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Book of Abstracts

Contents

4

Advanced Q/A=1/2 K100 heavy-ion compact cyclotron design for multidisciplinary utilization

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We have designed a compact Q/A=1/2 K100 cyclotron for multipurpose applications including the productions of medical isotopes and neutrons at an energy of 25 MeV/u. With use of charge-stripping extraction for H2+, lower energy protons can also be produced. By accelerating Q/A=1/2 ions such as N7+, 36Ar18+ we can irradiate semiconductor chips for heavy-ion space radiation effects and living tissues for radiobiology study. Both vertical and horizontal beam lines have been designed to form uniform beam in air as well as micro-size beam for precision research. The K100 cyclotron facility needs to accommodate comfortably both high-current proton beam and low-current fully charge-stripped light heavy-ions that can be produced by high-performing superconducting ECR ion source located on the upper floor of the cyclotron. I will present some detailed designs of the cyclotron and its beam lines chiefly in terms of beam optics.

Paper submission Plan:

No

Best Presentation:

No

5

The Performance and Lifetime Improvement Report on Thyratron System for PAL-XFEL

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A total of 51 klystron modulators in the PAL-XFEL have been operated with thyratron tubes as high voltage pulse switch devices to drive the beam energy of 10 GeV. In stably accelerating the electron beam, the output stability of the modulator is a very important factor. Thyratrons are evaluated as the most suitable device as a high-voltage switch for a pulse modulator due to their high voltage, repeatability, and easy impedance matching. We employ E2V thyratron (CX1836A) model as a key component in the modulator system. To stably manage the components that make up the thyratron, system improvement R&D was conducted to reduce damage of components from the switching noise flowing into the three parts (RC snubber, pulse width of G1, grid circuit). In this paper, the improvement results of three kinds of devices will be described.

Paper submission Plan:

Yes

Best Presentation:

No

6

Mechanistic Investigations on the Annealing Induced Diffusion and Crystallization in Lithium Lanthanum Zirconate Thin Films

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Herein, we reported the thermal annealing induced crystallization and diffusion process in the Lithium Lanthanum Zirconium Oxide (LLZO) thin films. LLZO thin films were grown on n-type silicon wafers using radio frequency (RF) sputtering technique and annealed at 500˚C, 700˚C and 900oC for investigation of crystallization and diffusion phenomena. Structural studies carried out on these films showed amorphous nature in case of no annealing. Annealing initiated the crystallization process in these films, which was completely achieved at annealing temperature of 900oC as envisaged from X-ray diffraction studies. Cross-sectional scanning electron microscopic studies showed almost 17% increase in film thickness with respect to as-deposited film. A broad distribution for thickness was also observed at this annealing temperature. Both these factors were ascribed to the diffusion of various ions in the films into the substrate as investigated from the Rutherford backscattering spectroscopic measurements. Diffusion process also lead to the change into the interaction among the ions as revealed from the O K-edge near edge X-ray absorption fine structure (NEXAFS) measurements. X-ray absorption spectroscopy carried out at Li K-edge, La L-edge and Zr K-edge exhibit specific spectral features corresponding to their site symmetry in the film grown at 900oC. Appropriate mechanism of annealing induced crystallization in these films is underway [1].

References
1. P. Barai, T. Fister, Y. Liang, J. Libera, M. Wolfman, X. Wang, J. Garcia, H. Iddir, and V. Srinivasan, Chemistry of Materials, 33 4337- 4352 (2021)

Paper submission Plan:

Yes

Best Presentation:

No

7

Investigating the 13N(α, p)16O Reaction Rates via the 19F(p, t)17F Reaction

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Recent sensitivity studies have shown that nucleosynthesis in Core-collapse supernovae (CCSNe) is significantly influenced by the 13N(α, p)16O reaction rate. However, the rate at stellar temperatures (up to 4-GK) remains poorly constrained, primarily due to the limited precise knowledge of the decay properties of relevant resonances. To improve these constraints, we performed the 19F(p, t)17F transfer reaction experiment aimed at refining the 13N(α, p)16O rate. The experiment was performed at the tandem accelerator facility of the Japan Atomic Energy Agency using 30.5-MeV proton beams incident on CaF2 targets backed with gold. Recoiling tritons from the 19F(p, t)17F reaction were detected with segmented CD silicon detector arrays. To determine the branching ratios of 17F, decay proton and alpha particles from the 19F(p, t)17F*(p)16O and 19F(p, t)17F*(a)13N channels will be identified. Experimental details and current progress of data analysis will be presented.

Paper submission Plan:

Yes

Best Presentation:

Yes

8

Prospects for RAON Experiments with the KISTI-6 Supercomputer

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The RAON heavy-ion accelerator facility in Korea is entering a new era of precision nuclear physics experiments. These include studies on exotic nuclei near the proton drip line. One recent large-scale computational achievement using the KISTI-5 supercomputer (Nurion, 25.7 PF) was the theoretical and simulation-based support for the determination of nuclear charge radii in neutron-deficient

sodium isotopes. This project required extensive *ab initio* nuclear structure calculations and advanced reaction modeling. The calculations pushed Nurion to its computational limits. In addition, Geant4-based beam simulations were also carried out on Nurion to support the RAON experiments. These simulations provided key insights into beam dynamics and detector performance.

The KISTI-6 supercomputer, providing 600 PF GPU-accelerated performance, will create unprecedented opportunities for the RAON experimental program. The massively parallel architecture and high memory bandwidth of GPU nodes will enable large-scale coupled-cluster and nuclear lattice effective field theory (NLEFT) simulations. It will also support higher-precision Monte Carlo analysis and more accurate modeling of nuclear charge radii in isotopes far from stability. We anticipate that this computational leap will not only refine the theoretical interpretation of experimental data but also guide detector design, optimize beam time usage. It will significantly improve predictive accuracy for upcoming measurements beyond the current sodium isotope study.

The synergy between RAON's experimental capabilities and the KISTI-6 supercomputer will advance nuclear structure research. It will set new benchmarks at the exascale level. It will also pave the way for discoveries in both fundamental nuclear properties and applications in astrophysical modeling.

Paper submission Plan:

Yes

Best Presentation:

No

9

Transverse Phase Space Characterization and Benchmarking Studies Using Multi-Diagnostic Techniques at the KOMAC Beam Test Stand

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We characterize the space charge-dominated 1 MeV/nucleon proton beam at the Beam Test Stand (BTS) of the Korea Multipurpose Accelerator Complex (KOMAC) through comprehensive transverse beam diagnostics and phase space analysis. A suite of diagnostic tools, including a conventional pepper-pot (PP), virtual pepper-pot (VPP), Allison scanner, and multi-slit system, is employed to measure the beam distributions under varying space charge conditions. The dynamics and optimization of space charge compensation (SCC) in the Low Energy Beam Transport (LEBT) line are investigated through time-resolved measurements. Experimental benchmarking between the VPP and conventional pepper-pot methods demonstrates strong agreement, validating the accuracy of the multi-diagnostic approach. Furthermore, by utilizing the generative phase space reconstruction algorithm based on neural networks and differentiable simulations, we investigate the phase space reconstruction by considering both the matrix calibration and self-consistent beam propagation.

Paper submission Plan:

No

Best Presentation:

No

10

Development of Ion Beam Source Test Bench with Beam Diagnostics for Ion Implantation Applications

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Ion implantation, a key step in advanced processes, requires both low-energy, high-current beams for shallow source/drain doping and high-energy beams for deep junction formation necessary for power devices or long-wavelength CMOS. To address this wide range of energy and current needs, it's become crucial to develop various ion implanters. This study focuses on creating a test bench to compare different ion sources, improve their performance, and find optimal operating conditions. A Faraday cup array (FCA) and an Allison scanner are used for the quantitative evaluation of beam characteristics. This study analyzes the design considerations for the FCA and Allison scanner used in the test bench, as well as the effects of plasma density, extraction voltage, and inter-electrode distance on beam characteristics.

Paper submission Plan:

Yes

Best Presentation:

Yes

11

The RF power sources of CSNS-II Linac

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The CSNS-II Linac consists of H- ion source, RFQ and four DTLs, twenty superconducting Spoke cavities and twenty-four superconducting Elliptical cavities. The RF frequency of the RFQ, DTLs and

Spoke cavities is 324MHz, and the Elliptical cavities are 648MHz. The repetition rate of the RF pulse is 50Hz, the RF pulse width of the normal conducting is less than 900μs, and the superconducting is less than 1.2ms. The 324MHz klystron power sources provide RF power to the RFQ and DTL accelerators. The prototype of the mega-material 324MHz klystron has been developed tested successfully, the peak power can reach 3MW. The 648MHz klystron power source provide RF power to Spoke cavities, both the 324MHz klystrons and the 648MHz klystrons are provided high voltage pulse by long-pulse solid-state modulator. The Spoke cavities are powered by 324MHz/300kW solid-state RF power sources based on the GaN amplifier. The prototype of the 324MHz/300kW solid-state RF power source is also developed now, the test results satisfied the requirements of the spoke cavities.

Paper submission Plan:

Yes

Best Presentation:

No

12

Non-invasive beam profile monitors for the CSNS Accelerator

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The China Spallation Neutron Source (CSNS) is a major facility for neutron science in China, and is currently operating at an averaged beam power of 170 kW with a beam energy of 1.6 GeV and repetation rate of 25 Hz. In 2024, the CSNS Upgrade project (CSNS-II) was launched aiming to improve the average beam power to 500 kW. In the sequence, a number of new instrumentations will be equiped at the new superconducting linac, RCS and new beamlines. In this talk, we will present an overview of the new diagnostics and the corresponding the high-intensity challenges. The recent progresses on the non-invasive profile monitors, such as the ionization profile monitor and laser-wire profile monitor, will be highlighted.

Paper submission Plan:

No

Best Presentation:

No

13

Design modification of the power couplers for the Half Wave Resonators in IRIS

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A heavy-ion accelerator facility was constructed for the Rare Isotope Science Project (RISP) at the Institute for Rare Isotope Science (IRIS) in Daejeon, Korea. The cryomodule, featuring quarter-wave resonators (QWRs) and half-wave resonators (HWRs), was installed in the SCL (Superconducting Linac) 3 tunnel, and beam commissioning (Beam energy: 16.4 MeV/u, 40Ar8+) has been completed. The geometry of the power coupler for the HWRs is a coaxial capacitive type based on a conventional 1-5/8inch Electronic Industries Alliance (EIA) 50 Ω coaxial transmission line with a single ceramic window. A multi-physics analysis, encompassing electromagnetic, thermal, and mechanical analysis, was conducted using ANSYS to assess the thermal expansion of the power couplers.
This paper will present the results of multi-physics analysis and the current design status of the power coupler for the HWRs.

Paper submission Plan:

Yes

Best Presentation:

No

14

The fabrication of 1.3 GHz single-cell cavities by using niobium materials with fine and medium grain sizes

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As a part of research into the fabrication methods for SRF (superconducting radio frequency) cavities used in ILC (International Linear Collider), two 1.3 GHz single-cell cavities have been fabricated successfully by using niobium materials with different grain sizes; fine grain (ASTM 5-6) and medium grain (ASTM 0-3). Both cavities have been fabricated using identical manufacturing equipments. After fabrication, They are shipped to KEK in Japan to conduct the surface treatments and VT (vertical test). We present a comprehensive overview of the cavity fabrication process and the performance test results in cryogenic temperature.

Paper submission Plan:

No

Best Presentation:

No

15

DESIGN OF A NATURAL THORIUM-232 METAL TARGET FOR ACTINIUM-225 DEVELOPMENT AT IRIS

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Recently targeted alpha therapy (TAT) using actinium-225 (225Ac) has been interested due to impressive clinical results. The 225Ac radioisotope decays into bismuth-209 by emitting four alpha and two beta particles with a half-life of 9.9 days, which is appropriate for medical applications. Several research groups reported that ample quantities of 225Ac could be produced via spallation of thorium-232 (232Th) with energetic protons, having less than 0.1% of 225Ac as a byproduct. In order to reduce the 227Ac/225Ac ratio, IRIS will employ the energy range of 50-70 MeV protons irradiated onto the Th target. The target has the structure of 30 mm diameter and the thickness of 5 mm ThO2 encapsulated by 0.5 mm Al foil, which securely sealed the target material. To ensure the stability and safety of thorium targets under high-power beam conditions, a packaging design for the protective Al layer of thorium targets will be adapted with accompanied by detailed mechanical and thermal analyses. Also, an evaluation of the radiation shielding for proton-irradiated thorium target will be presented. This process focuses on protecting personnel and the public by calculating dose rates around the target system and ensuring the dose rates remain below regulatory limits.

This work was supported by INNOPOLIS grant funded (RS-2025-13632970) and by National Research Foundation (NRF) grant (TOPTIER, RS-2024-00436392) by the Korea government of Ministry of Science and ICT (MSIT)

Paper submission Plan:

Yes

Best Presentation:

No

16

Generative learning-based 6-dimensional phase space reconstruction using standard elements

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Generative phase space reconstruction using neural networks and differentiable simulation has been developed to enable robust phase space diagnostics. Recently, an experimental demonstration of a

complete 6-dimensional phase space reconstruction was successfully performed using RF transverse deflecting cavities and dipole magnets. Since the deflecting cavity is a specialized element mainly for diagnostics, we further carried out the reconstruction using standard elements, such as RF accelerating cavities in place of the deflecting cavity, to reduce such diagnostic costs. In particular, we were inspired by the conventional longitudinal emittance measurement, in which the fractional energy deviation can be measured at the screen placed in the dispersive section, enabling the extraction of the time–energy correlation of the beam by varying the RF cavity phase. We performed simulation and experimental demonstrations using the beamline at the Pohang Accelerator Laboratory X-ray Free Electron Laser. We observed that the predicted screen images from the reconstructed phase space successfully matched the experimental dataset. In addition, we achieved both qualitative and quantitative agreement on the longitudinal phase space independently measured at a further downstream beamline that was not considered during the training, indicating that the reconstructed phase space closely resembles the ground physical distribution. It is thus expected that the GPSR method can be considered as a general diagnostic tool in accelerator facilities using readily available beamline elements.

Paper submission Plan:

No

Best Presentation:

No

17

Microwave Instability Study in an Intense Storage Ring

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In modern storage rings, microwave instability frequently represents a critical performance-limiting factor. The Shanghai Advanced Light Source Test Facility (SLIGHT) is a storage ring-based light source designed to generate fully coherent X-ray radiation, featuring exceptionally strong damping capabilities and high beam current operation. To achieve intense X-ray free-electron laser (FEL) radiation with a relatively high average power, SLIGHT maintains beam parameters characterized by high intensity, short bunch length, and reduced momentum compaction factor, which heighten the significance of microwave instability. Notably, when particles propagate through bending magnets, there would be substantially stronger coherent synchrotron radiation (CSR) effects compared to conventional light sources. Furthermore, the implementation of multiple damping wigglers to achieve short damping times produces intense coherent wiggler radiation (CWR). Given these considerations, thorough investigation of microwave instability becomes imperative. This paper provides a comprehensive characterization of the dominant THz-scale short-range wake fields in the SLIGHT storage ring and investigates the corresponding microwave instability thresholds

Paper submission Plan:

Yes

Best Presentation:

No

18

Structural Characterization of Urea-Induced BSA Denaturation using Size-Exclusion Chromatography Coupled with Small-Angle X-ray Scattering

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This study investigates the urea-induced structural transitions of bovine serum albumin (BSA) in solution using size-exclusion chromatography coupled with small-angle X-ray scattering (SEC-SAXS). BSA samples treated with 0 to 8 M urea were subjected to SEC to isolate monomeric species, enabling the acquisition of high-quality SAXS data and ab initio 3D modeling using GASBOR. Key structural parameters–including the radius of gyration (Rg), maximum dimension (Dmax), and pair distance distribution function P(r)–were derived from the scattering profiles. Three major conformational states were identified: a compact globular form (0–3 M urea), a partially unfolded intermediate (4 M urea), and a fully extended, denatured conformation (5–8 M urea). These transitions were corroborated by Kratky analysis and structural modeling. At higher urea concentrations, GASBOR yielded representative average structures, while the ensemble optimization method (EOM) revealed conformational heterogeneity, reflecting increased structural flexibility. Overall, SEC-SAXS enabled detailed characterization of BSA unfolding and provided insights into protein dynamics and stability under denaturing conditions.

Paper submission Plan:

Yes

Best Presentation:

Yes

20

Integration of RF Interlock System into the High-Power RF Auto-Start Logic for the 100 MeV Proton Linac at KOMAC

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KOMAC (Korea Multi-purpose Accelerator Complex) of KAERI has operated the 100 MeV proton linear accelerator since 2013. To accelerate the proton beam, the high-power RF is delivered to the cavities using 1.6 MW, 350 MHz klystrons. KOMAC has provided 24-hour user service since August 2024. To reduce the operational burden on accelerator operators, an auto-start logic was developed to automatically boost the high-power RF. This logic enabled automatic operation of the modulator and RF system, as well as self-diagnosis and recovery in the event of an unexpected stop.

In 2025, the auto-start logic was upgraded through the integration of the RF interlock system with remote communication capability. The upgraded system enables operators to monitor fault status in real time, archive fault history, and perform remote reset of the RF interlock system. By linking these functions with the auto-start sequence, the upgraded logic improves system reliability, reduces recovery time after interlock events, and enables flexible remote operation. This paper presents the upgraded auto-start logic algorithm and sequence flow, together with experimental results from the high-power RF system of the 100 MeV linac.

Paper submission Plan:

No

Best Presentation:

No

21

Beyond the Curve: A Machine Learning Approach for Wobbling Proton Beam Therapy Output Prediction

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Purpose: While analytical models for monitor unit (MU) prediction in wobbling proton beam therapy are well-established, they can exhibit reduced accuracy in clinically extreme cases, such as for small field sizes. This study proposes a machine learning framework designed to act as a supportive verification tool for the analytical model, enhancing predictive confidence across the wide spectrum of treatment parameters.

Materials and Methods: A pretreatment quality assurance (QA) dataset of 2,859 wobbling proton fields, collected between 2016 and 2024, was used to train a suite of machine learning algorithms, including Gradient Boosting Machines (e.g., XGBoost), Random Forests, and Neural Networks. The input features were expanded from the analytical model to include field size, alongside proton energy, scatter thickness, and the width of the spread-out Bragg peak (SOBP). The framework was evaluated on its ability to provide reliable predictions, particularly for cases where the analytical model is known to be less accurate.

Results: The machine learning models demonstrated a strong ability to generalize from the measurement data. For common treatment plan parameters, their predictions showed excellent agreement with the analytical model. However, for extreme cases involving small field sizes and sparse data, the ML models provided stable and reliable predictions where the analytical model showed significant deviations. This confirms their utility in addressing the known limitations of the analytical method.

Conclusion: A machine learning framework can serve as a powerful complementary tool for MU prediction in proton beam therapy. By running in parallel with the established analytical model, it provides an essential safety layer, offering robust predictions for non-standard fields while confirming results for routine cases. This synergetic approach enhances the overall reliability and safety of the clinical workflow without discarding the proven value of the analytical method.

Paper submission Plan:

Yes

Best Presentation:

No

22

Enhanced Self-Seeding of Hard X-ray FEL using a Few-Femtosecond-Duration Electron Bunch

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We present an enhanced self-seeding scheme for hard X-ray free-electron lasers (FELs) using a few-femtosecond-duration, high-current electron bunch. Such short bunches produce a seed pulse with a spectrum consisting of only a single or few spikes before filtering at the diamond crystal, depending on the photon energy. The reduced number of spectral modes helps mitigate the large pulse energy jitter (≈30%) typically observed in conventional self-seeded FELs. The scheme is investigated through start-to-end simulations with ELEGANT and GENESIS, and a parallel MPI-based processing pipeline was developed to apply the filtering and reconstruct GENESIS-compatible field data. Simulation results indicate that this approach can significantly reduce the pulse energy jitter, thereby enabling the generation of more spectrally stable few-femtosecond FEL pulses.

Paper submission Plan:

No

Best Presentation:

No

23

Stabilization of ferroelectric phase in HfO2-based materials via He ion beam irradiation

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Continuous advancement in nonvolatile and morphotropic beyond-Moore electronic devices requires integration of ferroelectric and semiconductor materials. The emergence of HfO2-based ferroelectrics that are compatible with atomic-layer deposition has opened interesting and promising avenues of research. However, the origins of ferroelectricity and pathways to controlling it in HfO2 are still mysterious. In this presentation, I will present how we are able to stabilize ferroelectric orthorhombic phase in these materials by defect engineering via local He ion beam irradiation and discuss the possible competing mechanisms for resulted highly enhanced ferroelectricity [1]. We first examine feasibility of defect engineering via local He ion beam irradiation using prototypical two-dimensional (2D) transition metal dichalcogenides (TMD) MoTe2. Then, we investigate how controlled irradiation influences on the ferroelectric phase in HfO2-based materials. Our piezoresponse force microscopy results indicate that the amplitude of piezoresponse in the ion irradiated region increased by approximately twofold compared with that in the pristine region and the scanning transmission electron microscopy results show a homogeneous distribution of oxygen vacancies and a

phase transition to the ferroelectric phase. These findings both reveal the origins of ferroelectricity in this system and open pathways for nano-engineered binary ferroelectrics.

Paper submission Plan:

No

Best Presentation:

No

25

Operation Status of Beam Loss Monitors for KOMAC DTL tanks

Author: Gyuhaeng Jo[1]

Co-authors: Sang-Pil Yoon [2]; Jae-ha Kim [1]; Sung-Yun Cho [3]; Young-gi Song [1]; DongHwan Kim [4]; Han-Sung Kim [5]; Hyeok-Jung Kwon [6]

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Beam loss monitor (BLM) is a key device for protecting accelerator systems, as it measures secondary radiation produced by a particle beam colliding with the inner wall of the accelerator. Therefore, in the KOMAC 100 MeV proton accelerator, BLMs were installed on the 20 MeV DTL (Drift Tube Linac) and 100 MeV DTL tanks for the purpose of machine protection. These BLMs are scintillator-based radiation detectors capable of operating in high-radiation environments, with two or more devices installed on each DTL tank. In this study, the linearity between BLM signal intensity and beam loss in each DTL tank was analyzed to evaluate the performance of the BLM as a machine protection system (MPS) for the accelerator.

Paper submission Plan:

No

Best Presentation:

No

26

Allison Scanner Development and Measurements in the LEBT of the KOMAC 100 MeV Proton Accelerator

Authors: SeokHo Moon[1]; DongHwan Kim[2]; Seung-Hyun Lee[1]; Sang-Pil Yoon[3]; 성윤조[4]; Han-Sung Kim[5]; Hyeok-Jung Kwon[6]

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This work presents the design, development, and measurement results of the Allison scanner installed in the Low Energy Beam Transport (LEBT) section of the 100 MeV proton accelerator at KOMAC. The Allison scanner is a widely used diagnostic device that enables precise measurement of transverse emittance by electrostatically sweeping the beam and detecting angular distributions. In this study, we describe the development process of the scanner, highlight technical issues encountered during fabrication and integration, and discuss their underlying causes along with the solutions that were implemented. Furthermore, we present measurement results obtained with the scanner and evaluate its performance in characterizing the beam quality. In addition, the stability of the ion source, monitored with the Allison scanner during the first half of the 2025 user service period, is analyzed and discussed.

