. In addition, the tutorial provides an overview of the numerous challenges encountered in femtosecond optical synchronisation and solutions developed to overcome them. It discusses technological developments, such as ultra-stable optical lasers or timing diagnostics both for optical pulses and electron beams. Moreover, practical considerations for implementing such systems in FEL facilities are addressed, including stability requirements, scalability, and integration with experimental setups. Results from recent studies highlighting successful synchronisation implementations at prominent FEL facilities are presented.

THAI2 09:50 **Cost-effective time-stretch Terahertz electro-optic recorders, by using 1550 nm laser probes**

Christelle Hanoun (Laboratoire de Physique des Lasers, Atomes et Molécules).

Photonic time-stretch is a powerful method for recording electro-optic signals with terahertz bandwidth and high repetition rates. The method consists of modulating a chirped laser probe with the signal of interest. Then, the laser pulse is stretched it in time up to several nanoseconds, so that it can be read using an oscilloscope or ADC board. This technique has been shown to be efficient for monitoring the dynamics of Coherent Synchrotron Radiation (CSR) at SOLEIL, and to study electron bunch shape dynamics at KARA. However, the use of this technique has been strongly limited by the need of high bandwidth and costly oscilloscopes required for the readout. We present here a new design that allows a considerable reduction of the required oscilloscope bandwidth. A key point consists of using the 1550 nm wavelength for the probe. We will also present results obtained at SOLEIL, where THz pulses have been recorded, in single-shot and at MHz repetition rates, using an oscilloscope and ADC board with 1 to 3 GHz bandwidth.

12-Sep-24 10:50 – 12:30 China Hall 2

THB: Machine Parameter Measurements

Chair: Peter Forck (GSI Helmholtzzentrum für Schwerionenforschung GmbH)

THBI1 10:50 **High-dimensional and ultra-sensitive diagnostics for electron beams**

Sonja Jaster-Merz (Deutsches Elektronen-Synchrotron).

Detailed knowledge of particle beam properties is of great importance to understand and push the performance of existing and next generation accelerators. This includes full knowledge of the particle distribution but also the characterization of femtocoulomb (fC) charge beams. We recently proposed a new phase space tomography method to reconstruct the full 5-dimensional (5D) phase space, i.e., the charge density distribution in all three spatial directions and the two transverse momenta. In this contribution, we first present the experimental demonstration of the method at the FLASH Forward facility at DESY. This includes the reconstruction of the full 5D phase space distribution of an electron bunch, the use of this measured phase space to create a particle distribution for highly-realistic simulations, and the extraction of the 4D slice emittance. In a second part, we address the characterization of fC charge beams and present a diagnostic device based on silicon strip sensors that is able to measure the profile, time structure, and charge of beams with low charge density. The device demonstrates the applicability of silicon sensors as versatile beam instrumentation devices and can extend the capabilities of existing diagnostic devices to a new charge range.

THBI2 11:20 **Nondestructive beam energy measurement using RF cavity beam arrival time monitor**

Shanshan Cao (Shanghai Advanced Research Institute).

Beam energy is one of the key factors for those free electron laser facilities (FEL). There are several methods to detect the beam energy. One of the commonly used nondestructive systems measures the bunch position in a magnetic bunch compressor with a beam position monitor (BPM). A chicane stripline beam position is utilized for this purpose at the Shanghai Soft X-ray FEL facility (SXFEL). However, this method is highly related to the initial bunch position before entering the chicane. A new nondestructive beam energy measurement system is proposed, which uses two cavity-based bunch arrival time monitors to measure the bunch flight time. This paper introduces the development of this system, including the design details, build-up, as well as measurement results. Moreover, it also covers the comparison of the two different bunch energy measurement methods from several aspects: bunch position-based and bunch flight time-based.

THBC3 11:50 **Laser modulator for SSMB used as a diagnostic tool**

Arnold Kruschinski (Helmholtz-Zentrum Berlin fuer Materialien und Energie GmbH).
Joerg Feikes (Helmholtz-Zentrum Berlin für Materialien und Energie GmbH), Arne Hoehl, Roman Klein (Physikalisch Technische Bundesanstalt Institut Berlin), Xiujie Deng (Tsinghua University in Beijing).

At the Metrology Light Source in Berlin, the concept of Steady-state microbunching (SSMB) is evaluated in a proof-of-principle (PoP) experiment. SSMB has been proposed to deliver kilowatt level average power EUV radiation from an electron storage ring. In the PoP experiment, an energy modulation is impressed onto the electron beam using an infrared laser pulse co-propagating inside an undulator. We show that the beam energy can be measured absolutely by detuning the undulator gap from optimum resonance and observing the intensity of the resulting coherent synchrotron radiation.

THBC4 12:10 **Observation and study of space charge effect frequency shifts in high-intensity accelerators**

Yuwen An (Institute of High Energy Physics).
Liangsheng Huang, Ming-Yang Huang, Xiaohan Lu, Yaoshuo Yuan, Yue Yuan (Institute of High Energy Physics), Shouyan Xu, Yong Li, Zhiping Li (Dongguan Neutron Science Center).

The China Spallation Neutron Source Rapid Cycling Synchrotron (CSNS-RCS) is the first high-intensity pulsed proton accelerator in China and the fourth in the world. The space charge effect is a key factor limiting power enhancement. Measuring the frequency shift induced by the space charge effect is an important method for studying this phenomenon. In our experiments, we varied the beam current by adjusting the injection pulse length and chopping rate. Using a combination of narrow-band filtering and Fast Fourier Transform (FFT) techniques, we successfully observed a tune shift of approximately 0.02 induced by a beam power of 140 kW. These experimental results were compared with simulation outcomes, showing good agreement.

12-Sep-24 13:30 – 14:40 China Hall 2

THC: Longitudinal Diagnostics and Synchronization

Chair: Marco Veronese (Elettra-Sincrotrone Trieste S.C.p.A.)

THCI1 13:30 **Approaching an optimum time resolution for synchroscan streak-camera measurements with visible synchrotron light**

Marco Marongiu (Helmholtz-Zentrum Berlin fuer Materialien und Energie GmbH).

The optical beam diagnostics at the BESSY II light source in Berlin have been improved significantly over the last few years. In particular, the streak-camera system has been extended in precision and sensitivity to allow two-dimensional imaging in time and space for equilibrated and non-equilibrated bunch patterns. In this paper, we prove experimentally and theoretically that we have reached a sub-ps RMS total time resolution using filtered synchrotron light. Detailed simulations, including the different physical time-dispersion mechanisms, show the influence of various band-pass and edge wavelength filters on the resolution. The limits for unfiltered near-visible synchrotron radiation (white-light) and the band-pass filter to achieve optimal time resolution are derived as well, providing a basis for more advanced beam-dynamics studies in the near future.

THCC2 14:00 **Direct measurement of the longitudinal emittance for a proton beam at exit of a radio frequency quadrupole**

Yong Zhang (Institute of Modern Physics, Chinese Academy of Sciences).
Jia Yin, Jianjun Su, Li Li, Yuanshuai Qin, Ze Du, Huan Jia (Institute of Modern Physics, Chinese Academy of Sciences).

Clarifying the longitudinal phase space distribution at the exit of a radio frequency quadrupole (RFQ) is crucial for precise beam tuning to minimize beam loss in a high-power superconducting linac. In this contribution, we introduce a method for direct measurement of the longitudinal emittance of a proton beam at the RFQ exit, which delivers an output energy of 1.51 MeV. Initially, we developed a bunch shape monitor (BSM) inspired by Feschenko's design, achieving a resolution of 20 picoseconds. To conduct the direct measurement of longitudinal emittance, we integrate this BSM with a waist-to-waist beam transfer matrix, an energy-spread dipole, and a horizontal slit with a 0.2 mm width. The horizontal slit is positioned at the first waist at the dipole's input, while the BSM wire is situated at the second waist, at the dipole's output. This arrangement, enhanced by the waist-to-waist transfer matrix, improves the energy spread resolution to 0.01%. Using the BSM wire, we measure the energy spread and horizontal profile. Through adjusting the buncher voltage and synchronous phase, we use dipole and BSM to measure different longitudinal emittances and ascertain the effects of bunching and debunching conditions on the longitudinal phase space. Consequently, this comprehensive direct measurement setup for longitudinal emittance serves to elucidate the impact of RFQ and buncher on the longitudinal phase space distribution within a medium-energy beam transport (MEBT) system.

THCC3 14:20 **Absolute Characterization of sub-fs Electron Bunch-Length in SwissFEL using a Bunch-Compressor Monitor**

Gian Luca Orlandi (Paul Scherrer Institut).
Eduard Prat, Francesca Addesa, Helge Brands, Philipp Dijkstal, Rasmus Ischebeck, Thomas Schietinger (Paul Scherrer Institut).

The shot-to-shot and non-invasive monitoring of the electron bunch length in a linac driven Free Electron Laser (FEL) relies on Bunch Compressor Monitors (BCMs). A BCM is designed to detect-and fully integrate in a given wavelength band-the radiation energy spectrum emitted at the threshold of the temporal coherence by the electron beam while crossing the last dipole of a magnetic chicane or a diffraction radiation screen placed just downstream of it. The BCM signal response is hence a direct-albeit non-absolute-function of the electron bunch length and of the beam charge as well. Due to its full non-invasiveness, a BCM is the ideal diagnostics to be integrated into the machine feedback to stabilize the bunch compression. Recently, we presented a formal method for the absolute determination of the electron bunch length from the analysis of the signal readout of a BCM which is equipped with two independent detectors integrating the radiation energy pulse in two different wavelength bands. Theoretical highlights of the method as well as experimental results on the characterization in SwissFEL of electron beams with sub-fs bunch length will be presented in this contribution.

12-Sep-24 15:10 – 16:00 China Hall 2

THD: Longitudinal Diagnostics and Synchronization

Chair: Gero Kube (Deutsches Elektronen-Synchrotron)

THDI1 15:10 **On-line beam synchronous phase calibration using beam-induced RF signals**

Feng Qiu (Institute of Modern Physics, Chinese Academy of Sciences).
Cecilia Maiano, Paolo Pierini (European Spallation Source ERIC), Chengye Xu, Yuan He, Zhijun Wang (Institute of Modern Physics, Chinese Academy of Sciences).

Accurate calibration of beam synchronous phase is essential for the optimal operation of accelerators. Traditional methods, such as the "phase scan method," not only consume significant machine runtime but are also susceptible to environmental disturbances. DESY has introduced a novel method based on "transient beam loading effects" for calibrating synchronous phase. However, this method requires the RF system to operate in an open-loop mode, limiting its applicability in proton linear accelerators. In this paper, leveraging the classical cavity differential equations, we propose a new method based on the steady-state "vector diagram of beam-induced voltage "for calibrating beam phase. This method enables on line calibration of beam phase and beam current under closed-loop operation of the radio-frequency cavities. We validated our approach on the CAFe (the Chinese ADS Front-end proton facility) at the Institute of Modern Physics, China, and the European Spallation Source. The measurement errors for beam current and phase using our method and the beam diagnostic system were 2% and within ±1 degree, respectively. Experimental results confirm the effectiveness of our method as a new solution for on line calibration of beam synchronous phase.

THDC2 15:40 **Capacitive pick-up type bunch shape monitors for low-energy ion beams at RAON**

Donghyun Kwak (Institute for Basic Science).
Cheolmin Ham, CheongSoo Lee, Donggun Kim, Gi dong Kim, Jaiseong Kim, Jangwon Kwon, Kwangbok Lee, Kyongho Tshoo, Taeksu Shin (Institute for Basic Science), JeongHoon Park, Jinsik Ju, Jongchul Lee (Advanced Radiation Technology Institute), Moses Chung (Pohang University of Science and Technology).

For Time Of Flight (TOF) experiments in the Rare isotope Accelerator complex for ON-line experiments (RAON), specifically at the Korea Broad Acceptance Recoil spectrometer and Apparatus (KoBRA) and the Nuclear Data Production System (NDPS), the beam repetition rate must not be excessively high, and the bunch length needs to be suppressed. The pre-bunching and re-bunching systems will be operational to achieve these objectives. To measure the bunch shapes near the production targets of KoBRA and NDPS without disrupting the beam, we optimized and manufactured capacitive pick-up monitors for installation upstream of the production targets. Furthermore, an algorithm was developed to reconstruct the shape of non-relativistic ion beams using experimental results measured by capacitive pick-up type monitors. An experiment using bunched hydrogen ion beams was conducted to verify the pick-up monitors' capability to measure bunch shapes. This presentation discusses the design methodology, simulation results, and bench tests of the capacitive pick-up monitors for ion beams with non-relativistic speed and nanosecond-order bunch lengths. Additionally, experimental results using hydrogen ion beams are also presented.

12-Sep-24 16:00 – 17:30 China Hall 3

THP: Thursday Poster Session

THP02 **Characterization of the PREF slow extraction parameters**

Tong Liu (Institute of Modern Physics, Chinese Academy of Sciences).
Hang Ren, Jiajian Ding, Jianjun Su, Junxia Wu, Li Li, Liping Yao, Long Jing, Ning Li, Shuang Ruan, Yongliang Yang, ZhiXue Li (Institute of Modern Physics, Chinese Academy of Sciences).

Providing 10 to 60 MeV proton beams, the PREF (Proton Radiation Effects Facility) is dedicated to the displacement damage effect experiments. The slow extracted beams from the synchrotron are delivered to two experimental terminals, which required the flux as constant as possible. To characterize the slow extraction parameters, scintillators and ionization chambers are equipped in the transport line and the terminals. The frequency response reveals the major influencing factor, power supply ripples. The duty factor reached over 90% shows the high slow extraction quality of the new accelerator.

THP03 **Design choices for the Cryogenic Current Comparator for FAIR**

Thomas Sieber (GSI Helmholtzzentrum für Schwerionenforschung GmbH).
David Haider, Marcus Schwickert, Thomas Stoehlker (GSI Helmholtzzentrum für Schwerionenforschung GmbH), Frank Schmidl (Friedrich-Schiller-Universitaet Jena), Jocelyn Tan (European Organization for Nuclear Research), Lorenzo Crescimbeni (Friedrich-Schiller-Universität), Matthias Schmelz, Ronny Stolz (Leibniz Institute of Photonic Technology), Nicolas Marsic (Technische Universität Darmstadt), Volker Tympel (Helmholtz-Institut Jena), Vyacheslav Zakosarenko (Supracon AG).

The Cryogenic Current Comparator (CCC) is a superconducting SQUID-based device, which measures extremely low electrical currents via their azimuthal magnetic field. Triggered by the need for nA current measurement of slow extracted beams and weak beams of exotic ions in the storage rings at FAIR and CERN, the idea of the CCC as a diagnostics instrument has been revitalized during the last ten years. The work of a collaboration of institutes specialized on the various subtopics resulted in a large variety of CCC types with respect to field-pickup, magnetic shielding, SQUID types and SQUID coupling. Many of them have been tested under laboratory and under beamline conditions, which formed a detailed picture of the application possibilities for CCCs in accelerators. In parallel to CCC detector development the cryogenic support system has steadily been optimized, to fulfil the requirement of a standalone liquid helium cryostat, which is nonmagnetic, fit for UHV application, vibration damped, compact and accessible for maintenance and repair. We present the major development steps of the CCC for FAIR. The latest beamtime results are shown as well as recent tests with the cryogenic system. The most promising CCC type for FAIR is the so called Dual-Core CCC (DCCC), which runs two pickups in parallel with independent electronics for noise reduction. The magnetic shielding has an axial meander geometry, which provides superior attenuation of external magnetic noise.

THP04 **Measurement of beam phase and energy using BPMs and FCTs at the MEBT section of CSNS H-LINAC**

Fang Li (Institute of High Energy Physics).
Lei Zeng, Muhammad Abdul Rehman, Renjun Yang, Ruiyang Qiu, Tao Yang, Weiling Huang, Zhihong Xu (Institute of High Energy Physics).

