MEDSI 2025
LUND • SWEDEN

THE 13th INTERNATIONAL CONFERENCE ON MECHANICAL ENGINEERING DESIGN OF SYNCHROTRON RADIATION EQUIPMENT AND INSTRUMENTATION

September 15–19, 2025, Lund, Sweden

CONFERENCE GUIDE

MAX IV

LUND UNIVERSITY

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Welcome from the Local Organizing Committee

Dear Colleagues and Friends,

It is our great pleasure to welcome you to *MEDSI 2025*, the 13th International Conference on Mechanical Engineering Design of Synchrotron Radiation Equipment and Instrumentation, held in Lund, Sweden, from 15 to 19 September.

This year marks a special occasion: the 25th anniversary of the inaugural MEDSI workshop, held at the Paul Scherrer Institute in 2000. Since then, MEDSI has grown into the leading global platform for engineers, designers, and technical specialists engaged in the development of advanced instrumentation and mechanical systems for synchrotron and FEL facilities.

We are proud to host this edition at MAX IV Laboratory, where innovation and collaboration are part of everyday work. Over the course of five days, more than 375 delegates from around the world will gather to share expertise, exchange ideas, and explore new solutions in mechanical engineering for advanced light sources.

The programme features 46 contributed oral presentations, along with five keynote and two invited talks, more than 180 posters, and an industrial exhibition with over 35 participating sponsors and companies. Key topics range from accelerator and beamline systems to optics, vacuum, cryogenics, and high-precision instrumentation.

We are truly excited to bring the MEDSI community together in Lund, and we hope the conference will be a memorable, productive, and enjoyable experience for all participants.

Welcome to MEDSI 2025 – and welcome to Sweden.

Warm regards,
Joaquín B. González Fernández
Chair of the Local Organizing Committee
MEDSI 2025

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About MAX IV Laboratory

MAX IV Laboratory is Sweden's national synchrotron light source, operated by Lund University. Inaugurated in 2016, MAX IV is recognized as the world's first fourth-generation synchrotron, designed to deliver exceptionally high-brightness and coherent X-rays for advanced scientific research.

Researchers from around the world use MAX IV to study materials and phenomena at the atomic and molecular level, supporting progress in fields such as physics, chemistry, structural biology, engineering, geology, nanotechnology, and medicine.

The facility is built around two storage rings and a linear accelerator. Today, 16 beamlines are in full operation, with a 17th beamline recently entering the design and construction phase. When fully developed, MAX IV will serve up to 3,000 visiting researchers annually.

The laboratory is funded through a broad collaboration led by the Swedish Research Council, Lund University, VINNOVA, Region Skåne, and the Knut and Alice Wallenberg Foundation, along with contributions from several other national and international academic and governmental institutions.

For more information, visit www.maxiv.lu.se

About MEDSI

The International Conference on Mechanical Engineering Design of Synchrotron Radiation Equipment and Instrumentation (MEDSI) is the leading international forum for engineers, designers, and technical experts working on the development of advanced mechanical systems for synchrotron radiation and free-electron laser facilities.

Established in 2000 as a small international workshop at the Paul Scherrer Institute, MEDSI has grown into a vibrant, biennial conference that brings together specialists from around the world to share ideas, technical solutions, and best practices in the design and construction of cutting-edge instrumentation.

The conference covers a wide range of topics, including storage rings, beamlines, optics, insertion devices, end-station instrumentation, and enabling technologies such as vacuum systems, cryogenics, and precision mechanics.

MEDSI 2025 marks the 25th anniversary of the first edition and continues the tradition of providing a collaborative platform for knowledge exchange, innovation, and industry engagement. The program includes invited and contributed talks, poster sessions, an industrial exhibition, and a guided tour of the host facility.

To learn more about the MEDSI community and access past conference materials, visit the official website: **medsi.lbl.gov**

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ACKNOWLEDGMENTS

We extend our sincere thanks to all members of the organizing team, volunteers, and staff whose dedication and hard work have been essential to the success of this conference. Without their invaluable support behind the scenes, MEDSI 2025 would not have been possible.

The Lundagård park in central Lund.

Practical Information

VENUE

The MEDSI 2025 conference takes place at The Loop, a modern innovation and conference centre located in the Science Village area of Lund, Sweden. The Loop has been designed as a space for collaboration, innovation, and exchange, featuring flexible, state-of-the-art facilities for conferences, seminars, and workshops.

Its architecture reflects a distinct Scandinavian aesthetic, combining natural materials and daylight with a clean, contemporary atmosphere that supports both focused work and informal interaction. As a net-zero energy building, The Loop is designed to produce as much energy as it consumes annually, demonstrating its strong commitment to sustainability.

Strategically positioned between two major European research infrastructures – the European Spallation Source (ESS) and the MAX IV Laboratory – The Loop is at the heart of Science Village.

All conference lectures will take place in the Science Village Hall, the venue's main auditorium. The industrial exhibition, coffee breaks, and lunch will be held in the Atrium.

The venue is easily accessible by tram and is located just across from the final stop, Lund ESS. Tram tickets between Lund Central Station and The Loop will be provided by the MEDSI 2025 organisers for all international registered delegates, valid for the duration of the conference. Tickets can be collected at the registration desk.

For more details on reaching Lund from the airport and using local transport, see the Travel to Lund & The Loop section.

Venue Address

The Loop
Science Village
Mesongatan 4, Lund, Sweden

Opening Hours

The venue will be open to MEDSI 2025 participants from 07:45 until the end of the scheduled programme each day. Conference staff will be available throughout to assist with any logistical or practical queries.

Floor Plan

A printed floor plan of The Loop is provided as a separate folded A4 insert included with this guide.

Smoking Policy

Smoking and vaping are not permitted inside The Loop or at any conference-related indoor spaces, in accordance with Swedish law.

To learn more about The Loop, visit www.thelooplund.se

TRAVEL TO LUND AND THE LOOP

From Copenhagen Airport (Kastrup, CPH)

Copenhagen Airport is the closest international airport to Lund.

- Train: Take an Öresundståg train from Kastrup to Lund Central Station (~35 minutes)
- Buy tickets before boarding via:
  - Skånetrafiken machines or app (skanetrafiken.se)
  - DSB machines or ticket office (dsb.dk)
- Ticket tip: Duo/Family/Together tickets offer a discount for 2+ people
- Your ticket is also valid for local travel within Lund after arrival

From Malmö Airport (MMX)

The closest domestic airport.

- Take the Flygbussarna coach to Malmö Central Station
- Continue by train to Lund Central Station

More info: www.flygbussarna.se

From Lund Central Station to The Loop

- Take the Lund tram to the final stop Lund ESS (~15 minutes)
- The Loop is located directly by the stop at Mesongatan 4

Local Transport

- You can use contactless cards on green buses in Lund and Malmö
- Visit: www.skanetrafiken.se/english/tickets-and-discount

WEATHER AND CLOTHING

In mid-September, Lund typically sees mild temperatures between 12–18 °C during the day, with cooler evenings around 10 °C. Light rain and windy conditions are common, especially near The Loop.

We recommend layered clothing, a windproof jacket, and comfortable shoes suitable for walking. Check www.smhi.se/en for updated forecasts before you travel.

REGISTRATION & INFORMATION DESK

The registration and information desk is located near the main entrance of The Loop, inside the wardrobe area.

Lost items may be brought to or reclaimed from the Registration Desk during opening hours.

Opening hours: Monday–Thursday: 08:00–17:00, Friday: 08:00–14:00.

FOOD AND SOCIAL EVENTS

Daily Lunch & Coffee Breaks

Lunch is served each day as a cold, standing buffet in the atrium of The Loop, offering an informal setting to connect with colleagues.

Coffee breaks and fika are provided throughout the programme each day.

Monday: Due to the MAX IV tour, lunch boxes will be available at The Loop either before or after the visit, depending on your scheduled time.

The Øresund bridge as seen from Luftkastellet.

Welcome Reception – Monday at 17:00

The conference opens with a casual mingle-style reception on Monday at 17:00, in the Atrium at The Loop. Drinks and small bites will be served.

Conference Dinner – Thursday Evening

The conference dinner takes place on Thursday evening at Luftkastellet, a scenic venue by the sea in the outskirts of Malmö, with views over the Öresund and the Øresund Bridge.

Buses will depart from The Loop at 17:30. Travel time is approximately 45 minutes. Please note that return buses will first stop in central Lund before continuing to MAX IV. Final details about bus transport will be communicated on Thursday via email and announced in the auditorium before departure. **Important**: Luftkastellet is not served by public transport. Delegates who miss the scheduled buses will only be able to reach the venue by private car or taxi.

The evening begins with a cocktail-style gathering on the terrace, followed by dinner indoors.

A meal card system will be used to indicate dietary preferences. Delegates will receive their meal card upon arrival at the restaurant, to present when food is served.

MAX IV TOUR

As part of the MEDSI 2025 programme, delegates will have the opportunity to visit MAX IV Laboratory, located next to the conference venue.

The tour will include a walk through the 3 GeV storage ring tunnel and a visit to one of the beamlines currently in operation.

Tour Details

- Date: Monday, 15 September 2025
- Time: 09:00–14:00
- Duration: Approximately 1.5 hours
- Group size: Up to 20 participants per group
- Meeting point: Registration desk at The Loop, at your assigned time

Participants will be assigned a time slot in advance. Tour schedules and group details will be sent to registered delegates prior to the conference week.

Lunch: As groups return at different times, lunch boxes will be available at The Loop throughout the tour period.

Please note: Participation is limited to 240 delegates, allocated on a first-come, first-served basis during registration, due to safety considerations.

WI-FI & CONFERENCE APP

Wi-Fi Access

Free wireless internet is available throughout The Loop.

- Science Village Hall and Atrium: Network name: *The Loop* – no password required
- First floor (poster sessions): Network name: *Level Two* – password: *Loop2024!*

MEDSI 2025 App

Stay updated with the latest programme, venue information, and announcements using the official conference app: *Invajo Conference & Events*.

Scan the QR code below to download the app from the App Store or Google Play.

Once installed:
1. Open the app
2. Tap the "+" button at the bottom of the screen
3. Enter the event code: *medsi2025*

EMERGENCY NUMBERS

In case of a serious or life-threatening emergency, dial:

- **112** – Police, Fire, Ambulance, Rescue

Available 24/7, free of charge. Operators speak English.

For non-emergency matters or general support during the conference, you can contact:

- MAX IV Reception: +46 (0)46 222 98 72
- The Loop Reception: +46 (0)70 211 93 05

Reception hours: 08:00–16:30 (Monday to Friday)

If you need assistance at the conference venue, you may also approach the registration desk or any staff member.

CODE OF CONDUCT

MEDSI 2025 is committed to providing a safe, inclusive, and respectful environment for all participants. This Code of Conduct applies to all attendees, speakers, exhibitors, organizers, and volunteers at all official conference venues and events.

We expect all participants to:

- Behave professionally and respectfully
- Communicate appropriately for a diverse, international audience
- Refrain from harassment, discrimination, or offensive behaviour

Harassment includes, but is not limited to: offensive comments related to gender, sexual orientation, disability, appearance, race, religion; unwanted physical contact; inappropriate images or language in talks or public spaces; deliberate intimidation or disruption; and unwelcome attention.

Sexualized language, clothing, or materials are not appropriate at the conference, including within sponsor exhibits.

Reporting a Problem

If you experience or witness behaviour that violates this Code of Conduct, please contact:

- A member of the conference staff
- The registration desk
- Or email: medsi2025@maxiv.lu.se

All reports will be handled confidentially and respectfully. Conference staff are trained to assist and can help connect you with venue security or local authorities if needed.

In cases where a participant violates this Code, organizers may take any action deemed appropriate, including removal from the event without refund.

If you feel unsafe and require immediate assistance, you can also contact local emergency services by calling 112.

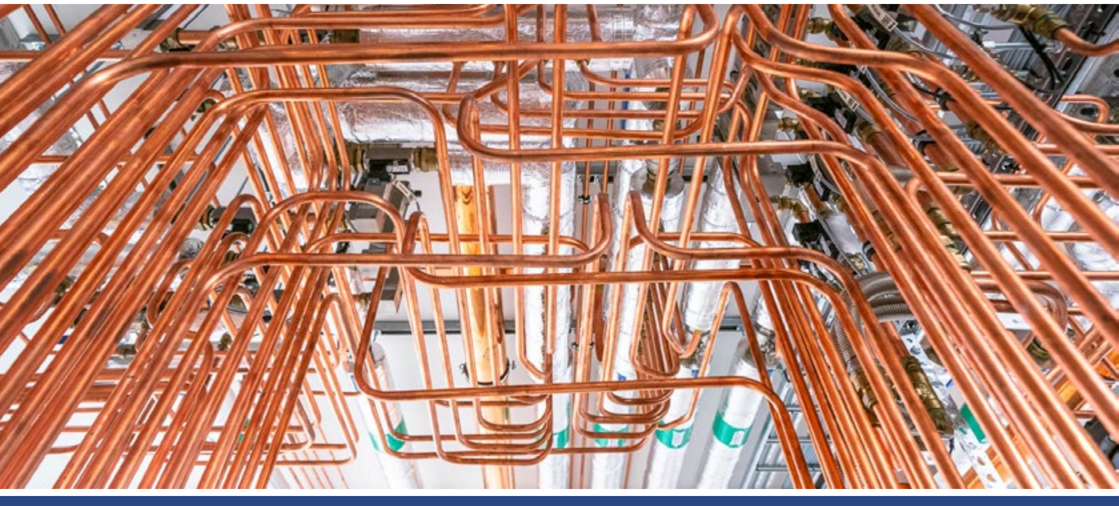
Additional Information

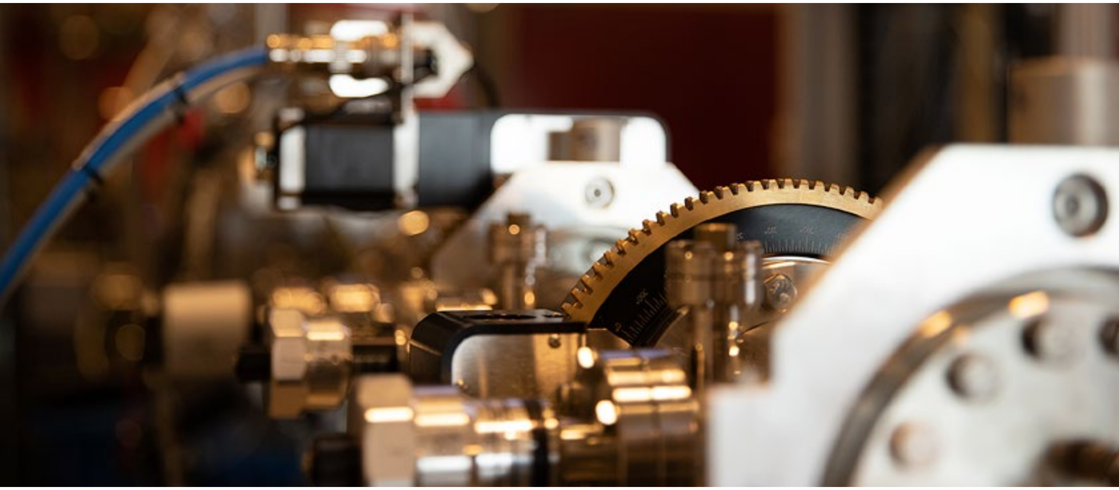
The full version of the MEDSI 2025 Code of Conduct, including reporting procedures, is available at www.medsi2025.com/code-of-conduct.

Photography and Filming

Photographs and videos may be taken during MEDSI 2025 for documentation and communication purposes. These may be used in conference materials, social media, or future promotion.

If you prefer not to appear in any published photos or videos, please notify the registration desk at your earliest convenience.





Scientific Programme

PROGRAMME CODES

Each contribution in the MEDSI 2025 programme is assigned a unique code. These codes help identify the schedule, format, and order of presentations. For example: *TUP99*

- The first two letters indicate the day of the week:
  - MO = Monday
  - TU = Tuesday
  - WE = Wednesday
  - TH = Thursday
  - FR = Friday
- The third character denotes the presentation type:
  - O = Oral contribution
  - P = Poster contribution
- The final two digits are a sequential number used to differentiate between contributions on the same day and format.

So, for example, TUP99 refers to the 99th poster contribution presented on Tuesday.

These codes are used throughout the conference material – including the schedule, poster boards, and proceedings – to help delegates navigate the programme with ease.

PROGRAMME AT A GLANCE

Monday 15th

08:00–17:00	**Registration** Location: *The Loop*
09:00–14:00	**MAX IV Tour** Location: *The Loop / MAX IV* Chair: ***Albert Torrente*** (MAX IV Laboratory)
11:00–15:00	**Lunch**
14:00–17:00	**MEDSI Parallel Workshop on Sample Environments for Synchrotron X-ray Imaging: Design and Commissioning** Location: *The Loop, LINXS*
17:00–17:20	**Welcome and Acknowledgements** Location: *The Loop, Atrium* Chair: ***Joaquín B. González*** (MAX IV Laboratory)
17:20–19:00	**Welcome Reception** Location: *The Loop, Atrium*

Tuesday 16th

08:00–09:00	**Registration** Location: *The Loop*
09:00–10:00	**Welcome & MEDSI 25th Anniversary Keynote** Location: *The Loop, Science Village Hall* Chair: ***Joaquín B. González*** (MAX IV Laboratory)
09:00–09:20	**Opening & Welcome** ***Joaquín B. González*** (MAX IV Laboratory), ***Carles Colldelram*** (ALBA)
09:20–10:00	**MEDSI: from inception to the 25th anniversary and beyond – founders' perspective (TUKA01)** ***Sasa Zelenika*** (University of Rijeka), ***Sushil Sharma*** (Brookhaven National Laboratory)
10:00–10:20	**Coffee Break**

10:20–12:00	**Keynote Session 2** Location: *The Loop, Science Village Hall* Chair: *Carles Colldelram* (ALBA-CELLS Synchrotron)
10:20–10:50	**MAX 4U – Our vision for MAX IV (TUKB01)** *Aymeric Robert* (MAX IV Laboratory)
10:50–11:20	**MAX 4U – Accelerator physics and engineering challenges of the first upgrade of a fourth-generation synchrotron light source (TUKB02)** *Pedro Tavares* (MAX IV Laboratory)
11:20–12:00	**The European Spallation Source – ESS: Mechanical engineering and structural health monitoring (TUKB03)** *Nikolaos Gazis* (European Spallation Source ERIC)
12:00–12:15	**Gold Sponsor Presentation: AXILON**
12:00–13:00	**Lunch**
13:00–14:40	**Beamlines Session 1** Session Location: *The Loop, Science Village Hall* Chair: *Evgeny Nazaretski* (Brookhaven National Laboratory)
13:00–13:20	**APS upgrade – beamline engineering overview (TUOA01)** *Oliver Schmidt* (Advanced Photon Source)
13:20–13:40	**Design and technical commissioning of the In Situ Nanoprobe endstation and instrument at the Advanced Photon Source (TUOA02)** *Benjamin Davis* (Advanced Photon Source)
13:40–14:00	**NMX, a long neutron beamline at the European Spallation Source (TUOA03)** *Giuseppe Aprigliano* (European Spallation Source)
14:00–14:20	**Engineering advancements in x-ray pump–probe techniques using delayline technology at LCLS (TUOA04)** *Hengzi Wang* (SLAC National Accelerator Laboratory)
14:20–14:40	**The design of SIBIPIRUNA, a cryogenic soft X-ray tomography beamline with BSL2, BSL3 and BSL4 compatibility for Sirius and Orion at CNPEM (TUOA05)** *Renan Ramalho Geraldes* (Brazilian Synchrotron Light Laboratory)
14:40–15:20	**Coffee Break**

15:20–17:00	**Beamlines Session 2** Location: ***The Loop, Science Village Hall*** Chair: ***Paul Palecek*** (Brookhaven National Laboratory)
15:20–15:40	**Research on active feedback control of monochromator crystal angle based on FPGA (TUOB01)** *Jian He* (Shanghai Advanced Research Institute, Chinese Academy of Sciences)
15:40–16:00	**Grating mirrors active cooling system design for soft X-ray monochromator (TUOB02)** *Alban Moyne* (European Synchrotron Radiation Facility)
16:00–16:20	**First steps into the operation of the SAPOTI cryogenic nanoprobe at the CARNAÚBA beamline at Sirius/LNLS (TUOB03)** *Vinicius Bomfim Falchetto* (Brazilian Center for Research in Energy and Materials)
16:20–16:40	**Recent advances in X-ray microscopy instrumentation developments at NSLS-II (TUOB04)** *Evgeny Nazaretski* (Brookhaven National Laboratory)
16:40–17:00	**Development of a Coherent Diffractive Imaging (CDI) Endstation at the SPring-8 II 12XU (TUOB05)** *Bo-Yi Chen* (National Synchrotron Radiation Research Center)
17:00–18:15	**Poster Session 1** Location: ***The Loop, Poster Session Room*** Chair: ***Keyu Zhou*** (MAX IV Laboratory)

Wednesday 17th

09:00–09:45	**Keynote Session 3** Location: ***The Loop, Science Village Hall*** Chair: ***Joachim Schnadt*** (MAX IV Laboratory)
	Attosecond Science *Anne L'Huillier, Nobel Prize in Physics 2023*
09:45–10:00	**Group Photo** Location: ***The Loop, Science Village Hall***
10:00–10:20	**Coffee Break**

10:20–12:00	**Beamlines Session 3** Location: ***The Loop, Science Village Hall*** Chair: ***Renan Geraldes*** (Brazilian Synchrotron Light Laboratory)
10:20–10:40	**Additive manufacture 3D-printed, metallic X-ray mirror for synchrotron & XFEL facilities (WEOA01)** *Simon Alcock* (Diamond Light Source)
10:40–11:00	**Designing and fine-tuning cryo-cooled silicon monochromator crystals to minimize optical distortions caused by photon-beam heating (WEOA02)** *Pablo Sanchez Navarro* (Diamond Light Source)
11:00–11:20	**2-color pump probe optical delay line (WEOA03)** *Marc Planas Carbonell* (European X-Ray Free-Electron Laser)
11:20–11:40	**SPIDER – a Scanning Platform for Imaging and Diffraction with Extreme Resolution (WEOA04)** *Ralph Doehrmann* (Deutsches Elektronen-Synchrotron DESY)
11:40–12:00	**A compact, high throughput SVLS spectrometer for LCLS-II (WEOA05)** *Jean-Pierre Torras* (SLAC National Accelerator Laboratory)
12:00–13:00	**Lunch**
12:20–12:35	**Gold Sponsor Presentation: AVS – Added Value Solutions**
13:00–14:40	**Accelerators Session 1** Location: ***The Loop, Science Village Hall*** Chair: ***Michael Seegitz*** (National Synchrotron Light Source II)
13:00–13:20	**Copper alloy additive manufacturing for SOLEIL II (WEOB01)** *Keihan Tavakoli* (Synchrotron soleil)
13:20–13:40	**ALS BL5.0 photon stop recovery (WEOB02)** *Will Hutcheson* (Lawrence Berkeley National Laboratory)
13:40–14:00	**Cryogenic radiometry: a new absorber for X-rays up to 150 keV (WEOB03)** *Omar Renzo Piminchumo Marinos* (Canadian Light Source Inc.)
14:00–14:20	**CBXFEL design, production, assembly, testing and installation status (WEOB04)** *Xavier Permanyer* (SLAC National Accelerator Laboratory)

14:20–14:40	**A new RF-contact spring mechanism for exchangeable cathodes in high brightness guns at DESY (WEOB05)** ***Frieder Mueller*** (Deutsches Elektronen-Synchrotron DESY)
14:40–15:20	**Coffee Break**
14:40–14:55	**Gold Sponsor Presentation: SAES**
15:20–17:00	**Accelerators Session 2** Location: ***The Loop, Science Village Hall*** Chair: ***Taekyun Ha*** (Pohang Accelerator Laboratory)
15:20–15:40	**Development of magnet prototype for Siam Photon Source II (WEOC01)** ***Supachai Prawanta*** (Synchrotron Light Research Institute)
15:40–16:00	**Lessons learned during removal and installation period of the Advanced Photon Source (WEOC02)** ***Mark Erdmann*** (Argonne National Laboratory)
16:00–16:20	**Complex bend vacuum chamber for NSLSII-U (WEOC03)** ***Michael Seegitz*** (National Synchrotron Light Source II)
16:20–16:40	**Experience with a bunch lengthening cavity at the APS (WEOC04)** ***Joel Fuerst*** (Argonne National Laboratory)
16:40–17:00	**Results from the ALS-U storage ring alignment system prototype (WEOC05)** ***Ryan Miller*** (Advanced Light Source)
17:00–18:15	**Poster Session 2** Location: ***The Loop, Poster Session Room*** Chair: ***Roberto Appio*** (MAX IV Laboratory)
18:30–20:30	**International Organizing Committee Meeting** IOC members only Location: ***Grand Hotel Lund, Bantorget 1, Lund*** Chair: ***Joaquín B. González*** (MAX IV Laboratory)

Thursday 18th

09:00–10:00	**Simulation session 1** Location: ***The Loop, Science Village Hall*** Chair: ***Keihan Tavakoli*** (Synchrotron Soleil)
09:00–09:40	**Simulation Driven Design – Towards Sustainable Plant Based Packages (THOA01)** ***Eskil Andreasson*** (Tetra Pak (Sweden))

09:40–10:00	**Parametric design and optimization of SOLEIL II vacuum chamber thermal properties (THOA02)** *Zhengxuan Fan* (Synchrotron soleil)
10:00–10:20	**Coffee Break**
10:20–12:00	**Simulation Session 2** Location: *The Loop, Science Village Hall* Chair: *Ralph Doehrmann* (Deutsches Elektronen-Synchrotron DESY)
10:20–10:40	**Simulation-driven innovation for instrumentation development at DESY and European XFEL (THOB01)** *Fan Yang* (European X-Ray Free-Electron Laser)
10:40–11:00	**Development of new bent crystal assemblies for SPS and LHC accelerators (THOB02)** *Tristan Calvet* (European Organization for Nuclear Research)
11:00–11:20	**Challenges and optimization of Mu2e proton target design with radiative cooling (THOB03)** *Zunping Liu* (Fermi National Accelerator Laboratory)
11:20–11:40	**From simulation to measurement: Enhancing FE simulation for PETRA IV and EuXFEL girders (THOB04)** *Daniel Thoden* (Deutsches Elektronen-Synchrotron DESY)
11:40–12:00	**Design of SLS 2.0 BPM block support structure with damping mechanism (THOB05)** *Xinyu Wang* (Paul Scherrer Institute)
12:00–13:00	**Lunch**
13:00–14:40	**New Facility Design and Upgrade Session** Location: *The Loop, Science Village Hall* Chair: *Oliver Schmidt* (Advanced Photon Source)
13:00–13:20	**Progress in engineering design and installation of the HIAF Project (THOC01)** *Yajun Zheng* (Institute of Modern Physics, Chinese Academy of Sciences)
13:20–13:40	**LoKI instrument - Installation update (THOC02)** *Clara Lopez* (European Spallation Source)
13:40–14:00	**Design of alignment network for the Siam Photon Source II (THOC04)** *Jullada Saetiaw* (Synchrotron Light Research Institute)
14:00–14:20	**Storage ring vacuum system design for Korea-4GSR with pill-type getters (THOC05)** *Taekyun Ha* (Pohang Accelerator Laboratory)

14:20–14:40	**Layout of the ALBA II accelerator (THOC06)** *Llibert Ribo* (ALBA Synchrotron (Spain)
14:40–15:00	**Coffee Break**
15:00–16:20	**Precision Mechanics Session** Location: *The Loop, Science Village Hall* Chair: *Martin Dommach* (European XFEL GmbH)
15:00–15:20	**A laser tracking system for sample positioning (THOD01)** *François Villar* (European Synchrotron Radiation Facility)
15:20–15:40	**The X-ray free-electron laser oscillator at the European XFEL: design and status (THOD02)** *Bertram Friedrich* (European X-Ray Free-Electron Laser)
15:40–16:00	**Enabling high-precision nano-positioning for beamlines: the Precision Metrology Laboratory at Diamond Light Source (THOD03)** *Qingxin Meng* (Diamond Light Source)
16:00–16:20	**Traceable sub-nanometre interferometry to improve nanopositioning applications at synchrotron & XFEL beamlines (THOD04)** *Simon Alcock* (Diamond Light Source)
16:20–17:30	**Poster Session 3** Location: *The Loop, Poster Session Room* Chair: *Eshraq Al-Dmour* (MAX IV Laboratory)
17:30–18:30	**Conference Dinner: Bus to Malmö** Location: *The Loop*
18:30–22:00	**Conference Dinner** Location: *Luftkastellet, Utsiktsvägen 10, Limhamn (Malmö)*

Friday 19th

09:00–10:00	**Core Technology Developments Session 1** Location: *The Loop, Science Village Hall* Chair: *Ping He* (Institute of High Energy Physics)
09:00–09:40	**Brazing as a Precision Joining Technique: Design, Process, and Case Studies from Sirius (FROA01)** *Rafael Defavari* (Brazilian Center for Research in Energy and Materials)

09:40–10:00	**Development of Non-Evaporable Getter (NEG): Set-up and characterization (FROA02)** *Eva Gutierrez Berasategui* (Tekniker)
10:00–10:20	**Coffee Break**
10:20–12:00	**Core Technology Developments Session 2** Location: *The Loop, Science Village Hall* Chair: *Mark Erdmann* (Argonne National Laboratory)
10:20–10:40	**Test bench for development of cooling mechanism of the first optical crystal towards SPring-8-II (FROB01)** *Haruhiko Ohashi* (Japan Synchrotron Radiation Research Institute)
10:40–11:00	**Corrosion studies of MAX IV storage rings' vacuum components (FROB02)** *Simone Scolari* (MAX IV Laboratory)
11:00–11:20	**Non-destructive & destructive testing on accelerator's components and materials at the European Spallation Source (FROB03)** *Andrea Bignami* (European Spallation Source ERIC)
11:20–11:40	**CAD and PLM solutions at ESS (FROB04)** *Dawid Patrzalek* (European Spallation Source)
11:40–12:00	**Compact differential pumping system for windowless in-air sample environments beamline (FROB05)** *Cristian Maccarrone* (European Synchrotron Radiation Facility)
12:00–12:40	**Closing Remarks and Best Poster Prizes Session** Location: *The Loop, Science Village Hall* Chair: *Joaquín B. González* (MAX IV Laboratory)
12:40–13:40	**Lunch**

TOPICS AND SESSIONS

The scientific programme is organised into the following topical areas and session categories.

Beamlines

- Beamlines and Instruments
- Front Ends
- Optics
- End Stations
- Sample Environment

Accelerator

- Storage Rings
- Insertion Devices
- Magnets
- Absorbers
- Free Electron Lasers
- Neutron Sources

New Facility Design and Upgrade

- Status
- Quality Assurance & Tracking
- Assembly and Installation
- Simulation
- Thermal
- Structural
- Vibration
- FEA Methods

Precision Mechanics

- Nano-positioning
- Stability Issues
- Mechatronics
- Automation

Core Technology

- Vacuum
- Cryogenics
- Infrastructures
- Big Data and AI
- Others

KEYNOTE & INVITED SPEAKERS

MEDSI 2025 includes contributions from a number of invited speakers with backgrounds in accelerator science, mechanical engineering, applied physics, and industrial innovation.

Keynote Speakers

Anne L'Huillier *(Lund University, Sweden)*
2023 Nobel Laureate in Physics, recognised for her pioneering work in attosecond science. Her research has opened new frontiers in ultrafast laser technology and continues to inspire cross-disciplinary developments in fundamental and applied physics.

Sushil Sharma *(Senior Advisor, Brookhaven National Laboratory, USA)*
One of the founders of the MEDSI conference series, Sharma has led mechanical engineering efforts at several major facilities, including NSLS, NSLS-II, APS and LCLS.

Saša Zelenika *(University of Rijeka, Croatia)*
Vice-Rector for Strategic Projects, with a long-standing commitment to open science and innovation. He has worked at PSI and Sincrotrone Trieste, and co-initiated the MEDSI community.

Nick Gazis *(Group Leader, META Group, ESS, Sweden)*
Specialist in mechanical and materials engineering for large-scale research infrastructures. His career includes previous work at CERN and current leadership at the European Spallation Source.

Pedro Fernandes Tavares *(Accelerator Director, MAX IV Laboratory, Sweden)*
Key figure in the design, commissioning and operation of MAX IV. Dr Tavares is currently leading the laboratory's long-term development strategy through the MAX4U project.

Aymeric Robert *(Senior Advisor, MAX IV Laboratory, Sweden)*
An expert in X-ray coherence and accelerator science, currently supporting strategic development for the MAX IV upgrade project, MAX4U.

Invited Speakers

Eskil Andreasson *(Technology Specialist, Virtual Modelling, Tetra Pak, Sweden)*
Works at the intersection of numerical simulation and experimental mechanics, with a focus on simulation-driven design and industrial innovation.

Rafael Defavari *(CNPEM, Brazil)*
Leads the Materials Integration Group at CNPEM, with a focus on vacuum components and advanced joining techniques for accelerator applications. He is involved in superconducting equipment development and early-stage research on NbTi alloy production in Brazil.

GOLD SPONSORS PRESENTATIONS

Several of our Gold Sponsors will give brief presentations as part of the programme, highlighting technologies and developments of interest to the engineering community.

These talks will take place in the Science Village Hall at the scheduled times below.

Axilon AG

Tuesday, 16 September – 12:00

First, we would like to take the opportunity and express our appreciation to the conference organisers who very successfully started and continued the MEDSI conference series and we will highlight the importance of this conference series also for the associated industry.

The advancement in Synchrotron and Free-Electron-Laser (FEL) technology necessitates the development of beamline components that exhibit superior optical and mechanical capabilities. A critical factor for improving these components is the reduction of angular vibration amplitude, which impacts the x-ray beam's positional stability and spatial coherence. Of similar criticality is the thermal management of all optical components. We will present some highlights of our latest developments for beamline instrumentation, from complete beamlines to monochromators, mirror systems as well as some special experimental stations.

SAES High Vacuum Division

Wednesday, 17 September – 14:40

SAES High Vacuum Division develops proprietary solutions for High, Ultra High, and Extreme High Vacuum (HV, UHV, XHV) systems. With a strong technology portfolio and vertically integrated production, it is a global leader in delivering advanced, high-quality vacuum technologies. Its UHV and XHV Non Evaporable Getter (NEG) pumps are essential for ultra-clean environments in demanding industrial and scientific applications.

Through SAES Rial Vacuum in Parma, the company designs and manufactures complex vacuum chambers and custom components tailored to specific needs. Strumenti Scientifici CINEL in Vigonza provides advanced X-ray systems for synchrotrons, XFELs, and nuclear physics labs. The recent acquisition of FMB Berlin, known for electron beam solutions and vacuum systems for synchrotrons and storage rings, expands SAES's capabilities and its role as a trusted partner for global research.

In the present talk, examples of recent achievements in ultra-low emittance synchrotron facilities will be shown. This is in line with SAES High Vacuum's collaborative approach to meet technical challenges and provide reliable solutions.

AVS – Added Value Solutions

Wednesday, 17 September – 12:20

AVS – Added Value Solutions designs, builds and installs bespoke scientific equipment for large-scale facilities worldwide. Our team boasts very strong competences in design for service under harsh conditions (e.g. combined UHV, ionising radiation and high or low temperature), engineering analysis, precision motion of large loads, vacuum technology, advanced manufacturing as well as handling of exotic materials. The presentation will showcase a few recent and noteworthy projects of interest to the synchrotron engineering community.

INFORMATION FOR SPEAKERS

We kindly ask all oral presenters to follow these key points to ensure a smooth and well-run programme.

- Talk format: 15 minutes + 5 minutes for questions
- Slide format: 16:9 aspect ratio
- Presentation upload: No later than one day before your scheduled session via the JACoW Indico page
- Personal laptops may not be used during the sessions
- Check your presentation at the registration desk the day before your talk
- Uploaded and presented slides will be published in the official conference proceedings
- Special requirements (e.g. video, audio) should be flagged to the conference team in advance or at the registration desk

Please be seated near the front of the room at the start of your session. Conference staff will ensure your slides are loaded and ready, and a technician will be present to assist if needed.

For complete speaker instructions, including software details and file upload guidance, please visit www.medsi2025.com/speaker-preparation-guidelines

POSTER GUIDELINES

We look forward to your contributions to the poster sessions. Please take note of the following:

- Posters must be printed in portrait orientation, in either:
  - ISO A0 (84.1 × 118.9 cm), or
  - US Arch E (36 × 48 in)
- Landscape posters cannot be accommodated.
- Mounting materials will be provided by the organisers.
- Your assigned board will be available from the morning of your session day.

- Please hang your poster during the morning coffee break and remove it at the end of the session. Posters left after 18:15 will be removed and discarded by the conference staff .
- The correct location to hang your poster will be clearly marked with your programme code (e.g. TUP99) on the poster board.
- Presenters must be available during their assigned session to discuss their work.

A digital copy of each poster is required for inclusion in the conference proceedings.

Please upload a PDF named as follows: *TUP99_poster.pdf* via the 'My Contributions' section of the Indico platform. Select 'Poster' as the file type.

Full guidelines – including instructions for uploading, file format, and access to the MEDSI 2025 logo – are available at www.medsi2025.com/poster-presentation-guidelines

BEST POSTER PRIZE

To recognise the quality and impact of contributions presented during MEDSI 2025, two poster prizes will be awarded:

- Best Poster Prize
- Best Young Poster Prize (for main authors under the age of 30 at the time of the conference)

A small committee – composed of representatives from the International Organising Committee, MAX IV Laboratory, and the European Spallation Source – will evaluate all eligible posters during the official sessions. Judging will consider scientific content, clarity of presentation, visual design, and overall engagement.

The Best Young Poster Prize is kindly sponsored by lightsources.org, the international collaboration of synchrotron and FEL facilities sharing knowledge and promoting light source science across the globe.

Both awards will be announced during the Closing Session. Each winner will receive a small trophy and a gift bag in appreciation of their contribution.

lightsources.org 20 years
One voice for the brightest science since 2004

PROCEEDINGS

MEDSI2025 encourages all presenting authors to contribute to the conference proceedings. Submissions will become part of the open-access JACoW database, supporting knowledge-sharing across the accelerator engineering community.

Submission deadline: Wednesday, 10 September 2025 at 13:59 UTC.

All contributions must be submitted via the JACoW Indico platform, following the official guidelines. Only properly submitted and presented contributions will be included in the proceedings.

The editorial team will begin processing submissions one week before the conference. You can follow the status of your paper:

- By logging into your JACoW Author Account
- By checking the status screen located in the Atrium at The Loop
- By visiting the Editorial Room during the conference

On the status screen, each paper is listed using its programme code (e.g. TUP99). A colour system indicates the status of the submission:

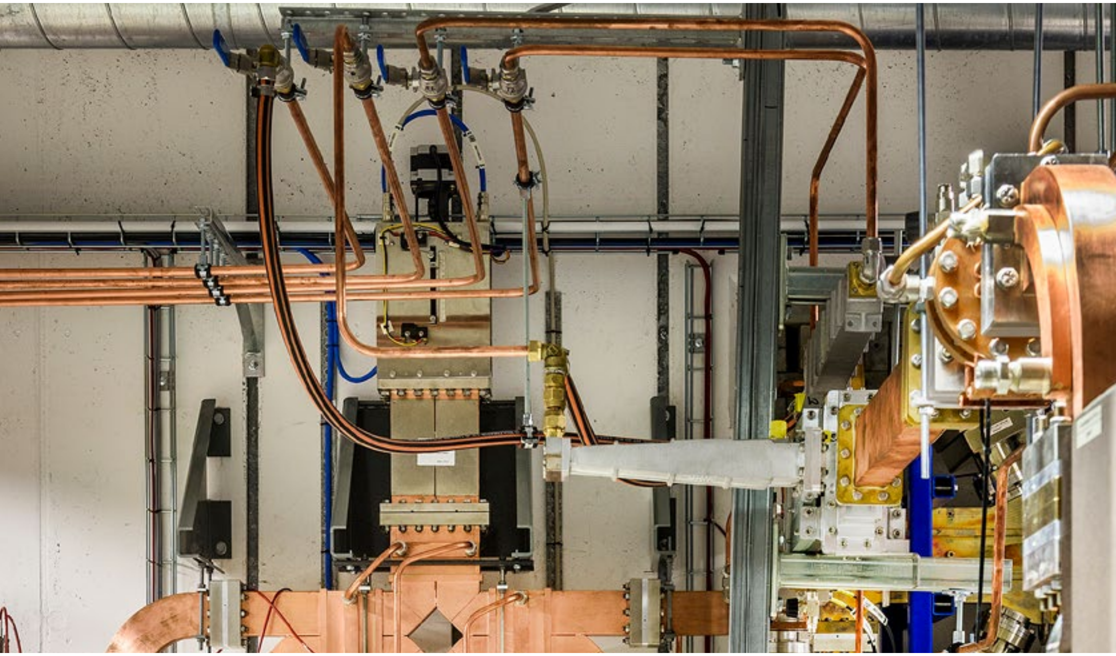
■ Red – Problem detected; author action required

■ Yellow – Minor revisions needed

■ Green – Accepted and ready for publication

Authors will also receive email updates as their papers are processed. Please monitor your inbox and respond promptly if any action is required.

For detailed instructions, templates, and guidelines, visit
www.medsi2025.com/paper-submission



Abstracts

TUKA - Welcome & MEDSI 25th Anniversary Keynote

16 September 2025 09:00 / 10:00

Chair: Joaquín B. González (MAX IV Laboratory)

TUKA01 / 09:30

MEDSI: from inception to the 25th anniversary and beyond – founders' perspective

Sasa Zelenika(University of Rijeka).
Sushil Sharma(Brookhaven National Laboratory).

The 2000 two-day Mechanical Engineering Design of Synchrotron Radiation Equipment and Instrumentation (MEDSI) workshop has since evolved into a key event fostering the networking of light sources' engineering community. The conference was conceived to address a key gap in the synchrotron radiation (SR) community: although mechanical engineers played a crucial role in the development of the facilities, their contributions were mostly not recognized and presented at major scientific conferences, hindering valuable information exchange. To address these challenges, a small group of initiators proposed the establishment of MEDSI, dedicated specifically to mechanical engineering topics within the SR community. The inaugural workshop was held at the Swiss Light Source (SLS) in Switzerland, attracting approximately 35 participants from leading facilities. Thanks to the dedicated efforts of the local organizers and the international program, scientific and organizing committees, over the past 25 years MEDSI has grown into a major week-long international conference, with a perspective to perhaps aim in the future at even broader intersectoral and career development scopes.

TUKB - Keynote Session 2

16 September 2025 10:20 / 12:00

Chair: Carles Colldelram (ALBA-CELLS Synchrotron)

TUKB01 / 10:20

MAX 4U- Our vision for MAX IV

Aymeric ROBERT(MAX IV Laboratory).