Paper submission Plan:

Yes

Best Presentation:

No

27

Effect of Gamma(γ)-ray Radiation on Tin Oxide Field-Effect Transistors

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In next-generation space applications, semiconductors are inevitably exposed to radiation environments, where performance degradation and reliability issues represent critical challenges for electronic devices [1,2]. Tin oxide (SnO2) exhibits a high mobility of 20–30 cm2/V·s even under low-temperature below 400 ℃, and its wide bandgap of over 3.8 eV provides strong extreme environment tolerance, making it a highly promising candidate for space electronics [3,4]. However, there have been hardly systematic researches on the degradation mechanisms and reliability of SnO2-based devices under space radiation exposure. In this work, SnO2 thin films and field-effect transistors were irradiated with γ-ray dose of 1, 3, and 5 kGy by using 60Co radioisotope, and their material and device properties were systematically estimated before and after irradiation. Based on these results, we confirmed the radiation-induced degradation mechanisms of SnO2 devices and the potential for application in radiation-hardened electronics for space environments.

Acknowledgement
This work was supported by the National Research Foundation of Korea(No. RS-2024-00437064)

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Paper submission Plan:

No

Best Presentation:

Yes

28

Performance Test and Quantum Effects of Single-Spoke Resonator Superconducting Cavities

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Co-authors: Juwan Kim [2]; Sungmin Jeon [2]

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The performance of Single-Spoke Resonator (SSR) type superconducting cavities has been systematically investigated. Key design parameters of the SSR cavities are presented, followed by vertical test results obtained under operational conditions. The measurements include the quality factor (Q) as a function of accelerating field (Eacc), as well as evaluations of Lorentz Force Detuning (LFD) and pressure sensitivity. To further elucidate the determinants of the superconducting quality factor, we examine the underlying mechanisms of heat dissipation using a quantum-mechanical framework. The superconducting properties of niobium, BCS surface resistance, and contributions from magnetic heating resistance are analyzed to establish their connection to the overall quality factor of the superconducting cavities.

Paper submission Plan:

Yes

Best Presentation:

No

29

Development of In-Situ Field Measurement System for Korea-4GSR In-Vacuum Undulators

Authors: Geonhee Choi[1]; Yoongeol Choi[2]

Co-authors: Beom Jun Kim [3]; Dong-Eon Kim [4]; YoungGyu JUNG [3]; Woulwoo Lee [4]; Garam Hahn [3]

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Accurate magnetic field characterization of in-vacuum undulators is essential for ensuring beam quality in synchrotron light sources. We present the design and development of an in-situ field measurement system that combines a SAFALI (Self-Aligned Field Analyzer with Laser Instrumentation)–based Hall probe system and a stretched-wire system to enable both local field mapping and field integral measurements. The Hall probe system employs laser interferometry and optical feedback to achieve micrometer-level positioning accuracy, while the stretched wire system provides reliable evaluation of the first and second magnetic field integrals. All structural components are fabricated from low magnetic permeability materials to minimize magnetic interference. The system is designed to characterize in-vacuum undulators with a magnetic length of up to 3 m, enabling comprehensive field mapping without dismantling the chamber. This integrated system is currently under construction for application to in-vacuum undulators at the Korea 4th Generation Synchrotron Radiation Facility, with the goal of providing high-precision magnetic field mapping, improved phase error reproducibility, and direct verification of magnetic performance.

Paper submission Plan:

No

Best Presentation:

No

30

Down-Ramp Injection in LWFA with a Segmented Capillary Gas Cell

Authors: sihyeon lee[1]; Junyeong Jeong[2]; Myunghoon Cho[3]; Inhyuk Nam[2]

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[3] *Pohang Accelerator Laboratory*

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Controlling electron injection in laser wakefield acceleration (LWFA) is crucial to obtaining a high-quality electron beam. The down-ramp injection mechanism, which utilizes a longitudinal decrease in plasma density to trigger localized electron trapping, has been proposed and is often implemented using gas jets. Here, we experimentally demonstrate for the first time that down-ramp injection is feasible using a capillary gas cell. We present the design of a segmented capillary gas cell capable of producing a tailored plasma density gradient, and we show via experiments and simulations that this approach provides control over electron injection, yielding electron beams with higher peak energies and reduced energy spread.

Paper submission Plan:

No

Best Presentation:

No

31

Development of Accelerator Operation Infrastructure for User Beam Delivery at RAON

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Co-authors: Jang Won KWON [2]; eunsang kwon [3]; Eunhun IM [1]; Mijeong Park [4]; Sang-Gil Lee [5]; Hyung Jin Kim [6]

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RAON (Rare Isotope Accelerator complex for On-line experiments), a heavy-ion linear accelerator designed to advance fundamental and nuclear science with rare-isotope beams, has successfully commenced user operation by delivering argon beams and has since continued to provide reliable user services. With the initiation of regular beam delivery, a comprehensive accelerator operation framework has been established to ensure safe, efficient, and precise beam operation while minimizing human intervention and judgment to reduce the risk of human error. This work presents the development of the operational infrastructure at RAON, encompassing the formulation of beam modes, the design and implementation of beam delivery scenarios, and the establishment of a beam interlock system enabled through a readiness manager program.

Paper submission Plan:

No

Best Presentation:

No

32

Measurement of the p+^{11}B Aneutronic Fusion Reaction Near 2 MeV

Authors: Dahyun Choi[1]; Jung Keun Ahn[1]; Rishav K Jaiswal[1]; Soo-ho Chae[1]; Sungwook Choi[1]

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Stellar hydrogen-burning stages lack the abundant presence of the elements ^{6}Li,^{9}Be, and ^{11}B.At proton energies of only a few MeV, the reaction of protons with boron (p + ^{11}B), which produces ^{12}C through radiative capture, exhibits a very small cross section due to the Coulomb barrier. Hence, proton capture by ^{11}B is typically overlooked in Big Bang nucleosynthesis study.

However, investigating this specific capture pathway (p + ^{11}B) is important because it helps constrain the S-factor and the resonance structure that feed into nucleosynthesis networks. Additionally, the gamma lines at 4.439 and 3.215 MeV from ^{12}C serve as reference features for flare and cosmic gamma-ray astronomy. The competing (p, α) channel, which generates three alpha particles, is central to the concept of aneutronic fusion. This approach can be proposed for proton-boron dose boosting in therapy and can potentially serve as a source of clean energy without producing neutrons.

Despite extensive research,the low-lying resonance structure in ^{12}C has yet to be fully understood. To analyze the gamma and alpha energies resulting from the reaction channels ^{11}B(p, γ)^{12}C and ^{11}B(p, α)^{8}Be , we aim to explore the resonance levels of ^{12}C at 17.76 MeV (0+), 18.35 MeV (3−), and 18.39 MeV (0−). We utilized a proton beam energy of Ep = 2 MeV and Ep = 2.61 - 2.67 MeV to bombard a 1 mm thick boron target (25 x 25 x 1 mm), leading to the formation of the desired resonance levels in ^{12}C.Gamma ray detection was achieved using the LaBr3(Ce) detector array.

We currently measure γ rays emitted from the reactions ^{11}B(p, γ)^{12}C and ^{11}B(p, p'γ)^{11}B using the 2 MV tandem accelerator at the Korea Institute of Science and Technology (KIST). In this presentation, we will present preliminary results on the cross sections for ^{11}B(p, γ)^{12}C and ^{11}B(p, p'γ)^{11}B reactions.

Paper submission Plan:

Yes

Best Presentation:

Yes

33

HG-VPU development at PAL

Authors: Changbum Kim[1]; Dong-Eon Kim[2]; Ki-Hyeon Park[3]; Yoongeol Choi[4]; YoungGyu JUNG[1]

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PAL-XFEL is planning to install second hard X-ray undulator line (HX2) to meet the high beamtime demand from the users. The photon energy range for the second hard X-ray beam line is from 2~ to 11 keV which is lower than the first hard X-ray photon energy range (2 ~ 20 keV). The required undulator parameters are 35 mm period, max Keff=3.48 at 9.00 mm gap, ~3.0 m magnetic length with phase error less than 5 degrees. In addition to the existing conventional undulator design, horizontal gap vertical polarized undulator (HGVPU) concept is also being considered. HGVPU is

well developed by LCLS-II team and applied in LCLS-II. In this report, we summarize the VPU design for PAL-XFEL HX2, and reports progress in the prototyping.

Paper submission Plan:

Yes

Best Presentation:

No

34

Physical Design of a High-Gradient Superconducting System for a Magnetic Particle Imaging (MPI) for Nanorobot Navigation

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This paper presents the comprehensive electromechanical design and multiphysics analysis of a large-bore Magnetic Particle Imaging (MPI) system. The system architecture integrates multiple specialized coil sets, including high-power resistive AC drive coils for the x, y, and z axes, and DC focus coils for field-of-view manipulation. The core of the platform is a high-performance superconducting selection coil system, which is the key enabler for achieving high-resolution imaging. This central component is designed to generate a highly linear field gradient exceeding 5 T/m, which is essential for sub-millimeter spatial resolution. A significant focus of this work is the detailed analysis of the complex interactions between all system components. This includes electromagnetic simulations to ensure field quality and homogeneity, and a rigorous structural analysis using ANSYS to manage the large static and oscillating Lorentz forces between the superconducting, drive, and focus coils. The resulting integrated design, validated by simulation, provides a complete blueprint for a robust, next-generation MPI platform capable of advanced nanomaterial characterization.

Paper submission Plan:

Yes

Best Presentation:

No

35

The incident laser-electron beam interaction in undulator concerning analysis and simulation.

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This study reveals a crucial mechanism by which the incident angle of a laser profoundly alters the oscillation and modulation of electron beams. Depending on the relative phase of the electrons, the beam can experience either acceleration or deceleration, fundamentally shaping its energy distribution. Through detailed trajectory analysis and simulations, the team modeled a y-propagating electron beam oscillating transversely in the undulator's magnetic field. By introducing a seed laser at a slight angle to the z-axis, they showed that the combined Lorentz force of the undulator's magnetic field and the laser's electric field dynamically governs the beam's position and energy modulation in time. The real breakthrough comes from the application to the Echo-Enabled Harmonic Generation (EEHG) system, where two undulators and two chicanes are aligned. By understanding and exploiting these angle-dependent interactions, the study demonstrates how precisely tailored laser-beam geometry can enhance harmonic generation efficiency.

Paper submission Plan:

Yes

Best Presentation:

No

36

Accelerator-Based Ion Beam Analysis at KIST: Applications to Fusion Materials

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The Accelerator Laboratory at the Korea Institute of Science and Technology (KIST) operates accelerator systems for ion beam analysis (IBA), accelerator mass spectrometry (AMS), and ion implantation. The facility consists of three accelerators with dedicated beamlines: a 6 MV tandem accelerator (IBA, AMS, and ion implantation), a 2 MV pelletron accelerator (IBA and ion implantation), and a 400 kV Cockcroft-Walton type accelerator (ion implantation). The IBA station employs Rutherford Backscattering Spectrometry (RBS), Elastic Recoil Detection (ERD), and Time-of-Flight ERD (ToF-ERD). The AMS line measures rare isotopes such as C-14, Be-10, Al-26, Cl-36, and I-129, with applications in geochronology and biomedical research. The ion implantation beamlines, using various ion sources, are utilised for studies in semiconductors, space materials, nuclear materials, and nuclear synthesis research.

One of the principal advantages of IBA is the quantitative detection of hydrogen and its isotopes. This is a key capability for nuclear fusion material analysis. The development of nuclear fusion reactors requires plasma-facing materials (PFMs) that can withstand extreme thermal loads and intense particle fluxes. Understanding plasma–wall interactions (PWI), i.e. fuel retention, erosion–deposition processes, and surface modification, is therefore essential for reactor design. IBA is a suitable technique to provide experimental evidence in these studies.

We have initiated the analysis of fusion materials, including the samples from the tungsten divertor of the KSTAR tokamak, exposed during the 2024 campaign, as well as tungsten-coated carbon specimens tested under controlled laboratory plasma conditions. This work is the first application of IBA to PWI studies in Korea, and it will support KSTAR operation and future fusion research.

Paper submission Plan:

No

Best Presentation:

No

37

Beam Operation Procedure of the RAON Heavy Ion Accelerator Based on User Beam Services

Author: Jehyeong Yu[1]

Co-authors: Chul Jin Choi [2]; Ho Nam Park [1]; Kwang Hyun Park [1]; Young Soo Jang [1]; Yujung Ahn [2]

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The heavy ion accelerator RAON requires real-time remote control system for the beam operation. To fulfill this, an integrated control system based on the EPICS toolkit 'Phoebus'has been implemented for the stable beam service. The operator interface for beam transmission includes procedures such as beam parameter configuration, RF power and acceleration mode setup, interlock system verification, the startup or shutdown of beam transmission, and the monitoring of the user experiments. In this poster, we describe the beam operation procedure based on the beam transmission for a user.

Paper submission Plan:

No

Best Presentation:

No

38

Numerical Analysis of Longitudinal Phase Space Tomography

Author: Geunwoo Kim[None]

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An accurate measurement of the Longitudinal Phase Space (LPS) is essential for optimizing accelerator performance. This study presents the technique of computed tomography to measure the LPS using only basic accelerator components: a booster cavity and a spectrometer. The method consists of two main steps. First, for data acquisition, a series of beam projections are obtained. A controlled longitudinal chirp is introduced by scanning the booster cavity phase, and a spectrometer converts

the energy deviation to spatial distribution on a screen. Second, for image reconstruction, iterative algorithms are applied to retrieve the LPS from obtained projections, specifically the Filtered Back-Projection (FBP) and Simultaneous Algebraic Reconstruction Technique (SART). To improve accuracy, a charge cut is applied to remove artifacts introduced by the reconstruction algorithm. The reconstructed LPS shows good agreement with the ground-truth data, as validated by the good match between their 1D profiles. Future work will focus on three areas: further optimization and improvement of the reconstruction algorithms, experimental verification by comparison with measurements using a transverse deflecting cavity either at eLABs or PAL-XFEL, and exploring the extension of this method to the characterization of non-relativistic ion beams.

Paper submission Plan:

No

Best Presentation:

Yes

39

A Study of RF Cavity Frequency Sensitivity to Structural Tolerances Using Simulation and Measurement Data

Author: Pikad Buaphad[1]

Co-authors: Dong Hyeok Jeong [2]; Heuijin Lim [1]; Hyun Kim [1]; Kyoung Won Jang [1]; Manwoo Lee [1]; Sang Jin Lee [1]; Sang Koo Kang [1]; Wung-Hoa Park [1]

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A compact C-band (5712 MHz) electron linear accelerator is under development at Dongnam Institute of Radiological and Medical Sciences (DIRAMS) for medical applications, where high frequency stability and mechanical precision are essential. A few micrometers of cavity dimensional deviations can lead to frequency shifts of 5–15 MHz, while the required frequency accuracy is typically within 1 MHz. This study explores the impact of dimensional tolerances on cavity resonance frequency through a combination of simulations and experimental measurements. A unit cell is simulated to determine its resonant frequency and evaluate its sensitivity to geometric variations. Then a cavity is fabricated and measured using cold testing. Precise cavity dimensions are obtained using a laser 3D measurement system to quantify manufacturing tolerances. Finally, the simulation results are compared with experimental data to evaluate the influence of fabrication tolerances on frequency performance. The results provide valuable insights for enhancing the precision and efficiency of RF cavity design and fabrication.

Paper submission Plan:

Yes

Best Presentation:

No

40

Analysis of Orbit Stability under External Perturbations in Low-Emittance Storage Rings

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Co-authors: Hyunchang Jin [2]; Jaehyun Kim [3]; Jaeyu Lee [1]; Jimin Seok [4]; JunHa Kim

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The beam stability relative to the beam size is a key performance parameter for storage ring light sources. In next-generation storage rings, the substantial reduction in natural emittance makes the electron beam orbit far more sensitive to external perturbations. As a result, orbit stability must be controlled to within only a few percent of the beam size across a broad frequency range. In this work, we investigate how ground vibrations, magnet power-supply ripple, and RF-induced energy variation contribute to the electron beam orbit stability as a function of frequency.

Paper submission Plan:

No

Best Presentation:

No

41

Feasibility study on nonlinear kicker injection scheme for PLS-II and Korea-4GSR

Author: Jaehyun Kim[1]

Co-authors: Changbum Kim [2]; GYEONGSU JANG [2]; Jaeyu Lee [2]

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The nonlinear kicker (NLK) injection scheme is a well-established method to realize off-axis injection without perturbing the stored beam. We investigated the feasibility of applying this scheme to PLS-II and Korea-4GSR. Two scenarios were compared: replacing the existing four-kicker system with an NLK, and installing the NLK in another straight section so that both injection schemes coexist redundantly. Six-dimensional tracking simulations were carried out to validate the feasibility of the NLK scheme in the machines without major modifications and to estimate the required NLK specifications.

Paper submission Plan:

No

Best Presentation:

No

42

Analysis of Wakefield-Driven Beam Instabilities in Korea-4GSR

Author: Jimin Seok[1]

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The electron storage ring of Korea-4GSR must operate under diverse beam filling patterns depending on user requirements. The most preferred mode is the brightness mode with uniform filling, which provides many bunches at high total beam current. However, some users demand very high single-bunch current for timing experiments. In such cases, the ring can be operated in hybrid or timing modes, where only a few bunches carry extremely high current. The maximum achievable single-bunch current and total beam current, however, are ultimately limited by beam instabilities. When an electron beam passes through vacuum components, it excites wakefields that act back on the bunches. These wakefield effects, which are proportional to the beam current, can drive collective instabilities. Therefore, in order to achieve the target beam currents, it is essential to estimate the wakefields of the ring and to evaluate the resulting instabilities using both analytical models and numerical simulations.

Paper submission Plan:

No

Best Presentation:

No

43

Monte Carlo Design and Experimental Validation of a Compact ^{241}Am–Be Neutron Irradiation System

Author: Taekyu Lee[1]

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A compact multi-purpose neutron irradiation system employing a ^{241}Am–Be source was designed, constructed, and experimentally validated. The system was developed with two primary objectives: to provide a collimated fast-neutron beam for the development and calibration of time-of-flight (ToF) plastic scintillator detectors, and to enable long-term irradiation of solid materials for radiation-resistance studies. The shielding assembly, optimized through MCNP6.2 simulations, incorporated 430 mm of high-density polyethylene (HDPE) supplemented by 3 mm of lead and 5 mm of stainless steel, and was verified to comply with the Nuclear Safety and Security Commission (NSSC) regulatory requirement of 1 $\mu Sv \cdot h^{-1}$ for fully shielded devices. Collimator optimization indicated that a

730 mm length provided the most favorable balance, effectively suppressing thermal and epithermal neutrons, maximizing fast-neutron transmission, and minimizing γ-ray background. Experimental verification using BF_3 proportional counters and CR-39 detectors showed good agreement with Monte Carlo predictions. Discrepancies between measured and simulated dose rates were attributed to the conservative assumptions inherent in the simulation as well as uncertainties in shielding material properties, geometric deviations, and dosimeter response. Overall, the system demonstrated compliance with regulatory safety requirements and reliable dosimetric performance. The developed system supports diverse applications in detector calibration and radiation-resistance studies of advanced materials.

Paper submission Plan:

Yes

Best Presentation:

No

44

Improvement of RAON Linac Beam Commissioning

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The RAON linear accelerator consists of an injector and a superconducting linear accelerator (SCL3). The injector is composed of an ECR ion source, LEBT, RFQ, and MEBT. The ECR ion source generates various ion beams (A/Q = 1~7.2) with an energy of 10 keV/u, and the RFQ accelerates them to 500 keV/u. The superconducting accelerator (SCL3) is composed of two types of superconducting accelerating cavities, QWR and HWR, and accelerates uranium beams up to 18.5 MeV/u. In last year' s beam commissioning of the superconducting linac using an argon beam, the measured energy was lower than expected; however, this issue has been resolved this year. In this presentation, we summarize the results of injector and superconducting accelerator beam commissioning performed this year, along with several improvements.

Paper submission Plan:

No

Best Presentation:

No

45

PRELIMINARY DESIGN OF A NATURAL THORIUM-232 METAL TARGET FOR ACTINIUM-225 DEVELOPMENT AT IRIS

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Actinium-225 has recently attracted significant attention as a promising α-emitting radionuclide for targeted alpha therapy, owing to its decay process that produces four alpha particles and its suitable half-life of 9.9 days for pharmaceutical development. However, the limited supply of Ac-225 is a significant barrier to widespread clinical use. One effective production route is the proton irradiation of thorium oxide (ThO_2) targets by using proton accelerators. This work presents the engineering design of ThO_2 targets intended for irradiation with 70 MeV protons. Mechanical analyses were conducted to ensure target integrity under demanding operational conditions. In addition, the target fabrication process employing ThO_2 powder will be presented.

This work was supported by INNOPOLIS grant funded (RS-2025-13632970) and by National Research Foundation (NRF) grant (TOPTIER, RS-2024-00436392) by the Korea government of Ministry of Science and ICT (MSIT)

Paper submission Plan:

Yes

Best Presentation:

No

46

Evaluation of Chemical Pretreatment Protocols for AMS-Based Radiocarbon Analysis of Atmospheric CO_2

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Accelerator Mass Spectrometry (AMS) is recognized as a highly effective technique for tracing fossil fuel-derived carbon dioxide emissions in the atmosphere. To reduce sample contamination and improve the reliability of radiocarbon measurements, chemical pretreatment is routinely employed in AMS laboratories. This study investigates the influence of chemical pretreatment by comparing

measurement outcomes obtained under three distinct pretreatment protocols. The results are systematically analyzed and discussed to evaluate their impact on data quality and consistency.

Paper submission Plan:

Yes

Best Presentation:

No

47

Crossbar Switch Development for 4GSR BPM Electronics to Suppress SA Drift from Gain Difference and AC Effects

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The development of beam position monitor (BPM) electronics for the Korea 4GSR storage ring includes a dedicated crossbar switch architecture to address drift effects observed in slow acquisition (SA) data. Without the crossbar switch, the difference in standard deviation appears minimal in turn-by-turn (TbT) data, but in practice, gain mismatches between channels combined with temperature drift and AC ripple prevent the standard deviation of SA data from decreasing ideally with averaging. As a result, the SA resolution remains at the 50–70 nm level, as confirmed by both simulation and measurement. With the crossbar switch implemented, effective channel isolation and averaging reduce the SA standard deviation to the 10–20 nm level. This study presents the modeling, design, and experimental validation of the crossbar switch, highlighting its importance in meeting the stringent stability requirements of the 4GSR storage ring.