Accurately measuring the beam phase is critical when determining the ideal RF cavity parameters for beam acceleration. In the past, only Fast Current Transformers (FCTs) were used to measure the beam phase. However, with the upcoming upgrade of the MEBT section for the CSNS-II project, shorted stripline-type BPMs will now be utilized to measure beam position, phase, and energy. LIBERA singlepass electronics are employed to measure the beam position and phase from the BPMs. Pairs of BPMs were used to measure beam phase shift, which can also be used to calculate beam energy. This paper compares beam phase measurement systematically by BPMs and FCT.

THP05 **Development of bunch-by-bunch beam charge monitor for High Energy Photon Source**

Zhi Liu (Institute of High Energy Physics).
Jianshe Cao, Jun He, Junhui Yue, Qiang Ye, Taoguang Xu, Yan Lu, Yanfeng Sui, Yaoyao Du, Ying Zhao (Institute of High Energy Physics), Lin Wang, Shu-Jun Wei (Chinese Academy of Sciences).

A bunch-by-bunch beam monitor electronics for High Energy Photon Source (HEPS) was designed. The hardware of electronics consists of analog signal acquisition board and digital signal processing board. The software consists of underlying firmware and application software. The sampling frequencies 500 MHz, and the bandwidth is 1 GHz. The electronics digitizes four analog signals from BPM probe, and ZYNQ chip was used to process the beam data and calculate the charge of each bunch. This system has been used in HEPS booster and will be used in HEPS storage ring.

THP06 **The analysis of electron and ion movement inside the Faraday cup and error generation for finding the best biasing configuration**

Amin Masoumzadeh (Amirkabir University of Technology).
Morteza Habibi (Amirkabir University of Technology), Hamidreza Mirzaei (Nuclear Science and Technology Research Institute).

In this work, we analyze the movement of the electrons and ions inside a Faraday cup with different biasing of the collector cup, drift tube and suppressor ring. The possible error due to wrong biasing is also investigated. The particle pass is tracked in different biasing configurations. Also, the effect of stray electrons and ions, which are generated due to gas ionization along the beam pass, is studied. Through the analysis, we found the best biasing for the proposed configurations of the Faraday cup.

THP07 **Wide range and high precision grid-cathode modulation of beam current for High Energy Photon Source electron gun**

Jingdong Liu (Chinese Academy of Sciences).
Dayong He, Jingyi Li, Zusheng Zhou (Institute of High Energy Physics), Cai Meng, Jingru Zhang, Xiang He, Xiaoping Li (Chinese Academy of Sciences).

High Energy Photon Source (HEPS) is the fourth-generation light source under construction in China. The electron gun system is the origin of beam acceleration. This article introduces the wide range and high precision grid-cathode modulation of beam current for the HEPS electron gun system. Its grid-bias voltage adjustment is as fine as 0.01V. Cathode filament current and voltage ripple<0.1%. Its grid-bias voltage adjustment accuracy reaches 0.01V. The cathode filament current and voltage ripple <0.1%. The beam test results show that the beam current amplitude stabilization of 2.37% (small current)，0.13% (high current), beam current time jitter 12.459ps. Meets physical requirements for a wide range of injector from 2.8nC to 7nC.

THP08 **Using transimpedance amplifiers for intensity measurements of long beam pulses**

Marek Gasior (European Organization for Nuclear Research).
Diogo Alves, Miha Dolenc, Romain Ruffieux (European Organization for Nuclear Research).

CERN proton Linac 4 (L4) and ion Linac (L3) operate with beam pules long up to 1 ms, posing a challenge for beam intensity measurements based on Fast Bam Current Transformers (FBCTs). Since the beginning of L4 operation, low cut-off frequencies of the FBCTs were actively lowered using integrating amplifiers, and in L3, using transimpedance (TI) amplifiers. Unfortunately, in many locations such amplifiers were sensitive to interference from neighbouring power systems. The situation was particularly difficult in L3, where in addition to long beam pulses, the challenge was also the small beam currents. The interference problems had been addressed for years with limited success and finally it was decided that the whole FBCT front-end electronics should be renovated, with the main objective to improve the immunity to interferences. This paper describes the evolution of the FBCT front-end electronics and its installations, which finally has allowed reliable intensity measurements, whose examples are provided. The key improvement was the use of small TI amplifiers directly connected to the FBCTs, which in addition simplified installations in both linacs. The TI amplifiers provide active low load to the FBCTs, extending their time constants by some two orders of magnitude, as compared to operation with the 50 Ohm load. Challenges of TI amplifier implementation are described, along with particularities of their beam commissioning.

THP09 **Development of a metamaterial-based cavity beam current monitor**

Yuexin Lu (Huazhong University of Science and Technology).
Jian Wang, Jiqing Li, Kuanjun Fan, Zhengzheng Liu (Huazhong University of Science and Technology), Jinfeng Yang (Osaka University), Oleg Meshkov (Budker Institute of Nuclear Physics).

Non-intrusive cavity beam diagnostic devices offer advantages such as high induced signal and sensitivity. The size of the resonant cavity is inversely related to its operating frequency, resulting in an increase in size at lower operating frequencies, thus limiting its applicability. Therefore, exploring how to modify the cavity structure to regulate its internal electromagnetic field distribution and achieve a decrease in operating frequency has become a research topic of significant importance. In current cyclotron-based proton therapy devices, challenges arise from low beam repetition rates and weak intensities. These characteristics make traditional cavity beam diagnostics ineffective, resulting in monitoring blind spots during treatment. To tackle this challenge, this paper introduces a metamaterial-loaded cavity beam current monitor (BCM). Electromagnetic simulations reveal that this approach significantly reduces the size of the cavity under low-frequency operational settings. Moreover, this technique addresses the problem of high energy loss observed in conventional dielectric-loaded cavity BCM, effectively improving sensitivity. The all-metal metamaterial structure also circumvents difficulties associated with processing. This innovative design presents a fresh avenue for exploring the development of compact cavity beam diagnostics suitable for low-frequency operational environments.

THP10 **Calibration of beam current monitors at J-PARC accelerator facility**

Kenichirou Satou (High Energy Accelerator Research Organization).

Accelerators at J-PARC, a high-intensity proton accelerator facility, consists of a 400 MeV linac, 3 GeV RCS, and 30 GeV MR. The RCS is aiming for steady operation with output beam power of 1 MW, while the MR has achieved its initial target of 750 kW by shortening its operating cycle, and further beam tunings and developments are underway to achieve the next target of 1.3 MW. At J-PARC, it is necessary to suppress beam losses to an extremely low level to suppress the activation of the accelerator devices, and thus it is essential to improve the measurement accuracy of beam loss and current monitors. Particularly in MR, with the significant improvement in beam power, there is a need to improve the measurement accuracy of the beam current monitors from 1% at the present. Accordingly, the current monitors have been calibrated regularly, but have not been carried out in a unified manner throughout the accelerators. In this presentation, we will report on the calibration methods and its accuracy.

THP11 **Absolute beam current measurement for slow extracted beams at CERN's North Area facility**

Jocelyn Tan (European Organization for Nuclear Research).
Ghanshyambhai Khatri, Mark McLean, Torsten Koettig (European Organization for Nuclear Research), Lorenzo Crescimbeni (Friedrich-Schiller-Universität), Marcus Schwickert, Thomas Sieber, Thomas Stoehlker (GSI Helmholtzzentrum für Schwerionenforschung GmbH), Volker Tympel (Helmholtz-Institut Jena).

The North Area facility (NA), built in the 1970s at CERN, hosts several secondary beam lines for a large variety of physics experiments: Neutrino Platform, Dark matter, high energy physics, R&D, detector validation etc. 400 GeV/c primary proton beams, extracted from the SPS ring, are split along the transfer lines to fire on 4 targets and serve the users with secondary particles such as e-, e+, muons, pions, hadrons, kaons... Within a typical slow extraction scheme of 4.8 s, one gets a spill intensity of about 4E13 protons heading to the splitters. Available beam intensity monitors are ageing fast and are accurate up to 10% only, which is not compatible for future high intensity physics programs and new demanding specifications for the beam instrumentation. In the wake of the NA consolidation project, it is proposed to measure the beam intensity with a Cryogenic Current Comparator (CCC). Such devices installed at FAIR (GSI) and in the Antimatter Factory (CERN) have proven to be operational and having a resolution of a few nA. This paper describes the roadmap and challenges to come for the development of the new CCC.

THP12 **Energy spectrum of an ICP-RF ion source using a spherical electrostatic energy analyzer**

Sepideh Ghassami (Amirkabir University of Technology).
Behzad Yadollahzadeh, Hamidreza Mirzaei (Nuclear Science and Technology Research Institute), Anna Eydan, Masoud Keshavarz (Amirkabir University of Technology).

The energy characterization of an RF ion beam, generated by an inductively coupled plasma (ICP) RF ion source, has been conducted using a spherical electrostatic energy analyzer. The RF ion source, operating at an applied frequency of 13.56 MHz and a power level of 300 W, was assessed in both pulse and continuous modes. The ion energy spectrum of the hydrogen

beam was meticulously measured under various conditions, with the extraction voltage ranging from 1 to 10 keV. The analysis revealed variations in the energy profiles under different operational conditions, providing insights into the ion source's performance and optimization. These findings contribute to a deeper understanding of RF ion beams for enhancing the design and efficiency of ion sources used in particle accelerators and related technologies. The importance of precise energy spectrum measurements in enhancing the efficiency and functionality of ion sources in advanced beam instrumentation is underscored by this research.

THP13 **DCCT noise and beam lifetime measurement**

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Klaus Knaack, Matthias Werner (Deutsches Elektronen-Synchrotron).

Beam lifetime measurements are an important tool to characterize the key storage ring and machine performance parameters. They are usually derived from the dc current transformer (DCCT) data, and their accuracy depends on DCCT noise and data duration period. However, accurate dc current and fast lifetime determination are in contradiction and have to be balanced carefully. In this contribution, a model is presented which relates the relative accuracy in lifetime determination and the DCCT noise with the acquisition time. For the PETRA IV project at DESY (Hamburg, Germany) which aims to upgrade the present PETRA III synchrotron into an ultra low-emittance source, according to this model a lifetime determination to the level of 1% should be possible within 5-6 s acquisition time.

THP16 **Status and performance of LumiBelle2 in the 2024 beam operation of SuperKEKB**

Meng Li (Chinese Academy of Sciences).
Philip Bambade, Sandry Wallon (Université Paris-Saclay, CNRS/IN2P3, IJCLab).

LumiBelle2 is a fast luminosity monitoring system designed to do fast luminosity feedback and machine tuning and beam parameters studies for SuperKEKB. It uses sCVD diamond detectors placed in both the electron and positron rings to measure the Bhabha scattering process at vanishing photon scattering angle. Two types of online luminosity signals are provided, Train-Integrated-Luminosity signals at 1 kHz as input to the dithering feedback system used to maintain optimum overlap between the colliding beams in horizontal plane, and Bunch-Integrated-Luminosity signals at about 1 Hz to check for variations along the bunch trains. Vertical beam sizes and offsets can also be determined from collision scanning. This paper will describe the design of LumiBelle2 and report on its performance in the 2024 beam operation of SuperKEKB.

THP17 **Study of gas bremsstrahlung for 3 GeV electron storage ring using FLUKA Monte Carlo code**

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Ehsan Salimi, Zahra Rezaei (Iranian Light Source Facility), Isabela Moraes (Centro Nacional de Pesquisa em Energia e Materiais).

The Iranian Light Source Facility, ILSF, is under design as a 3 GeV synchrotron light source. The storage ring of ILSF with a 528 m circumference and NEG-coated vacuum chamber is used to achieve the desired vacuum level. In this paper, the monitoring system for gas bremsstrahlung radiation from the storage ring is studied. Gas bremsstrahlung is produced when the stored electron beam interacts with residual gas molecules in a storage ring vacuum chamber. The simplified geometry of the gas bremsstrahlung detector consists of a scintillator, an aluminum holder, and a lead sheet. This geometry is used in the FLUKA simulation package to study gas bremsstrahlung production in SR and its interaction with the detector.

THP18 **The status of beam loss diagnostics system for the SKIF synchrotron light source**

Oleg Meshkov (Budker Institute of Nuclear Physics).
Aleksandr Khilchenko, Lev Fomin, Petr Zubarev, Yuliya Maltseva (Russian Academy of Sciences), Ekaterina Puryga, Xiaochao Ma (Budker Institute of Nuclear Physics).

The Siberian Ring Photon Source (SKIF) is a fourth-generation synchrotron light source that operates at a beam energy of 3 GeV. In order to ensure the reliable operation of the accelerator, a beam loss diagnostics system will be implemented. For the linear accelerator, linac-to-booster and booster-to-storage ring transfer lines, fiber-based Cherenkov beam loss sensors will be used. Multi-mode quartz fibers and photo multiplier tubes (PMTs) will provide spatial resolution for this diagnostic system at a level of about 1 meter. The storage ring will be equipped with 128 scintillation-based detectors with acquisition electronics that are placed around the circumference of the ring. These detectors will be able to measure beam losses both during beam injection and during regular SKIF operations for SR users. Since SKIF will operate in different working modes, the BLMs system will require high sensitivity, a large dynamic range, and sophisticated electronics. The paper describes the design of both types of beam loss monitors (BLMs) and the choice of their positioning around the storage ring. It also discusses the final design of the acquisition electronics, the tests of the BLMs and the current status of diagnostics.

THP19 **BLM system of Novosibirsk Free Electron Laser**

Oleg Meshkov (Budker Institute of Nuclear Physics).
Ekaterina Puryga (Budker Institute of Nuclear Physics), Lev Fomin, Oleg Shevchenko, Yuliya Maltseva (Russian Academy of Sciences).

The article describes the BLM system of the Novosibirsk Free Electron (NovoFEL) microtron. Cherenkov radiation detectors are used to monitor beam losses. When beam of electrons hit the wall of the vacuum chamber, they create a shower of secondary electrons that fly out of the chamber and pass through the detector material, creating Cherenkov radiation in the process. The facility uses two types of Cherenkov detectors: optic fibers and quartz rods. Optic fibers are applied for the localization of the source of beam losses due to short duration of Cherenkov flashes. Quartz rods, on the other hand, measure the average beam loss at their location. In both cases, photomultiplier tubes (PMTs) are used to detect the Cherenkov radiation, and the voltage from the PMTs is digitized using an analog-to-digital converter (ADC) and displayed on a computer screen. This allows operators to monitor beam losses and tune the system accordingly. The article provides an overview of the basic principles of the BLS system of NFEL and describes in detail its operation. It also discusses the choice of detectors and the experience gained from applying diagnostics to tune the NovoFEL.

THP20 **Design of beam loss measurement electronic at superconducting section in CSNS-II**

Lei Zeng (Institute of High Energy Physics).
Fang Li, Renjun Yang, Ruiyang Qiu, Tao Yang, Weiling Huang, Zhihong Xu (Institute of High Energy Physics).

The CSNS-II linear accelerator upgrade will adopt superconducting accelerator structures, with the beamline enclosed in low-temperature modules. Detection of beam loss can only be done on the outer surface of the low-temperature modules. The CSNS-II accelerator plans to use a parallel plate multi-electrode ionization chamber as the beam loss monitor (BLM) probe for the superconducting section. The electronic system of the beam loss measurement (BLM) is primarily used for signal conditioning, digitization (ADC), transmission storage as EPICS PV quantities, and providing interlock signals for machine protection based on the output signals from the BLM probes. The main tasks of the development of the beam loss measurement (BLM) electronic system include: signal conditioning of weak current output from the BLM probes in the analog circuit section; and analog-to-digital conversion, digital signal processing, storage, PV quantity publication in the digital circuit section for the front-end analog output signals.