In 2016, MAX IV inaugurated the first fourth-generation storage ring in the world. With unprecedented performance, this new accelerator paved the way for a new era of X-ray science. Currently, four more fourth-generation light sources are in operation, with many more to come online by 2040. Overall, the accelerator community is making considerable advancements in Multi-Bend Achromat (MBA)-type lattices. This is to such an extent that, whereas MAX IV paved the way for fourth-generation light sources, we will have difficulties competing with other synchrotrons in the future. With this in mind, we developed our vision for the laboratory to ensure the excellence, relevance, and leadership of Swedish academic and industrial research with X-rays for the next decades. This is called MAX 4U, and is our proposal to upgrade our 3GeV storage ring. MAX 4U will reduce the 3GeV ring horizontal emittance further from the current of 328pm×rad to better than 100pm×rad on the horizon of the early 2030s. Beyond an accelerator upgrade, MAX 4U provides opportunities for beamline performance improvements that will keep MAX IV a leading platform for accelerating science, discovery, and innovation.

TUKB02/10:50

MAX 4U: Accelerator physics and engineering challenges of the first upgrade of a fourth-generation synchrotron light source
Pedro Tavares(MAX IV Laboratory).

The MAX IV 3 GeV storage ring in Lund, Sweden, is the first multibend achromat (MBA) lattice fourth-generation light source worldwide and delivered at the time of its inauguration, in June 2016, a world-record ultralow electron beam emittance of 328 pm rad with a corresponding ultrahigh photon beam brightness. This contribution summarizes the accelerator physics and engineering challenges to implement the first ever upgrade of a fourth-generation source aimed at reducing the electron beam emittance further down to below 100 pm rad. We focus in particular on the engineering design concepts proposed to enable this major performance boost through a minimum-interference upgrade in which localized interventions in selected subsystems and components are carefully chosen to provide the maximum impact with minimum cost and, equally important, minimum dark time for the MAX IV user community.

TUKB03/11:20

The European Spallation Source – ESS: Mechanical engineering and structural health monitoring.
Nikolaos Gazis(European Spallation Source ERIC, European Spallation Source).

European Spallation Source (ESS) is a multi-disciplinary research facility currently being commissioned with major upcoming milestones for starting up operations. The mission of ESS is to operate the world’s most powerful accelerator-based neutron source to enable scientific breakthroughs in the areas of materials, energy, health and the environment. ESS is a multi-disciplinary research facility currently under commissioning. Neutrons are obtained through the process of spallation by delivering 2 GeV protons to the solid tungsten target. The Mechanical Engineering, Technology & Analysis (META) group develops and performs mechanical engineering on facility level as well as performs the consolidated machine design under the ESS Plant Layout. ESS pursues stringent goals for machine availability and reliability with the META group implementing Structural Health Monitoring (SHM) techniques and Non-Destructive Testing (NDT) focusing on ultrasound, optical and modal, to validate machines’ behavior, monitoring the aging effects and achieve steady state operations.

TUOA - Beamlines Session 1

16 September 2025 13:00 / 14:40

Chair: Evgeny Nazaretski (Brookhaven National Laboratory)

TUOA01/13:00

APS upgrade - beamline engineering overview
Oliver Schmidt(Advanced Photon Source).
Altaf Khan, Daniela Capatina, Jonathan Knopp, Mohan Ramanathan, Robert Winarski, Sunil Bean(Advanced Photon Source).

The Advanced Photon Source Upgrade (APSU) has transformed the APS into a 4th generation light source. The new 6 GeV, 200 mA multi-bend achromat (MBA) storage ring, along with injector improvements and new front ends will provide an increased brightness and an orders-of-magnitude improvement in coherent flux over the current facility. To take advantage of these new capabilities, we have designed and constructed nine new "feature beamlines" and implemented numerous additional beamline enhancements, all while ensuring the compatibility of existing programs. This talk will present a comprehensive overview of the APSU beamline scope, focusing on successes, challenges, and lessons learned.

TUOA02 / 13:20

Design and technical commissioning of the In Situ Nanoprobe endstation and instrument at the Advanced Photon Source

Benjamin Davis(Advanced Photon Source).
Deming Shu, Jörg Maser, Luca Rebuffi, Sarah Wieghold, Steven Kearney, Tim Mooney, Xianbo Shi, Zhonghou Cai(Advanced Photon Source), Barry Lai, Pedro Mercado Lozano(Advanced Photon Source, Argonne National Laboratory).

The In Situ Nanoprobe (ISN) is a newly constructed, best-in-class experimental instrument at sector 19 of the upgraded Advanced Photon Source (APS-U). The new ISN beamline provides a 5-30 keV monochromatic x-ray beam, high coherence, and focused flux of >3x10^11 photon/sec @ 25 keV. KB mirror focusing offers a focal spot as low as 20 nm. The KB mirrors also provide a long working distance of 61 mm, to enable a versatile suite of sample environments: in-vacuum or in-air operation, heating to >1000˚C, cooling to 40K, flow of liquids & gases, and applied electrical fields. The instrument supports fast fly-scanning of relatively large and heavy samples of ~10x10mm and 2kg at 1mm/s. Measurement techniques include 2D and 3D XRF mapping, ptychographic coherent structural imaging, x-ray diffraction, and x-ray excited optical luminescence. This work presents the first mechanical results from the ongoing technical commissioning in Summer 2025, including the design and architecture of the endstation, vibrational and thermal management, beam conditioning optics, KB mirror alignment, vacuum chamber design, sample scanning, sample environments, metrology, and detector systems design.

TUOA03 / 13:40

NMX, a long neutron beamline at the European Spallation Source

Giuseppe Aprigliano(European Spallation Source).
Daniel Lundström, Rosa Camilleri Lledo(European Spallation Source), Esko Oksanen(European Spallation Source; Lund University, Lund University, European Spallation Source).

NMX, the neutron macromolecular crystallography beamline, with its 157m distance between neutron source and sample, is one of the long instruments about to enter into commissioning phase with neutrons at the European Spallation Source in Lund. While the neutron shielding system, 3 chopper disks and more than 150m of finely aligned neutron guide mirrors safely transport a tailored beam to the sample position, the end-station delivers extended automation capability to the experiment: As a robotic goniometer exchanges, positions, precisely aligns and orients the crystal sample, three industrial robots arrange the bespoke neutron detectors to optimize neutron scattering detection. Although the scientific technique has similarities with synchrotron MX beamline, some engineering challenges are specific to the integration in a modern neutron spallation source.

TUOA04/14:00

Engineering advancements in x-ray pump–probe techniques using delayline technology at LCLS

Hengzi Wang(SLAC National Accelerator Laboratory).

X-ray pump–probe techniques at XFELs have revolutionized ultrafast science by enabling precise control of X-ray pulse pairs with tunable delays. This talk highlights key engineering breakthroughs in LCLS behind two critical methods: magnetic chicane systems and split-and-delay optics. Magnetic chicane systems manipulate electron and photon beams to generate delays up to hundreds of femtoseconds, with LCLS upgrades extending tunable delays from 0 to 10 fs for attosecond-resolution studies. Split-and-delay optics use Laue crystals, diamond gratings, or mirrors to divide, delay, and recombine X-ray pulses, achieving delays from femtoseconds to sub-nanoseconds. We will explore the engineering challenges of designing, aligning, and stabilizing these systems, including high-precision mechanics, advanced control systems, and real-time diagnostics. Ongoing upgrades are enhancing performance and expanding opportunities in condensed matter physics, chemistry, and materials science, pushing the boundaries of ultrafast X-ray science.

TUOA05/14:20

The design of SIBIPIRUNA, a cryogenic soft X-ray tomography beamline with BSL2, BSL3 and BSL4 compatibility for Sirius and Orion at CNPEM

Renan Ramalho Geraldes(Brazilian Synchrotron Light Laboratory).
Artur Clarindo Pinto, Bernd Christian Meyer, Erik Olivi Pereira, Gabriel Antunes Souza, Gabriel Gonçalves Basilio, Gustavo Lorencini M. P. Rodrigues, Harry Westfahl Jr, Lucas Sanfelici, Mairon Oliveira Lima, Marco Orlando Eneas Leal, Mateus Borba Cardoso, Michel Bernardino Machado, Pedro Pereira da Rocha Proença, Renata Santos Rabelo(Brazilian Synchrotron Light Laboratory).

Recent outbreaks of emerging infectious diseases have highlighted the need for enhanced biosafety measures and research capabilities. Addressing this, the Brazilian Center for Research in Energy and Materials(CNPEM) is spearheading the development of Orion, Latin America's first facility to host a Biosafety Level 4(BSL4) laboratory. More ambitiously, Orion will pioneer a groundbreaking global achievement: the integration between BSL4 areas and synchrotron beamlines. A connection between Orion and the 4th-generation storage ring Sirius/LNLS will enable unprecedented X-ray bioimaging opportunities in soft,tender and hard X-rays, with a program covering cells, tissues up to entire organisms. At the lower energy range, the SIBIPIRUNA beamline will allow for 3D imaging of infected single cells using cryogenic soft X-ray tomography. With a resolution target of 30nm, rapid full tomography time around 5 to 10 minutes, and whole unstained samples, unmatching detailed studies of viral infection mechanisms will be unlocked.

This work describes the design of the beamline and its end-stations, highlighting their compatibility and compliance with biocontainment and decontamination needs.

TUOB - Beamlines Session 2

16 September 2025 15:20 / 17:00

Chair: Paul Palecek (Brookhaven National Laboratory)

TUOB01 / 15:20

Research on active feedback control of monochromator crystal angle based on FPGA

Jian He(Shanghai Advanced Research Institute, Chinese Academy of Sciences).
Yueliang Gu, Wanqian Zhu(Shanghai Advanced Research Institute, Chinese Academy of Sciences).

During the experiment, the photon flux at the Surface Diffraction Beamline (BL02U2) of the Shanghai Synchrotron Radiation Facility exhibited a gradual attenuation phenomenon, which severely impacted the progress of scientific experiments. At 8 keV, the photon flux decreased by 20% over a period of 20 hours; whereas at 19 keV, the photon flux dropped by 78% within just 20 minutes. To address this issue, a software correction technique was introduced. This technique involved reading the crystal angle encoder position every 5 minutes and comparing it with the target position. By compensating the difference to the coarse adjustment motor of the crystal angle, this method effectively alleviated the flux attenuation problem in the low-energy region. However, in the high-energy region, the photon flux still showed a sawtooth-like attenuation trend, with a 30% decrease within 24 hours. A solution based on FPGA was further adopted, which managed to keep the photon flux variation within 5% over a 24-hour period. This significantly enhanced the stability of the photon flux and thereby greatly improved experimental efficiency.

TUOB02 / 15:40

Grating mirrors active cooling system design for soft X-ray monochromator

Alban Moyne(European Synchrotron Radiation Facility).
Amparo Vivo, Damien Coulon, Flora Yakhou-Harris, Kurt Kummer, Laurent Eybert-Berard, Nicholas Brookes, Philipp Brumund(European Synchrotron Radiation Facility).

We present an active cooling system for the grating mirrors of ID32 soft X-ray beamline at the European Synchrotron Radiation Facility (ESRF). The design combines flexible copper braids to minimize mechanical stress in the grating mirrors with active temperature control to accelerate thermal response. Development followed a model-based approach, integrating dynamic Simulink thermal simulations with static finite element analysis. Under variable beam heat loads, the system maintains mirror temperature stability within ±2 mK and reduces thermal settling time from several hours to under 10 minutes. Interferometric measurements confirm improved optical surface flatness, with the cooling system contributing less than 50 nrad RMS to slope error. This enhancement translates to improved beamline energy resolution from 25.6 meV to 22 meV.

TUOB03 / 16:00

First steps into the operation of the SAPOTI cryogenic nanoprobe at the CARNAÚBA beamline at Sirius/LNLS

Vinicius Bomfim Falchetto(Brazilian Synchrotron Light Laboratory, Brazilian Center for Research in Energy and Materials).
Anna Paula da Silva Sotero, Antônio Carlos Piccino Neto, Carlos Alberto Pérez, Erik Olivi Pereira, Francisco Mateus Cirilo da SIlva, Gabriel Oehlmeyer Brunheira, Gabriel Gonçalves Basilio, Hélio César Nogueira Tolentino, Leonardo Kofukuda, Michel Bernardino Machado, Pedro Pereira da Rocha Proença, Renan Ramalho Geraldes, Rodrigo Szostak, Verônica de Carvalho Teixeira, Yago Antoniolli Marino(Brazilian Synchrotron Light Laboratory).

SAPOTI is the second nanoprobe at the CARNAÚBA (Coherent X-Ray Nanoprobe Beamline) beamline at the 4th-generation light source Sirius/LNLS. Working from 2.05 to 15 keV, it relies on simultaneous multi-analytical X-ray techniques (absorption, diffraction, spectroscopy, fluorescence and luminescence) and imaging in 2D and 3D. It has been designed for highly-stable fully-coherent beam sizes from 30 to 120 nm, and monochromatic flux up to 1e11ph/s/100-mA/0.01%BW after an achromatic KB (Kirkpatrick-Baez) focusing optics. Moreover, a new in-vacuum high-performance cryogenic sample stage has been developed aiming at single-nanometer resolution images. The nanoprobe is now successfully installed and technical commissioning is underway. The focus of this work is two-fold. Firstly, it highlights the system integration results at the beamline, namely: overall thermo-mechanical performance of the loading module, KB mirrors and sample stage; and nanopositioning scanning capabilities. And, finally, it showcases the instrument's technical commissioning results, namely: KB alignment and focus stability, and initial fly-scan potential for ptychography and absorption imaging.

TUOB04/16:20

Recent advances in X-ray microscopy instrumentation developments at NSLS-II

Evgeny Nazaretski(Brookhaven National Laboratory).
Andrew Kiss, David Coburn, Hanfei Yan, Juan Zhou, Mingyuan Ge, Nathalie Bouet, Wah-keat Lee, Wei Xu, Weihe Xu, Xiaojing Huang, Yang Yang, Yong Chu, Zirui Gao(Brookhaven National Laboratory).

X-ray microscopy is a mature characterization tool routinely used to investigate diverse material questions of science, technology, and engineering. The high penetration power of X-rays allows the utilization of different characterization methods and reveals elemental composition, crystalline phases, strain distribution, oxidation states, etc. in macroscopic and microscopic samples. Full-field and scanning X-ray microscopes serve similar scientific purposes but prvoide technical capabilities that complement each other. In recent years, a number of X-ray microscopy systems have been designed, constructed, and commissioned at NSLS-II. During the presentation, we will provide a technical overview of recently designed microscopy instruments. It will include the design details of the Multilayer Laue Lens-based nanoprobe optimized for ~10 nm spatial resolution imaging, its current status, and future upgrades; the zoneplate-based full-field imaging system capable of 1-minute nano-tomography measurements; and a new Kirkpatrick-Baez based scanning microscope designed for ~200 nm spatial resolution

experiments.

TUOB05 / 16:40

Development of a Coherent Diffractive Imaging (CDI) Endstation at the SPring-8 II 12XU

Bo-Yi Chen(National Synchrotron Radiation Research Center).
Chi Chan, Chiu Chao-Chih, Chun-Yu Chen, Gung-Chian Yin, Hsin-Wei Chen, Jhih-Min Lin, Kang-Ching Chu, Masato Yoshimura, Ming-Ying Hsu, Nozomu Hiraoka, Po-Wei Lee, Tsai Yi-Wei, Ying-Shuo Tseng, Yu-Cheng Shao, Yu-Shan Huang(National Synchrotron Radiation Research Center).

The National Synchrotron Radiation Research Center operates two beamlines, 12B2 and 12XU, at the Super Photon ring-8 GeV. The SPring-8 II significant improvements in beam properties such as coherence, stability, and intensity are expected. NSRRC has initiated the construction of a Coherent Diffractive Imaging endstation on beamline 12XU. This endstation consists of two main subsystems: zone plate-based X-ray microscope and detector assembly. The microscope is mounted on a granite base to ensure mechanical stability and to minimize vibrational and thermal disturbances. The zone plate-based microscope comprises beam stopper, zone plate optic, optical stop aperture, and sample positioning stage. Each module is equipped with an independent XYZ piezo-driven translation stage. To further mitigate thermal drift and ensure dimensional stability, the stage bases are constructed from Invar alloy, which offers low thermal expansion characteristics critical to maintaining optical alignment over extended experimental durations. The detector system is mounted on a precision linear guideway allowing for fine adjustments of the distance to optimize image resolution and experimental flexibility.

TUP - Poster Session 1

16 September 2025 17:00 / 18:15

Chair: Keyu Zhou (MAX IV Laboratory)

| TUP01 |

Airbox housing for Jungfrau hybrit pixel area detectors used for X-ray laser applications in vacuum

Andreas Schmidt(European X-Ray Free-Electron Laser).
Roman Shayduk, Sebastian Goede, Thomas Preston(European X-Ray Free-Electron Laser).

At the European XFEL facility, the scientific instruments HED and MID deploy Jungfrau cameras for two-dimensional x-ray detection. At HED, respective diagnostics and methods aim at resolving atomic lattice structures via X-ray diffraction, laser-induced microscopic material changes such as shock-wave dynamics via X-ray imaging and small-angle x-ray scattering, or plasma temperature probing by inelastic x-ray spectroscopy. MID instrument exploits coherence of X-rays, and therefore, a windowless X-ray photon beam path all the way from the source to the sample and the detector plane is part of the instrument design. This calls for the need for a flexible mount of an area X-ray detector inside vacuum chambers. Originally designed for an in-air use at Swiss-FEL,

a detector airbox housing has been designed and built to meet the requirements of in-vacuum use at the European XFEL. This poster contribution presents the housing design for a single and double module, which separates the vacuum-compatible front-end sensor from the enclosed read-out electronics board, and displays fully integrated solutions for selected x-ray diagnostics.

| TUP02 |

A new beamline for Enhanced Liquid Interface Spectroscopy and Analysis (ELISA) at BESSY II

Stefan Hendel(Helmholtz-Zentrum Berlin für Materialien und Energie).

Andrey Sokolov, Christian Kalus, Frank Siewert, Jens Viefhaus, Karsten Holldack, Lisa Schwarz, Manuel Noppel, Simone Vadilonga(Helmholtz-Zentrum Berlin für Materialien und Energie), Hendrik Bluhm(Fritz Haber Institute of the Max Planck Society), Jan Philipp Hofmann(Technical University of Darmstadt).

The Enhanced Liquid Interface Spectroscopy and Analysis (ELISA) beamline at BESSY-II is engineered for cutting-edge liquid interface research. Integrating soft X-ray (40–3500 eV) and infrared (10–10,000 cm^{-1}) radiation, its dual-branch design optimizes beamtime efficiency and experimental versatility. ELISA features ultra-precise gratings (of 400, 1200 and 2400 l/mm line density, including Cr/C multilayer-coatings on the gratings and pre-mirror at the monochromator), special mirror coatings allow to cover the soft-to-tender X-ray energy range with high flux. Synchrotron-based IR integration ensures precise temporal and spatial correlation with sub-nanosecond resolution. Supporting ambient pressure X-ray photoelectron spectroscopy and reflection-absorption IR spectroscopy, the beamline adapts to variable sample environments. We present ELISA's innovative design, technical specifications, expected performance, and development timeline, showcasing its transformative potential for interface science.

| TUP03 |

A new integrated x-ray diffractometer for advanced diffraction beamlines

Raphael RICHAUD(IRELEC).

Aymeric CUNRATH(IRELEC, Alcen (France)), Nicolas Foos(IRELEC).

The advent at last generation synchrotron sources of extremely brilliant beamlines combined with fast photon-counter detector and high throughput sample changers change the paradigm of beamtime use. The time required by the diffractometer to handle the sample is the new bottleneck for the beamtime throughput. At IRELEC, we developed a new x-ray diffractometer aiming to close the gap and accelerate the whole process while pushing the mechanical precision and stability to new standard that exceed the usual requirements at modern diffraction beamlines. To reach this goal, we combined fast and synchronic translations to setup the sample environment with a high precision rotation stage keeping the ensemble very compact to minimize the in-air beam path and make the sample to detector distance as small as possible. To demonstrate the performance during our qualification tests on a first prototype, we had to tackle metrology challenge. The device and its performance are presented as well as the comparison of different method to perform the metrology. The commissioning at Synchrotron beamlines of this new device will be performed end of 2025 at APS and beginning of 2026 at MAX IV.

| TUP04 |

A new monochromator chamber design for XUV/ soft X-ray spectroscopy at FLASH

Holger Weigelt(Deutsches Elektronen-Synchrotron DESY, Helmholtz-Zentrum Berlin für Materialien und Energie).

Frank Eggenstein, Jens Viefhaus, Thomas Zeschke(Helmholtz-Zentrum Berlin für Materialien und Energie), Elke Plönjes-Palm, Günter Brenner(Deutsches Elektronen-Synchrotron DESY).

FLASH, the soft X-ray free-electron laser (FEL) in Hamburg provides high-brilliance ultrashort femtosecond pulses at MHz repetition rate for user experiments. For many spectroscopic and dynamical studies in various research fields a small FEL energy bandwidth and ultrashort pulses are a prerequisite. In order to increase the spectral resolution while still keeping the photon pulses short, a new double grating monochromator beamline has been designed and taken into operation at FLASH. The new ultra-high vacuum compatible monochromator chamber along with the diffraction grating holders were designed in-house at DESY in collaboration with HZB Berlin. In order to meet the required optics adjustment resolution and stability special care was taken on the stability and reproducibility of all mechanical movements. Here, we present the new monochromator chamber design. Based on the required specifications regarding resolution and accuracy, the technical implementation, including optics pre-alignment and test results, are shown.

| TUP05 |

An overview of the mechanical design of the quad crystal monochromator for the I20 XAS beamline.

Callum Tetrault(Diamond Light Source).

Andrew Peach, Henry Deverill, ***Mark Hooper(Diamond Light Source)***.

A new QCM design that has been developed to replace the existing system on the I20 XAS beamline at Diamond Light Source will be presented. The QCM adopts a 4-bounce channel-cut configuration eliminating beam offset, which features two Bragg axes covering an energy range of 4-35 keV, each housing two pairs of S111 and S311 crystals. Thermal challenges are present, with a typical power load of 600 W and up to 730 W for the D-II upgrade. The design addresses thermal challenges with an optimised direct and indirect LN2 cooling scheme. Precise crystal positioning is achieved by using very stable rotary and linear air bearings with high resolution alignment mechanisms. The design is influenced by prior FEA, thermal analysis, and mechanical tests to ensure a robust design ready for integration into the beamline.

| TUP06 |

An overview of the time-resolved capabilities and sample setups modularity at CoSAXS

Roberto Appio(MAX IV Laboratory).

Ann Terry, Byungnam Ahn, Fatima Herranz Trillo, Jackson Luis Da Silva, Tomás Plivelic, Vanessa Da Silva(MAX IV Laboratory), Pablo Mota-Santiago(Australian Nuclear Science and Technology Organisation).

CoSAXS is a multipurpose SAXS instrument located at the 3 GeV ring of MAX IV Laboratory in Sweden. This instrument provides a versatile platform for conducting Small-Angle X-ray scattering (SAXS) experiments on a wide range of research fields. With an extensive pool of sample environments, CoSAXS enables the application of multiple techniques and complex experiments on solid and solution samples. To accomodate the high demand and facilitate the rapid exchange of sample setups, a standardized mounting system has been implemented and additive manufacturing techniques are utilized for fast and efficient prototyping and production of customized sample holders. Furthermore, CoSAXS is equipped with advanced sample environments, such as the setup for milliseconds Time-Resolved SAXS-WAXS experiments in solution (TR-XSS). Among other studies it has been used in non-reversible protein reactions after laser activation of caged compounds.

| TUP07 |

Applying advanced manufacturing techniques to improve in-vacuum cooling within the SWIFT beamline.

Owen Harding(Diamond Light Source).

SWIFT is one of the flagship beamlines being developed in the Diamond-II programme. As part of D-II upgrades, the electron beam energy will be increased from 3GeV to 3.5GeV, leading both to a brighter beam and higher power deposition onto beam conditioning components (filters, slits, beam shutters) presenting new thermal management challenges. These components are usually water cooled via a copper pipe loop brazed around the main component, requiring a double vacuum brazing process (copper-to-copper and copper-to-stainless-steel). Requiring multiple vacuum brazing passes, this approach is costly, complex, and restrictive. Following several iterations with suppliers, I developed a design which only requires one brazing process. This novel process involves drilling a borehole into the component and installing a stainless-steel helix (manufactured via laser sintering) designed to shape the coolant flow. In addition to the reduced cost the concept is applicable across a variety of components, allowing for more rapid designs, simpler assembly, and more design flexibility.

| TUP08 |

A safe and X-ray transparent aluminium sample cell for high pressure and high temperature nano-diffraction imaging

Anne-Lise Buisson(European Synchrotron Radiation Facility).
Hamid Djazouli, Philipp Brumund, Yves Watier(European Synchrotron Radiation Facility), Kyle Olson, Marie-Ingrid Richard(CEA Grenoble).

The European Synchrotron Radiation Facility beamline ID01 performs Bragg Coherent Diffraction Imaging and X-ray nano-diffraction experiments with in-situ environments. A new sample environment for nanoparticles has been designed and tested. It combines a furnace and a pressurized X-ray transparent chamber, without the use of beryllium for safety reasons. The required 180°C horizontal and 45°C vertical viewing angles necessitate the use of a dome-shaped pressure chamber. Early in the design phase, the thermal effects of the 500°C furnace on the dome's mechanical properties were identified as critical. A Finite Element Analysis (FEA) study was conducted, accounting for heat sources, gas turbulence, and static pressure. Aluminium 6082-T6 was chosen for the pressurized dome, providing a safe and easy-to-procure solution. A dome thickness of 0.5mm provides 80% X-ray transmission at 33keV. The sample, a 200nm-diameter palladium nanoparticle, reaches 340°C in a 50-bar hydrogen atmosphere. Unlike beryllium-based pressure domes, this design uses aluminium, avoiding machining difficulties, procurement issues, and safety hazards.

| TUP09 |

Automated high pressure water cell - HPWC

Arne Meyer(Deutsches Elektronen-Synchrotron DESY).

The poster presents the development of a high-pressure water cell (HPWC) to be used at the diffraction beamline P02.1, at PETRA III depicting its mechanical design and the challenges to achieve operating pressures up to 10 kbar (1 GPa). A crucial part of this setup is on its automation, in which the pressure increments are introduced by means of a spindle-pump type compressor. The spindle pump is driven by a stepper motor, which is controlled by a PLC from the Beckhoff brand. The PLC monitors the pressures and temperatures and controls the motor and the valves of the system. The pressure is controlled by a PID-controller and the System has several different operation and safety routines that can be selected by the user. Two pressure sensors monitor the pressure in different positions. Inductive limit switches protect the pump from collisions and magnetic valves with pneumatic actuators split the system in different parts. The valves are also monitor by inductive limit switches. The HPWC consists of a hardened stainless-steel block with three main apertures: two in the beam direction with a set of diamond windows, and a dedicated port for sample loading.

| TUP10 |

A wavelength-dispersive spectrometer for resonant inelastic X-ray scattering

Jan Weser(Physikalisch-Technische Bundesanstalt).

Adrian Jonas, Burkhard Beckhoff, Christian Stadlhoff(Physikalisch-Technische Bundesanstalt).

Conventional X-ray techniques often lack the energy resolution, the efficiency or the polarization sensitivity required. In collaboration with the NIST the PTB has developed a new wavelength-dispersive spectrometer (WDS) capable of high-resolution XES and RIXS in the photon energy range from 80 eV to 1500 eV. The WDS finds its main applications in the investigation of low Z compounds and battery material research, the validation and development of theoretical calculation tools, and the accurate determination of x-ray fundamental parameters. The innovative design is based on a modified Hettrick-Underwood geometry and is equipped with sets of variable line spacing (VLS) gratings and related spherical mirrors allowing for efficient collection and diffraction of X-rays. In addition, the perpendicular dual detection arms enable simultaneous measurements in different orientations to the polarization plane of the incident synchrotron radiation. The incident monochromatized undulator radiation is focused down to a 7 µm spot size using a single-bounce monocapillary X-ray optics. A position-sensitive CCD camera is used as a detector in each arm.

| TUP11 |

Compact multi-purpose imager for the Matter in Extreme Conditions end-station at LCLS

Nina Boiadjieva(SLAC National Accelerator Laboratory).
Ariel Arnott, Bob Nagler, Dimitri Khaghani, Elon Goliger Mallimson, Eric Galtier, Gilliss Dyer, Hae Ja Lee, Meriame Berboucha, Nick Czapla, Peregrine McGehee(SLAC National Accelerator Laboratory).

This paper presents the mechanical design of a new imaging system developed at the Matter in Extreme Conditions (MEC) instrument at the Linac Coherent Light Source (LCLS) to improve setup efficiency while maintaining high-quality imaging performances. We designed an in-vacuum setup for imaging both the focal spot of a laser and the targets themselves. The system integrates high-resolution optics, remote positioning relative to the interaction point and control system. It supports spot sizes from 2 to 600 μm and spatial resolutions down to 1 μm. Using kinematic mounting features, we ensured repeatability of internal components positioning and user-friendly way when modifications are needed. The system is versatile as it accommodates different laser wavelengths, it can function as a confocal imager for precise target positioning and its compactness allows it to fit in various experimental geometries. Additionally, the system includes vacuum-compatible, adjustable wavelength filtering and attenuation that maintain optical alignment. Finally, a shutter protects the high-resolution optics from target debris while the whole imager is fully retractable to further clear the target area.

| TUP13 |

Controlling of a nano imaging test device

Patrik Wiljes(Deutsches Elektronen-Synchrotron DESY).
Ralph Doehrmann, Stephan Botta(Deutsches Elektronen-Synchrotron DESY).

In preparation for the accelerator upgrade "PETRA IV" at DESY, a nano imaging test device for the experiment end stations, called SPIDER, is under development. Aside to new concepts for the ultra stable mechanical design, the controlling of the mechatronical parts and sensors as active feedback plays another important role. The device is driven by different motor types like steppers, servos and piezos. For synchronization purposes most of the controllers are connected via a real-time bus which is led by one master real-time controller (plc). All axes are equipped with nanometer resolving encoders and the sample holder is monitored by a laser interferometer. With these sensors as feedback, the master plc can not only monitor all axes but also provides capabilities for online correction of mechanical imperfections and active damping of vibrations. The poster will show the control structure together with measurement results from the prototype in the lab.

| TUP14 |

CoSAXS beamline at MAX IV: optical design and sample environment for advanced SAXS/WAXS applications

Matheus Da Silva(MAX IV Laboratory).
Ann Terry, Byungnam Ahn, Fatima Herranz Trillo, Jackson Luis Da Silva, Marcelo Alcocer, Marco Leorato, Roberto Appio, Tomás Plivelic, Vanessa Da Silva(MAX IV Laboratory), Raul Barrea(Benedictine University).

CoSAXS is a versatile SAXS/WAXS beamline at the 3 GeV diffraction-limited ring of MAX IV Laboratory in Sweden. The optical design delivers X-ray beams from 4–20 keV with 0.01% bandwidth and photon flux of 10^{12}–10^{13} ph/s, with up to 10% coherent flux at 7.1 keV. Beam sizes at the sample range from 250 × 250 μm^2 to 30 × 15 μm^2 (FWHM). The SAXS detector (Eiger2 4M) moves longitudinally and transversely inside a 15 m vacuum vessel. The fixed WAXS detector (Pilatus3) is positioned at the vessel entrance, and a Mythen2 1K in air provides 1D WAXS. The q-range spans ~6 × 10^{-4} to 3 $Å^{-1}$ (d-spacings: 1 µm–2 Å). Supported techniques include solution and solid SAXS/WAXS, SEC/AF4-SAXS, USAXS, TRSS in the ms range, and coherent scattering. Sample environments include magnetic fields, rheology, biaxial stretching, and microfluidics. Control and data systems are described in. After nearly 5 years of operation, CoSAXS has completed 190 proposals, including 19 proprietary research projects. The beamline has a high demand and has contributed to 47 publications.

| TUP15 |

Creating a Multi-Capillary Furnace (MCF)

Mark Morrow(Diamond Light Source).
David Butler, Luke Keenan, Nitya Ramanan(Diamond Light Source).

The Multi-Capillary Furnace (MCF) is a novel furnace design with four independent furnace units for use on the Spectroscopy beamlines at Diamond Light Source. This furnace offers users the opportunity for improved experimental efficiency by permitting up to four different samples in a reaction (e.g. catalysis reactions) to occur concurrently, with remote operation to allow for moving the different samples into the beamline path. Thermal isolation between each furnace, required to achieve the performance within a compact envelope, is achieved with integrated water cooling and ceramic insulation. This paper details the design of the MCF and presents the results from commissioning.

| TUP16 |

CRISTALLINA-Q XFEL Diffractometers

Gheorghe Olea(HUBER Diffraktionstechnik GmbH&Co.KG company.).
Norman Huber, *Rudolf Schneider, Wolfgang Schülein(HUBER Diffraktionstechnik GmbH&Co.KG company.)*.

In a well-known European free-electron laser facility (SwissFEL), a new branch(ARAMIS 3) of the beam line delivers hard X-ray to the CRISTALLINA experimental hutch. CRISTALINA-Q station inside, intends to investigate advanced materials focused on specific Quantum materials (QM) structures and processes. Two new heavy load dedicated Diffractometers (Dm) have been developed. They are heavy load precision machines which, through adequate techniques and instruments, under extreme conditions (temp, press, rad), working in tandem are expected to fastly advance the investigations. The first(CrQ-Dm1) is manipulating a large-size (h=2.5m) cryo-magnet (1t, 5.2T, -10mK) and the second one(CrQ-Dm2) a smaller pulse-magnet (0.6t, 50T, 30 rate) sample instruments. They are able to perform most of the investigations in horizontal scattering, but not only. From flexibility and versatility reasons, Dm(s) have been conceived with similar configurations, having each a high level of compatibility inside & outside, however exhibiting some distinct differences. The kinematic, design, simulations and precision principles applied, together with challenging aspects and results of tests are presented.

| TUP17 |

CXI end station at Softimax beamline MAX IV

Niklas Johansson(MAX IV Laboratory).

Erik Malm, Joaquín B. González, Jörg Schwenke(MAX IV Laboratory).

A documentation of the design and production process of the CXI (coherent x-ray imaging) end station at SoftiMAX, a soft X-ray beamline at MAX IV. The station needs to allow practical removal from the beam allowing for visiting end stations. The diffracted light from the sample should be captured by a detector at a widely adjustable angle. The detector position longitudinally from the sample should be very adjustable both inside the chamber but also by extending the vacuum from ports on the side of the chamber. Going into key specifics of the mechanical solutions chosen to accommodate the scientific requests as well as describing the failures and solutions along the way.

| TUP18 |

Design of a dedicated multilayer monochromator for electron beam size measurements using the Heterodyne Near Field Speckles (HNFS) technique at the ALBA synchrotron

Jose Maria Alvarez(ALBA Synchrotron (Spain)).

Andriy Nosych, Carles Colldelram, Julián García, Nahikari Gonzalez, Ubaldo Iriso(ALBA Synchrotron (Spain)).

Within the framework of the ALBA Diagnostics Group’s participation in a Future Circular Collider (FCC) collaboration, a dedicated setup for electron beam size measurement based on Heterodyne Near Field Speckles (HNFS) has been developed and is currently under commissioning at ALBA Front End 21 using radiation from a dipole bending magnet. The setup incorporates a high-energy (20–30 keV), high-bandwidth (~1.3%) monochromator, entirely designed in-house, along with the colloid sample environment and the detector system with their corresponding supports. The monochromator features a 300 mm Si substrate with W/B_4C multilayer coating and operates in a vertical Laue reflection geometry. To reduce complexity and for this HNFS-specific application, ultra-high vacuum (UHV) conditions and submicron precision mechanics are not required. The mirror assembly is housed within a standard DN400 CF chamber, mechanically coupled to the chamber itself. This chamber is mounted on a granite-based “skin concept” table, providing two degrees of freedom (vertical translation and tilt) for energy tuning and beam path insertion/retraction. The complete design of the set-up is presented in this paper.

| TUP20 |

Scanning and transfer of cryogenic samples in the BioNanoProbe-II instrument at the Advanced Photon Source

Benjamin Davis(Advanced Photon Source).

Barry Lai, Evan Maxey, Jie Liu, Josh Han, Kevin Peterson, Michael Wojcik, Si Chen, Sunil Bean, Tim Mooney, Xiaozhi Zhang(Advanced Photon Source), Tugba Isik(Center for Nanoscale Materials).

A new hard x-ray fluorescence nanoprobe instrument called Bionanoprobe-II (BNP-II) has been designed and will be constructed at 2-ID-D of the upgraded Advanced Photon Source. BNP-II will take advantage of the orders-of-magnitude increase in brightness and coherent flux with advanced sample scanning, metrology, cryogenics, and controls. These advancements will enable high-throughput XRF imaging under cryogenic conditions with 10 nm spatial resolution, 2D survey of mm-sized samples, and fast tomography for 3D visualization. BNP-II also introduces a novel robotic sample transfer system that interconnects a cryogenic plasma focused ion beam (cryo-PFIB) milling station alongside the x-ray nanoprobe. The interconnected instruments enable an iterative workflow between x-ray measurements and cryo-PFIB milling and maintains the integrity of vitrified samples by remaining below 110K even during transfer. Regions of interest can be identified by fast large-area scans, after which the sample geometry can be optimized for nanoscale x-ray imaging and tomography. This work details the engineering advancements required to examine highly complex, multidimensional systems with BNP-II.

| TUP21 |

Design of the high energy microscopy beamline at Korea-4GSR

Yongsung Park(Pohang Accelerator Laboratory).

Jae-Hong Lim, Kijeong Kim(Pohang Accelerator Laboratory).

The High Energy Microscopy (HEM) beamline is being developed for X-ray projection imaging and computed tomography at the Korea 4th Generation Storage Ring (Korea-4GSR) currently under construction in Ochang, South Korea. The HEM beamline will deliver a fan beam with a horizontal size of 200 mm and a vertical size of 28 mm at the sample position located 100 meters from the 2-Tesla bending magnet source, with a critical energy of 21 keV. Projection imaging will be performed in two modes: a monochromatic mode using a double-multilayer monochromator and a filter array, covering the energy range of 5–40 keV, and a white beam mode with energies up to 100 keV. The end-station is positioned at 95 meters and will be equipped with a high-load air-bearing rotation stage to enable operando and in-situ experiments. For phase-contrast imaging, the sample-to-detector distance can be extended up to 20 meters, benefiting from the extremely small source divergence of approximately 0.1 μrad at the sample location. Large field-of-view images will be captured using a high-aspect-ratio detector composed of a high-resolution camera array.

| TUP22 |

Designs of the first-phase beamlines for Siam Photon Source-II

Chanan Euaruksakul(Synchrotron Light Research Institute).

Siam photon source-II (SPS-II) is a new synchrotron facility that is going to be built in Thailand. There are seven beamlines to be constructed together with the new machine. These consist of one soft X-ray beamline, two X-ray absorption beamlines, three X-ray scattering beamlines and one imaging beamline in the lineups. The designs and the selections of insertion devices, front end and beamline components will be presented together with the optical simulation results and the considerations for thermal load management using the combination of front-end components, filters, white/pink beam slits and mirrors along each beamline. New experimental station equipment and the existing equipment from the current Thai synchrotron facility (Siam Photon Source-I) that will be transferred to SPS-II will also be discussed.

| TUP23 |

Development of a white X-ray beam monitor for the undulator beamline at Korea-4GSR

Hyung-seok Choi(Pohang Accelerator Laboratory).

Jehan Kim, Jongha Park, Ki-jeong Kim, Sungnam Kim, Young Duck Yun(Pohang Accelerator Laboratory).

Korea-4GSR, a 4th generation synchrotron radiation facility under construction in Ochang, South Korea, will install ten beamlines in Phase-1, nine of which will use undulators as light sources. The central cone entering each beamline's optics has a beam size about 1/10 that of the full white beam, requiring precise shaping and diagnostics at the front-end. The white beam from IVU24(In-Vacuum Undulator) reaches up to 18 kW power with a peak power density of 165 kW/mrad^2. Such high thermal loads can cause damage or vacuum failure with slight misalignments. Therefore, diagnostics must endure this load and provide accurate measurements. The diagnostic system must offer sub-100 μm resolution to detect beam size and position, while also managing heat. For this, scCVD(single crystalline Chemical Vapor Deposition) diamond is used to detect current signals and X-ray fluorescence, supported by a low-conductive water cooling channel. This presentation introduces the white beam monitoring system for Korea-4GSR undulator beamlines, including mechanical design, cooling system, and thermal analysis.

| TUP23 |

FemtoMAX beamline instrumentation and femtosecond pump-probe time-resolved experiments at the MAX IV Laboratory

Byungnam Ahn(MAX IV Laboratory).

Andrius Jurgilaitis, Carl Ekström, David Kroon, Jörgen Larsson(MAX IV Laboratory).

FemtoMAX is a multi-purpose, short-pulse X-ray beamline at MAX IV, uniquely located at the short pulse facility downstream of the LINAC, rather than the 3 GeV storage ring. Operational since 2021, it enables time-resolved X-ray diffraction/scattering experiments in the femtosecond to picosecond range using <100 fs X-ray photon pulses that make it possible to follow the ultrafast dynamics in solid materials and biological molecules by investigating the structure of transient states along the optical response. FemtoMAX combines the temporal resolution of an FEL with the operational stability of a storage ring. The beamline features versatile optics including monochromators and focusing systems, and multiple 2D detectors in air and vacuum endstations providing a flexible sample environment. It is equipped with an ultrafast laser system and terahertz pump capabilities for pump–probe experiments. Controlled via the Sardana framework, the beamline supports custom scans and real-time data analysis. We present the beamline instrumentation, recent applications highlighting FemtoMAX's value, and opportunities of the experiments at the FemtoMAX beamline at the MAX IV Laboratory.

| TUP24 |

Energy distribution of photoelectrons from the first mirror of a synchrotron radiation beamline

Ryoma Kataoka(High Energy Accelerator Research Organization).
Daisuke Wakabayashi, Hirokazu Tanaka(High Energy Accelerator Research Organization), Kazuhiko Mase(Institute of Materials Structure Science).

Photoelectrons (PEs) are emitted from the surface of the first mirror of a synchrotron radiation (SR) beamline when irradiated with white x rays. It has been reported that the PEs transfer heat to the chamber walls and mirror holder, inducing thermal drift of the mirror and consequently causing beam position and energy drift. We designed a copper shield which covers the entire mirror surface to absorb the PEs. However, it was difficult to install due to its large size and hindered observation of the mirror surface, thereby making the maintenance of the mirror more difficult. To better understand the phenomenon of PE emission and to design a smaller and more efficient shield, we have conducted spectroscopic analysis of PEs involved in heat transfer using a retarding field energy analyzer at the beamline BL-11A of Photon Factory. The analyses revealed that the energy distribution of PEs is largely independent of the beam's angle of incidence on the mirror surface, and that most of the emitted power originates from PEs with energies in the 1-2 keV range, although more than half of the emitted PEs have energies below 100 eV.

| TUP25 |

Engineering design of the CDI beamline endstation at NSLS-II

Yi Zhu(National Synchrotron Light Source II).
Gao Yuan, Garth Williams, Jake Hawkes, Lonny Berman(National Synchrotron Light Source II).