Paper submission Plan:

Yes

Best Presentation:

No

48

Intelligent Design Optimization of Half-Wave Resonator (HWR): A Machine Learning-based Approach

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This study presents a methodology for the radio-frequency (RF) design optimization of a half-wave resonator (HWR) that can be used at the SCL-21 section of the RAON heavy ion accelerator. To overcome the limitations of conventional manual parameter sweep methods, such as computational inefficiency and convergence to a local optimum, we introduce a machine learning-based, data-driven optimization workflow. To build a dataset that efficiently represents the entire design space, we applied Latin Hypercube Sampling (LHS) and utilized a Support Vector Machine (SVM) classifier with probabilistic output to efficiently acquire valid CST simulation data. Based on the acquired data, we trained a Gaussian Process Regression (GPR) surrogate model with an ARD (Automatic Relevance Determination) kernel, which automatically infers the importance of each variable. The hyperparameters of this model were automatically optimized through Bayesian Optimization. Finally, we coupled the highly trained surrogate models with a Multi-objective Genetic Algorithm to derive a Pareto optimal front for the conflicting objectives of maximizing the accelerating electric field (Eacc), and minimizing the peak surface electric field ratio (Epk/Eacc) and magnetic field ratio (Bpk/Eacc). During this process, we iteratively performed adaptive sampling, which leverages the uncertainty information from the GPR models, to progressively improve the model's predictive accuracy and enhance the search for a global optimum. The proposed methodology offers a new direction for the complex field of accelerator cavity design by providing both significant design time reduction and performance enhancement, overcoming the limitations of previous experience-based design approaches.

Paper submission Plan:

No

Best Presentation:

No

49

Commissioning of a Stretched Wire System for 4GSR Magnet Measurements

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The 4th-Generation Synchrotron Radiation Source (4GSR) requires multipole magnets with a 15 mm aperture radius to achieve an ultra-low emittance of 58 pm·rad. Within this narrow good field region, high-order multipole errors must remain below 1.0E-4. To evaluate such small components, a stretched wire (SW) measurement system, developed by ESRF, has been introduced and commissioned at PAL. The system can support magnets up to 2 tons and enables fiducialization, field strength measurements, and multipole characterization, with typical repeatability of 2 μm for magnetic center, 0.1 mrad for pitch/yaw/roll, and 0.2 G·m for integrated field. Validation was performed by measuring a quadrupole magnet and comparing results with the PCB Rotating Coil System (PRCS) developed at PAL. For SW, the harmonics were C6/C2 = 1.37E-3, C10/C2 = 1.06E-4, C14/C2 = 4.18E-5, and C18/C2 = 7.41E-5. For PRCS, the values were C6/C2 = 1.80E-3, C10/C2 = 4.43E-5, C14/C2 = 1.87E-5, and C18/C2 = 2.50E-5. Except for C6, PRCS yielded slightly smaller values, but overall trends were consistent. The C2 repeatability was 3.25E-4 for SW and 1.25E-5 for PRCS. These results demonstrate successful commissioning of the SW system and its capability for reliable multipole field quality measurements in 4GSR magnets.

Paper submission Plan:

No

Best Presentation:

No

50

Beam-based alignment simulations at Korea-4GSR storage ring

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The Korea-4GSR is an advanced fourth-generation synchrotron radiation source designed to deliver ultra-low emittance and high brightness. To achieve its demanding beam quality, the precise alignment of magnetic elements is required. This study presents beam-based alignment (BBA) simulations for the Korea-4GSR storage ring, utilizing the electron beam to diagnose and correct misalignments of quadrupoles and beam position monitors (BPMs). Here we describe the results of standard BBA simulation under realistic conditions with achievable alignment precision.

Paper submission Plan:

Yes

Best Presentation:

No

51

Characterization of Niobium Surface and Microstructure after Buffered Chemical Polishing for SRF cavities

Authors: Jangwon Han[1]; Gi Yeol Han[1]; JunWoo Lee[1]; JongWan Choi[1]; Moo Sang Kim[1]; Sungmin Jeon[2]; Youngkwon Kim[1]; Yong-Sub Cho[1]

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Buffered chemical polishing (BCP) is a widely applied surface treatment for high-purity niobium in superconducting radio-frequency (SRF) cavities. While effective in removing damaged layers, BCP often introduces inhomogeneities such as streak patterns, bubble-like features, and nanoscale

roughness that can degrade cavity performance. To elucidate these effects, surface roughness measurements and atomic force microscopy (AFM) were employed to quantify nanoscale roughness, while scanning electron microscopy (SEM) revealed bubble-like features and groove formation. X-ray diffraction (XRD) was further conducted to examine crystallographic texture. AFM measurements quantified nanoscale roughness, while SEM/XRD analyses demonstrated that the roughness variations are dependent on crystallographic orientation. These results provide new insight into the microstructural origins of BCP-induced inhomogeneities and underscore the importance of multi-scale surface characterization for optimizing SRF cavity preparation.

Paper submission Plan:

No

Best Presentation:

No

52

Beam dynamics studies for SDTL-based 200 MeV energy upgrade of KOMAC proton linac

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The Korea Multi-purpose Accelerator Complex (KOMAC) is proposing an energy upgrade for the existing 100 MeV proton linear accelerator (linac). The design for this extended linac is based on a normal-conducting separated-drift tube linac (SDTL) structure. The drift tubes (DTs) of the SDTL share the same structural configuration as those of a drift tube linac (DTL); however, they do not incorporate any quadrupole magnets within the DTs. Instead, transverse beam focusing is achieved through the incorporation of a doublet focusing structure placed between the SDTL tanks. The proposed configuration includes 5 DTs per SDTL tank, resulting in a 6-cell SDTL design. A total of 16 SDTL tanks are required to accelerate the proton beam from 100 MeV to 200 MeV. Beam dynamics simulations and comprehensive error analyses were conducted to assess the tolerances of the linac design. Furthermore, a correction scheme was implemented to enhance the lattice tolerance by installing steerers. This paper presents preliminary studies on beam dynamics and error analysis, including orbit correction results, for the 200 MeV SDTL linac conducted at KOMAC.

This work has been supported through KOMAC (Korea Multi-purpose Accelerator Complex) operation fund of KAERI by Ministry of Science and ICT, Korean Govt. (KAERI ID no. 524320-25).

Paper submission Plan:

Yes

Best Presentation:

No

53

Evaluation of Alanine Dosimetry Response to High Dose-Rate Pulsed 100 MeV Proton Beams at KOMAC

Authors: Gi Wan Jeon[1]; Young Seok Hwang[2]; Yu-Mi Kim[3]; Jun Kue Park[4]; Jaehyun Lee[1]; Gwangil Jung[1]; Seong-Gu Kim[1]; 정현김[5]; EUN JOO OH[1]

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Alanine dosimetry has been widely applied for quantifying radiation fields, particularly in photon and proton beam experiments, due to its stability and well-characterized response to accumulated absorbed dose. Most reported studies, however, have been performed using continuous or quasi-continuous irradiation conditions, where the instantaneous dose rate is relatively low. In contrast, the Korea Multi-purpose Accelerator Complex (KOMAC) provides pulsed proton beams with high peak dose rates during each pulse. Such beam characteristics can potentially influence the radiation chemical reactions in alanine and thereby affect the accuracy or linearity of its dosimetric response.

In this work, we performed alanine dosimetry experiments at KOMAC using a 100-MeV class proton accelerator with pulsed beam operation. Alanine pellets were irradiated under various pulse frequencies, beam currents, and total doses, and their responses were analyzed by electron spin resonance (ESR) spectroscopy. Particular attention was paid to the comparison between total absorbed dose and signal yield under different pulse intensities.

Paper submission Plan:

No

Best Presentation:

No

54

Generation and diagnostics of sub-200-fs synchronized pulse train for Korea-4GSR Photocathode RF guns

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The Korea-4GSR(4th Generation Storage Ring) project requires a high-precision, time synchronized laser pulse train for the photocathode RF gun in multibunch mode. This photocathode RF gun generates low-emittance electron bunches with low energy spread. The laser pulse train is generated

using a beam splitter and combiner method, producing a 64-pulse laser train with 2 ns intervals synchronized to a 500 MHz RF reference. Additionally, a 500 MHz femtosecond oscillator is being developed to improve the precision of pulse timing at the femtosecond scale. This system will enhance synchronization and stability for Korea-4GSR photocathode RF gun.

Paper submission Plan:

No

Best Presentation:

No

55

Overview of the Korea-4GSR LINAC System

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The Korea-4GSR project is developing a fourth-generation storage ring light source that employs a linear accelerator (LINAC) and a booster ring as injector systems. In the LINAC, electron bunches are produced by a UV laser in the photocathode RF gun and subsequently accelerated to 200 MeV. To achieve this target energy, four accelerating structures are utilized, with a solenoid magnet positioned near the gun to provide initial beam focusing. To ensure efficient beam matching into the booster ring, nine quadrupole magnets are arranged downstream of the first accelerating structure. RF power is delivered by two klystron–modulator systems, each exceeding 70 MW in peak power and independently stabilized through dedicated LLRF–SSA feedback control. The RF power supplied to the gun is further conditioned by a waveguide-based phase shifter, circulator, and attenuator, which are manually adjusted prior to operation and fixed during beam delivery. Detailed system parameters and performance characteristics will be presented.

This research was supported in part by the Korean Government(MSIT: Ministry of Science and ICT)

Paper submission Plan:

No

Best Presentation:

No

56

A study on the low energy beam transport for a multi-species ion implantation system

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The Busan Ion Beam Accelerator (BIBA) is a compact linear accelerator facility that uses a 28 GHz Superconducting Electron Cyclotron Resonance Ion Source (SC-ECRIS) at the Korea Basic Science Institute (KBSI). The practical purpose of BIBA is to produce fast neutrons for use in high-resolution radiography technology. A new ion implantation system has been developed to use a high-charge-state and multi-species ion beam produced by a 28 GHz SC-ECRIS. In this study, we conducted a design and beam dynamics investigation of a low-energy beam transport (LEBT) for a multi-species ion implantation system employing a 28 GHz SC-ECRIS. The system is designed to deliver ion energies from tens to hundreds of keV, covering the low-energy regime that is essential for advanced materials science applications. This study reports the measured and simulated results of the fringe-field effects of the developed magnets.

Paper submission Plan:

No

Best Presentation:

No

57

Comparative Study of FODO and Triplet Lattice Structures for a Rapid-Cycling Synchrotron using Xsuite

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Accelerator-based neutron sources are increasingly recognized as key technologies for next-generation applications, including fusion-material qualification, accelerator-driven transmutation systems, and advanced materials science. Among them, the rapid-cycling synchrotron (RCS) is a critical component of pulsed spallation neutron sources, where lattice design strongly influences beam stability, acceptance, and beam loss control. This work introduces a comparative study of the FODO lattice of the Proton Engineering Frontier Project (PEFP) in Korea and the triplet lattice adopted at the China Spallation Neutron Source (CSNS), using Xsuite simulations. The analysis aims to establish a systematic methodology and highlight key implications for lattice optimization in support of future RCS development at the Korea Multi-purpose Accelerator Complex (KOMAC).

Paper submission Plan:

No

Best Presentation:

No

58

Micro-patterned Ga2O3 Thin Films for Synchrotron X-ray Photodetectors

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Ga2O3, with its wide bandgap (4.9 eV) and high breakdown field (8 MV/cm), has been widely studied for high-power electronics and solar-blind photodetectors, and more recently explored for X-ray detection, though mostly with in-house sources.
Here we demonstrate a micro-patterned device fabricated by H3PO4 wet etching at 120 ℃ on Ga2O3/sapphire (0001) thin films synthesized by RF powder sputtering, and evaluate its X-ray sensing under a 10 keV synchrotron micro-beam focused to ~ 10 × 30 μm2. Four-point probe measurements were performed while toggling irradiation at bias voltages from self-powered (0 −0.1 V) up to 20 V. Compared with unpatterned devices, the micro-patterned Ga2O3 exhibits an order-of magnitude higher current gain, reaching photocurrents of ~ 1 μA, a practical detection level. The photocurrent-to-darkcurrent ratio (PDCR) improves more modestly, due to trap sites introduced at etched sidewalls, which increase the darkcurrent.
Sensing responses were fitted with a simple two-component model, yielding rise and decay times comparable to unpatterned films. This indicates that micro-patterning mainly enhances collection efficiency without altering intrinsic recombination. These findings demonstrate a simple and scalable strategy to improve Ga2O3 X-ray photodetectors without complex device architectures. Detailed results on X-ray photo-current measurements will be presented.

Paper submission Plan:

Yes

Best Presentation:

No

59

Design of SRF Operation System for PLS-II Storage Ring

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To provide stable user-services and reduce power consumption, a Superconducting RF system (SRF) has been chosen as an energy compensator of storage ring in the Pohang Light Source II. The SRF is composed of several RF subsystems (low level RF, high power RF, cryomodule, cryogenic, etc.) and each RF subsystem has own local network to ensure stability and safety. The Experimental Physics and Industrial Control System (EPICS) protocol is used on a control network for the SRF operation

and the Beam operation. An interface server is needed in each RF subsystem to support the EPICS protocol and connect a local network with the control network. For stable operation and machine safety, integrated control is required on the SRF. In this paper, the design of the SRF Operation System will be described. It will include networks, servers, operation scenario and so on.

Paper submission Plan:

No

Best Presentation:

No

60

Magnetic Design for the 4GSR Combined-Function Booster Dipoles

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The 4GSR Project is a plan to construct a next-generation 4 GeV Multipurpose Synchrotron Radiation Accelerator, designed for stable electron beam operation at 4 GeV and 400 mA. The facility comprises an about 800 meter circumference Storage Ring and a Booster for beam energy ramping. This study details the systematic design of the Booster Dipoles (BDs), which are essential components for beam transfer in the 4GSR Booster. The Booster accelerates the beam received from the Linac and stably injects it into the Storage Ring, utilizing a total of 60 Combined-Function BDs (4 BD1s and 56 BD2s). These Combined-Function BDs simultaneously implement both dipole (bending) and quadrupole (focusing) fields, maximizing the efficiency of the booster lattice. Based on accelerator physics requirements, each BD type must precisely meet specific magnetic field (B) and field gradient (G) specifications. For BD1s, the required specifications are B=0.82 T and G=−1.46 T/m, while the majority BD2s require higher specifications of B=0.99 T and G=−1.76 T/m. Finite Element Analysis (FEA) simulations were employed to optimize the magnet yoke and coil geometry, successfully achieving the required B and G simultaneously while ensuring high field uniformity in the beam area. This presentation will thoroughly detail the final magnetic design and characterization results of the BDs, demonstrating their capability to ensure stable operation of the 4GSR Booster.

Paper submission Plan:

Yes

Best Presentation:

No

61

UI Optimization for Accelerator Operation Parameter Adjustment and Monitoring

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In accelerator operation, real-time adjustment and monitoring of various device states and beam parameters require intuitive understanding and prompt response from operators. However, the previous user interface (UI) presented mixed critical and non-essential information, making it difficult for operators to efficiently identify and adjust key parameters. In this work, we optimized the UI by incorporating operator feedback. The major improvements include ▲restructuring the layout to highlight critical parameters ▲enhancing visual recognition through the use of colors and graphical elements ▲reinforcing operational history management. As a result, operators can now access and adjust essential parameters more intuitively, leading to faster anomaly recognition and improved operational efficiency. This presentation will introduce the UI optimization process in detail and discuss its effectiveness, along with future directions for further enhancing the accelerator operation environment.

Paper submission Plan:

No

Best Presentation:

No

62

Feasibility of predicting radiation-induced dermatitis using fluorescence analysis

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Purpose:

Radiation therapy is one of the effective treatment modalities for cancer, but it has the drawback of causing damage to normal tissues as one of its side effects. Among them, radiation-induced dermatitis is a complication that can impair patients'quality of life; however, it presents considerable individual variability and is difficult to predict or prevent in advance. In this study, we analyzed the temporal changes in fluorescence emitted from the skin of mouse paws and tails after X-ray irradiation, in order to evaluate the potential for predicting and assessing radiation-induced dermatitis in humans.

Material & methods:

A device consisting of a laser and a photomultiplier tube (PMT) was constructed to analyze fluorescence signals emitted from mice. Eight mice were divided into two groups (Control and X-ray 20 Gy), with four mice per group. Following a single X-ray irradiation to the lower body, fluorescence signals from the legs and tails were measured once weekly over five weeks. Fluorescence wavelength

signals were acquired using a PMT configured with seven channels in the 500–640 nm range and analyzed by channel.

Results:

A significant difference in fluorescence wavelength signals between the 20 Gy and control groups was detected within the 500–540 nm range. Measurements taken two days after irradiation revealed that the 20 Gy group exhibited markedly higher fluorescence intensity in the skin of the legs and tails compared to the control group. The divergence in fluorescence signals peaked at one week after irradiation and subsequently diminished over time.

Conclusion:

In this study, the feasibility of predicting radiation-induced dermatitis through the analysis of fluorescence signals was demonstrated through in vivo experiments. Future work will aim to further specify the predictive conditions for radiation dermatitis by exploring a wider range of radiation doses and experimental parameters.

Paper submission Plan:

No

Best Presentation:

No

63

Improvements to prevent malfunction of SCL3 QWR SSPA cooling water

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Co-authors: Hyung Jin Kim [2]; Kyungtae Seol [3]; Sangyoon Bae [4]; Yang-ho Lee [1]

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The Superconducting Linac-3 (SCL3) employs high-power Solid-State Power Amplifiers (SSPAs) to drive the 81.25 MHz Quarter-Wave Resonators (QWR) and the 162.5 MHz Half-Wave Resonators (HWR). Each SSPA is rated for 4 kW RF output and is designed with a direct water-cooling system to remove heat from critical components. In particular, dedicated cooling lines are designed for the PA pallets, which generate the highest heat load, to ensure stable operation. In addition, other critical high-power components, including the circulator, combiner, and dummy load, are cooled through the same system to maintain reliable operation.

During the initial operation, however, the deionized (DI) water carried organic matter and residual metallic particles from the supply lines. These contaminants caused blockages and corrosion in the internal cooling branches of the SSPA system.

This study addresses the cooling line blockages in the SSPA system caused by contaminants from the external cooling utility. It presents the mitigation measures implemented to resolve these issues and discusses the improved performance achieved through this process.

Best Presentation:

No

Paper submission Plan:

Yes

64

Status and prospects of the ISOL facility at the RAON facility

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The Rare Isotope Accelerator complex for ON-line experiments (RAON) at the Institute for Rare Isotope Science (IRIS) is the first heavy-ion accelerator complex in Korea, built to advance rare-isotope beam science.Its main objectives include the discovery of new isotopes and elements using various radioactive-isotope (RI) beams,followed by precision studies to constrain nuclear-structure models and astrophysical processes.To support these goals, a high-power Isotope Separator On-Line (ISOL) facility is being developed to deliver RI beams as primary drivers for experiments.

The ISOL system consists of a proton cyclotron, target and ion-source stations, a radio-frequency quadrupole cooler and buncher (RFQCB), and an electron beam ion source (EBIS), all connected by dedicated transport beamlines. Design work and offline commissioning have been completed,and the first production, extraction, and transport of RI beams have been successfully demonstrated.

Ongoing developments focus on enhancing beam intensity and isotopic variety.A high-beam-intensity capacity target container is being tested to improve in-target production and release.In parallel, laser and Forced Electron Beam Induced Arc Discharge (FEBIAD) ion sources are being optimized offline and integrated online to broaden efficiency, selectivity, and chemical coverage.Beam optics from the target to the cooler and the charge breeder are also being refined to improve transmission and purity.

The presentation will summarize the current status of the ISOL facility, including optics performance and initial online results,and will outline near-term upgrades to targets and ion sources, aimed at maximizing the scientific potential of RAON in nuclear physics.

Paper submission Plan:

Yes

Best Presentation:

No

65

In situ mulstiscale analysis of fiber-reinforced composite materials based on DVC and DIC techniques

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Synchrotron radiation computed tomography (SRCT)-based in situ testing has emerged as a powerful tool for characterizing complex deforming behavior occurring inside fiber-reinforced composite materials. The computed tomography (CT) data are utilized to compute 3D deformation and strain fields through a digital volume correlation (DVC) technique, which provides unprecedented information about internal material behavior. However, DVC requires extremely high-resolution CT images to track either natural or artificial microscale features inside a sample. This requirement inherently limits the DVC technique to a small scanning area and often disconnects such DVC results from the global response of an entire composite structure. Moreover, because CT scanning should be performed at a specific load level with a loading frame temporarily being paused, the temporal resolution of DVC cannot be as fine as that of a traditional digital image correlation (DIC) technique. This coarse temporal resolution impedes the real-time monitoring of dynamic changes occurring inside a material. Although finer temporal resolution is achievable from the DIC technique, the deformation information is limited to the surface of a specimen. In this study, we present the simultaneous application of the DIC and DVC techniques to overcome the mutual limitations. The existing in situ test setup for DVC analysis was modified to take pictures of the specimen surface for DIC analysis. The modified test setup was demonstrated using an open-hole tension test and the image data for both the DIC and DVC computations were successfully collected. DIC results were useful for understanding the global response of the sample because the surface image data were collected every second. Although DVC results were limited only to seven load levels, the internal strain fields localized around the hole provided insightful information that could not be obtained from the DIC technique.

Paper submission Plan:

No

Best Presentation:

No

66

Channeling in oriented crystals and nanostructures breaking down the challenges in accelerator physics

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Co-authors: Laura Bandiera [1]; Kihyeon Cho [2]; Vincenzo Guidi [3]; Andrea Mazzolari [3]; Gianfranco Paternò [1]; Marco Romagnoni [3]

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Oriented crystals create a unique environment for high-energy charged particles and photons. When charged particles undergo channeling [1], they are guided by atomic electric fields with angstrom-level precision, similar to accelerator optics and achieving effects equivalent to magnetic fields exceeding 100 T. This process also generates intense X-ray and gamma radiation due to transverse e+/e- oscillations and reduces radiation length by up to a factor of 5 [2]. Furthermore, crystals and nanostructures are the key materials for plasma wakefield acceleration in solid-state targets, achieving gradients over 1 TeV/m [3].

These properties enable innovative applications, including instruments for crystal-based beam manipulation and beam focusing; X-ray and gamma sources for cancer radiotherapy, nuclear spectroscopy, and radioisotope production; positron sources for future lepton colliders; compact crystalline calorimeters for HEP experiments; and plasma wakefield acceleration for future colliders.

This presentation offers a comprehensive overview of these applications and introduces the Geant4 G4ChannelingFastSimModel [4], which enables simulation-driven design for their development.

[1] J. Lindhard. Mat. Fys. Medd. Dan. Vid. Selsk. 34(14), 64 (1965).
[2] L. Bandiera et al. Phys. Rev. Lett. 121, 021603 (2018).
[3] M.F. Gilljohann et al. JINST 18, P11008 (2023).
[4] A. Sytov et al. JKPS 83, 132 (2023).