THP21 **Development of beam loss measurement electronics based on ZYNQ in RCS of CSNS-II**

Zhihong Xu (Institute of High Energy Physics).
Fang Li, Lei Zeng, Renjun Yang, Ruiyang Qiu, Tao Yang, Weiling Huang (Institute of High Energy Physics), Mengyu Liu (Chinese Academy of Sciences).

The beam loss measurement system is an important beam measurement device in the CSNS accelerator, used to measure the beam loss signals along the entire accelerator to monitor the beam status. In CSNS, the beam loss measurement system uses NI's PXIe-6358 acquisition card combined with self-developed front-end analog electronics. In the RCS of CSNS-II, a new beam loss electronics based on ZYNQ development is planned to replace the existing electronics for beam loss signal acquisition. The CSNS-II ring beam loss measurement electronics based on ZYNQ consists of independently developed high-voltage output modules, front-end analog boards, digital boards, as well as related driver programs, EPICS IOC software, etc., realizing functions such as signal acquisition, range control, data processing, EPICS publishing, etc.

THP22 **Development of Analog circuit in BLM System at RAON**

Sungjune Lee (Korea University).
Eun-San Kim (Korea University Sejong Campus), Eunhoon Lim, Jangwon Kwon (Institute for Basic Science).

The Rare Isotope Accelerator complex for ON-line experiments (RAON) is a heavy ion accelerator with a maximum beam power of 400 kW. The Beam Loss Monitor (BLM) system has been developed to investigate the amount of beam loss in the accelerator. BLM system utilizes current read-out system, analog pre-amp circuit and BLM devices. These devices comprise three types: Proportional Counter, Plastic Detector and Beam Loss Collector (BLC). Bench test was conducted to develop the analog circuit to measure current with a DAQ board. BLM devices have been installed and they are undergoing commissioning. This poster presents the bench test results and the preliminary results during the beam commissioning with Argon beam current of 50 uA.

THP23 **FPGA algorithm of beam diagnostic devices for fast protection system**

Jangwon Kwon (Institute for Basic Science).

RAON is a multi-purpose accelerator facility that can accelerate various heavy ion beams and exotic rare isotope beam, with a maximum energy of 200 MeV/u for uranium beams. Abnormal behavior or excessive instability of the device may result in damage to the device when an ion beam is irradiated onto the device. A fast protection system has been built, which quickly blocks the beam and prevents damage to devices. Signals generated from LLRF, SSPA, and beam diagnostic devices cause the MPS to block the beam within 50 μs. In beam diagnostic devices, AC current transformer (ACCT), mTCA-based data acquisition (DAQ), and beam position monitor (BPM) electronics are used to inform the MPS of beam transmission status in real time. Post-mortem data is stored on each device, allowing the cause of errors to be identified in the short term before fast protection is activated. This poster shows the measurement details and signal generation algorithm for fast protection in three beam diagnostic electronic circuits produced by the RAON heavy ion accelerator.

THP24 **Design and first results of a cryogenic beam loss monitor installed at the LHC**

Ewald Effinger (European Organization for Nuclear Research).
Belen Salvachua, Christos Zamantzas, Sara Morales Vigo (European Organization for Nuclear Research), James Storey (CERN), Erich Griesmayer (CIVIDEC Instrumentation).

The Large Hadron Collider (LHC) is equipped with NiTb superconducting magnets operating at the cryogenic temperature of 2.9 K. A tiny fraction of proton beam at 7 TeV impacting the magnet coils has the potential to generate enough heat, leading to the loss of superconductivity in the magnets. Consequently, it is imperative for machine performance to detect such beam losses before the quench event occurs. To enhance the sensitivity of magnet quench detection through the measurement of beam losses, ongoing efforts focus on the development of cryogenic beam loss monitors. This contribution outlines the design improvements made to a semiconductor-based beam loss detector installed inside the magnet cryostat, positioned just outside the vacuum vessel of the superconductive LHC dispersion suppressor magnets.

THP25 **Machine protection system for HIAF**

Yuan Wei (Institute of Modern Physics, Chinese Academy of Sciences).
Fafu Ni, Guangyu Zhu, Hongming Xie, Jianjun Su, Junxia Wu, Kewei Gu, Xiaoxuan Qiu, Yong Zhang, Yongliang Yang, ZhiXue Li (Institute of Modern Physics, Chinese Academy of Sciences).

The High Intensity Heavy-ion Accelerator Facility (HIAF), currently under construction, is a complex machine that couples a Continuous Wave (CW) superconducting ion Linear accelerator (iLinac) with a high-energy synchrotron to produce various stable and radioactive intense beams with high energies. The machine has a versatile operation mode which requires a high flexibility and reliability to the Machine Protection System (MPS). A customized and robust MPS is designed and developed to give the readiness of the machine for operation, to mitigate and analyze faults related to the relative damage potential. To get a high speed and have a high level of reliability, all interlock signal processing is processed on radiation-tolerant Field-Programmable Gate Arrays (FPGA) with triple or dual redundancy, as well as with a fail-safe design. By implementing a multiprocessing platform system-on-chip FPGA, the HIAF MPS can be tightly integrated with other systems to maximize availability pinpoint failures for operations, and give the postmortem analysis. This paper will describe the architecture of the interlocks linking the protection systems, the strategies to manage the complexity, the detailed components, and the interlock logic of the customized HIAF MPS, as well as the test and verification of the prototype.

THP26 **Beam loss measurement at AichiSR storage ring**

Masaki Fujimoto (Nagoya University).
Keigo Tanabe, Yoshifumi Takashima (Nagoya University).

We are developing a system of beam loss monitor at the Aichi Synchrotron Radiation Center, AichiSR in Japan, for accelerator operation stable. AichiSR is a light source mainly for industrial applications with a 1.2 GeV electron storage ring, the circumference of 72 m. It is operated with a beam current of 300 mA at all times by top-up injection. The beam loss measurement uses PIN photodiode BLMs from Bergoz. The BLMs are fixed to beam ducts of the storage ring and the detector outputs are measured with an oscilloscope just after 1 Hz beam injection with using four pulse kickers. Several continuous and strange signal waveforms were observed during a few microseconds of the kickers operation. Since the signals were synchronized with the beam circumference time of 240 ns, we have considered that the signals contain coordinate information of the beam loss in a circumference of the storage ring and derived the stepwise loss distribution of one injected beam. In this presentation, the simple method and results of time-resolved beam loss measurement using a photodiode BLM is discussed and development status of the monitor system at AichiSR is reported.

THP27 **High dose pass-rate sealed ion chamber**

Zhiquan Zhang (Elekta Beijing Medical Systems Co.Ltd.).

With the development of radiotherapy, the need for high doses became strong. However, existing ion chambers are either more absorbent of X-rays in terms of material or are non-sealed, that subject to environmental influences and have a short lifecycle. Now we designed a new ion chamber, which have high dose pass-rate, sealed and long lifecycle under radiation environments. The dose pass-rate improves a lot than the latest one, keeps ultra high vacuum as very low leakage rate and 10 years lifecycle. Another important point is this kind of ion chamber have very simple assembly process and low cost. After our beam test, it performed very well with various test environments as Reproducibility of the dose response, Proportionality of the dose response, Stability of the dose response and so on.

THP28 **Application of Fiber Beam Loss Monitoring System (FBLM) and Scintillator Beam Loss Monitoring System (SBLM) on HEPS**

Lingda Yu (Institute of High Energy Physics).
Lin Wang (Chinese Academy of Sciences), Taoguang Xu, Ying Zhao, Zhi Liu (Institute of High Energy Physics).

The High Energy Photon Source (HEPS) is a fourth-generation light source with a beam energy of 6 GeV currently under development by the Institute of High Energy Physics. The Beam Loss Monitor (BLM) system is designed for monitoring beam losses during machine commissioning. Two types of beam loss monitors have been installed in both the booster and storage ring. This paper introduces the principles and composition of these two BLMs, as well as their application in beam commissioning.

THP29 **SIRIUS fast beam orbit interlock system**

Lucas da Silva Perissinotto (Brazilian Synchrotron Light Laboratory).
Ana Clara de Souza Oliveira, Augusto Fraga Giachero, Daniel de Oliveira Tavares, Fernando Henrique Cardoso, Fernando Henrique de Sá, Gabriel de Goes Saretti, Guilherme Ricioli Cruz, João Leandro Neto Brito, Mauricio Donatti, Thiago Mendes da Rocha (Brazilian Synchrotron Light Laboratory), Lucas Russo (Lawrence Berkeley National Laboratory), Érico Nogueira Rolim (Brazilian Nanotechnology National Laboratory).

Insertion devices (IDs) are currently being installed at the SIRIUS storage ring to provide photon beams for upcoming high-brilliance beamlines. A fast orbit distortion detection system is imperative to safeguard critical vacuum chambers located near the straight sections of the IDs. In November 2023, an in-house Delta undulator was successfully installed, and a fast orbit interlock protection system has been in place, utilizing BPMs and the timing system's infrastructure. A dedicated position and angle calculation is implemented in FPGA and operates at a 6 kHz rate in the BPM processing electronics. A timing receiver board at the BPM uTCA crate acts as a bridge between orbit distortion detection and the timing system's event generator (EVG), which sends an interlock signal to the LLRF controller. The main purposes of this work are to provide details about a new full-

duplex timing network implementation, to discuss the main requirements of the orbit interlock, and to present measured performance results. Additionally, in pursuit of enhancing system reliability, post-mortem analysis and ongoing implementation proposals will also be presented.

THP30 **Beam dynamics design of the superconducting section of a 100 mA superconducting linac**

Man Yi (Advanced Energy Science and Technology Guangdong Laboratory).
Zhijun Wang (Institute of Modern Physics, Chinese Academy of Sciences).

Beam loss is a critical challenge in the physics design of high power superconducting proton linacs. The challenge is even more acute in linacs that feature high peak intensity and low energy, which has strong space charge effect and RF nonlinear force. In this paper, we study how to achieve a high transmission rate for beam halo particles, commonly a major source of beam loss, via beam halo matching and acceptance optimization. We employ this method of beam loss reduction to improve the physics design of a high power 100 mA superconducting linac which has potential applications in high brightness neutron production.

THP31 **Design and implementation of electron current measurement module for superconducting accelerator**

Zhiyu Wang (SPIC Nuelectronic Company Limited).
Xudong Wang, Ye Chen, haoran fu, xiaowei cai (SPIC Nuelectronic Company Limited), Gangjia Zhai, Yalong Wu (State Power Investment Corporation (SPIC)).

The electron current measurement module is a key component of the superconducting cryomodule testing platform. Serving as a vital monitoring signal device within the coupler interlock system, this module monitors the electron cloud of high-energy power couplers and waveguide systems to ensure their effective protections. This article details the design and performance testing of the electron current measurement module, highlighting key technologies including anti-interference, weak cur-rent detection, multi-channel signal acquisition and processing, and weak current calibration. This module boasts a large dynamic range, high precision, and multi-channel weak current detection, featuring 32 detection channels with a detection range of nA~10μA. Its detection accuracy surpasses 1nA, and its response time is under 5ms. Additionally, the module's design took into account the impact of ionizing and electromagnetic radiation on its performance to ensure its reliability and stability.

THP32 **New beam loss monitor ionisation chambers engineering**

Gerhard Schneider (European Organization for Nuclear Research).

More than 4000 Beam Loss Monitors (BLM) systems are operating at CERN. About 93% of them are installed in the LHC machine. The Ionisation Chambers (IC) are the part of the system where the lost beam particles ionise nitrogen gas in a chamber with electrodes at high voltage. The resulting current indicates the quantity of the beam loss. In the last 20 years, all BLM ICs were produced in collaboration with external institutes. Control of all details of the materials and processes are required to ensure instrument sensitivity and precision across the large series. CERN took back this production process in 2022 and much of the specific knowledge of design details and production technology was required to be re-engineered. This work presents production specification, design of tooling and test facilities for the first prototypes of a new series to be produced including their test in CERN facilities with beam. The further ramp-up to an industrial process to allow for a production of 1000 units in the years to come is discussed.

THP35 **Longitudinal phase space reconstruction in an electron storage ring**

Hongshuang Wang,
Xing Yang (Shanghai Institute of Applied Physics), Yongbin Leng (University of Science and Technology of China).

This paper proposes a longitudinal phase space measurement and reconstruction technology of particle beam in a storage ring. The technology collects and analyzes the beam injection signals by a high-speed oscilloscope, so as to extract the phase and beam length information of the injected beam. The length of a single data collection covers several thousand circles, the measurement accuracy of the phase reaches 0.2ps, and the measurement accuracy of the beam length reaches 1ps. At the same time, we develop a

single beam tracking software based on the mbtrack2 software package. The simulation software can record the phase space evolution of the beam after injection under different initial conditions. By matching with the simulation results, we can get various initial parameters of the experimental beam, including the initial phase, the initial beam length, the initial energy deviation, the initial energy dispersion, and the initial injection angle of the beam in the phase space. This technology enables us to understand the kinetic behavior of the particle beam deeply and to monitor and adjust the injection system in real-time. By obtaining the phase space distribution information of the particle beam in real-time, we can find and correct the deviation and instability in the injection system in time, so as to improve the injection efficiency and the quality of the particle beam.

THP36 **Feasibility study of electron beam probe based longitudinal bunch shape monitor for high-intensity proton beam**

Heng Wang (Tsinghua University in Beijing).
Liang Sheng (State Key Laboratory of Intense Pulsed Radiation Simulation and Effect).

The knowledge of the longitudinal bunch shape is of high interest to accelerator performance optimization and advanced beam application. Attracted by the ability to continuously monitor the beam in real time, there is always a demand for bunch-by-bunch and non-invasive diagnosis. However, such diagnosis is difficult to achieve for proton beam with high intensity and high repetition. Using the principle of electron beam deflection, electron beam probe has the potential of multi-function beam diagnosis. Here, we proposed the concept of real-time longitudinal bunch shape monitor with photocathode DC electron gun. Considering the realistic bunch distribution, we investigated the feasibility of this monitor using particle tracking simulation. The results and analysis of feasibility are reported in this paper.

THP38 **Recent progress and experimental results of electro-optic bunch arrival time monitor for SHINE**

Xiaoqing Liu (Shanghai Advanced Research Institute).
Longwei Lai, Renxian Yuan, Yimei Zhou (Shanghai Advanced Research Institute).

The timing jitter of electron bunch will affect the temporal and power stability of FEL, as well as the resolution of pump-probe experiment at FELs. In order to improve the time stability of electron bunch by beam feedback, Shanghai high-repetition-rate XFEL and Extreme light facility (SHINE) will employ the Electro-optic Bunch Arrival Time Monitor (EOBAM) to accurately measure the electron bunch arrival time. This paper will introduce design of EOBAM, including the beam pick-up, the electro-optic front-end, the signal detection electronics and the high-level software. Then the latest research progress of the EOBAM for SHINE and the beam experiment for EOBAM prototype based on SXFEL will also be introduced. The experiment results show that the resolution of EOBAM based on the 18 GHz beam pick-up are 5.4 fs@200pC and 8.1fs@100pC.

THP39 **Autocorrelator for measuring the duration of the NovoFEL laser pulse**

Stanislav Reva (Budker Institute of Nuclear Physics SB RAS & Novosibirsk State University).
Oleg Meshkov (Budker Institute of Nuclear Physics), Oleg Shevchenko, Vladislav Borin (Russian Academy of Sciences).