The Coherent Diffractive Imaging (CDI) beamline is one of the three advanced beamlines developed through the NSLS-II Experimental Tools (NEXT II) project at Brookhaven National Laboratory. This advanced hard X-ray beamline supports a photon energy range from 5 keV to 15 keV, enabling high-resolution imaging and characterization techniques. The CDI endstation integrated a custom-built beam conditioning system with an in-house-developed microscope, a six-degree-of-freedom sample positioning system, and a Two-Detector Motion System (TDMS). Key engineering challenges included achieving high stability, enabling nanometer-scale sample positioning, and developing a large-scale TDMS. The TDMS exceeds 9 tons in mass, occupies over 100 square meters, and is capable of independently and synchronously supporting two state-of-art X-ray detectors. The detectors can be positioned around the sample with up to 9 m of variable drift, and horizontal angular range of 125 degrees, and a vertical range of motion of about 1.65 m the scale, complexity, and novel architecture of the TDMS impose significant demands on interface engineering, presenting challenges that are arguably without precedent.

| TUP26 |

Examples of 2025 upgrades and experiments at Eu.XFEL MID Instrument

Gabriele Ansaldi(European X-Ray Free-Electron Laser).
Jan-Etienne Pudell, Ulrike Boesenberg(European X-Ray Free-Electron Laser).

In this poster are given insights about some examples of 2025 Upgrades and

Experimental Setups at Eu.XFEL MID Instrument. It is reported the latest design and implementation status of Eu. XFEL MID Multi-Purpose Chamber (MPC_2) Project. This represents a set of upgrades of MID's instrumentation currently being developed. It's an evolution of the current multi-purpose chamber, used at MID since the first experiments in 2019. The aim is to enable new types of scientific experiments to expand the current capabilities of MID. Another aim is to make operation of experiments easier with better access to the sample environment and possibilities to install new ancillary equipment. The MPC_2 Project includes MPC-2 VESSEL Upgrade (where we indicate here the current concept design status, simulation and its evolution through different scenarios: SUCCESSOR, SEGMENTED, DN320ISO-K) and MPC-2 INNER Upgrade (MPC-2_IU), which in turn consists of Breadboard Assembly, Laser In-coupling 2 Setup, 2-theta Goniometer, Diffractometer. Reported are also examples of recent dedicated EX-PERIMENTAL SETUPS developments at MID, continuing in the direction of simultaneous multi-detector-use.

| TUP27 |

Experimental station at MicroMAX

Mirko Milas(MAX IV Laboratory).

Aaron Finke, Ishkhan Gorgisyan(European Spallation Source), Afshan Begum, Ana Gonzalez, Casadei Cecilia, Dean Lang, Ezequiel Panepucci, Jie Nan, Kevin Rollet, Linus Roslund, Magnus Malmgren, Manoop Chenchiliyan, Monika Bjelcic, Oskar Aurelius, Staffan Benedictsson, Thomas Ursby, Tobias Krojer(MAX IV Laboratory), Swati Aggarwal(Lund University).

MicroMAX is the second macromolecular crystallography (MX) beamline at MAX IV designed primarily for time resolved studies of microcrystals using novel sample delivery methods grouped under Serial Synchrotron Crystallography (SSX) as well as conventional rotation data collection. Samples can be studied in the range from room temperature to 90 K. Time resolved studies are supported by a tuneable nanosecond laser. The experimental station has two area detectors (Eiger2X 9M CdTe, and Jungfrau 9M); an Arinax MD3-UP goniometer; an Irelec ISARA sample changer with a liquid nitrogen dewar capable of storing 29 Unipucks (464 samples); a beam conditioning unit; and a granite gantry for supporting additional equipment. The inhouse designed instrumentation includes the detector support for the two detectors, the sample table with six degrees of freedom, the gantry, as well as the beam conditioning unit and the mirror system and their support.

| TUP28 |

MicroMAX beam conditioning unit

Staffan Benedictsson(MAX IV Laboratory).

Mohammad AL-Najdawi(Synchrotron-Light for Experimental Science and Applications in the Middle East, MAX IV Laboratory), Mirko Milas, Oskar Aurelius, Simone Scolari, Thomas Ursby(MAX IV Laboratory), Ishkhan Gorgisyan(MAX IV Laboratory, European Spallation Source).

A new Beam Conditioning Unit (BCU) has been developed for the MicroMAX beamline at MaxIV to condition the beam between the KB mirrors and the sample. It includes two

XBPMs, a set of slits, a rotating chopper, a fast shutter and a linear attenuator, all on piezo driven stages. MicroMAX has a close collaboration with the BioMAX beamline, to simplify future work the same fastening rail system, with the same distance from rail to beam was chosen. To protect the XBPMs from oxygen but still allow for some heat transfer through convection, the chamber is filled with a low-pressure helium environment.

| TUP30 |

FL28: A new diagnostic beamline for ultra-short XUV FEL pulses at FLASH

Michael Walther(Deutsches Elektronen-Synchrotron DESY).

Kai Tiedtke, Markus Braune, Stefan Düsterer(Deutsches Elektronen-Synchrotron DESY), Lasse Wülfing, Wolfram Helml(TU Dortmund University), Markus Ilchen(Universität Hamburg, Center for Free-Electron Laser Science, Deutsches Elektronen-Synchrotron DESY, Deutsches Elektronen-Synchrotron DESY; Center for Free-Electron Laser Science; Universität Hamburg).

The FLASH2020+ project, a major upgrade program for the high-repetition-rate XUV and soft X-ray free-electron laser FLASH at DESY, aims at significantly improving the FEL photon-beam properties for users. Besides external seeding at the full repetition rate of FLASH, a second focus is put on extremely short photon pulses in the lower fs range. Here, we will present the new diagnostic beamline concept for the FLASH2 branch to address the temporal characterization of the FEL photon pulses. The new FL28 beamline will be set up as a dedicated online diagnostic beamline. This is accomplished by an almost parasitic extraction of a small fraction of the FEL beam, while the main part of the beam is steered almost unaffected to the user experiments. The extraction and transport of the FEL radiation into the interaction chamber is realized by two Ni-coated mirrors under 16°, which cover a wavelength range from 2 nm to 90 nm, followed by a differential pumping stage and an ellipsoidal focusing mirror. Finally, the pulse length is derived from electron time-of-flight spectroscopy on noble gases in combination with an external infrared circularly-polarized streaking laser field.

| TUP31 |

Flexible instrument setups: concept and experience from the SCS Beamline at european XFEL

Jan Torben Delitz(European X-Ray Free-Electron Laser).

Alexander Reich, Carsten Broers, Martin Teichmann(European X-Ray Free-Electron Laser).

The spectroscopy and coherent scattering instrument (SCS) at the European XFEL was designed for a wide range of experimental techniques in the soft x-Ray regime. In order to conduct the experiments, the instruments have to host different kind of (experimental) chambers and detectors system(s). The changeover between the different configurations should be done as easy as possible but also with a reliable workaround. The poster will present different approaches and concepts in order to realize this. One the one hand the physical transport and installation will be shown. Examples are here the transport with air-pads and three fixation points for a suitable reproducibility of the different chambers. Experience from the operation and the needed infrastructure will be described as well. On the other hand, the electrical connections are important for control and taking data.

The poster will show here the local box solution as well as the usage of field bus terminals and give also the outlook for a flexible programming of the PLC control.

| TUP32 |

Hexi: The High-energy Electron Xtallography Instrument

Michela Semeraro(Diamond Light Source).

Alistair Siebert, Graham Duller, Khairul Sojib, Michael Esnouf, Pedro Nunes, Richard Littlewood, William Norman(Diamond Light Source).

The High-energy Electron Xtallography Instrument (HeXI), currently under construction at Diamond, is set to expand the range of samples suitable for structure determination via electron diffraction. Funded by the Wellcome Trust's "Electrifying Life Sciences" grant and Diamond Light Source, the HeXI project will utilize Mega-electron-volt (MeV) electrons to bridge the crystal size gap between electron and X-ray scattering. This will enable the determination of structures from crystals ranging between 300 nm and 3 µm. HeXI incorporates a tunable electron source, adjustable between 100 kV and 1 MeV, along with bespoke collimation and magnetic lenses, capable of achieving the precise optical properties necessary to interrogate nanometer-scale crystals within an in-vacuum sample environment. This first-of-its-kind instrument will combine the unique sensitivity of electrons to structural information with the advanced goniometry developed at Diamond for macromolecular X-ray crystallography to enhance overall data quality. In this poster, we will explore the design of this 7-meter-long electron beamline and its main challenges.

| TUP33 |

High-precision alignment of an upgraded soft X-ray polarimeter at Diamond Light Source

Qingxin Meng(Diamond Light Source).

Adam Howell, Andrew Malandain, Andrew Peach, Arindam Majhi, Ben Garvey, Douglas Winter, Hongchang Wang, Kawal Sawhney, Mark Hooper(Diamond Light Source).

Knowledge of X-ray beam polarisation on a synchrotron beamline is essential, not only for characterising the undulator performance, but also for precise analysis of dichroic and chiral experiments. The upgraded high-precision soft X-ray polarimeter at Diamond Light Source features multiple retarder adjusters to allow precise concentricity and angular alignment to the analyser. A novel offline alignment procedure has been developed, achieving 69 µm horizontal and 17 µm vertical concentricity alignment, as well as 4 µrad yaw and 9 µrad pitch alignment. Compared to the original version of the instrument, the vertical concentricity alignment improved by 14× and the yaw alignment improved by 18× . The procedure uses a laser diode to mimic the X-ray beam and a hexapod to align the analyser. Concentricity alignment relies on monitoring the intensity as the laser beam is cropped by plane mirrors on the retarder and analyser stages. Angular alignment is achieved by measuring the retarder and analyser rotation vectors using an autocollimator. The improved alignment allows the polarimeter to meet the stringent requirements for complete polarisation measurement above 1 keV.

| TUP34 |

High resolution beam defining slits for Korea–4GSR beamlines

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Dongtak Jeong, Hyung-seok Choi, Jehan Kim, Jongha Park, Ki-jeong Kim, Sungnam Kim(Pohang Accelerator Laboratory).

The beamlines of 4GSR use an undulator as the light source and consist of a DCM (Double Crystal Monochromator), beam focusing devices, and slit devices. The Beam Defining Slit, installed after the DCM, processes an X-ray beam of several tens of micrometers with sub-micron precision. This device minimizes parasitic scattering and maximizes X-ray beam intensity at the sample location. Materials resistant to the heat load from the synchrotron light source were chosen. The slit edges are designed with a knife-edge shape, and the surface roughness is polished to several hundred nanometers or less, optimizing fuzziness. The device achieves geometric stability and sub-micron precision for more accurate beam processing. The schematic structure includes four slit blades, four blade transport mechanisms, a vacuum chamber, and support structures. Additionally, the design includes a BPM function by receiving electrical signals from the slit blades. This presentation will describe the configuration and mechanical design of the Beam Defining Slit for the 4GSR beamlines, along with the detailed structure of the devices for beam processing.

| TUP35 |

Hybrid semitransparent beamstops for small-angle X-ray scattering instruments

Jackson Luis Da Silva(MAX IV Laboratory).
Kim Nygård(MAX IV Laboratory).

We report a novel concept of hybrid semitransparent beamstops for small-angle X-ray scattering (SAXS) instruments, removing the need for a separate photodiode to monitor the transmitted X-ray intensity. A beamstop is used to block the unscattered primary X-ray beam after it passes through the sample, protecting the detector while enabling measurement of the scattered signal. The design combines a semitransparent aluminum core with a highly absorbing steel cover to suppress parasitic scattering from the beamstop itself. The aluminum thickness is tailored to match the desired X-ray energy range, allowing sufficient transmission for beam monitoring while maintaining beam attenuation. Thanks to its modular architecture, the beamstop can be easily adapted to different beamline configurations, X-ray energies, and flux conditions.

| TUP36 |

In-line Sample viewer for sample alignment and visualization in SAXS/WAXS experiments at the CoSAXS Beamline at MAXIV Laboratory.

Jackson Luis Da Silva(MAX IV Laboratory).
Ann Terry, Roberto Appio, Tomás Plivelic(MAX IV Laboratory).

The CoSAXS beamline at MAX IV Laboratory has incorporated an in-line sample viewer. This new feature allows users to visually monitor and optimize the sample position within the beam path directly, which is crucial for experiments requiring precise micrometric alignment. The in-line viewer is designed to support intricate experimental setups such as microfluidics, where precise control of fluid flow and sample positioning is essential. The viewer is particularly helpful for TR-XSS, where experiments involve triggering structural changes with a laser and then rapidly collecting X-ray scattering data. Precise alignment is needed to ensure accurate measurements. The primary goal of the in-line viewer is to enable users to achieve and maintain micrometric precision in sample positioning, which is often necessary for advanced experiments.

| TUP37 |

Integrated system design of fluorescence detector and beam position monitor

Chang Sheng Lee(National Synchrotron Radiation Research Center).
*Cheng-Ying Chung(National Ilan University), Cheng-Yuan Lin, Chi-Yi Huang, Chien-Hung Chang, **Hok-Sum Fung**, Ming-Han Lee(National Synchrotron Radiation Research Center).*

This paper describes an integrated system combining a fluorescence detector and a beam position monitor to be implemented at the soft X-ray beamline of the Taiwan Photon Source (TPS) at the National Synchrotron Radiation Research Center (NSRRC). The system reduces production costs and features a more compact design. The TPS beamline is now in its third phase of development. According to user feedback, the fluorescence imaging design uses rear-side image capture in combination with a beam position monitor. This setup helps reduce stray light interference and improves the signal-to-noise ratio. The beam profile can be verified through image processing. The beam position monitors (BPMs) feature independently adjustable linear shift mechanism. The white beam section uses a coaxial heat dissipation system made of chromium-zirconium-copper alloy. This approach removes the need for brazing, reduces overall costs, and enhances both design and manufacturing efficiency. The BPM opening is adjustable within a range of 0 to 25 mm. The integrated system is expected to be deployed in multiple vacuum sections of the TPS 35A and TPS 43A beamlines in 2025.

| TUP38 |

Introduction of a new XRF microprobe at the Australian Synchrotron

***Benjamin Pocock(Australian Nuclear Science and Technology Organisation)*.**

Scanning X-ray fluorescence (XRF) microprobes (µProbe) provide element-specific, spatial associations between elements within heterogeneous, structured, and dynamic systems. A new scanning X-ray fluorescence (XRF) microprobe (µMEX) has been commissioned at the Medium Energy X-ray Absorption Spectroscopy beamline (MEX1) of the Australian Synchrotron. This offers X-ray microspectroscopy (µXANES) capabilities with a scan range of 100 x 100 mm, throughout an energy range of ~2.1 – 13.6 keV and with a spatial resolution or 3 – 20 µm which is unique within the facility and uncommon worldwide. In early 2025, the µMEX successfully recorded its first sulphur µXANES (S K-edge, 2.472 keV) from a 2.5 µm-thick, thin-section of an individual wool fibre ~35 µm in diameter. The low available flux at this bending magnet beamline coupled with the low energies (and corresponding low transmissivity) create significant engineering and optimisation challenges. Similarly, the broad selection of elements available to study, range of supported sample geometry and tight spatial constraints add to the design complexity.

| TUP39 |

Latest progress on two new ALS-U beamlines for diffraction-limited performance

***Maxime Bergeret(Lawrence Berkeley National Laboratory)*.**

The Advanced Light Source Upgrade (ALS-U) will increase soft X-ray coherent flux by 100×. We developed two new beamlines—COSMIC and MAESTRO—engineered to minimize loss of brightness and utilize the advanced coherence of the light source. Each beamline uses a minimalist optical layout: a cryo-cooled M1 mirror, a monochromator with variable-line-spacing gratings, and a final focusing M3 mirror. Optics are designed for Strehl ratio > 0.8 and sub-100 nrad vibration. A piezo-bimorph M3 mirror paired with a wavefront sensor allows for the wavefront optimization. Fabrication is underway. New test data include at-wavelength efficiency measurements for blazed gratings, and motion performance of piezo-actuated pitch/roll flexure systems at cryogenic temperatures, granite air-bearing positioners, and monochromators. We will present test results, expected performance, and recent progress updates on the ALS-U project.

| TUP40 |

Macromolecular crystallography at beamline P11

Alexander Grebentsov(Deutsches Elektronen-Synchrotron DESY).

Andrey Gruzinov, Guillaume Pompidor, Johanna Hakanpää, Olga Merkulova, Spyridon Chatziefthymiou(Deutsches Elektronen-Synchrotron DESY).

DESY's MX beamline P11 has been operating since 2012 at PETRA III and offers versatile focusing options to match the beam size and desired dose with diverse samples and various kinds of experiments. The important upgrade of P11 hardware is planned for the near future. We will exchange the diffractometer and the sample changer for a well-proven solution from Arinax, which is presented at EMBL and ESRF. The Arinax MD3up solution, in combination with a magnetic sample changer and a more spacious dewar that fits 37 unipacks, will allow us not only to decrease the data collection time but also improve the reliability. Serial synchrotron crystallography at P11 is enabled mainly with the CFEL tape-drive setup, also capable of time-resolved experiments by the mix-and-diffuse method. Real-time autoprocessing of serial data with CrystFEL has been developed within a long-term proposal. At PETRA IV, we are aiming to form a uniform bio-village at the current location of DESY and EMBL beamlines (P11-P14). Together with EMBL and Hamburg University of Applied Sciences (HAW Hamburg), DESY is currently building up a new logistics chain for MX samples.

| TUP41 |

Mechanical design and implementation of a High Harmonic Generation source at the SXP instrument

Vahagn Vardanyan(European X-Ray Free-Electron Laser).

David Doblas-Jimenez, Manuel Izquierdo, Patrik Grychtol, Pranav Bhardwaj, Shania Mitra(European X-Ray Free-Electron Laser), Michael Heber(Deutsches Elektronen-Synchrotron DESY; European X-Ray Free-Electron Laser, European X-Ray Free-Electron Laser, Deutsches Elektronen-Synchrotron DESY).

The Time-Resolved X-Ray Photoelectron Spectroscopy (TR-XPES) experimental station at the Soft X-ray Port - SXP Scientific Instrument of the European XFEL has been developed to perform femtosecond time-resolved photoelectron spectroscopy experiments on solids. The SXP Scientific Instrument opens new scientific opportunities for fs TR-XPES, including core level photoelectron spectroscopy (XPS), photoelectron diffraction in forward scattering (XPD), and increased probing depth through higher electron kinetic energies. To further extend experimental capabilities, a laser-based High Harmonic Generation (HHG) source is under development. HHG pulses in the extreme ultraviolet (XUV) range up to 70 eV will be generated using a 1030 nm pump laser with 200 μJ pulse energy at a nominal 334 kHz repetition rate. This photon energy range will enable to perform measurements more surface sensitive and allow to study of shallow core levels with high fidelity and the measurement of valence band dispersion with high angular precision. This contribution describes the mechanical design, key technological developments, implementation, and current status of the HHG source at the SXP Instrument.

| TUP42 |

Mechanical design of an off-axis parabolic mirror holder with six degrees of freedom

Alexander Reich(European X-Ray Free-Electron Laser).
Carsten Broers, Carsten Deiter, Jan Torben Delitz, Martin Teichmann, Robert Carley(European X-Ray Free-Electron Laser).

The XRD (X-Ray Diffraction Chamber) is one of the endstations of the SCS instrument, specifically designed for experiments on solid targets. Its sample holder features six-degree-of-freedom motion, allowing for precise positioning and alignment of the sample. During THz experiments at the XRD endstation of the SCS instrument, a 2" off-axis parabolic mirror must be precisely positioned in six degrees of freedom under UHV conditions (10^{-7} mbar). Each axis is equipped with encoder feedback and adjustable limit switches. Because of the focus length of 50.8 mm (2 ”) there is a very limited installation space. In operation, the mirror is translated and rotated into the X-ray beam path so that the THz and X-ray beams overlap exactly at the sample. After the measurement, the mirror has to be fully retracted from the beam path. The design challenge is to create a support system that is statically over-determined for rigidity. The system can be temporarily decoupled to form an under-determined mechanism for pre-alignment.

| TUP43 |

Microfocus tender X-ray beamline utilizing dipole radiation at BESSY II

Janin Lubeck(Physikalisch-Technische Bundesanstalt).
Konstantin Skudler, Matthias Müller, Michael Krumrey(Physikalisch-Technische Bundesanstalt), Andrey Sokolov(Helmholtz-Zentrum Berlin für Materialien und Energie).

A new beamline has been established on a dipole magnet at BESSY II in PTB’s own laboratory. The microfocus of the beamline has a typical spot size of 20 μm x 20 μm within the range of 1.5 keV to 10 keV monochromatized dipole radiation. Particularly, the microfocus will make X-ray spectrometric measurements more efficient and accurate, especially for techniques such as micro-X-ray fluorescence spectroscopy and X-ray emission spectroscopy using a von Hamos spectrometer. The core of the beamline is the monochromator that combines two modules: a plane grating monochromator (PGM) equipped with a multilayer-coated blazed grating and a plane mirror for energies up to 3.5 keV, and a double crystal monochromator (DCM) with two Si (111) crystals for energies above 2.45 keV. All the other mirrors are coated with Pt. To suppress higher-order contributions above 4 keV, the toroid M1 has an additional coating stripe of carbon. M1 and cylindrical M2 generate an intermediate focus at the exit slit. The final microfocus is created by a Kirkpatrick-Baez optic with two plane-elliptical mirrors. Initial results will be presented regarding beamline performance as well as from the commissioning phase.

| TUP44 |

Multilayer based soft-x-ray polarimeter at SOLARIS National Synchrotron Radiation Centre

Pawel Nowak(SOLARIS National Synchrotron Radiation Centre).

The main goal of the project is to design and manufacture a multilayer soft-x-ray polarimeter. It will give us the opportunity to compare theoretical polarization with actual polarization, which will make it possible to adjust the synchrotron beam to optimal parameters. The device will be inserted very precisely before the end station of the beam line and will work in ultra-high vacuum environment. The polarimeter will be small, universal and mobile. It will be possible to move it and connect it to lines that require it. Additionally, there will be a sample storage inside the device, which will enable to change polarizers and analyzers without breaking the vacuum, which will make beam analysis much easier. The polarimeter, analyzer and detector will change angles inside the device, which will enable research.

| TUP45 |

Nano-tomo-ptychography 3D-imaging on the Swing Beamline

Filipe Alves(Synchrotron soleil).

Alain Lestrade, Arnaud Gibert, Bizien thomas, Christer Engblom, Florent Langlois, Javier Perez, Yves-Marie Abiven(Synchrotron soleil).

In 2018, a new Nanoprobe system was installed and validated on the SWING beamline (Synchrotron SOLEIL) for 2D-nano-ptychography with an expected imaging resolution of 40 nm. The setup had been designed to be portable and capable of handling multiscale sample-sizes (from micrometer to hundreds of a micrometer). This system was then successively upgraded to allow for 2D-imaging resolutions of 20 nm, and 3D-nano-tomo-ptychography imaging with spatial resolutions of 50 nm. The end-station is composed of: a sample stage (5DOF), an optical stage comprised of a central stop and a Fresnel zone plate optical (3DOF), an order sorting aperture stage (3DOF). All positioning stages comprise piezo-driven actuators, of which synchronized control (with kinematic modelling) is done using the SOLEIL Delta Tau platform. In addition, fibber interferometry feedback was used for image reconstruction purposes. After the last improvements in 2023, imaging results show that the system can resolve 3D-images with a spatial resolution of 31 nm using a teeth sample (18h of acquisition). This contribution will present an overview of the mechanical design concepts and solutions adopted for the Nanoprobe project.

| TUP46 |

New HXS (Hard X-ray Scattering) beamline design at European XFEL

Nicole Kohlstrunk(European X-Ray Free-Electron Laser).

Daniele La Civita, Harald Sinn, Martin Dommach, Massimiliano Di Felice, Michaela Petrich(European X-Ray Free-Electron Laser), Wolfgang Clement(Deutsches Elektronen-Synchrotron DESY).

The European XFEL, located in Schenefeld, Germany is a major X-ray research facility which started operation in September 2017 and generates ultrashort X-ray flashes for photon science experiments with an outstanding peak brilliance. In the six months long maintenance period starting in June 2025 it is planned to build up the new HXS experimental station in the experimental hall and its beam transport system in the tunnel. HXS will be the third experiment of the SASE2 hard X-Ray beamline. For the beam transport system, the scope consists of design, installation and commissioning of ~500m vacuum pipes and implementation of a new Front End. This contribution reports about the design of the vacuum system of the beam transport, that due to space constraints required an unconventional pipe support from the tunnel wall and also reports about the Front End design implementing all the modifications after the experience of more than five years of operation.

| TUP47 |

Optimizing SGM beamline performance: hexapod and spectroscopy enhancements

Tor Pedersen(Canadian Light Source (Canada)).

James Dynes, Sandra LeBlanc, Tom Regier(Canadian Light Source (Canada)).

Recent developments on the Spherical Grating Monochromator (SGM) beamline at the Canadian Light Source (CLS) have significantly enhanced its capabilities, particularly through the integration of a vacuum-compatible Physik Instrumente hexapod (H-811.I2V) and the implementation of Bluesky data acquisition software. These upgrades have facilitated the transition from traditional X-ray Absorption Spectroscopy (XAS) measurements to advanced spectromicroscopy techniques. The hexapod allows for sub-micron scale sample manipulation, enabling high-resolution imaging with a 20 mm × 15 mm field of view. Additionally, the modelling of the Kirkpatrick-Baez (KB) mirror system for adaptive focusing has further optimized the beamline's performance providing a beam spot size of less than 10 μm^2. These developments have not only significantly improved the beamline's capabilities for environmental and catalytic material studies, but also increased the data quality for all routine spectroscopy measurements conducted on the beamline.

| TUP48 |

Rapid beamline diagnostics for upcoming BESSY II+ SoTeXS beamline

David Kraft(Helmholtz-Zentrum Berlin für Materialien und Energie).

Andrey Sokolov, Jens Viefhaus, Manuel Noppel, Philipp Hönicke, Simone Vadilonga, William Smith(Helmholtz-Zentrum Berlin für Materialien und Energie).

As part of the BESSY II+ * upgrade, the new SoTeXS (Soft-to-Tender X-ray Spectroscopy) beamline will enable high-precision, high-throughput studies of battery materials in the 0.5–5 keV energy range. At the endstation, battery cells with varying material combinations will undergo charging and discharging phases while being exposed to the beam. To ensure that, variations in the measurements are attributable to changes within the cells rather than fluctuations in beam properties, a rapid diagnostics procedure will be implemented. This procedure will monitor beam performance in between the battery measurements. This includes measurement of key parameters such as photon flux, energy resolution, and beam focus. The system combines a retractable ionization

chamber for energy resolution measurements and a camera-based setup using OpenCV and ChArUco markers for determining beam spot size and position. These tools allow beam performance monitoring between sample loading cycles and represent an advance over commissioning-only diagnostics on current BESSY II beamlines. This paper presents the technical requirements of the SoTeXS beamline and a selection of potential diagnostic tools.

| TUP49 |

Reconfiguration of the ASTRA beamline and its adaptation for Raman spectroscopy measurements

Marcin Brzyski(Jagiellonian University).

We present the reconfiguration of the ASTRA beamline (Absorption Spectroscopy beamline for Tender energy Range and Above) and its adaptation for combined X-ray absorption and Raman spectroscopy measurements. A new modular support system was designed and constructed to allow rapid and flexible reconfiguration of the end station, facilitating a broad range of experimental setups. Each vacuum chamber was equipped with an individual precision alignment system, while a central support rail mounted on the optical table ensured high positional accuracy relative to the synchrotron beam. A key part of the beamline modification was the design and construction of a new vacuum chamber with a port, allowing the Raman microscope head to reduce the distance to the sample. This solution enabled simultaneous measurement of the sample using both X-ray absorption spectroscopy and Raman spectroscopy.

| TUP50 |

Remote cryo valve adjuster – a new device to improve safety and reduce cost

Edwin Haas(National Synchrotron Light Source II).
AM Milinda Abeykoon, John Trunk, Steven LaMarra(National Synchrotron Light Source II), Zhijian Yin(Brookhaven National Laboratory).

During the COVID-19 pandemic, non-essential businesses closed or reduced output, prices for products rose, and availability of products needed for research decreased significantly. Many cryogenic gas producers either closed or significantly reduced production, causing the price of cryogenic gases such as liquid helium (LHe) to rise. Concurrently, much effort was focused on remote and multi-sample processing capabilities at NSLS-II, especially when non-essential staff members were not allowed on site and forced to work from home. Efforts therefore increased to develop equipment to facilitate remote and efficient research operations with minimal on-site presence. A prototype remote cryogenic transfer line valve adjuster was initially developed at this time which successfully cut LHe consumption to less than half in one week-long series of experiments, but it needed improvement. This paper describes the engineering efforts to develop, incrementally improve, and produce working remote cryogenic transfer line valve adjusters that could attach to existing standard cryogenic transfer lines.

| TUP51 |

Sample environment @ PETRA III for in-situ & operando x-ray experiments

Jan Torben Röh(Deutsches Elektronen-Synchrotron DESY).

The Sample Environment Team was established to bundle information, knowledge and expertise within Petra III, with the aim of speeding up the engineering process, reducing duplicate developments und promoting standardization wherever possible. Since the start of Petra III, the SaEn-Team has developed various devices. These devices are either specialised for a certain beamline or developed with feedback from several beamlines for our own pool of equipment that is available for user beamtimes. This poster will present a selection of the Sample Environment Team's completed, ongoing and future projects at Petra III, categorized by topic. These topics are: Cryogenic; High Temperature; High Pressure; Mechanical Devices; Automation; and Vacuum or Reactive Chambers. Each project will be briefly presented with images and specifications. Projects to be presented include an MBE-Insitu chamber, a multipurpose sample heater, diamond anvil cells and the automation of sample changes in closed chambers with focus on cryogenic chambers.

| TUP52 |

SPring-8 BL12B2 Attenuator Design

Ming-Ying Hsu(National Synchrotron Radiation Research Center).

Bo-Yi Chen, Gung-Chian Yin, Tim Lo, Yu-Chun chou(National Synchrotron Radiation Research Center).

The light source of the BL12B2 beamline is one of the bending magnets in SPring-8; with this beamline, scientists can conduct experiments in X-ray absorption spectroscopy, high-resolution X-ray scattering, protein crystallography, and micro-beam scattering. The SPring-8-II will undergo an upgrade in the next few years. The attenuator, designed for the future upgrade of BL12B2, features nine filters and is cooled by the chamber wall. Each filter carrier can absorb 100 W, and the carrier's maximum temperature is lower than 75 °C when the wall temperature is 25 °C. The attenuator also provides the pumping station function; it has a 6" port for the ion and turbo pump. The attenuator filter is driven by a pneumatic actuator, which positions the filter on the beam and in the cooling position. This attenuator was already installed in the SPring-8 BL12B2 beamline in April 2025.

| TUP53 |

Studies for a novel generation of the beam profile measurements (beam wire scanner) for the Large Hadron Collider (LHC)

William Andreazza(European Organization for Nuclear Research).

Federico Roncarolo, Harry Sullivan, Hikmet Bursali, Jonathan Emery, Maria Teresa Ramos Garcia, Marie Faure, Morad Hamani, Nabil El-Kassem, Raymond Veness(European Organization for Nuclear Research).

Aiming for the improvement of the reliability and maintainability of the LHC linear wire scanners, a completely new concept is currently under development. The innovative design will eliminate the use of bellows, feature a more precise and optimized wire positioning system, and incorporate a significantly more robust and resilient mechanical structure. Four next-generation instruments are scheduled for installation in the LHC during Long Shutdown 3, enabling both horizontal and vertical beam profiling for beam 1 and beam 2 with improved accuracy and stability. This paper presents the conceptual study, detailed mechanical design, integration strategy, and the initial experimental tests of the newly developed magnetically driven linear wire scanner.

| TUP54 |

Technical developments of the microfocus endstation at Beamline P03/ PETRAIII

Jan Rubeck(Deutsches Elektronen-Synchrotron DESY).

Andrei Chumakov, Benedikt Sochor, Joanne Neumann, Matthias Schwartzkopf(Deutsches Elektronen-Synchrotron DESY), Sarathlal Koyiloth Vayalil(Deutsches Elektronen-Synchrotron DESY; Applied Science Cluster UPES, Deutsches Elektronen-Synchrotron DESY, Applied Science Cluster UPES).

P03 is the MiNaXS Beamline at PETRA III covering a variety of technics, e.g. Gi/T-S/W-AXS, XRF and XRR. An adaptive flight-tube enables changes of the SAXS detector distance (from 1.5 - 9.7 m). Another key feature of P03 is the operation of a customized L-shaped LAMBDA 9M detector system (X-Spectrum). Different sample environments can be implemented at the P03 beamline, e.g. a RF sputter equipment (HASE), printing setup, a flow cell and a myoSAXS (muscle research) setup. In addition, we have recently employed an X-ray reflector setup for GIUSAXS/GTUSAXS at air/liquid interfaces. At the microfocus endstation EH1, a flexible heavy-load 5-axes goniometer is operated, which can be optionally equipped with a linear translation stage and/or a hexapod for precise alignment. We implemented a frontend-compatible system with a fast pneumatically-actuated beam shutter and an Ionisation chamber. In the near future, P03 is planning to develop a low energy ion beam irradiation chamber. Recently, we commissioned an additional CRL in close vicinity to the sample position. Furthermore, we plan to parallelize the beam after monochromator by a new transfocator.

| TUP55 |

Test beamline construction and device performance evaluation at PLS-II

Sang Hun Kim(Pohang Accelerator Laboratory).

Jangwoo Kim(Pohang Accelerator Laboratory).

A test beamline has been built at the Pohang Light Source-II (PLS-II) to check the performance of new diagnostic and optical devices. The entire beamline is installed inside an experimental hutch, which includes basic support systems like a portable crane, cooling lines, and air lines for easier setup and testing. Currently, the beamline includes a 4-way slit, screen monitor, wire scanner, and a double crystal monochromator (DCM). New diagnostic devices for synchrotron radiation will also be developed and tested here. Optical devices such as the DCM and mirror manipulator are being upgraded, and we are focusing on improving mechanical stability and reducing beam vibrations. The goal is to apply these improvements step-by-step to the existing beamlines at PLS-II.

| TUP56 |

The extreme conditions catalytic cell for BL01 at ALBA

Antonio Carballedo Costa(ALBA Synchrotron (Spain)).

Auxane Jacquet(École nationale supérieure de techniques avancées Bretagne), Ibraheem Yousef, Marcos Quispe, Nahikari Gonzalez(ALBA Synchrotron (Spain)), Raphael Cohen Aberdam(European Molecular Biology Laboratory).

A new catalytic cell has been developed for the Infrared Spectroscopy and Microscopy (MIRAS-BL01) beamline at the ALBA synchrotron. The aim of this instrument is to study catalytic reactions, crucial for advancing sustainable chemistry by enabling energy-efficient processes and minimizing by-products. Infrared (IR) spectroscopy offers key molecular insights, helping identify active species, understand mechanisms and link structure to activity. It also monitors catalysts in real time, revealing structural changes that affect performance. The reactor is designed to operate in transmission mode from vacuum conditions to pressures up to 20 bar of different mixtures of gases and within a wide temperature range, covering from cryogenic temperatures up to a maximum of 500°C, while allowing the sample to move vertically few millimetres in order to alternate between exposing it and the background. Currently in production, the design's key aspects are presented, covering the sample position mechanics, the various FEA calculations performed as well as the necessary auxiliary systems, such as cooling mechanisms and the pressurized gas circuit.

| TUP57 |

The millisecond x-ray fast shutter for BL31 at ALBA

Antonio Carballedo Costa(ALBA Synchrotron (Spain)).

Alessandra Patera, Federico Cova, Javier García Álvarez, Juan Luis Frieiro, Llibert Ribó Mor, Nahikari González, Nilson Bernardo Pereira, Steven Wohl, Victorien Bouffetier, Álvaro Baucells(ALBA Synchrotron (Spain)).

A new high-speed beam shutter has been developed for the fast x-ray tomography & radioscopy (FAXTOR-BL31) beamline at the ALBA synchrotron, which aims at preventing high dose rate at the sample and provides a synchronization to the acquisition protocol. The non-periodic fast shutter is based on the combination of two tungsten blades each one driven by linear voice coil actuators. The blades synchronization achieves opening and closing times of 10 ms for a monochromatic beam size of H 40 mm x V 12 mm aperture. The design provides flexibility to adjust the aperture dimensions and speed to be able to control the radiation dosage upon the sample, triggered by the image acquisition rate of the detector or timing device. The essential aspects of the design are presented, along with an analysis of the commissioning tests that demonstrate the required performance.

| TUP58 |

The new ALBA diffractometer for microfocus beam macromolecular crystallography experiments at XAIRA beamline

Nahikari Gonzalez(ALBA Synchrotron (Spain)).

Antonio Carballedo Costa, Carles Colldelram, Damià Garriga, Igors Sics, Isidro Crespo, Josep Nicolás, Juan Luis Frieiro, Judith Juanhuix, Nilson Bernardo Pereira(ALBA Synchrotron (Spain)).

XAIRA, the new microfocus MX beamline at ALBA aims to deliver optimal diffraction images by enclosing the entire end-station in He atmosphere, including the diffractometer and the detector, while keeping the compatibility with standard cryo-crystallography tools and robot. The sub-100 nm SoC diffractometer, based on a unique helium bearing goniometer also compatible with air, has been designed to deliver high quality data from micron sized crystals from fast oscillation and fixed-target MX experiments while allowing a tight sample to detector distance of 70mm. The diffractometer also includes a double on-axis visualization system for sample imaging at sub-micron resolutions, a quick retractile collimator and beamstop assembly, a front- and backlight illumination system and a fast in/out YAG:Ce screen system for beam positioning. Here, the overall system design and performance results are presented.

| TUP59 |

The new microfocus station for the NOTOS beamline at the ALBA synchrotron

Antoni Garcia-Herreros(ALBA Synchrotron (Spain)).

Carles Colldelram, Carlo Marini, Carlos Escudero, Eduardo Villalobos, Josep Nicolás, Lucia Aballe, Nahikari Gonzalez(ALBA Synchrotron (Spain)).

The NOTOS beamline at ALBA combines X-ray Absorption Spectroscopy (XAS) and X-ray Diffraction (XRD) experiments, operating in the 4.5-30 keV range. Since 2022, it has offered two end stations (ES): one for metrology and XAS, and another combining XAS and XRD. To overcome the current 100×100 μm^2 spot size limitation, we present a third microfocus ES (μFo-ES), planned for commissioning by the end of 2025. It will provide spot sizes below 10×10 μm^2 with a flux >$7.3\cdot10^{13}$ ph/s/mm^2, enabling XAS in fluorescence and transmission. It uses the existing optics plus a pair of Kirkpatrick–Baez (KB) mirrors working under high vacuum. The KB positioning system is based on an in-housed developed design and the mirrors will be elliptically bent using ALBA mirror benders with sub-nanometric resolution. High-precision slits placed upstream the KB will ensure beam size, collimation, and diagnostics. The μFo-ES will integrate a compact sample environment including a ionization chamber, on-axis camera, and a fluorescence detector for variable incident angles. To ensure compatibility with downstream ES and prevent photon flux loss, the μFo-ES has been designed to be fully retractable from the beam path.

| TUP60 |

Thermal modelling, design and evaluation of a cryogenic cooling system for a beamline endstation

David Tillin(Diamond Light Source).

Claudio Bovo, David Burn, Jon Kelly, Scott Beamish, Steve Davies(Diamond Light Source).

The accurate estimation of thermal contact conductance (TCC) is a fundamental need towards the optimal design of a cryogenic cooling system for the new flagship beamline CSXID at Diamond Light Source, which utilizes mechanically pressed copper components to form the heat conduction path. To aid development, a study of thermally conducting joints at cryogenic temperatures has been performed combining Simulink and ANSYS Mechanical. To verify and validate the simulation results, an experimental setup will be made to carry out experiments to determine performance of the system, taking into consideration parameters including surface roughness, surface finish, temperature, & clamping force, which all greatly influence TCC.

| TUP61 |

Ultra-high-resolution monochromators for XFEL applications at LCLS-II-HE: a 4f Optical approach with channel-cut crystals

Hengzi Wang(SLAC National Accelerator Laboratory).

Traditional synchrotron monochromators cannot handle the extreme thermal loads and stability demands of XFELs, especially for seeded X-rays. To overcome this, LCLS-II-HE has developed a multi-stage monochromator system integrating two double channel-cut (DCCMs) and two consecutive channel-cut monochromators (CCMs) in a 4f optical configuration. This ensures precise beam collimation, spectral filtering, and wavefront preservation while achieving ultra-high energy resolution. Asymmetrically cut silicon crystals distribute thermal loads over a larger beam footprint, reducing distortions and enhancing stability—critical for RIXS experiments probing low-energy excitations in quantum materials. The 4f alignment minimizes spectral drift and enhances reproducibility, ensuring the sensitivity needed for resolving subtle electronic and phononic interactions. This presentation details the design, implementation, and impact of this system, providing a scalable solution for next-generation RIXS studies at LCLS.

| TUP62 |

Upgrade of crystal positioners for ESRF Double Crystal Monochromator

Ludovic Ducotté(European Synchrotron Radiation Facility).
Cédric Regaldo, Hugo Pedroso Marques, Jose Maria Clement, Kirill Lomachenko, Marine Cotte, Olivier Mathon, Philippe Tardieu, Sébastien Reyes, Thomas Dehaeze(European Synchrotron Radiation Facility).

The ESRF Double Crystal Monochromator (ESRF-DCM) was designed and developed in-house to enable spectroscopy beamlines to fully exploit the ESRF-EBS upgrade. While such key components always demand high beam positioning accuracy and stability, the EBS source requires even more stringent performance, such as a fast and continuous energy scanning crucial for modern spectroscopy. Meeting the challenging ESRF-DCM specifications involved high-precision mechanical design coupled with a mechatronic system for active correction of the crystal parallelism based on an online metrology. As part of ongoing optimization efforts, we recently focused on upgrading the actuators for crystal positioning to further enhance performance. These new actuators were integrated onto an ESRF-DCM during Spring 2025. This presentation will provide a brief overview of the DCM design principles, then focus on the design, integration, and commissioning results of these upgraded actuators. Finally, key performance characterizations of the DCM using X-rays, demonstrating the impact of the upgrade, will be presented.

| TUP63 |

Versatile x-ray reflector extension setup for grazing-incidence experiments at SAXS Facilities for liquid surface study at Beamline P03/PETRA III

Andrei Chumakov(Deutsches Elektronen-Synchrotron DESY).
Jan Rubeck, Matthias Schwartzkopf(Deutsches Elektronen-Synchrotron DESY).

Existing beamlines for in situ GISAXS on liquids are either limited in angular range or incompatible with the large sample-detector distance required for submicron resolution. We present a low-cost, easily assembled beam-tilting extension for synchrotron-based ultra-small-angle X-ray scattering (USAXS) facilities, enabling grazing-incidence (GI-) and transmitted scattering (GIUSAXS, GTUSAXS) studies on liquid surfaces. The setup is compatible with standard USAXS beamlines and requires only ~0.5 m of space at the sample stage. It allows X-ray beam incidence angles of up to ~0.6° at the liquid surface, equal to twice the angle of incidence on a reflector and below its critical angle of reflector materials, and provides access to a q-range of approximately 0.003–0.5 nm^{-1}. The system was tested at P03 beamline (DESY) using polystyrene nanoparticles, self-assembled at the air/water interface. The proposed scheme enables selective depth profiling and expands the research capabilities of existing SAXS synchrotron facilities for in situ studying submicron nanostructured objects at liquid surfaces under GI-geometry, combined also with GIWAXS and TXRF techniques.

| TUP64 |

XBPF design and prototyping

Benjamin Moser(European Organization for Nuclear Research).
Inaki Ortega, Robert Larsen(European Organization for Nuclear Research).