Paper submission Plan:

No

Best Presentation:

No

67

RF-driven H- ion source and beam transport optimization for CSNS-II

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The RF-driven H^- ion source has accumulated 1200 days of service time on the accelerator of the China Spallation Neutron Source (CSNS) over the last 4 run cycles. It operates unattended with nearly 100% availability. To achieve the goal of delivering 500 kW beam power to the spallation target, as required by CSNS-II, the beam current from the ion source must be increased while minimizing beam emittance. Research on beam intensity, space charge compensation, and stripped proton beam elimination has been conducted on the ion source test bench with a newly designed Low Energy Beam Transport (LEBT). This report presents the latest experimental results from these studies, along with issues encountered during commissioning. The influence of the chopper structure on beam emittance growth and the systematic error caused by the double-slit scanner are also discussed.

Paper submission Plan:

Yes

Best Presentation:

No

68

Dynamic Aperture and Lifetime Studies for the Korea-4GSR Storage Ring via Systematic Tune and Chromaticity Scans

Author: JunHa Kim[None]

Co-authors: Gyeongsu Jang [1]; Jaehyun Kim [2]; Jaeyu Lee [3]; Jimin Seok [1]; Moses Chung [4]

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Recent upgrades of synchrotron light sources aim to achieve ultralow emittances, which requires stronger magnet strengths and inevitably results in severer nonlinear effects. In this work, we perform systematic scans of tune and chromaticity to investigate the dynamic aperture and Touschek lifetime, with the goal of identifying optimal working points and characterizing the lattice properties in the presence of nonlinearities and errors.
Clear differences are observed between the bare and error lattices. When errors are included, resonance effects are amplified, the momentum aperture is reduced, and the lifetime is significantly shortened. Furthermore, the lifetime trends with respect to chromaticity differ between the bare and error cases. These results provide insights into the nonlinear dynamics of the error lattice and support the selection of optimal tunes and chromaticities for the Korea-4GSR storage ring.

Paper submission Plan:

No

Best Presentation:

Yes

69

RF Reference Distribution System for the RAON Low-energy Superconducting Liac

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The heavy-ion accelerator of the Institute for Rare Isotope Science (IRIS) has been developed and beam commissioning for the low energy superconducting linear accelerator (SCL3) has been performed. There are three types of SRF cavity, which are 81.25 MHz quarterwave resonator (QWR), 162.5 MHz half-wave resonator (HWR), 325 MHz single-spoke resonator (SSR). There are 22 QWRs and 102 HWRs in the low-energy superconducting linac (SCL3), and 69 SSR1s and 144 SSR2s in the high-energy superconducting linac (SCL2). The RF reference distribution system must deliver a phase reference signals to all low-level RF (LLRF) systems and BPM systems with low phase noise and low phase drift. The frequencies of RISP linac are 81.25MHz, 162.5MHz and 325MHz, and there are 130 LLRF systems and 60 BPMs respectively for SCL3, and 240 LLRF systems and 70 BPMs for SCL2. 81.25 MHz signal is chosen to the reference frequency, and 1-5/8“rigid coaxial line is installed with temperature control. This paper describes the design, test results and operation during the beam commissioning of the low-energy superconducting linac.

Paper submission Plan:

No

Best Presentation:

No

70

The Performance of the Sync. Rad. Beamline through the X-ray Scattering Measurement.

Author: Yongjun Park[1]

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There are numerous synchrotron radiation accelerators in operation around the world, competing in terms of performance. The intensity of synchrotron radiation supplied from the storage ring varies depending on the X-ray energy from monochromator of each beamline, and intensity differences of 10-100 times can occur depending on the performance and operation of beamline optics component. It is unclear whether the beamlines deliver X-rays at the designed intensity to the sample.
One method for measuring beamline X-ray intensity is X-Ray Reflectivity (XRR), which provides an intuitive view of the intensity through data measurement process. We will compare the results of standard sample measurements at 16, 12, and 8 keV, frequently used energies in the PLS-II 8D beamline, to verify beamline performance. XRR measurement requires half-cut correction and geometric correction.
XRD measurements can also investigate fluorescence background and instrument background values for different sample materials. And, the absorption amount from windows used for various purposes in beamlines must also be considered from the design stage.

Paper submission Plan:

No

Best Presentation:

No

71

Efficient Production of 11C Radioisotopes from Boron Nirtide for Hadron Therapy

Authors: Heejoong Yim[1]; Hyunwoo Jung[None]; Jaehong Kim[2]

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External beam radiation therapy employing 11C radioisotope beams has been considered due to the dual advantage of enabling Positron Emission Tomography (PET) imaging and cancer treatment. Carbon ion therapy offers unique benefits for the treatment of solid tumors owing to its distinct physical and biological properties. From a physical standpoint, carbon ions exhibit the Bragg peak, enabling precise deposition of energy at the desired target depth while minimizing unnecessary radiation to surrounding normal tissues. Since 11C is a positron emitter (half-life = 20.4 min), online PET imaging can be performed simultaneously with therapy, enabling real-time in vivo verification of the therapeutic radioisotope range.
In this study, two porous Boron Nitride (BN) solid disks will be employed to produce sufficient quantities (~109 ions/sec) of 11C ions at the patient site. An Isotope Separation On-Line (ISOL) type target system is considered as a suitable ion source. The recently installed ISOL facility at the Institute for Basic Science (IBS), which includes an Electron Beam Ion Source (EBIS), provides the necessary infrastructure. EBIS can be utilized to strip electrons from radioactive carbon ions extracted from BN targets.
The 11C radioisotopes are produced by bombarding BN targets with energetic protons. A proton energy range of 4-20 MeV was adopted to maximize 11C yield while suppressing the production of unwanted impurities. The target is operated at 1,500 oC to facilitate the release of 11C radioisotopes from the BN disks. BN targets are characterized by their physical thickness properties, and calculations indicate that in-target yields from two BN targets of 1.5 mm thickness and 50 % porosity, irradiated with 20 MeV proton beam, can provide in-target yields sufficient to meet the requirements for hadron therapy applications.
This work was supported by the National Research Foundation of Korea (NRF) funded by Ministry of Science and ICT(RS-2022-00165168 & RS-2024-00436392)

Paper submission Plan:

No

Best Presentation:

No

72

Development of an automated on/off system for ECR ion source operation at RAON

Author: Eunhun IM[1]

Co-authors: JEONGIL HEO [1]; HYOJEONG JANG ; SukJin Choi [1]; In Seok Hong [1]

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The Rare-isotope Accelerator complex for ON-line experiment (RAON) is a heavy-ion accelerator facility, designed to provide various rare isotope beams for applied science research. The ECR ion source installed in injector of RAON produces ion beams with an energy of 10 keV/u for various A/q values. Operating the ECR ion source involves the coordinated adjustment of various devices such as RF, gas system, and power supplies. To reduce human errors and improve operational efficiency, an automated startup and shutdown sequence based on the EPICS control system has been developed. The sequence controls the devices step by step following predefined target values. This poster presents the components for ion source operation, the design of the automated sequence program, and its application in operation.

Paper submission Plan:

No

Best Presentation:

No

73

Development of Hard X-ray Emission Spectrometer for Advanced Material Study

Authors: Byeong-Gwan Cho[1]; In Hye Kwak[2]; Kyung-Tae Ko[3]; Yong-Hyun Kim[3]

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(Resonant) Inelastic X-ray Scattering (RIXS, XES, and X-ray Raman Scattering) are photon-in/photon-out techniques that enable the analysis of elementary excitations as well as the investigation of electronic structures and underlying mechanisms, by measuring the energy loss or gain of the scattered photons. Over the past few decades, significant progress has been made in the development of beamline optics and detectors.

In particular, we have focused on a representative technique, High Energy-Resolution Fluorescence Detected X-ray Absorption Near Edge Structure (HERFD-XANES), which measures X-ray absorption spectra using a Rowland circle spectrometer. This technique achieves higher energy resolution than conventional absorption spectroscopy and allows the observation of unoccupied valence states. However, because the fluorescence signal is intrinsically weak, this technique is considered a photon-hungry experiment. Moreover, as resolution increases, the signal intensity decreases, which presents a critical limitation for materials analysis.

We aim to obtain high-resolution spectra using HERFD-XANES, analyze the results, and design an improved spectrometer to increase the inelastic signal-to-noise ratio. Here, we summarize several experimental results and introduce a new spectrometer design.

Paper submission Plan:

No

Best Presentation:

No

74

Optimization of PAL-UED Instrument by Multi-objective Bayesian Algorithm

Authors: Minseo Jeong[None]; Moses Chung[1]; Chang-Ki Min[2]

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Ultrafast electron diffraction (UED) is a method to study the structure of the matter and its dynamics by scattering of a pulsed electron beam. Its performance depends on electron beam parameters

such as beam size and bunch length, which are in turn affected by UED machine settings including solenoid strength and RF phase. However, these beam parameters cannot be optimized simultaneously due to their mutual correlations, such as those arising from space-charge effects.
In this paper, we searched the optimization points (Pareto front) of the beam parameters at the sample position via particle tracking simulations. The parametric space consists of machine settings of PAL-UED, which delivers MeV-level electron beams using the infrastructures of the PAL eLABs. To prevent over-exploration and reduce the number of iteration required for optimization, multi-objective regionalized Bayesian optimization (MORBO), which performs the multi-objective Bayesian optimization only in the trust regions, was used to optimized the UED beam parameters.

Paper submission Plan:

No

Best Presentation:

Yes

75

Design and Simulation of X-ray tube for Hypersonic Vehicle Data Transmission Studies

Author: Changsun Na[1]

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X-ray communication (XCOM) offers a promising alternative for data transmission during hypersonic vehicle reentry, where plasma interference prevents the use of conventional wireless signals. In this study, we present design techniques for a compact X-ray pulse generation device for XCOM and optimize the trajectories of electron beams emitted from a thermionic cathode. The design incorporates a focusing cup to focus the electron beam and guide it toward the anode for efficient X-ray production. The proposed device is modeled and analyzed under various operating conditions using CST simulations. This work serves as an initial step toward the development of practical XCOM transmitters and provides a foundation for the advancement of the X-ray pulse generator.

Acknowledgment
This work was supported by the National Research Foundation of Korea (NRF) funded by the Korea Government (MSIT) under Grant (RS-2024-00421687 and RS-2022-00154676).

Paper submission Plan:

Yes

Best Presentation:

No

76

Effects of Space Radiation and Microgravity on the Transcriptome of a Hypothalamic Cell Line

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Background: As human activities expand into deep space, understanding molecular responses to space environments is crucial to mitigate potential health risks. Indeed, the NASA Twins Study has already revealed various physiological alterations in space. Therefore, the present study aimed to investigate transcriptomic changes in the hypothalamus, a central regulator of systemic physiology.
Method: Embryonic mouse hypothalamic N38 cell was cultured under four conditions: a ground condition (GC), space radiation condition (SR), simulated microgravity condition (SM), and combined condition (combination). Space radiation was simulated by irradiating cells with 100 MeV protons (1 Gy). Microgravity was simulated using a 3D clinostat (~10-3 G). RNA sequencing (RNA-seq) was performed to identify differentially expressed genes (DEGs).
Results: A total of 355 DEGs were identified based on |log2 fold change| ≥2 and p-value <0.05. The DEGs exhibited distinct expression patterns across the groups. Among them, UCN2 and UGT1A5 were the protein-coding genes consistently and significantly altered across all pairwise comparisons with the GC. Especially in the combined condition, gene ontology analysis revealed that the DEGs were most significantly enriched for biological processes including protein deubiquitination, regulation of apoptotic process, and ubiquitin-dependent protein catabolic processes. These signatures are consistent with involvement of the USP17L family. Additionally, DEGs were also enriched for telomere maintenance, implicating the ZSCAN4 family. Alterations in four key targets (UCN2, UGT1A5, USP17L family, and ZSCAN4 family) were validated through polymerase chain reaction analysis in an independent experimental batch and were mostly consistent with the RNA-seq results.
Conclusion: The present study demonstrates that space environments (high-energy proton irradiation and microgravity) induce complex molecular changes at the transcriptomic level, with potential disease-relevant implications involving pathways related to stress response, detoxification of various substances, DNA repair, and telomere maintenance. These findings may serve as a cornerstone for developing countermeasures to protect human health in deep space.

Paper submission Plan:

No

Best Presentation:

No

77

Selection of Optimal Higher-Harmonic Cavity Type for Korea-4GSR under Collective Effects

Authors: Jimin Seok[1]; Moses Chung[2]; Youngmin Park[None]

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Fourth-generation storage rings operate at ultralow emittance, which makes it challenging to maintain a sufficiently long Touschek lifetime. Higher-harmonic cavities (HHCs) are widely employed to enhance the Touschek lifetime by lengthening the bunch. However, the introduction of an HHC

can adversely affect beam stability through collective effects such as transient beam loading and various longitudinal instabilities (such as Robinson, mode-coupling, and coupled-bunch instabilities) driven by uneven filling patterns and resonator impedances. For the Korea-4GSR, we compare the performance of active and passive HHCs using semi-analytic models for transient beam loading and longitudinal instabilities, and cross-check the results with ELEGANT tracking simulations. The evaluation focuses on the bunch-lengthening factor, instability growth rate as a function of beam current, and bunch-by-bunch phase and bunch length. This work presents a unified comparison framework for selecting between active and passive HHCs in the Korea-4GSR under collective-effects constraints.

Paper submission Plan:

No

Best Presentation:

Yes

79

Development of White Beam Profile Monitor for Korea-4GSR

Author: Woojin Song[1]

Co-authors: Garam HAHN [2]; Hyojung Hyun [3]; Jae-Hong Lim [2]; Moses Chung [1]; Seonghan Kim [3]; Sunmin Hwang ; YONGSUNG PARK

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Accurate measurement of photon beam position and profile is crucial for beamline users to achieve precise alignment and efficient utilization of the desired photon beam. In low-emittance storage rings, however, the power density of the photon beam has increased, making it challenging for conventional profile monitors such as wire scanners and scintillating screens to withstand the high power without damage. Here, we present the development of a White Beam Profile Monitor (WBPM) capable of robustly measuring the photon beam position and enabling non-destructive beam profile measurement. The WBPM, consisting of two chambers, was designed to enable simultaneous measurements of horizontal and vertical beam profiles. Its performance was evaluated at the PLS-II wiggler beamline, where results were compared against those from a screen monitor. The photon beam profile, sharply defined by a slit, was successfully measured in both directions, and the point spread function was estimated to be 118 μm. Furthermore, vertical position measurements demonstrated a position resolution of 29 μm at an exposure time of 0.3 ms, confirming the feasibility of the WBPM for photon beam diagnostics.

Paper submission Plan:

No

Best Presentation:

No

81

Prototype System for Beam-Synchronized Data Logging and Real-Time Statistical Processing at KOMAC

Author: Sungyun Cho[1]

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At the Korea Multi-purpose Accelerator Complex (KOMAC), a 100 MeV proton accelerator is operated with an Archiver Appliance that continuously collects device data in real time. The archiver records signals asynchronously, triggered by individual device events, thereby reducing the risk of missing critical data and providing reliable data for device state monitoring. While this approach is valuable for diagnosing system status, the lack of synchronized logging makes direct statistical comparison or the preparation of machine-learning training datasets difficult without additional post-processing.
To address this issue, a beam-synchronized data logging logic is currently under preparation, and a prototype system for data collection and statistical processing has been developed as a preliminary step. By aligning data collection with beam events and maintaining statistical summaries in real time, the system is expected to enable more accurate analysis of variables influencing beam performance. This work presents the beam-synchronized data logging concept, the real-time statistical processing logic, and the prototype system developed.

Paper submission Plan:

No

Best Presentation:

No

82

Beam physics evaluation of cross-talk effect in magnets

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The PAL-EUV storage ring has a compact circumference of 36 m, which inherently requires narrow spacing between instruments. Because each magnet generates fringe fields that extend beyond its physical length, these fields can reach the yoke of neighboring magnets and distort the direction of the magnetic flux. This mutual interference not only modifies the primary field but also enhances higher-order multipole components in a magnet—a phenomenon known as the cross-talk effect. Although conventional accelerator design approaches typically assume that individual magnet fields are independent, it is necessary to evaluate this effect. This study aims to evaluate and quantify cross-talk phenomena through detailed simulations.

Paper submission Plan:

Yes

Best Presentation:

Yes

83

Coherent X-ray laser pumped by 4GSR

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Atoms with discrete energy levels can act as frequency filters for incident radiation, leading to atomic superfluorescence. While this effect has been demonstrated using x-ray free-electron lasers (XFELs) as pumps in the hard x-ray regime—mitigating shot-to-shot fluctuations and the lack of phase locking—the linear geometry of XFELs constrains simultaneous beamline access. As an alternative, we investigate the feasibility of employing fourth-generation synchrotron radiation (4GSR), which offers lower peak brightness but higher repetition rates. A central question is whether such pumping can drive the system above the lasing threshold in the low-gain regime. To address this, we employ stochastic Maxwell–Bloch equations (SMBEs), whose intrinsic accuracy makes them ideally suited for evaluating threshold conditions and gain dynamics under realistic experimental constraints.

Paper submission Plan:

No

Best Presentation:

No

84

Physics Design of a Permanent Quadrupole Magnet

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Permanent Magnet Quadrupole (PMQ) magnets have been spotlighted as a promising alternative to conventional electromagnets for accelerator systems, characterized by lower power consumption with a higher gradient. In this work, we designed a PMQ magnet that can reach a high gradient with a wide tunable range. Using finite-element analysis, field uniformity, gradient strength, and sensitivity to alignment errors were evaluated. The design can obtain multipole components to below 10^-3 as well as field uniformity of below 0.01% across the good field region. The results demonstrate that the

proposed PMQ design is sufficient for accelerator requirements, providing a step towards prototype development for implementing it in future machines.

Paper submission Plan:

Yes

Best Presentation:

Yes

85

Study on the Application of an AI Agent for Accelerator Operation Log Analysis

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RAON, a rare isotope accelerator facility, entered its full-scale beam operation phase in 2024–2025 following its initial commissioning in 2023. However, the early control system lacked sufficient capabilities for log collection and analysis, which imposed significant manual effort to identify anomalies and determine fault causes during operations. Although a logging system was later constructed and operated based on the Beam Permit System (BPS), the burden of analyzing logs remained considerable.

To address this challenge, we developed and tested a prototype AI-based Log Analysis Agent utilizing a Large Language Model (LLM). This agent offers a conversational interface that allows users to issue natural language queries and receive summarized beam log reports and information for specific dates or conditions.

A core component of the system is the Model Context Protocol (MCP), named RAON LOG ANALYZER MCP. The MCP formalizes key structural and semantic features of the logs, enabling the LLM to better understand contextual information and generate accurate responses.

In addition, prompt engineering techniques were employed to guide the LLM in interpreting logs through the MCP format. To efficiently process large-scale log data, header-based preprocessing and counting strategies were implemented. These enhancements mitigated the context-length limitations of the LLM and improved both response speed and reliability.

Paper submission Plan:

Yes

Best Presentation:

No

86

Optimization of a Dual-Layer N_2/Ne Capillary for Dephasing-Free, High-Charge LWFA

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Co-authors: Sihyeon Lee [1]; Hyeon Woo Lee [1]; Bonghoon Oh [1]; Jeong-Wan Park [1]; Keonho Kim [1]; Hee Jin Cho [1]; Seong Hee Park [1]

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An enhancement of the beam charge with narrow energy spread and good emittance remains a central challenge in laser wakefield acceleration (LWFA). We demonstrate dephasing-free and high-charge LWFA by applying insights from ionization dynamics in LWFA using Al^{3+}/Ti^{4+} metal plasmas to a practical dual-layered nitrogen–neon capillary gas cell. In prior work, Al^{3+} plasmas yielded stable and dephasing-free acceleration, and composite Ti^{4+}–Al^{3+} plasmas substantially increased a beam charge by coupling ongoing ionization to wake formation, injection, and beam loading. Guided by these results, we design and optimize a capillary gas-cell target that reproduces the beneficial ionization effects and tailored loading without relying on laser-ablation. Geometries and profiles obtained through CFD simulations are used to embed the layer lengths and densities in PIC simulations. We report stability and charge-scaling trends consistent with the metal-plasma regime and discuss remaining issues uncovered by the optimization. This study outlines a pathway to robust, dephasing-free LWFA with higher charge than conventional neutral gas-jet targets, using a readily deployable gas-cell platform.

Paper submission Plan:

No

Best Presentation:

No

87

In-situ Phase Calibration of BPM Electronics for TOF-based Beam Energy Measurement at RAON SCL3

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Accurate calibration of the BPM phase is important for reliable longitudinal diagnostics in superconducting linear accelerators. In RAON SCL3, the time-of-flight method is used during cavity phase scans to determine beam energy, which is essential for setting the cavity phase. The BPM electronics has an internal amplifiers and process signals at the first, second, and third harmonic frequencies, resulting in six signal that require independent calibration. On-line calibration was carried out for all installed BPMs from the MEBT to the P2DT section. Absolute phase alignment was established in Zone 1 and Zone 2 using two independent RF reference signals, while offsets from gallery racks, long cables, and electronics modules were systematically included. The calibrated system was successfully applied to cavity phase scans, improving the accuracy of TOF-based beam energy measurements under operational conditions. This paper presents the detail calibration method with circuit and the achieved results.

Paper submission Plan:

No

Best Presentation:

No

88

Measurement of Electron Beam Phase Space Using Passive Dechirper

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Measuring the longitudinal phase space of energetic electron beams is critical in X-ray Free Electron Laser (XFEL), which determines characteristics FEL performance. Conventional way is applying strong external RF fields to deflect transversely electron beams, then the longitudinal position correlates the transverse tilt position. However, this method requires complex and cost equipment such as X-band Transverse Deflector Cavity(XTCAV) because the short (tens of fs range) and energetic electron beam (in GeV range) requires a short and strong electric field. In this presentation, we introduce a passive streaking dechirper method, which is composed of two corrugated flat structures. Electron beams pass between two corrugated plates, where self-generated strong wakefields deflect electron beams transversely. Not like XTCAV, dechirper wakefiels has non-linear profile, so we demonstrate that the nonlinear correlation issue, a key limitation in conventional dechirper diagnostics, can be numerically treated by applying the Tikhonov regularization method. The effectiveness of this approach is tested by well-defined simulations, and we also conducted experiments in the PAL-XFEL facility to show usefulness of the passive Dechirper method.

Paper submission Plan:

No

Best Presentation:

No

89

Optimization of Beam Stability in Quartz-Based Dielectric Laser Undulators for Compact THz Radiation Sources

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Dielectric laser undulators (DLUs) have recently emerged as a promising approach for compact radiation sources, utilizing high-intensity laser pulses to interact with microstructured dielectric lattices and generate strong transverse forces. Previous design studies demonstrated the potential for efficient terahertz radiation generation; however, preliminary simulations also revealed challenges such as beam trajectory instability and difficulty in sustaining symmetric oscillations across phase-reversal sections. In this work, we present an optimization study of beam stability through systematic variation of key geometric parameters, including lattice rotation angle, section length, and phase-reversal schemes (λ/2 polarization flip versus structural angle inversion). The results provide new insights into balancing stable beam transport with efficient undulator action, offering practical guidance for future experimental implementation of quartz-based DLU systems.