The Novosibirsk Free Electron Laser (NovoFEL) is a powerful source of narrow-band terahertz and infrared radiation, operating at the Institute of Nuclear Physics of the Siberian Branch of the Russian Academy of Sciences (INP SB RAS). It is based on an accelerator-recuperator system and is one of the main user facilities of the Siberian Synchrotron and Terahertz Radiation Center. In recent years, there has been active work to develop new diagnostics for measuring the parameters of the electron beam in the third stage of the NovoFEL. The laser generates pulses of radiation with picosecond durations in the mid-infrared range of 8-12 micrometers that is the challenge for the diagnostics. This paper describes the development of diagnostic systems for the spectral and temporal characteristics of laser radiation from the third stage of the NovoFEL facility. To record the radiation spectra, a diffraction monochromator was used in conjunction with a bolometric array as a detector. A nonlinear autocorrelator based on ZnGeP2 crystal was developed to measure the temporal profile of the radiation. The correct operation of the autocorrelator was demonstrated in experiments with YAG laser radiation acquired using a nonlinear β-BaB2O4 crystal. The paper presents results from measurements of the spectrum and autocorrelation function for laser radiation from the third stage of the NovoFEL. Self-

consistency between the spectrum and autocorrelation functions is demonstrated.

THP40 **Development of a method for visualizing the magnetic axis of multipole magnets**

Stanislav Reva (Budker Institute of Nuclear Physics SB RAS & Novosibirsk State University).
Leonid Serdakov, Vladimir Krapivin (Russian Academy of Sciences), Oleg Meshkov (Budker Institute of Nuclear Physics).

Accelerator technology development requires an increase in the precision of both the manufacturing of magnetic elements and their positioning during accelerator installation. In order to monitor the quality of the magnetic elements created, various methods are used. Most of the methods involve the use of precision stands, so magnetic elements are typically measured immediately after production and the data obtained is used for positioning. However, subsequent possible parameter changes are not taken into account. This work is dedicated to the study of an alternative optical magnetic measurement method*. The method is based on the magneto-optical phenomenon of light polarization plane rotation in optically active media, which allows visualizing the magnetic field projection in a given transverse direction. The use of a geodesic laser tracker as a light source could allow us to apply this method directly during accelerator component positioning, solving the aforementioned problem. Our main goal was to verify the feasibility of the method for determining magnetic axes in multipole magnets. A method for creating an optically active medium was developed, the sensitivity of the technique to magnetic fields was studied, and experiments to verify its accuracy on magnetic components produced for the SKIF photon source were conducted. The results of this study provide insight into the potential of this method and indicate directions for its future development.

THP41 **Longitudinal bunch diagnostic in the Terahertz domain at ELBE using fast room temperature operable zero-biased Schottky diode THz Detectors**

Rahul Yadav (Terahertz Devices and Systems, TU Darmstadt, Germany).
Andreas Penirschke (Technische Hochschule Mittelhessen), Michael Kuntzsch (Helmholtz-Zentrum Dresden-Rossendorf), Sascha Preu (Terahertz Devices and Systems, TU Darmstadt, Germany).

Modern accelerator-based light sources rely on short bunches to generate intense photon pulses. To achieve this, the electron bunches from the accelerator need to be compressed longitudinally in a bunch compression chicane. Due to instabilities in the acceleration process, the bunch duration varies which in turn also affects the secondary photon beam. A valuable tool for the measurement of bunch compression is the use of broadband detectors covering a spectral range from few 100 GHz up to THz frequencies. They measure the electromagnetic signal emitted by the charged bunch when flying by the detector or likewise synchrotron-, diffraction- or transition radiation which all scale with its compression factor. Zero-bias Schottky diodes are the most prominent member because of their high sensitivity and fast response compared to their slower thermal counterparts such as Golay cells, Pyroelectric, Hot-electron bolometer, etc. In this paper we demonstrate the pre-commissioning of broadband Schottky THz detectors operating at room temperature for the diagnosis of compressed short electron bunches at the ELBE facilities at the Helmholtz-Zentrum Dresden-Rossendorf, Germany. Qualitative bunch compression measurements are done to diagnose the beam, optimize the machine parameters and provide feedback to the beamline for optimum machine operation. These detectors are scheduled to be commissioned at free-electron facilities in near-future.

THP42 **A test bench for 324MHz RF deflectors used in bunch shape monitors for the upgrade of CSNS-II linac**

Quanru Liu (University of Chinese Academy of Sciences), Weiling Huang (Institute of High Energy Physics).
Fang Li, Lei Zeng, Muhammad Abdul Rehman, Renjun Yang, Ruiyang Qiu, Tao Yang, Xiaojun Nie, Zhihong Xu (Institute of High Energy Physics), Mengyu Liu (Chinese Academy of Sciences).

The Feschenko-type bunch shape monitors based on the transverse modulation of low energy secondary emission electrons, will be used in the measurement of longitudinal beam density distribution in the upgrade of CSNS-II linac. A test bench for commissioning the 324MHz RF deflectors used in BSM has been built in the laboratory, which consists of a Kimball E-gun, an RF stimulator, a 324MHz RF power source and a set of MCP+Screen. This paper gives the design consideration, test results of the test bench and the continuing CST design of a λ/2 RF deflector.

THP43 **Terahertz diagnoses bunch-to-bunch spacing for ultrafast electron bunch trains**

Yang Xu (Huazhong University of Science and Technology).
Kuanjun Fan (Huazhong University of Science and Technology).

Ultrafast micro-bunched electron beams have broad applications, including wakefield-based acceleration and coherent Terahertz sources, where precise diagnosis of individual bunch-to-bunch spacings is critical. However, high-precision direct measurements of these spacings remain challenging. This paper introduces a novel method capable of measuring these spacings with femtosecond temporal resolution using a THz-driven resonator. Simulations on a 3 MeV electron bunch train demonstrate a temporal resolution better than 10 fs for the bunch-to-bunch spacings. This method facilitates in-depth investigation of the longitudinal characteristics of the bunch train, promising significant advancement in narrow-band Terahertz sources and compact accelerators.

THP44 **The timeless timing system**

Tonia Batten (Canadian Light Source Inc.).
Johannes Vogt (Canadian Light Source Inc.).

The Canadian Light Source (CLS) is a third generation 2.9 GeV synchrotron comprised of a 250 MeV LINAC, a full energy booster, and a storage ring with 13 insertion devices and 22 operational beamlines ranging from infrared light to hard X-rays. The Timing System supplies the triggers required to synchronize operation of all components responsible for injecting current into the storage ring. Signals from the Timing System can also be used to synchronize data acquisition on beamlines. The Trigger Generator Unit (TGU), which was designed by the CLS, is the centerpiece of the timing electronics. The TGU is driven by the 500 MHz master oscillator and is controlled using digital I/O. The trigger signals are distributed via a fiber optic system, which was also designed in house. The Timing System has been in operation since 2001 and has proven itself to be stable and robust. This paper provides a detailed overview of the system and its history and operational performance.

THP45 **Advancements in beam arrival time measurement for SHINE***

Yimei Zhou (Shanghai Advanced Research Institute).
Longwei Lai, Shanshan Cao, Xiaoqing Liu (Shanghai Advanced Research Institute), Jian Chen (Shanghai Synchrotron Radiation Facility), Renxian Yuan (SSRF).

The jitter of the beam arrival time can significantly impact the synchronization between the seed laser and the electron beam, which will constrain the brightness and stability of the FEL. It is one of the important parameters for beam diagnostics. To align with the SHINE's (Shanghai HIgh repetition rate XFEL aNd Extreme light facility) requirements of a 1MHz repetition rate and a dynamic range from 10pC to 300pC, we developed a beam arrival time measurement system utilizing a cavity probe. This system is capable of achieving a specification of 20fs at a charge of 100pC. Our approach included designing measurement schemes based on intermediate and radio frequencies and establishing a comparative test platform at the SXFEL (Shanghai Soft X-ray Free-Electron Laser Facility). This article will detail the construction of two systems and compare their test results across various charges. It has also been confirmed that the system can accurately measure beam arrival times for charges less than 1pC. A major challenge identified was temperature drift, which significantly affects measurement accuracy and limits the system's application in beam feedback. To counter this, we implemented and evaluated constant temperature controls for the RF cables, demonstrating their effectiveness in enhancing measurement reliability.

THP46 **Phase-temperature stability measurement of various RF coaxial cables**

Xinpeng Ma (IHEP).
Nan Gan, Yongyi Peng (IHEP).

Phase stable coaxial cables are widely used for the transmission of reference signals, monitoring signals and control signals in accelerator low-level RF, beam measurement and control systems, especially for high requirements of time/phase stability. The change in ambient temperature will change the electrical length of the coaxial cables leading to the transmission time/signal phase drift, this effect is termed as temperature coefficient of delay(TCD). The TCD curves at room temperature (15~40deg) of various types of coaxial cables commonly used in particle accelerators and other industries are measured. Some

cables are tested for the first time, the cables with lowest coefficients are CommScope LDF2-50A, Trigiant HCTAYZ-50-22, and Zhongtian HCAAYZ-50-12 for different cable diameters. According to attenuation, mechanical and TCD parameters, these three cables are chosen in the HEPS phase reference line system and Linac LLRF system respectively.

THP47 **The synchronization and timing system updating at CTFEL facility**

Shuai Ma (China Academy of Engineering Physics, Institute of Applied electronics).
Kui Zhou (China Academy of Engineering Physics, Institute of Applied electronics).

Chinese Academy of Engineering Physics terahertz free electron laser facility (CTFEL) is a superconducting linac-based user facility. It provides laser pulses with frequencies from 0.1 THz to 4.2 THz. CTFEL works in pulsed mode with a repetition of 10 Hz where up to about 54000 bunches at a bunch spacing of 18.5 ns are accelerated in one macro-pulse. To satisfy the high-precision synchronization requirement from user experiments, the synchronization system based on coaxial lines is updated to a continuous laser carrier and Michelson interferometer-based system. The timing system is updated to the event system.

THP48 **The bunch length monitor based on CSR in SXFEL**

Lianfa Hua (Shanghai Synchrotron Radiation Facility).
Ning Zhang, Zhichu Chen (Shanghai Synchrotron Radiation Facility), Yongbin Leng (University of Science and Technology of China).

Monitoring the beam length and maintaining stability during operation is crucial for Free Electron Laser (FEL) user facilities. A monitor based on Coherent Synchrotron Radiation (CSR) is an ideal candidate, and it has been successfully developed at the Shanghai X-ray Free Electron Laser (SXFEL). This article presents the basic principles, system configuration, and experimental results. The results show that the monitor is capable of measuring the bunch length within a range of 0.6 ps to 1.4 ps, achieving a precision better than 10%.

THP49 **Online beam phase and energy gain measurement through beam-cavity interaction**

Lingyun Gong (Institute of Modern Physics, Chinese Academy of Sciences).
Muyuan Wang, Rihua Zeng (European Spallation Source ERIC), Feng Qiu, Zhijun Wang (Institute of Modern Physics, Chinese Academy of Sciences).

Online beam monitoring is crucial for enhancing the efficiency and availability of high-power accelerator operations. While real-time monitoring of transverse beam parameters is commonly employed in modern accelerators, there is a scarcity of online measurement techniques for longitudinal beam characteristics. We are currently developing an online tool for measuring fundamental longitudinal beam parameters: synchronous phase and energy gain. This endeavor is founded upon a comprehensive understanding of beam-RF cavity interactions, facilitated by advanced hardware platforms, flexible software applications, and computationally intensive algorithms. Validation of our measurement methods has been conducted using beam and RF data acquired during the latest beam commissioning at the European Spallation Source (ESS). This validation encompassed both single-cell and multi-cell cavities, affirming the reliability and feasibility of our techniques. Furthermore, comprehensive comparative analyses were performed, aligning results from various measurement methodologies with theoretical calculations, enhancing our understanding of measurement accuracy. Our ongoing research aims to provide accelerators with robust and real-time monitoring tools for longitudinal dynamics aspects based on beam and RF cavity interaction, thereby ensuring optimal efficiency and performance in high power accelerator operation.

THP50 **Design and experiment of an optimized eight-stripline beam energy and energy spread monitor**

Qian Wang (University of Science and Technology of China).
Letian Huang, Liuxu Zong, Qingyang Dong (Dalian Institute of Chemical Physics).

In order to achieve nondestructive measurement and feedback of beam energy and energy spread for high repetition frequency Linac, an eight-stripline beam energy and energy spread monitor have been designed to replace destructive monitor such as fluorescent screen. Different from the conventional evenly arranged stripline structure, an unevenly arranged stripline layout is proposed to improve the sensitivity. At the same time, impedance transition structures are added to the Feedthroughs and striplines connection parts to further enhance the system sensitivity and resolution. The electronics adopts the method of separating the analog front-end and digital acquisition part from each other, and has the

function of bunch-by-bunch measurement and data storage with a high repetition frequency of 1 MHz. The processing of the monitor has now been completed. Experiments show that the position sensitivity with an inner diameter of 63 mm reaches 0.0538 mm^{-1}, which is close to the theoretical result of numerical calculation. Compared with monitors of traditional structure, the performance has been greatly optimized.

THP51 **Optical pulse picker system for bunch-by-bunch measurement in storage ring**

MingDong Ma (University of Science and Technology of China).
Bao-gen Sun, Dongyu Wang, Jigang Wang, Yunkun Zhao (University of Science and Technology of China).

The non-uniformity and longitudinal oscillations in multiple-bunch filling, as well as space charge effects in an electron storage ring, can lead to significant deviations in the streak camera's measurements of bunch length. Selecting a single bunch for measurement can effectively improve the accuracy of bunch length measurements and the observation of rapid bunch oscillations. This paper introduces the construction of an optical pulse selection system using a Pockels cell based on RTP crystals. The system controls the RTP crystal using fast electronics and high-voltage electronics. By adjusting the drive voltage frequency and trigger delay of the high-voltage driver, precise selection of single pulses in a multi-bunch filling mode is achieved. Relevant experimental studies have been conducted. This system can effectively select specific bunches or bunch trains from multiple bunches, which is of significant importance for diagnosing the longitudinal characteristics and instabilities of the beam in an electron storage ring.

THP52 **Development status of the fiber length stabilizers for the laser arrival-time measurement**

Bowei Wu (Shanghai Advanced Research Institute).
Bo Liu, Jinguo Wang (Shanghai Advanced Research Institute).

The Shanghai soft X-ray Free-Electron Laser facility (SXFEL) is a fourth-generation linac-based light source, capable of producing X-ray pulses with duration of tens of femtosecond. The photocathode laser and the seed laser for external seeding FEL therefore have tight requirements for relative arrival time to the machine and electron bunch. To reach required energy and wavelength to drive photocathode, as well as for external seeding FEL, further optical amplification and frequency conversion is needed. the femtosecond-stable pulsed optical reference, which are delivered via fiber length stabilizers. In this paper, we present the development status of the fiber length stabilizers for the laser-arrival time measurement.

THP53 **Measurement of the longitudinal beam size at the Novosibirsk FEL**

Vladislav Borin (Budker Institute of Nuclear Physics).
Nikolay Vinokurov, Oleg Shevchenko (Russian Academy of Sciences), Oleg Meshkov (Budker Institute of Nuclear Physics), Stanislav Reva (Budker Institute of Nuclear Physics SB RAS & Novosibirsk State University), Vitaly Kubarev (Novosibirsk State University).

The Novosibirsk Free Electron Laser (NovoFEL) facility consists of three free electron lasers (FELs) installed on different tracks of the Energy Recovery Linac (ERL). These FELs share a common acceleration system, which allows for the generation of high average electron currents, typically around 10 mA. This high current facilitates the production of significant average FEL powers, often exceeding 100 watts in the spectral range between THz and mid-infrared wavelengths. Precise measurement of electron beam parameters is crucial for monitoring the performance of the accelerator and fine-tuning its operating modes. The length of the electron bunch is particularly important, as it directly influences the efficiency of laser radiation generation. This study focuses on the dependence of the electron bunch length on the parameters of the radio frequency (RF) and bunching systems for the first and second FELs at NovoFEL. Measurements were conducted using a Cherenkov aerogel radiator in conjunction with a streak camera to accurately determine the electron beam properties. The measurement results, along with a plan for future experiments, are discussed in detail in this publication.