The CERN Beam Instrumentation Group has developed a new scintillating fibre beam profile monitor for the secondary beam lines of the CERN North Experimental Area. This innovative monitor employs plastic scintillating fibres, read out with silicon photomultipliers, to provide a cost-effective and efficient solution for beam profile measurement. The design goals for the new monitor included ease and low cost of production, achieving a particle detection efficiency above 95%, compatibility with beam intensities ranging from 1 to 10^8 particles per second, a spatial resolution of 1 mm, a low material budget, coverage of an active area of 10 cm x 10 cm and 20 cm x 20 cm, operability in a vacuum environment, and equipped with in/out motorisation for retracting the equipment from the beamline. A prototype was tested at the CERN East and North Area facilities, demonstrating excellent performance and validating the design for mass production.

| TUP65 |

Beamline engineering progress and key equipment development at Hefei Advanced Light Facility (HALF)

Xuewei Du(National Synchrotron Radiation Laboratory, University of Science and Technology of China, National Synchrotron Radiation Laboratory; University of Science and Technology of China).
Jie Chen, Qiuping Wang, Shen Wei, Yang Peng, Zimeng Wang(National Synchrotron Radiation Laboratory, University of Science and Technology of China, National Synchrotron Radiation Laboratory; University of Science and Technology of China), Shuaikang Jiang, Zhanglang Xu(National Synchrotron Radiation Laboratory, University of Science and Technology of China).

The Hefei Advanced Light Facility (HALF) is a diffraction-limited storage ring light source currently under construction. Its storage ring will operate at 2.2 GeV with a circumference of 479.86 m and a natural emittance of 86.3 pm·rad. Engineering design for the first phase, comprising 10 beamlines covering the vacuum ultraviolet (VUV) to medium-energy X-ray range, has been completed. Among these beamlines, eight utilize grating monochromators, one employs a double-crystal monochromator (DCM), and one incorporates both grating and crystal monochromators. To address the unique advantages and challenges of diffraction-limited light sources—characterized by high coherence, high brightness, and high resolution—we have undertaken a series of key technology developments in beamline engineering. This paper presents the latest progress on beamline construction and the development of high-resolving-power plane grating monochromators (PGMs), DCMs, and mirror systems.

| TUP66 |

FEL-I beamline at SHINE

Yajun TONG(ShanghaiTech University).

Chaofan Xue, Zhi Guo(Shanghai Advanced Research Institute), Zhibin Sun, zhi Qiao(ShanghaiTech University).

The Shanghai High Repetition Rate XFEL and Extreme Light Facility (SHINE) encompasses a high repetition rate XFEL and a 100 PW laser facility. The facility is designed to operate at a repetition rate of 1 MHz, with an energy range from 0.4 keV to 15 keV. SHINE features two primary beamlines: FEL-I and FEL-II. The FEL-II beamline covers the energy range from 0.4 to 3 keV, while the FEL-I beamline operates within the range of 3 to 15 keV. Each beamline is equipped with three endstations to facilitate a variety of experiments. At FEL-II, the endstations include the SSS, SES, and AMO endstations. Meanwhile, FEL-I comprises the HSS, CDS, and SEL endstations. This paper will present the optical design and the current status of the FEL-I beamline, including details on the optics and diagnostics.

| TUP67 |

Design of high power load front ends for two upcoming beamlines at CHESS

Matthew Popov(AVS|US).

Alan Pauling, Christopher Whiting, Dave Spurgin, Gregg McElwee, Timothy I OConnell(Cornell University), ***Fernando Cacho-Nerin****, Rene Santillana-Padilla(AVS – Added Value Solutions), Santiago Terrón(Universidad Politécnica de Madrid, AVS – Added Value Solutions).*

Front end components must endure the harshest operating conditions of all the elements in a synchrotron beamline. At the same time, reliability is a key aspect of their design, with no tolerance for downtime due to the typically very limited access. The unique challenges presented by the front ends of the upcoming Sector 5 and 6 beamlines at CHESS are presented here together with the solutions adopted. The beamlines feature each two undulator sources. In one beamline, the undulators are installed in series for a power load of 12.4 kW over a 6x9 mm2 area, with a peak power density of 2270 W/mm2. In the other beamline, the undulators are canted to serve two independent branches, with a total radiated power of 14 kW. In addition to these high power loads, further challenges in the design of these front ends included severe space limitations for installation, due to the presence of existing infrastructure in the narrow underground accelerator tunnel; and intense ambient radiation from the 6 GeV storage ring during operation, especially in the beam plane, which affected the cooling and wiring routes as well as local shielding.

| TUP68 |

The High Magnetic Field beamline at CHESS: endstation challenges, solutions and implementation

Fernando Cacho-Nerin(AVS – Added Value Solutions).
Alan Pauling, David Burke, Gregg McElwee, Timothy I OConnell(Cornell University), Asier Iglesias Aristimuno(ALBA Synchrotron (Spain)), Eric Van Every(AVS|US).

The High Magnetic Field (ID5A) beamline currently under construction at CHESS will enable the study of samples with hard X-rays under an extreme DC magnetic field up to 20T. The sample is inserted into an XYZ stage embedded at the center of a superconducting magnet, which can rotate around the vertical axis. Magnet rotation is achieved from the air side through a vacuum-tight 1.1 m diameter rotary seal. X-rays downstream from the sample are collected by an in-vacuum area detector mounted on a θRZ stage, which allows synchronized coaxial motion with the magnet within a very tight cylinder of confusion (20 µm radius). A large, curved gate valve separates the large vacuum vessel into two independent chambers, allowing maintenance operations in the detector space while keeping the magnet under cryogenic conditions. Furthermore, the whole endstation (around 24 mt weight) can be moved by +/- 25 mm in the vertical plane perpendicular to the beam, in order to adjust for changes in the beam position. Due to the high field, magnetic permeability must be as low as possible everywhere, ruling out the use of carbon steel anywhere in any significant amount e.g. for rails.

| TUP69 |
Status of SLS 2.0 front ends
David Just(Paul Scherrer Institute).
Claude Pradervand, Marcel Brüstle(Paul Scherrer Institute).

As part of the SLS 2.0 upgrade program, front-end systems have been extensively redesigned, refurbished, or constructed entirely anew to accommodate increased heat load, higher power density, and more compact device requirements. Of the 18 front ends in scope, 12 have been installed and connected to the storage ring, most achieving first light at 400 mA and enabling initial user preparation; the remaining six are scheduled for installation in 2026 (Phase 2). Commissioning demonstrated flawless front-end performance, with beam delivery to the beamlines requiring minimal intervention. While design, procurement, manufacturing, and assembly adhered to schedule, ancillary systems such as cabling, vacuum, cooling, alignment, and PLC-based beamline control posed greater scheduling challenges due to complex inter-group coordination and shifting project priorities. The first-light results confirmed the efficacy of a fixed-mask plus movable-slit configuration, with newly developed slits reliably withstanding the increased thermal load.

WEOA - Beamlines Session 3
17 September 2025 10:20 / 12:00
Chair: Renan Geraldes (Brazilian Synchrotron Light Laboratory)

WEOA01 / 10:20

Additive manufacture 3D-printed, metallic X-ray mirror for synchrotron & XFEL facilities
Simon Alcock(Diamond Light Source).
Thomas Wearing(University of York), Jon Kelly, Kawal Sawhney, Scott Beamish(Diamond

Light Source).

We have designed and fabricated the world's first, Additive Manufacture (AM) mirror for X-ray beamlines. For traditional optics, beamline performance is limited by: distortion caused by mechanical clamping; heat-bumps induced by photon-beam illumination; and strain caused by differential thermal expansion when dissimilar materials are cooled. AM enables the creation of intricate internal structures, and the fusion of multiple components into a single piece. The optical substrate, beamline mount, and internal cooling manifold were combined into a monolithic structure. The X-ray mirror was 3D-printed in aluminium alloy AlSi10Mg. Single point diamond turning created an optical surface, which was coated in ~ 75 µm of electroless NiP, followed by "super-polishing" using chemo-mechanical processing. Optical metrology demonstrates the AM mirror has surface quality comparable to a traditional silicon mirror, and is virtually immune to clamping deformations, which simplifies beamline installation. AM unlocks exotic internal channel designs, including enhanced cooling performance by turbulent flow, reducing vibrations caused by fluid flow, and conforming to the heat load distribution.

WEOA02/10:40

Designing and fine-tuning cryo-cooled silicon monochromator crystals to minimize optical distortions caused by photon-beam heating

Pablo Sanchez Navarro(Diamond Light Source).
Andrew Peach, Simon Alcock(Diamond Light Source).

Slope errors on X-ray optics create distortions in the reflected or diffracted X-ray wavefront and reduce energy resolution. This study addresses this challenge by demonstrating a precise and adaptable method for tuning the geometry of liquid nitrogen (LN2)-cooled silicon crystals, with the goal of achieving zero slope errors under specified input power conditions. The findings reveal that an optimal temperature minimizes thermal distortion and slope errors at the X-ray beam footprint. By establishing a straightforward engineering approach to achieve this temperature, the study provides a practical solution for manipulating silicon crystal geometry. This technique ensures minimal slope errors across a broad energy spectrum, enhancing beamline performance and energy resolution. This work overcomes a longstanding limitation in particle accelerator beamlines, where conventional approaches relied on extensive cooling to mitigate thermal effects. The proposed methodology not only improves operational efficiency but also offers a versatile tool for fine-tuning crystal behavior in response to varying energy demands.

WEOA03/11:00

2-color pump probe optical delay line

Marc Planas Carbonell(European X-Ray Free-Electron Laser).
Andreas Koch, Benoit Rio, Daniele La Civita, Fan Yang, Harald Sinn, Marziyeh Tavakkoly, Maurizio Vannoni, Michael Meyer(European X-Ray Free-Electron Laser), Christian Schröter, Hanjo Ryll, Karsten Blümer(FMB Feinwerk- und Messtechnik (Germany)), Lukas Müller, Torsten Wohlenberg(Deutsches Elektronen-Synchrotron DESY).

The SASE3 soft X-Ray beamline at the European XFEL is equipped with a magnetic chicane allowing two-color X-ray pump probe experiments. This chicane splits the undulator area in two, the first part generates photons with a specific wavelength, then the electron beam is delayed with respect to the produced photons and lasers in the second section at another wavelength. The Optical Delay Line (ODL) installed along the photon path will increase the variety of experiments achievable. The ODL consists in four flat mirrors mounted in a vertical chicane geometry creating a fix delay to the photons produced and allows, in combination with the variable magnetic chicane, the two pulses to be crossed with negative or zero-time delay. The device adjustments need a motion resolution down to tens of nanometer and very high stability due to the long distance to the experiment (≃520m). All mechanics are mounted in UHV and particle free conditions and comply to the electron accelerator specifications. The ODL project is a collaborative effort of European XFEL and FMB Berlin GmbH. In this contribution, the conceptual design, final design, mechanical challenges and the first tests are described.

WEOA04 / 11:20

SPIDER – a Scanning Platform for Imaging and Diffraction with Extreme Resolution

Ralph Doehrmann(Deutsches Elektronen-Synchrotron DESY).
Patrik Wiljes, Stephan Botta(Deutsches Elektronen-Synchrotron DESY).

Experiments with Nano-meter resolution, as planned at PETRA IV, require highly stable experimental conditions. Here, the relative position of sample and optics in the experiment and the highest degree of positional stability are of crucial importance. However, this requires extensive study of interactions between Nano-focusing optics, dynamic scanners, and precise position detection. Aim of the SPIDER project is to develop a modular setup that meets the high stability requirements of the experiments at PETRA IV and can be used either in the laboratory for performance tests or in synchrotron experiments at PETRA. According to the project specifications, we have designed the platform based on several main modules. These can be flexibly combined with other modules in various configurations. The structure of these main modules was also largely realized modular in order to be flexible and sustainable. This contribution, introduce the general concept of SPIDER and describe the design of the SPIDER platform and the individual modules in detail. We will also present some of the initial results from studies that have been carried out recently.

WEOA05 / 11:40

A compact, high throughput SVLS spectrometer for LCLS-II

Jean-Pierre Torras(SLAC National Accelerator Laboratory).
Hengzi Wang, Kristjan Kunnus(SLAC National Accelerator Laboratory), Joseph Dvorak(Brookhaven National Laboratory).

A spherical variable line spacing (SVLS) grating spectrometer has been designed and commissioned for use at the ChemRIXS endstation at the Linac Coherent Light Source (LCLS), SLAC National Accelerator Laboratory. We present the design evolution, capabilities, and performance of the SVLS, which was developed to facilitate resonant inelastic X-ray scattering (RIXS) experiments across a broad range of photon energies (250–1200 eV) on the LCLS-II beam. The SVLS spectrometer leverages a spherical grating to achieve simultaneous imaging and spectral dispersion with high energy resolution, while maintaining a compact form factor. A key design feature is its modular architecture, consisting of three components: a grating chamber containing the optic and its conditioning units, slits, and a foil; a rotation arm housing the detector; and a vertical stage that drives the detector to its intended diffraction angles. The 36-megapixel sCMOS camera is inclined at a 20° grazing angle to maximize spatial resolution, resulting in a resolving power exceeding 2000 across the relevant photon energy range and offering more than 30× higher throughput compared to existing spectrometers at SLAC.

WEOB - Accelerators Session 1

17 September 2025 13:00 / 14:40

Chair: Michael Seegitz (National Synchrotron Light Source II)

WEOB01 / 13:00

Copper alloy additive manufacturing for SOLEIL II

Keihan Tavakoli(Synchrotron soleil).
Frank DePaola, Michael Johanson, Sushil Sharma(Brookhaven National Laboratory), Arnaud Mary, Marc Ribbens, Nicolas Bechu, Vincent Leroux, Zhengxuan Fan(Synchrotron soleil).

The Synchrotron SOLEIL is a large-scale research facility in France that provides synchrotron radiation from terahertz to hard X-rays for various scientific applications. To meet the evolving needs of the scientific community and to remain competitive with other European facilities, SOLEIL has planned an upgrade project called SOLEIL II. The project aims to reconstruct the storage ring as a Diffraction Limited Storage Ring (DLSR) with a record low emittance which will enable nanometric resolution. The mechanical design of this project involves several challenges such as the integration of new magnets, vacuum chambers, insertion devices and beamlines in the existing infrastructure and is mainly based on extensive simulations, prototyping and testing new fabrication methods such as additive manufacturing (AM) to ensure the feasibility, reliability, and performance of several key elements. This paper presents an overview of the mechanical design R&D and thermomechanical performance verifications on copper alloy parts fabricated in additive manufacturing in the scope of SOLEIL-II project.

WEOB02 / 13:20

ALS BL5.0 photon stop recovery

Will Hutcheson(Lawrence Berkeley National Laboratory).
Grant Cutler, Lucas Kistulentz, Nicolas Wenner, Simon Morton, Tom Swain(Lawrence Berkeley National Laboratory).

In June of 2023, the Advanced Light Source (ALS) at Lawrence Berkeley National Laboratory, Berkeley, California, United States, experienced a vacuum interlock event that caused a beam dump. Upon investigation, the vacuum technicians discovered a leak in the cooling system of a custom photon stop in Sector 5 (12 total). This paper will detail the event, the temporary restoration of operations, and the process of how a new photon stop was designed, analyzed, fabricated, assembled, tested, qualified, installed and commissioned in a fourteen week window. Over 20 years had passed since the original photon stop was installed in the ALS. Since then, the technology landscape has changed and many of the manufacturing capabilities have lapsed or become extinct not only in the United States, but across international boundaries. This is especially true of brazing. There is a parallel discussion of the causality for the failure which led to the destructive evaluation of the original photon stop. Finally, engineering looked at the thermal fatigue analysis and provided the operation staff with a specific tool to evaluate and maintain the new photon stop.

WEOB03/13:40

Cryogenic radiometry: a new absorber for X-rays up to 150 keV

Omar Renzo Piminchumo Marinos(Canadian Light Source (Canada), Canadian Light Source Inc.).
Johannes Vogt(Canadian Light Source (Canada), Canadian Light Source Inc.).

The accurate measurement of radiant power is essential for the calibration of X-ray detectors, such as silicon photodiodes. Cryogenic electrical substitution radiometers (ESRs) perform high accuracy, absolute, measurements of radiant power. Material and geometry of the absorber in an ESR are chosen to maximize the absorption in the energy range of interest, while providing a high thermal response and a short time constant. The highest energy design previously reported allowed the measurement of X-rays up to 60 keV. In this work we present a new absorber developed at the Canadian Light Source for energies from 25 keV to 150 keV. Monte Carlo simulations led to a design with an absorption > 99% in the entire energy range while considering all losses due to fluorescence and scattering. Measurements have been successfully performed at the Biomedical Imaging and Therapy beamline (05ID-2), which has a 3.7 T wiggler source and provides X-ray energies up to 150 keV.

WEOB04/14:00

CBXFEL design, production, assembly, testing and installation status

Xavier Permanyer(SLAC National Accelerator Laboratory).

Use of a cavity-based X-ray free electron laser (CBXFEL) is potentially a way to dramatically improve the stability and coherence of existing XFELs. A proof-of-principle project is underway as a collaboration between SLAC National Accelerator Laboratory, Argonne National Laboratory (ANL), and The Institute of Physical and Chemical Research in Japan (RIKEN). The CBXFEL is expected to operate using 9.831 keV photons from LCLS, using synthetic diamonds as cavity Bragg mirrors. The LCLS copper linac will deliver two electron bunches 624 RF buckets apart, resulting in a total X-ray cavity length of 65500.87 mm. The final X-ray cavity design, assembly, testing, and installation and production status will be presented.

WEOB05/14:20

A new RF-contact spring mechanism for exchangeable cathodes in high brightness guns at DESY

Frieder Mueller(Deutsches Elektronen-Synchrotron DESY).
Alexey Ermakov, Anne Oppelt, Frank Brinker, Frank Stephan, Lutz Jachmann, Mikhail Krasilnikov, Sebastian Philipp, Winfried Koehler, Xiangkun Li(Deutsches Elektronen-Synchrotron DESY), Mohsen Dayyani Kelisani(School of Particles and Accelerators), Arno Jeromin(DESY Nanolab).

A new 5th generation normal conducting electron gun with improved cell geometry and cooling concept for RF pulse durations of up to 1 ms at 10 Hz repetition rate, and gradients of ~60 MV/m at the cathode was developed and is being tested at the Photo Injector Test Facility at DESY in Zeuthen (PITZ). The cathode is inserted into the back wall of the gun cavity via a load lock system and a RF contact spring connects the cathode to the gun. In order to ensure reliable high gradient operation at such long pulse durations, a new RF contact spring mechanism for the exchangeable photo cathode plug was developed. The novel spring mechanism was integrated into the mechanical constraints given by the existing Gun5 design and is compatible with the standard cathode plugs. The new spring increases the number of contact points, shortens the path length of the RF currents and improves the spatial distribution of the contacts over the full circumference of the cathode plug. A new preloading mechanism allows to insert the cathode plug while the spring is unloaded and thus reduce friction and particle generation close to the RF cavitiy.

WEOC - Accelerators Session 2

17 September 2025 15:20 / 17:00
Chair: Taekyun Ha (Pohang Accelerator Laboratory)

WEOC01 / 15:20

Development of magnet prototype for Siam Photon Source II

Supachai Prawanta(Synchrotron Light Research Institute).
Meechok Sroison, Netchanok Thiabsi, Pajeeraphorn Numanoy, Phatthara Chaithaweep, Prapaiwan Sunwong, thongchai Leetha(Synchrotron Light Research Institute).

The construction of Siam Photon Source II (SPS-II), Thailand's second synchrotron light source, represents a major advancement in the nation's scientific and technological infrastructure. Designed to produce high-intensity synchrotron radiation for a wide range of applications, the project necessitates the development of advanced accelerator components. This work presents the engineering design and prototyping of magnets for the storage ring, with a focus on the precise control of magnetic field, mechanical precision, and thermal stability. Finite element analysis was employed to simulate and optimize key parameters. The manufacturing process involved high-precision machining, quality control of material and vacuum pressure impregnation for coil insulation. Testing results confirmed agreement between the measured magnetic field and design specification. Notably, this marks the first domestic development of magnet prototype in Thailand, integrating multidisciplinary technical knowledge and expertise with industrial collaboration. This work constitutes a critical milestone in Thailand's magnet technology development and provides a solid foundation for the realization of SPS-II.

WEOC02 / 15:40

Lessons learned during removal and installation period of the Advanced Photon Source

Mark Erdmann(Argonne National Laboratory).

The Advanced Photon Source, a fourth generation light source located at Argonne

National Laboratory, recently went through an upgrade where almost the entire storage ring and all the front ends were removed and either replaced or refurbished. The shutdown began in April of 2023 where all 200 girders and associated hardware were removed by the end of June. The first upgraded girder was installed in July 2024, hardware installation was completed by February 2024, first beam taken in April 2024 and first x-rays taken in June 2024. The $815M project has created a 200mA beam with a world record emittance of 33 pm rad that is 500 times brighter than the old machine. The lessons learned during the Removal and Installation of the storage ring and front ends will be presented.

WEOC03/16:00

Complex bend vacuum chamber for NSLSII-U

Michael Seegitz(Brookhaven National Laboratory, National Synchrotron Light Source II).

Aamna Khan, Paul Palecek, Robert Todd, Sushil Sharma, Timur Shaftan, Victor Smaluk(Brookhaven National Laboratory), Dean Hidas(National Synchrotron Light Source II), Marcelo Juni Ferreira(European Spallation Source).

While the NSLSII synchrotron is a third-generation light source providing outstanding brightness and flux, there is a robust R&D program in place to upgrade to a fourth generation, or beyond, facility. Inherent in the so-called complex-bend magnet and lattice designs are significant limitations on the beam and exit slot apertures of the vacuum chamber. These restrictions and the need for the vacuum chamber to be mechanically aligned and decoupled from the magnets impose unique challenges. For our chamber, the selected solution is not novel and utilizes an aluminum split clamshell design that has been done in many machines past and present. The adaptation of this design along with improved machining and welding should provide the most cost-effective solution. The geometrical and impedance solutions and structural and thermal modeling will be shown along with dynamic pressure simulations generated by Synrad and Molflow modeling code. With continuing changes in lattice and magnet parameters, a systematic, iterative approach to vacuum design has been implemented and will be presented.

WEOC04/16:20

Experience with a bunch lengthening cavity at the APS

Joel Fuerst(Argonne National Laboratory).

Michael Kelly, Stephen MacDonald, Tim Berenc, Ulrich Wienands(Argonne National Laboratory).

The Advanced Photon Source Upgrade at Argonne National Laboratory (ANL) provides hard x-ray photon beams with a brightness 500 times greater than the original machine. A bunch lengthening cavity is used to decrease the effects of Touschek scattering (on beam lifetime) and intrabeam scattering (on beam emittance). The superconducting RF (SRF) cavity operates at 2 K in a passive, i.e. beam-driven mode at the 4th harmonic (1408 MHz) of the main RF system. A helium cryoplant provides 2 K refrigeration for the SRF cavity. The cavity and cryostat were built and tested by the ANL Physics Division and installed into the electron storage ring starting in August 2023. Cryoplant commissioning began in December 2023 followed by 2 K operation in January 2024. Since then, the cavity and associated RF, cryogenic, and vacuum systems have been brought on-line in stages as part of the overall storage ring and x-ray beamline commissioning. In February 2025 the cavity demonstrated a stable 1.1 MV accelerating gradient with 200 mA beam for user operation. The bunch lengthening subsystems, commissioning, and operating experiences are described.

WEOC05/16:40

Results from the ALS-U storage ring alignment system prototype
Ryan Miller(Advanced Light Source).

ALS-U stability and alignment requirements coupled with tight space constraints present in the existing ALS have driven a new design for the storage ring support and alignment system. A prototype has been built and tested with alignment accuracy results in the 30 micron range and stability results in the 35 nm range. The new design overcomes distinct ergonomic challenges and reliability failures of earlier hardware iterations. The prototype has also been tested to an alignment time requirement that is necessary to minimize dark time--the phase of the program when alignment of the storage ring will occur. This paper presents the innovative solutions implemented on the alignment system prototype to address the unique problems of ALS-U.

WEP - Poster Session 2

17 September 2025 17:00 / 18:15
Chair: Roberto Appio (MAX IV Laboratory)

| WEP01 |
A concept improvement design of the girder adjustment system for TPS storage ring
Tse-Chuan Tseng(National Synchrotron Radiation Research Center).
Chia-Jui Lin, Chien-Kuang Kuan, Chun-Shien Huang, Huai-San Wang, Keng-Hao Hsu, Wei-Yang Lai(National Synchrotron Radiation Research Center).

The girder adjustment system of TPS storage ring can fine adjust each girder in 6 axes with 6 kinematic mounting motorized cam movers. The installation of the TPS had demonstrated this design. However, this design is freely mounted with gravity and the 1st natural frequency is less than 30 Hz even with supplement side locking system. Moreover, the motor controller restricts the beginning power output and sometimes the girder will falling when the electromagnetic motor brake is released. A concept improvement design is thus introduced to modify these situations. In this design, a worm gearbox addition can raised the reduction ratio to prevent the falling and inverse kinematic mounting movers with strong springs not only firmly lack the girder to raise the natural frequency but also preserve the motorized algorithm. This paper describes the design in detail.

| WEP02 |
As built front ends for the Advance Photon Source MBA upgrade
Yifei Jaski(Argonne National Laboratory).
Frank Westferro, Mark Erdmann, Mohan Ramanathan, Samuel Oprondek, Tim

Clute(Advanced Photon Source).

The Advanced Photon Source (APS) upgrade from double-bend achromats (DBA) to multi-bend achro-mats (MBA) lattice is completed. All storage ring components and front ends were installed between April 2023 to April 2024 and fully commissioned. Some major changes have been made on front ends since our last front end design paper published in MEDSI2018 proceedings. The changes are: 1) Removed clearing magnet from all front ends, 2) Incorporated a Burn-Through-Mask (BTM) as the first fixed mask for all Insertion Device (ID) front ends, 3) Added a new-design diamond window to replace beryllium window for windowed High Heat Load Front End (HHLFE). The upgraded APS front ends will only have three types: a) HHLFE for single beam, b) Canted Front End (CFE) for canted beam, c) Bending Magnet Front End (BMFE) for bending magnet beam. This paper presents the as-built version of all three types of front ends.

| WEP03 |

Clamping deformation patterns and solutions for LN2 cooled monochromator crystal

Shaofeng Wang(Institute of High Energy Physics).

This study reveals the limitations of indium as a thermal interface material for LN2-cooled monochromator crystal. Under clamping force, the indium foil forms excessively strong contact with the cooling block and the crystal, exhibiting a bonding-like characteristic. This transmits the shear force generated by the thermal expansion coefficient difference between the cooling block and the crystal within the contact plane, leading to significant clamping deformation, which far exceeds the deformation caused by the clamping force itself. Moreover, since the actual contact state between the crystal and the cooling block is difficult to assess, asymmetric surface distortion is easily induced. Based on the above low-temperature clamping deformation patterns, this paper proposes replacing indium foil with graphite materials as thermal interface materials. Experimental test results demonstrate that the inherent lubricating properties of graphite materials significantly reduce the shear force acting on the crystal. Additionally, specially structured graphene exhibits high thermal conductivity, ensuring good thermal contact while minimizing clamping deformation.

| WEP04 |

Collaborative design with an integrated CAD model in the PETRA IV project

Marlon Diercks(Deutsches Elektronen-Synchrotron DESY).
Benno List, Cédric Kula, Lars Hagge, Markus Huening, Per-Ole Petersen(Deutsches Elektronen-Synchrotron DESY).

The PETRA IV project involves the refurbishment of the 2.3 km PETRA accelerator to accommodate almost 40 beamlines. It also includes the conversion and construction of numerous buildings, including a large experimental hall, with first light planned for 2032. To support planning and design with a model-based approach, a comprehensive, integrated CAD model has been set up. The model comprises civil infrastructure, the accelerator, beamlines, and infrastructure systems. Serving as a single source of truth, it supports a diverse project team, including civil and mechanical engineers, beamline scientists, and other stakeholders, each with different technical backgrounds and needs.

The fully integrated CAD model is tied to systems engineering processes like requirements management, and supports collaboration across disciplines. Multiple levels of abstraction, a structured hierarchy, and explicit modelling of interfaces help bridge communication gaps. They also reduce redundant work and minimize design errors, all critical for efficient design in collaboration.

| WEP05 |

Systematic reduction of lattice complexity through variant minimization

Marlon Diercks(Deutsches Elektronen-Synchrotron DESY).
Benno List, Cédric Kula, Lars Hagge, Markus Huening(Deutsches Elektronen-Synchrotron DESY).

The design of an accelerator system requires translating the lattice into an engineering design model from which the machine can be built, fulfilling the requirements of beam dynamics and from mechanical engineering. To achieve this in an efficient manner, a systematic and manageable iterative design process has been established, which ensures consistency between the lattice and the mechanical model and enables a fast translation of the calculated lattice into a CAD model with correctly placed components within one day through the use of newly developed automation tools. An analysis process of the lattice, a highly modular CAD structure focused on maximal reuse, and strategic variant management together minimize the number of variants necessary. As a result, design, manufacturing and logistics efforts are significantly reduced. This approach establishes a fundamental toolkit. It ensures the traceable integration of physics and engineering requirements throughout the system design process of PETRA IV, the planned next-generation synchrotron light source at DESY.

| WEP06 |

Compact permanent magnets for small bore accelerators

Christopher Huschke(Lawrence Berkeley National Laboratory).
Arnaud Allézy, Ross Schlueter(Lawrence Berkeley National Laboratory).

In synchrotron light sources, electromagnets are used to bend and accelerate electron beams. In 4th generation sources, the electron beam can fit in smaller bore accelerators, allowing the use of permanent magnets, which have many advantages over electromagnets. This poster focuses on the mechanical design, fabrication and testing of two compact permanent magnet systems, which have a 1:5 magnet to metal volume ratio. The first is a dipole-quadrupole magnet assembly, providing a 1 T dipole + 50 T/m quadrupole field to steer the electron. The second is an assembly to adjust a set of tuner and corrector permanent magnets. Regardless of the magnetic forces involved, the tuner magnets can rotate simultaneously and provide a +/- 1 T/m quadrupole field for in situ quadrupole focusing strength adjustments, while corrector magnets can be oriented into a prescribed configuration to compensate for small field errors. Prototypes for the dipole-quadrupole, tuner and corrector holders were manufactured and tested, validating the conceptual design.

| WEP07 |

Conceptual design of AS2 - A new synchrotron for Australia

Brad Mountford(Australian Nuclear Science and Technology Organisation).

The Australian Synchrotron is now in its 18th year of operation and currently planning for its future. Over the past 1.5 years there as been a facility wide initiative to draft a Conceptual Design Report for a new synchrotron to meet the future needs of Australia and the region. This poster will present the high level concepts of the proposed facility summarizing key design philosophies and concepts It will also describe technologies identified as key to success along with technologies and concepts development through R&D.

| WEP08 |

Cooled photoelectron shields on the first mirror of the MAX IV soft x-ray beamlines

Louisa Pickworth(MAX IV Laboratory).

The higher brightness of 4th-generation storage rings comes with smaller beam sizes and narrower radiation cones, which in turn can deposit higher power density in the optical components. Maximizing the stability from the source to the sample via the many optical components depends on good mechanics and dealing effectively with the increased heat load. This paper presents the cooled photoelectron shields recently installed at the soft x-ray beamlines at MAX IV. These shields were developed in order to address observed long thermal stabilization times of the first mirrors in the beamline, and the negative impacts of increased photoelectron generation at the mirror surfaces.

| WEP10 |

Design and analysis of photon absorbers for Korea-4GSR

Sangbong Lee(Pohang Accelerator Laboratory).

Hosun Choi, Jaehoon Kim, Mansoo Hong, Taekyun Ha(Pohang Accelerator Laboratory).

Korea-4GSR, which is currently being developed in Korea, aims to provide high performance photon beams. In this work, I present the design and thermodynamic simulation of the photon absorption system to be installed in Korea-4GSR. In synchrotron accelerators, managing the intense photon flux generated by bending magnets and insertion devices is very important for maintaining the accelerator's performance. The emitted synchrotron radiation, characterized by its high intensity and broad spectrum, imposes significant thermal and structural demands on accelerator components. Photon absorbers are essential to effectively block excess photons, ensuring stable operation and extending the lifespan of the vacuum components. The storage ring of Korea-4GSR consists of a total of 28 cells. Each cell is planned to be equipped with 5 photon absorbers and 3 photon masks. The synchrotron radiation power per cell is 15.68[kW], of which the photon absorbers and photon masks absorb 11.51[kW], while the vacuum chamber absorbs 3.11[kW]. In the first phase, 9 ID beamlines and one bending magnet beamline are planned to be installed. The crotch absorber has been designed based on the EPU98, which has the largest beam divergence angle and intensity. Extensive research has been conducted to ensure accurate and efficient thermal analysis. Thermal and structural simulations with ANSYS workbench in the worst-case scenario are performed to validate the integrity of the absorber within the acceptable material stress limit. Furthermore, vacuum compatibility is carefully integrated to support long-term operation within the UHV environment.

| WEP11 |

Design and analysis of the ALS-U Photon Transport Line

Tao Cui(Lawrence Berkeley National Laboratory).

The Advanced Light Source Upgrade (ALS-U) will increase the brightness and coherent flux of soft X-rays by a factor of 100 through the use of a multibend achromat lattice. While maintaining a similar number of beamlines, this enhancement introduces significant challenges in packaging photon transport line (PTL) components and managing elevated thermal loads within increasingly constrained spaces. To address these issues, we performed a comprehensive design and analysis of all PTL absorbers and vacuum chambers, using CAD-based ray tracing, geometric evaluations, and numerical simulations to assess beam power deposition under both nominal and missteered conditions. Different thermal analysis strategies were employed for insertion device and bend magnet beamlines to ensure safe operation across varied beam characteristics. This work summarizes the design methodology, analysis results, and the current development status of the ALS-U Photon Transport Line as it advances toward production and testing.

| WEP12 |

Design and development of the beam collimation system for CiADS

Haihua Niu(Institute of Modern Physics).

Hanjie Cai, Huan Jia, Yajun Zheng, Yuanshuai Qin, Yuxuan Huang, fengfeng wang(Institute of Modern Physics).

China initiative Accelerator Driven System (CiADS) consists of a 350m-long linac, a spallation target, a sub-critical reactor and several experimental terminals. The linac will provide protons at the energy of 500MeV with 2.5MW power. In order to keep the uncontrolled beam loss along the beam transport line before entering the target and the reactor less than 1 W/m, a two-stage collimation system with (2+1) periodic lattice has been designed for the linac and target coupling section of CiADS. The detailed design of the beam collimation system is presented, including material selection, structural design, thermal performance analysis, radiation shielding optimization, and remote maintenance. Key technical issues which affect the collimation equipment development are also introduced.

| WEP13 |

Design and implementation of an in-vacuum magnetic field measurement system for the TPS nonlinear in-vacuum kicker

Chih-Sheng Yang(National Synchrotron Radiation Research Center).

Che-Kai Chan, Chin-Chun Chang, Chin-Kang Yang, Chyi-Shyan Fann, Fu-Yuan Lin, Hsiung Chen, Jyh-Chyuan Jan, Ting-Yi Chung, Yun-Liang Chu(National Synchrotron Radiation Research Center).

The Taiwan Photon Source (TPS) storage ring employs a traditional four-kicker bump off-axis injection scheme, which can introduce perturbations to the stored beam during the injection phase. To address these issues and facilitate stable top-up injection, a Nonlinear In-vacuum Kicker (NIK) has been developed. This innovative device is specifically designed to produce zero magnetic fields in both the horizontal (Bx) and vertical (By) directions at the beam center, while generating a peak By field at the injection point. This field configuration ensures a transparent injection process by minimizing interference with the stored beam during injection. To accurately assess and refine the magnetic field properties of the NIK while avoiding arcing during measurements in atmospheric condition, a specialized in-vacuum magnetic field measurement system has been developed and deployed. This system enables precise mapping of the magnetic field profile over a range of excitation currents. This paper details the system's mechanical design, fabrication methodology, and presents preliminary results from its implementation.

| WEP14 |

Design and implementation of an optical diagnostic beamline at the BESSY II injection line

Pauline Ahmels(Helmholtz-Zentrum Berlin für Materialien und Energie).
Markus Ries, Stefan Wiese, Terry Atkinson(Helmholtz-Zentrum Berlin für Materialien und Energie).

In order to improve and extend the current diagnostic system of the third-generation synchrotron radiation source BESSY II, a source point imaging system is being developed. This paper presents the conceptual design, including technical requirements, simulation results, and expectations for the optical transport line and mechanical integration. The design aims to ensure beam quality during operation using synchrotron radiation emitted from the dipole magnet. The primary components of this beamline are a CCD camera and a lens system. To enable precise positioning of the achromat, the system is equipped with a motorized linear feedthrough. The entire setup is designed to operate under high vacuum conditions. A basic existing setup is employed to experimentally validate the simulation results, using the same CCD camera as in the final beamline setup.

| WEP15 |

Design and implementation of a parallel linkage mechanism with spring assembly for magnetic force compensation in insertion devices

Chien-Kuang Kuan(National Synchrotron Radiation Research Center).
Chia-Jui Lin, Chun-Shien Huang, Ding-Goa Huang, Keng-Hao Hsu, Tse-Chuan Tseng, ***Wei-Yang Lai****, Yi-Chih Liu(National Synchrotron Radiation Research Center)*.

This study presents the design and fabrication of a me-chanical compensation system aimed at neutralizing the magnetic attraction forces inherent in insertion devices (IDs) used in synchrotron radiation facilities. In long IDs, such as those measuring 4 meters in length, multiple compensation modules—typically four—are required to maintain structural stability and magnetic field uniformi-ty. In this work, a single compensation module was de-signed, fabricated, and installed on a test platform to verify the feasibility and mechanical performance of the proposed mechanism. The system integrates a parallel linkage mechanism with a spring assembly consisting of twelve coil springs. The parallel linkage ensures synchronized and stable movement of the magnetic arrays with minimal structural deformation, while the spring assembly provides a counteracting force that balances the increasing magnetic attraction as the ID gap narrows. Although the mechanism was not installed on a working ID, test results demonstrate its effectiveness in reducing structural load and maintaining precise displacement control under simulated magnetic force conditions. This confirms the concept's viability and its potential for improving operational efficiency and safety in future ID applications.

| WEP16 |

Mechanical design of the in-vacuum tapered undulator at Taiwan Photon Source

Wei-Yang Lai(National Synchrotron Radiation Research Center).
Chien-Kuang Kuan, Keng-Hao Hsu(National Synchrotron Radiation Research Center).

Synchrotron light sources commonly provide users with two types of insertion devices for experiments in biology, medicine, and other fields: in-vacuum undulators (IU) with short period lengths for medium-energy photon sources and cryogenic permanent magnet undulators (CPMU) for higher photon energy. The strong magnetic field generates significant forces on the insertion device magnets, leading to structural deformation and ultimately degrading the magnetic field quality. This paper presents the design and measurement methods of an in-vacuum tapered undulator, analyzes the simulation and measurement results of its structural deformation, and introduces how a flexible structure can be used to establish nonlinear magnetic force compensation to improve system performance

| WEP17 |

Design of a damping wiggler at SPring-8-II as a high-energy X-ray source

Koji Tsubota(Japan Synchrotron Radiation Research Institute).
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SPring-8 will be upgraded to SPring-8-II, a fourth-generation synchrotron with a multi-bend achromat lattice, by 2028. The beam energy will be reduced from 8 to 6 GeV, substantially lowering emittance. To further reduce the emittance, a damping wiggler is planned for installation in a 30 m straight section. High-energy X-ray above 100 keV are in demand for industrial use, but lowering the beam energy reduces photon flux in this range. A damping wiggler can enhance this flux. We therefore designed the wiggler not only for emittance reduction but also as a high-energy X-ray source. The wiggler will be installed in a straight section with five drift spaces, each about 4 m long, to accommodate the wiggler, masks and related components. Its parameters—unit number, period length, gap and total length—were optimized to achieve low emittance, high photon flux and reduced heat load on absorbers. To handle radiation up to 75 kW and 800 W/mm^2 over a wide solid angle, the mask aperture was designed to limit angular spread and reduce the heat load on the absorber at the downstream bending magnet chamber. This study presents the optimized wiggler design and power density evaluation at the mask.

| WEP18 |

Design of a mirror chamber for the FL24 with 5-axis precision adjustment and additional fast pneumatic movement out of the beam

Hilmar Bienert(Deutsches Elektronen-Synchrotron DESY).
Boris Steffen, Elke Plönjes-Palm, Günter Brenner, Hakan Bolat, Mathias Hesse, Michael Sprung(Deutsches Elektronen-Synchrotron DESY).

For the new pulse-length-preserving monochromator beamline FL23 at FLASH2, the beam is horizontally decoupled from the straight line at FL24 by means of a non-planar mirror. The mirror is adjustable in all three rotational degrees of freedom. The bearings for yaw and pitch are mounted outside the vacuum. For the roll movement, the mirror is mounted in two bearings that have a large enough opening so that the beam can also be guided straight past the mirror. In addition, the different layers can be approached by translation along the vertical axis. All drives are outside the vacuum. The horizontal movement can be adjusted with high precision and is also pneumatically driven, allowing rapid movement out of the beam for fast operation of the FL24 beamline.

| WEP19 |

Design of an adjustable permanent dipole magnet

Ya Zhu(Shanghai Advanced Research Institute).

Hongcui Wang, Shudong Zhou, Wei Zhang(Shanghai Advanced Research Institute).

This paper focuses on the design of an adjustable permanent dipole magnet that achieves changes in magnetic field strength through mechanical adjustment. The use of permanent magnets, as opposed to electromagnets, offers several advantages, including a compact structure, reduced energy consumption, and stable magnetic field. However, challenges remain in replacing electromagnets with permanent magnets in applications such as gas pedals. These challenges include difficulties in adjusting the magnetic field, the impact of temperature on permanent magnets, and susceptibility to radiation damage. This thesis presents an adjustable permanent dipole magnet with a maximum magnetic field strength of 1.4 T, a minimum magnetic gap of 30 mm, and a magnetic integral field ranging from 0.117 T·m to 0.35 T·m.

| WEP20 |

Design of a stable Double Crystal Monochromator for synchrotron beamlines

Seonghan Kim(Pohang Accelerator Laboratory).

Jangwoo Kim, Sanghun Kim(Pohang Accelerator Laboratory).