Paper submission Plan:

No

Best Presentation:

Yes

90

Towards Automated Large-Scale Facilities at Rutherford Appleton Laboratory

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Modern large-scale research facilities generate vast amounts of data and rely on highly complex systems whose operation has traditionally depended on human expertise and manual tuning. As these facilities grow in scale and complexity, there is an increasing need for intelligent approaches that can automate calibration, diagnostics, and decision-making, enabling more efficient and adaptive operations.
At the Rutherford Appleton Laboratory, we are developing AI-driven methods to support this vision of smart facilities. These include the use of surrogate models and optimization techniques to accelerate tuning and diagnostics in particle accelerators, as well as ongoing efforts to extend similar approaches to imaging and laser facilities. By integrating machine learning with domain expertise, these methods aim to improve efficiency, adaptability, and predictive capabilities across different facility environments.
This talk will highlight case studies from Rutherford, showing how AI can transform the way large-scale facilities are operated, paving the way for more automated, reliable, and intelligent scientific infrastructure.

Paper submission Plan:

No

Best Presentation:

No

91

Frequency-Dependent Ground Motion Orbit Amplification Analysis for Korea-4GSR

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Understanding the frequency dependence of ground motion–induced orbit amplification is essential for achieving the high level of beam stability required in next-generation storage rings. In this study, we analyze the orbit amplification factors for the Korea-4GSR by extending methodologies originally developed for the APS-U. While adopting a similar lattice-based simulation framework, we introduce a modified filtering approach to process ground motion spectra and to extract coherence-dependent amplification characteristics. A key aspect of our analysis is the recognition that low-frequency ground motion tends to exhibit strong coherence across the accelerator footprint. This spatial coherence reduces relative displacements between magnets but simultaneously alters the lattice amplification behavior, making its role critical in predicting the net orbit stability. By quantifying these effects, our results not only provide new insights into the frequency-dependent orbit response of the Korea-4GSR lattice but also highlight the importance of targeted mitigation strategies. These findings will support future efforts in vibration control, active orbit feedback, and overall stabilization of electron beams in high-brightness storage rings.

Paper submission Plan:

No

Best Presentation:

Yes

92

Design of a Precise Coordinates Calibration Instrument for Beam Profile Monitors

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Beam Profile Monitors (BPRMs) have an intuitive configuration and a convenient camera-based structure, which has made them widely adopted beam diagnostic instruments. The two-dimensional images they provide yield important beam parameters such as beam size and spatial distribution. However, the unprocessed image often involves errors arising from the mechanical misalignment of the equipment, variation in the measurement, or perspective-induced image distortion, leading to inaccuracies of the quantitative properties of the beam. We introduce a device that enables us not only to reconstruct the 2D transverse beam profile within a precise coordinate space but also to calibrate

systematic uncertainties in the device components. This device comprises a two-axis motorized linear actuator, a CMOS camera, and a BPRM chamber with a scintillating screen supporter. Using a pair of geometrically aligned grid glass plates, we measured the screen image at specific coordinates in units of 0.1 mm through the numerically-controlled CMOS camera mounted on the stepping motor stage. A perspective transformation matrix maps the screen image viewed vertically from the beamline onto the measured coordinates of the transverse beam plane. We present the overall design of the device, the numerical model, and the measurement results. This work includes geometric modeling of the measured position of the screen image and device calibration for precise coordinates, along with the acquisition of undistorted images through perspective transformation.

Paper submission Plan:

No

Best Presentation:

Yes

93

Development of an EPICS Based Rack Temperature and Humidity Monitoring System for the Central Control System Rack at RAON

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Co-authors: Yong Jun Choi [1]; Sang-Gil Lee [2]; Hyun Man Jang [1]

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The Central Control System (CCS) rack in the RAON accelerator gallery comprises network switches, a Raspberry Pi based IOC server, a timing system, and FPS that support stable accelerator operation. However, heat generated by multiple devices raises the internal rack temperature, and conventional fan based cooling in standard control racks is insufficient to manage the thermal load. This study presents the development of an EPICS based rack temperature and humidity monitoring system for continuous in rack environmental monitoring and early warning. Temperature and humidity data from Modbus RTU sensors installed inside the rack are acquired by a Raspberry Pi via an RS485 to USB converter. An EPICS IOC was implemented using Asyn and the Modbus module, and a Phoebus GUI enables real time monitoring and alarm status display. The deployed system provides real time visibility into thermal conditions inside the rack and supports early detection of anomalies. Data are archived for long term retention through integration with an archiver. Future work will integrate status monitoring of additional devices, including network switches, to further improve the reliability and availability of the control infrastructure.

Paper submission Plan:

No

Best Presentation:

No

94

Design of an LLM-Based Multi-Agent System for Leveraging the RAON Control System Infrastructure

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The RAON control system uses EPICS as the foundational framework to integrate local control systems into central control. EPICS provides CA client applications and related services for control system operations including the Archiver Appliance, Online Log (Olog), and Phoebus that can be accessed directly or extended as needed.

With the rapid growth of research utilizing AI and large language models (LLMs), there has been increasing effort to integrate pre-established services into LLM-based frameworks. Approaches such as Retrieval-Augmented Generation (RAG) and Model Context Protocol (MCP) have been proposed to connect server APIs and internal documents with LLMs, and discussions are underway to build such integrations into agent-based systems.

In this study, we propose an LLM-based multi-agent system architecture to enhance the usability of the RAON control system infrastructure. By employing MCP and RAG, we design agents that connect existing EPICS services. These agents are organized into supervisor or hierarchical architectures to form a multi-agent system. The LLM-based AI, orchestrated as a multi-agent system, aims to process natural language inputs to perform complex tasks, such as PV monitoring, PV data analysis, Olog entries, PV name recommendations and inference based on the RAON control system naming conventions.

Currently, we have completed the development of a prototype single-agent AI that connects the EPICS ChannelFinder API with an LLM. We conduct preliminary tests and their results demonstrate that our prototype system successfully works for PV data inference and name extraction. Based on this prototype, we proceed to design the configuration of a multi-agent environment by establishing relationships among agents.

Paper submission Plan:

No

Best Presentation:

Yes

95

Durability Evaluation of Antistatic Property in Ion-Implanted Materials

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Ion implantation is a widely used technique in the semiconductor field for doping processes. Its application enables mechanical and chemical surface modification, extending its potential to various industrial fields such as semiconductor, aerospace, and defense. Unlike conventional surface treatments such as coatings, ion implantation can selectively modify the surface while preserving the intrinsic bulk properties of the material.
With the recent miniaturization of semiconductor processes, the defect rate caused by electrostatic charging in insulating components such as polymers and ceramics has been increasing. To address this problem, ionizers and carbon-added products have been introduced, but these approaches suffer from limitations such as carbon contamination. To overcome these challenges, our company has developed an ion-beam-based technology that imparts electrical conductivity to insulating surfaces, thereby preventing the generation of static charges, and has been operating beam irradiation services for industrial applications.
In this study, durability tests were conducted to verify the reliability of this antistatic ion implantation technique. Alumina (Al_2O_3) and polytetrafluoroethylene (PTFE) substrates were irradiated with 50 kV nitrogen ion beams, reducing their original surface resistance from above 10^{12} Ω to the antistatic range of 10^7–10^8 Ω. The long-term stability of the antistatic function under harsh environmental conditions was then evaluated. Reliability assessments included temperature-dependent surface resistance measurements across 50–350 ℃ in 50 ℃ intervals, standardized qualification tests following the JEDEC JESD22-A104 protocol, and temperature–humidity testing at 85 ℃ and 85 % RH.

Paper submission Plan:

Yes

Best Presentation:

No

96

Beam Profile Monitor for PAL-XFEL

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A beam profile monitor was developed for measuring the electron beam at PAL-XFEL. Given the high beam energy, precise alignment of optical transition radiation (OTR) is essential for reliable diagnostics. To address this, the monitor was designed to enable pre-alignment of the optical system prior to installation. Furthermore, a dedicated scintillator-based target holder was fabricated to avoid coherent optical transition radiation (COTR) arising from the ultra-short bunch length of the compressed beam. Building on the SwissFEL approach, the design was further optimized to reduce the vacuum chamber size and to mitigate diffraction radiation by increasing the separation between the mirror and the electron beam path. Experimental measurements demonstrated that the COTR contribution was effectively suppressed and no diffraction radiation was observed in the beam images.

Paper submission Plan:

Yes

Best Presentation:

No

97

Comparison of Simulated and Measured Emittance of a 6.5 MeV Microtron Electron Beam Using OptiMX

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This study aims to compare the emittance of a 6.5 MeV electron beam generated by a microtron installed at Korea University.
Based on the initial beam parameters and lattice alignment, the beam size evolution was simulated using OptiMX, and the emittance was estimated.
The microtron was then operated under the same conditions, and the beam size was measured at the target location to calculate the experimental emittance.In this presentation, we compare the simulated and measured emittance values and discuss the differences.

Paper submission Plan:

No

Best Presentation:

No

98

Modernization of the Legacy RF Interlock System for the 100-MeV Proton Linac at KOMAC

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At KOMAC, the 100-MeV proton accelerator uses high-power RF systems to generate accelerating fields. To ensure reliability and safety, interlock systems quickly detect unstable sources and shut down RF sources to prevent damage. The main limitations of the legacy interlock system are the difficulty of checking and changing interlock thresholds and the lack of remote monitoring, which makes it hard for operators and engineers to monitor system status and log data. To address these weaknesses, the legacy system was modernized into a digital interlock system. Using a Zynq SoC and an ADC chip, forward and reflected high-frequency signals are sampled and compared with preset thresholds to determine interlock conditions. In addition, a post-mortem function for data analysis was implemented to make it easier for operators and engineers to analyze data after an interlock. The latency from signal input to RF source shutdown upon an interlock was minimized. This paper describes the design and performance of the digital interlock system developed as a modernization of the legacy system.

Paper submission Plan:

Yes

Best Presentation:

No

99

Surrogate-model based Optimizer for Online Control of Particle Accelerator.

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Control of charged particle beams is an essential process to meet the requirements of various applications. However, particle tracking simulations demand substantial computational resources, which limits their use in real-time optimization. In this study, we developed a neural network–based surrogate model trained on Particle-In-Cell simulations and applied it to beamline control. The proposed surrogate model simplifies the underlying physics calculations while maintaining high prediction accuracy, and it was successfully employed to optimize the strengths of quadrupole and corrector magnets, effectively achieving the desired beam conditions at the target location.

Paper submission Plan:

Yes

Best Presentation:

Yes

100

Dual In-Situ Transmission XRD for Perovskite Thin-Glass Encapsulation and Nylon 5,6 Drawing

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Received: 31 July 2025 Revised: 28 August 2025 Accepted: 29 August 2025 Published: 31 August 2025 Citation: Jo, K.; Lee, H.H.; Kwon, S.H.; to-α Structural Transformation in Bio-based Nylon 5,6 Fibers via X-Ray Diffraction and DFT Analysis. Polymers 2025, 17, 2385. https://doi.org polym17172385 *Nam-gu, Pohang 37673, Republic of Korea*

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Analyzing material structure by X-ray diffraction in real time is crucial because it probes physical properties during deformation rather than only after the material has stabilized. To this end, we built two in-situ X-ray diffraction systems that monitor nylon 5,6 fibers and perovskite thin films, respectively. For the fibers, drawing above Tg induces polymer-chain orientation and markedly increases mechanical strength. To observe this process, we developed a heater-integrated X-ray transmission drawing stage. With the fiber axis aligned to the beam, WAXS patterns were collected, and the (004) reflections were analyzed to quantify phase fraction, orientation, and lattice strain. The results show a continuous γ⟶α structural transition during drawing, followed by additional growth of the α component during unloading and cooling. For the perovskite films, we measured degradation behavior in real time. Reflection-mode measurements in air often fail to secure reliable diffraction signals because the encapsulation cover perturbs the optical path. To overcome this, the perovskite was coated on ~150 μm glass and an equally thin glass was used as a cover to enable transmission. The sample was then sealed under N_2 and monitored with a transmission in-situ setup. GIWAXS tracked lattice-parameter shifts, peak-width changes, and the emergence of PbI_2 diffraction, enabling simultaneous quantification of early-stage degradation, phase segregation, and texture evolution. Leveraging these real-time in-situ methods provides structural information that explains—and helps predict—the physical properties of diverse materials.

Paper submission Plan:

No

Best Presentation:

No

101

First experimental results for generation of fresh-slice self-seeded hard X-ray FEL at PAL-XFEL

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We present the first experimental results on the generation of fresh-slice self-seeded hard X-ray free-electron laser (FEL) pulses at PAL-XFEL. The self-seeding scheme is designed to significantly enhance the spectral brightness of FELs, while the fresh-slice technique enables higher average pulse power by reducing the pulse duration. By combining these two approaches, self-seeded FEL pulses can be generated more enhanced, producing higher-power and higher-brightness radiation compared to conventional self-seeding scheme. In particular, the fresh-slice method mitigates the trade-off between the seed FEL intensity and the slice energy spread of the electron beam.
Recently, we generated the fresh-slice self-seeded FEL pulses at the 9.00 keV by exploiting wakefield-induced vertical tilts in the electron bunch. As a result, the pulse duration was reduced while maintaining peak brightness comparable to that of standard self-seeded FELs. Based on these experimental results, it is considered that optimizing the wakefield strength and FODO lattice design is essential to maximize the performance of fresh-slice self-seeded FELs.
In this presentation, we will report on the first experimental results together with beam dynamics studies for the future works.

Paper submission Plan:

No

Best Presentation:

No

102

Influence of high temperature baking on DC surface flashover voltage over wide ranges of background pressure

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Understanding the effects of high-temperature baking on DC surface flashover across atmospheric to high vacuum pressures is critical for the design of gas-insulated, high-power equipment. In this study, two MC901 dielectric samples are evaluated: one subjected to high-temperature baking to reduce moisture and outgassing, and the other left untreated. Background pressure is systematically varied from high vacuum to atmospheric levels, with ten breakdown measurements collected at each pressure point. High-bandwidth electrical diagnostics captures breakdown waveforms, and flashover data are analyzed using a two-parameter Weibull model to determine characteristic voltage (α) and dispersion (β). The baked and untreated samples demonstrates distinct pressure-dependent behaviors, including shifts in the pressure threshold where flashover voltage decreases. These findings facilitate quantification of the impact of baking on insulation performance and provide insights into how outgassing influences the pressure dependence of breakdown voltage in vacuum conditions.

Paper submission Plan:

Yes

Best Presentation:

Yes

103

Influence of Background Pressure on Beam Extraction and Focusing Dynamics in a PIG Ion Source

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Ion beams are widely used in semiconductor manufacturing, surface treatment, and accelerator injection. One significant challenge in ion beam systems is the increase in background pressure resulting from process-generated impurities or residual gases, which can have a critical impact on beam current and focusing characteristics. In this study, we experimentally examine the effects of background

pressure on the extraction and focusing dynamics of ion beams using a small Penning Ionization Gauge (PIG) ion source with controlled impurity injection. Our findings indicate that elevated background pressure decreases the extracted current and shifts the optimal focusing point toward lower suppression voltages. At higher impurity concentrations, the distinction between under-focusing and over-focusing becomes less defined, thereby narrowing the operational focusing window. This paper provides detailed experimental data on how variations in background gas pressure affect ion beam optics.

Paper submission Plan:

Yes

Best Presentation:

Yes

104

Design of Helical Resonator for the Double Gap Buncher in RAON.

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Pulsed ion beams are essential for TOF experiments in the Nuclear Data Production System (NDPS), which provides proton beams for nuclear data measurements in RAON. NDPS requires a repetition rate below 200 kHz and a bunch length shorter than 1 ns (FWHM). The pre-buncher system was introduced to satisfy these requirements.

The pre-buncher system—comprising of a fast chopper, slit, and double gap buncher (DGB)—has been developed to efficiently generate bunched beams for injection into the RFQ of RAON.

The DGB consists of three cylindrical electrodes with two gaps between them, similar in structure to an Einzel lens. It compress the ion-beam pulse length to less than one RFQ cycle (12.3 ns). SIMION simulations indicate that a voltage of about 4.5 kV□□ is required at the DGB electrodes to compress beams with □/□=7 at the target frequency of 2.03125 MHz.

A helical resonator with variable capacitor and 1 kW RF amplifier was adopted to meet this high-voltage requirement. the helical resonator forms an LC circuit with the DGB electrodes and provides voltage amplification proportional to its quality factor (Q).

In this poster, we present the design of a high-Q helical resonator and report prototype measurements results.

Paper submission Plan:

No

Best Presentation:

Yes

105

Monte Carlo Study on Beam Current Transformer-Based Real-Time Dosimetry for FLASH Radiotherapy

Author: Kyoung Won Jang[1]

Co-authors: Dong Hyeok Jeong [2]; Manwoo Lee [3]; Heuijin Lim [2]; Hyun Kim [2]; Sang Koo Kang [3]; Sang Jin Lee [3]; Wung-Hoa Park [3]; Pikad Buaphad [3]

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FLASH radiotherapy, characterized by ultra-high dose rates (UHDR, >40 Gy/s), has demonstrated the potential to spare normal tissues while maintaining tumor control, offering a paradigm shift in radiation oncology. However, reliable and real-time dosimetry remains a critical challenge for clinical translation. Conventional dosimeters such as ionization chambers and solid-state detectors suffer from saturation and nonlinear response under UHDR conditions, necessitating the development of alternative monitoring technologies.

In this study, we propose a beam current transformer (BCT)-based approach for real-time electron beam monitoring to estimate patient dose during FLASH irradiation. Using Monte Carlo N-Particle transport code, the relationship between electron flux measured through the BCT and absorbed dose at specific points in a water phantom was evaluated. A strong correlation was identified, suggesting that BCT signals can serve as a surrogate for direct dose measurement in UHDR electron beams.

These findings highlight the feasibility of employing BCT as a non-invasive, contactless dosimetry tool for FLASH radiotherapy. This work provides a foundation for establishing robust quality assurance and dose verification systems, paving the way for safe and effective clinical implementation of FLASH treatments (This work was supported by the Dongnam Institute of Radiological & Medical Sciences (DIRAMS) grant funded by the Korea government (MSIT) (No. 50493-2025).

Paper submission Plan:

Yes

Best Presentation:

No

106

Calibration Approaches to Enhance BPM Accuracy

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[2] *IBS*

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Beam position monitors and electronics have nonlinear distortion errors in position measurement due to device offset and signal transmissibility. Therefore, a correction factor must be applied to the measurement position to improve accuracy. The developed BPM and I-tech's Libera Spark ERXR electronics were used to measure the error on an offline wire test bench. The raw digital signal was

used to determine the signal strength using methods such as RMSE, MAE, and MSE. The difference-to-sum and logarithmic ratio methods were used to calculate the wire position. The standard deviation and mean values were obtained for the calculated position values by repeating the test multiple times with the same signal applied. After determining the scaling factor to convert the calculated position values to millimeters, the BPM was rotated to perform an offset evaluation to adjust the mechanical center. The calibration method using two-dimensional nonlinear fitting was found to be the most effective method for calculating the distortion of a given BPM system, providing the highest accuracy. This paper presents the need for selecting an appropriate calibration strategy and describes a systematic approach to improve BPM accuracy in offline testing.

Paper submission Plan:

Yes

Best Presentation:

Yes

107

CFD Studies of a Differential-Pumping Cavity for Continuous Gas Flow and a Capillary Station for Experimental Integration

Author: Junyeong Jeong[1]

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Achieving kilohertz-repetition operation is a critical for laser wakefield acceleration (LWFA) to progress toward applications in compact accelerators and light sources. We report the development of a continuous-flow gas-cell platform that enables stable operation at kHz repetition rates. The approach integrates a cavity module for segmented capillary (SC) plasma sources, featuring differential pumping at both outlets to suppress gas backflow and maintain vacuum stability. In parallel, a bottom-mounted gas-injection station was designed to eliminate diagnostic beam obstruction, mitigate laser scattering during capillary translation, and reduce spatial conflicts with surrounding optics. Using computational fluid dynamics (CFD) simulations we studied confined and stable gas flow under experimental conditions. This cavity–station scheme represents a scalable pathway to high-repetition-rate plasma sources, supporting the future deployment of LWFA in advanced accelerator and radiation science applications.

Paper submission Plan:

No

Best Presentation:

No

108

Design of prototype thick septum magent power supply using solid-state switch

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We designed three kinds of pulsed septum magnet for the Korea 4th generation sotrage ring(Korea-4GSR) project. The prototype pulse septum magnet power supply is designed to thick septum types. There is specification: 10kA, 100us, 2Hz. In addition, it was changed to a solid-state switch without using a gas switch such as the thyratron. This paper will focus on the topology, parameter, configuration of the magnet power supply. Currently, parameter was verified through simulation. In the future, we plan to manufacture and prove with the prototype of thick septum magnet power supply.

Paper submission Plan:

No

Best Presentation:

No

109

Controlling injection and acceleration using a plasma density down-ramp under transverse guiding structures for the improvement of electron beam quality in laser wakefield acceleration

Author: Hyeon Myeong Jeong[1]

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High-intensity laser pulses propagating in plasma can excite wakefields with electric field strengths sufficient to accelerate electrons to GeV energies within centimeter distances. This laser wakefield acceleration (LWFA) offers a pathway to more compact and efficient electron accelerators than conventional LINACs. However, one of the main challenges in laser–plasma acceleration is maintaining electron beam quality, which is degraded by the nonlinear nature of the injection process and the associated large energy spread. Furthermore, electron energy gain is limited by laser diffraction, pump depletion, and dephasing between the accelerated electrons and the wake phase. These diffraction effects can be overcome by guiding the laser pulse in a plasma channel with a transversely parabolic density profile which can increase electron energy up to GeV scale. We explored improving electron beam quality by modifying the electron plasma density using a down-gradient in a two-step density profile with the help of parabolic density structure as a waveguide to increase electron beam energy, using the particle-in-cell simulation code FBPIC. Analysis of simulation results indicated that the density gradient and the relative density in the second plateau (n_e2/n_e1) are sensitive factors for beam quality improvement. The electron beam quality was improved using down-gradient injection with the parabolic guiding structure. These preliminary simulation results provide insights for long-distance LWFA aimed at achieving higher electron beam energies up to GeV scale while maintaining improved beam quality.