THP54 **Research and development at the BESSY II booster beamline**

Pauline Ahmels (Helmholtz-Zentrum Berlin fuer Materialien und Energie GmbH).
Günther Rehm (Helmholtz-Zentrum Berlin für Materialien und Energie), Marco Marongiu (Helmholtz-Zentrum Berlin fuer Materialien und Energie GmbH), Markus Ries, Terry Atkinson (Helmholtz-Zentrum Berlin für Materialien und Energie GmbH).

With the refurbishment completed, the optical beamline delivers all the required diagnostics.

This paper reports on their status focusing in particular on the R&D beamline branch. The additional branch is equipped with programable mirror and lens position controllers allowing elaborate optical optimisation. This system is used for educational purposes and for improving the source point imaging system through the study of polarisation characteristics. Test systems for an ultra-fast diode and a THz detector are equipped with CMOS cameras and polarisation filters. Furthermore, the R&D branch complements the existing diagnostics to measure bunch lengths and investigate non-linear beam dynamics.

THP55 **Transverse and longitudinal optical beam diagnostics for the BESSY II booster**

Marco Marongiu (Helmholtz-Zentrum Berlin fuer Materialien und Energie GmbH).
Günther Rehm (Helmholtz-Zentrum Berlin für Materialien und Energie), Markus Ries, Terry Atkinson (Helmholtz-Zentrum Berlin für Materialien und Energie GmbH), Pauline Ahmels (Helmholtz-Zentrum Berlin fuer Materialien und Energie GmbH).

This paper describes the optical beam diagnostics available at the BESSY II booster synchrotron. For the first time, diagnostics are established to investigate the distribution of the electron beam in all three dimensions. A permanent installation of a source-point imaging system aided by a telescope optic depicts the transverse properties of the electron beam. Additionally, the bunch length is measured using a streak camera with a resolution in the picosecond range. Both systems can work in parallel and are able to observe the non-equilibrium beam dynamics over the entire booster ramp.

THP56 **Recent progress in stabilized fiber link**

Jinguo Wang (Shanghai Advanced Research Institute).
Bo Liu, Bowei Wu (Shanghai Advanced Research Institute).

Femtosecond pulsed optical synchronization systems have developed rapidly in the past decade and has become a preferred technique to synchronize FELs. As a bridge connecting the reference source and the clients, the stabilized fiber links need to transmit the reference signal over a long distance to the clients with ultra-low additional jitter, which are used to precisely measure the electron bunch arrival time for fast feedback correction, to precisely synchronize various laser clients, and to regenerate RF reference signals for low level control system. This paper presents the recent progress in stabilized fiber link.

THP57 **A longitudinal phase space measurement using the dechirper composed of corrugated metallic at PAL-XFEL**

Chang-Kyu Sung (Pohang Accelerator Laboratory).
Inhyuk Nam, MyungHoon Cho, Seongyeol Kim (Pohang Accelerator Laboratory).

We present the experimental results of the longitudinal phase space measurement using the well-known wakefield deflector driven by the dechirper. When the electron bunch travels through the dechirper, electrons at the head of bunch generate the strong transverse wakefield which forces the trailing electrons to be transversely streaked. In such a way, the temporal structure of bunch can be reconstructed by analyzing the distribution of transverse profile at the downstream of dechirper. In the soft X-ray line of the PAL-XFEL (Pohang Accelerator Laboratory, X-ray Free Electron Laser), the dechirper composed of 1.4-meter-long corrugated metallic walls streaks the bunch horizontally via the wakefield. By combining with the bending magnet having the vertical dispersion, the longitudinal phase space of electron beam can be interpreted as the spatial distribution at the screen monitor. We show the results of the longitudinal phase space measurement using the wakefield deflector.

THP59 **First results with a Base Band Tune (BBQ) measurement system at Solaris**

Marek Gasior (European Organization for Nuclear Research).
Adriana Wawrzyniak, Mateusz Szczepaniak, Roman Panas (National Synchrotron Radiation Centre).

All CERN circular accelerators are equipped with Base Band Tune (BBQ) measurement systems, based on the direct diode detection technique, allowing measuring tunes of hadron beams with their residual betatron oscillations or very small explicit excitation. In the framework of Future Circular Collider, a study was launched to investigate how such a system would perform with short electron bunches. A prototype system has been recently installed in Solaris light source. The system has immediately allowed an unprecedented detection of residual beam betatron oscillations, whose amplitudes are more than two orders of magnitude lower than the smallest beam oscillations permitting tune measurements with the standard BPM system. The residual oscillations allowed reliable continuous tune measurements, who have also revealed spectral content never observed before. This paper provides an overview of the installed BBQ system and describes first beam measurement results obtained so far. The aim of the paper is also to disseminate new results in the light source community, with the hope for a support in explaining origins of the observed signals.

THP60 **BPM displacement measurement and prediction at HLS II**

Chuhan Wang (University of Science and Technology of China).

The beam orbit stability is a crucial indicator to evaluate the performance of the synchrotron radiation source. It can be improved through precise orbit measurement by beam position monitors (BPM) and appropriate orbit feedback. The movement of BPMs directly affects the measurement of the beam orbit and indirectly affects the beam orbit through orbit feedback system. Two sets of BPM displacement measurement systems with nanometer resolution were established at HLS II to measure the BPM displacement and analysis the related factors. According to these measurement results, the variation of the beam current and the vacuum chamber temperature is correlated with BPM displacement. Combining the ideas of machine learning and physical principles, a neural network for predicting the BPM displacement was designed and trained, which will be used for unmeasured BPMs. Associated with OFB system, the beam orbit deviation due to BPM displacement will be corrected and the local beam orbit stability can be satisfied.

THP61 **Laser polarimeter at VEPP-4M collider**

Viacheslav Kaminskiy (Russian Academy of Sciences).
Ivan Nikolaev (Russian Academy of Sciences).

VEPP-4M collider and KEDR detector are going to measure precisely ϒ (1S) mass and leptonic width. In this experiment the electron beam energy is precisely measured using resonant depolarisation tecnhique at "Laser Polarimeter" facility. The electron beam polarisation degree is measured using Compton backscattering with accuracy of 5% in 100 seconds. The beam energy is measured during KEDR data acquisition runs every 30~minutes with accuracy of 20~keV. In this report the facility design and current status are discussed.

THP62 **The beam orbit reconstruction in the linac of CSNS**

Yanliang Han (Institute of High Energy Physics).
Jun Peng (Institute of High Energy Physics).

In the high current hadron machine, it is essential to reduce the beam loss along the machine for machine maintenance and safety reasons. The linac of Chinese Spallation Neutron Source (CSNS) delivery negative hydrogen bunches with power of 5kW to the RCS which increase the power to 100kW. In the following several years, the power of the linac beam will be increased to 100kW, therefor it is important to deal the beam loss more carefully. In this paper, we present the reconstruction of the beam orbit along the linac using beam tracking software with the input data measured with BPMs. This kind of reconstruction is expected to provide suggestions for the future machine tuning.

THP63 **Correction of insert device errors of the SAPS storage ring**

Jianliang Chen (Chinese Academy of Sciences).
Sheng Wang (Institute of High Energy Physics, CAS), Weihang Liu, Xiao Li, Yi Jiao, Yu Zhao (Institute of High Energy Physics).

The first phase of the Southern Advanced Photon Source (SAPS) project currently plans to construct 10 beam lines. According to user requirements, all 10 beam lines are based on the radiation of insert devices, and the parameters of each insert device are optimized. These insert device models were added to the lattice to calculate the impact on the lattice of the SAPS storage ring, and their effects were corrected.

THP64 **The study of the beam characteristics of the SKIF linear accelerator**

Alexey Levichev
Danila Nikiforov, Mariya Arsentyeva, Victor Dorokhov (Russian Academy of Sciences), Oleg Meshkov, Xiaochao Ma (Budker Institute of Nuclear Physics).

The fourth-generation synchrotron light source Siberian Ring Photon Source (SKIF), located

in Novosibirsk, Russia, underwent the tuning of its linear accelerator segment successfully. By deploying a designed beam diagnostic system, crucial parameters of the beam including beam transverse and longitudinal dimensions, energy spread, emittance, and current, were accurately measured. To achieve these measurements, the system was equipped with several fluorescent screens, Cherenkov radiation detectors, a dipole energy spectrometer, and a Faraday cup. This paper elaborates on the design, mode of operation, and practical applications of these diagnostic devices during the accelerator's tuning process. Further, potential areas of optimization for these diagnostic methods are explored to provide feasible directions for enhancing the performance of the linear accelerator. These precise diagnostic tools have been pivotal in the successful tuning of the SKIF linear accelerator. The results thus gathered will form a significant reference point for the development and refinement of similar accelerators in the future.

THP65 **Bunch-by-bunch feedback system used as a diagnostic tool for multi-bunch beams in the DAFNE collider**

Danilo Quartullo (Istituto Nazionale di Fisica Nucleare).
Alessandro D'Uffizi, Angelo Stella, Antonio De Santis, Catia Milardi, Donato Pellegrini, Gianluca Grilli, Giovanni Franzini, Mikhail Zobov, Simone Spampinati, Thomas De Nardis (Istituto Nazionale di Fisica Nucleare), Ozgur Etisken (Kirikkale University), Senem Ozdemir (Ege University).

DAFNE is an electron-positron collider in operation at INFN-LNF since 2001. Bunch-by-bunch feedback systems installed in each of the two rings allow to store high-intensity and stable beams, by counteracting coupled-bunch instabilities. The feedback systems can be also used as a diagnostic tool able to measure beam parameters which are significant for the evaluation of the instabilities. In this paper, we first describe the acquisition system used to collect the beam data provided by the feedback systems. Then we report recent transverse tune shift and grow-damp measurements with positron beams, performed using the feedback as a diagnostic tool. These measurements helped to characterize the electron-cloud beam instability, which is one of the main factors currently limiting the DAFNE performance. Finally, we describe the first measurements and feedback system setup designed to automatically record turn-by-turn bunch position displacements when a sudden loss in beam current occurs due to any faults in the collider. This tool can be very useful in identifying the causes of these events and performing beam dynamics studies and code validation.

THP66 **Measurement of beam energy characteristics at the LHe-free Nb3Sn demo SRF e-linac**

Yimeng Chu (Institute of Modern Physics, Chinese Academy of Sciences).
Duanyang Jia, Weilong Chen, Zehua Liang, Zhijun Wang (Institute of Modern Physics, Chinese Academy of Sciences), tielong wang (Institute of Modern physics, Chinese Academy of Science).

The demonstration of a 100mA, 4.6MeV superconducting radio frequency linear electron accelerator, based on conduction cooling and developed by the Institute of Modern Physics (IMP), aims to validate the feasibility of stable beam commissioning in a liquid helium-free 5-cell-βopt=0.82 Nb3Sn elliptical cavity, and to offer guidance for subsequent industrial applications. The beam energy characteristics, considered one of the critical parameters, need to be precisely measured. Due to the high energy of the beam and the compact, simple layout requirement of this accelerator, only one dipole magnet is used for energy measurement. This paper compares errors from three different experimental processes, presenting simulation and online measurement results of energy measurement under various cavity voltage. It analyzes the impact of various errors during online energy measurement and examines the effects of the slit after the dipole and its shape on energy measurement.

THP67 **Measurement and optimization of the beam coupling impedance of a novel 3D-printed titanium alloy cage inside the thin-wall vacuum chamber**

Guangyu Zhu (Institute of Modern Physics, Chinese Academy of Sciences).
Jiqiang Jiao, Shaohui Du (Institute of Modern physics, Chinese Academy of Science), Junxia Wu (Institute of Modern Physics, Chinese Academy of Sciences).

Dipole magnet vacuum chambers are among the critical and costly components of rapid-cycling accelerator facilities. Alternative approaches to traditional ceramic chambers have been explored for the implementation of fast-ramping dipole-magnet vacuum chambers, including thin-wall metallic beam pipe chambers strengthened with transverse ribs. Here, we report a novel 3D-printed titanium alloy cage inside the thin-wall vacuum chamber, which is designed for HIAF project to reduce manufacturing difficulty and cost, shorten the production cycle, and improve the quality. Because the beam impedance aspects are highly important for beam stability, comprehensive studies were undertaken to characterize the impedance of the 3D-printed titanium alloy cage inside thin-wall vacuum chamber. The beam-coupling impedance of the new thin-wall vacuum chamber were studied numerically. Strategies for further reducing the beam-coupling impedance were explored. In addition, impedance bench measurements using the “half wavelength” resonant method were conducted to identify the longitudinal and transverse impedance of this thin-wall vacuum chamber prototype experimentally. The simulated and measured results for the impedance were consistent. Furthermore, a campaign for resonance-check measurements on this thin-wall vacuum chamber prototype was launched. This novel thin-wall vacuum chamber structure has been ready for installation in the Booster Ring (BRing).

THP68 **Beam parameters studies of the CAEP THz FEL as injector for ERL**

Xin Yang (Institute of Modern Physics, Chinese Academy of Sciences).
Hanxun Xu, Kui Zhou (China Academy of Engineering Physics, Institute of Applied electronics), Ping Yuan, Quantang Zhao, Xiaoxiao Yuan, Zimin Zhang (Institute of Modern Physics, Chinese Academy of Sciences).

The Energy Recovery Linac (ERL) serves as a primary means to simultaneously achieve high energy utilization efficiency, high average beam current, and high-brightness electron beams. The Chinese Academy of Engineering Physics’ Infrared Terahertz Free-Electron Laser (CAEP IR-THz FEL) aims to produce FEL light within the 0.1-125 THz spectrum with updated beam energy and undulators. Another goal of the project is to build Chinese first ERL experimental research platform. The original CAEP THz FEL accelerator will be the injector of the ERL. This paper focuses on the generation and measurement of high repetition rate, low emittance electron beams of the injector, combining numerical simulation optimization with experimental measurements. The beam dynamics of the injector is optimized with ASTRA. The fully beam parameters, including beam transverse emittance, bunch charge, beam energy and energy spread and bunch length are measured and analyzed in detail, which will be used for further ERL beam dynamics design.

THP69 **Measurement of the H- content in mixed beam from ion source**

Baichuan Wang (State Key Laboratory of Intense Pulsed Radiation Simulation and Effect).
Di Wang, Minwen Wang, Yihua Yan, Zhongming Wang (Northwest Institute of Nuclear Technology), Maocheng Wang, Mingtong Zhao, Wei Lv, Wolong Liu (State Key Laboratory of Intense Pulsed Radiation Simulation and Effect).

H- ion source produces mixed beam of H- and electrons. Usually, a bending magnet is needed to measure the contents of mixed beam. However, bending magnet is generally lacked in H- machine, because bending magnet increases the transport line length, leading to more serve decline of H-. How to measure the H- content in mixed beam without the help of bending magnet is worthy to be studied. In this paper we describe a method to measure the H- content utilizing common devices in low energy beam transport line. This method is mainly based on a solenoid. the H- and electron contents can be obtained by analyzing the change of the beam transmission when sweeping the solenoid current. The experiments were performed.

THP71 **Betatron stopbands and coupling resonance driving terms characterization at VEPP-2000 collider**

Danil Chistyakov (Budker Institute of Nuclear Physics SB RAS & Novosibirsk State University).
Evgeny Perevedentsev, Yury Rogovsky (Budker Institute of Nuclear Physics SB RAS & Novosibirsk State University).

The final-focus solenoids of the round-beam e+e- collider VEPP-2000 can cause stopbands in the betatron tune plane. This specific stopband domain limits the available tune space in the most important region above the integer tunes. We present a study of the combined effect of coupling resonances caused by the decompensated solenoids and the integer-tune parametric resonances. The results are compared with numerical investigations of this combined effect. Presented experimental data includes scanning of the available betatron tune plane domain and evaluation of coupling RDTs using beam oscillation histories from BPMs.