Pohang Accelerator Laboratory (PAL) has developed various double crystal monochromators (DCMs) using domestic technologies and is currently pursuing a new design focused on enhanced performance and mechanical stability. This study introduces the design and fabrication of a next-generation DCM optimized to minimize thermal deformation under high heat loads and suppress mechanical vibrations for improved beam stability. High thermal conductivity materials and an efficient cooling system were integrated to mitigate thermal effects, while a structurally reinforced design was employed to reduce vibration. The system was validated through thermal and structural simulations, vibration testing, and performance evaluation under actual beamline conditions. The developed DCM demonstrates improved energy stability and positional accuracy, contributing to high-precision synchrotron radiation experiments.

| WEP22 |

Development and fabrication of a dummy vacuum chamber for straight sections in the Siam Photon Source-II storage ring

Thanapong Phimsen(Synchrotron Light Research Institute).

Jirayu Sukain, Narongsak Sonsuphap, Orayanee Seegauncha, Porntip Sudmuang, Sakonkawee Prabnguleaum, Sarawut Chitthaisong, Sireegorn Sumklang, Supachai Prawanta, Supan Boonsuya, Surachai Pongampai, worakrit woranut(Synchrotron Light Research Institute).

A dummy vacuum chamber for the straight sections of the Siam Photon Source-II storage ring has been successfully developed to validate the mechanical design and fabrication process. The main chamber was fabricated using extruded aluminum alloy from a local company and chemically cleaned prior to welding. A custom circular cross-section with an inner diameter of 62.71 mm and a wall thickness of 4 mm was adopted to optimize vacuum conductance, incorporating racetrack-shaped cooling channels. Tapers with a slope of less than 1/5 were welded to connect to the standard elliptical beam ducts. Structural and thermal simulations were performed on the tapers to ensure integrity under synchrotron radiation heat load. TIG welding was conducted in a cleanroom to minimize contamination, eliminating the need for post-weld heat treatment. To control deformation, a welding training program and butt joint tests were carried out. After welding and assembly, deformation was measured to assess post-weld geometric accuracy. The successful development of this dummy chamber provides critical experience for the manufacturing and mechanical quality assurance of SPS-II vacuum chambers.

| WEP23 |

Development of high stability mirror systems at HALF

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Jie Chen, Qiuping Wang, Shen Wei, Xuewei Du, Yang Peng, Zimeng Wang(National Synchrotron Radiation Laboratory, University of Science and Technology of China, National Synchrotron Radiation Laboratory; University of Science and Technology of China).

Hefei Advanced Light Source (HALF) is a diffraction-limited light source in the soft X-ray range. It provides a powerful tool for nano-focusing, ultra-high spectral-resolution power experiments and applications. To fully utilize the source characteristics, beamline mirrors and manipulators require high accuracy and stability. In phase I, 10 beamlines will be built, requiring dozens of mirrors with different shapes, sizes, and working conditions to achieve high-fidelity transmission, collimation and focusing, which can be divided into three categories: The first mirror of each beamline, with fixed-shape that needs water cooling, due to absorb high heat load and deflect the beam; The fixed-shape mirror without water cooling for beam transmission, focusing and collimation; The bendable mirrors for KB focusing systems. In this paper, the manipulator for each kind of mirror with high stability is proposed. A universal mirror system with a three-point support structure is developed to hold different manipulators and provide fine-tuning for Height, Roll, and Yaw. Prototype design and preliminary test results are also presented.

| WEP24 |

Development of LN_2 cooled permanent magnet undulators

Hakan Bolat(Deutsches Elektronen-Synchrotron DESY).

Andreas Schöps, Markus Tischer, Maximilian Trunk, Pavel Vagin(Deutsches Elektronen-Synchrotron DESY).

This work presents a novel design for a cryogenically cooled permanent magnet undulator (CPMU), advancing compact, high-field insertion devices for synchrotron light source PETRA IV at DESY. Operating at cryogenic temperatures allows significantly smaller gaps and higher fields than conventional undulators. The proposed 4 m long device, the longest of its kind, uses high-performance PrFeB magnets in a hybrid structure. The inner and outer girder design is optimized through mechanical simulations to endure strong magnetic forces while maintaining micrometer tolerances. Forces up to 35 kN are compensated using auxiliary magnets integrated into the inner girder. Adjustable link rods form the critical mechanical connection between girders, enabling fine tuning; they are undergoing cryogenic testing at 77 K to assess performance. Fluid dynamics and thermal simulations of the liquid nitrogen (LN_2) cooling system reveal temperature distributions and gradients along the undulator, crucial for ensuring magnetic field stability and optimal operation in accelerator environments.

| WEP25 |

Development of permanent magnets replacing electromagnets at NSRRC

Jyh-Chyuan Jan(National Synchrotron Radiation Research Center).

Chih-Sheng Yang, Ting-Yi Chung, Yang-Yang Hsu, Yun-Liang Chu(National Synchrotron Radiation Research Center).

Integrating permanent magnets as substitutes for large electromagnets offers advantages such as energy savings, space efficiency, and low maintenance. An electromagnetic dipole magnet on the TPS transfer line is proposed to be replaced by a permanent magnet. This permanent magnet will be hybridized with an electrical coil to allow fine tuning of the magnetic field. Additionally, an NMR system is integrated into the magnet to monitor long-term field variations. The magnetic circuit design for the 1m-long permanent magnet has been preliminarily completed. Currently, the prototype-1 magnet with 0.15 m employs adhesive technology to bond small magnetic blocks into larger ones. The magnetic field strength and uniformity of prototype-1 meet the design specifications. NiFe material has also been used for temperature compensation. During the development process, some assembly procedures and mechanical designs were revised. The prototype-2 is currently in production. This paper presents the magnetic circuit design, the mechanism design, the magnet prototype and the field measurement result of the permanent dipole magnet.

| WEP26 |

Development of Radial Magic Finger Design for Permanent Magnet Quadrupole

Thomas Brookbank(Brookhaven National Laboratory).

Permanent Magnets (PM) have been used in Synchrotron Light Sources for years, but PM's do not have natural tuning capabilities. So, the use of Magic Fingers (MF) has been implemented to improve field quality in Insertion Devices and other PM designs. NSLS-II has been developing a new lattice design called "Complex Bend" using Permanent Magnet Quadrupole (PMQ) to replace the long dipole electro-magnets in the current ring. These PMQ's need to be characterized and tuned to make sure the required harmonics

can be reached. Although the radial design of the PMQs makes improving field quality challenging, the need for a creative way to hold the magnets was sought out. This paper will describe the design, prototyping, testing and future design of the PMQ MF's. The prototype design consists of a circular array of square magnets that can be placed radially around the bore of the PMQ. The field quality of the PMQ was improved from 130 units down to 10 units using NSLS-II new Rotating-Coil measurement bench. Although the results were acceptable, designing the radial MF's to produce these results caused many mechanical challenges that will be explained in this paper.

| WEP27 |

Diamond-II prototype girder testing

Paul Vivian(Diamond Light Source).

Jason Giles, Jorge Linde-Cerezo, Tony Lundyates, William Hoffman(Diamond Light Source).

This presentation will detail the development and testing of the Diamond-II girder and support system for the Diamond-II storage ring. Key topics include the design choices for the mechanical positioning system, comprehensive vibration test and analysis, alignment, and transport testing. Additionally, the laser tracker survey processes and impact on alignment uncertainty will be discussed. The manual alignment system features a primary overconstrained four-wedge jack system atop a series of base plates each controlling different degrees of freedom, linear encoders are used to feedback relative movements of the girder during the alignment process. A secondary mechanical locking system is included which is intended to improve the overall system stiffness and vibration response. Extensive vibration and alignment test and analyses have been conducted to ensure the system meets the physics requirements for the Diamond-II storage ring and the results of this will be presented.

| WEP28 |

Double crystal bent Laue monochromator: modelling and measurements up to 150 keV

Omar Renzo Piminchumo Marinos(Canadian Light Source (Canada), Canadian Light Source Inc.).

Sergey Gasilov(Helmholtz-Zentrum Hereon), Dean Chapman(Canadian Light Source (Canada), Canadian Light Source Inc.).

A main application of Laue diffraction in thick bent crystals is on developing high energy/high power monochromators for synchrotron sources. Whereas most of the studies mainly focuses on modelling and simulation of ideal shapes, e.g., cylindrical deformation, this work adds as well a wide set of mechanical and optical measurements performed on 2 mm thickness double bent Laue crystal monochromator currently used at the Biomedical Imaging and Therapy (BMIT) beamline at the Canadian Light Source. Measurements are compared to simulations from tools such as ANSYS and XRT ray-tracing based on Tagaki -Taupin equations. We found real deformed crystal profile is far from ideal cylindrical shape, that the diffracted beam intensity raised 12X due to deformation using an incident white beam. Also, photon flux measurements were performed using a cryogenic radiometer. Measurements have been performed at the

05ID-2 (3.7 T wiggler) and the 05B1-1 (1.35 T bending magnet) BMIT beamlines with energies between 25 keV to 150 keV. Thus, considering the scarcity of experimental data, this work becomes relevant as it presents measurements of a real bent Laue monochromator and compares it to simulations.

| WEP29 |

Elettra 2.0 discrete storage ring photon absorbers

Giulio Scrimali(Elettra-Sincrotrone Trieste S.C.p.A.).

The Elettra 2.0 project is upgrading the Elettra synchrotron radiation facility to 4th generation standards. This paper presents the overall photon absorption strategy adopted in the design, which includes both distributed and localized absorption of emitted photons, focusing on discrete photon absorbers and their geometrical configurations within the storage ring. All discrete photon absorbers will be manufactured entirely from Copper-Chromium-Zirconium alloy (CW106C or CuCr1Zr). The components will be produced using wire electrical discharge machining (EDM) for the main geometries, supplemented by conventional milling, with the integration of the flange knife-edge into the absorber geometry without the need for brazing. Two main absorber families are introduced: transversal photon absorbers, designed to protect vacuum chambers near bending magnets and to serve as initial beam-shaping elements, and axial photon absorbers, which function as transitions between different chamber geometries and protect sensitive components, such as RF contact bellows. The paper also presents the current production status and includes photographs of the first manufactured units.

| WEP30 |

Enhancing the performance of old X-ray mirrors through surface figure correction

Jangwoo Kim(Pohang Accelerator Laboratory).

Hyeong Ju Choi, Hyun Hwi Lee, Jihyeon Park, Jinhyuk Choi, Jiwoo Kim, Jun Lim, Jung Sue Kim, Sanghun Kim, Seong Han Kim(Pohang Accelerator Laboratory).

The X-ray Optics Laboratory at the Pohang Accelerator Laboratory is advancing synchrotron radiation research by enhancing X-ray mirror performance through in-house precision metrology and coating technologies. A thin-film deposition system was developed for coating X-ray mirrors up to 1 meter in length. By precisely controlling the substrate stage speed, the system can correct and modify the surface figure of the mirror. Differential deposition is achieved by continuously adjusting the substrate's movement during coating. The stage control system calculates the dwell time using deconvolution algorithms, based on accurate measurements of the unit coating distribution and the target surface figure. Recently, the lab successfully reduced the figure error of the 5A beamline mirror by a factor of 15, and plans are underway to extend these improvements to other beamlines, including those at PLS-II and XFEL.

| WEP31 |

Flange aperture gap RF contact gasket for Elettra 2.0 storage ring

Igor Mrak(Elettra-Sincrotrone Trieste S.C.p.A.).

Giulio Scrimali, Stefano Cleva(Elettra-Sincrotrone Trieste S.C.p.A.).

The fourth-generation X-ray source Elettra 2.0, currently under development, aims to significantly enhance the brilliance and coherence of the emitted light, with high currents and ultra-low emittances as design goals. Fourth generation machines have tight constraints in terms of beam coupling impedance, requiring that the flanged connections along the beam orbit contributes as less as possible to the storage ring impedance budget, either by reducing the flange aperture gaps ideally to zero (zero-gap flanges connections), or by properly shielding the cavities generated (RF contact fingers). Space constraints of Elettra 2.0 limit the usage of conventional RF contact fingers, and the storage ring includes components where zero-gap flanges connections cannot be applied. This paper presents a compact RF contact gasket designed to work within the constraints of Elettra 2.0 chambers, inside the cavity created by the coupling of two CF40 flanges. The geometry is presented, along with its characterization with finite element modeling and RF Impedance calculations. A presentation of prototypes is also included.

| WEP32 |

Improving of sputtered titanium film for NIK ceramic chamber in TPS

Chun-Shien Huang(National Synchrotron Radiation Research Center).

Bo-Ying Chen, Chia-Jui Lin, Chien-Kuang Kuan, Tse-Chuan Tseng, Wei-Yang Lai, Yi-Chih Liu(National Synchrotron Radiation Research Center).

The development of the Nonlinear In-vacuum Kicker (NIK) is one of the key projects of the Taiwan Photon Source (TPS). Efficient conduction of the image current generated by the stored beam requires the deposition of a highly conductive titanium thin film on the inner surface of the NIK ceramic chamber. Based on tests involving the sputtering of a 5.5 μm titanium film onto a 34 cm × 6 cm ceramic substrate, the uniformity of the titanium film was controlled within 5%. The adhesion strength between the titanium film and the ceramic substrate reached 60 MPa, and the electrical resistivity was measured at 7.2 × 10^{-5} Ω·cm. This paper presents a detailed overview of the coating system, experimental methodology, and test results.

| WEP33 |

Innovative design strategies and development of girders using topology optimization for PETRA IV

Normann Koldrack(Deutsches Elektronen-Synchrotron DESY).

Precise magnet alignment and mechanical stability are critical challenges in the design of support structures for the PETRA IV synchrotron radiation facility at DESY. Due to the limitations of the existing tunnel infrastructure, magnets must be pre-aligned on girders with high precision before installation, while the girders themselves must accommodate relative tunnel movement and meet stringent vibration stability requirements. A topology optimization approach was applied to develop lightweight yet stiff girder structures with high eigenfrequencies, balancing structural performance and manufacturing efficiency. A full-scale demonstrator was successfully cast, validating the feasibility of the approach. The results highlight the advantages of topology-optimized casting in terms of cost, tolerance control, and design agility, enabling faster iteration and integration of changes during the development cycle.

| WEP34 |

KB mirror mechanics innovations for optimal nanobeam focus and stability at the ESRF ID01 beamline

Carole Clavel(European Synchrotron Radiation Facility).

The highly coherent beam delivered by the Extremely Brilliant Source allows improving beam quality and size on long nano-beamlines. To benefit from this upgrade, the focusing mirrors of the Kirkpatrick-Baez (KB) and its mechanics were redesigned to improve the nano-beam stability in the versatile experimental setup of ID01 beamline. The optical design to get a 50nmx50nm beam lead to two fixed focused elliptical mirrors with a multilayer coating and a 50nrad slope error with a working distance of 37mm. In this context, there are two crucial aspects for the mechanics: one is to be able to hold the optics without degrading the shape of the mirrors; the other is to have a very precise alignment and adjustment of the opto-mechanical equipment at the beamline. I will describe the mechanical design used to achieve these two objectives, the laboratory measurements and the results obtained on the beamline.

| WEP36 |

LiDAR-based 3D scanning for accurate infrastructure modeling at MAX IV

Albert Torrente(MAX IV Laboratory).

*Behrouz Afzali-Far, Gabor Felcsuti, **Keyu Zhou(MAX IV Laboratory)***.

This project explores the use of advanced 3D scanning technology at MAX IV, focusing on the Leica RTC360 scanner to capture high-precision scans of accelerator tunnels and restricted beamline areas. Known for its rapid scanning and accuracy (1.9mm at 10m), the RTC360 generates detailed 3D models of these complex environments. The goal is to produce accurate digital representations to aid in maintenance, structural assessments, and long-term planning. To improve scan data positioning, it can be best-fitted to a reference network of points measured with laser tracker instrumentation, ensuring precise alignment reference. This integration enables overlaying scan data with CAD models, linking the physical environment to its design representation. Using the RTC360's LiDAR technology, the project ensures efficient data capture in hard-to-reach areas, supporting enhanced analysis and decision-making. The resulting 3D models can improve workflow and provide stakeholders with valuable insights into the condition of MAX IV infrastructure, supporting current and future operational needs.

| WEP37 |

Longitudinal gradient bending magnet(LGBM) permanent magnet for Korea-4GSR Project

YoungGyu Jung(Pohang Accelerator Laboratory).

Beom Jun Kim, Dong Eon Kim, Garam Hahn, Inwoo Chun, Woul Woo Lee(Pohang Accelerator Laboratory).

A 4th generation storage ring based light source is being developed in Korea since 2021. It features <60 pm rad intrinsic beam emittance, about 800 m circumference, 4 GeV e-beam energy, full energy booster injection, and more than 40 beamlines which includes more than 24 insertion device (ID) beamlines. To optimize the beam emittances, longitudinal gradient bending magnet is applied in the storage ring design. The initial design was using conventional electrical excitation, but the design is changed to use permanent magnet (Sm2Co17) to minimize energy costs. In this report, the physics design and prototyping is described including field integral, field tuning, and temperature compensation scheme.

| WEP38 |

Longitudinally tuned cooling conductivity for passive preservation of xray mirror optical figure under variable shape and heat loads requirements

Matthew Church(Stanford Synchrotron Radiation Lightsource).

Wiggler sources thermally challenge mirrors particularly when multiple reflection angles are required for variable energy cutoff. A newly installed vertically deflecting collimating mirror at SLAC-SSRL utilizes longitudinally variable conductivity between the cooling water and the mirror, strategically remapping the Gaussian heat bump to produce a spherical thermal deformation that can more effectively be eliminated by adjusting the end moments. By simultaneously optimizing the contributions of both static conductivity and adjustable bending, sub-microradian figure error was achieved. The design utilized a bounded value least squares method incorporating the effects of incremental conductivity changes to each segment of the cooling interface and end moments at each of three required thermal conditions while weighting the local error by the useful reflected flux contribution. Used iteratively, this method converged on the optimal geometry of the copper cooling blades conducting heat from the gallium indium filled troughs along either side of the optically active mirror region to the cooling water tubes.

| WEP40 |

MAX IV photoinjector gun

Linus Roslund(MAX IV Laboratory).

Dionis Kumbaro, Henrique Duarte, Joel Andersson, Robin Svärd(MAX IV Laboratory).

This paper presents the latest photoinjector gun developed for the Short Pulse Facility (SPF) at MAX IV. The focus is on the mechanical design, which has been optimized around a simulated RF internal volume to ensure high performance and precision. Key areas of investigation include RF tuning strategies, thermal management via integrated internal cooling channels, and the challenges encountered during manufacturing and assembly, along with the corresponding engineering solutions. Design enhancements introduced throughout development are highlighted to provide insights into technical progress and practical experience. Potential future improvements are also discussed, targeting further optimization of performance, efficiency, and long-term operational reliability.

| WEP41 |

Mechanical analysis of quadrupole magnets for the 3 GeV storage ring of Siam Photon Source II

thongchai Leetha(Synchrotron Light Research Institute).

Pajeeraphorn Numanoy, Piyawat Pruekthaisong, Prapaiwan Sunwong, Supachai Prawanta, Thanapong Phimsen(Synchrotron Light Research Institute).

Quadrupole magnets for the 3 GeV storage ring of Siam Photon Source II (SPS-II) focus and defocus the electron beam according to the lattice design. This work investigates the impact of fabrication errors on the magnetic field of quadrupole magnets. Magnetic field

simulations in Opera-3D show that misalignment and assembly errors lead to unwanted multipole components. Mechanical analysis was performed on two quadrupole magnet structures: Type A, with two removable poles for coil insertion, and Type B, with no removable poles and four symmetric pieces. ANSYS Workbench was used for static structural simulation. The material used is AISI 1006 low-carbon steel. Results showed maximum deformation at the magnet poles in both types. Detailed analysis and comparison with prototype measurements will be discussed to validate the magnet design and simulation for future manufacturing for the SPS-II Project.

| WEP42 |

Mechanical design and development status of a Superconducting Wavelength Shifter for Sirius

Gustavo Rovigatti de Oliveira(Brazilian Synchrotron Light Laboratory, Brazilian Center for Research in Energy and Materials).

Gustavo Pilon, Isadora Cavassani, Milton Rocha, Pedro Martins, Pedro Souza, Thiago Jasso(Brazilian Center for Research in Energy and Materials).

A cryogen-free Superconducting Wavelength Shifter (SWLS) designed to generate a peak magnetic field of 6.6 T, operating at 5 K, is currently under development for an upcoming hard X-ray beamline of Sirius, the Brazilian synchrotron fourth-generation light source. This work presents an overview of the mechanical development of several key subsystems of the SWLS. It includes the design and fabrication of the clamps for both lateral and central coils, the development of all thermal components responsible for coupling the cold mass to the cryostat cooling stages, and the construction of the base frame that supports the SWLS cold mass. Additionally, the implementation and testing of Kevlar wires used to suspend the base frame are described. The design of the vacuum chamber through which the beam will pass is also presented, along with the tolerance analysis to ensure the 0.5 mm gap between the coils and the vacuum chamber is maintained. The project also considers the reuse of some parts from a decommissioned Superconducting Wiggler previously operated at the UVX. This article summarizes the ongoing mechanical design and development of the SWLS project.

| WEP43 |

Mechanical design and finite element analysis of booster girders for particle accelerators under variable construction environments

Gwang-Wook Hong(Pohang Accelerator Laboratory).

Sangbong Lee, Seung ha Shin, Taekyun Ha(Pohang Accelerator Laboratory).

This study presents a comprehensive engineering design and finite element analysis (FEA) of booster girders, with a focus on their adaptability to diverse construction environments. Booster girders play a pivotal role in maintaining the structural stability and alignment precision of particle accelerators, necessitating robust performance under variable site conditions. A detailed FEA methodology is employed to evaluate the static and dynamic responses of the girders under a range of loading conditions, including seismic forces, which are identified as critical design factors. The simulation results validate the proposed design approach, demonstrating enhanced structural integrity and operational reliability across challenging construction scenarios. This work

provides a rigorous design and analysis framework that supports the development of resilient accelerator components, thereby advancing the reliability and scalability of next-generation particle accelerator infrastructures.

| WEP44 |

Mechanical design of high heat load front-end for IVU beamline at Korea-4GSR

Jongha Park(Pohang Accelerator Laboratory).

Hyung-seok Choi, Jehan Kim, Ki-jeong Kim, Sungnam Kim, Young Duck Yun(Pohang Accelerator Laboratory).

The Korea-4GSR, to be built in Ochang, South Korea by 2030, is a new 4th generation synchrotron radiation facility. It is designed with an electron beam energy of 4 GeV, a stored electron beam current of 400 mA, and an emittance of 62 pm.rad. In Phase I, 10 beamlines will be constructed, five of which will use the IVU24 undulator. When the undulator gap is set to 5 mm, the X-ray source has a total power of 17.95 kW and peak power density of 165 kW/mrad^2. The High Heat Load Front-End(HHLFE) system is designed to absorb up to 17kW of heat using a fixed mask and a movable mask, ensuring that only the central cone is transmitted to the beamline optical devices. The main materials are GlidCop or CuCrZr, selected for their high thermal conductivity, and the cooling channels are designed with a rectangular cross-section to maximize the heat exchange area for efficient thermal management. In addition, tungsten is applied to precisely shape and effectively absorb the X-ray beam. The structural design of the heat-absorbing devices was determined based on thermal analysis results. This presentation introduces the structural and mechanical design details of the HHLFE.

| WEP45 |

Mechanical design of the D-II injection striplines

Vitalii Zhiltsov(Diamond Light Source).

Alun Morgan, Anusorn Lueangaramwong, Arash Amiri, Ian Martin, Lorraine Bobb, Matthew Cox, Neil Warner, Richard Fielder, Roy Grant, Toby Lockwood, Walter Tizzano(Diamond Light Source).

Transparent injection is a key goal of the upgrade of Diamond Light Source to a fourth-generation synchrotron, Diamond-II. This work presents the mechanical design of the Diamond-II K01 straight, which includes three pairs of injection stripline modules, and highlights the following aspects of the design: the general layout (covering the location of the modules, vacuum pumping, and protection from synchrotron radiation); detailed design and assembly of the stripline modules; and lessons learned from the testing of the stripline prototype on the existing machine. The general layout ensures that the modules are optimally positioned to maximize efficiency and minimize interference from synchrotron radiation. The detailed design and assembly process involved rigorous testing and refinement to ensure that each component met the high standards required for operation in a high-energy environment. Lessons learned from the prototype testing provided valuable insights into potential improvements and adjustments needed for the final design, ensuring that the system will perform reliably under operational conditions.

| WEP46 |

Mechanical engineering design of the D-II injection systems

Walter Tizzano(Diamond Light Source).
Abolfazl Shahveh, Chris Bailey, David Grenville, Ian Martin, Matthew Cox, Syed Rishan Ahamad, Toby Lockwood, Vitalii Zhiltsov(Diamond Light Source).

This work presents the mechanical engineering design of the Diamond-II injector, which includes a new low-emittance booster with combined function magnets, modifications to the existing transfer lines and a novel storage ring injection scheme. The latter features two alternative schemes: the first scheme is based on a traditional four-kicker closed bump paired with a novel in-vacuum thin septum, combined with an in-air permanent magnet thick septum. This arrangement will be used for commissioning and initial fill of the ring; the second scheme, used for top-up during user operation, aims to deliver transparent injection and it is based on innovative strip line kickers.

| WEP47 |

Mechanical evaluation and CAD modeling for MAX 4^{U}: MAXIV storage ring upgrade

Karl Åhnberg(MAX IV Laboratory).
Ake Andersson, Ana Martinez Carboneres, Eshraq Al-Dmour, Marek Grabski, Pedro Tavares(MAX IV Laboratory).

MAX 4U is an upgrade project of the MAX IV 3 GeV storage ring, to be realized by the early 2030’s in Lund, Sweden. The goal of the upgrade is to reduce the horizontal electron beam emittance to below 100 pm.rad. A new magnet lattice will be used to achieve this goal. Many different scenarios for different lattices are evaluated from the mechanical engineering aspect to serve as input for the final lattice choice. In this paper, we describe the method used to build CAD-models for the evaluation work and how the components are affected, both mechanical and thermal loads on the vacuum system from the new synchrotron radiation power.

| WEP48 |

Mechanical structure upgrade of the Pivot KB mirror system for improved vibration and stability

Miso Park(Pohang Accelerator Laboratory).
GwanYeop Lee, Hyoyun Kim, Jihyeon Park, Ki-jeong Kim, Sanghun Kim, Seong Han Kim(Pohang Accelerator Laboratory).

At this conference, we introduce an upgraded Kirkpatrick–Baez (KB) mirror system developed by the Pohang Accelerator Laboratory (PAL) for the PLS-II beamline. PAL is also actively involved in designing KB mirrors for the upcoming Korea 4GSR project, aiming to enhance the overall stability and precision of synchrotron beamline optics. To address vibration and axis instability, the KB mirror structure originally designed for PLS-II has undergone major mechanical improvements. Key upgrades include ultra-high vacuum (UHV) actuators, Inconel 718-based cartwheel mechanisms for pitch and yaw axes, and cross-roller guide systems. These enhancements improve structural rigidity, enable precise angular adjustments, and suppress vibration transmission, achieving sub-micron positioning accuracy. The system is now being installed on the PLS-II beamline, with commissioning planned to demonstrate compound-axis control and beam reproducibility. In parallel, research is underway to explore alternative cartwheel materials for further performance optimization. We look forward to presenting the

enhanced Pivot KB Mirror and related technologies from PLS-II and Korea 4GSR at this conference.

| WEP49 |

Mechanical system of the double-period undulator prototype for SHINE

Shengwang Xiang(Shanghai Advanced Research Institute).

Haixiao Deng, Jie Yang, Shudong Zhou, Tingting Zhen, Wei Zhang, Ya Zhu, Yangyang Lei, Zhiqiang Jiang(Shanghai Advanced Research Institute).

The Shanghai High repetition rate XFEL and Extreme light facility (SHINE) is under construction and aims at generating X-rays between 0.4 and 25 keV with three FEL beamlines at repetition rates of up to 1 MHz. The three undulator lines of the SHINE are referred to as the FEL-I, FEL-II, and FEL-III. Shanghai Advanced Research Institute(SARI) will manufacture 14 double-period undulators with period lengths of 55 mm and 75 mm for FEL-II. Magnetic arrays with different period lengths are mounted on the same aluminum beam, which can generate repulsive forces on the non working side through translation, thereby eliminating the magnetic force on the driving unit. The the working period can be switched by translating the support frame. A double-period undulator prototype has been developed and tested at SARI. This paper describes the mechanical system design, simulation and testing results of the double-period undulator prototype.

| WEP50 |

Mock-up assembly of an SRF module: space frame as tooling and structural support for highly HOM-damped cavities

Nora Wunderer(Helmholtz-Zentrum Berlin für Materialien und Energie).

Adolfo Velez(Helmholtz-Zentrum Berlin für Materialien und Energie; TU Dortmund University, TU Dortmund University, Helmholtz-Zentrum Berlin für Materialien und Energie), Andre Frahm, Daniel Böhlick, Fabian Pflocksch, Felix Glöckner, Henry Plötz, Kevin Schemmel, Stefan Wiese, Volker Dürr(Helmholtz-Zentrum Berlin für Materialien und Energie), Jens Knobloch(Helmholtz-Zentrum Berlin für Materialien und Energie; University of Siegen, University of Siegen, Helmholtz-Zentrum Berlin für Materialien und Energie).

To support the VSR cavities with five protruding waveguides, a space frame was engineered to serve a dual purpose: providing structural support and functioning as tooling during assembly. This space frame facilitates cavity rotation in the cleanroom, simplifying the installation of HOM loads and fundamental power coupler components. Designed specifically for the particular cavity geometry, the space frame has a diameter of about 1500 mm and provides axial and radial support for the cavity, along with its ancillaries, magnetic and thermal shields, and piping. A mock-up assembly was conducted to evaluate the design's functionality, assessing key aspects such as rotation and railing performance, cavity support and alignment, and the mountability and stability of ancillary components.

| WEP51 |

NMX neutron instrument installation in the bunker area at the European Spallation Source

Rosa Camilleri Lledo(European Spallation Source).

Daniel Lundström, Esko Oksanen, Giuseppe Aprigliano(European Spallation Source).

The European Spallation Source (ESS) is currently in the process of designing and installing 15 neutron beamlines, each aimed at supporting a diverse range of experimental techniques. These beamlines will provide scientists from various fields with unprecedented opportunities for groundbreaking research. The installation of the beamlines presents significant challenges, as both the infrastructure and the beamlines themselves are being planned and constructed concurrently, but at different stages. One of the most complex areas for beamline installation is the so-called "bunker area," which is located closest to the neutron source which is highly radioactive. From here, all instrument ports are radially distributed in close proximity to neighboring scientific instruments that host the neutron experimental stations. This poster aims to illustrate the installation process of the NMX beamline within the bunker area, highlighting the engineering challenges faced during the installation.

| WEP52 |

Optical metrology of SOLEIL II prototype long focal bendable mirror

Cyprian Wozniak(Synchrotron soleil).

Coline Vascart, David Dennetiere, Javier Perez, Thierry Moreno(Synchrotron soleil).

In preparation for the SOLEIL storage ring upgrade, the SWING beamline has replaced its bendable vertically focusing optic with a state of the art mirror. Acceptance tests were conducted at SOLEIL’s Optical Metrology Laboratory. Driven by two stepper motors with absolute encoders, the mirror enables precise torque control and a wide range of elliptical shapes. This presentation will cover interferometric measurements, motor motion characterization, surface quality assessments, mirror shaping strategies, and calibration for beamline integration. We will detail the use of tiling and stitching methods on a Fizeau interferometer to characterize surfaces with slope errors below 0.1 µrad, crucial for next-generation synchrotron sources. The impact of vibrations and temperature variations on measurements will be discussed, along with mitigation techniques. We will also present topography results, statistical analyses, and the installation process, concluding with initial beamline performance results.

| WEP53 |

PETRA IV: Frontend design

Benjamin Steiniger(Deutsches Elektronen-Synchrotron DESY).

Hilmar Bienert, Mathias Hesse, Michael Sprung, Nicole von Bargen(Deutsches Elektronen-Synchrotron DESY).

New frontends are required to upgrade the PETRA accelerator to the 4th generation. The design is based on the original design concept developed for the photon beamline frontends at PETRA III. The newly designed frontends aimed at using the same proven components and minimizing of the number of girder variations. In addition, a lot of the old components (complete girder) can be used for the new beamlines. A total of 36 new frontends are required for the PETRA IV project, which are divided into the types of 28 Frontends for single beamlines, 6 Frontends for 5 mrad canting and, 2 Frontends for 1.5 mrad canting. The frontends will be installed over four different experimental halls, so that the last part of the system has to be adapted accordingly. On the accelerator girder, the frontend is assembled as a complete string to minimize assembly times on the accelerator girder. Furthermore, the calibration of individual components prior to installation enables a substantial reduction in measurement and set-up times on the accelerator girder. A further benefit is that the entire assembly of the individual strings can be carried out in a cleanroom environment.

| WEP54 |

Precision by design: The eight-piece quadrupole method for high-precision pole tip placement

Nicholas Bechtold(Advanced Photon Source, Argonne National Laboratory).
Animesh Jain(Advanced Photon Source, Advanced Photon Source; Argonne National Laboratory, Argonne National Laboratory), Mark Jaski(Advanced Photon Source, Argonne National Laboratory; Advanced Photon Source, Argonne National Laboratory).

The 8-piece quadrupole method, developed and patented by the Advanced Photon Source (APS) for APS-Upgrade magnets, is a manufacturing and assembly technique in which magnet pole tips and core quarters are machined separately to standard machining tolerances and bolted together during assembly. The APS-U was able to avoid traditional methods of high precision machining to achieve high positional accuracy, which is costly, difficult and time consuming. By using standard machining tolerances and the 8-piece quadrupole method, magnets were assembled to precise mechanical tolerances, ensuring the resulting magnetic field met specification. This approach allowed mechanical assembly, rather than precise machining, to drive the magnetic field performance. The modular design allowed for fine adjustments, ensuring the pole tip and core could be manipulated to achieve the prescribed tolerance. As a result, APS-U production using the 8-piece method met the required quality standards.

| WEP55 |

Progression of the development of a four-crystal monochromator for PETRA IV

Jana Raabe(Deutsches Elektronen-Synchrotron DESY).
Daniel Weschke, Joshua Rauß, Michael Sprung, Oliver Seeck, Wojciech Roseker(Deutsches Elektronen-Synchrotron DESY).

The development of a four-crystal monochromator (4CM) represents a crucial step in advancing beamline instrumentation for PETRA IV, DESY's upcoming ultralow-emittance synchrotron source. Conceived to fulfil the stringent requirements of fourth generation light sources, the 4CM as a device without high heat load should provide exceptional energy resolution, achieving a small energy bandwidth and stability while preserving beam quality. The poster presents the ongoing development of 4CM designed specifically for PETRA IV. Two different beamlines will be discussed and compared. Our approach focuses on optimizing the crystal arrangement, vibration control and precise alignment to achieve excellent energy resolution, band width selection and intensity. Utilizing silicon crystals in a channel-cut configuration, the monochromator ensures high mechanical stiffness and robust control, enabling stable operation over a wide energy range. In addition, the engineering challenges and solutions encountered during the design phase, including thermal management and mechanical stability, are outlined.

| WEP56 |

Progress of front ends at HALF

Ming Chen(Zhejiang Institute of Photoelectronics & Zhejiang Institute for Advanced Light Source).

Chao Wang(National Synchrotron Radiation Laboratory), Jie Chen, Shen Wei, Xuewei Du, Yang Peng(National Synchrotron Radiation Laboratory, University of Science and Technology of China, National Synchrotron Radiation Laboratory; University of Science and Technology of China).

Hefei Advanced Light Facility (HALF) is a 4th generation synchrotron radiation facility building in Hefei, with a 2.2 GeV storage ring perimeter of 479.86 m and 40 straight sections. In phase I, 11 front ends will be installed, including 10 undulator front ends and 1 bending magnet front end. 10 undulator beamlines will be open to users, while the bending magnet will be used for machine study. The undulator front end will receive 17.3 kW/mrad2 of peak power density and 4.7 kW of the total power. These front ends adopt a common modular design, which is based on compatibility with various front ends. The difference lies in the selection of individual components and the variations in parameters. In this paper, the designs and the progress of HALF front ends are presented.

| WEP57 |

Stitching Fizeau interferometry for X-ray optics metrology at MAX IV

Maxime Lebugle(MAX IV Laboratory).

Joaquín B. González, Johan Adell, Johan Selberg, Louisa Pickworth, Marcelo Alcocer, Margit Andersson, Peter Sondhauss(MAX IV Laboratory).

Precise metrology of synchrotron optics is essential for maintaining the performance of X-ray beamlines at diffraction-limited storage rings. We are developing a stitching Fizeau interferometer system designed to measure large synchrotron X-ray mirrors and gratings. Using a stitching approach, the system will provide full-aperture measurements of curved and flat surfaces, with sub-nanometre accuracy over lengths up to 0.75 m. The system will integrate a stable Fizeau interferometer with a motorized, multi-axis positioning platform, enabling automated scanning and acquisition across large optical surfaces presented sideways. Surface maps will be reconstructed from individual sub-aperture measurements using advanced algorithms, including using the PyLost software developed at ESRF. The design focuses on minimizing environmental noise, optical aberrations, and mechanical drift to ensure repeatable and reliable measurements. At MAX IV, the system will strengthen in-house capabilities in optical metrology. It will support the inspection of new mirror substrates before installation, the monitoring of ageing optics already in operation, and the optimization of mounting strategies.

| WEP58 |

Structural design of the injection and extraction electrostatic septum of PREF

Yongxiang Pan(Institute of Modern Physics).

Bin Zhang, Haihua Niu, Haijiao Lu, Lu Zhang, Wenjun Chen, Xiaowei Xu, Yajun Zheng, Yongbin Lang, fengfeng wang(Institute of Modern Physics).

Proton Radiation Effects Facility (PREF) is a dedicated accelerator generating 10-60 MeV proton beams for studying space radiation impacts on satellites and optoelectronics. To achieve a compact and cost-effective synchrotron (circumference of 18 m), an

electrostatic septum system was developed, delivering uniform fields of 72 kV/cm (injection) and 135 kV/cm (extraction) at 350 mm and 730 mm installation spacing, respectively, in a 1×10^{-8} Pa·m^3/s vacuum .The system enables ±15 mm adjustment range for both the anode and high-voltage cathode with accuracy within 0.1 mm, while the use of adaptive high-voltage feed-in method ensures stable electrical contact and eliminates mechanical stress during conditioning. Considering the mechanical properties and the bending constraints of the cutting plate, an array of 0.1mm arched tungsten wire ribbons arranged with small spacing were adapted for the structural design. Lab tests confirm the design's superior compliance with physical requirements, and two years of operation demonstrate the devices' high stability and long-term reliability.

| WEP59 |

Succesfull repair of a S-Band Cavity

Nick Strohmaier(Paul Scherrer Institute).

Reto Fortunati(Paul Scherrer Institute).

For this poster presentation, I will present you the entire process for reconstructing and repairing of a defective S-band cavity. The repaired cavity will be used in an Experiment inside the Free Electron Laser (SwissFEL). In the final check we found an error after brazing and we decided to try to fix the cavity before we order new one to save time and costs. The cavity was cleanly separated in two parts and machined. The defective cup segments were replaced by new cups and the S-band Cavity was re-brazed. The repair was a complete success and the cavity can be used in operation.

| WEP60 |

Survey and alignment of beamlines for Advanced Photon Source Upgrade

Altaf Khan(Advanced Photon Source).

Jonathan Knopp, Oliver Schmidt(Advanced Photon Source), Mark Erdmann(Argonne National Laboratory).

As part of the Advanced Photon Source Upgrade (APS-U) Project, all 72 beamlines needed to undergo alignment to the new storage ring installation. Prior to beginning the alignment efforts, beamline geometry files were to identify the location of components with respect to the beam source. For new beamline installations, the remaining process was simpler. New components were fiducialized in a lab, along with their support tables. Tables were then installed and aligned to the beamline geometry configuration and a final report was generated for approval. However, for existing beamlines, the process was more intricate. Fiducial records dating back to 1996 were used to generate fiducial files. However, some information was lost over the years. In response, new techniques were implemented to fiducialize components missing records in-situ to avoid removing components from the beamline. Existing component positions were measured with respect to the new source, then realigned. A report of pre-alignment and a report of realignment were generated for approval. All beamlines have undergone realignment in one year timeline and successfully gone through commissioning process.

| WEP62 |

The girder system prototype for the ALBA II storage ring

Javier Boyer(ALBA Synchrotron Light Source).

Barbara de Abreu Francisco, Carles Colldelram, Llibert Ribó Mor, Nahikari Gonzalez, Pol Salmeron Roma(ALBA Synchrotron (Spain)).

ALBA Synchrotron is developing an upgrade project for transforming its accelerator into a diffraction limited storage ring, with twenty-fold reduction of the emittance. The upgrade will be executed before the end of the decade, profiting at maximum all existing infrastructures, as the tunnel, and renewing SR elements such as magnets, vacuum chambers and girders. This paper presents the design status of the new girder system required for supporting the new magnets array of the Alba II lattice, which more than doubles in quantity. Design requirements include positioning accuracy between adjacent magnets of 50 μm, to enable repositioning the magnets due to long term deformation of the slab, ensuring the vibrational stability of the components on top and modular construction to minimize the installation time, dividing each of the 16 arcs into modules with all the subsystems preassembled, providing easiness in the assembly, transportation and final installation. A dedicated project was awarded to build prototypes for ALBA II machine. Two girder prototypes are currently being constructed in order to check their full functionality and are expected to be tested by the end of this year.

| WEP63 |

Thermal analysis of front end vacuum components & mirror for IVU24 beamline at the Korea-4GSR

Sungnam Kim(Pohang Accelerator Laboratory).

Hyung-seok Choi, Jehan Kim, Jongha Park, Ki-jeong Kim, Young Duck Yun(Pohang Accelerator Laboratory).

Currently under construction in Ochang, Chungcheongbuk-do, Korea-4GSR is a 4GeV, 4th Generation Synchrotron Light Source. The front end is being designed to pass the powerful synchrotron radiation generated by the insertion device. High heat load components have hence been customized to meet the requirements of beamline users and account for the thermomechanical limits of materials. In the analysis of the 4GSR beamline device, the values of IVU24, which has the largest beam intensity, were used, and the specifications for securing the safety of the front end device were determined. In the case of devices that come into direct contact with the beam, the flow rate and cooling passage structure were determined so that the convection coefficient could be increased under conditions that did not cause significant vibration. And cooling system optimization analysis was conducted to minimize the slope error of the mirror, and as a result, partial cooling according to the footprint size resulted in the best slope error value. In this paper, we describe the characteristics and analysis results of the front end and mirror.

| WEP64 |

Thermal fatigue tests on CuCrZr photon shutters

Sushil Sharma(Brookhaven National Laboratory).

Frank DePaola, Guimei Wang, James Grandy, Michael Johanson, Richard Faussete, Robert Todd(Brookhaven National Laboratory).