Paper submission Plan:

No

Best Presentation:

Yes

110

Advancing Accelerator Design and Control with Machine Learning: Case Studies from RAON LEBT Orbit Correction and Electron Linac Optimization

Author: Chong Shik Park[1]

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Machine learning (ML) is emerging as a transformative tool in accelerator science, complementing physics-based approaches for design, optimization, and control. Modern accelerators—including heavy-ion drivers, electron linacs, and next-generation light sources—face challenges from high-dimensional parameter spaces, nonlinear beam dynamics, and limited diagnostic access. This presentation surveys the expanding role of ML in accelerator research, with emphasis on recent global progress and developments within the Korean accelerator community. Two case studies illustrate our contributions: (i) RAON's Low Energy Beam Transport (LEBT), where we developed synapticTrack, a Python-based framework for ML-driven orbit correction; and (ii) electron linac injector optimization, where Bayesian optimization techniques are employed for multi-objective tuning of emittance and energy spread. Beyond these case studies, we highlight broader ML applications across accelerator facilities worldwide, including online optimization at light sources, surrogate modeling of high-fidelity simulations, beam diagnostics reconstruction, and anomaly detection in high-power machines. We conclude with a discussion of future directions, emphasizing physics-informed ML, integration into accelerator control systems, and the path toward autonomous accelerator operation.

Paper submission Plan:

No

Best Presentation:

No

111

Suppression of Electron Acceleration in Magnetized Plasma by Coherent R-Wave Injection

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In magnetized plasmas, charged particles and waves exchange energy through mechanisms like resonance, damping, and scattering, which are crucial for understanding various plasma phenomena. A

recent single-particle analysis revealed that electrons in a coherent R-wave or whistler wave undergo instantaneous pitch angle scattering [1,2]. We have extended the analysis by including steady-state electric field parallel to the steady-state magnetic field, predicting a firewall effect of R-waves to suppress electron acceleration. Single-particle simulation results using relativistic Boris algorithm coincide with the prediction of the extended analysis. We then validate the firewall effect using self-consistent particle-in-cell (PIC) simulations, finding the condition of the externally applied whistler waves to inhibit the growth of bump-on-tail features in the electron distribution. The timescale of pitch angle scattering is compared to predictions from quasilinear diffusion theory. The total power required to achieve the firewall effect is estimated, suggesting that wave injection offers a promising strategy for mitigating energetic electron in fusion devices.

This work was supported by NRF of Korea under grant no. RS-2022-00154676, RS-2023-00281272, RS-2024-00409564. The computational resources for the simulations are provided by the KAIROS supercomputing system at the Korea Institute of Fusion Energy (KFE).

References
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Paper submission Plan:

No

Best Presentation:

No

112

Measurement of XFEL beam size and divergence at PAL-XFEL hard X-ray beamline

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We have carried out direct measurements of the XFEL beam size at the PAL-XFEL hard X-ray beamline. The beam profile was characterized using two methods: a knife-edge scan with a slit and beam imaging with a YAG screen. The measured beam sizes and divergence were compared with simulation results, and the findings will be presented along with brief discussions of their implications. Further studies are planned to refine these measurements and improve our understanding of the current beam source characteristics.

Paper submission Plan:

No

Best Presentation:

No

113

Characterization of the RFT-30 Neutron source Using Multi-Sample Activation Analysis

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The RFT-30 neutron source generates neutrons via a thick beryllium target irradiated with a 30 MeV proton beam produced by the RFT-30 cyclotron. This study characterizes the neutron energy spectrum using an unfolding procedure based on the multi-foil activation technique. A selection of activation foils, chosen to cover a broad spectrum of neutron energies through their unique threshold reactions, is utilized. Gamma activity from these foils is measured using a calibrated high-purity germanium (HPGe) detector. Reaction rates for each foil are calculated from full-energy peak counts, with adjustments made for gamma-ray self-absorption and decay occurring during both irradiation and cooling periods. The GRAVEL method is applied to unfold the neutron spectrum from the measured reaction rates, employing response functions derived from the TENDL-2017 nuclear data library. This paper presents the results of the neutron spectrum unfolding and compares them with Monte Carlo simulations conducted using MCNP6.3.

Paper submission Plan:

Yes

Best Presentation:

Yes

114

The Overview of the KOMAC 100 MeV Proton Linac Operation

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In August 2024, The 100 MeV proton linac began the operating 24-hours a day at KOMAC (Korea Multi-Purpose Accelerator Complex), to meet the rapidly growing demands for the proton radiation effect testing. The current pilot 24-hours operation is operated by 5 days per a week. The rotating shifts for accelerator operation consist of 12 hours shift, which have the 4-week rotating pattern. Nominally, one staff is assigned to the each shift. The most of beam time consist of the 3 slots with 'Day', 'Night 1', and 'Night 2'. The accelerator operator in control room is responsible for equipment operation, system monitoring, and performance evaluation. Equipment operation is primarily limited to system initiation and shutdown.
For the efficient and reliable accelerator operation, we upgraded the accelerator control system for the reducing the human resource, as which the automated RF operation system, the automated magnet power supply controls, the electronic log system and so on. In addition, we are currently continue to make efforts for automation of the accelerator operation. In this paper, the details of the organization, rotating shift patterns, and the responsibilities of operator will be introduced.

Paper submission Plan:

No

Best Presentation:

No

115

DVC-based micromechanical analysis of epoxy molding compound for semiconductors

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Epoxy molding compounds (EMC) are widely used as encapsulants in semiconductor packaging, providing resistance to moisture ingress and mechanical shock. The resistance performance of EMC is governed by its filler-matrix-pore architecture. In this study, the microstructural architecture of EMC is quantitatively examined through synchrotron-based high-resolution computed tomography (CT). From the three-dimensional (3D) CT images, the fillers and porous areas were first segmented based on their grayscale levels. It was found that the sizes of the filler particles significantly vary, ranging from 5 to 1000 μm2. The particle sizes were measured by the number of pixels, with a single pixel resolution being 1.3 μm. The volume fractions of the filler and porosity were also measured from the CT images and they are 32.78% and 0.08%, respectively. The effects of the silica filler sizes and volume fractions on the global and local mechanical behavior of EMC are also investigated by in situ uniaxial tensile tests. The image volume datasets acquired at various loading steps are utilized to compute 3D strain fields inside the material through an in-house digital volume correlation (DVC) code. The DVC analysis finds that both global and internal strain fields are locally non-uniform because of the complex microstructural architecture composed of various shapes of the fillers and pores. The local non-uniformity is further investigated at a single filler particle level to find a correlation among the filler size, local volume fraction, pore distribution, and strain field. These correlations are examined within segmented micro-scale subvolumes. The subvolume-based investigation has revealed that the shape of the silica fillers do not change noticeably even after the global strain reaches near the failure strain.

Paper submission Plan:

No

Best Presentation:

Yes

116

Optimization of a CPU-BSM for Application to the RFT-30 Cyclotron

Author: Donghyun Kwak[None]

Co-authors: Cheolmin Ham [1]; Jeong-Hoon Park [2]; Jinsik Ju [2]; Jongchul Lee [2]; Kyoungho Tshoo [3]; Min Goo Hur [2]; Moses Chung [4]; Youngbae Kong [2]

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Characterization of the longitudinal bunch profile is important for optimizing accelerator performance and enhancing beam quality. To measure the bunch profile of proton beam bunches at the RFT-30 cyclotron, the adaptation of a Capacitive Pick-Up type Bunch Shape Monitor (CPU-BSM) is being investigated at the Advanced Radiation Technology Institute (ARTI), Jeongeup, Korea.
The optimized CPU-BSM structure has been designed with an enlarged inner diameter to allow direct installation into the existing beam pipe. Electromagnetic simulations were performed to verify the bunch signal detection capability and to minimize impedance mismatching arising from the modified geometry.
In this presentation, we will introduce the newly designed CPU-BSM structure and present the simulation results that validate its performance.

Paper submission Plan:

No

Best Presentation:

No

117

Implementation and Commissioning of the Slow MPS for the 100-MeV Proton Linac at KOMAC

Author: Jae-ha Kim[1]

Co-authors: Young-gi Song [1]; 성윤조 [2]; Hae-Seong Jeong [1]; Hyeok-Jung Kwon [3]

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The Korea Multi-purpose Accelerator Complex (KOMAC) operates a 100 MeV proton linear accelerator that provides high-intensity proton beams for various research applications. The accelerator consists of an ion source, a radio-frequency quadrupole (RFQ), and drift tube linacs (DTLs), which

deliver beams to multiple user facilities.
To prevent equipment damage and maintain stable operation, a multi-layer Machine Protection System (MPS) has been introduced. While the fast protection layer responds to instantaneous hardware faults, a dedicated Slow MPS has been developed to manage slower abnormal conditions such as vacuum degradation, cooling system instability, and power supply interruptions.
The Slow MPS is built around industrial programmable logic controllers (PLCs) with embedded Linux CPUs. Within this platform, EPICS Input/Output Controllers (IOCs) run natively, allowing interlock states and operational data to be exchanged through shared memory and interrupt-driven communication between the ladder logic and EPICS process variables.
Independent from the fast protection chain, the Slow MPS is seamlessly integrated into KOMAC's EPICS-based control infrastructure. This paper presents the system architecture, implementation, and commissioning results of the Slow MPS, demonstrating its effectiveness in enhancing reliability and operational safety of the 100 MeV proton linac.

Best Presentation:

No

Paper submission Plan:

No

118

CFD Design and Evaluation of a Nitrogen–Neon Layered Capillary Gas Cell for Dephasing-Free, High-Charge LWFA

Author: Hyeon Woo Lee[1]

Co-authors: Sihyeon Lee [2]; Sang Yun Shin [2]; Bonghoon Oh [2]; Jeong-Wan Park [2]; Keonho Kim [2]; Hee Jin Cho [2]; Seong Hee Park [2]

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We propose an optimized nitrogen–neon layered capillary gas cell for high-charge, dephasing-free laser wakefield acceleration (LWFA). Previous studies with aluminum plasmas have demonstrated stable, dephasing-free acceleration, and titanium–aluminum layered plasmas have increased beam charge with different injection mechanisms compared with conventional gas targets. However, these approaches relied on the laser-ablation process. We design a practical capillary gas cell that reproduces the beneficial ionization effects and tailored beam loading without laser ablation. Ansys Fluent CFD is performed to set a capillary geometry and a density profile, which is evaluated using SMILEI PIC simulations. This work involves control of the density profile (e.g., ramp shape, uniformity, position of the layer). We also discuss several issues and experimental strategies, e.g., profile tolerances, entrance/exit hydrodynamics, and repetition rate. This paper delivers an optimized capillary design and target profile, and will be a pioneering study for a readily deployable alternative to laser-ablated plasma targets for robust, dephasing-free, high-charge LWFA.

Paper submission Plan:

No

Best Presentation:

No

119

Multi-physics analysis on the first tank of 200 MeV separated drift tube in Korea Multi-purpose Accelerator Complex

Author: Sungbin Park[1]

Co-authors: Han-Sung Kim [2]; Hyeok-Jung Kwon [3]; Seunghyun Lee [4]

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Korea Multi-purpose Accelerator Complex (KOMAC) has been designing 200 MeV linac. As an option for normal conducting structure, separated drift tube linac (SDTL) type is considered in this study. To investigate the adequacy of the cooling system, multi-physics analysis is conducted to evaluate frequency detuning of the tank under RF duty factor of 3%. For the first tank of the SDTL, multi-physics analysis is conducted in the flow of electromagnetic, thermal, structural, and again electromagnetic analysis which finally derives frequency detuning of the tank. In this process, contributions from each component of tank wall, stem, and drift tube are evaluated separately. Varying heat transfer coefficient of the cooling channel, trend of the frequency detuning originated from each component are observed.

Paper submission Plan:

Yes

Best Presentation:

No

120

X-ray diffraction study on polymorphism of SnTiO2 thin films

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Herein, we report the phase stability in TiO2 doped SnO2 thin films deposited on sapphire(0001) substrates using radio-frequency powder sputtering. A powder sputtering target was prepared by mixing SnO2 (99.99% purity) and TiO2 (99.99% purity) powders. The stoichiometry of (Sn0.9Ti0.1)O2 was achieved by adding 10 at% TiO2 powder to 90 at% SnO2 powder. According to the previously reported SnnO2-TiO2 phase diagram, the spinodal decomposition occurred into SnO2-rich and TiO2-rich phases to minize the interaction between Sn and Ti atoms. In this study, we prepared (Sn0.9Ti0.1)O2 thin films with different film thicknesses and investigated their structural propertiesb by high-resolution synchrotron X-ray diffraction and scanning electron microscopy analyses. As a result, we determined the effet of misfit strain on the phase separation as a function of film thickness. Detailed results will be presented in this poster presentation.

Paper submission Plan:

No

Best Presentation:

Yes

121

Synthesis and characterization of amorphous (In,Ga)2O3 thin films grown by radio-frequency powder sputtering

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Over the past decades, gallium oxide (Ga2O3) has been intensively investigated owing to its excellent physical properties, such as its breakdown field of 8 MV/cm and wide bandgap of ~4.9 eV for β-phase Ga2O3. Despite the structural or crystallographic mismatch, such as cation coordination, between indium oxide (In2O3) and Ga2O3, adding In2O3 to the host Ga2O3 could form a chemical alloy, usually in the form of (InxGa1-x)2O3. In addition to the intermediate phase near x ≈ 0.5 with a hexagonal structure, Ga-rich monoclinic and In-rich cubic bixbyite phases are preferential. In this study, we focused on the competition between In and Ga atoms and concentration profiling of In atoms in a Ga2O3–In2O3 alloy system during sputter growth in a reducing atmosphere, leading to the spontaneous phase separation of In atoms to In-rich and In-poor domains. In this study, we prepared (In0.1Ga0.9)2O3 thin films with varying the growth temperature and their structural and electrical properties were investigated using XRD, SEM, AFM, and Hall measurements. In this presentation, details on the fabrication process and physical properties of (InxGa1-x)2O3 thin films will be reported.

Paper submission Plan:

No

Best Presentation:

Yes

122

Design of a Proton Beamline Specialized for Radiation Testing of Semiconductors at KOMAC

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The demand for radiation hardness evaluation of semiconductor devices and materials has been steadily increasing in recent years. To address this need, the Korea Multi-purpose Accelerator Complex (KOMAC), which currently operates a 100-MeV proton accelerator, is developing a dedicated beamline for semiconductor radiation testing. The beamline comprises a linear beam optics system featuring conventional dipole and quadrupole magnets for efficiently transporting the 100-MeV proton beam, along with a collimator that reduces the beam intensity to levels suitable for semiconductor testing. Additionally, two octupole magnets are used to generate a wide and uniform beam profile. At the end of the beamline, a multi-purpose chamber will be installed to enable proton irradiation as well as simultaneous high-vacuum and thermal cycling tests. This presentation provides a detailed report on the design status of the dedicated beamline currently under development at KOMAC.

Paper submission Plan:

Yes

Best Presentation:

No

123

Development of an acceleration tube for electrostatic accelerator at KOMAC

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KOMAC has been operating the 150 kV ion implanter since 2015 and providing metal ion beams to beam users. For this implanter, 20 keV ion beam current was more than three times higher than 150 keV beam current. It is due to the design of acceleration tube. It has just three electrodes and the electrodes of existing acceleration tube were too close together, so the focusing power was too strong for 150keV ion beams. To enhance the beam transport efficiency and ease of maintenance, we developed the new acceleration tube for 150 kV ion implanter. The new accelerator tube for 150keV single ended accelerator consists of a periodic repetition of insulator rings and metal electrodes. The number of electrodes was 10, so that the potential gap between adjacent electrodes not exceed 15kV. In this conference, we would like to present our design and test results of the acceleration tube.

Paper submission Plan:

No

Best Presentation:

No

125

Evaluation of Dosimetric Effects on the Therapeutic Carbon Ion Beam Due to Gold Fiducial Markers

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Co-authors: Chanil Jeon [3]; Shunsuke Inagaki [4]; ChanKyu Kim [2]; Hak Soo Kim [2]; Jong Hwi Jeong [2]; Dongho Shin [2]; Se Byeong Lee [2]; Tae Hyun Kim [2]; Mutsumi Tashiro [4]

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Purpose/Objective
Accurate dose delivery and target localization are crucial in carbon ion beam therapy. However, gold (Au) fiducial markers cause significant dosimetric perturbations and induce metal artifacts in CT images, compromising efficacy. This study aimed to evaluate the degree of carbon ion beam dose perturbation within the SOBP using markers with different gold contents.

Materials and Methods
We used two different rod-shaped markers: Au 100% and Au 5%. CT images compared their imaging properties. The setup used a PMMA phantom with markers' axes perpendicular to the 380 MeV/u carbon ion beam, generating a 6 cm SOBP. Markers were placed at Position A (5.0 cm depth, mid-SOBP) and Position B (6.5 cm depth, distal SOBP). Dose perturbation was evaluated using EBT XD film, inserted at 0.5 cm intervals downstream from Position A. Film measurements were converted to physical dose after correction for quenching effects specific to the carbon ion beam's dose-response characteristics.

Results
Both markers showed differences in dosimetric and imaging properties. The Au 100% marker generated metal artifacts in CT scans, significantly hindering marker boundary identification and surrounding tissue visibility. In contrast, the Au 5% marker showed little to no severe imaging artifacts. Dosimetrically, the Au 100% marker induced a high dose reduction, ranging from -5.3% to a critical -44.3%, a marked difference compared to the Au 5% marker (reduction range: -1.8% to -7.2%). The degree of dose reduction and perturbation was confirmed to increase sharply with gold content.

Conclusions
The comparative analysis confirmed that the conventional marker (Au 100%) caused more severe distortion in both carbon ion beam dose and CT images than the Au 5% marker. The Au 100% marker caused a large dose reduction (up to -44.3%). The severe imaging artifacts generated by the Au 100% marker are a major factor contributing to treatment planning uncertainty.

Paper submission Plan:

Yes

Best Presentation:

Yes

126

Performance study of a triode electron gun through combination of the gun power supply and an external heating power expansion system

Authors: Sang Koo Kang[1]; Heuijin Lim[2]

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In the electron accelerators currently developed and operated by the Dongnam Institute of Radiological and Medical Science (DIRAMS), both a diode-type electron gun and a triode-type electron gun with a modulating-anode configuration have been implemented. Our triode gun can control the beam current by adjusting the high-voltage for modulating anode. For fast and real-time control of beam current, the grid-type gun is commonly used. We tested the grid-type gun using the gun diagnostics system developed in DIRAMS. For operating the gun, the cathode voltage was applied to 20 kV, the grid voltage to 141 V, and the filament voltage to 7.09 V. Our grid-type gun requires the filament current of 4 A, which exceeds the capability of the gun power supply (maximum 2 A), making sufficient heating difficult. To overcome this limitation, an external heating power expansion system was implemented, enabling electron emission by heating the filament to the required level. Current measurements were performed as a function of grid voltage, the spatial distribution of emitted electrons was analyzed, and the beam size was analyzed according to distance from the cathode. Based on these experimental results, DIRAMS plans to apply the findings to the electron gun design of a high-power accelerator. (This work was supported by the Dongnam Institute of Radiological & Medical Sciences (DIRAMS) grant funded by the Korea government (MSIT) (No. 50493-2025).

Paper submission Plan:

No

Best Presentation:

No

127

Development of plasma targets for controlled injection in laser plasma acceleration

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Laser–plasma acceleration (LPA) is a promising approach for generating high-energy electron beams, but achieving stable and high-quality performance requires precise control of the injection process. We present the development of plasma targets based on gas cells incorporating a bump injection structure and operated with a helium–nitrogen mixture. Tailored density profiles were optimized through CFD simulations, enabling controlled electron injection that shortens the injection length and is expected to reduce the energy spread while improving beam stability. The targets were fabricated by laser micromachining, ensuring robustness under intense laser irradiation. This work demonstrates a practical approach to controlled injection in LPA and indicates the suitability of such plasma targets for future high-repetition-rate accelerator applications.

Paper submission Plan:

No

Best Presentation:

Yes

128

Soft X-Ray Bremsstrahlung Dose Calculation Based on Low-Energy Electron Transport model

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Soft X-rays are widely used in materials research, XRF, and nondestructive testing, yet their characterization is modeled primarily with Monte Carlo (MC) methods. In the soft X-ray regime, the X-ray yield declines as the incident electron energy decreases, and even small increases in solid-target thickness can strongly enhance self-shielding, sharply degrading the efficiency of MC-based computations. Focusing on bremsstrahlung, this work proposes a simulational cost-saving approach that modifing monte-carlo electron transport into a numerical approximation. This study apply the model to slab solid targets to evaluate X-ray yield as a function of thickness and to provide practical guidance for soft X-ray tube system design. We further identify how the optimal thickness varies with target material and discuss the underlying causes.

Paper submission Plan:

No

Best Presentation:

Yes

129

operation status of the CSNS Linac

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The China Spallation Neutron Source (CSNS) is a pulsed spallation neutron source based on a high-power proton accelerator. Specifically, it comprises an 80 MeV H^- Linac (Linear Accelerator) and a 1.6 GeV Rapid Cycling Synchrotron (RCS), with a designed beam power of 100 kW and a repetition rate of 25 Hz. CSNS officially started operation in 2018 and has since steadily increased its beam power to 170 kW. The accelerator system maintains an average annual beam supply time of over 5,000 hours and an operational efficiency of more than 95%. This report presents the operation status of the CSNS Linac as well as the Linac's future application plans.

Paper submission Plan:

No

Best Presentation:

No

130

Laser pulse compression in gradient-plasma photonic crystal for laser wakefield acceleration (LWFA)

Author: Jaeho Lee[1]

Co-authors: Manoj Kumar [1]; Dohyun Park [1]; MinSup Hur [1]

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Chirped-pulse amplification (CPA) has been the cornerstone of petawatt-class laser development. Yet, scaling this approach toward the exawatt or zettawatt regime would demand diffraction gratings spanning hundreds of meters, a requirement beyond current technical feasibility. Through particle-in-cell (PIC) simulations, we have recently shown that pulse compression by factors of several hundred can be realized using a near-critical plasma with a smooth density gradient [1]. The concept relies on introducing path length differences for the frequency components of a negatively chirped, long-duration pulse. Nevertheless, this approach requires millimeter-scale plasmas of near-critical density with highly uniform profiles, a condition that is challenging to maintain since unavoidable density fluctuations tend to degrade compression efficiency. In this work, we report that gradient-plasma photonic crystals (GPPCs), by virtue of their dispersive properties, can achieve equivalent compression gains while reducing the required plasma length and density. Our preliminary one-dimensional PIC simulations reveal that GPPCs can deliver compression gains in the range of 30–45. These high-power lasers hold great potential for future applications in plasma-based accelerators, particularly laser wakefield acceleration (LWFA).

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References
[1] M. Hur, et al. “Laser pulse compression by a density gradient plasma for exawatt to zettawatt lasers” Nat. Photonics 17, 1074 (2023).