THP72 **A preliminary design of a Compton polarimeter at BEPC-II**

Zhe Duan (Institute of High Energy Physics).
Aurélien Martens (Université Paris-Saclay, CNRS/IN2P3, IJCLab), Daheng Ji, Jianli Wang, Yanchun Li (Institute of High Energy Physics), Guangyi Tang, Qingfu Han, Zhijun Liang (Chinese Academy of Sciences), Mengyu Su (University of Chinese Academy of Sciences).

BEPC II is a double ring e+ e- collider running in the tau-charm energy region. We proposal reusing the beamline of a dismantled wiggler magnet to implement a Compton polarimeter detecting scattered γ photons, to measure the self-polarization of the electron beam at BEPC II. As a testbed for future colliders like the CEPC, this would enable resonant depolarization, and thus provide precision beam energy calibration for BEPC II. In this paper, the preliminary design of this Compton polarimeter is presented, as well as the tentative plan for implementation and commissioning in the coming years are shown.

THP73 **Methodology for identifying the centre of a solenoid magnet based on the beam dynamics**

Dong Hyuck Kim (Gangneung-Wonju National University).
Ji-Gwang Hwang (Helmholtz-Zentrum Berlin für Materialien und Energie GmbH).

The method of varying the strength of the corrector magnet installed upstream and minimising the position variation in diagnostics located downstream is widely used for identifying the centre of the magnetic field produced by a quadrupole magnet. However, in the case of a solenoid magnet, unlike a quadrupole magnet, it is not suitable to apply the variable separation method in the x-y direction since both field components are correlated, and the focusing of the magnetic field occurs in the azimuthal direction. In this presentation, we propose an analytical method for finding the centre of a solenoid magnet and present results validated by simulations.

THP74 **Beam based alignment by using double correctors**

Changbum Kim (Pohang Accelerator Laboratory).
Donghyun Song (Pohang Accelerator Laboratory).

Beam based alignment is a well-known technique for obtaining a small emittance beam which is critical in an injector of an accelerator or a matching section between two accelerators. The simplest beam based alignment can be performed with a corrector, a quadrupole, and a beam position monitor. This work presents a beam based alignment technique with double correctors located before the quadrupole magnet. The merit function was used to find the corrector settings of each beam based alignment. The measurement results showed that minimum corrector strengths could be achieved to have the ideal beam based alignment by using the fitting results of the merit function.

FRA: Transverse Profile and Emittance Monitors

Chair: Kenichirou Satou (High Energy Accelerator Research Organization)

FRAT1 09:00 **Secondary, thermionic and delta electrons emission from thin targets**

Mariusz Sapinski (Paul Scherrer Institut).

Thin objects in the form of wires, foils or strips are often used as targets in various instruments that measure beam parameters or for other purposes. They usually cause only small beam perturbations and suffer from relatively low temperature increases. The beam induces the emission of secondary electrons, which are usually the source of the measured signal. In high brightness beams, the targets can reach high temperatures, which lead to thermionic current emission. Also, a small amount of delta electrons is emitted, which has a negligible effect on the emitted current but affects the beam heating. These three types of electrons have different properties and influence the measured signal as well as the temperature evolution of the target. This paper discusses how the signal is generated by the escaping electrons, how bunch field affects this signal and how the target temperature depends on the electron emission.

FRAC2 09:50 **BGC monitor: first year of operation at the LHC**

Hao Zhang (Cockcroft Institute).
Adriana Rossi, Ashley Churchman, Cristina Sequeiro, Daniele Butti, Gerhard Schneider, Krystian Sidorowski, Marton Ady, Muhammed Sameed, Raymond Veness, Stefano Mazzoni, Thibaut Lefevre (European Organization for Nuclear Research), Carsten Welsch (The University of Liverpool), Oliver Stringer (Cockcroft Institute), Peter Forck, Serban Udrea (GSI Helmholtzzentrum f ü r Schwerionenforschung GmbH).

The Beam Gas Curtain (BGC) monitor was installed in the beam one of the Large Hadron Collider (LHC) during Long Shutdown 2 (LS2) and the Year-End Technical Stop (YETS) 2022. The monitor detects the fluorescence signal generated due to the interaction between the charged particle beams in the LHC and the neon atoms in the supersonic gas curtain. This provides 2D images of the primary beam. In the 2023 run, it was demonstrated that transverse beam profile measurement for both, proton beam and lead ion beams in the LHC is possible across injection, energy ramp-up and top energy operation. The BGC has shown the potential to be an operational instrument and efforts to integrate the monitor into the main machine control system are being undertaken. In this contribution, we will present measurement results and discuss the operational experience including observed gas loads to the LHC, observed impact on beam losses and demonstrated resolution of the monitor. Finally, we will also discuss future plans for the continued optimization of this monitor and the installation of a second monitor into beam two.

13-Sep-24 10:50 – 12:20 China Hall 2

FRB: Beam Loss Monitors and Machine Protection/Beam Charge and Current Monitors

Chair: Thibaut Lefevre (European Organization for Nuclear Research)

FRBI1 10:50 **Development of ultra-fast diamond-sensor based systems for Advanced Accelerator Diagnostics**

Bruce Schumm (University of California, Santa Cruz). *Renee Pedilla.*

We report on the activities of the University of California-funded Advanced Accelerator Diagnostics (AAD) Collaboration to develop ultra-fast diamond-sensor-based detection systems. Results are presented on the performance properties of monocrystalline diamond, including charge collection efficiency and time, and radiation tolerance. We follow with presentations of diagnostic-system prototypes completed or under development by the collaboration that pushes the state-of-the-art in terms of radiation tolerance, position sensitivity, and detector system bandwidth. These include a pass-through quadrant monitor with a resolution of 1% of beam width aimed at cavity-based FELs such as CBXFEL with pulse rates of 50 MHz. A different prototype is being developed for a wire-free monitor for real-time profiling of intense proton beams, geared towards improving the efficiency and yield of isotope-production facilities. Progress is also being made on next-generation XFEL detectors with multi-bunch operation requiring 5-10 GHz measurement rates. Above 1-2 GHz, detection systems enter the "RF region" for which challenges arise in all four areas of charge collection speed, signal path integrity, high-bandwidth signal transport, and amplification and digitization. Progress on all these fronts, and remaining challenges, will be presented.

FRBC2 11:20 **A systematic investigation of beam losses and position reconstruction techniques measured with a novel oBLM at CLEAR**

Montague King (European Organization for Nuclear Research).
Belen Salvachua, Ewald Effinger, Jean Michel Meyer, Jose Esteban Felipe, Sara Benitez, Wilfrid Farabolini (European Organization for Nuclear Research), Carsten Welsch (The University of Liverpool), Joseph Wolfenden (Cockcroft Institute), Pierre Korysko (Oxford University).

Optical Beam Loss Monitors (oBLMs) allow for cost-efficient and spatially continuous measurements of beam losses at accelerator facilities. A standard oBLM consists of several tens of meters of optical fibre aligned parallel to the beamline, coupled to photosensors at either or both ends. Using the timing information from loss signals, the loss positions can be reconstructed. This contribution presents a novel oBLM system recently deployed at the CERN Linear Electron Accelerator for Research (CLEAR). Multiple methods of extracting timing and position information from measured waveforms are investigated, and the potential impact of varying beam parameters such as bunch charge or number is analysed. This work has resulted in the development of a GUI to aid operations by visualizing the beam losses and their positions in real time.

FRBC3 11:40 **SPS fast spill monitor developments**

Sara Benitez Berrocal (European Organization for Nuclear Research).
Aurelie Goldblatt, Miguel Martin Nieto, Stephane Burger (CERN), David Belohrad, Federico Roncarolo, Stefano Mazzoni (European Organization for Nuclear Research).

The North Area facility (NA) receives the 400 GeV proton beam through a slow extraction process at the CERN Super Proton Synchrotron (SPS). To improve the SPS spill quality, it is crucial to monitor the spill intensity from the nA up to the μA range with a bandwidth extending from a few Hz up to several GHz along the extraction line. The most promising measurement options for this purpose are the Optical Transition Radiation-PhotoMultiplier (OTR-PMT) and the Cherenkov proton Flux Monitor (CpFM). This document presents recent improvements of both devices based on the operational experience gathered throughout the 2023 Run. It includes a detailed analysis and discussion of the present performance, comparing the capabilities of each instrument. Additionally, future ideas for multi-GHz detectors, particularly for the SHIP collaboration, are also outlined.

FRCL 12:00 **Closing Remarks**

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北方夜视科技（南京）研究院有限公司 NORTH NIGHT VISION SCIENCE&TECHNOLOGY (NANJING) RESEARCH INSTITUTE CO.,LTD

离子仪器 Lanzhou Ion Instrument

沈阳科仪 SKY TECHNOLOGY DEVELOPMENT

Tektronix

nVent SCHROFF

坤驰科技 Queentest

PANTECHNIK Boost Your Physics

EMERSON.

奥远电源 Allrun Power Supply

TELEDYNE LECROY Everywhereyoulook

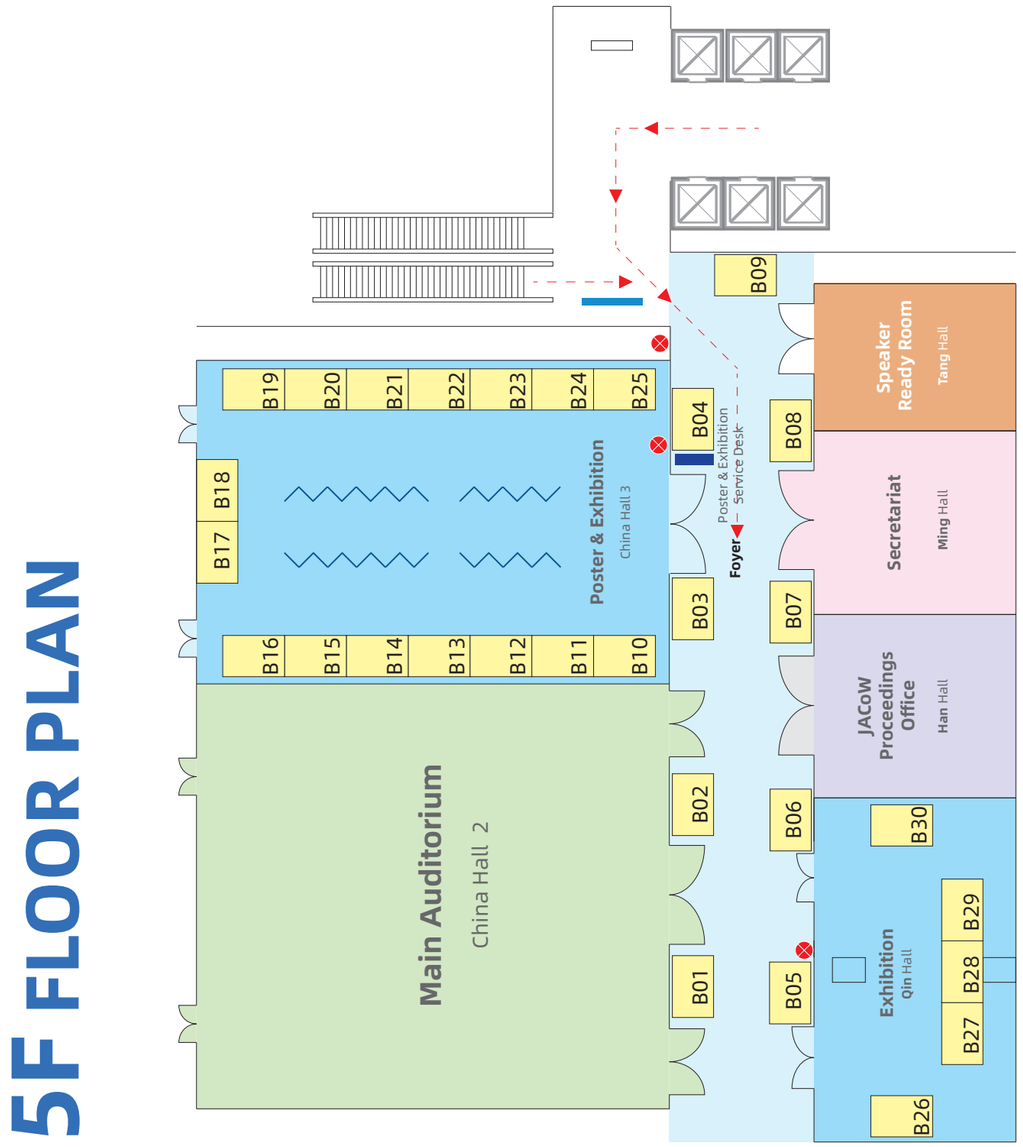
ROHDE&SCHWARZ Make ideas real

中科采象 EVERACO TECHNOLOGIES

SIGLENT 鼎阳

D-Pace

Exhibition Floor Plan



Booth No.	Exhibitor Name
B01	Beijing Yaqiang Century Technology Co., Ltd. 北京亚强世纪科技有限公司
B02	MoreTek Electronic Technology (Suzhou) Co., Ltd 摩科斯电子科技（苏州）有限公司
B03	Dimtel, Inc.
B04	北京嘉兆华明电子科技有限公司 / RIGOL
B05	Tianjin YingGe Excellent Control Technology Co., Ltd. 天津盈科卓控科技有限公司
B06	The Aerospace Information Research Institute, Chinese Academy of Sciences 中国科学院空天信息创新研究院
B07	Instrumentation Technologies
B08	ANDESUN Technology Accelerator Co., Ltd 江苏安德信加速器有限公司
B09	ESE Trading (Shanghai) Co. Ltd. 科电贸易（上海）有限公司
B10	NORTH NIGHT VISION SCIENCE & TECHNOLOGY (NANJING) RESEARCH INSTITUTE CO., LTD 北方夜视科技（南京）研究院有限公司
B11	Beijing Intrepidity Technology Co., Ltd. 北京英迪普蒂科技有限公司
B12	Suzhou Lair Microwave Inc. 苏州莱尔微波技术有限公司
B13	Suzhou RADSYS Co., Ltd. 苏州瑞地测控技术有限公司
B14	CAENels 北京中检维康电子技术有限公司（简称：北京中检电子）
B15	Beijing Queentest Technology Co., Ltd 北京坤驰科技有限公司
B16	SKY Technology Development CO., LTD. Chinese Academy of Sciences 中国科学院沈阳科学仪器股份有限公司
B17	nVent Electrical Products China CO., Ltd. 盈凡电气产品 (青岛) 有限公司
B18	PANTECHNIK Boost Your Physics
B19	Allrun Power Supply 大连奥远电源有限公司
B20	Tektronix (China) Co., Ltd. 泰克科技（中国）有限公司
B21	National Instruments 恩艾（中国）仪器
B22	Bobang Hongguang 北京博邦弘光科技有限公司
B23	Anhui Huadong Photoelectric Technology Research Institute Co., LTD 安徽华东光电技术研究所有限公司
B24	Bergoz Instrumentation & Conveyi
B25	Lanzhou Ion Instrument Co., Ltd. 兰州离子仪器有限公司
B26	Hefei EverACQ Technologies Co., LTD 合肥中科采象科技有限公司（简称：中科采象）
B27	D-Pace Inc.
B28	SIGLENT TECHNOLOGIES CO., LTD. 深圳市鼎阳科技股份有限公司
B29	Teledyne LeCroy Inc. 特励达力科公司
B30	ROHDE & SCHWARZ 罗德与施瓦茨（中国）科技有限公司

Exhibition Opening Hours

Date	Opening Hour
Tuesday, September 10, 2024	09:00-17:30
Wednesday, September 11, 2024	09:00-16:00
Thursday, September 12, 2024	09:00-17:30
Friday, September 13, 2024	09:00-12:00

Sponsors & Exhibitors List

GOLD SPONSORS

科電貿易（上海）有限公司
ESE Trading (Shanghai) Co.,Ltd. **Booth No. : B09**

ESE Trading(Shanghai) Co. Ltd.
科电贸易（上海）有限公司

Electronic Testing Systems (ETS) is your trusted partner for a comprehensive range of electronic testing and measurement services. With expertise in RF and Microwave, Telecommunications, Multimedia, Power Electronics, and EMC testing equipment, we offer professional solutions and system integration. Our department also specializes in Microwave Plasma CVD Systems for diamond deposition and carbon materials research and production. Supported by experienced sales engineers, technical support specialists, and a dedicated service team, we deliver innovative and precise solutions for industries including automotive, renewable energy, semiconductor, telecommunications, and university research. With offices and service centers strategically located throughout China, we provide prompt localization services from technical sharing to product purchase and after-sales support.