The CuCrZr alloy has emerged as a preferred material for thermal absorbers in synchrotron light sources, balancing mechanical strength, thermal conductivity, and

cost-effectiveness. Yet, thermal fatigue design criteria for CuCrZr components under high-intensity X-ray beam exposure are not well established. This is due to a lack of experimental data from test specimens subjected to several thousand cycles of localized high temperatures exceeding 300°C. To address this gap, thermal fatigue tests were conducted on CuCrZr photon shutters at the NSLS-II instrumentation front end. This setup, receiving an X-ray beam from an undulator (16 kW/mrad^2 peak power density at 500 mA), resulted in a peak normal power density of 38.8 W/mm^2 on the shutters. Within the beam footprints, calculated peak temperatures ranged from 322°C to 416°C. This paper presents the experimental setup, the test results, and finite element analyses of the photon shutters' thermo-mechanical responses. Drawing from both experimental and analytical findings, a conservative thermal fatigue design criterion for CuCrZr absorbers is proposed.

| WEP65 |

Thermal stability of the Diamond storage ring

Ella Rippin(Diamond Light Source).

This presentation explores the thermal stability of the Diamond storage ring, highlighting significant air temperature variations both spatially and temporally. To monitor component temperatures, 34 Pt1000 temperature sensors have been installed across three girders within the same cell. Observations indicate a 0.5°C increase in girder temperature during machine startup, primarily due to a rise in magnet temperature of up to 2.5°C when powered, while beam presence has minimal impact on machine temperature. This data has been instrumental in informing the development and analysis models for Diamond-II. Additionally, sensors installed on two Diamond EBPM columns provide targeted analysis to enhance Diamond-II beam stability.

| WEP66 |

Upgrade tuning system 3rd harmonic cavity SLS 2.0

Reto Fortunati(Paul Scherrer Institute).

Alessandro Citterio, Marco Schneider, Mark Dällenbach, Renzo Rotundo(Paul Scherrer Institute).

As part of the SLS2.0 upgrade, it was foreseen to upgrade the tuning system of the 3rd harmonic cavity of the storage ring. The complete tuning system is installed in an isolation vacuum and has direct contact to a 4 Kelvin source, which means all components have to perform in cryogenic conditions. The existing system comprised of a standard stepper motor and a coated spindle with two hard-stops at both ends. The new installed tuning system offers now better adapted stepper motor including temperature sensor and position encoder. The spindle was also changed to a roller-bearing system. To design the mechanical setup we analyzed the required forces which are required to deform the superconducting Niobium-coated copper cavities. The torque of the motor is multiplied by a lever-arm system and the pitch of the roller-bearing. Based on this analysis, we designed and purchased the complete mechanism which was then successfully installed and integrated into the SLS2.0 environment. On the poster I will lay out the analysis, findings and solutions to share it with the community with similar systems.

| WEP67 |

Vibration-based condition monitoring of a lead screw in the mirror positioning unit on the CIRI beamline

Marcel Piszak(SOLARIS National Synchrotron Radiation Centre).

A newly constructed infrared (CIRI) beamline at the SOLARIS National Synchrotron Radiation Centre features a front-end mirror positioning system capable of inserting the mirror directly into the storage ring vacuum chamber. The positioning mechanism utilizes a lead screw drive, which recently experienced a mechanical failure during operation. To enhance reliability and enable early fault detection, a vibration-based condition monitoring strategy is being implemented. The approach employs an industrial accelerometer mounted on the mirror assembly to measure vibration signals during insertion and extraction cycles. These signals are analysed to assess the operational condition of the lead screw and to identify early indicators of mechanical degradation, supporting predictive maintenance and reducing the risk of unexpected failures. The presentation will cover the concept, implementation, and results obtained from vibration-based monitoring, with particular emphasis on improving system reliability.

| WEP68 |

Development of a circular flexure bender for a long, elliptically bent X-ray mirror

Zuyang Ren(Shanghai Advanced Research Institute).

Jiahua Chen, Jinhao Zhang, Nan Wang, Song Xue, Wanqian Zhu(Shanghai Advanced Research Institute), Naxi Tian, Yumei He(Shanghai Advanced Research Institute, Chinese Academy of Sciences).

Mechanical benders are classical instruments for shaping X-ray mirror surfaces with high precision. A circular flexure bender has been developed at SSRF (Shanghai Synchrotron Radiation Facility) for a 1200 mm-long hard X-ray mirror with an effective optical length of 1000 mm. Elliptical bending in the tangential direction is achieved using two actuators equipped with high-precision force sensors, transmitting torque through circular flexure hinges at both ends of the mirror. The mirror is oriented to reflect vertically and faces upward, requiring consideration of gravitational deformation. Slope profilometry measurements using a Long Trace Profiler (LTP) indicate a total slope error of 0.45 µrad (RMS), with mechanical error compensating gravity limited to less than 0.1 µrad. A liquid-metal-bath water cooling method is integrated to manage thermal loads. Finite element analysis (FEA) is conducted to evaluate thermally induced deformation, calculated at 0.2 µrad (RMS), and to optimize the flexure hinge design. The developed system provides stable, high-precision elliptical bending for long X-ray mirrors and is well adapted for advanced synchrotron radiation beamlines.

| WEP69 |

Mechanical aspects of a magnetic measurement setup for superconducting undulators at European XFEL

Pawel Ziolkowski(European X-Ray Free-Electron Laser).

Ajit Nandawadekar, Amir Mohammad Doosti, Enrico Fioresi(European X-Ray Free-Electron Laser), Sara Casalbuoni, Thomas Schmidt(European X-Ray Free-Electron Laser, European XFEL GmbH).

The European XFEL is developing superconducting undulators (SCUs) and planning their implementation with the goal of generating extremely hard X-rays with energies exceeding 40 keV. A key component for the development and quality assurance of SCU coils is SUNDAE1, a vertical liquid helium bath test stand designed for training SCU coils and measuring their magnetic field profiles. This contribution presents the mechanical design and commissioning of a sledge equipped with Hall probes that travel along precisely machined rails, as well as a high-resolution linear motion system that guides the sledge via a rod—both developed specifically for accurate magnetic field profile measurements.

| WEP70 |

Optimization of a bending mirror system for dynamic focusing

Meiyi Wu(Institute of Advanced Light Source Facilities Shenzhen, Institute of Advanced Science Facilities, Shenzhen).

Baoning Sun(Dalian Institute of Chemical Physics, University of Chinese Academy of Sciences, State Key Laboratory of Chemical Reaction Dynamics), Jun Luo, Qinghao Zhu, Qinming Li, Yaxiang Liang, Zhixiang Wen(Institute of Advanced Light Source Facilities Shenzhen, Institute of Advanced Science Facilities, Shenzhen), Weiqing Zhang(Dalian Institute of Chemical Physics, State Key Laboratory of Chemical Reaction Dynamics, Institute of Advanced Light Source Facilities Shenzhen).

In this paper, we present the preliminary development and optimization of a bending mirror system conducted as a preparatory study for the Shenzhen Superconducting Soft X-ray Free-Electron Laser (S3FEL). A prototype of the dynamic bending system is fabricated for experimental validation. It is designed to bend a flat mirror to 500 m radius of curvature (360 m RoC experimentally achieved eventually). Surface quality of the mirror before and after then bending are characterized in a cleanroom to minimize environmental disturbances. The bending system was mounted on the granite base of a long-trace profiler (LTP) for high-precision metrology. Two technical approaches are explored on this system. The first involved a coarse force estimation method based on analytical bending formulas, combined with manual fine tuning. The second employed a surrogate model constructed through transfer learning-based neural networks to enable rapid prediction and inverse optimization of actuator forces. Experimental evaluations of both approaches confirm the system’s capability to achieve large-range curvature modulation while maintaining sub-microradian slope precision.

| WEP71 |

Removal and installation plans for the SOLEIL II upgrade

Gil Baranton(Synchrotron soleil).

Alexandre Carcy, Carlos De Oliveira, François Trias, Nicolas Bechu(Synchrotron soleil).

The SOLEIL synchrotron, which has been open to the scientific community since 2008, will benefit from an upgrade aimed at improving the brilliance, coherence, and flux of the X-ray beam delivered. This will make it possible to follow biological processes or the functioning of devices operating at sub-millisecond timescales at nanometric resolution, while sharply reducing the detection limit for trace elements. The accelerators (booster and storage ring) will be completely renewed, while the existing tunnels. In addition, six beamlines will be relocated to other places in the experiment hall. A 24-month "dark period" is planned to bring the SOLEIL II program to a successful conclusion. This article presents the strategic plans being developed for dismantling the current accelerators, installing the upgraded components of the new accelerators (girders, magnets, vacuum chambers, electrical and fluid servitudes), and move the six beamlines (radiation protection hutchs and equipments). Prioritizing a cost-effective and time-efficient approach, we began planning by focusing on optimizing spaces and equipment movements necessary for the upgrade process.

THOA - Simulation session 1

18 September 2025 09:00 / 10:00

Chair: Keihan Tavakoli (Synchrotron Soleil)

THOA01 / 09:00

Simulation Driven Design - Towards Sustainable Plant Based Packages

Eskil Andreasson(Tetra Pak (Sweden)).

At Tetra Pak® we use advanced virtual engineering methods to build knowledge, increase quality and to shorten development times. Within Modelling and Simulation, our package simulation models are continuously developed and improved. Today we have realistic package simulation models available in several applications and across the full value chain. The Finite Element (FE)-models are predictive and used during early technology development as well as during knowledge building and issue resolution. The maturity and level of accuracy in the FE-model is different depending on the simulation request. As a complement to our virtual modelling world, we have started to utilize X-ray techniques both in our in-house CT-equipment´s but also at LSRI´s. Our first experiment at MAX IV at the ForMAX beamline, started with paper straws, provided additional analysis capabilities into how paper straw material interacts with different types of liquids in real-time. These new insights and knowledge will be applied to developing the package of the future in our virtual modelling tools, helping us to improve their functionality.

THOA02 / 09:40

Parametric design and optimization of SOLEIL II vacuum chamber thermal properties

Zhengxuan Fan(Synchrotron soleil).
Christian Herbeaux, Keihan Tavakoli, Marc Ribbens, Thomas Souské, Vincent Leroux(Synchrotron soleil).

In the context of the upgrade to SOLEIL II, a 4th-generation synchrotron, the use of Multi-Bend Achromat lattices significantly reduces natural emittance but requires smaller vacuum chambers (12–16 mm), leading to higher power density on chamber walls with limited cooling space. In some cases, there is no room for crotch absorbers, and chambers must fit between magnet poles with less than 1 mm clearance. These constraints demand high thermo-mechanical stability, making design highly challenging and and it is often difficult to identify the most efficient direction for further optimization. This paper presents a parametric thermal analysis and optimization method for SOLEIL II vacuum chambers. Simulations are conducted using ANSYS DesignXplorer, with key parameters identified through sensitivity analysis of their impact on thermal performance. The heat-flux map, imported from Synrad+, provides precise power distribution. From multiple parameter combinations, a predictive temperature map (response surface) is generated, enabling estimation of thermal behavior without lengthy simulations. An optimized parameter set is proposed to streamline the design while ensuring performance.

THOB - Simulation Session 2

18 September 2025 10:20 / 12:00

Chair: Ralph Doehrmann (Deutsches Elektronen-Synchrotron DESY)

THOB01 / 10:20

Simulation-driven innovation for instrumentation development at DESY and European XFEL

Fan Yang(European X-Ray Free-Electron Laser).
Daniel Loureiro, Daniele La Civita, Sebastain Goede(European X-Ray Free-Electron Laser), Martin Rehwald(Helmholtz-Zentrum Dresden-Rossendorf), Martin Lemke, Sandra Schneider, Thorsten Stoye(Deutsches Elektronen-Synchrotron DESY).

Simulation is becoming a key driver of digital transformation strategies. Through AI/ML and data-driven methodologies, the “shift left” approach is increasing the impact of simulation on instrumentation R&D. This contribution presents two examples illustrating this progress at DESY and European XFEL.The first focuses on CFD simulations for the cryogenic liquid jet platform at the High Energy Density(HED) instrument at EuXFEL, supporting high-repetition-rate sample delivery. The simulations study the sensitivity of jet behavior to nozzle geometry, boundary conditions, physical and numerical parameters, showing strong agreement with experimental data and providing insights for optimization. The second highlights a novel simulation-driven design for detector cooling system. With extreme energy intensity and heat load from the x-ray laser beam, efficient and compact cooling solutions are crucial. Using the generative design tool Coldstream, innovative cooling structures are developed through an automated, multi-objective optimization process considering manufacturability. Across both examples, systematic validation and verification are implemented to ensure simulation reliability.

THOB02 / 10:40

Development of new bent crystal assemblies for SPS and LHC accelerators

Tristan Calvet(European Organization for Nuclear Research).
Antonio Perillo Marcone, Hana Havlikova, Marco Calviani, Michael Howes, Oliver Aberle, Quentin Demassieux, Regis Seidenbinder(European Organization for Nuclear Research).

Bent crystal assemblies developed at CERN allow high-energy particles to be channeled in its accelerators (SPS, LHC). This channeling of particles using crystals enables either to minimize losses (SPS) or to replace of primary collimators (LHC). Crystals may also be expected to be used in electron machines (eg. FCC-ee). The performance of such single bent crystals depends on the ability to precisely position a crystal onto a supporting assembly while minimizing crystal torsion. In the case of multiple crystals mounted on the same assembly, the relative positioning of each crystal becomes crucial, as particles must interact precisely with the successive lattice structures of distinct crystals. In this study, different materials are considered for the precision manufacturing of crystal benders, and an analysis of crystal torsion is provided. Simulations of crystal anticlastic deformation and torsion as a function of clamping surface tolerances are presented. The sensitivity of bent crystal assemblies to high-temperature cycles is also analyzed. Finally, the manual assembly process, including the clamping of the crystals onto the supporting benders, is discussed.

THOB03/11:00

Challenges and optimization of Mu2e proton target design with radiative cooling

Zunping Liu(Fermi National Accelerator Laboratory).
Alajos Makovec, Frederique Pellemoine, Gerald Annala, Jonathan Williams, Katsuya Yonehara, Kevin Lynch, Michael Hedges(Fermi National Accelerator Laboratory), Andrew Edmonds, James Popp(York College, City University of New York), James Miller(Boston University), Madeleine Bloomer(Emory University).

Mu2e, the Muon-to-Electron Conversion Experiment, aims to identify physics beyond the Standard Model, namely, the conversion of muons to electrons without the emission of neutrinos. The muons are produced from pions generated in a production target when it is hit by an 8 GeV proton beam from the Fermilab Booster. The target design is constrained by the one-year operating lifetime and radiative cooling in a vacuum environment. Uncertainties in the lifetime of the existing baseline design – a monolithic, segmented tungsten target – are large, particularly due to unknown impacts of radiation damage at the high proton fluences expected in experiment. A new design utilizing Inconel 718 over the WL10 used in the existing target design has been evaluated. The resultant structural design of the target has evolved significantly. The focus is on lowering the target temperature, minimizing obstruction to muons, increasing structural stability, maximizing fatigue lifetime, simplifying the fabrication process, and more. The thermal management, structural stability and fatigue lifetime are emphasized here. The optimizations have led to a promising new target design for the Mu2e experiment.

THOB04/11:20

From simulation to measurement: Enhancing FE simulation for PETRA IV and EuXFEL girders

Daniel Thoden(Deutsches Elektronen-Synchrotron DESY).
Normann Koldrack(Deutsches Elektronen-Synchrotron DESY).

Finite element analyses provide high-accuracy results when analysing monolithic parts like girders for accelerator components. To account for the supports and loads, simple entities such as springs and single-point masses are added to the model during design and development. However, the mechanical properties of real-world parts are often estimated, leading to deviating results, particularly on low-frequency modes, when measured in situ. To address this issue, a method is demonstrated using vibration measurements on a topology-optimised girder for the PETRA IV synchrotron radiation facility. This method allows for tuning the simulation properties accordingly. Even with simple models, an excellent correlation between measurement and simulation, spanning a wide range of modes, can be achieved. The results are then applied to

different girder setups for the European XFEL to validate the approach. By comparing simulation and measurement of girders made from welded steel and ultra-high-performance concrete, the robustness of the method is discussed.

THOB05 / 11:40

Design of SLS 2.0 BPM block support structure with damping mechanism

Xinyu Wang(Paul Scherrer Institute).
Boris Keil, Maximilian Wurm, Romain Ganter(Paul Scherrer Institute).

The positional stability of SLS 2.0 beam position monitors is crucial for effective fast orbit feedback and beam stability. Long-term stability is ensured by minimizing thermal drift through precise control of ambient air and cooling water temperatures. Mechanical stability is achieved using a specially designed sandwich support structure that incorporates damping material to suppress vibrations. The BPM support comprises double steel plates bonded with a stiff end-grain balsa wood core using a viscoelastic adhesive, effectively enhancing both stiffness and damping. To further reduce beam-induced temperature fluctuations, the upper section of the support includes a water-cooled copper block. To select the adhesive type and optimize the bonding layer thickness, dedicated vibration tests were performed. For final qualification, the specimen underwent aging tests in a climate chamber. This work presents tests for selection and qualification of the damping material, along with a numerical study of thermal dilatation of the arc section during synchrotron radiation power heat up. The temperature measured at 400 mA beam current will be presented and compared with simulation results.

THOC - New Facility Design and Upgrade Session

18 September 2025 13:00 / 14:40

Chair: Oliver Schmidt (Advanced Photon Source)

THOC01 / 13:00

Progress in engineering design and installation of the HIAF Project

Yajun Zheng(Institute of Modern Physics, Chinese Academy of Sciences).
Bin Zhang, Haihua Niu, Haijiao Lu, Jiancheng Yang, Long Yang, Lu Zhang, Wenjun Chen, Xiaowei Xu, Yaqing Yang, Yongbin Lang, Yongxiang Pan, fengfeng wang(Institute of Modern Physics).

The High Intensity heavy-ion Accelerator Facility (HIAF) is a new accelerator complex under constructed at IMP (Huizhou campus) China. It aims to provide an international-class experimental platform for fundamental research in nuclear physics, atomic physics, and applied heavy ion beam research. The 2-kilometer beamline, installed in an underground tunnel 12.7 meters below ground, comprises over 6,000 large-scale devices, 5 million components, and 1 million meters of pipelines. To address multidisciplinary coordination challenges across complex subsystems and stakeholders, we developed cross-domain collaborative design strategies and a Building Information Modeling (BIM)-based lifecycle management platform covering architecture, accelerator systems, auxiliary facilities, and decommissioning. This integrated model provides digital support for the facility's lifecycle engineering processes. The full installation of the Booster Ring (BRing), Spectrometer Ring (SRing), and beamline components was completed within 8 months, with integrated commissioning currently underway. The project is on track to achieve national acceptance by late 2025.

THOC02/13:20

LoKI instrument - Installation update
Clara Lopez(European Spallation Source).

LoKI a small angle neutron scattering (SANS) instrument under construction at ESS, addressing the needs of the soft matter, biophysics and materials science communities. It is optimised for small sample gauge volumes and a wide simultaneously measured size range. This instrument is an in-kind contribution from UK, with STFC serving as the host facility, assuming full responsibility for the detailed design, manufacturing, procurement, installation, and integration. An agreement was established in which the integration and physical installation activities would be coordinated and executed by ESS personnel, under the guidance of the technical team at STFC. This presentation outlines the end to end installation process, starting with the shipping of components from the STFC facilities, followed by their reception at the ESS site, and culminating in the full installation and local testing of all subsystems. The presentation will focus on the challenges encountered during installation, including coordination among multiple stakeholders, evolving infrastructure conditions at ESS, and the need to adapt plans in real time due to unforeseen events. Additionally, we will highlight the lessons learned from installing a scientific instrument in a facility undergoing multiple construction projects, while simultaneously defining processes and procedures for future operations.

THOC04/13:40

Design of alignment network for the Siam Photon Source II
Jullada Saetiaw(Synchrotron Light Research Institute).
Kamthon Rittaprom, Peerawoot Rattanawichai, Piyawat Pruekthaisong, Supachai Prawanta, Supawan Srichan(Synchrotron Light Research Institute).

The development of the 3 GeV synchrotron light source in Thailand represents a major advancement in national scientific infrastructure, aiming to provide high-brightness synchrotron radiation for broad scientific and industrial applications. The installation of core accelerator systems, including magnet systems, vacuum systems, and girder systems, requires micrometer-level precision to ensure long-term stability. This study introduces a newly designed alignment network system focused on minimizing measurement uncertainty to meet the tight positioning tolerances of the electron storage ring. Simulations and analyses were performed using Spatial Analyzer software and the Unified Spatial Metrology Network (USMN), integrated with high-precision laser trackers. The resulting network achieves sub-millimeter accuracy within specified tolerances, supporting precise component installation. This work enhances the capabilities of Thailand in reference network design for high-precision systems and offers an adaptable framework for future advanced technology applications.

THOC05/14:00

Storage ring vacuum system design for Korea-4GSR with pill-type getters
Taekyun Ha(Pohang Accelerator Laboratory).

Hosun Choi, Jaehoon Kim, Mansoo Hong(Pohang Accelerator Laboratory).

The Korea Fourth-Generation Storage Ring (Korea-4GSR) is under construction in Chungju, Korea, aiming for ultra-low emittance at 4 GeV. Korea-4GSR employs pill-type getters strategically positioned within its vacuum chambers as an alternative to Non-Evaporable Getter (NEG) coatings commonly used in similar facilities. This design choice offers simplified manufacturing processes and ease of maintenance. In this presentation, we highlight updated aspects of the Korea-4GSR vacuum system utilizing pill-type getters. Recent progress includes refined chamber geometries, optimized pill-getter placement for improved pumping efficiency, and enhanced thermal management strategies ensuring structural integrity under high photon flux. Additionally, results from prototype chamber testing, covering achievable vacuum pressure, getter activation procedures, and long-term performance, are discussed. These updates aim to enhance the operational performance and reliability of the vacuum system for synchrotron radiation applications.

THOC06 / 14:20

Layout of the ALBA II accelerator

Llibert Ribo(ALBA Synchrotron (Spain)).
Ferran Fernandez, Juan Carlos Giraldo González, Nahikari Gonzalez, Pol Salmeron Roma(ALBA Synchrotron (Spain)), Javier Boyer(ALBA Synchrotron Light Source), Francis Perez, Ricardo Parise(ALBA Synchrotron (Spain), ALBA-CELLS Synchrotron).

ALBA Synchrotron Light Source will be upgraded into a diffraction limited machine by the replacement of the storage ring, which implies the reduction of the emittance by at least a factor of twenty. Compactness ratio of the magnetic elements has increased by a factor of 2. The new lattice has been designed with two constrains. firstly, Keeping the same orbit length allows us to preserve the actual injector. secondly, the medium and short straights will be collinear with respect to ALBA current layout to avoid moving the present ID Beamlines. The bending magnet beamlines must be repositioned on the new machine. Magnetic array, vacuum chambers and girders are positioned with respect to the main orbit under tight clearances, that's why envelope studies of those clearances will have to be performed for the 3 subsystems. Easiness of assembling and installation of the different subsystems of the machine has to be considered also as a design requirement, in order to minimize the installation time A mock-up of one sector is being prepared for this reason. The upgrade will be executed before the end of the decade and will be profiting at maximum all existing ALBA infrastructures.

THOD - Precision Mechanics Session

18 September 2025 15:00 / 16:20

Chair: Martin Dommach (European XFEL GmbH)

THOD01 / 15:00

A laser tracking system for sample positioning

François Villar(European Synchrotron Radiation Facility).
Daniel Fiole, Jose Maria Clement, Julien Bonnefoy, Pierrick Got, Thomas Dehaeze(European Synchrotron Radiation Facility), Juan Luis Frieiro(ALBA Synchrotron

(Spain)), Sébastien Ducourtieux(Synchrotron soleil), Jens Fluegge(Physikalisch-Technische Bundesanstalt), Klaus Kiefer(Helmholtz-Zentrum Berlin für Materialien und Energie).

In the frame of the LEAPS-Innov pilot project, the ESRF together with ALBA, Soleil, PTB and HZB have developed a position measuring system based on fibered laser interferometers and beam steering mirrors that track the position of the object to be measured thanks to a closed loop control system. The global objective is to measure the position of objects moving in a plane along 3 degrees of freedom (2 translations and one rotation), with a typical range of a few millimeters and a few tens of degrees and with a repeatability of 10 nanometers. This system could typically be used for measuring sample position in experimental stations. The project was divided in 2 parts, the first one being dedicated to the characterization of periodic non linearities of commercially available fibered interferometers by all project partners and continued with the design and construction of a 3 axes prototype system at ESRF. I will present the results of the interferometers characterization, the design of the mechanical, optical and control systems used to implement this prototype and the experimental results obtained.

THOD02/15:20

The X-ray free-electron laser oscillator at the European XFEL: design and status

Bertram Friedrich(European X-Ray Free-Electron Laser).

Benoit Rio, Daniele La Civita, Immo Bahns, Massimiliano Di Felice, Maurizio Vannoni, Silja Schmidtchen(European X-Ray Free-Electron Laser), Harald Sinn(European X-Ray Free-Electron Laser, European XFEL GmbH), Lukas Müller, Patrick Rauer, Torsten Wohlenberg(Deutsches Elektronen-Synchrotron DESY).

This contribution provides an insight into the X-ray Free Electron Laser Oscillator (XFELO), an R&D project currently under commissioning at the European XFEL. XFELO aims to be the first demonstrator of a cavity-based free electron laser, promising significantly enhanced beam properties. The layout of the optical cavity and its integration into the SASE1 undulator section present unique challenges, particularly regarding the optomechanics to align the individual optical elements. These requirements include two angular and two linear degrees of freedom (DoF) with nanoradian-level angular stability and resolution, long travel ranges of up to 40 mrad, ultra-high vacuum compatibility, non-magnetic materials, and radiation resistance. To meet these demands, high-precision mechanics were developed that are based on flexures and combine parallel kinematics for high-resolution angular alignment with integrated serial kinematics for linear positioning. We will provide an overview of the XFELO setup, followed by a detailed look at the design and implementation of the precision mechanics. Finally, we will present a brief summary of the current status of commissioning and performance.

THOD03/15:40

Enabling high-precision nano-positioning for beamlines: the Precision Metrology Laboratory at Diamond Light Source

Qingxin Meng(Diamond Light Source).

Bee Mullan, Hiten Patel, Kawal Sawhney, Simon Alcock(Diamond Light Source), Rabia Ince(National Physical Laboratory).

The Precision Metrology Laboratory (PML) at Diamond Light Source provides an ultra-stable environment and instrumentation to perform micro- to nano- scale dimensional metrology to support beamline operation. The lab is actively stabilised to ± 10 mK in temperature and ± 0.5 %RH in humidity. Under these conditions, sub-nm displacements have been measured using capacitive sensor and linear interferometer, and sub-nrad angles have been measured using autocollimator and angle interferometer. Such measurement capabilities are required to characterise and enhance the performance of beamline positioning systems prior to installation. This philosophy has frequently helped to identify faults, including misalignments, parasitic motion errors, and controller issues. Solving these problems before beamline operation has saved a significant amount of X-ray commissioning time. Increasingly, the PML is involved in the prototyping of new beamline components that are beyond the production limits of commercial suppliers. Providing metrology feedback to guide design decisions following the mechatronics principle.

THOD04/16:00

Traceable sub-nanometre interferometry to improve nanopositioning applications at synchrotron & XFEL beamlines

Simon Alcock(Diamond Light Source).
Andrew Yacoot, Rabia Ince(National Physical Laboratory), Hiten Patel, Kawal Sawhney, Qingxin Meng(Diamond Light Source).

Coupled with faster detectors, X-ray optic upgrades, new flagship beamlines, and advanced data pipelines, the new low emittance Diamond-II source will benefit a wide range of scientific communities. Smaller, brighter, X-ray beams enable sample scanning systems to progress from slow, step-based motion to rapid, freeform dynamic trajectories. Metrology feedback devices, such as interferometers or capacitive displacement sensors, are increasingly used for real-time monitoring and correction of parasitic errors of micro- and nano-positioning stages. Beamlines are often noisy environments, with mechanical, acoustic and electrical disturbances, and temperature or humidity fluctuations. To provide accurate, closed-loop feedback for nano-positioning stages, metrology instruments need to be calibrated and optimised to nullify errors caused by variations on the beamline. We demonstrate the importance of characterising a nano-positioning stage in the ultra-stable environment of the Precision Metrology Lab using a traceable, linear interferometer. Lessons learnt are applied to compensate for environmental changes in “real-world” beamline conditions to achieve sub-nm nano-positioning.

THP - Poster Session 3

18 September 2025 16:20 / 17:30

Chair: Eshraq Al-Dmour (MAX IV Laboratory)

| THP01 |

Activation mechanism of surface partially nitrided high-purity titanium deposited film as a nonevaporable getter (NEG) studied by soft X-ray photoelectron spectroscopy (XPS) and angle-resolved hard X-ray photoelectron spectroscopy (HAXPES)

Kazuhiko Mase(The Graduate University for Advanced Studies, SOKENDAI, Institute of Materials Structure Science).
Keisuke Yoshida, Shinya Ohno(Yokohama National University), takashi kikuchi(High Energy Accelerator Research Organization), Kenichi Ozawa(The Graduate University for Advanced Studies, SOKENDAI, Institute of Materials Structure Science, Institute of Materials Structure Science; The Graduate University for Advanced Studies, SOKENDAI), Yasumasa Takagi(SPring-8 (Japan)), Takuhiro Kakiuchi(Ehime University).

Recently we found that the surface partially nitrided high-purity Ti deposited film can be activated as a nonevaporable getter (NEG) by heating at 185 °C. In this study, we investigated the activation mechanism of surface partially nitrided high-purity Ti by using soft X-ray photoelectron spectroscopy (XPS) and angle resolved Hard X-ray Photoelectron Spectroscopy (HAXPES). Both XPS and HAXPES measurements show that most of the surface oxygen atoms diffuse into the Ti bulk by heating at 470 °C. Based on these results we proposed the following activation mechanism for the surface partially nitrided high-purity Ti film. When heated at 185 °C, oxygen atoms in the vicinity of the surface nitrogen atoms diffuse into the Ti bulk, creating a narrow path of oxygen deficiency sites along the diffusion route of the oxygen atoms. When returning to room temperature, hydrogen gas is slightly pumped through this oxygen deficiency path. When heated at 450 °C, most of the surface oxygen atoms diffuse into the Ti bulk, exposing a large area of metallic Ti on the surface. When returning to room temperature, it starts to pump reactive residual gases with high pumping speeds.

| THP02 |

Advanced figure control scheme for piezoelectric deformable mirror

Baoning Sun(Dalian Institute of Chemical Physics).
Chuan Yang, Kai Hu, Qinming Li, Zhongmin Xu(Institute of Advanced Science Facilities, Shenzhen), Xiaohao Dong(Shanghai Advanced Research Institute), Weiqing Zhang, Xueming Yang(Dalian Institute of Chemical Physics).

Mirrors in beamlines exhibit various imperfections such as polishing defects, gravity-induced sag, clamping strain, misalignment, vacuum force distortions and heat-load-induced thermal deformations. These imperfections introduce aberrations including beam broadening, diffraction, defocusing and wavefront distortions, thus challenging the beamline's performance. To address these issues, considerable efforts have focused on active and adaptive optics. Piezoelectric deformable mirrors offer an effective approach for surface shape control, wavefront aberration correction, and focus adjustment. To fully exploit their potential, finite element simulation of thermal–piezoelectric–mechanical behavior and precise shape control algorithms under voltage constraints are essential. This study presents an advanced figure control scheme to enable direct simulation and resolve the inverse problem of shape control. The corrected surfaces achieve sub-nanometer RMS errors and fulfill diffraction-limited requirements with strong adaptability. The method could apply to various active and adaptive optics, with potential for generalization in free-electron laser and synchrotron radiation beamlines.

| THP06 |

An ultra-stable, 3-axis goniometer for precise angular positioning for optical

metrology of X-ray mirrors

Simon Alcock(Diamond Light Source).
Adam Howell, Alessandro Evangelista, Andrew Male, Geoff Preece, Ioana-Theodora Nistea, Jon Kelly, Nicolas Rubies(Diamond Light Source).

Deterministic polishing requires optical metrology instruments capable of accurately measuring X-ray mirrors with slope errors < 50 nrad rms. To improve the performance of the Diamond-NOM slope profiler , we have developed an ultra-stable, 3-axis rotation stage to orient the mirror under test. The goniometer employs a spherical air-bearing, actuated by three piezo-walkers via flexure struts. This provides high stiffness, zero friction, and minimal parasitic errors. Linear interferometers provide positional feedback to the piezo actuators for fast, closed-loop control of 3D angles. Temperature controllers and forced air stabilisation minimise thermal drifts. FEA and dynamic modelling optimised all components via mechatronic principles. The goniometer can accommodate X-ray mirrors up to 500 mm long and 10 kg in mass. It has an angular range of ± 10 mrad in 3 orthogonal directions, a minimal incremental step of < 100 nrad, and thermal drift of ~ 100 nrad over 30 minutes. Shielding of heat sources reduces air turbulence for probing autocollimators or laser beams. The system is controllable via EPICS to enables dynamical synchronisation with other motion stages and detectors.

| THP07 |

Application of AI intelligent control in utility systems

Zong-Da Tsai(National Synchrotron Radiation Research Center).
Chih-Sheng Chen(National Synchrotron Radiation Research Center).

At the Taiwan Photon Source (TPS), several studies on energy savings and utility system optimization are currently underway, with AI solutions being actively explored for laboratory applications. The proper operation of the cooling tower and chilled water system plays a crucial role in energy conservation. Through AI-based analysis, we can clearly observe the impact of ambient wet-bulb temperature on system energy consumption. Furthermore, system efficiency is enhanced by optimizing temperature setpoints, controlling pump flow, and managing the on/off scheduling or frequency modulation of facility operations. In this study, a model is constructed to verify the practical impact on energy consumption. The analysis demonstrates that these mechanisms can effectively improve overall energy performance.

| THP08 |

As-build process for accelerator, target and neutron scattering systems at European Spallation Source

Antoine Lepine(European Spallation Source ERIC, European Spallation Source).

As the European Spallation Source (ESS) advances through construction and commissioning in Lund, Sweden, it is crucial to evaluate the status of each system and ensure that 3D models and 2D drawings accurately represent on-site conditions. The as-built process for mechanical systems is fundamental in maintaining accuracy, ensuring compliance, and reducing risks while easing future maintenance. Achieving this requires strong collaboration between project management, design, engineering, and installation teams to track modifications, resolve discrepancies, and systematically document

changes. Data from 3D scans, manufacturer documentation, NCRs, and project records are utilized to compare the built structures with the original designs. This contribution outlines the as-built process, its key stakeholders, and their roles at different project stages. Additionally, it presents a proof of concept showcasing the benefits and challenges of its implementation at ESS.

| THP09 |

A vibration control method for linear accelerator

Zhidi Lei(Shanghai Advanced Research Institute, Chinese Academy of Sciences).

Fei Gao(Shanghai Synchrotron Radiation Facility), Haixiao Deng(Shanghai Institute of Applied Physics), Lixin Yin(Shanghai Advanced Research Institute), Rongbing Deng, Yiyong Liu, Zhiqiang Jiang, tingting Zhen(Shanghai Advanced Research Institute, Chinese Academy of Sciences).

The beam orbit or effective emittance is correlated with the mechanical vibrations of quadrupole magnets. To mitigate the impact of vibrations on beam orbit stability, active vibration isolation platforms can be employed to enhance the stability of magnets and other components. This paper presents an active vibration isolation system based on the inverse piezoelectric effect, combined with a feedforward control algorithm to improve the positional stability of the magnets. This vibration isolation system has been deployed in batches in the SHINE project. Test results demonstrate that the active vibration isolation system achieves over 50% displacement attenuation, facilitating beam tuning and indicating that this control strategy holds significant potential for broader application in linear accelerator construction.

| THP10 |

Beam-induced heating on the sector gate valve in the SPring-8-II storage ring

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SPring-8-II is an upgrade project toward the 4th generation synchrotron light source to provide hard X-ray with nearly two-orders of magnitude higher brilliance than the current SPring-8. Low electron beam emittance less than 100 pm・rad for the high brilliance requires high gradient multi-pole magnets with a small bore radius and vacuum chambers with a narrow aperture. The SPring-8-II vacuum ducts passing through electron beam have a rhombic cross-section with a small dimension of 26.16 mm between opposing inner surfaces. Strong beam wake field due to the narrow aperture increases vacuum chamber heating, so its evaluation and countermeasures are an important issue. In particular, the heating of the sector gate valve (SGV) with RF shield structure inside, which requires high reliability, should be evaluated, and measures such as water cooling should be taken if necessary. In this presentation, we report the results of simulations using the Finite Element Analysis (FEA) code ANSYS to evaluate temperature rising at the SGV for SPring-8-II due to beam-induced heating and to determine whether forced cooling is necessary.

| THP11 |

Becoming a synchrotron designer; experiences, challenges, and teachings.

Owen Harding(Diamond Light Source).
Callum Tetrault(Diamond Light Source).

I am early in my career designing synchrotron systems within high vacuum (HV) and ultra-high vacuum (UHV) conditions, joining the Diamond Light Source around a year ago. Since starting I've been working on SWIFT (Spectroscopy WithIn Fast Timescales), one of the Diamond-II flagship beamlines. To get up to speed I needed to rapidly become accustomed to the unique features and challenges surrounding designing for HV & UHV. These challenges tested my understanding of physics, mechanics, electromagnetism, and control systems. While training provides a strong basis of understanding, getting involved and interacting with colleagues frequently provides a stronger grasp on how these technical problems should be approached. My findings summarise my recommendations I have for fellow engineers new to this sector. With this advice I hope to help clear the path toward future technical prowess and personal development for others in this industry.

| THP12 |

Can stepper motors replace the piezos in a high-resolution monochromator?

Frank-Uwe Dill(Deutsches Elektronen-Synchrotron DESY).

The IXS High Resolution Monochromator (HRM) on the Petra III Beamline P01 is used for the medium X-ray range from 2.5keV to 3.5keV. The core piece is a disk that carries the crystals. An encoder ring is attached to the circumference. A radial and axial runout of less than 1µm during rotation of maximum +-20° is ensured by a high-precision spindle bearing. Rotation is performed by a PiezoLEG with a 110 mm long ceramic rod, which is coupled to the disk and offers an angular resolution of 100nrad at best. The HRM has been in operation since mid-2017 with four independent superstructures - two for the inline arrangement, two for the nested arrangement. Unfortunately, the PiezoLEGs stop from time to time because cold welding occurs between the piezo legs and the ceramic rod in a high vacuum, which is probably due to the very long ceramic rods and the imperfect coupling to the structure. As the currently required angular resolution is 1700nrad +-500nrad, the idea arose to replace the PiezoLEGs with a pusher, driven by a stepper motor. Initial tests with a commercially available pusher show promising results in closed-loop operation.

| THP13 |

Characterization and damping control of mechanical connections to improve performance of horn stripline

Zunping Liu(Fermi National Accelerator Laboratory).
Adrian Orea, Bill Paley, Yun He(Fermi National Accelerator Laboratory).

Magnetic focusing horns are critical components for creating a stable beam of neutrinos for neutrino facilities, such as the Long Baseline Neutrino Facility (LBNF) at Fermilab. The pulsed magnetic horns are powered by high current electricity through long striplines, which must survive in a harsh radiation environment for the operational life of the component. Each stripline assembly consists of four layers of Al 6101-T6. As an electromechanical system, the stripline layers are bolted together with ceramic isolators for electrical insulation and to facilitate passive cooling and mechanical stability. The striplines experience vibrational force in addition to clamping force, repetitive thermal and electro-magnetic loading. The holes of stripline plates for ceramic joints represent one of the weak links for potential failure. By characterizing the behavior of these joints and optimizing their damping properties through finite element analysis and experimental modal analysis, stripline performance and longevity can be improved. This study not only helps predict the behavior of the striplines but also improves their performance to meet the required operational lifetime.

| THP14 |

Commissioning of the APS-Upgrade storage ring vacuum system

Jason Carter(Argonne National Laboratory).
Tim Clute(Advanced Photon Source).

The APS-Upgrade Project (APS-U) built a new electron 1100 meter circumference storage ring within the original APS tunnel. APS-U's new storage ring vacuum system is a complex assembly of over 2500 custom vacuum chambers. The vacuum pumping system is a hybrid combination of NEG-coated vacuum chambers, ion pumps, and uncoated chambers with NEG strip pumping. APS-U began operations in April 2024 and by early 2025 has successfully commissioned the vacuum system to achieve low UHV operating pressures which helped the machine reach key performance parameters and allows for reliable delivery of beam to the users with minimal downtime. The commissioning performance of the machine indicates the NEG coated chambers are performing reliably even with a relatively minimal bakeout and activation. This presentation will share results and analysis of the vacuum system commissioning and performance along with lessons learned from the installation and operations phases.

| THP15 |

Comparison of FEA simulations and experimental data for a new germanium detector for X-ray spectroscopy at synchrotron facilities

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As part of the European LEAPS-INNOV project, a new generation of high-purity germanium detectors has been developed for synchrotron applications requiring spectroscopic capabilities. This novel design focuses on the development of monolithic multi-element Germanium detectors for X-ray Absorption Fine Structure (XAFS) and X-ray Fluorescence Spectroscopy (XRF) applications. This article presents the thermo-mechanical simulation results of the final detector prototype, based on Finite Element Analysis (FEA). These results are compared with the first experimental data obtained in the laboratory. Numerical calculations were carried out using ANSYS software, simulating combined thermal and mechanical effects under cryogenic and vacuum conditions. The numerical studies presented here represent an extension and update of previous work conducted during the development of this project.

| THP16 |

ConFlat® vacuum flange application and analysis in various non-circular flange geometries

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Andrew Kudler, Hannah Brodsky(National Synchrotron Light Source II), Paul Palecek, Robert Todd(Brookhaven National Laboratory).

The National Synchrotron Light Source II (NSLS-II) facility at Brookhaven National Laboratory uses an ultra-high vacuum (UHV) system to operate, which typically uses circular ConFlat (CF) flanges to connect vacuum components together. With varying equipment design restrictions, the implementation of non-circular CF flanges is being studied as a possible alternative, as it has been used in other accelerators. Here, an analysis of noncircular CF flanges was conducted to identify sealing problems associated with such flanges, particularly at the HEX beamline. Autodesk Inventor and ANSYS Workbench were used to create models and conduct finite element analysis (FEA) simulations, respectively. Parameters relating to the flange rigidity and geometry were performed to find problem areas. The results suggest that the geometry, combined with plastic deformation of the CF knife-edge and uneven pressure distribution, may contribute to the overall sealing failure.

| THP17 |

Corrosion-suppressed thermal interfaces with indium-gallium alloy for high-energy synchrotron beamline cooling

Dezhi Diao(Zhejiang Institute of Photoelectronics & Zhejiang Institute for Advanced Light Source).
Jie Chen, Qi Zhou, Xuewei Du(National Synchrotron Radiation Laboratory, University of Science and Technology of China, National Synchrotron Radiation Laboratory; University of Science and Technology of China), Shuaikang Jiang(National Synchrotron Radiation Laboratory, University of Science and Technology of China).