Paper submission Plan:

No

Best Presentation:

Yes

131

Report on the Re-fabrication of the Ion Pump for the PLS-II Beamlines

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An ultra-high vacuum (UHV) ion pump system has been used at the beamlines of the Pohang Light Source II. It was found that the PHI ion pump (220–600 l/s, CF8 inch flange), which has been in use for a long time from the early days of PLS to the present, cannot fulfil the needs of the pump

specifications required by the laboratory, even though it is supposed to achieve a maximum reachable vacuum level of around 1x10^-10 Torr. After identifying the cause first, then apply a high voltage of up to 7 kV to the pump cell to ensure insulation will be checked. The results are organized and designed using the ion pump system, mostly used in the beamlines, so that they can be reflected in the re-manufacturing process. In addition, a process was proposed to address this issue, which includes a high-temperature vacuum degassing treatment at 480 ℃, and it also mentions how this process was applied to the manufacturing of ion pumps.

Paper submission Plan:

No

Best Presentation:

No

132

Two dimensional layered materials exploration using synchroton-based techniques.

Author: Tim Verhagen[None]

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The recent theoretical prediction [1] and experimental confirmation of sliding ferroelectricity [2,3] has significantly expanded the group of two-dimensional (2D) ferroelectrics. Due to the weak van der Waals interactions in layered van der Waals multilayers, an out-of-plane polarization can be created in many of those systems via in-plane interlayer sliding of a layer and thereby breaking the inversion symmetry. Although the most common bulk phase of ‘perfect’TMD crystals is the centrosymmetric 2H-form, the presence of sliding ferroelectricty should not be limited to manually stacked 2D few-layer crystals.

Using lab and synchroton-based single crystal X-ray diffraction experiments and a combination of imaging techniques, the sliding ferroelectric properties of (PbS)1.11VS2 were explored [4]. The interaction between the two subsystems is derived from the presence of satellite reflections in the diffraction pattern of the composite. We find
that the subtle interaction between the two subsystems causes the presence of twins, where two of the majority twins have a twist angle below one degree, the the necessary condition for sliding ferroelectricity

We will also present first data about the possibility to grow 2D materials and misfit layer compounds using molecular-beam epitaxy and show how we use synchroton-based X-ray absorption analyses to characterize the grown materials.

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(2021)
[4] C. Antunes Corrêa, J. Volný, K. Tetalová, K. Uhlířová, V. Petříček, M. Vondráček, J.Honolka, and T. Verhagen, Phys. Rev. Lett. 134, 056202, (2025)

Paper submission Plan:

No

Best Presentation:

No

133

Current status of the J-PARC accelerators

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By 2025, J-PARC has achieved its initial performance goals, realizing 1 MW operation in the RCS, 750 kW fast extraction and 90 kW slow extraction operation in the MR. Furthermore, ongoing developments aim for higher beam intensities —for the RCS toward the second target station of the MLF, and for the MR toward the Hyper-Kamiokande experiment. In addition, for the linac, an upgrade project to double the repetition rate is in progress to realize a proton beam irradiation facility. This presentation reports on the current status and upgrade progress of the J-PARC accelerators.

Paper submission Plan:

No

Best Presentation:

No

134

Plasma-Based Beam Combining via Detuned Multi-Pump Raman Backward Amplification for Compact Accelerator Drivers

Author: 도현박[1]

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Next-generation plasma accelerators and beamline facilities demand compact, high-power laser drivers with enhanced stability and scalability. Raman backward amplification (RBA) in plasma offers a promising route for generating ultra-intense, short laser pulses beyond the limits of solid-state amplification. However, conventional single-pump RBA requires long plasma lengths, which lead to noise accumulation and wavebreaking instabilities. In this study, we investigate a detuned multi-pump RBA scheme as a plasma-based beam combining technique to achieve stable and efficient amplification within compact plasma regions. Particle-in-cell simulations show that two 1.2-ps pump lasers in a 200-μm plasma yield amplification comparable to or exceeding that of a single 2.4-ps pump in a 400-μm plasma. A slight frequency detuning (~1%) between pumps induces localized, phase-mixed interaction patterns that suppress wavebreaking and stabilize the amplification process. This plasma-based beam combining approach provides a scalable and damage-free pathway toward compact, high-repetition-rate laser drivers for plasma accelerator front-ends and advanced beam utilization systems.

Paper submission Plan:

No

Best Presentation:

No

135

Evaluation of a Reversible Chromogenic Leak Detection Sensor for Cooling Water Systems in Proton Accelerators

Author: Kyunghyun Kim[1]

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This study evaluates the applicability and characteristics of a reversible chromogenic leak detection sensor for the cooling water system of a proton accelerator. Conventional electrical leak sensors are prone to malfunction due to condensation and humidity. To overcome these issues, a color-changing and reversible linear sensor was applied to the cooling water line. The relationship between leak volume, sensor response time, alarm recovery time, and color restoration time was investigated experimentally. The sensor demonstrated stable performance even under low-conductivity cooling water conditions. Owing to its reusability and ease of maintenance, the proposed sensor system can be effectively utilized for real-time leak monitoring in accelerator cooling systems.

Paper submission Plan:

Yes

Best Presentation:

No

136

Improvement of Vacuum Integrity in 200MHz RFQ Section Brazing at KOMAC

Author: Kyunghyun Kim[1]

Co-authors: Han-Sung Kim [2]; Hyeok-Jung Kwon [3]; Junggoo Hong [4]

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The fabrication of a Radio Frequency Quadrupole (RFQ) involves multiple high-vacuum brazing processes that are prone to vacuum leak issues. This study investigates the physical mechanisms of vacuum leakage during section brazing and presents process improvements implemented at the Korea Multi-purpose Accelerator Complex (KOMAC). Enhanced filler layouts and a weighted ring-type jig were designed to optimize brazing quality. Physical models related to capillary pressure, filler flow, and leak rate were analyzed to interpret the observed phenomena. The improved methods achieved

a leak rate below 1.0×10^{-9} torr·L/s, demonstrating significant improvement in vacuum integrity and overall RFQ fabrication reliability.

Paper submission Plan:

No

Best Presentation:

No

137

Characterization of the Neutron Field at KOMAC Using Multi-Sample Activation Analysis

Authors: Donghwan Kim[1]; Geehyun Kim[2]; Jeong Jeung Dang[3]; Joonsik Kim[2]; Jooyub Lee[2]; Soobin Lim[4]

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A neutron activation study was performed at the Korea Multipurpose Accelerator Complex (KOMAC) 100 MeV linear accelerator using a five foil multi-sample set that included bismuth (Bi). To obtain the reasonable counting statistics while controlling systematic effects, the sample geometry and the beam profile was optimized with respect to facility constraints guided by trial irradiations. HPGe gamma ray spectrometry was conducted with time variant acquisitions considering activated nuclide's half life and reaction. The local neutron field adjacent to the multi-sample was evaluated with a validated Monte Carlo model of the beamline and target assembly. The model was used to compute spatial energy differential fluence, visualize flux maps. Response functions for each activation channel were generated with FISPACT with the beam profile taken into account, and their consistency with the nuclear data was verified. The neutron spectrum was reconstructed using two unfolding algorithms, GRAVEL and MAXED, allowing direct comparison of convergence behavior, sensitivity to prior assumptions. The resulting spectra were cross-checked against predicted energy distributions from MCNP6 and validated by refolding to match the measured reaction rates within uncertainties. This approach presents a practical workflow for neutron energy characterization at KOMAC and establishes a basis for estimating the neutron energy distribution characteristics in future beam applications.

Paper submission Plan:

Yes

Best Presentation:

Yes

138

Preliminary study on the collective effects in a high-current and low-energy storage ring

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Co-author: Weijie Fan [2]

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High-current and low-energy storage ring is an essential part of accelerator for industrial application. However, high intensity poses great challenge to beam stability through collective effects, which can be exacerbated at low energy. In this paper, we present a preliminary study on various collective effects in an application-oriented storage ring. The classical theory is reviewed, and numerical analysis is performed on Touschek scattering, intra-beam scattering, resistive-wall, beam-ion and so on. In addition, Particle tracking is carried out using elegant, mbrack2, etc. Lastly, techniques to improve the current threshold are also discussed.

Paper submission Plan:

Yes

Best Presentation:

No

139

Design and Test of Electron Gun & Magnet of Klystron for High Power Proton Beam Acceleration for CSNS-II

Author: Munawar Iqbal[1]

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China Neutron Spallation Source has successfully delivered 100kW proton beam power. The first phase used the 324 MHz frequency to derive the cavity. Now for the second phase, to achieve 500 kW proton beam power at the target, superconducting cavities will be used derived by the 648MHz frequency. To meet the RF power goal, an indigenous 648 MHz, 1.2 MW pulsed RF power source (Klystron) has been designed and simulated at IHEP. This article describes the design, simulation and test results of the electron gun and magnet of the Klystron.

Paper submission Plan:

Yes

Best Presentation:

No

140

Optimizing Magnet of IRANCYC-10 Cyclotron: Matrix Modeling vs. Experimental Shimming

Author: Raheleh Solhju[None]

Co-authors: Hossein Afarideh [1]; Mitra Ghergherehchi [2]

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This paper presents preliminary steps for the shimming of IRANCYC-10 cyclotron magnet. Shimming, as a crucial step in magnet fabrication, significantly contributes to improving particle acceleration quality, beam stability, and the precision of output energy. Since some shimming procedures —such as pole edge trimming—are irreversible, they require a high degree of accuracy. In this study, the required adjustments for magnetic field corrections are predicted using a matrix method based on mathematical modeling, alongside an experimental approach. A comprehensive comparison of these two methods is provided, highlighting their respective limitations and advantages. The findings of this research offer valuable guidance for optimizing and designing future AVF cyclotron magnets, contributing to their improved performance.

Paper submission Plan:

Yes

Best Presentation:

No

141

Design and commissioning of a 10 MeV cyclotron accelerator cooling system

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The proposed cooling system is designed with a high reliability factor and considering the financial issues and costs, based on the use of a 40 ton chiller for temperature changes of 4.5 to 10 degrees Celsius, which is able to continuously control the water temperature in this range.
In this system, the parts of magnet coil, cavity, power transmission line, ion-source and radiofrequency current amplifier with an inlet water flow of 201.9 L/min are fed from an air-cooled chiller at a height of 40 m on the roof of the building along with a vertical industrial water pump of 4 KW and has been done in CST software, also the distribution of surface flow on the cavity was shown and the hottest point of the cavity was determined. The magnet system includes a hollow multi-layer coils with a square outer cross-sectional area with length 10 mm and an circular inner cross- sectional area with a diameter of 4 mm. Due to the change in impedance of power transmission a cooling system was used.
In the PIG , ion-source with a power consumption of 500 watt and the amplifier part of the water pressure limit lamp is Set at 3.5 bar pressure for optimal cooling.
In this study, practical solutions are presented in the optimal design and commissioning of the cyclotron accelerator cooling system.

Paper submission Plan:

Yes

Best Presentation:

No

142

Establishing solar power generation facilities to reduce accelerator operating budgets(RAON)

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abstract

RAON, a large accelerator research facility, is one of the most most power-consuming facility single research facilities. Currently, more than 10 billion won is spent annually on electricity usage alone. As the accelerator operation stabilizes in the future and continues to operate, the electricity usage fee is expected to increase to an unpredictable level, and at the same time, the accelerator operation may even have to be reduced due to the electricity usage fee issue. Accordingly, we are actively seeking ways to reduce electricity bills by producing electricity using solar power, a clean resource that is infinite, environmentally friendly, and pollution-free.

Paper submission Plan:

No

Best Presentation:

No

143

The vital role of using a chiller system in ensuring the stability and cooling efficiency of the 10MeV cyclotron accelerator and its design and selection calculations

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As one of the most advanced particle accelerators, the cyclotron has an irreplaceable place in research, nuclear medicine (production of radioisotopes) and radiotherapy. The accurate and reliable operation of this device directly depends on the stability of the operating conditions of its key components, including electromagnetic magnets, RF cavities and targets. These components generate significant heat during operation. Inefficient dissipation of this heat leads to thermal expansion,

changes in magnetic and electric fields, beam instability and ultimately to a decrease in efficiency, misalignment and even irreparable physical damage. A closed-loop cooling system using a chiller is the standard engineering solution to overcome this challenge. This article provides a specialized analysis of the importance of using a chiller in this system and completes the technical discussion by describing the principles of design calculations and the selection process. The selection and design of a chiller system for a cyclotron is a multidisciplinary engineering process that requires a thorough understanding of thermodynamics, heat transfer, and the operational requirements of the device itself. A proper design, accompanied by accurate heat load calculations and appropriate chiller selection, not only ensures stable and repeatable cyclotron operation, but also reduces unexpected maintenance costs and significantly increases the useful life of this large investment. Periodic monitoring and preventive maintenance of the cooling system is equally important as the initial design. In the following, we describe the benefits of using, followed by the calculation method and key considerations in the design and implementation of a chiller system for the 10MeV accelerator cyclotron at Amirkabir University of Technology.

Paper submission Plan:

No

Best Presentation:

No

144

Preliminary Study on Instrument Uncertainty Analysis of Laser Tracker in KOMAC

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The Korea Multi-purpose Accelerator Complex (KOMAC) has been conducting alignment procedures for accelerator components and beamlines to extract high-quality proton beams. A laser tracker (Model: AT901) was employed to determine the position of each accelerator component. The laser tracker measures reflector positions in three-dimensional space using a spherical coordinate system (horizontal angle, vertical angle, and distance) with the rotational center as the origin, then converts these measurements into Cartesian coordinates. The measured coordinates are transformed into the machine coordinate system through the Unified Spatial Metrology Network (USMN) and compared with design coordinates to evaluate alignment accuracy.

USMN enables experimental determination of actual instrument uncertainty in the specific operational environment. Instrument Uncertainty Analysis provides a means to evaluate instrument performance under actual conditions. These values can be used as instrument uncertainty during measurements, providing confidence that the measurement uncertainty reflects the results obtained with the specific instrument.

This study introduces the Instrument Uncertainty Analysis of the laser tracker and presents a preliminary study comparing instrument uncertainties in both test bench and KOMAC tunnel environments. In the controlled test bench, uncertainties of 0.316 arcsec horizontally, 0.333 arcsec vertically, and 38.555 μm in distance were obtained. In the tunnel environment, distance uncertainty at point A3(Ion source) increased by 2.39-fold compared to the test bench, while at point A1(Dump), horizontal uncertainty increased 13.9-fold and distance uncertainty 9.8-fold. It was confirmed that uncertainties vary depending on the environment even when using the same instrument.

The future goal is to conduct continuous measurements to verify reproducibility and apply the findings to actual alignment data, thereby deriving more realistic data for the specific environment and

contributing to maximizing the performance of the proton accelerator through enhanced alignment accuracy.

Paper submission Plan:

No

Best Presentation:

No

145

Energy savings by introducing Free Cooling for heavy ion accelerator devices.

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abstract

Heavy ion accelerators, which are large-scale accelerator research facilities, are energy-intensive research institutes that use electrical energy and tap water to cool their equipment. At the time of design, the required water usage was estimated to be approximately 2,236 tons per day. Currently, it is maintained at less than 50%. As accelerator operation continues to increase in the future, it is expected that the usage will increase to the level at the time of design. Accordingly, the pre-cooling method is being introduced and used as a means to reduce electricity and water usage.
Free Cooling operation is a method of cooling the cooling water by operating only the upper blower of the cooling tower without operating the refrigerator, and then lowering the temperature of the cooling water by heat exchange between the cooling water and the device cooling water. It shows good efficiency when operated in winter when the average daily temperature is below 7 degrees Celsius.

Paper submission Plan:

No

Best Presentation:

No

146

Calibration of External Beam PIXE Based on the 1.7 MV Tandem Accelerator Using XRF standards

Author: Kye-Ryung KIM[1]

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The Korea Multi-purpose Accelerator Complex (KOMAC) at the Korea Atomic Energy Research Institute (KAERI) constructed an external beam PIXE (Proton Induced X-ray Emission) beamline based on a 1.7 MV tandem accelerator in the first half of this year. The newly established external beam PIXE system is capable of analyzing samples in the air, making it particularly useful for the analysis of cultural heritage samples that are large in size or at risk of damage in a vacuum environment. An external beam PIXE system can be broadly divided into three main components: an accelerator, a beamline, and a nozzle unit. The nozzle unit, which is the most critical part for determining the performance, consists of a beam window and detectors. The beam window is made as thin as possible to minimize the reduction in proton beam energy, and materials such as Silicon Nitride, Kapton, and Havar foil can be selected and used depending on the type of sample. For the detectors, an SDD (Silicon Drift Detector) and a CdTe detector were installed to measure X-rays in the low-energy and high-energy regions, respectively. Calibration of the device using standard reference materials is essential for accurate quantitative elemental analysis of a sample using an external beam PIXE. The calibration of a PIXE system varies depending on the characteristics of the sample being analyzed, such as its thickness and elemental matrix. In this paper, we will primarily present the experimental results focusing on the calibration performed for the analysis of thin samples.

Paper submission Plan:

No

Best Presentation:

No

147

Magnetic cross-talks among storage ring magnets at the Korea-4GSR

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This presentation introduces magnetic cross-talk effects caused by the close placement of magnets in the Korea-4GSR storage ring. Korea-4GSR, under development since 2021, is a next-generation 4GeV-class synchrotron light source designed to achieve ultralow emittances (below 100 pm·rad). It adopts a hybrid multi-bend achromat (HMBA) lattice, which requires more magnets per cell than conventional designs, resulting in extremely short spacing between adjacent magnets. The cross-talk effects caused by the proximity placement can degrade the magnetic field quality, leading to beam trajectory distortion and increased nonlinearity in beam dynamics. In the Korea-4GSR storage ring, most magnets are separated by less than 10 cm yoke-to-yoke, making them susceptible to mutual magnetic interference. In this study, cross-talk effects were evaluated for all magnets of the storage ring using 3D finite element simulations. This work presents the quantitative analysis of magnetic cross-talk and reports the interference levels for representative magnet pairs.

Paper submission Plan:

Yes

Best Presentation:

No

148

Extraction of Hydrogen Ion Beam Using an Alphatross Ion Source for Large-Area Proton Beam Irradiation

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Co-authors: Han-Sung Kim [2]; Hyeok-Jung Kwon [3]; Jae-ha Kim [4]; Young-gi Song [4]

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Proton beam irradiation technology, typically using beams in the energy range of hundreds of keV to several MeV, is utilized to enhance the performance of power semiconductors. Backside irradiation allows for the formation of a Field-Stop Layer, which improves the voltage blocking capability. Frontside irradiation, on the other hand, enables minority carrier lifetime control, thereby improving the switching speed. To apply proton beam irradiation technology to enhance the performance of power semiconductors, a large-area proton beam irradiation system capable of handling 6-inch to 8-inch wafers considering the wafer size used for power semiconductor production is necessary. Furthermore, for its industrial utilization, the stable extraction and acceleration of the proton beam must be achieved above all else. Generally, a SNICS (Source of Negative Ions by Cesium Sputtering) ion source is used for extracting the proton beam in a tandem accelerator. While the SNICS ion source can extract a proton beam of a few μA, the frequent replacement of the cathode and the resulting beam instability both immediately after replacement and when the replacement time is imminent are obstacles to long-term stable beam irradiation. To address this, the extraction of a negative hydrogen ion beam using an Alphatross ion source was considered. Using the Alphatross ion source makes long-term stable extraction of the proton beam possible. Two methods can be used to extract a negative hydrogen ion beam from an Alphatross ion source: (1) using a Ta canal with a He-balanced mixed gas containing 1–3% hydrogen, and (2) utilizing an Al canal with high-purity hydrogen gas. The experimental results to be presented in this paper are the findings of a feasibility study on the extraction of a negative hydrogen ion beam using an Alphatross ion source, showing that a maximum negative hydrogen ion beam of 1.2μA was successfully extracted.

Paper submission Plan:

Yes

Best Presentation:

No

149

Simulation of Actinium Production via p+Th Reaction at the RAON Cyclotron using PHITS/DCHAIN

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Actinium-225 (^{225}Ac) is a promising alpha-emitting radionuclide for Targeted Alpha Therapy (TAT). This study investigates the production of ^{225}Ac through the proton–induced reactionon a Thorium–232 (^{232}Th) target, utilizing the capabilities of the 70 MeV cyclotron at the RAON heavy-ion accelerator facility. A key challenge in production is the co-production of the long-lived impurity ^{227}Ac, making the minimization of the ^{227}Ac/^{225}Ac activity ratio a critical objective for clinical applications.

This research employs the Particle and Heavy Ion Transport code System (PHITS) and the DCHAIN decay calculation code to conduct a comprehensive simulation. We calculated the production yields of ^{225}Ac and the activity of the ^{227}Ac/^{225}Ac ratio under various conditions, including incident proton energy and target thickness. Furthermore, the generation of prompt radiations, such as gamma rays and neutrons during beam irradiation, was analyzed to provide data for radiation safety management. The study also includes an assessment of the effective dose rate from the target as a function of cooling time post-irradiation.

The results of this simulation offer essential data for optimizing the production parameters to maximize the yield of high-purity ^{225}Ac and for designing appropriate radiation shielding and handling procedures at the RAON facility.

Paper submission Plan:

Yes

Best Presentation:

No

150

Establishing a testbench for RF cavity installation for the Korea-4GSR storage ring.

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The Korea 4th-Generation Storage Ring (Korea-4GSR) is being developed with the goal of producing ultra-high-brightness synchrotron radiation by utilizing a 4 GeV low-emittance electron beam and a stored current of 400 mA. As a next-generation light source facility, a verified and robust system configuration is essential to maintain precise beam quality and ensure stable long-term operation. For stable and efficient beam operation, a total of ten radio-frequency (RF) cavities are planned to be installed in the storage ring. These RF cavities play a key role in compensating the beam energy and maintaining phase stability, and their performance and reliability directly affect the overall operational quality of the accelerator. Therefore, it is crucial to verify the installation, maintenance,

and potential operational issues of the cavities in advance.
To meet these requirements, this study carried out the mechanical design and construction planning of an RF cavity testbench that can simulate actual operating conditions. The designed testbench replicates the real installation configuration, including the cavity body, cooling lines, and vacuum chamber, to verify mechanical assembly, alignment precision, and maintenance accessibility, as well as to identify possible mechanical interferences.
The testbench is designed to perform stepwise conditioning and high-power tests of the cavity, enabling experimental verification of the reliability and stability of its mechanical components. Through this setup, potential issues that may arise during the assembly, alignment, and operation stages can be identified and resolved in advance, thereby enhancing the operational reliability and mechanical completeness of the RF system for the Korea-4GSR

Paper submission Plan:

No

Best Presentation:

No

151

Evaluation of target cooling water activation in RAON'ISOL system

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IRIS'RAON is a large radiation accelerator facility that produces various heavy ion beams and accelerates them for use in various experiments. From a safety perspective, the critical area of the RAON facility is the target area where the primary beam collides, and cooling water is circulated and supplied for cooling. It is necessary to identify the radioactive nuclides in the coolant supplied to the target of the ISOL system and to evaluate the characteristics of the radiation. In order to calculate the activation of the cooling water generated during the operation of the SiC target used in the ISOL system, Monte Carlo simulation was performed under the condition of 0.7 kW (70 MeV, 10 μA) for 8 hours of operation. The half-lives and radioactivity concentrations of the major gamma-ray nuclides generated in the cooling water are N-16 (T1/2: 7 s, 8.69E+04 Bq/cc), O-15 (T1/2: 2 m, 2.01E+04 Bq/cc), C-11 (T1/2: 20 m, 1.05E+03 Bq/cc), N-13 (T1/2: 10 m, 7.41E+02 Bq/cc), O-14 (T1/2: 1.2 m, 3.38E+02 Bq/cc), most of which are nuclides with half-lives of less than a few minutes. All nuclides except N-16 are β+ decay nuclides, emitting two annihilation gamma rays of 0.511 MeV. A peak of 511 keV was confirmed in the cooling water pipes measured with a portable radionuclide analyzer, and the area radiation dose rate was measured to be a maximum of 0.7 μSv/h. The half-life was calculated using the decay rate of radioactivity after the end of operation based on the measured value of RMS, and the average was 22 minutes, indicating that it was estimated to be a C-11 nuclide. Currently, it is being operated at low power, but considering future power increases, OSLD will be installed to monitor the radiation dose around the cooling water pipes.