SILVER SPONSORS

Booth No. : B06

The Aerospace Information Research Institute, Chinese Academy of Sciences
中国科学院空天信息创新研究院

Since the development of China's first klystron in 1956, the Key Laboratory of High Power Microwave Source and Technology of the Academy of Aerospace Information Innovation of the Chinese Academy of Sciences has focused on the research and work of vacuum electronic technology and related processes. At the same time, it also focuses on the construction of tube making process technology platform, establishes and improves the special process specifications of electric vacuum devices and large device components, and has the production capacity of 1200 devices per year.

MoreTek 摩科斯电子科技(苏州)有限公司 **Booth No. : B02**

MoreTek Electronic Technology (Suzhou) Co., Ltd.
摩科斯电子科技（苏州）有限公司

MoreTek Electronic Technology (Suzhou) Co., Ltd was established in May 2019, operated under the medical and electric vacuum division in a 3,000 sqm site with a 500 sqm 10k class clean room and 50 sqm 100 class room. Our version is “ Quality First, Customer First”.

We focus on ceramic to metal assembling process and serve the multiple markets including high energy physics, medical device, semiconductor, laser. Our key capabilities are sputtering, brazing, electroplating, passivating.
Our typical products are as implantable feedthroughs, feedthroughs, microwave windows, high power couplers, HOM absorbers. We have a complete and high standard production and inspection equipments such as brazing furnaces, sputter furnaces, laser marking and welding machines, ultrasonic cleaning machines, Helium leak detectors.

EXHIBITORS

dimtel **Booth No. : B03**

Dimtel, Inc.

Dimtel, Inc. is a provider of analog and digital signal processing solutions for particle accelerators, with primary focus on low level RF and instability control systems. Dimtel products are in use at 32 accelerators in 26 facilities around the world.

INSTRUMENTATION TECHNOLOGIES **Booth No. : B07**

Instrumentation Technologies

Instrumentation Technologies, a high-tech company founded in 1998 in Slovenia, is today a leading provider of instrumentation for high-speed signal acquisition and processing. Their devices are used in particle accelerators, proton therapy medical applications, and industries such as aerospace, transportation, and energy.
The LIBERA brand identifies solutions, products, and services in the accelerator field, measuring critical beam parameters (Beam Position and Phase, Beam Current, Beam Losses) and controlling the RF field inside accelerating structures. These parameters are used in feedback loops to optimize performance. LIBERA electronics are today’s reference standard and state-of-the-art in many applications.

bergoz INSTRUMENTATION Distributed in China Mainland and Taiwan by CONVeYI **Booth No. : B24**

Bergoz Instrumentation & Conveyi

BERGOZ Instrumentation is a French SME, founded in 1981, focusing on non-destructive beam instrumentation for particle accelerators.
It develops and manufactures current transformers, current monitoring devices and electronic instrumentation for current measurement and elementary particle beams diagnostics, nondestructively. Bergoz instruments are found in applications as diverse as high energy particle accelerators, in research and medicine, on synchrotron radiation light sources, on ion implanters used for materials surface modification, on conformance test benches, to measure partial discharge, corona, isolation breakdown, and many more.
Beijing Conveyi Limited is acting as an exclusive distributor of Bergoz‘s products in China market.

ANDESUN 安德信科技 **Booth No. : B08**

ANDESUN Technology Accelerator Co., Ltd
江苏安德信加速器有限公司

ANDESUN Technology Company is a trusted company that specializes in Feedthrough, BPM and charged-particle beam-testing equipment. The high-performance multipin and coaxial feedthroughs, which are developed and produced by ANDESUN Technology, have undergone a series of tests including ultra-high vacuum, ultra-high temperature, extreme-low temperature, high pressure, high voltage, high current, microwave performance, etc. The products have low insertion loss, stable performance, and excellent quality, and can be used in various environments. Their products have been applied to hundreds of particle accelerators.

Booth No. : B05

Tianjin YingGe Excellent Control Technology Co., Ltd.

天津盈科卓控科技有限公司

Tianjin YingGe Excellent Control Technology Co.,Ltd. is a high-tech enterprise. We can provide customers with based on EPLAN drawing design and assembly sets, C # software and engineering software development.

Based on the TwinCAT3 software of German BECKHOFF, we realize the control through a controller of DI, DO, AI, AO, molecular pump R232/RS485, vacuum meter R232/RS485, TKD power communication and Faraday cylinder motion, and realize the real-time communication IOC between the controller and EPICS.

CSRm vacuum status monitoring and LEAF, CAFe, SSC_Linac, ICT_Linac beam diagnosis probe and Xinjiang-Institute-of-Physics-and-Chemistry and Harbin-Institute-of-Technology linear accelerator and Guangdong-Huizhou HIRFL and CiADS motion control system…

Contact: Jiang Zhijun 18920375500

zj.jiang@ygex-control.com

Booth No. : B01

Beijing Yaqiang Century Technology Co., Ltd.

北京亚强世纪科技有限公司

Beijing Yaqiang Century Technology Co., Ltd. was established on March 30, 2015, with its registered address at 3A04, 4th Floor, 4th Floor, Courtyard 18, Suzhou Street, Haidian District, Beijing. The registered capital is 20 million yuan. The main business scope includes: technical services, technology development, technology consulting, and technology promotion; Software sales; Sales of cloud computing devices; Sales of information security equipment; Sales of industrial control computers and systems; Software development, etc; Information system integration, etc.

Booth No. : B04

北京嘉兆华明电子科技有限公司/ RIGOL

Jiaozhao Huaming, currently has 5 companies including Beijing Jiazhao Huaming Electronic Technology Co., Ltd., Nanjing Jiazhao Huaming, Xi'an Jiazhao Huaming, Shenzhen Jiazhao Huaming, and Beijing Ningpu Electromagnetic, as well as 9 offices in Shanghai, Shenyang, Shenzhen, Tianjin, Chengdu, Wuhan, etc. It is a high-tech enterprise that integrates system integration, research and development, production and manufacturing, sales, and technical services. In addition to the independent brand Jiazhao Huaming and the holding brand Ningpu Electromagnetic, the main agent brands are AR-Vectawave-Narda-HILO-AE-Ametek-Solar-ETS-Schwarzbeck-Montena-FCC-Wavecontrol-Ettus-Keysight-NoiseKen-IZT-DBM and other imported brands. General agent or authorized first-level agent in the China region, etc, Representing domestic brands such as RIGOL, PROSUND, Wuhan Luowave SDR, Beijing Daze, Xi'an Hengda, Xi'an Aigtek, Beijing Jitai, Ceyear, and Shanghai Prima.

Booth No. : B22

Beijing Bobang Hongguang Technology Co., Ltd.

北京博邦弘光科技有限公司

Beijing Bobang Hongguang Technology Co., Ltd. is a technology company specializing in the field of optical communication. Its main business includes special optical fibers, special optical cables, special optical fiber components, comprehensive solutions, etc. It can provide customers with personalized customized services and overall solutions, adhering to the development concept of "people-oriented, win-win cooperation".

13th INTERNATIONAL BEAM INSTRUMENTATION CONFERENCE
Sept. 9 -13, 2024 · Beijing, China

Booth No. : B12

Suzhou Lair Microwave Inc.

苏州莱尔微波技术有限公司

Lair Microwave Inc. is a leading manufacturer in RF/Microwave industry with over 15 years of proven performance. We design and manufacture RF/Microwave products in a wide frequency range from DC to 110GHz, including RF cables, RF connectors, RF cable assemblies, Microwave and mmWave components, widely used for IoT, 5G, satellite, high speed, aerospace, commercial and telecommunication applications.

Booth No. : B11

Beijing Intrepidity Technology Co., Ltd.

北京英迪普蒂科技有限公司

Beijing Intrepidity Technology Co., Ltd. Is a technology-based enterprise established in Beijing. The company's main business is to provide customers with high-quality semiconductor component agency, related equipment import services, as well as PCBA research and development and outsourcing services and technical support. The company has an independent and strong R&D team and technical support team. And there is a PCB SMT production line established in Changping, Beijing.

Booth No. : B13

Suzhou RADSYS Co., Ltd.

苏州瑞地测控技术有限公司

Suzhou RADSYS Co., Ltd. (referred to as "RADSYS") was founded in September 2015. The company is dedicated to developing synchronized test and measurement instruments to assist engineers in addressing challenges in the real-world and cyber-physical system. The test and measurement instrument developed by RADSYS integrates advanced White Rabbit and FPGA technology to fulfill the requirements of synchronization performance and high bandwidth for large-scale distributed systems. The modular architecture and lower development costs also facilitate engineers in developing unique and outstanding solutions.

Signalmicrowave

河北时光射频技术有限公司

Signalmicrowave was founded in 2015 in China, with a team serving the particle accelerator industry and engaged in research and development of microwave electronics technology. Signalmicrowave focuses on customized products and engages in new design and development. These technologies are applied in analog circuit applications such as microwave front-end, frequency synthesis, power amplifiers, phase shifters, etc. In the past 10 years, Signalmicrowave has provided hundreds of customized equipment for scientific research linear accelerators built in China.

Booth No. : B23

Anhui Huadong Photoelectric Technology Research Institute Co., LTD

安徽华东光电技术研究所有限公司

Anhui Huadong Photoelectric Technology Research Institute limited company is located in Wuhu City, Anhui province High-tech Development Zone, registered capital of 16.933 million yuan, covers an area of 500 mu, More than 300 employees, with a variety of production, testing, testing equipment more than 500 sets, the main products include microwave vacuum devices, microwave solid-state devices, etc.

Booth No. : B14

CAEN ELS

北京中检维康电子技术有限公司

Established in 2009, CAEN ELS (a spin-off company of CAEN Nuclear) is a leading company in the design of power supplies and state-of-the-art complete electronic systems, having its main focus on dedicated solutions for the particle accelerator community and high-end industrial applications.

By analyzing and sharing the needs of the particle accelerator community, CAEN ELS can provide both complete solutions and electronic instrumentation for several applications in these environments, from magnet power supplies to diagnostic electronic instrumentation, from precision current sensors to complex beamline electronic systems.

Booth No. : B10

NORTH NIGHT VISION SCIENCE & TECHNOLOGY (NANJING) RESEARCH INSTITUTE CO., LTD

北方夜视科技（南京）研究院有限公司

Established on March 11, 2021, with a registered capital of 100 million, North Night Vision Technology (Nanjing) Research Institute Co, Ltd. (NVN) belongs to North Night Vision Science & Technology Research Institute Group Co, Ltd. NVN has more than 300 full-time employees.

Laying out a new digital and intelligent night vision imaging equipment industry, shaping a new industrial park, and integrating production and research of new night vision devices, NVN is accelerating research on advanced technology and frontier technology, which will provide strong support for the NVG to build a world-class enterprise through deepening the reform of technological innovation mechanism.

Booth No. : B25

Lanzhou Ion Instrument Co., Ltd.

兰州离子仪器有限公司

Lanzhou Ion Instrument Co., Ltd. is a professional manufacturer and supplier of vacuum mechanical equipment and instrumentation. It bases its technology research and development on customer demand and provides services for non-standard custom machinery, high vacuum applications, and the instrumentation industry. The product is highly practical and reliable, and the service is highly flexible to meet customer needs. The company has comprehensive R&D capabilities, enabling it to offer customers tailored services.

Booth No. : B16

SKY Technology Development CO., LTD. Chinese Academy of Sciences

中国科学院沈阳科学仪器股份有限公司

SKY Technology Development Co.,Ltd. Chinese Academy of Sciences (SKY Technology) founded in 1958. After half century development, based on vacuum technology with the concept of innovation in mind, SKY has created vacuum equipment for high technology、new materials and new energy fields such as high-end R&D equipment, semiconductors, solar energy and LEDs. Focused on equipment manufacturing, SKY has become a modern company integrated with R&D, manufacture, market and service of vacuum instrument and device.

Main Products:

Vacuum Applying Products:

(1) Vacuum thin film equipment: PVD coating equipment, CVD coating equipment;

(2) New materials preparing equipment: vacuum metallurgy equipment, crystal material preparing equipment;

(3) Major national science and Engineering facility: Vacuum interconnected facility, synchrotron radiation facility.

Booth No. : B20

Tektronix (China) Co., Ltd.

泰克科技（中国）有限公司

Tektronix is a global leader in providing test, measurement, and monitoring solutions. Founded in 1946 and the inventor of the world's first triggered oscilloscope, Tektronix designs and manufactures solutions that help break through layers of complexity and accelerate industry innovation. With offices in 21 countries, Tektronix serves scientists, engineers, and technicians across diverse fields such as communications, automotive, semiconductor, medical, and education, providing critical support for significant advancements over the past 78 years.

Booth No. : B17

nVent Electrical Products China CO., Ltd.

盈凡电气产品(青岛)有限公司

nVent is the world's leading provider of electronic and electrical system control solutions. nVent has 120+ locations in 35 countries across the globe. Its business covers Europe, the Americas, Asia Pacific and other regions.

Founded in Germany in 1962, SCHROFF is the European leader in electronic system protection solutions. Dedicated to the development and promotion of the 19" standard, SCHROFF offers the most comprehensive range of standard 19" cabinets, chassis, plugins and electronic system solutions, capable of responding quickly to all types of design challenges, as well as having a significant research and development capability for customization.

Booth No. : B15

Beijing Queentest Technology Co., Ltd

北京坤驰科技有限公司

Queentest Technology started operating in 2008, focusing on the field of modular high-speed data acquisition, providing users with signal acquisition and processing platform products based on FPGA, high-speed AD, DA, and multiple buses. The functions cover high-speed signal acquisition and retrieval, high-speed data storage and playback, real-time processing and display of high-speed signals, etc.

Providing users with easy-to-use modular signal acquisition and processing products and creating a deep value chain is the company's market foothold.

Booth No. : B18

PANTECHNIK

Pantechnik has been committed to serve particle accelerators community for more than 30 years.

Amongst our products and services, we supply ECR ion sources, turnkey injectors with LEBT, and various beam diagnostics to measure beam current, profile and emittance. 、Our diagnostics can be delivered as a turnkey system, with vacuum tank and software. 、Installation, training and maintenance are services that we provide to our customers.

Booth No. : B21

National Instruments

恩艾（中国）仪器

At NI, our automated test and automated measurement systems make breakthroughs possible. Let's work together to select the right combination of hardware, software, and services so that you're fully equipped to build the extraordinary.

NI is uniquely equipped to help our customers

outpace change, so they can come out ahead of their competitors. We have the industry's most comprehensive portfolio of software, which helps our customers drive performance from the instrument all the way to the enterprise.
We're trusted: Proven test automation technology delivers leading test accuracy, throughput, and reliability from the lab to beyond the manufacturing floor.

奥远电源 Allrun Power Supply

Booth No. : B19

Allrun Power Supply
大连奥远电源有限公司

Allrun Power Supply is a high-tech enterprise under Allrun Group , specializing in the research and development, production, and sales of the power supply industry. The company's independently developed high-voltage DC power supply, pulse and RF power supply have received high praise from customers.
Allrun Power Supply has collaborated with Dalian University of Technology to develop a 150kV-350kV high-voltage power supply, which will provide stable supply to the National Atomic Energy Research Institute, Qixian Nuclear and other units.