TIM (Thermal interface materials) is critical component for mitigating the thermal load from high-energy X-rays in beamline systems. This paper presents the effectiveness of anti-corrosion coatings in liquid metal gap cooling systems and their painting processes, demonstrating significant reductions in interface corrosion and gas entrapment at contact surfaces We developed an in-situ thermal resistance experimental setup, verifying that the contact thermal conductance exceeds 60,000 W/(m^2·K), which has less affect on cooling and thermal deformation. Tests on outgassing rates of anti-corrosion layer and InGa demonstrate compliance with stringent requirements for vacuum compatibility and fluidity. The development of these technologies will provide a

significant enhancement in the reliability of liquid metal-based cooling solutions for high-heat-load optical components.

| THP18 |

Designing a 3-axis delta robot capable of sub-nanometre stability for a synchrotron flagship beamline

Scott Beamish(Diamond Light Source).

Claudio Bovo, David Burn, David Tillin, Jon Kelly, Steve Davies(Diamond Light Source).

Understanding the structure of quantum materials is essential for unlocking the next generation of low-cost, energy-efficient devices. To achieve this, a state-of-the-art Coherent Soft X-ray Imaging and Diffraction (CSXID) beamline is currently under development at Diamond Light Source. At the heart of the end station will be a three-axis delta robot capable of manipulating samples with sub-nanometre RMS stability at cryogenic temperatures. This work presents the mechatronics process applied to design this delta robot, from initial concepts to a manufacturable assembly and a fully simulated closed-loop control system. The results demonstrate the power of the mechatronics process to accurately predict system performance and enable a right-first-time approach.

| THP19 |

Determination of a reliable metrology method to characterize a sphere of confusion in the hundred of nanometer range

Aymeric CUNRATH(IRELEC, Alcen (France)).

Nicolas Foos, Raphael RICHAUD(IRELEC).

We designed a new diffractometer with the willing to establish new standards for the exactitude and speed. This goal drove us to implement, as main rotation stage, an air bearing rotating up to 1000°/s with a sphere of confusion of the hundred of nanometer range. Achieving such performance requires not only cutting-edge technical development and manufacturing of the device itself, but also the proper metrology set-up to control the performance of the rotational stage. The exactitude to reach made us questioning the metrology procedure used for rotation stages. As a result, our work has aimed to establish robust procedure applicable when high precision rotation stage is involved such as in diffractometer for X-ray or neutron diffraction (powder or crystal) or the the trending nano-tomography or nano X-ray imaging. We will present our results for three different methods. We established one method using the embedded high resolution viewing device (on-axis camera) in visible light (possible daily use) that we compared with two others, one using capacitive sensors and one relying on interferometry to get the most accurate metrology.

| THP20 |

Environmental vibration characterization and spectral analysis of ground motion sources at the SHINE facility

Fang Liu(ShanghaiTech University).

Hao Ding, Nuo Chen, Wei Li, Xinsheng Li(ShanghaiTech University), Limin Zhang, Rongbing Deng, Yiyong Liu(Shanghai Advanced Research Institute), Zhidi Lei(ShanghaiTech University, Shanghai Advanced Research Institute).

The Shanghai High Repetition Rate XFEL and Extreme Light Facility (SHINE), spanning 3.1 kilometers in length, faces unique environmental vibration challenges due to its proximity to multiple urban vibration sources. SHINE's operational environment is characterized by adjacent rivers, metro lines, and elevated roadways that collectively generate elevated ground vibration levels. This study systematically investigates the civil engineering vibration sources affecting SHINE through comprehensive measurements of environmental excitations, including river boats, metro operations, heavy-duty truck movement, and HVAC systems within the experimental hall. Our analysis reveals distinct spectral characteristics in the vibrations induced by HVAC systems and maritime traffic, exhibiting prominent frequency-specific signatures. In contrast, ground vibrations from heavy trucks and metro operations demonstrate broadband excitation patterns, significantly impacting a wider frequency range from 10 Hz to 100 Hz. The quantified vibration spectra provide critical input for developing targeted vibration mitigation strategies essential for maintaining the facility's operational stability and precision.

| THP21 |

From 80 nrad to 35 nrad: active damping control achieves sub-50-nrad stability in SHINE's beamline mirror system

Fang Liu(ShanghaiTech University).
Haoran Yuan, Nuo Chen, Shjing He, Wei Li(ShanghaiTech University).

The Shanghai High Repetition Rate XFEL and Extreme Light Facility (SHINE) extends over 3.1 kilometers in length. Its surrounding environment – including rivers, metro lines, and elevated roadways – results in significantly stronger ground vibrations compared to similar facilities worldwide. To investigate the correlation between ground vibrations and angular vibrations induced on optical components, as well as evaluate system performance under site-specific vibration conditions, a prototype mirror chamber system was constructed and the methods for angular vibration measurement were developed. Through theoretical calculations and experimental verification, the transfer function from ground vibrations to mirror vibrations was determined. Measurements revealed angular vibrations of approximately 45 nrad in the experimental hall and 80 nrad in the beamline transportation tunnel during daytime operations. To enhance mirror stability, an active damping control system was implemented. This intervention successfully reduced angular vibrations in the beamline tunnel from 80 nrad to 35 nrad under daytime conditions, demonstrating significant improvement in vibration suppression.

| THP22 |

Evaluation of 3D-printed plastics for ultra-high vacuum applications: Outgassing, and residual gas analysis

Artur Domingues(MAX IV Laboratory).
Ana Martinez Carboneres, Stefan Carlson(MAX IV Laboratory).

The demand for cost- and time-effective and customizable components for High Vaccum (HV) and Ultra-High Vacuum (UHV) has prompted exploration into the application of 3D-printing technology. This study investigates the viability of utilizing 3D-printed plastics in UHV by evaluating their outgassing properties. An extensive evaluation of 3D-printing materials was carried out, highlighting the best polymer candidates using two of the most common 3D-printing techniques, Fused Deposition Modelling and Stereolithography. Further experimental investigations were conducted to assess the selected 3D-printed plastics under UHV, focusing on their low outgassing and resistance to baking temperatures. Furthermore, residual gas analysis was used to evaluate the possible presence of contaminants. The findings suggest that certain 3D-printed plastics exhibit promising characteristics for use in HV and UHV systems, with notable examples including COC and PEEK along with Rigid 10K and Tullomer™. A comparison between machined and 3D-printed parts demonstrated that challenges such as porosity and surface roughness showed not to be a cause of great concern.

| THP23 |

Experimental characterization of rail-to-carriage dynamic stiffness in linear guides

Gabor Felcsuti(MAX IV Laboratory).

Linear guides are common components in precision motion systems, and their stiffness significantly influences the eigenfrequencies of structures used in synchrotron research. However, no generally accepted or validated guideline exists for including them in finite element models. This study employs an indirect method to experimentally determine their dynamic stiffness, avoiding the complications associated with direct measurement of high-rigidity components. Simple structures with well-known dynamic behavior are connected to a linear guide, and frequency response measurements are performed to determine frequency-dependent stiffness and damping factors. Further conclusions are drawn regarding the stiffness values provided in vendor catalogues, offering practical guidance for the design of synchrotron equipment.

| THP24 |

Experimental evaluation of vibrational sensitivity in the Veritas spectrometer arm

Gabor Felcsuti(MAX IV Laboratory).
Peter Sjöblom(MAX IV Laboratory).

We present a vibration study of the ten-meter-long Rowland spectrometer arm at the VERITAS beamline at MAX IV, aiming to assess how mechanical vibrations influence experimental quality. Using the width of the spectral peak recorded by the DLD8080 detector from Surface Concept as a quality metric, we introduced vibrations to the spectrometer structure and correlated the resulting rotational amplitudes of the grating to the detector readout. This approach allowed us to directly evaluate the influence of mechanical disturbances on energy resolution. By focusing on the detector output rather than vibration levels alone, we gained insight into the relative significance of vibrations compared to the cumulative effect of all other noise sources (detector electronics, optical imperfections, etc.), providing practical guidance for beamline scientists to improve their instrumentation.

| THP25 |

Experimental modal analysis, model correlation, and tuning for synchrotron storage rings applications

Ryan Johnson(Lawrence Berkeley National Laboratory).
Arnaud Allézy(Lawrence Berkeley National Laboratory).

The ALS-U project will deliver a beam 100x brighter than the existing ALS beam. In order to achieve this, the RMS displacement levels above 10 Hz for all magnets in a sector of the storage ring, shall be < 200 nm along the electron beam direction and < 35 nm in both transverse directions. A prototype storage ring raft was built to undergo vibration measurements and inform on the expected performance of the production rafts. This paper details the approach chosen to tune the prototype FEA model using specific measurements. First, the modal behavior of the model was tuned using multiple impact multiple output hammer measurements. Through the iterative updating of selective spring constant parameters representing the stiffness of the storage ring supports, the mode frequency, shape and damping coefficient were then determined to closely match the experimental results. Random vibration FEA predicted levels at the magnets were validated with measured magnet motion on the prototype raft. With the validated modeling and updated parameters, the production raft types are predicted to meet the displacement level requirements.

| THP26 |

In-situ vibration measurements for evaluating impact of low conductivity water induced vibrations on Advanced Light Source upgrade (ALS-U) accumulator ring magnets and electron beam positioning monitors

Ryan Johnson(Lawrence Berkeley National Laboratory).
Arnaud Allézy, Dima Zaytsev(Lawrence Berkeley National Laboratory).

Maximum vibration limit for the magnets of the accumulator ring (AR) for the Advanced Light Source upgrade (ALS-U) project is <1 um in the transverse direction (X), <0.2 um in vertical (Y), and < 1 um in beamline (Z). For the beam position monitors (BPM), it is <140 nm in X, Y and Z. Since the ALS-U project is reusing the existing tunnel for the new AR and storage ring, a combination of floor mounted and wall mounted AR supports stands are used with first natural frequency below 20 Hz, (possibly) rendering them sensitive to flow induced vibration. Significant FEA modelling was done to estimate preliminary vibration levels, though it was challenging to model flow induced vibration, necessitating measurements. The AR is now installed in the current ALS storage ring tunnel, in order to be commissioned early, while the current ALS storage ring is operating. As part of the installation, low conductivity water flows to all the magnets and beam position monitors. A 2 week measurement campaign was set up to leave accelerometers on the AR magnets and BPM's in the tunnel while the current ALS storage ring is running. Results were compared to the FEA predictions and to the requirements.

| THP27 |

Extended travel range and parallel-decoupled compliant positioning mechanism for medium energy resolution monochromator at HEPS

Lu Zhang(Institute of High Energy Physics, Chinese Academy of Sciences).
Hao Liang, Ming Li, Wei Xu, Weifan Sheng, Xiaobao Deng, Yang Yang, Yunsheng Zhang(Institute of High Energy Physics, Chinese Academy of Sciences, Institute of High Energy Physics; Chinese Academy of Sciences).

We developed a novel medium energy resolution monochromator(MRM) for Resonant Inelastic X-ray Scattering (RIXS) experiments at the High Energy Photon Source (HEPS) featuring an integrated flexible high-precision positioning system that surpasses conventional designs. Our rotation platform delivers unprecedented performance with a travel range of hundreds of milliradians—three times greater than existing systems—while maintaining sub-microradian precision, with potential for nano-radian resolution if an additional simple configuration is developed. The breakthrough innovation is our two-axis rotation mechanism using parallel decoupled architecture that uniquely combines structural rigidity with precise motion control, solving the longstanding challenge of spatial motion decoupling while enhancing stability. Rigorous simulation and testing confirm all performance metrics exceed design targets. This technology not only meets the exacting requirements for monochromators but extends high-precision capabilities in high-vacuum environments, with our parallel decoupling principle offering transformative potential across multiple precision engineering applications.

| THP28 |

FE-Analyses as the key to successful high-temperature brazing of complex components

Martin Lemke(Deutsches Elektronen-Synchrotron DESY).
Silke Vilcins(Deutsches Elektronen-Synchrotron DESY).

Alongside welding, high-temperature vacuum brazing is one of the most frequently used joining processes. At the Deutsches Elektronen Synchrotron (DESY) we have a well-equipped workshop area with vacuum brazing furnaces. Several components for beampipe parts, high-frequency components or diagnostic components made from a wide range of materials have been brazed there, sometimes for an ultra-high vacuum application. Unfortunately, it also happens that these components are defective after brazing. And the cause is often very difficult to find. As in this example the component is made of high-alloy stainless steel. A brazed component has already been successfully manufactured in series. For use case a modification has been made. A small series of six pieces was produced and brazed at DESY. This report describes the research into the causes by using FE-Analyses. We present FE-Analyses as a very powerful tool for detecting errors early on in the design process that could potentially lead to the component being rejected. All results will be presented. On top practical tips for vacuum brazing will be given.

| THP29 |

FEA simulations for the reuse of front-end components for PETRA IV

Jörn Seltmann(Deutsches Elektronen-Synchrotron DESY).
Hilmar Bienert(Deutsches Elektronen-Synchrotron DESY).

The DESY upgrade project PETRA IV includes a major change of design parameters for all components in the ring as well as in the beamlines. Especially the white beam high heat load components currently in use in PETRA III have to be evaluated for their reusability. A case study of a front-end power slit is presented in this paper to show the necessary steps. From given ring and undulator parameters the heat load profiles are calculated. They are imported into ANSYS Workbench using a method to apply heat flux even on freeform surfaces. The FEA model then allows to evaluate cooling water parameters as well as temperatures, deformations and von Mises stresses for all components.

| THP30 |

Final design stage completed: SX-700 successor ready for production

Frank Eggenstein(Helmholtz-Zentrum Berlin für Materialien und Energie).
Christian Weniger, Jens Viefhaus, Lisa Schwarz, Peter Baumgärtel, Stefan Hendel, Thomas Zeschke(Helmholtz-Zentrum Berlin für Materialien und Energie).

The 40-year-old SX700 monochromators are being replaced due to missing spare parts. The new monochromator reuses the existing synchrotron optics, reducing both integration effort and system costs. A key challenge was the eccentric motion of the 650 mm, 7 kg pre-mirror. A novel UHV-precision drive combining a planetary roller screw and torque motor was developed to provide high thrust and precision up to 1 degree/s over a 27 degree range. This doubles the angular range of the original SX700 and enabling fast XUV energy scans. A new stepper-driven grating revolver alternates between two gratings. Absolute angle encoders, developed as RON905 replacements, provide 0.02 arcsec precision for both mirror and grating axes. A specially designed tilted UHV chamber fits the space constraints while maintaining a compact overall structure. Infrared monochromatizating and optical alignment via visible light diffraction with geodetic instruments are possible. After successful drive tests, the full design is finalized, and the first Prototype is ready for production. This poster presents the final design and compares its performance to modern monochromators.

| THP31 |

Fully NEG-coated vacuum system design for the storage ring of Iranian Light Source Facility

Hossein Karimi(Iranian Light Source Facility).

The Iranian Light Source Facility (ILSF) is a 4th-generation synchrotron radiation facility currently in the design phase, featuring a storage ring with a circumference of 528 meters. The lattice of the 3GeV storage ring is based on a compact multi-bend achromat (MBA) lattice and has a nominal horizontal emittance equal to 270 pm.rad. The vacuum system for the ILSF storage ring is designed with Non-Evaporable Getter (NEG)-coated vacuum chambers to ensure optimal performance. These chambers are constructed from copper tubes with an inner diameter of 26 mm and a wall thickness of 1 mm. To manage the heat generated by synchrotron radiation, a water-cooled copper pipe with an inner diameter of 3.18 mm is integrated into the vacuum chambers. The total coated surface area in one super period of ILSF is about 2.45 m^2, while the surface area of the uncoated parts, primarily connections for ion pumps, is about 0.16 m^2 (6% of the total surface area). Based on the pressure profile simulations, only 6 ion pumps with 20 l/s pumping speed will be sufficient to provide the desired pressure along one super period of ILSF (26.4 m length).

| THP32 |

Heat load study of insertion devices for the Iranian Light Source Facility

Hossein Karimi(Iranian Light Source Facility).

The parameters for seven insertion devices (IDs) have been determined for the Iranian Light Source Facility (ILSF). To calculate the heat load on the vacuum chambers, the power irradiated from the IDs is simulated using Synrad. Analytical formulas are also

employed to verify the Synrad results and optimize the mesh size. Simulations reveal that the most severe case occurs when the Solid-State Electron Spectroscopy Beamline (ESCA) operates in vertical polarization mode. In this mode, ESCA generates a total power of 7.14 kW at a beam current of 400 mA, with the majority of the power being absorbed by the first dipole vacuum chamber and the adjacent pumping port. Specifically, 4.4 kW of synchrotron radiation power is deposited over a 20 cm length of the first dipole chamber. Consequently, thermal and mechanical simulations are performed using ANSYS to calculate the maximum temperature and assess the thermal stresses on these vacuum components.

| THP33 |

Vacuum system design for the booster of Iranian Light Source Facility

Hossein Karimi(Iranian Light Source Facility).

The Iranian Light Source Facility (ILSF) booster serves as a 3 GeV injector for the ILSF storage ring. The booster ring has a circumference of 504 meters, divided into five equal sections. Each section comprises ten dipole magnets, each 1300 mm in length, designed to deflect the electron beam by 7.2° per magnet. The distance between two successive bending magnets is 8780mm. The vacuum chambers are fabricated from 1 mm thick stainless steel 316L tubes. This material and thickness were carefully selected to minimize eddy current effects at the 2 Hz repetition rate caused by the rapidly changing magnetic fields. For all magnets except the dipoles, the vacuum chambers have an outer diameter of 35 mm, with a minimum clearance of 1.5 mm maintained between the chambers and the magnet poles. In the dipole regions, the vacuum chamber diameter is reduced to 20 mm, with a clearance of 2 mm to accommodate the tighter magnetic gap. A Monte Carlo simulation is performed using Molflow and Synrad to calculate the pressure profile along the booster. According to the result, 250 Starcell ion pumps with 20 l/s pumping speed will be required to provide the desired pressure at ultra-high vacuum regime.

| THP34 |

High heat load annealed pyrolytic graphite filter for the material science beamline at SESAME

Mohammad AL-Najdawi(Synchrotron-Light for Experimental Science and Applications in the Middle East).

The Materials Science Beamline has historically relied on a rotating filter system for beam attenuation, which introduced mechanical complexity, risk of failure, thermal instabilities, and high outgassing during conditioning. To address these limitations, we have developed a new fixed filter assembly using annealed pyrolytic graphite, chosen for its excellent thermal conductivity and low outgassing characteristics. By eliminating moving parts, the fixed filter improves mechanical stability and reduces operational interruptions. A comprehensive Finite Element Analysis (FEA) was conducted to evaluate the thermal and structural performance of the filter under both nominal and worst-case beam power densities. The results show that the design maintains acceptable thermal gradients and mechanical stresses, ensuring long-term structural integrity and minimal distortion. This work presents the design methodology, material selection criteria, FEA

simulation setup, and resulting performance data, demonstrating the viability of the fixed filter concept for high heat load applications.

| THP35 |

High-stability double multilayer monochromator with gravity-driven water cooling for the SDB beamline at HEPS

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Bingbing Zhang, Changrui Zhang, Ming Li, Shuaipeng Yue, Weifan Sheng, Xiaobao Deng, Yang Yang, Yuanshu Lu, Yunsheng Zhang, Zhen Hong(Institute of High Energy Physics, Chinese Academy of Sciences), Lu Zhang(Chinese Academy of Sciences, Institute of High Energy Physics, Chinese Academy of Sciences), Zheng Sun(Institute of High Energy Physics, Institute of High Energy Physics, Chinese Academy of Sciences).

Multilayer monochromators are commonly employed in photon hungry synchrotron beamlines to deliver intense, monochromatic X-ray beams. We present the design, validation, and beamline integration of a high-stability, high energy (20-70keV) double multilayer monochromator developed for the Structural Dynamics Beamline (SDB) at HEPS. The system features a novel flexure-based architecture, optimized via finite element analysis (FEA), to significantly enhance stiffness, particularly in the roll direction of the Bragg axis. A monolithic flexure mechanism is employed for pitch and gap adjustment of the second multilayer, improving mechanical integrity and stability. A special gravity-driven water cooling system, coupled with a unique indium-gallium interface for clamping and thermal contact, was developed to suppress vibrational disturbances. FEA simulations and experimental validation confirmed a clamping-induced deformation below 69 nrad RMS. A vibration level as low as 5 nrad under cooling was measured by laser interferometry. The system has been successfully installed and tested with synchrotron beam, meeting requirements of the beamline.

| THP36 |

Improvement of structural dynamic stability experimental assessment: principle and actual performance of advanced methods

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When assessing the stability performance of structures, two figures of merits are required: ground motion transmissibility and mechanical compliance. The former quantifies amplification ofground transmitted vibrations, and the second the displacement induced by on-board disturbance sources. Both must remain sufficiently low to keep structural response within stability requirements. In practice, a direct measurement of these quantities is preferred, since it allows to characterize the structure in real conditions. Still, this method requires the use of specific sensors, which is not always feasible due to practical limitations. Less-than-ideal excitation is also to be expected. As a consequence, actual measurements most often suffer noise contamination. In this article, the authors share their experience with using one promising methods -the so-called PRANK approach- combining both space and

frequency Truncated Singular Values Decomposition (TSVD) with Hankel reduction. The method is applied on both transmissibility and compliance quantities, as obtained on one of the key elements for the SOLEIL II project: multipole magnets installed on the girder.

| THP37 |

In-situ characterization thermal contact variations between InGa and anti-corrosion layer for beamline thermal management

Jie Chen(National Synchrotron Radiation Laboratory, University of Science and Technology of China, National Synchrotron Radiation Laboratory; University of Science and Technology of China).
Dezhi Diao(Zhejiang Institute of Photoelectronics & Zhejiang Institute for Advanced Light Source), Qi Zhou, Shen Wei, Xuewei Du(National Synchrotron Radiation Laboratory, University of Science and Technology of China, National Synchrotron Radiation Laboratory; University of Science and Technology of China), Shuaikang Jiang(National Synchrotron Radiation Laboratory, University of Science and Technology of China).

Liquid metals as thermal interface materials (TIMs) offer ultrahigh contact thermal conductance while their inherent compliance eliminates clamping stress-induced deformation in optical components, such as InGa bath or InGa gap cooling. However, their corrosivity toward metals (e.g., Cu, Al) necessitates protective coatings such as high-phosphorus electroless nickel (Ni-P), though minor corrosion persists during prolonged baking operation. To investigate the correlation between corrosion behavior and baking conditions (80~150 ℃/14 days), we developed an in situ measurement system for liquid metal thermal contact conductance. The setup employs a square-waved heating excitation method to monitor transient temperature responses (peak values, PV), coupled with finite element modeling, to quantify interfacial thermal conductance degradation. This work provides critical insights into thermochemical reliability for liquid metal cooling solutions in high-heat-load synchrotron optics.

| THP38 |

Mechanical design and analysis for a DMM at the EMBL@PETRA III beamline P14

Enrique Rodriguez Garcia(European Molecular Biology Laboratory).
Stefan Fiedler(European Molecular Biology Laboratory).

Development is underway for a Double Multilayer Monochromator (DMM) at the EMBL beamline P14 at PETRA III (DESY). This beamline focuses on macromolecular crystallography (MX) and biological imaging. It is planned to operate this DMM alternately with the existing Double Crystal Monochromator (DCM). Due to its larger bandwidth, the DMM is expected to increase flux by nearly two orders of magnitude, significantly extending the accessible time domain for time-resolved X-ray crystallography into the microsecond range. Maintaining the stability and performance of the DMM's precision optics and mechanics requires a robust housing. A custom vacuum chamber has been engineered to provide exceptional stability and minimal deformation under operational and vacuum loads. Both the DMM substrates and the vacuum chamber design were rigorously analysed using Finite Element Analysis (FEA). This comprehensive analysis characterised and optimised stress and displacement distributions, ensuring the

necessary stability for the DMM's sensitive internal components.

| THP39 |

Mechanical design of a flexible bunch compressor for SHINE linac

Fei Gao(Shanghai Advanced Research Institute).

Rongbing Deng, Sen Sun, Shengwang Xiang, Tingting Zhen, Zhiqiang Jiang(Shanghai Advanced Research Institute).

The SHINE linear accelerator is designed to enhance the electron beam peak current to 1.5 kA at 100 pC through a two-stage bunch length compression process. The magnetic compression support platform (movable chicane) functions as a specialized electromechanically-controlled structure in the linear accelerator tunnel, serving to house critical components including fixed magnetic compression section magnets, vacuum systems, and beam diagnostics. The magnetic bunch compressor (BC) vacuum chamber consists of two side arms and a central section connected by flexible vacuum bellows. The central section, equipped with two middle dipoles on a movable frame, can shift vertically using servomotors (micrometer-scale control). This design allows adjusting the beam path from 0 mm to 328 mm displacement, equivalent to bending angles of 0° to 5°. These platforms are strategically implemented at both BC1 and BC2 positions within the linear accelerator lattice.

| THP40 |

Minimization of the heat-induced deformation in the switching mirror for the Elettra 2.0 nanoESCA/nanospectroscopy beamline

Giulio Scrimali(Elettra-Sincrotrone Trieste S.C.p.A.).

As part of the Elettra storage ring upgrade to 4th generation standards, the Nanospectroscopy/nanoESCA beamline is replacing its switching mirror. The new mirror is based on a 100 mm x 40 mm x 40 mm monocristalline silicon piece, optimized for the maximum heatload produced by the 25 eV horizontal polarity of the elliptical undulator serving the beamline (100.4 mm period, kx = 7.3). To minimize the deformations, a notched, top-side cooling design was chosen for the mirror, with an almost full-illumination of its top surface, in combination with slits downwards in the beam trajectory to select only the center portion of the reflected radiation. This paper presents the calculations and the optimization process of the mirror geometry. As a novelty, the contact length between the cooling circuit and the mirror was introduced as a parameter. This led to a cooling circuit shorter than the mirror length and to slightly higher temperatures in the mirror extremities, which proved to be beneficial for the reduction of the heatload-induced bump. Additional simulations confirmed that the optimized design performs equally well or better at higher photon energies.

| THP41 |

Nano-tomography instrumentation based on magnetically levitated 6 DoF actuation

Theo Ruijl(MI-Partners B.V.).

Bas van Aert, Martijn Princen, Ronald Schneider(MI-Partners B.V.), Javier Perez, Laura Munoz-Hernandez, Sébastien Ducourtieux, Yves-Marie Abiven(Synchrotron soleil).

The latest, 4th generation synchrotrons, offer nanometer-scale imaging resolution and fast data acquisition. However, corresponding existing sample manipulators mostly rely on quasistatic actuation principles and are built by stacking straightforward 1 DoF stages. This approach limits dynamics performance and precision. To address this challenge, MI-Partners developed on behalf of and in close collaboration with SOLEIL, a fully actively controlled 6-DoF sample manipulator based on electromagnetic actuation. This system enables fast scanning with nanometer precision, providing translational motions and continuous rotation, for full 360-degree angular tomography reconstructions. The demonstrator was realized as part of the LEAPS-INNOV project. This paper outlines the mechatronic design and development process to achieve first-time-right performance in high-end mechatronic systems. Finally, acceptance test results are presented, demonstrating nanometer-range tracking errors during high-speed 2D scanning modes (step-scan and fly-scan). The manipulator also revealed clear limitations in some commercially available fiber-based displacement interferometer systems.

| THP42 |

NSLS-II magnetron coating system and upgrade

Paul Palecek(Brookhaven National Laboratory).
Charles Hetzel, Robert Todd(Brookhaven National Laboratory), William Waldron(Lawrence Berkeley National Laboratory).

Subsequent to the commissioning of NSLSII, the Vacuum Group established a vertical magnetron coating facility to support continued NSLSII operations and research activities. Some of the early projects included titanium coating injection kicker ceramic chambers as well as NEG coating standard vacuum chambers. This coating facility was also used to apply copper-oxide coating to the APS-U Injection Strip-line Kickers to manage thermal loads. While these efforts proved successful, the coating system was upgraded with a moveable, higher field-strength water-cooled solenoid to allow small aperture coating of varying length. The upgraded facility was used to develop the titanium coating for the ALS-U injection kickers and will also be used to test small aperture NEG coatings for a potential upgrade to NSLSII. The coating system can now coat chambers up to 2m in length which will allow for photon stimulated desorption measurements here at NSLSII. The facility history and upgrade will be described in detail along with the results of the ALS-U coating effort.

| THP43 |

Numerical simulation and thermal optimization of a catalysis chamber for the MIRAS beamline at the ALBA synchrotron

Auxane Jacquet(École nationale supérieure de techniques avancées Bretagne).
*Antonio Carballedo Costa, **Barbara de Abreu Francisco**, Carles Colldelram, Ibraheem Yousef, Joan Casas, Marcos Quispe(ALBA Synchrotron (Spain)), Javier Zamarripa Lopez, Patricia Concepcion Heydorn(Universitat Politècnica de València).*

In the context of the development plan for the MIRAS beamline at the ALBA Synchrotron (Infrared Microspectroscopy Beamline), a dedicated experimental chamber has been designed for the study of catalytic reactions using synchrotron-based infrared spectroscopy. This chamber is designed to operate with a reactive gas mixture composed of O_2, H_2, CO, and an inert gas such as Ar, at pressures up to 20 bar, while maintaining sample temperatures between 480 °C and 500 °C. To meet these operational requirements, a study strategy based on numerical simulations has been defined. This work presents all the numerical details considered in the simulations. Computational fluid dynamics (CFD) analyses were performed using the ANSYS Workbench suite, incorporating turbulence modeling, vacuum boundary conditions, and combined forced and natural convection. Three design configurations were evaluated, followed by detailed parametric studies, including mesh sensitivity analysis and simulations under extreme thermal conditions. The final configuration meets all specified operational and thermal mechanical constraints, ensuring reliable performance under synchrotron operating conditions.

| THP44 |

Simulation approaches for magnet design in the ALBA II synchrotron upgrade

Barbara de Abreu Francisco(ALBA Synchrotron (Spain)).

Bo Zhang, Marcos Quispe, Pol Salmeron Roma, Valentí Massana Gràcia(ALBA Synchrotron (Spain)).

ALBA II, developed by ALBA CELLS (Barcelona, Spain), is a fourth-generation upgrade of the ALBA synchrotron. To achieve its targeted increase in photon beam brilliance and coherence, the new storage ring requires precise validation and optimization of its magnetic structures. The design includes six magnet families—bending, antibending, quadrupoles, sextupoles, octupoles, and correctors—totaling around 720 units, including electromagnets and permanent magnets. This work compares three simulation workflows for ALBA II magnets: ANSYS Maxwell – Magnetostatic (FEA), ANSYS Workbench – Magnetostatic (FEA), and Opera/RADIA. Each is used to predict field distribution, magnetic forces, and mechanical loads, and to provide boundary conditions for coupled thermo-structural analysis. We discuss the capabilities and limitations of each approach, focusing on meshing, solution time, post-processing, and CAD integration. Results are consistent across platforms, with key advantages: meshing speed (in-house tool), multiphysics coupling (Workbench), and batch processing (Maxwell). Uncertainties, cross-validation, and schedule impacts are also addressed.

| THP45 |

Parallel flexure-based RADSI instrument for curved X-ray mirror metrology

Lukas Lienhard(Brookhaven National Laboratory).

Corey Austin, David Coburn, Evgeny Nazaretski, Lei Huang, Mourad Idir, Steven Hulbert, Tianyi Wang, Weihe Xu(Brookhaven National Laboratory).

New high-resolution X-ray beamlines demand reflective optics with higher surface profile accuracy to achieve diffraction-limited focusing. This necessitates advanced metrology instruments capable of delivering repeatable measurements in the nanometer to sub-nanometer range. Slope ranges exceeding 15 mrad (0.86°) and greater pose significant challenges for mirror metrology using conventional interferometric methods especially on shorter mirrors with low radius of curvature (<20 m). To address this, we present a new Relative Angle Determinable Stitching Interferometry (RADSI) instrument featuring a parallel flexure-based mechanical design. This approach enhances vibration and thermal stability while maintaining a compact and lightweight system. Initial measurements of a cylindrical mirror with a 16 m radius of curvature and a slope range of 5 mrad demonstrate nanometer-level repeatability. Comprehensive system characterization suggests the potential for achieving sub-nanometer repeatability with further refinement to the instrument.

| THP47 |

Pumping station for UCV and UHV Components in the European XFEL cleanroom

Joshua Ohnesorge(European X-Ray Free-Electron Laser, European XFEL GmbH).
Janni Eidam, Martin Dommach(European X-Ray Free-Electron Laser, European XFEL GmbH).

The European XFEL (X-ray Free-Electron Laser) is a research facility that generates ultra-short X-ray flashes for scientific experiments across various fields. Operating at MHz repetition rates, it produces coherent femtosecond X-ray pulses with unprecedented brilliance in the energy range of 250 eV to 25 keV. The facility consists of a linear accelerator and three photon beamlines in underground tunnels. To protect the sensitive optical components, such as mirrors that guide the X-ray beam to the experimental stations, strict contamination control within the photon beamlines is essential. A cleanroom is therefore required to handle critical components, ensuring that all equipment near the mirrors remains particle-free. Many of these components must meet ultra-clean vacuum (UCV) and ultra-high vacuum (UHV) standards to prevent contamination. This poster presents a newly designed pumping station for cleanroom applications. It enables standard vacuum tests, including leak testing and residual gas analysis (RGA), while minimizing contamination risks. To maintain cleanroom integrity, the pumping station is housed in a separate technical room and features remote operation capabilities.

| THP49 |

Residual gas analysis in oxygen-free Pd/Ti deposited UHV chamber

Takashi Kikuchi(High Energy Accelerator Research Organization).
Daisuke Wakabayashi, Haruno Ishii, Hiroaki Nitani, Hirokazu Tanaka, Ryoma Kataoka, Takuji Ohigashi(High Energy Accelerator Research Organization), Kazuhiko Mase(High Energy Accelerator Research Organization, Institute of Materials Structure Science).

Recently we have developed a new NEG, oxygen-free Pd/Ti. The initial pumping speeds of the oxygen-free Pd/Ti thin film after baking at 150 °C were estimated to be 3.2 L s–1 cm–2 for H2 and 7.6 L s–1 cm–2 for CO at room temperature. The oxygen-free Pd/Ti deposition for vacuum chambers and components in soft X-ray beamlines of synchrotron radiation (SR) facility seems to be ideal because it can be partially activated by baking at 75 °C for 6 h , and its pumping speed does not decrease in the pressure region below 10–8 Pa. We applied oxygen-free Pd/Ti deposition for the first mirror (M1) test chamber of a soft X-ray branch in a new beamline BL-11 in the Photon Factory 2.5 GeV ring (Tsukuba, Japan). Then the mirror and mirror holder system were installed in the M1 test chamber. After pumping and baking at 90–110 °C for 52 hours, the pressure in the M1 test chamber reached 6.9 × 10–8 Pa. When the M1 test chamber was isolated from TMP the pressure was maintained at ca. 5 × 10–7 Pa. Analysis of residual gases in the oxygen-free Pd/Ti deposition M1 test chamber showed that amount of hydrocarbons were below detection limits and that major of the residual gas was H2.

| THP50 |

ROCK-IT: automated sample handling for operando catalysis at synchrotron beamlines

Shrouk Ehab(Deutsches Elektronen-Synchrotron DESY).

In the context of the ROCK-IT project, an automated sample handling system was developed at beamline P65 (DESY) to streamline in-situ and operando catalysis experiments. It uses a UR10e robotic arm with a RobotIQ 2F-85 gripper to handle catalyst samples in standardized holders, each identified via QR codes. Upon Tango control system initiation, the robot scans a 6-sample magazine, locates the next sample using a vision system and AruCo markers, and positions it at the measurement station. The sample is clamped with pneumatic cylinders, connected to gas lines, leak-tested, and heated. ROS2 is used as the main control framework to hide the robotics complexity, enable modularity, and allow scaling to other beamlines. It interfaces with Tango controls, triggered by the Bluesky plan, creating a seamless pipeline from experiment planning to execution. This setup improves safety, reproducibility, and enables remote operation and replication across other beamlines.

| THP51 |

Simulation study on the motion process of copper foil tensioning device in vacuum undulator

Hongcui Wang(Shanghai Advanced Research Institute).
Shudong Zhou, Wei Zhang, Ya Zhu(Shanghai Advanced Research Institute).

The copper foil tensioning device is installed at both ends of the magnetic array of the vacuum undulator. One end of the copper foil is connected with the vacuum cavity flange, and the other end is connected with the end face of the magnetic array, which can move three-dimensional with the magnetic array of the undulator. Among them, compression spring, volute spring and torsion spring are the most important parts of the device. Only reasonable spring design parameters can ensure that the device moves with the magnetic array. The elasticity and torque of the three kinds of springs are constantly changing in the process of movement. In this paper, the movement process of the three kinds of springs is simulated and analyzed to ensure that the copper foil will not be stuck or broken in the movement.

| THP52 |

Stability evaluation of a double crystal monochromator using an optical linear encoder

Masato Okui(Kohzu Precision Co., Ltd. (Japan), University of Hyogo, Kohzu Precision Co., Ltd. (Japan); University of Hyogo).
Atsushi Shimoguchi, Daiki Nagata, Naoki Yato(Kohzu Precision Co., Ltd. (Japan)), Hironobu Fukuzawa, Hiroyuki Yamane(Photon Science Innovation Center), Junya Yoshida(Tohoku University), Tetsuya Nakamura(Tohoku University; Photon Science Innovation Center, Photon Science Innovation Center, Tohoku University), Yuki Ikeya(Kohzu Precision Co., Ltd. (Japan), Photon Science Innovation Center).

A dedicated jig with an optical linear encoder was developed to evaluate the pitching stability between the first and second crystals of a double crystal monochromator in a standalone configuration. This method does not require synchrotron radiation, enabling direct assessment of the monochromator's intrinsic stability. Unlike beamline-based measurements influenced by upstream optics, this approach isolates the monochromator's performance. Designed and implemented by Kohzu Precision, the system is currently applied to a symmetrical layout monochromator to assess angular stability in mechanically decoupled configurations. The encoder counter supports readout rates up to 12 MHz; however, considering the latch interval of the system, the effective sampling rate is about 5 kHz. Measurements were conducted at approximately 2 kHz. At a Bragg angle of 10 degrees, the angular stability (RMS) in the pitching direction was better than 20 nrad, and a dominant vibration peak was observed near 180 Hz. These results demonstrate the system's effectiveness in characterizing the stability of high-performance monochromator configurations.

| THP53 |

Strategic maintenance transformation: integrating processes, tools, and asset intelligence

Gurhan Yana(MAX IV Laboratory).
Andreas Lassesson, Johan Thånell(MAX IV Laboratory).

We're currently leading a maintenance project aimed at standardizing workflows and enhancing asset management practices across the MAX IV. At the core of the initiative is the implementation of the J5 platform to support structured, approval-based work request and order processes that ensure clear communication and accountability among teams. Building on an existing naming convention, we have established a unified approach to asset identification, enabling the creation of a traceable and consistent asset database. By utilizing J5 to monitor maintenance and event history, we improve equipment traceability and enable data-driven decision-making. The project also focuses on equipment criticality assessments to guide preventive maintenance planning, alongside consolidating key documentation e.g. work instructions, user guides, and OEM manuals. While shutdown planning, work permit management, and spare part tracking are already established to varying degrees, future phases aim to integrate these processes into the J5 platform. This will help reduce system fragmentation and support the development of a scalable, centralized maintenance framework aligned with long-term operational goals.

| THP54 |

The first particle-free beam stop for the ESS superconducting linac

Elena Donegani(European Spallation Source).
*Anders Olsson, **Artur Gevorgyan(European Spallation Source)**, Juan Herranz(European Organization for Nuclear Research)*.

For the ESS superconducting linac, a compact beam stop for [21, 100] MeV protons was designed instead of a bulky beam dump. Its mass is 60 kg, its length 1200 mm (perpendicular to the beamline), and the cylindrical beam-intercepting part fits into a CF160 flange. In the most demanding beam mode (40 MeV, 50 μs, 1 Hz, 62.5 mA), thermomechanical calculations predict a peak temperature of 685 ˚ C in the graphite core that is enclosed in a shell of TZM (a Ti-Zr-Mo alloy). The beam stop is water-cooled, equipped with thermocouples and moved by a pneumatic actuator. The beam stop was manufactured by Proactive R&D in Spain and shipped under vacuum to ESS in Sweden. The assembly, tests and metrology measurements were performed in an ISO 5 cleanroom. During August 2024, the beam stop was installed with a dedicated cart in the ESS beamline, surrounded by a portable cleanroom to maintain a particle-free environment next to superconducting cavities. The results of the beam commissioning and the main challenges (e.g. ISO 5 requirements, unconventional brazing and demanding engineering tolerances) are summarized and useful to design future particle-free devices intercepting high-power beams.

| THP55 |

The new Nanomotion laboratory at ALBA

Juan Luis Frieiro(ALBA Synchrotron (Spain)).

Carles Colldelram, Josep Nicolas, Nahikari Gonzalez, Nilson Bernardo Pereira(ALBA Synchrotron (Spain)).

The ALBA Synchrotron has recently opened a Nanomotion Laboratory to support the upcoming ALBA II upgrade to a 4th-generation light source. The laboratory is dedicated to research, development, and commissioning of high-performance motion-and-positioning instrumentation, control systems, and synchronisation between components. It is operated as a clean room with particles, humidity, pressure and temperature control, built in the Experimental Hall to benefit from the main slab's vibration isolation. This work presents the laboratory's specialised spaces, infrastructure, and capabilities, together with commissioning data that verify the design specifications. We also highlight current collaborations within ALBA and invite external partners to explore joint projects that leverage the laboratory resources.

| THP56 |

Thermal analysis and design optimization of a DCM for Korea-4GSR based on PLS-II benchmarking

Siwoo Noh(Pohang Accelerator Laboratory, Korea University, Korea University; Pohang Accelerator Laboratory).

Daseul Ham, Ki-jeong Kim, Su Yong Lee(Pohang Accelerator Laboratory), Seong Hee Park(Korea University), ***Jinjoo Ko(Korea Basic Science Institute)***.

The Korea fourth-generation storage ring (Korea-4GSR) is scheduled for construction in Ochang, Cheongju, Chungbuk by 2029. Designed with a significantly lower emittance of 60 pm·rad and higher storage ring energy of 4 GeV compared to PLS-II, Korea-4GSR is expected to extend the capabilities of beamline experiments by providing photon beams with enhanced brightness and coherence. However, the thermal impact of such high-intensity beams on beamline optical components must be carefully evaluated. In particular, we conducted a benchmark study at the PLS-II beamline to analyze the heat load on the first crystal of the double-crystal monochromator (DCM) in a hard X-ray beamline. Based on the benchmark results, this study presents a comprehensive thermal analysis of the Korea-4GSR DCM, evaluates its impact on photon beam

performance, and proposes an improved design to mitigate thermal distortions.

| THP58 |

Vacuum system design and prototyping for the ALBA II upgrade

Ricardo Parise(ALBA Synchrotron (Spain)).

Andrea Fontanet, Barbara de Abreu Francisco, Bo Zhang, Carles Colldelram, Ferran Fernandez, Francis Perez, Gabriel Peña Calurano, Gabriele Benedetti, Ignasi Bellafont, Javier Boyer, Joan Casas, Jon Ladrera Fernández, Jordi Marcos, Laura Torino, Liudmila Nikitina, Lizet Andrea Carvajal Rocha, Llibert Ribo, Maisui Ning, Marcos Quispe, Marta Llonch Burgos, Michele Carlà, Montserrat Pont, Nahikari Gonzalez, Oriol Traver Ramos, Oscar Blanco-García, Pau Ros Bosch, Pol Salmeron Roma, Thomas Günzel, Ubaldo Iriso, Valentí Massana Gràcia, Zeus Martí(ALBA Synchrotron (Spain)).