Paper submission Plan:

Yes

Best Presentation:

No

152

Defect evolution comparison between He+ and He 2+ ions irradiation on graphene

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Defect engineering in two-dimensional materials has drawn significant attention because defects profoundly affect their electrical, optical, and mechanical properties. Given the atomic thinness of 2D systems, defects cause more pronounced alterations than in bulk, which is crucial for applications in sensing, next-generation electronics, and optoelectronics across diverse operating conditions. Among these materials, graphene—a single atomic layer of sp2-hybridized carbon atoms in a honeycomb lattice—stands out for its exceptional carrier mobility and extreme surface-to-volume ratio. These characteristics render it exquisitely sensitive to environmental changes, making it an ideal platform for chemiresistive gas sensors that operate via charge transfer between adsorbed molecules and the graphene surface. Despite this potential, pristine, defect-free graphene is chemically stable and inert, interacting with most gases only through weak van der Waals forces. This yields low sensitivity, poor selectivity, and slow response, limiting practical sensor use and durability. To address this, defect engineering intentionally introduces structural defects into the lattice. Defects such as atomic vacancies act as localized, highly reactive sites, increasing binding with gas molecules, promoting more efficient charge transfer, and enhancing sensor performance. Among techniques for generating defects, ion beam irradiation is a powerful tool: a residue-free physical process enabling precise control over defect type and density. In the keV energy range, defect creation is predominantly governed by nuclear collisions between incident ions and graphene carbon atoms, with outcomes determined by dose, ion species, and energy. The projectile's charge state is another variable that can influence the ion–solid interaction. Accordingly, this work reports a comparative study of defect generation in graphene focusing on ion charge state. Graphene samples were irradiated with He+ and He2+ ions at an identical kinetic energy of 120 keV. Defect density was quantified by Raman spectroscopy, and functional properties were evaluated by analyzing the resistance response of fabricated gas-sensor devices.

Paper submission Plan:

Yes

Best Presentation:

No

153

Synergistic Effects and Mechanistic Insights of Combined STAT5 Inhibitor and Proton Beam Therapy in Prostate Cancer Cells

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Prostate cancer is one of the most prevalent malignancies in men and frequently metastasizes to bone. Standard treatments, including surgery, chemotherapy, and radiotherapy, face limitations due to drug resistance and cumulative radiation toxicity. This study investigated the synergistic effects of the STAT5 inhibitor III (pimozide, 100 ng/mL) combined with proton beam irradiation at doses of 7.3, 11.8, and 16.6 Gy on metastatic PC-3 cells. Pretreatment with pimozide for 18 hours enhanced the cytotoxic effects of proton therapy. Trypan blue and Annexin V–PI assays revealed dose-dependent decreases in cell viability and increased apoptosis, reaching 57.35% with the combination therapy. RT-PCR and immunofluorescence showed downregulation of BCL2 and upregulation of BAX and Caspase-3, confirming apoptosis induction. Flow cytometry indicated G2 arrest and elevated sub-G1 apoptotic populations, while wound healing assays demonstrated inhibited cell migration and proliferation, particularly by pimozide. Furthermore, the combination treatment suppressed epithelial–mesenchymal transition (EMT) via reduced expression of ZEB1, ZEB2, TWIST1, and SNAI1. Collectively, these findings suggest that the combined use of pimozide and proton beam therapy enhances apoptosis, induces cell cycle arrest, and inhibits EMT, providing a potential therapeutic strategy for advanced prostate cancer with improved efficacy and reduced side effects.

Paper submission Plan:

Yes

Best Presentation:

No

154

Agentic AI, Physical AI, AI Scientist, and Superfacility for Accelerator Facilities

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Recent progress in Artificial Intelligence (AI) has accelerated the development of high-performance Large Language Models (LLMs), with leading global companies releasing new generations every few months. The emergence of GPT-5, exhibiting expert-level reasoning capabilities, has reduced hallucination errors to only a few percent, suggesting the feasibility of near-zero-hallucination LLMs in the near future. This rapid advancement is reshaping the research landscape, where tasks once requiring large teams can now be executed by a single expert working collaboratively with an intelligent AI Scientist. In accelerator science, Agentic AI and Physical AI are being introduced to enhance accelerator design, diagnostics, autonomous operation, fault detection, and predictive maintenance. To maximize scientific productivity, the Superfacility concept integrates accelerator beamlines, high-performance computing (HPC), big-data centers, and AI platforms through high-speed networks, enabling autonomous and data-driven experimentation. In this paper, we present our recent developments of ELEGANT–LLM–based Agentic AI, designed to estimate magnetic-field and alignment tolerances and to improve the dynamic aperture of the Korea-4GSR light source project. We also describe EPICS–LLM–based Physical AI for autonomous accelerator operation. Furthermore, the concepts of the AI Scientist and Advanced Superfacility platform for accelerator beamlines are introduced, demonstrating the potential of AI-driven accelerator facilities in achieving intelligent, self-optimizing research infrastructures.

Paper submission Plan:

Yes

Best Presentation:

No

155

Test of full performance (80 MW, 4 us, 60 Hz) for latest version of klystron in PAL

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Co-authors: Chang-Ki Min [2]; G. Y. Jang [3]; H. S. Shin [3]; Yong Jung Park [1]

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We report high-power processing and performance of a domestically manufactured S-band pulse klystron for the Pohang Accelerator Laboratory (PAL). Our earlier studies identified 60 Hz gun-arcing mechanisms—clump-assisted breakdown in the diode region and electron multiplication seeded at the ceramic triple point—and we proposed mitigation via improved surface preparation and a triple-point electrostatic shield. These design and process measures were incorporated into the latest unit fabrication (serial number VK4). VK4 was conditioned in the PAL Klystron & Modulator Test Lab using standard processes. It reached 80 MW peak RF output with a 4-μs pulse width at 60-Hz repetition rate. During and after conditioning, the system showed stable operation consistent with suppression of gun breakdowns associated with electrode surfaces and triple-point effects. In this paper we summarize the conditioning history and performance test results. The successful demonstration of 80 MW, 4 μs, 60 Hz with a domestically produced tube validates the klystron gun design improvements and supports readiness for routine accelerator service and series production. Ongoing work is to test long-term reliability at full duty in real accelerator facilities.

Paper submission Plan:

Yes

Best Presentation:

No

156

Phase-Space Tomography of Charged Beams Using Quadrupole Scans

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Accurate gauging of the phase-space distribution in an accelerator is essential for understanding beam dynamics and optimizing accelerator performance. However, direct measurement of the full phase space is extremely challenging. Instruments such as pepper-pot masks, slit scanners, and Allison scanners can offer partial phase-space measurements, but their use is often limited by beam energy, intensity, or spatial constraints.

In this study, we present a phase-space tomography method that reconstructs the two-dimensional distribution of an accelerated beam using a series of beam profile measurements obtained under varying quadrupole magnet strengths. By scanning the effective focusing parameters, multiple projections of the beam are acquired, which are then mathematically inverted to reconstruct the underlying phase-space distribution. Simulations and preliminary experiments demonstrate that this approach can reproduce key characteristics of the beam's emittance and phase correlation with high fidelity.

Our method offers a flexible and non-invasive diagnostic alternative that can be implemented in existing beamlines with minimal instrumentation changes. The results highlight its potential as a practical tool for routine beam optimization and advanced accelerator studies.

Paper submission Plan:

Yes

Best Presentation:

No

157

TRIBs Simulation for Korea-4GSR Timing Mode Experiment –Focusing on Beam Separation

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The Korea-4GSR is exploring advanced operation modes to expand user capabilities. Among the advanced modes, the hybrid mode allows brightness and timing modes to run in parallel. This mode is based on Transverse Resonance Island Buckets (TRIBs), which enable spatial beam separation and clean photon pulses without mechanical choppers. In this study, we adjusted the horizontal tune close to the third-integer resonance and optimized the sextupole strengths. As a result, the photon beam was separated by ~5 mm horizontally at about 30 m downstream, and the characteristics of both the electron and photon beams were examined under these conditions. This study will focus on implementing hybrid-mode operation at Korea-4GSR in the future.

Paper submission Plan:

No

Best Presentation:

No

158

Prototype Development and Magnetic Field Measurement of a Thick-Type Septum Magnet for the Korea-4GSR Injection and Extraction System

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A prototype thick-type septum magnet for the Korea-4GSR injection and extraction system was fabricated and evaluated. Magnetic field measurements using a search coil confirmed a main field constant of 0.05436 T/kA with a half-sine pulsed current up to 7 kA. The leakage-to-main field ratio was measured as 8.6×10^{-4}, satisfying the design criterion of below 1.0×10^{-3}. The leakage field exhibited a long decay component with a settling time of about 2.7 ms, attributed to eddy-current coupling between the conductor and core. Field-mapping also revealed asymmetric fringe-field distributions due to the conductor geometry. These results demonstrate that the prototype meets the magnetic performance requirements and provides essential data for further reduction of residual leakage fields in the final design.

Paper submission Plan:

No

Best Presentation:

No

159

Development and Experimental Status of a Cryogen-Free, Conduction-Cooled 5-Tesla HTS Wavelength Shifter

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A cryogen-free, conduction-cooled high-temperature-superconducting (HTS) wavelength shifter (WLS) has been developed collaboratively by the Pohang Accelerator Laboratory (PAL) and Seoul National University (SNU) as part of the HTS insertion-device (ID) roadmap for future light sources in Korea. The device employs multi-width REBCO conductors with no-insulation (NI) technology to achieve high current density and quench-free operation near 20 K. The magnet core, cryostat, and vacuum chamber were fully assembled and successfully cooled using a pulse-tube cryocooler without liquid helium. A central magnetic field of 5.02 T was achieved and stably maintained, confirming the feasibility of LHe-free operation. Following iterative improvements to electrical and thermal insulation, the system demonstrated long-term stability and sufficient temperature margin under conduction cooling. The next phase involves detailed field-mapping under cryogenic and vacuum conditions to determine operational current pairs, followed by beam-based characterization in the storage-ring environment. The results represent a significant step toward realizing compact, low-maintenance HTS insertion devices for next-generation synchrotron radiation facilities.

Paper submission Plan:

No

Best Presentation:

No

160

Design of 2nd hard-X-ray undulator line in PAL-XFEL with bunch by bunch operation

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The second hard X-ray undulator line in PAL-XFEL, the Korean hard X-ray FEL facility, had been reported its conceptual design several yeas ago. The main idea is that the construction of the branch line at the end of the 10 GeV electron linac and a long hard X-ray planner undulator line dedicated in 2~11 keV X-rays range. However, since by using a kicker which separates the incoming single bunch electron beams in pulse by pulse with 60 Hz, the each of the two hard X-ray undulator lines can not generate FEL in 60 Hz simultaneous operation mode. In this presentation, we suggest a kicker branch line operating in bunch by bunch mode which makes the two hard X-ray undulator lines service in 60 Hz simultaneously, and discuss its requirements of the system.

Paper submission Plan:

No

Best Presentation:

No

161

The SCRIT electron scattering facility at RIKEN RI Beam Factory

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Electron scattering is a powerful tool for studying nuclear structure, because it allows model-independent studies of nuclear structure. For example, the charge density distribution of nuclei can be determined very accurately by electron elastic scattering. Therefore, electron scattering has been long awaited in the study of unstable nuclei, especially short-lived unstable nuclei.

To realize electron scattering with unstable nuclei, a new ion trapping method, Self-Confining Radioactive Isotope Ion Target (SCRIT) method, was developed.[1] After demonstrating the principle of the SCRIT method, the SCRIT electron scattering facility was constructed at RIKEN RI Beam Factory in 2009.[2] The SCRIT facility consists of an electron accelerator, an electron storage ring equipped with the SCRIT system, an online isotope separator, and an electron spectrometer besides the SCRIT system. Produced Radio Isotope (RI) beams are injected to the SCRIT system and RIs trapped inside the SCRIT system play as stationary targets. Electron beam stored in the ring are scattered from the RI targets and analyzed by the spectrometer.

After the success of the commissioning experiment using Xe [3] and the development of the RI production, the world's first electron scattering experiment using online-produced unstable nuclei was successfully conducted using Cs beam in 2022.[4] For the next stage, the upgrade of the SCRIT facility is underway for electron scattering off Sn, which is a iconic nuclei. In this contribution, we will report details of the first experiment, and the present status and perspective of the SCRIT facility.
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Paper submission Plan:

No

Best Presentation:

No

162

Nanoscale Projection Hard X-Ray Microscope for Statistical Analysis of Chemical Heterogeneity in Lithium-Ion Battery Cathodes

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Spatiotemporal heterogeneity of the state of charge (SOC) in battery electrodes significantly impairs the rate capability and cycle life of Li-ion batteries (LIBs). However, mapping of this heterogeneity is challenging due to the absence of experimental methods that can quantify SOC across the entire electrode scale, while also offering the nanoscale resolution for in-depth analysis of individual particles. Here, we report an advanced projection hard X-ray microscopy (PXM) offering a nanometric resolution with a large field-of-view, and high chemical sensitivity, significantly minimizing beam damage by lowering beam compared to traditional transmission X-ray microscopy (TXM) while sufficiently maintaining fast X-ray absorption near edge structure (XANES) imaging speed. Employing full-field imaging on hundreds of Ni-rich layered oxide particles during real-time (de)lithiation at various C-rates, we probed the origin of SOC heterogeneities, and revealed that the battery degradation does not occur uniformly across the entire electrode but progresses differently at the level of individual particles.

Paper submission Plan:

Yes

Best Presentation:

No

164

Current state of the KOMAC facilities and beam measurement systems

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The KOrea Multi-purpose Accelerator Complex (KOMAC) has provided high energy proton beams since 2013 and low energy ion beams since 2015. In 2025, the facility will begin radioisotope production and operate a high energy neutron source, thereby the facility provides high energy protons and neutrons also various low energy ion species. High energy beams are applied to atmospheric and space radiation effects research, as well as the theranostic radioisotope production such as Cu-67 and Ge-68, whereas low energy ion beams may be explored for the development of low dimensional materials. Detection systems include the Artificial Intelligence-based beam uniformity monitoring, pA level measurement for ultra low flux ion beams, and complementary neutron detectors that yield results comparable to leading international facilities. These capabilities establish a versatile platform for both fundamental research and applied technology, fostering international collaboration and industrial innovation. This presentation introduces the current status of the facilities developed for diverse purposes and describes the measurement systems employed in their operation.

Paper submission Plan:

Yes

Best Presentation:

No

165

Development of a pulsed power plasma experiment for generating highly charged ions

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Highly charged ions (HCIs) are important because they can be used to generate Extreme Ultra-Violet (EUV) photons and to study atomic data. However, it is difficult to generate HCIs using conventional plasma experiments operating in the continuous wave mode due to low electron temperatures. In order to produce HCIs by increasing the electron temperature of the plasma in the laboratory, we developed a pulsed power plasma experiment using capacitor banks and ignitrons. Our capacitor banks have a capacitance of 120 uF and can store up to 1.5 kJ of energy. The discharge current provided by the pulse power supply can reach to 100 kA with a discharge time of 20 us. After constructing the pulsed power supply, we successfully ignited Ar plasma. We confirmed that the plasmas last about 10 us with a discharge current of few tens of kA. Our facility will be used to study EUV light source and spectroscopy for HCI in the future.

Paper submission Plan:

No

Best Presentation:

No

166

Measurement of Vacuum Ultraviolet Emission from Plasmas Generated in the KAERI Plasma Beam Irradiation Facility

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Vacuum ultraviolet (VUV) spectroscopy is an effective diagnostic technique for analyzing radiative processes and ionization dynamics in plasmas. In this study, VUV emission spectra from plasmas generated in the KAERI Plasma Beam Irradiation Facility (KPBIF) were measured to investigate their spectral characteristics. The KPBIF, which was developed based on an applied-field magnetoplasmadynamic (AF-MPD) thruster, provides a high-density plasma beam. The VUV spectra were measured in the wavelength range of 20–80 nm using a spectrometer equipped with a Laminar-type replica diffraction grating. Measurements were conducted for helium, nitrogen, and argon discharges with gas flow rates ranging from 500 to 1000 sccm and input powers between 2 and 5 kW. Distinct emission lines were observed for each gas and these lines were also used for wavelength calibration of the spectrometer, enabling accurate spectral identification. The obtained emission data will be useful for validating atomic databases and analyzing excitation and ionization processes in plasmas.

Paper submission Plan:

No

Best Presentation:

No

167

Design of a Synchrotron Radiation Light Source for Industrial Application at SSRF

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Synchrotron radiation light sources have attracted significant interest for industrial applications. Unlike large-scale light sources designed for scientific research, those intended for industrial use must be highly compact to save space and reduce cost. The Shanghai Synchrotron Radiation Facility (SSRF) has developed a compact synchrotron-based light source, with its storage ring having a circumference of several tens of meters. Short-period undulators are employed to generate high-flux synchrotron radiation, covering the range from ultraviolet (UV) light to soft X-rays. This presentation will introduce the design of this light source, including the lattice design and key aspects of its implementation.

Paper submission Plan:

No

Best Presentation:

No

168

test

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Paper submission Plan:

No

Best Presentation:

Yes

169

Current status of SNUH Heavy Ion Therapy Gijang Center

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The Seoul National University Hospital (SNUH) Heavy Ion Therapy Gijang Center is a national project aiming to begin treatment at the end of 2027. This project, which began in 2010 at the Korea Institute of Radiological and Medical Sciences (KIRAMS), was transferred to SNUH in May 2019. A contract with Toshiba was signed in September 2020, and it had been decided to install the synchrotron in the completed building previously planned for a cyclotron. A new gantry treatment room also has been built connecting to the existing building. Construction of the gantry room expansion has been completed in April 2025, and equipment installation has begun in May 2025. Equipment installation is scheduled until May 2026, with beam tuning beginning in February or March 2026 and expected to be completed by April 2027. Following the completion of the Acceptance Test Procedure (ATP) in May 2027 and several months of commissioning, simultaneous treatment of the horizontal port and gantry port is planned to be started at the end of 2027. This project will involve both carbon and helium ions, and the installation of a research beamline in the remaining bunker is under consideration. This presentation will briefly outline the current status of SNUH Heavy Ion Therapy Gijang Center.

Paper submission Plan:

No

Best Presentation:

No

172

Fabrication and Beam Testing of a 180 GHz Colinear Wakefield Accelerator

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X-Ray Free Electron Lasers (XFEL) allow for intense, ultrashort X-ray pulses to probe matter at the femtosecond scale with high spatial resolution. Despite the critical research enabled by XFELs, there are currently only a handful of facilities, resulting in a fraction of proposed experiments being conducted.
An issue preventing the broad dissemination of XFELs is their overall size and cost along with the limited number of users they can accommodate compared to storage-ring-based synchrotron sources. A multi-user XFEL based on beam-driven collinear structure wakefield acceleration (SWFA) using corrugated waveguides as accelerating structures offer a path to deploying a compact, multi-user, XFEL. In addition to supporting simultaneous experiments (~10), such an XFEL could also be more versatile and could support the generation of attosecond pulses at high-repetition rates while also providing a path to full coherence.
Argonne National Laboratory has recently developed a conceptual design report for such an XFEL facility –the Argonne Sub-THz Accelerator (ASTAR). This talk will cover the design of ASTAR, testing of its components, and electron beam testing that was conducted at Brookhaven National Lab' s Accelerator Test Facility. Additionally, discussion regarding beam break up instabilities and controlling them via gradient quadrupole magnets.

173

Production of radioisotopes for application studies at RIKEN RI Beam Factory: Exploring new elements through cancer therapy

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At the RIKEN RI Beam Factory, Wako, Japan, we have been developing production technologies of radioisotopes (RIs) and conducting RI application studies in the fields of physics, chemistry, biology, engineering, medicine, pharmaceutical and environmental sciences [1]. Using light- to heavy-ion beams from the RIKEN AVF cyclotron, we produce over 100 RIs from 7Be (Z = 4) to 262Db (Z = 105). In superheavy element (SHE) chemistry, we investigate the properties of Rf (Z = 104) and Db in aqueous solutions in collaboration with Univ. Osaka, Kanazawa Univ., Niigata Univ., and JAEA. In nuclear medicine, we develop production technologies for 211At and 225Ac via the 209Bi(α,2n)211At and 226Ra(p,2n)225Ac reactions for targeted α-particle therapy (TAT).
We also produce multitracers from metallic targets (e.g., natTi, natAg) irradiated with a 135-MeV/nucleon 14N beam from the RIKEN Ring Cyclotron (RRC), enabling simultaneous tracing of multiple elements. Recently, we developed a large-scale 211At production system with a rotating 209Bi target and online dry distillation unit. 225Ac can also be produced in the 232Th(14N,xn)225Ac reaction for TAT.
An isotope of element 113 was synthesized in the 209Bi(70Zn,n)278113 reaction using the RIKEN gas-filled recoil ion separator (GARIS) at the RIKEN linear accelerator (RILAC), completing the 7th period of the periodic table with the approval of the name, nihonium (Nh). A synthesis experiment of element 119 is ongoing in the 248Cm(51V,xn)299–x119 reaction using GARIS-III at the upgraded superconducting RILAC facility. We installed a gas-jet transport system to GARIS as a novel SHE chemistry technique. Long-lived 261Rf, 262Db, 265Sg (Z = 106), and 266Bh (Z = 107) were produced in reactions on a 248Cm target and their decay properties were analyzed using a rotating wheel apparatus for α and spontaneous fission spectrometry

174

Challenge to direct observation of structure dynamics in photochemical reactions by using Soft X-ray FEL of PAL-XFEL

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175

Operation Status of KOMAC Linac

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176

Status of PLS-II and PAL-XFEL

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177

Oral Poster

178

SPring-8, SACLA, and SPring-8-II

179

The Smart Light Source - the future vision in AI for HEPS

180

Status of the RAON Experimental Systems

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181

The Status and Plan of Korea 4th Generation Storage Ring Project