TELEDYNE LECROY Everywhereyoulook™

Booth No. : B29

Teledyne LeCroy Inc.
特励达力科公司

Teledyne LeCroy is a leading provider of oscilloscopes that enable companies across a wide range of industries to design and test electronic devices of all types. Since our founding in 1964, we have focused on creating products that improve productivity by helping engineers resolve design issues faster and more effectively.
Our oscilloscopes offer a powerful combination of large and informative displays combined with advanced waveshape analysis capabilities typically tailored to enhance the productivity of engineers. LeCroy build the first scope with 12bits resolution, the first scope with 100GHz bandwidth and 240GS/s sample rate, the first scope with 80-channels …

ROHDE&SCHWARZ Make ideas real

Booth No. : B30

罗德与施瓦茨公司

The Rohde & Schwarz technology group develops, produces, and markets a wide range of electronic capital goods. With its extensive product portfolio, the company makes an important contribution to a safer and more connected world. In the test & measurement, secure communications, networks & cybersecurity and broadcast & media markets, customers worldwide rely on Rohde & Schwarz and its cutting-edge solutions. In addition to its established business fields, Rohde & Schwarz has made substantial investments in future technologies such as artificial intelligence, the industrial internet of things (IIoT), 6G, cloud solutions and quantum technology.
Established almost 90 years ago, the group is recognized as a reliable partner for industry customers.

中科采象 EVERACO TECHNOLOGIES

Booth No. : B26

Hefei EverACQ Technologies Co., LTD
合肥中科采象科技有限公司（简称：中科采象）

Specializing in “fast electronics technology” and “modular instrumentation technology”, our company meets the precision signal acquisition needs in sectors like electronic information, industrial automation, testing and measurement, marine resource exploration, and nuclear technology. Our instruments feature world-class specifications, particularly in synchronization, offering exceptional flexibility for various applications. These solutions have been effectively applied in radiation detection, energy exploration,

national defense, LiDAR, and optical fiber sensing, etc.

SIGLENT 鼎阳

Booth No. : B28

SIGLENT
深圳市鼎阳科技股份有限公司

SIGLENT founders began developing digital oscilloscopes in 2002. After more than a decade of research and development, our products include digital oscilloscopes, handheld oscilloscopes, function/arbitrary waveform generators, DC power supplies, digital multimeters, spectrum analyzers and other general test instruments. In 2005, SIGLENT produced the ADS 7000 series digital oscilloscope, and from that point on our annual growth has been 50% or more every year. We’re proud to announce that SIGLENT delivers. Every Bench. Every Engineer. Every Day.

D-Pace

Booth No. : B27

D-Pace Inc.

D-Pace supplies products and services to the international accelerator industry. Our areas of expertise include beamline systems, beam diagnostic devices, solid target stations, and ion sources for research, industrial, and commercial accelerator systems. Located in Nelson, BC, Canada, we serve the medical radioisotope manufacturing industry, medical therapy industry, discovery science, and others. We can provide a variety of solutions from hardware to full turnkey systems custom designed to interface with your facility. With over 30 years of accelerator experience, we look forward to seeing how we can help!

HeFei RongKe Instrument Co., Ltd.
合肥融科科研仪器有限公司

HeFei RongKe Instrument Co., Ltd. was established at May 2023 and currently has more than 50 employees and nearly 80 equipment of various types. The core team members (20 people) have more than ten years of experience in the construction and operation of large scientific facilities. The personnel composition covers the entire business process including R&D, machinery, electrical, production, welding, assembly, and testing, and has professional knowledge in vacuum, cryogenics, superconductivity, precision machinery, computers, and electrical control. The business field of the company is the development in vacuum, cryogenics, magnets, and automation equipment related to the large scientific facilities.

Event Sponsors

bergoz INSTRUMENTATION Distributed in China Mainland and Taiwan by CONVeYI

Booth No. : B24

Bergoz Instrumentation & Conveyi

BERGOZ Instrumentation is a French SME, founded in 1981, focusing on non-destructive beam instrumentation for particle accelerators.
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离子仪器

Lanzhou Ion Instrument

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The company's business scope includes instrument sales, manufacturing and repair; technical services on technology development, consulting, transfer, and promotion; big data services; data processing and storage support services; computer hardware and auxiliary equipment wholesale and retail; import and export agency; technology import and export; housing leasing and so on.
The Ion Instrument Company is dedicated to providing its customers with high-quality products and services. We are committed to offering our customers warm, thoughtful and prompt service. We are committed to establishing long-term, mutually beneficial relationships with our customers. We will continue to provide our customers with the best service possible. The company is open to collaboration with all sectors of the community with the goal of creating something truly remarkable.

Email: lanzhouliziyiqi@sina.com

MEMO

bergoz INSTRUMENTATION

Distributed in China Mainland and Taiwan by CONVeYI

BERGOZ Instrumentation is a French SME, founded in 1981, focusing on non-destructive beam instrumentation for particle accelerators.
Partner in Non-Destructive Diagnostic Solutions for Low Current Measurements.

1 - NPCT

新型束流传感器

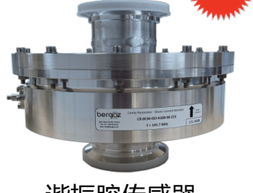
DC Beam

非拦截式
束流测量

带 宽	分辨率
DC to10kHz	< 0.5μArms √ Hz

测量范围：±20mA 到 ±20A
线性误差：<0.1%

2 - CR-BCM NEW!



谐振腔传感器

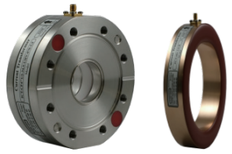
CW/Macropulse

连续脉冲与宏脉冲
Flash, Isotope

束流重频	分辨率
30MHz - 175MHz	100pA@500Hz

尺寸(长+外径)：100mm+300mm
响应时间：<1μs

3 - ICT



电荷积分器

Charge

电荷积分

灵敏度	量 程
0.5Vs/C - 20Vs/C	400pC - 800nC

温度范围: 100°C, 155°C, 185°C
单脉冲噪声：0.55pCrms

4 - ACCT

AC 束流传感器

macropulses

长脉冲与宏脉冲

带 宽	分辨率
< 3Hz to 3MHz	0.5μArms

量程范围： ±1mA to ±2A
外部磁场屏蔽: 20-500 Gauss

Beijing Conveyi Limited is the exclusive distributor of Bergoz product in China / 北京科维泰信科技有限公司是 Bergoz 在中国区的独家代理商

北京科维泰信科技有限公司
办公室：北京海淀区西三旗建材城东路 10 号尚德智造产业园 D1-129　网址：www.conveyi.com
手机：18901205447, 13671118525, 13911290461,
电话：010-80753647 邮件：sales@conveyi.com

MEMO

13th INTERNATIONAL BEAM INSTRUMENTATION CONFERENCE
Sept. 9 -13, 2024 · Beijing, China

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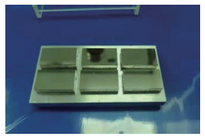
中国科学院空天信息创新研究院

Aerospace Information Research Institute，Chinese Academy of Science

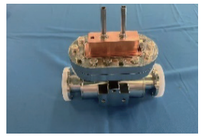
Email: wangbf@aircas.ac.cn Tel: 13391806105

The Aerospace Information Research Institute of the Chinese Academy of Science is one of the earliest units engaged in the development and production of vacuum electronic devices in China. For over 65 years, we have completed vacuum devices and components such as **Klystron, beam detectors, DCCT ceramic vacuum boxes, synchronous light extraction system, visible beam measurement lines, X-ray beam measurement lines, photon absorbers, RF shield bellows, vacuum boxes, electronic chambers, couplers, photocathodes,** etc. The key process links include precision machining of parts, surface treatment, preparation of electron guns, brazing of ceramic components and metal parts, electron beam welding, laser welding, TIG welding, cold welding, vacuum leak detection, ultra-high vcuum baking and exhaust, microwave testing, etc.

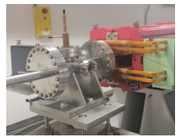
X-ray absorber



Convex mirror

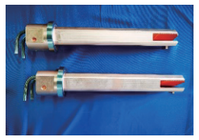


Thin film absorber



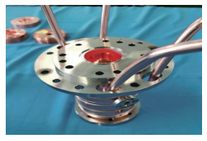
Synchrotron Light Extraction System

Electron beam window

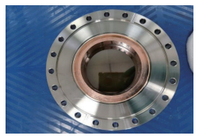


Glidcop photon absorber

Klystron



Electron cavity



Diamond window

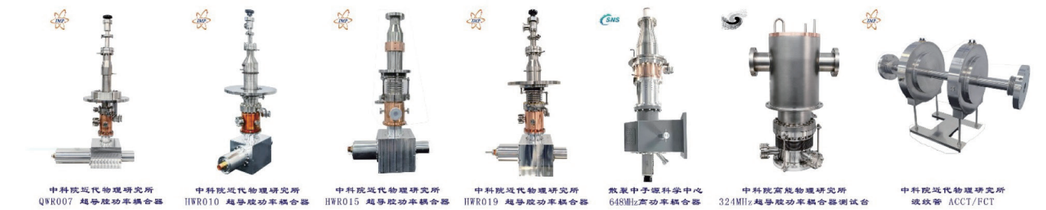
摩科斯电子科技（苏州）有限公司

——高性能陶瓷馈通 / 高功率电真空器件解决方案专家

摩科斯电子科技（苏州）有限公司位于苏州高新区医疗器械产业园，**厂房面积 3000m2，其中包含 500 m2 万级洁净车间，50 m2 百级洁净车间和 800 m2 电真空产品生产车间**，主要为粒子加速器、半导体、激光、航空航天、医疗领域提供精密的真空产品和真空器件。公司在粒子加速器领域先后为**强流重离子加速器装置 (HIAF)/ 加速器驱动嬗变研究装置 (CiADS)/ 散裂中子源工程 (SNS) 提供可靠的高功率输入耦合器、高功率测试台、BPM、ACCT/FCT、高性能陶瓷馈通及真空产品，拥有从产品设计改进到生产加工和检验测试的全套设备和技术。**

制造/检测能力

- ✓ 超高真空钎焊
- ✓ 陶瓷表面处理
- ✓ 金属化PVD镀膜
- ✓ 电镀铜膜
- ✓ 电子束焊接
- ✓ 激光焊接
- ✓ 钨极氩弧焊
- ✓ 洁净清洗组装
- ✓ 高功率锻炼
- ✓ 气密性测试(He)
- ✓ 安规测试
- ✓ 磁导率测试
- ✓ 金相分析
- ✓ 冷热冲击
- ✓ 耐水压测试
- ✓ TiN膜层SEY测试
- ✓ 镀铜层结合力
- ✓ 镀铜RRR值测试



中科院近代物理研究所 QWR007 超导腔功率耦合器 | 中科院近代物理研究所 HWR010 超导腔功率耦合器 | 中科院近代物理研究所 HWR015 超导腔功率耦合器 | 中科院近代物理研究所 HWR019 超导腔功率耦合器 | 散裂中子源科学中心 648MHz超导腔功率耦合器 | 中科院高能物理研究所 324MHz超导腔功率耦合器测试台 | 中科院近代物理研究所 镀铜管 ACCT/FCT

低温器间隙耦合环及BPM探针 | 低温/常温BPM组件 | 低磁导率纯钛BPM Button | 低磁导率纯钛陶瓷馈通 | 常温RFQ/DTL耦合器

科电工程有限公司

科电贸易（上海）有限公司

科电集团电子测量系统及设备部，自 1980 年始，专业提供射频、微波通讯、电磁兼容、音视频声学和电力电子测试设备、解决方案及系统集成服务；通过代理多个国际知名品牌测试设备，功放类产品有 AMETEK-AR/MILMEGA/TESEQ。

AR 250A400 (250 W, 10 KHz ~ 400 MHz)

AR 350A400 (350 W, 10 KHz ~ 400 MHz)

主要代理品牌

Elektro-Automatik · KIKUSUI · ESPEC · AP · GRAS · imc · 爱科赛博 ACTIONPOWER · HIOKI · FOTRIC 飞础科 · ASTRO · UNIGRAF · ROHDE&SCHWARZ · levear · KONICA MINOLTA · ECHO · Boonton · Noisecom · WAVECONTROL Safety, Quality, Service · SCHWARZBECK Mess-Elektronik · COM-POWER · XENA NETWORKS · Microwave Factory Co.,Ltd. · TESEQ / AMETEK · emtest / AMETEK · APREL · Telebyte BROADBAND · SEKI DIAMOND SYSTEMS A Unit of Cornes Technologies Ltd. · MILMEGA / AMETEK · raditeq · FLUKE · ThermoFisher SCIENTIFIC · mks | Spectra-Physics · QUALISYS Motion Capture Systems · SUPERNAVI

电话/Tel：18811435167 Email: cubezhou@bj.ese.com.hk Web：https://ese.com.hk

ANDESUN

Jiangsu Andesun Accelerator Co., Ltd

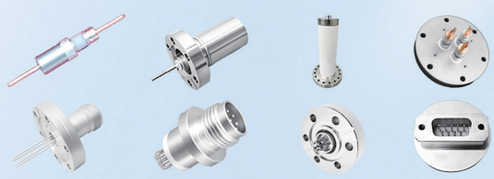
Vacuum Electrode and Beam Measurement Components Supplier

ANDESUN Technology Company is a trusted company that specializes in Feedthrough, BPM and charged-particle beam-testing equipment. The high-performance multipin and coaxial feedthroughs, which are developed and produced by ANDESUN Technology, have undergone a series of tests including ultra-high vacuum, ultra-high temperature, extreme-low temperature, high pressure, high voltage, high current, microwave performance, etc. The products have low insertion loss, stable performance, excellent quality, and can be used in various environments. Their products have been applied to hundreds of particle accelerators.

Coaxial Connectors

Frequence: DC-40GHz

Multipin Connectors



Pins: 1-9 // Voltage: 0-120kV

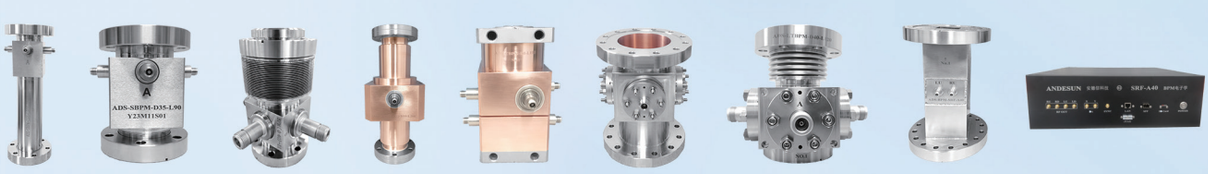
BPM Button

Tempreture: 2K-873K

RF Window

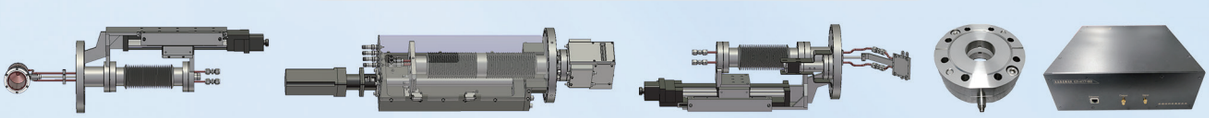
Power: 0-40kWcw

Beam Position Monitor Series



Strip BPM // Button BPM // Cavity BPM // Low Tempreture BPM // Linear-cut BPM

Other Beam Measurement Components



Faraday Cup // Allison Emittance Scanner // Beam Profile Monitor // AC Current Transformer

CONTACT US

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Address: Nanjing Proton Source, Building B4, Hongfeng Science and Technology Park, Qixia District, Nanjing City, Jiangsu Province