ALBA is working on the ALBA II upgrade to transform the current storage ring, in operation since 2012, into a 4th-generation diffraction-limited synchrotron light source. The vacuum system is designed for a compact geometry with tight magnet apertures, where synchrotron power is distributed directly onto the chamber walls. Nevertheless, crotch absorbers will be used at key locations. Due to the low conductivity in such small chambers, the entire ring will be NEG coated to accelerate vacuum conditioning and achieve the required ultimate pressure. Most of the vacuum chambers of the 268.8 m long ring, divided into 16 arcs of 12.8 m each, will be made of OFHC-Cu or CuCrZr to dissipate synchrotron radiation and reduce resistive wall impedance. The chambers will have a nominal internal diameter of 16 mm, a minimum wall thickness of 1 mm, and clearances of up to 0.5 mm from magnet poles. Launched in 2021, the upgrade includes an R&D program focused on prototyping critical components. This contribution presents the overall vacuum system status, the design and production of vacuum prototypes, and initial component tests.

| THP59 |

Verification of SPring-8-II vacuum system prototype chamber

Kazuhiro Tamura(Japan Synchrotron Radiation Research Institute, RIKEN).

Hideki Dewa, Hiroshi Ota, Mitsuhiro Masaki, Takemasa Masuda, Yosuke Ueda, Yukiko Taniuchi(Japan Synchrotron Radiation Research Institute), Masaya Oishi, Masazumi Shoji, Shiro Takano, Takahiro Watanabe(Japan Synchrotron Radiation Research Institute, RIKEN).

The SPring-8-II project, upgrading SPring-8 to a 4th generation light source, started in FY2024. SPring-8 will shut down after summer 2027 for removal of existing equipment and installation of new accelerator components. User operation is scheduled to resume in spring 2029. The project requires a vacuum system compatible with compact, reduced-aperture magnets, ensuring sufficient beam lifetime and operational flexibility. An efficient pumping system was introduced for lifetime assurance, localizing photon-stimulated desorption gas near distributed absorbers and utilizing closely placed NEG pumps. A low coupling impedance vacuum system was designed by optimizing chamber geometry etc. to enable various operation modes. Prior to the mass production of vacuum components, prototypes of the main vacuum chambers were fabricated and their performance was verified with magnet arrays. These tests confirmed procedures for

rapid installation and vacuum commissioning excluding in-situ baking after installation, checked for interference with other equipment, and verified vacuum performance. We present the design progress and prototype verification results for the SPring-8-II vacuum system.

| THP60 |

Vibration stability measurement and simulation for the Future Circular Collider studies

Audrey Piccini(European Organization for Nuclear Research).
David Thuliez, Emeric Bernard, Federico Carra, Ghislain Roy, Jorg Wenninger, Marc Timmins, ***Michael GUINCHARD(European Organization for Nuclear Research)***.

The Future Circular Collider (FCC) study completed the FCC feasibility study on 31 March 2025 and published its report, which examined the technical and financial viability of the FCC at CERN. The first stage of the FCC will be the construction of an electron-positron collider for precision measurements, with a 15-year research programme from the late 2040s (FCC-ee). The beam sizes and emittances involved impose stringent requirements in terms of alignment and nanometric vibration stability. Several sources of vibration can disturb the beam and cause luminosity loss, this paper focuses on the effect of ground vibration. An experimental campaign and numerical analyses, using Finite Element Analysis, were conducted in parallel on a simple Short Straight Section (SSS) demonstrator. The multi-stage characterisation aims to understand how the different elements of the SSS affect the overall stability of the system. The experimental results are compared with the numerical analyses with the aim of gradually refining the simulations to determine more accurately the dynamic stability of the different elements and then extrapolating the results.

| THP61 |

Vibration stability of a liquid nitrogen cooled double-crystal monochromator at HALF

Zhanglang Xu(National Synchrotron Radiation Laboratory, University of Science and Technology of China, National Synchrotron Radiation Laboratory; University of Science and Technology of China).
Jie Chen, Qiuping Wang, Xuewei Du, Zimeng Wang(National Synchrotron Radiation Laboratory, University of Science and Technology of China, National Synchrotron Radiation Laboratory; University of Science and Technology of China), Shuaikang Jiang(National Synchrotron Radiation Laboratory, University of Science and Technology of China).

The requirement for monochromators with high precision and vibrational stability is crucial for the beamlines of diffraction-limited storage-ring light sources. A high stability double-crystal monochromator (DCM) with a high-stiffness flexure hinge has been developed for the Hefei Advanced Light Facility (HALF) at the National Synchrotron Radiation Laboratory. A comprehensive test was conducted to assess the stability performance of the DCM. Under a liquid nitrogen flow rate of 2 L/min, the system achieved a relative stability of 10.1 nrad RMS within the frequency range of 1–500 Hz. Additional stability tests performed at various Bragg angles demonstrated consistently

favorable performance across the full angular range of 0° to 60°. Long-term stability was also investigated, yielding a peak-to-valley relative stability of 135.5 nrad over a continuous 2-hour period under identical cooling conditions. These results confirm that the DCM exhibits excellent overall stability, sufficient to meet the requirements of synchrotron beamlines.

| THP62 |

Modular sensor supports for precision alignment of HL-LHC components

Mateusz Sosin(European Organization for Nuclear Research).
Christian Casarotto(Technical University of Denmark), Michel Noir, Piotr Biedrawa(European Organization for Nuclear Research).

The High Luminosity Large Hadron Collider (HL-LHC) is an ambitious upgrade project to increase the LHC collision rate, significantly enhancing the physics discovery potential of the present LHC beyond 2030. As part of this effort, new components must be aligned within an elliptical 1σ tolerance zone, with radii of 0.17 mm vertically and 0.33 mm radially over 420 m around the two high luminosity experiments ATLAS and CMS. To meet these stringent requirements, all components will be equipped with micrometric alignment sensors, including 276 Wire Positioning Sensors and 148 Hydrostatic Levelling Sensors. These sensors must be rigidly attached to the component structures to enable precise position determination and they must be accurately pre-adjusted relative to external reference networks. These requirements led CERN’s geodetic metrology group to develop a modular support system. This system ensures an ergonomic sensor adjustment, a long-term positional stability, and a robustness against mechanical constraints. This paper presents the design approach and the results of the final testing and validation of the modular sensor support solution.

| THP63 |

Qualification of serial production of the universal adjustment platforms for the High luminosity project

Michel Noir(European Organization for Nuclear Research).
Bartlomiej Pudlo, Mateusz Sosin, Noe Bendotti(European Organization for Nuclear Research), Leo Sjöberg(KTH Royal Institute of Technology, European Organization for Nuclear Research).

As part of the High Luminosity LHC (HL-LHC) project, a modular platform with 6 degrees of freedom, the Universal Adjustment Platform, has been developed. This platform, based on standardized micrometric adjustment jigs, enables the precise alignment of accelerator components weighing up to 2000 kg. Following the successful validation of a fully functional prototype, serial production of the standardized components began in 2025. To ensure quality and to meet the stringent requirements, a validation test sequence—based on a specially designed test bench—was established. This sequence allows the verification of the series production (140 vertical jigs and 70 radial jigs) including their micrometric backlash behavior under nominal load. This paper presents the testing methodology for such a qualification and the results obtained.

| THP64 |

Technical drawing reviews, ways of working and ISO GPS implementation for

mechanical design at European Spallation Source (ESS)
Michail Anastasopoulos(European Spallation Source).

The European Spallation Source (ESS) in Lund, Sweden is built on the successful collaboration of experts and technological teams of different nationalities and backgrounds, with both in-house and external contributions. In the effort to homogenize and streamline the process from the beginning to the end of the mechanical design projects, specialized practices, methodologies and ways of working have been developed and put in place to ensure the appropriate resource allocation, progress tracking and quality assurance of the end-mechanical products. This poster presents highlights of the aforementioned processes and tools that play a major role in ensuring our common goal towards realizing engineering, minimizing delays, capturing reworks and oversights as early as possible and delivering the necessary technology that pushes neutron research forward.

FROA - Core Technology Developments Session 1

19 September 2025 09:00 / 10:00

Chair: Ping He (Institute of High Energy Physics)

FROA01 / 09:00

Brazing as a Precision Joining Technique: Design, Process, and Case Studies from Sirius
Rafael Defavari(Brazilian Center for Research in Energy and Materials).

This presentation offers a comprehensive overview of brazing as a precision joining technique, drawing on the extensive in-house experience of the Sirius team. Aimed at design engineers and manufacturing professionals, the session will cover key aspects of brazing including materials selection, joint and fixturing design, process parameters, equipment operation, and quality control. Real-world case studies from Sirius projects will illustrate best practices and practical challenges encountered during brazing operations. Attendees will gain valuable insight into effective bonding strategies and learn how to integrate brazing considerations early in the design process to optimize performance and reliability. The talk will conclude with an open discussion to exchange ideas and address specific design or process questions from the audience.

FROA02 / 09:40

Development of Non-Evaporable Getter (NEG): Set-up and characterization
Unai Ruiz de Gopegui Llona(Tekniker).
Eva Gutierrez Berasategui(Tekniker).

Achieving Ultra High Vacuum (UHV) conditions is crucial for accelerator or synchrotron design. This can be done by coating copper and stainless-steel beam pipes with TiZrV Non-Evaporable Getter (NEG) thin films. In this work, we present the development of a setup for coating 40 mm and 16 mm diameter and 1 meter long pipes, studying the effects of sputtering pressure and gas on the coating properties. The coated pipes have been characterized in a setup based on the aperture method and Monte Carlo simulations have been carried out to determine coating sticking factor. The elemental composition, structure, hydrogen pumping speed, and CO saturation have been evaluated.

FROB - Core Technology Developments Session 2
19 September 2025 10:20 / 12:00
Chair: Mark Erdmann (Argonne National Laboratory)

FROB01/10:20

Test bench for development of cooling mechanism of the first optical crystal towards SPring-8-II

Haruhiko Ohashi(Japan Synchrotron Radiation Research Institute, RIKEN).
Hiroshi Yamazaki, Yasunori Senba(Japan Synchrotron Radiation Research Institute, RIKEN, Japan Synchrotron Radiation Research Institute; RIKEN), Hikaru Kishimoto, Koji Tsubota(Japan Synchrotron Radiation Research Institute).

SPring-8 will be upgraded to SPring-8-II, a fourth-generation synchrotron source based on a multi-bend achromat by 2028. Electron beam energy will change from 8 GeV to 6 GeV, substantially decreasing beam emittance. The reduced emittance enables direct observation of the photon source in a beamline design, thus demanding enhanced thermal and mechanical stability in the optics. Currently, most X-ray undulator beamlines at SPring-8 employ standardized double-crystal monochromators with silicon crystals indirectly cooled using liquid nitrogen. Distortion of the crystal directly affects beam quality; hence, optimizing thermal contact between crystal and holder is essential. To accurately replicate beamline operating conditions, we developed a test bench incorporating a crystal holder identical to the actual beamline configuration. In this test bench, the surface deformation of a cryogenically cooled silicon mounted on the holder is precisely measured using a Fizeau interferometer while heating it with an infrared laser, whose penetration depth closely matches that of X-rays. This presentation describes the test bench design and representative results.

FROB02/10:40

Corrosion studies of MAX IV storage rings' vacuum components

Simone Scolari(MAX IV Laboratory).
Eshraq Al-Dmour, Marek Grabski(MAX IV Laboratory).

MAX IV is in operation since 2015. The vacuum system is based on copper, water cooled vacuum chambers and lumped absorbers. A study was carried out to analyse the corrosion level of the water cooling channels. The aim was to determine the root causes and the possible impact on vacuum system operation. The focus was on finding pitting corrosion, since it is the most critical for creating cracks through the thickness of the chambers' walls and potentially causing leaks. The study is important in view of MAX IV 3 GeV storage ring upgrade project - MAX 4U - under development since 2024. There, one of possible scenarios is to reuse and adapt the geometry of the existing vacuum system to a new lattice, therefore ensuring its longer lifespan is crucial.

FROB03/11:00

Non-destructive & destructive testing on accelerator's components and materials at the European Spallation Source

Andrea Bignami(European Spallation Source ERIC, European Spallation Source).

The European Spallation Source - ESS, has achieved its major construction in Lund, Sweden and is currently continuing parallel commissioning activities of its first systems. ESS aims to install and commission the most powerful proton LINear ACcelerator (LINAC) designed for neutron production and a 5MW Target system for the production of pulsed neutrons from spallation. In support of this ambitious goal, the Mechanical Measurements Lab (MML) at ESS provides an array of investigative solutions such as Resonant Ultrasound Spectroscopy (RUS), Transient Grating Spectroscopy (TGS), Modal Analysis, Structural Health Monitoring (SHM), Strain and Stress Analysis and Destructive Testing, guaranteeing full support to all the groups that have the mandate to install all the different components of the machine. The scope of this contribution is to describe the current status of the undergoing studies, together with the applied methodology and the definition of the testing apparatuses.

FROB04/11:20

CAD and PLM solutions at ESS

Dawid Patrzalek(European Spallation Source).

The European Spallation Source (ESS) has made the strategic engineering choice of developing an integrated 3D model as the Single-Point-of-Truth (SPT) for engineering design, integration, manufacturing and installation. The design and integration tools along with the associated methodologies play a crucial role in the development and maintenance of ESS. This talk gives an overview of the incorporated CAD tools, ways of working, and methodologies in handling design engineering, focusing on their impact on system traceability and lifecycle management. In this framework the Facility Breakdown Structure (FBS) is presented as structured 3D representations that allow for seamless collaboration among design engineers, integration engineers and technical coordination teams. Tools and methods will be presented, with collaboration examples in CATIA V6 (handling large assemblies, revisions control, integration).

FROB05/11:40

Compact differential pumping system for windowless in-air sample environments beamline

Cristian Maccarrone(European Synchrotron Radiation Facility).
Anne-Lise Buisson, Karim Lhoste, Marco Cammarata(European Synchrotron Radiation Facility).

In this contribution we present a compact differential pumping chamber with apertures ≥ 500 μm. It allows windowless operation for in-air sample environments as well as to connect low-quality in-vacuum sample environments to the beamline UHV vacuum section. To simplify the design, it was decided not to integrate a positioning system and to rely on machining tolerances. In the end, the assembly consists of just 7 parts: 1 main aluminium body, 3 threaded cylinders with apertures and 3 covers with link to pumping units to be assembled with viton seals. The overall footprint is restricted to 368mm on the beam axis.

Author Index

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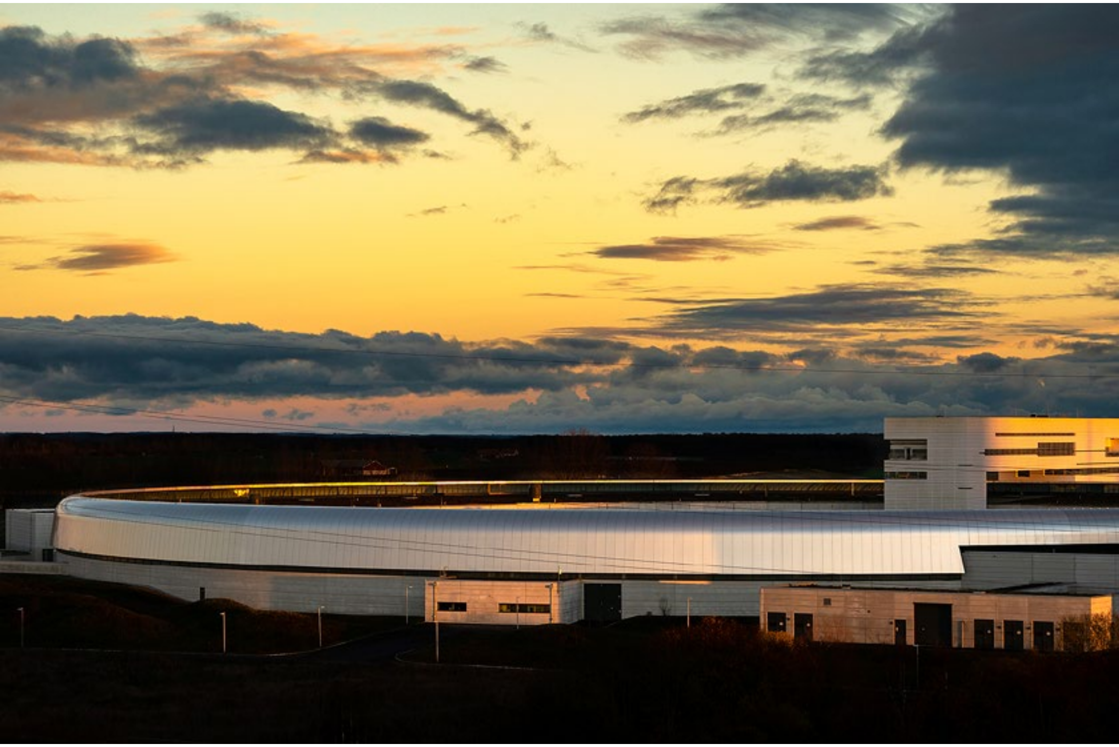

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We also extend our heartfelt thanks to our Institutional Sponsors: ***Lund Municipality***, ***Skåne Region*** (whose grant supports the cultural music at the conference dinner), ***Carl Tryggers Stiftelse***, and lightsources.org, for their invaluable support of both the scientific programme and the wider conference experience.

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Axilon AG / Booth 16

Axilon is your industrial partner in the international synchrotron, accelerator, and photon community. Based on the extensive and long-term experience (over 25 years) of our dedicated experts, we serve our customers with excellent and efficient solutions for complete beamlines, beamline components, monochromators, cryo coolers, mirror systems, experimental stations, X-ray microscopes, insertion devices, and other special engineering and manufacturing solutions. AXILON is proud of the high level of satisfaction expressed by our customers.

SAES High Vacuum / Booths 14

SAES High Vacuum Division develops and produces proprietary, engineered solutions for High Vacuum (HV), Ultra High Vacuum (UHV), and Extreme High Vacuum (XHV) equipment. With a strong technological portfolio and fully integrated production, SAES High Vacuum is a world leader in delivering high-quality solutions that address complex market challenges. Key technologies include UHV and XHV Non Evaporable Getter (NEG) pumps essential for advanced industrial and research applications.

Through SAES Rial Vacuum in Parma, it designs and manufactures custom vacuum chambers and components. Strumenti Scientifici CINEL in Vigonza provides advanced X-ray instrumentation for synchrotrons and XFELs.

The acquisition of FMB Berlin, an expert in electron beam and vacuum systems, further strengthens SAES High Vacuum's global position, supporting scientific communities with reliable, advanced technologies. Every project is developed closely with customers to meet demanding technical needs and anticipate future challenges.

AVS, Added Value Industrial Engineering Solutions, S.L. / Booth 15

AVS is an international company that aims to provide technology-based services to innovative and challenging projects. Strongly focused on the development of outstanding devices, instruments, mechanisms, and structures, our expertise covers design, manufacturing, assembly, testing, and supply under ISO 9001 and EN 9100 certifications, supporting our customers all the way from concept to turnkey projects.

AVS has established expertise in UHV-compatible mechatronic devices, machine tools, beam diagnostics, and instruments for synchrotrons, laser facilities, neutron sources, and fusion reactors, among others.

AVS has delivered major projects to all prominent light sources, including ESRF, APS, MAX IV, SIRIUS, ALBA, PSI, ALS, and others.

Silver Sponsors

PINK GmbH Vakuumtechnik / Booth 8

PINK GmbH Vakuumtechnik, founded by Friedrich Pink in 1986, is a global leader in ultra-high vacuum (UHV) technology, known for exceptional quality and precision.

We provide customised UHV equipment and systems for the semiconductor and electronics industry, optics, medical technology, aerospace, and research. Our portfolio includes systems for linear accelerators, ion beam therapy, precision coating, leak testing, vacuum soldering ovens, and standard UHV components.

Together with PINK GmbH Thermosysteme, the PINK Group employs over 300 staff and continues to grow through innovation and strong customer focus.

Smaract GmbH / Booth 9

The SmarAct Group develops high-precision solutions for positioning, metrology, and automation. Founded in 2005 in Oldenburg, we support innovation across industries including semiconductors, photonics, life sciences, and high-energy research.

Our systems operate in demanding environments such as UHV, cryogenics, and cleanrooms, addressing challenges like nanometre-scale alignment and quantum applications. With over 250 experts and a strong customer focus, we deliver tailored solutions that help shape the technologies of tomorrow.

XDS Oxford / Booth 7

XDS Oxford is a UK-based designer, developer, and manufacturer of equipment for particle accelerators, including X-ray Synchrotron, FEL, and Neutron sources. Our company has more than 30 years of experience supplying complete beamlines and individual equipment to new and upgrading facilities, continually innovating, integrating, and optimising to provide performance that enables scientists to achieve world-leading results.

We welcome the opportunity to talk to you about your current and future requirements and how we can contribute to your success. We're always happy to discuss new concepts – with our depth of knowledge and appetite for challenge, we aim to make your ideas a reality.

Toyama Co., Ltd. / Booth 10

Toyama is fundamentally an engineering company, manufacturing ultra-precision systems for experimentation at the cutting edge of science. Our product range covers all aspects of soft and hard X-ray synchrotron science and includes not only beamline components but also front ends and end stations. We have been engaged in manufacturing various ultra-precision systems such as monochromators, diffractometers, reflectometers, q- and nano-RIXS spectrometers, nano-ARPES, STXM, ellipsometry for polarisation analysis of soft X-rays, and so on. Our experience ensures that we can meet your requirements, which need highly customised design and manufacturing skills.

MI-Partners / Booth 17

MI-Partners is a research and development partner for high-end mechatronic systems and scientific instrumentation. The development of these systems is often very challenging in terms of accuracy and/or speed. We cover the full trajectory in system design:

starting from whiteboard and specifications, we generate concepts and select the best one together with our customer. Then we begin an iterative design process, where modelling, performance prediction, and mechanical design go hand in hand. We outsource the manufacturing of parts, but assembly and testing are done in-house. As we mostly develop one-of-a-kind machines, such as prototypes, test equipment, or research equipment, we always face unique challenges. Our company consists of 55 highly educated and skilled engineers, with main competences in concept design, precision engineering, thermal design, dynamics, and control.

JJ X-Ray / Booth 11

JJ X-Ray is a dynamic and forward-thinking company based in Denmark. We specialise in the design, production, testing, and commissioning of synchrotron, free-electron laser (FEL), and neutron beamline equipment. Our team of dedicated experts has practical experience in high-precision instrumentation for these facilities. We develop state-of-the-art equipment that empowers scientists to push the boundaries of science. As many of us hold a PhD in synchrotron experimentation, we understand the challenges and high expectations of our customers. We are an agile company with no sharp boundaries between departments, enabling us to keep the customer at the centre of our focus.

Allectra / Booth 12

Allectra is a leading manufacturer and supplier of high-quality components for high vacuum (HV) and ultra-high vacuum (UHV) applications. Founded in 2002, the company has grown to serve a global customer base across research institutions, universities, and advanced technology industries including semiconductor, quantum computing, and particle physics.

With design and manufacturing facilities in the UK and Germany, Allectra offers a broad portfolio of standard and custom-engineered solutions, including electrical feedthroughs, cables and connectors, viewports, PFAS-free radiation resistant KAP301 wires and non-magnetic components. All products are developed to meet the highest standards of precision, reliability, and vacuum compatibility.

Allectra is committed to technical excellence, collaborative problem-solving, and continuous innovation to support the evolving needs of the scientific and engineering communities.

IRELEC / Booth 5

IRELEC's precision robotic systems deliver the performance improvements essential to advancing scientific research and enhancing quality and efficiency across industrial sectors. High-precision and automated equipment, powered by advanced, user-friendly software, brings added value to synchrotron beamlines, biobanks, and industrial processes across a wide range of applications. IRELEC's experts are available to discuss how precision robotics and mechatronics can support the achievement of specific technical and operational goals.

Nortemecanica S.A. / Booth 4

Nortemecánica was founded in 1992 by a group of entrepreneurs and experienced professionals, focused on manufacturing machinery, spare parts and capital goods for industry. Initial activities targeted the mining and steel sectors in Spain, later expanding into wind energy, cement, and research laboratories across Europe.

Today, Nortemecánica supplies mechanical components not only to Big Science facilities, engineering firms and research centres, but also for the Medical Sector for the Proton Therapy.in Spain, Germany, France, Switzerland, Denmark, the UK and the US. With a turnover above €7 million, over 90% of which comes from exports, we serve sectors including pressure vessels, medical equipment and the steel and wind industries.

Continuous investment in technology and process development, combined with a skilled team with over 30 years of experience, allows us to meet demanding requirements worldwide.

PicoPascal AB / Booth 6

PicoPascal is established in 2024 as a subsidiary to SV Vacuumservice Oy, specialize in vacuum technology in Finland since 1984. SV Vacuumservice Oy is the market leader, and longest-operating company in Finland in the HV and UHV market.

Our goal is to provide necessary products for the vacuum applications for our customers in Sweden. We provide you our expertise combined with high-quality products.

Our Sales and Service Engineers will be starting at the beginning of 2025 in our new premises in Sweden.

FMB Berlin / Booth 13

FMB, based at the WISTA Science and Technology Park in Berlin-Adlershof, has been a trusted supplier of synchrotron radiation equipment since its founding in 1990. We offer complete in-house development, engineering, production, testing, and installation services.

With 4,000 m^2 of office and production space, FMB designs and manufactures advanced components and systems for synchrotron storage rings, including vacuum chambers, front-ends, beamlines, monochromators, mirror systems, slits, and diagnostics. All products are supported by rigorous simulations and testing.

We also develop custom ultra-high vacuum and precision mechanical equipment, continuously pushing technical limits. Our strong links with scientific experts ensure our solutions meet the evolving needs of research and industry.

Luvata Pori Oy / Booth 3

Luvata Pori Oy, founded in 1939 and located on Finland's west coast, is one of the largest industrial employers in the Pori region with around 350 staff. Over 90% of its 40,000 tonnes of annual copper product output is exported worldwide.

Specialising in customised fabricated copper solutions, Luvata serves a wide range of industries. Its strength lies in metallurgical expertise, problem-solving, and a strong commitment to customer value. With vertical integration and full control of its processes – including casting, extruding, drawing, annealing, and machining – Luvata ensures top-quality results for niche applications.

Now part of the Mitsubishi Materials Corporation, Luvata continues to support modern high-growth industries with reliable, tailored solutions from its headquarters in Pori.

Huber Diffraktionstechnik GmbH & Co. KG / Booth 1

The outstanding precision and reliability of Huber's products (www.xhuber.com) have made them widely used in laboratories and research centres worldwide.

Huber's diffractometers are recognised as among the best in the world. They are known for their durability, precision, high degrees of freedom, open sample environment, versatile and flexible modes, precise return to position, and long lifespan. They excel in designing customised solutions to meet specific customer requirements.

Furthermore, Huber is increasingly focusing on the development and production of high-precision positioning systems. These systems are primarily used in laboratory settings and synchrotron beam sources for X-ray diffraction. They also find applications in neutron diffraction experiments, laser technology, astronomy, and precision measurement technology.

Norcada / Booth 2

Norcada is a Canadian company specialising in MEMS and photonic products, with a state-of-the-art fabrication facility in Edmonton, Alberta. Since 2002, it has delivered innovative solutions for scientific and industrial applications.

Norcada develops MEMS devices such as silicon nitride TEM grids, X-ray microscopy membranes, liquid cell chips for in-situ TEM, and custom components including micropores, nanopores, and single-crystal silicon foils. Standard and tailor-made products are available to meet specific research needs.

The company also designs custom MEMS for industrial use – ranging from optical devices for telecoms to cantilevers for bioanalysis – and manufactures near-IR and mid-IR DFB lasers for sensing, gas monitoring, and TDLAS applications.

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Vacuum FAB Srl / Table B06

Founded in the mid-nineties as miCos, the company specialized in developing and distributing micropositioning systems for vacuum, high-vacuum (HV), ultra-high vacuum (UHV), and cryogenic environments. In the 2000s, it pioneered the SpaceFAB, the first parallel robot featuring an innovative, easily scalable design. This groundbreaking system seamlessly combines six degrees of freedom, a low profile, high accuracy, and impressive rigidity. This technology was subsequently adapted for HV and low-temperature applications.

With extensive experience and an agile company structure, Vacuum FAB stands as an ideal partner for analysing applications, designing custom ad-hoc systems, and delivering optimal, tailor-made solutions.

Vacuum FAB also strengthens its offerings through key collaborations: we proudly distribute Phytron vacuum, UHV, space, and cryogenic motors and controllers throughout Italy. Additionally, we partner with Qioptiq (Excelitas) to provide a comprehensive range of optics and optical components.

UHV Design ltd / Table B07

UHV Design specialises in the design, manufacture, and supply of high-performance HV and UHV motion and heating products. With over 25 years of experience, the company offers low-maintenance manipulation solutions for vacuum applications, managing the full process in-house – from design to after-sales support.

In addition to a wide range of proven standard products, UHV Design is known for customised solutions tailored to specific applications. Its long-standing collaborations with leading scientific and technical institutions have helped develop innovative products, many of which have become part of its core offering.

Kashiyama Europe GmbH / Table B01

Kashiyama Europe GmbH is the European subsidiary of KASHIYAMA Industries, Ltd. (Japan), providing advanced vacuum pump solutions for the high-tech sector. Guided by a "Customer First" philosophy, the company combines next-generation technology with flexible service to meet evolving market needs.

Since 1946, Kashiyama has delivered high-quality vacuum pumps, leading the Japanese market in solutions for semiconductor and FPD manufacturing. The company also has experience in snow-making systems and operates a winery in Nagano, Japan.

Kashiyama offers full-cycle support – from design to maintenance – focusing on clean, oil-free vacuum environments and total cost of ownership. All products are developed in state-of-the-art, meticulously maintained facilities aligned with the company's "Factory is a Showroom" commitment to quality.

OWIS GmbH / Table B08

At OWIS, we turn our customers' pioneering ideas into reality and drive progress in high-tech industries. In doing so, we rely on our high-quality standard components, our outstanding engineering expertise and our ambition to push technological boundaries.

Following the idea of our founders, we now offer a modular system of optomechanical components and positioners that can be used to simplify and customize applications in industry and science.

Things get exciting when we combine our expertise and develop customer-specific systems based on our standard components. Typical application examples include laser processing, sensor technology, analytics, medical technology, semiconductor technology and clean room applications in general.

Lasers love OWIS. Not without reason. Our products and engineering services are characterized by precision, functionality, scalability, sophistication and reliability that you can rely on and that will take you further.

ISP System / Table B05

ISP System specialises in precision engineering, combining mechanics, electronics, optics, industrial computing, automation, and robotics. ISP System's opto-mechanics product range covers the high-intensity laser industry and scientific research applications. It deals with special environments and testing such as Cleanroom, Ultra-High Vacuum, Residual Gas Analyser and Electromagnetic Compatibility. ISP System success stories are found in major scientific projects like the Mega Joule Laser, SOLEIL Synchrotron, and the European ELI projects.

With over 25 years of experience in various industries, including aeronautics (Airbus), automotive (hybrid vehicles), space, and defence, as a designer and manufacturer, ISP System delivers expertise in high-precision motorised mechanical positioning equipment, opto-mechanics, complex system integration with control, and embedded electric actuators featuring Artificial Intelligence.

Celeroton AG / Table B02

The Swiss high-tech company Celeroton offers low jitter magnetic-bearing choppers for operation in vacuum to pulse infrared (IR), laser, vacuum ultraviolet (VUV) and x-ray beams for various applications like nanospectroscopy or crystallography. In addition, Celeroton provides oilfree turbo compressors and expander turbines with highest energy efficiency for noble gas and cryogenic applications.

Johann Fischer Aschaffenburg Praezisionswerk GmbH & Co. KG / Table B15

Johann Fischer Aschaffenburg (JFA) is a medium-size manufacturing company in the field of precision mechanical engineering.

Construction, manufacturing, assembly and (clean room) commissioning of machine superstructures and complete systems made of natural hardstone – granite – weighing up to 60 tons are our range of service's main focus. In addition, we have in-depth knowledge of precision machining of other hardbrittle or difficult-to-machine materials such as (glass) ceramics or Invar. JFA is also happy to take over the selection and dimensioning (analytical, FEM) of a motion system (roller bearing guide, aerostatic guide, hydrostatic guide) and therefore required drives, suitable for your individual application. The focus is on the realization of permanent running and positioning accuracies in the 0.001 mm range.

A large number of renowned institutions such as MAX IV, DESY, ALBA, ESRF, and PSI rely on JFA's decades of experience and expertise, so do not hesitate to contact us to benefit from the JFA quality as well

T.E.E.S. srl. / Table B04

T.E.E.S. srl designs and manufactures mechanical equipment for scientific research laboratories. Its activities cover design, manufacturing, assembly, testing, quality assurance, administration, marketing, sales, and R&D.

The company primarily focuses on meeting research laboratory needs and collaborates with industry R&D for prototypes and custom applications.

Key areas include high-precision motion stages, ultra-high vacuum technologies, geophysics, space, neutron science, art and cultural heritage, and industrial technologies.

In 2019, T.E.E.S. srl upgraded its Quality Management System to EN ISO 9001:2015. It applies its own procedures for design, manufacturing, testing, calibration, document management, procurement, material certification, and traceability within its Quality Assurance framework.

Symétrie / Table B11

Created in 2001 by Olivier Lapierre and Thierry Roux, two former engineers of LNE, the French national laboratory of metrology, SYMETRIE is one of the world's leading providers of hexapod solutions for positioning and motion applications.

Our design and research office produces high-tech positioning and movement systems. Our skills combined with a strong cooperation with our customers throughout the projects allow us to provide solutions adapted to their needs, as soon as possible.

Our systems are designed to meet the most demanding criteria of industrialists and research laboratories.

Bestec GmbH / Table B09

Bestec offers innovative customised UHV systems for: VUV, soft and hard X-ray illumination for synchrotron/XFEL radiation and soft X-ray laboratory sources, VUV and soft X-ray reflectometry/ellipsometry, diffractometry and spectroscopy, systems for fabrication and analysis of nanostructured surfaces.

Our product portfolio ranges from soft X-ray lab sources and beamline components to thin film deposition systems, and dedicated soft X-ray reflectometers, ellipsometers, and spectrometers for the qualification of complex layered surface systems and basic research.

We provide integrated system solutions as well as single components for both scientific and industrial applications.

Shanghai Shuosong Electronic Technology Co., Ltd. / Table B14

Shanghai Shuosong Electronic Technology established in 2006, we are a high technology enterprise that specialized in detective equipment window researching and manufacturing. Shuosong have cooperated with many university research centres since its set up, with the efforts and constant innovation, we have become a leading company in detective equipment window fields. Most of our product are used in synchrotron radiation, space detection, analytical instruments, CT facility, industrial detection, etc.

Our main products include beryllium foil, brazed beryllium window to stainless steel, water-cooling beryllium window to copper to stainless steel, brazed sapphire window, brazed diamond window to copper, diamond coating tungsten layer (X ray transmission target), ceramics to metal brazing and detector window design and full solutions. We accept customized design according to customer’s different requirements.

We hope to cooperate with you by our high quality products and efficient service.

KOHZU Precision Co., Ltd. / Table B13

Kohzu develops and supplies precision elemental technologies and equipment supporting research, development, and production worldwide. Specialising in precision positioning equipment, the company holds a significant market share domestically and internationally, focusing on experimental research instruments and precision tools for ultra-fine material analysis and semiconductor wafer development.

Driven by the philosophy of pioneering the future through technology, Kohzu contributes to advanced scientific projects such as meteorite analysis from the Hayabusa asteroid probe, materials research, and semiconductor inspection. The company emphasises the development of skilled, team-oriented personnel to meet evolving scientific and technological demands, proud that its products serve as a standard in cutting-edge research both in Japan and internationally.

Pfeiffer Vacuum Scandinavia AB / Table B12

Pfeiffer Vacuum is one of the world's leading providers of vacuum solutions. In addition to a full range of hybrid and magnetically levitated turbopumps, the product portfolio includes backing pumps, leak detectors, measurement and analysis devices, components, as well as vacuum chambers and systems.

Since the invention of the turbopump by Pfeiffer Vacuum, the company has stood for innovative solutions and high-tech products used in the analytics, industry, research & development, coating, and semiconductor markets.

Founded in 1890, Pfeiffer Vacuum is active worldwide today. The company employs around 4,000 people and has more than 20 subsidiaries.

For more information, please visit www.pfeiffer-vacuum.com.

Heftytec AB/ Table B03

Established in 2021 and located in Lund Municipality we specialise in the design of micropositioning systems and production and testing equipment for optics production. Our products are made in our facilities in Södra Sandby utilizing 3-4-5 Axis milling and SLA printing.

Equally important as our own products is our manufacturing service. We make everything from single prototype parts designed by our customers, subassemblies, complete automated machines as well as volume production.

For those not having in-house design we offer the complete range of design services from idea to finished and fully documented parts or systems. This includes software development and electrical systems.

Phytron GmbH/ Table B10

With decades of experience and a constant pursuit of perfection, Phytron is a leading supplier of high-tech automation solutions for extreme environments. Offering high-precision stepper motors, linear actuators with optional gears and feedback, plus a wide range of power electronics and controls, Phytron supports customers worldwide. Every product and custom solution reflects the same passion for quality, expertise, and precision.

Founded in 1947, Phytron maintains its commitment to excellence, certified since 1994 under DIN EN ISO 9001, with additional certifications through the years. Continuous staff training and open communication contribute to Phytron’s steady success and recognition as a "TopJob" company. These values form the foundation of Phytron’s lasting popularity with customers and partners.

Cecom Srl/ Table B16

Founded in 1964 in Rome by Cesare Ceracchi, Cecom has built its reputation through collaborations with CERN, INFN, ENEA, Italian universities, and the Leonardo group. Known for excellence, precision, and advanced technology, Cecom is a leader in high-precision mechanics and UHV applications.

Since the 2000s, Cecom has strengthened its presence in the European synchrotron, nuclear, and proton therapy markets.

Cecom’s expert team designs, manufactures, and tests prototypes, series components, and turnkey systems using advanced CNC machinery and a class 1000 clean room, achieving tolerances down to 10 μm. Facilities include a bake-out system with gas analysis and a galvanic department specialised in copper and nickel coatings for nuclear and cryogenic use.

The company also manages complementary technologies such as vacuum brazing and electron-beam welding through trusted partners and uses CAD/CAM systems to optimise production.

Cecom's experience covers vacuum chambers, beamline components, RF devices, and diagnostics for synchrotrons, proton therapy, and nuclear projects including ITER and JET.

EXHIBITION OPENING HOURS

The Industrial Exhibition will be open to all conference participants during the following hours:

Tuesday, 16 September 2025 – **09:00 to 17:00**

Wednesday, 17 September 2025 – **09:00 to 17:00**

Thursday, 18 September 2025 – **09:00 to 17:00**

We invite all delegates to visit the exhibition area, meet our sponsors and exhibitors, discover the latest technologies, and build new connections. Their support is essential to making MEDSI 2025 possible.

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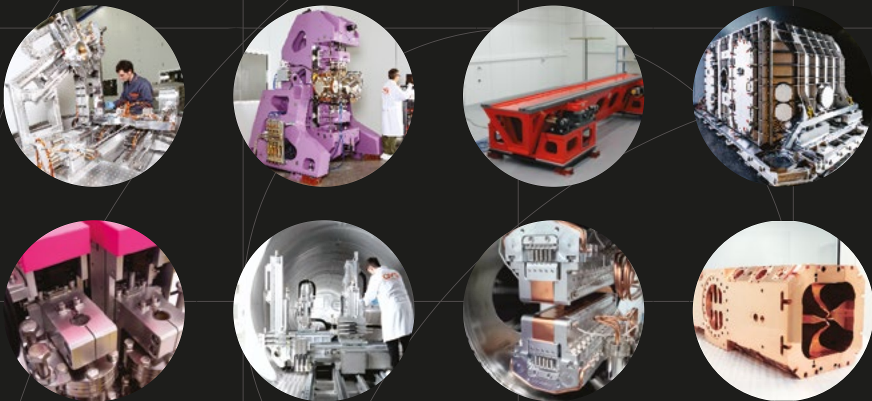

AVS designs and develops specific equipment for X-Ray synchrotrons where standard solutions don't fulfil clients' specifications.

From the machine to the experimental beamlines, AVS offers know-how in high precision mechanics and UHV systems. AVS has a wide experience in collimation and diagnostic systems: slits, scrapers and diagnostic boxes.

AVS can supply high stability and high precision large positioning devices such as girders or undulators.

Regarding beamlines, AVS provides bespoke systems such as spectrometers, diffractometers and specific positioning devices.

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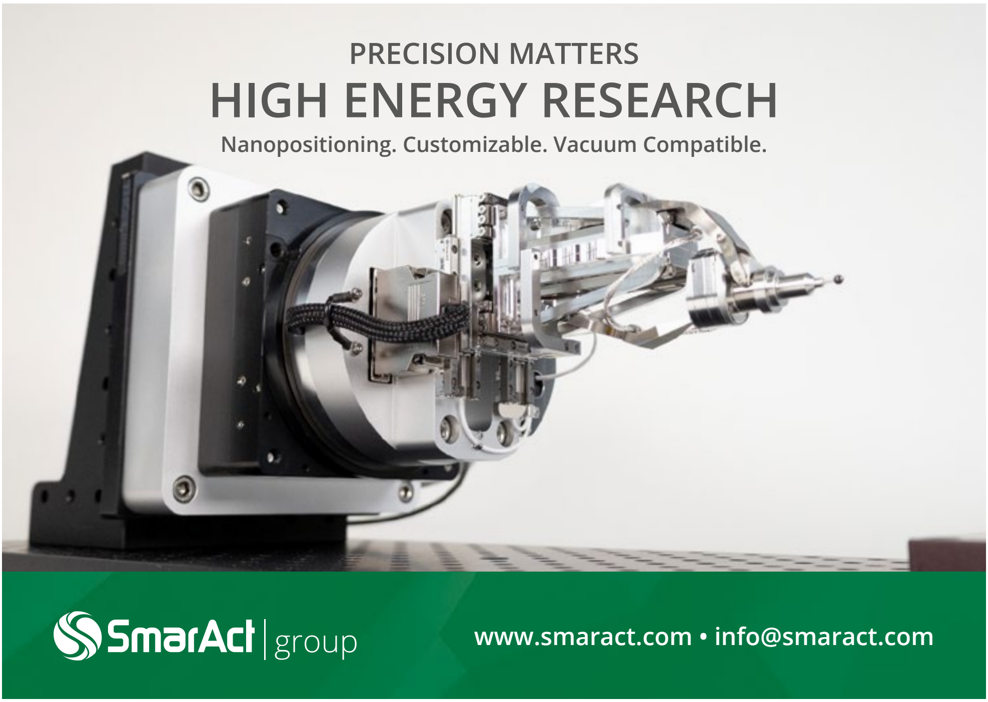

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